

**FINAL BRIDGE GEOTECHNICAL ENGINEERING
REPORT BRIDGE 11 – REPLACE ROPER MOUNTAIN
ROAD OVERPASS OVER I-85**



a joint venture

**INTERSTATE 85/385 INTERCHANGE IMPROVEMENTS
FEDERAL AID PROJECT NO. IM23(009)
PROJECT ID: 0038111
CECS PROJECT NO. 4177A
GREENVILLE COUNTY, SOUTH CAROLINA
ECS PROJECT NO. 08-9283
MAY 29, 2015
Rev July 24, 2015**



**Civil Engineering
Consulting Services, Inc.**



FINAL BRIDGE GEOTECHNICAL ENGINEERING REPORT

Interstate 85/385 Interchange Improvements
Bridge 11 – Replace Roper Mountain Road Overpass over I-85

Federal Aid Project No. IM23(009)

Project ID. 0038111

CECS Project No. 4177A

Greenville County, South Carolina

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08-9283

Report Date:

May 29, 2015
Rev July 24, 2015



ECS CAROLINAS, LLP

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May 29, 2015
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Reference: Final Bridge Geotechnical Engineering Report
Bridge 11 – Replace Roper Mountain Road Overpass over I-85
Interstate 85/385 Interchange Improvements
Federal Aid Project No. IM23(009)
Project ID. 0038111
CECS Project No. 4177A
Greenville County, South Carolina
ECS Project No. 08-9283


Dear Mr. Kneece:

ECS Carolinas, LLP (ECS) has completed the Final Bridge Geotechnical Engineering Report (BGER) for the above referenced project. The purpose of this report is to provide the geotechnical information required for the final design of the subject bridge to the design team as outlined in the SCDOT Geotechnical Design Manual.

ECS Carolinas, LLP appreciates the opportunity to assist you during this phase of the project. If you have questions concerning this report, please contact our office.

Respectfully,

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1. INTRODUCTION

FlatIron/Zachry JV (FZJV) has been selected by SCDOT to design and construct the Interstate 85/385 Interchange Improvements in Greenville County, South Carolina. ECS Carolinas, LLP (ECS) has been selected by the design team as the Geotechnical Engineer for the project.

ECS is pleased to present this Final Bridge Geotechnical Engineering Report (BGER) for Bridge 11 – Replace Roper Mountain Road Overpass over I-85. The purpose of this report is to provide subsurface information and final geotechnical engineering recommendations relative to the subsurface soil conditions, deep foundation design for Bridge 11, embankment and earth retaining structures, and other geotechnical considerations that pertain to the proposed Bridge 11.

A separate BGER will be issued for each bridge associated with the interchange improvements. Additionally, a Roadway Geotechnical Engineering Report (RGER) will be provided as a separate document for the main interchange and a separate RGER will be provided for the Chrome Drive and Roper Mountain Road improvements. The RGER will address embankment design and construction considerations beyond 150 feet from the bridge abutments.

2. PROJECT INFORMATION

2.1. Project Location

The project site is centered at the intersection of Interstates 85 and 385 in Greenville, South Carolina. The interchange is located approximately 6 miles east-southeast of downtown Greenville. The Roper Mountain Road overpass is located approximately ½ mile north of the main interchange along I-85. See Appendix A for the location map.

2.2. General Project Description

The general project entails improvements to the I-85/385 Interchange including:

- A. At the I-85/385 Interchange, remove all existing bridges and construct seven (7) new bridges with associated new collector distributor (CD) roadways and added travel lanes.
- B. Replace the Roper Mountain Road Overpass over I-85 with a new bridge.
- C. Relocate Chrome Drive and portions of Roper Mountain Road.
- D. Widen the existing I-385 NB and SB Overpass Bridges over Garlington Road and GE Railroad.
- E. Construct a new bridge over Garlington Road carrying the I-385 NB/I-85 NB CD traffic.
- F. Provide clearance for new and existing north and south bound lanes of I-385 and new collector distributor roadways at the existing Woodruff Road underpass for I-385.
- G. Resurface portions of I-85 and I-385 extending 2 to 5 miles north and south of the current I-85/385 Interchange.

2.3. Bridge Description

Bridge 11 is the Roper Mountain Road overpass replacement. As part of the interchange project, I-85 will be widened at Roper Mountain Road from 8 travel lanes (including interchange ramps) to 14 travel lanes (including interchange ramps). Bridge 11 is a four (4) span bridge that will convey Roper Mountain Road traffic over Ramp 2A, I-85 Northbound and Southbound travel lanes, Ramp 1 and Ramp 1A. The bridge replacement includes a longer bridge, new abutment walls at both ends, and additional travel lanes for Roper Mountain Road.

The existing bridge is currently supported on spread footings at the interior bent and timber piles at the end bents. The existing bridge foundations will not be incorporated into the new bridge and are not anticipated to affect the performance of the new bridge. The existing superstructure will be removed as part of this project; however, some of the subsurface elements may remain in place. Structure removal and disposal shall be in accordance with Section 202 of the SCDOT Standard Specifications for Highway Construction.

Bridge 11 will be constructed in two phases. Phase I includes the construction of the southern (left) half of the bridge. Once Phase 1 construction is complete, the existing bridge will be razed and the northern (right) half of the bridge will be constructed. The planned construction phasing will require a temporary excavation support system at the common side of Phase 1 and Phase 2.

Stantec Consulting Services, Inc (Stantec) is the Bridge Engineer. The bridge superstructure will have both vertical and horizontal curvature and will consist of pre-stressed concrete girders. Bridge 11 begins at Roper Mountain Road Station 36+63.11 and ends at Station 39+73.28 with an overall length of approximately 310'-2" along the bridge centerline with single girder individual span lengths ranging from 75'-6" to 82'-6". The bridge will be approximately 63 feet wide and will consist of one travel lane in each direction with a center turn lane. Additionally, bike lanes, curb and gutter and sidewalks will also be constructed in each direction. The bridge will be supported on deep foundations consisting of HP12x53 piles at End Bents 1 and 5, and at interior Bents Bent 2 and 4. Interior Bent 3 will be supported by four 3'-6" diameter drilled shafts (with 3'-0" columns).

Table 1 – Summary of Design Information (Bridge 11)

Bent No.	Approximate Bent Stationing	Foundation Type	Bottom of Cap/Footing Elevation (feet)
End Bent 1	36+63	HP12x53 piles	933.66 to 936.73
Bent 2	37+39	HP12x53 piles	914.97
Bent 3	38+21	3'-6" Drilled Shafts	938.6 to 940.3 Top of Shaft el. 920.22
Bent 4	38+98	HP12x53 piles	917.28
End Bent 5	39+73	HP12x53 piles	939.7 to 941.69

Stantec provided the following design information to ECS as referenced in Table 1. Additionally, The Bridge Load Data Sheet is included in Appendix H of this report.

Grade changes of less than 3 feet are planned along the bridge centerline. The design entails widening the southern side of the existing approach embankments. Mechanically Stabilized Earth (MSE) wing walls will be constructed along the south sides of End Bent 1 and End Bent 5 approach embankments. In addition, up to 20.6-foot tall permanent cut walls consisting of combination walls of MSE walls over soil nail walls, will also be constructed parallel to the bridge abutments to accommodate the construction of Ramp 1A and Ramp 2A positions. 20 foot approach slabs are planned on both ends of the bridge.

At End Bent 1, the bridge plans indicate the abutment wall height (top of coping to bottom of leveling pad) is planned at 22 ft at the north and south ends of the wall. At End Bent 5, the wall height is planned at approximately 21 ft at the north and south ends of the wall.

2.4. Field Testing Summary

The SCDOT provided a Geotechnical Data Report prepared by Florence & Hutcheson, an ICA Company (F&H) prepared for the project dated January 25, 2013. In order to satisfy the requirements of the SCDOT GDM Chapter 4, Subsurface Investigation Guidelines and to obtain additional information to evaluate geotechnical the design-build team contracted with Thompson Engineering (TE) to obtain additional geotechnical subsurface investigations and laboratory

testing based on the final layout of the new bridge, bridge approach embankments, and associated walls. The two subsurface explorations are described in the following sections.

2.4.1. Florence & Hutcheson (F&H) Geotechnical Data Report

Two borings (B-30, and B-31) from the January F&H report were situated along the Bridge 11 alignment or within 150 feet of Bridge 11. The borings were drilled using a CME 55 and a CME 550 drill rig and 3-1/4 inch hollow stem augers. Standard Penetration Tests (SPTs) were conducted at 2-foot intervals within the top 10 feet and 5-foot intervals thereafter until achieving the boring termination depths. The Standard Penetration Test is used to provide an index for estimating soil strength and density. In conjunction with the penetration testing, split-barrel soil samples were recovered for soil classification and potential laboratory tests at each test interval. N-values presented in the F&H boring logs are the uncorrected, field N-values. Blow counts recorded at these intervals were produced from a standard penetration test hammer with an energy efficiency of 73% (Boring B-30) and 77% (Boring B-31). Hammer efficiency reports are included in the F&H report in Appendix L. Rock coring was performed at both borings. Individual boring logs for borings along the Bridge 11 alignment and within 150 feet of the bridge are provided in Appendix B.

2.4.2. Thompson Engineering (TE) Geotechnical Data Report

TE completed a total of fourteen (14) soil borings (B11-SPT-01 through B11-SPT-06, W1A-1R-03, W1A-1R-04, W2A-1R-03, W2A-1R-04, WRM-1L-01, WRM-2L-01) and two (2) DMTs (B11-DMT-01 and B11-DMT-02) along the bridge alignment or within 150 feet of the bridge. Boring B11-SPT-05A is the rock core portion of the continuation of Boring B11-SPT-05. The GSDR for Bridge 11 prepared by TE titled "Report of Geotechnical Consulting Services, Geotechnical Subsurface Data Report (GSDR), Interstate 85/385 Interchange Improvements, CECS, Inc. Revised Priority 1: Bridge 11 (Roper Mt. Road), Retaining Wall (I-85 NB/CD) and Roper Mt. Road, dated May 16, 2015, is included in Appendix M of this report. Individual boring logs for borings along the Bridge 11 alignment and within 150 feet of the bridge are provided in Appendix B.

The borings were drilled utilizing one CME 550X drill rig using mud rotary drilling techniques. Standard Penetration Tests (SPTs) were conducted at 2-ft. intervals within the top 10 ft. and 5-ft. intervals thereafter until achieving the boring termination depths. The SPT is used to provide an index for estimating soil strength and density. In conjunction with the penetration testing, split barrel soil samples were recovered for soil classification and laboratory testing at various intervals. The N-values presented in the boring logs prepared by TE are uncorrected, field N-values. Blow counts recorded at these intervals were produced from a standard penetration test hammer with an energy efficiency of 88% as reported in the Geotechnical Subsurface Data Report (GDSR) prepared by TE. TE collected Undisturbed Shelby Tube samples at select boring locations when low blow counts were reported in the field. In addition, rock coring was performed at four of the six borings drilled for Bridge 11 (Borings B11-SPT-01, B11-SPT-03, B11-SPT-04 and B11-SPT-05A).

A summary of boring locations associated with Bridge 11 are shown in Table 2. The water table depths in Table 2 are reported as the stabilized (24-hr.) water readings, where applicable. When 24-hr water readings were not reported, the water table depth was reported at the 0-hr (time of drilling) elevations.

Table 2 – Summary of Subsurface Exploration Test Locations

Test ID	Test Type	Alignment	Station	Offset (ft.)	Test Depth (ft.)	Ground Surface Elevation (ft.)	Water Table Depth (ft.)	Water Table Elevation (ft.)
B11-DMT-01	DMT	Roper Mtn	36+50	43 RT	31.0	938.7	---	N/A
B11-DMT-02	DMT	Roper Mtn	40+09	41 RT	14.0	943.5	---	N/A
B11-SPT-01	SPT	Roper Mtn	36+76	27 LT	98.0	935.7	26.0	909.7
B11-SPT-02	SPT	Roper Mtn	37+53	14 LT	73.6	922.6	11.0	911.6
B11-SPT-03	SPT	Roper Mtn	38+40	18 LT	96.6	924.8	N.O.	N/A
B11-SPT-04	SPT	Roper Mtn	37+99	93 RT	79.4	920.2	N.O.	N/A
B11-SPT-05	SPT	Roper Mtn	39+21	42 LT	48.6	925.5	11.0	914.5
B11-SPT-05A	RC	Roper Mtn	39+20	44 LT	71.0	925.5	11.0	914.5
B11-SPT-06	SPT	Roper Mtn	40+02	30 LT	68.6	933.5	17.0	916.5
W1A-1R-03	SPT	Ramp 1	49+21	11 RT	38.6	927.7	16.9	910.8
W-1A-1R-04	SPT	Ramp 1	51+48	27 RT	25.0	929.3	14.2	915.1
W2A-1R-03	SPT	I-85 NB/CD	108+66	37 RT	45.0	933.3	21.7	911.6
W2A-1R-04	SPT	I-85 NB/CD	110+92	42 RT	45.0	935.2	27.0	908.2
WRM-1L-01	SPT	Roper Mtn	35+60	32 LT	20.0	935.2	N.E.	N.E.
WRM-2L-01	SPT	Roper Mtn	41+39	27 LT	20.0	947.0	N.E.	N.E.
B-30	SPT	Roper Mtn	36+75	76 LT	90.0	936.2	N.R.	N.R.
B-31	SPT	Roper Mtn	40+57	10 RT	85.0	937.4	N.R.	N.R.

N.O.: Groundwater reading not observed during drilling and 24-hour stabilized readings could not be obtained at boring location because the boring was situated in the I-85 median.

N.R.: Groundwater reading not reported by F&H.

N.E.: Groundwater not encountered.

2.5. Laboratory Testing Summary

TE and F&H completed laboratory testing programs. The laboratory results are summarized in Appendix L and Appendix M respectively. Table 3 is a summary of the laboratory tests performed by TE and F&H for Bridge 11.

Table 3 – Summary of Laboratory Test Quantities

Test Type	Quantity	
	F&H	TE
Atterberg Limits	6	54
Sieve Analysis	6	54
Hydrometer	--	8
Moisture Content	6	54

In addition to the Bridge 11 specific laboratory test data, TE and F&H performed advanced laboratory testing including shear strength testing and consolidation testing at various locations across the project site. Because the entire project is situated within a region of similar geologic

origin, the laboratory test results were considered in this analysis. Table 4 is a summary of the TE and F&H advanced laboratory test on undisturbed (Shelby Tube) samples. The advanced laboratory test results, and summary tables are provided in Appendix C.

Table 4 – Summary of Advanced Laboratory Tests

Boring Number	Sample Number	Depth (ft)	USCS Classification	Laboratory Test
B-13	ST-1	20.3-20.8	SM	Triaxial Compression
B-39	ST-2	8-9.2	CL	Consolidation
B-39	ST-1	4-5.3	SC	Triaxial Compression
B-39	ST-2	8-9.2	CL	Triaxial Compression
B-40	ST-1	6-7.5	SM	Consolidation
B-40	ST-3	10-11.3	SM	Triaxial Compression
B-40	ST-2	8-9.2	SM	Triaxial Compression
B-40	ST-1	6-7.5	SM	Triaxial Compression
B-43	ST-1	2-2.9	SC	Triaxial Compression
B-44	ST-1	4-5	SM	Triaxial Compression
B-44	ST-2	8-8.9	SM	Triaxial Compression
B-46	ST-1	4-4.8	SM	Triaxial Compression
B-46	ST-2	8-9.5	SM	Triaxial Compression
B-49	ST-2	8-9.3	SM	Triaxial Compression
B-49	ST-1	4-4.8	SM	Triaxial Compression
B-51	ST-2	6-7.2	SM	Triaxial Compression
B-53	ST-2	8-9.3	SM	Triaxial Compression
B-54	ST-1	4-5.7	SM	Triaxial Compression
B-54	ST-2	8-9.5	ML	Triaxial Compression
B-61	ST-1	2-3.3	SM	Consolidation
B-61	ST-1	2-3.3	SM	Triaxial Compression
B-64	ST-1	4-5.2	SM	Triaxial Compression
B-64	ST-2	8-9.5	SM	Triaxial Compression
B-65	ST-2	10-11.4	SM	Consolidation
B-65	ST-2	10-11.4	SM	Triaxial Compression
B-67	ST-1	4-4.7	SM	Consolidation
B-67	ST-1	4-4.7	SM	Triaxial Compression
B-68	ST-1	2-3.5	SP-SM	Triaxial Compression
B-68	ST-2	6-7.3	SM	Triaxial Compression
B-70	ST-1	6-6.6	SM	Triaxial Compression
B-74	ST-1	4-5.3	ML	Consolidation
B-74	ST-1	4-5.3	ML	Triaxial Compression
B01-SPT-09	T-1	19-21	SC	Triaxial CU
B01-SPT-14	T-1	25-27	CL	Triaxial CU
B06-SPT-12	T-3	35-37	ML	Triaxial CU
B07-SPT-01				Triaxial CU
BR11-SPT-02	T-1	9.5-11.5	ML	Triaxial CU

Boring Number	Sample Number	Depth (ft)	USCS Classification	Laboratory Test
R2-43	T-1	10-12	SM	Direct Shear
RRM-47	T-1	25-27	ML	Triaxial CU
W1B-2R-02	T-1	8-10	SM	Triaxial CU
W1B-2R-03	T-1	4-6	CL	Triaxial CU
W1B-2R-03	T-2	15-17	SM	Triaxial CU
W2A-MB2-01	T-1	10-12	CL	Triaxial CU
W3A-1R-01	T-1	12-14	CL	Triaxial CU
W4B-1L-02	T-2	8-10	ML	Direct Shear
WCR-1L-02	T-1	15-17	ML	Triaxial CU

3. SUBSURFACE CONDITIONS

3.1. Area Geology

The United States Geologic Survey (USGS) presents the I-85/I-385 Interchange improvement project site within the limits of the Mauldin 7.5 minute topographic quadrangle map. The Geologic Map of the Greenville 1°x2° Quadrangle, South Carolina, Georgia, and North Carolina (Arthur E. Nelson, J. Wright Horton, Jr., and James W. Clarke dated April 12, 1990), identifies the project within the Inner Piedmont Physiographic Province of South Carolina. The Piedmont Province consists mainly of residual soils underlain by parent bedrock. The Generalized Geologic Map of South Carolina (revised by Willoughby, Howard, and Nystrom in 2005) identifies parent bedrock within this region in the Sixmile thrust sheet limits. The Sixmile Thrust sheet contains muscovite-biotite schist, biotite schist, sillimanite-mica schist and gneiss, amphibolite, biotite gneisses including some that are porphyroblastic, felsic gneiss, and some manganese schist and metamorphosed manganese silicate.

The native soils in the Piedmont Province consist mainly of residuum with underlying saprolites weathered from the parent bedrock (Sixmile thrust sheet), which can be found in both weathered and unweathered states. Although the surficial materials (residual soils) normally retain the structure of the original parent bedrock, they typically have a much lower density and exhibit strengths and other engineering properties typical of soil. In a mature weathering profile of the Piedmont Province, the soils are generally found to be finer grained at the surface where more extensive weathering has occurred. The particle size of the soils generally becomes more granular with increasing depth and gradually changes first to weathered and finally to unweathered parent bedrock. The mineral composition of the parent rock and the environment in which weathering occurs largely control the residual soil engineering characteristics.

The boundary between soil and rock is not sharply defined. This transitional zone termed “partially weathered rock” (PWR) is normally found overlying the parent bedrock. Partially weathered rock is defined, for engineering purposes and by Section 11.4 of the GDM, as residual material with Standard Penetration Test resistances greater than 100 blows per foot (bpf). The partially weathered rock is considered in geotechnical engineering as an Intermediate Geomaterial (IGM). The degree of weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the PWR and hard rock is generally irregular and erratic, even over short horizontal distances.

Alluvial soils in the piedmont occur in river and stream flood plains. The engineering characteristics of the alluvium are dependent on the dispositional environmental.

The natural geology across the project extent has been modified by past grading that included cut excavation and embankment fill, in most cases associated with the existing I-85/385 interchange.

3.2. Subsurface Information

A total of sixteen (16) borings were considered in this report. Six (6) soil borings and two (2) DMTs were drilled along the Bridge 11 alignment, and six (6) borings were performed within 150 feet of the Bridge along approach embankments and transverse abutment walls. The borings

referenced include B11-DMT-01, B11-DMT-02, and B11-SPT-01 through B11-SPT-06, W1A-1R-03, W1A-1R-04, W2A-1R-03, W2A-1R-04, WRM-1L-01, WRM-2L-01, B-30, and B-31. A Boring Location Plan is attached in Appendix A. The boring locations are represented on the drawing based on station and offset provided on the TE boring logs. The referenced boring logs and associated test data are presented in Appendix B and included in the individual GSDR in Appendix L and M of this report. The following section includes a summary of each boring drilled for Bridge 11 and a corresponding stratification table for each boring.

For the purpose of this report, we have identified a “PWR Lens” as a layer of partially weathered rock (located within the residual soil zone) having a thickness of 5 feet or less. A “PWR Layer” is referred to as a layer of partially weathered rock (also within the residual soil zone) with a thickness greater than 5 feet, overlying a deeper residual soil layer. “Continuous PWR” refers to the layer of PWR that is encountered directly above the bedrock layer.

Rock coring was performed at several of the boring locations. The borings logs present rock core Recovery and Rock Quality Designation as reported in the individual GSDR. The Recovery is defined as the length of the recovered core divided by the length of the core run, and the Rock Quality Designation (RQD) is defined as the total length of recovered pieces longer than 4 inches divided by the length of the core run. The RQD gives a relative indication of the degree of fracturing, soundness, and continuity of the rock.

Boring B11-SPT-01

Boring B11-SPT-01 encountered a 4 ft. layer of firm to stiff silt (fill), underlain by a 64 ft. layer of loose to dense silty sand (residuum), underlain by continuous PWR that extends to a depth of 75.0 ft., at which point, rock coring began. In general, the rock consisted of grayish black to grayish orange and pink Granite. The recovered rock cores consisted of fresh to moderately weathered, strong to very strong with close to moderately spaced joints.

The recoveries ranged from 85.8% to 100% and the RQD's ranged from 68.9% to 100%. Boring B11-SPT-01 was terminated at a depth of 98.0 ft. in bedrock.

Table 5 – B11-SPT-01 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	935.7 – 931.7	4	ML	7 to 12	Fill Soil
Piedmont	931.7 – 867.7	64	SM	7 to 49	Residual Soil
PWR	867.7 – 860.7	7	SM	100+	Continuous PWR over Rock

Table 6 – B11-SPT-01 Rock Core Summary

Boring No.	Sample No.	Sample Depth (ft.)	Recovery (%)	RQD (%)
B11-SPT-01	C-1	75.0 – 78.0	85.8	68.9
B11-SPT-01	C-2	78.0 – 83.0	100.0	100.0
B11-SPT-01	C-3	83.0 – 88.0	100.0	100.0
B11-SPT-01	C-4	88.0 – 93.0	94.0	86.0
B11-SPT-01	C-5	93.0 – 98.0	92.0	74.0

Boring B11-SPT-02

Boring B11-SPT-02 encountered a 11.5 ft. layer of medium dense to very loose silty sand (residuum), underlain by a 5.5 ft. layer of very soft silt, underlain by a 31 ft. layer of very loose to very dense silty sand, underlain by a 10 ft. layer of PWR, underlain by a 5 ft. layer of very dense silty sand, underlain by continuous PWR that extends to the boring termination depth of 73.6 ft. Boring B11-SPT-02 was terminated in the PWR at a depth of 73.6 ft. below existing grades.

Table 7 – B11-SPT-02 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Piedmont	922.6 – 911.1	11.5	SM	2 to 13	Residual Soil
Piedmont	911.1 – 905.6	5.5	ML	2	Residual Soil
Piedmont	905.6 – 874.6	31	SM	0 to 70	Residual Soil
PWR	874.6 – 864.6	10	SM	100+	PWR Layer
Piedmont	864.6 – 859.6	5	SM	69	Residual Soil
PWR	859.6 – 849.0	10.6	SM	100+	Continuous PWR over Rock

Boring B11-SPT-03

Boring B11-SPT-03 encountered a 1.3 ft. layer of asphalt/soil at the surface, underlain by an 9.2 ft. layer of medium dense to loose clayey sand (fill), underlain by a 2.5 ft. layer of very stiff lean clay (residuum), underlain by a 30 ft. layer of loose to dense silty sand, underlain by continuous PWR that extends to a depth of 59.0 ft., at which point, rock coring began. In general, the rock consisted of grayish black to grayish orange and pink Granite. The recovered rock cores consisted of moderately to highly weathered, weak to medium strong with close to moderately spaced joints. According to TE, below a depth of approximately 76.6 feet, the rock became highly fractured or weathered rock which prevented the core barrel from catching. Therefore, Core Run 3 and Core Run 4 are PWR.

The recoveries ranged from 0% to 99.0% and the RQD's ranged from 0% to 90.0%. Boring B11-SPT-03 was terminated at a depth of 96.5 ft. in highly fractured bedrock/weathered rock.

Table 8 – B11-SPT-03 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Asphalt/Soil	924.8 – 923.5	1.3	N/A	N/A	Asphalt/Soil
Fill	923.5 – 914.3	9.2	SC	6 to 15	Fill Soil
Piedmont	914.3 – 911.8	2.5	CL	18	Residual Soil
Piedmont	911.8 – 881.8	30	SM	4 to 48	Residual Soil
PWR	881.8 – 865.8	16	SM	100+	Continuous PWR over Rock

Table 9 – B11-SPT-03 Rock Core Summary

Boring No.	Sample No.	Sample Depth (ft.)	Recovery (%)	RQD (%)
B11-SPT-03	C-1	59.0 – 66.5	98.9	90.0
B11-SPT-03	C-2	66.5 – 76.5	99.0	40.0
B11-SPT-03	C-3	76.5 – 86.5	0.0	0.0
B11-SPT-03	C-4	86.5 – 96.5	0.0	0.0

Boring B11-SPT-04

Boring B11-SPT-04 encountered a 1.4 ft. layer of asphalt at the surface, underlain by a 4.1 ft. layer of medium dense to loose clayey sand (fill), underlain by a 2 ft. layer of stiff silt (fill), underlain by a 6 ft. layer of very soft to soft silt (residuum), underlain by a 24.5 ft. layer of loose to very dense silty sand, underlain by continuous PWR that extends to a depth of 54.0 ft., at which point, rock coring began. In general, the rock consisted of grayish black to grayish orange and pink Granite. The recovered rock cores consisted of fresh to slightly weathered, strong to very strong with close to moderately spaced joints.

The recoveries ranged from 93.8% to 106.6% and the RQD's ranged from 90.7% to 100%. Boring B11-SPT-04 was terminated at a depth of 79.4 ft. in bedrock.

Table 10 – B11-SPT-04 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Asphalt	920.2 – 918.8	1.4	N/A	N/A	Asphalt
Fill	918.8 – 914.7	4.1	SC	10 to 21	Fill Soil
Fill	914.7 – 912.7	2	ML	10	Fill Soil
Piedmont	912.7 – 906.7	6	ML	0 to 4	Residual Soil
Piedmont	906.7 – 882.2	24.5	SM	6 to 85	Residual Soil
PWR	882.2 – 866.2	16	SM	100+	Continuous PWR over Rock

Table 11 – B11-SPT-04 Rock Core Summary

Boring No.	Sample No.	Sample Depth (ft.)	Recovery (%)	RQD (%)
B11-SPT-04	C-1	54.0 – 63.0	95.8	95.8
B11-SPT-04	C-2	63.0 – 73.0	93.8	90.7
B11-SPT-04	C-3	73.0 – 79.4	106.6	100.0

Boring B11-SPT-05/05A

Boring B11-SPT-05 encountered an 4 ft. layer of medium dense to dense silty sand (fill), underlain by a 19 ft. layer of loose to very dense silty sand (residuum), underlain by a 5 ft. lens of PWR, underlain by a 10 ft. layer of medium dense to dense silty sand, underlain by a continuous layer of PWR that extended to the boring termination depth of 48.6 feet. To obtain rock core data, the boring (B11-SPT-05A) was offset several feet and re-drilled to a depth of 44.5 feet, at which point, rock coring began. In general, the rock consisted of grayish black to grayish orange and pink Granite. The recovered rock cores consisted of fresh to moderately weathered, strong to very strong with close to moderately spaced joints.

The recoveries ranged from 92.9% to 100.0% and the RQD's ranged from 66.7% to 100%. Boring B11-SPT-05A was terminated at a depth of 71.0 ft. in bedrock.

Table 12 – B11-SPT-05 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	925.5 – 921.5	4	SM	13 to 32	Fill Soil
Piedmont	921.5 – 902.5	19	SM	9 to 80	Residual Soil
PWR	902.5 – 897.5	5	SM	100+	PWR Lens
Piedmont	897.5 – 887.5	10	SM	28 to 33	Piedmont
PWR	887.5 – 876.9	10.6	SM	100+	Continuous PWR

Table 13 – B11-SPT-05A Rock Core Summary

Boring No.	Sample No.	Sample Depth (ft.)	Recovery (%)	RQD (%)
B11-SPT-05A	C-1	44.5 – 51.0	92.9	66.7
B11-SPT-05A	C-2	51.0 – 61.0	99.2	73.2
B11-SPT-05A	C-3	61.0 – 71.0	100.0	100.0

Boring B11-SPT-06

Boring B11-SPT-06 encountered an 8 ft. layer of very stiff fat clay (fill), underlain by a 4 ft. layer of dense clayey sand (residuum), underlain by a 21 ft. layer of medium dense to very dense silty sand, underlain by a 5 ft. lens of PWR, underlain by a 15 ft. layer of dense to very dense silty

sand, underlain by continuous PWR that extends to the boring termination depth of 68.6 ft. Boring B11-SPT-06 was terminated in the PWR at a depth of 68.6 ft. below existing grades.

Table 14 – B11-SPT-06 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	933.5 – 925.5	8	CH	15 to 17	Fill Soil
Piedmont	925.5 – 921.5	4	SC	38	Residual Soil
Piedmont	921.5 – 900.5	21	SM	23 to 56	Residual Soil
PWR	900.5 – 895.5	5	SM	100+	PWR Lens
Piedmont	895.5 – 880.5	15	SM	34 to 82	Residual Soil
PWR	880.5 – 864.9	15.6	SM	100+	Continuous PWR over Rock

Boring W1A-1R-03

Boring W1A-1R-03 encountered a 2 ft layer of soft sandy clay (fill), underlain by a 2 ft layer of medium dense silty sand (fill), underlain by a 6 ft layer of firm to very stiff elastic silt (fill), underlain by a 28.6 ft layer of a medium dense to very dense silty sand (residuum) that extends to boring termination a top rock at 38.6 ft. No rock coring was performed.

Table 15 – W1A-1R-03 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	927.7 – 925.7	2	CL	4	Fill Soil
Fill	925.7 – 923.7	2	SM	15	Fill Soil
Fill	923.7 – 917.7	6	MH	7 to 17	Fill Soil
Piedmont	917.7 – 889.1	28.6	SM	13 to 63	Residual Soil
PWR	889.1		Rock	100+	PWR over Rock

Boring W1A-1R-04

Boring W1A-1R-04 encountered a 2 ft layer of soft sandy clay (fill), underlain by a 2 ft layer of loose silty sand (residuum), underlain by a 4 ft layer of firm sand silt, underlain by a 6 ft layer of soft to firm sandy elastic silt, underlain by a 3 ft layer of soft sandy silt, underlain by a 8 ft layer of loose to medium dense silty sand that extends to the boring termination depth of 25 ft. No rock coring was performed.

Table 16 – W1A-1R-04 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	929.3 – 927.3	2	CL	2	Fill Soil
Piedmont	927.3 – 925.3	2	SM	6	Residual Soil
Piedmont	925.3 – 921.3	4	ML	5 to 6	Residual Soil
Piedmont	921.3 – 915.3	6	MH	3 to 5	Residual Soil
Piedmont	915.3 – 912.3	3	ML	2	Residual Soil
Piedmont	912.3 – 904.3	8	SM	3 to 25	Residual Soil

Boring W2A-1R-03

Boring W2A-1R-03 encountered an 7 ft. layer of soft to stiff fat clay (fill), underlain by a 38 ft. layer of medium dense silty sand (residuum), that extends to the boring termination a depth of 45.0 ft. No rock coring was performed.

Table 17 – W2A-1R-03 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	933.3 – 926.3	7	CH	3 to 9	Fill Soil
Piedmont	926.3 – 888.3	38	SM	11 to 21	Residual Soil

Boring W2A-1R-04

Boring W2A-1R-04 encountered a 4 ft. layer of firm to medium dense sandy elastic silt (fill), underlain by a 2 ft. layer of stiff sandy silt (fill), underlain by a 6.5 ft layer of firm sandy silt, underlain by a 33.5 ft. layer of medium dense silty sand (residuum), that extends to the boring termination a depth of 45.0 ft. No rock coring was performed.

Table 18 – W2A-1R-04 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	935.2 – 931.2	4	MH	5 to 12	Fill Soil
Fill	932.2 – 929.2	2	ML	10	Fill Soil
Piedmont	930.2 – 922.7	6.5	ML	7 to 10	Residual Soil
Piedmont	922.7 – 890.2	32.5	SM	3 to 17	Residual Soil

Boring WRM-1L-01

Boring WRM-1L-01 encountered a 4 ft layer of firm sandy lean clay (fill), underlain by a 16 ft layer of loose to medium dense silty sand, that extends to the boring termination depth of 20 ft. No rock coring was performed.

Table 19 – WRM-1L-01 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	935.2 – 931.2	4	CL	7	Fill Soil
Piedmont	931.2 – 915.2	16	SM	5 to 12	Residual Soil

Boring WRM-2L-01

Boring WRM-2L-01 encountered a 6 ft layer of loose to medium dense silty sand (fill), underlain by a 2 ft layer of medium dense silty sand (residuum), underlain by a 9 ft layer of firm to stiff sandy elastic silt, underlain by a 3 ft layer of medium dense silty sand that extends to the boring termination depth of 20 ft. No rock coring was performed.

Table 20 – WRM-2L-01 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Fill	947 – 941	6	SM	3 to 13	Fill Soil
Piedmont	941 – 939	2	SM	9	Residual Soil
Piedmont	939 – 930	9	MH	6 to 10	Residual Soil
Piedmont	930 – 927	3	SM	14	Residual Soil

Boring B-30

Boring B-30 encountered loose silty sands to a depth of approximately 53 ft. Partially weathered rock (PWR), sampled as silty sand, and was encountered below 53 ft until auger refusal at a depth of 70 ft. Rock coring initiated after auger refusal was encountered and extended to a depth of 90 ft.

The rock consisted of Feldspar Augite Gneiss with recoveries ranging from 38% to 90% and Rock Quality Designation (RQD) ranging from 26% to 68%.

Table 21 – B-30 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Piedmont	936.2 – 883.2	53	SM	7 to 16	Residual Soil
PWR	883.2 – 846.2	37	SM	100+	Continuous PWR over Rock

Table 22 – B-30 Rock Core Summary

Boring No.	Sample No.	Sample Depth (ft.)	Recovery (%)	RQD (%)
B-30	NQ-1	70 to 75	84	68
B-30	NQ-2	75 to 80	90	48
B-30	NQ-3	80 to 85	70	50
B-30	NQ-4	85 to 90	38	26

Boring B-31

Boring B-31 encountered a 5.8 foot layer of loose to dense clayey sand, underlain by dense to very dense silty sand to a depth of 43 ft, underlain by very dense gravel that extended to auger refusal at a depth of 65 ft. Although reported as gravel, N-values in the gravel layer below a depth of 50 ft exceeded 50 blows per 6 inches, which would indicated the gravel layer is Partially Weathered Rock (PWR). Rock coring initiated after auger refusal was encountered and extended to a depth of 85 ft.

The rock consisted of Feldspar Quartz Granitoid and Feldspar Quartz Biotite Muscovite Gneiss with recoveries ranging from 90% to 100% and RQD ranging from 52% to 94%.

Table 23 – B-31 Soil Stratification Table

Geologic Formation	Elevation (feet)	Layer Thickness (feet)	USCS Soil Type	SPT N-values (bpf)	Comments
Piedmont	937.4 – 931.6	5.8	SC	5 to 21	Residual Soil
Piedmont	931.6 – 923.6	8	SM	21 to 63	Residual Soil
PWR	923.6 – 909.6	14	SM	100+	PWR Lens
Piedmont	906.6 – 894.1	12.5	SM	27 to 49	Residual Soil
Piedmont	894.1 – 887.4	6.7	GW-GM	56	Residual Soil
PWR	887.4 – 872.4	15	GW-GM	100+	Continuous PWR over Rock

Table 24 – B-31 Rock Core Summary

Boring No.	Sample No.	Sample Depth (ft.)	Recovery (%)	RQD (%)
B-31	NQ-1	65 to 70	100	94
B-31	NQ-2	70 to 75	100	52
B-31	NQ-3	75 to 80	100	80
B-31	NQ-4	80 to 85	90	86

3.3. Groundwater

Groundwater measurements were not reported on the F&H boring logs. Groundwater measurements were attempted by TE at the termination of drilling and at least 24 hours after completion of drilling (when possible without impacting the health and safety of the traveling public) as summarized in Table 2 in Section 2.4 of this report. Groundwater was encountered at several boring locations at depths ranging from approximately 11.0 to 27.0 feet below the ground surface which corresponds to elevations ranging from 916.5 to 909.7 feet. Groundwater measurements were not reported at Borings B11-SPT-03, B11-SPT-04, B-30 and B-31.

Fluctuations in the groundwater elevation must be expected depending on precipitation, run-off, utility leaks, and other factors not evident at the time of our evaluation. Normally, highest groundwater levels occur in late winter and spring and the lowest levels occur in late summer and fall. Depending on time of construction, groundwater may be encountered at shallower depths and locations not explored during this study.

4. GEOTECHNICAL SEISMIC CONSIDERATIONS

4.1. Seismic Design

The seismic bridge design will be governed by the 2008 SCDOT Seismic Design Specifications for Highway Bridges. Bridge 11 has an Operation Classification (OC) of II as defined by the SCDOT. The Geotechnical Design Manual (GDM) indicates that roadway bridge approach embankments and earth retaining structures located within 150 feet of a bridge with an OC=II bridge classification will have a Roadway Operational Classification (ROC) of II. The GDM also indicates that roadway embankments and structures located more than 150 feet from a bridge will have an ROC of III; however, Bridge Design Memorandum DM0211 revised the ROC for embankments more than 150 from a bridge to ROC IV. This BGER will limit its geotechnical evaluation to the bridge foundation design and to the bridge approach embankments and earth retaining structures located within 150 feet of the bridge end bents, therefore the bridge, structures (i.e. retaining walls) and embankments discussed in this report are classified as ROC II.

4.2. Seismic Response

The SCDOT provided a three point Acceleration Design Response Spectrum (ADRS) curve dated March 27, 2014 based on a Site Class D. The site classification is based on four (4) Multichannel Analysis of Surface Wave (MASW) tests performed by F&H as part of their geotechnical report date January, 2013. The MASW results are presented in Appendix E of this report, and the results are summarized in Table 25 below. The testing indicates a weighted average shear wave velocity of 1,145 feet per second (fps), which correlates to a Site Class D based on the procedures outlined in the SCDOT GDM. Table 26 summarizes the ADRS parameters provided by SCDOT.

Table 25 – MASW Test Results

MASW Analysis No.	Alignment	Station	Offset (feet)	Average Shear Wave Velocity in Top 100 feet (fps)
MASW-1	I-385 NB C/D	359+39	17' RT	1,405.6
MASW-2	I-385	393+66	115' RT	1,034.8
MASW-3	Ramp 4B	408+70	102' RT	1,081.5
MASW-4	Roper Mt. Rd.	36+15	25' LT	1,060.2

Table 26 – Summary of ADRS Seismic Design Values

Design EQ	PGA	S _{DS}	S _{D1}	M _w	R (km)	Geologic Condition	Site Class
FEE	0.07	0.11	0.06	7.37	267.2	Hard Rock Basement Outcrop	D
SEE	0.20	0.29	0.14	7.37	266.4	Hard Rock Basement Outcrop	D

Based on the shear wave velocity measurements, the seismic Site Class for the bridge has been determined to be a “D”. Taking into account the Operational Classification (OC) = II and the

Safety Evaluation Earthquake (SEE) acceleration coefficient at the one-second period, the bridge is Seismic Design Category (SDC) A.

4.3. Seismic Soil Shear Strength Loss and Liquefaction Triggering

A geotechnical seismic hazard evaluation was performed to determine if the soils located within the bridge foundation limits are susceptible to Soil Shear Strength Loss (SSL) and or Liquefaction during the design seismic events. Soil Shear Strength Loss (SSL) and seismic settlements were evaluated using the procedures outlined by Idriss and Boulanger (2008) and Chapter 13 – “Geotechnical Seismic Hazards” of the 2010 GDM to determine soil SSL.

The SPT field results, N_{Meas} , have been corrected to account for energy losses, normalized to a reference overburden pressure of 1 tsf (1 atm), and corrected for fines content to an equivalent clean sand. The corrected SPT penetration results were used to estimate static soil shear strengths, evaluate soil shear strength loss (SSL), estimate seismic soil shear strengths, and estimate seismic settlement.

The SSL and Liquefaction triggering analysis considers an age factor to account for the reduction in SSL and Liquefaction potential as geologic formations age. For SSL and Liquefaction triggering analysis, the soils across the general project extent are grouped into three (3) geologic origins including man-made fills, Alluvial Soils and Piedmont Residual Soils. Age Factors of 1, 1.5 and up to 2.5 are used for man-made fills, Alluvial Soils, and Piedmont Residual Soils respectively. The Age Factor for Alluvial soils considers an age of at least 10,000 years and was estimated with GDM Equation 13-47 where $K_{DR} = 0.17 \cdot \log_{10}(t) + 0.83$ and t is in years. For existing fills associated with existing approach embankments an Age Factor of 1.2 was used in the analysis. The age factor for existing fills accounts for the age of the deposit (40 to 50 years based on original bridge construction), as well as the compactive effort, or artificial aging due to compaction. The triggering analysis results are provided in Appendix E-1.

The analysis was performed using a Moment Magnitude of 7.37 and a Peak Ground Acceleration of 0.20g and 0.07g for the SEE and FEE design events, respectively. The potential for seismic soil shear strength loss (SSL) and liquefaction of the subsurface soils was evaluated by first screening the SPT soil borings to determine if the soils encountered are susceptible to soil shear strength loss. Soils identified as susceptible to soil SSL, were then evaluated to determine if the seismic demand (FEE and SEE) was capable of triggering soil SSL.

The SSL and liquefaction triggering evaluation indicates that triggering and shear strength loss will not occur during the FEE or SEE event, and seismic induced soil settlement will be less than $\frac{1}{4}$ ".

5. GEOTECHNICAL RECOMMENDATIONS

5.1. Structure Overview

The new bridge will be supported on deep foundations consisting of HP 12x53 piles at End Bents 1 and 5 and at Interior Bents 2 and 4. Interior Bent 3 will be supported on four 3'-6" diameter drilled shafts (with 3'-0" columns).

Earth Retaining Walls will be constructed parallel to the bridge abutments to retain the bridge approach embankment in the bridge longitudinal direction. Combination walls are planned at each end bent. The combination walls consist of Mechanically Stabilized Earth (MSE) Walls constructed over Soil Nail Walls. The abutment walls at both End Bents 1 and 5 will extend more than 150 feet beyond the bents. Along the south side of each bent, a short MSE Wall is planned parallel to the direction of travel to meet site constraints. Each of the MSE Walls will be constructed over a soil nail wall.

At End Bent 1, the bridge plans indicate the abutment wall height (top of coping to bottom of leveling pad) is planned at 22 ft at the north and south ends of the wall. At End Bent 5, the wall height is planned at approximately 21 ft at the north and south ends of the wall.

5.2. Corrosion and Deterioration

The effects of corrosion and deterioration from environmental conditions were considered in the selection of pile type and size. In accordance with Section 16-3 of the GDM, analysis for the long-term durability of the pile in service (i.e. corrosion and deterioration) was based on the 2012 AASHTO LRFD Bridge Design Specifications, Section 10.7.5. Site-specific laboratory soil pH testing of the subsurface soils was performed by TestAmerica Laboratories, Inc and incorporated into the Thompson Engineering GSDR at Boring B11-SPT-06, which is located in the vicinity of End Bent 5. The test results for corrosion testing on boring B11-SPT-06 are summarized in Table 27.

In accordance with AASHTO LRFD Section 10.7.5, the following soil or site conditions that must be considered indicative of a potential pile deterioration or corrosion situation are as follows:

- Resistivity less than 2,000 ohm-cm,
- pH less than 5.5,
- pH between 5.5 and 8.5 in soils with high organic content,
- Sulfate concentrations greater than 1,000 ppm,
- Landfills and cinder fills,
- Soils subject to mine or industrial drainage,
- Areas with a mixture of high resistivity soils and low resistivity high alkaline soils, and
- Insects (for wood piles only).

Table 27 – Summary of Corrosion Testing

Sample	Sample Depth (feet)	Resistivity (ohm-m)	pH	Sulfate (mg/kg)	Chloride (mg/kg)
B11-SPT-06	13.5 – 23.5	96,000	5.42	<23	<23

The corrosion test results were provided to the structural engineer to determine if additional measures are required to offset the low pH results.

5.3. Bridge Foundation Geotechnical Recommendations

The bridge plans indicate End Bent 1 and End Bent 5 foundations will consist of a single row of ten (10) driven HP 12x53 ($f_y > 50$ ksi) piles at each of the end bent locations. Interior Bents 2 and 4 will be supported on square pile footings (7.5 ft by 7.5 ft in plan view) with five (5) driven HP 12x53 piles within each pile footing. Since piles will be driven to PWR or penetrate thin lenses of PWR, pile points with rock teeth are required to limit potential pile damage during driving.

Four (4) 42-inch diameter drilled shafts are planned for foundation support at Bent 3. Drilled shaft diameters must be a minimum of 6 inches larger than the column above the shaft. In accordance with DM0111 construction casing shall be used at each drilled shaft location. The portion of the shaft below the bottom of the casing, whether in soil or rock, shall have a diameter that is six (6) inches smaller than the diameter of the construction casing. Additionally, the drilled shafts must be constructed in accordance with Section 712 of the SCDOT Standard Specifications titled “Drilled Shafts and Drilled Pile Foundations”.

5.3.1. Pile Supported Foundations

5.3.1.1. Driven Pile Axial Resistance

ECS evaluated the axial (compressive and tensile) capacity of HP 12x53 piles using the engineering software Driven by the Federal Highway Administration (FHWA). Table 28 through 30 and Appendix F summarize the recommended pile capacities including the Nominal Axial Resistance, Factored Compressive and Factored Tensile Capacities during both service and extreme event states. The static resistance factors provided are based on Table 9-2 of DM0310 assuming a redundant foundation system and piles driven to refusal. Factored axial resistances are provided with dynamic testing (PDA) at End Bents 1 and 5, and without dynamic testing at interior bents 2 and 4. The governing design condition for development of the pile tip elevation at the End Bents and pile-supported Interior Bents is axial compression under static loading.

Potential downdrag loads were evaluated based on the estimated immediate and consolidation settlement at End Bent 1 and End Bent 5. If the piles are installed prior to embankment construction, the settlement will induce unfactored downdrag loads in the range of 46 kips and 30 kips per pile, respectively. The downdrag forces were estimated using the Nordlund Method in granular soils and Alpha method in cohesive soils. The analysis considered residual shear strengths equal to 80 percent of peak shear strength values. For granular soils a δ/ϕ ratio of 0.5 was used. A load factor of 1.4 is required in accordance with Section 8.7 of the GDM.

Table 28 – Pile Bearing – End Bent 1 (HP 12x53)

Factored Design Load	125 tons
Geotechnical Resistance Factor	0.65
Nominal Resistance	192 tons
Estimated Loss Due to Scour	N/A
Estimated Loss Due to Downdrag (unfactored)	23 tons
Required Driving Resistance	215 tons

Table 29 – Pile Bearing – Bent 2 and Bent 4 (HP 12x53)

Factored Design Load	105 tons
Geotechnical Resistance Factor	0.5
Nominal Resistance	210 tons
Estimated Loss Due to Scour	N/A
Estimated Loss Due to Downdrag (unfactored)	N/A
Required Driving Resistance	210 tons

Table 30 – Pile Bearing – End Bent 5 (HP 12x53)

Factored Design Load	111 tons
Geotechnical Resistance Factor	0.65
Nominal Resistance	170 tons
Estimated Loss Due to Scour	N/A
Estimated Loss Due to Downdrag (unfactored)	15 tons
Required Driving Resistance	185 tons

A driveability analysis was performed to evaluate pile installation stresses and pile driving equipment required to penetrate the Piedmont residual soils and Partially Weathered Rock. The contractor had not selected a piling hammer at the time this report was prepared. The preliminary driving analysis is based on a pile hammer having a rated energy between 40 and 50 ft.-kips (equivalent to Hammers Delmag D19-42 or ICE 42-S). Note that hammers approaching the 50 kip-ft. range may require operation at a reduced stroke to limit pile driving stresses. Once the contractor selects a piling hammer, a final drivability analysis and a wave equation analysis must be performed considering the Contractor's selected pile driving hammer(s) for this project. In accordance with the SCDOT GDM, the required number of blows must range from 36 to 180 blows per foot for the driving system to be considered acceptable. Practical refusal is defined as 20 blows per inch. Table 31 includes a summary of our drivability analysis.

Table 31 – Summary of Drivability Analysis

	End Bent 1	Bent 2	Bent 4	End Bent 5
Skin Quake (QS)	0.10 in.	0.10 in.	0.10 in.	0.10 in.
Toe Quake (QT)	0.10 in.	0.10 in.	0.10 in.	0.10 in.
Skin Damping (SD)	0.05 s/ft.	0.05 s/ft.	0.05 s/ft.	0.05 s/ft.
Toe Damping (TD)	0.15 s/ft.	0.15 s/ft.	0.15 s/ft.	0.15 s/ft.
% Skin Friction	90%	15%	20%	65%
Distribution Shape No.	0.0	0.0	0.0	0.0
Bearing Graph	Proportional	Proportional	Proportional	Proportional
Pile Penetration	93%	95%	86%	90%
Hammer Energy Range	40 – 50 ft.-kips	40 – 50 ft.-kips	40 – 50 ft.-kips	40 – 50 ft.-kips

Note: GRLWEAP (2005) was used to perform the wave equation analysis.

5.3.1.2. Static Foundation Settlement Analysis

Settlement of the steel H-piles at the bent locations is anticipated to be minimal since the piles will be driven to practical refusal on/into partially weathered rock. Based on our previous experience, we estimate pile penetration into PWR will be only a few feet. Therefore, no detailed static settlement analysis was performed.

5.3.1.3. Driven Pile Lateral Resistance

Stantec provided ECS with structural loading information for individual driven piles at each bent location. The pile loading information is included in Appendix H. ECS evaluated the lateral performance of individual piles using the engineering software L-Pile 2012 by Ensoft, Inc.

ECS evaluated lateral pile performance at each bent. Appendix H summarizes the soil parameters for each bent along with the output data, deflection, moment and shear plots versus depth for each bent. The lateral analysis has been performed to estimate the critical depth required to maintain lateral stability of the piles at each bent location. The L-pile analysis considered a p-y multiplier of 0.5 in the transverse direction and 1.0 in the longitudinal direction based on Table 10.7.2.4-1 of the AASHTO 2012 LRFD Bridge Design Specifications. Because the end bents include a single row of piles with a spacing of about 5 pile diameters, no p-y multiplier was applied at the end bents. Critical depth is determined for the Strength Limit State and is defined as the elevation where the stiffness of the soil overcomes the stiffness of the pile (i.e. pile becomes unstable), which correlates to the second moment crossing on the respective LPILE graph. The anticipated pile tip elevations (based on Driven) and the critical depth elevations (based on L-Pile) for the End Bents and Interior Bents are summarized in Table 32.

Table 32 – Anticipated Pile Tip and Critical Depth Elevations

Bent	Pile Size	Bottom of Footing/Cap Elevation (feet)	Anticipated Pile Tip Elevation (feet)	Critical Depth Elevation (feet)
End Bent 1	HP 12x53	936.0	866.0	922.5
Bent 2	HP 12x53	915.5	858.0	884.0
Bent 4	HP 12x53	915.5	886.0	895.0
End Bent 5	HP 12x53	941.0	880.0	928.5

A shallow PWR lens at Bent 4 may prevent the pile from reaching the minimum tip depth. Boring B11-SPT-05 indicated the presence of a 5 ft thick PWR lens at a depth of about 12.5 feet below existing grade. Dense residual soils were encountered Below the PWR lens and extend to a depth of approximately 28.5 feet, at which point, continuous PWR was encountered (Elevation 887.5 ft.). The contractor must be prepared to predrill through the PWR lens, and then commence pile driving to ensure the minimum pile tip elevation is achieved.

Predrilling typically includes a small diameter auger to excavate a pilot hole into the PWR. The auger diameter is less than the pile section depth resulting in the pile flanges cutting into undisturbed soil and PWR during driving. Pre-drilling does not modify the geotechnical engineering analysis. Uplift capacities and lateral pile analysis for pre-drilled driven piles are presented in Appendix F and Appendix H, respectively.

5.3.2. Drilled Shaft Supported Foundations

Four (4) 42-inch diameter drilled shafts are planned for foundation support at Interior Bent 3. In accordance with DM0111 all drilled shafts shall incorporate a construction casing that will remain in place after shaft construction. The portion of the shaft below the bottom of the casing, whether in soil or rock, shall have a diameter that is six (6) inches smaller than the diameter of the construction casing resulting in a 36" diameter shaft below the construction casing tip. Additionally, the drilled shafts must be constructed in accordance with Section 712 of the SCDOT Standard Specifications titled "Drilled Shafts and Drilled Pile Foundations".

The drilled shaft axial design ignores the increased pile diameter resulting from the construction casing. The design and drilled shaft analysis is based on the 36-inch diameter shaft, ignoring shaft resistance where the casing is present. The construction casing must extend into continuous PWR, estimated to be at approximate elevation 882 feet, to limit water infiltration into the drilled shaft excavation. If the construction casing does not provide an adequate groundwater cut off or "seal", the contractor must be prepared with alternate "wet" drilling methods. As previously mentioned, ECS must be notified immediately if the contractor plans to use different means and methods than outlined above.

The drilled shaft design is based on the results of the axial and lateral analysis presented in the following sections.

5.3.3. Drilled Shaft Axial Resistance

Section 16.4.1 of the GDM states that the axial capacity of the drilled shafts shall follow the procedures outlined in the AASHTO LRFD Bridge Design Specifications, Article 10.8. ECS evaluated the axial capacity of the 36-inch drilled shafts using the engineering software Shaft v2012 by Ensoft, Inc. The axial capacity calculations are included in Appendix G. The static resistance factors provided are based on Table 9-5 of the GDM assuming a non-redundant foundation system in IGM. The GDM defines non-redundant foundations as drilled shaft footings with four or less drilled shafts supporting a single column or individual drilled shafts supporting individual columns in a bent.

The governing design condition for the tip elevation for the drilled shafts at Interior Bent 3 is axial loading for the static condition. Table 33 is a summary of the drilled shaft bearing loads for Bent 3. The Factored Design Load accounts for the weight of the column and drilled pier.

Table 33 – Drilled Shaft Bearing – Bent 3

Factored Design Load	420 tons
Factored Resistance – Side	320 tons
Factored Resistance – End	115 tons
Geotechnical Resistance Factor – Side (IGM)	0.60
Geotechnical Resistance Factor – End (IGM)	0.55
Total Nominal Resistance	740 tons

The estimated bottom of casing and minimum tip elevation is indicated in the table below. Table 34 presents a summary of the recommended casing elevations, estimated excavation quantities and minimum tip elevation to satisfy axial capacity calculations.

Table 34 – Summary of Casing and Excavation Quantities

Interior Bent No.	Number of Shafts/Bent	Estimated Bottom of Construction Casing Elevation (feet)	Estimated 42" Wet & Dry Excavation (per shaft)	Estimated 36" Excavation Soil/Rock (per shaft)	Minimum Tip Elevation (feet)
3	4	882.0	38 feet	16 feet / 10 feet	856.0

5.3.3.1. Static Foundation Settlement Analysis

Based on our axial analysis, settlement of the drilled shafts at the interior bent location is anticipated to be minimal ($< 0.75"$) since the drilled shafts are designed to bear in PWR or on hard rock. In accordance with Table 10-32 of the GDM, the maximum vertical differential settlement for a Fixed Bearing interior bent and the maximum vertical differential settlement for an Expansion Bearing interior bent is $0.020 L_{span}$ and $0.040 L_{span}$, respectively. Using the shortest adjacent span length of 76.7 feet, this correlates to a maximum vertical settlement of

1.5" and 3.1", respectively. Since our analysis indicated less than 1 inch of settlement is anticipated, the performance limit for the service limit state has been satisfied.

5.3.3.2. Drilled Shaft Lateral Resistance

ECS completed the lateral drilled shaft analysis using the engineering software L-Pile 2012 by Ensoft, Inc. This analysis uses the structural loads provided to us by Stantec for both the Longitudinal and Transverse loading conditions. The lateral analysis considered the increased shaft diameter for the length of shaft with construction casing.

Appendix H summarize the soil parameters used in our lateral analysis and the output data along with the deflection, moment and shear plots versus depth are also included in Appendix H.

The lateral analysis has been performed to estimate the critical depth required to maintain lateral stability of the drilled shafts at Interior Bent 3. Because Bent 3 includes a single row of drilled shafts with a spacing of about 5 pile diameters, no p-y multiplier was applied at Bent 3. Critical depth is determined for the Strength Limit State and is defined as the elevation where the stiffness of the soil overcomes the stiffness of the pile (i.e. pile becomes stable), which correlates to the second moment crossing on the respective LPILE graph. The anticipated drilled shaft tip elevations and the critical depth elevations (based on L-Pile) for the Interior Bent 3 is summarized in Table 35.

Our analysis was based on the foundation loads acting at the Top of Column (TOC) elevation.

Table 35 – Anticipated Drilled Shaft Tip and Critical Depth Elevation

Bent No.	Drilled Shaft Size	Top of Shaft Elevation (feet)	Minimum Drilled Shaft Tip Elevation (feet)	Critical Depth Elevation (feet)
Bent 3	42-inch	920.2	856.0	876.0

5.3.3.3. Drilled Shaft Construction Considerations

Drilled shafts must be constructed in accordance with Section 712 of the 2007 SCDOT Standard Specifications. Drilled shafts constructed at this site will require advancement below the water table through dense residual soils as well as through zones of PWR. As previously mentioned, our design is based on the construction casing extending to the top of the PWR. However, if the contractor is unable to extend the construction casing to the anticipated casing tip elevation, we assume the contractor will utilize telescoping temporary casing as his means and methods of excavation. Drilled shafts extending through residual soils will require temporary steel casing to prevent intrusion of soil and groundwater into the excavation. The temporary casing must be sealed into the top of bedrock or PWR and must be extended to the bearing level as the drilled shaft excavation is advanced. Casing must be equipped with carbide teeth and must be spun into the formation to achieve competent seals. The contractor must be prepared to encounter rock during the drilled pier excavation.

As discussed previously, the drilled shafts will achieve the design capacity through a combination of skin friction and end bearing. SCDOT allows “wet” drilling methods including slurry drilling methods. The drilled shaft design assumes the drilled shaft contractor will either maintain a dry rock socket through a properly sealed temporary casing or use a properly maintained slurry. If the contractor elects to use alternate drilling fluids (i.e. water only), ECS must be contacted to re-evaluate achievable skin friction capacities.

Since drilled piers are expected to advance through weathered zones of rock, adequately sized construction equipment will be required so that adequate penetration can be achieved by drilling techniques. Rock augers will be required to advance the drilled shaft excavation once earth auger refusal is obtained. Rock auger means helical augers with “cheater bits” and carbide toothed cutting edges. The drilling machine used must have an overall minimum weight of 85,000 pounds and must be equipped with a kelly bar or bars that apply a minimum of 7,000 pounds of dead weight to the auger. In addition, the kelly bar must be equipped with a hydraulic crowd system capable of raising the machine’s rear leveling hacks completely clear of the ground to apply the maximum dead weight of the drill machine itself in order to ensure maximum penetration. The machine must be capable of applying at least 50,000 pounds downward total force and a minimum of 95,000 ft-lb torque capacity to the auger while drilling the excavation. Rock is defined as any material that cannot be drilled with rock augers and under-reaming tools and required the use of core barrels, rotary percussion drills, and/or blasting.

If the surface of the bedrock is sloping at the drilled pier base, it must be cut flat or stepped down across the bottom of the bearing surface. The slope of the bedrock must be no steeper than 10 percent, and steps must not exceed 9 inches in height.

Concrete must be placed in the drilled shaft excavation as soon as possible after the excavation is completed and approved. Concrete must be placed by either a tremie or concrete pump. Free fall placement of concrete from the end of the tremie or pump line is not permitted; however, free fall from the top may be allowed in a dry hole when conditions outlined in Subsection 712.4.13.5 of the Standard Specifications are met. We recommend a positive head of concrete at least 5 ft. or more be maintained at all times during extraction of the casing. This will prevent the soil from entering into the concrete as well as prevent necking of the drilled shaft during casing removal.

5.4. Bridge Approach Embankments and MSE/Soil Nail Wall Design

Bridge approach embankments are defined by SCDOT as any embankment within 150 feet from the bridge abutment in the longitudinal direction will be addressed in this BGER. Roadway embankments beyond 150 feet from the bridge abutment will be addressed in the Roadway Geotechnical Engineering Report (RGER). At Bridge 11 earth retaining walls extend more than 150 in the transverse direction from the centerline of the bridge. Walls within 150 feet of the bridge centerline are considered in this report; walls that extend more than 150 feet from the bridge centerline will be addressed in the RGER.

The bridge approach embankment height at End Bent 1 will be approximately 25 feet. A combination wall consisting of a Mechanically Stabilized Earth (MSE) walls situated over a Soil Nail wall will be constructed parallel to the bridge abutments to retain the bridge approach

embankment in the longitudinal direction to the bridge. The approach embankment at both End Bents includes an MSE wall on the south side of the abutments

Earth Retaining Walls will be constructed parallel to the bridge abutments to retain the bridge approach embankment in the longitudinal direction to the bridge. Combination walls are currently planned at each bridge bent. The combination walls consist of Mechanically Stabilized Earth (MSE) Walls constructed over Soil Nail Walls. The abutment walls at both End Bents 1 and 5 will extend more than 150 feet beyond the bents. Along the south side of each bent, a short MSE Wall is planned to parallel to the direction of travel to meet site constraints. Each of the MSE Walls will be constructed over a soil nail wall.

At End Bent 1, the bridge plans indicate the abutment wall height (top of coping to bottom of leveling pad) is planned at 22 ft at the north and south ends of the wall. At End Bent 5, the wall height is planned at approximately 21 ft at the north and south ends of the wall.

The design of combination or hybrid walls must consider several factors including relative deflection and non-uniform displacements of the hybrid wall face. Deflection and wall facing displacements can be adequately controlled. This analysis must consider the soil nail wall installation methods, soil nail wall permanent and temporary facing materials, MSE Wall reinforcement type and facing. The final analysis of these structures is an interactive process between the MSE Wall Designer and the Soil Nail Wall designer. The analyses provided herein and discussed below is a demonstration that overall global stability, in accordance with SCDOT standards, can be achieved. The Soil Nail Wall and MSE Wall designers must demonstrate that global stability is achieved with the final wall configuration.

We anticipate most soil nail walls in this project will require soil nail lengths equal to about 1.4 to 1.6 times the wall height. The MSE wall reinforcing length is anticipated to be approximately 0.7 to 0.9 times the wall height. For combination walls, nail lengths and reinforcement lengths must consider the total wall height from ground surface elevation at the toe of wall to the ground surface at the top of wall, and not the individual component heights.

Outside the lateral extent of the bridge abutment, Soldier Pile and concrete lagging walls are planned to the south of Bent 1 and soil nail walls are planned to the north and south of Bent 5 as well as to the North of Bent 1.

There is an existing pond to the south west of Bridge 11. The current bridge plans incorporate a soldier pile lagging wall that parallels the existing earthen embankment that defines the eastern side of the pond. The groundwater elevation measured in the area of the wall ranged from about 910 to 915 feet (14 to 16 feet below ground surface), as just presented. The planned toe of wall elevation in the vicinity of the lake will only modify the ground surface elevation by a few feet (typically less than 3 feet). Due to the depth to ground water and the minor modifications to the ground surface, the construction of the proposed wall south of Bridge 11 will not impact the existing pond.

5.5. Preliminary MSE Wall/Soil Nail Wall Global Stability

The global stability of the proposed cut wall was evaluated with the computer program Slide 6.0 by Rocscience Inc, 439 University Ave Ste 780, Toronto, Ontario M5G 1Y88, e-mail: software@rocscience.com, website: www.rocscience.com.

The global stability analyses were conducted in the longitudinal direction for the Service and for the Extreme Event I limit states. The longitudinal slope stability analyses modeled a vertical MSE wall facing. Slide considers numerous potential failure surfaces extending in front of, behind and through the soil nail reinforced soils, MSE fill, retained soil and foundation soils.

ECS completed the global stability analysis for the abutment walls, soil nail walls and MSE Walls based on subsurface information obtained at the borings drilled in the vicinity of the respective bent locations. The slope stability computer program uses soil shear strength parameters under the Service limit state and the Extreme Event I limit state to estimate the factor of safety against slope instability accounting for force and moment equilibrium. The following sections summarize the soil profiles, shear strength parameters (Effective and Total) and geometry considered in the global stability analysis.

Soil nail walls will be designed and installed by specialty geotechnical design/build contractors. The evaluation presented below is intended to demonstrate the minimum SCDOT global stability requirements can be achieved at the noted portion of the subject wall alignment. The specialty geotechnical design/build contractor must design the wall in accordance with SCDOT requirements including a final global stability analysis based on the contractor's final nail layout and facing.

5.5.1. Slope Stability Model Geometry and Critical Sections

A total of seven (7) cross sections were evaluated for global stability. The seven sections include:

- End Bent 1 – Ramp 2A – Station 109+50, parallel to direction of travel.
- End Bent 1 – Ramp 2A – Station 110+00 (Section is Common to Ramp 2A Station 112+50).
- End Bent 5 – Ramp 1A – Station 50+00, parallel to direction of travel.
- End Bent 5 – Ramp 1A – Station 50+50 (Section is Common to Ramp 2A Station 112+50)
- Roper Mountain Road Station 36+50, transverse to the direction of travel.
- Roper Mountain Road Station 40+00, transverse to the direction of travel.
- Soldier Pile Wall adjacent to Pond – Ramp 1A – Station 53+00, transverse to the direction of travel.

The preliminary global stability analysis was conducted in the transverse direction on Ramp 2A at Station 112+50 for the Service and for the Extreme Event I limit states. This location was selected as the critical section because it represents the maximum wall height. A plan sheet showing the roadways and bridges near cross section locations is attached to this report along with transverse cross sections provided by CECS.

ECS selected a preliminary soil nail spacing of 4 foot horizontally and 4 foot vertically in this analysis. Our analysis considered an initial soil nail length equal to 1.5 times the wall height and a minimum MSE Wall reinforcement length equal to 0.7 times the height of wall.

5.5.2. Shear Strength Parameters

Soil shear strength parameters were selected based on correlations provided in the SCDOT GDM, advanced laboratory testing, and our experience in the Piedmont geologic formation. Section 6.2 of this report further outlines the methods used to estimate shear strength parameters. Tables 36 through 40 summarize the shear strength parameters selected for this analysis for End Bent 1 through End Bent 5.

The Contractor has elected to construct the MSE walls with No. 57 stone which meets the backfill requirements indicated in the SCDOT Supplemental Technical Specification for Mechanically Stabilized Earth (MSE) Walls, which replaces Section 713 of the 2007 Standard Specifications for Highway Construction.

Table 36 – Summary of Shear Strength Parameters (End Bent 1)

Material Description	Effective Stress		Total Stress	
	Friction Angle (ϕ') degrees	Cohesion (c') psf	Friction Angle (ϕ) degrees	Cohesion (c) psf
Existing Fill (ML/MH/CH)	30	50	0	750
Loose to Medium Dense Silty Sand	30	50	30	50
Medium Dense Silty Sand	32	50	32	50
Embankment Fill	32	50	32	50
MSE Wall Fill	36	4000	36	4000

Table 37 – Summary of Shear Strength Parameters (Bent 2)

Material Description	Effective Stress		Total Stress	
	Friction Angle (ϕ') degrees	Cohesion (c') psf	Friction Angle (ϕ) degrees	Cohesion (c) psf
Very Loose Silty Sand	27	50	27	50
Soft Sandy Silt	30	50	30	50
Very Loose Silty Sand	26	50	26	50
Loose Silty Sand	29	50	29	50
Very Dense Silty Sand	36	50	36	50
PWR	36	1000	36	1000
Very Dense Silty Sand	36	50	36	50
PWR	36	1000	36	1000

Table 38 – Summary of Shear Strength Parameters (Bent 3)

Material Description	Effective Stress		Total Stress	
	Friction Angle (ϕ') degrees	Cohesion (c') psf	Friction Angle (ϕ) degrees	Cohesion (c) psf
Existing Fill (ML/SC)	30	50	30	50
Soft Sandy Silt	30	50	30	50
Very Dense Silty Sand	35	50	35	50
PWR	36	1000	36	1000

Table 39 – Summary of Shear Strength Parameters (Bent 4)

Material Description	Effective Stress		Total Stress	
	Friction Angle (ϕ') degrees	Cohesion (c') psf	Friction Angle (ϕ) degrees	Cohesion (c) psf
Very Dense Silty Sand	36	50	36	50
PWR	36	1000	36	1000
Dense Silty Sand	36	50	36	50
PWR	36	1000	36	1000

Table 40 – Summary of Shear Strength Parameters (End Bent 5)

Material Description	Effective Stress		Total Stress	
	Friction Angle (ϕ') degrees	Cohesion (c') psf	Friction Angle (ϕ) degrees	Cohesion (c) psf
Existing Fill (ML/MH/CH)	30	50	0	750
Medium Dense to Dense Silty Sand	34	50	34	50
Embankment Fill	32	50	32	50
MSE Wall Fill	36	4000	36	4000

For granular soils (i.e. any material not classified as SC, MH, CH or CL) and for man made fills, the total stress shear strength parameters are considered equal to the effective stress shear strength parameters. The results of the slope stability analyses and the soil shear strengths used in the soil models are included in Appendix I.

5.5.3. Geotechnical Resistance Factors

The following tables are the geotechnical resistance factors utilized in our analyses of embankments, cut sections, and MSE walls and can be found in the Bridge Design Memorandum – DM0310.

Table 41 – SCDOT Resistance Factors for Flexible Retaining Walls

Performance Limit		Limit States		
		Strength	Service	Extreme Event
Soil Bearing Resistance		0.65	N/A	1.00
Sliding Frictional Resistance		1.00	N/A	1.00
Lateral Displacement		N/A	1.00	1.00
Vertical Settlement		N/A	1.00	1.00
Global Stability Fill Walls	ROC- I, II	N/A	0.65	0.90
	ROC= III		0.75	1.00
Global Stability Cut Walls	ROC- I, II	N/A	0.60	0.90
	ROC= III		0.70	1.00

Table 42 – SCDOT Resistance Factors for Embankments (Fill/Cut Section)

Performance Limit		Limit States		
		Strength	Service	Extreme Event
Lateral Displacement		N/A	1.00	1.00
Vertical Settlement		N/A	1.00	1.00
Global Stability Embankment (Fill)	ROC= I, II	N/A	0.65	0.90
	ROC= III		0.75	1.00
Global Stability Cut Section	ROC= I, II	N/A	0.60	0.90
	ROC= III		0.70	1.00

5.5.4. Static (Service Limit) Slope Stability

The Service limit state was used to evaluate the static slope stability at the End Bents using the Bishop Simplified, Morgenstern-Price, and Spencer methods of analyzing slope stability. In accordance with Table 8-8 in the GDM and Sections 17.3.1 and 17.3.2, a uniform surcharge of 250 psf (Load Factor, $\gamma=1.0$) was used to simulate the live load surcharge (LS) for End-of-Construction and Long Term Loading conditions. In addition, for the Long Term loading condition a dead load surcharge of 140 psf was considered in accordance with Section 17.3.2 of the GDM to represent a 12 inch thick asphalt overlay.

The proposed walls to the north and south of each bent do not directly support infrastructure. Table 8-8 in the GDM does not provide specific guidance for surcharge loading of walls not supporting infrastructure. We considered a uniform surcharge of 140 psf (Load Factor, $\gamma=1.0$) was used to simulate light vehicular or other pedestrian traffic that may approach the walls to the north or south of the abutments. This loading condition was only considered in one stability analysis representing the soldier pile and lagging wall to the south of End Bent 1.

A summary of the static (Service limit state) global slope stability analyses and the governing Demand/Capacity ratios (D/C) is provided in Table 43. The Service limit state slope stability results indicate that the slope stability analysis using the provided soil shear strengths meets the design criteria and that ground modification or additional grid length will not be required.

Table 43 – Static Slope Stability Analysis

Bent Location (Ramp ID & Station No.)	Direction	Loading Condition	Demand/Capacity, D/C			Performance Criteria Met
			Morgenstern - Price	Bishop	Spencer	
Bent 1 Roper Mtn. Rd Sta 36+50	Transverse	ESA	0.61	0.60	0.61	Yes
		TSA	0.48	0.45	0.48	Yes
Bent 1 Ramp 2A Sta 109+50	Longitudinal	ESA	0.63	0.63	0.63	Yes
		TSA	0.52	0.52	0.53	Yes
Bent 1 Ramp 2A Sta 110+00	Longitudinal	ESA	0.61	0.61	0.61	Yes
		TSA	0.52	0.52	0.52	Yes
Bent 2 Roper Mtn. Rd Sta 40+00	Transverse	ESA	0.62	0.62	0.63	Yes
		TSA	0.63	0.63	0.63	Yes
Bent 2 Ramp 1A Sta 50+00	Longitudinal	ESA	0.63	0.63	0.63	Yes
		TSA	0.57	0.57	0.57	Yes
Bent 2 Ramp 1A Sta 50+50	Longitudinal	ESA	0.65	0.65	0.65	Yes
		TSA	0.59	0.60	0.60	Yes
Soldier Pile and Lagging Wall Ramp 1A Sta 53+00	Transverse	ESA	0.53	0.53	0.53	Yes
		TSA	0.27	0.27	0.27	Yes

5.5.5. Seismic Slope Stability

The Extreme Event I limit state is used to evaluate the seismic global slope stability. Section 13.15 of the GDM recommends accounting for Wave Scattering in accordance with Section 13.16 of the GDM when evaluating seismic slope stability of embankments greater than 20 feet in height. We considered wave scattering for a $PGA=0.20$, $S_d=0.14$, wall heights of 21 to 27 feet resulting in a pseudo-static horizontal acceleration (kh) of 0.165 to 0.173, respectively.

As discussed in section 4.3 of this report, ECS evaluated the potential for liquefaction and SSL triggering events in accordance with Section 13.6 of the GDM for both the FEE and SEE seismic events. The analysis indicated that SSL and Liquefaction will not occur and minimum Seismic

D/C is achieved in all cases. Since the analysis demonstrated SSL and Liquefaction will not occur, the global stability analysis considered fully mobilized shear strengths (i.e. no shear strength loss).

The Bishop, Morgenstern-Price, and Spencer slope stability method was used to evaluate the Demand/Capacity ratio (D/C) and slope performance. The analysis considered the surcharge loads presented in Section 5.5.2 of this report with a load factor load factor, $\gamma=0.5$ in accordance with Section 8.7 of the GDM.

Seismic loading was evaluated first evaluated for the Safety Evaluation Earthquake (SEE).

Since minimum stability requirements were achieved in the SEE event, the walls are considered stable by inspection during FEE event. A summary of the seismic global slope stability analyses and the governing Demand/Capacity ratios (D/C) is provided in Table 44.

Table 44 – Extreme Limit State Global Stability Analysis

Bent Location (Ramp ID & Station No.)	Direction	kh	Demand/Capacity, D/C			Performance Criteria Met
			Morgenstern - Price	Bishop	Spencer	
Bent 1 Roper Mtn. Rd Sta 36+50	Transverse	0.2	0.62	0.57	0.61	Yes
Bent 1 Ramp 2A Sta 109+50	Longitudinal	0.173	0.63	0.63	0.63	Yes
Bent 1 Ramp 2A Sta 110+00	Longitudinal	0.173	0.65	0.65	0.65	Yes
Bent 2 Roper Mtn. Rd Sta 40+00	Transverse	0.2	0.79	0.79	0.78	Yes
Bent 2 Ramp 1A Sta 50+00	Longitudinal	0.165	0.70	0.71	0.69	Yes
Bent 2 Ramp 1A Sta 50+50	Longitudinal	0.165	0.69	0.70	0.68	Yes
Soldier Pile and Lagging Wall Ramp 1A Sta 53+00	Transverse	0.20	0.55	0.55	0.55	Yes

5.6. Settlement

5.6.1. Elastic Settlement

Elastic settlements resulting from the embankment construction loading being placed over the unsaturated cohesive soils and cohesionless soils were estimated using the computer program FoSSA by Adama Engineering, Inc. The performance criteria outlined in Chapter 10 of the GDM was referenced to establish acceptable limits for static settlement under the Service Limit State. Refer to Table 47 for a summary of the MSE Wall settlement analysis.

The estimated elastic settlement due the placement of 3 to 17 feet of new fill on the existing approach embankment is estimated to range from less than ¼" to 1 ½ inches. Based on local experience and the available boring and laboratory data, it is anticipated that surcharging would not be necessary during construction and that the total settlement will occur within 2 to 6 weeks following fill placement. Appendix J contains our settlement analysis calculations.

Table 45 - Summary of Settlement Analysis Parameters (End Bent 1)

Material Description	Bottom of Layer Elevation (ft)	Soil Unit Weight (pcf)	Consolidation Parameters					Elastic Modulus (ksf)
			C _c	C _r	e ₀	Preconsolidation Pressure	OCR	
Existing Fill (ML/MH/CH)	935	115	N/A	N/A	N/A	N/A	N/A	182
Loose to Med. Dense Sand	930	110	N/A	N/A	N/A	N/A	N/A	236
Med. Dense Sand	900	120	N/A	N/A	N/A	N/A	N/A	562

Table 46 - Summary of Settlement Analysis Parameters (End Bent 5)

Material Description	Elevation (ft)	Soil Unit Weight (pcf)	Consolidation Parameters					Elastic Modulus (ksf)
			C _c	C _r	e ₀	Preconsolidation Pressure	OCR	
Existing Fill (ML/MH/CH)	933	115	N/A	N/A	N/A	N/A	N/A	240
Med. Dense Sand	925	120	N/A	N/A	N/A	N/A	N/A	720
Med. Dense Sand	917	120	N/A	N/A	N/A	N/A	N/A	1,050
Med. Dense Sand	900.5	120	N/A	N/A	N/A	N/A	N/A	1,030

Table 47 – Summary of Settlement Analysis

Deformation ID No.		Performance Limit	MSE Wall 1	MSE Wall 2
Table 10-37 (Service Limit State)	RV-01	12.00 in.	1.5	0.9
	RV-02	0.10 in./yr.	<0.1 in/yr*	<0.1in/yr*
	RV-03	2.00 in./50 ft.	<1in / 50 ft	<1 in / 50 ft
	RV-04	0.150 L _{Reinf}	<1in	<1in

RV-01: Maximum Vertical Settlement at the top of wall profile grade over the design life of the embankment or wall.

RV-02: Maximum settlement rate per year after the wall has been constructed.

RV-03: Maximum vertical differential settlement observed longitudinally along the top of wall profile grade after the wall has been constructed.

RV-04: Maximum vertical differential settlement observed perpendicular to the top of wall profile after the wall has been constructed.

*Rate to be confirmed through settlement monitoring after fill placement.

5.6.2. Consolidation Settlement

The soils at the approach embankments generally consisted of residual silts and sands. Based on the granular nature of the soils, the elastic settlement estimates are assumed to represent the total at the end bents. The time for 90% of consolidation to occur is anticipated to be on the order of 21 to 45 days. We recommend incorporating a settlement monitoring program to determine when primary consolidation settlement is complete.

5.6.3. Settlement Monitoring

We recommend incorporating a settlement monitoring program to determine when primary consolidation settlement is complete. The settlement monitoring program shall include establishing settlement monitoring instruments on the subgrade soils prior to fill placement. Settlement monitoring instruments are recommended at a spacing of every 100 feet along MSE Walls, with two (2) instruments recommended on MSE Walls with an overall length of less than 200 feet. Instruments shall be established at the centerline of road and edge of roadway. Settlement monitoring devices shall consist of either mechanical devices, vibrating wire settlement cells or piezoelectric settlement monitoring cells at the base of the fill, and monitoring hubs placed within the fill at design top of fill. Monitoring of the MSE wall may also include establishing a control point on the top of the pre-cast concrete panel.

5.7. MSE/Soil Nail Wall Construction

MSE walls will be constructed at each bridge end parallel to the bridge abutment to retain the bridge approach embankment in the longitudinal direction. MSE Wall design and construction shall be in accordance with the Supplemental Technical Specification for Mechanically Stabilized Earth (MSE) Walls SC-M-713.

Soil Nail Wall design and construction must be in accordance with FHWA “Soil Nail Walls Reference Manual” Publication No. FHAW-NHI-147 (dated February 2015). A special provision for Soil Nail Wall construction is provided in Section 7 of this report.

The MSE Walls at End Bents 1 and 5, and combination walls, were evaluated for soil bearing, sliding, overturning, and settlement per SCDOT requirements using boring and laboratory test data at or near the vicinity of the MSE wall locations. The global stability results were presented in Section 5.5 of this report, and the settlement analysis is presented in Section 5.6 of this report. This section discusses external stability and provides minimum reinforcement length recommendations. The Resistance Factors for Flexible Retaining Walls table in Section 5.5 summarizes the minimum resistance factors for embankment sections based on Table 9-7 from the Bridge Design Memorandum – DM0310.

The MSE Wall reinforced zone was modeled based on soil properties outlined in this report. This analysis assumed a reinforced zone approximately 0.8 times the wall height at End Bent 1 and 0.75 times the height of wall at End Bent 5, and assumes that the MSE wall will be designed by an MSE wall design/builder licensed in South Carolina, and that internal stability of the wall will meet or exceed AASHTO and SCDOT requirements. Additional information regarding the soil parameters and the results of the global stability analyses are located in section 6.2 of this report.

Based on the results of the analysis, the available subsurface information, and our experience in the Piedmont formation, we anticipate that the proposed MSE Walls will exhibit geotechnical resistance factors for bearing capacity in accordance with SCDOT requirements.

Table 48 – MSE Wall External Stability Analysis Results

Location	Design Height, H ft ¹	Minimum Reinforcement Length, B _{req} , ft (%H)	Calculated Resistance Factor		Max. Factored Bearing Stress, psf
			Bearing Capacity ²	Sliding ³	
Bridge 11 – Bent 1	0 < H ≤ 10	8 ft (0.8H)	0.46	0.92	3,220
Bridge 11 – Bent 5	0 < H ≤ 17	13 ft (0.76H)	0.42	0.81	4,001

Notes:

1. Height analyzed is measured from top of coping to leveling pad.
2. Minimum Resistance factor is 0.65 for Bearing Capacity
3. Minimum resistance factor is 1.0 for sliding.

The maximum factored bearing stress is about 1.81 times the value obtained from ASD analysis. Therefore, for field inspection purposes, it should be recognized in plan sets and performance documents that this is a factored value.

The required embedment depths for MSE walls should be noted on the plans. These depths are presented in section C.4 of SCDOT's GDM for Mechanically Stabilized Walls. Additional embedment depths may be required based on table C-9 from the GDM as presented below. A horizontal bench with a minimum width of 4.0 feet shall extend from the toe of the wall before sloping to protect against local instability at the base of the wall.

Table 49 – (GDM Table C-9), Minimum MSE Wall Embedment Depth Based on Local Bearing Capacity

Slope in Front of Wall	Minimum Embedment Depth
Horizontal (walls)	H/20
Horizontal (abutments)	H/10
3H:1V	H/10
2H:1V	H/7
1.5H:1V	H/5

Given the gradation of the proposed MSE reinforced backfill, which has a nominal size of about 3/4 inches, it is recommended that the vertical sides of MSE fill exposed to natural soil or soil backfill be covered with a non-woven geotextile that meets the SCDOT Specifications.

To enhance the life of metal reinforcement when roadways are located above an MSE wall, an impervious membrane that meets SCDOT specifications should be placed beneath the pavement aggregate base. A geotextile located at the top of the MSE stone is not required if an impervious membrane is used.

5.8. Preconstruction Surveys and Vibration Monitoring

Some of the Bridge 11 bent locations are situated within 300 feet of existing and/or proposed roadway structures and bridges. In addition, some bents are located within 600 feet of private structures. Vibration monitoring is recommended for roadway structures and bridges within 300 feet of pile driving and for private structures within 600 feet of pile driving. A pre-construction condition assessment must be performed to document the conditions of nearby buildings and sensitive structures prior to the beginning of construction.

5.9. Construction Considerations

As a result of the replacing of the existing Roper Mountain Road overpass over the existing I-85, temporary shoring will be required perpendicular to the existing bridge to allow the construction of the new bridge and for temporary maintenance of traffic. The temporary excavation support is anticipated at the interface between Phase 1 and Phase 2 construction. Temporary excavation support systems consisting of soil nail walls, MSE walls, or internally/externally braced support walls are feasible. The soil parameters provided in Tables 36 and 37 must be used for design.

Existing spread footings, pile caps and piles will likely interfere with the new piles and caps for the interior bents. Thus, these must be removed to accommodate the new piles and caps.

6. EMBANKMENT CONSIDERATIONS

6.1. Borrow Materials

Borrow materials for this project will meet the SCDOT 2007 Standard Specifications for Highway Construction, Section 203.2.1.8. SCDOT specifications indicate that in Greenville County borrow materials are classified as Group A. Borrow materials in Group A require AASHTO soils A-1, A-2, A-3, A-4, A-5, and A-6 to be within the top 5 feet of the embankment. Below a depth of 5 feet, any soil that does not meet the description of muck may be used to form embankments as long as it is stable when compacted to the required density.

Based on the soil borings, it is anticipated that potential project borrow source materials near Bridge 11 will meet the required SCDOT specifications indicated in Section 203.2.1.8 of the SCDOT 2007 Standard Specification for Highway Construction. When borrow sources are identified, bulk samples will be collected and the appropriate soil properties will be tested in accordance with Chapter 7 of the GDM.

6.2. In-Situ Soil Shear Strength

Static short-term soil shear strengths were computed using the SPT soil borings for the evaluation of the Strength and Service limit states. The corrected SPT blow counts were used to obtain total soil shear strength (cohesion, c) for cohesive soils and effective shear strength (internal friction angle, ϕ') for cohesionless soils based on correlations included in the 2010 SCDOT GDM, Sections 7.10 and 7.11, respectively. For sand-like soils (cohesionless soils, $FC \leq 20\%$ and $PI \leq 7$) an internal angle of friction was assigned based on correlations for sands. For clay-like soils (cohesive soils, $FC > 20\%$ and $PI > 7$) a cohesion value was assigned based on correlations for clays. The computed SPT soil shear strength parameters (internal angle of friction and cohesion) parameters were combined and evaluated to use either a lower bound shear strength approach or limit to the maximum allowable total and effective soil shear strengths in general accordance with Tables 7-15 and 7-16 of the SCDOT GDM, unless advanced laboratory testing warranted deviating from the SCDOT GDM.

Table 50 – Summary of Average N-values (End Bent 1)

	N_{meas}	N_{60}	$N_{1,60}$
Existing Fill (ML/MH/CH)	9	14	17
Loose to Medium Dense Silty Sand	10	15	14
Medium Dense Silty Sand	25	36	26
PWR	100	147	144

Table 51 – Summary of Average N-values (Bent 2)

	N_{meas}	N₆₀	N_{1,60}
Very Loose Silty Sand	6	10	12
Soft Sandy Silt	2	3	3
Very Loose Silty Sand	3	5	4
Very Dense Silty Sand	70	103	96
PWR	100	147	145
Very Dense Silty Sand	69	101	91
PWR	100	147	145

Table 52 – Summary of Average N-values (Bent 3)

	N_{meas}	N₆₀	N_{1,60}
Existing Fill (ML/SC)	9	14	17
Very Stiff Clay	18	26	23
Loose to Dense Silty Sand	18	26	23
PWR	100	147	145

Table 53 – Summary of Average N-values (Bent 4)

	N_{meas}	N₆₀	N_{1,60}
Medium Dense to Dense Silty Sand	20	30	34
Very Dense Silty Sand	80	117	112
PWR	100	147	139
Medium Dense to Dense Silty Sand	31	45	40
PWR	100	147	145

Table 54 – Summary of Average N-values (End Bent 5)

	N_{meas}	N₆₀	N_{1,60}
Existing Fill (ML/MH/CH)	16	24	30
Medium Dense to Dense Silty Sand	43	63	56
PWR	100	147	145
Dense to Very Dense Silty Sand	56	83	74
PWR	100	147	145

Seismic soil shear strengths were computed using SPT soil borings for the evaluation of the Extreme Event I limit state. Soils that are not susceptible to soil shear strength loss were assigned the static short-term soil shear strengths. Static long-term soil shear strengths only affect clay-like soils after excess pore water pressure has dissipated. The static long-term soil shear strength of clay-like soils is typically modeled using drained effective shear strength parameters (i.e. internal friction angle, ϕ'). The effective shear strengths of normally consolidated clay soils were computed using the correlations included in SCDOT GDM Section 7.11.2.

7. NOTES ON PLANS

We recommend the following notes be included on the final structure plans:

PILE BEARING (END BENT 1)	
Factored Design Load	125 tons
Geotechnical Resistance Factor	0.65
Nominal Resistance	192 tons
Estimated Loss Due to Scour	N/A
Estimated Loss Due to Downdrag (unfactored)	23 tons
Required Driving Resistance	215 tons

PILE BEARING (BENT 2 AND BENT 4)	
Factored Design Load	105 tons
Geotechnical Resistance Factor	0.5
Nominal Resistance	210 tons
Estimated Loss Due to Scour	N/A
Estimated Loss Due to Downdrag (unfactored)	N/A
Required Driving Resistance	210 tons

PILE BEARING (END BENT 5)	
Factored Design Load	111 tons
Geotechnical Resistance Factor	0.65
Nominal Resistance	170 tons
Estimated Loss Due to Scour	N/A
Estimated Loss Due to Downdrag (unfactored)	15 tons
Required Driving Resistance	185 tons

Method of controlling installation of piles and verifying their capacity: Pile Installation Chart from a wave equation analysis without Pile Driving Analyzer (PDA) testing at interior bents. Pile Installation Chart from a wave equation analysis with PDA testing at End Bents.

The estimated tip elevation at End Bent 1 is 866 feet msl. The required minimum tip elevation to achieve lateral stability is 911 feet msl.

The estimated tip elevation at Bent 2 is 858 feet msl. The required minimum tip elevation to achieve lateral stability is 884 feet msl.

The estimated tip elevation at Bent 4 is 886 feet msl. The required minimum tip elevation to achieve lateral stability is 895 feet msl.

The estimated tip elevation at End Bent 5 is 880 feet msl. The required minimum tip elevation to achieve lateral stability is 922 feet msl.

The top of rock elevation may vary across the bent and may result in varying pile lengths.

Each pile is to be installed in one continuous operation. The contractor must be aware that if an entire pile is not installed in one continuous operation during initial drive, pile freeze (set-up) may occur. The contractor shall anticipate this in preparation of the pile driving operations and shall address this in the pile installation plan.

Reinforced pile tips with teeth shall be used on each steel pile. Installation of the reinforced pile tips with teeth shall be installed according to the manufacturer's recommendations.

For pile driving, the required number of blows must range from 36 to 180 blows per foot for the driving system to be considered acceptable. Practical refusal is defined as 20 blows per inch.

The following estimated parameters were used for performing a drivability analysis for the piles:

PILE DRIVABILITY ANALYSIS				
	End Bent 1	Bent 2	Bent 4	End Bent 5
Skin Quake (QS)	0.10 in.	0.10 in.	0.10 in.	0.10 in.
Toe Quake (QT)	0.10 in.	0.10 in.	0.10 in.	0.10 in.
Skin Damping (SD)	0.05 s/ft.	0.05 s/ft.	0.05 s/ft.	0.05 s/ft.
Toe Damping (TD)	0.15 s/ft.	0.15 s/ft.	0.15 s/ft.	0.15 s/ft.
% Skin Friction	90%	15%	20%	65%
Distribution Shape No.	0.0	0.0	0.0	0.0
Bearing Graph	Proportional	Proportional	Proportional	Proportional
Pile Penetration	93%	95%	86%	90%
Hammer Energy Range	40 – 50 ft.-kips	40 – 50 ft.-kips	40 – 50 ft.-kips	40 – 50 ft.-kips

Note: GRLWEAP (2005) was used to perform the wave equation analysis.

A pile hammer having the rated energy as indicated above is considered suitable for driven pile installation. However, final hammer acceptance is based on a wave equation analysis that accurately reflects the Contractor's proposed driving system.

The contractor must be aware that if an entire pile is not installed in one continuous operation during initial drive, pile freeze (set-up) may occur. The contractor shall anticipate this in preparation of the pile driving operations and shall address this in the pile installation plan.

For additional details on driven piles, refer to Section 711 of the 2007 SCDOT Standard Specifications for Highway Construction. Notes included in these plans are in addition to the requirements of the 2007 Standard Specifications.

Add the following notes to the plans for Interior Bent 3:

DRILLED SHAFT BEARING – BENT 3	
Factored Design Load	420 tons
Factored Resistance – Side	320 tons
Factored Resistance – End	115 tons
Geotechnical Resistance Factor – Side (IGM)	0.60
Geotechnical Resistance Factor – End	0.55
Total Nominal Resistance	740 tons

CONSTRUCTION CASING AND SHAFT DATA TABLE - Bent 3	
Shaft Length (ft.)	64.0
Casing Length (ft.)	38.0
Top of Shaft Elevation (ft.)	920.2
Top of Casing Elevation (ft.)	920.2
Bottom of Casing Elevation (ft.)	882.0
Bottom of Shaft Elevation (ft.)	856.0

The drilled shafts shall have a minimum diameter of 36 inches. The shafts shall have a minimum tip elevation for axial load as indicated in the table above.

Construction casing shall have a minimum diameter of 42 inches and will be required for the installation of the drilled shafts. Support the top of casing to maintain construction tolerances during construction. The casing shall be installed to within +/- 2 feet of the Bottom of Casing Elevation shown in the above table.

Contractor shall be prepared with wet drilling methods in accordance with the 2007 SCDOT Standard Specifications for Highway Construction if dry drilling methods prove unsuccessful.

During construction, the tip elevations of the drilled shafts may vary if rock is encountered at different elevations than shown in the plans. If rock is encountered less than 2 feet higher than the elevation shown, extend the rock socket to the tip elevation shown. If rock is encountered less than 2 feet lower than the elevation shown, lower the tip elevation as needed to maintain the required rock socket depth. If rock is encountered more than 2 feet higher or lower than the elevation shown, notify the Engineer for recommendations.

For additional details on drilled shaft installation, refer to Section 712 of the 2007 SCDOT Standard Specifications for Highway Construction. For Crosshole Sonic Logging of

Drilled Shafts, refer to Section 727 of the Standard Specifications. Notes included in these plans are in addition to the requirements of the 2007 Standard Specifications.

The following notes apply for settlement and displacement monitoring:

The contractor shall establish a monitoring program consisting of settlement instruments. The settlement monitoring program must include establishing settlement monitoring instruments on the subgrade soils prior to fill placement, and at design pavement subgrade elevation. Settlement monitoring instruments are recommended at a spacing of every 100 feet along MSE Walls, with at least one instrument situated within 5 feet of each end bent. Instruments must be established at the centerline of road and edge of roadway. A minimum of 2 measurements must be obtained on monuments prior to fill placement, and instruments must be measured weekly during fill placement. Instrumentation measurements shall be provided to the Geotechnical Engineer within 24 hours of measurements for interpretation. Interpreted results shall be provided to the RCE.

The following Plan Notes apply to temporary shoring walls:

Use buoyant unit weights in computations for soils below the water level. Designer shall determine appropriate water level and consider all unbalanced water forces in design. Design shall accommodate live loading. Use the following soil strength parameters for determining earth pressure coefficients.

Temporary Shoring Wall Soil Design Parameters (End Bent 1)						
Soil Description	Elevation, ft	Cohesion, c (psf)	Friction Angle (ϕ') degrees	Unit Weight (γ), pcf	Active Earth Pressure Coefficient, K_a	Passive Earth Pressure Coefficient, K_p
Existing Fill (ML/MH/CH)	Above 930 ft	-	30	115	0.33	3.0
Loose to Medium Dense Silty Sand	930 ft to 890 ft	-	30	110	0.33	3.0
Medium Dense Silty Sand	890 ft to 875 ft	-	32	120	0.31	3.25

Temporary Shoring Wall Soil Design Parameters (End Bent 5)						
Soil Description	Elevation, ft	Cohesion, c (psf)	Friction Angle (ϕ') degrees	Unit Weight (γ), pcf	Active Earth Pressure Coefficient, K_a	Passive Earth Pressure Coefficient, K_p
Existing Fill (ML/MH/CH)	Above 925 ft	-	30	115	0.33	3.0
Medium Dense to Dense Silty Sand	925 ft to 885 ft	-	34	120	0.28	3.54

The following Plan Notes apply to Mechanically Stabilized Earth walls:

Reinforced Backfill:

Internal Friction Angle (deg) = 36

Total Unit Weight = 120 pcf

Bent 1

Foundation Soils

Total – Internal Friction Angle (deg) = 30

Total – Cohesion = 0 psf

Effective – Internal Friction Angle (deg) = 30

Effective – Cohesion = 0 psf

Wall Height	Min. B_{req}	Factored Bearing (Static)	Factored Bearing (Seismic)
0 < H < 10	8 ft	4,700 psf	7,300 psf

Foundation Soils (Bent 5)

Total – Internal Friction Angle (deg) = 30

Total – Cohesion = 0 psf

Effective – Internal Friction Angle (deg) = 30

Effective – Cohesion = 0 psf

Wall Height	Min. B_{req}	Factored Bearing (Static)	Factored Bearing (Seismic)
0 < H < 17	13 ft	7,000 psf	10,900 psf

The following notes apply for MSE Wall Subgrades:

Prior to construction of the leveling pad and MSE fill, QA representative, shall verify that the retaining wall is founded on subgrade materials possessing the minimum allowable bearing capacity noted on wall plan and elevation sheets. If the QA representative determines that the subgrade is unacceptable for placement of MSE fill, the contractor shall undercut the subgrade to the limits directed by the QA representative. Unacceptable subgrade materials include, but are not limited to, all high plasticity clays and elastic silts (CH, MH), low plasticity clays and silts (CL, ML) with an unconfined

compressive strength less than 2,000 psf, and deleterious debris. Replacement of undercut material will be with Select Backfill Material, meeting requirements outlined in the SCDOT Standard Specifications for Highway Construction.

The foundation area for the MSE wall might have scattered pockets of soft soils that might be present at the surface or just below the surface for the base of the MSE fill. These soft pockets are only expected to extend a few feet below the base of the MSE fill. The quality assurance representative must proofroll the subgrade in this area and/or conduct dynamic cone tests at regular intervals to determine that the subgrade meets the requirements of the paragraph above.

The following notes apply to borrow materials:

Provide borrow materials meeting the following minimum requirements:

- A sandy material with a minimum total soil unit weight, γ_{total} of 105 pcf, with a maximum dry density exceeding 90 pcf.**
- Minimum friction angle, ϕ , of 32° and cohesion, c , of 50 psf for embankment fill.**
- No. 57 Stone backfill for Mechanically Stabilized Earth Walls**

In addition, determine the moisture-density relationship and classification of the material. Test and submit the classification, moisture-density relationship, and soil strength parameters of the material to the Engineer for acceptance. An AASHTO certified laboratory is required to perform the testing. Contact the RPG Geotechnical Engineer for a list of locally available AASHTO certified laboratories. The Department may perform independent testing to assure quality.

Determine the friction angle and cohesion using either direct shear testing or consolidated-undrained triaxial shear testing with pore pressure measurements. Classification testing includes grain-size distribution with wash #200 sieve, moisture plasticity testing and natural moisture content. Use the Standard Proctor test to determine the moisture-density relationship. Remold all samples used in shear strength testing to 95 percent of the Standard Proctor density. Conduct shear strength testing at the initial selection of the borrow pit, any subsequent changes in borrow pits, and for every 1000 cy of materials placed. Perform classification testing for every 5000 cy of materials placed including the material used for the shear strength testing. Additional shear testing may be required if, in the opinion of the RCE, the materials being placed are different from those originally tested.

If these minimum criteria cannot be met, provide the soil parameters for the intended borrow excavation material for the project site to the Engineer for review and acceptance. After acceptable borrow material is obtained, compact the fill to the required finish grade line using the compactive effort indicated in the Standard Specifications for Highway Construction, Section 205 (Embankment Construction).

The following notes apply to muck excavation:

Any areas identified on the plans and any additional areas that are discovered to deflect or settle may require corrective action as directed by the RCE. This may include undercutting, placing No. 57 stone aggregate that is separated from other borrow materials by a geotextile for separation of sub-grade and sub-base, and/or additional compactive effort to the approval of the RCE.

In areas that require mucking or undercutting, borrow material soil may be placed as a bridge lift as long as the grade on which the material is being placed is at least 2 feet above ground water level. In the event that groundwater does not allow backfilling with a borrow material soil, use a No. 57 stone as the bridge lift material. Borrow material bridge lifts may not exceed a 2-foot thickness. The depth at which mucking or undercutting is required is dependent upon encountering a suitable bearing material within the excavation or if a predetermined elevation or depth is required. In most cases, do not undercut more than 3 to 5 feet. The RCE will determine the final mucking or undercutting thickness, unless otherwise specified in the project plans and/or specifications. If a suitable bearing soil is not encountered within this depth range, place a P1 biaxial geogrid with an aperture size of less than or equal to 1 inch beneath a 2-foot thick bridge lift of No. 57 stone. If additional compacted borrow material soil is needed to reach grade, place a geotextile for separation of sub-grade and sub-base between the No. 57 stone and the overlying compacted soil. A bridge lift consisting of borrow material soil may not be placed within 3 feet of the base of the pavement section. Place only compacted borrow material soil or No. 57 stone within this zone. Reference the Standard Specifications for Highway Construction, Earthwork Section, Division 200.

The following is the Special Provision for Soil Nail Wall design and construction.

September 22, 2009

PERMANENT SOIL NAILED RETAINING WALL

Scope of Work

The work covered under this SPECIAL PROVISION includes the furnishing of all materials, labor, tools equipment, and other incidental items for the designing, detailing, construction, and testing of permanent soil nailed retaining wall. The Contractor shall submit the proposed surface finish and provide a sample on-site for Department approval prior to wall construction.

The soil nailed retaining wall shall be constructed from the top down as the soil in front of the wall is removed and the nails are installed and grouted at each level. The exposed soil face shall be protected with a welded wire reinforced shotcrete facing. Drainage systems shall be installed prior to applying shotcrete. A structural cast-in-place or precast concrete facing with architectural finish shall be constructed and suitably attached to the soil nailed retaining structure. Attachment method for facing shall be designed by the Contractor and submitted to the Regional Production Group Structural Design Engineer for review prior to installation.

The soil nail walls addressed in this special provision are part of combination walls, with Mechanically Stabilized Earth (MSE) walls planned above the MSE walls. The design and construction of Soil Nail Walls shall be coordinated with the MSE Wall designer and installer.

Contractor Qualifications

The Contractor or Subcontractor shall be experienced in the design and installation of permanent soil nailed retaining walls. His staff shall include at least one Registered Professional Engineer licensed in the State of South Carolina. The Contractor or Subcontractor shall have the following qualifications:

I. Design:

The designer shall have designed a minimum of three permanent soil nailed retaining walls in the past three years, with one permanent soil nailed retaining wall of at least 20 feet in height. The Design Engineer shall be available at any time during the life of the Contract to discuss the design of the soil nailed structure directly with the Department.

Design the soil nail walls in accordance with “FHWA Geotechnical Engineering Circular No. 7 - Soil Nail Walls Reference Manual” FHWA Publication No. FHWA-NHI-14-007.

II. Construction:

- (1) The Supervising Engineer shall have constructed a minimum of three permanent soil nailed retaining walls in three years, with one permanent soil nailed retaining wall of at least 20 feet in height.
- (2) The Foreman shall have constructed a minimum of three permanent soil nailed retaining walls in three years, with one permanent soil nailed retaining wall of at least 20 feet in height.
- (3) The Drill Operator shall have installed soil nails on a minimum of three permanent soil nailed retaining walls in three years, with one permanent soil nailed retaining wall of at least 20 feet in height.
- (4) Shotcrete Supervisor shall have supervised the application of shotcrete on projects of comparable nature or work for at least three years
- (5) Shotcreting Nozzle Operators shall have at least 1 year experience in the application of shotcrete on projects of comparable nature or work under the immediate supervisions of a foreman or instructor with at least 2 years of such experience.

General

Unless otherwise specified, section references in this specification are to the South Carolina Department of Transportation Standard Specifications for Highway Construction, Edition of 2007.

The Contractor shall select the nail installation method and may increase the drill hole diameter or length, within the property constraints shown on the plans, to develop the required design loads. The Contractor will also be required to locate any underground utilities and adjust location of soil nails accordingly.

Materials

- (1) *Steel Nails:* AASHTO M 31/ASTM A 615. Threaded, a minimum of 6 inches on the wall anchorage end, to allow proper attachment of bearing plate and nut. Threading may be continuous spiral deformed ribbing provided by the bar deformations (continuous thread bars) or may be cut into a reinforcing bar. If threads are cut into a reinforcing bar, provide the next-larger bar number designation from that shown on the Plans, at no additional cost.
- (2) *Corrosion Protection:* Where required, corrosion protection shall consist of one of the following:

- (a) **Epoxy Coating:** The epoxy coating shall be in accordance with AASHTO M 284/ASTM A 775. Bend test requirements shall be waived. Epoxy coating is for soil nails.
- (b) **Galvanizing:** Galvanizing shall be done in accordance with AASHTO M 111/ASTM A 123 or AASHTO M 232/ASTM A 153 as applicable.
- (c) All steel components shall be encapsulated in grout or shotcrete with adequate cover.
- (3) **Steel Welded Wire Fabric:** Steel Welded Wire Fabric shall conform to the requirements of AASHTO M 55/ASTM A 185.
- (4) **Reinforcing Steel:** All steel used for reinforcement other than soil nails shall be ASTM A 706.
- (5) **Shotcrete Specifications:** This work consists of constructing one or more courses of shotcrete on a prepared surface. Refer to shotcrete specifications at the end of this section. The shotcrete will be a permanent facing and shall have a minimum of 6 inches thickness.
- (6) **Grout for Nails:** Provide a neat cement or a sand/cement mixture with a minimum 3-day compressive strength of 1,500 psi and a minimum 28-day compressive strength of 3,000 psi, per AASHTO T 106/ASTM C 109 to be used in soil nail anchorage consisting of a pumpable mixture. Admixtures that control bleed, improve flowability, reduce water content, and retard set may be used in the grout subject to review and acceptance by the Engineer. Accelerators are not permitted. Expansive admixtures may only be added to grout used for filling sealed encapsulations. Admixtures shall be compatible with the grout and mixed in accordance with the manufacturer's recommendations. No admixtures will be allowed that could have corrosive properties or can cause deterioration of the nails' protective epoxy coating. The Contractor shall submit documentation to the Engineer showing that the admixtures used will not be detrimental to the nails or their protective epoxy coating.
- (7) **Fasteners and Attachment Devices:** Provide high strength nuts conforming to AASHTO M 291, Grade B, Hexagonal, or equivalent. Hexagonal nut shall be fitted with beveled washer or spherical seat to provide uniform bearing. Provide plates conforming to AASHTO M 183/ASTM A 36 or equivalent. Shear connector studs on bearing plates shall be in accordance with 709.2.2. Provide only plastic centralizers of a minimum diameter of 1 in. smaller than the nominal diameter of the drill hole which permit free flow of grout.
- (8) **Centralizers:** Centralizers shall be manufactured from Schedule 40 PVC pipe securely attached to the soil nail. The centralizers shall be sized to position the soil nail within 1 inch of the center of the drill hole, sized to allow trimie pipe insertion to the bottom of the drill hole, and sized to allow grout to freely flow up the drill hole. Centralizers must be provided inside and outside of encapsulated nail assemblies and shall be spaced no further than 8 ft. apart. Centralizers shall also be located no further than 1.5 ft. from each end of end of the soil nails.
- (9) **Geocomposite Wall Drains:** Geocomposite wall drains shall consist of Ameridrain C-90 by American Wick Drain, Inc. or equivalent.

Shotcrete Specifications

I. Materials

- (1) Use the South Carolina Department of Transportation Standard Specifications for Highway Construction, Edition of 2007 for the following:
 - (a) Air-entraining admixture, Section 701.2.5.1 (wet mix only)

- (b) Chemical admixtures, Section 701.2.6 (wet mix only)
 - (c) Curing material, Section 702
 - (d) Cement, Section 701
 - (e) Pozzolans, Section 701
 - (f) Reinforcing steel, 703 (also see above)
- (2) Shotcrete Aggregate
- (a) For fine aggregate, furnish rounded particles conforming to AASHTO M 6 Class B including the reactive aggregate supplementary requirement, except as amended or supplemented by the following:

 Material passing 75- μ m sieve, AASHTO T 11/ASTM C 117: 3.0% max

 Sand equivalent value, AASHTO T 176: 75 min. referee method
 - (b) For coarse aggregate, conform to AASHTO M 80 Class B, except as amended or supplemented by the following:

 Los Angeles abrasion, AASHTO T 96/ASTM C 131: 40% max

 Combine the aggregates to meet the designated gradation in Table 1.

Table 1: Shotcrete Gradation Limits for Combined Aggregates

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27)		
	Grading Designation		
	A	B	C
19 mm	100	100	100
12.5 mm	100	100	80-95
9.5 mm	100	90-100	70-90
4.75 mm	95-100	70-85	50-70
2.4 mm	80-100	50-70	35-55
1.2 mm	50-85	35-55	20-40
600 μ m	25-60	20-35	10-30
300 μ m	10-30	8-20	5-17
150 μ m	2-10	2-10	2-10

II. Reinforcing

Contractor may elect to use deformed bar reinforcing steel in instead of welded wire reinforcement.

III. General

Conform to the following:

- (1) ACI 506R Guide to Shotcrete

- (2) ACI 506.2 Specifications for Proportioning Application of Shotcrete
- (3) AASHTO C 311 Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Concrete
- (4) ASTM C 1077 Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation

IV. Preconstruction Submissions

- (1) Shotcrete material, equipment, preparation, and application. Submit the following to the Engineer for acceptance at least 30 days before placing shotcrete:
 - (a) Description of proposed equipment for mixing and applying shotcrete conforming to Section V. Include the manufacturer instructions, recommendations, literature, performance, and test data.
 - (b) Proposed shotcrete mix design conforming to Section VI with mix proportions.
 - (c) Representative samples of shotcrete material, if requested by the Engineer.
 - (d) Results of all shotcrete preconstruction testing conforming to Section VII.
 - (e) Proposed method for applying and curing shotcrete conforming to Sections VIII, IX, and X.
 - (f) Other information necessary to verify compliance with ACI 506.2.
 - (g) Certification that shotcrete conforms to the standards specified herein.
- (2) Submit the following to the Engineer for acceptance at least 30 days before placing shotcrete:
 - (a) *Project references:* Include project name, owner's name, and phone numbers for completed projects as described in "Contractor Qualifications" above.
 - (b) *Nozzle Operator's experience and training;* For each nozzle operator, include shotcrete application experience on at least two projects of comparable nature and showing that they meet the qualifications described in "Contractor Qualifications" above.
 - (c) *Shotcrete Supervisor experience:* Include direct shotcrete application experience on at least three comparable projects and showing that they meet the qualifications described in "Contractor Qualifications" above.
 - (d) *Testing Laboratory certification;* Include documentation that the strength-testing laboratory complies with ASTM C 1077 and has the experience to perform the tests specified in this section. The testing laboratory shall be AASHTO accredited for ASTM C 1077 or demonstrate the ability to perform the requisite tests.

V. Equipment

- (1) *Water Supply System:* For dry mix, provide a water storage tank at the job site. Provide a positive displacement pump with a regulating valve that is accurately controlled to provide water in the pressures and volumes recommended by the delivery machine manufacturer.
- (2) *Mixing:* Use equipment capable of handling and applying shotcrete containing the specified maximum size aggregate and admixtures. Provide an air hose and blowpipe to clear dust and rebound during shotcrete application.
- (3) *Air Supply System:* Use an air supply system capable of supplying the delivery machine and hose with air at the pressures and volumes recommended by the machine manufacturer. Do not use air supply systems that deliver oil-contaminated air or are incapable of maintaining constant pressure.
- (4) *Delivery Machine:* Use a delivery machine capable of supplying material to the delivery hose at a uniform rate. The ejection from the nozzle must adhere to the treated surface with minimum rebound and maximum density when the nozzle is held in the range of 3 to 6 ft from the target surface.

VI. Composition (Shotcrete Mix Design)

- (1) Design and produce shotcrete mixtures conforming to Table 2 for the type of shotcrete specified. Use the amount of water required to produce shotcrete of suitable strength, consistency, quality, and uniformity with the minimum amount of rebound. Use the same material types and sources as submitted with the mix design in the field trials and production work.
 - (a) *Hydration stabilizing admixtures:* Hydration stabilizing admixtures may be used to extend the allowable delivery time for shotcrete. Dosage is based on the time needed to delay the initial set of the shotcrete for delivery and discharge on the job. Design shall include discharge time limit in the dosage submittal. Dosage required to stabilize shotcrete shall be determined using job site material and field trial mixtures. The extended-set admixture shall control the hydration of all cement minerals and gypsum. The maximum allowable design discharge time is 3.50 hours.
 - (b) If a hydration-stabilizing admixture is approved for use in the concrete mix, concrete shall be delivered and placed within the approved design discharge time limit. An approved and compatible hydration activator may be used at the discharge site to insure proper placement and testing.
 - (c) Dosage and type of extended-set admixture shall be included with proposed mix design. When requested, the admixture manufacturer shall provide the service of a qualified person to assist in establishing the proper dose of extended-set admixture and make dosage adjustments required to meet changing job site conditions.

Table 2: Composition of Shotcrete

Type of Shotcrete Process	Minimum Cement Content	Maximum W/C ⁽¹⁾ Ratio	Air Content Range (%)	Minimum 28-Day Compressive Strength ⁽³⁾
	(lb/cy)			(psi)
Wet	550	0.55	NA	150
Dry	550	0.50	NA	150
Wet (w/EA) ⁽²⁾	550	0.45	5 min	150
Dry (w/EA) ⁽²⁾	550	0.45	5 min	150

Notes: (1) W/C = Water/Cement (by weight)

(2) EA = Entrained Air

(3) According to AASHTO T 23

VII. Preconstruction Testing

Conduct preconstruction shotcrete field trials before starting shotcrete production. Allow the Engineer the opportunity to witness all phases of the preconstruction testing.

- (1) *Field Trials:* Construct wood forms at least 6 in. thick by 3 ft by 3 ft in size. Have each proposed nozzle operator make test panels on two vertical wood forms. Cure the test panels according to AASHTO T 23/ASTM C 31, without immersing the panels.
- (2) *Coring:* Drill six 3 in. diameter cores from each test panel according to AASHTO T 24/ASTM C 42. Trim the ends of the cores according to AASHTO T 24/ASTM C 42 to make cylinders at least 3 in. long.
- (3) *Compressive Strength Testing:* Soak the cylinders in water for 40 hours immediately before testing. Test three cylinders from each test panel four days after field trial and test the remaining three cylinders 28 days after the field trial. Perform tests according to AASHTO T 23/ASTM C 31. All specified strength requirements shall be satisfied before the shotcrete mix design will be considered for acceptance.
- (4) *Mix Design Acceptance:* The Engineer will accept or reject the shotcrete mix design based on the results of the preconstruction field trials and testing. Before approving any changes to a previously accepted mix design, the Engineer may require additional preconstruction testing at no additional cost to the Department.

VIII. Surface Preparation and Application of Shotcrete

- (1) *Surface Preparation:* Clean loose material, mud, rebound, and other foreign matter from all surfaces to receive shotcrete. Remove curing compound on previously placed shotcrete surfaces by sandblasting. Install approved depth gages to indicate the thickness of the shotcrete layers. Install depth gages on 6 ft centers longitudinally and transversely with no less than two gauges per increment of surface area to receive the shotcrete. Moisten all surfaces.
- (2) *Weather Limitations:* Place shotcrete when the ambient temperature is 41°F(5°C) or higher. Do not perform shotcrete operations during high wind and heavy rains.
- (3) *Shotcrete Application:*
 - (a) Do not apply shotcrete to frozen surfaces.
 - (b) Use acceptable nozzle operators who have fabricated acceptable test panels and have meet qualifications described above.
 - (c) Apply shotcrete within 45 minutes of adding cement to the mixture. Apply shotcrete at a temperature between 50°F(10°C) and 86°F(30°C).
 - (d) Direct the shotcrete at right angles to the receiving surface except when shooting ground reinforcing bars. Apply shotcrete in a circular fashion to build up the required layer thickness. Apply shotcrete in a steady uninterrupted flow. If the flow becomes intermittent, direct the flow away from the work area until it becomes steady.
 - (e) Make the surface of each shotcrete layer uniform and free of sags, drips, or runs.
 - (f) Limit the layer thickness of each shotcrete application to 2 in. Thicker applications may be approved if the Contractor can demonstrate that no sloughing or sagging is occurring. If additional thickness is required, broom or scarify the applied surface and allow the layer to harden. Dampen the surface before applying an additional layer.

- (g) Remove laitance, loose material, and rebound. Promptly removed rebound from the work area.
 - (h) Taper construction joints to a thin edge over a distance of at least 1 foot. Wet the joint surface before placing additional shotcrete on the joint. Do not use square construction joint.
- (4) *Production Summary:* Prepare and submit a summary of shotcrete production application for each shift. Furnish the summary to the Engineer within 24 hours. Include the following information in the report:
- (a) Quantity and location of shotcrete applied including sketches.
 - (b) Observations of success or problems of equipment operation, application, final product conditions, and any other relevant issues during production and application.
 - (c) Description of placement equipment.
 - (d) Batch number(s) if applicable.

IX. Quality Control Records

Submit field quality control test reports within two working days of performing the tests. Include the following information in the reports:

- (a) Sample identification including mix design and test panel number and orientation.
- (b) Date and time of sample preparation including curing conditions and sample dimensions.
- (c) Date, time, and type of test.
- (d) Complete test results including load and deformation data during testing, sketch of sample before and after testing, and any unusual occurrences observed.
- (e) Names and signature of person performing the test.
- (f) Location of steel reinforcement, if used, covered by shotcrete.
- (g) Name of nozzle operator.

X. Protection and Curing

Protect and cure the surface according to Section 702.4.4.2. Protect and maintain shotcrete at a temperature above 41°F (5°C) until shotcrete has achieved a minimum strength of 750 psi.

XI. Acceptance

Material for concrete will be evaluated by visual inspection of the work, conformance testing and by certification for materials manufactured off-site. Compressive strength will be evaluated by conformance testing using Table 2 for specification limits. See Table 3 for minimum sampling and testing requirements and acceptance quality category.

Table 3: Sampling and Testing of Shotcrete

Material or Product	Property or Characteristic	Category	Test Methods or Specifications	Frequency	Sampling Point
Shotcrete	Air content	--	AASHTO T 152/ASTM C 231 or AASHTO T 196/ASTM C 173	1 per load ⁽¹⁾	Truck, mixer or agitator ⁽²⁾
	Unit Mass	--	AASHTO T 121/ASTM C 138	1 per load ⁽¹⁾	Truck, mixer or agitator ⁽²⁾
	Compressive strength	II	AASHTO T 23/ASTM C 31	1 set per 33 CY, but not less than 1 set each day ⁽³⁾	Production test panels ⁽³⁾

- Notes: (1) When continuous mixing is used sample every 10 CY.
 (2) Sample according to AASHTO T 141/ASTM C 172
 (3) Prepare production test panels according to Section VII. Obtain two 3-in. diameter core specimens from each panel according to AASHTO T 24/ASTM C 42. A single compressive strength test result is the average result from two 3-in. diameter core specimens from the same test panel tested according to AASHTO T 23/ASTM C 31 at 28 days.

Submittals

The Contractor shall also submit at least 30 days prior to beginning construction of soil nailed retaining wall the following:

- (1) Resumes of personnel described in “Contractor Qualifications” above. The resumes shall include project names, description, and owner contact information on the projects described in “Contractor Qualifications” above.
- (2) Design Calculations.
- (3) Construction Drawings.
- (4) Shop Drawings.
- (5) Construction procedures and detailed construction sequencing plans, including excavation sequence.
- (6) Test nail procedures.
- (7) Material and mill test certificates.
- (8) Mix designs.
- (9) Any other details necessary for successful completion of this work.

The above submittals shall be prepared and sealed by the Design Engineer who must be registered as a Professional Engineer in the State of South Carolina. Design the soil nail walls in accordance with “FHWA Geotechnical Engineering Circular No. 7 - Soil Nail Walls Reference Manual” FHWA Publication No. FHWA-NHI-14-007.

The Contractor will be notified by the Resident Construction Engineer of acceptance or rejection of submissions within 21 days of receipt of each submission.

Work shall not be started and no materials shall be ordered until the all submissions have been approved in writing by the Engineer. If work is suspended due to the substitution of unqualified personnel, the Contractor shall be fully liable for additional costs resulting from the suspension of the work and no adjustments in contract time resulting from the suspension will be allowed.

The Department will be the sole judge of the adequacy of the information submitted. The review and acceptance of the final design plans, shop plans, and methods of construction by the Department shall not in any way relieve the Contractor of his responsibility for the successful completion of the work or the proper design of soil nailed retaining wall. Contractor delays due to untimely submissions and insufficient information shall not be considered as justification for time extensions.

Design Calculations

The design calculations shall include, but not be limited to:

- (1) A written summary report which describes the overall soil nailed retaining wall design.
- (2) Applicable code requirements and design references.
- (3) Soil nailed retaining wall design cross-section(s) geometry including soil/rock strata and location, magnitude, and direction of design slope or external surcharge loads and piezometric levels.
- (4) Design criteria including soil/rock shear strengths (friction angle and cohesion), unit weights, and ground-grout pullout resistances and nail drillhole diameter assumptions for each soil/rock strata.
- (5) Partial safety factors/strength factors (for Service Load) used in the design of the pullout resistance, surcharges, soil/rock unit weights, nail head strengths, and steel, shotcrete, and concrete materials. Minimum required global stability soil factor of safety for SLD design or minimum required global stability soil resistance/ load ratio for LRFD design.
- (6) Seismic design acceleration coefficient
- (7) Design calculation sheets with project number, wall location, designation, date of preparation, initials of designer and checker, and page number at the top of each page. Provide an index page with the design calculations.
- (8) Design notes including an explanation of any symbols and computer programs used in the design.
- (9) Soil nail wall final design cross-section(s) geometry including soil/rock strata and location, magnitude, and direction of slope or external surcharge loads and piezometric levels with slip critical surface shown along with a minimum calculated global stability soil factor of safety for SLD design or for minimum global stability soil resistance/load ratio for LRFD design and required nail lengths and strengths (nail bar sizes and grades) for each nail row.
- (10) Any other geotechnical parameters used in the design that are not mentioned above.
- (11) Any other necessary design calculations, such as for the connection of architectural facing to the soil nailed retaining wall and connections of soil nailed retaining wall and architectural facing around drainage facilities.

Construction

- (1) *Excavation:* Excavation to be made to the limits and construction stages indicated on the plans. Excavation shall proceed in stages, exposing the minimum amount of soil or rock face which will allow the practical and expeditious application of the initial layer of shotcrete and the installation of soil nails while assuring stability of the excavated face and minimizing ground movements.
- (2) *Shotcreting:* After each stage cut, in anticipation of shotcreting, clean surfaces of all loose material, mud, rebound from previously placed shotcrete and other foreign material that will prevent bond of shotcrete. Dampen surface before shotcreting. Install permanent drainage as specified in the submitted plans. Connect drainage system at the bottom of the wall in such a manner as to carry the water away from the toe. Use weep holes, horizontal drains, or other methods to control seepage.

Control thickness, method of support, air pressure and water content of shotcrete to preclude sagging or sloughing off.

Shotcrete shall emerge from the nozzle in a steady uninterrupted flow.

- (3) *Attachment of Nail Head Bearing Plate and Nut:* Attach a bearing plate, washers, and nut to each nail head as shown on the plans. While the shotcrete construction facing is still plastic and before its initial set, uniformly seat the plate on the shotcrete by hand-wrench tightening the nut. Where uniform contact between the plate and the shotcrete cannot be provided, set the plate in a bed of grout. After grout has been set for 24 hours, hand-wrench tighten the nut. Ensure bearing plates with headed studs are located within the tolerances shown on the plans.
- (4) *Shotcrete Facing Tolerances:* Construction tolerances for the shotcrete facing from the plan location and plan dimensions are as follows:
 - (a) Horizontal location of welded wire mesh and reinforcing bars: 0.4 in
 - (b) Spacing between reinforcing bars: 1 in
 - (c) Reinforcing lap, from specified dimension: 1 in
 - (d) Complete thickness of shotcrete:
 - If troweled or screeded: 0.6 in
 - If left as shot: 1.2 in
 - (e) Planeness of finish face surface-gap under 10 ft straightedge:
 - If troweled or screeded: 0.6 in
 - If left as shot: 1.2 in
 - (f) Nail head bearing plate deviation from parallel to wall face: 10 degrees
- (5) *Nail Installation:* Drill holes for soil nails at the locations required in the submitted plans. Provide nail length and nail diameter necessary to develop load capacity to satisfy testing acceptance criteria for the design load required. Core drilling, rotary drilling, or auger drilling can be used. It shall be the Contractor's responsibility to choose drilling methods that will maintain open holes and do not promote mining and loosening of the soil at the perimeter of the drill hole or fracture soils with weak stratification planes by use of high flush volumes and pressures. At the ground surface the drill hole shall be located within 6 inches of the location shown on the submitted plans. At the point of entry the nail angle shall be within plus or minus 3 degrees of that shown on the approved plans. The nails shall not extend more than

24 feet measured horizontally from the face of the wall. Subsidence or physical damage by such operations shall be cause for immediate cessation of operations and repair at Contractor's expense.

Inject grout at the lowest point of the drill hole. Pump grout through grout tubes, casing, or drill rods such that the hole is filled to prevent air voids with grout progressively from the bottom to the top. Grout until the hole is completely filled with grout and clean grout is seen to run from the top of the hole.

Provide grouting equipment capable of continuous mixing and producing a grout free of lumps. Nails shall be placed in each drilled hole within 15 minutes of the grout injection.

Mortar packing and secondary grouting to the wall face shall be accomplished as soon as practical after nail installation.

(6) *Nail Testing:*

(a) *Equipment:* A dial gauge capable of measuring to 0.001 of-an-inch shall be used to measure movement. A hydraulic jack and gauge calibrated as a unit shall be used to apply the test load. The pressure gauge shall be graduated in 100 psi increments or less and used to measure the applied load. The test loads shall be applied incrementally.

(b) *Verification Testing:* Install 1 nail per horizontal row but no more than 1 percent of the total number of nails as non-service nails for Verification Testing. Verification Testing should be performed in accordance with Section 9.4.3 of FHWA Geotechnical Circular No. 7. The shop drawing submittal should identify location of test nails, bond length, Verification Test Load (VTL) and detailed Verification Test Loading Schedule..

All nail test results shall be submitted to the Regional Production Group Structural Engineer for review.

(c) *Proof Testing:* Proof test a minimum of 5 percent of production nails in accordance with Section 9.4.3 of FHWA Geotechnical Circular No. 7. The shop drawing submittal shall identify Proof Test Load (PTL) and provide a detailed Proof Test Loading Schedule.

All nail test results shall be submitted to the Regional Production Group Structural Engineer for review.

(d) *Acceptance Criteria:* The nail is deemed acceptable if:

1. No pullout occurs at loads less than 1.0 PTL or VTL.
2. The total soil nail movement (Δ PTL or Δ VTL) measured at PTL or VTL is greater than 80 percent of the theoretical elastic elongation of the unbonded length, as defined below.
3. The creep movement does not exceed the criteria presented in Section 9.4.5 of FHWA Geotechnical Circular No. 7

(7) *Construction Sequencing:* Follow closely the construction sequence on the approved plans.

(8) *Storage and Handling:* Nails, cement, bars and drainage material shall be kept dry and stored in a protected location. Bars shall be placed on supports to prevent contact with ground. Replace any bars that exhibit abrasions, cuts, welds, weld splatter, corrosion, or pitting. Bars shall be replaced or repaired that exhibit damage to encapsulation or epoxy coating. For repair of epoxy coated bars, the areas shall have a minimum 0.3 mm (0.012 inch) thick coat.

Shop Plans

The shop plans shall include, but not be limited to:

- (1) A plan view of the wall identifying:
 - (a) A reference baseline and elevation datum.
 - (b) The offset from the construction centerline or baseline to the face of the wall at its base at all changes in horizontal alignment.
 - (c) Beginning and end of wall stations.
 - (d) Right-of-way and permanent or temporary construction easement limits, location of all known active and abandoned existing utilities, adjacent structures, or other potential interferences. The centerline of any drainage structure or drainage pipe behind, passing through, or passing under the wall.
 - (e) Limit of longest nails.
 - (f) Subsurface investigation locations shown on a plan view of the wall alignment with appropriate reference baselines to fix the locations of the explorations relative to the wall.
- (2) An elevation view of the wall indentifying:
 - (a) The elevation at the top of the wall, at all horizontal and vertical break points, and at least every 10 feet along the wall.
 - (b) Elevations at the finished grade at front of architectural finished face, at front face of soil nailed wall base and the top of the leveling pad for architectural faced wall, if split faced block or cast-in-place facing are used.
 - (c) Beginning and end of wall stations.
 - (d) The distance along face of wall to all steps in the wall base.
 - (e) Wall elevation view showing nail locations and elevations, vertical and horizontal nail spacing, the location of wall drainage elements, and the location of permanent facing expansion/contraction joints along the wall length (if applicable).
 - (f) Existing finished grade profiles both behind and in front of the wall.
- (3) Design parameters and applicable codes.
- (4) General notes for constructing the wall including construction sequencing or other special requirements.
- (5) Horizontal and vertical curve data affecting the wall and wall control points. Match lines or other details to relate wall stationing to centerline stationing.
- (6) A list of the quantities showing estimated surface area of wall face and other pay items.
- (7) Soil nailed wall typical sections staged excavation lift elevations, wall and excavation face batter, nail and spacing inclination, nail bar sizes, and corrosion protection details.

- (8) A typical detail of production and test nails defining nail length, minimum drill hole diameter, inclination, and test nail bonded and unbonded test lengths.
- (9) Details, dimensions, and schedule for all nails, reinforcing steel, wire mesh, bearing plates, headed studs, etc. and attachment devices of architectural facing.
- (10) Dimensions and schedules of all reinforcing steel including reinforcing bar bending details.
- (11) Details and dimensions for wall appurtenances such as barriers, coping, drainage gutters, fences.
- (12) Details for constructing wall around drainage facilities.
- (13) Details for terminating wall and adjacent slope construction.
- (14) Facing finishes, color and architectural treatment requirements for permanent wall facing elements.

Redesign

If anchors fail during performance tests or proof tests, the Contractor shall modify the design or construction procedures, subject to review by the Department. These modifications may include reducing the soil nail load by increasing the number of nails, increasing the grout pressure, requiring post-grouting or increasing the bond length (within parameters of the plans). Any modification of design or construction procedure shall be at no cost to the Department. The redesigned anchors shall be installed and tested as previously defined at no cost to the Department. Those nails that fail the performance tests may be incorporated in the structure. The Contractor shall propose a reduced Design Load and retest as noted above. Acceptance of such anchors will be at the discretion of the Department.

Method of Measurement

The quantities to be paid for shall be the total square feet of soil nailed wall with architectural face area completed and accepted.

8. GENERAL COMMENTS

Due to the prevailing geology, changes in the subsurface conditions can occur over relatively short distances that have not been disclosed by the results of the borings evaluated. Consequently, there may be undisclosed subsurface conditions that require special treatment or additional preparation once these conditions are revealed during construction.

Our evaluation of foundation support conditions has been based on our understanding of the site and project information and the data obtained in our evaluation. The general subsurface conditions utilized in our foundation evaluation have been based on interpolation of subsurface data between and away from the test holes. If the project information is incorrect or if the structure locations (horizontal or vertical) and/or dimensions are changed, please contact us so that we can review our recommendations and revise, if necessary. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration must be reported to us for our evaluation. The assessment of site environmental conditions for the presence of pollutants in the soil, rock, and groundwater of the site was beyond the scope of services for this project.

The recommendations outlined herein must not be construed to address moisture or water intrusion effects after construction is completed. Proper design of landscaping, surface and subsurface water control measures are required to properly address these issues. In addition, proper operation and maintenance of building systems is required to minimize the effects of moisture or water intrusion. The design, construction, operation, and maintenance of waterproofing and dampproofing systems are also beyond the scope of services for this project.

APPENDICES

Appendix A – Site Vicinity Map and Boring Location Diagram

Appendix B – Bridge 11 Boring Logs

B11-SPT-01 through B11-SPT-06, W1A-1R-03, W1A-1R-04, W2A-1R-03,
W2A-1R-04, WRM-1L-01 AND WRM-2L-01 by Thompson Engineering
B-30 and B-31 by Florence & Hutcheson

Appendix C – Advanced Laboratory Test Results

Appendix D – Plan and Profile Drawings: Bridge 11- Replace Roper Mountain Road
Overpass over I-85

Appendix E – SCDOT MASW Curves/Responses

Appendix E-1 – Liquefaction and Shear Strength Loss Triggering Evaluation

Appendix F – Driven Pile Axial resistance and Capacities

Appendix G – Axial Capacity of Drilled Shafts

Appendix H – Lateral Pile Response Analysis

Appendix I – Global Stability Analysis

Appendix I-1 – MSE Wall External Stability Analysis Results

Appendix J – Settlement Analysis

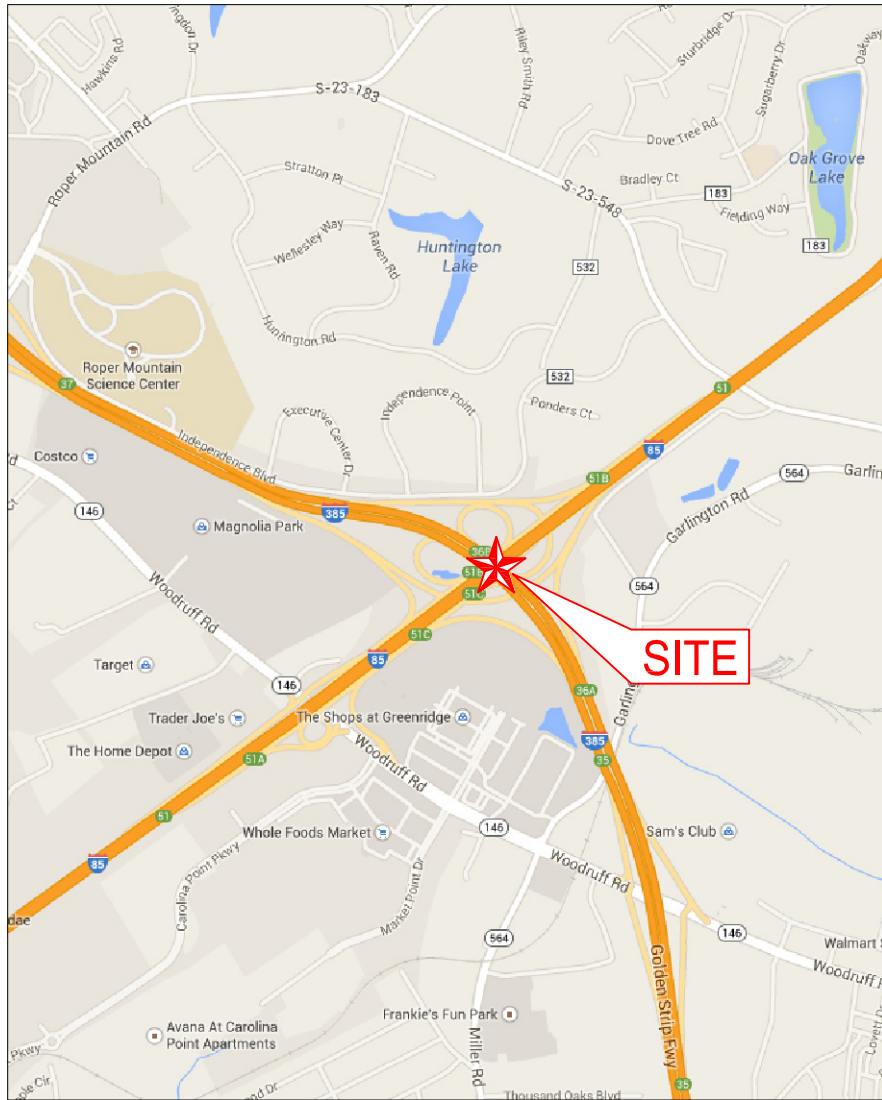
Appendix K – Test America Analytical Report

Appendix L – F&H Geotechnical Data Report

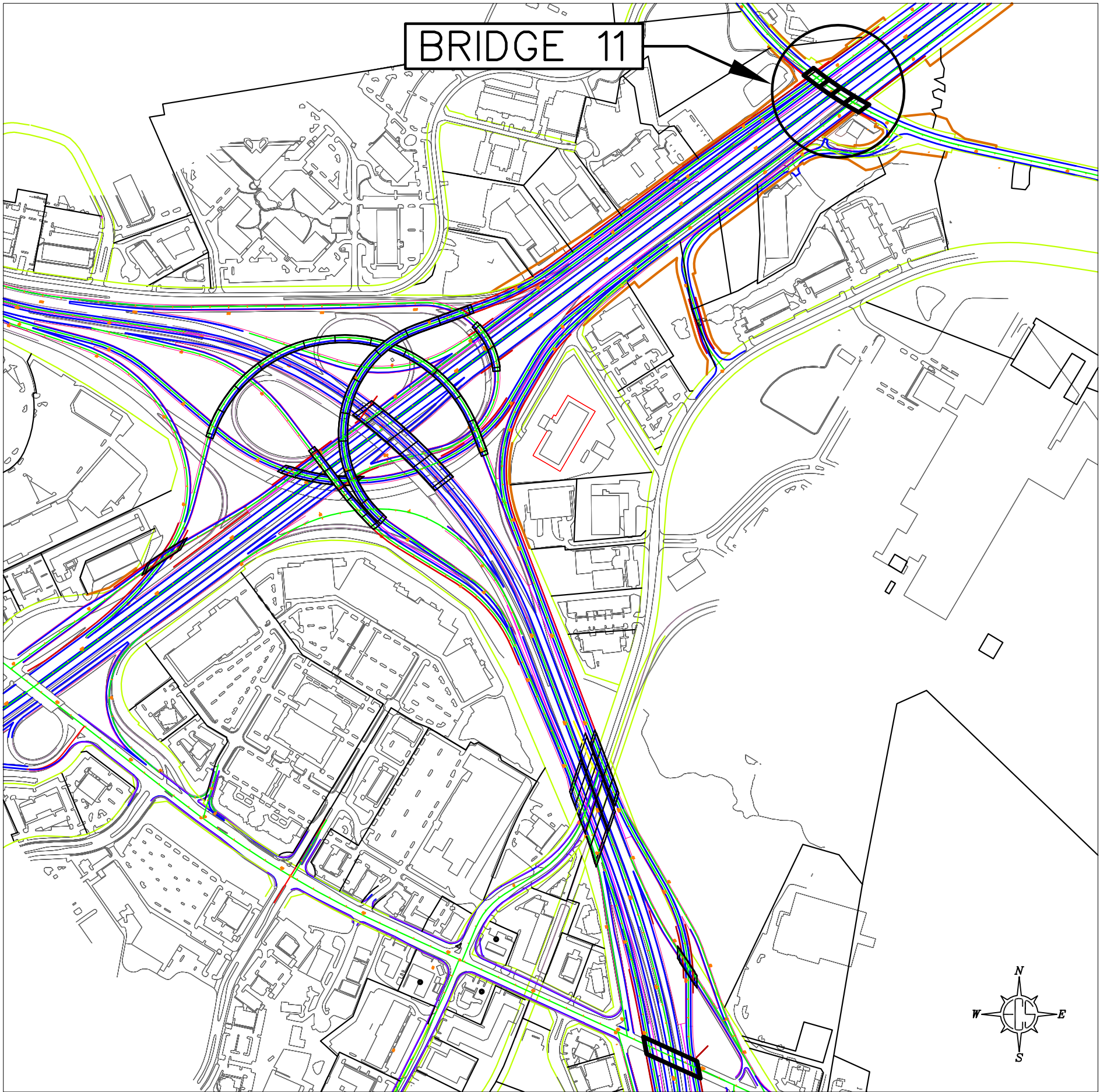
Appendix M – Thompson Engineering Geotechnical Data Report

Appendix A

Site Vicinity Map and Boring Location Diagram



SITE VICINITY MAP
NOT TO SCALE



PROPOSED SITE PLAN VIEW
NOT TO SCALE

I-85 & I-385
INTERCHANGE DESIGN

ECS CAROLINAS, LLP
1812 CENTER PARK DRIVE
SUITE D
CHARLOTTE NC 28217
(704) 525-5152 [PHONE]
(704) 357-0023 [FAX]
NC REGISTERED
ENGINEERING
FIRM # F-1078



SITE VICINITY MAP
BRIDGE 11

ECS REVISIONS

ENGINEER	DRAFTING
MFP	DFA



SCALE
AS SHOWN

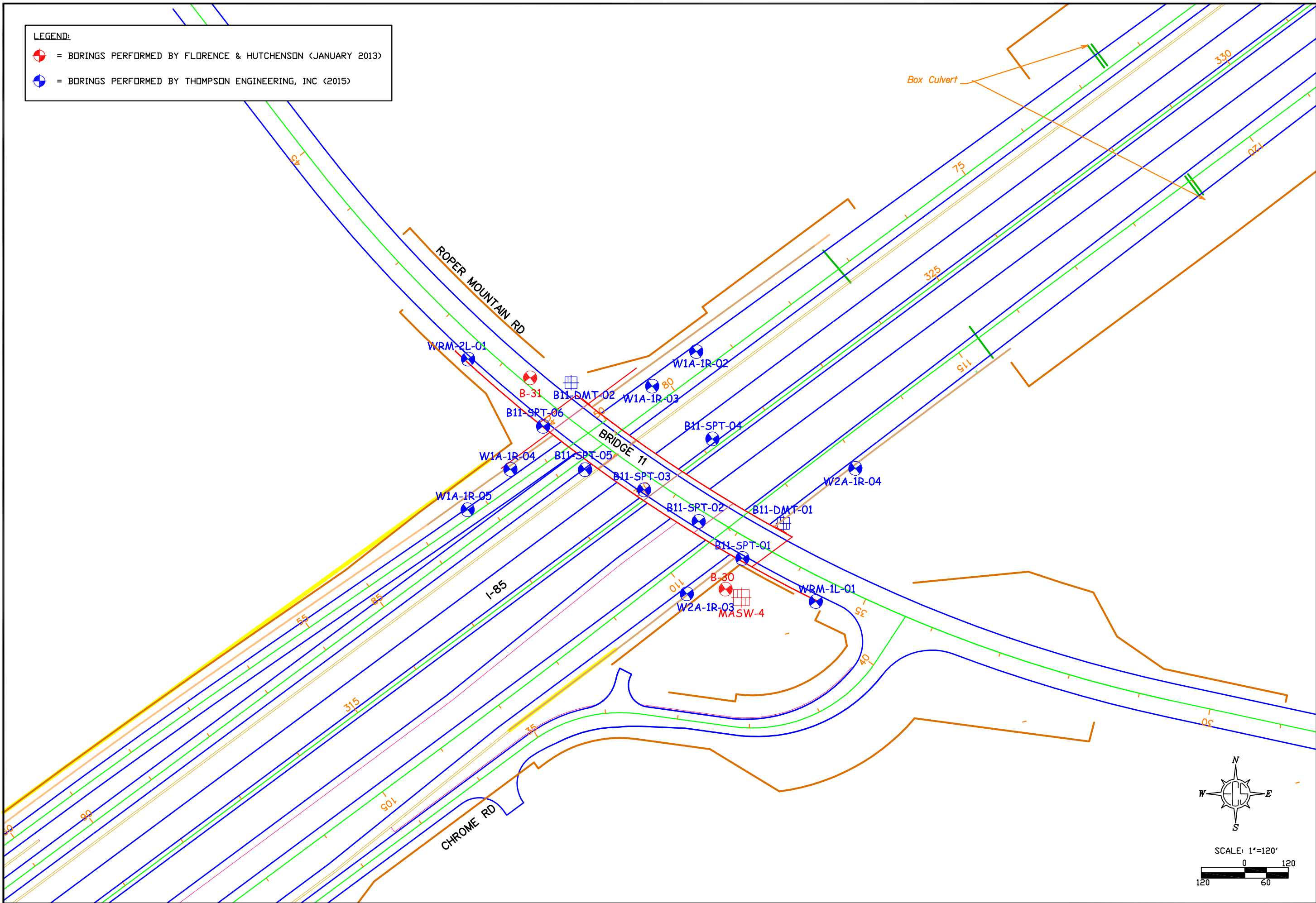
PROJECT NO.
08-9283

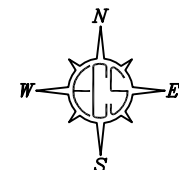
FIGURE 1

DATE: 5-21-2015

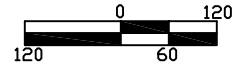
LEGEND:

-  = BORINGS PERFORMED BY FLORENCE & HUTCHENSON (JANUARY 2013)
-  = BORINGS PERFORMED BY THOMPSON ENGINEERING, INC (2015)






SCALE: 1"=120'



**I-85 & I-385
INTERCHANGE DESIGN**

ECS CAROLINAS, LLP
SUITE D
1812 CENTER PARK DRIVE
CHARLOTTE NC 28217
(704) 525-5152 [PHONE]
(704) 357-0023 [FAX]
NC REGISTERED
ENGINEERING
FIRM # F-1076



**BORING LOCATION DIAGRAM
BRIDGE 11**

ECS REVISIONS	
ENGINEER MFP	DRAFTING DFA
SCALE AS SHOWN	
PROJECT NO. 08-9283	
FIGURE 2	
DATE: 5-21-2015	

Appendix B

**Bridge 11 Boring Logs
B11-SPT-01 through B11-SPT-06,
W1A-1R-03, W1A-1R-04, W2A-1R-03,
W2A-1R-04, WRM-1L-01 and WRM-2L-01
By Thompson Engineering
B-30 and B-31 By Florence & Hutchenson**

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-01	Boring Location:	36+76	Offset:	LT 27	Alignment:	Roper
Elev.:	935.7 ft.	Latitude:	34.83779425	Longitude:	-82.28861805	Date Started:	1/5/2015
Total Depth:	98.0 ft.	Soil Depth:	75.0 ft.	Core Depth:	23.0 ft.	Date Completed:	1/6/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB 44.0 ft.	24 HR	26.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
0.0										10 20 30 40 50 60 70 80 90
	935.0	Approximately 6 inches of topsoil. Firm, moist, brown, SILT with SAND (ML, A-4(0)), FILL, LL=NP PL=NP PI=NP NMC=27.1 % #200=71.6		0.0	SS-1	2	2	5	7 X	● ○ ▲
		Stiff, reddish brown, fine to medium grained, FILL		2.0	SS-2	4	6	6	12	●
5.0		Loose, moist, brown, fine grained, SILTY SAND (SM, A-2), RESIDUUM		4.0	SS-3	3	5	5	10	●
	930.0	Medium dense, moist, brown and white, weakly reactive, fine to medium grained, SILTY SAND (SM, A-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=34.9 % #200=45.8		6.0	SS-4	4	4	8	12 X	● ○ ▲
		Loose, brown and light brown, RESIDUUM		8.0	SS-5	2	5	5	10	●
10.0		Medium dense, moist, brown, fine grained, SILTY SAND (SM, A-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=44.7 % #200=43.3		10.0	SS-6	3	5	6	11 X	● ○ ▲
	925.0	Loose, moist, brown, white and tan, fine grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=31.3 % #200=31.7		13.5	SS-7	3	3	5	8 X	● ○ ▲
15.0										
	920.0	Medium dense, moist, brown, tan and white, RESIDUUM		18.5	SS-8	2	4	6	10	●
20.0										
	915.0	Loose, RESIDUUM		23.5	SS-9	2	2	5	7	●
25.0										

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-01	Boring Location:	36+76	Offset:	LT 27	Alignment:	Roper
Elev.:	935.7 ft.	Latitude:	34.83779425	Longitude:	-82.28861805	Date Started:	1/5/2015
Total Depth:	98.0 ft.	Soil Depth:	75.0 ft.	Core Depth:	23.0 ft.	Date Completed:	1/6/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB 44.0 ft.	24 HR	26.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
25.0	910.0									
30.0	905.0	Medium dense, brown, black and tan, fine grained, RESIDUUM		28.5	SS-10	3	6	5	11	●
35.0	900.0	Medium dense, moist, brown, tan, white and black, weakly reactive, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=32.8 % #200=30.4		33.5	SS-11	3	6	7	13	● ○
40.0	895.0	Medium dense, fine grained, RESIDUUM		38.5	SS-12	3	5	8	13	●
45.0	890.0	Medium dense, tan, white and black, RESIDUUM		43.5	SS-13	4	5	8	13	●
50.0		Medium dense, brown, tan, white and black, RESIDUUM		48.5	SS-14	6	7	10	17	●

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-01	Boring Location:	36+76	Offset:	LT 27	Alignment:	Roper
Elev.:	935.7 ft.	Latitude:	34.83779425	Longitude:	-82.28861805	Date Started:	1/5/2015
Total Depth:	98.0 ft.	Soil Depth:	75.0 ft.	Core Depth:	23.0 ft.	Date Completed:	1/6/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB 44.0 ft.	24 HR	26.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
50.0										
	885.0									
55.0		Medium dense, moist, brown, tan, white and black, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=23.9 % _{#200} =23.8		53.5	SS-15	7	8	12	20X	●
	880.0									
60.0		Dense, fine to medium grained, RESIDUUM		58.5	SS-16	10	25	24	49	●
	875.0									
65.0		Medium dense, fine to medium grained, RESIDUUM		63.5	SS-17	20	12	12	24	●
	870.0									
70.0		Very dense, fine grained, ROCK		68.5	SS-18	50/1	X	X	50/1	>>●
	865.0									
75.0		Very dense, fine to medium grained, ROCK Began rock coring at 75.0 feet.		73.5	SS-19	50/3	X	X	50/3	>>●

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
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DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-01	Boring Location:	36+76	Offset:	LT 27	Alignment:	Roper
Elev.:	935.7 ft.	Latitude:	34.83779425	Longitude:	-82.28861805	Date Started:	1/5/2015
Total Depth:	98.0 ft.	Soil Depth:	75.0 ft.	Core Depth:	23.0 ft.	Date Completed:	1/6/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB 44.0 ft.	24 HR	26.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
75.0	860.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, fresh to slightly weathered, strong to very strong, with close to moderately spaced joints RQD(%)=68.9 Rec(%)=85.8 RMR=65		75.0	RC-1					
80.0	855.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar, and mica, fresh to slightly weathered, strong to very strong, with close to moderately spaced joints RQD(%)=100.0 Rec(%)=100.0 RMR=77 Horizontal joint, moderately open to wide, planar, slightly rough to smooth, with mica surface stains 2 - 10 degree joints (seperated approximately 2 inches), moderately open to wide, planar, slightly rough to smooth, with mica surface stains		78.0	RC-2					
85.0	850.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar, and mica, slightly to moderately weathered, strong to very strong with close to moderately spaced joints RQD(%)=100.0 Rec(%)=100.0 RMR=77		83.0	RC-3					
90.0	845.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, slightly to moderately weathered, strong to very strong, with close to moderately spaced joints, horizontal joints, open to wide, planar, slightly rough to smooth, with mica surface stains RQD(%)=86.0 Rec(%)=94.0 RMR=73		88.0	RC-4					
95.0	840.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, slightly to moderately weathered, strong to very strong with close to moderately spaced joints RQD(%)=74.0 Rec(%)=92.0 RMR=65 20 degree joint, moderately open to wide, planar, slightly rough to smooth, with mica surface stains 15 degree joint moderately open to wide, planar, slightly rough to smooth, with mica surface stains 15 degree joint and 20 degree joint (seperated by approximately 3 inches), moderately open to wide, planar, slightly rough to smooth, with mica surface stains		93.0	RC-5					

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer
AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger
MR - Mud Rotary Wash
RC - Rock Coring



Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis	
Site Description:	I-85 and I-385 Interchange Design						Route:	I-85 / I-385
Boring No.:	B11-SPT-01	Boring Location:	36+76	Offset:	LT 27	Alignment:	Roper	
Elev.:	935.7 ft.	Latitude:	34.83779425	Longitude:	-82.28861805	Date Started:	1/5/2015	
Total Depth:	98.0 ft.	Soil Depth:	75.0 ft.	Core Depth:	23.0 ft.	Date Completed:	1/6/2015	
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA	
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%	
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB 44.0 ft.	24 HR	26.0 ft.	

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6" 2nd 6" 3rd 6"	N Value	<div style="text-align: center;"> <p>● SPT N VALUE (blows / foot)</p> <p>▲ FINES CONTENT (%) ▲</p> </div>
		Boring Terminated at 98.0 feet.						<div style="text-align: center;"> <p>PL MC LL</p> <p>10 20 30 40 50 60 70 80 90</p> </div>

LEGEND

SAMPLER TYPE

SS - Split Spoon AC - Auger Cuttings
ST - Shelby Tube GB - Grab Bag
DCP - Dynamic Cone Penetrometer NQ - Rock Core

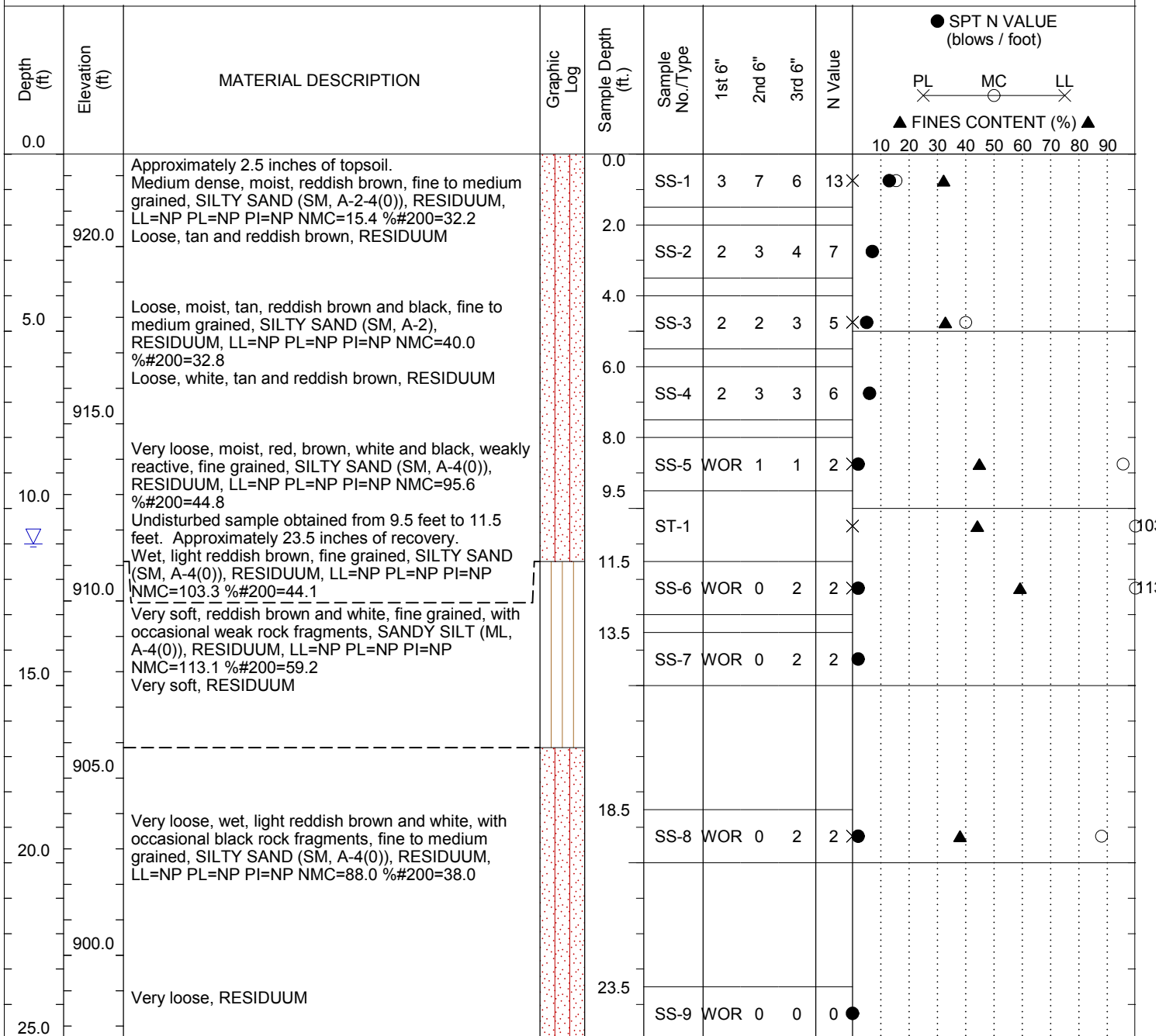
DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-02	Boring Location:	37+53	Offset:	LT 14	Alignment:	Roper
Elev.:	922.6 ft.	Latitude:	34.83793244	Longitude:	-82.28882109	Date Started:	11/10/2014
Total Depth:	73.6 ft.	Soil Depth:	68.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/10/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.



LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer
AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger
MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-02	Boring Location:	37+53	Offset:	LT 14	Alignment:	Roper
Elev.:	922.6 ft.	Latitude:	34.83793244	Longitude:	-82.28882109	Date Started:	11/10/2014
Total Depth:	73.6 ft.	Soil Depth:	68.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/10/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
25.0										10 20 30 40 50 60 70 80 90
		Undisturbed sample obtained from 25.0 to 27.0 feet. Approximately 24 inches of recovery.		25.0	ST-2					
	895.0	Very loose, moist, reddish brown, black and white, RESIDUUM		27.0	SS-10	WOH	2	2	4	●
		Very loose, reddish brown, RESIDUUM		28.5	SS-11	WOR	2	2	4	●
30.0										
	890.0									
		Very loose, moist, reddish brown and black, weakly reactive, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=64.3 % #200=19.6		33.5	SS-12	1	2	2	4	● ▲ ○
35.0										
	885.0									
		Loose, RESIDUUM		38.5	SS-13	1	2	4	6	●
40.0										
	880.0									
		Very dense, black and reddish brown, fine to coarse grained, with rock fragments, RESIDUUM		43.5	SS-14	30	32	38	70	●
45.0										
	875.0									
		Very dense, black and reddish brown with rock fragments, PARTIALLY WEATHERED ROCK		48.5	SS-15	50/2	X	X	100	● >>
50.0										

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-02	Boring Location:	37+53	Offset:	LT 14	Alignment:	Roper
Elev.:	922.6 ft.	Latitude:	34.83793244	Longitude:	-82.28882109	Date Started:	11/10/2014
Total Depth:	73.6 ft.	Soil Depth:	68.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/10/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
50.0										
55.0	870.0	Very dense, black reddish brown and tan, with rock fragments, PARTIALLY WEATHERED ROCK		53.5	SS-16	37	27	50/1	50/1	>>●
60.0	865.0	Very dense, red, brown, tan, black, white and light green, RESIDUUM		58.5	SS-17	41	32	37	69	●
65.0	860.0	Very dense, black, reddish brown and tan, fine to medium grained, with rock fragments, PARTIALLY WEATHERED ROCK		63.5	SS-18	50/2	X	X	100	>>●
70.0	855.0	Very dense, dark gray, ROCK		68.5	SS-19	50/1	X	X	50/1	>>●
	850.0	Very dense, No Recovery, ROCK Boring Terminated at 74.1 feet.		73.5	SS-20	50/1	X	X	50/1	>>●

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-03	Boring Location:	38+40	Offset:	LT 18	Alignment:	Roper
Elev.:	924.8 ft.	Latitude:	34.83804971	Longitude:	-82.28907417	Date Started:	1/10/2015
Total Depth:	96.6 ft.	Soil Depth:	60.0 ft.	Core Depth:	36.6 ft.	Date Completed:	1/10/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL — MC — LL ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
0.0		Approximately 3 inches of asphalt (top), 2 inches of soil (middle), 11 inches of asphalt (bottom).								
		Medium dense, moist, red, fine to medium grained, CLAYEY SAND (SC, A-2), FILL		1.5	SS-1	18	8	7	15	●
		No Recovery, FILL		3.5	SS-2	2	2	4	6	●
5.0	920.0	Loose, moist, red and light brown, fine to medium grained, CLAYEY SAND (SC, A-6(4)), FILL, LL=36 PL=18 PI=18 NMC=24.3 %200=45.3		5.5	SS-3	3	4	4	8	● × ○ × ▲
		Loose, moist, red and light brown, fine to medium grained, CLAYEY SAND (SC, A-6(2)), FILL, LL=37 PL=17 PI=20 NMC=32.7 %200=36.0		7.5	SS-4	2	3	5	8	● × ○ ▲
10.0	915.0	Undisturbed sample obtained from 9.5 to 11.5 feet.		9.5	ST-1					
		Very stiff, moist, light brown, LEAN CLAY with SAND (CL, A-7-6(21)), RESIDUUM, LL=47 PL=20 PI=27 NMC=16.3 %200=77.5		11.5	SS-5	5	8	10	18	● × ○ × ▲
15.0	910.0	Loose, moist, white and light brown, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=23.2 %200=34.2		13.5	SS-6	3	2	2	4	● × ○ ▲
		Loose, light reddish brown, RESIDUUM		18.5	SS-7	3	4	6	10	●
20.0	905.0									
25.0	900.0	Medium dense, brown, fine grained, with mica, RESIDUUM		23.5	SS-8	3	5	7	12	●

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-03	Boring Location:	38+40	Offset:	LT 18	Alignment:	Roper
Elev.:	924.8 ft.	Latitude:	34.83804971	Longitude:	-82.28907417	Date Started:	1/10/2015
Total Depth:	96.6 ft.	Soil Depth:	60.0 ft.	Core Depth:	36.6 ft.	Date Completed:	1/10/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
25.0										
30.0	895.0	Medium dense, wet, light brown, RESIDUUM		28.5	SS-9	2	7	6	13	●
35.0	890.0	Medium dense, moist, brown, weakly reactive, fine to medium grained, with trace gravel, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=31.1 % #200=19.4		33.5	SS-10	9	9	11	20 X	● ○
40.0	885.0	Dense, light brown, fine to medium grained, with trace gravel, RESIDUUM		38.5	SS-11	11	18	30	48	●
45.0	880.0	Very dense, fine to coarse grained, with gravel, PARTIALLY WEATHERED ROCK		43.5	SS-12	50/3	X	X	100	>> ●
50.0	875.0	Very dense, light brown, fine to medium grained, PARTIALLY WEATHERED ROCK		48.5	SS-13	50/3	X	X	100	>> ●

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-03	Boring Location:	38+40	Offset:	LT 18	Alignment:	Roper
Elev.:	924.8 ft.	Latitude:	34.83804971	Longitude:	-82.28907417	Date Started:	1/10/2015
Total Depth:	96.6 ft.	Soil Depth:	60.0 ft.	Core Depth:	36.6 ft.	Date Completed:	1/10/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
50.0										
55.0	870.0	Very dense, PARTIALLY WEATHERED ROCK		53.5	SS-14	50/2	X	X	100	>>●
60.0	865.0	Very dense, No recovery, ROCK Began rock coring at 59.0 feet. Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, moderately to highly weathered, weak to medium strong with close to moderately space joints RQD(%)=66.9 Rec(%)=98.9 RMR=30 horizontal joint, moderately open to wide, planar, slightly rough to smooth, with iron oxide surface stains		58.5 59.0	SS-15	50/1	X	X	50/1	>>●
65.0	860.0				RC-1					
70.0	855.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar, and mica, moderately to highly weathered, weak to medium strong with close to moderately spaced joints RQD(%)=40.0 Rec(%)=99.0 RMR=20 horizontal joint, moderately open to wide, planar, slightly rough to smooth, with iron oxide surface stains		66.6						
75.0	850.0				RC-2					

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-03	Boring Location:	38+40	Offset:	LT 18	Alignment:	Roper
Elev.:	924.8 ft.	Latitude:	34.83804971	Longitude:	-82.28907417	Date Started:	1/10/2015
Total Depth:	96.6 ft.	Soil Depth:	60.0 ft.	Core Depth:	36.6 ft.	Date Completed:	1/10/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
75.0										10 20 30 40 50 60 70 80 90
		No Recovery		76.6						
		Highly fractured or weathered rock which prevented the core barrel from catching. RQD(%)=0.0 Rec(%)=0.0 RMR=0								
80.0	845.0				RC-3					
85.0	840.0									
		No Recovery		86.6						
		Highly fractured or weathered rock which prevented the core barrel from catching RQD(%)=0.0 Rec(%)=0.0 RMR=0								
90.0	835.0				RC-4					
95.0	830.0									
		Boring Terminated at 96.5 feet.								

LEGEND

SAMPLER TYPE

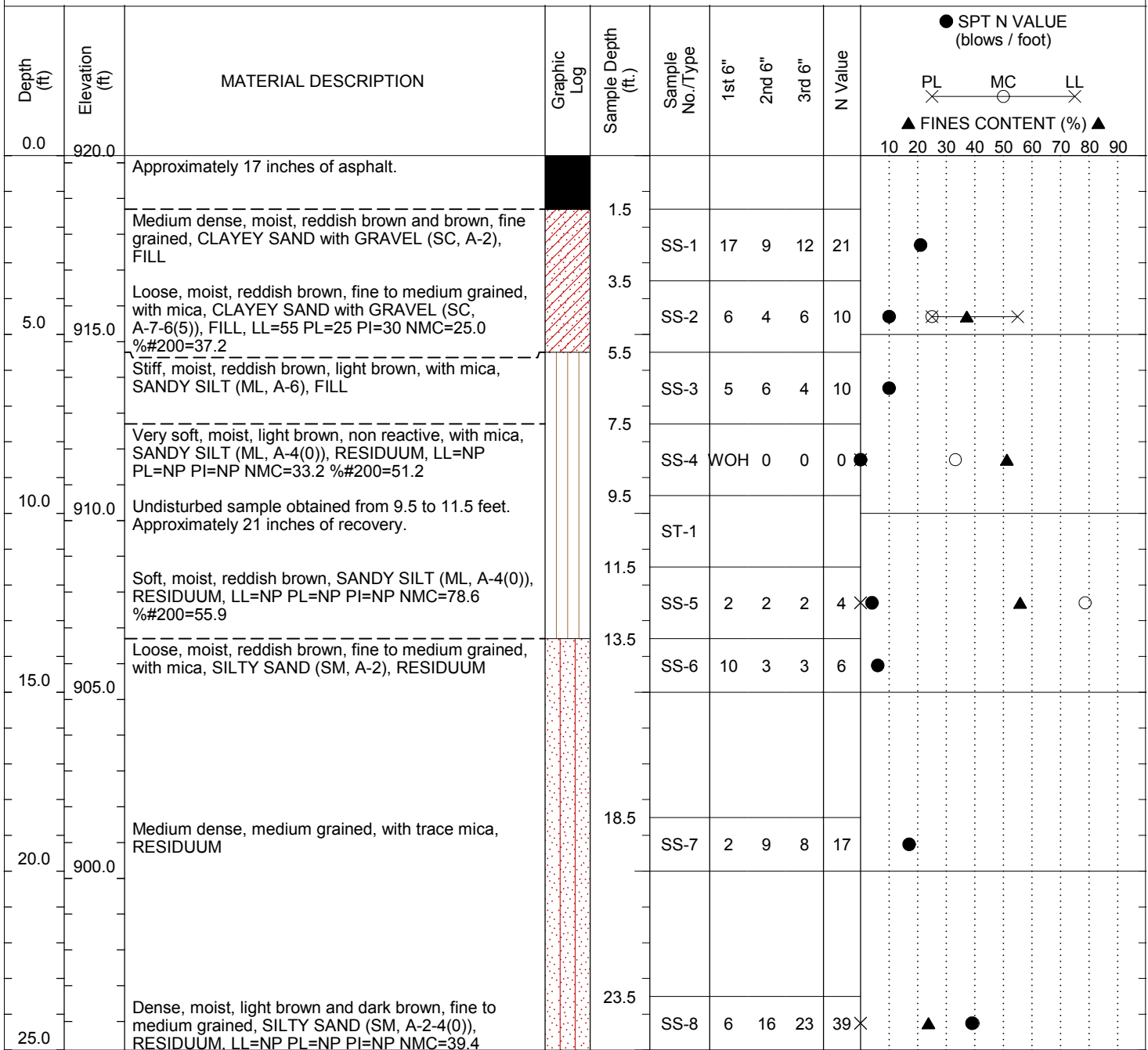
SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-04	Boring Location:	37+99	Offset:	RT 93	Alignment:	Roper
Elev.:	920.2 ft.	Latitude:	34.83824617	Longitude:	-82.28876272	Date Started:	3/7/2015
Total Depth:	79.4 ft.	Soil Depth:	54.4 ft.	Core Depth:	25.0 ft.	Date Completed:	3/7/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.



LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-04	Boring Location:	37+99	Offset:	RT 93	Alignment:	Roper
Elev.:	920.2 ft.	Latitude:	34.83824617	Longitude:	-82.28876272	Date Started:	3/7/2015
Total Depth:	79.4 ft.	Soil Depth:	54.4 ft.	Core Depth:	25.0 ft.	Date Completed:	3/7/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
25.0	895.0	%#200=23.8								
30.0	890.0	Very dense, light brown, black and white, with mica, weathered rock, RESIDUUM		28.5	SS-9	26	45	40	85	●
35.0	885.0	Very dense, moist, dark brown, light brown, non reactive, fine to coarse grained, with mica, SILTY SAND (SM, A-1-b(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=15.0 %#200=14.5		33.5	SS-10	26	29	23	52 X	●
40.0	880.0	Very dense, No Recovery, PARTIALLY WEATHERED ROCK		38.5	SS-11	50/2	X	X	100	>>●
45.0	875.0	Very dense, moist, white and black, with mica, PARTIALLY WEATHERED ROCK		43.5	SS-12	50/2	X	X	100	>>●
50.0		Very dense, No Recovery, ROCK		48.5	SS-13	50/1	X	X	50/1	>>●

LEGEND

SAMPLER TYPE

SS - Split Spoon
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DRILLING METHOD

HSA - Hollow Stem Augers
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MR - Mud Rotary Wash
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Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-04	Boring Location:	37+99	Offset:	RT 93	Alignment:	Roper
Elev.:	920.2 ft.	Latitude:	34.83824617	Longitude:	-82.28876272	Date Started:	3/7/2015
Total Depth:	79.4 ft.	Soil Depth:	54.4 ft.	Core Depth:	25.0 ft.	Date Completed:	3/7/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
50.0	870.0									
		Very dense, No Recovery, ROCK Began rock coring at 54.0 feet.		53.5						
55.0	865.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, fresh to slightly weathered, strong to very strong with close to moderately spaced joints RQD(%)=95.8 Rec(%)=95.8 RMR=65 horizontal joint, moderately open to wide, planar, slightly rough to smooth		54.0	SS-14	50/3	X	X	50/3	>>●
					RC-1					
60.0	860.0									
		Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, fresh to slightly weathered, strong to very strong with close to moderately spaced joints RQD(%)=90.7 Rec(%)=93.8 RMR=65 horizontal joint, moderately open to wide, planar, slightly rough to smooth		63.0						
65.0	855.0				RC-2					
70.0	850.0									
		Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar and mica, fresh to slightly weathered, strong to very strong with close to moderately spaced joints		73.0						
75.0										

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
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AC - Auger Cuttings
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DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Blake Ellis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-04	Boring Location:	37+99	Offset:	RT 93	Alignment:	Roper
Elev.:	920.2 ft.	Latitude:	34.83824617	Longitude:	-82.28876272	Date Started:	3/7/2015
Total Depth:	79.4 ft.	Soil Depth:	54.4 ft.	Core Depth:	25.0 ft.	Date Completed:	3/7/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	N.O.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
75.0	845.0	RQD(%)=100.0 Rec(%)=106.6 RMR=70 horizontal joint, moderately open to wide, planar, slightly rough to smooth			RC-3					<div> <div>10 20 30 40 50 60 70 80 90</div> </div>
		Boring Terminated at 79.4 feet.								

LEGEND

SAMPLER TYPE

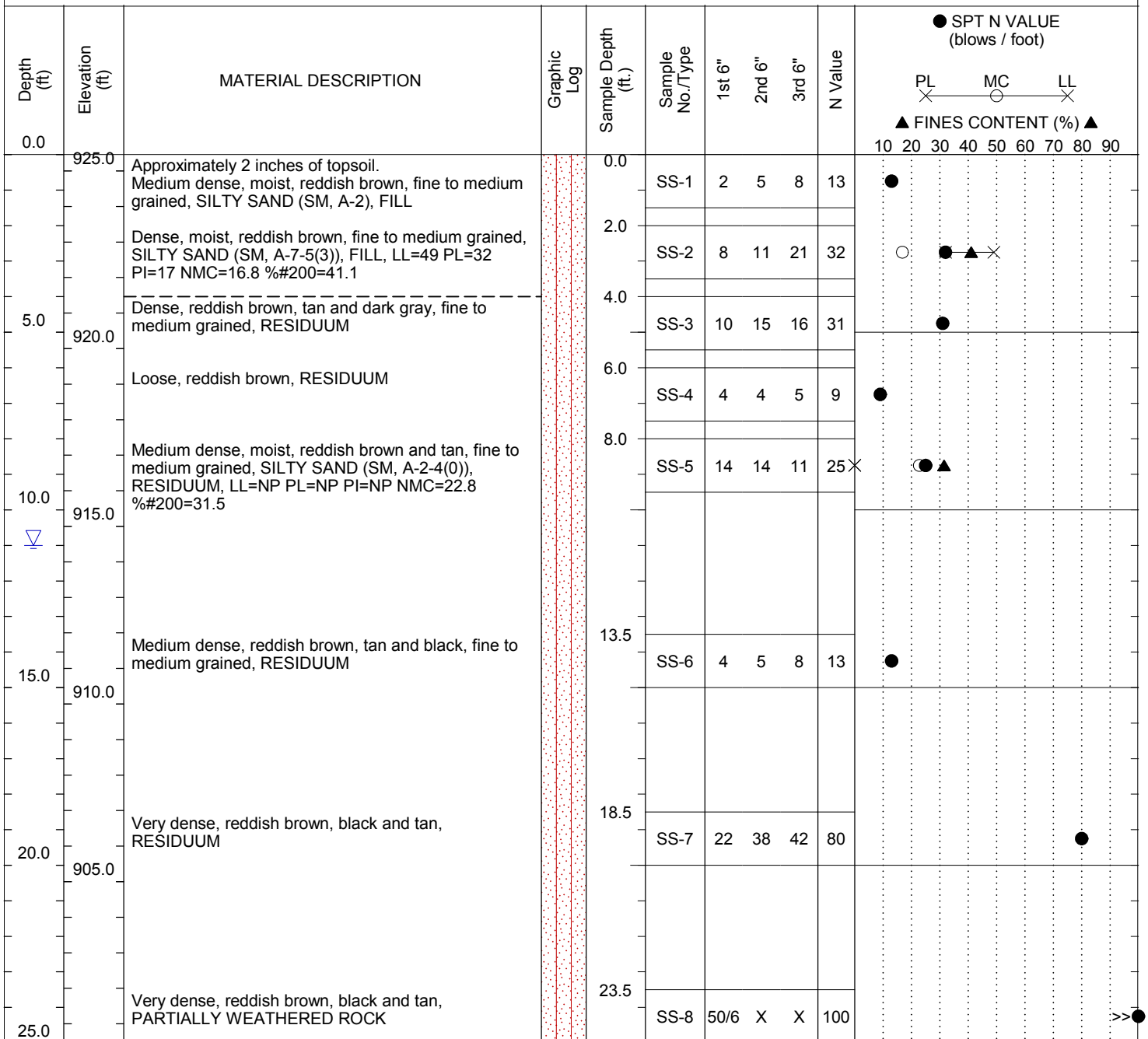
SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
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 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-05	Boring Location:	39+21	Offset:	LT 42	Alignment:	Roper
Elev.:	925.5 ft.	Latitude:	34.8381235	Longitude:	-82.28934643	Date Started:	11/9/2014
Total Depth:	48.6 ft.	Soil Depth:	48.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/9/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NA	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.



LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-05	Boring Location:	39+21	Offset:	LT 42	Alignment:	Roper
Elev.:	925.5 ft.	Latitude:	34.8381235	Longitude:	-82.28934643	Date Started:	11/9/2014
Total Depth:	48.6 ft.	Soil Depth:	48.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/9/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NA	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
25.0	900.0									
30.0	895.0	Medium dense, moist, black and reddish brown, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=22.0 % _{#200} =25.3		28.5	SS-9	8	13	15	28X	●
35.0	890.0	Dense, fine to coarse grained, RESIDUUM		33.5	SS-10	10	12	21	33	●
40.0	885.0	Very dense, No Recovery, PARTIALLY WEATHERED ROCK		38.5	SS-11	50/2	X	X	100	>>●
45.0	880.0	Very dense, No Recovery, PARTIALLY WEATHERED ROCK		43.5	SS-12	50/2	X	X	100	>>●
		Very Dense, No Recovery, ROCK Boring Terminated at 48.6 feet.		48.5	SS-13	50/.5	X	X	50/.5	>>●

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-05A	Boring Location:	39+20	Offset:	LT 44	Alignment:	Roper
Elev.:	925.5 ft.	Latitude:	34.838124	Longitude:	-82.289336	Date Started:	11/9/2014
Total Depth:	71.0 ft.	Soil Depth:	44.5 ft.	Core Depth:	26.5 ft.	Date Completed:	11/9/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
0.0	925.0	Offset boring approximately 2 feet from B11-SPT-05. Mud rotary wash to 44.5 feet.								
5.0	920.0									
10.0	915.0									
15.0	910.0									
20.0	905.0									
25.0										

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-05A	Boring Location:	39+20	Offset:	LT 44	Alignment:	Roper
Elev.:	925.5 ft.	Latitude:	34.838124	Longitude:	-82.289336	Date Started:	11/9/2014
Total Depth:	71.0 ft.	Soil Depth:	44.5 ft.	Core Depth:	26.5 ft.	Date Completed:	11/9/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
25.0	900.0									
30.0	895.0									
35.0	890.0									
40.0	885.0									
45.0	880.0	Began Rock Coring at 44.5 feet. Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar, and mica, slightly to moderately weathered, strong to very strong with close to moderately spaced joints RQD(%)=64.1 Rec(%)=92.9 RMR=40 Horizontal joint, moderately open to wide, planar, slightly rough to smooth, with mica surface stains		44.5						
50.0		45 degree joint, moderately open to wide, planar,			RC-1					

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
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NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-05A	Boring Location:	39+20	Offset:	LT 44	Alignment:	Roper
Elev.:	925.5 ft.	Latitude:	34.838124	Longitude:	-82.289336	Date Started:	11/9/2014
Total Depth:	71.0 ft.	Soil Depth:	44.5 ft.	Core Depth:	26.5 ft.	Date Completed:	11/9/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR / RC	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NQ Wireline	Driller:	TE	Groundwater:	TOB N.E.	24 HR	11.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
50.0	875.0	slightly rough to smooth, with mica surface stains		51.0						
55.0	870.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar, and mica, slightly to moderately weathered, strong to very strong with close to moderately spaced joints RQD(%)=75.4 Rec(%)=99.2 RMR=45 45 degree joint, moderately open to wide, planar, slightly rough to smooth, with mica surface stains			RC-2					
60.0	865.0	45 degree joint, moderately open to wide, planar, slightly rough to smooth, with mica surface stains								
65.0	860.0	Igneous, GRANITE, grayish black to grayish orange pink, quartz, feldspar, and mica, fresh to slightly weathered, strong to very strong with close to moderately spaced joints RQD(%)=100.0 Rec(%)=100.0 RMR=70 45 degree joint, moderately open to wide, planar, slightly rough to smooth, with mica surface stains		61.0						
70.0	855.0				RC-3					
		Boring Terminated at 71.0 feet.								

LEGEND

SAMPLER TYPE

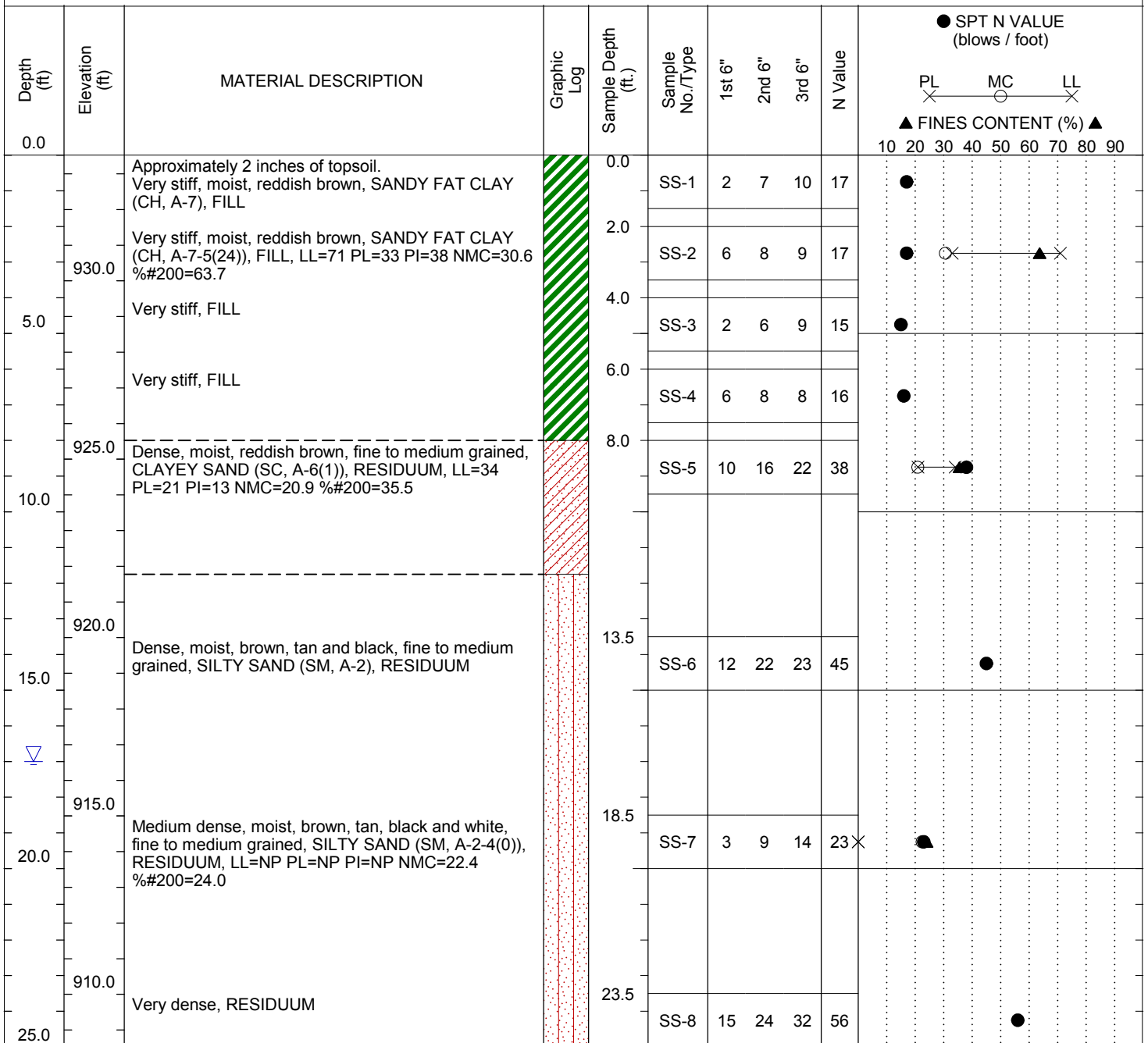
SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-06	Boring Location:	40+02	Offset:	LT 30	Alignment:	Roper
Elev.:	933.5 ft.	Latitude:	34.83828582	Longitude:	-82.28954166	Date Started:	11/5/2014
Total Depth:	68.6 ft.	Soil Depth:	68.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/7/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NA	Driller:	TE	Groundwater:	TOB N.E.	24 HR	17.0 ft.



LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-06	Boring Location:	40+02	Offset:	LT 30	Alignment:	Roper
Elev.:	933.5 ft.	Latitude:	34.83828582	Longitude:	-82.28954166	Date Started:	11/5/2014
Total Depth:	68.6 ft.	Soil Depth:	68.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/7/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NA	Driller:	TE	Groundwater:	TOB N.E.	24 HR	17.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
25.0										10 20 30 40 50 60 70 80 90
30.0	905.0	Dense, moist, brown, tan and white, weakly reactive, fine to coarse grained, SILTY SAND (SM, A-1-b(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=18.1 % _{#200} =14.7		28.5	SS-9	10	18	34	52X	<div> <div>▲</div> <div>●</div> </div>
35.0	900.0	Very dense, dark brown, black and tan, with highly friable rock fragments, PARTIALLY WEATHERED ROCK		33.5	SS-10	21	50/4	X	100	<div> <div>>>●</div> </div>
40.0	895.0	Very dense, reddish brown, black and tan, with rock fragments, RESIDUUM		38.5	SS-11	11	26	27	53	<div> <div>●</div> </div>
45.0	890.0	Very dense, moist, white, reddish tan and black, weakly reactive, fine to medium grained, with rock fragments, SILTY SAND (SM, A-1-b(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=14.9 % _{#200} =18.6		43.5	SS-12	50	50	32	82X	<div> <div>○▲</div> <div>●</div> </div>
50.0	885.0	Dense, moist, white, tan, brown and black, RESIDUUM		48.5	SS-13	11	17	17	34	<div> <div>●</div> </div>

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Phillip Mabry
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	B11-SPT-06	Boring Location:	40+02	Offset:	LT 30	Alignment:	Roper
Elev.:	933.5 ft.	Latitude:	34.83828582	Longitude:	-82.28954166	Date Started:	11/5/2014
Total Depth:	68.6 ft.	Soil Depth:	68.6 ft.	Core Depth:	0.0 ft.	Date Completed:	11/7/2014
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	88%
Core Size:	NA	Driller:	TE	Groundwater:	TOB N.E.	24 HR	17.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
50.0										
55.0	880.0	Very dense, reddish tan, white and black, with rock fragments, PARTIALLY WEATHERED ROCK		53.5	SS-14	50/3	X	X	100	>>●
60.0	875.0	Very dense, ROCK		58.5	SS-15	50/5	X	X	50/5	>>●
65.0	870.0	Very dense, reddish brown and white, fine grained, ROCK		63.5	SS-16	50/1	X	X	50/1	>>●
	865.0	Very dense, No Recovery, ROCK		68.5	SS-17	50/5	X	X	50/5	>>●
		Boring Terminated at 68.6 feet.								

LEGEND

SAMPLER TYPE

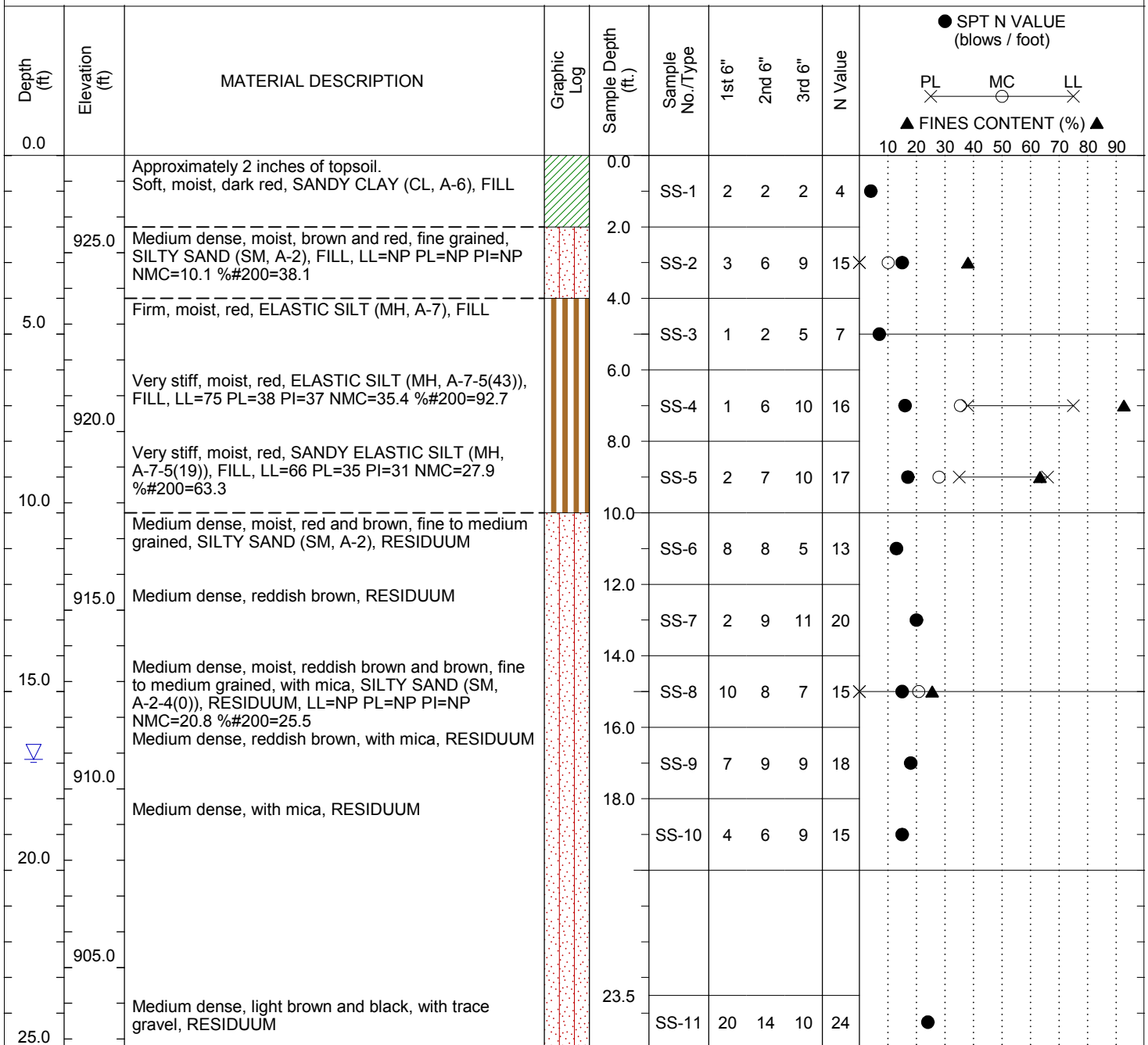
SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W1A-1R-03	Boring Location:	49+21	Offset:	RT 11	Alignment:	Ramp 1
Elev.:	927.7 ft.	Latitude:	34.83844343	Longitude:	-82.28904261	Date Started:	1/9/2015
Total Depth:	38.6 ft.	Soil Depth:	38.6 ft.	Core Depth:	0.0 ft.	Date Completed:	1/9/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB 28.5 ft.	24 HR	16.9 ft.



LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W1A-1R-03	Boring Location:	49+21	Offset:	RT 11	Alignment:	Ramp 1
Elev.:	927.7 ft.	Latitude:	34.83844343	Longitude:	-82.28904261	Date Started:	1/9/2015
Total Depth:	38.6 ft.	Soil Depth:	38.6 ft.	Core Depth:	0.0 ft.	Date Completed:	1/9/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB 28.5 ft.	24 HR	16.9 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
25.0										10 20 30 40 50 60 70 80 90
	900.0									
	30.0	Dense, reddish brown, black and white, RESIDUUM		28.5	SS-12	20	22	24	46	●
	895.0									
	35.0	Very dense, moist, reddish brown, black and white, fine to medium grained, SILTY SAND (SM, A-1-b(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=24.5 % _{#200} =16.9		33.5	SS-13	23	27	36	63	▲ ○ ●
	890.0									
		Very dense, No recovery, ROCK Boring Terminated at 38.6 feet.		38.5	SS-14	50/5	X	X	50/5	>>●

LEGEND

SAMPLER TYPE

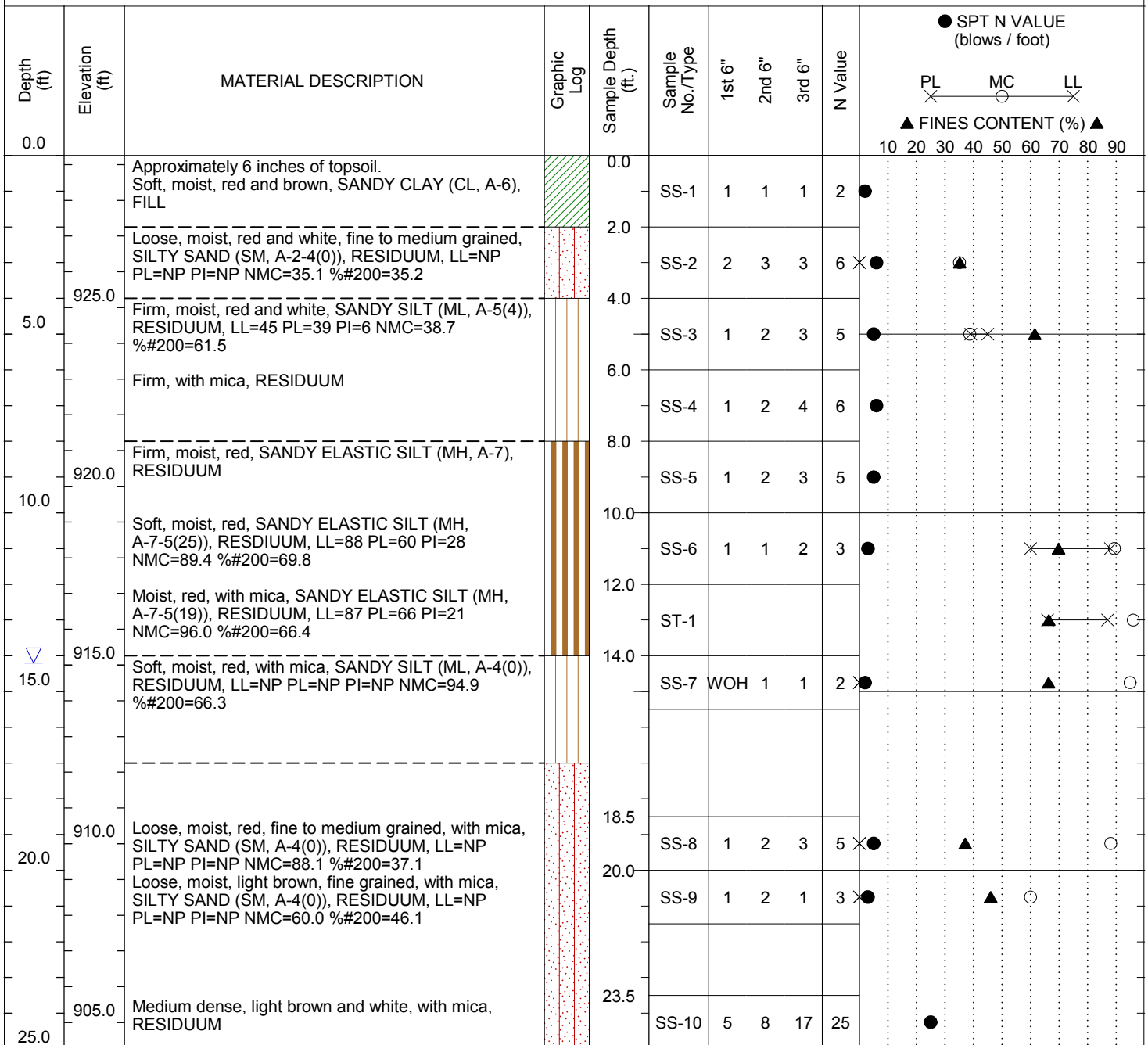
SS - Split Spoon
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DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W1A-1R-04	Boring Location:	51+48	Offset:	RT 27	Alignment:	Ramp 1A
Elev.:	929.3 ft.	Latitude:	34.83812144	Longitude:	-82.28969003	Date Started:	1/12/2015
Total Depth:	25.0 ft.	Soil Depth:	25.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/12/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	14.2 ft.



LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring



Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher	
Site Description:	I-85 and I-385 Interchange Design						Route:	I-85 / I-385
Boring No.:	W1A-1R-04	Boring Location:	51+48	Offset:	RT 27	Alignment:	Ramp 1A	
Elev.:	929.3 ft.	Latitude:	34.83812144	Longitude:	-82.28969003	Date Started:	1/12/2015	
Total Depth:	25.0 ft.	Soil Depth:	25.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/12/2015	
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA	
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%	
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	14.2 ft.	

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6" 2nd 6" 3rd 6"	N Value	<div> <div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div> <div>▲ FINES CONTENT (%) ▲</div> <div>10 20 30 40 50 60 70 80 90</div> </div> </div> </div>
		Boring Terminated at 25.0 feet.						<div> <div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div> <div>▲ FINES CONTENT (%) ▲</div> <div>10 20 30 40 50 60 70 80 90</div> </div> </div> </div>

LEGEND

SAMPLER TYPE

SS - Split Spoon	AC - Auger Cuttings
ST - Shelby Tube	GB - Grab Bag
DCP - Dynamic Cone Penetrometer	NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W2A-1R-03	Boring Location:	108+66	Offset:	RT 37	Alignment:	I-85 NB / CD
Elev.:	933.3 ft.	Latitude:	34.83765748	Longitude:	-82.28887174	Date Started:	1/4/2015
Total Depth:	45.0 ft.	Soil Depth:	45.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/4/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	21.7 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	● SPT N VALUE (blows / foot) PL X MC O LL X ▲ FINES CONTENT (%) ▲ 10 20 30 40 50 60 70 80 90
0.0		Approximately 6 inches of topsoil. Soft, moist, reddish brown, SANDY FAT CLAY (CH, A-7), FILL		0.0	SS-1	2	2	1	3	●
	930.0	Firm, moist, reddish brown, SANDY FAT CLAY (CH, A-7-5(25)), FILL, LL=67 PL=31 PI=36 NMC=34.8 % _{#200} =69.0		2.0	SS-2	2	3	5	8	●
5.0		Stiff, FILL		4.0	SS-3	1	4	5	9	●
		Firm, FILL		6.0	SS-4	2	3	4	7	●
	925.0	Medium dense, moist, brown and white, non reactive, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=31.1 % _{#200} =34.3		8.0	SS-5	3	5	6	11	●
10.0		Medium dense, brown and black, with trace gravel, RESIDUUM		10.0	SS-6	3	4	7	11	●
	920.0	Medium dense, brown, RESIDUUM		13.5	SS-7	2	3	10	13	●
15.0										
	915.0	Medium dense, moist, brown and white, fine to medium grained, SILTY SAND (SM, A-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=32.2 % _{#200} =39.7		18.5	SS-8	3	5	7	12	●
20.0										
	910.0	Medium dense, wet, brown and white, fine to coarse grained, RESIDUUM		23.5	SS-9	3	3	8	11	●
25.0										

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W2A-1R-03	Boring Location:	108+66	Offset:	RT 37	Alignment:	I-85 NB / CD
Elev.:	933.3 ft.	Latitude:	34.83765748	Longitude:	-82.28887174	Date Started:	1/4/2015
Total Depth:	45.0 ft.	Soil Depth:	45.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/4/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	21.7 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div> </div>
25.0										10 20 30 40 50 60 70 80 90
30.0	905.0	Medium dense, fine grained, RESIDUUM		28.5	SS-10	4	5	16	21	●
35.0	900.0	Medium dense, moist, brown and black, RESIDUUM		33.5	SS-11	4	6	9	15	●
40.0	895.0	Medium dense, wet, brown and white, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=32.6 % _{#200} =32.6		38.5	SS-12	6	8	13	21	● ▲
45.0	890.0	Medium dense, moist, RESIDUUM		43.5	SS-13	4	5	9	14	●
		Boring Terminated at 45.0 feet.								

LEGEND

SAMPLER TYPE

SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W2A-1R-04	Boring Location:	110+92	Offset:	RT 42	Alignment:	I-85 NB / CD
Elev.:	935.2 ft.	Latitude:	34.83803479	Longitude:	-82.28827284	Date Started:	1/7/2015
Total Depth:	45.0 ft.	Soil Depth:	45.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/7/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	27.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
0.0	935.0	Approximately 3 inches of topsoil. Firm, moist, reddish brown, with organics, SANDY ELASTIC SILT (MH, A-7), FILL		0.0	SS-1	1	2	3	5	●
		Medium dense, moist, reddish brown, with mica, SANDY ELASTIC SILT (MH, A-7-5(17)), FILL, LL=67 PL=46 PI=21 NMC=34.1 % _{#200} =68.3		2.0	SS-2	3	5	7	12	● ○ × ▲
5.0	930.0	Stiff, moist, reddish brown, with mica, SANDY SILT (ML, A-4), FILL		4.0	SS-3	2	4	6	10	●
		Firm, moist, reddish brown, weakly reactive, with mica, SANDY SILT (ML, A-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=32.8 % _{#200} =55.1		6.0	SS-4	2	5	5	10	● ○ ▲
		Firm, RESIDUUM		8.0	SS-5	3	3	4	7	●
10.0	925.0	Firm, RESIDUUM		10.0	SS-6	3	3	4	7	●
				13.5	SS-7	2	3	4	7	● ○ ▲
15.0	920.0	Loose, moist, reddish brown and tan, fine to medium grained, SILTY SAND (SM, A-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=48.7 % _{#200} =42.3								
		Loose, tan, white and brown, RESIDUUM		18.5	SS-8	1	3	6	9	●
20.0	915.0									
		Very loose, moist, brown and tan, RESIDUUM		23.5	SS-9	2	1	3	4	●
25.0										

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Michael Davis
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	W2A-1R-04	Boring Location:	110+92	Offset:	RT 42	Alignment:	I-85 NB / CD
Elev.:	935.2 ft.	Latitude:	34.83803479	Longitude:	-82.28827284	Date Started:	1/7/2015
Total Depth:	45.0 ft.	Soil Depth:	45.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/7/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	27.0 ft.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
25.0	910.0									10 20 30 40 50 60 70 80 90
30.0	905.0	Very loose, brown, tan, white and black, with mica, RESIDUUM		28.5	SS-10	2	1	2	3 ●	
35.0	900.0	Loose, moist, brown, black and tan, fine to medium grained, with mica, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=52.9 % _{#200} =31.5		33.5	SS-11	1	2	3	5 X ●	▲ ○
40.0	895.0	Loose, RESIDUUM		38.5	SS-12	1	3	4	7 ●	
45.0		Medium dense, brown, fine grained, RESIDUUM		43.5	SS-13	3	7	10	17 ●	
		Boring Terminated at 45.0 feet.								

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer

AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger

MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	WRM-1L-01	Boring Location:	35+60	Offset:	LT 32	Alignment:	Roper
Elev.:	935.2 ft.	Latitude:	34.83763434	Longitude:	-82.28827794	Date Started:	1/8/2015
Total Depth:	20.0 ft.	Soil Depth:	20.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/8/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	N.E.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
0.0	935.0	Approximately 3 inches of topsoil. Firm, moist, reddish brown, SANDY LEAN CLAY (CL, A-6), FILL, NMC=39.1 % $\#$ 200=71.0		0.0	SS-1	2	4	3	7	<div> <div>●</div> <div>○</div> <div>▲</div> </div>
		Firm, with trace mica, FILL		2.0	SS-2	2	2	5	7	<div> <div>●</div> </div>
5.0	930.0	Loose, moist, reddish brown, fine to medium grained, with trace mica, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=45.5 % $\#$ 200=30.1		4.0	SS-3	1	2	3	5	<div> <div>●</div> <div>○</div> <div>▲</div> </div>
		Medium dense, fine grained, RESIDUUM		6.0	SS-4	2	5	5	10	<div> <div>●</div> </div>
10.0	925.0	Loose, moist, reddish brown, fine to medium grained, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=35.4 % $\#$ 200=28.0		8.0	SS-5	1	3	4	7	<div> <div>●</div> <div>○</div> <div>▲</div> </div>
		Loose, RESIDUUM		10.0	SS-6	2	4	5	9	<div> <div>●</div> </div>
15.0	920.0	Medium dense, light brown and white, with trace mica, RESIDUUM		13.5	SS-7	2	5	7	12	<div> <div>●</div> </div>
20.0		Medium dense, moist, light brown and white, fine to medium grained, with trace mica, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=22.6 % $\#$ 200=29.3		18.5	SS-8	3	6	6	12	<div> <div>●</div> <div>○</div> <div>▲</div> </div>
		Boring Terminated at 20.0 feet.								

LEGEND

SAMPLER TYPE

SS - Split Spoon
ST - Shelby Tube
DCP - Dynamic Cone Penetrometer
AC - Auger Cuttings
GB - Grab Bag
NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
SSA - Solid Stem Augers
HA - Hand Auger
MR - Mud Rotary Wash
RC - Rock Coring

Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	Justin Fancher
Site Description:	I-85 and I-385 Interchange Design					Route:	I-85 / I-385
Boring No.:	WRM-2L-01	Boring Location:	41+39	Offset:	LT 27	Alignment:	Roper
Elev.:	947.0 ft.	Latitude:	34.83853742	Longitude:	-82.28989101	Date Started:	1/8/2015
Total Depth:	20.0 ft.	Soil Depth:	20.0 ft.	Core Depth:	0.0 ft.	Date Completed:	1/8/2015
Bore Hole Diameter (in):	3-7/8	Sampler Configuration		Liner Required:	No	Liner Used:	NA
Drill Machine:	CME 550X	Drill Method:	MR	Hammer Type:	Automatic	Energy Ratio:	79%
Core Size:	NA	Driller:	SCI	Groundwater:	TOB N.E.	24 HR	N.E.

Depth (ft)	Elevation (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft.)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE (blows / foot)</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%) ▲</div> </div>
0.0										10 20 30 40 50 60 70 80 90
	945.0	Approximately 2 inches of topsoil Loose, moist, reddish brown, fine to medium grained, SILTY SAND (SM, A-2), FILL		0.0	SS-1	2	3	4	7	●
		Medium dense, red and brown, fine to medium grained, with trace organics, SILTY SAND (SM, A-4(0)), FILL, LL=NP PL=NP PI=NP NMC=27.5 % _{#200} =46.8		2.0	SS-2	5	7	6	13	● ○ ▲
5.0		Very loose, brownish, with trace mica, FILL		4.0	SS-3	2	1	2	3	●
	940.0	Medium dense, moist, white, black and brown, fine to medium grained, with trace mica, SILTY SAND (SM, A-2-4(0)), RESIDUUM, LL=NP PL=NP PI=NP NMC=29.7 % _{#200} =23.6		6.0	SS-4	3	3	6	9	● ○ ▲
		Firm, moist, reddish brown, with trace mica, SANDY ELASTIC SILT (MH, A-7), RESIDUUM		8.0	SS-5	3	3	3	6	●
10.0		Stiff, red, with trace mica, RESIDUUM		10.0	SS-6	3	4	6	10	●
	935.0									
		Stiff, moist, reddish brown, fine to medium grained, with trace mica, SANDY ELASTIC SILT (MH, A-7-5(15)), RESIDUUM, LL=59 PL=37 PI=22 NMC=26.4 % _{#200} =64.7		13.5	SS-7	1	4	5	9	● ○ × × ▲
15.0										
	930.0									
		Medium dense, moist, brown and white, fine to medium grained, SILTY SAND (SM, A-2), RESIDUUM		18.5	SS-8	8	8	6	14	●
20.0										
		Boring Terminated at 20.0 feet.								

LEGEND

SAMPLER TYPE

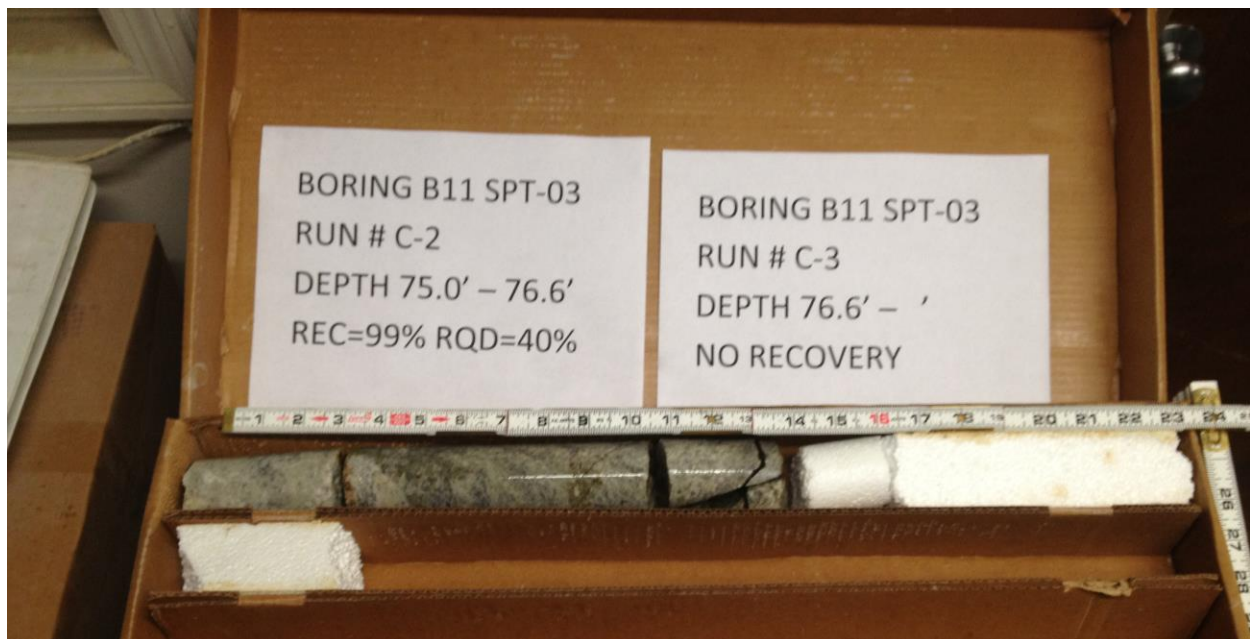
SS - Split Spoon
 ST - Shelby Tube
 DCP - Dynamic Cone Penetrometer
 AC - Auger Cuttings
 GB - Grab Bag
 NQ - Rock Core

DRILLING METHOD

HSA - Hollow Stem Augers
 SSA - Solid Stem Augers
 HA - Hand Auger
 MR - Mud Rotary Wash
 RC - Rock Coring















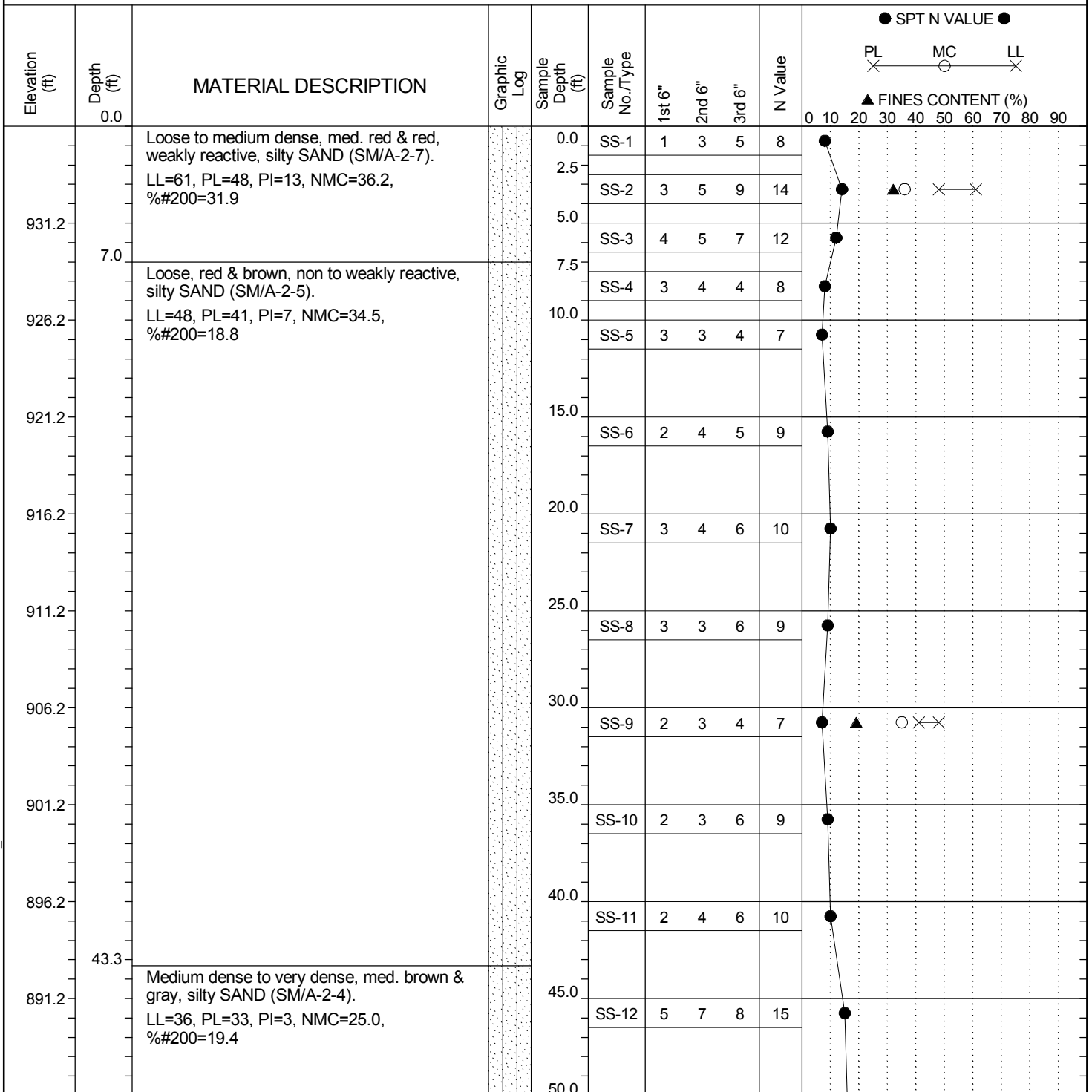






SCDOT Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	J. Patterson
Site Description:	I-85/I-385 Interchange Improvements					Route:	
Boring No.:	B-30	Boring Location:	36+39	Offset:	25' Lt.	Alignment:	Roper Mounta
Elev.:	936.2 ft	Latitude:	34.83776	Longitude:	82.28849	Date Started:	12/5/2011
Total Depth:	90 ft	Soil Depth:	70.0 ft	Core Depth:	85.0 ft	Date Completed:	12/5/2011
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 55	Drill Method:	RC	Hammer Type:	Automatic	Energy Ratio:	73%
Core Size:	NQ2	Driller:	SCI	Groundwater:	TOB	24HR	



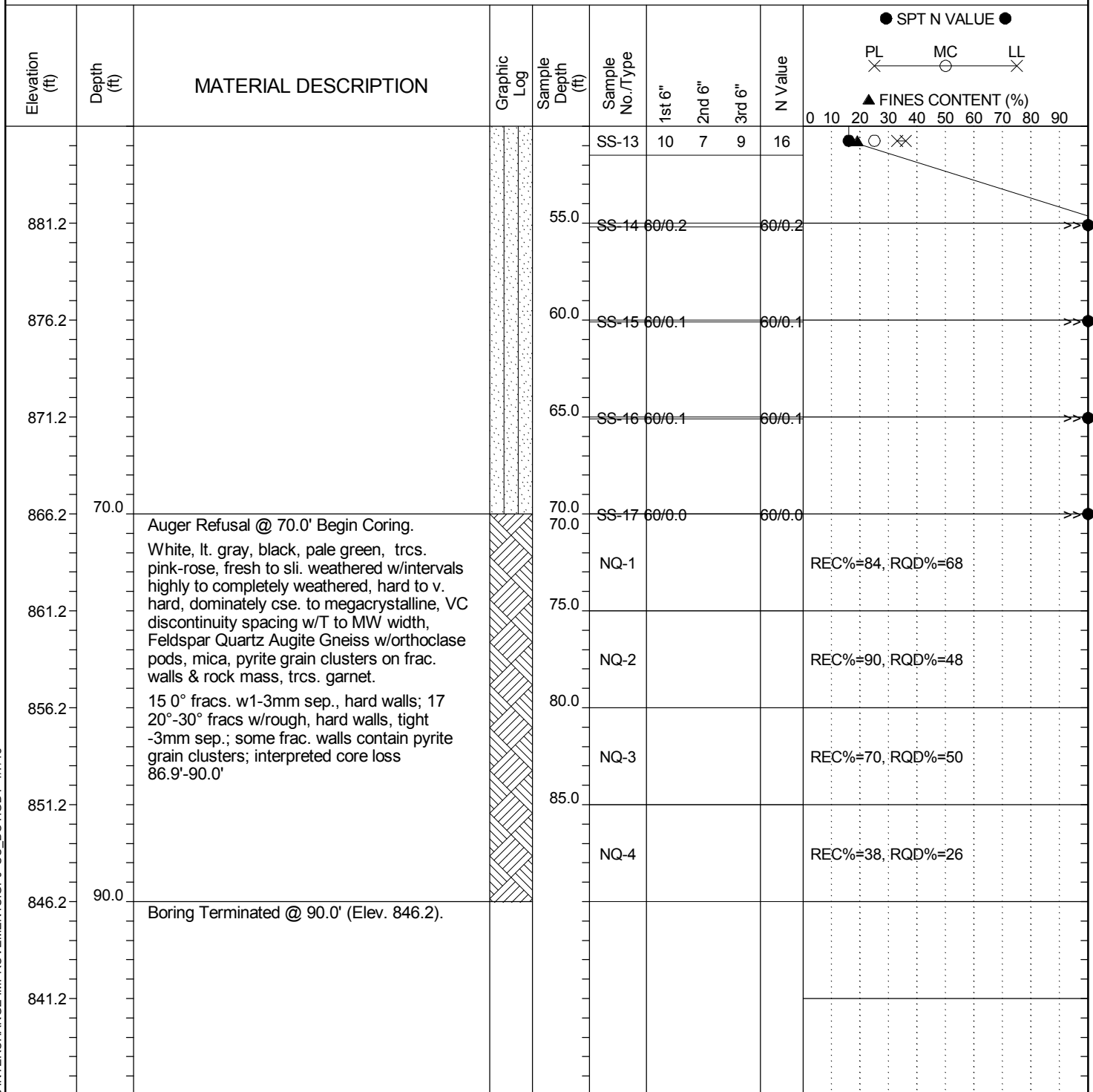
LEGEND

Continued Next Page

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	J. Patterson
Site Description:	I-85/I-385 Interchange Improvements					Route:	
Boring No.:	B-30	Boring Location:	36+39	Offset:	25' Lt.	Alignment:	Roper Mounta
Elev.:	936.2 ft	Latitude:	34.83776	Longitude:	82.28849	Date Started:	12/5/2011
Total Depth:	90 ft	Soil Depth:	70.0 ft	Core Depth:	85.0 ft	Date Completed:	12/5/2011
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 55	Drill Method:	RC	Hammer Type:	Automatic	Energy Ratio:	73%
Core Size:	NQ2	Driller:	SCI	Groundwater:	TOB	24HR	



LEGEND

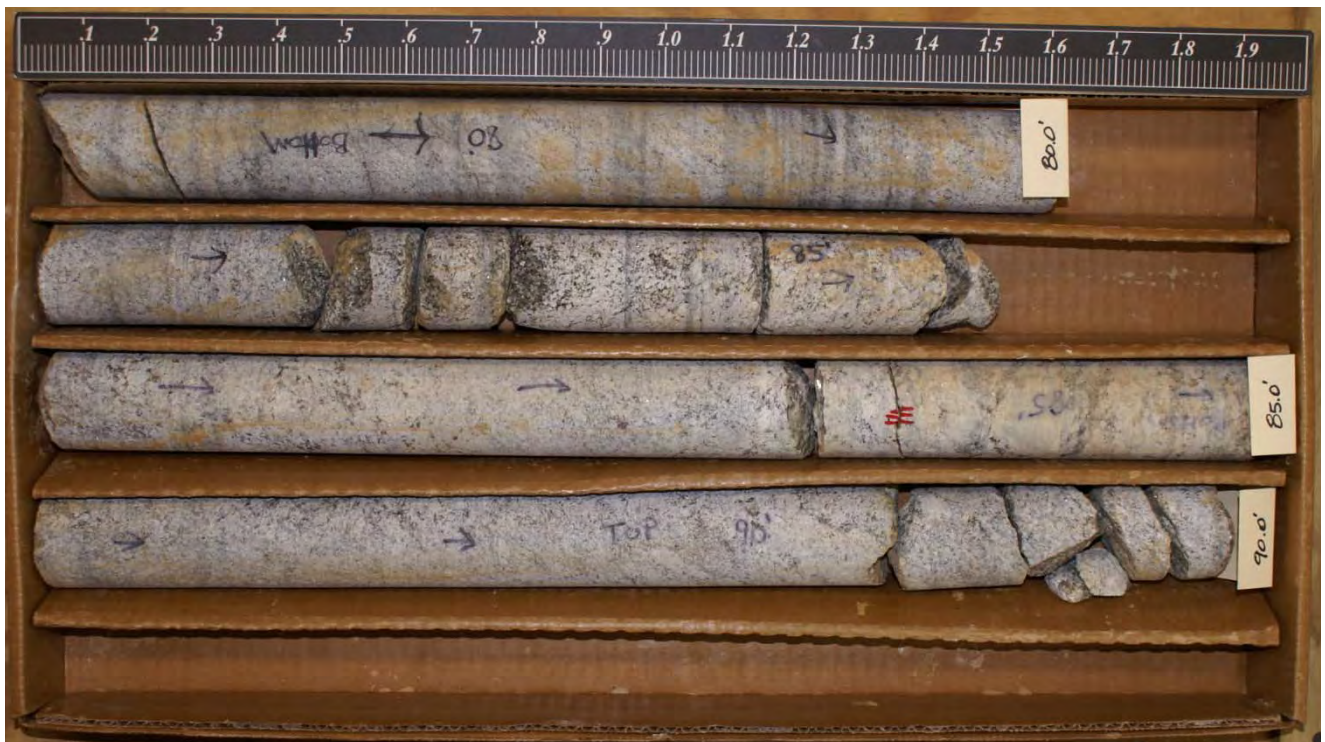
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

CORE PHOTOGRAPHIC RECORD

I-85 / I-385 Interchange Improvements



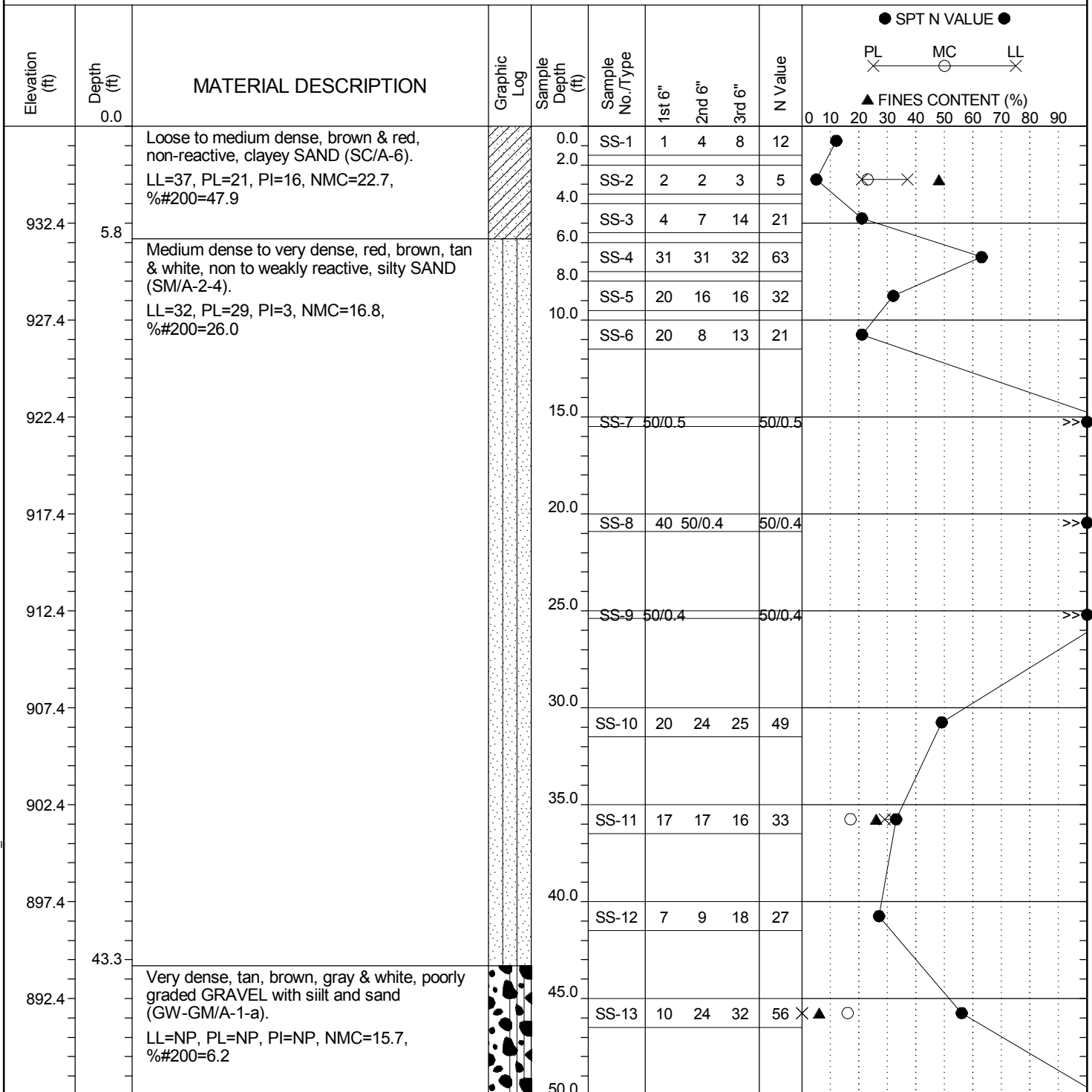
B-30 Box 1 of 2



B-30 Box 2 of 2

SCDOT Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	J. Patterson
Site Description:	I-85/I-385 Interchange Improvements					Route:	
Boring No.:	B-31	Boring Location:	40+08	Offset:	69' Rt.	Alignment:	Roper Mounta
Elev.:	937.4 ft	Latitude:	34.83852	Longitude:	82.28934	Date Started:	7/16/2012
Total Depth:	85 ft	Soil Depth:	65.0 ft	Core Depth:	85.0 ft	Date Completed:	7/19/2012
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 550	Drill Method:	RC	Hammer Type:	Automatic	Energy Ratio:	77%
Core Size:	NQ2	Driller:	SCI	Groundwater:	TOB	24HR	



LEGEND

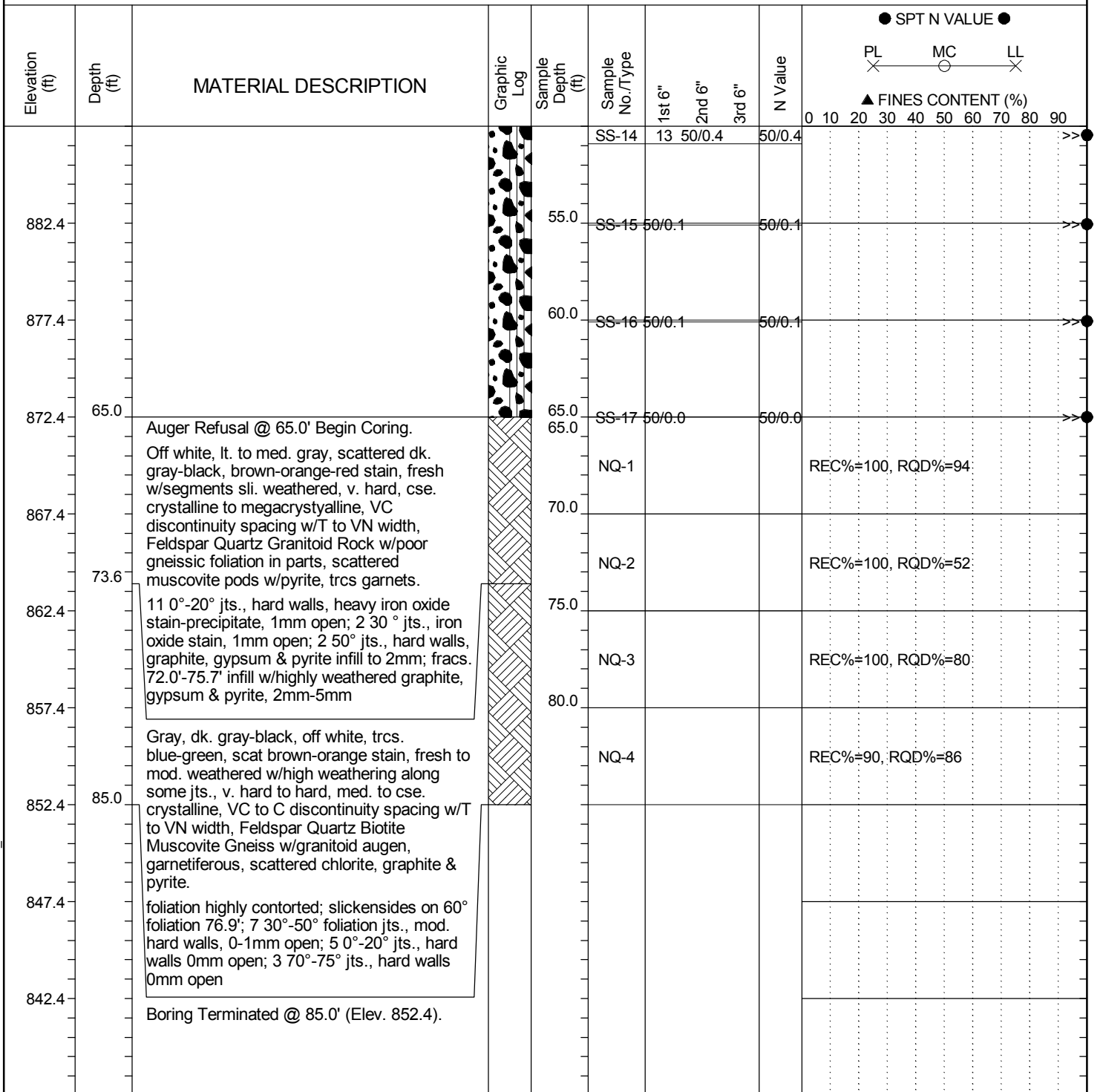
Continued Next Page

SC_DOT I-85 I-385 INTERCHANGE IMPROVEMENTS.GPJ SC_DOT.GDT 1/11/13

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	DC - Driving Casing	

SCDOT Soil Test Boring Log

File No.:	23.038111	Project No. (PIN):		County:	Greenville	Eng./Geo.:	J. Patterson
Site Description:	I-85/I-385 Interchange Improvements					Route:	
Boring No.:	B-31	Boring Location:	40+08	Offset:	69' Rt.	Alignment:	Roper Mounta
Elev.:	937.4 ft	Latitude:	34.83852	Longitude:	82.28934	Date Started:	7/16/2012
Total Depth:	85 ft	Soil Depth:	65.0 ft	Core Depth:	85.0 ft	Date Completed:	7/19/2012
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 550	Drill Method:	RC	Hammer Type:	Automatic	Energy Ratio:	77%
Core Size:	NQ2	Driller:	SCI	Groundwater:	TOB	24HR	



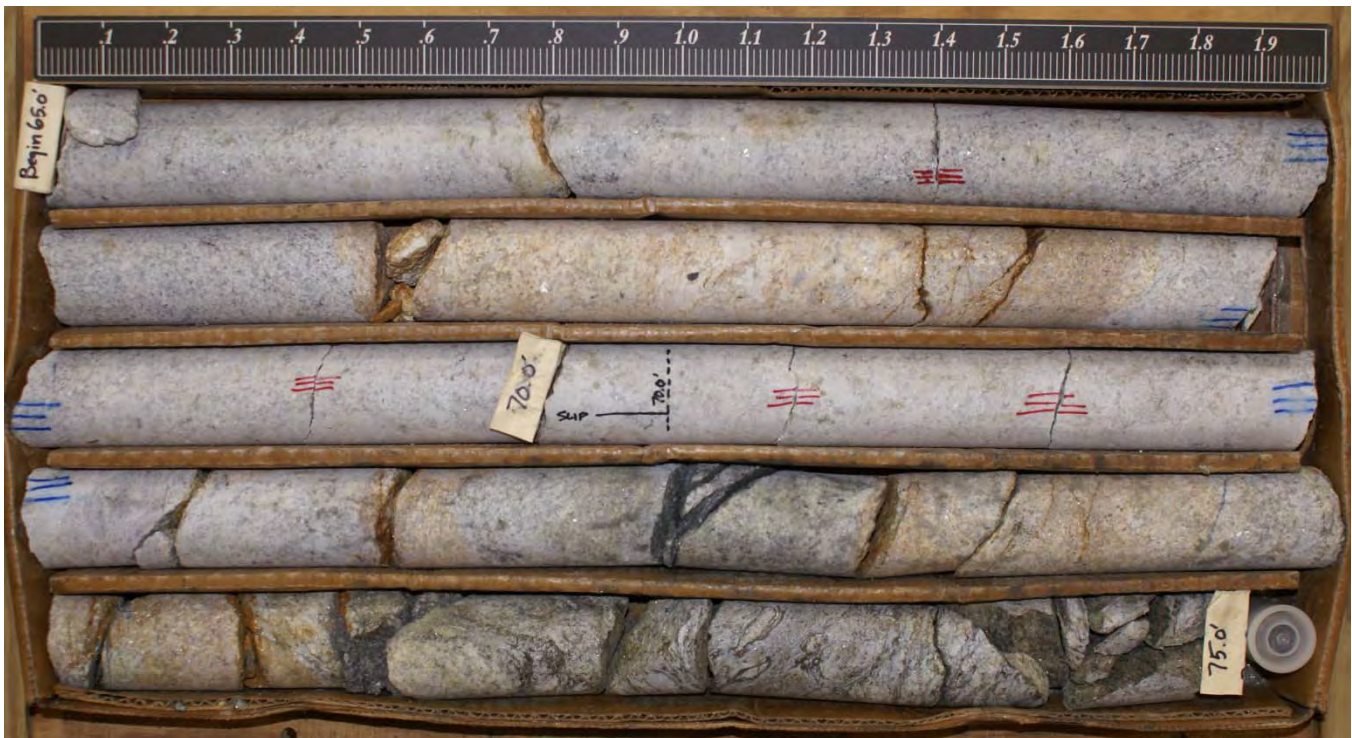
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SAMPLER TYPE		DRILLING METHOD	
SS	- Split Spoon	HSA	- Hollow Stem Auger
ST	- Shelby Tube	CFA	- Continuous Flight Augers
AWG	- Rock Core, 1-1/8"	DC	- Driving Casing
NQ	- Rock Core, 1-7/8"	RW	- Rotary Wash
CU	- Cuttings	RC	- Rock Core
CT	- Continuous Tube		

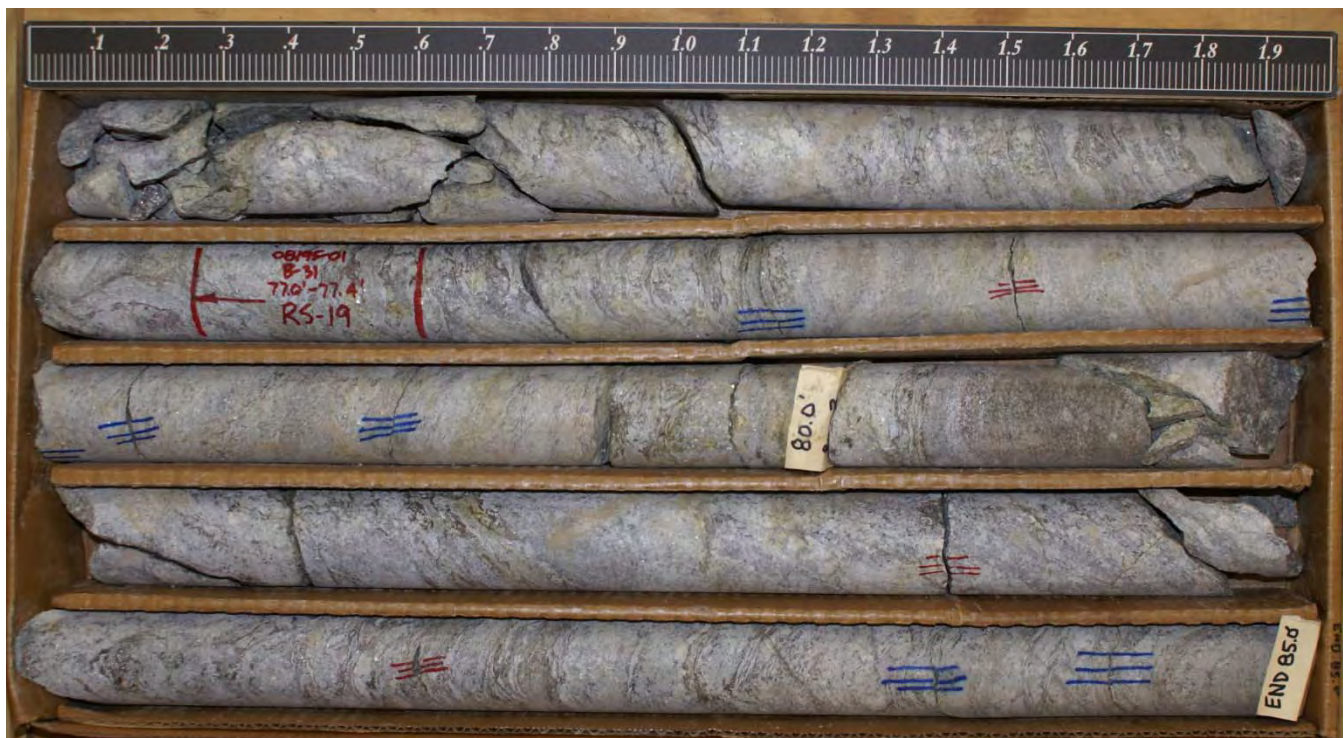
SC_DOT I-85 I-385 INTERCHANGE IMPROVEMENTS.GPJ SC_DOT.GDT 1/11/13

CORE PHOTOGRAPHIC RECORD

I-85 / I-385 Interchange Improvements



B-31 Box 1 of 2



B-31 Box 2 of 2

Appendix C

Advanced Laboratory Test Results

Consolidated Undrained Triaxial Summary

Boring Number	Depth (ft)	ASTM Classification	C (psi)	Φ	C' (psi)	Φ'
B-49	0-21.5	SM	1.0	29.0	2.1	25.2
B-51	0-36	SM	1.9	28.0	0.8	31.1
B-54	0-41	SM	2.5	24.0	1.2	28.0
B-56	0-10	CL	1.0	26.0	0.7	29.4
B-56	10-35	SM	1.8	26.0	1.2	29.0
B-59	0-40	SM	1.4	28.2	1.1	30.3
B-65	0-15	SM	1.0	31.0	0.1	36.6
B-68	0-16	MH	0.5	33.0	0.6	32.8
B01-SPT-09	19-21	SC	1.0	19.0	0.6	34.0
B01-SPT-14	25-27	CL	1.0	16.0	0.9	31.0
B06-SPT-12	35-37	ML	0.8	18.5	2.0	28.0
RRM-47	25-27	ML	4.5	15.7	1.8	30.5
W1B-2R-02	8-10	SM	2.0	23.0	2.0	34.0
W1B-2R-03	4-6	CL	2.0	28.0	2.0	34.0
W1B-2R-03	15-17	CM	3.0	23.0	3.3	32.9
W2A-MB2-01	10-12	CL	1.5	23.5	2.4	35.0

Consolidation Summary

Boring Number	Depth (ft)	ASTM Classification	C_c	C_r	e_o	P_c (tsf)	C_{vt90} (ft ² /yr)	C_{vt50} (ft ² /yr)
B-39	8-9.2	CL	0.15	0.01	0.641	3.4	267	112
B-65	10-11.4	SM	0.47	0.04	1.2238	1.9	147	62
B-40	6-7.5	SM	0.2	0.01	0.916	4.5	195	82
B-67	4-4.7	SM	0.13	0.01	0.7971	3.2	229	96
B-74	4-5.3	ML	0.34	0.02	1.1323	0.69	45	19
B-61	2-3.3	SM	0.11	0.01	0.6389	3.6	241	101
R2B-42	10-12	ML	0.408	0.034	1.1026	2.25	163	474
W85-2L-03	25-27	ML	0.395	0.04	1.0438	1.5	594	365
B07-SPT-01	25-27	ML	0.224	0.026	0.7774	2.0	801	575
B09-SPT-05	6-8	MH	0.218	0.019	0.9300	1.0	619	461



Project Name : I-85/I-385 Interchange
Location : Greenville County, South Carolina
Job Number : 08195-01
Project Job No. : 08195-01

Unconfined Compressive Strength Summary

Boring Number	Sample Number	Depth (ft)	Natural Moisture (%)	ASTM Classification	Wet Density (pcf)	Dry Density (pcf)	q _u (ksf)	Cohesion (psf)
B-39	ST-1	4-4.5	10.7	SC	138.7	125.3	1.09	545
B-40	ST-2	8.5-9.0	26	SM	119.1	94.5	2.23	1115
B-43	ST-1	2-2.5	17.5	SC	132.4	112.7	2.48	1240
B-46	ST-1	4-4.5	26.2	SM	117.3	93.0	1.81	905
B-46	ST-2	8-8.5	28.7	SM	111.8	86.9	1.15	575
B-53	ST-2	8-8.5	34.6	SM	54.6	40.6	0.03	15
B-54	ST-1	5-5.5	22.2	SM	121.8	99.6	1.96	980
B-54	ST-2	9-9.5	22.8	ML	121.6	99.0	1.47	735
B-65	ST-2	10-10.5	39.1	SM	110.0	79.1	0.47	235
B-68	ST-2	6-6.5	33.2	SM	117.6	88.3	1.92	960
B-70	ST-1	6-6.5	30.8	SM	126.4	96.6	0.46	230

**UNCONFINED COMPRESSION TEST**

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-39

Sample Depth : 4.0' to 4.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Brown Silty Sand

Wet Density : 138.7 pcf

Dry Density : 125.3 pcf

Moisture : 10.7 %

Initial Height : 5.86 in

Initial Diameter : 2.84 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	9.6	0.05	2.6	0.21
3	18.3	0.05	5.1	0.39
4	26.9	0.05	7.7	0.56
5	35.6	0.05	10.2	0.73
6	47.1	0.05	12.8	0.93
7	57.7	0.05	15.3	1.11
8	67.3	0.05	17.9	1.26
9	75.0	0.06	20.5	1.36
10	80.8	0.06	23.9	1.40
11	78.9	0.06	27.3	1.30
12	77.9	0.06	30.7	1.23
13	74.1	0.07	34.1	1.11
14	69.3	0.07	37.5	0.98
15	65.4	0.07	40.9	0.88
16	58.7	0.08	44.3	0.74



Florence & Hutcheson

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UNCONFINED COMPRESSION TEST

Page 2 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-39

Sample Depth : 4.0' to 4.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Brown Silty Sand

Wet Density : 138.7 pcf

Dry Density : 125.3 pcf

Moisture : 10.7 %

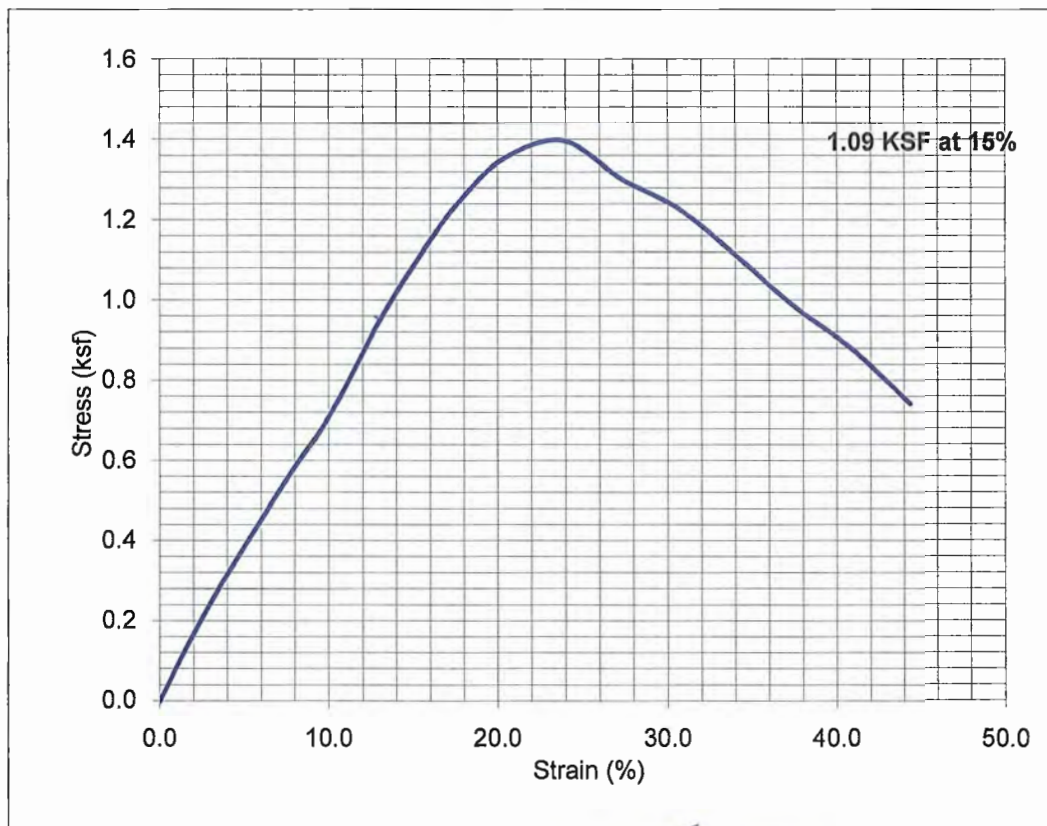
Deg. of Sat. : NA

Initial Height : 5.86 in

Initial Diameter : 2.84 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:

[Signature]



UNCONFINED COMPRESSION TEST

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-40

Sample Depth : 8.5' to 9.0'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Red Silty Sand

Wet Density : 119.1 pcf

Dry Density : 94.5 pcf

Moisture : 26.0 %

Initial Height : 5.92 in

Initial Diameter : 2.89 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.05	0.0	0.00
2	20.2	0.05	2.5	0.43
3	37.5	0.05	5.1	0.78
4	51.9	0.05	7.6	1.06
5	73.1	0.05	10.1	1.45
6	95.2	0.05	12.7	1.83
7	121.2	0.05	15.2	2.26
8	144.3	0.06	17.7	2.61
9	167.4	0.06	20.3	2.94
10	184.7	0.06	23.7	3.10
11	176.0	0.06	27.0	2.83
12	135.6	0.07	30.4	2.08
13	75.0	0.07	33.8	1.09



Florence & Hutcheson

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UNCONFINED COMPRESSION TEST

Page 2 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-40

Sample Depth : 8.5' to 9.0'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Red Silty Sand

Wet Density : 119.1 pcf

Dry Density : 94.5 pcf

Moisture : 26.0 %

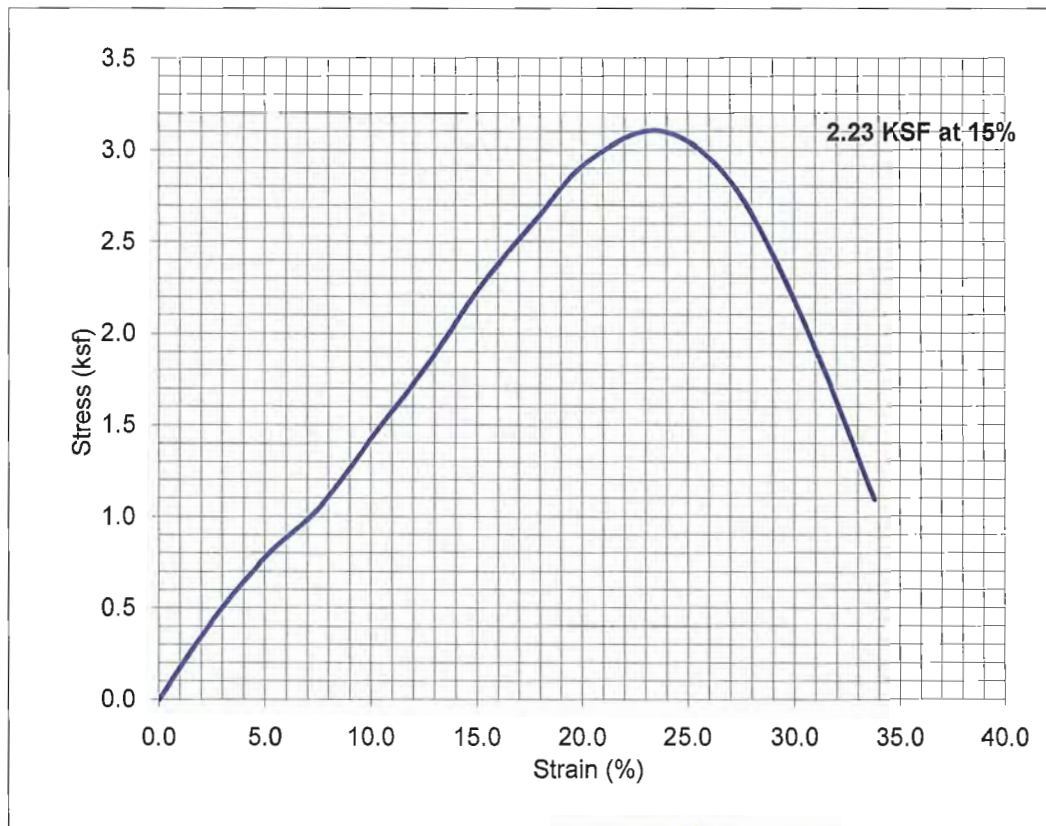
Deg. of Sat. : NA

Initial Height : 5.92 in

Initial Diameter : 2.89 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:

**UNCONFINED COMPRESSION TEST**

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-43

Sample Depth : 2.0' to 2.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Orange & Tan Clayey Sand

Wet Density : 132.4 pcf

Dry Density : 112.7 pcf

Moisture : 17.5 %

Initial Height : 5.84 in

Initial Diameter : 2.86 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	21.2	0.05	2.6	0.46
3	46.2	0.05	5.1	0.98
4	69.3	0.05	7.7	1.43
5	89.5	0.05	10.3	1.80
6	112.5	0.05	12.8	2.20
7	133.7	0.05	15.4	2.53
8	153.9	0.05	18.0	2.83
9	164.5	0.06	20.5	2.93
10	175.1	0.06	24.0	2.98
11	178.9	0.06	27.4	2.91
12	175.1	0.06	30.8	2.71
13	161.6	0.07	34.2	2.38
14	142.4	0.07	37.7	1.99



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST

Page 2 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-43

Sample Depth : 2.0' to 2.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Orange & Tan Clayey Sand

Wet Density : 132.4 pcf

Dry Density : 112.7 pcf

Moisture : 17.5 %

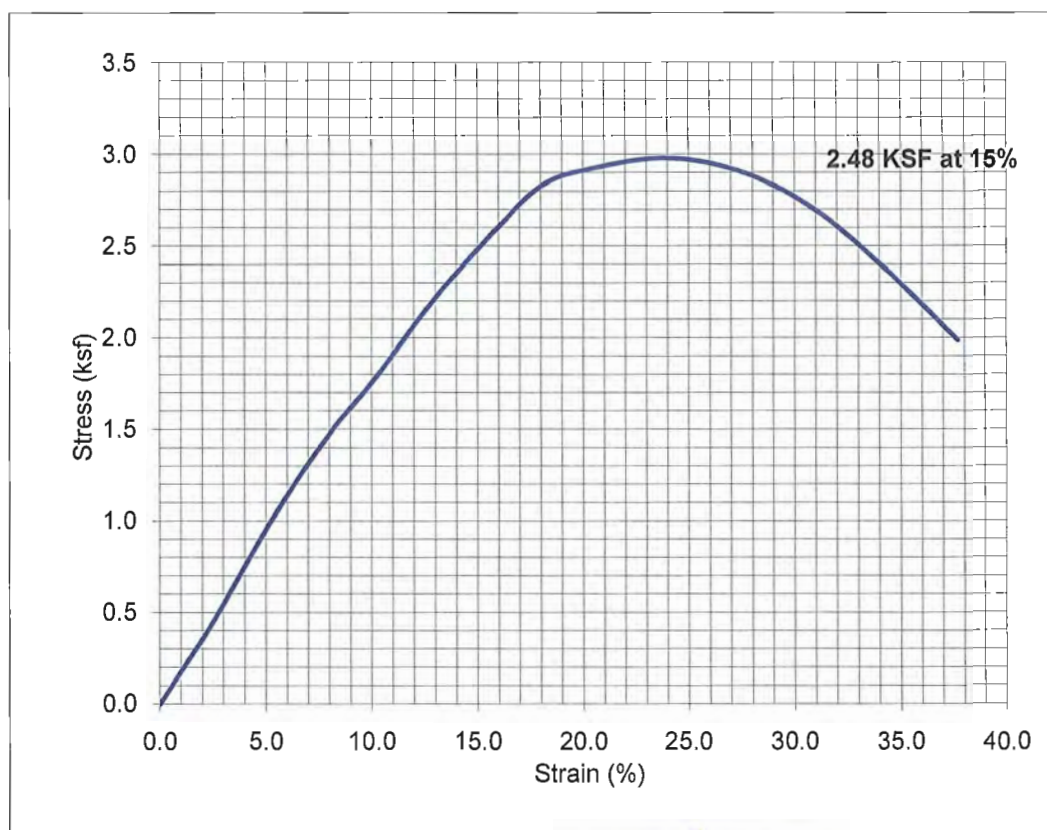
Deg. of Sat. : NA

Initial Height : 5.84 in

Initial Diameter : 2.86 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:



UNCONFINED COMPRESSION TEST

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-46

Sample Depth : 4.0' to 4.5'

Date Tested : 10/23/12

Date Reported : 10/30/12

Soil Type : Red & Orange Silty Sand

Wet Density : 117.3 pcf

Dry Density : 93.0 pcf

Moisture : 26.2 %

Initial Height : 5.95 in

Initial Diameter : 2.86 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	6.7	0.05	2.5	0.15
3	15.4	0.05	5.0	0.33
4	32.7	0.05	7.6	0.68
5	51.0	0.05	10.1	1.03
6	72.1	0.05	12.6	1.41
7	96.2	0.05	15.1	1.83
8	107.7	0.05	17.6	1.99
9	114.5	0.06	20.2	2.05
10	108.7	0.06	23.5	1.87
11	90.4	0.06	26.9	1.48
12	69.3	0.06	30.3	1.08



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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-46

Sample Depth : 4.0' to 4.5'

Date Tested : 10/23/12

Date Reported : 10/30/12

Soil Type : Red & Orange Silty Sand

Wet Density : 117.3 pcf

Dry Density : 93.0 pcf

Moisture : 26.2 %

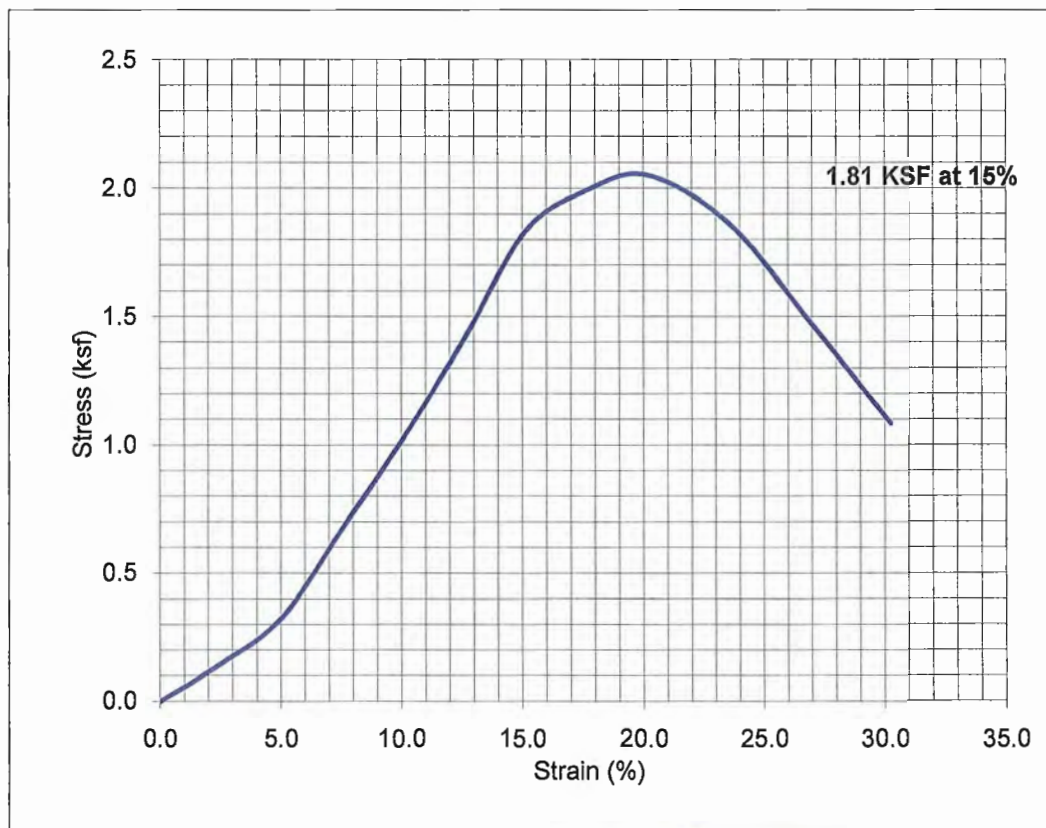
Deg. of Sat. : NA

Initial Height : 5.95 in

Initial Diameter : 2.86 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:



UNCONFINED COMPRESSION TEST

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-46

Sample Depth : 8.0' to 8.5'

Date Tested : 10/23/12

Date Reported : 10/30/12

Soil Type : Gray, Brown & Red Silty Sand

Wet Density : 111.8 pcf

Dry Density : 86.9 pcf

Moisture : 28.7 %

Initial Height : 5.80 in

Initial Diameter : 2.85 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	12.5	0.05	2.6	0.27
3	23.1	0.05	5.2	0.49
4	35.6	0.05	7.8	0.74
5	45.2	0.05	10.4	0.91
6	53.9	0.05	12.9	1.06
7	61.6	0.05	15.5	1.17
8	66.4	0.05	18.1	1.22
9	61.6	0.06	20.7	1.10
10	53.9	0.06	24.2	0.92
11	51.9	0.06	27.6	0.85
12	44.2	0.06	31.1	0.69



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-46

Sample Depth : 8.0' to 8.5'

Date Tested : 10/23/12

Date Reported : 10/30/12

Soil Type : Gray, Brown & Red Silty Sand

Wet Density : 111.8 pcf

Dry Density : 86.9 pcf

Moisture : 28.7 %

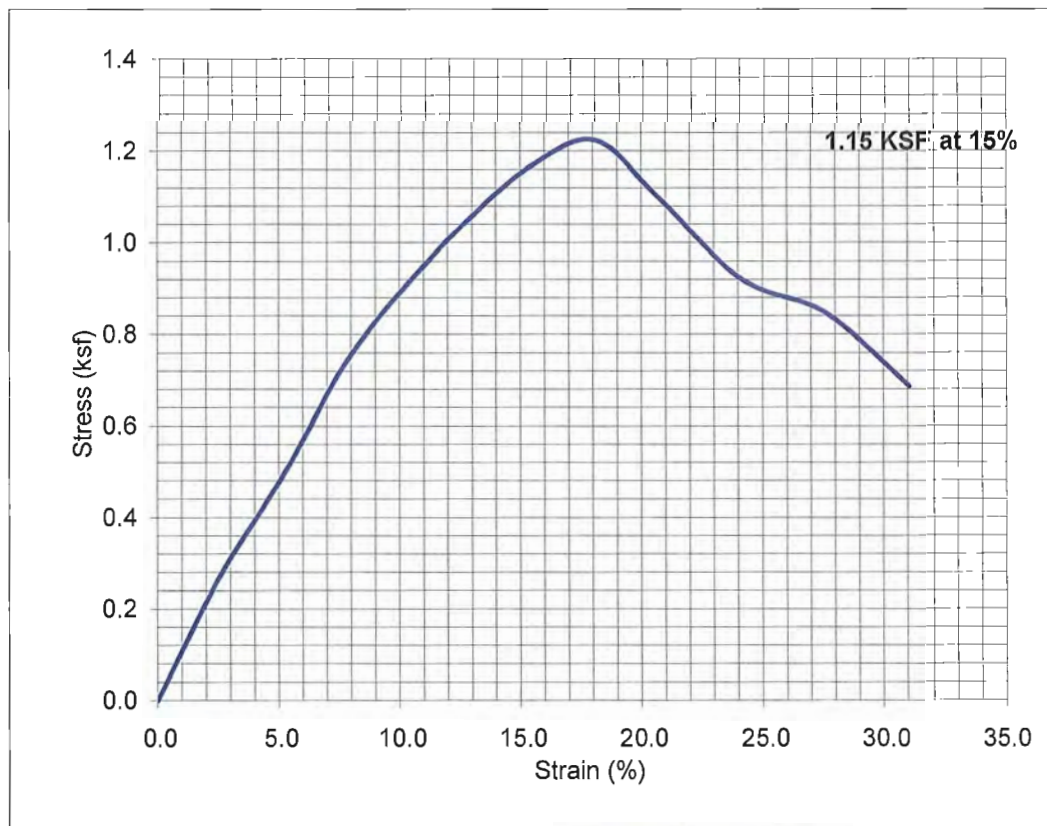
Deg. of Sat. : NA

Initial Height : 5.80 in

Initial Diameter : 2.85 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:

Amy Sells

**UNCONFINED COMPRESSION TEST**

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-53

Sample Depth : 8.0' to 8.5'

Date Tested : 10/22/12

Date Reported : 10/30/12

Soil Type : Gray, Tan & Orange Silty Sand

Wet Density : 54.6 pcf

Dry Density : 40.6 pcf

Moisture : 34.6 %

Initial Height : 2.84 in

Initial Diameter : 5.87 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.19	0.0	0.00
2	1.0	0.20	5.3	0.00
3	3.8	0.21	10.6	0.02
4	6.7	0.22	15.9	0.03
5	8.7	0.24	21.1	0.04
6	12.5	0.26	26.4	0.05
7	16.4	0.28	31.7	0.06
8	21.2	0.30	37.0	0.07
9	24.0	0.33	42.3	0.07
10	29.8	0.37	49.3	0.08
11	33.7	0.43	56.4	0.08
12	36.6	0.51	63.4	0.07
13	39.4	0.64	70.5	0.06
14	42.3	0.84	77.5	0.05
15	43.3	1.22	84.6	0.04
16	44.2	2.25	91.6	0.02
17	44.2	14.42	98.7	0.00



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-53

Sample Depth : 8.0' to 8.5'

Date Tested : 10/22/12

Date Reported : 10/30/12

Soil Type : Gray, Tan & Orange Silty Sand

Wet Density : 54.6 pcf

Dry Density : 40.6 pcf

Moisture : 34.6 %

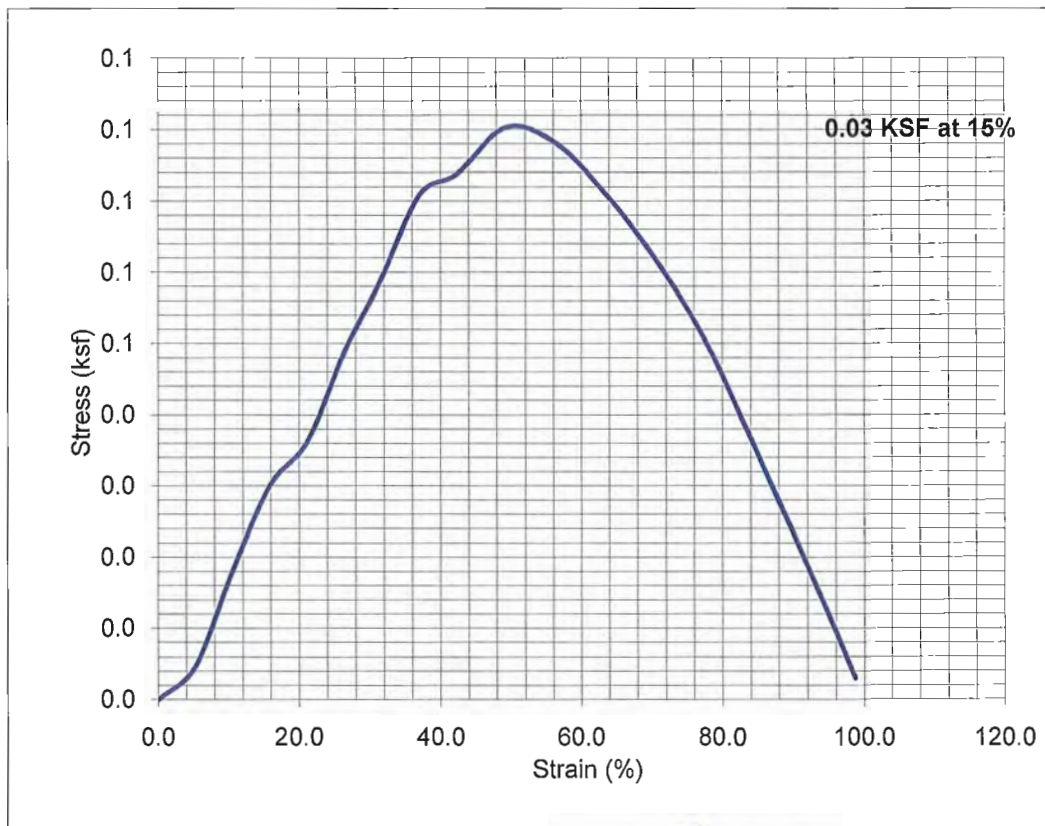
Deg. of Sat. : NA

Initial Height : 2.84 in

Initial Diameter : 5.87 in

Proving Ring : #22734

Comments : AASHTO: T-208 ; L / D Ratio < 2



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-54

Sample Depth : 5.0' to 5.5'

Date Tested : 10/24/12

Date Reported : 10/30/12

Soil Type : Red & Orange Silty Sand

Wet Density : 121.8 pcf

Dry Density : 99.6 pcf

Moisture : 22.2 %

Initial Height : 5.88 in

Initial Diameter : 2.87 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.05	0.0	0.00
2	17.3	0.05	2.6	0.37
3	37.5	0.05	5.1	0.79
4	56.8	0.05	7.7	1.16
5	74.1	0.05	10.2	1.48
6	90.4	0.05	12.8	1.75
7	105.8	0.05	15.3	1.99
8	121.2	0.05	17.9	2.21
9	136.6	0.06	20.4	2.42
10	154.9	0.06	23.8	2.62
11	168.3	0.06	27.2	2.72
12	181.8	0.06	30.6	2.80
13	192.4	0.07	34.0	2.82
14	196.2	0.07	37.4	2.73
15	167.4	0.08	40.8	2.20
16	103.9	0.08	44.2	1.29



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-54

Sample Depth : 5.0' to 5.5'

Date Tested : 10/24/12

Date Reported : 10/30/12

Soil Type : Red & Orange Silty Sand

Wet Density : 121.8 pcf

Dry Density : 99.6 pcf

Moisture : 22.2 %

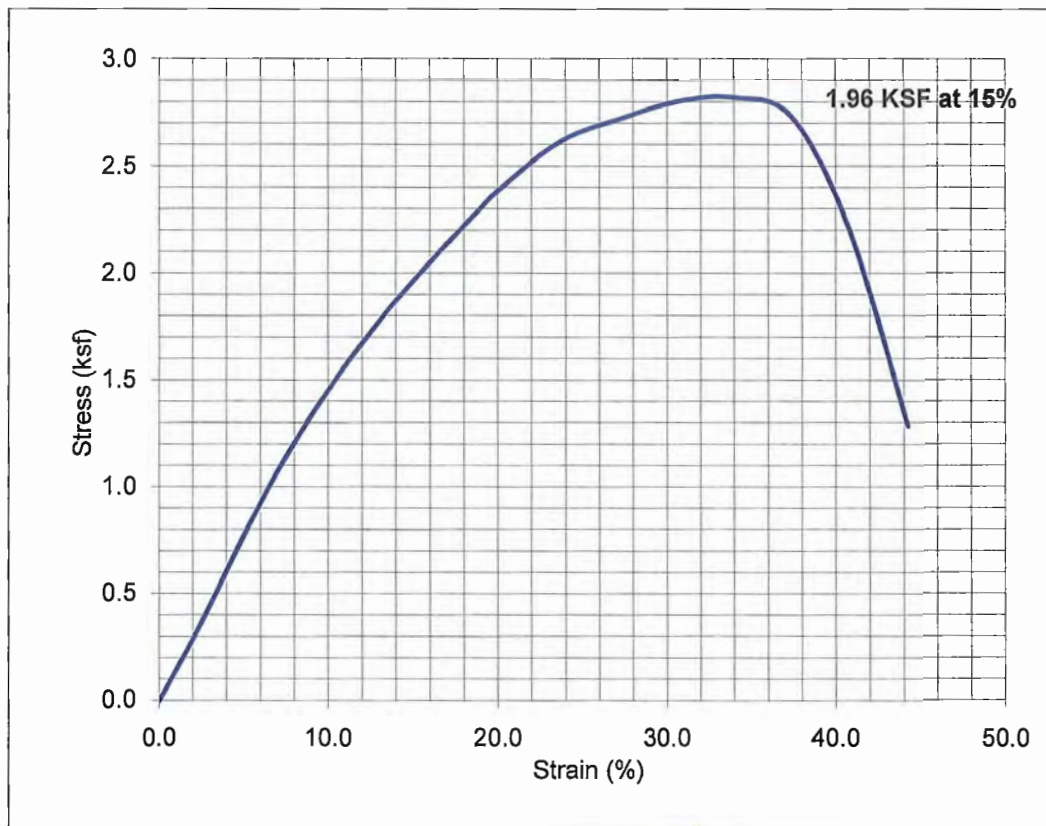
Deg. of Sat. : NA

Initial Height : 5.88 in

Initial Diameter : 2.87 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:

[Signature]



UNCONFINED COMPRESSION TEST

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-54

Sample Depth : 9.0' to 9.5'

Date Tested : 10/24/12

Date Reported : 10/30/12

Soil Type : Red & Yellow Sandy Silt

Wet Density : 121.6 pcf

Dry Density : 99.0 pcf

Moisture : 22.8 %

Initial Height : 5.87 in

Initial Diameter : 2.86 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	14.4	0.05	2.6	0.31
3	26.9	0.05	5.1	0.57
4	41.4	0.05	7.7	0.85
5	53.9	0.05	10.2	1.08
6	67.3	0.05	12.8	1.31
7	78.9	0.05	15.3	1.49
8	92.3	0.05	17.9	1.70
9	105.8	0.06	20.4	1.88
10	121.2	0.06	23.9	2.06
11	134.7	0.06	27.3	2.19
12	143.3	0.06	30.7	2.22
13	148.1	0.07	34.1	2.18
14	146.2	0.07	37.5	2.04



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-54

Sample Depth : 9.0' to 9.5'

Date Tested : 10/24/12

Date Reported : 10/30/12

Soil Type : Red & Yellow Sandy Silt

Wet Density : 121.6 pcf

Dry Density : 99.0 pcf

Moisture : 22.8 %

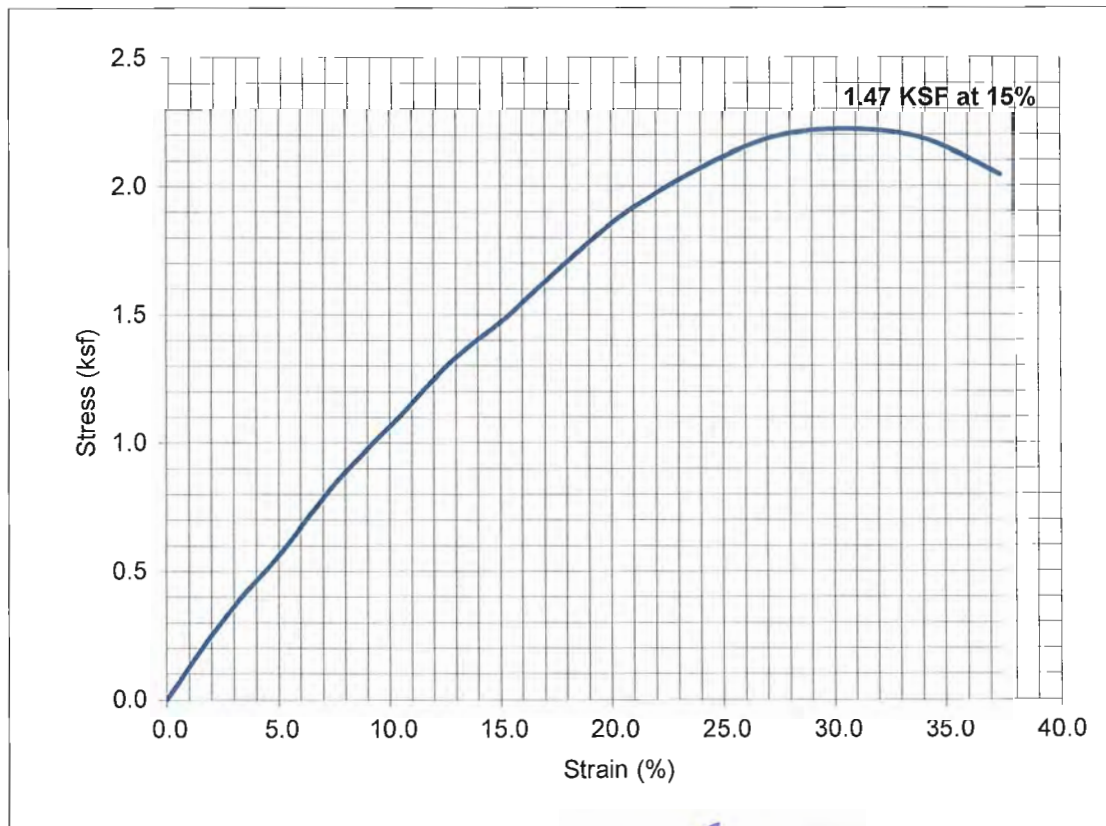
Deg. of Sat. : NA

Initial Height : 5.87 in

Initial Diameter : 2.86 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:

Henry Soto



UNCONFINED COMPRESSION TEST

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-65

Sample Depth : 10.0' to 10.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Gray, Black & Yellow Silty Sand

Wet Density : 110.0 pcf

Dry Density : 79.1 pcf

Moisture : 39.1 %

Initial Height : 5.90 in

Initial Diameter : 2.84 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	3.8	0.05	2.5	0.09
3	7.7	0.05	5.1	0.17
4	11.5	0.05	7.6	0.24
5	15.4	0.05	10.2	0.31
6	20.2	0.05	12.7	0.40
7	25.0	0.05	15.3	0.48
8	28.9	0.05	17.8	0.54
9	32.7	0.06	20.3	0.59
10	35.6	0.06	23.7	0.62
11	39.4	0.06	27.1	0.65
12	42.3	0.06	30.5	0.67
13	43.3	0.07	33.9	0.65
14	44.2	0.07	37.3	0.63
15	45.2	0.07	40.7	0.61
16	42.3	0.08	44.1	0.54



UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-65

Sample Depth : 10.0' to 10.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Gray, Black & Yellow Silty Sand

Wet Density : 110.0 pcf

Dry Density : 79.1 pcf

Moisture : 39.1 %

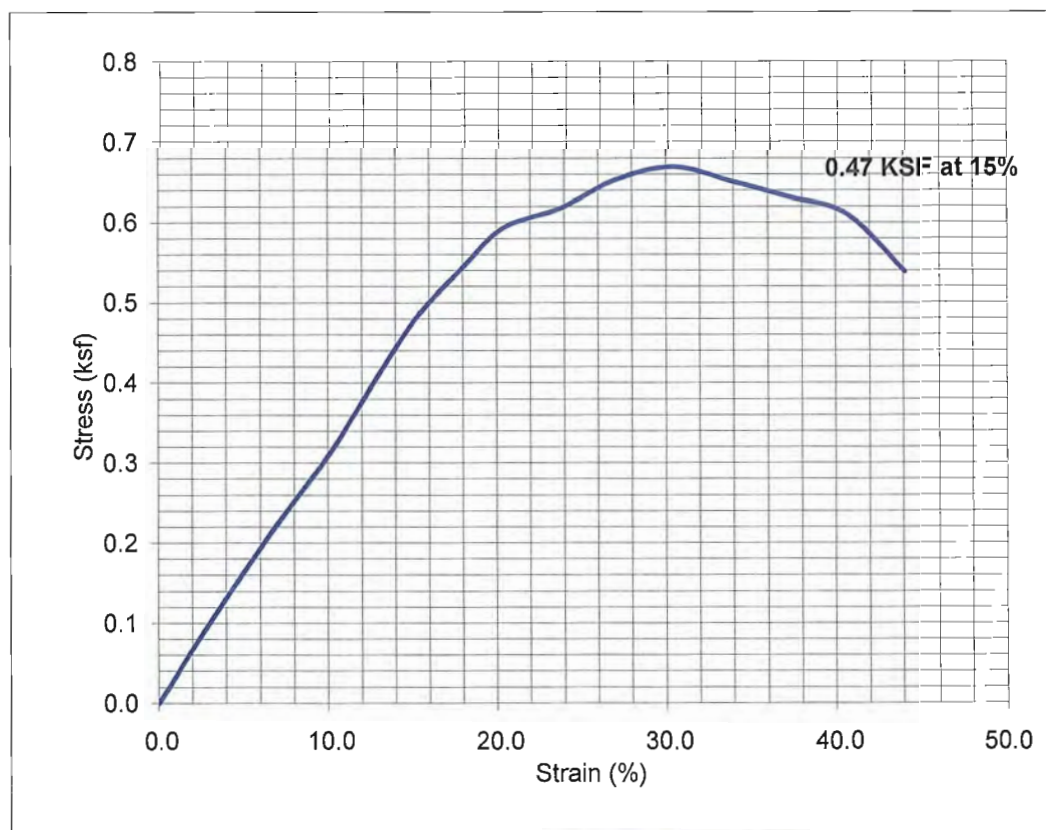
Deg. of Sat. : NA

Initial Height : 5.90 in

Initial Diameter : 2.84 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:



UNCONFINED COMPRESSION TEST

Page 1 of 2

Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-68

Sample Depth : 6.0' to 6.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Tan & Yellow Silty Sand

Wet Density : 117.6 pcf

Dry Density : 88.3 pcf

Moisture : 33.2 %

Initial Height : 5.86 in

Initial Diameter : 2.84 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	<u>lbs</u>	<u>sf</u>	<u>%</u>	<u>Ksf</u>
1	0.0	0.04	0.0	0.00
2	13.5	0.05	2.6	0.30
3	28.9	0.05	5.1	0.62
4	47.1	0.05	7.7	0.99
5	65.4	0.05	10.2	1.34
6	84.6	0.05	12.8	1.68
7	102.0	0.05	15.4	1.96
8	116.4	0.05	17.9	2.17
9	127.9	0.06	20.5	2.31
10	135.6	0.06	23.9	2.35
11	134.7	0.06	27.3	2.23



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-2

Sample Loc. : Boring No. B-68

Sample Depth : 6.0' to 6.5'

Date Tested : 10/22/12

Date Reported : 10/24/12

Soil Type : Tan & Yellow Silty Sand

Wet Density : 117.6 pcf

Dry Density : 88.3 pcf

Moisture : 33.2 %

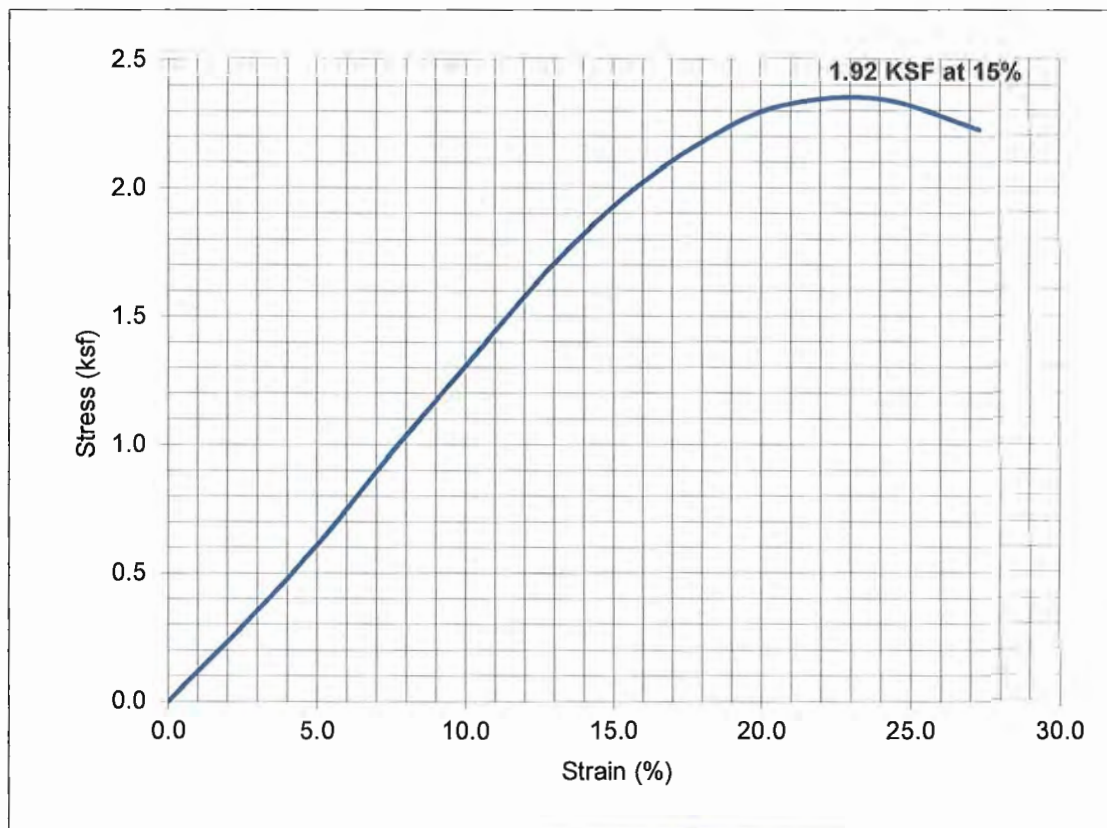
Deg. of Sat. : NA

Initial Height : 5.86 in

Initial Diameter : 2.84 in

Proving Ring : #22734

Comments : AASHTO: T-208



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-70

Sample Depth : 6.0' to 6.5'

Date Tested : 10/24/12

Date Reported : 10/30/12

Soil Type : Tan & Green Silty Sand

Wet Density : 126.4 pcf

Dry Density : 96.6 pcf

Moisture : 30.8 %

Initial Height : 5.77 in

Initial Diameter : 2.86 in

Proving Ring : #22734

RESULTS:	Axial	Corrected	Unit	
	Load	Area	Strain	Stress
#	lbs	sf	%	Ksf
1	0.0	0.04	0.0	0.00
2	4.8	0.05	2.6	0.11
3	9.6	0.05	5.2	0.20
4	12.5	0.05	7.8	0.26
5	17.3	0.05	10.4	0.35
6	21.2	0.05	13.0	0.41
7	25.0	0.05	15.6	0.47
8	27.9	0.05	18.2	0.51
9	32.7	0.06	20.8	0.58
10	41.4	0.06	24.2	0.70
11	47.1	0.06	27.7	0.77
12	51.9	0.06	31.2	0.80
13	54.8	0.07	34.6	0.81
14	46.2	0.07	38.1	0.64
15	6.7	0.08	41.6	0.09



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UNCONFINED COMPRESSION TEST

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Project Name : I-85/I-385 Interchange

Project # : 08195-01

Project County : Greenville

Project State : South Carolina

Laboratory # : 08195-01

Submitted By : Florence & Hutcheson, Inc.

Sample # : ST-1

Sample Loc. : Boring No. B-70

Sample Depth : 6.0' to 6.5'

Date Tested : 10/24/12

Date Reported : 10/30/12

Soil Type : Tan & Green Silty Sand

Wet Density : 126.4 pcf

Dry Density : 96.6 pcf

Moisture : 30.8 %

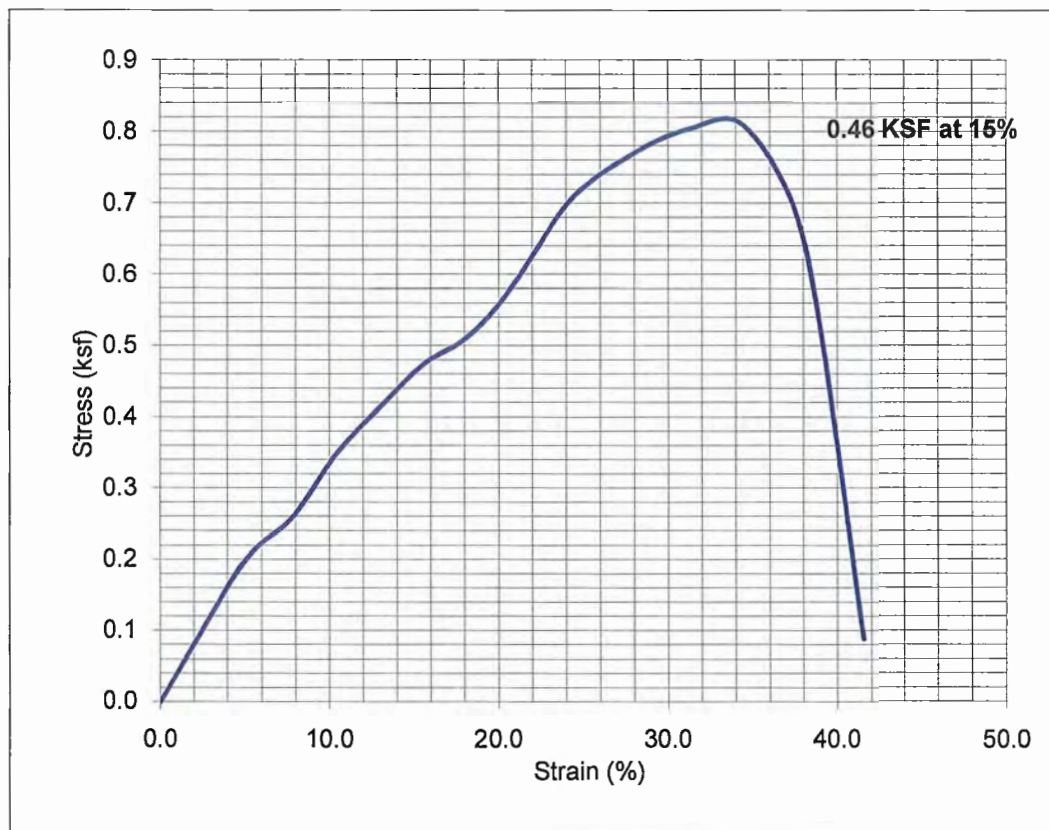
Deg. of Sat. : NA

Initial Height : 5.77 in

Initial Diameter : 2.86 in

Proving Ring : #22734

Comments : AASHTO: T-208



APPROVED BY:



Florence & Hutcheson

An **ICA** Company

Project Name : I-85/I-385 Interchange
Location : Greenville County, South Carolina
Job Number : 08195-01
Project Job No. : 08195-01

Triaxial Compression Summary

Boring Number	Sample Number	Depth (ft)	Natural Moisture (%)	ASTM Classification	Wet Density (pcf)	Dry Density (pcf)	q _u (psf)	Cohesion (psf)
B-13	ST-1	20.3-20.8	28.4	SM	116.7	90.9	1152	576
B-39	ST-2	8-8.5	19.4	CL	126.9	106.3	1232	616
B-40	ST-1	6.5-7	30.4	SM	118.9	91.2	2610	1305
B-40	ST-3	10.5-11	25.5	SM	123.9	98.7	2406	1203
B-44	ST-1	4-4.5	26.9	SM	120.2	94.8	1833	917
B-44	ST-2	8-8.5	21.6	SM	115.0	94.6	2128	1064
B-49	ST-1	4-4.5	37.1	SM	113.7	82.9	1655	828
B-49	ST-2	8.5-9	24.1	SM	119.3	96.2	882	441
B-51	ST-2	6.5-7	17.2	SM	123.1	105.0	3276	1638
B-61	ST-1	2-2.5	20.9	SM	125.1	103.5	2071	1035
B-64	ST-1	4.5-5	23.9	SM	114.9	92.7	2765	1383
B-64	ST-2	9-9.5	29.7	SM	108.2	83.4	1855	928
B-67	ST-1	4-4.5	21.5	SM	122.1	100.5	3532	1766
B-68	ST-1	2-2.5	23.7	SP-SM	124.7	100.8	1834	917
B-74	ST-1	4-4.5	33.1	ML	114.7	86.2	396	198



Florence & Hutcheson

CONSULTING ENGINEERS

TRIAXIAL COMPRESSION TEST

Page 1 of 3

PROJECT NAME : I85 / I385 Interchange

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY # : 08195-01

SUBMITTED BY : Florence & Hutcheson

POINT # : 1

SAMPLE LOC. : B-13

SAMPLE DEPTH : 20.3' To 20.8'

DATE TESTED : 12/27/2011

DATE REPORTED : 1/12/2012

SOIL TYPE : Redish Brown Silty Sand

WET DENSITY : 116.65 pcf

DELTA HEIGHT : NA

INITIAL HEIGHT : 14.91 cm

DRY DENSITY : 90.87 pcf

DELTA VOLUME : NA

INITIAL DIAMETER : 7.18 cm

MOISTURE : 28.38 %

CHAMBER PRES. : 12.22 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.85	12.22	13.33	1.09
3	1.70	12.22	14.2	1.16
4	2.56	12.22	14.4	1.18
5	3.41	12.22	14.81	1.21
6	4.26	12.22	15.64	1.28
7	5.11	12.22	16.03	1.31
8	10.22	12.22	18.63	1.52
9	15.33	12.22	20.34	1.66
10	20.44	12.22	21.61	1.77
11	25.55	12.22	22.15	1.81
12	30.67	12.22	22.38	1.83
13	34.07	12.22	22.46	1.84
14	42.59	12.22	22.02	1.8
15	51.11	12.22	21.11	1.73
16	59.63	12.22	20.09	1.64
17	68.15	12.22	18.57	1.52
18	76.66	12.22	17.08	1.4
19	85.18	12.22	15.4	1.26
20	93.70	12.22	13.6	1.11
21	102.22	12.22	11.73	0.96
22	110.74	12.22	9.8	0.8
23	119.25	12.22	7.8	0.64
24	127.77	12.22	5.78	0.47
25	136.29	12.22	3.73	0.31
26	144.81	12.22	1.74	0.14
27	153.33	12.22	-0.6	-0.05
28	161.84	12.22	-2.78	-0.23
29	170.36	12.22	-5.14	-0.42
30	178.88	12.22	-7.24	-0.59
31	187.40	12.22	-9.91	-0.81
32	195.92	12.22	-12.27	-1



Florence & Hutcheson

CONSULTING ENGINEERS

TRIAxIAL COMPRESSION TEST

PROJECT NAME : I85 / I385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

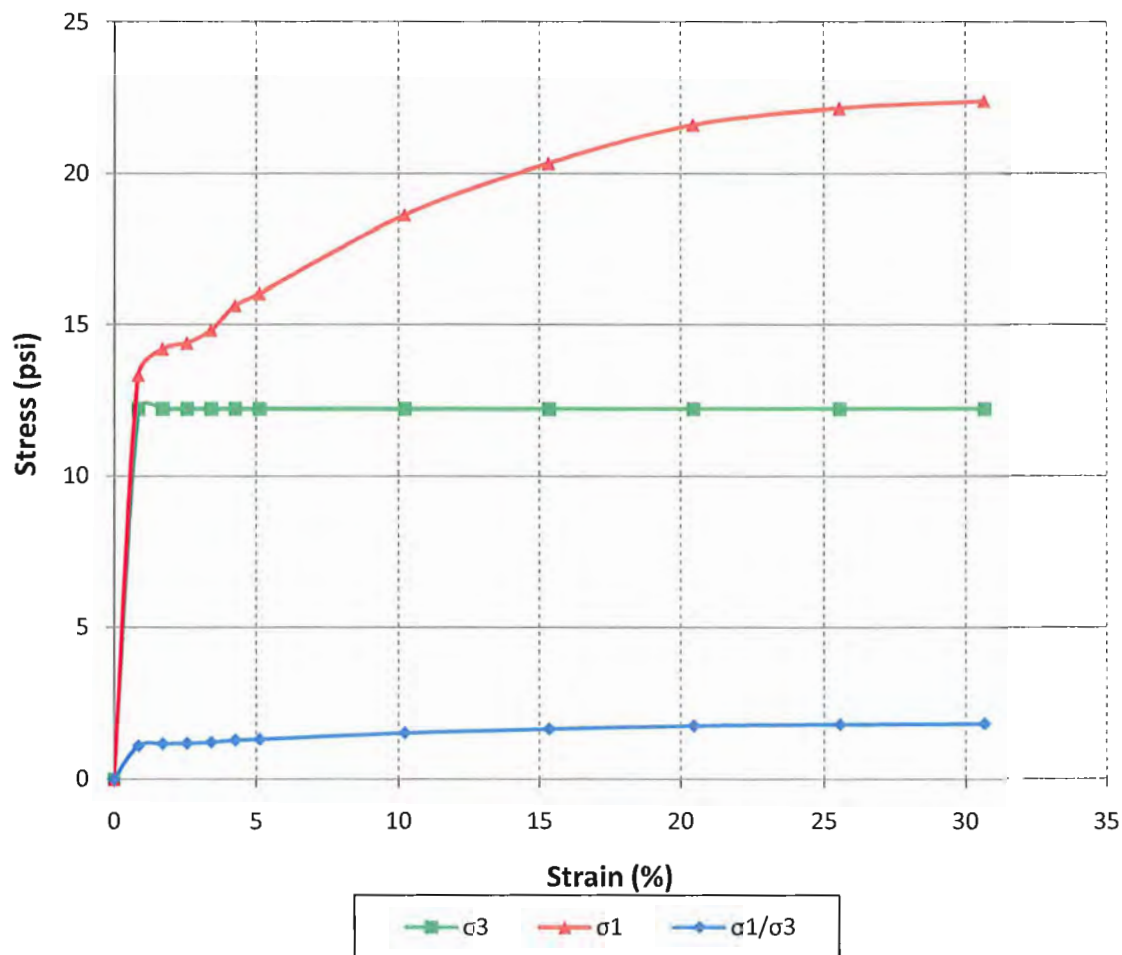
POINT # : 1
SAMPLE LOC. : B-13
SAMPLE DEPTH : 20.3' To 20.8'
DATE TESTED : 12/27/2011
DATE REPORTED : 1/12/2012

Page 2 of 3

FINAL MOISTURE : 28.38 %
FINAL HEIGHT : 11.99 cm
FINAL DIAMETER : 8.01 cm

EFF. CONS. STRESS : 12.22 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





TRIAXIAL COMPRESSION TEST

PROJECT NAME : I85 / I385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

SAMPLE LOC. : B-13
SAMPLE DEPTH : 20.3' To 20.8'
DATE TESTED : 12/27/2011
DATE REPORTED : 1/12/2012

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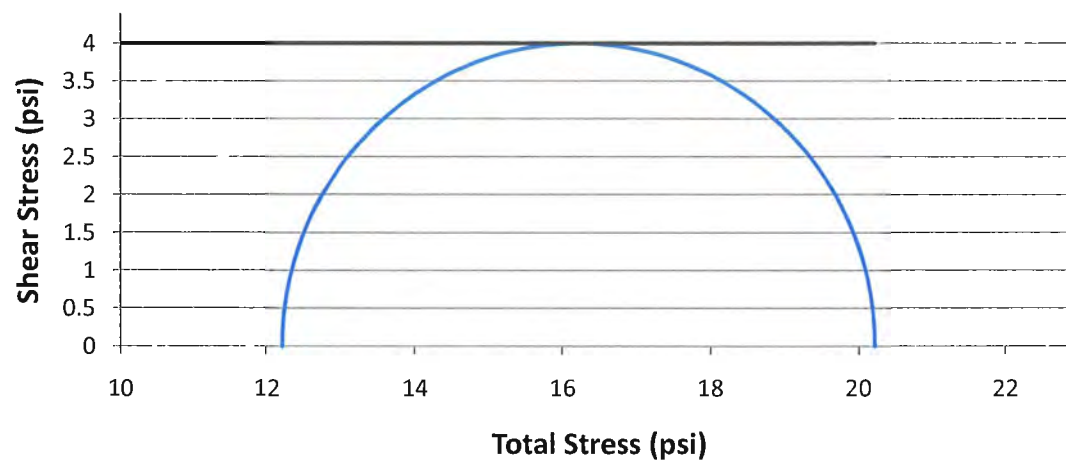
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	1152 psf
1	12.22	20.22	Cohesion =	576 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange
 PROJECT # : 08195-01
 PROJECT COUNTY : Greenville
 PROJECT STATE : South Carolina
 LABORATORY # : 08195-01
 SUBMITTED BY : Florence & Hutcheson

POINT # : 1
 SAMPLE LOC. : B-39
 SAMPLE DEPTH : 8.0' to 8.5'
 DATE TESTED : 10/23/12
 DATE REPORTED : 10/30/12

Page 1 of 3

SOIL TYPE : Red & Yellow Sandy Lean Clay
 WET DENSITY : 126.94 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 15 cm
 DRY DENSITY : 106.28 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.21 cm
 MOISTURE : 19.43 % CHAMBER PRES. : 7.54 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.85	7.54	8.42	1.12
3	1.69	7.54	9.28	1.23
4	2.54	7.54	10.13	1.34
5	3.39	7.54	10.75	1.43
6	4.23	7.54	11.15	1.48
7	5.08	7.54	11.96	1.59
8	10.16	7.54	14.51	1.92
9	15.24	7.54	16.18	2.14
10	20.32	7.54	17.41	2.31
11	25.40	7.54	18.25	2.42
12	30.48	7.54	18.73	2.48
13	33.87	7.54	19.2	2.55
14	42.33	7.54	19.72	2.61
15	50.80	7.54	19.72	2.61
16	59.27	7.54	19.35	2.57
17	67.73	7.54	18.25	2.42
18	76.20	7.54	16.51	2.19
19	84.66	7.54	13.83	1.83
20	93.13	7.54	10.58	1.4
21	101.60	7.54	6.79	0.9
22	110.06	7.54	2.5	0.33
23	118.53	7.54	-2.01	-0.27
24	127.00	7.54	-6.74	-0.89
25	135.46	7.54	-11.58	-1.54
26	143.93	7.54	-16.7	-2.21
27	152.40	7.54	-21.59	-2.86
28	160.86	7.54	-26.55	-3.52
29	169.33	7.54	-31.44	-4.17
30	177.80	7.54	-36.69	-4.86
31	186.26	7.54	-41.68	-5.53
32	194.73	7.54	-46.51	-6.17



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

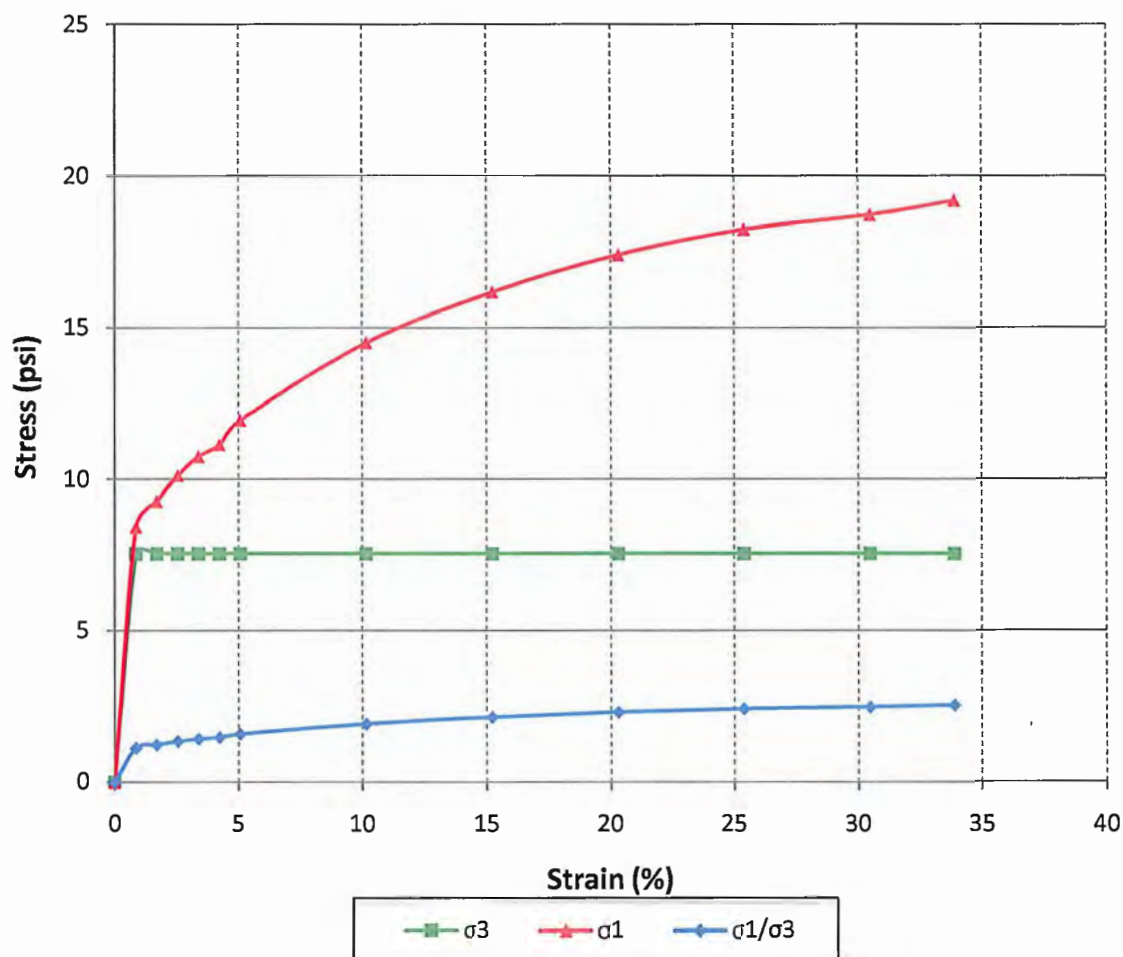
POINT # : 1
SAMPLE LOC. : B-39
SAMPLE DEPTH : 8.0' to 8.5'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 19.43 %
FINAL HEIGHT : 12.08 cm
FINAL DIAMETER : 8.03 cm

EFF. CONS. STRESS : 7.54 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-39

PROJECT STATE : South Carolina

SAMPLE DEPTH : 8.0' to 8.5'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

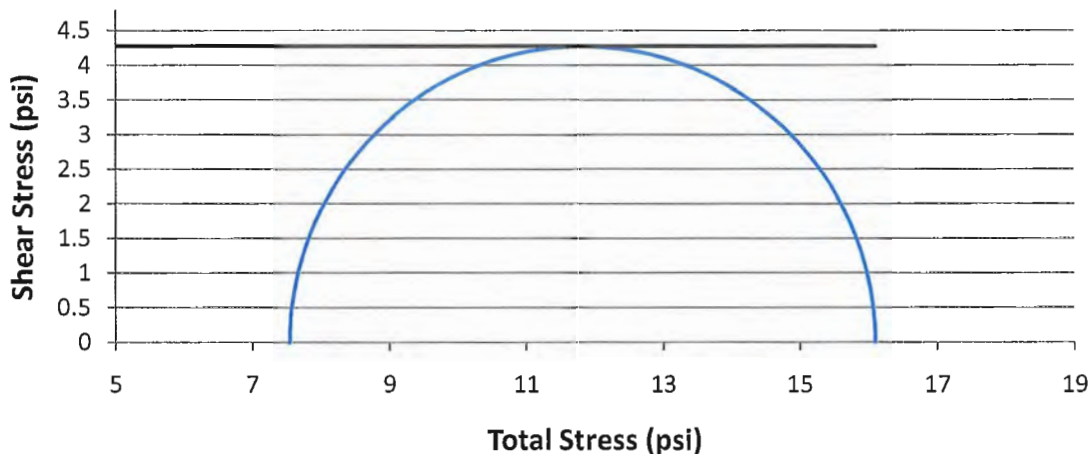
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	1232 psf
1	7.54	16.1	Cohesion =	616 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By:



PROJECT NAME : I-85/I-385 Interchange
 PROJECT # : 08195-01
 PROJECT COUNTY : Greenville
 PROJECT STATE : South Carolina
 LABORATORY # : 08195-01
 SUBMITTED BY : Florence & Hutcheson

POINT # : 1
 SAMPLE LOC. : B-40
 SAMPLE DEPTH : 6.5' to 7.0'
 DATE TESTED : 10/23/12
 DATE REPORTED : 10/30/12

Page 1 of 3

SOIL TYPE : Red Silty Sand
 WET DENSITY : 118.88 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 15.06 cm
 DRY DENSITY : 91.15 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.28 cm
 MOISTURE : 30.42 % CHAMBER PRES. : 6.05 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.84	6.05	9.06	1.5
3	1.69	6.05	10.32	1.71
4	2.53	6.05	11.55	1.91
5	3.37	6.05	12.55	2.08
6	4.22	6.05	13.74	2.27
7	5.06	6.05	14.7	2.43
8	10.12	6.05	20.03	3.31
9	15.18	6.05	24.33	4.02
10	20.24	6.05	27.21	4.5
11	25.30	6.05	29.29	4.84
12	30.36	6.05	30.43	5.03
13	33.74	6.05	30.52	5.05
14	42.17	6.05	29.97	4.95
15	50.60	6.05	28.07	4.64
16	59.04	6.05	25.16	4.16
17	67.47	6.05	21.63	3.58
18	75.91	6.05	17.86	2.95
19	84.34	6.05	13.81	2.28
20	92.77	6.05	9.68	1.6
21	101.21	6.05	5.44	0.9
22	109.64	6.05	1.07	0.18
23	118.08	6.05	-3.4	-0.56
24	126.51	6.05	-7.91	-1.31
25	134.95	6.05	-12.57	-2.08
26	143.38	6.05	-17.24	-2.85
27	151.81	6.05	-21.66	-3.58
28	160.25	6.05	-25.92	-4.29
29	168.68	6.05	-30.4	-5.03
30	177.12	6.05	-34.71	-5.74



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

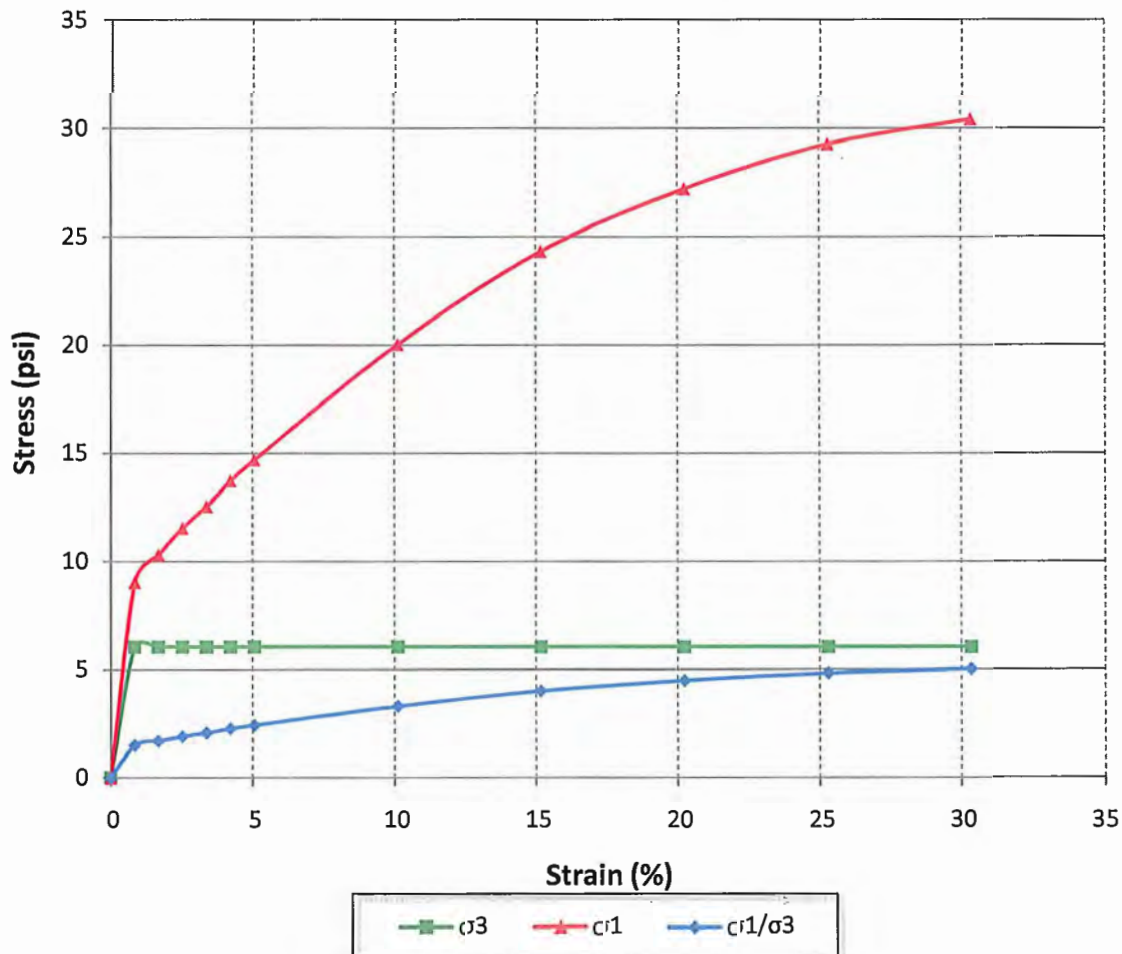
POINT # : 1
SAMPLE LOC. : B-40
SAMPLE DEPTH : 6.5' to 7.0'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 30.42 %
FINAL HEIGHT : 12.14 cm
FINAL DIAMETER : 8.11 cm

EFF. CONS. STRESS : 6.05 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-40

PROJECT STATE : South Carolina

SAMPLE DEPTH : 6.5' to 7.0'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

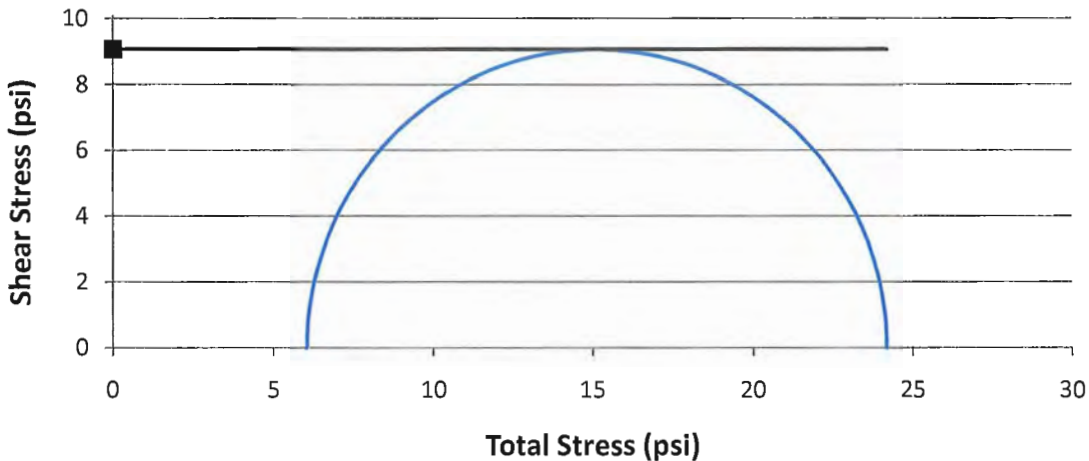
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	2610 psf
1	6.05	24.17	Cohesion =	1305 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange

Page 1 of 3

PROJECT # : 08195-01

POINT # : 1

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-40

PROJECT STATE : South Carolina

SAMPLE DEPTH : 10.5' to 11.0'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

SOIL TYPE : Red Silty Sand

WET DENSITY : 123.88 pcf

DELTA HEIGHT : NA

INITIAL HEIGHT : 14.85 cm

DRY DENSITY : 98.73 pcf

DELTA VOLUME : NA

INITIAL DIAMETER : 7.22 cm

MOISTURE : 25.48 %

CHAMBER PRES. : 9.04 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.85	9.04	11.88	1.31
3	1.71	9.04	12.94	1.43
4	2.56	9.04	13.98	1.55
5	3.42	9.04	15	1.66
6	4.27	9.04	15.79	1.75
7	5.13	9.04	16.77	1.86
8	10.26	9.04	21.65	2.4
9	15.39	9.04	26.08	2.89
10	20.52	9.04	29.45	3.26
11	25.65	9.04	31.58	3.49
12	30.78	9.04	32.83	3.63
13	34.20	9.04	33.2	3.67
14	42.75	9.04	31.74	3.51
15	51.30	9.04	30.01	3.32
16	59.85	9.04	27.3	3.02
17	68.40	9.04	24.01	2.66
18	76.94	9.04	20.08	2.22
19	85.49	9.04	15.8	1.75
20	94.04	9.04	11.81	1.31
21	102.59	9.04	7.8	0.86
22	111.14	9.04	3.69	0.41
23	119.69	9.04	-0.47	-0.05
24	128.24	9.04	-4.75	-0.53
25	136.79	9.04	-9.28	-1.03
26	145.34	9.04	-13.87	-1.54
27	153.89	9.04	-18.6	-2.06
28	162.44	9.04	-23.46	-2.6
29	170.99	9.04	-27.91	-3.09
30	179.54	9.04	-32.36	-3.58
31	188.09	9.04	-36.89	-4.08
32	196.64	9.04	-41.62	-4.61



PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

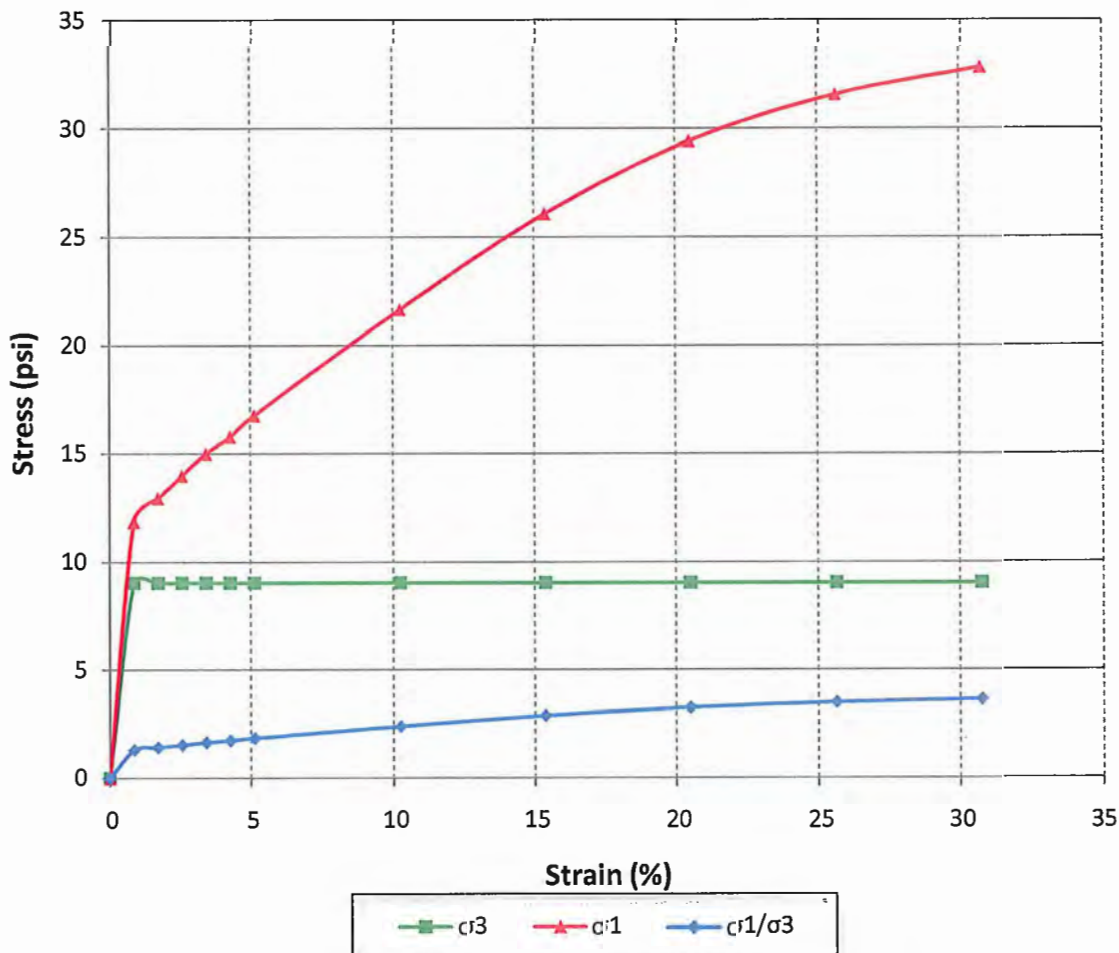
POINT # : 1
SAMPLE LOC. : B-40
SAMPLE DEPTH : 10.5' to 11.0'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 25.48 %
FINAL HEIGHT : 11.93 cm
FINAL DIAMETER : 8.06 cm

EFF. CONS. STRESS : 9.04 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-40

PROJECT STATE : South Carolina

SAMPLE DEPTH : 10.5' to 11.0'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

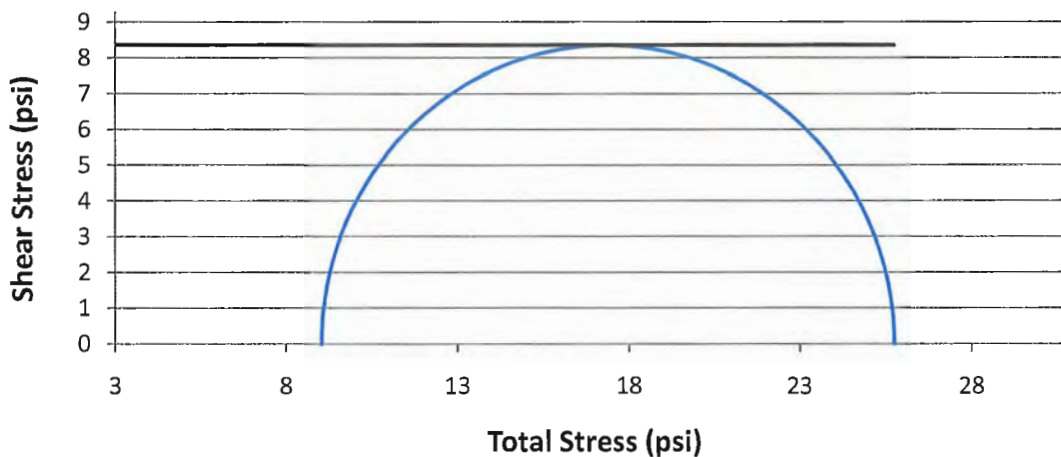
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	2406 psf
1	9.04	25.74	Cohesion =	1203 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By:



PROJECT NAME : I-85/I-385 Interchange
 PROJECT # : 08195-01
 PROJECT COUNTY : Greenville
 PROJECT STATE : South Carolina
 LABORATORY # : 08195-01
 SUBMITTED BY : Florence & Hutcheson

POINT # : 1
 SAMPLE LOC. : B-44
 SAMPLE DEPTH : 4.0' to 4.5'
 DATE TESTED : 10/23/12
 DATE REPORTED : 10/30/12

Page 1 of 3

SOIL TYPE : Red Silty Sand
 WET DENSITY : 120.21 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.61 cm
 DRY DENSITY : 94.75 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.24 cm
 MOISTURE : 26.87 % CHAMBER PRES. : 3.86 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.87	3.86	5.16	1.34
3	1.74	3.86	6.01	1.56
4	2.61	3.86	6.63	1.72
5	3.48	3.86	7.25	1.88
6	4.35	3.86	7.63	1.98
7	5.22	3.86	8.22	2.13
8	10.43	3.86	11.52	2.99
9	15.65	3.86	17.31	4.49
10	20.87	3.86	23.09	5.99
11	26.08	3.86	27.57	7.15
12	31.30	3.86	29.24	7.58
13	34.78	3.86	28.85	7.48
14	43.47	3.86	27.49	7.13
15	52.17	3.86	25	6.48
16	60.86	3.86	22.06	5.72
17	69.56	3.86	18.37	4.76
18	78.25	3.86	14.45	3.75
19	86.95	3.86	10.38	2.69
20	95.64	3.86	6.08	1.58
21	104.34	3.86	1.63	0.42
22	113.03	3.86	-2.71	-0.7
23	121.73	3.86	-7.06	-1.83
24	130.42	3.86	-11.45	-2.97
25	139.11	3.86	-15.83	-4.1
26	147.81	3.86	-20.56	-5.33
27	156.50	3.86	-25.48	-6.61
28	165.20	3.86	-30.31	-7.86
29	173.89	3.86	-35.33	-9.16
30	182.59	3.86	-40.45	-10.5
31	191.28	3.86	-45.87	-11.9
32	199.98	3.86	-51.02	-13.2



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

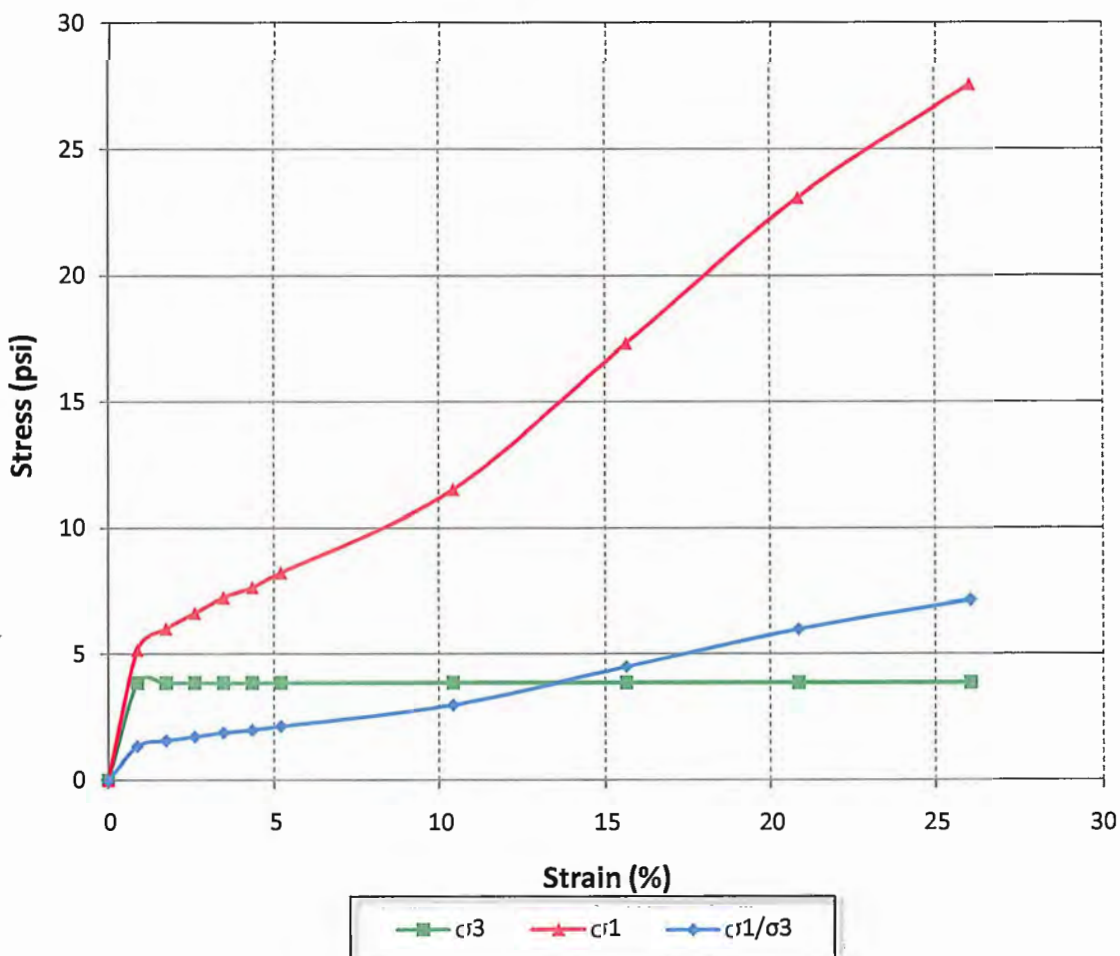
POINT # : 1
SAMPLE LOC. : B-44
SAMPLE DEPTH : 4.0' to 4.5'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 26.87 %
FINAL HEIGHT : 11.69 cm
FINAL DIAMETER : 8.09 cm

EFF. CONS. STRESS : 3.86 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-44

PROJECT STATE : South Carolina

SAMPLE DEPTH : 4.0' to 4.5'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

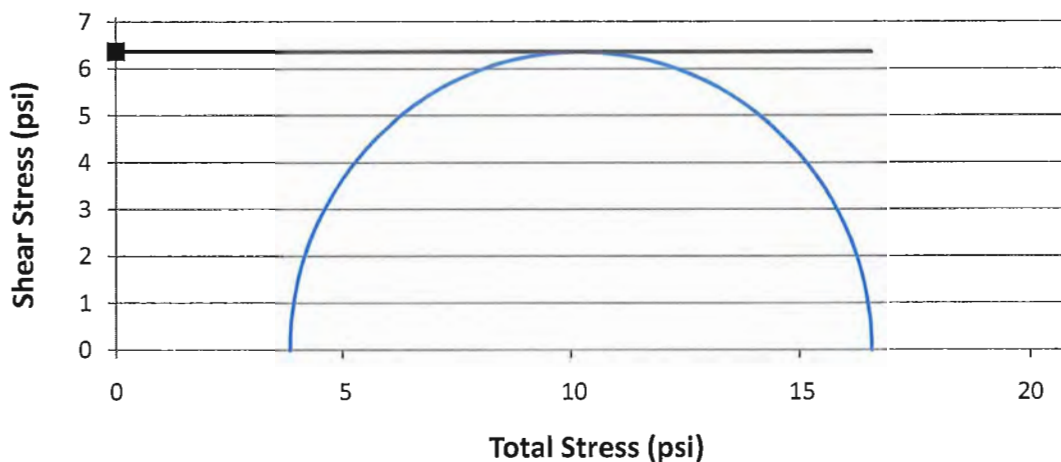
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	1833 psf
1	3.86	16.59	Cohesion =	917 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson
SOIL TYPE : Orange Silty Sand
WET DENSITY : 114.98 pcf
DRY DENSITY : 94.55 pcf
MOISTURE : 21.61 %

POINT # : 1
SAMPLE LOC. : B-44
SAMPLE DEPTH : 8.0' to 8.5'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

DELTA HEIGHT : NA
DELTA VOLUME : NA
CHAMBER PRES. : 6.75 psi

INITIAL HEIGHT : 14.16 cm
INITIAL DIAMETER : 7.29 cm

Page 1 of 3

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.90	6.75	8.68	1.29
3	1.79	6.75	9.93	1.47
4	2.69	6.75	10.75	1.59
5	3.59	6.75	11.13	1.65
6	4.48	6.75	12.53	1.86
7	5.38	6.75	13.09	1.94
8	10.76	6.75	18.12	2.69
9	16.14	6.75	22.44	3.33
10	21.52	6.75	26.21	3.89
11	26.90	6.75	28.66	4.25
12	32.28	6.75	30.13	4.47
13	35.87	6.75	30.25	4.48
14	44.83	6.75	28.76	4.26
15	53.80	6.75	25.94	3.85
16	62.77	6.75	21.75	3.22
17	71.73	6.75	17.48	2.59
18	80.70	6.75	13.74	2.04
19	89.66	6.75	10.43	1.55



TRIAXIAL COMPRESSION TEST

Page 2 of 3

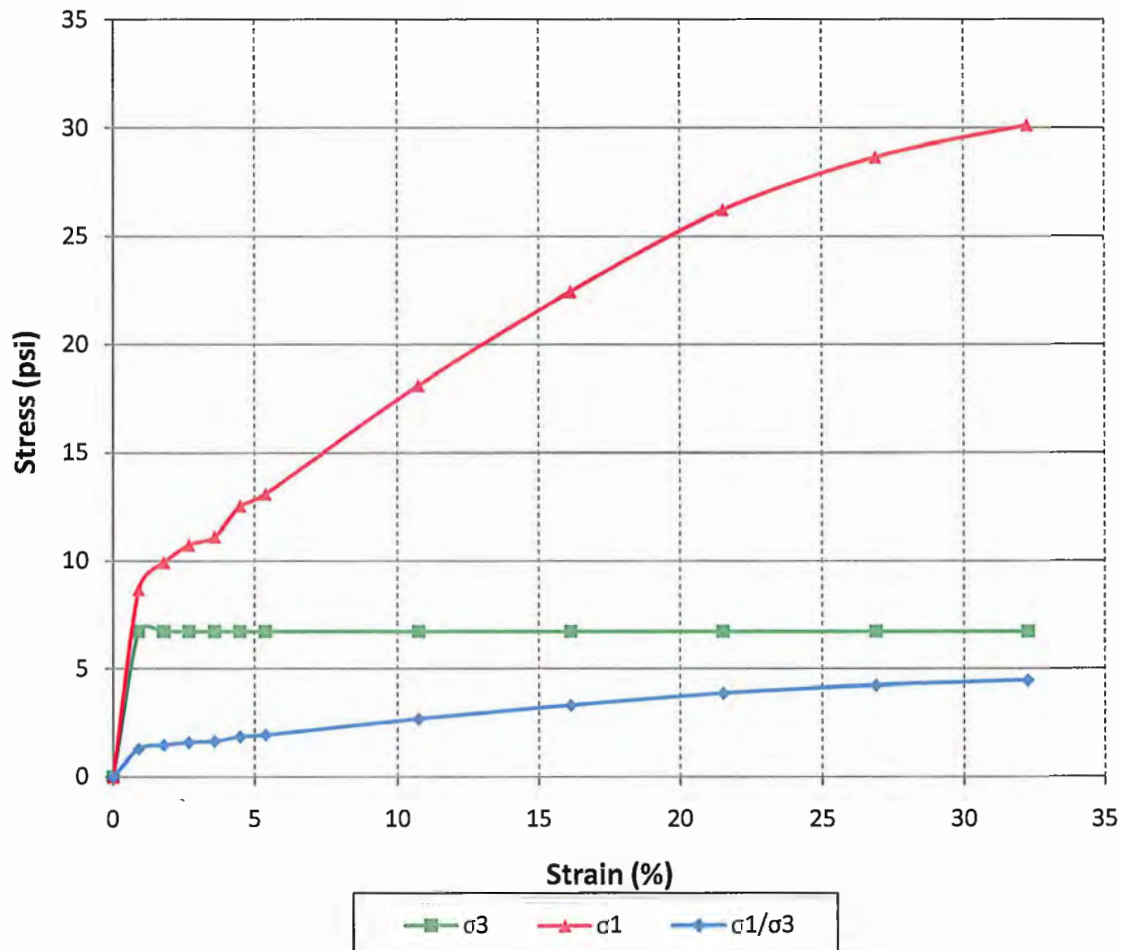
PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

POINT # : 1
SAMPLE LOC. : B-44
SAMPLE DEPTH : 8.0' to 8.5'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

FINAL MOISTURE : 21.61 %
FINAL HEIGHT : 11.24 cm
FINAL DIAMETER : 8.18 cm

EFF. CONS. STRESS : 6.75 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

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PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-44

PROJECT STATE : South Carolina

SAMPLE DEPTH : 8.0' to 8.5'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

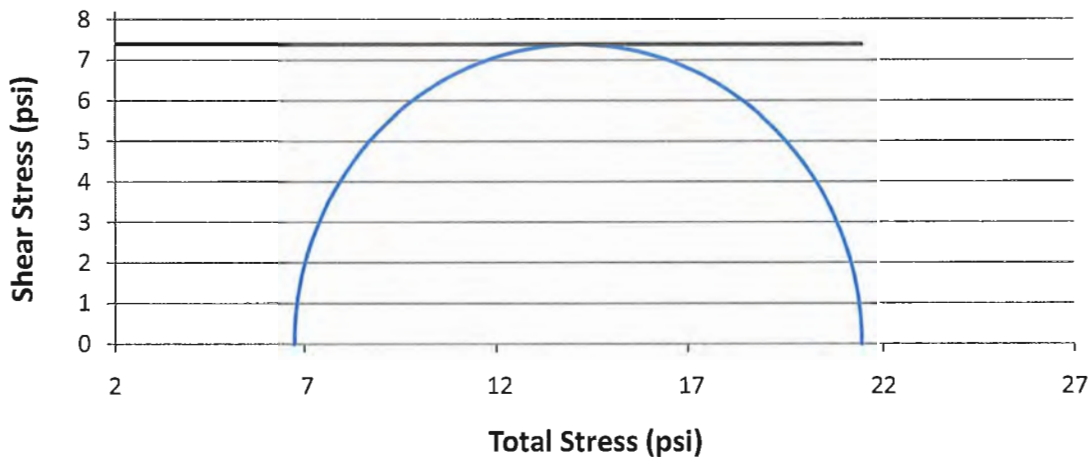
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	2128 psf
1	6.75	21.53	Cohesion =	1064 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange
 PROJECT # : 08195-01
 PROJECT COUNTY : Greenville
 PROJECT STATE : South Carolina
 LABORATORY # : 08195-01
 SUBMITTED BY : Florence & Hutcheson

POINT # : 1
 SAMPLE LOC. : B-49
 SAMPLE DEPTH : 4.0' to 4.5'
 DATE TESTED : 10/28/12
 DATE REPORTED : 10/30/12

Page 1 of 3

SOIL TYPE : Red Silty Sand
 WET DENSITY : 113.66 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.99 cm
 DRY DENSITY : 82.94 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.22 cm
 MOISTURE : 37.03 % CHAMBER PRES. : 3.66 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.85	3.66	6.28	1.72
3	1.70	3.66	7.56	2.07
4	2.54	3.66	8.6	2.35
5	3.39	3.66	9.84	2.69
6	4.24	3.66	10.63	2.91
7	5.09	3.66	11.19	3.06
8	10.17	3.66	13.96	3.82
9	15.26	3.66	15.22	4.16
10	20.34	3.66	16.43	4.49
11	25.43	3.66	17.07	4.67
12	30.51	3.66	18.57	5.08
13	33.90	3.66	19.67	5.38
14	42.38	3.66	21.02	5.75
15	50.85	3.66	19.99	5.47
16	59.33	3.66	17.42	4.76
17	67.80	3.66	14.55	3.98
18	76.28	3.66	11.64	3.18
19	84.75	3.66	8.84	2.42
20	93.23	3.66	6	1.64
21	101.70	3.66	3.06	0.84
22	110.18	3.66	0.06	0.02
23	118.65	3.66	-3.13	-0.85
24	127.13	3.66	-6.21	-1.7
25	135.60	3.66	-9.5	-2.6
26	144.08	3.66	-12.63	-3.45
27	152.55	3.66	-15.76	-4.31
28	161.03	3.66	-18.89	-5.17
29	169.50	3.66	-22.03	-6.02
30	177.98	3.66	-25.16	-6.88
31	186.45	3.66	-28.46	-7.78
32	194.93	3.66	-31.61	-8.64



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

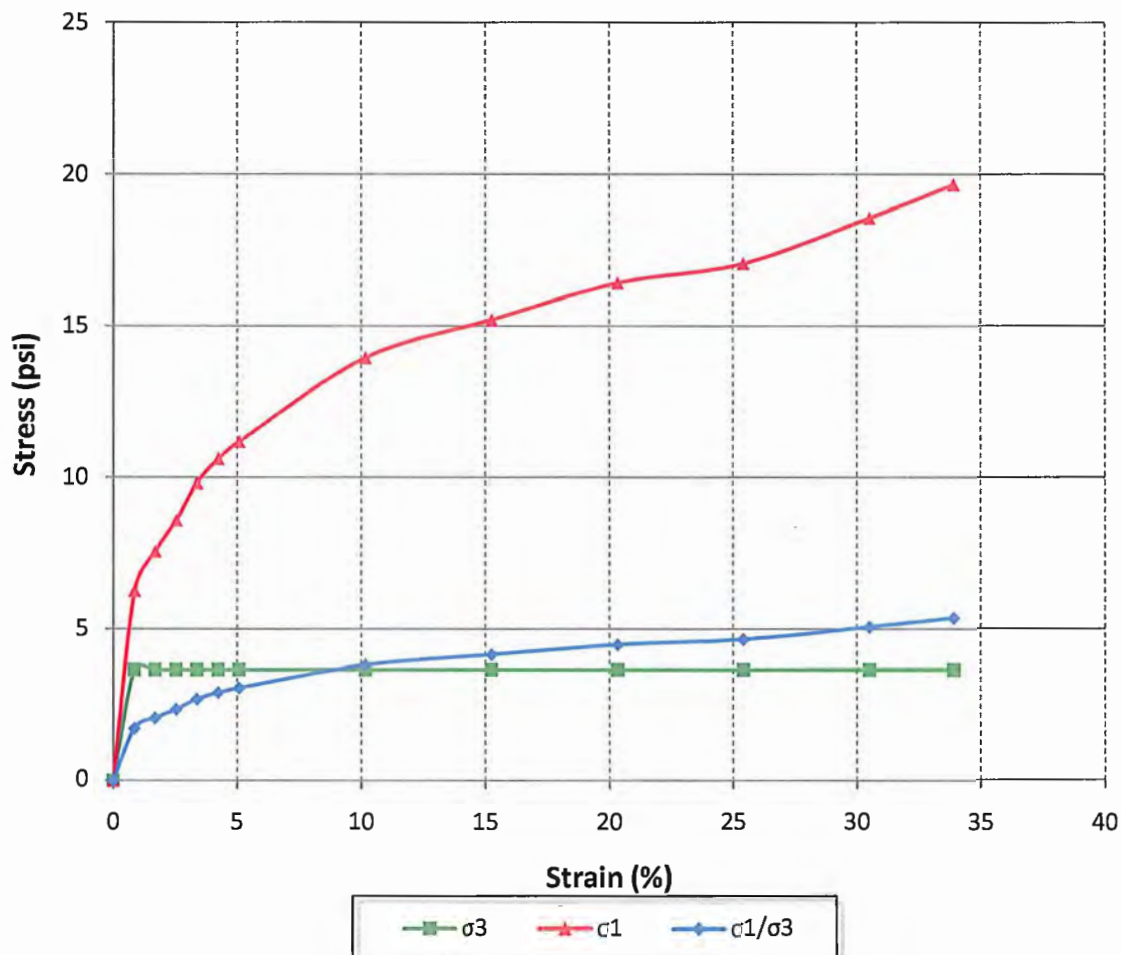
POINT # : 1
SAMPLE LOC. : B-49
SAMPLE DEPTH : 4.0' to 4.5'
DATE TESTED : 10/28/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 37.03 %
FINAL HEIGHT : 12.06 cm
FINAL DIAMETER : 8.05 cm

EFF. CONS. STRESS : 3.66 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-49

PROJECT STATE : South Carolina

SAMPLE DEPTH : 4.0' to 4.5'

LABORATORY # : 08195-01

DATE TESTED : 10/28/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

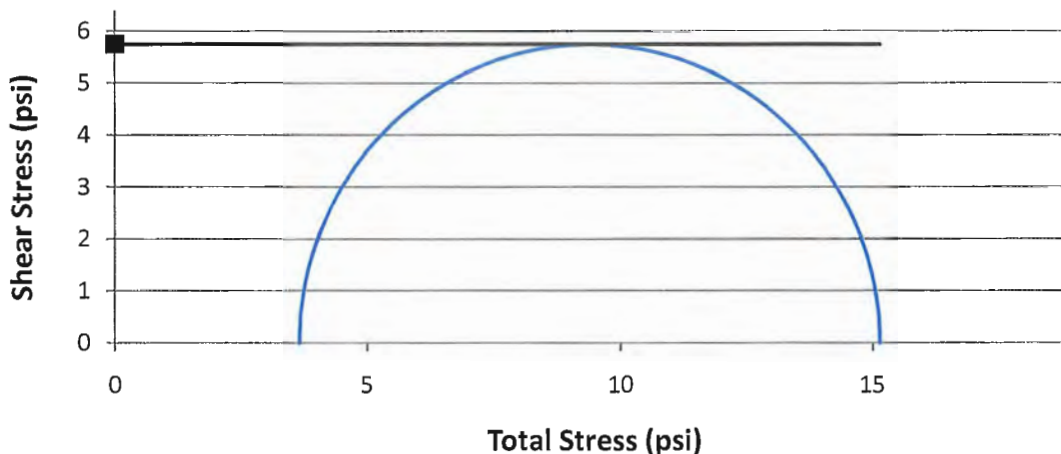
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	1655 psf
1	3.66	15.15	Cohesion =	828 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By:



PROJECT NAME : I-85/I-385 Interchange
 PROJECT # : 08195-01
 PROJECT COUNTY : Greenville
 PROJECT STATE : South Carolina
 LABORATORY # : 08195-01
 SUBMITTED BY : Florence & Hutcheson

POINT # : 1
 SAMPLE LOC. : B-49
 SAMPLE DEPTH : 8.5' to 9.0'
 DATE TESTED : 10/29/12
 DATE REPORTED : 11/01/12

Page 1 of 3

SOIL TYPE : Green, Orange & Gray
 WET DENSITY : 119.32 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.67 cm
 DRY DENSITY : 96.16 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.25 cm
 MOISTURE : 24.08 % CHAMBER PRES. : 7.54 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.87	7.54	8.19	1.09
3	1.73	7.54	9.05	1.2
4	2.60	7.54	9.46	1.25
5	3.46	7.54	9.86	1.31
6	4.33	7.54	10.47	1.39
7	5.20	7.54	10.86	1.44
8	10.39	7.54	12.44	1.65
9	15.59	7.54	13.82	1.83
10	20.78	7.54	14.99	1.99
11	25.98	7.54	16.12	2.14
12	31.17	7.54	16.7	2.21
13	34.64	7.54	16.66	2.21
14	43.30	7.54	15.58	2.07
15	51.95	7.54	14.25	1.89
16	60.61	7.54	13.12	1.74
17	69.27	7.54	12.1	1.6
18	77.93	7.54	11	1.46
19	86.59	7.54	9.79	1.3
20	95.25	7.54	8.38	1.11
21	103.91	7.54	6.82	0.9
22	112.57	7.54	5.17	0.68
23	121.23	7.54	3.48	0.46
24	129.89	7.54	1.76	0.23
25	138.54	7.54	0	0
26	147.20	7.54	-1.79	-0.24
27	155.86	7.54	-3.75	-0.5
28	164.52	7.54	-5.5	-0.73
29	173.18	7.54	-7.25	-0.96
30	181.84	7.54	-9.17	-1.22
31	190.50	7.54	-11.33	-1.5
32	199.16	7.54	-13.35	-1.77



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

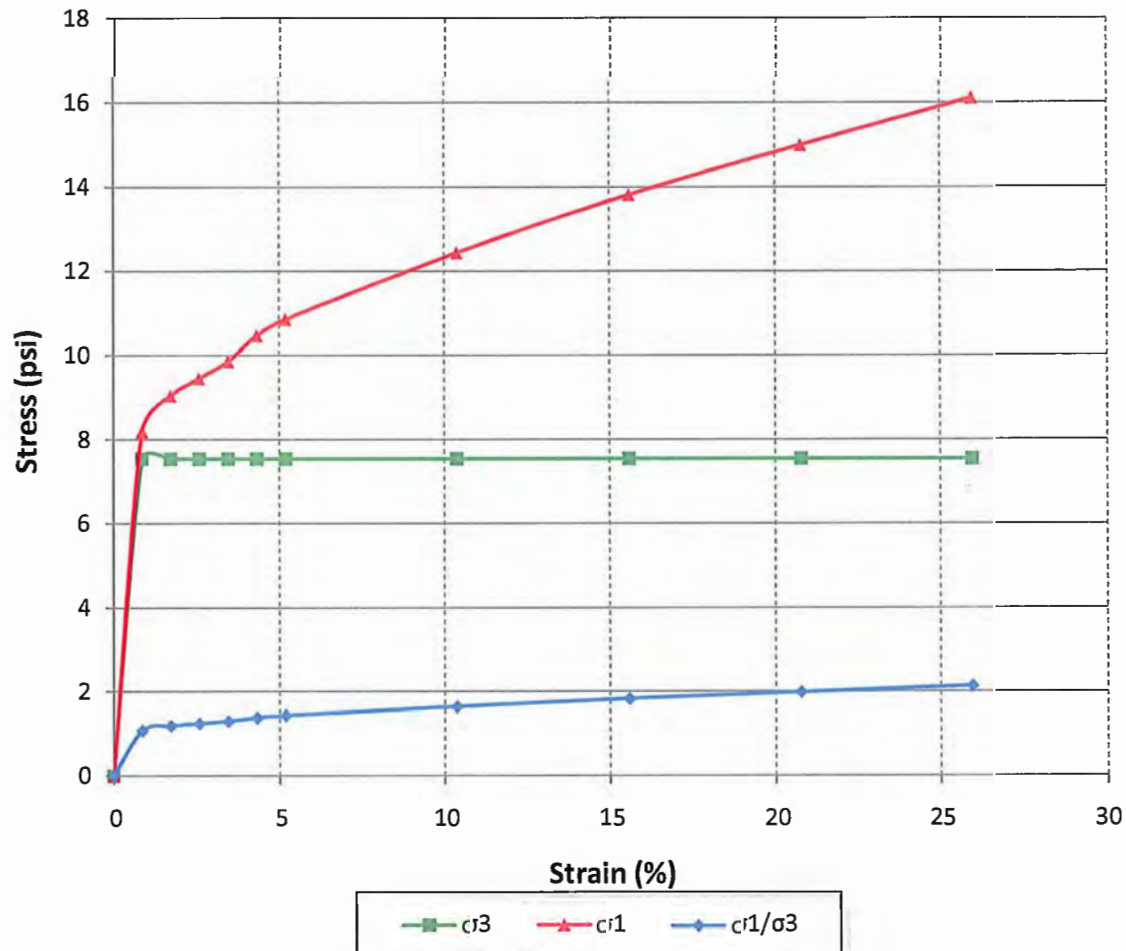
POINT # : 1
SAMPLE LOC. : B-49
SAMPLE DEPTH : 8.5' to 9.0'
DATE TESTED : 10/29/12
DATE REPORTED : 11/01/12

Page 2 of 3

FINAL MOISTURE : 24.08 %
FINAL HEIGHT : 11.75 cm
FINAL DIAMETER : 8.1 cm

EFF. CONS. STRESS : 7.54 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-49

PROJECT STATE : South Carolina

SAMPLE DEPTH : 8.5' to 9.0'

LABORATORY # : 08195-01

DATE TESTED : 10/29/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 11/01/12

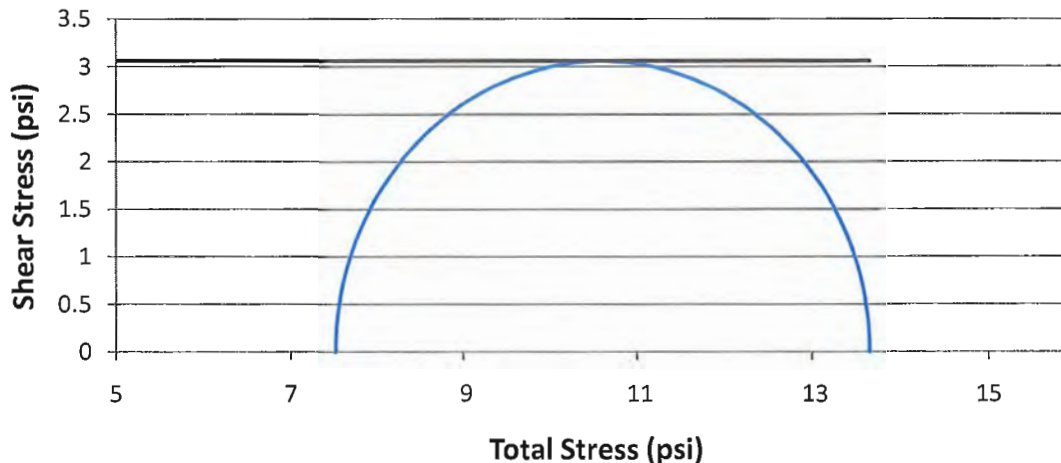
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	882 psf
1	7.54	13.66	Cohesion =	441 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson
SOIL TYPE : Orange & Tan Silty Sand
WET DENSITY : 123.09 pcf
DRY DENSITY : 105.04 pcf
MOISTURE : 17.18 %

POINT # : 1
SAMPLE LOC. : B-51
SAMPLE DEPTH : 6.5' to 7.0'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

DELTA HEIGHT : NA
DELTA VOLUME : NA
CHAMBER PRES. : 6.05 psi

INITIAL HEIGHT : 14.83 cm
INITIAL DIAMETER : 7.29 cm

Page 1 of 3

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.86	6.05	8.62	1.43
3	1.71	6.05	10.3	1.7
4	2.57	6.05	11.74	1.94
5	3.43	6.05	13.15	2.17
6	4.28	6.05	14.54	2.4
7	5.14	6.05	15.9	2.63
8	10.28	6.05	23.03	3.81
9	15.41	6.05	29.3	4.85
10	20.55	6.05	34.7	5.74
11	25.69	6.05	39.49	6.53
12	30.83	6.05	42.08	6.96
13	34.25	6.05	41.77	6.91
14	42.81	6.05	38.98	6.45
15	51.38	6.05	34.35	5.68
16	59.94	6.05	28.71	4.75
17	68.50	6.05	22.97	3.8
18	77.07	6.05	17.83	2.95
19	85.63	6.05	13.33	2.2
20	94.19	6.05	8.98	1.49



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

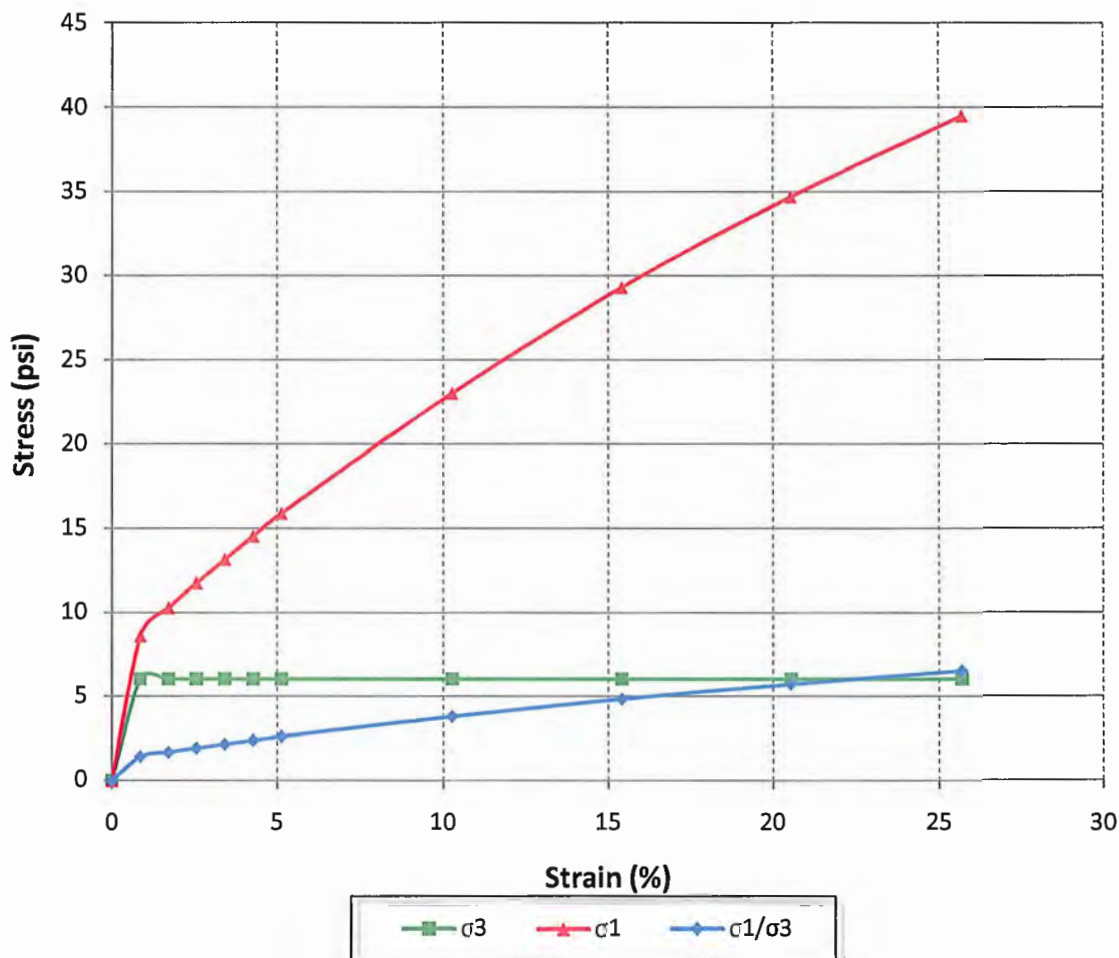
POINT # : 1
SAMPLE LOC. : B-51
SAMPLE DEPTH : 6.5' to 7.0'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 17.18 %
FINAL HEIGHT : 11.91 cm
FINAL DIAMETER : 8.13 cm

EFF. CONS. STRESS : 6.05 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

Page 3 of 3

SAMPLE LOC. : B-51
SAMPLE DEPTH : 6.5' to 7.0'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

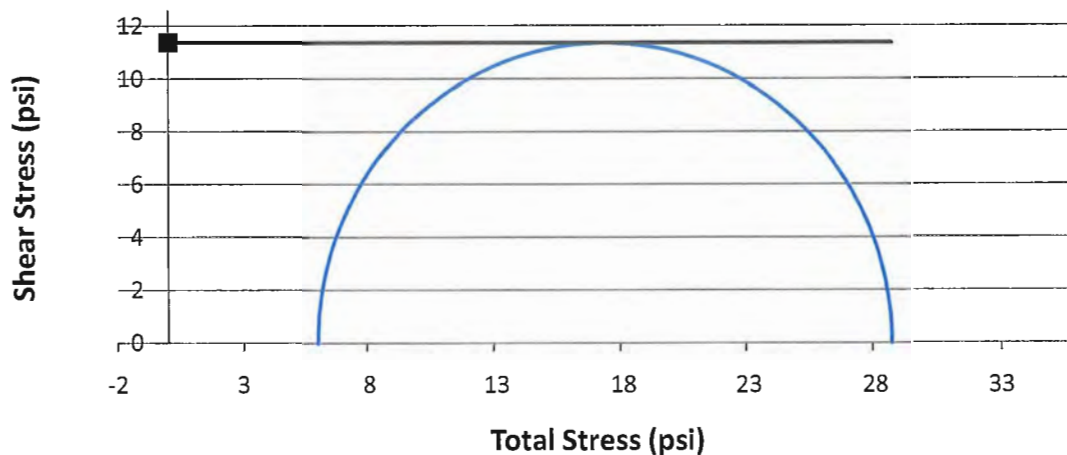
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	3276 psf
1	6.05	28.8	Cohesion =	1638 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange
 PROJECT # : 08195-01
 PROJECT COUNTY : Greenville
 PROJECT STATE : South Carolina
 LABORATORY # : 08195-01
 SUBMITTED BY : Florence & Hutcheson

POINT # : 1
 SAMPLE LOC. : B-61
 SAMPLE DEPTH : 2.0' to 2.5'
 DATE TESTED : 10/23/12
 DATE REPORTED : 10/30/12

Page 1 of 3

SOIL TYPE : Red Silty Sand
 WET DENSITY : 125.08 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.86 cm
 DRY DENSITY : 103.48 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.21 cm
 MOISTURE : 20.88 % CHAMBER PRES. : 2.26 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.85	2.26	3.14	1.39
3	1.71	2.26	3.79	1.67
4	2.56	2.26	4.85	2.14
5	3.42	2.26	5.68	2.51
6	4.27	2.26	6.71	2.97
7	5.13	2.26	7.3	3.23
8	10.25	2.26	12.39	5.48
9	15.38	2.26	16.98	7.51
10	20.51	2.26	21.08	9.32
11	25.63	2.26	23.02	10.18
12	30.76	2.26	23.64	10.45
13	34.18	2.26	23.56	10.42
14	42.72	2.26	22.49	9.94
15	51.27	2.26	20.05	8.86
16	59.81	2.26	17.32	7.66
17	68.36	2.26	14.49	6.41
18	76.90	2.26	11.24	4.97
19	85.45	2.26	8.03	3.55
20	93.99	2.26	4.69	2.07
21	102.53	2.26	1.21	0.54
22	111.08	2.26	-2.37	-1.05
23	119.62	2.26	-6.02	-2.66
24	128.17	2.26	-9.83	-4.35
25	136.71	2.26	-13.99	-6.18
26	145.26	2.26	-17.92	-7.92
27	153.80	2.26	-21.85	-9.66
28	162.35	2.26	-25.61	-11.3
29	170.89	2.26	-29.58	-13.1
30	179.44	2.26	-33.07	-14.6
31	187.98	2.26	-36.97	-16.3
32	196.53	2.26	-40.99	-18.1



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

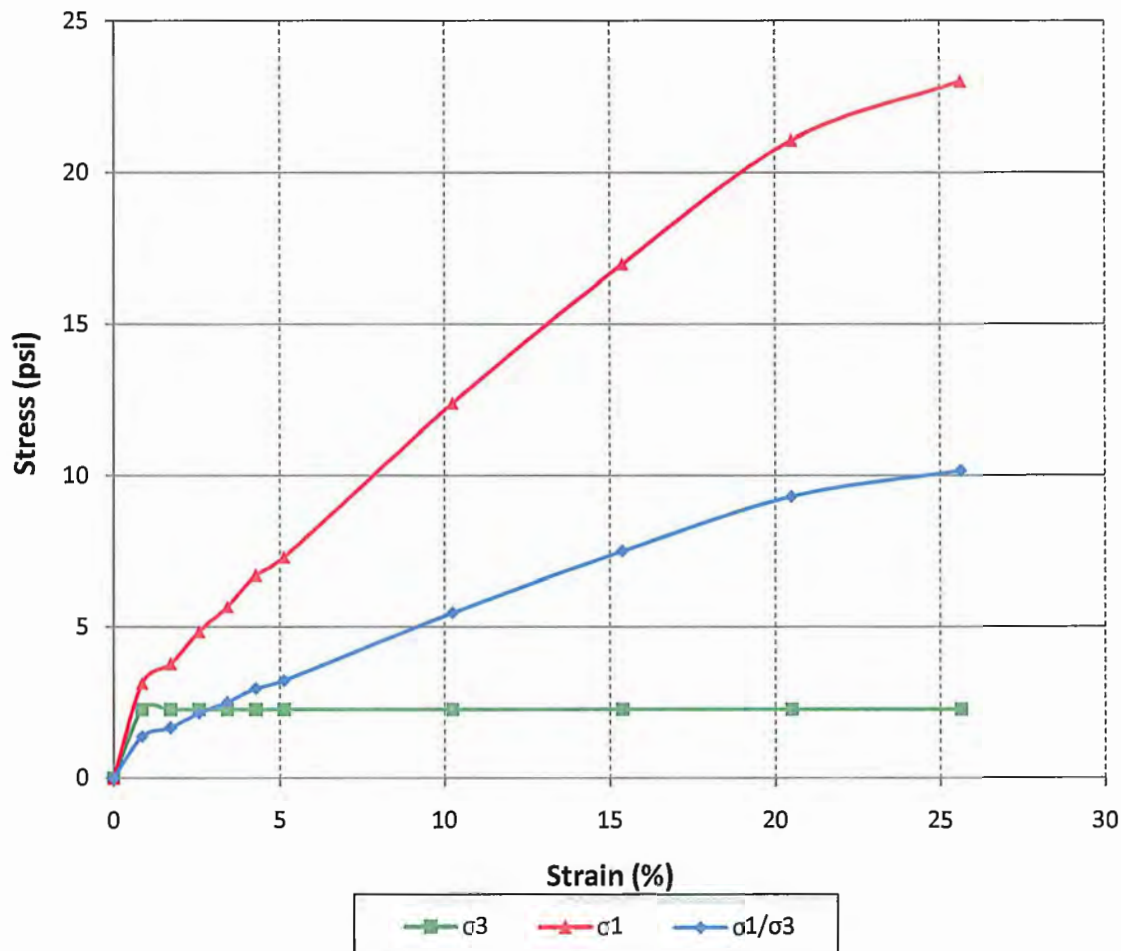
POINT # : 1
SAMPLE LOC. : B-61
SAMPLE DEPTH : 2.0' to 2.5'
DATE TESTED : 10/23/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 20.88 %
FINAL HEIGHT : 11.94 cm
FINAL DIAMETER : 8.04 cm

EFF. CONS. STRESS : 2.26 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-61

PROJECT STATE : South Carolina

SAMPLE DEPTH : 2.0' to 2.5'

LABORATORY # : 08195-01

DATE TESTED : 10/23/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

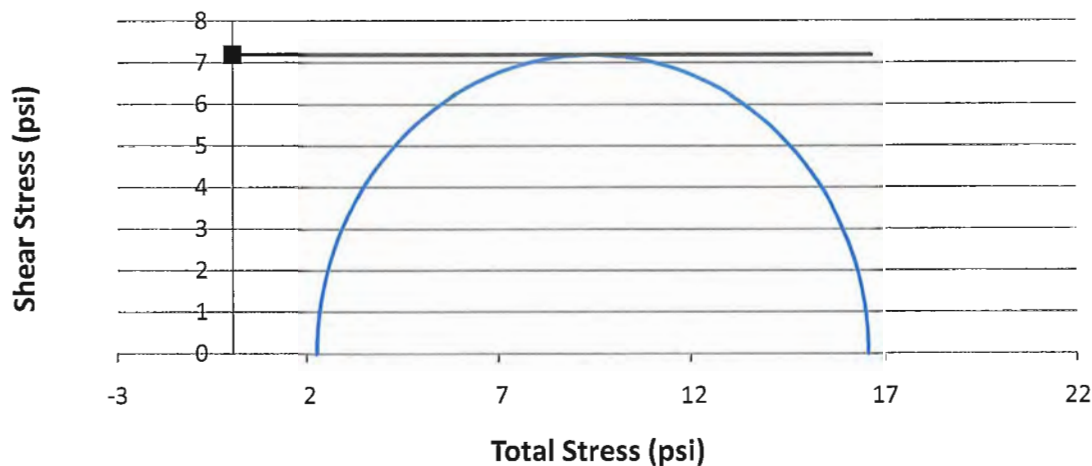
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	2071 psf
1	2.26	16.64	Cohesion =	1035 psf
			Phi =	0 deg
			Tan (Phi) =	0

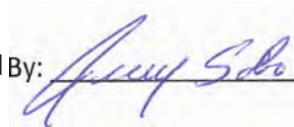
At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____





PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

POINT # : 1
SAMPLE LOC. : B-64
SAMPLE DEPTH : 4.5' to 5.0'
DATE TESTED : 10/26/12
DATE REPORTED : 10/30/12

Page 1 of 3

SOIL TYPE : Red, Orange & Yellow Silty Sand
WET DENSITY : 114.88 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.71 cm
DRY DENSITY : 92.73 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.3 cm
MOISTURE : 23.89 % CHAMBER PRES. : 4.35 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.86	4.35	8.2	1.88
3	1.73	4.35	9.86	2.27
4	2.59	4.35	11.28	2.59
5	3.45	4.35	12.26	2.82
6	4.32	4.35	13.43	3.08
7	5.18	4.35	14.37	3.3
8	10.36	4.35	19.73	4.53
9	15.54	4.35	24	5.51
10	20.72	4.35	26.56	6.1
11	25.90	4.35	26.64	6.12
12	31.08	4.35	25.79	5.92
13	34.53	4.35	24.72	5.68
14	43.17	4.35	19.69	4.52
15	51.80	4.35	17.36	3.99
16	60.43	4.35	14.78	3.4
17	69.06	4.35	12.44	2.86



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

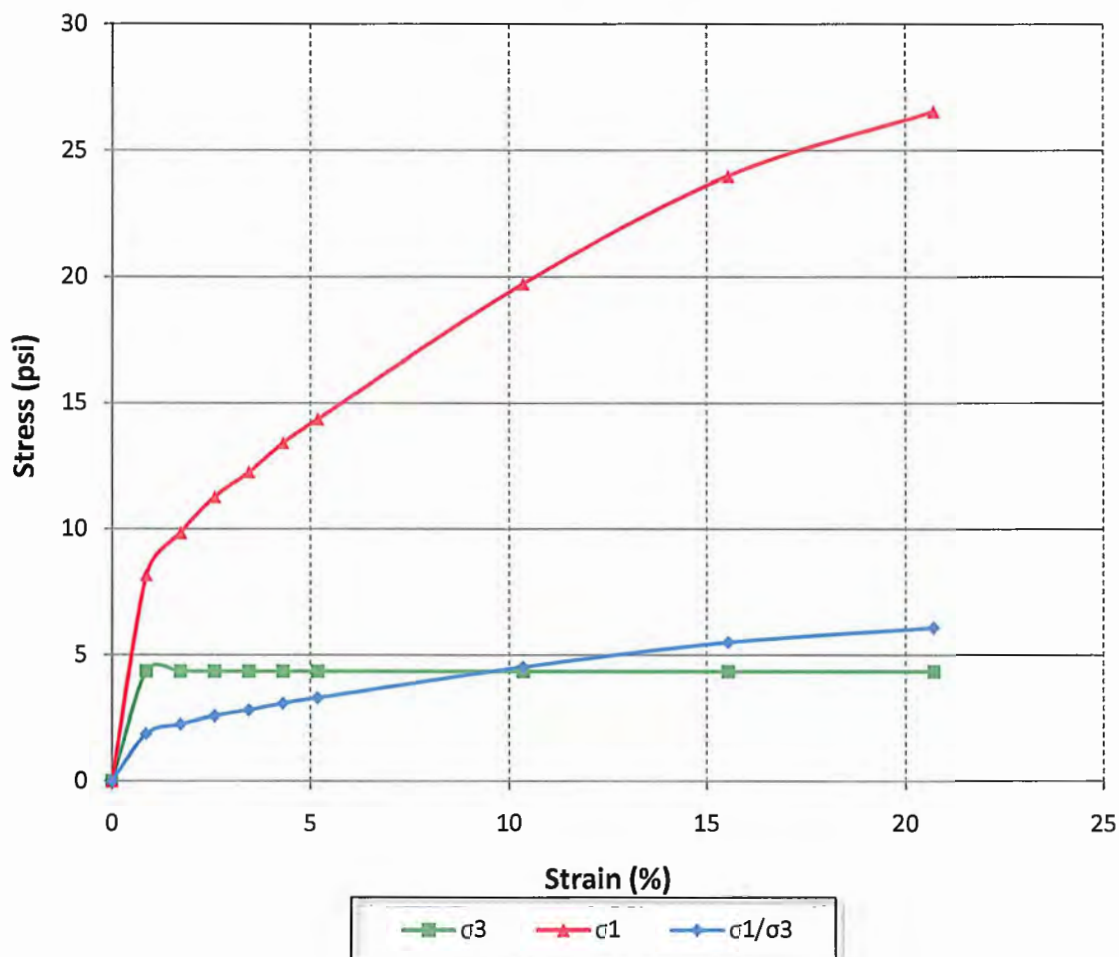
POINT # : 1
SAMPLE LOC. : B-64
SAMPLE DEPTH : 4.5' to 5.0'
DATE TESTED : 10/26/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 23.89 %
FINAL HEIGHT : 11.79 cm
FINAL DIAMETER : 8.16 cm

EFF. CONS. STRESS : 4.35 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-64

PROJECT STATE : South Carolina

SAMPLE DEPTH : 4.5' to 5.0'

LABORATORY # : 08195-01

DATE TESTED : 10/26/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

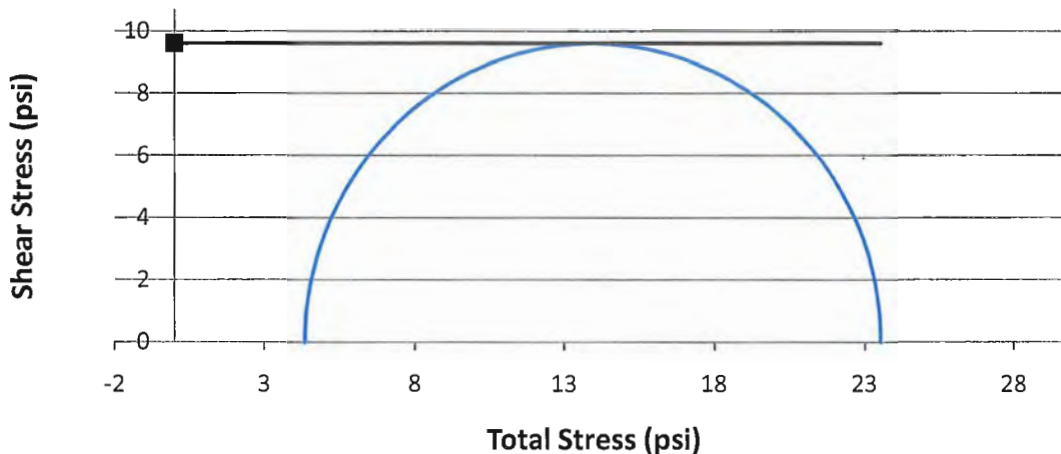
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	2765 psf
1	4.35	23.56	Cohesion =	1383 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson
SOIL TYPE : Gray, Red, Orange & White Silty Sand
WET DENSITY : 108.21 pcf
DRY DENSITY : 83.41 pcf
MOISTURE : 29.73 %

POINT # : 1
SAMPLE LOC. : B-64
SAMPLE DEPTH : 9.0' to 9.5'
DATE TESTED : 10/25/12
DATE REPORTED : 10/30/12

DELTA HEIGHT : NA
DELTA VOLUME : NA
CHAMBER PRES. : 7.14 psi

INITIAL HEIGHT : 14.66 cm
INITIAL DIAMETER : 7.2 cm

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.87	7.14	9.12	1.28
3	1.73	7.14	10.2	1.43
4	2.60	7.14	11.03	1.54
5	3.47	7.14	12.07	1.69
6	4.33	7.14	12.66	1.77
7	5.20	7.14	13.45	1.88
8	10.40	7.14	17.28	2.42
9	15.60	7.14	20.38	2.85
10	20.79	7.14	23.21	3.25
11	25.99	7.14	25.33	3.55
12	31.19	7.14	26.83	3.76
13	34.66	7.14	27.23	3.81
14	43.32	7.14	26.65	3.73
15	51.99	7.14	24.71	3.46
16	60.65	7.14	22.08	3.09
17	69.32	7.14	19.09	2.67
18	77.98	7.14	15.85	2.22
19	86.65	7.14	12.4	1.74
20	95.31	7.14	8.94	1.25
21	103.97	7.14	5.72	0.8



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

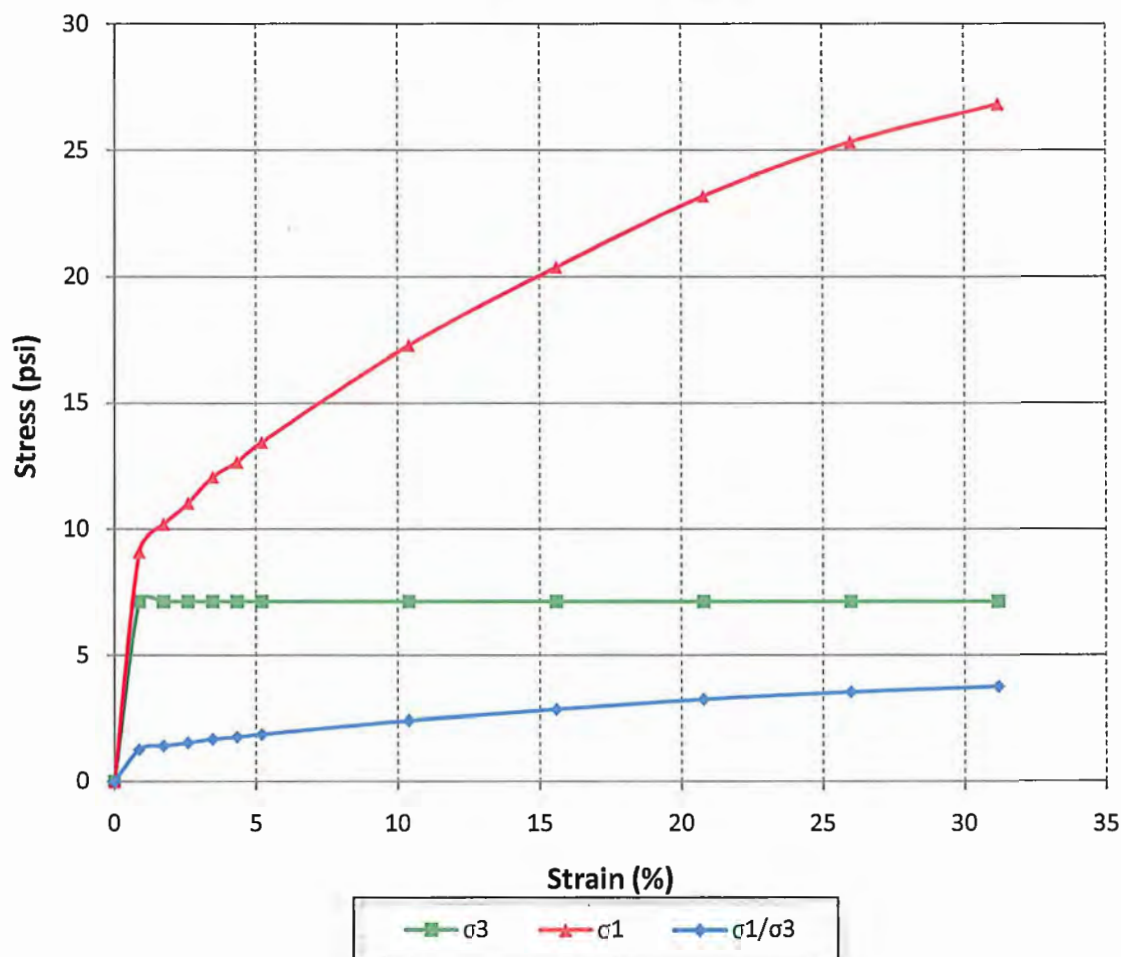
POINT # : 1
SAMPLE LOC. : B-64
SAMPLE DEPTH : 9.0' to 9.5'
DATE TESTED : 10/25/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 29.73 %
FINAL HEIGHT : 11.74 cm
FINAL DIAMETER : 8.05 cm

EFF. CONS. STRESS : 7.14 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-64

PROJECT STATE : South Carolina

SAMPLE DEPTH : 9.0' to 9.5'

LABORATORY # : 08195-01

DATE TESTED : 10/25/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

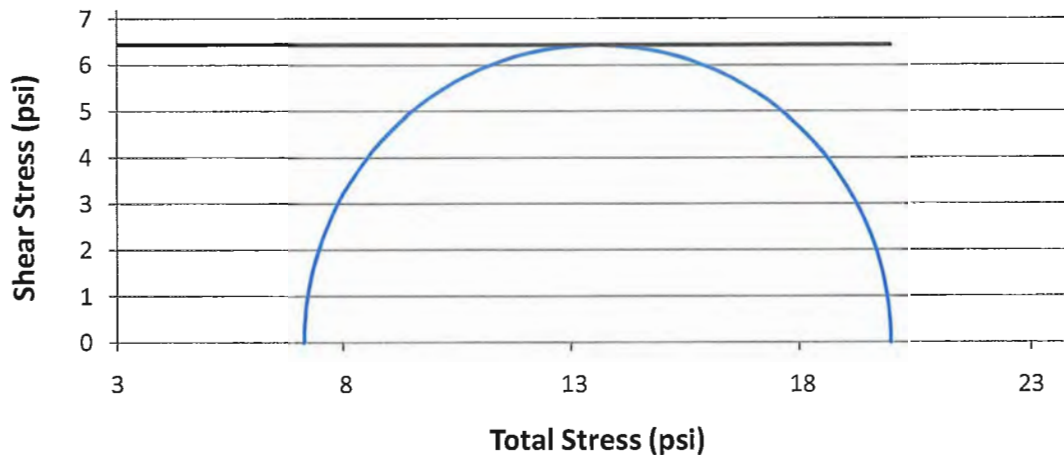
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	1855 psf
1	7.14	20.03	Cohesion =	928 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____



PROJECT NAME : I-85/I-385 Interchange Page 1 of 3
 PROJECT # : 08195-01 POINT # : 1
 PROJECT COUNTY : Greenville SAMPLE LOC. : B-67
 PROJECT STATE : South Carolina SAMPLE DEPTH : 4.0' to 4.5'
 LABORATORY # : 08195-01 DATE TESTED : 10/26/12
 SUBMITTED BY : Florence & Hutcheson DATE REPORTED : 10/30/12
 SOIL TYPE : Orange, Red & White
 WET DENSITY : 122.12 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.99 cm
 DRY DENSITY : 100.54 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.21 cm
 MOISTURE : 21.47 % CHAMBER PRES. : 3.96 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.85	3.96	6.8	1.72
3	1.69	3.96	8.08	2.04
4	2.54	3.96	9.34	2.36
5	3.39	3.96	10.79	2.73
6	4.24	3.96	12.21	3.09
7	5.08	3.96	13.6	3.44
8	10.17	3.96	22.1	5.59
9	15.25	3.96	28.82	7.29
10	20.34	3.96	32.82	8.3
11	25.42	3.96	34.33	8.68
12	30.51	3.96	34.35	8.68
13	33.90	3.96	33.81	8.55
14	42.37	3.96	32.06	8.1
15	50.85	3.96	28.44	7.19
16	59.32	3.96	24.64	6.23
17	67.80	3.96	20.54	5.19
18	76.27	3.96	16.4	4.15
19	84.75	3.96	11.97	3.03
20	93.22	3.96	7.53	1.9
21	101.69	3.96	3.05	0.77
22	110.17	3.96	-1.49	-0.38
23	118.64	3.96	-6.04	-1.53
24	127.12	3.96	-10.52	-2.66
25	135.59	3.96	-14.9	-3.77
26	144.07	3.96	-19.48	-4.92
27	152.54	3.96	-23.66	-5.98
28	161.02	3.96	-27.94	-7.06



TRIAXIAL COMPRESSION TEST

Page 2 of 3

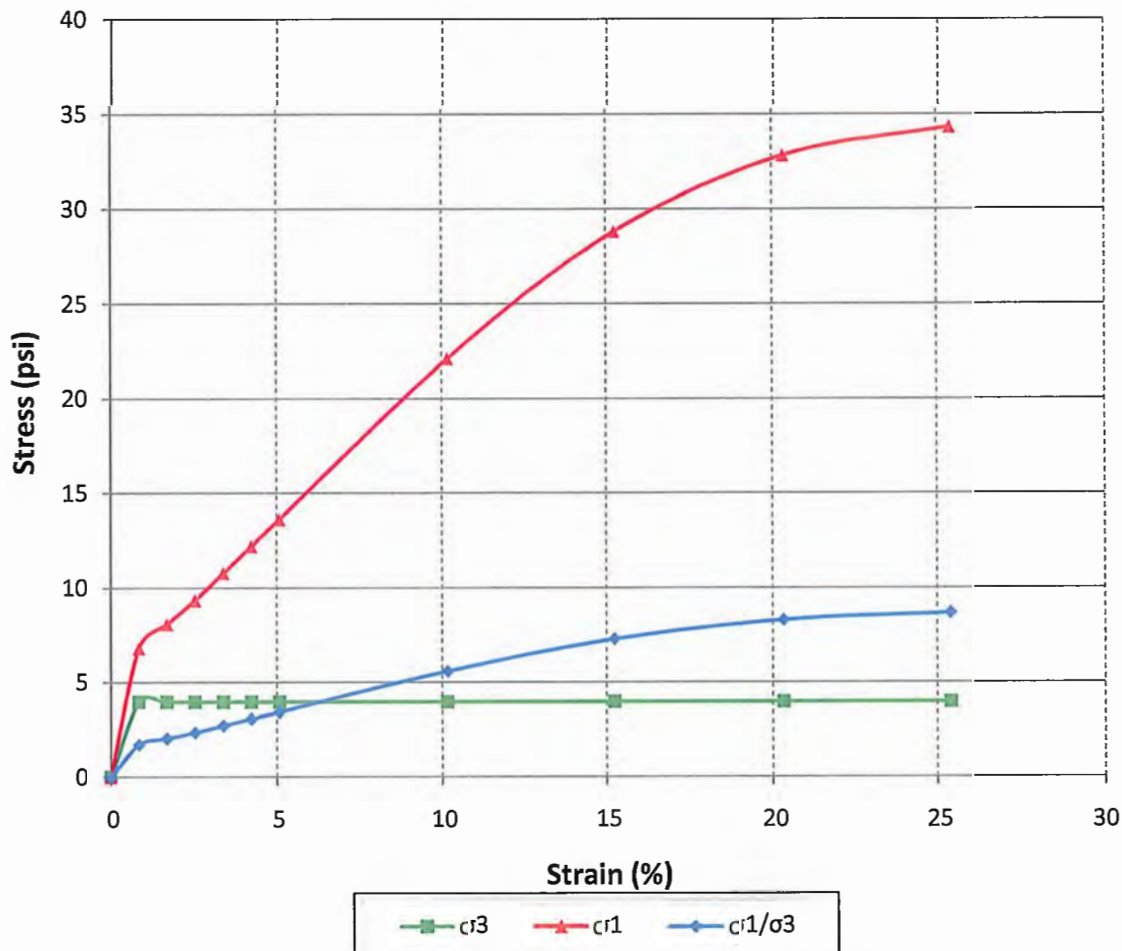
PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

POINT # : 1
SAMPLE LOC. : B-67
SAMPLE DEPTH : 4.0' to 4.5'
DATE TESTED : 10/26/12
DATE REPORTED : 10/30/12

FINAL MOISTURE : 21.47 %
FINAL HEIGHT : 12.07 cm
FINAL DIAMETER : 8.04 cm

EFF. CONS. STRESS : 3.96 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

Page 3 of 3

SAMPLE LOC. : B-67
SAMPLE DEPTH : 4.0' to 4.5'
DATE TESTED : 10/26/12
DATE REPORTED : 10/30/12

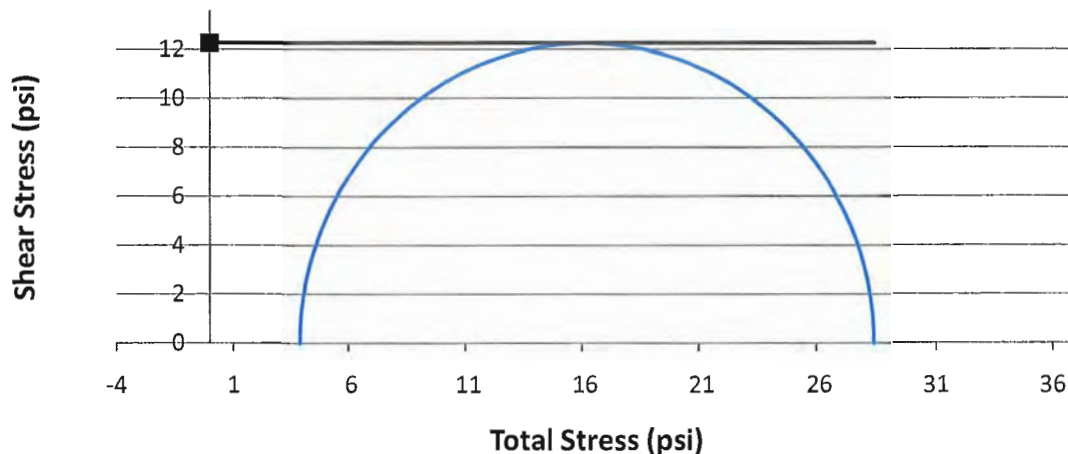
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	3532 psf
1	3.96	28.48	Cohesion =	1766 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By: _____

Handwritten signature in blue ink.



PROJECT NAME : I-85/I-385 Interchange Page 1 of 3
 PROJECT # : 08195-01 POINT # : 1
 PROJECT COUNTY : Greenville SAMPLE LOC. : B-68
 PROJECT STATE : South Carolina SAMPLE DEPTH : 2.0' to 2.5'
 LABORATORY # : 08195-01 DATE TESTED : 10/22/12
 SUBMITTED BY : Florence & Hutcheson DATE REPORTED : 10/30/12
 SOIL TYPE : Orange & Yellow Poorly Graded Sand with Silt
 WET DENSITY : 124.68 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 15.05 cm
 DRY DENSITY : 100.83 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.27 cm
 MOISTURE : 23.65 % CHAMBER PRES. : 2.26 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.84	2.26	4.42	1.95
3	1.69	2.26	5.26	2.32
4	2.53	2.26	6.08	2.69
5	3.38	2.26	6.89	3.04
6	4.22	2.26	7.47	3.3
7	5.06	2.26	8.05	3.56
8	10.13	2.26	11.65	5.15
9	15.19	2.26	15.13	6.69
10	20.25	2.26	18.12	8.01
11	25.31	2.26	20.89	9.23
12	30.38	2.26	23.4	10.34
13	33.75	2.26	24.63	10.89
14	42.19	2.26	26.12	11.55
15	50.63	2.26	24.44	10.8
16	59.07	2.26	21.45	9.48
17	67.50	2.26	16.83	7.44
18	75.94	2.26	12.24	5.41
19	84.38	2.26	8.74	3.86
20	92.82	2.26	5.26	2.33
21	101.25	2.26	1.74	0.77
22	109.69	2.26	-1.74	-0.77



TRIAXIAL COMPRESSION TEST

PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

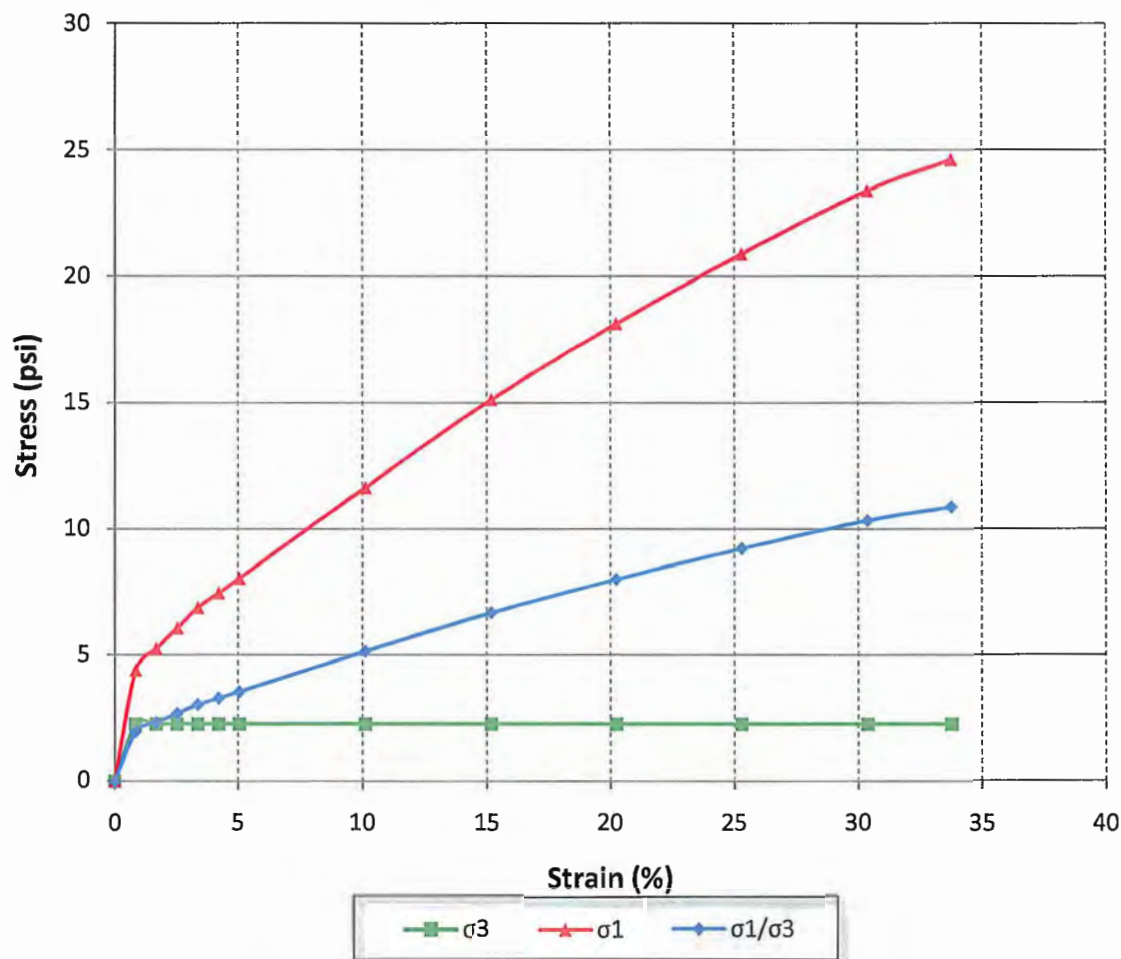
POINT # : 1
SAMPLE LOC. : B-68
SAMPLE DEPTH : 2.0' to 2.5'
DATE TESTED : 10/22/12
DATE REPORTED : 10/30/12

Page 2 of 3

FINAL MOISTURE : 23.65 %
FINAL HEIGHT : 12.13 cm
FINAL DIAMETER : 8.1 cm

EFF. CONS. STRESS : 2.26 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-68

PROJECT STATE : South Carolina

SAMPLE DEPTH : 2.0' to 2.5'

LABORATORY # : 08195-01

DATE TESTED : 10/22/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 10/30/12

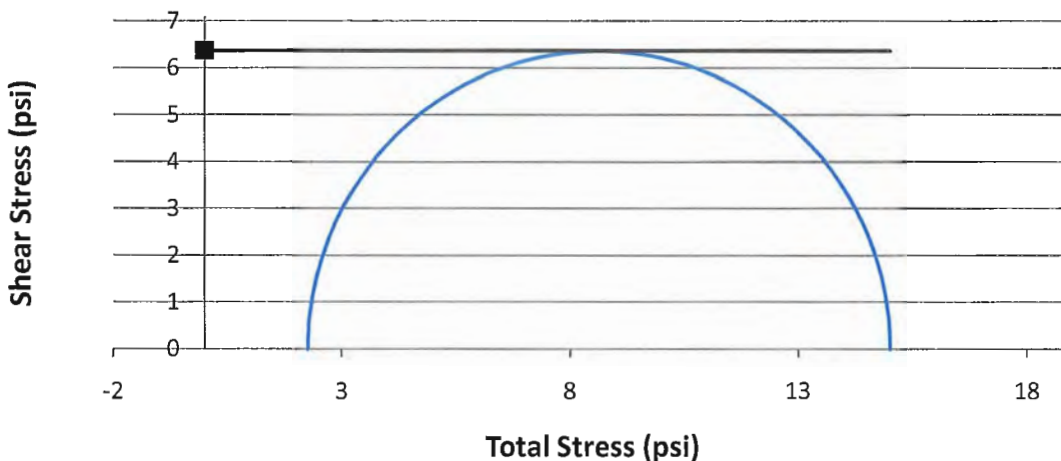
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	1834 psf
1	2.26	15	Cohesion =	917 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test



Approved By:



PROJECT NAME : I-85/I-385 Interchange Page 1 of 3
 PROJECT # : 08195-01 POINT # : 1
 PROJECT COUNTY : Greenville SAMPLE LOC. : B-74
 PROJECT STATE : South Carolina SAMPLE DEPTH : 4.0' to 4.5'
 LABORATORY # : 08195-01 DATE TESTED : 10/30/12
 SUBMITTED BY : Florence & Hutcheson DATE REPORTED : 11/01/12

SOIL TYPE : Brown Sandy Silt
 WET DENSITY : 114.72 pcf DELTA HEIGHT : NA INITIAL HEIGHT : 14.76 cm
 DRY DENSITY : 86.21 pcf DELTA VOLUME : NA INITIAL DIAMETER : 7.18 cm
 MOISTURE : 33.07 % CHAMBER PRES. : 3.66 psi

RESULTS:

	ϵ_a	σ_3 (psi)	σ_1 (psi)	σ_1/σ_3
1	0.00	0.00	0.00	0.00
2	0.86	3.66	4.1	1.12
3	1.72	3.66	4.53	1.24
4	2.58	3.66	4.74	1.3
5	3.44	3.66	4.95	1.35
6	4.30	3.66	5.15	1.41
7	5.16	3.66	5.35	1.46
8	10.33	3.66	5.66	1.55
9	15.49	3.66	6.48	1.77
10	20.66	3.66	6.84	1.87
11	25.82	3.66	7.3	1.99
12	30.98	3.66	7.5	2.05
13	34.43	3.66	7.6	2.08
14	43.03	3.66	7.59	2.08
15	51.64	3.66	7.32	2
16	60.25	3.66	7.11	1.95
17	68.85	3.66	6.43	1.76
18	77.46	3.66	5.77	1.58
19	86.07	3.66	5.05	1.38
20	94.68	3.66	4.21	1.15
21	103.28	3.66	3.31	0.9
22	111.89	3.66	2.38	0.65
23	120.50	3.66	1.37	0.38
24	129.10	3.66	0.28	0.08
25	137.71	3.66	-0.55	-0.15
26	146.32	3.66	-1.51	-0.41
27	154.92	3.66	-2.83	-0.77
28	163.53	3.66	-3.84	-1.05
29	172.14	3.66	-4.86	-1.33
30	180.74	3.66	-5.7	-1.56
31	189.35	3.66	-6.7	-1.83
32	197.96	3.66	-7.91	-2.16



TRIAXIAL COMPRESSION TEST

Page 2 of 3

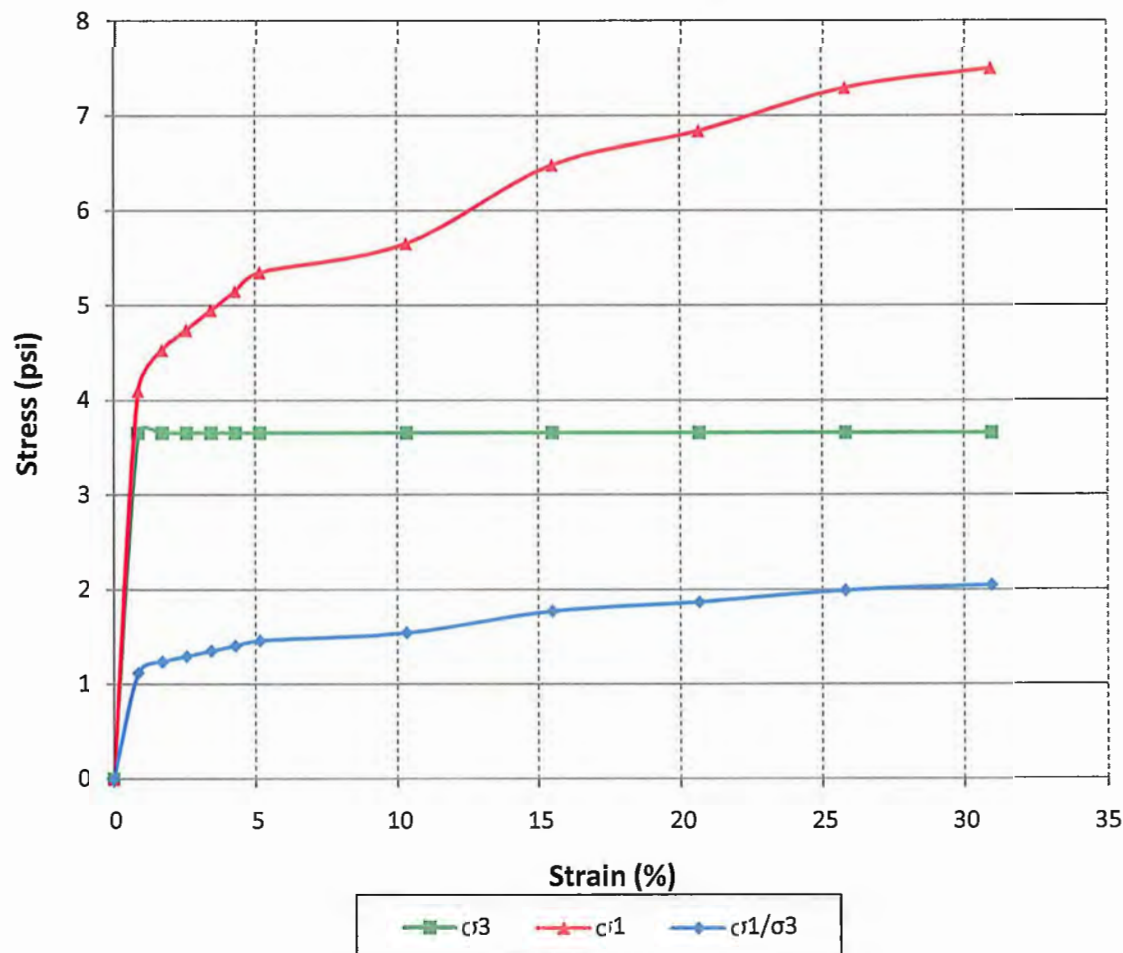
PROJECT NAME : I-85/I-385 Interchange
PROJECT # : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY # : 08195-01
SUBMITTED BY : Florence & Hutcheson

POINT # : 1
SAMPLE LOC. : B-74
SAMPLE DEPTH : 4.0' to 4.5'
DATE TESTED : 10/30/12
DATE REPORTED : 11/01/12

FINAL MOISTURE : 33.07 %
FINAL HEIGHT : 11.83 cm
FINAL DIAMETER : 8.02 cm

EFF. CONS. STRESS : 3.66 psi
SPECIFIC GRAVITY : NA
COMMENTS : AASHTO T-296

RESULTS:





PROJECT NAME : I-85/I-385 Interchange

Page 3 of 3

PROJECT # : 08195-01

PROJECT COUNTY : Greenville

SAMPLE LOC. : B-74

PROJECT STATE : South Carolina

SAMPLE DEPTH : 4.0' to 4.5'

LABORATORY # : 08195-01

DATE TESTED : 10/30/12

SUBMITTED BY : Florence & Hutcheson

DATE REPORTED : 11/01/12

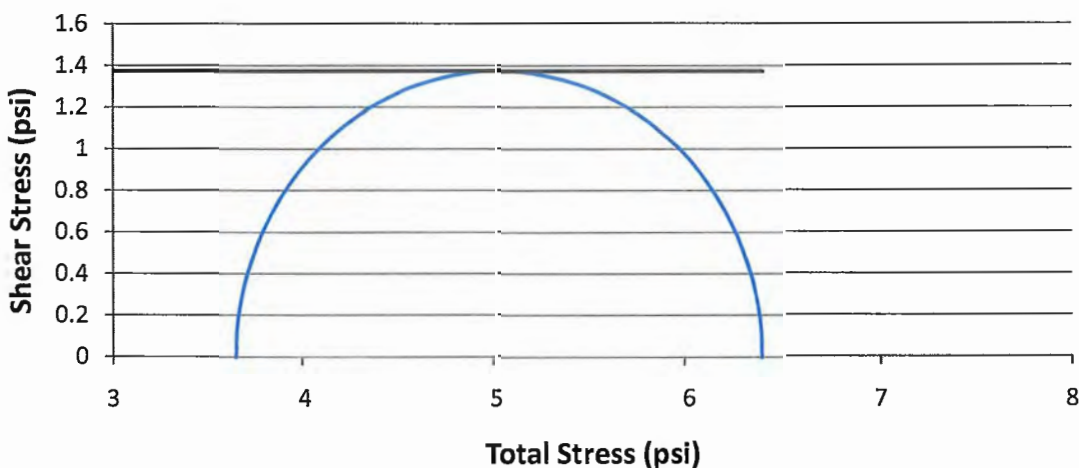
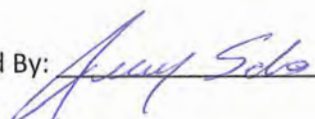
COEFFICIENT OF INTERNAL FRICTION AND COHESION BY THE METHOD OF LEAST SQUARES

Test	Lateral	Total	Compressive Strength =	396 psf
1	3.66	6.4	Cohesion =	198 psf
			Phi =	0 deg
			Tan (Phi) =	0

At Maximum Deviator Stress 15%

Triaxial Mohr's Circles

Unconsolidated Undrained Triaxial Test

Approved By: 



Florence & Hutcheson

An **ICA** Company

Project Name : I-85/I-385 Interchange
Location : Greenville County, South Carolina
Job Number : 08195-01
Project Job No. : 08195-01

Unconfined Compression (Rock Core) Summary

Boring Number	Sample Number	Depth	Air-Dry Density (pcf)	Max Stress (psi)
B-1	RS-20	29.5-29.9	160.0	4597.7
B-2	RS-21	92.5-92.9	164.0	7391.1
B-3	RS-12	85.2-85.6	164.1	314.2
B-4	RS-15	28.2-28.6	160.2	8599.6
B-5	RS-16	17.2-17.6	166.7	9481.7
B-6	RS-13	48.4-48.7	165.8	8658.2
B-6	RS-14	55.5-55.9	163.1	11348.9
B-7	RS-18	47.2-47.5	161.5	9554.9
B-8	RS-4	29.1-29.4	158.8	8094.2
B-9	RS-3	57.2-57.6	161.4	7720.8
B-10	RS-2	81.3-81.7	159.4	1069.5
B-14	RS-6	104.6-104.9	168.5	1535.5
B-14	RS-7	90.9-91.3	165.0	5312.3
B-15	RS-5	30.3-30.7	165.7	10548.8
B-16	RS-1	113.6-113.9	116.9	3050.8
B-20	RS-8	52.4-52.8	170.8	4720.3
B-21	RS-11	72.2-72.6	157.5	2353.8
B-27	RS-10	101.3-101.7	164.2	1517.1
B-28	RS-17	35.8-36.1	162.6	7111.2
B-30	RS-9	72.4-72.7	161.4	7352.8
B-31	RS-19	77-77.4	174.4	6448.8
B-45	RS-24	19.5-19.9	157.4	2157.4
B-45	RS-25	28.4-28.7	163.4	5337.9
B-45	RS-26	32.7-33	165.4	4408.8
B-65	RS-23	20.9-21.2	166.1	5751.6
B-67	RS-22	33.5-33.8	163.8	3377.1



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange
PROJECT NO. : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY NO. : 08195-01
SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-20
SAMPLE LOC. : B-1
SAMPLE DEPTH : 29.5' to 29.9'
DATE TESTED : 11/07/12
DATE REPORTED : 11/14/12

ROCK DESCRIPTION : Feldspar quartz biotite gneiss, sli. withd

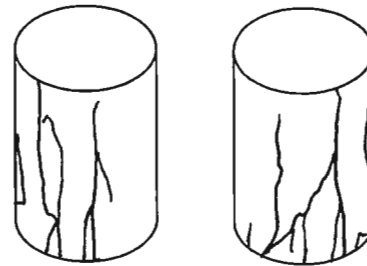
Diameter : 1.98 in
Height : 4.00 in

Area : 3.09 in²
Volume : 0.00715 ft³

RESULTS :

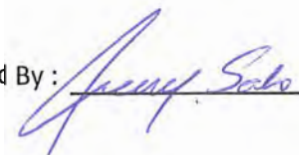
Moisture Air-Dry : NA
Air-Dry Density : 160.03 lbs/ft.³

Maximum Stress : 4597.7 psi
Elapsed Time : 5:20 min.
Rate of Loading : 50.0 lb/sec



Comments :

Approved By :

_____



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-21

SAMPLE LOC. : B-2

SAMPLE DEPTH : 92.5' to 92.9'

DATE TESTED : 11/07/12

DATE REPORTED : 11/14/12

ROCK DESCRIPTION : Feldspar quartz biotite gneiss, shistose, med. crystalline, sli. wthd

Diameter : 1.98 in

Area : 3.09 in²

Height : 4.05 in

Volume : 0.00724 ft³

RESULTS :

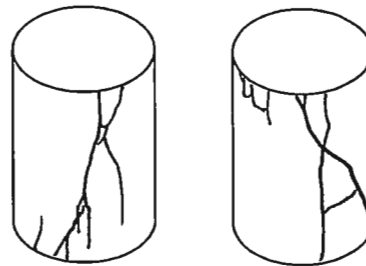
Moisture Air-Dry : NA

Air-Dry Density : 163.97 lbs/ft.³

Maximum Stress : 7391.1 psi

Elapsed Time : 6:37 min.

Rate of Loading : 80.0 lb/sec



Comments :

Approved By : 



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange
PROJECT NO. : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY NO. : 08195-01
SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-12
SAMPLE LOC. : B-3
SAMPLE DEPTH : 85.2' to 85.6'
DATE TESTED : 07/31/12
DATE REPORTED : 08/07/12

ROCK DESCRIPTION : Feldspar Quartz Biotite Gneiss w/part. Healed jt. Mod. Wthd

Diameter : 1.98 in

Area : 3.09 in²

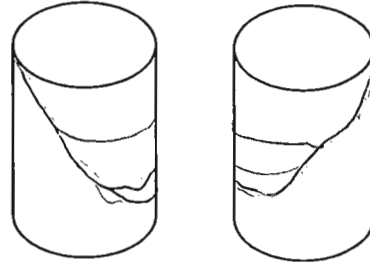
Height : 3.96 in

Volume : 0.00707 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 164.13 lbs/ft.³

Maximum Stress : 314.2 psi
Elapsed Time : 1:08 min.
Rate of Loading : 20 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-15

SAMPLE LOC. : B-4

SAMPLE DEPTH : 28.2' to 28.6'

DATE TESTED : 07/31/12

DATE REPORTED : 08/07/12

ROCK DESCRIPTION : Feldspar Quartz Pegmatite Fresh

Diameter : 1.99 in

Height : 4.08 in

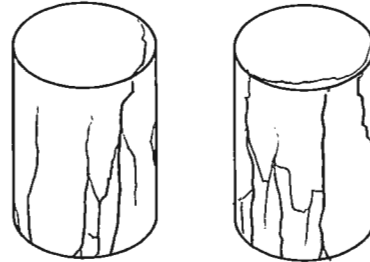
Area : 3.11 in²

Volume : 0.00733 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 160.2 lbs/ft.³

Maximum Stress : 8599.6 psi
Elapsed Time : 6:23 min.
Rate of Loading : 90 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange
PROJECT NO. : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY NO. : 08195-01
SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-16
SAMPLE LOC. : B-5
SAMPLE DEPTH : 17.2' to 17.6'
DATE TESTED : 7/31/2012
DATE REPORTED : 8/7/2012

ROCK DESCRIPTION : Feldspar Quartz Biotite Gneiss Fresh

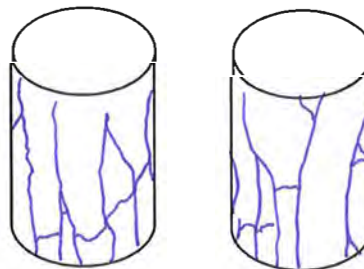
Diameter : 1.99 in
Height : 4.10 in

Area : 3.12 in²
Volume : 0.00739 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 166.65 lbs/ft.³

Maximum Stress : 9481.7 psi
Elapsed Time : 6:15 min.
Rate of Loading : 90 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-13

SAMPLE LOC. : B-6

SAMPLE DEPTH : 48.4' to 48.7'

DATE TESTED : 07/31/12

DATE REPORTED : 08/07/12

ROCK DESCRIPTION : Feldspar Quartz Augite Gneiss Fresh

Diameter : 1.99 in

Height : 4.08 in

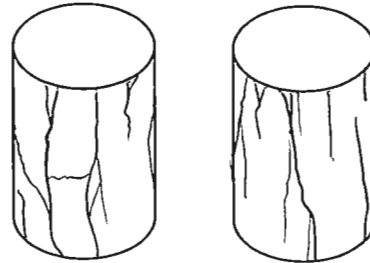
Area : 3.10 in²

Volume : 0.00732 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 165.79 lbs/ft.³

Maximum Stress : 8658.2 psi
Elapsed Time : 7:25 min.
Rate of Loading : 80 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-14

SAMPLE LOC. : B-6

SAMPLE DEPTH : 55.5' to 55.9'

DATE TESTED : 07/31/12

DATE REPORTED : 08/07/12

ROCK DESCRIPTION : Feldspar Quartz Granitoid Rock Fresh

Diameter : 1.99 in

Height : 4.04 in

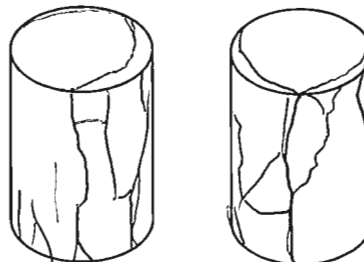
Area : 3.11 in²

Volume : 0.00728 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 163.1 lbs/ft.³

Maximum Stress : 11348.9 psi
Elapsed Time : 8:05 min.
Rate of Loading : 100 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-18

SAMPLE LOC. : B-7

SAMPLE DEPTH : 47.2' to 47.5'

DATE TESTED : 11/07/12

DATE REPORTED : 11/14/12

ROCK DESCRIPTION : Feldspar quartz granitoid rock, fresh

Diameter : 1.98 in

Height : 4.04 in

Area : 3.08 in²

Volume : 0.00721 ft³

RESULTS :

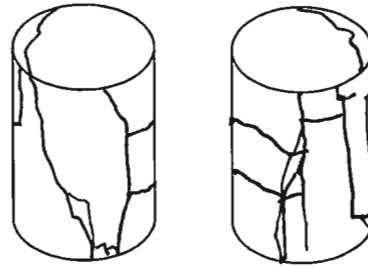
Moisture Air-Dry : NA

Air-Dry Density : 161.45 lbs/ft.³

Maximum Stress : 9554.9 psi

Elapsed Time : 7:20 min.

Rate of Loading : 70.0 lb/sec



Comments :

Approved By : 



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-4

SAMPLE LOC. : B-8

SAMPLE DEPTH : 29.1' to 29.4'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz augite schist fresh

Diameter : 1.97 in

Height : 4.15 in

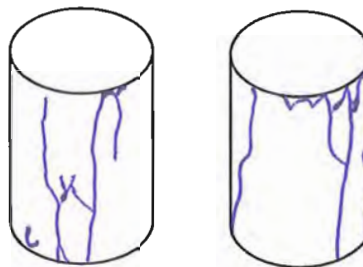
Area : 3.06 in²

Volume : 0.00733 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 158.76 lbs/ft.³

Maximum Stress : 8094.2 psi
Elapsed Time : 9:02 min.
Strain : 1.76 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-3

SAMPLE LOC. : B-9

SAMPLE DEPTH : 57.2' to 57.6'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz augite schist slight wthd

Diameter : 1.99 in

Height : 4.00 in

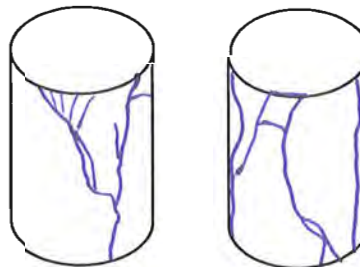
Area : 3.12 in²

Volume : 0.00721 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 161.43 lbs/ft.³

Maximum Stress : 7720.8 psi
Elapsed Time : 11:40 min.
Strain : 1.83 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-2

SAMPLE LOC. : B-10

SAMPLE DEPTH : 81.3' to 81.7'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz pegmatite slight withd

Diameter : 1.99 in

Height : 3.98 in

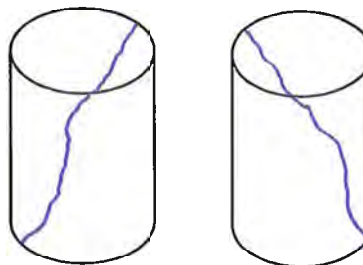
Area : 3.12 in²

Volume : 0.0072 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 159.36 lbs/ft.³

Maximum Stress : 1069.5 psi
Elapsed Time : 2:06 min.
Strain : 1.83 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-6

SAMPLE LOC. : B-14

SAMPLE DEPTH : 104.6' to 104.9'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Augite quartz schist mod withd

Diameter : 1.97 in

Height : 3.98 in

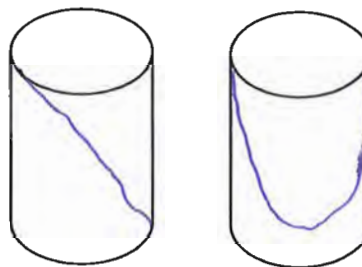
Area : 3.04 in²

Volume : 0.007 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 168.5 lbs/ft.³

Maximum Stress : 1535.5 psi
Elapsed Time : 1:50 min.
Strain : 1.83 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-7

SAMPLE LOC. : B-14

SAMPLE DEPTH : 90.9' to 91.3'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz sillimanite schist slight wthd

Diameter : 1.96 in

Height : 4.01 in

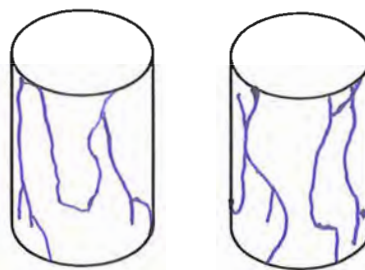
Area : 3.02 in²

Volume : 0.007 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 164.97 lbs/ft.³

Maximum Stress : 5312.3 psi
Elapsed Time : 6:53 min.
Strain : 1.82 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-5

SAMPLE LOC. : B-15

SAMPLE DEPTH : 30.3' to 30.7'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz bitite gneiss slight wthd

Diameter : 1.99 in

Height : 4.14 in

Area : 3.12 in²

Volume : 0.00747 ft³

RESULTS :

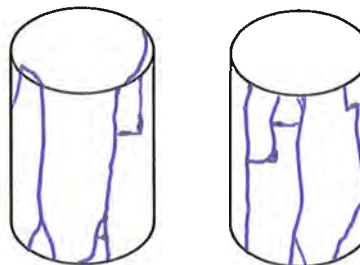
Moisture Air-Dry : NA

Air-Dry Density : 165.68 lbs/ft.³

Maximum Stress : 10548.8 psi

Elapsed Time : 10:31 min.

Strain : 1.76 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-1

SAMPLE LOC. : B-16

SAMPLE DEPTH : 113.6' to 113.9'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Muscovite quartz schist fresh

Diameter : 1.99 in

Height : 3.91 in

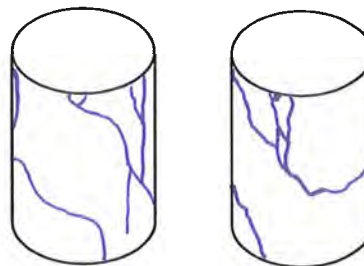
Area : 3.11 in²

Volume : 0.00704 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 166.86 lbs/ft.³

Maximum Stress : 3050.8 psi
Elapsed Time : 5:53 min.
Strain : 1.87 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-8

SAMPLE LOC. : B-20

SAMPLE DEPTH : 52.4' to 52.8'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Quartz augite schist fresh

Diameter : 1.99 in

Height : 3.94 in

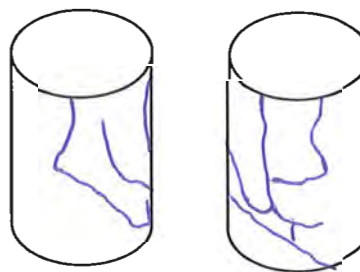
Area : 3.11 in²

Volume : 0.00708 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 170.8 lbs/ft.³

Maximum Stress : 4720.3 psi
Elapsed Time : 5:21 min.
Strain : 1.85 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-11

SAMPLE LOC. : B-21

SAMPLE DEPTH : 72.2' to 72.6'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz pegmatite slight with

Diameter : 1.99 in

Height : 4.06 in

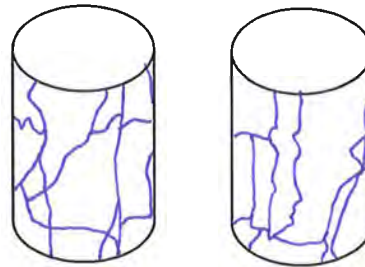
Area : 3.11 in²

Volume : 0.00729 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 157.48 lbs/ft.³

Maximum Stress : 2353.8 psi
Elapsed Time : 3:13 min.
Strain : 1.80 %



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-10

SAMPLE LOC. : B-27

SAMPLE DEPTH : 101.3' to 101.7'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz sillimanite augite schist mod

Diameter : 1.99 in

Height : 4.03 in

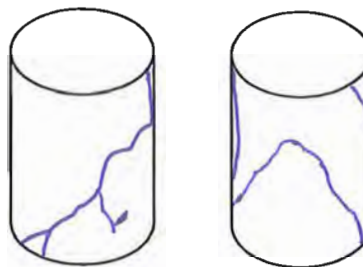
Area : 3.10 in²

Volume : 0.00723 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 164.16 lbs/ft.³

Maximum Stress : 1517.1 psi
Elapsed Time : 2:00 min.
Strain : 1.81 %



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange
PROJECT NO. : 08195-01
PROJECT COUNTY : Greenville
PROJECT STATE : South Carolina
LABORATORY NO. : 08195-01
SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-17
SAMPLE LOC. : B-28
SAMPLE DEPTH : 35.8' to 36.1'
DATE TESTED : 07/31/12
DATE REPORTED : 08/07/12

ROCK DESCRIPTION : Feldspar Quartz Pegmatite Fresh

Diameter : 2.00 in

Height : 4.13 in

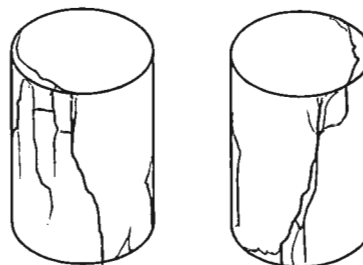
Area : 3.15 in²

Volume : 0.00754 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 162.63 lbs/ft.³

Maximum Stress : 7111.2 psi
Elapsed Time : 5:30 min.
Rate of Loading : 70 lb/sec



Comments :

Approved By :



Florence & Hutcheson

CONSULTING ENGINEERS

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I85 / I385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-9

SAMPLE LOC. : B-30

SAMPLE DEPTH : 72.4' to 72.7'

DATE TESTED : 2/27/2012

DATE REPORTED : 2/29/2012

ROCK DESCRIPTION : Feldspar quartz augite gneiss fresh

Diameter : 1.98 in

Height : 4.08 in

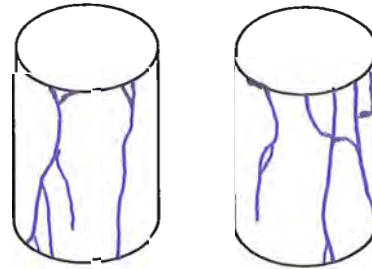
Area : 3.09 in²

Volume : 0.00729 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 161.37 lbs/ft.³

Maximum Stress : 7352.8 psi
Elapsed Time : 7:46 min.
Strain : 1.79 %



Comments :

Approved By : 



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-19

SAMPLE LOC. : B-31

SAMPLE DEPTH : 77.0' to 77.4'

DATE TESTED : 11/07/12

DATE REPORTED : 11/14/12

ROCK DESCRIPTION : Feldspar quartz augite muscovite biotite gneiss, schistose, contorted foliation, fresh

Diameter : 1.98 in

Area : 3.09 in²

Height : 4.04 in

Volume : 0.00723 ft³

RESULTS :

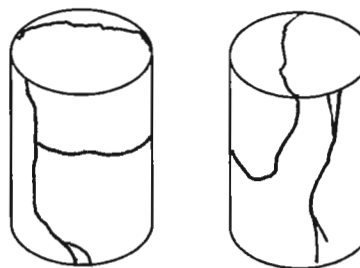
Moisture Air-Dry : NA

Air-Dry Density : 174.43 lbs/ft.³

Maximum Stress : 6448.8 psi

Elapsed Time : 5:25 min.

Rate of Loading : 60.0 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-24

SAMPLE LOC. : B-45

SAMPLE DEPTH : 19.5' to 19.9'

DATE TESTED : 11/16/12

DATE REPORTED : 11/19/12

ROCK DESCRIPTION : Feldspar quartz biotite augite gneiss, mod. whtd

Diameter : 1.99 in

Height : 4.03 in

Area : 3.10 in²

Volume : 0.00722 ft³

RESULTS :

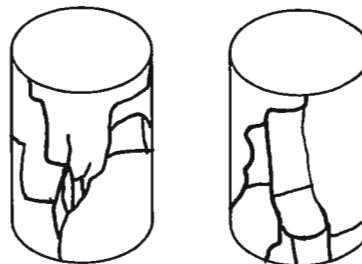
Moisture Air-Dry : NA

Air-Dry Density : 157.41 lbs/ft.³

Maximum Stress : 2157.4 psi

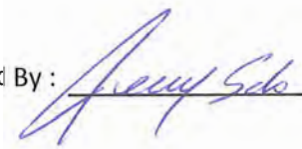
Elapsed Time : 3:05 min.

Rate of Loading : 30 lb/sec



Comments :

Approved By :





Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-25

SAMPLE LOC. : B-45

SAMPLE DEPTH : 28.4' to 28.7'

DATE TESTED : 11/16/12

DATE REPORTED : 11/19/12

ROCK DESCRIPTION : Feldspar quartz muscovite pegmatite, sli. whtd

Diameter : 1.99 in

Height : 4.05 in

Area : 3.12 in²

Volume : 0.0073 ft³

RESULTS :

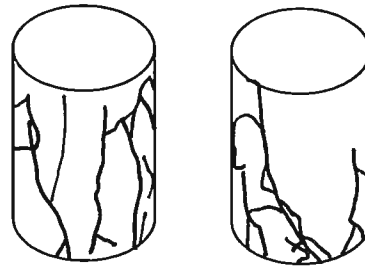
Moisture Air-Dry : NA

Air-Dry Density : 163.36 lbs/ft.³

Maximum Stress : 5337.9 psi

Elapsed Time : 5:30 min.

Rate of Loading : 60 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-26

SAMPLE LOC. : B-45

SAMPLE DEPTH : 32.7' to 33.0'

DATE TESTED : 11/16/12

DATE REPORTED : 11/19/12

ROCK DESCRIPTION : Quartz feldspar biotite gneiss, fresh

Diameter : 1.99 in

Height : 4.04 in

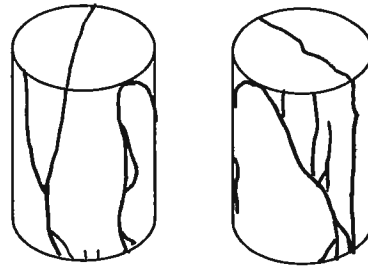
Area : 3.12 in²

Volume : 0.00728 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 165.37 lbs/ft.³

Maximum Stress : 4408.8 psi
Elapsed Time : 6:20 min.
Rate of Loading : 40 lb/sec



Comments :

Approved By :



Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-23

SAMPLE LOC. : B-65

SAMPLE DEPTH : 20.9' to 21.2'

DATE TESTED : 11/07/12

DATE REPORTED : 11/14/12

ROCK DESCRIPTION : Feldspar quartz augite gneiss w/garnets, fresh

Diameter : 1.98 in

Height : 4.04 in

Area : 3.07 in²

Volume : 0.00718 ft³

RESULTS :

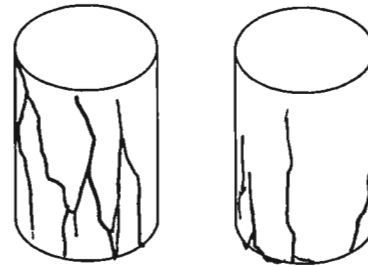
Moisture Air-Dry : NA

Air-Dry Density : 166.14 lbs/ft.³

Maximum Stress : 5751.6 psi

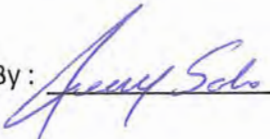
Elapsed Time : 5:15 min.

Rate of Loading : 60.0 lb/sec



Comments :

Approved By :





Florence & Hutcheson

An **ICA** Company

UNCONFINED COMPRESSION TEST (ROCK CORE)

PROJECT NAME : I-85/I-385 Interchange

PROJECT NO. : 08195-01

PROJECT COUNTY : Greenville

PROJECT STATE : South Carolina

LABORATORY NO. : 08195-01

SUBMITTED BY : Florence & Hutcheson

SAMPLE NO. : RS-22

SAMPLE LOC. : B-67

SAMPLE DEPTH : 33.5' to 33.8'

DATE TESTED : 11/07/12

DATE REPORTED : 11/14/12

ROCK DESCRIPTION : Feldspar quartz augite gneiss, fresh

Diameter : 1.98 in

Height : 4.01 in

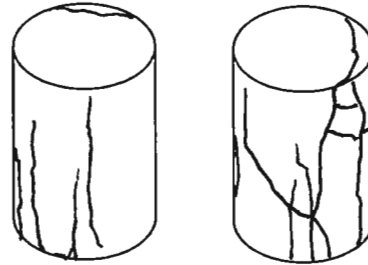
Area : 3.09 in²

Volume : 0.00717 ft³

RESULTS :

Moisture Air-Dry : NA
Air-Dry Density : 163.82 lbs/ft.³

Maximum Stress : 3377.1 psi
Elapsed Time : 4:20 min.
Rate of Loading : 40.0 lb/sec



Comments :

Approved By : _____



Florence & Hutcheson

An **ICA** Company

Project Name : I-85/I-385 Interchange
Location : Greenville County, South Carolina
Job Number : 08195-01
Project Job No. : 08195-01

Consolidated Undrained Triaxial Summary

Boring Number	Sample Number	Depth (ft)	Natural Moisture (%)	ASTM Classification	LL	PL	PI	C (psi)	ϕ (°)	C' (psi)	ϕ' (°)
B-49	Bag-1	0-21.5	23.0	SM	45	34	11	5.5	9.1	2.1	25.2
B-51	Bag-1	0-36	25.0	SM	33	24	9	3.9	14.6	0.8	31.1
B-54	Bag-1	0-41	18.1	SM	46	30	16	3	14.6	1.2	28
B-56	Bag-1	0-10	16.5	CL	40	24	16	2.2	13.5	0.7	29.4
B-56	Bag-2	10-35	17.0	SM	34	24	10	0	28.9	1.2	29
B-59	Bag-1	0-40	4.3	SM	32	27	5	1.4	28.2	1.1	30.3
B-65	Bag-1	0-15	25.3	SM	36	26	10	0	31.6	0.1	36.6
B-68	Bag-1	0-16	29.9	MH	52	33	19	2.8	16.4	0.6	32.8

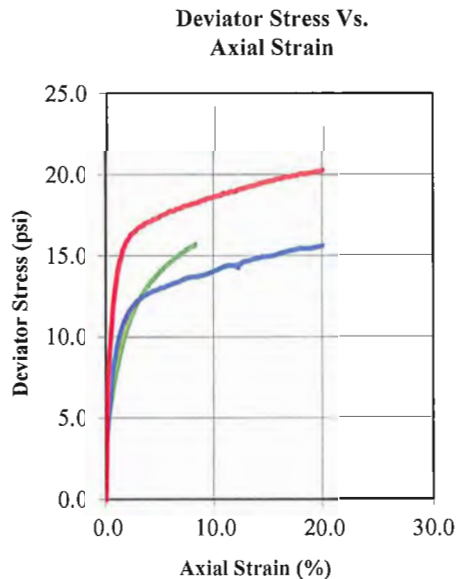


Florence & Hutcheson

CONSULTING ENGINEERS

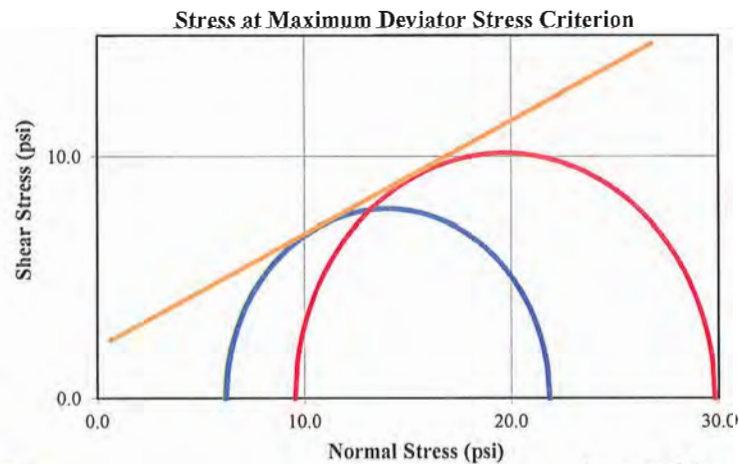
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0' to 21.5'
PROJECT LOCATION : B-49	SAMPLE TYPE : Remolded
BORING NUMBER : B-49	DESCRIPTION : Red Brown & Gray Silty Sand
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	22.2	22.8	22.1	
Dry Density (pcf)	88.6	88.3	89.5	
Saturation (%)	67.83	69.13	69.08	
Void Ratio	0.863	0.869	0.845	
Diameter (in)	2.807	2.808	2.807	
Height (in)	5.733	5.742	5.684	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	45	45	45	
Plastic Limit	34	34	34	
After Consolidation	A	B	C	D
B-Value	0.96	0.99	0.96	
Water Content (%)	32.7	34.1	31.7	
Dry Density (pcf)	89.41	88.35	89.46	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.850	0.872	0.849	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	63.0	88.0	54.4	
Rate of Strain	0.002	0.002	0.002	

Maximum Deviator Stress Criterion		After Shear	A	B	C	D
C (psi)	5.5	σ'_1 at Failure (psi)	21.85	21.84	29.83	
ϕ (deg)	9.1	σ'_3 at Failure (psi)	6.14	6.19	9.53	
C' (psi)	2.1					
ϕ' (deg)	25.2					



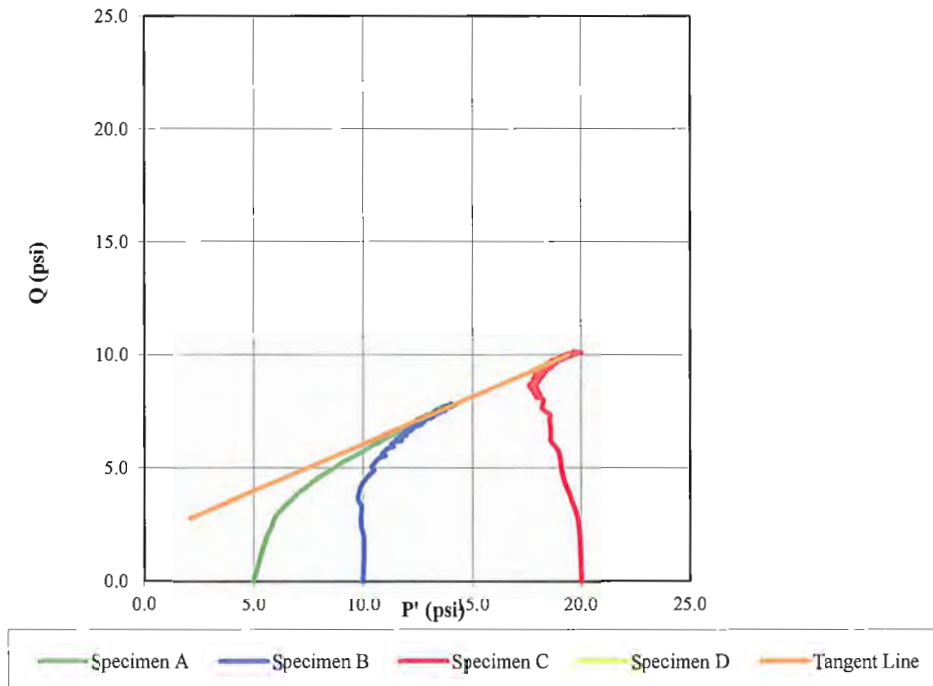
Tested By: [Signature]
Date: 12-11-12

Approved By: SKB
Date: 12-11-12

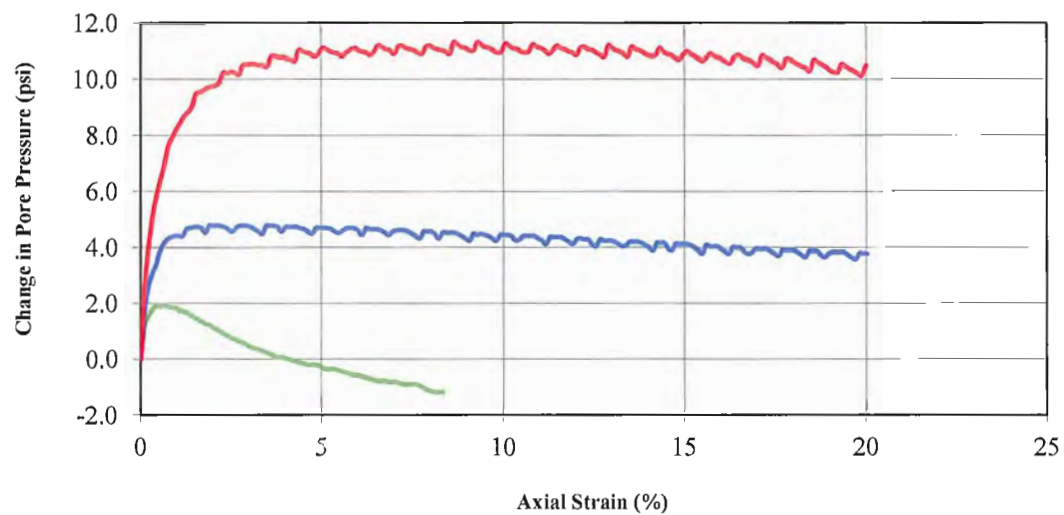


Consolidated Undrained Triaxial Test (ASTM D4767)

Stress Paths (Effective)
($a = 1.9$ $\alpha = 22.6$)



Change in Pore Pressure vs. Axial Strain





File Location
B-49 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-49
Sample Description: Red Brown & Gray Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 45.000
PL: 34.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.807	2.803	
Height (in)	5.733	5.700	
Weight (grams)	1008.40		1094.95
Moisture (%)	22.19		32.68
Dry Density (pcf)	88.61	89.41	
Saturation (%)	67.83	100.00	
Void Ratio	0.863	0.850	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 68.000
Effective Confining Stress (psi): 5.0
Corrected Peak Deviator Stress (psi): 15.718 at reading number: 79

Specimen A

Reading No.	Deviator Load (lbs)	~ Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in2)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	2.3	0.000	63.0	0.0	6.17	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	24.4	0.006	64.3	1.2	6.18	0.105	3.576	3.572	8.5	5.0	7.3	3.7	1.96	0.35	6.8	1.8	5.5
2	31.9	0.012	64.6	1.6	6.18	0.211	4.795	4.785	9.8	5.0	8.2	3.4	2.41	0.33	7.4	2.4	5.8
3	35.7	0.018	64.8	1.8	6.19	0.316	5.411	5.394	10.4	5.0	8.6	3.2	2.69	0.33	7.7	2.7	5.9
4	38.7	0.024	64.9	1.9	6.19	0.421	5.893	5.868	10.8	5.0	8.9	3.1	2.91	0.32	7.9	2.9	6.0
5	41.4	0.030	64.9	1.9	6.20	0.526	6.335	6.302	11.3	5.0	9.4	3.1	3.05	0.30	8.1	3.2	6.2
6	44.1	0.036	65.0	1.9	6.21	0.632	6.777	6.734	11.7	5.0	9.8	3.0	3.22	0.29	8.3	3.4	6.4
7	46.5	0.042	64.9	1.9	6.21	0.737	7.166	7.113	12.1	5.0	10.2	3.1	3.31	0.27	8.5	3.6	6.6
8	49.0	0.048	64.9	1.8	6.22	0.842	7.568	7.504	12.5	5.0	10.6	3.1	3.40	0.25	8.7	3.8	6.9
9	51.4	0.054	64.9	1.8	6.23	0.947	7.956	7.881	12.9	5.0	11.0	3.1	3.53	0.23	8.9	3.9	7.1
10	53.5	0.060	64.8	1.8	6.23	1.053	8.291	8.204	13.2	5.0	11.4	3.2	3.56	0.22	9.1	4.1	7.3
11	55.5	0.066	64.8	1.7	6.24	1.158	8.626	8.526	13.5	5.0	11.8	3.2	3.63	0.20	9.2	4.3	7.5
12	57.6	0.072	64.7	1.7	6.25	1.263	8.960	8.847	13.8	5.0	12.1	3.3	3.70	0.19	9.4	4.4	7.7
13	59.6	0.078	64.6	1.6	6.25	1.368	9.282	9.155	14.1	5.0	12.5	3.4	3.72	0.18	9.5	4.6	7.9
14	61.3	0.084	64.6	1.5	6.26	1.474	9.563	9.422	14.4	5.0	12.9	3.4	3.74	0.16	9.7	4.7	8.2
15	63.2	0.090	64.5	1.4	6.27	1.579	9.871	9.715	14.7	5.0	13.2	3.5	3.76	0.15	9.8	4.9	8.4
16	64.6	0.096	64.4	1.4	6.27	1.684	10.099	9.929	14.9	5.0	13.5	3.6	3.76	0.14	9.9	5.0	8.6
17	66.3	0.102	64.3	1.3	6.28	1.790	10.367	10.181	15.2	5.0	13.9	3.7	3.76	0.13	10.1	5.1	8.8
18	67.8	0.108	64.3	1.2	6.29	1.895	10.621	10.420	15.4	5.0	14.1	3.7	3.80	0.12	10.2	5.2	8.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	69.2	0.114	64.2	1.2	6.29	2.000	10.836	10.619	15.6	5.0	14.4	3.8	3.79	0.11	10.3	5.3	9.1
20	70.6	0.120	64.1	1.1	6.30	2.105	11.063	10.830	15.8	5.0	14.7	3.9	3.79	0.10	10.4	5.4	9.3
21	71.9	0.126	64.0	1.0	6.31	2.211	11.278	11.028	16.0	5.0	15.0	4.0	3.78	0.09	10.5	5.5	9.5
22	73.1	0.132	64.0	0.9	6.32	2.316	11.479	11.213	16.2	5.0	15.3	4.0	3.77	0.08	10.6	5.6	9.7
23	74.2	0.138	63.9	0.8	6.32	2.421	11.653	11.371	16.3	5.0	15.5	4.1	3.76	0.07	10.7	5.7	9.8
24	75.3	0.144	63.8	0.8	6.33	2.526	11.827	11.528	16.5	5.0	15.7	4.2	3.74	0.07	10.7	5.8	10.0
25	76.4	0.150	63.8	0.7	6.34	2.632	12.014	11.698	16.7	5.0	15.9	4.2	3.76	0.06	10.8	5.8	10.1
26	77.5	0.156	63.7	0.6	6.34	2.737	12.188	11.855	16.8	5.0	16.2	4.3	3.74	0.05	10.9	5.9	10.3
27	78.5	0.162	63.6	0.6	6.35	2.842	12.349	11.998	17.0	5.0	16.4	4.4	3.75	0.05	11.0	6.0	10.4
28	79.4	0.168	63.6	0.5	6.36	2.947	12.496	12.128	17.1	5.0	16.6	4.4	3.73	0.04	11.0	6.1	10.5
29	80.2	0.174	63.5	0.4	6.36	3.053	12.630	12.245	17.2	5.0	16.8	4.5	3.70	0.04	11.1	6.1	10.6
30	81.1	0.180	63.4	0.4	6.37	3.158	12.764	12.361	17.3	5.0	16.9	4.6	3.71	0.03	11.2	6.2	10.7
31	82.0	0.186	63.4	0.4	6.38	3.263	12.925	12.503	17.5	5.0	17.1	4.6	3.71	0.03	11.2	6.3	10.9
32	82.9	0.192	63.4	0.3	6.38	3.369	13.059	12.619	17.6	5.0	17.3	4.6	3.71	0.03	11.3	6.3	11.0
33	83.6	0.198	63.3	0.2	6.39	3.474	13.180	12.722	17.7	5.0	17.5	4.7	3.69	0.02	11.3	6.4	11.1
34	84.4	0.204	63.2	0.2	6.40	3.579	13.313	12.837	17.8	5.0	17.6	4.8	3.69	0.02	11.4	6.4	11.2
35	85.3	0.210	63.2	0.1	6.40	3.684	13.447	12.952	17.9	5.0	17.8	4.8	3.67	0.01	11.4	6.5	11.3
36	86.0	0.216	63.1	0.1	6.41	3.790	13.568	13.054	18.0	5.0	17.9	4.9	3.67	0.01	11.5	6.5	11.4
37	86.8	0.222	63.1	0.1	6.42	3.895	13.689	13.155	18.1	5.0	18.0	4.9	3.69	0.01	11.5	6.6	11.5
38	87.5	0.228	63.1	0.0	6.43	4.000	13.809	13.257	18.2	5.0	18.2	4.9	3.69	0.00	11.6	6.6	11.6
39	88.2	0.234	63.0	0.0	6.43	4.105	13.916	13.345	18.3	5.0	18.3	5.0	3.69	0.00	11.6	6.7	11.6
40	88.8	0.240	63.0	0.0	6.44	4.211	14.023	13.433	18.4	5.0	18.4	5.0	3.68	0.00	11.7	6.7	11.7
41	89.3	0.246	62.9	-0.1	6.45	4.316	14.104	13.495	18.5	5.0	18.5	5.1	3.67	-0.01	11.7	6.7	11.8
42	89.8	0.252	62.9	-0.1	6.45	4.421	14.184	13.557	18.5	5.0	18.6	5.1	3.66	-0.01	11.7	6.8	11.9
43	90.5	0.258	62.9	-0.2	6.46	4.526	14.291	13.644	18.6	5.0	18.8	5.1	3.66	-0.01	11.8	6.8	12.0
44	91.1	0.264	62.8	-0.2	6.47	4.632	14.398	13.731	18.7	5.0	18.9	5.2	3.66	-0.01	11.8	6.9	12.0
45	91.8	0.270	62.8	-0.2	6.48	4.737	14.506	13.818	18.8	5.0	19.0	5.2	3.67	-0.01	11.9	6.9	12.1
46	92.4	0.276	62.8	-0.2	6.48	4.842	14.599	13.892	18.9	5.0	19.1	5.2	3.69	-0.01	11.9	6.9	12.1
47	93.0	0.282	62.8	-0.2	6.49	4.947	14.693	13.966	18.9	5.0	19.2	5.2	3.68	-0.02	12.0	7.0	12.2
48	93.6	0.288	62.7	-0.3	6.50	5.053	14.800	14.052	19.0	5.0	19.3	5.3	3.66	-0.02	12.0	7.0	12.3
49	94.0	0.294	62.7	-0.4	6.50	5.158	14.867	14.100	19.1	5.0	19.4	5.3	3.64	-0.03	12.0	7.1	12.4
50	94.6	0.300	62.7	-0.4	6.51	5.263	14.961	14.173	19.1	5.0	19.5	5.3	3.66	-0.03	12.1	7.1	12.4
51	95.3	0.306	62.7	-0.4	6.52	5.369	15.068	14.259	19.2	5.0	19.6	5.3	3.67	-0.03	12.1	7.1	12.5
52	95.8	0.312	62.6	-0.4	6.53	5.474	15.148	14.319	19.3	5.0	19.7	5.4	3.67	-0.03	12.1	7.2	12.5
53	96.3	0.318	62.6	-0.4	6.53	5.579	15.229	14.379	19.3	5.0	19.8	5.4	3.66	-0.03	12.2	7.2	12.6
54	96.8	0.324	62.5	-0.5	6.54	5.684	15.323	14.452	19.4	5.0	19.9	5.5	3.65	-0.03	12.2	7.2	12.7
55	97.3	0.330	62.5	-0.5	6.55	5.790	15.403	14.511	19.5	5.0	20.0	5.5	3.64	-0.04	12.2	7.3	12.7
56	97.7	0.336	62.5	-0.6	6.56	5.895	15.470	14.558	19.5	5.0	20.1	5.5	3.63	-0.04	12.2	7.3	12.8
57	98.2	0.342	62.5	-0.6	6.56	6.000	15.550	14.617	19.6	5.0	20.1	5.5	3.64	-0.04	12.3	7.3	12.8
58	98.7	0.348	62.4	-0.6	6.57	6.105	15.631	14.676	19.6	5.0	20.2	5.6	3.63	-0.04	12.3	7.3	12.9
59	99.2	0.354	62.4	-0.6	6.58	6.211	15.711	14.735	19.7	5.0	20.3	5.6	3.63	-0.04	12.3	7.4	13.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	99.7	0.360	62.3	-0.7	6.58	6.316	15.791	14.794	19.8	5.0	20.4	5.7	3.62	-0.05	12.4	7.4	13.1
61	100.1	0.366	62.3	-0.7	6.59	6.421	15.858	14.840	19.8	5.0	20.5	5.7	3.61	-0.05	12.4	7.4	13.1
62	100.6	0.372	62.3	-0.8	6.60	6.526	15.939	14.898	19.9	5.0	20.6	5.7	3.60	-0.05	12.4	7.4	13.2
63	101.0	0.378	62.3	-0.8	6.61	6.632	15.992	14.932	19.9	5.0	20.7	5.7	3.60	-0.05	12.4	7.5	13.2
64	101.6	0.384	62.3	-0.8	6.61	6.737	16.099	15.015	20.0	5.0	20.7	5.7	3.62	-0.05	12.5	7.5	13.2
65	102.0	0.390	62.2	-0.8	6.62	6.842	16.166	15.060	20.0	5.0	20.8	5.8	3.61	-0.05	12.5	7.5	13.3
66	102.5	0.396	62.2	-0.8	6.63	6.948	16.247	15.118	20.1	5.0	20.9	5.8	3.62	-0.05	12.5	7.6	13.3
67	103.0	0.402	62.2	-0.8	6.64	7.053	16.327	15.176	20.1	5.0	20.9	5.8	3.63	-0.05	12.6	7.6	13.4
68	103.5	0.408	62.2	-0.8	6.64	7.158	16.407	15.233	20.2	5.0	21.0	5.8	3.62	-0.06	12.6	7.6	13.4
69	103.9	0.414	62.1	-0.9	6.65	7.263	16.461	15.265	20.2	5.0	21.1	5.9	3.61	-0.06	12.6	7.6	13.5
70	104.4	0.420	62.1	-0.9	6.66	7.369	16.541	15.323	20.3	5.0	21.2	5.9	3.62	-0.06	12.6	7.7	13.5
71	104.9	0.426	62.1	-0.9	6.67	7.474	16.622	15.379	20.3	5.0	21.2	5.9	3.63	-0.06	12.7	7.7	13.5
72	105.2	0.432	62.1	-0.9	6.67	7.579	16.675	15.411	20.4	5.0	21.3	5.9	3.63	-0.06	12.7	7.7	13.6
73	105.7	0.438	62.1	-0.9	6.68	7.684	16.756	15.468	20.4	5.0	21.4	5.9	3.62	-0.06	12.7	7.7	13.6
74	105.9	0.444	62.0	-1.0	6.69	7.790	16.796	15.488	20.5	5.0	21.5	6.0	3.59	-0.06	12.7	7.7	13.7
75	106.3	0.450	61.9	-1.1	6.70	7.895	16.863	15.532	20.5	5.0	21.6	6.1	3.57	-0.07	12.7	7.8	13.8
76	106.7	0.456	61.9	-1.1	6.71	8.000	16.916	15.563	20.5	5.0	21.7	6.1	3.55	-0.07	12.8	7.8	13.9
77	107.0	0.462	61.9	-1.2	6.71	8.105	16.970	15.595	20.6	5.0	21.7	6.1	3.54	-0.07	12.8	7.8	13.9
78	107.4	0.468	61.9	-1.2	6.72	8.211	17.037	15.638	20.6	5.0	21.8	6.1	3.55	-0.07	12.8	7.8	14.0
79	108.1	0.474	61.9	-1.2	6.73	8.316	17.144	15.718	20.7	5.0	21.9	6.1	3.56	-0.07	12.8	7.9	14.0
80	108.1	0.474	61.9	-1.2	6.73	8.316	17.144	15.718	20.7	5.0	21.9	6.1	3.56	-0.07	12.8	7.9	14.0



File Location
B-49 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-49
Sample Description: Red Brown & Gray Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 45.000
PL: 34.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.808	2.818	
Height (in)	5.742	5.700	
Weight (grams)	1012.40		1105.60
Moisture (%)	22.76		34.06
Dry Density (pcf)	88.35	88.35	
Saturation (%)	69.13	100.00	
Void Ratio	0.869	0.872	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 98.000
Effective Confining Stress (psi): 10.0
Corrected Peak Deviator Stress (psi): 15.645 at reading number: 190

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in2)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	12.0	0.000	88.0	0.0	6.24	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	35.0	0.006	89.8	1.8	6.24	0.105	3.693	3.689	13.7	10.0	11.9	8.2	1.45	0.49	11.8	1.8	10.0
2	43.4	0.012	90.6	2.6	6.25	0.211	5.038	5.027	15.0	10.0	12.4	7.4	1.68	0.52	12.5	2.5	9.9
3	49.2	0.018	91.1	3.1	6.26	0.316	5.961	5.942	15.9	10.0	12.9	6.9	1.86	0.51	13.0	3.0	9.9
4	53.6	0.024	91.4	3.4	6.26	0.421	6.673	6.645	16.6	10.0	13.2	6.6	2.01	0.51	13.3	3.3	9.9
5	57.8	0.030	91.9	3.9	6.27	0.527	7.333	7.294	17.3	10.0	13.4	6.1	2.19	0.53	13.6	3.6	9.8
6	61.5	0.036	92.1	4.1	6.28	0.632	7.926	7.876	17.9	10.0	13.7	5.9	2.34	0.52	13.9	3.9	9.8
7	64.4	0.042	92.3	4.3	6.28	0.737	8.401	8.339	18.3	10.0	14.0	5.7	2.46	0.51	14.1	4.2	9.9
8	67.1	0.048	92.4	4.4	6.29	0.843	8.836	8.762	18.7	10.0	14.4	5.6	2.56	0.50	14.4	4.4	10.0
9	69.7	0.055	92.4	4.4	6.30	0.948	9.245	9.157	19.1	10.0	14.7	5.6	2.64	0.48	14.6	4.6	10.2
10	72.0	0.061	92.4	4.4	6.30	1.053	9.614	9.513	19.5	10.0	15.1	5.6	2.71	0.46	14.7	4.8	10.3
11	74.0	0.067	92.4	4.4	6.31	1.159	9.931	9.816	19.8	10.0	15.4	5.6	2.76	0.45	14.9	4.9	10.5
12	75.8	0.073	92.7	4.6	6.32	1.264	10.221	10.092	20.1	10.0	15.4	5.3	2.89	0.46	15.0	5.0	10.4
13	77.4	0.079	92.7	4.7	6.33	1.369	10.485	10.341	20.3	10.0	15.6	5.3	2.95	0.45	15.2	5.2	10.5
14	79.0	0.085	92.7	4.7	6.33	1.475	10.735	10.577	20.6	10.0	15.8	5.3	3.01	0.45	15.3	5.3	10.5
15	80.4	0.091	92.7	4.7	6.34	1.580	10.959	10.786	20.8	10.0	16.0	5.3	3.05	0.44	15.4	5.4	10.6
16	81.5	0.097	92.7	4.7	6.35	1.685	11.144	10.956	20.9	10.0	16.3	5.3	3.07	0.43	15.5	5.5	10.8
17	82.6	0.103	92.5	4.5	6.35	1.791	11.316	11.113	21.1	10.0	16.6	5.5	3.04	0.41	15.5	5.6	11.0
18	83.6	0.109	92.8	4.8	6.36	1.896	11.474	11.256	21.2	10.0	16.5	5.2	3.16	0.42	15.6	5.6	10.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	84.6	0.115	92.8	4.8	6.37	2.001	11.632	11.399	21.4	10.0	16.6	5.2	3.19	0.42	15.7	5.7	10.9
20	85.6	0.121	92.8	4.8	6.37	2.107	11.790	11.542	21.5	10.0	16.8	5.2	3.21	0.41	15.8	5.8	11.0
21	86.4	0.127	92.8	4.8	6.38	2.212	11.922	11.658	21.6	10.0	16.9	5.2	3.24	0.41	15.8	5.8	11.0
22	87.1	0.133	92.7	4.7	6.39	2.317	12.041	11.762	21.7	10.0	17.0	5.3	3.24	0.40	15.9	5.9	11.1
23	87.8	0.139	92.7	4.6	6.39	2.423	12.146	11.852	21.8	10.0	17.2	5.3	3.22	0.39	15.9	5.9	11.3
24	88.4	0.145	92.6	4.6	6.40	2.528	12.239	11.929	21.9	10.0	17.3	5.4	3.20	0.38	15.9	6.0	11.4
25	88.9	0.151	92.7	4.7	6.41	2.633	12.331	12.006	22.0	10.0	17.3	5.3	3.27	0.39	16.0	6.0	11.3
26	89.7	0.157	92.8	4.8	6.41	2.739	12.450	12.109	22.1	10.0	17.3	5.2	3.32	0.39	16.0	6.1	11.3
27	90.3	0.163	92.8	4.8	6.42	2.844	12.542	12.185	22.2	10.0	17.4	5.2	3.34	0.39	16.1	6.1	11.3
28	90.7	0.169	92.8	4.8	6.43	2.949	12.621	12.249	22.2	10.0	17.5	5.2	3.35	0.39	16.1	6.1	11.3
29	91.2	0.175	92.7	4.7	6.43	3.055	12.700	12.312	22.3	10.0	17.6	5.3	3.34	0.38	16.1	6.2	11.4
30	91.7	0.181	92.7	4.6	6.44	3.160	12.766	12.363	22.3	10.0	17.7	5.3	3.32	0.38	16.2	6.2	11.5
31	92.0	0.187	92.6	4.6	6.45	3.265	12.819	12.400	22.4	10.0	17.8	5.4	3.29	0.37	16.2	6.2	11.6
32	92.5	0.193	92.5	4.5	6.46	3.371	12.898	12.463	22.4	10.0	18.0	5.5	3.27	0.36	16.2	6.2	11.7
33	93.0	0.199	92.8	4.8	6.46	3.476	12.977	12.526	22.5	10.0	17.7	5.2	3.40	0.38	16.2	6.3	11.5
34	93.3	0.205	92.8	4.8	6.47	3.582	13.030	12.563	22.5	10.0	17.8	5.2	3.41	0.38	16.3	6.3	11.5
35	93.6	0.211	92.8	4.8	6.48	3.687	13.083	12.600	22.6	10.0	17.8	5.2	3.42	0.38	16.3	6.3	11.5
36	94.0	0.217	92.7	4.7	6.48	3.792	13.149	12.650	22.6	10.0	17.9	5.3	3.41	0.37	16.3	6.3	11.6
37	94.4	0.223	92.6	4.6	6.49	3.898	13.201	12.687	22.7	10.0	18.1	5.4	3.34	0.36	16.3	6.3	11.8
38	94.7	0.229	92.7	4.7	6.50	4.003	13.254	12.724	22.7	10.0	18.0	5.3	3.42	0.37	16.3	6.4	11.6
39	94.9	0.235	92.7	4.7	6.51	4.108	13.294	12.748	22.7	10.0	18.0	5.3	3.43	0.37	16.4	6.4	11.6
40	95.3	0.241	92.7	4.7	6.51	4.214	13.347	12.784	22.8	10.0	18.0	5.3	3.43	0.37	16.4	6.4	11.6
41	95.7	0.247	92.7	4.7	6.52	4.319	13.413	12.833	22.8	10.0	18.1	5.3	3.44	0.37	16.4	6.4	11.7
42	95.9	0.253	92.7	4.7	6.53	4.424	13.452	12.857	22.8	10.0	18.2	5.3	3.43	0.36	16.4	6.4	11.7
43	96.1	0.259	92.7	4.6	6.53	4.530	13.478	12.868	22.8	10.0	18.2	5.3	3.41	0.36	16.4	6.4	11.8
44	96.3	0.265	92.6	4.6	6.54	4.635	13.518	12.891	22.9	10.0	18.3	5.4	3.38	0.35	16.4	6.4	11.9
45	96.6	0.271	92.5	4.5	6.55	4.740	13.558	12.915	22.9	10.0	18.4	5.5	3.35	0.35	16.4	6.5	12.0
46	96.8	0.277	92.7	4.7	6.56	4.846	13.597	12.938	22.9	10.0	18.2	5.3	3.44	0.36	16.4	6.5	11.8
47	97.2	0.283	92.7	4.7	6.56	4.951	13.650	12.974	23.0	10.0	18.3	5.3	3.45	0.36	16.5	6.5	11.8
48	97.6	0.289	92.7	4.7	6.57	5.056	13.716	13.022	23.0	10.0	18.3	5.3	3.46	0.36	16.5	6.5	11.8
49	97.8	0.295	92.7	4.7	6.58	5.162	13.755	13.045	23.0	10.0	18.3	5.3	3.46	0.36	16.5	6.5	11.8
50	97.8	0.301	92.7	4.6	6.59	5.267	13.755	13.031	23.0	10.0	18.4	5.3	3.44	0.36	16.5	6.5	11.9
51	98.1	0.307	92.6	4.6	6.59	5.372	13.795	13.054	23.0	10.0	18.5	5.4	3.41	0.35	16.5	6.5	11.9
52	98.5	0.313	92.5	4.5	6.60	5.478	13.861	13.102	23.1	10.0	18.6	5.5	3.40	0.35	16.5	6.6	12.0
53	98.7	0.319	92.6	4.6	6.61	5.583	13.900	13.124	23.1	10.0	18.5	5.4	3.44	0.35	16.5	6.6	11.9
54	99.1	0.325	92.7	4.7	6.61	5.688	13.953	13.160	23.1	10.0	18.5	5.3	3.49	0.36	16.6	6.6	11.9
55	99.3	0.331	92.7	4.7	6.62	5.794	13.993	13.182	23.2	10.0	18.5	5.3	3.49	0.36	16.6	6.6	11.9
56	99.6	0.337	92.7	4.7	6.63	5.899	14.046	13.217	23.2	10.0	18.5	5.3	3.50	0.35	16.6	6.6	11.9
57	99.9	0.343	92.6	4.6	6.64	6.004	14.085	13.239	23.2	10.0	18.6	5.4	3.46	0.35	16.6	6.6	12.0
58	100.1	0.349	92.5	4.4	6.64	6.110	14.125	13.262	23.2	10.0	18.8	5.5	3.39	0.33	16.6	6.6	12.2
59	100.4	0.355	92.7	4.7	6.65	6.215	14.164	13.284	23.3	10.0	18.6	5.3	3.51	0.35	16.6	6.6	11.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	100.8	0.361	92.7	4.6	6.66	6.320	14.230	13.331	23.3	10.0	18.7	5.3	3.50	0.35	16.6	6.7	12.0
61	101.0	0.367	92.7	4.6	6.67	6.426	14.257	13.340	23.3	10.0	18.7	5.3	3.50	0.35	16.7	6.7	12.0
62	101.3	0.373	92.7	4.6	6.67	6.531	14.309	13.375	23.4	10.0	18.7	5.3	3.51	0.35	16.7	6.7	12.0
63	101.5	0.379	92.6	4.6	6.68	6.636	14.349	13.397	23.4	10.0	18.8	5.4	3.49	0.34	16.7	6.7	12.1
64	101.6	0.385	92.5	4.5	6.69	6.742	14.362	13.394	23.4	10.0	18.9	5.5	3.45	0.34	16.7	6.7	12.2
65	102.0	0.391	92.5	4.4	6.70	6.847	14.428	13.440	23.4	10.0	19.0	5.5	3.43	0.33	16.7	6.7	12.3
66	102.3	0.397	92.6	4.6	6.70	6.952	14.481	13.474	23.5	10.0	18.9	5.4	3.49	0.34	16.7	6.7	12.2
67	102.7	0.403	92.6	4.6	6.71	7.058	14.534	13.508	23.5	10.0	18.9	5.4	3.51	0.34	16.7	6.8	12.1
68	103.1	0.409	92.6	4.6	6.72	7.163	14.599	13.554	23.5	10.0	18.9	5.4	3.52	0.34	16.8	6.8	12.2
69	103.4	0.415	92.6	4.6	6.73	7.268	14.652	13.587	23.6	10.0	19.0	5.4	3.53	0.34	16.8	6.8	12.2
70	103.5	0.421	92.6	4.6	6.74	7.374	14.665	13.584	23.6	10.0	19.0	5.4	3.51	0.34	16.8	6.8	12.2
71	103.9	0.427	92.5	4.5	6.74	7.479	14.731	13.630	23.6	10.0	19.1	5.5	3.48	0.33	16.8	6.8	12.3
72	104.3	0.433	92.4	4.4	6.75	7.584	14.797	13.675	23.7	10.0	19.3	5.6	3.45	0.32	16.8	6.8	12.4
73	104.5	0.439	92.3	4.3	6.76	7.690	14.824	13.684	23.7	10.0	19.3	5.7	3.42	0.32	16.8	6.8	12.5
74	104.7	0.445	92.6	4.6	6.77	7.795	14.850	13.692	23.7	10.0	19.1	5.4	3.53	0.33	16.8	6.8	12.3
75	104.8	0.451	92.6	4.6	6.77	7.900	14.876	13.701	23.7	10.0	19.1	5.4	3.53	0.33	16.8	6.9	12.3
76	105.1	0.457	92.6	4.6	6.78	8.006	14.916	13.722	23.7	10.0	19.1	5.4	3.53	0.33	16.8	6.9	12.3
77	105.0	0.463	92.5	4.5	6.79	8.111	14.903	13.694	23.7	10.0	19.2	5.5	3.49	0.33	16.8	6.8	12.3
78	105.1	0.469	92.3	4.3	6.80	8.216	14.929	13.703	23.7	10.0	19.4	5.7	3.42	0.32	16.8	6.9	12.5
79	105.3	0.475	92.5	4.5	6.80	8.322	14.956	13.711	23.7	10.0	19.2	5.5	3.51	0.33	16.8	6.9	12.3
80	105.6	0.481	92.5	4.5	6.81	8.427	14.995	13.731	23.7	10.0	19.2	5.5	3.52	0.33	16.8	6.9	12.3
81	105.6	0.487	92.5	4.5	6.82	8.532	14.995	13.716	23.7	10.0	19.2	5.5	3.51	0.33	16.8	6.9	12.3
82	106.0	0.493	92.5	4.5	6.83	8.638	15.061	13.760	23.7	10.0	19.2	5.5	3.52	0.33	16.9	6.9	12.3
83	106.3	0.499	92.5	4.5	6.84	8.743	15.114	13.792	23.8	10.0	19.3	5.5	3.51	0.32	16.9	6.9	12.4
84	106.5	0.505	92.4	4.4	6.84	8.848	15.153	13.813	23.8	10.0	19.4	5.6	3.48	0.32	16.9	6.9	12.5
85	106.5	0.511	92.3	4.3	6.85	8.954	15.153	13.797	23.8	10.0	19.5	5.7	3.44	0.31	16.9	6.9	12.6
86	106.7	0.517	92.3	4.2	6.86	9.059	15.180	13.805	23.8	10.0	19.5	5.7	3.40	0.31	16.9	6.9	12.6
87	107.0	0.523	92.5	4.5	6.87	9.164	15.232	13.837	23.8	10.0	19.3	5.5	3.52	0.32	16.9	6.9	12.4
88	107.3	0.529	92.5	4.4	6.88	9.270	15.272	13.856	23.8	10.0	19.4	5.5	3.50	0.32	16.9	6.9	12.5
89	107.7	0.535	92.5	4.5	6.88	9.375	15.338	13.900	23.9	10.0	19.4	5.5	3.53	0.32	16.9	7.0	12.4
90	107.9	0.541	92.5	4.4	6.89	9.480	15.364	13.908	23.9	10.0	19.4	5.5	3.51	0.32	16.9	7.0	12.5
91	108.2	0.547	92.4	4.4	6.90	9.586	15.417	13.939	23.9	10.0	19.5	5.6	3.50	0.32	17.0	7.0	12.5
92	108.5	0.553	92.3	4.3	6.91	9.691	15.470	13.971	24.0	10.0	19.6	5.7	3.47	0.31	17.0	7.0	12.6
93	108.8	0.559	92.3	4.2	6.92	9.796	15.523	14.002	24.0	10.0	19.7	5.7	3.44	0.30	17.0	7.0	12.7
94	109.2	0.565	92.5	4.4	6.92	9.902	15.575	14.033	24.0	10.0	19.6	5.5	3.53	0.32	17.0	7.0	12.6
95	109.6	0.571	92.5	4.4	6.93	10.007	15.641	14.076	24.1	10.0	19.6	5.5	3.54	0.32	17.0	7.0	12.6
96	109.8	0.577	92.5	4.4	6.94	10.113	15.681	14.095	24.1	10.0	19.6	5.5	3.54	0.32	17.0	7.0	12.6
97	110.1	0.583	92.4	4.4	6.95	10.218	15.720	14.114	24.1	10.0	19.7	5.6	3.53	0.31	17.0	7.1	12.6
98	110.5	0.589	92.3	4.2	6.96	10.323	15.786	14.157	24.1	10.0	19.9	5.7	3.47	0.30	17.1	7.1	12.8
99	110.7	0.595	92.3	4.3	6.96	10.429	15.813	14.164	24.1	10.0	19.9	5.7	3.48	0.30	17.1	7.1	12.8
100	111.2	0.601	92.4	4.4	6.97	10.534	15.892	14.218	24.2	10.0	19.8	5.6	3.55	0.31	17.1	7.1	12.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	111.5	0.607	92.4	4.4	6.98	10.639	15.945	14.248	24.2	10.0	19.8	5.6	3.55	0.31	17.1	7.1	12.7
102	111.8	0.613	92.4	4.4	6.99	10.745	15.997	14.279	24.3	10.0	19.9	5.6	3.56	0.31	17.1	7.1	12.7
103	112.2	0.619	92.4	4.4	7.00	10.850	16.063	14.321	24.3	10.0	19.9	5.6	3.57	0.31	17.1	7.2	12.7
104	112.4	0.625	92.3	4.3	7.01	10.955	16.090	14.327	24.3	10.0	20.0	5.7	3.53	0.30	17.1	7.2	12.8
105	112.9	0.631	92.3	4.2	7.01	11.061	16.169	14.381	24.4	10.0	20.1	5.7	3.50	0.29	17.2	7.2	12.9
106	112.9	0.637	92.1	4.1	7.02	11.166	16.169	14.363	24.3	10.0	20.2	5.9	3.45	0.29	17.2	7.2	13.0
107	113.1	0.643	92.4	4.4	7.03	11.271	16.208	14.382	24.4	10.0	20.0	5.6	3.56	0.30	17.2	7.2	12.8
108	113.6	0.649	92.4	4.4	7.04	11.377	16.288	14.435	24.4	10.0	20.1	5.6	3.57	0.30	17.2	7.2	12.8
109	113.6	0.655	92.4	4.4	7.05	11.482	16.288	14.417	24.4	10.0	20.0	5.6	3.57	0.30	17.2	7.2	12.8
110	113.8	0.661	92.4	4.4	7.06	11.587	16.314	14.424	24.4	10.0	20.0	5.6	3.57	0.30	17.2	7.2	12.8
111	113.6	0.667	92.3	4.3	7.06	11.693	16.288	14.383	24.4	10.0	20.1	5.7	3.52	0.30	17.2	7.2	12.9
112	113.9	0.673	92.2	4.2	7.07	11.798	16.340	14.412	24.4	10.0	20.2	5.8	3.49	0.29	17.2	7.2	13.0
113	114.1	0.679	92.1	4.1	7.08	11.903	16.367	14.419	24.4	10.0	20.3	5.9	3.46	0.29	17.2	7.2	13.1
114	113.9	0.685	92.3	4.3	7.09	12.009	16.340	14.378	24.4	10.0	20.1	5.7	3.52	0.30	17.2	7.2	12.9
115	114.7	0.691	92.3	4.3	7.10	12.114	16.459	14.465	24.4	10.0	20.1	5.7	3.56	0.30	17.2	7.2	12.9
116	113.5	0.697	92.3	4.3	7.11	12.219	16.274	14.286	24.3	10.0	20.0	5.7	3.51	0.30	17.1	7.1	12.8
117	115.1	0.703	92.3	4.3	7.12	12.325	16.525	14.488	24.5	10.0	20.2	5.7	3.54	0.30	17.2	7.2	12.9
118	115.5	0.709	92.1	4.1	7.12	12.430	16.591	14.529	24.5	10.0	20.4	5.9	3.48	0.28	17.2	7.3	13.1
119	115.6	0.715	92.1	4.0	7.13	12.535	16.604	14.523	24.5	10.0	20.5	5.9	3.44	0.28	17.2	7.3	13.2
120	116.3	0.721	92.3	4.3	7.14	12.641	16.723	14.609	24.6	10.0	20.3	5.7	3.56	0.29	17.3	7.3	13.0
121	116.7	0.727	92.3	4.2	7.15	12.746	16.789	14.649	24.6	10.0	20.4	5.7	3.55	0.29	17.3	7.3	13.1
122	117.0	0.733	92.3	4.2	7.16	12.851	16.828	14.666	24.6	10.0	20.4	5.7	3.55	0.29	17.3	7.3	13.1
123	117.1	0.739	92.3	4.2	7.17	12.957	16.841	14.659	24.6	10.0	20.4	5.7	3.55	0.29	17.3	7.3	13.1
124	117.5	0.745	92.2	4.2	7.18	13.062	16.907	14.699	24.7	10.0	20.5	5.8	3.54	0.29	17.3	7.3	13.1
125	117.5	0.751	92.1	4.1	7.18	13.167	16.907	14.681	24.7	10.0	20.5	5.9	3.50	0.28	17.3	7.3	13.2
126	117.9	0.757	92.1	4.0	7.19	13.273	16.973	14.721	24.7	10.0	20.7	5.9	3.48	0.27	17.3	7.4	13.3
127	118.1	0.763	92.1	4.1	7.20	13.378	17.013	14.737	24.7	10.0	20.6	5.9	3.50	0.28	17.3	7.4	13.3
128	118.6	0.769	92.2	4.2	7.21	13.483	17.079	14.776	24.8	10.0	20.6	5.8	3.55	0.28	17.4	7.4	13.2
129	119.0	0.775	92.2	4.2	7.22	13.589	17.145	14.815	24.8	10.0	20.6	5.8	3.56	0.28	17.4	7.4	13.2
130	119.1	0.781	92.2	4.2	7.23	13.694	17.171	14.820	24.8	10.0	20.6	5.8	3.56	0.28	17.4	7.4	13.2
131	119.2	0.787	92.2	4.2	7.24	13.799	17.184	14.813	24.8	10.0	20.6	5.8	3.54	0.28	17.4	7.4	13.2
132	119.5	0.793	92.1	4.1	7.25	13.905	17.237	14.840	24.8	10.0	20.7	5.9	3.51	0.27	17.4	7.4	13.3
133	119.8	0.799	92.0	4.0	7.25	14.010	17.277	14.856	24.8	10.0	20.8	6.0	3.48	0.27	17.4	7.4	13.4
134	120.0	0.805	91.9	3.9	7.26	14.115	17.316	14.872	24.9	10.0	20.9	6.1	3.45	0.26	17.4	7.4	13.5
135	120.3	0.811	92.2	4.2	7.27	14.221	17.356	14.888	24.9	10.0	20.7	5.8	3.56	0.28	17.4	7.4	13.3
136	120.6	0.817	92.2	4.2	7.28	14.326	17.409	14.915	24.9	10.0	20.7	5.8	3.56	0.28	17.4	7.5	13.3
137	120.9	0.823	92.2	4.2	7.29	14.431	17.461	14.941	24.9	10.0	20.8	5.8	3.57	0.28	17.5	7.5	13.3
138	121.2	0.829	92.0	4.0	7.30	14.537	17.501	14.957	24.9	10.0	20.9	6.0	3.50	0.27	17.5	7.5	13.5
139	121.1	0.835	91.9	3.9	7.31	14.642	17.488	14.927	24.9	10.0	21.0	6.1	3.46	0.26	17.4	7.5	13.5
140	121.4	0.841	92.1	4.1	7.32	14.747	17.540	14.954	24.9	10.0	20.8	5.9	3.55	0.28	17.5	7.5	13.3
141	121.7	0.847	92.1	4.1	7.33	14.853	17.580	14.969	24.9	10.0	20.8	5.9	3.55	0.27	17.5	7.5	13.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	121.8	0.853	92.1	4.1	7.34	14.958	17.606	14.973	25.0	10.0	20.8	5.9	3.55	0.27	17.5	7.5	13.4
143	122.2	0.859	92.1	4.1	7.34	15.063	17.659	14.999	25.0	10.0	20.9	5.9	3.56	0.27	17.5	7.5	13.4
144	122.2	0.865	92.1	4.1	7.35	15.169	17.659	14.980	25.0	10.0	20.9	5.9	3.54	0.27	17.5	7.5	13.4
145	122.3	0.871	92.0	4.0	7.36	15.274	17.686	14.984	25.0	10.0	21.0	6.0	3.50	0.27	17.5	7.5	13.5
146	122.6	0.877	91.9	3.9	7.37	15.379	17.725	14.999	25.0	10.0	21.1	6.1	3.47	0.26	17.5	7.5	13.6
147	123.0	0.883	91.8	3.8	7.38	15.485	17.791	15.036	25.0	10.0	21.2	6.2	3.43	0.25	17.5	7.5	13.7
148	123.2	0.889	92.1	4.1	7.39	15.590	17.817	15.040	25.0	10.0	20.9	5.9	3.55	0.27	17.5	7.5	13.4
149	123.4	0.895	92.1	4.0	7.40	15.695	17.857	15.054	25.0	10.0	21.0	5.9	3.53	0.27	17.5	7.5	13.5
150	123.7	0.901	92.1	4.0	7.41	15.801	17.910	15.080	25.1	10.0	21.0	5.9	3.54	0.27	17.5	7.5	13.5
151	124.2	0.907	92.1	4.0	7.42	15.906	17.976	15.116	25.1	10.0	21.1	5.9	3.54	0.27	17.5	7.6	13.5
152	124.5	0.913	92.0	4.0	7.43	16.011	18.028	15.142	25.1	10.0	21.2	6.0	3.51	0.26	17.6	7.6	13.6
153	124.8	0.919	91.9	3.9	7.44	16.117	18.081	15.167	25.1	10.0	21.3	6.1	3.48	0.26	17.6	7.6	13.7
154	125.0	0.925	91.8	3.8	7.45	16.222	18.108	15.170	25.2	10.0	21.4	6.2	3.45	0.25	17.6	7.6	13.8
155	125.1	0.931	92.0	4.0	7.46	16.327	18.134	15.173	25.2	10.0	21.2	6.0	3.53	0.26	17.6	7.6	13.6
156	125.6	0.937	92.0	4.0	7.47	16.433	18.213	15.220	25.2	10.0	21.2	6.0	3.54	0.26	17.6	7.6	13.6
157	125.9	0.943	92.0	4.0	7.47	16.538	18.253	15.234	25.2	10.0	21.2	6.0	3.54	0.26	17.6	7.6	13.6
158	126.1	0.949	91.9	3.9	7.48	16.644	18.292	15.248	25.2	10.0	21.4	6.1	3.50	0.25	17.6	7.6	13.7
159	126.4	0.955	91.8	3.8	7.49	16.749	18.332	15.261	25.2	10.0	21.5	6.2	3.47	0.25	17.6	7.6	13.8
160	126.7	0.961	91.9	3.8	7.50	16.854	18.385	15.286	25.3	10.0	21.4	6.1	3.49	0.25	17.6	7.6	13.8
161	127.0	0.967	92.0	4.0	7.51	16.960	18.437	15.310	25.3	10.0	21.3	6.0	3.54	0.26	17.6	7.7	13.7
162	127.2	0.973	92.0	4.0	7.52	17.065	18.464	15.313	25.3	10.0	21.3	6.0	3.54	0.26	17.6	7.7	13.7
163	127.5	0.979	92.0	4.0	7.53	17.170	18.516	15.337	25.3	10.0	21.4	6.0	3.54	0.26	17.6	7.7	13.7
164	127.7	0.985	92.0	4.0	7.54	17.276	18.543	15.339	25.3	10.0	21.4	6.0	3.54	0.26	17.7	7.7	13.7
165	127.9	0.991	91.9	3.9	7.55	17.381	18.582	15.353	25.3	10.0	21.5	6.1	3.51	0.25	17.7	7.7	13.8
166	128.3	0.997	91.8	3.8	7.56	17.486	18.648	15.387	25.4	10.0	21.6	6.2	3.49	0.25	17.7	7.7	13.9
167	128.6	1.003	91.7	3.7	7.57	17.592	18.688	15.400	25.4	10.0	21.7	6.3	3.46	0.24	17.7	7.7	14.0
168	128.8	1.009	91.9	3.9	7.58	17.697	18.714	15.402	25.4	10.0	21.5	6.1	3.54	0.25	17.7	7.7	13.8
169	129.1	1.015	91.9	3.9	7.59	17.802	18.767	15.426	25.4	10.0	21.5	6.1	3.54	0.25	17.7	7.7	13.8
170	129.5	1.021	91.9	3.9	7.60	17.908	18.833	15.460	25.4	10.0	21.5	6.1	3.55	0.25	17.7	7.7	13.8
171	129.7	1.027	91.9	3.9	7.61	18.013	18.872	15.473	25.5	10.0	21.5	6.1	3.55	0.25	17.7	7.7	13.8
172	129.8	1.033	91.9	3.8	7.62	18.118	18.886	15.464	25.4	10.0	21.6	6.1	3.51	0.25	17.7	7.7	13.9
173	129.9	1.039	91.8	3.7	7.63	18.224	18.899	15.455	25.4	10.0	21.7	6.2	3.48	0.24	17.7	7.7	14.0
174	130.1	1.045	91.7	3.7	7.64	18.329	18.925	15.456	25.4	10.0	21.8	6.3	3.45	0.24	17.7	7.7	14.0
175	130.2	1.051	91.9	3.9	7.65	18.434	18.938	15.447	25.4	10.0	21.6	6.1	3.53	0.25	17.7	7.7	13.8
176	130.3	1.057	91.9	3.9	7.66	18.540	18.965	15.449	25.4	10.0	21.6	6.1	3.53	0.25	17.7	7.7	13.8
177	130.6	1.063	91.9	3.9	7.67	18.645	19.004	15.461	25.4	10.0	21.6	6.1	3.53	0.25	17.7	7.7	13.8
178	130.8	1.069	91.8	3.7	7.68	18.750	19.044	15.473	25.5	10.0	21.7	6.2	3.48	0.24	17.7	7.7	14.0
179	130.8	1.075	91.7	3.7	7.69	18.856	19.044	15.453	25.4	10.0	21.8	6.3	3.45	0.24	17.7	7.7	14.0
180	131.0	1.081	91.8	3.8	7.70	18.961	19.070	15.454	25.4	10.0	21.6	6.2	3.50	0.25	17.7	7.7	13.9
181	131.4	1.087	91.9	3.8	7.71	19.066	19.136	15.488	25.5	10.0	21.6	6.1	3.52	0.25	17.7	7.7	13.9
182	131.7	1.093	91.9	3.8	7.72	19.172	19.189	15.510	25.5	10.0	21.7	6.1	3.52	0.25	17.7	7.8	13.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	131.8	1.099	91.9	3.8	7.73	19.277	19.202	15.501	25.5	10.0	21.7	6.1	3.52	0.25	17.7	7.8	13.9
184	132.2	1.105	91.9	3.8	7.74	19.382	19.268	15.534	25.5	10.0	21.7	6.1	3.53	0.25	17.7	7.8	13.9
185	132.4	1.111	91.8	3.7	7.75	19.488	19.294	15.534	25.5	10.0	21.8	6.2	3.49	0.24	17.7	7.8	14.0
186	132.8	1.117	91.7	3.7	7.76	19.593	19.360	15.567	25.5	10.0	21.9	6.3	3.47	0.24	17.8	7.8	14.1
187	133.0	1.123	91.6	3.6	7.77	19.698	19.387	15.568	25.5	10.0	22.0	6.4	3.43	0.23	17.8	7.8	14.2
188	133.3	1.129	91.8	3.8	7.78	19.804	19.440	15.590	25.6	10.0	21.8	6.2	3.52	0.24	17.8	7.8	14.0
189	133.6	1.135	91.8	3.8	7.79	19.909	19.492	15.612	25.6	10.0	21.8	6.2	3.52	0.24	17.8	7.8	14.0
190	134.0	1.141	91.8	3.8	7.80	20.006	19.558	15.645	25.6	10.0	21.8	6.2	3.53	0.24	17.8	7.8	14.0



File Location
B-49 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-49
Sample Description: Red Brown & Gray Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 45.000
PL: 34.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.807	2.831	
Height (in)	5.684	5.590	
Weight (grams)	1009.10		1088.00
Moisture (%)	22.14		31.69
Dry Density (pcf)	89.46	89.46	
Saturation (%)	69.08	100.00	
Void Ratio	0.845	0.849	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 74.400
Effective Confining Stress (psi): 20.0
Corrected Peak Deviator Stress (psi): 20.298 at reading number: 182

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	-5.8	0.000	54.4	0.0	6.29	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	25.6	0.007	57.0	2.6	6.30	0.109	4.991	4.986	25.0	20.0	22.4	17.4	1.29	0.52	22.5	2.5	19.9
2	39.7	0.013	58.4	4.1	6.31	0.218	7.238	7.222	27.3	20.0	23.2	16.0	1.45	0.56	23.6	3.6	19.6
3	49.2	0.019	59.5	5.1	6.31	0.328	8.741	8.712	28.7	20.0	23.6	14.9	1.58	0.59	24.4	4.4	19.3
4	56.8	0.025	60.2	5.9	6.32	0.437	9.956	9.912	29.9	20.0	24.1	14.2	1.70	0.59	25.0	5.0	19.1
5	62.9	0.031	60.8	6.4	6.33	0.546	10.923	10.863	30.9	20.0	24.5	13.6	1.80	0.59	25.5	5.4	19.1
6	68.3	0.037	61.3	7.0	6.34	0.655	11.785	11.708	31.7	20.0	24.8	13.1	1.90	0.59	25.9	5.9	18.9
7	72.9	0.043	62.0	7.6	6.34	0.764	12.517	12.421	32.5	20.0	24.8	12.4	2.00	0.61	26.2	6.2	18.6
8	77.0	0.049	62.3	7.9	6.35	0.874	13.157	13.042	33.1	20.0	25.1	12.1	2.08	0.61	26.6	6.5	18.6
9	80.5	0.055	62.6	8.2	6.36	0.983	13.719	13.584	33.6	20.0	25.4	11.8	2.15	0.60	26.8	6.8	18.6
10	83.3	0.062	62.8	8.5	6.36	1.092	14.163	14.008	34.0	20.0	25.6	11.6	2.21	0.60	27.0	7.0	18.6
11	85.8	0.068	63.0	8.7	6.37	1.201	14.555	14.380	34.4	20.0	25.8	11.4	2.26	0.60	27.2	7.2	18.6
12	88.1	0.074	63.2	8.8	6.38	1.310	14.921	14.725	34.8	20.0	25.9	11.2	2.31	0.60	27.4	7.4	18.6
13	89.2	0.080	63.4	9.0	6.38	1.420	15.104	14.889	34.9	20.0	25.9	11.0	2.35	0.61	27.5	7.4	18.5
14	91.9	0.086	63.8	9.5	6.39	1.529	15.522	15.284	35.3	20.0	25.9	10.6	2.45	0.62	27.7	7.6	18.2
15	93.1	0.092	63.9	9.5	6.40	1.638	15.718	15.460	35.5	20.0	26.0	10.5	2.47	0.62	27.8	7.7	18.2
16	94.3	0.098	64.0	9.6	6.41	1.747	15.914	15.636	35.7	20.0	26.1	10.4	2.50	0.62	27.9	7.8	18.2
17	95.6	0.104	64.1	9.7	6.41	1.856	16.110	15.810	35.8	20.0	26.1	10.3	2.53	0.61	27.9	7.9	18.2
18	96.5	0.110	64.1	9.7	6.42	1.966	16.253	15.934	36.0	20.0	26.2	10.3	2.55	0.61	28.0	8.0	18.3



Florence & Hutcheson

CONSULTING ENGINEERS

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	97.2	0.116	64.1	9.8	6.43	2.075	16.371	16.031	36.1	20.0	26.3	10.3	2.56	0.61	28.0	8.0	18.3
20	98.0	0.123	64.3	9.9	6.43	2.184	16.502	16.141	36.2	20.0	26.3	10.1	2.59	0.61	28.1	8.1	18.2
21	99.0	0.129	64.6	10.2	6.44	2.293	16.658	16.276	36.3	20.0	26.1	9.8	2.66	0.63	28.2	8.1	18.0
22	99.7	0.135	64.6	10.2	6.45	2.402	16.763	16.360	36.4	20.0	26.2	9.8	2.67	0.62	28.2	8.2	18.0
23	100.1	0.141	64.6	10.3	6.46	2.512	16.828	16.405	36.4	20.0	26.2	9.8	2.68	0.63	28.2	8.2	18.0
24	100.6	0.147	64.6	10.2	6.46	2.621	16.907	16.463	36.5	20.0	26.3	9.8	2.68	0.62	28.3	8.2	18.0
25	101.0	0.153	64.5	10.2	6.47	2.730	16.972	16.509	36.5	20.0	26.4	9.9	2.68	0.62	28.3	8.3	18.1
26	101.8	0.159	64.9	10.5	6.48	2.839	17.103	16.617	36.7	20.0	26.1	9.5	2.74	0.63	28.3	8.3	17.8
27	102.9	0.171	64.9	10.5	6.49	3.058	17.272	16.744	36.8	20.0	26.2	9.5	2.76	0.63	28.4	8.4	17.9
28	103.2	0.178	64.9	10.5	6.50	3.167	17.325	16.776	36.8	20.0	26.3	9.5	2.77	0.63	28.4	8.4	17.9
29	103.5	0.184	64.9	10.5	6.51	3.276	17.377	16.808	36.8	20.0	26.3	9.5	2.76	0.62	28.4	8.4	17.9
30	104.1	0.190	64.9	10.5	6.51	3.385	17.468	16.877	36.9	20.0	26.4	9.5	2.77	0.62	28.5	8.4	18.0
31	104.3	0.196	64.8	10.5	6.52	3.494	17.494	16.883	36.9	20.0	26.5	9.6	2.76	0.62	28.5	8.4	18.0
32	105.0	0.202	65.2	10.8	6.53	3.604	17.612	16.977	37.0	20.0	26.2	9.2	2.84	0.64	28.5	8.5	17.7
33	105.5	0.208	65.2	10.8	6.54	3.713	17.690	17.034	37.1	20.0	26.2	9.2	2.85	0.64	28.6	8.5	17.7
34	105.7	0.214	65.2	10.8	6.54	3.822	17.730	17.052	37.1	20.0	26.3	9.2	2.84	0.63	28.6	8.5	17.8
35	106.1	0.220	65.2	10.8	6.55	3.931	17.782	17.083	37.1	20.0	26.3	9.2	2.85	0.63	28.6	8.5	17.8
36	106.2	0.226	65.1	10.7	6.56	4.040	17.808	17.089	37.1	20.0	26.4	9.3	2.84	0.63	28.6	8.5	17.8
37	106.6	0.232	65.1	10.7	6.57	4.150	17.860	17.119	37.2	20.0	26.4	9.3	2.83	0.63	28.6	8.6	17.9
38	107.0	0.239	65.0	10.7	6.57	4.259	17.926	17.162	37.2	20.0	26.5	9.4	2.83	0.62	28.6	8.6	18.0
39	107.6	0.245	65.4	11.0	6.58	4.368	18.030	17.243	37.3	20.0	26.3	9.0	2.91	0.64	28.7	8.6	17.6
40	107.9	0.251	65.4	11.0	6.59	4.477	18.069	17.260	37.3	20.0	26.3	9.0	2.91	0.64	28.7	8.6	17.7
41	108.1	0.257	65.3	10.9	6.60	4.586	18.095	17.266	37.3	20.0	26.4	9.1	2.90	0.63	28.7	8.6	17.7
42	108.5	0.263	65.3	10.9	6.60	4.696	18.161	17.308	37.3	20.0	26.4	9.1	2.90	0.63	28.7	8.7	17.8
43	108.7	0.269	65.2	10.8	6.61	4.805	18.200	17.326	37.4	20.0	26.5	9.2	2.88	0.62	28.7	8.7	17.9
44	109.0	0.275	65.3	10.9	6.62	4.914	18.252	17.355	37.4	20.0	26.5	9.1	2.90	0.63	28.7	8.7	17.8
45	109.6	0.281	65.5	11.1	6.63	5.023	18.344	17.422	37.5	20.0	26.3	8.9	2.95	0.64	28.7	8.7	17.6
46	110.0	0.287	65.4	11.1	6.63	5.132	18.409	17.464	37.5	20.0	26.4	9.0	2.95	0.63	28.8	8.7	17.7
47	110.4	0.293	65.4	11.0	6.64	5.242	18.474	17.506	37.5	20.0	26.6	9.0	2.93	0.63	28.8	8.8	17.8
48	110.8	0.300	65.3	10.9	6.65	5.351	18.527	17.535	37.6	20.0	26.6	9.1	2.93	0.62	28.8	8.8	17.9
49	111.1	0.306	65.3	10.9	6.66	5.460	18.579	17.564	37.6	20.0	26.7	9.1	2.92	0.62	28.8	8.8	17.9
50	111.3	0.312	65.2	10.8	6.66	5.569	18.605	17.569	37.6	20.0	26.8	9.2	2.91	0.62	28.8	8.8	18.0
51	111.8	0.318	65.3	10.9	6.67	5.679	18.683	17.622	37.7	20.0	26.7	9.1	2.94	0.62	28.8	8.8	17.9
52	112.8	0.330	65.5	11.1	6.69	5.897	18.853	17.742	37.8	20.0	26.7	8.9	2.99	0.63	28.9	8.9	17.8
53	113.1	0.336	65.4	11.0	6.70	6.006	18.892	17.758	37.8	20.0	26.8	9.0	2.97	0.62	28.9	8.9	17.9
54	113.0	0.342	65.4	11.0	6.70	6.115	18.879	17.725	37.8	20.0	26.8	9.0	2.96	0.62	28.9	8.9	17.9
55	113.4	0.348	65.3	10.9	6.71	6.225	18.945	17.766	37.8	20.0	26.9	9.1	2.95	0.62	28.9	8.9	18.0
56	113.6	0.355	65.2	10.9	6.72	6.334	18.984	17.782	37.8	20.0	27.0	9.2	2.94	0.61	28.9	8.9	18.1
57	113.9	0.361	65.4	11.0	6.73	6.443	19.023	17.797	37.8	20.0	26.8	9.0	2.97	0.62	28.9	8.9	17.9
58	114.6	0.367	65.6	11.2	6.74	6.552	19.141	17.887	37.9	20.0	26.7	8.8	3.02	0.63	29.0	8.9	17.8
59	114.8	0.373	65.5	11.1	6.74	6.661	19.167	17.890	37.9	20.0	26.8	8.9	3.01	0.62	29.0	8.9	17.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	115.0	0.379	65.4	11.1	6.75	6.771	19.206	17.906	37.9	20.0	26.9	9.0	3.00	0.62	29.0	9.0	17.9
61	115.4	0.385	65.4	11.0	6.76	6.880	19.258	17.933	38.0	20.0	26.9	9.0	2.99	0.61	29.0	9.0	18.0
62	115.5	0.391	65.3	10.9	6.77	6.989	19.284	17.937	38.0	20.0	27.1	9.1	2.96	0.61	29.0	9.0	18.1
63	116.2	0.397	65.5	11.1	6.77	7.098	19.389	18.013	38.0	20.0	26.9	8.9	3.03	0.62	29.0	9.0	17.9
64	116.6	0.403	65.6	11.2	6.78	7.207	19.454	18.052	38.1	20.0	26.9	8.8	3.04	0.62	29.1	9.0	17.9
65	116.8	0.409	65.5	11.1	6.79	7.317	19.493	18.067	38.1	20.0	27.0	8.9	3.02	0.61	29.1	9.0	18.0
66	117.1	0.416	65.4	11.1	6.80	7.426	19.533	18.082	38.1	20.0	27.0	9.0	3.02	0.61	29.1	9.0	18.0
67	117.3	0.422	65.4	11.0	6.81	7.535	19.572	18.097	38.1	20.0	27.1	9.0	3.01	0.61	29.1	9.0	18.1
68	117.5	0.428	65.3	10.9	6.81	7.644	19.598	18.100	38.1	20.0	27.2	9.1	2.99	0.60	29.1	9.0	18.1
69	117.8	0.434	65.3	10.9	6.82	7.753	19.650	18.127	38.2	20.0	27.3	9.1	2.99	0.60	29.1	9.1	18.2
70	118.2	0.440	65.5	11.1	6.83	7.863	19.716	18.165	38.2	20.0	27.1	8.9	3.04	0.61	29.1	9.1	18.0
71	118.7	0.446	65.6	11.2	6.84	7.972	19.781	18.204	38.2	20.0	27.1	8.8	3.06	0.61	29.1	9.1	17.9
72	118.8	0.452	65.5	11.1	6.85	8.081	19.807	18.206	38.2	20.0	27.1	8.9	3.04	0.61	29.1	9.1	18.0
73	119.2	0.458	65.4	11.1	6.86	8.190	19.859	18.233	38.3	20.0	27.2	9.0	3.03	0.61	29.2	9.1	18.1
74	119.3	0.464	65.4	11.0	6.86	8.299	19.885	18.235	38.3	20.0	27.2	9.0	3.02	0.60	29.2	9.1	18.1
75	119.5	0.471	65.4	11.0	6.87	8.409	19.912	18.237	38.3	20.0	27.3	9.0	3.02	0.60	29.2	9.1	18.2
76	119.9	0.477	65.3	10.9	6.88	8.518	19.977	18.275	38.3	20.0	27.4	9.1	3.00	0.60	29.2	9.1	18.3
77	120.4	0.483	65.7	11.3	6.89	8.627	20.055	18.325	38.4	20.0	27.1	8.7	3.10	0.62	29.2	9.2	17.9
78	120.7	0.489	65.6	11.2	6.90	8.736	20.108	18.351	38.4	20.0	27.2	8.8	3.08	0.61	29.2	9.2	18.0
79	121.1	0.495	65.5	11.1	6.90	8.845	20.173	18.389	38.4	20.0	27.3	8.9	3.07	0.61	29.2	9.2	18.1
80	121.5	0.501	65.5	11.1	6.91	8.955	20.225	18.414	38.4	20.0	27.3	8.9	3.06	0.60	29.2	9.2	18.1
81	121.8	0.507	65.4	11.0	6.92	9.064	20.277	18.440	38.5	20.0	27.4	9.0	3.05	0.60	29.3	9.2	18.2
82	121.9	0.513	65.4	11.0	6.93	9.173	20.304	18.441	38.5	20.0	27.4	9.0	3.05	0.60	29.3	9.2	18.2
83	122.6	0.519	65.7	11.3	6.94	9.282	20.408	18.514	38.5	20.0	27.2	8.7	3.12	0.61	29.3	9.3	18.0
84	122.9	0.525	65.6	11.2	6.95	9.391	20.460	18.539	38.6	20.0	27.3	8.8	3.11	0.61	29.3	9.3	18.1
85	123.1	0.532	65.5	11.1	6.95	9.501	20.486	18.540	38.6	20.0	27.4	8.9	3.09	0.60	29.3	9.3	18.2
86	123.4	0.538	65.5	11.1	6.96	9.610	20.539	18.565	38.6	20.0	27.5	8.9	3.08	0.60	29.3	9.3	18.2
87	123.6	0.544	65.4	11.0	6.97	9.719	20.565	18.566	38.6	20.0	27.6	9.0	3.06	0.59	29.3	9.3	18.3
88	123.8	0.550	65.3	10.9	6.98	9.828	20.604	18.579	38.6	20.0	27.7	9.1	3.04	0.59	29.3	9.3	18.4
89	124.1	0.556	65.4	11.0	6.99	9.937	20.643	18.592	38.6	20.0	27.6	9.0	3.05	0.59	29.3	9.3	18.3
90	124.7	0.562	65.6	11.3	7.00	10.047	20.735	18.652	38.7	20.0	27.4	8.8	3.13	0.60	29.4	9.3	18.1
91	125.0	0.568	65.6	11.2	7.01	10.156	20.787	18.676	38.7	20.0	27.5	8.8	3.11	0.60	29.4	9.3	18.2
92	125.1	0.574	65.5	11.1	7.01	10.265	20.800	18.665	38.7	20.0	27.6	8.9	3.09	0.60	29.4	9.3	18.3
93	125.3	0.580	65.4	11.1	7.02	10.374	20.839	18.677	38.7	20.0	27.6	9.0	3.08	0.59	29.4	9.3	18.3
94	125.8	0.587	65.4	11.0	7.03	10.483	20.918	18.725	38.8	20.0	27.8	9.0	3.07	0.59	29.4	9.4	18.4
95	126.1	0.593	65.3	10.9	7.04	10.593	20.957	18.737	38.8	20.0	27.8	9.1	3.06	0.58	29.4	9.4	18.5
96	126.2	0.599	65.4	11.0	7.05	10.702	20.983	18.737	38.8	20.0	27.8	9.0	3.07	0.59	29.4	9.4	18.4
97	127.0	0.605	65.6	11.2	7.06	10.811	21.114	18.831	38.9	20.0	27.6	8.8	3.14	0.60	29.4	9.4	18.2
98	127.2	0.611	65.5	11.1	7.07	10.920	21.140	18.831	38.9	20.0	27.7	8.9	3.12	0.59	29.4	9.4	18.3
99	127.5	0.617	65.5	11.1	7.07	11.029	21.192	18.855	38.9	20.0	27.8	8.9	3.11	0.59	29.5	9.4	18.4
100	127.5	0.623	65.4	11.0	7.08	11.139	21.192	18.831	38.9	20.0	27.8	9.0	3.09	0.59	29.4	9.4	18.4



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	127.7	0.629	65.3	10.9	7.09	11.248	21.218	18.832	38.9	20.0	28.0	9.1	3.06	0.58	29.4	9.4	18.5
102	128.2	0.635	65.4	11.0	7.10	11.357	21.297	18.878	38.9	20.0	27.9	9.0	3.10	0.58	29.5	9.4	18.4
103	128.8	0.641	65.6	11.2	7.11	11.466	21.388	18.936	39.0	20.0	27.8	8.8	3.14	0.59	29.5	9.5	18.3
104	129.0	0.648	65.5	11.1	7.12	11.575	21.427	18.947	39.0	20.0	27.9	8.9	3.12	0.59	29.5	9.5	18.4
105	129.3	0.654	65.4	11.1	7.13	11.685	21.466	18.958	39.0	20.0	27.9	9.0	3.11	0.58	29.5	9.5	18.4
106	129.6	0.660	65.4	11.0	7.14	11.794	21.519	18.981	39.0	20.0	28.0	9.0	3.10	0.58	29.5	9.5	18.5
107	129.5	0.666	65.3	10.9	7.14	11.903	21.506	18.946	39.0	20.0	28.0	9.1	3.08	0.58	29.5	9.5	18.6
108	129.8	0.672	65.2	10.9	7.15	12.012	21.558	18.968	39.0	20.0	28.1	9.2	3.07	0.57	29.5	9.5	18.7
109	130.5	0.678	65.5	11.1	7.16	12.121	21.662	19.037	39.1	20.0	28.0	8.9	3.13	0.58	29.6	9.5	18.4
110	130.9	0.684	65.5	11.1	7.17	12.231	21.728	19.070	39.1	20.0	28.0	8.9	3.15	0.58	29.6	9.5	18.4
111	131.1	0.690	65.4	11.1	7.18	12.340	21.754	19.069	39.1	20.0	28.0	9.0	3.13	0.58	29.6	9.5	18.5
112	131.6	0.696	65.4	11.0	7.19	12.449	21.832	19.114	39.1	20.0	28.1	9.0	3.12	0.58	29.6	9.6	18.6
113	131.7	0.703	65.3	10.9	7.20	12.558	21.858	19.113	39.1	20.0	28.2	9.1	3.10	0.57	29.6	9.6	18.6
114	132.1	0.709	65.2	10.9	7.21	12.667	21.911	19.135	39.2	20.0	28.3	9.2	3.09	0.57	29.6	9.6	18.7
115	132.5	0.715	65.2	10.8	7.22	12.777	21.976	19.168	39.2	20.0	28.4	9.2	3.08	0.56	29.6	9.6	18.8
116	132.9	0.721	65.6	11.2	7.22	12.886	22.041	19.201	39.2	20.0	28.0	8.8	3.17	0.58	29.6	9.6	18.4
117	133.2	0.727	65.5	11.1	7.23	12.995	22.093	19.222	39.3	20.0	28.1	8.9	3.15	0.58	29.6	9.6	18.5
118	133.5	0.733	65.4	11.0	7.24	13.104	22.133	19.232	39.3	20.0	28.2	9.0	3.14	0.57	29.6	9.6	18.6
119	133.8	0.739	65.4	11.0	7.25	13.213	22.185	19.254	39.3	20.0	28.3	9.0	3.13	0.57	29.7	9.6	18.7
120	134.1	0.745	65.3	10.9	7.26	13.323	22.237	19.275	39.3	20.0	28.4	9.1	3.11	0.57	29.7	9.6	18.8
121	134.2	0.751	65.2	10.8	7.27	13.432	22.250	19.262	39.3	20.0	28.5	9.2	3.09	0.56	29.7	9.6	18.8
122	134.7	0.757	65.5	11.1	7.28	13.541	22.329	19.305	39.3	20.0	28.2	8.9	3.17	0.58	29.7	9.7	18.5
123	134.9	0.764	65.4	11.1	7.29	13.650	22.368	19.315	39.3	20.0	28.3	9.0	3.15	0.57	29.7	9.7	18.6
124	135.3	0.770	65.4	11.0	7.30	13.759	22.420	19.335	39.4	20.0	28.3	9.0	3.15	0.57	29.7	9.7	18.7
125	135.6	0.776	65.3	10.9	7.31	13.869	22.472	19.356	39.4	20.0	28.4	9.1	3.13	0.57	29.7	9.7	18.8
126	135.9	0.782	65.2	10.9	7.32	13.978	22.525	19.376	39.4	20.0	28.5	9.2	3.11	0.56	29.7	9.7	18.9
127	136.2	0.788	65.2	10.8	7.33	14.087	22.564	19.385	39.4	20.0	28.6	9.2	3.11	0.56	29.7	9.7	18.9
128	136.7	0.794	65.2	10.9	7.34	14.196	22.642	19.428	39.5	20.0	28.6	9.2	3.12	0.56	29.7	9.7	18.9
129	137.3	0.800	65.5	11.1	7.34	14.305	22.747	19.493	39.5	20.0	28.4	8.9	3.18	0.57	29.8	9.7	18.7
130	137.5	0.806	65.4	11.0	7.35	14.415	22.773	19.490	39.5	20.0	28.5	9.0	3.15	0.56	29.8	9.7	18.8
131	137.9	0.812	65.3	10.9	7.36	14.524	22.838	19.521	39.6	20.0	28.6	9.1	3.14	0.56	29.8	9.8	18.9
132	138.2	0.819	65.2	10.9	7.37	14.633	22.890	19.541	39.6	20.0	28.7	9.2	3.13	0.56	29.8	9.8	18.9
133	138.3	0.825	65.2	10.8	7.38	14.742	22.904	19.527	39.6	20.0	28.8	9.2	3.11	0.55	29.8	9.8	19.0
134	138.6	0.831	65.1	10.7	7.39	14.851	22.956	19.547	39.6	20.0	28.9	9.3	3.10	0.55	29.8	9.8	19.1
135	139.0	0.837	65.2	10.9	7.40	14.961	23.008	19.566	39.6	20.0	28.7	9.2	3.13	0.56	29.8	9.8	19.0
136	139.3	0.843	65.4	11.0	7.41	15.070	23.060	19.585	39.6	20.0	28.6	9.0	3.16	0.56	29.8	9.8	18.8
137	139.7	0.849	65.3	10.9	7.42	15.179	23.126	19.615	39.6	20.0	28.7	9.1	3.15	0.56	29.8	9.8	18.9
138	139.9	0.855	65.2	10.8	7.43	15.288	23.152	19.612	39.6	20.0	28.8	9.2	3.13	0.55	29.8	9.8	19.0
139	140.2	0.861	65.1	10.7	7.44	15.397	23.204	19.631	39.7	20.0	28.9	9.3	3.11	0.55	29.8	9.8	19.1
140	140.3	0.867	65.0	10.7	7.45	15.507	23.217	19.617	39.7	20.0	29.0	9.4	3.09	0.54	29.8	9.8	19.2
141	140.9	0.873	65.2	10.8	7.46	15.616	23.309	19.669	39.7	20.0	28.9	9.2	3.13	0.55	29.9	9.8	19.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	141.4	0.880	65.3	10.9	7.47	15.725	23.400	19.720	39.8	20.0	28.8	9.1	3.16	0.55	29.9	9.9	19.0
143	141.8	0.886	65.2	10.8	7.48	15.834	23.452	19.739	39.8	20.0	28.9	9.2	3.14	0.55	29.9	9.9	19.1
144	141.9	0.892	65.2	10.8	7.49	15.943	23.478	19.735	39.8	20.0	29.0	9.2	3.13	0.55	29.9	9.9	19.1
145	142.2	0.898	65.1	10.7	7.50	16.053	23.518	19.742	39.8	20.0	29.1	9.3	3.12	0.54	29.9	9.9	19.2
146	142.6	0.904	65.0	10.6	7.51	16.162	23.583	19.771	39.8	20.0	29.2	9.4	3.10	0.54	29.9	9.9	19.3
147	142.8	0.910	64.9	10.6	7.52	16.271	23.609	19.768	39.8	20.0	29.2	9.5	3.09	0.54	29.9	9.9	19.3
148	143.2	0.916	65.2	10.8	7.53	16.380	23.687	19.807	39.8	20.0	29.1	9.2	3.14	0.54	29.9	9.9	19.2
149	143.7	0.922	65.2	10.9	7.54	16.490	23.766	19.847	39.9	20.0	29.0	9.2	3.16	0.55	30.0	9.9	19.1
150	144.0	0.928	65.2	10.8	7.55	16.599	23.805	19.854	39.9	20.0	29.1	9.2	3.15	0.54	30.0	9.9	19.2
151	144.2	0.934	65.1	10.7	7.56	16.708	23.844	19.860	39.9	20.0	29.2	9.3	3.13	0.54	30.0	9.9	19.3
152	144.4	0.941	65.0	10.7	7.57	16.817	23.870	19.856	39.9	20.0	29.2	9.4	3.12	0.54	30.0	9.9	19.3
153	144.7	0.947	64.9	10.6	7.58	16.926	23.923	19.873	39.9	20.0	29.3	9.5	3.10	0.53	30.0	9.9	19.4
154	144.9	0.953	64.9	10.5	7.59	17.036	23.949	19.869	39.9	20.0	29.4	9.5	3.08	0.53	30.0	9.9	19.5
155	145.4	0.959	65.2	10.8	7.60	17.145	24.027	19.908	39.9	20.0	29.1	9.2	3.16	0.54	30.0	10.0	19.2
156	145.7	0.965	65.2	10.8	7.61	17.254	24.079	19.925	40.0	20.0	29.2	9.2	3.15	0.54	30.0	10.0	19.2
157	146.0	0.971	65.1	10.7	7.62	17.363	24.119	19.931	40.0	20.0	29.3	9.3	3.14	0.54	30.0	10.0	19.3
158	146.1	0.977	65.0	10.6	7.63	17.472	24.145	19.926	40.0	20.0	29.3	9.4	3.12	0.53	30.0	10.0	19.4
159	146.5	0.983	64.9	10.5	7.64	17.582	24.197	19.943	40.0	20.0	29.4	9.5	3.10	0.53	30.0	10.0	19.5
160	146.6	0.989	64.8	10.4	7.65	17.691	24.223	19.938	40.0	20.0	29.5	9.6	3.07	0.52	30.0	10.0	19.6
161	147.4	0.996	65.1	10.7	7.66	17.800	24.341	20.008	40.0	20.0	29.3	9.3	3.14	0.53	30.0	10.0	19.3
162	147.7	1.002	65.1	10.7	7.67	17.909	24.393	20.024	40.1	20.0	29.4	9.3	3.15	0.53	30.0	10.0	19.3
163	148.2	1.008	65.0	10.6	7.68	18.018	24.471	20.062	40.1	20.0	29.5	9.4	3.13	0.53	30.1	10.0	19.4
164	148.3	1.014	64.9	10.5	7.69	18.128	24.484	20.046	40.1	20.0	29.5	9.5	3.11	0.53	30.1	10.0	19.5
165	148.6	1.020	64.8	10.5	7.70	18.237	24.537	20.062	40.1	20.0	29.6	9.6	3.10	0.52	30.1	10.0	19.6
166	148.7	1.026	64.8	10.4	7.71	18.346	24.550	20.046	40.1	20.0	29.7	9.6	3.09	0.52	30.1	10.0	19.6
167	148.9	1.032	64.7	10.3	7.72	18.455	24.589	20.051	40.1	20.0	29.8	9.7	3.06	0.51	30.1	10.0	19.8
168	149.6	1.038	65.0	10.7	7.73	18.564	24.693	20.109	40.1	20.0	29.5	9.4	3.15	0.53	30.1	10.1	19.4
169	149.7	1.044	65.0	10.6	7.74	18.674	24.707	20.093	40.1	20.0	29.5	9.4	3.14	0.53	30.1	10.0	19.5
170	150.0	1.050	64.9	10.5	7.75	18.783	24.759	20.108	40.1	20.0	29.6	9.5	3.12	0.52	30.1	10.1	19.5
171	150.2	1.057	64.8	10.5	7.76	18.892	24.785	20.103	40.1	20.0	29.7	9.6	3.10	0.52	30.1	10.1	19.6
172	150.4	1.063	64.7	10.3	7.77	19.001	24.824	20.107	40.1	20.0	29.8	9.7	3.07	0.51	30.1	10.1	19.7
173	150.8	1.069	64.6	10.3	7.78	19.110	24.889	20.133	40.2	20.0	29.9	9.8	3.06	0.51	30.1	10.1	19.8
174	151.1	1.075	64.6	10.3	7.79	19.220	24.929	20.137	40.2	20.0	29.9	9.8	3.06	0.51	30.1	10.1	19.8
175	151.6	1.081	64.9	10.5	7.80	19.329	25.007	20.174	40.2	20.0	29.7	9.5	3.13	0.52	30.1	10.1	19.6
176	151.9	1.087	64.8	10.5	7.81	19.438	25.059	20.188	40.2	20.0	29.8	9.6	3.11	0.52	30.1	10.1	19.7
177	152.1	1.093	64.7	10.4	7.82	19.547	25.099	20.192	40.2	20.0	29.8	9.7	3.09	0.51	30.1	10.1	19.7
178	152.4	1.099	64.7	10.3	7.83	19.656	25.138	20.197	40.2	20.0	29.9	9.7	3.08	0.51	30.1	10.1	19.8
179	152.8	1.105	64.6	10.2	7.84	19.766	25.203	20.222	40.3	20.0	30.0	9.8	3.06	0.51	30.1	10.1	19.9
180	152.9	1.112	64.5	10.1	7.85	19.875	25.229	20.215	40.2	20.0	30.1	9.9	3.04	0.50	30.1	10.1	20.0
181	153.5	1.118	64.8	10.5	7.87	19.984	25.321	20.261	40.3	20.0	29.8	9.6	3.12	0.52	30.2	10.1	19.7
182	153.9	1.119	64.9	10.5	7.87	20.001	25.373	20.298	40.3	20.0	29.8	9.5	3.13	0.52	30.2	10.1	19.7

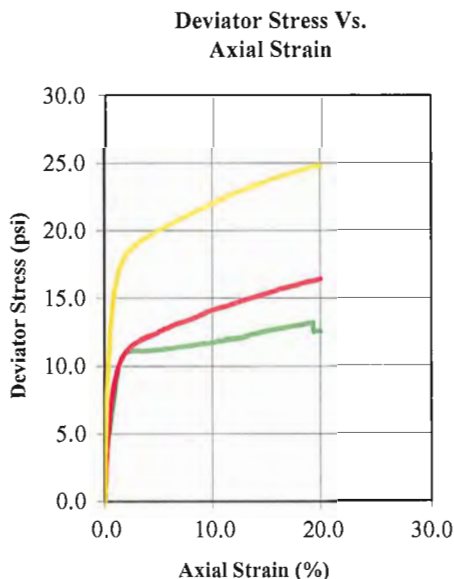


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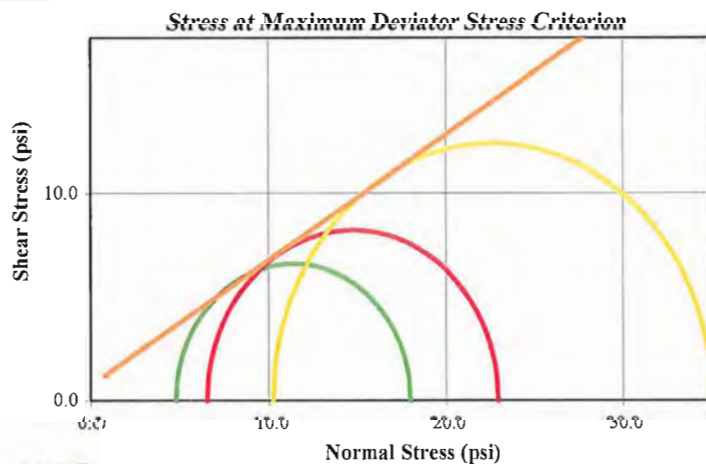
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0' to 36.0'
PROJECT LOCATION : B-51	SAMPLE TYPE : Remolded
BORING NUMBER : B-51	DESCRIPTION : Brown & Red Silty Sand
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	D	C	B
Water Content (%)	15.6	16.6	15.6	
Dry Density (pcf)	101.1	101.9	101.5	
Saturation (%)	64.93	70.50	65.86	
Void Ratio	0.633	0.619	0.626	
Diameter (in)	2.808	0.619	2.810	
Height (in)	5.647	5.634	5.650	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	33	33	33	
Plastic Limit	24	24	24	
After Consolidation		A	D	C
B-Value		0.95	0.97	0.95
Water Content (%)		23.9	20.9	23.1
Dry Density (pcf)		102.18	102.88	109.04
Saturation (%)		100.00	100.00	100.00
Void Ratio		0.619	0.608	0.517
Effective Stress (psi)		5.0	20.0	10.0
Back Press. (psi)		69.7	63.9	57.3
Rate of Strain		0.002	0.002	0.002

Maximum Deviator Stress Criterion		After Shear		A	D	C
C (psi)	3.9	σ'_1 at Failure (psi)		17.97	35.04	22.95
ϕ (deg)	14.6	σ'_3 at Failure (psi)		4.77	10.22	6.50
C' (psi)	0.8					
ϕ' (deg)	31.1					



Tested By: _____

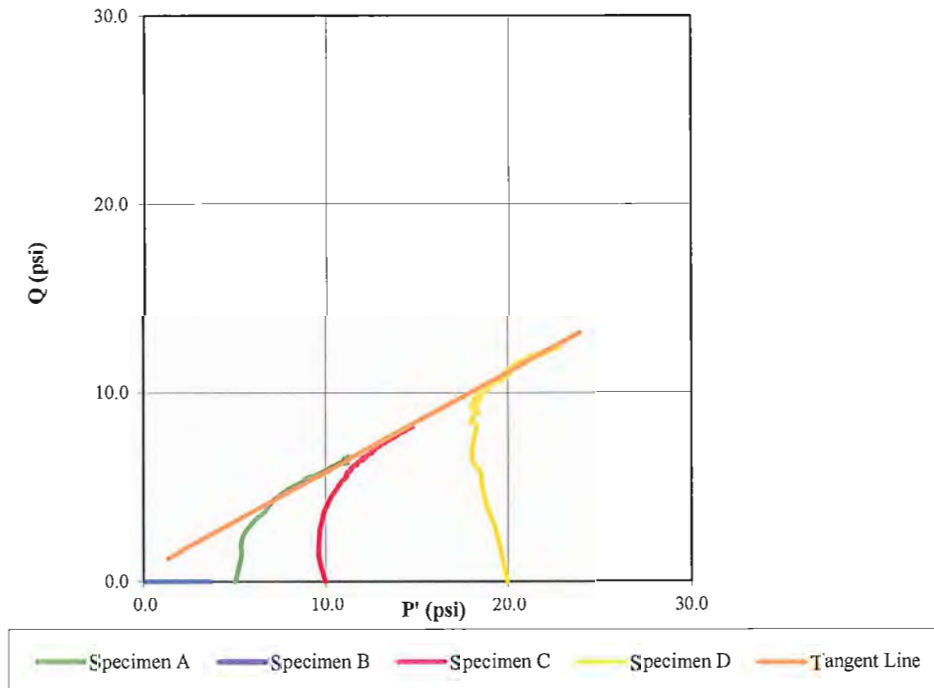
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Approved By: SKB

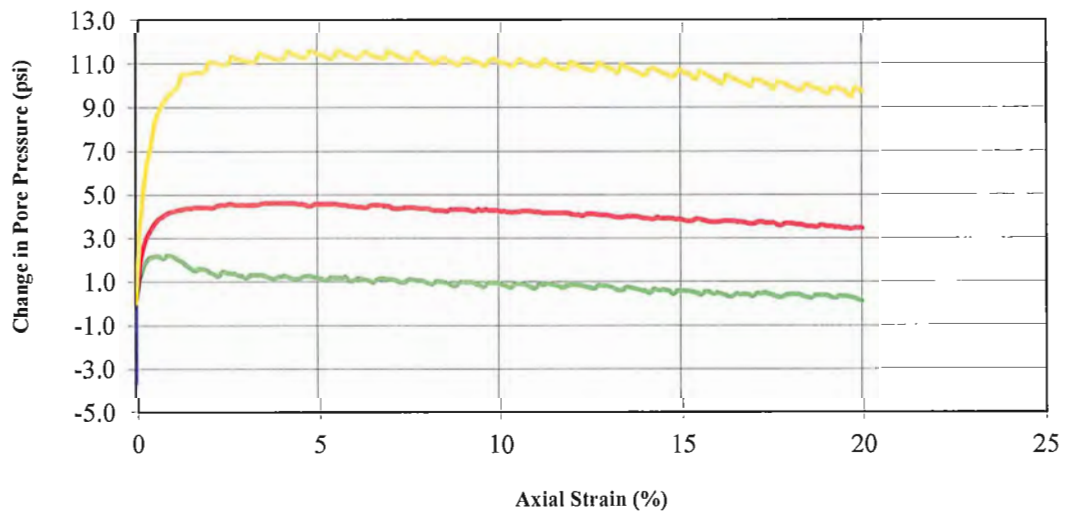
Date: 12-11-12



Stress Paths (Effective)
($a = 0.5$ $\alpha = 27.8$)



Change in Pore Pressure vs. Axial Strain





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Specimen A Shear Data

CU Triaxial Test

File Location
B-51 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-51
Sample Description: Brown & Red Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 33.000
PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.808	2.801	
Height (in)	5.647	5.612	
Weight (grams)	1072.60		1150.00
Moisture (%)	15.59		23.94
Dry Density (pcf)	101.10	102.18	
Saturation (%)	64.93	100.00	
Void Ratio	0.633	0.619	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 74.700
Effective Confining Stress (psi): 5.0
Corrected Peak Deviator Stress (psi): 13.196 at reading number: 177

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.6	0.000	69.7	0.0	6.16	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	17.6	0.007	70.7	1.1	6.17	0.109	2.762	2.759	7.8	5.0	6.7	4.0	1.70	0.38	6.4	1.4	5.3
2	25.1	0.013	71.4	1.7	6.18	0.218	3.976	3.967	9.0	5.0	7.3	3.3	2.19	0.42	7.0	2.0	5.3
3	30.6	0.019	71.7	2.0	6.18	0.326	4.869	4.853	9.9	5.0	7.9	3.0	2.61	0.41	7.4	2.4	5.4
4	34.6	0.025	71.8	2.1	6.19	0.435	5.523	5.499	10.5	5.0	8.4	2.9	2.90	0.39	7.8	2.7	5.6
5	38.9	0.031	71.8	2.2	6.20	0.544	6.217	6.183	11.2	5.0	9.0	2.9	3.16	0.35	8.1	3.1	5.9
6	42.8	0.037	71.8	2.2	6.20	0.653	6.857	6.812	11.8	5.0	9.7	2.9	3.38	0.32	8.4	3.4	6.3
7	46.6	0.043	71.8	2.1	6.21	0.761	7.471	7.414	12.4	5.0	10.4	2.9	3.52	0.28	8.7	3.7	6.6
8	50.7	0.049	71.9	2.2	6.22	0.870	8.124	8.054	13.1	5.0	10.9	2.8	3.86	0.27	9.0	4.0	6.8
9	54.3	0.055	71.9	2.2	6.22	0.979	8.711	8.626	13.6	5.0	11.4	2.8	4.06	0.26	9.3	4.3	7.1
10	57.8	0.062	71.8	2.1	6.23	1.088	9.285	9.184	14.2	5.0	12.1	2.9	4.17	0.23	9.6	4.6	7.5
11	60.7	0.068	71.7	2.0	6.24	1.197	9.752	9.635	14.7	5.0	12.7	3.0	4.19	0.21	9.8	4.8	7.8
12	63.2	0.074	71.6	1.9	6.25	1.305	10.166	10.033	15.1	5.0	13.1	3.1	4.23	0.19	10.0	5.0	8.1
13	65.0	0.080	71.4	1.8	6.25	1.414	10.459	10.311	15.3	5.0	13.6	3.3	4.16	0.17	10.2	5.2	8.4
14	66.7	0.086	71.3	1.6	6.26	1.523	10.726	10.563	15.6	5.0	14.0	3.4	4.12	0.15	10.3	5.3	8.7
15	67.8	0.092	71.2	1.5	6.27	1.632	10.899	10.721	15.7	5.0	14.2	3.5	4.05	0.14	10.4	5.4	8.9
16	68.7	0.098	71.3	1.6	6.27	1.740	11.059	10.867	15.9	5.0	14.3	3.4	4.17	0.15	10.5	5.4	8.9
17	69.6	0.104	71.3	1.6	6.28	1.849	11.193	10.986	16.0	5.0	14.4	3.4	4.20	0.14	10.5	5.5	8.9
18	70.1	0.110	71.2	1.5	6.29	1.958	11.273	11.052	16.1	5.0	14.5	3.5	4.19	0.14	10.5	5.5	9.0



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	70.2	0.116	71.1	1.4	6.29	2.067	11.300	11.066	16.1	5.0	14.7	3.6	4.08	0.13	10.6	5.5	9.1
20	70.5	0.123	71.0	1.3	6.30	2.175	11.340	11.093	16.1	5.0	14.8	3.7	4.02	0.12	10.6	5.5	9.2
21	70.6	0.129	70.9	1.3	6.31	2.284	11.366	11.107	16.1	5.0	14.9	3.8	3.96	0.11	10.6	5.6	9.3
22	70.9	0.135	71.1	1.5	6.31	2.393	11.406	11.133	16.2	5.0	14.7	3.6	4.14	0.13	10.6	5.6	9.1
23	71.0	0.141	71.1	1.4	6.32	2.502	11.420	11.134	16.2	5.0	14.7	3.6	4.10	0.13	10.6	5.6	9.2
24	71.1	0.147	71.1	1.4	6.33	2.611	11.446	11.147	16.2	5.0	14.8	3.6	4.07	0.12	10.6	5.6	9.2
25	71.2	0.153	71.1	1.4	6.34	2.719	11.460	11.148	16.2	5.0	14.8	3.6	4.07	0.12	10.6	5.6	9.2
26	71.2	0.159	71.0	1.3	6.34	2.828	11.460	11.136	16.2	5.0	14.8	3.7	4.00	0.12	10.6	5.6	9.3
27	71.5	0.165	70.9	1.3	6.35	2.937	11.500	11.162	16.2	5.0	14.9	3.8	3.97	0.11	10.6	5.6	9.3
28	71.5	0.171	70.9	1.2	6.36	3.046	11.500	11.149	16.2	5.0	15.0	3.8	3.91	0.11	10.6	5.6	9.4
29	71.6	0.178	71.0	1.3	6.36	3.154	11.526	11.163	16.2	5.0	14.9	3.7	4.01	0.12	10.6	5.6	9.3
30	71.6	0.184	71.0	1.3	6.37	3.263	11.526	11.150	16.2	5.0	14.9	3.7	4.00	0.12	10.6	5.6	9.3
31	71.6	0.190	71.0	1.3	6.38	3.372	11.526	11.138	16.2	5.0	14.9	3.7	4.00	0.12	10.6	5.6	9.3
32	71.7	0.196	71.0	1.3	6.39	3.481	11.540	11.138	16.2	5.0	14.9	3.7	4.00	0.12	10.6	5.6	9.3
33	71.8	0.202	70.9	1.3	6.39	3.590	11.553	11.138	16.2	5.0	14.9	3.8	3.97	0.11	10.6	5.6	9.3
34	72.0	0.208	70.9	1.2	6.40	3.698	11.580	11.151	16.2	5.0	15.0	3.8	3.91	0.11	10.6	5.6	9.4
35	72.0	0.214	70.8	1.1	6.41	3.807	11.593	11.152	16.2	5.0	15.0	3.9	3.88	0.10	10.6	5.6	9.5
36	72.0	0.220	70.9	1.2	6.42	3.916	11.593	11.139	16.2	5.0	14.9	3.8	3.93	0.11	10.6	5.6	9.4
37	72.2	0.226	70.9	1.3	6.42	4.025	11.620	11.152	16.2	5.0	14.9	3.8	3.97	0.11	10.6	5.6	9.3
38	72.4	0.232	70.9	1.3	6.43	4.133	11.646	11.165	16.2	5.0	14.9	3.8	3.97	0.11	10.6	5.6	9.3
39	72.5	0.239	70.9	1.2	6.44	4.242	11.673	11.178	16.2	5.0	15.0	3.8	3.91	0.11	10.6	5.6	9.4
40	72.6	0.245	70.8	1.1	6.44	4.351	11.686	11.178	16.2	5.0	15.1	3.9	3.88	0.10	10.6	5.6	9.5
41	72.9	0.251	70.8	1.1	6.45	4.460	11.726	11.203	16.2	5.0	15.1	3.9	3.89	0.10	10.6	5.6	9.5
42	72.9	0.257	70.9	1.2	6.46	4.569	11.726	11.191	16.2	5.0	15.0	3.8	3.95	0.11	10.6	5.6	9.4
43	73.0	0.263	70.9	1.3	6.47	4.677	11.753	11.203	16.2	5.0	15.0	3.8	3.98	0.11	10.6	5.6	9.4
44	73.1	0.269	70.9	1.3	6.47	4.786	11.766	11.203	16.2	5.0	15.0	3.8	3.98	0.11	10.6	5.6	9.4
45	73.3	0.275	70.9	1.2	6.48	4.895	11.806	11.229	16.2	5.0	15.0	3.8	3.96	0.11	10.6	5.6	9.4
46	73.4	0.281	70.9	1.2	6.49	5.004	11.820	11.228	16.2	5.0	15.1	3.8	3.93	0.11	10.6	5.6	9.5
47	73.6	0.287	70.8	1.1	6.50	5.112	11.846	11.241	16.3	5.0	15.1	3.9	3.90	0.10	10.6	5.6	9.5
48	73.5	0.293	70.7	1.1	6.50	5.221	11.833	11.215	16.2	5.0	15.2	4.0	3.83	0.09	10.6	5.6	9.6
49	73.8	0.300	70.9	1.2	6.51	5.330	11.887	11.253	16.3	5.0	15.1	3.8	3.93	0.11	10.6	5.6	9.5
50	73.9	0.306	70.9	1.2	6.52	5.439	11.900	11.253	16.3	5.0	15.1	3.8	3.93	0.11	10.6	5.6	9.5
51	74.1	0.312	70.9	1.2	6.53	5.547	11.927	11.265	16.3	5.0	15.1	3.8	3.94	0.10	10.7	5.6	9.5
52	74.4	0.318	70.9	1.2	6.53	5.656	11.980	11.302	16.3	5.0	15.1	3.8	3.95	0.10	10.7	5.7	9.5
53	74.7	0.324	70.9	1.2	6.54	5.765	12.020	11.327	16.3	5.0	15.1	3.8	3.98	0.11	10.7	5.7	9.5
54	74.7	0.330	70.7	1.1	6.55	5.874	12.033	11.326	16.3	5.0	15.3	4.0	3.86	0.09	10.7	5.7	9.6
55	74.7	0.336	70.7	1.1	6.56	5.983	12.033	11.313	16.3	5.0	15.3	4.0	3.86	0.09	10.7	5.7	9.6
56	74.9	0.342	70.8	1.1	6.56	6.091	12.060	11.325	16.3	5.0	15.2	3.9	3.92	0.10	10.7	5.7	9.5
57	75.1	0.348	70.8	1.1	6.57	6.200	12.087	11.337	16.4	5.0	15.2	3.9	3.92	0.10	10.7	5.7	9.5
58	75.2	0.355	70.8	1.1	6.58	6.309	12.113	11.349	16.4	5.0	15.3	3.9	3.90	0.10	10.7	5.7	9.6
59	75.2	0.361	70.7	1.1	6.59	6.418	12.113	11.336	16.4	5.0	15.3	4.0	3.86	0.09	10.7	5.7	9.6



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	75.5	0.367	70.7	1.0	6.59	6.526	12.153	11.360	16.4	5.0	15.4	4.0	3.81	0.09	10.7	5.7	9.7
61	76.0	0.373	70.8	1.1	6.60	6.635	12.233	11.422	16.4	5.0	15.3	3.9	3.92	0.10	10.7	5.7	9.6
62	76.0	0.379	70.8	1.1	6.61	6.744	12.233	11.408	16.4	5.0	15.3	3.9	3.94	0.10	10.7	5.7	9.6
63	76.1	0.385	70.8	1.1	6.62	6.853	12.247	11.407	16.4	5.0	15.3	3.9	3.94	0.10	10.7	5.7	9.6
64	76.2	0.391	70.8	1.1	6.63	6.962	12.273	11.419	16.4	5.0	15.3	3.9	3.91	0.10	10.7	5.7	9.6
65	76.4	0.397	70.8	1.1	6.63	7.070	12.300	11.430	16.4	5.0	15.3	3.9	3.92	0.10	10.7	5.7	9.6
66	76.7	0.403	70.7	1.1	6.64	7.179	12.353	11.467	16.5	5.0	15.4	4.0	3.90	0.09	10.8	5.7	9.7
67	76.8	0.409	70.7	1.0	6.65	7.288	12.367	11.466	16.5	5.0	15.5	4.0	3.84	0.09	10.8	5.7	9.8
68	77.0	0.416	70.7	1.0	6.66	7.397	12.393	11.477	16.5	5.0	15.5	4.0	3.84	0.09	10.8	5.7	9.8
69	77.1	0.422	70.8	1.1	6.66	7.505	12.420	11.488	16.5	5.0	15.4	3.9	3.93	0.10	10.8	5.7	9.7
70	77.4	0.428	70.8	1.1	6.67	7.614	12.460	11.511	16.5	5.0	15.4	3.9	3.94	0.10	10.8	5.8	9.7
71	77.5	0.434	70.7	1.1	6.68	7.723	12.474	11.510	16.5	5.0	15.5	4.0	3.91	0.09	10.8	5.8	9.7
72	77.7	0.440	70.7	1.1	6.69	7.832	12.514	11.534	16.6	5.0	15.5	4.0	3.91	0.09	10.8	5.8	9.7
73	77.8	0.446	70.7	1.0	6.70	7.940	12.527	11.532	16.6	5.0	15.5	4.0	3.88	0.09	10.8	5.8	9.8
74	78.0	0.452	70.6	0.9	6.70	8.049	12.567	11.555	16.6	5.0	15.6	4.1	3.83	0.08	10.8	5.8	9.9
75	78.0	0.458	70.6	0.9	6.71	8.158	12.567	11.542	16.6	5.0	15.7	4.1	3.80	0.08	10.8	5.8	9.9
76	78.4	0.464	70.7	1.0	6.72	8.267	12.620	11.577	16.6	5.0	15.6	4.0	3.89	0.09	10.8	5.8	9.8
77	78.5	0.471	70.7	1.0	6.73	8.376	12.647	11.588	16.6	5.0	15.6	4.0	3.90	0.09	10.8	5.8	9.8
78	78.7	0.477	70.7	1.0	6.74	8.484	12.674	11.598	16.6	5.0	15.6	4.0	3.87	0.08	10.8	5.8	9.8
79	78.9	0.483	70.6	0.9	6.74	8.593	12.700	11.609	16.6	5.0	15.7	4.1	3.84	0.08	10.8	5.8	9.9
80	79.0	0.489	70.5	0.9	6.75	8.702	12.727	11.619	16.6	5.0	15.8	4.2	3.79	0.07	10.8	5.8	10.0
81	79.4	0.495	70.5	0.8	6.76	8.811	12.780	11.654	16.7	5.0	15.9	4.2	3.77	0.07	10.8	5.8	10.0
82	79.4	0.501	70.7	1.0	6.77	8.919	12.794	11.653	16.7	5.0	15.7	4.0	3.88	0.08	10.8	5.8	9.9
83	79.5	0.507	70.7	1.0	6.78	9.028	12.807	11.651	16.7	5.0	15.7	4.0	3.88	0.08	10.8	5.8	9.9
84	79.8	0.513	70.7	1.0	6.78	9.137	12.847	11.673	16.7	5.0	15.7	4.0	3.89	0.08	10.9	5.8	9.9
85	80.1	0.519	70.7	1.0	6.79	9.246	12.900	11.708	16.7	5.0	15.7	4.0	3.90	0.08	10.9	5.9	9.9
86	80.1	0.525	70.6	0.9	6.80	9.355	12.900	11.694	16.7	5.0	15.8	4.1	3.84	0.08	10.9	5.8	10.0
87	80.3	0.532	70.5	0.9	6.81	9.463	12.927	11.704	16.7	5.0	15.9	4.2	3.81	0.07	10.9	5.9	10.0
88	80.4	0.538	70.5	0.8	6.82	9.572	12.954	11.714	16.7	5.0	16.0	4.2	3.76	0.07	10.9	5.9	10.1
89	80.6	0.544	70.6	0.9	6.82	9.681	12.980	11.724	16.7	5.0	15.8	4.1	3.87	0.08	10.9	5.9	9.9
90	80.8	0.550	70.6	0.9	6.83	9.790	13.020	11.746	16.8	5.0	15.8	4.1	3.88	0.08	10.9	5.9	10.0
91	81.2	0.556	70.6	0.9	6.84	9.898	13.074	11.780	16.8	5.0	15.9	4.1	3.89	0.08	10.9	5.9	10.0
92	81.2	0.562	70.6	0.9	6.85	10.007	13.087	11.778	16.8	5.0	15.9	4.1	3.89	0.08	10.9	5.9	10.0
93	81.4	0.568	70.5	0.9	6.86	10.116	13.114	11.787	16.8	5.0	15.9	4.2	3.83	0.07	10.9	5.9	10.1
94	81.7	0.574	70.5	0.8	6.87	10.225	13.167	11.821	16.8	5.0	16.0	4.2	3.81	0.07	10.9	5.9	10.1
95	81.7	0.580	70.4	0.7	6.87	10.334	13.154	11.795	16.8	5.0	16.1	4.3	3.75	0.06	10.9	5.9	10.2
96	82.1	0.587	70.6	0.9	6.88	10.442	13.234	11.852	16.9	5.0	16.0	4.1	3.88	0.08	10.9	5.9	10.0
97	82.3	0.593	70.6	0.9	6.89	10.551	13.261	11.861	16.9	5.0	16.0	4.1	3.88	0.08	10.9	5.9	10.1
98	82.6	0.599	70.6	0.9	6.90	10.660	13.301	11.883	16.9	5.0	16.0	4.1	3.88	0.08	11.0	5.9	10.1
99	82.5	0.605	70.5	0.9	6.91	10.769	13.287	11.856	16.9	5.0	16.0	4.2	3.85	0.07	10.9	5.9	10.1
100	82.8	0.611	70.5	0.8	6.92	10.877	13.341	11.890	16.9	5.0	16.1	4.2	3.80	0.07	11.0	5.9	10.2



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101	83.0	0.617	70.4	0.7	6.92	10.986	13.367	11.899	16.9	5.0	16.2	4.3	3.75	0.06	11.0	5.9	10.3
102	83.3	0.623	70.5	0.9	6.93	11.095	13.421	11.932	16.9	5.0	16.1	4.2	3.87	0.07	11.0	6.0	10.1
103	83.5	0.629	70.5	0.9	6.94	11.204	13.447	11.941	17.0	5.0	16.1	4.2	3.87	0.07	11.0	6.0	10.1
104	83.8	0.635	70.6	0.9	6.95	11.312	13.501	11.973	17.0	5.0	16.1	4.1	3.91	0.07	11.0	6.0	10.1
105	83.9	0.641	70.6	0.9	6.96	11.421	13.514	11.971	17.0	5.0	16.1	4.1	3.90	0.07	11.0	6.0	10.1
106	84.0	0.648	70.5	0.9	6.97	11.530	13.527	11.968	17.0	5.0	16.1	4.2	3.88	0.07	11.0	6.0	10.1
107	84.4	0.654	70.5	0.8	6.98	11.639	13.594	12.012	17.0	5.0	16.2	4.2	3.86	0.07	11.0	6.0	10.2
108	84.4	0.660	70.4	0.7	6.98	11.748	13.594	11.997	17.0	5.0	16.3	4.3	3.80	0.06	11.0	6.0	10.3
109	84.8	0.666	70.5	0.8	6.99	11.856	13.661	12.041	17.1	5.0	16.2	4.2	3.86	0.07	11.0	6.0	10.2
110	84.8	0.672	70.5	0.9	7.00	11.965	13.661	12.026	17.0	5.0	16.2	4.2	3.89	0.07	11.0	6.0	10.2
111	85.0	0.678	70.5	0.9	7.01	12.074	13.701	12.047	17.1	5.0	16.2	4.2	3.89	0.07	11.0	6.0	10.2
112	85.1	0.684	70.5	0.9	7.02	12.183	13.714	12.043	17.1	5.0	16.2	4.2	3.89	0.07	11.0	6.0	10.2
113	85.4	0.690	70.5	0.8	7.03	12.291	13.768	12.075	17.1	5.0	16.3	4.2	3.87	0.07	11.1	6.0	10.2
114	85.5	0.696	70.5	0.8	7.04	12.400	13.781	12.072	17.1	5.0	16.3	4.2	3.84	0.06	11.1	6.0	10.3
115	85.7	0.703	70.4	0.7	7.05	12.509	13.808	12.080	17.1	5.0	16.4	4.3	3.82	0.06	11.1	6.0	10.3
116	85.8	0.709	70.4	0.7	7.05	12.618	13.834	12.089	17.1	5.0	16.4	4.3	3.80	0.06	11.1	6.0	10.4
117	86.1	0.715	70.5	0.8	7.06	12.727	13.874	12.109	17.1	5.0	16.3	4.2	3.88	0.07	11.1	6.1	10.3
118	86.4	0.721	70.5	0.8	7.07	12.835	13.928	12.140	17.2	5.0	16.3	4.2	3.89	0.07	11.1	6.1	10.3
119	86.8	0.727	70.5	0.8	7.08	12.944	13.994	12.183	17.2	5.0	16.4	4.2	3.90	0.07	11.1	6.1	10.3
120	87.1	0.733	70.5	0.8	7.09	13.053	14.034	12.202	17.2	5.0	16.4	4.2	3.88	0.06	11.1	6.1	10.3
121	87.2	0.739	70.4	0.7	7.10	13.162	14.061	12.210	17.2	5.0	16.5	4.3	3.82	0.06	11.1	6.1	10.4
122	87.3	0.745	70.3	0.6	7.11	13.270	14.074	12.207	17.2	5.0	16.6	4.4	3.77	0.05	11.1	6.1	10.5
123	87.9	0.751	70.3	0.6	7.12	13.379	14.168	12.272	17.3	5.0	16.7	4.4	3.78	0.05	11.2	6.1	10.5
124	88.3	0.757	70.4	0.7	7.12	13.488	14.234	12.315	17.3	5.0	16.6	4.3	3.87	0.06	11.2	6.2	10.4
125	88.5	0.764	70.4	0.7	7.13	13.597	14.261	12.322	17.3	5.0	16.6	4.3	3.88	0.06	11.2	6.2	10.4
126	88.6	0.770	70.4	0.7	7.14	13.706	14.288	12.330	17.3	5.0	16.7	4.3	3.85	0.06	11.2	6.2	10.5
127	89.0	0.776	70.3	0.7	7.15	13.814	14.341	12.360	17.4	5.0	16.7	4.4	3.83	0.05	11.2	6.2	10.5
128	89.2	0.782	70.3	0.6	7.16	13.923	14.381	12.379	17.4	5.0	16.8	4.4	3.81	0.05	11.2	6.2	10.6
129	89.3	0.788	70.3	0.6	7.17	14.032	14.395	12.375	17.4	5.0	16.8	4.4	3.78	0.05	11.2	6.2	10.6
130	89.6	0.794	70.2	0.5	7.18	14.141	14.448	12.405	17.4	5.0	16.9	4.5	3.74	0.04	11.2	6.2	10.7
131	90.0	0.800	70.3	0.7	7.19	14.249	14.501	12.435	17.5	5.0	16.8	4.4	3.85	0.05	11.2	6.2	10.6
132	90.4	0.806	70.3	0.6	7.20	14.358	14.568	12.476	17.5	5.0	16.9	4.4	3.83	0.05	11.3	6.2	10.6
133	90.5	0.812	70.3	0.6	7.21	14.467	14.595	12.483	17.5	5.0	16.9	4.4	3.83	0.05	11.3	6.2	10.6
134	90.8	0.819	70.3	0.6	7.22	14.576	14.635	12.502	17.5	5.0	16.9	4.4	3.84	0.05	11.3	6.3	10.7
135	90.9	0.825	70.3	0.6	7.22	14.684	14.661	12.508	17.5	5.0	17.0	4.4	3.81	0.05	11.3	6.3	10.7
136	91.1	0.831	70.1	0.4	7.23	14.793	14.688	12.515	17.5	5.0	17.1	4.6	3.74	0.04	11.3	6.3	10.8
137	91.5	0.837	70.3	0.6	7.24	14.902	14.755	12.556	17.6	5.0	17.0	4.4	3.82	0.05	11.3	6.3	10.7
138	91.9	0.843	70.3	0.6	7.25	15.011	14.821	12.597	17.6	5.0	17.0	4.4	3.83	0.05	11.3	6.3	10.7
139	91.9	0.849	70.3	0.6	7.26	15.120	14.821	12.581	17.6	5.0	17.0	4.4	3.83	0.05	11.3	6.3	10.7
140	92.3	0.855	70.3	0.6	7.27	15.228	14.875	12.610	17.6	5.0	17.1	4.4	3.84	0.05	11.3	6.3	10.8
141	92.7	0.861	70.2	0.5	7.28	15.337	14.942	12.650	17.7	5.0	17.1	4.5	3.82	0.04	11.3	6.3	10.8



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	92.8	0.867	70.2	0.5	7.29	15.446	14.955	12.645	17.7	5.0	17.2	4.5	3.79	0.04	11.3	6.3	10.9
143	92.8	0.873	70.1	0.4	7.30	15.555	14.968	12.640	17.7	5.0	17.3	4.6	3.74	0.03	11.3	6.3	10.9
144	93.2	0.880	70.2	0.5	7.31	15.663	15.022	12.669	17.7	5.0	17.2	4.5	3.82	0.04	11.4	6.3	10.8
145	93.3	0.886	70.2	0.5	7.32	15.772	15.048	12.675	17.7	5.0	17.2	4.5	3.82	0.04	11.4	6.3	10.8
146	93.8	0.892	70.1	0.4	7.33	15.881	15.128	12.726	17.7	5.0	17.3	4.6	3.78	0.04	11.4	6.4	10.9
147	94.1	0.898	70.2	0.5	7.34	15.990	15.168	12.743	17.8	5.0	17.3	4.5	3.81	0.04	11.4	6.4	10.9
148	94.3	0.904	70.1	0.4	7.35	16.099	15.208	12.760	17.8	5.0	17.3	4.6	3.79	0.04	11.4	6.4	10.9
149	94.6	0.910	70.1	0.4	7.36	16.207	15.248	12.777	17.8	5.0	17.4	4.6	3.77	0.03	11.4	6.4	11.0
150	94.6	0.916	70.0	0.3	7.37	16.316	15.248	12.760	17.8	5.0	17.5	4.7	3.72	0.03	11.4	6.4	11.1
151	94.8	0.922	70.0	0.3	7.38	16.425	15.288	12.777	17.8	5.0	17.5	4.7	3.72	0.03	11.4	6.4	11.1
152	95.1	0.928	70.1	0.4	7.38	16.534	15.342	12.805	17.8	5.0	17.4	4.6	3.80	0.04	11.4	6.4	11.0
153	95.2	0.934	70.1	0.4	7.39	16.642	15.355	12.800	17.8	5.0	17.4	4.6	3.78	0.03	11.4	6.4	11.0
154	95.6	0.941	70.1	0.4	7.40	16.751	15.408	12.827	17.8	5.0	17.4	4.6	3.78	0.03	11.4	6.4	11.0
155	95.9	0.947	70.1	0.4	7.41	16.860	15.462	12.855	17.9	5.0	17.5	4.6	3.79	0.03	11.4	6.4	11.0
156	96.0	0.953	70.0	0.3	7.42	16.969	15.475	12.849	17.9	5.0	17.5	4.7	3.74	0.03	11.4	6.4	11.1
157	96.4	0.959	70.1	0.4	7.43	17.078	15.542	12.888	17.9	5.0	17.5	4.6	3.82	0.03	11.5	6.4	11.0
158	96.6	0.965	70.1	0.4	7.44	17.186	15.582	12.904	17.9	5.0	17.5	4.6	3.82	0.03	11.5	6.5	11.0
159	96.9	0.971	70.2	0.5	7.45	17.295	15.622	12.920	17.9	5.0	17.4	4.5	3.85	0.04	11.5	6.5	11.0
160	97.0	0.977	70.1	0.4	7.46	17.404	15.649	12.925	17.9	5.0	17.5	4.6	3.83	0.03	11.5	6.5	11.0
161	97.4	0.983	70.1	0.4	7.47	17.513	15.702	12.952	18.0	5.0	17.6	4.6	3.81	0.03	11.5	6.5	11.1
162	97.6	0.989	70.0	0.3	7.48	17.621	15.742	12.968	18.0	5.0	17.7	4.7	3.76	0.03	11.5	6.5	11.2
163	97.8	0.996	70.0	0.3	7.49	17.730	15.769	12.973	18.0	5.0	17.7	4.7	3.74	0.02	11.5	6.5	11.2
164	98.2	1.002	70.0	0.3	7.50	17.839	15.835	13.010	18.0	5.0	17.7	4.7	3.77	0.03	11.5	6.5	11.2
165	98.3	1.008	70.1	0.4	7.51	17.948	15.862	13.015	18.0	5.0	17.6	4.6	3.82	0.03	11.5	6.5	11.1
166	98.3	1.014	70.1	0.4	7.52	18.056	15.862	12.998	18.0	5.0	17.6	4.6	3.82	0.03	11.5	6.5	11.1
167	98.8	1.020	70.1	0.4	7.53	18.165	15.929	13.035	18.1	5.0	17.6	4.6	3.83	0.03	11.5	6.5	11.1
168	99.0	1.026	70.1	0.4	7.54	18.274	15.969	13.051	18.1	5.0	17.7	4.6	3.83	0.03	11.5	6.5	11.1
169	99.3	1.032	70.0	0.3	7.55	18.383	16.022	13.077	18.1	5.0	17.8	4.7	3.79	0.02	11.6	6.5	11.2
170	99.6	1.038	70.0	0.3	7.56	18.492	16.062	13.092	18.1	5.0	17.8	4.7	3.77	0.02	11.6	6.5	11.3
171	99.7	1.044	69.9	0.2	7.57	18.600	16.089	13.096	18.1	5.0	17.9	4.8	3.74	0.02	11.6	6.5	11.3
172	100.2	1.050	70.0	0.4	7.58	18.709	16.156	13.133	18.2	5.0	17.8	4.7	3.82	0.03	11.6	6.6	11.2
173	100.4	1.057	70.0	0.4	7.59	18.818	16.196	13.148	18.2	5.0	17.8	4.7	3.83	0.03	11.6	6.6	11.2
174	100.4	1.063	70.0	0.4	7.60	18.927	16.196	13.130	18.1	5.0	17.8	4.7	3.82	0.03	11.6	6.6	11.2
175	100.7	1.069	70.0	0.4	7.61	19.035	16.249	13.156	18.2	5.0	17.8	4.7	3.83	0.03	11.6	6.6	11.2
176	100.9	1.075	70.0	0.3	7.62	19.144	16.276	13.160	18.2	5.0	17.9	4.7	3.78	0.02	11.6	6.6	11.3
177	101.3	1.081	69.9	0.2	7.63	19.253	16.342	13.196	18.2	5.0	18.0	4.8	3.76	0.02	11.6	6.6	11.4
178	101.5	1.087	70.0	0.3	7.64	19.362	16.369	12.536	17.6	5.0	17.2	4.7	3.67	0.03	11.3	6.3	11.0
179	101.7	1.093	70.0	0.3	7.65	19.471	16.409	12.547	17.6	5.0	17.2	4.7	3.67	0.03	11.3	6.3	11.0
180	101.9	1.099	70.0	0.3	7.66	19.579	16.436	12.547	17.6	5.0	17.2	4.7	3.67	0.03	11.3	6.3	11.0
181	102.1	1.105	70.0	0.3	7.67	19.688	16.476	12.557	17.6	5.0	17.3	4.7	3.65	0.02	11.3	6.3	11.0
182	102.5	1.112	69.9	0.2	7.69	19.797	16.529	12.578	17.6	5.0	17.4	4.8	3.64	0.02	11.3	6.3	11.1



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	102.6	1.118	69.8	0.2	7.70	19.906	16.556	12.578	17.6	5.0	17.4	4.9	3.59	0.01	11.3	6.3	11.1
184	102.8	1.122	69.8	0.1	7.70	19.989	16.582	12.583	17.6	5.0	17.5	4.9	3.57	0.01	11.3	6.3	11.2



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Specimen D Shear Data

CU Triaxial Test

File Location
B-51 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-51
Sample Description: Brown & Red Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 33.000
PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.800	2.794	
Height (in)	5.634	5.607	
Weight (grams)	1082.20		1122.80
Moisture (%)	16.57		20.94
Dry Density (pcf)	101.94	102.88	
Saturation (%)	70.50	100.00	
Void Ratio	0.619	0.608	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 83.900
Effective Confining Stress (psi): 20.0
Corrected Peak Deviator Stress (psi): 24.820 at reading number: 187

Specimen D

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.7	0.000	63.9	0.0	6.13	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	32.0	0.006	67.1	3.1	6.14	0.107	5.113	5.107	25.1	20.0	21.9	16.8	1.30	0.61	22.5	2.6	19.4
2	49.9	0.012	69.1	5.1	6.14	0.214	8.038	8.021	28.0	20.0	22.9	14.8	1.54	0.64	24.0	4.0	18.9
3	62.7	0.018	70.3	6.4	6.15	0.321	10.118	10.085	30.0	20.0	23.6	13.6	1.74	0.63	25.0	5.0	18.6
4	72.0	0.024	71.2	7.2	6.16	0.428	11.634	11.584	31.5	20.0	24.3	12.7	1.91	0.63	25.7	5.8	18.5
5	79.2	0.030	72.2	8.2	6.16	0.535	12.815	12.746	32.7	20.0	24.5	11.7	2.09	0.65	26.3	6.4	18.1
6	85.4	0.036	72.7	8.8	6.17	0.643	13.822	13.733	33.7	20.0	24.9	11.2	2.23	0.64	26.8	6.9	18.1
7	90.5	0.042	73.1	9.1	6.18	0.750	14.654	14.544	34.5	20.0	25.4	10.8	2.34	0.63	27.2	7.3	18.1
8	94.7	0.048	73.4	9.4	6.18	0.857	15.338	15.206	35.2	20.0	25.7	10.5	2.44	0.62	27.6	7.6	18.1
9	98.1	0.055	73.6	9.6	6.19	0.964	15.888	15.735	35.7	20.0	26.1	10.3	2.52	0.61	27.8	7.9	18.2
10	100.9	0.061	73.7	9.8	6.20	1.071	16.344	16.169	36.1	20.0	26.3	10.2	2.59	0.60	28.0	8.1	18.3
11	103.4	0.067	73.9	9.9	6.20	1.178	16.760	16.563	36.5	20.0	26.6	10.0	2.65	0.60	28.2	8.3	18.3
12	105.7	0.073	74.4	10.5	6.21	1.285	17.136	16.916	36.9	20.0	26.4	9.5	2.78	0.62	28.4	8.5	18.0
13	107.7	0.079	74.4	10.5	6.22	1.392	17.458	17.215	37.2	20.0	26.7	9.5	2.82	0.61	28.6	8.6	18.1
14	109.2	0.085	74.5	10.5	6.22	1.499	17.700	17.434	37.4	20.0	26.8	9.4	2.85	0.60	28.7	8.7	18.1
15	110.6	0.091	74.5	10.6	6.23	1.606	17.928	17.640	37.6	20.0	27.0	9.4	2.88	0.60	28.8	8.8	18.2
16	111.9	0.097	74.5	10.6	6.24	1.713	18.142	17.832	37.8	20.0	27.2	9.4	2.90	0.59	28.9	8.9	18.3
17	112.9	0.103	74.5	10.6	6.24	1.820	18.303	17.970	37.9	20.0	27.3	9.4	2.92	0.59	28.9	9.0	18.4
18	113.9	0.109	74.6	10.7	6.25	1.928	18.464	18.109	38.1	20.0	27.4	9.3	2.95	0.59	29.0	9.1	18.3



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	115.0	0.115	75.0	11.1	6.26	2.035	18.652	18.273	38.2	20.0	27.2	8.9	3.06	0.61	29.1	9.1	18.0
20	115.8	0.121	75.0	11.0	6.27	2.142	18.773	18.371	38.3	20.0	27.3	8.9	3.06	0.60	29.1	9.2	18.1
21	116.4	0.127	75.0	11.0	6.27	2.249	18.880	18.456	38.4	20.0	27.4	8.9	3.07	0.60	29.2	9.2	18.2
22	117.2	0.133	74.9	11.0	6.28	2.356	19.001	18.554	38.5	20.0	27.5	9.0	3.07	0.59	29.2	9.3	18.2
23	117.7	0.139	74.9	10.9	6.29	2.463	19.095	18.625	38.6	20.0	27.6	9.0	3.07	0.59	29.3	9.3	18.3
24	118.3	0.145	75.0	11.0	6.29	2.570	19.189	18.696	38.7	20.0	27.6	8.9	3.09	0.59	29.3	9.3	18.3
25	119.1	0.151	75.3	11.3	6.30	2.677	19.323	18.806	38.8	20.0	27.5	8.6	3.17	0.60	29.4	9.4	18.1
26	119.6	0.157	75.2	11.2	6.31	2.784	19.404	18.864	38.8	20.0	27.6	8.7	3.16	0.60	29.4	9.4	18.2
27	120.2	0.163	75.1	11.2	6.31	2.891	19.498	18.934	38.9	20.0	27.7	8.8	3.16	0.59	29.4	9.5	18.2
28	120.8	0.169	75.1	11.1	6.32	2.998	19.592	19.004	39.0	20.0	27.8	8.8	3.16	0.59	29.5	9.5	18.3
29	121.4	0.175	75.1	11.1	6.33	3.105	19.686	19.074	39.0	20.0	27.9	8.8	3.16	0.58	29.5	9.5	18.4
30	121.7	0.181	75.0	11.1	6.33	3.213	19.739	19.105	39.1	20.0	28.0	8.9	3.15	0.58	29.5	9.6	18.4
31	122.3	0.187	75.1	11.1	6.34	3.320	19.833	19.175	39.1	20.0	28.0	8.8	3.18	0.58	29.5	9.6	18.4
32	122.8	0.193	75.4	11.5	6.35	3.427	19.927	19.244	39.2	20.0	27.7	8.5	3.27	0.60	29.6	9.6	18.1
33	123.4	0.199	75.3	11.4	6.36	3.534	20.021	19.314	39.3	20.0	27.9	8.6	3.25	0.59	29.6	9.7	18.2
34	123.8	0.205	75.3	11.3	6.36	3.641	20.088	19.357	39.3	20.0	28.0	8.6	3.25	0.59	29.6	9.7	18.3
35	124.2	0.211	75.2	11.3	6.37	3.748	20.142	19.387	39.3	20.0	28.1	8.7	3.23	0.58	29.6	9.7	18.4
36	124.6	0.217	75.2	11.2	6.38	3.855	20.222	19.443	39.4	20.0	28.2	8.7	3.23	0.58	29.7	9.7	18.5
37	125.0	0.223	75.1	11.2	6.38	3.962	20.276	19.473	39.4	20.0	28.2	8.8	3.22	0.57	29.7	9.7	18.5
38	125.6	0.229	75.2	11.3	6.39	4.069	20.383	19.554	39.5	20.0	28.2	8.7	3.25	0.58	29.7	9.8	18.5
39	126.2	0.235	75.5	11.5	6.40	4.176	20.477	19.622	39.6	20.0	28.0	8.4	3.33	0.59	29.8	9.8	18.2
40	126.7	0.241	75.4	11.5	6.41	4.283	20.558	19.677	39.6	20.0	28.2	8.5	3.32	0.58	29.8	9.8	18.3
41	127.1	0.247	75.4	11.4	6.41	4.391	20.625	19.719	39.7	20.0	28.2	8.5	3.31	0.58	29.8	9.9	18.4
42	127.4	0.253	75.3	11.3	6.42	4.498	20.679	19.749	39.7	20.0	28.4	8.6	3.29	0.57	29.8	9.9	18.5
43	128.0	0.259	75.2	11.3	6.43	4.605	20.773	19.816	39.8	20.0	28.5	8.7	3.28	0.57	29.9	9.9	18.6
44	128.4	0.265	75.3	11.3	6.43	4.712	20.840	19.858	39.8	20.0	28.5	8.6	3.31	0.57	29.9	9.9	18.5
45	129.1	0.271	75.5	11.6	6.44	4.819	20.947	19.938	39.9	20.0	28.3	8.4	3.38	0.58	29.9	10.0	18.3
46	129.6	0.277	75.5	11.5	6.45	4.926	21.028	19.992	39.9	20.0	28.4	8.4	3.37	0.58	30.0	10.0	18.4
47	130.0	0.283	75.4	11.4	6.46	5.033	21.095	20.033	40.0	20.0	28.6	8.5	3.35	0.57	30.0	10.0	18.5
48	130.3	0.289	75.3	11.4	6.46	5.140	21.148	20.061	40.0	20.0	28.6	8.6	3.34	0.57	30.0	10.0	18.6
49	130.7	0.295	75.3	11.3	6.47	5.247	21.215	20.102	40.1	20.0	28.8	8.6	3.32	0.56	30.0	10.1	18.7
50	131.1	0.301	75.2	11.2	6.48	5.354	21.269	20.130	40.1	20.0	28.9	8.7	3.31	0.56	30.0	10.1	18.8
51	131.6	0.307	75.3	11.3	6.49	5.461	21.350	20.184	40.1	20.0	28.8	8.6	3.34	0.56	30.0	10.1	18.7
52	132.1	0.313	75.5	11.6	6.49	5.568	21.443	20.249	40.2	20.0	28.6	8.4	3.42	0.57	30.1	10.1	18.5
53	132.5	0.319	75.5	11.5	6.50	5.676	21.497	20.277	40.2	20.0	28.7	8.4	3.40	0.57	30.1	10.1	18.6
54	132.9	0.325	75.4	11.4	6.51	5.783	21.564	20.317	40.3	20.0	28.8	8.5	3.38	0.56	30.1	10.2	18.7
55	133.2	0.331	75.3	11.4	6.51	5.890	21.618	20.345	40.3	20.0	28.9	8.6	3.37	0.56	30.1	10.2	18.7
56	133.7	0.337	75.3	11.3	6.52	5.997	21.698	20.397	40.4	20.0	29.0	8.6	3.36	0.55	30.2	10.2	18.8
57	134.0	0.343	75.2	11.2	6.53	6.104	21.752	20.424	40.4	20.0	29.2	8.7	3.34	0.55	30.2	10.2	18.9
58	134.6	0.349	75.3	11.4	6.54	6.211	21.846	20.489	40.4	20.0	29.1	8.6	3.39	0.56	30.2	10.2	18.8
59	135.2	0.355	75.5	11.5	6.54	6.318	21.940	20.554	40.5	20.0	29.0	8.4	3.44	0.56	30.2	10.3	18.7



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	135.5	0.361	75.4	11.5	6.55	6.425	21.994	20.581	40.5	20.0	29.1	8.5	3.42	0.56	30.2	10.3	18.8
61	136.2	0.367	75.3	11.4	6.56	6.532	22.101	20.657	40.6	20.0	29.2	8.6	3.41	0.55	30.3	10.3	18.9
62	136.4	0.373	75.3	11.3	6.57	6.639	22.141	20.671	40.6	20.0	29.3	8.6	3.39	0.55	30.3	10.3	19.0
63	137.0	0.379	75.2	11.3	6.57	6.746	22.235	20.735	40.7	20.0	29.4	8.7	3.39	0.54	30.3	10.4	19.1
64	137.3	0.385	75.2	11.3	6.58	6.853	22.289	20.761	40.7	20.0	29.5	8.7	3.39	0.54	30.3	10.4	19.1
65	138.1	0.391	75.5	11.5	6.59	6.961	22.410	20.850	40.8	20.0	29.3	8.4	3.48	0.55	30.4	10.4	18.8
66	138.4	0.397	75.4	11.5	6.60	7.068	22.463	20.876	40.8	20.0	29.4	8.5	3.46	0.55	30.4	10.4	18.9
67	138.8	0.403	75.3	11.4	6.61	7.175	22.530	20.914	40.9	20.0	29.5	8.6	3.44	0.54	30.4	10.5	19.0
68	139.3	0.409	75.3	11.3	6.61	7.282	22.611	20.964	40.9	20.0	29.6	8.6	3.42	0.54	30.4	10.5	19.1
69	139.6	0.415	75.2	11.2	6.62	7.389	22.665	20.990	40.9	20.0	29.7	8.7	3.40	0.53	30.5	10.5	19.2
70	140.0	0.421	75.1	11.2	6.63	7.496	22.732	21.028	41.0	20.0	29.8	8.8	3.40	0.53	30.5	10.5	19.3
71	140.5	0.427	75.1	11.2	6.64	7.603	22.812	21.078	41.0	20.0	29.8	8.8	3.40	0.53	30.5	10.5	19.3
72	141.2	0.433	75.5	11.5	6.64	7.710	22.920	21.152	41.1	20.0	29.6	8.4	3.50	0.54	30.5	10.6	19.0
73	141.6	0.439	75.3	11.4	6.65	7.817	22.987	21.190	41.1	20.0	29.8	8.6	3.47	0.54	30.6	10.6	19.2
74	141.9	0.445	75.3	11.3	6.66	7.924	23.040	21.215	41.2	20.0	29.9	8.6	3.45	0.53	30.6	10.6	19.3
75	142.3	0.451	75.2	11.2	6.67	8.031	23.107	21.252	41.2	20.0	30.0	8.7	3.43	0.53	30.6	10.6	19.4
76	142.8	0.457	75.1	11.1	6.67	8.139	23.188	21.301	41.3	20.0	30.2	8.8	3.41	0.52	30.6	10.7	19.5
77	143.2	0.463	74.9	11.0	6.68	8.246	23.255	21.338	41.3	20.0	30.3	9.0	3.38	0.51	30.6	10.7	19.6
78	143.7	0.469	75.1	11.1	6.69	8.353	23.322	21.374	41.3	20.0	30.2	8.8	3.43	0.52	30.6	10.7	19.5
79	144.3	0.475	75.2	11.3	6.70	8.460	23.430	21.447	41.4	20.0	30.1	8.7	3.47	0.53	30.7	10.7	19.4
80	144.6	0.481	75.1	11.1	6.71	8.567	23.483	21.471	41.4	20.0	30.3	8.8	3.44	0.52	30.7	10.7	19.5
81	145.0	0.487	75.1	11.1	6.71	8.674	23.550	21.508	41.5	20.0	30.4	8.8	3.43	0.52	30.7	10.8	19.6
82	145.5	0.493	75.0	11.0	6.72	8.781	23.617	21.544	41.5	20.0	30.5	8.9	3.41	0.51	30.7	10.8	19.7
83	145.8	0.499	74.9	10.9	6.73	8.888	23.671	21.567	41.5	20.0	30.6	9.0	3.39	0.51	30.7	10.8	19.8
84	146.2	0.505	75.1	11.1	6.74	8.995	23.738	21.603	41.6	20.0	30.5	8.8	3.44	0.51	30.8	10.8	19.7
85	146.9	0.511	75.2	11.3	6.75	9.102	23.845	21.675	41.6	20.0	30.4	8.7	3.49	0.52	30.8	10.8	19.5
86	147.1	0.517	75.1	11.2	6.75	9.209	23.886	21.686	41.6	20.0	30.5	8.8	3.47	0.52	30.8	10.8	19.6
87	147.5	0.523	75.1	11.1	6.76	9.316	23.953	21.721	41.7	20.0	30.6	8.8	3.45	0.51	30.8	10.9	19.7
88	147.8	0.529	75.0	11.1	6.77	9.424	24.007	21.744	41.7	20.0	30.6	8.9	3.45	0.51	30.8	10.9	19.8
89	148.3	0.535	74.9	11.0	6.78	9.531	24.074	21.779	41.7	20.0	30.7	9.0	3.43	0.50	30.8	10.9	19.9
90	148.8	0.541	74.8	10.9	6.79	9.638	24.154	21.826	41.8	20.0	30.9	9.1	3.41	0.50	30.9	10.9	20.0
91	149.4	0.547	75.1	11.1	6.79	9.745	24.261	21.897	41.9	20.0	30.7	8.8	3.47	0.51	30.9	10.9	19.8
92	150.0	0.553	75.2	11.2	6.80	9.852	24.355	21.956	41.9	20.0	30.7	8.7	3.52	0.51	30.9	11.0	19.7
93	150.5	0.559	75.1	11.1	6.81	9.959	24.436	22.002	42.0	20.0	30.8	8.8	3.50	0.51	31.0	11.0	19.8
94	151.0	0.565	75.0	11.1	6.82	10.066	24.516	22.049	42.0	20.0	30.9	8.9	3.48	0.50	31.0	11.0	19.9
95	151.3	0.571	75.0	11.0	6.83	10.173	24.570	22.071	42.0	20.0	31.0	8.9	3.47	0.50	31.0	11.0	20.0
96	151.7	0.577	74.9	10.9	6.83	10.280	24.637	22.104	42.1	20.0	31.1	9.0	3.45	0.50	31.0	11.1	20.1
97	152.1	0.583	74.8	10.9	6.84	10.387	24.704	22.138	42.1	20.0	31.2	9.1	3.44	0.49	31.0	11.1	20.2
98	152.8	0.589	75.0	11.1	6.85	10.494	24.812	22.208	42.2	20.0	31.1	8.9	3.50	0.50	31.1	11.1	20.0
99	153.2	0.595	75.1	11.2	6.86	10.601	24.879	22.241	42.2	20.0	31.0	8.8	3.54	0.50	31.1	11.1	19.9
100	153.7	0.601	75.1	11.1	6.87	10.709	24.959	22.286	42.2	20.0	31.1	8.8	3.52	0.50	31.1	11.1	20.0



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	153.9	0.607	75.0	11.0	6.87	10.816	25.000	22.296	42.3	20.0	31.2	8.9	3.50	0.49	31.1	11.1	20.1
102	154.4	0.613	74.9	10.9	6.88	10.923	25.080	22.341	42.3	20.0	31.4	9.0	3.48	0.49	31.1	11.2	20.2
103	154.8	0.619	74.8	10.9	6.89	11.030	25.147	22.373	42.3	20.0	31.4	9.1	3.47	0.49	31.1	11.2	20.2
104	155.2	0.625	74.8	10.9	6.90	11.137	25.201	22.394	42.4	20.0	31.4	9.1	3.47	0.49	31.2	11.2	20.2
105	156.2	0.631	75.1	11.2	6.91	11.244	25.362	22.510	42.5	20.0	31.3	8.8	3.57	0.50	31.2	11.3	20.0
106	156.5	0.637	75.0	11.1	6.92	11.351	25.416	22.531	42.5	20.0	31.4	8.9	3.53	0.49	31.2	11.3	20.2
107	156.9	0.643	74.9	11.0	6.92	11.458	25.483	22.563	42.5	20.0	31.5	9.0	3.52	0.49	31.2	11.3	20.3
108	157.4	0.649	74.8	10.9	6.93	11.565	25.563	22.607	42.6	20.0	31.7	9.1	3.50	0.48	31.3	11.3	20.4
109	157.7	0.655	74.8	10.8	6.94	11.672	25.617	22.627	42.6	20.0	31.8	9.1	3.48	0.48	31.3	11.3	20.4
110	158.2	0.661	74.7	10.7	6.95	11.779	25.697	22.670	42.6	20.0	31.9	9.2	3.46	0.47	31.3	11.3	20.5
111	158.8	0.667	74.7	10.8	6.96	11.887	25.791	22.726	42.7	20.0	31.9	9.2	3.48	0.47	31.3	11.4	20.5
112	159.3	0.673	75.0	11.1	6.97	11.994	25.872	22.769	42.7	20.0	31.7	8.9	3.56	0.49	31.3	11.4	20.3
113	159.8	0.679	74.9	11.0	6.98	12.101	25.952	22.812	42.8	20.0	31.8	9.0	3.54	0.48	31.4	11.4	20.4
114	160.0	0.685	74.8	10.9	6.98	12.208	25.993	22.819	42.8	20.0	31.9	9.1	3.52	0.48	31.4	11.4	20.5
115	160.4	0.691	74.8	10.8	6.99	12.315	26.046	22.839	42.8	20.0	32.0	9.1	3.50	0.47	31.4	11.4	20.6
116	160.7	0.697	74.7	10.7	7.00	12.422	26.100	22.858	42.8	20.0	32.1	9.2	3.48	0.47	31.4	11.4	20.6
117	161.0	0.703	74.6	10.7	7.01	12.529	26.154	22.877	42.8	20.0	32.1	9.3	3.47	0.47	31.4	11.4	20.7
118	161.4	0.709	74.6	10.7	7.02	12.636	26.221	22.907	42.9	20.0	32.2	9.3	3.48	0.47	31.4	11.5	20.7
119	162.1	0.715	75.0	11.0	7.03	12.743	26.328	22.973	42.9	20.0	31.9	8.9	3.57	0.48	31.4	11.5	20.4
120	162.3	0.721	74.9	10.9	7.04	12.850	26.368	22.980	42.9	20.0	32.0	9.0	3.55	0.48	31.4	11.5	20.5
121	162.8	0.727	74.8	10.9	7.04	12.957	26.449	23.022	43.0	20.0	32.1	9.1	3.53	0.47	31.5	11.5	20.6
122	163.1	0.733	74.7	10.8	7.05	13.064	26.502	23.040	43.0	20.0	32.2	9.2	3.51	0.47	31.5	11.5	20.7
123	163.6	0.739	74.6	10.7	7.06	13.172	26.583	23.082	43.0	20.0	32.3	9.3	3.49	0.46	31.5	11.5	20.8
124	164.0	0.745	74.5	10.6	7.07	13.279	26.637	23.100	43.1	20.0	32.5	9.4	3.46	0.46	31.5	11.5	20.9
125	164.6	0.751	74.9	10.9	7.08	13.386	26.744	23.164	43.1	20.0	32.2	9.0	3.57	0.47	31.5	11.6	20.6
126	165.1	0.757	74.8	10.9	7.09	13.493	26.825	23.205	43.2	20.0	32.3	9.1	3.55	0.47	31.6	11.6	20.7
127	165.5	0.763	74.7	10.8	7.10	13.600	26.892	23.234	43.2	20.0	32.4	9.2	3.53	0.46	31.6	11.6	20.8
128	165.9	0.769	74.6	10.7	7.11	13.707	26.945	23.252	43.2	20.0	32.5	9.3	3.51	0.46	31.6	11.6	20.9
129	166.5	0.775	74.6	10.6	7.11	13.814	27.053	23.316	43.3	20.0	32.6	9.3	3.50	0.46	31.6	11.7	21.0
130	166.9	0.781	74.5	10.5	7.12	13.921	27.120	23.344	43.3	20.0	32.8	9.4	3.48	0.45	31.6	11.7	21.1
131	167.2	0.787	74.4	10.5	7.13	14.028	27.160	23.350	43.3	20.0	32.8	9.5	3.46	0.45	31.6	11.7	21.2
132	167.7	0.793	74.6	10.7	7.14	14.135	27.240	23.390	43.3	20.0	32.6	9.3	3.53	0.46	31.7	11.7	20.9
133	168.2	0.799	74.7	10.8	7.15	14.242	27.321	23.430	43.4	20.0	32.6	9.2	3.55	0.46	31.7	11.7	20.9
134	168.7	0.805	74.6	10.7	7.16	14.349	27.402	23.470	43.4	20.0	32.7	9.3	3.54	0.46	31.7	11.7	21.0
135	168.9	0.811	74.6	10.6	7.17	14.457	27.442	23.475	43.4	20.0	32.8	9.3	3.52	0.45	31.7	11.7	21.1
136	169.3	0.817	74.5	10.5	7.18	14.564	27.509	23.503	43.5	20.0	32.9	9.4	3.50	0.45	31.7	11.8	21.2
137	169.6	0.823	74.4	10.5	7.19	14.671	27.563	23.519	43.5	20.0	33.0	9.5	3.48	0.44	31.7	11.8	21.3
138	169.9	0.829	74.3	10.4	7.19	14.778	27.603	23.524	43.5	20.0	33.1	9.6	3.46	0.44	31.7	11.8	21.3
139	170.7	0.835	74.5	10.5	7.20	14.885	27.737	23.608	43.6	20.0	33.0	9.4	3.51	0.45	31.8	11.8	21.2
140	171.2	0.841	74.6	10.7	7.21	14.992	27.818	23.647	43.6	20.0	32.9	9.3	3.56	0.45	31.8	11.8	21.1
141	171.5	0.847	74.5	10.6	7.22	15.099	27.871	23.663	43.6	20.0	33.0	9.4	3.52	0.45	31.8	11.8	21.2



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142	172.1	0.853	74.5	10.5	7.23	15.206	27.965	23.713	43.7	20.0	33.1	9.4	3.52	0.44	31.8	11.9	21.3
143	172.6	0.859	74.4	10.5	7.24	15.313	28.046	23.751	43.7	20.0	33.2	9.5	3.50	0.44	31.8	11.9	21.4
144	173.0	0.865	74.2	10.3	7.25	15.420	28.113	23.778	43.7	20.0	33.4	9.7	3.46	0.43	31.8	11.9	21.5
145	173.8	0.871	74.6	10.6	7.26	15.527	28.233	23.850	43.8	20.0	33.2	9.3	3.56	0.45	31.9	11.9	21.3
146	174.2	0.877	74.5	10.6	7.27	15.635	28.301	23.876	43.8	20.0	33.2	9.4	3.55	0.44	31.9	11.9	21.3
147	174.4	0.883	74.4	10.5	7.28	15.742	28.341	23.880	43.8	20.0	33.4	9.5	3.52	0.44	31.9	11.9	21.4
148	174.7	0.889	74.3	10.4	7.29	15.849	28.381	23.883	43.8	20.0	33.5	9.6	3.49	0.43	31.9	11.9	21.5
149	175.1	0.895	74.2	10.3	7.30	15.956	28.448	23.909	43.9	20.0	33.6	9.7	3.47	0.43	31.9	12.0	21.6
150	175.5	0.901	74.1	10.2	7.30	16.063	28.515	23.935	43.9	20.0	33.7	9.8	3.45	0.43	31.9	12.0	21.7
151	175.9	0.907	74.0	10.1	7.31	16.170	28.582	23.961	43.9	20.0	33.8	9.9	3.43	0.42	31.9	12.0	21.8
152	176.6	0.913	74.4	10.5	7.32	16.277	28.690	24.020	44.0	20.0	33.5	9.5	3.53	0.44	32.0	12.0	21.5
153	176.7	0.919	74.3	10.4	7.33	16.384	28.717	24.012	44.0	20.0	33.6	9.6	3.51	0.43	32.0	12.0	21.6
154	177.2	0.925	74.2	10.3	7.34	16.491	28.797	24.048	44.0	20.0	33.7	9.7	3.49	0.43	32.0	12.0	21.7
155	177.5	0.931	74.2	10.2	7.35	16.598	28.851	24.062	44.0	20.0	33.8	9.7	3.47	0.42	32.0	12.0	21.8
156	178.0	0.937	74.1	10.1	7.36	16.705	28.931	24.098	44.1	20.0	33.9	9.8	3.46	0.42	32.0	12.0	21.9
157	178.3	0.943	74.0	10.1	7.37	16.812	28.972	24.101	44.1	20.0	34.0	9.9	3.44	0.42	32.0	12.1	21.9
158	178.7	0.949	73.9	10.0	7.38	16.920	29.039	24.125	44.1	20.0	34.1	10.0	3.42	0.41	32.0	12.1	22.0
159	179.3	0.955	74.2	10.2	7.39	17.027	29.133	24.172	44.1	20.0	33.9	9.7	3.48	0.42	32.0	12.1	21.8
160	179.9	0.961	74.2	10.3	7.40	17.134	29.240	24.230	44.2	20.0	33.9	9.7	3.50	0.42	32.1	12.1	21.8
161	180.4	0.967	74.1	10.2	7.41	17.241	29.320	24.265	44.2	20.0	34.0	9.8	3.48	0.42	32.1	12.1	21.9
162	180.6	0.973	74.0	10.1	7.42	17.348	29.347	24.256	44.2	20.0	34.1	9.9	3.46	0.42	32.1	12.1	22.0
163	181.1	0.979	74.0	10.0	7.43	17.455	29.428	24.291	44.2	20.0	34.2	9.9	3.44	0.41	32.1	12.1	22.1
164	181.4	0.985	73.8	9.9	7.44	17.562	29.481	24.304	44.3	20.0	34.4	10.1	3.41	0.41	32.1	12.2	22.2
165	182.2	0.991	74.1	10.1	7.45	17.669	29.602	24.372	44.3	20.0	34.2	9.8	3.48	0.42	32.1	12.2	22.0
166	182.4	0.997	74.1	10.1	7.46	17.776	29.642	24.373	44.3	20.0	34.2	9.8	3.48	0.42	32.1	12.2	22.0
167	182.7	1.003	74.0	10.1	7.47	17.883	29.696	24.385	44.3	20.0	34.3	9.9	3.46	0.41	32.1	12.2	22.1
168	183.1	1.009	73.9	10.0	7.48	17.990	29.763	24.409	44.4	20.0	34.4	10.0	3.45	0.41	32.2	12.2	22.2
169	183.6	1.015	73.8	9.9	7.49	18.097	29.844	24.443	44.4	20.0	34.5	10.1	3.43	0.41	32.2	12.2	22.3
170	184.0	1.021	73.8	9.8	7.50	18.205	29.911	24.466	44.4	20.0	34.6	10.1	3.41	0.40	32.2	12.2	22.4
171	184.4	1.027	73.7	9.7	7.51	18.312	29.965	24.478	44.4	20.0	34.7	10.2	3.40	0.40	32.2	12.2	22.5
172	184.9	1.033	73.9	10.0	7.52	18.419	30.045	24.511	44.5	20.0	34.5	10.0	3.46	0.41	32.2	12.3	22.2
173	185.4	1.039	74.0	10.0	7.53	18.526	30.139	24.555	44.5	20.0	34.5	9.9	3.47	0.41	32.2	12.3	22.2
174	185.9	1.045	73.9	9.9	7.54	18.633	30.206	24.578	44.5	20.0	34.6	10.0	3.45	0.40	32.2	12.3	22.3
175	186.4	1.051	73.8	9.9	7.55	18.740	30.287	24.611	44.6	20.0	34.7	10.1	3.44	0.40	32.3	12.3	22.4
176	186.7	1.057	73.8	9.8	7.56	18.847	30.340	24.622	44.6	20.0	34.8	10.1	3.43	0.40	32.3	12.3	22.4
177	187.0	1.063	73.6	9.7	7.57	18.954	30.394	24.633	44.6	20.0	34.9	10.3	3.40	0.39	32.3	12.3	22.6
178	187.5	1.069	73.6	9.6	7.58	19.061	30.474	24.666	44.6	20.0	35.0	10.3	3.39	0.39	32.3	12.3	22.7
179	187.9	1.075	73.8	9.9	7.59	19.168	30.542	24.687	44.6	20.0	34.8	10.1	3.44	0.40	32.3	12.3	22.4
180	188.4	1.081	73.8	9.9	7.60	19.275	30.622	24.720	44.7	20.0	34.8	10.1	3.46	0.40	32.3	12.4	22.4
181	188.7	1.087	73.8	9.8	7.61	19.383	30.662	24.719	44.7	20.0	34.9	10.1	3.44	0.40	32.3	12.4	22.5
182	189.1	1.093	73.7	9.8	7.62	19.490	30.729	24.740	44.7	20.0	34.9	10.2	3.43	0.40	32.3	12.4	22.5



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	189.4	1.099	73.6	9.7	7.63	19.597	30.783	24.751	44.7	20.0	35.0	10.3	3.40	0.39	32.3	12.4	22.7
184	189.6	1.105	73.4	9.5	7.64	19.704	30.823	24.750	44.7	20.0	35.2	10.5	3.37	0.38	32.3	12.4	22.8
185	190.2	1.111	73.8	9.9	7.65	19.811	30.917	24.792	44.7	20.0	34.9	10.1	3.46	0.40	32.4	12.4	22.5
186	190.6	1.117	73.8	9.8	7.66	19.918	30.984	24.813	44.8	20.0	35.0	10.1	3.45	0.40	32.4	12.4	22.5
187	190.9	1.122	73.7	9.7	7.66	20.000	31.025	24.820	44.8	20.0	35.0	10.2	3.43	0.39	32.4	12.4	22.6



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Specimen C Shear Data

CU Triaxial Test

File Location
B-51 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-51
Sample Description: Brown & Red Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 33.000
PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.810	2.721	
Height (in)	5.650	5.608	
Weight (grams)	1079.80		1149.41
Moisture (%)	15.65		23.10
Dry Density (pcf)	101.51	109.04	
Saturation (%)	65.86	100.00	
Void Ratio	0.626	0.517	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 67.300
Effective Confining Stress (psi): 10.0
Corrected Peak Deviator Stress (psi): 16.450 at reading number: 186

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	20.0	0.001	57.3	0.0	5.82	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	35.0	0.006	59.0	1.6	5.82	0.099	2.573	2.570	12.5	10.0	10.9	8.3	1.31	0.63	11.3	1.3	9.6
2	45.3	0.012	59.9	2.5	5.83	0.206	4.355	4.346	14.3	10.0	11.8	7.4	1.58	0.58	12.1	2.2	9.6
3	52.0	0.018	60.4	3.1	5.84	0.313	5.501	5.484	15.4	10.0	12.4	6.9	1.79	0.56	12.7	2.7	9.7
4	57.3	0.024	60.7	3.4	5.84	0.420	6.406	6.379	16.3	10.0	13.0	6.6	1.97	0.53	13.2	3.2	9.8
5	61.5	0.030	61.0	3.7	5.85	0.527	7.142	7.104	17.1	10.0	13.4	6.3	2.13	0.52	13.5	3.6	9.8
6	65.2	0.036	61.2	3.9	5.85	0.634	7.764	7.715	17.7	10.0	13.8	6.1	2.27	0.50	13.8	3.9	10.0
7	68.5	0.042	61.3	4.0	5.86	0.741	8.330	8.268	18.2	10.0	14.2	6.0	2.38	0.48	14.1	4.1	10.1
8	71.2	0.048	61.5	4.1	5.87	0.848	8.796	8.722	18.7	10.0	14.6	5.8	2.49	0.47	14.3	4.4	10.2
9	73.7	0.055	61.5	4.2	5.87	0.955	9.235	9.147	19.1	10.0	14.9	5.8	2.59	0.46	14.5	4.6	10.3
10	75.7	0.061	61.6	4.2	5.88	1.062	9.574	9.473	19.4	10.0	15.2	5.7	2.65	0.45	14.7	4.7	10.5
11	77.6	0.067	61.6	4.3	5.89	1.170	9.900	9.784	19.7	10.0	15.5	5.7	2.72	0.44	14.9	4.9	10.6
12	79.1	0.073	61.7	4.3	5.89	1.277	10.154	10.025	20.0	10.0	15.7	5.6	2.78	0.43	15.0	5.0	10.7
13	80.5	0.079	61.7	4.4	5.90	1.384	10.395	10.251	20.2	10.0	15.9	5.6	2.83	0.43	15.1	5.1	10.7
14	81.6	0.085	61.7	4.4	5.90	1.491	10.593	10.435	20.4	10.0	16.0	5.6	2.86	0.42	15.2	5.2	10.8
15	82.8	0.091	61.7	4.4	5.91	1.598	10.791	10.618	20.6	10.0	16.2	5.6	2.91	0.41	15.3	5.3	10.9
16	83.6	0.097	61.7	4.4	5.92	1.705	10.932	10.746	20.7	10.0	16.3	5.6	2.93	0.41	15.3	5.4	10.9
17	84.6	0.103	61.7	4.4	5.92	1.812	11.102	10.901	20.9	10.0	16.5	5.6	2.96	0.40	15.4	5.5	11.0
18	85.2	0.109	61.7	4.4	5.93	1.919	11.215	11.000	21.0	10.0	16.6	5.6	2.98	0.40	15.5	5.5	11.1



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CONSULTING ENGINEERS

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	86.1	0.115	61.7	4.4	5.94	2.026	11.357	11.127	21.1	10.0	16.7	5.6	3.00	0.40	15.5	5.6	11.1
20	86.6	0.121	61.7	4.4	5.94	2.133	11.456	11.211	21.2	10.0	16.8	5.6	3.01	0.39	15.6	5.6	11.2
21	87.4	0.127	61.8	4.5	5.95	2.240	11.583	11.323	21.3	10.0	16.8	5.5	3.07	0.40	15.6	5.7	11.1
22	87.9	0.133	61.9	4.5	5.96	2.347	11.668	11.394	21.4	10.0	16.8	5.4	3.09	0.40	15.7	5.7	11.1
23	88.4	0.139	61.9	4.5	5.96	2.454	11.767	11.478	21.4	10.0	16.9	5.4	3.11	0.39	15.7	5.7	11.2
24	89.0	0.145	61.9	4.6	5.97	2.562	11.866	11.562	21.5	10.0	17.0	5.4	3.14	0.39	15.7	5.8	11.2
25	89.5	0.151	61.9	4.6	5.98	2.669	11.951	11.632	21.6	10.0	17.0	5.4	3.15	0.39	15.8	5.8	11.2
26	89.8	0.157	61.9	4.5	5.98	2.776	12.007	11.674	21.6	10.0	17.1	5.4	3.15	0.39	15.8	5.8	11.3
27	90.3	0.163	61.9	4.5	5.99	2.883	12.092	11.744	21.7	10.0	17.2	5.4	3.16	0.39	15.8	5.9	11.3
28	90.7	0.169	61.9	4.5	6.00	2.990	12.149	11.785	21.8	10.0	17.2	5.4	3.17	0.38	15.9	5.9	11.3
29	91.1	0.175	61.9	4.5	6.00	3.097	12.219	11.841	21.8	10.0	17.3	5.4	3.18	0.38	15.9	5.9	11.4
30	91.3	0.181	61.9	4.5	6.01	3.204	12.262	11.869	21.8	10.0	17.3	5.4	3.18	0.38	15.9	5.9	11.4
31	91.7	0.187	61.9	4.5	6.02	3.311	12.318	11.911	21.9	10.0	17.4	5.4	3.19	0.38	15.9	6.0	11.4
32	92.1	0.193	61.9	4.6	6.02	3.418	12.389	11.966	21.9	10.0	17.4	5.4	3.22	0.38	15.9	6.0	11.4
33	92.4	0.199	61.9	4.6	6.03	3.525	12.446	12.007	22.0	10.0	17.4	5.4	3.24	0.38	16.0	6.0	11.4
34	92.7	0.205	61.9	4.6	6.04	3.632	12.502	12.048	22.0	10.0	17.4	5.4	3.25	0.38	16.0	6.0	11.4
35	93.1	0.211	61.9	4.6	6.04	3.739	12.573	12.103	22.1	10.0	17.5	5.4	3.26	0.38	16.0	6.1	11.4
36	93.4	0.217	61.9	4.6	6.05	3.846	12.615	12.130	22.1	10.0	17.5	5.4	3.26	0.38	16.0	6.1	11.4
37	93.7	0.223	61.9	4.6	6.06	3.953	12.672	12.171	22.1	10.0	17.5	5.4	3.27	0.38	16.1	6.1	11.4
38	94.0	0.229	61.9	4.6	6.06	4.061	12.714	12.198	22.2	10.0	17.6	5.4	3.28	0.38	16.1	6.1	11.5
39	94.3	0.235	61.9	4.6	6.07	4.168	12.771	12.239	22.2	10.0	17.6	5.4	3.28	0.38	16.1	6.1	11.5
40	94.4	0.241	61.9	4.6	6.08	4.275	12.785	12.239	22.2	10.0	17.6	5.4	3.28	0.38	16.1	6.1	11.5
41	94.7	0.247	61.9	4.6	6.08	4.382	12.842	12.279	22.2	10.0	17.6	5.4	3.29	0.38	16.1	6.1	11.5
42	94.9	0.253	61.9	4.6	6.09	4.489	12.870	12.292	22.3	10.0	17.7	5.4	3.28	0.37	16.1	6.1	11.5
43	95.3	0.259	61.9	4.6	6.10	4.596	12.941	12.346	22.3	10.0	17.7	5.4	3.29	0.37	16.1	6.2	11.6
44	95.5	0.265	61.9	4.5	6.10	4.703	12.983	12.373	22.3	10.0	17.8	5.4	3.27	0.37	16.2	6.2	11.6
45	95.8	0.271	61.8	4.5	6.11	4.810	13.040	12.413	22.4	10.0	17.9	5.5	3.26	0.36	16.2	6.2	11.7
46	96.3	0.277	61.9	4.6	6.12	4.917	13.111	12.466	22.4	10.0	17.9	5.4	3.31	0.37	16.2	6.2	11.6
47	96.8	0.283	61.9	4.6	6.12	5.024	13.195	12.532	22.5	10.0	17.9	5.4	3.32	0.36	16.2	6.3	11.7
48	97.1	0.289	61.9	4.6	6.13	5.131	13.252	12.572	22.5	10.0	18.0	5.4	3.33	0.36	16.3	6.3	11.7
49	97.4	0.295	61.9	4.6	6.14	5.238	13.309	12.611	22.6	10.0	18.0	5.4	3.33	0.36	16.3	6.3	11.7
50	97.7	0.301	61.9	4.6	6.15	5.345	13.351	12.637	22.6	10.0	18.0	5.4	3.34	0.36	16.3	6.3	11.7
51	98.1	0.307	61.9	4.6	6.15	5.452	13.422	12.690	22.7	10.0	18.1	5.4	3.35	0.36	16.3	6.3	11.7
52	98.5	0.313	61.9	4.6	6.16	5.560	13.492	12.742	22.7	10.0	18.1	5.4	3.36	0.36	16.3	6.4	11.8
53	98.6	0.319	61.9	4.5	6.17	5.667	13.521	12.755	22.7	10.0	18.2	5.4	3.34	0.35	16.3	6.4	11.8
54	98.9	0.325	61.9	4.5	6.17	5.774	13.563	12.780	22.7	10.0	18.2	5.4	3.35	0.35	16.4	6.4	11.8
55	99.2	0.331	61.8	4.5	6.18	5.881	13.620	12.819	22.8	10.0	18.3	5.5	3.34	0.35	16.4	6.4	11.9
56	99.5	0.337	61.8	4.5	6.19	5.988	13.662	12.844	22.8	10.0	18.3	5.5	3.34	0.35	16.4	6.4	11.9
57	100.0	0.343	61.8	4.4	6.19	6.095	13.747	12.909	22.9	10.0	18.4	5.5	3.34	0.34	16.4	6.5	12.0
58	100.3	0.349	61.8	4.4	6.20	6.202	13.804	12.947	22.9	10.0	18.5	5.5	3.34	0.34	16.4	6.5	12.0
59	100.5	0.355	61.7	4.4	6.21	6.309	13.832	12.959	22.9	10.0	18.5	5.6	3.33	0.34	16.4	6.5	12.0



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	100.9	0.361	61.8	4.5	6.22	6.416	13.903	13.011	23.0	10.0	18.5	5.5	3.37	0.34	16.5	6.5	12.0
61	101.2	0.367	61.9	4.5	6.22	6.523	13.959	13.049	23.0	10.0	18.5	5.4	3.40	0.35	16.5	6.5	12.0
62	101.5	0.373	61.9	4.5	6.23	6.630	14.016	13.086	23.1	10.0	18.5	5.4	3.40	0.35	16.5	6.5	12.0
63	101.9	0.379	61.9	4.5	6.24	6.737	14.072	13.124	23.1	10.0	18.6	5.4	3.41	0.34	16.5	6.6	12.0
64	102.1	0.385	61.8	4.5	6.24	6.844	14.115	13.149	23.1	10.0	18.6	5.5	3.40	0.34	16.5	6.6	12.1
65	102.4	0.391	61.8	4.5	6.25	6.951	14.171	13.186	23.2	10.0	18.7	5.5	3.41	0.34	16.6	6.6	12.1
66	102.6	0.397	61.7	4.4	6.26	7.059	14.200	13.197	23.2	10.0	18.8	5.6	3.37	0.33	16.6	6.6	12.2
67	102.8	0.403	61.7	4.4	6.27	7.166	14.228	13.208	23.2	10.0	18.8	5.6	3.36	0.33	16.6	6.6	12.2
68	103.0	0.409	61.7	4.4	6.27	7.273	14.270	13.233	23.2	10.0	18.8	5.6	3.36	0.33	16.6	6.6	12.2
69	103.4	0.415	61.7	4.4	6.28	7.380	14.341	13.283	23.2	10.0	18.8	5.6	3.39	0.33	16.6	6.6	12.2
70	103.7	0.421	61.7	4.4	6.29	7.487	14.398	13.320	23.3	10.0	18.9	5.6	3.39	0.33	16.6	6.7	12.2
71	104.0	0.427	61.7	4.4	6.29	7.594	14.440	13.344	23.3	10.0	18.9	5.6	3.40	0.33	16.6	6.7	12.2
72	104.2	0.433	61.7	4.4	6.30	7.701	14.483	13.367	23.3	10.0	18.9	5.6	3.40	0.33	16.6	6.7	12.2
73	104.6	0.439	61.7	4.4	6.31	7.808	14.539	13.404	23.4	10.0	19.0	5.6	3.39	0.33	16.7	6.7	12.3
74	104.8	0.445	61.7	4.4	6.32	7.915	14.582	13.427	23.4	10.0	19.0	5.6	3.40	0.32	16.7	6.7	12.3
75	105.1	0.451	61.7	4.4	6.32	8.022	14.638	13.464	23.4	10.0	19.1	5.6	3.40	0.32	16.7	6.7	12.3
76	105.5	0.457	61.7	4.3	6.33	8.129	14.695	13.500	23.5	10.0	19.1	5.6	3.39	0.32	16.7	6.8	12.4
77	105.8	0.463	61.6	4.3	6.34	8.236	14.751	13.536	23.5	10.0	19.2	5.7	3.38	0.32	16.7	6.8	12.5
78	106.1	0.469	61.6	4.3	6.35	8.343	14.794	13.559	23.5	10.0	19.2	5.7	3.38	0.32	16.7	6.8	12.5
79	106.4	0.475	61.6	4.3	6.35	8.450	14.850	13.595	23.6	10.0	19.3	5.7	3.39	0.31	16.8	6.8	12.5
80	106.7	0.481	61.6	4.2	6.36	8.558	14.907	13.631	23.6	10.0	19.4	5.7	3.38	0.31	16.8	6.8	12.5
81	107.1	0.487	61.7	4.3	6.37	8.665	14.978	13.680	23.6	10.0	19.3	5.6	3.42	0.32	16.8	6.8	12.5
82	107.5	0.493	61.7	4.3	6.38	8.772	15.048	13.728	23.7	10.0	19.4	5.6	3.43	0.31	16.8	6.9	12.5
83	107.8	0.499	61.7	4.3	6.38	8.879	15.091	13.751	23.7	10.0	19.4	5.6	3.44	0.31	16.8	6.9	12.5
84	108.2	0.505	61.7	4.3	6.39	8.986	15.161	13.799	23.8	10.0	19.4	5.6	3.44	0.31	16.9	6.9	12.5
85	108.5	0.511	61.7	4.3	6.40	9.093	15.218	13.834	23.8	10.0	19.5	5.6	3.45	0.31	16.9	6.9	12.6
86	108.9	0.517	61.6	4.3	6.41	9.200	15.289	13.882	23.8	10.0	19.6	5.7	3.44	0.31	16.9	6.9	12.6
87	109.2	0.523	61.6	4.2	6.41	9.307	15.331	13.904	23.9	10.0	19.6	5.7	3.43	0.30	16.9	7.0	12.7
88	109.6	0.529	61.7	4.3	6.42	9.414	15.402	13.952	23.9	10.0	19.6	5.6	3.47	0.31	16.9	7.0	12.6
89	110.0	0.535	61.6	4.3	6.43	9.521	15.473	13.999	24.0	10.0	19.7	5.7	3.46	0.31	17.0	7.0	12.7
90	110.3	0.541	61.7	4.3	6.44	9.628	15.529	14.034	24.0	10.0	19.7	5.6	3.49	0.31	17.0	7.0	12.7
91	110.7	0.547	61.6	4.3	6.44	9.735	15.586	14.068	24.0	10.0	19.8	5.7	3.47	0.30	17.0	7.0	12.7
92	111.0	0.553	61.6	4.3	6.45	9.842	15.642	14.103	24.1	10.0	19.8	5.7	3.48	0.30	17.0	7.1	12.7
93	111.3	0.559	61.6	4.3	6.46	9.949	15.699	14.137	24.1	10.0	19.8	5.7	3.49	0.30	17.0	7.1	12.8
94	111.6	0.565	61.6	4.2	6.47	10.057	15.741	14.158	24.1	10.0	19.9	5.7	3.47	0.30	17.0	7.1	12.8
95	111.8	0.571	61.6	4.2	6.47	10.164	15.784	14.180	24.1	10.0	19.9	5.7	3.48	0.30	17.1	7.1	12.8
96	112.1	0.577	61.5	4.2	6.48	10.271	15.826	14.201	24.2	10.0	20.0	5.8	3.46	0.30	17.1	7.1	12.9
97	112.6	0.589	61.5	4.2	6.50	10.485	15.911	14.243	24.2	10.0	20.0	5.8	3.47	0.29	17.1	7.1	12.9
98	113.0	0.595	61.6	4.2	6.51	10.592	15.982	14.289	24.3	10.0	20.0	5.7	3.50	0.30	17.1	7.1	12.9
99	113.1	0.601	61.6	4.2	6.51	10.699	16.010	14.297	24.3	10.0	20.0	5.7	3.50	0.30	17.1	7.1	12.9
100	113.5	0.607	61.6	4.2	6.52	10.806	16.067	14.330	24.3	10.0	20.1	5.7	3.50	0.30	17.1	7.2	12.9



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	113.7	0.613	61.6	4.2	6.53	10.913	16.109	14.351	24.3	10.0	20.1	5.7	3.51	0.30	17.1	7.2	12.9
102	113.8	0.619	61.5	4.2	6.54	11.020	16.123	14.346	24.3	10.0	20.1	5.8	3.49	0.29	17.1	7.2	12.9
103	114.4	0.625	61.5	4.2	6.55	11.127	16.222	14.417	24.4	10.0	20.2	5.8	3.50	0.29	17.2	7.2	13.0
104	114.4	0.631	61.5	4.2	6.55	11.234	16.236	14.412	24.4	10.0	20.2	5.8	3.48	0.29	17.2	7.2	13.0
105	114.8	0.637	61.5	4.2	6.56	11.341	16.293	14.445	24.4	10.0	20.3	5.8	3.49	0.29	17.2	7.2	13.0
106	115.0	0.643	61.5	4.2	6.57	11.449	16.335	14.465	24.4	10.0	20.3	5.8	3.49	0.29	17.2	7.2	13.0
107	115.3	0.649	61.5	4.2	6.58	11.556	16.378	14.485	24.5	10.0	20.3	5.8	3.49	0.29	17.2	7.2	13.1
108	115.7	0.655	61.5	4.2	6.58	11.663	16.449	14.530	24.5	10.0	20.3	5.8	3.50	0.29	17.2	7.3	13.1
109	116.1	0.661	61.5	4.2	6.59	11.770	16.519	14.575	24.5	10.0	20.4	5.8	3.51	0.29	17.3	7.3	13.1
110	116.3	0.667	61.5	4.2	6.60	11.877	16.548	14.582	24.5	10.0	20.4	5.8	3.51	0.29	17.3	7.3	13.1
111	116.7	0.673	61.5	4.1	6.61	11.984	16.618	14.627	24.6	10.0	20.5	5.8	3.50	0.28	17.3	7.3	13.2
112	116.8	0.679	61.4	4.1	6.62	12.091	16.647	14.634	24.6	10.0	20.5	5.9	3.48	0.28	17.3	7.3	13.2
113	117.2	0.685	61.4	4.1	6.62	12.198	16.703	14.666	24.6	10.0	20.6	5.9	3.49	0.28	17.3	7.3	13.2
114	117.4	0.691	61.4	4.0	6.63	12.305	16.746	14.685	24.7	10.0	20.6	5.9	3.48	0.27	17.3	7.3	13.3
115	117.7	0.697	61.5	4.1	6.64	12.412	16.802	14.717	24.7	10.0	20.6	5.8	3.52	0.28	17.3	7.4	13.2
116	118.3	0.703	61.5	4.1	6.65	12.519	16.901	14.785	24.8	10.0	20.6	5.8	3.53	0.28	17.4	7.4	13.2
117	118.5	0.709	61.5	4.1	6.66	12.626	16.929	14.792	24.8	10.0	20.6	5.8	3.53	0.28	17.4	7.4	13.2
118	119.0	0.715	61.4	4.1	6.67	12.733	17.014	14.848	24.8	10.0	20.7	5.9	3.52	0.27	17.4	7.4	13.3
119	119.0	0.721	61.4	4.1	6.67	12.840	17.014	14.830	24.8	10.0	20.7	5.9	3.52	0.27	17.4	7.4	13.3
120	119.5	0.727	61.4	4.1	6.68	12.948	17.099	14.885	24.9	10.0	20.8	5.9	3.53	0.27	17.4	7.4	13.3
121	119.9	0.733	61.4	4.0	6.69	13.055	17.170	14.928	24.9	10.0	20.9	5.9	3.52	0.27	17.4	7.5	13.4
122	120.0	0.739	61.3	4.0	6.70	13.162	17.184	14.922	24.9	10.0	20.9	6.0	3.50	0.27	17.4	7.5	13.4
123	120.2	0.745	61.3	4.0	6.71	13.269	17.227	14.941	24.9	10.0	21.0	6.0	3.49	0.26	17.4	7.5	13.5
124	120.4	0.751	61.3	4.0	6.71	13.376	17.269	14.959	24.9	10.0	21.0	6.0	3.49	0.26	17.4	7.5	13.5
125	120.9	0.757	61.3	4.0	6.72	13.483	17.340	15.002	25.0	10.0	21.0	6.0	3.51	0.27	17.5	7.5	13.5
126	121.3	0.763	61.3	4.0	6.73	13.590	17.410	15.044	25.0	10.0	21.0	6.0	3.52	0.27	17.5	7.5	13.5
127	121.4	0.769	61.3	4.0	6.74	13.697	17.439	15.050	25.0	10.0	21.0	6.0	3.52	0.27	17.5	7.5	13.5
128	121.7	0.775	61.3	4.0	6.75	13.804	17.481	15.068	25.0	10.0	21.0	6.0	3.52	0.27	17.5	7.5	13.5
129	122.2	0.781	61.3	4.0	6.76	13.911	17.566	15.122	25.1	10.0	21.1	6.0	3.52	0.26	17.5	7.6	13.6
130	122.3	0.787	61.2	3.9	6.77	14.018	17.580	15.116	25.1	10.0	21.2	6.1	3.50	0.26	17.5	7.6	13.6
131	122.6	0.793	61.2	3.9	6.77	14.125	17.637	15.145	25.1	10.0	21.2	6.1	3.50	0.26	17.5	7.6	13.6
132	122.8	0.799	61.2	3.9	6.78	14.232	17.679	15.163	25.1	10.0	21.3	6.1	3.49	0.26	17.5	7.6	13.7
133	123.2	0.805	61.3	4.0	6.79	14.339	17.736	15.192	25.2	10.0	21.2	6.0	3.53	0.26	17.6	7.6	13.6
134	123.6	0.811	61.2	3.9	6.80	14.447	17.806	15.234	25.2	10.0	21.3	6.1	3.52	0.26	17.6	7.6	13.7
135	123.9	0.817	61.2	3.9	6.81	14.554	17.863	15.263	25.2	10.0	21.3	6.1	3.52	0.26	17.6	7.6	13.7
136	124.1	0.823	61.2	3.9	6.82	14.661	17.891	15.268	25.2	10.0	21.3	6.1	3.52	0.26	17.6	7.6	13.7
137	124.6	0.829	61.2	3.9	6.82	14.768	17.976	15.321	25.3	10.0	21.4	6.1	3.53	0.26	17.6	7.7	13.7
138	124.8	0.835	61.2	3.9	6.83	14.875	18.019	15.338	25.3	10.0	21.4	6.1	3.52	0.25	17.6	7.7	13.8
139	125.1	0.841	61.2	3.9	6.84	14.982	18.075	15.367	25.3	10.0	21.5	6.1	3.52	0.25	17.6	7.7	13.8
140	125.4	0.847	61.2	3.8	6.85	15.089	18.118	15.384	25.3	10.0	21.5	6.1	3.51	0.25	17.7	7.7	13.8
141	125.6	0.853	61.1	3.8	6.86	15.196	18.146	15.388	25.4	10.0	21.6	6.2	3.49	0.25	17.7	7.7	13.9



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	126.0	0.859	61.1	3.8	6.87	15.303	18.231	15.441	25.4	10.0	21.6	6.2	3.50	0.25	17.7	7.7	13.9
143	126.4	0.865	61.2	3.9	6.88	15.410	18.287	15.469	25.4	10.0	21.6	6.1	3.54	0.25	17.7	7.7	13.8
144	126.7	0.871	61.2	3.9	6.89	15.517	18.344	15.497	25.5	10.0	21.6	6.1	3.54	0.25	17.7	7.7	13.8
145	126.9	0.877	61.2	3.8	6.89	15.624	18.386	15.514	25.5	10.0	21.6	6.1	3.53	0.25	17.7	7.8	13.9
146	127.3	0.883	61.1	3.8	6.90	15.731	18.443	15.542	25.5	10.0	21.7	6.2	3.52	0.24	17.7	7.8	13.9
147	127.6	0.889	61.1	3.7	6.91	15.838	18.499	15.569	25.5	10.0	21.8	6.2	3.50	0.24	17.7	7.8	14.0
148	127.9	0.895	61.1	3.7	6.92	15.946	18.556	15.597	25.6	10.0	21.8	6.2	3.51	0.24	17.8	7.8	14.0
149	128.3	0.901	61.1	3.7	6.93	16.053	18.613	15.625	25.6	10.0	21.8	6.2	3.51	0.24	17.8	7.8	14.0
150	128.7	0.907	61.1	3.8	6.94	16.160	18.683	15.664	25.6	10.0	21.8	6.2	3.54	0.24	17.8	7.8	14.0
151	129.1	0.913	61.1	3.8	6.95	16.267	18.754	15.703	25.7	10.0	21.9	6.2	3.54	0.24	17.8	7.9	14.0
152	129.3	0.919	61.1	3.8	6.96	16.374	18.782	15.707	25.7	10.0	21.9	6.2	3.54	0.24	17.8	7.9	14.0
153	129.5	0.925	61.1	3.8	6.96	16.481	18.825	15.722	25.7	10.0	21.9	6.2	3.55	0.24	17.8	7.9	14.0
154	129.7	0.931	61.1	3.7	6.97	16.588	18.867	15.738	25.7	10.0	22.0	6.2	3.53	0.24	17.8	7.9	14.1
155	130.2	0.937	61.1	3.7	6.98	16.695	18.938	15.776	25.7	10.0	22.0	6.2	3.54	0.24	17.9	7.9	14.1
156	130.5	0.943	61.0	3.7	6.99	16.802	18.995	15.803	25.8	10.0	22.1	6.3	3.53	0.23	17.9	7.9	14.2
157	130.7	0.949	61.0	3.7	7.00	16.909	19.037	15.818	25.8	10.0	22.1	6.3	3.51	0.23	17.9	7.9	14.2
158	131.0	0.955	61.0	3.7	7.01	17.016	19.079	15.833	25.8	10.0	22.1	6.3	3.51	0.23	17.9	7.9	14.2
159	131.3	0.961	61.1	3.7	7.02	17.123	19.136	15.859	25.8	10.0	22.1	6.2	3.55	0.24	17.9	7.9	14.1
160	131.6	0.967	61.1	3.7	7.03	17.230	19.178	15.874	25.8	10.0	22.1	6.2	3.55	0.24	17.9	7.9	14.2
161	131.8	0.973	61.0	3.7	7.04	17.337	19.221	15.888	25.9	10.0	22.1	6.3	3.54	0.23	17.9	7.9	14.2
162	132.2	0.979	61.0	3.7	7.05	17.445	19.292	15.926	25.9	10.0	22.2	6.3	3.55	0.23	17.9	8.0	14.2
163	132.5	0.985	61.0	3.7	7.06	17.552	19.334	15.941	25.9	10.0	22.2	6.3	3.55	0.23	17.9	8.0	14.2
164	132.5	0.991	61.0	3.6	7.06	17.659	19.348	15.932	25.9	10.0	22.3	6.3	3.51	0.23	17.9	8.0	14.3
165	133.0	0.997	60.9	3.6	7.07	17.766	19.419	15.969	25.9	10.0	22.3	6.4	3.50	0.22	17.9	8.0	14.4
166	133.4	1.003	61.0	3.7	7.08	17.873	19.490	16.006	26.0	10.0	22.3	6.3	3.54	0.23	18.0	8.0	14.3
167	133.9	1.009	61.0	3.7	7.09	17.980	19.574	16.055	26.0	10.0	22.4	6.3	3.55	0.23	18.0	8.0	14.3
168	134.2	1.015	61.0	3.7	7.10	18.087	19.631	16.080	26.0	10.0	22.4	6.3	3.55	0.23	18.0	8.0	14.3
169	134.5	1.021	61.0	3.6	7.11	18.194	19.688	16.106	26.1	10.0	22.4	6.3	3.54	0.23	18.0	8.1	14.4
170	134.8	1.027	61.0	3.6	7.12	18.301	19.744	16.131	26.1	10.0	22.5	6.3	3.54	0.22	18.0	8.1	14.4
171	135.2	1.033	60.9	3.6	7.13	18.408	19.801	16.156	26.1	10.0	22.5	6.4	3.53	0.22	18.0	8.1	14.5
172	135.4	1.039	60.9	3.5	7.14	18.515	19.843	16.169	26.1	10.0	22.6	6.4	3.52	0.22	18.0	8.1	14.5
173	135.8	1.045	60.9	3.5	7.15	18.622	19.914	16.205	26.2	10.0	22.6	6.4	3.52	0.22	18.1	8.1	14.5
174	136.1	1.051	60.8	3.5	7.16	18.729	19.956	16.219	26.2	10.0	22.7	6.5	3.51	0.22	18.1	8.1	14.6
175	136.3	1.057	60.9	3.6	7.17	18.837	19.999	16.232	26.2	10.0	22.6	6.4	3.54	0.22	18.1	8.1	14.5
176	136.6	1.063	60.9	3.6	7.18	18.944	20.041	16.245	26.2	10.0	22.6	6.4	3.55	0.22	18.1	8.1	14.5
177	136.9	1.069	60.9	3.5	7.19	19.051	20.098	16.269	26.2	10.0	22.7	6.4	3.53	0.22	18.1	8.1	14.6
178	137.1	1.075	60.9	3.5	7.20	19.158	20.126	16.270	26.2	10.0	22.7	6.4	3.53	0.22	18.1	8.1	14.6
179	137.2	1.081	60.8	3.5	7.20	19.265	20.154	16.272	26.2	10.0	22.7	6.5	3.52	0.22	18.1	8.1	14.6
180	137.6	1.087	60.8	3.5	7.21	19.372	20.211	16.296	26.3	10.0	22.8	6.5	3.52	0.22	18.1	8.1	14.6
181	137.8	1.093	60.8	3.5	7.22	19.479	20.253	16.308	26.3	10.0	22.8	6.5	3.51	0.21	18.1	8.2	14.7
182	138.3	1.099	60.8	3.5	7.23	19.586	20.338	16.355	26.3	10.0	22.9	6.5	3.52	0.21	18.1	8.2	14.7



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	138.6	1.105	60.8	3.4	7.24	19.693	20.395	16.378	26.3	10.0	22.9	6.5	3.50	0.21	18.2	8.2	14.7
184	138.9	1.111	60.8	3.5	7.25	19.800	20.437	16.391	26.4	10.0	22.9	6.5	3.52	0.21	18.2	8.2	14.7
185	139.2	1.117	60.8	3.5	7.26	19.907	20.494	16.414	26.4	10.0	22.9	6.5	3.52	0.21	18.2	8.2	14.7
186	139.6	1.123	60.8	3.5	7.27	20.006	20.565	16.450	26.4	10.0	23.0	6.5	3.53	0.21	18.2	8.2	14.7

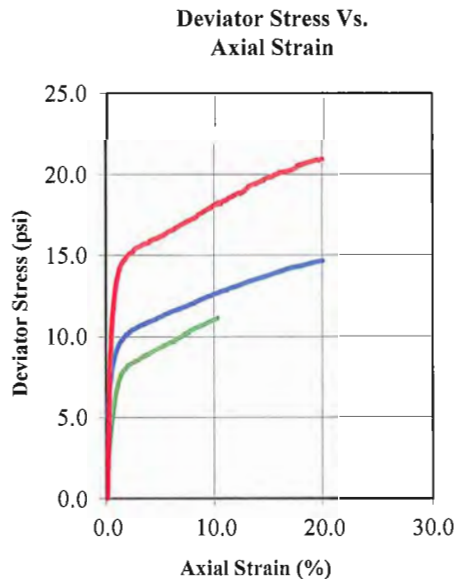


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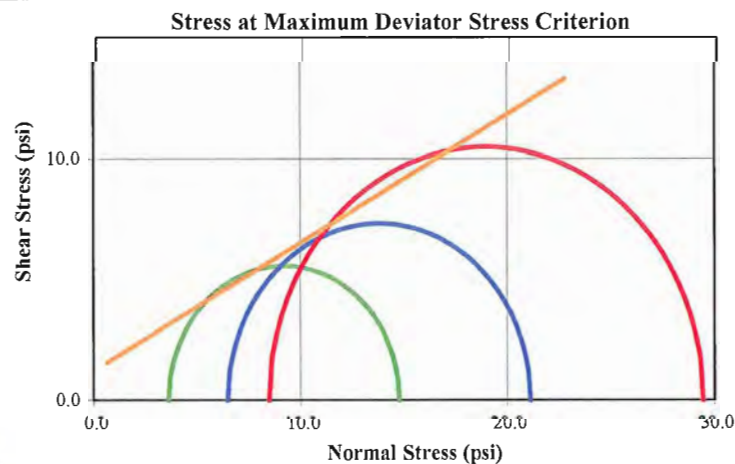
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0' to 41.0'
PROJECT LOCATION : B-54	SAMPLE TYPE : Remolded
BORING NUMBER : B-54	DESCRIPTION : Red, Brown & Gray Silty Sand
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	18.6	18.1	17.8	
Dry Density (pcf)	100.2	99.5	100.0	
Saturation (%)	75.71	72.62	72.02	
Void Ratio	0.647	0.659	0.650	
Diameter (in)	2.801	2.800	2.803	
Height (in)	5.616	5.645	5.643	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	46	46	46	
Plastic Limit	30	30	30	
After Consolidation				
B-Value	1.00	0.95	0.95	
Water Content (%)	25.1	24.6	23.4	
Dry Density (pcf)	100.76	99.78	100.13	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.642	0.658	0.652	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	51.2	63.7	72.4	
Rate of Strain	0.002	0.0020	0.002	

Maximum Deviator Stress Criterion		After Shear	A	B	C	D
C (psi)	3.0	σ'_1 at Failure (psi)	14.76	21.13	29.44	
ϕ (deg)	14.6	σ'_3 at Failure (psi)	3.62	6.47	8.46	
C' (psi)	1.2					
ϕ' (deg)	28.0					



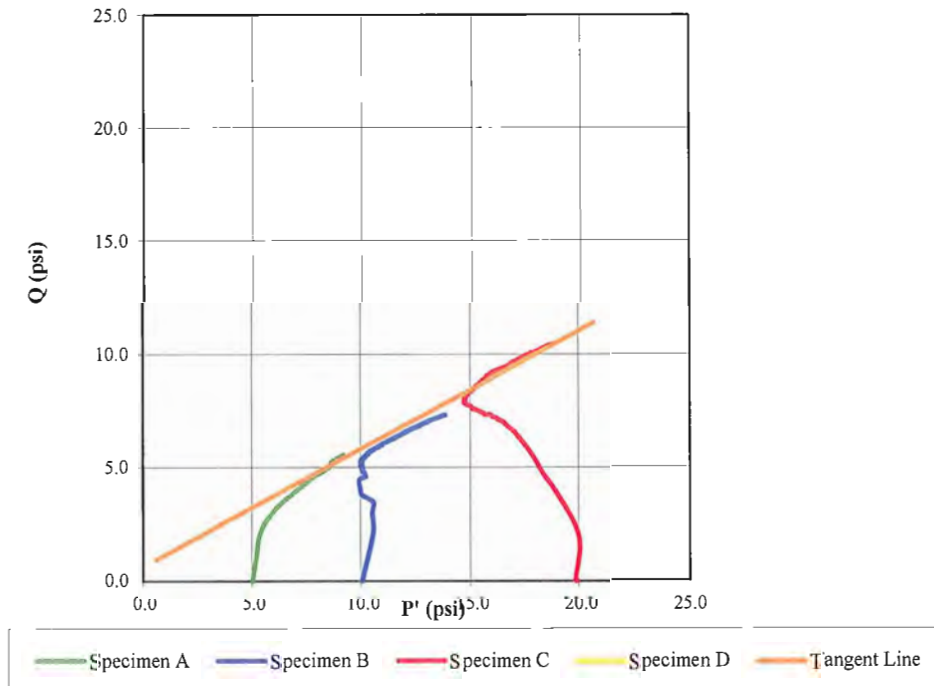
Tested By: SH
Date: 12-11-12

Approved By: SKB
Date: 12-11-12

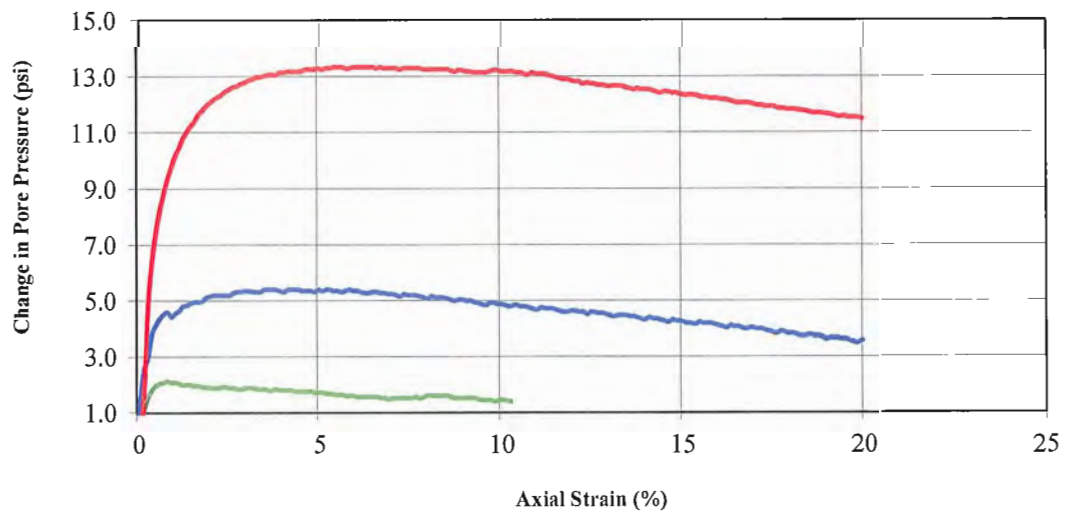


Consolidated Undrained Triaxial Test (ASTM D4767)

Stress Paths (Effective)
($a = 0.6$ $\alpha = 27.5$)



Change in Pore Pressure vs. Axial Strain





File Location
B-54 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-54
Sample Description: Red, Brown & Gray Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 46.000
PL: 30.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.801	2.798	
Height (in)	5.616	5.601	
Weight (grams)	1079.80		1139.05
Moisture (%)	18.59		25.09
Dry Density (pcf)	100.22	100.76	
Saturation (%)	75.71	100.00	
Void Ratio	0.647	0.642	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 56.200
Effective Confining Stress (psi): 5.0
Corrected Peak Deviator Stress (psi): 11.140 at reading number: 97

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	4.1	0.018	51.2	0.0	6.15	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	11.2	0.024	51.7	0.5	6.15	0.107	1.143	1.141	6.2	5.0	5.7	4.5	1.25	0.42	5.6	0.6	5.1
2	20.7	0.030	52.3	1.1	6.16	0.214	2.688	2.683	7.7	5.0	6.6	3.9	1.69	0.42	6.4	1.3	5.2
3	26.9	0.036	52.7	1.6	6.17	0.321	3.697	3.685	8.7	5.0	7.1	3.5	2.06	0.43	6.9	1.8	5.3
4	31.2	0.042	53.0	1.8	6.17	0.429	4.409	4.390	9.4	5.0	7.6	3.2	2.36	0.41	7.2	2.2	5.4
5	35.0	0.048	53.1	2.0	6.18	0.536	5.014	4.987	10.0	5.0	8.0	3.1	2.63	0.39	7.5	2.5	5.6
6	38.6	0.054	53.2	2.1	6.19	0.643	5.605	5.569	10.6	5.0	8.5	3.0	2.87	0.37	7.8	2.8	5.8
7	41.5	0.060	53.3	2.1	6.19	0.750	6.076	6.030	11.1	5.0	9.0	2.9	3.05	0.35	8.0	3.0	6.0
8	44.1	0.066	53.3	2.1	6.20	0.857	6.506	6.450	11.5	5.0	9.3	2.9	3.23	0.33	8.3	3.2	6.1
9	46.4	0.072	53.3	2.1	6.21	0.964	6.869	6.803	11.8	5.0	9.7	2.9	3.32	0.31	8.4	3.4	6.3
10	48.3	0.078	53.3	2.1	6.21	1.071	7.191	7.114	12.1	5.0	10.1	2.9	3.42	0.29	8.6	3.6	6.5
11	49.9	0.084	53.2	2.1	6.22	1.179	7.447	7.359	12.4	5.0	10.3	3.0	3.47	0.28	8.7	3.7	6.7
12	51.1	0.090	53.2	2.0	6.23	1.286	7.648	7.550	12.6	5.0	10.6	3.0	3.50	0.27	8.8	3.8	6.8
13	52.1	0.096	53.2	2.0	6.23	1.393	7.810	7.701	12.7	5.0	10.7	3.0	3.55	0.26	8.9	3.9	6.9
14	53.0	0.102	53.2	2.0	6.24	1.500	7.944	7.825	12.9	5.0	10.8	3.0	3.59	0.26	8.9	3.9	6.9
15	53.6	0.108	53.1	2.0	6.25	1.607	8.052	7.922	13.0	5.0	11.0	3.1	3.59	0.25	9.0	4.0	7.0
16	54.1	0.114	53.1	2.0	6.25	1.714	8.132	7.993	13.0	5.0	11.1	3.1	3.61	0.25	9.0	4.0	7.1
17	54.6	0.120	53.1	1.9	6.26	1.821	8.213	8.063	13.1	5.0	11.2	3.1	3.60	0.24	9.1	4.0	7.1
18	55.4	0.126	53.1	1.9	6.27	1.928	8.334	8.173	13.2	5.0	11.3	3.1	3.64	0.24	9.1	4.1	7.2



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	55.7	0.132	53.1	1.9	6.27	2.036	8.388	8.217	13.2	5.0	11.4	3.1	3.62	0.23	9.1	4.1	7.2
20	56.1	0.138	53.1	1.9	6.28	2.143	8.455	8.274	13.3	5.0	11.4	3.1	3.64	0.23	9.2	4.1	7.3
21	56.4	0.144	53.1	1.9	6.29	2.250	8.509	8.317	13.3	5.0	11.5	3.1	3.65	0.23	9.2	4.2	7.3
22	56.9	0.150	53.1	1.9	6.30	2.357	8.589	8.387	13.4	5.0	11.5	3.1	3.71	0.23	9.2	4.2	7.3
23	57.2	0.156	53.1	1.9	6.30	2.464	8.630	8.417	13.4	5.0	11.5	3.1	3.72	0.23	9.2	4.2	7.3
24	57.5	0.162	53.1	1.9	6.31	2.571	8.683	8.460	13.5	5.0	11.6	3.1	3.70	0.22	9.3	4.2	7.4
25	57.8	0.168	53.1	1.9	6.32	2.678	8.737	8.503	13.5	5.0	11.6	3.1	3.71	0.22	9.3	4.3	7.4
26	58.2	0.174	53.0	1.8	6.32	2.786	8.791	8.546	13.6	5.0	11.7	3.2	3.69	0.22	9.3	4.3	7.5
27	58.3	0.180	53.0	1.8	6.33	2.893	8.804	8.550	13.6	5.0	11.7	3.2	3.69	0.22	9.3	4.3	7.5
28	58.7	0.186	53.1	1.9	6.34	3.000	8.872	8.606	13.6	5.0	11.7	3.1	3.74	0.22	9.3	4.3	7.4
29	58.9	0.192	53.1	1.9	6.34	3.107	8.912	8.635	13.7	5.0	11.8	3.1	3.75	0.22	9.3	4.3	7.5
30	59.3	0.198	53.1	1.9	6.35	3.214	8.979	8.691	13.7	5.0	11.8	3.1	3.77	0.22	9.4	4.3	7.5
31	59.7	0.204	53.0	1.8	6.36	3.321	9.046	8.746	13.8	5.0	11.9	3.2	3.75	0.21	9.4	4.4	7.6
32	60.1	0.210	53.0	1.8	6.36	3.428	9.100	8.788	13.8	5.0	12.0	3.2	3.76	0.21	9.4	4.4	7.6
33	60.3	0.216	53.0	1.8	6.37	3.536	9.141	8.817	13.8	5.0	12.0	3.2	3.77	0.21	9.4	4.4	7.6
34	60.6	0.222	53.0	1.8	6.38	3.643	9.194	8.859	13.9	5.0	12.1	3.2	3.75	0.20	9.5	4.4	7.6
35	61.0	0.228	53.0	1.8	6.39	3.750	9.248	8.901	13.9	5.0	12.1	3.2	3.77	0.20	9.5	4.5	7.7
36	61.1	0.234	53.0	1.8	6.39	3.857	9.275	8.917	13.9	5.0	12.1	3.2	3.81	0.21	9.5	4.5	7.6
37	61.6	0.240	53.0	1.8	6.40	3.964	9.342	8.972	14.0	5.0	12.2	3.2	3.79	0.20	9.5	4.5	7.7
38	62.0	0.246	53.0	1.8	6.41	4.071	9.409	9.026	14.1	5.0	12.2	3.2	3.80	0.20	9.5	4.5	7.7
39	62.3	0.252	53.0	1.8	6.41	4.178	9.463	9.068	14.1	5.0	12.3	3.2	3.82	0.20	9.6	4.5	7.8
40	62.5	0.258	53.0	1.8	6.42	4.286	9.503	9.096	14.1	5.0	12.3	3.2	3.83	0.20	9.6	4.5	7.8
41	63.0	0.264	52.9	1.8	6.43	4.393	9.571	9.150	14.2	5.0	12.4	3.3	3.81	0.19	9.6	4.6	7.8
42	63.3	0.270	52.9	1.8	6.44	4.500	9.624	9.191	14.2	5.0	12.5	3.3	3.82	0.19	9.6	4.6	7.9
43	63.5	0.276	52.9	1.8	6.44	4.607	9.665	9.219	14.2	5.0	12.5	3.3	3.83	0.19	9.6	4.6	7.9
44	64.0	0.282	52.9	1.8	6.45	4.714	9.732	9.273	14.3	5.0	12.5	3.3	3.85	0.19	9.7	4.6	7.9
45	64.1	0.288	52.9	1.8	6.46	4.821	9.759	9.288	14.3	5.0	12.5	3.3	3.85	0.19	9.7	4.6	7.9
46	64.4	0.294	52.9	1.7	6.47	4.928	9.799	9.316	14.3	5.0	12.6	3.3	3.82	0.19	9.7	4.7	8.0
47	64.8	0.300	52.9	1.7	6.47	5.035	9.866	9.370	14.4	5.0	12.7	3.3	3.84	0.18	9.7	4.7	8.0
48	64.9	0.306	52.9	1.7	6.48	5.143	9.893	9.384	14.4	5.0	12.7	3.3	3.84	0.18	9.7	4.7	8.0
49	65.3	0.312	52.9	1.7	6.49	5.250	9.947	9.425	14.5	5.0	12.8	3.3	3.82	0.18	9.7	4.7	8.1
50	65.6	0.318	52.9	1.7	6.49	5.357	10.001	9.465	14.5	5.0	12.8	3.3	3.83	0.18	9.8	4.7	8.1
51	65.8	0.324	52.8	1.6	6.50	5.464	10.028	9.480	14.5	5.0	12.9	3.4	3.80	0.17	9.8	4.7	8.1
52	66.1	0.330	52.8	1.6	6.51	5.571	10.081	9.520	14.5	5.0	12.9	3.4	3.82	0.17	9.8	4.8	8.1
53	66.5	0.336	52.8	1.6	6.52	5.678	10.149	9.572	14.6	5.0	13.0	3.4	3.83	0.17	9.8	4.8	8.2
54	66.8	0.342	52.8	1.6	6.52	5.785	10.202	9.612	14.6	5.0	13.0	3.4	3.81	0.17	9.8	4.8	8.2
55	67.2	0.348	52.8	1.6	6.53	5.893	10.256	9.652	14.7	5.0	13.1	3.4	3.82	0.17	9.9	4.8	8.2
56	67.3	0.354	52.8	1.6	6.54	6.000	10.283	9.666	14.7	5.0	13.1	3.4	3.83	0.17	9.9	4.8	8.3
57	67.5	0.360	52.7	1.6	6.55	6.107	10.310	9.680	14.7	5.0	13.1	3.5	3.80	0.16	9.9	4.8	8.3
58	67.8	0.366	52.7	1.6	6.55	6.214	10.364	9.720	14.7	5.0	13.2	3.5	3.81	0.16	9.9	4.9	8.3
59	68.2	0.372	52.7	1.6	6.56	6.321	10.431	9.772	14.8	5.0	13.2	3.5	3.82	0.16	9.9	4.9	8.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	68.7	0.378	52.7	1.6	6.57	6.428	10.498	9.823	14.9	5.0	13.3	3.5	3.84	0.16	9.9	4.9	8.4
61	69.2	0.384	52.7	1.6	6.58	6.535	10.592	9.900	14.9	5.0	13.4	3.5	3.86	0.16	10.0	4.9	8.4
62	69.5	0.390	52.7	1.6	6.58	6.643	10.633	9.926	15.0	5.0	13.4	3.5	3.87	0.16	10.0	5.0	8.4
63	69.7	0.396	52.7	1.5	6.59	6.750	10.673	9.953	15.0	5.0	13.5	3.5	3.84	0.15	10.0	5.0	8.5
64	70.1	0.402	52.7	1.5	6.60	6.857	10.727	9.991	15.0	5.0	13.5	3.5	3.85	0.15	10.0	5.0	8.5
65	70.4	0.408	52.7	1.5	6.61	6.964	10.780	10.030	15.1	5.0	13.6	3.5	3.83	0.15	10.0	5.0	8.6
66	70.7	0.414	52.7	1.5	6.61	7.071	10.834	10.068	15.1	5.0	13.6	3.5	3.88	0.15	10.1	5.0	8.5
67	71.2	0.420	52.7	1.5	6.62	7.178	10.915	10.131	15.2	5.0	13.6	3.5	3.89	0.15	10.1	5.1	8.6
68	71.6	0.426	52.7	1.5	6.63	7.285	10.969	10.170	15.2	5.0	13.7	3.5	3.91	0.15	10.1	5.1	8.6
69	71.8	0.432	52.7	1.5	6.64	7.393	11.009	10.195	15.2	5.0	13.7	3.5	3.91	0.15	10.1	5.1	8.6
70	72.1	0.438	52.7	1.5	6.65	7.500	11.063	10.233	15.3	5.0	13.7	3.5	3.92	0.15	10.1	5.1	8.6
71	72.5	0.444	52.7	1.5	6.65	7.607	11.116	10.271	15.3	5.0	13.8	3.5	3.93	0.15	10.2	5.1	8.6
72	73.0	0.450	52.7	1.6	6.66	7.714	11.197	10.333	15.4	5.0	13.8	3.5	3.99	0.15	10.2	5.2	8.6
73	73.3	0.456	52.7	1.5	6.67	7.821	11.251	10.371	15.4	5.0	13.9	3.5	3.96	0.15	10.2	5.2	8.7
74	73.5	0.462	52.7	1.6	6.68	7.928	11.291	10.396	15.4	5.0	13.9	3.5	4.00	0.15	10.2	5.2	8.7
75	73.9	0.468	52.8	1.6	6.68	8.035	11.345	10.433	15.5	5.0	13.9	3.4	4.05	0.15	10.2	5.2	8.6
76	74.4	0.474	52.8	1.6	6.69	8.142	11.426	10.495	15.5	5.0	13.9	3.4	4.07	0.15	10.3	5.2	8.7
77	74.5	0.480	52.8	1.6	6.70	8.250	11.453	10.508	15.5	5.0	13.9	3.4	4.07	0.15	10.3	5.3	8.7
78	74.9	0.486	52.8	1.6	6.71	8.357	11.506	10.545	15.6	5.0	14.0	3.4	4.08	0.15	10.3	5.3	8.7
79	75.0	0.492	52.8	1.6	6.72	8.464	11.533	10.557	15.6	5.0	14.0	3.4	4.09	0.15	10.3	5.3	8.7
80	75.4	0.498	52.8	1.6	6.72	8.571	11.600	10.606	15.6	5.0	14.0	3.4	4.10	0.15	10.3	5.3	8.7
81	75.8	0.505	52.7	1.6	6.73	8.678	11.654	10.643	15.7	5.0	14.1	3.5	4.08	0.15	10.3	5.3	8.8
82	76.0	0.511	52.7	1.5	6.74	8.785	11.694	10.667	15.7	5.0	14.2	3.5	4.05	0.14	10.4	5.3	8.8
83	76.3	0.517	52.7	1.5	6.75	8.892	11.735	10.691	15.7	5.0	14.2	3.5	4.05	0.14	10.4	5.3	8.8
84	76.6	0.523	52.7	1.5	6.75	9.000	11.789	10.728	15.8	5.0	14.2	3.5	4.06	0.14	10.4	5.4	8.9
85	76.8	0.529	52.7	1.5	6.76	9.107	11.815	10.739	15.8	5.0	14.2	3.5	4.07	0.14	10.4	5.4	8.9
86	77.2	0.535	52.7	1.5	6.77	9.214	11.883	10.788	15.8	5.0	14.3	3.5	4.08	0.14	10.4	5.4	8.9
87	77.5	0.541	52.7	1.5	6.78	9.321	11.936	10.824	15.9	5.0	14.3	3.5	4.09	0.14	10.4	5.4	8.9
88	77.7	0.547	52.7	1.5	6.79	9.428	11.977	10.848	15.9	5.0	14.4	3.5	4.06	0.14	10.5	5.4	9.0
89	78.2	0.553	52.6	1.4	6.79	9.535	12.044	10.896	15.9	5.0	14.5	3.6	4.04	0.13	10.5	5.4	9.0
90	78.3	0.559	52.6	1.4	6.80	9.642	12.071	10.907	15.9	5.0	14.5	3.6	4.05	0.13	10.5	5.5	9.0
91	78.7	0.565	52.6	1.4	6.81	9.750	12.138	10.955	16.0	5.0	14.5	3.6	4.06	0.13	10.5	5.5	9.1
92	79.1	0.571	52.6	1.4	6.82	9.857	12.192	10.990	16.0	5.0	14.6	3.6	4.03	0.13	10.5	5.5	9.1
93	79.3	0.577	52.6	1.4	6.83	9.964	12.232	11.013	16.0	5.0	14.6	3.6	4.08	0.13	10.5	5.5	9.1
94	79.6	0.583	52.6	1.4	6.84	10.071	12.286	11.049	16.1	5.0	14.6	3.6	4.09	0.13	10.6	5.5	9.1
95	79.9	0.589	52.6	1.4	6.84	10.178	12.326	11.072	16.1	5.0	14.7	3.6	4.09	0.13	10.6	5.5	9.1
96	80.3	0.595	52.6	1.4	6.85	10.285	12.393	11.119	16.1	5.0	14.7	3.6	4.07	0.13	10.6	5.6	9.2
97	80.5	0.596	52.6	1.4	6.85	10.310	12.420	11.140	16.2	5.0	14.8	3.6	4.08	0.13	10.6	5.6	9.2



Florence & Hutcheson

CONSULTING ENGINEERS

Specimen B Shear Data

CU Triaxial Test

File Location
B-54 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: 1-85/I-385 Interchange
Client:
Sample Location: B-54
Sample Description: Red, Brown & Gray Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 46.000
PL: 30.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.800	2.806	
Height (in)	5.645	5.605	
Weight (grams)	1072.90		1131.89
Moisture (%)	18.15		24.65
Dry Density (pcf)	99.52	99.78	
Saturation (%)	72.62	100.00	
Void Ratio	0.659	0.658	

Test Data

Rate of Strain: 0
Cell Pressure (psi): 73.700
Effective Confining Stress (psi): 10.0
Corrected Peak Deviator Stress (psi): 14.662 at reading number: 186

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	1.8	0.000	63.7	0.0	6.18	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	27.8	0.006	65.3	1.6	6.19	0.107	4.208	4.204	14.3	10.0	12.6	8.4	1.50	0.38	12.1	2.1	10.5
2	39.6	0.012	66.2	2.6	6.20	0.214	6.105	6.092	16.1	10.0	13.6	7.5	1.82	0.42	13.1	3.0	10.5
3	45.1	0.018	66.6	3.0	6.20	0.321	7.000	6.978	17.0	10.0	14.0	7.1	1.99	0.43	13.5	3.5	10.6
4	49.0	0.024	67.4	3.8	6.21	0.428	7.628	7.595	17.6	10.0	13.9	6.3	2.21	0.50	13.8	3.8	10.1
5	52.1	0.030	67.8	4.1	6.22	0.535	8.136	8.092	18.1	10.0	14.0	5.9	2.36	0.51	14.1	4.0	10.0
6	54.6	0.036	68.0	4.3	6.22	0.642	8.536	8.481	18.5	10.0	14.2	5.7	2.49	0.51	14.3	4.2	9.9
7	56.4	0.042	68.2	4.5	6.23	0.749	8.830	8.764	18.8	10.0	14.3	5.5	2.58	0.51	14.4	4.4	9.9
8	58.2	0.048	68.2	4.6	6.24	0.856	9.111	9.033	19.1	10.0	14.5	5.5	2.65	0.51	14.6	4.5	10.0
9	59.2	0.054	68.1	4.4	6.25	0.963	9.284	9.195	19.2	10.0	14.8	5.6	2.64	0.48	14.6	4.6	10.2
10	60.5	0.060	68.2	4.5	6.25	1.070	9.485	9.383	19.4	10.0	14.9	5.5	2.71	0.48	14.7	4.7	10.2
11	61.5	0.066	68.3	4.6	6.26	1.178	9.645	9.531	19.6	10.0	15.0	5.4	2.76	0.49	14.8	4.8	10.2
12	62.4	0.072	68.4	4.8	6.27	1.285	9.792	9.666	19.7	10.0	14.9	5.3	2.84	0.50	14.9	4.8	10.1
13	63.0	0.078	68.5	4.8	6.27	1.392	9.899	9.761	19.8	10.0	15.0	5.2	2.87	0.49	14.9	4.9	10.1
14	63.5	0.084	68.6	4.9	6.28	1.499	9.979	9.829	19.9	10.0	15.0	5.1	2.91	0.50	15.0	4.9	10.1
15	64.2	0.090	68.6	4.9	6.29	1.606	10.086	9.924	20.0	10.0	15.0	5.1	2.95	0.50	15.0	5.0	10.1
16	64.8	0.096	68.6	4.9	6.29	1.713	10.179	10.005	20.1	10.0	15.1	5.1	2.96	0.49	15.1	5.0	10.1
17	65.4	0.102	68.6	5.0	6.30	1.820	10.273	10.086	20.1	10.0	15.1	5.1	2.99	0.49	15.1	5.0	10.1
18	65.7	0.108	68.8	5.1	6.31	1.927	10.326	10.127	20.2	10.0	15.1	4.9	3.05	0.50	15.1	5.1	10.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	66.2	0.114	68.8	5.2	6.31	2.034	10.407	10.195	20.2	10.0	15.1	4.9	3.08	0.51	15.1	5.1	10.0
20	66.7	0.120	68.8	5.2	6.32	2.141	10.487	10.262	20.3	10.0	15.1	4.9	3.11	0.51	15.2	5.1	10.0
21	66.9	0.126	68.8	5.2	6.33	2.248	10.527	10.290	20.3	10.0	15.1	4.9	3.12	0.50	15.2	5.1	10.0
22	67.5	0.132	68.8	5.2	6.33	2.355	10.620	10.370	20.4	10.0	15.2	4.9	3.13	0.50	15.2	5.2	10.0
23	67.8	0.138	68.8	5.2	6.34	2.462	10.674	10.411	20.5	10.0	15.3	4.9	3.14	0.50	15.3	5.2	10.1
24	68.1	0.144	68.8	5.2	6.35	2.569	10.714	10.439	20.5	10.0	15.3	4.9	3.15	0.50	15.3	5.2	10.1
25	68.3	0.150	68.9	5.3	6.36	2.676	10.754	10.466	20.5	10.0	15.2	4.8	3.19	0.50	15.3	5.2	10.0
26	68.7	0.156	69.0	5.3	6.36	2.783	10.821	10.519	20.6	10.0	15.3	4.7	3.22	0.50	15.3	5.3	10.0
27	69.1	0.162	69.0	5.3	6.37	2.890	10.874	10.560	20.6	10.0	15.3	4.7	3.23	0.50	15.3	5.3	10.0
28	69.4	0.168	69.0	5.4	6.38	2.997	10.928	10.600	20.6	10.0	15.3	4.7	3.26	0.50	15.3	5.3	10.0
29	69.7	0.174	69.0	5.4	6.38	3.104	10.981	10.640	20.7	10.0	15.3	4.7	3.27	0.50	15.4	5.3	10.0
30	70.0	0.180	69.0	5.3	6.39	3.211	11.021	10.667	20.7	10.0	15.4	4.7	3.25	0.50	15.4	5.3	10.1
31	70.2	0.186	69.0	5.3	6.40	3.319	11.061	10.694	20.7	10.0	15.4	4.7	3.26	0.50	15.4	5.3	10.1
32	70.6	0.192	69.0	5.3	6.40	3.426	11.115	10.734	20.8	10.0	15.5	4.7	3.27	0.49	15.4	5.4	10.1
33	70.7	0.198	69.0	5.4	6.41	3.533	11.141	10.748	20.8	10.0	15.4	4.7	3.31	0.50	15.4	5.4	10.0
34	71.1	0.204	69.0	5.4	6.42	3.640	11.208	10.800	20.8	10.0	15.5	4.7	3.32	0.50	15.4	5.4	10.1
35	71.4	0.210	69.0	5.4	6.43	3.747	11.248	10.827	20.9	10.0	15.5	4.7	3.33	0.50	15.5	5.4	10.1
36	71.6	0.216	69.0	5.4	6.43	3.854	11.288	10.853	20.9	10.0	15.5	4.7	3.33	0.50	15.5	5.4	10.1
37	72.0	0.222	69.0	5.4	6.44	3.961	11.342	10.892	20.9	10.0	15.6	4.7	3.32	0.49	15.5	5.4	10.1
38	72.2	0.228	69.0	5.3	6.45	4.068	11.382	10.919	21.0	10.0	15.7	4.7	3.31	0.49	15.5	5.5	10.2
39	72.5	0.234	69.0	5.4	6.45	4.175	11.422	10.945	21.0	10.0	15.6	4.7	3.35	0.49	15.5	5.5	10.1
40	72.8	0.240	69.0	5.4	6.46	4.282	11.475	10.984	21.0	10.0	15.6	4.7	3.36	0.49	15.5	5.5	10.1
41	73.0	0.246	69.0	5.4	6.47	4.389	11.515	11.010	21.1	10.0	15.7	4.7	3.36	0.49	15.6	5.5	10.2
42	73.3	0.252	69.0	5.4	6.48	4.496	11.555	11.036	21.1	10.0	15.7	4.7	3.37	0.49	15.6	5.5	10.2
43	73.5	0.258	69.0	5.4	6.48	4.603	11.595	11.062	21.1	10.0	15.8	4.7	3.36	0.48	15.6	5.5	10.2
44	73.9	0.264	69.0	5.4	6.49	4.710	11.662	11.113	21.2	10.0	15.8	4.7	3.37	0.48	15.6	5.6	10.3
45	74.3	0.270	69.0	5.4	6.50	4.817	11.716	11.151	21.2	10.0	15.8	4.7	3.37	0.48	15.6	5.6	10.3
46	74.5	0.276	69.0	5.3	6.51	4.924	11.756	11.177	21.2	10.0	15.9	4.7	3.36	0.48	15.6	5.6	10.3
47	74.8	0.282	69.0	5.4	6.51	5.031	11.796	11.202	21.3	10.0	15.9	4.7	3.41	0.48	15.6	5.6	10.3
48	75.1	0.288	69.0	5.4	6.52	5.138	11.849	11.240	21.3	10.0	15.9	4.7	3.39	0.48	15.7	5.6	10.3
49	75.4	0.294	69.0	5.4	6.53	5.245	11.903	11.278	21.3	10.0	15.9	4.7	3.42	0.48	15.7	5.6	10.3
50	75.8	0.300	69.0	5.4	6.53	5.352	11.969	11.329	21.4	10.0	16.0	4.7	3.43	0.48	15.7	5.7	10.3
51	76.1	0.306	69.0	5.4	6.54	5.460	12.010	11.354	21.4	10.0	16.1	4.7	3.42	0.47	15.7	5.7	10.4
52	76.4	0.312	69.0	5.4	6.55	5.567	12.063	11.392	21.4	10.0	16.1	4.7	3.43	0.47	15.7	5.7	10.4
53	76.6	0.318	69.0	5.3	6.56	5.674	12.090	11.404	21.5	10.0	16.1	4.7	3.41	0.47	15.7	5.7	10.4
54	76.8	0.324	69.0	5.4	6.56	5.781	12.116	11.416	21.5	10.0	16.1	4.7	3.43	0.47	15.8	5.7	10.4
55	77.3	0.330	69.0	5.4	6.57	5.888	12.197	11.478	21.5	10.0	16.1	4.7	3.47	0.47	15.8	5.7	10.4
56	77.5	0.336	69.0	5.4	6.58	5.995	12.237	11.503	21.6	10.0	16.2	4.7	3.45	0.47	15.8	5.8	10.4
57	77.7	0.342	69.0	5.4	6.59	6.102	12.277	11.528	21.6	10.0	16.2	4.7	3.45	0.46	15.8	5.8	10.5
58	78.2	0.348	69.0	5.3	6.59	6.209	12.344	11.577	21.6	10.0	16.3	4.7	3.44	0.46	15.8	5.8	10.5
59	78.2	0.354	68.9	5.3	6.60	6.316	12.357	11.576	21.6	10.0	16.4	4.8	3.42	0.46	15.8	5.8	10.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	78.5	0.360	68.9	5.3	6.61	6.423	12.397	11.601	21.6	10.0	16.4	4.8	3.43	0.45	15.8	5.8	10.6
61	78.6	0.366	69.0	5.3	6.62	6.530	12.410	11.600	21.6	10.0	16.3	4.7	3.45	0.46	15.8	5.8	10.5
62	79.0	0.372	69.0	5.3	6.62	6.637	12.477	11.649	21.7	10.0	16.4	4.7	3.46	0.46	15.9	5.8	10.6
63	79.4	0.378	68.9	5.3	6.63	6.744	12.544	11.698	21.7	10.0	16.5	4.8	3.45	0.45	15.9	5.8	10.6
64	79.6	0.384	68.9	5.3	6.64	6.851	12.584	11.722	21.8	10.0	16.5	4.8	3.45	0.45	15.9	5.9	10.6
65	79.9	0.390	68.9	5.2	6.65	6.958	12.624	11.746	21.8	10.0	16.6	4.8	3.44	0.45	15.9	5.9	10.7
66	80.1	0.396	68.9	5.2	6.66	7.065	12.664	11.769	21.8	10.0	16.6	4.8	3.44	0.44	15.9	5.9	10.7
67	80.4	0.402	68.8	5.2	6.66	7.172	12.704	11.793	21.8	10.0	16.7	4.9	3.43	0.44	15.9	5.9	10.8
68	80.7	0.408	68.8	5.2	6.67	7.279	12.758	11.829	21.9	10.0	16.7	4.9	3.42	0.44	16.0	5.9	10.8
69	80.9	0.414	68.9	5.2	6.68	7.386	12.784	11.840	21.9	10.0	16.7	4.8	3.46	0.44	16.0	5.9	10.7
70	81.3	0.420	68.8	5.2	6.69	7.493	12.851	11.888	21.9	10.0	16.7	4.9	3.45	0.44	16.0	5.9	10.8
71	81.6	0.426	68.8	5.2	6.69	7.601	12.905	11.924	22.0	10.0	16.8	4.9	3.45	0.44	16.0	6.0	10.8
72	81.9	0.432	68.8	5.2	6.70	7.708	12.945	11.947	22.0	10.0	16.8	4.9	3.46	0.43	16.0	6.0	10.8
73	82.2	0.438	68.8	5.2	6.71	7.815	12.998	11.982	22.0	10.0	16.9	4.9	3.45	0.43	16.0	6.0	10.9
74	82.5	0.444	68.8	5.1	6.72	7.922	13.052	12.018	22.1	10.0	17.0	4.9	3.43	0.43	16.1	6.0	10.9
75	82.5	0.450	68.7	5.1	6.72	8.029	13.052	12.004	22.1	10.0	17.0	5.0	3.41	0.42	16.0	6.0	11.0
76	82.9	0.456	68.8	5.2	6.73	8.136	13.105	12.039	22.1	10.0	16.9	4.9	3.46	0.43	16.1	6.0	10.9
77	83.5	0.462	68.8	5.1	6.74	8.243	13.199	12.111	22.2	10.0	17.0	4.9	3.45	0.42	16.1	6.1	11.0
78	83.9	0.468	68.8	5.1	6.75	8.350	13.265	12.158	22.2	10.0	17.1	4.9	3.46	0.42	16.1	6.1	11.0
79	84.2	0.474	68.8	5.1	6.76	8.457	13.319	12.192	22.2	10.0	17.1	4.9	3.47	0.42	16.1	6.1	11.0
80	84.4	0.480	68.7	5.1	6.76	8.564	13.359	12.215	22.3	10.0	17.2	5.0	3.45	0.42	16.2	6.1	11.1
81	84.7	0.486	68.7	5.0	6.77	8.671	13.399	12.237	22.3	10.0	17.3	5.0	3.44	0.41	16.2	6.1	11.1
82	84.9	0.492	68.6	5.0	6.78	8.778	13.439	12.259	22.3	10.0	17.3	5.1	3.42	0.41	16.2	6.1	11.2
83	85.2	0.498	68.7	5.0	6.79	8.885	13.479	12.281	22.3	10.0	17.3	5.0	3.45	0.41	16.2	6.1	11.2
84	85.7	0.505	68.7	5.0	6.80	8.992	13.559	12.340	22.4	10.0	17.4	5.0	3.46	0.41	16.2	6.2	11.2
85	86.0	0.511	68.6	5.0	6.80	9.099	13.613	12.374	22.4	10.0	17.4	5.1	3.45	0.40	16.2	6.2	11.2
86	86.3	0.517	68.6	5.0	6.81	9.206	13.653	12.396	22.4	10.0	17.5	5.1	3.45	0.40	16.2	6.2	11.3
87	86.6	0.523	68.6	4.9	6.82	9.313	13.706	12.430	22.5	10.0	17.5	5.1	3.44	0.40	16.3	6.2	11.3
88	86.9	0.529	68.6	4.9	6.83	9.420	13.760	12.463	22.5	10.0	17.6	5.1	3.43	0.39	16.3	6.2	11.4
89	87.2	0.535	68.5	4.9	6.84	9.527	13.800	12.485	22.5	10.0	17.7	5.2	3.41	0.39	16.3	6.2	11.4
90	87.4	0.541	68.5	4.8	6.84	9.634	13.840	12.506	22.6	10.0	17.7	5.2	3.40	0.39	16.3	6.3	11.5
91	87.6	0.547	68.6	4.9	6.85	9.742	13.866	12.516	22.6	10.0	17.7	5.1	3.44	0.39	16.3	6.3	11.4
92	88.1	0.553	68.6	4.9	6.86	9.849	13.947	12.573	22.6	10.0	17.7	5.1	3.45	0.39	16.3	6.3	11.4
93	88.4	0.559	68.5	4.9	6.87	9.956	14.000	12.606	22.7	10.0	17.8	5.2	3.43	0.39	16.4	6.3	11.5
94	88.7	0.565	68.5	4.9	6.88	10.063	14.040	12.627	22.7	10.0	17.8	5.2	3.44	0.39	16.4	6.3	11.5
95	88.9	0.571	68.5	4.8	6.89	10.170	14.080	12.648	22.7	10.0	17.9	5.2	3.42	0.38	16.4	6.3	11.5
96	89.0	0.577	68.4	4.8	6.89	10.277	14.094	12.645	22.7	10.0	17.9	5.3	3.40	0.38	16.4	6.3	11.6
97	89.5	0.583	68.5	4.8	6.90	10.384	14.174	12.702	22.7	10.0	17.9	5.2	3.43	0.38	16.4	6.4	11.6
98	89.8	0.589	68.5	4.8	6.91	10.491	14.227	12.735	22.8	10.0	18.0	5.2	3.44	0.38	16.4	6.4	11.6
99	90.0	0.595	68.4	4.8	6.92	10.598	14.254	12.743	22.8	10.0	18.0	5.3	3.42	0.38	16.4	6.4	11.6
100	90.3	0.601	68.4	4.8	6.93	10.705	14.307	12.776	22.8	10.0	18.0	5.3	3.43	0.37	16.4	6.4	11.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	90.6	0.607	68.4	4.7	6.93	10.812	14.361	12.808	22.9	10.0	18.1	5.3	3.42	0.37	16.5	6.4	11.7
102	90.7	0.613	68.4	4.7	6.94	10.919	14.374	12.805	22.9	10.0	18.1	5.3	3.40	0.37	16.5	6.4	11.7
103	91.2	0.619	68.3	4.7	6.95	11.026	14.454	12.860	22.9	10.0	18.2	5.4	3.39	0.36	16.5	6.4	11.8
104	91.1	0.625	68.4	4.7	6.96	11.133	14.441	12.833	22.9	10.0	18.1	5.3	3.42	0.37	16.5	6.4	11.7
105	91.7	0.631	68.4	4.7	6.97	11.240	14.534	12.901	22.9	10.0	18.2	5.3	3.42	0.36	16.5	6.5	11.8
106	92.0	0.637	68.4	4.7	6.98	11.347	14.588	12.933	23.0	10.0	18.3	5.3	3.42	0.36	16.5	6.5	11.8
107	92.4	0.643	68.4	4.7	6.99	11.454	14.641	12.964	23.0	10.0	18.3	5.3	3.43	0.36	16.5	6.5	11.8
108	92.7	0.649	68.3	4.7	6.99	11.561	14.695	12.996	23.0	10.0	18.4	5.4	3.42	0.36	16.5	6.5	11.9
109	92.9	0.655	68.3	4.6	7.00	11.668	14.721	13.004	23.1	10.0	18.4	5.4	3.40	0.36	16.5	6.5	11.9
110	93.0	0.661	68.2	4.6	7.01	11.775	14.748	13.011	23.1	10.0	18.5	5.5	3.38	0.35	16.6	6.5	12.0
111	93.3	0.667	68.2	4.6	7.02	11.883	14.788	13.031	23.1	10.0	18.5	5.5	3.39	0.35	16.6	6.5	12.0
112	93.8	0.673	68.3	4.6	7.03	11.990	14.868	13.086	23.1	10.0	18.5	5.4	3.41	0.35	16.6	6.5	12.0
113	94.1	0.679	68.3	4.6	7.04	12.097	14.922	13.117	23.2	10.0	18.5	5.4	3.42	0.35	16.6	6.6	12.0
114	94.4	0.685	68.2	4.6	7.04	12.204	14.962	13.136	23.2	10.0	18.6	5.5	3.41	0.35	16.6	6.6	12.0
115	94.6	0.691	68.2	4.6	7.05	12.311	15.002	13.155	23.2	10.0	18.6	5.5	3.41	0.35	16.6	6.6	12.0
116	94.9	0.697	68.2	4.5	7.06	12.418	15.055	13.186	23.2	10.0	18.7	5.5	3.38	0.34	16.6	6.6	12.1
117	95.1	0.703	68.2	4.6	7.07	12.525	15.082	13.193	23.2	10.0	18.7	5.5	3.42	0.35	16.6	6.6	12.1
118	95.8	0.715	68.2	4.5	7.09	12.739	15.202	13.266	23.3	10.0	18.8	5.5	3.41	0.34	16.7	6.6	12.1
119	96.2	0.721	68.2	4.5	7.10	12.846	15.256	13.296	23.3	10.0	18.8	5.5	3.42	0.34	16.7	6.6	12.1
120	96.4	0.727	68.2	4.5	7.11	12.953	15.296	13.315	23.4	10.0	18.9	5.5	3.40	0.34	16.7	6.7	12.2
121	96.8	0.733	68.1	4.5	7.11	13.060	15.349	13.345	23.4	10.0	18.9	5.6	3.39	0.33	16.7	6.7	12.3
122	97.1	0.739	68.1	4.4	7.12	13.167	15.403	13.375	23.4	10.0	19.0	5.6	3.38	0.33	16.7	6.7	12.3
123	97.2	0.745	68.1	4.5	7.13	13.274	15.429	13.381	23.4	10.0	19.0	5.6	3.40	0.33	16.7	6.7	12.3
124	97.7	0.751	68.1	4.5	7.14	13.381	15.510	13.434	23.5	10.0	19.0	5.6	3.41	0.33	16.8	6.7	12.3
125	98.0	0.757	68.1	4.5	7.15	13.488	15.550	13.452	23.5	10.0	19.0	5.6	3.41	0.33	16.8	6.7	12.3
126	98.2	0.763	68.1	4.4	7.16	13.595	15.590	13.470	23.5	10.0	19.1	5.6	3.40	0.33	16.8	6.7	12.4
127	98.5	0.769	68.1	4.4	7.17	13.702	15.630	13.488	23.5	10.0	19.1	5.6	3.40	0.33	16.8	6.7	12.4
128	98.7	0.775	68.0	4.4	7.18	13.809	15.670	13.506	23.6	10.0	19.2	5.7	3.39	0.32	16.8	6.8	12.4
129	99.1	0.781	68.0	4.3	7.18	13.916	15.723	13.535	23.6	10.0	19.2	5.7	3.37	0.32	16.8	6.8	12.5
130	99.3	0.787	68.0	4.3	7.19	14.024	15.763	13.553	23.6	10.0	19.3	5.7	3.36	0.32	16.8	6.8	12.5
131	99.4	0.793	68.0	4.4	7.20	14.131	15.777	13.547	23.6	10.0	19.2	5.7	3.39	0.32	16.8	6.8	12.4
132	99.9	0.799	68.0	4.3	7.21	14.238	15.857	13.599	23.6	10.0	19.3	5.7	3.38	0.32	16.8	6.8	12.5
133	100.1	0.805	68.0	4.3	7.22	14.345	15.884	13.605	23.7	10.0	19.3	5.7	3.39	0.32	16.9	6.8	12.5
134	100.4	0.811	68.0	4.3	7.23	14.452	15.937	13.634	23.7	10.0	19.4	5.7	3.37	0.32	16.9	6.8	12.6
135	100.6	0.817	67.9	4.3	7.24	14.559	15.977	13.651	23.7	10.0	19.4	5.8	3.36	0.31	16.9	6.8	12.6
136	100.8	0.823	67.9	4.2	7.25	14.666	16.004	13.657	23.7	10.0	19.5	5.8	3.35	0.31	16.9	6.8	12.7
137	101.3	0.829	68.0	4.3	7.26	14.773	16.084	13.708	23.8	10.0	19.5	5.7	3.39	0.31	16.9	6.9	12.6
138	101.6	0.835	67.9	4.3	7.27	14.880	16.137	13.736	23.8	10.0	19.5	5.8	3.38	0.31	16.9	6.9	12.7
139	101.9	0.841	67.9	4.3	7.28	14.987	16.178	13.753	23.8	10.0	19.5	5.8	3.38	0.31	16.9	6.9	12.7
140	102.2	0.847	67.9	4.2	7.28	15.094	16.231	13.781	23.8	10.0	19.6	5.8	3.37	0.31	16.9	6.9	12.7
141	102.5	0.853	67.8	4.2	7.29	15.201	16.284	13.809	23.9	10.0	19.7	5.9	3.36	0.30	17.0	6.9	12.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	102.8	0.859	67.8	4.2	7.30	15.308	16.324	13.825	23.9	10.0	19.7	5.9	3.36	0.30	17.0	6.9	12.8
143	103.0	0.865	67.8	4.1	7.31	15.415	16.365	13.842	23.9	10.0	19.7	5.9	3.34	0.30	17.0	6.9	12.8
144	103.4	0.871	67.9	4.2	7.32	15.522	16.418	13.870	23.9	10.0	19.7	5.8	3.38	0.30	17.0	6.9	12.8
145	103.9	0.877	67.8	4.2	7.33	15.629	16.498	13.920	24.0	10.0	19.8	5.9	3.37	0.30	17.0	7.0	12.8
146	104.0	0.883	67.8	4.2	7.34	15.736	16.525	13.924	24.0	10.0	19.8	5.9	3.37	0.30	17.0	7.0	12.8
147	104.4	0.889	67.8	4.2	7.35	15.843	16.578	13.952	24.0	10.0	19.8	5.9	3.38	0.30	17.0	7.0	12.8
148	104.6	0.895	67.8	4.1	7.36	15.950	16.618	13.968	24.0	10.0	19.9	5.9	3.37	0.30	17.0	7.0	12.9
149	104.9	0.901	67.8	4.1	7.37	16.057	16.658	13.984	24.0	10.0	19.9	5.9	3.35	0.29	17.0	7.0	12.9
150	105.3	0.907	67.7	4.1	7.38	16.165	16.725	14.022	24.1	10.0	20.0	6.0	3.34	0.29	17.1	7.0	13.0
151	105.3	0.913	67.7	4.0	7.39	16.272	16.725	14.004	24.1	10.0	20.0	6.0	3.32	0.29	17.0	7.0	13.0
152	105.8	0.919	67.8	4.1	7.40	16.379	16.819	14.064	24.1	10.0	20.0	5.9	3.37	0.29	17.1	7.0	13.0
153	106.3	0.925	67.7	4.1	7.41	16.486	16.886	14.102	24.1	10.0	20.1	6.0	3.36	0.29	17.1	7.1	13.0
154	106.5	0.931	67.7	4.1	7.42	16.593	16.926	14.117	24.2	10.0	20.1	6.0	3.36	0.29	17.1	7.1	13.0
155	106.8	0.937	67.7	4.0	7.42	16.700	16.979	14.144	24.2	10.0	20.2	6.0	3.35	0.28	17.1	7.1	13.1
156	107.0	0.943	67.6	4.0	7.43	16.807	17.006	14.148	24.2	10.0	20.2	6.1	3.33	0.28	17.1	7.1	13.1
157	107.2	0.949	67.7	4.0	7.44	16.914	17.046	14.163	24.2	10.0	20.2	6.0	3.35	0.28	17.1	7.1	13.1
158	107.7	0.955	67.7	4.0	7.45	17.021	17.126	14.211	24.3	10.0	20.2	6.0	3.36	0.28	17.2	7.1	13.1
159	108.0	0.961	67.6	4.0	7.46	17.128	17.166	14.226	24.3	10.0	20.3	6.1	3.35	0.28	17.2	7.1	13.2
160	108.2	0.967	67.6	4.0	7.47	17.235	17.206	14.241	24.3	10.0	20.3	6.1	3.35	0.28	17.2	7.1	13.2
161	108.4	0.973	67.6	3.9	7.48	17.342	17.233	14.244	24.3	10.0	20.3	6.1	3.33	0.28	17.2	7.1	13.2
162	108.7	0.979	67.6	3.9	7.49	17.449	17.286	14.270	24.3	10.0	20.4	6.1	3.32	0.27	17.2	7.1	13.3
163	109.0	0.985	67.5	3.9	7.50	17.556	17.326	14.285	24.3	10.0	20.5	6.2	3.31	0.27	17.2	7.1	13.3
164	109.2	0.991	67.5	3.8	7.51	17.663	17.366	14.299	24.3	10.0	20.5	6.2	3.30	0.27	17.2	7.1	13.4
165	109.2	0.997	67.6	3.9	7.52	17.770	17.366	14.280	24.3	10.0	20.4	6.1	3.32	0.27	17.2	7.1	13.3
166	109.6	1.003	67.5	3.9	7.53	17.877	17.433	14.317	24.4	10.0	20.5	6.2	3.31	0.27	17.2	7.2	13.3
167	110.0	1.009	67.5	3.8	7.54	17.993	17.487	14.340	24.4	10.0	20.6	6.2	3.30	0.27	17.2	7.2	13.4
168	110.2	1.015	67.5	3.8	7.55	18.108	17.527	14.353	24.4	10.0	20.6	6.2	3.31	0.27	17.2	7.2	13.4
169	110.6	1.022	67.4	3.8	7.56	18.223	17.594	14.387	24.4	10.0	20.7	6.3	3.30	0.26	17.2	7.2	13.5
170	110.9	1.028	67.4	3.7	7.57	18.338	17.634	14.400	24.4	10.0	20.7	6.3	3.28	0.26	17.2	7.2	13.5
171	111.2	1.035	67.4	3.7	7.58	18.454	17.687	14.423	24.5	10.0	20.7	6.3	3.29	0.26	17.3	7.2	13.5
172	111.4	1.041	67.4	3.8	7.60	18.569	17.714	14.425	24.5	10.0	20.7	6.3	3.30	0.26	17.3	7.2	13.5
173	111.8	1.048	67.4	3.7	7.61	18.684	17.781	14.458	24.5	10.0	20.8	6.3	3.29	0.26	17.3	7.2	13.5
174	112.0	1.054	67.4	3.7	7.62	18.791	17.821	14.472	24.5	10.0	20.8	6.3	3.29	0.26	17.3	7.2	13.5
175	112.4	1.060	67.4	3.7	7.63	18.898	17.874	14.496	24.5	10.0	20.8	6.3	3.28	0.26	17.3	7.2	13.6
176	112.7	1.066	67.3	3.6	7.64	19.005	17.928	14.520	24.6	10.0	20.9	6.4	3.26	0.25	17.3	7.3	13.7
177	112.9	1.072	67.3	3.7	7.65	19.113	17.954	14.523	24.6	10.0	20.9	6.4	3.27	0.25	17.3	7.3	13.6
178	113.3	1.078	67.3	3.7	7.66	19.220	18.021	14.557	24.6	10.0	20.9	6.4	3.28	0.25	17.3	7.3	13.7
179	113.6	1.084	67.3	3.7	7.67	19.327	18.074	14.581	24.6	10.0	21.0	6.4	3.28	0.25	17.3	7.3	13.7
180	113.9	1.090	67.3	3.6	7.68	19.434	18.115	14.594	24.6	10.0	21.0	6.4	3.27	0.25	17.3	7.3	13.7
181	114.1	1.096	67.3	3.6	7.69	19.541	18.155	14.607	24.7	10.0	21.0	6.4	3.27	0.25	17.4	7.3	13.7
182	114.4	1.102	67.2	3.6	7.70	19.648	18.208	14.631	24.7	10.0	21.1	6.5	3.26	0.24	17.4	7.3	13.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	114.7	1.108	67.2	3.5	7.71	19.755	18.248	14.643	24.7	10.0	21.2	6.5	3.25	0.24	17.4	7.3	13.8
184	114.9	1.114	67.2	3.5	7.72	19.870	18.288	14.654	24.7	10.0	21.2	6.5	3.24	0.24	17.4	7.3	13.9
185	115.0	1.121	67.2	3.6	7.73	19.985	18.302	14.644	24.7	10.0	21.1	6.5	3.26	0.24	17.4	7.3	13.8
186	115.2	1.122	67.2	3.6	7.73	20.002	18.328	14.662	24.7	10.0	21.1	6.5	3.27	0.24	17.4	7.3	13.8



File Location
B-54 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-54
Sample Description: Red, Brown & Gray Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 46.000
PL: 30.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.803	2.811	
Height (in)	5.643	5.605	
Weight (grams)	1076.70		1128.33
Moisture (%)	17.77		23.42
Dry Density (pcf)	100.03	100.13	
Saturation (%)	72.02	100.00	
Void Ratio	0.650	0.652	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 92.400
Effective Confining Stress (psi): 20.0
Corrected Peak Deviator Stress (psi): 20.976 at reading number: 187

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	2.9	0.000	72.4	0.0	6.21	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	3.6	0.006	72.6	0.2	6.21	0.107	0.107	0.106	20.1	20.0	19.9	19.8	1.01	1.51	20.0	0.1	19.8
2	27.3	0.012	74.3	1.9	6.22	0.214	3.928	3.920	23.9	20.0	22.0	18.1	1.22	0.48	21.9	2.0	20.0
3	50.5	0.018	77.2	4.7	6.23	0.321	7.670	7.645	27.6	20.0	22.9	15.2	1.50	0.62	23.8	3.8	19.0
4	61.9	0.024	78.8	6.3	6.23	0.428	9.507	9.466	29.4	20.0	23.1	13.6	1.69	0.67	24.7	4.7	18.4
5	70.1	0.030	79.8	7.3	6.24	0.535	10.839	10.781	30.7	20.0	23.4	12.6	1.86	0.68	25.3	5.4	18.0
6	76.1	0.036	80.6	8.2	6.25	0.642	11.797	11.722	31.7	20.0	23.5	11.8	1.99	0.70	25.8	5.9	17.7
7	80.6	0.042	81.2	8.8	6.25	0.749	12.516	12.423	32.4	20.0	23.6	11.2	2.11	0.71	26.2	6.2	17.4
8	84.2	0.048	81.8	9.3	6.26	0.856	13.102	12.990	32.9	20.0	23.6	10.6	2.22	0.72	26.4	6.5	17.1
9	87.0	0.054	82.2	9.8	6.27	0.963	13.555	13.424	33.4	20.0	23.6	10.2	2.32	0.73	26.7	6.7	16.9
10	89.3	0.060	82.6	10.2	6.27	1.070	13.928	13.779	33.7	20.0	23.6	9.8	2.41	0.74	26.8	6.9	16.7
11	91.1	0.066	82.9	10.4	6.28	1.178	14.221	14.053	34.0	20.0	23.6	9.5	2.48	0.74	27.0	7.0	16.5
12	92.6	0.072	83.2	10.8	6.29	1.285	14.460	14.275	34.2	20.0	23.5	9.2	2.55	0.75	27.1	7.1	16.3
13	93.9	0.078	83.5	11.0	6.29	1.392	14.660	14.456	34.4	20.0	23.4	8.9	2.62	0.76	27.2	7.2	16.2
14	94.5	0.084	83.7	11.2	6.30	1.499	14.767	14.545	34.5	20.0	23.3	8.7	2.66	0.77	27.2	7.3	16.0
15	95.6	0.090	83.8	11.4	6.31	1.606	14.940	14.700	34.7	20.0	23.3	8.6	2.71	0.77	27.3	7.3	15.9
16	95.8	0.096	84.1	11.6	6.31	1.713	14.966	14.710	34.7	20.0	23.1	8.3	2.76	0.79	27.3	7.4	15.7
17	96.8	0.102	84.2	11.8	6.32	1.820	15.126	14.851	34.8	20.0	23.0	8.2	2.81	0.79	27.4	7.4	15.6
18	97.4	0.108	84.4	11.9	6.33	1.927	15.233	14.939	34.9	20.0	23.0	8.0	2.86	0.80	27.4	7.5	15.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	98.0	0.114	84.5	12.0	6.33	2.034	15.326	15.014	35.0	20.0	22.9	7.9	2.90	0.80	27.5	7.5	15.4
20	98.6	0.120	84.6	12.2	6.34	2.141	15.419	15.089	35.0	20.0	22.9	7.8	2.94	0.81	27.5	7.5	15.3
21	98.9	0.126	84.7	12.2	6.35	2.248	15.472	15.125	35.1	20.0	22.8	7.7	2.96	0.81	27.5	7.6	15.3
22	99.4	0.132	84.8	12.3	6.35	2.355	15.552	15.186	35.1	20.0	22.8	7.6	2.99	0.81	27.5	7.6	15.2
23	99.6	0.138	84.9	12.4	6.36	2.462	15.592	15.208	35.2	20.0	22.7	7.5	3.03	0.82	27.6	7.6	15.1
24	100.6	0.144	85.0	12.5	6.37	2.569	15.739	15.334	35.3	20.0	22.8	7.4	3.07	0.82	27.6	7.7	15.1
25	101.1	0.150	85.1	12.6	6.38	2.676	15.832	15.408	35.4	20.0	22.7	7.3	3.10	0.82	27.7	7.7	15.0
26	101.6	0.156	85.1	12.7	6.38	2.783	15.912	15.469	35.4	20.0	22.8	7.3	3.12	0.82	27.7	7.7	15.0
27	102.0	0.162	85.2	12.7	6.39	2.890	15.965	15.504	35.5	20.0	22.7	7.2	3.15	0.82	27.7	7.8	15.0
28	102.2	0.168	85.2	12.8	6.40	2.997	16.005	15.525	35.5	20.0	22.7	7.2	3.16	0.82	27.7	7.8	14.9
29	102.5	0.174	85.3	12.9	6.40	3.104	16.045	15.547	35.5	20.0	22.6	7.1	3.19	0.83	27.7	7.8	14.9
30	102.9	0.180	85.3	12.9	6.41	3.211	16.125	15.607	35.6	20.0	22.7	7.1	3.21	0.83	27.8	7.8	14.9
31	103.3	0.186	85.4	13.0	6.42	3.318	16.178	15.641	35.6	20.0	22.6	7.0	3.24	0.83	27.8	7.8	14.8
32	103.5	0.192	85.4	13.0	6.43	3.426	16.218	15.663	35.6	20.0	22.6	7.0	3.24	0.83	27.8	7.8	14.8
33	104.0	0.198	85.5	13.0	6.43	3.533	16.298	15.722	35.7	20.0	22.7	6.9	3.27	0.83	27.8	7.9	14.8
34	104.2	0.204	85.5	13.1	6.44	3.640	16.325	15.730	35.7	20.0	22.6	6.9	3.28	0.83	27.8	7.9	14.8
35	104.4	0.210	85.5	13.1	6.45	3.747	16.365	15.751	35.7	20.0	22.6	6.9	3.28	0.83	27.8	7.9	14.8
36	104.6	0.216	85.5	13.1	6.45	3.854	16.391	15.760	35.7	20.0	22.7	6.9	3.28	0.83	27.8	7.9	14.8
37	105.2	0.222	85.6	13.1	6.46	3.961	16.484	15.831	35.8	20.0	22.6	6.8	3.32	0.83	27.9	7.9	14.7
38	105.8	0.228	85.6	13.1	6.47	4.068	16.578	15.903	35.9	20.0	22.7	6.8	3.33	0.83	27.9	8.0	14.8
39	106.1	0.234	85.6	13.2	6.48	4.175	16.631	15.937	35.9	20.0	22.7	6.8	3.35	0.83	27.9	8.0	14.7
40	106.4	0.240	85.6	13.2	6.48	4.282	16.684	15.970	35.9	20.0	22.7	6.8	3.36	0.82	27.9	8.0	14.8
41	106.8	0.246	85.6	13.2	6.49	4.389	16.737	16.003	36.0	20.0	22.8	6.8	3.36	0.82	28.0	8.0	14.8
42	107.1	0.252	85.6	13.2	6.50	4.496	16.791	16.036	36.0	20.0	22.8	6.8	3.37	0.82	28.0	8.0	14.8
43	107.2	0.258	85.7	13.2	6.50	4.603	16.804	16.030	36.0	20.0	22.8	6.7	3.38	0.82	28.0	8.0	14.8
44	107.6	0.264	85.7	13.3	6.51	4.710	16.871	16.076	36.0	20.0	22.8	6.7	3.40	0.82	28.0	8.0	14.7
45	108.0	0.270	85.7	13.3	6.52	4.817	16.937	16.121	36.1	20.0	22.8	6.7	3.41	0.82	28.0	8.1	14.8
46	108.3	0.276	85.7	13.3	6.53	4.924	16.990	16.154	36.1	20.0	22.9	6.7	3.41	0.82	28.0	8.1	14.8
47	108.7	0.282	85.7	13.3	6.53	5.031	17.057	16.199	36.1	20.0	22.9	6.7	3.43	0.82	28.0	8.1	14.8
48	109.1	0.288	85.7	13.3	6.54	5.138	17.110	16.231	36.2	20.0	22.9	6.7	3.42	0.82	28.1	8.1	14.8
49	109.1	0.294	85.7	13.3	6.55	5.245	17.124	16.225	36.2	20.0	22.9	6.7	3.44	0.82	28.1	8.1	14.8
50	109.8	0.300	85.7	13.3	6.56	5.352	17.230	16.308	36.3	20.0	23.0	6.7	3.45	0.82	28.1	8.2	14.8
51	110.1	0.306	85.8	13.3	6.56	5.459	17.283	16.340	36.3	20.0	23.0	6.6	3.47	0.82	28.1	8.2	14.8
52	110.5	0.312	85.8	13.3	6.57	5.566	17.337	16.372	36.3	20.0	23.0	6.6	3.47	0.81	28.1	8.2	14.8
53	111.0	0.318	85.8	13.3	6.58	5.674	17.416	16.428	36.4	20.0	23.0	6.6	3.48	0.81	28.2	8.2	14.8
54	111.4	0.324	85.7	13.3	6.59	5.781	17.483	16.472	36.4	20.0	23.1	6.7	3.47	0.81	28.2	8.2	14.9
55	111.8	0.330	85.7	13.3	6.59	5.888	17.550	16.516	36.5	20.0	23.2	6.7	3.48	0.80	28.2	8.3	14.9
56	112.0	0.336	85.8	13.3	6.60	5.995	17.576	16.523	36.5	20.0	23.1	6.6	3.50	0.81	28.2	8.3	14.9
57	112.3	0.342	85.8	13.3	6.61	6.102	17.629	16.554	36.5	20.0	23.2	6.6	3.50	0.81	28.2	8.3	14.9
58	112.8	0.348	85.8	13.3	6.62	6.209	17.709	16.610	36.6	20.0	23.2	6.6	3.51	0.80	28.3	8.3	14.9
59	113.1	0.354	85.8	13.3	6.62	6.316	17.763	16.641	36.6	20.0	23.3	6.6	3.51	0.80	28.3	8.3	14.9



Florence & Hutcheson

CONSULTING ENGINEERS

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	113.7	0.360	85.8	13.3	6.63	6.423	17.856	16.709	36.7	20.0	23.3	6.6	3.53	0.80	28.3	8.4	15.0
61	114.1	0.366	85.8	13.3	6.64	6.530	17.922	16.752	36.7	20.0	23.4	6.6	3.53	0.80	28.3	8.4	15.0
62	114.4	0.372	85.7	13.3	6.65	6.637	17.976	16.783	36.7	20.0	23.4	6.7	3.52	0.79	28.3	8.4	15.0
63	114.7	0.378	85.8	13.3	6.65	6.744	18.016	16.801	36.8	20.0	23.4	6.6	3.54	0.79	28.4	8.4	15.0
64	115.3	0.384	85.7	13.3	6.66	6.851	18.122	16.881	36.8	20.0	23.5	6.7	3.54	0.79	28.4	8.4	15.1
65	115.8	0.390	85.7	13.3	6.67	6.958	18.189	16.923	36.9	20.0	23.6	6.7	3.54	0.79	28.4	8.5	15.1
66	116.1	0.396	85.7	13.3	6.68	7.065	18.242	16.953	36.9	20.0	23.6	6.7	3.55	0.78	28.4	8.5	15.1
67	116.5	0.402	85.7	13.3	6.68	7.172	18.309	16.995	36.9	20.0	23.7	6.7	3.55	0.78	28.4	8.5	15.2
68	116.9	0.408	85.7	13.3	6.69	7.279	18.375	17.038	37.0	20.0	23.7	6.7	3.54	0.78	28.5	8.5	15.2
69	117.1	0.414	85.7	13.3	6.70	7.386	18.402	17.043	37.0	20.0	23.7	6.7	3.56	0.78	28.5	8.5	15.2
70	117.7	0.420	85.7	13.3	6.71	7.493	18.508	17.121	37.1	20.0	23.8	6.7	3.57	0.78	28.5	8.6	15.2
71	118.0	0.426	85.7	13.3	6.72	7.600	18.548	17.139	37.1	20.0	23.8	6.7	3.57	0.78	28.5	8.6	15.2
72	118.4	0.432	85.7	13.3	6.72	7.707	18.615	17.180	37.1	20.0	23.8	6.7	3.58	0.77	28.5	8.6	15.2
73	118.8	0.438	85.7	13.3	6.73	7.814	18.681	17.222	37.2	20.0	23.9	6.7	3.59	0.77	28.6	8.6	15.3
74	119.2	0.444	85.7	13.3	6.74	7.922	18.748	17.263	37.2	20.0	24.0	6.7	3.58	0.77	28.6	8.6	15.3
75	119.6	0.450	85.7	13.3	6.75	8.029	18.801	17.292	37.2	20.0	24.0	6.7	3.58	0.77	28.6	8.6	15.3
76	119.6	0.456	85.7	13.3	6.75	8.136	18.815	17.284	37.2	20.0	24.0	6.7	3.58	0.77	28.6	8.6	15.3
77	120.3	0.462	85.7	13.3	6.76	8.243	18.921	17.361	37.3	20.0	24.1	6.7	3.59	0.76	28.6	8.7	15.4
78	120.7	0.468	85.7	13.3	6.77	8.350	18.988	17.402	37.4	20.0	24.1	6.7	3.60	0.76	28.7	8.7	15.4
79	121.3	0.474	85.7	13.3	6.78	8.457	19.081	17.467	37.4	20.0	24.2	6.7	3.61	0.76	28.7	8.7	15.4
80	122.0	0.480	85.7	13.3	6.79	8.564	19.201	17.556	37.5	20.0	24.3	6.7	3.62	0.75	28.7	8.8	15.5
81	122.4	0.486	85.7	13.2	6.79	8.671	19.254	17.584	37.5	20.0	24.3	6.7	3.61	0.75	28.7	8.8	15.5
82	122.7	0.492	85.6	13.2	6.80	8.778	19.307	17.612	37.6	20.0	24.4	6.8	3.60	0.75	28.8	8.8	15.6
83	123.0	0.498	85.7	13.2	6.81	8.885	19.360	17.640	37.6	20.0	24.4	6.7	3.62	0.75	28.8	8.8	15.6
84	123.6	0.505	85.7	13.2	6.82	8.992	19.454	17.704	37.7	20.0	24.4	6.7	3.63	0.75	28.8	8.9	15.6
85	124.1	0.511	85.6	13.2	6.83	9.099	19.534	17.756	37.7	20.0	24.5	6.8	3.62	0.74	28.8	8.9	15.7
86	124.4	0.517	85.6	13.2	6.83	9.206	19.587	17.784	37.7	20.0	24.6	6.8	3.62	0.74	28.8	8.9	15.7
87	124.9	0.523	85.6	13.1	6.84	9.313	19.667	17.835	37.8	20.0	24.7	6.8	3.62	0.74	28.9	8.9	15.7
88	125.4	0.529	85.6	13.1	6.85	9.420	19.747	17.886	37.8	20.0	24.7	6.8	3.62	0.73	28.9	8.9	15.8
89	125.6	0.535	85.6	13.1	6.86	9.527	19.773	17.889	37.8	20.0	24.7	6.8	3.62	0.73	28.9	8.9	15.8
90	126.2	0.541	85.6	13.1	6.87	9.634	19.880	17.965	37.9	20.0	24.8	6.8	3.63	0.73	28.9	9.0	15.8
91	126.6	0.547	85.6	13.2	6.87	9.741	19.933	17.991	37.9	20.0	24.8	6.8	3.65	0.73	28.9	9.0	15.8
92	127.1	0.553	85.7	13.2	6.88	9.848	20.013	18.042	38.0	20.0	24.8	6.7	3.68	0.73	29.0	9.0	15.8
93	127.7	0.559	85.7	13.2	6.89	9.955	20.119	18.116	38.1	20.0	24.9	6.7	3.69	0.73	29.0	9.1	15.8
94	128.1	0.565	85.6	13.2	6.90	10.063	20.173	18.143	38.1	20.0	24.9	6.8	3.68	0.73	29.0	9.1	15.8
95	128.6	0.571	85.6	13.2	6.91	10.170	20.253	18.193	38.1	20.0	25.0	6.8	3.68	0.72	29.0	9.1	15.9
96	128.5	0.577	85.6	13.2	6.92	10.277	20.239	18.159	38.1	20.0	24.9	6.8	3.68	0.73	29.0	9.1	15.9
97	129.3	0.583	85.6	13.2	6.92	10.384	20.372	18.257	38.2	20.0	25.0	6.8	3.69	0.72	29.1	9.1	15.9
98	129.6	0.589	85.6	13.1	6.93	10.491	20.426	18.283	38.2	20.0	25.1	6.8	3.68	0.72	29.1	9.1	16.0
99	129.1	0.595	85.6	13.1	6.94	10.598	20.346	18.190	38.1	20.0	25.0	6.8	3.67	0.72	29.0	9.1	15.9
100	130.1	0.601	85.5	13.1	6.95	10.705	20.506	18.311	38.3	20.0	25.2	6.9	3.67	0.72	29.1	9.2	16.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	130.5	0.607	85.5	13.1	6.96	10.812	20.559	18.336	38.3	20.0	25.2	6.9	3.66	0.71	29.1	9.2	16.1
102	131.0	0.613	85.6	13.1	6.97	10.919	20.652	18.397	38.3	20.0	25.2	6.8	3.70	0.71	29.1	9.2	16.0
103	131.1	0.619	85.5	13.1	6.97	11.026	20.665	18.387	38.3	20.0	25.2	6.9	3.68	0.71	29.1	9.2	16.1
104	131.7	0.625	85.5	13.1	6.98	11.133	20.759	18.448	38.4	20.0	25.3	6.9	3.69	0.71	29.2	9.2	16.1
105	132.2	0.631	85.5	13.1	6.99	11.240	20.838	18.496	38.4	20.0	25.4	6.9	3.70	0.71	29.2	9.2	16.1
106	132.7	0.637	85.5	13.1	7.00	11.347	20.918	18.545	38.5	20.0	25.4	6.9	3.69	0.70	29.2	9.3	16.2
107	133.1	0.643	85.5	13.0	7.01	11.454	20.985	18.581	38.5	20.0	25.5	6.9	3.68	0.70	29.2	9.3	16.2
108	133.6	0.649	85.4	13.0	7.02	11.561	21.065	18.630	38.6	20.0	25.6	7.0	3.67	0.70	29.3	9.3	16.3
109	133.8	0.655	85.4	12.9	7.02	11.668	21.091	18.630	38.6	20.0	25.6	7.0	3.65	0.69	29.3	9.3	16.3
110	134.5	0.661	85.3	12.9	7.03	11.775	21.211	18.714	38.7	20.0	25.8	7.1	3.65	0.69	29.3	9.4	16.4
111	134.8	0.667	85.3	12.9	7.04	11.882	21.251	18.726	38.7	20.0	25.8	7.1	3.65	0.69	29.3	9.4	16.4
112	135.2	0.673	85.3	12.9	7.05	11.989	21.318	18.762	38.7	20.0	25.9	7.1	3.64	0.68	29.3	9.4	16.5
113	135.8	0.679	85.3	12.8	7.06	12.096	21.411	18.821	38.8	20.0	26.0	7.1	3.64	0.68	29.4	9.4	16.5
114	136.0	0.685	85.3	12.8	7.07	12.203	21.451	18.833	38.8	20.0	26.0	7.1	3.64	0.68	29.4	9.4	16.6
115	136.4	0.691	85.2	12.7	7.08	12.311	21.518	18.869	38.8	20.0	26.1	7.2	3.61	0.67	29.4	9.4	16.7
116	136.3	0.697	85.2	12.8	7.08	12.418	21.504	18.834	38.8	20.0	26.0	7.2	3.62	0.68	29.4	9.4	16.6
117	136.9	0.703	85.2	12.7	7.09	12.525	21.597	18.892	38.8	20.0	26.1	7.2	3.62	0.67	29.4	9.4	16.7
118	137.4	0.709	85.2	12.7	7.10	12.632	21.677	18.939	38.9	20.0	26.2	7.2	3.62	0.67	29.4	9.5	16.7
119	137.7	0.715	85.1	12.7	7.11	12.739	21.717	18.951	38.9	20.0	26.2	7.3	3.61	0.67	29.4	9.5	16.7
120	138.6	0.721	85.1	12.7	7.12	12.846	21.864	19.055	39.0	20.0	26.3	7.3	3.62	0.67	29.5	9.5	16.8
121	139.1	0.727	85.1	12.7	7.13	12.953	21.957	19.113	39.1	20.0	26.4	7.3	3.62	0.66	29.5	9.6	16.9
122	139.7	0.733	85.1	12.7	7.14	13.060	22.050	19.170	39.1	20.0	26.5	7.3	3.63	0.66	29.5	9.6	16.9
123	140.5	0.739	85.1	12.7	7.15	13.167	22.183	19.262	39.2	20.0	26.6	7.3	3.64	0.66	29.6	9.6	16.9
124	140.9	0.745	85.1	12.7	7.15	13.274	22.237	19.285	39.2	20.0	26.6	7.3	3.64	0.66	29.6	9.6	16.9
125	141.5	0.751	85.1	12.7	7.16	13.381	22.330	19.342	39.3	20.0	26.6	7.3	3.65	0.65	29.6	9.7	17.0
126	141.8	0.757	85.1	12.6	7.17	13.488	22.383	19.364	39.3	20.0	26.7	7.3	3.64	0.65	29.6	9.7	17.0
127	142.2	0.763	85.0	12.6	7.18	13.595	22.450	19.398	39.3	20.0	26.8	7.4	3.63	0.65	29.6	9.7	17.1
128	142.5	0.769	85.0	12.5	7.19	13.702	22.503	19.420	39.4	20.0	26.8	7.4	3.62	0.65	29.7	9.7	17.1
129	142.6	0.775	85.0	12.6	7.20	13.809	22.516	19.407	39.4	20.0	26.8	7.4	3.63	0.65	29.7	9.7	17.1
130	143.4	0.781	85.0	12.5	7.21	13.916	22.636	19.486	39.4	20.0	26.9	7.4	3.63	0.64	29.7	9.7	17.2
131	143.6	0.787	85.0	12.5	7.22	14.023	22.676	19.496	39.4	20.0	26.9	7.4	3.63	0.64	29.7	9.7	17.2
132	144.0	0.793	85.0	12.5	7.23	14.130	22.743	19.529	39.5	20.0	26.9	7.4	3.63	0.64	29.7	9.8	17.2
133	144.4	0.799	84.9	12.5	7.24	14.237	22.809	19.562	39.5	20.0	27.0	7.5	3.62	0.64	29.7	9.8	17.2
134	144.8	0.805	84.9	12.4	7.24	14.344	22.862	19.583	39.5	20.0	27.1	7.5	3.61	0.64	29.7	9.8	17.3
135	145.3	0.811	84.9	12.4	7.25	14.451	22.942	19.627	39.6	20.0	27.2	7.5	3.60	0.63	29.8	9.8	17.4
136	145.5	0.817	84.9	12.4	7.26	14.559	22.982	19.636	39.6	20.0	27.1	7.5	3.62	0.63	29.8	9.8	17.3
137	146.3	0.823	84.9	12.4	7.27	14.666	23.115	19.725	39.7	20.0	27.2	7.5	3.63	0.63	29.8	9.9	17.4
138	146.8	0.829	84.9	12.4	7.28	14.773	23.195	19.769	39.7	20.0	27.3	7.5	3.62	0.63	29.8	9.9	17.4
139	147.2	0.835	84.9	12.4	7.29	14.880	23.249	19.789	39.7	20.0	27.3	7.5	3.62	0.63	29.8	9.9	17.4
140	147.6	0.841	84.8	12.4	7.30	14.987	23.328	19.832	39.8	20.0	27.4	7.6	3.62	0.62	29.9	9.9	17.5
141	147.9	0.847	84.8	12.3	7.31	15.094	23.368	19.841	39.8	20.0	27.5	7.6	3.60	0.62	29.9	9.9	17.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	148.0	0.853	84.8	12.3	7.32	15.201	23.382	19.828	39.8	20.0	27.4	7.6	3.60	0.62	29.9	9.9	17.5
143	148.2	0.859	84.8	12.3	7.33	15.308	23.422	19.836	39.8	20.0	27.5	7.6	3.60	0.62	29.9	9.9	17.5
144	148.8	0.865	84.8	12.3	7.34	15.415	23.515	19.890	39.8	20.0	27.5	7.6	3.61	0.62	29.9	9.9	17.6
145	149.5	0.871	84.7	12.3	7.35	15.522	23.621	19.955	39.9	20.0	27.6	7.7	3.60	0.62	29.9	10.0	17.6
146	150.0	0.877	84.7	12.2	7.35	15.629	23.701	19.997	39.9	20.0	27.7	7.7	3.60	0.61	29.9	10.0	17.7
147	150.2	0.883	84.7	12.2	7.36	15.736	23.741	20.005	40.0	20.0	27.7	7.7	3.60	0.61	30.0	10.0	17.7
148	150.8	0.889	84.7	12.2	7.37	15.843	23.834	20.058	40.0	20.0	27.8	7.7	3.59	0.61	30.0	10.0	17.8
149	151.0	0.895	84.7	12.2	7.38	15.950	23.861	20.055	40.0	20.0	27.8	7.7	3.59	0.61	30.0	10.0	17.8
150	151.9	0.901	84.7	12.2	7.39	16.057	24.008	20.153	40.1	20.0	27.9	7.7	3.60	0.61	30.0	10.1	17.8
151	151.8	0.907	84.6	12.2	7.40	16.164	23.994	20.116	40.1	20.0	27.9	7.8	3.59	0.60	30.0	10.1	17.8
152	152.3	0.913	84.6	12.2	7.41	16.271	24.074	20.157	40.1	20.0	27.9	7.8	3.59	0.60	30.0	10.1	17.9
153	152.4	0.919	84.6	12.1	7.42	16.378	24.101	20.153	40.1	20.0	28.0	7.8	3.58	0.60	30.0	10.1	17.9
154	152.8	0.925	84.5	12.1	7.43	16.485	24.154	20.172	40.1	20.0	28.0	7.9	3.57	0.60	30.0	10.1	17.9
155	153.2	0.931	84.5	12.0	7.44	16.592	24.221	20.202	40.2	20.0	28.1	7.9	3.56	0.60	30.1	10.1	18.0
156	153.2	0.937	84.5	12.0	7.45	16.699	24.221	20.176	40.1	20.0	28.1	7.9	3.55	0.60	30.0	10.1	18.0
157	153.7	0.943	84.5	12.0	7.46	16.807	24.300	20.216	40.2	20.0	28.1	7.9	3.56	0.60	30.1	10.1	18.0
158	154.2	0.949	84.5	12.0	7.47	16.914	24.380	20.257	40.2	20.0	28.2	7.9	3.56	0.59	30.1	10.1	18.0
159	154.3	0.955	84.5	12.0	7.48	17.021	24.407	20.253	40.2	20.0	28.2	7.9	3.55	0.59	30.1	10.1	18.1
160	154.8	0.961	84.4	12.0	7.49	17.128	24.474	20.282	40.2	20.0	28.3	8.0	3.54	0.59	30.1	10.1	18.1
161	155.2	0.967	84.4	12.0	7.50	17.235	24.540	20.311	40.3	20.0	28.3	8.0	3.54	0.59	30.1	10.2	18.1
162	155.5	0.973	84.4	11.9	7.51	17.342	24.593	20.328	40.3	20.0	28.4	8.0	3.53	0.59	30.1	10.2	18.2
163	156.0	0.979	84.4	11.9	7.52	17.449	24.673	20.368	40.3	20.0	28.4	8.0	3.54	0.59	30.1	10.2	18.2
164	156.6	0.985	84.4	11.9	7.53	17.556	24.767	20.419	40.4	20.0	28.4	8.0	3.55	0.58	30.2	10.2	18.2
165	157.5	0.991	84.3	11.9	7.54	17.663	24.913	20.513	40.5	20.0	28.6	8.1	3.54	0.58	30.2	10.3	18.3
166	158.1	0.997	84.3	11.8	7.55	17.770	25.020	20.574	40.5	20.0	28.7	8.1	3.54	0.58	30.2	10.3	18.4
167	158.6	1.003	84.3	11.8	7.56	17.877	25.086	20.601	40.6	20.0	28.7	8.1	3.54	0.58	30.3	10.3	18.4
168	158.9	1.009	84.3	11.8	7.57	17.992	25.139	20.616	40.6	20.0	28.8	8.1	3.53	0.57	30.3	10.3	18.5
169	159.1	1.015	84.3	11.8	7.58	18.108	25.166	20.609	40.6	20.0	28.8	8.1	3.53	0.57	30.3	10.3	18.4
170	159.6	1.022	84.3	11.8	7.59	18.223	25.259	20.656	40.6	20.0	28.8	8.1	3.54	0.57	30.3	10.3	18.5
171	160.0	1.028	84.2	11.8	7.60	18.338	25.312	20.671	40.6	20.0	28.9	8.2	3.53	0.57	30.3	10.3	18.5
172	160.5	1.035	84.2	11.8	7.61	18.453	25.392	20.707	40.7	20.0	28.9	8.2	3.53	0.57	30.3	10.4	18.5
173	161.0	1.041	84.2	11.7	7.62	18.569	25.472	20.742	40.7	20.0	29.0	8.2	3.52	0.57	30.3	10.4	18.6
174	161.3	1.048	84.1	11.7	7.63	18.684	25.525	20.756	40.7	20.0	29.0	8.3	3.51	0.56	30.3	10.4	18.6
175	161.7	1.054	84.1	11.7	7.64	18.791	25.592	20.783	40.7	20.0	29.0	8.3	3.52	0.56	30.3	10.4	18.7
176	162.1	1.060	84.1	11.7	7.65	18.898	25.659	20.810	40.8	20.0	29.1	8.3	3.52	0.56	30.4	10.4	18.7
177	162.4	1.066	84.1	11.6	7.66	19.005	25.712	20.825	40.8	20.0	29.1	8.3	3.51	0.56	30.4	10.4	18.7
178	162.8	1.072	84.1	11.6	7.67	19.112	25.765	20.841	40.8	20.0	29.1	8.3	3.51	0.56	30.4	10.4	18.7
179	163.1	1.078	84.1	11.6	7.68	19.219	25.818	20.856	40.8	20.0	29.2	8.3	3.50	0.56	30.4	10.4	18.8
180	163.6	1.084	84.0	11.6	7.69	19.326	25.898	20.893	40.8	20.0	29.3	8.4	3.49	0.55	30.4	10.4	18.8
181	164.0	1.090	84.0	11.6	7.70	19.433	25.965	20.919	40.9	20.0	29.3	8.4	3.50	0.55	30.4	10.5	18.8
182	164.0	1.096	84.0	11.6	7.71	19.540	25.965	20.891	40.8	20.0	29.3	8.4	3.49	0.55	30.4	10.4	18.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	164.2	1.102	84.0	11.5	7.72	19.647	25.992	20.885	40.8	20.0	29.3	8.4	3.48	0.55	30.4	10.4	18.9
184	164.6	1.108	84.0	11.5	7.73	19.754	26.058	20.910	40.9	20.0	29.3	8.4	3.48	0.55	30.4	10.5	18.9
185	165.2	1.114	84.0	11.5	7.74	19.870	26.151	20.955	40.9	20.0	29.4	8.4	3.49	0.55	30.4	10.5	18.9
186	165.5	1.121	83.9	11.5	7.76	19.985	26.205	20.968	40.9	20.0	29.4	8.5	3.48	0.55	30.4	10.5	18.9
187	165.6	1.121	83.9	11.5	7.76	19.993	26.218	20.976	40.9	20.0	29.4	8.5	3.48	0.55	30.4	10.5	19.0

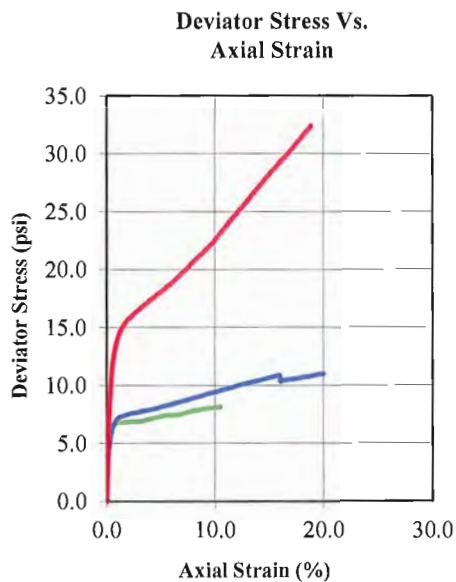


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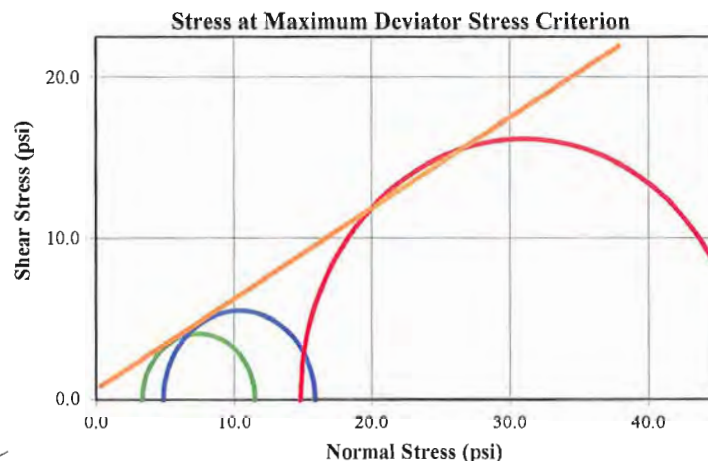
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0' to 10.0'
PROJECT LOCATION : B-56	SAMPLE TYPE : Remolded
BORING NUMBER : B-56	DESCRIPTION : Red, Tan & White Sandy Lean Clay
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	15.7	15.9	15.5	
Dry Density (pcf)	101.5	100.6	102.6	
Saturation (%)	66.19	65.61	67.19	
Void Ratio	0.626	0.640	0.610	
Diameter (in)	2.802	2.810	2.805	
Height (in)	5.610	5.612	5.547	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	40	40	40	
Plastic Limit	24	24	24	
After Consolidation	A	B	C	D
B-Value	0.98	0.95	0.95	
Water Content (%)	23.4	22.6	18.9	
Dry Density (pcf)	101.51	100.64	114.54	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.630	0.644	0.444	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	87.4	76.5	65.2	
Rate of Strain	0.002	0.002	0.002	
After Shear	A	B	C	D
σ'_1 at Failure (psi)	11.51	15.89	47.18	
σ'_3 at Failure (psi)	3.32	4.84	14.78	

Maximum Deviator Stress Criterion	
C (psi)	2.2
ϕ (deg)	13.5
C' (psi)	0.7
ϕ' (deg)	29.4

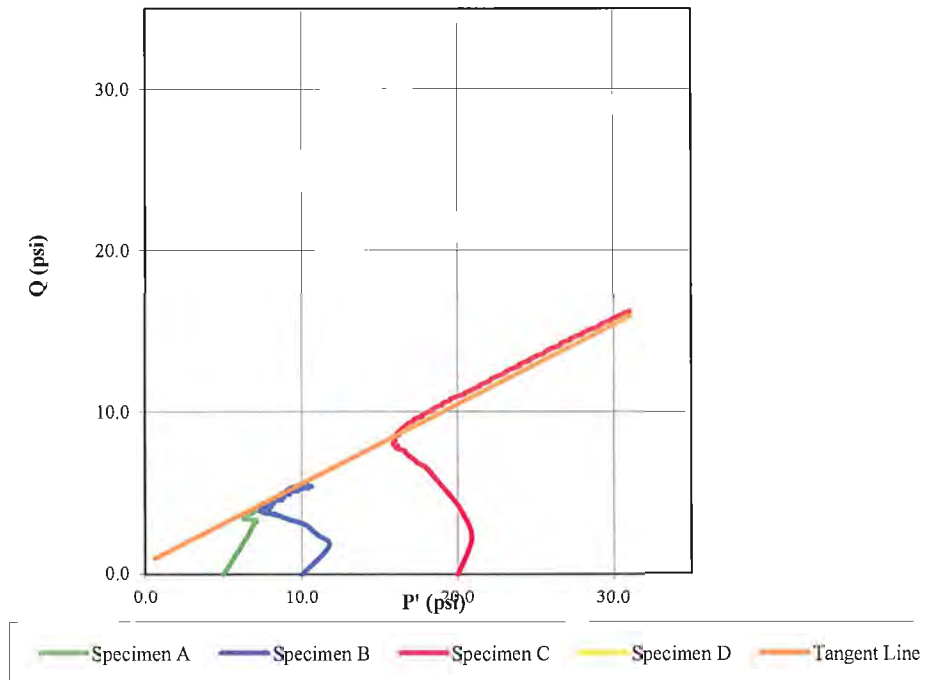


Tested By: [Signature]
Date: 12-19-12

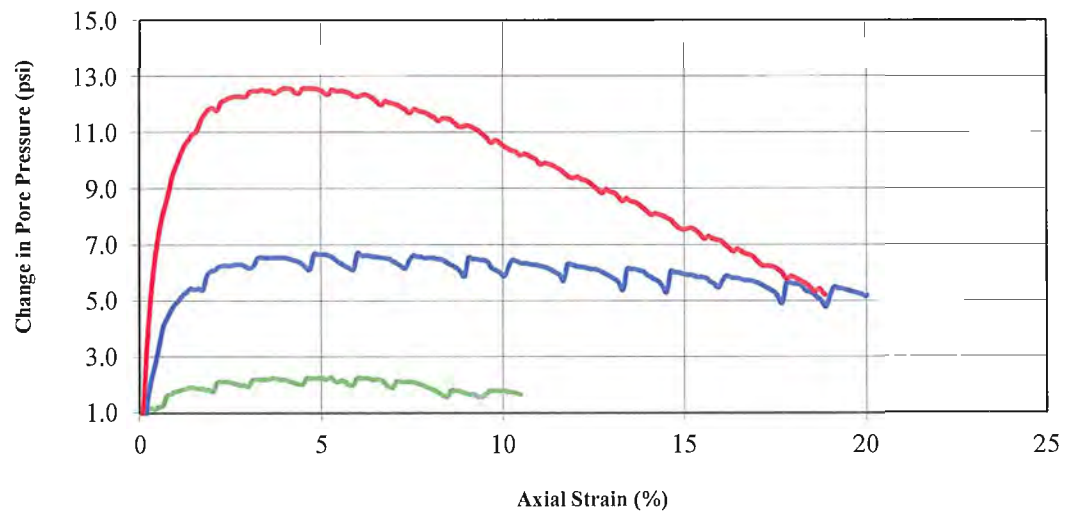
Approved By: SKB
Date: 12/19/12



Stress Paths (Effective)
($a = 0.7$ $\alpha = 26.2$)



Change in Pore Pressure vs. Axial Strain





File Location

B-56 Bag 1 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: B-56

Sample Description: Red, Tan & White Sandy Lean Clay

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 40.000

PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.802	2.803	
Height (in)	5.610	5.609	
Weight (grams)	1066.90		1137.80
Moisture (%)	15.73		23.42
Dry Density (pcf)	101.51	101.51	
Saturation (%)	66.19	100.00	
Void Ratio	0.626	0.630	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 92.400

Effective Confining Stress (psi): 5.0

Corrected Peak Deviator Stress (psi): 8.187 at reading number: 98

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	-5.0	0.000	87.4	0.0	6.17	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	23.4	0.006	88.2	0.8	6.18	0.107	4.612	4.607	9.6	5.0	8.8	4.2	2.10	0.18	7.3	2.3	6.5
2	31.3	0.012	88.5	1.1	6.18	0.214	5.879	5.866	10.9	5.0	9.8	3.9	2.51	0.19	7.9	2.9	6.8
3	34.1	0.018	88.6	1.2	6.19	0.321	6.345	6.325	11.3	5.0	10.1	3.8	2.66	0.19	8.2	3.2	7.0
4	35.4	0.024	88.5	1.1	6.20	0.428	6.546	6.518	11.5	5.0	10.4	3.9	2.69	0.18	8.3	3.3	7.1
5	36.0	0.030	88.6	1.2	6.20	0.535	6.652	6.617	11.6	5.0	10.4	3.8	2.76	0.18	8.3	3.3	7.1
6	36.4	0.036	88.7	1.3	6.21	0.642	6.719	6.676	11.7	5.0	10.4	3.7	2.79	0.19	8.3	3.3	7.1
7	36.9	0.042	89.0	1.6	6.22	0.749	6.799	6.748	11.7	5.0	10.2	3.4	2.98	0.24	8.4	3.4	6.8
8	37.1	0.048	89.1	1.7	6.22	0.856	6.826	6.767	11.8	5.0	10.1	3.3	3.04	0.25	8.4	3.4	6.7
9	37.3	0.055	89.2	1.8	6.23	0.964	6.852	6.786	11.8	5.0	10.0	3.2	3.09	0.26	8.4	3.4	6.6
10	37.4	0.061	89.2	1.8	6.24	1.071	6.879	6.805	11.8	5.0	10.0	3.2	3.13	0.26	8.4	3.4	6.6
11	37.4	0.067	89.2	1.8	6.24	1.178	6.879	6.798	11.8	5.0	10.0	3.2	3.15	0.27	8.4	3.4	6.6
12	37.6	0.073	89.3	1.9	6.25	1.285	6.906	6.817	11.8	5.0	9.9	3.1	3.19	0.27	8.4	3.4	6.5
13	37.5	0.079	89.3	1.9	6.26	1.392	6.892	6.796	11.8	5.0	9.9	3.1	3.21	0.28	8.4	3.4	6.5
14	37.8	0.085	89.3	1.9	6.26	1.499	6.932	6.828	11.8	5.0	9.9	3.1	3.22	0.28	8.4	3.4	6.5
15	37.9	0.091	89.3	1.9	6.27	1.606	6.959	6.847	11.8	5.0	10.0	3.1	3.20	0.27	8.4	3.4	6.5
16	37.9	0.097	89.3	1.9	6.28	1.713	6.959	6.840	11.8	5.0	10.0	3.1	3.19	0.27	8.4	3.4	6.5
17	38.0	0.103	89.2	1.8	6.28	1.820	6.972	6.845	11.8	5.0	10.0	3.2	3.17	0.27	8.4	3.4	6.6
18	38.1	0.109	89.2	1.8	6.29	1.927	6.986	6.851	11.8	5.0	10.0	3.2	3.17	0.27	8.4	3.4	6.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	38.2	0.115	89.2	1.8	6.30	2.034	6.999	6.857	11.8	5.0	10.1	3.2	3.14	0.26	8.4	3.4	6.6
20	38.3	0.121	89.5	2.1	6.30	2.141	7.012	6.862	11.9	5.0	9.8	2.9	3.36	0.30	8.4	3.4	6.3
21	38.4	0.127	89.5	2.1	6.31	2.248	7.039	6.881	11.9	5.0	9.8	2.9	3.40	0.31	8.4	3.4	6.3
22	38.4	0.133	89.5	2.1	6.32	2.355	7.039	6.873	11.9	5.0	9.7	2.9	3.39	0.31	8.4	3.4	6.3
23	38.4	0.139	89.5	2.1	6.32	2.462	7.039	6.866	11.9	5.0	9.7	2.9	3.39	0.31	8.4	3.4	6.3
24	38.6	0.145	89.5	2.1	6.33	2.569	7.066	6.884	11.9	5.0	9.8	2.9	3.36	0.30	8.4	3.4	6.4
25	38.7	0.151	89.4	2.0	6.34	2.676	7.079	6.890	11.9	5.0	9.8	3.0	3.33	0.30	8.4	3.4	6.4
26	38.8	0.157	89.4	2.0	6.35	2.784	7.092	6.895	11.9	5.0	9.9	3.0	3.30	0.29	8.4	3.4	6.4
27	38.8	0.163	89.4	2.0	6.35	2.891	7.092	6.887	11.9	5.0	9.9	3.0	3.30	0.29	8.4	3.4	6.4
28	38.8	0.169	89.4	2.0	6.36	2.998	7.106	6.893	11.9	5.0	9.9	3.0	3.27	0.28	8.4	3.4	6.5
29	39.0	0.175	89.6	2.2	6.37	3.105	7.132	6.911	11.9	5.0	9.7	2.8	3.44	0.31	8.4	3.5	6.3
30	39.2	0.181	89.6	2.2	6.37	3.212	7.159	6.929	11.9	5.0	9.7	2.8	3.48	0.32	8.5	3.5	6.3
31	39.3	0.187	89.6	2.2	6.38	3.319	7.186	6.947	11.9	5.0	9.7	2.8	3.49	0.32	8.5	3.5	6.3
32	39.7	0.193	89.6	2.2	6.39	3.426	7.239	6.991	12.0	5.0	9.8	2.8	3.50	0.31	8.5	3.5	6.3
33	39.8	0.199	89.6	2.2	6.39	3.533	7.266	7.009	12.0	5.0	9.8	2.8	3.51	0.31	8.5	3.5	6.3
34	40.1	0.205	89.6	2.2	6.40	3.640	7.306	7.040	12.0	5.0	9.8	2.8	3.56	0.32	8.5	3.5	6.3
35	40.3	0.211	89.6	2.2	6.41	3.747	7.346	7.071	12.1	5.0	9.8	2.8	3.57	0.32	8.5	3.5	6.3
36	40.4	0.217	89.6	2.2	6.42	3.854	7.359	7.075	12.1	5.0	9.9	2.8	3.53	0.31	8.5	3.5	6.3
37	40.6	0.223	89.6	2.2	6.42	3.961	7.399	7.106	12.1	5.0	9.9	2.8	3.55	0.31	8.5	3.6	6.3
38	40.9	0.229	89.6	2.2	6.43	4.068	7.439	7.136	12.1	5.0	10.0	2.8	3.52	0.30	8.6	3.6	6.4
39	41.1	0.235	89.5	2.1	6.44	4.175	7.466	7.154	12.1	5.0	10.0	2.9	3.49	0.30	8.6	3.6	6.4
40	41.4	0.241	89.5	2.1	6.44	4.282	7.519	7.197	12.2	5.0	10.1	2.9	3.47	0.29	8.6	3.6	6.5
41	41.4	0.247	89.4	2.0	6.45	4.389	7.519	7.189	12.2	5.0	10.1	3.0	3.43	0.28	8.6	3.6	6.5
42	41.6	0.253	89.4	2.0	6.46	4.496	7.559	7.219	12.2	5.0	10.2	3.0	3.44	0.28	8.6	3.6	6.6
43	42.0	0.259	89.6	2.2	6.47	4.604	7.613	7.262	12.3	5.0	10.0	2.8	3.64	0.31	8.6	3.6	6.4
44	42.1	0.265	89.6	2.2	6.47	4.711	7.639	7.279	12.3	5.0	10.0	2.8	3.65	0.31	8.6	3.6	6.4
45	42.5	0.271	89.6	2.2	6.48	4.818	7.693	7.322	12.3	5.0	10.1	2.8	3.66	0.31	8.7	3.7	6.4
46	42.5	0.277	89.6	2.2	6.49	4.925	7.706	7.326	12.3	5.0	10.1	2.8	3.66	0.31	8.7	3.7	6.4
47	42.9	0.283	89.6	2.2	6.50	5.032	7.759	7.369	12.4	5.0	10.1	2.8	3.68	0.30	8.7	3.7	6.4
48	42.9	0.289	89.6	2.2	6.50	5.139	7.759	7.360	12.4	5.0	10.2	2.8	3.64	0.30	8.7	3.7	6.5
49	43.4	0.295	89.7	2.3	6.51	5.246	7.839	7.428	12.4	5.0	10.1	2.7	3.74	0.31	8.7	3.7	6.4
50	43.4	0.301	89.6	2.2	6.52	5.353	7.839	7.420	12.4	5.0	10.3	2.8	3.62	0.29	8.7	3.7	6.5
51	43.3	0.307	89.5	2.1	6.53	5.460	7.826	7.399	12.4	5.0	10.3	2.9	3.58	0.29	8.7	3.7	6.6
52	43.5	0.313	89.6	2.2	6.53	5.567	7.866	7.428	12.4	5.0	10.3	2.8	3.62	0.29	8.7	3.7	6.5
53	43.7	0.319	89.5	2.1	6.54	5.674	7.893	7.445	12.4	5.0	10.3	2.9	3.59	0.28	8.7	3.7	6.6
54	43.8	0.325	89.4	2.0	6.55	5.781	7.906	7.449	12.4	5.0	10.4	3.0	3.49	0.27	8.7	3.7	6.7
55	43.9	0.331	89.4	2.0	6.55	5.888	7.919	7.453	12.4	5.0	10.4	3.0	3.52	0.27	8.7	3.7	6.7
56	43.7	0.337	89.6	2.2	6.56	5.995	7.893	7.419	12.4	5.0	10.2	2.8	3.70	0.30	8.7	3.7	6.5
57	44.1	0.343	89.6	2.2	6.57	6.102	7.959	7.474	12.5	5.0	10.2	2.8	3.72	0.30	8.7	3.7	6.5
58	43.9	0.349	89.6	2.2	6.58	6.209	7.919	7.428	12.4	5.0	10.2	2.8	3.70	0.30	8.7	3.7	6.5
59	44.0	0.355	89.6	2.2	6.58	6.316	7.946	7.444	12.4	5.0	10.2	2.8	3.71	0.30	8.7	3.7	6.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	44.2	0.361	89.6	2.2	6.59	6.424	7.973	7.460	12.5	5.0	10.3	2.8	3.67	0.29	8.7	3.7	6.5
61	44.3	0.367	89.6	2.2	6.60	6.531	7.986	7.464	12.5	5.0	10.3	2.8	3.67	0.29	8.7	3.7	6.5
62	44.4	0.373	89.6	2.2	6.61	6.638	8.013	7.481	12.5	5.0	10.3	2.8	3.68	0.29	8.7	3.7	6.5
63	44.7	0.379	89.5	2.1	6.61	6.745	8.053	7.510	12.5	5.0	10.4	2.9	3.58	0.28	8.7	3.8	6.7
64	44.8	0.385	89.4	2.0	6.62	6.852	8.079	7.526	12.5	5.0	10.6	3.0	3.48	0.26	8.8	3.8	6.8
65	45.3	0.391	89.3	1.9	6.63	6.959	8.146	7.579	12.6	5.0	10.7	3.1	3.46	0.25	8.8	3.8	6.9
66	45.4	0.397	89.5	2.1	6.64	7.066	8.173	7.595	12.6	5.0	10.5	2.9	3.64	0.28	8.8	3.8	6.7
67	45.6	0.403	89.5	2.1	6.65	7.173	8.199	7.611	12.6	5.0	10.5	2.9	3.65	0.28	8.8	3.8	6.7
68	45.9	0.409	89.5	2.1	6.65	7.280	8.253	7.652	12.6	5.0	10.5	2.9	3.66	0.28	8.8	3.8	6.7
69	46.3	0.415	89.5	2.1	6.66	7.387	8.319	7.705	12.7	5.0	10.6	2.9	3.68	0.28	8.8	3.9	6.7
70	46.3	0.421	89.5	2.1	6.67	7.494	8.319	7.696	12.7	5.0	10.6	2.9	3.68	0.28	8.8	3.8	6.7
71	46.6	0.427	89.5	2.1	6.68	7.601	8.373	7.736	12.7	5.0	10.6	2.9	3.66	0.27	8.9	3.9	6.8
72	47.0	0.433	89.4	2.0	6.68	7.708	8.426	7.777	12.8	5.0	10.7	3.0	3.63	0.26	8.9	3.9	6.8
73	47.1	0.439	89.4	2.0	6.69	7.815	8.453	7.792	12.8	5.0	10.8	3.0	3.60	0.26	8.9	3.9	6.9
74	47.5	0.445	89.3	1.9	6.70	7.922	8.506	7.832	12.8	5.0	10.9	3.1	3.55	0.24	8.9	3.9	7.0
75	47.4	0.451	89.3	1.9	6.71	8.029	8.493	7.811	12.8	5.0	10.9	3.1	3.51	0.24	8.9	3.9	7.0
76	47.6	0.457	89.2	1.8	6.72	8.136	8.533	7.839	12.8	5.0	11.0	3.2	3.45	0.23	8.9	3.9	7.1
77	48.0	0.463	89.1	1.7	6.72	8.244	8.586	7.878	12.9	5.0	11.2	3.3	3.40	0.22	8.9	3.9	7.2
78	48.0	0.469	89.0	1.6	6.73	8.351	8.599	7.881	12.9	5.0	11.2	3.4	3.34	0.21	8.9	3.9	7.3
79	48.2	0.475	89.0	1.6	6.74	8.458	8.626	7.897	12.9	5.0	11.3	3.4	3.32	0.20	8.9	3.9	7.4
80	48.5	0.481	89.2	1.8	6.75	8.565	8.666	7.924	12.9	5.0	11.1	3.2	3.48	0.23	9.0	4.0	7.2
81	48.8	0.487	89.2	1.8	6.75	8.672	8.720	7.963	13.0	5.0	11.2	3.2	3.49	0.23	9.0	4.0	7.2
82	48.9	0.493	89.2	1.8	6.76	8.779	8.733	7.966	13.0	5.0	11.2	3.2	3.49	0.23	9.0	4.0	7.2
83	48.9	0.499	89.2	1.8	6.77	8.886	8.733	7.957	12.9	5.0	11.2	3.2	3.46	0.22	9.0	4.0	7.2
84	49.0	0.505	89.1	1.7	6.78	8.993	8.760	7.972	13.0	5.0	11.3	3.3	3.43	0.21	9.0	4.0	7.3
85	49.4	0.511	89.1	1.7	6.79	9.100	8.813	8.011	13.0	5.0	11.3	3.3	3.41	0.21	9.0	4.0	7.3
86	49.4	0.517	89.1	1.7	6.79	9.207	8.826	8.014	13.0	5.0	11.3	3.3	3.41	0.21	9.0	4.0	7.3
87	49.7	0.523	89.0	1.6	6.80	9.314	8.866	8.040	13.0	5.0	11.4	3.4	3.36	0.20	9.0	4.0	7.4
88	49.8	0.529	89.0	1.6	6.81	9.421	8.880	8.043	13.0	5.0	11.4	3.4	3.36	0.20	9.0	4.0	7.4
89	49.9	0.535	89.1	1.7	6.82	9.528	8.906	8.058	13.0	5.0	11.4	3.3	3.43	0.21	9.0	4.0	7.3
90	50.0	0.541	89.2	1.8	6.83	9.635	8.920	8.060	13.1	5.0	11.3	3.2	3.52	0.22	9.0	4.0	7.2
91	50.3	0.547	89.2	1.8	6.83	9.742	8.960	8.087	13.1	5.0	11.3	3.2	3.53	0.22	9.0	4.0	7.2
92	50.4	0.553	89.2	1.8	6.84	9.849	8.973	8.089	13.1	5.0	11.3	3.2	3.53	0.22	9.0	4.0	7.2
93	50.6	0.559	89.2	1.8	6.85	9.956	9.013	8.116	13.1	5.0	11.3	3.2	3.54	0.22	9.0	4.1	7.3
94	50.7	0.565	89.2	1.8	6.86	10.064	9.026	8.118	13.1	5.0	11.3	3.2	3.54	0.22	9.1	4.1	7.3
95	50.8	0.571	89.2	1.8	6.87	10.171	9.053	8.132	13.1	5.0	11.4	3.2	3.51	0.22	9.1	4.1	7.3
96	51.0	0.577	89.2	1.8	6.88	10.278	9.080	8.146	13.1	5.0	11.4	3.2	3.51	0.22	9.1	4.1	7.3
97	51.2	0.583	89.1	1.7	6.88	10.385	9.106	8.161	13.2	5.0	11.4	3.3	3.49	0.21	9.1	4.1	7.4
98	51.4	0.588	89.1	1.7	6.89	10.484	9.146	8.187	13.2	5.0	11.5	3.3	3.47	0.20	9.1	4.1	7.4
99	51.3	0.588	89.1	1.7	6.89	10.484	9.120	8.164	13.2	5.0	11.5	3.3	3.46	0.20	9.1	4.1	7.4



Florence & Hutcheson

CONSULTING ENGINEERS

Specimen B Shear Data

CU Triaxial Test

File Location

B-56 Bag 1 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: B-56

Sample Description: Red, Tan & White Sandy Lean Clay

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 40.000

PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.810	2.815	
Height (in)	5.612	5.593	
Weight (grams)	1065.90		1127.18
Moisture (%)	15.94		22.60
Dry Density (pcf)	100.64	100.64	
Saturation (%)	65.61	100.00	
Void Ratio	0.640	0.644	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 86.500

Effective Confining Stress (psi): 10.0

Corrected Peak Deviator Stress (psi): 11.046

at reading number: 183

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in2)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.0	0.000	76.5	0.0	6.22	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	21.9	0.007	76.5	0.0	6.23	0.109	3.515	3.511	13.5	10.0	13.5	10.0	1.35	0.01	11.8	1.8	11.7
2	29.9	0.013	77.9	1.4	6.24	0.218	4.810	4.800	14.8	10.0	13.4	8.6	1.56	0.28	12.4	2.4	11.0
3	34.6	0.019	78.7	2.2	6.24	0.327	5.563	5.545	15.5	10.0	13.4	7.8	1.71	0.39	12.8	2.8	10.6
4	37.9	0.025	79.2	2.7	6.25	0.437	6.092	6.065	16.1	10.0	13.3	7.3	1.83	0.45	13.0	3.0	10.3
5	40.1	0.031	79.9	3.4	6.26	0.546	6.449	6.414	16.4	10.0	13.0	6.6	1.97	0.53	13.2	3.2	9.8
6	41.9	0.037	80.6	4.1	6.26	0.655	6.739	6.695	16.7	10.0	12.6	5.9	2.13	0.61	13.3	3.3	9.3
7	43.1	0.043	80.9	4.4	6.27	0.764	6.924	6.872	16.9	10.0	12.5	5.6	2.22	0.64	13.4	3.4	9.0
8	44.0	0.049	81.2	4.7	6.28	0.873	7.070	7.008	17.0	10.0	12.3	5.3	2.32	0.67	13.5	3.5	8.8
9	44.8	0.055	81.4	4.9	6.28	0.982	7.202	7.131	17.1	10.0	12.3	5.1	2.39	0.68	13.6	3.6	8.7
10	45.4	0.062	81.5	5.0	6.29	1.092	7.294	7.215	17.2	10.0	12.2	5.0	2.45	0.70	13.6	3.6	8.6
11	45.8	0.068	81.7	5.2	6.30	1.201	7.361	7.272	17.3	10.0	12.1	4.8	2.51	0.71	13.6	3.6	8.4
12	46.0	0.074	81.8	5.3	6.31	1.310	7.387	7.290	17.3	10.0	12.0	4.7	2.56	0.73	13.6	3.6	8.3
13	46.3	0.080	81.9	5.4	6.31	1.419	7.440	7.334	17.3	10.0	11.9	4.6	2.61	0.74	13.7	3.7	8.2
14	46.6	0.086	81.9	5.4	6.32	1.528	7.493	7.378	17.4	10.0	12.0	4.6	2.60	0.73	13.7	3.7	8.3
15	47.0	0.092	81.9	5.4	6.33	1.637	7.546	7.422	17.4	10.0	12.0	4.6	2.63	0.73	13.7	3.7	8.3
16	47.1	0.098	81.9	5.4	6.33	1.746	7.572	7.440	17.4	10.0	12.0	4.6	2.62	0.73	13.7	3.7	8.3
17	47.4	0.104	82.4	5.9	6.34	1.856	7.625	7.483	17.5	10.0	11.6	4.1	2.82	0.79	13.7	3.7	7.9
18	47.8	0.110	82.5	6.0	6.35	1.965	7.678	7.527	17.5	10.0	11.5	4.0	2.90	0.80	13.8	3.8	7.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	47.9	0.116	82.6	6.1	6.35	2.074	7.704	7.544	17.5	10.0	11.5	3.9	2.93	0.81	13.8	3.8	7.7
20	48.3	0.123	82.7	6.2	6.36	2.183	7.757	7.588	17.6	10.0	11.4	3.8	3.00	0.82	13.8	3.8	7.6
21	48.4	0.129	82.7	6.2	6.37	2.292	7.770	7.592	17.6	10.0	11.3	3.8	3.02	0.82	13.8	3.8	7.5
22	48.4	0.135	82.7	6.2	6.38	2.401	7.783	7.596	17.6	10.0	11.3	3.8	3.02	0.82	13.8	3.8	7.6
23	48.7	0.141	82.7	6.2	6.38	2.511	7.823	7.627	17.6	10.0	11.4	3.8	3.03	0.82	13.8	3.8	7.6
24	48.8	0.147	82.8	6.3	6.39	2.620	7.849	7.644	17.6	10.0	11.4	3.7	3.06	0.82	13.8	3.8	7.5
25	49.0	0.153	82.8	6.3	6.40	2.729	7.876	7.661	17.7	10.0	11.4	3.7	3.06	0.82	13.8	3.8	7.5
26	49.0	0.159	82.8	6.3	6.40	2.838	7.876	7.652	17.7	10.0	11.4	3.7	3.06	0.82	13.8	3.8	7.5
27	49.4	0.165	82.7	6.2	6.41	2.947	7.942	7.708	17.7	10.0	11.5	3.8	3.03	0.81	13.9	3.9	7.6
28	49.4	0.171	82.7	6.2	6.42	3.056	7.942	7.699	17.7	10.0	11.5	3.8	3.01	0.80	13.8	3.8	7.7
29	49.7	0.178	82.8	6.3	6.43	3.165	7.995	7.742	17.7	10.0	11.5	3.7	3.09	0.81	13.9	3.9	7.6
30	50.2	0.184	83.0	6.5	6.43	3.275	8.061	7.797	17.8	10.0	11.3	3.5	3.25	0.84	13.9	3.9	7.4
31	50.2	0.190	83.0	6.5	6.44	3.384	8.061	7.788	17.8	10.0	11.3	3.5	3.24	0.84	13.9	3.9	7.4
32	50.4	0.196	83.0	6.5	6.45	3.493	8.101	7.818	17.8	10.0	11.3	3.5	3.25	0.84	13.9	3.9	7.4
33	50.7	0.202	83.0	6.5	6.46	3.602	8.140	7.847	17.8	10.0	11.3	3.5	3.26	0.83	13.9	3.9	7.4
34	50.7	0.208	83.0	6.5	6.46	3.711	8.153	7.851	17.9	10.0	11.3	3.5	3.26	0.83	13.9	3.9	7.4
35	50.9	0.214	83.0	6.5	6.47	3.820	8.180	7.867	17.9	10.0	11.3	3.5	3.27	0.83	13.9	3.9	7.4
36	51.1	0.220	83.0	6.5	6.48	3.930	8.219	7.896	17.9	10.0	11.4	3.5	3.28	0.83	13.9	3.9	7.4
37	51.3	0.226	83.0	6.5	6.48	4.039	8.246	7.913	17.9	10.0	11.4	3.5	3.28	0.83	14.0	4.0	7.4
38	51.6	0.232	83.0	6.5	6.49	4.148	8.286	7.942	17.9	10.0	11.5	3.5	3.26	0.82	14.0	4.0	7.5
39	51.7	0.239	82.9	6.4	6.50	4.257	8.312	7.958	18.0	10.0	11.5	3.6	3.24	0.81	14.0	4.0	7.5
40	52.0	0.245	82.9	6.4	6.51	4.366	8.352	7.987	18.0	10.0	11.6	3.6	3.22	0.80	14.0	4.0	7.6
41	52.1	0.251	82.8	6.3	6.51	4.475	8.378	8.003	18.0	10.0	11.7	3.7	3.18	0.79	14.0	4.0	7.7
42	52.3	0.257	82.7	6.2	6.52	4.585	8.404	8.019	18.0	10.0	11.8	3.8	3.11	0.77	14.0	4.0	7.8
43	52.5	0.263	82.6	6.1	6.53	4.694	8.444	8.048	18.0	10.0	11.9	3.9	3.08	0.76	14.0	4.0	7.9
44	52.9	0.269	83.2	6.7	6.54	4.803	8.497	8.089	18.1	10.0	11.4	3.3	3.42	0.82	14.0	4.0	7.4
45	53.2	0.275	83.2	6.7	6.54	4.912	8.550	8.130	18.1	10.0	11.5	3.3	3.43	0.82	14.1	4.1	7.4
46	53.4	0.281	83.2	6.7	6.55	5.021	8.576	8.146	18.1	10.0	11.5	3.3	3.43	0.82	14.1	4.1	7.4
47	53.7	0.287	83.2	6.7	6.56	5.130	8.629	8.186	18.2	10.0	11.5	3.3	3.44	0.81	14.1	4.1	7.4
48	54.0	0.293	83.1	6.6	6.57	5.239	8.682	8.227	18.2	10.0	11.6	3.4	3.43	0.80	14.1	4.1	7.5
49	54.1	0.300	83.0	6.5	6.57	5.349	8.695	8.230	18.2	10.0	11.7	3.5	3.37	0.79	14.1	4.1	7.6
50	54.3	0.306	82.9	6.4	6.58	5.458	8.722	8.246	18.2	10.0	11.8	3.6	3.30	0.78	14.1	4.1	7.7
51	54.7	0.312	82.8	6.3	6.59	5.567	8.788	8.299	18.3	10.0	12.0	3.7	3.26	0.76	14.1	4.1	7.8
52	54.8	0.318	82.7	6.2	6.60	5.676	8.801	8.301	18.3	10.0	12.1	3.8	3.21	0.75	14.2	4.2	7.9
53	55.0	0.324	82.7	6.2	6.60	5.785	8.841	8.329	18.3	10.0	12.2	3.8	3.17	0.74	14.2	4.2	8.0
54	55.1	0.330	82.6	6.1	6.61	5.894	8.854	8.332	18.3	10.0	12.2	3.9	3.15	0.74	14.2	4.2	8.0
55	55.6	0.336	83.2	6.7	6.62	6.004	8.933	8.397	18.4	10.0	11.7	3.3	3.54	0.80	14.2	4.2	7.5
56	55.9	0.342	83.1	6.6	6.63	6.113	8.986	8.437	18.4	10.0	11.8	3.4	3.49	0.78	14.2	4.2	7.6
57	56.2	0.348	83.1	6.6	6.64	6.222	9.039	8.476	18.5	10.0	11.9	3.4	3.50	0.78	14.2	4.2	7.6
58	56.6	0.355	83.1	6.6	6.64	6.331	9.092	8.516	18.5	10.0	11.9	3.4	3.51	0.78	14.3	4.3	7.6
59	56.7	0.361	83.1	6.6	6.65	6.440	9.105	8.518	18.5	10.0	11.9	3.4	3.48	0.77	14.3	4.3	7.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	56.8	0.367	83.1	6.6	6.66	6.549	9.131	8.533	18.5	10.0	12.0	3.4	3.49	0.77	14.3	4.3	7.7
61	57.0	0.373	83.0	6.5	6.67	6.658	9.158	8.548	18.5	10.0	12.0	3.5	3.46	0.76	14.3	4.3	7.7
62	57.3	0.379	83.0	6.5	6.67	6.768	9.211	8.587	18.6	10.0	12.1	3.5	3.47	0.76	14.3	4.3	7.8
63	57.6	0.385	83.0	6.5	6.68	6.877	9.263	8.626	18.6	10.0	12.1	3.5	3.46	0.75	14.3	4.3	7.8
64	57.8	0.391	82.9	6.4	6.69	6.986	9.290	8.641	18.6	10.0	12.2	3.6	3.41	0.74	14.3	4.3	7.9
65	58.1	0.397	82.8	6.3	6.70	7.095	9.343	8.680	18.7	10.0	12.4	3.7	3.36	0.73	14.3	4.3	8.0
66	58.4	0.403	82.7	6.2	6.71	7.204	9.382	8.706	18.7	10.0	12.5	3.8	3.32	0.72	14.4	4.4	8.1
67	58.5	0.409	82.7	6.2	6.71	7.313	9.396	8.708	18.7	10.0	12.5	3.8	3.27	0.71	14.4	4.4	8.2
68	58.7	0.416	82.9	6.4	6.72	7.423	9.435	8.735	18.7	10.0	12.3	3.6	3.46	0.74	14.4	4.4	7.9
69	59.3	0.422	83.1	6.6	6.73	7.532	9.528	8.810	18.8	10.0	12.2	3.4	3.60	0.75	14.4	4.4	7.8
70	59.5	0.428	83.1	6.6	6.74	7.641	9.554	8.824	18.8	10.0	12.3	3.4	3.57	0.74	14.4	4.4	7.8
71	59.8	0.434	83.1	6.6	6.75	7.750	9.607	8.862	18.9	10.0	12.3	3.4	3.58	0.74	14.4	4.4	7.9
72	60.0	0.440	83.0	6.5	6.75	7.859	9.647	8.889	18.9	10.0	12.4	3.5	3.56	0.73	14.4	4.4	7.9
73	60.4	0.446	83.0	6.5	6.76	7.968	9.700	8.927	18.9	10.0	12.4	3.5	3.57	0.73	14.5	4.5	7.9
74	60.5	0.452	83.0	6.5	6.77	8.077	9.726	8.940	18.9	10.0	12.4	3.5	3.58	0.73	14.5	4.5	7.9
75	60.8	0.458	83.0	6.5	6.78	8.187	9.766	8.966	19.0	10.0	12.5	3.5	3.55	0.72	14.5	4.5	8.0
76	61.0	0.464	83.0	6.5	6.79	8.296	9.805	8.992	19.0	10.0	12.5	3.5	3.56	0.72	14.5	4.5	8.0
77	61.3	0.471	82.9	6.4	6.79	8.405	9.858	9.030	19.0	10.0	12.6	3.6	3.51	0.71	14.5	4.5	8.1
78	61.6	0.477	82.8	6.3	6.80	8.514	9.898	9.055	19.1	10.0	12.7	3.7	3.47	0.70	14.5	4.5	8.2
79	61.8	0.483	82.7	6.2	6.81	8.623	9.937	9.080	19.1	10.0	12.8	3.8	3.42	0.69	14.5	4.5	8.3
80	62.1	0.489	82.7	6.2	6.82	8.732	9.977	9.106	19.1	10.0	12.9	3.8	3.38	0.68	14.6	4.6	8.4
81	62.3	0.495	82.5	6.0	6.83	8.842	10.017	9.131	19.1	10.0	13.1	4.0	3.31	0.66	14.6	4.6	8.5
82	62.6	0.501	82.4	5.9	6.83	8.951	10.056	9.156	19.2	10.0	13.3	4.1	3.22	0.64	14.6	4.6	8.7
83	63.1	0.507	83.0	6.5	6.84	9.060	10.136	9.217	19.2	10.0	12.7	3.5	3.66	0.71	14.6	4.6	8.1
84	63.4	0.513	83.0	6.5	6.85	9.169	10.188	9.254	19.3	10.0	12.8	3.5	3.64	0.70	14.6	4.6	8.1
85	63.7	0.519	83.0	6.5	6.86	9.278	10.241	9.291	19.3	10.0	12.8	3.5	3.65	0.70	14.6	4.6	8.2
86	63.9	0.525	82.9	6.4	6.87	9.387	10.268	9.304	19.3	10.0	12.9	3.6	3.62	0.69	14.7	4.7	8.2
87	64.2	0.532	82.9	6.4	6.88	9.496	10.321	9.341	19.3	10.0	12.9	3.6	3.63	0.69	14.7	4.7	8.2
88	64.4	0.538	82.9	6.4	6.88	9.606	10.347	9.353	19.4	10.0	13.0	3.6	3.58	0.68	14.7	4.7	8.3
89	64.6	0.544	82.7	6.2	6.89	9.715	10.387	9.378	19.4	10.0	13.2	3.8	3.45	0.66	14.7	4.7	8.5
90	64.8	0.550	82.6	6.1	6.90	9.824	10.413	9.390	19.4	10.0	13.3	3.9	3.40	0.65	14.7	4.7	8.6
91	65.0	0.556	82.5	6.0	6.91	9.933	10.453	9.414	19.4	10.0	13.4	4.0	3.36	0.64	14.7	4.7	8.7
92	65.4	0.562	82.4	5.9	6.92	10.042	10.506	9.451	19.5	10.0	13.6	4.1	3.30	0.62	14.7	4.7	8.8
93	65.6	0.568	82.7	6.2	6.93	10.151	10.545	9.475	19.5	10.0	13.3	3.8	3.50	0.66	14.7	4.7	8.5
94	65.9	0.574	82.9	6.4	6.93	10.261	10.598	9.511	19.5	10.0	13.1	3.6	3.68	0.68	14.8	4.8	8.3
95	66.4	0.580	82.9	6.4	6.94	10.370	10.664	9.558	19.6	10.0	13.1	3.6	3.66	0.67	14.8	4.8	8.4
96	66.6	0.587	82.9	6.4	6.95	10.479	10.704	9.582	19.6	10.0	13.2	3.6	3.64	0.66	14.8	4.8	8.4
97	66.8	0.593	82.8	6.3	6.96	10.588	10.730	9.594	19.6	10.0	13.3	3.7	3.61	0.66	14.8	4.8	8.5
98	67.2	0.599	82.8	6.3	6.97	10.697	10.796	9.641	19.6	10.0	13.3	3.7	3.63	0.66	14.8	4.8	8.5
99	67.3	0.605	82.8	6.3	6.98	10.806	10.823	9.653	19.7	10.0	13.4	3.7	3.60	0.65	14.8	4.8	8.5
100	67.7	0.611	82.8	6.3	6.99	10.916	10.876	9.688	19.7	10.0	13.4	3.7	3.61	0.65	14.8	4.8	8.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	67.9	0.617	82.7	6.2	6.99	11.025	10.915	9.712	19.7	10.0	13.5	3.8	3.59	0.64	14.9	4.9	8.6
102	68.2	0.623	82.7	6.2	7.00	11.134	10.955	9.735	19.7	10.0	13.5	3.8	3.57	0.64	14.9	4.9	8.7
103	68.5	0.629	82.7	6.2	7.01	11.243	11.008	9.770	19.8	10.0	13.6	3.8	3.55	0.63	14.9	4.9	8.7
104	68.6	0.635	82.6	6.1	7.02	11.352	11.021	9.770	19.8	10.0	13.7	3.9	3.50	0.62	14.9	4.9	8.8
105	69.0	0.641	82.5	6.0	7.03	11.461	11.087	9.816	19.8	10.0	13.8	4.0	3.46	0.61	14.9	4.9	8.9
106	69.3	0.648	82.4	5.9	7.04	11.570	11.140	9.851	19.9	10.0	13.9	4.1	3.42	0.60	14.9	4.9	9.0
107	69.4	0.654	82.2	5.7	7.05	11.680	11.153	9.850	19.9	10.0	14.1	4.3	3.30	0.58	14.9	4.9	9.2
108	69.9	0.660	82.8	6.3	7.05	11.789	11.232	9.908	19.9	10.0	13.6	3.7	3.67	0.63	15.0	5.0	8.7
109	70.3	0.666	82.8	6.3	7.06	11.898	11.298	9.954	20.0	10.0	13.7	3.7	3.68	0.63	15.0	5.0	8.7
110	70.5	0.672	82.7	6.2	7.07	12.007	11.325	9.965	20.0	10.0	13.7	3.8	3.66	0.63	15.0	5.0	8.7
111	70.9	0.678	82.7	6.2	7.08	12.116	11.391	10.011	20.0	10.0	13.8	3.8	3.64	0.62	15.0	5.0	8.8
112	71.1	0.684	82.7	6.2	7.09	12.225	11.431	10.033	20.0	10.0	13.8	3.8	3.65	0.62	15.0	5.0	8.8
113	71.5	0.690	82.7	6.2	7.10	12.335	11.483	10.067	20.1	10.0	13.9	3.8	3.63	0.61	15.0	5.0	8.9
114	71.6	0.696	82.6	6.1	7.11	12.444	11.510	10.078	20.1	10.0	14.0	3.9	3.60	0.61	15.0	5.0	8.9
115	72.0	0.703	82.6	6.1	7.12	12.553	11.576	10.123	20.1	10.0	14.0	3.9	3.61	0.61	15.1	5.1	8.9
116	72.3	0.709	82.6	6.1	7.12	12.662	11.616	10.145	20.1	10.0	14.1	3.9	3.59	0.60	15.1	5.1	9.0
117	72.4	0.715	82.5	6.0	7.13	12.771	11.642	10.155	20.2	10.0	14.2	4.0	3.54	0.59	15.1	5.1	9.1
118	72.9	0.721	82.4	5.9	7.14	12.880	11.708	10.200	20.2	10.0	14.3	4.1	3.50	0.58	15.1	5.1	9.2
119	73.0	0.727	82.3	5.8	7.15	12.989	11.735	10.210	20.2	10.0	14.4	4.2	3.46	0.57	15.1	5.1	9.3
120	73.4	0.733	82.3	5.8	7.16	13.099	11.801	10.255	20.3	10.0	14.5	4.2	3.42	0.56	15.1	5.1	9.4
121	73.6	0.739	82.1	5.6	7.17	13.208	11.827	10.265	20.3	10.0	14.6	4.4	3.36	0.55	15.1	5.1	9.5
122	73.7	0.745	81.9	5.4	7.18	13.317	11.840	10.264	20.3	10.0	14.9	4.6	3.23	0.53	15.1	5.1	9.7
123	74.2	0.751	82.6	6.1	7.19	13.426	11.920	10.319	20.3	10.0	14.2	3.9	3.66	0.59	15.2	5.2	9.0
124	74.5	0.757	82.6	6.1	7.20	13.535	11.972	10.352	20.4	10.0	14.2	3.9	3.67	0.59	15.2	5.2	9.0
125	74.6	0.764	82.6	6.1	7.21	13.644	11.986	10.350	20.4	10.0	14.2	3.9	3.67	0.59	15.2	5.2	9.0
126	74.9	0.770	82.6	6.1	7.21	13.754	12.039	10.383	20.4	10.0	14.3	3.9	3.65	0.59	15.2	5.2	9.1
127	75.2	0.776	82.5	6.0	7.22	13.863	12.091	10.415	20.4	10.0	14.4	4.0	3.63	0.58	15.2	5.2	9.2
128	75.5	0.782	82.4	5.9	7.23	13.972	12.131	10.436	20.4	10.0	14.5	4.1	3.56	0.57	15.2	5.2	9.3
129	75.7	0.788	82.3	5.8	7.24	14.081	12.171	10.457	20.5	10.0	14.6	4.2	3.52	0.56	15.2	5.2	9.4
130	76.1	0.794	82.3	5.8	7.25	14.190	12.224	10.489	20.5	10.0	14.7	4.2	3.48	0.55	15.2	5.2	9.5
131	76.3	0.800	82.2	5.7	7.26	14.299	12.263	10.510	20.5	10.0	14.8	4.3	3.43	0.54	15.3	5.3	9.6
132	76.6	0.806	82.0	5.5	7.27	14.408	12.316	10.541	20.5	10.0	15.0	4.5	3.35	0.52	15.3	5.3	9.8
133	76.8	0.812	81.8	5.3	7.28	14.518	12.342	10.551	20.6	10.0	15.2	4.7	3.25	0.50	15.3	5.3	10.0
134	77.1	0.819	82.5	6.0	7.29	14.627	12.395	10.582	20.6	10.0	14.5	4.0	3.68	0.57	15.3	5.3	9.2
135	77.5	0.825	82.5	6.0	7.30	14.736	12.461	10.625	20.6	10.0	14.6	4.0	3.66	0.57	15.3	5.3	9.3
136	77.7	0.831	82.5	6.0	7.31	14.845	12.488	10.634	20.6	10.0	14.6	4.0	3.66	0.56	15.3	5.3	9.3
137	78.0	0.837	82.5	6.0	7.32	14.954	12.541	10.665	20.7	10.0	14.7	4.0	3.64	0.56	15.3	5.3	9.4
138	78.4	0.843	82.4	5.9	7.33	15.063	12.594	10.697	20.7	10.0	14.8	4.1	3.62	0.55	15.3	5.3	9.4
139	78.7	0.849	82.4	5.9	7.34	15.173	12.646	10.728	20.7	10.0	14.8	4.1	3.63	0.55	15.4	5.4	9.4
140	78.9	0.855	82.4	5.9	7.35	15.282	12.673	10.736	20.7	10.0	14.9	4.1	3.61	0.55	15.4	5.4	9.5
141	79.2	0.861	82.3	5.8	7.35	15.391	12.726	10.767	20.8	10.0	14.9	4.2	3.59	0.54	15.4	5.4	9.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	79.5	0.867	82.3	5.8	7.36	15.500	12.779	10.798	20.8	10.0	15.0	4.2	3.60	0.54	15.4	5.4	9.6
143	79.8	0.873	82.3	5.8	7.37	15.609	12.818	10.817	20.8	10.0	15.0	4.2	3.58	0.54	15.4	5.4	9.6
144	80.1	0.880	82.2	5.7	7.38	15.718	12.871	10.848	20.8	10.0	15.2	4.3	3.51	0.52	15.4	5.4	9.7
145	80.4	0.886	82.1	5.6	7.39	15.827	12.924	10.878	20.9	10.0	15.3	4.4	3.47	0.51	15.4	5.4	9.8
146	80.7	0.892	82.0	5.5	7.40	15.937	12.964	10.898	20.9	10.0	15.4	4.5	3.41	0.50	15.4	5.4	10.0
147	81.0	0.898	82.2	5.7	7.41	16.046	13.016	10.381	20.4	10.0	14.7	4.3	3.43	0.55	15.2	5.2	9.5
148	81.5	0.904	82.4	5.9	7.42	16.155	13.096	10.429	20.4	10.0	14.5	4.1	3.53	0.56	15.2	5.2	9.3
149	81.7	0.910	82.3	5.8	7.43	16.264	13.135	10.444	20.4	10.0	14.6	4.2	3.51	0.56	15.2	5.2	9.4
150	82.0	0.916	82.3	5.8	7.44	16.373	13.175	10.459	20.5	10.0	14.7	4.2	3.49	0.55	15.2	5.2	9.4
151	82.3	0.922	82.3	5.8	7.45	16.482	13.228	10.485	20.5	10.0	14.7	4.2	3.50	0.55	15.2	5.2	9.4
152	82.5	0.928	82.3	5.8	7.46	16.592	13.254	10.489	20.5	10.0	14.7	4.2	3.48	0.55	15.2	5.2	9.5
153	82.7	0.934	82.2	5.7	7.47	16.701	13.294	10.504	20.5	10.0	14.8	4.3	3.46	0.54	15.3	5.3	9.5
154	83.1	0.941	82.2	5.7	7.48	16.810	13.360	10.541	20.5	10.0	14.8	4.3	3.46	0.54	15.3	5.3	9.5
155	83.1	0.947	82.2	5.7	7.49	16.919	13.347	10.512	20.5	10.0	14.8	4.3	3.43	0.54	15.3	5.3	9.6
156	83.5	0.953	82.1	5.6	7.50	17.028	13.426	10.559	20.6	10.0	14.9	4.4	3.42	0.53	15.3	5.3	9.6
157	83.5	0.959	82.1	5.6	7.51	17.137	13.413	10.530	20.5	10.0	15.0	4.4	3.37	0.53	15.3	5.3	9.7
158	84.0	0.965	82.0	5.5	7.52	17.247	13.492	10.577	20.6	10.0	15.1	4.5	3.34	0.52	15.3	5.3	9.8
159	84.2	0.971	81.9	5.4	7.53	17.356	13.532	10.591	20.6	10.0	15.2	4.6	3.30	0.51	15.3	5.3	9.9
160	84.5	0.977	81.8	5.3	7.54	17.465	13.571	10.606	20.6	10.0	15.3	4.7	3.27	0.50	15.3	5.3	10.0
161	84.7	0.983	81.7	5.2	7.55	17.574	13.611	10.620	20.6	10.0	15.5	4.8	3.19	0.49	15.3	5.3	10.2
162	84.8	0.989	81.4	4.9	7.56	17.683	13.624	10.612	20.6	10.0	15.7	5.1	3.09	0.46	15.3	5.3	10.4
163	85.3	0.996	82.1	5.6	7.57	17.792	13.704	10.659	20.7	10.0	15.1	4.4	3.42	0.53	15.3	5.3	9.7
164	85.8	1.002	82.1	5.6	7.58	17.901	13.783	10.705	20.7	10.0	15.1	4.4	3.46	0.53	15.4	5.4	9.7
165	85.8	1.008	82.1	5.6	7.59	18.011	13.796	10.697	20.7	10.0	15.1	4.4	3.43	0.52	15.3	5.3	9.7
166	86.1	1.014	82.1	5.6	7.60	18.120	13.836	10.711	20.7	10.0	15.1	4.4	3.43	0.52	15.4	5.4	9.8
167	86.5	1.020	82.0	5.5	7.61	18.229	13.902	10.746	20.7	10.0	15.2	4.5	3.40	0.51	15.4	5.4	9.9
168	86.8	1.026	81.9	5.4	7.62	18.338	13.941	10.759	20.8	10.0	15.4	4.6	3.32	0.50	15.4	5.4	10.0
169	86.9	1.032	81.8	5.3	7.63	18.447	13.968	10.762	20.8	10.0	15.4	4.7	3.30	0.49	15.4	5.4	10.1
170	87.2	1.038	81.7	5.2	7.64	18.556	14.021	10.786	20.8	10.0	15.5	4.8	3.26	0.49	15.4	5.4	10.2
171	87.3	1.044	81.6	5.1	7.65	18.666	14.034	10.778	20.8	10.0	15.7	4.9	3.21	0.47	15.4	5.4	10.3
172	87.7	1.050	81.5	5.0	7.66	18.775	14.100	10.812	20.8	10.0	15.8	5.0	3.16	0.46	15.4	5.4	10.4
173	88.1	1.057	81.3	4.8	7.67	18.884	14.153	10.836	20.8	10.0	16.0	5.2	3.08	0.44	15.4	5.4	10.6
174	88.4	1.063	81.7	5.2	7.68	18.993	14.206	10.860	20.9	10.0	15.7	4.8	3.26	0.48	15.4	5.4	10.2
175	88.8	1.069	82.0	5.5	7.69	19.102	14.272	10.894	20.9	10.0	15.4	4.5	3.41	0.50	15.4	5.4	10.0
176	89.1	1.075	81.9	5.4	7.70	19.211	14.325	10.917	20.9	10.0	15.5	4.6	3.39	0.50	15.5	5.5	10.0
177	89.3	1.081	81.9	5.4	7.71	19.320	14.351	10.919	20.9	10.0	15.5	4.6	3.39	0.50	15.5	5.5	10.0
178	89.8	1.087	81.9	5.4	7.72	19.430	14.430	10.964	21.0	10.0	15.6	4.6	3.38	0.49	15.5	5.5	10.1
179	90.1	1.093	81.9	5.4	7.73	19.539	14.483	10.987	21.0	10.0	15.6	4.6	3.37	0.49	15.5	5.5	10.1
180	90.3	1.099	81.8	5.3	7.74	19.648	14.510	10.989	21.0	10.0	15.7	4.7	3.35	0.48	15.5	5.5	10.2
181	90.5	1.105	81.8	5.3	7.75	19.757	14.549	11.001	21.0	10.0	15.7	4.7	3.33	0.48	15.5	5.5	10.2
182	90.9	1.112	81.7	5.2	7.77	19.866	14.602	11.024	21.0	10.0	15.8	4.8	3.31	0.48	15.5	5.5	10.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	91.2	1.118	81.7	5.2	7.78	19.975	14.655	11,046	21.0	10.0	15.9	4.8	3.28	0.47	15.5	5.5	10.4
184	91.2	1.120	81.7	5.2	7.78	20.009	14.655	11,040	21.0	10.0	15.8	4.8	3.30	0.47	15.5	5.5	10.3



File Location

B-56 Bag 1 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: B-56

Sample Description: Red, Tan & White Sandy Lean Clay

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 40.000

PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.805	2.708	
Height (in)	5.547	5.331	
Weight (grams)	1066.30		1097.50
Moisture (%)	15.54		18.92
Dry Density (pcf)	102.57	114.54	
Saturation (%)	67.19	100.00	
Void Ratio	0.610	0.444	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 85.200

Effective Confining Stress (psi): 20.0

Corrected Peak Deviator Stress (psi): 32.391

at reading number: 167

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.0	0.061	65.2	0.0	5.76	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	26.2	0.067	66.6	1.4	5.76	0.113	4.558	4.553	24.6	20.0	23.2	18.6	1.24	0.30	22.3	2.3	20.9
2	45.7	0.073	68.9	3.7	5.77	0.225	7.944	7.927	27.9	20.0	24.2	16.3	1.49	0.47	24.0	4.0	20.2
3	56.9	0.079	70.7	5.5	5.78	0.338	9.888	9.854	29.9	20.0	24.4	14.5	1.68	0.55	24.9	4.9	19.5
4	64.3	0.085	71.9	6.7	5.78	0.451	11.174	11.123	31.1	20.0	24.4	13.3	1.84	0.60	25.6	5.6	18.9
5	69.9	0.091	72.8	7.6	5.79	0.563	12.131	12.063	32.1	20.0	24.5	12.4	1.97	0.63	26.0	6.0	18.5
6	74.1	0.097	73.4	8.2	5.80	0.676	12.874	12.787	32.8	20.0	24.6	11.8	2.09	0.64	26.4	6.4	18.2
7	77.2	0.103	74.0	8.8	5.80	0.788	13.403	13.297	33.3	20.0	24.5	11.2	2.18	0.66	26.6	6.6	17.9
8	79.8	0.109	74.6	9.4	5.81	0.901	13.860	13.735	33.7	20.0	24.3	10.6	2.30	0.69	26.9	6.9	17.5
9	82.1	0.115	75.0	9.8	5.82	1.014	14.260	14.115	34.1	20.0	24.3	10.2	2.39	0.70	27.1	7.1	17.2
10	84.0	0.121	75.4	10.2	5.82	1.126	14.589	14.424	34.4	20.0	24.2	9.8	2.47	0.71	27.2	7.2	17.0
11	85.6	0.127	75.7	10.5	5.83	1.239	14.860	14.676	34.7	20.0	24.2	9.5	2.55	0.72	27.3	7.3	16.8
12	87.0	0.133	75.9	10.7	5.84	1.352	15.103	14.899	34.9	20.0	24.2	9.3	2.60	0.72	27.4	7.4	16.7
13	88.1	0.139	76.1	10.9	5.84	1.464	15.303	15.079	35.1	20.0	24.2	9.1	2.66	0.72	27.5	7.5	16.6
14	89.2	0.145	76.2	11.0	5.85	1.577	15.489	15.244	35.2	20.0	24.2	9.0	2.70	0.72	27.6	7.6	16.6
15	90.2	0.151	76.6	11.4	5.86	1.690	15.660	15.396	35.4	20.0	24.0	8.6	2.79	0.74	27.7	7.7	16.3
16	91.2	0.157	76.9	11.7	5.86	1.802	15.832	15.546	35.5	20.0	23.9	8.3	2.86	0.75	27.8	7.8	16.1
17	92.1	0.163	77.0	11.8	5.87	1.915	16.003	15.697	35.7	20.0	23.9	8.2	2.92	0.75	27.8	7.8	16.0
18	92.7	0.169	77.1	11.9	5.88	2.028	16.103	15.777	35.8	20.0	23.9	8.1	2.94	0.75	27.9	7.9	16.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	93.3	0.175	77.0	11.8	5.88	2.140	16.203	15.856	35.9	20.0	24.1	8.2	2.93	0.74	27.9	7.9	16.2
20	94.0	0.181	77.3	12.1	5.89	2.253	16.317	15.950	36.0	20.0	23.9	7.9	3.01	0.76	28.0	8.0	15.9
21	94.8	0.187	77.3	12.1	5.90	2.365	16.460	16.071	36.1	20.0	23.9	7.9	3.05	0.76	28.0	8.0	15.9
22	95.4	0.193	77.4	12.2	5.90	2.478	16.560	16.150	36.2	20.0	23.9	7.8	3.08	0.76	28.1	8.1	15.9
23	96.2	0.199	77.5	12.3	5.91	2.591	16.703	16.271	36.3	20.0	24.0	7.7	3.10	0.75	28.1	8.1	15.9
24	96.7	0.205	77.5	12.3	5.92	2.703	16.789	16.335	36.3	20.0	24.1	7.7	3.11	0.75	28.2	8.2	15.9
25	97.4	0.211	77.5	12.3	5.92	2.816	16.918	16.441	36.4	20.0	24.2	7.7	3.13	0.75	28.2	8.2	16.0
26	98.1	0.217	77.5	12.3	5.93	2.929	17.032	16.533	36.5	20.0	24.3	7.7	3.14	0.74	28.3	8.3	16.0
27	98.6	0.223	77.6	12.4	5.94	3.041	17.118	16.597	36.6	20.0	24.2	7.6	3.19	0.75	28.3	8.3	15.9
28	99.5	0.229	77.7	12.5	5.95	3.154	17.275	16.730	36.7	20.0	24.3	7.5	3.22	0.75	28.4	8.4	15.9
29	99.9	0.235	77.7	12.5	5.95	3.267	17.346	16.780	36.8	20.0	24.3	7.5	3.23	0.74	28.4	8.4	15.9
30	100.6	0.241	77.7	12.5	5.96	3.379	17.475	16.884	36.9	20.0	24.4	7.5	3.25	0.74	28.4	8.4	15.9
31	101.4	0.247	77.7	12.5	5.97	3.492	17.603	16.989	37.0	20.0	24.5	7.5	3.26	0.73	28.5	8.5	16.0
32	101.9	0.253	77.7	12.5	5.97	3.605	17.689	17.052	37.1	20.0	24.6	7.5	3.26	0.73	28.5	8.5	16.1
33	102.5	0.259	77.6	12.4	5.98	3.717	17.803	17.142	37.1	20.0	24.8	7.6	3.25	0.72	28.6	8.6	16.2
34	103.1	0.265	77.7	12.5	5.99	3.830	17.903	17.218	37.2	20.0	24.7	7.5	3.29	0.72	28.6	8.6	16.1
35	103.9	0.271	77.8	12.6	5.99	3.942	18.046	17.335	37.3	20.0	24.8	7.4	3.33	0.72	28.7	8.7	16.1
36	104.6	0.277	77.8	12.6	6.00	4.055	18.161	17.424	37.4	20.0	24.9	7.4	3.34	0.72	28.7	8.7	16.2
37	105.1	0.283	77.8	12.6	6.01	4.168	18.246	17.486	37.5	20.0	24.9	7.4	3.35	0.72	28.7	8.7	16.2
38	105.6	0.289	77.6	12.4	6.02	4.280	18.346	17.561	37.6	20.0	25.1	7.6	3.32	0.71	28.8	8.8	16.4
39	106.2	0.295	77.6	12.4	6.02	4.393	18.446	17.636	37.6	20.0	25.2	7.6	3.32	0.70	28.8	8.8	16.4
40	106.9	0.301	77.8	12.6	6.03	4.506	18.561	17.724	37.7	20.0	25.2	7.4	3.38	0.71	28.9	8.9	16.3
41	107.8	0.307	77.8	12.6	6.04	4.618	18.718	17.853	37.9	20.0	25.3	7.4	3.40	0.70	28.9	8.9	16.4
42	108.2	0.313	77.8	12.6	6.04	4.731	18.789	17.900	37.9	20.0	25.3	7.4	3.40	0.70	29.0	9.0	16.4
43	109.0	0.319	77.8	12.6	6.05	4.844	18.932	18.015	38.0	20.0	25.5	7.4	3.42	0.70	29.0	9.0	16.5
44	109.6	0.325	77.7	12.5	6.06	4.956	19.032	18.089	38.1	20.0	25.6	7.5	3.42	0.69	29.0	9.0	16.5
45	110.1	0.331	77.6	12.4	6.07	5.069	19.118	18.149	38.1	20.0	25.7	7.6	3.40	0.68	29.1	9.1	16.6
46	110.7	0.337	77.5	12.3	6.07	5.182	19.218	18.222	38.2	20.0	25.9	7.7	3.38	0.68	29.1	9.1	16.8
47	111.3	0.343	77.7	12.5	6.08	5.294	19.332	18.309	38.3	20.0	25.8	7.5	3.44	0.68	29.2	9.2	16.6
48	112.1	0.349	77.7	12.5	6.09	5.407	19.475	18.422	38.4	20.0	26.0	7.5	3.45	0.68	29.2	9.2	16.7
49	113.0	0.355	77.7	12.5	6.09	5.519	19.618	18.535	38.5	20.0	26.1	7.5	3.46	0.67	29.3	9.3	16.8
50	113.7	0.361	77.7	12.5	6.10	5.632	19.747	18.635	38.6	20.0	26.2	7.5	3.47	0.67	29.3	9.3	16.8
51	114.0	0.367	77.6	12.4	6.11	5.745	19.804	18.666	38.7	20.0	26.2	7.6	3.47	0.67	29.3	9.3	16.9
52	114.8	0.373	77.5	12.3	6.12	5.857	19.932	18.765	38.8	20.0	26.4	7.7	3.45	0.66	29.4	9.4	17.0
53	115.5	0.379	77.5	12.3	6.12	5.970	20.061	18.863	38.9	20.0	26.6	7.7	3.44	0.65	29.4	9.4	17.2
54	116.1	0.385	77.5	12.3	6.13	6.083	20.161	18.935	38.9	20.0	26.6	7.7	3.46	0.65	29.5	9.5	17.2
55	117.0	0.391	77.5	12.3	6.14	6.195	20.318	19.059	39.1	20.0	26.7	7.7	3.49	0.65	29.5	9.5	17.2
56	117.7	0.397	77.5	12.3	6.15	6.308	20.433	19.144	39.1	20.0	26.8	7.7	3.49	0.64	29.6	9.6	17.3
57	118.6	0.403	77.4	12.2	6.15	6.421	20.590	19.268	39.3	20.0	27.0	7.8	3.48	0.63	29.6	9.6	17.4
58	119.1	0.409	77.3	12.1	6.16	6.533	20.690	19.338	39.3	20.0	27.2	7.9	3.45	0.63	29.7	9.7	17.6
59	120.0	0.415	77.2	12.0	6.17	6.646	20.833	19.448	39.4	20.0	27.5	8.0	3.42	0.62	29.7	9.7	17.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	120.7	0.421	77.3	12.1	6.18	6.759	20.961	19.545	39.5	20.0	27.4	7.9	3.47	0.62	29.8	9.8	17.7
61	121.6	0.427	77.3	12.1	6.18	6.871	21.118	19.667	39.7	20.0	27.6	7.9	3.48	0.61	29.8	9.8	17.8
62	123.2	0.439	77.2	12.0	6.20	7.096	21.390	19.872	39.9	20.0	27.9	8.0	3.48	0.60	29.9	9.9	18.0
63	123.8	0.445	77.1	11.9	6.21	7.209	21.504	19.954	40.0	20.0	28.1	8.1	3.46	0.60	30.0	10.0	18.1
64	124.6	0.451	77.0	11.8	6.21	7.322	21.633	20.049	40.0	20.0	28.2	8.2	3.45	0.59	30.0	10.0	18.2
65	125.4	0.457	76.9	11.7	6.22	7.434	21.776	20.157	40.2	20.0	28.5	8.3	3.43	0.58	30.1	10.1	18.4
66	126.1	0.463	77.0	11.8	6.23	7.547	21.904	20.251	40.3	20.0	28.4	8.2	3.47	0.58	30.1	10.1	18.3
67	127.0	0.469	77.0	11.8	6.24	7.660	22.061	20.372	40.4	20.0	28.6	8.2	3.48	0.58	30.2	10.2	18.4
68	127.9	0.475	76.9	11.7	6.24	7.772	22.219	20.492	40.5	20.0	28.8	8.3	3.48	0.57	30.2	10.2	18.5
69	128.6	0.481	76.9	11.7	6.25	7.885	22.333	20.572	40.6	20.0	28.9	8.3	3.48	0.57	30.3	10.3	18.6
70	129.3	0.487	76.8	11.6	6.26	7.998	22.462	20.665	40.7	20.0	29.1	8.4	3.46	0.56	30.3	10.3	18.7
71	130.2	0.493	76.7	11.5	6.27	8.110	22.604	20.771	40.8	20.0	29.2	8.5	3.45	0.56	30.4	10.4	18.9
72	130.8	0.499	76.6	11.4	6.27	8.223	22.719	20.851	40.9	20.0	29.4	8.6	3.43	0.55	30.4	10.4	19.0
73	131.7	0.505	76.7	11.5	6.28	8.336	22.876	20.969	41.0	20.0	29.5	8.5	3.46	0.55	30.5	10.5	19.0
74	132.5	0.511	76.7	11.5	6.29	8.448	23.019	21.074	41.1	20.0	29.6	8.5	3.48	0.55	30.5	10.5	19.0
75	133.3	0.517	76.7	11.5	6.30	8.561	23.147	21.166	41.2	20.0	29.7	8.5	3.48	0.54	30.6	10.6	19.1
76	134.0	0.523	76.5	11.3	6.30	8.673	23.276	21.257	41.3	20.0	29.9	8.7	3.45	0.53	30.6	10.6	19.3
77	134.8	0.529	76.4	11.2	6.31	8.786	23.405	21.348	41.3	20.0	30.1	8.8	3.43	0.52	30.7	10.7	19.5
78	135.6	0.535	76.4	11.2	6.32	8.899	23.547	21.452	41.5	20.0	30.2	8.8	3.44	0.52	30.7	10.7	19.5
79	136.5	0.541	76.4	11.2	6.33	9.011	23.705	21.569	41.6	20.0	30.3	8.8	3.46	0.52	30.8	10.8	19.5
80	137.3	0.547	76.4	11.2	6.34	9.124	23.848	21.672	41.7	20.0	30.5	8.8	3.46	0.52	30.8	10.8	19.6
81	138.1	0.553	76.3	11.1	6.34	9.237	23.990	21.774	41.8	20.0	30.7	8.9	3.45	0.51	30.9	10.9	19.8
82	139.0	0.559	76.2	11.0	6.35	9.349	24.133	21.877	41.9	20.0	30.8	9.0	3.44	0.50	30.9	10.9	19.9
83	139.9	0.565	76.1	10.9	6.36	9.462	24.305	22.005	42.0	20.0	31.1	9.1	3.42	0.50	31.0	11.0	20.1
84	140.8	0.571	76.0	10.8	6.37	9.575	24.448	22.107	42.1	20.0	31.3	9.2	3.40	0.49	31.1	11.1	20.3
85	141.5	0.577	75.8	10.6	6.38	9.687	24.576	22.195	42.2	20.0	31.6	9.4	3.37	0.48	31.1	11.1	20.5
86	142.6	0.583	75.9	10.7	6.38	9.800	24.762	22.335	42.3	20.0	31.6	9.3	3.41	0.48	31.2	11.2	20.5
87	143.6	0.589	75.8	10.6	6.39	9.913	24.933	22.462	42.5	20.0	31.8	9.4	3.40	0.47	31.2	11.2	20.6
88	144.6	0.595	75.7	10.5	6.40	10.025	25.105	22.588	42.6	20.0	32.1	9.5	3.38	0.47	31.3	11.3	20.8
89	145.7	0.601	75.6	10.4	6.41	10.138	25.305	22.740	42.7	20.0	32.3	9.6	3.38	0.46	31.4	11.4	20.9
90	146.6	0.607	75.6	10.4	6.42	10.250	25.462	22.852	42.9	20.0	32.5	9.6	3.37	0.45	31.4	11.4	21.1
91	147.7	0.613	75.5	10.3	6.42	10.363	25.648	22.990	43.0	20.0	32.7	9.7	3.37	0.45	31.5	11.5	21.2
92	148.8	0.619	75.4	10.2	6.43	10.476	25.848	23.140	43.1	20.0	33.0	9.8	3.36	0.44	31.6	11.6	21.4
93	149.5	0.625	75.4	10.2	6.44	10.588	25.962	23.213	43.2	20.0	33.0	9.8	3.38	0.44	31.6	11.6	21.4
94	150.9	0.631	75.4	10.2	6.45	10.701	26.205	23.401	43.4	20.0	33.2	9.8	3.38	0.44	31.7	11.7	21.5
95	151.7	0.637	75.3	10.1	6.46	10.814	26.348	23.499	43.5	20.0	33.4	9.9	3.37	0.43	31.7	11.7	21.6
96	152.7	0.643	75.2	10.0	6.46	10.926	26.519	23.622	43.6	20.0	33.6	10.0	3.37	0.42	31.8	11.8	21.8
97	153.9	0.649	75.1	9.9	6.47	11.039	26.734	23.783	43.8	20.0	33.9	10.1	3.35	0.41	31.9	11.9	22.0
98	154.6	0.655	75.1	9.9	6.48	11.152	26.848	23.854	43.9	20.0	34.0	10.1	3.36	0.42	31.9	11.9	22.0
99	155.9	0.661	75.1	9.9	6.49	11.264	27.077	24.027	44.0	20.0	34.2	10.1	3.37	0.41	32.0	12.0	22.2
100	157.1	0.667	75.0	9.8	6.50	11.377	27.277	24.174	44.2	20.0	34.4	10.2	3.37	0.41	32.1	12.1	22.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	158.0	0.673	74.9	9.7	6.51	11.490	27.434	24.282	44.3	20.0	34.5	10.3	3.37	0.40	32.1	12.1	22.4
102	159.0	0.679	74.9	9.7	6.51	11.602	27.605	24.403	44.4	20.0	34.7	10.3	3.36	0.40	32.2	12.2	22.5
103	160.1	0.685	74.7	9.5	6.52	11.715	27.805	24.548	44.5	20.0	35.0	10.5	3.35	0.39	32.3	12.3	22.7
104	160.9	0.691	74.6	9.4	6.53	11.827	27.948	24.643	44.6	20.0	35.2	10.6	3.33	0.38	32.3	12.3	22.9
105	161.9	0.697	74.6	9.4	6.54	11.940	28.120	24.762	44.8	20.0	35.4	10.6	3.33	0.38	32.4	12.4	23.0
106	163.1	0.703	74.6	9.4	6.55	12.053	28.320	24.907	44.9	20.0	35.5	10.6	3.35	0.38	32.5	12.5	23.0
107	164.1	0.709	74.5	9.3	6.56	12.165	28.491	25.025	45.0	20.0	35.7	10.7	3.35	0.37	32.5	12.5	23.2
108	165.3	0.715	74.5	9.3	6.56	12.278	28.706	25.181	45.2	20.0	35.9	10.7	3.35	0.37	32.6	12.6	23.3
109	166.2	0.721	74.4	9.2	6.57	12.391	28.863	25.286	45.3	20.0	36.1	10.8	3.34	0.36	32.6	12.6	23.4
110	167.1	0.727	74.3	9.1	6.58	12.503	29.020	25.392	45.4	20.0	36.3	10.9	3.33	0.36	32.7	12.7	23.6
111	168.3	0.733	74.2	9.0	6.59	12.616	29.234	25.546	45.5	20.0	36.6	11.0	3.31	0.35	32.8	12.8	23.8
112	169.2	0.739	74.0	8.8	6.60	12.729	29.391	25.650	45.7	20.0	36.8	11.2	3.30	0.34	32.8	12.8	24.0
113	170.1	0.745	74.2	9.0	6.61	12.841	29.549	25.754	45.8	20.0	36.8	11.0	3.33	0.35	32.9	12.9	23.9
114	171.4	0.751	74.1	8.9	6.61	12.954	29.763	25.908	45.9	20.0	37.0	11.1	3.33	0.34	33.0	13.0	24.1
115	172.5	0.757	74.0	8.8	6.62	13.066	29.963	26.048	46.0	20.0	37.2	11.2	3.33	0.34	33.0	13.0	24.2
116	173.6	0.763	73.9	8.7	6.63	13.179	30.149	26.175	46.2	20.0	37.5	11.3	3.32	0.33	33.1	13.1	24.4
117	174.8	0.769	73.8	8.6	6.64	13.292	30.349	26.315	46.3	20.0	37.8	11.4	3.30	0.33	33.2	13.2	24.6
118	175.7	0.775	73.8	8.6	6.65	13.404	30.520	26.429	46.4	20.0	37.8	11.4	3.33	0.33	33.2	13.2	24.6
119	176.9	0.781	73.8	8.6	6.66	13.517	30.720	26.568	46.6	20.0	38.0	11.4	3.32	0.32	33.3	13.3	24.7
120	178.1	0.787	73.7	8.5	6.67	13.630	30.935	26.718	46.7	20.0	38.2	11.5	3.33	0.32	33.4	13.4	24.8
121	179.1	0.793	73.6	8.4	6.68	13.742	31.106	26.831	46.8	20.0	38.4	11.6	3.32	0.31	33.4	13.4	25.0
122	180.3	0.799	73.5	8.3	6.68	13.855	31.306	26.969	47.0	20.0	38.7	11.7	3.31	0.31	33.5	13.5	25.2
123	181.2	0.805	73.4	8.2	6.69	13.968	31.478	27.081	47.1	20.0	38.9	11.8	3.29	0.30	33.5	13.5	25.4
124	182.4	0.811	73.3	8.1	6.70	14.080	31.678	27.217	47.2	20.0	39.1	11.9	3.28	0.30	33.6	13.6	25.5
125	183.4	0.817	73.3	8.1	6.71	14.193	31.849	27.329	47.3	20.0	39.2	11.9	3.30	0.30	33.7	13.7	25.6
126	184.5	0.823	73.3	8.1	6.72	14.306	32.035	27.452	47.5	20.0	39.4	11.9	3.30	0.29	33.7	13.7	25.7
127	185.5	0.829	73.2	8.0	6.73	14.418	32.221	27.575	47.6	20.0	39.5	12.0	3.30	0.29	33.8	13.8	25.8
128	186.8	0.835	73.1	7.9	6.74	14.531	32.449	27.734	47.7	20.0	39.8	12.1	3.30	0.29	33.9	13.9	25.9
129	187.7	0.841	73.1	7.9	6.75	14.643	32.606	27.832	47.8	20.0	40.0	12.1	3.29	0.28	33.9	13.9	26.1
130	188.9	0.847	72.9	7.7	6.75	14.756	32.806	27.965	48.0	20.0	40.3	12.3	3.27	0.28	34.0	14.0	26.3
131	190.0	0.853	72.8	7.6	6.76	14.869	32.992	28.087	48.1	20.0	40.5	12.4	3.26	0.27	34.0	14.0	26.5
132	190.9	0.859	72.7	7.5	6.77	14.981	33.149	28.183	48.2	20.0	40.6	12.5	3.26	0.27	34.1	14.1	26.6
133	192.4	0.865	72.8	7.6	6.78	15.094	33.407	28.364	48.4	20.0	40.8	12.4	3.28	0.27	34.2	14.2	26.6
134	193.4	0.871	72.8	7.6	6.79	15.207	33.592	28.484	48.5	20.0	40.9	12.4	3.29	0.27	34.2	14.2	26.7
135	194.4	0.877	72.7	7.5	6.80	15.319	33.764	28.591	48.6	20.0	41.1	12.5	3.29	0.26	34.3	14.3	26.8
136	195.4	0.883	72.6	7.4	6.81	15.432	33.935	28.698	48.7	20.0	41.3	12.6	3.27	0.26	34.3	14.3	27.0
137	196.3	0.889	72.4	7.2	6.82	15.545	34.092	28.793	48.8	20.0	41.6	12.8	3.25	0.25	34.4	14.4	27.2
138	197.5	0.895	72.5	7.3	6.83	15.657	34.307	28.935	48.9	20.0	41.6	12.7	3.28	0.25	34.5	14.5	27.2
139	198.5	0.901	72.4	7.2	6.84	15.770	34.478	29.041	49.0	20.0	41.8	12.8	3.27	0.25	34.5	14.5	27.3
140	199.7	0.907	72.4	7.2	6.85	15.883	34.678	29.170	49.2	20.0	42.0	12.8	3.27	0.25	34.6	14.6	27.4
141	200.7	0.913	72.3	7.1	6.85	15.995	34.850	29.275	49.3	20.0	42.1	12.9	3.27	0.24	34.6	14.6	27.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	201.7	0.919	72.2	7.0	6.86	16.108	35.021	29.380	49.4	20.0	42.4	13.0	3.26	0.24	34.7	14.7	27.7
143	202.7	0.925	72.1	6.9	6.87	16.220	35.207	29.496	49.5	20.0	42.6	13.1	3.25	0.23	34.7	14.7	27.9
144	203.6	0.931	72.0	6.8	6.88	16.333	35.364	29.588	49.6	20.0	42.8	13.2	3.24	0.23	34.8	14.8	28.0
145	204.8	0.937	72.0	6.8	6.89	16.446	35.564	29.715	49.7	20.0	42.9	13.2	3.26	0.23	34.9	14.9	28.0
146	205.8	0.943	72.0	6.8	6.90	16.558	35.736	29.818	49.8	20.0	43.1	13.2	3.25	0.23	34.9	14.9	28.1
147	207.0	0.949	71.9	6.7	6.91	16.671	35.950	29.957	50.0	20.0	43.3	13.3	3.25	0.22	35.0	15.0	28.3
148	207.9	0.955	71.8	6.6	6.92	16.784	36.107	30.047	50.0	20.0	43.4	13.4	3.25	0.22	35.0	15.0	28.4
149	209.2	0.961	71.8	6.6	6.93	16.896	36.336	30.196	50.2	20.0	43.6	13.4	3.25	0.22	35.1	15.1	28.5
150	210.2	0.967	71.6	6.4	6.94	17.009	36.507	30.298	50.3	20.0	43.9	13.6	3.23	0.21	35.1	15.1	28.8
151	211.4	0.973	71.5	6.3	6.95	17.122	36.707	30.422	50.4	20.0	44.1	13.7	3.22	0.21	35.2	15.2	28.9
152	212.4	0.979	71.4	6.2	6.96	17.234	36.893	30.535	50.5	20.0	44.3	13.8	3.22	0.20	35.3	15.3	29.0
153	213.8	0.985	71.4	6.2	6.97	17.347	37.136	30.694	50.7	20.0	44.5	13.8	3.23	0.20	35.3	15.3	29.1
154	214.8	0.991	71.4	6.2	6.98	17.460	37.307	30.794	50.8	20.0	44.6	13.8	3.23	0.20	35.4	15.4	29.2
155	216.3	0.997	71.3	6.1	6.99	17.572	37.564	30.964	51.0	20.0	44.9	13.9	3.23	0.20	35.5	15.5	29.4
156	217.5	1.003	71.2	6.0	7.00	17.685	37.765	31.086	51.1	20.0	45.1	14.0	3.22	0.19	35.5	15.5	29.6
157	218.5	1.009	71.0	5.8	7.00	17.797	37.950	31.196	51.2	20.0	45.4	14.2	3.19	0.19	35.6	15.6	29.8
158	219.7	1.015	71.1	5.9	7.01	17.910	38.150	31.318	51.3	20.0	45.4	14.1	3.22	0.19	35.7	15.7	29.8
159	220.8	1.021	71.0	5.8	7.02	18.023	38.350	31.439	51.4	20.0	45.6	14.2	3.22	0.19	35.7	15.7	29.9
160	222.1	1.027	70.9	5.7	7.03	18.135	38.579	31.583	51.6	20.0	45.8	14.3	3.22	0.18	35.8	15.8	30.0
161	223.3	1.033	70.9	5.7	7.04	18.248	38.779	31.703	51.7	20.0	46.0	14.3	3.21	0.18	35.9	15.9	30.2
162	224.4	1.039	70.8	5.6	7.05	18.361	38.965	31.811	51.8	20.0	46.2	14.4	3.21	0.18	35.9	15.9	30.3
163	225.8	1.045	70.7	5.5	7.06	18.473	39.208	31.965	52.0	20.0	46.5	14.5	3.20	0.17	36.0	16.0	30.5
164	226.7	1.051	70.5	5.3	7.07	18.586	39.365	32.049	52.0	20.0	46.7	14.7	3.19	0.17	36.0	16.0	30.7
165	227.8	1.057	70.6	5.4	7.08	18.699	39.565	32.167	52.2	20.0	46.7	14.6	3.21	0.17	36.1	16.1	30.7
166	229.2	1.063	70.5	5.3	7.09	18.811	39.808	32.319	52.3	20.0	47.1	14.7	3.19	0.16	36.2	16.2	30.9
167	229.9	1.066	70.4	5.2	7.10	18.863	39.922	32.391	52.4	20.0	47.2	14.8	3.19	0.16	36.2	16.2	31.0

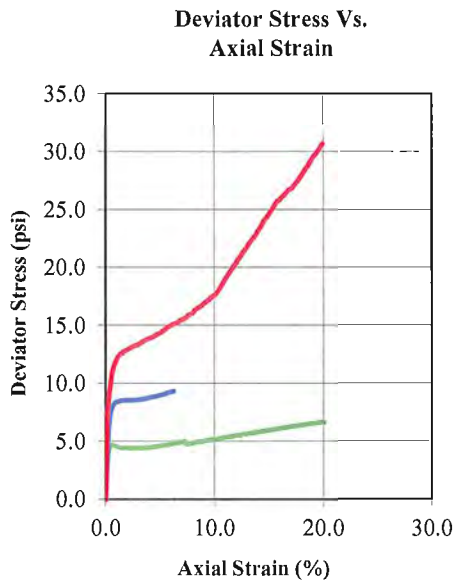


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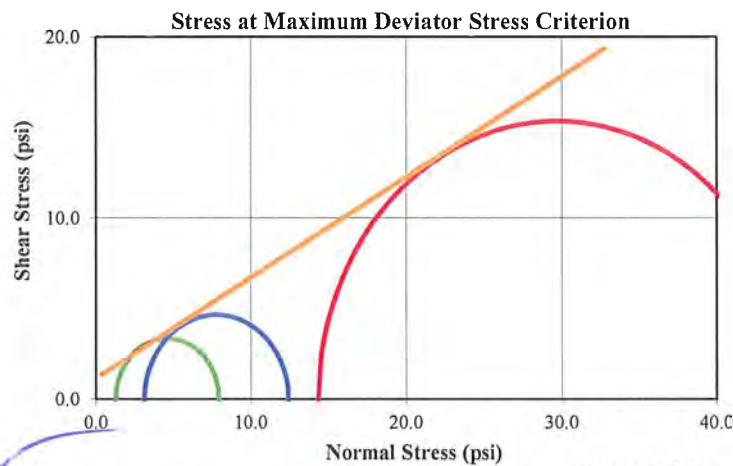
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #2
PROJECT NO. : 08195-01	SAMPLE DEPTH : 10.0' to 35.0'
PROJECT LOCATION : B-56	SAMPLE TYPE : Remolded
BORING NUMBER : B-56	DESCRIPTION : White & Tan Silty Sand
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	15.1	14.7	15.0	
Dry Density (pcf)	105.5	105.0	105.4	
Saturation (%)	70.70	67.63	69.85	
Void Ratio	0.564	0.572	0.566	
Diameter (in)	2.802	2.800	2.805	
Height (in)	5.621	5.647	5.617	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	34	34	34	
Plastic Limit	24	24	24	
After Consolidation	A	B	C	D
B-Value	0.95	1.00	0.98	
Water Content (%)	21.6	20.8	18.9	
Dry Density (pcf)	105.54	105.39	105.60	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.568	0.570	0.567	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	71.5	78.4	62.5	
Rate of Strain	0.002	0.002	0.002	

Maximum Deviator Stress Criterion		After Shear	A	B	C	D
C (psi)	0.0	σ'_1 at Failure (psi)	7.93	12.43	45.03	
ϕ (deg)	28.9	σ'_3 at Failure (psi)	1.23	3.09	14.35	
C' (psi)	1.2					
ϕ' (deg)	29.0					



Tested By: [Signature]
Date: 12-11-12

Approved By: SKB
Date: 12-11-12



File Location

B-56 Bag 2 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: Bag #2

Sample Description: White & Tan Silty Sand

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 34.000

PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.802	2.803	
Height (in)	5.621	5.616	
Weight (grams)	1105.70		1167.40
Moisture (%)	15.14		21.57
Dry Density (pcf)	105.54	105.54	
Saturation (%)	70.70	100.00	
Void Ratio	0.564	0.568	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 76.500

Effective Confining Stress (psi): 5.0

Corrected Peak Deviator Stress (psi): 6.702 at reading number: 184

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.0	0.000	71.5	0.0	6.17	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	20.4	0.007	73.5	2.0	6.18	0.109	3.304	3.301	8.3	5.0	6.3	3.0	2.11	0.62	6.7	1.7	4.6
2	25.7	0.013	74.0	2.5	6.19	0.217	4.170	4.161	9.2	5.0	6.7	2.5	2.65	0.60	7.1	2.1	4.6
3	28.4	0.019	74.3	2.8	6.19	0.326	4.597	4.582	9.6	5.0	6.8	2.2	3.05	0.60	7.3	2.3	4.5
4	29.1	0.025	74.5	3.0	6.20	0.435	4.717	4.696	9.7	5.0	6.7	2.0	3.35	0.64	7.3	2.3	4.3
5	29.0	0.031	74.8	3.3	6.21	0.543	4.703	4.678	9.7	5.0	6.4	1.7	3.73	0.70	7.3	2.3	4.1
6	29.0	0.037	75.0	3.5	6.21	0.652	4.703	4.673	9.7	5.0	6.2	1.5	4.09	0.75	7.3	2.3	3.8
7	28.8	0.043	75.3	3.8	6.22	0.761	4.663	4.628	9.6	5.0	5.8	1.2	4.90	0.82	7.3	2.3	3.5
8	28.7	0.049	75.4	3.9	6.23	0.870	4.650	4.609	9.6	5.0	5.8	1.1	5.02	0.84	7.3	2.3	3.5
9	28.5	0.055	75.4	3.9	6.23	0.978	4.623	4.578	9.6	5.0	5.6	1.1	5.30	0.86	7.3	2.3	3.4
10	28.4	0.062	75.5	4.0	6.24	1.087	4.597	4.547	9.5	5.0	5.5	1.0	5.62	0.88	7.3	2.3	3.3
11	28.3	0.068	75.6	4.1	6.25	1.196	4.583	4.528	9.5	5.0	5.5	0.9	5.79	0.90	7.3	2.3	3.2
12	28.1	0.074	75.6	4.1	6.25	1.304	4.557	4.497	9.5	5.0	5.4	0.9	5.97	0.91	7.2	2.2	3.2
13	28.0	0.080	75.6	4.1	6.26	1.413	4.530	4.466	9.5	5.0	5.3	0.9	6.17	0.93	7.2	2.2	3.1
14	27.9	0.086	75.9	4.4	6.27	1.522	4.517	4.448	9.4	5.0	5.0	0.6	8.66	0.99	7.2	2.2	2.8
15	28.0	0.092	75.9	4.4	6.27	1.630	4.530	4.456	9.5	5.0	5.1	0.6	8.17	0.98	7.2	2.2	2.8
16	28.0	0.098	75.9	4.4	6.28	1.739	4.530	4.451	9.5	5.0	5.0	0.6	8.66	0.99	7.2	2.2	2.8
17	28.0	0.104	75.9	4.4	6.29	1.848	4.530	4.446	9.4	5.0	5.0	0.6	8.66	0.99	7.2	2.2	2.8
18	27.9	0.110	75.9	4.4	6.29	1.957	4.517	4.428	9.4	5.0	5.0	0.6	8.62	1.00	7.2	2.2	2.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	27.9	0.116	76.0	4.5	6.30	2.065	4.517	4.423	9.4	5.0	4.9	0.5	9.85	1.02	7.2	2.2	2.7
20	27.9	0.123	76.1	4.6	6.31	2.174	4.517	4.418	9.4	5.0	4.8	0.4	12.66	1.05	7.2	2.2	2.6
21	28.0	0.129	76.1	4.6	6.32	2.283	4.530	4.427	9.4	5.0	4.8	0.4	11.56	1.03	7.2	2.2	2.6
22	28.0	0.135	76.0	4.5	6.32	2.391	4.543	4.435	9.4	5.0	4.9	0.5	10.65	1.02	7.2	2.2	2.7
23	28.0	0.141	76.0	4.5	6.33	2.500	4.543	4.430	9.4	5.0	4.9	0.5	10.64	1.02	7.2	2.2	2.7
24	28.1	0.147	76.0	4.5	6.34	2.609	4.557	4.438	9.4	5.0	4.9	0.5	10.66	1.02	7.2	2.2	2.7
25	28.0	0.153	76.0	4.5	6.34	2.717	4.543	4.420	9.4	5.0	4.9	0.5	9.84	1.02	7.2	2.2	2.7
26	28.1	0.159	76.0	4.5	6.35	2.826	4.557	4.428	9.4	5.0	4.9	0.5	9.86	1.02	7.2	2.2	2.7
27	28.2	0.165	76.2	4.7	6.36	2.935	4.570	4.436	9.4	5.0	4.7	0.3	15.89	1.06	7.2	2.2	2.5
28	28.3	0.171	76.2	4.7	6.37	3.044	4.583	4.444	9.4	5.0	4.8	0.3	14.13	1.05	7.2	2.2	2.6
29	28.3	0.178	76.2	4.7	6.37	3.152	4.583	4.439	9.4	5.0	4.8	0.3	14.12	1.05	7.2	2.2	2.6
30	28.5	0.184	76.1	4.6	6.38	3.261	4.610	4.460	9.5	5.0	4.8	0.4	12.77	1.04	7.2	2.2	2.6
31	28.4	0.190	76.1	4.6	6.39	3.370	4.597	4.442	9.4	5.0	4.9	0.4	11.60	1.03	7.2	2.2	2.6
32	28.5	0.196	76.1	4.6	6.39	3.478	4.623	4.462	9.5	5.0	4.9	0.4	11.65	1.03	7.2	2.2	2.7
33	28.5	0.202	76.0	4.5	6.40	3.587	4.623	4.457	9.5	5.0	4.9	0.5	10.70	1.02	7.2	2.2	2.7
34	28.7	0.208	76.2	4.7	6.41	3.696	4.650	4.478	9.5	5.0	4.8	0.3	16.03	1.05	7.2	2.2	2.5
35	28.8	0.214	76.2	4.7	6.42	3.804	4.663	4.486	9.5	5.0	4.7	0.3	18.42	1.06	7.2	2.2	2.5
36	28.8	0.220	76.2	4.7	6.42	3.913	4.663	4.481	9.5	5.0	4.8	0.3	16.04	1.05	7.2	2.2	2.5
37	28.9	0.226	76.2	4.7	6.43	4.022	4.690	4.501	9.5	5.0	4.8	0.3	16.11	1.04	7.3	2.3	2.5
38	29.0	0.232	76.1	4.6	6.44	4.130	4.703	4.509	9.5	5.0	4.9	0.4	12.90	1.02	7.3	2.3	2.6
39	29.1	0.239	76.2	4.7	6.45	4.239	4.717	4.517	9.5	5.0	4.9	0.3	14.35	1.03	7.3	2.3	2.6
40	29.3	0.245	76.3	4.8	6.45	4.348	4.743	4.537	9.5	5.0	4.8	0.2	21.89	1.05	7.3	2.3	2.5
41	29.4	0.251	76.2	4.7	6.46	4.457	4.756	4.545	9.5	5.0	4.8	0.3	18.64	1.04	7.3	2.3	2.5
42	29.5	0.257	76.2	4.7	6.47	4.565	4.783	4.565	9.6	5.0	4.9	0.3	16.32	1.03	7.3	2.3	2.6
43	29.6	0.263	76.2	4.7	6.47	4.674	4.796	4.572	9.6	5.0	4.9	0.3	16.34	1.03	7.3	2.3	2.6
44	29.7	0.269	76.2	4.7	6.48	4.783	4.810	4.580	9.6	5.0	4.9	0.3	14.53	1.02	7.3	2.3	2.6
45	29.8	0.275	76.2	4.7	6.49	4.891	4.836	4.600	9.6	5.0	4.9	0.3	14.59	1.01	7.3	2.3	2.6
46	30.0	0.281	76.1	4.6	6.50	5.000	4.863	4.620	9.6	5.0	5.0	0.4	13.20	1.00	7.3	2.3	2.7
47	30.2	0.287	76.3	4.8	6.50	5.109	4.890	4.640	9.6	5.0	4.9	0.2	22.37	1.03	7.3	2.3	2.5
48	30.3	0.293	76.3	4.8	6.51	5.217	4.903	4.647	9.6	5.0	4.9	0.2	22.40	1.03	7.3	2.3	2.5
49	30.4	0.300	76.2	4.7	6.52	5.326	4.930	4.667	9.7	5.0	4.9	0.3	19.12	1.02	7.3	2.3	2.6
50	30.7	0.306	76.2	4.7	6.53	5.435	4.970	4.700	9.7	5.0	5.0	0.3	16.77	1.00	7.3	2.3	2.6
51	30.8	0.312	76.2	4.7	6.53	5.544	4.983	4.707	9.7	5.0	5.0	0.3	16.80	1.00	7.4	2.4	2.7
52	30.9	0.318	76.2	4.7	6.54	5.652	5.010	4.726	9.7	5.0	5.1	0.3	14.97	0.99	7.4	2.4	2.7
53	30.9	0.324	76.1	4.6	6.55	5.761	5.010	4.721	9.7	5.0	5.1	0.4	13.46	0.98	7.4	2.4	2.7
54	31.2	0.330	76.2	4.7	6.56	5.870	5.050	4.753	9.8	5.0	5.0	0.3	19.45	1.00	7.4	2.4	2.6
55	31.3	0.336	76.3	4.8	6.56	5.978	5.076	4.773	9.8	5.0	5.0	0.2	22.98	1.00	7.4	2.4	2.6
56	31.6	0.342	76.2	4.7	6.57	6.087	5.116	4.805	9.8	5.0	5.1	0.3	19.65	0.99	7.4	2.4	2.7
57	31.7	0.348	76.2	4.7	6.58	6.196	5.143	4.824	9.8	5.0	5.1	0.3	19.73	0.98	7.4	2.4	2.7
58	31.9	0.355	76.2	4.7	6.59	6.304	5.170	4.844	9.8	5.0	5.2	0.3	15.31	0.96	7.4	2.4	2.8
59	32.1	0.361	76.1	4.6	6.59	6.413	5.196	4.863	9.9	5.0	5.2	0.4	13.84	0.95	7.4	2.4	2.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	32.2	0.367	76.3	4.8	6.60	6.522	5.209	4.870	9.9	5.0	5.0	0.2	28.55	0.99	7.4	2.4	2.6
61	32.4	0.373	76.2	4.7	6.61	6.630	5.249	4.901	9.9	5.0	5.2	0.3	20.03	0.97	7.5	2.5	2.7
62	32.4	0.379	76.2	4.7	6.62	6.739	5.249	4.896	9.9	5.0	5.2	0.3	17.43	0.96	7.4	2.4	2.7
63	32.7	0.385	76.2	4.7	6.63	6.848	5.303	4.940	9.9	5.0	5.2	0.3	17.58	0.95	7.5	2.5	2.8
64	32.9	0.391	76.2	4.7	6.63	6.957	5.329	4.959	10.0	5.0	5.3	0.3	15.65	0.94	7.5	2.5	2.8
65	33.1	0.397	76.1	4.6	6.64	7.065	5.356	4.978	10.0	5.0	5.4	0.4	14.14	0.93	7.5	2.5	2.9
66	33.3	0.403	76.1	4.6	6.65	7.174	5.396	5.009	10.0	5.0	5.4	0.4	12.95	0.91	7.5	2.5	2.9
67	33.5	0.409	76.2	4.7	6.66	7.283	5.423	5.028	10.0	5.0	5.3	0.3	17.87	0.94	7.5	2.5	2.8
68	33.6	0.416	76.2	4.7	6.66	7.391	5.449	4.793	9.8	5.0	5.1	0.3	17.09	0.98	7.4	2.4	2.7
69	33.9	0.422	76.2	4.7	6.67	7.500	5.489	4.821	9.8	5.0	5.2	0.3	15.25	0.97	7.4	2.4	2.7
70	34.0	0.428	76.1	4.6	6.68	7.609	5.503	4.823	9.8	5.0	5.2	0.4	13.73	0.96	7.4	2.4	2.8
71	34.0	0.434	76.1	4.6	6.69	7.717	5.516	4.826	9.8	5.0	5.2	0.4	12.51	0.95	7.4	2.4	2.8
72	34.2	0.440	76.1	4.6	6.70	7.826	5.543	4.841	9.8	5.0	5.3	0.4	12.55	0.95	7.4	2.4	2.8
73	34.4	0.446	76.0	4.5	6.70	7.935	5.569	4.856	9.9	5.0	5.3	0.5	11.56	0.94	7.4	2.4	2.9
74	34.5	0.452	76.1	4.6	6.71	8.044	5.596	4.870	9.9	5.0	5.2	0.4	13.86	0.95	7.4	2.4	2.8
75	34.9	0.458	76.2	4.7	6.72	8.152	5.662	4.922	9.9	5.0	5.3	0.3	15.54	0.95	7.5	2.5	2.8
76	35.0	0.464	76.1	4.6	6.73	8.261	5.676	4.924	9.9	5.0	5.3	0.4	14.00	0.94	7.5	2.5	2.8
77	35.3	0.471	76.1	4.6	6.74	8.370	5.716	4.951	10.0	5.0	5.4	0.4	12.81	0.93	7.5	2.5	2.9
78	35.4	0.477	76.0	4.5	6.74	8.478	5.742	4.965	10.0	5.0	5.4	0.5	11.80	0.91	7.5	2.5	2.9
79	35.6	0.483	76.0	4.5	6.75	8.587	5.769	4.980	10.0	5.0	5.5	0.5	10.96	0.90	7.5	2.5	3.0
80	35.8	0.489	76.2	4.7	6.76	8.696	5.796	4.994	10.0	5.0	5.3	0.3	15.76	0.93	7.5	2.5	2.8
81	35.9	0.495	76.1	4.6	6.77	8.804	5.822	5.008	10.0	5.0	5.4	0.4	14.22	0.92	7.5	2.5	2.9
82	36.1	0.501	76.1	4.6	6.78	8.913	5.849	5.022	10.0	5.0	5.4	0.4	12.98	0.91	7.5	2.5	2.9
83	36.4	0.507	76.0	4.5	6.78	9.022	5.902	5.061	10.1	5.0	5.5	0.5	12.01	0.90	7.5	2.5	3.0
84	36.5	0.513	76.0	4.5	6.79	9.131	5.916	5.063	10.1	5.0	5.6	0.5	11.13	0.89	7.5	2.5	3.0
85	36.8	0.519	76.0	4.5	6.80	9.239	5.969	5.101	10.1	5.0	5.6	0.5	10.44	0.87	7.6	2.6	3.1
86	36.8	0.525	75.9	4.4	6.81	9.348	5.969	5.091	10.1	5.0	5.7	0.6	9.77	0.87	7.5	2.5	3.1
87	37.1	0.532	76.1	4.6	6.82	9.457	6.009	5.117	10.1	5.0	5.5	0.4	14.51	0.90	7.6	2.6	2.9
88	37.3	0.538	76.1	4.6	6.82	9.565	6.036	5.131	10.1	5.0	5.5	0.4	13.24	0.89	7.6	2.6	3.0
89	37.4	0.544	76.0	4.5	6.83	9.674	6.062	5.144	10.1	5.0	5.6	0.5	12.19	0.88	7.6	2.6	3.0
90	37.7	0.550	76.0	4.5	6.84	9.783	6.102	5.170	10.2	5.0	5.6	0.5	12.25	0.88	7.6	2.6	3.0
91	37.7	0.556	76.0	4.5	6.85	9.891	6.115	5.172	10.2	5.0	5.7	0.5	11.34	0.87	7.6	2.6	3.1
92	38.0	0.562	76.0	4.5	6.86	10.000	6.155	5.197	10.2	5.0	5.7	0.5	10.62	0.86	7.6	2.6	3.1
93	37.9	0.568	76.0	4.5	6.87	10.109	6.142	5.175	10.2	5.0	5.7	0.5	10.58	0.86	7.6	2.6	3.1
94	38.2	0.574	76.0	4.5	6.87	10.217	6.195	5.212	10.2	5.0	5.7	0.5	12.34	0.87	7.6	2.6	3.1
95	38.6	0.580	76.1	4.6	6.88	10.326	6.262	5.262	10.3	5.0	5.7	0.4	13.55	0.87	7.6	2.6	3.1
96	38.6	0.587	76.0	4.5	6.89	10.435	6.262	5.251	10.3	5.0	5.7	0.5	12.43	0.86	7.6	2.6	3.1
97	39.0	0.593	76.0	4.5	6.90	10.544	6.315	5.288	10.3	5.0	5.8	0.5	11.58	0.85	7.6	2.6	3.1
98	39.1	0.599	75.9	4.4	6.91	10.652	6.329	5.290	10.3	5.0	5.9	0.6	10.11	0.84	7.6	2.6	3.2
99	39.1	0.605	76.0	4.5	6.92	10.761	6.342	5.291	10.3	5.0	5.8	0.5	10.79	0.84	7.6	2.6	3.2
100	39.6	0.611	76.1	4.6	6.92	10.870	6.409	5.340	10.3	5.0	5.8	0.4	13.74	0.86	7.7	2.7	3.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	39.8	0.617	76.0	4.5	6.93	10.978	6.449	5.365	10.4	5.0	5.8	0.5	12.67	0.85	7.7	2.7	3.1
102	39.9	0.623	76.0	4.5	6.94	11.087	6.462	5.366	10.4	5.0	5.9	0.5	11.73	0.84	7.7	2.7	3.2
103	40.1	0.629	76.0	4.5	6.95	11.196	6.502	5.391	10.4	5.0	5.9	0.5	10.97	0.83	7.7	2.7	3.2
104	40.2	0.635	75.9	4.4	6.96	11.304	6.515	5.392	10.4	5.0	6.0	0.6	10.28	0.82	7.7	2.7	3.3
105	40.5	0.641	75.9	4.4	6.97	11.413	6.555	5.416	10.4	5.0	6.0	0.6	9.72	0.81	7.7	2.7	3.3
106	40.5	0.648	75.8	4.3	6.98	11.522	6.555	5.405	10.4	5.0	6.1	0.7	9.17	0.80	7.7	2.7	3.4
107	40.8	0.654	76.0	4.5	6.98	11.631	6.608	5.442	10.4	5.0	5.9	0.5	11.88	0.83	7.7	2.7	3.2
108	41.0	0.660	76.0	4.5	6.99	11.739	6.648	5.466	10.5	5.0	6.0	0.5	11.93	0.82	7.7	2.7	3.2
109	41.4	0.666	76.0	4.5	7.00	11.848	6.715	5.514	10.5	5.0	6.1	0.5	11.20	0.81	7.8	2.8	3.3
110	41.6	0.672	75.9	4.4	7.01	11.957	6.742	5.526	10.5	5.0	6.1	0.6	10.51	0.80	7.8	2.8	3.3
111	41.7	0.678	75.9	4.4	7.02	12.065	6.755	5.527	10.5	5.0	6.1	0.6	9.90	0.79	7.8	2.8	3.4
112	41.8	0.684	75.8	4.3	7.03	12.174	6.768	5.527	10.5	5.0	6.2	0.7	9.35	0.78	7.8	2.8	3.4
113	42.0	0.690	75.8	4.3	7.04	12.283	6.808	5.551	10.6	5.0	6.3	0.7	8.91	0.77	7.8	2.8	3.5
114	42.3	0.696	75.9	4.4	7.04	12.391	6.848	5.575	10.6	5.0	6.2	0.6	10.60	0.79	7.8	2.8	3.4
115	42.5	0.703	76.0	4.5	7.05	12.500	6.888	5.599	10.6	5.0	6.1	0.5	11.36	0.80	7.8	2.8	3.3
116	42.8	0.709	75.9	4.4	7.06	12.609	6.928	5.623	10.6	5.0	6.2	0.6	10.68	0.79	7.8	2.8	3.4
117	42.8	0.715	75.8	4.3	7.07	12.717	6.928	5.612	10.6	5.0	6.3	0.7	9.48	0.77	7.8	2.8	3.5
118	43.1	0.721	75.8	4.3	7.08	12.826	6.981	5.647	10.6	5.0	6.4	0.7	8.61	0.75	7.8	2.8	3.6
119	43.3	0.727	75.8	4.3	7.09	12.935	7.008	5.659	10.7	5.0	6.4	0.7	9.06	0.76	7.8	2.8	3.5
120	43.7	0.733	75.9	4.4	7.10	13.044	7.075	5.705	10.7	5.0	6.3	0.6	10.82	0.77	7.9	2.9	3.4
121	43.7	0.739	75.9	4.4	7.11	13.152	7.075	5.694	10.7	5.0	6.3	0.6	10.17	0.77	7.8	2.8	3.5
122	43.9	0.745	75.8	4.3	7.12	13.261	7.115	5.717	10.7	5.0	6.4	0.7	9.64	0.76	7.9	2.9	3.5
123	44.0	0.751	75.8	4.3	7.12	13.370	7.128	5.717	10.7	5.0	6.4	0.7	9.14	0.75	7.9	2.9	3.6
124	44.2	0.757	75.8	4.3	7.13	13.478	7.168	5.740	10.7	5.0	6.5	0.7	8.73	0.74	7.9	2.9	3.6
125	44.5	0.764	75.7	4.2	7.14	13.587	7.208	5.763	10.8	5.0	6.5	0.8	8.36	0.73	7.9	2.9	3.7
126	44.8	0.770	75.7	4.2	7.15	13.696	7.261	5.798	10.8	5.0	6.6	0.8	8.04	0.72	7.9	2.9	3.7
127	45.0	0.776	75.8	4.3	7.16	13.804	7.288	5.809	10.8	5.0	6.5	0.7	9.78	0.75	7.9	2.9	3.6
128	45.1	0.782	75.8	4.3	7.17	13.913	7.315	5.820	10.8	5.0	6.5	0.7	9.29	0.74	7.9	2.9	3.6
129	45.2	0.788	75.8	4.3	7.18	14.022	7.328	5.820	10.8	5.0	6.5	0.7	9.29	0.74	7.9	2.9	3.6
130	45.5	0.794	75.8	4.3	7.19	14.131	7.368	5.843	10.8	5.0	6.6	0.7	8.87	0.73	7.9	2.9	3.7
131	45.8	0.800	75.7	4.2	7.20	14.239	7.421	5.877	10.9	5.0	6.7	0.8	8.51	0.72	7.9	2.9	3.7
132	45.9	0.806	75.7	4.2	7.21	14.348	7.434	5.876	10.9	5.0	6.7	0.8	8.14	0.71	7.9	2.9	3.8
133	46.0	0.812	75.6	4.1	7.21	14.457	7.461	5.887	10.9	5.0	6.8	0.9	7.82	0.70	7.9	2.9	3.8
134	46.3	0.819	75.8	4.3	7.22	14.565	7.501	5.910	10.9	5.0	6.7	0.7	8.96	0.72	8.0	3.0	3.7
135	46.5	0.825	75.8	4.3	7.23	14.674	7.528	5.921	10.9	5.0	6.6	0.7	9.43	0.73	8.0	3.0	3.7
136	46.8	0.831	75.8	4.3	7.24	14.783	7.581	5.954	11.0	5.0	6.7	0.7	9.02	0.72	8.0	3.0	3.7
137	46.9	0.837	75.7	4.2	7.25	14.891	7.594	5.953	11.0	5.0	6.8	0.8	8.23	0.70	8.0	3.0	3.8
138	47.1	0.843	75.6	4.1	7.26	15.000	7.634	5.975	11.0	5.0	6.8	0.9	7.92	0.69	8.0	3.0	3.9
139	47.3	0.849	75.6	4.1	7.27	15.109	7.661	5.986	11.0	5.0	6.9	0.9	7.62	0.68	8.0	3.0	3.9
140	47.4	0.855	75.8	4.3	7.28	15.218	7.688	5.997	11.0	5.0	6.7	0.7	9.54	0.72	8.0	3.0	3.7
141	47.9	0.861	75.7	4.2	7.29	15.326	7.754	6.041	11.0	5.0	6.8	0.8	8.72	0.70	8.0	3.0	3.8



Florence & Hutcheson

CONSULTING ENGINEERS

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	48.1	0.867	75.7	4.2	7.30	15.435	7.794	6.063	11.1	5.0	6.9	0.8	8.36	0.69	8.0	3.0	3.9
143	48.2	0.873	75.6	4.1	7.31	15.544	7.808	6.062	11.1	5.0	6.9	0.9	8.02	0.68	8.0	3.0	3.9
144	48.4	0.880	75.6	4.1	7.32	15.652	7.848	6.083	11.1	5.0	7.0	0.9	7.73	0.67	8.0	3.0	3.9
145	48.6	0.886	75.6	4.1	7.33	15.761	7.874	6.093	11.1	5.0	7.0	0.9	7.74	0.67	8.0	3.0	4.0
146	48.9	0.892	75.5	4.0	7.34	15.870	7.927	6.126	11.1	5.0	7.1	1.0	7.22	0.66	8.1	3.1	4.0
147	49.1	0.898	75.7	4.2	7.35	15.978	7.954	6.136	11.1	5.0	7.0	0.8	8.45	0.68	8.1	3.1	3.9
148	49.4	0.904	75.7	4.2	7.36	16.087	8.007	6.168	11.2	5.0	7.0	0.8	8.49	0.68	8.1	3.1	3.9
149	49.6	0.910	75.6	4.1	7.36	16.196	8.034	6.178	11.2	5.0	7.0	0.9	8.15	0.67	8.1	3.1	4.0
150	49.7	0.916	75.6	4.1	7.37	16.304	8.047	6.177	11.2	5.0	7.1	0.9	7.83	0.66	8.1	3.1	4.0
151	50.0	0.922	75.6	4.1	7.38	16.413	8.101	6.209	11.2	5.0	7.2	0.9	7.57	0.65	8.1	3.1	4.0
152	50.1	0.928	75.5	4.0	7.39	16.522	8.114	6.208	11.2	5.0	7.2	1.0	7.30	0.65	8.1	3.1	4.1
153	50.3	0.934	75.5	4.0	7.40	16.631	8.154	6.228	11.2	5.0	7.3	1.0	7.07	0.64	8.1	3.1	4.1
154	50.4	0.941	75.6	4.1	7.41	16.739	8.167	6.227	11.2	5.0	7.1	0.9	7.89	0.66	8.1	3.1	4.0
155	51.0	0.947	75.6	4.1	7.42	16.848	8.261	6.292	11.3	5.0	7.2	0.9	7.96	0.65	8.1	3.1	4.0
156	51.1	0.953	75.6	4.1	7.43	16.957	8.287	6.301	11.3	5.0	7.2	0.9	7.67	0.64	8.2	3.2	4.1
157	51.3	0.959	75.5	4.0	7.44	17.065	8.314	6.311	11.3	5.0	7.3	1.0	7.16	0.63	8.2	3.2	4.2
158	51.5	0.965	75.4	3.9	7.45	17.174	8.340	6.320	11.3	5.0	7.4	1.1	6.93	0.62	8.2	3.2	4.2
159	51.7	0.971	75.5	4.0	7.46	17.283	8.380	6.340	11.3	5.0	7.4	1.0	7.18	0.63	8.2	3.2	4.2
160	51.8	0.977	75.6	4.1	7.47	17.391	8.394	6.338	11.3	5.0	7.2	0.9	8.01	0.65	8.2	3.2	4.1
161	52.1	0.983	75.6	4.1	7.48	17.500	8.434	6.359	11.4	5.0	7.3	0.9	7.73	0.64	8.2	3.2	4.1
162	52.3	0.989	75.5	4.0	7.49	17.609	8.474	6.379	11.4	5.0	7.4	1.0	7.48	0.63	8.2	3.2	4.2
163	52.5	0.996	75.5	4.0	7.50	17.718	8.500	6.388	11.4	5.0	7.4	1.0	7.23	0.62	8.2	3.2	4.2
164	52.6	1.002	75.4	3.9	7.51	17.826	8.527	6.396	11.4	5.0	7.5	1.1	7.00	0.62	8.2	3.2	4.3
165	53.0	1.008	75.4	3.9	7.52	17.935	8.580	6.427	11.4	5.0	7.5	1.1	6.81	0.61	8.2	3.2	4.3
166	53.0	1.014	75.4	3.9	7.53	18.044	8.594	6.425	11.4	5.0	7.6	1.1	6.60	0.60	8.2	3.2	4.4
167	53.2	1.020	75.6	4.1	7.54	18.152	8.620	6.434	11.4	5.0	7.4	0.9	7.81	0.63	8.2	3.2	4.2
168	53.5	1.026	75.5	4.0	7.55	18.261	8.674	6.464	11.5	5.0	7.4	1.0	7.56	0.62	8.2	3.2	4.2
169	53.8	1.032	75.5	4.0	7.56	18.370	8.714	6.484	11.5	5.0	7.5	1.0	7.32	0.61	8.2	3.2	4.3
170	54.1	1.038	75.4	3.9	7.57	18.478	8.767	6.514	11.5	5.0	7.6	1.1	7.11	0.60	8.3	3.3	4.3
171	54.4	1.044	75.4	3.9	7.58	18.587	8.807	6.533	11.5	5.0	7.6	1.1	6.91	0.60	8.3	3.3	4.4
172	54.4	1.050	75.4	3.9	7.59	18.696	8.820	6.531	11.5	5.0	7.7	1.1	6.70	0.59	8.3	3.3	4.4
173	54.8	1.057	75.3	3.8	7.60	18.804	8.873	6.561	11.6	5.0	7.7	1.2	6.53	0.58	8.3	3.3	4.5
174	54.8	1.063	75.4	3.9	7.61	18.913	8.873	6.547	11.5	5.0	7.6	1.1	7.14	0.60	8.3	3.3	4.3
175	55.1	1.069	75.5	4.0	7.62	19.022	8.927	6.577	11.6	5.0	7.6	1.0	7.42	0.60	8.3	3.3	4.3
176	55.3	1.075	75.4	3.9	7.63	19.131	8.967	6.596	11.6	5.0	7.7	1.1	6.96	0.59	8.3	3.3	4.4
177	55.4	1.081	75.3	3.8	7.64	19.239	8.980	6.593	11.6	5.0	7.8	1.2	6.56	0.58	8.3	3.3	4.5
178	55.7	1.087	75.3	3.8	7.65	19.348	9.020	6.612	11.6	5.0	7.8	1.2	6.57	0.58	8.3	3.3	4.5
179	55.8	1.093	75.4	3.9	7.66	19.457	9.047	6.620	11.6	5.0	7.7	1.1	6.99	0.59	8.3	3.3	4.4
180	56.1	1.099	75.4	3.9	7.67	19.565	9.087	6.639	11.6	5.0	7.7	1.1	7.23	0.59	8.3	3.3	4.4
181	56.5	1.105	75.4	3.9	7.68	19.674	9.153	6.679	11.7	5.0	7.8	1.1	7.04	0.58	8.3	3.3	4.4
182	56.7	1.112	75.4	3.9	7.69	19.783	9.180	6.686	11.7	5.0	7.8	1.1	6.83	0.58	8.3	3.3	4.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	56.7	1.118	75.3	3.8	7.70	19.891	9.193	6.683	11.7	5.0	7.9	1.2	6.63	0.57	8.3	3.3	4.5
184	57.0	1.124	75.3	3.8	7.71	20.000	9.233	6.702	11.7	5.0	7.9	1.2	6.46	0.56	8.4	3.4	4.6
185	57.0	1.124	75.3	3.8	7.71	20.000	9.233	6.702	11.7	5.0	7.9	1.2	6.46	0.56	8.4	3.4	4.6



File Location

B-56 Bag 2 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: Bag #2

Sample Description: White & Tan Silty Sand

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 34.000

PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.800	2.807	
Height (in)	5.647	5.599	
Weight (grams)	1099.30		1157.70
Moisture (%)	14.69		20.78
Dry Density (pcf)	105.00	105.39	
Saturation (%)	67.63	100.00	
Void Ratio	0.572	0.570	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 88.400

Effective Confining Stress (psi): 10.0

Corrected Peak Deviator Stress (psi): 9.335

at reading number: 59

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	1.2	0.000	78.4	0.0	6.19	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	18.6	0.006	78.4	0.0	6.20	0.107	2.811	2.808	12.8	10.0	12.8	10.0	1.28	-0.01	11.4	1.4	11.4
2	36.3	0.012	80.0	1.6	6.20	0.215	5.669	5.657	15.7	10.0	14.0	8.4	1.68	0.29	12.8	2.8	11.2
3	43.4	0.018	80.9	2.5	6.21	0.322	6.826	6.804	16.8	10.0	14.3	7.5	1.91	0.37	13.4	3.4	10.9
4	47.6	0.024	81.6	3.2	6.22	0.429	7.504	7.471	17.5	10.0	14.3	6.8	2.09	0.42	13.7	3.7	10.6
5	50.0	0.030	82.1	3.7	6.22	0.536	7.889	7.847	17.8	10.0	14.2	6.3	2.24	0.47	13.9	3.9	10.2
6	51.7	0.036	82.5	4.1	6.23	0.644	8.155	8.103	18.1	10.0	14.0	5.9	2.37	0.51	14.1	4.1	10.0
7	52.5	0.042	82.9	4.5	6.24	0.751	8.288	8.226	18.2	10.0	13.8	5.5	2.48	0.54	14.1	4.1	9.7
8	53.2	0.048	83.1	4.7	6.24	0.858	8.408	8.336	18.3	10.0	13.6	5.3	2.57	0.56	14.2	4.2	9.5
9	53.6	0.055	83.3	4.9	6.25	0.965	8.461	8.379	18.4	10.0	13.5	5.1	2.64	0.58	14.2	4.2	9.3
10	53.9	0.061	83.5	5.1	6.26	1.073	8.514	8.423	18.4	10.0	13.3	4.9	2.72	0.61	14.2	4.2	9.1
11	54.1	0.067	83.7	5.3	6.26	1.180	8.541	8.440	18.4	10.0	13.2	4.7	2.78	0.62	14.2	4.2	9.0
12	54.3	0.073	83.8	5.4	6.27	1.287	8.580	8.470	18.5	10.0	13.1	4.6	2.83	0.64	14.2	4.2	8.9
13	54.4	0.079	83.9	5.5	6.28	1.394	8.594	8.474	18.5	10.0	13.0	4.5	2.87	0.64	14.2	4.2	8.8
14	54.7	0.085	84.2	5.8	6.28	1.502	8.647	8.517	18.5	10.0	12.7	4.2	3.04	0.68	14.3	4.3	8.4
15	54.8	0.091	84.3	5.9	6.29	1.609	8.660	8.521	18.5	10.0	12.6	4.1	3.10	0.70	14.3	4.3	8.3
16	54.9	0.097	84.5	6.1	6.30	1.716	8.674	8.525	18.5	10.0	12.5	3.9	3.17	0.71	14.3	4.3	8.2
17	55.0	0.103	84.5	6.1	6.30	1.823	8.700	8.542	18.5	10.0	12.4	3.9	3.22	0.72	14.3	4.3	8.1
18	55.0	0.109	84.6	6.2	6.31	1.931	8.700	8.532	18.5	10.0	12.3	3.8	3.26	0.73	14.3	4.3	8.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	55.1	0.115	84.7	6.3	6.32	2.038	8.713	8.536	18.5	10.0	12.2	3.7	3.31	0.74	14.3	4.3	8.0
20	55.2	0.121	84.7	6.3	6.32	2.145	8.727	8.540	18.5	10.0	12.2	3.7	3.34	0.74	14.3	4.3	7.9
21	55.4	0.127	84.8	6.4	6.33	2.252	8.753	8.556	18.6	10.0	12.2	3.6	3.37	0.75	14.3	4.3	7.9
22	55.4	0.133	84.8	6.4	6.34	2.360	8.753	8.547	18.5	10.0	12.1	3.6	3.39	0.75	14.3	4.3	7.8
23	55.4	0.139	84.8	6.4	6.35	2.467	8.753	8.537	18.5	10.0	12.1	3.6	3.39	0.75	14.3	4.3	7.8
24	55.5	0.145	84.9	6.5	6.35	2.574	8.780	8.554	18.6	10.0	12.1	3.5	3.42	0.76	14.3	4.3	7.8
25	55.6	0.151	84.8	6.4	6.36	2.681	8.793	8.557	18.6	10.0	12.1	3.6	3.39	0.75	14.3	4.3	7.9
26	55.6	0.157	84.9	6.5	6.37	2.789	8.793	8.548	18.5	10.0	12.0	3.5	3.45	0.76	14.3	4.3	7.8
27	55.9	0.163	85.2	6.8	6.37	2.896	8.833	8.577	18.6	10.0	11.8	3.2	3.67	0.79	14.3	4.3	7.5
28	56.0	0.169	85.2	6.8	6.38	3.003	8.860	8.594	18.6	10.0	11.8	3.2	3.67	0.79	14.3	4.3	7.5
29	56.2	0.175	85.2	6.8	6.39	3.110	8.886	8.610	18.6	10.0	11.8	3.2	3.71	0.79	14.3	4.3	7.5
30	56.4	0.181	85.3	6.9	6.39	3.218	8.913	8.626	18.6	10.0	11.7	3.1	3.79	0.80	14.3	4.3	7.4
31	56.4	0.187	85.3	6.9	6.40	3.325	8.926	8.629	18.6	10.0	11.7	3.1	3.79	0.80	14.3	4.3	7.4
32	56.6	0.193	85.3	6.9	6.41	3.432	8.953	8.645	18.6	10.0	11.7	3.1	3.83	0.80	14.3	4.3	7.4
33	56.9	0.199	85.4	7.0	6.42	3.539	8.993	8.674	18.7	10.0	11.7	3.0	3.88	0.81	14.3	4.3	7.3
34	57.0	0.205	85.2	6.8	6.42	3.647	9.019	8.690	18.7	10.0	11.9	3.2	3.74	0.79	14.3	4.3	7.5
35	57.1	0.211	85.1	6.7	6.43	3.754	9.033	8.693	18.7	10.0	11.9	3.3	3.67	0.78	14.3	4.3	7.6
36	57.3	0.217	85.2	6.8	6.44	3.861	9.072	8.722	18.7	10.0	11.9	3.2	3.71	0.78	14.4	4.4	7.6
37	57.7	0.223	85.4	7.0	6.44	3.968	9.126	8.763	18.8	10.0	11.7	3.0	3.95	0.80	14.4	4.4	7.4
38	57.8	0.229	85.4	7.0	6.45	4.076	9.152	8.779	18.8	10.0	11.8	3.0	3.95	0.80	14.4	4.4	7.4
39	57.9	0.235	85.4	7.0	6.46	4.183	9.165	8.782	18.8	10.0	11.8	3.0	3.95	0.80	14.4	4.4	7.4
40	58.3	0.241	85.5	7.1	6.47	4.290	9.232	8.836	18.8	10.0	11.8	2.9	4.01	0.80	14.4	4.4	7.4
41	58.4	0.247	85.5	7.1	6.47	4.397	9.245	8.839	18.8	10.0	11.8	2.9	4.01	0.80	14.4	4.4	7.4
42	58.6	0.253	85.5	7.1	6.48	4.505	9.272	8.854	18.9	10.0	11.8	2.9	4.02	0.80	14.4	4.4	7.4
43	58.7	0.259	85.5	7.1	6.49	4.612	9.298	8.870	18.9	10.0	11.8	2.9	4.07	0.80	14.4	4.4	7.3
44	59.1	0.265	85.5	7.1	6.50	4.719	9.352	8.910	18.9	10.0	11.8	2.9	4.04	0.79	14.5	4.5	7.4
45	59.3	0.271	85.4	7.0	6.50	4.826	9.391	8.938	18.9	10.0	11.9	3.0	4.01	0.79	14.5	4.5	7.4
46	59.6	0.277	85.4	7.0	6.51	4.934	9.431	8.966	19.0	10.0	11.9	3.0	4.02	0.78	14.5	4.5	7.5
47	59.8	0.283	85.4	7.0	6.52	5.041	9.471	8.994	19.0	10.0	12.0	3.0	3.99	0.78	14.5	4.5	7.5
48	60.0	0.289	85.3	6.9	6.52	5.148	9.498	9.009	19.0	10.0	12.1	3.1	3.95	0.77	14.5	4.5	7.6
49	60.2	0.295	85.3	6.9	6.53	5.255	9.538	9.036	19.0	10.0	12.1	3.1	3.92	0.76	14.5	4.5	7.6
50	60.6	0.301	85.3	6.9	6.54	5.363	9.591	9.077	19.1	10.0	12.2	3.1	3.90	0.76	14.5	4.5	7.7
51	60.8	0.307	85.5	7.1	6.55	5.470	9.631	9.104	19.1	10.0	12.0	2.9	4.15	0.78	14.6	4.6	7.4
52	61.0	0.313	85.5	7.1	6.55	5.577	9.671	9.131	19.1	10.0	12.0	2.9	4.20	0.78	14.6	4.6	7.4
53	61.5	0.319	85.5	7.1	6.56	5.684	9.737	9.184	19.2	10.0	12.0	2.9	4.22	0.78	14.6	4.6	7.4
54	61.6	0.325	85.5	7.1	6.57	5.792	9.764	9.198	19.2	10.0	12.1	2.9	4.18	0.77	14.6	4.6	7.5
55	61.9	0.331	85.4	7.0	6.58	5.899	9.804	9.225	19.2	10.0	12.2	3.0	4.10	0.76	14.6	4.6	7.6
56	62.1	0.337	85.4	7.0	6.58	6.006	9.843	9.252	19.3	10.0	12.2	3.0	4.11	0.76	14.6	4.6	7.6
57	62.4	0.343	85.4	7.0	6.59	6.113	9.883	9.279	19.3	10.0	12.3	3.0	4.08	0.75	14.6	4.6	7.7
58	62.6	0.349	85.3	6.9	6.60	6.221	9.923	9.306	19.3	10.0	12.4	3.1	4.05	0.75	14.7	4.7	7.7
59	62.9	0.353	85.3	6.9	6.60	6.303	9.963	9.335	19.3	10.0	12.4	3.1	4.02	0.74	14.7	4.7	7.8



File Location

B-56 Bag 2 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: Bag #2

Sample Description: White & Tan Silty Sand

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 34.000

PL: 24.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.805	2.814	
Height (in)	5.617	5.573	
Weight (grams)	1104.90		1142.02
Moisture (%)	15.00		18.86
Dry Density (pcf)	105.43	105.60	
Saturation (%)	69.85	100.00	
Void Ratio	0.566	0.567	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 82.500

Effective Confining Stress (psi): 20.0

Corrected Peak Deviator Stress (psi): 30.686

at reading number: 184

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.0	0.006	62.5	0.0	6.22	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	35.0	0.012	65.8	3.3	6.23	0.108	5.633	5.626	25.6	20.0	22.3	16.7	1.34	0.59	22.8	2.8	19.5
2	49.2	0.018	68.1	5.6	6.23	0.215	7.917	7.900	27.9	20.0	22.3	14.4	1.55	0.71	24.0	4.0	18.3
3	57.4	0.024	69.6	7.1	6.24	0.323	9.233	9.203	29.2	20.0	22.1	12.9	1.71	0.77	24.6	4.6	17.5
4	62.8	0.030	70.6	8.1	6.25	0.431	10.096	10.053	30.1	20.0	22.0	11.9	1.84	0.81	25.0	5.0	16.9
5	66.9	0.036	71.4	8.9	6.25	0.538	10.760	10.702	30.7	20.0	21.8	11.1	1.96	0.83	25.4	5.4	16.4
6	69.8	0.042	72.0	9.6	6.26	0.646	11.225	11.153	31.2	20.0	21.6	10.5	2.07	0.86	25.6	5.6	16.0
7	72.1	0.048	72.6	10.1	6.27	0.754	11.597	11.510	31.5	20.0	21.4	9.9	2.16	0.88	25.8	5.8	15.6
8	73.9	0.054	73.1	10.6	6.27	0.861	11.876	11.774	31.8	20.0	21.2	9.4	2.25	0.90	25.9	5.9	15.3
9	75.4	0.060	73.4	10.9	6.28	0.969	12.129	12.011	32.0	20.0	21.1	9.1	2.32	0.91	26.0	6.0	15.1
10	76.8	0.066	73.8	11.3	6.29	1.077	12.354	12.221	32.2	20.0	20.9	8.7	2.40	0.92	26.1	6.1	14.8
11	77.7	0.072	74.1	11.6	6.29	1.184	12.487	12.339	32.3	20.0	20.8	8.4	2.46	0.94	26.2	6.2	14.6
12	78.6	0.078	74.4	11.9	6.30	1.292	12.633	12.470	32.5	20.0	20.6	8.1	2.54	0.95	26.2	6.2	14.4
13	79.2	0.084	74.6	12.1	6.31	1.400	12.740	12.561	32.6	20.0	20.5	7.9	2.59	0.96	26.3	6.3	14.2
14	79.3	0.090	74.8	12.3	6.31	1.507	12.753	12.561	32.6	20.0	20.2	7.7	2.64	0.98	26.3	6.3	14.0
15	80.4	0.096	75.0	12.5	6.32	1.615	12.926	12.717	32.7	20.0	20.2	7.5	2.70	0.99	26.4	6.4	13.8
16	80.8	0.102	75.2	12.7	6.33	1.723	12.992	12.768	32.8	20.0	20.1	7.3	2.74	0.99	26.4	6.4	13.7
17	81.3	0.108	75.3	12.8	6.34	1.830	13.072	12.832	32.8	20.0	20.0	7.2	2.78	1.00	26.4	6.4	13.6
18	81.6	0.114	75.4	12.9	6.34	1.938	13.112	12.857	32.9	20.0	19.9	7.1	2.82	1.01	26.4	6.4	13.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	82.0	0.120	75.5	13.1	6.35	2.046	13.191	12.921	32.9	20.0	19.9	7.0	2.86	1.01	26.5	6.5	13.4
20	82.5	0.126	75.7	13.2	6.36	2.154	13.271	12.985	33.0	20.0	19.8	6.8	2.90	1.01	26.5	6.5	13.3
21	82.9	0.132	75.7	13.2	6.36	2.261	13.324	13.023	33.0	20.0	19.8	6.8	2.92	1.01	26.5	6.5	13.3
22	83.5	0.138	75.8	13.3	6.37	2.369	13.430	13.112	33.1	20.0	19.8	6.7	2.95	1.01	26.6	6.6	13.3
23	83.8	0.144	75.9	13.4	6.38	2.477	13.470	13.137	33.1	20.0	19.8	6.6	2.98	1.02	26.6	6.6	13.2
24	84.4	0.150	75.9	13.4	6.38	2.584	13.563	13.213	33.2	20.0	19.8	6.6	3.00	1.02	26.6	6.6	13.2
25	84.8	0.156	76.0	13.5	6.39	2.692	13.630	13.263	33.3	20.0	19.8	6.5	3.04	1.02	26.6	6.6	13.1
26	84.9	0.162	76.0	13.5	6.40	2.800	13.643	13.261	33.3	20.0	19.7	6.5	3.05	1.02	26.6	6.6	13.1
27	85.1	0.168	76.1	13.6	6.41	2.907	13.683	13.285	33.3	20.0	19.7	6.4	3.08	1.02	26.7	6.6	13.0
28	85.8	0.174	76.1	13.7	6.41	3.015	13.789	13.373	33.4	20.0	19.7	6.4	3.10	1.02	26.7	6.7	13.0
29	86.3	0.180	76.2	13.7	6.42	3.123	13.869	13.436	33.4	20.0	19.8	6.3	3.13	1.02	26.7	6.7	13.0
30	86.7	0.186	76.2	13.7	6.43	3.230	13.935	13.485	33.5	20.0	19.8	6.3	3.15	1.02	26.8	6.7	13.0
31	87.1	0.192	76.3	13.8	6.43	3.338	14.002	13.534	33.5	20.0	19.8	6.2	3.17	1.02	26.8	6.8	13.0
32	87.8	0.198	76.3	13.8	6.44	3.446	14.121	13.635	33.6	20.0	19.8	6.2	3.20	1.01	26.8	6.8	13.0
33	88.2	0.204	76.3	13.9	6.45	3.553	14.174	13.671	33.7	20.0	19.8	6.2	3.22	1.01	26.8	6.8	13.0
34	88.7	0.210	76.3	13.9	6.46	3.661	14.254	13.732	33.7	20.0	19.9	6.2	3.23	1.01	26.9	6.9	13.0
35	89.1	0.216	76.4	13.9	6.46	3.769	14.320	13.781	33.8	20.0	19.9	6.1	3.25	1.01	26.9	6.9	13.0
36	89.6	0.222	76.4	13.9	6.47	3.876	14.400	13.842	33.9	20.0	20.0	6.1	3.26	1.00	26.9	6.9	13.0
37	89.6	0.228	76.4	13.9	6.48	3.984	14.413	13.839	33.8	20.0	19.9	6.1	3.28	1.01	26.9	6.9	13.0
38	90.3	0.234	76.4	13.9	6.49	4.092	14.520	13.926	33.9	20.0	20.0	6.1	3.29	1.00	27.0	7.0	13.0
39	90.6	0.240	76.4	13.9	6.49	4.199	14.560	13.948	34.0	20.0	20.0	6.1	3.30	1.00	27.0	7.0	13.0
40	90.9	0.246	76.4	13.9	6.50	4.307	14.613	13.983	34.0	20.0	20.1	6.1	3.30	1.00	27.0	7.0	13.1
41	91.4	0.252	76.4	13.9	6.51	4.415	14.692	14.044	34.1	20.0	20.1	6.1	3.31	0.99	27.0	7.0	13.1
42	91.8	0.258	76.4	13.9	6.51	4.522	14.759	14.091	34.1	20.0	20.2	6.1	3.32	0.99	27.1	7.0	13.1
43	92.5	0.264	76.4	13.9	6.52	4.630	14.865	14.177	34.2	20.0	20.3	6.1	3.33	0.98	27.1	7.1	13.2
44	92.9	0.270	76.5	14.0	6.53	4.738	14.932	14.224	34.2	20.0	20.3	6.0	3.36	0.98	27.1	7.1	13.1
45	93.2	0.276	76.5	14.0	6.54	4.845	14.985	14.259	34.3	20.0	20.3	6.0	3.36	0.98	27.1	7.1	13.2
46	93.7	0.282	76.5	14.0	6.54	4.953	15.064	14.318	34.3	20.0	20.4	6.0	3.37	0.98	27.2	7.2	13.2
47	94.2	0.288	76.5	14.0	6.55	5.061	15.144	14.378	34.4	20.0	20.4	6.0	3.38	0.97	27.2	7.2	13.2
48	94.8	0.294	76.5	14.0	6.56	5.168	15.237	14.450	34.5	20.0	20.5	6.0	3.39	0.97	27.2	7.2	13.3
49	95.4	0.300	76.5	14.0	6.57	5.276	15.343	14.534	34.5	20.0	20.6	6.0	3.41	0.96	27.3	7.3	13.3
50	96.0	0.306	76.5	14.0	6.57	5.384	15.436	14.605	34.6	20.0	20.6	6.0	3.42	0.96	27.3	7.3	13.3
51	96.3	0.312	76.5	14.0	6.58	5.491	15.489	14.639	34.6	20.0	20.6	6.0	3.44	0.96	27.3	7.3	13.3
52	97.3	0.318	76.5	14.0	6.59	5.599	15.649	14.773	34.8	20.0	20.8	6.0	3.46	0.95	27.4	7.4	13.4
53	97.8	0.324	76.5	14.0	6.60	5.707	15.729	14.831	34.8	20.0	20.9	6.0	3.46	0.94	27.4	7.4	13.4
54	98.3	0.330	76.5	14.0	6.60	5.815	15.808	14.889	34.9	20.0	20.9	6.0	3.48	0.94	27.5	7.4	13.4
55	98.7	0.336	76.5	14.0	6.61	5.922	15.875	14.935	34.9	20.0	21.0	6.0	3.48	0.94	27.5	7.5	13.5
56	99.2	0.342	76.5	14.0	6.62	6.030	15.954	14.992	35.0	20.0	21.0	6.0	3.48	0.93	27.5	7.5	13.5
57	99.8	0.348	76.5	14.0	6.63	6.138	16.047	15.063	35.1	20.0	21.1	6.0	3.50	0.93	27.5	7.5	13.6
58	100.2	0.354	76.4	13.9	6.63	6.245	16.114	15.107	35.1	20.0	21.2	6.1	3.49	0.92	27.6	7.6	13.6
59	100.6	0.360	76.5	14.0	6.64	6.353	16.167	15.140	35.1	20.0	21.2	6.0	3.51	0.92	27.6	7.6	13.6



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CONSULTING ENGINEERS

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	101.0	0.366	76.4	13.9	6.65	6.461	16.247	15.197	35.2	20.0	21.3	6.1	3.50	0.92	27.6	7.6	13.7
61	101.0	0.372	76.4	13.9	6.66	6.568	16.247	15.180	35.2	20.0	21.3	6.1	3.50	0.92	27.6	7.6	13.7
62	101.9	0.378	76.4	13.9	6.66	6.676	16.380	15.286	35.3	20.0	21.4	6.1	3.52	0.91	27.7	7.6	13.7
63	102.5	0.384	76.4	13.9	6.67	6.784	16.473	15.355	35.4	20.0	21.5	6.1	3.51	0.90	27.7	7.7	13.8
64	103.1	0.390	76.4	13.9	6.68	6.891	16.579	15.436	35.4	20.0	21.6	6.1	3.52	0.90	27.7	7.7	13.8
65	103.4	0.396	76.4	13.9	6.69	6.999	16.632	15.468	35.5	20.0	21.6	6.1	3.53	0.90	27.7	7.7	13.8
66	104.0	0.402	76.4	13.9	6.70	7.107	16.725	15.536	35.5	20.0	21.7	6.1	3.54	0.89	27.8	7.8	13.9
67	104.5	0.408	76.3	13.8	6.70	7.214	16.805	15.592	35.6	20.0	21.8	6.2	3.52	0.89	27.8	7.8	14.0
68	105.0	0.414	76.3	13.8	6.71	7.322	16.884	15.648	35.7	20.0	21.9	6.2	3.51	0.88	27.8	7.8	14.1
69	105.8	0.420	76.2	13.7	6.72	7.430	17.004	15.741	35.8	20.0	22.0	6.3	3.51	0.87	27.9	7.9	14.1
70	106.5	0.426	76.1	13.7	6.73	7.537	17.123	15.833	35.8	20.0	22.2	6.4	3.49	0.86	27.9	7.9	14.3
71	107.2	0.432	76.1	13.7	6.73	7.645	17.230	15.913	35.9	20.0	22.3	6.4	3.50	0.86	28.0	8.0	14.3
72	107.6	0.438	76.1	13.6	6.74	7.753	17.296	15.955	36.0	20.0	22.4	6.4	3.49	0.85	28.0	8.0	14.4
73	108.2	0.444	76.1	13.6	6.75	7.860	17.389	16.022	36.0	20.0	22.5	6.4	3.49	0.85	28.0	8.0	14.4
74	108.3	0.450	76.1	13.6	6.76	7.968	17.416	16.028	36.0	20.0	22.5	6.4	3.49	0.85	28.0	8.0	14.4
75	109.5	0.456	76.0	13.5	6.77	8.076	17.602	16.180	36.2	20.0	22.7	6.5	3.50	0.84	28.1	8.1	14.6
76	110.3	0.462	76.0	13.5	6.77	8.183	17.735	16.283	36.3	20.0	22.8	6.5	3.51	0.83	28.2	8.1	14.6
77	111.1	0.468	76.0	13.5	6.78	8.291	17.867	16.386	36.4	20.0	22.9	6.5	3.51	0.82	28.2	8.2	14.7
78	111.8	0.474	75.9	13.5	6.79	8.399	17.974	16.464	36.5	20.0	23.0	6.6	3.51	0.82	28.2	8.2	14.8
79	112.2	0.480	75.9	13.5	6.80	8.506	18.040	16.506	36.5	20.0	23.1	6.6	3.52	0.82	28.3	8.3	14.8
80	112.9	0.486	75.9	13.4	6.81	8.614	18.146	16.583	36.6	20.0	23.2	6.6	3.51	0.81	28.3	8.3	14.9
81	113.3	0.492	75.9	13.4	6.81	8.722	18.213	16.624	36.6	20.0	23.3	6.6	3.50	0.80	28.3	8.3	14.9
82	114.1	0.498	75.8	13.3	6.82	8.829	18.346	16.726	36.7	20.0	23.4	6.7	3.49	0.79	28.4	8.4	15.1
83	114.8	0.505	75.7	13.2	6.83	8.937	18.465	16.815	36.8	20.0	23.6	6.8	3.47	0.79	28.4	8.4	15.2
84	115.6	0.511	75.7	13.2	6.84	9.045	18.585	16.904	36.9	20.0	23.7	6.8	3.47	0.78	28.5	8.5	15.3
85	116.3	0.517	75.6	13.1	6.85	9.152	18.691	16.980	37.0	20.0	23.9	6.9	3.47	0.77	28.5	8.5	15.4
86	117.0	0.523	75.6	13.1	6.85	9.260	18.811	17.069	37.1	20.0	23.9	6.9	3.48	0.77	28.5	8.5	15.4
87	117.7	0.529	75.6	13.1	6.86	9.368	18.917	17.145	37.2	20.0	24.0	6.9	3.49	0.77	28.6	8.6	15.4
88	118.0	0.535	75.5	13.1	6.87	9.475	18.970	17.172	37.2	20.0	24.1	7.0	3.47	0.76	28.6	8.6	15.5
89	119.1	0.541	75.5	13.0	6.88	9.583	19.156	17.320	37.3	20.0	24.4	7.0	3.46	0.75	28.7	8.7	15.7
90	119.7	0.547	75.5	13.0	6.89	9.691	19.249	17.384	37.4	20.0	24.4	7.0	3.47	0.75	28.7	8.7	15.7
91	120.6	0.553	75.4	12.9	6.90	9.799	19.395	17.495	37.5	20.0	24.6	7.1	3.46	0.74	28.8	8.7	15.9
92	121.3	0.559	75.3	12.8	6.90	9.906	19.501	17.569	37.6	20.0	24.8	7.2	3.44	0.73	28.8	8.8	16.0
93	121.9	0.565	75.2	12.7	6.91	10.014	19.594	17.632	37.6	20.0	24.9	7.3	3.42	0.72	28.8	8.8	16.1
94	122.7	0.571	75.1	12.7	6.92	10.122	19.727	17.730	37.7	20.0	25.1	7.4	3.41	0.71	28.9	8.9	16.2
95	123.9	0.577	74.9	12.4	6.93	10.229	19.913	17.876	37.9	20.0	25.5	7.6	3.35	0.69	28.9	8.9	16.5
96	124.9	0.583	74.7	12.2	6.94	10.337	20.086	18.010	38.0	20.0	25.8	7.8	3.32	0.68	29.0	9.0	16.8
97	125.9	0.589	74.7	12.2	6.95	10.445	20.245	18.131	38.1	20.0	26.0	7.8	3.31	0.67	29.1	9.1	16.9
98	127.4	0.595	74.5	12.0	6.95	10.552	20.484	18.323	38.3	20.0	26.3	8.0	3.29	0.66	29.2	9.2	17.2
99	128.6	0.601	74.4	11.9	6.96	10.660	20.670	18.467	38.5	20.0	26.6	8.1	3.27	0.64	29.2	9.2	17.4
100	130.0	0.607	74.3	11.8	6.97	10.768	20.896	18.646	38.7	20.0	26.8	8.2	3.27	0.63	29.3	9.3	17.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	131.2	0.613	74.2	11.7	6.98	10.875	21.095	18.801	38.8	20.0	27.1	8.3	3.27	0.62	29.4	9.4	17.7
102	132.7	0.619	74.1	11.6	6.99	10.983	21.335	18.991	39.0	20.0	27.4	8.4	3.25	0.61	29.5	9.5	17.9
103	134.0	0.625	74.1	11.6	7.00	11.091	21.547	19.157	39.2	20.0	27.6	8.4	3.27	0.60	29.6	9.6	18.0
104	135.1	0.631	73.9	11.4	7.00	11.198	21.720	19.288	39.3	20.0	27.9	8.6	3.25	0.59	29.7	9.6	18.2
105	136.3	0.637	73.8	11.3	7.01	11.306	21.919	19.441	39.5	20.0	28.1	8.7	3.24	0.58	29.7	9.7	18.4
106	137.7	0.643	73.7	11.2	7.02	11.414	22.145	19.617	39.6	20.0	28.4	8.8	3.23	0.57	29.8	9.8	18.6
107	138.8	0.649	73.6	11.1	7.03	11.521	22.318	19.746	39.8	20.0	28.6	8.9	3.22	0.56	29.9	9.9	18.8
108	140.0	0.655	73.6	11.1	7.04	11.629	22.504	19.887	39.9	20.0	28.8	8.9	3.23	0.56	30.0	9.9	18.9
109	142.6	0.667	73.5	11.0	7.06	11.844	22.929	20.213	40.2	20.0	29.2	9.0	3.24	0.54	30.1	10.1	19.1
110	143.4	0.673	73.4	10.9	7.06	11.952	23.062	20.305	40.3	20.0	29.4	9.1	3.22	0.54	30.2	10.2	19.3
111	145.3	0.679	73.3	10.8	7.07	12.060	23.354	20.537	40.5	20.0	29.8	9.2	3.22	0.52	30.3	10.3	19.5
112	146.4	0.685	73.2	10.7	7.08	12.167	23.540	20.676	40.7	20.0	30.0	9.3	3.23	0.52	30.3	10.3	19.6
113	147.6	0.691	73.2	10.7	7.09	12.275	23.726	20.813	40.8	20.0	30.1	9.3	3.23	0.51	30.4	10.4	19.7
114	149.0	0.697	73.1	10.6	7.10	12.383	23.952	20.986	41.0	20.0	30.4	9.4	3.23	0.51	30.5	10.5	19.9
115	150.0	0.703	73.0	10.5	7.11	12.490	24.124	21.111	41.1	20.0	30.6	9.5	3.23	0.50	30.6	10.6	20.0
116	151.6	0.709	72.9	10.4	7.12	12.598	24.377	21.306	41.3	20.0	30.9	9.6	3.23	0.49	30.7	10.7	20.2
117	152.8	0.715	72.9	10.4	7.12	12.706	24.563	21.442	41.5	20.0	31.1	9.6	3.22	0.48	30.7	10.7	20.4
118	154.0	0.721	72.7	10.2	7.13	12.813	24.762	21.589	41.6	20.0	31.4	9.8	3.21	0.47	30.8	10.8	20.6
119	155.3	0.727	72.7	10.2	7.14	12.921	24.961	21.736	41.7	20.0	31.6	9.8	3.21	0.47	30.9	10.9	20.7
120	156.2	0.733	72.6	10.1	7.15	13.029	25.121	21.848	41.9	20.0	31.8	9.9	3.20	0.46	30.9	10.9	20.9
121	157.9	0.739	72.5	10.0	7.16	13.136	25.386	22.051	42.1	20.0	32.0	10.0	3.21	0.46	31.0	11.0	21.0
122	158.8	0.745	72.4	9.9	7.17	13.244	25.532	22.151	42.2	20.0	32.2	10.1	3.20	0.45	31.1	11.1	21.2
123	160.2	0.751	72.4	9.9	7.18	13.352	25.758	22.319	42.3	20.0	32.4	10.1	3.20	0.44	31.2	11.2	21.3
124	161.2	0.757	72.3	9.8	7.19	13.460	25.918	22.429	42.4	20.0	32.6	10.2	3.21	0.44	31.2	11.2	21.4
125	162.3	0.763	72.2	9.8	7.20	13.567	26.090	22.551	42.6	20.0	32.8	10.3	3.20	0.43	31.3	11.3	21.5
126	163.4	0.769	72.2	9.7	7.20	13.675	26.276	22.683	42.7	20.0	33.0	10.3	3.20	0.43	31.4	11.3	21.6
127	164.6	0.775	72.0	9.6	7.21	13.783	26.462	22.815	42.8	20.0	33.3	10.5	3.18	0.42	31.4	11.4	21.9
128	166.1	0.781	72.0	9.5	7.22	13.890	26.701	22.993	43.0	20.0	33.5	10.5	3.18	0.41	31.5	11.5	22.0
129	167.4	0.787	71.9	9.4	7.23	13.998	26.914	23.147	43.2	20.0	33.8	10.6	3.18	0.41	31.6	11.6	22.2
130	168.6	0.793	71.8	9.3	7.24	14.106	27.113	23.289	43.3	20.0	34.0	10.7	3.17	0.40	31.7	11.6	22.4
131	170.0	0.799	71.7	9.2	7.25	14.213	27.326	23.442	43.5	20.0	34.3	10.8	3.17	0.39	31.7	11.7	22.5
132	171.5	0.805	71.5	9.0	7.26	14.321	27.578	23.629	43.6	20.0	34.6	11.0	3.15	0.38	31.8	11.8	22.8
133	172.8	0.811	71.4	8.9	7.27	14.429	27.791	23.781	43.8	20.0	34.9	11.1	3.14	0.37	31.9	11.9	23.0
134	174.8	0.817	71.3	8.8	7.28	14.536	28.096	24.012	44.0	20.0	35.2	11.2	3.14	0.37	32.0	12.0	23.2
135	176.0	0.823	71.4	9.0	7.29	14.644	28.296	24.152	44.2	20.0	35.2	11.1	3.18	0.37	32.1	12.1	23.1
136	176.9	0.829	71.3	8.8	7.30	14.752	28.442	24.246	44.3	20.0	35.4	11.2	3.17	0.36	32.1	12.1	23.3
137	178.1	0.835	71.2	8.8	7.31	14.859	28.641	24.385	44.4	20.0	35.6	11.3	3.17	0.36	32.2	12.2	23.4
138	179.5	0.841	71.2	8.7	7.31	14.967	28.853	24.535	44.5	20.0	35.9	11.3	3.16	0.35	32.3	12.3	23.6
139	181.1	0.847	71.1	8.6	7.32	15.075	29.119	24.730	44.7	20.0	36.1	11.4	3.17	0.35	32.4	12.4	23.8
140	182.3	0.853	71.0	8.5	7.33	15.182	29.305	24.856	44.9	20.0	36.4	11.5	3.16	0.34	32.4	12.4	23.9
141	183.7	0.859	70.9	8.4	7.34	15.290	29.531	25.016	45.0	20.0	36.6	11.6	3.16	0.34	32.5	12.5	24.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	185.1	0.865	70.8	8.4	7.35	15.398	29.757	25.175	45.2	20.0	36.8	11.7	3.16	0.33	32.6	12.6	24.2
143	186.6	0.871	70.8	8.4	7.36	15.505	30.009	25.356	45.4	20.0	37.0	11.7	3.18	0.33	32.7	12.7	24.3
144	188.1	0.877	70.8	8.3	7.37	15.613	30.248	25.526	45.5	20.0	37.3	11.7	3.17	0.32	32.8	12.8	24.5
145	189.1	0.883	70.7	8.2	7.38	15.721	30.408	25.627	45.6	20.0	37.4	11.8	3.18	0.32	32.8	12.8	24.6
146	190.3	0.889	70.8	8.3	7.39	15.828	30.594	25.751	45.8	20.0	37.5	11.7	3.19	0.32	32.9	12.9	24.6
147	190.8	0.895	70.8	8.4	7.40	15.936	30.673	25.785	45.8	20.0	37.4	11.7	3.21	0.32	32.9	12.9	24.5
148	192.1	0.901	70.8	8.3	7.41	16.044	30.886	25.931	45.9	20.0	37.6	11.7	3.22	0.32	33.0	13.0	24.7
149	193.1	0.907	70.8	8.3	7.42	16.151	31.045	26.031	46.0	20.0	37.7	11.7	3.23	0.32	33.0	13.0	24.7
150	194.1	0.913	70.8	8.3	7.43	16.259	31.205	26.131	46.1	20.0	37.8	11.7	3.23	0.32	33.1	13.1	24.8
151	195.0	0.919	70.7	8.2	7.44	16.367	31.351	26.220	46.2	20.0	38.0	11.8	3.23	0.31	33.1	13.1	24.9
152	196.0	0.925	70.6	8.2	7.45	16.474	31.510	26.319	46.3	20.0	38.2	11.9	3.22	0.31	33.2	13.2	25.0
153	197.1	0.931	70.6	8.1	7.46	16.582	31.696	26.440	46.5	20.0	38.3	11.9	3.22	0.31	33.2	13.2	25.1
154	198.2	0.937	70.5	8.0	7.47	16.690	31.869	26.550	46.6	20.0	38.5	12.0	3.22	0.30	33.3	13.3	25.3
155	199.4	0.943	70.5	8.0	7.48	16.797	32.055	26.671	46.7	20.0	38.7	12.0	3.22	0.30	33.3	13.3	25.4
156	199.9	0.949	70.4	8.0	7.49	16.905	32.135	26.702	46.7	20.0	38.8	12.1	3.21	0.30	33.4	13.4	25.4
157	200.9	0.955	70.4	8.0	7.49	17.013	32.294	26.800	46.8	20.0	38.9	12.1	3.22	0.30	33.4	13.4	25.5
158	201.4	0.961	70.4	7.9	7.50	17.120	32.374	26.831	46.8	20.0	38.9	12.1	3.22	0.29	33.4	13.4	25.5
159	202.6	0.967	70.0	7.6	7.51	17.228	32.573	26.961	47.0	20.0	39.4	12.5	3.16	0.28	33.5	13.5	25.9
160	204.0	0.973	70.0	7.5	7.52	17.336	32.799	27.113	47.1	20.0	39.7	12.5	3.16	0.28	33.6	13.6	26.1
161	205.2	0.979	69.9	7.4	7.53	17.444	32.998	27.242	47.3	20.0	39.9	12.6	3.16	0.27	33.6	13.6	26.2
162	206.5	0.985	69.7	7.2	7.54	17.551	33.197	27.371	47.4	20.0	40.2	12.8	3.14	0.26	33.7	13.7	26.5
163	207.8	0.991	69.6	7.1	7.55	17.659	33.410	27.510	47.5	20.0	40.4	12.9	3.14	0.26	33.8	13.8	26.6
164	209.3	0.997	69.6	7.1	7.56	17.767	33.649	27.671	47.7	20.0	40.6	12.9	3.14	0.26	33.8	13.8	26.8
165	210.8	1.003	69.5	7.0	7.57	17.874	33.888	27.831	47.8	20.0	40.9	13.0	3.14	0.25	33.9	13.9	26.9
166	212.2	1.009	69.3	6.8	7.58	17.990	34.114	27.977	48.0	20.0	41.2	13.2	3.12	0.24	34.0	14.0	27.2
167	213.8	1.015	69.2	6.7	7.59	18.106	34.380	28.155	48.2	20.0	41.4	13.3	3.12	0.24	34.1	14.1	27.3
168	215.6	1.022	69.1	6.6	7.61	18.222	34.659	28.343	48.4	20.0	41.7	13.4	3.12	0.23	34.2	14.2	27.6
169	217.3	1.028	69.1	6.6	7.62	18.338	34.938	28.531	48.5	20.0	42.0	13.4	3.13	0.23	34.3	14.3	27.7
170	218.5	1.035	69.0	6.5	7.63	18.454	35.137	28.653	48.7	20.0	42.1	13.5	3.13	0.23	34.3	14.3	27.8
171	220.3	1.041	68.9	6.4	7.64	18.570	35.416	28.839	48.8	20.0	42.5	13.6	3.12	0.22	34.4	14.4	28.0
172	222.2	1.048	68.8	6.3	7.65	18.686	35.721	29.047	49.1	20.0	42.8	13.7	3.12	0.22	34.5	14.5	28.2
173	223.7	1.054	68.8	6.3	7.66	18.794	35.961	29.202	49.2	20.0	42.9	13.7	3.12	0.21	34.6	14.6	28.3
174	225.3	1.060	68.7	6.2	7.67	18.901	36.226	29.379	49.4	20.0	43.2	13.8	3.13	0.21	34.7	14.7	28.5
175	226.8	1.066	68.6	6.1	7.68	19.009	36.465	29.534	49.5	20.0	43.4	13.9	3.12	0.21	34.8	14.8	28.7
176	228.0	1.072	68.6	6.1	7.69	19.117	36.665	29.656	49.7	20.0	43.6	13.9	3.13	0.20	34.8	14.8	28.8
177	229.3	1.078	68.5	6.0	7.70	19.224	36.864	29.777	49.8	20.0	43.8	14.0	3.13	0.20	34.9	14.9	28.9
178	230.6	1.084	68.4	5.9	7.71	19.332	37.076	29.909	49.9	20.0	44.0	14.1	3.13	0.20	35.0	15.0	29.0
179	231.8	1.090	68.4	5.9	7.72	19.440	37.276	30.029	50.0	20.0	44.1	14.1	3.13	0.20	35.0	15.0	29.1
180	233.2	1.096	68.4	5.9	7.73	19.547	37.502	30.171	50.2	20.0	44.3	14.1	3.13	0.19	35.1	15.1	29.2
181	234.9	1.102	68.2	5.7	7.74	19.655	37.767	30.344	50.4	20.0	44.6	14.3	3.13	0.19	35.2	15.2	29.4
182	236.4	1.108	68.2	5.7	7.75	19.763	38.006	30.495	50.5	20.0	44.8	14.3	3.13	0.19	35.3	15.2	29.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	237.9	1.114	68.2	5.7	7.76	19.879	38.245	30.643	50.7	20.0	45.0	14.3	3.14	0.18	35.3	15.3	29.7
184	238.3	1.116	68.2	5.7	7.77	19.903	38.312	30.686	50.7	20.0	45.0	14.3	3.14	0.18	35.4	15.3	29.7

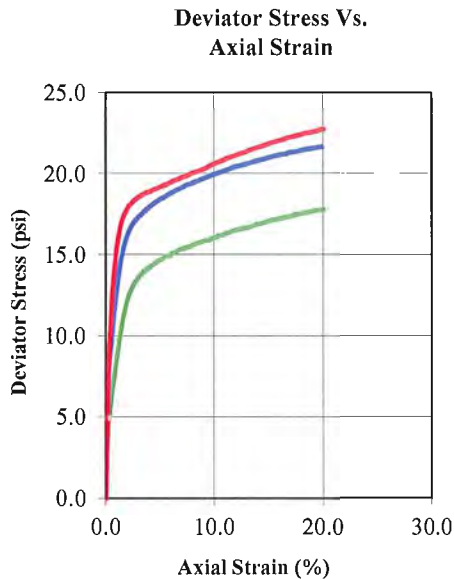


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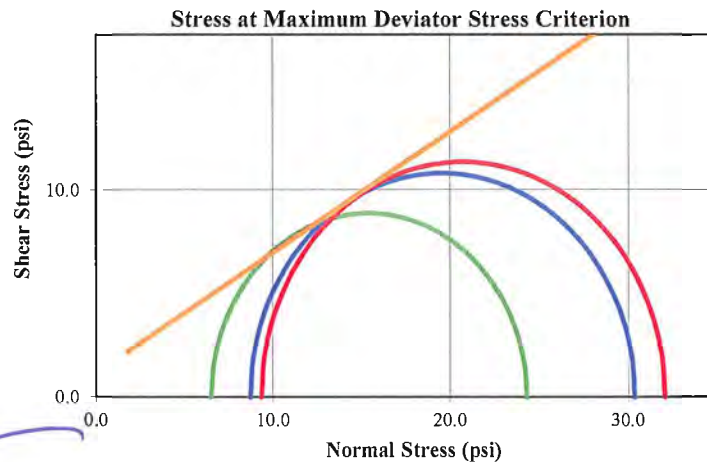
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0'- 40.0'
PROJECT LOCATION : B-59	SAMPLE TYPE : Remolded
BORING NUMBER : B-59	DESCRIPTION : Brown, Gray, Tan, Red & White Silty Sand
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	11.9	11.9	11.7	
Dry Density (pcf)	105.7	108.0	108.0	
Saturation (%)	56.06	59.30	58.36	
Void Ratio	0.561	0.528	0.528	
Diameter (in)	2.833	2.810	2.807	
Height (in)	5.691	5.692	5.688	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	32	32	32	
Plastic Limit	27	27	27	
After Consolidation	A	B	C	D
B-Value	0.95	0.96	0.95	
Water Content (%)	21.4	20.8	20.6	
Dry Density (pcf)	105.86	108.20	110.92	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.563	0.529	0.491	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	83.2	73.0	73.0	
Rate of Strain	0.002	0.0020	0.002	

Maximum Deviator Stress Criterion		After Shear	A	B	C	D
C (psi)	1.4	σ'_1 at Failure (psi)	24.30	30.36	32.06	
ϕ (deg)	28.2	σ'_3 at Failure (psi)	6.51	8.71	9.34	
C' (psi)	1.1					
ϕ' (deg)	30.3					



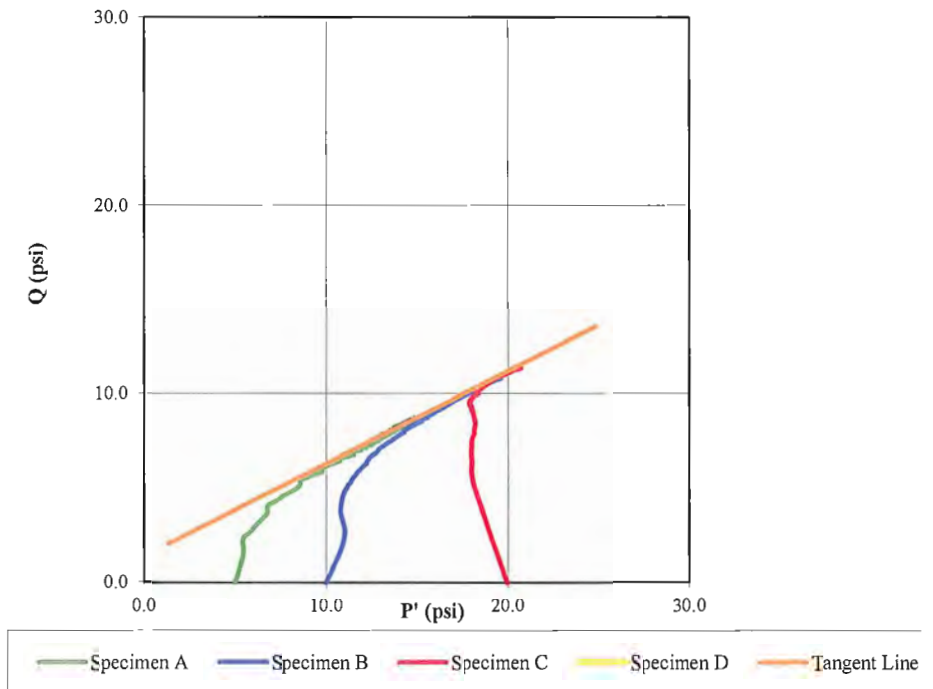
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Date: 12-11-12

Approved By: SKB
Date: 12-11-12

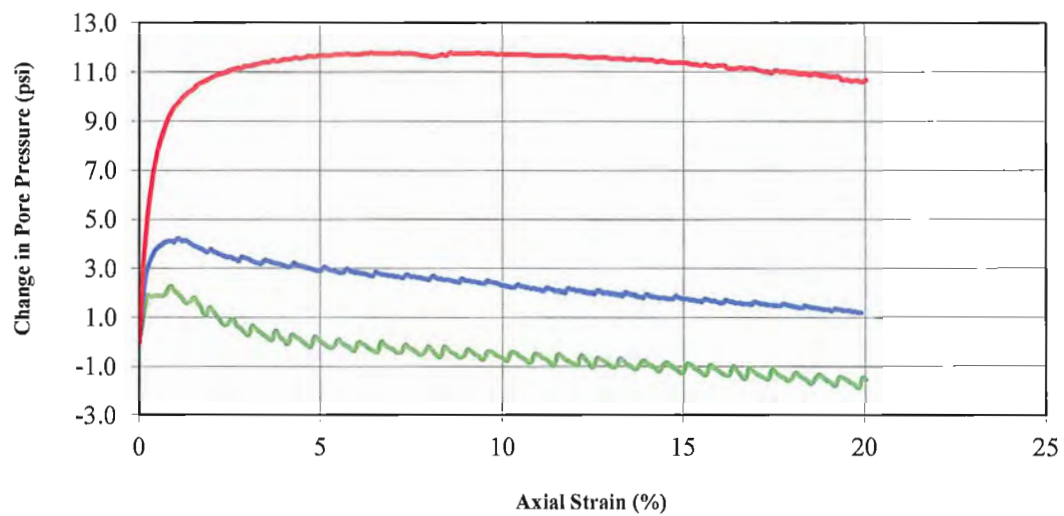


Consolidated Undrained Triaxial Test (ASTM D4767)

Stress Paths (Effective)
($a = 1.4$ $\alpha = 26.2$)



Change in Pore Pressure vs. Axial Strain





File Location
B-59 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-59
Sample Description: Brown, Gray, Tan, Red & White Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 32.000
PL: 27.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.833	2.837	
Height (in)	5.691	5.669	
Weight (grams)	1114.50		1208.93
Moisture (%)	11.94		21.42
Dry Density (pcf)	105.75	105.86	
Saturation (%)	56.06	100.00	
Void Ratio	0.561	0.563	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 88.200
Effective Confining Stress (psi): 5.0
Corrected Peak Deviator Stress (psi): 17.788 at reading number: 186

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.7	0.000	83.2	0.0	6.32	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	19.6	0.007	84.3	1.0	6.33	0.108	2.980	2.976	8.0	5.0	6.9	3.9	1.76	0.35	6.5	1.5	5.4
2	30.2	0.013	85.1	1.9	6.33	0.215	4.658	4.648	9.6	5.0	7.7	3.1	2.50	0.41	7.3	2.3	5.4
3	34.7	0.019	85.1	1.9	6.34	0.323	5.374	5.356	10.3	5.0	8.5	3.1	2.71	0.35	7.7	2.7	5.8
4	38.7	0.025	85.1	1.9	6.35	0.431	6.011	5.985	11.0	5.0	9.1	3.1	2.94	0.32	8.0	3.0	6.1
5	42.1	0.031	85.1	1.9	6.35	0.538	6.545	6.509	11.5	5.0	9.6	3.1	3.11	0.29	8.2	3.3	6.3
6	45.6	0.037	85.1	1.9	6.36	0.646	7.104	7.058	12.0	5.0	10.1	3.1	3.28	0.27	8.5	3.5	6.6
7	49.0	0.043	85.2	2.0	6.37	0.754	7.638	7.580	12.6	5.0	10.5	3.0	3.55	0.27	8.8	3.8	6.8
8	52.4	0.049	85.5	2.3	6.37	0.861	8.171	8.101	13.1	5.0	10.8	2.7	3.97	0.28	9.0	4.1	6.8
9	55.6	0.055	85.3	2.1	6.38	0.969	8.678	8.594	13.6	5.0	11.5	2.9	3.98	0.24	9.3	4.3	7.2
10	58.8	0.062	85.2	2.0	6.39	1.077	9.186	9.087	14.1	5.0	12.1	3.0	4.02	0.22	9.5	4.5	7.6
11	61.7	0.068	85.0	1.8	6.40	1.184	9.641	9.527	14.5	5.0	12.7	3.2	4.01	0.19	9.7	4.8	7.9
12	64.7	0.074	84.8	1.6	6.40	1.292	10.123	9.992	15.0	5.0	13.4	3.4	3.96	0.16	10.0	5.0	8.4
13	67.6	0.080	84.9	1.6	6.41	1.400	10.578	10.430	15.4	5.0	13.8	3.3	4.13	0.16	10.2	5.2	8.5
14	70.2	0.086	85.0	1.8	6.42	1.508	10.994	10.829	15.8	5.0	14.0	3.2	4.42	0.17	10.4	5.4	8.6
15	72.4	0.092	84.8	1.6	6.42	1.615	11.346	11.162	16.1	5.0	14.5	3.4	4.31	0.14	10.6	5.6	9.0
16	74.6	0.098	84.6	1.4	6.43	1.723	11.684	11.483	16.5	5.0	15.1	3.6	4.18	0.12	10.7	5.7	9.4
17	76.5	0.104	84.3	1.1	6.44	1.831	11.983	11.764	16.7	5.0	15.7	3.9	4.02	0.09	10.9	5.9	9.8
18	78.5	0.110	84.6	1.4	6.44	1.938	12.309	12.070	17.1	5.0	15.6	3.6	4.38	0.12	11.0	6.0	9.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	80.1	0.116	84.5	1.2	6.45	2.046	12.556	12.299	17.3	5.0	16.0	3.7	4.29	0.10	11.1	6.1	9.9
20	81.6	0.123	84.3	1.0	6.46	2.154	12.790	12.514	17.5	5.0	16.4	3.9	4.18	0.08	11.2	6.3	10.2
21	82.8	0.129	84.1	0.8	6.47	2.261	12.985	12.691	17.7	5.0	16.8	4.1	4.07	0.07	11.3	6.3	10.5
22	84.0	0.135	83.9	0.7	6.47	2.369	13.167	12.855	17.8	5.0	17.2	4.3	3.99	0.05	11.4	6.4	10.7
23	85.0	0.141	84.0	0.8	6.48	2.477	13.336	13.006	18.0	5.0	17.2	4.2	4.11	0.06	11.5	6.5	10.7
24	86.2	0.147	84.1	0.9	6.49	2.584	13.519	13.169	18.1	5.0	17.2	4.1	4.25	0.07	11.6	6.6	10.6
25	87.0	0.153	83.9	0.7	6.49	2.692	13.649	13.281	18.3	5.0	17.6	4.3	4.09	0.05	11.6	6.6	10.9
26	87.6	0.159	83.8	0.6	6.50	2.800	13.740	13.355	18.3	5.0	17.8	4.4	4.02	0.04	11.7	6.7	11.1
27	88.4	0.165	83.6	0.4	6.51	2.907	13.870	13.467	18.4	5.0	18.0	4.6	3.94	0.03	11.7	6.7	11.3
28	89.3	0.171	83.5	0.3	6.52	3.015	14.013	13.590	18.6	5.0	18.3	4.7	3.89	0.02	11.8	6.8	11.5
29	90.0	0.178	83.9	0.6	6.52	3.123	14.130	13.689	18.7	5.0	18.0	4.3	4.16	0.05	11.8	6.8	11.2
30	90.7	0.184	83.7	0.5	6.53	3.230	14.234	13.774	18.8	5.0	18.2	4.5	4.09	0.04	11.9	6.9	11.3
31	91.1	0.190	83.6	0.4	6.54	3.338	14.299	13.822	18.8	5.0	18.4	4.6	4.02	0.03	11.9	6.9	11.5
32	91.9	0.196	83.5	0.3	6.55	3.446	14.416	13.920	18.9	5.0	18.6	4.7	3.96	0.02	11.9	7.0	11.7
33	92.3	0.202	83.4	0.2	6.55	3.553	14.494	13.979	19.0	5.0	18.8	4.8	3.90	0.01	12.0	7.0	11.8
34	92.6	0.208	83.3	0.1	6.56	3.661	14.533	14.001	19.0	5.0	18.9	4.9	3.86	0.01	12.0	7.0	11.9
35	93.5	0.214	83.7	0.4	6.57	3.769	14.677	14.123	19.1	5.0	18.7	4.5	4.11	0.03	12.0	7.1	11.6
36	93.8	0.220	83.4	0.2	6.57	3.876	14.729	14.158	19.1	5.0	18.9	4.8	3.96	0.01	12.1	7.1	11.9
37	94.2	0.226	83.3	0.1	6.58	3.984	14.781	14.192	19.2	5.0	19.1	4.9	3.90	0.01	12.1	7.1	12.0
38	94.6	0.232	83.1	-0.1	6.59	4.092	14.859	14.251	19.2	5.0	19.3	5.1	3.82	-0.01	12.1	7.1	12.2
39	95.3	0.239	83.5	0.3	6.60	4.200	14.963	14.334	19.3	5.0	19.0	4.7	4.05	0.02	12.1	7.2	11.9
40	95.6	0.245	83.4	0.2	6.60	4.307	15.015	14.368	19.3	5.0	19.1	4.8	4.01	0.01	12.2	7.2	12.0
41	96.0	0.251	83.3	0.1	6.61	4.415	15.080	14.414	19.4	5.0	19.3	4.9	3.97	0.01	12.2	7.2	12.1
42	96.5	0.257	83.2	0.0	6.62	4.523	15.158	14.472	19.5	5.0	19.5	5.0	3.91	0.00	12.2	7.2	12.2
43	96.8	0.263	83.1	-0.1	6.63	4.630	15.197	14.493	19.5	5.0	19.6	5.1	3.84	-0.01	12.2	7.2	12.3
44	97.2	0.269	83.0	-0.2	6.63	4.738	15.262	14.539	19.5	5.0	19.7	5.2	3.81	-0.01	12.3	7.3	12.5
45	97.9	0.275	83.4	0.2	6.64	4.846	15.379	14.634	19.6	5.0	19.4	4.8	4.06	0.01	12.3	7.3	12.1
46	98.0	0.281	83.3	0.1	6.65	4.953	15.392	14.630	19.6	5.0	19.5	4.9	3.99	0.01	12.3	7.3	12.2
47	98.5	0.287	83.2	0.0	6.66	5.061	15.470	14.687	19.7	5.0	19.7	5.0	3.93	0.00	12.3	7.3	12.4
48	98.8	0.293	83.1	-0.2	6.66	5.169	15.522	14.720	19.7	5.0	19.9	5.1	3.86	-0.01	12.3	7.4	12.5
49	99.2	0.300	83.0	-0.2	6.67	5.276	15.574	14.753	19.7	5.0	20.0	5.2	3.83	-0.02	12.4	7.4	12.6
50	99.5	0.306	83.1	-0.2	6.68	5.384	15.626	14.785	19.8	5.0	19.9	5.1	3.88	-0.01	12.4	7.4	12.5
51	100.1	0.312	83.3	0.1	6.69	5.492	15.717	14.854	19.8	5.0	19.8	4.9	4.03	0.01	12.4	7.4	12.3
52	100.4	0.318	83.2	0.0	6.69	5.599	15.769	14.886	19.9	5.0	19.9	5.0	3.96	0.00	12.4	7.4	12.5
53	100.6	0.324	83.1	-0.2	6.70	5.707	15.809	14.906	19.9	5.0	20.0	5.1	3.90	-0.01	12.4	7.5	12.6
54	100.9	0.330	83.0	-0.2	6.71	5.815	15.848	14.926	19.9	5.0	20.1	5.2	3.86	-0.02	12.4	7.5	12.7
55	101.1	0.336	82.9	-0.4	6.72	5.922	15.874	14.933	19.9	5.0	20.3	5.3	3.80	-0.02	12.4	7.5	12.8
56	101.7	0.342	83.2	0.0	6.73	6.030	15.978	15.014	20.0	5.0	20.0	5.0	3.99	0.00	12.5	7.5	12.5
57	102.1	0.348	83.1	-0.1	6.73	6.138	16.043	15.058	20.0	5.0	20.1	5.1	3.98	-0.01	12.5	7.5	12.6
58	102.5	0.355	83.1	-0.2	6.74	6.245	16.095	15.090	20.1	5.0	20.2	5.1	3.93	-0.01	12.5	7.5	12.7
59	102.6	0.361	82.9	-0.3	6.75	6.353	16.121	15.097	20.1	5.0	20.4	5.3	3.87	-0.02	12.5	7.5	12.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	103.1	0.367	82.9	-0.4	6.76	6.461	16.199	15.152	20.1	5.0	20.5	5.3	3.84	-0.02	12.6	7.6	12.9
61	103.5	0.373	82.8	-0.4	6.76	6.568	16.264	15.196	20.2	5.0	20.6	5.4	3.82	-0.03	12.6	7.6	13.0
62	103.9	0.379	83.2	0.0	6.77	6.676	16.329	15.239	20.2	5.0	20.2	5.0	4.06	0.00	12.6	7.6	12.6
63	104.4	0.385	83.1	-0.2	6.78	6.784	16.407	15.294	20.3	5.0	20.4	5.1	3.97	-0.01	12.6	7.6	12.8
64	104.8	0.391	83.0	-0.2	6.79	6.892	16.459	15.325	20.3	5.0	20.5	5.2	3.93	-0.02	12.6	7.7	12.9
65	104.9	0.397	82.9	-0.3	6.80	6.999	16.485	15.331	20.3	5.0	20.6	5.3	3.89	-0.02	12.6	7.7	13.0
66	105.3	0.403	82.8	-0.4	6.80	7.107	16.537	15.362	20.3	5.0	20.8	5.4	3.83	-0.03	12.7	7.7	13.1
67	105.4	0.409	82.8	-0.4	6.81	7.215	16.563	15.368	20.3	5.0	20.8	5.4	3.85	-0.03	12.7	7.7	13.1
68	106.0	0.416	83.1	-0.1	6.82	7.322	16.654	15.435	20.4	5.0	20.5	5.1	4.03	-0.01	12.7	7.7	12.8
69	106.2	0.422	83.0	-0.2	6.83	7.430	16.680	15.441	20.4	5.0	20.7	5.2	3.96	-0.02	12.7	7.7	12.9
70	106.6	0.428	82.9	-0.3	6.84	7.538	16.745	15.483	20.5	5.0	20.8	5.3	3.92	-0.02	12.7	7.7	13.0
71	106.7	0.434	82.8	-0.4	6.84	7.645	16.758	15.477	20.5	5.0	20.9	5.4	3.85	-0.03	12.7	7.7	13.2
72	106.7	0.440	82.7	-0.5	6.85	7.753	16.771	15.471	20.5	5.0	21.0	5.5	3.81	-0.03	12.7	7.7	13.2
73	107.3	0.446	82.8	-0.4	6.86	7.861	16.862	15.537	20.5	5.0	20.9	5.4	3.89	-0.03	12.7	7.8	13.2
74	107.9	0.452	83.0	-0.2	6.87	7.968	16.953	15.603	20.6	5.0	20.8	5.2	4.01	-0.01	12.8	7.8	13.0
75	108.2	0.458	82.9	-0.4	6.88	8.076	17.006	15.632	20.6	5.0	21.0	5.3	3.93	-0.02	12.8	7.8	13.2
76	108.3	0.464	82.7	-0.5	6.88	8.184	17.019	15.626	20.6	5.0	21.1	5.5	3.84	-0.03	12.8	7.8	13.3
77	108.6	0.471	82.6	-0.6	6.89	8.291	17.071	15.655	20.6	5.0	21.2	5.6	3.80	-0.04	12.8	7.8	13.4
78	109.0	0.477	83.0	-0.2	6.90	8.399	17.136	15.696	20.7	5.0	20.9	5.2	4.03	-0.01	12.8	7.8	13.0
79	109.4	0.483	82.9	-0.3	6.91	8.507	17.188	15.726	20.7	5.0	21.0	5.3	3.97	-0.02	12.8	7.9	13.2
80	109.6	0.489	82.8	-0.4	6.92	8.614	17.227	15.743	20.7	5.0	21.2	5.4	3.90	-0.03	12.9	7.9	13.3
81	109.9	0.495	82.7	-0.5	6.92	8.722	17.266	15.760	20.7	5.0	21.3	5.5	3.86	-0.03	12.9	7.9	13.4
82	110.0	0.501	82.6	-0.6	6.93	8.830	17.292	15.765	20.7	5.0	21.4	5.6	3.80	-0.04	12.9	7.9	13.5
83	110.4	0.507	82.7	-0.6	6.94	8.937	17.344	15.794	20.8	5.0	21.3	5.5	3.85	-0.04	12.9	7.9	13.4
84	110.8	0.513	82.9	-0.3	6.95	9.045	17.422	15.846	20.8	5.0	21.1	5.3	3.99	-0.02	12.9	7.9	13.2
85	111.0	0.519	82.8	-0.4	6.96	9.153	17.448	15.851	20.8	5.0	21.2	5.4	3.94	-0.03	12.9	7.9	13.3
86	111.2	0.525	82.7	-0.5	6.96	9.261	17.474	15.856	20.8	5.0	21.4	5.5	3.88	-0.03	12.9	7.9	13.4
87	111.4	0.532	82.6	-0.6	6.97	9.368	17.513	15.872	20.9	5.0	21.5	5.6	3.84	-0.04	12.9	7.9	13.5
88	111.6	0.538	82.5	-0.7	6.98	9.476	17.539	15.877	20.9	5.0	21.6	5.7	3.78	-0.05	12.9	7.9	13.6
89	111.9	0.544	82.8	-0.4	6.99	9.584	17.591	15.905	20.9	5.0	21.3	5.4	3.93	-0.03	12.9	8.0	13.4
90	112.3	0.550	82.8	-0.4	7.00	9.691	17.656	15.945	20.9	5.0	21.3	5.4	3.96	-0.03	13.0	8.0	13.4
91	112.7	0.556	82.7	-0.5	7.01	9.799	17.708	15.973	21.0	5.0	21.5	5.5	3.90	-0.03	13.0	8.0	13.5
92	113.1	0.562	82.6	-0.6	7.01	9.907	17.786	16.024	21.0	5.0	21.6	5.6	3.87	-0.04	13.0	8.0	13.6
93	113.3	0.568	82.5	-0.7	7.02	10.014	17.812	16.028	21.0	5.0	21.7	5.7	3.83	-0.04	13.0	8.0	13.7
94	113.6	0.574	82.5	-0.8	7.03	10.122	17.864	16.056	21.0	5.0	21.8	5.7	3.79	-0.05	13.0	8.0	13.8
95	114.1	0.580	82.8	-0.4	7.04	10.230	17.942	16.107	21.1	5.0	21.5	5.4	3.97	-0.03	13.0	8.1	13.5
96	114.6	0.587	82.8	-0.4	7.05	10.337	18.020	16.158	21.1	5.0	21.6	5.4	3.98	-0.03	13.1	8.1	13.5
97	114.8	0.593	82.7	-0.6	7.06	10.445	18.046	16.161	21.1	5.0	21.7	5.5	3.92	-0.03	13.1	8.1	13.6
98	115.0	0.599	82.6	-0.6	7.07	10.553	18.072	16.165	21.1	5.0	21.8	5.6	3.87	-0.04	13.1	8.1	13.7
99	115.4	0.605	82.5	-0.8	7.07	10.660	18.138	16.204	21.2	5.0	21.9	5.7	3.82	-0.05	13.1	8.1	13.8
100	115.4	0.611	82.4	-0.8	7.08	10.768	18.138	16.184	21.2	5.0	22.0	5.8	3.78	-0.05	13.1	8.1	13.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	115.9	0.617	82.7	-0.5	7.09	10.876	18.229	16.246	21.2	5.0	21.7	5.5	3.95	-0.03	13.1	8.1	13.6
102	116.4	0.623	82.7	-0.5	7.10	10.983	18.294	16.284	21.3	5.0	21.8	5.5	3.96	-0.03	13.1	8.1	13.6
103	116.7	0.629	82.6	-0.6	7.11	11.091	18.346	16.311	21.3	5.0	21.9	5.6	3.90	-0.04	13.1	8.2	13.8
104	117.1	0.635	82.5	-0.7	7.12	11.199	18.411	16.349	21.3	5.0	22.1	5.7	3.87	-0.04	13.2	8.2	13.9
105	117.1	0.641	82.4	-0.8	7.13	11.306	18.411	16.329	21.3	5.0	22.2	5.8	3.80	-0.05	13.1	8.2	14.0
106	117.4	0.648	82.3	-0.9	7.13	11.414	18.463	16.355	21.3	5.0	22.3	5.9	3.77	-0.06	13.2	8.2	14.1
107	118.1	0.654	82.7	-0.5	7.14	11.522	18.567	16.428	21.4	5.0	21.9	5.5	3.98	-0.03	13.2	8.2	13.7
108	118.3	0.660	82.6	-0.6	7.15	11.629	18.606	16.442	21.4	5.0	22.0	5.6	3.94	-0.04	13.2	8.2	13.8
109	118.7	0.666	82.5	-0.7	7.16	11.737	18.658	16.468	21.4	5.0	22.2	5.7	3.89	-0.04	13.2	8.2	13.9
110	118.9	0.672	82.4	-0.8	7.17	11.845	18.697	16.482	21.5	5.0	22.3	5.8	3.85	-0.05	13.2	8.2	14.0
111	119.1	0.678	82.3	-0.9	7.18	11.953	18.723	16.485	21.5	5.0	22.4	5.9	3.81	-0.05	13.2	8.2	14.1
112	119.4	0.684	82.3	-0.9	7.19	12.060	18.775	16.511	21.5	5.0	22.4	5.9	3.80	-0.06	13.2	8.3	14.2
113	120.0	0.690	82.7	-0.6	7.20	12.168	18.866	16.571	21.6	5.0	22.1	5.5	3.99	-0.03	13.3	8.3	13.8
114	120.0	0.696	82.5	-0.7	7.20	12.276	18.866	16.550	21.5	5.0	22.3	5.7	3.90	-0.04	13.3	8.3	14.0
115	120.1	0.703	82.3	-0.9	7.21	12.383	18.892	16.553	21.5	5.0	22.4	5.9	3.82	-0.05	13.3	8.3	14.1
116	120.4	0.709	82.2	-1.0	7.22	12.491	18.931	16.567	21.5	5.0	22.6	6.0	3.77	-0.06	13.3	8.3	14.3
117	120.9	0.715	82.5	-0.7	7.23	12.599	19.009	16.614	21.6	5.0	22.3	5.7	3.93	-0.04	13.3	8.3	14.0
118	121.1	0.721	82.5	-0.7	7.24	12.706	19.048	16.628	21.6	5.0	22.3	5.7	3.91	-0.04	13.3	8.3	14.0
119	121.5	0.727	82.4	-0.8	7.25	12.814	19.113	16.664	21.6	5.0	22.4	5.8	3.88	-0.05	13.3	8.3	14.1
120	121.5	0.733	82.3	-0.9	7.26	12.922	19.100	16.632	21.6	5.0	22.5	5.9	3.82	-0.06	13.3	8.3	14.2
121	121.7	0.739	82.2	-1.0	7.27	13.029	19.139	16.646	21.6	5.0	22.6	6.0	3.78	-0.06	13.3	8.3	14.3
122	122.1	0.745	82.3	-1.0	7.28	13.137	19.204	16.682	21.7	5.0	22.6	5.9	3.81	-0.06	13.3	8.3	14.3
123	122.4	0.751	82.5	-0.7	7.28	13.245	19.256	16.706	21.7	5.0	22.4	5.7	3.95	-0.04	13.3	8.4	14.0
124	122.8	0.757	82.4	-0.8	7.29	13.352	19.309	16.730	21.7	5.0	22.5	5.8	3.89	-0.05	13.3	8.4	14.2
125	123.0	0.764	82.3	-0.9	7.30	13.460	19.348	16.743	21.7	5.0	22.6	5.9	3.83	-0.06	13.4	8.4	14.3
126	123.6	0.770	82.2	-1.0	7.31	13.568	19.439	16.801	21.8	5.0	22.8	6.0	3.81	-0.06	13.4	8.4	14.4
127	123.8	0.776	82.1	-1.1	7.32	13.675	19.465	16.803	21.8	5.0	22.9	6.1	3.77	-0.06	13.4	8.4	14.5
128	124.2	0.782	82.3	-0.9	7.33	13.783	19.530	16.838	21.8	5.0	22.7	5.9	3.85	-0.05	13.4	8.4	14.3
129	124.7	0.788	82.5	-0.8	7.34	13.891	19.608	16.884	21.9	5.0	22.6	5.7	3.94	-0.05	13.4	8.4	14.2
130	124.7	0.794	82.3	-0.9	7.35	13.998	19.621	16.874	21.9	5.0	22.7	5.9	3.88	-0.05	13.4	8.4	14.3
131	125.1	0.800	82.3	-1.0	7.36	14.106	19.673	16.898	21.9	5.0	22.8	5.9	3.84	-0.06	13.4	8.4	14.4
132	125.2	0.806	82.2	-1.0	7.37	14.214	19.686	16.888	21.9	5.0	22.9	6.0	3.80	-0.06	13.4	8.4	14.5
133	125.5	0.812	82.1	-1.2	7.38	14.321	19.738	16.911	21.9	5.0	23.1	6.1	3.75	-0.07	13.4	8.5	14.6
134	125.9	0.819	82.3	-1.0	7.39	14.429	19.803	16.946	21.9	5.0	22.9	5.9	3.85	-0.06	13.5	8.5	14.4
135	126.1	0.825	82.4	-0.8	7.39	14.537	19.842	16.958	21.9	5.0	22.8	5.8	3.91	-0.05	13.5	8.5	14.3
136	126.6	0.831	82.3	-1.0	7.40	14.645	19.907	16.992	22.0	5.0	22.9	5.9	3.86	-0.06	13.5	8.5	14.4
137	126.8	0.837	82.2	-1.0	7.41	14.752	19.946	17.004	22.0	5.0	23.0	6.0	3.82	-0.06	13.5	8.5	14.5
138	127.0	0.843	82.1	-1.2	7.42	14.860	19.985	17.015	22.0	5.0	23.2	6.1	3.77	-0.07	13.5	8.5	14.7
139	127.4	0.849	82.0	-1.2	7.43	14.968	20.037	17.038	22.0	5.0	23.3	6.2	3.74	-0.07	13.5	8.5	14.7
140	127.8	0.855	82.3	-0.9	7.44	15.075	20.102	17.072	22.1	5.0	23.0	5.9	3.89	-0.05	13.5	8.5	14.4
141	128.2	0.861	82.3	-0.9	7.45	15.183	20.167	17.105	22.1	5.0	23.0	5.9	3.90	-0.05	13.5	8.6	14.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	128.5	0.867	82.2	-1.0	7.46	15.291	20.219	17.128	22.1	5.0	23.2	6.0	3.84	-0.06	13.5	8.6	14.6
143	128.9	0.873	82.1	-1.1	7.47	15.398	20.271	17.150	22.1	5.0	23.3	6.1	3.81	-0.07	13.6	8.6	14.7
144	128.9	0.880	82.0	-1.2	7.48	15.506	20.284	17.139	22.1	5.0	23.4	6.2	3.75	-0.07	13.6	8.6	14.8
145	129.2	0.886	81.9	-1.3	7.49	15.614	20.323	17.150	22.1	5.0	23.5	6.3	3.72	-0.08	13.6	8.6	14.9
146	129.4	0.892	82.3	-1.0	7.50	15.721	20.362	17.161	22.1	5.0	23.1	5.9	3.89	-0.06	13.6	8.6	14.5
147	129.9	0.898	82.2	-1.0	7.51	15.829	20.440	17.205	22.2	5.0	23.2	6.0	3.85	-0.06	13.6	8.6	14.6
148	130.2	0.904	82.1	-1.1	7.52	15.937	20.480	17.216	22.2	5.0	23.3	6.1	3.82	-0.07	13.6	8.6	14.7
149	130.3	0.910	82.0	-1.2	7.53	16.044	20.493	17.205	22.2	5.0	23.4	6.2	3.76	-0.07	13.6	8.6	14.8
150	130.6	0.916	81.9	-1.3	7.54	16.152	20.545	17.226	22.2	5.0	23.5	6.3	3.73	-0.08	13.6	8.6	14.9
151	130.8	0.922	81.9	-1.3	7.55	16.260	20.584	17.237	22.2	5.0	23.5	6.3	3.73	-0.08	13.6	8.6	14.9
152	131.4	0.928	82.2	-1.0	7.56	16.367	20.675	17.291	22.3	5.0	23.3	6.0	3.89	-0.06	13.6	8.6	14.6
153	131.6	0.934	82.1	-1.2	7.57	16.475	20.701	17.290	22.3	5.0	23.4	6.1	3.81	-0.07	13.6	8.6	14.8
154	131.7	0.941	81.9	-1.3	7.58	16.583	20.714	17.279	22.3	5.0	23.6	6.3	3.74	-0.08	13.6	8.6	14.9
155	132.0	0.947	81.7	-1.5	7.59	16.690	20.766	17.300	22.3	5.0	23.8	6.5	3.67	-0.09	13.6	8.6	15.1
156	132.4	0.953	82.1	-1.1	7.60	16.798	20.831	17.332	22.3	5.0	23.4	6.1	3.86	-0.06	13.6	8.7	14.7
157	132.8	0.959	82.1	-1.2	7.61	16.906	20.896	17.363	22.3	5.0	23.5	6.1	3.82	-0.07	13.7	8.7	14.8
158	133.0	0.965	81.9	-1.3	7.62	17.013	20.935	17.373	22.4	5.0	23.6	6.3	3.77	-0.07	13.7	8.7	15.0
159	133.4	0.971	81.9	-1.4	7.63	17.121	20.987	17.394	22.4	5.0	23.7	6.3	3.74	-0.08	13.7	8.7	15.0
160	133.7	0.977	81.8	-1.4	7.64	17.229	21.039	17.414	22.4	5.0	23.8	6.4	3.71	-0.08	13.7	8.7	15.1
161	133.9	0.983	81.7	-1.5	7.65	17.337	21.065	17.413	22.4	5.0	23.9	6.5	3.69	-0.09	13.7	8.7	15.2
162	134.6	0.989	82.1	-1.1	7.66	17.444	21.182	17.487	22.5	5.0	23.6	6.1	3.86	-0.06	13.7	8.7	14.9
163	134.9	0.996	82.0	-1.2	7.67	17.552	21.221	17.496	22.5	5.0	23.7	6.2	3.81	-0.07	13.7	8.7	15.0
164	134.9	1.002	81.9	-1.4	7.68	17.660	21.221	17.474	22.5	5.0	23.8	6.3	3.75	-0.08	13.7	8.7	15.1
165	135.2	1.008	81.8	-1.4	7.69	17.767	21.273	17.494	22.5	5.0	23.9	6.4	3.72	-0.08	13.7	8.7	15.2
166	135.4	1.014	81.6	-1.6	7.70	17.875	21.299	17.492	22.5	5.0	24.0	6.6	3.67	-0.09	13.7	8.7	15.3
167	135.6	1.020	81.8	-1.4	7.71	17.983	21.338	17.501	22.5	5.0	23.9	6.4	3.72	-0.08	13.7	8.8	15.2
168	136.2	1.026	82.0	-1.2	7.72	18.090	21.429	17.553	22.5	5.0	23.8	6.2	3.82	-0.07	13.8	8.8	15.0
169	136.5	1.032	81.9	-1.4	7.73	18.198	21.481	17.572	22.6	5.0	23.9	6.3	3.77	-0.08	13.8	8.8	15.1
170	136.7	1.038	81.8	-1.4	7.74	18.306	21.507	17.570	22.6	5.0	24.0	6.4	3.73	-0.08	13.8	8.8	15.2
171	137.0	1.044	81.6	-1.6	7.75	18.413	21.559	17.590	22.6	5.0	24.1	6.6	3.69	-0.09	13.8	8.8	15.3
172	137.0	1.050	81.5	-1.7	7.76	18.521	21.559	17.566	22.5	5.0	24.2	6.7	3.63	-0.10	13.8	8.8	15.5
173	137.5	1.057	81.7	-1.5	7.77	18.629	21.637	17.607	22.6	5.0	24.1	6.5	3.72	-0.08	13.8	8.8	15.3
174	138.1	1.063	81.9	-1.3	7.78	18.736	21.742	17.668	22.6	5.0	24.0	6.3	3.80	-0.08	13.8	8.8	15.1
175	138.2	1.069	81.8	-1.4	7.79	18.844	21.755	17.655	22.6	5.0	24.1	6.4	3.75	-0.08	13.8	8.8	15.3
176	138.4	1.075	81.6	-1.6	7.80	18.952	21.781	17.653	22.6	5.0	24.2	6.6	3.70	-0.09	13.8	8.8	15.4
177	138.8	1.081	81.6	-1.6	7.81	19.059	21.846	17.682	22.7	5.0	24.3	6.6	3.67	-0.09	13.8	8.8	15.5
178	138.9	1.087	81.4	-1.8	7.82	19.167	21.859	17.669	22.6	5.0	24.4	6.8	3.62	-0.10	13.8	8.8	15.6
179	139.4	1.093	81.8	-1.4	7.83	19.275	21.937	17.708	22.7	5.0	24.1	6.4	3.75	-0.08	13.8	8.9	15.3
180	139.7	1.099	81.8	-1.4	7.84	19.382	21.989	17.727	22.7	5.0	24.2	6.4	3.76	-0.08	13.8	8.9	15.3
181	139.9	1.105	81.7	-1.5	7.85	19.490	22.015	17.724	22.7	5.0	24.2	6.5	3.72	-0.09	13.8	8.9	15.4
182	140.0	1.112	81.6	-1.6	7.86	19.598	22.041	17.721	22.7	5.0	24.4	6.6	3.67	-0.09	13.8	8.9	15.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	140.4	1.118	81.5	-1.7	7.87	19.705	22.093	17.739	22.7	5.0	24.5	6.7	3.64	-0.10	13.9	8.9	15.6
184	140.6	1.124	81.4	-1.9	7.88	19.813	22.132	17.747	22.7	5.0	24.6	6.8	3.60	-0.10	13.9	8.9	15.7
185	141.1	1.130	81.8	-1.4	7.89	19.921	22.210	17.786	22.8	5.0	24.2	6.4	3.77	-0.08	13.9	8.9	15.3
186	141.3	1.135	81.7	-1.5	7.90	20.004	22.236	17.788	22.8	5.0	24.3	6.5	3.73	-0.09	13.9	8.9	15.4



File Location
B-59 5PSLHSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-59
Sample Description: Brown, Gray, Tan, Red & White Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 32.000
PL: 27.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.810	2.818	
Height (in)	5.692	5.649	
Weight (grams)	1120.10		1209.50
Moisture (%)	11.89		20.82
Dry Density (pcf)	108.03	108.20	
Saturation (%)	59.30	100.00	
Void Ratio	0.528	0.529	

Test Data

Rate of Strain: 0
Cell Pressure (psi): 83.000
Effective Confining Stress (psi): 10.0
Corrected Peak Deviator Stress (psi): 21.643 at reading number: 475

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.0	0.008	73.0	0.0	6.24	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	20.3	0.010	73.9	0.8	6.24	0.042	3.255	3.254	13.2	10.0	12.4	9.1	1.36	0.26	11.6	1.6	10.7
2	32.6	0.012	74.6	1.6	6.24	0.083	5.219	5.215	15.2	10.0	13.6	8.4	1.62	0.30	12.6	2.6	11.0
3	39.4	0.015	75.2	2.2	6.25	0.125	6.313	6.305	16.3	10.0	14.1	7.8	1.81	0.34	13.1	3.2	10.9
4	43.6	0.017	75.7	2.6	6.25	0.166	6.985	6.974	16.9	10.0	14.3	7.3	1.95	0.38	13.4	3.5	10.8
5	46.5	0.019	75.9	2.9	6.25	0.208	7.460	7.444	17.4	10.0	14.5	7.1	2.05	0.39	13.7	3.7	10.8
6	49.0	0.022	76.1	3.1	6.25	0.249	7.855	7.836	17.8	10.0	14.7	6.9	2.14	0.40	13.9	3.9	10.8
7	51.2	0.024	76.3	3.3	6.26	0.291	8.211	8.187	18.1	10.0	14.9	6.7	2.22	0.40	14.1	4.1	10.8
8	53.5	0.026	76.5	3.4	6.26	0.332	8.580	8.552	18.5	10.0	15.1	6.5	2.31	0.40	14.2	4.3	10.8
9	55.5	0.029	76.6	3.5	6.26	0.374	8.897	8.863	18.8	10.0	15.3	6.4	2.38	0.40	14.4	4.4	10.9
10	57.6	0.031	76.7	3.7	6.26	0.416	9.226	9.188	19.1	10.0	15.5	6.3	2.46	0.40	14.6	4.6	10.9
11	59.5	0.033	76.8	3.7	6.27	0.457	9.529	9.486	19.4	10.0	15.7	6.2	2.53	0.39	14.7	4.7	11.0
12	61.3	0.036	76.9	3.8	6.27	0.499	9.819	9.770	19.7	10.0	15.9	6.1	2.59	0.39	14.8	4.9	11.0
13	63.1	0.038	76.9	3.9	6.27	0.540	10.109	10.055	20.0	10.0	16.2	6.1	2.65	0.38	15.0	5.0	11.1
14	64.9	0.040	77.0	3.9	6.28	0.582	10.399	10.339	20.3	10.0	16.4	6.0	2.72	0.38	15.1	5.2	11.2
15	66.6	0.043	77.0	3.9	6.28	0.623	10.676	10.609	20.6	10.0	16.6	6.0	2.76	0.37	15.3	5.3	11.3
16	68.4	0.045	77.1	4.0	6.28	0.665	10.966	10.893	20.9	10.0	16.8	5.9	2.83	0.37	15.4	5.4	11.4
17	70.1	0.047	77.1	4.1	6.28	0.707	11.229	11.150	21.1	10.0	17.0	5.9	2.89	0.36	15.5	5.6	11.5
18	71.8	0.050	77.1	4.1	6.29	0.748	11.506	11.420	21.4	10.0	17.3	5.9	2.94	0.36	15.7	5.7	11.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	73.3	0.052	77.1	4.1	6.29	0.790	11.744	11.651	21.6	10.0	17.5	5.9	2.99	0.35	15.8	5.8	11.7
20	75.0	0.054	77.1	4.1	6.29	0.831	12.020	11.920	21.9	10.0	17.8	5.9	3.04	0.34	15.9	6.0	11.8
21	76.5	0.057	77.1	4.1	6.29	0.873	12.258	12.151	22.1	10.0	18.0	5.9	3.07	0.34	16.0	6.1	11.9
22	78.1	0.059	77.1	4.1	6.30	0.914	12.521	12.407	22.4	10.0	18.3	5.9	3.12	0.33	16.2	6.2	12.1
23	79.7	0.062	77.1	4.1	6.30	0.956	12.772	12.649	22.6	10.0	18.5	5.9	3.14	0.32	16.3	6.3	12.2
24	80.9	0.064	77.2	4.1	6.30	0.997	12.969	12.840	22.8	10.0	18.7	5.8	3.21	0.32	16.4	6.4	12.2
25	82.5	0.066	77.2	4.2	6.30	1.039	13.220	13.082	23.0	10.0	18.9	5.8	3.26	0.32	16.5	6.5	12.3
26	83.9	0.069	77.3	4.2	6.31	1.081	13.444	13.298	23.3	10.0	19.0	5.7	3.32	0.32	16.6	6.6	12.4
27	85.2	0.071	77.2	4.2	6.31	1.122	13.655	13.501	23.5	10.0	19.3	5.8	3.34	0.31	16.7	6.8	12.5
28	86.4	0.073	77.2	4.1	6.31	1.164	13.852	13.691	23.7	10.0	19.5	5.8	3.35	0.30	16.8	6.8	12.7
29	87.6	0.076	77.1	4.1	6.32	1.205	14.037	13.868	23.8	10.0	19.7	5.9	3.37	0.30	16.9	6.9	12.8
30	88.8	0.078	77.2	4.1	6.32	1.247	14.235	14.057	24.0	10.0	19.9	5.8	3.42	0.29	17.0	7.0	12.8
31	90.0	0.080	77.2	4.1	6.32	1.288	14.419	14.233	24.2	10.0	20.1	5.8	3.45	0.29	17.1	7.1	12.9
32	91.2	0.083	77.1	4.1	6.32	1.330	14.617	14.422	24.4	10.0	20.3	5.9	3.46	0.28	17.2	7.2	13.1
33	92.0	0.085	77.1	4.1	6.33	1.372	14.749	14.546	24.5	10.0	20.4	5.9	3.47	0.28	17.2	7.3	13.2
34	93.2	0.087	77.1	4.0	6.33	1.413	14.933	14.722	24.7	10.0	20.7	5.9	3.48	0.27	17.3	7.4	13.3
35	94.0	0.090	77.0	4.0	6.33	1.455	15.065	14.846	24.8	10.0	20.8	6.0	3.48	0.27	17.4	7.4	13.4
36	94.8	0.092	77.0	3.9	6.33	1.496	15.197	14.969	24.9	10.0	21.0	6.0	3.49	0.26	17.4	7.5	13.5
37	95.6	0.094	76.9	3.9	6.34	1.538	15.329	15.093	25.1	10.0	21.2	6.1	3.49	0.26	17.5	7.5	13.6
38	96.3	0.097	76.9	3.9	6.34	1.579	15.434	15.190	25.2	10.0	21.2	6.1	3.51	0.26	17.6	7.6	13.7
39	97.3	0.099	76.9	3.9	6.34	1.621	15.592	15.339	25.3	10.0	21.4	6.1	3.52	0.25	17.6	7.7	13.8
40	98.0	0.101	76.9	3.8	6.34	1.662	15.711	15.450	25.4	10.0	21.6	6.1	3.52	0.25	17.7	7.7	13.9
41	98.8	0.104	76.9	3.8	6.35	1.704	15.843	15.573	25.5	10.0	21.7	6.1	3.54	0.25	17.7	7.8	13.9
42	99.5	0.106	76.8	3.8	6.35	1.746	15.948	15.670	25.6	10.0	21.8	6.2	3.54	0.24	17.8	7.8	14.0
43	100.2	0.108	76.8	3.7	6.35	1.787	16.053	15.767	25.7	10.0	22.0	6.2	3.54	0.24	17.8	7.9	14.1
44	100.7	0.111	76.7	3.7	6.36	1.829	16.146	15.850	25.8	10.0	22.1	6.3	3.53	0.23	17.9	7.9	14.2
45	101.4	0.113	76.7	3.7	6.36	1.870	16.251	15.947	25.9	10.0	22.2	6.3	3.53	0.23	17.9	8.0	14.3
46	101.9	0.116	76.7	3.7	6.36	1.912	16.330	16.018	26.0	10.0	22.3	6.3	3.56	0.23	18.0	8.0	14.3
47	102.5	0.118	76.8	3.7	6.36	1.953	16.422	16.102	26.1	10.0	22.3	6.2	3.59	0.23	18.0	8.1	14.3
48	102.9	0.120	76.8	3.8	6.37	1.995	16.488	16.159	26.1	10.0	22.3	6.2	3.62	0.23	18.0	8.1	14.3
49	103.4	0.123	76.7	3.7	6.37	2.037	16.581	16.243	26.2	10.0	22.5	6.3	3.59	0.23	18.1	8.1	14.4
50	104.0	0.125	76.7	3.7	6.37	2.078	16.673	16.326	26.3	10.0	22.6	6.3	3.59	0.22	18.1	8.2	14.5
51	104.5	0.127	76.7	3.7	6.37	2.120	16.752	16.397	26.4	10.0	22.7	6.3	3.60	0.22	18.2	8.2	14.5
52	104.9	0.130	76.7	3.6	6.38	2.161	16.818	16.454	26.4	10.0	22.8	6.3	3.60	0.22	18.2	8.2	14.6
53	105.3	0.132	76.6	3.6	6.38	2.203	16.884	16.512	26.5	10.0	22.9	6.4	3.59	0.22	18.2	8.3	14.6
54	105.7	0.134	76.6	3.6	6.38	2.244	16.950	16.569	26.5	10.0	22.9	6.4	3.60	0.22	18.2	8.3	14.7
55	106.2	0.137	76.6	3.5	6.38	2.286	17.016	16.627	26.6	10.0	23.0	6.4	3.59	0.21	18.3	8.3	14.7
56	106.6	0.139	76.5	3.5	6.39	2.327	17.081	16.684	26.6	10.0	23.1	6.5	3.58	0.21	18.3	8.3	14.8
57	107.1	0.141	76.5	3.5	6.39	2.369	17.161	16.754	26.7	10.0	23.2	6.5	3.59	0.21	18.3	8.4	14.8
58	107.2	0.144	76.5	3.5	6.39	2.411	17.187	16.773	26.7	10.0	23.3	6.5	3.58	0.21	18.3	8.4	14.9
59	107.6	0.146	76.5	3.5	6.40	2.452	17.240	16.817	26.8	10.0	23.3	6.5	3.59	0.21	18.4	8.4	14.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	108.0	0.148	76.5	3.5	6.40	2.494	17.306	16.874	26.8	10.0	23.4	6.5	3.60	0.21	18.4	8.4	14.9
61	108.3	0.151	76.5	3.5	6.40	2.535	17.358	16.918	26.9	10.0	23.4	6.5	3.60	0.20	18.4	8.5	15.0
62	108.5	0.153	76.5	3.4	6.40	2.577	17.385	16.937	26.9	10.0	23.5	6.5	3.59	0.20	18.4	8.5	15.0
63	108.6	0.155	76.4	3.4	6.41	2.618	17.411	16.955	26.9	10.0	23.5	6.6	3.58	0.20	18.4	8.5	15.1
64	109.2	0.158	76.4	3.4	6.41	2.660	17.503	17.038	27.0	10.0	23.6	6.6	3.59	0.20	18.5	8.5	15.1
65	109.4	0.160	76.4	3.3	6.41	2.702	17.530	17.056	27.0	10.0	23.7	6.6	3.58	0.20	18.5	8.5	15.1
66	109.6	0.162	76.3	3.3	6.41	2.743	17.569	17.087	27.0	10.0	23.7	6.7	3.56	0.19	18.5	8.5	15.2
67	109.9	0.165	76.4	3.4	6.42	2.785	17.622	17.131	27.1	10.0	23.7	6.6	3.60	0.20	18.5	8.6	15.1
68	110.2	0.167	76.5	3.5	6.42	2.826	17.661	17.162	27.1	10.0	23.7	6.5	3.64	0.20	18.5	8.6	15.1
69	110.5	0.170	76.5	3.5	6.42	2.868	17.714	17.206	27.2	10.0	23.7	6.5	3.65	0.20	18.6	8.6	15.1
70	110.7	0.172	76.5	3.4	6.43	2.909	17.740	17.224	27.2	10.0	23.8	6.5	3.63	0.20	18.6	8.6	15.2
71	111.0	0.174	76.5	3.4	6.43	2.951	17.793	17.268	27.2	10.0	23.8	6.5	3.64	0.20	18.6	8.6	15.2
72	111.2	0.177	76.4	3.4	6.43	2.992	17.820	17.286	27.2	10.0	23.9	6.6	3.63	0.20	18.6	8.6	15.2
73	111.4	0.179	76.4	3.4	6.43	3.034	17.859	17.317	27.3	10.0	23.9	6.6	3.63	0.20	18.6	8.7	15.2
74	111.7	0.181	76.4	3.3	6.44	3.076	17.899	17.348	27.3	10.0	24.0	6.6	3.62	0.19	18.6	8.7	15.3
75	111.9	0.184	76.3	3.3	6.44	3.117	17.938	17.379	27.3	10.0	24.0	6.7	3.61	0.19	18.7	8.7	15.4
76	112.2	0.186	76.3	3.3	6.44	3.159	17.978	17.410	27.4	10.0	24.1	6.7	3.60	0.19	18.7	8.7	15.4
77	112.3	0.188	76.3	3.3	6.45	3.200	18.004	17.428	27.4	10.0	24.1	6.7	3.60	0.19	18.7	8.7	15.4
78	112.4	0.191	76.3	3.2	6.45	3.242	18.017	17.433	27.4	10.0	24.2	6.7	3.59	0.18	18.7	8.7	15.5
79	112.7	0.193	76.3	3.2	6.45	3.283	18.070	17.477	27.4	10.0	24.2	6.7	3.59	0.18	18.7	8.7	15.5
80	112.9	0.195	76.2	3.2	6.45	3.325	18.096	17.495	27.5	10.0	24.3	6.8	3.58	0.18	18.7	8.7	15.5
81	113.1	0.198	76.2	3.2	6.46	3.367	18.136	17.525	27.5	10.0	24.3	6.8	3.58	0.18	18.7	8.8	15.5
82	113.4	0.200	76.3	3.3	6.46	3.408	18.175	17.556	27.5	10.0	24.3	6.7	3.62	0.19	18.7	8.8	15.5
83	113.6	0.202	76.3	3.3	6.46	3.450	18.215	17.587	27.5	10.0	24.2	6.7	3.64	0.19	18.8	8.8	15.5
84	114.1	0.205	76.4	3.3	6.46	3.491	18.281	17.643	27.6	10.0	24.3	6.6	3.66	0.19	18.8	8.8	15.4
85	114.1	0.207	76.3	3.3	6.47	3.533	18.294	17.648	27.6	10.0	24.3	6.7	3.65	0.19	18.8	8.8	15.5
86	114.2	0.209	76.3	3.3	6.47	3.574	18.307	17.653	27.6	10.0	24.3	6.7	3.65	0.19	18.8	8.8	15.5
87	114.4	0.212	76.3	3.3	6.47	3.616	18.334	17.671	27.6	10.0	24.4	6.7	3.64	0.18	18.8	8.8	15.5
88	114.7	0.214	76.3	3.3	6.48	3.657	18.386	17.714	27.7	10.0	24.4	6.7	3.64	0.18	18.8	8.9	15.6
89	115.2	0.216	76.3	3.2	6.48	3.699	18.465	17.782	27.7	10.0	24.5	6.7	3.64	0.18	18.9	8.9	15.6
90	115.2	0.219	76.3	3.2	6.48	3.741	18.465	17.775	27.7	10.0	24.5	6.7	3.64	0.18	18.8	8.9	15.6
91	115.4	0.221	76.2	3.2	6.48	3.782	18.492	17.792	27.8	10.0	24.6	6.8	3.62	0.18	18.9	8.9	15.7
92	115.6	0.224	76.2	3.2	6.49	3.824	18.531	17.823	27.8	10.0	24.6	6.8	3.63	0.18	18.9	8.9	15.7
93	115.8	0.226	76.2	3.2	6.49	3.865	18.558	17.840	27.8	10.0	24.6	6.8	3.63	0.18	18.9	8.9	15.7
94	116.1	0.228	76.2	3.1	6.49	3.907	18.610	17.883	27.8	10.0	24.7	6.8	3.62	0.18	18.9	8.9	15.8
95	116.1	0.231	76.2	3.1	6.50	3.948	18.610	17.876	27.8	10.0	24.7	6.8	3.62	0.18	18.9	8.9	15.8
96	116.4	0.233	76.1	3.1	6.50	3.990	18.663	17.918	27.9	10.0	24.8	6.9	3.61	0.17	18.9	9.0	15.8
97	116.6	0.235	76.1	3.1	6.50	4.032	18.689	17.936	27.9	10.0	24.8	6.9	3.61	0.17	18.9	9.0	15.8
98	116.8	0.238	76.1	3.1	6.50	4.073	18.729	17.966	27.9	10.0	24.9	6.9	3.60	0.17	18.9	9.0	15.9
99	116.9	0.240	76.1	3.1	6.51	4.115	18.742	17.971	27.9	10.0	24.9	6.9	3.60	0.17	18.9	9.0	15.9
100	117.2	0.242	76.1	3.1	6.51	4.156	18.782	18.001	28.0	10.0	24.9	6.9	3.61	0.17	19.0	9.0	15.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	117.4	0.245	76.1	3.1	6.51	4.198	18.821	18.031	28.0	10.0	24.9	6.9	3.63	0.17	19.0	9.0	15.9
102	117.5	0.247	76.2	3.2	6.52	4.239	18.834	18.036	28.0	10.0	24.8	6.8	3.66	0.18	19.0	9.0	15.8
103	117.8	0.249	76.3	3.2	6.52	4.281	18.887	18.079	28.0	10.0	24.8	6.7	3.68	0.18	19.0	9.0	15.8
104	118.0	0.252	76.2	3.1	6.52	4.322	18.914	18.096	28.1	10.0	24.9	6.8	3.65	0.17	19.0	9.0	15.9
105	118.2	0.254	76.2	3.1	6.52	4.364	18.940	18.113	28.1	10.0	24.9	6.8	3.65	0.17	19.0	9.1	15.9
106	118.4	0.256	76.1	3.1	6.53	4.406	18.979	18.143	28.1	10.0	25.0	6.9	3.64	0.17	19.0	9.1	15.9
107	118.4	0.259	76.1	3.1	6.53	4.447	18.979	18.135	28.1	10.0	25.0	6.9	3.64	0.17	19.0	9.1	15.9
108	118.9	0.261	76.1	3.1	6.53	4.489	19.059	18.203	28.2	10.0	25.1	6.9	3.65	0.17	19.1	9.1	16.0
109	118.8	0.263	76.1	3.1	6.53	4.530	19.045	18.183	28.1	10.0	25.1	6.9	3.63	0.17	19.1	9.1	16.0
110	119.2	0.266	76.1	3.1	6.54	4.572	19.098	18.225	28.2	10.0	25.1	6.9	3.64	0.17	19.1	9.1	16.0
111	119.3	0.268	76.1	3.0	6.54	4.613	19.124	18.242	28.2	10.0	25.2	6.9	3.63	0.17	19.1	9.1	16.1
112	119.4	0.270	76.1	3.0	6.54	4.655	19.138	18.247	28.2	10.0	25.2	6.9	3.63	0.17	19.1	9.1	16.1
113	119.5	0.273	76.1	3.0	6.55	4.697	19.151	18.251	28.2	10.0	25.2	6.9	3.63	0.17	19.1	9.1	16.1
114	119.6	0.275	76.0	3.0	6.55	4.738	19.177	18.268	28.2	10.0	25.3	7.0	3.62	0.16	19.1	9.1	16.1
115	120.1	0.278	76.0	3.0	6.55	4.780	19.243	18.323	28.3	10.0	25.3	7.0	3.62	0.16	19.1	9.2	16.1
116	120.0	0.280	76.0	2.9	6.55	4.821	19.230	18.303	28.3	10.0	25.3	7.0	3.61	0.16	19.1	9.2	16.2
117	120.2	0.282	76.0	2.9	6.56	4.863	19.269	18.332	28.3	10.0	25.4	7.0	3.61	0.16	19.1	9.2	16.2
118	120.4	0.285	75.9	2.9	6.56	4.904	19.296	18.349	28.3	10.0	25.4	7.1	3.60	0.16	19.1	9.2	16.2
119	120.6	0.287	75.9	2.9	6.56	4.946	19.335	18.379	28.3	10.0	25.4	7.1	3.60	0.16	19.2	9.2	16.3
120	120.8	0.289	75.9	2.9	6.57	4.987	19.362	18.396	28.4	10.0	25.5	7.1	3.60	0.16	19.2	9.2	16.3
121	121.0	0.292	76.0	2.9	6.57	5.029	19.388	18.413	28.4	10.0	25.4	7.0	3.62	0.16	19.2	9.2	16.2
122	121.0	0.294	76.1	3.0	6.57	5.071	19.401	18.417	28.4	10.0	25.4	6.9	3.65	0.16	19.2	9.2	16.2
123	121.4	0.296	76.1	3.1	6.58	5.112	19.454	18.459	28.4	10.0	25.4	6.9	3.67	0.17	19.2	9.2	16.1
124	121.5	0.299	76.1	3.0	6.58	5.154	19.467	18.464	28.4	10.0	25.4	6.9	3.66	0.16	19.2	9.2	16.2
125	121.5	0.301	76.0	3.0	6.58	5.195	19.480	18.468	28.4	10.0	25.5	7.0	3.64	0.16	19.2	9.2	16.2
126	121.8	0.303	76.0	2.9	6.58	5.237	19.520	18.498	28.5	10.0	25.5	7.0	3.63	0.16	19.2	9.2	16.3
127	121.8	0.306	76.0	2.9	6.59	5.278	19.520	18.489	28.5	10.0	25.5	7.0	3.63	0.16	19.2	9.2	16.3
128	121.9	0.308	75.9	2.9	6.59	5.320	19.546	18.506	28.5	10.0	25.6	7.1	3.62	0.16	19.2	9.3	16.3
129	121.9	0.310	75.9	2.9	6.59	5.362	19.546	18.498	28.5	10.0	25.6	7.1	3.62	0.16	19.2	9.2	16.3
130	122.3	0.313	75.9	2.9	6.60	5.403	19.599	18.540	28.5	10.0	25.6	7.1	3.62	0.16	19.2	9.3	16.3
131	122.4	0.315	75.9	2.9	6.60	5.445	19.625	18.557	28.5	10.0	25.7	7.1	3.61	0.15	19.2	9.3	16.4
132	122.6	0.317	75.9	2.9	6.60	5.486	19.652	18.573	28.5	10.0	25.7	7.1	3.61	0.15	19.2	9.3	16.4
133	122.8	0.320	75.9	2.8	6.60	5.528	19.678	18.590	28.6	10.0	25.7	7.1	3.60	0.15	19.3	9.3	16.4
134	122.9	0.322	75.9	2.8	6.61	5.569	19.691	18.594	28.6	10.0	25.7	7.1	3.60	0.15	19.3	9.3	16.4
135	122.9	0.324	75.9	2.8	6.61	5.611	19.704	18.599	28.6	10.0	25.7	7.1	3.60	0.15	19.3	9.3	16.4
136	123.3	0.327	75.9	2.9	6.61	5.652	19.757	18.640	28.6	10.0	25.7	7.1	3.62	0.15	19.3	9.3	16.4
137	123.4	0.329	76.0	2.9	6.62	5.694	19.783	18.657	28.6	10.0	25.7	7.0	3.66	0.16	19.3	9.3	16.4
138	123.6	0.332	76.0	3.0	6.62	5.736	19.810	18.674	28.6	10.0	25.7	7.0	3.67	0.16	19.3	9.3	16.3
139	123.8	0.334	76.0	2.9	6.62	5.777	19.836	18.690	28.7	10.0	25.7	7.0	3.66	0.16	19.3	9.3	16.4
140	124.0	0.336	75.9	2.9	6.62	5.819	19.876	18.719	28.7	10.0	25.8	7.1	3.65	0.15	19.3	9.4	16.4
141	124.1	0.339	75.9	2.9	6.63	5.860	19.889	18.723	28.7	10.0	25.8	7.1	3.64	0.15	19.3	9.4	16.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	124.2	0.341	75.9	2.9	6.63	5.902	19.902	18.727	28.7	10.0	25.8	7.1	3.64	0.15	19.3	9.4	16.5
143	124.3	0.343	75.9	2.8	6.63	5.943	19.928	18.744	28.7	10.0	25.9	7.1	3.62	0.15	19.3	9.4	16.5
144	124.5	0.346	75.9	2.9	6.64	5.985	19.955	18.760	28.7	10.0	25.9	7.1	3.64	0.15	19.3	9.4	16.5
145	124.8	0.348	75.9	2.8	6.64	6.027	20.007	18.802	28.8	10.0	25.9	7.1	3.63	0.15	19.4	9.4	16.5
146	124.9	0.350	75.9	2.8	6.64	6.068	20.021	18.806	28.8	10.0	26.0	7.1	3.63	0.15	19.4	9.4	16.5
147	125.2	0.353	75.9	2.8	6.64	6.110	20.060	18.835	28.8	10.0	26.0	7.1	3.64	0.15	19.4	9.4	16.6
148	125.2	0.355	75.8	2.8	6.65	6.151	20.073	18.839	28.8	10.0	26.0	7.2	3.62	0.15	19.4	9.4	16.6
149	125.3	0.357	75.8	2.8	6.65	6.193	20.087	18.843	28.8	10.0	26.0	7.2	3.62	0.15	19.4	9.4	16.6
150	125.5	0.360	75.8	2.8	6.65	6.234	20.113	18.859	28.8	10.0	26.0	7.2	3.62	0.15	19.4	9.4	16.6
151	125.7	0.362	75.8	2.7	6.66	6.276	20.152	18.888	28.8	10.0	26.1	7.2	3.61	0.14	19.4	9.4	16.7
152	125.9	0.364	75.8	2.7	6.66	6.317	20.179	18.904	28.9	10.0	26.1	7.2	3.62	0.14	19.4	9.5	16.7
153	126.0	0.367	75.7	2.7	6.66	6.359	20.192	18.908	28.9	10.0	26.2	7.3	3.60	0.14	19.4	9.5	16.7
154	126.1	0.369	75.7	2.7	6.67	6.401	20.218	18.924	28.9	10.0	26.2	7.3	3.60	0.14	19.4	9.5	16.7
155	126.3	0.371	75.7	2.7	6.67	6.442	20.245	18.941	28.9	10.0	26.2	7.3	3.61	0.14	19.4	9.5	16.7
156	126.5	0.374	75.8	2.8	6.67	6.484	20.271	18.957	28.9	10.0	26.1	7.2	3.64	0.15	19.4	9.5	16.7
157	126.6	0.376	75.9	2.9	6.67	6.525	20.297	18.973	28.9	10.0	26.1	7.1	3.67	0.15	19.4	9.5	16.6
158	126.7	0.378	75.9	2.8	6.68	6.567	20.311	18.977	28.9	10.0	26.1	7.1	3.66	0.15	19.5	9.5	16.6
159	126.8	0.381	75.8	2.8	6.68	6.608	20.324	18.981	28.9	10.0	26.2	7.2	3.64	0.15	19.5	9.5	16.7
160	127.0	0.383	75.8	2.8	6.68	6.650	20.350	18.997	29.0	10.0	26.2	7.2	3.64	0.15	19.5	9.5	16.7
161	127.0	0.386	75.8	2.7	6.69	6.692	20.363	19.001	29.0	10.0	26.2	7.2	3.63	0.14	19.5	9.5	16.7
162	127.4	0.388	75.8	2.7	6.69	6.733	20.416	19.041	29.0	10.0	26.3	7.2	3.64	0.14	19.5	9.5	16.7
163	127.4	0.390	75.8	2.7	6.69	6.775	20.416	19.033	29.0	10.0	26.3	7.2	3.63	0.14	19.5	9.5	16.7
164	127.6	0.393	75.8	2.7	6.70	6.816	20.456	19.061	29.0	10.0	26.3	7.2	3.64	0.14	19.5	9.5	16.8
165	127.7	0.395	75.7	2.7	6.70	6.858	20.469	19.065	29.0	10.0	26.3	7.3	3.62	0.14	19.5	9.5	16.8
166	127.8	0.397	75.7	2.7	6.70	6.899	20.482	19.069	29.0	10.0	26.3	7.3	3.62	0.14	19.5	9.5	16.8
167	128.0	0.400	75.7	2.7	6.70	6.941	20.522	19.097	29.1	10.0	26.4	7.3	3.63	0.14	19.5	9.5	16.8
168	128.1	0.402	75.7	2.7	6.71	6.982	20.535	19.101	29.1	10.0	26.4	7.3	3.63	0.14	19.5	9.6	16.8
169	128.4	0.404	75.7	2.7	6.71	7.024	20.587	19.141	29.1	10.0	26.4	7.3	3.62	0.14	19.5	9.6	16.9
170	128.5	0.407	75.7	2.7	6.71	7.066	20.601	19.145	29.1	10.0	26.5	7.3	3.62	0.14	19.5	9.6	16.9
171	128.6	0.409	75.7	2.7	6.72	7.107	20.614	19.149	29.1	10.0	26.5	7.3	3.62	0.14	19.5	9.6	16.9
172	128.8	0.411	75.7	2.7	6.72	7.149	20.640	19.165	29.1	10.0	26.5	7.3	3.62	0.14	19.5	9.6	16.9
173	128.8	0.414	75.7	2.6	6.72	7.190	20.640	19.156	29.1	10.0	26.5	7.3	3.61	0.14	19.5	9.6	16.9
174	129.1	0.416	75.7	2.6	6.73	7.232	20.693	19.196	29.2	10.0	26.5	7.3	3.61	0.14	19.6	9.6	16.9
175	129.3	0.418	75.7	2.6	6.73	7.273	20.719	19.212	29.2	10.0	26.6	7.3	3.62	0.14	19.6	9.6	17.0
176	129.6	0.421	75.7	2.7	6.73	7.315	20.772	19.252	29.2	10.0	26.5	7.3	3.65	0.14	19.6	9.6	16.9
177	129.7	0.423	75.8	2.7	6.73	7.356	20.785	19.256	29.2	10.0	26.5	7.2	3.67	0.14	19.6	9.6	16.9
178	129.8	0.425	75.8	2.7	6.74	7.398	20.798	19.260	29.2	10.0	26.5	7.2	3.67	0.14	19.6	9.6	16.9
179	129.9	0.428	75.7	2.7	6.74	7.440	20.825	19.275	29.2	10.0	26.5	7.3	3.65	0.14	19.6	9.6	16.9
180	130.0	0.430	75.7	2.7	6.74	7.481	20.838	19.279	29.2	10.0	26.6	7.3	3.64	0.14	19.6	9.6	16.9
181	130.2	0.432	75.7	2.7	6.75	7.523	20.864	19.295	29.3	10.0	26.6	7.3	3.64	0.14	19.6	9.6	17.0
182	130.3	0.435	75.7	2.7	6.75	7.564	20.891	19.310	29.3	10.0	26.6	7.3	3.64	0.14	19.6	9.7	17.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	130.4	0.437	75.7	2.7	6.75	7.606	20.904	19.314	29.3	10.0	26.6	7.3	3.64	0.14	19.6	9.7	17.0
184	130.7	0.440	75.7	2.6	6.76	7.647	20.943	19.342	29.3	10.0	26.7	7.3	3.63	0.14	19.6	9.7	17.0
185	130.7	0.442	75.7	2.6	6.76	7.689	20.943	19.333	29.3	10.0	26.7	7.3	3.63	0.14	19.6	9.7	17.0
186	130.7	0.444	75.7	2.6	6.76	7.731	20.956	19.336	29.3	10.0	26.7	7.3	3.63	0.14	19.6	9.7	17.0
187	131.0	0.447	75.7	2.6	6.76	7.772	20.996	19.364	29.3	10.0	26.7	7.3	3.64	0.14	19.6	9.7	17.0
188	131.0	0.449	75.6	2.6	6.77	7.814	20.996	19.355	29.3	10.0	26.7	7.4	3.62	0.13	19.6	9.7	17.1
189	131.2	0.451	75.6	2.6	6.77	7.855	21.036	19.383	29.3	10.0	26.8	7.4	3.62	0.13	19.7	9.7	17.1
190	131.4	0.454	75.6	2.6	6.77	7.897	21.062	19.399	29.4	10.0	26.8	7.4	3.63	0.13	19.7	9.7	17.1
191	131.4	0.456	75.6	2.5	6.78	7.938	21.062	19.390	29.4	10.0	26.8	7.4	3.61	0.13	19.7	9.7	17.1
192	131.7	0.458	75.6	2.5	6.78	7.980	21.101	19.418	29.4	10.0	26.8	7.4	3.61	0.13	19.7	9.7	17.1
193	131.7	0.461	75.7	2.6	6.78	8.021	21.115	19.421	29.4	10.0	26.8	7.3	3.64	0.13	19.7	9.7	17.1
194	131.9	0.463	75.7	2.7	6.79	8.063	21.141	19.436	29.4	10.0	26.7	7.3	3.66	0.14	19.7	9.7	17.0
195	132.2	0.465	75.7	2.7	6.79	8.105	21.194	19.476	29.4	10.0	26.7	7.3	3.68	0.14	19.7	9.7	17.0
196	132.1	0.468	75.7	2.6	6.79	8.146	21.181	19.455	29.4	10.0	26.8	7.3	3.65	0.13	19.7	9.7	17.1
197	132.1	0.470	75.7	2.6	6.80	8.188	21.181	19.446	29.4	10.0	26.8	7.3	3.65	0.13	19.7	9.7	17.1
198	132.4	0.472	75.6	2.6	6.80	8.229	21.220	19.474	29.4	10.0	26.9	7.4	3.64	0.13	19.7	9.7	17.1
199	132.6	0.475	75.6	2.6	6.80	8.271	21.246	19.489	29.5	10.0	26.9	7.4	3.64	0.13	19.7	9.7	17.1
200	132.8	0.477	75.6	2.6	6.80	8.312	21.286	19.517	29.5	10.0	26.9	7.4	3.64	0.13	19.7	9.8	17.1
201	132.9	0.479	75.6	2.5	6.81	8.354	21.299	19.520	29.5	10.0	26.9	7.4	3.63	0.13	19.7	9.8	17.2
202	133.0	0.482	75.6	2.5	6.81	8.396	21.312	19.523	29.5	10.0	26.9	7.4	3.63	0.13	19.7	9.8	17.2
203	133.1	0.484	75.6	2.5	6.81	8.437	21.339	19.538	29.5	10.0	27.0	7.4	3.63	0.13	19.7	9.8	17.2
204	133.2	0.486	75.6	2.5	6.82	8.479	21.352	19.542	29.5	10.0	27.0	7.4	3.63	0.13	19.7	9.8	17.2
205	133.3	0.489	75.6	2.5	6.82	8.520	21.365	19.545	29.5	10.0	27.0	7.4	3.63	0.13	19.7	9.8	17.2
206	133.5	0.491	75.5	2.5	6.82	8.562	21.391	19.560	29.5	10.0	27.0	7.5	3.62	0.13	19.7	9.8	17.2
207	133.6	0.494	75.5	2.5	6.83	8.603	21.418	19.575	29.5	10.0	27.0	7.5	3.62	0.13	19.7	9.8	17.3
208	133.7	0.496	75.5	2.5	6.83	8.645	21.431	19.578	29.5	10.0	27.0	7.5	3.62	0.13	19.8	9.8	17.3
209	134.0	0.498	75.5	2.5	6.83	8.686	21.484	19.617	29.6	10.0	27.1	7.5	3.61	0.13	19.8	9.8	17.3
210	134.0	0.501	75.5	2.5	6.84	8.728	21.484	19.609	29.6	10.0	27.1	7.5	3.61	0.13	19.8	9.8	17.3
211	134.2	0.503	75.5	2.5	6.84	8.770	21.510	19.624	29.6	10.0	27.1	7.5	3.61	0.13	19.8	9.8	17.3
212	134.3	0.505	75.5	2.4	6.84	8.811	21.523	19.627	29.6	10.0	27.2	7.5	3.60	0.12	19.8	9.8	17.4
213	134.5	0.508	75.6	2.5	6.84	8.853	21.563	19.654	29.6	10.0	27.1	7.4	3.65	0.13	19.8	9.8	17.3
214	134.7	0.510	75.6	2.6	6.85	8.894	21.589	19.669	29.6	10.0	27.1	7.4	3.66	0.13	19.8	9.8	17.2
215	134.7	0.512	75.6	2.5	6.85	8.936	21.589	19.660	29.6	10.0	27.1	7.4	3.65	0.13	19.8	9.8	17.3
216	135.0	0.515	75.5	2.5	6.85	8.977	21.642	19.699	29.7	10.0	27.2	7.5	3.64	0.13	19.8	9.8	17.3
217	135.0	0.517	75.5	2.5	6.86	9.019	21.642	19.690	29.7	10.0	27.2	7.5	3.64	0.13	19.8	9.8	17.3
218	135.3	0.519	75.5	2.5	6.86	9.061	21.681	19.717	29.7	10.0	27.2	7.5	3.64	0.13	19.8	9.9	17.3
219	135.4	0.522	75.5	2.5	6.86	9.102	21.695	19.720	29.7	10.0	27.2	7.5	3.64	0.13	19.8	9.9	17.3
220	135.4	0.524	75.5	2.5	6.87	9.144	21.708	19.723	29.7	10.0	27.2	7.5	3.63	0.12	19.8	9.9	17.4
221	135.6	0.526	75.5	2.5	6.87	9.185	21.734	19.738	29.7	10.0	27.2	7.5	3.63	0.12	19.8	9.9	17.4
222	135.8	0.529	75.5	2.5	6.87	9.227	21.760	19.753	29.7	10.0	27.3	7.5	3.63	0.12	19.8	9.9	17.4
223	135.9	0.531	75.5	2.5	6.88	9.268	21.787	19.768	29.7	10.0	27.3	7.5	3.63	0.12	19.8	9.9	17.4



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
224	135.9	0.533	75.5	2.4	6.88	9.310	21.787	19.758	29.7	10.0	27.3	7.5	3.62	0.12	19.8	9.9	17.4
225	136.1	0.536	75.5	2.4	6.88	9.351	21.813	19.773	29.7	10.0	27.3	7.5	3.62	0.12	19.8	9.9	17.4
226	136.3	0.538	75.5	2.4	6.89	9.393	21.840	19.788	29.7	10.0	27.3	7.5	3.62	0.12	19.9	9.9	17.4
227	136.3	0.541	75.4	2.4	6.89	9.435	21.853	19.791	29.8	10.0	27.4	7.6	3.61	0.12	19.9	9.9	17.5
228	136.4	0.543	75.4	2.4	6.89	9.476	21.866	19.794	29.8	10.0	27.4	7.6	3.61	0.12	19.9	9.9	17.5
229	136.7	0.545	75.4	2.4	6.90	9.518	21.905	19.821	29.8	10.0	27.4	7.6	3.61	0.12	19.9	9.9	17.5
230	136.8	0.548	75.5	2.5	6.90	9.559	21.932	19.835	29.8	10.0	27.3	7.5	3.64	0.12	19.9	9.9	17.4
231	136.8	0.550	75.5	2.5	6.90	9.601	21.932	19.826	29.8	10.0	27.3	7.5	3.66	0.13	19.9	9.9	17.4
232	137.2	0.552	75.5	2.5	6.90	9.642	21.984	19.865	29.8	10.0	27.4	7.5	3.65	0.12	19.9	9.9	17.4
233	137.2	0.555	75.5	2.5	6.91	9.684	21.998	19.867	29.8	10.0	27.4	7.5	3.65	0.12	19.9	9.9	17.4
234	137.4	0.557	75.5	2.4	6.91	9.726	22.024	19.882	29.8	10.0	27.4	7.5	3.63	0.12	19.9	9.9	17.5
235	137.7	0.559	75.5	2.4	6.91	9.767	22.064	19.909	29.9	10.0	27.5	7.5	3.64	0.12	19.9	10.0	17.5
236	137.7	0.562	75.5	2.4	6.92	9.809	22.064	19.899	29.9	10.0	27.4	7.5	3.64	0.12	19.9	9.9	17.5
237	138.0	0.564	75.4	2.4	6.92	9.850	22.116	19.938	29.9	10.0	27.5	7.6	3.63	0.12	19.9	10.0	17.6
238	137.9	0.566	75.4	2.4	6.92	9.892	22.103	19.917	29.9	10.0	27.5	7.6	3.62	0.12	19.9	10.0	17.5
239	138.1	0.569	75.4	2.3	6.93	9.933	22.143	19.943	29.9	10.0	27.6	7.6	3.61	0.12	19.9	10.0	17.6
240	138.3	0.571	75.3	2.3	6.93	9.975	22.169	19.958	29.9	10.0	27.6	7.7	3.60	0.11	19.9	10.0	17.6
241	138.2	0.573	75.3	2.3	6.93	10.016	22.156	19.937	29.9	10.0	27.6	7.7	3.60	0.12	19.9	10.0	17.6
242	138.5	0.576	75.3	2.3	6.94	10.058	22.195	19.963	29.9	10.0	27.6	7.7	3.60	0.11	19.9	10.0	17.6
243	138.6	0.578	75.3	2.3	6.94	10.100	22.222	19.977	29.9	10.0	27.7	7.7	3.59	0.11	20.0	10.0	17.7
244	138.9	0.580	75.3	2.3	6.94	10.141	22.261	20.004	30.0	10.0	27.7	7.7	3.60	0.11	20.0	10.0	17.7
245	138.9	0.583	75.3	2.3	6.95	10.183	22.261	19.994	30.0	10.0	27.7	7.7	3.59	0.11	20.0	10.0	17.7
246	138.9	0.585	75.3	2.2	6.95	10.224	22.261	19.985	29.9	10.0	27.7	7.7	3.58	0.11	20.0	10.0	17.7
247	139.1	0.587	75.3	2.2	6.95	10.266	22.288	20.000	30.0	10.0	27.7	7.7	3.58	0.11	20.0	10.0	17.7
248	139.2	0.590	75.3	2.2	6.96	10.307	22.314	20.014	30.0	10.0	27.8	7.7	3.58	0.11	20.0	10.0	17.8
249	139.4	0.592	75.3	2.3	6.96	10.349	22.340	20.028	30.0	10.0	27.7	7.7	3.60	0.11	20.0	10.0	17.7
250	139.6	0.595	75.3	2.3	6.96	10.391	22.380	20.055	30.0	10.0	27.7	7.7	3.62	0.11	20.0	10.0	17.7
251	139.6	0.597	75.4	2.3	6.97	10.432	22.380	20.045	30.0	10.0	27.7	7.6	3.63	0.12	20.0	10.0	17.7
252	139.8	0.599	75.3	2.3	6.97	10.474	22.406	20.060	30.0	10.0	27.7	7.7	3.62	0.11	20.0	10.0	17.7
253	140.0	0.602	75.3	2.3	6.97	10.515	22.433	20.074	30.0	10.0	27.8	7.7	3.60	0.11	20.0	10.0	17.7
254	140.1	0.604	75.3	2.3	6.98	10.557	22.459	20.088	30.0	10.0	27.8	7.7	3.61	0.11	20.0	10.0	17.8
255	140.1	0.606	75.3	2.3	6.98	10.598	22.459	20.079	30.0	10.0	27.8	7.7	3.60	0.11	20.0	10.0	17.7
256	140.2	0.609	75.3	2.2	6.98	10.640	22.472	20.081	30.0	10.0	27.8	7.7	3.59	0.11	20.0	10.0	17.8
257	140.4	0.611	75.3	2.2	6.99	10.681	22.499	20.095	30.1	10.0	27.8	7.7	3.59	0.11	20.0	10.0	17.8
258	140.5	0.613	75.3	2.2	6.99	10.723	22.525	20.110	30.1	10.0	27.9	7.7	3.60	0.11	20.0	10.1	17.8
259	140.6	0.616	75.2	2.2	6.99	10.765	22.538	20.112	30.1	10.0	27.9	7.8	3.58	0.11	20.0	10.1	17.8
260	140.9	0.618	75.2	2.2	6.99	10.806	22.591	20.150	30.1	10.0	27.9	7.8	3.59	0.11	20.0	10.1	17.9
261	140.9	0.620	75.2	2.2	7.00	10.848	22.591	20.140	30.1	10.0	27.9	7.8	3.59	0.11	20.0	10.1	17.9
262	141.1	0.623	75.2	2.2	7.00	10.889	22.617	20.154	30.1	10.0	27.9	7.8	3.59	0.11	20.0	10.1	17.9
263	141.4	0.625	75.2	2.1	7.00	10.931	22.657	20.180	30.1	10.0	28.0	7.8	3.58	0.11	20.1	10.1	17.9
264	141.4	0.627	75.2	2.1	7.01	10.972	22.657	20.171	30.1	10.0	28.0	7.8	3.58	0.11	20.0	10.1	17.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
265	141.4	0.630	75.2	2.1	7.01	11.014	22.670	20.173	30.1	10.0	28.0	7.8	3.58	0.11	20.0	10.1	17.9
266	141.6	0.632	75.1	2.1	7.01	11.056	22.696	20.187	30.1	10.0	28.1	7.9	3.57	0.10	20.1	10.1	18.0
267	141.7	0.634	75.1	2.1	7.02	11.097	22.709	20.189	30.2	10.0	28.1	7.9	3.57	0.10	20.1	10.1	18.0
268	141.9	0.637	75.1	2.1	7.02	11.139	22.749	20.215	30.2	10.0	28.1	7.9	3.57	0.10	20.1	10.1	18.0
269	142.1	0.639	75.2	2.2	7.02	11.180	22.775	20.229	30.2	10.0	28.0	7.8	3.60	0.11	20.1	10.1	17.9
270	142.3	0.641	75.3	2.2	7.03	11.222	22.815	20.255	30.2	10.0	28.0	7.7	3.61	0.11	20.1	10.1	17.9
271	142.3	0.644	75.2	2.2	7.03	11.263	22.802	20.233	30.2	10.0	28.0	7.8	3.60	0.11	20.1	10.1	17.9
272	142.4	0.646	75.2	2.2	7.03	11.305	22.828	20.247	30.2	10.0	28.0	7.8	3.60	0.11	20.1	10.1	17.9
273	142.7	0.649	75.2	2.1	7.04	11.346	22.868	20.273	30.2	10.0	28.1	7.8	3.59	0.11	20.1	10.1	18.0
274	142.7	0.651	75.2	2.1	7.04	11.388	22.868	20.263	30.2	10.0	28.1	7.8	3.59	0.11	20.1	10.1	18.0
275	142.8	0.653	75.1	2.1	7.04	11.430	22.894	20.277	30.2	10.0	28.1	7.9	3.58	0.10	20.1	10.1	18.0
276	142.9	0.656	75.1	2.1	7.05	11.471	22.907	20.279	30.2	10.0	28.1	7.9	3.58	0.10	20.1	10.1	18.0
277	143.2	0.658	75.1	2.1	7.05	11.513	22.960	20.317	30.3	10.0	28.2	7.9	3.58	0.10	20.1	10.2	18.0
278	143.2	0.660	75.1	2.1	7.05	11.554	22.960	20.307	30.3	10.0	28.2	7.9	3.58	0.10	20.1	10.2	18.0
279	143.4	0.663	75.1	2.1	7.06	11.596	22.986	20.321	30.3	10.0	28.2	7.9	3.57	0.10	20.1	10.2	18.1
280	143.5	0.665	75.1	2.1	7.06	11.637	22.999	20.323	30.3	10.0	28.2	7.9	3.57	0.10	20.1	10.2	18.1
281	143.6	0.667	75.1	2.1	7.06	11.679	23.013	20.325	30.3	10.0	28.2	7.9	3.57	0.10	20.1	10.2	18.1
282	144.0	0.670	75.1	2.0	7.07	11.721	23.078	20.374	30.3	10.0	28.3	7.9	3.56	0.10	20.1	10.2	18.1
283	143.9	0.672	75.2	2.1	7.07	11.762	23.065	20.352	30.3	10.0	28.2	7.8	3.60	0.10	20.1	10.2	18.0
284	144.2	0.674	75.2	2.2	7.07	11.804	23.118	20.389	30.4	10.0	28.2	7.8	3.62	0.11	20.2	10.2	18.0
285	144.6	0.677	75.2	2.2	7.08	11.845	23.171	20.426	30.4	10.0	28.2	7.8	3.62	0.11	20.2	10.2	18.0
286	144.6	0.679	75.2	2.1	7.08	11.887	23.171	20.416	30.4	10.0	28.2	7.8	3.61	0.10	20.2	10.2	18.0
287	144.7	0.681	75.2	2.1	7.08	11.928	23.197	20.430	30.4	10.0	28.3	7.8	3.61	0.10	20.2	10.2	18.0
288	144.7	0.684	75.2	2.1	7.09	11.970	23.197	20.420	30.4	10.0	28.2	7.8	3.61	0.10	20.2	10.2	18.0
289	144.8	0.686	75.1	2.1	7.09	12.011	23.210	20.422	30.4	10.0	28.3	7.9	3.60	0.10	20.2	10.2	18.1
290	145.1	0.688	75.1	2.1	7.09	12.053	23.250	20.447	30.4	10.0	28.3	7.9	3.60	0.10	20.2	10.2	18.1
291	145.0	0.691	75.1	2.1	7.10	12.095	23.237	20.426	30.4	10.0	28.3	7.9	3.60	0.10	20.2	10.2	18.1
292	145.2	0.693	75.1	2.1	7.10	12.136	23.276	20.451	30.4	10.0	28.3	7.9	3.60	0.10	20.2	10.2	18.1
293	145.2	0.695	75.1	2.1	7.10	12.178	23.276	20.442	30.4	10.0	28.3	7.9	3.60	0.10	20.2	10.2	18.1
294	145.5	0.698	75.1	2.1	7.11	12.219	23.316	20.467	30.4	10.0	28.4	7.9	3.59	0.10	20.2	10.2	18.1
295	145.5	0.700	75.1	2.1	7.11	12.261	23.329	20.469	30.4	10.0	28.4	7.9	3.59	0.10	20.2	10.2	18.1
296	145.5	0.703	75.1	2.1	7.11	12.302	23.329	20.459	30.4	10.0	28.4	7.9	3.59	0.10	20.2	10.2	18.1
297	145.7	0.705	75.1	2.0	7.12	12.344	23.355	20.472	30.4	10.0	28.4	7.9	3.58	0.10	20.2	10.2	18.2
298	145.8	0.707	75.1	2.0	7.12	12.386	23.368	20.474	30.4	10.0	28.4	7.9	3.58	0.10	20.2	10.2	18.2
299	145.9	0.710	75.1	2.0	7.12	12.427	23.382	20.476	30.4	10.0	28.4	7.9	3.58	0.10	20.2	10.2	18.2
300	146.0	0.712	75.1	2.0	7.13	12.469	23.395	20.478	30.4	10.0	28.4	7.9	3.58	0.10	20.2	10.2	18.2
301	146.1	0.714	75.0	2.0	7.13	12.510	23.421	20.491	30.5	10.0	28.5	8.0	3.56	0.10	20.2	10.2	18.2
302	146.4	0.717	75.1	2.0	7.13	12.552	23.461	20.516	30.5	10.0	28.5	7.9	3.58	0.10	20.2	10.3	18.2
303	146.6	0.719	75.1	2.1	7.14	12.593	23.500	20.541	30.5	10.0	28.4	7.9	3.61	0.10	20.2	10.3	18.1
304	146.5	0.721	75.1	2.1	7.14	12.635	23.487	20.519	30.5	10.0	28.4	7.9	3.61	0.10	20.2	10.3	18.1
305	146.8	0.724	75.1	2.1	7.14	12.676	23.527	20.544	30.5	10.0	28.4	7.9	3.61	0.10	20.2	10.3	18.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
306	146.8	0.726	75.1	2.1	7.15	12.718	23.527	20.534	30.5	10.0	28.4	7.9	3.60	0.10	20.2	10.3	18.2
307	147.1	0.728	75.1	2.0	7.15	12.760	23.579	20.571	30.5	10.0	28.5	7.9	3.59	0.10	20.2	10.3	18.2
308	147.2	0.731	75.1	2.0	7.15	12.801	23.592	20.572	30.5	10.0	28.5	7.9	3.59	0.10	20.2	10.3	18.2
309	147.1	0.733	75.1	2.0	7.16	12.843	23.579	20.551	30.5	10.0	28.5	7.9	3.59	0.10	20.2	10.3	18.2
310	147.4	0.735	75.1	2.0	7.16	12.884	23.619	20.576	30.5	10.0	28.5	7.9	3.59	0.10	20.2	10.3	18.2
311	147.4	0.738	75.1	2.0	7.17	12.926	23.632	20.577	30.5	10.0	28.5	7.9	3.59	0.10	20.3	10.3	18.2
312	147.7	0.740	75.0	2.0	7.17	12.967	23.672	20.602	30.6	10.0	28.6	8.0	3.58	0.10	20.3	10.3	18.3
313	147.7	0.742	75.0	2.0	7.17	13.009	23.672	20.592	30.6	10.0	28.6	8.0	3.58	0.10	20.3	10.3	18.3
314	147.9	0.745	75.0	2.0	7.18	13.051	23.711	20.617	30.6	10.0	28.6	8.0	3.58	0.10	20.3	10.3	18.3
315	148.0	0.747	75.0	2.0	7.18	13.092	23.724	20.618	30.6	10.0	28.6	8.0	3.58	0.10	20.3	10.3	18.3
316	148.1	0.749	75.0	1.9	7.18	13.134	23.737	20.620	30.6	10.0	28.7	8.0	3.57	0.09	20.3	10.3	18.3
317	148.3	0.752	75.0	1.9	7.19	13.175	23.764	20.633	30.6	10.0	28.7	8.0	3.57	0.09	20.3	10.3	18.3
318	148.3	0.754	75.0	1.9	7.19	13.217	23.777	20.634	30.6	10.0	28.7	8.0	3.57	0.09	20.3	10.3	18.3
319	148.4	0.757	75.0	1.9	7.19	13.258	23.790	20.636	30.6	10.0	28.7	8.0	3.57	0.09	20.3	10.3	18.3
320	148.6	0.759	74.9	1.9	7.20	13.300	23.817	20.649	30.6	10.0	28.7	8.1	3.56	0.09	20.3	10.3	18.4
321	148.7	0.761	75.0	1.9	7.20	13.341	23.830	20.650	30.6	10.0	28.7	8.0	3.57	0.09	20.3	10.3	18.4
322	148.8	0.764	75.1	2.0	7.20	13.383	23.856	20.663	30.6	10.0	28.6	7.9	3.60	0.10	20.3	10.3	18.3
323	149.1	0.766	75.1	2.0	7.21	13.425	23.896	20.688	30.6	10.0	28.6	7.9	3.60	0.10	20.3	10.3	18.3
324	149.2	0.768	75.0	2.0	7.21	13.466	23.909	20.689	30.7	10.0	28.7	8.0	3.59	0.10	20.3	10.3	18.3
325	149.4	0.771	75.0	2.0	7.21	13.508	23.948	20.713	30.7	10.0	28.7	8.0	3.59	0.10	20.3	10.4	18.3
326	149.5	0.773	75.0	1.9	7.22	13.549	23.962	20.715	30.7	10.0	28.7	8.0	3.58	0.09	20.3	10.4	18.4
327	149.5	0.775	75.0	1.9	7.22	13.591	23.962	20.705	30.7	10.0	28.7	8.0	3.58	0.09	20.3	10.4	18.4
328	149.8	0.778	75.0	1.9	7.22	13.632	24.014	20.741	30.7	10.0	28.8	8.0	3.58	0.09	20.3	10.4	18.4
329	149.8	0.780	74.9	1.9	7.23	13.674	24.014	20.731	30.7	10.0	28.8	8.1	3.57	0.09	20.3	10.4	18.4
330	150.1	0.782	74.9	1.9	7.23	13.715	24.054	20.755	30.7	10.0	28.8	8.1	3.57	0.09	20.3	10.4	18.4
331	150.0	0.785	74.9	1.9	7.23	13.757	24.041	20.733	30.7	10.0	28.8	8.1	3.56	0.09	20.3	10.4	18.5
332	150.2	0.787	74.9	1.9	7.24	13.799	24.067	20.746	30.7	10.0	28.9	8.1	3.56	0.09	20.3	10.4	18.5
333	150.3	0.789	74.9	1.9	7.24	13.840	24.093	20.759	30.7	10.0	28.9	8.1	3.56	0.09	20.3	10.4	18.5
334	150.5	0.792	74.8	1.8	7.24	13.882	24.120	20.771	30.7	10.0	28.9	8.2	3.55	0.09	20.3	10.4	18.5
335	150.7	0.794	74.9	1.9	7.25	13.923	24.159	20.795	30.8	10.0	28.9	8.1	3.58	0.09	20.4	10.4	18.5
336	150.8	0.796	75.0	1.9	7.25	13.965	24.172	20.797	30.8	10.0	28.8	8.0	3.59	0.09	20.4	10.4	18.4
337	150.8	0.799	75.0	1.9	7.26	14.006	24.172	20.787	30.7	10.0	28.8	8.0	3.59	0.09	20.4	10.4	18.4
338	151.1	0.801	74.9	1.9	7.26	14.048	24.212	20.811	30.8	10.0	28.9	8.1	3.58	0.09	20.4	10.4	18.5
339	151.1	0.803	74.9	1.9	7.26	14.090	24.212	20.801	30.8	10.0	28.9	8.1	3.58	0.09	20.4	10.4	18.5
340	151.3	0.806	74.9	1.9	7.27	14.131	24.251	20.824	30.8	10.0	28.9	8.1	3.57	0.09	20.4	10.4	18.5
341	151.5	0.808	74.9	1.9	7.27	14.173	24.278	20.837	30.8	10.0	28.9	8.1	3.57	0.09	20.4	10.4	18.5
342	151.6	0.811	74.9	1.9	7.27	14.214	24.291	20.838	30.8	10.0	28.9	8.1	3.57	0.09	20.4	10.4	18.5
343	151.7	0.813	74.9	1.9	7.28	14.256	24.317	20.851	30.8	10.0	29.0	8.1	3.57	0.09	20.4	10.4	18.5
344	151.7	0.815	74.8	1.8	7.28	14.297	24.317	20.841	30.8	10.0	29.0	8.2	3.56	0.09	20.4	10.4	18.6
345	152.0	0.818	74.8	1.8	7.28	14.339	24.357	20.864	30.8	10.0	29.0	8.2	3.56	0.09	20.4	10.4	18.6
346	152.0	0.820	74.8	1.8	7.29	14.380	24.370	20.866	30.8	10.0	29.0	8.2	3.56	0.09	20.4	10.4	18.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
347	152.0	0.822	74.8	1.8	7.29	14.422	24.370	20.855	30.8	10.0	29.0	8.2	3.56	0.09	20.4	10.4	18.6
348	152.2	0.825	74.8	1.8	7.29	14.464	24.396	20.868	30.8	10.0	29.0	8.2	3.56	0.09	20.4	10.4	18.6
349	152.4	0.827	74.8	1.8	7.30	14.505	24.423	20.880	30.8	10.0	29.0	8.2	3.56	0.09	20.4	10.4	18.6
350	152.4	0.829	74.8	1.8	7.30	14.547	24.423	20.870	30.8	10.0	29.1	8.2	3.55	0.08	20.4	10.4	18.6
351	152.6	0.832	74.8	1.8	7.30	14.588	24.462	20.894	30.9	10.0	29.1	8.2	3.55	0.08	20.4	10.4	18.6
352	152.7	0.834	74.8	1.8	7.31	14.630	24.476	20.895	30.9	10.0	29.1	8.2	3.55	0.08	20.4	10.4	18.6
353	152.9	0.836	74.8	1.8	7.31	14.671	24.502	20.907	30.9	10.0	29.1	8.2	3.55	0.08	20.4	10.5	18.6
354	153.0	0.839	74.8	1.8	7.32	14.713	24.528	20.919	30.9	10.0	29.1	8.2	3.55	0.08	20.4	10.5	18.7
355	153.0	0.841	74.9	1.9	7.32	14.755	24.528	20.909	30.9	10.0	29.0	8.1	3.58	0.09	20.4	10.5	18.6
356	153.4	0.843	74.9	1.9	7.32	14.796	24.594	20.955	30.9	10.0	29.0	8.1	3.60	0.09	20.4	10.5	18.5
357	153.4	0.846	74.9	1.9	7.33	14.838	24.594	20.945	30.9	10.0	29.1	8.1	3.58	0.09	20.4	10.5	18.6
358	153.7	0.848	74.8	1.8	7.33	14.879	24.634	20.968	30.9	10.0	29.1	8.2	3.57	0.09	20.4	10.5	18.6
359	153.6	0.850	74.8	1.8	7.33	14.921	24.621	20.947	30.9	10.0	29.1	8.2	3.57	0.09	20.4	10.5	18.6
360	153.7	0.853	74.8	1.8	7.34	14.962	24.634	20.948	30.9	10.0	29.1	8.2	3.56	0.08	20.4	10.5	18.7
361	153.9	0.855	74.8	1.8	7.34	15.004	24.673	20.971	30.9	10.0	29.2	8.2	3.56	0.08	20.4	10.5	18.7
362	154.2	0.857	74.8	1.8	7.34	15.045	24.713	20.995	31.0	10.0	29.2	8.2	3.56	0.08	20.5	10.5	18.7
363	154.3	0.860	74.8	1.8	7.35	15.087	24.726	20.996	31.0	10.0	29.2	8.2	3.56	0.08	20.5	10.5	18.7
364	154.3	0.862	74.8	1.8	7.35	15.129	24.739	20.996	31.0	10.0	29.2	8.2	3.56	0.08	20.5	10.5	18.7
365	154.4	0.865	74.8	1.7	7.35	15.170	24.752	20.997	31.0	10.0	29.2	8.2	3.55	0.08	20.5	10.5	18.7
366	154.7	0.867	74.8	1.7	7.36	15.212	24.792	21.021	31.0	10.0	29.3	8.2	3.55	0.08	20.5	10.5	18.7
367	154.8	0.869	74.8	1.7	7.36	15.253	24.805	21.021	31.0	10.0	29.3	8.2	3.55	0.08	20.5	10.5	18.7
368	155.0	0.872	74.8	1.7	7.37	15.295	24.845	21.045	31.0	10.0	29.3	8.2	3.56	0.08	20.5	10.5	18.8
369	155.1	0.874	74.7	1.7	7.37	15.336	24.858	21.045	31.0	10.0	29.3	8.3	3.54	0.08	20.5	10.5	18.8
370	155.2	0.876	74.7	1.7	7.37	15.378	24.871	21.046	31.0	10.0	29.3	8.3	3.54	0.08	20.5	10.5	18.8
371	155.4	0.879	74.7	1.7	7.38	15.420	24.910	21.069	31.0	10.0	29.3	8.3	3.55	0.08	20.5	10.5	18.8
372	155.4	0.881	74.7	1.7	7.38	15.461	24.910	21.059	31.0	10.0	29.3	8.3	3.55	0.08	20.5	10.5	18.8
373	155.4	0.883	74.7	1.6	7.38	15.503	24.910	21.049	31.0	10.0	29.4	8.3	3.53	0.08	20.5	10.5	18.8
374	155.7	0.886	74.8	1.7	7.39	15.544	24.950	21.072	31.0	10.0	29.3	8.2	3.56	0.08	20.5	10.5	18.8
375	155.9	0.888	74.8	1.8	7.39	15.586	24.990	21.095	31.1	10.0	29.3	8.2	3.58	0.08	20.5	10.5	18.7
376	156.0	0.890	74.8	1.8	7.39	15.627	25.003	21.095	31.1	10.0	29.3	8.2	3.58	0.08	20.5	10.5	18.7
377	156.0	0.893	74.8	1.7	7.40	15.669	25.003	21.085	31.0	10.0	29.3	8.2	3.56	0.08	20.5	10.5	18.8
378	156.0	0.895	74.8	1.7	7.40	15.710	25.003	21.075	31.0	10.0	29.3	8.2	3.56	0.08	20.5	10.5	18.8
379	156.3	0.897	74.7	1.7	7.41	15.752	25.055	21.109	31.1	10.0	29.4	8.3	3.55	0.08	20.5	10.6	18.8
380	156.4	0.900	74.7	1.7	7.41	15.794	25.069	21.109	31.1	10.0	29.4	8.3	3.55	0.08	20.5	10.6	18.8
381	156.6	0.902	74.7	1.7	7.41	15.835	25.108	21.132	31.1	10.0	29.4	8.3	3.55	0.08	20.5	10.6	18.8
382	156.7	0.904	74.7	1.7	7.42	15.877	25.121	21.133	31.1	10.0	29.4	8.3	3.55	0.08	20.5	10.6	18.8
383	156.9	0.907	74.7	1.6	7.42	15.918	25.148	21.145	31.1	10.0	29.5	8.3	3.54	0.08	20.5	10.6	18.9
384	157.0	0.909	74.7	1.6	7.42	15.960	25.161	21.145	31.1	10.0	29.5	8.3	3.54	0.08	20.5	10.6	18.9
385	156.8	0.911	74.6	1.6	7.43	16.001	25.135	21.113	31.1	10.0	29.5	8.4	3.53	0.08	20.5	10.6	18.9
386	157.1	0.914	74.6	1.6	7.43	16.043	25.187	21.146	31.1	10.0	29.5	8.4	3.53	0.08	20.5	10.6	18.9
387	157.2	0.916	74.6	1.6	7.43	16.085	25.200	21.147	31.1	10.0	29.5	8.4	3.53	0.08	20.5	10.6	18.9



Florence & Hutcheson

CONSULTING ENGINEERS

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
388	157.5	0.919	74.7	1.7	7.44	16.126	25.240	21.170	31.1	10.0	29.4	8.3	3.56	0.08	20.5	10.6	18.9
389	157.5	0.921	74.8	1.7	7.44	16.168	25.240	21.159	31.1	10.0	29.4	8.2	3.57	0.08	20.5	10.6	18.8
390	157.6	0.923	74.7	1.7	7.45	16.209	25.266	21.171	31.1	10.0	29.4	8.3	3.56	0.08	20.5	10.6	18.9
391	157.8	0.926	74.7	1.7	7.45	16.251	25.293	21.182	31.1	10.0	29.5	8.3	3.56	0.08	20.6	10.6	18.9
392	157.8	0.928	74.7	1.6	7.45	16.292	25.293	21.172	31.1	10.0	29.5	8.3	3.55	0.08	20.5	10.6	18.9
393	157.9	0.930	74.7	1.6	7.46	16.334	25.306	21.172	31.1	10.0	29.5	8.3	3.55	0.08	20.5	10.6	18.9
394	158.0	0.933	74.7	1.6	7.46	16.375	25.332	21.184	31.1	10.0	29.5	8.3	3.55	0.08	20.6	10.6	18.9
395	158.2	0.935	74.6	1.6	7.46	16.417	25.359	21.195	31.2	10.0	29.5	8.4	3.54	0.08	20.6	10.6	18.9
396	158.4	0.937	74.6	1.6	7.47	16.459	25.385	21.207	31.2	10.0	29.6	8.4	3.54	0.08	20.6	10.6	19.0
397	158.5	0.940	74.6	1.6	7.47	16.500	25.398	21.207	31.2	10.0	29.6	8.4	3.54	0.08	20.6	10.6	19.0
398	158.5	0.942	74.6	1.6	7.48	16.542	25.411	21.208	31.2	10.0	29.6	8.4	3.54	0.08	20.6	10.6	19.0
399	158.5	0.944	74.6	1.6	7.48	16.583	25.411	21.197	31.2	10.0	29.5	8.4	3.54	0.08	20.6	10.6	19.0
400	158.6	0.947	74.6	1.6	7.48	16.625	25.425	21.198	31.2	10.0	29.6	8.4	3.53	0.07	20.6	10.6	19.0
401	158.9	0.949	74.6	1.6	7.49	16.666	25.464	21.220	31.2	10.0	29.6	8.4	3.53	0.07	20.6	10.6	19.0
402	158.9	0.951	74.6	1.6	7.49	16.708	25.464	21.210	31.2	10.0	29.6	8.4	3.53	0.07	20.6	10.6	19.0
403	159.1	0.954	74.6	1.6	7.49	16.750	25.504	21.232	31.2	10.0	29.6	8.4	3.53	0.07	20.6	10.6	19.0
404	159.4	0.956	74.6	1.6	7.50	16.791	25.543	21.254	31.2	10.0	29.6	8.4	3.53	0.07	20.6	10.6	19.0
405	159.5	0.958	74.6	1.6	7.50	16.833	25.570	21.265	31.2	10.0	29.7	8.4	3.53	0.07	20.6	10.6	19.0
406	159.6	0.961	74.6	1.5	7.51	16.874	25.583	21.266	31.2	10.0	29.7	8.4	3.52	0.07	20.6	10.6	19.1
407	159.8	0.963	74.6	1.6	7.51	16.916	25.609	21.277	31.2	10.0	29.6	8.4	3.55	0.08	20.6	10.6	19.0
408	159.9	0.965	74.7	1.6	7.51	16.957	25.635	21.288	31.3	10.0	29.6	8.3	3.56	0.08	20.6	10.6	19.0
409	160.2	0.968	74.7	1.6	7.52	16.999	25.675	21.310	31.3	10.0	29.6	8.3	3.56	0.08	20.6	10.7	19.0
410	160.3	0.970	74.6	1.6	7.52	17.040	25.701	21.322	31.3	10.0	29.7	8.4	3.55	0.08	20.6	10.7	19.0
411	160.3	0.973	74.6	1.6	7.52	17.082	25.688	21.300	31.3	10.0	29.7	8.4	3.55	0.08	20.6	10.7	19.0
412	160.5	0.975	74.6	1.6	7.53	17.124	25.728	21.322	31.3	10.0	29.7	8.4	3.54	0.07	20.6	10.7	19.1
413	160.5	0.977	74.6	1.6	7.53	17.165	25.728	21.311	31.3	10.0	29.7	8.4	3.54	0.07	20.6	10.7	19.0
414	160.6	0.980	74.6	1.6	7.54	17.207	25.741	21.312	31.3	10.0	29.7	8.4	3.54	0.07	20.6	10.7	19.0
415	160.8	0.982	74.6	1.6	7.54	17.248	25.767	21.323	31.3	10.0	29.7	8.4	3.54	0.07	20.6	10.7	19.1
416	160.8	0.984	74.6	1.5	7.54	17.290	25.767	21.312	31.3	10.0	29.7	8.4	3.53	0.07	20.6	10.7	19.1
417	161.0	0.987	74.6	1.5	7.55	17.331	25.807	21.334	31.3	10.0	29.8	8.4	3.53	0.07	20.6	10.7	19.1
418	161.0	0.989	74.6	1.5	7.55	17.373	25.807	21.323	31.3	10.0	29.8	8.4	3.53	0.07	20.6	10.7	19.1
419	161.2	0.991	74.6	1.5	7.55	17.415	25.833	21.334	31.3	10.0	29.8	8.4	3.53	0.07	20.6	10.7	19.1
420	161.3	0.994	74.6	1.5	7.56	17.456	25.846	21.335	31.3	10.0	29.8	8.4	3.53	0.07	20.6	10.7	19.1
421	161.3	0.996	74.5	1.5	7.56	17.498	25.859	21.335	31.3	10.0	29.8	8.5	3.52	0.07	20.6	10.7	19.1
422	161.6	0.998	74.5	1.5	7.57	17.539	25.899	21.357	31.3	10.0	29.8	8.5	3.52	0.07	20.6	10.7	19.2
423	161.7	1.001	74.5	1.5	7.57	17.581	25.912	21.357	31.3	10.0	29.8	8.5	3.52	0.07	20.6	10.7	19.2
424	161.7	1.003	74.5	1.5	7.57	17.622	25.925	21.357	31.3	10.0	29.8	8.5	3.52	0.07	20.6	10.7	19.2
425	161.8	1.005	74.5	1.5	7.58	17.664	25.939	21.357	31.3	10.0	29.8	8.5	3.52	0.07	20.6	10.7	19.2
426	162.0	1.008	74.6	1.5	7.58	17.705	25.965	21.368	31.3	10.0	29.8	8.4	3.53	0.07	20.6	10.7	19.1
427	162.2	1.010	74.6	1.6	7.59	17.747	25.991	21.379	31.3	10.0	29.8	8.4	3.55	0.07	20.7	10.7	19.1
428	162.3	1.012	74.6	1.6	7.59	17.789	26.018	21.389	31.4	10.0	29.8	8.4	3.55	0.07	20.7	10.7	19.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
429	162.6	1.015	74.6	1.5	7.59	17.830	26.057	21.411	31.4	10.0	29.8	8.4	3.54	0.07	20.7	10.7	19.1
430	162.7	1.017	74.6	1.5	7.60	17.872	26.070	21.411	31.4	10.0	29.8	8.4	3.54	0.07	20.7	10.7	19.1
431	162.7	1.019	74.5	1.5	7.60	17.913	26.070	21.400	31.4	10.0	29.9	8.5	3.53	0.07	20.7	10.7	19.2
432	162.9	1.022	74.5	1.5	7.60	17.955	26.110	21.422	31.4	10.0	29.9	8.5	3.53	0.07	20.7	10.7	19.2
433	163.1	1.024	74.5	1.5	7.61	17.996	26.136	21.433	31.4	10.0	29.9	8.5	3.53	0.07	20.7	10.7	19.2
434	163.1	1.027	74.5	1.4	7.61	18.038	26.136	21.422	31.4	10.0	29.9	8.5	3.52	0.07	20.7	10.7	19.2
435	163.2	1.029	74.5	1.4	7.62	18.080	26.163	21.433	31.4	10.0	29.9	8.5	3.52	0.07	20.7	10.7	19.2
436	163.3	1.031	74.5	1.4	7.62	18.121	26.176	21.432	31.4	10.0	29.9	8.5	3.52	0.07	20.7	10.7	19.2
437	163.6	1.034	74.4	1.4	7.62	18.163	26.215	21.454	31.4	10.0	30.0	8.6	3.51	0.07	20.7	10.7	19.3
438	163.6	1.036	74.4	1.4	7.63	18.204	26.215	21.443	31.4	10.0	30.0	8.6	3.51	0.07	20.7	10.7	19.3
439	163.8	1.038	74.4	1.4	7.63	18.246	26.255	21.464	31.4	10.0	30.0	8.6	3.51	0.07	20.7	10.7	19.3
440	163.9	1.041	74.4	1.4	7.64	18.287	26.268	21.464	31.4	10.0	30.0	8.6	3.51	0.07	20.7	10.7	19.3
441	164.0	1.043	74.5	1.5	7.64	18.329	26.281	21.464	31.4	10.0	29.9	8.5	3.53	0.07	20.7	10.7	19.2
442	164.0	1.045	74.5	1.5	7.64	18.370	26.294	21.464	31.4	10.0	29.9	8.5	3.53	0.07	20.7	10.7	19.2
443	164.2	1.048	74.5	1.4	7.65	18.412	26.321	21.475	31.4	10.0	30.0	8.5	3.52	0.07	20.7	10.7	19.3
444	164.4	1.050	74.5	1.4	7.65	18.454	26.347	21.485	31.4	10.0	30.0	8.5	3.52	0.07	20.7	10.7	19.3
445	164.5	1.052	74.5	1.4	7.65	18.495	26.373	21.496	31.5	10.0	30.0	8.5	3.53	0.07	20.7	10.7	19.3
446	164.9	1.055	74.4	1.4	7.66	18.537	26.426	21.528	31.5	10.0	30.1	8.6	3.52	0.07	20.7	10.8	19.3
447	165.0	1.057	74.4	1.4	7.66	18.578	26.439	21.527	31.5	10.0	30.1	8.6	3.52	0.07	20.7	10.8	19.3
448	164.9	1.059	74.4	1.4	7.67	18.620	26.426	21.506	31.5	10.0	30.1	8.6	3.51	0.07	20.7	10.8	19.3
449	165.1	1.062	74.4	1.4	7.67	18.661	26.466	21.527	31.5	10.0	30.1	8.6	3.52	0.07	20.7	10.8	19.3
450	165.1	1.064	74.4	1.4	7.67	18.703	26.466	21.516	31.5	10.0	30.1	8.6	3.50	0.06	20.7	10.8	19.4
451	165.3	1.066	74.4	1.4	7.68	18.745	26.492	21.526	31.5	10.0	30.1	8.6	3.50	0.06	20.7	10.8	19.4
452	165.4	1.069	74.4	1.4	7.68	18.786	26.505	21.526	31.5	10.0	30.1	8.6	3.50	0.06	20.7	10.8	19.4
453	165.4	1.071	74.4	1.3	7.69	18.828	26.505	21.515	31.5	10.0	30.1	8.6	3.49	0.06	20.7	10.8	19.4
454	165.6	1.073	74.4	1.3	7.69	18.869	26.545	21.536	31.5	10.0	30.2	8.6	3.49	0.06	20.7	10.8	19.4
455	165.6	1.076	74.4	1.3	7.69	18.911	26.545	21.525	31.5	10.0	30.2	8.6	3.49	0.06	20.7	10.8	19.4
456	165.9	1.078	74.4	1.3	7.70	18.952	26.598	21.557	31.5	10.0	30.2	8.6	3.50	0.06	20.7	10.8	19.4
457	165.9	1.081	74.4	1.3	7.70	18.994	26.584	21.535	31.5	10.0	30.2	8.6	3.49	0.06	20.7	10.8	19.4
458	166.0	1.083	74.3	1.3	7.71	19.035	26.611	21.545	31.5	10.0	30.2	8.7	3.48	0.06	20.7	10.8	19.4
459	166.1	1.085	74.3	1.3	7.71	19.077	26.624	21.545	31.5	10.0	30.2	8.7	3.48	0.06	20.7	10.8	19.4
460	166.3	1.088	74.4	1.3	7.71	19.119	26.650	21.555	31.5	10.0	30.2	8.6	3.50	0.06	20.7	10.8	19.4
461	166.4	1.090	74.4	1.4	7.72	19.160	26.663	21.555	31.5	10.0	30.1	8.6	3.51	0.06	20.7	10.8	19.4
462	166.7	1.092	74.4	1.4	7.72	19.202	26.716	21.586	31.5	10.0	30.2	8.6	3.51	0.06	20.8	10.8	19.4
463	166.8	1.095	74.4	1.3	7.73	19.243	26.729	21.586	31.5	10.0	30.2	8.6	3.50	0.06	20.8	10.8	19.4
464	166.8	1.097	74.4	1.3	7.73	19.285	26.729	21.575	31.5	10.0	30.2	8.6	3.50	0.06	20.7	10.8	19.4
465	167.0	1.099	74.4	1.3	7.73	19.326	26.769	21.595	31.6	10.0	30.2	8.6	3.50	0.06	20.8	10.8	19.4
466	167.1	1.102	74.3	1.3	7.74	19.368	26.782	21.595	31.6	10.0	30.3	8.7	3.49	0.06	20.8	10.8	19.5
467	167.3	1.104	74.3	1.3	7.74	19.410	26.822	21.616	31.6	10.0	30.3	8.7	3.49	0.06	20.8	10.8	19.5
468	167.3	1.106	74.3	1.3	7.75	19.451	26.822	21.605	31.6	10.0	30.3	8.7	3.49	0.06	20.8	10.8	19.5
469	167.3	1.109	74.3	1.3	7.75	19.493	26.822	21.593	31.6	10.0	30.3	8.7	3.49	0.06	20.8	10.8	19.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
470	167.4	1.111	74.3	1.3	7.75	19.534	26.835	21.593	31.6	10.0	30.3	8.7	3.49	0.06	20.8	10.8	19.5
471	167.6	1.113	74.3	1.3	7.76	19.576	26.861	21.603	31.6	10.0	30.3	8.7	3.49	0.06	20.8	10.8	19.5
472	167.9	1.116	74.3	1.2	7.76	19.617	26.914	21.634	31.6	10.0	30.3	8.7	3.48	0.06	20.8	10.8	19.5
473	167.9	1.118	74.3	1.2	7.77	19.659	26.914	21.623	31.6	10.0	30.3	8.7	3.48	0.06	20.8	10.8	19.5
474	167.9	1.120	74.3	1.2	7.77	19.700	26.914	21.612	31.6	10.0	30.3	8.7	3.48	0.06	20.8	10.8	19.5
475	168.2	1.123	74.3	1.2	7.77	19.742	26.967	21.643	31.6	10.0	30.4	8.7	3.48	0.06	20.8	10.8	19.5
476	168.2	1.125	74.2	1.2	7.78	19.784	26.967	21.632	31.6	10.0	30.4	8.8	3.47	0.06	20.8	10.8	19.6
477	168.3	1.127	74.2	1.2	7.78	19.825	26.980	21.631	31.6	10.0	30.4	8.8	3.47	0.06	20.8	10.8	19.6
478	168.4	1.130	74.2	1.2	7.79	19.867	26.993	21.630	31.6	10.0	30.4	8.8	3.47	0.06	20.8	10.8	19.6
479	168.5	1.131	74.2	1.2	7.79	19.883	27.006	21.636	31.6	10.0	30.4	8.8	3.47	0.06	20.8	10.8	19.6



File Location
B-59 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-59
Sample Description: Brown, Gray, Tan, Red & White Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 32.000
PL: 27.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.807	2.782	
Height (in)	5.688	5.638	
Weight (grams)	1115.00		1204.15
Moisture (%)	11.71		20.65
Dry Density (pcf)	108.00	110.92	
Saturation (%)	58.36	100.00	
Void Ratio	0.528	0.491	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 93.000
Effective Confining Stress (psi): 20.0
Corrected Peak Deviator Stress (psi): 22.724 at reading number: 184

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	30.0	0.000	73.0	0.0	6.08	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	57.1	0.007	76.1	3.1	6.09	0.108	4.452	4.447	24.4	20.0	21.4	16.9	1.26	0.69	22.2	2.2	19.1
2	73.8	0.013	77.9	4.9	6.09	0.217	7.211	7.195	27.2	20.0	22.2	15.1	1.48	0.68	23.6	3.6	18.7
3	85.4	0.019	79.2	6.2	6.10	0.325	9.118	9.088	29.1	20.0	22.9	13.8	1.66	0.68	24.5	4.5	18.3
4	94.8	0.025	80.2	7.2	6.11	0.433	10.660	10.614	30.6	20.0	23.4	12.8	1.83	0.68	25.3	5.3	18.1
5	102.5	0.031	81.0	7.9	6.11	0.541	11.931	11.867	31.8	20.0	23.9	12.0	1.99	0.67	25.9	5.9	18.0
6	109.3	0.037	81.5	8.5	6.12	0.650	13.040	12.956	32.9	20.0	24.5	11.5	2.13	0.65	26.4	6.5	18.0
7	114.9	0.043	82.0	8.9	6.13	0.758	13.960	13.854	33.8	20.0	24.9	11.0	2.26	0.64	26.9	6.9	18.0
8	119.6	0.049	82.3	9.3	6.13	0.866	14.731	14.603	34.6	20.0	25.3	10.7	2.37	0.64	27.3	7.3	18.0
9	123.5	0.055	82.6	9.6	6.14	0.975	15.380	15.230	35.2	20.0	25.6	10.4	2.47	0.63	27.6	7.6	18.0
10	126.9	0.062	82.8	9.7	6.15	1.083	15.935	15.762	35.7	20.0	26.0	10.2	2.54	0.62	27.8	7.9	18.1
11	129.7	0.068	83.0	9.9	6.15	1.191	16.394	16.199	36.2	20.0	26.2	10.0	2.62	0.61	28.1	8.1	18.1
12	132.1	0.074	83.1	10.1	6.16	1.299	16.787	16.569	36.5	20.0	26.4	9.9	2.68	0.61	28.2	8.3	18.1
13	134.0	0.080	83.3	10.2	6.17	1.408	17.098	16.857	36.8	20.0	26.6	9.7	2.73	0.61	28.4	8.4	18.2
14	135.6	0.086	83.4	10.3	6.17	1.516	17.368	17.105	37.1	20.0	26.7	9.6	2.78	0.60	28.5	8.6	18.2
15	137.0	0.092	83.5	10.5	6.18	1.624	17.598	17.312	37.3	20.0	26.8	9.5	2.83	0.61	28.6	8.7	18.1
16	138.2	0.098	83.6	10.6	6.19	1.732	17.801	17.493	37.5	20.0	26.9	9.4	2.87	0.61	28.7	8.7	18.1
17	139.1	0.104	83.7	10.7	6.19	1.841	17.950	17.619	37.6	20.0	26.9	9.3	2.90	0.61	28.8	8.8	18.1
18	140.1	0.110	83.8	10.7	6.20	1.949	18.112	17.759	37.7	20.0	27.0	9.2	2.93	0.61	28.8	8.9	18.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	140.9	0.116	83.9	10.8	6.21	2.057	18.247	17.872	37.8	20.0	27.0	9.1	2.96	0.61	28.9	8.9	18.1
20	141.9	0.123	83.9	10.9	6.21	2.166	18.410	18.011	38.0	20.0	27.1	9.1	2.99	0.61	29.0	9.0	18.1
21	142.3	0.129	84.0	10.9	6.22	2.274	18.477	18.057	38.0	20.0	27.1	9.0	3.00	0.61	29.0	9.0	18.0
22	142.9	0.135	84.0	11.0	6.23	2.382	18.572	18.130	38.1	20.0	27.1	9.0	3.02	0.61	29.0	9.1	18.0
23	143.6	0.141	84.1	11.1	6.24	2.490	18.680	18.215	38.2	20.0	27.1	8.9	3.05	0.61	29.1	9.1	18.0
24	144.1	0.147	84.1	11.1	6.24	2.599	18.775	18.287	38.2	20.0	27.1	8.9	3.07	0.61	29.1	9.1	18.0
25	144.7	0.153	84.2	11.1	6.25	2.707	18.870	18.359	38.3	20.0	27.2	8.8	3.08	0.61	29.1	9.2	18.0
26	145.1	0.159	84.2	11.1	6.26	2.815	18.937	18.404	38.4	20.0	27.2	8.8	3.09	0.61	29.2	9.2	18.0
27	145.7	0.165	84.3	11.2	6.26	2.924	19.032	18.475	38.4	20.0	27.2	8.7	3.12	0.61	29.2	9.2	18.0
28	146.1	0.171	84.3	11.2	6.27	3.032	19.099	18.520	38.5	20.0	27.3	8.7	3.12	0.61	29.2	9.3	18.0
29	146.6	0.178	84.3	11.3	6.28	3.140	19.181	18.578	38.5	20.0	27.3	8.7	3.14	0.61	29.3	9.3	18.0
30	146.9	0.184	84.3	11.3	6.28	3.248	19.235	18.610	38.6	20.0	27.3	8.7	3.15	0.61	29.3	9.3	18.0
31	147.5	0.190	84.4	11.3	6.29	3.357	19.329	18.681	38.6	20.0	27.3	8.6	3.17	0.61	29.3	9.3	18.0
32	147.8	0.196	84.4	11.4	6.30	3.465	19.370	18.699	38.7	20.0	27.3	8.6	3.18	0.61	29.3	9.3	17.9
33	148.1	0.202	84.4	11.4	6.31	3.573	19.424	18.730	38.7	20.0	27.3	8.6	3.18	0.61	29.3	9.4	17.9
34	148.7	0.208	84.5	11.5	6.31	3.681	19.519	18.800	38.8	20.0	27.3	8.5	3.21	0.61	29.4	9.4	17.9
35	148.9	0.214	84.5	11.4	6.32	3.790	19.559	18.818	38.8	20.0	27.4	8.5	3.21	0.61	29.4	9.4	17.9
36	149.2	0.220	84.5	11.5	6.33	3.898	19.600	18.836	38.8	20.0	27.3	8.5	3.22	0.61	29.4	9.4	17.9
37	149.6	0.226	84.5	11.5	6.33	4.006	19.668	18.880	38.8	20.0	27.3	8.5	3.23	0.61	29.4	9.4	17.9
38	149.7	0.232	84.5	11.5	6.34	4.115	19.681	18.871	38.8	20.0	27.3	8.5	3.23	0.61	29.4	9.4	17.9
39	150.2	0.239	84.6	11.5	6.35	4.223	19.762	18.928	38.9	20.0	27.3	8.4	3.25	0.61	29.4	9.5	17.9
40	150.6	0.245	84.6	11.6	6.36	4.331	19.830	18.971	38.9	20.0	27.3	8.4	3.27	0.61	29.4	9.5	17.9
41	150.8	0.251	84.6	11.5	6.36	4.439	19.870	18.988	39.0	20.0	27.4	8.4	3.26	0.61	29.5	9.5	17.9
42	151.1	0.257	84.6	11.6	6.37	4.548	19.925	19.018	39.0	20.0	27.4	8.4	3.27	0.61	29.5	9.5	17.9
43	151.5	0.263	84.7	11.6	6.38	4.656	19.979	19.048	39.0	20.0	27.4	8.3	3.29	0.61	29.5	9.5	17.9
44	151.8	0.269	84.7	11.6	6.38	4.764	20.033	19.078	39.0	20.0	27.4	8.3	3.29	0.61	29.5	9.5	17.9
45	152.2	0.275	84.7	11.6	6.39	4.873	20.100	19.121	39.1	20.0	27.5	8.3	3.29	0.61	29.5	9.6	17.9
46	152.5	0.281	84.7	11.7	6.40	4.981	20.154	19.151	39.1	20.0	27.4	8.3	3.31	0.61	29.5	9.6	17.9
47	152.8	0.287	84.7	11.7	6.41	5.089	20.195	19.167	39.1	20.0	27.5	8.3	3.31	0.61	29.5	9.6	17.9
48	153.2	0.293	84.7	11.7	6.41	5.197	20.263	19.210	39.2	20.0	27.5	8.3	3.32	0.61	29.6	9.6	17.9
49	153.6	0.300	84.7	11.7	6.42	5.306	20.330	19.252	39.2	20.0	27.5	8.3	3.32	0.61	29.6	9.6	17.9
50	153.9	0.306	84.7	11.7	6.43	5.414	20.371	19.268	39.2	20.0	27.5	8.3	3.34	0.61	29.6	9.6	17.9
51	153.9	0.312	84.7	11.7	6.44	5.522	20.384	19.259	39.2	20.0	27.5	8.3	3.33	0.61	29.6	9.6	17.9
52	154.4	0.318	84.7	11.7	6.44	5.630	20.465	19.313	39.3	20.0	27.6	8.3	3.34	0.61	29.6	9.7	17.9
53	154.8	0.324	84.8	11.8	6.45	5.739	20.533	19.355	39.3	20.0	27.6	8.2	3.36	0.61	29.6	9.7	17.9
54	155.2	0.330	84.7	11.7	6.46	5.847	20.587	19.383	39.3	20.0	27.6	8.3	3.35	0.60	29.7	9.7	17.9
55	155.6	0.336	84.7	11.7	6.46	5.955	20.655	19.425	39.4	20.0	27.7	8.3	3.35	0.60	29.7	9.7	18.0
56	155.9	0.342	84.7	11.7	6.47	6.064	20.709	19.453	39.4	20.0	27.7	8.3	3.36	0.60	29.7	9.7	18.0
57	156.2	0.348	84.8	11.8	6.48	6.172	20.763	19.482	39.4	20.0	27.7	8.2	3.37	0.60	29.7	9.7	18.0
58	156.8	0.355	84.8	11.8	6.49	6.280	20.858	19.548	39.5	20.0	27.8	8.2	3.38	0.60	29.7	9.8	18.0
59	157.0	0.361	84.8	11.8	6.49	6.388	20.885	19.551	39.5	20.0	27.7	8.2	3.39	0.60	29.7	9.8	17.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	157.3	0.367	84.8	11.8	6.50	6.497	20.939	19.579	39.5	20.0	27.8	8.2	3.38	0.60	29.8	9.8	18.0
61	157.7	0.373	84.8	11.8	6.51	6.605	21.006	19.619	39.6	20.0	27.8	8.2	3.39	0.60	29.8	9.8	18.0
62	157.9	0.379	84.8	11.8	6.52	6.713	21.034	19.622	39.6	20.0	27.8	8.2	3.39	0.60	29.8	9.8	18.0
63	158.3	0.385	84.8	11.8	6.52	6.822	21.101	19.662	39.6	20.0	27.9	8.2	3.39	0.60	29.8	9.8	18.0
64	158.8	0.391	84.8	11.8	6.53	6.930	21.182	19.714	39.7	20.0	27.9	8.2	3.40	0.60	29.8	9.9	18.1
65	159.2	0.397	84.8	11.8	6.54	7.038	21.250	19.754	39.7	20.0	28.0	8.2	3.41	0.59	29.8	9.9	18.1
66	159.4	0.403	84.8	11.8	6.55	7.146	21.291	19.769	39.7	20.0	27.9	8.2	3.42	0.60	29.8	9.9	18.1
67	159.7	0.409	84.8	11.8	6.56	7.255	21.331	19.784	39.7	20.0	28.0	8.2	3.41	0.59	29.9	9.9	18.1
68	160.1	0.416	84.8	11.8	6.56	7.363	21.399	19.823	39.8	20.0	28.0	8.2	3.41	0.59	29.9	9.9	18.1
69	160.3	0.422	84.8	11.8	6.57	7.471	21.426	19.825	39.8	20.0	28.0	8.2	3.41	0.59	29.9	9.9	18.1
70	160.8	0.428	84.8	11.8	6.58	7.579	21.520	19.889	39.9	20.0	28.1	8.2	3.42	0.59	29.9	9.9	18.2
71	161.2	0.434	84.7	11.7	6.59	7.688	21.575	19.916	39.9	20.0	28.2	8.3	3.41	0.59	29.9	10.0	18.2
72	161.5	0.440	84.7	11.7	6.59	7.796	21.629	19.942	39.9	20.0	28.2	8.3	3.41	0.59	29.9	10.0	18.3
73	162.0	0.446	84.7	11.7	6.60	7.904	21.710	19.994	40.0	20.0	28.3	8.3	3.41	0.58	30.0	10.0	18.3
74	162.2	0.452	84.7	11.6	6.61	8.013	21.737	19.995	40.0	20.0	28.3	8.3	3.40	0.58	30.0	10.0	18.3
75	162.6	0.458	84.7	11.6	6.62	8.121	21.804	20.034	40.0	20.0	28.4	8.3	3.40	0.58	30.0	10.0	18.3
76	163.0	0.464	84.7	11.7	6.63	8.229	21.872	20.072	40.0	20.0	28.4	8.3	3.42	0.58	30.0	10.0	18.3
77	163.1	0.471	84.7	11.7	6.63	8.337	21.899	20.073	40.0	20.0	28.3	8.3	3.43	0.58	30.0	10.0	18.3
78	163.6	0.477	84.7	11.7	6.64	8.446	21.967	20.112	40.1	20.0	28.4	8.3	3.43	0.58	30.0	10.1	18.3
79	163.9	0.483	84.8	11.8	6.65	8.554	22.021	20.137	40.1	20.0	28.3	8.2	3.46	0.59	30.0	10.1	18.2
80	164.2	0.489	84.8	11.8	6.66	8.662	22.075	20.163	40.1	20.0	28.4	8.2	3.46	0.58	30.0	10.1	18.3
81	164.6	0.495	84.8	11.8	6.66	8.771	22.143	20.201	40.2	20.0	28.4	8.2	3.46	0.58	30.1	10.1	18.3
82	165.0	0.501	84.8	11.8	6.67	8.879	22.197	20.226	40.2	20.0	28.4	8.2	3.46	0.58	30.1	10.1	18.3
83	165.3	0.507	84.8	11.8	6.68	8.987	22.251	20.251	40.2	20.0	28.5	8.2	3.47	0.58	30.1	10.1	18.3
84	165.4	0.513	84.8	11.8	6.69	9.095	22.278	20.252	40.2	20.0	28.5	8.2	3.47	0.58	30.1	10.1	18.3
85	166.0	0.519	84.8	11.8	6.70	9.204	22.373	20.313	40.3	20.0	28.5	8.2	3.47	0.58	30.1	10.2	18.4
86	166.4	0.525	84.8	11.8	6.70	9.312	22.427	20.338	40.3	20.0	28.5	8.2	3.49	0.58	30.1	10.2	18.3
87	166.8	0.532	84.8	11.8	6.71	9.420	22.508	20.387	40.3	20.0	28.6	8.2	3.48	0.58	30.2	10.2	18.4
88	167.3	0.538	84.8	11.8	6.72	9.528	22.589	20.437	40.4	20.0	28.6	8.2	3.49	0.57	30.2	10.2	18.4
89	167.7	0.544	84.8	11.8	6.73	9.637	22.657	20.473	40.4	20.0	28.7	8.2	3.49	0.57	30.2	10.2	18.4
90	168.0	0.550	84.8	11.8	6.74	9.745	22.697	20.485	40.4	20.0	28.7	8.2	3.49	0.57	30.2	10.2	18.5
91	168.6	0.556	84.7	11.7	6.74	9.853	22.792	20.546	40.5	20.0	28.8	8.3	3.49	0.57	30.2	10.3	18.5
92	168.7	0.562	84.8	11.8	6.75	9.962	22.819	20.546	40.5	20.0	28.8	8.2	3.50	0.57	30.2	10.3	18.5
93	169.2	0.568	84.7	11.7	6.76	10.070	22.900	20.594	40.6	20.0	28.8	8.3	3.50	0.57	30.3	10.3	18.5
94	169.7	0.574	84.7	11.7	6.77	10.178	22.981	20.642	40.6	20.0	28.9	8.3	3.50	0.57	30.3	10.3	18.6
95	170.1	0.580	84.7	11.7	6.78	10.286	23.035	20.666	40.6	20.0	28.9	8.3	3.50	0.57	30.3	10.3	18.6
96	170.4	0.587	84.7	11.7	6.79	10.395	23.089	20.689	40.7	20.0	28.9	8.3	3.51	0.57	30.3	10.3	18.6
97	170.8	0.593	84.7	11.7	6.79	10.503	23.157	20.725	40.7	20.0	29.0	8.3	3.51	0.57	30.3	10.4	18.6
98	171.0	0.599	84.7	11.7	6.80	10.611	23.184	20.724	40.7	20.0	29.0	8.3	3.51	0.57	30.3	10.4	18.6
99	171.5	0.605	84.7	11.7	6.81	10.720	23.279	20.783	40.7	20.0	29.0	8.3	3.52	0.56	30.4	10.4	18.6
100	171.9	0.611	84.7	11.7	6.82	10.828	23.346	20.818	40.8	20.0	29.1	8.3	3.51	0.56	30.4	10.4	18.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	172.2	0.617	84.7	11.7	6.83	10.936	23.387	20.829	40.8	20.0	29.1	8.3	3.51	0.56	30.4	10.4	18.7
102	172.8	0.623	84.7	11.7	6.83	11.044	23.495	20.900	40.9	20.0	29.2	8.3	3.52	0.56	30.4	10.5	18.7
103	173.0	0.629	84.7	11.7	6.84	11.153	23.522	20.899	40.9	20.0	29.2	8.3	3.52	0.56	30.4	10.4	18.7
104	173.5	0.635	84.7	11.7	6.85	11.261	23.603	20.945	40.9	20.0	29.2	8.3	3.53	0.56	30.4	10.5	18.8
105	173.8	0.641	84.7	11.7	6.86	11.369	23.657	20.968	40.9	20.0	29.3	8.3	3.53	0.56	30.4	10.5	18.8
106	174.1	0.648	84.7	11.7	6.87	11.477	23.698	20.978	40.9	20.0	29.3	8.3	3.53	0.56	30.5	10.5	18.8
107	174.6	0.654	84.7	11.7	6.88	11.586	23.779	21.024	41.0	20.0	29.3	8.3	3.54	0.56	30.5	10.5	18.8
108	175.0	0.660	84.7	11.7	6.89	11.694	23.847	21.058	41.0	20.0	29.3	8.3	3.54	0.55	30.5	10.5	18.8
109	175.2	0.666	84.7	11.7	6.89	11.802	23.887	21.068	41.0	20.0	29.4	8.3	3.54	0.55	30.5	10.5	18.8
110	175.4	0.672	84.7	11.6	6.90	11.911	23.914	21.066	41.0	20.0	29.4	8.3	3.53	0.55	30.5	10.5	18.9
111	175.9	0.678	84.7	11.6	6.91	12.019	23.996	21.112	41.1	20.0	29.4	8.3	3.53	0.55	30.5	10.6	18.9
112	176.1	0.684	84.7	11.6	6.92	12.127	24.036	21.121	41.1	20.0	29.5	8.3	3.53	0.55	30.5	10.6	18.9
113	176.6	0.690	84.7	11.6	6.93	12.235	24.117	21.166	41.1	20.0	29.5	8.3	3.54	0.55	30.5	10.6	18.9
114	177.1	0.696	84.6	11.6	6.94	12.344	24.198	21.211	41.2	20.0	29.6	8.4	3.53	0.55	30.6	10.6	19.0
115	177.4	0.703	84.6	11.6	6.94	12.452	24.239	21.221	41.2	20.0	29.6	8.4	3.53	0.55	30.6	10.6	19.0
116	177.5	0.709	84.6	11.6	6.95	12.560	24.266	21.218	41.2	20.0	29.6	8.4	3.53	0.55	30.6	10.6	19.0
117	178.0	0.715	84.6	11.6	6.96	12.669	24.347	21.263	41.2	20.0	29.6	8.4	3.54	0.55	30.6	10.6	19.0
118	178.4	0.721	84.6	11.6	6.97	12.777	24.401	21.284	41.2	20.0	29.7	8.4	3.54	0.54	30.6	10.6	19.0
119	178.7	0.727	84.6	11.6	6.98	12.885	24.455	21.304	41.3	20.0	29.7	8.4	3.54	0.54	30.6	10.7	19.0
120	179.2	0.733	84.6	11.5	6.99	12.993	24.536	21.348	41.3	20.0	29.8	8.4	3.54	0.54	30.6	10.7	19.1
121	179.6	0.739	84.6	11.5	7.00	13.102	24.604	21.381	41.3	20.0	29.8	8.4	3.54	0.54	30.7	10.7	19.1
122	180.0	0.745	84.6	11.5	7.01	13.210	24.672	21.413	41.4	20.0	29.8	8.4	3.55	0.54	30.7	10.7	19.1
123	180.4	0.751	84.6	11.5	7.01	13.318	24.739	21.445	41.4	20.0	29.9	8.4	3.55	0.54	30.7	10.7	19.1
124	180.7	0.757	84.5	11.5	7.02	13.426	24.793	21.465	41.4	20.0	29.9	8.5	3.54	0.54	30.7	10.7	19.2
125	181.2	0.764	84.5	11.5	7.03	13.535	24.875	21.508	41.5	20.0	30.0	8.5	3.54	0.54	30.7	10.8	19.2
126	181.4	0.770	84.6	11.5	7.04	13.643	24.902	21.504	41.5	20.0	29.9	8.4	3.56	0.54	30.7	10.8	19.2
127	181.8	0.776	84.5	11.5	7.05	13.751	24.969	21.536	41.5	20.0	30.0	8.5	3.55	0.53	30.7	10.8	19.2
128	182.2	0.782	84.5	11.5	7.06	13.860	25.037	21.567	41.5	20.0	30.0	8.5	3.55	0.53	30.7	10.8	19.2
129	182.6	0.788	84.5	11.5	7.07	13.968	25.105	21.598	41.6	20.0	30.1	8.5	3.56	0.53	30.8	10.8	19.3
130	182.9	0.794	84.5	11.5	7.08	14.076	25.145	21.606	41.6	20.0	30.1	8.5	3.56	0.53	30.8	10.8	19.3
131	183.4	0.800	84.5	11.5	7.08	14.184	25.226	21.648	41.6	20.0	30.1	8.5	3.55	0.53	30.8	10.8	19.3
132	183.5	0.806	84.5	11.4	7.09	14.293	25.253	21.644	41.6	20.0	30.2	8.5	3.54	0.53	30.8	10.8	19.4
133	183.9	0.812	84.5	11.5	7.10	14.401	25.321	21.674	41.6	20.0	30.2	8.5	3.55	0.53	30.8	10.8	19.3
134	184.4	0.819	84.5	11.4	7.11	14.509	25.389	21.705	41.7	20.0	30.2	8.5	3.54	0.53	30.8	10.9	19.4
135	184.8	0.825	84.4	11.4	7.12	14.618	25.456	21.735	41.7	20.0	30.3	8.6	3.54	0.52	30.8	10.9	19.4
136	185.3	0.831	84.4	11.4	7.13	14.726	25.537	21.777	41.7	20.0	30.4	8.6	3.54	0.52	30.9	10.9	19.5
137	185.3	0.837	84.4	11.4	7.14	14.834	25.551	21.761	41.7	20.0	30.3	8.6	3.54	0.52	30.8	10.9	19.5
138	185.8	0.843	84.4	11.4	7.15	14.942	25.632	21.802	41.8	20.0	30.4	8.6	3.54	0.52	30.9	10.9	19.5
139	186.3	0.849	84.4	11.4	7.16	15.051	25.700	21.832	41.8	20.0	30.4	8.6	3.55	0.52	30.9	10.9	19.5
140	186.7	0.855	84.4	11.3	7.17	15.159	25.781	21.873	41.8	20.0	30.5	8.6	3.54	0.52	30.9	10.9	19.6
141	187.0	0.861	84.3	11.3	7.18	15.267	25.821	21.879	41.8	20.0	30.5	8.7	3.53	0.52	30.9	10.9	19.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	187.2	0.867	84.3	11.3	7.18	15.375	25.862	21.886	41.8	20.0	30.5	8.7	3.53	0.52	30.9	10.9	19.6
143	187.7	0.873	84.3	11.3	7.19	15.484	25.943	21.926	41.9	20.0	30.6	8.7	3.52	0.51	30.9	11.0	19.7
144	188.1	0.880	84.3	11.3	7.20	15.592	25.997	21.944	41.9	20.0	30.6	8.7	3.54	0.52	30.9	11.0	19.6
145	188.4	0.886	84.3	11.3	7.21	15.700	26.051	21.961	41.9	20.0	30.7	8.7	3.53	0.51	30.9	11.0	19.7
146	188.8	0.892	84.3	11.2	7.22	15.809	26.119	21.990	42.0	20.0	30.7	8.7	3.52	0.51	31.0	11.0	19.7
147	189.1	0.898	84.3	11.3	7.23	15.917	26.173	22.007	42.0	20.0	30.7	8.7	3.53	0.51	31.0	11.0	19.7
148	189.5	0.904	84.3	11.3	7.24	16.025	26.227	22.024	42.0	20.0	30.7	8.7	3.53	0.51	31.0	11.0	19.7
149	189.7	0.910	84.3	11.3	7.25	16.133	26.268	22.030	42.0	20.0	30.7	8.7	3.53	0.51	31.0	11.0	19.7
150	190.0	0.916	84.2	11.1	7.26	16.242	26.322	22.047	42.0	20.0	30.9	8.8	3.50	0.51	31.0	11.0	19.8
151	190.5	0.922	84.2	11.1	7.27	16.350	26.403	22.086	42.0	20.0	30.9	8.8	3.51	0.50	31.0	11.0	19.9
152	190.9	0.928	84.2	11.1	7.28	16.458	26.471	22.114	42.1	20.0	30.9	8.8	3.51	0.50	31.0	11.1	19.9
153	191.3	0.934	84.2	11.2	7.29	16.567	26.538	22.142	42.1	20.0	30.9	8.8	3.52	0.51	31.0	11.1	19.8
154	191.8	0.941	84.2	11.1	7.30	16.675	26.619	22.181	42.1	20.0	31.0	8.8	3.52	0.50	31.1	11.1	19.9
155	192.2	0.947	84.2	11.1	7.31	16.783	26.673	22.197	42.2	20.0	31.0	8.8	3.52	0.50	31.1	11.1	19.9
156	192.6	0.953	84.2	11.1	7.32	16.891	26.741	22.224	42.2	20.0	31.0	8.8	3.52	0.50	31.1	11.1	19.9
157	192.9	0.959	84.1	11.1	7.33	17.000	26.795	22.240	42.2	20.0	31.1	8.9	3.51	0.50	31.1	11.1	20.0
158	193.2	0.965	84.1	11.1	7.33	17.108	26.836	22.245	42.2	20.0	31.1	8.9	3.50	0.50	31.1	11.1	20.0
159	193.3	0.971	84.1	11.0	7.34	17.216	26.863	22.238	42.2	20.0	31.2	8.9	3.49	0.50	31.1	11.1	20.1
160	193.9	0.977	84.1	11.0	7.35	17.324	26.957	22.287	42.2	20.0	31.2	8.9	3.49	0.49	31.1	11.1	20.1
161	194.2	0.983	84.0	11.0	7.36	17.433	27.012	22.303	42.3	20.0	31.3	9.0	3.48	0.49	31.1	11.2	20.1
162	194.6	0.989	84.1	11.1	7.37	17.541	27.066	22.318	42.3	20.0	31.2	8.9	3.51	0.50	31.1	11.2	20.1
163	195.0	0.996	84.1	11.0	7.38	17.649	27.133	22.344	42.3	20.0	31.3	8.9	3.50	0.49	31.1	11.2	20.1
164	195.2	1.002	84.1	11.0	7.39	17.758	27.174	22.348	42.3	20.0	31.3	8.9	3.50	0.49	31.1	11.2	20.1
165	195.5	1.008	84.1	11.0	7.40	17.866	27.214	22.352	42.3	20.0	31.3	8.9	3.50	0.49	31.1	11.2	20.1
166	195.9	1.014	84.0	11.0	7.41	17.974	27.282	22.378	42.3	20.0	31.4	9.0	3.49	0.49	31.2	11.2	20.2
167	196.3	1.020	84.0	11.0	7.42	18.082	27.350	22.404	42.4	20.0	31.4	9.0	3.50	0.49	31.2	11.2	20.2
168	196.7	1.026	84.0	10.9	7.43	18.191	27.417	22.430	42.4	20.0	31.4	9.0	3.49	0.49	31.2	11.2	20.2
169	197.3	1.032	84.0	10.9	7.44	18.299	27.512	22.478	42.4	20.0	31.5	9.0	3.49	0.49	31.2	11.2	20.3
170	197.5	1.038	84.0	10.9	7.45	18.407	27.553	22.481	42.4	20.0	31.5	9.0	3.49	0.49	31.2	11.2	20.3
171	197.8	1.044	83.9	10.9	7.46	18.516	27.607	22.495	42.5	20.0	31.6	9.1	3.48	0.48	31.2	11.2	20.3
172	198.0	1.050	84.0	10.9	7.47	18.624	27.634	22.487	42.4	20.0	31.5	9.0	3.49	0.49	31.2	11.2	20.3
173	198.3	1.057	83.9	10.9	7.48	18.732	27.674	22.490	42.5	20.0	31.5	9.1	3.48	0.48	31.2	11.2	20.3
174	198.8	1.063	83.9	10.9	7.49	18.840	27.755	22.526	42.5	20.0	31.6	9.1	3.48	0.48	31.2	11.3	20.4
175	199.2	1.069	83.9	10.9	7.50	18.949	27.823	22.551	42.5	20.0	31.6	9.1	3.48	0.48	31.2	11.3	20.4
176	199.3	1.075	83.9	10.8	7.51	19.057	27.850	22.543	42.5	20.0	31.7	9.1	3.47	0.48	31.2	11.3	20.4
177	199.8	1.081	83.9	10.8	7.52	19.165	27.931	22.578	42.5	20.0	31.7	9.1	3.47	0.48	31.3	11.3	20.4
178	200.1	1.087	83.9	10.8	7.53	19.274	27.972	22.581	42.5	20.0	31.7	9.1	3.47	0.48	31.3	11.3	20.4
179	200.4	1.093	83.7	10.7	7.54	19.382	28.026	22.594	42.6	20.0	31.9	9.3	3.44	0.47	31.3	11.3	20.6
180	200.7	1.099	83.7	10.7	7.55	19.490	28.080	22.607	42.6	20.0	31.9	9.3	3.44	0.47	31.3	11.3	20.6
181	201.2	1.105	83.7	10.7	7.56	19.598	28.161	22.642	42.6	20.0	31.9	9.3	3.44	0.47	31.3	11.3	20.6
182	201.7	1.112	83.7	10.7	7.57	19.707	28.242	22.677	42.6	20.0	32.0	9.3	3.44	0.47	31.3	11.3	20.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	202.2	1.118	83.7	10.7	7.58	19.815	28.323	22.711	42.7	20.0	32.0	9.3	3.44	0.47	31.3	11.4	20.7
184	202.5	1.124	83.7	10.6	7.59	19.923	28.378	22.724	42.7	20.0	32.1	9.3	3.43	0.47	31.3	11.4	20.7
185	202.7	1.129	83.7	10.7	7.60	20.015	28.405	22.719	42.7	20.0	32.0	9.3	3.45	0.47	31.3	11.4	20.6

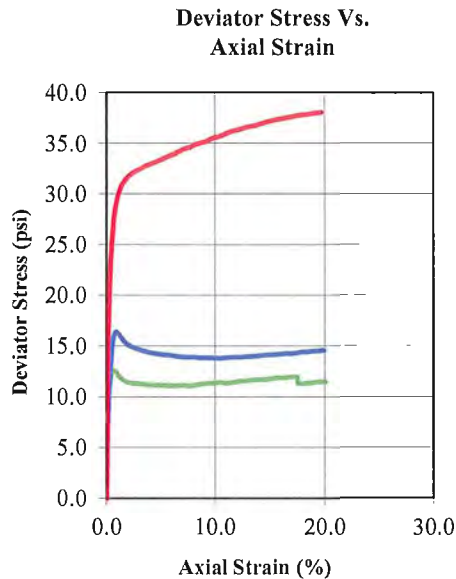


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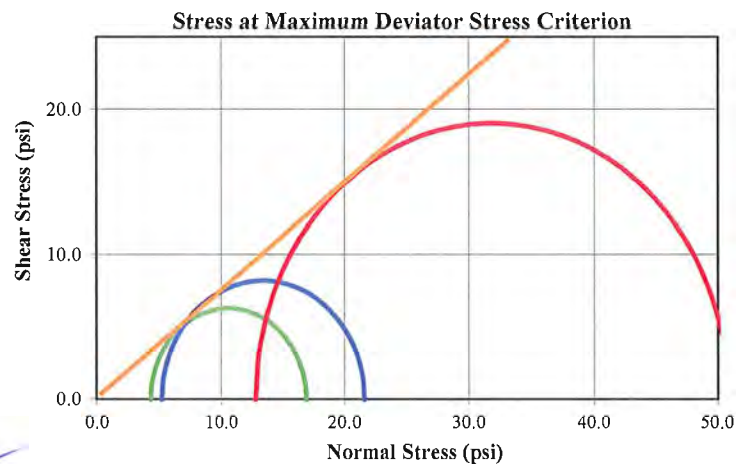
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0' to 15.0'
PROJECT LOCATION : B-65	SAMPLE TYPE : Remolded
BORING NUMBER : B-65	DESCRIPTION : Red & Brown Silty Sand
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	18.1	18.2	19.6	
Dry Density (pcf)	99.8	99.5	100.8	
Saturation (%)	72.73	72.85	80.92	
Void Ratio	0.655	0.658	0.638	
Diameter (in)	2.803	2.802	2.797	
Height (in)	5.618	5.634	5.559	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	36	36	36	
Plastic Limit	26	26	26	
After Consolidation	A	B	C	D
B-Value	0.95	0.95	0.97	
Water Content (%)	24.1	24.3	20.9	
Dry Density (pcf)	99.75	99.91	116.59	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.658	0.656	0.419	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	89.2	88.2	44.4	
Rate of Strain	0.002	0.002	0.002	

Maximum Deviator Stress Criterion		After Shear	A	B	C	D
C (psi)	0.0	σ'_1 at Failure (psi)	16.92	21.59	50.86	
ϕ (deg)	31.6	σ'_3 at Failure (psi)	4.31	5.19	12.78	
C' (psi)	0.1					
ϕ' (deg)	36.6					



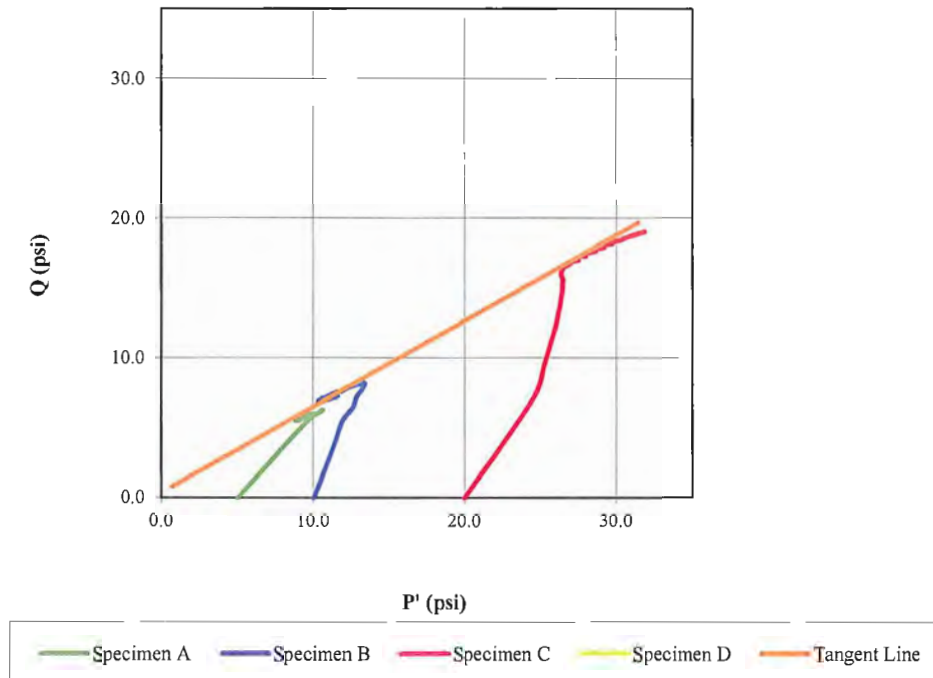
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Date: 12-11-12

Approved By: SKB
Date: 12-11-12

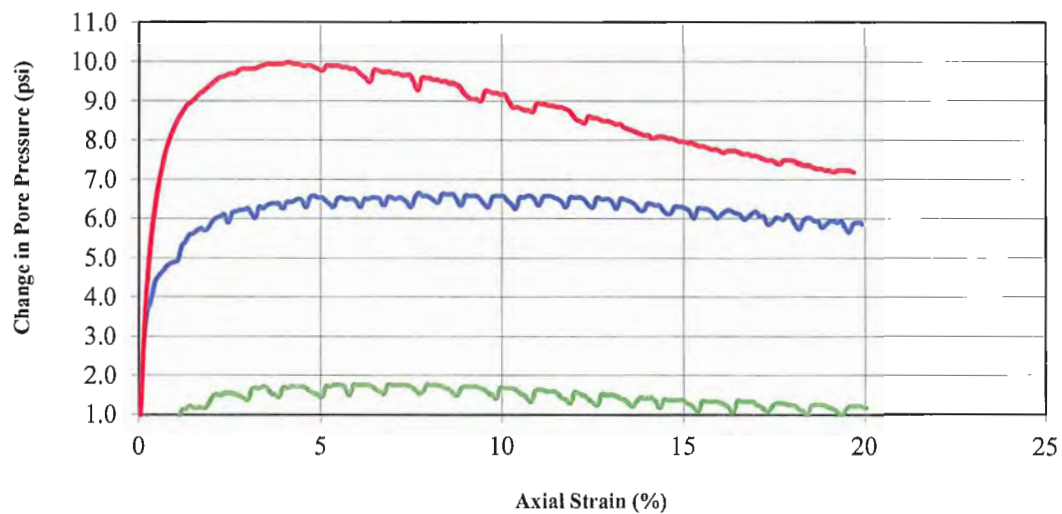


Consolidated Undrained Triaxial Test (ASTM D4767)

Stress Paths (Effective)
($a = 0.4$ $\alpha = 31.6$)



Change in Pore Pressure vs. Axial Strain





File Location
B-65 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-65
Sample Description: Red & Brown Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 36.000
PL: 26.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.803	2.803	
Height (in)	5.618	5.618	
Weight (grams)	1072.10		1127.30
Moisture (%)	18.07		24.15
Dry Density (pcf)	99.76	99.75	
Saturation (%)	72.73	100.00	
Void Ratio	0.655	0.658	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 94.200
Effective Confining Stress (psi): 5.0
Corrected Peak Deviator Stress (psi): 12.610 at reading number: 6

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	-20.0	0.000	89.2	0.0	6.17	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	38.3	0.006	90.0	0.8	6.18	0.107	9.439	9.429	14.4	5.0	13.6	4.2	3.25	0.09	9.7	4.7	8.9
2	46.9	0.012	90.1	0.9	6.19	0.214	10.839	10.815	15.8	5.0	14.9	4.1	3.64	0.08	10.4	5.4	9.5
3	52.7	0.018	90.1	0.9	6.19	0.321	11.785	11.747	16.7	5.0	15.9	4.1	3.84	0.07	10.9	5.9	10.0
4	56.1	0.024	90.0	0.8	6.20	0.428	12.332	12.279	17.3	5.0	16.5	4.2	3.91	0.06	11.1	6.1	10.4
5	57.9	0.030	89.9	0.7	6.21	0.534	12.625	12.557	17.6	5.0	16.8	4.3	3.94	0.06	11.3	6.3	10.5
6	58.3	0.036	89.9	0.7	6.21	0.641	12.691	12.610	17.6	5.0	16.9	4.3	3.93	0.05	11.3	6.3	10.6
7	58.1	0.042	89.9	0.7	6.22	0.748	12.651	12.557	17.6	5.0	16.9	4.3	3.92	0.06	11.3	6.3	10.6
8	57.4	0.048	89.9	0.7	6.23	0.855	12.545	12.438	17.4	5.0	16.7	4.3	3.89	0.06	11.2	6.2	10.5
9	56.5	0.055	89.9	0.7	6.23	0.962	12.398	12.279	17.3	5.0	16.5	4.3	3.88	0.06	11.1	6.1	10.4
10	55.7	0.061	90.0	0.8	6.24	1.069	12.265	12.134	17.1	5.0	16.4	4.2	3.87	0.06	11.1	6.1	10.3
11	55.0	0.067	90.3	1.1	6.25	1.176	12.158	12.015	17.0	5.0	15.9	3.9	4.08	0.09	11.0	6.0	9.9
12	54.5	0.073	90.3	1.1	6.25	1.283	12.065	11.910	16.9	5.0	15.8	3.9	4.09	0.10	11.0	6.0	9.8
13	54.1	0.079	90.4	1.2	6.26	1.389	11.998	11.832	16.8	5.0	15.6	3.8	4.13	0.10	10.9	5.9	9.7
14	53.6	0.085	90.4	1.2	6.27	1.496	11.918	11.740	16.7	5.0	15.6	3.8	4.08	0.10	10.9	5.9	9.7
15	53.1	0.091	90.4	1.2	6.27	1.603	11.838	11.649	16.6	5.0	15.5	3.8	4.05	0.10	10.8	5.8	9.6
16	52.7	0.097	90.4	1.2	6.28	1.710	11.772	11.570	16.6	5.0	15.4	3.8	4.03	0.10	10.8	5.8	9.6
17	52.4	0.103	90.4	1.2	6.29	1.817	11.732	11.519	16.5	5.0	15.3	3.8	4.02	0.10	10.8	5.8	9.6
18	52.1	0.109	90.5	1.3	6.29	1.924	11.678	11.454	16.5	5.0	15.1	3.7	4.10	0.11	10.7	5.7	9.4



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	52.0	0.115	90.7	1.5	6.30	2.031	11.665	11.428	16.4	5.0	15.0	3.5	4.24	0.13	10.7	5.7	9.2
20	52.0	0.121	90.7	1.5	6.31	2.138	11.665	11.416	16.4	5.0	14.9	3.5	4.27	0.13	10.7	5.7	9.2
21	51.9	0.127	90.7	1.5	6.31	2.244	11.652	11.390	16.4	5.0	14.9	3.5	4.26	0.13	10.7	5.7	9.2
22	51.8	0.133	90.7	1.5	6.32	2.351	11.625	11.352	16.4	5.0	14.8	3.5	4.29	0.14	10.7	5.7	9.1
23	51.9	0.139	90.7	1.5	6.33	2.458	11.652	11.365	16.4	5.0	14.8	3.5	4.29	0.14	10.7	5.7	9.1
24	51.9	0.145	90.7	1.5	6.33	2.565	11.652	11.353	16.4	5.0	14.8	3.5	4.29	0.14	10.7	5.7	9.1
25	52.1	0.151	90.7	1.5	6.34	2.672	11.678	11.366	16.4	5.0	14.9	3.5	4.26	0.13	10.7	5.7	9.2
26	52.1	0.157	90.7	1.5	6.35	2.779	11.678	11.354	16.4	5.0	14.9	3.5	4.21	0.13	10.7	5.7	9.2
27	51.9	0.163	90.6	1.4	6.36	2.886	11.652	11.315	16.3	5.0	14.9	3.6	4.17	0.13	10.7	5.7	9.2
28	52.0	0.169	90.6	1.4	6.36	2.993	11.665	11.316	16.3	5.0	14.9	3.6	4.13	0.12	10.7	5.7	9.3
29	51.9	0.175	90.8	1.6	6.37	3.099	11.652	11.291	16.3	5.0	14.7	3.4	4.35	0.14	10.6	5.6	9.0
30	52.1	0.181	90.9	1.7	6.38	3.206	11.678	11.304	16.3	5.0	14.6	3.3	4.40	0.15	10.7	5.7	9.0
31	51.9	0.187	90.9	1.7	6.38	3.313	11.652	11.266	16.3	5.0	14.6	3.3	4.39	0.15	10.6	5.6	9.0
32	52.0	0.193	90.9	1.7	6.39	3.420	11.665	11.266	16.3	5.0	14.6	3.3	4.43	0.15	10.6	5.6	8.9
33	52.0	0.199	90.9	1.7	6.40	3.527	11.665	11.254	16.3	5.0	14.6	3.3	4.38	0.15	10.6	5.6	9.0
34	51.9	0.205	90.7	1.5	6.40	3.634	11.652	11.228	16.2	5.0	14.7	3.5	4.25	0.14	10.6	5.6	9.1
35	51.9	0.211	90.7	1.5	6.41	3.741	11.652	11.216	16.2	5.0	14.7	3.5	4.21	0.13	10.6	5.6	9.1
36	51.8	0.217	90.7	1.5	6.42	3.848	11.625	11.178	16.2	5.0	14.7	3.5	4.16	0.13	10.6	5.6	9.1
37	51.6	0.223	90.9	1.7	6.43	3.954	11.598	11.140	16.1	5.0	14.5	3.3	4.35	0.15	10.6	5.6	8.9
38	51.9	0.229	90.9	1.7	6.43	4.061	11.652	11.178	16.2	5.0	14.5	3.3	4.36	0.15	10.6	5.6	8.9
39	51.8	0.235	90.9	1.7	6.44	4.168	11.638	11.153	16.2	5.0	14.4	3.3	4.39	0.15	10.6	5.6	8.9
40	51.9	0.241	90.9	1.7	6.45	4.275	11.652	11.154	16.2	5.0	14.4	3.3	4.39	0.15	10.6	5.6	8.9
41	51.8	0.247	90.9	1.7	6.45	4.382	11.638	11.128	16.1	5.0	14.4	3.3	4.39	0.15	10.6	5.6	8.9
42	52.2	0.253	90.9	1.7	6.46	4.489	11.692	11.167	16.2	5.0	14.5	3.3	4.40	0.15	10.6	5.6	8.9
43	52.2	0.259	90.9	1.7	6.47	4.596	11.705	11.167	16.2	5.0	14.5	3.3	4.36	0.15	10.6	5.6	8.9
44	52.2	0.265	90.8	1.6	6.48	4.703	11.705	11.155	16.2	5.0	14.6	3.4	4.27	0.14	10.6	5.6	9.0
45	52.3	0.271	90.7	1.5	6.48	4.809	11.718	11.155	16.2	5.0	14.6	3.5	4.23	0.14	10.6	5.6	9.0
46	52.4	0.277	90.7	1.5	6.49	4.916	11.732	11.155	16.2	5.0	14.6	3.5	4.20	0.14	10.6	5.6	9.1
47	52.3	0.283	90.7	1.5	6.50	5.023	11.718	11.130	16.1	5.0	14.7	3.5	4.15	0.13	10.6	5.6	9.1
48	52.3	0.289	90.9	1.7	6.51	5.130	11.718	11.117	16.1	5.0	14.4	3.3	4.38	0.15	10.6	5.6	8.8
49	52.7	0.295	90.9	1.7	6.51	5.237	11.772	11.155	16.2	5.0	14.4	3.3	4.39	0.15	10.6	5.6	8.9
50	52.7	0.301	91.0	1.8	6.52	5.344	11.785	11.155	16.2	5.0	14.4	3.2	4.44	0.16	10.6	5.6	8.8
51	52.6	0.307	91.0	1.8	6.53	5.451	11.758	11.117	16.1	5.0	14.4	3.2	4.42	0.16	10.6	5.6	8.8
52	52.8	0.313	91.0	1.8	6.54	5.558	11.798	11.143	16.1	5.0	14.4	3.2	4.43	0.16	10.6	5.6	8.8
53	52.6	0.319	90.9	1.7	6.54	5.664	11.758	11.092	16.1	5.0	14.4	3.3	4.33	0.15	10.5	5.5	8.9
54	52.5	0.325	90.7	1.5	6.55	5.771	11.745	11.067	16.1	5.0	14.6	3.5	4.17	0.14	10.5	5.5	9.0
55	53.0	0.331	91.0	1.8	6.56	5.878	11.825	11.130	16.1	5.0	14.4	3.2	4.43	0.16	10.6	5.6	8.8
56	53.0	0.337	91.0	1.8	6.56	5.985	11.825	11.117	16.1	5.0	14.4	3.2	4.42	0.16	10.6	5.6	8.8
57	53.1	0.343	91.0	1.8	6.57	6.092	11.838	11.117	16.1	5.0	14.4	3.2	4.42	0.16	10.6	5.6	8.8
58	53.1	0.349	91.0	1.8	6.58	6.199	11.838	11.104	16.1	5.0	14.4	3.2	4.42	0.16	10.6	5.6	8.8
59	53.1	0.355	91.0	1.8	6.59	6.306	11.838	11.092	16.1	5.0	14.3	3.2	4.42	0.16	10.5	5.5	8.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	53.3	0.361	90.9	1.7	6.59	6.413	11.878	11.117	16.1	5.0	14.4	3.3	4.38	0.15	10.6	5.6	8.8
61	53.4	0.367	90.8	1.6	6.60	6.519	11.892	11.116	16.1	5.0	14.5	3.4	4.30	0.15	10.6	5.6	8.9
62	53.6	0.373	90.8	1.6	6.61	6.626	11.932	11.141	16.1	5.0	14.6	3.4	4.27	0.14	10.6	5.6	9.0
63	53.7	0.379	90.7	1.5	6.62	6.733	11.945	11.141	16.1	5.0	14.6	3.5	4.23	0.14	10.6	5.6	9.0
64	53.6	0.385	91.0	1.8	6.63	6.840	11.932	11.115	16.1	5.0	14.4	3.2	4.42	0.16	10.6	5.6	8.8
65	53.9	0.391	91.0	1.8	6.63	6.947	11.972	11.140	16.1	5.0	14.4	3.2	4.43	0.16	10.6	5.6	8.8
66	54.1	0.397	91.0	1.8	6.64	7.054	12.012	11.164	16.2	5.0	14.4	3.2	4.44	0.16	10.6	5.6	8.8
67	54.1	0.403	91.0	1.8	6.65	7.161	11.998	11.139	16.1	5.0	14.4	3.2	4.43	0.16	10.6	5.6	8.8
68	54.1	0.409	91.0	1.8	6.66	7.268	12.012	11.139	16.1	5.0	14.4	3.2	4.43	0.16	10.6	5.6	8.8
69	54.0	0.415	91.0	1.8	6.66	7.374	11.985	11.101	16.1	5.0	14.3	3.2	4.42	0.16	10.5	5.6	8.8
70	54.2	0.421	90.9	1.7	6.67	7.481	12.025	11.125	16.1	5.0	14.4	3.3	4.38	0.15	10.6	5.6	8.8
71	54.2	0.427	90.8	1.6	6.68	7.588	12.025	11.112	16.1	5.0	14.5	3.4	4.30	0.15	10.6	5.6	8.9
72	54.2	0.433	90.7	1.5	6.69	7.695	12.025	11.100	16.1	5.0	14.5	3.5	4.22	0.14	10.5	5.5	9.0
73	54.4	0.439	90.8	1.6	6.69	7.802	12.052	11.111	16.1	5.0	14.5	3.4	4.26	0.14	10.6	5.6	9.0
74	54.5	0.445	91.0	1.8	6.70	7.909	12.078	11.123	16.1	5.0	14.4	3.2	4.43	0.16	10.6	5.6	8.8
75	54.9	0.451	91.0	1.8	6.71	8.016	12.132	11.159	16.2	5.0	14.4	3.2	4.44	0.16	10.6	5.6	8.8
76	55.2	0.457	91.0	1.8	6.72	8.123	12.185	11.195	16.2	5.0	14.4	3.2	4.45	0.16	10.6	5.6	8.8
77	55.5	0.463	91.0	1.8	6.73	8.229	12.238	11.231	16.2	5.0	14.5	3.2	4.46	0.16	10.6	5.6	8.9
78	55.5	0.469	90.9	1.7	6.73	8.336	12.238	11.218	16.2	5.0	14.5	3.3	4.41	0.15	10.6	5.6	8.9
79	55.6	0.475	90.9	1.7	6.74	8.443	12.252	11.217	16.2	5.0	14.5	3.3	4.37	0.15	10.6	5.6	8.9
80	56.1	0.481	90.8	1.6	6.75	8.550	12.332	11.277	16.3	5.0	14.6	3.4	4.35	0.14	10.6	5.6	9.0
81	56.1	0.487	90.7	1.5	6.76	8.657	12.332	11.264	16.3	5.0	14.7	3.5	4.26	0.14	10.6	5.6	9.1
82	56.4	0.493	90.7	1.5	6.76	8.764	12.372	11.287	16.3	5.0	14.8	3.5	4.23	0.13	10.6	5.6	9.1
83	56.4	0.499	90.9	1.7	6.77	8.871	12.385	11.286	16.3	5.0	14.6	3.3	4.39	0.15	10.6	5.6	9.0
84	56.5	0.505	90.9	1.7	6.78	8.978	12.398	11.285	16.3	5.0	14.6	3.3	4.43	0.15	10.6	5.6	8.9
85	56.8	0.511	90.9	1.7	6.79	9.084	12.438	11.308	16.3	5.0	14.6	3.3	4.44	0.15	10.7	5.7	8.9
86	56.9	0.517	90.9	1.7	6.80	9.191	12.451	11.307	16.3	5.0	14.6	3.3	4.44	0.15	10.7	5.7	8.9
87	56.9	0.523	90.9	1.7	6.80	9.298	12.465	11.306	16.3	5.0	14.6	3.3	4.44	0.15	10.7	5.7	8.9
88	57.1	0.529	90.9	1.7	6.81	9.405	12.491	11.317	16.3	5.0	14.6	3.3	4.40	0.15	10.7	5.7	9.0
89	57.4	0.535	90.8	1.6	6.82	9.512	12.545	11.352	16.4	5.0	14.7	3.4	4.37	0.14	10.7	5.7	9.0
90	57.5	0.541	90.7	1.5	6.83	9.619	12.558	11.350	16.3	5.0	14.8	3.5	4.29	0.14	10.7	5.7	9.1
91	57.6	0.547	90.7	1.5	6.84	9.726	12.571	11.349	16.3	5.0	14.8	3.5	4.25	0.13	10.7	5.7	9.2
92	57.7	0.553	90.6	1.4	6.85	9.833	12.585	11.347	16.3	5.0	14.9	3.6	4.18	0.13	10.7	5.7	9.2
93	57.9	0.559	90.9	1.7	6.85	9.939	12.625	11.370	16.4	5.0	14.7	3.3	4.42	0.15	10.7	5.7	9.0
94	58.4	0.565	90.9	1.7	6.86	10.046	12.705	11.428	16.4	5.0	14.8	3.3	4.43	0.15	10.7	5.7	9.0
95	58.4	0.571	90.9	1.7	6.87	10.153	12.705	11.415	16.4	5.0	14.7	3.3	4.43	0.15	10.7	5.7	9.0
96	58.5	0.577	90.9	1.7	6.88	10.260	12.718	11.413	16.4	5.0	14.7	3.3	4.43	0.15	10.7	5.7	9.0
97	58.7	0.583	90.8	1.6	6.89	10.367	12.745	11.424	16.4	5.0	14.8	3.4	4.39	0.14	10.7	5.7	9.1
98	58.8	0.589	90.7	1.5	6.89	10.474	12.771	11.434	16.4	5.0	14.9	3.5	4.31	0.14	10.7	5.7	9.2
99	58.8	0.595	90.7	1.5	6.90	10.581	12.771	11.420	16.4	5.0	14.9	3.5	4.27	0.13	10.7	5.7	9.2
100	58.8	0.601	90.6	1.4	6.91	10.688	12.771	11.406	16.4	5.0	15.0	3.6	4.19	0.13	10.7	5.7	9.3



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Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	58.8	0.607	90.5	1.3	6.92	10.794	12.771	11.393	16.4	5.0	15.0	3.7	4.12	0.12	10.7	5.7	9.4
102	58.7	0.613	90.8	1.6	6.93	10.901	12.745	11.355	16.4	5.0	14.8	3.4	4.33	0.14	10.7	5.7	9.1
103	58.9	0.619	90.8	1.6	6.94	11.008	12.785	11.377	16.4	5.0	14.7	3.4	4.38	0.14	10.7	5.7	9.1
104	58.8	0.625	90.8	1.6	6.94	11.115	12.771	11.352	16.4	5.0	14.7	3.4	4.37	0.14	10.7	5.7	9.0
105	59.1	0.631	90.8	1.6	6.95	11.222	12.811	11.374	16.4	5.0	14.8	3.4	4.34	0.14	10.7	5.7	9.1
106	59.2	0.637	90.8	1.6	6.96	11.329	12.838	11.384	16.4	5.0	14.8	3.4	4.34	0.14	10.7	5.7	9.1
107	59.5	0.643	90.8	1.6	6.97	11.436	12.878	11.405	16.4	5.0	14.8	3.4	4.35	0.14	10.7	5.7	9.1
108	59.7	0.649	90.7	1.5	6.98	11.543	12.918	11.427	16.4	5.0	14.9	3.5	4.27	0.13	10.7	5.7	9.2
109	59.8	0.655	90.6	1.4	6.99	11.649	12.931	11.425	16.4	5.0	15.0	3.6	4.20	0.12	10.7	5.7	9.3
110	60.1	0.661	90.6	1.4	6.99	11.756	12.985	11.458	16.5	5.0	15.1	3.6	4.17	0.12	10.7	5.7	9.3
111	60.3	0.667	90.5	1.3	7.00	11.863	13.011	11.468	16.5	5.0	15.2	3.7	4.10	0.11	10.7	5.7	9.4
112	60.6	0.673	90.7	1.5	7.01	11.970	13.051	11.489	16.5	5.0	14.9	3.5	4.33	0.13	10.7	5.7	9.2
113	61.0	0.679	90.7	1.5	7.02	12.077	13.118	11.534	16.5	5.0	15.0	3.5	4.34	0.13	10.8	5.8	9.2
114	61.2	0.685	90.7	1.5	7.03	12.184	13.158	11.555	16.6	5.0	15.0	3.5	4.31	0.13	10.8	5.8	9.3
115	61.5	0.691	90.7	1.5	7.04	12.291	13.198	11.576	16.6	5.0	15.1	3.5	4.28	0.13	10.8	5.8	9.3
116	61.5	0.697	90.6	1.4	7.05	12.398	13.198	11.562	16.6	5.0	15.2	3.6	4.20	0.12	10.8	5.8	9.4
117	61.7	0.703	90.5	1.3	7.05	12.505	13.238	11.583	16.6	5.0	15.3	3.7	4.13	0.11	10.8	5.8	9.5
118	61.7	0.709	90.5	1.3	7.06	12.611	13.238	11.568	16.6	5.0	15.3	3.7	4.10	0.11	10.8	5.8	9.5
119	61.7	0.715	90.7	1.5	7.07	12.718	13.238	11.554	16.6	5.0	15.0	3.5	4.31	0.13	10.8	5.8	9.3
120	62.0	0.721	90.7	1.5	7.08	12.825	13.278	11.575	16.6	5.0	15.1	3.5	4.32	0.13	10.8	5.8	9.3
121	62.4	0.727	90.7	1.5	7.09	12.932	13.345	11.619	16.6	5.0	15.1	3.5	4.33	0.13	10.8	5.8	9.3
122	62.5	0.733	90.7	1.5	7.10	13.039	13.371	11.628	16.6	5.0	15.1	3.5	4.33	0.13	10.8	5.8	9.3
123	62.7	0.739	90.7	1.5	7.11	13.146	13.398	11.637	16.6	5.0	15.2	3.5	4.29	0.13	10.8	5.8	9.4
124	63.1	0.745	90.6	1.4	7.11	13.253	13.465	11.680	16.7	5.0	15.3	3.6	4.27	0.12	10.8	5.8	9.4
125	63.1	0.751	90.6	1.4	7.12	13.360	13.465	11.666	16.7	5.0	15.3	3.6	4.23	0.12	10.8	5.8	9.4
126	63.2	0.757	90.5	1.3	7.13	13.466	13.478	11.663	16.7	5.0	15.4	3.7	4.16	0.11	10.8	5.8	9.5
127	63.4	0.763	90.4	1.2	7.14	13.573	13.518	11.683	16.7	5.0	15.5	3.8	4.09	0.10	10.8	5.8	9.6
128	63.5	0.769	90.5	1.3	7.15	13.680	13.531	11.680	16.7	5.0	15.3	3.7	4.20	0.12	10.8	5.8	9.5
129	63.8	0.775	90.6	1.4	7.16	13.787	13.585	11.712	16.7	5.0	15.3	3.6	4.28	0.12	10.9	5.9	9.4
130	64.0	0.781	90.6	1.4	7.17	13.894	13.611	11.720	16.7	5.0	15.3	3.6	4.28	0.12	10.9	5.9	9.4
131	63.9	0.787	90.6	1.4	7.18	14.001	13.598	11.694	16.7	5.0	15.3	3.6	4.27	0.12	10.8	5.8	9.4
132	64.3	0.793	90.6	1.4	7.19	14.108	13.665	11.737	16.7	5.0	15.3	3.6	4.29	0.12	10.9	5.9	9.4
133	64.5	0.799	90.5	1.3	7.19	14.215	13.691	11.745	16.7	5.0	15.4	3.7	4.21	0.11	10.9	5.9	9.5
134	64.3	0.805	90.4	1.2	7.20	14.321	13.665	11.708	16.7	5.0	15.5	3.8	4.07	0.10	10.9	5.9	9.7
135	64.3	0.811	90.6	1.4	7.21	14.428	13.665	11.693	16.7	5.0	15.3	3.6	4.24	0.12	10.8	5.8	9.5
136	64.4	0.817	90.6	1.4	7.22	14.535	13.678	11.690	16.7	5.0	15.3	3.6	4.24	0.12	10.8	5.8	9.5
137	64.9	0.823	90.6	1.4	7.23	14.642	13.758	11.743	16.7	5.0	15.4	3.6	4.25	0.12	10.9	5.9	9.5
138	65.2	0.829	90.6	1.4	7.24	14.749	13.811	11.774	16.8	5.0	15.4	3.6	4.26	0.12	10.9	5.9	9.5
139	65.2	0.835	90.6	1.4	7.25	14.856	13.798	11.748	16.7	5.0	15.4	3.6	4.25	0.12	10.9	5.9	9.5
140	65.6	0.841	90.6	1.4	7.26	14.963	13.864	11.790	16.8	5.0	15.4	3.6	4.26	0.12	10.9	5.9	9.5
141	65.8	0.847	90.5	1.3	7.27	15.070	13.904	11.809	16.8	5.0	15.5	3.7	4.20	0.11	10.9	5.9	9.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	66.1	0.853	90.5	1.3	7.28	15.176	13.958	11.839	16.8	5.0	15.6	3.7	4.17	0.11	10.9	5.9	9.7
143	66.1	0.859	90.4	1.2	7.29	15.283	13.944	11.813	16.8	5.0	15.6	3.8	4.09	0.10	10.9	5.9	9.7
144	66.1	0.865	90.3	1.1	7.29	15.390	13.958	11.810	16.8	5.0	15.7	3.9	4.03	0.09	10.9	5.9	9.8
145	66.7	0.871	90.5	1.3	7.30	15.497	14.051	11.874	16.9	5.0	15.5	3.7	4.25	0.11	10.9	5.9	9.6
146	66.9	0.877	90.5	1.3	7.31	15.604	14.078	11.881	16.9	5.0	15.5	3.7	4.25	0.11	10.9	5.9	9.6
147	67.2	0.883	90.5	1.3	7.32	15.711	14.131	11.911	16.9	5.0	15.6	3.7	4.26	0.11	11.0	6.0	9.6
148	67.5	0.889	90.5	1.3	7.33	15.818	14.171	11.930	16.9	5.0	15.6	3.7	4.26	0.11	11.0	6.0	9.6
149	67.5	0.895	90.5	1.3	7.34	15.925	14.184	11.926	16.9	5.0	15.6	3.7	4.26	0.11	11.0	6.0	9.6
150	67.4	0.901	90.5	1.3	7.35	16.031	14.158	11.888	16.9	5.0	15.6	3.7	4.22	0.11	10.9	5.9	9.6
151	67.4	0.907	90.5	1.3	7.36	16.138	14.158	11.873	16.9	5.0	15.6	3.7	4.18	0.11	10.9	5.9	9.7
152	67.4	0.913	90.4	1.2	7.37	16.245	14.158	11.858	16.9	5.0	15.7	3.8	4.11	0.10	10.9	5.9	9.7
153	67.8	0.919	90.3	1.1	7.38	16.352	14.224	11.898	16.9	5.0	15.8	3.9	4.02	0.09	10.9	5.9	9.9
154	68.0	0.925	90.5	1.3	7.39	16.459	14.251	11.905	16.9	5.0	15.6	3.7	4.26	0.11	11.0	6.0	9.6
155	68.3	0.931	90.5	1.3	7.40	16.566	14.304	11.935	16.9	5.0	15.6	3.7	4.27	0.11	11.0	6.0	9.6
156	68.5	0.937	90.5	1.3	7.41	16.673	14.344	11.953	17.0	5.0	15.6	3.7	4.27	0.11	11.0	6.0	9.6
157	68.7	0.943	90.5	1.3	7.42	16.780	14.371	11.960	17.0	5.0	15.6	3.7	4.27	0.11	11.0	6.0	9.6
158	68.9	0.949	90.5	1.3	7.43	16.886	14.411	11.978	17.0	5.0	15.6	3.7	4.28	0.11	11.0	6.0	9.6
159	69.1	0.955	90.5	1.3	7.44	16.993	14.438	11.984	17.0	5.0	15.7	3.7	4.21	0.11	11.0	6.0	9.7
160	69.1	0.961	90.4	1.2	7.45	17.100	14.438	11.969	17.0	5.0	15.7	3.8	4.17	0.10	11.0	6.0	9.8
161	69.2	0.967	90.3	1.1	7.45	17.207	14.451	11.964	17.0	5.0	15.8	3.9	4.10	0.10	11.0	6.0	9.8
162	69.4	0.973	90.3	1.1	7.46	17.314	14.478	11.971	17.0	5.0	15.9	3.9	4.07	0.09	11.0	6.0	9.9
163	69.4	0.979	90.4	1.2	7.47	17.421	14.491	11.967	17.0	5.0	15.7	3.8	4.17	0.10	11.0	6.0	9.8
164	69.7	0.985	90.5	1.3	7.48	17.528	14.531	11.384	16.4	5.0	15.1	3.7	4.08	0.11	10.7	5.7	9.4
165	69.4	0.991	90.5	1.3	7.49	17.635	14.491	11.332	16.3	5.0	15.0	3.7	4.07	0.12	10.7	5.7	9.4
166	69.6	0.997	90.5	1.3	7.50	17.741	14.518	11.334	16.3	5.0	15.0	3.7	4.07	0.12	10.7	5.7	9.4
167	69.6	1.003	90.5	1.3	7.51	17.848	14.518	11.315	16.3	5.0	15.1	3.7	4.03	0.11	10.7	5.7	9.4
168	69.8	1.009	90.5	1.3	7.52	17.955	14.544	11.318	16.3	5.0	15.1	3.7	4.03	0.11	10.7	5.7	9.4
169	70.3	1.015	90.4	1.2	7.53	18.062	14.624	11.364	16.4	5.0	15.1	3.8	4.01	0.11	10.7	5.7	9.5
170	70.3	1.021	90.3	1.1	7.54	18.169	14.624	11.345	16.3	5.0	15.2	3.9	3.94	0.10	10.7	5.7	9.5
171	70.3	1.027	90.3	1.1	7.55	18.276	14.638	11.337	16.3	5.0	15.2	3.9	3.91	0.10	10.7	5.7	9.6
172	70.6	1.033	90.2	1.0	7.56	18.383	14.678	11.350	16.3	5.0	15.3	4.0	3.85	0.09	10.7	5.7	9.7
173	70.7	1.039	90.4	1.2	7.57	18.490	14.691	11.341	16.3	5.0	15.1	3.8	4.00	0.11	10.7	5.7	9.4
174	70.8	1.045	90.5	1.3	7.58	18.596	14.718	11.344	16.3	5.0	15.1	3.7	4.04	0.11	10.7	5.7	9.4
175	71.6	1.051	90.5	1.3	7.59	18.703	14.838	11.422	16.4	5.0	15.2	3.7	4.06	0.11	10.7	5.7	9.4
176	71.6	1.057	90.5	1.3	7.60	18.810	14.838	11.402	16.4	5.0	15.1	3.7	4.05	0.11	10.7	5.7	9.4
177	71.9	1.063	90.4	1.2	7.61	18.917	14.891	11.426	16.4	5.0	15.2	3.8	4.03	0.11	10.7	5.7	9.5
178	72.2	1.069	90.4	1.2	7.62	19.024	14.944	11.450	16.4	5.0	15.3	3.8	4.00	0.10	10.7	5.7	9.5
179	72.4	1.075	90.3	1.1	7.63	19.131	14.971	11.452	16.5	5.0	15.3	3.9	3.97	0.10	10.7	5.7	9.6
180	72.8	1.081	90.3	1.1	7.64	19.238	15.038	11.486	16.5	5.0	15.4	3.9	3.92	0.09	10.7	5.7	9.7
181	72.9	1.087	90.2	1.0	7.65	19.345	15.051	11.477	16.5	5.0	15.5	4.0	3.88	0.09	10.7	5.7	9.7
182	73.1	1.093	90.3	1.1	7.66	19.451	15.078	11.479	16.5	5.0	15.3	3.9	3.98	0.10	10.7	5.7	9.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	73.1	1.099	90.4	1.2	7.67	19.558	15.091	11.470	16.5	5.0	15.2	3.8	4.04	0.11	10.7	5.7	9.5
184	73.5	1.105	90.4	1.2	7.68	19.665	15.144	11.493	16.5	5.0	15.3	3.8	4.04	0.11	10.7	5.7	9.5
185	73.6	1.111	90.4	1.2	7.69	19.772	15.157	11.483	16.5	5.0	15.3	3.8	4.04	0.11	10.7	5.7	9.5
186	73.7	1.117	90.4	1.2	7.70	19.879	15.184	11.485	16.5	5.0	15.3	3.8	4.04	0.11	10.7	5.7	9.5
187	74.0	1.123	90.4	1.2	7.71	19.986	15.237	11.508	16.5	5.0	15.3	3.8	4.01	0.10	10.8	5.8	9.6
188	74.1	1.125	90.4	1.2	7.72	20.010	15.251	11.514	16.5	5.0	15.3	3.8	4.02	0.10	10.8	5.8	9.6



File Location
B-65 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-65
Sample Description: Red & Brown Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 36.000
PL: 26.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.802	2.800	
Height (in)	5.634	5.623	
Weight (grams)	1073.10		1128.70
Moisture (%)	18.20		24.32
Dry Density (pcf)	99.54	99.91	
Saturation (%)	72.85	100.00	
Void Ratio	0.658	0.656	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 98.200
Effective Confining Stress (psi): 10.0
Corrected Peak Deviator Stress (psi): 16.410 at reading number: 8

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	-10.0	0.006	88.2	0.0	6.16	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	38.4	0.012	90.7	2.5	6.16	0.107	7.865	7.857	17.9	10.0	15.4	7.5	2.05	0.32	14.0	3.9	11.4
2	57.5	0.018	91.7	3.6	6.17	0.214	10.965	10.942	21.0	10.0	17.4	6.5	2.69	0.33	15.5	5.5	11.9
3	69.8	0.024	92.1	3.9	6.18	0.320	12.956	12.915	23.0	10.0	19.1	6.1	3.10	0.30	16.5	6.5	12.6
4	78.7	0.030	92.5	4.4	6.18	0.427	14.400	14.338	24.4	10.0	20.0	5.7	3.53	0.31	17.2	7.2	12.8
5	85.0	0.036	92.7	4.5	6.19	0.534	15.429	15.346	25.4	10.0	20.9	5.5	3.79	0.30	17.7	7.7	13.2
6	89.0	0.042	92.8	4.7	6.20	0.641	16.083	15.980	26.0	10.0	21.4	5.4	3.97	0.29	18.0	8.0	13.4
7	91.1	0.048	92.9	4.8	6.20	0.748	16.418	16.295	26.3	10.0	21.6	5.3	4.09	0.29	18.2	8.1	13.4
8	91.9	0.055	93.0	4.9	6.21	0.854	16.551	16.410	26.5	10.0	21.6	5.2	4.16	0.30	18.2	8.2	13.4
9	91.7	0.061	93.1	4.9	6.22	0.961	16.511	16.352	26.4	10.0	21.5	5.1	4.18	0.30	18.2	8.2	13.3
10	91.1	0.067	93.1	4.9	6.22	1.068	16.418	16.242	26.3	10.0	21.3	5.1	4.18	0.30	18.2	8.1	13.2
11	90.3	0.073	93.5	5.3	6.23	1.175	16.284	16.093	26.1	10.0	20.8	4.7	4.39	0.33	18.1	8.0	12.8
12	89.3	0.079	93.6	5.4	6.24	1.282	16.137	15.930	26.0	10.0	20.6	4.6	4.45	0.34	18.0	8.0	12.6
13	88.5	0.085	93.7	5.6	6.24	1.388	16.003	15.781	25.8	10.0	20.2	4.5	4.54	0.35	17.9	7.9	12.4
14	88.0	0.091	93.8	5.6	6.25	1.495	15.910	15.672	25.7	10.0	20.1	4.4	4.54	0.36	17.9	7.8	12.3
15	87.0	0.097	93.9	5.7	6.26	1.602	15.749	15.497	25.5	10.0	19.8	4.3	4.57	0.37	17.8	7.7	12.1
16	86.4	0.103	93.9	5.7	6.26	1.709	15.656	15.388	25.4	10.0	19.7	4.3	4.58	0.37	17.7	7.7	12.0
17	85.7	0.109	93.9	5.7	6.27	1.815	15.549	15.267	25.3	10.0	19.6	4.3	4.52	0.37	17.7	7.6	12.0
18	85.1	0.115	93.9	5.8	6.28	1.922	15.442	15.145	25.2	10.0	19.4	4.3	4.55	0.38	17.6	7.6	11.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	85.0	0.121	94.1	5.9	6.28	2.029	15.429	15.116	25.2	10.0	19.2	4.1	4.69	0.39	17.6	7.6	11.7
20	84.7	0.127	94.2	6.0	6.29	2.136	15.389	15.060	25.1	10.0	19.1	4.0	4.75	0.40	17.6	7.5	11.6
21	84.4	0.133	94.2	6.1	6.30	2.243	15.335	14.991	25.0	10.0	19.0	4.0	4.77	0.40	17.5	7.5	11.5
22	84.2	0.139	94.3	6.1	6.30	2.349	15.295	14.936	25.0	10.0	18.9	3.9	4.79	0.41	17.5	7.5	11.4
23	83.9	0.145	94.1	5.9	6.31	2.456	15.255	14.880	24.9	10.0	19.0	4.1	4.59	0.40	17.5	7.4	11.6
24	83.8	0.151	94.3	6.1	6.32	2.563	15.242	14.851	24.9	10.0	18.8	3.9	4.81	0.41	17.5	7.4	11.3
25	83.7	0.157	94.3	6.2	6.33	2.670	15.215	14.809	24.9	10.0	18.7	3.9	4.84	0.42	17.4	7.4	11.3
26	83.5	0.163	94.4	6.2	6.33	2.777	15.188	14.766	24.8	10.0	18.6	3.8	4.87	0.42	17.4	7.4	11.2
27	83.4	0.169	94.4	6.2	6.34	2.883	15.175	14.737	24.8	10.0	18.6	3.8	4.86	0.42	17.4	7.4	11.2
28	83.3	0.175	94.4	6.3	6.35	2.990	15.148	14.695	24.7	10.0	18.5	3.8	4.89	0.43	17.4	7.3	11.1
29	82.9	0.181	94.3	6.1	6.35	3.097	15.095	14.627	24.7	10.0	18.5	3.9	4.75	0.42	17.4	7.3	11.2
30	82.7	0.187	94.2	6.0	6.36	3.204	15.054	14.572	24.6	10.0	18.6	4.0	4.62	0.41	17.3	7.3	11.3
31	82.7	0.193	94.5	6.3	6.37	3.311	15.054	14.556	24.6	10.0	18.3	3.7	4.89	0.43	17.3	7.3	11.0
32	82.7	0.199	94.4	6.3	6.37	3.417	15.054	14.540	24.6	10.0	18.3	3.8	4.85	0.43	17.3	7.3	11.1
33	82.5	0.205	94.5	6.3	6.38	3.524	15.028	14.498	24.5	10.0	18.2	3.7	4.92	0.44	17.3	7.2	10.9
34	82.4	0.211	94.5	6.4	6.39	3.631	15.014	14.469	24.5	10.0	18.1	3.7	4.95	0.44	17.3	7.2	10.9
35	82.2	0.217	94.5	6.4	6.40	3.738	14.974	14.415	24.5	10.0	18.1	3.7	4.94	0.44	17.2	7.2	10.9
36	82.1	0.223	94.5	6.4	6.40	3.845	14.961	14.386	24.4	10.0	18.0	3.7	4.93	0.44	17.2	7.2	10.9
37	81.9	0.229	94.4	6.3	6.41	3.951	14.934	14.344	24.4	10.0	18.1	3.8	4.79	0.44	17.2	7.2	11.0
38	81.9	0.235	94.6	6.4	6.42	4.058	14.934	14.328	24.4	10.0	17.9	3.6	4.96	0.45	17.2	7.2	10.8
39	82.0	0.241	94.6	6.4	6.42	4.165	14.948	14.325	24.4	10.0	17.9	3.6	4.96	0.45	17.2	7.2	10.8
40	81.9	0.247	94.6	6.5	6.43	4.272	14.934	14.296	24.3	10.0	17.9	3.6	4.99	0.45	17.2	7.1	10.7
41	81.9	0.253	94.7	6.5	6.44	4.378	14.934	14.280	24.3	10.0	17.8	3.5	5.03	0.46	17.2	7.1	10.7
42	81.9	0.259	94.6	6.5	6.45	4.485	14.934	14.264	24.3	10.0	17.8	3.6	4.99	0.45	17.2	7.1	10.7
43	81.9	0.265	94.5	6.3	6.45	4.592	14.921	14.236	24.3	10.0	18.0	3.7	4.81	0.44	17.2	7.1	10.9
44	81.8	0.271	94.7	6.5	6.46	4.699	14.907	14.207	24.2	10.0	17.7	3.5	5.06	0.46	17.1	7.1	10.6
45	81.9	0.277	94.7	6.6	6.47	4.806	14.934	14.216	24.3	10.0	17.7	3.5	5.11	0.46	17.2	7.1	10.6
46	81.9	0.283	94.7	6.5	6.47	4.912	14.934	14.201	24.2	10.0	17.7	3.5	5.06	0.46	17.1	7.1	10.6
47	81.9	0.289	94.7	6.5	6.48	5.019	14.934	14.185	24.2	10.0	17.7	3.5	5.05	0.46	17.1	7.1	10.6
48	81.9	0.295	94.6	6.5	6.49	5.126	14.934	14.169	24.2	10.0	17.7	3.6	4.96	0.46	17.1	7.1	10.7
49	81.9	0.301	94.5	6.4	6.50	5.233	14.921	14.140	24.2	10.0	17.8	3.7	4.86	0.45	17.1	7.1	10.7
50	82.0	0.307	94.5	6.3	6.50	5.340	14.948	14.149	24.2	10.0	17.9	3.7	4.78	0.45	17.1	7.1	10.8
51	81.9	0.313	94.7	6.5	6.51	5.446	14.934	14.121	24.2	10.0	17.7	3.5	4.99	0.46	17.1	7.1	10.6
52	82.1	0.319	94.7	6.5	6.52	5.553	14.961	14.130	24.2	10.0	17.6	3.5	5.04	0.46	17.1	7.1	10.6
53	82.3	0.325	94.7	6.5	6.53	5.660	14.988	14.139	24.2	10.0	17.7	3.5	5.00	0.46	17.1	7.1	10.6
54	82.2	0.331	94.7	6.5	6.53	5.767	14.974	14.111	24.2	10.0	17.6	3.5	4.99	0.46	17.1	7.1	10.6
55	82.3	0.337	94.7	6.5	6.54	5.874	14.988	14.107	24.1	10.0	17.6	3.5	4.99	0.46	17.1	7.1	10.6
56	82.1	0.343	94.6	6.4	6.55	5.980	14.961	14.066	24.1	10.0	17.7	3.6	4.89	0.46	17.1	7.0	10.7
57	82.1	0.349	94.5	6.3	6.56	6.087	14.961	14.050	24.1	10.0	17.8	3.7	4.76	0.45	17.1	7.0	10.8
58	82.1	0.355	94.7	6.5	6.56	6.194	14.961	14.034	24.1	10.0	17.6	3.5	4.97	0.46	17.1	7.0	10.6
59	82.2	0.361	94.7	6.5	6.57	6.301	14.974	14.031	24.1	10.0	17.6	3.5	4.96	0.46	17.1	7.0	10.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	82.1	0.367	94.7	6.5	6.58	6.408	14.961	14.002	24.0	10.0	17.5	3.5	5.00	0.47	17.0	7.0	10.5
61	82.2	0.373	94.7	6.5	6.59	6.514	14.974	13.999	24.0	10.0	17.5	3.5	5.00	0.47	17.0	7.0	10.5
62	82.0	0.379	94.7	6.5	6.59	6.621	14.948	13.958	24.0	10.0	17.5	3.5	4.94	0.47	17.0	7.0	10.5
63	82.1	0.385	94.5	6.3	6.60	6.728	14.961	13.954	24.0	10.0	17.7	3.7	4.77	0.45	17.0	7.0	10.7
64	82.0	0.391	94.7	6.5	6.61	6.835	14.948	13.926	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
65	82.1	0.397	94.7	6.5	6.62	6.942	14.961	13.922	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
66	82.3	0.403	94.7	6.5	6.62	7.048	14.988	13.931	24.0	10.0	17.5	3.5	4.94	0.47	17.0	7.0	10.5
67	82.4	0.409	94.7	6.5	6.63	7.155	15.001	13.928	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
68	82.4	0.415	94.7	6.5	6.64	7.262	15.001	13.912	24.0	10.0	17.5	3.5	4.93	0.47	17.0	7.0	10.5
69	82.4	0.421	94.6	6.4	6.65	7.369	15.014	13.908	24.0	10.0	17.5	3.6	4.84	0.46	17.0	7.0	10.6
70	82.5	0.427	94.5	6.3	6.65	7.475	15.028	13.904	23.9	10.0	17.6	3.7	4.72	0.45	17.0	7.0	10.7
71	82.7	0.433	94.7	6.5	6.66	7.582	15.054	13.913	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
72	82.8	0.439	94.8	6.7	6.67	7.689	15.068	13.909	24.0	10.0	17.3	3.4	5.12	0.48	17.0	7.0	10.3
73	82.9	0.445	94.7	6.6	6.68	7.796	15.095	13.918	24.0	10.0	17.4	3.5	5.02	0.47	17.0	7.0	10.4
74	82.9	0.451	94.7	6.6	6.68	7.903	15.095	13.902	23.9	10.0	17.4	3.5	5.02	0.47	17.0	7.0	10.4
75	83.0	0.457	94.7	6.5	6.69	8.009	15.108	13.898	23.9	10.0	17.4	3.5	4.97	0.47	17.0	6.9	10.4
76	83.2	0.463	94.6	6.5	6.70	8.116	15.135	13.906	23.9	10.0	17.5	3.6	4.89	0.46	17.0	7.0	10.5
77	83.1	0.469	94.6	6.4	6.71	8.223	15.121	13.878	23.9	10.0	17.5	3.6	4.83	0.46	17.0	6.9	10.6
78	83.2	0.475	94.8	6.6	6.72	8.330	15.135	13.874	23.9	10.0	17.3	3.4	5.06	0.48	17.0	6.9	10.4
79	83.3	0.481	94.8	6.6	6.72	8.437	15.148	13.870	23.9	10.0	17.3	3.4	5.06	0.48	17.0	6.9	10.4
80	83.4	0.487	94.8	6.6	6.73	8.543	15.175	13.878	23.9	10.0	17.3	3.4	5.06	0.48	17.0	6.9	10.4
81	83.3	0.493	94.8	6.6	6.74	8.650	15.161	13.850	23.9	10.0	17.3	3.4	5.05	0.48	17.0	6.9	10.3
82	83.5	0.499	94.7	6.5	6.75	8.757	15.188	13.858	23.9	10.0	17.4	3.5	4.92	0.47	17.0	6.9	10.5
83	83.4	0.505	94.5	6.3	6.76	8.864	15.175	13.830	23.9	10.0	17.5	3.7	4.74	0.46	17.0	6.9	10.6
84	83.6	0.511	94.7	6.6	6.76	8.971	15.201	13.838	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
85	83.8	0.517	94.7	6.6	6.77	9.077	15.242	13.858	23.9	10.0	17.3	3.5	5.01	0.48	17.0	6.9	10.4
86	83.8	0.523	94.7	6.6	6.78	9.184	15.242	13.842	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
87	84.0	0.529	94.7	6.6	6.79	9.291	15.268	13.850	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
88	84.2	0.535	94.7	6.5	6.80	9.398	15.295	13.858	23.9	10.0	17.4	3.5	4.92	0.47	17.0	6.9	10.5
89	84.2	0.541	94.5	6.4	6.80	9.505	15.295	13.841	23.9	10.0	17.5	3.7	4.78	0.46	17.0	6.9	10.6
90	84.2	0.547	94.5	6.3	6.81	9.611	15.308	13.837	23.9	10.0	17.6	3.7	4.70	0.46	17.0	6.9	10.7
91	84.2	0.553	94.7	6.5	6.82	9.718	15.308	13.821	23.9	10.0	17.3	3.5	4.95	0.47	17.0	6.9	10.4
92	84.4	0.559	94.7	6.6	6.83	9.825	15.335	13.828	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
93	84.5	0.565	94.7	6.6	6.84	9.932	15.348	13.824	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
94	84.6	0.571	94.7	6.6	6.84	10.038	15.362	13.820	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
95	84.7	0.577	94.6	6.5	6.85	10.145	15.375	13.815	23.9	10.0	17.4	3.6	4.86	0.47	17.0	6.9	10.5
96	84.7	0.583	94.5	6.4	6.86	10.252	15.389	13.811	23.9	10.0	17.5	3.7	4.77	0.46	16.9	6.9	10.6
97	84.8	0.589	94.4	6.3	6.87	10.359	15.402	13.806	23.8	10.0	17.6	3.8	4.65	0.45	16.9	6.9	10.7
98	85.0	0.595	94.7	6.5	6.88	10.466	15.429	13.814	23.9	10.0	17.3	3.5	4.95	0.47	16.9	6.9	10.4
99	85.2	0.601	94.7	6.5	6.88	10.572	15.469	13.833	23.9	10.0	17.3	3.5	4.95	0.47	17.0	6.9	10.4
100	85.4	0.607	94.7	6.6	6.89	10.679	15.495	13.841	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	85.5	0.613	94.7	6.6	6.90	10.786	15.509	13.836	23.9	10.0	17.3	3.5	5.00	0.48	17.0	6.9	10.4
102	85.7	0.619	94.7	6.5	6.91	10.893	15.549	13.855	23.9	10.0	17.4	3.5	4.91	0.47	17.0	6.9	10.5
103	85.8	0.625	94.5	6.3	6.92	11.000	15.562	13.850	23.9	10.0	17.6	3.7	4.74	0.46	17.0	6.9	10.6
104	86.0	0.631	94.7	6.5	6.93	11.106	15.589	13.858	23.9	10.0	17.4	3.5	4.96	0.47	17.0	6.9	10.4
105	86.2	0.637	94.7	6.6	6.93	11.213	15.629	13.877	23.9	10.0	17.3	3.5	5.01	0.47	17.0	6.9	10.4
106	86.4	0.643	94.7	6.6	6.94	11.320	15.656	13.884	23.9	10.0	17.3	3.5	5.01	0.47	17.0	6.9	10.4
107	86.6	0.649	94.7	6.5	6.95	11.427	15.683	13.891	23.9	10.0	17.4	3.5	4.97	0.47	17.0	6.9	10.4
108	86.8	0.655	94.7	6.5	6.96	11.534	15.723	13.909	24.0	10.0	17.4	3.5	4.93	0.47	17.0	7.0	10.5
109	86.9	0.661	94.6	6.4	6.97	11.640	15.736	13.904	23.9	10.0	17.5	3.6	4.84	0.46	17.0	7.0	10.6
110	87.0	0.667	94.5	6.3	6.98	11.747	15.749	13.899	23.9	10.0	17.6	3.7	4.72	0.45	17.0	6.9	10.7
111	87.0	0.673	94.7	6.5	6.98	11.854	15.763	13.894	23.9	10.0	17.4	3.5	4.97	0.47	17.0	6.9	10.4
112	87.4	0.679	94.7	6.5	6.99	11.961	15.816	13.924	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
113	87.4	0.685	94.7	6.5	7.00	12.068	15.816	13.908	24.0	10.0	17.4	3.5	4.97	0.47	17.0	7.0	10.5
114	87.6	0.691	94.7	6.5	7.01	12.174	15.856	13.926	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
115	87.6	0.697	94.6	6.5	7.02	12.281	15.856	13.909	24.0	10.0	17.5	3.6	4.89	0.46	17.0	7.0	10.5
116	87.7	0.703	94.5	6.3	7.03	12.388	15.870	13.904	23.9	10.0	17.6	3.7	4.76	0.46	17.0	7.0	10.7
117	88.0	0.709	94.5	6.3	7.04	12.495	15.910	13.922	24.0	10.0	17.7	3.7	4.72	0.45	17.0	7.0	10.7
118	88.2	0.715	94.7	6.5	7.04	12.602	15.950	13.940	24.0	10.0	17.4	3.5	4.98	0.47	17.0	7.0	10.5
119	88.4	0.721	94.7	6.5	7.05	12.708	15.990	13.958	24.0	10.0	17.5	3.5	4.94	0.47	17.0	7.0	10.5
120	88.5	0.727	94.7	6.5	7.06	12.815	16.003	13.952	24.0	10.0	17.5	3.5	4.94	0.47	17.0	7.0	10.5
121	88.8	0.733	94.7	6.5	7.07	12.922	16.043	13.970	24.0	10.0	17.5	3.5	4.95	0.47	17.0	7.0	10.5
122	88.9	0.739	94.6	6.4	7.08	13.029	16.057	13.965	24.0	10.0	17.6	3.6	4.86	0.46	17.0	7.0	10.6
123	88.9	0.745	94.4	6.3	7.09	13.135	16.070	13.959	24.0	10.0	17.7	3.8	4.69	0.45	17.0	7.0	10.8
124	89.2	0.751	94.7	6.5	7.10	13.242	16.110	13.977	24.0	10.0	17.5	3.5	4.95	0.47	17.0	7.0	10.5
125	89.3	0.757	94.7	6.5	7.11	13.349	16.137	13.983	24.0	10.0	17.5	3.5	4.95	0.47	17.0	7.0	10.5
126	89.6	0.763	94.6	6.5	7.11	13.456	16.177	14.000	24.0	10.0	17.6	3.6	4.91	0.46	17.0	7.0	10.6
127	89.7	0.769	94.6	6.4	7.12	13.563	16.190	13.994	24.0	10.0	17.6	3.6	4.87	0.46	17.0	7.0	10.6
128	90.0	0.775	94.5	6.3	7.13	13.669	16.244	14.023	24.1	10.0	17.7	3.7	4.79	0.45	17.1	7.0	10.7
129	90.0	0.781	94.4	6.2	7.14	13.776	16.244	14.006	24.0	10.0	17.8	3.8	4.67	0.44	17.0	7.0	10.8
130	90.2	0.787	94.4	6.2	7.15	13.883	16.271	14.012	24.1	10.0	17.8	3.8	4.67	0.44	17.0	7.0	10.8
131	90.6	0.793	94.5	6.4	7.16	13.990	16.337	14.052	24.1	10.0	17.7	3.7	4.84	0.45	17.1	7.0	10.7
132	90.7	0.799	94.5	6.4	7.17	14.097	16.351	14.046	24.1	10.0	17.7	3.7	4.84	0.45	17.1	7.0	10.7
133	91.0	0.805	94.5	6.3	7.18	14.203	16.404	14.074	24.1	10.0	17.8	3.7	4.80	0.45	17.1	7.0	10.7
134	91.2	0.811	94.5	6.3	7.18	14.310	16.431	14.080	24.1	10.0	17.8	3.7	4.81	0.45	17.1	7.0	10.7
135	91.4	0.817	94.4	6.2	7.19	14.417	16.471	14.096	24.1	10.0	17.9	3.8	4.69	0.44	17.1	7.0	10.9
136	91.6	0.823	94.3	6.1	7.20	14.524	16.498	14.102	24.1	10.0	18.0	3.9	4.62	0.44	17.1	7.1	11.0
137	91.8	0.829	94.3	6.1	7.21	14.631	16.538	14.118	24.2	10.0	18.0	3.9	4.62	0.44	17.1	7.1	11.0
138	92.1	0.835	94.5	6.3	7.22	14.737	16.578	14.135	24.2	10.0	17.9	3.7	4.78	0.45	17.1	7.1	10.8
139	92.2	0.841	94.5	6.3	7.23	14.844	16.605	14.140	24.2	10.0	17.9	3.7	4.78	0.45	17.1	7.1	10.8
140	92.4	0.847	94.5	6.3	7.24	14.951	16.631	14.145	24.2	10.0	17.9	3.7	4.78	0.45	17.1	7.1	10.8
141	92.6	0.853	94.4	6.3	7.25	15.058	16.658	14.150	24.2	10.0	17.9	3.8	4.74	0.44	17.1	7.1	10.9



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	92.7	0.859	94.3	6.2	7.26	15.165	16.685	14.155	24.2	10.0	18.0	3.9	4.67	0.44	17.1	7.1	10.9
143	92.7	0.865	94.2	6.0	7.27	15.271	16.685	14.137	24.2	10.0	18.2	4.0	4.52	0.43	17.1	7.1	11.1
144	93.0	0.871	94.4	6.3	7.28	15.378	16.725	14.153	24.2	10.0	17.9	3.8	4.74	0.44	17.1	7.1	10.9
145	93.2	0.877	94.4	6.3	7.28	15.485	16.765	14.169	24.2	10.0	17.9	3.8	4.75	0.44	17.1	7.1	10.9
146	93.5	0.883	94.4	6.3	7.29	15.592	16.805	14.185	24.2	10.0	18.0	3.8	4.75	0.44	17.1	7.1	10.9
147	93.7	0.889	94.4	6.2	7.30	15.698	16.845	14.201	24.2	10.0	18.0	3.8	4.72	0.44	17.1	7.1	10.9
148	93.8	0.895	94.3	6.1	7.31	15.805	16.859	14.194	24.2	10.0	18.1	3.9	4.64	0.43	17.1	7.1	11.0
149	94.1	0.901	94.2	6.0	7.32	15.912	16.912	14.221	24.3	10.0	18.2	4.0	4.54	0.42	17.2	7.1	11.1
150	94.0	0.907	94.3	6.1	7.33	16.019	16.899	14.192	24.2	10.0	18.1	3.9	4.60	0.43	17.1	7.1	11.0
151	94.5	0.913	94.3	6.2	7.34	16.126	16.979	14.241	24.3	10.0	18.1	3.9	4.69	0.43	17.2	7.1	11.0
152	94.7	0.919	94.4	6.2	7.35	16.232	17.005	14.245	24.3	10.0	18.1	3.8	4.73	0.44	17.2	7.1	10.9
153	94.9	0.925	94.3	6.2	7.36	16.339	17.032	14.249	24.3	10.0	18.1	3.9	4.69	0.43	17.2	7.1	11.0
154	95.3	0.931	94.3	6.1	7.37	16.446	17.099	14.287	24.3	10.0	18.2	3.9	4.66	0.43	17.2	7.1	11.0
155	95.2	0.937	94.3	6.1	7.38	16.553	17.086	14.258	24.3	10.0	18.2	3.9	4.62	0.43	17.2	7.1	11.1
156	95.4	0.943	94.1	6.0	7.39	16.660	17.112	14.262	24.3	10.0	18.3	4.1	4.51	0.42	17.2	7.1	11.2
157	95.4	0.949	94.2	6.1	7.40	16.766	17.112	14.243	24.3	10.0	18.2	4.0	4.58	0.43	17.2	7.1	11.1
158	95.7	0.955	94.3	6.1	7.41	16.873	17.166	14.269	24.3	10.0	18.2	3.9	4.66	0.43	17.2	7.1	11.0
159	95.9	0.961	94.3	6.2	7.42	16.980	17.206	14.284	24.3	10.0	18.1	3.9	4.70	0.43	17.2	7.1	11.0
160	96.1	0.967	94.2	6.1	7.43	17.087	17.233	14.288	24.3	10.0	18.3	4.0	4.59	0.42	17.2	7.1	11.1
161	96.3	0.973	94.2	6.1	7.44	17.194	17.259	14.292	24.3	10.0	18.3	4.0	4.59	0.42	17.2	7.1	11.1
162	96.5	0.979	94.0	5.9	7.44	17.300	17.299	14.307	24.3	10.0	18.5	4.2	4.42	0.41	17.2	7.2	11.3
163	96.8	0.985	94.1	5.9	7.45	17.407	17.340	14.321	24.4	10.0	18.5	4.1	4.46	0.41	17.2	7.2	11.3
164	97.2	0.991	94.2	6.0	7.46	17.514	17.406	14.358	24.4	10.0	18.4	4.0	4.57	0.42	17.2	7.2	11.2
165	97.6	0.997	94.2	6.0	7.47	17.621	17.473	14.394	24.4	10.0	18.4	4.0	4.58	0.42	17.2	7.2	11.2
166	97.7	1.003	94.1	6.0	7.48	17.728	17.500	14.398	24.4	10.0	18.5	4.1	4.55	0.42	17.2	7.2	11.3
167	98.0	1.009	94.3	6.1	7.49	17.834	17.540	14.412	24.5	10.0	18.4	3.9	4.66	0.42	17.2	7.2	11.1
168	98.2	1.015	94.2	6.0	7.50	17.941	17.567	14.415	24.5	10.0	18.4	4.0	4.58	0.42	17.3	7.2	11.2
169	98.3	1.021	94.0	5.9	7.51	18.048	17.593	14.418	24.5	10.0	18.6	4.2	4.45	0.41	17.3	7.2	11.4
170	98.4	1.027	93.9	5.7	7.52	18.155	17.607	14.410	24.5	10.0	18.7	4.3	4.35	0.40	17.2	7.2	11.5
171	98.7	1.033	94.1	5.9	7.53	18.262	17.660	14.435	24.5	10.0	18.5	4.1	4.52	0.41	17.3	7.2	11.3
172	98.8	1.039	94.2	6.0	7.54	18.368	17.674	14.427	24.5	10.0	18.4	4.0	4.59	0.42	17.3	7.2	11.2
173	99.1	1.045	94.2	6.0	7.55	18.475	17.727	14.452	24.5	10.0	18.5	4.0	4.59	0.42	17.3	7.2	11.2
174	99.5	1.051	94.1	5.9	7.56	18.582	17.781	14.477	24.5	10.0	18.6	4.1	4.53	0.41	17.3	7.2	11.3
175	99.6	1.057	94.1	5.9	7.57	18.689	17.807	14.479	24.5	10.0	18.6	4.1	4.53	0.41	17.3	7.2	11.3
176	100.0	1.063	93.9	5.8	7.58	18.795	17.861	14.504	24.5	10.0	18.8	4.3	4.40	0.40	17.3	7.3	11.5
177	100.0	1.069	94.0	5.9	7.59	18.902	17.874	14.496	24.5	10.0	18.7	4.2	4.47	0.40	17.3	7.2	11.4
178	100.3	1.075	94.1	5.9	7.60	19.009	17.914	14.509	24.6	10.0	18.6	4.1	4.54	0.41	17.3	7.3	11.4
179	100.6	1.081	94.1	5.9	7.61	19.116	17.968	14.533	24.6	10.0	18.6	4.1	4.54	0.41	17.3	7.3	11.4
180	100.7	1.087	94.1	5.9	7.62	19.223	17.981	14.525	24.6	10.0	18.7	4.1	4.51	0.41	17.3	7.3	11.4
181	101.0	1.093	94.1	5.9	7.63	19.329	18.021	14.538	24.6	10.0	18.6	4.1	4.54	0.41	17.3	7.3	11.4
182	101.1	1.099	93.9	5.8	7.64	19.436	18.048	14.540	24.6	10.0	18.8	4.3	4.41	0.40	17.3	7.3	11.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	101.3	1.105	93.8	5.7	7.65	19.543	18.075	14.542	24.6	10.0	18.9	4.4	4.32	0.39	17.3	7.3	11.7
184	101.5	1.111	94.0	5.9	7.66	19.650	18.115	14.555	24.6	10.0	18.7	4.2	4.48	0.40	17.3	7.3	11.5
185	101.9	1.117	94.1	5.9	7.67	19.757	18.168	14.579	24.6	10.0	18.7	4.1	4.52	0.40	17.3	7.3	11.4
186	102.0	1.123	94.1	5.9	7.68	19.863	18.195	14.581	24.6	10.0	18.7	4.1	4.52	0.40	17.3	7.3	11.4
187	102.1	1.125	94.0	5.9	7.69	19.896	18.208	14.585	24.6	10.0	18.8	4.2	4.49	0.40	17.3	7.3	11.5



File Location
B-65 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-65
Sample Description: Red & Brown Silty Sand
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 36.000
PL: 26.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.797	2.619	
Height (in)	5.559	5.481	
Weight (grams)	1080.70		1092.51
Moisture (%)	19.58		20.89
Dry Density (pcf)	100.80	116.59	
Saturation (%)	80.92	100.00	
Void Ratio	0.638	0.419	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 64.400
Effective Confining Stress (psi): 20.0
Corrected Peak Deviator Stress (psi): 38.078 at reading number: 180

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.0	0.018	44.4	0.0	5.39	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	76.0	0.024	47.0	2.6	5.39	0.109	14.109	14.094	34.1	20.0	31.5	17.4	1.81	0.18	27.0	7.0	24.5
2	103.0	0.030	48.7	4.3	5.40	0.219	19.124	19.082	39.1	20.0	34.8	15.7	2.22	0.23	29.5	9.5	25.2
3	121.2	0.036	49.9	5.5	5.41	0.328	22.498	22.424	42.4	20.0	36.9	14.5	2.55	0.25	31.2	11.2	25.7
4	133.4	0.042	50.7	6.3	5.41	0.438	24.767	24.659	44.6	20.0	38.3	13.7	2.80	0.26	32.3	12.3	26.0
5	142.2	0.048	51.4	7.0	5.42	0.547	26.393	26.249	46.2	20.0	39.3	13.0	3.02	0.27	33.1	13.1	26.1
6	149.1	0.054	51.9	7.4	5.42	0.657	27.666	27.484	47.5	20.0	40.0	12.5	3.19	0.27	33.7	13.7	26.3
7	154.1	0.060	52.3	7.8	5.43	0.766	28.601	28.382	48.4	20.0	40.5	12.1	3.34	0.28	34.2	14.2	26.3
8	158.1	0.066	52.5	8.1	5.44	0.876	29.337	29.081	49.1	20.0	40.9	11.9	3.45	0.28	34.5	14.5	26.4
9	161.1	0.072	52.8	8.4	5.44	0.985	29.905	29.610	49.6	20.0	41.2	11.6	3.55	0.28	34.8	14.8	26.4
10	163.8	0.078	53.0	8.6	5.45	1.095	30.396	30.063	50.0	20.0	41.5	11.4	3.63	0.29	35.0	15.0	26.4
11	165.7	0.084	53.2	8.7	5.45	1.204	30.748	30.378	50.4	20.0	41.6	11.2	3.70	0.29	35.2	15.2	26.4
12	167.5	0.090	53.3	8.9	5.46	1.314	31.086	30.677	50.7	20.0	41.8	11.1	3.77	0.29	35.3	15.3	26.4
13	169.0	0.096	53.4	9.0	5.47	1.423	31.362	30.915	50.9	20.0	41.9	11.0	3.81	0.29	35.4	15.5	26.5
14	170.2	0.102	53.5	9.1	5.47	1.533	31.592	31.108	51.1	20.0	42.0	10.9	3.85	0.29	35.5	15.6	26.5
15	171.3	0.108	53.6	9.2	5.48	1.642	31.791	31.269	51.2	20.0	42.1	10.8	3.89	0.29	35.6	15.6	26.4
16	172.4	0.114	53.7	9.3	5.48	1.752	31.991	31.430	51.4	20.0	42.2	10.7	3.93	0.29	35.7	15.7	26.4
17	173.1	0.120	53.8	9.3	5.49	1.861	32.129	31.531	51.5	20.0	42.2	10.6	3.96	0.30	35.7	15.8	26.4
18	174.3	0.126	53.8	9.4	5.50	1.971	32.343	31.706	51.7	20.0	42.3	10.6	4.00	0.30	35.8	15.9	26.4



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	174.9	0.132	53.9	9.5	5.50	2.080	32.466	31.791	51.8	20.0	42.3	10.5	4.03	0.30	35.9	15.9	26.4
20	175.6	0.138	54.0	9.6	5.51	2.190	32.589	31.875	51.9	20.0	42.3	10.4	4.06	0.30	35.9	15.9	26.3
21	176.4	0.144	54.0	9.6	5.51	2.299	32.742	31.989	52.0	20.0	42.4	10.4	4.09	0.30	36.0	16.0	26.4
22	177.1	0.150	54.1	9.7	5.52	2.409	32.865	32.073	52.1	20.0	42.4	10.3	4.11	0.30	36.0	16.0	26.4
23	177.6	0.156	54.1	9.7	5.53	2.518	32.957	32.127	52.1	20.0	42.4	10.3	4.12	0.30	36.0	16.1	26.3
24	178.2	0.162	54.1	9.7	5.53	2.627	33.079	32.210	52.2	20.0	42.5	10.3	4.13	0.30	36.1	16.1	26.4
25	178.8	0.168	54.2	9.8	5.54	2.737	33.187	32.278	52.3	20.0	42.5	10.2	4.16	0.30	36.1	16.1	26.3
26	179.5	0.174	54.2	9.8	5.55	2.846	33.309	32.361	52.3	20.0	42.5	10.2	4.18	0.30	36.2	16.2	26.3
27	180.0	0.180	54.2	9.8	5.55	2.956	33.401	32.414	52.4	20.0	42.6	10.2	4.19	0.30	36.2	16.2	26.4
28	180.5	0.186	54.2	9.8	5.56	3.065	33.493	32.467	52.4	20.0	42.6	10.2	4.19	0.30	36.2	16.2	26.4
29	180.9	0.192	54.2	9.8	5.56	3.175	33.585	32.519	52.5	20.0	42.7	10.2	4.20	0.30	36.2	16.3	26.4
30	181.5	0.198	54.3	9.9	5.57	3.284	33.693	32.586	52.6	20.0	42.7	10.1	4.22	0.30	36.3	16.3	26.4
31	182.1	0.204	54.3	9.9	5.58	3.394	33.800	32.653	52.6	20.0	42.7	10.1	4.24	0.30	36.3	16.3	26.4
32	182.8	0.210	54.4	9.9	5.58	3.503	33.923	32.734	52.7	20.0	42.8	10.0	4.26	0.30	36.3	16.4	26.4
33	183.3	0.216	54.4	9.9	5.59	3.613	34.015	32.786	52.8	20.0	42.8	10.0	4.26	0.30	36.4	16.4	26.4
34	183.6	0.222	54.4	9.9	5.60	3.722	34.076	32.808	52.8	20.0	42.9	10.0	4.27	0.30	36.4	16.4	26.4
35	184.3	0.228	54.4	9.9	5.60	3.832	34.199	32.889	52.9	20.0	42.9	10.0	4.28	0.30	36.4	16.4	26.5
36	184.6	0.234	54.4	9.9	5.61	3.941	34.260	32.910	52.9	20.0	43.0	10.0	4.28	0.30	36.4	16.5	26.5
37	185.2	0.240	54.4	10.0	5.62	4.051	34.383	32.990	53.0	20.0	43.0	10.0	4.30	0.30	36.5	16.5	26.5
38	185.7	0.246	54.4	10.0	5.62	4.160	34.460	33.026	53.0	20.0	43.0	10.0	4.30	0.30	36.5	16.5	26.5
39	186.2	0.252	54.4	9.9	5.63	4.270	34.552	33.076	53.1	20.0	43.1	10.0	4.29	0.30	36.5	16.5	26.6
40	186.6	0.258	54.4	9.9	5.63	4.379	34.628	33.112	53.1	20.0	43.2	10.0	4.30	0.30	36.5	16.6	26.6
41	186.9	0.264	54.3	9.9	5.64	4.489	34.690	33.133	53.1	20.0	43.2	10.1	4.29	0.30	36.5	16.6	26.6
42	187.5	0.270	54.3	9.9	5.65	4.598	34.797	33.197	53.2	20.0	43.3	10.1	4.29	0.30	36.6	16.6	26.7
43	188.1	0.276	54.3	9.9	5.65	4.708	34.904	33.261	53.2	20.0	43.3	10.1	4.30	0.30	36.6	16.6	26.7
44	188.4	0.282	54.3	9.9	5.66	4.817	34.966	33.281	53.3	20.0	43.4	10.1	4.29	0.30	36.6	16.6	26.8
45	189.0	0.288	54.2	9.8	5.67	4.926	35.088	33.360	53.3	20.0	43.5	10.2	4.28	0.29	36.7	16.7	26.8
46	189.3	0.294	54.2	9.8	5.67	5.036	35.134	33.365	53.3	20.0	43.6	10.2	4.27	0.29	36.7	16.7	26.9
47	190.0	0.300	54.3	9.9	5.68	5.145	35.257	33.443	53.4	20.0	43.5	10.1	4.32	0.30	36.7	16.7	26.8
48	190.7	0.306	54.3	9.9	5.69	5.255	35.395	33.535	53.5	20.0	43.6	10.1	4.33	0.30	36.7	16.8	26.9
49	191.0	0.312	54.3	9.9	5.69	5.364	35.456	33.554	53.5	20.0	43.6	10.1	4.33	0.29	36.8	16.8	26.9
50	191.8	0.318	54.3	9.9	5.70	5.474	35.594	33.646	53.6	20.0	43.7	10.1	4.34	0.29	36.8	16.8	26.9
51	192.2	0.324	54.3	9.9	5.71	5.583	35.671	33.680	53.7	20.0	43.8	10.1	4.33	0.29	36.8	16.8	27.0
52	192.7	0.330	54.3	9.9	5.71	5.693	35.763	33.727	53.7	20.0	43.8	10.1	4.33	0.29	36.8	16.9	27.0
53	193.2	0.336	54.2	9.8	5.72	5.802	35.855	33.775	53.8	20.0	43.9	10.2	4.32	0.29	36.9	16.9	27.1
54	193.7	0.342	54.2	9.8	5.73	5.912	35.947	33.822	53.8	20.0	44.0	10.2	4.33	0.29	36.9	16.9	27.1
55	194.2	0.348	54.2	9.7	5.73	6.021	36.055	33.884	53.9	20.0	44.1	10.2	4.31	0.29	36.9	16.9	27.2
56	194.5	0.354	54.1	9.7	5.74	6.131	36.101	33.887	53.9	20.0	44.2	10.3	4.28	0.28	36.9	16.9	27.3
57	195.1	0.360	54.0	9.6	5.75	6.240	36.208	33.948	53.9	20.0	44.4	10.4	4.26	0.28	37.0	17.0	27.4
58	195.5	0.366	53.9	9.5	5.75	6.350	36.285	33.981	54.0	20.0	44.5	10.5	4.24	0.28	37.0	17.0	27.5
59	196.4	0.372	54.2	9.8	5.76	6.459	36.453	34.099	54.1	20.0	44.3	10.2	4.34	0.29	37.0	17.0	27.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	197.0	0.378	54.2	9.8	5.77	6.569	36.561	34.159	54.1	20.0	44.4	10.2	4.35	0.29	37.1	17.1	27.3
61	197.5	0.384	54.2	9.7	5.77	6.678	36.653	34.205	54.2	20.0	44.4	10.2	4.34	0.28	37.1	17.1	27.3
62	198.0	0.390	54.2	9.7	5.78	6.788	36.745	34.251	54.2	20.0	44.5	10.2	4.34	0.28	37.1	17.1	27.4
63	198.5	0.396	54.2	9.7	5.79	6.897	36.852	34.310	54.3	20.0	44.6	10.2	4.35	0.28	37.1	17.2	27.4
64	199.2	0.402	54.1	9.7	5.79	7.007	36.975	34.384	54.4	20.0	44.7	10.3	4.34	0.28	37.2	17.2	27.5
65	199.5	0.408	54.1	9.7	5.80	7.116	37.036	34.401	54.4	20.0	44.7	10.3	4.35	0.28	37.2	17.2	27.5
66	200.1	0.414	54.1	9.7	5.81	7.226	37.143	34.460	54.4	20.0	44.8	10.3	4.34	0.28	37.2	17.2	27.6
67	200.7	0.420	54.1	9.7	5.81	7.335	37.251	34.518	54.5	20.0	44.8	10.3	4.34	0.28	37.2	17.3	27.6
68	201.2	0.426	54.1	9.7	5.82	7.444	37.343	34.563	54.5	20.0	44.9	10.3	4.35	0.28	37.3	17.3	27.6
69	201.4	0.432	53.9	9.5	5.83	7.554	37.389	34.564	54.5	20.0	45.0	10.5	4.30	0.27	37.3	17.3	27.8
70	201.7	0.438	53.7	9.3	5.83	7.663	37.435	34.566	54.5	20.0	45.3	10.7	4.23	0.27	37.3	17.3	28.0
71	202.5	0.444	54.0	9.6	5.84	7.773	37.588	34.666	54.6	20.0	45.1	10.4	4.33	0.28	37.3	17.3	27.7
72	203.2	0.450	54.0	9.6	5.85	7.882	37.711	34.738	54.7	20.0	45.1	10.4	4.34	0.28	37.3	17.4	27.8
73	203.8	0.456	54.0	9.6	5.86	7.992	37.834	34.810	54.8	20.0	45.2	10.4	4.35	0.28	37.4	17.4	27.8
74	204.3	0.462	54.0	9.5	5.86	8.101	37.926	34.853	54.8	20.0	45.3	10.4	4.34	0.27	37.4	17.4	27.9
75	204.9	0.468	54.0	9.5	5.87	8.211	38.033	34.910	54.9	20.0	45.4	10.4	4.34	0.27	37.4	17.5	27.9
76	205.2	0.474	53.9	9.5	5.88	8.320	38.079	34.911	54.9	20.0	45.4	10.5	4.33	0.27	37.4	17.5	27.9
77	205.8	0.480	53.9	9.5	5.88	8.430	38.202	34.981	55.0	20.0	45.5	10.5	4.34	0.27	37.5	17.5	28.0
78	206.1	0.486	53.9	9.5	5.89	8.539	38.263	34.996	55.0	20.0	45.5	10.5	4.32	0.27	37.5	17.5	28.0
79	206.6	0.492	53.9	9.5	5.90	8.649	38.340	35.024	55.0	20.0	45.5	10.5	4.33	0.27	37.5	17.5	28.0
80	207.2	0.498	53.8	9.4	5.90	8.758	38.462	35.094	55.1	20.0	45.7	10.6	4.32	0.27	37.5	17.5	28.1
81	207.3	0.505	53.8	9.3	5.91	8.868	38.478	35.066	55.0	20.0	45.7	10.6	4.29	0.27	37.5	17.5	28.2
82	208.0	0.511	53.6	9.2	5.92	8.977	38.600	35.135	55.1	20.0	45.9	10.8	4.25	0.26	37.5	17.6	28.4
83	208.2	0.517	53.5	9.1	5.93	9.087	38.646	35.135	55.1	20.0	46.0	10.9	4.23	0.26	37.5	17.6	28.5
84	208.8	0.523	53.5	9.1	5.93	9.196	38.754	35.190	55.2	20.0	46.1	10.9	4.22	0.26	37.6	17.6	28.5
85	209.4	0.529	53.5	9.1	5.94	9.306	38.861	35.245	55.2	20.0	46.2	10.9	4.23	0.26	37.6	17.6	28.5
86	209.9	0.535	53.4	9.0	5.95	9.415	38.953	35.286	55.3	20.0	46.3	11.0	4.22	0.26	37.6	17.6	28.6
87	210.7	0.541	53.7	9.3	5.95	9.525	39.106	35.382	55.4	20.0	46.1	10.7	4.30	0.26	37.7	17.7	28.4
88	211.4	0.547	53.7	9.3	5.96	9.634	39.229	35.450	55.4	20.0	46.2	10.7	4.30	0.26	37.7	17.7	28.5
89	211.8	0.553	53.6	9.2	5.97	9.743	39.321	35.490	55.5	20.0	46.3	10.8	4.30	0.26	37.7	17.7	28.5
90	212.4	0.559	53.6	9.2	5.98	9.853	39.428	35.544	55.5	20.0	46.3	10.8	4.30	0.26	37.8	17.8	28.5
91	212.8	0.565	53.6	9.2	5.98	9.962	39.490	35.556	55.5	20.0	46.4	10.8	4.29	0.26	37.8	17.8	28.6
92	213.4	0.571	53.6	9.2	5.99	10.072	39.612	35.623	55.6	20.0	46.4	10.8	4.30	0.26	37.8	17.8	28.6
93	213.7	0.577	53.4	9.0	6.00	10.181	39.658	35.621	55.6	20.0	46.6	11.0	4.25	0.25	37.8	17.8	28.8
94	214.1	0.583	53.3	8.9	6.01	10.291	39.735	35.646	55.6	20.0	46.8	11.1	4.20	0.25	37.8	17.8	29.0
95	214.7	0.589	53.3	8.9	6.01	10.400	39.843	35.699	55.7	20.0	46.8	11.1	4.21	0.25	37.8	17.8	29.0
96	215.2	0.595	53.2	8.8	6.02	10.510	39.950	35.751	55.7	20.0	46.9	11.2	4.20	0.25	37.9	17.9	29.0
97	215.6	0.601	53.2	8.8	6.03	10.619	40.027	35.776	55.8	20.0	47.0	11.2	4.19	0.25	37.9	17.9	29.1
98	216.3	0.607	53.2	8.8	6.04	10.729	40.149	35.842	55.8	20.0	47.1	11.2	4.20	0.24	37.9	17.9	29.1
99	216.7	0.613	53.2	8.7	6.04	10.838	40.226	35.866	55.8	20.0	47.1	11.2	4.19	0.24	37.9	17.9	29.2
100	217.5	0.619	53.4	8.9	6.05	10.948	40.379	35.959	55.9	20.0	47.0	11.0	4.25	0.25	38.0	18.0	29.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	218.0	0.625	53.4	8.9	6.06	11.057	40.471	35.996	56.0	20.0	47.0	11.0	4.26	0.25	38.0	18.0	29.0
102	218.7	0.631	53.4	8.9	6.06	11.167	40.594	36.061	56.0	20.0	47.1	11.0	4.26	0.25	38.0	18.0	29.1
103	219.2	0.637	53.3	8.9	6.07	11.276	40.686	36.098	56.1	20.0	47.2	11.1	4.26	0.25	38.0	18.0	29.1
104	219.5	0.643	53.3	8.9	6.08	11.386	40.747	36.108	56.1	20.0	47.2	11.1	4.26	0.25	38.0	18.1	29.1
105	220.2	0.649	53.3	8.9	6.09	11.495	40.870	36.172	56.2	20.0	47.3	11.1	4.25	0.24	38.1	18.1	29.2
106	220.6	0.655	53.3	8.9	6.09	11.605	40.947	36.195	56.2	20.0	47.3	11.1	4.25	0.24	38.1	18.1	29.2
107	221.2	0.661	53.2	8.8	6.10	11.714	41.054	36.245	56.2	20.0	47.4	11.2	4.25	0.24	38.1	18.1	29.3
108	221.7	0.667	53.2	8.8	6.11	11.824	41.146	36.281	56.3	20.0	47.5	11.2	4.24	0.24	38.1	18.1	29.3
109	221.9	0.673	53.1	8.7	6.12	11.933	41.192	36.277	56.3	20.0	47.6	11.3	4.20	0.24	38.1	18.1	29.5
110	222.3	0.679	52.9	8.5	6.13	12.043	41.269	36.299	56.3	20.0	47.7	11.5	4.17	0.23	38.1	18.1	29.6
111	222.8	0.685	52.9	8.5	6.13	12.152	41.361	36.335	56.3	20.0	47.8	11.5	4.16	0.23	38.1	18.2	29.7
112	223.6	0.691	52.9	8.4	6.14	12.261	41.499	36.410	56.4	20.0	47.9	11.5	4.16	0.23	38.2	18.2	29.7
113	223.8	0.697	53.0	8.6	6.15	12.371	41.545	36.405	56.4	20.0	47.8	11.4	4.20	0.24	38.2	18.2	29.6
114	224.6	0.703	53.0	8.6	6.16	12.480	41.683	36.481	56.5	20.0	47.9	11.4	4.20	0.23	38.2	18.2	29.7
115	225.0	0.709	53.0	8.6	6.16	12.590	41.759	36.502	56.5	20.0	47.9	11.4	4.20	0.23	38.2	18.3	29.7
116	225.4	0.715	52.9	8.5	6.17	12.699	41.836	36.523	56.5	20.0	48.0	11.5	4.19	0.23	38.2	18.3	29.7
117	226.1	0.721	52.9	8.5	6.18	12.809	41.959	36.584	56.6	20.0	48.1	11.5	4.18	0.23	38.3	18.3	29.8
118	226.4	0.727	52.9	8.5	6.19	12.918	42.020	36.592	56.6	20.0	48.1	11.5	4.18	0.23	38.3	18.3	29.8
119	226.9	0.733	52.9	8.4	6.19	13.028	42.112	36.626	56.6	20.0	48.2	11.5	4.18	0.23	38.3	18.3	29.8
120	227.5	0.739	52.8	8.4	6.20	13.137	42.220	36.673	56.7	20.0	48.2	11.6	4.17	0.23	38.3	18.3	29.9
121	227.9	0.745	52.8	8.4	6.21	13.247	42.296	36.693	56.7	20.0	48.3	11.6	4.17	0.23	38.3	18.3	29.9
122	228.2	0.751	52.7	8.3	6.22	13.356	42.358	36.700	56.7	20.0	48.4	11.7	4.15	0.23	38.3	18.4	30.0
123	228.7	0.757	52.7	8.3	6.23	13.466	42.450	36.733	56.7	20.0	48.4	11.7	4.14	0.23	38.3	18.4	30.1
124	229.1	0.763	52.7	8.2	6.23	13.575	42.526	36.753	56.7	20.0	48.5	11.7	4.13	0.22	38.4	18.4	30.1
125	229.4	0.769	52.6	8.2	6.24	13.685	42.572	36.746	56.7	20.0	48.5	11.8	4.12	0.22	38.4	18.4	30.1
126	230.1	0.775	52.6	8.2	6.25	13.794	42.710	36.819	56.8	20.0	48.6	11.8	4.12	0.22	38.4	18.4	30.2
127	230.7	0.781	52.5	8.1	6.26	13.904	42.818	36.864	56.8	20.0	48.7	11.9	4.11	0.22	38.4	18.4	30.3
128	231.2	0.787	52.5	8.1	6.27	14.013	42.910	36.897	56.9	20.0	48.7	11.9	4.11	0.22	38.4	18.4	30.3
129	231.7	0.793	52.5	8.0	6.27	14.123	43.002	36.929	56.9	20.0	48.9	11.9	4.09	0.22	38.4	18.5	30.4
130	232.1	0.799	52.5	8.1	6.28	14.232	43.078	36.947	56.9	20.0	48.8	11.9	4.11	0.22	38.5	18.5	30.4
131	232.7	0.805	52.5	8.1	6.29	14.342	43.186	36.992	57.0	20.0	48.9	11.9	4.11	0.22	38.5	18.5	30.4
132	233.2	0.811	52.5	8.1	6.30	14.451	43.293	37.037	57.0	20.0	48.9	11.9	4.11	0.22	38.5	18.5	30.4
133	233.8	0.817	52.5	8.0	6.31	14.561	43.400	37.081	57.1	20.0	49.0	11.9	4.11	0.22	38.5	18.5	30.5
134	234.3	0.823	52.5	8.0	6.31	14.670	43.492	37.112	57.1	20.0	49.0	11.9	4.11	0.22	38.5	18.6	30.5
135	234.7	0.829	52.4	8.0	6.32	14.779	43.554	37.117	57.1	20.0	49.1	12.0	4.10	0.22	38.5	18.6	30.5
136	235.2	0.835	52.4	8.0	6.33	14.889	43.661	37.160	57.1	20.0	49.2	12.0	4.09	0.21	38.6	18.6	30.6
137	235.6	0.841	52.4	8.0	6.34	14.998	43.738	37.178	57.2	20.0	49.2	12.0	4.09	0.21	38.6	18.6	30.6
138	236.2	0.847	52.3	7.9	6.35	15.108	43.845	37.221	57.2	20.0	49.3	12.1	4.09	0.21	38.6	18.6	30.7
139	236.8	0.853	52.3	7.9	6.35	15.217	43.953	37.264	57.2	20.0	49.3	12.1	4.09	0.21	38.6	18.6	30.7
140	237.2	0.859	52.3	7.9	6.36	15.327	44.029	37.281	57.3	20.0	49.4	12.1	4.08	0.21	38.6	18.6	30.7
141	237.6	0.865	52.3	7.8	6.37	15.436	44.106	37.298	57.3	20.0	49.4	12.1	4.07	0.21	38.6	18.6	30.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	238.2	0.871	52.3	7.8	6.38	15.546	44.213	37.340	57.3	20.0	49.5	12.1	4.08	0.21	38.7	18.7	30.8
143	238.5	0.877	52.2	7.8	6.39	15.655	44.275	37.343	57.3	20.0	49.5	12.2	4.07	0.21	38.7	18.7	30.8
144	239.1	0.883	52.2	7.8	6.40	15.765	44.382	37.385	57.4	20.0	49.6	12.2	4.06	0.21	38.7	18.7	30.9
145	239.6	0.889	52.2	7.8	6.40	15.874	44.474	37.414	57.4	20.0	49.6	12.2	4.06	0.21	38.7	18.7	30.9
146	240.0	0.895	52.1	7.7	6.41	15.984	44.551	37.430	57.4	20.0	49.7	12.3	4.05	0.21	38.7	18.7	31.0
147	240.4	0.901	52.1	7.7	6.42	16.093	44.612	37.432	57.4	20.0	49.7	12.3	4.04	0.21	38.7	18.7	31.0
148	240.6	0.907	52.1	7.7	6.43	16.203	44.658	37.422	57.4	20.0	49.7	12.3	4.05	0.21	38.7	18.7	31.0
149	241.3	0.913	52.1	7.7	6.44	16.312	44.796	37.489	57.5	20.0	49.7	12.3	4.06	0.21	38.7	18.7	31.0
150	241.9	0.919	52.1	7.7	6.45	16.422	44.903	37.529	57.5	20.0	49.8	12.3	4.06	0.21	38.7	18.8	31.0
151	242.4	0.925	52.1	7.7	6.45	16.531	44.995	37.557	57.5	20.0	49.9	12.3	4.05	0.20	38.8	18.8	31.1
152	242.8	0.931	52.1	7.6	6.46	16.641	45.072	37.572	57.6	20.0	49.9	12.3	4.05	0.20	38.8	18.8	31.1
153	243.2	0.937	52.1	7.6	6.47	16.750	45.149	37.586	57.6	20.0	49.9	12.3	4.05	0.20	38.8	18.8	31.1
154	243.6	0.943	52.0	7.6	6.48	16.860	45.210	37.588	57.6	20.0	50.0	12.4	4.04	0.20	38.8	18.8	31.2
155	244.2	0.949	52.0	7.6	6.49	16.969	45.333	37.640	57.6	20.0	50.0	12.4	4.04	0.20	38.8	18.8	31.2
156	244.8	0.955	52.0	7.6	6.50	17.078	45.440	37.680	57.7	20.0	50.1	12.4	4.03	0.20	38.8	18.8	31.3
157	245.1	0.961	51.9	7.5	6.51	17.188	45.486	37.668	57.6	20.0	50.1	12.5	4.02	0.20	38.8	18.8	31.3
158	245.6	0.967	51.9	7.5	6.51	17.297	45.593	37.707	57.7	20.0	50.2	12.5	4.02	0.20	38.8	18.9	31.4
159	246.1	0.973	51.9	7.5	6.52	17.407	45.670	37.720	57.7	20.0	50.2	12.5	4.02	0.20	38.8	18.9	31.4
160	246.5	0.979	51.9	7.4	6.53	17.516	45.747	37.734	57.7	20.0	50.3	12.5	4.01	0.20	38.8	18.9	31.4
161	246.9	0.985	51.8	7.4	6.54	17.626	45.823	37.747	57.7	20.0	50.3	12.6	4.00	0.20	38.9	18.9	31.5
162	247.6	0.991	51.9	7.5	6.55	17.735	45.962	37.810	57.8	20.0	50.3	12.5	4.03	0.20	38.9	18.9	31.4
163	248.0	0.997	51.9	7.5	6.56	17.845	46.023	37.810	57.8	20.0	50.3	12.5	4.03	0.20	38.9	18.9	31.4
164	248.2	1.003	51.9	7.5	6.57	17.954	46.069	37.798	57.8	20.0	50.3	12.5	4.02	0.20	38.9	18.9	31.4
165	248.8	1.009	51.9	7.4	6.58	18.072	46.176	37.831	57.8	20.0	50.4	12.5	4.02	0.20	38.9	18.9	31.5
166	249.2	1.015	51.8	7.4	6.59	18.190	46.253	37.839	57.8	20.0	50.4	12.6	4.01	0.20	38.9	18.9	31.5
167	249.7	1.022	51.8	7.4	6.60	18.308	46.345	37.860	57.8	20.0	50.5	12.6	4.00	0.19	38.9	18.9	31.5
168	250.4	1.028	51.8	7.4	6.60	18.426	46.468	37.906	57.9	20.0	50.5	12.6	4.00	0.19	38.9	19.0	31.6
169	250.7	1.035	51.7	7.3	6.61	18.544	46.529	37.901	57.9	20.0	50.6	12.7	3.99	0.19	38.9	19.0	31.6
170	251.3	1.041	51.7	7.3	6.62	18.662	46.636	37.933	57.9	20.0	50.6	12.7	3.99	0.19	38.9	19.0	31.7
171	251.6	1.048	51.7	7.3	6.63	18.780	46.698	37.928	57.9	20.0	50.6	12.7	3.99	0.19	38.9	19.0	31.7
172	252.1	1.054	51.7	7.2	6.64	18.889	46.790	37.952	57.9	20.0	50.7	12.7	3.98	0.19	39.0	19.0	31.7
173	252.4	1.060	51.7	7.2	6.65	18.999	46.851	37.950	57.9	20.0	50.7	12.7	3.98	0.19	39.0	19.0	31.7
174	253.0	1.066	51.6	7.2	6.66	19.108	46.958	37.986	58.0	20.0	50.8	12.8	3.97	0.19	39.0	19.0	31.8
175	253.3	1.072	51.7	7.2	6.67	19.218	47.020	37.984	58.0	20.0	50.7	12.7	3.98	0.19	39.0	19.0	31.7
176	253.7	1.078	51.7	7.2	6.68	19.327	47.096	37.994	58.0	20.0	50.7	12.7	3.98	0.19	39.0	19.0	31.7
177	254.3	1.084	51.7	7.2	6.69	19.436	47.204	38.029	58.0	20.0	50.8	12.7	3.99	0.19	39.0	19.0	31.8
178	254.7	1.090	51.7	7.2	6.70	19.546	47.280	38.039	58.0	20.0	50.8	12.7	3.99	0.19	39.0	19.0	31.8
179	255.3	1.096	51.6	7.2	6.71	19.655	47.388	38.073	58.1	20.0	50.9	12.8	3.98	0.19	39.0	19.0	31.8
180	255.4	1.097	51.6	7.2	6.71	19.672	47.403	38.078	58.1	20.0	50.9	12.8	3.98	0.19	39.0	19.0	31.8

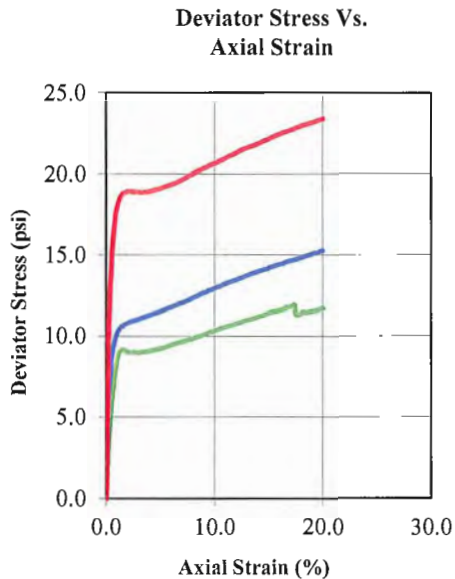


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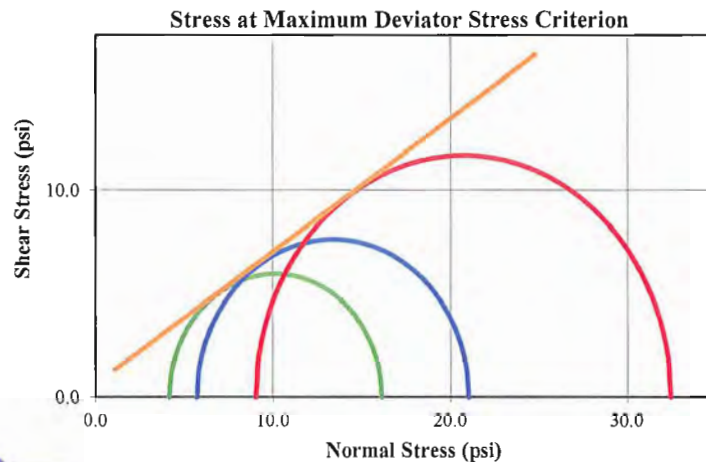
Consolidated Undrained Triaxial Test (ASTM D4767)

PROJECT NAME : I-85/I-385 Interchange	SAMPLE NO. : Bag #1
PROJECT NO. : 08195-01	SAMPLE DEPTH : 0.0' to 16.0'
PROJECT LOCATION : B-68	SAMPLE TYPE : Remolded
BORING NUMBER : B-68	DESCRIPTION : Red Elastic Silt
REMARKS :	TEST TYPE : Consolidated Undrained



Initial	Specimen			
	A	B	C	D
Water Content (%)	22.4	22.8	22.3	
Dry Density (pcf)	95.3	95.0	96.3	
Saturation (%)	80.62	81.38	82.25	
Void Ratio	0.732	0.737	0.714	
Diameter (in)	2.799	2.807	2.800	
Height (in)	5.674	5.643	5.647	
Specific Gravity	2.65	2.65	2.65	
Liquid Limit	52	52	52	
Plastic Limit	33	33	33	
After Consolidation	A	B	C	D
B-Value	0.96	1.03	0.97	
Water Content (%)	28.6	28.4	26.2	
Dry Density (pcf)	95.35	95.62	98.10	
Saturation (%)	100.00	100.00	100.00	
Void Ratio	0.735	0.730	0.686	
Effective Stress (psi)	5.0	10.0	20.0	
Back Press. (psi)	87.0	74.1	82.0	
Rate of Strain	0.002	0.002	0.002	

Maximum Deviator Stress Criterion		After Shear			
		A	B	C	D
C (psi)	2.8	σ'_1 at Failure (psi)	16.08	21.01	32.42
ϕ (deg)	16.4	σ'_3 at Failure (psi)	4.16	5.72	9.02
C' (psi)	0.6				
ϕ' (deg)	32.8				



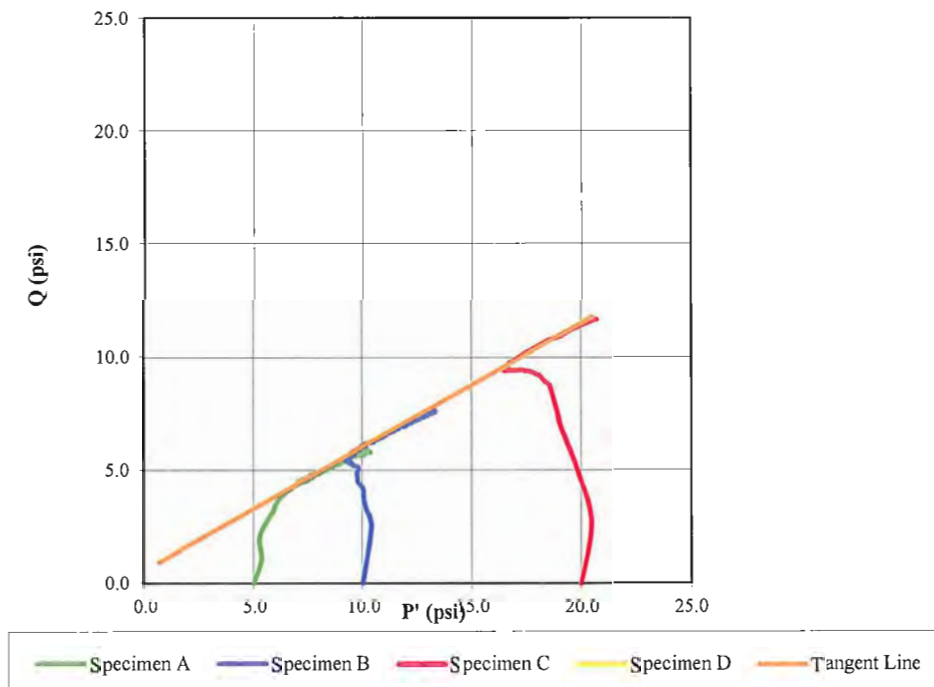
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Date: 12-11-12

Approved By: SKB
Date: 12-11-12

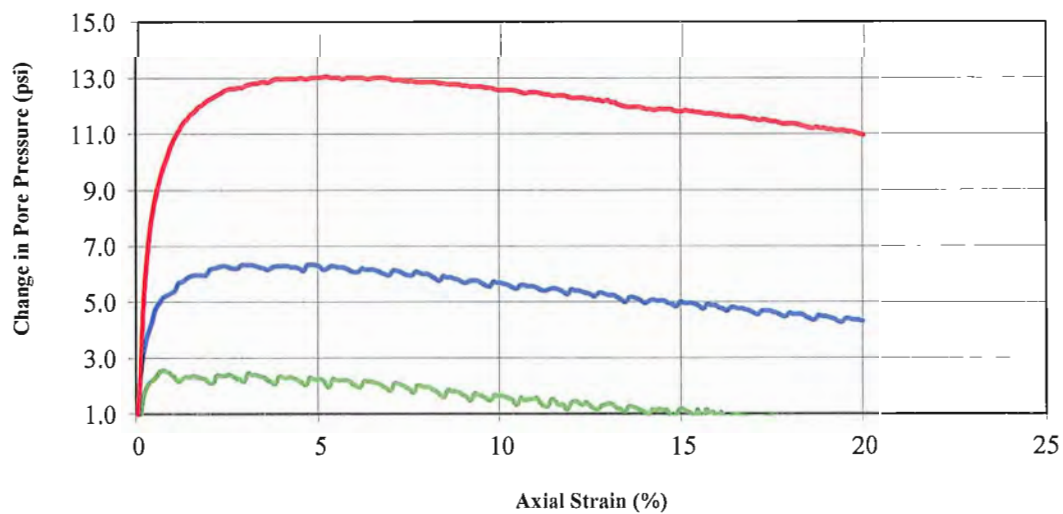


Consolidated Undrained Triaxial Test (ASTM D4767)

Stress Paths (Effective)
($a = 0.6$ $\alpha = 28.7$)



Change in Pore Pressure vs. Axial Strain





File Location

B-68 5PSI.HSD

Project Information

Project No. 08195-01

Project Name: I-85/I-385 Interchange

Client:

Sample Location: B-68

Sample Description: Red Elastic Silt

Remarks:

Sample Data

Sample Type: Remolded

Specific Gravity: 2.6500001

LL: 52.000

PL: 33.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.799	2.800	
Height (in)	5.674	5.669	
Weight (grams)	1069.20		1123.50
Moisture (%)	22.39		28.61
Dry Density (pcf)	95.30	95.35	
Saturation (%)	80.62	100.00	
Void Ratio	0.732	0.735	

Test Data

Rate of Strain: 0.002

Cell Pressure (psi): 92.000

Effective Confining Stress (psi): 5.0

Corrected Peak Deviator Stress (psi): 11.919

at reading number: 163

Specimen A

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	0.8	0.000	87.0	0.0	6.16	0.000	0.000	0.000	5.0	5.0	5.0	5.0	1.00	0.00	5.0	0.0	5.0
1	14.1	0.006	87.7	0.7	6.16	0.106	2.152	2.149	7.2	5.0	6.4	4.3	1.50	0.34	6.1	1.1	5.4
2	24.4	0.012	88.6	1.6	6.17	0.212	3.822	3.814	8.8	5.0	7.2	3.4	2.13	0.43	6.9	1.9	5.3
3	30.7	0.018	89.0	2.0	6.18	0.318	4.851	4.836	9.8	5.0	7.8	3.0	2.61	0.42	7.4	2.4	5.4
4	35.5	0.024	89.2	2.2	6.18	0.424	5.639	5.616	10.6	5.0	8.5	2.8	2.98	0.39	7.8	2.8	5.6
5	39.9	0.030	89.3	2.3	6.19	0.530	6.348	6.314	11.3	5.0	9.0	2.7	3.32	0.36	8.2	3.2	5.9
6	44.1	0.036	89.5	2.5	6.20	0.635	7.029	6.985	12.0	5.0	9.5	2.5	3.77	0.36	8.5	3.5	6.0
7	48.0	0.042	89.6	2.6	6.20	0.741	7.657	7.601	12.6	5.0	10.0	2.4	4.12	0.34	8.8	3.8	6.2
8	51.1	0.048	89.5	2.5	6.21	0.847	8.165	8.096	13.1	5.0	10.6	2.5	4.27	0.31	9.1	4.0	6.5
9	53.8	0.055	89.4	2.4	6.22	0.953	8.606	8.524	13.5	5.0	11.1	2.6	4.33	0.29	9.3	4.3	6.8
10	55.7	0.061	89.3	2.3	6.22	1.059	8.913	8.819	13.8	5.0	11.5	2.7	4.29	0.26	9.4	4.4	7.1
11	57.1	0.067	89.2	2.2	6.23	1.165	9.141	9.034	14.0	5.0	11.9	2.8	4.18	0.24	9.5	4.5	7.4
12	57.6	0.073	89.2	2.2	6.24	1.271	9.221	9.104	14.1	5.0	11.9	2.8	4.30	0.25	9.6	4.6	7.3
13	57.9	0.079	89.3	2.3	6.24	1.377	9.274	9.147	14.2	5.0	11.8	2.7	4.41	0.25	9.6	4.6	7.3
14	58.1	0.085	89.3	2.3	6.25	1.483	9.301	9.163	14.2	5.0	11.8	2.7	4.42	0.25	9.6	4.6	7.3
15	58.2	0.091	89.4	2.4	6.26	1.589	9.314	9.166	14.2	5.0	11.8	2.6	4.47	0.26	9.6	4.6	7.2
16	57.9	0.097	89.3	2.3	6.26	1.695	9.274	9.117	14.1	5.0	11.8	2.7	4.40	0.26	9.6	4.6	7.2
17	57.7	0.103	89.3	2.3	6.27	1.801	9.234	9.068	14.1	5.0	11.8	2.7	4.34	0.25	9.5	4.5	7.3
18	57.8	0.109	89.2	2.2	6.28	1.906	9.248	9.071	14.1	5.0	11.8	2.8	4.29	0.25	9.5	4.5	7.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	57.7	0.115	89.1	2.1	6.28	2.012	9.234	9.048	14.1	5.0	11.9	2.9	4.14	0.24	9.5	4.5	7.4
20	57.6	0.121	89.1	2.1	6.29	2.118	9.221	9.025	14.0	5.0	11.9	2.9	4.13	0.24	9.5	4.5	7.4
21	57.6	0.127	89.4	2.4	6.30	2.224	9.221	9.016	14.0	5.0	11.7	2.6	4.42	0.26	9.5	4.5	7.1
22	57.7	0.133	89.4	2.4	6.30	2.330	9.234	9.019	14.0	5.0	11.7	2.6	4.42	0.26	9.5	4.5	7.1
23	57.8	0.139	89.4	2.4	6.31	2.436	9.248	9.022	14.0	5.0	11.7	2.6	4.42	0.26	9.5	4.5	7.1
24	57.8	0.145	89.4	2.4	6.32	2.542	9.261	9.026	14.0	5.0	11.6	2.6	4.47	0.27	9.5	4.5	7.1
25	57.8	0.151	89.4	2.4	6.32	2.648	9.261	9.016	14.0	5.0	11.7	2.6	4.42	0.26	9.5	4.5	7.1
26	57.8	0.157	89.3	2.3	6.33	2.754	9.248	8.993	14.0	5.0	11.7	2.7	4.31	0.25	9.5	4.5	7.2
27	58.0	0.163	89.2	2.2	6.34	2.860	9.288	9.022	14.0	5.0	11.8	2.8	4.27	0.25	9.5	4.5	7.3
28	57.8	0.169	89.2	2.2	6.34	2.966	9.261	8.986	14.0	5.0	11.8	2.8	4.17	0.24	9.5	4.5	7.3
29	58.2	0.175	89.4	2.4	6.35	3.072	9.314	9.028	14.0	5.0	11.6	2.6	4.53	0.27	9.5	4.5	7.1
30	58.3	0.181	89.4	2.4	6.36	3.177	9.328	9.031	14.0	5.0	11.6	2.6	4.48	0.27	9.5	4.5	7.1
31	58.3	0.187	89.4	2.4	6.37	3.283	9.341	9.034	14.0	5.0	11.6	2.6	4.48	0.27	9.5	4.5	7.1
32	58.5	0.193	89.4	2.4	6.37	3.389	9.368	9.050	14.1	5.0	11.7	2.6	4.43	0.26	9.5	4.5	7.2
33	58.6	0.199	89.3	2.3	6.38	3.495	9.381	9.053	14.1	5.0	11.7	2.7	4.38	0.26	9.5	4.5	7.2
34	58.7	0.205	89.2	2.2	6.39	3.601	9.395	9.056	14.1	5.0	11.8	2.8	4.28	0.25	9.5	4.5	7.3
35	58.7	0.211	89.2	2.2	6.39	3.707	9.408	9.059	14.1	5.0	11.9	2.8	4.19	0.24	9.5	4.5	7.4
36	59.0	0.217	89.1	2.1	6.40	3.813	9.448	9.088	14.1	5.0	12.0	2.9	4.11	0.23	9.6	4.5	7.5
37	59.3	0.223	89.3	2.3	6.41	3.919	9.501	9.129	14.1	5.0	11.8	2.7	4.41	0.26	9.6	4.6	7.2
38	59.3	0.229	89.3	2.3	6.41	4.025	9.501	9.119	14.1	5.0	11.8	2.7	4.40	0.26	9.6	4.6	7.2
39	59.6	0.235	89.3	2.3	6.42	4.131	9.542	9.147	14.2	5.0	11.9	2.7	4.36	0.25	9.6	4.6	7.3
40	59.6	0.241	89.3	2.3	6.43	4.237	9.555	9.150	14.2	5.0	11.8	2.7	4.42	0.25	9.6	4.6	7.3
41	59.8	0.247	89.3	2.3	6.44	4.343	9.582	9.166	14.2	5.0	11.9	2.7	4.37	0.25	9.6	4.6	7.3
42	60.0	0.253	89.2	2.2	6.44	4.448	9.608	9.181	14.2	5.0	12.0	2.8	4.28	0.24	9.6	4.6	7.4
43	60.1	0.259	89.1	2.1	6.45	4.554	9.635	9.196	14.2	5.0	12.1	2.9	4.19	0.23	9.6	4.6	7.5
44	60.2	0.265	89.0	2.0	6.46	4.660	9.648	9.199	14.2	5.0	12.2	3.0	4.11	0.22	9.6	4.6	7.6
45	60.3	0.271	89.3	2.3	6.46	4.766	9.662	9.201	14.2	5.0	11.9	2.7	4.38	0.25	9.6	4.6	7.3
46	60.7	0.277	89.2	2.2	6.47	4.872	9.729	9.255	14.3	5.0	12.0	2.8	4.35	0.24	9.6	4.6	7.4
47	61.0	0.283	89.2	2.2	6.48	4.978	9.782	9.295	14.3	5.0	12.1	2.8	4.37	0.24	9.7	4.6	7.4
48	60.9	0.289	89.2	2.2	6.49	5.084	9.755	9.259	14.3	5.0	12.0	2.8	4.36	0.24	9.6	4.6	7.4
49	61.1	0.295	89.1	2.1	6.49	5.190	9.795	9.287	14.3	5.0	12.2	2.9	4.23	0.23	9.7	4.6	7.5
50	61.3	0.301	89.0	2.0	6.50	5.296	9.822	9.302	14.3	5.0	12.3	3.0	4.06	0.21	9.7	4.7	7.7
51	61.6	0.307	89.2	2.2	6.51	5.402	9.876	9.342	14.3	5.0	12.1	2.8	4.39	0.24	9.7	4.7	7.4
52	61.7	0.313	89.2	2.2	6.52	5.508	9.889	9.344	14.4	5.0	12.1	2.8	4.34	0.24	9.7	4.7	7.5
53	62.0	0.319	89.2	2.2	6.52	5.613	9.942	9.384	14.4	5.0	12.2	2.8	4.35	0.24	9.7	4.7	7.5
54	62.3	0.325	89.2	2.2	6.53	5.719	9.983	9.412	14.4	5.0	12.2	2.8	4.36	0.23	9.7	4.7	7.5
55	62.6	0.331	89.2	2.2	6.54	5.825	10.036	9.451	14.5	5.0	12.3	2.8	4.38	0.23	9.7	4.7	7.5
56	62.7	0.337	89.1	2.1	6.54	5.931	10.049	9.453	14.5	5.0	12.4	2.9	4.24	0.22	9.7	4.7	7.6
57	63.0	0.343	89.0	2.0	6.55	6.037	10.103	9.493	14.5	5.0	12.5	3.0	4.16	0.21	9.8	4.7	7.7
58	63.3	0.349	89.0	2.0	6.56	6.143	10.143	9.520	14.5	5.0	12.6	3.0	4.13	0.21	9.8	4.8	7.8
59	63.5	0.355	89.2	2.2	6.57	6.249	10.183	9.547	14.6	5.0	12.4	2.8	4.36	0.23	9.8	4.8	7.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	63.8	0.361	89.2	2.2	6.57	6.355	10.223	9.573	14.6	5.0	12.4	2.8	4.37	0.23	9.8	4.8	7.6
61	64.0	0.367	89.2	2.2	6.58	6.461	10.263	9.600	14.6	5.0	12.4	2.8	4.38	0.23	9.8	4.8	7.6
62	64.2	0.373	89.1	2.1	6.59	6.567	10.290	9.614	14.6	5.0	12.5	2.9	4.34	0.22	9.8	4.8	7.7
63	64.4	0.379	89.1	2.1	6.60	6.673	10.330	9.641	14.6	5.0	12.6	2.9	4.30	0.22	9.8	4.8	7.7
64	64.4	0.385	89.0	2.0	6.60	6.779	10.330	9.630	14.6	5.0	12.6	3.0	4.21	0.21	9.8	4.8	7.8
65	64.6	0.391	88.9	1.9	6.61	6.884	10.357	9.644	14.7	5.0	12.7	3.1	4.13	0.20	9.8	4.8	7.9
66	64.8	0.397	88.8	1.8	6.62	6.990	10.397	9.670	14.7	5.0	12.8	3.2	4.06	0.19	9.8	4.8	8.0
67	65.2	0.403	89.1	2.1	6.63	7.096	10.464	9.721	14.7	5.0	12.6	2.9	4.33	0.21	9.9	4.9	7.8
68	65.4	0.409	89.1	2.1	6.63	7.202	10.490	9.735	14.7	5.0	12.7	2.9	4.33	0.21	9.9	4.9	7.8
69	65.7	0.415	89.0	2.0	6.64	7.308	10.530	9.761	14.8	5.0	12.7	3.0	4.30	0.21	9.9	4.9	7.8
70	65.7	0.421	89.0	2.0	6.65	7.414	10.544	9.762	14.8	5.0	12.8	3.0	4.21	0.20	9.9	4.9	7.9
71	66.0	0.427	88.9	1.9	6.66	7.520	10.584	9.788	14.8	5.0	12.9	3.1	4.14	0.19	9.9	4.9	8.0
72	66.2	0.433	88.8	1.8	6.66	7.626	10.624	9.814	14.8	5.0	13.1	3.2	4.03	0.18	9.9	4.9	8.1
73	66.3	0.439	89.0	2.0	6.67	7.732	10.637	9.815	14.8	5.0	12.8	3.0	4.27	0.20	9.9	4.9	7.9
74	66.6	0.445	89.0	2.0	6.68	7.838	10.677	9.841	14.8	5.0	12.8	3.0	4.28	0.20	9.9	4.9	7.9
75	66.8	0.451	89.0	2.0	6.69	7.944	10.718	9.866	14.9	5.0	12.9	3.0	4.25	0.20	9.9	4.9	8.0
76	67.1	0.457	89.0	2.0	6.70	8.050	10.771	9.904	14.9	5.0	12.9	3.0	4.26	0.20	10.0	5.0	8.0
77	67.4	0.463	88.9	1.9	6.70	8.155	10.811	9.929	14.9	5.0	13.0	3.1	4.18	0.19	10.0	5.0	8.1
78	67.6	0.469	88.8	1.8	6.71	8.261	10.851	9.955	15.0	5.0	13.2	3.2	4.11	0.18	10.0	5.0	8.2
79	67.9	0.475	88.7	1.7	6.72	8.367	10.891	9.980	15.0	5.0	13.3	3.3	4.01	0.17	10.0	5.0	8.3
80	68.0	0.481	88.6	1.6	6.73	8.473	10.918	9.993	15.0	5.0	13.4	3.4	3.94	0.16	10.0	5.0	8.4
81	68.3	0.487	88.8	1.8	6.73	8.579	10.958	10.018	15.0	5.0	13.2	3.2	4.17	0.18	10.0	5.0	8.2
82	68.6	0.493	88.8	1.8	6.74	8.685	11.012	10.055	15.1	5.0	13.3	3.2	4.14	0.18	10.0	5.0	8.2
83	68.9	0.499	88.8	1.8	6.75	8.791	11.052	10.080	15.1	5.0	13.3	3.2	4.15	0.18	10.0	5.0	8.2
84	69.1	0.505	88.8	1.8	6.76	8.897	11.092	10.105	15.1	5.0	13.3	3.2	4.12	0.17	10.1	5.1	8.3
85	69.4	0.511	88.7	1.7	6.77	9.003	11.132	10.130	15.1	5.0	13.5	3.3	4.05	0.17	10.1	5.1	8.4
86	69.8	0.517	88.6	1.6	6.77	9.109	11.199	10.179	15.2	5.0	13.6	3.4	3.99	0.16	10.1	5.1	8.5
87	69.9	0.523	88.5	1.5	6.78	9.215	11.212	10.179	15.2	5.0	13.7	3.5	3.89	0.15	10.1	5.1	8.6
88	69.9	0.529	88.7	1.7	6.79	9.320	11.225	10.179	15.2	5.0	13.5	3.3	4.10	0.17	10.1	5.1	8.4
89	70.5	0.535	88.7	1.7	6.80	9.426	11.319	10.252	15.3	5.0	13.6	3.3	4.09	0.16	10.1	5.1	8.4
90	70.7	0.541	88.6	1.6	6.81	9.532	11.346	10.264	15.3	5.0	13.6	3.4	4.05	0.16	10.1	5.1	8.5
91	70.8	0.547	88.6	1.6	6.81	9.638	11.372	10.276	15.3	5.0	13.7	3.4	3.99	0.15	10.1	5.1	8.6
92	71.2	0.553	88.5	1.5	6.82	9.744	11.426	10.312	15.3	5.0	13.8	3.5	3.93	0.14	10.2	5.2	8.7
93	71.5	0.559	88.6	1.6	6.83	9.850	11.479	10.349	15.4	5.0	13.7	3.4	4.08	0.16	10.2	5.2	8.5
94	71.7	0.565	88.6	1.6	6.84	9.956	11.506	10.360	15.4	5.0	13.7	3.4	4.08	0.16	10.2	5.2	8.5
95	72.0	0.571	88.6	1.6	6.85	10.062	11.559	10.396	15.4	5.0	13.8	3.4	4.09	0.16	10.2	5.2	8.6
96	72.2	0.577	88.6	1.6	6.85	10.168	11.586	10.408	15.4	5.0	13.8	3.4	4.06	0.15	10.2	5.2	8.6
97	72.5	0.583	88.6	1.6	6.86	10.274	11.640	10.444	15.5	5.0	13.9	3.4	4.03	0.15	10.2	5.2	8.7
98	72.6	0.589	88.5	1.5	6.87	10.380	11.666	10.455	15.5	5.0	14.0	3.5	3.97	0.14	10.2	5.2	8.7
99	73.0	0.595	88.3	1.3	6.88	10.486	11.720	10.491	15.5	5.0	14.2	3.7	3.85	0.13	10.3	5.2	8.9
100	73.2	0.601	88.6	1.6	6.89	10.591	11.760	10.514	15.5	5.0	14.0	3.4	4.06	0.15	10.3	5.3	8.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	73.5	0.607	88.5	1.5	6.89	10.697	11.800	10.538	15.5	5.0	14.1	3.5	3.99	0.14	10.3	5.3	8.8
102	73.7	0.613	88.5	1.5	6.90	10.803	11.840	10.561	15.6	5.0	14.0	3.5	4.03	0.14	10.3	5.3	8.8
103	74.0	0.619	88.5	1.5	6.91	10.909	11.880	10.584	15.6	5.0	14.1	3.5	4.04	0.14	10.3	5.3	8.8
104	74.1	0.625	88.6	1.6	6.92	11.015	11.907	10.595	15.6	5.0	14.0	3.4	4.08	0.15	10.3	5.3	8.7
105	74.5	0.631	88.4	1.4	6.93	11.121	11.960	10.630	15.6	5.0	14.2	3.6	3.95	0.13	10.3	5.3	8.9
106	74.6	0.637	88.3	1.3	6.94	11.227	11.987	10.641	15.6	5.0	14.4	3.7	3.86	0.12	10.3	5.3	9.0
107	74.7	0.643	88.3	1.3	6.94	11.333	12.000	10.640	15.6	5.0	14.4	3.7	3.86	0.12	10.3	5.3	9.0
108	75.1	0.649	88.5	1.5	6.95	11.439	12.067	10.687	15.7	5.0	14.2	3.5	4.07	0.14	10.4	5.3	8.8
109	75.2	0.655	88.4	1.4	6.96	11.545	12.081	10.686	15.7	5.0	14.2	3.6	4.00	0.14	10.3	5.3	8.9
110	75.4	0.661	88.3	1.3	6.97	11.651	12.121	10.709	15.7	5.0	14.4	3.7	3.91	0.12	10.4	5.4	9.0
111	75.8	0.667	88.3	1.3	6.98	11.757	12.174	10.743	15.7	5.0	14.4	3.7	3.92	0.12	10.4	5.4	9.1
112	75.9	0.673	88.2	1.2	6.99	11.862	12.201	10.754	15.8	5.0	14.6	3.8	3.80	0.11	10.4	5.4	9.2
113	76.3	0.679	88.4	1.4	6.99	11.968	12.254	10.788	15.8	5.0	14.4	3.6	3.96	0.13	10.4	5.4	9.0
114	76.6	0.685	88.4	1.4	7.00	12.074	12.308	10.822	15.8	5.0	14.4	3.6	4.04	0.13	10.4	5.4	9.0
115	76.7	0.691	88.4	1.4	7.01	12.180	12.321	10.820	15.8	5.0	14.4	3.6	4.00	0.13	10.4	5.4	9.0
116	77.1	0.697	88.3	1.3	7.02	12.286	12.388	10.866	15.9	5.0	14.5	3.7	3.95	0.12	10.4	5.4	9.1
117	77.2	0.703	88.4	1.4	7.03	12.392	12.401	10.865	15.9	5.0	14.5	3.6	4.02	0.13	10.4	5.4	9.0
118	77.5	0.709	88.3	1.3	7.04	12.498	12.455	10.898	15.9	5.0	14.6	3.7	3.93	0.12	10.5	5.4	9.2
119	77.8	0.715	88.2	1.2	7.04	12.604	12.508	10.932	15.9	5.0	14.7	3.8	3.87	0.11	10.5	5.5	9.3
120	78.1	0.721	88.2	1.2	7.05	12.710	12.548	10.953	16.0	5.0	14.8	3.8	3.85	0.11	10.5	5.5	9.3
121	78.2	0.727	88.3	1.3	7.06	12.816	12.575	10.963	16.0	5.0	14.7	3.7	3.95	0.12	10.5	5.5	9.2
122	78.6	0.733	88.3	1.3	7.07	12.922	12.629	10.997	16.0	5.0	14.7	3.7	3.99	0.12	10.5	5.5	9.2
123	78.8	0.739	88.4	1.4	7.08	13.028	12.669	11.018	16.0	5.0	14.7	3.6	4.03	0.12	10.5	5.5	9.2
124	78.9	0.745	88.3	1.3	7.09	13.133	12.682	11.016	16.0	5.0	14.7	3.7	3.99	0.12	10.5	5.5	9.2
125	79.1	0.751	88.2	1.2	7.10	13.239	12.722	11.038	16.0	5.0	14.8	3.8	3.90	0.11	10.5	5.5	9.3
126	79.5	0.757	88.2	1.2	7.10	13.345	12.776	11.071	16.1	5.0	14.9	3.8	3.88	0.11	10.5	5.5	9.4
127	79.7	0.763	88.1	1.1	7.11	13.451	12.816	11.092	16.1	5.0	15.0	3.9	3.83	0.10	10.6	5.5	9.5
128	79.8	0.769	88.2	1.2	7.12	13.557	12.829	11.090	16.1	5.0	14.9	3.8	3.95	0.11	10.6	5.5	9.3
129	80.2	0.775	88.2	1.2	7.13	13.663	12.896	11.134	16.1	5.0	14.9	3.8	3.96	0.11	10.6	5.6	9.3
130	80.5	0.781	88.2	1.2	7.14	13.769	12.936	11.155	16.2	5.0	15.0	3.8	3.93	0.11	10.6	5.6	9.4
131	80.8	0.787	88.1	1.1	7.15	13.875	12.989	11.187	16.2	5.0	15.1	3.9	3.88	0.10	10.6	5.6	9.5
132	81.1	0.793	88.1	1.1	7.16	13.981	13.043	11.219	16.2	5.0	15.1	3.9	3.86	0.10	10.6	5.6	9.5
133	81.3	0.799	88.0	1.0	7.17	14.087	13.070	11.228	16.2	5.0	15.3	4.0	3.78	0.09	10.6	5.6	9.7
134	81.5	0.805	88.1	1.1	7.17	14.193	13.110	11.249	16.3	5.0	15.1	3.9	3.90	0.10	10.6	5.6	9.5
135	81.8	0.811	88.1	1.1	7.18	14.298	13.150	11.269	16.3	5.0	15.2	3.9	3.90	0.10	10.6	5.6	9.5
136	81.9	0.817	88.2	1.2	7.19	14.404	13.163	11.267	16.3	5.0	15.1	3.8	3.93	0.10	10.6	5.6	9.5
137	82.3	0.823	88.1	1.1	7.20	14.510	13.230	11.310	16.3	5.0	15.2	3.9	3.91	0.10	10.7	5.7	9.5
138	82.8	0.829	88.1	1.1	7.21	14.616	13.310	11.365	16.4	5.0	15.2	3.9	3.93	0.10	10.7	5.7	9.6
139	82.8	0.835	88.0	1.0	7.22	14.722	13.323	11.362	16.4	5.0	15.4	4.0	3.81	0.08	10.7	5.7	9.7
140	83.1	0.841	87.9	0.9	7.23	14.828	13.364	11.382	16.4	5.0	15.5	4.1	3.76	0.08	10.7	5.7	9.8
141	83.5	0.847	88.1	1.1	7.24	14.934	13.430	11.425	16.4	5.0	15.3	3.9	3.94	0.10	10.7	5.7	9.6



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	83.9	0.853	88.2	1.2	7.25	15.040	13.497	11.467	16.5	5.0	15.3	3.8	3.98	0.10	10.7	5.7	9.6
143	83.9	0.859	88.1	1.1	7.26	15.146	13.497	11.453	16.5	5.0	15.4	3.9	3.92	0.09	10.7	5.7	9.6
144	84.2	0.865	88.0	1.0	7.26	15.252	13.537	11.473	16.5	5.0	15.4	4.0	3.89	0.09	10.7	5.7	9.7
145	84.7	0.871	87.9	0.9	7.27	15.358	13.617	11.526	16.5	5.0	15.6	4.1	3.82	0.08	10.8	5.8	9.8
146	84.7	0.877	88.1	1.1	7.28	15.464	13.631	11.523	16.5	5.0	15.4	3.9	3.97	0.10	10.8	5.8	9.6
147	84.9	0.883	87.7	0.7	7.29	15.569	13.658	11.531	16.5	5.0	15.9	4.3	3.67	0.06	10.8	5.8	10.1
148	85.1	0.889	88.1	1.1	7.30	15.675	13.684	11.539	16.5	5.0	15.4	3.9	3.97	0.10	10.8	5.8	9.7
149	85.3	0.895	88.0	1.0	7.31	15.781	13.724	11.558	16.6	5.0	15.5	4.0	3.92	0.09	10.8	5.8	9.7
150	85.6	0.901	88.0	1.0	7.32	15.887	13.778	11.589	16.6	5.0	15.6	4.0	3.92	0.09	10.8	5.8	9.8
151	86.0	0.907	87.8	0.8	7.33	15.993	13.831	11.619	16.6	5.0	15.8	4.2	3.76	0.07	10.8	5.8	10.0
152	86.1	0.913	88.0	1.0	7.34	16.099	13.858	11.627	16.6	5.0	15.6	4.0	3.93	0.09	10.8	5.8	9.8
153	86.2	0.919	87.8	0.8	7.35	16.205	13.871	11.623	16.6	5.0	15.8	4.2	3.76	0.07	10.8	5.8	10.0
154	86.6	0.925	87.8	0.8	7.36	16.311	13.925	11.654	16.7	5.0	15.9	4.2	3.75	0.07	10.8	5.8	10.1
155	86.8	0.931	88.0	1.0	7.37	16.417	13.965	11.672	16.7	5.0	15.7	4.0	3.89	0.08	10.8	5.8	9.9
156	87.3	0.937	88.0	1.0	7.38	16.523	14.045	11.724	16.7	5.0	15.8	4.0	3.90	0.08	10.9	5.9	9.9
157	87.7	0.943	87.9	0.9	7.38	16.629	14.112	11.765	16.8	5.0	15.8	4.1	3.88	0.08	10.9	5.9	10.0
158	88.0	0.949	87.9	0.9	7.39	16.735	14.165	11.795	16.8	5.0	15.9	4.1	3.89	0.08	10.9	5.9	10.0
159	88.3	0.955	87.9	0.9	7.40	16.840	14.205	11.813	16.8	5.0	15.9	4.1	3.86	0.07	10.9	5.9	10.0
160	88.5	0.961	87.8	0.8	7.41	16.946	14.246	11.831	16.8	5.0	16.0	4.2	3.81	0.07	10.9	5.9	10.1
161	88.7	0.967	87.7	0.7	7.42	17.052	14.272	11.838	16.8	5.0	16.2	4.3	3.74	0.06	10.9	5.9	10.2
162	89.2	0.973	87.8	0.8	7.43	17.158	14.352	11.890	16.9	5.0	16.1	4.2	3.83	0.07	11.0	5.9	10.1
163	89.5	0.979	87.8	0.8	7.44	17.264	14.406	11.919	16.9	5.0	16.1	4.2	3.86	0.07	11.0	6.0	10.1
164	89.6	0.985	87.9	0.9	7.45	17.370	14.419	11.915	16.9	5.0	16.0	4.1	3.89	0.07	11.0	6.0	10.1
165	90.0	0.991	87.9	0.9	7.46	17.476	14.486	11.355	16.4	5.0	15.4	4.1	3.78	0.08	10.7	5.7	9.8
166	90.0	0.997	87.8	0.8	7.47	17.582	14.486	11.336	16.3	5.0	15.5	4.2	3.70	0.07	10.7	5.7	9.9
167	90.0	1.003	87.7	0.7	7.48	17.688	14.486	11.317	16.3	5.0	15.6	4.3	3.64	0.06	10.7	5.7	9.9
168	90.5	1.009	87.6	0.6	7.49	17.794	14.566	11.364	16.4	5.0	15.8	4.4	3.58	0.05	10.7	5.7	10.1
169	90.9	1.015	87.8	0.8	7.50	17.900	14.633	11.400	16.4	5.0	15.6	4.2	3.74	0.07	10.7	5.7	9.9
170	91.3	1.021	87.8	0.8	7.51	18.005	14.700	11.436	16.4	5.0	15.6	4.2	3.72	0.07	10.7	5.7	9.9
171	91.7	1.027	87.7	0.7	7.52	18.111	14.767	11.471	16.5	5.0	15.8	4.3	3.68	0.06	10.7	5.7	10.0
172	92.0	1.033	87.8	0.8	7.53	18.217	14.807	11.485	16.5	5.0	15.7	4.2	3.73	0.07	10.7	5.7	9.9
173	92.0	1.039	87.7	0.7	7.54	18.323	14.807	11.465	16.5	5.0	15.7	4.3	3.68	0.06	10.7	5.7	10.0
174	92.3	1.045	87.7	0.7	7.55	18.429	14.860	11.490	16.5	5.0	15.8	4.3	3.66	0.06	10.8	5.7	10.1
175	92.4	1.051	87.6	0.6	7.56	18.535	14.874	11.481	16.5	5.0	15.9	4.4	3.58	0.05	10.7	5.7	10.2
176	92.6	1.057	87.6	0.6	7.57	18.641	14.914	11.494	16.5	5.0	15.9	4.4	3.61	0.05	10.8	5.7	10.2
177	92.9	1.063	87.8	0.8	7.58	18.747	14.954	11.508	16.5	5.0	15.8	4.2	3.71	0.07	10.8	5.8	10.0
178	93.2	1.069	87.8	0.8	7.59	18.853	15.007	11.532	16.5	5.0	15.8	4.2	3.72	0.07	10.8	5.8	10.0
179	93.3	1.075	87.8	0.8	7.60	18.959	15.021	11.523	16.5	5.0	15.7	4.2	3.74	0.07	10.8	5.8	10.0
180	93.5	1.081	87.7	0.7	7.61	19.065	15.061	11.536	16.5	5.0	15.9	4.3	3.67	0.06	10.8	5.8	10.1
181	93.8	1.087	87.6	0.6	7.62	19.171	15.101	11.549	16.6	5.0	15.9	4.4	3.65	0.06	10.8	5.8	10.1
182	94.2	1.093	87.5	0.5	7.63	19.276	15.168	11.583	16.6	5.0	16.1	4.5	3.58	0.05	10.8	5.8	10.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	94.5	1.099	87.4	0.4	7.64	19.382	15.221	11.606	16.6	5.0	16.2	4.6	3.54	0.04	10.8	5.8	10.4
184	94.8	1.105	87.8	0.8	7.65	19.488	15.261	11.619	16.6	5.0	15.9	4.2	3.74	0.07	10.8	5.8	10.1
185	95.3	1.111	87.6	0.6	7.66	19.594	15.341	11.663	16.7	5.0	16.0	4.4	3.67	0.06	10.8	5.8	10.2
186	95.6	1.117	87.7	0.7	7.67	19.700	15.395	11.686	16.7	5.0	16.0	4.3	3.70	0.06	10.9	5.8	10.2
187	95.9	1.123	87.6	0.6	7.68	19.806	15.448	11.709	16.7	5.0	16.2	4.4	3.63	0.05	10.9	5.9	10.3
188	96.3	1.129	87.6	0.6	7.69	19.912	15.502	11.732	16.7	5.0	16.1	4.4	3.66	0.05	10.9	5.9	10.3
189	96.4	1.134	87.7	0.7	7.70	20.002	15.528	11.737	16.7	5.0	16.1	4.3	3.71	0.06	10.9	5.9	10.2



File Location
B-68 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-68
Sample Description: Red Elastic Silt
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 52.000
PL: 33.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.807	2.807	
Height (in)	5.643	5.606	
Weight (grams)	1068.90		1117.84
Moisture (%)	22.76		28.38
Dry Density (pcf)	95.01	95.62	
Saturation (%)	81.38	100.00	
Void Ratio	0.737	0.730	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 84.100
Effective Confining Stress (psi): 10.0
Corrected Peak Deviator Stress (psi): 15.285 at reading number: 186

Specimen B

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	1.5	0.000	74.1	0.0	6.19	0.000	0.000	0.000	10.0	10.0	10.0	10.0	1.00	0.00	10.0	0.0	10.0
1	32.7	0.006	76.2	2.1	6.19	0.107	5.047	5.042	15.1	10.0	12.9	7.9	1.64	0.42	12.5	2.5	10.4
2	42.8	0.012	77.3	3.2	6.20	0.214	6.676	6.662	16.7	10.0	13.5	6.8	1.97	0.48	13.4	3.3	10.2
3	49.0	0.018	77.9	3.8	6.21	0.321	7.677	7.653	17.7	10.0	13.9	6.2	2.23	0.49	13.9	3.8	10.1
4	53.7	0.024	78.3	4.2	6.21	0.428	8.438	8.402	18.4	10.0	14.2	5.8	2.44	0.50	14.2	4.2	10.0
5	57.3	0.030	78.8	4.7	6.22	0.535	9.026	8.978	19.0	10.0	14.3	5.3	2.69	0.52	14.5	4.5	9.8
6	60.2	0.036	79.0	4.9	6.23	0.642	9.493	9.432	19.5	10.0	14.5	5.1	2.86	0.52	14.7	4.7	9.8
7	62.4	0.042	79.2	5.2	6.23	0.749	9.840	9.767	19.8	10.0	14.6	4.9	3.00	0.53	14.9	4.9	9.8
8	64.0	0.048	79.3	5.2	6.24	0.856	10.107	10.021	20.0	10.0	14.8	4.8	3.09	0.52	15.0	5.0	9.8
9	65.3	0.054	79.4	5.3	6.25	0.963	10.308	10.208	20.2	10.0	14.9	4.7	3.16	0.52	15.1	5.1	9.8
10	66.2	0.060	79.5	5.4	6.26	1.070	10.455	10.343	20.4	10.0	15.0	4.6	3.23	0.52	15.2	5.2	9.8
11	66.9	0.066	79.7	5.7	6.26	1.177	10.575	10.450	20.5	10.0	14.8	4.4	3.40	0.54	15.3	5.2	9.6
12	67.6	0.072	79.8	5.7	6.27	1.285	10.682	10.544	20.6	10.0	14.9	4.3	3.44	0.54	15.3	5.3	9.6
13	68.1	0.078	79.9	5.8	6.28	1.392	10.762	10.612	20.6	10.0	14.8	4.2	3.53	0.55	15.3	5.3	9.5
14	68.2	0.084	80.0	5.9	6.28	1.499	10.788	10.627	20.7	10.0	14.7	4.1	3.58	0.56	15.3	5.3	9.4
15	68.8	0.090	80.0	6.0	6.29	1.606	10.882	10.707	20.7	10.0	14.8	4.1	3.63	0.56	15.4	5.4	9.4
16	69.2	0.096	80.0	6.0	6.30	1.713	10.935	10.748	20.8	10.0	14.8	4.1	3.64	0.55	15.4	5.4	9.4
17	69.4	0.102	80.0	6.0	6.30	1.820	10.975	10.776	20.8	10.0	14.8	4.1	3.65	0.55	15.4	5.4	9.5
18	69.7	0.108	80.0	6.0	6.31	1.927	11.015	10.803	20.8	10.0	14.9	4.1	3.65	0.55	15.4	5.4	9.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	70.0	0.114	80.2	6.2	6.32	2.034	11.069	10.844	20.9	10.0	14.7	3.9	3.80	0.57	15.4	5.4	9.3
20	70.3	0.120	80.3	6.2	6.32	2.141	11.122	10.884	20.9	10.0	14.7	3.8	3.84	0.57	15.5	5.4	9.3
21	70.6	0.126	80.3	6.2	6.33	2.248	11.162	10.911	20.9	10.0	14.7	3.8	3.88	0.57	15.5	5.5	9.2
22	70.8	0.132	80.3	6.3	6.34	2.355	11.202	10.939	21.0	10.0	14.7	3.8	3.92	0.57	15.5	5.5	9.2
23	71.1	0.138	80.3	6.3	6.34	2.462	11.242	10.966	21.0	10.0	14.7	3.8	3.92	0.57	15.5	5.5	9.2
24	71.2	0.144	80.3	6.2	6.35	2.569	11.269	10.980	21.0	10.0	14.8	3.8	3.90	0.57	15.5	5.5	9.3
25	71.4	0.150	80.3	6.2	6.36	2.676	11.296	10.994	21.0	10.0	14.8	3.8	3.87	0.56	15.5	5.5	9.3
26	71.6	0.156	80.3	6.2	6.37	2.783	11.323	11.007	21.0	10.0	14.8	3.8	3.87	0.56	15.5	5.5	9.3
27	71.7	0.162	80.4	6.3	6.37	2.890	11.349	11.021	21.0	10.0	14.7	3.7	3.97	0.57	15.5	5.5	9.2
28	72.1	0.168	80.4	6.3	6.38	2.997	11.416	11.074	21.1	10.0	14.8	3.7	3.98	0.57	15.6	5.5	9.2
29	72.4	0.174	80.4	6.3	6.39	3.104	11.456	11.100	21.1	10.0	14.8	3.7	3.99	0.57	15.6	5.6	9.3
30	72.6	0.180	80.4	6.3	6.39	3.211	11.496	11.127	21.2	10.0	14.8	3.7	4.00	0.57	15.6	5.6	9.3
31	72.8	0.186	80.3	6.3	6.40	3.318	11.523	11.140	21.2	10.0	14.9	3.8	3.97	0.56	15.6	5.6	9.3
32	73.0	0.192	80.3	6.2	6.41	3.425	11.563	11.167	21.2	10.0	15.0	3.8	3.95	0.56	15.6	5.6	9.4
33	73.4	0.198	80.3	6.2	6.41	3.532	11.616	11.206	21.2	10.0	15.0	3.8	3.93	0.55	15.6	5.6	9.4
34	73.6	0.204	80.2	6.2	6.42	3.639	11.656	11.232	21.3	10.0	15.1	3.9	3.90	0.55	15.6	5.6	9.5
35	73.7	0.210	80.3	6.2	6.43	3.746	11.670	11.232	21.3	10.0	15.0	3.8	3.96	0.56	15.6	5.6	9.4
36	74.1	0.216	80.3	6.3	6.44	3.854	11.736	11.284	21.3	10.0	15.0	3.8	4.01	0.56	15.7	5.6	9.4
37	74.4	0.222	80.3	6.3	6.44	3.961	11.790	11.323	21.3	10.0	15.1	3.8	4.02	0.55	15.7	5.7	9.4
38	74.5	0.228	80.3	6.3	6.45	4.068	11.803	11.323	21.4	10.0	15.1	3.8	4.02	0.55	15.7	5.7	9.4
39	74.9	0.234	80.3	6.3	6.46	4.175	11.857	11.362	21.4	10.0	15.1	3.8	4.03	0.55	15.7	5.7	9.4
40	75.0	0.240	80.3	6.2	6.46	4.282	11.883	11.374	21.4	10.0	15.2	3.8	4.00	0.55	15.7	5.7	9.5
41	75.4	0.246	80.3	6.2	6.47	4.389	11.937	11.413	21.4	10.0	15.2	3.8	4.01	0.55	15.7	5.7	9.5
42	75.5	0.252	80.3	6.2	6.48	4.496	11.963	11.426	21.5	10.0	15.3	3.8	3.98	0.54	15.7	5.7	9.5
43	75.7	0.258	80.2	6.1	6.49	4.603	11.990	11.438	21.5	10.0	15.3	3.9	3.92	0.53	15.7	5.7	9.6
44	75.9	0.264	80.4	6.3	6.49	4.710	12.030	11.464	21.5	10.0	15.2	3.7	4.09	0.55	15.8	5.7	9.4
45	76.5	0.276	80.4	6.3	6.51	4.924	12.124	11.527	21.6	10.0	15.2	3.7	4.11	0.55	15.8	5.8	9.5
46	76.8	0.282	80.3	6.3	6.52	5.031	12.177	11.564	21.6	10.0	15.3	3.8	4.08	0.54	15.8	5.8	9.5
47	77.0	0.288	80.2	6.2	6.52	5.138	12.204	11.577	21.6	10.0	15.4	3.9	3.99	0.53	15.8	5.8	9.7
48	77.2	0.294	80.3	6.2	6.53	5.245	12.230	11.589	21.6	10.0	15.4	3.8	4.03	0.53	15.8	5.8	9.6
49	77.7	0.300	80.3	6.3	6.54	5.352	12.311	11.652	21.7	10.0	15.4	3.8	4.11	0.54	15.9	5.8	9.6
50	77.8	0.306	80.3	6.3	6.55	5.459	12.337	11.664	21.7	10.0	15.4	3.8	4.11	0.54	15.9	5.8	9.6
51	78.1	0.312	80.3	6.2	6.55	5.566	12.377	11.688	21.7	10.0	15.5	3.8	4.08	0.53	15.9	5.8	9.6
52	78.4	0.318	80.3	6.2	6.56	5.673	12.431	11.726	21.8	10.0	15.5	3.8	4.09	0.53	15.9	5.9	9.7
53	78.7	0.324	80.3	6.2	6.57	5.780	12.471	11.750	21.8	10.0	15.6	3.8	4.07	0.53	15.9	5.9	9.7
54	78.9	0.330	80.2	6.1	6.58	5.887	12.511	11.774	21.8	10.0	15.7	3.9	4.01	0.52	15.9	5.9	9.8
55	79.1	0.336	80.1	6.1	6.58	5.994	12.538	11.786	21.8	10.0	15.7	4.0	3.98	0.52	15.9	5.9	9.8
56	79.3	0.342	80.1	6.1	6.59	6.101	12.578	11.810	21.8	10.0	15.8	4.0	3.99	0.51	15.9	5.9	9.9
57	79.7	0.348	80.3	6.2	6.60	6.208	12.644	11.859	21.9	10.0	15.7	3.8	4.10	0.52	16.0	5.9	9.8
58	80.0	0.354	80.2	6.2	6.61	6.315	12.684	11.883	21.9	10.0	15.8	3.9	4.07	0.52	16.0	5.9	9.8
59	80.3	0.360	80.2	6.2	6.61	6.423	12.738	11.920	21.9	10.0	15.8	3.9	4.08	0.52	16.0	6.0	9.8



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	80.6	0.366	80.2	6.2	6.62	6.530	12.778	11.944	22.0	10.0	15.8	3.9	4.09	0.52	16.0	6.0	9.8
61	80.9	0.372	80.2	6.1	6.63	6.637	12.831	11.980	22.0	10.0	15.9	3.9	4.06	0.51	16.0	6.0	9.9
62	81.2	0.378	80.1	6.0	6.64	6.744	12.885	12.016	22.0	10.0	16.0	4.0	4.01	0.50	16.0	6.0	10.0
63	81.6	0.384	80.1	6.0	6.64	6.851	12.938	12.052	22.1	10.0	16.1	4.0	3.99	0.50	16.1	6.0	10.1
64	81.6	0.390	80.0	6.0	6.65	6.958	12.951	12.050	22.1	10.0	16.1	4.1	3.96	0.49	16.1	6.0	10.1
65	81.8	0.396	80.2	6.1	6.66	7.065	12.978	12.061	22.1	10.0	16.0	3.9	4.08	0.51	16.1	6.0	9.9
66	82.3	0.402	80.2	6.1	6.67	7.172	13.058	12.122	22.1	10.0	16.0	3.9	4.10	0.50	16.1	6.1	10.0
67	82.5	0.408	80.1	6.1	6.67	7.279	13.098	12.145	22.2	10.0	16.1	4.0	4.07	0.50	16.1	6.1	10.0
68	82.8	0.414	80.1	6.0	6.68	7.386	13.138	12.168	22.2	10.0	16.2	4.0	4.02	0.49	16.1	6.1	10.1
69	83.0	0.420	80.0	6.0	6.69	7.493	13.178	12.191	22.2	10.0	16.3	4.1	3.99	0.49	16.1	6.1	10.2
70	83.4	0.426	80.0	6.0	6.70	7.600	13.232	12.226	22.3	10.0	16.3	4.1	4.00	0.49	16.1	6.1	10.2
71	83.7	0.432	80.1	6.1	6.70	7.707	13.285	12.261	22.3	10.0	16.2	4.0	4.10	0.50	16.2	6.1	10.1
72	84.1	0.438	80.1	6.0	6.71	7.814	13.352	12.309	22.3	10.0	16.3	4.0	4.08	0.49	16.2	6.2	10.1
73	84.4	0.444	80.1	6.0	6.72	7.921	13.405	12.344	22.4	10.0	16.4	4.0	4.06	0.49	16.2	6.2	10.2
74	84.8	0.450	80.1	6.0	6.73	8.028	13.459	12.378	22.4	10.0	16.4	4.0	4.07	0.48	16.2	6.2	10.2
75	85.1	0.456	80.0	5.9	6.74	8.135	13.512	12.413	22.4	10.0	16.5	4.1	4.02	0.48	16.2	6.2	10.3
76	85.4	0.462	79.9	5.8	6.74	8.242	13.552	12.435	22.5	10.0	16.6	4.2	3.97	0.47	16.2	6.2	10.4
77	85.7	0.468	79.8	5.8	6.75	8.349	13.606	12.470	22.5	10.0	16.7	4.3	3.92	0.46	16.3	6.2	10.5
78	85.9	0.474	80.0	5.9	6.76	8.456	13.646	12.492	22.5	10.0	16.6	4.1	4.04	0.47	16.3	6.2	10.4
79	86.4	0.480	79.9	5.9	6.77	8.563	13.726	12.550	22.6	10.0	16.7	4.2	4.02	0.47	16.3	6.3	10.4
80	86.8	0.486	79.9	5.9	6.78	8.670	13.779	12.585	22.6	10.0	16.7	4.2	4.03	0.47	16.3	6.3	10.4
81	87.0	0.492	79.9	5.8	6.78	8.777	13.819	12.606	22.6	10.0	16.8	4.2	4.01	0.46	16.3	6.3	10.5
82	87.5	0.498	79.9	5.8	6.79	8.884	13.899	12.665	22.7	10.0	16.9	4.2	3.99	0.46	16.4	6.3	10.6
83	87.7	0.505	79.8	5.7	6.80	8.992	13.926	12.674	22.7	10.0	17.0	4.3	3.94	0.45	16.4	6.3	10.7
84	87.9	0.511	79.7	5.7	6.81	9.099	13.966	12.695	22.7	10.0	17.0	4.4	3.92	0.45	16.4	6.3	10.7
85	88.2	0.517	79.8	5.8	6.82	9.206	14.020	12.729	22.8	10.0	17.0	4.3	3.98	0.45	16.4	6.4	10.6
86	88.7	0.523	79.8	5.8	6.82	9.313	14.086	12.775	22.8	10.0	17.0	4.3	3.99	0.45	16.4	6.4	10.7
87	89.1	0.529	79.8	5.8	6.83	9.420	14.153	12.820	22.8	10.0	17.1	4.3	4.00	0.45	16.4	6.4	10.7
88	89.3	0.535	79.7	5.7	6.84	9.527	14.193	12.841	22.9	10.0	17.2	4.4	3.95	0.44	16.4	6.4	10.8
89	89.5	0.541	79.7	5.6	6.85	9.634	14.220	12.850	22.9	10.0	17.3	4.4	3.90	0.44	16.5	6.4	10.9
90	89.8	0.547	79.6	5.6	6.86	9.741	14.273	12.883	22.9	10.0	17.4	4.5	3.88	0.43	16.5	6.4	10.9
91	90.1	0.553	79.8	5.7	6.86	9.848	14.327	12.916	22.9	10.0	17.2	4.3	3.99	0.44	16.5	6.5	10.8
92	90.6	0.559	79.7	5.7	6.87	9.955	14.393	12.961	23.0	10.0	17.3	4.4	3.98	0.44	16.5	6.5	10.8
93	90.9	0.565	79.7	5.7	6.88	10.062	14.447	12.993	23.0	10.0	17.3	4.4	3.98	0.44	16.5	6.5	10.9
94	91.2	0.571	79.7	5.6	6.89	10.169	14.500	13.026	23.1	10.0	17.4	4.4	3.96	0.43	16.5	6.5	10.9
95	91.4	0.577	79.7	5.6	6.90	10.276	14.527	13.034	23.1	10.0	17.5	4.4	3.94	0.43	16.5	6.5	11.0
96	91.5	0.583	79.6	5.5	6.91	10.383	14.554	13.043	23.1	10.0	17.6	4.5	3.89	0.42	16.5	6.5	11.0
97	91.9	0.589	79.5	5.5	6.91	10.490	14.607	13.075	23.1	10.0	17.6	4.6	3.87	0.42	16.6	6.5	11.1
98	92.3	0.595	79.7	5.6	6.92	10.597	14.674	13.119	23.1	10.0	17.6	4.4	3.96	0.43	16.6	6.6	11.0
99	92.6	0.601	79.7	5.6	6.93	10.704	14.727	13.151	23.2	10.0	17.6	4.4	3.97	0.43	16.6	6.6	11.0
100	93.1	0.607	79.6	5.6	6.94	10.811	14.807	13.207	23.2	10.0	17.7	4.5	3.95	0.42	16.6	6.6	11.1



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	93.3	0.613	79.6	5.6	6.95	10.918	14.834	13.214	23.2	10.0	17.7	4.5	3.95	0.42	16.6	6.6	11.1
102	93.6	0.619	79.6	5.5	6.95	11.025	14.887	13.246	23.3	10.0	17.8	4.5	3.93	0.42	16.7	6.6	11.1
103	93.9	0.625	79.5	5.4	6.96	11.132	14.941	13.278	23.3	10.0	17.9	4.6	3.89	0.41	16.7	6.6	11.2
104	94.3	0.631	79.5	5.4	6.97	11.239	14.994	13.309	23.3	10.0	17.9	4.6	3.87	0.41	16.7	6.7	11.3
105	94.4	0.637	79.5	5.4	6.98	11.346	15.008	13.305	23.3	10.0	17.9	4.6	3.90	0.41	16.7	6.7	11.2
106	94.8	0.643	79.5	5.5	6.99	11.454	15.074	13.348	23.4	10.0	17.9	4.6	3.93	0.41	16.7	6.7	11.2
107	95.0	0.649	79.5	5.5	7.00	11.561	15.114	13.367	23.4	10.0	17.9	4.6	3.93	0.41	16.7	6.7	11.2
108	95.3	0.655	79.5	5.4	7.01	11.668	15.168	13.398	23.4	10.0	18.0	4.6	3.92	0.41	16.7	6.7	11.3
109	95.6	0.661	79.4	5.4	7.01	11.775	15.208	13.417	23.4	10.0	18.1	4.7	3.87	0.40	16.7	6.7	11.4
110	95.9	0.667	79.3	5.3	7.02	11.882	15.261	13.448	23.5	10.0	18.2	4.8	3.83	0.39	16.8	6.7	11.5
111	96.3	0.673	79.5	5.4	7.03	11.989	15.315	13.479	23.5	10.0	18.1	4.6	3.93	0.40	16.8	6.7	11.3
112	96.6	0.679	79.5	5.4	7.04	12.096	15.368	13.509	23.5	10.0	18.1	4.6	3.91	0.40	16.8	6.8	11.4
113	96.9	0.685	79.5	5.4	7.05	12.203	15.422	13.540	23.6	10.0	18.2	4.6	3.92	0.40	16.8	6.8	11.4
114	97.2	0.691	79.4	5.4	7.06	12.310	15.462	13.558	23.6	10.0	18.2	4.7	3.90	0.39	16.8	6.8	11.5
115	97.5	0.697	79.4	5.3	7.07	12.417	15.515	13.589	23.6	10.0	18.3	4.7	3.88	0.39	16.8	6.8	11.5
116	97.7	0.703	79.3	5.3	7.07	12.524	15.555	13.607	23.6	10.0	18.4	4.8	3.86	0.39	16.8	6.8	11.6
117	98.2	0.709	79.3	5.2	7.08	12.631	15.622	13.649	23.7	10.0	18.5	4.8	3.82	0.38	16.9	6.8	11.7
118	98.5	0.715	79.4	5.3	7.09	12.738	15.675	13.679	23.7	10.0	18.4	4.7	3.90	0.39	16.9	6.8	11.6
119	98.8	0.721	79.4	5.3	7.10	12.845	15.729	13.708	23.7	10.0	18.4	4.7	3.91	0.39	16.9	6.9	11.6
120	99.1	0.727	79.3	5.3	7.11	12.952	15.782	13.738	23.8	10.0	18.5	4.8	3.89	0.38	16.9	6.9	11.6
121	99.3	0.733	79.3	5.2	7.12	13.059	15.809	13.744	23.8	10.0	18.5	4.8	3.87	0.38	16.9	6.9	11.7
122	99.8	0.739	79.3	5.2	7.13	13.166	15.889	13.797	23.8	10.0	18.6	4.8	3.88	0.38	16.9	6.9	11.7
123	100.1	0.745	79.2	5.2	7.14	13.273	15.942	13.826	23.9	10.0	18.7	4.9	3.84	0.37	16.9	6.9	11.8
124	100.4	0.751	79.1	5.1	7.14	13.380	15.982	13.844	23.9	10.0	18.8	5.0	3.79	0.37	16.9	6.9	11.9
125	100.6	0.757	79.1	5.0	7.15	13.487	16.022	13.861	23.9	10.0	18.9	5.0	3.75	0.36	17.0	6.9	12.0
126	100.9	0.763	79.2	5.2	7.16	13.594	16.062	13.879	23.9	10.0	18.8	4.9	3.85	0.37	17.0	6.9	11.8
127	101.3	0.769	79.2	5.2	7.17	13.701	16.129	13.919	23.9	10.0	18.8	4.9	3.85	0.37	17.0	7.0	11.8
128	101.6	0.775	79.2	5.1	7.18	13.808	16.183	13.948	24.0	10.0	18.9	4.9	3.84	0.37	17.0	7.0	11.9
129	101.8	0.781	79.1	5.0	7.19	13.915	16.209	13.954	24.0	10.0	19.0	5.0	3.79	0.36	17.0	7.0	12.0
130	102.2	0.787	79.0	4.9	7.20	14.023	16.276	13.994	24.0	10.0	19.1	5.1	3.76	0.35	17.0	7.0	12.1
131	102.4	0.793	79.1	5.0	7.21	14.130	16.303	13.999	24.0	10.0	19.0	5.0	3.80	0.36	17.0	7.0	12.0
132	102.8	0.799	79.1	5.1	7.22	14.237	16.370	14.039	24.1	10.0	19.0	5.0	3.83	0.36	17.0	7.0	12.0
133	103.0	0.805	79.1	5.0	7.22	14.344	16.410	14.056	24.1	10.0	19.1	5.0	3.81	0.36	17.1	7.0	12.0
134	103.4	0.811	79.1	5.0	7.23	14.451	16.463	14.084	24.1	10.0	19.1	5.0	3.82	0.36	17.1	7.0	12.0
135	103.7	0.817	79.1	5.0	7.24	14.558	16.516	14.112	24.1	10.0	19.1	5.0	3.82	0.36	17.1	7.1	12.1
136	103.9	0.823	79.0	4.9	7.25	14.665	16.543	14.117	24.1	10.0	19.2	5.1	3.78	0.35	17.1	7.1	12.1
137	104.1	0.829	79.0	4.9	7.26	14.772	16.583	14.134	24.2	10.0	19.3	5.1	3.76	0.35	17.1	7.1	12.2
138	104.4	0.835	78.9	4.8	7.27	14.879	16.623	14.150	24.2	10.0	19.3	5.2	3.72	0.34	17.1	7.1	12.3
139	104.7	0.841	79.1	5.0	7.28	14.986	16.677	14.178	24.2	10.0	19.2	5.0	3.81	0.35	17.1	7.1	12.1
140	105.3	0.847	79.0	4.9	7.29	15.093	16.783	14.250	24.3	10.0	19.3	5.1	3.81	0.35	17.2	7.1	12.2
141	105.5	0.853	79.0	4.9	7.30	15.200	16.810	14.255	24.3	10.0	19.3	5.1	3.81	0.35	17.2	7.1	12.2



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	105.8	0.859	79.0	4.9	7.31	15.307	16.850	14.271	24.3	10.0	19.3	5.1	3.81	0.35	17.2	7.1	12.2
143	106.1	0.865	79.0	4.9	7.32	15.414	16.904	14.298	24.3	10.0	19.4	5.1	3.79	0.34	17.2	7.1	12.3
144	106.4	0.871	78.9	4.8	7.33	15.521	16.957	14.325	24.4	10.0	19.5	5.2	3.76	0.34	17.2	7.2	12.4
145	106.8	0.877	78.8	4.7	7.33	15.628	17.024	14.363	24.4	10.0	19.6	5.3	3.72	0.33	17.2	7.2	12.5
146	107.1	0.883	79.0	4.9	7.34	15.735	17.064	14.379	24.4	10.0	19.5	5.1	3.81	0.34	17.2	7.2	12.3
147	107.3	0.889	78.9	4.9	7.35	15.842	17.104	14.394	24.4	10.0	19.6	5.2	3.79	0.34	17.2	7.2	12.4
148	107.6	0.895	78.9	4.9	7.36	15.949	17.144	14.410	24.4	10.0	19.6	5.2	3.79	0.34	17.2	7.2	12.4
149	108.0	0.901	78.9	4.8	7.37	16.056	17.211	14.447	24.5	10.0	19.7	5.2	3.76	0.33	17.3	7.2	12.5
150	108.2	0.907	78.8	4.7	7.38	16.163	17.251	14.462	24.5	10.0	19.7	5.3	3.74	0.33	17.3	7.2	12.5
151	108.5	0.913	78.7	4.7	7.39	16.270	17.291	14.478	24.5	10.0	19.8	5.4	3.70	0.32	17.3	7.2	12.6
152	108.7	0.919	78.9	4.8	7.40	16.377	17.318	14.481	24.5	10.0	19.7	5.2	3.76	0.33	17.3	7.2	12.5
153	109.2	0.925	78.9	4.8	7.41	16.484	17.411	14.541	24.6	10.0	19.8	5.2	3.78	0.33	17.3	7.3	12.5
154	109.6	0.931	78.8	4.7	7.42	16.592	17.478	14.578	24.6	10.0	19.9	5.3	3.76	0.33	17.3	7.3	12.6
155	109.9	0.937	78.8	4.7	7.43	16.699	17.518	14.593	24.6	10.0	19.9	5.3	3.76	0.33	17.3	7.3	12.6
156	110.1	0.943	78.8	4.7	7.44	16.806	17.558	14.607	24.6	10.0	19.9	5.3	3.75	0.32	17.3	7.3	12.6
157	110.6	0.949	78.7	4.7	7.45	16.913	17.625	14.644	24.7	10.0	20.0	5.4	3.73	0.32	17.3	7.3	12.7
158	110.7	0.955	78.7	4.6	7.46	17.020	17.651	14.647	24.7	10.0	20.1	5.4	3.69	0.31	17.4	7.3	12.8
159	111.0	0.961	78.6	4.5	7.47	17.127	17.691	14.661	24.7	10.0	20.1	5.5	3.68	0.31	17.4	7.3	12.8
160	111.2	0.967	78.7	4.7	7.48	17.234	17.731	14.676	24.7	10.0	20.0	5.4	3.74	0.32	17.4	7.3	12.7
161	111.5	0.973	78.7	4.7	7.49	17.341	17.772	14.690	24.7	10.0	20.0	5.4	3.74	0.32	17.4	7.3	12.7
162	111.9	0.979	78.7	4.7	7.50	17.448	17.838	14.726	24.8	10.0	20.1	5.4	3.75	0.32	17.4	7.4	12.7
163	112.0	0.985	78.7	4.6	7.51	17.555	17.865	14.729	24.8	10.0	20.1	5.4	3.73	0.31	17.4	7.4	12.8
164	112.6	0.991	78.7	4.6	7.52	17.662	17.958	14.787	24.8	10.0	20.2	5.4	3.72	0.31	17.4	7.4	12.8
165	112.9	0.997	78.6	4.5	7.53	17.769	18.012	14.811	24.8	10.0	20.3	5.5	3.68	0.30	17.4	7.4	12.9
166	113.2	1.003	78.5	4.5	7.54	17.876	18.052	14.825	24.9	10.0	20.4	5.6	3.67	0.30	17.4	7.4	13.0
167	113.4	1.009	78.7	4.6	7.55	17.991	18.092	14.837	24.9	10.0	20.3	5.4	3.73	0.31	17.4	7.4	12.9
168	113.9	1.015	78.6	4.5	7.56	18.107	18.159	14.871	24.9	10.0	20.4	5.5	3.71	0.31	17.5	7.4	12.9
169	114.3	1.022	78.6	4.5	7.57	18.222	18.226	14.904	24.9	10.0	20.4	5.5	3.72	0.31	17.5	7.5	12.9
170	114.7	1.028	78.6	4.5	7.58	18.337	18.292	14.938	25.0	10.0	20.4	5.5	3.73	0.30	17.5	7.5	12.9
171	114.9	1.035	78.5	4.5	7.59	18.452	18.332	14.950	25.0	10.0	20.5	5.6	3.69	0.30	17.5	7.5	13.0
172	115.3	1.041	78.5	4.4	7.60	18.568	18.399	14.983	25.0	10.0	20.6	5.6	3.66	0.29	17.5	7.5	13.1
173	115.7	1.048	78.4	4.3	7.61	18.683	18.452	15.005	25.0	10.0	20.7	5.7	3.64	0.29	17.5	7.5	13.2
174	115.8	1.054	78.6	4.5	7.62	18.790	18.479	15.007	25.0	10.0	20.5	5.5	3.72	0.30	17.5	7.5	13.0
175	116.3	1.060	78.5	4.5	7.63	18.897	18.546	15.041	25.1	10.0	20.6	5.6	3.70	0.30	17.5	7.5	13.1
176	116.8	1.066	78.5	4.5	7.64	19.004	18.639	15.097	25.1	10.0	20.7	5.6	3.71	0.30	17.6	7.5	13.1
177	117.0	1.072	78.5	4.4	7.65	19.111	18.666	15.099	25.1	10.0	20.7	5.6	3.70	0.29	17.6	7.5	13.2
178	117.2	1.078	78.5	4.4	7.66	19.218	18.693	15.100	25.1	10.0	20.7	5.6	3.68	0.29	17.6	7.6	13.2
179	117.4	1.084	78.4	4.3	7.67	19.325	18.733	15.113	25.1	10.0	20.8	5.7	3.64	0.28	17.6	7.6	13.3
180	117.7	1.090	78.3	4.3	7.68	19.432	18.773	15.125	25.2	10.0	20.9	5.8	3.62	0.28	17.6	7.6	13.3
181	118.1	1.096	78.5	4.4	7.69	19.539	18.840	15.159	25.2	10.0	20.8	5.6	3.69	0.29	17.6	7.6	13.2
182	118.6	1.102	78.5	4.4	7.70	19.646	18.933	15.213	25.2	10.0	20.9	5.6	3.70	0.29	17.6	7.6	13.2



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	118.9	1.108	78.4	4.3	7.71	19.753	18.973	15.225	25.3	10.0	20.9	5.7	3.68	0.29	17.6	7.6	13.3
184	119.2	1.114	78.4	4.3	7.72	19.869	19.027	15.246	25.3	10.0	20.9	5.7	3.68	0.29	17.7	7.6	13.3
185	119.6	1.121	78.4	4.3	7.73	19.984	19.093	15.278	25.3	10.0	21.0	5.7	3.67	0.28	17.7	7.6	13.4
186	119.7	1.122	78.4	4.3	7.74	20.000	19.107	15.285	25.3	10.0	21.0	5.7	3.67	0.28	17.7	7.6	13.4



File Location
B-68 5PSI.HSD

Project Information

Project No. 08195-01
Project Name: I-85/I-385 Interchange
Client:
Sample Location: B-68
Sample Description: Red Elastic Silt
Remarks:

Sample Data

Sample Type: Remolded
Specific Gravity: 2.6500001
LL: 52.000
PL: 33.000

Sample Parameters	Initial	After Consolidation	Final
Diameter (in)	2.800	2.788	
Height (in)	5.647	5.594	
Weight (grams)	1074.90		1109.15
Moisture (%)	22.27		26.16
Dry Density (pcf)	96.32	98.10	
Saturation (%)	82.25	100.00	
Void Ratio	0.714	0.686	

Test Data

Rate of Strain: 0.002
Cell Pressure (psi): 102.000
Effective Confining Stress (psi): 20.0
Corrected Peak Deviator Stress (psi): 23.400 at reading number: 186

Specimen C

Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
0	1.0	0.000	82.0	0.0	6.10	0.000	0.000	0.000	20.0	20.0	20.0	20.0	1.00	0.00	20.0	0.0	20.0
1	34.9	0.006	84.3	2.3	6.11	0.107	5.550	5.544	25.5	20.0	23.2	17.7	1.31	0.41	22.8	2.8	20.5
2	62.5	0.012	87.2	5.2	6.12	0.215	10.071	10.050	30.0	20.0	24.9	14.8	1.68	0.52	25.0	5.0	19.8
3	77.4	0.018	88.9	6.9	6.12	0.322	12.522	12.481	32.5	20.0	25.6	13.1	1.95	0.55	26.2	6.2	19.4
4	87.5	0.024	90.0	8.0	6.13	0.429	14.173	14.112	34.1	20.0	26.1	12.0	2.18	0.57	27.1	7.1	19.1
5	95.2	0.030	90.8	8.8	6.14	0.536	15.432	15.349	35.3	20.0	26.6	11.2	2.37	0.57	27.7	7.7	18.9
6	101.0	0.036	91.4	9.4	6.14	0.644	16.393	16.288	36.3	20.0	26.9	10.6	2.53	0.58	28.1	8.1	18.8
7	105.8	0.042	91.9	9.8	6.15	0.751	17.165	17.036	37.0	20.0	27.2	10.1	2.68	0.58	28.5	8.5	18.7
8	109.1	0.048	92.2	10.2	6.16	0.858	17.720	17.568	37.6	20.0	27.4	9.8	2.80	0.58	28.8	8.8	18.6
9	111.5	0.054	92.6	10.6	6.16	0.965	18.112	17.938	37.9	20.0	27.3	9.4	2.91	0.59	29.0	9.0	18.4
10	113.4	0.060	92.9	10.9	6.17	1.073	18.424	18.226	38.2	20.0	27.3	9.1	3.00	0.60	29.1	9.1	18.2
11	115.0	0.066	93.1	11.1	6.18	1.180	18.681	18.461	38.5	20.0	27.3	8.9	3.08	0.60	29.2	9.2	18.1
12	116.0	0.072	93.4	11.4	6.18	1.287	18.843	18.601	38.6	20.0	27.2	8.6	3.16	0.61	29.3	9.3	17.9
13	116.8	0.078	93.5	11.5	6.19	1.395	18.979	18.714	38.7	20.0	27.2	8.5	3.21	0.62	29.4	9.4	17.8
14	117.4	0.084	93.7	11.7	6.20	1.502	19.074	18.787	38.8	20.0	27.1	8.3	3.26	0.62	29.4	9.4	17.7
15	117.9	0.090	93.8	11.8	6.20	1.609	19.155	18.847	38.8	20.0	27.0	8.2	3.30	0.63	29.4	9.4	17.6
16	118.0	0.096	94.0	12.0	6.21	1.716	19.168	18.839	38.8	20.0	26.9	8.0	3.35	0.64	29.4	9.4	17.4
17	118.5	0.102	94.1	12.1	6.22	1.824	19.250	18.898	38.9	20.0	26.8	7.9	3.38	0.64	29.4	9.4	17.4
18	118.7	0.108	94.2	12.2	6.22	1.931	19.290	18.918	38.9	20.0	26.7	7.8	3.42	0.64	29.5	9.5	17.3



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
19	118.9	0.114	94.3	12.3	6.23	2.038	19.317	18.924	38.9	20.0	26.7	7.7	3.45	0.65	29.5	9.5	17.2
20	119.0	0.120	94.3	12.3	6.24	2.145	19.331	18.916	38.9	20.0	26.6	7.7	3.47	0.65	29.5	9.5	17.1
21	119.1	0.126	94.4	12.4	6.24	2.253	19.344	18.909	38.9	20.0	26.5	7.6	3.50	0.66	29.5	9.5	17.0
22	119.1	0.132	94.5	12.5	6.25	2.360	19.344	18.888	38.9	20.0	26.4	7.5	3.52	0.66	29.4	9.4	16.9
23	119.4	0.138	94.6	12.6	6.26	2.467	19.398	18.920	38.9	20.0	26.3	7.4	3.55	0.67	29.5	9.5	16.9
24	119.3	0.144	94.6	12.6	6.26	2.575	19.385	18.886	38.9	20.0	26.3	7.4	3.56	0.67	29.4	9.4	16.8
25	119.6	0.150	94.6	12.6	6.27	2.682	19.426	18.905	38.9	20.0	26.3	7.4	3.56	0.67	29.4	9.5	16.8
26	119.6	0.156	94.7	12.7	6.28	2.789	19.439	18.897	38.9	20.0	26.2	7.3	3.58	0.67	29.4	9.4	16.8
27	119.7	0.162	94.7	12.7	6.29	2.896	19.453	18.889	38.9	20.0	26.2	7.3	3.58	0.67	29.4	9.4	16.8
28	119.8	0.168	94.7	12.7	6.29	3.004	19.466	18.881	38.9	20.0	26.1	7.3	3.60	0.67	29.4	9.4	16.7
29	119.9	0.174	94.8	12.8	6.30	3.111	19.480	18.874	38.9	20.0	26.1	7.2	3.62	0.68	29.4	9.4	16.7
30	120.0	0.180	94.8	12.8	6.31	3.218	19.493	18.866	38.9	20.0	26.0	7.2	3.63	0.68	29.4	9.4	16.6
31	120.1	0.186	94.8	12.8	6.31	3.325	19.520	18.871	38.9	20.0	26.0	7.2	3.63	0.68	29.4	9.4	16.6
32	120.4	0.192	94.9	12.9	6.32	3.433	19.561	18.889	38.9	20.0	26.0	7.1	3.65	0.68	29.4	9.4	16.6
33	120.4	0.198	94.9	12.9	6.33	3.540	19.561	18.868	38.9	20.0	26.0	7.1	3.65	0.68	29.4	9.4	16.6
34	120.6	0.204	94.9	12.9	6.33	3.647	19.601	18.887	38.9	20.0	26.0	7.1	3.65	0.68	29.4	9.4	16.6
35	120.8	0.210	94.9	12.9	6.34	3.755	19.629	18.892	38.9	20.0	25.9	7.1	3.68	0.69	29.4	9.4	16.5
36	121.0	0.216	95.0	13.0	6.35	3.862	19.669	18.910	38.9	20.0	25.9	7.0	3.70	0.69	29.5	9.5	16.5
37	121.4	0.222	95.0	13.0	6.36	3.969	19.723	18.940	38.9	20.0	26.0	7.0	3.70	0.69	29.5	9.5	16.5
38	121.5	0.228	95.0	13.0	6.36	4.076	19.750	18.945	38.9	20.0	26.0	7.0	3.70	0.69	29.5	9.5	16.5
39	121.8	0.234	95.0	13.0	6.37	4.184	19.791	18.963	39.0	20.0	26.0	7.0	3.70	0.68	29.5	9.5	16.5
40	122.1	0.240	95.0	13.0	6.38	4.291	19.845	18.994	39.0	20.0	26.0	7.0	3.71	0.68	29.5	9.5	16.5
41	122.2	0.246	95.0	13.0	6.38	4.398	19.859	18.985	39.0	20.0	26.0	7.0	3.71	0.68	29.5	9.5	16.5
42	122.6	0.252	95.0	13.0	6.39	4.505	19.926	19.029	39.0	20.0	26.0	7.0	3.73	0.68	29.5	9.5	16.5
43	122.9	0.258	95.0	13.0	6.40	4.613	19.981	19.059	39.1	20.0	26.1	7.0	3.72	0.68	29.5	9.5	16.5
44	123.1	0.264	95.0	13.0	6.41	4.720	20.008	19.063	39.1	20.0	26.1	7.0	3.72	0.68	29.5	9.5	16.5
45	123.4	0.270	95.0	13.0	6.41	4.827	20.048	19.080	39.1	20.0	26.1	7.0	3.74	0.68	29.5	9.5	16.5
46	123.7	0.276	95.0	13.0	6.42	4.935	20.102	19.110	39.1	20.0	26.1	7.0	3.74	0.68	29.6	9.6	16.5
47	123.9	0.282	95.0	13.0	6.43	5.042	20.143	19.127	39.1	20.0	26.1	7.0	3.74	0.68	29.6	9.6	16.5
48	124.3	0.288	95.1	13.1	6.43	5.149	20.197	19.157	39.2	20.0	26.1	6.9	3.76	0.68	29.6	9.6	16.5
49	124.7	0.294	95.1	13.1	6.44	5.256	20.265	19.200	39.2	20.0	26.1	6.9	3.77	0.68	29.6	9.6	16.5
50	124.8	0.300	95.0	13.0	6.45	5.364	20.292	19.204	39.2	20.0	26.2	7.0	3.75	0.68	29.6	9.6	16.6
51	125.2	0.306	95.0	13.0	6.46	5.471	20.346	19.233	39.2	20.0	26.2	7.0	3.76	0.68	29.6	9.6	16.6
52	125.4	0.312	95.0	13.0	6.46	5.578	20.387	19.249	39.2	20.0	26.2	7.0	3.76	0.68	29.6	9.6	16.6
53	125.8	0.318	95.0	13.0	6.47	5.685	20.441	19.279	39.3	20.0	26.3	7.0	3.75	0.67	29.6	9.6	16.7
54	126.1	0.324	95.0	13.0	6.48	5.793	20.495	19.308	39.3	20.0	26.3	7.0	3.77	0.67	29.7	9.7	16.6
55	126.4	0.330	95.0	13.0	6.49	5.900	20.549	19.337	39.3	20.0	26.3	7.0	3.77	0.67	29.7	9.7	16.6
56	126.7	0.336	95.0	13.0	6.49	6.007	20.590	19.353	39.3	20.0	26.3	7.0	3.78	0.67	29.7	9.7	16.6
57	127.1	0.342	95.0	13.0	6.50	6.114	20.657	19.394	39.4	20.0	26.4	7.0	3.78	0.67	29.7	9.7	16.7
58	127.3	0.348	95.0	13.0	6.51	6.222	20.698	19.410	39.4	20.0	26.4	7.0	3.78	0.67	29.7	9.7	16.7
59	127.7	0.354	95.0	13.0	6.52	6.329	20.752	19.439	39.4	20.0	26.5	7.0	3.77	0.67	29.7	9.7	16.7



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
60	128.1	0.360	95.0	13.0	6.52	6.436	20.820	19.480	39.5	20.0	26.5	7.0	3.78	0.67	29.7	9.7	16.8
61	128.4	0.366	95.0	13.0	6.53	6.544	20.874	19.508	39.5	20.0	26.5	7.0	3.80	0.67	29.8	9.8	16.7
62	128.7	0.372	95.0	13.0	6.54	6.651	20.928	19.536	39.5	20.0	26.5	7.0	3.80	0.67	29.8	9.8	16.7
63	129.1	0.378	95.0	13.0	6.55	6.758	20.996	19.577	39.6	20.0	26.5	7.0	3.81	0.67	29.8	9.8	16.8
64	129.5	0.384	95.0	13.0	6.55	6.865	21.050	19.605	39.6	20.0	26.6	7.0	3.81	0.66	29.8	9.8	16.8
65	129.9	0.390	95.0	13.0	6.56	6.973	21.118	19.645	39.6	20.0	26.7	7.0	3.80	0.66	29.8	9.8	16.8
66	130.3	0.396	94.9	12.9	6.57	7.080	21.185	19.685	39.7	20.0	26.7	7.1	3.79	0.66	29.8	9.8	16.9
67	130.7	0.402	94.9	12.9	6.58	7.187	21.253	19.726	39.7	20.0	26.8	7.1	3.80	0.66	29.9	9.9	16.9
68	131.1	0.408	94.9	12.9	6.58	7.294	21.321	19.765	39.8	20.0	26.8	7.1	3.80	0.65	29.9	9.9	16.9
69	131.5	0.414	94.9	12.9	6.59	7.402	21.388	19.805	39.8	20.0	26.9	7.1	3.79	0.65	29.9	9.9	17.0
70	132.0	0.420	94.9	12.9	6.60	7.509	21.456	19.845	39.8	20.0	26.9	7.1	3.80	0.65	29.9	9.9	17.0
71	132.4	0.426	94.9	12.9	6.61	7.616	21.524	19.884	39.9	20.0	27.0	7.1	3.80	0.65	29.9	9.9	17.0
72	132.8	0.432	94.9	12.9	6.61	7.724	21.591	19.924	39.9	20.0	27.1	7.1	3.79	0.65	30.0	10.0	17.1
73	133.1	0.438	94.9	12.9	6.62	7.831	21.646	19.951	39.9	20.0	27.1	7.1	3.80	0.64	30.0	10.0	17.1
74	133.4	0.444	94.9	12.9	6.63	7.938	21.686	19.965	40.0	20.0	27.1	7.1	3.80	0.64	30.0	10.0	17.1
75	133.9	0.450	94.9	12.9	6.64	8.045	21.781	20.029	40.0	20.0	27.2	7.1	3.81	0.64	30.0	10.0	17.1
76	134.4	0.456	94.9	12.9	6.65	8.153	21.862	20.080	40.1	20.0	27.2	7.1	3.82	0.64	30.0	10.0	17.2
77	134.8	0.462	94.9	12.9	6.65	8.260	21.916	20.106	40.1	20.0	27.2	7.1	3.82	0.64	30.0	10.1	17.2
78	135.1	0.468	94.8	12.8	6.66	8.367	21.970	20.132	40.1	20.0	27.3	7.2	3.81	0.64	30.1	10.1	17.2
79	135.5	0.474	94.8	12.8	6.67	8.474	22.038	20.171	40.2	20.0	27.3	7.2	3.81	0.64	30.1	10.1	17.3
80	135.9	0.480	94.8	12.8	6.68	8.582	22.106	20.209	40.2	20.0	27.4	7.2	3.80	0.63	30.1	10.1	17.3
81	136.2	0.486	94.8	12.8	6.68	8.689	22.146	20.222	40.2	20.0	27.4	7.2	3.80	0.63	30.1	10.1	17.3
82	136.7	0.492	94.8	12.8	6.69	8.796	22.241	20.285	40.3	20.0	27.5	7.2	3.81	0.63	30.1	10.1	17.4
83	137.2	0.498	94.8	12.8	6.70	8.904	22.309	20.323	40.3	20.0	27.5	7.2	3.82	0.63	30.2	10.2	17.4
84	137.5	0.505	94.7	12.7	6.71	9.011	22.363	20.348	40.3	20.0	27.6	7.3	3.81	0.63	30.2	10.2	17.4
85	137.7	0.511	94.7	12.7	6.72	9.118	22.404	20.361	40.4	20.0	27.6	7.3	3.81	0.63	30.2	10.2	17.4
86	138.1	0.517	94.7	12.7	6.72	9.225	22.471	20.398	40.4	20.0	27.7	7.3	3.80	0.62	30.2	10.2	17.5
87	138.6	0.523	94.7	12.7	6.73	9.333	22.539	20.436	40.4	20.0	27.7	7.3	3.80	0.62	30.2	10.2	17.5
88	139.0	0.529	94.7	12.7	6.74	9.440	22.607	20.473	40.5	20.0	27.8	7.3	3.81	0.62	30.2	10.2	17.5
89	139.5	0.535	94.7	12.7	6.75	9.547	22.688	20.522	40.5	20.0	27.8	7.3	3.81	0.62	30.3	10.3	17.6
90	139.8	0.541	94.7	12.7	6.76	9.654	22.742	20.546	40.5	20.0	27.9	7.3	3.80	0.62	30.3	10.3	17.6
91	140.2	0.547	94.7	12.7	6.76	9.762	22.810	20.583	40.6	20.0	27.9	7.3	3.81	0.62	30.3	10.3	17.6
92	140.5	0.553	94.6	12.6	6.77	9.869	22.850	20.595	40.6	20.0	28.0	7.4	3.79	0.61	30.3	10.3	17.7
93	140.9	0.559	94.6	12.6	6.78	9.976	22.918	20.632	40.6	20.0	28.0	7.4	3.78	0.61	30.3	10.3	17.7
94	141.2	0.565	94.6	12.6	6.79	10.084	22.972	20.656	40.7	20.0	28.1	7.4	3.79	0.61	30.3	10.3	17.7
95	141.7	0.571	94.6	12.6	6.80	10.191	23.053	20.704	40.7	20.0	28.1	7.4	3.79	0.61	30.3	10.4	17.8
96	142.2	0.577	94.6	12.6	6.80	10.298	23.135	20.752	40.7	20.0	28.2	7.4	3.80	0.61	30.4	10.4	17.8
97	142.6	0.583	94.6	12.6	6.81	10.405	23.202	20.788	40.8	20.0	28.2	7.4	3.80	0.61	30.4	10.4	17.8
98	142.9	0.589	94.5	12.5	6.82	10.513	23.256	20.812	40.8	20.0	28.3	7.5	3.79	0.60	30.4	10.4	17.9
99	143.4	0.595	94.5	12.5	6.83	10.620	23.324	20.847	40.8	20.0	28.3	7.5	3.78	0.60	30.4	10.4	17.9
100	143.8	0.601	94.5	12.5	6.84	10.727	23.392	20.883	40.9	20.0	28.4	7.5	3.77	0.60	30.4	10.4	18.0



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
101	144.1	0.607	94.5	12.5	6.85	10.834	23.446	20.906	40.9	20.0	28.4	7.5	3.79	0.60	30.4	10.5	17.9
102	144.6	0.613	94.5	12.5	6.85	10.942	23.527	20.953	40.9	20.0	28.4	7.5	3.80	0.60	30.5	10.5	18.0
103	145.0	0.619	94.5	12.5	6.86	11.049	23.595	20.988	41.0	20.0	28.5	7.5	3.80	0.60	30.5	10.5	18.0
104	145.4	0.625	94.5	12.5	6.87	11.156	23.663	21.023	41.0	20.0	28.6	7.5	3.79	0.59	30.5	10.5	18.0
105	145.8	0.631	94.4	12.4	6.88	11.264	23.730	21.057	41.1	20.0	28.6	7.6	3.78	0.59	30.5	10.5	18.1
106	146.3	0.637	94.4	12.4	6.89	11.371	23.811	21.104	41.1	20.0	28.7	7.6	3.79	0.59	30.5	10.6	18.1
107	146.6	0.643	94.4	12.4	6.90	11.478	23.852	21.114	41.1	20.0	28.7	7.6	3.77	0.59	30.6	10.6	18.2
108	147.1	0.649	94.4	12.4	6.90	11.585	23.933	21.161	41.2	20.0	28.8	7.6	3.78	0.59	30.6	10.6	18.2
109	147.4	0.655	94.4	12.4	6.91	11.693	23.987	21.183	41.2	20.0	28.8	7.6	3.78	0.58	30.6	10.6	18.2
110	147.8	0.661	94.4	12.4	6.92	11.800	24.055	21.217	41.2	20.0	28.8	7.6	3.79	0.58	30.6	10.6	18.2
111	148.3	0.667	94.3	12.3	6.93	11.907	24.136	21.262	41.3	20.0	28.9	7.7	3.78	0.58	30.6	10.6	18.3
112	148.7	0.673	94.3	12.3	6.94	12.014	24.204	21.296	41.3	20.0	29.0	7.7	3.77	0.58	30.6	10.6	18.3
113	149.1	0.679	94.3	12.3	6.95	12.122	24.272	21.330	41.3	20.0	29.0	7.7	3.77	0.58	30.7	10.7	18.4
114	149.7	0.685	94.3	12.3	6.95	12.229	24.366	21.387	41.4	20.0	29.1	7.7	3.78	0.58	30.7	10.7	18.4
115	150.1	0.691	94.3	12.3	6.96	12.336	24.434	21.420	41.4	20.0	29.1	7.7	3.78	0.57	30.7	10.7	18.4
116	150.5	0.697	94.3	12.3	6.97	12.444	24.502	21.453	41.4	20.0	29.2	7.7	3.77	0.57	30.7	10.7	18.5
117	151.1	0.703	94.3	12.3	6.98	12.551	24.597	21.510	41.5	20.0	29.2	7.7	3.78	0.57	30.8	10.8	18.5
118	151.4	0.709	94.2	12.2	6.99	12.658	24.637	21.519	41.5	20.0	29.3	7.8	3.77	0.57	30.8	10.8	18.5
119	151.8	0.715	94.2	12.2	7.00	12.765	24.705	21.551	41.5	20.0	29.3	7.8	3.77	0.57	30.8	10.8	18.6
120	152.2	0.721	94.2	12.2	7.01	12.873	24.773	21.584	41.6	20.0	29.4	7.8	3.76	0.56	30.8	10.8	18.6
121	152.4	0.727	94.2	12.2	7.01	12.980	24.813	21.592	41.6	20.0	29.4	7.8	3.78	0.57	30.8	10.8	18.6
122	152.9	0.733	94.1	12.1	7.02	13.087	24.894	21.636	41.6	20.0	29.5	7.9	3.75	0.56	30.8	10.8	18.7
123	153.3	0.739	94.1	12.1	7.03	13.194	24.949	21.657	41.7	20.0	29.5	7.9	3.76	0.56	30.8	10.8	18.7
124	153.6	0.745	94.1	12.1	7.04	13.302	25.003	21.677	41.7	20.0	29.6	7.9	3.73	0.56	30.8	10.8	18.8
125	154.0	0.751	94.0	12.0	7.05	13.409	25.070	21.709	41.7	20.0	29.7	8.0	3.72	0.55	30.9	10.9	18.8
126	154.4	0.757	94.0	12.0	7.06	13.516	25.138	21.740	41.7	20.0	29.8	8.0	3.71	0.55	30.9	10.9	18.9
127	154.7	0.763	94.0	12.0	7.07	13.624	25.179	21.748	41.7	20.0	29.8	8.0	3.71	0.55	30.9	10.9	18.9
128	155.2	0.769	94.0	12.0	7.08	13.731	25.260	21.792	41.8	20.0	29.8	8.0	3.72	0.55	30.9	10.9	18.9
129	155.5	0.775	94.0	12.0	7.08	13.838	25.314	21.811	41.8	20.0	29.8	8.0	3.72	0.55	30.9	10.9	18.9
130	156.0	0.781	93.9	11.9	7.09	13.945	25.395	21.854	41.9	20.0	29.9	8.1	3.71	0.55	30.9	10.9	19.0
131	156.3	0.787	93.9	11.9	7.10	14.053	25.449	21.873	41.9	20.0	30.0	8.1	3.70	0.54	30.9	10.9	19.0
132	156.7	0.793	93.9	11.9	7.11	14.160	25.517	21.904	41.9	20.0	30.0	8.1	3.70	0.54	30.9	11.0	19.0
133	157.2	0.799	93.9	11.9	7.12	14.267	25.585	21.935	41.9	20.0	30.1	8.1	3.70	0.54	31.0	11.0	19.1
134	157.6	0.805	93.9	11.9	7.13	14.374	25.666	21.977	42.0	20.0	30.1	8.1	3.71	0.54	31.0	11.0	19.1
135	158.0	0.811	93.9	11.9	7.14	14.482	25.720	21.995	42.0	20.0	30.1	8.1	3.72	0.54	31.0	11.0	19.1
136	158.5	0.817	93.9	11.9	7.15	14.589	25.801	22.037	42.0	20.0	30.1	8.1	3.72	0.54	31.0	11.0	19.1
137	158.8	0.823	93.9	11.9	7.16	14.696	25.856	22.056	42.1	20.0	30.2	8.1	3.72	0.54	31.0	11.0	19.1
138	159.2	0.829	93.9	11.9	7.16	14.804	25.923	22.086	42.1	20.0	30.2	8.1	3.71	0.54	31.0	11.0	19.2
139	159.6	0.835	93.8	11.8	7.17	14.911	25.991	22.115	42.1	20.0	30.3	8.2	3.70	0.53	31.1	11.1	19.2
140	160.1	0.841	93.8	11.8	7.18	15.018	26.072	22.157	42.2	20.0	30.3	8.2	3.71	0.53	31.1	11.1	19.3
141	160.5	0.847	93.9	11.9	7.19	15.125	26.140	22.186	42.2	20.0	30.3	8.1	3.73	0.53	31.1	11.1	19.2



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
142	161.0	0.853	93.8	11.8	7.20	15.233	26.221	22.227	42.2	20.0	30.4	8.2	3.72	0.53	31.1	11.1	19.3
143	161.4	0.859	93.8	11.8	7.21	15.340	26.289	22.256	42.3	20.0	30.4	8.2	3.72	0.53	31.1	11.1	19.3
144	161.9	0.865	93.8	11.8	7.22	15.447	26.356	22.285	42.3	20.0	30.5	8.2	3.71	0.53	31.1	11.1	19.4
145	162.4	0.871	93.8	11.8	7.23	15.554	26.438	22.325	42.3	20.0	30.5	8.2	3.72	0.53	31.2	11.2	19.4
146	162.6	0.877	93.7	11.7	7.24	15.662	26.478	22.331	42.3	20.0	30.6	8.3	3.70	0.53	31.2	11.2	19.4
147	163.1	0.883	93.7	11.7	7.25	15.769	26.559	22.371	42.4	20.0	30.6	8.3	3.71	0.52	31.2	11.2	19.4
148	163.8	0.889	93.7	11.7	7.26	15.876	26.668	22.434	42.4	20.0	30.7	8.3	3.72	0.52	31.2	11.2	19.5
149	164.0	0.895	93.7	11.7	7.26	15.983	26.708	22.439	42.4	20.0	30.7	8.3	3.70	0.52	31.2	11.2	19.5
150	164.4	0.901	93.7	11.7	7.27	16.091	26.776	22.468	42.5	20.0	30.8	8.3	3.71	0.52	31.2	11.2	19.5
151	164.9	0.907	93.7	11.7	7.28	16.198	26.857	22.507	42.5	20.0	30.8	8.3	3.70	0.52	31.2	11.3	19.6
152	165.3	0.913	93.7	11.7	7.29	16.305	26.925	22.535	42.5	20.0	30.9	8.3	3.70	0.52	31.3	11.3	19.6
153	165.7	0.919	93.6	11.6	7.30	16.413	26.993	22.562	42.6	20.0	30.9	8.4	3.69	0.51	31.3	11.3	19.7
154	166.1	0.925	93.6	11.6	7.31	16.520	27.047	22.579	42.6	20.0	31.0	8.4	3.69	0.51	31.3	11.3	19.7
155	166.5	0.931	93.6	11.6	7.32	16.627	27.115	22.606	42.6	20.0	31.0	8.4	3.70	0.51	31.3	11.3	19.7
156	166.9	0.937	93.6	11.6	7.33	16.734	27.182	22.633	42.6	20.0	31.0	8.4	3.70	0.51	31.3	11.3	19.7
157	167.2	0.943	93.6	11.6	7.34	16.842	27.236	22.649	42.6	20.0	31.1	8.4	3.69	0.51	31.3	11.3	19.7
158	167.6	0.949	93.5	11.5	7.35	16.949	27.304	22.676	42.7	20.0	31.1	8.5	3.68	0.51	31.3	11.3	19.8
159	168.1	0.955	93.5	11.5	7.36	17.056	27.372	22.703	42.7	20.0	31.2	8.5	3.68	0.51	31.3	11.4	19.8
160	168.5	0.961	93.5	11.5	7.37	17.163	27.439	22.730	42.7	20.0	31.2	8.5	3.67	0.51	31.4	11.4	19.9
161	168.9	0.967	93.5	11.5	7.38	17.271	27.507	22.756	42.8	20.0	31.2	8.5	3.69	0.51	31.4	11.4	19.8
162	169.4	0.973	93.5	11.5	7.39	17.378	27.588	22.794	42.8	20.0	31.3	8.5	3.68	0.50	31.4	11.4	19.9
163	169.9	0.979	93.5	11.5	7.40	17.485	27.670	22.831	42.8	20.0	31.4	8.5	3.67	0.50	31.4	11.4	20.0
164	170.4	0.985	93.5	11.5	7.41	17.593	27.751	22.869	42.9	20.0	31.4	8.5	3.68	0.50	31.4	11.4	20.0
165	170.7	0.991	93.4	11.4	7.42	17.700	27.805	22.883	42.9	20.0	31.5	8.6	3.67	0.50	31.4	11.4	20.0
166	171.1	0.997	93.4	11.4	7.43	17.807	27.873	22.909	42.9	20.0	31.5	8.6	3.66	0.50	31.5	11.5	20.1
167	171.6	1.003	93.4	11.4	7.44	17.914	27.954	22.946	42.9	20.0	31.6	8.6	3.66	0.50	31.5	11.5	20.1
168	172.0	1.009	93.4	11.4	7.45	18.030	28.021	22.969	43.0	20.0	31.6	8.6	3.66	0.50	31.5	11.5	20.1
169	172.5	1.015	93.4	11.4	7.46	18.145	28.103	23.003	43.0	20.0	31.6	8.6	3.67	0.49	31.5	11.5	20.1
170	172.8	1.022	93.3	11.3	7.47	18.261	28.157	23.015	43.0	20.0	31.7	8.7	3.66	0.49	31.5	11.5	20.2
171	173.3	1.028	93.3	11.3	7.48	18.376	28.238	23.049	43.0	20.0	31.7	8.7	3.65	0.49	31.5	11.5	20.2
172	173.8	1.035	93.3	11.3	7.49	18.492	28.306	23.071	43.1	20.0	31.8	8.7	3.64	0.49	31.5	11.5	20.3
173	174.2	1.041	93.2	11.2	7.50	18.608	28.373	23.094	43.1	20.0	31.9	8.8	3.63	0.49	31.5	11.5	20.3
174	174.6	1.048	93.3	11.3	7.51	18.723	28.441	23.116	43.1	20.0	31.9	8.7	3.64	0.49	31.6	11.6	20.3
175	174.9	1.054	93.2	11.2	7.52	18.830	28.495	23.130	43.1	20.0	31.9	8.8	3.63	0.48	31.6	11.6	20.3
176	175.4	1.060	93.2	11.2	7.53	18.938	28.576	23.165	43.2	20.0	31.9	8.8	3.64	0.48	31.6	11.6	20.4
177	175.7	1.066	93.2	11.2	7.54	19.045	28.631	23.178	43.2	20.0	32.0	8.8	3.63	0.48	31.6	11.6	20.4
178	176.2	1.072	93.2	11.2	7.55	19.152	28.698	23.202	43.2	20.0	32.0	8.8	3.63	0.48	31.6	11.6	20.4
179	176.6	1.078	93.1	11.1	7.56	19.259	28.766	23.226	43.2	20.0	32.1	8.9	3.62	0.48	31.6	11.6	20.5
180	176.9	1.084	93.1	11.1	7.57	19.367	28.820	23.239	43.2	20.0	32.1	8.9	3.62	0.48	31.6	11.6	20.5
181	177.6	1.090	93.1	11.1	7.58	19.474	28.928	23.295	43.3	20.0	32.2	8.9	3.63	0.48	31.6	11.6	20.5
182	177.8	1.096	93.1	11.1	7.59	19.581	28.969	23.297	43.3	20.0	32.2	8.9	3.62	0.48	31.6	11.6	20.5



Reading No.	Deviator Load (lbs)	Axial Deformation (in)	Pore Pressure (psi)	Change in Pore Pressure (psi)	Corrected Area (in ²)	Axial Strain (%)	Deviator Stress (psi)	Corrected Deviator Stress (psi)	σ_1 (psi)	σ_3 (psi)	σ'_1 (psi)	σ'_3 (psi)	σ'_1/σ'_3	Abar	P (psi)	Q (psi)	P' (psi)
183	178.3	1.102	93.1	11.1	7.60	19.688	29.050	23.331	43.3	20.0	32.2	8.9	3.62	0.48	31.7	11.7	20.6
184	178.8	1.108	93.1	11.1	7.61	19.796	29.132	23.365	43.4	20.0	32.3	8.9	3.61	0.47	31.7	11.7	20.6
185	179.1	1.114	93.0	11.0	7.62	19.911	29.186	23.374	43.4	20.0	32.4	9.0	3.60	0.47	31.7	11.7	20.7
186	179.5	1.120	93.0	11.0	7.63	20.010	29.253	23.400	43.4	20.0	32.4	9.0	3.59	0.47	31.7	11.7	20.7



Florence & Hutcheson

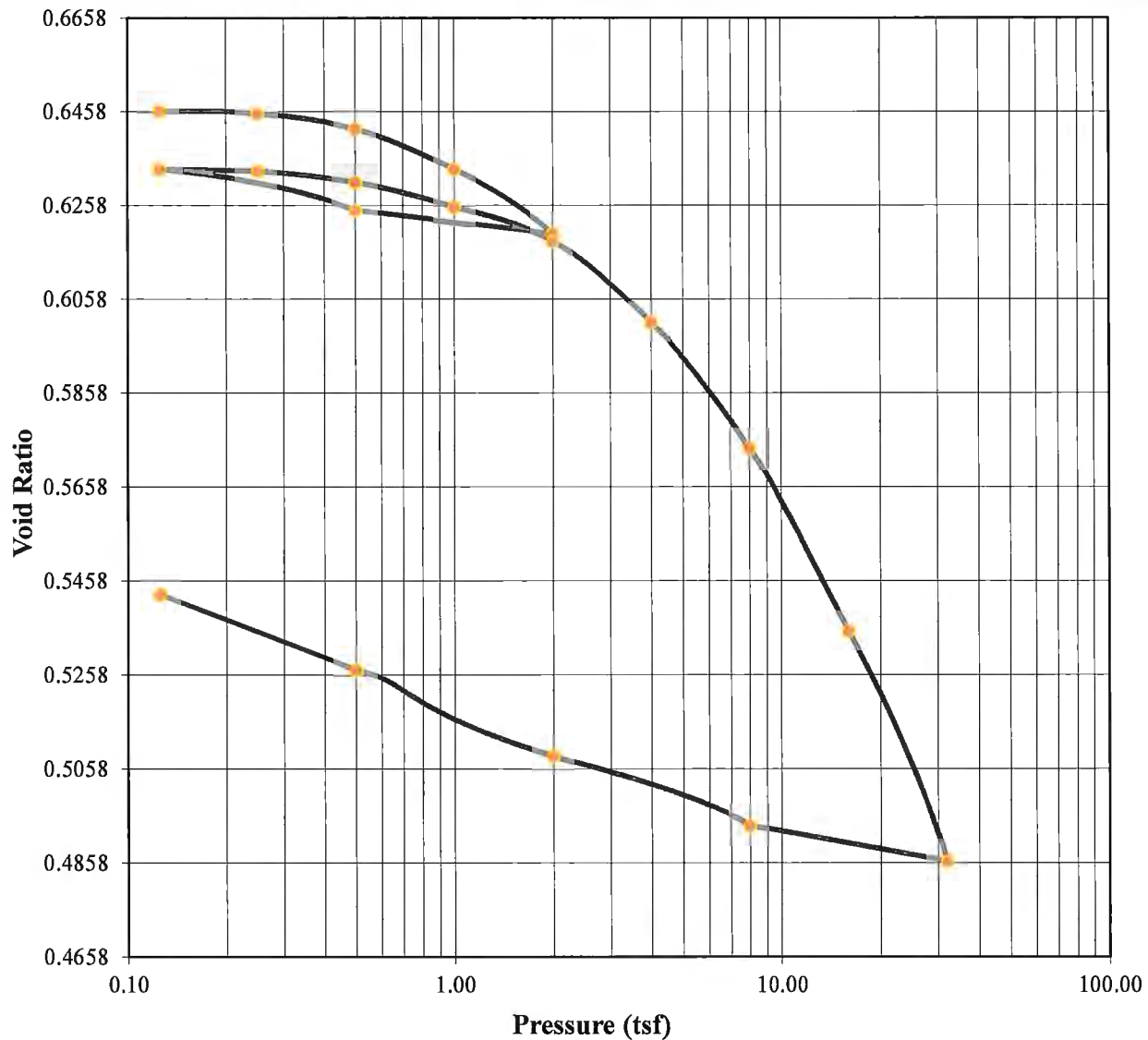
An **ICA** Company

Project Name : I-85/I-385 Interchange
Location : Greenville County, South Carolina
Job Number : 08195-01
Project Job No. : 08195-01

Consolidation Summary

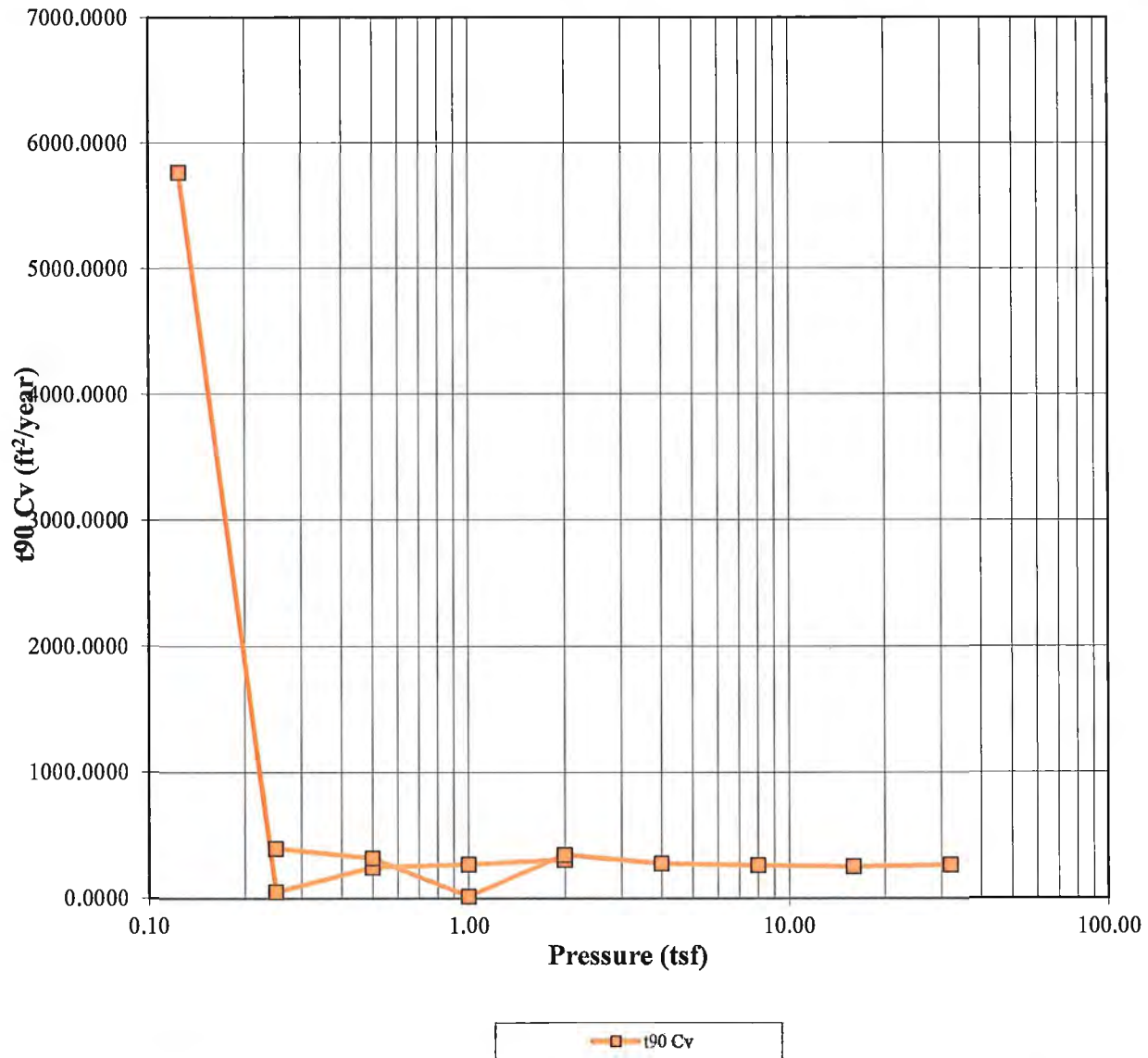
Boring Number	Sample Number	Depth (ft)	ASTM Classification	Overburden Pressure (tsf)	Preconsol. Pressure (tsf)	OCR	Compression Index, C_c	Rebound Index, C_r
B-39	ST-2	9-9.2	CL	0.47	3.4	7.23	0.15	0.12
B-40	St-1	6-6.5	SM	0.27	4.5	16.48	0.2	0.01
B-61	ST-1	2.5-3	SM	0.14	3.6	25.71	0.11	0.01
B-65	ST-2	11-11.4	SM	0.42	1.9	4.55	0.47	0.04
B-67	ST-1	4.5-4.7	SM	0.22	3.2	14.86	0.13	0.01
B-74	ST-1	5-5.3	ML	0.2	0.69	3.43	0.34	0.02

Consolidation Test Test Results



Test Date: 10/26/12			
Summary of Consoliation Test Results			
Overburden Pressure (tsf)	0.47	Compression Index, Cc Rebound Index, Cr	0.15
Preconsol. Pressure (tsf)	3.40		0.12
Over Consolidation Ratio	7.23		
Soil Description: Red & Yellow Sandy Lean Clay			
Project Number:	08195-01	Depth: 9.0' to 9.2'	Remarks:
Sample Number:	ST-2	Boring Number: B-39	
Project: I-85/ I 385 Interchange			
Client:			
Location: B-39 ST-2 9.0' to 9.2'			

Consolidation Test Test Results



	Before	After	Liquid Limits:	47	Test Date:	10/26/12
Moisture (%):	18.19	18.97	Plastic Limits:	25		
Dry Density (pcf):	102.53	114.07	Plasticity Index (%):	22		
Saturation (%):	76.44	107.56				
Void Ratio:	0.6410	0.4680	Specific Gravity:	2.696	Measured	
Soil Description:	Red & Yellow Sandy Lean Clay					
Project Number:	08195-01		Depth: 9.0' to 9.2'		Remarks:	
Sample Number:	ST-2		Boring Number: B-39			
Project:	I-85/ I 385 Interchange					
Client:						
Location:	B-39 ST-2 9.0' to 9.2'					

Consolidation Test Results Summary

Project: I-85/I 385 Interchange
Location: B-39 ST-2 9.0' to 9.2'
Job Number: 08195-01

Project Number: 08195-01

Sample Number: ST-2
Boring Number: B-39
Depth: 9.0' to 9.2'
Sample Type: Undisturbed

Sample Description:
Red & Yellow Sandy Lean Clay
Remarks:

Test Number:
Test Date: 10/26/12

Index	Load Sequence (tsf)	Cumulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft ² /year)	t50 Cv (ft ² /year)
0	0.000	0.0000	0.9995	0.3895	0.00	0.6386	0.000	0.000	0.000	0.000
1	0.125	-0.0045	1.0040	0.3940	-0.45	0.6460	0.135	* 0.0752	5761.453	2409.621
2	0.250	-0.0042	1.0037	0.3937	-0.42	0.6455	14.858	* 8.2542	52.467	21.940
3	0.500	-0.0022	1.0017	0.3917	-0.22	0.6422	3.106	* 1.7254	250.000	104.541
4	1.000	0.0031	0.9964	0.3864	0.31	0.6336	2.822	* 1.5677	272.252	113.842
5	2.000	0.0114	0.9881	0.3781	1.14	0.6199	2.446	* 1.3586	308.937	129.184
6	0.500	0.0084	0.9911	0.3811	0.84	0.6249	0.000	0.000	0.000	0.000
7	0.125	0.0031	0.9964	0.3864	0.31	0.6336	0.000	0.000	0.000	0.000
8	0.250	0.0033	0.9962	0.3862	0.33	0.6332	1.927	* 1.0706	398.506	166.634
9	0.500	0.0048	0.9947	0.3847	0.48	0.6308	2.384	* 1.3246	321.108	134.276
10	1.000	0.0079	0.9916	0.3816	0.79	0.6257	39.018	* 21.6769	19.500	8.154
11	2.000	0.0124	0.9871	0.3771	1.24	0.6183	2.158	* 1.1988	349.415	146.108
12	4.000	0.0230	0.9765	0.3665	2.30	0.6009	2.656	* 1.4756	277.795	116.165
13	8.000	0.0393	0.9602	0.3502	3.93	0.5742	2.700	* 1.5002	264.200	110.477
14	16.000	0.0631	0.9364	0.3264	6.31	0.5352	2.652	* 1.4730	255.898	107.009
15	32.000	0.0930	0.9065	0.2965	9.30	0.4862	2.381	* 1.3225	267.104	111.696
16	8.000	0.0883	0.9112	0.3012	8.83	0.4939	0.000	0.000	0.000	0.000
17	2.000	0.0793	0.9202	0.3102	7.93	0.5086	0.000	0.000	0.000	0.000
18	0.500	0.0681	0.9314	0.3214	6.81	0.5270	0.000	0.000	0.000	0.000
19	0.125	0.1054	0.8941	0.2841	5.97	0.5430	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: MR

Checked By: JS

Consolidation Test

Consolidation Specimen Information

Project: I-85/ I 385 Interchange
Location: B-39 ST-2 9.0' to 9.2'
Job Number: 08195-01

Project Number: 08195-01

Test Date: 10/26/12

Sample Number: ST-2
Boring Number: B-39
Depth: 9.0' to 9.2'
Sample Type: Undisturbed

Sample Description:
 Red & Yellow Sandy Lean Clay
Remarks:

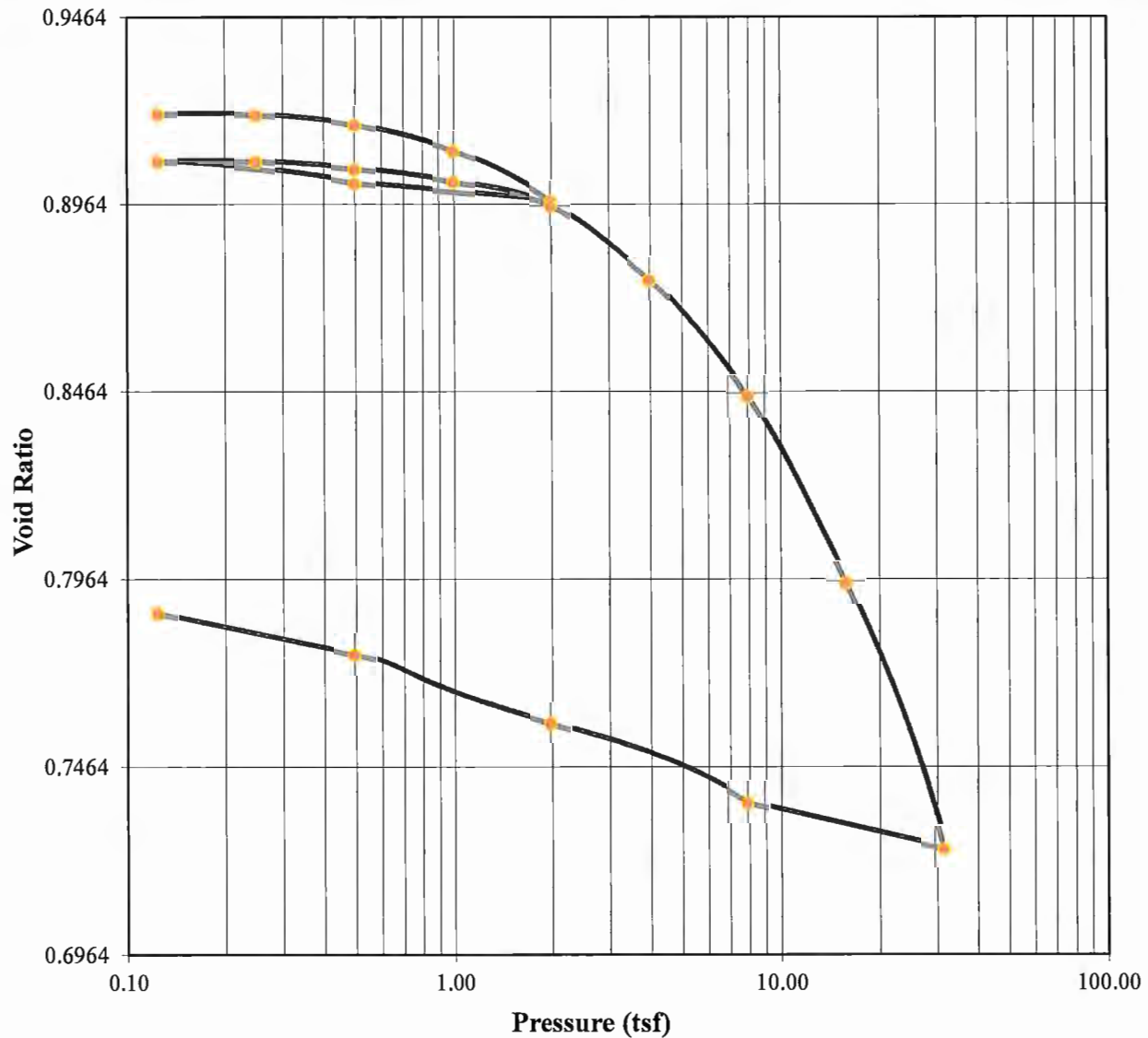
Test Number:				
Liquid Limit:	47.0000	Initial Void Ratio:	0.6410	Initial Height (in): 0.9995
Plastic Limit:	25.0000	Plasticity Index (%):	22.0000	Initial Diameter (in): 2.4983
Specific Gravity:	2.6960	Weight of Ring (g):	109.6000	
	Measured			

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	331.13	232.26
Dry Soil + Container (g)	291.61	207.40
Weight of Container (g)	74.40	76.38
Moisture Content (%)	18.19	18.97
Void Ratio	0.6410	0.4680
Saturation (%)	76.44	107.56
Dry Density (pcf)	102.53	114.07

Tested By: MK

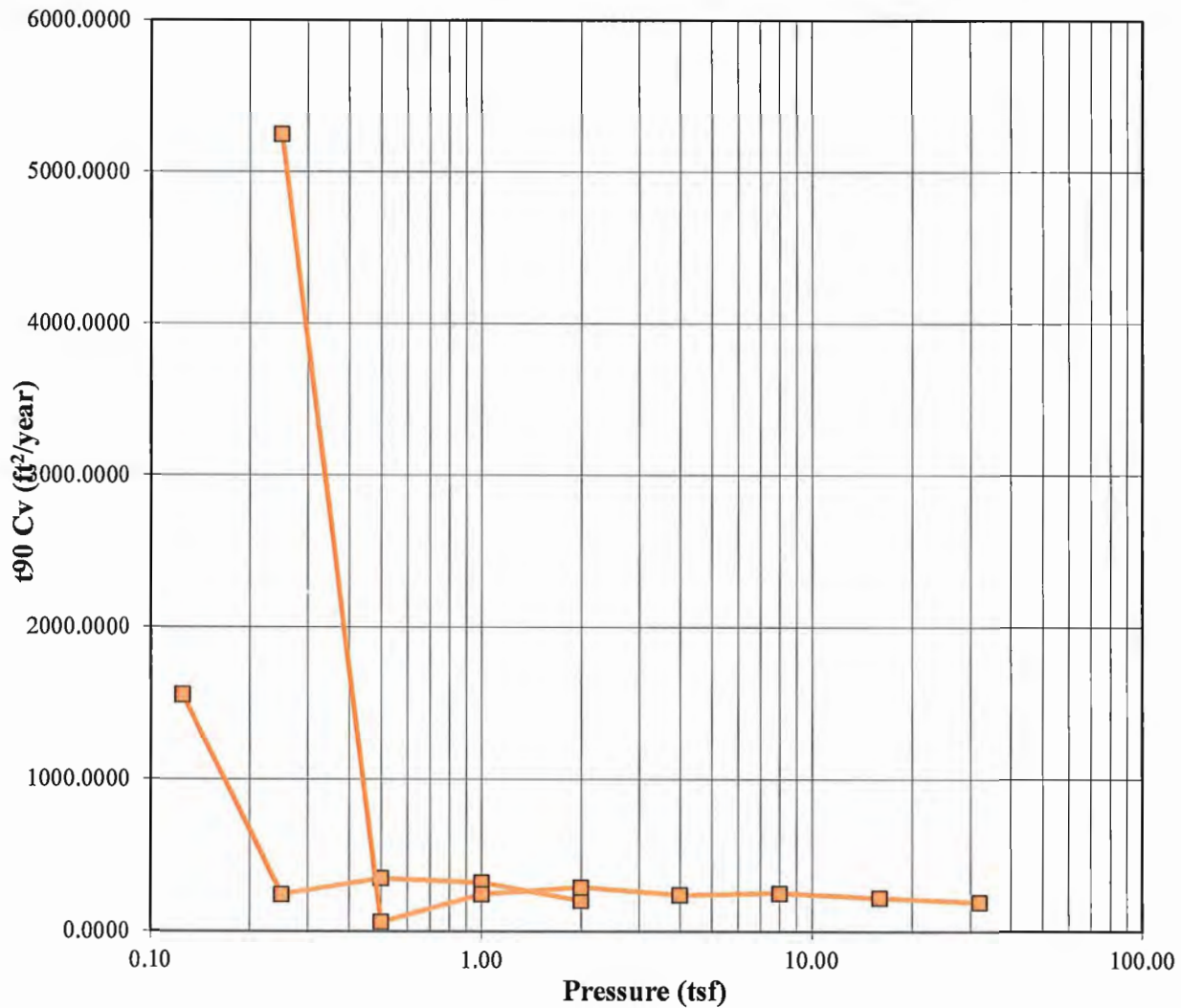
Checked By: JS

Consolidation Test Test Results



Summary of Consoliation Test Results			Test Date: 11/19/12
Overburden Pressure (tsf)	0.27	Compression Index, Cc Rebound Index, Cr	0.20
Preconsol. Pressure (tsf)	4.50		0.01
Over Consolidation Ratio	16.48		
Soil Description:	Red Silty Sand		
Project Number:	08195-01	Depth: 6.0' to 6.5'	Remarks:
Sample Number:	ST-1	Boring Number: B-40	
Project:	I-85/I-385 Interchange		
Client:			
Location:	B-40 ST-1 6.0' to 6.5'		

Consolidation Test Test Results



—■— $t_{90} C_v$

	Before	After	Liquid Limits:	59	Test Date:	11/19/12
Moisture (%):	30.42	29.10	Plastic Limits:	41		
Dry Density (pcf):	87.49	98.91	Plasticity Index (%):	18		
Saturation (%):	89.15	112.42				
Void Ratio:	0.9160	0.6990	Specific Gravity:	2.686	Measured	
Soil Description:	Red Silty Sand					
Project Number:	08195-01	Depth: 6.0' to 6.5'		Remarks:		
Sample Number:	ST-1	Boring Number: B-40				
Project:	I-85/I-385 Interchange					
Client:						
Location:	B-40 ST-1 6.0' to 6.5'					

Consolidation Test Results Summary

Project: I-85/I-385 Interchange
Location: B-40 ST-1 6.0' to 6.5'
Job Number: 08195-01

Project Number: 08195-01

Sample Number: ST-1
Boring Number: B-40
Depth: 6.0' to 6.5'
Sample Type: Undisturbed

Sample Description:
Red Silty Sand
Remarks:

Test Number:
Test Date: 11/19/12

Index	Load Sequence (tsf)	Cumulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft ² /year)	t50 Cv (ft ² /year)
0	0.000	0.0000	1.0020	0.4783	0.00	0.9132	0.000	0.000	0.000	0.000
1	0.125	-0.0040	1.0060	0.4823	-0.40	0.9208	0.502	* 0.2791	1558.923	651.831
2	0.250	-0.0039	1.0059	0.4822	-0.39	0.9206	3.177	* 1.7650	246.442	103.054
3	0.500	-0.0025	1.0045	0.4808	-0.25	0.9179	2.215	* 1.2303	352.572	147.431
4	1.000	0.0011	1.0009	0.4772	0.11	0.9111	2.397	* 1.3314	323.462	135.261
5	2.000	0.0081	0.9939	0.4702	0.81	0.8977	3.726	* 2.0699	205.158	85.790
6	0.500	0.0056	0.9964	0.4727	0.56	0.9025	0.000	0.000	0.000	0.000
7	0.125	0.0026	0.9994	0.4757	0.26	0.9082	0.000	0.000	0.000	0.000
8	0.250	0.0026	0.9994	0.4757	0.26	0.9082	0.147	* 0.0818	5247.203	2194.949
9	0.500	0.0036	0.9984	0.4747	0.36	0.9063	12.087	* 6.7148	63.817	26.685
10	1.000	0.0054	0.9966	0.4729	0.54	0.9028	3.105	* 1.7252	247.492	103.491
11	2.000	0.0088	0.9932	0.4695	0.88	0.8964	2.606	* 1.4476	292.934	122.497
12	4.000	0.0191	0.9829	0.4592	1.91	0.8767	3.077	* 1.7093	242.977	101.601
13	8.000	0.0354	0.9666	0.4429	3.53	0.8456	2.839	* 1.5774	254.627	106.476
14	16.000	0.0614	0.9406	0.4169	6.13	0.7959	3.079	* 1.7106	222.338	92.974
15	32.000	0.0985	0.9035	0.3798	9.83	0.7251	3.240	* 1.8001	194.949	81.519
16	8.000	0.0921	0.9099	0.3862	9.19	0.7373	0.000	0.000	0.000	0.000
17	2.000	0.0811	0.9209	0.3972	8.09	0.7583	0.000	0.000	0.000	0.000
18	0.500	0.0715	0.9305	0.4068	7.14	0.7766	0.000	0.000	0.000	0.000
19	0.125	0.1135	0.8885	0.3648	6.71	0.7875	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By:

ML

Checked By:

JS

Consolidation Test

Consolidation Specimen Information

Project: I-85/I-385 Interchange
Location: B-40 ST-1 6.0' to 6.5'
Job Number: 08195-01

Project Number: 08195-01

Test Date: 11/19/12

Sample Number: ST-1
Boring Number: B-40
Depth: 6.0' to 6.5'
Sample Type: Undisturbed

Sample Description:
 Red Silty Sand
Remarks:

Test Number:

Liquid Limit: 59.0000

Plastic Limit: 41.0000

Specific Gravity: 2.6860
 Measured

Initial Void Ratio: 0.9160

Plasticity Index (%): 18.0000

Weight of Ring (g): 109.5800

Initial Height (in): 1.0020

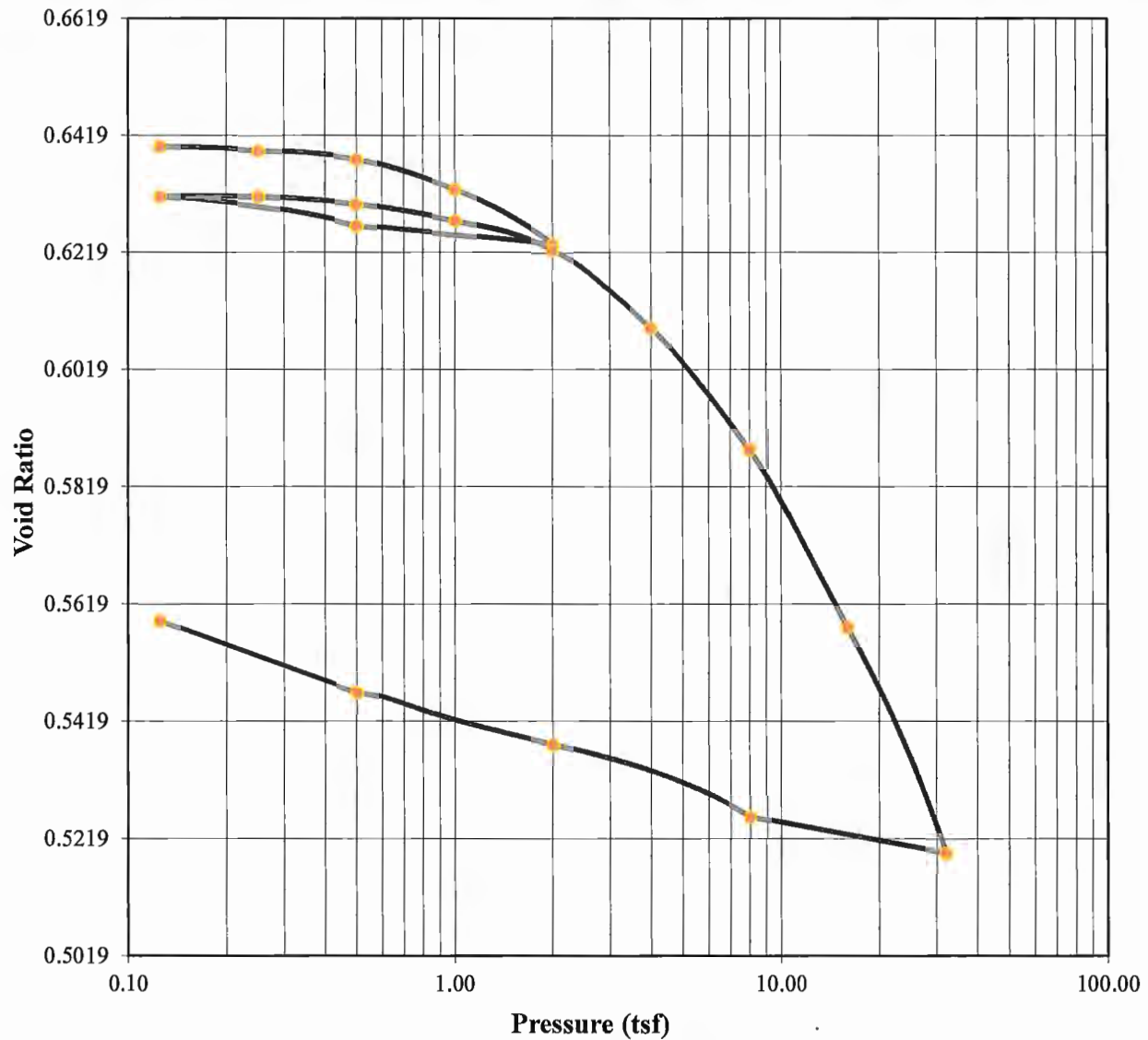
Initial Diameter (in): 2.4983

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	1403.00	218.51
Dry Soil + Container (g)	1124.70	185.65
Weight of Container (g)	209.80	72.72
Moisture Content (%)	30.42	29.10
Void Ratio	0.9160	0.6990
Saturation (%)	89.15	112.42
Dry Density (pcf)	87.49	98.91

Tested By: MR

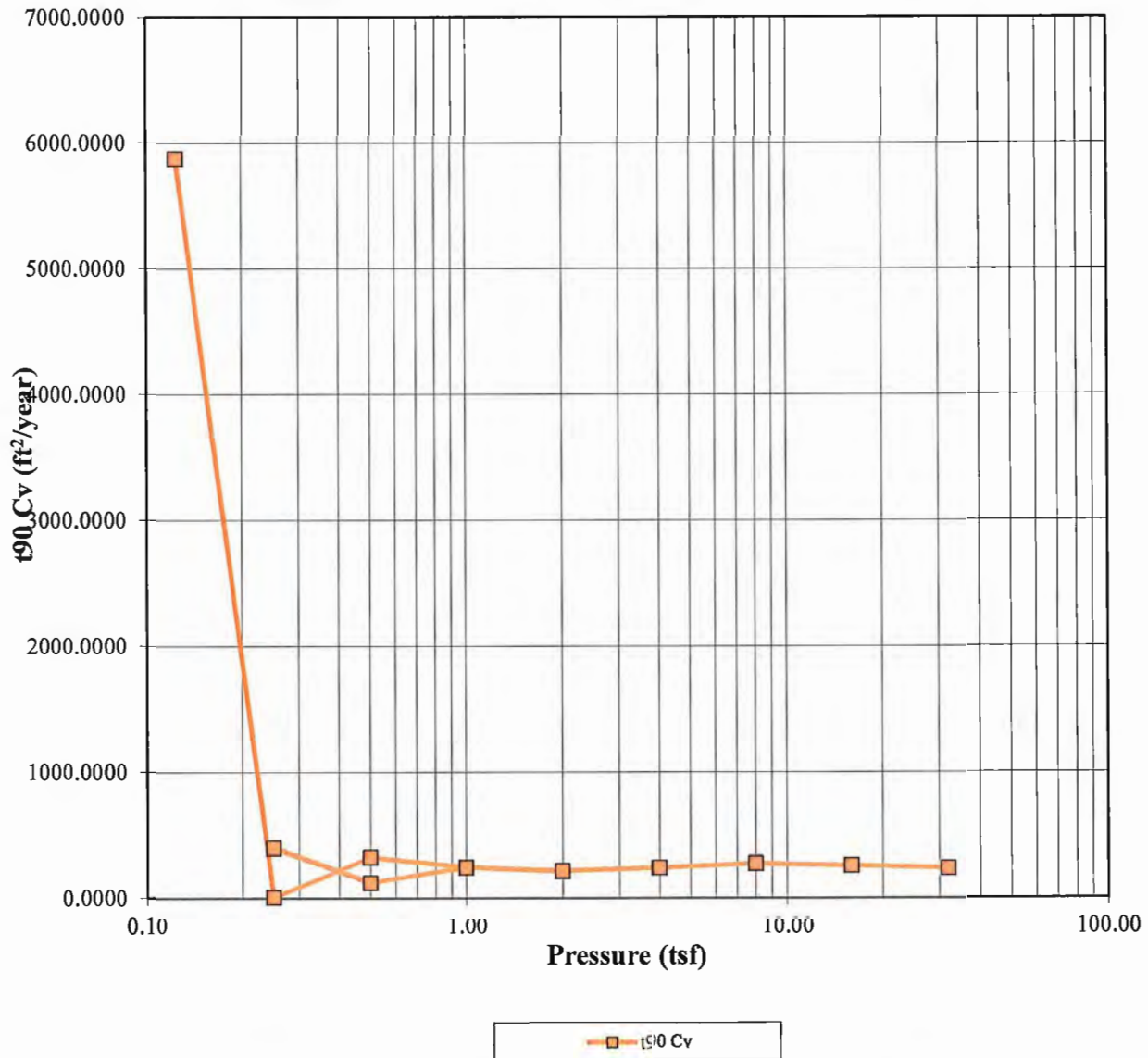
Checked By: JS

Consolidation Test Test Results



			Test Date: 10/26/12
Summary of Consoliation Test Results			
Overburden Pressure (tsf)	0.14	Compression Index, Cc Rebound Index, Cr	0.11
Preconsol. Pressure (tsf)	3.60		0.01
Over Consolidation Ratio	25.71		
Soil Description:		Red Silty Sand	
Project Number:	08195-01	Depth: 2.5' to 3.0'	Remarks:
Sample Number:	ST-1	Boring Number: B-61	
Project: I-85/I-385 Interchange			
Client:			
Location: B-61 ST-1 2.5' to 3.0'			

Consolidation Test Test Results



	Before	After	Liquid Limits:	39	Test Date:	10/26/12
Moisture (%):	22.96	18.51	Plastic Limits:	34		
Dry Density (pcf):	102.70	116.37	Plasticity Index (%):	5		
Saturation (%):	96.79	111.62				
Void Ratio:	0.6389	0.5035	Specific Gravity:	2.698	Measured	
Soil Description:	Red Silty Sand					
Project Number:	08195-01		Depth: 2.5' to 3.0'		Remarks:	
Sample Number:	ST-1		Boring Number: B-61			
Project:	I-85/I-385 Interchange					
Client:						
Location:	B-61 ST-1 2.5' to 3.0'					

Consolidation Test Results Summary

Project: I-85/I-385 Interchange
Location: B-61 ST-1 2.5' to 3.0'
Job Number: 08195-01

Project Number: 08195-01

Sample Number: ST-1
Boring Number: B-61
Depth: 2.5' to 3.0'
Sample Type: Undisturbed

Sample Description:
Red Silty Sand
Remarks:

Test Number:
Test Date: 10/26/12

Index	Load Sequence (tsf)	Cumulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft ² /year)	t50 Cv (ft ² /year)
0	0.000	0.0000	1.0025	0.3901	0.00	0.6371	0.000	0.000	0.000	0.000
1	0.125	-0.0018	1.0043	0.3919	-0.18	0.6400	0.133	* 0.0738	5875.937	2456.799
2	0.250	-0.0014	1.0039	0.3915	-0.14	0.6394	86.092	* 47.8290	9.058	3.788
3	0.500	-0.0005	1.0030	0.3906	-0.05	0.6379	2.384	* 1.3246	326.491	136.526
4	1.000	0.0027	0.9998	0.3874	0.27	0.6327	3.106	* 1.7254	249.054	104.144
5	2.000	0.0084	0.9941	0.3817	0.84	0.6234	3.550	* 1.9720	215.434	90.085
6	0.500	0.0064	0.9961	0.3837	0.64	0.6266	0.000	0.000	0.000	0.000
7	0.125	0.0034	0.9991	0.3867	0.34	0.6315	0.000	0.000	0.000	0.000
8	0.250	0.0034	0.9991	0.3867	0.34	0.6315	1.927	* 1.0706	400.829	167.606
9	0.500	0.0042	0.9983	0.3859	0.42	0.6302	6.155	* 3.4196	125.286	52.390
10	1.000	0.0059	0.9966	0.3842	0.59	0.6274	3.106	* 1.7254	247.461	103.479
11	2.000	0.0090	0.9935	0.3811	0.90	0.6224	3.488	* 1.9379	218.961	91.560
12	4.000	0.0172	0.9853	0.3729	1.72	0.6090	3.079	* 1.7105	243.992	102.027
13	8.000	0.0299	0.9726	0.3602	2.98	0.5882	2.656	* 1.4756	275.582	115.239
14	16.000	0.0484	0.9541	0.3417	4.83	0.5580	2.709	* 1.5049	260.039	108.737
15	32.000	0.0720	0.9305	0.3181	7.18	0.5195	2.783	* 1.5461	240.745	100.669
16	8.000	0.0682	0.9343	0.3219	6.80	0.5257	0.000	0.000	0.000	0.000
17	2.000	0.0607	0.9418	0.3294	6.05	0.5380	0.000	0.000	0.000	0.000
18	0.500	0.0552	0.9473	0.3349	5.51	0.5469	0.000	0.000	0.000	0.000
19	0.125	0.0828	0.9197	0.3073	4.87	0.5591	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: MR

Checked By: JS

Consolidation Test

Consolidation Specimen Information

Project: I-85/I-385 Interchange
Location: B-61 ST-1 2.5' to 3.0'
Job Number: 08195-01

Project Number: 08195-01

Test Date: 10/26/12

Sample Number: ST-1
Boring Number: B-61
Depth: 2.5' to 3.0'
Sample Type: Undisturbed

Sample Description:
 Red Silty Sand
Remarks:

Test Number:

Liquid Limit: 39.0000

Initial Void Ratio: 0.6389

Initial Height (in): 1.0025

Plastic Limit: 34.0000

Plasticity Index (%): 5.0000

Initial Diameter (in): 2.4953

Specific Gravity: 2.6980
 Measured

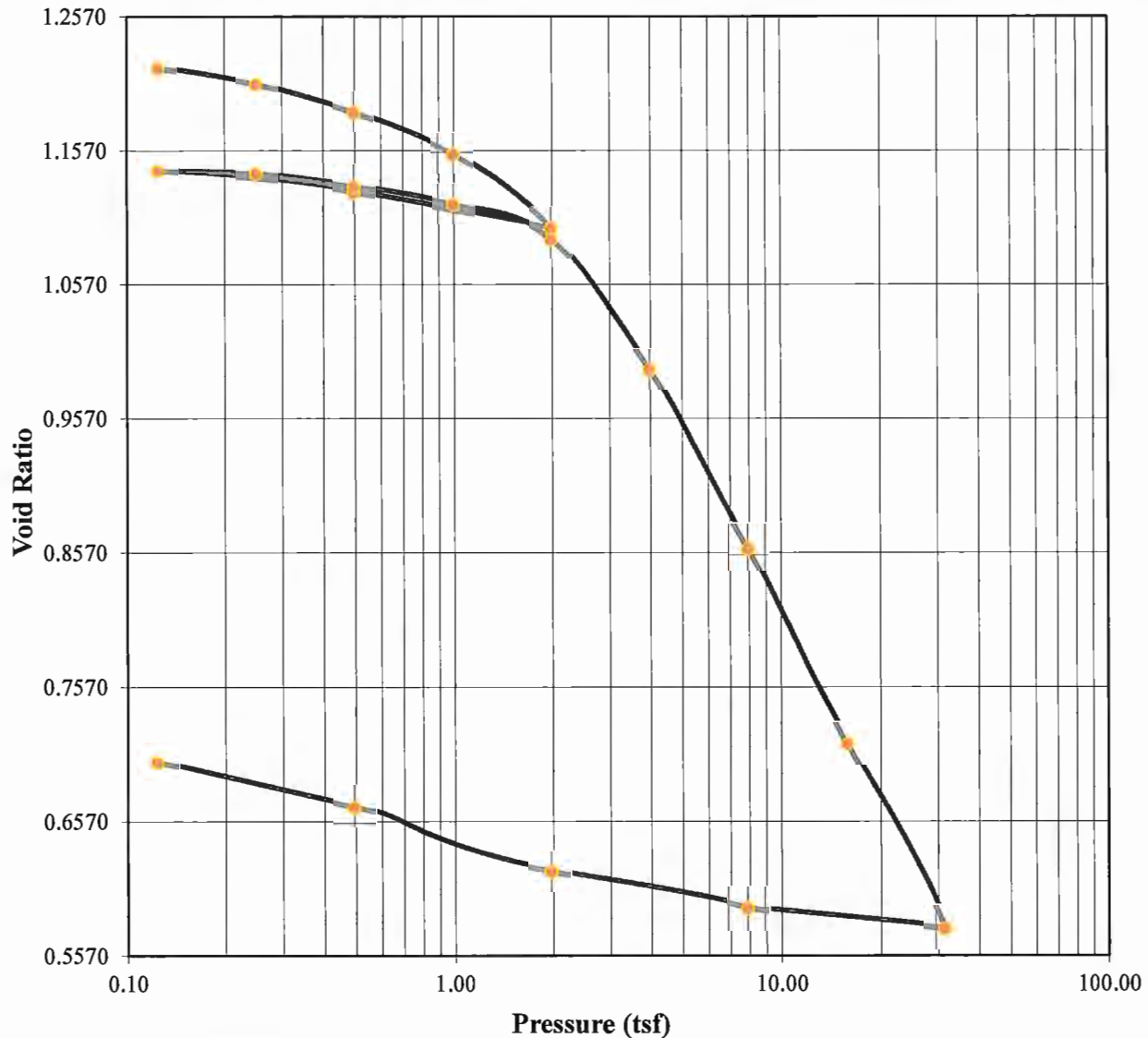
Weight of Ring (g): 110.8600

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	412.12	235.99
Dry Soil + Container (g)	349.10	210.58
Weight of Container (g)	74.59	73.30
Moisture Content (%)	22.96	18.51
Void Ratio	0.6389	0.5035
Saturation (%)	96.79	111.62
Dry Density (pcf)	102.70	116.37

Tested By: MTR

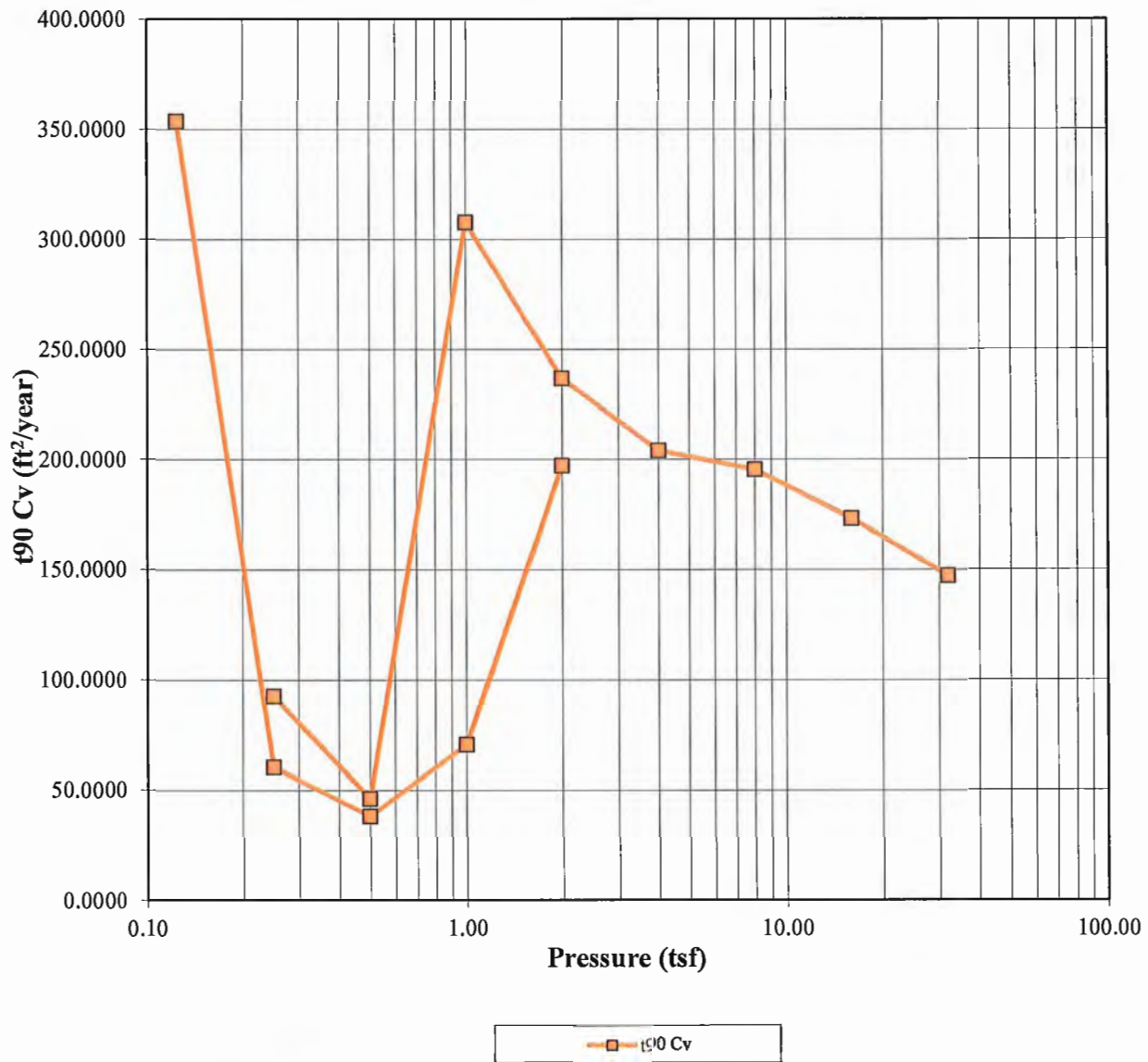
Checked By: JS

Consolidation Test Test Results



Test Date: 11/01/12			
Summary of Consoliation Test Results			
Overburden Pressure (tsf)	0.42	Compression Index, Cc Rebound Index, Cr	0.47
Preconsol. Pressure (tsf)	1.90		0.04
Over Consolidation Ratio	4.55		
Soil Description: Gray, Black & Yellow Silty Sand			
Project Number:	08195-01	Depth: 11.0' to 11.4'	Remarks:
Sample Number:	ST-2	Boring Number: B-65	
Project: I-85/I-385 Interchange			
Client:			
Location: B-65 ST-2 11.0' to 11.4'			

Consolidation Test Test Results



	Before	After	Liquid Limits:	45	Test Date:	11/01/12
Moisture (%):	36.00	29.62	Plastic Limits:	42		
Dry Density (pcf):	74.60	105.07	Plasticity Index (%):	3		
Saturation (%):	78.08	135.65				
Void Ratio:	1.2238	0.5576	Specific Gravity:	2.661	Measured	
Soil Description:	Gray, Black & Yellow Silty Sand					
Project Number:	08195-01	Depth: 11.0' to 11.4'		Remarks:		
Sample Number:	ST-2	Boring Number: B-65				
Project:	I-85/I-385 Interchange					
Client:						
Location:	B-65 ST-2 11.0' to 11.4'					

Consolidation Test Results Summary

Project: I-85/I-385 Interchange
Location: B-65 ST-2 11.0' to 11.4'
Job Number: 08195-01

Project Number: 08195-01

Sample Number: ST-2
Boring Number: B-65
Depth: 11.0' to 11.4'
Sample Type: Undisturbed

Sample Description:
Gray, Black & Yellow Silty Sand
Remarks:

Test Number:
Test Date: 11/01/12

Index	Load Sequence (tsf)	Cumulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	0.9980	0.5490	0.00	1.2229	0.000	0.000	0.000	0.000
1	0.125	0.0017	0.9963	0.5473	0.17	1.2192	2.171	* 1.2063	353.752	147.919
2	0.250	0.0071	0.9909	0.5419	0.71	1.2071	12.549	* 6.9718	60.544	25.317
3	0.500	0.0165	0.9815	0.5325	1.65	1.1862	19.425	* 10.7914	38.376	16.047
4	1.000	0.0303	0.9677	0.5187	3.04	1.1555	10.239	* 5.6881	70.774	29.595
5	2.000	0.0551	0.9429	0.4939	5.52	1.1002	3.486	* 1.9365	197.363	82.530
6	0.500	0.0430	0.9550	0.5060	4.31	1.1272	0.000	0.000	0.000	0.000
7	0.125	0.0362	0.9618	0.5128	3.63	1.1423	0.000	0.000	0.000	0.000
8	0.250	0.0371	0.9609	0.5119	3.72	1.1403	7.699	* 4.2771	92.804	38.807
9	0.500	0.0413	0.9567	0.5077	4.14	1.1310	15.291	* 8.4950	46.318	19.368
10	1.000	0.0474	0.9506	0.5016	4.75	1.1174	2.272	* 1.2620	307.811	128.717
11	2.000	0.0588	0.9392	0.4902	5.89	1.0920	2.883	* 1.6014	236.793	99.018
12	4.000	0.1026	0.8954	0.4464	10.28	0.9944	3.039	* 1.6884	204.138	85.361
13	8.000	0.1623	0.8357	0.3867	16.26	0.8614	2.764	* 1.5355	195.525	81.762
14	16.000	0.2275	0.7705	0.3215	22.80	0.7162	2.652	* 1.4730	173.255	72.451
15	32.000	0.2891	0.7089	0.2599	28.97	0.5790	2.637	* 1.4650	147.465	61.664
16	8.000	0.2826	0.7154	0.2664	28.32	0.5935	0.000	0.000	0.000	0.000
17	2.000	0.2702	0.7278	0.2788	27.07	0.6211	0.000	0.000	0.000	0.000
18	0.500	0.2490	0.7490	0.3000	24.95	0.6683	0.000	0.000	0.000	0.000
19	0.125	0.2990	0.6990	0.2500	23.47	0.7020	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: *MR*

Checked By: *JS*

Consolidation Test

Consolidation Specimen Information

Project: I-85/I-385 Interchange
Location: B-65 ST-2 11.0' to 11.4'
Job Number: 08195-01

Project Number: 08195-01

Test Date: 11/01/12

Sample Number: ST-2
Boring Number: B-65
Depth: 11.0' to 11.4'
Sample Type: Undisturbed

Sample Description:
 Gray, Black & Yellow Silty Sand
Remarks:

Test Number:

Liquid Limit: 45.0000

Initial Void Ratio: 1.2238

Initial Height (in): 0.9980

Plastic Limit: 42.0000

Plasticity Index (%): 3.0000

Initial Diameter (in): 2.4973

Specific Gravity: 2.6610
 Measured

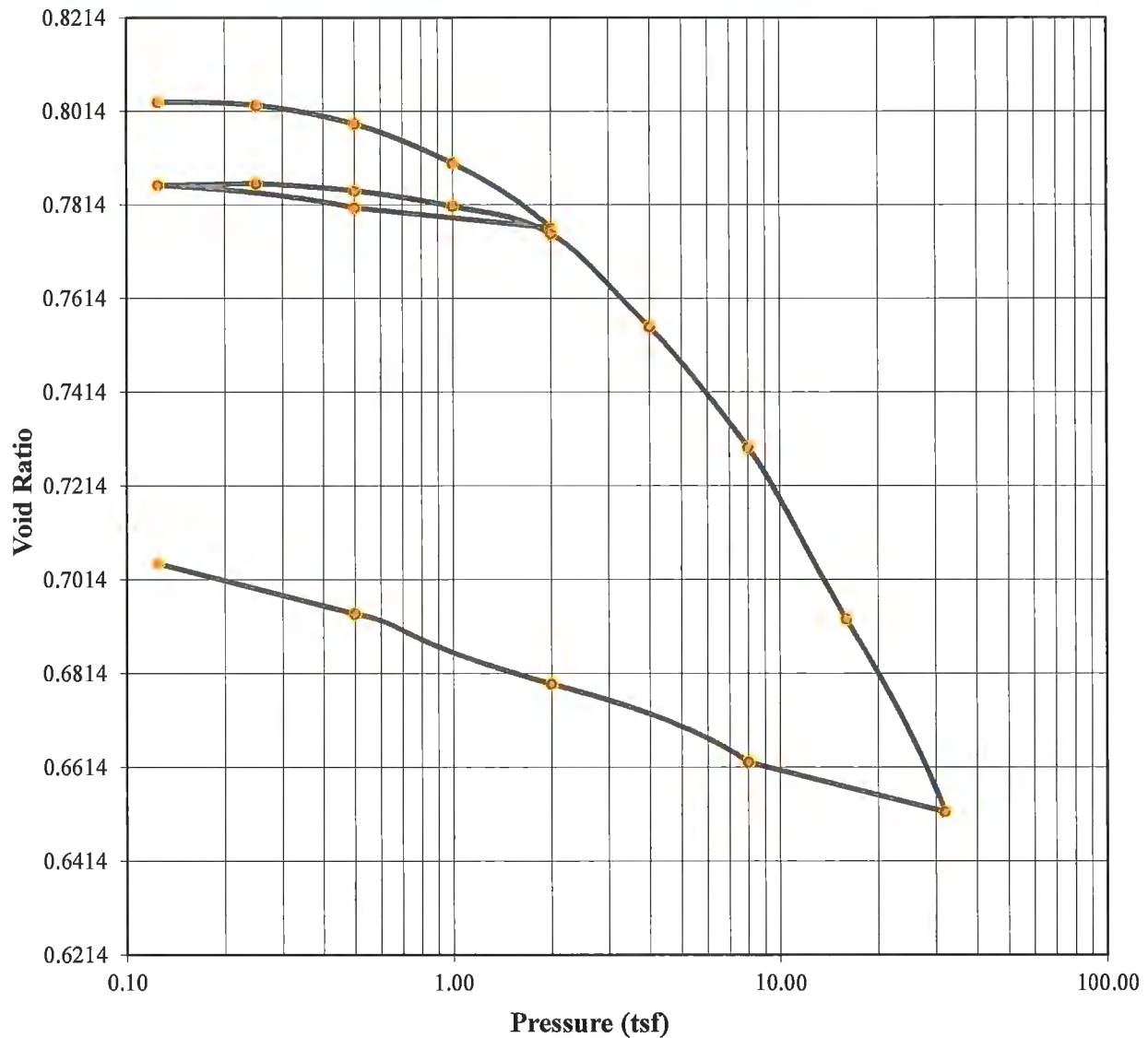
Weight of Ring (g): 110.1700

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	272.98	195.85
Dry Soil + Container (g)	219.70	167.90
Weight of Container (g)	71.72	73.54
Moisture Content (%)	36.00	29.62
Void Ratio	1.2238	0.5576
Saturation (%)	78.08	135.65
Dry Density (pcf)	74.60	105.07

Tested By: *HR*

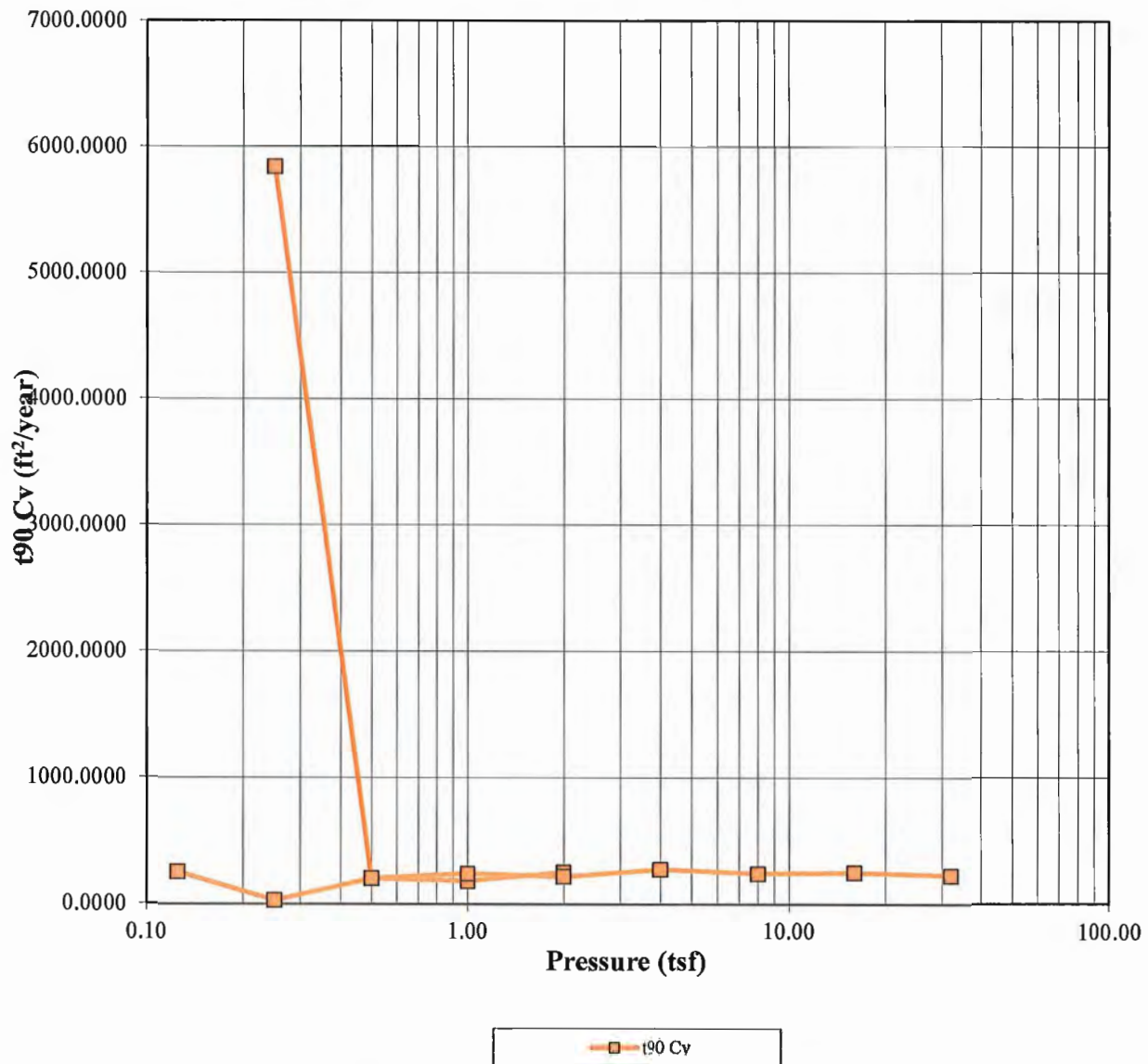
Checked By: *JS*

Consolidation Test Test Results



Summary of Consoliation Test Results				Test Date:
Overburden Pressure (tsf)	0.22	Compression Index, Cc Rebound Index, Cr	0.13	
Preconsol. Pressure (tsf)	3.20		0.01	
Over Consolidation Ratio	14.86			
Soil Description:		Orange, Red & White Silty Sand		
Project Number:	08195-01	Depth: 4.5' to 4.7'	Remarks:	
Sample Number:	ST-1	Boring Number: B-67		
Project:		I-85/I-385 Interchange		
Client:				
Location:		B-67 ST-1 4.5' to 4.7'		

Consolidation Test Test Results



	Before	After	Liquid Limits:	39	Test Date:
Moisture (%):	23.65	27.50	Plastic Limits:	34	
Dry Density (pcf):	93.64	100.76	Plasticity Index (%):	5	
Saturation (%):	80.00	110.65			
Void Ratio:	0.7971	0.6246	Specific Gravity:	2.695	Measured
Soil Description: Orange, Red & White Silty Sand					
Project Number:	08195-01	Depth: 4.5' to 4.7'		Remarks:	
Sample Number:	ST-1	Boring Number: B-67			
Project: I-85/I-385 Interchange					
Client:					
Location: B-67 ST-1 4.5' to 4.7'					

Consolidation Test Results Summary

Project: I-85/I-385 Interchange
Location: B-67 ST-1 4.5' to 4.7'
Job Number: 08195-01

Project Number: 08195-01

Sample Number: ST-1
Boring Number: B-67
Depth: 4.5' to 4.7'
Sample Type: Undisturbed

Sample Description:
Orange, Red & White Silty Sand
Remarks:

Test Number:
Test Date:

Index	Load Sequence (tsf)	Cumulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	0.9993	0.4421	0.00	0.7935	0.000	0.000	0.000	0.000
1	0.125	-0.0055	1.0048	0.4476	-0.55	0.8034	3.029	* 1.6826	257.956	107.864
2	0.250	-0.0051	1.0044	0.4472	-0.51	0.8027	24.360	* 13.5336	32.045	13.400
3	0.500	-0.0029	1.0022	0.4450	-0.29	0.7987	3.775	* 2.0969	205.910	86.105
4	1.000	0.0018	0.9975	0.4403	0.18	0.7903	4.127	* 2.2930	186.543	78.005
5	2.000	0.0095	0.9898	0.4326	0.95	0.7765	2.959	* 1.6440	256.181	107.125
6	0.500	0.0071	0.9922	0.4350	0.71	0.7808	0.000	0.000	0.000	0.000
7	0.125	0.0044	0.9949	0.4377	0.44	0.7856	0.000	0.000	0.000	0.000
8	0.250	0.0042	0.9951	0.4379	0.42	0.7860	0.131	* 0.0729	5839.553	2441.771
9	0.500	0.0051	0.9942	0.4370	0.51	0.7844	3.684	* 2.0467	207.610	86.815
10	1.000	0.0069	0.9924	0.4352	0.69	0.7811	3.105	* 1.7252	245.410	102.620
11	2.000	0.0102	0.9891	0.4319	1.02	0.7752	3.426	* 1.9032	220.978	92.405
12	4.000	0.0213	0.9780	0.4208	2.13	0.7553	2.664	* 1.4798	277.870	116.191
13	8.000	0.0356	0.9637	0.4065	3.56	0.7296	2.933	* 1.6295	245.008	102.454
14	16.000	0.0560	0.9433	0.3861	5.60	0.6930	2.714	* 1.5078	253.691	106.085
15	32.000	0.0789	0.9204	0.3632	7.90	0.6519	2.860	* 1.5889	229.202	95.842
16	8.000	0.0730	0.9263	0.3691	7.31	0.6625	0.000	0.000	0.000	0.000
17	2.000	0.0637	0.9356	0.3784	6.37	0.6792	0.000	0.000	0.000	0.000
18	0.500	0.0554	0.9439	0.3867	5.54	0.6941	0.000	0.000	0.000	0.000
19	0.125	0.0959	0.9034	0.3462	5.13	0.7048	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: MR

Checked By: JS

Consolidation Test

Consolidation Specimen Information

Project: I-85/I-385 Interchange

Project Number: 08195-01

Location: B-67 ST-1 4.5' to 4.7'

Job Number: 08195-01

Test Date:

Sample Number: ST-1

Sample Description:

Boring Number: B-67

Orange, Red & White Silty Sand

Depth: 4.5' to 4.7'

Remarks:

Sample Type: Undisturbed

Test Number:

Liquid Limit: 39.0000

Initial Void Ratio: 0.7971

Initial Height (in): 0.9993

Plastic Limit: 34.0000

Plasticity Index (%): 5.0000

Initial Diameter (in): 2.4955

Specific Gravity: 2.6950

Weight of Ring (g): 109.2200

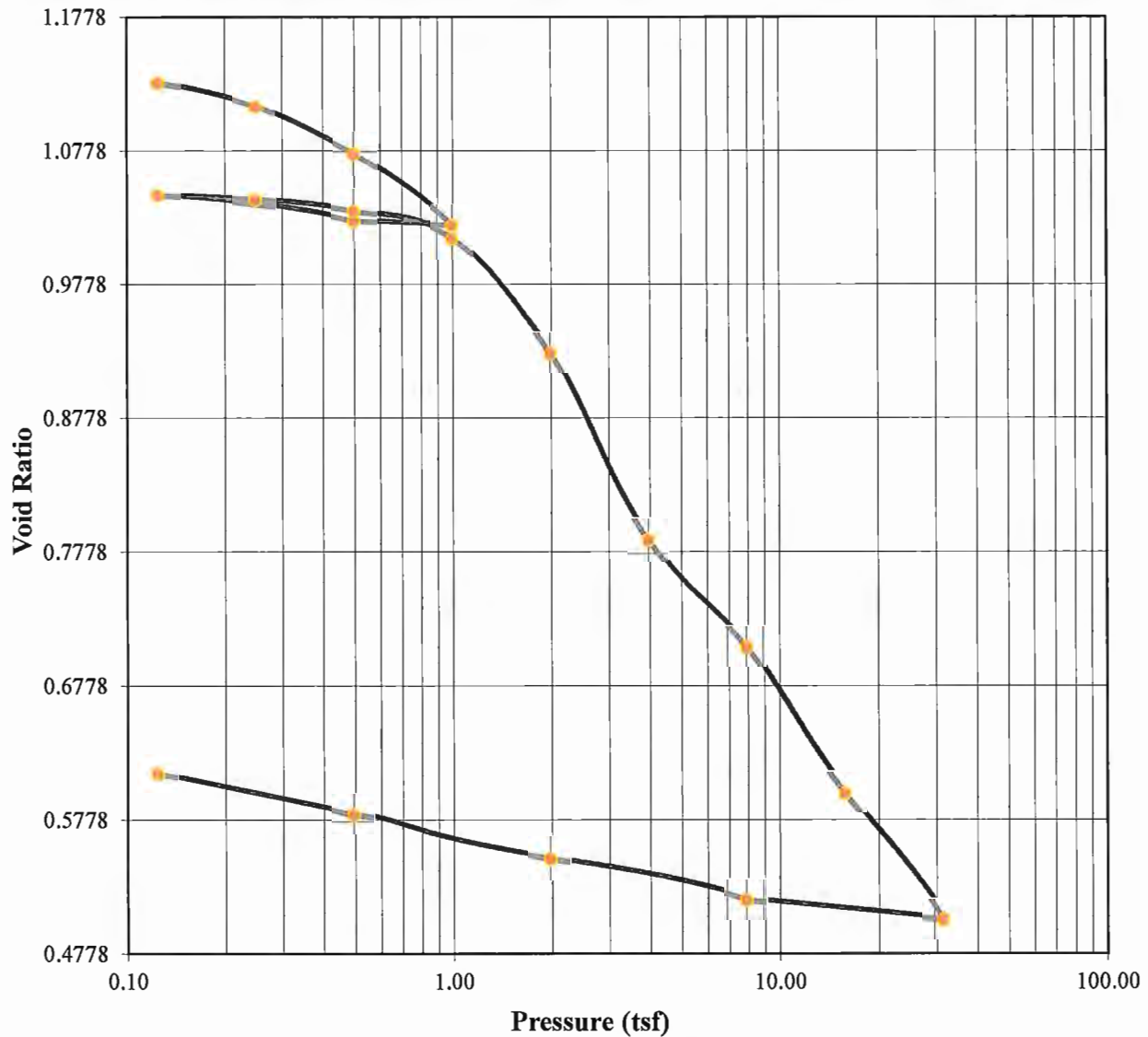
Measured

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	384.24	223.25
Dry Soil + Container (g)	325.04	191.14
Weight of Container (g)	74.76	74.39
Moisture Content (%)	23.65	27.50
Void Ratio	0.7971	0.6246
Saturation (%)	80.00	110.65
Dry Density (pcf)	93.64	100.76

Tested By: MR

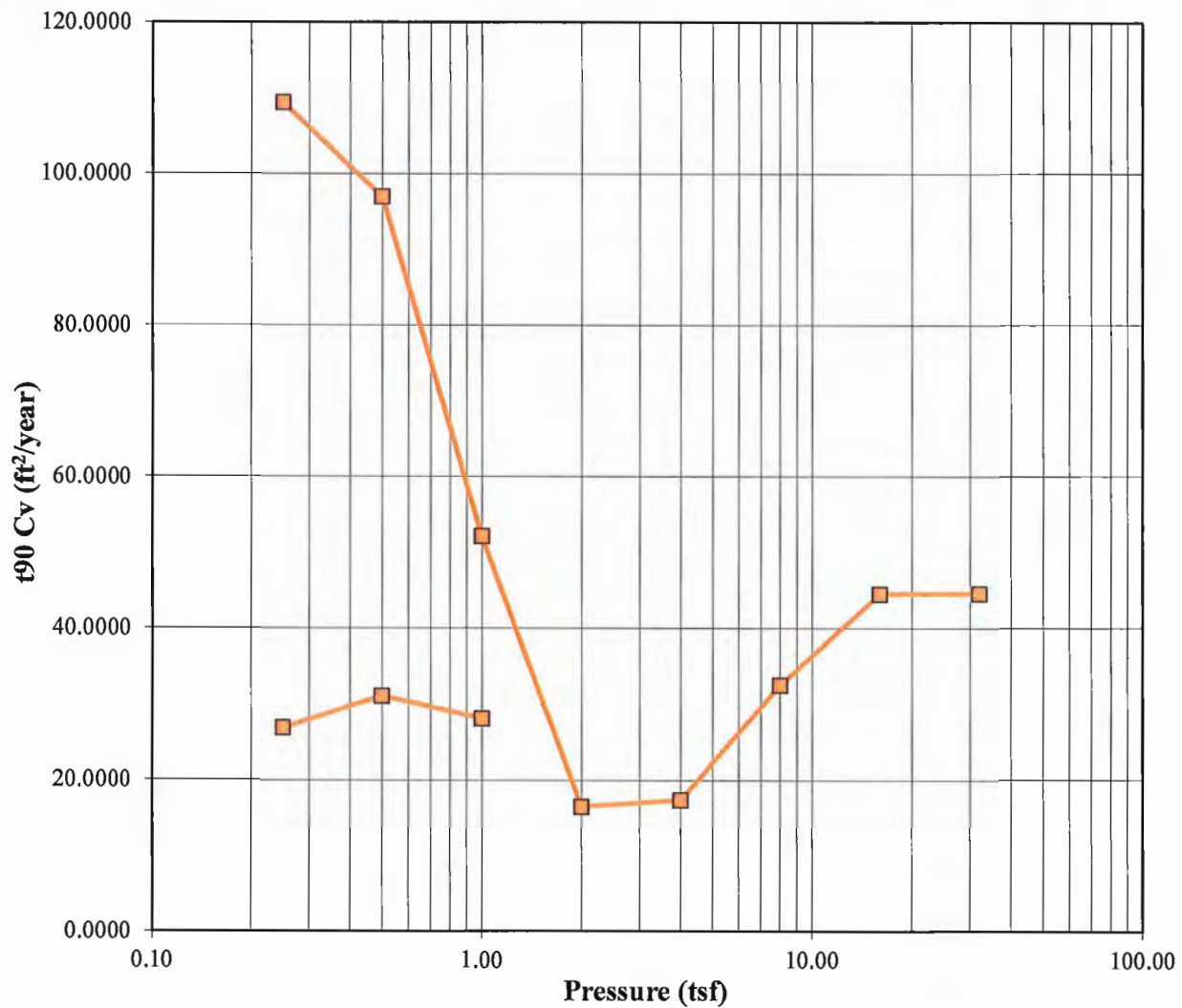
Checked By: JS

Consolidation Test Test Results



Summary of Consoliation Test Results				Test Date: 11/05/12
Overburden Pressure (tsf)	0.20	Compression Index, Cc Rebound Index, Cr	0.34	
Preconsol. Pressure (tsf)	0.69		0.02	
Over Consolidation Ratio	3.43			
Soil Description: Brown Sandy Silt				
Project Number:	08195-01	Depth: 5.0' to 5.3'	Remarks:	
Sample Number:	ST-1	Boring Number: B-74		
Project: I-85/I-385 Interchange				
Client:				
Location: B-74 ST-1 5.0' to 5.3'				

Consolidation Test Test Results



—■— $t_{90} C_v$

	Before	After	Liquid Limits:	30	Test Date:	11/05/12
Moisture (%):	33.07	31.59	Plastic Limits:	23		
Dry Density (pcf):	78.14	97.39	Plasticity Index (%):	7		
Saturation (%):	77.89	118.50				
Void Ratio:	1.1323	0.4793	Specific Gravity:	2.671	Measured	
Soil Description:	Brown Sandy Silt					
Project Number:	08195-01	Depth: 5.0' to 5.3'		Remarks:		
Sample Number:	ST-1	Boring Number: B-74				
Project:	I-85/I-385 Interchange					
Client:						
Location:	B-74 ST-1 5.0' to 5.3'					

Consolidation Test Results **Summary**

Project: I-85/I-385 Interchange
Location: B-74 ST-1 5.0' to 5.3'
Job Number: 08195-01

Project Number: 08195-01

Sample Number: ST-1
Boring Number: B-74
Depth: 5.0' to 5.3'
Sample Type: Undisturbed

Sample Description:
Brown Sandy Silt
Remarks:

Test Number:
Test Date: 11/05/12

Index	Load Sequence (tsf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	1.0145	0.5382	0.00	1.1302	0.000	0.000	0.000	0.000
1	0.125	0.0004	1.0141	0.5378	0.04	1.1293	0.000	0.000	0.000	0.000
2	0.250	0.0089	1.0056	0.5293	0.88	1.1115	29.083	* 16.1569	26.906	11.251
3	0.500	0.0257	0.9888	0.5125	2.53	1.0762	24.299	* 13.4992	31.136	13.020
4	1.000	0.0511	0.9634	0.4871	5.04	1.0229	25.499	* 14.1663	28.165	11.778
5	0.500	0.0496	0.9649	0.4886	4.89	1.0260	0.000	0.000	0.000	0.000
6	0.125	0.0405	0.9740	0.4977	3.99	1.0451	0.000	0.000	0.000	0.000
7	0.250	0.0420	0.9725	0.4962	4.14	1.0420	6.691	* 3.7169	109.383	45.740
8	0.500	0.0460	0.9685	0.4922	4.53	1.0336	7.485	* 4.1581	96.975	40.551
9	1.000	0.0556	0.9589	0.4826	5.48	1.0134	13.635	* 7.5752	52.181	21.820
10	2.000	0.0965	0.9180	0.4417	9.51	0.9275	39.294	* 21.8297	16.596	6.940
11	4.000	0.1630	0.8515	0.3752	16.07	0.7879	32.188	* 17.8823	17.430	7.289
12	8.000	0.2009	0.8136	0.3373	19.80	0.7083	15.730	* 8.7389	32.563	13.616
13	16.000	0.2528	0.7617	0.2854	24.92	0.5994	10.075	* 5.5972	44.561	18.634
14	32.000	0.2979	0.7166	0.2403	29.36	0.5047	8.897	* 4.9425	44.664	18.677
15	8.000	0.2909	0.7236	0.2473	28.67	0.5194	0.000	0.000	0.000	0.000
16	2.000	0.2764	0.7381	0.2618	27.24	0.5498	0.000	0.000	0.000	0.000
17	0.500	0.2608	0.7537	0.2774	25.71	0.5826	0.000	0.000	0.000	0.000
18	0.125	0.3107	0.7038	0.2275	24.35	0.6131	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: *MR*

Checked By: *JS*

Consolidation Test

Consolidation Specimen Information

Project: I-85/I-385 Interchange

Project Number: 08195-01

Location: B-74 ST-1 5.0' to 5.3'

Job Number: 08195-01

Test Date: 11/05/12

Sample Number: ST-1

Sample Description:

Boring Number: B-74

Brown Sandy Silt

Depth: 5.0' to 5.3'

Remarks:

Sample Type: Undisturbed

Test Number:

Liquid Limit: 30.0000

Initial Void Ratio: 1.1323

Initial Height (in): 1.0145

Plastic Limit: 23.0000

Plasticity Index (%): 7.0000

Initial Diameter (in): 2.4965

Specific Gravity: 2.6710
Measured

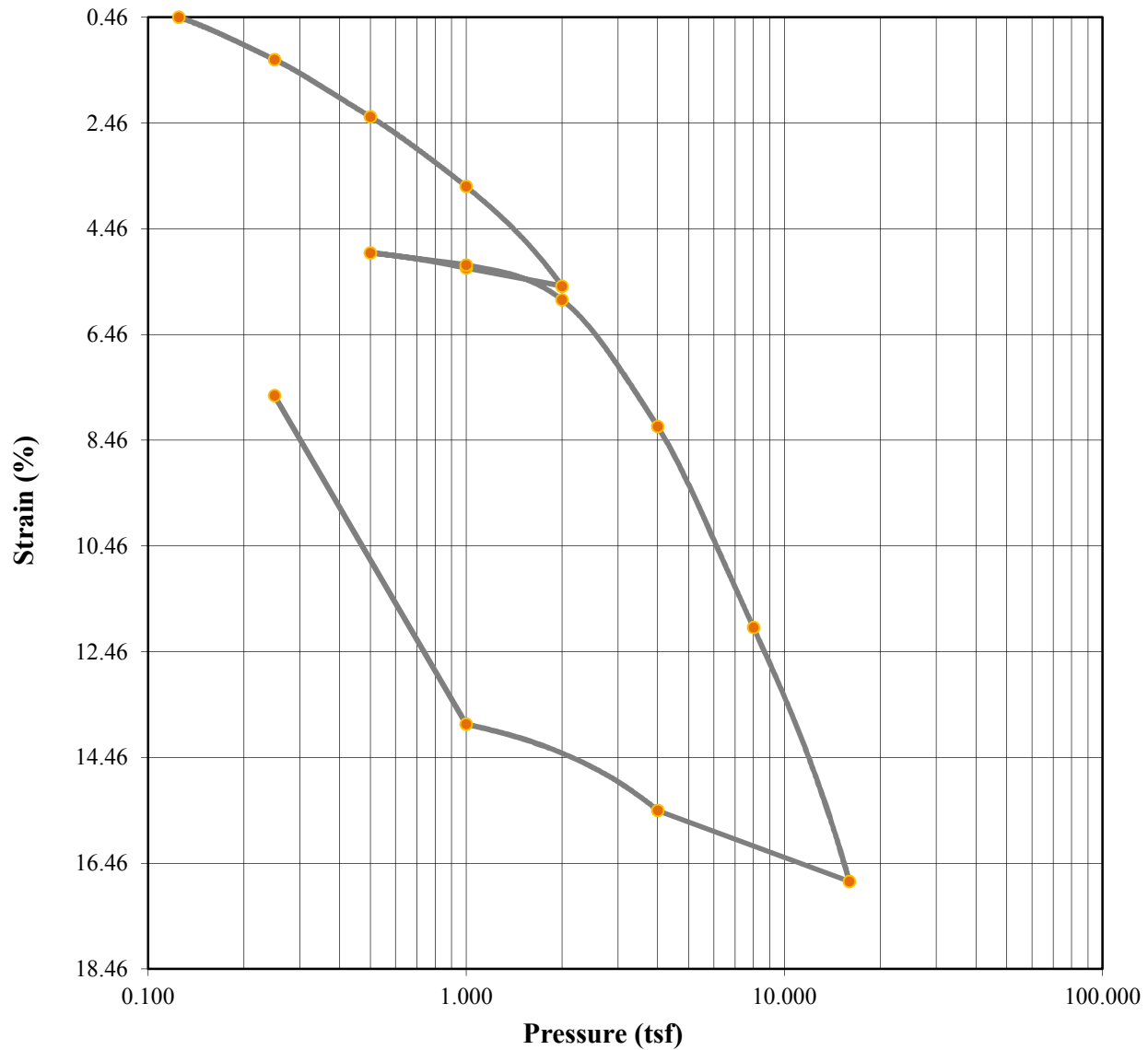
Weight of Ring (g): 110.8600

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	1309.50	192.68
Dry Soil + Container (g)	1036.50	164.90
Weight of Container (g)	210.90	76.95
Moisture Content (%)	33.07	31.59
Void Ratio	1.1323	0.4793
Saturation (%)	77.89	118.50
Dry Density (pcf)	78.14	97.39

Tested By: MR

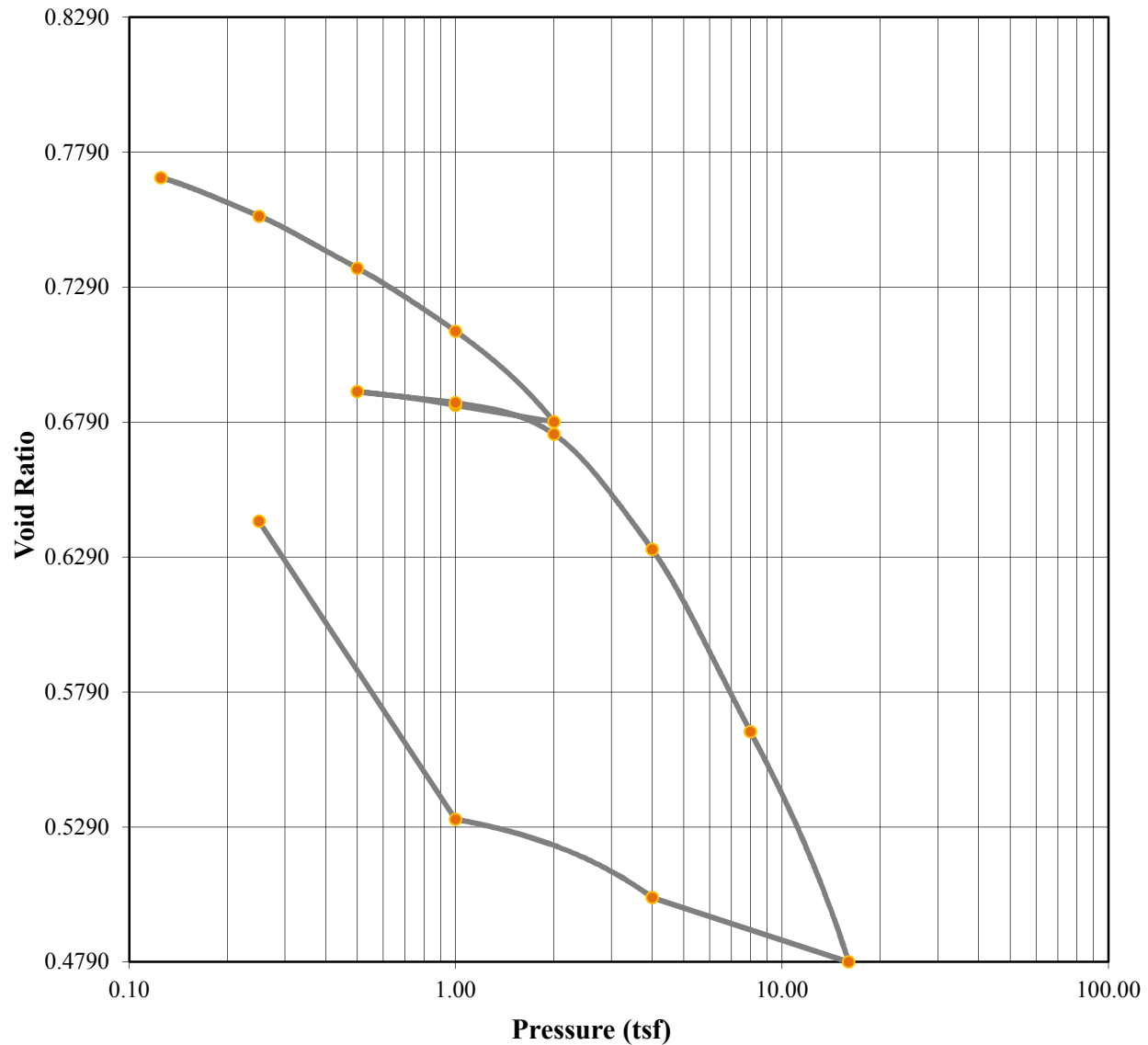
Checked By: JS

Consolidation Test Test Results



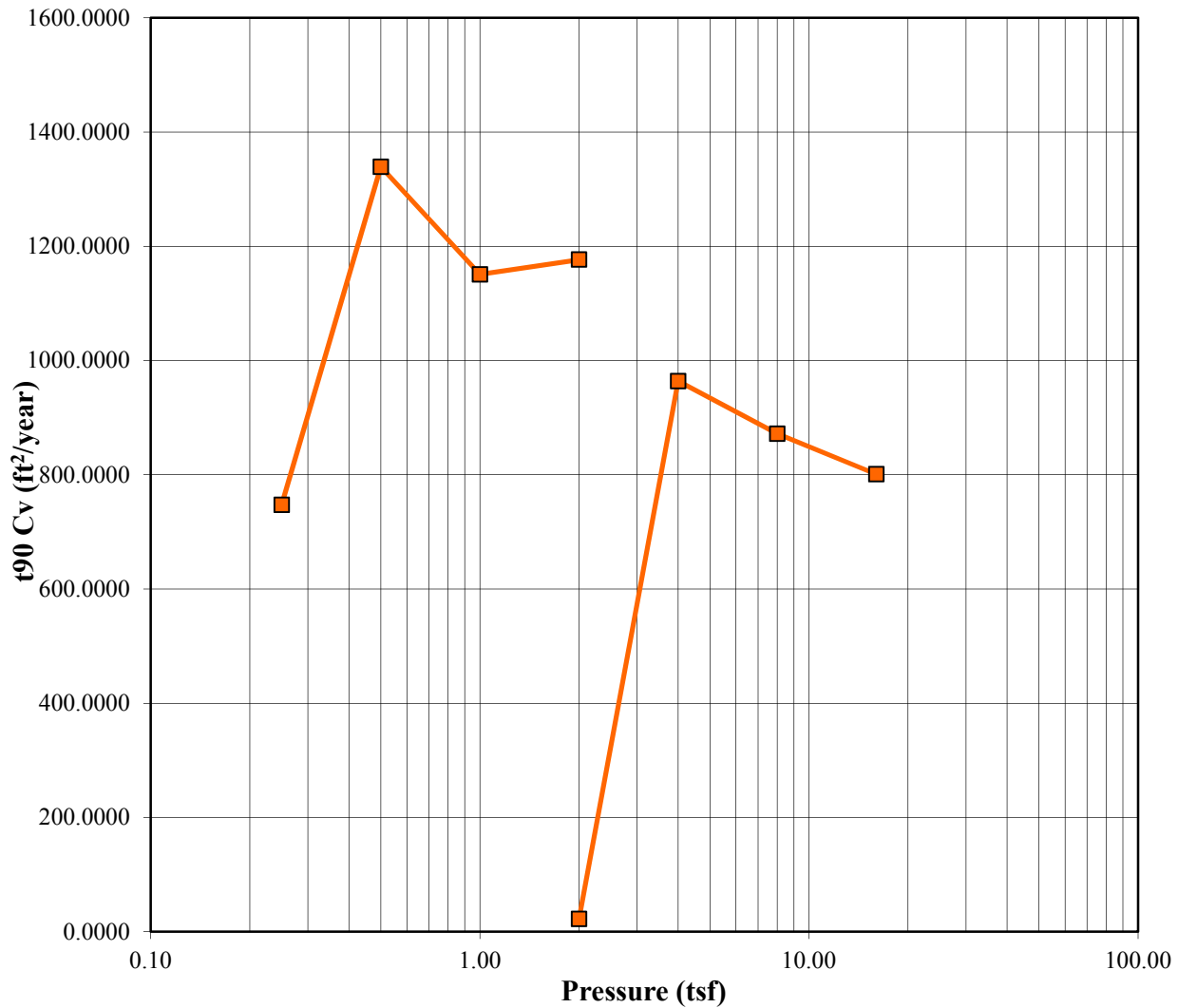
	Before	After	Liquid Limits:	0	Test Date:	5/1/15			
Moisture (%):	28.17	24.23	Plastic Limits:	0					
Dry Density (pcf):	91.14	101.56	Plasticity Index (%):	0					
Saturation (%):	93.80	105.32							
Void Ratio:	0.7774	0.6420	Specific Gravity:	2.600	Assumed				
Sample Description: Gray Silty Sand with Mica									
Project Number:	7393-17	Depth: 25.0-27.0 ft.		Remarks:					
Sample Number:	T-2	Boring Number: B07-SPT-01							
Project:	SCDOT I-85/I-385 Interchange Modifications								
Client:	CECS								
Location:	Soils Lab								

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	5/1/15
Moisture (%):	28.17	24.23	Plastic Limits:	0		
Dry Density (pcf):	91.14	101.56	Plasticity Index (%):	0		
Saturation (%):	93.80	105.32				
Void Ratio:	0.7774	0.6420	Specific Gravity:	2.600	Assumed	
Soil Description:	Gray Silty Sand with Mica					
Project Number:	7393-17	Depth: 25.0-27.0 ft.		Remarks:		
Sample Number:	T-2	Boring Number: B07-SPT-01				
Project:	SCDOT I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

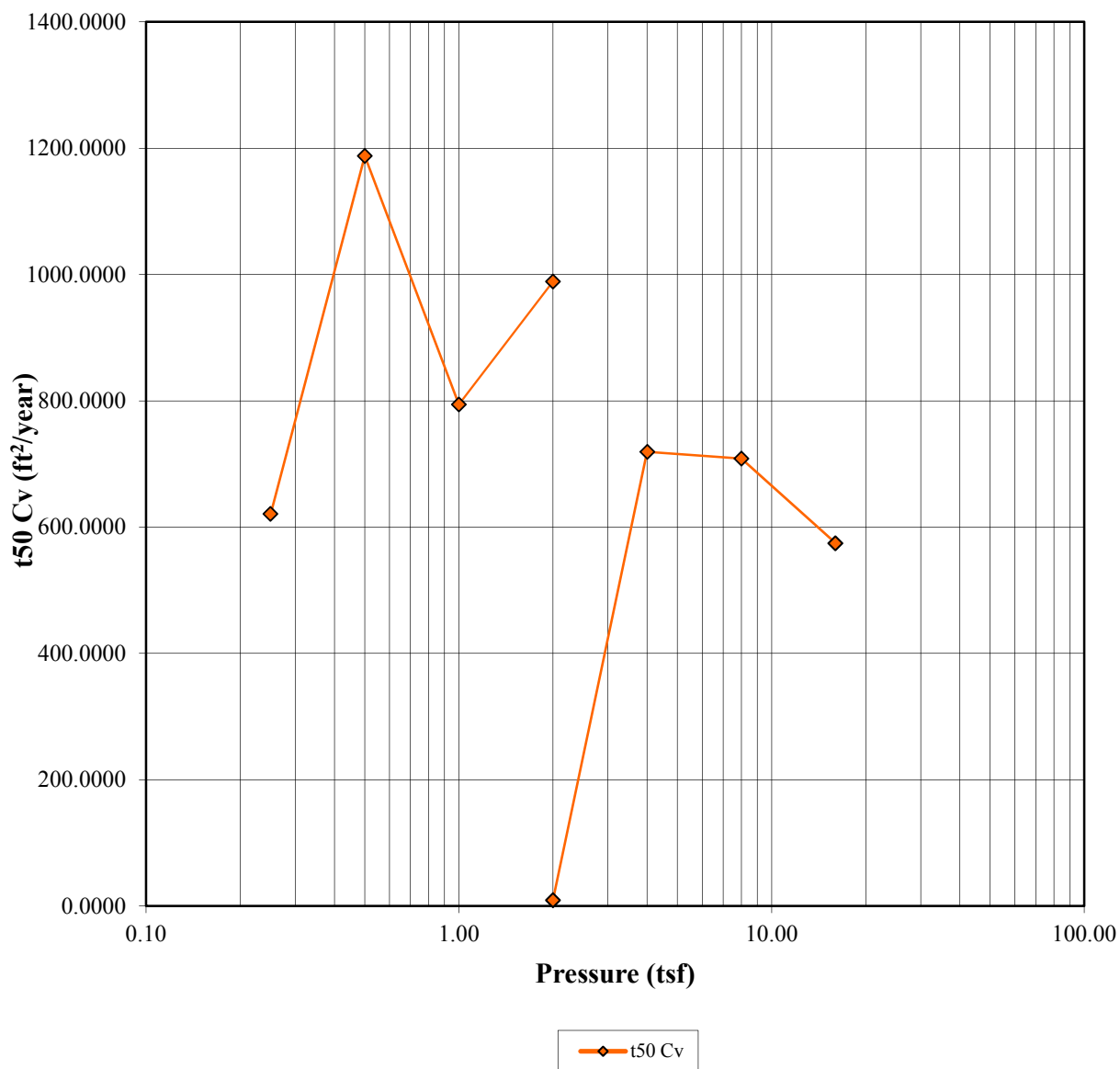
Consolidation Test Test Results



—■— t90 Cv

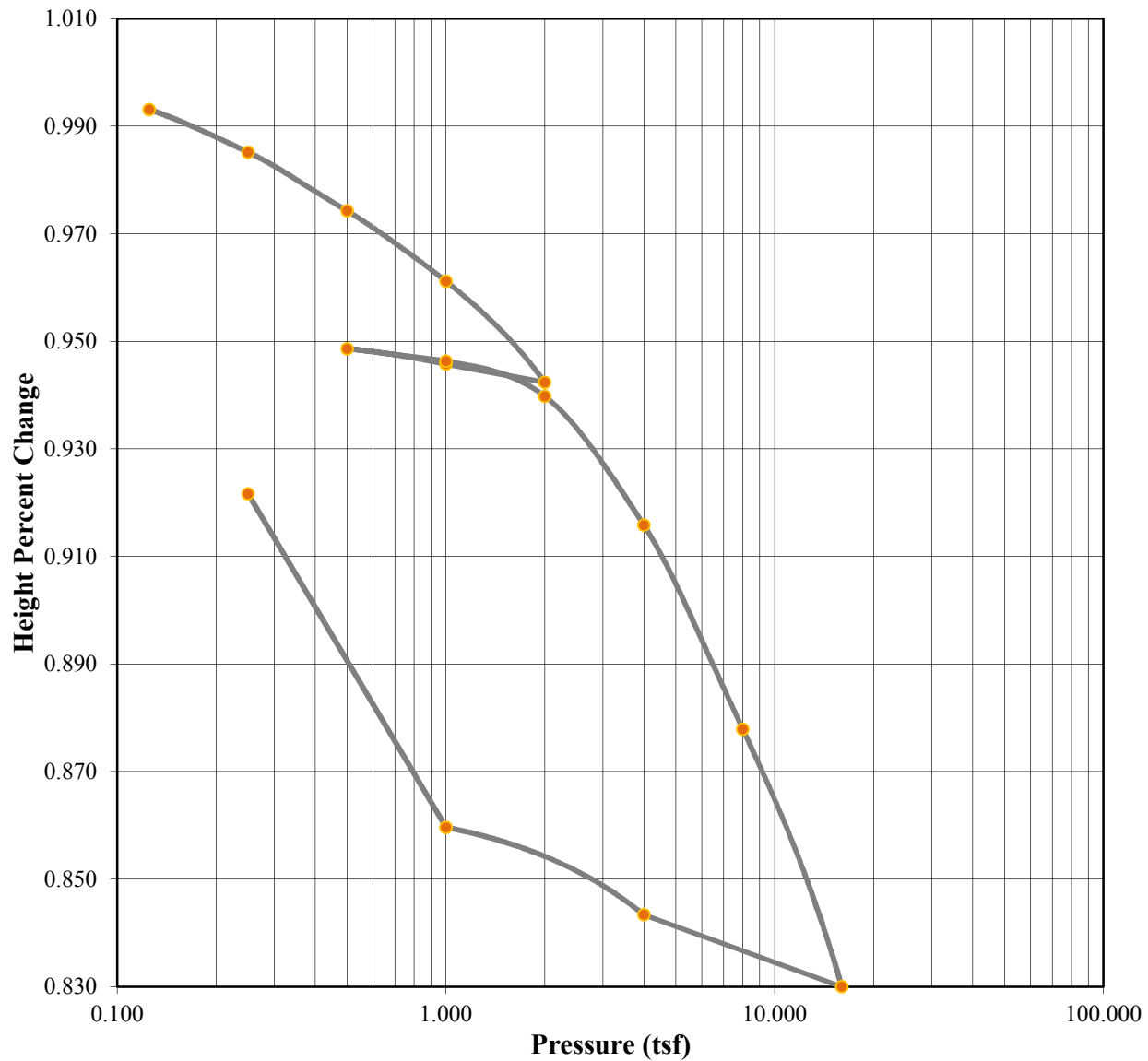
	Before	After	Liquid Limits:	0	Test Date:	5/1/15	
Moisture (%):	28.17	24.23	Plastic Limits:	0			
Dry Density (pcf):	91.14	101.56	Plasticity Index (%):	0			
Saturation (%):	93.80	105.32					
Void Ratio:	0.7774	0.6420	Specific Gravity:	2.600	Assumed		
Soil Description:	Gray Silty Sand with Mica						
Project Number:	7393-17	Depth: 25.0-27.0 ft.		Remarks:			
Sample Number:	T-2	Boring Number: B07-SPT-01					
Project:	SCDOT I-85/I-385 Interchange Modifications						
Client:	CECS						
Location:	Soils Lab						

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	5/1/15
Moisture (%):	28.17	24.23	Plastic Limits:	0		
Dry Density (pcf):	91.14	101.56	Plasticity Index (%):	0		
Saturation (%):	93.80	105.32				
Void Ratio:	0.7774	0.6420	Specific Gravity:	2.600	Assumed	
Soil Description:	Gray Silty Sand with Mica					
Project Number:	7393-17		Depth: 25.0-27.0 ft.		Remarks:	
Sample Number:	T-2		Boring Number: B07-SPT-01			
Project:	SCDOT I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	5/1/15
Moisture (%):	28.17	24.23	Plastic Limits:	0		
Dry Density (pcf):	91.14	101.56	Plasticity Index (%):	0		
Saturation (%):	93.80	105.32				
Void Ratio:	0.7774	0.6420	Specific Gravity:	2.600	Assumed	
Soil Description:	Gray Silty Sand with Mica					
Project Number:	7393-17		Depth: 25.0-27.0 ft.		Remarks:	
Sample Number:	T-2		Boring Number: B07-SPT-01			
Project:	SCDOT I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Results

Summary

Project: SCDOT I-85/I-385 Interchange Modifications
Location: Soils Lab
Job Number: 14-1101-0276

Project Number: 7393-17

Sample Number: T-2
Boring Number: B07-SPT-01
Depth: 25.0-27.0 ft.
Sample Type: Undisturbed

Sample Description:
 Gray Silty Sand with Mica
Remarks:

Test Number:
Test Date: 5/1/15

Index	Load Sequence (tsf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	0.9980	0.4366	0.00	0.7777	0.000	0.000	0.000	0.000
1	0.125	0.0046	0.9934	0.4320	0.46	0.7696	0.000	0.000	0.000	0.000
2	0.250	0.0125	0.9855	0.4241	1.26	0.7554	1.005	0.281	747.749	621.042
3	0.500	0.0234	0.9746	0.4132	2.34	0.7361	0.549	0.144	1339.546	1187.674
4	1.000	0.0365	0.9615	0.4001	3.66	0.7127	0.622	0.209	1150.931	794.407
5	2.000	0.0553	0.9427	0.3813	5.54	0.6792	0.584	0.162	1176.755	988.690
6	1.000	0.0519	0.9461	0.3847	5.20	0.6853	0.000	0.000	0.000	0.000
7	0.500	0.0490	0.9490	0.3876	4.91	0.6903	0.000	0.000	0.000	0.000
8	1.000	0.0513	0.9467	0.3853	5.14	0.6863	0.000	0.000	0.000	0.000
9	2.000	0.0579	0.9401	0.3787	5.80	0.6746	0.000	0.000	0.000	0.000
10	4.000	0.0818	0.9162	0.3548	8.20	0.6319	0.674	0.210	964.351	719.100
11	8.000	0.1198	0.8782	0.3168	12.00	0.5644	0.684	0.196	872.204	708.316
12	16.000	0.1677	0.8303	0.2689	16.80	0.4790	0.666	0.216	801.091	574.634
13	4.000	0.1543	0.8437	0.2823	15.46	0.5029	0.000	0.000	0.000	0.000
14	1.000	0.1380	0.8600	0.2986	13.83	0.5319	0.000	0.000	0.000	0.000
15	0.250	0.0760	0.9220	0.3606	7.62	0.6423	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: B. Hak

Checked By: C. Dugger

Consolidation Test

Consolidation Specimen Information

Project: SCDOT I-85/I-385 Interchange Modifications

Project Number: 7393-17

Location: Soils Lab

Job Number: 14-1101-0276

Test Date: 5/1/15

Sample Number: T-2

Sample Description:

Boring Number: B07-SPT-01

Gray Silty Sand with Mica

Depth: 25.0-27.0 ft.

Remarks:

Sample Type: Undisturbed

Test Number:

Liquid Limit: 0.0000

Initial Void Ratio: 0.7774

Initial Height (in): 0.9980

Plastic Limit: 0.0000

Plasticity Index (%): 0.0000

Initial Diameter (in): 2.5010

Specific Gravity: 2.6000
Assumed

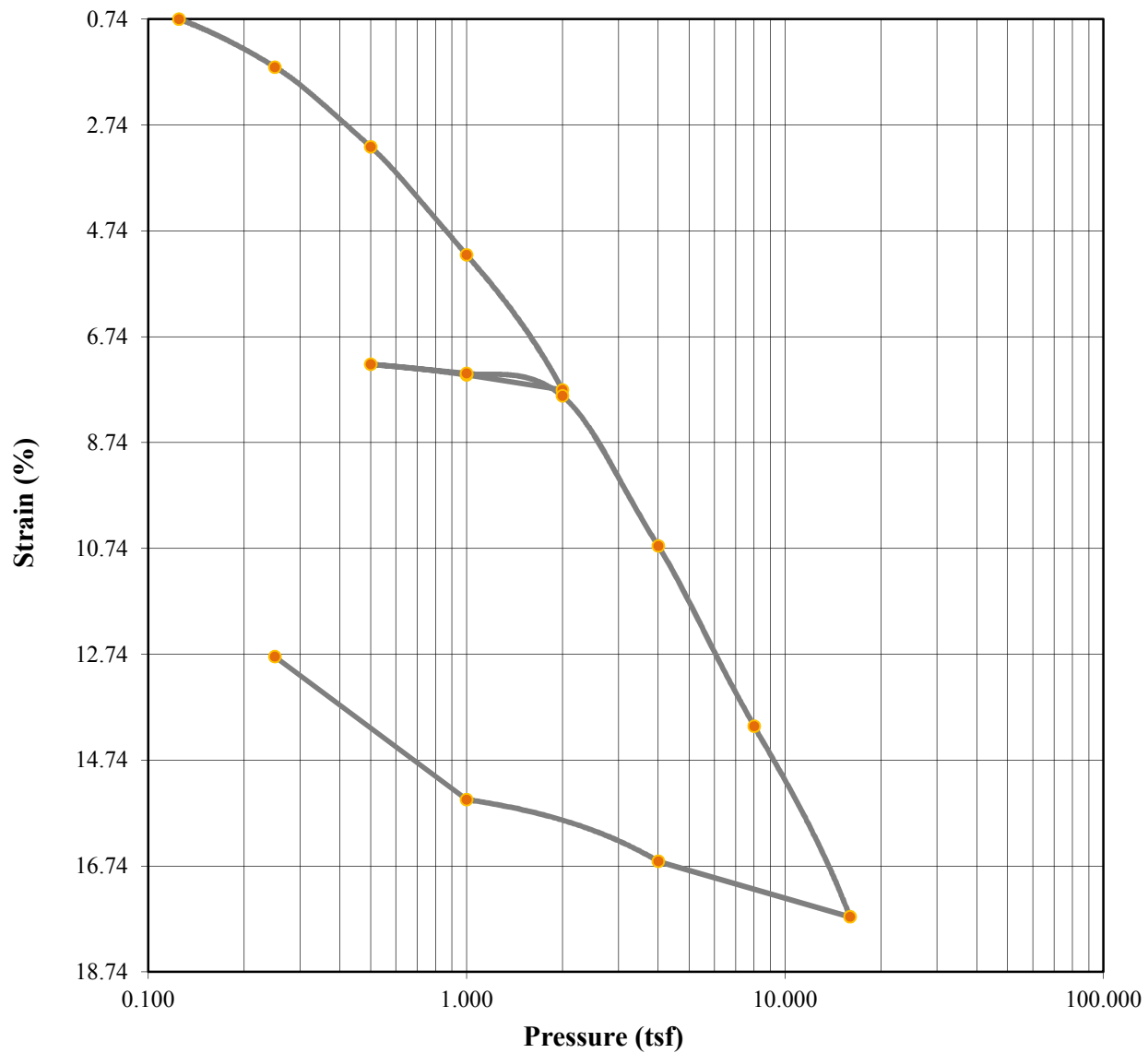
Weight of Ring (g): 110.8000

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	130.39	281.99
Dry Soil + Container (g)	108.80	252.79
Weight of Container (g)	32.17	132.27
Moisture Content (%)	28.17	24.23
Void Ratio	0.7774	0.6420
Saturation (%)	93.80	105.32
Dry Density (pcf)	91.14	101.56

Tested By: B. Hak

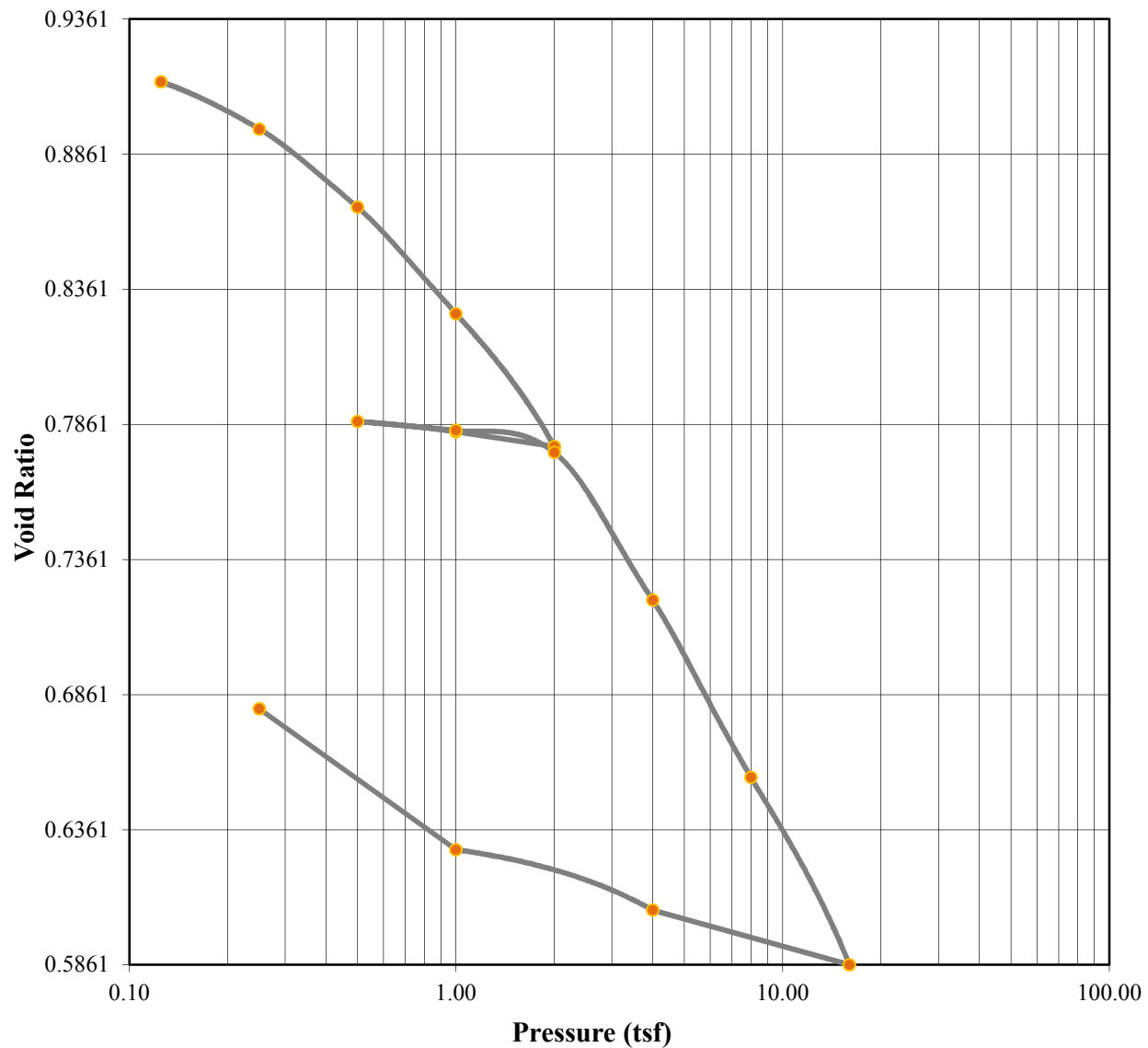
Checked By: C. Dugger

Consolidation Test Test Results



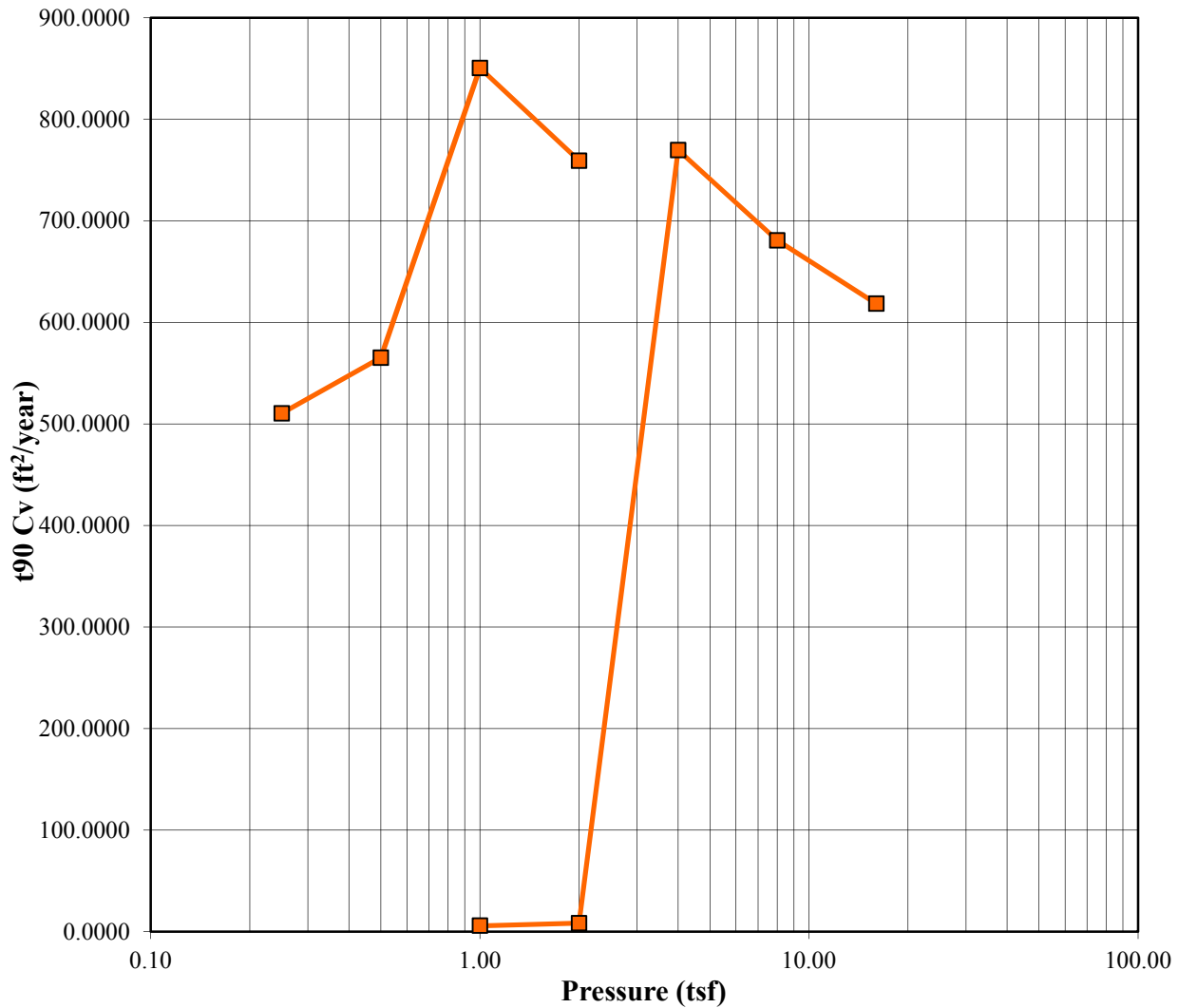
	Before	After	Liquid Limits:	0	Test Date:	4-28-15		
Moisture (%):	32.82	24.49	Plastic Limits:	0				
Dry Density (pcf):	86.82	99.67	Plasticity Index (%):	0				
Saturation (%):	94.70	96.46						
Void Ratio:	0.9300	0.6833	Specific Gravity:	2.685	Assumed			
Sample Description: Reddish brown, Sandy Clay								
Project Number:	14-1101-0276		Depth:	Remarks:				
Sample Number:	T-1		Boring Number:				B09-SPT-05	
Project:	SCDOT I-85/I-385 Interchange Modifications							
Client:	CECS							
Location:								

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	4-28-15		
Moisture (%):	32.82	24.49	Plastic Limits:	0				
Dry Density (pcf):	86.82	99.67	Plasticity Index (%):	0				
Saturation (%):	94.70	96.46						
Void Ratio:	0.9300	0.6833	Specific Gravity:	2.685	Assumed			
Soil Description:	Reddish brown, Sandy Clay							
Project Number:	14-1101-0276		Depth:	Remarks:				
Sample Number:	T-1		Boring Number:				B09-SPT-05	
Project:	SCDOT I-85/I-385 Interchange Modifications							
Client:	CECS							
Location:								

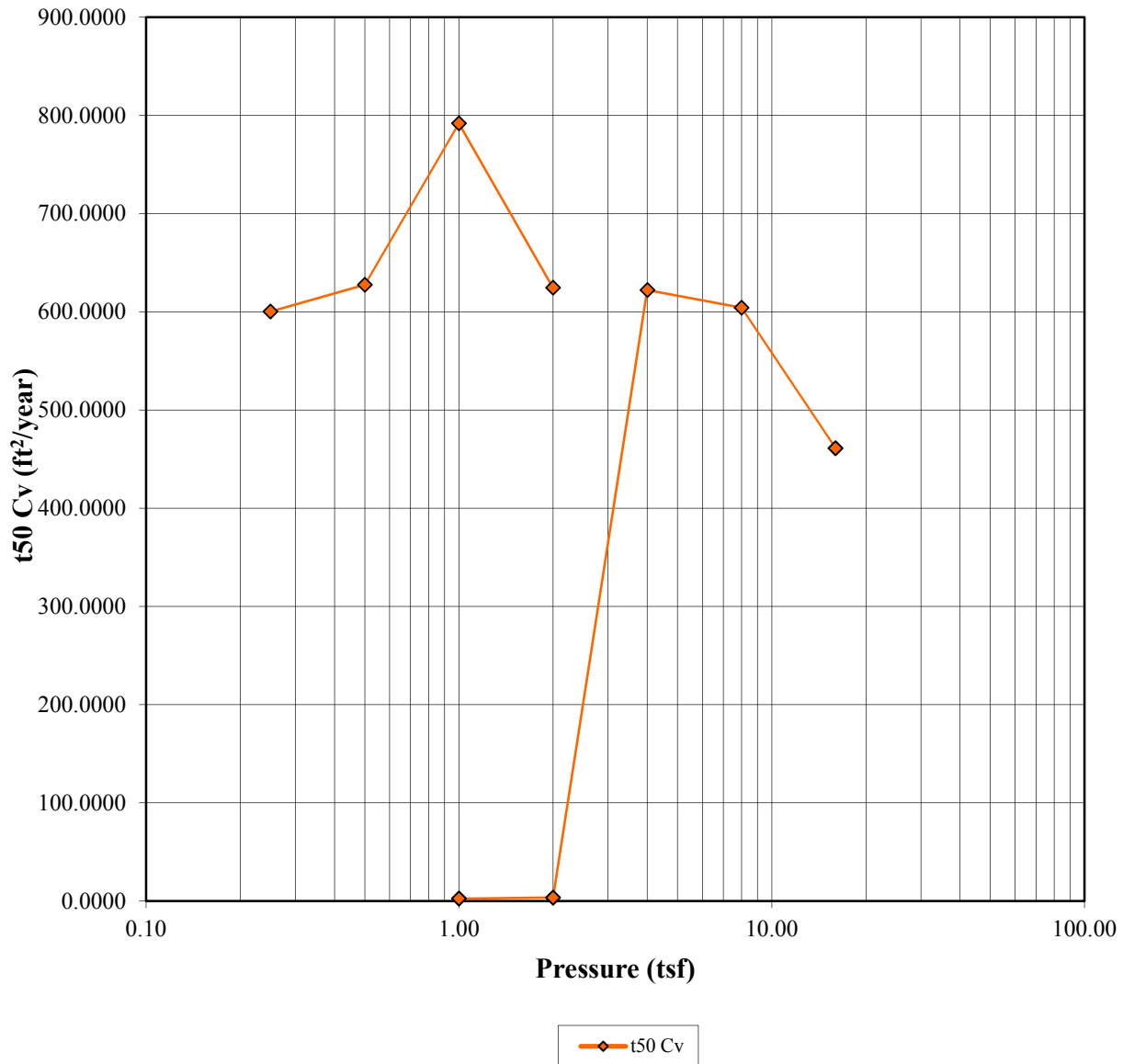
Consolidation Test Test Results



—■— t90 Cv

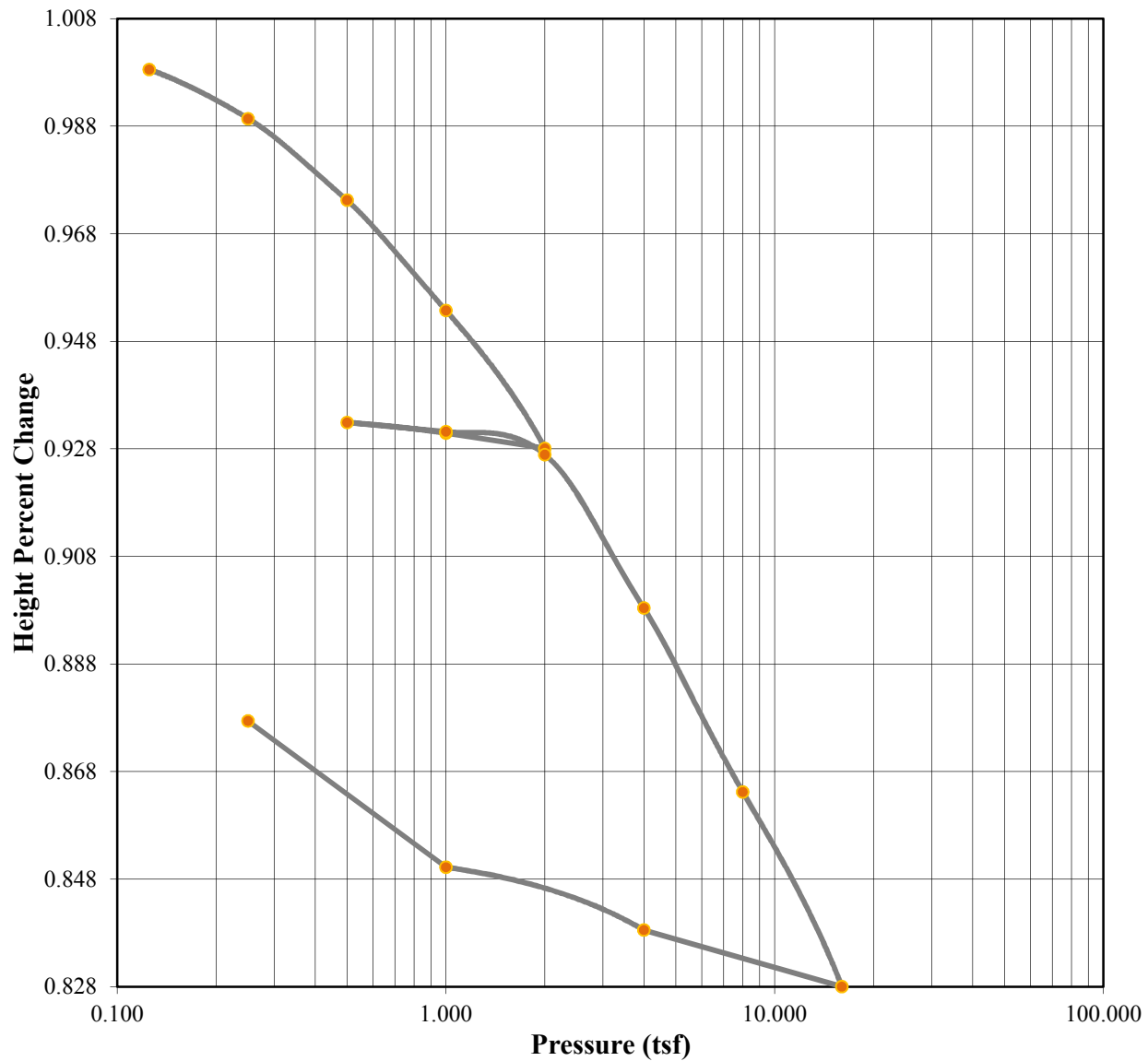
	Before	After	Liquid Limits:	0	Test Date:	4-28-15		
Moisture (%):	32.82	24.49	Plastic Limits:	0				
Dry Density (pcf):	86.82	99.67	Plasticity Index (%):	0				
Saturation (%):	94.70	96.46						
Void Ratio:	0.9300	0.6833	Specific Gravity:	2.685	Assumed			
Soil Description:	Reddish brown, Sandy Clay							
Project Number:	14-1101-0276		Depth:	Remarks:				
Sample Number:	T-1		Boring Number:				B09-SPT-05	
Project:	SCDOT I-85/I-385 Interchange Modifications							
Client:	CECS							
Location:								

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	4-28-15
Moisture (%):	32.82	24.49	Plastic Limits:	0		
Dry Density (pcf):	86.82	99.67	Plasticity Index (%):	0		
Saturation (%):	94.70	96.46				
Void Ratio:	0.9300	0.6833	Specific Gravity:	2.685	Assumed	
Soil Description:	Reddish brown, Sandy Clay					
Project Number:	14-1101-0276		Depth:	Remarks:		
Sample Number:	T-1		Boring Number:			
Project:	SCDOT I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:						

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	4-28-15
Moisture (%):	32.82	24.49	Plastic Limits:	0		
Dry Density (pcf):	86.82	99.67	Plasticity Index (%):	0		
Saturation (%):	94.70	96.46				
Void Ratio:	0.9300	0.6833	Specific Gravity:	2.685	Assumed	
Soil Description:	Reddish brown, Sandy Clay					
Project Number:	14-1101-0276		Depth:	Remarks:		
Sample Number:	T-1		Boring Number:			
Project:	SCDOT I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:						

Consolidation Test Results

Summary

Project: SCDOT I-85/I-385 Interchange Modifications

Project Number: 4-1101-0276

Location:

Job Number: 7393

Sample Number: T-1

Sample Description:

Boring Number: B09-SPT-05

Reddish brown, Sandy Clay

Depth:

Remarks:

Sample Type: Undisturbed

Test Number:

Test Date: 4-28-15

Index	Load Sequence (tsf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	1.0055	0.4837	0.00	0.9271	0.000	0.000	0.000	0.000
1	0.125	0.0074	0.9981	0.4763	0.74	0.9129	0.000	0.000	0.000	0.000
2	0.250	0.0165	0.9890	0.4672	1.64	0.8954	1.482	0.293	510.700	600.359
3	0.500	0.0317	0.9738	0.4521	3.15	0.8664	1.298	0.272	565.361	627.645
4	1.000	0.0522	0.9533	0.4316	5.19	0.8271	0.827	0.206	850.780	792.002
5	2.000	0.0778	0.9277	0.4059	7.74	0.7779	0.877	0.248	759.299	624.703
6	1.000	0.0750	0.9305	0.4087	7.46	0.7834	0.000	0.000	0.000	0.000
7	0.500	0.0730	0.9325	0.4107	7.26	0.7872	0.000	0.000	0.000	0.000
8	1.000	0.0747	0.9308	0.4090	7.43	0.7839	0.000	0.000	0.000	0.000
9	2.000	0.0790	0.9265	0.4047	7.86	0.7757	0.000	0.000	0.000	0.000
10	4.000	0.1075	0.8980	0.3762	10.69	0.7211	0.811	0.233	769.897	622.355
11	8.000	0.1417	0.8638	0.3420	14.09	0.6555	0.848	0.222	680.919	604.413
12	16.000	0.1779	0.8276	0.3058	17.70	0.5861	0.857	0.267	618.601	461.181
13	4.000	0.1674	0.8381	0.3164	16.65	0.6063	0.000	0.000	0.000	0.000
14	1.000	0.1557	0.8498	0.3280	15.48	0.6287	0.000	0.000	0.000	0.000
15	0.250	0.1285	0.8770	0.3552	12.78	0.6808	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: B. Hak

Checked By: C. Dugger

Consolidation Test

Consolidation Specimen Information

Project: SCDOT I-85/I-385 Interchange Modifications

Project Number: 4-1101-0276

Location:

Job Number: 7393

Test Date: 4-28-15

Sample Number: T-1

Sample Description:

Boring Number: B09-SPT-05

Reddish brown, Sandy Clay

Depth:

Remarks:

Sample Type: Undisturbed

Test Number:

Liquid Limit: 0.0000

Initial Void Ratio: 0.9300

Initial Height (in): 1.0055

Plastic Limit: 0.0000

Plasticity Index (%): 0.0000

Initial Diameter (in): 2.4860

Specific Gravity: 2.6850

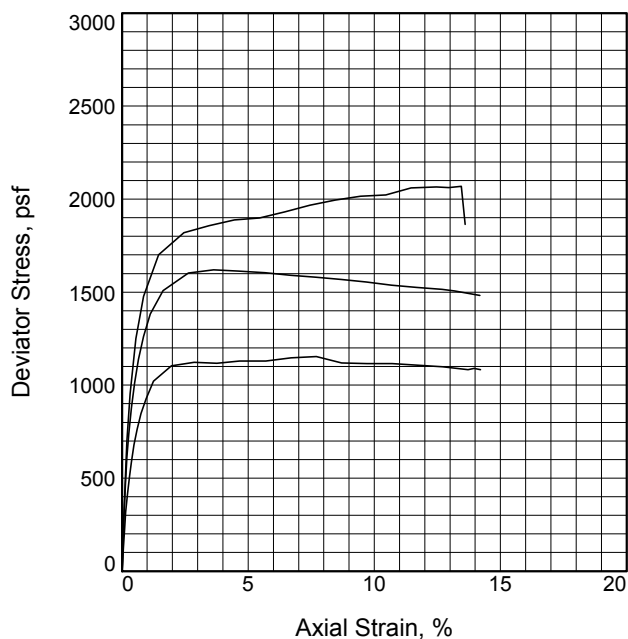
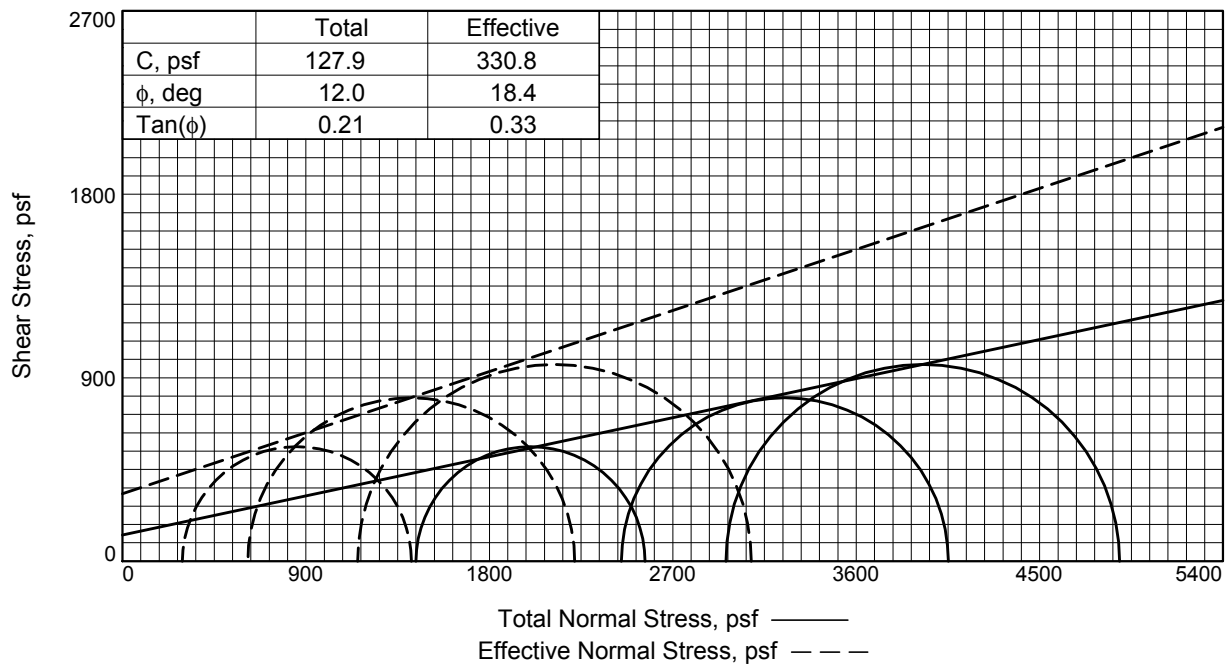
Weight of Ring (g): 111.1400

Assumed

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	125.69	266.52
Dry Soil + Container (g)	102.49	239.29
Weight of Container (g)	31.81	128.11
Moisture Content (%)	32.82	24.49
Void Ratio	0.9300	0.6833
Saturation (%)	94.70	96.46
Dry Density (pcf)	86.82	99.67

Tested By: B. Hak

Checked By: C. Dugger



Specimen No.		1	2	3
Initial	Water Content, %	97.1	105.6	109.3
	Dry Density, pcf	46.6	44.6	43.5
	Saturation, %	100.9	103.3	103.3
	Void Ratio	2.5607	2.7203	2.8141
	Diameter, in.	2.743	2.744	2.729
	Height, in.	5.570	5.550	5.540
At Test	Water Content, %	106.2	97.4	86.5
	Dry Density, pcf	46.6	44.6	43.5
	Saturation, %	110.3	95.3	81.8
	Void Ratio	2.5607	2.7203	2.8141
	Diameter, in.	2.743	2.744	2.729
	Height, in.	5.570	5.550	5.540
Strain at peak, %		2.9	5.7	6.5
Eff. Cell Pressure, psf		1440.0	2448.0	2960.6
Fail. Stress, psf		1123.4	1603.9	1931.2
Excess Pore Pr., psf		1146.0	1833.2	1806.6
Strain, %		2.9	5.7	6.5
Ult. Stress, psf		1123.4	1603.9	1931.2
Excess Pore Pr., psf		1146.0	1833.2	1806.6
Strain, %		2.9	5.7	6.5
$\bar{\sigma}_1$ Failure, psf		1417.4	2218.7	3085.2
$\bar{\sigma}_3$ Failure, psf		294.0	614.8	1154.1

Type of Test:

CU with Pore Pressures

Sample Type: 3-in. Shelby Tube

Description:

LL= NP

PI= NP

Assumed Specific Gravity= 2.66

Remarks:

Figure _____

Client: CECS

Project: SCDOT I-85 & I-385 Interchange Modification

Source of Sample: B-11 SPT 02

Depth: 9.5

Sample Number: T-1

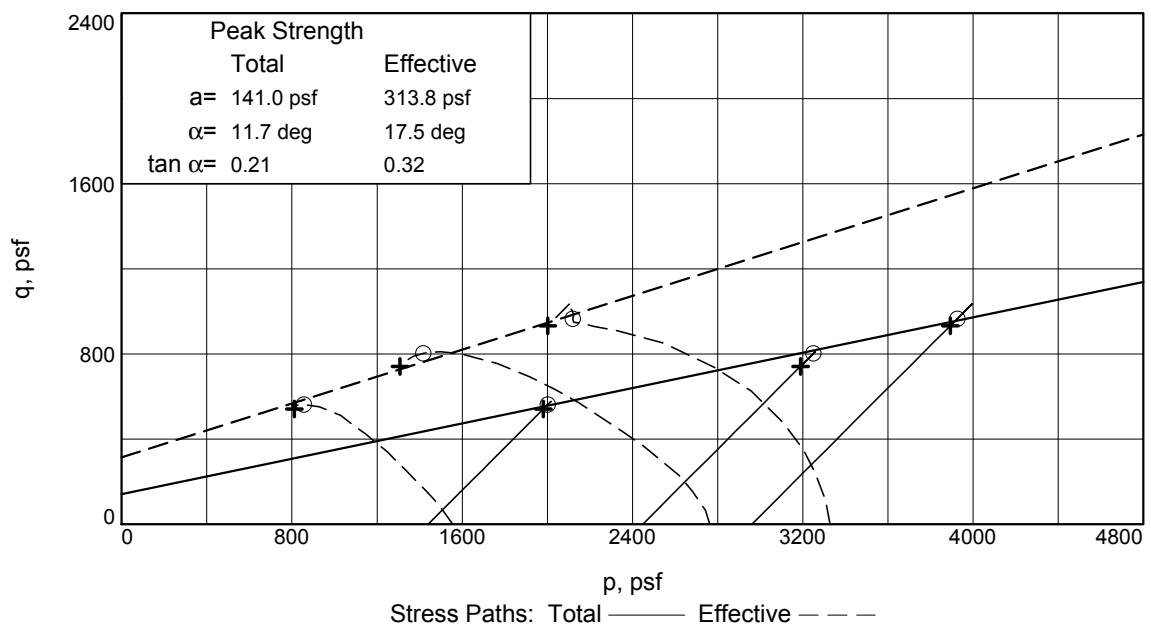
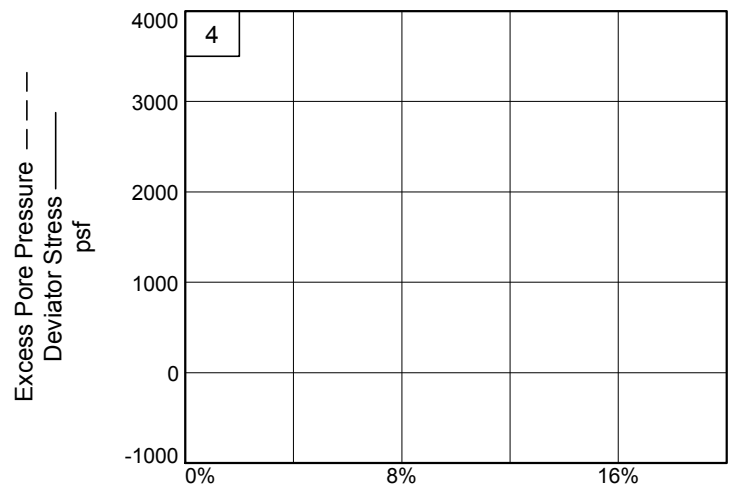
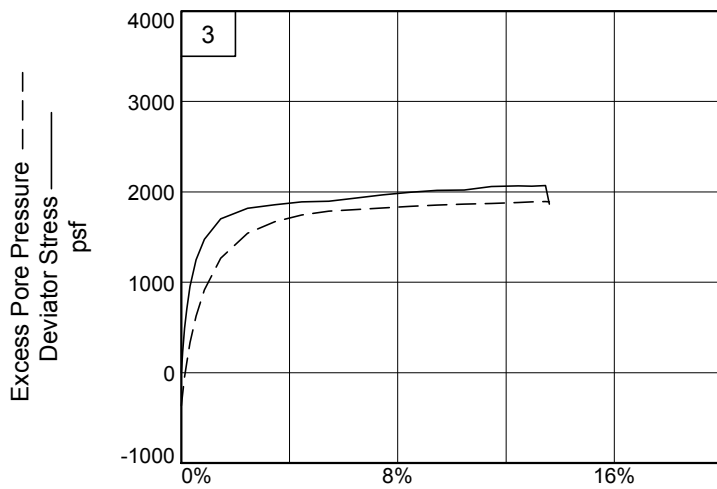
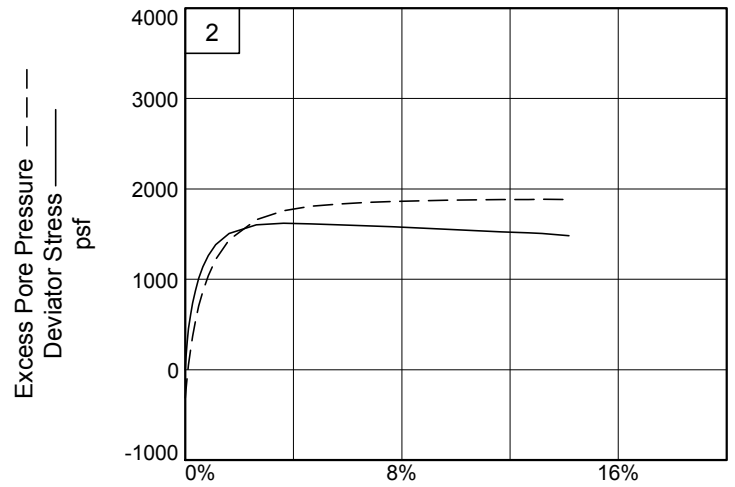
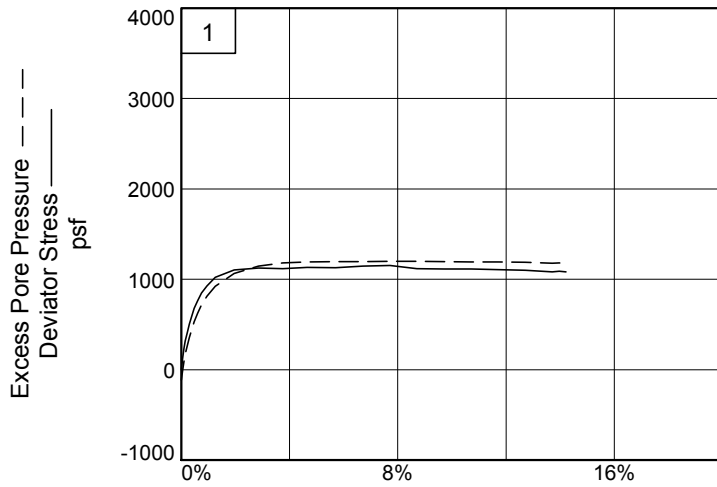
Proj. No.: 1411010276

Date Sampled: 12/04/14

TRIAXIAL SHEAR TEST REPORT

Thompson Engineering

Mobile, Alabama



Client: CECS

Project: SCDOT I-85 & I-385 Interchange Modification

Source of Sample: B-11 SPT 02

Depth: 9.5

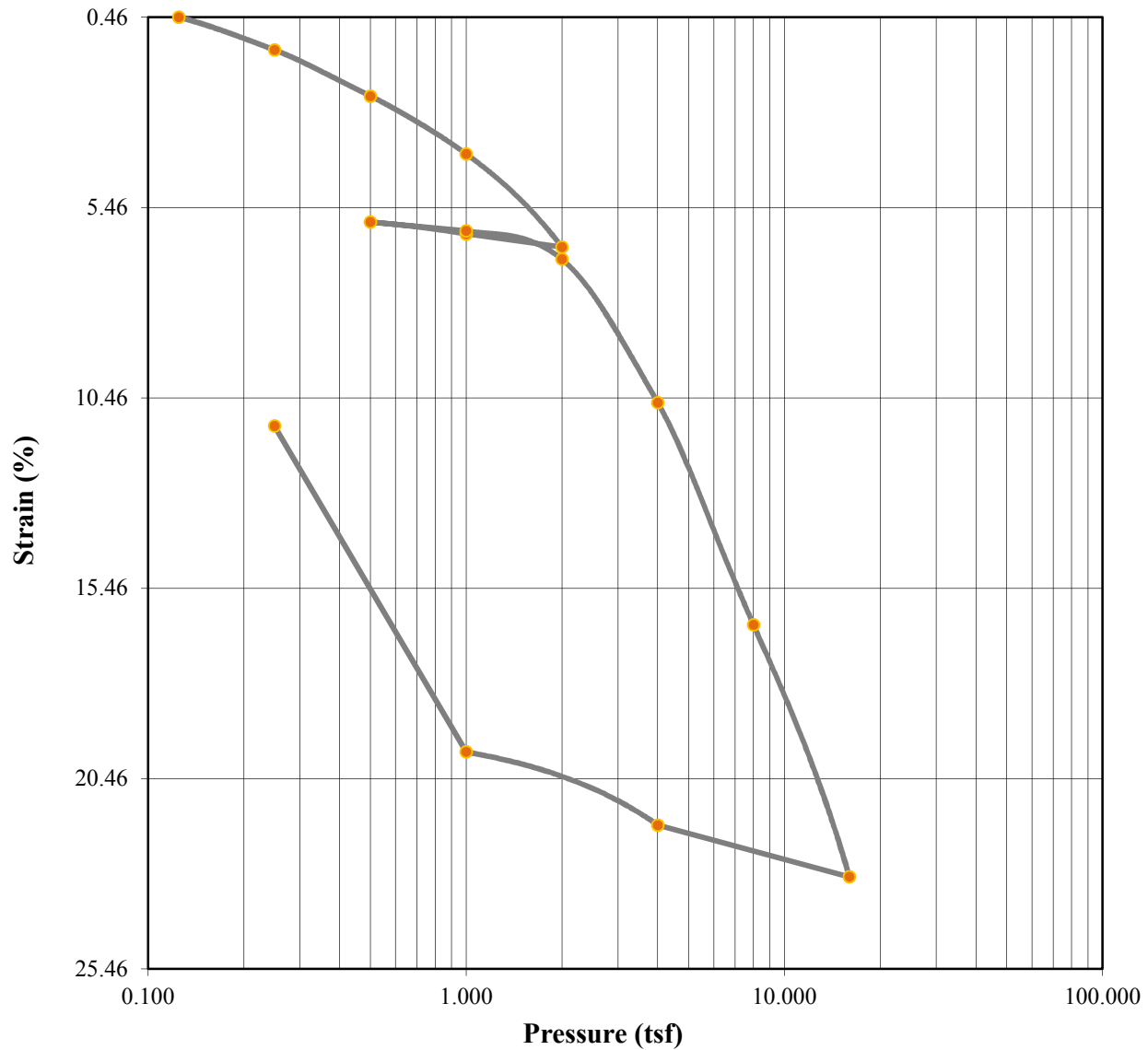
Sample Number: T-1

Project No.: 1411010276

Figure _____

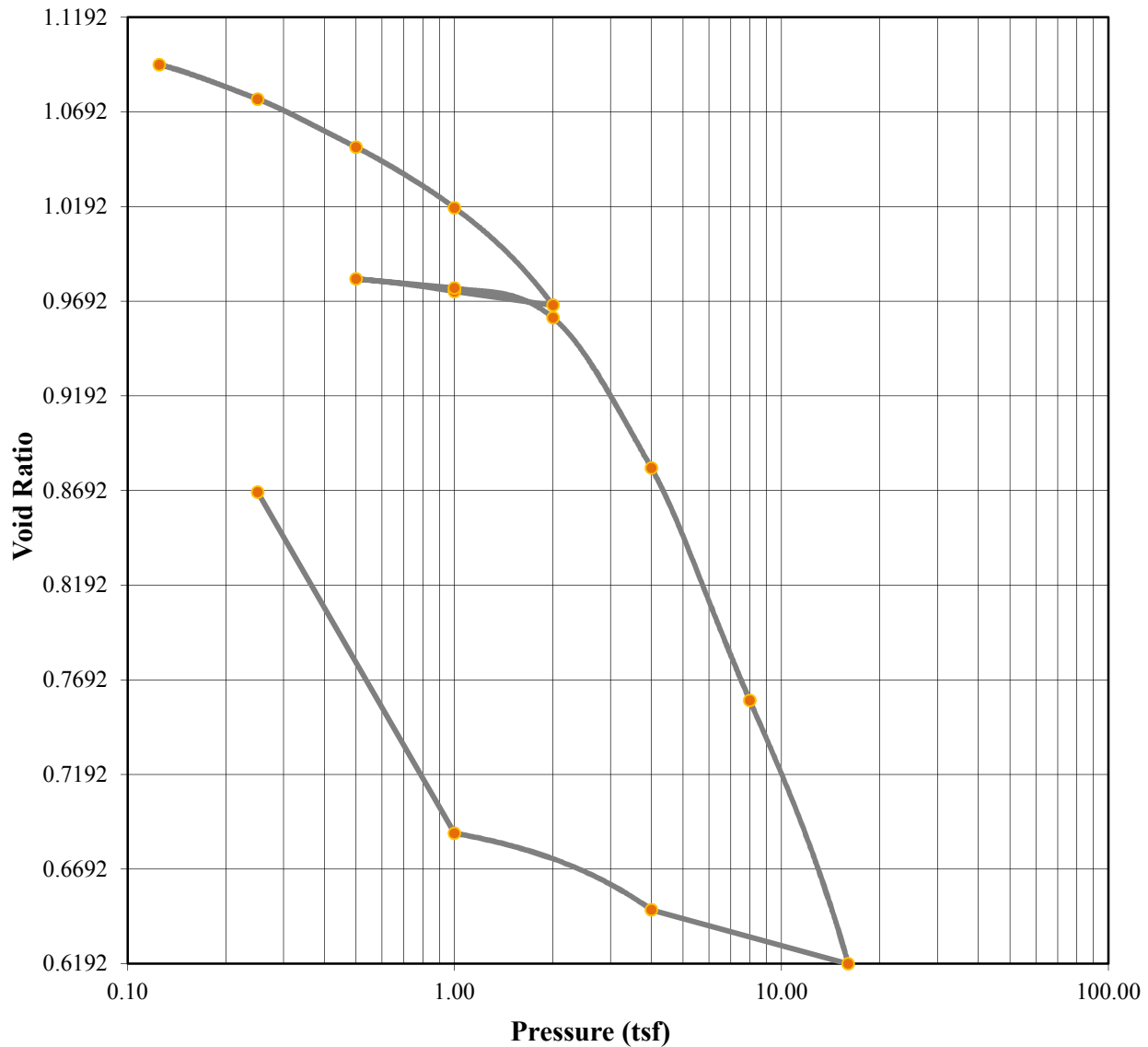
Thompson Engineering

Consolidation Test Test Results



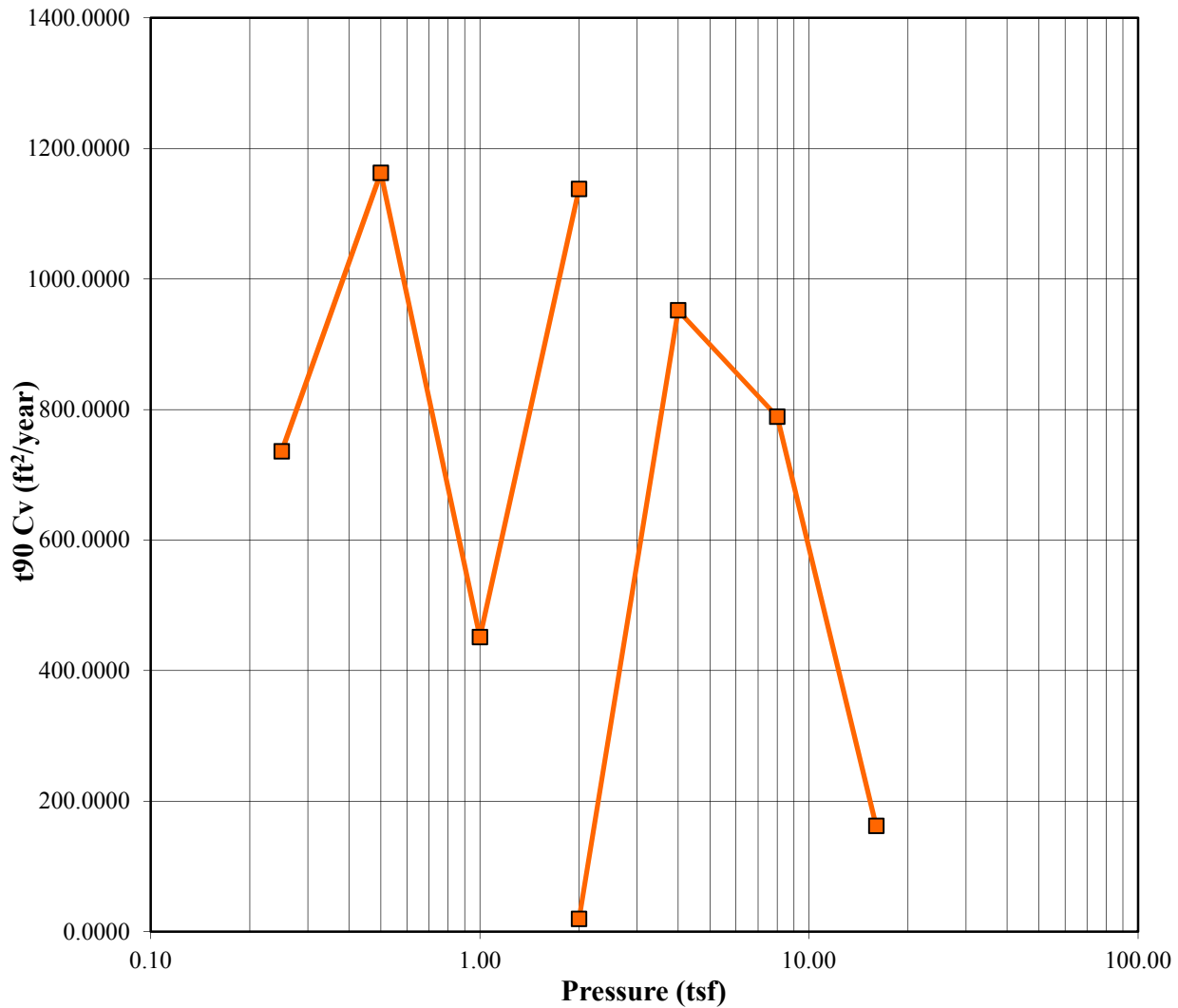
	Before	After	Liquid Limits:	0	Test Date:	3-27-15
Moisture (%):	40.85	33.94	Plastic Limits:	0		
Dry Density (pcf):	75.92	85.75	Plasticity Index (%):	0		
Saturation (%):	94.52	100.45				
Void Ratio:	1.1026	0.8672	Specific Gravity:	2.563	Measured	
Sample Description: Redish- Brown silty clay						
Project Number:		7352	Depth: 10-12 ft		Remarks:	
Sample Number:		T-1	Boring Number: R2B-42			
Project: I-85/I-385 Interchange Modifications						
Client: CECS						
Location: Soils Lab						

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	3-27-15
Moisture (%):	40.85	33.94	Plastic Limits:	0		
Dry Density (pcf):	75.92	85.75	Plasticity Index (%):	0		
Saturation (%):	94.52	100.45				
Void Ratio:	1.1026	0.8672	Specific Gravity:	2.563	Measured	
Soil Description:	Redish- Brown silty clay					
Project Number:	7352	Depth:		10-12 ft	Remarks:	
Sample Number:	T-1	Boring Number:		R2B-42		
Project:	I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

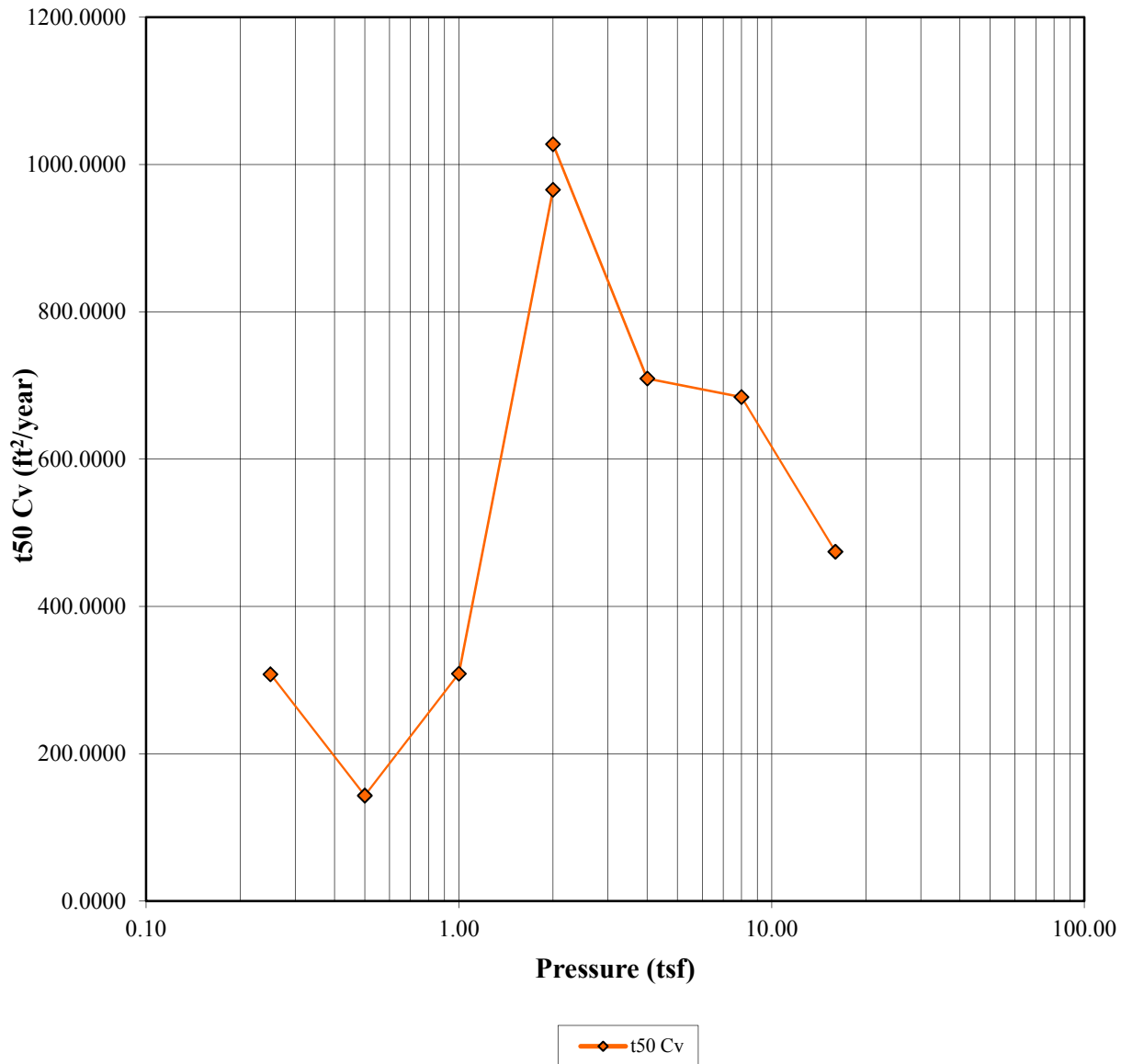
Consolidation Test Test Results



— t90 Cv

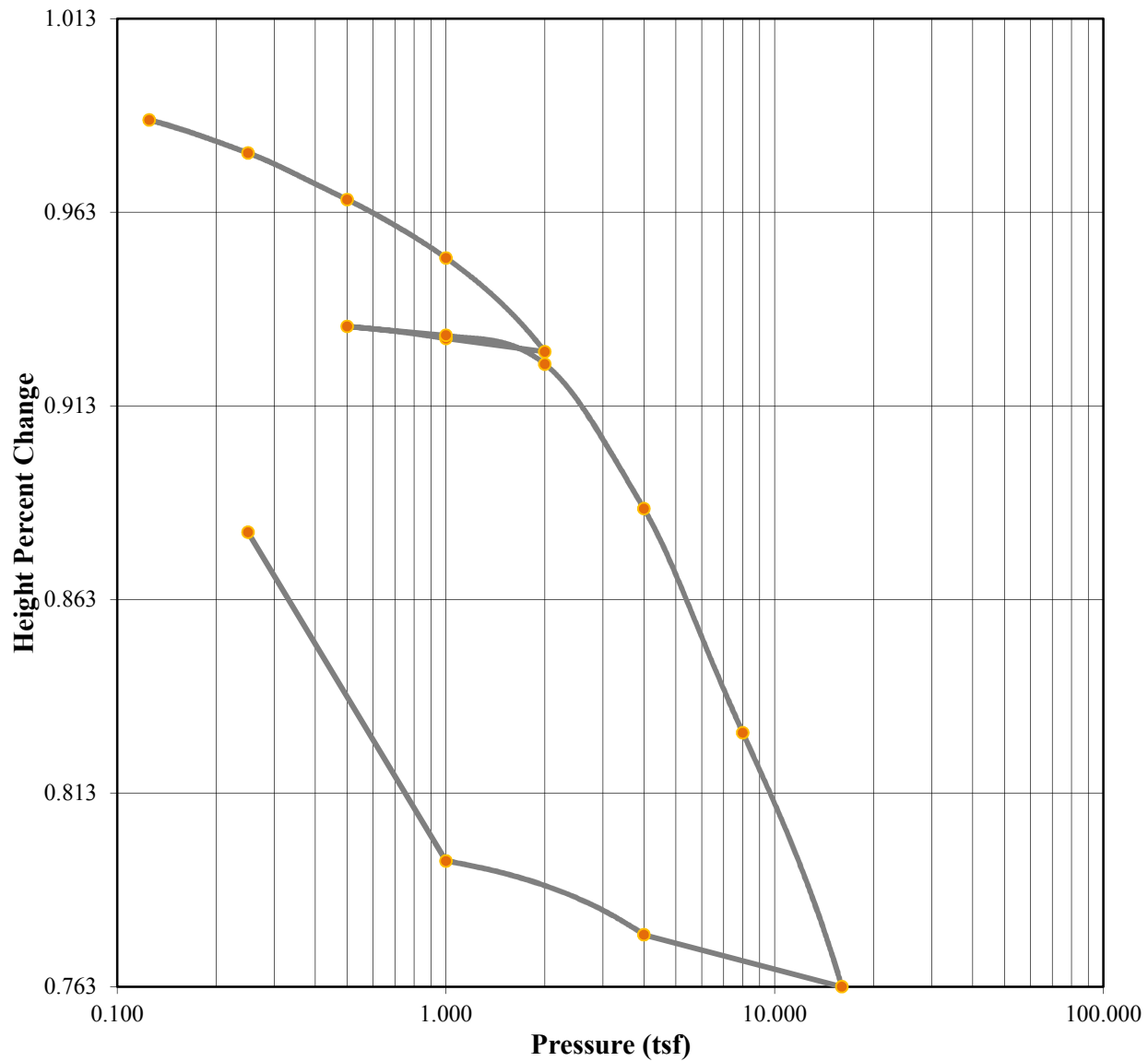
	Before	After	Liquid Limits:	0	Test Date:	3-27-15
Moisture (%):	40.85	33.94	Plastic Limits:	0		
Dry Density (pcf):	75.92	85.75	Plasticity Index (%):	0		
Saturation (%):	94.52	100.45				
Void Ratio:	1.1026	0.8672	Specific Gravity:	2.563	Measured	
Soil Description:	Redish- Brown silty clay					
Project Number:	7352	Depth: 10-12 ft		Remarks:		
Sample Number:	T-1	Boring Number: R2B-42				
Project:	I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	3-27-15
Moisture (%):	40.85	33.94	Plastic Limits:	0		
Dry Density (pcf):	75.92	85.75	Plasticity Index (%):	0		
Saturation (%):	94.52	100.45				
Void Ratio:	1.1026	0.8672	Specific Gravity:	2.563	Measured	
Soil Description:	Redish- Brown silty clay					
Project Number:	7352	Depth: 10-12 ft		Remarks:		
Sample Number:	T-1	Boring Number: R2B-42				
Project:	I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	3-27-15
Moisture (%):	40.85	33.94	Plastic Limits:	0		
Dry Density (pcf):	75.92	85.75	Plasticity Index (%):	0		
Saturation (%):	94.52	100.45				
Void Ratio:	1.1026	0.8672	Specific Gravity:	2.563	Measured	
Soil Description:	Redish- Brown silty clay					
Project Number:	7352	Depth: 10-12 ft			Remarks:	
Sample Number:	T-1	Boring Number: R2B-42				
Project:	I-85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Results

Summary

Project: I-85/I-385 Interchange Modifications
Location: Soils Lab
Job Number: 14-1101-0276

Project Number: 7352

Sample Number: T-1
Boring Number: R2B-42
Depth: 10-12 ft
Sample Type: Undisturbed

Sample Description:
 Redish- Brown silty clay
Remarks:

Test Number:
Test Date: 3-27-15

Index	Load Sequence (tsf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	0.9915	0.5202	0.00	1.1039	0.000	0.000	0.000	0.000
1	0.125	0.0046	0.9869	0.5157	0.46	1.0942	0.000	0.000	0.000	0.000
2	0.250	0.0131	0.9784	0.5071	1.32	1.0760	1.006	* 0.5591	736.040	307.771
3	0.500	0.0251	0.9664	0.4951	2.53	1.0506	0.622	1.172	1162.714	143.296
4	1.000	0.0402	0.9513	0.4800	4.05	1.0186	1.552	0.527	451.338	308.953
5	2.000	0.0644	0.9271	0.4558	6.50	0.9671	0.584	0.160	1137.961	965.892
6	1.000	0.0610	0.9305	0.4592	6.15	0.9744	0.000	0.000	0.000	0.000
7	0.500	0.0579	0.9336	0.4623	5.84	0.9810	0.000	0.000	0.000	0.000
8	1.000	0.0602	0.9313	0.4601	6.07	0.9762	0.000	0.000	0.000	0.000
9	2.000	0.0676	0.9239	0.4526	6.82	0.9605	34.368	0.149	19.219	1027.587
10	4.000	0.1049	0.8866	0.4153	10.58	0.8812	0.639	0.199	951.872	709.340
11	8.000	0.1628	0.8287	0.3574	16.42	0.7584	0.674	0.180	788.929	684.406
12	16.000	0.2284	0.7631	0.2918	23.04	0.6192	2.773	0.221	162.501	474.365
13	4.000	0.2150	0.7765	0.3052	21.68	0.6477	0.000	0.000	0.000	0.000
14	1.000	0.1959	0.7956	0.3243	19.76	0.6882	0.000	0.000	0.000	0.000
15	0.250	0.1110	0.8805	0.4092	11.20	0.8683	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: B. Hak

Checked By: C. Dugger

Consolidation Test

Consolidation Specimen Information

Project: I-85/I-385 Interchange Modifications

Project Number: 7352

Location: Soils Lab

Job Number: 14-1101-0276

Test Date: 3-27-15

Sample Number: T-1

Sample Description:

Boring Number: R2B-42

Redish- Brown silty clay

Depth: 10-12 ft

Remarks:

Sample Type: Undisturbed

Test Number:

Liquid Limit: 0.0000

Initial Void Ratio: 1.1026

Initial Height (in): 0.9915

Plastic Limit: 0.0000

Plasticity Index (%): 0.0000

Initial Diameter (in): 2.4950

Specific Gravity: 2.5630

Weight of Ring (g): 110.7900

Measured

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	78.42	261.57
Dry Soil + Container (g)	65.02	228.78
Weight of Container (g)	32.22	132.16
Moisture Content (%)	40.85	33.94
Void Ratio	1.1026	0.8672
Saturation (%)	94.52	100.45
Dry Density (pcf)	75.92	85.75

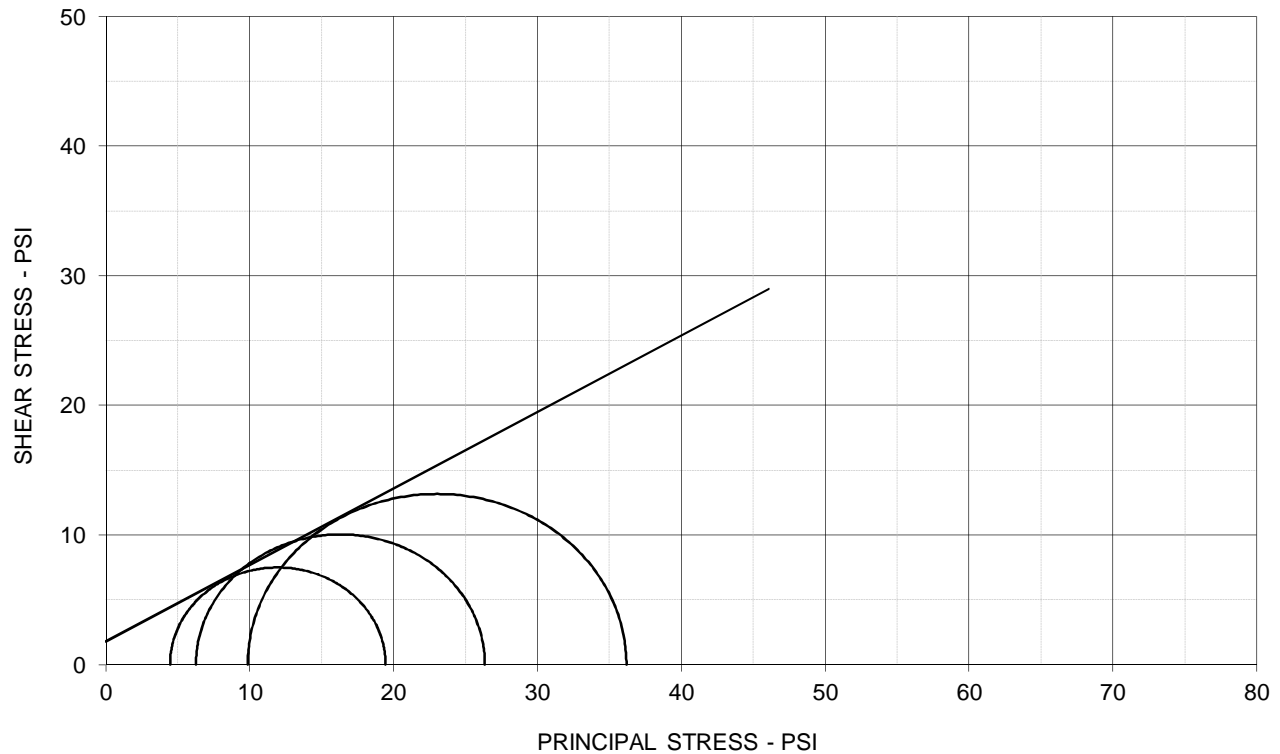
Tested By: B. Hak

Checked By: C. Dugger

TRIAXIAL SHEAR TEST REPORT



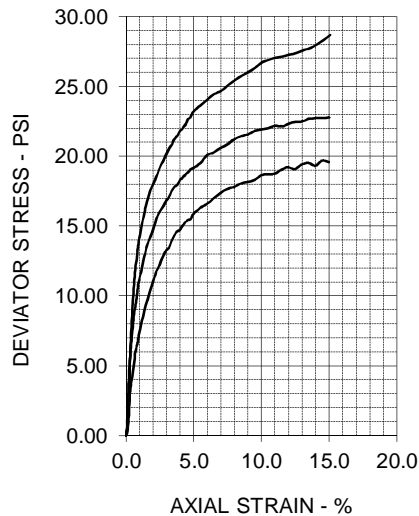
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 30.5 \text{ deg}$

$c' = 1.8 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	27.2	27.2	27.2
Dry Density - pcf	90.3	90.3	90.3
Diameter - inches	2.00	2.00	2.00
Height - inches	4.00	4.00	4.00

AT TEST

Final Moisture - %	31.4	30.7	30.6
Dry Density - pcf	90.3	90.8	91.5
Calculated Diameter (in.)	1.97	1.97	1.99
Height - inches	3.93	3.92	3.96
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	14.98	20.08	26.32
Total Pore Pressure - psi	50.5	53.7	60.1
Strain Rate - inches/min.	0.00040	0.00040	0.00040
Failure Strain - %	4.2	6.0	9.5
σ_1' Failure - psi	19.45	26.35	36.19
σ_3' Failure - psi	4.47	6.27	9.87

TEST DESCRIPTION

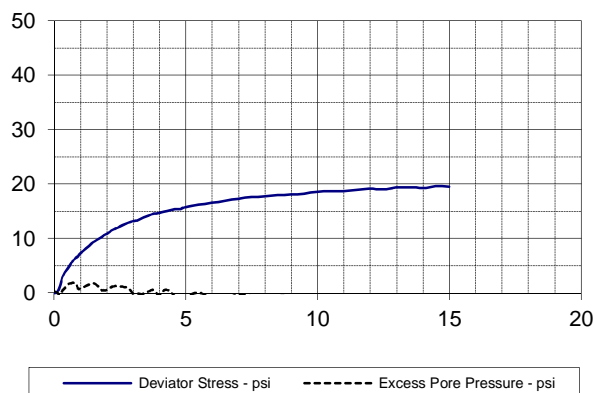
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Remolded
 DESCRIPTION: Silty Sand (SM)
 SAMPLE LOCATION: RRM-47 25-27 ft.
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 49 PL: 46 PI: 3 Percent -200: 21.5
 REMARKS: Specimens Remolded

PROJECT INFORMATION

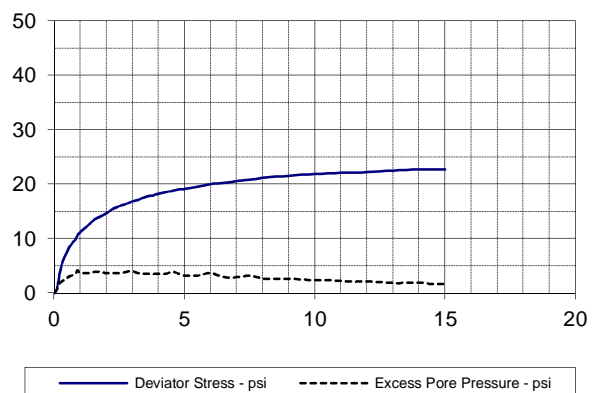
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 4/3/15

TERRACON

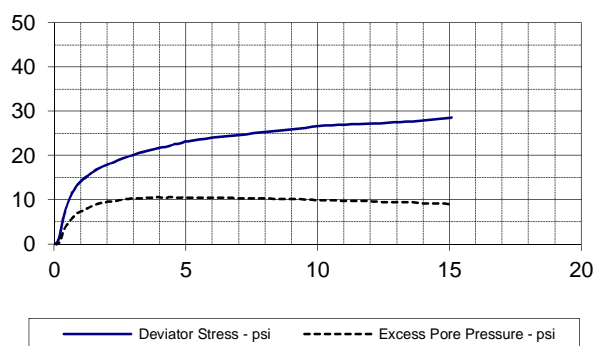
SPECIMEN NO. 1



SPECIMEN NO. 2



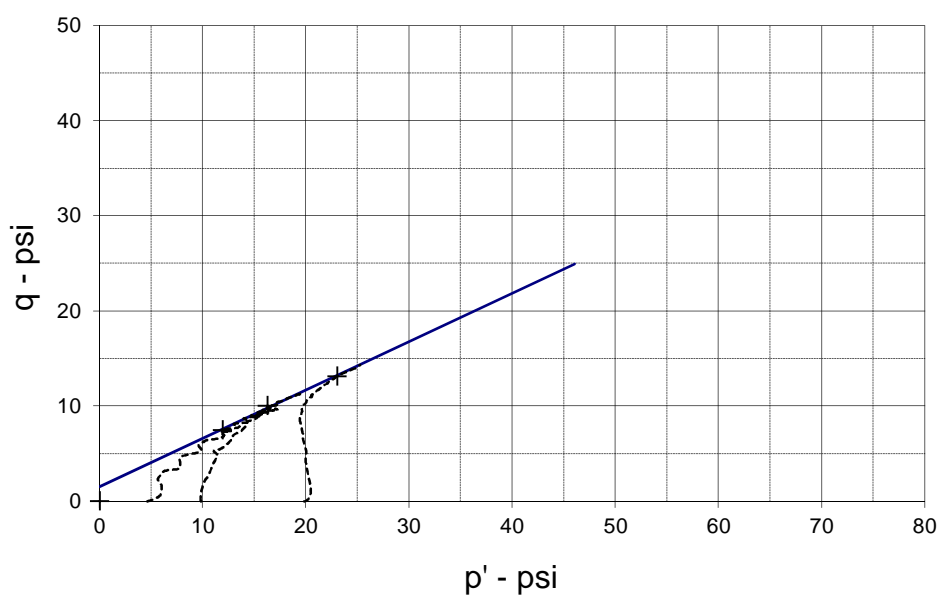
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 26.9

a (psi) = 1.5

PROJECT: I-85/I-385 Interchange Modifications

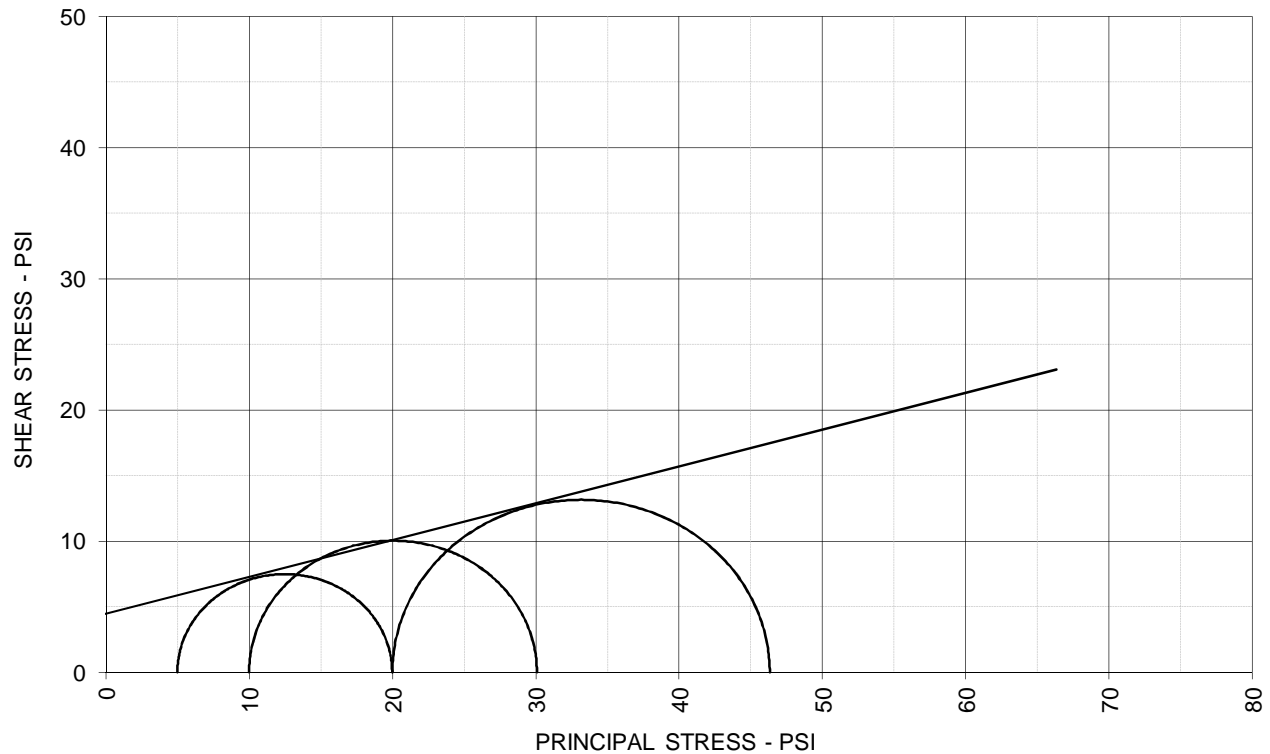
TYPE OF TEST & NO: CU with Pore Pressure

PROJECT NO: E2156301

DESCRIPTION: Silty Sand (SM)

TERRACON

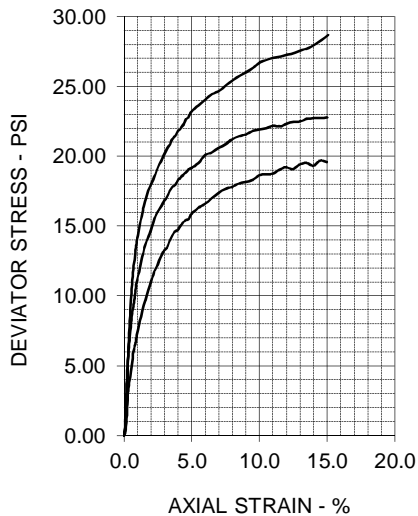
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

$\phi = 15.7 \text{ deg}$

$c = 4.5 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	27.2	27.2	27.2
Dry Density - pcf	90.3	90.3	90.3
Diameter - inches	2.00	2.00	2.00
Height - inches	4.00	4.00	4.00

AT TEST

Final Moisture - %	31.4	30.7	30.6
Dry Density - pcf	90.3	90.8	91.5
Calculated Diameter (in.)	1.97	1.97	1.99
Height - inches	3.93	3.92	3.96
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	14.98	20.08	26.32
Total Pore Pressure - psi	50.5	53.7	60.1
Strain Rate - inches/min.	0.00040	0.00040	0.00040
Failure Strain - %	4.2	6.0	9.5
σ_1 Failure - psi	19.98	30.08	46.32
σ_3 Failure - psi	5.00	10.00	20.00

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Remolded
 DESCRIPTION: Silty Sand (SM)
 SAMPLE LOCATION: RRM-47 25-27 ft.
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 49 PL: 46 PI: 3 Percent -200: 21.5
 REMARKS: Specimens Remolded

PROJECT INFORMATION

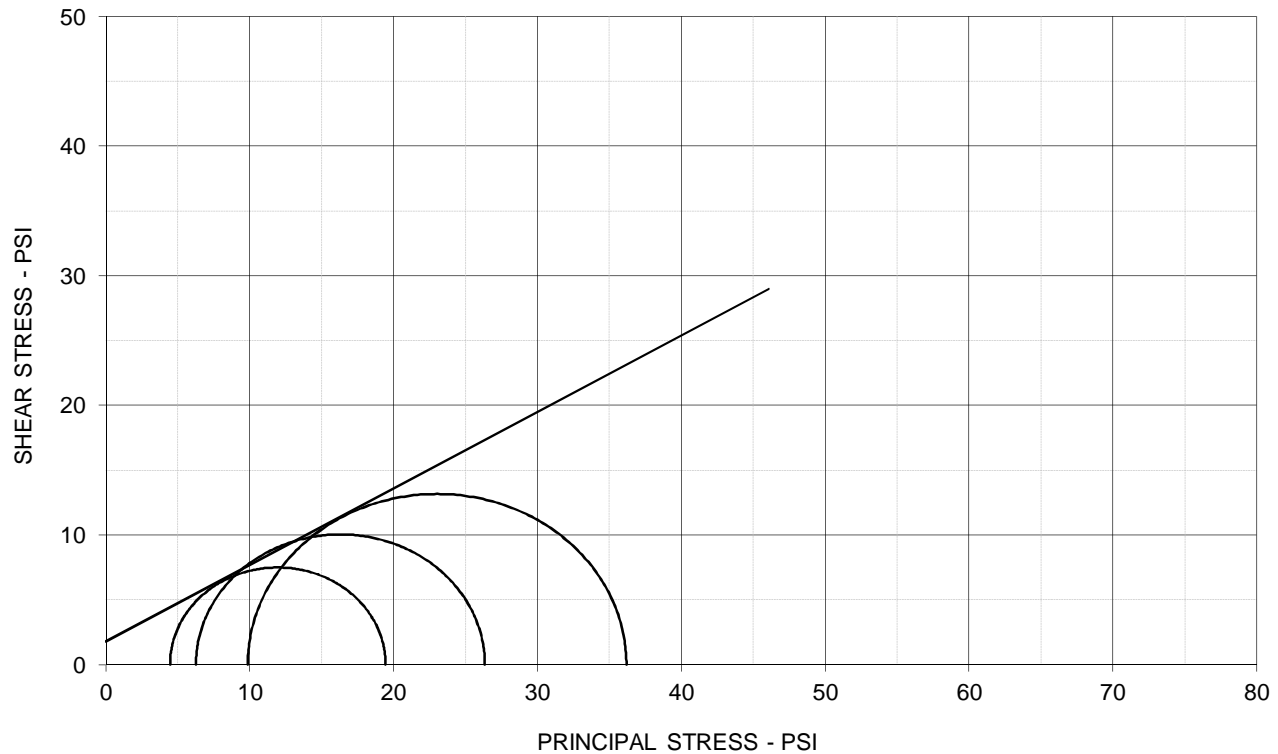
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 4/3/15

TERRACON

TRIAXIAL SHEAR TEST REPORT



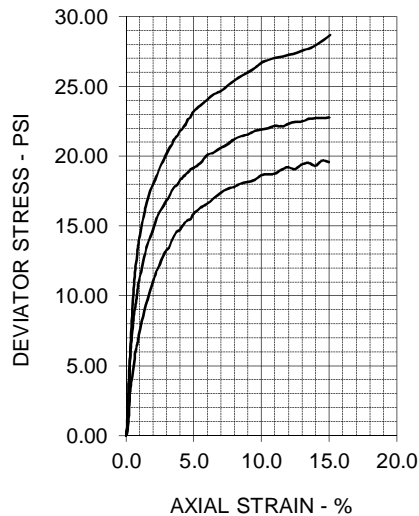
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 30.5 \text{ deg}$

$c' = 1.8 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	27.2	27.2	27.2
Dry Density - pcf	90.3	90.3	90.3
Diameter - inches	2.00	2.00	2.00
Height - inches	4.00	4.00	4.00

AT TEST

Final Moisture - %	31.4	30.7	30.6
Dry Density - pcf	90.3	90.8	91.5
Calculated Diameter (in.)	1.97	1.97	1.99
Height - inches	3.93	3.92	3.96
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	14.98	20.08	26.32
Total Pore Pressure - psi	50.5	53.7	60.1
Strain Rate - inches/min.	0.00040	0.00040	0.00040
Failure Strain - %	4.2	6.0	9.5
σ_1' Failure - psi	19.45	26.35	36.19
σ_3' Failure - psi	4.47	6.27	9.87

TEST DESCRIPTION

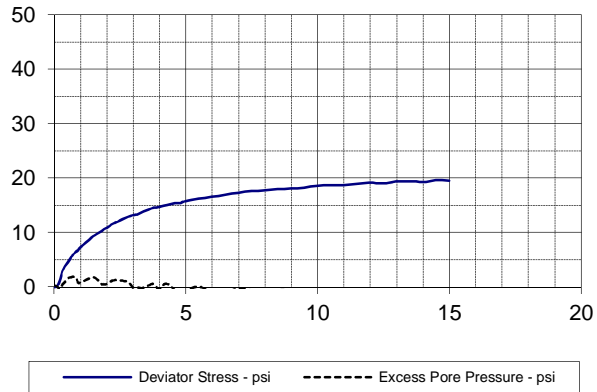
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Remolded
 DESCRIPTION: Silty Sand (SM)
 SAMPLE LOCATION: RRM-47 25-27 ft.
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 49 PL: 46 PI: 3 Percent -200: 21.5
 REMARKS: Specimens Remolded

PROJECT INFORMATION

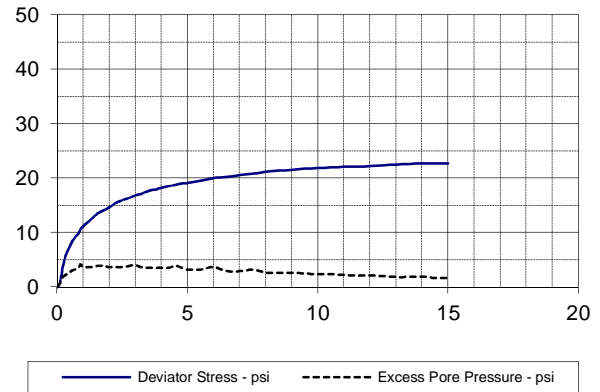
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 4/3/15

TERRACON

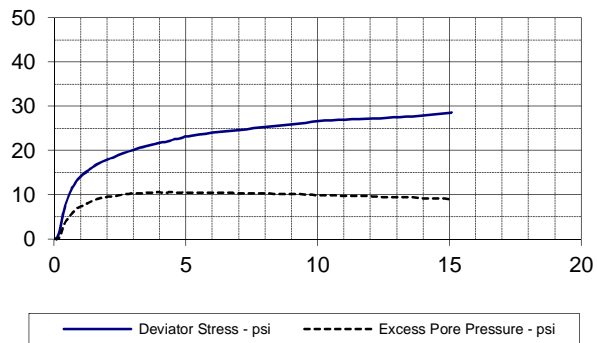
SPECIMEN NO. 1



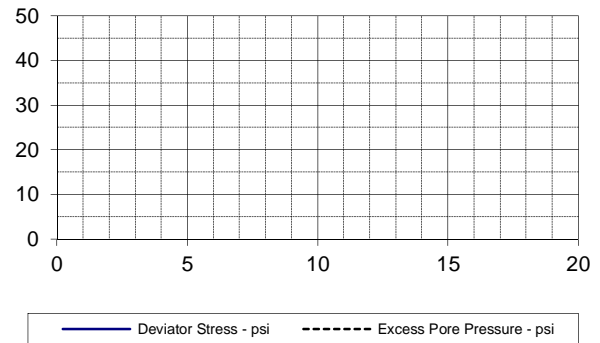
SPECIMEN NO. 2



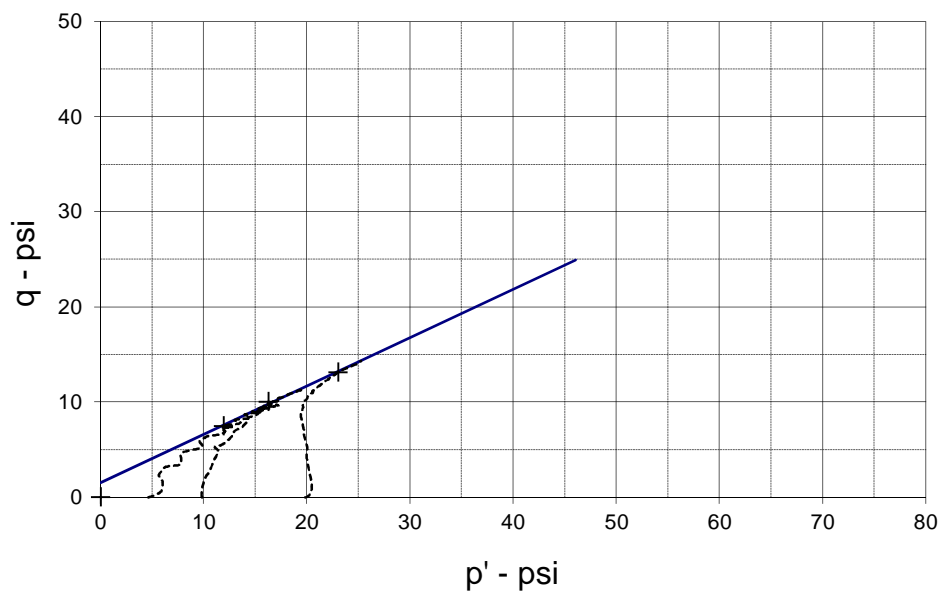
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 26.9

a (psi) = 1.5

PROJECT: I-85/I-385 Interchange Modifications

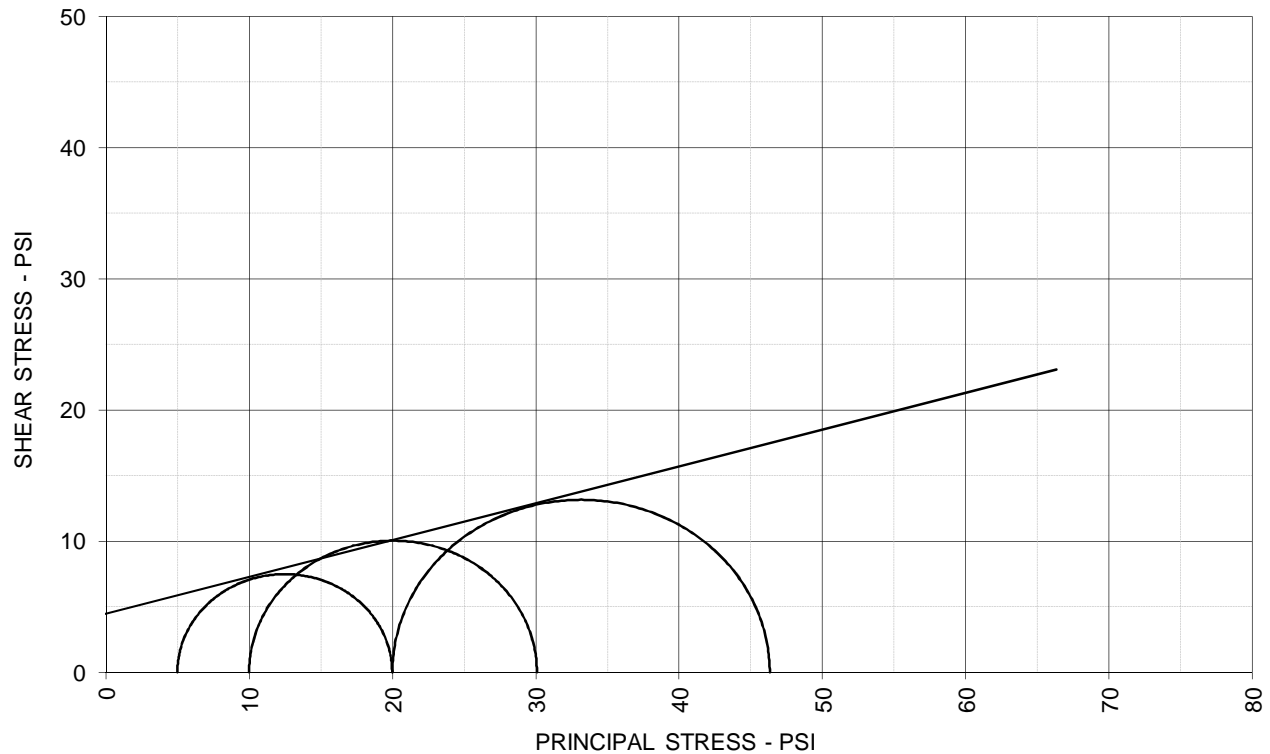
TYPE OF TEST & NO: CU with Pore Pressure

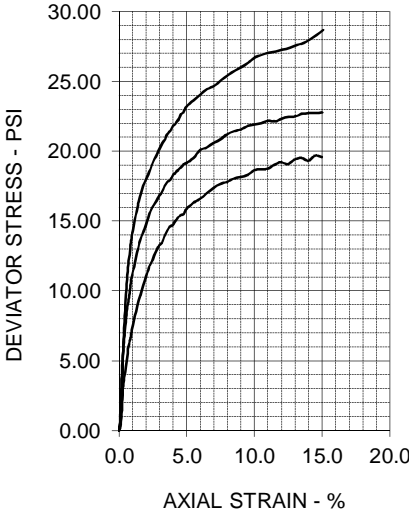
PROJECT NO: E2156301

DESCRIPTION: Silty Sand (SM)

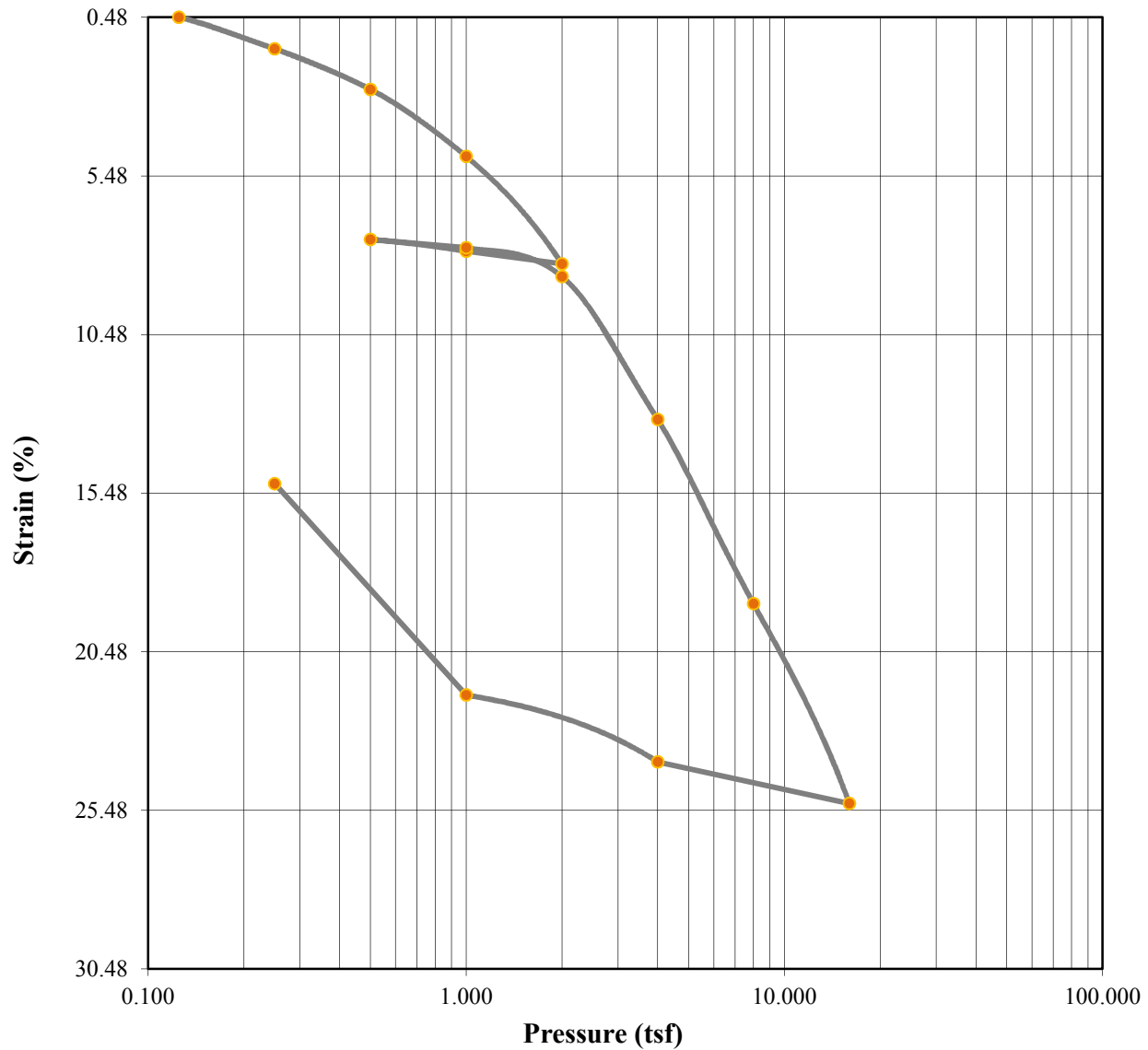
TERRACON

TRIAXIAL SHEAR TEST REPORT



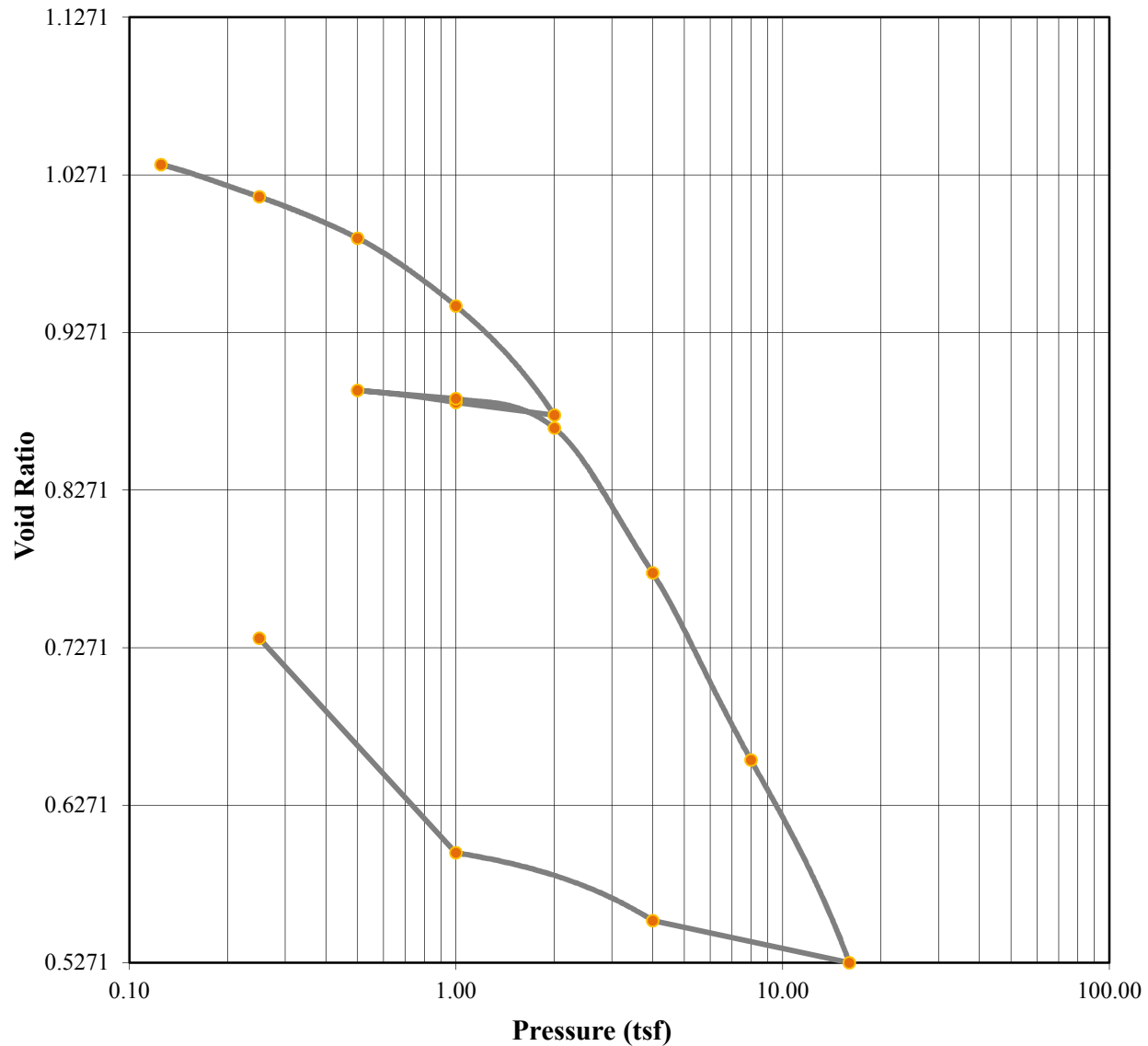
TOTAL STRESS PARAMETERS		ϕ = 15.7 deg		c = 4.5 psi	
	SPECIMEN NO.	1	2	3	4
	INITIAL				
	Moisture Content - %	27.2	27.2	27.2	
	Dry Density - pcf	90.3	90.3	90.3	
	Diameter - inches	2.00	2.00	2.00	
	Height - inches	4.00	4.00	4.00	
	AT TEST				
	Final Moisture - %	31.4	30.7	30.6	
	Dry Density - pcf	90.3	90.8	91.5	
	Calculated Diameter (in.)	1.97	1.97	1.99	
	Height - inches	3.93	3.92	3.96	
	Effect. Cell Pressure - psi	5.0	10.0	20.0	
	Failure Stress - psi	14.98	20.08	26.32	
Total Pore Pressure - psi	50.5	53.7	60.1		
Strain Rate - inches/min.	0.00040	0.00040	0.00040		
Failure Strain - %	4.2	6.0	9.5		
σ_1 Failure - psi	19.98	30.08	46.32		
σ_3 Failure - psi	5.00	10.00	20.00		
TEST DESCRIPTION		PROJECT INFORMATION			
TYPE OF TEST & NO: CU with Pore Pressure		PROJECT: I-85/I-385 Interchange Modifications			
SAMPLE TYPE: Remolded		LOCATION: I-85/I-385 Interchange			
DESCRIPTION: Silty Sand (SM)		PROJECT NO: E2156301			
SAMPLE LOCATION: RRM-47 25-27 ft.		CLIENT: Thompson Engineering			
ASSUMED SPECIFIC GRAVITY: 2.7		DATE: 4/3/15			
LL: 49 PL: 46 PI: 3 Percent -200: 21.5		TERRACON			
REMARKS: Specimens Remolded					

Consolidation Test Test Results



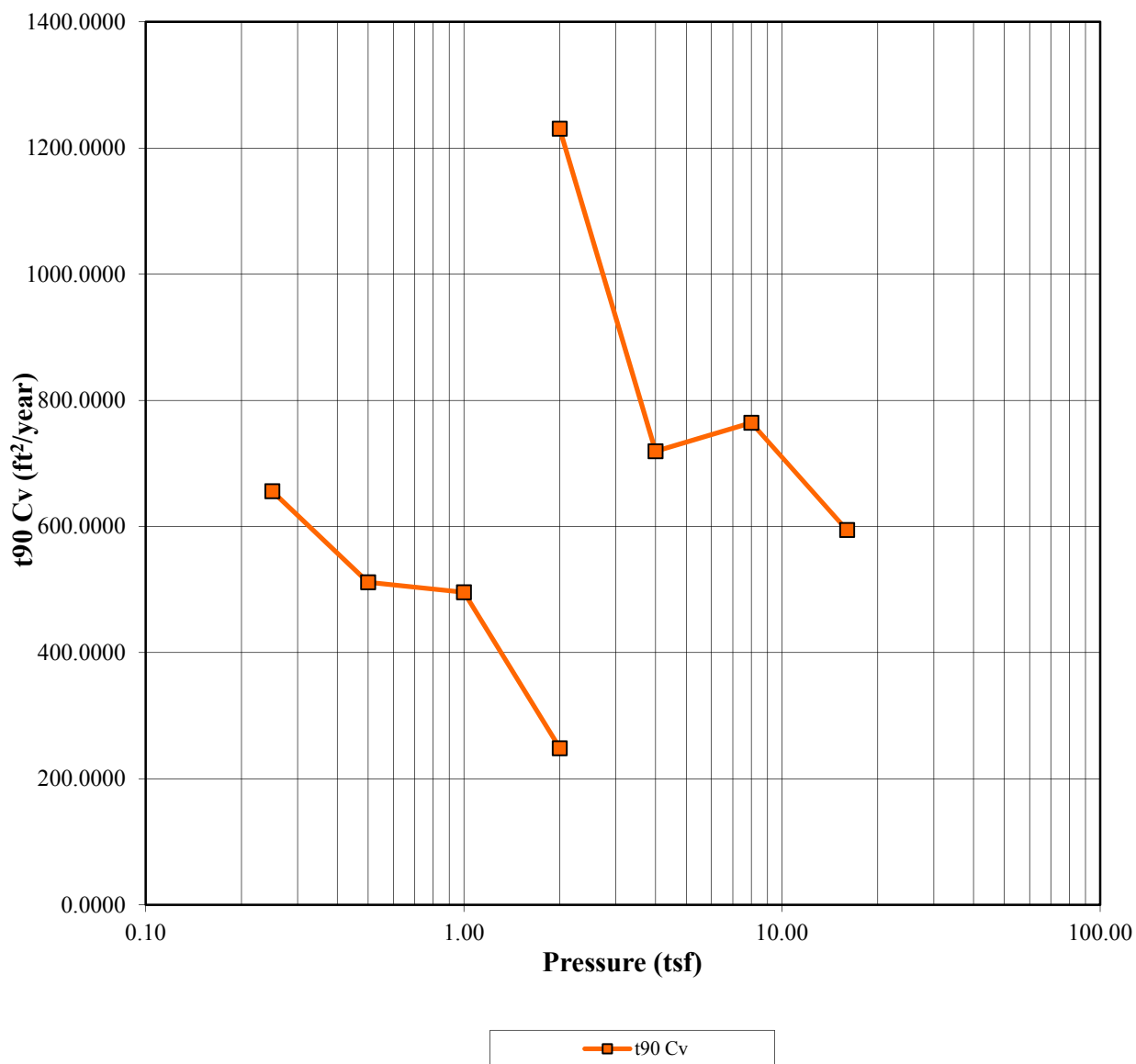
	Before	After	Liquid Limits:	0	Test Date:	3-24-15
Moisture (%):	39.65	32.71	Plastic Limits:	0		
Dry Density (pcf):	76.58	89.79	Plasticity Index (%):	0		
Saturation (%):	95.09	110.14				
Void Ratio:	1.0438	0.7335	Specific Gravity:	2.511	Measured	
Sample Description: Yellowish brown, sandy silt with mica						
Project Number:	7352	Depth: 25.0-27.0 ft		Remarks:		
Sample Number:	T-2	Boring Number: W85-2L-03				
Project:	I85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Test Results



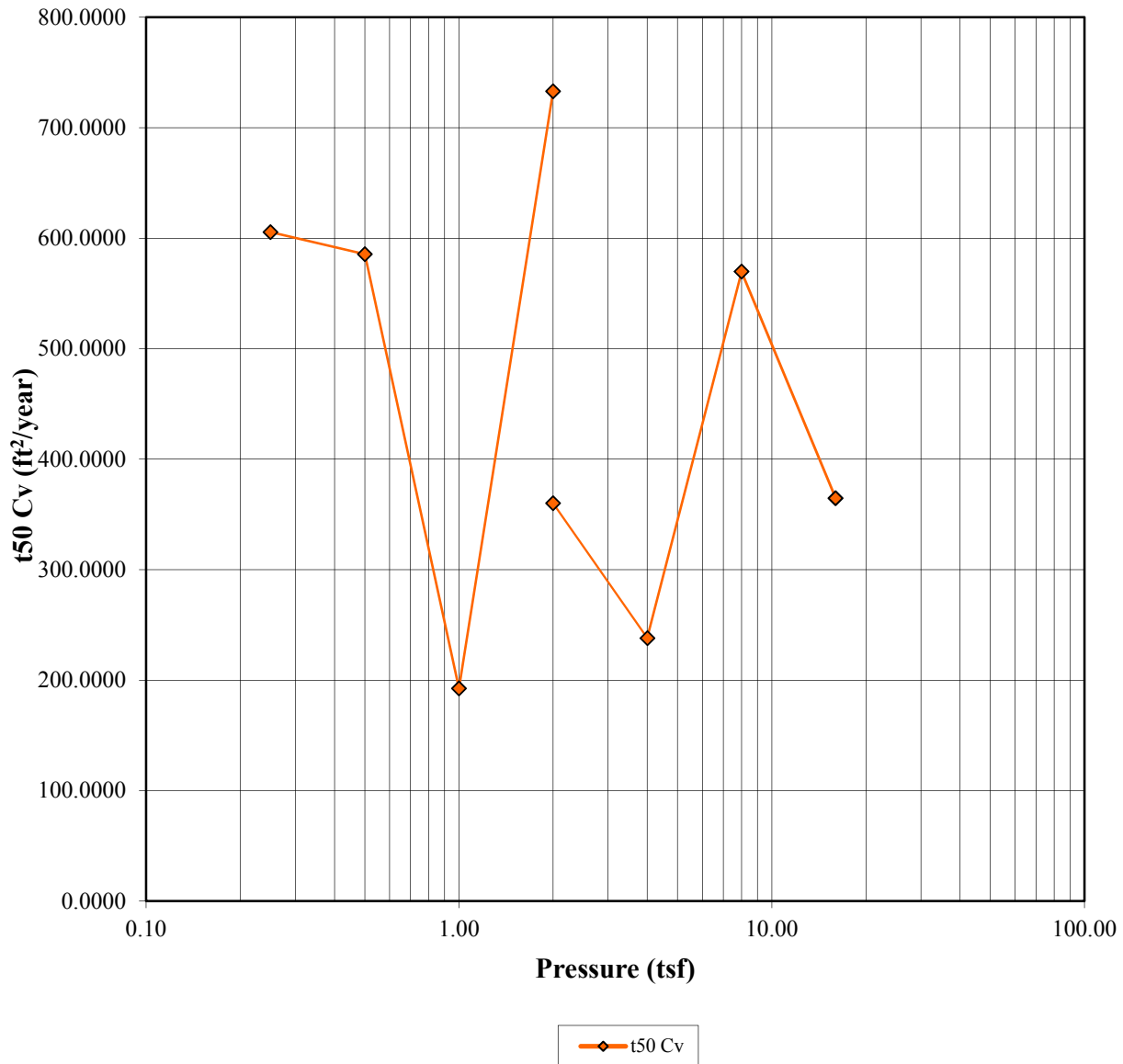
	Before	After	Liquid Limits:	0	Test Date:	3-24-15	
Moisture (%):	39.65	32.71	Plastic Limits:	0			
Dry Density (pcf):	76.58	89.79	Plasticity Index (%):	0			
Saturation (%):	95.09	110.14					
Void Ratio:	1.0438	0.7335	Specific Gravity:	2.511	Measured		
Soil Description:	Yellowish brown, sandy silt with mica						
Project Number:	7352	Depth: 25.0-27.0 ft		Remarks:			
Sample Number:	T-2	Boring Number: W85-2L-03					
Project:	I85/I-385 Interchange Modifications						
Client:	CECS						
Location:	Soils Lab						

Consolidation Test Test Results



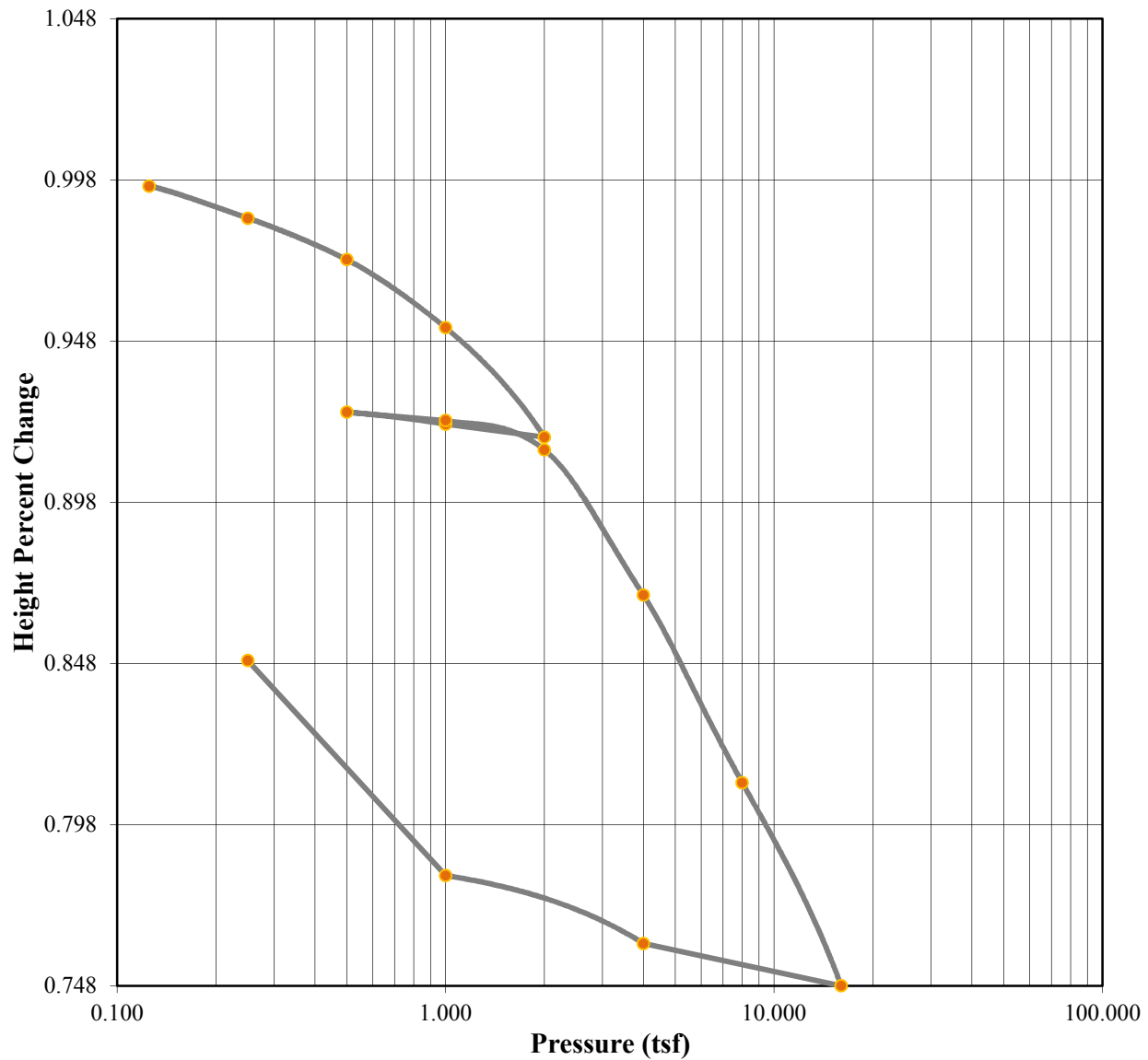
	Before	After	Liquid Limits:	0	Test Date:	3-24-15
Moisture (%):	39.65	32.71	Plastic Limits:	0		
Dry Density (pcf):	76.58	89.79	Plasticity Index (%):	0		
Saturation (%):	95.09	110.14				
Void Ratio:	1.0438	0.7335	Specific Gravity:	2.511	Measured	
Soil Description:	Yellowish brown, sandy silt with mica					
Project Number:	7352	Depth: 25.0-27.0 ft		Remarks:		
Sample Number:	T-2	Boring Number: W85-2L-03				
Project:	I85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	3-24-15
Moisture (%):	39.65	32.71	Plastic Limits:	0		
Dry Density (pcf):	76.58	89.79	Plasticity Index (%):	0		
Saturation (%):	95.09	110.14				
Void Ratio:	1.0438	0.7335	Specific Gravity:	2.511	Measured	
Soil Description:	Yellowish brown, sandy silt with mica					
Project Number:	7352		Depth: 25.0-27.0 ft		Remarks:	
Sample Number:	T-2		Boring Number: W85-2L-03			
Project:	I85/I-385 Interchange Modifications					
Client:	CECS					
Location:	Soils Lab					

Consolidation Test Test Results



	Before	After	Liquid Limits:	0	Test Date:	3-24-15	
Moisture (%):	39.65	32.71	Plastic Limits:	0			
Dry Density (pcf):	76.58	89.79	Plasticity Index (%):	0			
Saturation (%):	95.09	110.14					
Void Ratio:	1.0438	0.7335	Specific Gravity:	2.511	Measured		
Soil Description:	Yellowish brown, sandy silt with mica						
Project Number:	7352	Depth: 25.0-27.0 ft		Remarks:			
Sample Number:	T-2	Boring Number: W85-2L-03					
Project:	I85/I-385 Interchange Modifications						
Client:	CECS						
Location:	Soils Lab						

Consolidation Test Results

Summary

Project: I85/I-385 Interchange Modifications
Location: Soils Lab
Job Number: 14-1101-0276

Project Number: 7352

Sample Number: T-2
Boring Number: W85-2L-03
Depth: 25.0-27.0 ft
Sample Type: Undisturbed

Sample Description: Yellowish brown, sandy silt with mica
Remarks:

Test Number:
Test Date: 3-24-15

Index	Load Sequence (tsf)	Cummulative Change in Height (in)	Specimen Height (in)	Height of Void (in)	Vertical Strain (%)	Void Ratio	t90 Fitting Time (min)	t50 Fitting Time (min)	t90 Cv (ft2/year)	t50 Cv (ft2/year)
0	0.000	0.0000	1.0010	0.5111	0.00	1.0434	0.000	0.000	0.000	0.000
1	0.125	0.0048	0.9962	0.5063	0.48	1.0335	0.000	0.000	0.000	0.000
2	0.250	0.0148	0.9862	0.4963	1.48	1.0131	1.148	0.289	655.732	605.513
3	0.500	0.0277	0.9733	0.4835	2.76	0.9869	1.433	0.291	511.633	585.514
4	1.000	0.0488	0.9522	0.4624	4.87	0.9438	1.415	0.847	495.780	192.425
5	2.000	0.0827	0.9183	0.4284	8.26	0.8746	2.625	0.207	248.619	733.041
6	1.000	0.0787	0.9223	0.4324	7.86	0.8827	0.000	0.000	0.000	0.000
7	0.500	0.0750	0.9260	0.4361	7.49	0.8903	0.000	0.000	0.000	0.000
8	1.000	0.0776	0.9234	0.4336	7.75	0.8851	0.000	0.000	0.000	0.000
9	2.000	0.0867	0.9143	0.4244	8.66	0.8664	0.526	0.417	1230.389	360.092
10	4.000	0.1317	0.8693	0.3794	13.16	0.7745	0.813	0.570	719.045	238.128
11	8.000	0.1899	0.8111	0.3212	18.97	0.6557	0.666	0.208	764.384	569.735
12	16.000	0.2529	0.7481	0.2582	25.27	0.5271	0.728	0.276	594.494	364.661
13	4.000	0.2398	0.7612	0.2713	23.96	0.5539	0.000	0.000	0.000	0.000
14	1.000	0.2187	0.7823	0.2924	21.85	0.5969	0.000	0.000	0.000	0.000
15	0.250	0.1520	0.8490	0.3591	15.18	0.7331	0.000	0.000	0.000	0.000

Predicted value indicated with *

Tested By: B. Hak

Checked By: C. Dugger

Consolidation Test

Consolidation Specimen Information

Project: I85/I-385 Interchange Modifications

Project Number: 7352

Location: Soils Lab

Job Number: 14-1101-0276

Test Date: 3-24-15

Sample Number: T-2

Sample Description:

Boring Number: W85-2L-03

Yellowish brown, sandy silt with mica

Depth: 25.0-27.0 ft

Remarks:

Sample Type: Undisturbed

Test Number:

Liquid Limit: 0.0000

Initial Void Ratio: 1.0438

Initial Height (in): 1.0010

Plastic Limit: 0.0000

Plasticity Index (%): 0.0000

Initial Diameter (in): 2.4950

Specific Gravity: 2.5110

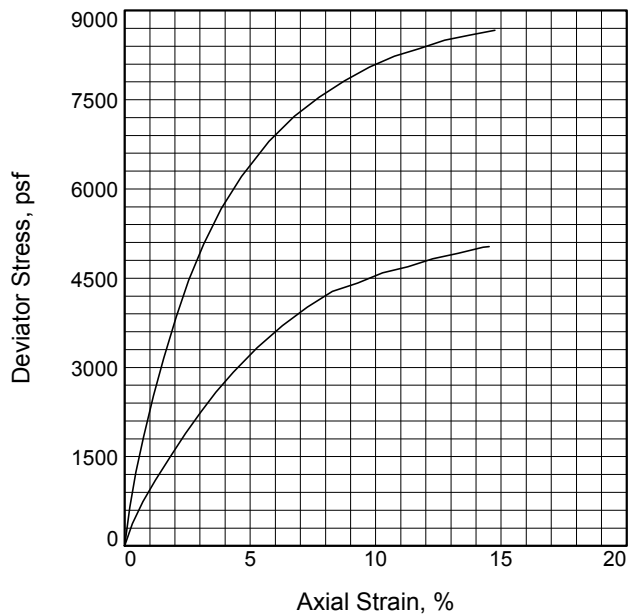
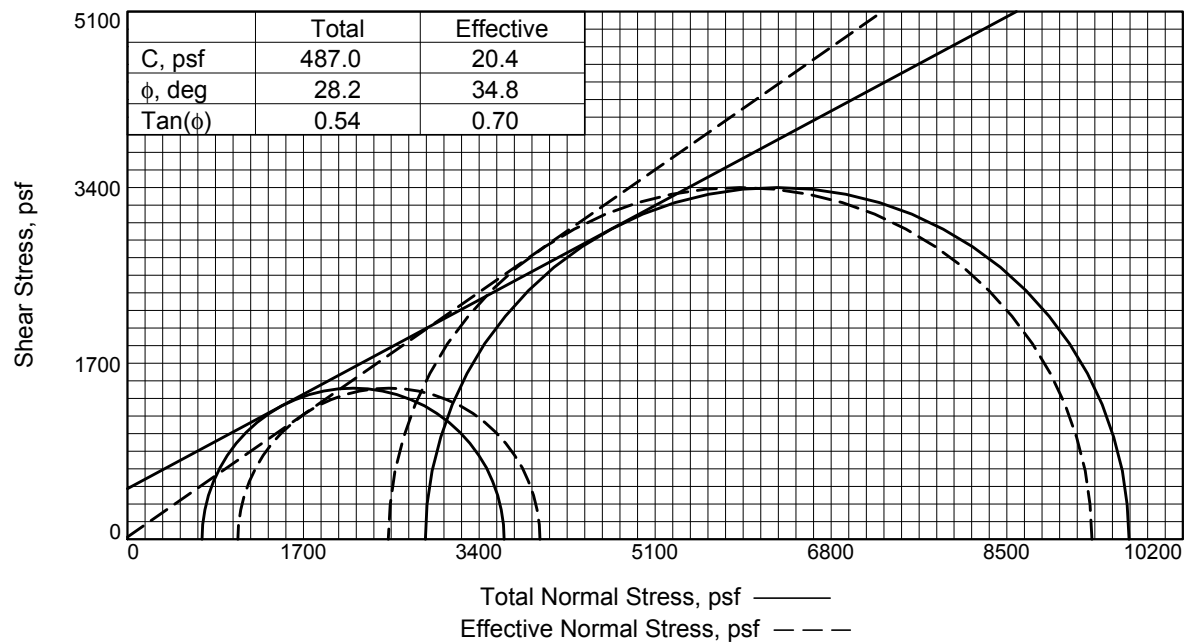
Weight of Ring (g): 111.1400

Measured

Parameters	Initial Specimen	Final Specimen
Moist Weight + Container (g)	96.26	258.20
Dry Soil + Container (g)	76.19	226.28
Weight of Container (g)	25.57	128.69
Moisture Content (%)	39.65	32.71
Void Ratio	1.0438	0.7335
Saturation (%)	95.09	110.14
Dry Density (pcf)	76.58	89.79

Tested By: B. Hak

Checked By: C. Dugger



Specimen No.		1	2
Initial	Water Content, %	20.4	20.5
	Dry Density, pcf	107.8	103.2
	Saturation, %	100.4	89.4
	Void Ratio	0.5399	0.6090
	Diameter, in.	2.771	2.777
	Height, in.	5.120	5.520
At Test	Water Content, %	20.3	22.9
	Dry Density, pcf	107.8	103.2
	Saturation, %	100.0	100.0
	Void Ratio	0.5399	0.6090
	Diameter, in.	2.771	2.777
	Height, in.	5.120	5.520
Strain at peak, %		4.3	5.8
Eff. Cell Pressure, psf		720.0	2880.0
Fail. Stress, psf		2921.2	6799.1
Excess Pore Pr., psf		-346.6	358.7
Strain, %		4.3	5.8
Ult. Stress, psf		2921.2	6799.1
Excess Pore Pr., psf		-346.6	358.7
Strain, %		4.3	5.8
$\bar{\sigma}_1$ Failure, psf		3987.9	9320.5
$\bar{\sigma}_3$ Failure, psf		1066.6	2521.3

Type of Test:

CU with Pore Pressures

Sample Type: 3-in. Shelby Tube

Description:

LL= 32

PL= 27

PI= 5

Assumed Specific Gravity= 2.66

Remarks:

Figure _____

Client: CECS

Project: SCDOT I-85 & I-385 Interchange Modification

Source of Sample: W3A-1R-01

Depth: 12.0

Sample Number: T-1

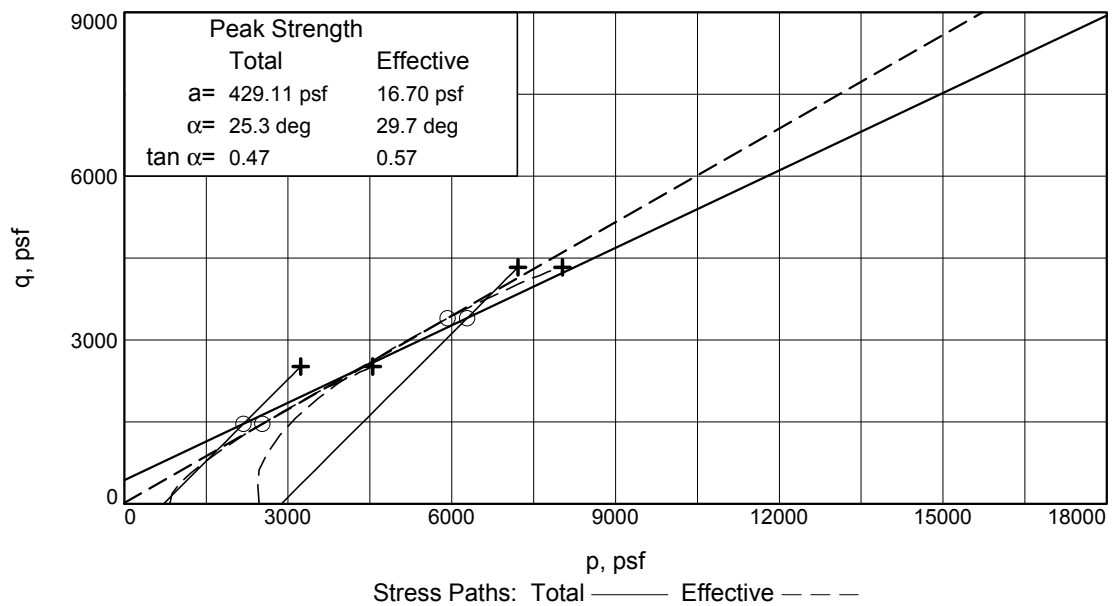
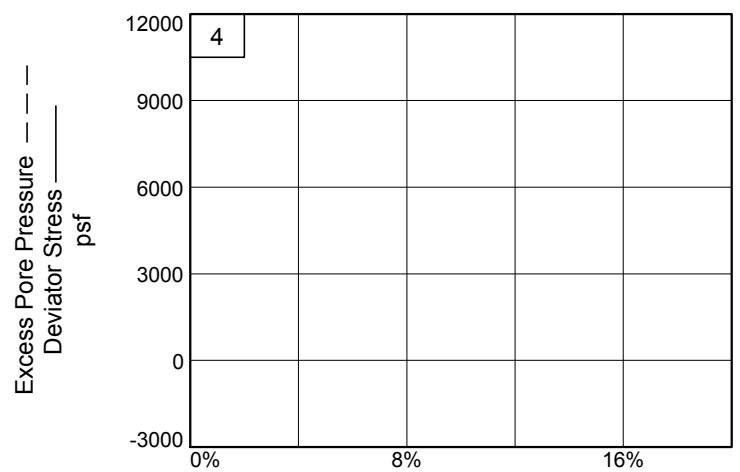
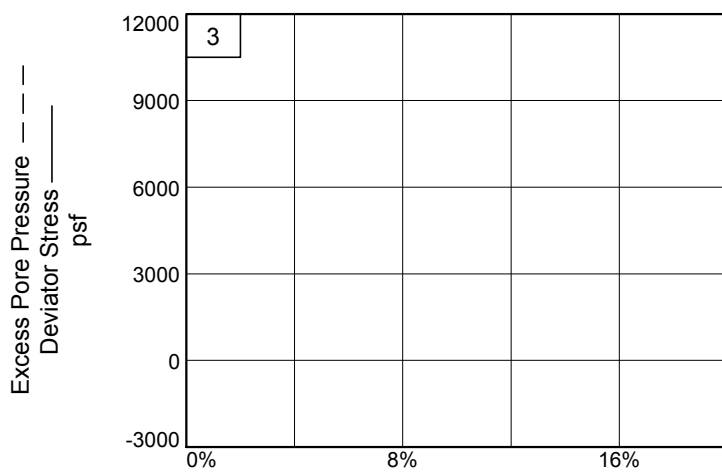
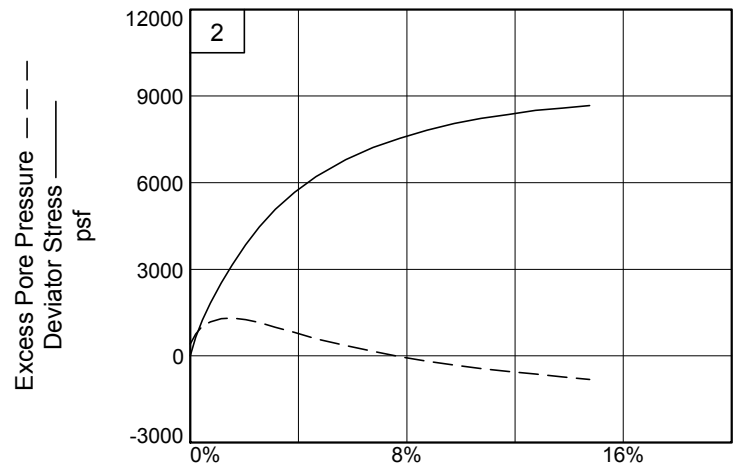
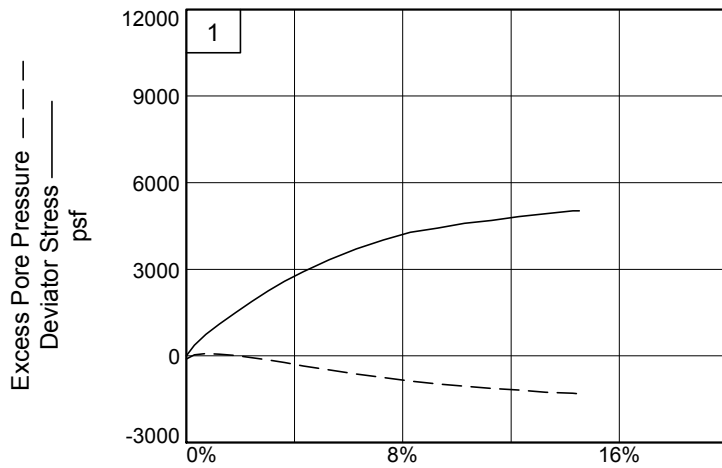
Proj. No.: 1411010276

Date Sampled: 1/22/15

TRIAXIAL SHEAR TEST REPORT

Thompson Engineering
Mobile, Alabama

Tested By: B. Hak



Client: CECS

Project: SCDOT I-85 & I-385 Interchange Modification

Source of Sample: W3A-1R-01

Depth: 12.0

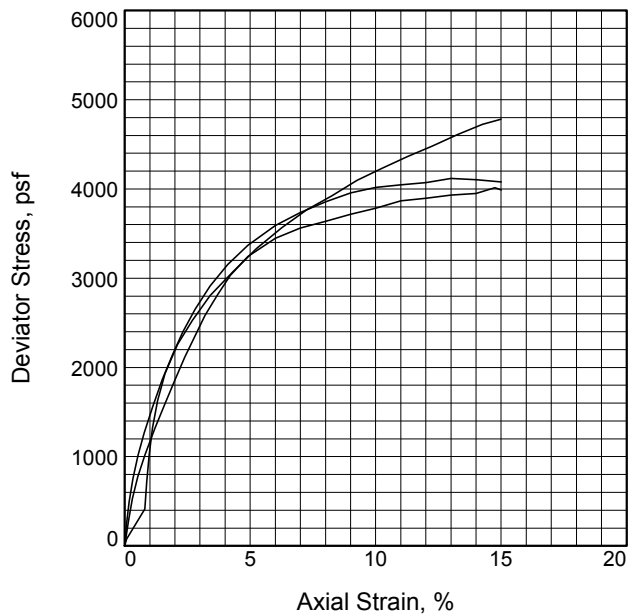
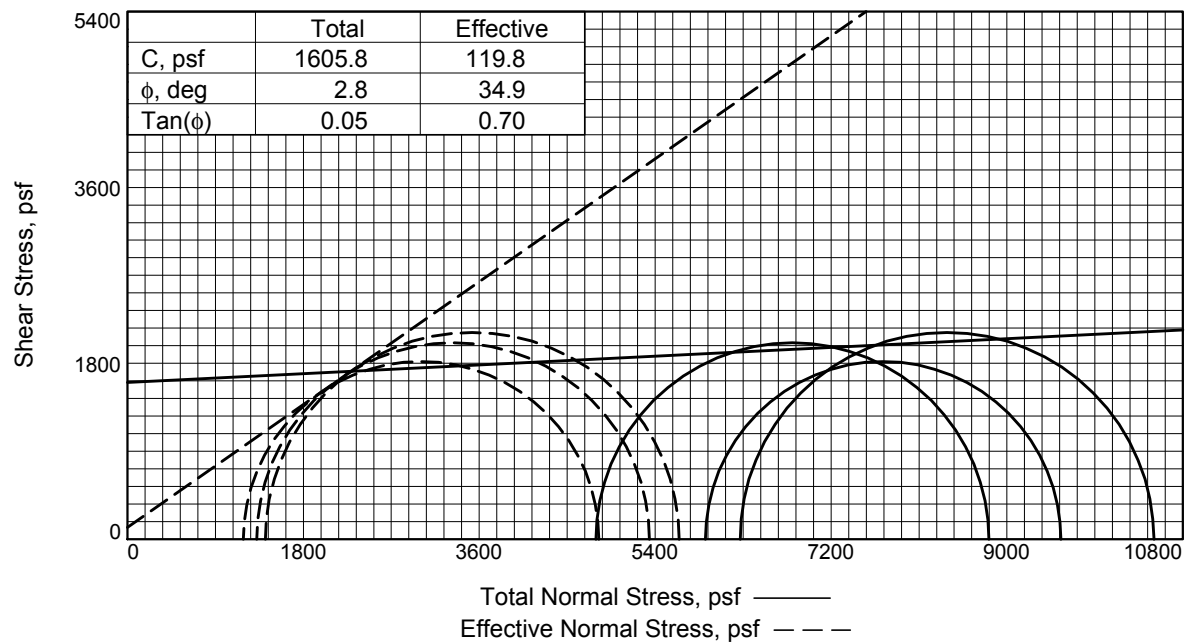
Sample Number: T-1

Project No.: 1411010276

Figure _____

Thompson Engineering

Tested By: B. Hak _____



Specimen No.		1	2	3
Initial	Water Content, %	30.7	31.5	34.5
	Dry Density, pcf	85.6	87.1	88.1
	Saturation, %	87.1	92.5	103.6
	Void Ratio	0.9392	0.9069	0.8859
	Diameter, in.	2.758	2.766	2.749
	Height, in.	5.340	5.460	5.510
At Test	Water Content, %	35.3	34.1	33.3
	Dry Density, pcf	85.6	87.1	88.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9392	0.9069	0.8859
	Diameter, in.	2.758	2.766	2.749
	Height, in.	5.340	5.460	5.510
Strain at peak, %		8.0	10.0	10.3
Eff. Cell Pressure, psf		5914.1	4795.2	6269.8
Fail. Stress, psf		3636.6	4019.3	4233.7
Excess Pore Pr., psf		4727.0	3473.0	4858.6
Strain, %		8.0	10.0	10.3
Ult. Stress, psf		3636.6	4019.3	4233.7
Excess Pore Pr., psf		4727.0	3473.0	4858.6
Strain, %		8.0	10.0	10.3
$\bar{\sigma}_1$ Failure, psf		4823.6	5341.5	5644.8
$\bar{\sigma}_3$ Failure, psf		1187.0	1322.2	1411.1

Type of Test:

CU with Pore Pressures

Sample Type: 3-in. Shelby Tube

Description:

LL= NP

PI= NP

Assumed Specific Gravity= 2.66

Remarks:

Figure _____

Client: CECS

Project: SCDOT I-85 & I-385 Interchange Modification

Source of Sample: WCR-1L-02

Depth: 15.0

Sample Number: T-1

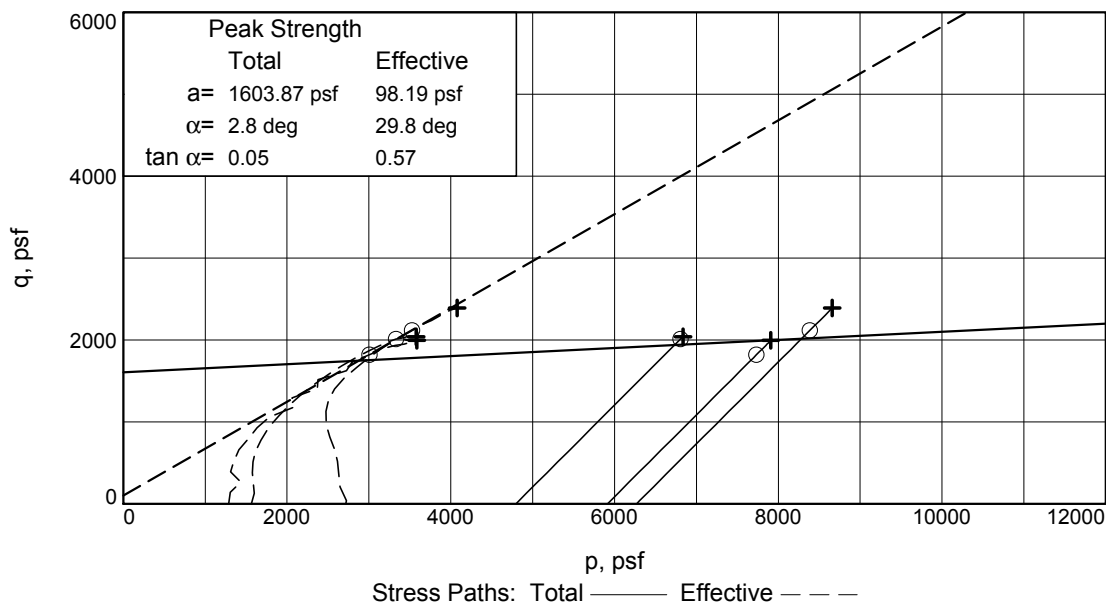
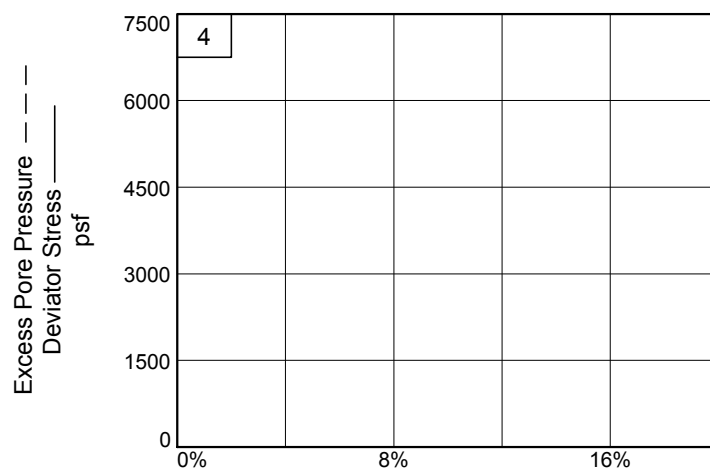
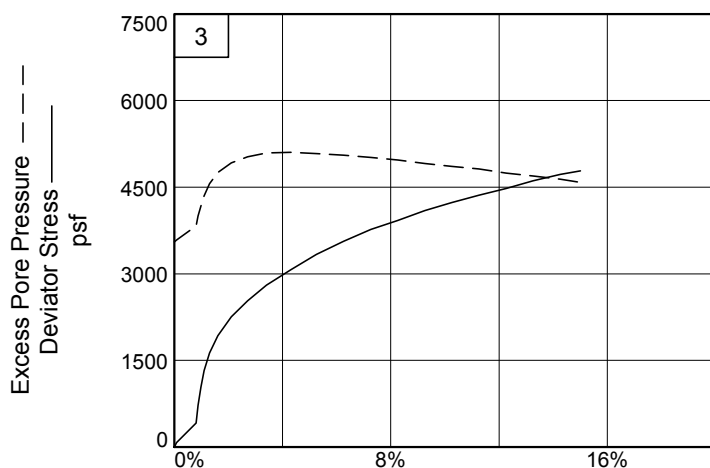
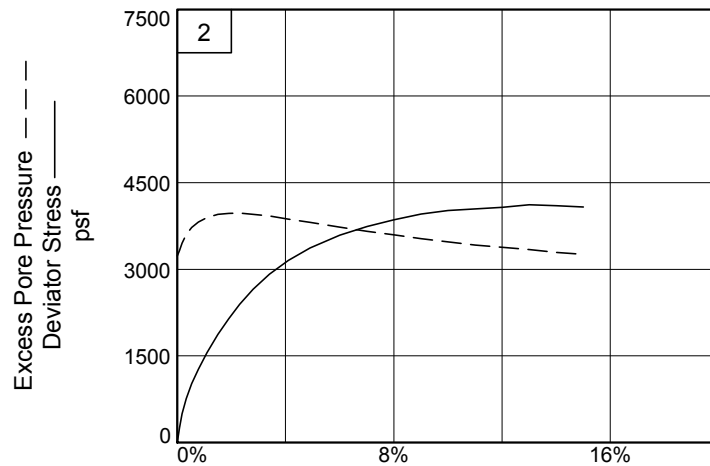
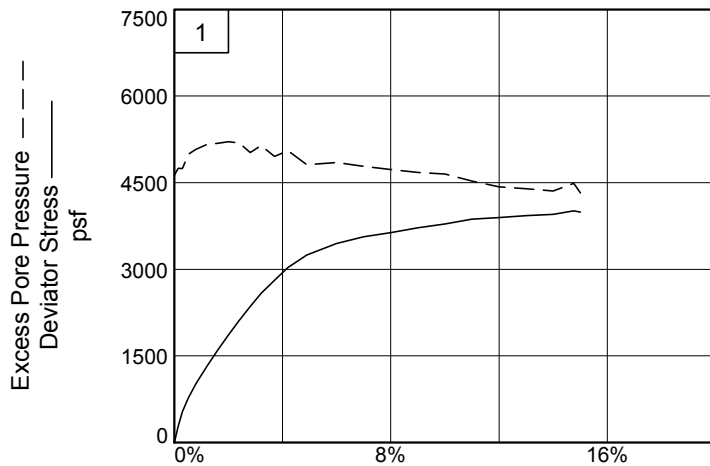
Proj. No.: 1411010276

Date Sampled:

TRIAXIAL SHEAR TEST REPORT

Thompson Engineering
Mobile, Alabama

Tested By: B. Hak



Client: CECS

Project: SCDOT I-85 & I-385 Interchange Modification

Source of Sample: WCR-1L-02

Depth: 15.0

Sample Number: T-1

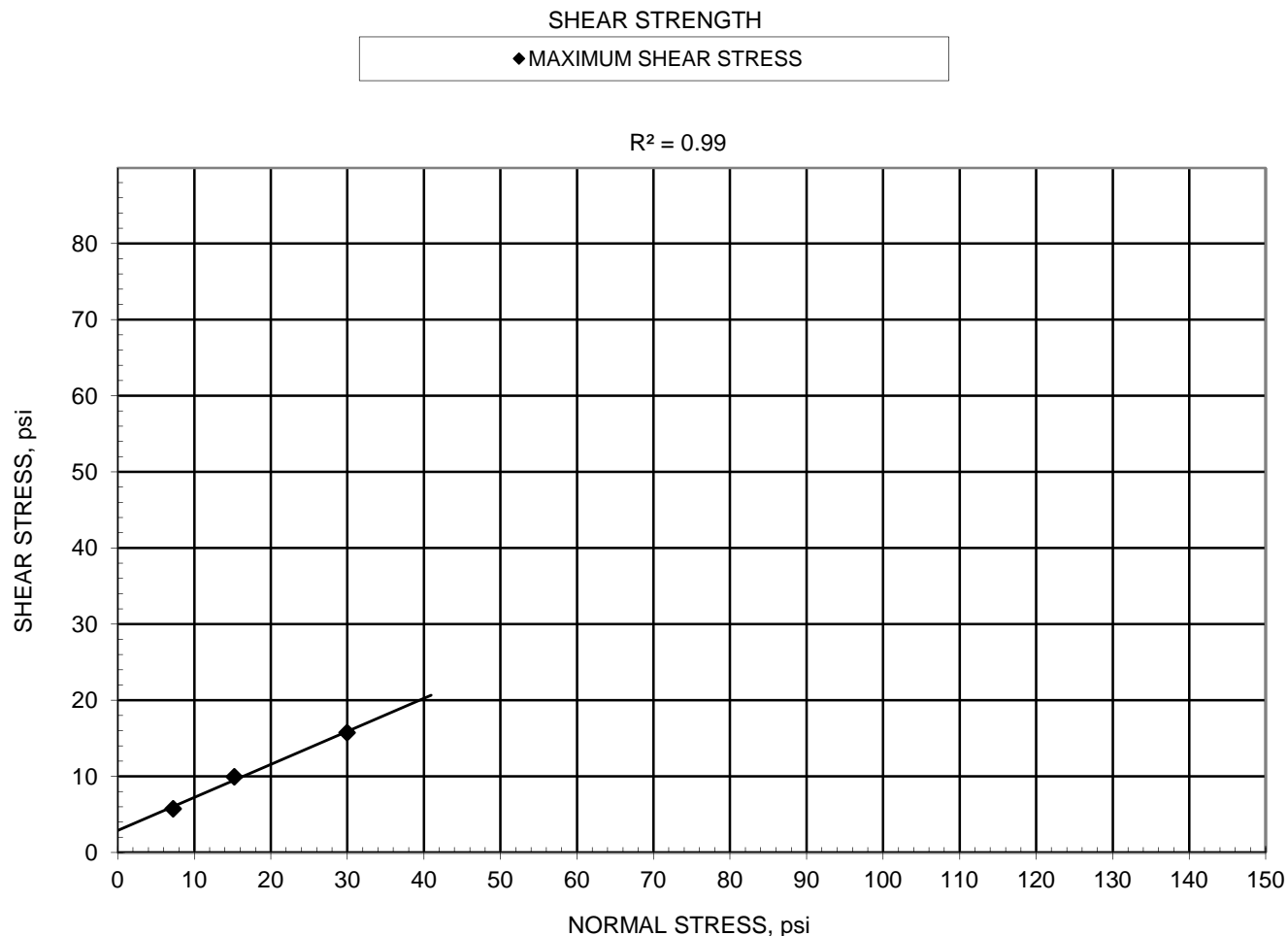
Project No.: 1411010276

Figure _____

Thompson Engineering

Tested By: B. Hak _____

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS ASTM D3080



The reported cohesion may be apparent cohesion.

		FRICTION ANGLE	COHESION	NORMAL	NORMAL	NORMAL
AT MAXIMUM SHEAR STRESS		23.5 deg	2.9 psi	STRESS, psi	STRESS, psi	STRESS, psi
				7.5	15.0	30.0
INITIAL AREA, mm2	3166.9	INITIAL MOISTURE, %		39.4	37.8	39.4
INITIAL LENGTH, mm	25.40	INITIAL DRY DENSITY, pcf		74.9	77.9	77.9
SPECIFIC GRAVITY	2.70	INITIAL SATURATION, %		85	88	91
SG TESTED		INITIAL VOID RATIO		1.25	1.16	1.16
SG ASSUMED	X	FINAL MOISTURE, %		45.0	34.0	27.9
LIQUID LIMIT	47	FINAL SATURATION, %		97	97	97
PLASTIC LIMIT	43	FINAL VOID RATIO		1.25	0.95	0.78
PLASTICITY INDEX	4	MAXIMUM SHEAR STRESS, psi		5.75	9.96	15.75
SAMPLE TYPE	UNDISTURBED	RATE OF LOADING, in/min		0.0042	0.0042	0.0042
DESCRIPTION	Silty Sand (SM)					

PROJECT NAME: I-85/I-385 Interchange Modifications

BORING NO. R2-43

LOCATION: I-85/I-385 Interchange

SAMPLE NO. T-1

JOB NO.: E2156301

DEPTH, feet 10 TO 12

DATE: 4/3/2015

Terracon

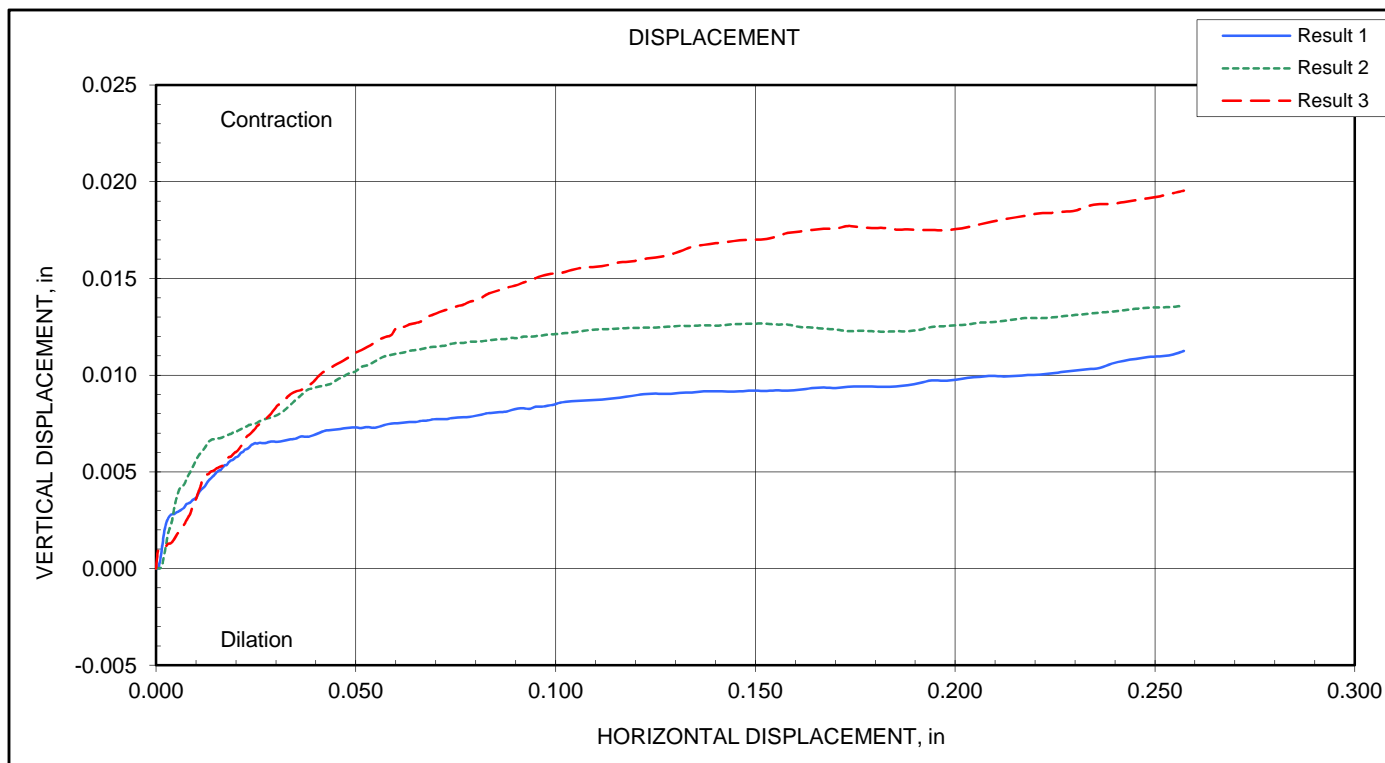
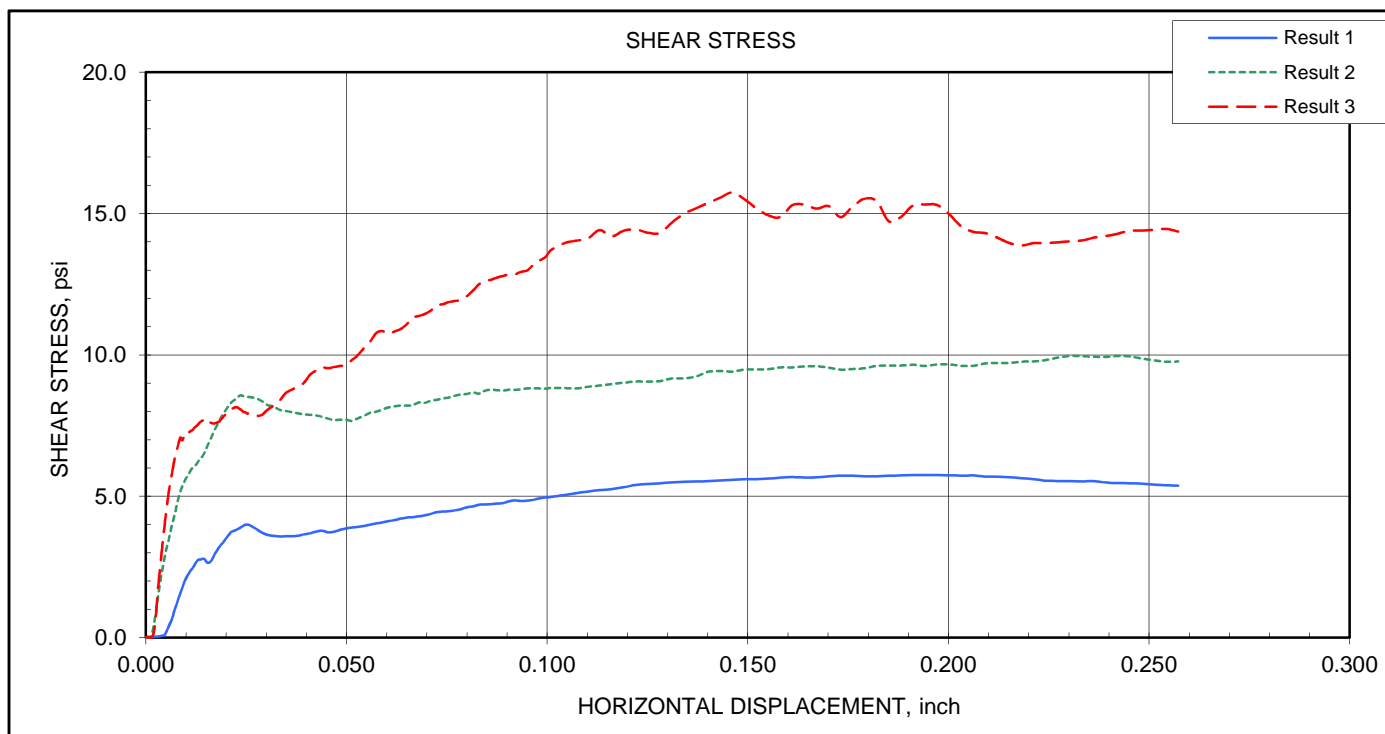
I-85/I-385 Interchange Modifications

I-85/I-385 Interchange

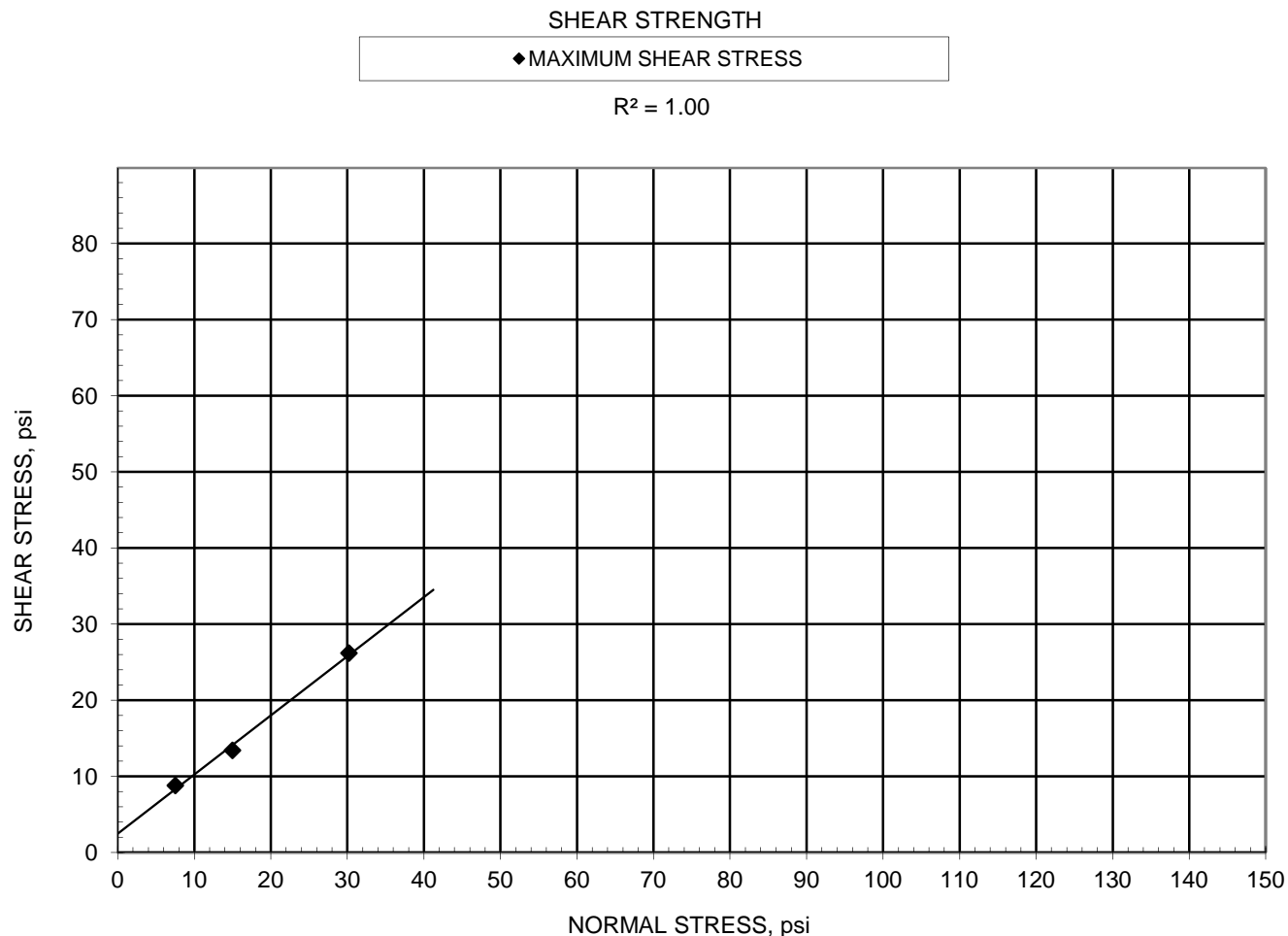
E2156301

4/3/2015

BORING NO.	R2-43
SAMPLE NO.	T-1
DEPTH, feet	10 TO 12



DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS ASTM D3080



The reported cohesion may be apparent cohesion.

		FRICTION ANGLE	COHESION	NORMAL	NORMAL	NORMAL		
AT MAXIMUM SHEAR STRESS		37.8	deg	2.5	psi	STRESS, psi	STRESS, psi	STRESS, psi
						7.5	15.0	30.0
INITIAL AREA, mm2	3166.9	INITIAL MOISTURE, %			31.5	31.4	31.8	
INITIAL LENGTH, mm	25.40	INITIAL DRY DENSITY, pcf			87.9	83.9	87.1	
SPECIFIC GRAVITY	2.70	INITIAL SATURATION, %			93	84	92	
SG TESTED		INITIAL VOID RATIO			0.92	1.01	0.93	
SG ASSUMED	X	FINAL MOISTURE, %			32.4	34.5	27.9	
LIQUID LIMIT	42	FINAL SATURATION, %			98	97	97	
PLASTIC LIMIT	28	FINAL VOID RATIO			0.89	0.96	0.78	
PLASTICITY INDEX	14	MAXIMUM SHEAR STRESS, psi			8.81	13.43	26.21	
SAMPLE TYPE	SHELBY TUBE	RATE OF LOADING, in/min			0.0030	0.0030	0.0030	
DESCRIPTION	Sandy Silt (ML)							

PROJECT NAME: I-85/I-385 Interchange Modifications

BORING NO. W4B-1L-02

LOCATION: I-85/I-385 Interchange

SAMPLE NO. T-2

JOB NO.: E2156301

DEPTH, feet 8 TO 10

DATE: 1/22/2015

Terracon

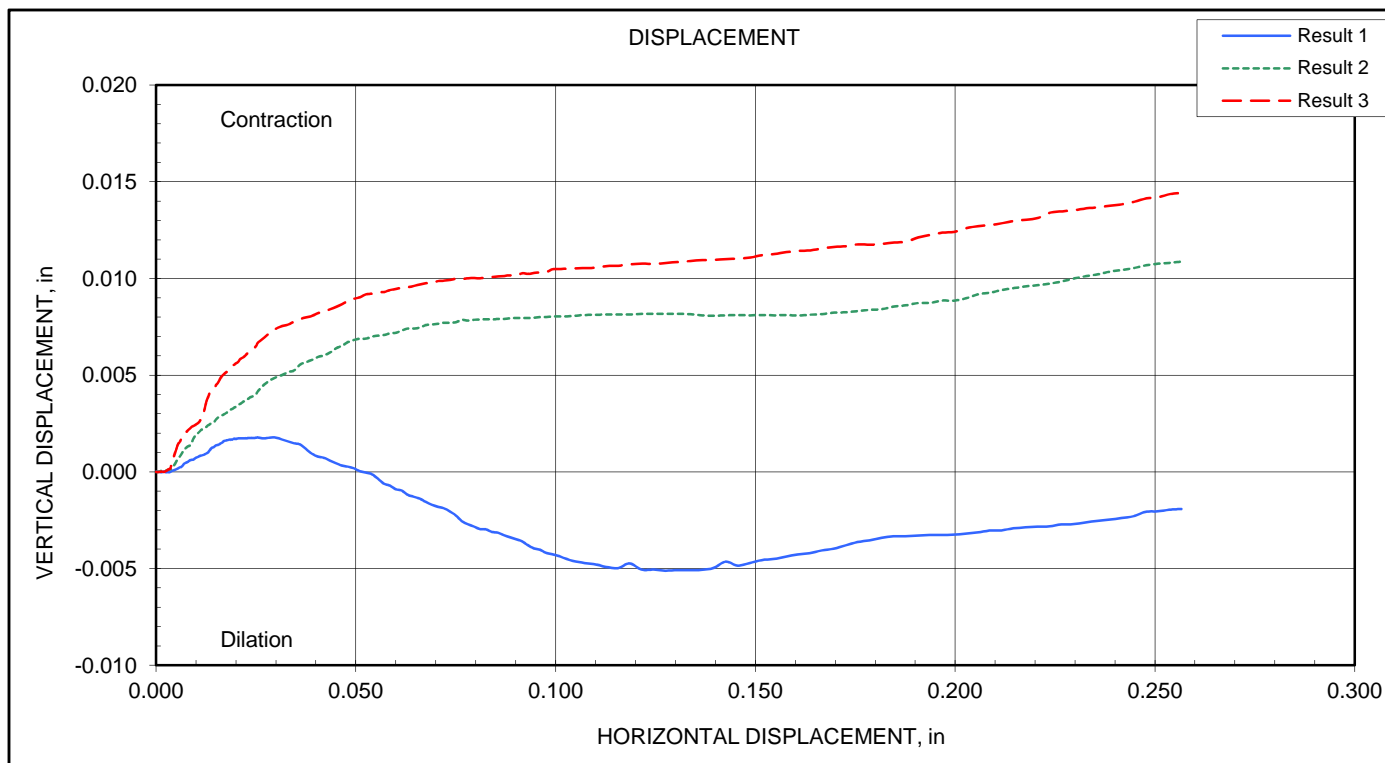
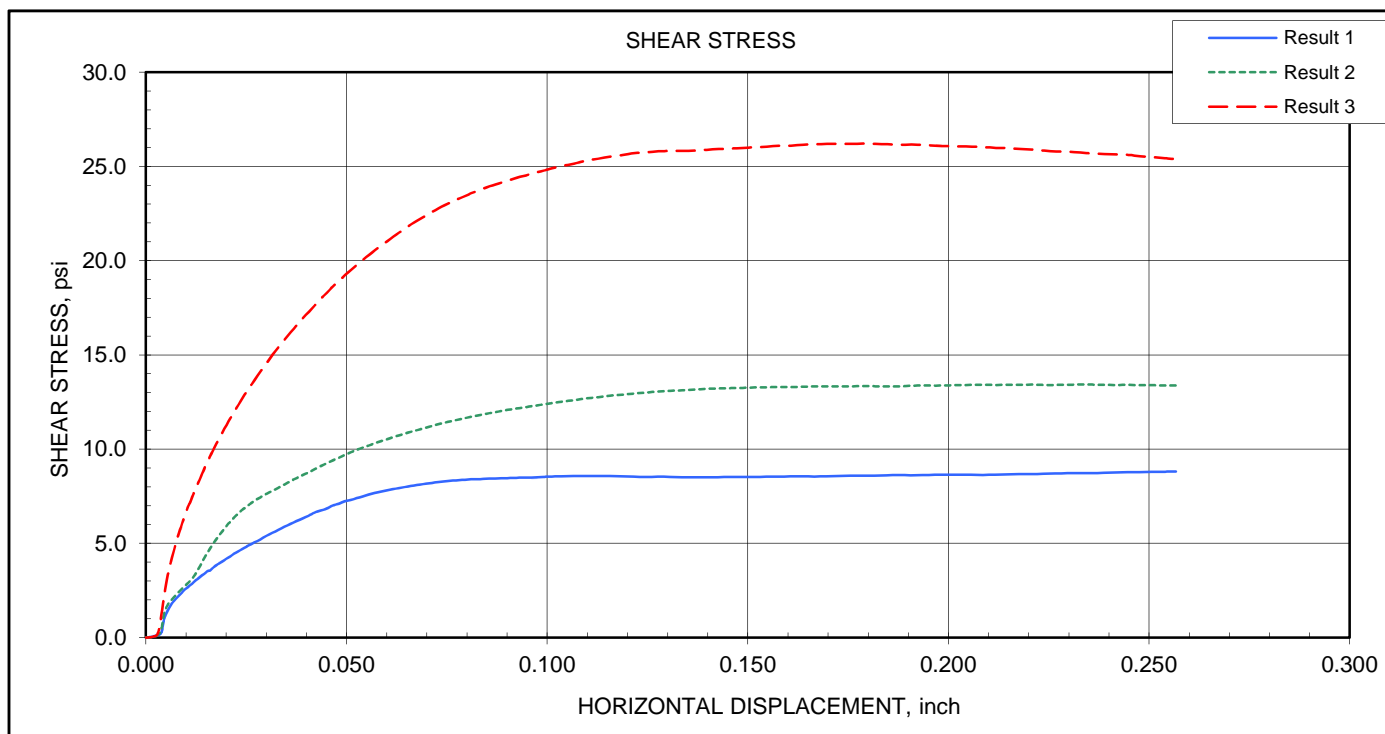
I-85/I-385 Interchange Modifications

I-85/I-385 Interchange

E2156301

1/22/2015

BORING NO.	W4B-1L-02
SAMPLE NO.	T-2
DEPTH, feet	8 TO 10

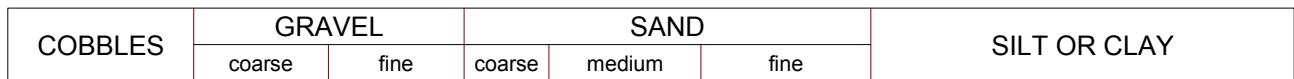



ASTM D4318



CLIENT: Thompson Engineering, Inc.
Mobile, AL

ASTM D422



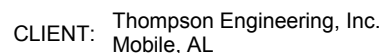
	GRAIN SIZE		
			
D ₆₀	0.2		
D ₃₀	0.044		
D ₁₀	0.006		
	COEFFICIENTS		
C _C	1.62		
C _U	33.60		

<u>SOIL DESCRIPTION</u>	
●	SILTY SAND(SM)
<u>REMARKS</u>	
●	

CLIENT: Thompson Engineering, Inc.
Mobile, AL

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 E2156301 I-85 I-385 INTERCHANGE MODIFICATIONS.GPJ TERRACON2012.GDT 4/3/15

ASTM D422

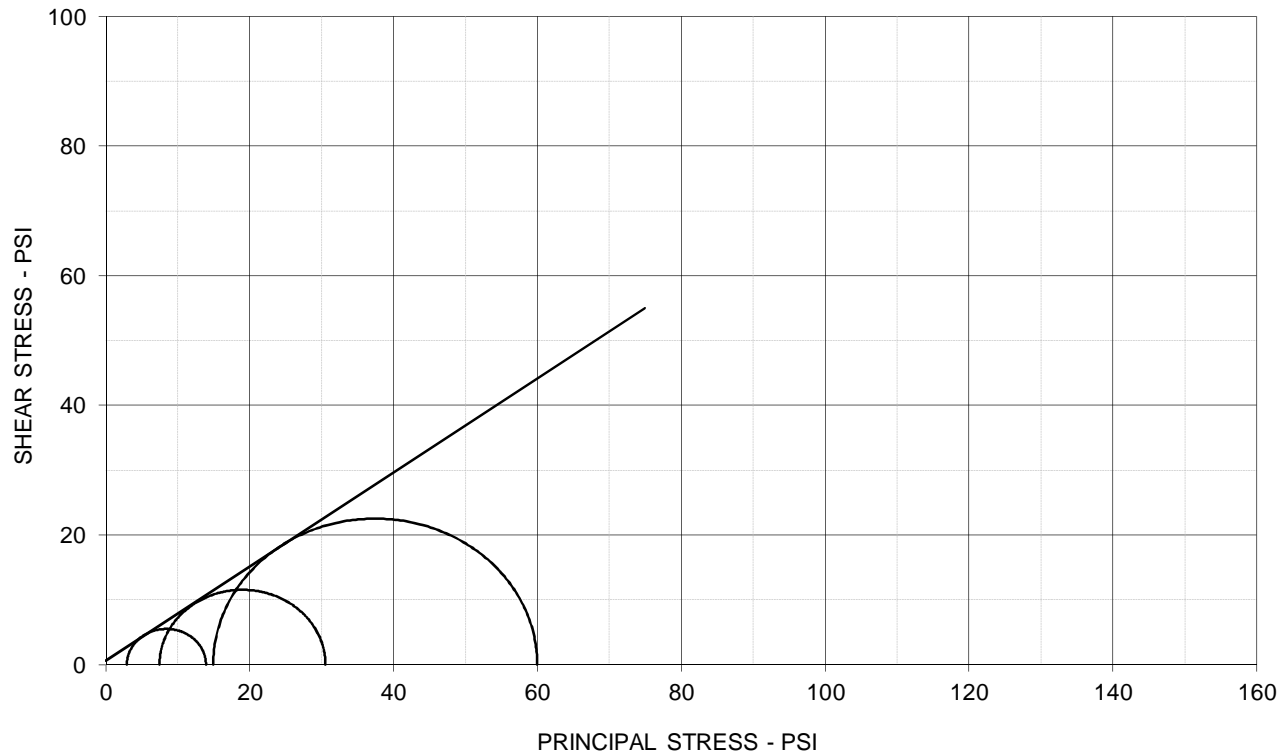


LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 E2156301 I-851385 INTERCHANGE MODIFICATIONS:CPJ TERRACON2012,GDT 4/3/15

TRIAXIAL SHEAR TEST REPORT



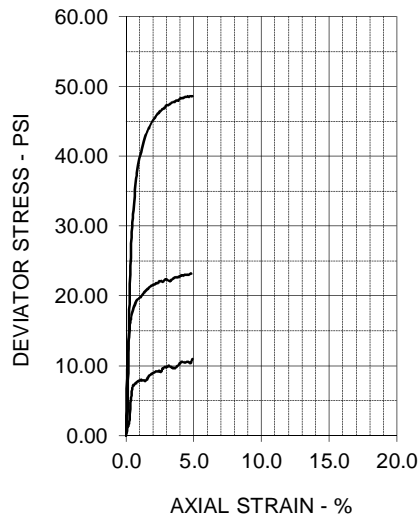
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 36.0 \text{ deg}$

$c' = 0.6 \text{ psi}$



SPECIMEN NO.

1

2

3

4

INITIAL

Moisture Content - %

25.2

25.2

25.2

Dry Density - pcf

98.1

98.1

98.1

Diameter - inches

2.88

2.88

2.88

Height - inches

5.71

5.71

5.71

AT TEST

Final Moisture - %

23.7

Dry Density - pcf

99.4

100.5

102.6

Calculated Diameter (in.)

2.87

2.88

2.88

Height - inches

5.67

5.71

5.70

Effect. Cell Pressure - psi

10.0

20.0

40.0

Failure Stress - psi

10.99

23.06

45.04

Total Pore Pressure - psi

57.1

62.5

75.1

Strain Rate - inches/min.

0.00060

0.00060

0.00060

Failure Strain - %

4.9

4.7

2.0

σ_1' Failure - psi

13.93

30.54

59.98

σ_3' Failure - psi

2.94

7.48

14.94

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Yellowish Red Sandy Clay

SAMPLE LOCATION: B-01-SPT-09, T-1, 19.0-21.0ft

SPECIFIC GRAVITY: 2.719

LL: PL: PI: Percent -200:

REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: I-85/I-385 Interchange Modifications

LOCATION: I-85/I-385 Interchange

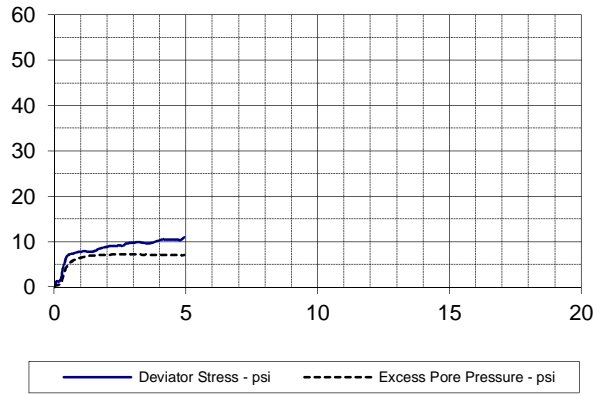
PROJECT NO: E2156301

CLIENT: Thompson Engineering

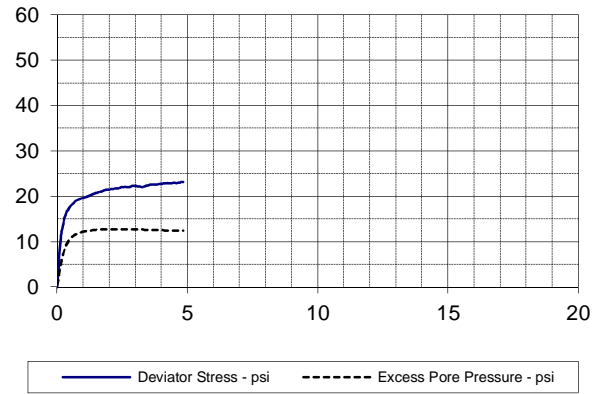
DATE: 5/14/15

TERRACON

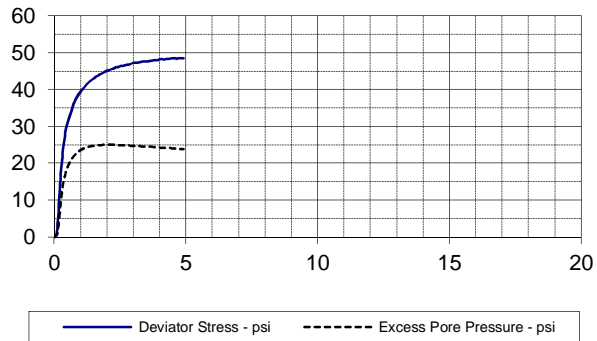
SPECIMEN NO. 1



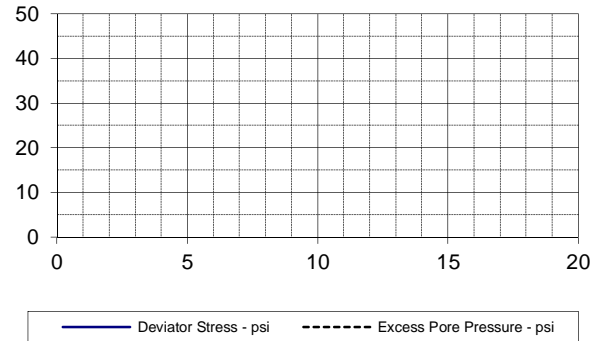
SPECIMEN NO. 2



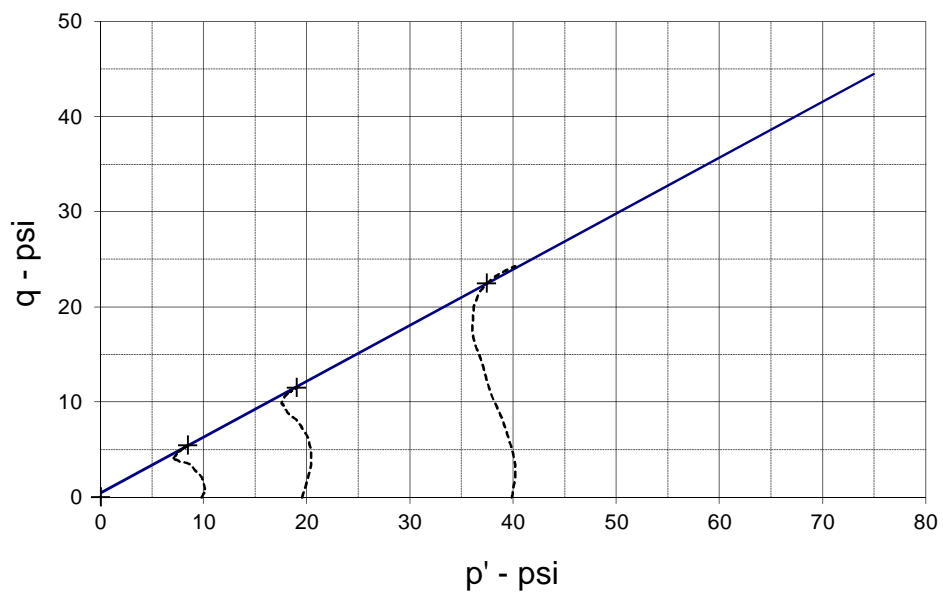
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 30.4

a (psi) = 0.5

PROJECT: I-85/I-385 Interchange Modifications

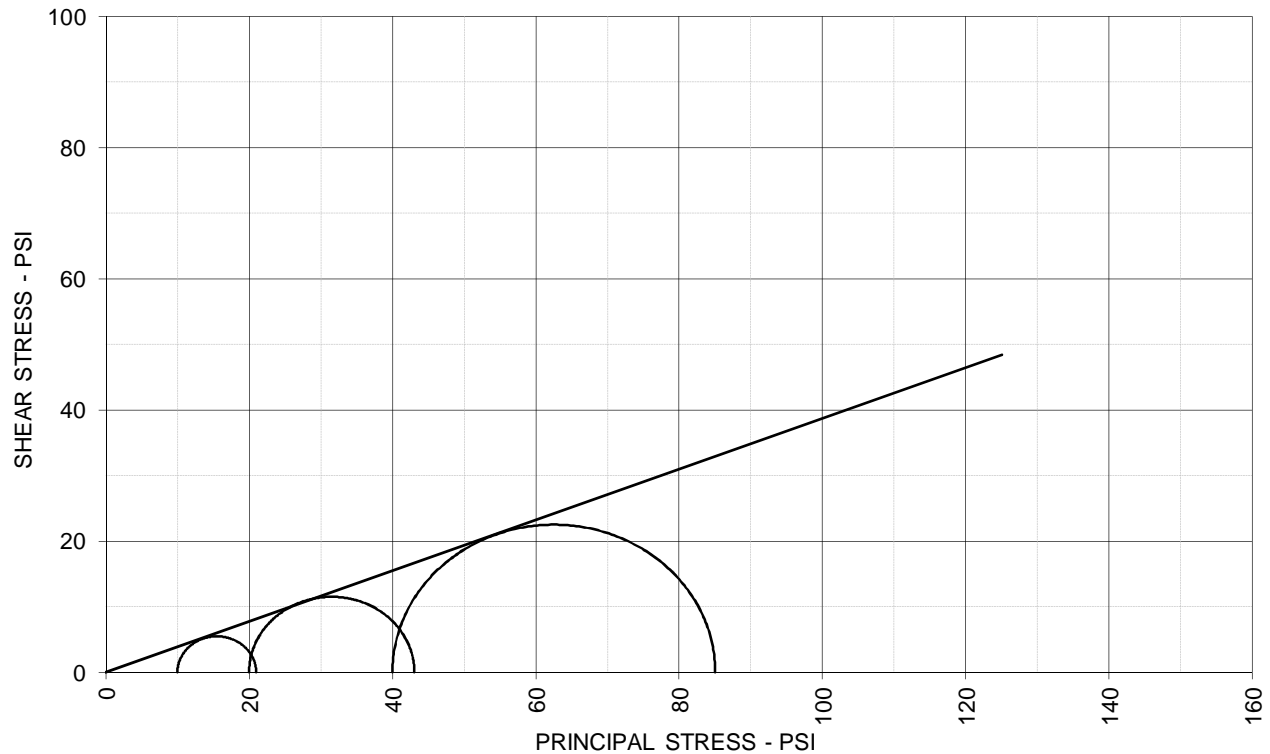
TYPE OF TEST & NO: CU with Pore Pressure

PROJECT NO: E2156301

DESCRIPTION: Yellowish Red Sandy Clay

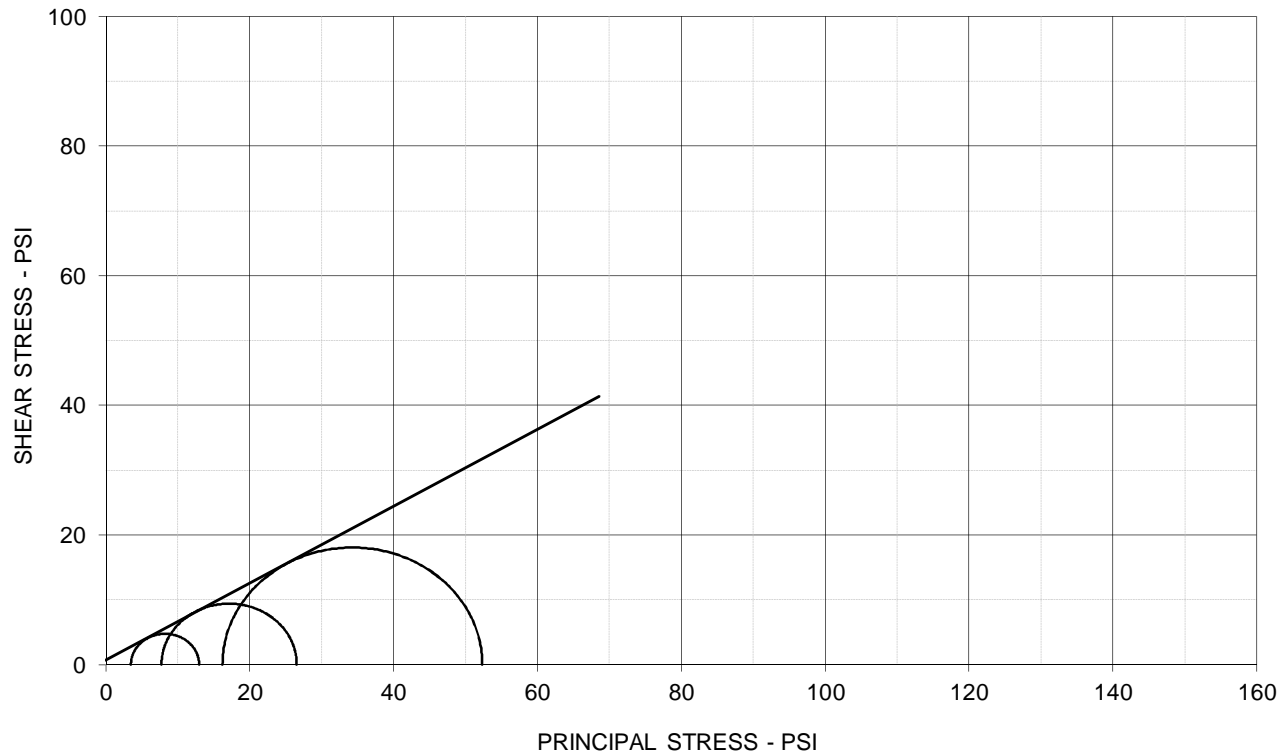
TERRACON

TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS		ϕ = 21.2 deg		c = 0.0 psi		
<p>DEVIATOR STRESS - PSI</p> <p>AXIAL STRAIN - %</p>	SPECIMEN NO.		1	2	3	4
	INITIAL					
	Moisture Content - %		25.2	25.2	25.2	
	Dry Density - pcf		98.1	98.1	98.1	
	Diameter - inches		2.88	2.88	2.88	
	Height - inches		5.71	5.71	5.71	
	AT TEST					
	Final Moisture - %				23.7	
	Dry Density - pcf		99.4	100.5	102.6	
	Calculated Diameter (in.)		2.87	2.88	2.88	
	Height - inches		5.67	5.71	5.70	
	Effect. Cell Pressure - psi		10.0	20.0	40.0	
	Failure Stress - psi		10.99	23.06	45.04	
Total Pore Pressure - psi		57.1	62.5	75.1		
Strain Rate - inches/min.		0.00060	0.00060	0.00060		
Failure Strain - %		4.9	4.7	2.0		
σ_1 Failure - psi		20.99	43.06	85.04		
σ_3 Failure - psi		10.00	20.00	40.00		
TEST DESCRIPTION			PROJECT INFORMATION			
TYPE OF TEST & NO: CU with Pore Pressure			PROJECT: I-85/I-385 Interchange Modifications			
SAMPLE TYPE: Shelby Tube			LOCATION: I-85/I-385 Interchange			
DESCRIPTION: Yellowish Red Sandy Clay			PROJECT NO: E2156301			
SAMPLE LOCATION: B-01-SPT-09, T-1, 19.0-21.0ft			CLIENT: Thompson Engineering			
SPECIFIC GRAVITY: 2.719			DATE: 5/14/15			
LL:	PL:	PI:	Percent -200:		TERRACON	
REMARKS: Multistage Triaxial						

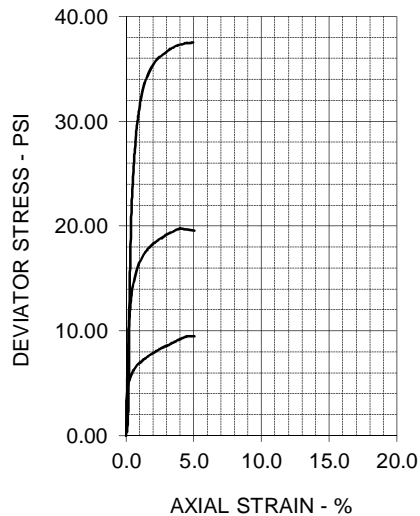
TRIAXIAL SHEAR TEST REPORT



EFFECTIVE STRESS PARAMETERS

$\phi' = 30.7 \text{ deg}$

$c' = 0.7 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	28.2	28.2	28.2
Dry Density - pcf	99.7	99.7	99.7
Diameter - inches	2.87	2.87	2.87
Height - inches	5.55	5.55	5.55

AT TEST

Final Moisture - %			20.6
Dry Density - pcf	101.4	103.9	106.5
Calculated Diameter (in.)	2.85	2.87	2.86
Height - inches	5.50	5.55	5.53
Effect. Cell Pressure - psi	10.0	20.0	40.0
Failure Stress - psi	9.48	18.80	36.12
Total Pore Pressure - psi	56.5	62.3	73.8
Strain Rate - inches/min.	0.00060	0.00060	0.00060
Failure Strain - %	4.5	2.5	2.5
σ_1' Failure - psi	12.98	26.55	52.35
σ_3' Failure - psi	3.50	7.75	16.23

TEST DESCRIPTION

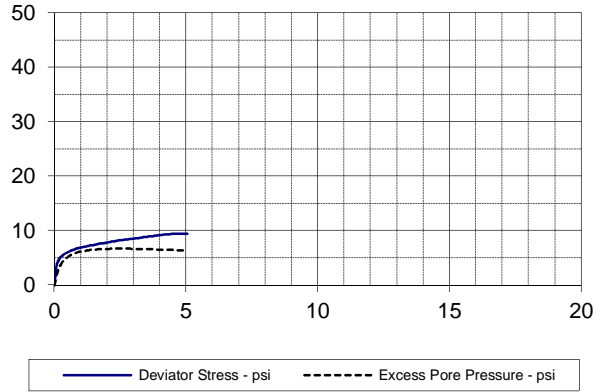
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: White Sandy Clay
 SAMPLE LOCATION: B-01-SPT-14, T-1, 25.0-27.0ft
 SPECIFIC GRAVITY: 2.654
 LL: PL: PI: Percent -200:
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

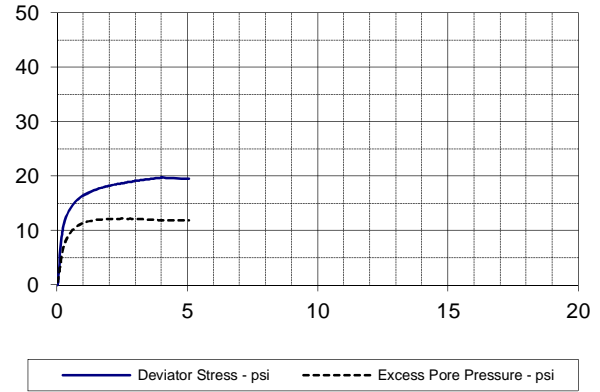
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 5/14/15

TERRACON

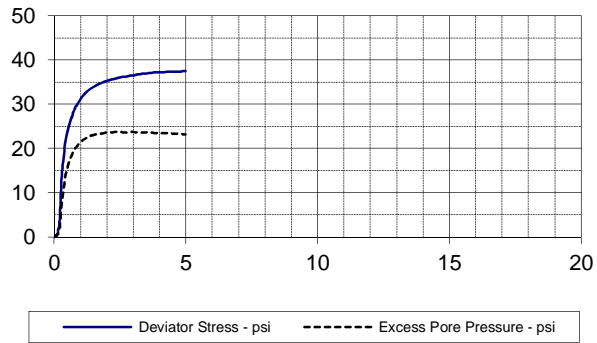
SPECIMEN NO. 1



SPECIMEN NO. 2



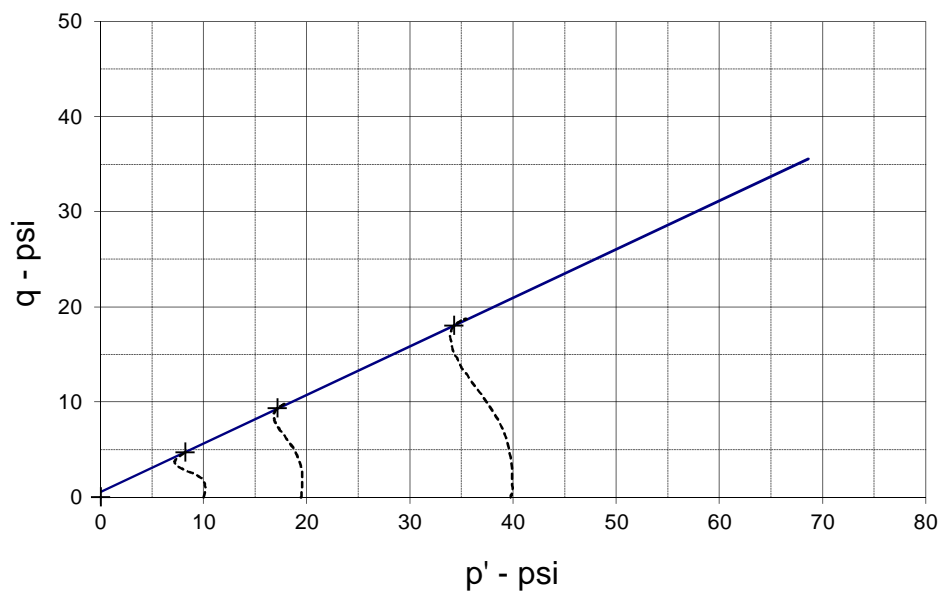
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 27.0

a (psi) = 0.6

PROJECT: I-85/I-385 Interchange Modifications

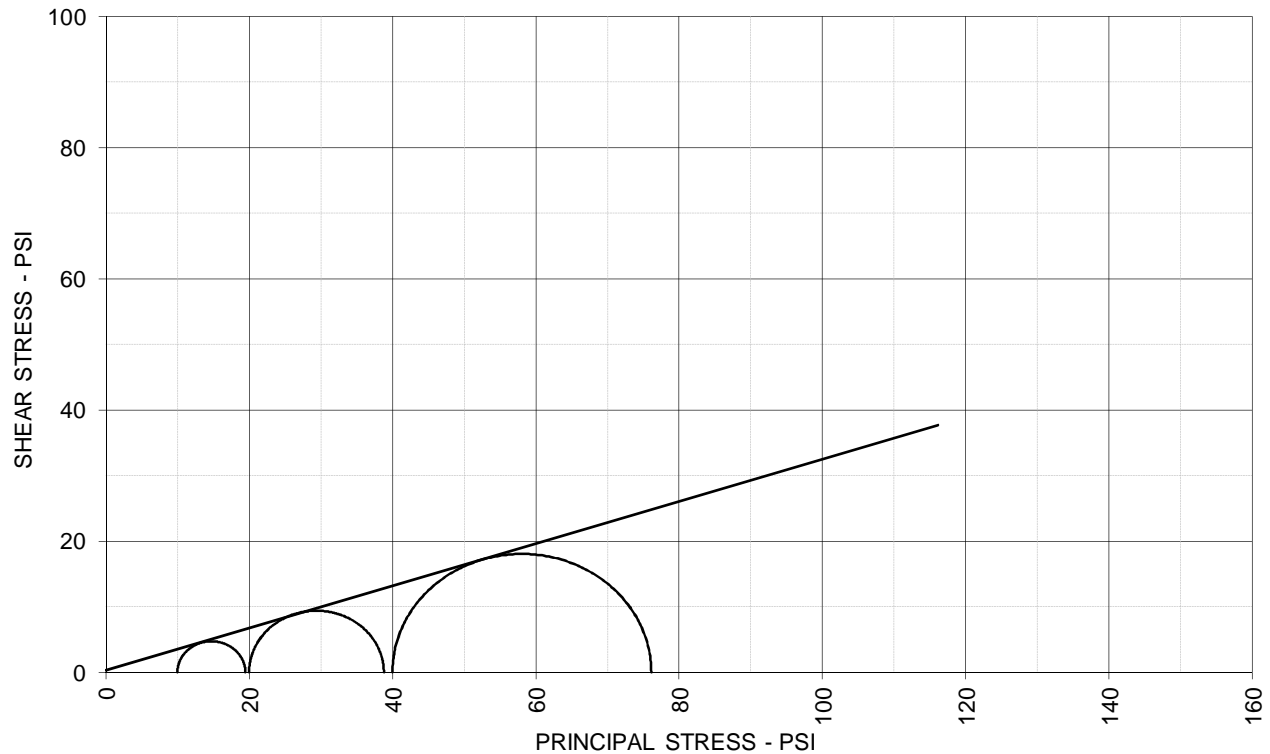
TYPE OF TEST & NO: CU with Pore Pressure

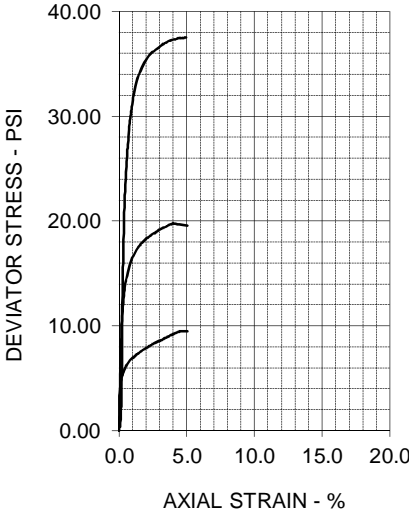
PROJECT NO: E2156301

DESCRIPTION: White Sandy Clay

TERRACON

TRIAXIAL SHEAR TEST REPORT

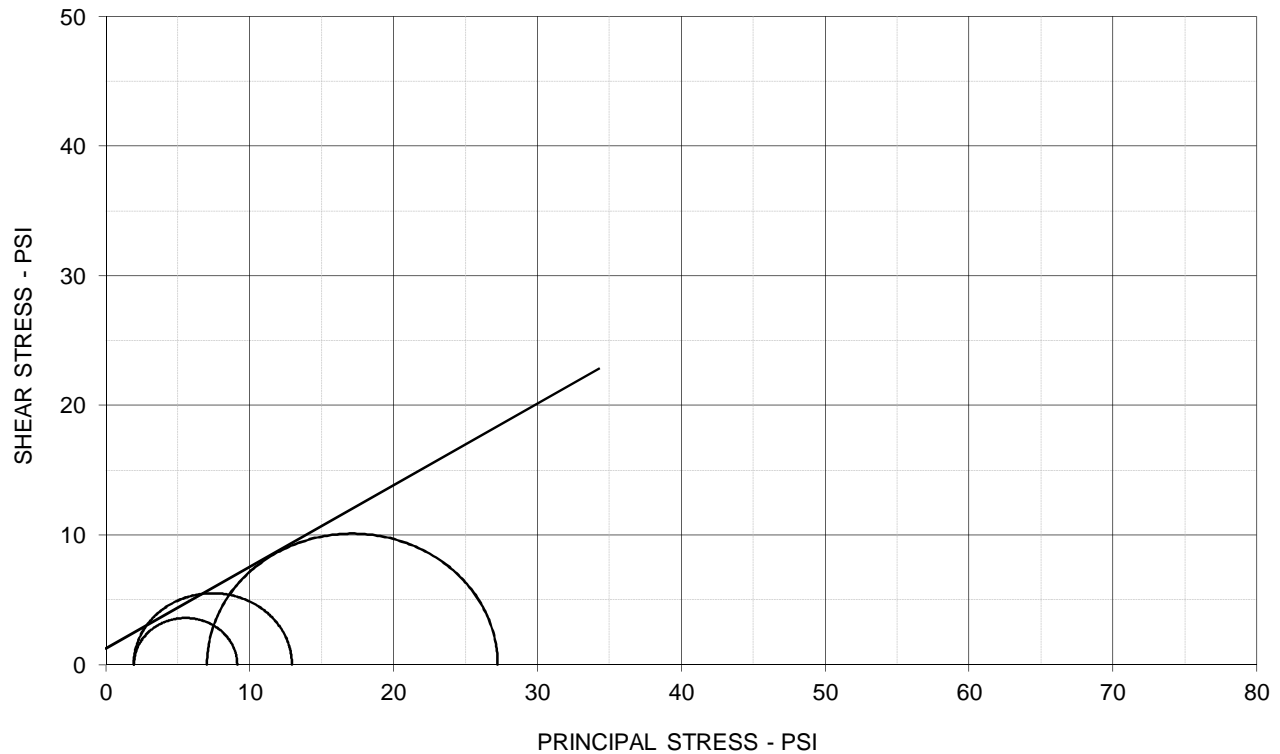


TOTAL STRESS PARAMETERS		ϕ = 17.9 deg		c = 0.3 psi		
	SPECIMEN NO.		1	2	3	4
	INITIAL					
	Moisture Content - %		28.2	28.2	28.2	
	Dry Density - pcf		99.7	99.7	99.7	
	Diameter - inches		2.87	2.87	2.87	
	Height - inches		5.55	5.55	5.55	
	AT TEST					
	Final Moisture - %				20.6	
	Dry Density - pcf		101.4	103.9	106.5	
	Calculated Diameter (in.)		2.85	2.87	2.86	
	Height - inches		5.50	5.55	5.53	
	Effect. Cell Pressure - psi		10.0	20.0	40.0	
	Failure Stress - psi		9.48	18.80	36.12	
	Total Pore Pressure - psi		56.5	62.3	73.8	
Strain Rate - inches/min.		0.00060	0.00060	0.00060		
Failure Strain - %		4.5	2.5	2.5		
σ_1 Failure - psi		19.48	38.80	76.12		
σ_3 Failure - psi		10.00	20.00	40.00		
TEST DESCRIPTION			PROJECT INFORMATION			
TYPE OF TEST & NO: CU with Pore Pressure			PROJECT: I-85/I-385 Interchange Modifications			
SAMPLE TYPE: Shelby Tube			LOCATION: I-85/I-385 Interchange			
DESCRIPTION: White Sandy Clay			PROJECT NO: E2156301			
SAMPLE LOCATION: B-01-SPT-14, T-1, 25.0-27.0ft			CLIENT: Thompson Engineering			
SPECIFIC GRAVITY: 2.654			DATE: 5/14/15			
LL:	PL:	PI:	TERRACON			
Percent -200:						
REMARKS: Multistage Triaxial						

TRIAXIAL SHEAR TEST REPORT



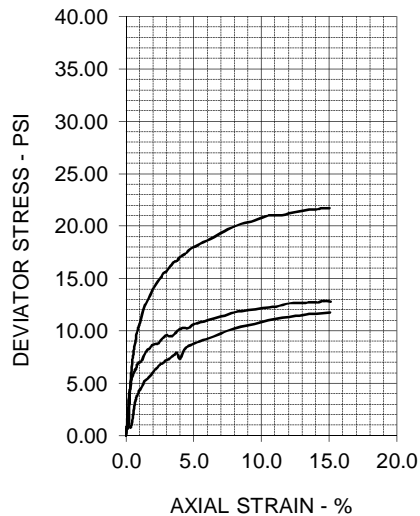
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 32.2 \text{ deg}$

$c' = 1.2 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	34.7	37.8	37.8
Dry Density - pcf	87.1	82.8	82.8
Diameter - inches	1.99	1.98	1.99
Height - inches	3.98	3.97	3.98

AT TEST

Final Moisture - %	34.2	35.9	33.7
Dry Density - pcf	87.1	84.5	87.6
Calculated Diameter (in.)	1.97	1.95	1.95
Height - inches	3.93	3.89	3.87
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	7.18	11.00	20.20
Total Pore Pressure - psi	53.0	58.1	63.0
Strain Rate - inches/min.	0.00040	0.00040	0.00040
Failure Strain - %	2.9	6.0	8.5
σ_1' Failure - psi	9.14	12.94	27.24
σ_3' Failure - psi	1.96	1.94	7.04

TEST DESCRIPTION

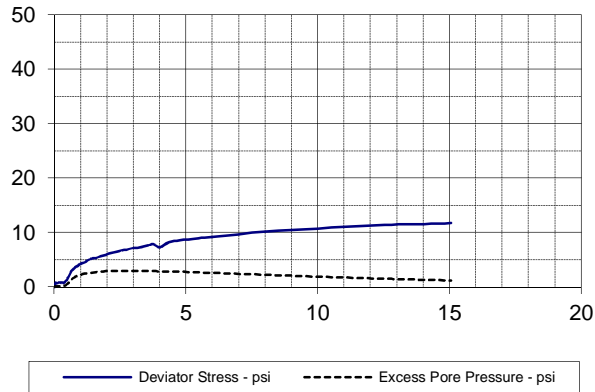
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Silty Sand (SM)
 SAMPLE LOCATION: B06-SPT-12, T3, 35.0-37.0ft
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 42 PL: 34 PI: 8 Percent -200: 44.0
 REMARKS: Specimens trimmed to 2.0" in diameter.

PROJECT INFORMATION

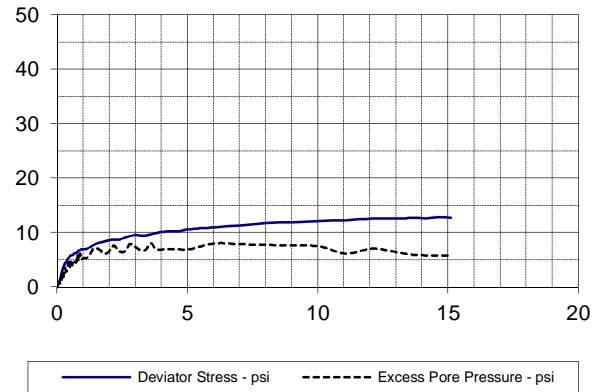
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 1/22/15

TERRACON

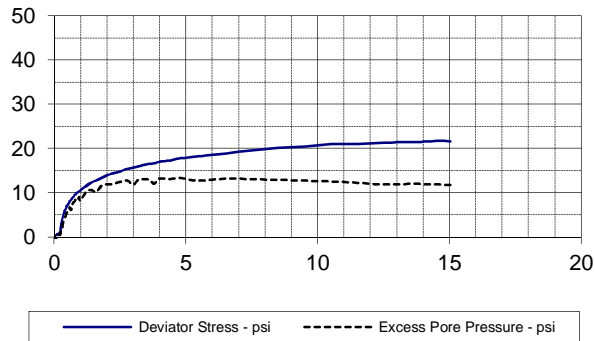
SPECIMEN NO. 1



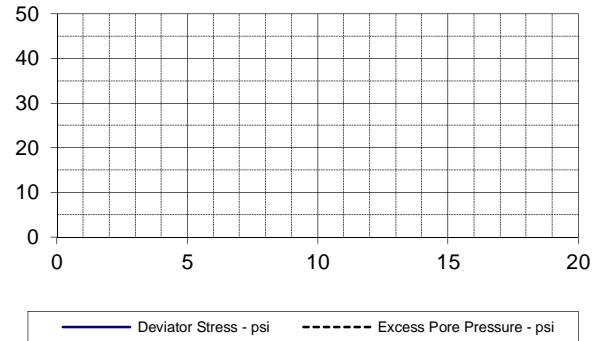
SPECIMEN NO. 2



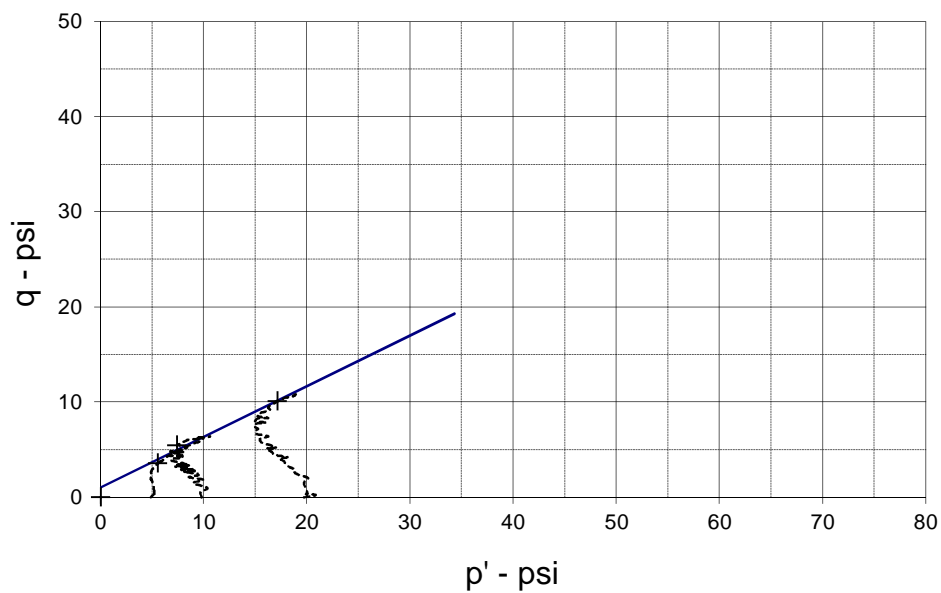
SPECIMEN NO. 3



SPECIMEN NO. 4

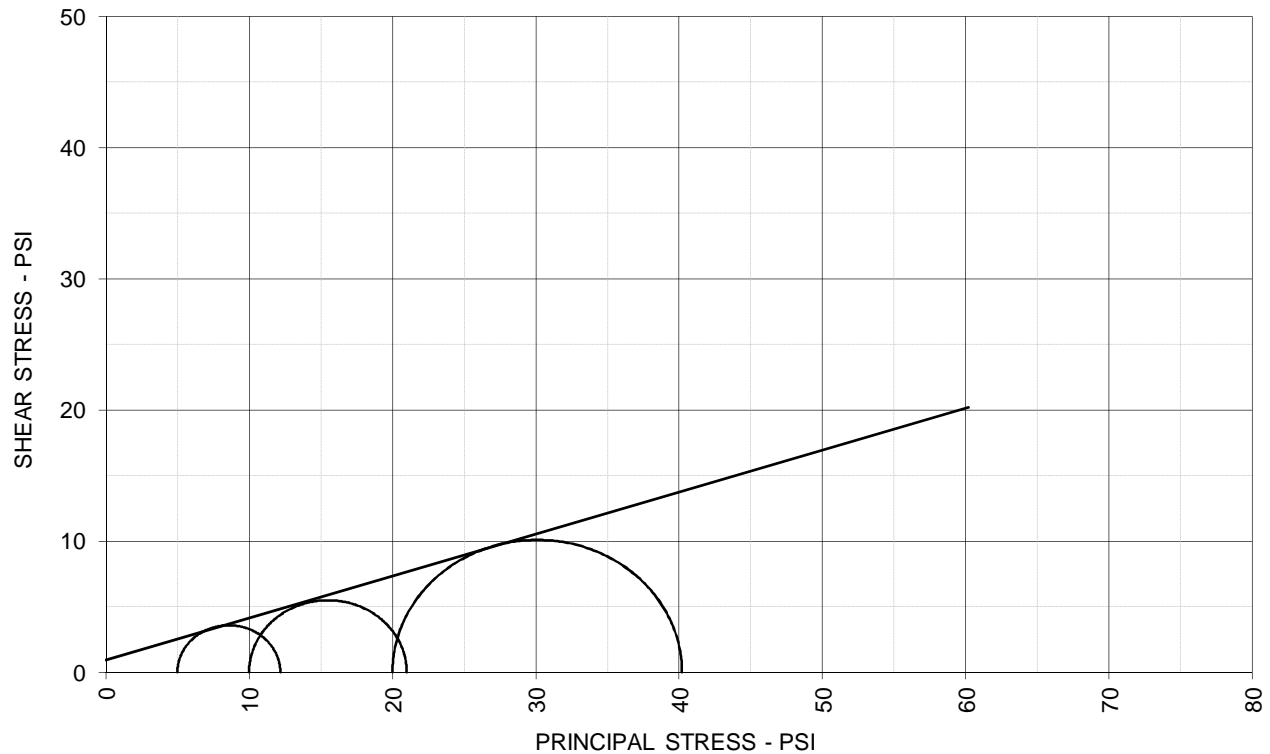


p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS	$R^2 = 0.99$	α (deg) = 28.1	a (psi) = 1.0
PROJECT: I-85/I-385 Interchange Modifications	TYPE OF TEST & NO: CU with Pore Pressure		
PROJECT NO: E2156301	TERRACON		
DESCRIPTION: Silty Sand (SM)			

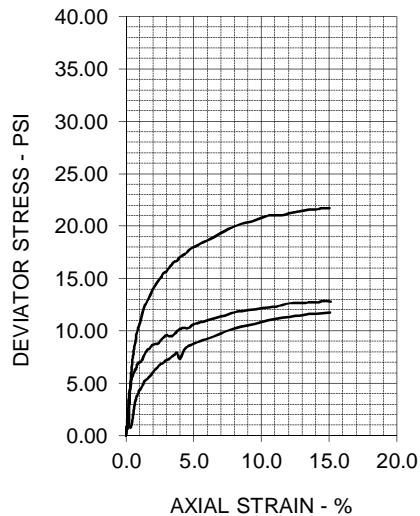
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

$\phi = 17.7 \text{ deg}$

$c = 0.9 \text{ psi}$



SPECIMEN NO.

1

2

3

4

INITIAL

Moisture Content - %

34.7

37.8

37.8

Dry Density - pcf

87.1

82.8

82.8

Diameter - inches

1.99

1.98

1.99

Height - inches

3.98

3.97

3.98

AT TEST

Final Moisture - %

34.2

35.9

33.7

Dry Density - pcf

87.1

84.5

87.6

Calculated Diameter (in.)

1.97

1.95

1.95

Height - inches

3.93

3.89

3.87

Effect. Cell Pressure - psi

5.0

10.0

20.0

Failure Stress - psi

7.18

11.00

20.20

Total Pore Pressure - psi

53.0

58.1

63.0

Strain Rate - inches/min.

0.00040

0.00040

0.00040

Failure Strain - %

2.9

6.0

8.5

σ_1 Failure - psi

12.18

21.00

40.20

σ_3 Failure - psi

5.00

10.00

20.00

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Silty Sand (SM)

SAMPLE LOCATION: B06-SPT-12, T3, 35.0-37.0ft

ASSUMED SPECIFIC GRAVITY: 2.7

LL: 42 PL: 34 PI: 8 Percent -200: 44.0

REMARKS: Specimens trimmed to 2.0" in diameter.

PROJECT INFORMATION

PROJECT: I-85/I-385 Interchange Modifications

LOCATION: I-85/I-385 Interchange

PROJECT NO: E2156301

CLIENT: Thompson Engineering

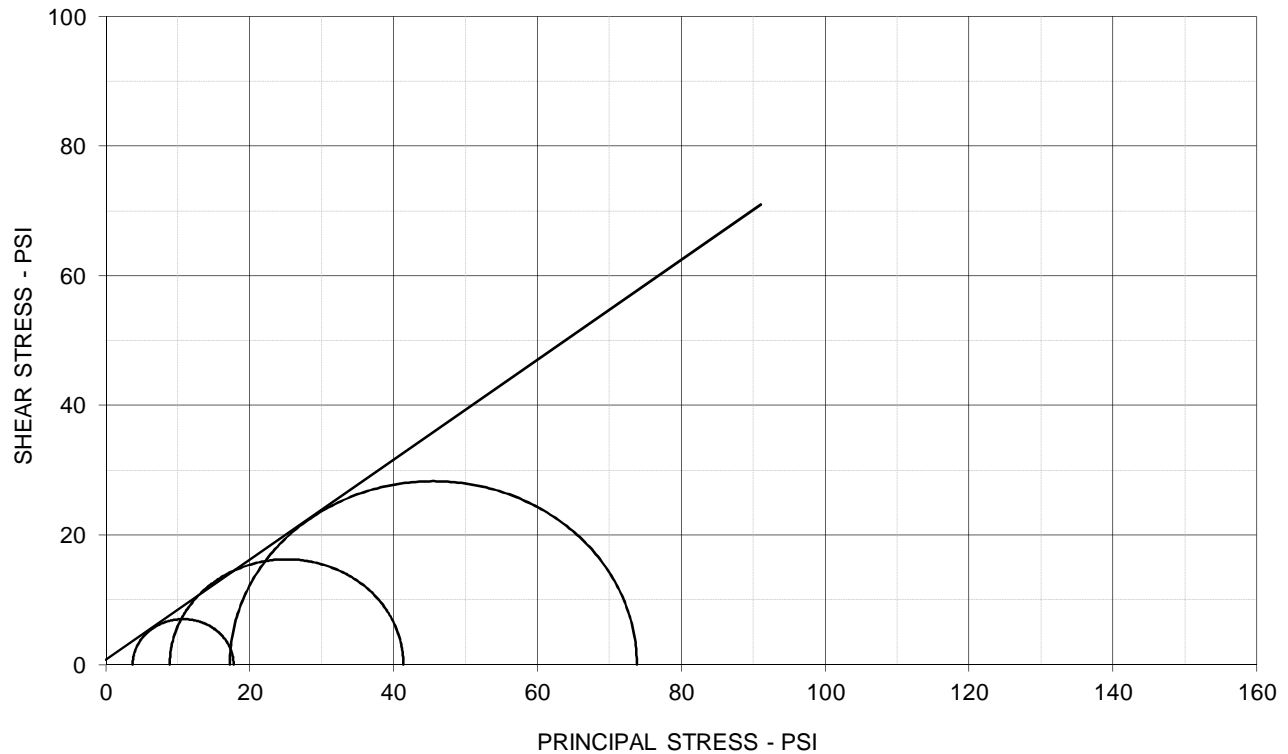
DATE: 1/22/15

TERRACON

TRIAXIAL SHEAR TEST REPORT



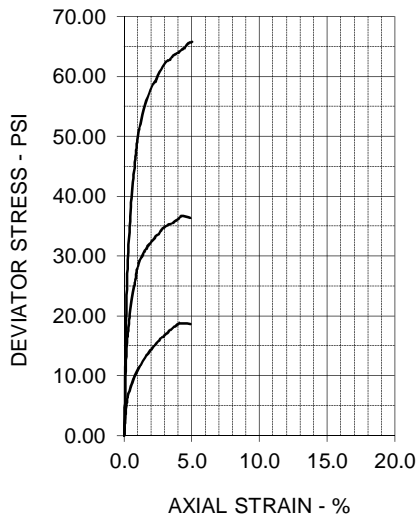
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 37.6 \text{ deg}$

$c' = 0.8 \text{ psi}$



SPECIMEN NO.

1

2

3

4

INITIAL

Moisture Content - %

27.2

27.2

27.2

Dry Density - pcf

101.4

101.4

101.4

Diameter - inches

2.82

2.82

2.82

Height - inches

5.72

5.72

5.72

AT TEST

Final Moisture - %

21.9

Dry Density - pcf

102.2

103.8

105.5

Calculated Diameter (in.)

2.80

2.82

2.82

Height - inches

5.66

5.71

5.72

Effect. Cell Pressure - psi

10.0

20.0

40.0

Failure Stress - psi

14.02

32.48

56.59

Total Pore Pressure - psi

56.3

61.1

72.8

Strain Rate - inches/min.

0.00060

0.00060

0.00060

Failure Strain - %

1.9

2.1

1.8

σ_1' Failure - psi

17.77

41.38

73.83

σ_3' Failure - psi

3.75

8.90

17.24

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Brown Sandy Clay

SAMPLE LOCATION: W2A-MB2-01, T-1, 10.0-12.0ft

SPECIFIC GRAVITY: 2.701

LL: PL: PI: Percent -200:

REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: I-85/I-385 Interchange Modifications

LOCATION: I-85/I-385 Interchange

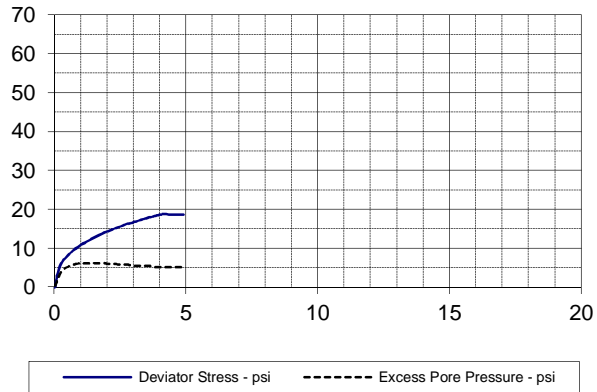
PROJECT NO: E2156301

CLIENT: Thompson Engineering

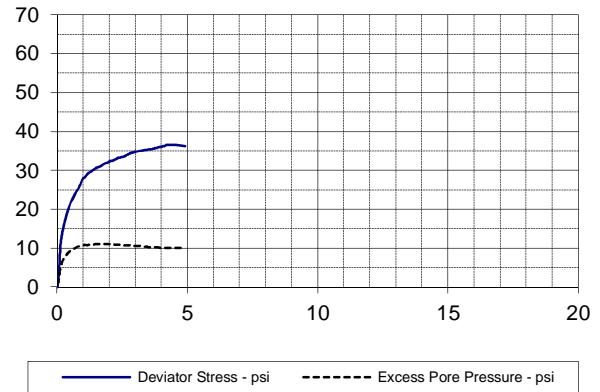
DATE: 5/14/15

TERRACON

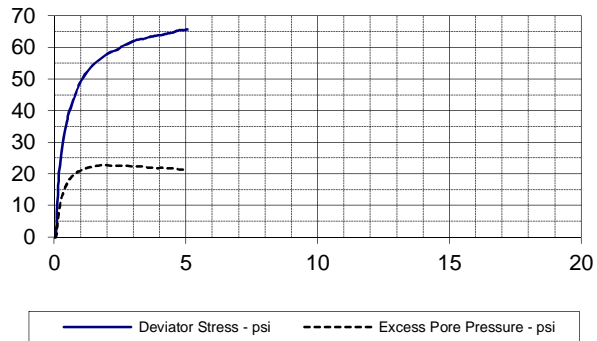
SPECIMEN NO. 1



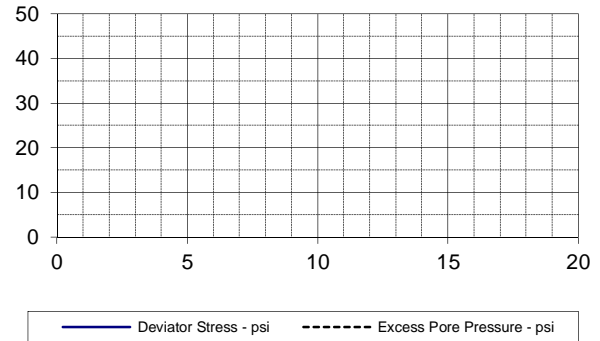
SPECIMEN NO. 2



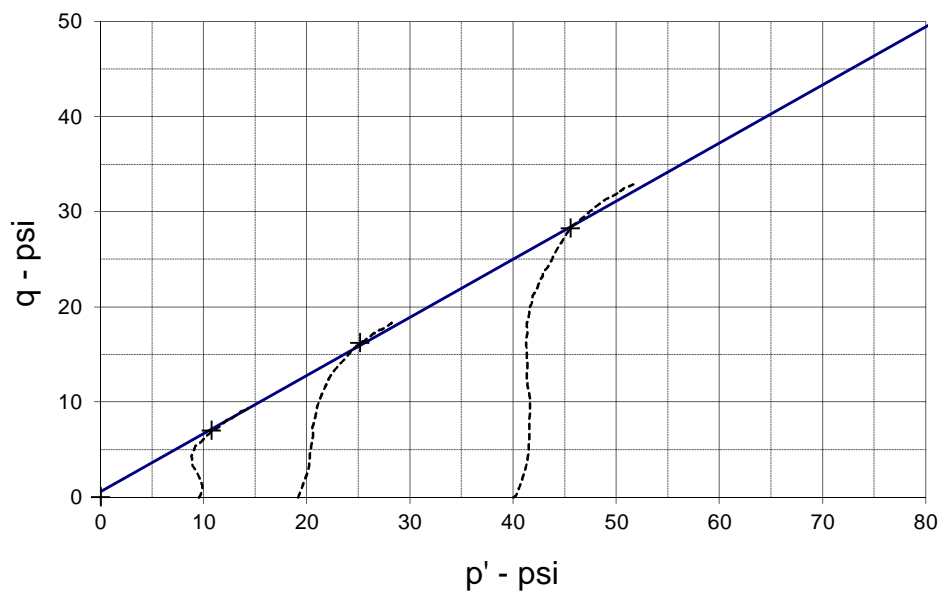
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 31.4

a (psi) = 0.6

PROJECT: I-85/I-385 Interchange Modifications

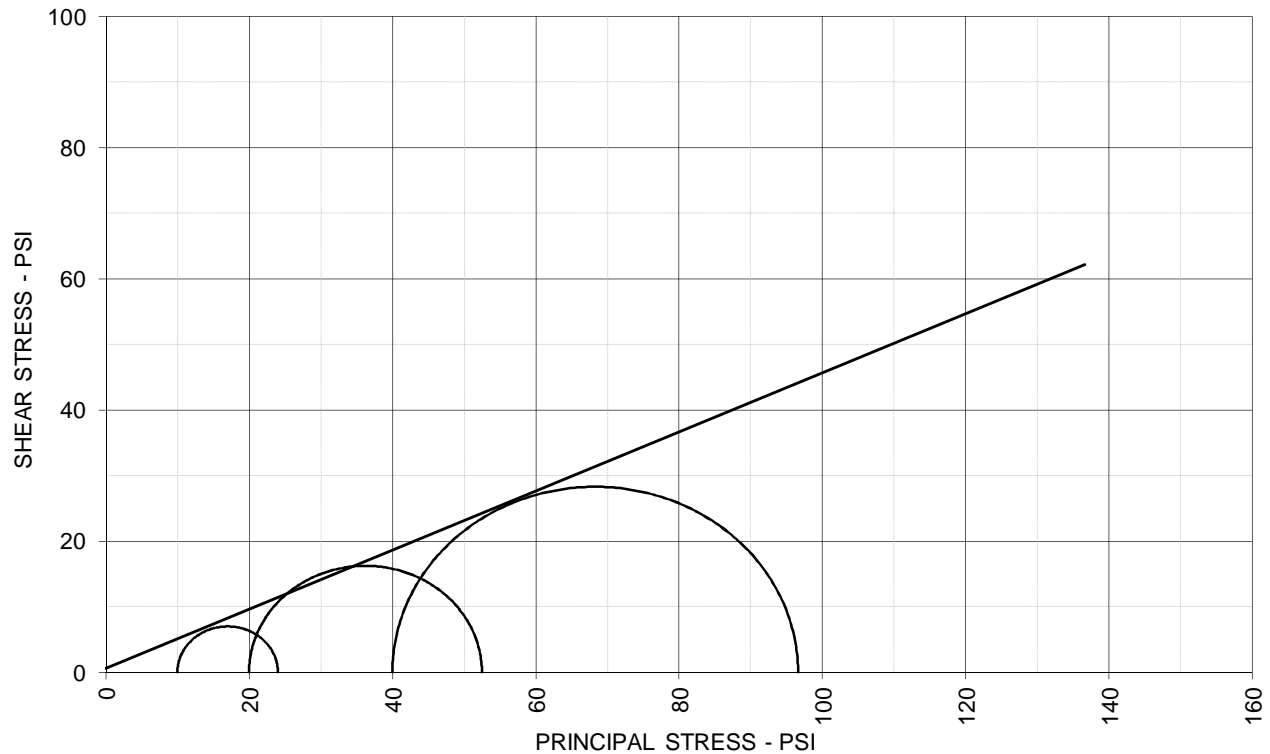
TYPE OF TEST & NO: CU with Pore Pressure

PROJECT NO: E2156301

DESCRIPTION: Brown Sandy Clay

TERRACON

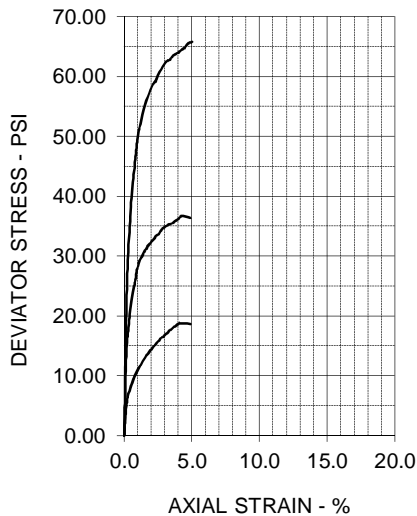
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

$\phi = 24.3 \text{ deg}$

$c = 0.6 \text{ psi}$



SPECIMEN NO.

1

2

3

4

INITIAL

Moisture Content - %

27.2

27.2

27.2

Dry Density - pcf

101.4

101.4

101.4

Diameter - inches

2.82

2.82

2.82

Height - inches

5.72

5.72

5.72

AT TEST

Final Moisture - %

21.9

Dry Density - pcf

102.2

103.8

105.5

Calculated Diameter (in.)

2.80

2.82

2.82

Height - inches

5.66

5.71

5.72

Effect. Cell Pressure - psi

10.0

20.0

40.0

Failure Stress - psi

14.02

32.48

56.59

Total Pore Pressure - psi

56.3

61.1

72.8

Strain Rate - inches/min.

0.00060

0.00060

0.00060

Failure Strain - %

1.9

2.1

1.8

σ_1 Failure - psi

24.02

52.48

96.59

σ_3 Failure - psi

10.00

20.00

40.00

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure

SAMPLE TYPE: Shelby Tube

DESCRIPTION: Brown Sandy Clay

SAMPLE LOCATION: W2A-MB2-01, T-1, 10.0-12.0ft

SPECIFIC GRAVITY: 2.701

LL: PL: PI: Percent -200:

REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: I-85/I-385 Interchange Modifications

LOCATION: I-85/I-385 Interchange

PROJECT NO: E2156301

CLIENT: Thompson Engineering

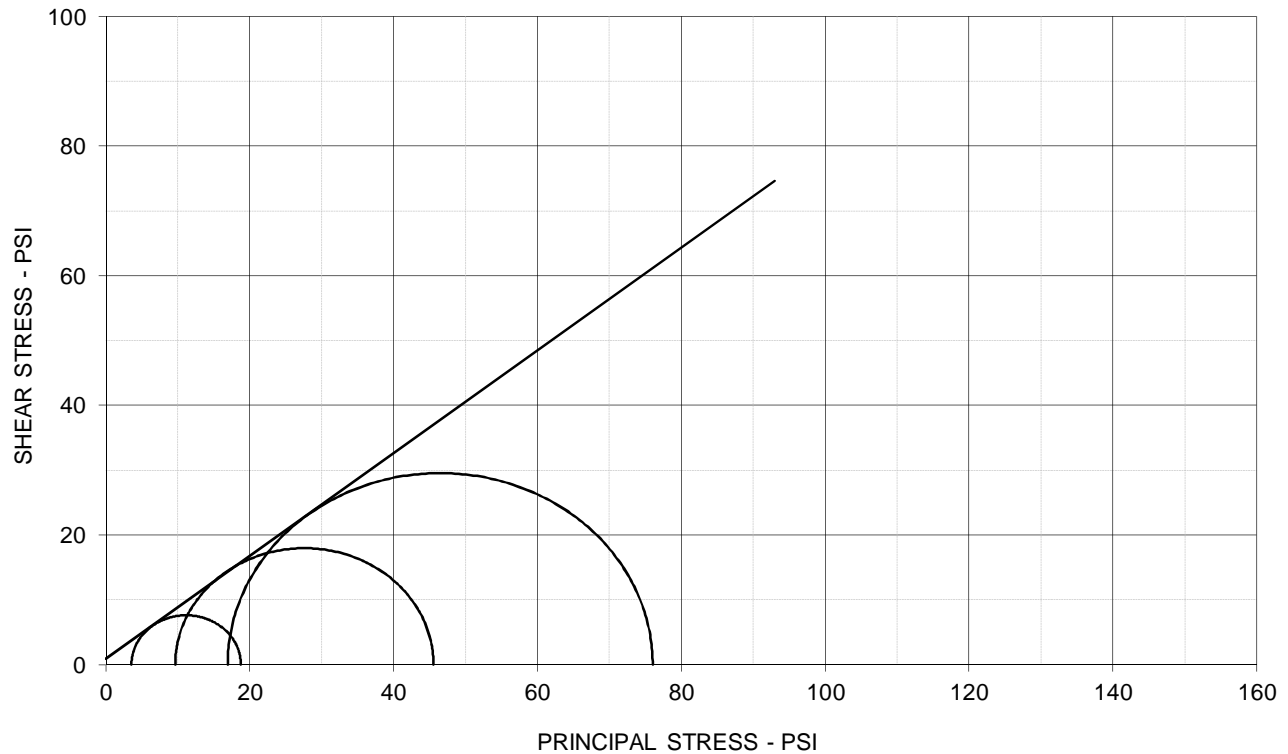
DATE: 5/14/15

TERRACON

TRIAXIAL SHEAR TEST REPORT



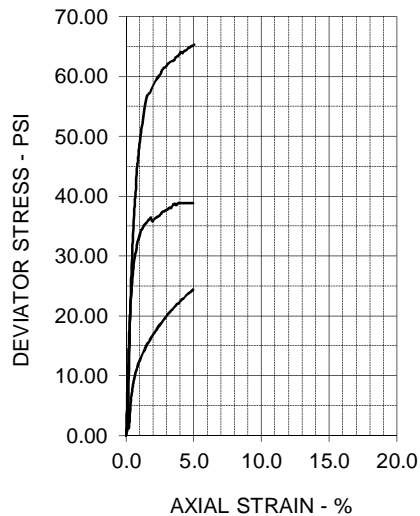
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 38.4 \text{ deg}$

$c' = 0.9 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	23.5	23.5	23.5
Dry Density - pcf	103.2	103.2	103.2
Diameter - inches	2.85	2.85	2.85
Height - inches	5.64	5.64	5.64

AT TEST

Final Moisture - %			21.3
Dry Density - pcf	103.7	104.9	106.2
Calculated Diameter (in.)	2.84	2.86	2.85
Height - inches	5.61	5.65	5.64
Effect. Cell Pressure - psi	10.0	20.0	40.0
Failure Stress - psi	15.20	35.90	59.08
Total Pore Pressure - psi	56.4	60.3	73.1
Strain Rate - inches/min.	0.00060	0.00060	0.00060
Failure Strain - %	1.6	1.6	2.2
σ_1' Failure - psi	18.78	45.56	76.03
σ_3' Failure - psi	3.58	9.66	16.95

TEST DESCRIPTION

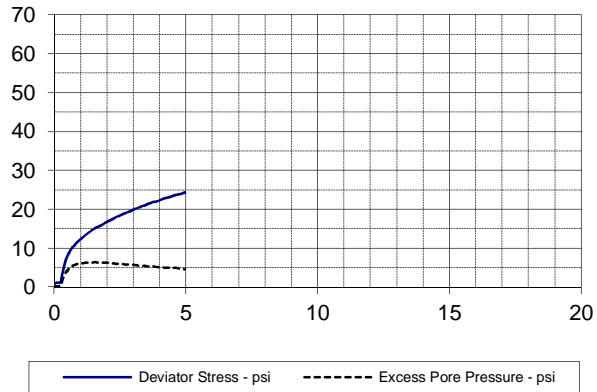
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Grayish Brown Silty Sand
 SAMPLE LOCATION: W1B-2R-02, T-1, 8.0-10.0ft
 SPECIFIC GRAVITY: 2.624
 LL: PL: PI: Percent -200:
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

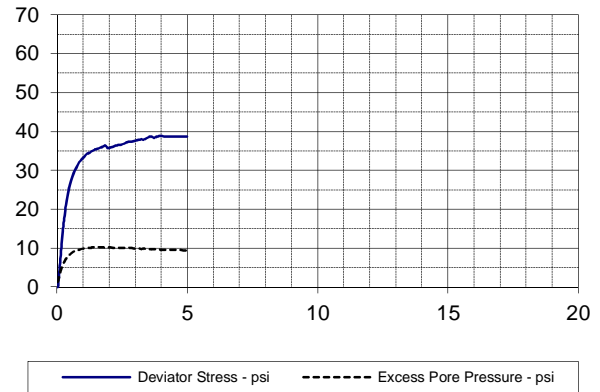
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 5/14/15

TERRACON

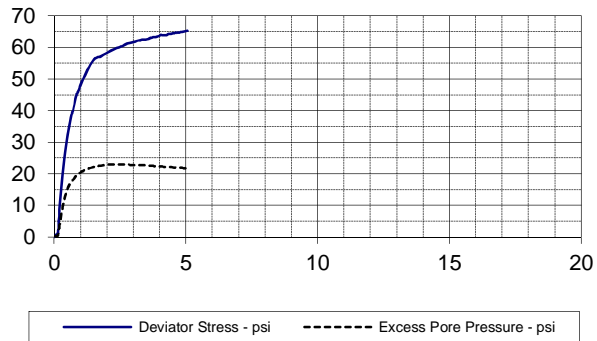
SPECIMEN NO. 1



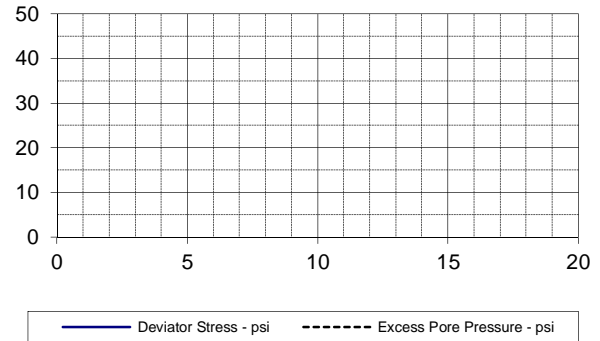
SPECIMEN NO. 2



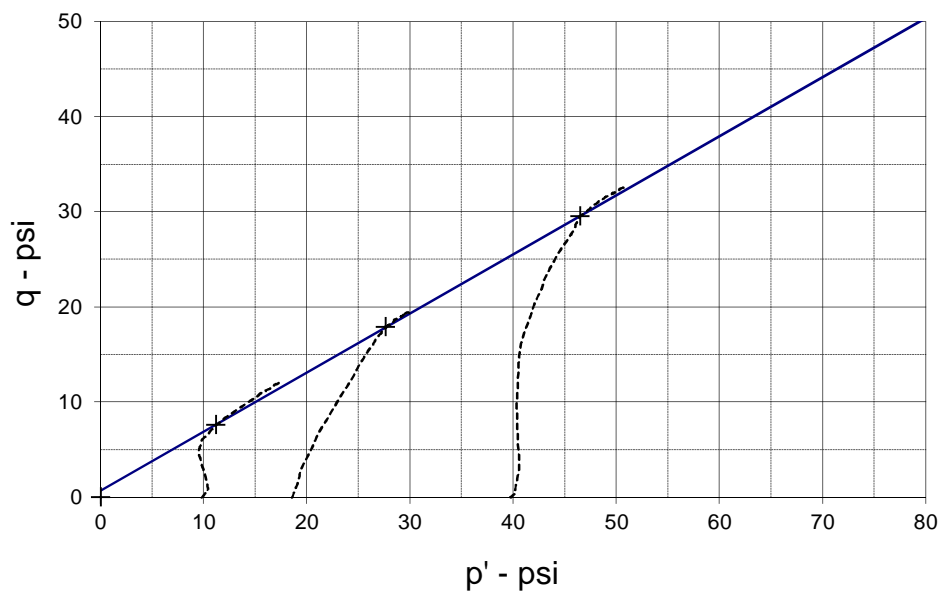
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 31.8

a (psi) = 0.7

PROJECT: I-85/I-385 Interchange Modifications

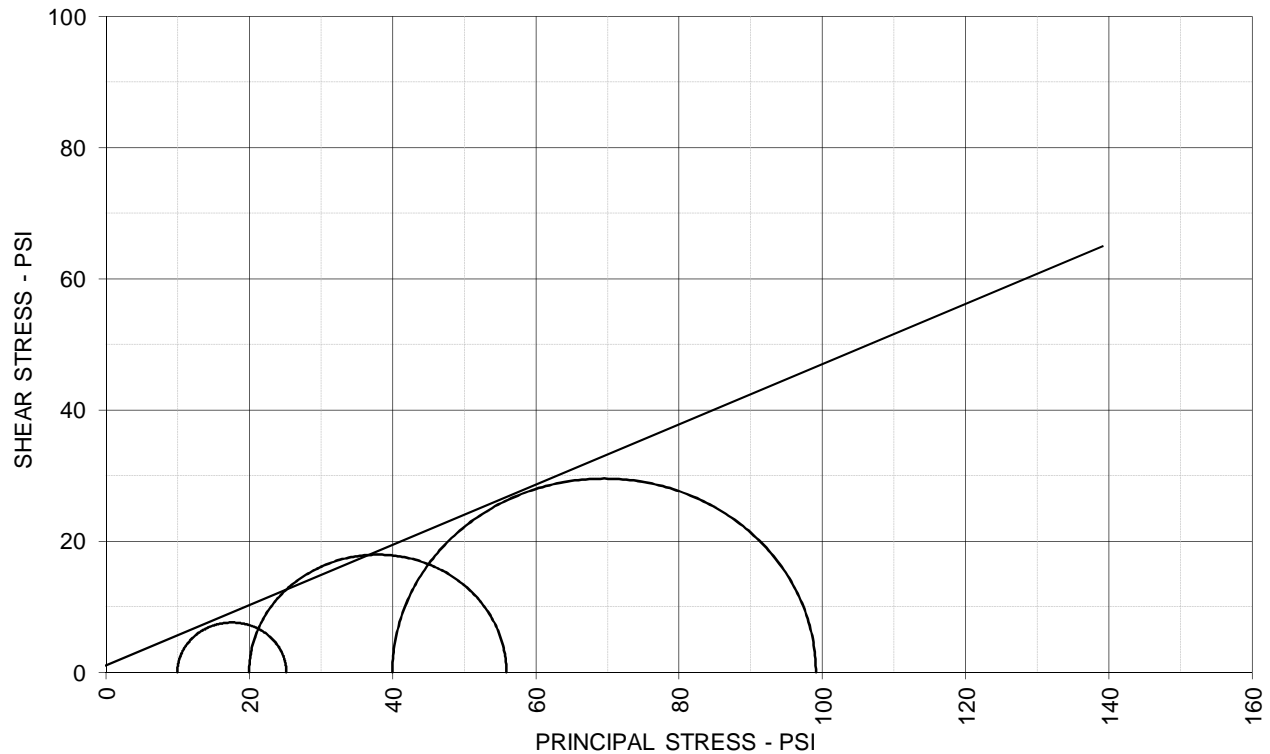
TYPE OF TEST & NO: CU with Pore Pressure

PROJECT NO: E2156301

DESCRIPTION: Grayish Brown Silty Sand

TERRACON

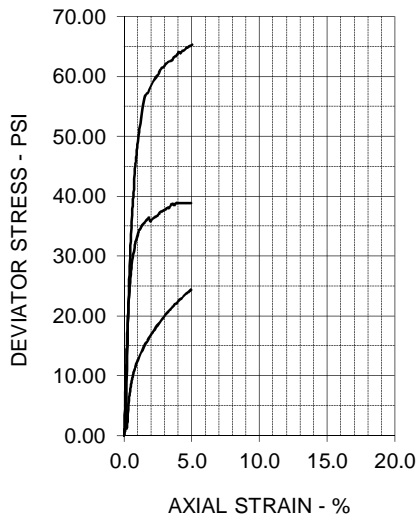
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

$\phi = 24.7 \text{ deg}$

$c = 1.0 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	23.5	23.5	23.5
Dry Density - pcf	103.2	103.2	103.2
Diameter - inches	2.85	2.85	2.85
Height - inches	5.64	5.64	5.64

AT TEST

Final Moisture - %			21.3
Dry Density - pcf	103.7	104.9	106.2
Calculated Diameter (in.)	2.84	2.86	2.85
Height - inches	5.61	5.65	5.64
Effect. Cell Pressure - psi	10.0	20.0	40.0
Failure Stress - psi	15.20	35.90	59.08
Total Pore Pressure - psi	56.4	60.3	73.1
Strain Rate - inches/min.	0.00060	0.00060	0.00060
Failure Strain - %	1.6	1.6	2.2
σ_1 Failure - psi	25.20	55.90	99.08
σ_3 Failure - psi	10.00	20.00	40.00

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Grayish Brown Silty Sand
 SAMPLE LOCATION: W1B-2R-02, T-1, 8.0-10.0ft
 SPECIFIC GRAVITY: 2.624
 LL: PL: PI: Percent -200:
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

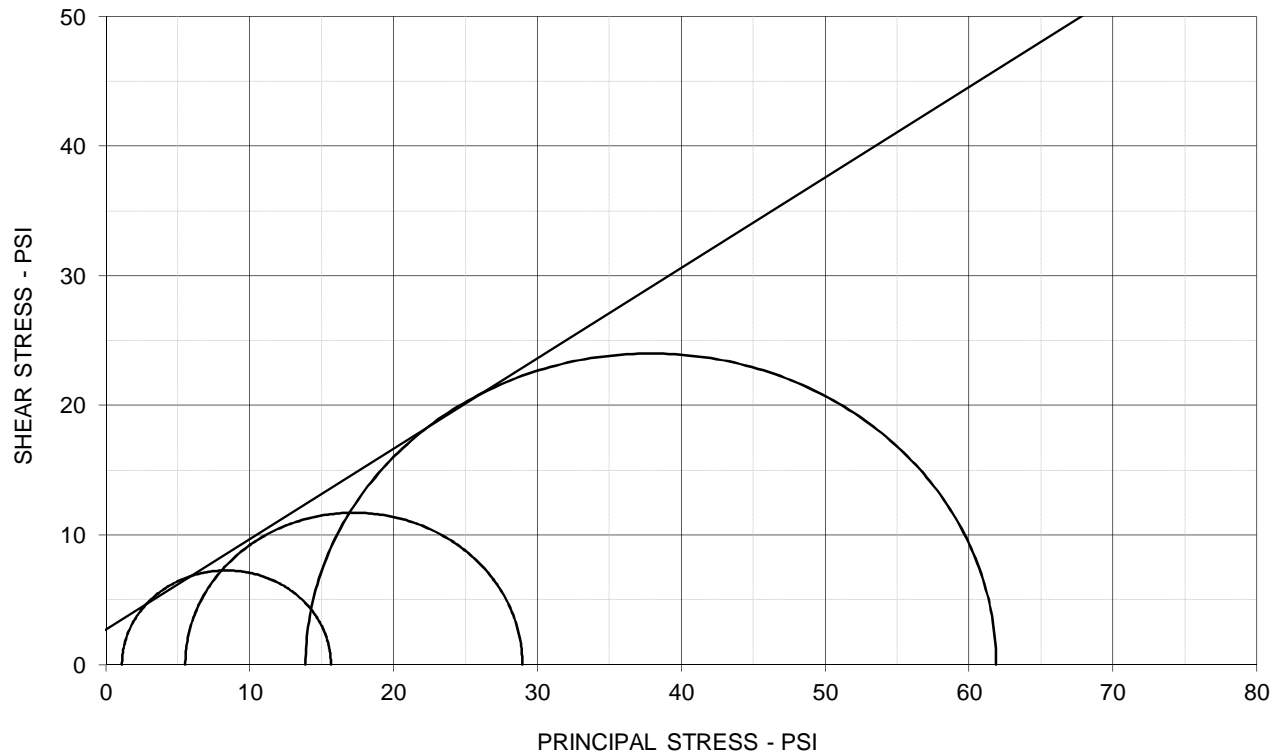
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 5/14/15

TERRACON

TRIAXIAL SHEAR TEST REPORT



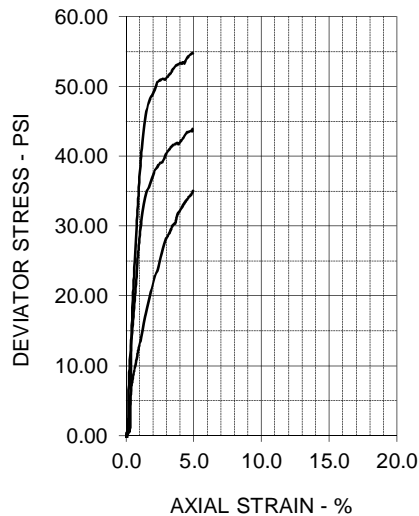
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 34.9 \text{ deg}$

$c' = 2.7 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	20.1	20.1	20.1
Dry Density - pcf	101.0	101.0	101.0
Diameter - inches	2.02	2.02	2.02
Height - inches	4.01	4.01	4.01

AT TEST

Final Moisture - %			23.5
Dry Density - pcf	101.0	101.4	102.4
Calculated Diameter (in.)	2.02	2.02	2.02
Height - inches	4.01	4.01	4.02
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	14.52	23.43	48.00
Total Pore Pressure - psi	53.9	54.5	56.1
Strain Rate - inches/min.	0.00040	0.00040	0.00040
Failure Strain - %	1.2	0.8	1.7
σ_1' Failure - psi	15.65	28.96	61.89
σ_3' Failure - psi	1.13	5.53	13.89

TEST DESCRIPTION

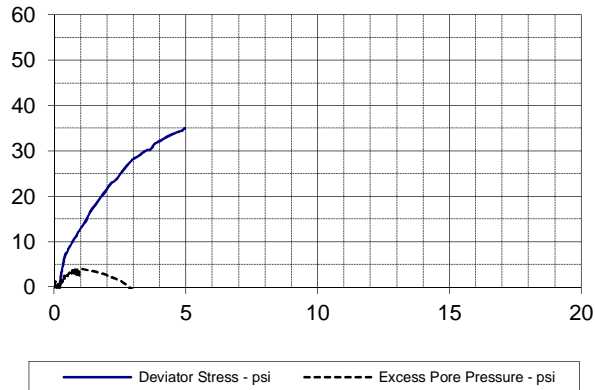
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Sandy Lean Clay (CL)
 SAMPLE LOCATION: W1B-2R-03, T-1, 4.0-6.0ft
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 43 PL: 23 PI: 20 Percent -200: 56.3
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

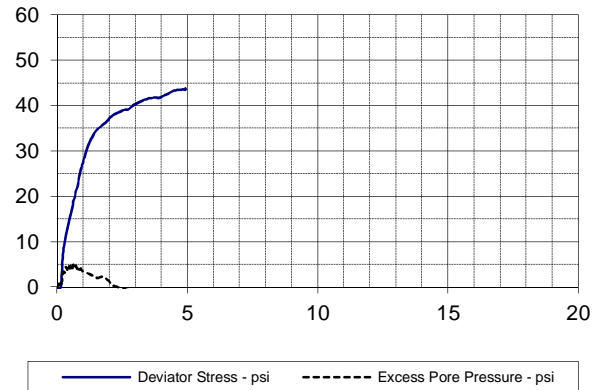
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 1/22/15

TERRACON

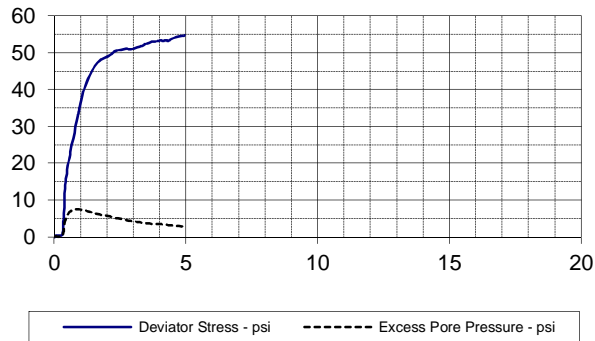
SPECIMEN NO. 1



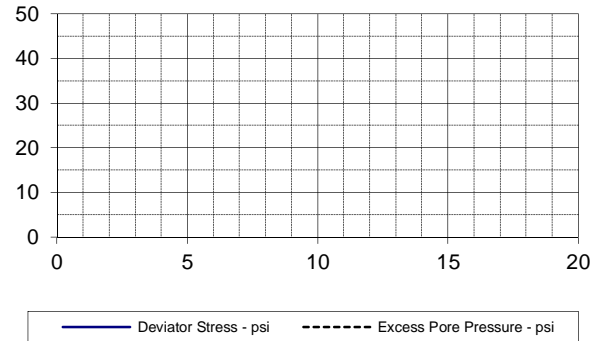
SPECIMEN NO. 2



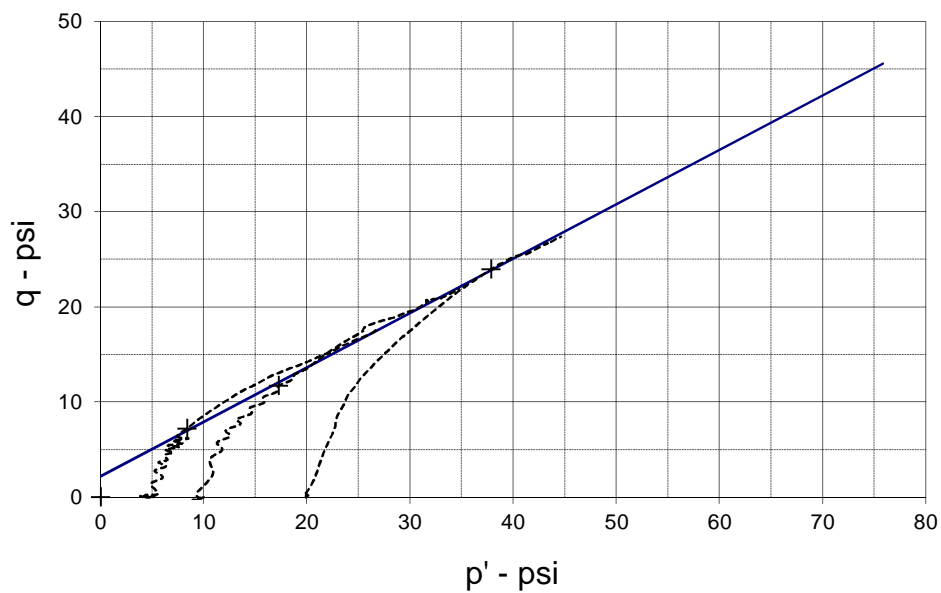
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 29.8

a (psi) = 2.2

PROJECT: I-85/I-385 Interchange Modifications

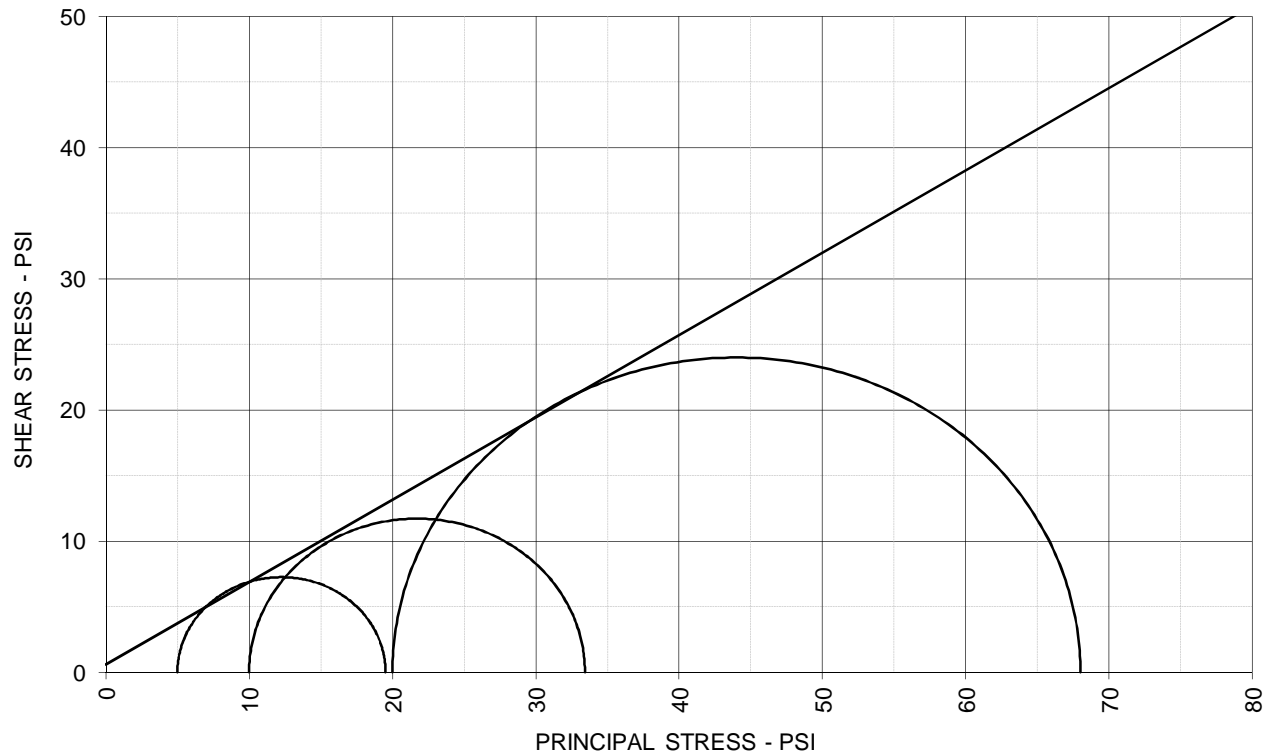
TYPE OF TEST & NO: CU with Pore Pressure

PROJECT NO: E2156301

DESCRIPTION: Sandy Lean Clay (CL)

TERRACON

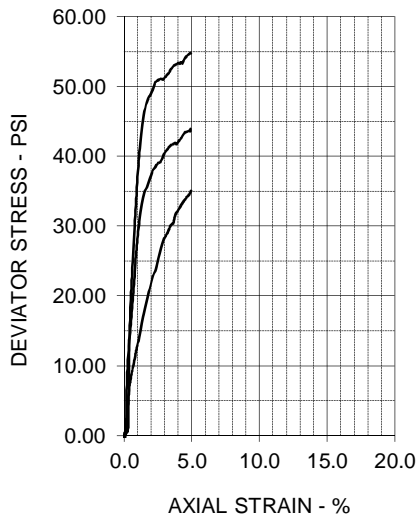
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

$\phi = 32.1 \text{ deg}$

$c = 0.6 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	20.1	20.1	20.1
Dry Density - pcf	101.0	101.0	101.0
Diameter - inches	2.02	2.02	2.02
Height - inches	4.01	4.01	4.01

AT TEST

Final Moisture - %			23.5
Dry Density - pcf	101.0	101.4	102.4
Calculated Diameter (in.)	2.02	2.02	2.02
Height - inches	4.01	4.01	4.02
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	14.52	23.43	48.00
Total Pore Pressure - psi	53.9	54.5	56.1
Strain Rate - inches/min.	0.00040	0.00040	0.00040
Failure Strain - %	1.2	0.8	1.7
σ_1 Failure - psi	19.52	33.43	68.00
σ_3 Failure - psi	5.00	10.00	20.00

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Sandy Lean Clay (CL)
 SAMPLE LOCATION: W1B-2R-03, T-1, 4.0-6.0ft
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 43 PL: 23 PI: 20 Percent -200: 56.3
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

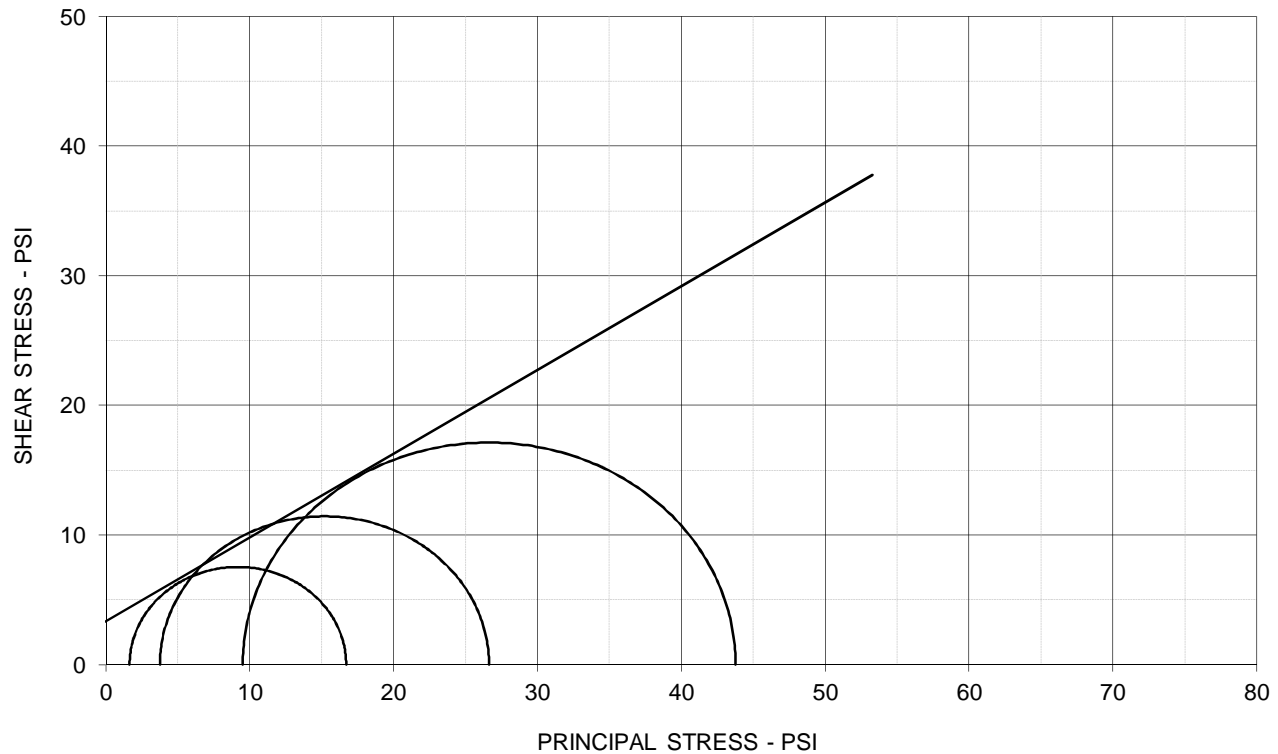
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 1/22/15

TERRACON

TRIAXIAL SHEAR TEST REPORT



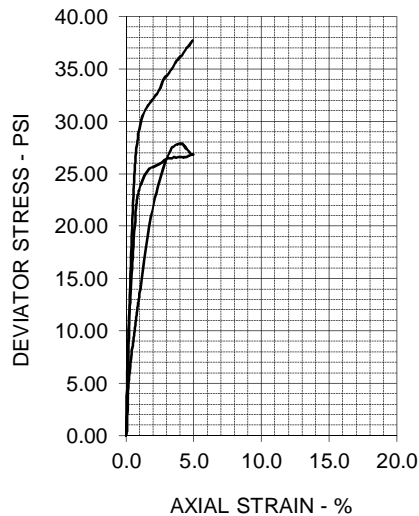
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 32.9 \text{ deg}$

$c' = 3.3 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	22.1	22.1	22.1
Dry Density - pcf	106.4	106.4	106.4
Diameter - inches	2.86	2.86	2.86
Height - inches	5.72	5.72	5.72

AT TEST

Final Moisture - %			20.7
Dry Density - pcf	106.4	107.0	107.9
Calculated Diameter (in.)	2.84	2.86	2.85
Height - inches	5.67	5.72	5.71
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	15.05	22.87	34.25
Total Pore Pressure - psi	53.3	56.2	60.5
Strain Rate - inches/min.	0.00060	0.00060	0.00060
Failure Strain - %	1.2	0.9	2.7
σ_1' Failure - psi	16.71	26.64	43.77
σ_3' Failure - psi	1.66	3.77	9.52

TEST DESCRIPTION

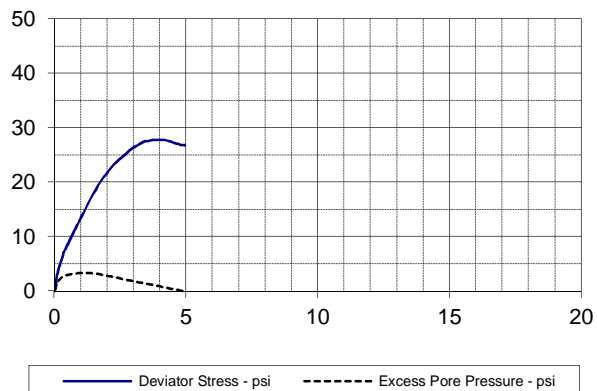
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Silty Sand (SM)
 SAMPLE LOCATION: W1B-2R-03, T-2, 15.0-17.0ft
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 43 PL: 35 PI: 8 Percent -200: 21.9
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

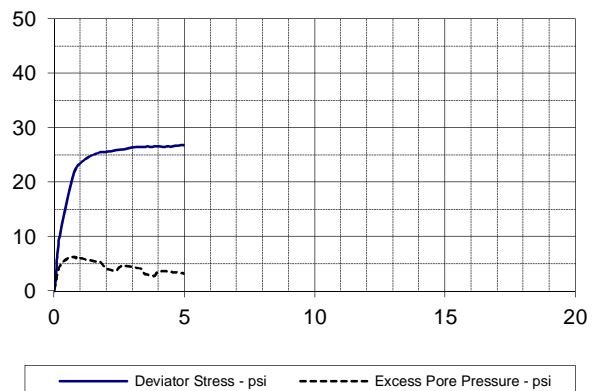
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 1/22/15

TERRACON

SPECIMEN NO. 1



SPECIMEN NO. 2



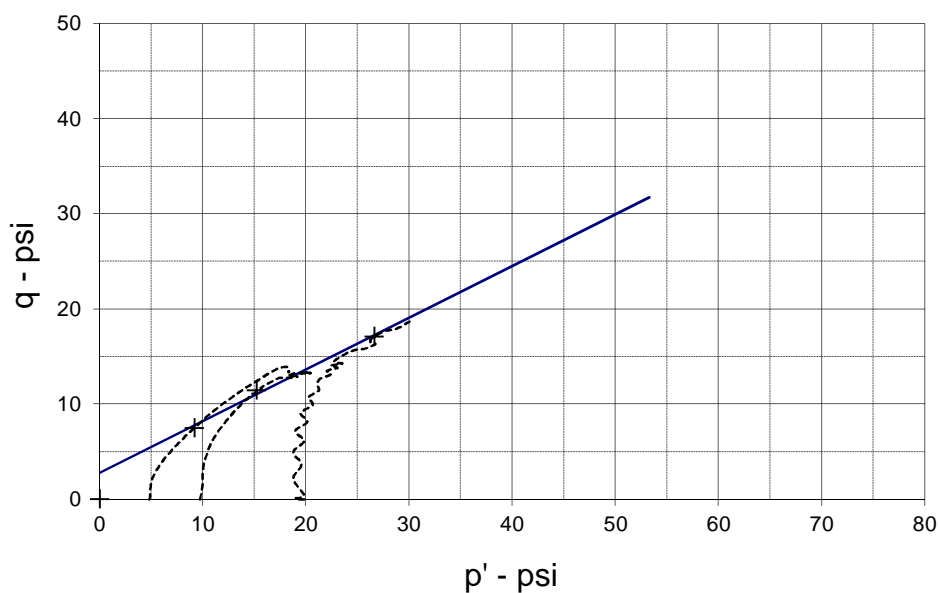
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 28.5

a (psi) = 2.8

PROJECT: I-85/I-385 Interchange Modifications

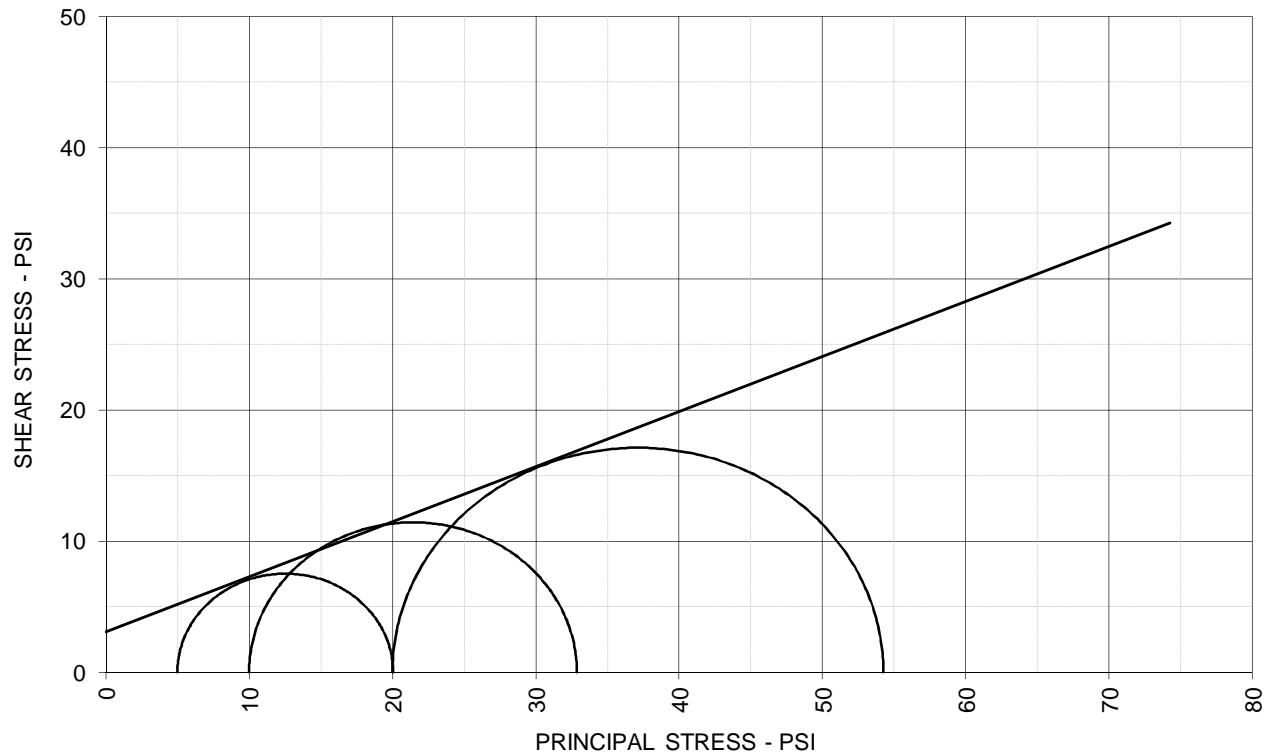
TYPE OF TEST & NO: CU with Pore Pressure

PROJECT NO: E2156301

DESCRIPTION: Silty Sand (SM)

TERRACON

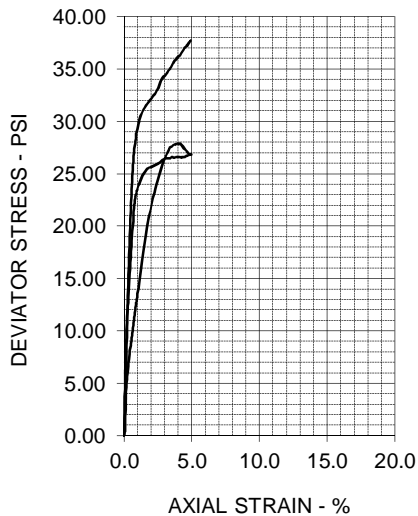
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

$\phi = 22.8 \text{ deg}$

$c = 3.1 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	22.1	22.1	22.1
Dry Density - pcf	106.4	106.4	106.4
Diameter - inches	2.86	2.86	2.86
Height - inches	5.72	5.72	5.72

AT TEST

Final Moisture - %			20.7
Dry Density - pcf	106.4	107.0	107.9
Calculated Diameter (in.)	2.84	2.86	2.85
Height - inches	5.67	5.72	5.71
Effect. Cell Pressure - psi	5.0	10.0	20.0
Failure Stress - psi	15.05	22.87	34.25
Total Pore Pressure - psi	53.3	56.2	60.5
Strain Rate - inches/min.	0.00060	0.00060	0.00060
Failure Strain - %	1.2	0.9	2.7
σ_1 Failure - psi	20.05	32.87	54.25
σ_3 Failure - psi	5.00	10.00	20.00

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Silty Sand (SM)
 SAMPLE LOCATION: W1B-2R-03, T-2, 15.0-17.0ft
 ASSUMED SPECIFIC GRAVITY: 2.7
 LL: 43 PL: 35 PI: 8 Percent -200: 21.9
 REMARKS: Multistage Triaxial

PROJECT INFORMATION

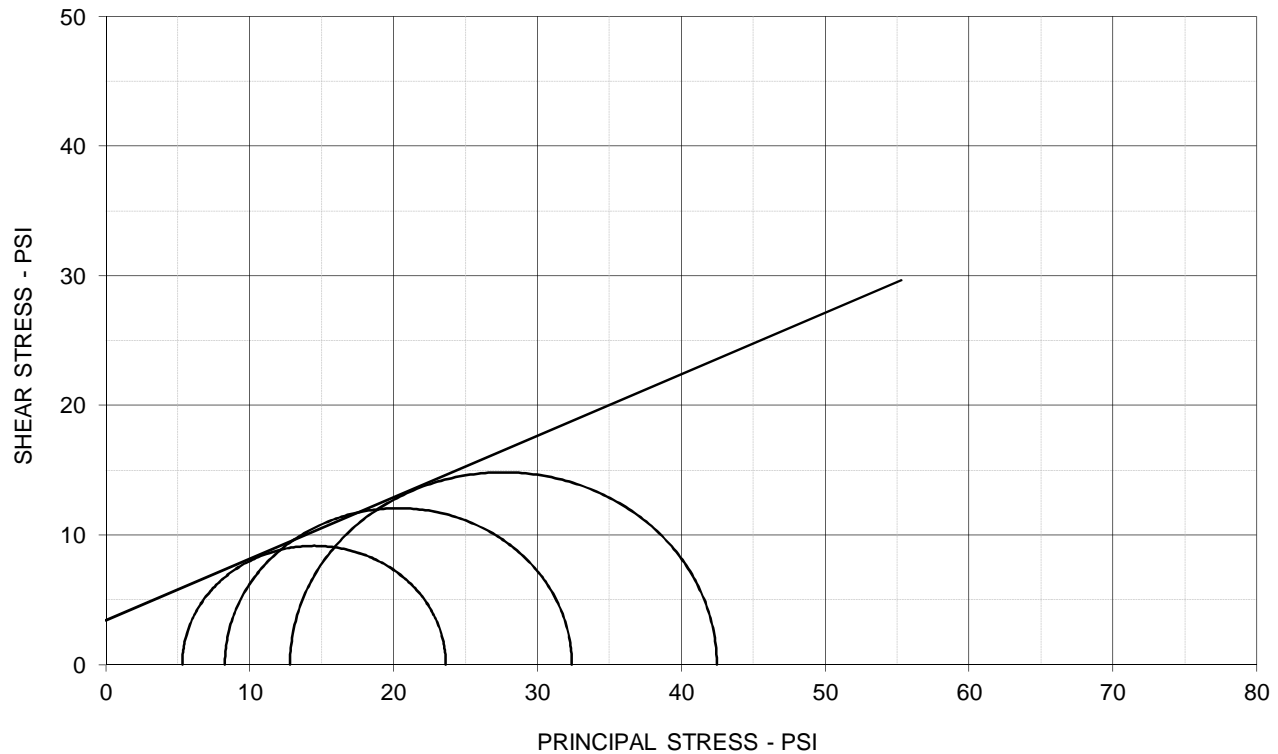
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 1/22/15

TERRACON

TRIAXIAL SHEAR TEST REPORT



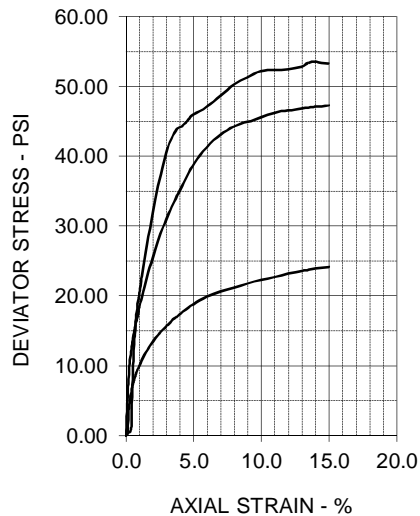
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS

$\phi' = 25.4 \text{ deg}$

$c' = 3.4 \text{ psi}$



SPECIMEN NO.

1 2 3 4

INITIAL

Moisture Content - %	35.9	27.2	24.2
Dry Density - pcf	88.5	95.3	97.1
Diameter - inches	2.82	2.84	2.86
Height - inches	5.67	5.68	5.69

AT TEST

Final Moisture - %	32.4	26.5	21.7
Dry Density - pcf	89.4	97.0	104.6
Calculated Diameter (in.)	2.80	2.83	2.83
Height - inches	5.61	5.63	5.60
Effect. Cell Pressure - psi	10.0	20.0	40.0
Failure Stress - psi	18.32	24.12	29.66
Total Pore Pressure - psi	54.7	61.7	77.2
Strain Rate - inches/min.	0.00060	0.00060	0.00060
Failure Strain - %	4.6	1.8	1.8
σ_1' Failure - psi	23.64	32.40	42.47
σ_3' Failure - psi	5.32	8.28	12.81

TEST DESCRIPTION

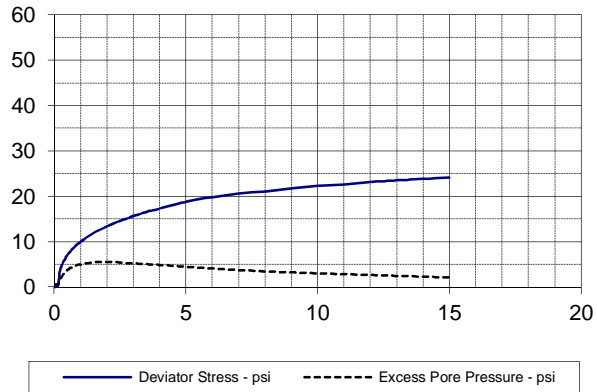
TYPE OF TEST & NO: CU with Pore Pressure
 SAMPLE TYPE: Shelby Tube
 DESCRIPTION: Yellowish Orange Sandy Clay
 SAMPLE LOCATION: W2A-MB2-01, T-1, 10.0-12.0ft
 SPECIFIC GRAVITY: 2.684
 LL: PL: PI: Percent -200:
 REMARKS: Three specimen series.

PROJECT INFORMATION

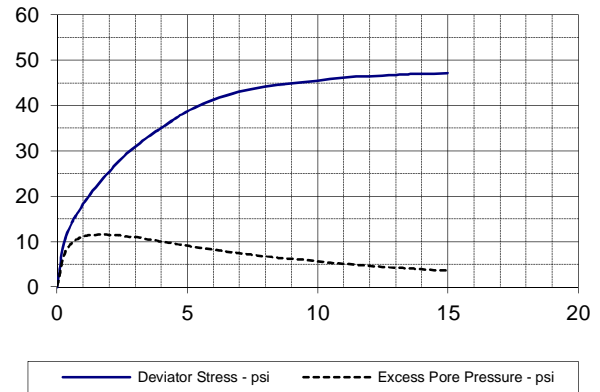
PROJECT: I-85/I-385 Interchange Modifications
 LOCATION: I-85/I-385 Interchange
 PROJECT NO: E2156301
 CLIENT: Thompson Engineering
 DATE: 5/14/15

TERRACON

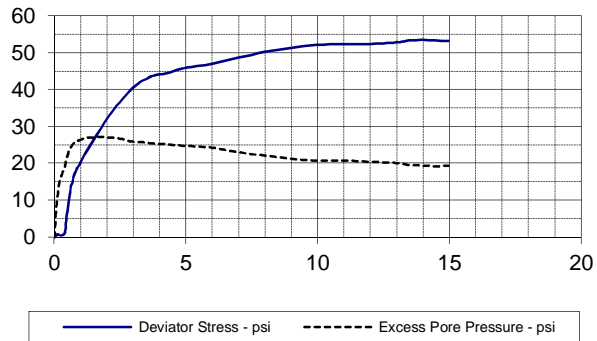
SPECIMEN NO. 1



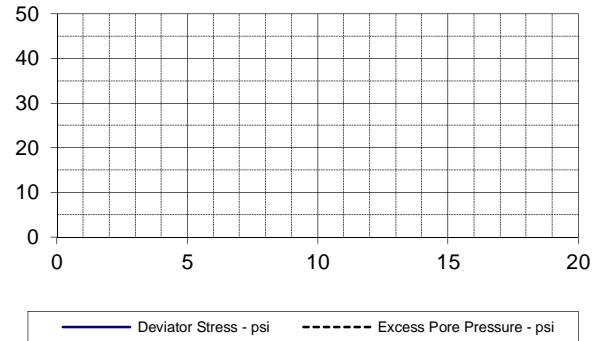
SPECIMEN NO. 2



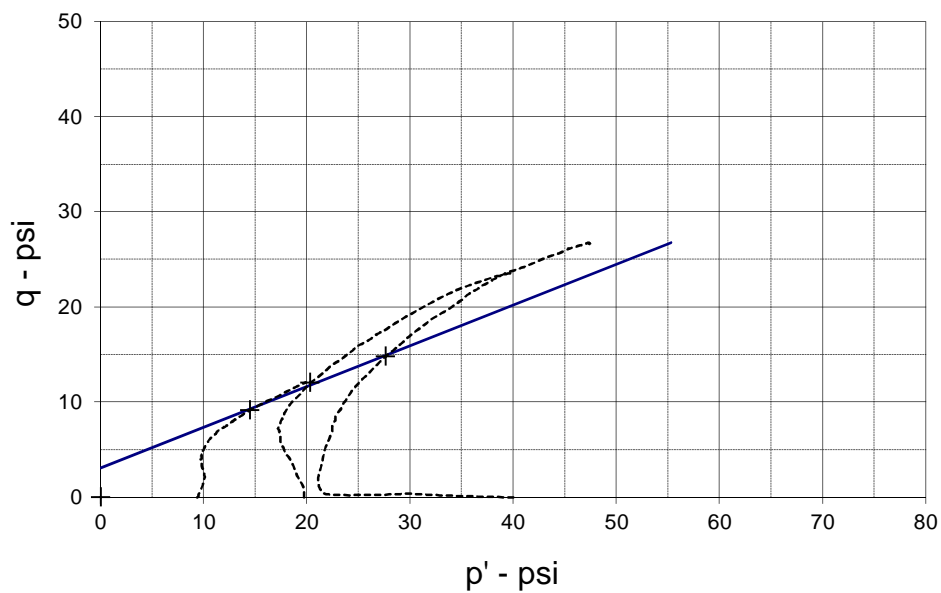
SPECIMEN NO. 3



SPECIMEN NO. 4



p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS

 $R^2 = 1.00$ α (deg) = 23.2 a (psi) = 3.1

PROJECT: I-85/I-385 Interchange Modifications

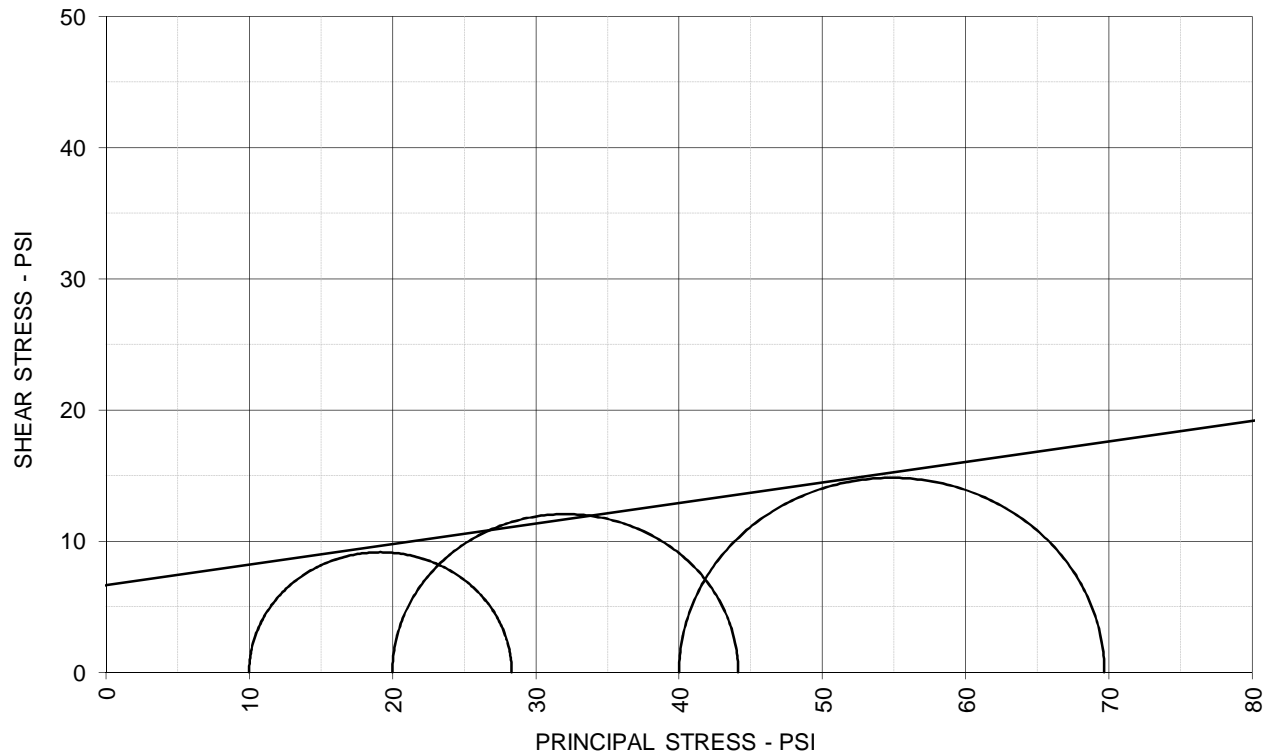
TYPE OF TEST & NO: CU with Pore Pressure

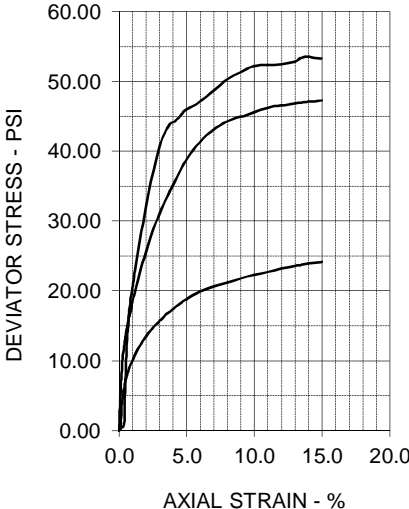
PROJECT NO: E2156301

DESCRIPTION: Yellowish Orange Sandy Clay

TERRACON

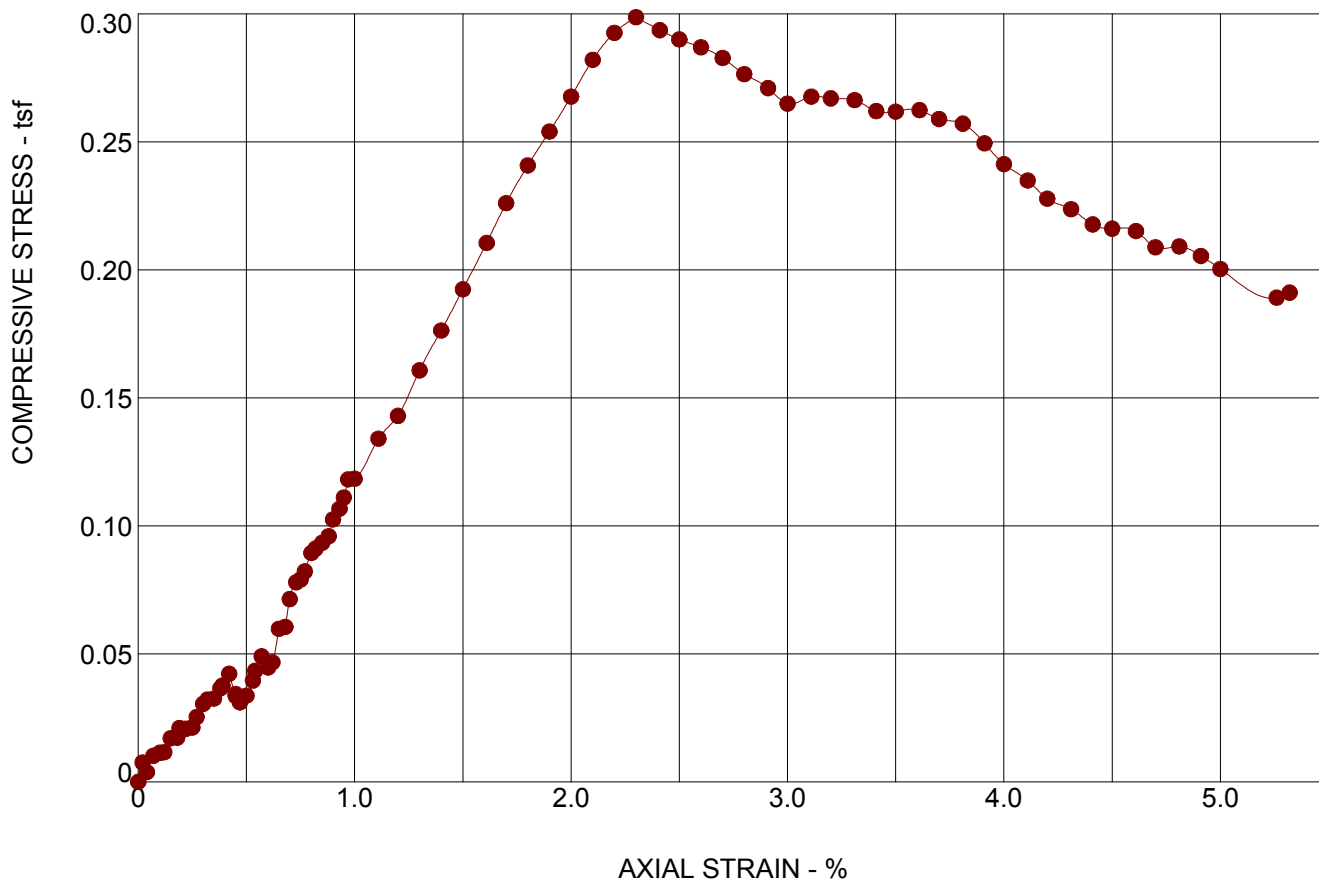
TRIAXIAL SHEAR TEST REPORT



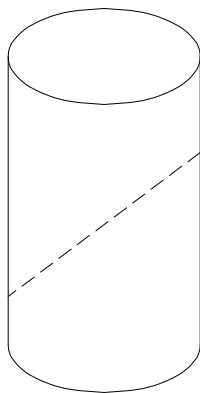
TOTAL STRESS PARAMETERS		ϕ = 8.9 deg		c = 6.6 psi		
	SPECIMEN NO.		1	2	3	4
	INITIAL					
	Moisture Content - %		35.9	27.2	24.2	
	Dry Density - pcf		88.5	95.3	97.1	
	Diameter - inches		2.82	2.84	2.86	
	Height - inches		5.67	5.68	5.69	
	AT TEST					
	Final Moisture - %		32.4	26.5	21.7	
	Dry Density - pcf		89.4	97.0	104.6	
	Calculated Diameter (in.)		2.80	2.83	2.83	
	Height - inches		5.61	5.63	5.60	
	Effect. Cell Pressure - psi		10.0	20.0	40.0	
	Failure Stress - psi		18.32	24.12	29.66	
	Total Pore Pressure - psi		54.7	61.7	77.2	
	Strain Rate - inches/min.		0.00060	0.00060	0.00060	
Failure Strain - %		4.6	1.8	1.8		
σ_1 Failure - psi		28.32	44.12	69.66		
σ_3 Failure - psi		10.00	20.00	40.00		
TEST DESCRIPTION			PROJECT INFORMATION			
TYPE OF TEST & NO: CU with Pore Pressure			PROJECT: I-85/I-385 Interchange Modifications			
SAMPLE TYPE: Shelby Tube			LOCATION: I-85/I-385 Interchange			
DESCRIPTION: Yellowish Orange Sandy Clay			PROJECT NO: E2156301			
SAMPLE LOCATION: W2A-MB2-01, T-1, 10.0-12.0ft			CLIENT: Thompson Engineering			
SPECIFIC GRAVITY: 2.684			DATE: 5/14/15			
LL:	PL:	PI:	TERRACON			
Percent -200:						
REMARKS: Three specimen series.						

UNCONFINED COMPRESSION TEST

ASTM D2166



SPECIMEN FAILURE MODE



Failure Mode: Shear (dashed)

SPECIMEN TEST DATA

Moisture Content:	%	21
Dry Density:	pcf	100
Diameter:	in.	1.99
Height:	in.	4.00
Height / Diameter Ratio:		2.01
Calculated Saturation:	%	78.96
Calculated Void Ratio:		0.72
Assumed Specific Gravity:		2.75
Failure Strain:	%	2.30
Unconfined Compressive Strength	(tsf)	0.30
Undrained Shear Strength:	(tsf)	0.15
Strain Rate:	in/min	0.0400
Remarks:		

SAMPLE TYPE: Shelby Tube

SAMPLE LOCATION: WIB-2R-03 @ 4 Feet

DESCRIPTION: SANDY LEAN CLAY(CL)

LL
43

PL
23

PI
20

Percent < #200 Sieve
56

PROJECT: I-85/I-385 Interchange
Modifications

PROJECT NUMBER: E2156301

SITE: Laboratory Testing

CLIENT: Thompson Engineering, Inc.
Mobile, AL

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

Appendix D

Plan and Profile Drawings: Bridge 11 – Replace Roper Mountain Overpass over I-85


See roadway plans for utility locations

VERTICAL GRADE DATA I-85 (Future)

© - P.O.C. Sta. 50+28.37 @ Ramp 1A =
P.O.C. Sta. 39+36.95 @ Roper Mountain Road-

⑤ - 6" Dia. deck drains 10'-0" each side of
C Bents 2 & 4 (Total 4)

VERTICAL GRADE DATA RAMP 1

$PVI = 50 \cdot 50.00$
 $EI = 924.678$
 $LVC = 26.53'$
 $+4.088\%$  $+4.174\%$

VERTICAL GRADE DATA RAMP 1A

$PVI = 109 \cdot 50.00$
 $EI. 922.150$
 $LVC = 150'$
 -4.500% Δ -3.530%

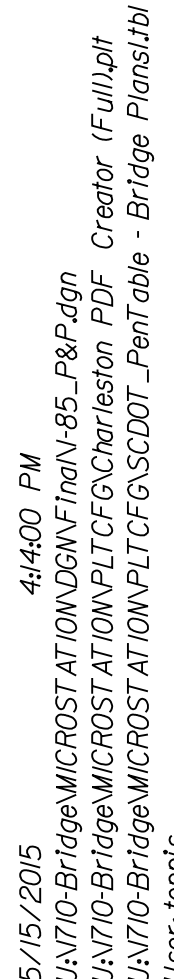
VERTICAL GRADE DATA RAMP 2A

Curve RAMP_1A-1
P.L. Station 49+94.13
N 1,095.775.0415 E 1,613.129.6042
Delta = 2° 02' 51.54" (RT)
Degree = 0° 34' 22.65"
Tangent = 178.7101
Length = 357.3822
Radius = 10,000.0000
External = 1.5367
Long Chord = 357.3632
P.C. Station 48+15.42
P.T. Station 51+72.80
Back = S 53° 22' 27.86" W
Ahead = S 55° 25' 19.40" W
Chord Bear = S 54° 23' 53.63" W

Curve RAMP_1-1
P.L. Station 57+38.09
N 1,097.192, 4759 E 1,615,056, 5157
Delta = 30° 10' 36.37" (RT)
Degree = 1° 59' 59.47"
Tangent = 772.4133
Length = 1,508.9496
Radius = 2,865.0000
External = 102.2363
Long Chord = 1,491.5693
P.C. Station 49+65.68
P.T. Station 64+74.63
Back = S 23° 11' 51.49" W
Ahead = S 53° 22' 27.86" W
Chord Bear = S 38° 17' 09.68" W

Curve ROPER RELOC-1
P.L. Station 38+11.99
N 1.095,554,3021 E 1,613,157.5931
Delta = 40° 23' 10.18" (RT)
Degree = 2° 47' 41.70"
Tangent = 753.9721'
Length = 1,444.9866'
Radius = 2,050.0000'
External = 134.2559'
Long Chord = 1,415.2579'
P.C. Station 30+58.02
P.T. Station 45+03.00
Back = N 77° 47' 17.37" W
Ahead = N 37° 24' 07.19" W
Chord Bear = N 57° 35' 42.28" W
S.E. = 0.0287 f+ft

Curve RAMP_2A-8			
P.I. Station		111+41.28	
N 1,095.740.0182		E 1,613.3,423.5983	
Delta = 1° 25'		15.01" (RT)	
Degree =		0° 30' 01.44"	
Tangent =		141.9773	
Length =		283.9400	
Radius =		11,450.0000	
External =		0.8802	
Long Chord =		283.9328	
P.C. Station		109+99.30	
P.T. Station		112+83.24	
Back = N 51° 57'		12.86" E	
Ahead = N 53° 22'		27.86" E	
Chord Bear = N 52° 39'		50.36" E	



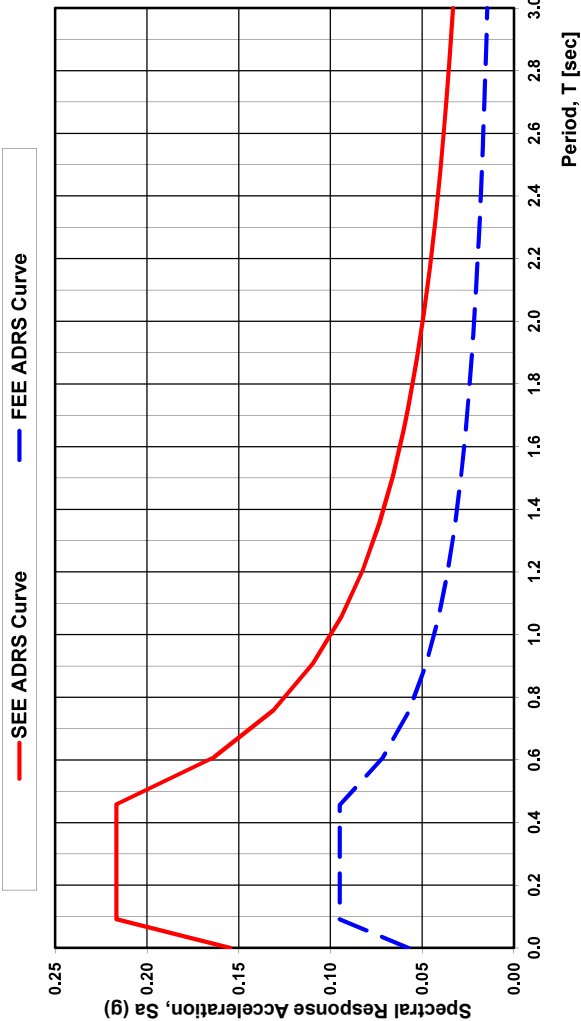
Appendix E

SCDOT MASW Curves/Responses

SC Seismic Hazard Map Three-Point ADRS Curves				
PIN No: 38111	Project ID: 0038111	Latitude: 34.8377	Designer: M. Humphries - Upstate RPG	
Route: I-85/I-385	County: Greenville	Longitude: 82.2884	Date: 10/27/2014	
Project: I-85/I-385 Interchange Design Build				

Design EQ	PGA	S _{as}	S _{p1}	M _W	R (km)	Geologic Condition	Site Class	Damping
FEE	0.06	0.09	0.04	7.4	266	Geologically Realistic (Q = 100)	C	5%
SEE	0.15	0.22	0.10	7.4	266	Geologically Realistic (Q = 100)	C	

SC Seismic Hazard Map Three-Point ADRS Curve From Ground Surface



FEE ADRS Curve Three-Point Method			SEE ADRS Curve Three-Point Method		
T	S _a	T ₀	T	S _a	T ₀
0.00	0.06		0.00	0.22	
0.02	0.06		0.02	0.16	
0.03	0.07		0.03	0.18	
0.05	0.08		0.05	0.19	
0.06	0.08		0.06	0.20	
0.08	0.09		0.08	0.21	
0.09	0.09		0.09	0.22	
0.12	0.09		0.12	0.22	
0.15	0.09		0.15	0.22	
0.18	0.09		0.18	0.22	
0.21	0.09		0.21	0.22	
0.24	0.09		0.24	0.22	
0.27	0.09		0.28	0.22	
0.30	0.09		0.31	0.22	
0.33	0.09		0.34	0.22	
0.37	0.09		0.37	0.22	
0.40	0.09		0.40	0.22	
0.43	0.09		0.43	0.22	
0.46	0.09		0.46	0.22	
0.61	0.07		0.61	0.16	
0.76	0.06		0.76	0.13	
0.91	0.05		0.91	0.11	
1.06	0.04		1.06	0.09	
1.20	0.04		1.21	0.08	
1.35	0.03		1.36	0.07	
1.50	0.03		1.51	0.07	
1.65	0.03		1.65	0.06	
1.80	0.02		1.80	0.06	
1.95	0.02		1.95	0.05	
2.10	0.02		2.10	0.05	
2.25	0.02		2.25	0.04	
2.40	0.02		2.40	0.04	
2.55	0.02		2.55	0.04	
2.70	0.02		2.70	0.04	
2.85	0.02		2.85	0.03	
3.00	0.01		3.00	0.03	

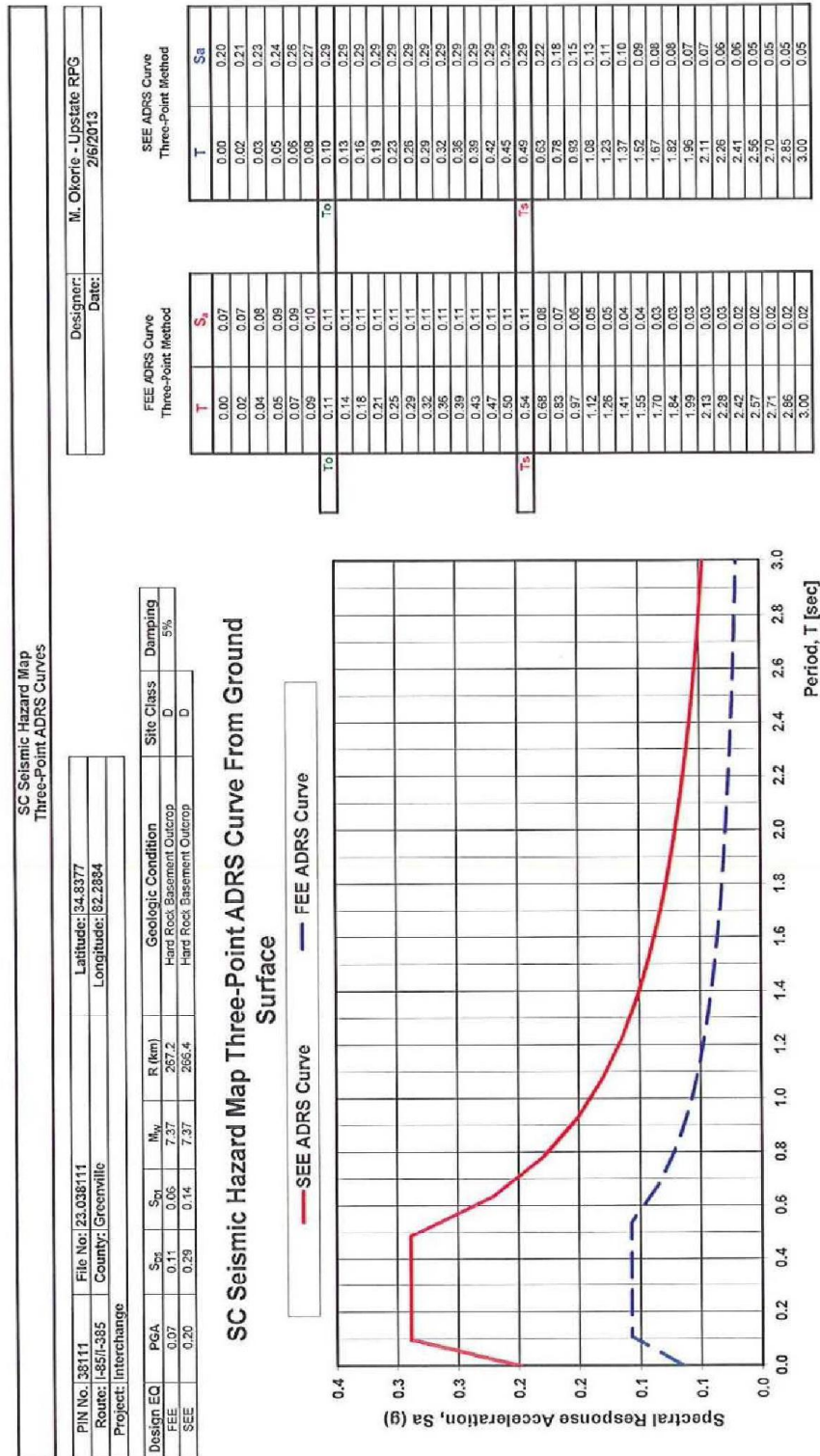


Figure 1: SC Seismic Hazard Map Three-Point ADRS Curves



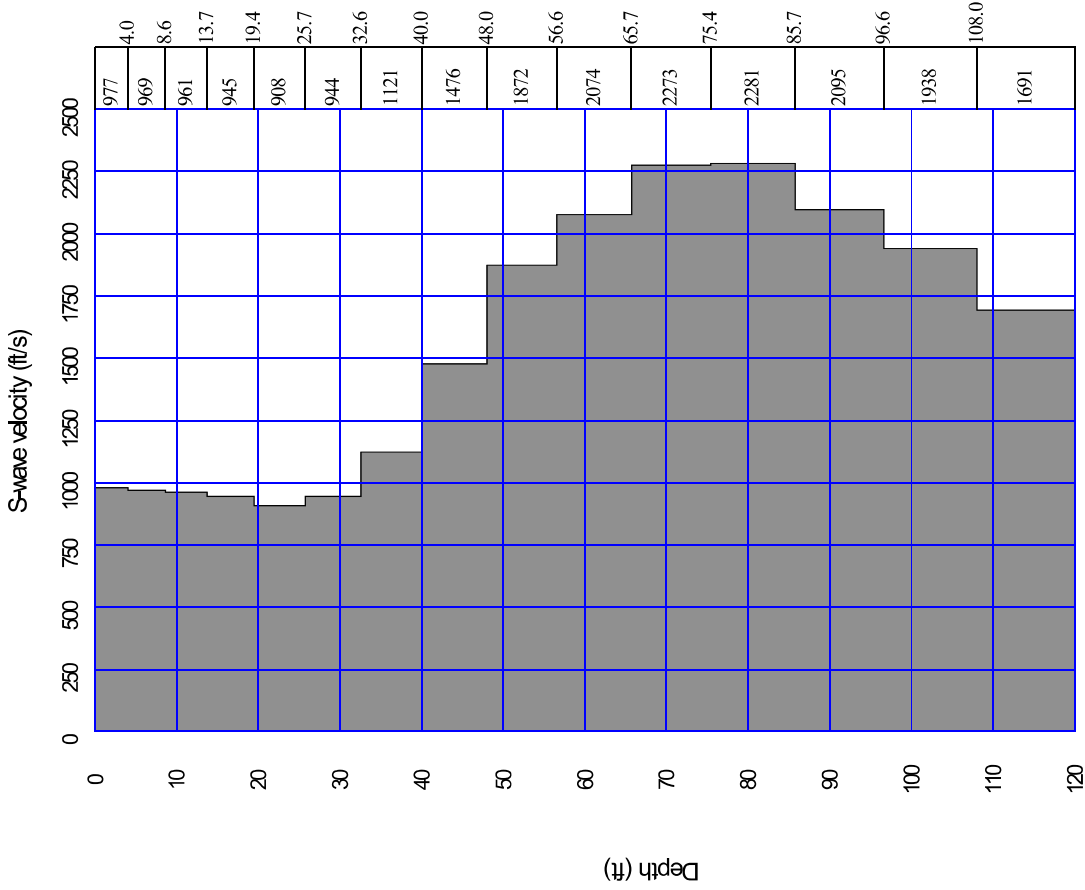
Florence & Hutcheson

An **ICA** Company

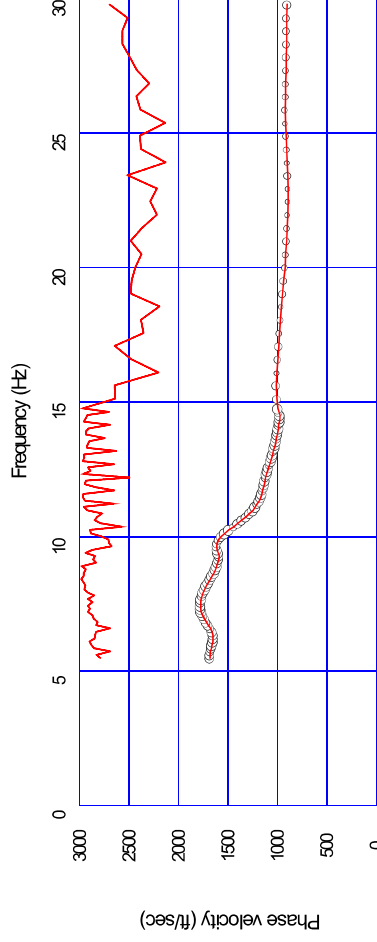
Project Name : I-85/I-385 Interchange
Location : Greenville County, South Carolina
Job Number : 08195-01
Project Job No. : 08195-01

MASW Summary

MASW Analysis No.	Alignment	Station	Offset (ft)	Average Shear Wave Velocity in Top 100 feet (ft/sec)
MASW-1	I-385 NB C/D	359+39	17' RT	1405.6
MASW-2	I-385	393+66	115' RT	1034.8
MASW-3	Ramp 4B	408+70	102' RT	1081.5
MASW-4	Roper Mt. Rd.	36+15	25' LT	1060.2



S-wave velocity model (inverted): I85-I385 MASW1 Active Passive Combined.rst
Average Vs 100ft = 1405.6 ft/sec



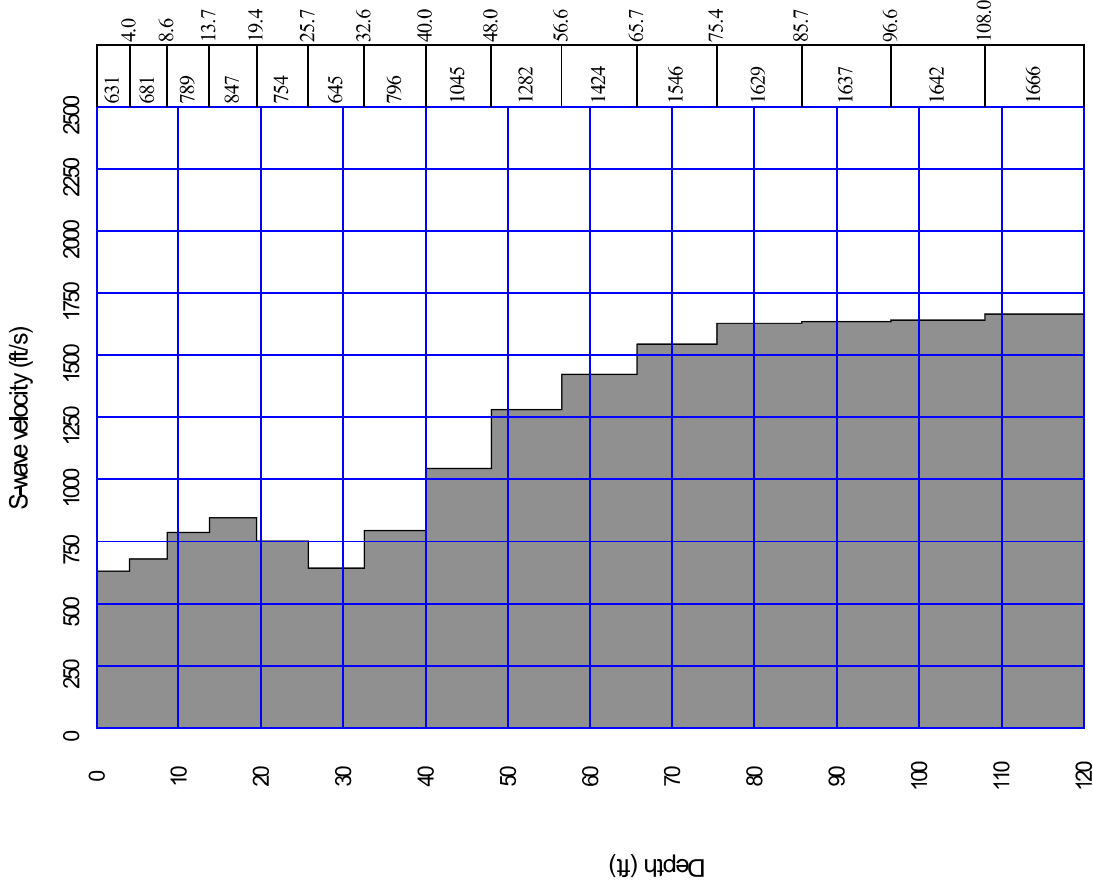
Dispersion curve: I85-I385 MASW1 Active Passive Combined.rst

Testing Results	
Depth(ft)	S-wave velocity(ft/s)
0.0	978.0
4.0	969.3
8.6	961.7
13.7	945.1
19.4	908.4
25.7	944.2
32.6	1121.6
40.0	1476.1
48.0	1872.5
56.6	2074.3
65.7	2273.2
75.4	2281.4
85.7	2095.7
96.6	1938.6
108.0	1691.2

Project Mgr:	WL	Project No.	EN105084
Prepared by:	BTS	Scale:	NA
Checked by:	WL	Date:	12/7/2011
Approved by:	GL		

GEOPHYSICAL TESTING RESULTS MASW SHEAR WAVE VELOCITY I85 and I385 Interchange Greenville County, SC		TEST NO MASW1
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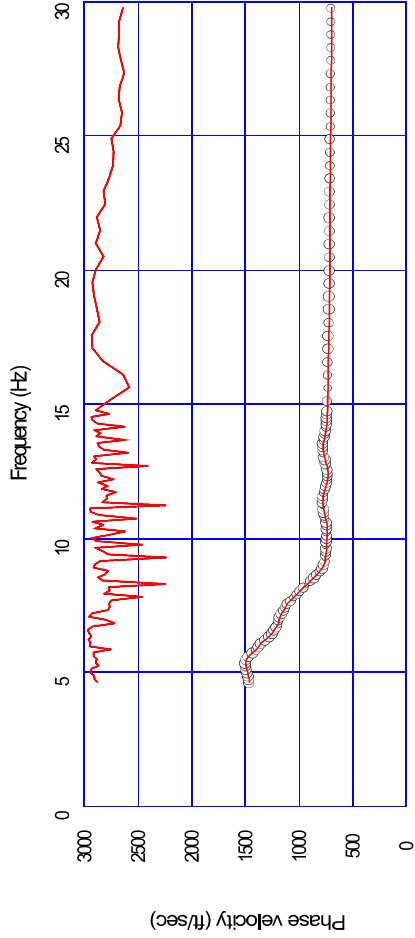
1450 FIFTH STREET WEST SUITE 604 NORTH CHARLESTON, SC 29405 PH: (843) 884-1234 FAX: (843) 884-0234	



S-wave velocity model (inverted): 385 85 MASW2 Active Passive Combined.rst

Average Vs 100ft = 1034.8 ft/sec

Testing Results	
Depth(ft)	S-wave velocity(ft/s)
0.0	631.3
4.0	681.8
8.6	789.1
13.7	847.7
19.4	754.4
25.7	645.9
32.6	796.9
40.0	1045.9
48.0	1282.7
56.6	1424.0
65.7	1546.4
75.4	1629.8
85.7	1637.7
96.6	1642.6
108.0	1666.9



Project No. EN105084

Scale: NA

Date: 12/7/2011

Project Mgr: WL

Prepared by: BTS

Checked by: WL

Approved by: GL

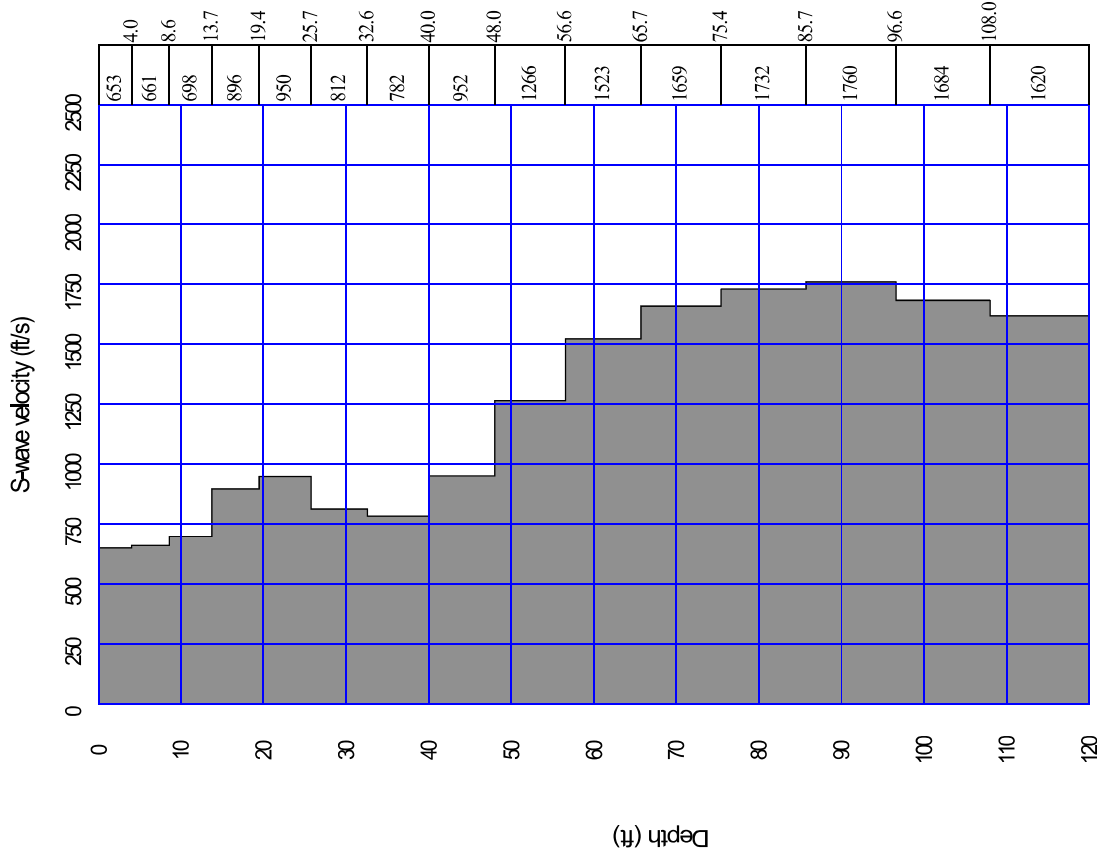
TEST NO
MASW2

GEOPHYSICAL TESTING RESULTS

MASW SHEAR WAVE VELOCITY

185 and I385 Interchange

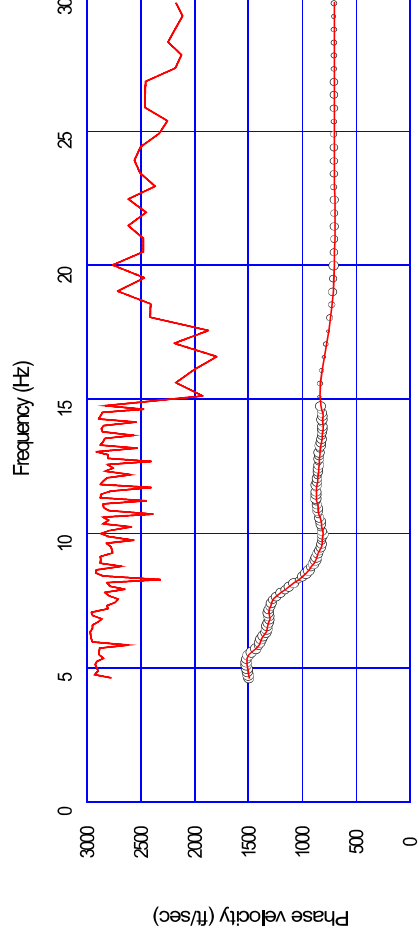
Greenville County, SC



S-wave velocity model (inverted): 385 85 MASW/3 Active Passive Combined.rst

Average Vs 100ft = 1081.5 ft/sec

Testing Results	
Depth(ft)	S-wave velocity(ft/s)
0.0	653.3
4.0	661.7
8.6	698.7
13.7	897.0
19.4	950.0
25.7	812.5
32.6	782.9
40.0	952.8
48.0	1266.2
56.6	1523.1
65.7	1659.9
75.4	1732.3
85.7	1760.4
96.6	1684.9
108.0	1620.0

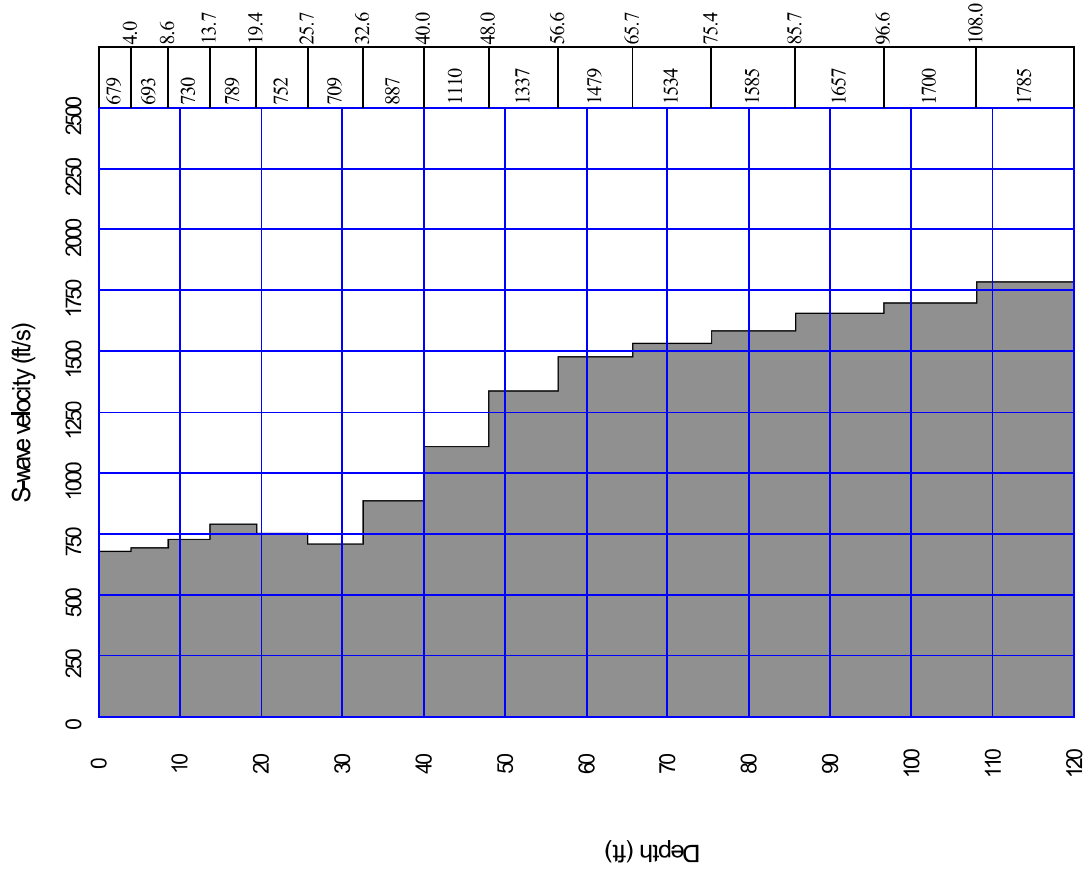


Dispersion curve : 385 85 MASW/3 Active Passive Combined.rst

Project Mgr:	WL	Project No.	EN105084
Prepared by:	BTS	Scale:	NA
Checked by:	WL	Date:	12/7/2011
Approved by:	GL		

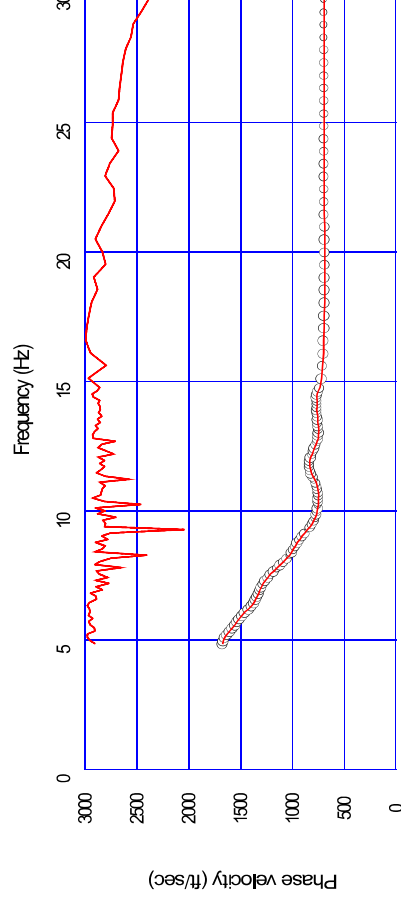
1450 FIFTH STREET WEST
 3RD FLOOR
 ATLANTA, GA 30309
 Phone: (404) 884-2244
 Fax: (404) 884-2245
 NORTH CHARLESTON, SC

GEOPHYSICAL TESTING RESULTS MASW SHEAR WAVE VELOCITY 185 and I385 Interchange Greenville County, SC		TEST NO MASW3
--	--	--------------------------------



S-wave velocity model (inverted): 385 85 MASW 4 Active Passive Combined.rst

Average Vs 100ft = 1060.2 ft/sec



Testing Results	
Depth(ft)	S-wave velocity(ft/s)
0.0	679.3
4.0	694.0
8.6	730.0
13.7	789.8
19.4	752.7
25.7	709.4
32.6	887.2
40.0	1110.1
48.0	1337.1
56.6	1479.8
65.7	1534.6
75.4	1585.6
85.7	1657.5
96.6	1700.0
108.0	1785.1

Project Mgr:	WL	Project No.	EN105084
Prepared by:	BTS	Scale:	NA
Checked by:	WL	Date:	12/7/2011
Approved by:	GL		

GEOPHYSICAL TESTING RESULTS MASW SHEAR WAVE VELOCITY 185 and I385 Interchange Greenville County, SC		TEST NO MASW4
--	--	--------------------------------

1450 FIFTH STREET WEST
 291 (843) 884-224
 NORTH CHARLESTON, SC
 Fax: (843) 884-2234

Appendix E-1

Liquefaction and Shear Strength Loss Triggering Evaluation

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 88 %

C_E: 1.47

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B11-SPT-01

GW Depth: 26.0 ft

Sample	USCS	Layer		z	N _m	(FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSR _{eq} / CRReq	
		top	bottom	(ft)			(ksf)	(ksf)	α	β	r _d	SEE	FEE		SEE	FEE						C _σ	K _σ	K _{DR}	SAND	CLAY		SEE	FEE
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	ML	0.0	2.0	1.0	7	72	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	13	5.5	19	0.10	1.10	1	0.190	5.833	0.21	0.60	0.21
2	ML	2.0	4.0	3.0	12	72	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	22	5.5	28	0.15	1.10	1	0.381	3.333	0.42	0.30	0.10
3	SM	4.0	6.0	5.0	10	46	0.6	0.6	-0.052	0.006	0.99	0.13	0.05	1.04	0.12	0.04	1.70	0.75	19	5.5	24	0.13	1.10	2	0.272	1.667	0.60	0.21	0.07
4	SM	6.0	8.0	7.0	12	46	0.8	0.8	-0.084	0.010	0.99	0.13	0.04	1.04	0.12	0.04	1.57	0.75	21	5.5	26	0.14	1.10	2	0.321	1.429	0.71	0.18	0.06
5	SM	8.0	10.0	9.0	10	46	1.1	1.1	-0.119	0.014	0.98	0.13	0.04	1.04	0.12	0.04	1.40	0.75	15	5.5	21	0.11	1.07	2	0.217	0.926	0.46	0.27	0.09
6	SM	10.0	13.0	11.5	11	43	1.4	1.4	-0.165	0.019	0.97	0.13	0.04	1.04	0.12	0.04	1.22	0.75	15	5.5	20	0.11	1.04	2	0.209	0.797	0.43	0.28	0.10
7	SM	13.0	18.0	15.5	8	32	1.9	1.9	-0.247	0.028	0.96	0.12	0.04	1.04	0.12	0.04	1.04	0.85	10	5.4	16	0.09	1.01	2	0.163	0.430	0.33	0.37	0.13
8	SM	18.0	23.0	20.5	10	32	2.5	2.5	-0.360	0.041	0.94	0.12	0.04	1.04	0.12	0.04	0.89	0.95	12	5.4	18	0.10	0.98	2	0.183	0.407	0.36	0.33	0.12
9	SM	23.0	28.0	25.5	7	32	3.1	3.1	-0.485	0.054	0.92	0.12	0.04	1.04	0.12	0.04	0.78	0.95	8	5.4	13	0.08	0.96	2	0.140	0.229	0.27	0.43	0.15
10	SM	28.0	33.0	30.5	11	32	3.7	3.4	-0.618	0.069	0.90	0.13	0.04	1.04	0.12	0.04	0.76	0.95	12	5.4	17	0.10	0.95	2	0.174	0.326	0.33	0.37	0.13
11	SM	33.0	38.0	35.5	13	31	4.3	3.7	-0.758	0.085	0.87	0.13	0.05	1.04	0.13	0.04	0.74	1.00	14	5.4	19	0.11	0.94	2	0.199	0.354	0.37	0.34	0.12
12	SM	38.0	43.0	40.5	13	31	4.9	4.0	-0.902	0.101	0.85	0.14	0.05	1.04	0.13	0.05	0.71	1.00	13	5.4	19	0.10	0.93	2	0.193	0.329	0.36	0.37	0.13
13	SM	43.0	48.0	45.5	13	31	5.5	4.2	-1.048	0.116	0.83	0.14	0.05	1.04	0.13	0.05	0.68	1.00	13	5.4	18	0.10	0.92	2	0.188	0.306	0.35	0.39	0.13
14	SM	48.0	53.0	50.5	17	31	6.1	4.5	-1.194	0.132	0.80	0.14	0.05	1.04	0.13	0.05	0.68	1.00	17	5.4	22	0.12	0.90	2	0.240	0.375	0.43	0.31	0.11
15	SM	53.0	58.0	55.5	20	24	6.7	4.8	-1.336	0.147	0.78	0.14	0.05	1.04	0.14	0.05	0.68	1.00	20	5.0	25	0.13	0.88	2	0.288	0.415	0.51	0.27	0.09
16	SM	58.0	63.0	60.5	49	24	7.3	5.1	-1.473	0.162	0.76	0.14	0.05	1.04	0.13	0.05	0.79	1.00	57	5.0	31	0.30	0.72	2	0.555	0.959	0.80	0.17	0.06
17	SM	63.0	68.0	65.5	24	24	7.9	5.4	-1.603	0.175	0.73	0.14	0.05	1.04	0.13	0.05	0.67	1.00	23	5.0	28	0.15	0.85	2	0.404	0.445	0.69	0.20	0.07
18	PWR	68.0	73.0	70.5	100	24	8.5	5.7	-1.722	0.188	0.71	0.14	0.05	1.04	0.13	0.05	0.98	1.00	144	5.0	31	0.30	0.69	2	0.555	1.760	0.76	0.17	0.06
19	PWR	73.0	75.0	74.0	100	24	8.9	5.9	-1.798	0.195	0.70	0.14	0.05	1.04	0.13	0.05	0.98	1.00	144	5.0	31	0.30	0.68	2	0.555	1.699	0.75	0.18	0.06
20																													
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-01

GW Depth:

26.0 ft



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		Φ _{SSL}	Φ _{SSLQ_N}	Φ _{F,S,EQ}	Φ _{SSL}	Φ _{SSLQ_N}	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	ML	0.0	2.0	0.60	0.21	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	ML	2.0	4.0	0.30	0.10	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SM	4.0	6.0	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SM	6.0	8.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SM	8.0	10.0	0.27	0.09	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	SM	10.0	13.0	0.28	0.10	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	SM	13.0	18.0	0.37	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	SM	18.0	23.0	0.33	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	SM	23.0	28.0	0.43	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	28.0	33.0	0.37	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	SM	33.0	38.0	0.34	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	SM	38.0	43.0	0.37	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	SM	43.0	48.0	0.39	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14	SM	48.0	53.0	0.31	0.11	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
15	SM	53.0	58.0	0.27	0.09	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
16	SM	58.0	63.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
17	SM	63.0	68.0	0.20	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
18	PWR	68.0	73.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
19	PWR	73.0	75.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
20		-													
21		-													
22		-													
23		-													
24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-01

GW Depth:

26.0 ft



Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ´	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	ML	0	2	7	10	13	0	0	30	0.98	6.82		733.0
2	ML	2	4	12	18	22	0	0	30	1.68	11.69		1256.6
3	SM	4	6	10	15	19	0	0	36	1.40	9.74		1813.9
4	SM	6	8	12	18	21	0	0	36	1.55	10.77		2006.7
5	SM	8	10	10	15	15	0	0	35	1.15	8.00		1489.3
6	SM	10	13	11	16	15	0	0	35	1.10	7.67		1428.4
7	SM	13	18	8	12	10	0	0	33	0.78	5.41		1008.0
8	SM	18	23	10	15	12	0	0	34	0.93	6.49		1208.3
9	SM	23	28	7	10	8	0	0	31	0.57	3.97		739.0
10	SM	28	33	11	16	12	0	0	33	0.87	6.05		1126.3
11	SM	33	38	13	19	14	0	0	35	1.05	7.30		1360.0
12	SM	38	43	13	19	13	0	0	34	1.01	7.03		1308.8
13	SM	43	48	13	19	13	0	0	34	0.98	6.78		1263.0
14	SM	48	53	17	25	17	0	0	36	1.28	8.86		1650.3
15	SM	53	58	20	29	20	0	0	36	1.49	10.37		1931.4
16	SM	58	63	49	72	57	0	0	36	4.28	29.71		5533.2
17	SM	63	68	24	35	23	0	0	36	1.76	12.23		2278.1
18	PWR	68	73	100	147	144	0	0	40	10.82	75.12		13990.9
19	PWR	73	75	100	147	144	0	0	40	10.81	75.08		13983.1
20		-											
21		-											
22		-											
23		-											
24		-											
25		-											
26		-											
27		-											
28		-											
29		-											
30		-											

182.6

236.4

185.522

562.417

Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

For cohesionless soils, Equation 7-41 of the GDM was used to calculate ϕ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate ϕ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{r_{1.60}.60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>=40

$$c_{u.High} := .15 \cdot N_{1.60}$$

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 88 %

C_E: 1.47

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B11-SPT-02

GW Depth: 11.0 ft

Sample	USCS	Layer		z (ft)	N _m	(FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSR _{eq} / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE	SEE	FEE		C _σ	K _σ						SAND	CLAY					SEE	FEE
Equation No.		top	bottom						(1)	(2)	(3)	(4) (5)	(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)			
1	SM	0.0	2.0	1.0	13	32	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	24	5.4	30	0.16	1.10	2	0.469	10.833	1.03	0.12	0.04
2	SM	2.0	4.0	3.0	7	32	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	13	5.4	19	0.10	1.10	2	0.189	1.944	0.42	0.30	0.11
3	SM	4.0	6.0	5.0	5	33	0.6	0.6	-0.052	0.006	0.99	0.13	0.05	1.04	0.12	0.04	1.70	0.75	9	5.5	15	0.09	1.10	2	0.155	0.833	0.34	0.37	0.13
4	SM	6.0	8.0	7.0	6	33	0.8	0.8	-0.084	0.010	0.99	0.13	0.04	1.04	0.12	0.04	1.68	0.75	11	5.5	17	0.10	1.08	2	0.170	0.714	0.37	0.34	0.12
5	SM	8.0	10.0	9.0	2	45	1.1	1.1	-0.119	0.014	0.98	0.13	0.04	1.04	0.12	0.04	1.52	0.75	3	5.5	9	0.07	1.04	2	0.110	0.185	0.23	0.54	0.19
6	ML	10.0	13.0	11.5	2	59	1.4	1.3	-0.165	0.019	0.97	0.13	0.05	1.04	0.13	0.04	1.30	0.75	3	5.5	8	0.07	1.03	2	0.107	0.148	0.22	0.57	0.20
7	ML	13.0	18.0	15.5	2	59	1.9	1.6	-0.247	0.028	0.96	0.15	0.05	1.04	0.14	0.05	1.17	0.85	3	5.5	8	0.07	1.02	2	0.107	0.127	0.22	0.65	0.23
8	SM	18.0	23.0	20.5	2	38	2.5	1.9	-0.360	0.041	0.94	0.16	0.06	1.04	0.16	0.05	1.05	0.95	3	5.5	8	0.07	1.00	2	0.107	0.107	0.22	0.72	0.25
9	SM	23.0	27.0	25.0	0	38	3.0	2.1	-0.472	0.053	0.92	0.17	0.06	1.04	0.16	0.06	0.95	0.95	0	5.5	6	0.05	1.00	2.5	0.089	0.000	0.22	0.74	0.26
10	SM	27.0	28.5	27.8	4	38	3.3	2.3	-0.544	0.061	0.91	0.17	0.06	1.04	0.17	0.06	0.92	0.95	5	5.5	11	0.08	0.99	2	0.122	0.175	0.24	0.69	0.24
11	SM	28.5	33.0	30.8	4	38	3.7	2.5	-0.625	0.070	0.90	0.18	0.06	1.04	0.17	0.06	0.88	0.95	5	5.5	10	0.08	0.98	2	0.121	0.163	0.24	0.71	0.25
12	SM	33.0	38.0	35.5	4	20	4.3	2.7	-0.758	0.085	0.87	0.18	0.06	1.04	0.17	0.06	0.82	1.00	5	4.5	9	0.08	0.98	2.5	0.113	0.146	0.28	0.62	0.22
13	SM	38.0	43.0	40.5	6	20	4.9	3.0	-0.902	0.101	0.85	0.18	0.06	1.04	0.17	0.06	0.78	1.00	7	4.5	11	0.08	0.97	2	0.128	0.199	0.25	0.70	0.24
14	SM	43.0	48.0	45.5	70	20	5.5	3.3	-1.048	0.116	0.83	0.18	0.06	1.04	0.17	0.06	0.93	1.00	96	4.5	31	0.30	0.85	2	0.555	2.117	0.94	0.18	0.06
15	PWR	48.0	53.0	50.5	100	20	6.1	3.6	-1.194	0.132	0.80	0.18	0.06	1.04	0.17	0.06	0.99	1.00	145	4.5	31	0.30	0.82	2	0.555	2.781	0.91	0.19	0.07
16	PWR	53.0	58.0	55.5	100	20	6.7	3.9	-1.336	0.147	0.78	0.17	0.06	1.04	0.17	0.06	0.99	1.00	145	4.5	31	0.30	0.80	2	0.555	2.575	0.89	0.19	0.07
17	SM	58.0	63.0	60.5	69	20	7.3	4.2	-1.473	0.162	0.76	0.17	0.06	1.04	0.17	0.06	0.90	1.00	91	4.5	31	0.30	0.78	2	0.555	1.654	0.87	0.19	0.07
18	PWR	63.0	68.0	65.5	100	20	7.9	4.5	-1.603	0.175	0.73	0.17	0.06	1.04	0.16	0.06	0.99	1.00	145	4.5	31	0.30	0.76	2	0.555	2.243	0.84	0.19	0.07
19	PWR	68.0	73.0	70.5	100	20	8.5	4.7	-1.722	0.188	0.71	0.17	0.06	1.04	0.16	0.06	0.99	1.00	145	4.5	31	0.30	0.74	2	0.555	2.107	0.82	0.19	0.07
20	PWR	73.0	75.0	74.0	100	20	8.9	4.9	-1.798	0.195	0.70	0.16	0.06	1.04	0.16	0.06	0.99	1.00	145	4.5	31	0.30	0.73	2	0.555	2.021	0.81	0.19	0.07
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26																													
27																													
28																													
29																													
30																													

Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-02

GW Depth:

11.0 ft



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		Φ _{SSL}	Φ _{SSLQ_N}	Φ _{F,S,EQ}	Φ _{SSL}	Φ _{SSLQ_N}	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	SM	0.0	2.0	0.12	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	SM	2.0	4.0	0.30	0.11	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SM	4.0	6.0	0.37	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SM	6.0	8.0	0.34	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SM	8.0	10.0	0.54	0.19	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	ML	10.0	13.0	0.57	0.20	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	ML	13.0	18.0	0.65	0.23	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	SM	18.0	23.0	0.72	0.25	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	SM	23.0	27.0	0.74	0.26	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	27.0	28.5	0.69	0.24	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	SM	28.5	33.0	0.71	0.25	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	SM	33.0	38.0	0.62	0.22	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	SM	38.0	43.0	0.70	0.24	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14	SM	43.0	48.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
15	PWR	48.0	53.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
16	PWR	53.0	58.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
17	SM	58.0	63.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
18	PWR	63.0	68.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
19	PWR	68.0	73.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
20	PWR	73.0	75.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
21		-													
22		-													
23		-													
24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information													
Date: July 21, 2015													
Site: I-85/385													
Location: Greenville, SC													
Project ID: 0038111													
Boring: B11-SPT-02													
GW Depth: 11.0 ft													
Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ´	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	SM	0	2	13	19	24	0	0	36	1.82	12.66		2358.1
2	SM	2	4	7	10	13	0	0	34	0.98	6.82		1269.7
3	SM	4	6	5	7	9	0	0	32	0.70	4.87		907.0
4	SM	6	8	6	9	11	0	0	33	0.83	5.76		1073.5
5	SM	8	10	2	3	3	0	0	27	0.25	1.74		323.5
6	ML	10	13	2	3	3	0	0	30	0.22	1.50		160.8
7	ML	13	18	2	3	3	0	0	30	0.22	1.52		163.8
8	SM	18	23	2	3	3	0	0	27	0.22	1.52		283.1
9	SM	23	27	0	0	0	0	0	20	0.00	0.00		0.0
10	SM	27	28.5	4	6	5	0	0	29	0.38	2.67		497.1
11	SM	28.5	33	4	6	5	0	0	29	0.37	2.55		474.8
12	SM	33	38	4	6	5	0	0	29	0.36	2.51		467.6
13	SM	38	43	6	9	7	0	0	30	0.52	3.59		667.8
14	SM	43	48	70	103	96	0	0	36	7.17	49.80		9274.8
15	PWR	48	53	100	147	145	0	0	40	10.90	75.68		14093.8
16	PWR	53	58	100	147	145	0	0	40	10.88	75.58		14076.4
17	SM	58	63	69	101	91	0	0	36	6.82	47.34		8817.1
18	PWR	63	68	100	147	145	0	0	40	10.86	75.42		14045.3
19	PWR	68	73	100	147	145	0	0	40	10.85	75.34		14031.3
20	PWR	73	75	100	147	145	0	0	40	10.84	75.29		14021.9
21			-										
22			-										
23			-										
24			-										
25			-										
26			-										
27			-										
28			-										
29			-										
30			-										

For cohesionless soils, Equation 7-41 of the GDM was used to calculate φ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate φ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{\Gamma_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>=40

$$c_{u.High} := .15 \cdot N_{1.60}$$



Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 88 %

C_E: 1.47

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B11-SPT-03

GW Depth: 13.0 ft

Assumed water depth

Sample	USCS	Layer		z	N _m	(FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		top	bottom	(ft)			(ksf)	(ksf)	α	β	r _d	SEE	FEE		SEE	FEE						C _σ	K _σ	K _{DR}	SAND	CLAY		SEE	FEE
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	ASPH	0.0	1.5	0.8	100	45	0.1	0.1	0.007	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.05	0.75	116	5.5	31	0.30	1.10	1	0.555	111.111	0.61	0.21	0.07
2	SC	1.5	3.5	2.5	15	45	0.3	0.3	-0.016	0.002	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	28	5.5	31	0.19	1.10	1	0.555	5.000	0.61	0.21	0.07
3	SC	3.5	5.5	4.5	6	45	0.5	0.5	-0.045	0.005	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	11	5.5	17	0.10	1.10	1	0.171	1.111	0.19	0.66	0.23
4	SC	5.5	7.5	6.5	8	36	0.8	0.8	-0.076	0.009	0.99	0.13	0.05	1.04	0.12	0.04	1.70	0.75	15	5.5	20	0.11	1.10	1	0.212	1.026	0.23	0.53	0.19
5	SC	7.5	11.0	9.3	8	51	1.1	1.1	-0.123	0.014	0.98	0.13	0.04	1.04	0.12	0.04	1.40	0.75	12	5.5	18	0.10	1.06	2	0.182	0.721	0.38	0.32	0.11
6	CL	11.0	13.0	12.0	18	56	1.4	1.4	-0.175	0.020	0.97	0.13	0.04	1.01	0.13	0.04	1.16	0.75	23	5.5	29	0.15	1.05	2	0.406	1.250	1.25	0.10	0.04
7	SM	13.0	18.0	15.5	4	56	1.9	1.7	-0.247	0.028	0.96	0.14	0.05	1.04	0.13	0.05	1.11	0.85	6	5.5	11	0.08	1.01	2	0.125	0.235	0.25	0.52	0.18
8	SM	18.0	23.0	20.5	10	56	2.5	2.0	-0.360	0.041	0.94	0.15	0.05	1.04	0.15	0.05	1.00	0.95	14	5.5	19	0.11	1.00	2	0.200	0.502	0.40	0.37	0.13
9	SM	23.0	28.0	25.5	12	24	3.1	2.3	-0.485	0.054	0.92	0.16	0.06	1.04	0.16	0.05	0.93	0.95	16	5.0	21	0.11	0.99	2	0.213	0.526	0.42	0.37	0.13
10	SM	28.0	33.0	30.5	13	24	3.7	2.6	-0.618	0.069	0.90	0.17	0.06	1.04	0.16	0.06	0.88	0.95	16	5.0	21	0.11	0.97	2	0.218	0.506	0.42	0.38	0.13
11	SM	33.0	38.0	35.5	20	15	4.3	2.9	-0.758	0.085	0.87	0.17	0.06	1.04	0.16	0.06	0.85	1.00	25	3.3	28	0.16	0.94	2	0.398	0.700	0.75	0.22	0.08
12	SM	38.0	43.0	40.5	48	15	4.9	3.1	-0.902	0.101	0.85	0.17	0.06	1.04	0.17	0.06	0.89	1.00	63	3.3	31	0.30	0.86	2	0.555	1.527	0.96	0.17	0.06
13	PWR	43.0	48.0	45.5	100	15	5.5	3.4	-1.048	0.116	0.83	0.17	0.06	1.04	0.17	0.06	0.99	1.00	145	3.3	31	0.30	0.84	2	0.555	2.914	0.93	0.18	0.06
14	PWR	48.0	53.0	50.5	100	15	6.1	3.7	-1.194	0.132	0.80	0.17	0.06	1.04	0.16	0.06	0.99	1.00	145	3.3	31	0.30	0.81	2	0.555	2.688	0.90	0.18	0.06
15	PWR	53.0	59.0	56.0	100	15	6.7	4.0	-1.350	0.149	0.78	0.17	0.06	1.04	0.16	0.06	0.99	1.00	145	3.3	31	0.30	0.79	2	0.555	2.477	0.88	0.19	0.06
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-03

GW Depth:

13.0 ft



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		ϕ _{SSL}	ϕ _{SSLQ}	ϕ _{F,S,EQ}	ϕ _{SSL}	ϕ _{SSLQ}	ϕ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	ASPH	0.0	1.5	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	SC	1.5	3.5	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SC	3.5	5.5	0.66	0.23	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SC	5.5	7.5	0.53	0.19	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SC	7.5	11.0	0.32	0.11	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	CL	11.0	13.0	0.10	0.04	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
7	SM	13.0	18.0	0.52	0.18	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	SM	18.0	23.0	0.37	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	SM	23.0	28.0	0.37	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	28.0	33.0	0.38	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	SM	33.0	38.0	0.22	0.08	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	SM	38.0	43.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	PWR	43.0	48.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14	PWR	48.0	53.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
15	PWR	53.0	59.0	0.19	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
16		-													
17		-													
18		-													
19		-													
20		-													
21		-													
22		-													
23		-													
24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring: B11-SPT-03

GW Depth: 13.0 ft



Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ´	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	ASPH	0	1.5	100	147	116	0	0	26	8.67	60.21		6473.4
2	SC	1.5	3.5	15	22	28	36	18	30	2.10	14.61		1570.8
3	SC	3.5	5.5	6	9	11	36	18	30	0.84	5.84		628.3
4	SC	5.5	7.5	8	12	15	37	20	30	1.12	7.79		837.8
5	SC	7.5	11	8	12	12	37	20	30	0.92	6.40		688.0
6	CL	11	13	18	26	23	47	27	26	3.45	23.98	0.33	1288.9
7	SM	13	18	4	6	6	0	0	29	0.41	2.87		535.1
8	SM	18	23	10	15	14	0	0	35	1.05	7.27		1354.5
9	SM	23	28	12	18	16	0	0	36	1.17	8.14		1515.4
10	SM	28	33	13	19	16	0	0	36	1.20	8.31		1547.8
11	SM	33	38	20	29	25	0	0	36	1.88	13.06		2432.0
12	SM	38	43	48	70	63	0	0	36	4.71	32.72		6093.3
13	PWR	43	48	100	147	145	0	0	40	10.91	75.73		14104.3
14	PWR	48	53	100	147	145	0	0	40	10.89	75.63		14086.1
15	PWR	53	59	100	147	145	0	0	40	10.88	75.54		14067.7
16		-											
17		-											
18													
19		-											
20		-											
21		-											
22		-											
23		-											
24		-											
25		-											
26		-											
27		-											
28		-											
29		-											
30		-											

For cohesionless soils, Equation 7-41 of the GDM was used to calculate ϕ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate ϕ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - \left(0.28 \cdot PI\right) + 0.00145 \cdot \left(PI\right)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{\text{r}_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u.High} := .15 \cdot N_{1.60}$$

Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 88 %

C_E: 1.47

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B11-SPT-04

GW Depth: 8.0 ft

Assumed water depth

Sample	USCS	Layer		z	N _m	(FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE		SEE		FEE								C _σ					K _σ	K _{DR}
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	ASPH	0.0	1.5	0.8	100	37	0.1	0.1	0.007	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.05	0.75	116	5.5	31	0.30	1.10	1	0.555	111.111	0.61	0.21	0.07
2	SC	1.5	3.5	2.5	21	37	0.3	0.3	-0.016	0.002	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	39	5.5	31	0.30	1.10	1	0.555	7.000	0.61	0.21	0.07
3	SC	3.5	5.5	4.5	10	37	0.5	0.5	-0.045	0.005	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	19	5.5	24	0.13	1.10	1	0.272	1.852	0.30	0.42	0.15
4	ML	5.5	7.5	6.5	10	37	0.8	0.8	-0.076	0.009	0.99	0.13	0.05	1.04	0.12	0.04	1.66	0.75	18	5.5	24	0.13	1.10	1	0.264	1.282	0.29	0.43	0.15
5	ML	7.5	10.0	8.8	1	51	1.1	1.0	-0.114	0.013	0.98	0.13	0.05	1.04	0.13	0.05	1.63	0.75	2	5.5	7	0.06	1.04	2	0.100	0.100	0.21	0.62	0.22
6	ML	10.0	13.5	11.8	4	51	1.4	1.2	-0.170	0.019	0.97	0.15	0.05	1.04	0.15	0.05	1.40	0.75	6	5.5	12	0.08	1.04	2	0.130	0.340	0.27	0.54	0.19
7	SM	13.5	18.0	15.8	6	56	1.9	1.4	-0.252	0.029	0.96	0.17	0.06	1.04	0.16	0.06	1.23	0.85	9	5.5	15	0.09	1.03	2	0.154	0.427	0.32	0.51	0.18
8	SM	18.0	23.0	20.5	17	56	2.5	1.7	-0.360	0.041	0.94	0.18	0.06	1.04	0.17	0.06	1.08	0.95	26	5.5	31	0.17	1.03	2	0.555	1.012	1.14	0.15	0.05
9	SM	23.0	28.0	25.5	39	24	3.1	2.0	-0.485	0.054	0.92	0.19	0.07	1.04	0.18	0.06	1.00	0.95	55	5.0	31	0.30	1.00	2	0.555	1.982	1.12	0.16	0.06
10	SM	28.0	33.0	30.5	85	24	3.7	2.3	-0.618	0.069	0.90	0.19	0.07	1.04	0.18	0.06	0.99	0.95	117	5.0	31	0.30	0.96	2	0.555	3.768	1.07	0.17	0.06
11	SM	33.0	38.0	35.5	52	15	4.3	2.5	-0.758	0.085	0.87	0.19	0.07	1.04	0.18	0.06	0.95	1.00	72	3.3	31	0.30	0.93	2	0.555	2.044	1.03	0.18	0.06
12	PWR	38.0	43.0	40.5	100	15	4.9	2.8	-0.902	0.101	0.85	0.19	0.07	1.04	0.18	0.06	0.99	1.00	146	3.3	31	0.30	0.90	2	0.555	3.531	0.99	0.18	0.06
13	PWR	43.0	48.0	45.5	100	15	5.5	3.1	-1.048	0.116	0.83	0.19	0.07	1.04	0.18	0.06	0.99	1.00	146	3.3	31	0.30	0.87	2	0.555	3.205	0.96	0.19	0.07
14	PWR	48.0	53.0	50.5	100	15	6.1	3.4	-1.194	0.132	0.80	0.19	0.06	1.04	0.18	0.06	0.99	1.00	145	3.3	31	0.30	0.84	2	0.555	2.934	0.93	0.19	0.07
15	PWR	53.0	54.0	53.5	100	15	6.4	3.6	-1.280	0.141	0.79	0.18	0.06	1.04	0.18	0.06	0.99	1.00	145	3.3	31	0.30	0.83	2	0.555	2.793	0.92	0.19	0.07
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-04

GW Depth:

8.0

ft



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		Φ _{SSL}	Φ _{SSLQ} N	Φ _{F,S,EQ}	Φ _{SSL}	Φ _{SSLQ} N	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	ASPH	0.0	1.5	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	SC	1.5	3.5	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SC	3.5	5.5	0.42	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	ML	5.5	7.5	0.43	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.02	0.00
5	ML	7.5	10.0	0.62	0.22	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	ML	10.0	13.5	0.54	0.19	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	SM	13.5	18.0	0.51	0.18	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	SM	18.0	23.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	SM	23.0	28.0	0.16	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	28.0	33.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	SM	33.0	38.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	PWR	38.0	43.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	PWR	43.0	48.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14	PWR	48.0	53.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
15	PWR	53.0	54.0	0.19	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
16		-													
17		-													
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24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.02	0.00

L-Pile Input Parameters

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-04

GW Depth:

8.0

ft



Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ´	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	ASPH	0	1.5	100	147	116	0	0	26	8.67	60.21		6473.4
2	SC	1.5	3.5	21	31	39	55	30	30	5.89	40.91		2199.1
3	SC	3.5	5.5	10	15	19	55	30	30	2.81	19.48		1047.2
4	ML	5.5	7.5	10	15	18	0	0	30	1.37	9.54		1025.3
5	ML	7.5	10	1	1	2	0	0	30	0.13	0.93		100.3
6	ML	10	13.5	4	6	6	0	0	30	0.46	3.20		344.4
7	SM	13.5	18	6	9	9	0	0	32	0.69	4.81		894.9
8	SM	18	23	17	25	26	0	0	36	1.93	13.38		2492.7
9	SM	23	28	39	57	55	0	0	36	4.10	28.44		5296.9
10	SM	28	33	85	125	117	0	0	36	8.80	61.12		11383.4
11	SM	33	38	52	76	72	0	0	36	5.41	37.58		6999.3
12	PWR	38	43	100	147	146	0	0	40	10.94	75.96		14147.7
13	PWR	43	48	100	147	146	0	0	40	10.92	75.85		14125.8
14	PWR	48	53	100	147	145	0	0	40	10.91	75.74		14105.9
15	PWR	53	54	100	147	145	0	0	40	10.90	75.68		14094.7
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17		-											
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19		-											
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27		-											
28		-											
29		-											
30		-											

For cohesionless soils, Equation 7-41 of the GDM was used to calculate ϕ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate ϕ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - \left(0.28 \cdot PI\right) + 0.00145 \cdot \left(PI\right)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{\Gamma_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u.High} := .15 \cdot N_{1.60}$$

Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 88 %

C_E: 1.47

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B11-SPT-05

GW Depth: 11.0 ft

Sample	USCS	Layer		z (ft)	N _m	(FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5} SAND	CRR _{7.5} CLAY	CRR* _{EQ}	CSReq / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE	SEE	FEE		C _σ	K _σ						K _{DR}	SEE					FEE	
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	SM	0.0	2.0	1.0	13	41	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	24	5.5	30	0.16	1.10	1	0.473	10.833	0.52	0.24	0.08
2	SM	2.0	4.0	3.0	32	41	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	60	5.5	31	0.30	1.10	1	0.555	8.889	0.61	0.21	0.07
3	SM	4.0	6.0	5.0	31	41	0.6	0.6	-0.052	0.006	0.99	0.13	0.05	1.04	0.12	0.04	1.54	0.75	52	5.5	31	0.30	1.10	2	0.555	5.167	1.22	0.10	0.04
4	SM	6.0	8.0	7.0	9	41	0.8	0.8	-0.084	0.010	0.99	0.13	0.04	1.04	0.12	0.04	1.62	0.75	16	5.5	22	0.11	1.10	2	0.226	1.071	0.50	0.25	0.09
5	SM	8.0	13.0	10.5	25	32	1.3	1.3	-0.146	0.017	0.98	0.13	0.04	1.04	0.12	0.04	1.20	0.75	33	5.4	31	0.24	1.10	2	0.555	1.984	1.22	0.10	0.04
6	SM	13.0	18.0	15.5	13	32	1.9	1.6	-0.247	0.028	0.96	0.15	0.05	1.04	0.14	0.05	1.13	0.85	18	5.4	24	0.12	1.03	2	0.262	0.823	0.54	0.26	0.09
7	SM	18.0	23.0	20.5	80	32	2.5	1.9	-0.360	0.041	0.94	0.16	0.06	1.04	0.16	0.05	1.01	0.95	112	5.4	31	0.30	1.02	2	0.555	4.284	1.13	0.14	0.05
8	PWR	23.0	28.0	25.5	100	32	3.1	2.2	-0.485	0.054	0.92	0.17	0.06	1.04	0.16	0.06	1.00	0.95	139	5.4	31	0.30	0.98	2	0.555	4.640	1.09	0.15	0.05
9	SM	28.0	33.0	30.5	28	25	3.7	2.4	-0.618	0.069	0.90	0.17	0.06	1.04	0.17	0.06	0.93	0.95	36	5.1	31	0.28	0.94	2	0.555	1.146	1.05	0.16	0.06
10	SM	33.0	38.0	35.5	33	25	4.3	2.7	-0.758	0.085	0.87	0.18	0.06	1.04	0.17	0.06	0.90	1.00	43	5.1	31	0.30	0.91	2	0.555	1.208	1.01	0.17	0.06
11	PWR	38.0	43.0	40.5	100	25	4.9	3.0	-0.902	0.101	0.85	0.18	0.06	1.04	0.17	0.06	0.99	1.00	146	5.1	31	0.30	0.88	2	0.555	3.312	0.97	0.18	0.06
12	PWR	43.0	48.0	45.5	100	25	5.5	3.3	-1.048	0.116	0.83	0.18	0.06	1.04	0.17	0.06	0.99	1.00	145	5.1	31	0.30	0.85	2	0.555	3.024	0.94	0.18	0.06
13	PWR	48.0	49.0	48.5	100	25	5.8	3.5	-1.136	0.126	0.81	0.18	0.06	1.04	0.17	0.06	0.99	1.00	145	5.1	31	0.30	0.83	2	0.555	2.874	0.93	0.18	0.06
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B11-SPT-05

GW Depth:

11.0 ft



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		ϕ _{SSL}	ϕ _{SSLQ}	ϕ _{F,S,EQ}	ϕ _{SSL}	ϕ _{SSLQ}	ϕ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	SM	0.0	2.0	0.24	0.08	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	SM	2.0	4.0	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SM	4.0	6.0	0.10	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SM	6.0	8.0	0.25	0.09	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SM	8.0	13.0	0.10	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	SM	13.0	18.0	0.26	0.09	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	SM	18.0	23.0	0.14	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	PWR	23.0	28.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	SM	28.0	33.0	0.16	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	33.0	38.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	PWR	38.0	43.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	PWR	43.0	48.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	PWR	48.0	49.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14		-													
15		-													
16		-													
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24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring: B11-SPT-05

GW Depth: 11.0 ft

Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ´	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	SM	0	2	13	19	24	49	17	36	3.65	25.32		2358.1
2	SM	2	4	32	47	60	49	17	36	8.98	62.33		5804.5
3	SM	4	6	31	45	52	49	17	36	7.86	54.56		5080.2
4	SM	6	8	9	13	16	49	17	36	2.40	16.67		1552.3
5	SM	8	13	25	37	33	0	0	36	2.48	17.23		3209.0
6	SM	13	18	13	19	18	0	0	36	1.37	9.52		1772.1
7	SM	18	23	80	117	112	0	0	36	8.42	58.44		10884.6
8	PWR	23	28	100	147	139	0	0	40	10.44	72.48		13499.2
9	SM	28	33	28	41	36	0	0	36	2.71	18.84		3508.8
10	SM	33	38	33	48	43	0	0	36	3.26	22.65		4219.2
11	PWR	38	43	100	147	146	0	0	40	10.93	75.89		14133.2
12	PWR	43	48	100	147	145	0	0	40	10.91	75.78		14112.6
13	PWR	48	49	100	147	145	0	0	40	10.90	75.71		14101.1
14		-											
15		-											
16		-											
17		-											
18													
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25		-											
26		-											
27		-											
28		-											
29		-											
30		-											

For cohesionless soils, Equation 7-41 of the GDM was used to calculate φ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate φ.
Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u,Low} := .075 \cdot N_{1.60}^{r_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u,High} := .15 \cdot N_{1.60}$$



Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 88 %

C_E: 1

C_B: 1

C_S: 1

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B11-SPT-06

GW Depth: 17.0 ft

Sample	USCS	Layer		z	N _m	(FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		top	bottom	(ft)			(ksf)	(ksf)	α	β	r _d	SEE	FEE		SEE	FEE						C _σ	K _σ	K _{DR}	SAND	CLAY		SEE	FEE
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	CH	0.0	2.0	1.0	17	64	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1	0.13	0.05	1.70	0.75	32	5.5	31	0.22	1.10	1	0.555	14.167	14.17	0.01	0.00
2	CH	2.0	4.0	3.0	17	64	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1	0.13	0.05	1.70	0.75	32	5.5	31	0.22	1.10	1	0.555	4.722	4.72	0.03	0.01
3	CH	4.0	6.0	5.0	15	64	0.6	0.6	-0.052	0.006	0.99	0.13	0.05	1	0.13	0.04	1.70	0.75	28	5.5	31	0.19	1.10	1	0.555	2.500	2.50	0.05	0.02
4	CH	6.0	8.0	7.0	16	64	0.8	0.8	-0.084	0.010	0.99	0.13	0.04	1	0.13	0.04	1.51	0.75	27	5.5	31	0.17	1.10	1	0.555	1.905	1.90	0.07	0.02
5	SC	8.0	12.0	10.0	38	36	1.2	1.2	-0.137	0.016	0.98	0.13	0.04	1	0.12	0.04	1.17	0.75	49	5.5	31	0.30	1.10	2	0.555	3.167	1.22	0.10	0.04
6	SM	12.0	18.0	15.0	45	36	1.8	1.8	-0.236	0.027	0.96	0.13	0.04	1	0.12	0.04	1.03	0.85	58	5.5	31	0.30	1.03	2	0.555	2.500	1.15	0.11	0.04
7	SM	18.0	23.0	20.5	23	24	2.5	2.2	-0.360	0.041	0.94	0.13	0.05	1	0.13	0.05	0.95	0.95	31	5.0	31	0.21	0.98	2	0.555	1.026	1.08	0.12	0.04
8	SM	23.0	28.0	25.5	56	24	3.1	2.5	-0.485	0.054	0.92	0.14	0.05	1	0.14	0.05	0.95	0.95	74	5.0	31	0.30	0.93	2	0.555	2.214	1.03	0.14	0.05
9	SM	28.0	33.0	30.5	52	15	3.7	2.8	-0.618	0.069	0.90	0.15	0.05	1	0.15	0.05	0.92	0.95	67	3.3	31	0.30	0.90	2	0.555	1.846	1.00	0.15	0.05
10	PWR	33.0	38.0	35.5	100	15	4.3	3.1	-0.758	0.085	0.87	0.16	0.05	1	0.15	0.05	0.99	1.00	146	3.3	31	0.30	0.87	2	0.555	3.220	0.96	0.16	0.05
11	SM	38.0	43.0	40.5	53	15	4.9	3.4	-0.902	0.101	0.85	0.16	0.06	1	0.15	0.05	0.89	1.00	69	3.3	31	0.30	0.84	2	0.555	1.562	0.93	0.16	0.06
12	SM	43.0	48.0	45.5	82	19	5.5	3.7	-1.048	0.116	0.83	0.16	0.06	1	0.15	0.05	0.95	1.00	114	4.3	31	0.30	0.82	2	0.555	2.227	0.91	0.17	0.06
13	SM	48.0	53.0	50.5	34	19	6.1	4.0	-1.194	0.132	0.80	0.16	0.06	1	0.15	0.05	0.79	1.00	40	4.3	31	0.30	0.79	2	0.555	0.857	0.88	0.17	0.06
14	PWR	53.0	58.0	55.5	100	19	6.7	4.3	-1.336	0.147	0.78	0.16	0.06	1	0.15	0.05	0.99	1.00	145	4.3	31	0.30	0.77	2	0.555	2.349	0.86	0.18	0.06
15	PWR	58.0	63.0	60.5	100	19	7.3	4.5	-1.473	0.162	0.76	0.16	0.05	1	0.15	0.05	0.99	1.00	145	4.3	31	0.30	0.75	2	0.555	2.200	0.84	0.18	0.06
16	PWR	63.0	68.0	65.5	100	19	7.9	4.8	-1.603	0.175	0.73	0.16	0.05	1	0.15	0.05	0.99	1.00	145	4.3	31	0.30	0.74	2	0.555	2.069	0.82	0.18	0.06
17	PWR	68.0	68.6	68.3	100	19	8.2	5.0	-1.671	0.182	0.72	0.15	0.05	1	0.15	0.05	0.99	1.00	145	4.3	31	0.30	0.73	2	0.555	2.002	0.81	0.18	0.06
18																													
19																													
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

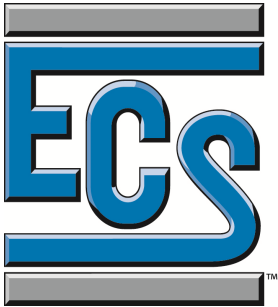
Project ID: 0038111

Boring:

B11-SPT-06

GW Depth:

17.0 ft



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		Φ _{SSL}	Φ _{SSLQ} N	Φ _{F,S,EQ}	Φ _{SSL}	Φ _{SSLQ} N	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	CH	0.0	2.0	0.01	0.00	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0	0.00
2	CH	2.0	4.0	0.03	0.01	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0	0.00
3	CH	4.0	6.0	0.05	0.02	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0	0.00
4	CH	6.0	8.0	0.07	0.02	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0	0.00
5	SC	8.0	12.0	0.10	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
6	SM	12.0	18.0	0.11	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
7	SM	18.0	23.0	0.12	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
8	SM	23.0	28.0	0.14	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
9	SM	28.0	33.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
10	PWR	33.0	38.0	0.16	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
11	SM	38.0	43.0	0.16	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
12	SM	43.0	48.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
13	SM	48.0	53.0	0.17	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
14	PWR	53.0	58.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
15	PWR	58.0	63.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
16	PWR	63.0	68.0	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
17	PWR	68.0	68.6	0.18	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0	0.00
18		-													
19		-													
20		-													
21		-													
22		-													
23		-													
24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0	0.00

L-Pile Input Parameters

Project Information													
Date: July 21, 2015				Boring: B11-SPT-06									
Site: I-85/385				GW Depth: 17.0 ft									
Location: Greenville, SC													
Project ID: 0038111													
Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ'	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	CH	0	2	17	25	32	71	38	26	4.77	33.11	0.55	1780.2
2	CH	2	4	17	25	32	71	38	26	4.77	33.11	0.55	1780.2
3	CH	4	6	15	22	28	71	38	26	4.21	29.22	0.55	1570.8
4	CH	6	8	16	23	27	71	38	26	3.99	27.73	0.55	1490.5
5	SC	8	12	38	56	49	34	13	30	3.67	25.51		2743.2
6	SM	12	18	45	66	58	0	0	36	4.33	30.06		5598.0
7	SM	18	23	23	34	31	0	0	36	2.29	15.92		2964.6
8	SM	23	28	56	82	74	0	0	36	5.57	38.69		7205.5
9	SM	28	33	52	76	67	0	0	36	5.02	34.87		6494.8
10	PWR	33	38	100	147	146	0	0	40	10.92	75.85		14126.8
11	SM	38	43	53	78	69	0	0	36	5.18	35.95		6694.8
12	SM	43	48	82	120	114	0	0	36	8.55	59.34		11052.3
13	SM	48	53	34	50	40	0	0	36	2.97	20.63		3841.4
14	PWR	53	58	100	147	145	0	0	40	10.87	75.47		14055.7
15	PWR	58	63	100	147	145	0	0	40	10.86	75.39		14041.0
16	PWR	63	68	100	147	145	0	0	40	10.85	75.32		14027.2
17	PWR	68	68.6	100	147	145	0	0	40	10.84	75.28		14019.8
18													
19			-										
20			-										
21			-										
22			-										
23			-										
24			-										
25			-										
26			-										
27			-										
28			-										
29			-										
30			-										

For cohesionless soils, Equation 7-41 of the GDM was used to calculate φ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate φ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u,Low} := .075 \cdot N_{1.60}^{\Gamma_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u,High} := .15 \cdot N_{1.60}$$



Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

238,385

720,178

2,034,266

1,036,249

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 73 %

C_E: 1.22

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B-30

GW Depth: 55.0 ft

Assumed

Sample	USCS	Layer		z (ft)	N _m	% Passing #4 (FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE	SEE	FEE		C _σ	K _σ						SAND	CLAY					SEE	FEE
Equation No.		top	bottom						(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	SM	0.0	2.5	1.3	8	100	0.2	0.2	0.000	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	12	5.5	18	0.10	1.10	2	0.183	5.333	0.40	0.31	0.11
2	SM	2.5	5.0	3.8	14	100	0.5	0.5	-0.034	0.004	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	22	5.5	27	0.14	1.10	2	0.354	3.111	0.78	0.16	0.06
3	SM	5.0	7.5	6.3	12	100	0.8	0.8	-0.072	0.009	0.99	0.13	0.05	1.04	0.12	0.04	1.66	0.75	18	5.5	24	0.12	1.10	2	0.262	1.600	0.58	0.22	0.08
4	SM	7.5	10.0	8.8	8	100	1.1	1.1	-0.114	0.013	0.98	0.13	0.04	1.04	0.12	0.04	1.44	0.75	11	5.5	16	0.09	1.06	2	0.165	0.762	0.35	0.35	0.12
5	SM	10.0	15.0	12.5	7	100	1.5	1.5	-0.185	0.021	0.97	0.13	0.04	1.04	0.12	0.04	1.18	0.75	8	5.5	13	0.08	1.02	2	0.140	0.467	0.29	0.42	0.15
6	SM	15.0	20.0	17.5	9	100	2.1	2.1	-0.291	0.033	0.95	0.12	0.04	1.04	0.12	0.04	0.97	0.85	9	5.5	15	0.09	1.00	2	0.152	0.429	0.30	0.39	0.14
7	SM	20.0	25.0	22.5	10	100	2.7	2.7	-0.409	0.046	0.93	0.12	0.04	1.04	0.12	0.04	0.85	0.95	10	5.5	15	0.09	0.97	2	0.159	0.370	0.31	0.38	0.13
8	SM	25.0	30.0	27.5	9	100	3.3	3.3	-0.537	0.060	0.91	0.12	0.04	1.04	0.11	0.04	0.76	0.95	8	5.5	13	0.09	0.96	2	0.143	0.273	0.27	0.42	0.15
9	SM	30.0	35.0	32.5	7	100	3.9	3.9	-0.673	0.075	0.89	0.12	0.04	1.04	0.11	0.04	0.68	0.95	5	5.5	11	0.08	0.95	2	0.125	0.179	0.24	0.47	0.16
10	SM	35.0	40.0	37.5	9	100	4.5	4.5	-0.815	0.091	0.87	0.11	0.04	1.04	0.11	0.04	0.64	1.00	7	5.5	12	0.08	0.93	2	0.136	0.200	0.25	0.43	0.15
11	SM	40.0	45.0	42.5	10	100	5.1	5.1	-0.961	0.107	0.84	0.11	0.04	1.04	0.11	0.04	0.60	1.00	7	5.5	13	0.08	0.92	2	0.139	0.196	0.26	0.41	0.14
12	SM	45.0	50.0	47.5	15	100	5.7	5.7	-1.107	0.123	0.82	0.11	0.04	1.04	0.10	0.04	0.60	1.00	11	5.5	16	0.10	0.90	2	0.169	0.263	0.30	0.34	0.12
13	SM	50.0	55.0	52.5	16	100	6.3	6.3	-1.252	0.138	0.79	0.10	0.04	1.04	0.10	0.03	0.58	1.00	11	5.5	17	0.10	0.89	2	0.172	0.254	0.31	0.33	0.11
14	PWR	55.0	60.0	57.5	100	100	6.9	6.7	-1.392	0.153	0.77	0.10	0.04	1.04	0.10	0.03	0.98	1.00	119	5.5	31	0.30	0.64	2	0.555	1.483	0.71	0.14	0.05
15	PWR	60.0	65.0	62.5	100	100	7.5	7.0	-1.526	0.167	0.75	0.10	0.04	1.04	0.10	0.04	0.98	1.00	119	5.5	31	0.30	0.62	2	0.555	1.422	0.69	0.14	0.05
16	PWR	65.0	70.0	67.5	100	100	8.1	7.3	-1.652	0.180	0.73	0.10	0.04	1.04	0.10	0.04	0.98	1.00	119	5.5	31	0.30	0.61	2	0.555	1.366	0.68	0.15	0.05
17																													
18																													
19																													
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring: B-30

GW Depth: 55.0 ft Assumed



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		ϕ _{SSL}	ϕ _{SSLQ_N}	ϕ _{F,S,EQ}	ϕ _{SSL}	ϕ _{SSLQ_N}	ϕ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	SM	0.0	2.5	0.31	0.11	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	SM	2.5	5.0	0.16	0.06	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SM	5.0	7.5	0.22	0.08	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SM	7.5	10.0	0.35	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SM	10.0	15.0	0.42	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	SM	15.0	20.0	0.39	0.14	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	SM	20.0	25.0	0.38	0.13	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	SM	25.0	30.0	0.42	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	SM	30.0	35.0	0.47	0.16	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	35.0	40.0	0.43	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	SM	40.0	45.0	0.41	0.14	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	SM	45.0	50.0	0.34	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	SM	50.0	55.0	0.33	0.11	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14	PWR	55.0	60.0	0.14	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
15	PWR	60.0	65.0	0.14	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
16	PWR	65.0	70.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
17		-													
18		-													
19		-													
20		-													
21		-													
22		-													
23		-													
24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring: B-30

GW Depth: 55.0 ft Assumed



Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ´	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	SM	0	2.5	8	10	12	61	13	34	1.86	12.93		1203.8
2	SM	2.5	5	14	17	22	61	13	36	3.26	22.62		2106.6
3	SM	5	7.5	12	15	18	61	13	36	2.73	18.96		1765.3
4	SM	7.5	10	8	10	11	61	13	33	1.58	10.96		1020.2
5	SM	10	15	7	9	8	61	13	31	1.13	7.86		732.3
6	SM	15	20	9	11	9	61	13	32	1.36	9.44		878.8
7	SM	20	25	10	12	10	61	13	32	1.47	10.24		953.1
8	SM	25	30	9	11	8	61	13	31	1.18	8.21		764.7
9	SM	30	35	7	9	5	48	7	29	0.82	5.72		532.5
10	SM	35	40	9	11	7	48	7	30	1.05	7.28		678.0
11	SM	40	45	10	12	7	48	7	31	1.10	7.64		711.1
12	SM	45	50	15	18	11	48	7	33	1.64	11.42		1063.5
13	SM	50	55	16	19	11	36	3	33	0.84	5.87		1092.6
14	PWR	55	60	100	122	119	36	3	40	8.95	62.15		11574.4
15	PWR	60	65	100	122	119	36	3	40	8.94	62.11		11566.6
16	PWR	65	70	100	122	119	36	3	40	8.94	62.07		11559.2
17		-											
18													
19		-											
20		-											
21		-											
22		-											
23		-											
24		-											
25		-											
26		-											
27		-											
28		-											
29		-											
30		-											

For cohesionless soils, Equation 7-41 of the GDM was used to calculate ϕ.

ϕ'_{Cohesionless} := (15.4 \cdot N'_{1.60})^{0.5} + 20

For cohesive soils, Equation 7-45 of the GDM was used to calculate ϕ.

Please note that the +/- 8° was omitted from the end of the equation.

ϕ'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

c_{u,Low} := .075 \cdot N_{1.60}^{r_{1.60} .60}

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>=40

c_{u,High} := .15 \cdot N_{1.60}

Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	ϕ´ (deg)	c´ (psf)	ϕ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

ER: 73 %

C_E: 1.22

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: B-31

GW Depth: 50.0 ft

Assumed

Sample	USCS	Layer		z (ft)	N _m	% Passing #4 (FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE	SEE	FEE		C _σ	K _σ						K _{DR}	SAND					CLAY	SEE
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	SC	0.0	2.0	1.0	12	99	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	19	5.5	24	0.13	1.10	2	0.270	10.000	0.59	0.21	0.07
2	SC	2.0	4.0	3.0	5	99	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1.04	0.13	0.04	1.70	0.75	8	5.5	13	0.08	1.10	2	0.142	1.389	0.31	0.40	0.14
3	SC	4.0	6.0	5.0	21	99	0.6	0.6	-0.052	0.006	0.99	0.13	0.05	1.04	0.12	0.04	1.68	0.75	32	5.5	31	0.23	1.10	2	0.555	3.500	1.22	0.10	0.04
4	SM	6.0	8.0	7.0	63	99	0.8	0.8	-0.084	0.010	0.99	0.13	0.04	1.04	0.12	0.04	1.16	0.75	67	5.5	31	0.30	1.10	2	0.555	7.500	1.22	0.10	0.04
5	SM	8.0	10.0	9.0	32	99	1.1	1.1	-0.119	0.014	0.98	0.13	0.04	1.04	0.12	0.04	1.24	0.75	36	5.5	31	0.28	1.10	2	0.555	2.963	1.22	0.10	0.04
6	SM	10.0	13.0	11.5	21	99	1.4	1.4	-0.165	0.019	0.97	0.13	0.04	1.04	0.12	0.04	1.17	0.75	22	5.5	28	0.15	1.05	2	0.383	1.522	0.81	0.15	0.05
7	PWR	13.0	18.0	15.5	100	99	1.9	1.9	-0.247	0.028	0.96	0.12	0.04	1.04	0.12	0.04	1.00	0.85	104	5.5	31	0.30	1.02	2	0.555	5.376	1.13	0.11	0.04
8	PWR	18.0	23.0	20.5	100	99	2.5	2.5	-0.360	0.041	0.94	0.12	0.04	1.04	0.12	0.04	1.00	0.95	115	5.5	31	0.30	0.94	2	0.555	4.065	1.04	0.11	0.04
9	PWR	23.0	28.0	25.5	100	99	3.1	3.1	-0.485	0.054	0.92	0.12	0.04	1.04	0.12	0.04	0.99	0.95	115	5.5	31	0.30	0.87	2	0.555	3.268	0.97	0.12	0.04
10	SM	28.0	33.0	30.5	49	99	3.7	3.7	-0.618	0.069	0.90	0.12	0.04	1.04	0.11	0.04	0.86	0.95	49	5.5	31	0.30	0.82	2	0.555	1.339	0.91	0.12	0.04
11	SM	33.0	38.0	35.5	33	99	4.3	4.3	-0.758	0.085	0.87	0.11	0.04	1.04	0.11	0.04	0.77	1.00	31	5.5	31	0.21	0.84	2	0.555	0.775	0.93	0.12	0.04
12	SM	38.0	43.0	40.5	27	99	4.9	4.9	-0.902	0.101	0.85	0.11	0.04	1.04	0.11	0.04	0.71	1.00	23	5.5	29	0.15	0.87	2	0.420	0.556	0.73	0.15	0.05
13	GW	43.0	48.0	45.5	56	38	5.5	5.5	-1.048	0.116	0.83	0.11	0.04	1.04	0.10	0.04	0.81	1.00	55	5.5	31	0.30	0.70	2	0.555	1.026	0.78	0.13	0.05
14	PWR	48.0	53.0	50.5	100	38	6.1	6.0	-1.194	0.132	0.80	0.10	0.04	1.04	0.10	0.04	0.98	1.00	120	5.5	31	0.30	0.67	2	0.555	1.659	0.74	0.14	0.05
15	PWR	53.0	58.0	55.5	100	38	6.7	6.3	-1.336	0.147	0.78	0.11	0.04	1.04	0.10	0.04	0.98	1.00	119	5.5	31	0.30	0.65	2	0.555	1.583	0.73	0.14	0.05
16	PWR	58.0	63.0	60.5	100	38	7.3	6.6	-1.473	0.162	0.76	0.11	0.04	1.04	0.10	0.04	0.98	1.00	119	5.5	31	0.30	0.64	2	0.555	1.514	0.71	0.15	0.05
17	PWR	63.0	65.0	64.0	100	38	7.7	6.8	-1.565	0.172	0.74	0.11	0.04	1.04	0.10	0.04	0.98	1.00	119	5.5	31	0.30	0.63	2	0.555	1.469	0.70	0.15	0.05
18																													
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30																													

Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

B-31

GW Depth:

50.0

ft

Assumed



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		ϕ _{SSL}	ϕ _{SSLQ_N}	Φ _{F,S,EQ}	ϕ _{SSL}	ϕ _{SSLQ_N}	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	SC	0.0	2.0	0.21	0.07	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
2	SC	2.0	4.0	0.40	0.14	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
3	SC	4.0	6.0	0.10	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SM	6.0	8.0	0.10	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SM	8.0	10.0	0.10	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	SM	10.0	13.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	PWR	13.0	18.0	0.11	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	PWR	18.0	23.0	0.11	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
9	PWR	23.0	28.0	0.12	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
10	SM	28.0	33.0	0.12	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
11	SM	33.0	38.0	0.12	0.04	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
12	SM	38.0	43.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
13	GW	43.0	48.0	0.13	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
14	PWR	48.0	53.0	0.14	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
15	PWR	53.0	58.0	0.14	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
16	PWR	58.0	63.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
17	PWR	63.0	65.0	0.15	0.05	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
18		-													
19		-													
20		-													
21		-													
22		-													
23		-													
24		-													
25		-													
26		-													
27		-													
28		-													
29		-													
30		-													
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information												
Date: July 21, 2015												
Site: I-85/385												
Location: Greenville, SC												
Project ID: 0038111												
Boring: B-31												
GW Depth: 50.0 ft Assumed												

Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ'	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	SC	0	2	12	15	19	37	16	30	1.40	9.70		1042.4
2	SC	2	4	5	6	8	37	16	30	0.58	4.04		434.4
3	SC	4	6	21	26	32	37	16	30	2.42	16.79		1805.3
4	SM	6	8	63	77	67	32	3	36	5.02	34.83		6487.2
5	SM	8	10	32	39	36	32	3	36	2.72	18.86		3513.2
6	SM	10	13	21	26	22	32	3	36	1.69	11.72		2182.0
7	PWR	13	18	100	122	104	32	3	40	7.77	53.93		10043.1
8	PWR	18	23	100	122	115	32	3	40	8.64	60.00		11174.5
9	PWR	23	28	100	122	115	32	3	40	8.61	59.79		11135.6
10	SM	28	33	49	60	49	32	3	36	3.66	25.42		4733.6
11	SM	33	38	33	40	31	32	3	36	2.32	16.14		3005.3
12	SM	38	43	27	33	23	32	3	36	1.75	12.16		2264.0
13	GW	43	48	56	68	55	0	0	40	4.14	28.76		9221.4
14	PWR	48	53	100	122	120	0	0	40	8.97	62.26		11595.1
15	PWR	53	58	100	122	119	0	0	40	8.96	62.21		11586.5
16	PWR	58	63	100	122	119	0	0	40	8.95	62.17		11578.2
17	PWR	63	65	100	122	119	0	0	40	8.95	62.14		11572.7
18													
19			-										
20			-										
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For cohesionless soils, Equation 7-41 of the GDM was used to calculate φ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate φ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - \left(0.28 \cdot PI\right) + 0.00145 \cdot \left(PI\right)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{\text{r}_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u.High} := .15 \cdot N_{1.60}$$



Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c´ (psf)	φ´ (deg)	c´ (psf)	φ´ (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

Assumed

ER: 80 %

C_E: 1.33

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: WRM-1L-01

GW Depth: 3.6 ft

Assumed

Sample	USCS	Layer		z (ft)	N _m	% Passing #4 (FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE		SEE		FEE								C _σ					K _σ	K _{DR}
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	CL	0.0	2.0	1.0	7	99	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1.01	0.13	0.05	1.70	0.75	12	5.5	17	0.10	1.10	2	0.178	5.833	5.83	0.02	0.01
2	CL	2.0	4.0	3.0	7	99	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1.01	0.13	0.05	1.70	0.75	12	5.5	17	0.10	1.10	2	0.178	1.944	1.94	0.07	0.02
3	CL	4.0	6.0	5.0	5	99	0.6	0.5	-0.052	0.006	0.99	0.15	0.05	1.01	0.15	0.05	1.70	0.75	9	5.5	14	0.09	1.10	2	0.148	0.975	0.98	0.15	0.05
4	SM	6.0	8.0	7.0	10	99	0.8	0.6	-0.084	0.010	0.99	0.17	0.06	1.04	0.17	0.06	1.70	0.75	17	5.5	22	0.12	1.10	2	0.241	1.593	0.53	0.31	0.11
5	SM	8.0	10.0	9.0	7	99	1.1	0.7	-0.119	0.014	0.98	0.19	0.06	1.04	0.18	0.06	1.70	0.75	12	5.5	17	0.10	1.10	2	0.178	0.942	0.39	0.46	0.16
6	SM	10.0	12.0	11.0	9	99	1.3	0.9	-0.156	0.018	0.98	0.20	0.07	1.04	0.19	0.07	1.60	0.75	14	5.5	20	0.11	1.09	2	0.204	1.049	0.45	0.42	0.15
7	SM	12.0	18.0	15.0	12	99	1.8	1.1	-0.236	0.027	0.96	0.21	0.07	1.04	0.20	0.07	1.37	0.85	19	5.5	24	0.13	1.08	2	0.271	1.102	0.58	0.34	0.12
8	SM	18.0	20.0	19.0	12	99	2.3	1.3	-0.325	0.037	0.95	0.21	0.07	1.04	0.21	0.07	1.24	0.85	17	5.5	22	0.12	1.05	2	0.239	0.910	0.50	0.41	0.14
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

WRM-1L-01

GW Depth:

3.6

ft

Assumed



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		Φ _{SSL}	Φ _{SSLQ}	Φ _{F,S,EQ}	Φ _{SSL}	Φ _{SSLQ}	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	CL	0.0	2.0	0.02	0.01	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
2	CL	2.0	4.0	0.07	0.02	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
3	CL	4.0	6.0	0.15	0.05	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
4	SM	6.0	8.0	0.31	0.11	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	SM	8.0	10.0	0.46	0.16	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
6	SM	10.0	12.0	0.42	0.15	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
7	SM	12.0	18.0	0.34	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
8	SM	18.0	20.0	0.41	0.14	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
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27															
28															
29															
30															
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring: WRM-1L-01

GW Depth: 3.6 ft

Assumed

Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ'	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	CL	0	2	7	9	12	0	0	26	0.89	6.20	-0.09	666.4
2	CL	2	4	7	9	12	0	0	26	0.89	6.20	-0.09	666.4
3	CL	4	6	5	7	9	0	0	26	0.64	4.43	-0.09	476.0
4	SM	6	8	10	13	17	0	0	36	1.28	8.85		1649.0
5	SM	8	10	7	9	12	0	0	34	0.89	6.20		1154.3
6	SM	10	12	9	12	14	0	0	35	1.08	7.49		1394.5
7	SM	12	18	12	16	19	0	0	36	1.40	9.71		1807.7
8	SM	18	20	12	16	17	0	0	36	1.27	8.79		1636.6
9			-										
10			-										
11			-										
12			-										
13			-										
14			-										
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23			-										
24			-										
25			-										
26			-										
27			-										
28			-										
29			-										
30			-										

For cohesionless soils, Equation 7-41 of the GDM was used to calculate φ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate φ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{\Gamma_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u.High} := .15 \cdot N_{1.60}$$



Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c' (psf)	φ' (deg)	c' (psf)	φ' (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c' (psf)	φ' (deg)	c' (psf)	φ' (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET

* Areas of user input are shaded in green



Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Quake Parameters

M_w: 7.37

MSF¹: 1.04 sand

MSF²: 1.01 clay

a_{SEE}: 0.2 % g

a_{FEE}: 0.07 % g

Hammer Parameters

Assumed

ER: 80 %

C_E: 1.33

C_B: 1

C_S: 1.0

General Parameters

γ_{soil}: 120 lb/ft³

γ_{water}: 62.4 lb/ft³

Boring: WRM-2L-01

GW Depth: 3.7 ft

Assumed

Sample	USCS	Layer		z (ft)	N _m	% Passing #4 (FC)	σ _{vo}	σ' _{vo}	Shear Stress Reduction Coefficient			CSR _{eq}		MSF	CSR* _{eq}		C _N	C _R	(N ₁) ₆₀	ΔN* _{1,60}	(N ₁) _{60cs}	High Overburden Correction		Age Factor	CRR _{7.5}	CRR _{7.5}	CRR* _{EQ}	CSReq / CRReq	
		(ksf)	(ksf)				α	β	r _d	SEE	FEE		SEE		FEE								C _σ					K _σ	K _{DR}
Equation No.									(1)	(2)	(3)	(4) (5)		(6) (7)	(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)		
1	CL	0.0	2.0	1.0	7	99	0.1	0.1	0.004	0.000	1.00	0.13	0.05	1.01	0.13	0.05	1.70	0.75	12	5.5	17	0.10	1.10	2	0.178	5.833	5.83	0.02	0.01
2	CL	2.0	4.0	3.0	13	99	0.4	0.4	-0.023	0.003	1.00	0.13	0.05	1.01	0.13	0.05	1.70	0.75	22	5.5	28	0.14	1.10	2	0.367	3.611	3.61	0.04	0.01
3	SC	4.0	6.0	5.0	3	99	0.6	0.5	-0.052	0.006	0.99	0.15	0.05	1.04	0.14	0.05	1.70	0.75	5	5.5	11	0.08	1.10	2	0.122	0.578	0.27	0.54	0.19
4	SC	6.0	8.0	7.0	9	99	0.8	0.6	-0.084	0.010	0.99	0.17	0.06	1.04	0.16	0.06	1.70	0.75	15	5.5	21	0.11	1.10	2	0.216	1.419	0.47	0.35	0.12
5	CL	8.0	10.0	9.0	6	99	1.1	0.7	-0.119	0.014	0.98	0.18	0.06	1.01	0.18	0.06	1.70	0.75	10	5.5	16	0.09	1.09	2	0.162	0.801	0.80	0.23	0.08
6	CL	10.0	12.0	11.0	10	99	1.3	0.9	-0.156	0.018	0.98	0.19	0.07	1.01	0.19	0.07	1.57	0.75	16	5.5	21	0.11	1.10	2	0.222	1.157	1.16	0.17	0.06
7	CL	12.0	18.0	15.0	9	99	1.8	1.1	-0.236	0.027	0.96	0.21	0.07	1.01	0.20	0.07	1.40	0.85	14	5.5	20	0.11	1.06	2	0.203	0.822	0.82	0.25	0.09
8	SC	18.0	20.0	19.0	14	99	2.3	1.3	-0.325	0.037	0.95	0.21	0.07	1.04	0.20	0.07	1.23	0.85	19	5.5	25	0.13	1.05	2	0.289	1.056	0.61	0.34	0.12
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Notes:
Triggering analysis and seismic settlement analysis based on Chapter 13 of South Carolina Department of Transportation (SCDOT) Geotechnical Design Manual (GDM).

SPT LIQUEFACTION POTENTIAL SUMMARY

Project Information

Date: July 21, 2015

Site: I-85/385

Location: Greenville, SC

Project ID: 0038111

Boring:

WRM-2L-01

GW Depth:

3.7

ft

Assumed



Sample	USCS	Layer		CSR _{eq} / CRR _{eq}		Φ _{SSL}	Φ _{SSLQ} N	Φ _{F,S,EQ}	Φ _{SSL}	Φ _{SSLQ} N	Φ _{F,S,EQ}	Triggering		Settlement	
		top	bottom	SEE	FEE	SEE			FEE			SEE	FEE	SEE	FEE
1	CL	0.0	2.0	0.02	0.01	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
2	CL	2.0	4.0	0.04	0.01	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
3	SC	4.0	6.0	0.54	0.19	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
4	SC	6.0	8.0	0.35	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
5	CL	8.0	10.0	0.23	0.08	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
6	CL	10.0	12.0	0.17	0.06	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
7	CL	12.0	18.0	0.25	0.09	0.9	N/A	0.95	0.85	N/A	0.90	no	no	0.00	0.00
8	SC	18.0	20.0	0.34	0.12	0.75	0.9	0.95	0.7	0.85	0.90	no	no	0.00	0.00
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30															
												Total Seismic Settlement		0.00	0.00

L-Pile Input Parameters

Project Information													
Date: July 21, 2015													
Site: I-85/385													
Location: Greenville, SC													
Project ID: 0038111													
Boring: WRM-2L-01													
GW Depth: 3.7 ft Assumed													
Sample	USCS	Layer		N	N ₆₀	N _{1.60}	LL	PI	ϕ'	c _u (ksf)	c _u (psi)	c _c	E _s (psi)
		top	bottom										
1	CL	0	2	7	9	12	0	0	26	0.89	6.20	-0.09	666.4
2	CL	2	4	13	17	22	0	0	26	1.66	11.51	-0.09	1237.6
3	SC	4	6	3	4	5	0	0	29	0.38	2.66		285.6
4	SC	6	8	9	12	15	0	0	30	1.15	7.97		856.8
5	CL	8	10	6	8	10	0	0	26	0.77	5.31	-0.09	571.2
6	CL	10	12	10	13	16	0	0	26	1.18	8.20	-0.09	881.7
7	CL	12	18	9	12	14	0	0	26	1.07	7.42	-0.09	797.3
8	SC	18	20	14	19	19	0	0	30	1.46	10.14		1090.0
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10		-											
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29		-											
30		-											

For cohesionless soils, Equation 7-41 of the GDM was used to calculate ϕ.

$$\phi'_{Cohesionless} := \left(15.4 \cdot N'_{1.60}\right)^{0.5} + 20$$

For cohesive soils, Equation 7-45 of the GDM was used to calculate ϕ.

Please note that the +/- 8° was omitted from the end of the equation.

$$\phi'_{Cohesive} := 35.7 - (0.28 \cdot PI) + 0.00145 \cdot (PI)^2$$

For Low Plasticity Soils, Equation 7-30 of the GDM was used to calculate c
LL<40

$$c_{u.Low} := .075 \cdot N_{1.60}^{\Gamma_{1.60} .60}$$

For High Plasticity Soils, Equation 7-31 of the GDM was used to calculate c
LL>/=40

$$c_{u.High} := .15 \cdot N_{1.60}$$



Table 7-15, Maximum Allowable Total Soil Shear Strengths

Soil Description		Peak		Residual	
		c' (psf)	ϕ' (deg)	c' (psf)	ϕ' (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	34	0	18
SW	Coarse Grained Sand	0	17	0	7
SM, SP	Fine Grained Sand	0	17	0	7
SP	Uniform Rounded Sand	0	15	0	6
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	1500	15	1200	6
SM-ML	Residual Soils	900	14	700	6
CL-ML	NC Clay (Low Plasticity)	1500	0	900	0
CL, CH	NC Clay (Med-High Plasticity)	2500	0	1250	0
CL-ML	OC Clay (Low Plasticity)	2500	0	1400	0
CL, CH	OC Clay (Med-High Plasticity)	4000	0	2000	0

Table 7-16, Maximum Allowable Effective Soil Shear Strengths

Soil Description		Peak		Residual	
		c' (psf)	ϕ' (deg)	c' (psf)	ϕ' (deg)
USCS	Description				
GW, GP, GM, GC	Stone and Gravel	0	40	0	34
SW	Coarse Grained Sand	0	38	0	32
SM, SP	Fine Grained Sand	0	36	0	30
SP	Uniform Rounded Sand	0	32	0	32
ML, MH, SC	Silt, Clayey Sand, Clayey Silt	0	30	0	27
SM-ML	Residual Soils	0	27	0	22
CL-ML	NC Clay (Low Plasticity)	0	35	0	31
CL, CH	NC Clay (Med-High Plasticity)	0	26	0	16
CL-ML	OC Clay (Low Plasticity)	0	34	0	31
CL, CH	OC Clay (Med-High Plasticity)	0	28	0	16

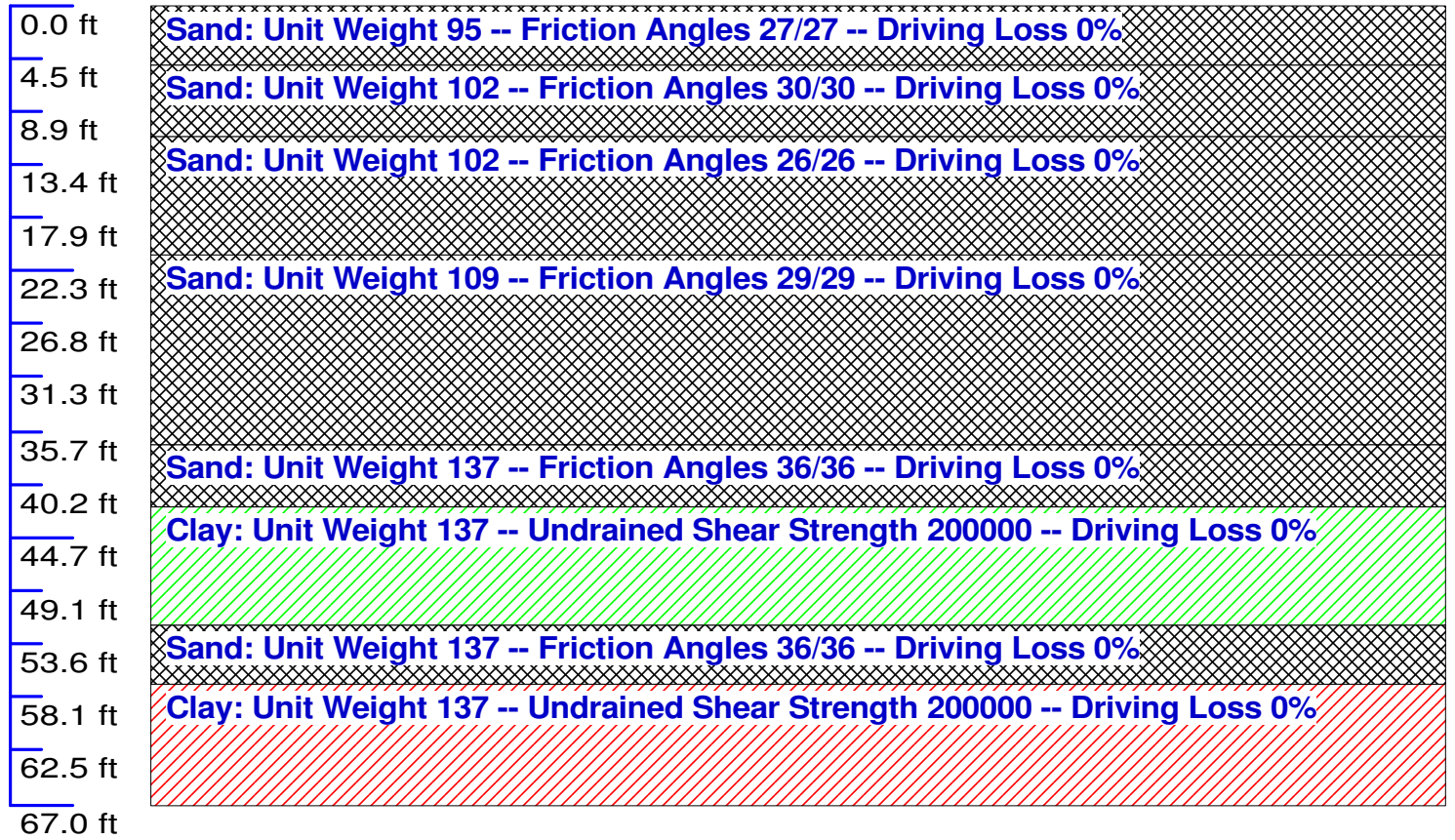
Table 7-18, Elastic Modulus Correlations For Soil

Soil Description		Elastic Modulus, E _s (psi)
USCS	Description	
GW, GP, GM, GC	Sandy gravels and gravels	167*N _{1.60}
SW	Coarse grained sands	139*N _{1.60}
SM, SP, PWR	Clean fine to medium grained sands and slightly silty sands, Partially Weathered Rock	97*N _{1.60}
ML, MH, SC, SM-ML, CL-ML, CL, CH	Silts, sandy silts, slightly cohesive mixtures	56*N _{1.60}

Appendix F

Driven Pile Axial Resistance and Capacities

Bridge 11 Bent 2 Soil Profile



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\BR11B2.DVN
Project Name: Bridge 11 Bent 2 Project Date: 05/08/2015
Project Client: CECS
Computed By: MJW
Project Manager: MFP

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	5.00 ft
	- Driving/Restrike	5.00 ft
	- Ultimate:	5.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	5.00 ft	0.00%	95.00 pcf	27.0/27.0	Nordlund
2	Cohesionless	6.00 ft	0.00%	102.00 pcf	30.0/30.0	Nordlund
3	Cohesionless	10.00 ft	0.00%	102.00 pcf	26.0/26.0	Nordlund
4	Cohesionless	16.00 ft	0.00%	109.00 pcf	29.0/29.0	Nordlund
5	Cohesionless	5.00 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
6	Cohesive	10.00 ft	0.00%	137.00 pcf	200000.00 psf	User Def.
7	Cohesionless	5.00 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
8	Cohesive	10.00 ft	0.00%	137.00 pcf	200000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.47 psf	20.33	N/A	0.00 Kips
4.99 ft	Cohesionless	237.02 psf	20.33	N/A	1.15 Kips
5.01 ft	Cohesionless	475.20 psf	22.59	N/A	1.17 Kips
10.99 ft	Cohesionless	593.60 psf	22.59	N/A	5.41 Kips
11.01 ft	Cohesionless	712.80 psf	19.58	N/A	5.43 Kips
20.01 ft	Cohesionless	891.00 psf	19.58	N/A	12.70 Kips
20.99 ft	Cohesionless	910.40 psf	19.58	N/A	13.67 Kips
21.01 ft	Cohesionless	1108.83 psf	21.84	N/A	13.69 Kips
30.01 ft	Cohesionless	1318.53 psf	21.84	N/A	26.99 Kips
36.99 ft	Cohesionless	1481.17 psf	21.84	N/A	40.22 Kips
37.01 ft	Cohesionless	1854.57 psf	27.11	N/A	40.28 Kips
41.99 ft	Cohesionless	2040.33 psf	27.11	N/A	60.85 Kips
42.01 ft	Cohesive	N/A	N/A	2000.00 psf	60.98 Kips
51.01 ft	Cohesive	N/A	N/A	2000.00 psf	132.45 Kips
51.99 ft	Cohesive	N/A	N/A	2000.00 psf	140.23 Kips
52.01 ft	Cohesionless	2973.57 psf	27.11	N/A	140.37 Kips
56.99 ft	Cohesionless	3159.33 psf	27.11	N/A	172.22 Kips
57.01 ft	Cohesive	N/A	N/A	2000.00 psf	172.37 Kips
66.01 ft	Cohesive	N/A	N/A	2000.00 psf	243.84 Kips
66.99 ft	Cohesive	N/A	N/A	2000.00 psf	251.63 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.95 psf	19.80	13.12 Kips	0.01 Kips
4.99 ft	Cohesionless	474.05 psf	19.80	13.12 Kips	4.75 Kips
5.01 ft	Cohesionless	475.40 psf	30.00	13.12 Kips	8.15 Kips
10.99 ft	Cohesionless	712.20 psf	30.00	13.12 Kips	12.21 Kips
11.01 ft	Cohesionless	713.00 psf	17.40	13.12 Kips	6.01 Kips
20.01 ft	Cohesionless	1069.40 psf	17.40	13.12 Kips	9.02 Kips
20.99 ft	Cohesionless	1108.20 psf	17.40	13.12 Kips	9.22 Kips
21.01 ft	Cohesionless	1109.07 psf	26.40	13.12 Kips	13.12 Kips
30.01 ft	Cohesionless	1528.47 psf	26.40	13.12 Kips	13.12 Kips
36.99 ft	Cohesionless	1853.73 psf	26.40	13.12 Kips	13.12 Kips
37.01 ft	Cohesionless	1854.95 psf	77.60	149.38 Kips	97.65 Kips
41.99 ft	Cohesionless	2226.45 psf	77.60	149.38 Kips	117.02 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
51.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
52.01 ft	Cohesionless	2973.95 psf	77.60	149.38 Kips	149.38 Kips
56.99 ft	Cohesionless	3345.45 psf	77.60	149.38 Kips	149.38 Kips
57.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
66.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
66.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.99 ft	1.15 Kips	4.75 Kips	5.91 Kips
5.01 ft	1.17 Kips	8.15 Kips	9.32 Kips
10.99 ft	5.41 Kips	12.21 Kips	17.62 Kips
11.01 ft	5.43 Kips	6.01 Kips	11.44 Kips
20.01 ft	12.70 Kips	9.02 Kips	21.72 Kips
20.99 ft	13.67 Kips	9.22 Kips	22.89 Kips
21.01 ft	13.69 Kips	13.12 Kips	26.82 Kips
30.01 ft	26.99 Kips	13.12 Kips	40.12 Kips
36.99 ft	40.22 Kips	13.12 Kips	53.35 Kips
37.01 ft	40.28 Kips	97.65 Kips	137.93 Kips
41.99 ft	60.85 Kips	117.02 Kips	177.87 Kips
42.01 ft	60.98 Kips	1773.62 Kips	1834.60 Kips
51.01 ft	132.45 Kips	1773.62 Kips	1906.08 Kips
51.99 ft	140.23 Kips	1773.62 Kips	1913.86 Kips
52.01 ft	140.37 Kips	149.38 Kips	289.75 Kips
56.99 ft	172.22 Kips	149.38 Kips	321.60 Kips
57.01 ft	172.37 Kips	1773.62 Kips	1945.99 Kips
66.01 ft	243.84 Kips	1773.62 Kips	2017.47 Kips
66.99 ft	251.63 Kips	1773.62 Kips	2025.25 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.47 psf	20.33	N/A	0.00 Kips
4.99 ft	Cohesionless	237.02 psf	20.33	N/A	1.15 Kips
5.01 ft	Cohesionless	475.20 psf	22.59	N/A	1.17 Kips
10.99 ft	Cohesionless	593.60 psf	22.59	N/A	5.41 Kips
11.01 ft	Cohesionless	712.80 psf	19.58	N/A	5.43 Kips
20.01 ft	Cohesionless	891.00 psf	19.58	N/A	12.70 Kips
20.99 ft	Cohesionless	910.40 psf	19.58	N/A	13.67 Kips
21.01 ft	Cohesionless	1108.83 psf	21.84	N/A	13.69 Kips
30.01 ft	Cohesionless	1318.53 psf	21.84	N/A	26.99 Kips
36.99 ft	Cohesionless	1481.17 psf	21.84	N/A	40.22 Kips
37.01 ft	Cohesionless	1854.57 psf	27.11	N/A	40.28 Kips
41.99 ft	Cohesionless	2040.33 psf	27.11	N/A	60.85 Kips
42.01 ft	Cohesive	N/A	N/A	2000.00 psf	60.98 Kips
51.01 ft	Cohesive	N/A	N/A	2000.00 psf	132.45 Kips
51.99 ft	Cohesive	N/A	N/A	2000.00 psf	140.23 Kips
52.01 ft	Cohesionless	2973.57 psf	27.11	N/A	140.37 Kips
56.99 ft	Cohesionless	3159.33 psf	27.11	N/A	172.22 Kips
57.01 ft	Cohesive	N/A	N/A	2000.00 psf	172.37 Kips
66.01 ft	Cohesive	N/A	N/A	2000.00 psf	243.84 Kips
66.99 ft	Cohesive	N/A	N/A	2000.00 psf	251.63 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.95 psf	19.80	13.12 Kips	0.01 Kips
4.99 ft	Cohesionless	474.05 psf	19.80	13.12 Kips	4.75 Kips
5.01 ft	Cohesionless	475.40 psf	30.00	13.12 Kips	8.15 Kips
10.99 ft	Cohesionless	712.20 psf	30.00	13.12 Kips	12.21 Kips
11.01 ft	Cohesionless	713.00 psf	17.40	13.12 Kips	6.01 Kips
20.01 ft	Cohesionless	1069.40 psf	17.40	13.12 Kips	9.02 Kips
20.99 ft	Cohesionless	1108.20 psf	17.40	13.12 Kips	9.22 Kips
21.01 ft	Cohesionless	1109.07 psf	26.40	13.12 Kips	13.12 Kips
30.01 ft	Cohesionless	1528.47 psf	26.40	13.12 Kips	13.12 Kips
36.99 ft	Cohesionless	1853.73 psf	26.40	13.12 Kips	13.12 Kips
37.01 ft	Cohesionless	1854.95 psf	77.60	149.38 Kips	97.65 Kips
41.99 ft	Cohesionless	2226.45 psf	77.60	149.38 Kips	117.02 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
51.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
52.01 ft	Cohesionless	2973.95 psf	77.60	149.38 Kips	149.38 Kips
56.99 ft	Cohesionless	3345.45 psf	77.60	149.38 Kips	149.38 Kips
57.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
66.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
66.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.99 ft	1.15 Kips	4.75 Kips	5.91 Kips
5.01 ft	1.17 Kips	8.15 Kips	9.32 Kips
10.99 ft	5.41 Kips	12.21 Kips	17.62 Kips
11.01 ft	5.43 Kips	6.01 Kips	11.44 Kips
20.01 ft	12.70 Kips	9.02 Kips	21.72 Kips
20.99 ft	13.67 Kips	9.22 Kips	22.89 Kips
21.01 ft	13.69 Kips	13.12 Kips	26.82 Kips
30.01 ft	26.99 Kips	13.12 Kips	40.12 Kips
36.99 ft	40.22 Kips	13.12 Kips	53.35 Kips
37.01 ft	40.28 Kips	97.65 Kips	137.93 Kips
41.99 ft	60.85 Kips	117.02 Kips	177.87 Kips
42.01 ft	60.98 Kips	1773.62 Kips	1834.60 Kips
51.01 ft	132.45 Kips	1773.62 Kips	1906.08 Kips
51.99 ft	140.23 Kips	1773.62 Kips	1913.86 Kips
52.01 ft	140.37 Kips	149.38 Kips	289.75 Kips
56.99 ft	172.22 Kips	149.38 Kips	321.60 Kips
57.01 ft	172.37 Kips	1773.62 Kips	1945.99 Kips
66.01 ft	243.84 Kips	1773.62 Kips	2017.47 Kips
66.99 ft	251.63 Kips	1773.62 Kips	2025.25 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.47 psf	20.33	N/A	0.00 Kips
4.99 ft	Cohesionless	237.02 psf	20.33	N/A	1.15 Kips
5.01 ft	Cohesionless	475.20 psf	22.59	N/A	1.17 Kips
10.99 ft	Cohesionless	593.60 psf	22.59	N/A	5.41 Kips
11.01 ft	Cohesionless	712.80 psf	19.58	N/A	5.43 Kips
20.01 ft	Cohesionless	891.00 psf	19.58	N/A	12.70 Kips
20.99 ft	Cohesionless	910.40 psf	19.58	N/A	13.67 Kips
21.01 ft	Cohesionless	1108.83 psf	21.84	N/A	13.69 Kips
30.01 ft	Cohesionless	1318.53 psf	21.84	N/A	26.99 Kips
36.99 ft	Cohesionless	1481.17 psf	21.84	N/A	40.22 Kips
37.01 ft	Cohesionless	1854.57 psf	27.11	N/A	40.28 Kips
41.99 ft	Cohesionless	2040.33 psf	27.11	N/A	60.85 Kips
42.01 ft	Cohesive	N/A	N/A	2000.00 psf	60.98 Kips
51.01 ft	Cohesive	N/A	N/A	2000.00 psf	132.45 Kips
51.99 ft	Cohesive	N/A	N/A	2000.00 psf	140.23 Kips
52.01 ft	Cohesionless	2973.57 psf	27.11	N/A	140.37 Kips
56.99 ft	Cohesionless	3159.33 psf	27.11	N/A	172.22 Kips
57.01 ft	Cohesive	N/A	N/A	2000.00 psf	172.37 Kips
66.01 ft	Cohesive	N/A	N/A	2000.00 psf	243.84 Kips
66.99 ft	Cohesive	N/A	N/A	2000.00 psf	251.63 Kips

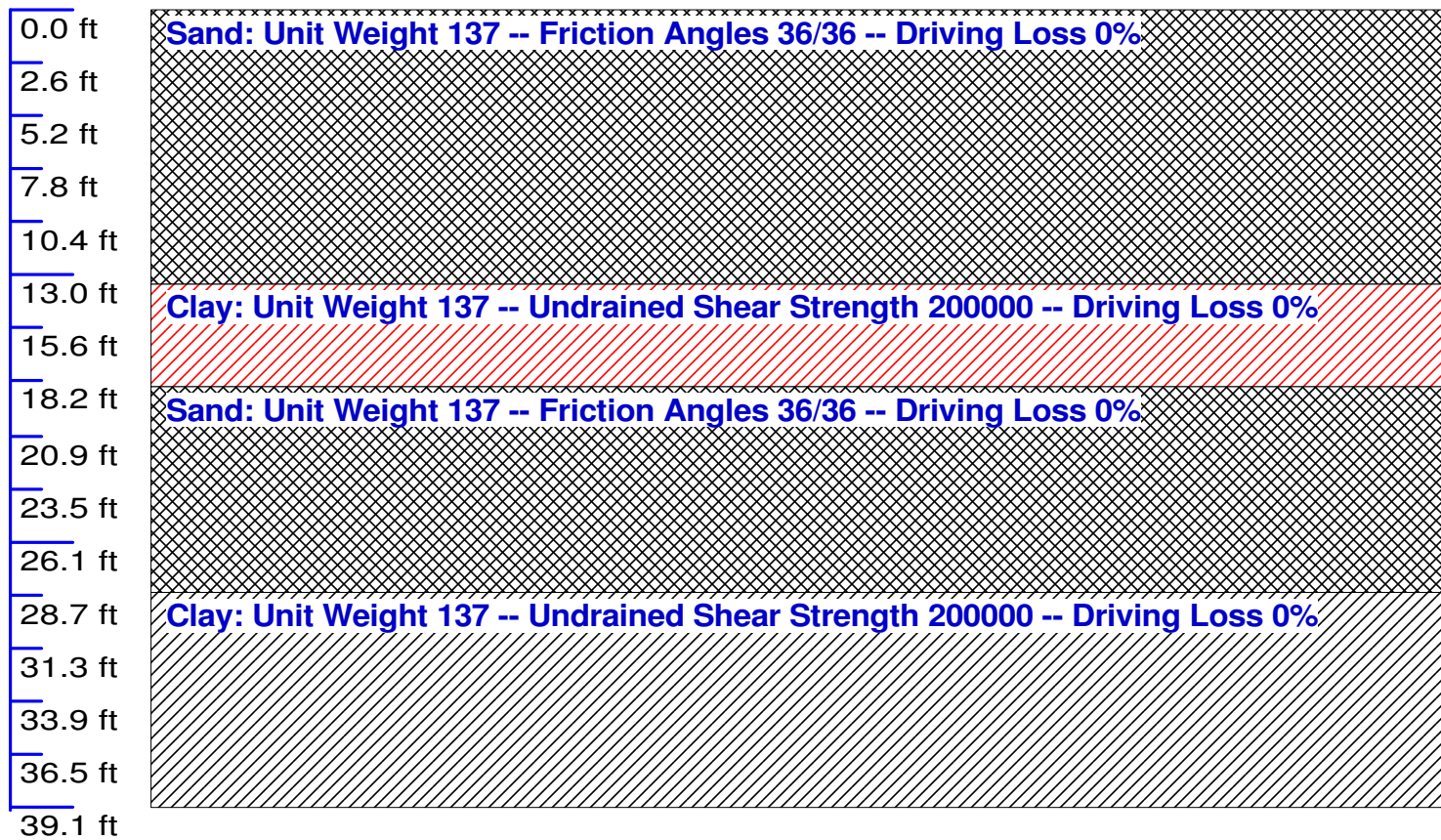
ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.95 psf	19.80	13.12 Kips	0.01 Kips
4.99 ft	Cohesionless	474.05 psf	19.80	13.12 Kips	4.75 Kips
5.01 ft	Cohesionless	475.40 psf	30.00	13.12 Kips	8.15 Kips
10.99 ft	Cohesionless	712.20 psf	30.00	13.12 Kips	12.21 Kips
11.01 ft	Cohesionless	713.00 psf	17.40	13.12 Kips	6.01 Kips
20.01 ft	Cohesionless	1069.40 psf	17.40	13.12 Kips	9.02 Kips
20.99 ft	Cohesionless	1108.20 psf	17.40	13.12 Kips	9.22 Kips
21.01 ft	Cohesionless	1109.07 psf	26.40	13.12 Kips	13.12 Kips
30.01 ft	Cohesionless	1528.47 psf	26.40	13.12 Kips	13.12 Kips
36.99 ft	Cohesionless	1853.73 psf	26.40	13.12 Kips	13.12 Kips
37.01 ft	Cohesionless	1854.95 psf	77.60	149.38 Kips	97.65 Kips
41.99 ft	Cohesionless	2226.45 psf	77.60	149.38 Kips	117.02 Kips
42.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
51.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
51.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
52.01 ft	Cohesionless	2973.95 psf	77.60	149.38 Kips	149.38 Kips
56.99 ft	Cohesionless	3345.45 psf	77.60	149.38 Kips	149.38 Kips
57.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
66.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
66.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.99 ft	1.15 Kips	4.75 Kips	5.91 Kips
5.01 ft	1.17 Kips	8.15 Kips	9.32 Kips
10.99 ft	5.41 Kips	12.21 Kips	17.62 Kips
11.01 ft	5.43 Kips	6.01 Kips	11.44 Kips
20.01 ft	12.70 Kips	9.02 Kips	21.72 Kips
20.99 ft	13.67 Kips	9.22 Kips	22.89 Kips
21.01 ft	13.69 Kips	13.12 Kips	26.82 Kips
30.01 ft	26.99 Kips	13.12 Kips	40.12 Kips
36.99 ft	40.22 Kips	13.12 Kips	53.35 Kips
37.01 ft	40.28 Kips	97.65 Kips	137.93 Kips
41.99 ft	60.85 Kips	117.02 Kips	177.87 Kips
42.01 ft	60.98 Kips	1773.62 Kips	1834.60 Kips
51.01 ft	132.45 Kips	1773.62 Kips	1906.08 Kips
51.99 ft	140.23 Kips	1773.62 Kips	1913.86 Kips
52.01 ft	140.37 Kips	149.38 Kips	289.75 Kips
56.99 ft	172.22 Kips	149.38 Kips	321.60 Kips
57.01 ft	172.37 Kips	1773.62 Kips	1945.99 Kips
66.01 ft	243.84 Kips	1773.62 Kips	2017.47 Kips
66.99 ft	251.63 Kips	1773.62 Kips	2025.25 Kips

Bridge 11 Bent 4 Soil Profile



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\BR11B4.DVN
Project Name: Bridge 11 Bent 4 Project Date: 05/08/2015
Project Client: CECS
Computed By: MJW
Project Manager: MFP

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	0.00 ft
	- Driving/Restrike	0.00 ft
	- Ultimate:	0.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	13.50 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
2	Cohesive	5.00 ft	0.00%	137.00 pcf	200000.00 psf	User Def.
3	Cohesionless	10.00 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
4	Cohesive	10.60 ft	0.00%	137.00 pcf	200000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.37 psf	27.11	N/A	0.00 Kips
9.01 ft	Cohesionless	336.07 psf	27.11	N/A	6.13 Kips
13.49 ft	Cohesionless	503.18 psf	27.11	N/A	13.74 Kips
13.51 ft	Cohesive	N/A	N/A	2000.00 psf	13.84 Kips
18.49 ft	Cohesive	N/A	N/A	2000.00 psf	53.39 Kips
18.51 ft	Cohesionless	1380.47 psf	27.11	N/A	53.50 Kips
27.51 ft	Cohesionless	1716.17 psf	27.11	N/A	84.76 Kips
28.49 ft	Cohesionless	1752.73 psf	27.11	N/A	88.91 Kips
28.51 ft	Cohesive	N/A	N/A	2000.00 psf	89.03 Kips
37.51 ft	Cohesive	N/A	N/A	2000.00 psf	160.51 Kips
39.09 ft	Cohesive	N/A	N/A	2000.00 psf	173.05 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.75 psf	77.60	149.38 Kips	0.04 Kips
9.01 ft	Cohesionless	672.15 psf	77.60	149.38 Kips	35.63 Kips
13.49 ft	Cohesionless	1006.35 psf	77.60	149.38 Kips	53.35 Kips
13.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
18.51 ft	Cohesionless	1380.85 psf	77.60	149.38 Kips	73.20 Kips
27.51 ft	Cohesionless	2052.25 psf	77.60	149.38 Kips	108.41 Kips
28.49 ft	Cohesionless	2125.35 psf	77.60	149.38 Kips	112.22 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
39.09 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.04 Kips	0.04 Kips
9.01 ft	6.13 Kips	35.63 Kips	41.76 Kips
13.49 ft	13.74 Kips	53.35 Kips	67.09 Kips
13.51 ft	13.84 Kips	1773.62 Kips	1787.46 Kips
18.49 ft	53.39 Kips	1773.62 Kips	1827.01 Kips
18.51 ft	53.50 Kips	73.20 Kips	126.70 Kips
27.51 ft	84.76 Kips	108.41 Kips	193.18 Kips
28.49 ft	88.91 Kips	112.22 Kips	201.13 Kips
28.51 ft	89.03 Kips	1773.62 Kips	1862.66 Kips
37.51 ft	160.51 Kips	1773.62 Kips	1934.13 Kips
39.09 ft	173.05 Kips	1773.62 Kips	1946.68 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.37 psf	27.11	N/A	0.00 Kips
9.01 ft	Cohesionless	336.07 psf	27.11	N/A	6.13 Kips
13.49 ft	Cohesionless	503.18 psf	27.11	N/A	13.74 Kips
13.51 ft	Cohesive	N/A	N/A	2000.00 psf	13.84 Kips
18.49 ft	Cohesive	N/A	N/A	2000.00 psf	53.39 Kips
18.51 ft	Cohesionless	1380.47 psf	27.11	N/A	53.50 Kips
27.51 ft	Cohesionless	1716.17 psf	27.11	N/A	84.76 Kips
28.49 ft	Cohesionless	1752.73 psf	27.11	N/A	88.91 Kips
28.51 ft	Cohesive	N/A	N/A	2000.00 psf	89.03 Kips
37.51 ft	Cohesive	N/A	N/A	2000.00 psf	160.51 Kips
39.09 ft	Cohesive	N/A	N/A	2000.00 psf	173.05 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.75 psf	77.60	149.38 Kips	0.04 Kips
9.01 ft	Cohesionless	672.15 psf	77.60	149.38 Kips	35.63 Kips
13.49 ft	Cohesionless	1006.35 psf	77.60	149.38 Kips	53.35 Kips
13.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
18.51 ft	Cohesionless	1380.85 psf	77.60	149.38 Kips	73.20 Kips
27.51 ft	Cohesionless	2052.25 psf	77.60	149.38 Kips	108.41 Kips
28.49 ft	Cohesionless	2125.35 psf	77.60	149.38 Kips	112.22 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
39.09 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.04 Kips	0.04 Kips
9.01 ft	6.13 Kips	35.63 Kips	41.76 Kips
13.49 ft	13.74 Kips	53.35 Kips	67.09 Kips
13.51 ft	13.84 Kips	1773.62 Kips	1787.46 Kips
18.49 ft	53.39 Kips	1773.62 Kips	1827.01 Kips
18.51 ft	53.50 Kips	73.20 Kips	126.70 Kips
27.51 ft	84.76 Kips	108.41 Kips	193.18 Kips
28.49 ft	88.91 Kips	112.22 Kips	201.13 Kips
28.51 ft	89.03 Kips	1773.62 Kips	1862.66 Kips
37.51 ft	160.51 Kips	1773.62 Kips	1934.13 Kips
39.09 ft	173.05 Kips	1773.62 Kips	1946.68 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.37 psf	27.11	N/A	0.00 Kips
9.01 ft	Cohesionless	336.07 psf	27.11	N/A	6.13 Kips
13.49 ft	Cohesionless	503.18 psf	27.11	N/A	13.74 Kips
13.51 ft	Cohesive	N/A	N/A	2000.00 psf	13.84 Kips
18.49 ft	Cohesive	N/A	N/A	2000.00 psf	53.39 Kips
18.51 ft	Cohesionless	1380.47 psf	27.11	N/A	53.50 Kips
27.51 ft	Cohesionless	1716.17 psf	27.11	N/A	84.76 Kips
28.49 ft	Cohesionless	1752.73 psf	27.11	N/A	88.91 Kips
28.51 ft	Cohesive	N/A	N/A	2000.00 psf	89.03 Kips
37.51 ft	Cohesive	N/A	N/A	2000.00 psf	160.51 Kips
39.09 ft	Cohesive	N/A	N/A	2000.00 psf	173.05 Kips

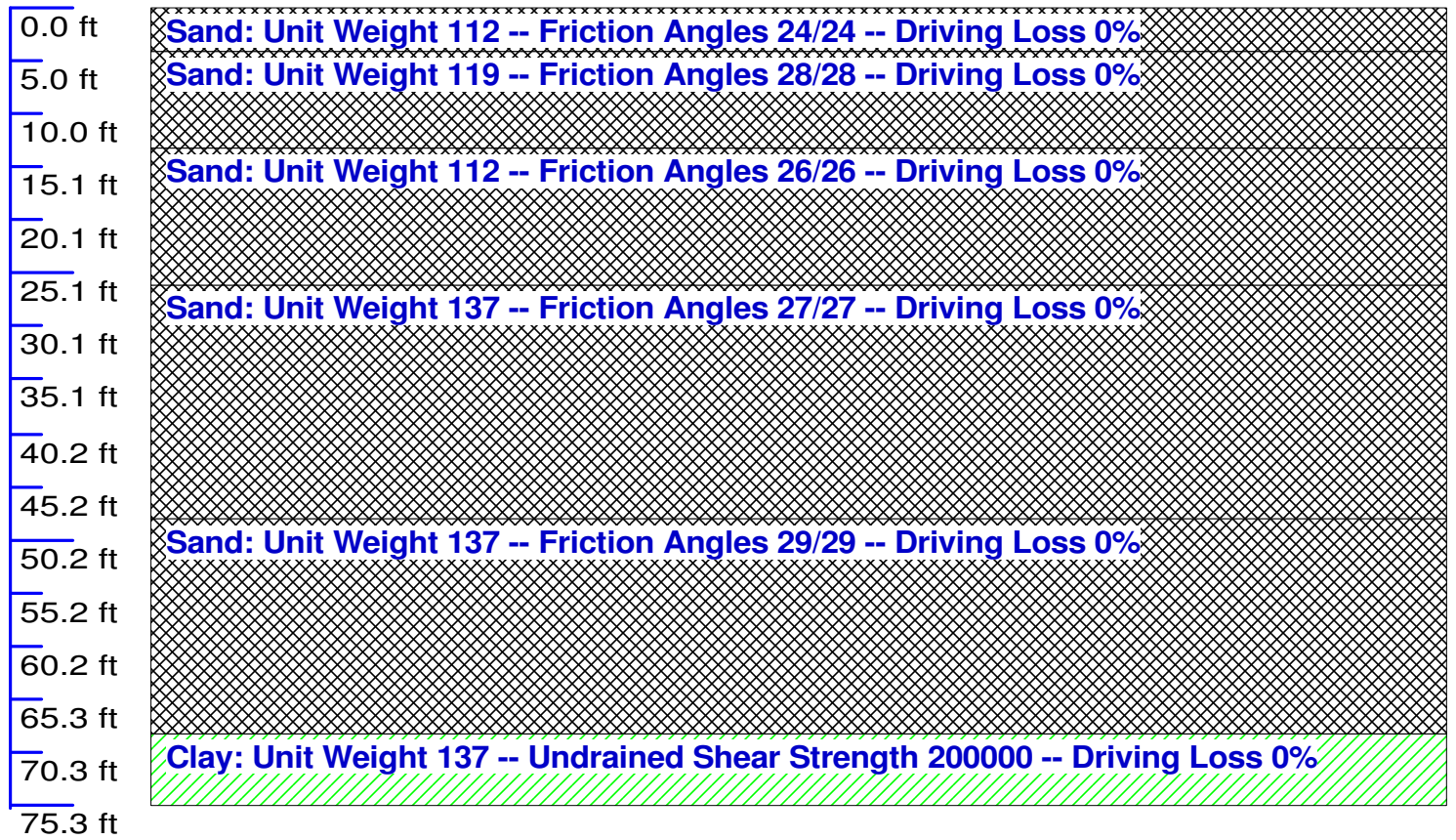
ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.75 psf	77.60	149.38 Kips	0.04 Kips
9.01 ft	Cohesionless	672.15 psf	77.60	149.38 Kips	35.63 Kips
13.49 ft	Cohesionless	1006.35 psf	77.60	149.38 Kips	53.35 Kips
13.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
18.49 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
18.51 ft	Cohesionless	1380.85 psf	77.60	149.38 Kips	73.20 Kips
27.51 ft	Cohesionless	2052.25 psf	77.60	149.38 Kips	108.41 Kips
28.49 ft	Cohesionless	2125.35 psf	77.60	149.38 Kips	112.22 Kips
28.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
37.51 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
39.09 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.04 Kips	0.04 Kips
9.01 ft	6.13 Kips	35.63 Kips	41.76 Kips
13.49 ft	13.74 Kips	53.35 Kips	67.09 Kips
13.51 ft	13.84 Kips	1773.62 Kips	1787.46 Kips
18.49 ft	53.39 Kips	1773.62 Kips	1827.01 Kips
18.51 ft	53.50 Kips	73.20 Kips	126.70 Kips
27.51 ft	84.76 Kips	108.41 Kips	193.18 Kips
28.49 ft	88.91 Kips	112.22 Kips	201.13 Kips
28.51 ft	89.03 Kips	1773.62 Kips	1862.66 Kips
37.51 ft	160.51 Kips	1773.62 Kips	1934.13 Kips
39.09 ft	173.05 Kips	1773.62 Kips	1946.68 Kips

Bridge 11 End Bent 1 Downdrag soil Profile



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\BR11B1DD.DVN
Project Name: Bridge 11 End Bent 1 Project Date: 05/21/2015
Project Client: CECS
Computed By: MJW
Project Manager: MFP

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	26.00 ft
	- Driving/Restrike	26.00 ft
	- Ultimate:	26.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	29.00 ft
	(Downdrag Condition)	

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	4.30 ft	0.00%	112.00 pcf	24.0/24.0	Nordlund
2	Cohesionless	9.00 ft	0.00%	119.00 pcf	28.0/28.0	Nordlund
3	Cohesionless	13.00 ft	0.00%	112.00 pcf	26.0/26.0	Nordlund
4	Cohesionless	21.90 ft	0.00%	137.00 pcf	27.0/27.0	Nordlund
5	Cohesionless	20.10 ft	0.00%	137.00 pcf	29.0/29.0	Nordlund
6	Cohesive	7.00 ft	0.00%	137.00 pcf	200000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	18.07	N/A	0.00 Kips
4.29 ft	Cohesionless	240.24 psf	18.07	N/A	0.84 Kips
4.31 ft	Cohesionless	482.20 psf	21.09	N/A	0.85 Kips
13.29 ft	Cohesionless	1016.51 psf	21.09	N/A	10.42 Kips
13.31 ft	Cohesionless	1553.16 psf	19.58	N/A	10.45 Kips
22.31 ft	Cohesionless	2057.16 psf	19.58	N/A	27.25 Kips
25.99 ft	Cohesionless	2263.24 psf	19.58	N/A	36.49 Kips
26.01 ft	Cohesionless	2975.25 psf	19.58	N/A	36.54 Kips
26.29 ft	Cohesionless	2982.19 psf	19.58	N/A	37.30 Kips
26.31 ft	Cohesionless	2990.25 psf	20.33	N/A	37.36 Kips
35.31 ft	Cohesionless	3325.95 psf	20.33	N/A	66.59 Kips
44.31 ft	Cohesionless	3661.65 psf	20.33	N/A	101.71 Kips
48.19 ft	Cohesionless	3806.38 psf	20.33	N/A	118.68 Kips
48.21 ft	Cohesionless	4623.99 psf	21.84	N/A	118.78 Kips
57.21 ft	Cohesionless	4959.69 psf	21.84	N/A	168.80 Kips
66.21 ft	Cohesionless	5295.39 psf	21.84	N/A	225.60 Kips
68.29 ft	Cohesionless	5372.98 psf	21.84	N/A	239.69 Kips
68.31 ft	Cohesive	N/A	N/A	2000.00 psf	239.84 Kips
75.29 ft	Cohesive	N/A	N/A	2000.00 psf	295.28 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	13.80	13.12 Kips	0.01 Kips
4.29 ft	Cohesionless	480.48 psf	13.80	13.12 Kips	2.93 Kips
4.31 ft	Cohesionless	482.79 psf	22.80	13.12 Kips	5.81 Kips
13.29 ft	Cohesionless	1551.41 psf	22.80	13.12 Kips	13.12 Kips
13.31 ft	Cohesionless	1553.72 psf	17.40	13.12 Kips	13.11 Kips
22.31 ft	Cohesionless	2561.72 psf	17.40	13.12 Kips	13.12 Kips
25.99 ft	Cohesionless	2973.88 psf	17.40	13.12 Kips	13.12 Kips
26.01 ft	Cohesionless	2975.50 psf	17.40	13.12 Kips	13.12 Kips
26.29 ft	Cohesionless	2989.38 psf	17.40	13.12 Kips	13.12 Kips
26.31 ft	Cohesionless	2990.63 psf	19.80	13.12 Kips	13.12 Kips
35.31 ft	Cohesionless	3662.03 psf	19.80	13.12 Kips	13.12 Kips
44.31 ft	Cohesionless	4333.43 psf	19.80	13.12 Kips	13.12 Kips
48.19 ft	Cohesionless	4622.87 psf	19.80	13.12 Kips	13.12 Kips
48.21 ft	Cohesionless	4624.37 psf	26.40	13.12 Kips	13.12 Kips
57.21 ft	Cohesionless	5295.77 psf	26.40	13.12 Kips	13.12 Kips
66.21 ft	Cohesionless	5967.17 psf	26.40	13.12 Kips	13.12 Kips
68.29 ft	Cohesionless	6122.33 psf	26.40	13.12 Kips	13.12 Kips
68.31 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
75.29 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.29 ft	0.84 Kips	2.93 Kips	3.77 Kips
4.31 ft	0.85 Kips	5.81 Kips	6.66 Kips
13.29 ft	10.42 Kips	13.12 Kips	23.54 Kips
13.31 ft	10.45 Kips	13.11 Kips	23.55 Kips
22.31 ft	27.25 Kips	13.12 Kips	40.37 Kips
25.99 ft	36.49 Kips	13.12 Kips	49.61 Kips
26.01 ft	36.54 Kips	13.12 Kips	49.67 Kips
26.29 ft	37.30 Kips	13.12 Kips	50.43 Kips
26.31 ft	37.36 Kips	13.12 Kips	50.48 Kips
35.31 ft	66.59 Kips	13.12 Kips	79.71 Kips
44.31 ft	101.71 Kips	13.12 Kips	114.84 Kips
48.19 ft	118.68 Kips	13.12 Kips	131.80 Kips
48.21 ft	118.78 Kips	13.12 Kips	131.90 Kips
57.21 ft	168.80 Kips	13.12 Kips	181.93 Kips
66.21 ft	225.60 Kips	13.12 Kips	238.73 Kips
68.29 ft	239.69 Kips	13.12 Kips	252.82 Kips
68.31 ft	239.84 Kips	1773.62 Kips	2013.47 Kips
75.29 ft	295.28 Kips	1773.62 Kips	2068.90 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	18.07	N/A	0.00 Kips
4.29 ft	Cohesionless	240.24 psf	18.07	N/A	0.84 Kips
4.31 ft	Cohesionless	482.20 psf	21.09	N/A	0.85 Kips
13.29 ft	Cohesionless	1016.51 psf	21.09	N/A	10.42 Kips
13.31 ft	Cohesionless	1553.16 psf	19.58	N/A	10.45 Kips
22.31 ft	Cohesionless	2057.16 psf	19.58	N/A	27.25 Kips
25.99 ft	Cohesionless	2263.24 psf	19.58	N/A	36.49 Kips
26.01 ft	Cohesionless	2975.25 psf	19.58	N/A	36.54 Kips
26.29 ft	Cohesionless	2982.19 psf	19.58	N/A	37.30 Kips
26.31 ft	Cohesionless	2990.25 psf	20.33	N/A	37.36 Kips
35.31 ft	Cohesionless	3325.95 psf	20.33	N/A	66.59 Kips
44.31 ft	Cohesionless	3661.65 psf	20.33	N/A	101.71 Kips
48.19 ft	Cohesionless	3806.38 psf	20.33	N/A	118.68 Kips
48.21 ft	Cohesionless	4623.99 psf	21.84	N/A	118.78 Kips
57.21 ft	Cohesionless	4959.69 psf	21.84	N/A	168.80 Kips
66.21 ft	Cohesionless	5295.39 psf	21.84	N/A	225.60 Kips
68.29 ft	Cohesionless	5372.98 psf	21.84	N/A	239.69 Kips
68.31 ft	Cohesive	N/A	N/A	2000.00 psf	239.84 Kips
75.29 ft	Cohesive	N/A	N/A	2000.00 psf	295.28 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	13.80	13.12 Kips	0.01 Kips
4.29 ft	Cohesionless	480.48 psf	13.80	13.12 Kips	2.93 Kips
4.31 ft	Cohesionless	482.79 psf	22.80	13.12 Kips	5.81 Kips
13.29 ft	Cohesionless	1551.41 psf	22.80	13.12 Kips	13.12 Kips
13.31 ft	Cohesionless	1553.72 psf	17.40	13.12 Kips	13.11 Kips
22.31 ft	Cohesionless	2561.72 psf	17.40	13.12 Kips	13.12 Kips
25.99 ft	Cohesionless	2973.88 psf	17.40	13.12 Kips	13.12 Kips
26.01 ft	Cohesionless	2975.50 psf	17.40	13.12 Kips	13.12 Kips
26.29 ft	Cohesionless	2989.38 psf	17.40	13.12 Kips	13.12 Kips
26.31 ft	Cohesionless	2990.63 psf	19.80	13.12 Kips	13.12 Kips
35.31 ft	Cohesionless	3662.03 psf	19.80	13.12 Kips	13.12 Kips
44.31 ft	Cohesionless	4333.43 psf	19.80	13.12 Kips	13.12 Kips
48.19 ft	Cohesionless	4622.87 psf	19.80	13.12 Kips	13.12 Kips
48.21 ft	Cohesionless	4624.37 psf	26.40	13.12 Kips	13.12 Kips
57.21 ft	Cohesionless	5295.77 psf	26.40	13.12 Kips	13.12 Kips
66.21 ft	Cohesionless	5967.17 psf	26.40	13.12 Kips	13.12 Kips
68.29 ft	Cohesionless	6122.33 psf	26.40	13.12 Kips	13.12 Kips
68.31 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
75.29 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.01 Kips	0.01 Kips
4.29 ft	0.84 Kips	2.93 Kips	3.77 Kips
4.31 ft	0.85 Kips	5.81 Kips	6.66 Kips
13.29 ft	10.42 Kips	13.12 Kips	23.54 Kips
13.31 ft	10.45 Kips	13.11 Kips	23.55 Kips
22.31 ft	27.25 Kips	13.12 Kips	40.37 Kips
25.99 ft	36.49 Kips	13.12 Kips	49.61 Kips
26.01 ft	36.54 Kips	13.12 Kips	49.67 Kips
26.29 ft	37.30 Kips	13.12 Kips	50.43 Kips
26.31 ft	37.36 Kips	13.12 Kips	50.48 Kips
35.31 ft	66.59 Kips	13.12 Kips	79.71 Kips
44.31 ft	101.71 Kips	13.12 Kips	114.84 Kips
48.19 ft	118.68 Kips	13.12 Kips	131.80 Kips
48.21 ft	118.78 Kips	13.12 Kips	131.90 Kips
57.21 ft	168.80 Kips	13.12 Kips	181.93 Kips
66.21 ft	225.60 Kips	13.12 Kips	238.73 Kips
68.29 ft	239.69 Kips	13.12 Kips	252.82 Kips
68.31 ft	239.84 Kips	1773.62 Kips	2013.47 Kips
75.29 ft	295.28 Kips	1773.62 Kips	2068.90 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	18.07	N/A	0.00 Kips
4.29 ft	Cohesionless	240.24 psf	18.07	N/A	-0.84 Kips
4.31 ft	Cohesionless	482.20 psf	21.09	N/A	-0.85 Kips
13.29 ft	Cohesionless	1016.51 psf	21.09	N/A	-10.42 Kips
13.31 ft	Cohesionless	1553.16 psf	19.58	N/A	-10.45 Kips
22.31 ft	Cohesionless	2057.16 psf	19.58	N/A	-27.25 Kips
25.99 ft	Cohesionless	2263.24 psf	19.58	N/A	-36.49 Kips
26.01 ft	Cohesionless	2975.25 psf	19.58	N/A	-36.54 Kips
26.29 ft	Cohesionless	2982.19 psf	19.58	N/A	-37.30 Kips
26.31 ft	Cohesionless	2990.25 psf	20.33	N/A	-37.36 Kips
28.99 ft	Cohesionless	3090.22 psf	20.33	N/A	-45.44 Kips
29.00 ft	Cohesionless	3191.30 psf	20.33	N/A	-45.47 Kips
35.31 ft	Cohesionless	3426.66 psf	20.33	N/A	-24.36 Kips
44.31 ft	Cohesionless	3762.36 psf	20.33	N/A	10.76 Kips
48.19 ft	Cohesionless	3907.09 psf	20.33	N/A	27.73 Kips
48.21 ft	Cohesionless	4623.99 psf	21.84	N/A	27.83 Kips
57.21 ft	Cohesionless	4959.69 psf	21.84	N/A	77.85 Kips
66.21 ft	Cohesionless	5295.39 psf	21.84	N/A	134.65 Kips
68.29 ft	Cohesionless	5372.98 psf	21.84	N/A	148.75 Kips
68.31 ft	Cohesive	N/A	N/A	2000.00 psf	148.89 Kips
75.29 ft	Cohesive	N/A	N/A	2000.00 psf	204.33 Kips

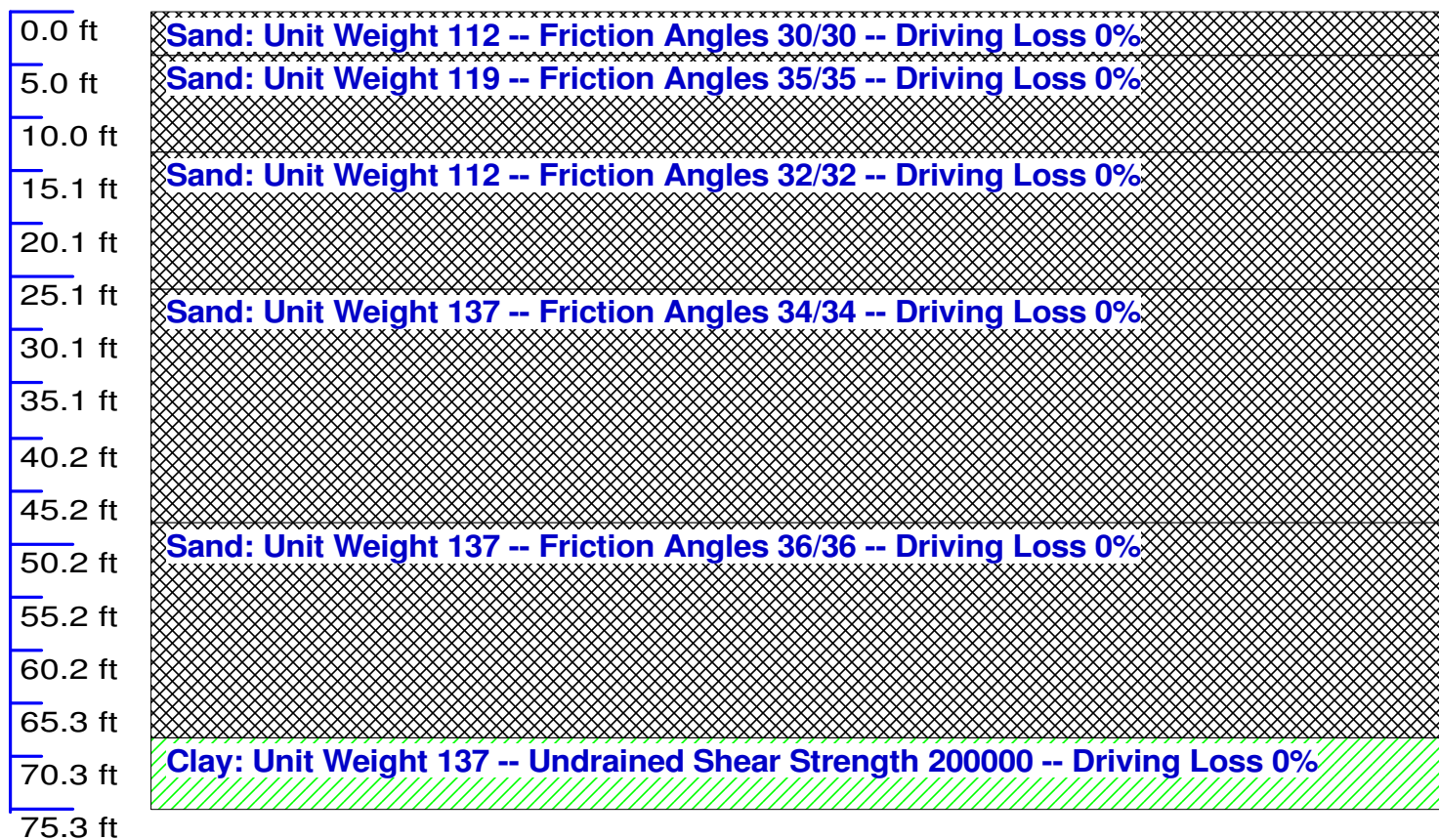
ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
4.29 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
4.31 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
13.29 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
13.31 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
22.31 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
25.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
26.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
26.29 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
26.31 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
28.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
29.00 ft	Cohesionless	3191.30 psf	19.80	13.12 Kips	13.12 Kips
35.31 ft	Cohesionless	3662.03 psf	19.80	13.12 Kips	13.12 Kips
44.31 ft	Cohesionless	4333.43 psf	19.80	13.12 Kips	13.12 Kips
48.19 ft	Cohesionless	4622.87 psf	19.80	13.12 Kips	13.12 Kips
48.21 ft	Cohesionless	4624.37 psf	26.40	13.12 Kips	13.12 Kips
57.21 ft	Cohesionless	5295.77 psf	26.40	13.12 Kips	13.12 Kips
66.21 ft	Cohesionless	5967.17 psf	26.40	13.12 Kips	13.12 Kips
68.29 ft	Cohesionless	6122.33 psf	26.40	13.12 Kips	13.12 Kips
68.31 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
75.29 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
4.29 ft	-0.84 Kips	0.00 Kips	-0.84 Kips
4.31 ft	-0.85 Kips	0.00 Kips	-0.85 Kips
13.29 ft	-10.42 Kips	0.00 Kips	-10.42 Kips
13.31 ft	-10.45 Kips	0.00 Kips	-10.45 Kips
22.31 ft	-27.25 Kips	0.00 Kips	-27.25 Kips
25.99 ft	-36.49 Kips	0.00 Kips	-36.49 Kips
26.01 ft	-36.54 Kips	0.00 Kips	-36.54 Kips
26.29 ft	-37.30 Kips	0.00 Kips	-37.30 Kips
26.31 ft	-37.36 Kips	0.00 Kips	-37.36 Kips
28.99 ft	-45.44 Kips	0.00 Kips	-45.44 Kips
29.00 ft	-45.47 Kips	13.12 Kips	-32.35 Kips
35.31 ft	-24.36 Kips	13.12 Kips	-11.24 Kips
44.31 ft	10.76 Kips	13.12 Kips	23.89 Kips
48.19 ft	27.73 Kips	13.12 Kips	40.85 Kips
48.21 ft	27.83 Kips	13.12 Kips	40.95 Kips
57.21 ft	77.85 Kips	13.12 Kips	90.98 Kips
66.21 ft	134.65 Kips	13.12 Kips	147.78 Kips
68.29 ft	148.75 Kips	13.12 Kips	161.87 Kips
68.31 ft	148.89 Kips	1773.62 Kips	1922.52 Kips
75.29 ft	204.33 Kips	1773.62 Kips	1977.95 Kips

Bridge 11 End Bent 1 Soil Profile



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\BR11EB1.DVN
Project Name: Bridge 11 End Bent 1 Project Date: 00/00/ 0
Project Client: CECS
Computed By: MJW
Project Manager: MFP

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	26.00 ft
	- Driving/Restrike	26.00 ft
	- Ultimate:	26.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	4.30 ft	0.00%	112.00 pcf	30.0/30.0	Nordlund
2	Cohesionless	9.00 ft	0.00%	119.00 pcf	35.0/35.0	Nordlund
3	Cohesionless	13.00 ft	0.00%	112.00 pcf	32.0/32.0	Nordlund
4	Cohesionless	21.90 ft	0.00%	137.00 pcf	34.0/34.0	Nordlund
5	Cohesionless	20.10 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
6	Cohesive	7.00 ft	0.00%	137.00 pcf	200000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	22.59	N/A	0.00 Kips
4.29 ft	Cohesionless	240.24 psf	22.59	N/A	1.23 Kips
4.31 ft	Cohesionless	482.20 psf	26.36	N/A	1.25 Kips
13.29 ft	Cohesionless	1016.51 psf	26.36	N/A	17.78 Kips
13.31 ft	Cohesionless	1553.16 psf	24.10	N/A	17.83 Kips
22.31 ft	Cohesionless	2057.16 psf	24.10	N/A	44.36 Kips
25.99 ft	Cohesionless	2263.24 psf	24.10	N/A	58.95 Kips
26.01 ft	Cohesionless	2975.25 psf	24.10	N/A	59.03 Kips
26.29 ft	Cohesionless	2982.19 psf	24.10	N/A	60.23 Kips
26.31 ft	Cohesionless	2990.25 psf	25.61	N/A	60.32 Kips
35.31 ft	Cohesionless	3325.95 psf	25.61	N/A	110.66 Kips
44.31 ft	Cohesionless	3661.65 psf	25.61	N/A	171.15 Kips
48.19 ft	Cohesionless	3806.38 psf	25.61	N/A	200.36 Kips
48.21 ft	Cohesionless	4623.99 psf	27.11	N/A	200.53 Kips
57.21 ft	Cohesionless	4959.69 psf	27.11	N/A	290.89 Kips
66.21 ft	Cohesionless	5295.39 psf	27.11	N/A	393.47 Kips
68.29 ft	Cohesionless	5372.98 psf	27.11	N/A	418.92 Kips
68.31 ft	Cohesive	N/A	N/A	2000.00 psf	419.12 Kips
75.29 ft	Cohesive	N/A	N/A	2000.00 psf	474.56 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	30.00	13.12 Kips	0.02 Kips
4.29 ft	Cohesionless	480.48 psf	30.00	13.12 Kips	8.24 Kips
4.31 ft	Cohesionless	482.79 psf	64.00	106.02 Kips	20.70 Kips
13.29 ft	Cohesionless	1551.41 psf	64.00	106.02 Kips	66.53 Kips
13.31 ft	Cohesionless	1553.72 psf	40.40	32.52 Kips	32.52 Kips
22.31 ft	Cohesionless	2561.72 psf	40.40	32.52 Kips	32.52 Kips
25.99 ft	Cohesionless	2973.88 psf	40.40	32.52 Kips	32.52 Kips
26.01 ft	Cohesionless	2975.50 psf	40.40	32.52 Kips	32.52 Kips
26.29 ft	Cohesionless	2989.38 psf	40.40	32.52 Kips	32.52 Kips
26.31 ft	Cohesionless	2990.63 psf	55.60	72.44 Kips	72.44 Kips
35.31 ft	Cohesionless	3662.03 psf	55.60	72.44 Kips	72.44 Kips
44.31 ft	Cohesionless	4333.43 psf	55.60	72.44 Kips	72.44 Kips
48.19 ft	Cohesionless	4622.87 psf	55.60	72.44 Kips	72.44 Kips
48.21 ft	Cohesionless	4624.37 psf	77.60	149.38 Kips	149.38 Kips
57.21 ft	Cohesionless	5295.77 psf	77.60	149.38 Kips	149.38 Kips
66.21 ft	Cohesionless	5967.17 psf	77.60	149.38 Kips	149.38 Kips
68.29 ft	Cohesionless	6122.33 psf	77.60	149.38 Kips	149.38 Kips
68.31 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
75.29 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
4.29 ft	1.23 Kips	8.24 Kips	9.47 Kips
4.31 ft	1.25 Kips	20.70 Kips	21.95 Kips
13.29 ft	17.78 Kips	66.53 Kips	84.31 Kips
13.31 ft	17.83 Kips	32.52 Kips	50.35 Kips
22.31 ft	44.36 Kips	32.52 Kips	76.87 Kips
25.99 ft	58.95 Kips	32.52 Kips	91.46 Kips
26.01 ft	59.03 Kips	32.52 Kips	91.55 Kips
26.29 ft	60.23 Kips	32.52 Kips	92.74 Kips
26.31 ft	60.32 Kips	72.44 Kips	132.76 Kips
35.31 ft	110.66 Kips	72.44 Kips	183.10 Kips
44.31 ft	171.15 Kips	72.44 Kips	243.59 Kips
48.19 ft	200.36 Kips	72.44 Kips	272.81 Kips
48.21 ft	200.53 Kips	149.38 Kips	349.91 Kips
57.21 ft	290.89 Kips	149.38 Kips	440.27 Kips
66.21 ft	393.47 Kips	149.38 Kips	542.85 Kips
68.29 ft	418.92 Kips	149.38 Kips	568.30 Kips
68.31 ft	419.12 Kips	1773.62 Kips	2192.75 Kips
75.29 ft	474.56 Kips	1773.62 Kips	2248.18 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	22.59	N/A	0.00 Kips
4.29 ft	Cohesionless	240.24 psf	22.59	N/A	1.23 Kips
4.31 ft	Cohesionless	482.20 psf	26.36	N/A	1.25 Kips
13.29 ft	Cohesionless	1016.51 psf	26.36	N/A	17.78 Kips
13.31 ft	Cohesionless	1553.16 psf	24.10	N/A	17.83 Kips
22.31 ft	Cohesionless	2057.16 psf	24.10	N/A	44.36 Kips
25.99 ft	Cohesionless	2263.24 psf	24.10	N/A	58.95 Kips
26.01 ft	Cohesionless	2975.25 psf	24.10	N/A	59.03 Kips
26.29 ft	Cohesionless	2982.19 psf	24.10	N/A	60.23 Kips
26.31 ft	Cohesionless	2990.25 psf	25.61	N/A	60.32 Kips
35.31 ft	Cohesionless	3325.95 psf	25.61	N/A	110.66 Kips
44.31 ft	Cohesionless	3661.65 psf	25.61	N/A	171.15 Kips
48.19 ft	Cohesionless	3806.38 psf	25.61	N/A	200.36 Kips
48.21 ft	Cohesionless	4623.99 psf	27.11	N/A	200.53 Kips
57.21 ft	Cohesionless	4959.69 psf	27.11	N/A	290.89 Kips
66.21 ft	Cohesionless	5295.39 psf	27.11	N/A	393.47 Kips
68.29 ft	Cohesionless	5372.98 psf	27.11	N/A	418.92 Kips
68.31 ft	Cohesive	N/A	N/A	2000.00 psf	419.12 Kips
75.29 ft	Cohesive	N/A	N/A	2000.00 psf	474.56 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	30.00	13.12 Kips	0.02 Kips
4.29 ft	Cohesionless	480.48 psf	30.00	13.12 Kips	8.24 Kips
4.31 ft	Cohesionless	482.79 psf	64.00	106.02 Kips	20.70 Kips
13.29 ft	Cohesionless	1551.41 psf	64.00	106.02 Kips	66.53 Kips
13.31 ft	Cohesionless	1553.72 psf	40.40	32.52 Kips	32.52 Kips
22.31 ft	Cohesionless	2561.72 psf	40.40	32.52 Kips	32.52 Kips
25.99 ft	Cohesionless	2973.88 psf	40.40	32.52 Kips	32.52 Kips
26.01 ft	Cohesionless	2975.50 psf	40.40	32.52 Kips	32.52 Kips
26.29 ft	Cohesionless	2989.38 psf	40.40	32.52 Kips	32.52 Kips
26.31 ft	Cohesionless	2990.63 psf	55.60	72.44 Kips	72.44 Kips
35.31 ft	Cohesionless	3662.03 psf	55.60	72.44 Kips	72.44 Kips
44.31 ft	Cohesionless	4333.43 psf	55.60	72.44 Kips	72.44 Kips
48.19 ft	Cohesionless	4622.87 psf	55.60	72.44 Kips	72.44 Kips
48.21 ft	Cohesionless	4624.37 psf	77.60	149.38 Kips	149.38 Kips
57.21 ft	Cohesionless	5295.77 psf	77.60	149.38 Kips	149.38 Kips
66.21 ft	Cohesionless	5967.17 psf	77.60	149.38 Kips	149.38 Kips
68.29 ft	Cohesionless	6122.33 psf	77.60	149.38 Kips	149.38 Kips
68.31 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
75.29 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
4.29 ft	1.23 Kips	8.24 Kips	9.47 Kips
4.31 ft	1.25 Kips	20.70 Kips	21.95 Kips
13.29 ft	17.78 Kips	66.53 Kips	84.31 Kips
13.31 ft	17.83 Kips	32.52 Kips	50.35 Kips
22.31 ft	44.36 Kips	32.52 Kips	76.87 Kips
25.99 ft	58.95 Kips	32.52 Kips	91.46 Kips
26.01 ft	59.03 Kips	32.52 Kips	91.55 Kips
26.29 ft	60.23 Kips	32.52 Kips	92.74 Kips
26.31 ft	60.32 Kips	72.44 Kips	132.76 Kips
35.31 ft	110.66 Kips	72.44 Kips	183.10 Kips
44.31 ft	171.15 Kips	72.44 Kips	243.59 Kips
48.19 ft	200.36 Kips	72.44 Kips	272.81 Kips
48.21 ft	200.53 Kips	149.38 Kips	349.91 Kips
57.21 ft	290.89 Kips	149.38 Kips	440.27 Kips
66.21 ft	393.47 Kips	149.38 Kips	542.85 Kips
68.29 ft	418.92 Kips	149.38 Kips	568.30 Kips
68.31 ft	419.12 Kips	1773.62 Kips	2192.75 Kips
75.29 ft	474.56 Kips	1773.62 Kips	2248.18 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.56 psf	22.59	N/A	0.00 Kips
4.29 ft	Cohesionless	240.24 psf	22.59	N/A	1.23 Kips
4.31 ft	Cohesionless	482.20 psf	26.36	N/A	1.25 Kips
13.29 ft	Cohesionless	1016.51 psf	26.36	N/A	17.78 Kips
13.31 ft	Cohesionless	1553.16 psf	24.10	N/A	17.83 Kips
22.31 ft	Cohesionless	2057.16 psf	24.10	N/A	44.36 Kips
25.99 ft	Cohesionless	2263.24 psf	24.10	N/A	58.95 Kips
26.01 ft	Cohesionless	2975.25 psf	24.10	N/A	59.03 Kips
26.29 ft	Cohesionless	2982.19 psf	24.10	N/A	60.23 Kips
26.31 ft	Cohesionless	2990.25 psf	25.61	N/A	60.32 Kips
35.31 ft	Cohesionless	3325.95 psf	25.61	N/A	110.66 Kips
44.31 ft	Cohesionless	3661.65 psf	25.61	N/A	171.15 Kips
48.19 ft	Cohesionless	3806.38 psf	25.61	N/A	200.36 Kips
48.21 ft	Cohesionless	4623.99 psf	27.11	N/A	200.53 Kips
57.21 ft	Cohesionless	4959.69 psf	27.11	N/A	290.89 Kips
66.21 ft	Cohesionless	5295.39 psf	27.11	N/A	393.47 Kips
68.29 ft	Cohesionless	5372.98 psf	27.11	N/A	418.92 Kips
68.31 ft	Cohesive	N/A	N/A	2000.00 psf	419.12 Kips
75.29 ft	Cohesive	N/A	N/A	2000.00 psf	474.56 Kips

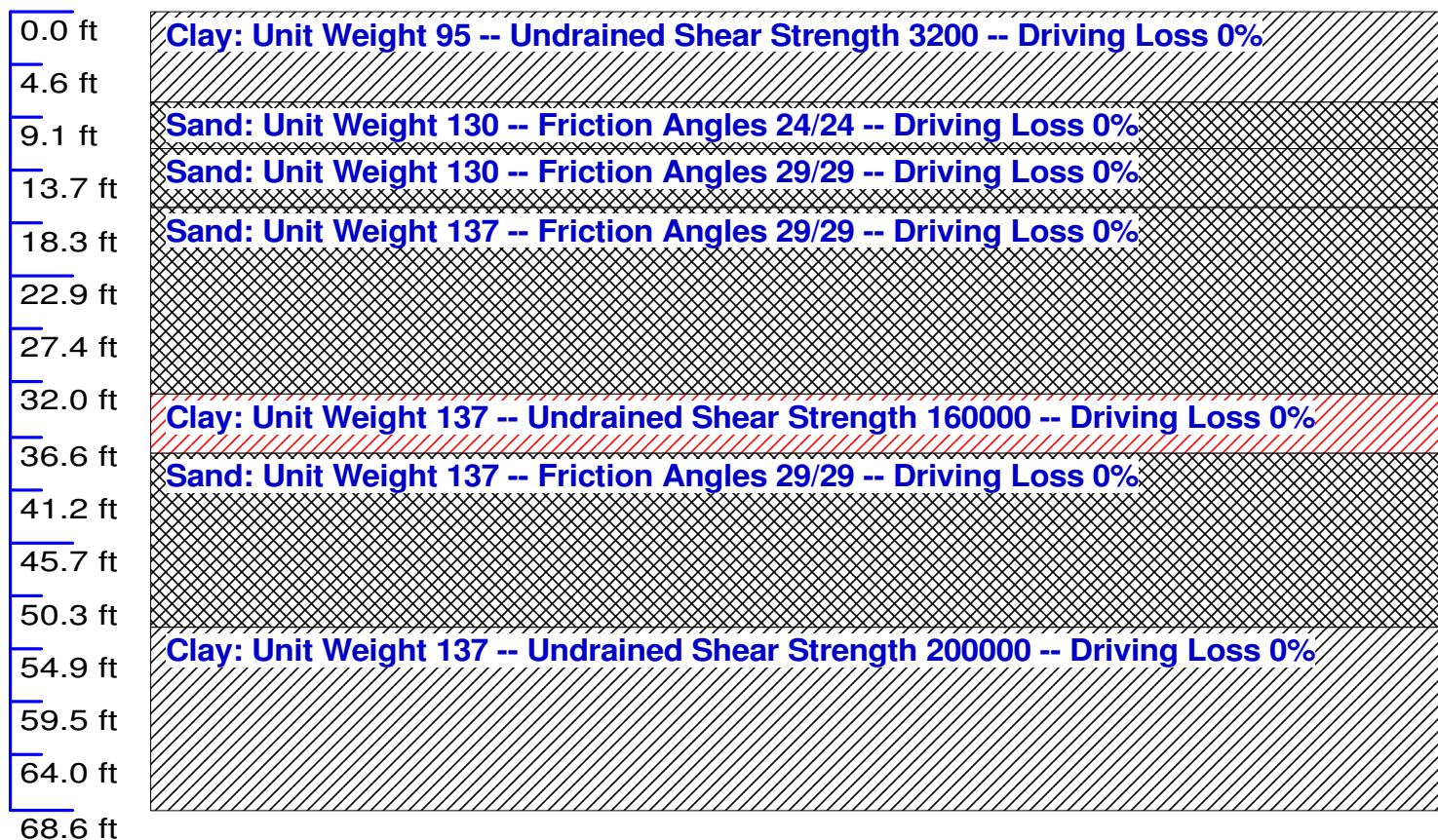
ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	1.12 psf	30.00	13.12 Kips	0.02 Kips
4.29 ft	Cohesionless	480.48 psf	30.00	13.12 Kips	8.24 Kips
4.31 ft	Cohesionless	482.79 psf	64.00	106.02 Kips	20.70 Kips
13.29 ft	Cohesionless	1551.41 psf	64.00	106.02 Kips	66.53 Kips
13.31 ft	Cohesionless	1553.72 psf	40.40	32.52 Kips	32.52 Kips
22.31 ft	Cohesionless	2561.72 psf	40.40	32.52 Kips	32.52 Kips
25.99 ft	Cohesionless	2973.88 psf	40.40	32.52 Kips	32.52 Kips
26.01 ft	Cohesionless	2975.50 psf	40.40	32.52 Kips	32.52 Kips
26.29 ft	Cohesionless	2989.38 psf	40.40	32.52 Kips	32.52 Kips
26.31 ft	Cohesionless	2990.63 psf	55.60	72.44 Kips	72.44 Kips
35.31 ft	Cohesionless	3662.03 psf	55.60	72.44 Kips	72.44 Kips
44.31 ft	Cohesionless	4333.43 psf	55.60	72.44 Kips	72.44 Kips
48.19 ft	Cohesionless	4622.87 psf	55.60	72.44 Kips	72.44 Kips
48.21 ft	Cohesionless	4624.37 psf	77.60	149.38 Kips	149.38 Kips
57.21 ft	Cohesionless	5295.77 psf	77.60	149.38 Kips	149.38 Kips
66.21 ft	Cohesionless	5967.17 psf	77.60	149.38 Kips	149.38 Kips
68.29 ft	Cohesionless	6122.33 psf	77.60	149.38 Kips	149.38 Kips
68.31 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
75.29 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.02 Kips	0.02 Kips
4.29 ft	1.23 Kips	8.24 Kips	9.47 Kips
4.31 ft	1.25 Kips	20.70 Kips	21.95 Kips
13.29 ft	17.78 Kips	66.53 Kips	84.31 Kips
13.31 ft	17.83 Kips	32.52 Kips	50.35 Kips
22.31 ft	44.36 Kips	32.52 Kips	76.87 Kips
25.99 ft	58.95 Kips	32.52 Kips	91.46 Kips
26.01 ft	59.03 Kips	32.52 Kips	91.55 Kips
26.29 ft	60.23 Kips	32.52 Kips	92.74 Kips
26.31 ft	60.32 Kips	72.44 Kips	132.76 Kips
35.31 ft	110.66 Kips	72.44 Kips	183.10 Kips
44.31 ft	171.15 Kips	72.44 Kips	243.59 Kips
48.19 ft	200.36 Kips	72.44 Kips	272.81 Kips
48.21 ft	200.53 Kips	149.38 Kips	349.91 Kips
57.21 ft	290.89 Kips	149.38 Kips	440.27 Kips
66.21 ft	393.47 Kips	149.38 Kips	542.85 Kips
68.29 ft	418.92 Kips	149.38 Kips	568.30 Kips
68.31 ft	419.12 Kips	1773.62 Kips	2192.75 Kips
75.29 ft	474.56 Kips	1773.62 Kips	2248.18 Kips

Bridge 11 End Bent 5 Downdrag Soil Profile



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\BR11B5DD.DVN
Project Name: Bridge 11 End Bent 5 Project Date: 05/08/2015
Project Client: CECS
Computed By: MJW
Project Manager: MFP

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	17.00 ft
	- Driving/Restrike	17.00 ft
	- Ultimate:	17.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	14.00 ft
	(Downdrag Condition)	

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	8.00 ft	0.00%	95.00 pcf	3200.00 psf	T-79 Steel
2	Cohesionless	4.00 ft	0.00%	130.00 pcf	24.0/24.0	Nordlund
3	Cohesionless	5.00 ft	0.00%	130.00 pcf	29.0/29.0	Nordlund
4	Cohesionless	16.00 ft	0.00%	137.00 pcf	29.0/29.0	Nordlund
5	Cohesive	5.00 ft	0.00%	137.00 pcf	160000.00 psf	User Def.
6	Cohesionless	15.00 ft	0.00%	137.00 pcf	29.0/29.0	Nordlund
7	Cohesive	15.60 ft	0.00%	137.00 pcf	200000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	770.00 psf	0.03 Kips
7.99 ft	Cohesive	N/A	N/A	770.00 psf	24.43 Kips
8.01 ft	Cohesionless	760.65 psf	18.07	N/A	24.47 Kips
11.99 ft	Cohesionless	1019.35 psf	18.07	N/A	27.78 Kips
12.01 ft	Cohesionless	1280.65 psf	21.84	N/A	27.80 Kips
16.99 ft	Cohesionless	1604.35 psf	21.84	N/A	36.76 Kips
17.01 ft	Cohesionless	1930.37 psf	21.84	N/A	36.80 Kips
26.01 ft	Cohesionless	2266.07 psf	21.84	N/A	59.66 Kips
32.99 ft	Cohesionless	2526.43 psf	21.84	N/A	82.05 Kips
33.01 ft	Cohesive	N/A	N/A	1600.00 psf	82.15 Kips
37.99 ft	Cohesive	N/A	N/A	1600.00 psf	113.79 Kips
38.01 ft	Cohesionless	3496.97 psf	21.84	N/A	113.89 Kips
47.01 ft	Cohesionless	3832.67 psf	21.84	N/A	152.55 Kips
52.99 ft	Cohesionless	4055.73 psf	21.84	N/A	181.99 Kips
53.01 ft	Cohesive	N/A	N/A	2000.00 psf	182.12 Kips
62.01 ft	Cohesive	N/A	N/A	2000.00 psf	253.59 Kips
68.59 ft	Cohesive	N/A	N/A	2000.00 psf	305.85 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	28.38 Kips
7.99 ft	Cohesive	N/A	N/A	N/A	28.38 Kips
8.01 ft	Cohesionless	761.30 psf	13.80	13.12 Kips	4.64 Kips
11.99 ft	Cohesionless	1278.70 psf	13.80	13.12 Kips	7.80 Kips
12.01 ft	Cohesionless	1281.30 psf	26.40	13.12 Kips	13.12 Kips
16.99 ft	Cohesionless	1928.70 psf	26.40	13.12 Kips	13.12 Kips
17.01 ft	Cohesionless	1930.75 psf	26.40	13.12 Kips	13.12 Kips
26.01 ft	Cohesionless	2602.15 psf	26.40	13.12 Kips	13.12 Kips
32.99 ft	Cohesionless	3122.85 psf	26.40	13.12 Kips	13.12 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	1418.90 Kips
37.99 ft	Cohesive	N/A	N/A	N/A	1418.90 Kips
38.01 ft	Cohesionless	3497.35 psf	26.40	13.12 Kips	13.12 Kips
47.01 ft	Cohesionless	4168.75 psf	26.40	13.12 Kips	13.12 Kips
52.99 ft	Cohesionless	4614.85 psf	26.40	13.12 Kips	13.12 Kips
53.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
62.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
68.59 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	28.38 Kips	28.41 Kips
7.99 ft	24.43 Kips	28.38 Kips	52.81 Kips
8.01 ft	24.47 Kips	4.64 Kips	29.11 Kips
11.99 ft	27.78 Kips	7.80 Kips	35.57 Kips
12.01 ft	27.80 Kips	13.12 Kips	40.93 Kips
16.99 ft	36.76 Kips	13.12 Kips	49.88 Kips
17.01 ft	36.80 Kips	13.12 Kips	49.93 Kips
26.01 ft	59.66 Kips	13.12 Kips	72.79 Kips
32.99 ft	82.05 Kips	13.12 Kips	95.18 Kips
33.01 ft	82.15 Kips	1418.90 Kips	1501.05 Kips
37.99 ft	113.79 Kips	1418.90 Kips	1532.69 Kips
38.01 ft	113.89 Kips	13.12 Kips	127.02 Kips
47.01 ft	152.55 Kips	13.12 Kips	165.68 Kips
52.99 ft	181.99 Kips	13.12 Kips	195.11 Kips
53.01 ft	182.12 Kips	1773.62 Kips	1955.74 Kips
62.01 ft	253.59 Kips	1773.62 Kips	2027.22 Kips
68.59 ft	305.85 Kips	1773.62 Kips	2079.47 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	770.00 psf	0.03 Kips
7.99 ft	Cohesive	N/A	N/A	770.00 psf	24.43 Kips
8.01 ft	Cohesionless	760.65 psf	18.07	N/A	24.47 Kips
11.99 ft	Cohesionless	1019.35 psf	18.07	N/A	27.78 Kips
12.01 ft	Cohesionless	1280.65 psf	21.84	N/A	27.80 Kips
16.99 ft	Cohesionless	1604.35 psf	21.84	N/A	36.76 Kips
17.01 ft	Cohesionless	1930.37 psf	21.84	N/A	36.80 Kips
26.01 ft	Cohesionless	2266.07 psf	21.84	N/A	59.66 Kips
32.99 ft	Cohesionless	2526.43 psf	21.84	N/A	82.05 Kips
33.01 ft	Cohesive	N/A	N/A	1600.00 psf	82.15 Kips
37.99 ft	Cohesive	N/A	N/A	1600.00 psf	113.79 Kips
38.01 ft	Cohesionless	3496.97 psf	21.84	N/A	113.89 Kips
47.01 ft	Cohesionless	3832.67 psf	21.84	N/A	152.55 Kips
52.99 ft	Cohesionless	4055.73 psf	21.84	N/A	181.99 Kips
53.01 ft	Cohesive	N/A	N/A	2000.00 psf	182.12 Kips
62.01 ft	Cohesive	N/A	N/A	2000.00 psf	253.59 Kips
68.59 ft	Cohesive	N/A	N/A	2000.00 psf	305.85 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	28.38 Kips
7.99 ft	Cohesive	N/A	N/A	N/A	28.38 Kips
8.01 ft	Cohesionless	761.30 psf	13.80	13.12 Kips	4.64 Kips
11.99 ft	Cohesionless	1278.70 psf	13.80	13.12 Kips	7.80 Kips
12.01 ft	Cohesionless	1281.30 psf	26.40	13.12 Kips	13.12 Kips
16.99 ft	Cohesionless	1928.70 psf	26.40	13.12 Kips	13.12 Kips
17.01 ft	Cohesionless	1930.75 psf	26.40	13.12 Kips	13.12 Kips
26.01 ft	Cohesionless	2602.15 psf	26.40	13.12 Kips	13.12 Kips
32.99 ft	Cohesionless	3122.85 psf	26.40	13.12 Kips	13.12 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	1418.90 Kips
37.99 ft	Cohesive	N/A	N/A	N/A	1418.90 Kips
38.01 ft	Cohesionless	3497.35 psf	26.40	13.12 Kips	13.12 Kips
47.01 ft	Cohesionless	4168.75 psf	26.40	13.12 Kips	13.12 Kips
52.99 ft	Cohesionless	4614.85 psf	26.40	13.12 Kips	13.12 Kips
53.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
62.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
68.59 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	28.38 Kips	28.41 Kips
7.99 ft	24.43 Kips	28.38 Kips	52.81 Kips
8.01 ft	24.47 Kips	4.64 Kips	29.11 Kips
11.99 ft	27.78 Kips	7.80 Kips	35.57 Kips
12.01 ft	27.80 Kips	13.12 Kips	40.93 Kips
16.99 ft	36.76 Kips	13.12 Kips	49.88 Kips
17.01 ft	36.80 Kips	13.12 Kips	49.93 Kips
26.01 ft	59.66 Kips	13.12 Kips	72.79 Kips
32.99 ft	82.05 Kips	13.12 Kips	95.18 Kips
33.01 ft	82.15 Kips	1418.90 Kips	1501.05 Kips
37.99 ft	113.79 Kips	1418.90 Kips	1532.69 Kips
38.01 ft	113.89 Kips	13.12 Kips	127.02 Kips
47.01 ft	152.55 Kips	13.12 Kips	165.68 Kips
52.99 ft	181.99 Kips	13.12 Kips	195.11 Kips
53.01 ft	182.12 Kips	1773.62 Kips	1955.74 Kips
62.01 ft	253.59 Kips	1773.62 Kips	2027.22 Kips
68.59 ft	305.85 Kips	1773.62 Kips	2079.47 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	770.00 psf	-0.03 Kips
7.99 ft	Cohesive	N/A	N/A	770.00 psf	-24.43 Kips
8.01 ft	Cohesionless	760.65 psf	18.07	N/A	-24.47 Kips
11.99 ft	Cohesionless	1019.35 psf	18.07	N/A	-27.78 Kips
12.01 ft	Cohesionless	1280.65 psf	21.84	N/A	-27.80 Kips
13.99 ft	Cohesionless	1409.35 psf	21.84	N/A	-30.93 Kips
14.00 ft	Cohesionless	1540.00 psf	21.84	N/A	-30.95 Kips
16.99 ft	Cohesionless	1734.35 psf	21.84	N/A	-25.14 Kips
17.01 ft	Cohesionless	1930.37 psf	21.84	N/A	-25.09 Kips
26.01 ft	Cohesionless	2266.07 psf	21.84	N/A	-2.23 Kips
32.99 ft	Cohesionless	2526.43 psf	21.84	N/A	20.16 Kips
33.01 ft	Cohesive	N/A	N/A	1600.00 psf	20.26 Kips
37.99 ft	Cohesive	N/A	N/A	1600.00 psf	51.90 Kips
38.01 ft	Cohesionless	3496.97 psf	21.84	N/A	52.00 Kips
47.01 ft	Cohesionless	3832.67 psf	21.84	N/A	90.66 Kips
52.99 ft	Cohesionless	4055.73 psf	21.84	N/A	120.09 Kips
53.01 ft	Cohesive	N/A	N/A	2000.00 psf	120.23 Kips
62.01 ft	Cohesive	N/A	N/A	2000.00 psf	191.70 Kips
68.59 ft	Cohesive	N/A	N/A	2000.00 psf	243.96 Kips

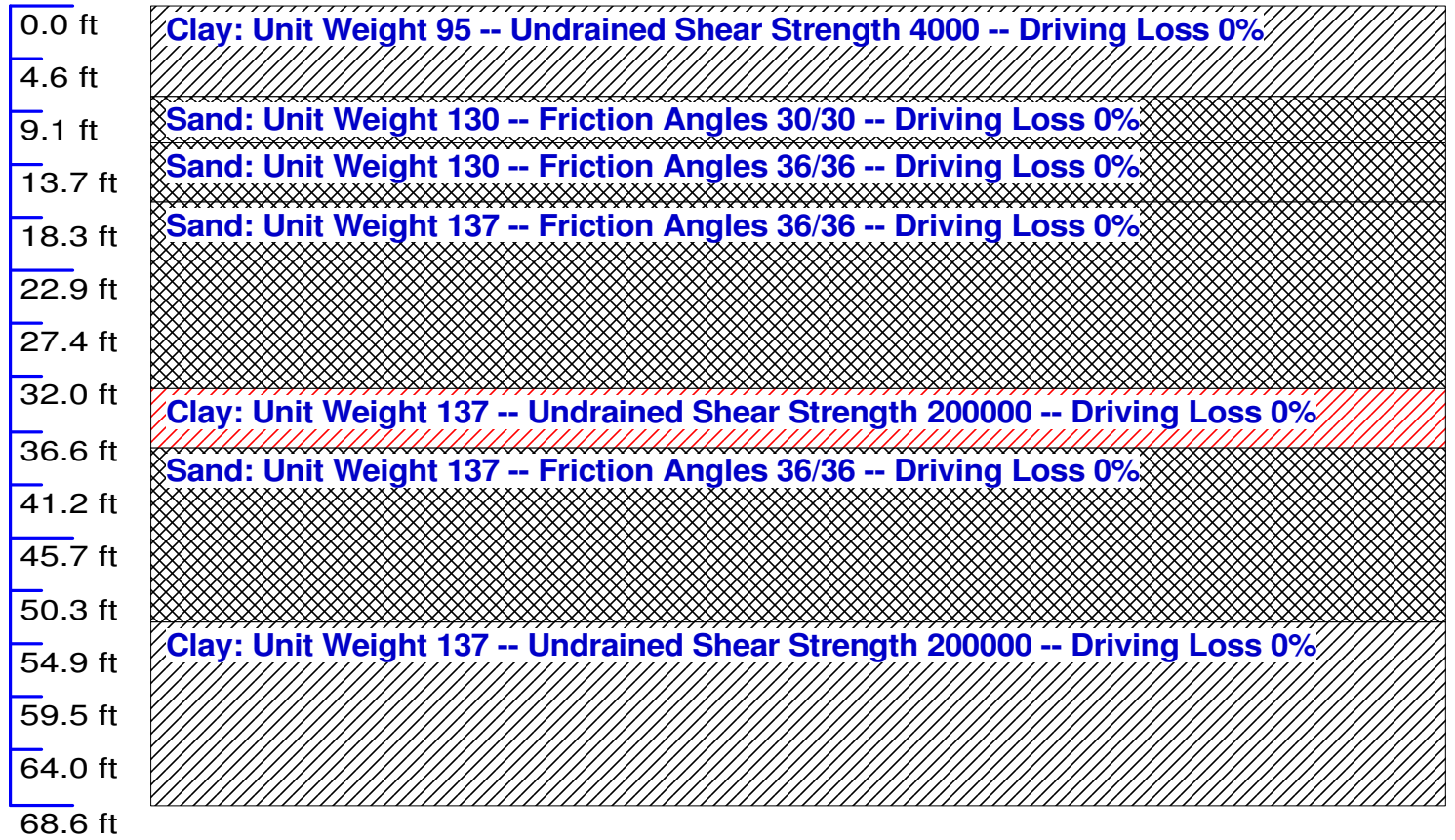
ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
11.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
12.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
13.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.00 ft	Cohesionless	1540.00 psf	26.40	13.12 Kips	13.12 Kips
16.99 ft	Cohesionless	1928.70 psf	26.40	13.12 Kips	13.12 Kips
17.01 ft	Cohesionless	1930.75 psf	26.40	13.12 Kips	13.12 Kips
26.01 ft	Cohesionless	2602.15 psf	26.40	13.12 Kips	13.12 Kips
32.99 ft	Cohesionless	3122.85 psf	26.40	13.12 Kips	13.12 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	1418.90 Kips
37.99 ft	Cohesive	N/A	N/A	N/A	1418.90 Kips
38.01 ft	Cohesionless	3497.35 psf	26.40	13.12 Kips	13.12 Kips
47.01 ft	Cohesionless	4168.75 psf	26.40	13.12 Kips	13.12 Kips
52.99 ft	Cohesionless	4614.85 psf	26.40	13.12 Kips	13.12 Kips
53.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
62.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
68.59 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	-0.03 Kips	0.00 Kips	-0.03 Kips
7.99 ft	-24.43 Kips	0.00 Kips	-24.43 Kips
8.01 ft	-24.47 Kips	0.00 Kips	-24.47 Kips
11.99 ft	-27.78 Kips	0.00 Kips	-27.78 Kips
12.01 ft	-27.80 Kips	0.00 Kips	-27.80 Kips
13.99 ft	-30.93 Kips	0.00 Kips	-30.93 Kips
14.00 ft	-30.95 Kips	13.12 Kips	-17.82 Kips
16.99 ft	-25.14 Kips	13.12 Kips	-12.01 Kips
17.01 ft	-25.09 Kips	13.12 Kips	-11.97 Kips
26.01 ft	-2.23 Kips	13.12 Kips	10.89 Kips
32.99 ft	20.16 Kips	13.12 Kips	33.28 Kips
33.01 ft	20.26 Kips	1418.90 Kips	1439.16 Kips
37.99 ft	51.90 Kips	1418.90 Kips	1470.80 Kips
38.01 ft	52.00 Kips	13.12 Kips	65.13 Kips
47.01 ft	90.66 Kips	13.12 Kips	103.79 Kips
52.99 ft	120.09 Kips	13.12 Kips	133.22 Kips
53.01 ft	120.23 Kips	1773.62 Kips	1893.85 Kips
62.01 ft	191.70 Kips	1773.62 Kips	1965.33 Kips
68.59 ft	243.96 Kips	1773.62 Kips	2017.58 Kips

Bridge 11 End Bent 5 Soil Profile



DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\BR11EB5.DVN
Project Name: Bridge 11 End Bent 5 Project Date: 05/08/2015
Project Client: CECS
Computed By: MJW
Project Manager: MFP

PILE INFORMATION

Pile Type: H Pile - HP12X53
Top of Pile: 0.00 ft
Perimeter Analysis: Box
Tip Analysis: Box Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	17.00 ft
	- Driving/Restrike	17.00 ft
	- Ultimate:	17.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	8.00 ft	0.00%	95.00 pcf	4000.00 psf	T-79 Steel
2	Cohesionless	4.00 ft	0.00%	130.00 pcf	30.0/30.0	Nordlund
3	Cohesionless	5.00 ft	0.00%	130.00 pcf	36.0/36.0	Nordlund
4	Cohesionless	16.00 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
5	Cohesive	5.00 ft	0.00%	137.00 pcf	200000.00 psf	User Def.
6	Cohesionless	15.00 ft	0.00%	137.00 pcf	36.0/36.0	Nordlund
7	Cohesive	15.60 ft	0.00%	137.00 pcf	200000.00 psf	User Def.

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	770.00 psf	0.03 Kips
7.99 ft	Cohesive	N/A	N/A	770.00 psf	24.43 Kips
8.01 ft	Cohesionless	760.65 psf	22.59	N/A	24.47 Kips
11.99 ft	Cohesionless	1019.35 psf	22.59	N/A	29.32 Kips
12.01 ft	Cohesionless	1280.65 psf	27.11	N/A	29.37 Kips
16.99 ft	Cohesionless	1604.35 psf	27.11	N/A	45.54 Kips
17.01 ft	Cohesionless	1930.37 psf	27.11	N/A	45.62 Kips
26.01 ft	Cohesionless	2266.07 psf	27.11	N/A	86.91 Kips
32.99 ft	Cohesionless	2526.43 psf	27.11	N/A	127.35 Kips
33.01 ft	Cohesive	N/A	N/A	2000.00 psf	127.49 Kips
37.99 ft	Cohesive	N/A	N/A	2000.00 psf	167.04 Kips
38.01 ft	Cohesionless	3496.97 psf	27.11	N/A	167.19 Kips
47.01 ft	Cohesionless	3832.67 psf	27.11	N/A	237.01 Kips
52.99 ft	Cohesionless	4055.73 psf	27.11	N/A	290.17 Kips
53.01 ft	Cohesive	N/A	N/A	2000.00 psf	290.34 Kips
62.01 ft	Cohesive	N/A	N/A	2000.00 psf	361.82 Kips
68.59 ft	Cohesive	N/A	N/A	2000.00 psf	414.07 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	35.47 Kips
7.99 ft	Cohesive	N/A	N/A	N/A	35.47 Kips
8.01 ft	Cohesionless	761.30 psf	30.00	13.12 Kips	13.05 Kips
11.99 ft	Cohesionless	1278.70 psf	30.00	13.12 Kips	13.12 Kips
12.01 ft	Cohesionless	1281.30 psf	77.60	149.38 Kips	67.93 Kips
16.99 ft	Cohesionless	1928.70 psf	77.60	149.38 Kips	102.25 Kips
17.01 ft	Cohesionless	1930.75 psf	77.60	149.38 Kips	102.36 Kips
26.01 ft	Cohesionless	2602.15 psf	77.60	149.38 Kips	137.56 Kips
32.99 ft	Cohesionless	3122.85 psf	77.60	149.38 Kips	149.38 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
37.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
38.01 ft	Cohesionless	3497.35 psf	77.60	149.38 Kips	149.38 Kips
47.01 ft	Cohesionless	4168.75 psf	77.60	149.38 Kips	149.38 Kips
52.99 ft	Cohesionless	4614.85 psf	77.60	149.38 Kips	149.38 Kips
53.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
62.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
68.59 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	35.47 Kips	35.50 Kips
7.99 ft	24.43 Kips	35.47 Kips	59.90 Kips
8.01 ft	24.47 Kips	13.05 Kips	37.52 Kips
11.99 ft	29.32 Kips	13.12 Kips	42.45 Kips
12.01 ft	29.37 Kips	67.93 Kips	97.29 Kips
16.99 ft	45.54 Kips	102.25 Kips	147.79 Kips
17.01 ft	45.62 Kips	102.36 Kips	147.98 Kips
26.01 ft	86.91 Kips	137.56 Kips	224.47 Kips
32.99 ft	127.35 Kips	149.38 Kips	276.73 Kips
33.01 ft	127.49 Kips	1773.62 Kips	1901.12 Kips
37.99 ft	167.04 Kips	1773.62 Kips	1940.66 Kips
38.01 ft	167.19 Kips	149.38 Kips	316.57 Kips
47.01 ft	237.01 Kips	149.38 Kips	386.39 Kips
52.99 ft	290.17 Kips	149.38 Kips	439.55 Kips
53.01 ft	290.34 Kips	1773.62 Kips	2063.97 Kips
62.01 ft	361.82 Kips	1773.62 Kips	2135.44 Kips
68.59 ft	414.07 Kips	1773.62 Kips	2187.70 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	770.00 psf	0.03 Kips
7.99 ft	Cohesive	N/A	N/A	770.00 psf	24.43 Kips
8.01 ft	Cohesionless	760.65 psf	22.59	N/A	24.47 Kips
11.99 ft	Cohesionless	1019.35 psf	22.59	N/A	29.32 Kips
12.01 ft	Cohesionless	1280.65 psf	27.11	N/A	29.37 Kips
16.99 ft	Cohesionless	1604.35 psf	27.11	N/A	45.54 Kips
17.01 ft	Cohesionless	1930.37 psf	27.11	N/A	45.62 Kips
26.01 ft	Cohesionless	2266.07 psf	27.11	N/A	86.91 Kips
32.99 ft	Cohesionless	2526.43 psf	27.11	N/A	127.35 Kips
33.01 ft	Cohesive	N/A	N/A	2000.00 psf	127.49 Kips
37.99 ft	Cohesive	N/A	N/A	2000.00 psf	167.04 Kips
38.01 ft	Cohesionless	3496.97 psf	27.11	N/A	167.19 Kips
47.01 ft	Cohesionless	3832.67 psf	27.11	N/A	237.01 Kips
52.99 ft	Cohesionless	4055.73 psf	27.11	N/A	290.17 Kips
53.01 ft	Cohesive	N/A	N/A	2000.00 psf	290.34 Kips
62.01 ft	Cohesive	N/A	N/A	2000.00 psf	361.82 Kips
68.59 ft	Cohesive	N/A	N/A	2000.00 psf	414.07 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	35.47 Kips
7.99 ft	Cohesive	N/A	N/A	N/A	35.47 Kips
8.01 ft	Cohesionless	761.30 psf	30.00	13.12 Kips	13.05 Kips
11.99 ft	Cohesionless	1278.70 psf	30.00	13.12 Kips	13.12 Kips
12.01 ft	Cohesionless	1281.30 psf	77.60	149.38 Kips	67.93 Kips
16.99 ft	Cohesionless	1928.70 psf	77.60	149.38 Kips	102.25 Kips
17.01 ft	Cohesionless	1930.75 psf	77.60	149.38 Kips	102.36 Kips
26.01 ft	Cohesionless	2602.15 psf	77.60	149.38 Kips	137.56 Kips
32.99 ft	Cohesionless	3122.85 psf	77.60	149.38 Kips	149.38 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
37.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
38.01 ft	Cohesionless	3497.35 psf	77.60	149.38 Kips	149.38 Kips
47.01 ft	Cohesionless	4168.75 psf	77.60	149.38 Kips	149.38 Kips
52.99 ft	Cohesionless	4614.85 psf	77.60	149.38 Kips	149.38 Kips
53.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
62.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
68.59 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	35.47 Kips	35.50 Kips
7.99 ft	24.43 Kips	35.47 Kips	59.90 Kips
8.01 ft	24.47 Kips	13.05 Kips	37.52 Kips
11.99 ft	29.32 Kips	13.12 Kips	42.45 Kips
12.01 ft	29.37 Kips	67.93 Kips	97.29 Kips
16.99 ft	45.54 Kips	102.25 Kips	147.79 Kips
17.01 ft	45.62 Kips	102.36 Kips	147.98 Kips
26.01 ft	86.91 Kips	137.56 Kips	224.47 Kips
32.99 ft	127.35 Kips	149.38 Kips	276.73 Kips
33.01 ft	127.49 Kips	1773.62 Kips	1901.12 Kips
37.99 ft	167.04 Kips	1773.62 Kips	1940.66 Kips
38.01 ft	167.19 Kips	149.38 Kips	316.57 Kips
47.01 ft	237.01 Kips	149.38 Kips	386.39 Kips
52.99 ft	290.17 Kips	149.38 Kips	439.55 Kips
53.01 ft	290.34 Kips	1773.62 Kips	2063.97 Kips
62.01 ft	361.82 Kips	1773.62 Kips	2135.44 Kips
68.59 ft	414.07 Kips	1773.62 Kips	2187.70 Kips

ULTIMATE - SKIN FRICTION

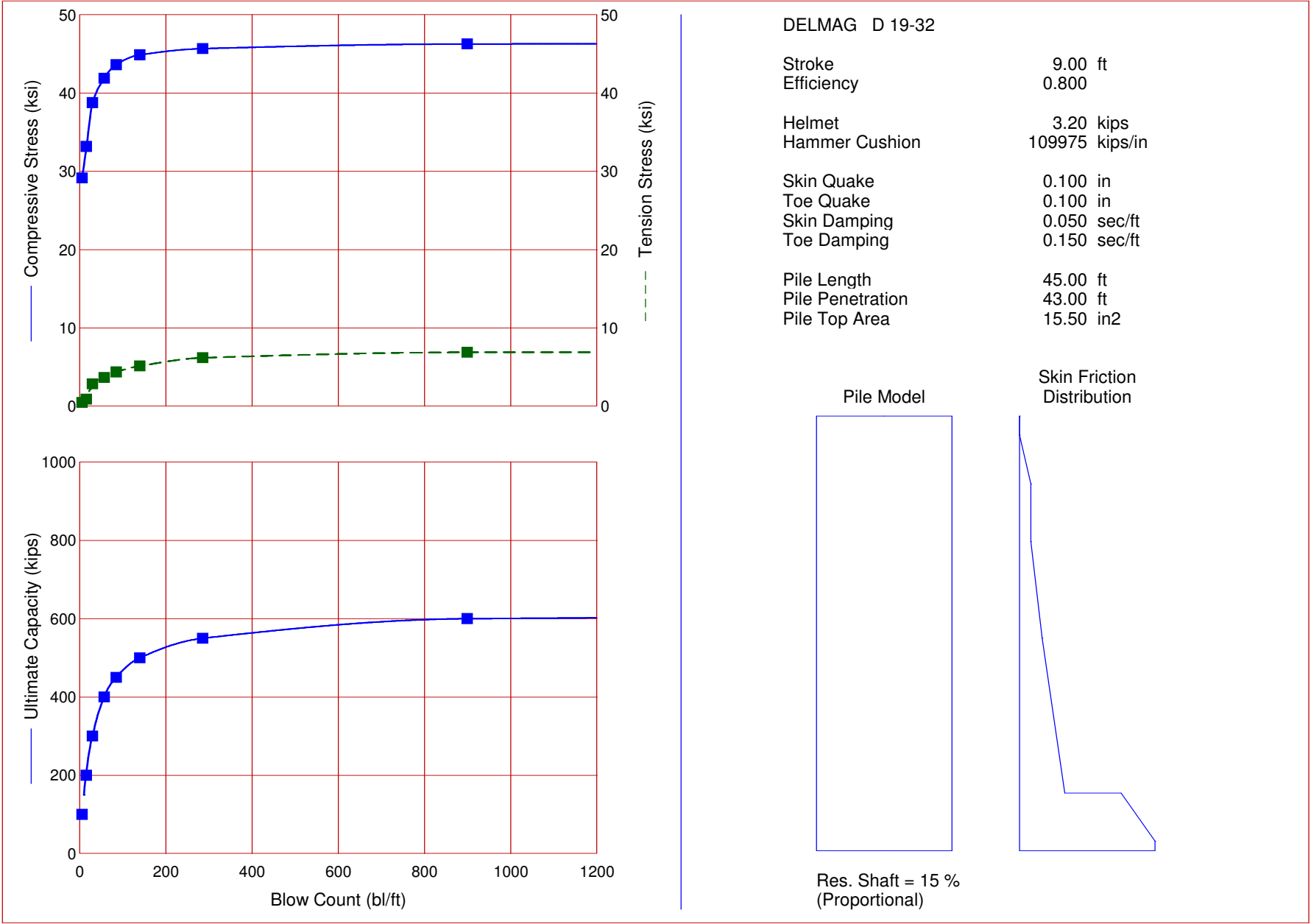
Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	770.00 psf	0.03 Kips
7.99 ft	Cohesive	N/A	N/A	770.00 psf	24.43 Kips
8.01 ft	Cohesionless	760.65 psf	22.59	N/A	24.47 Kips
11.99 ft	Cohesionless	1019.35 psf	22.59	N/A	29.32 Kips
12.01 ft	Cohesionless	1280.65 psf	27.11	N/A	29.37 Kips
16.99 ft	Cohesionless	1604.35 psf	27.11	N/A	45.54 Kips
17.01 ft	Cohesionless	1930.37 psf	27.11	N/A	45.62 Kips
26.01 ft	Cohesionless	2266.07 psf	27.11	N/A	86.91 Kips
32.99 ft	Cohesionless	2526.43 psf	27.11	N/A	127.35 Kips
33.01 ft	Cohesive	N/A	N/A	2000.00 psf	127.49 Kips
37.99 ft	Cohesive	N/A	N/A	2000.00 psf	167.04 Kips
38.01 ft	Cohesionless	3496.97 psf	27.11	N/A	167.19 Kips
47.01 ft	Cohesionless	3832.67 psf	27.11	N/A	237.01 Kips
52.99 ft	Cohesionless	4055.73 psf	27.11	N/A	290.17 Kips
53.01 ft	Cohesive	N/A	N/A	2000.00 psf	290.34 Kips
62.01 ft	Cohesive	N/A	N/A	2000.00 psf	361.82 Kips
68.59 ft	Cohesive	N/A	N/A	2000.00 psf	414.07 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	35.47 Kips
7.99 ft	Cohesive	N/A	N/A	N/A	35.47 Kips
8.01 ft	Cohesionless	761.30 psf	30.00	13.12 Kips	13.05 Kips
11.99 ft	Cohesionless	1278.70 psf	30.00	13.12 Kips	13.12 Kips
12.01 ft	Cohesionless	1281.30 psf	77.60	149.38 Kips	67.93 Kips
16.99 ft	Cohesionless	1928.70 psf	77.60	149.38 Kips	102.25 Kips
17.01 ft	Cohesionless	1930.75 psf	77.60	149.38 Kips	102.36 Kips
26.01 ft	Cohesionless	2602.15 psf	77.60	149.38 Kips	137.56 Kips
32.99 ft	Cohesionless	3122.85 psf	77.60	149.38 Kips	149.38 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
37.99 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
38.01 ft	Cohesionless	3497.35 psf	77.60	149.38 Kips	149.38 Kips
47.01 ft	Cohesionless	4168.75 psf	77.60	149.38 Kips	149.38 Kips
52.99 ft	Cohesionless	4614.85 psf	77.60	149.38 Kips	149.38 Kips
53.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
62.01 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips
68.59 ft	Cohesive	N/A	N/A	N/A	1773.62 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.03 Kips	35.47 Kips	35.50 Kips
7.99 ft	24.43 Kips	35.47 Kips	59.90 Kips
8.01 ft	24.47 Kips	13.05 Kips	37.52 Kips
11.99 ft	29.32 Kips	13.12 Kips	42.45 Kips
12.01 ft	29.37 Kips	67.93 Kips	97.29 Kips
16.99 ft	45.54 Kips	102.25 Kips	147.79 Kips
17.01 ft	45.62 Kips	102.36 Kips	147.98 Kips
26.01 ft	86.91 Kips	137.56 Kips	224.47 Kips
32.99 ft	127.35 Kips	149.38 Kips	276.73 Kips
33.01 ft	127.49 Kips	1773.62 Kips	1901.12 Kips
37.99 ft	167.04 Kips	1773.62 Kips	1940.66 Kips
38.01 ft	167.19 Kips	149.38 Kips	316.57 Kips
47.01 ft	237.01 Kips	149.38 Kips	386.39 Kips
52.99 ft	290.17 Kips	149.38 Kips	439.55 Kips
53.01 ft	290.34 Kips	1773.62 Kips	2063.97 Kips
62.01 ft	361.82 Kips	1773.62 Kips	2135.44 Kips
68.59 ft	414.07 Kips	1773.62 Kips	2187.70 Kips



Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	29.16	0.49	6.0	9.00	38.71
200.0	33.17	0.90	16.2	9.00	27.62
300.0	38.77	2.87	30.2	9.00	24.17
400.0	41.87	3.67	57.3	9.00	22.46
450.0	43.60	4.38	85.3	9.00	21.70
500.0	44.87	5.14	140.1	9.00	21.14
550.0	45.67	6.19	285.5	9.00	20.56
600.0	46.26	6.89	899.1	9.00	20.15
650.0	46.70	7.25	9999.0	9.00	19.95

GRLWEAP - Version 2005
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.
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ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

Input File: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385 INTERCHANGE
DESIGN\01 FINAL REPORTS\11 BRIDGE 11\06 DRIVEABILITY ANALYSIS (WEAP)\BRIDGE 11
BENT 2 D19-32.GWI

Hammer File: C:\Program Files\PDI\GRLWEAP 2005\HAMMER2003.GW

Hammer File Version: 2003 (1/11/2007)

Input File Contents

I-85 Bridge 11 Bent 2

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEX
6	0	40	-1	1	0	0	0	0	0	15	1	0	0	0	0	0	0	0.000

File g	Hammer g	Toe Area	Pile Size	Pile Type
32.170	32.170	144.000	12.000	H File

W Cp	A Cp	E Cp	T Cp	CoR	ROut	StCp
3.200	415.000	530.0	2.000	0.800	0.010	0.0

A Cu	E Cu	T Cu	CoR	ROut	StCu
0.000	0.0	0.000	0.000	0.000	0.0

LPle	APle	EPle	WPle	Peri	Strg	CoR	ROut
45.000	15.500	30000.000	492.000	4.000	36.000	0.850	0.010

Manufac	Hmr Name	HmrType	No	Seg-s
DELMAG	D 19-32	1	5	

Ram Wt	Ram L	Ram Dia	MaxStrk	RtdStrk	Efficy
4.00	129.10	12.60	11.76	10.61	0.80

IB. Wt	IB. L	IB.Dia	IB CoR	IB RO
0.75	25.30	12.60	0.900	0.010

CompStrk	A Chamber	V Chamber	C Delay	C Duratn	Exp Coeff	VolCStart	Vol CEnd
15.50	124.70	157.70	0.002	0.002	1.250	0.00	0.00

P atm	P1	P2	P3	P4	P5
14.70	1500.00	1350.00	1215.00	1094.00	0.00

Stroke	Effic.	Pressure	R-Weight	T-Delay	Exp-Coeff	Eps-Str	Total-AW
9.0000	0.8000	1500.0000	0.0000	0.0000	0.0000	0.0100	0.0000

Qs	Qt	Js	Jt	Qx	Jx	Rati	Dept
0.100	0.100	0.050	0.150	0.000	0.000	0.000	0.000

Research Soil Model: Atoe, Plug, Gap, Q-fac

0.000	0.000	0.000	0.000
-------	-------	-------	-------

Research Soil Model: RD-skn: m, d, toe: m, d

0.000	0.000	0.000	0.000
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Res. Distribution

Dpth	Rskn	Dpth	Dpth						
0.00	0.00	43.00	43.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
37.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
37.00	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.00	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42.00	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

52.00	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rult									
100.0	200.0	300.0	400.0	450.0	500.0	550.0	600.0	650.0	700.0
Diameter	COGHammer	WHammer	ABatter	Depth	Sup		Flag		
0.000	0.000	0.000	0.000	0.000	0.000		0		

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2005
English Units

I-85 Bridge 11 Bent 2

Hammer Model:	D 19-32	Made by:	DELMAG
No.	Weight kips	Stiffn k/inch	CoR
1	0.800		
2	0.800	140046.7	1.000
3	0.800	140046.7	1.000
4	0.800	140046.7	1.000
5	0.800	140046.7	1.000
Imp Block	0.753	70735.6	0.900
Helmet	3.200	109975.0	0.800
Combined Pile Top		12055.6	

HAMMER OPTIONS:

Hammer File ID No.	40	Hammer Type	OE Diesel
Stroke Option	VarP-FxdS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.76	Actual Stroke	(ft)	9.00
Rated Stroke	(ft)	10.61	Efficiency		0.800
Maximum Pressure	(psi)	1500.00	Actual Pressure	(psi)	1500.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION

Cross Sect. Area	(in2)	415.00
Elastic-Modulus	(ksi)	530.0
Thickness	(inch)	2.00
Coeff of Restitution		0.8
RoundOut	(ft)	0.0
Stiffness	(kips/in)	109975.0

PILE CUSHION

Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	0.00
Coeff of Restitution		0.0
RoundOut	(ft)	0.0
Stiffness	(kips/in)	0.0

PILE PROFILE:

Toe Area	(in2)	144.000	Pile Type	H Pile
Pile Size	(inch)	12.000		

L b Top	Area	E-Mod	Spec Wt	Perim	Strength	Wave Sp	EA/c
ft	in2	ksi	lb/ft3	ft	ksi	ft/s	k/ft/s
0.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7
45.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7

Wave Travel Time 2L/c (ms) 5.355

Pile and Soil Model						Total Capacity Rut			(kips)	100.0	
No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.170	12056.	0.010	0.000	0.85	0.0	0.050	0.100	3.21	4.0	15.5
2	0.170	12056.	0.000	0.000	1.00	0.2	0.050	0.100	6.43	4.0	15.5
3	0.170	12056.	0.000	0.000	1.00	0.3	0.050	0.100	9.64	4.0	15.5
4	0.170	12056.	0.000	0.000	1.00	0.4	0.050	0.100	12.86	4.0	15.5
5	0.170	12056.	0.000	0.000	1.00	0.5	0.050	0.100	16.07	4.0	15.5
6	0.170	12056.	0.000	0.000	1.00	0.5	0.050	0.100	19.29	4.0	15.5
7	0.170	12056.	0.000	0.000	1.00	0.6	0.050	0.100	22.50	4.0	15.5
8	0.170	12056.	0.000	0.000	1.00	0.8	0.050	0.100	25.71	4.0	15.5
9	0.170	12056.	0.000	0.000	1.00	0.9	0.050	0.100	28.93	4.0	15.5
10	0.170	12056.	0.000	0.000	1.00	1.0	0.050	0.100	32.14	4.0	15.5
11	0.170	12056.	0.000	0.000	1.00	1.1	0.050	0.100	35.36	4.0	15.5
12	0.170	12056.	0.000	0.000	1.00	1.2	0.050	0.100	38.57	4.0	15.5
13	0.170	12056.	0.000	0.000	1.00	3.3	0.050	0.100	41.79	4.0	15.5
14	0.170	12056.	0.000	0.000	1.00	4.1	0.050	0.100	45.00	4.0	15.5
Toe						85.0	0.150	0.100			

2.383 kips total unreduced pile weight (g= 32.17 ft/s2)
2.383 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
Pile Penetration (ft)	43.00	Pile Damping Fact. (k/ft/s)	0.553
% Shaft Resistance	15		
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	2	Analysis Time-Input (ms)	0
Output Level: Variable vs Time			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170
Output Segment Generation: Automatic			

Rut= 100.0, Rtoe = 85.0 kips, Time Inc. =0.067 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	450.5	2	0.00	0	29.07	2	15.52	2	2.182	29	38.71
2	-2.2	43	451.6	2	-0.14	43	29.14	2	15.49	2	2.176	29	38.70
3	-3.9	49	452.0	2	-0.25	49	29.16	2	15.45	2	2.169	29	38.64
4	-5.2	49	451.7	3	-0.34	49	29.14	3	15.40	3	2.162	29	38.55
5	-6.3	49	451.3	3	-0.40	49	29.12	3	15.35	3	2.156	29	38.44
6	-7.0	48	450.9	3	-0.45	48	29.09	3	15.30	3	2.149	29	38.32
7	-7.4	48	450.6	3	-0.48	48	29.07	3	15.24	3	2.142	29	38.18
8	-7.5	48	450.3	3	-0.49	48	29.05	3	15.33	6	2.135	29	38.01
9	-7.3	48	450.1	4	-0.47	48	29.04	4	15.15	4	2.128	29	37.81
10	-6.9	48	449.4	4	-0.45	48	28.99	4	15.18	4	2.121	29	37.57
11	-6.5	48	444.2	4	-0.42	48	28.66	4	15.75	4	2.113	29	37.30
12	-5.8	47	426.1	4	-0.38	47	27.49	4	16.76	4	2.106	30	37.01
13	-5.2	47	395.1	4	-0.33	47	25.49	4	18.05	5	2.099	30	36.44
14	-2.9	47	366.7	4	-0.19	47	23.66	4	18.94	5	2.092	30	36.01

(Eq) Return Strokes and Stroke Analyzed (ft):
5.15 7.34 8.69 8.99 9.00

Max. Combustion Pressure 2623.0 psi

Rut= 200.0, Rtoe= 170.0 kips, Time Inc. =0.067 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	456.3	2	0.00	0	29.44	2	15.48	2	1.041	13	27.62
2	-3.3	26	457.6	2	-0.22	26	29.52	2	15.43	2	1.026	13	27.49
3	-6.1	27	457.9	2	-0.39	27	29.54	2	15.37	3	1.010	13	27.32
4	-8.7	27	457.6	3	-0.56	27	29.52	3	15.30	3	0.994	14	27.12
5	-10.9	27	457.1	3	-0.70	27	29.49	3	15.22	3	0.978	14	26.91
6	-12.5	27	456.7	3	-0.81	27	29.46	3	15.15	3	0.962	14	26.68
7	-13.6	26	456.3	3	-0.88	26	29.44	3	15.07	3	0.946	14	26.45
8	-13.9	26	456.1	3	-0.90	26	29.43	3	14.98	3	0.931	14	26.19
9	-12.8	26	455.6	4	-0.83	26	29.40	4	14.89	4	0.915	15	25.91
10	-10.6	26	454.4	4	-0.69	26	29.32	4	14.86	4	0.900	15	25.60
11	-8.9	27	450.0	4	-0.57	27	29.03	4	15.09	4	0.884	15	25.28
12	-7.2	27	448.8	5	-0.46	27	28.95	5	15.26	4	0.869	15	24.94
13	-5.6	27	498.1	5	-0.36	27	32.13	5	14.13	4	0.854	15	24.42
14	-2.5	27	514.1	5	-0.16	27	33.17	5	12.58	5	0.839	15	24.01

(Eq) Return Strokes and Stroke Analyzed (ft):
6.45 8.19 8.89 8.99 9.00

Max. Combustion Pressure 2124.0 psi

Rut= 300.0, Rtoe = 255.0 kips, Time Inc. =0.067 ms

No	mxTForce kips	t ms	mxCFforce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	548.1	7	0.00	0	35.36	7	15.47	2	0.850	9	24.17
2	-13.2	21	519.8	8	-0.85	21	33.54	8	15.41	2	0.820	10	23.72
3	-24.2	21	520.2	8	-1.56	21	33.56	8	15.33	2	0.791	10	23.23
4	-31.8	21	510.0	8	-2.05	21	32.91	8	15.24	3	0.763	10	22.75
5	-38.7	21	506.5	8	-2.49	21	32.68	8	15.15	3	0.736	10	22.26
6	-43.1	20	506.9	8	-2.78	20	32.71	8	15.05	3	0.708	11	21.76
7	-44.5	20	506.2	9	-2.87	20	32.66	9	14.94	3	0.680	11	21.25
8	-43.7	20	517.1	6	-2.82	20	33.36	6	14.82	3	0.652	11	20.71
9	-41.4	20	496.9	6	-2.67	20	32.06	6	14.69	4	0.624	11	20.13
10	-38.2	20	487.1	9	-2.46	20	31.43	9	14.60	4	0.595	11	19.53
11	-33.7	20	505.7	5	-2.17	20	32.62	5	14.66	4	0.567	12	18.95
12	-27.3	20	533.8	5	-1.76	20	34.44	5	14.38	4	0.543	12	18.45
13	-19.6	19	576.1	5	-1.26	19	37.17	5	12.69	4	0.519	13	17.83
14	-9.3	20	600.9	5	-0.60	20	38.77	5	9.00	4	0.497	13	17.33

(Eq) Return Strokes and Stroke Analyzed (ft):
7.41 8.59 8.94 9.00

Max. Combustion Pressure 1844.3 psi

Rut= 400.0, Rtoe= 340.0 kips, Time Inc. =0.055 ms

No	mxTForce kips	t ms	mxCFforce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	646.5	7	0.00	0	41.71	7	15.49	2	0.781	9	22.46
2	-12.1	17	622.8	8	-0.78	17	40.18	8	15.42	2	0.744	9	21.74
3	-21.7	18	608.1	8	-1.40	18	39.23	8	15.33	2	0.707	9	20.95
4	-28.6	18	597.8	8	-1.85	18	38.57	8	15.23	3	0.668	9	20.10
5	-34.4	18	588.6	8	-2.22	18	37.98	8	15.12	3	0.631	10	19.28
6	-40.2	18	585.8	8	-2.60	18	37.79	8	14.99	3	0.596	10	18.53
7	-48.6	18	588.8	9	-3.14	18	37.99	9	14.85	3	0.561	10	17.78
8	-55.9	18	584.4	9	-3.60	18	37.70	9	14.70	3	0.527	10	17.01
9	-56.9	18	569.1	9	-3.67	18	36.72	9	14.54	4	0.491	10	16.18
10	-52.1	18	559.2	9	-3.36	18	36.08	9	14.40	4	0.453	10	15.29
11	-47.3	18	555.9	5	-3.05	18	35.87	5	14.28	4	0.414	11	14.34
12	-42.3	18	584.5	5	-2.73	18	37.71	5	13.67	4	0.376	11	13.40
13	-34.3	18	618.3	5	-2.21	18	39.89	5	11.64	4	0.341	11	12.50
14	-18.6	18	649.0	5	-1.20	18	41.87	5	7.67	4	0.309	12	11.80

(Eq) Return Strokes and Stroke Analyzed (ft):
8.36 8.86 8.98 9.00

Max. Combustion Pressure 1632.0 psi

Rut= 450.0, Rtoe = 382.5 kips, Time Inc. =0.050 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	675.9	7	0.00	0	43.60	7	15.50	2	0.757	9	21.70
2	-14.6	17	659.0	8	-0.95	17	42.51	8	15.43	2	0.716	9	20.85
3	-28.3	17	636.8	8	-1.83	17	41.08	8	15.34	2	0.676	9	19.94
4	-39.2	17	627.8	8	-2.53	17	40.50	8	15.23	3	0.634	9	18.97
5	-47.0	17	614.5	8	-3.03	17	39.65	8	15.11	3	0.593	10	17.99
6	-52.3	17	612.0	8	-3.38	17	39.48	8	14.97	3	0.555	10	17.09
7	-55.8	17	615.5	9	-3.60	17	39.71	9	14.82	3	0.517	10	16.23
8	-59.0	18	611.5	9	-3.80	18	39.45	9	14.65	3	0.480	10	15.37
9	-65.0	18	595.3	9	-4.19	18	38.41	9	14.48	4	0.442	10	14.44
10	-67.8	18	583.2	9	-4.38	18	37.62	9	14.31	4	0.402	10	13.44
11	-67.0	18	576.1	9	-4.32	18	37.17	9	14.12	4	0.360	10	12.37
12	-60.0	18	600.2	5	-3.87	18	38.72	5	13.38	4	0.316	10	11.25
13	-45.6	17	629.4	5	-2.94	17	40.61	5	11.23	4	0.276	11	10.16
14	-20.9	17	661.8	5	-1.35	17	42.69	5	7.15	4	0.241	11	9.37

(Eq) Return Strokes and Stroke Analyzed (ft):
8.84 8.97 9.00

Max. Combustion Pressure 1527.4 psi

Rut= 500.0, Rtoe= 425.0 kips, Time Inc. =0.046 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	695.5	7	0.00	0	44.87	7	15.50	2	0.738	8	21.14
2	-19.1	16	686.3	8	-1.24	16	44.28	8	15.43	2	0.694	9	20.15
3	-34.4	16	661.0	8	-2.22	16	42.64	8	15.33	3	0.652	9	19.13
4	-48.7	17	650.3	8	-3.14	17	41.95	8	15.22	3	0.608	9	18.06
5	-62.1	17	635.4	8	-4.01	17	41.00	8	15.08	3	0.564	9	16.94
6	-72.0	17	632.8	8	-4.64	17	40.83	8	14.94	3	0.522	10	15.90
7	-77.4	17	635.8	9	-4.99	17	41.02	9	14.78	3	0.482	10	14.94
8	-78.0	17	633.6	9	-5.03	17	40.88	9	14.60	3	0.443	10	13.99
9	-77.1	17	616.8	9	-4.97	17	39.79	9	14.41	4	0.403	10	13.00
10	-79.6	17	602.5	9	-5.14	17	38.87	9	14.21	4	0.361	10	11.92
11	-77.5	17	592.6	9	-5.00	17	38.23	9	13.96	4	0.317	10	10.75
12	-67.8	17	610.3	5	-4.38	17	39.37	5	13.12	4	0.271	10	9.51
13	-49.7	17	636.1	5	-3.21	17	41.04	5	10.86	4	0.225	11	8.20
14	-23.4	17	667.3	5	-1.51	17	43.05	5	6.70	4	0.186	11	7.28

(Eq) Return Strokes and Stroke Analyzed (ft):
9.27 9.05 9.00

Max. Combustion Pressure 1454.3 psi

Rut= 550.0, Rtoe = 467.5 kips, Time Inc. =0.042 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	707.9	7	0.00	0	45.67	7	15.51	2	0.721	8	20.56
2	-22.0	16	705.2	8	-1.42	16	45.50	8	15.43	2	0.674	9	19.44
3	-40.0	16	683.0	8	-2.58	16	44.06	8	15.32	2	0.630	9	18.34
4	-55.9	16	666.7	8	-3.60	16	43.01	8	15.20	3	0.585	9	17.18
5	-72.0	17	652.0	8	-4.65	17	42.06	8	15.06	3	0.540	6	15.97
6	-85.6	17	647.0	8	-5.53	17	41.74	8	14.91	3	0.495	6	14.81
7	-94.4	17	649.8	9	-6.09	17	41.92	9	14.73	3	0.452	10	13.77
8	-95.9	17	650.4	9	-6.19	17	41.96	9	14.54	3	0.412	10	12.76
9	-90.0	17	634.2	9	-5.81	17	40.92	9	14.33	4	0.371	10	11.73
10	-84.8	17	616.7	9	-5.47	17	39.79	9	14.11	4	0.329	10	10.62
11	-81.5	17	604.2	9	-5.26	17	38.98	9	13.80	4	0.284	10	9.40
12	-71.3	17	616.2	5	-4.60	17	39.76	5	12.87	4	0.236	10	8.09
13	-53.3	17	640.2	5	-3.44	17	41.30	5	10.52	4	0.186	10	6.63
14	-25.0	17	669.5	5	-1.61	17	43.19	5	6.30	4	0.142	11	5.52

(Eq) Return Strokes and Stroke Analyzed (ft):
9.66 9.11 9.02 9.00

Max. Combustion Pressure 1372.9 psi

Rut= 600.0, Rtoe= 510.0 kips, Time Inc. =0.039 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	716.1	7	0.00	0	46.20	7	15.51	2	0.708	8	20.15
2	-21.6	16	717.1	8	-1.39	16	46.26	8	15.43	2	0.659	9	18.92
3	-40.8	16	700.8	8	-2.63	16	45.21	8	15.31	2	0.614	6	17.74
4	-57.8	16	681.2	8	-3.73	16	43.95	8	15.18	3	0.575	6	16.63
5	-75.3	16	665.3	8	-4.86	16	42.93	8	15.04	3	0.533	6	15.58
6	-91.7	17	655.8	8	-5.91	17	42.31	8	14.88	3	0.487	6	14.36
7	-103.1	17	656.7	9	-6.65	17	42.37	9	14.69	3	0.440	6	13.04
8	-106.9	17	659.3	9	-6.90	17	42.53	9	14.48	3	0.395	5	11.94
9	-101.0	17	644.5	9	-6.52	17	41.58	9	14.26	4	0.352	5	10.89
10	-88.3	17	624.8	9	-5.70	17	40.31	9	14.02	4	0.307	10	9.74
11	-83.0	17	611.2	9	-5.35	17	39.43	9	13.65	4	0.262	10	8.50
12	-73.9	17	619.8	5	-4.77	17	39.99	5	12.65	4	0.213	10	7.16
13	-54.9	17	643.2	5	-3.54	17	41.50	5	10.23	4	0.162	10	5.63
14	-25.7	17	670.6	5	-1.66	17	43.26	5	5.95	4	0.113	11	4.32

(Eq) Return Strokes and Stroke Analyzed (ft):
9.96 9.14 9.03 9.00

Max. Combustion Pressure 1320.4 psi

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05/09/2015
GRLWEAP(TM) Version 2005

Rut= 650.0, Rtoe = 552.5 kips, Time Inc. =0.036 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	722.4	7	0.00	0	46.61	7	15.50	2	0.700	8	19.95
2	-22.2	16	723.9	7	-1.43	16	46.70	7	15.42	2	0.649	8	18.61
3	-41.4	16	709.5	8	-2.67	16	45.77	8	15.31	2	0.609	6	17.47
4	-59.6	17	692.3	8	-3.84	17	44.66	8	15.17	3	0.570	6	16.54
5	-77.4	17	674.3	8	-4.99	17	43.50	8	15.01	3	0.527	6	15.46
6	-93.9	16	661.7	8	-6.06	16	42.69	8	14.84	3	0.481	6	14.21
7	-106.9	17	660.3	9	-6.90	17	42.60	9	14.64	3	0.434	6	12.89
8	-112.4	17	663.2	9	-7.25	17	42.79	9	14.42	3	0.390	5	11.73
9	-106.3	16	649.5	9	-6.86	16	41.90	9	14.19	4	0.346	5	10.55
10	-90.2	17	628.8	9	-5.82	17	40.57	9	13.92	4	0.300	5	9.27
11	-83.1	17	614.5	9	-5.36	17	39.64	9	13.51	4	0.251	5	7.99
12	-74.7	17	622.4	5	-4.82	17	40.16	5	12.43	4	0.201	10	6.64
13	-54.7	17	645.4	5	-3.53	17	41.64	5	9.95	4	0.149	10	5.09
14	-24.2	17	670.6	5	-1.56	17	43.26	5	5.64	4	0.098	11	3.69

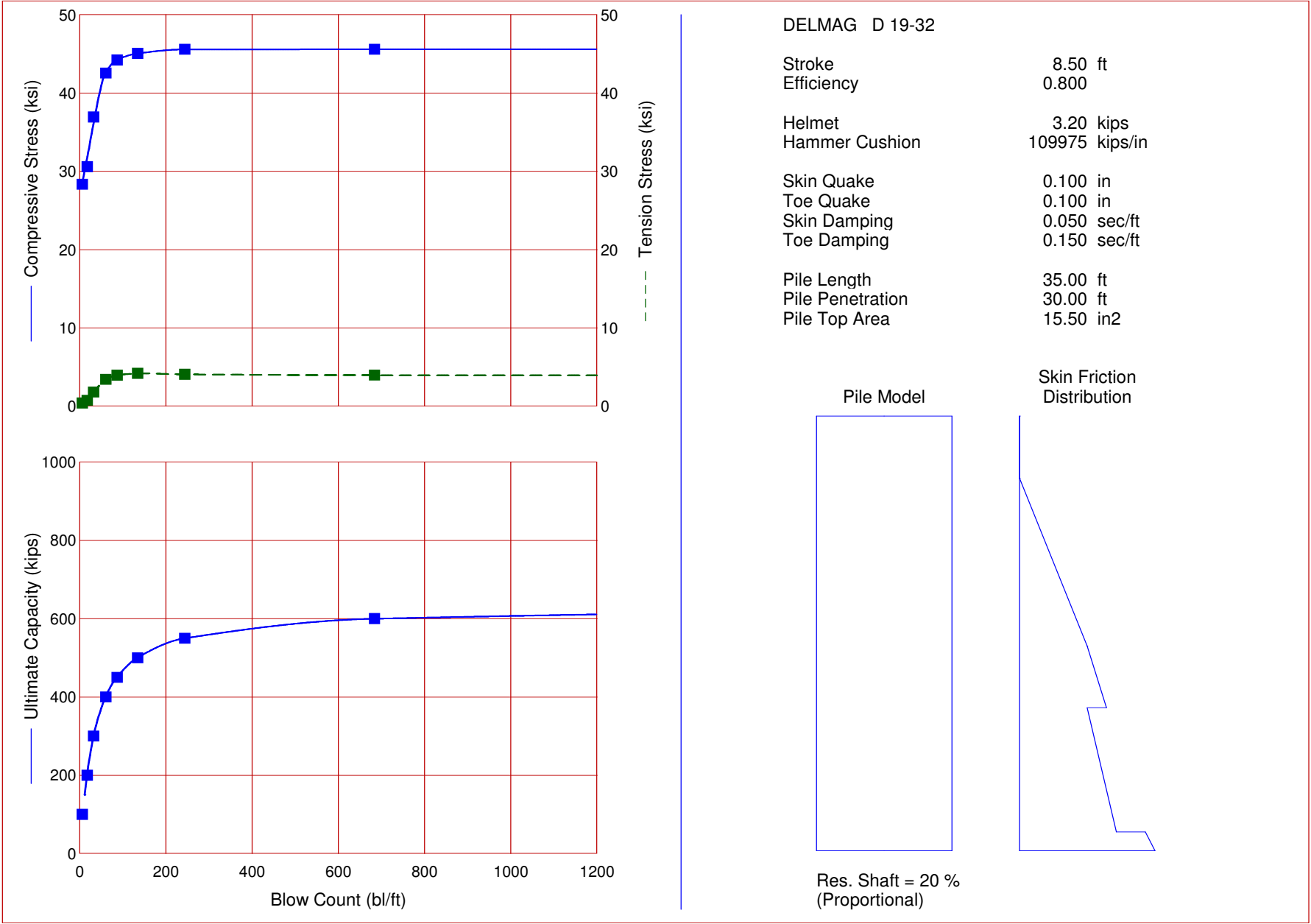
Activated Capacity 639.8 k
(Eq) Return Strokes and Stroke Analyzed (ft):
10.13 9.12 9.03 9.00

Max. Combustion Pressure 1294.5 psi

I-85 Bridge 11 Bent 2
ECS Carolinas LLP

05/09/2015
GRLWEAP(TM) Version 2005

Rut kips	Bl Ct b/ft	Stroke down	(ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
100.0	6.0	9.00	8.99	-0.49	8	48	29.16	3	2	38.7	39.7
200.0	16.2	9.00	8.99	-0.90	8	26	33.17	14	5	27.6	39.5
300.0	30.2	9.00	8.94	-2.87	7	20	38.77	14	5	24.2	39.5
400.0	57.3	9.00	8.98	-3.67	9	18	41.87	14	5	22.5	39.5
450.0	85.3	9.00	8.97	-4.38	10	18	43.60	1	7	21.7	39.5
500.0	140.1	9.00	9.05	-5.14	10	17	44.87	1	7	21.1	39.4
550.0	285.5	9.00	9.02	-6.19	8	17	45.67	1	7	20.6	39.4
600.0	899.1	9.00	9.03	-6.90	8	17	46.26	2	8	20.1	39.4
650.0	9999.0	9.00	9.03	-7.25	8	17	46.70	2	7	20.0	39.4



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09-May-2015
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Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	28.34	0.40	6.3	8.50	36.06
200.0	30.58	0.75	17.8	8.50	24.62
300.0	36.93	1.80	32.9	8.50	21.47
400.0	42.55	3.44	61.4	8.50	19.81
450.0	44.20	3.96	87.3	8.50	19.33
500.0	45.05	4.19	135.0	8.50	18.84
550.0	45.57	4.07	244.2	8.50	18.51
600.0	45.58	3.97	684.3	8.50	18.13
650.0	45.70	3.88	3902.4	8.50	17.98
700.0	45.84	3.78	9999.0	8.50	17.86

GRLWEAP - Version 2005
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.
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ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

Input File: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385 INTERCHANGE
DESIGN\01 FINAL REPORTS\11 BRIDGE 11\06 DRIVEABILITY ANALYSIS (WEAP)\BRIDGE 11
BENT 4 D19-32.GWI

Hammer File: C:\Program Files\PDI\GRLWEAP 2005\HAMMER2003.GW

Hammer File Version: 2003 (1/11/2007)

Input File Contents

I-85 Bridge 11 Bent 4

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx	
6	0	40	-1	1	0	0	0	0	0	20	1	0	0	0	0	0	0	0.000	
File g		Hammer g		Toe Area		Pile Size		Pile Type											
32.170		32.170		144.000		12.000		H File											
W Cp		A Cp		E Cp		T Cp		CoR		ROut		StCp							
3.200		415.000		530.0		2.000		0.800		0.010		0.0							
A Cu		E Cu		T Cu		CoR		ROut		StCu									
0.000		0.0		0.000		0.000		0.000		0.0									
LPle		APle		EPle		WPle		Peri		Strg		CoR		ROut					
35.000		15.500		30000.000		492.000		4.000		36.000		0.850		0.010					
Manufac		Hmr Name		HmrType		No		Seg-s											
DELMAG		D 19-32		1		5													
Ram Wt		Ram L		Ram Dia		MaxStrk		RtdStrk		Efficy									
4.00		129.10		12.60		11.76		10.61		0.80									
IB. Wt		IB. L		IB.Dia		IB CoR		IB RO											
0.75		25.30		12.60		0.900		0.010											
CompStrk		A Chamber		V Chamber		C Delay		C Duratn		Exp Coeff		VolCStart		Vol CEnd					
15.50		124.70		157.70		0.002		0.002		1.250		0.00		0.00					
P atm		P1		P2		P3		P4		P5									
14.70		1500.00		1350.00		1215.00		1094.00		0.00									
Stroke		Effic.		Pressure		R-Weight		T-Delay		Exp-Coeff		Eps-Str		Total-AW					
8.5000		0.8000		1500.0000		0.0000		0.0000		0.0000		0.0100		0.0000					
Qs		Qt		Js		Jt		Qx		Jx		Rati		Dept					
0.100		0.100		0.050		0.150		0.000		0.000		0.000		0.000					
Research		Soil Model:		Atoe, Plug,		Gap,		Q-fac											
0.000		0.000		0.000		0.000													
Research		Soil Model:		RD-skn: m, d,		toe: m, d													
0.000		0.000		0.000		0.000													
Res. Distribution																			
Dpth		Rskn		Dpth		Dpth													
0.00		0.00		30.00		30.00		0.00		0.00		0.00		0.00		0.00		0.00	
13.50		0.66		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
13.50		0.66		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
18.50		0.90		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
18.50		0.69		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
28.50		1.01		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
28.50		1.31		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
30.00		1.38		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
30.00		1.38		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
39.10		1.82		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
Rult																			
100.0		200.0		300.0		400.0		450.0		500.0		550.0		600.0		650.0		700.0	
Diameter		COGHammer		WHammer		ABatter		Depth		Sup		Flag							

0.000 0.000 0.000 0.000 0.000 0

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2005
English Units

I-85 Bridge 11 Bent 4

Hammer Model:	D 19-32	Made by:	DELMAG
No.	Weight kips	Stiffn k/inch	CoR
1	0.800		
2	0.800	140046.7	1.000
3	0.800	140046.7	1.000
4	0.800	140046.7	1.000
5	0.800	140046.7	1.000
Imp Block	0.753	70735.6	0.900
Helmet	3.200	109975.0	0.800
Combined Pile Top		12178.6	

HAMMER OPTIONS:

Hammer File ID No.	40	Hammer Type	OE Diesel
Stroke Option	VarP-FxdS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.76	Actual Stroke	(ft)	8.50
Rated Stroke	(ft)	10.61	Efficiency		0.800
Maximum Pressure	(psi)	1500.00	Actual Pressure	(psi)	1500.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION

Cross Sect. Area	(in2)	415.00
Elastic-Modulus	(ksi)	530.0
Thickness	(inch)	2.00
Coeff of Restitution		0.8
RoundOut	(ft)	0.0
Stiffness	(kips/in)	109975.0

PILE CUSHION

Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	0.00
Coeff of Restitution		0.0
RoundOut	(ft)	0.0
Stiffness	(kips/in)	0.0

PILE PROFILE:

Toe Area	(in2)	144.000	Pile Type	H Pile
Pile Size	(inch)	12.000		

L b Top	Area	E-Mod	Spec Wt	Perim	Strength	Wave Sp	EA/c
ft	in2	ksi	lb/ft3	ft	ksi	ft/s	k/ft/s
0.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7
35.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7

Wave Travel Time 2L/c (ms) 4.165

Pile and Soil Model						Total Capacity Rut			(kips)	100.0	
No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.169	12179.	0.010	0.000	0.85	0.0	0.050	0.100	3.18	4.0	15.5
2	0.169	12179.	0.000	0.000	1.00	0.0	0.050	0.100	6.36	4.0	15.5
3	0.169	12179.	0.000	0.000	1.00	0.5	0.050	0.100	9.55	4.0	15.5
4	0.169	12179.	0.000	0.000	1.00	1.0	0.050	0.100	12.73	4.0	15.5
5	0.169	12179.	0.000	0.000	1.00	1.5	0.050	0.100	15.91	4.0	15.5
6	0.169	12179.	0.000	0.000	1.00	2.1	0.050	0.100	19.09	4.0	15.5
7	0.169	12179.	0.000	0.000	1.00	2.6	0.050	0.100	22.27	4.0	15.5
8	0.169	12179.	0.000	0.000	1.00	2.6	0.050	0.100	25.45	4.0	15.5
9	0.169	12179.	0.000	0.000	1.00	2.7	0.050	0.100	28.64	4.0	15.5
10	0.169	12179.	0.000	0.000	1.00	3.1	0.050	0.100	31.82	4.0	15.5
11	0.169	12179.	0.000	0.000	1.00	3.9	0.050	0.100	35.00	4.0	15.5
Toe						80.0	0.150	0.100			

1.854 kips total unreduced pile weight (g= 32.17 ft/s2)

1.854 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
Pile Penetration (ft)	30.00	Pile Damping Fact. (k/ft/s)	0.553
% Shaft Resistance	20		
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	2	Analysis Time-Input (ms)	0
Output Level: Variable vs Time			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170
Output Segment Generation: Automatic			

Rut= 100.0, Rtoe = 80.0 kips, Time Inc. =0.067 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	436.9	2	0.00	0	28.19	2	14.88	2	2.085	28	36.06
2	-2.4	41	438.2	2	-0.15	41	28.27	2	14.84	2	2.078	28	36.05
3	-4.4	45	439.1	2	-0.28	45	28.33	2	14.78	2	2.071	28	35.99
4	-5.7	45	439.3	3	-0.37	45	28.34	3	14.70	3	2.063	28	35.81
5	-6.2	45	438.9	3	-0.40	45	28.32	3	14.97	5	2.056	28	35.51
6	-6.1	45	437.8	3	-0.40	45	28.25	3	14.65	5	2.049	28	35.08
7	-5.5	45	435.3	3	-0.36	45	28.09	3	14.52	3	2.042	28	34.53
8	-4.6	44	427.4	3	-0.30	44	27.57	3	15.18	4	2.035	29	33.91
9	-3.5	44	404.9	3	-0.23	44	26.12	3	16.30	4	2.028	29	33.27
10	-2.7	44	366.6	4	-0.18	44	23.65	4	17.57	4	2.021	29	32.58
11	-1.6	44	337.9	4	-0.10	44	21.80	4	18.38	4	2.014	29	32.20

(Eq) Return Strokes and Stroke Analyzed (ft):
5.18 7.18 8.28 8.49 8.50

Max. Combustion Pressure 2472.2 psi

Rut= 200.0, Rtoe= 160.0 kips, Time Inc. =0.067 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	443.3	2	0.00	0	28.60	2	14.84	2	0.923	13	24.62
2	-4.4	25	445.0	2	-0.28	25	28.71	2	14.77	2	0.907	13	24.50
3	-8.3	25	446.7	2	-0.54	25	28.82	2	14.67	3	0.892	13	24.33
4	-10.9	25	447.3	3	-0.70	25	28.86	3	14.54	3	0.876	13	24.07
5	-11.6	25	446.9	3	-0.75	25	28.84	3	14.39	3	0.860	13	23.72
6	-10.6	25	445.5	3	-0.68	25	28.74	3	14.23	3	0.845	14	23.27
7	-8.6	25	442.1	3	-0.55	25	28.52	3	14.12	3	0.830	14	22.74
8	-6.0	25	432.5	3	-0.39	25	27.90	3	14.37	4	0.815	14	22.17
9	-3.7	25	418.4	4	-0.24	25	26.99	4	14.60	4	0.800	14	21.60
10	-2.0	24	459.6	4	-0.13	24	29.65	4	13.63	4	0.786	14	21.02
11	-0.7	24	474.0	4	-0.05	24	30.58	4	12.17	4	0.773	14	20.67

(Eq) Return Strokes and Stroke Analyzed (ft):
6.53 8.00 8.45 8.50

Max. Combustion Pressure 1956.1 psi

Rut= 300.0, Rtoe= 240.0 kips, Time Inc. =0.067 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	572.4	6	0.00	0	36.93	6	14.83	2	0.724	9	21.47
2	-10.4	18	553.5	6	-0.67	18	35.71	6	14.74	2	0.696	9	21.08
3	-18.2	18	552.5	7	-1.18	18	35.64	7	14.61	2	0.668	9	20.64
4	-23.2	18	545.7	7	-1.50	18	35.21	7	14.43	3	0.640	9	20.08
5	-26.3	18	538.3	7	-1.70	18	34.73	7	14.22	3	0.611	9	19.39
6	-28.0	19	534.8	7	-1.80	19	34.51	7	13.98	3	0.582	10	18.64
7	-26.4	19	528.6	7	-1.70	19	34.11	7	13.78	3	0.556	10	17.89

8	-20.6	19	514.0	8	-1.33	19	33.16	8	13.79	3	0.532	10	17.14
9	-13.7	18	499.7	8	-0.89	18	32.24	8	13.55	4	0.508	11	16.43
10	-7.6	19	528.4	4	-0.49	19	34.09	4	12.15	4	0.486	11	15.76
11	-3.2	19	551.9	4	-0.21	19	35.60	4	8.96	4	0.465	11	15.32

(Eq) Return Strokes and Stroke Analyzed (ft):
7.37 8.29 8.48 8.50

Max. Combustion Pressure 1742.7 psi

Rut= 400.0, Rtoe = 320.0 kips, Time Inc. =0.057 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	659.5	6	0.00	0	42.55	6	14.83	2	0.651	8	19.81
2	-15.4	16	638.3	6	-0.99	16	41.18	6	14.74	2	0.615	8	19.12
3	-30.1	16	631.5	7	-1.94	16	40.74	7	14.57	2	0.577	8	18.35
4	-41.4	16	621.0	7	-2.67	16	40.07	7	14.36	3	0.539	8	17.45
5	-49.2	16	612.4	7	-3.18	16	39.51	7	14.08	3	0.503	8	16.48
6	-53.3	16	607.7	7	-3.44	16	39.21	7	13.77	3	0.467	9	15.47
7	-51.1	16	602.3	8	-3.30	16	38.86	8	13.47	3	0.431	9	14.39
8	-42.4	16	584.7	8	-2.73	16	37.72	8	13.29	3	0.394	9	13.26
9	-29.6	16	565.5	8	-1.91	16	36.48	8	12.69	4	0.357	9	12.14
10	-16.6	16	561.8	8	-1.07	16	36.25	8	11.09	3	0.324	10	11.22
11	-7.0	16	593.4	4	-0.45	16	38.29	4	7.64	3	0.295	10	10.65

(Eq) Return Strokes and Stroke Analyzed (ft):
8.25 8.48 8.50

Max. Combustion Pressure 1543.6 psi

Rut= 450.0, Rtoe= 360.0 kips, Time Inc. =0.052 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	685.2	6	0.00	0	44.20	6	14.84	2	0.632	7	19.33
2	-17.5	16	668.8	6	-1.13	16	43.15	6	14.73	2	0.592	8	18.51
3	-33.3	16	656.9	7	-2.15	16	42.38	7	14.56	2	0.551	8	17.61
4	-45.2	16	647.1	7	-2.92	16	41.75	7	14.32	3	0.510	8	16.56
5	-55.2	16	637.6	7	-3.56	16	41.14	7	14.01	3	0.469	8	15.41
6	-61.3	16	631.9	7	-3.96	16	40.77	7	13.67	3	0.430	8	14.25
7	-61.1	16	627.2	7	-3.94	16	40.46	7	13.33	3	0.392	9	13.06
8	-52.5	16	608.5	8	-3.39	16	39.25	8	13.06	3	0.352	9	11.82
9	-39.0	16	587.7	8	-2.52	16	37.92	8	12.32	3	0.311	9	10.57
10	-23.3	15	586.1	8	-1.50	15	37.82	8	10.64	3	0.270	9	9.41
11	-10.1	15	601.6	4	-0.65	15	38.81	4	7.11	3	0.238	10	8.71

(Eq) Return Strokes and Stroke Analyzed (ft):
8.66 8.52 8.50

Max. Combustion Pressure 1472.5 psi

Rut= 500.0, Rtoe= 400.0 kips, Time Inc. =0.048 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	698.2	6	0.00	0	45.05	6	14.85	2	0.615	7	18.84
2	-19.0	16	687.7	6	-1.22	16	44.37	6	14.72	2	0.572	8	17.88
3	-35.1	16	671.5	7	-2.27	16	43.32	7	14.54	2	0.529	8	16.86
4	-48.1	16	663.6	7	-3.10	16	42.81	7	14.27	3	0.485	8	15.70
5	-57.5	16	652.0	7	-3.71	16	42.06	7	13.95	3	0.441	8	14.39
6	-63.4	16	645.8	7	-4.09	16	41.66	7	13.57	3	0.398	8	13.08
7	-64.9	15	642.2	8	-4.19	15	41.43	8	13.19	3	0.357	8	11.76

8	-58.5	15	623.1	8	-3.77	15	40.20	8	12.83	3	0.315	9	10.42
9	-45.8	15	601.0	8	-2.95	15	38.78	8	11.99	3	0.271	9	9.07
10	-27.0	15	601.7	8	-1.74	15	38.82	8	10.25	3	0.227	9	7.78
11	-11.8	15	607.8	8	-0.76	15	39.21	8	6.66	3	0.189	9	6.91

(Eq) Return Strokes and Stroke Analyzed (ft):
9.04 8.55 8.50

Max. Combustion Pressure 1405.2 psi

Rut= 550.0, Rtoe = 440.0 kips, Time Inc. =0.044 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	706.3	6	0.00	0	45.57	6	14.85	2	0.603	7	18.51
2	-18.7	16	702.6	7	-1.21	16	45.33	7	14.72	2	0.557	7	17.42
3	-34.9	16	684.7	7	-2.25	16	44.18	7	14.52	3	0.511	8	16.29
4	-48.0	16	676.1	7	-3.10	16	43.62	7	14.23	3	0.465	8	15.00
5	-58.0	16	664.3	7	-3.74	16	42.86	7	13.88	3	0.418	8	13.56
6	-62.1	15	659.2	7	-4.00	15	42.53	7	13.47	3	0.373	8	12.09
7	-63.1	15	655.8	8	-4.07	15	42.31	8	13.04	3	0.329	8	10.66
8	-59.6	15	635.7	8	-3.84	15	41.01	8	12.60	3	0.284	8	9.22
9	-48.5	15	612.7	8	-3.13	15	39.53	8	11.69	3	0.238	9	7.77
10	-29.9	15	614.8	8	-1.93	15	39.66	8	9.91	3	0.191	9	6.37
11	-12.4	15	619.3	8	-0.80	15	39.95	8	6.25	3	0.149	9	5.35

(Eq) Return Strokes and Stroke Analyzed (ft):
9.38 8.56 8.50

Max. Combustion Pressure 1345.1 psi

Rut= 600.0, Rtoe= 480.0 kips, Time Inc. =0.041 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	706.5	6	0.00	0	45.58	6	14.85	2	0.591	7	18.13
2	-18.2	14	705.4	6	-1.18	14	45.51	6	14.71	2	0.543	7	16.95
3	-35.1	16	692.8	7	-2.27	16	44.70	7	14.49	2	0.496	8	15.74
4	-48.6	16	682.1	7	-3.14	16	44.01	7	14.19	3	0.448	8	14.38
5	-58.2	15	667.8	7	-3.75	15	43.08	7	13.81	3	0.400	8	12.85
6	-61.3	15	660.1	7	-3.96	15	42.59	7	13.36	3	0.352	8	11.26
7	-61.5	15	658.4	8	-3.97	15	42.48	8	12.90	3	0.306	8	9.72
8	-59.8	15	640.9	8	-3.86	15	41.35	8	12.38	3	0.260	8	8.19
9	-50.6	15	617.1	8	-3.26	15	39.81	8	11.42	3	0.212	8	6.67
10	-32.6	15	621.2	8	-2.10	15	40.08	8	9.59	3	0.163	9	5.19
11	-13.1	14	623.0	8	-0.84	14	40.19	8	5.90	3	0.118	9	4.04

(Eq) Return Strokes and Stroke Analyzed (ft):
9.66 8.53 8.50

Max. Combustion Pressure 1295.7 psi

Rut= 650.0, Rtoe= 520.0 kips, Time Inc. =0.038 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	708.4	6	0.00	0	45.70	6	14.85	2	0.584	7	17.98
2	-19.9	14	707.4	6	-1.29	14	45.64	6	14.71	2	0.535	7	16.75
3	-36.1	16	694.3	7	-2.33	16	44.79	7	14.48	2	0.487	8	15.52
4	-49.4	15	684.7	7	-3.19	15	44.17	7	14.15	3	0.439	8	14.12
5	-58.0	15	668.1	7	-3.74	15	43.10	7	13.74	3	0.391	8	12.56
6	-60.2	15	658.9	7	-3.88	15	42.51	7	13.27	3	0.342	8	10.91
7	-58.4	15	656.5	8	-3.77	15	42.36	8	12.76	3	0.296	8	9.32

8	-58.0	15	639.3	8	-3.74	15	41.24	8	12.17	3	0.249	8	7.77
9	-51.2	15	614.5	8	-3.30	15	39.65	8	11.17	3	0.201	8	6.23
10	-33.9	15	617.3	8	-2.18	15	39.82	8	9.29	3	0.151	9	4.72
11	-13.2	14	621.7	8	-0.85	14	40.11	8	5.58	3	0.103	9	3.45

(Eq) Return Strokes and Stroke Analyzed (ft):
9.78 8.54 8.50

Max. Combustion Pressure 1273.6 psi

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Rut= 700.0, Rtoe = 560.0 kips, Time Inc. =0.036 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	710.5	6	0.00	0	45.84	6	14.85	2	0.578	7	17.86
2	-21.5	13	709.6	6	-1.39	13	45.78	6	14.70	2	0.528	7	16.61
3	-38.7	14	695.6	7	-2.49	14	44.88	7	14.45	2	0.480	8	15.35
4	-49.8	15	685.9	7	-3.21	15	44.25	7	14.11	3	0.432	8	13.93
5	-57.4	15	668.1	7	-3.70	15	43.10	7	13.67	3	0.383	8	12.34
6	-58.6	15	657.7	7	-3.78	15	42.43	7	13.16	3	0.334	8	10.65
7	-56.9	15	654.7	7	-3.67	15	42.24	7	12.62	3	0.287	8	9.02
8	-56.9	15	637.4	8	-3.67	15	41.12	8	11.97	3	0.241	8	7.44
9	-50.3	15	611.8	8	-3.25	15	39.47	8	10.94	3	0.192	8	5.90
10	-32.1	15	612.3	8	-2.07	15	39.51	8	9.03	3	0.143	9	4.41
11	-12.7	14	613.8	8	-0.82	14	39.60	8	5.29	3	0.095	9	3.13

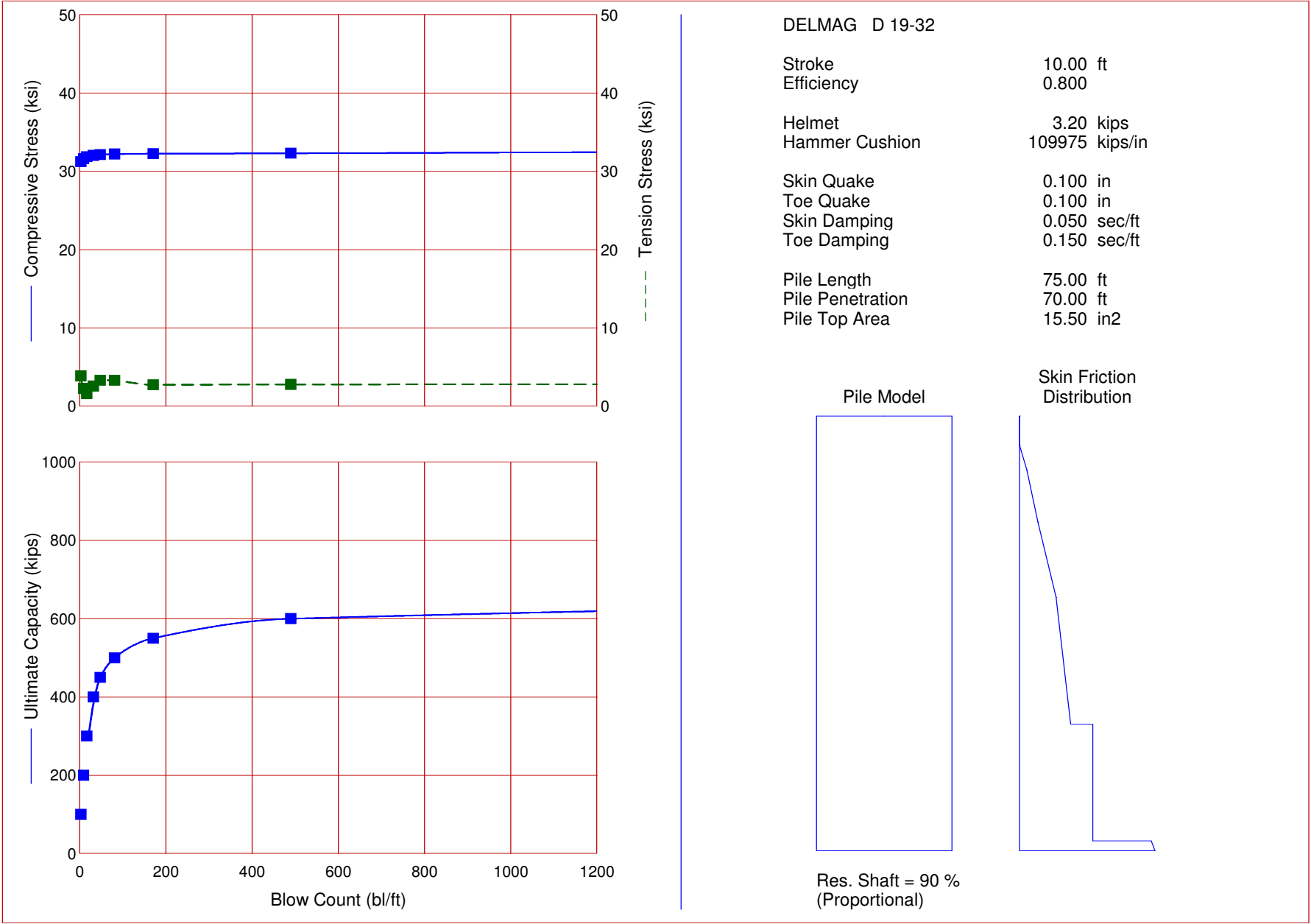
Activated Capacity 670.8 k
(Eq) Return Strokes and Stroke Analyzed (ft):
9.85 8.52 8.50

Max. Combustion Pressure 1262.2 psi

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Rut kips	Bl Ct b/ft	Stroke down	(ft) up	Ten Str ksi	i	t	Comp Str ksi	i	t	ENTHRU kip-ft	Bl Rt b/min
100.0	6.3	8.50	8.49	-0.40	5	45	28.34	4	3	36.1	40.8
200.0	17.8	8.50	8.45	-0.75	5	25	30.58	11	4	24.6	40.7
300.0	32.9	8.50	8.48	-1.80	6	19	36.93	1	6	21.5	40.7
400.0	61.4	8.50	8.48	-3.44	6	16	42.55	1	6	19.8	40.6
450.0	87.3	8.50	8.52	-3.96	6	16	44.20	1	6	19.3	40.6
500.0	135.0	8.50	8.55	-4.19	7	15	45.05	1	6	18.8	40.5
550.0	244.2	8.50	8.56	-4.07	7	15	45.57	1	6	18.5	40.5
600.0	684.3	8.50	8.53	-3.97	7	15	45.58	1	6	18.1	40.6
650.0	3902.4	8.50	8.54	-3.88	6	15	45.70	1	6	18.0	40.6
700.0	9999.0	8.50	8.52	-3.78	6	15	45.84	1	6	17.9	40.6



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09-May-2015
GRLWEAP (TM) Version 2005

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	31.23	3.86	3.4	10.00	49.74
200.0	31.61	2.27	9.6	10.00	36.41
300.0	31.86	1.61	17.2	10.00	30.94
400.0	32.02	2.57	32.2	10.00	28.58
450.0	32.12	3.29	48.3	10.00	27.55
500.0	32.20	3.31	81.7	10.00	26.56
550.0	32.25	2.73	171.1	10.00	26.05
600.0	32.30	2.79	489.8	10.00	25.71
650.0	32.79	2.89	2982.6	10.00	25.42
700.0	33.48	3.25	9999.0	10.00	25.15

GRLWEAP - Version 2005
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.
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ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

Input File: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385 INTERCHANGE
DESIGN\01 FINAL REPORTS\11 BRIDGE 11\06 DRIVEABILITY ANALYSIS (WEAP)\BRIDGE 11
END BENT 1 D19-32.GWI

Hammer File: C:\Program Files\PDI\GRLWEAP 2005\HAMMER2003.GW

Hammer File Version: 2003 (1/11/2007)

Input File Contents

I-85 Bridge 11 End Bent 1

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEX		
6	0	40	-1	1	0	0	0	0	0	90	1	0	0	0	0	0	0	0.000		
File g		Hammer g		Toe Area		Pile Size		Pile Type												
32.170		32.170		144.000		12.000		H File												
W Cp		A Cp		E Cp		T Cp		CoR		ROut		StCp								
3.200		415.000		530.0		2.000		0.800		0.010		0.0								
A Cu		E Cu		T Cu		CoR		ROut		StCu										
0.000		0.0		0.000		0.000		0.000		0.0										
LPle		APle		EPle		WPle		Peri		Strg		CoR		ROut						
75.000		15.500		30000.000		492.000		4.000		36.000		0.850		0.010						
Manufac		Hmr Name		HmrType		No		Seg-s												
DELMAG		D 19-32		1		5														
Ram Wt		Ram L		Ram Dia		MaxStrk		RtdStrk		Efficy										
4.00		129.10		12.60		11.76		10.61		0.80										
IB. Wt		IB. L		IB.Dia		IB CoR		IB RO												
0.75		25.30		12.60		0.900		0.010												
CompStrk		A Chamber		V Chamber		C Delay		C Duratn		Exp Coeff		VolCStart		Vol CEnd						
15.50		124.70		157.70		0.002		0.002		1.250		0.00		0.00						
P atm		P1		P2		P3		P4		P5										
14.70		1500.00		1350.00		1215.00		1094.00		0.00										
Stroke		Effic.		Pressure		R-Weight		T-Delay		Exp-Coeff		Eps-Str		Total-AW						
10.0000		0.8000		1500.0000		0.0000		0.0000		0.0000		0.0100		0.0000						
Qs		Qt		Js		Jt		Qx		Jx		Rati		Dept						
0.100		0.100		0.050		0.150		0.000		0.000		0.000		0.000						
Research		Soil Model: Atoe, Plug, Gap, Q-fac																		
0.000		0.000		0.000		0.000														
Research		Soil Model: RD-skn: m, d, toe: m, d																		
0.000		0.000		0.000		0.000														
Res. Distribution																				
Dpth		Rskn		Dpth		Dpth														
0.00		0.00		70.00		70.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
4.30		0.16		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
4.30		0.16		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
13.30		0.50		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
13.30		0.50		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
26.30		0.99		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
26.30		0.99		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
48.20		1.39		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
48.20		2.00		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
68.30		2.00		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
68.30		3.61		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
70.00		3.69		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												
70.00		3.69		0.00		0.00		0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00												

75.30	3.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rult									
100.0	200.0	300.0	400.0	450.0	500.0	550.0	600.0	650.0	700.0
Diameter	COGHammer	WHammer	ABatter	Depth	Sup		Flag		
0.000	0.000	0.000	0.000	0.000	0.000		0		

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2005
English Units

I-85 Bridge 11 End Bent 1

Hammer Model:	D 19-32	Made by:	DELMAG
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No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.7	1.000	0.0100	
3	0.800	140046.7	1.000	0.0100	
4	0.800	140046.7	1.000	0.0100	
5	0.800	140046.7	1.000	0.0100	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	3.200	109975.0	0.800	0.0100	5.8
Combined Pile Top		11883.3			

HAMMER OPTIONS:

Hammer File ID No.	40	Hammer Type	OE Diesel
Stroke Option	VarP-FxdS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.76	Actual Stroke	(ft)	10.00
Rated Stroke	(ft)	10.61	Efficiency		0.800
Maximum Pressure	(psi)	1500.00	Actual Pressure	(psi)	1500.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION

Cross Sect. Area	(in2)	415.00
Elastic-Modulus	(ksi)	530.0
Thickness	(inch)	2.00
Coeff of Restitution		0.8
RoundOut	(ft)	0.0
Stiffness	(kips/in)	109975.0

PILE CUSHION

Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	0.00
Coeff of Restitution		0.0
RoundOut	(ft)	0.0
Stiffness	(kips/in)	0.0

PILE PROFILE:

Toe Area (in2) 144.000 Pile Type H Pile
Pile Size (inch) 12.000

L b Top ft	Area in2	E-Mod ksi	Spec Wt lb/ft3	Perim ft	Strength ksi	Wave Sp ft/s	EA/c k/ft/s
0.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7
75.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7

Wave Travel Time 2L/c (ms) 8.925

Pile and Soil Model						Total Capacity Rut (kips)			100.0		
No.	Weight kips	Stiffn k/in	C-Slk ft	T-Slk ft	CoR	Soil-S kips	Soil-D s/ft	Quake inch	LbTop ft	Perim ft	Area in2
1	0.173	11883.	0.010	0.000	0.85	0.0	0.050	0.100	3.26	4.0	15.5
2	0.173	11883.	0.000	0.000	1.00	0.0	0.050	0.100	6.52	4.0	15.5
3	0.173	11883.	0.000	0.000	1.00	0.4	0.050	0.100	9.78	4.0	15.5
4	0.173	11883.	0.000	0.000	1.00	0.8	0.050	0.100	13.04	4.0	15.5
5	0.173	11883.	0.000	0.000	1.00	1.3	0.050	0.100	16.30	4.0	15.5
6	0.173	11883.	0.000	0.000	1.00	1.7	0.050	0.100	19.57	4.0	15.5
7	0.173	11883.	0.000	0.000	1.00	2.1	0.050	0.100	22.83	4.0	15.5
8	0.173	11883.	0.000	0.000	1.00	2.5	0.050	0.100	26.09	4.0	15.5
9	0.173	11883.	0.000	0.000	1.00	2.9	0.050	0.100	29.35	4.0	15.5
10	0.173	11883.	0.000	0.000	1.00	3.3	0.050	0.100	32.61	4.0	15.5
11	0.173	11883.	0.000	0.000	1.00	3.6	0.050	0.100	35.87	4.0	15.5
12	0.173	11883.	0.000	0.000	1.00	3.8	0.050	0.100	39.13	4.0	15.5
13	0.173	11883.	0.000	0.000	1.00	4.0	0.050	0.100	42.39	4.0	15.5
14	0.173	11883.	0.000	0.000	1.00	4.2	0.050	0.100	45.65	4.0	15.5
15	0.173	11883.	0.000	0.000	1.00	4.4	0.050	0.100	48.91	4.0	15.5
16	0.173	11883.	0.000	0.000	1.00	4.6	0.050	0.100	52.17	4.0	15.5
17	0.173	11883.	0.000	0.000	1.00	6.2	0.050	0.100	55.43	4.0	15.5
18	0.173	11883.	0.000	0.000	1.00	6.9	0.050	0.100	58.70	4.0	15.5
23	0.173	11883.	0.000	0.000	1.00	9.8	0.050	0.100	75.00	4.0	15.5
Toe						10.0	0.150	0.100			

3.972 kips total unreduced pile weight (g= 32.17 ft/s2)

3.972 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
Pile Penetration (ft)	70.00	Pile Damping Fact. (k/ft/s)	0.553
% Shaft Resistance	90		
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	2	Analysis Time-Input (ms)	0
Output Level: Variable vs Time			

Gravity Mass, Pile, Hammer: 32.170 32.170 32.170
Output Segment Generation: Automatic

Rut= 100.0, Rtoe = 10.0 kips, Time Inc. =0.067 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	482.3	2	0.00	0	31.11	2	17.79	11	3.672	42	49.74
2	-54.0	11	483.4	2	-3.48	11	31.19	2	16.66	2	3.670	46	49.72
3	-59.9	11	484.0	2	-3.86	11	31.23	2	16.76	10	3.669	46	49.61
4	-33.6	11	483.9	3	-2.17	11	31.22	3	17.85	10	3.668	46	49.36
5	-10.9	13	483.3	3	-0.71	13	31.18	3	18.08	10	3.667	47	48.93
6	-4.4	10	482.2	3	-0.28	10	31.11	3	17.98	10	3.665	47	48.32
7	-10.8	14	480.8	3	-0.69	14	31.02	3	18.52	10	3.663	47	47.51
8	-11.0	14	479.1	3	-0.71	14	30.91	3	19.43	9	3.660	47	46.51
9	-4.8	14	477.0	4	-0.31	14	30.77	4	19.72	9	3.658	47	45.32
10	0.0	0	474.4	4	0.00	0	30.61	4	19.34	9	3.656	47	43.94
11	0.0	0	471.7	4	0.00	0	30.43	4	19.46	9	3.653	47	42.41
12	-3.9	15	468.7	4	-0.25	15	30.24	4	20.64	9	3.650	47	40.77
13	-1.5	15	465.4	4	-0.10	15	30.03	4	21.20	9	3.647	46	39.03
14	0.0	0	461.9	4	0.00	0	29.80	4	20.73	8	3.644	46	37.19
15	0.0	0	458.3	5	0.00	0	29.57	5	20.27	8	3.641	46	35.24
16	-2.3	8	454.7	5	-0.15	8	29.34	5	21.49	8	3.637	46	33.18
17	0.0	0	451.3	5	0.00	0	29.11	5	22.29	8	3.633	47	30.71
18	0.0	0	444.9	5	0.00	0	28.70	5	21.82	8	3.630	47	27.69
19	-22.6	7	435.7	5	-1.46	7	28.11	5	20.85	7	3.628	47	24.51
20	-38.0	7	418.2	6	-2.45	7	26.98	6	21.53	7	3.626	47	21.31
21	-31.1	16	376.9	6	-2.01	16	24.32	6	22.75	7	3.625	47	18.10
22	-31.7	16	298.3	6	-2.05	16	19.24	6	24.66	7	3.623	47	14.85
23	-12.2	16	182.1	6	-0.79	16	11.75	6	26.27	6	3.622	47	13.22

(Eq) Return Strokes and Stroke Analyzed (ft):
4.63 7.25 9.35 10.00 10.00

Max. Combustion Pressure 3129.4 psi

Rut= 200.0, Rtoe = 20.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	487.7	2	0.00	0	31.46	2	16.65	2	1.563	22	36.41
2	-9.4	49	488.9	2	-0.61	49	31.54	2	16.59	2	1.551	22	36.35
3	-18.1	49	489.9	2	-1.17	49	31.60	2	16.50	2	1.538	22	36.21
4	-24.9	49	489.9	3	-1.61	49	31.61	3	16.38	3	1.525	22	35.91
5	-29.3	49	489.1	3	-1.89	49	31.56	3	16.24	3	1.510	23	35.46
6	-31.1	49	487.6	3	-2.01	49	31.46	3	16.09	3	1.497	23	34.88
7	-31.1	32	485.3	3	-2.00	32	31.31	3	15.94	3	1.484	23	34.16
8	-33.6	33	482.3	3	-2.16	33	31.12	3	15.77	3	1.470	23	33.30
9	-35.1	33	478.6	4	-2.27	33	30.87	4	15.59	4	1.457	23	32.30
10	-33.8	33	473.9	4	-2.18	33	30.57	4	15.39	4	1.444	24	31.18
11	-29.4	33	468.2	4	-1.89	33	30.20	4	15.19	4	1.433	24	29.97
12	-23.8	33	461.9	4	-1.53	33	29.80	4	14.97	4	1.421	24	28.70
13	-23.5	33	455.3	4	-1.52	33	29.37	4	14.74	4	1.410	24	27.36
14	-23.6	34	448.3	5	-1.52	34	28.92	5	14.50	5	1.399	24	25.96
15	-22.1	34	441.1	5	-1.43	34	28.46	5	14.23	5	1.388	24	24.51
16	-19.1	33	434.3	5	-1.23	33	28.02	5	15.21	8	1.379	25	23.01
17	-14.9	34	428.3	5	-0.96	34	27.63	5	15.68	8	1.370	25	21.23
18	-11.6	34	417.1	5	-0.75	34	26.91	5	15.27	8	1.362	25	19.09
19	-12.4	15	401.7	6	-0.80	15	25.92	6	14.51	7	1.355	25	16.85
20	-12.7	15	377.5	6	-0.82	15	24.35	6	15.39	7	1.352	26	14.62
21	-10.3	34	333.3	6	-0.67	34	21.50	6	16.80	6	1.349	26	12.38
22	-7.0	34	263.2	6	-0.45	34	16.98	6	18.65	6	1.347	26	10.12
23	-2.5	34	168.4	6	-0.16	34	10.86	6	19.71	6	1.345	26	8.98
(Eq) Return Strokes and Stroke Analyzed (ft):													
	5.88	8.21	9.59	9.96	10.00								

Max. Combustion Pressure 2599.4 psi

Rut= 300.0, Rtoe = 30.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	490.4	2	0.00	0	31.64	2	16.63	2	1.052	14	30.94
2	-7.2	25	492.0	2	-0.47	25	31.75	2	16.54	2	1.036	14	30.81
3	-15.9	40	493.6	2	-1.03	40	31.84	2	16.42	2	1.018	14	30.59
4	-22.5	40	493.8	3	-1.45	40	31.86	3	16.26	3	1.000	14	30.22
5	-24.9	40	492.8	3	-1.60	40	31.79	3	16.08	3	0.984	15	29.74
6	-23.7	40	490.6	3	-1.53	40	31.65	3	15.88	3	0.968	15	29.12
7	-19.5	40	487.2	3	-1.26	40	31.43	3	15.66	3	0.951	15	28.38
8	-13.3	39	482.6	3	-0.86	39	31.13	3	15.40	3	0.935	15	27.50
9	-10.4	39	476.8	4	-0.67	39	30.76	4	15.12	4	0.918	15	26.52
10	-5.8	39	469.6	4	-0.37	39	30.30	4	14.82	4	0.903	13	25.45
11	-0.4	39	461.0	4	-0.03	39	29.74	4	14.50	4	0.889	15	24.32
12	0.0	0	451.5	4	0.00	0	29.13	4	14.16	4	0.877	13	23.16
13	0.0	0	441.5	4	0.00	0	28.48	4	13.80	4	0.866	13	21.98
14	0.0	0	431.1	5	0.00	0	27.82	5	13.42	5	0.854	13	20.77
15	0.0	0	420.7	5	0.00	0	27.14	5	13.02	5	0.843	13	19.51
16	0.0	0	410.9	5	0.00	0	26.51	5	12.55	5	0.833	14	18.22
17	0.0	0	402.4	5	0.00	0	25.96	5	12.02	5	0.825	14	16.74
18	0.0	0	386.4	5	0.00	0	24.93	5	11.49	5	0.818	14	14.98
19	-0.9	26	364.8	6	-0.06	26	23.53	6	11.08	6	0.812	14	13.15
20	-2.4	26	334.5	6	-0.16	26	21.58	6	11.88	6	0.807	14	11.33
21	-2.5	25	294.0	6	-0.16	25	18.97	6	13.43	6	0.802	15	9.52
22	-0.3	25	234.9	6	-0.02	25	15.16	6	14.03	6	0.800	15	7.71
23	0.0	0	154.9	6	0.00	0	10.00	6	14.29	6	0.797	15	6.80
(Eq) Return Strokes and Stroke Analyzed (ft):													
	6.49	8.67	9.77	9.98	10.00								

Max. Combustion Pressure 2347.8 psi

I-85 Bridge 11 End Bent 1
ECS Carolinas LLP

05/09/2015
GRLWEAP(TM) Version 2005

Rut= 400.0, Rtoe = 40.0 kips, Time Inc. =0.067 ms

No	mxTForce kips	t ms	mxCForce kips	t ms	mxTStrss ksi	t ms	mxCStrss ksi	t ms	max V ft/s	t ms	max D inch	t ms	max Et kip-ft
1	0.0	0	491.6	2	0.00	0	31.72	2	16.63	2	0.928	11	28.58
2	-18.8	20	493.7	2	-1.21	20	31.85	2	16.52	2	0.904	11	28.30
3	-31.5	20	495.9	2	-2.03	20	31.99	2	16.37	2	0.878	11	27.88
4	-38.5	20	496.4	3	-2.48	20	32.02	3	16.18	3	0.851	11	27.30
5	-39.8	20	495.1	3	-2.57	20	31.94	3	15.95	3	0.824	11	26.52
6	-37.2	21	492.3	3	-2.40	21	31.76	3	15.68	3	0.795	11	25.57
7	-31.8	21	487.9	3	-2.05	21	31.48	3	15.38	3	0.765	11	24.49
8	-25.5	21	481.9	3	-1.65	21	31.09	3	15.03	3	0.736	11	23.32
9	-20.1	21	474.2	4	-1.30	21	30.60	4	14.66	4	0.709	12	22.10
10	-12.1	21	464.7	4	-0.78	21	29.98	4	14.25	4	0.685	12	20.85
11	-5.5	22	453.2	4	-0.36	22	29.24	4	13.81	4	0.660	12	19.56
12	0.0	0	440.8	4	0.00	0	28.44	4	13.36	4	0.636	12	18.26
13	0.0	0	427.7	4	0.00	0	27.60	4	12.89	4	0.613	12	16.99
14	0.0	0	414.1	5	0.00	0	26.71	5	12.40	5	0.592	13	15.76
15	0.0	0	400.2	5	0.00	0	25.82	5	11.88	5	0.573	13	14.56
16	0.0	0	387.5	5	0.00	0	25.00	5	11.33	5	0.555	13	13.38
17	0.0	0	376.7	5	0.00	0	24.30	5	10.73	5	0.536	13	12.06
18	0.0	0	356.4	5	0.00	0	22.99	5	10.18	5	0.520	13	10.59
19	0.0	0	328.7	6	0.00	0	21.21	6	9.69	5	0.507	14	9.14
20	0.0	0	296.6	5	0.00	0	19.14	5	9.74	6	0.496	14	7.75
21	0.0	0	263.2	6	0.00	0	16.98	6	10.63	6	0.487	14	6.42
22	0.0	0	211.9	6	0.00	0	13.67	6	11.39	6	0.479	14	5.15
23	0.0	0	143.3	6	0.00	0	9.25	6	11.57	6	0.473	14	4.51

(Eq) Return Strokes and Stroke Analyzed (ft):
7.24 9.07 9.83 9.98 10.00

Max. Combustion Pressure 2126.2 psi

Rut= 450.0, Rtoe = 45.0 kips, Time Inc. =0.067 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	492.4	2	0.00	0	31.77	2	16.62	2	0.885	10	27.55
2	-19.0	20	494.8	2	-1.23	20	31.92	2	16.51	2	0.857	10	27.16
3	-35.3	20	497.3	2	-2.28	20	32.08	2	16.35	2	0.827	10	26.61
4	-45.4	20	497.9	3	-2.93	20	32.12	3	16.13	3	0.795	10	25.86
5	-51.0	20	496.6	3	-3.29	20	32.04	3	15.88	3	0.762	11	24.93
6	-50.8	20	493.3	3	-3.28	20	31.83	3	15.58	3	0.730	11	23.87
7	-46.2	20	488.2	3	-2.98	20	31.50	3	15.25	3	0.698	11	22.68
8	-37.8	20	481.5	3	-2.44	20	31.06	3	14.86	3	0.665	11	21.38
9	-26.5	20	472.8	4	-1.71	20	30.51	4	14.44	4	0.633	11	19.99
10	-18.3	21	462.1	4	-1.18	21	29.82	4	13.98	4	0.601	11	18.56
11	-9.3	21	449.2	4	-0.60	21	28.98	4	13.50	4	0.570	11	17.13
12	0.0	0	435.3	4	0.00	0	28.08	4	12.99	4	0.543	12	15.80
13	0.0	0	420.7	4	0.00	0	27.14	4	12.47	4	0.517	12	14.52
14	0.0	0	405.4	5	0.00	0	26.15	5	11.92	4	0.492	12	13.27
15	0.0	0	390.0	5	0.00	0	25.16	5	11.38	5	0.467	12	12.05
16	0.0	0	376.4	5	0.00	0	24.28	5	10.84	5	0.444	12	10.91
17	0.0	0	364.3	5	0.00	0	23.50	5	10.24	5	0.425	12	9.72
18	0.0	0	341.8	5	0.00	0	22.05	5	9.66	5	0.407	12	8.42
19	0.0	0	311.5	6	0.00	0	20.10	6	9.16	5	0.390	13	7.17
20	0.0	0	281.6	5	0.00	0	18.16	5	8.87	5	0.376	13	5.99
21	0.0	0	250.4	6	0.00	0	16.16	6	9.39	6	0.364	13	4.89
22	0.0	0	201.7	6	0.00	0	13.01	6	10.48	6	0.355	13	3.86
23	0.0	0	143.3	7	0.00	0	9.25	7	10.68	6	0.348	13	3.34

(Eq) Return Strokes and Stroke Analyzed (ft):
7.63 9.27 9.87 9.98 10.00

Max. Combustion Pressure 2016.5 psi

Rut= 500.0, Rtoe = 50.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	493.3	2	0.00	0	31.82	2	16.62	2	0.847	9	26.56
2	-15.0	20	495.8	2	-0.97	20	31.98	2	16.50	2	0.815	10	26.06
3	-27.9	20	498.5	2	-1.80	20	32.16	2	16.32	2	0.784	10	25.46
4	-35.4	20	499.1	3	-2.28	20	32.20	3	16.10	3	0.751	10	24.67
5	-40.7	20	497.6	3	-2.62	20	32.10	3	15.82	3	0.717	10	23.66
6	-48.4	19	493.9	3	-3.12	19	31.87	3	15.50	3	0.681	10	22.47
7	-51.2	19	488.3	3	-3.31	19	31.50	3	15.12	3	0.645	10	21.12
8	-46.8	19	480.8	3	-3.02	19	31.02	3	14.70	3	0.609	10	19.69
9	-35.7	19	471.3	4	-2.30	19	30.40	4	14.23	4	0.573	10	18.19
10	-20.7	20	459.4	4	-1.33	20	29.64	4	13.72	4	0.538	10	16.64
11	-7.4	20	445.2	4	-0.48	20	28.72	4	13.18	4	0.503	10	15.10
12	0.0	0	429.8	4	0.00	0	27.73	4	12.62	4	0.471	10	13.65
13	0.0	0	413.6	4	0.00	0	26.68	4	12.04	4	0.440	10	12.28
14	0.0	0	396.8	5	0.00	0	25.60	5	11.48	4	0.410	11	11.00
15	0.0	0	380.4	5	0.00	0	24.54	5	10.94	5	0.383	11	9.81
16	0.0	0	365.3	5	0.00	0	23.57	5	10.40	5	0.357	11	8.69
17	0.0	0	352.4	5	0.00	0	22.74	5	9.78	5	0.333	11	7.56
18	0.0	0	328.1	6	0.00	0	21.17	6	9.20	5	0.312	11	6.42
19	0.0	0	294.6	6	0.00	0	19.00	6	8.67	5	0.293	11	5.34
20	0.0	0	268.0	5	0.00	0	17.29	5	8.34	5	0.277	12	4.38
21	0.0	0	238.0	6	0.00	0	15.36	6	8.70	6	0.264	12	3.53
22	0.0	0	192.5	6	0.00	0	12.42	6	9.72	6	0.254	12	2.75
23	0.0	0	142.8	7	0.00	0	9.21	7	9.88	6	0.247	12	2.36
(Eq) Return Strokes and Stroke Analyzed (ft):													
	8.01	9.43	9.92	10.00									

Max. Combustion Pressure 1899.9 psi

Rut= 550.0, Rtoe = 55.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	493.6	2	0.00	0	31.85	2	16.61	2	0.824	9	26.05
2	-13.6	20	496.2	2	-0.88	20	32.02	2	16.49	2	0.788	9	25.40
3	-24.8	20	499.2	2	-1.60	20	32.21	2	16.31	2	0.753	10	24.67
4	-31.7	19	499.9	3	-2.04	19	32.25	3	16.06	3	0.718	10	23.80
5	-36.5	19	498.2	3	-2.35	19	32.14	3	15.76	3	0.683	10	22.72
6	-41.9	19	494.2	3	-2.70	19	31.89	3	15.40	3	0.645	10	21.43
7	-42.4	19	488.2	3	-2.73	19	31.50	3	14.99	3	0.606	10	19.97
8	-39.2	19	480.1	3	-2.53	19	30.97	3	14.52	3	0.568	9	18.45
9	-32.0	19	469.7	4	-2.06	19	30.30	4	14.01	4	0.533	9	16.92
10	-18.8	19	456.8	4	-1.21	19	29.47	4	13.45	4	0.497	9	15.35
11	-1.8	19	441.2	4	-0.12	19	28.46	4	12.86	4	0.461	9	13.76
12	0.0	0	436.1	9	0.00	0	28.14	9	12.25	4	0.426	9	12.25
13	0.0	0	422.4	9	0.00	0	27.25	9	11.64	4	0.392	9	10.82
14	0.0	0	401.8	9	0.00	0	25.92	9	11.08	4	0.359	9	9.46
15	0.0	0	387.4	9	0.00	0	25.00	9	10.55	5	0.327	10	8.20
16	0.0	0	365.6	9	0.00	0	23.59	9	9.98	5	0.297	10	7.05
17	0.0	0	348.0	8	0.00	0	22.45	8	9.37	5	0.269	10	5.95
18	0.0	0	314.2	6	0.00	0	20.27	6	8.76	5	0.246	10	4.90
19	0.0	0	282.7	8	0.00	0	18.24	8	8.24	5	0.225	11	3.97
20	0.0	0	255.1	5	0.00	0	16.46	5	7.88	5	0.207	11	3.16
21	0.0	0	226.7	5	0.00	0	14.63	5	8.11	6	0.191	11	2.46
22	0.0	0	183.4	6	0.00	0	11.83	6	9.02	6	0.179	11	1.86
23	0.0	0	141.1	7	0.00	0	9.10	7	9.18	6	0.170	11	1.58
(Eq) Return Strokes and Stroke Analyzed (ft):													
	8.28	9.59	9.95	10.00									

Max. Combustion Pressure 1831.3 psi

Rut= 600.0, Rtoe = 60.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	493.7	2	0.00	0	31.85	2	16.61	2	0.807	9	25.71
2	-13.8	19	496.5	2	-0.89	19	32.03	2	16.48	2	0.769	9	24.99
3	-25.2	18	499.8	2	-1.63	18	32.24	2	16.28	2	0.730	9	24.14
4	-32.4	19	500.7	3	-2.09	19	32.30	3	16.01	3	0.692	9	23.14
5	-38.1	19	498.9	3	-2.46	19	32.19	3	15.69	3	0.654	9	21.96
6	-42.7	19	494.7	3	-2.76	19	31.91	3	15.30	3	0.616	9	20.59
7	-43.2	19	488.9	8	-2.79	19	31.54	8	14.85	3	0.577	9	19.09
8	-38.0	19	490.9	10	-2.45	19	31.67	10	14.34	3	0.540	9	17.58
9	-30.9	19	478.0	10	-2.00	19	30.84	10	13.78	4	0.503	9	16.02
10	-21.5	19	462.4	10	-1.39	19	29.83	10	13.18	4	0.466	9	14.38
11	-5.9	19	453.0	9	-0.38	19	29.22	9	12.54	4	0.428	9	12.72
12	0.0	0	456.6	9	0.00	0	29.46	9	11.89	4	0.390	9	11.08
13	0.0	0	442.8	9	0.00	0	28.57	9	11.28	4	0.353	8	9.58
14	0.0	0	418.3	9	0.00	0	26.99	9	10.73	4	0.321	8	8.28
15	0.0	0	400.9	9	0.00	0	25.87	9	10.17	5	0.290	8	7.08
16	0.0	0	375.8	9	0.00	0	24.25	9	9.61	5	0.259	8	5.97
17	0.0	0	361.4	8	0.00	0	23.32	8	8.96	5	0.231	8	4.91
18	0.0	0	325.7	8	0.00	0	21.01	8	8.37	5	0.205	8	3.89
19	0.0	0	290.6	8	0.00	0	18.75	8	7.82	5	0.181	9	3.01
20	0.0	0	254.1	8	0.00	0	16.39	8	7.43	5	0.160	9	2.29
21	0.0	0	216.4	5	0.00	0	13.96	5	7.59	6	0.145	7	1.74
22	0.0	0	174.8	6	0.00	0	11.28	6	8.41	6	0.134	7	1.30
23	0.0	0	137.4	7	0.00	0	8.86	7	8.52	6	0.125	7	1.08
(Eq) Return Strokes and Stroke Analyzed (ft):													
	8.45	9.64	9.97	10.00									

Max. Combustion Pressure 1795.7 psi

Rut= 650.0, Rtoe = 65.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	494.0	2	0.00	0	31.87	2	16.60	2	0.791	9	25.42
2	-16.3	17	497.0	2	-1.05	17	32.07	2	16.47	2	0.751	9	24.64
3	-27.7	17	500.7	2	-1.79	17	32.30	2	16.25	2	0.711	9	23.71
4	-35.4	19	501.7	3	-2.29	19	32.37	3	15.97	3	0.670	9	22.57
5	-40.4	19	499.9	3	-2.61	19	32.25	3	15.62	3	0.630	9	21.29
6	-44.7	19	497.3	8	-2.88	19	32.09	8	15.20	3	0.591	8	19.87
7	-44.8	19	505.2	10	-2.89	19	32.60	10	14.72	3	0.552	9	18.37
8	-39.7	19	508.2	10	-2.56	19	32.79	10	14.18	3	0.515	9	16.81
9	-33.4	19	494.3	10	-2.16	19	31.89	10	13.57	4	0.477	9	15.19
10	-25.7	19	471.6	9	-1.66	19	30.42	9	12.92	4	0.439	9	13.50
11	-11.1	19	469.8	9	-0.71	19	30.31	9	12.24	4	0.400	9	11.79
12	0.0	0	472.1	9	0.00	0	30.46	9	11.57	4	0.361	8	10.15
13	0.0	0	457.1	9	0.00	0	29.49	9	10.97	4	0.327	8	8.74
14	0.0	0	428.7	9	0.00	0	27.66	9	10.39	4	0.295	8	7.47
15	0.0	0	404.4	9	0.00	0	26.09	9	9.84	4	0.264	8	6.28
16	0.0	0	377.7	8	0.00	0	24.37	8	9.25	5	0.232	8	5.17
17	0.0	0	370.0	8	0.00	0	23.87	8	8.62	5	0.201	8	4.09
18	0.0	0	333.3	8	0.00	0	21.50	8	8.00	5	0.177	7	3.19
19	0.0	0	290.3	8	0.00	0	18.73	8	7.46	5	0.158	7	2.49
20	0.0	0	252.0	8	0.00	0	16.26	8	7.06	5	0.141	7	1.91
21	0.0	0	209.2	9	0.00	0	13.50	9	7.14	6	0.127	7	1.43
22	0.0	0	169.0	9	0.00	0	10.91	9	7.87	6	0.114	7	1.04
23	0.0	0	130.6	7	0.00	0	8.43	7	8.00	6	0.104	7	0.84
(Eq) Return Strokes and Stroke Analyzed (ft):													
8.57 9.67 9.96 10.00													

Max. Combustion Pressure 1770.7 psi

I-85 Bridge 11 End Bent 1
ECS Carolinas LLP

05/09/2015
GRLWEAP(TM) Version 2005

Rut= 700.0, Rtoe = 70.0 kips, Time Inc. =0.067 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	494.8	2	0.00	0	31.92	2	16.60	2	0.777	9	25.15
2	-20.0	17	497.8	2	-1.29	17	32.12	2	16.46	2	0.736	9	24.33
3	-34.0	17	501.7	2	-2.20	17	32.37	2	16.23	2	0.695	8	23.35
4	-41.6	17	502.8	3	-2.69	17	32.44	3	15.93	3	0.654	8	22.23
5	-44.5	17	500.8	3	-2.87	17	32.31	3	15.56	3	0.614	8	20.90
6	-49.9	18	509.0	8	-3.22	18	32.84	8	15.11	3	0.573	8	19.39
7	-50.3	18	518.0	10	-3.25	18	33.42	10	14.60	3	0.532	8	17.77
8	-45.5	18	519.0	10	-2.94	18	33.48	10	14.02	3	0.493	9	16.12
9	-36.7	18	502.2	10	-2.37	18	32.40	10	13.37	4	0.454	9	14.42
10	-27.4	18	481.1	9	-1.77	18	31.04	9	12.67	4	0.415	9	12.68
11	-13.3	18	481.6	9	-0.86	18	31.07	9	11.94	4	0.375	9	10.94
12	0.0	0	481.2	9	0.00	0	31.04	9	11.28	4	0.337	8	9.35
13	0.0	0	462.4	9	0.00	0	29.83	9	10.68	4	0.304	8	7.98
14	0.0	0	430.1	9	0.00	0	27.75	9	10.09	4	0.272	8	6.74
15	0.0	0	400.0	9	0.00	0	25.81	9	9.53	4	0.241	8	5.57
16	0.0	0	381.8	8	0.00	0	24.63	8	8.94	5	0.209	8	4.49
17	0.0	0	370.1	8	0.00	0	23.88	8	8.30	5	0.179	7	3.51
18	0.0	0	329.7	8	0.00	0	21.27	8	7.68	5	0.158	7	2.75
19	0.0	0	283.0	8	0.00	0	18.26	8	7.14	5	0.141	7	2.13
20	0.0	0	241.5	8	0.00	0	15.58	8	6.73	5	0.126	7	1.61
21	0.0	0	197.7	5	0.00	0	12.75	5	6.76	6	0.113	7	1.21
22	0.0	0	160.5	6	0.00	0	10.36	6	7.42	6	0.102	7	0.87
23	0.0	0	114.6	7	0.00	0	7.39	7	7.51	6	0.092	7	0.70

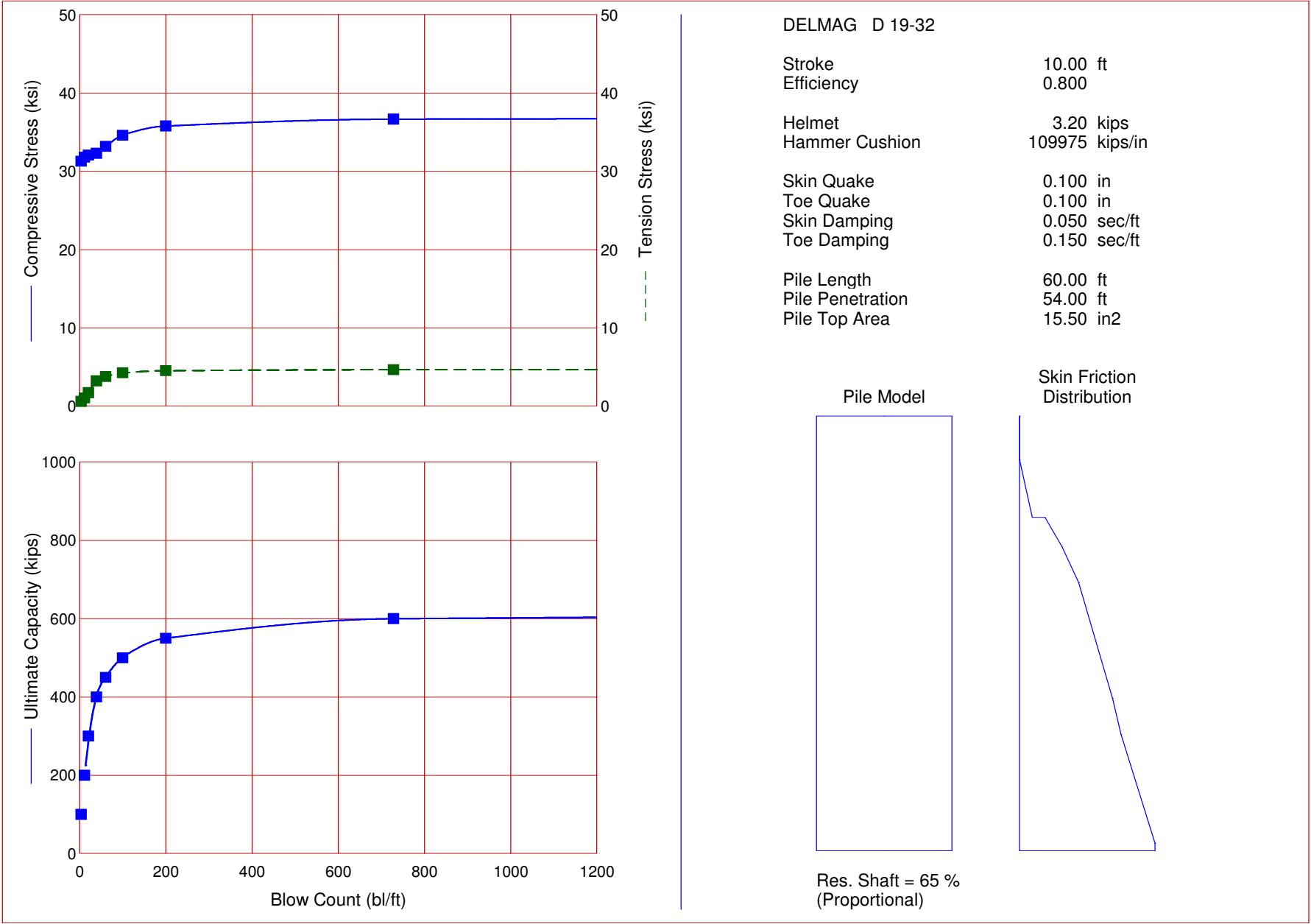
Activated Capacity 689.0 k
(Eq) Return Strokes and Stroke Analyzed (ft):
8.66 9.71 9.95 10.00

Max. Combustion Pressure 1749.2 psi

I-85 Bridge 11 End Bent 1
 ECS Carolinas LLP

05/09/2015
 GRLWEAP(TM) Version 2005

Rut	Bl Ct	Stroke (ft)		Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
100.0	3.4	10.00	10.00	-3.86	3	11	31.23	3	2	49.7	37.7
200.0	9.6	10.00	9.96	-2.27	9	33	31.61	4	3	36.4	37.7
300.0	17.2	10.00	9.98	-1.60	5	40	31.86	4	3	30.9	37.6
400.0	32.2	10.00	9.98	-2.57	5	20	32.02	4	3	28.6	37.5
450.0	48.3	10.00	9.98	-3.29	5	20	32.12	4	3	27.5	37.5
500.0	81.7	10.00	9.92	-3.31	7	19	32.20	4	3	26.6	37.6
550.0	171.1	10.00	9.95	-2.73	7	19	32.25	4	3	26.1	37.5
600.0	489.8	10.00	9.97	-2.79	7	19	32.30	4	3	25.7	37.5
650.0	2982.6	10.00	9.96	-2.89	7	19	32.79	8	10	25.4	37.5
700.0	9999.0	10.00	9.95	-3.25	7	18	33.48	8	10	25.2	37.5



ECS Carolinas LLP
I-85 Bridge 11 End Bent 5

09-May-2015
GRLWEAP (TM) Version 2005

Ultimate Capacity kips	Maximum Compression Stress ksi	Maximum Tension Stress ksi	Blow Count bl/ft	Stroke ft	Energy kips-ft
100.0	31.29	0.61	4.0	10.00	49.02
200.0	31.78	1.05	11.3	10.00	34.80
300.0	32.07	1.73	20.9	10.00	29.80
400.0	32.30	3.23	39.5	10.00	27.20
450.0	33.17	3.79	60.4	10.00	26.29
500.0	34.60	4.27	99.7	10.00	25.71
550.0	35.78	4.54	200.0	10.00	25.28
600.0	36.66	4.67	728.1	10.00	24.94
650.0	37.40	4.77	9999.0	10.00	24.69

GRLWEAP - Version 2005
WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS

written by GRL Engineers, Inc. (formerly Goble Rausche Likins
and Associates, Inc.) with cooperation from Pile Dynamics, Inc.
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ABOUT THE WAVE EQUATION ANALYSIS RESULTS

The GRLWEAP program simulates the behavior of a preformed pile driven by either an impact hammer or a vibratory hammer. The program is based on mathematical models, which describe motion and forces of hammer, driving system, pile and soil under the hammer action. Under certain conditions, the models only crudely approximate, often complex, dynamic situations.

A wave equation analysis generally relies on input data, which represents normal situations. In particular, the hammer data file supplied with the program assumes that the hammer is in good working order. All of the input data selected by the user may be the best available information at the time when the analysis is performed. However, input data and therefore results may significantly differ from actual field conditions.

Therefore, the program authors recommend prudent use of the GRLWEAP results. Soil response and hammer performance should be verified by static and/or dynamic testing and measurements. Estimates of bending or other local non-axial stresses and prestress effects must also be accounted for by the user.

The calculated capacity - blow count relationship, i.e. the bearing graph, should be used in conjunction with observed blow counts for the capacity assessment of a driven pile. Soil setup occurring after pile installation may produce bearing capacity values that differ substantially from those expected from a wave equation analysis due to soil setup or relaxation. This is particularly true for pile driven with vibratory hammers. The GRLWEAP user must estimate such effects and should also use proper care when applying blow counts from restrike because of the variability of hammer energy, soil resistance and blow count during early restriking.

Finally, the GRLWEAP capacities are ultimate values. They MUST be reduced by means of an appropriate factor of safety to yield a design or working load. The selection of a factor of safety should consider the quality of the construction control, the variability of the site conditions, uncertainties in the loads, the importance of building and other factors.

Input File: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385 INTERCHANGE
DESIGN\01 FINAL REPORTS\11 BRIDGE 11\06 DRIVEABILITY ANALYSIS (WEAP)\BRIDGE 11
END BENT 5 D19-32.GWI

Hammer File: C:\Program Files\PDI\GRLWEAP 2005\HAMMER2003.GW

Hammer File Version: 2003 (1/11/2007)

Input File Contents

I-85 Bridge 11 End Bent 5

OUT	OSG	HAM	STR	FUL	PEL	N	SPL	N-U	P-D	%SK	ISM	0	PHI	RSA	ITR	H-D	MXT	DEx	
6	0	40	-1	1	0	0	0	0	0	65	1	0	0	0	0	0	0	0.000	
File g		Hammer g		Toe Area		Pile Size		Pile Type											
32.170		32.170		144.000		12.000		H File											
W Cp		A Cp		E Cp		T Cp		CoR		ROut		StCp							
3.200		415.000		530.0		2.000		0.800		0.010		0.0							
A Cu		E Cu		T Cu		CoR		ROut		StCu									
0.000		0.0		0.000		0.000		0.000		0.0									
LPle		APle		EPle		WPle		Peri		Strg		CoR		ROut					
60.000		15.500		30000.000		492.000		4.000		36.000		0.850		0.010					
Manufac		Hmr Name		HmrType		No		Seg-s											
DELMAG		D 19-32		1		5													
Ram Wt		Ram L		Ram Dia		MaxStrk		RtdStrk		Efficy									
4.00		129.10		12.60		11.76		10.61		0.80									
IB. Wt		IB. L		IB.Dia		IB CoR		IB RO											
0.75		25.30		12.60		0.900		0.010											
CompStrk		A Chamber		V Chamber		C Delay		C Duratn		Exp Coeff		VolCStart		Vol CEnd					
15.50		124.70		157.70		0.002		0.002		1.250		0.00		0.00					
P atm		P1		P2		P3		P4		P5									
14.70		1500.00		1350.00		1215.00		1094.00		0.00									
Stroke		Effic.		Pressure		R-Weight		T-Delay		Exp-Coeff		Eps-Str		Total-AW					
10.0000		0.8000		1500.0000		0.0000		0.0000		0.0000		0.0100		0.0000					
Qs		Qt		Js		Jt		Qx		Jx		Rati		Dept					
0.100		0.100		0.050		0.150		0.000		0.000		0.000		0.000					
Research		Soil Model:		Atoe, Plug,		Gap,		Q-fac											
0.000		0.000		0.000		0.000													
Research		Soil Model:		RD-skn: m, d,		toe: m, d													
0.000		0.000		0.000		0.000													
Res. Distribution																			
Dpth		Rskn		Dpth		Dpth													
0.00		0.00		54.00		54.00		0.00		0.00		0.00		0.00		0.00		0.00	
8.00		0.30		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
8.00		0.61		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
12.00		0.96		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
12.00		0.96		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
17.00		1.40		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
17.00		1.40		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
33.00		2.18		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
33.00		2.18		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
38.00		2.42		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
38.00		2.42		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
53.00		3.15		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
53.00		3.15		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	

54.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
68.60	3.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rult									
100.0	200.0	300.0	400.0	450.0	500.0	550.0	600.0	650.0	700.0
Diameter	COGHammer	WHammer	ABatter	Depth	Sup		Flag		
0.000	0.000	0.000	0.000	0.000	0.000		0		

GRLWEAP: WAVE EQUATION ANALYSIS OF PILE FOUNDATIONS
Version 2005
English Units

I-85 Bridge 11 End Bent 5

Hammer Model:	D 19-32	Made by:	DELMAG
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No.	Weight kips	Stiffn k/inch	CoR	C-Slk ft	Dampg k/ft/s
1	0.800				
2	0.800	140046.7	1.000	0.0100	
3	0.800	140046.7	1.000	0.0100	
4	0.800	140046.7	1.000	0.0100	
5	0.800	140046.7	1.000	0.0100	
Imp Block	0.753	70735.6	0.900	0.0100	
Helmet	3.200	109975.0	0.800	0.0100	5.8
Combined Pile Top		11625.0			

HAMMER OPTIONS:

Hammer File ID No.	40	Hammer Type	OE Diesel
Stroke Option	VarP-FxdS	Stroke Convergence Crit.	0.010
Fuel Pump Setting	Maximum		

HAMMER DATA:

Ram Weight	(kips)	4.00	Ram Length	(inch)	129.10
Maximum Stroke	(ft)	11.76	Actual Stroke	(ft)	10.00
Rated Stroke	(ft)	10.61	Efficiency		0.800
Maximum Pressure	(psi)	1500.00	Actual Pressure	(psi)	1500.00
Compression Exponent		1.350	Expansion Exponent		1.250
Ram Diameter	(inch)	12.60			
Combustion Delay	(s)	0.00200	Ignition Duration	(s)	0.00200

The Hammer Data Includes Estimated (NON-MEASURED) Quantities

HAMMER CUSHION

Cross Sect. Area	(in2)	415.00
Elastic-Modulus	(ksi)	530.0
Thickness	(inch)	2.00
Coeff of Restitution		0.8
RoundOut	(ft)	0.0
Stiffness	(kips/in)	109975.0

PILE CUSHION

Cross Sect. Area	(in2)	0.00
Elastic-Modulus	(ksi)	0.0
Thickness	(inch)	0.00
Coeff of Restitution		0.0
RoundOut	(ft)	0.0
Stiffness	(kips/in)	0.0

PILE PROFILE:

Toe Area	(in2)	144.000	File Type	H File
File Size	(inch)	12.000		

L b Top	Area	E-Mod	Spec Wt	Perim	Strength	Wave Sp	EA/c
ft	in2	ksi	lb/ft3	ft	ksi	ft/s	k/ft/s
0.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7
60.0	15.50	30000.	492.0	4.0	36.000	16807.	27.7

Wave Travel Time 2L/c (ms) 7.140

Pile and Soil Model						Total Capacity Rut			(kips)	100.0	
No.	Weight	Stiffn	C-Slk	T-Slk	CoR	Soil-S	Soil-D	Quake	LbTop	Perim	Area
	kips	k/in	ft	ft		kips	s/ft	inch	ft	ft	in2
1	0.177	11625.	0.010	0.000	0.85	0.0	0.050	0.100	3.33	4.0	15.5
2	0.177	11625.	0.000	0.000	1.00	0.0	0.050	0.100	6.67	4.0	15.5
3	0.177	11625.	0.000	0.000	1.00	0.2	0.050	0.100	10.00	4.0	15.5
4	0.177	11625.	0.000	0.000	1.00	0.5	0.050	0.100	13.33	4.0	15.5
5	0.177	11625.	0.000	0.000	1.00	1.4	0.050	0.100	16.67	4.0	15.5
6	0.177	11625.	0.000	0.000	1.00	2.2	0.050	0.100	20.00	4.0	15.5
7	0.177	11625.	0.000	0.000	1.00	2.9	0.050	0.100	23.33	4.0	15.5
8	0.177	11625.	0.000	0.000	1.00	3.4	0.050	0.100	26.67	4.0	15.5
9	0.177	11625.	0.000	0.000	1.00	3.8	0.050	0.100	30.00	4.0	15.5
10	0.177	11625.	0.000	0.000	1.00	4.1	0.050	0.100	33.33	4.0	15.5
11	0.177	11625.	0.000	0.000	1.00	4.5	0.050	0.100	36.67	4.0	15.5
12	0.177	11625.	0.000	0.000	1.00	4.9	0.050	0.100	40.00	4.0	15.5
13	0.177	11625.	0.000	0.000	1.00	5.2	0.050	0.100	43.33	4.0	15.5
14	0.177	11625.	0.000	0.000	1.00	5.6	0.050	0.100	46.67	4.0	15.5
15	0.177	11625.	0.000	0.000	1.00	6.0	0.050	0.100	50.00	4.0	15.5
16	0.177	11625.	0.000	0.000	1.00	6.4	0.050	0.100	53.33	4.0	15.5
17	0.177	11625.	0.000	0.000	1.00	6.7	0.050	0.100	56.67	4.0	15.5
18	0.177	11625.	0.000	0.000	1.00	7.1	0.050	0.100	60.00	4.0	15.5
Toe						35.0	0.150	0.100			

3.178 kips total unreduced pile weight (g= 32.17 ft/s2)

3.178 kips total reduced pile weight (g= 32.17 ft/s2)

PILE, SOIL, ANALYSIS OPTIONS:

Uniform pile		Pile Segments: Automatic	
No. of Slacks/Splices	0	Pile Damping (%)	1
Pile Penetration (ft)	54.00	Pile Damping Fact. (k/ft/s)	0.553
% Shaft Resistance	65		
Soil Damping Option	Smith		
Max No Analysis Iterations	0	Time Increment/Critical	160
Output Time Interval	2	Analysis Time-Input (ms)	0
Output Level: Variable vs Time			
Gravity Mass, Pile, Hammer:	32.170	32.170	32.170

Output Segment Generation: Automatic

Rut= 100.0, Rtoe = 35.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	483.0	2	0.00	0	31.16	2	16.70	2	3.154	37	49.02
2	0.0	0	483.9	2	0.00	0	31.22	2	16.66	2	3.150	36	49.05
3	-1.2	49	484.5	2	-0.07	49	31.26	2	16.59	2	3.147	36	49.04
4	-9.4	11	484.8	3	-0.61	11	31.27	3	17.45	8	3.144	36	48.95
5	-5.9	11	485.0	3	-0.38	11	31.29	3	17.46	8	3.140	36	48.61
6	-1.5	49	484.1	3	-0.09	49	31.23	3	17.17	8	3.136	36	47.93
7	-0.8	49	482.4	3	-0.05	49	31.12	3	18.03	8	3.132	36	46.98
8	-4.1	12	479.9	3	-0.26	12	30.96	3	19.05	8	3.128	36	45.80
9	-5.8	12	476.9	4	-0.37	12	30.77	4	18.91	8	3.124	36	44.45
10	0.0	0	473.7	4	0.00	0	30.56	4	18.20	7	3.119	37	42.95
11	0.0	0	470.0	4	0.00	0	30.33	4	18.93	7	3.115	37	41.31
12	-3.3	13	466.0	4	-0.21	13	30.07	4	20.14	7	3.111	37	39.52
13	-4.4	13	461.5	4	-0.28	13	29.77	4	19.95	7	3.107	37	37.58
14	0.0	0	455.7	5	0.00	0	29.40	5	18.79	7	3.103	37	35.49
15	0.0	0	443.5	5	0.00	0	28.61	5	19.25	6	3.099	37	33.24
16	0.0	0	411.8	5	0.00	0	26.56	5	20.49	6	3.095	37	30.84
17	0.0	0	345.0	5	0.00	0	22.26	5	22.48	6	3.092	37	28.28
18	0.0	0	252.5	5	0.00	0	16.29	5	23.97	6	3.088	38	26.96

(Eq) Return Strokes and Stroke Analyzed (ft):
4.73 7.27 9.34 9.98 10.00

Max. Combustion Pressure 3108.0 psi

Rut= 200.0, Rtoe= 70.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	488.5	2	0.00	0	31.51	2	16.66	2	1.365	18	34.80
2	-5.3	29	489.2	2	-0.34	29	31.56	2	16.61	2	1.351	18	34.73
3	-10.1	29	490.2	2	-0.65	29	31.63	2	16.51	2	1.337	19	34.63
4	-13.8	29	491.4	3	-0.89	29	31.71	3	16.38	3	1.323	19	34.44
5	-16.3	30	492.7	3	-1.05	30	31.78	3	16.21	3	1.309	19	34.06
6	-16.1	30	491.5	3	-1.04	30	31.71	3	16.03	3	1.294	19	33.42
7	-13.7	30	488.5	3	-0.88	30	31.51	3	15.83	3	1.280	19	32.57
8	-11.5	31	483.9	3	-0.74	31	31.22	3	15.62	3	1.266	19	31.56
9	-10.0	31	478.2	4	-0.64	31	30.85	4	15.39	4	1.253	19	30.45
10	-8.0	31	471.9	4	-0.51	31	30.44	4	15.15	4	1.240	19	29.24
11	-5.3	31	464.8	4	-0.34	31	29.99	4	14.89	4	1.227	20	27.95
12	-2.1	31	457.1	4	-0.14	31	29.49	4	14.61	4	1.215	20	26.57
13	0.0	0	448.5	4	0.00	0	28.93	4	14.32	4	1.203	20	25.11
14	0.0	0	438.2	5	0.00	0	28.27	5	14.09	5	1.193	20	23.57
15	0.0	0	420.7	5	0.00	0	27.14	5	14.45	5	1.183	20	21.94
16	0.0	0	385.4	5	0.00	0	24.86	5	15.76	5	1.174	21	20.23
17	0.0	0	326.6	5	0.00	0	21.07	5	16.04	5	1.166	21	18.43
18	0.0	0	298.3	5	0.00	0	19.25	5	16.96	6	1.160	21	17.50

(Eq) Return Strokes and Stroke Analyzed (ft):

6.08 8.34 9.63 9.96 10.00

Max. Combustion Pressure 2525.5 psi

Rut= 300.0, Rtoe = 105.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	490.8	2	0.00	0	31.67	2	16.64	2	0.992	12	29.80
2	-8.0	22	492.1	2	-0.52	22	31.75	2	16.57	2	0.969	12	29.57
3	-15.7	22	493.3	2	-1.01	22	31.83	2	16.45	2	0.946	12	29.28
4	-22.1	22	495.0	3	-1.42	22	31.94	3	16.27	3	0.922	12	28.91
5	-26.7	22	497.1	3	-1.72	22	32.07	3	16.04	3	0.900	13	28.37
6	-26.7	23	495.5	3	-1.73	23	31.97	3	15.78	3	0.878	13	27.58
7	-22.4	23	491.1	3	-1.44	23	31.69	3	15.49	3	0.856	13	26.60
8	-15.0	23	484.3	3	-0.97	23	31.25	3	15.17	3	0.835	13	25.49
9	-8.4	23	475.9	4	-0.54	23	30.70	4	14.83	4	0.814	13	24.31
10	-1.6	23	466.4	4	-0.10	23	30.09	4	14.45	4	0.794	14	23.08
11	0.0	0	455.9	4	0.00	0	29.41	4	14.04	4	0.776	14	21.81
12	0.0	0	444.3	4	0.00	0	28.66	4	13.60	4	0.757	14	20.49
13	0.0	0	431.7	4	0.00	0	27.85	4	13.13	4	0.740	14	19.13
14	0.0	0	417.0	5	0.00	0	26.91	5	12.72	5	0.724	14	17.74
15	0.0	0	394.8	5	0.00	0	25.47	5	12.79	5	0.710	14	16.33
16	0.0	0	356.3	5	0.00	0	22.99	5	13.38	5	0.697	14	14.89
17	0.0	0	335.0	6	0.00	0	21.61	6	13.11	5	0.685	14	13.41
18	0.0	0	332.1	5	0.00	0	21.42	5	11.73	6	0.675	15	12.64
(Eq) Return Strokes and Stroke Analyzed (ft):													
6.83 8.83 9.78 9.98 10.00													

Max. Combustion Pressure 2254.0 psi

Rut= 400.0, Rtoe= 140.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	492.5	2	0.00	0	31.78	2	16.64	2	0.873	10	27.20
2	-14.9	19	494.2	2	-0.96	19	31.89	2	16.55	2	0.838	10	26.60
3	-26.9	19	495.9	2	-1.74	19	31.99	2	16.40	2	0.803	10	25.97
4	-36.0	19	497.8	3	-2.32	19	32.11	3	16.19	3	0.767	10	25.25
5	-44.7	19	500.6	3	-2.88	19	32.30	3	15.91	3	0.732	11	24.34
6	-50.0	20	498.7	3	-3.23	20	32.17	3	15.57	3	0.699	11	23.20
7	-50.1	20	492.9	3	-3.23	20	31.80	3	15.18	3	0.666	11	21.90
8	-44.2	20	483.8	3	-2.85	20	31.22	3	14.76	3	0.634	11	20.50
9	-34.2	20	472.5	4	-2.21	20	30.49	4	14.29	4	0.603	12	19.09
10	-21.7	20	459.8	4	-1.40	20	29.66	4	13.78	4	0.574	12	17.69
11	-9.2	20	445.9	4	-0.60	20	28.77	4	13.23	4	0.547	12	16.32
12	0.0	0	441.3	7	0.00	0	28.47	7	12.65	4	0.521	12	14.96
13	0.0	0	414.6	4	0.00	0	26.75	4	12.04	4	0.496	12	13.64
14	0.0	0	395.6	5	0.00	0	25.52	5	11.48	5	0.474	13	12.36
15	0.0	0	368.1	5	0.00	0	23.75	5	11.24	5	0.453	13	11.11
16	0.0	0	340.1	6	0.00	0	21.94	6	11.39	5	0.434	13	9.90
17	0.0	0	351.0	6	0.00	0	22.65	6	11.27	5	0.418	13	8.73
18	0.0	0	345.0	6	0.00	0	22.26	6	9.68	5	0.404	13	8.11
(Eq) Return Strokes and Stroke Analyzed (ft):													

7.70 9.25 9.87 9.98 10.00

Max. Combustion Pressure 2008.6 psi

Rut= 450.0, Rtoe = 157.5 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	493.0	2	0.00	0	31.81	2	16.63	2	0.837	9	26.29
2	-16.1	18	494.9	2	-1.04	18	31.93	2	16.54	2	0.798	9	25.57
3	-32.0	18	496.8	2	-2.06	18	32.05	2	16.39	2	0.757	9	24.72
4	-46.0	18	498.9	3	-2.97	18	32.18	3	16.15	3	0.717	9	23.82
5	-56.4	18	502.1	3	-3.64	18	32.39	3	15.84	3	0.677	9	22.71
6	-58.7	19	500.0	3	-3.79	19	32.26	3	15.46	3	0.638	9	21.36
7	-56.7	19	514.2	8	-3.66	19	33.18	8	15.03	3	0.600	10	19.85
8	-53.4	19	506.0	8	-3.45	19	32.65	8	14.55	3	0.562	10	18.28
9	-46.3	19	477.2	8	-2.99	19	30.79	8	14.02	4	0.527	10	16.73
10	-34.1	19	463.3	8	-2.20	19	29.89	8	13.45	4	0.494	10	15.23
11	-17.0	19	463.5	7	-1.10	19	29.90	7	12.83	4	0.462	11	13.78
12	0.0	0	461.2	7	0.00	0	29.75	7	12.18	4	0.432	11	12.39
13	0.0	0	424.9	7	0.00	0	27.42	7	11.54	4	0.404	12	11.08
14	0.0	0	400.8	7	0.00	0	25.86	7	10.96	4	0.378	12	9.84
15	0.0	0	371.9	7	0.00	0	23.99	7	10.56	5	0.355	12	8.68
16	0.0	0	348.1	6	0.00	0	22.46	6	10.65	5	0.334	12	7.59
17	0.0	0	351.5	6	0.00	0	22.68	6	10.54	5	0.315	12	6.59
18	0.0	0	344.0	6	0.00	0	22.19	6	8.97	5	0.299	12	6.05
(Eq) Return Strokes and Stroke Analyzed (ft):													
8.12 9.50 9.90 9.99 10.00													

Max. Combustion Pressure 1889.9 psi

Rut= 500.0, Rtoe= 175.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	500.0	9	0.00	0	32.26	9	16.63	2	0.812	9	25.71
2	-18.1	17	495.5	2	-1.16	17	31.97	2	16.53	2	0.772	8	24.95
3	-34.4	18	500.4	9	-2.22	18	32.29	9	16.37	2	0.731	8	24.10
4	-48.9	18	505.2	9	-3.16	18	32.59	9	16.12	3	0.690	8	23.15
5	-61.3	18	505.0	8	-3.96	18	32.58	8	15.78	3	0.647	8	21.90
6	-66.2	18	520.6	8	-4.27	18	33.58	8	15.36	3	0.602	8	20.29
7	-64.1	18	536.3	8	-4.14	18	34.60	8	14.88	3	0.559	8	18.58
8	-56.5	18	527.2	8	-3.65	18	34.02	8	14.34	3	0.518	9	16.84
9	-46.1	19	498.7	8	-2.97	19	32.17	8	13.76	4	0.479	9	15.12
10	-34.1	19	480.7	8	-2.20	19	31.01	8	13.12	4	0.441	9	13.47
11	-18.2	19	479.8	7	-1.17	19	30.95	7	12.44	4	0.404	9	11.90
12	0.0	0	475.3	7	0.00	0	30.67	7	11.75	4	0.370	10	10.44
13	0.0	0	441.6	7	0.00	0	28.49	7	11.11	4	0.339	10	9.10
14	0.0	0	411.5	7	0.00	0	26.55	7	10.52	4	0.310	10	7.87
15	0.0	0	380.4	7	0.00	0	24.54	7	10.08	5	0.283	10	6.75
16	0.0	0	351.0	6	0.00	0	22.65	6	10.06	5	0.259	10	5.74
17	0.0	0	347.6	6	0.00	0	22.43	6	9.91	5	0.238	11	4.86
18	0.0	0	338.9	6	0.00	0	21.86	6	8.32	5	0.220	11	4.39
(Eq) Return Strokes and Stroke Analyzed (ft):													

8.47 9.61 9.95 10.00

Max. Combustion Pressure 1795.9 psi

Rut= 550.0, Rtoe = 192.5 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	520.4	9	0.00	0	33.57	9	16.63	2	0.791	8	25.28
2	-19.2	17	516.0	9	-1.24	17	33.29	9	16.53	2	0.751	8	24.50
3	-36.7	17	520.4	9	-2.37	17	33.58	9	16.36	2	0.710	8	23.66
4	-52.7	17	523.5	9	-3.40	17	33.77	9	16.08	3	0.668	8	22.68
5	-64.6	18	523.7	8	-4.17	18	33.79	8	15.71	3	0.624	8	21.36
6	-70.3	18	540.0	8	-4.54	18	34.84	8	15.26	3	0.578	8	19.64
7	-69.6	18	554.6	8	-4.49	18	35.78	8	14.73	3	0.531	8	17.69
8	-61.2	18	544.9	8	-3.95	18	35.16	8	14.14	3	0.486	8	15.76
9	-47.2	18	518.8	8	-3.05	18	33.47	8	13.49	4	0.443	9	13.89
10	-32.7	18	496.2	8	-2.11	18	32.01	8	12.79	4	0.402	9	12.12
11	-17.2	19	491.8	7	-1.11	19	31.73	7	12.07	4	0.362	9	10.46
12	0.0	0	485.8	7	0.00	0	31.34	7	11.37	4	0.325	9	8.93
13	0.0	0	455.5	7	0.00	0	29.39	7	10.74	4	0.290	9	7.53
14	0.0	0	419.9	7	0.00	0	27.09	7	10.12	4	0.259	10	6.30
15	0.0	0	387.8	7	0.00	0	25.02	7	9.65	5	0.230	10	5.21
16	0.0	0	351.9	8	0.00	0	22.70	8	9.55	5	0.203	10	4.27
17	0.0	0	339.8	6	0.00	0	21.92	6	9.37	5	0.180	10	3.49
18	0.0	0	329.6	6	0.00	0	21.27	6	7.78	5	0.160	10	3.05

(Eq) Return Strokes and Stroke Analyzed (ft):
8.76 9.71 9.95 10.00

Max. Combustion Pressure 1735.7 psi

Rut= 600.0, Rtoe= 210.0 kips, Time Inc. =0.067 ms													
No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	532.8	9	0.00	0	34.38	9	16.63	2	0.774	8	24.94
2	-19.5	17	532.3	9	-1.26	17	34.34	9	16.52	2	0.733	8	24.14
3	-38.2	17	536.1	9	-2.46	17	34.59	9	16.34	2	0.692	8	23.30
4	-54.7	17	537.9	9	-3.53	17	34.70	9	16.04	3	0.650	8	22.27
5	-67.1	17	538.2	8	-4.33	17	34.72	8	15.64	3	0.605	8	20.88
6	-72.3	17	555.7	8	-4.67	17	35.85	8	15.15	3	0.557	8	19.07
7	-71.0	18	568.3	8	-4.58	18	36.66	8	14.57	3	0.508	8	17.02
8	-62.4	18	557.6	8	-4.03	18	35.97	8	13.93	3	0.463	7	15.04
9	-47.8	18	535.6	8	-3.09	18	34.55	8	13.23	4	0.420	7	13.16
10	-29.7	18	508.5	8	-1.92	18	32.80	8	12.47	4	0.378	7	11.30
11	-11.5	18	499.9	7	-0.74	18	32.25	7	11.72	4	0.335	7	9.52
12	0.0	0	490.6	7	0.00	0	31.65	7	11.04	4	0.295	7	7.88
13	0.0	0	464.4	7	0.00	0	29.96	7	10.38	4	0.258	8	6.44
14	0.0	0	425.9	7	0.00	0	27.48	7	9.78	4	0.224	8	5.18
15	0.0	0	392.2	7	0.00	0	25.31	7	9.26	5	0.192	8	4.10
16	0.0	0	353.3	8	0.00	0	22.79	8	9.10	5	0.164	8	3.20
17	0.0	0	330.3	6	0.00	0	21.31	6	8.84	5	0.138	8	2.47
18	0.0	0	313.3	6	0.00	0	20.21	6	7.28	5	0.116	9	2.06

(Eq) Return Strokes and Stroke Analyzed (ft):

8.92 9.80 9.97 10.00

Max. Combustion Pressure 1695.4 psi

I-85 Bridge 11 End Bent 5
ECS Carolinas LLP

05/09/2015
GRLWEAP(TM) Version 2005

Rut= 650.0, Rtoe = 227.5 kips, Time Inc. =0.067 ms

No	mxTForce	t	mxCForce	t	mxTStrss	t	mxCStrss	t	max V	t	max D	t	max Et
	kips	ms	kips	ms	ksi	ms	ksi	ms	ft/s	ms	inch	ms	kip-ft
1	0.0	0	540.6	9	0.00	0	34.88	9	16.62	2	0.760	8	24.69
2	-19.5	16	542.5	9	-1.26	16	35.00	9	16.51	2	0.719	8	23.88
3	-38.5	17	548.5	9	-2.48	17	35.38	9	16.32	2	0.677	8	23.01
4	-56.1	17	548.5	9	-3.62	17	35.39	9	16.00	3	0.634	8	21.93
5	-69.2	17	550.7	8	-4.46	17	35.53	8	15.57	3	0.588	8	20.47
6	-73.9	17	569.5	8	-4.77	17	36.74	8	15.04	3	0.539	8	18.58
7	-72.2	17	579.6	8	-4.66	17	37.39	8	14.42	3	0.490	7	16.47
8	-63.9	17	565.6	8	-4.12	17	36.49	8	13.73	3	0.445	7	14.50
9	-48.2	17	544.3	8	-3.11	17	35.12	8	12.98	4	0.402	7	12.57
10	-27.6	18	517.2	8	-1.78	18	33.37	8	12.18	4	0.359	7	10.67
11	-4.8	18	506.0	7	-0.31	18	32.64	7	11.42	4	0.316	7	8.85
12	0.0	0	491.9	7	0.00	0	31.74	7	10.72	4	0.274	7	7.18
13	0.0	0	463.8	7	0.00	0	29.92	7	10.07	4	0.236	6	5.71
14	0.0	0	427.6	7	0.00	0	27.59	7	9.42	4	0.205	6	4.56
15	0.0	0	390.1	7	0.00	0	25.17	7	8.88	4	0.175	6	3.55
16	0.0	0	348.6	8	0.00	0	22.49	8	8.65	5	0.146	6	2.68
17	0.0	0	320.0	6	0.00	0	20.64	6	8.39	5	0.120	6	1.99
18	0.0	0	294.7	6	0.00	0	19.01	6	6.80	5	0.097	6	1.59

Activated Capacity 642.3 k
(Eq) Return Strokes and Stroke Analyzed (ft):
9.02 9.81 9.98 10.00

Max. Combustion Pressure 1677.7 psi

I-85 Bridge 11 End Bent 5
 ECS Carolinas LLP

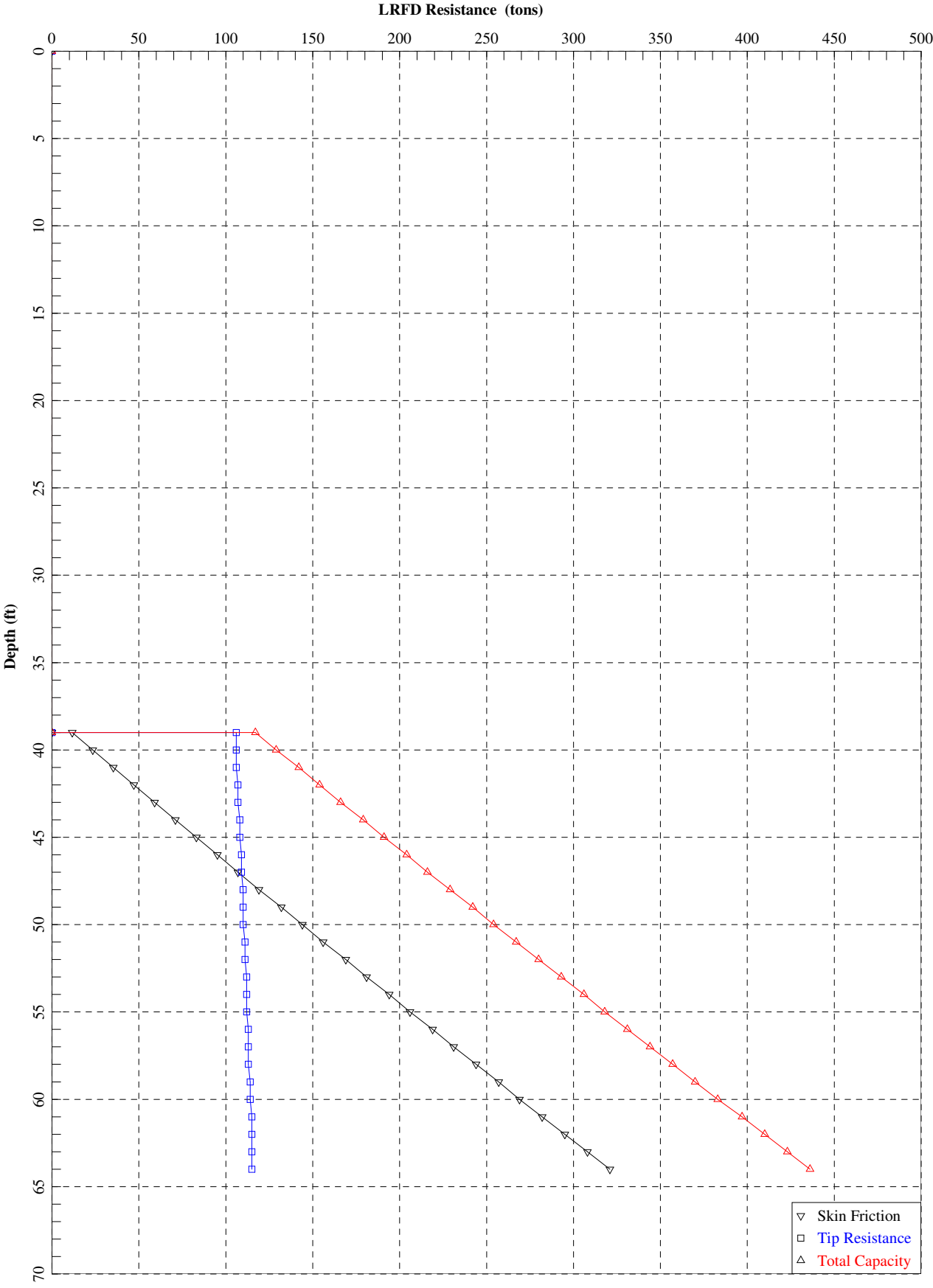
05/09/2015
 GRLWEAP(TM) Version 2005

Rut	Bl Ct	Stroke	(ft)	Ten Str	i	t	Comp Str	i	t	ENTHRU	Bl Rt
kips	b/ft	down	up	ksi			ksi			kip-ft	b/min
100.0	4.0	10.00	9.98	-0.61	4	11	31.29	5	3	49.0	37.7
200.0	11.3	10.00	9.96	-1.05	5	30	31.78	5	3	34.8	37.6
300.0	20.9	10.00	9.98	-1.73	6	23	32.07	5	3	29.8	37.6
400.0	39.5	10.00	9.98	-3.23	7	20	32.30	5	3	27.2	37.5
450.0	60.4	10.00	9.99	-3.79	6	19	33.18	7	8	26.3	37.5
500.0	99.7	10.00	9.95	-4.27	6	18	34.60	7	8	25.7	37.5
550.0	200.0	10.00	9.95	-4.54	6	18	35.78	7	8	25.3	37.5
600.0	728.1	10.00	9.97	-4.67	6	17	36.66	7	8	24.9	37.5
650.0	9999.0	10.00	9.98	-4.77	6	17	37.39	7	8	24.7	37.5

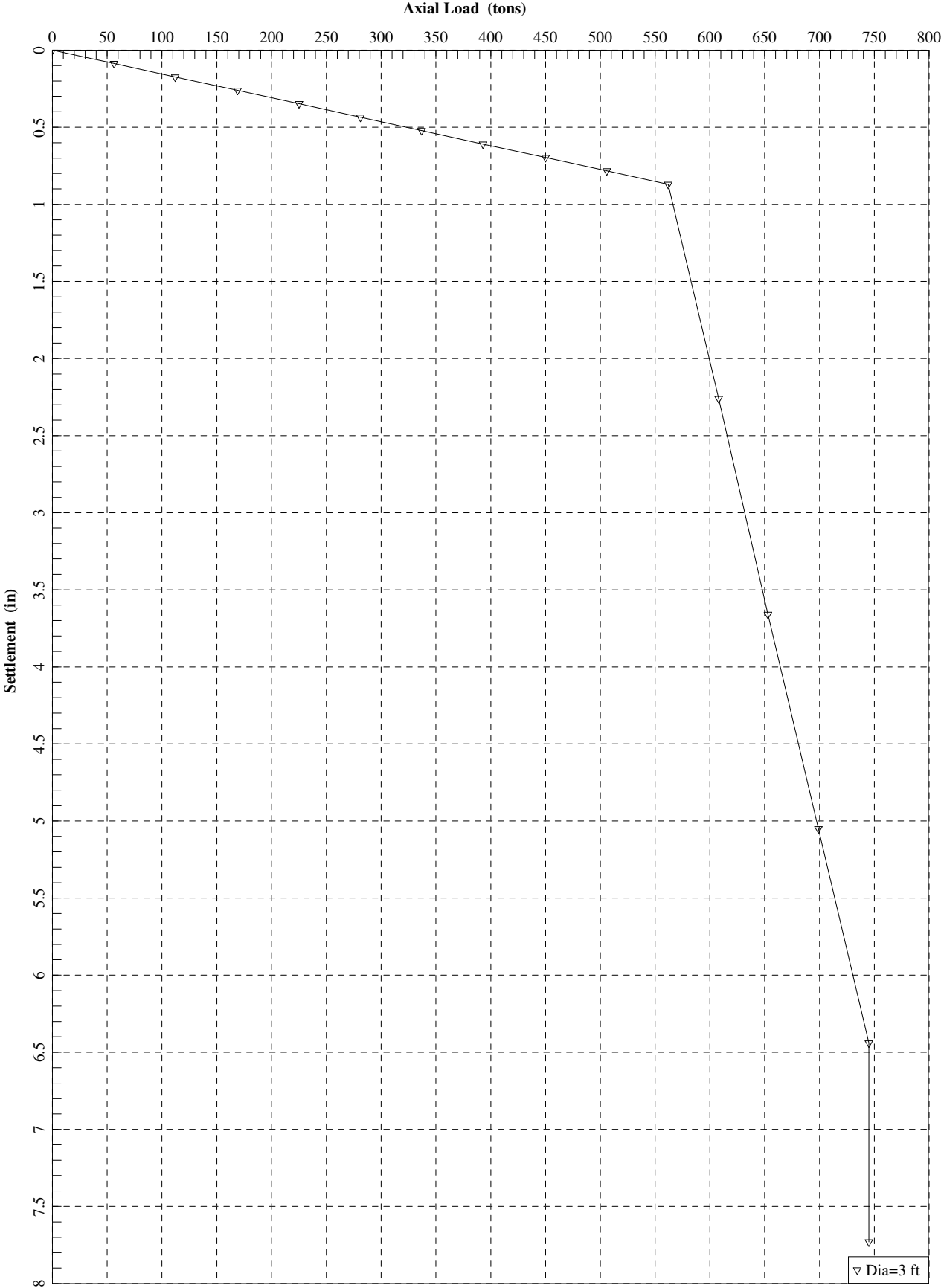
Appendix G

Axial Capacity of Drilled Shafts

Bridge 11 Bent 3 - Drilled Shaft
Subsurface Profile Based on Boring B11-SPT-04



Bridge 11 Bent 3 - Drilled Shaft
Subsurface Profile Based on Boring B11-SPT-04



SHAFT for windows, Version 2012.7.10

Serial Number : 155107490

VERTICALLY LOADED DRILLED SHAFT ANALYSIS
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Path to file locations : I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385 Interchange Design\01 Final
Reports\11 Bridge 11\04 Axial Capacity (Driven)\Drilled Shafts\
Name of input data file : Bridge 11 Bent 3 DP Axial Capacity.sfd
Name of output file : Bridge 11 Bent 3 DP Axial Capacity.sfo
Name of plot output file : Bridge 11 Bent 3 DP Axial Capacity.sfp
Name of runtime file : Bridge 11 Bent 3 DP Axial Capacity.sfr

Time and Date of Analysis

Date: May 29, 2015 Time: 09:37:57

Bridge 11 Bent 3 Drilled Shaft

PROPOSED DEPTH = 64.0 FT

NUMBER OF LAYERS = 6

WATER TABLE DEPTH = 10.2 FT.

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.120E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.118E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.550E+01

LRFD RESISTANCE FACTOR (SIDE FRICTION)	= 0.550E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE)	= 0.500E+00

LAYER NO 2----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.118E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.112E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.550E+01

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.113E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.112E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.750E+01

LRFD RESISTANCE FACTOR (SIDE FRICTION)	= 0.450E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE)	= 0.400E+00

LAYER NO 3----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.113E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.102E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.750E+01

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.102E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.135E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION)	= 0.550E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE)	= 0.500E+00

LAYER NO 4----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.350E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.137E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.135E+02

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.668E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.350E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.137E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.380E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION)	= 0.550E+00
LRFD RESISTANCE FACTOR (TIP RESISTANCE)	= 0.500E+00

LAYER NO 5----DECOMPOSED ROCK

AT THE TOP

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.764E+07
POISSON RATIO OF GRAVEL	= 0.200E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.100E+03
SOIL UNIT WEIGHT, LB/CU FT	= 0.137E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.380E+02

AT THE BOTTOM

ELASTIC MODULUS OF GRAVEL, LB/SQ IN	= 0.764E+07
POISSON RATIO OF GRAVEL	= 0.200E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.100E+03

Bridge 11 Bent 3 DP Axial Capacity.sfo

SOIL UNIT WEIGHT, LB/CU FT = 0.137E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
 DEPTH, FT = 0.540E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.600E+00
 LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.550E+00

LAYER NO 6----DECOMPOSED ROCK

AT THE TOP

ELASTIC MODULUS OF GRAVEL, LB/SQ IN = 0.764E+07
 POISSON RATIO OF GRAVEL = 0.200E+00
 BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.100E+03
 SOIL UNIT WEIGHT, LB/CU FT = 0.137E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
 DEPTH, FT = 0.540E+02

AT THE BOTTOM

ELASTIC MODULUS OF GRAVEL, LB/SQ IN = 0.764E+07
 POISSON RATIO OF GRAVEL = 0.200E+00
 BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.100E+03
 SOIL UNIT WEIGHT, LB/CU FT = 0.137E+03
 MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
 DEPTH, FT = 0.750E+02

LRFD RESISTANCE FACTOR (SIDE FRICTION) = 0.600E+00
 LRFD RESISTANCE FACTOR (TIP RESISTANCE) = 0.550E+00

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 3.000 FT.
 DIAMETER OF BASE = 3.000 FT.
 END OF STEM TO BASE = 0.000 FT.
 ANGLE OF BELL = 0.000 DEG.
 IGNORED TOP PORTION = 38.000 FT.
 IGNORED BOTTOM PORTION = 0.000 FT.
 AREA OF ONE PERCENT STEEL = 10.180 SQ.IN.
 ELASTIC MODULUS, Ec = 0.360E+07 LB/SQ IN
 VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
 QB = ULTIMATE BASE RESISTANCE;
 WT = WEIGHT OF DRILLED SHAFT (UPLIFT CAPACITY ONLY);
 QU = TOTAL ULTIMATE RESISTANCE;
 LRFD QS = TOTAL SIDE FRICTION USING LRFD RESISTANCE FACTOR
 TO THE ULTIMATE SIDE RESISTANCE;
 LRFD QB = TOTAL BASE BEARING USING LRFD RESISTANCE FACTOR
 TO THE ULTIMATE BASE RESISTANCE
 LRFD QU = TOTAL CAPACITY WITH LRFD RESISTANCE FACTOR.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	LRFD QS (TONS)	LRFD QB (TONS)	LRFD QU (TONS)
39.0	10.21	19.51	191.83	211.34	11.70	105.51	117.21
40.0	10.47	39.11	192.71	231.82	23.46	105.99	129.45
41.0	10.74	58.80	193.57	252.37	35.28	106.47	141.74
42.0	11.00	78.58	194.42	273.00	47.15	106.93	154.08
43.0	11.26	98.45	195.25	293.70	59.07	107.39	166.46
44.0	11.52	118.41	196.07	314.48	71.04	107.84	178.88
45.0	11.78	138.45	196.88	335.33	83.07	108.28	191.36
46.0	12.04	158.58	197.67	356.26	95.15	108.72	203.87
47.0	12.31	178.80	198.45	377.25	107.28	109.15	216.43
48.0	12.57	199.10	199.22	398.32	119.46	109.57	229.03
49.0	12.83	219.48	199.98	419.45	131.69	109.99	241.67
50.0	13.09	239.94	200.72	440.66	143.96	110.40	254.36
51.0	13.35	260.48	201.46	461.93	156.29	110.80	267.09
52.0	13.62	281.10	202.18	483.28	168.66	111.20	279.86
53.0	13.88	301.80	202.89	504.69	181.08	111.59	292.67
54.0	14.14	322.58	203.60	526.17	193.55	111.98	305.52
55.0	14.40	343.43	204.29	547.72	206.06	112.36	318.42
56.0	14.66	364.36	204.98	569.33	218.61	112.74	331.35
57.0	14.92	385.36	205.65	591.01	231.22	113.11	344.32
58.0	15.19	406.44	206.32	612.76	243.86	113.47	357.34

				Bridge 11	Bent 3	DP Axial	Capacity.sfo
59.0	15.45	427.59	206.98	634.57	256.55	113.84	370.39
60.0	15.71	448.81	207.63	656.44	269.29	114.19	383.48
61.0	15.97	470.11	208.27	678.38	282.07	114.55	396.61
62.0	16.23	491.48	208.90	700.38	294.89	114.90	409.78
63.0	16.50	512.92	209.53	722.44	307.75	115.24	422.99
64.0	16.76	534.42	209.93	744.35	320.65	115.46	436.11

LOAD SETTLEMENT RELATIONSHIP

TOP LOAD TONS	TOP MOVEMENT IN.
0.5621E+02	0.8703E-01
0.1124E+03	0.1741E+00
0.1686E+03	0.2611E+00
0.2248E+03	0.3481E+00
0.2810E+03	0.4352E+00
0.3373E+03	0.5222E+00
0.3935E+03	0.6092E+00
0.4497E+03	0.6963E+00
0.5059E+03	0.7833E+00
0.5621E+03	0.8703E+00
0.6077E+03	0.2264E+01
0.6533E+03	0.3657E+01
0.6989E+03	0.5050E+01
0.7446E+03	0.6444E+01
0.7446E+03	0.7732E+01

Appendix H

Lateral Pile Response Analysis



STANTEC

801 JONES FRANKLIN RD.

RALEIGH, NC 27606

Project: SCDOT I-85 / I-385

Completed by: VEF

Date: 5/4/2015

Checked by:

Date:

Job No.: 171001537

Bridge Load Data Sheet

PROJECT INFORMATION			
File No.	BRIDGE NO. 11		Project No. (PIN): 0038111
County:	SPARTANBURG		Route: ROPER MOUNTAIN ROAD
Description:	CURVED BRIDGE OVER I-85		
Report Request by:			Date Requested:
BRIDGE STRUCTURE INFORMATION			
Bridge Type:	AASHTO TYPE III PRESTRESSED GIRDERS		
No. Spans/Lengths:	4 / 75.5 82.5 76.574 75.592	Width/No. Lanes:	63 FT, OUT-TO-OUT / 5 LANES
Bridge Category/Seismic OC:	/ II		
Seismic Performance Category (SPC):	A		
Seismic Site Class:	D		
Structural Design Method:	LRFD YES		LFD
<i>Proposed Foundations (foundation type, size, and number per bent)</i>			
End Bent	10 HP12X53 STEEL PILES		
Interior Bent	BENTS 2 & 4: 4 FOOTINGS (5 HP12X53 STEEL PILES EA.)		
	BENT 3: 4 3'-6" DIA. DRILLED SHAFTS		
HYDRAULICS INFORMATION			
Design Scour	Contraction Scour (feet)	Local Scour (feet)	Total Scour (feet)
100 Yr			
500 Yr			
BRIDGE LOADS			
<i>End Bent 1 Foundation Loads</i>			
Location of Loads Reported:	Station:	36+63.11	Elevation: TOP OF PILE
<i>(Strength I, II, III, IV, and V) Longitudinal Loads (Along the bridge or perpendicular to bent cap)</i>			
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)
P (axial - kips) =	181.1		
V (shear - kips) =	11.11		
M (moment - ft-kip) =	23.9		
<i>(Strength I, II, III, IV, and V) Transverse Loads (Transverse to the bridge or in direction of bent cap)</i>			
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)
P (axial - kips) =	181.1		
V (shear - kips) =	1.12		
M (moment - ft-kip) =			



STANTEC

801 JONES FRANKLIN RD.

RALEIGH, NC 27606

Project: SCDOT I-85 / I-385

Completed by: VEF

Date: 5/4/2015

Checked by:

Date:

Job No.: 171001537

Bridge Load Data Sheet

Bent 2 Foundation Loads				
Location of Loads Reported:	Station:	37+38.61	Elevation:	TOP OF PILE
(Strength I, II, III, IV, and V) Longitudinal Loads (Along the bridge or perpendicular to bent cap)				
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)	
P (axial - kips) =	205.9			
V (shear - kips) =	3.17			
M (moment - ft-kip) =				
(Strength I, II, III, IV, and V) Transverse Loads (Transverse to the bridge or in direction of bent cap)				
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)	
P (axial - kips) =	205.9			
V (shear - kips) =	5.66			
M (moment - ft-kip) =				
Bent 3 Foundation Loads				
Location of Loads Reported:	Station:	38+21.11	Elevation:	TOP OF COLUMN
(Strength I, II, III, IV, and V) Longitudinal Loads (Along the bridge or perpendicular to bent cap)				
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)	
P (axial - kips) =	781.2	473.4	625.4	
V (shear - kips) =	-0.002	11.45	3.16	
M (moment - ft-kip) =	15.49	7.8	132	
(Strength I, II, III, IV, and V) Transverse Loads (Transverse to the bridge or in direction of bent cap)				
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)	
P (axial - kips) =	781.2	526.1	526.1	
V (shear - kips) =	11.8	21.53	21.53	
M (moment - ft-kip) =	145.7	265.9	265.9	
Bent 4 Foundation Loads				
Location of Loads Reported:	Station:	38+97.69	Elevation:	TOP OF PILE
(Strength I, II, III, IV, and V) Longitudinal Loads (Along the bridge or perpendicular to bent cap)				
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)	
P (axial - kips) =	205.9			
V (shear - kips) =	3.17			
M (moment - ft-kip) =				
(Strength I, II, III, IV, and V) Transverse Loads (Transverse to the bridge or in direction of bent cap)				
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)	
P (axial - kips) =	205.9			
V (shear - kips) =	5.66			
M (moment - ft-kip) =				

**STANTEC**

801 JONES FRANKLIN RD.

RALEIGH, NC 27606

Project: **SCDOT I-85 / I-385**Completed by: **VEF**Date: **5/4/2015**

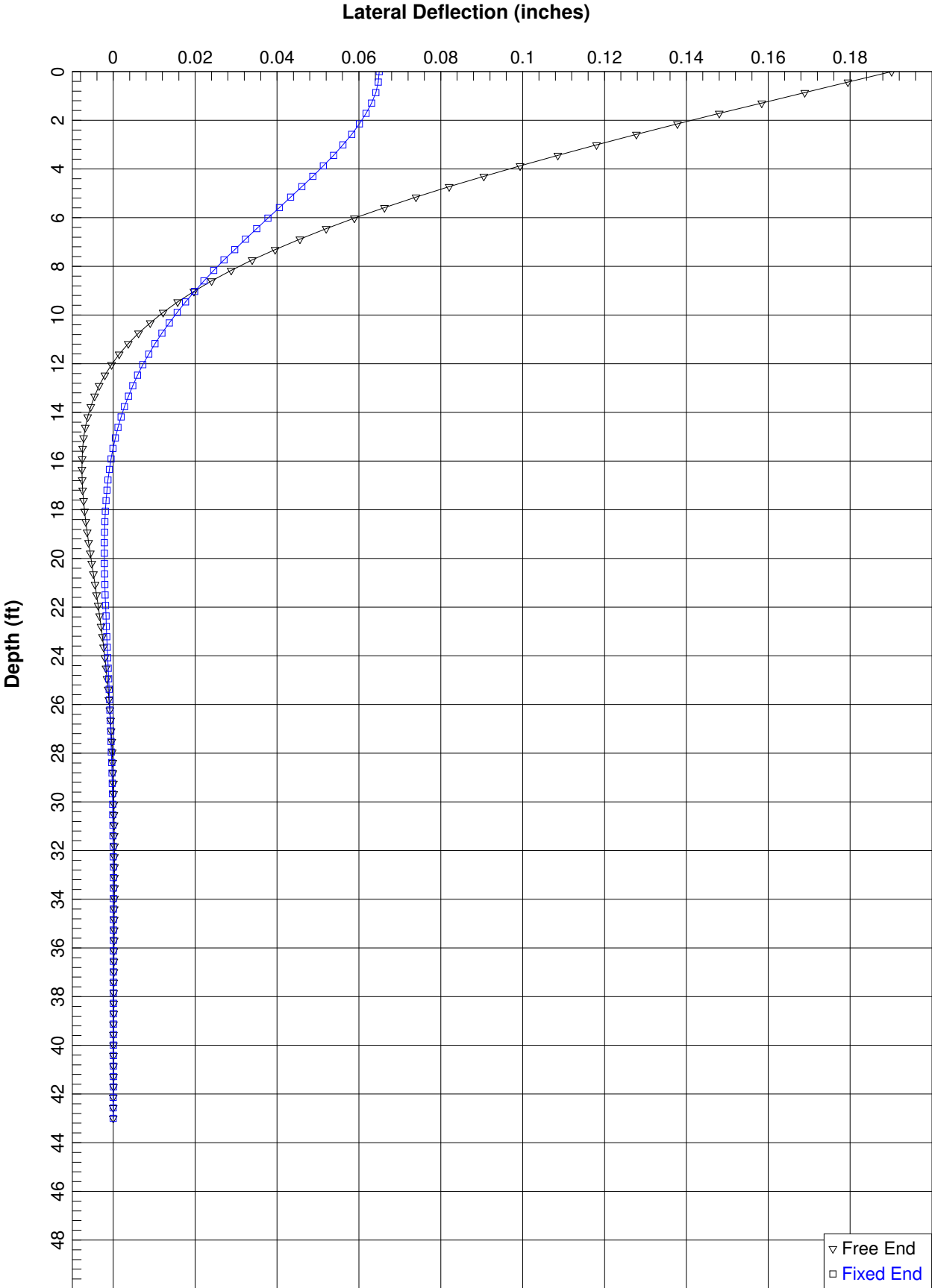
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Date:

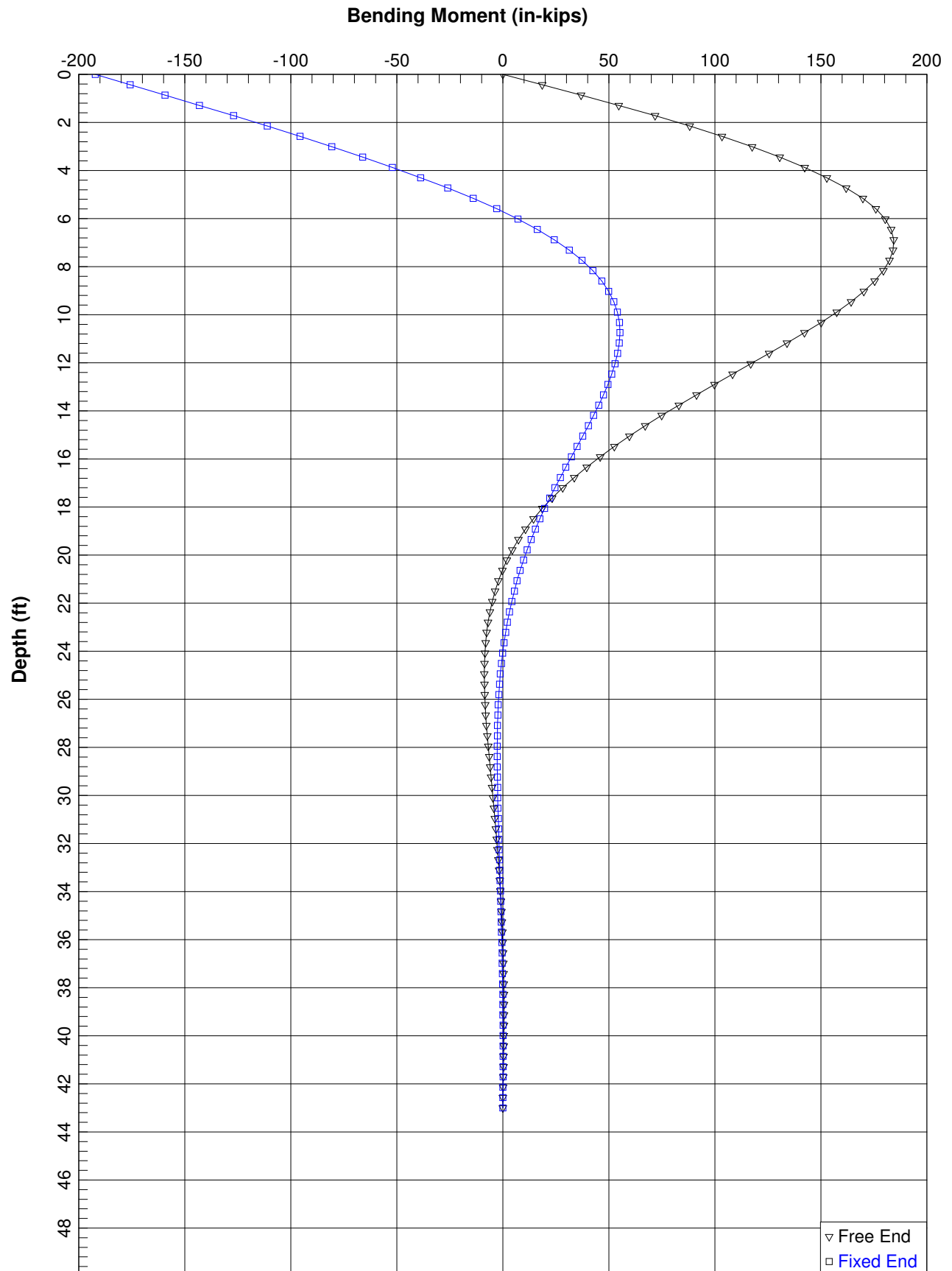
Job No.: **171001537****Bridge Load Data Sheet**

End Bent 5 Foundation Loads			
Location of Loads Reported:	Station:	39+73.28	Elevation: TOP OF PILE
(Strength I, II, III, IV, and V) Longitudinal Loads (Along the bridge or perpendicular to bent cap)			
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)
P (axial - kips) =	178.3		
V (shear - kips) =	10.73		
M (moment - ft-kip) =	11.3		
(Strength I, II, III, IV, and V) Transverse Loads (Transverse to the bridge or in direction of bent cap)			
Load Cases:	Case 1FL (P=Pmax)	Case 2FL (V=Vmax)	Case 3FL (M=Mmax)
P (axial - kips) =	178.3		
V (shear - kips) =	0.7385		
M (moment - ft-kip) =			

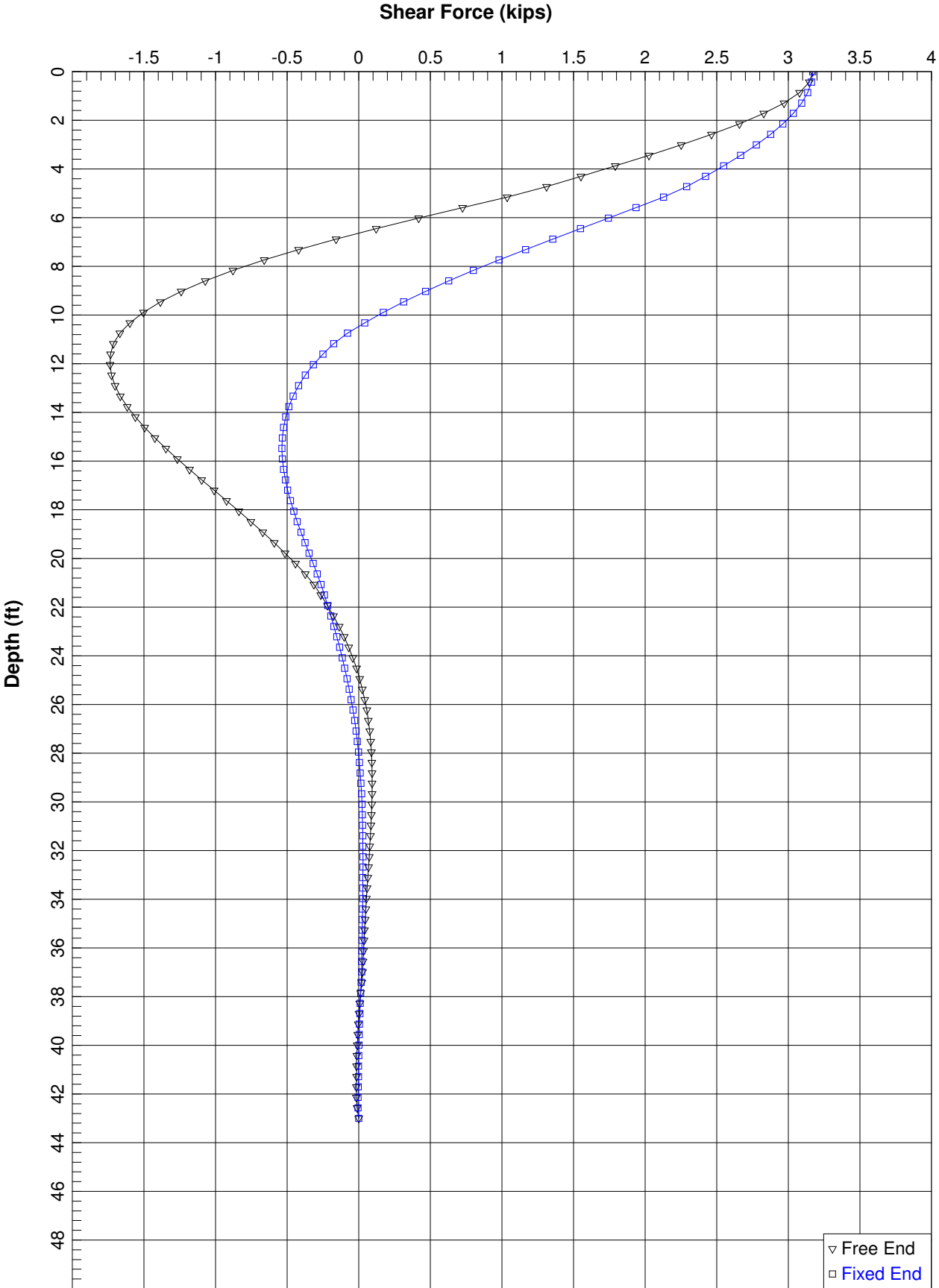
Bridge 11 Bent 2 - Provided Loading - Longitudinal
Subsurface Based on Boring B11



Bridge 11 Bent 2 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-02



Bridge 11 Bent 2 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-02



Bridge 11 Bent 2 Longitudinal Provided.lp6o

LPILE Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 Bent 2\Service\
Name of input data file: Bridge 11 Bent 2 Longitudinal Provided.lp6d
Name of output report file: Bridge 11 Bent 2 Longitudinal Provided.lp6o
Name of plot output file: Bridge 11 Bent 2 Longitudinal Provided.lp6p
Name of runtime message file: Bridge 11 Bent 2 Longitudinal Provided.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 9:40:12

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 Bent 2 (Boring B11-SPT-02)

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

- Total number of pile sections = 1
- Total length of pile = 43.00 ft
- Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	12.0450000
2	43.000000	12.0450000

Input Structural Properties:

Bridge 11 Bent 2 Longitudinal Provided.lp60

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	43.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	393.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	5.00000 ft
Effective unit weight at top of layer	=	95.00000 pcf
Effective unit weight at bottom of layer	=	95.00000 pcf
Friction angle at top of layer	=	27.00000 deg.
Friction angle at bottom of layer	=	27.00000 deg.
Subgrade k at top of layer	=	20.00000 pci
Subgrade k at bottom of layer	=	20.00000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.00000 ft
Distance from top of pile to bottom of layer	=	11.00000 ft
Effective unit weight at top of layer	=	40.00000 pcf
Effective unit weight at bottom of layer	=	40.00000 pcf
Friction angle at top of layer	=	30.00000 deg.
Friction angle at bottom of layer	=	30.00000 deg.
Subgrade k at top of layer	=	30.00000 pci
Subgrade k at bottom of layer	=	30.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	11.00000 ft
Distance from top of pile to bottom of layer	=	21.00000 ft
Effective unit weight at top of layer	=	40.00000 pcf
Effective unit weight at bottom of layer	=	40.00000 pcf

Bridge 11 Bent 2 Longitudinal Provided.lp60

Friction angle at top of layer	=	26.00000	deg.
Friction angle at bottom of layer	=	26.00000	deg.
Subgrade k at top of layer	=	20.00000	pci
Subgrade k at bottom of layer	=	20.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	21.00000	ft
Distance from top of pile to bottom of layer	=	37.00000	ft
Effective unit weight at top of layer	=	47.00000	pcf
Effective unit weight at bottom of layer	=	47.00000	pcf
Friction angle at top of layer	=	29.00000	deg.
Friction angle at bottom of layer	=	29.00000	deg.
Subgrade k at top of layer	=	20.00000	pci
Subgrade k at bottom of layer	=	20.00000	pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	37.00000	ft
Distance from top of pile to bottom of layer	=	42.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	42.00000	ft
Distance from top of pile to bottom of layer	=	52.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

Layer 7 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	52.00000	ft
Distance from top of pile to bottom of layer	=	57.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 8 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	57.00000	ft
Distance from top of pile to bottom of layer	=	67.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf

Bridge 11 Bent 2 Longitudinal Provided.lp60

Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 24.00 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor (p-y Curve Epsilon 50	Layer Soil Type kpy Criteria) pci	Layer Depth ft	Effective Unit wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	95.000	--
27.000	--	20.000			
			5.000	95.000	--
27.000	--	20.000			
2	Sand (Reese, et al.)		5.000	40.000	--
30.000	--	30.000			
			11.000	40.000	--
30.000	--	30.000			
3	Sand (Reese, et al.)		11.000	40.000	--
26.000	--	20.000			
			21.000	40.000	--
26.000	--	20.000			
4	Sand (Reese, et al.)		21.000	47.000	--
29.000	--	20.000			
			37.000	47.000	--
29.000	--	20.000			
5	Sand (Reese, et al.)		37.000	75.000	--
36.000	--	105.000			
			42.000	75.000	--
36.000	--	105.000			
6	Stiff Clay w/o Free Water, using k		42.000	75.000	8000.000
--	0.00400	2000.000			
			52.000	75.000	8000.000
--	0.00400	2000.000			
7	Sand (Reese, et al.)		52.000	75.000	--
36.000	--	105.000			
			57.000	75.000	--
36.000	--	105.000			
8	Stiff Clay w/o Free Water, using k		57.000	75.000	8000.000
--	0.00400	2000.000			
			67.000	75.000	8000.000
--	0.00400	2000.000			

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Bridge 11 Bent 2 Longitudinal Provided.lp6o

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.5000	1.0000
2	43.000	0.5000	1.0000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y vs. Pile Length				
1	1	V = 3170.00000 lbs	M = 0.0000 in-lbs	205900.
	No			
2	2	V = 3170.00000 lbs	S = 0.0000 in/in	205900.
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

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Shear force at pile head = 3170.000 lbs
 Applied moment at pile head = 0.000 in-lbs
 Axial thrust load on pile head = 205900.000 lbs

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. Load inches lb/inch	Bending Distrib. Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.00	0.1901	-4.752E-08	3170.0000	-0.002060	13284.	1.140E+10	
	0.430	0.1795	18546.	3146.6702	-0.002056	13568.	1.140E+10	
-9.0426	259.9668	0.1689	0.000	3078.3713	-0.002044	13848.	1.140E+10	
-17.4299	532.5120	0.1584	0.000	2970.1430	-0.002023	14121.	1.140E+10	
-24.5190	798.7680	0.1480	0.000	2828.0631	-0.001994	14384.	1.140E+10	
-30.5507	1065.0240	0.1378	0.000	2657.5106	-0.001958	14634.	1.140E+10	
-35.5549	1331.2800	0.1278	0.000	2463.6896	-0.001915	14868.	1.140E+10	
-39.5695	1597.5360	0.1180	0.000	2251.5913	-0.001865	15086.	1.140E+10	
-42.6391	1863.7920	0.1086	0.000	2025.9596	-0.001809	15285.	1.140E+10	
-44.8150	2130.0480	0.0994	0.000	1791.2607	-0.001747	15465.	1.140E+10	
-46.1536	2396.3040	0.0905	0.000	1551.6560	-0.001680	15625.	1.140E+10	
-46.7164	2662.5600	0.0820	0.000	1310.9802	-0.001609	15765.	1.140E+10	
-46.5688	2928.8160	0.0739	0.000	1036.0991	-0.001534	15885.	1.140E+10	
-59.9743	4185.8053	0.0662	0.000	725.4229	-0.001456	15979.	1.140E+10	
-60.4429	4710.0711	0.0589	0.000	417.6108	-0.001375	16047.	1.140E+10	
-58.8642	5155.8465	0.0520	0.000	121.2283	-0.001293	16090.	1.140E+10	
-56.0128	5555.2305	0.0456	0.000	-158.9653	-0.001209	16108.	1.140E+10	
-52.5894	5954.6145	0.0395	0.000	-420.2837	-0.001126	16104.	1.140E+10	
-48.6968	6353.9985	0.0340	0.000	-660.5615	-0.001043	16078.	1.140E+10	
-44.4341	6753.3825	0.0288	0.000	-878.1326	-0.000961	16033.	1.140E+10	
-39.8958	7152.7665	0.0240	0.000	-1071.8039	-0.000881	15971.	1.140E+10	
-35.1706	7552.1505	0.0197	0.000	-1240.8250	-0.000803	15893.	1.140E+10	
-30.3414	7951.5345	0.0157	0.000	-1384.8539	-0.000727	15801.	1.140E+10	
-25.4838	8350.9185	0.0122	0.000	-1503.9216	-0.000654	15697.	1.140E+10	
-20.6665	8750.3025	0.008995	0.000	-1598.3933	-0.000585	15584.	1.140E+10	
-15.9505	9149.6865	0.000	0.000					

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10.750	0.006154	142232.	-1668.9304	-0.000518	15463.	1.140E+10
-11.3895	9549.0705	0.000				
11.180	0.003646	133985.	-1712.7259	-0.000456	15337.	1.140E+10
-5.5855	7905.0928	0.000				
11.610	0.001450	125525.	-1733.0622	-0.000397	15207.	1.140E+10
-2.2968	8171.3488	0.000				
12.040	-0.000452	116944.	-1737.0811	-0.000342	15076.	1.140E+10
0.7390	8437.6048	0.000				
12.470	-0.002081	108326.	-1726.1178	-0.000291	14944.	1.140E+10
3.5103	8703.8608	0.000				
12.900	-0.003457	99749.	-1701.5558	-0.000244	14812.	1.140E+10
6.0098	8970.1168	0.000				
13.330	-0.004600	91284.	-1664.8064	-0.000201	14683.	1.140E+10
8.2342	9236.3728	0.000				
13.760	-0.005530	82995.	-1617.2882	-0.000161	14556.	1.140E+10
10.1837	9502.6288	0.000				
14.190	-0.006266	74937.	-1560.4097	-0.000126	14432.	1.140E+10
11.8622	9768.8848	0.000				
14.620	-0.006826	67158.	-1495.5529	-9.348E-05	14313.	1.140E+10
13.2761	10035.	0.000				
15.050	-0.007230	59701.	-1424.0590	-6.476E-05	14199.	1.140E+10
14.4347	10301.	0.000				
15.480	-0.007495	52600.	-1347.2163	-3.934E-05	14090.	1.140E+10
15.3493	10568.	0.000				
15.910	-0.007636	45882.	-1266.2495	-1.704E-05	13987.	1.140E+10
16.0332	10834.	0.000				
16.340	-0.007671	39568.	-1182.3109	2.301E-06	13890.	1.140E+10
16.5011	11100.	0.000				
16.770	-0.007613	33675.	-1096.4742	1.888E-05	13800.	1.140E+10
16.7690	11366.	0.000				
17.200	-0.007476	28213.	-1009.7284	3.289E-05	13716.	1.140E+10
16.8534	11633.	0.000				
17.630	-0.007273	23185.	-922.9752	4.453E-05	13639.	1.140E+10
16.7718	11899.	0.000				
18.060	-0.007016	18593.	-837.0266	5.398E-05	13569.	1.140E+10
16.5416	12165.	0.000				
18.490	-0.006716	14432.	-752.6043	6.146E-05	13505.	1.140E+10
16.1802	12431.	0.000				
18.920	-0.006382	10695.	-670.3408	6.715E-05	13448.	1.140E+10
15.7049	12698.	0.000				
19.350	-0.006023	7371.5812	-590.7810	7.124E-05	13397.	1.140E+10
15.1323	12964.	0.000				
19.780	-0.005647	4447.1446	-514.3852	7.391E-05	13352.	1.140E+10
14.4785	13230.	0.000				
20.210	-0.005260	1906.0673	-441.5332	7.535E-05	13313.	1.140E+10
13.7587	13496.	0.000				
20.640	-0.004869	-269.5930	-372.5289	7.572E-05	13288.	1.140E+10
12.9871	13763.	0.000				
21.070	-0.004479	-2099.3330	-313.6498	7.519E-05	13316.	1.140E+10
9.8342	11330.	0.000				
21.500	-0.004093	-3666.2209	-264.5441	7.388E-05	13340.	1.140E+10
9.1990	11596.	0.000				
21.930	-0.003716	-4986.4171	-218.7682	7.192E-05	13360.	1.140E+10
8.5436	11862.	0.000				
22.360	-0.003351	-6076.7358	-176.4037	6.942E-05	13377.	1.140E+10
7.8767	12129.	0.000				
22.790	-0.003000	-6954.4083	-137.4895	6.647E-05	13390.	1.140E+10
7.2063	12395.	0.000				
23.220	-0.002665	-7636.8642	-102.0255	6.316E-05	13401.	1.140E+10
6.5394	12661.	0.000				
23.650	-0.002348	-8141.5300	-69.9763	5.959E-05	13409.	1.140E+10
5.8827	12927.	0.000				
24.080	-0.002050	-8485.6480	-41.2745	5.583E-05	13414.	1.140E+10

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5.2420	13194.	0.000				
24.510	-0.001772	-8686.1136	-15.8251	5.194E-05	13417.	1.140E+10
4.6221	13460.	0.000				
24.940	-0.001514	-8759.3336	6.4913	4.799E-05	13418.	1.140E+10
4.0276	13726.	0.000				
25.370	-0.001277	-8721.1027	25.8143	4.404E-05	13418.	1.140E+10
3.4619	13993.	0.000				
25.800	-0.001060	-8586.5006	42.3005	4.012E-05	13415.	1.140E+10
2.9281	14259.	0.000				
26.230	-0.000863	-8369.8066	56.1199	3.628E-05	13412.	1.140E+10
2.4283	14525.	0.000				
26.660	-0.000685	-8084.4322	67.4525	3.255E-05	13408.	1.140E+10
1.9642	14791.	0.000				
27.090	-0.000527	-7742.8711	76.4854	2.897E-05	13403.	1.140E+10
1.5369	15058.	0.000				
27.520	-0.000386	-7356.6638	83.4100	2.555E-05	13397.	1.140E+10
1.1470	15324.	0.000				
27.950	-0.000263	-6936.3778	88.4192	2.232E-05	13390.	1.140E+10
0.7945	15590.	0.000				
28.380	-0.000156	-6491.6002	91.7052	1.928E-05	13383.	1.140E+10
0.4791	15856.	0.000				
28.810	-6.403E-05	-6030.9430	93.4575	1.644E-05	13376.	1.140E+10
0.2001	16123.	0.000				
29.240	1.377E-05	-5562.0579	93.8608	1.382E-05	13369.	1.140E+10
-0.0437	16389.	0.000				
29.670	7.858E-05	-5091.6619	93.0936	1.141E-05	13362.	1.140E+10
-0.2536	16655.	0.000				
30.100	0.000131	-4625.5697	91.3268	9.207E-06	13355.	1.140E+10
-0.4312	16921.	0.000				
30.530	0.000174	-4168.7333	88.7225	7.216E-06	13348.	1.140E+10
-0.5782	17188.	0.000				
30.960	0.000206	-3725.2875	85.4332	5.429E-06	13341.	1.140E+10
-0.6967	17454.	0.000				
31.390	0.000230	-3298.5989	81.6013	3.839E-06	13334.	1.140E+10
-0.7886	17720.	0.000				
31.820	0.000246	-2891.3195	77.3583	2.438E-06	13328.	1.140E+10
-0.8560	17986.	0.000				
32.250	0.000255	-2505.4415	72.8245	1.216E-06	13322.	1.140E+10
-0.9013	18253.	0.000				
32.680	0.000258	-2142.3549	68.1091	1.641E-07	13317.	1.140E+10
-0.9264	18519.	0.000				
33.110	0.000256	-1802.9042	63.3100	-7.290E-07	13311.	1.140E+10
-0.9337	18785.	0.000				
33.540	0.000251	-1487.4470	58.5138	-1.474E-06	13307.	1.140E+10
-0.9253	19051.	0.000				
33.970	0.000241	-1195.9105	53.7962	-2.081E-06	13302.	1.140E+10
-0.9032	19318.	0.000				
34.400	0.000229	-927.8481	49.2222	-2.562E-06	13298.	1.140E+10
-0.8696	19584.	0.000				
34.830	0.000215	-682.4937	44.8464	-2.927E-06	13294.	1.140E+10
-0.8264	19850.	0.000				
35.260	0.000199	-458.8150	40.7133	-3.185E-06	13291.	1.140E+10
-0.7755	20116.	0.000				
35.690	0.000182	-255.5645	36.8581	-3.347E-06	13288.	1.140E+10
-0.7188	20383.	0.000				
36.120	0.000164	-71.3285	33.3064	-3.421E-06	13285.	1.140E+10
-0.6578	20649.	0.000				
36.550	0.000147	95.4263	30.0755	-3.415E-06	13285.	1.140E+10
-0.5944	20915.	0.000				
36.980	0.000129	246.3077	27.1741	-3.338E-06	13288.	1.140E+10
-0.5301	21181.	0.000				
37.410	0.000112	382.9555	21.7079	-3.195E-06	13290.	1.140E+10
-1.5885	73049.	0.000				

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37.840	9.617E-05	477.1236	14.0298	-3.001E-06	13291.	1.140E+10
-1.3875	74447.	0.000				
38.270	8.124E-05	534.1194	7.3692	-2.772E-06	13292.	1.140E+10
-1.1941	75845.	0.000				
38.700	6.756E-05	559.0633	1.6789	-2.524E-06	13292.	1.140E+10
-1.0114	77243.	0.000				
39.130	5.519E-05	556.8094	-3.1006	-2.272E-06	13292.	1.140E+10
-0.8411	78640.	0.000				
39.560	4.412E-05	531.8919	-7.0364	-2.025E-06	13292.	1.140E+10
-0.6843	80038.	0.000				
39.990	3.429E-05	488.4974	-10.1982	-1.794E-06	13291.	1.140E+10
-0.5412	81436.	0.000				
40.420	2.560E-05	430.4587	-12.6549	-1.586E-06	13290.	1.140E+10
-0.4110	82834.	0.000				
40.850	1.792E-05	361.2698	-14.4700	-1.407E-06	13289.	1.140E+10
-0.2925	84232.	0.000				
41.280	1.108E-05	284.1184	-15.6992	-1.261E-06	13288.	1.140E+10
-0.1839	85630.	0.000				
41.710	4.908E-06	201.9337	-16.3872	-1.151E-06	13287.	1.140E+10
-0.0828	87027.	0.000				
42.140	-7.952E-07	117.4481	-16.0998	-1.079E-06	13286.	1.140E+10
0.1942	1259920.	0.000				
42.570	-6.224E-06	38.0755	-11.5955	-1.043E-06	13284.	1.140E+10
1.5517	1286545.	0.000				
43.000	-1.156E-05	0.000	0.000	-1.035E-06	13284.	1.140E+10
2.9427	656585.	0.000				

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.1901149 inches
Computed slope at pile head	=	-0.0020605 radians
Maximum bending moment	=	184301. inch-lbs
Maximum shear force	=	3170.000000 lbs
Depth of maximum bending moment	=	82.5600000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	6
Number of zero deflection points	=	3

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	3170.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	205900.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Load Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
feet	Es*h	Lat. inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/in
lb/inch		lb/inch						

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0.000	0.00	0.0650	-192168.	3170.0000	0.000	16229.	1.140E+10
	0.430	0.0647	-175765.	3161.3802	-8.329E-05	15977.	1.140E+10
-3.3410	266.2560	0.000	0.000				
	0.860	0.0641	-159366.	3135.6898	-0.000159	15726.	1.140E+10
-6.6165	532.5120	0.000	0.000				
	1.290	0.0631	-143066.	3093.4158	-0.000228	15476.	1.140E+10
-9.7688	798.7680	0.000	0.000				
	1.720	0.0618	-126958.	3035.3221	-0.000289	15229.	1.140E+10
-12.7481	1065.0240	0.000	0.000				
	2.150	0.0601	-111128.	2962.4096	-0.000343	14987.	1.140E+10
-15.5125	1331.2800	0.000	0.000				
	2.580	0.0582	-95658.	2875.8764	-0.000389	14750.	1.140E+10
-18.0274	1597.5360	0.000	0.000				
	3.010	0.0561	-80622.	2777.0799	-0.000429	14519.	1.140E+10
-20.2658	1863.7920	0.000	0.000				
	3.440	0.0538	-66086.	2667.4988	-0.000463	14297.	1.140E+10
-22.2075	2130.0480	0.000	0.000				
	3.870	0.0513	-52110.	2548.6986	-0.000489	14082.	1.140E+10
-23.8391	2396.3040	0.000	0.000				
	4.300	0.0487	-38744.	2422.2973	-0.000510	13878.	1.140E+10
-25.1536	2662.5600	0.000	0.000				
	4.730	0.0461	-26028.	2289.9341	-0.000525	13683.	1.140E+10
-26.1499	2928.8160	0.000	0.000				
	5.160	0.0433	-13997.	2128.0627	-0.000534	13498.	1.140E+10
-36.5909	4357.0785	0.000	0.000				
	5.590	0.0406	-2932.9860	1937.1873	-0.000537	13329.	1.140E+10
-37.3918	4756.4625	0.000	0.000				
	6.020	0.0378	7136.8274	1743.3034	-0.000536	13393.	1.140E+10
-37.7570	5155.8465	0.000	0.000				
	6.450	0.0350	16198.	1548.5976	-0.000531	13532.	1.140E+10
-37.7104	5555.2305	0.000	0.000				
	6.880	0.0323	24247.	1355.1221	-0.000522	13655.	1.140E+10
-37.2801	5954.6145	0.000	0.000				
	7.310	0.0296	31292.	1164.7739	-0.000509	13763.	1.140E+10
-36.4983	6353.9985	0.000	0.000				
	7.740	0.0270	37350.	979.2778	-0.000494	13856.	1.140E+10
-35.3994	6753.3825	0.000	0.000				
	8.170	0.0245	42448.	800.1749	-0.000476	13934.	1.140E+10
-34.0203	7152.7665	0.000	0.000				
	8.600	0.0221	46619.	628.8145	-0.000456	13998.	1.140E+10
-32.3985	7552.1505	0.000	0.000				
	9.030	0.0198	49906.	466.3505	-0.000434	14049.	1.140E+10
-30.5720	7951.5345	0.000	0.000				
	9.460	0.0177	52354.	313.7415	-0.000411	14086.	1.140E+10
-28.5787	8350.9185	0.000	0.000				
	9.890	0.0156	54016.	171.7539	-0.000387	14112.	1.140E+10
-26.4553	8750.3025	0.000	0.000				
	10.320	0.0137	54948.	40.9680	-0.000362	14126.	1.140E+10
-24.2370	9149.6865	0.000	0.000				
	10.750	0.0119	55208.	-78.2128	-0.000337	14130.	1.140E+10
-21.9571	9549.0705	0.000	0.000				
	11.180	0.0102	54857.	-175.1398	-0.000312	14125.	1.140E+10
-15.6115	7905.0928	0.000	0.000				
	11.610	0.008644	54064.	-250.7331	-0.000287	14112.	1.140E+10
-13.6883	8171.3488	0.000	0.000				
	12.040	0.007224	52880.	-316.5239	-0.000263	14094.	1.140E+10
-11.8120	8437.6048	0.000	0.000				
	12.470	0.005927	51357.	-372.7928	-0.000240	14071.	1.140E+10
-9.9976	8703.8608	0.000	0.000				
	12.900	0.004750	49542.	-419.8922	-0.000217	14043.	1.140E+10
-8.2580	8970.1168	0.000	0.000				

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13.330	0.003689	47484.	-458.2361	-0.000195	14012.	1.140E+10
-6.6040	9236.3728	0.000				
13.760	0.002739	45227.	-488.2905	-0.000174	13977.	1.140E+10
-5.0449	9502.6288	0.000				
14.190	0.001895	42814.	-510.5629	-0.000154	13940.	1.140E+10
-3.5878	9768.8848	0.000				
14.620	0.001151	40285.	-525.5937	-0.000135	13901.	1.140E+10
-2.2381	10035.	0.000				
15.050	0.000501	37677.	-533.9465	-0.000117	13861.	1.140E+10
-0.9994	10301.	0.000				
15.480	-6.155E-05	35025.	-536.1998	-0.000101	13821.	1.140E+10
0.1261	10568.	0.000				
15.910	-0.000542	32358.	-532.9392	-8.576E-05	13780.	1.140E+10
1.1377	10834.	0.000				
16.340	-0.000947	29707.	-524.7499	-7.171E-05	13739.	1.140E+10
2.0364	11100.	0.000				
16.770	-0.001282	27095.	-512.2102	-5.886E-05	13699.	1.140E+10
2.8239	11366.	0.000				
17.200	-0.001554	24546.	-495.8857	-4.717E-05	13660.	1.140E+10
3.5034	11633.	0.000				
17.630	-0.001769	22078.	-476.3240	-3.661E-05	13622.	1.140E+10
4.0787	11899.	0.000				
18.060	-0.001932	19708.	-454.0504	-2.715E-05	13586.	1.140E+10
4.5545	12165.	0.000				
18.490	-0.002049	17450.	-429.5642	-1.874E-05	13551.	1.140E+10
4.9363	12431.	0.000				
18.920	-0.002125	15315.	-403.3359	-1.132E-05	13519.	1.140E+10
5.2298	12698.	0.000				
19.350	-0.002166	13312.	-375.8046	-4.842E-06	13488.	1.140E+10
5.4413	12964.	0.000				
19.780	-0.002175	11447.	-347.3769	7.628E-07	13459.	1.140E+10
5.5772	13230.	0.000				
20.210	-0.002158	9725.0996	-318.4257	5.556E-06	13433.	1.140E+10
5.6442	13496.	0.000				
20.640	-0.002118	8148.9218	-289.2898	9.602E-06	13409.	1.140E+10
5.6488	13763.	0.000				
21.070	-0.002059	6719.2262	-263.0528	1.297E-05	13387.	1.140E+10
4.5206	11330.	0.000				
21.500	-0.001984	5406.6617	-239.8860	1.571E-05	13367.	1.140E+10
4.4588	11596.	0.000				
21.930	-0.001897	4210.2148	-217.1328	1.789E-05	13348.	1.140E+10
4.3603	11862.	0.000				
22.360	-0.001799	3127.8375	-194.9710	1.955E-05	13332.	1.140E+10
4.2296	12129.	0.000				
22.790	-0.001695	2156.5713	-173.5545	2.075E-05	13317.	1.140E+10
4.0713	12395.	0.000				
23.220	-0.001585	1292.6697	-153.0144	2.153E-05	13304.	1.140E+10
3.8899	12661.	0.000				
23.650	-0.001473	531.7181	-133.4591	2.194E-05	13292.	1.140E+10
3.6897	12927.	0.000				
24.080	-0.001359	-131.2500	-114.9754	2.203E-05	13286.	1.140E+10
3.4746	13194.	0.000				
24.510	-0.001245	-701.6423	-97.6297	2.184E-05	13295.	1.140E+10
3.2485	13460.	0.000				
24.940	-0.001133	-1185.2025	-81.4693	2.142E-05	13302.	1.140E+10
3.0152	13726.	0.000				
25.370	-0.001024	-1587.9120	-66.5236	2.079E-05	13308.	1.140E+10
2.7777	13993.	0.000				
25.800	-0.000919	-1915.8984	-52.8056	1.999E-05	13313.	1.140E+10
2.5393	14259.	0.000				
26.230	-0.000818	-2175.3524	-40.3134	1.907E-05	13317.	1.140E+10
2.3026	14525.	0.000				
26.660	-0.000722	-2372.4517	-29.0320	1.804E-05	13320.	1.140E+10

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2.0700	14791.	0.000				
27.090	-0.000632	-2513.2934	-18.9343	1.693E-05	13322.	1.140E+10
1.8438	15058.	0.000				
27.520	-0.000547	-2603.8347	-9.9833	1.577E-05	13324.	1.140E+10
1.6256	15324.	0.000				
27.950	-0.000469	-2649.8405	-2.1330	1.459E-05	13324.	1.140E+10
1.4171	15590.	0.000				
28.380	-0.000397	-2656.8401	4.6696	1.338E-05	13325.	1.140E+10
1.2196	15856.	0.000				
28.810	-0.000331	-2630.0902	10.4836	1.219E-05	13324.	1.140E+10
1.0339	16123.	0.000				
29.240	-0.000271	-2574.5457	15.3727	1.101E-05	13323.	1.140E+10
0.8610	16389.	0.000				
29.670	-0.000217	-2494.8370	19.4038	9.862E-06	13322.	1.140E+10
0.7014	16655.	0.000				
30.100	-0.000169	-2395.2535	22.6460	8.755E-06	13321.	1.140E+10
0.5553	16921.	0.000				
30.530	-0.000127	-2279.7333	25.1696	7.696E-06	13319.	1.140E+10
0.4229	17188.	0.000				
30.960	-8.990E-05	-2151.8575	27.0451	6.693E-06	13317.	1.140E+10
0.3041	17454.	0.000				
31.390	-5.788E-05	-2014.8499	28.3425	5.750E-06	13315.	1.140E+10
0.1988	17720.	0.000				
31.820	-3.056E-05	-1871.5810	29.1301	4.870E-06	13313.	1.140E+10
0.1065	17986.	0.000				
32.250	-7.619E-06	-1724.5753	29.4745	4.056E-06	13310.	1.140E+10
0.0270	18253.	0.000				
32.680	1.130E-05	-1576.0225	29.4395	3.309E-06	13308.	1.140E+10
-0.0405	18519.	0.000				
33.110	2.653E-05	-1427.7909	29.0857	2.629E-06	13306.	1.140E+10
-0.0966	18785.	0.000				
33.540	3.842E-05	-1281.4439	28.4705	2.016E-06	13304.	1.140E+10
-0.1419	19051.	0.000				
33.970	4.733E-05	-1138.2579	27.6474	1.468E-06	13301.	1.140E+10
-0.1772	19318.	0.000				
34.400	5.357E-05	-999.2419	26.6657	9.839E-07	13299.	1.140E+10
-0.2033	19584.	0.000				
34.830	5.748E-05	-865.1588	25.5706	5.618E-07	13297.	1.140E+10
-0.2211	19850.	0.000				
35.260	5.937E-05	-736.5472	24.4029	1.992E-07	13295.	1.140E+10
-0.2315	20116.	0.000				
35.690	5.954E-05	-613.7440	23.1990	-1.064E-07	13293.	1.140E+10
-0.2352	20383.	0.000				
36.120	5.827E-05	-496.9073	21.9906	-3.579E-07	13291.	1.140E+10
-0.2332	20649.	0.000				
36.550	5.584E-05	-386.0404	20.8050	-5.577E-07	13290.	1.140E+10
-0.2264	20915.	0.000				
36.980	5.252E-05	-281.0146	19.6648	-7.087E-07	13288.	1.140E+10
-0.2156	21181.	0.000				
37.410	4.853E-05	-181.5934	17.3361	-8.135E-07	13287.	1.140E+10
-0.6870	73049.	0.000				
37.840	4.412E-05	-100.3774	13.9212	-8.773E-07	13285.	1.140E+10
-0.6366	74447.	0.000				
38.270	3.948E-05	-36.0619	10.7819	-9.082E-07	13284.	1.140E+10
-0.5802	75845.	0.000				
38.700	3.475E-05	12.8215	7.9428	-9.134E-07	13284.	1.140E+10
-0.5202	77243.	0.000				
39.130	3.005E-05	47.8491	5.4193	-8.997E-07	13285.	1.140E+10
-0.4580	78640.	0.000				
39.560	2.546E-05	70.6600	3.2187	-8.729E-07	13285.	1.140E+10
-0.3950	80038.	0.000				
39.990	2.104E-05	82.9208	1.3429	-8.381E-07	13285.	1.140E+10
-0.3321	81436.	0.000				

```

Bridge 11 Bent 2 Longitudinal Provided.lp6o
  40.420  1.681E-05  86.2998  -0.2102 -7.998E-07  13285.  1.140E+10
-0.2699  82834.  0.000
  40.850  1.279E-05  82.4507  -1.4452 -7.616E-07  13285.  1.140E+10
-0.2087  84232.  0.000
  41.280  8.954E-06  73.0041  -2.3671 -7.264E-07  13285.  1.140E+10
-0.1486  85630.  0.000
  41.710  5.291E-06  59.5662  -2.9806 -6.964E-07  13285.  1.140E+10
-0.0892  87027.  0.000
  42.140  1.767E-06  43.7237  -4.3240 -6.730E-07  13285.  1.140E+10
-0.4314 1259920.  0.000
  42.570 -1.655E-06  16.3730  -4.3726 -6.594E-07  13284.  1.140E+10
0.4126 1286545.  0.000
  43.000 -5.038E-06  0.000  0.000 -6.557E-07  13284.  1.140E+10
1.2822  656585.  0.000

```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```

Pile-head deflection          = 0.0649729 inches
Computed slope at pile head  = 0.000000 radians
Maximum bending moment        = -192168. inch-lbs
Maximum shear force           = 3170.000000 lbs
Depth of maximum bending moment = 0.000000 inches below pile head
Depth of maximum shear force   = 0.000000 inches below pile head
Number of iterations          = 6
Number of zero deflection points = 3

```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

```

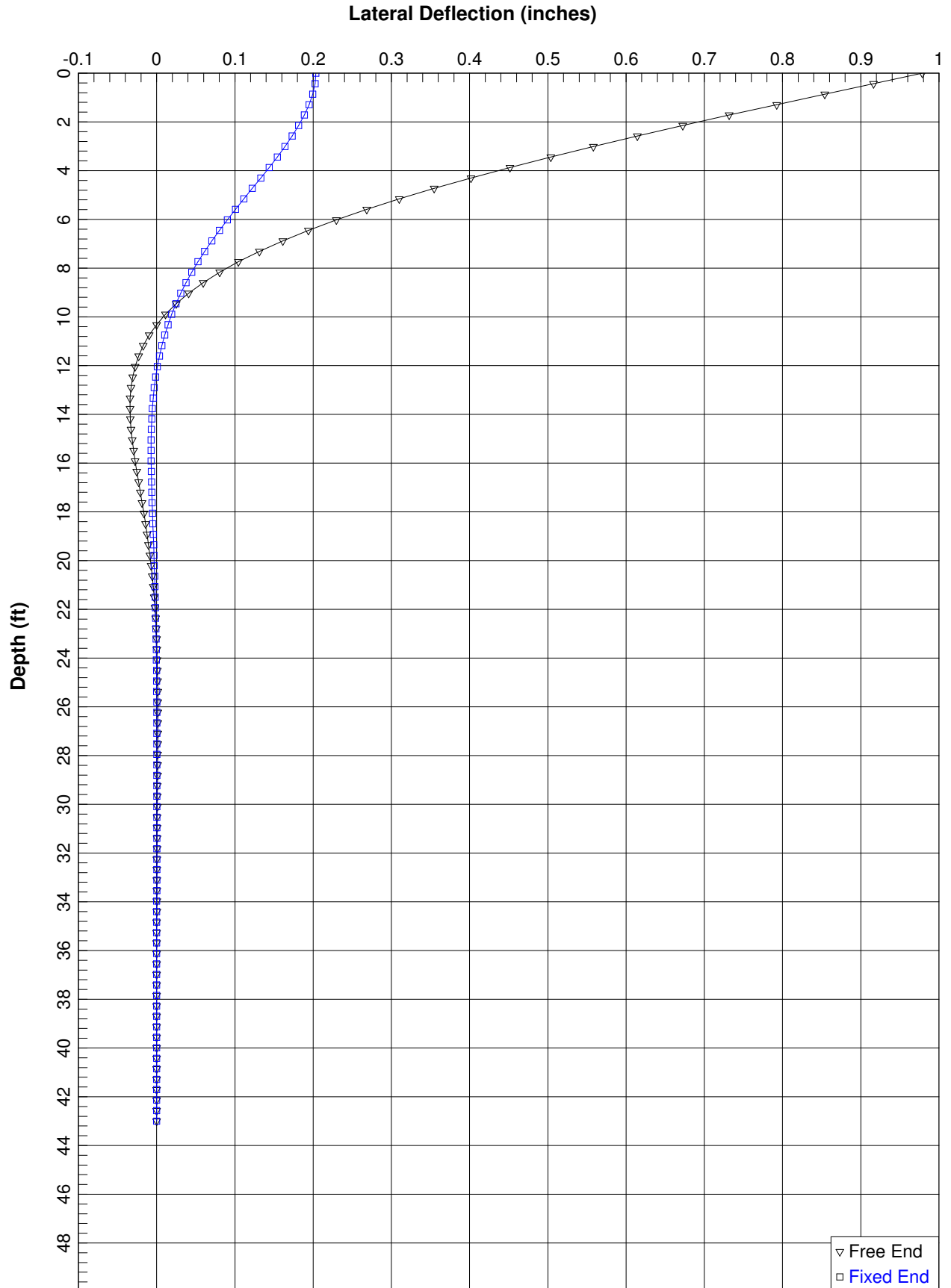
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

```

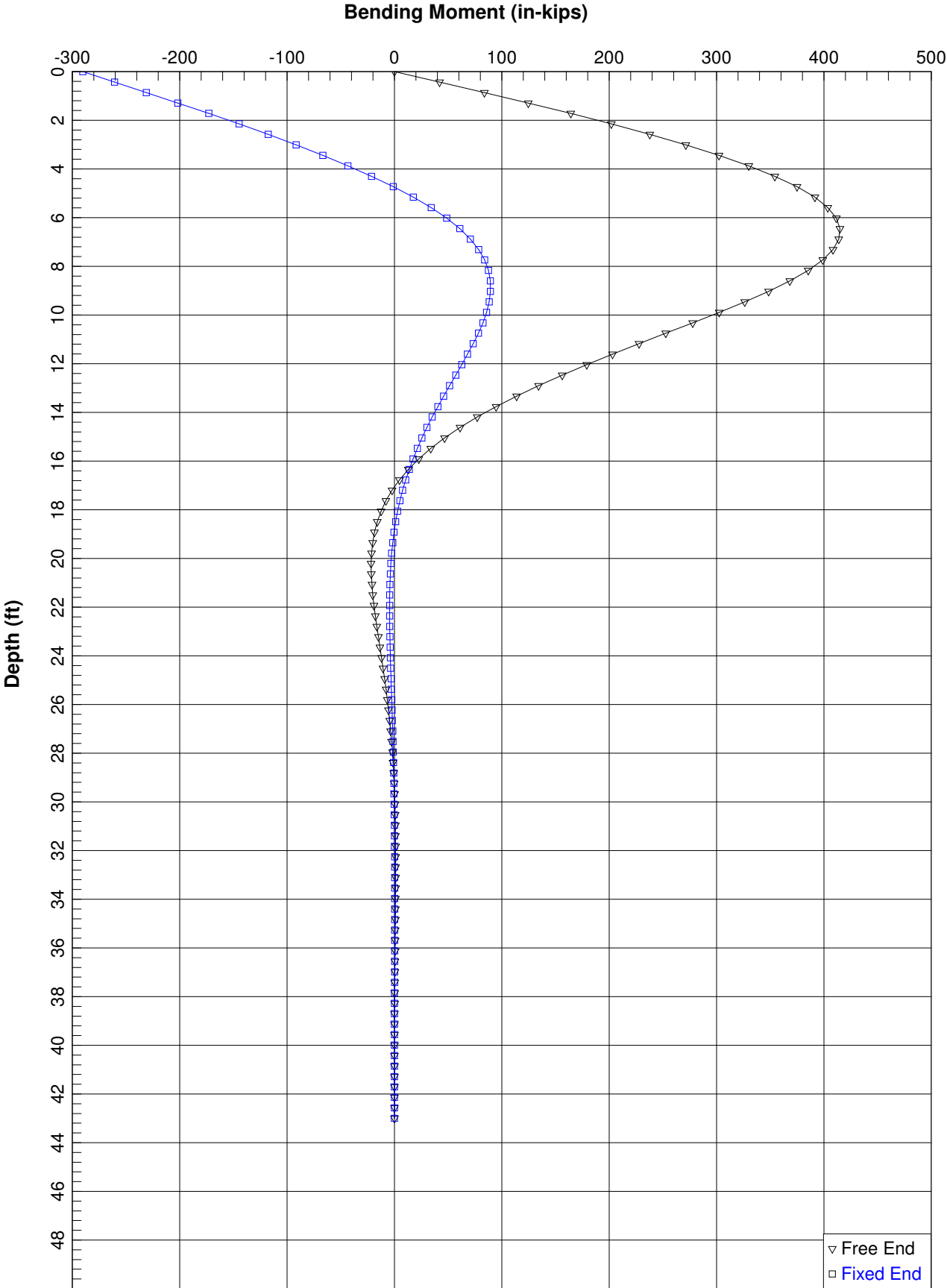
Load Case No.	Maximum Load Type No.	Pile-head Condition 1 Shear V(lbs) or Rotation y(inches) or radians	Pile-head Condition 2 Pile-head in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
1	1	V = 3170.0000	M = 0.000	205900.	0.19011489	
184301.		3170.0000	-0.00206046			
2	2	V = 3170.0000	S = 0.000	205900.	0.06497286	
-192168.		3170.0000	0.00000000			

The analysis ended normally.

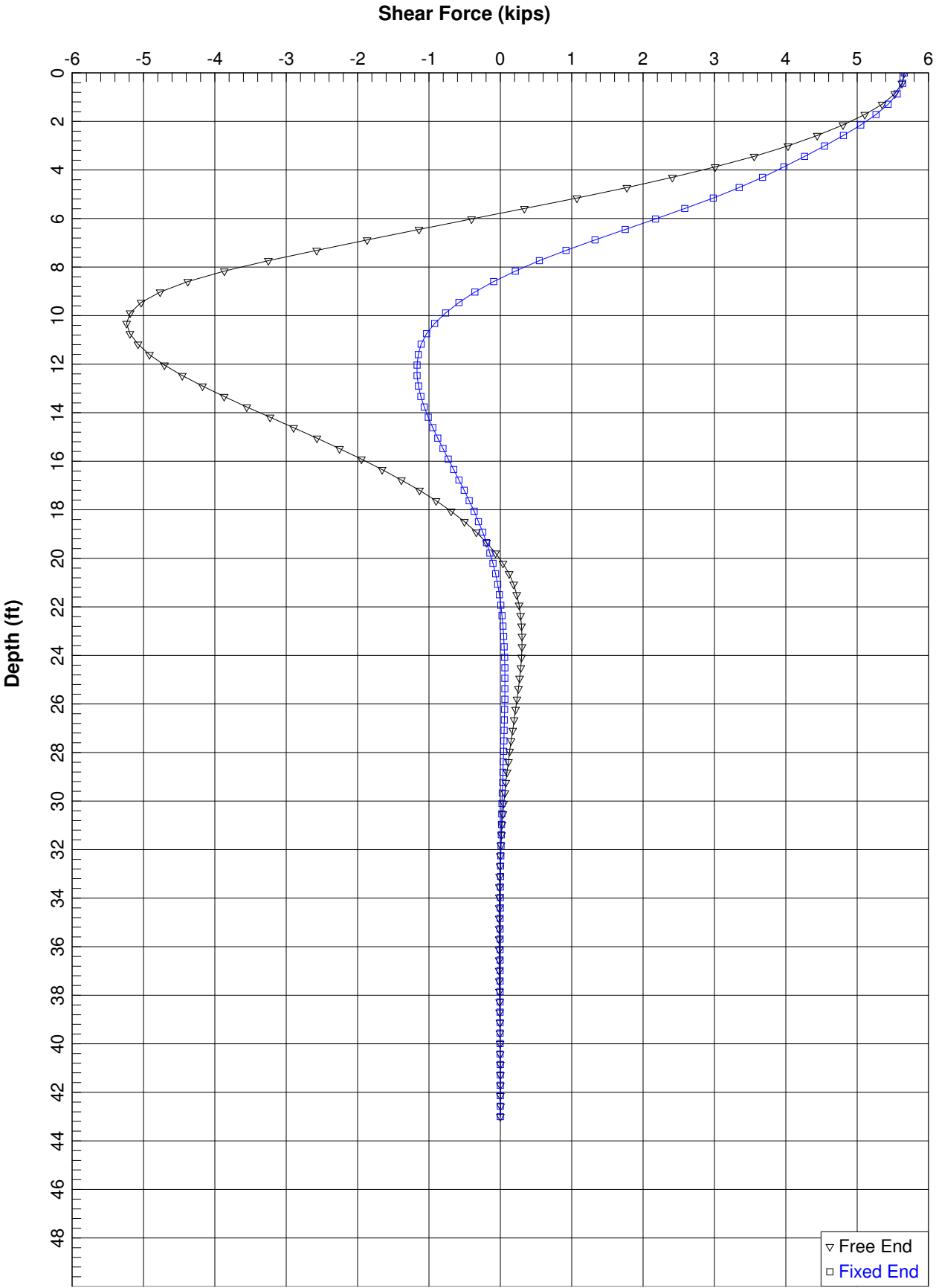
Bridge 11 Bent 2 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-02



Bridge 11 Bent 2 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-02



Bridge 11 Bent 2 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-02



Bridge 11 Bent 2 Transverse Provided.lp6o

LPILE Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 Bent 2\Service\
Name of input data file: Bridge 11 Bent 2 Transverse Provided.lp6d
Name of output report file: Bridge 11 Bent 2 Transverse Provided.lp6o
Name of plot output file: Bridge 11 Bent 2 Transverse Provided.lp6p
Name of runtime message file: Bridge 11 Bent 2 Transverse Provided.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 9:59:09

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 Bent 2 (Boring B11-SPT-02)

Bridge 11 Bent 2 Transverse Provided.lp6o

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 43.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth x ft	Pile Diameter in
1	0.00000	12.0450000
2	43.000000	12.0450000

Input Structural Properties:

Bridge 11 Bent 2 Transverse Provided.lp60

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	43.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	127.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	5.00000 ft
Effective unit weight at top of layer	=	95.00000 pcf
Effective unit weight at bottom of layer	=	95.00000 pcf
Friction angle at top of layer	=	27.00000 deg.
Friction angle at bottom of layer	=	27.00000 deg.
Subgrade k at top of layer	=	20.00000 pci
Subgrade k at bottom of layer	=	20.00000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	5.00000 ft
Distance from top of pile to bottom of layer	=	11.00000 ft
Effective unit weight at top of layer	=	40.00000 pcf
Effective unit weight at bottom of layer	=	40.00000 pcf
Friction angle at top of layer	=	30.00000 deg.
Friction angle at bottom of layer	=	30.00000 deg.
Subgrade k at top of layer	=	30.00000 pci
Subgrade k at bottom of layer	=	30.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	11.00000 ft
Distance from top of pile to bottom of layer	=	21.00000 ft
Effective unit weight at top of layer	=	40.00000 pcf
Effective unit weight at bottom of layer	=	40.00000 pcf

Bridge 11 Bent 2 Transverse Provided.lp6o

Friction angle at top of layer	=	26.00000	deg.
Friction angle at bottom of layer	=	26.00000	deg.
Subgrade k at top of layer	=	20.00000	pci
Subgrade k at bottom of layer	=	20.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	21.00000	ft
Distance from top of pile to bottom of layer	=	37.00000	ft
Effective unit weight at top of layer	=	47.00000	pcf
Effective unit weight at bottom of layer	=	47.00000	pcf
Friction angle at top of layer	=	29.00000	deg.
Friction angle at bottom of layer	=	29.00000	deg.
Subgrade k at top of layer	=	20.00000	pci
Subgrade k at bottom of layer	=	20.00000	pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	37.00000	ft
Distance from top of pile to bottom of layer	=	42.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	42.00000	ft
Distance from top of pile to bottom of layer	=	52.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

Layer 7 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	52.00000	ft
Distance from top of pile to bottom of layer	=	57.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 8 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	57.00000	ft
Distance from top of pile to bottom of layer	=	67.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf

Bridge 11 Bent 2 Transverse Provided.lp60

Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 24.00 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor (p-y Curve Epsilon 50	Layer Soil Type kpy (Criteria) pci	Layer Depth ft	Effective Unit wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	95.000	--
27.000	--	20.000			
			5.000	95.000	--
27.000	--	20.000			
2	Sand (Reese, et al.)		5.000	40.000	--
30.000	--	30.000			
			11.000	40.000	--
30.000	--	30.000			
3	Sand (Reese, et al.)		11.000	40.000	--
26.000	--	20.000			
			21.000	40.000	--
26.000	--	20.000			
4	Sand (Reese, et al.)		21.000	47.000	--
29.000	--	20.000			
			37.000	47.000	--
29.000	--	20.000			
5	Sand (Reese, et al.)		37.000	75.000	--
36.000	--	105.000			
			42.000	75.000	--
36.000	--	105.000			
6	Stiff Clay w/o Free Water, using k		42.000	75.000	8000.000
--	0.00400	2000.000			
			52.000	75.000	8000.000
--	0.00400	2000.000			
7	Sand (Reese, et al.)		52.000	75.000	--
36.000	--	105.000			
			57.000	75.000	--
36.000	--	105.000			
8	Stiff Clay w/o Free Water, using k		57.000	75.000	8000.000
--	0.00400	2000.000			
			67.000	75.000	8000.000
--	0.00400	2000.000			

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Bridge 11 Bent 2 Transverse Provided.lp6o

Point No.	Depth X ft	p-mult	y-mult
1	0.000	0.5000	1.0000
2	43.000	0.5000	1.0000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y vs. Pile Length				
1	1	V = 5660.00000 lbs	M = 0.0000 in-lbs	205900.
2	2	V = 5660.00000 lbs	S = 0.0000 in/in	205900.
	No			
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Bridge 11 Bent 2 Transverse Provided.lp60

Shear force at pile head = 5660.000 lbs
 Applied moment at pile head = 0.000 in-lbs
 Axial thrust load on pile head = 205900.000 lbs

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. Load inches lb/inch	Bending Distrib. Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.00	0.9787	2.764E-07	5660.0000	-0.0121	13284.	3.683E+09	
	0.430	0.9162	42069.	5627.5059	-0.0121	15279.	3.683E+09	
-12.5946	0.860	0.8541	83740.	5525.8594	-0.0120	17255.	3.683E+09	
-26.8033	1.290	0.7925	124573.	5351.4639	-0.0118	19191.	3.683E+09	
-40.7918	1.720	0.7318	164135.	5107.6159	-0.0116	21067.	3.683E+09	
-53.7229	2.150	0.6724	202021.	4800.7465	-0.0114	22864.	3.683E+09	
-65.2188	2.580	0.6143	237871.	4439.6721	-0.0111	24564.	3.683E+09	
-74.7325	3.010	0.5580	271376.	4028.5936	-0.0107	26153.	3.683E+09	
-84.6002	3.440	0.5037	302225.	3555.1540	-0.0103	27616.	3.683E+09	
-98.9035	3.870	0.4516	329991.	3009.8872	-0.009876	28932.	3.683E+09	
-112.4402	4.300	0.4018	354272.	2410.7044	-0.009396	30084.	3.683E+09	
-119.8012	4.730	0.3546	374836.	1772.4708	-0.008886	31059.	3.683E+09	
-127.5761	5.160	0.3101	391445.	1074.0998	-0.008349	31847.	3.683E+09	
-143.1103	5.590	0.2684	403660.	336.0619	-0.007792	32426.	3.683E+09	
-142.9509	6.020	0.2297	411469.	-402.2394	-0.007221	32796.	3.683E+09	
-143.2124	6.450	0.1939	414853.	-1138.7723	-0.006642	32957.	3.683E+09	
-142.2655	6.880	0.1611	413831.	-1865.8483	-0.006061	32908.	3.683E+09	
-139.5469	7.310	0.1314	408477.	-2573.3255	-0.005485	32654.	3.683E+09	
-134.6691	7.740	0.1045	398930.	-3249.8288	-0.004920	32202.	3.683E+09	
-127.5415	8.170	0.0806	385393.	-3867.0763	-0.004370	31560.	3.683E+09	
-111.7017	8.600	0.0594	368308.	-4379.6550	-0.003842	30749.	3.683E+09	
-86.9722	9.030	0.0409	348359.	-4766.7649	-0.003340	29804.	3.683E+09	
-63.0704	9.460	0.0250	326213.	-5033.6706	-0.002868	28753.	3.683E+09	
-40.3814	9.890	0.0113	302505.	-5187.4380	-0.002427	27629.	3.683E+09	
-19.2184	10.320	-9.872E-05	277836.	-5236.5698	-0.002021	26459.	3.683E+09	
0.1750	9149.6865	0.000	0.000					

Bridge 11 Bent 2 Transverse Provided.lp6o

10.750	-0.009522	252758.	-5190.6559	-0.001649	25270.	3.683E+09
17.6210	9549.0705	0.000				
11.180	-0.0171	227773.	-5077.5355	-0.001313	24085.	3.683E+09
26.2241	7905.0928	0.000				
11.610	-0.0231	203147.	-4915.6337	-0.001011	22917.	3.683E+09
36.5285	8171.3488	0.000				
12.040	-0.0275	179191.	-4705.1733	-0.000743	21781.	3.683E+09
45.0453	8437.6048	0.000				
12.470	-0.0307	156168.	-4455.2105	-0.000508	20690.	3.683E+09
51.8395	8703.8608	0.000				
12.900	-0.0328	134292.	-4174.4056	-0.000304	19652.	3.683E+09
56.9997	8970.1168	0.000				
13.330	-0.0339	113735.	-3870.9101	-0.000131	18677.	3.683E+09
60.6343	9236.3728	0.000				
13.760	-0.0341	94622.	-3552.2778	1.530E-05	17771.	3.683E+09
62.8666	9502.6288	0.000				
14.190	-0.0337	77043.	-3225.3975	0.000136	16937.	3.683E+09
63.8311	9768.8848	0.000				
14.620	-0.0327	61048.	-2896.4472	0.000232	16179.	3.683E+09
63.6690	10035.	0.000				
15.050	-0.0313	46658.	-2570.8670	0.000308	15496.	3.683E+09
62.5249	10301.	0.000				
15.480	-0.0296	33863.	-2253.3507	0.000364	14890.	3.683E+09
60.5435	10568.	0.000				
15.910	-0.0276	22629.	-1947.8523	0.000404	14357.	3.683E+09
57.8668	10834.	0.000				
16.340	-0.0254	12903.	-1657.6063	0.000429	13896.	3.683E+09
54.6316	11100.	0.000				
16.770	-0.0231	4612.1536	-1385.1603	0.000441	13503.	3.683E+09
50.9676	11366.	0.000				
17.200	-0.0208	-2328.5921	-1132.4159	0.000442	13394.	3.683E+09
46.9953	11633.	0.000				
17.630	-0.0186	-8014.5927	-900.6784	0.000435	13664.	3.683E+09
42.8254	11899.	0.000				
18.060	-0.0164	-12548.	-690.7110	0.000421	13879.	3.683E+09
38.5573	12165.	0.000				
18.490	-0.0142	-16037.	-502.7934	0.000401	14044.	3.683E+09
34.2790	12431.	0.000				
18.920	-0.0122	-18589.	-336.7819	0.000377	14165.	3.683E+09
30.0666	12698.	0.000				
19.350	-0.0103	-20313.	-192.1707	0.000349	14247.	3.683E+09
25.9843	12964.	0.000				
19.780	-0.008614	-21314.	-68.1520	0.000320	14295.	3.683E+09
22.0850	13230.	0.000				
20.210	-0.007039	-21696.	36.3257	0.000290	14313.	3.683E+09
18.4102	13496.	0.000				
20.640	-0.005621	-21556.	122.5018	0.000260	14306.	3.683E+09
14.9914	13763.	0.000				
21.070	-0.004358	-20984.	185.8701	0.000230	14279.	3.683E+09
9.5700	11330.	0.000				
21.500	-0.003248	-20126.	229.3931	0.000201	14238.	3.683E+09
7.2993	11596.	0.000				
21.930	-0.002283	-19044.	261.7665	0.000174	14187.	3.683E+09
5.2485	11862.	0.000				
22.360	-0.001456	-17794.	284.1357	0.000148	14128.	3.683E+09
3.4217	12129.	0.000				
22.790	-0.000757	-16426.	297.6557	0.000124	14063.	3.683E+09
1.8186	12395.	0.000				
23.220	-0.000177	-14985.	303.4690	0.000102	13994.	3.683E+09
0.4347	12661.	0.000				
23.650	0.000294	-13510.	302.6873	8.193E-05	13925.	3.683E+09
-0.7377	12927.	0.000				
24.080	0.000668	-12035.	296.3751	6.403E-05	13855.	3.683E+09

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-1.7089	13194.	0.000				
24.510	0.000955	-10588.	285.5372	4.818E-05	13786.	3.683E+09
-2.4918	13460.	0.000				
24.940	0.001166	-9191.0592	271.1086	3.433E-05	13720.	3.683E+09
-3.1007	13726.	0.000				
25.370	0.001310	-7863.0502	253.9470	2.238E-05	13657.	3.683E+09
-3.5511	13993.	0.000				
25.800	0.001397	-6617.8872	234.8282	1.224E-05	13598.	3.683E+09
-3.8593	14259.	0.000				
26.230	0.001436	-5465.6289	214.4434	3.774E-06	13543.	3.683E+09
-4.0418	14525.	0.000				
26.660	0.001436	-4412.8497	193.3988	-3.146E-06	13493.	3.683E+09
-4.1151	14791.	0.000				
27.090	0.001403	-3463.0675	172.2164	-8.663E-06	13448.	3.683E+09
-4.0952	15058.	0.000				
27.520	0.001346	-2617.1677	151.3367	-1.292E-05	13408.	3.683E+09
-3.9977	15324.	0.000				
27.950	0.001270	-1873.8130	131.1230	-1.607E-05	13373.	3.683E+09
-3.8371	15590.	0.000				
28.380	0.001180	-1229.8342	111.8656	-1.824E-05	13342.	3.683E+09
-3.6270	15856.	0.000				
28.810	0.001082	-680.5964	93.7876	-1.958E-05	13316.	3.683E+09
-3.3799	16123.	0.000				
29.240	0.000978	-220.3380	77.0514	-2.021E-05	13294.	3.683E+09
-3.1070	16389.	0.000				
29.670	0.000873	157.5224	61.7641	-2.026E-05	13291.	3.683E+09
-2.8183	16655.	0.000				
30.100	0.000769	460.1100	47.9851	-1.982E-05	13306.	3.683E+09
-2.5224	16921.	0.000				
30.530	0.000669	694.8512	35.7316	-1.901E-05	13317.	3.683E+09
-2.2269	17188.	0.000				
30.960	0.000573	869.2644	24.9859	-1.792E-05	13325.	3.683E+09
-1.9381	17454.	0.000				
31.390	0.000484	990.7815	15.7006	-1.662E-05	13331.	3.683E+09
-1.6609	17720.	0.000				
31.820	0.000401	1066.6015	7.8049	-1.517E-05	13334.	3.683E+09
-1.3995	17986.	0.000				
32.250	0.000327	1103.5720	1.2095	-1.365E-05	13336.	3.683E+09
-1.1569	18253.	0.000				
32.680	0.000261	1108.0979	-4.1879	-1.211E-05	13336.	3.683E+09
-0.9352	18519.	0.000				
33.110	0.000202	1086.0747	-8.4991	-1.057E-05	13335.	3.683E+09
-0.7358	18785.	0.000				
33.540	0.000152	1042.8434	-11.8407	-9.077E-06	13333.	3.683E+09
-0.5594	19051.	0.000				
33.970	0.000108	983.1656	-14.3314	-7.657E-06	13330.	3.683E+09
-0.4060	19318.	0.000				
34.400	7.249E-05	911.2145	-16.0886	-6.330E-06	13327.	3.683E+09
-0.2751	19584.	0.000				
34.830	4.311E-05	830.5822	-17.2263	-5.110E-06	13323.	3.683E+09
-0.1659	19850.	0.000				
35.260	1.975E-05	744.2974	-17.8529	-4.007E-06	13319.	3.683E+09
-0.0770	20116.	0.000				
35.690	1.762E-06	654.8548	-18.0695	-3.027E-06	13315.	3.683E+09
-0.006962	20383.	0.000				
36.120	-1.149E-05	564.2521	-17.9688	-2.173E-06	13311.	3.683E+09
0.0460	20649.	0.000				
36.550	-2.066E-05	474.0337	-17.6341	-1.446E-06	13306.	3.683E+09
0.0837	20915.	0.000				
36.980	-2.641E-05	385.3396	-17.1384	-8.436E-07	13302.	3.683E+09
0.1084	21181.	0.000				
37.410	-2.937E-05	298.9582	-15.7861	-3.642E-07	13298.	3.683E+09
0.4158	73049.	0.000				

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37.840	-3.017E-05	223.2013	-13.5905	1.579E-09	13294.	3.683E+09
0.4352	74447.	0.000				
38.270	-2.935E-05	158.7005	-11.3546	2.691E-07	13291.	3.683E+09
0.4314	75845.	0.000				
38.700	-2.739E-05	105.4503	-9.1837	4.541E-07	13289.	3.683E+09
0.4100	77243.	0.000				
39.130	-2.466E-05	62.9597	-7.1561	5.721E-07	13287.	3.683E+09
0.3759	78640.	0.000				
39.560	-2.148E-05	30.3838	-5.3265	6.375E-07	13285.	3.683E+09
0.3333	80038.	0.000				
39.990	-1.809E-05	6.6358	-3.7303	6.634E-07	13284.	3.683E+09
0.2854	81436.	0.000				
40.420	-1.464E-05	-9.5224	-2.3876	6.614E-07	13284.	3.683E+09
0.2350	82834.	0.000				
40.850	-1.126E-05	-19.4097	-1.3071	6.412E-07	13285.	3.683E+09
0.1838	84232.	0.000				
41.280	-8.021E-06	-24.3744	-0.4895	6.105E-07	13285.	3.683E+09
0.1331	85630.	0.000				
41.710	-4.959E-06	-25.7587	0.0697	5.754E-07	13285.	3.683E+09
0.0836	87027.	0.000				
42.140	-2.084E-06	-24.8775	1.5981	5.399E-07	13285.	3.683E+09
0.5087	1259920.	0.000				
42.570	6.124E-07	-10.4138	2.5167	5.152E-07	13284.	3.683E+09
-0.1527	1286545.	0.000				
43.000	3.233E-06	0.000	0.000	5.079E-07	13284.	3.683E+09
-0.8228	656585.	0.000				

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.9787101 inches
Computed slope at pile head	=	-0.0121075 radians
Maximum bending moment	=	414853. inch-lbs
Maximum shear force	=	5660.000000 lbs
Depth of maximum bending moment	=	77.4000000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	16
Number of zero deflection points	=	4

Computed values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	5660.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	205900.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
feet	Es*h	Lat. Load	in-lbs	lbs	radians	psi*	lb-in^2	lb/in
lb/inch	lb/inch	lb/inch						

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0.000	0.00	0.2035	-290173.	5660.0000	0.000	27044.	3.683E+09
	0.430	0.2025	-260752.	5635.8696	-0.000386	25649.	3.683E+09
-9.3529	238.3663	0.1995	-231191.	5561.1789	-0.000731	24247.	3.683E+09
-19.5970	506.7901	0.1949	-201808.	5434.9402	-0.001034	22854.	3.683E+09
-29.3328	776.4853	0.1889	-172906.	5261.7905	-0.001296	21483.	3.683E+09
-37.7795	1032.1964	0.1815	-144752.	5049.2713	-0.001519	20148.	3.683E+09
-44.5923	1267.4155	0.1732	-117570.	4806.8718	-0.001703	18859.	3.683E+09
-49.3611	1470.6842	0.1640	-91527.	4544.5120	-0.001849	17624.	3.683E+09
-52.3288	1646.6815	0.1541	-66741.	4264.9847	-0.001960	16449.	3.683E+09
-56.0151	1875.6055	0.1437	-43347.	3973.9648	-0.002037	15339.	3.683E+09
-56.7833	2038.2873	0.1331	-21401.	3672.1201	-0.002082	14299.	3.683E+09
-60.2108	2334.5766	0.1223	-1026.0886	3348.1544	-0.002098	13333.	3.683E+09
-65.3573	2758.4590	0.1114	17610.	2982.3287	-0.002087	14119.	3.683E+09
-76.4356	3539.5831	0.1007	34185.	2583.8786	-0.002050	14905.	3.683E+09
-78.0024	3995.9630	0.0903	48632.	2173.6641	-0.001992	15590.	3.683E+09
-80.9955	4629.9087	0.0802	60851.	1750.1663	-0.001916	16169.	3.683E+09
-83.1509	5352.2215	0.0705	70765.	1325.7358	-0.001823	16640.	3.683E+09
-81.3570	5954.6145	0.0613	78407.	920.9339	-0.001719	17002.	3.683E+09
-75.5430	6353.9985	0.0528	83921.	547.8735	-0.001605	17264.	3.683E+09
-69.0541	6753.3825	0.0448	87472.	209.5554	-0.001485	17432.	3.683E+09
-62.0770	7152.7665	0.0374	89239.	-91.9621	-0.001361	17516.	3.683E+09
-54.7903	7552.1505	0.0307	89415.	-355.5108	-0.001236	17524.	3.683E+09
-47.3604	7951.5345	0.0247	88197.	-580.7438	-0.001112	17466.	3.683E+09
-39.9392	8350.9185	0.0193	85784.	-768.0548	-0.000990	17352.	3.683E+09
-32.6620	8750.3025	0.0145	82374.	-918.4885	-0.000872	17190.	3.683E+09
-25.6457	9149.6865	0.0103	78158.	-1033.6454	-0.000760	16990.	3.683E+09
-18.9888	9549.0705	0.00624	73321.	-1108.8177	-0.000653	16761.	3.683E+09
-10.1477	7905.0928	0.003517	68104.	-1149.3677	-0.000554	16513.	3.683E+09
-5.5693	8171.3488	0.000902	62638.	-1167.5431	-0.000463	16254.	3.683E+09
-1.4754	8437.6048	0.0001260	57039.	-1165.8682	-0.000379	15989.	3.683E+09
2.1246	8703.8608	0.003009	51411.	-1146.8914	-0.000303	15722.	3.683E+09
5.2308	8970.1168	0.000					

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13.330	-0.004387	45846.	-1113.1370	-0.000235	15458.	3.683E+09
7.8523	9236.3728	0.000				
13.760	-0.005433	40423.	-1067.0637	-0.000174	15201.	3.683E+09
10.0056	9502.6288	0.000				
14.190	-0.006187	35205.	-1011.0282	-0.000121	14953.	3.683E+09
11.7136	9768.8848	0.000				
14.620	-0.006687	30247.	-947.2554	-7.563E-05	14718.	3.683E+09
13.0045	10035.	0.000				
15.050	-0.006968	25590.	-877.8148	-3.652E-05	14497.	3.683E+09
13.9104	10301.	0.000				
15.480	-0.007064	21266.	-804.6025	-3.697E-06	14292.	3.683E+09
14.4665	10568.	0.000				
15.910	-0.007006	17294.	-729.3283	2.332E-05	14104.	3.683E+09
14.7096	10834.	0.000				
16.340	-0.006823	13689.	-653.5087	4.502E-05	13933.	3.683E+09
14.6778	11100.	0.000				
16.770	-0.006541	10455.	-578.4643	6.193E-05	13780.	3.683E+09
14.4092	11366.	0.000				
17.200	-0.006184	7587.9900	-505.3206	7.457E-05	13644.	3.683E+09
13.9411	11633.	0.000				
17.630	-0.005772	5081.2536	-435.0140	8.345E-05	13525.	3.683E+09
13.3096	11899.	0.000				
18.060	-0.005323	2921.3292	-368.2990	8.905E-05	13422.	3.683E+09
12.5489	12165.	0.000				
18.490	-0.004853	1091.1794	-305.7597	9.186E-05	13336.	3.683E+09
11.6911	12431.	0.000				
18.920	-0.004375	-429.3123	-247.8222	9.233E-05	13304.	3.683E+09
10.7653	12698.	0.000				
19.350	-0.003900	-1662.5316	-194.7687	9.086E-05	13363.	3.683E+09
9.7980	12964.	0.000				
19.780	-0.003437	-2632.3980	-146.7535	8.785E-05	13409.	3.683E+09
8.8125	13230.	0.000				
20.210	-0.002993	-3363.7068	-103.8181	8.365E-05	13443.	3.683E+09
7.8291	13496.	0.000				
20.640	-0.002574	-3881.5553	-65.9084	7.858E-05	13468.	3.683E+09
6.8646	13763.	0.000				
21.070	-0.002182	-4210.8507	-35.8349	7.291E-05	13484.	3.683E+09
4.7917	11330.	0.000				
21.500	-0.001821	-4406.2954	-12.9121	6.687E-05	13493.	3.683E+09
4.0931	11596.	0.000				
21.930	-0.001492	-4486.2006	6.4985	6.064E-05	13497.	3.683E+09
3.4304	11862.	0.000				
22.360	-0.001195	-4468.0916	22.5987	5.437E-05	13496.	3.683E+09
2.8100	12129.	0.000				
22.790	-0.000931	-4368.5142	35.6187	4.818E-05	13491.	3.683E+09
2.2365	12395.	0.000				
23.220	-0.000698	-4202.8849	45.8093	4.218E-05	13483.	3.683E+09
1.7133	12661.	0.000				
23.650	-0.000496	-3985.3816	53.4344	3.644E-05	13473.	3.683E+09
1.2422	12927.	0.000				
24.080	-0.000322	-3728.8727	58.7646	3.104E-05	13461.	3.683E+09
0.8238	13194.	0.000				
24.510	-0.000176	-3444.8790	62.0713	2.601E-05	13447.	3.683E+09
0.4578	13460.	0.000				
24.940	-5.375E-05	-3143.5673	63.6214	2.140E-05	13433.	3.683E+09
0.1430	13726.	0.000				
25.370	4.529E-05	-2833.7691	63.6735	1.721E-05	13418.	3.683E+09
-0.1228	13993.	0.000				
25.800	0.000124	-2523.0225	62.4738	1.346E-05	13404.	3.683E+09
-0.3422	14259.	0.000				
26.230	0.000184	-2217.6317	60.2535	1.013E-05	13389.	3.683E+09
-0.5184	14525.	0.000				
26.660	0.000228	-1922.7416	57.2268	7.234E-06	13375.	3.683E+09

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-0.6548	14791.	0.000				
27.090	0.000259	-1642.4240	53.5889	4.737E-06	13362.	3.683E+09
-0.7552	15058.	0.000				
27.520	0.000277	-1379.7702	49.5156	2.620E-06	13349.	3.683E+09
-0.8236	15324.	0.000				
27.950	0.000286	-1136.9901	45.1627	8.569E-07	13338.	3.683E+09
-0.8636	15590.	0.000				
28.380	0.000286	-915.5124	40.6658	-5.809E-07	13327.	3.683E+09
-0.8793	15856.	0.000				
28.810	0.000280	-716.0851	36.1411	-1.724E-06	13318.	3.683E+09
-0.8744	16123.	0.000				
29.240	0.000268	-538.8734	31.6860	-2.603E-06	13309.	3.683E+09
-0.8524	16389.	0.000				
29.670	0.000253	-383.5545	27.3801	-3.249E-06	13302.	3.683E+09
-0.8166	16655.	0.000				
30.100	0.000235	-249.4065	23.2865	-3.693E-06	13296.	3.683E+09
-0.7701	16921.	0.000				
30.530	0.000215	-135.3919	19.4529	-3.962E-06	13290.	3.683E+09
-0.7158	17188.	0.000				
30.960	0.000194	-40.2333	15.9137	-4.085E-06	13286.	3.683E+09
-0.6560	17454.	0.000				
31.390	0.000173	37.5180	12.6908	-4.087E-06	13286.	3.683E+09
-0.5932	17720.	0.000				
31.820	0.000152	99.4204	9.7956	-3.991E-06	13289.	3.683E+09
-0.5290	17986.	0.000				
32.250	0.000132	147.0890	7.2303	-3.818E-06	13291.	3.683E+09
-0.4653	18253.	0.000				
32.680	0.000112	182.1503	4.9894	-3.588E-06	13293.	3.683E+09
-0.4033	18519.	0.000				
33.110	9.451E-05	206.2033	3.0613	-3.316E-06	13294.	3.683E+09
-0.3441	18785.	0.000				
33.540	7.815E-05	220.7885	1.4292	-3.017E-06	13294.	3.683E+09
-0.2885	19051.	0.000				
33.970	6.338E-05	227.3630	0.0727	-2.703E-06	13295.	3.683E+09
-0.2373	19318.	0.000				
34.400	5.025E-05	227.2817	-1.0315	-2.384E-06	13295.	3.683E+09
-0.1907	19584.	0.000				
34.830	3.877E-05	221.7838	-1.9084	-2.070E-06	13294.	3.683E+09
-0.1492	19850.	0.000				
35.260	2.889E-05	211.9844	-2.5839	-1.766E-06	13294.	3.683E+09
-0.1126	20116.	0.000				
35.690	2.055E-05	198.8702	-3.0839	-1.478E-06	13293.	3.683E+09
-0.0812	20383.	0.000				
36.120	1.364E-05	183.2988	-3.4342	-1.210E-06	13293.	3.683E+09
-0.0546	20649.	0.000				
36.550	8.060E-06	166.0009	-3.6593	-9.656E-07	13292.	3.683E+09
-0.0327	20915.	0.000				
36.980	3.678E-06	147.5860	-3.7826	-7.459E-07	13291.	3.683E+09
-0.0151	21181.	0.000				
37.410	3.624E-07	128.5496	-3.8348	-5.524E-07	13290.	3.683E+09
-0.005131	73049.	0.000				
37.840	-2.024E-06	109.1851	-3.7727	-3.859E-07	13289.	3.683E+09
0.0292	74447.	0.000				
38.270	-3.620E-06	90.4355	-3.5601	-2.461E-07	13288.	3.683E+09
0.0532	75845.	0.000				
38.700	-4.563E-06	72.9680	-3.2466	-1.316E-07	13287.	3.683E+09
0.0683	77243.	0.000				
39.130	-4.978E-06	57.2106	-2.8746	-4.041E-08	13287.	3.683E+09
0.0759	78640.	0.000				
39.560	-4.980E-06	43.3881	-2.4796	3.006E-08	13286.	3.683E+09
0.0772	80038.	0.000				
39.990	-4.668E-06	31.5577	-2.0902	8.256E-08	13285.	3.683E+09
0.0737	81436.	0.000				

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40.420	-4.128E-06	21.6419	-1.7292	1.198E-07	13285.	3.683E+09
0.0663	82834.	0.000				
40.850	-3.431E-06	13.4583	-1.4137	1.444E-07	13285.	3.683E+09
0.0560	84232.	0.000				
41.280	-2.638E-06	6.7460	-1.1562	1.586E-07	13284.	3.683E+09
0.0438	85630.	0.000				
41.710	-1.795E-06	1.1890	-0.9652	1.641E-07	13284.	3.683E+09
0.0303	87027.	0.000				
42.140	-9.437E-07	-3.5637	-0.2926	1.625E-07	13284.	3.683E+09
0.2304	1259920.	0.000				
42.570	-1.182E-07	-2.1760	0.3779	1.584E-07	13284.	3.683E+09
0.0295	1286545.	0.000				
43.000	6.915E-07	0.000	0.000	1.569E-07	13284.	3.683E+09
-0.1760	656585.	0.000				

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.2035140 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-290173. inch-lbs
Maximum shear force	=	5660.000000 lbs
Depth of maximum bending moment	=	0.000000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	9
Number of zero deflection points	=	4

Summary of Pile Response(s)

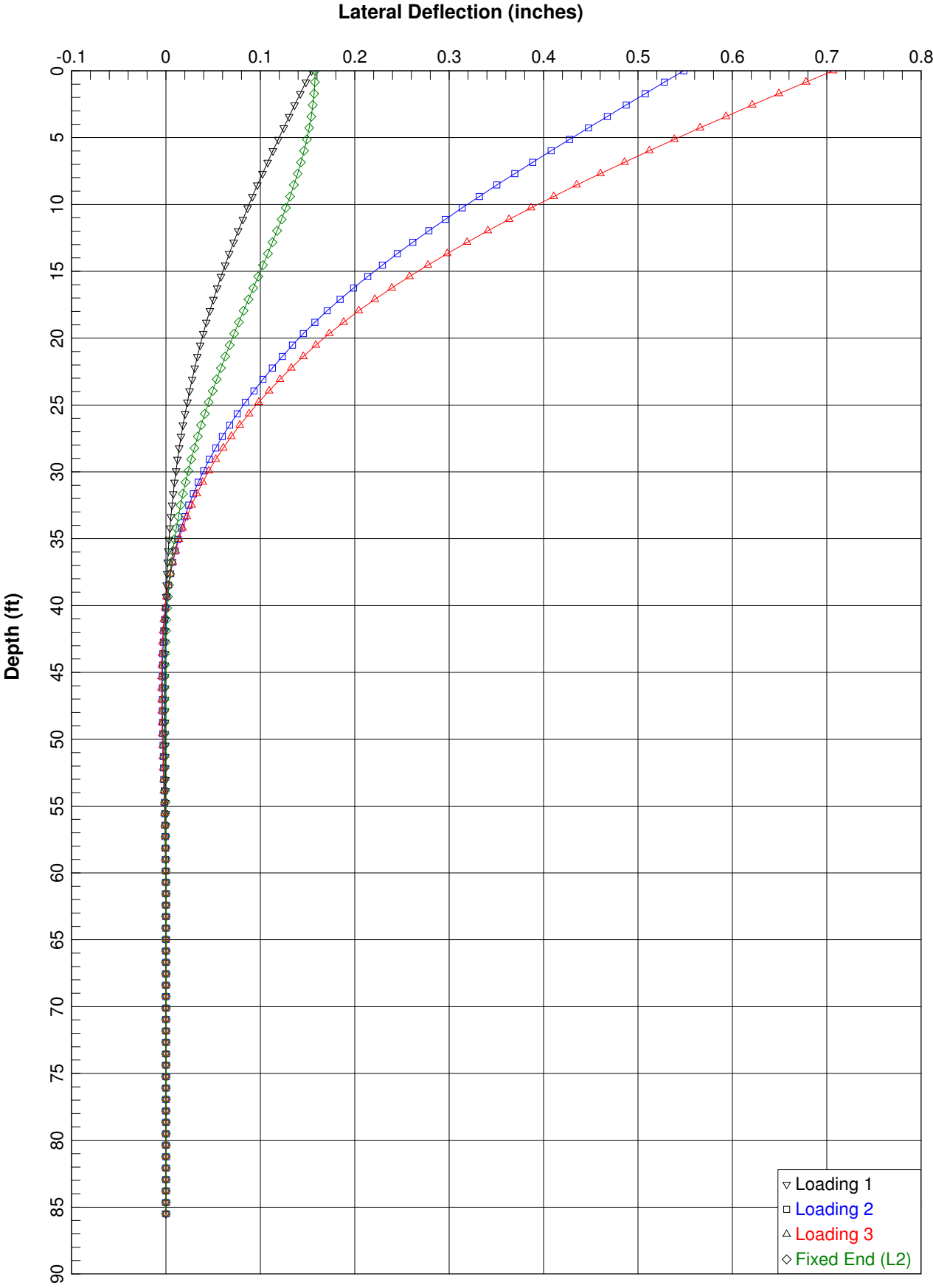
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
 Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
 Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
 Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
 Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

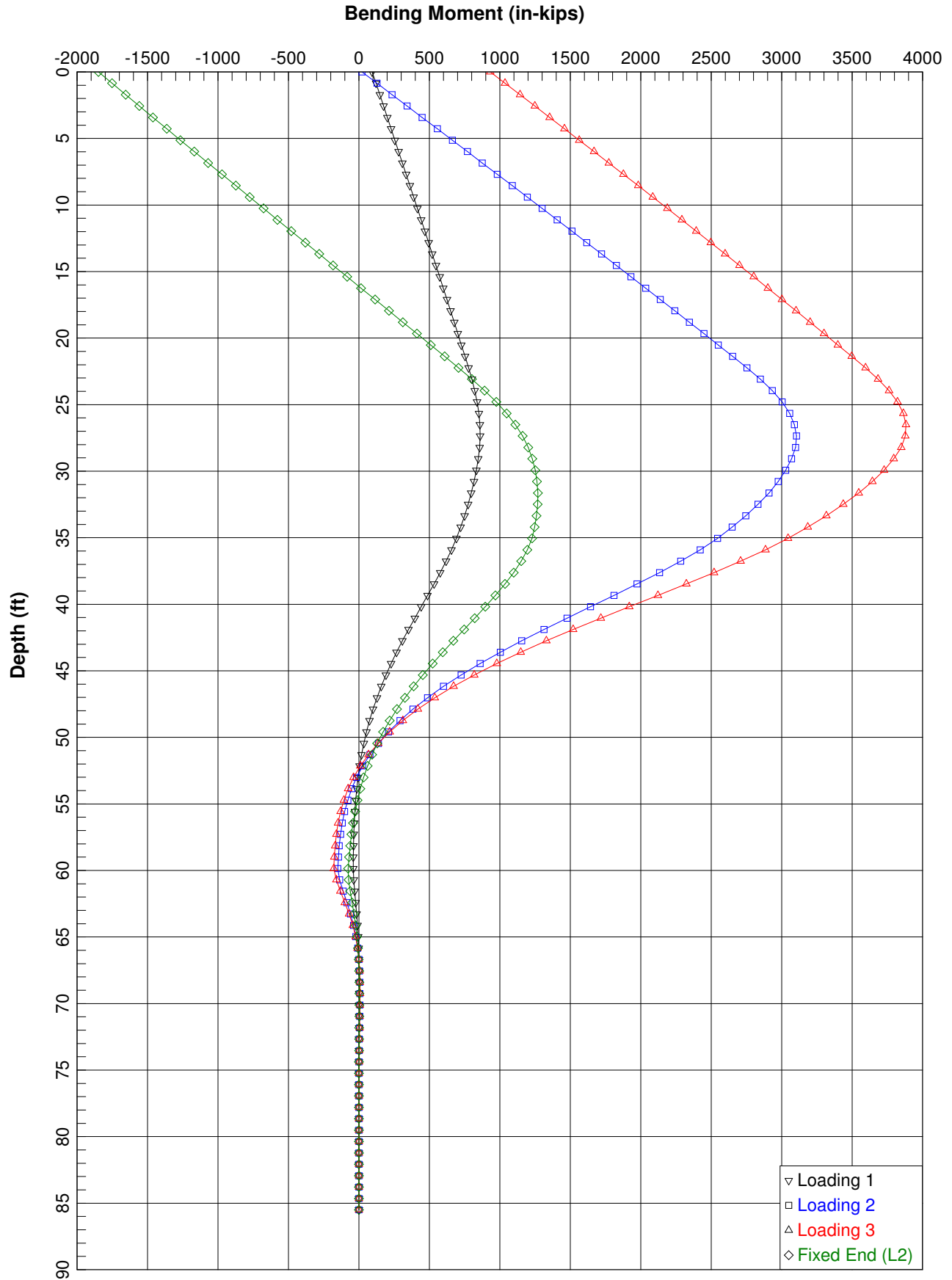
Load Case No.	Maximum Load Type No.	Pile-head Condition 1 Shear V(lbs) or Rotation y(inches) or radians	Pile-head Condition 2 Pile-head in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
1	1	V = 5660.0000	M = 0.000	205900.	0.97871009	
414853.		5660.0000	-0.01210749			
2	2	V = 5660.0000	S = 0.000	205900.	0.20351398	
-290173.		5660.0000	0.00000000			

The analysis ended normally.

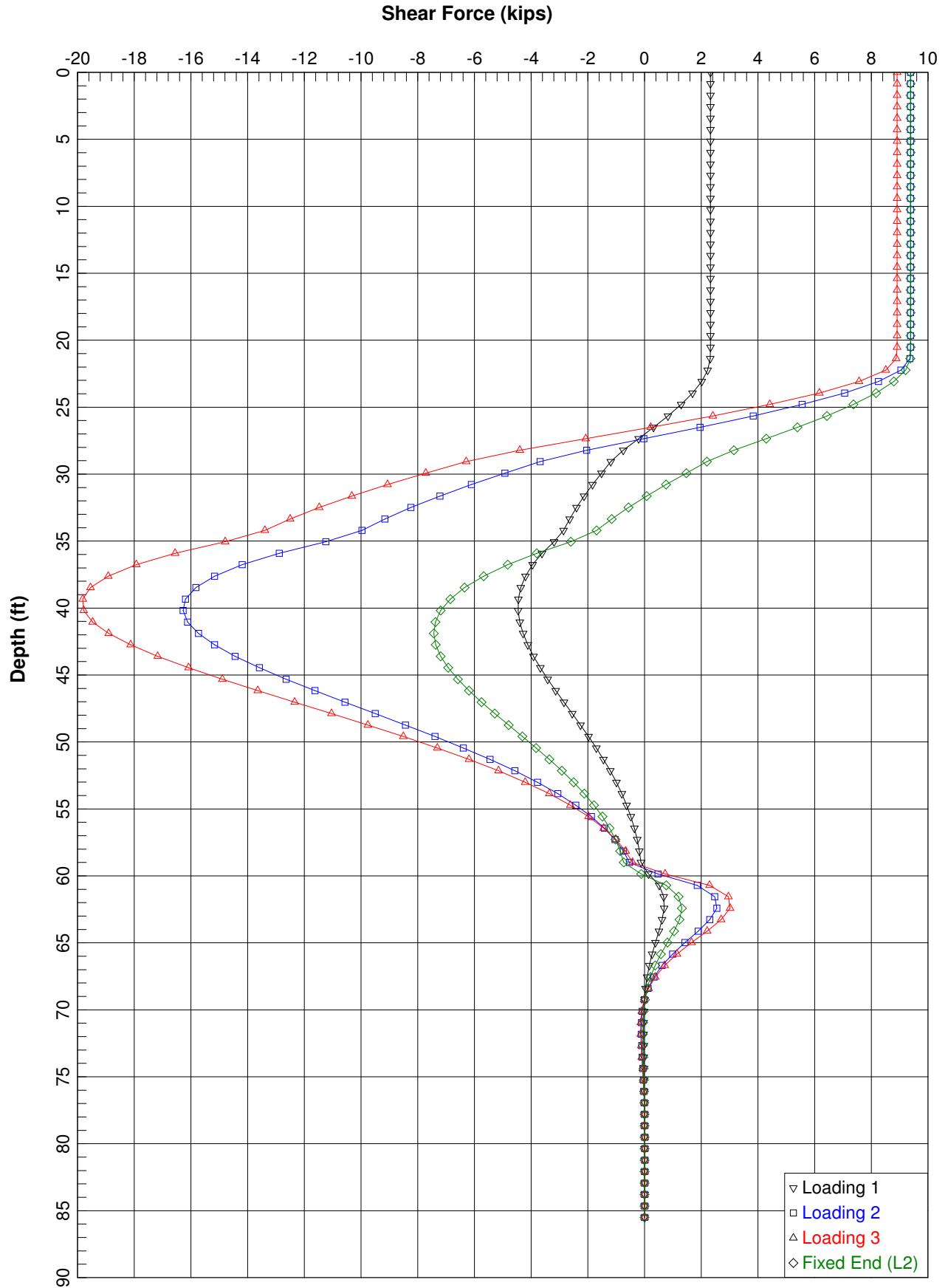
Bridge 11 Bent 3 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-03



Bridge 11 Bent 3 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-03



Bridge 11 Bent 3 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-03



Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

LPile Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 Bent 3\Bridge 11 Bent 3 Final Loads\
Name of input data file: Bridge 11 Bent 3 Longitudinal Final Loads.lp6d
Name of output report file: Bridge 11 Bent 3 Longitudinal Final Loads.lp6o
Name of plot output file: Bridge 11 Bent 3 Longitudinal Final Loads.lp6p
Name of runtime message file: Bridge 11 Bent 3 Longitudinal Final Loads.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:03:31

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 Bent 3 Drilled Shaft (Boring B11-SPT-04)

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

- Total number of pile sections = 3
- Total length of pile = 85.50 ft
- Depth of ground surface below top of pile = 21.30 ft

Pile diameter values used for p-y curve computations are defined using 6 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	36.0000000
2	21.30000	36.0000000
3	21.30000	42.0000000
4	59.30000	42.0000000
5	59.30000	36.0000000
6	85.50000	36.0000000

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Input Structural Properties:

Pile Section No. 1:

Section Type	= Drilled Shaft (Bored Pile)
Section Length	= 21.30000000 ft
Section Diameter	= 36.00000000 in

Pile Section No. 2:

Section Type	= Drilled Shaft (Bored Pile)
Section Length	= 38.00000000 ft
Section Diameter	= 42.00000000 in

Pile Section No. 3:

Section Type	= Drilled Shaft (Bored Pile)
Section Length	= 26.20000000 ft
Section Diameter	= 36.00000000 in

Ground Slope and Pile Batter Angles

Ground Slope Angle	= 0.000 degrees
	= 0.000 radians
Pile Batter Angle	= 0.000 degrees
	= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	= 21.30000 ft
Distance from top of pile to bottom of layer	= 26.80000 ft
Effective unit weight at top of layer	= 120.00000 pcf
Effective unit weight at bottom of layer	= 120.00000 pcf
Friction angle at top of layer	= 30.00000 deg.
Friction angle at bottom of layer	= 30.00000 deg.
Subgrade k at top of layer	= 45.00000 pci
Subgrade k at bottom of layer	= 45.00000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	= 26.80000 ft
Distance from top of pile to bottom of layer	= 28.80000 ft
Effective unit weight at top of layer	= 112.00000 pcf
Effective unit weight at bottom of layer	= 112.00000 pcf
Friction angle at top of layer	= 30.00000 deg.
Friction angle at bottom of layer	= 30.00000 deg.
Subgrade k at top of layer	= 45.00000 pci

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Subgrade k at bottom of layer = 45.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	28.80000	ft
Distance from top of pile to bottom of layer	=	34.80000	ft
Effective unit weight at top of layer	=	40.00000	pcf
Effective unit weight at bottom of layer	=	40.00000	pcf
Friction angle at top of layer	=	30.00000	deg.
Friction angle at bottom of layer	=	30.00000	deg.
Subgrade k at top of layer	=	30.00000	pci
Subgrade k at bottom of layer	=	30.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	34.80000	ft
Distance from top of pile to bottom of layer	=	59.30000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	35.00000	deg.
Friction angle at bottom of layer	=	35.00000	deg.
Subgrade k at top of layer	=	95.00000	pci
Subgrade k at bottom of layer	=	95.00000	pci

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	59.30000	ft
Distance from top of pile to bottom of layer	=	90.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 4.50 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor Epsilon 50	Layer Soil Type kpy (p-y Curve Criteria) pci	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		21.300	120.000	--
30.000	--	45.000	26.800	120.000	--
30.000	--	45.000	26.800	112.000	--
2	Sand (Reese, et al.)				
30.000	--	45.000			

Bridge 11 Bent 3 Longitudinal			Final Loads.1p6o		
			28.800	112.000	--
30.000	--	45.000			
3 Sand (Reese, et al.)			28.800	40.000	--
30.000	--	30.000			
			34.800	40.000	--
30.000	--	30.000			
4 Sand (Reese, et al.)			34.800	75.000	--
35.000	--	95.000			
			59.300	75.000	--
35.000	--	95.000			
5 Stiff Clay w/o Free water, using k			59.300	75.000	8000.000
--	0.00400	2000.000			
			90.000	75.000	8000.000
--	0.00400	2000.000			

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	1	V = 2321.00000 lbs	M = 94020. in-lbs	525300.
	No			
2	1	V = 9387.00000 lbs	M = 21408. in-lbs	524400.
	No			
3	1	V = 8909.00000 lbs	M = 931200. in-lbs	500200.
	No			
4	2	V = 9387.00000 lbs	S = 0.0000 in/in	524400.
	No			

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 3

Pile Section No. 1:

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

----- Dimensions and Properties of Drilled Shaft (Bored Pile): -----

Length of Section	=	21.30000000	ft
Shaft Diameter	=	36.00000000	in
Concrete Cover Thickness	=	4.75000000	in
Number of Reinforcing Bars	=	12	bars
Yield Stress of Reinforcing Bars	=	60.00000000	ksi
Modulus of Elasticity of Reinforcing Bars	=	29000.	ksi
Gross Area of Shaft	=	1017.87601976	sq. in.
Total Area of Reinforcing Steel	=	15.24000000	sq. in.
Area Ratio of Steel Reinforcement	=	1.50	percent
Edge-to-Edge Bar Spacing	=	5.26000451	in
Maximum Concrete Aggregate Size	=	0.75000000	in
Ratio of Bar Spacing to Aggregate Size	=	7.01	
Offset of Rebar Cage Center from Center of Pile	=	0.00000000	in

Axial Structural Capacities: -----

Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$	=	4323.363	kips
Tensile Load for Cracking of Concrete	=	-467.995	kips
Nominal Axial Tensile Capacity	=	-914.400	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.27000	1.27000	12.61500	0.00000
2	1.27000	1.27000	10.92491	6.30750
3	1.27000	1.27000	6.30750	10.92491
4	1.27000	1.27000	0.00000	12.61500
5	1.27000	1.27000	-6.30750	10.92491
6	1.27000	1.27000	-10.92491	6.30750
7	1.27000	1.27000	-12.61500	0.00000
8	1.27000	1.27000	-10.92491	-6.30750
9	1.27000	1.27000	-6.30750	-10.92491
10	1.27000	1.27000	0.00000	-12.61500
11	1.27000	1.27000	6.30750	-10.92491
12	1.27000	1.27000	10.92491	-6.30750

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 5.26000 inches between Bars 7 and 8

Spacing to aggregate size ratio = 7.01334

Concrete Properties: -----

Compressive Strength of Concrete	=	4.00000000	ksi
Modulus of Elasticity of Concrete	=	3604.99653259	ksi
Modulus of Rupture of Concrete	=	-0.47434164	ksi
Compression Strain at Peak Stress	=	0.00188627	
Tensile Strain at Fracture of Concrete	=	-0.00011537	
Maximum Coarse Aggregate Size	=	0.75000000	in

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 3

Number	Axial Thrust Force kips
1	500.200
2	524.400
3	525.300

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318-08 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-08, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 500.200 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.8293604	359726977.	193.1006839	0.0001207	0.0000982
0.4950367	3.4966874				
0.000001250	449.6876268	359750101.	105.5696302	0.0001320	0.0000870
0.5392090	3.8203741				
0.000001875	674.5348846	359751938.	76.4011693	0.0001433	0.0000758
0.5831640	4.1445261				
0.000002500	899.3656381	359746255.	61.8233571	0.0001546	0.0000646
0.6269007	4.4691434				
0.000003125	1124.1743907	359735805.	53.0818048	0.0001659	0.0000534
0.6704176	4.7942261				
0.000003750	1348.9556450	359721505.	47.2583829	0.0001772	0.0000422
0.7137138	5.1197741				
0.000004375	1573.7039024	359703749.	43.1024646	0.0001886	0.0000311
0.7567879	5.4457877				
0.000005000	1798.4136630	359682733.	39.9887365	0.0001999	0.0000199
0.7996387	5.7722668				
0.000005625	2023.0794253	359658565.	37.5698025	0.0002113	0.000008830
0.8422651	6.0992115				
0.000006250	2247.6955974	359631296.	35.6372246	0.0002227	-0.000002267
0.8846658	6.4266220				
0.000006875	2472.2230762	359596084.	34.0582964	0.0002342	-0.0000133
0.9268379	6.7544854				
0.000007500	2696.5212217	359536163.	32.7443573	0.0002456	-0.0000244
0.9687735	7.0827477				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.000008125	2920.4407375	359438860.	31.6339910	0.0002570	-0.0000355	
1.0104635	7.4113466					
0.000008750	3143.8637632	359298716.	30.6833641	0.0002685	-0.0000465	
1.0519004	7.7402287					
0.000009375	3366.7029981	359114986.	29.8603716	0.0002799	-0.0000576	
1.0930781	8.0693511					
0.0000100	3588.8942439	358889424.	29.1409660	0.0002914	-0.0000686	
1.1339918	8.3986802					
0.0000106	3810.3895876	358624902.	28.5067805	0.0003029	-0.0000796	
1.1746376	8.7281893					
0.0000113	4031.1537983	358324782.	27.9435475	0.0003144	-0.0000906	
1.2150126	9.0578574					
0.0000119	4251.1591689	357992351.	27.4400136	0.0003259	-0.0001016	
1.2551141	9.3876672					
0.0000125	4470.3830410	357630643.	26.9871826	0.0003373	-0.0001127	
1.2949401	9.7176037					
0.0000131	4470.3830410	340600613.	25.6084360	0.0003361	-0.0001364	
1.2902591	9.6786985	C				
0.0000138	4470.3830410	325118767.	25.1240037	0.0003455	-0.0001495	
1.3223893	9.9464215	C				
0.0000144	4470.3830410	310983168.	24.6740345	0.0003547	-0.0001628	
1.3539481	10.2109507	C				
0.0000150	4470.3830410	298025536.	24.2541499	0.0003638	-0.0001762	
1.3849385	10.4722552	C				
0.0000156	4470.3830410	286104515.	23.8619089	0.0003728	-0.0001897	
1.4154295	10.7308650	C				
0.0000163	4470.3830410	275100495.	23.4944604	0.0003818	-0.0002032	
1.4454455	10.9869395	C				
0.0000169	4529.2869286	268402188.	23.1491423	0.0003906	-0.0002169	
1.4749968	11.2405241	C				
0.0000175	4616.0042523	263771672.	22.8239195	0.0003994	-0.0002306	
1.5041082	11.4917892	C				
0.0000181	4700.3166140	259327813.	22.5167962	0.0004081	-0.0002444	
1.5327895	11.7407786	C				
0.0000188	4782.1861018	255049925.	22.2256704	0.0004167	-0.0002583	
1.5610270	11.9873333	C				
0.0000194	4862.1752651	250950981.	21.9499595	0.0004253	-0.0002722	
1.5888872	12.2319960	C				
0.0000200	4940.5434387	247027172.	21.6886455	0.0004338	-0.0002862	
1.6164017	12.4750145	C				
0.0000206	5017.3559467	243265743.	21.4404767	0.0004422	-0.0003003	
1.6435775	12.7164227	C				
0.0000213	5092.1104931	239628729.	21.2030935	0.0004506	-0.0003144	
1.6703354	12.9554814	C				
0.0000219	5165.8430834	236152827.	20.9775935	0.0004589	-0.0003286	
1.6968220	13.1934734	C				
0.0000225	5238.1988072	232808836.	20.7622233	0.0004672	-0.0003428	
1.7229846	13.4299007	C				
0.0000231	5309.1168550	229583432.	20.5558941	0.0004754	-0.0003571	
1.7488064	13.6645840	C				
0.0000238	5379.3721378	226499879.	20.3594843	0.0004835	-0.0003715	
1.7744104	13.8986199	C				
0.0000244	5447.9078857	223503913.	20.1699250	0.0004916	-0.0003859	
1.7996208	14.1303783	C				
0.0000256	5582.7428995	217863138.	19.8150398	0.0005078	-0.0004147	
1.8493315	14.5912890	C				
0.0000269	5714.1266265	212618665.	19.4875203	0.0005237	-0.0004438	
1.8980076	15.0477987	C				
0.0000281	5842.5399025	207734752.	19.1843749	0.0005396	-0.0004729	
1.9457216	15.5004433	C				
0.0000294	5968.4051637	203179750.	18.9031177	0.0005553	-0.0005022	
1.9925425	15.9497560	C				
0.0000306	6091.2032608	198896433.	18.6396680	0.0005708	-0.0005317	

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o				
2.0383551	16.3944925	C				
0.0000319	6212.1707941		194891633.	18.3942243	0.0005863	-0.0005612
2.0833903	16.8367737	C				
0.0000331	6331.6965386		191145556.	18.1655113	0.0006017	-0.0005908
2.1277301	17.2773319	C				
0.0000344	6448.8515093		187602953.	17.9495587	0.0006170	-0.0006205
2.1711693	-17.8145961	C				
0.0000356	6564.9870927		184280339.	17.7476966	0.0006323	-0.0006502
2.2139911	-18.6709484	C				
0.0000369	6679.5434585		181140162.	17.5572747	0.0006474	-0.0006801
2.2560738	-19.5297018	C				
0.0000381	6792.9374712		178175409.	17.3778872	0.0006625	-0.0007100
2.2975016	-20.3900609	C				
0.0000394	6905.0220465		175365639.	17.2081463	0.0006776	-0.0007399
2.3382438	-21.2524103	C				
0.0000406	7016.2497831		172707687.	17.0480082	0.0006926	-0.0007699
2.3784001	-22.1157528	C				
0.0000419	7126.0018423		170173178.	16.8952377	0.0007075	-0.0008000
2.4178203	-22.9817581	C				
0.0000431	7235.4888613		167779452.	16.7517694	0.0007224	-0.0008301
2.4568061	-23.8472058	C				
0.0000444	7343.2381978		165481424.	16.6134998	0.0007372	-0.0008603
2.4949727	-24.7163649	C				
0.0000456	7450.5922714		163300653.	16.4829229	0.0007520	-0.0008905
2.5326750	-25.5853701	C				
0.0000469	7557.4446184		161225485.	16.3591540	0.0007668	-0.0009207
2.5698805	-26.4545875	C				
0.0000481	7662.8509424		159228072.	16.2395092	0.0007815	-0.0009510
2.6063305	-27.3270224	C				
0.0000494	7768.0033220		157326650.	16.1263025	0.0007962	-0.0009813
2.6423564	-28.1989130	C				
0.0000506	7872.8887562		155513852.	16.0190318	0.0008110	-0.0010115
2.6779532	-29.0702963	C				
0.0000519	7976.2765738		153759548.	15.9144097	0.0008256	-0.0010419
2.7127624	-29.9454723	C				
0.0000531	8079.4151110		152083108.	15.8150622	0.0008402	-0.0010723
2.7471516	-30.8201071	C				
0.0000544	8182.3027635		150479131.	15.7206274	0.0008548	-0.0011027
2.7811190	-31.6941980	C				
0.0000556	8284.5792820		148936257.	15.6299131	0.0008694	-0.0011331
2.8145524	-32.5691338	C				
0.0000569	8385.8820763		147444080.	15.5418083	0.0008839	-0.0011636
2.8473424	-33.4463423	C				
0.0000581	8486.9385899		146011847.	15.4578149	0.0008985	-0.0011940
2.8797146	-34.3230080	C				
0.0000594	8587.7472706		144635744.	15.3776750	0.0009130	-0.0012245
2.9116673	-35.1991283	C				
0.0000606	8688.3065482		143312273.	15.3011515	0.0009276	-0.0012549
2.9431989	-36.0747003	C				
0.0000619	8787.7130705		142023646.	15.2258244	0.0009421	-0.0012854
2.9740150	-36.9536738	C				
0.0000631	8886.8621045		140781974.	15.1537454	0.0009566	-0.0013159
3.0044106	-37.8321622	C				
0.0000644	8985.7661540		139584717.	15.0847600	0.0009711	-0.0013464
3.0343887	-38.7101010	C				
0.0000656	9084.4237314		138429314.	15.0186930	0.0009856	-0.0013769
3.0639476	-39.5874872	C				
0.0000669	9182.8332860		137313395.	14.9553823	0.0010001	-0.0014074
3.0930857	-40.4643178	C				
0.0000681	9280.4258715		136226435.	14.8932389	0.0010146	-0.0014379
3.1216065	-41.3434322	C				
0.0000694	9377.5864849		135172418.	14.8331424	0.0010290	-0.0014685
3.1496456	-42.2229339	C				

	Bridge 11	Bent 3	Longitudinal	Final	Loads.l	lp6o	
0.0000706	9474.5032120		134152258.	14.7754466	0.0010435	-0.0014990	
3.1772670	-43.1018758	C					
0.0000719	9571.1745455		133164168.	14.7200277	0.0010580	-0.0015295	
3.2044692	-43.9802546	C					
0.0000731	9667.5989386		132206481.	14.6667705	0.0010725	-0.0015600	
3.2312503	-44.8580671	C					
0.0000744	9763.7748293		131277645.	14.6155676	0.0010870	-0.0015905	
3.2576088	-45.7353099	C					
0.0000794	10144.		127798798.	14.4243661	0.0011449	-0.0017126	
3.3581053	-49.2500754	C					
0.0000844	10520.		124680089.	14.2586171	0.0012031	-0.0018344	
3.4516663	-52.7580086	C					
0.0000894	10890.		121850190.	14.1114533	0.0012612	-0.0019563	
3.5378665	-56.2658398	C					
0.0000944	11256.		119272329.	13.9823005	0.0013196	-0.0020779	
3.6169992	-59.7670537	C					
0.0000994	11618.		116912011.	13.8696674	0.0013783	-0.0021992	
3.6891202	-60.0000000	CY					
0.0001044	11975.		114726962.	13.7679862	0.0014370	-0.0023205	
3.7537423	-60.0000000	CY					
0.0001094	12327.		112701569.	13.6787081	0.0014961	-0.0024414	
3.8111569	-60.0000000	CY					
0.0001144	12674.		110814759.	13.6006188	0.0015556	-0.0025619	
3.8612677	-60.0000000	CY					
0.0001194	13014.		109014229.	13.5311572	0.0016153	-0.0026822	
3.9038313	-60.0000000	CY					
0.0001244	13310.		107018540.	13.4573474	0.0016738	-0.0028037	
3.9379672	-60.0000000	CY					
0.0001294	13579.		104956316.	13.3834623	0.0017315	-0.0029260	
3.9643510	-60.0000000	CY					
0.0001344	13796.		102665444.	13.3021960	0.0017875	-0.0030500	
3.9829983	-60.0000000	CY					
0.0001394	13950.		100088830.	13.2095714	0.0018411	-0.0031764	
3.9944480	-60.0000000	CY					
0.0001444	14092.		97603958.	13.1217724	0.0018945	-0.0033030	
3.9996437	-60.0000000	CY					
0.0001494	14229.		95257391.	13.0392207	0.0019477	-0.0034298	
3.9995856	-60.0000000	CY					
0.0001544	14364.		93043042.	12.9644779	0.0020014	-0.0035561	
3.9993623	-60.0000000	CY					
0.0001594	14495.		90948401.	12.8968474	0.0020554	-0.0036821	
3.9988740	-60.0000000	CY					
0.0001644	14623.		88963070.	12.8356639	0.0021099	-0.0038076	
3.9979506	60.0000000	CY					
0.0001694	14749.		87077185.	12.7802437	0.0021647	-0.0039328	
3.9987474	60.0000000	CY					
0.0001744	14864.		85242285.	12.7249597	0.0022189	-0.0040586	
3.9998210	60.0000000	CY					
0.0001794	14954.		83365644.	12.6649926	0.0022718	-0.0041857	
3.9986831	60.0000000	CY					
0.0001844	15017.		81447469.	12.5995253	0.0023230	-0.0043145	
3.9983292	60.0000000	CY					
0.0001894	15064.		79547067.	12.5331471	0.0023735	-0.0044440	
3.9993460	60.0000000	CY					
0.0001944	15109.		77731438.	12.4708982	0.0024240	-0.0045735	
3.9963439	60.0000000	CY					
0.0001994	15152.		75999536.	12.4126600	0.0024748	-0.0047027	
3.9994762	60.0000000	CY					
0.0002044	15193.		74341238.	12.3554312	0.0025251	-0.0048324	
3.9959404	60.0000000	CY					
0.0002094	15233.		72756926.	12.3021235	0.0025758	-0.0049617	
3.9992060	60.0000000	CY					
0.0002144	15273.		71242545.	12.2522792	0.0026266	-0.0050909	

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
3.9977586	60.0000000	CY				
0.0002194	15311.		69792176.	12.2058749	0.0026777	-0.0052198
3.9983899	60.0000000	CY				
0.0002244	15348.		68403560.	12.1623154	0.0027289	-0.0053486
3.9999661	60.0000000	CY				
0.0002294	15384.		67070861.	12.1217680	0.0027804	-0.0054771
3.9965430	60.0000000	CY				
0.0002344	15420.		65792247.	12.0837055	0.0028321	-0.0056054
3.9993271	60.0000000	CY				
0.0002394	15455.		64563180.	12.0471944	0.0028838	-0.0057337
3.9979578	60.0000000	CY				
0.0002444	15488.		63378868.	12.0116333	0.0029353	-0.0058622
3.9971198	60.0000000	CY				
0.0002494	15521.		62240226.	11.9780870	0.0029870	-0.0059905
3.9994840	60.0000000	CY				
0.0002544	15554.		61144042.	11.9465637	0.0030389	-0.0061186
3.9975079	60.0000000	CYT				
0.0002594	15585.		60087246.	11.9170984	0.0030910	-0.0062465
3.9964951	60.0000000	CYT				
0.0002644	15616.		59068953.	11.8892543	0.0031432	-0.0063743
3.9991242	60.0000000	CYT				
0.0002694	15647.		58086982.	11.8629535	0.0031956	-0.0065019
3.9999531	60.0000000	CYT				
0.0002744	15677.		57137917.	11.8384816	0.0032482	-0.0066293
3.9944400	60.0000000	CYT				
0.0003044	15848.		52067356.	11.7181618	0.0035667	-0.0073908
3.9996370	60.0000000	CYT				
0.0003344	15889.		47518555.	11.6402066	0.0038922	-0.0081453
3.9938124	60.0000000	CYT				

Axial Thrust Force = 524.400 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.2055633	358728901.	201.8185441	0.0001261	0.0001036
0.5166349	3.6546986				
0.000001250	448.4417399	358753392.	109.9286137	0.0001374	0.0000924
0.5606707	3.9783872				
0.000001875	672.6668776	358755668.	79.3072177	0.0001487	0.0000812
0.6044892	4.3025425				
0.000002500	896.8754652	358750186.	64.0029556	0.0001600	0.0000700
0.6480893	4.6271643				
0.000003125	1121.0619909	358739837.	54.8255477	0.0001713	0.0000588
0.6914697	4.9522528				
0.000003750	1345.2209421	358725585.	48.7115672	0.0001827	0.0000477
0.7346293	5.2778079				
0.000004375	1569.3468050	358707841.	44.3481172	0.0001940	0.0000365
0.7775667	5.6038299				
0.000005000	1793.4340645	358686813.	41.0787493	0.0002054	0.0000254
0.8202809	5.9303187				
0.000005625	2017.4772038	358662614.	38.5387699	0.0002168	0.0000143
0.8627705	6.2572744				
0.000006250	2241.4707043	358635313.	36.5093631	0.0002282	0.000003184
0.9050344	6.5846971				
0.000006875	2465.4034650	358604140.	34.8512718	0.0002396	-0.000007898
0.9470711	6.9125848				

	Bridge 11	Bent 3	Longitudinal	Final	Loads.l	lp6o	
0.000007500	2689.1871258	358558283.	33.4715189	0.0002510	-0.0000190		
0.9888753	7.2409054						
0.000008125	2912.6718417	358482688.	32.3056187	0.0002625	-0.0000300		
1.0304383	7.5695989						
0.000008750	3135.7271913	358368822.	31.3075226	0.0002739	-0.0000411		
1.0717521	7.8986089						
0.000009375	3358.2519200	358213538.	30.4434959	0.0002854	-0.0000521		
1.1128099	8.2278880						
0.0000100	3580.1713251	358017133.	29.6882716	0.0002969	-0.0000631		
1.1536064	8.5573988						
0.0000106	3801.4284084	357781497.	29.0225502	0.0003084	-0.0000741		
1.1941373	8.8871108						
0.0000113	4021.9810341	357509425.	28.4313415	0.0003199	-0.0000851		
1.2343990	9.2170002						
0.0000119	4241.7972720	357203981.	27.9028247	0.0003313	-0.0000962		
1.2743890	9.5470478						
0.0000125	4460.8512561	356868100.	27.4275511	0.0003428	-0.0001072		
1.3141047	9.8772373						
0.0000131	4460.8512561	339874381.	26.1426903	0.0003431	-0.0001294		
1.3146813	9.8820489	C					
0.0000138	4460.8512561	324425546.	25.6440473	0.0003526	-0.0001424		
1.3471444	10.1537889	C					
0.0000144	4460.8512561	310320087.	25.1805397	0.0003620	-0.0001555		
1.3790043	10.4221000	C					
0.0000150	4460.8512561	297390084.	24.7485605	0.0003712	-0.0001688		
1.4103084	10.6873239	C					
0.0000156	4460.8512561	285494480.	24.3448630	0.0003804	-0.0001821		
1.4410917	10.9497036	C					
0.0000163	4528.7525082	278692462.	23.9666365	0.0003895	-0.0001955		
1.4713851	11.2094525	C					
0.0000169	4621.2835135	273853838.	23.6112736	0.0003984	-0.0002091		
1.5012066	11.4666795	C					
0.0000175	4710.9677757	269198159.	23.2763562	0.0004073	-0.0002227		
1.5305633	11.7214008	C					
0.0000181	4798.0665420	264720913.	22.9600587	0.0004162	-0.0002363		
1.5594777	11.9737684	C					
0.0000188	4882.8590264	260419148.	22.6608777	0.0004249	-0.0002501		
1.5879766	12.2239773	C					
0.0000194	4965.6183889	256289981.	22.3775423	0.0004336	-0.0002639		
1.6160889	12.4722441	C					
0.0000200	5046.6091887	252330459.	22.1089768	0.0004422	-0.0002778		
1.6438451	12.7188066	C					
0.0000206	5125.4185399	248505141.	21.8528902	0.0004507	-0.0002918		
1.6711853	12.9630975	C					
0.0000213	5202.5511370	244825936.	21.6090005	0.0004592	-0.0003058		
1.6981700	13.2056216	C					
0.0000219	5278.5272682	241304104.	21.3772323	0.0004676	-0.0003199		
1.7248704	13.4469943	C					
0.0000225	5352.6719559	237896531.	21.1551608	0.0004760	-0.0003340		
1.7511875	13.6862925	C					
0.0000231	5425.6053300	234620771.	20.9430878	0.0004843	-0.0003482		
1.7772050	13.9242458	C					
0.0000238	5497.5455624	231475603.	20.7406471	0.0004926	-0.0003624		
1.8029569	14.1611458	C					
0.0000244	5567.8785835	228425788.	20.5457569	0.0005008	-0.0003767		
1.8283431	14.3960444	C					
0.0000256	5705.8862209	222668731.	20.1804024	0.0005171	-0.0004054		
1.8783489	14.8627990	C					
0.0000269	5840.1466785	217307783.	19.8431483	0.0005333	-0.0004342		
1.9272893	15.3249663	C					
0.0000281	5971.1557352	212307759.	19.5308710	0.0005493	-0.0004632		
1.9752342	15.7830542	C					
0.0000294	6099.3845095	207638622.	19.2410434	0.0005652	-0.0004923		

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o				
2.0222566	16.2376264	C				
0.0000306	6224.5204771		203249648.	18.9700015	0.0005810	-0.0005215
2.0682866	16.6878702	C				
0.0000319	6347.3333914		199132028.	18.7167583	0.0005966	-0.0005509
2.1134535	17.1349159	C				
0.0000331	6468.4547324		195274105.	18.4804420	0.0006122	-0.0005803
2.1578777	17.5798622	C				
0.0000344	6587.4288055		191634293.	18.2581655	0.0006276	-0.0006099
2.2014650	18.0216714	C				
0.0000356	6704.7230636		188202753.	18.0491691	0.0006430	-0.0006395
2.2442983	18.4610853	C				
0.0000369	6820.9132294		184973918.	17.8532471	0.0006583	-0.0006692
2.2865034	-19.2131963	C				
0.0000381	6935.1607590		181905856.	17.6672305	0.0006736	-0.0006989
2.3278875	-20.0701558	C				
0.0000394	7048.7707542		179016400.	17.4928120	0.0006888	-0.0007287
2.3687430	-20.9273576	C				
0.0000406	7160.5747609		176260302.	17.3263835	0.0007039	-0.0007586
2.4087951	-21.7877919	C				
0.0000419	7271.7320503		173653303.	17.1695989	0.0007190	-0.0007885
2.4483170	-22.6485807	C				
0.0000431	7381.6678530		171169110.	17.0203166	0.0007340	-0.0008185
2.4871635	-23.5113539	C				
0.0000444	7490.5119871		168800270.	16.8781564	0.0007490	-0.0008485
2.5253703	-24.3757849	C				
0.0000456	7599.0857755		166555305.	16.7442140	0.0007640	-0.0008785
2.5631382	-25.2396492	C				
0.0000469	7705.8602413		164391685.	16.6145129	0.0007788	-0.0009087
2.6000747	-26.1074591	C				
0.0000481	7812.3197517		162333917.	16.4918414	0.0007937	-0.0009388
2.6365652	-26.9748613	C				
0.0000494	7918.4612084		160373898.	16.3756547	0.0008085	-0.0009690
2.6726067	-27.8418718	C				
0.0000506	8022.9904774		158478824.	16.2626201	0.0008233	-0.0009992
2.7078500	-28.7126782	C				
0.0000519	8127.2607701		156670087.	16.1554015	0.0008381	-0.0010294
2.7426645	-29.5829303	C				
0.0000531	8231.2703646		154941560.	16.0535898	0.0008528	-0.0010597
2.7770486	-30.4526256	C				
0.0000544	8334.2117242		153272859.	15.9549886	0.0008676	-0.0010899
2.8107711	-31.3246398	C				
0.0000556	8436.4794666		151667047.	15.8602370	0.0008822	-0.0011203
2.8439484	-32.1975926	C				
0.0000569	8538.4912782		150127319.	15.7699865	0.0008969	-0.0011506
2.8766993	-33.0699909	C				
0.0000581	8640.2455195		148649385.	15.6839482	0.0009116	-0.0011809
2.9090221	-33.9418321	C				
0.0000594	8740.9903858		147216680.	15.6001211	0.0009263	-0.0012112
2.9406901	-34.8161040	C				
0.0000606	8841.1808037		145833910.	15.5193820	0.0009409	-0.0012416
2.9718437	-35.6910238	C				
0.0000619	8941.1183133		144502922.	15.4422156	0.0009555	-0.0012720
3.0025730	-36.5653867	C				
0.0000631	9040.8013210		143220615.	15.3684111	0.0009701	-0.0013024
3.0328763	-37.4391898	C				
0.0000644	9140.1996010		141983683.	15.2977055	0.0009848	-0.0013327
3.0627430	-38.3125584	C				
0.0000656	9238.4851166		140776916.	15.2279605	0.0009993	-0.0013632
3.0919114	-39.1892251	C				
0.0000669	9336.5205782		139611523.	15.1611126	0.0010139	-0.0013936
3.1206573	-40.0653296	C				
0.0000681	9434.3043949		138485202.	15.0970040	0.0010285	-0.0014240
3.1489789	-40.9408689	C				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0000694	9531.8349613		137395819.	15.0354880	0.0010431	-0.0014544
3.1768747	-41.8158398	C				
0.0000706	9629.1106571		136341390.	14.9764288	0.0010577	-0.0014848
3.2043430	-42.6902392	C				
0.0000719	9725.8672700		135316414.	14.9190468	0.0010723	-0.0015152
3.2312947	-43.5654240	C				
0.0000731	9821.9100370		134316718.	14.8627696	0.0010868	-0.0015457
3.2576676	-44.4424264	C				
0.0000744	9917.7020488		133347254.	14.8086516	0.0011014	-0.0015761
3.2836158	-45.3188518	C				
0.0000794	10298.		129742743.	14.6117618	0.0011598	-0.0016977
3.3831281	-48.8187132	C				
0.0000844	10673.		126494722.	14.4374236	0.0012182	-0.0018193
3.4751010	-52.3204922	C				
0.0000894	11043.		123559602.	14.2854054	0.0012768	-0.0019407
3.5600070	-55.8149772	C				
0.0000944	11408.		120881804.	14.1507746	0.0013355	-0.0020620
3.6375813	-59.3059614	C				
0.0000994	11768.		118423066.	14.0312107	0.0013944	-0.0021831
3.7078114	-60.0000000	CY				
0.0001044	12124.		116158442.	13.9266134	0.0014536	-0.0023039
3.7708573	-60.0000000	CY				
0.0001094	12475.		114057545.	13.8340889	0.0015131	-0.0024244
3.8264933	-60.0000000	CY				
0.0001144	12821.		112094655.	13.7508379	0.0015728	-0.0025447
3.8745065	-60.0000000	CY				
0.0001194	13160.		110241729.	13.6773745	0.0016327	-0.0026648
3.9149672	-60.0000000	CY				
0.0001244	13464.		108252346.	13.6035379	0.0016919	-0.0027856
3.9471988	-60.0000000	CY				
0.0001294	13733.		106150971.	13.5292163	0.0017503	-0.0029072
3.9715013	-60.0000000	CY				
0.0001344	13964.		103921756.	13.4505455	0.0018074	-0.0030301
3.9880635	-60.0000000	CY				
0.0001394	14127.		101359169.	13.3573531	0.0018617	-0.0031558
3.9972256	-60.0000000	CY				
0.0001444	14267.		98821028.	13.2666400	0.0019154	-0.0032821
3.9990241	-60.0000000	CY				
0.0001494	14405.		96431960.	13.1844913	0.0019694	-0.0034081
3.9992162	-60.0000000	CY				
0.0001544	14538.		94173022.	13.1087050	0.0020237	-0.0035338
3.9999973	-60.0000000	CY				
0.0001594	14667.		92030955.	13.0381488	0.0020780	-0.0036595
3.9999063	-60.0000000	CY				
0.0001644	14794.		90001013.	12.9742648	0.0021326	-0.0037849
3.9995542	60.0000000	CY				
0.0001694	14918.		88074107.	12.9164127	0.0021877	-0.0039098
3.9987068	60.0000000	CY				
0.0001744	15036.		86230758.	12.8631956	0.0022430	-0.0040345
3.9970427	60.0000000	CY				
0.0001794	15136.		84379446.	12.8079924	0.0022974	-0.0041601
3.9999173	60.0000000	CY				
0.0001844	15207.		82477201.	12.7455963	0.0023500	-0.0042875
3.9986917	60.0000000	CY				
0.0001894	15255.		80554951.	12.6773978	0.0024008	-0.0044167
3.9989971	60.0000000	CY				
0.0001944	15299.		78706886.	12.6128107	0.0024516	-0.0045459
3.9990254	60.0000000	CY				
0.0001994	15341.		76945865.	12.5525305	0.0025027	-0.0046748
3.9980241	60.0000000	CY				
0.0002044	15382.		75264608.	12.4965442	0.0025540	-0.0048035
3.9989020	60.0000000	CY				
0.0002094	15422.		73659583.	12.4441986	0.0026055	-0.0049320

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
3.9990059	60.0000000	CY				
0.0002144	15461.		72120792.	12.3939556	0.0026570	-0.0050605
3.9982322	60.0000000	CY				
0.0002194	15498.		70646529.	12.3453028	0.0027083	-0.0051892
3.9999408	60.0000000	CY				
0.0002244	15534.		69233328.	12.2999555	0.0027598	-0.0053177
3.9965520	60.0000000	CY				
0.0002294	15570.		67878753.	12.2573963	0.0028115	-0.0054460
3.9993338	60.0000000	CY				
0.0002344	15604.		66579051.	12.2174569	0.0028635	-0.0055740
3.9978420	60.0000000	CY				
0.0002394	15638.		65329840.	12.1801748	0.0029156	-0.0057019
3.9974282	60.0000000	CY				
0.0002444	15672.		64129734.	12.1450324	0.0029679	-0.0058296
3.9996351	60.0000000	CY				
0.0002494	15704.		62974995.	12.1120789	0.0030204	-0.0059571
3.9962405	60.0000000	CYT				
0.0002544	15736.		61862806.	12.0812209	0.0030732	-0.0060843
3.9972595	60.0000000	CYT				
0.0002594	15768.		60791254.	12.0515177	0.0031259	-0.0062116
3.9995056	60.0000000	CYT				
0.0002644	15798.		59756704.	12.0221337	0.0031784	-0.0063391
3.9977369	60.0000000	CYT				
0.0002694	15828.		58758062.	11.9946268	0.0032311	-0.0064664
3.9957678	60.0000000	CYT				
0.0002744	15857.		57794597.	11.9685771	0.0032839	-0.0065936
3.9986518	60.0000000	CYT				
0.0003044	16023.		52643057.	11.8423846	0.0036045	-0.0073530
3.9937790	60.0000000	CYT				
0.0003344	16069.		48057694.	11.7735063	0.0039368	-0.0081007
3.9964660	60.0000000	CYT				

Axial Thrust Force = 525.300 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.1823309	358691729.	202.1432277	0.0001263	0.0001038
0.5174380	3.6605835				
0.000001250	448.3953387	358716271.	110.0909575	0.0001376	0.0000926
0.5614687	3.9842722				
0.000001875	672.5973064	358718563.	79.4154491	0.0001489	0.0000814
0.6052822	4.3084275				
0.000002500	896.7827224	358713089.	64.0841315	0.0001602	0.0000702
0.6488772	4.6330495				
0.000003125	1120.9460742	358702744.	54.8904908	0.0001715	0.0000590
0.6922525	4.9581382				
0.000003750	1345.0818487	358688493.	48.7656889	0.0001829	0.0000479
0.7354069	5.2836937				
0.000004375	1569.1845314	358670750.	44.3945097	0.0001942	0.0000367
0.7783393	5.6097159				
0.000005000	1793.2486067	358649721.	41.1193452	0.0002056	0.0000256
0.8210484	5.9362051				
0.000005625	2017.2685572	358625521.	38.5748577	0.0002170	0.0000145
0.8635329	6.2631612				
0.000006250	2241.2388639	358598218.	36.5418446	0.0002284	0.000003387
0.9057917	6.5905844				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.000006875	2465.1489065	358567114.	34.8808039	0.0002398	-0.000007694	
0.9478234	6.9184728					
0.000007500	2688.9124992	358521667.	33.4985983	0.0002512	-0.0000188	
0.9896226	7.2467951					
0.000008125	2912.3801300	358446785.	32.3306282	0.0002627	-0.0000298	
1.0311809	7.5754918					
0.000008750	3135.4210035	358333829.	31.3307631	0.0002741	-0.0000409	
1.0724900	7.9045062					
0.000009375	3357.9333207	358179554.	30.4652072	0.0002856	-0.0000519	
1.1135433	8.2337907					
0.0000100	3579.8419866	357984199.	29.7086481	0.0002971	-0.0000629	
1.1543354	8.5633080					
0.0000106	3801.0897280	357749621.	29.0417517	0.0003086	-0.0000739	
1.1948619	8.8930273					
0.0000113	4021.6340559	357478583.	28.4495007	0.0003201	-0.0000849	
1.2351194	9.2229247					
0.0000119	4241.4428054	357174131.	27.9200532	0.0003316	-0.0000959	
1.2751052	9.5529808					
0.0000125	4460.4901325	356839211.	27.4439435	0.0003430	-0.0001070	
1.3148168	9.8831796					
0.0000131	4460.4901325	339846867.	26.1622696	0.0003434	-0.0001291	
1.3155742	9.8895013	C				
0.0000138	4460.4901325	324399282.	25.6632835	0.0003529	-0.0001421	
1.3480579	10.1614593	C				
0.0000144	4460.4901325	310294966.	25.1992195	0.0003622	-0.0001553	
1.3799261	10.4298872	C				
0.0000150	4460.4901325	297366009.	24.7667391	0.0003715	-0.0001685	
1.4112388	10.6952315	C				
0.0000156	4460.4901325	285471368.	24.3625765	0.0003807	-0.0001818	
1.4420305	10.9577300	C				
0.0000163	4531.9017102	278886259.	23.9839272	0.0003897	-0.0001953	
1.4723325	11.2176007	C				
0.0000169	4624.5527233	274047569.	23.6281868	0.0003987	-0.0002088	
1.5021633	11.4749564	C				
0.0000175	4714.3646447	269392265.	23.2929437	0.0004076	-0.0002224	
1.5315306	11.7298189	C				
0.0000181	4801.5922148	264915433.	22.9763560	0.0004164	-0.0002361	
1.5604561	11.9823346	C				
0.0000188	4886.5136716	260614062.	22.6769158	0.0004252	-0.0002498	
1.5889669	12.2326980	C				
0.0000194	4969.4020446	256485267.	22.3933495	0.0004339	-0.0002636	
1.6170916	12.4811258	C				
0.0000200	5050.5217585	252526088.	22.1245797	0.0004425	-0.0002775	
1.6448608	12.7278563	C				
0.0000206	5129.3211874	248694361.	21.8680259	0.0004510	-0.0002915	
1.6721955	12.9721506	C				
0.0000213	5206.5827535	245015659.	21.6239759	0.0004595	-0.0003055	
1.6991937	13.2148502	C				
0.0000219	5282.6874631	241494284.	21.3920686	0.0004680	-0.0003195	
1.7259083	13.4564061	C				
0.0000225	5356.8227835	238081013.	21.1695909	0.0004763	-0.0003337	
1.7522199	13.6957081	C				
0.0000231	5429.8844751	234805815.	20.9574137	0.0004846	-0.0003479	
1.7782523	13.9338531	C				
0.0000238	5501.8155999	231655394.	20.7546019	0.0004929	-0.0003621	
1.8039985	14.1707571	C				
0.0000244	5572.2765025	228606215.	20.5596375	0.0005011	-0.0003764	
1.8294003	14.4058563	C				
0.0000256	5710.4025478	222844977.	20.1938942	0.0005175	-0.0004050	
1.8794166	14.8728252	C				
0.0000269	5844.7808500	217480218.	19.8563008	0.0005336	-0.0004339	
1.9283683	15.3352170	C				
0.0000281	5975.9069770	212476693.	19.5437277	0.0005497	-0.0004628	

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o			
1.9763252	15.7935404	C			
0.0000294	6104.2518248		207804317.	19.2536431	0.0005656 -0.0004919
2.0233602	16.2483598	C			
0.0000306	6229.3719420		203408063.	18.9820996	0.0005813 -0.0005212
2.0693784	16.6986148	C			
0.0000319	6352.3001275		199287847.	18.7286634	0.0005970 -0.0005505
2.1145586	17.1459208	C			
0.0000331	6473.5310626		195427353.	18.4921740	0.0006126 -0.0005799
2.1589960	17.5911322	C			
0.0000344	6592.4900406		191781528.	18.2694837	0.0006280 -0.0006095
2.2025712	18.0329542	C			
0.0000356	6709.8877688		188347727.	18.0603509	0.0006434 -0.0006391
2.2454174	18.4726376	C			
0.0000369	6826.0631314		185113576.	17.8640627	0.0006587 -0.0006688
2.2876103	-19.2016303	C			
0.0000381	6940.4120993		182043596.	17.6779481	0.0006740 -0.0006985
2.3290077	-20.0583061	C			
0.0000394	7054.0075573		179149398.	17.5032023	0.0006892 -0.0007283
2.3698509	-20.9154933	C			
0.0000406	7165.9150147		176391754.	17.3367171	0.0007043 -0.0007582
2.4099178	-21.7756176	C			
0.0000419	7277.0580199		173780490.	17.1796372	0.0007194 -0.0007881
2.4494272	-22.6363905	C			
0.0000431	7387.0983955		171295035.	17.0303339	0.0007344 -0.0008181
2.4882901	-23.4988260	C			
0.0000444	7495.9284828		168922332.	16.8879049	0.0007494 -0.0008481
2.5264841	-24.3632398	C			
0.0000456	7604.4881716		166673713.	16.7537085	0.0007644 -0.0008781
2.5642391	-25.2270868	C			
0.0000469	7711.3644707		164509109.	16.6240183	0.0007793 -0.0009082
2.6011925	-26.0945377	C			
0.0000481	7817.8100724		162448002.	16.5011132	0.0007941 -0.0009384
2.6376698	-26.9619212	C			
0.0000494	7923.9900153		160485874.	16.3848231	0.0008090 -0.0009685
2.6737125	-27.8287438	C			
0.0000506	8028.5653148		158588944.	16.2717074	0.0008238 -0.0009987
2.7089586	-28.6993371	C			
0.0000519	8132.8218738		156777289.	16.1642833	0.0008385 -0.0010290
2.7437598	-29.5695687	C			
0.0000531	8236.8176101		155045979.	16.0622760	0.0008533 -0.0010592
2.7781305	-30.4392434	C			
0.0000544	8339.8536282		153376618.	15.9637336	0.0008680 -0.0010895
2.8118705	-31.3108500	C			
0.0000556	8442.1076286		151768227.	15.8687992	0.0008827 -0.0011198
2.8450341	-32.1837806	C			
0.0000569	8544.1056383		150226033.	15.7783742	0.0008974 -0.0011501
2.8777712	-33.0561565	C			
0.0000581	8645.8460100		148745738.	15.6921690	0.0009121 -0.0011804
2.9100802	-33.9279750	C			
0.0000594	8746.6811303		147312524.	15.6084226	0.0009268 -0.0012107
2.9417657	-34.8018097	C			
0.0000606	8846.8577452		145927550.	15.5275264	0.0009414 -0.0012411
2.9729051	-35.6767050	C			
0.0000619	8946.7813879		144594447.	15.4502092	0.0009560 -0.0012715
3.0036202	-36.5510432	C			
0.0000631	9046.4504566		143310106.	15.3762600	0.0009706 -0.0013019
3.0339093	-37.4248213	C			
0.0000644	9145.8633153		142071663.	15.3054842	0.0009853 -0.0013322
3.0637708	-38.2980364	C			
0.0000656	9244.2052885		140864081.	15.2357715	0.0009998 -0.0013627
3.0929469	-39.1743598	C			
0.0000669	9342.2267946		139696849.	15.1687917	0.0010144 -0.0013931
3.1216782	-40.0504369	C			

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0000681	9439.9965361		138568756.	15.1045561	0.0010290	-0.0014235
3.1499851	-40.9259487	C				
0.0000694	9537.5129488		137477664.	15.0429179	0.0010436	-0.0014539
3.1778661	-41.8008918	C				
0.0000706	9634.7744113		136421585.	14.9837408	0.0010582	-0.0014843
3.2053195	-42.6752631	C				
0.0000719	9731.6098853		135396311.	14.9264767	0.0010728	-0.0015147
3.2322873	-43.5499374	C				
0.0000731	9827.6383609		134395055.	14.8700869	0.0010874	-0.0015451
3.2586449	-44.4269094	C				
0.0000744	9923.4159994		133424081.	14.8158601	0.0011019	-0.0015756
3.2845778	-45.3033040	C				
0.0000794	10304.		129813994.	14.6185709	0.0011603	-0.0016972
3.3840280	-48.8030394	C				
0.0000844	10679.		126562065.	14.4441008	0.0012187	-0.0018188
3.4759662	-52.3041538	C				
0.0000894	11049.		123622491.	14.2917650	0.0012773	-0.0019402
3.5608061	-55.7984939	C				
0.0000944	11414.		120941511.	14.1570678	0.0013361	-0.0020614
3.6383391	-59.2887375	C				
0.0000994	11774.		118479114.	14.0372456	0.0013950	-0.0021825
3.7084985	-60.0000000	CY				
0.0001044	12130.		116211164.	13.9324169	0.0014542	-0.0023033
3.7714717	-60.0000000	CY				
0.0001094	12481.		114107817.	13.8398957	0.0015137	-0.0024238
3.8270538	-60.0000000	CY				
0.0001144	12826.		112142099.	13.7564524	0.0015734	-0.0025441
3.8749884	-60.0000000	CY				
0.0001194	13166.		110287226.	13.6828403	0.0016334	-0.0026641
3.9153702	-60.0000000	CY				
0.0001244	13470.		108297930.	13.6089416	0.0016926	-0.0027849
3.9475258	-60.0000000	CY				
0.0001294	13739.		106194828.	13.5344928	0.0017510	-0.0029065
3.9717451	-60.0000000	CY				
0.0001344	13971.		103968337.	13.4560984	0.0018082	-0.0030293
3.9882358	-60.0000000	CY				
0.0001394	14134.		101406283.	13.3628871	0.0018625	-0.0031550
3.9973111	-60.0000000	CY				
0.0001444	14274.		98866047.	13.2720369	0.0019162	-0.0032813
3.9987798	-60.0000000	CY				
0.0001494	14411.		96475001.	13.1897636	0.0019702	-0.0034073
3.9989693	-60.0000000	CY				
0.0001544	14544.		94214906.	13.1141100	0.0020245	-0.0035330
3.9999994	-60.0000000	CY				
0.0001594	14674.		92071079.	13.0434446	0.0020788	-0.0036587
3.9999228	-60.0000000	CY				
0.0001644	14800.		90039482.	12.9794596	0.0021335	-0.0037840
3.9995916	60.0000000	CY				
0.0001694	14924.		88111018.	12.9215141	0.0021886	-0.0039089
3.9987719	60.0000000	CY				
0.0001744	15043.		86266401.	12.8682240	0.0022439	-0.0040336
3.9971430	60.0000000	CY				
0.0001794	15142.		84415265.	12.8130324	0.0022983	-0.0041592
3.9999339	60.0000000	CY				
0.0001844	15214.		82514130.	12.7509791	0.0023510	-0.0042865
3.9987667	60.0000000	CY				
0.0001894	15262.		80592122.	12.6828169	0.0024018	-0.0044157
3.9986754	60.0000000	CY				
0.0001944	15306.		78743068.	12.6181418	0.0024527	-0.0045448
3.9990928	60.0000000	CY				
0.0001994	15348.		76980868.	12.5577795	0.0025037	-0.0046738
3.9976960	60.0000000	CY				
0.0002044	15389.		75298586.	12.5017006	0.0025550	-0.0048025

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
3.9989748	60.0000000	CY				
0.0002094	15429.		73692500.	12.4492819	0.0026066	-0.0049309
3.9986722	60.0000000	CY				
0.0002144	15468.		72153362.	12.3992828	0.0026581	-0.0050594
3.9983326	60.0000000	CY				
0.0002194	15505.		70678209.	12.3505463	0.0027094	-0.0051881
3.9999581	60.0000000	CY				
0.0002244	15541.		69264086.	12.3051340	0.0027610	-0.0053165
3.9966951	60.0000000	CY				
0.0002294	15577.		67908712.	12.2624969	0.0028127	-0.0054448
3.9993963	60.0000000	CY				
0.0002344	15611.		66608164.	12.2225004	0.0028646	-0.0055729
3.9974714	60.0000000	CY				
0.0002394	15645.		65358233.	12.1851454	0.0029168	-0.0057007
3.9975546	60.0000000	CY				
0.0002444	15678.		64157434.	12.1499339	0.0029691	-0.0058284
3.9996820	60.0000000	CY				
0.0002494	15711.		63001957.	12.1169311	0.0030217	-0.0059558
3.9958611	60.0000000	CYT				
0.0002544	15743.		61889141.	12.0860078	0.0030744	-0.0060831
3.9973930	60.0000000	CYT				
0.0002594	15775.		60817351.	12.0565789	0.0031272	-0.0062103
3.9995655	60.0000000	CYT				
0.0002644	15805.		59782138.	12.0271527	0.0031797	-0.0063378
3.9973209	60.0000000	CYT				
0.0002694	15835.		58782941.	11.9995841	0.0032324	-0.0064651
3.9959500	60.0000000	CYT				
0.0002744	15864.		57818941.	11.9734758	0.0032852	-0.0065923
3.9987544	60.0000000	CYT				
0.0003044	16030.		52664280.	11.8470569	0.0036059	-0.0073516
3.9933331	60.0000000	CYT				
0.0003344	16076.		48077265.	11.7784585	0.0039384	-0.0080991
3.9966716	60.0000000	CYT				

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	500.200	15529.244	0.00300000
2	524.400	15691.660	0.00300000
3	525.300	15697.652	0.00300000

Note note that the values of moment capacity in the table above are not factored by a strength reduction factor (ϕ -factor).

In ACI 318-08, the value of the strength reduction factor depends on whether the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318-08, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Bridge 11 Bent 3 Longitudinal Final Loads.lp60					Ultimate Moment
Axial (Factored) Load Capacity No. in-kip	Resistance Bending Factor at Ult. for Moment	Stiffness Mom. Cap. kip-in^2	Nominal Moment Capacity in-kip	Ultimate (Factored) Axial Thrust kips	
1	0.65	128256428.752	15529.244	325.130	
10094.008					
2	0.65	130677912.923	15691.660	340.860	
10199.578					
3	0.65	130767455.377	15697.652	341.445	
10203.473					
1	0.70	122002120.835	15529.244	350.140	
10870.471					
2	0.70	124027273.490	15691.660	367.080	
10984.162					
3	0.70	124102276.853	15697.652	367.710	
10988.356					
1	0.75	116735476.694	15529.244	375.150	
11646.933					
2	0.75	118420185.023	15691.660	393.300	
11768.745					
3	0.75	118483375.774	15697.652	393.975	
11773.239					

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	38.00000000	ft
Shaft Diameter	=	42.00000000	in
Concrete Cover Thickness	=	4.75000000	in
Number of Reinforcing Bars	=	12	bars
Yield Stress of Reinforcing Bars	=	60.00000000	ksi
Modulus of Elasticity of Reinforcing Bars	=	29000.	ksi
Gross Area of Shaft	=	1385.44236023	sq. in.
Total Area of Reinforcing Steel	=	15.24000000	sq. in.
Area Ratio of Steel Reinforcement	=	1.10	percent
Edge-to-Edge Bar Spacing	=	6.81291878	in
Maximum Concrete Aggregate Size	=	0.75000000	in
Ratio of Bar Spacing to Aggregate Size	=	9.08	
Offset of Rebar Cage Center from Center of Pile	=	0.00000000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$	=	5573.088	kips
Tensile Load for Cracking of Concrete	=	-620.869	kips
Nominal Axial Tensile Capacity	=	-914.400	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
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	Bridge 11 Bent 3 Longitudinal Final Loads.lp6o			
1	1.27000	1.27000	15.61500	0.00000
2	1.27000	1.27000	13.52299	7.80750
3	1.27000	1.27000	7.80750	13.52299
4	1.27000	1.27000	0.00000	15.61500
5	1.27000	1.27000	-7.80750	13.52299
6	1.27000	1.27000	-13.52299	7.80750
7	1.27000	1.27000	-15.61500	0.00000
8	1.27000	1.27000	-13.52299	-7.80750
9	1.27000	1.27000	-7.80750	-13.52299
10	1.27000	1.27000	0.00000	-15.61500
11	1.27000	1.27000	7.80750	-13.52299
12	1.27000	1.27000	13.52299	-7.80750

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 6.81292 inches between Bars 7 and 8

Spacing to aggregate size ratio = 9.08389

Concrete Properties:

Compressive Strength of Concrete	=	4.00000000 ksi
Modulus of Elasticity of Concrete	=	3604.99653259 ksi
Modulus of Rupture of Concrete	=	-0.47434164 ksi
Compression Strain at Peak Stress	=	0.00188627
Tensile Strain at Fracture of Concrete	=	-0.00011537
Maximum Coarse Aggregate Size	=	0.75000000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 3

Number	Axial Thrust Force kips
-----	-----
1	500.200
2	524.400
3	525.300

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.

Y = stress in reinforcing steel has reached yield stress.

T = ACI 318-08 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-08, Section 10.3.4.

Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.

Position of neutral axis is measured from edge of compression side of pile.

Compressive stresses and strains are positive in sign.

Tensile stresses and strains are negative in sign.

Axial Thrust Force = 500.200 kips

Bending	Bending	Bending	Depth to	Max Comp	Max Tens
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Bridge 11 Bent 3 Longitudinal Final Loads.lp6o					
Max Concrete Curvature Stress rad/in. ksi	Max Steel Moment Stress in-kip ksi	Run Stiffness Msg kip-in2	N Axis in	Strain in/in	Strain in/in
0.000000625	416.3823673	666211788.	151.6293878	0.0000948	0.0000685
0.3913036	2.7444764				
0.000001250	832.7758404	666220672.	86.3412200	0.0001079	0.0000554
0.4435902	3.1222567				
0.000001875	1249.1411898	666208635.	64.5902760	0.0001211	0.0000424
0.4955830	3.5006775				
0.000002500	1665.4643639	666185746.	53.7236386	0.0001343	0.0000293
0.5472799	3.8797388				
0.000003125	2081.7313089	666154019.	47.2107248	0.0001475	0.0000163
0.5986790	4.2594407				
0.000003750	2497.9279676	666114125.	42.8746737	0.0001608	0.000003280
0.6497785	4.6397833				
0.000004375	2914.0126151	666060026.	39.7824924	0.0001740	-0.000009702
0.7005754	5.0207600				
0.000005000	3329.6377290	665927546.	37.4671466	0.0001873	-0.0000227
0.7510567	5.4022863				
0.000005625	3744.3291423	665658514.	35.6689039	0.0002006	-0.0000356
0.8012040	5.7842337				
0.000006250	4157.7668453	665242695.	34.2320938	0.0002140	-0.0000485
0.8510031	6.1665045				
0.000006875	4569.7500401	664690915.	33.0578006	0.0002273	-0.0000615
0.9004444	6.5490303				
0.000007500	4980.1483518	664019780.	32.0801687	0.0002406	-0.0000744
0.9495208	6.9317617				
0.000008125	5388.8733837	663245955.	31.2536602	0.0002539	-0.0000873
0.9982270	7.3146625				
0.000008750	5795.8655121	662384630.	30.5457864	0.0002673	-0.0001002
1.0465591	7.6977058				
0.000009375	6201.0837754	661448936.	29.9327479	0.0002806	-0.0001131
1.0945143	8.0808721				
0.0000100	6201.0837754	620108378.	27.6881864	0.0002769	-0.0001431
1.0805128	7.9686741	C			
0.0000106	6201.0837754	583631414.	27.0179487	0.0002871	-0.0001592
1.1168232	8.2601992	C			
0.0000113	6201.0837754	551207447.	26.4064939	0.0002971	-0.0001754
1.1522748	8.5466061	C			
0.0000119	6201.0837754	522196528.	25.8474634	0.0003069	-0.0001918
1.1870028	8.8289015	C			
0.0000125	6201.0837754	496086702.	25.3319333	0.0003166	-0.0002084
1.2209698	9.1067008	C			
0.0000131	6201.0837754	472463526.	24.8557359	0.0003262	-0.0002250
1.2542801	9.3807833	C			
0.0000138	6201.0837754	450987911.	24.4143082	0.0003357	-0.0002418
1.2869803	9.6514679	C			
0.0000144	6201.0837754	431379741.	24.0036679	0.0003451	-0.0002587
1.3191055	9.9189853	C			
0.0000150	6235.2274013	415681827.	23.6205543	0.0003543	-0.0002757
1.3506927	10.1835912	C			
0.0000156	6354.3435906	406677990.	23.2622891	0.0003635	-0.0002928
1.3817818	10.4455685	C			
0.0000163	6470.2761354	398170839.	22.9258749	0.0003725	-0.0003100
1.4123711	10.7048561	C			
0.0000169	6583.1141390	390110467.	22.6087369	0.0003815	-0.0003272
1.4424576	10.9613819	C			
0.0000175	6693.7574618	382500426.	22.3103971	0.0003904	-0.0003446
1.4721408	11.2159516	C			

	Bridge 11	Bent 3	Longitudinal	Final	Loads.l	lp6o	
0.0000181	6802.6061402		375316201.	22.0296401	0.0003993	-0.0003620	
1.5014689	11.4689484	C					
0.0000188	6908.5914347		368458210.	21.7623307	0.0004080	-0.0003795	
1.5302966	11.7190799	C					
0.0000194	7013.1499321		361969029.	21.5098733	0.0004168	-0.0003970	
1.5588034	11.9678664	C					
0.0000200	7116.1668644		355808343.	21.2706268	0.0004254	-0.0004146	
1.5869756	12.2151636	C					
0.0000206	7217.2693780		349928212.	21.0424282	0.0004340	-0.0004322	
1.6147511	12.4603961	C					
0.0000213	7317.6110027		344358165.	20.8266475	0.0004426	-0.0004499	
1.6422962	-12.9186659	C					
0.0000219	7415.9714402		339015837.	20.6195597	0.0004511	-0.0004677	
1.6694238	-13.4299980	C					
0.0000225	7513.8195505		333947536.	20.4234433	0.0004595	-0.0004855	
1.6963558	-13.9416782	C					
0.0000231	7609.9895294		329080628.	20.2348725	0.0004679	-0.0005033	
1.7229051	-14.4554074	C					
0.0000238	7705.4320420		324439244.	20.0552096	0.0004763	-0.0005212	
1.7492238	-14.9698368	C					
0.0000244	7799.9702647		319998780.	19.8833013	0.0004847	-0.0005391	
1.7752770	-15.4852976	C					
0.0000256	7986.2218778		311657439.	19.5602136	0.0005012	-0.0005750	
1.8265737	-16.5195100	C					
0.0000269	8168.6676609		303950425.	19.2609676	0.0005176	-0.0006111	
1.8767561	-17.5585648	C					
0.0000281	8348.7595142		296844783.	18.9850227	0.0005340	-0.0006473	
1.9260691	-18.6003095	C					
0.0000294	8526.5888681		290266855.	18.7295041	0.0005502	-0.0006836	
1.9745316	-19.6446599	C					
0.0000306	8701.4196308		284127988.	18.4900130	0.0005663	-0.0007200	
2.0219799	-20.6933010	C					
0.0000319	8875.3389401		278442006.	18.2689352	0.0005823	-0.0007564	
2.0688311	-21.7422842	C					
0.0000331	9046.0933453		273089610.	18.0592262	0.0005982	-0.0007930	
2.1146080	-22.7963745	C					
0.0000344	9216.4663308		268115384.	17.8654066	0.0006141	-0.0008296	
2.1598989	-23.8498290	C					
0.0000356	9384.1799060		263415576.	17.6808054	0.0006299	-0.0008664	
2.2041955	-24.9078118	C					
0.0000369	9551.3168981		259018763.	17.5088675	0.0006456	-0.0009031	
2.2479677	-25.9656360	C					
0.0000381	9716.9502546		254870826.	17.3462227	0.0006613	-0.0009399	
2.2909904	-27.0256513	C					
0.0000394	9881.1604964		250950108.	17.1921328	0.0006769	-0.0009768	
2.3332873	-28.0876895	C					
0.0000406	10045.		247261742.	17.0480499	0.0006926	-0.0010137	
2.3751119	-29.1491099	C					
0.0000419	10207.		243751932.	16.9099363	0.0007081	-0.0010506	
2.4161107	-30.2137273	C					
0.0000431	10368.		240425230.	16.7791585	0.0007236	-0.0010876	
2.4565095	-31.2791835	C					
0.0000444	10529.		237277960.	16.6562253	0.0007391	-0.0011246	
2.4964414	-32.3440262	C					
0.0000456	10689.		234279784.	16.5388340	0.0007546	-0.0011617	
2.5357102	-33.4104490	C					
0.0000469	10848.		231414442.	16.4260553	0.0007700	-0.0011988	
2.5742637	-34.4791122	C					
0.0000481	11006.		228690749.	16.3195736	0.0007854	-0.0012359	
2.6123557	-35.5471638	C					
0.0000494	11164.		226097900.	16.2189129	0.0008008	-0.0012729	
2.6499841	-36.6146002	C					
0.0000506	11320.		223612872.	16.1220315	0.0008162	-0.0013101	

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
2.6869487	-37.6837861	C				
0.0000519	11476.		221227691.	16.0286119	0.0008315	-0.0013473
2.7232501	-38.7547880	C				
0.0000531	11632.		218948328.	15.9399886	0.0008468	-0.0013844
2.7590929	-39.8251736	C				
0.0000544	11787.		216767447.	15.8558330	0.0008622	-0.0014216
2.7944751	-40.8949394	C				
0.0000556	11941.		214678365.	15.7758462	0.0008775	-0.0014587
2.8293949	-41.9640817	C				
0.0000569	12095.		212662052.	15.6979357	0.0008928	-0.0014959
2.8636165	-43.0355985	C				
0.0000581	12248.		210720280.	15.6228539	0.0009081	-0.0015332
2.8972627	-44.1079956	C				
0.0000594	12401.		208854560.	15.5512984	0.0009234	-0.0015704
2.9304509	-45.1797642	C				
0.0000606	12553.		207060150.	15.4830533	0.0009387	-0.0016076
2.9631791	-46.2509004	C				
0.0000619	12705.		205332693.	15.4179203	0.0009540	-0.0016448
2.9954453	-47.3214003	C				
0.0000631	12857.		203668174.	15.3557165	0.0009693	-0.0016819
3.0272477	-48.3912600	C				
0.0000644	13007.		202055253.	15.2949975	0.0009846	-0.0017191
3.0584153	-49.4628577	C				
0.0000656	13157.		200493013.	15.2359981	0.0009999	-0.0017564
3.0889965	-50.5355847	C				
0.0000669	13307.		198984097.	15.1795395	0.0010151	-0.0017936
3.1191176	-51.6076616	C				
0.0000681	13456.		197525537.	15.1254843	0.0010304	-0.0018308
3.1487764	-52.6790837	C				
0.0000694	13605.		196114577.	15.0737045	0.0010457	-0.0018680
3.1779711	-53.7498468	C				
0.0000706	13754.		194748656.	15.0240816	0.0010611	-0.0019052
3.2066995	-54.8199464	C				
0.0000719	13902.		193425392.	14.9765052	0.0010764	-0.0019423
3.2349597	-55.8893779	C				
0.0000731	14050.		192142563.	14.9308726	0.0010918	-0.0019794
3.2627496	-56.9581368	C				
0.0000744	14198.		190893704.	14.8861757	0.0011072	-0.0020166
3.2899459	-58.0281858	C				
0.0000794	14782.		186233127.	14.7214096	0.0011685	-0.0021652
3.3936128	-60.0000000	CY				
0.0000844	15361.		182057812.	14.5807826	0.0012303	-0.0023135
3.4896930	-60.0000000	CY				
0.0000894	15934.		178280018.	14.4591188	0.0012923	-0.0024615
3.5778888	-60.0000000	CY				
0.0000944	16468.		174490945.	14.3430514	0.0013536	-0.0026101
3.6568689	-60.0000000	CY				
0.0000994	16919.		170253513.	14.2231978	0.0014134	-0.0027603
3.7259722	-60.0000000	CY				
0.0001044	17257.		165336765.	14.0897784	0.0014706	-0.0029131
3.7847491	-60.0000000	CY				
0.0001094	17502.		160015231.	13.9432440	0.0015250	-0.0030687
3.8340563	-60.0000000	CY				
0.0001144	17742.		155117713.	13.8112277	0.0015797	-0.0032241
3.8771040	-60.0000000	CY				
0.0001194	17978.		150602391.	13.6930737	0.0016346	-0.0033791
3.9139083	-60.0000000	CY				
0.0001244	18210.		146411015.	13.5839902	0.0016895	-0.0035342
3.9441533	-60.0000000	CY				
0.0001294	18437.		142508172.	13.4839982	0.0017445	-0.0036893
3.9679111	-60.0000000	CY				
0.0001344	18636.		138688546.	13.3864527	0.0017988	-0.0038449
3.9849545	-60.0000000	CY				

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
0.0001394	18756.	134574011.	13.2744695	0.0018501	-0.0040036	
3.9951900	-60.0000000	CY				
0.0001444	18851.	130567637.	13.1621403	0.0019003	-0.0041635	
3.9997011	-60.0000000	CY				
0.0001494	18941.	126804437.	13.0571853	0.0019504	-0.0043233	
3.9989909	-60.0000000	CY				
0.0001544	19030.	123268934.	12.9612112	0.0020009	-0.0044829	
3.9974659	-60.0000000	CY				
0.0001594	19115.	119939966.	12.8733643	0.0020517	-0.0046421	
3.9999958	-60.0000000	CY				
0.0001644	19198.	116794286.	12.7919913	0.0021027	-0.0048011	
3.9992850	-60.0000000	CY				
0.0001694	19277.	113811125.	12.7136094	0.0021534	-0.0049604	
3.9968394	60.0000000	CY				
0.0001744	19353.	110987073.	12.6415832	0.0022044	-0.0051194	
3.9998523	60.0000000	CY				
0.0001794	19428.	108308356.	12.5754641	0.0022557	-0.0052780	
3.9977332	60.0000000	CY				
0.0001844	19501.	105765734.	12.5144779	0.0023074	-0.0054364	
3.9999739	60.0000000	CY				
0.0001894	19571.	103346070.	12.4585305	0.0023593	-0.0055944	
3.9978304	60.0000000	CY				
0.0001944	19640.	101043579.	12.4067806	0.0024116	-0.0057522	
3.9999679	60.0000000	CY				
0.0001994	19707.	98842445.	12.3569639	0.0024637	-0.0059101	
3.9971179	60.0000000	CY				
0.0002044	19771.	96740914.	12.3095870	0.0025158	-0.0060680	
3.9997707	60.0000000	CY				
0.0002094	19835.	94732305.	12.2659226	0.0025682	-0.0062256	
3.9951677	60.0000000	CY				
0.0002144	19896.	92811448.	12.2255161	0.0026208	-0.0063829	
3.9989373	60.0000000	CY				
0.0002194	19957.	90972271.	12.1879084	0.0026737	-0.0065400	
3.9986573	60.0000000	CY				
0.0002244	20011.	89186498.	12.1510765	0.0027264	-0.0066974	
3.9965832	60.0000000	CY				
0.0002294	20059.	87452126.	12.1141065	0.0027787	-0.0068551	
3.9994154	60.0000000	CY				
0.0002344	20095.	85739453.	12.0741735	0.0028299	-0.0070139	
3.9973485	60.0000000	CY				
0.0002394	20122.	84060003.	12.0328794	0.0028804	-0.0071734	
3.9957418	60.0000000	CY				
0.0002444	20140.	82414326.	11.9898783	0.0029300	-0.0073337	
3.9987051	60.0000000	CY				
0.0002494	20154.	80818776.	11.9456034	0.0029789	-0.0074948	
3.9999436	60.0000000	CY				
0.0002544	20165.	79273057.	11.9010758	0.0030273	-0.0076564	
3.9939579	60.0000000	CYT				
0.0002594	20176.	77785470.	11.8588319	0.0030759	-0.0078179	
3.9955142	60.0000000	CYT				
0.0002644	20186.	76353189.	11.8186117	0.0031245	-0.0079792	
3.9983200	60.0000000	CYT				
0.0002694	20196.	74973115.	11.7803089	0.0031733	-0.0081404	
3.9997787	60.0000000	CYT				
0.0002744	20205.	73641727.	11.7440219	0.0032223	-0.0083015	
3.9966253	60.0000000	CYT				
0.0003044	20257.	66551186.	11.5602080	0.0035186	-0.0092651	
3.9901846	60.0000000	CYT				
0.0003344	20290.	60680154.	11.4101359	0.0038153	-0.0102285	
3.9896264	60.0000000	CYT				

Axial Thrust Force = 524.400 kips

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	415.5251618	664840259.	158.0875886	0.0000988	0.0000726
0.4075453	2.8615313				
0.000001250	831.0626501	664850120.	89.5703755	0.0001120	0.0000595
0.4597140	3.2393136				
0.000001875	1246.5719562	664838377.	66.7431075	0.0001251	0.0000464
0.5115888	3.6177377				
0.000002500	1662.0389996	664815600.	55.3383265	0.0001383	0.0000333
0.5631677	3.9968037				
0.000003125	2077.4496970	664783903.	48.5025412	0.0001516	0.0000203
0.6144488	4.3765116				
0.000003750	2492.7899620	664743990.	43.9512546	0.0001648	0.000007317
0.6654302	4.7568614				
0.000004375	2908.0413544	664695167.	40.7053887	0.0001781	-0.000005664
0.7161098	5.1378525				
0.000005000	3322.9894936	664597899.	38.2750674	0.0001914	-0.0000186
0.7664790	5.5194348				
0.000005625	3737.1626264	664384467.	36.3876892	0.0002047	-0.0000316
0.8165201	5.9014856				
0.000006250	4150.1972338	664031557.	34.8797859	0.0002180	-0.0000445
0.8662179	6.2838987				
0.000006875	4561.8576897	663542937.	33.6474790	0.0002313	-0.0000574
0.9155614	6.6665974				
0.000007500	4971.9927933	662932372.	32.6216193	0.0002447	-0.0000703
0.9645427	7.0495272				
0.000008125	5380.4988593	662215244.	31.7543918	0.0002580	-0.0000832
1.0131560	7.4326473				
0.000008750	5787.3047664	661406259.	31.0116841	0.0002714	-0.0000961
1.0613970	7.8159274				
0.000009375	6192.3612749	660518536.	30.3685091	0.0002847	-0.0001090
1.1092623	8.1993447				
0.0000100	6192.3612749	619236127.	28.2520596	0.0002825	-0.0001375
1.1009081	8.1321973	C			
0.0000106	6192.3612749	582810473.	27.5632802	0.0002929	-0.0001534
1.1376486	8.4282295	C			
0.0000113	6192.3612749	550432113.	26.9349639	0.0003030	-0.0001695
1.1735104	8.7190194	C			
0.0000119	6192.3612749	521462002.	26.3599843	0.0003130	-0.0001857
1.2086076	9.0054009	C			
0.0000125	6192.3612749	495388902.	25.8314943	0.0003229	-0.0002021
1.2430010	9.2877917	C			
0.0000131	6192.3612749	471798954.	25.3419831	0.0003326	-0.0002186
1.2766597	9.5658610	C			
0.0000138	6192.3612749	450353547.	24.8882894	0.0003422	-0.0002353
1.3096964	9.8404679	C			
0.0000144	6258.3537621	435363740.	24.4662904	0.0003517	-0.0002520
1.3421461	10.1118411	C			
0.0000150	6384.6091088	425640607.	24.0725830	0.0003611	-0.0002689
1.3740445	10.3802237	C			
0.0000156	6507.3373612	416469591.	23.7043668	0.0003704	-0.0002859
1.4054298	10.6458850	C			
0.0000163	6626.4832101	407783582.	23.3582855	0.0003796	-0.0003029
1.4362849	10.9086296	C			
0.0000169	6742.4939419	399555197.	23.0324124	0.0003887	-0.0003201
1.4666464	11.1687181	C			

	Bridge 11	Bent 3	Longitudinal	Final Loads	lp6o	
0.0000175	6856.0675993	391775291.	22.7257107	0.0003977	-0.0003373	
1.4965859	11.4267232	C				
0.0000181	6967.6182549	384420318.	22.4368922	0.0004067	-0.0003546	
1.5261499	11.6830102	C				
0.0000188	7076.2752951	377401349.	22.1622868	0.0004155	-0.0003720	
1.5552249	11.9365560	C				
0.0000194	7183.1275148	370742065.	21.9024003	0.0004244	-0.0003894	
1.5839365	12.1884174	C				
0.0000200	7288.5920851	364429604.	21.6566510	0.0004331	-0.0004069	
1.6123406	12.4390576	C				
0.0000206	7391.5295203	358377189.	21.4213272	0.0004418	-0.0004244	
1.6402765	12.6870251	C				
0.0000213	7493.9233700	352655217.	21.1993343	0.0004505	-0.0004420	
1.6680128	12.9346773	C				
0.0000219	7593.8918243	347149341.	20.9857216	0.0004591	-0.0004597	
1.6952820	-13.1977141	C				
0.0000225	7693.6757553	341941145.	20.7841343	0.0004676	-0.0004774	
1.7224022	-13.7063273	C				
0.0000231	7791.1610934	336915074.	20.5893341	0.0004761	-0.0004951	
1.7490595	-14.2176965	C				
0.0000238	7888.5309691	332148672.	20.4050573	0.0004846	-0.0005129	
1.7755803	-14.7288792	C				
0.0000244	7984.0469220	327550643.	20.2269493	0.0004930	-0.0005307	
1.8016924	-15.2423815	C				
0.0000256	8173.1996795	318954134.	19.8944462	0.0005098	-0.0005665	
1.8532669	-16.2711333	C				
0.0000269	8358.5498268	311015808.	19.5871407	0.0005264	-0.0006023	
1.9037562	-17.3043534	C				
0.0000281	8540.4834930	303661635.	19.3019575	0.0005429	-0.0006384	
1.9532015	-18.3418098	C				
0.0000294	8720.3303347	296862309.	19.0384802	0.0005593	-0.0006745	
2.0018309	-19.3814508	C				
0.0000306	8897.3066932	290524300.	18.7923412	0.0005755	-0.0007107	
2.0494974	-20.4247957	C				
0.0000319	9072.1630643	284616880.	18.5626619	0.0005917	-0.0007471	
2.0963231	-21.4707707	C				
0.0000331	9245.2634328	279102292.	18.3482770	0.0006078	-0.0007835	
2.1423846	-22.5187051	C				
0.0000344	9416.2741743	273927976.	18.1465803	0.0006238	-0.0008200	
2.1875970	-23.5695340	C				
0.0000356	9585.8343059	269076051.	17.9575029	0.0006397	-0.0008565	
2.2320984	-24.6219485	C				
0.0000369	9754.0341391	264516180.	17.7797604	0.0006556	-0.0008931	
2.2758942	-25.6759499	C				
0.0000381	9920.3764863	260206596.	17.6111777	0.0006714	-0.0009298	
2.3188791	-26.7327103	C				
0.0000394	10086.	256161038.	17.4538545	0.0006872	-0.0009665	
2.3613808	-27.7888360	C				
0.0000406	10250.	252310493.	17.3028518	0.0007029	-0.0010033	
2.4029724	-28.8489215	C				
0.0000419	10413.	248672944.	17.1606716	0.0007186	-0.0010401	
2.4440081	-29.9092406	C				
0.0000431	10576.	245237695.	17.0272363	0.0007343	-0.0010770	
2.4845663	-30.9689312	C				
0.0000444	10737.	241951213.	16.8982682	0.0007499	-0.0011139	
2.5242402	-32.0325473	C				
0.0000456	10897.	238831461.	16.7763053	0.0007654	-0.0011508	
2.5633807	-33.0962446	C				
0.0000469	11056.	235870384.	16.6613069	0.0007810	-0.0011878	
2.6020492	-34.1593170	C				
0.0000481	11215.	233044007.	16.5514714	0.0007965	-0.0012247	
2.6400937	-35.2235214	C				
0.0000494	11373.	230332573.	16.4453467	0.0008120	-0.0012618	

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o				
2.6773905	-36.2903753	C				
0.0000506	11530.		227748056.	16.3448878	0.0008275	-0.0012988
2.7142205	-37.3566052	C				
0.0000519	11686.		225281235.	16.2496874	0.0008430	-0.0013358
2.7505817	-38.4222076	C				
0.0000531	11843.		222920753.	16.1590035	0.0008584	-0.0013728
2.7864258	-39.4877538	C				
0.0000544	11997.		220640882.	16.0702250	0.0008738	-0.0014099
2.8214650	-40.5568701	C				
0.0000556	12152.		218457215.	15.9858268	0.0008892	-0.0014470
2.8560401	-41.6253567	C				
0.0000569	12306.		216363369.	15.9055225	0.0009046	-0.0014841
2.8901492	-42.6932100	C				
0.0000581	12459.		214353509.	15.8290501	0.0009201	-0.0015212
2.9237904	-43.7604261	C				
0.0000594	12613.		212422289.	15.7561698	0.0009355	-0.0015582
2.9569618	-44.8270012	C				
0.0000606	12765.		210548823.	15.6843383	0.0009509	-0.0015954
2.9893611	-45.8970165	C				
0.0000619	12916.		208743964.	15.6155512	0.0009662	-0.0016325
3.0212676	-46.9667765	C				
0.0000631	13067.		207005063.	15.5498420	0.0009816	-0.0016697
3.0527085	-48.0358891	C				
0.0000644	13218.		205328245.	15.4870337	0.0009970	-0.0017068
3.0836817	-49.1043501	C				
0.0000656	13368.		203709923.	15.4269627	0.0010124	-0.0017439
3.1141852	-50.1721552	C				
0.0000669	13519.		202146783.	15.3694777	0.0010278	-0.0017809
3.1442170	-51.2393003	C				
0.0000681	13668.		200632314.	15.3138419	0.0010433	-0.0018180
3.1736967	-52.3069597	C				
0.0000694	13817.		199158973.	15.2590886	0.0010586	-0.0018552
3.2025123	-53.3768771	C				
0.0000706	13965.		197732836.	15.2066016	0.0010740	-0.0018923
3.2308596	-54.4461227	C				
0.0000719	14113.		196351407.	15.1562648	0.0010894	-0.0019294
3.2587365	-55.5146916	C				
0.0000731	14260.		195012359.	15.1079702	0.0011048	-0.0019665
3.2861409	-56.5825792	C				
0.0000744	14407.		193713522.	15.0616171	0.0011202	-0.0020035
3.3130708	-57.6497806	C				
0.0000794	14992.		188878672.	14.8931726	0.0011821	-0.0021516
3.4159174	-60.0000000	CY				
0.0000844	15569.		184523760.	14.7440299	0.0012440	-0.0022997
3.5103453	-60.0000000	CY				
0.0000894	16140.		180590223.	14.6161300	0.0013063	-0.0024474
3.5970011	-60.0000000	CY				
0.0000944	16683.		176775182.	14.5006323	0.0013685	-0.0025953
3.6750936	-60.0000000	CY				
0.0000994	17137.		172450699.	14.3760518	0.0014286	-0.0027451
3.7425747	-60.0000000	CY				
0.0001044	17498.		167643497.	14.2431946	0.0014866	-0.0028971
3.8002150	-60.0000000	CY				
0.0001094	17745.		162242743.	14.0972341	0.0015419	-0.0030519
3.8482869	-60.0000000	CY				
0.0001144	17984.		157239508.	13.9611005	0.0015968	-0.0032069
3.8895168	-60.0000000	CY				
0.0001194	18219.		152621442.	13.8379848	0.0016519	-0.0033618
3.9243354	-60.0000000	CY				
0.0001244	18451.		148346580.	13.7275868	0.0017074	-0.0035164
3.9527449	-60.0000000	CY				
0.0001294	18678.		144370600.	13.6273952	0.0017630	-0.0036707
3.9745715	-60.0000000	CY				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0001344	18884.	140529052.	13.5284865	0.0018179	-0.0038259	
3.9895094	-60.0000000	CY				
0.0001394	19020.	136462834.	13.4181966	0.0018702	-0.0039836	
3.9976850	-60.0000000	CY				
0.0001444	19114.	132393883.	13.3056961	0.0019210	-0.0041427	
3.9986142	-60.0000000	CY				
0.0001494	19206.	128573962.	13.2014451	0.0019720	-0.0043018	
3.9999205	-60.0000000	CY				
0.0001544	19292.	124969853.	13.1021618	0.0020226	-0.0044611	
3.9992564	-60.0000000	CY				
0.0001594	19376.	121576442.	13.0112655	0.0020737	-0.0046201	
3.9975291	-60.0000000	CY				
0.0001644	19458.	118375274.	12.9279299	0.0021250	-0.0047787	
3.9999907	60.0000000	CY				
0.0001694	19537.	115347837.	12.8516654	0.0021768	-0.0049370	
3.9990124	60.0000000	CY				
0.0001744	19613.	112477532.	12.7796917	0.0022285	-0.0050953	
3.9960436	60.0000000	CY				
0.0001794	19686.	109749011.	12.7110339	0.0022800	-0.0052537	
3.9995236	60.0000000	CY				
0.0001844	19757.	107158314.	12.6478019	0.0023319	-0.0054118	
3.9962602	60.0000000	CY				
0.0001894	19827.	104695100.	12.5895050	0.0023841	-0.0055696	
3.9995887	60.0000000	CY				
0.0001944	19894.	102349652.	12.5357723	0.0024366	-0.0057271	
3.9956908	60.0000000	CY				
0.0001994	19960.	100113798.	12.4861786	0.0024894	-0.0058843	
3.9993046	60.0000000	CY				
0.0002044	20025.	97980192.	12.4403465	0.0025425	-0.0060413	
3.9960986	60.0000000	CY				
0.0002094	20088.	95940762.	12.3981215	0.0025959	-0.0061979	
3.9983866	60.0000000	CY				
0.0002144	20149.	93987750.	12.3563989	0.0026489	-0.0063548	
3.9999919	60.0000000	CY				
0.0002194	20208.	92115340.	12.3174796	0.0027021	-0.0065116	
3.9960293	60.0000000	CY				
0.0002244	20263.	90310601.	12.2799573	0.0027553	-0.0066684	
3.9992276	60.0000000	CY				
0.0002294	20316.	88569898.	12.2439307	0.0028085	-0.0068253	
3.9978133	60.0000000	CY				
0.0002344	20354.	86844536.	12.2044174	0.0028604	-0.0069833	
3.9960261	60.0000000	CY				
0.0002394	20388.	85172901.	12.1653472	0.0029121	-0.0071417	
3.9989993	60.0000000	CY				
0.0002444	20407.	83507282.	12.1210666	0.0029621	-0.0073017	
3.9999960	60.0000000	CY				
0.0002494	20424.	81899478.	12.0789003	0.0030122	-0.0074616	
3.9930588	60.0000000	CYT				
0.0002544	20436.	80336490.	12.0366695	0.0030618	-0.0076219	
3.9968332	60.0000000	CYT				
0.0002594	20447.	78832153.	11.9964719	0.0031116	-0.0077822	
3.9991518	60.0000000	CYT				
0.0002644	20458.	77381824.	11.9570396	0.0031611	-0.0079426	
3.9999952	60.0000000	CYT				
0.0002694	20467.	75979198.	11.9173098	0.0032102	-0.0081035	
3.9928287	60.0000000	CYT				
0.0002744	20476.	74626825.	11.8794309	0.0032594	-0.0082643	
3.9949049	60.0000000	CYT				
0.0003044	20523.	67426110.	11.6870302	0.0035572	-0.0092265	
3.9966193	60.0000000	CYT				
0.0003344	20523.	61376664.	11.5897100	0.0038753	-0.0101684	
3.9974842	60.0000000	CYT				

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Axial Thrust Force = 525.300 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	415.4932479	664789197.	158.3280282	0.0000990	0.0000727
0.4081493	2.8658893				
0.000001250	830.9988677	664799094.	89.6905973	0.0001121	0.0000596
0.4603136	3.2436717				
0.000001875	1246.4763033	664787362.	66.8232577	0.0001253	0.0000465
0.5121840	3.6220959				
0.000002500	1661.9114728	664764589.	55.3984415	0.0001385	0.0000335
0.5637585	4.0011620				
0.000003125	2077.2902919	664732893.	48.5506357	0.0001517	0.0000205
0.6150352	4.3808701				
0.000003750	2492.5986733	664692980.	43.9913359	0.0001650	0.000007468
0.6660122	4.7612203				
0.000004375	2907.8185648	664644243.	40.7397473	0.0001782	-0.000005514
0.7166874	5.1422117				
0.000005000	3322.7402497	664548050.	38.3051433	0.0001915	-0.0000185
0.7670525	5.5237958				
0.000005625	3736.8929797	664336530.	36.4144449	0.0002048	-0.0000314
0.8170895	5.9058501				
0.000006250	4149.9117018	663985872.	34.9038936	0.0002181	-0.0000444
0.8667835	6.2882682				
0.000006875	4561.5594360	663499554.	33.6694261	0.0002315	-0.0000573
0.9161233	6.6709731				
0.000007500	4971.6841421	662891219.	32.6417704	0.0002448	-0.0000702
0.9651010	7.0539101				
0.000008125	5380.1815624	662176192.	31.7730265	0.0002582	-0.0000831
1.0137109	7.4370381				
0.000008750	5786.9801518	661369160.	31.0290218	0.0002715	-0.0000960
1.0619485	7.8203268				
0.000009375	6192.0302832	660483230.	30.3847247	0.0002849	-0.0001089
1.1098104	8.2037533				
0.0000100	6192.0302832	619203028.	28.2729140	0.0002827	-0.0001373
1.1016610	8.1382451	C			
0.0000106	6192.0302832	582779321.	27.5832398	0.0002931	-0.0001532
1.1384094	8.4343795	C			
0.0000113	6192.0302832	550402692.	26.9544763	0.0003032	-0.0001693
1.1742930	8.7253853	C			
0.0000119	6192.0302832	521434129.	26.3788059	0.0003132	-0.0001855
1.2093994	9.0118826	C			
0.0000125	6192.0302832	495362423.	25.8497081	0.0003231	-0.0002019
1.2438026	9.2943942	C			
0.0000131	6192.0302832	471773736.	25.3600006	0.0003329	-0.0002184
1.2774872	9.5727189	C			
0.0000138	6192.0302832	450329475.	24.9058326	0.0003425	-0.0002350
1.3105354	9.8474633	C			
0.0000144	6263.7103819	435736374.	24.4834153	0.0003519	-0.0002518
1.3429971	10.1189800	C			
0.0000150	6390.1225546	426008170.	24.0893396	0.0003613	-0.0002687
1.3749081	10.3875128	C			
0.0000156	6513.0074009	416832474.	23.7207999	0.0003706	-0.0002856
1.4063068	10.6533313	C			
0.0000163	6632.1417646	408131801.	23.3740929	0.0003798	-0.0003027
1.4371570	10.9160788	C			

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0000169	6748.3090591		399899796.	23.0479708	0.0003889	-0.0003198
1.4675324	11.1763320	C				
0.0000175	6862.0386823		392116496.	22.7410534	0.0003980	-0.0003370
1.4974867	11.4345096	C				
0.0000181	6973.7445248		384758319.	22.4520500	0.0004069	-0.0003543
1.5270662	11.6909776	C				
0.0000188	7082.3911278		377727527.	22.1769460	0.0004158	-0.0003717
1.5561361	11.9445269	C				
0.0000194	7189.3978987		371065698.	21.9169247	0.0004246	-0.0003891
1.5848640	12.1965783	C				
0.0000200	7294.8523481		364742617.	21.6707282	0.0004334	-0.0004066
1.6132631	12.4472224	C				
0.0000206	7397.9407303		358688035.	21.4353062	0.0004421	-0.0004241
1.6412156	12.6953863	C				
0.0000213	7500.4419937		352961976.	21.2131503	0.0004508	-0.0004417
1.6689635	12.9431914	C				
0.0000219	7600.4362980		347448516.	20.9992207	0.0004594	-0.0004594
1.6962326	-13.1891506	C				
0.0000225	7700.2764862		342234510.	20.7974012	0.0004679	-0.0004771
1.7233574	-13.6976706	C				
0.0000231	7797.8374228		337203780.	20.6024204	0.0004764	-0.0004948
1.7500222	-14.2089206	C				
0.0000238	7895.1980787		332429393.	20.4178062	0.0004849	-0.0005126
1.7765378	-14.7200984	C				
0.0000244	7990.8597680		327830144.	20.2396936	0.0004933	-0.0005304
1.8026690	-15.2333728	C				
0.0000256	8180.1496615		319225353.	19.9069043	0.0005101	-0.0005661
1.8542587	-16.2618755	C				
0.0000269	8365.4822848		311273759.	19.5990333	0.0005267	-0.0006020
1.9047374	-17.2950846	C				
0.0000281	8547.5514552		303912941.	19.3136453	0.0005432	-0.0006381
1.9541987	-18.3322769	C				
0.0000294	8727.5312376		297107446.	19.0499984	0.0005596	-0.0006742
2.0028450	-19.3716388	C				
0.0000306	8904.4909351		290758888.	18.8034036	0.0005759	-0.0007104
2.0505006	-20.4149709	C				
0.0000319	9079.4777342		284846360.	18.5736113	0.0005920	-0.0007467
2.0973441	-21.4606493	C				
0.0000331	9252.5617858		279322620.	18.3588276	0.0006081	-0.0007831
2.1433945	-22.5085699	C				
0.0000344	9423.6999036		274143997.	18.1570637	0.0006241	-0.0008196
2.1886257	-23.5590833	C				
0.0000356	9593.2440290		269284043.	17.9676330	0.0006401	-0.0008562
2.2331158	-24.6114828	C				
0.0000369	9761.5676097		264720478.	17.7898615	0.0006560	-0.0008927
2.2769311	-25.6651480	C				
0.0000381	9927.8942259		260403783.	17.6209624	0.0006718	-0.0009295
2.3199046	-26.7218921	C				
0.0000394	10094.		256351563.	17.4633430	0.0006876	-0.0009661
2.3623948	-27.7780013	C				
0.0000406	10258.		252498105.	17.3123539	0.0007033	-0.0010029
2.4040067	-28.8377269	C				
0.0000419	10421.		248854584.	17.1699048	0.0007190	-0.0010398
2.4450307	-29.8980280	C				
0.0000431	10583.		245413707.	17.0362165	0.0007347	-0.0010766
2.4855771	-30.9577004	C				
0.0000444	10744.		242124859.	16.9072955	0.0007503	-0.0011135
2.5252719	-32.0209304	C				
0.0000456	10904.		239000010.	16.7851003	0.0007658	-0.0011504
2.5644004	-33.0846078	C				
0.0000469	11064.		236034106.	16.6698821	0.0007814	-0.0011873
2.6030569	-34.1476602	C				
0.0000481	11223.		233205749.	16.5601213	0.0007970	-0.0012243

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o				
2.6411229	-35.2114493	C				
0.0000494	11380.		230489908.	16.4537929	0.0008124	-0.0012613
2.6784074	-36.2782814	C				
0.0000506	11537.		227901199.	16.3531405	0.0008279	-0.0012984
2.7152249	-37.3444892	C				
0.0000519	11694.		225430386.	16.2577561	0.0008434	-0.0013354
2.7515736	-38.4100693	C				
0.0000531	11851.		223068331.	16.1671741	0.0008589	-0.0013724
2.7874396	-39.4751659	C				
0.0000544	12005.		220784780.	16.0782232	0.0008743	-0.0014095
2.8224659	-40.5442579	C				
0.0000556	12159.		218597598.	15.9936606	0.0008896	-0.0014466
2.8570282	-41.6127199	C				
0.0000569	12313.		216500389.	15.9131991	0.0009051	-0.0014837
2.8911244	-42.6805483	C				
0.0000581	12467.		214487309.	15.8365765	0.0009205	-0.0015207
2.9247526	-43.7477393	C				
0.0000594	12620.		212553003.	15.7635525	0.0009360	-0.0015578
2.9579109	-44.8142891	C				
0.0000606	12772.		210678411.	15.6918489	0.0009513	-0.0015949
2.9903315	-45.8838119	C				
0.0000619	12924.		208870674.	15.6229255	0.0009667	-0.0016321
3.0222246	-46.9535442	C				
0.0000631	13075.		207129009.	15.5570856	0.0009820	-0.0016692
3.0536520	-48.0226287	C				
0.0000644	13226.		205449531.	15.4941518	0.0009974	-0.0017063
3.0846116	-49.0910614	C				
0.0000656	13376.		203828651.	15.4339603	0.0010129	-0.0017434
3.1151015	-50.1588379	C				
0.0000669	13526.		202263045.	15.3763594	0.0010283	-0.0017805
3.1451196	-51.2259541	C				
0.0000681	13676.		200747696.	15.3208716	0.0010437	-0.0018175
3.1746196	-52.2930716	C				
0.0000694	13824.		199272036.	15.2660075	0.0010591	-0.0018547
3.2034210	-53.3629572	C				
0.0000706	13973.		197843661.	15.2134137	0.0010744	-0.0018918
3.2317541	-54.4321707	C				
0.0000719	14121.		196460070.	15.1629740	0.0010898	-0.0019289
3.2596167	-55.5007072	C				
0.0000731	14268.		195118932.	15.1145802	0.0011053	-0.0019660
3.2870067	-56.5685620	C				
0.0000744	14415.		193818075.	15.0681313	0.0011207	-0.0020031
3.3139221	-57.6357304	C				
0.0000794	15000.		188976897.	14.8995849	0.0011827	-0.0021511
3.4167420	-60.0000000	CY				
0.0000844	15577.		184615310.	14.7501248	0.0012445	-0.0022992
3.5111081	-60.0000000	CY				
0.0000894	16148.		180675817.	14.6219455	0.0013068	-0.0024469
3.5977005	-60.0000000	CY				
0.0000944	16691.		176858341.	14.5062688	0.0013690	-0.0025947
3.6757363	-60.0000000	CY				
0.0000994	17145.		172531955.	14.3817540	0.0014292	-0.0027446
3.7431840	-60.0000000	CY				
0.0001044	17507.		167729166.	14.2489292	0.0014872	-0.0028965
3.8007819	-60.0000000	CY				
0.0001094	17754.		162324456.	14.1027672	0.0015425	-0.0030513
3.8487864	-60.0000000	CY				
0.0001144	17993.		157318293.	13.9667054	0.0015974	-0.0032063
3.8899682	-60.0000000	CY				
0.0001194	18228.		152696404.	13.8434048	0.0016526	-0.0033612
3.9247123	-60.0000000	CY				
0.0001244	18459.		148418015.	13.7328387	0.0017080	-0.0035157
3.9530455	-60.0000000	CY				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0001294	18687.	144439651.	13.6327585	0.0017637	-0.0036700	
3.9748056	-60.0000000	CY				
0.0001344	18893.	140597370.	13.5338038	0.0018186	-0.0038251	
3.9896640	-60.0000000	CY				
0.0001394	19029.	136532972.	13.4235810	0.0018709	-0.0039828	
3.9977609	-60.0000000	CY				
0.0001444	19124.	132461160.	13.3109398	0.0019218	-0.0041420	
3.9983768	-60.0000000	CY				
0.0001494	19216.	128639654.	13.2068536	0.0019728	-0.0043010	
3.9999350	-60.0000000	CY				
0.0001544	19302.	125032997.	13.1074465	0.0020235	-0.0044603	
3.9993028	-60.0000000	CY				
0.0001594	19386.	121637187.	13.0164368	0.0020745	-0.0046193	
3.9976152	-60.0000000	CY				
0.0001644	19468.	118433849.	12.9329874	0.0021259	-0.0047779	
3.9999953	60.0000000	CY				
0.0001694	19547.	115404299.	12.8566245	0.0021776	-0.0049362	
3.9990676	60.0000000	CY				
0.0001744	19623.	112532804.	12.7848802	0.0022294	-0.0050944	
3.9959913	60.0000000	CY				
0.0001794	19696.	109802477.	12.7161221	0.0022810	-0.0052528	
3.9995649	60.0000000	CY				
0.0001844	19767.	107209979.	12.6528083	0.0023329	-0.0054109	
3.9963790	60.0000000	CY				
0.0001894	19836.	104745164.	12.5944215	0.0023851	-0.0055687	
3.9996278	60.0000000	CY				
0.0001944	19904.	102398103.	12.5406170	0.0024376	-0.0057262	
3.9958209	60.0000000	CY				
0.0001994	19970.	100160824.	12.4909418	0.0024904	-0.0058834	
3.9993567	60.0000000	CY				
0.0002044	20034.	98025763.	12.4450470	0.0025435	-0.0060403	
3.9957974	60.0000000	CY				
0.0002094	20097.	95985060.	12.4027475	0.0025968	-0.0061969	
3.9984681	60.0000000	CY				
0.0002144	20158.	94031388.	12.3613183	0.0026500	-0.0063538	
3.9999970	60.0000000	CY				
0.0002194	20217.	92157712.	12.3223451	0.0027032	-0.0065105	
3.9961707	60.0000000	CY				
0.0002244	20273.	90352307.	12.2848027	0.0027564	-0.0066673	
3.9992903	60.0000000	CY				
0.0002294	20325.	88610437.	12.2487290	0.0028096	-0.0068242	
3.9974683	60.0000000	CY				
0.0002344	20364.	86885552.	12.2093179	0.0028616	-0.0069822	
3.9961781	60.0000000	CY				
0.0002394	20398.	85212940.	12.1701786	0.0029132	-0.0071405	
3.9990754	60.0000000	CY				
0.0002444	20417.	83547858.	12.1260086	0.0029633	-0.0073005	
3.9999995	60.0000000	CY				
0.0002494	20434.	81939060.	12.0837906	0.0030134	-0.0074604	
3.9932726	60.0000000	CYT				
0.0002544	20446.	80375621.	12.0415415	0.0030631	-0.0076207	
3.9969794	60.0000000	CYT				
0.0002594	20457.	78870445.	12.0012739	0.0031128	-0.0077809	
3.9992270	60.0000000	CYT				
0.0002644	20468.	77420010.	11.9622656	0.0031625	-0.0079412	
3.9999995	60.0000000	CYT				
0.0002694	20477.	76016520.	11.9224905	0.0032116	-0.0081021	
3.9923912	60.0000000	CYT				
0.0002744	20486.	74663401.	11.8845415	0.0032608	-0.0082629	
3.9951150	60.0000000	CYT				
0.0003044	20533.	67458510.	11.6918446	0.0035587	-0.0092250	
3.9967976	60.0000000	CYT				
0.0003344	20533.	61406157.	11.5944056	0.0038769	-0.0101669	

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 2

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	500.200	20158.927	0.00300000
2	524.400	20419.650	0.00300000
3	525.300	20429.129	0.00300000

Note note that the values of moment capacity in the table above are not factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318-08, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial (Factored) Load Capacity No. in-kip	Resistance Bending Stiffness Factor at Ult. Mom. Cap. for Moment	Nominal Moment Capacity in-kip	Ultimate (Factored) Axial Thrust kips	Ultimate Moment
1	0.65	20158.927	325.130	
13103.302		201055784.193		
2	0.65	20419.650	340.860	
13272.772		204739183.052		
3	0.65	20429.129	341.445	
13278.934		204877207.794		
1	0.70	20158.927	350.140	
14111.249		191626859.941		
2	0.70	20419.650	367.080	
14293.755		194716910.393		
3	0.70	20429.129	367.710	
14300.390		194833220.511		
1	0.75	20158.927	375.150	
15119.195		183802831.590		
2	0.75	20419.650	393.300	
15314.737		186444435.133		
3	0.75	20429.129	393.975	
15321.847		186543816.955		

Pile Section No. 3:

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	26.20000000	ft
Shaft Diameter	=	36.00000000	in
Concrete Cover Thickness	=	4.75000000	in
Number of Reinforcing Bars	=	12	bars
Yield Stress of Reinforcing Bars	=	60.00000000	ksi
Modulus of Elasticity of Reinforcing Bars	=	29000.	ksi
Gross Area of Shaft	=	1017.87601976	sq. in.
Total Area of Reinforcing Steel	=	15.24000000	sq. in.
Area Ratio of Steel Reinforcement	=	1.50	percent
Edge-to-Edge Bar Spacing	=	5.26000451	in
Maximum Concrete Aggregate Size	=	0.75000000	in
Ratio of Bar Spacing to Aggregate Size	=	7.01	
Offset of Rebar Cage Center from Center of Pile	=	0.00000000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$	=	4323.363	kips
Tensile Load for Cracking of Concrete	=	-467.995	kips
Nominal Axial Tensile Capacity	=	-914.400	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.27000	1.27000	12.61500	0.00000
2	1.27000	1.27000	10.92491	6.30750
3	1.27000	1.27000	6.30750	10.92491
4	1.27000	1.27000	0.00000	12.61500
5	1.27000	1.27000	-6.30750	10.92491
6	1.27000	1.27000	-10.92491	6.30750
7	1.27000	1.27000	-12.61500	0.00000
8	1.27000	1.27000	-10.92491	-6.30750
9	1.27000	1.27000	-6.30750	-10.92491
10	1.27000	1.27000	0.00000	-12.61500
11	1.27000	1.27000	6.30750	-10.92491
12	1.27000	1.27000	10.92491	-6.30750

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 5.26000 inches between Bars 7 and 8

Spacing to aggregate size ratio = 7.01334

Concrete Properties:

Compressive Strength of Concrete	=	4.00000000	ksi
Modulus of Elasticity of Concrete	=	3604.99653259	ksi
Modulus of Rupture of Concrete	=	-0.47434164	ksi
Compression Strain at Peak Stress	=	0.00188627	
Tensile Strain at Fracture of Concrete	=	-0.00011537	
Maximum Coarse Aggregate Size	=	0.75000000	in

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 3

Number	Axial Thrust Force kips
-----	-----
1	500.200
2	524.400
3	525.300

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318-08 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-08, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 500.200 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
-----	-----	---	-----	-----	-----
0.000000625	224.8293604	359726977.	193.1006839	0.0001207	0.0000982
0.4950367	3.4966874				
0.000001250	449.6876268	359750101.	105.5696302	0.0001320	0.0000870
0.5392090	3.8203741				
0.000001875	674.5348846	359751938.	76.4011693	0.0001433	0.0000758
0.5831640	4.1445261				
0.000002500	899.3656381	359746255.	61.8233571	0.0001546	0.0000646
0.6269007	4.4691434				
0.000003125	1124.1743907	359735805.	53.0818048	0.0001659	0.0000534
0.6704176	4.7942261				
0.000003750	1348.9556450	359721505.	47.2583829	0.0001772	0.0000422
0.7137138	5.1197741				
0.000004375	1573.7039024	359703749.	43.1024646	0.0001886	0.0000311
0.7567879	5.4457877				
0.000005000	1798.4136630	359682733.	39.9887365	0.0001999	0.0000199
0.7996387	5.7722668				
0.000005625	2023.0794253	359658565.	37.5698025	0.0002113	0.000008830
0.8422651	6.0992115				
0.000006250	2247.6955974	359631296.	35.6372246	0.0002227	-0.000002267
0.8846658	6.4266220				
0.000006875	2472.2230762	359596084.	34.0582964	0.0002342	-0.0000133
0.9268379	6.7544854				
0.000007500	2696.5212217	359536163.	32.7443573	0.0002456	-0.0000244
0.9687735	7.0827477				
0.000008125	2920.4407375	359438860.	31.6339910	0.0002570	-0.0000355

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
1.0104635	7.4113466					
0.000008750	3143.8637632	359298716.	30.6833641	0.0002685	-0.0000465	
1.0519004	7.7402287					
0.000009375	3366.7029981	359114986.	29.8603716	0.0002799	-0.0000576	
1.0930781	8.0693511					
0.0000100	3588.8942439	358889424.	29.1409660	0.0002914	-0.0000686	
1.1339918	8.3986802					
0.0000106	3810.3895876	358624902.	28.5067805	0.0003029	-0.0000796	
1.1746376	8.7281893					
0.0000113	4031.1537983	358324782.	27.9435475	0.0003144	-0.0000906	
1.2150126	9.0578574					
0.0000119	4251.1591689	357992351.	27.4400136	0.0003259	-0.0001016	
1.2551141	9.3876672					
0.0000125	4470.3830410	357630643.	26.9871826	0.0003373	-0.0001127	
1.2949401	9.7176037					
0.0000131	4470.3830410	340600613.	25.6084360	0.0003361	-0.0001364	
1.2902591	9.6786985	C				
0.0000138	4470.3830410	325118767.	25.1240037	0.0003455	-0.0001495	
1.3223893	9.9464215	C				
0.0000144	4470.3830410	310983168.	24.6740345	0.0003547	-0.0001628	
1.3539481	10.2109507	C				
0.0000150	4470.3830410	298025536.	24.2541499	0.0003638	-0.0001762	
1.3849385	10.4722552	C				
0.0000156	4470.3830410	286104515.	23.8619089	0.0003728	-0.0001897	
1.4154295	10.7308650	C				
0.0000163	4470.3830410	275100495.	23.4944604	0.0003818	-0.0002032	
1.4454455	10.9869395	C				
0.0000169	4529.2869286	268402188.	23.1491423	0.0003906	-0.0002169	
1.4749968	11.2405241	C				
0.0000175	4616.0042523	263771672.	22.8239195	0.0003994	-0.0002306	
1.5041082	11.4917892	C				
0.0000181	4700.3166140	259327813.	22.5167962	0.0004081	-0.0002444	
1.5327895	11.7407786	C				
0.0000188	4782.1861018	255049925.	22.2256704	0.0004167	-0.0002583	
1.5610270	11.9873333	C				
0.0000194	4862.1752651	250950981.	21.9499595	0.0004253	-0.0002722	
1.5888872	12.2319960	C				
0.0000200	4940.5434387	247027172.	21.6886455	0.0004338	-0.0002862	
1.6164017	12.4750145	C				
0.0000206	5017.3559467	243265743.	21.4404767	0.0004422	-0.0003003	
1.6435775	12.7164227	C				
0.0000213	5092.1104931	239628729.	21.2030935	0.0004506	-0.0003144	
1.6703354	12.9554814	C				
0.0000219	5165.8430834	236152827.	20.9775935	0.0004589	-0.0003286	
1.6968220	13.1934734	C				
0.0000225	5238.1988072	232808836.	20.7622233	0.0004672	-0.0003428	
1.7229846	13.4299007	C				
0.0000231	5309.1168550	229583432.	20.5558941	0.0004754	-0.0003571	
1.7488064	13.6645840	C				
0.0000238	5379.3721378	226499879.	20.3594843	0.0004835	-0.0003715	
1.7744104	13.8986199	C				
0.0000244	5447.9078857	223503913.	20.1699250	0.0004916	-0.0003859	
1.7996208	14.1303783	C				
0.0000256	5582.7428995	217863138.	19.8150398	0.0005078	-0.0004147	
1.8493315	14.5912890	C				
0.0000269	5714.1266265	212618665.	19.4875203	0.0005237	-0.0004438	
1.8980076	15.0477987	C				
0.0000281	5842.5399025	207734752.	19.1843749	0.0005396	-0.0004729	
1.9457216	15.5004433	C				
0.0000294	5968.4051637	203179750.	18.9031177	0.0005553	-0.0005022	
1.9925425	15.9497560	C				
0.0000306	6091.2032608	198896433.	18.6396680	0.0005708	-0.0005317	
2.0383551	16.3944925	C				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0000319	6212.1707941	194891633.	18.3942243	0.0005863	-0.0005612	
2.0833903	16.8367737	C				
0.0000331	6331.6965386	191145556.	18.1655113	0.0006017	-0.0005908	
2.1277301	17.2773319	C				
0.0000344	6448.8515093	187602953.	17.9495587	0.0006170	-0.0006205	
2.1711693	-17.8145961	C				
0.0000356	6564.9870927	184280339.	17.7476966	0.0006323	-0.0006502	
2.2139911	-18.6709484	C				
0.0000369	6679.5434585	181140162.	17.5572747	0.0006474	-0.0006801	
2.2560738	-19.5297018	C				
0.0000381	6792.9374712	178175409.	17.3778872	0.0006625	-0.0007100	
2.2975016	-20.3900609	C				
0.0000394	6905.0220465	175365639.	17.2081463	0.0006776	-0.0007399	
2.3382438	-21.2524103	C				
0.0000406	7016.2497831	172707687.	17.0480082	0.0006926	-0.0007699	
2.3784001	-22.1157528	C				
0.0000419	7126.0018423	170173178.	16.8952377	0.0007075	-0.0008000	
2.4178203	-22.9817581	C				
0.0000431	7235.4888613	167779452.	16.7517694	0.0007224	-0.0008301	
2.4568061	-23.8472058	C				
0.0000444	7343.2381978	165481424.	16.6134998	0.0007372	-0.0008603	
2.4949727	-24.7163649	C				
0.0000456	7450.5922714	163300653.	16.4829229	0.0007520	-0.0008905	
2.5326750	-25.5853701	C				
0.0000469	7557.4446184	161225485.	16.3591540	0.0007668	-0.0009207	
2.5698805	-26.4545875	C				
0.0000481	7662.8509424	159228072.	16.2395092	0.0007815	-0.0009510	
2.6063305	-27.3270224	C				
0.0000494	7768.0033220	157326650.	16.1263025	0.0007962	-0.0009813	
2.6423564	-28.1989130	C				
0.0000506	7872.8887562	155513852.	16.0190318	0.0008110	-0.0010115	
2.6779532	-29.0702963	C				
0.0000519	7976.2765738	153759548.	15.9144097	0.0008256	-0.0010419	
2.7127624	-29.9454723	C				
0.0000531	8079.4151110	152083108.	15.8150622	0.0008402	-0.0010723	
2.7471516	-30.8201071	C				
0.0000544	8182.3027635	150479131.	15.7206274	0.0008548	-0.0011027	
2.7811190	-31.6941980	C				
0.0000556	8284.5792820	148936257.	15.6299131	0.0008694	-0.0011331	
2.8145524	-32.5691338	C				
0.0000569	8385.8820763	147444080.	15.5418083	0.0008839	-0.0011636	
2.8473424	-33.4463423	C				
0.0000581	8486.9385899	146011847.	15.4578149	0.0008985	-0.0011940	
2.8797146	-34.3230080	C				
0.0000594	8587.7472706	144635744.	15.3776750	0.0009130	-0.0012245	
2.9116673	-35.1991283	C				
0.0000606	8688.3065482	143312273.	15.3011515	0.0009276	-0.0012549	
2.9431989	-36.0747003	C				
0.0000619	8787.7130705	142023646.	15.2258244	0.0009421	-0.0012854	
2.9740150	-36.9536738	C				
0.0000631	8886.8621045	140781974.	15.1537454	0.0009566	-0.0013159	
3.0044106	-37.8321622	C				
0.0000644	8985.7661540	139584717.	15.0847600	0.0009711	-0.0013464	
3.0343887	-38.7101010	C				
0.0000656	9084.4237314	138429314.	15.0186930	0.0009856	-0.0013769	
3.0639476	-39.5874872	C				
0.0000669	9182.8332860	137313395.	14.9553823	0.0010001	-0.0014074	
3.0930857	-40.4643178	C				
0.0000681	9280.4258715	136226435.	14.8932389	0.0010146	-0.0014379	
3.1216065	-41.3434322	C				
0.0000694	9377.5864849	135172418.	14.8331424	0.0010290	-0.0014685	
3.1496456	-42.2229339	C				
0.0000706	9474.5032120	134152258.	14.7754466	0.0010435	-0.0014990	

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o				
3.1772670	-43.1018758	C				
0.0000719	9571.1745455		133164168.	14.7200277	0.0010580	-0.0015295
3.2044692	-43.9802546	C				
0.0000731	9667.5989386		132206481.	14.6667705	0.0010725	-0.0015600
3.2312503	-44.8580671	C				
0.0000744	9763.7748293		131277645.	14.6155676	0.0010870	-0.0015905
3.2576088	-45.7353099	C				
0.0000794	10144.		127798798.	14.4243661	0.0011449	-0.0017126
3.3581053	-49.2500754	C				
0.0000844	10520.		124680089.	14.2586171	0.0012031	-0.0018344
3.4516663	-52.7580086	C				
0.0000894	10890.		121850190.	14.1114533	0.0012612	-0.0019563
3.5378665	-56.2658398	C				
0.0000944	11256.		119272329.	13.9823005	0.0013196	-0.0020779
3.6169992	-59.7670537	C				
0.0000994	11618.		116912011.	13.8696674	0.0013783	-0.0021992
3.6891202	-60.0000000	CY				
0.0001044	11975.		114726962.	13.7679862	0.0014370	-0.0023205
3.7537423	-60.0000000	CY				
0.0001094	12327.		112701569.	13.6787081	0.0014961	-0.0024414
3.8111569	-60.0000000	CY				
0.0001144	12674.		110814759.	13.6006188	0.0015556	-0.0025619
3.8612677	-60.0000000	CY				
0.0001194	13014.		109014229.	13.5311572	0.0016153	-0.0026822
3.9038313	-60.0000000	CY				
0.0001244	13310.		107018540.	13.4573474	0.0016738	-0.0028037
3.9379672	-60.0000000	CY				
0.0001294	13579.		104956316.	13.3834623	0.0017315	-0.0029260
3.9643510	-60.0000000	CY				
0.0001344	13796.		102665444.	13.3021960	0.0017875	-0.0030500
3.9829983	-60.0000000	CY				
0.0001394	13950.		100088830.	13.2095714	0.0018411	-0.0031764
3.9944480	-60.0000000	CY				
0.0001444	14092.		97603958.	13.1217724	0.0018945	-0.0033030
3.9996437	-60.0000000	CY				
0.0001494	14229.		95257391.	13.0392207	0.0019477	-0.0034298
3.9995856	-60.0000000	CY				
0.0001544	14364.		93043042.	12.9644779	0.0020014	-0.0035561
3.9993623	-60.0000000	CY				
0.0001594	14495.		90948401.	12.8968474	0.0020554	-0.0036821
3.9988740	-60.0000000	CY				
0.0001644	14623.		88963070.	12.8356639	0.0021099	-0.0038076
3.9979506	60.0000000	CY				
0.0001694	14749.		87077185.	12.7802437	0.0021647	-0.0039328
3.9987474	60.0000000	CY				
0.0001744	14864.		85242285.	12.7249597	0.0022189	-0.0040586
3.9998210	60.0000000	CY				
0.0001794	14954.		83365644.	12.6649926	0.0022718	-0.0041857
3.9986831	60.0000000	CY				
0.0001844	15017.		81447469.	12.5995253	0.0023230	-0.0043145
3.9983292	60.0000000	CY				
0.0001894	15064.		79547067.	12.5331471	0.0023735	-0.0044440
3.9993460	60.0000000	CY				
0.0001944	15109.		77731438.	12.4708982	0.0024240	-0.0045735
3.9963439	60.0000000	CY				
0.0001994	15152.		75999536.	12.4126600	0.0024748	-0.0047027
3.9994762	60.0000000	CY				
0.0002044	15193.		74341238.	12.3554312	0.0025251	-0.0048324
3.9959404	60.0000000	CY				
0.0002094	15233.		72756926.	12.3021235	0.0025758	-0.0049617
3.9992060	60.0000000	CY				
0.0002144	15273.		71242545.	12.2522792	0.0026266	-0.0050909
3.9977586	60.0000000	CY				

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
0.0002194	15311.	69792176.	12.2058749	0.0026777	-0.0052198	
3.9983899	60.0000000	CY				
0.0002244	15348.	68403560.	12.1623154	0.0027289	-0.0053486	
3.9999661	60.0000000	CY				
0.0002294	15384.	67070861.	12.1217680	0.0027804	-0.0054771	
3.9965430	60.0000000	CY				
0.0002344	15420.	65792247.	12.0837055	0.0028321	-0.0056054	
3.9993271	60.0000000	CY				
0.0002394	15455.	64563180.	12.0471944	0.0028838	-0.0057337	
3.9979578	60.0000000	CY				
0.0002444	15488.	63378868.	12.0116333	0.0029353	-0.0058622	
3.9971198	60.0000000	CY				
0.0002494	15521.	62240226.	11.9780870	0.0029870	-0.0059905	
3.9994840	60.0000000	CY				
0.0002544	15554.	61144042.	11.9465637	0.0030389	-0.0061186	
3.9975079	60.0000000	CYT				
0.0002594	15585.	60087246.	11.9170984	0.0030910	-0.0062465	
3.9964951	60.0000000	CYT				
0.0002644	15616.	59068953.	11.8892543	0.0031432	-0.0063743	
3.9991242	60.0000000	CYT				
0.0002694	15647.	58086982.	11.8629535	0.0031956	-0.0065019	
3.9999531	60.0000000	CYT				
0.0002744	15677.	57137917.	11.8384816	0.0032482	-0.0066293	
3.9944400	60.0000000	CYT				
0.0003044	15848.	52067356.	11.7181618	0.0035667	-0.0073908	
3.9996370	60.0000000	CYT				
0.0003344	15889.	47518555.	11.6402066	0.0038922	-0.0081453	
3.9938124	60.0000000	CYT				

Axial Thrust Force = 524.400 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.2055633	358728901.	201.8185441	0.0001261	0.0001036
0.5166349	3.6546986				
0.000001250	448.4417399	358753392.	109.9286137	0.0001374	0.0000924
0.5606707	3.9783872				
0.000001875	672.6668776	358755668.	79.3072177	0.0001487	0.0000812
0.6044892	4.3025425				
0.000002500	896.8754652	358750186.	64.0029556	0.0001600	0.0000700
0.6480893	4.6271643				
0.000003125	1121.0619909	358739837.	54.8255477	0.0001713	0.0000588
0.6914697	4.9522528				
0.000003750	1345.2209421	358725585.	48.7115672	0.0001827	0.0000477
0.7346293	5.2778079				
0.000004375	1569.3468050	358707841.	44.3481172	0.0001940	0.0000365
0.7775667	5.6038299				
0.000005000	1793.4340645	358686813.	41.0787493	0.0002054	0.0000254
0.8202809	5.9303187				
0.000005625	2017.4772038	358662614.	38.5387699	0.0002168	0.0000143
0.8627705	6.2572744				
0.000006250	2241.4707043	358635313.	36.5093631	0.0002282	0.000003184
0.9050344	6.5846971				
0.000006875	2465.4034650	358604140.	34.8512718	0.0002396	-0.000007898
0.9470711	6.9125848				
0.000007500	2689.1871258	358558283.	33.4715189	0.0002510	-0.00000190

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
0.9888753	7.2409054					
0.000008125	2912.6718417	358482688.	32.3056187	0.0002625	-0.0000300	
1.0304383	7.5695989					
0.000008750	3135.7271913	358368822.	31.3075226	0.0002739	-0.0000411	
1.0717521	7.8986089					
0.000009375	3358.2519200	358213538.	30.4434959	0.0002854	-0.0000521	
1.1128099	8.2278880					
0.0000100	3580.1713251	358017133.	29.6882716	0.0002969	-0.0000631	
1.1536064	8.5573988					
0.0000106	3801.4284084	357781497.	29.0225502	0.0003084	-0.0000741	
1.1941373	8.8871108					
0.0000113	4021.9810341	357509425.	28.4313415	0.0003199	-0.0000851	
1.2343990	9.2170002					
0.0000119	4241.7972720	357203981.	27.9028247	0.0003313	-0.0000962	
1.2743890	9.5470478					
0.0000125	4460.8512561	356868100.	27.4275511	0.0003428	-0.0001072	
1.3141047	9.8772373					
0.0000131	4460.8512561	339874381.	26.1426903	0.0003431	-0.0001294	
1.3146813	9.8820489	C				
0.0000138	4460.8512561	324425546.	25.6440473	0.0003526	-0.0001424	
1.3471444	10.1537889	C				
0.0000144	4460.8512561	310320087.	25.1805397	0.0003620	-0.0001555	
1.3790043	10.4221000	C				
0.0000150	4460.8512561	297390084.	24.7485605	0.0003712	-0.0001688	
1.4103084	10.6873239	C				
0.0000156	4460.8512561	285494480.	24.3448630	0.0003804	-0.0001821	
1.4410917	10.9497036	C				
0.0000163	4528.7525082	278692462.	23.9666365	0.0003895	-0.0001955	
1.4713851	11.2094525	C				
0.0000169	4621.2835135	273853838.	23.6112736	0.0003984	-0.0002091	
1.5012066	11.4666795	C				
0.0000175	4710.9677757	269198159.	23.2763562	0.0004073	-0.0002227	
1.5305633	11.7214008	C				
0.0000181	4798.0665420	264720913.	22.9600587	0.0004162	-0.0002363	
1.5594777	11.9737684	C				
0.0000188	4882.8590264	260419148.	22.6608777	0.0004249	-0.0002501	
1.5879766	12.2239773	C				
0.0000194	4965.6183889	256289981.	22.3775423	0.0004336	-0.0002639	
1.6160889	12.4722441	C				
0.0000200	5046.6091887	252330459.	22.1089768	0.0004422	-0.0002778	
1.6438451	12.7188066	C				
0.0000206	5125.4185399	248505141.	21.8528902	0.0004507	-0.0002918	
1.6711853	12.9630975	C				
0.0000213	5202.5511370	244825936.	21.6090005	0.0004592	-0.0003058	
1.6981700	13.2056216	C				
0.0000219	5278.5272682	241304104.	21.3772323	0.0004676	-0.0003199	
1.7248704	13.4469943	C				
0.0000225	5352.6719559	237896531.	21.1551608	0.0004760	-0.0003340	
1.7511875	13.6862925	C				
0.0000231	5425.6053300	234620771.	20.9430878	0.0004843	-0.0003482	
1.7772050	13.9242458	C				
0.0000238	5497.5455624	231475603.	20.7406471	0.0004926	-0.0003624	
1.8029569	14.1611458	C				
0.0000244	5567.8785835	228425788.	20.5457569	0.0005008	-0.0003767	
1.8283431	14.3960444	C				
0.0000256	5705.8862209	222668731.	20.1804024	0.0005171	-0.0004054	
1.8783489	14.8627990	C				
0.0000269	5840.1466785	217307783.	19.8431483	0.0005333	-0.0004342	
1.9272893	15.3249663	C				
0.0000281	5971.1557352	212307759.	19.5308710	0.0005493	-0.0004632	
1.9752342	15.7830542	C				
0.0000294	6099.3845095	207638622.	19.2410434	0.0005652	-0.0004923	
2.0222566	16.2376264	C				

	Bridge 11	Bent 3	Longitudinal	Final	Loads.l	lp6o	
0.0000306	6224.5204771	203249648.	18.9700015	0.0005810	-0.0005215		
2.0682866	16.6878702	C					
0.0000319	6347.3333914	199132028.	18.7167583	0.0005966	-0.0005509		
2.1134535	17.1349159	C					
0.0000331	6468.4547324	195274105.	18.4804420	0.0006122	-0.0005803		
2.1578777	17.5798622	C					
0.0000344	6587.4288055	191634293.	18.2581655	0.0006276	-0.0006099		
2.2014650	18.0216714	C					
0.0000356	6704.7230636	188202753.	18.0491691	0.0006430	-0.0006395		
2.2442983	18.4610853	C					
0.0000369	6820.9132294	184973918.	17.8532471	0.0006583	-0.0006692		
2.2865034	-19.2131963	C					
0.0000381	6935.1607590	181905856.	17.6672305	0.0006736	-0.0006989		
2.3278875	-20.0701558	C					
0.0000394	7048.7707542	179016400.	17.4928120	0.0006888	-0.0007287		
2.3687430	-20.9273576	C					
0.0000406	7160.5747609	176260302.	17.3263835	0.0007039	-0.0007586		
2.4087951	-21.7877919	C					
0.0000419	7271.7320503	173653303.	17.1695989	0.0007190	-0.0007885		
2.4483170	-22.6485807	C					
0.0000431	7381.6678530	171169110.	17.0203166	0.0007340	-0.0008185		
2.4871635	-23.5113539	C					
0.0000444	7490.5119871	168800270.	16.8781564	0.0007490	-0.0008485		
2.5253703	-24.3757849	C					
0.0000456	7599.0857755	166555305.	16.7442140	0.0007640	-0.0008785		
2.5631382	-25.2396492	C					
0.0000469	7705.8602413	164391685.	16.6145129	0.0007788	-0.0009087		
2.6000747	-26.1074591	C					
0.0000481	7812.3197517	162333917.	16.4918414	0.0007937	-0.0009388		
2.6365652	-26.9748613	C					
0.0000494	7918.4612084	160373898.	16.3756547	0.0008085	-0.0009690		
2.6726067	-27.8418718	C					
0.0000506	8022.9904774	158478824.	16.2626201	0.0008233	-0.0009992		
2.7078500	-28.7126782	C					
0.0000519	8127.2607701	156670087.	16.1554015	0.0008381	-0.0010294		
2.7426645	-29.5829303	C					
0.0000531	8231.2703646	154941560.	16.0535898	0.0008528	-0.0010597		
2.7770486	-30.4526256	C					
0.0000544	8334.2117242	153272859.	15.9549886	0.0008676	-0.0010899		
2.8107711	-31.3246398	C					
0.0000556	8436.4794666	151667047.	15.8602370	0.0008822	-0.0011203		
2.8439484	-32.1975926	C					
0.0000569	8538.4912782	150127319.	15.7699865	0.0008969	-0.0011506		
2.8766993	-33.0699909	C					
0.0000581	8640.2455195	148649385.	15.6839482	0.0009116	-0.0011809		
2.9090221	-33.9418321	C					
0.0000594	8740.9903858	147216680.	15.6001211	0.0009263	-0.0012112		
2.9406901	-34.8161040	C					
0.0000606	8841.1808037	145833910.	15.5193820	0.0009409	-0.0012416		
2.9718437	-35.6910238	C					
0.0000619	8941.1183133	144502922.	15.4422156	0.0009555	-0.0012720		
3.0025730	-36.5653867	C					
0.0000631	9040.8013210	143220615.	15.3684111	0.0009701	-0.0013024		
3.0328763	-37.4391898	C					
0.0000644	9140.1996010	141983683.	15.2977055	0.0009848	-0.0013327		
3.0627430	-38.3125584	C					
0.0000656	9238.4851166	140776916.	15.2279605	0.0009993	-0.0013632		
3.0919114	-39.1892251	C					
0.0000669	9336.5205782	139611523.	15.1611126	0.0010139	-0.0013936		
3.1206573	-40.0653296	C					
0.0000681	9434.3043949	138485202.	15.0970040	0.0010285	-0.0014240		
3.1489789	-40.9408689	C					
0.0000694	9531.8349613	137395819.	15.0354880	0.0010431	-0.0014544		

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
3.1768747	-41.8158398	C				
0.0000706	9629.1106571		136341390.	14.9764288	0.0010577	-0.0014848
3.2043430	-42.6902392	C				
0.0000719	9725.8672700		135316414.	14.9190468	0.0010723	-0.0015152
3.2312947	-43.5654240	C				
0.0000731	9821.9100370		134316718.	14.8627696	0.0010868	-0.0015457
3.2576676	-44.4424264	C				
0.0000744	9917.7020488		133347254.	14.8086516	0.0011014	-0.0015761
3.2836158	-45.3188518	C				
0.0000794	10298.		129742743.	14.6117618	0.0011598	-0.0016977
3.3831281	-48.8187132	C				
0.0000844	10673.		126494722.	14.4374236	0.0012182	-0.0018193
3.4751010	-52.3204922	C				
0.0000894	11043.		123559602.	14.2854054	0.0012768	-0.0019407
3.5600070	-55.8149772	C				
0.0000944	11408.		120881804.	14.1507746	0.0013355	-0.0020620
3.6375813	-59.3059614	C				
0.0000994	11768.		118423066.	14.0312107	0.0013944	-0.0021831
3.7078114	-60.0000000	CY				
0.0001044	12124.		116158442.	13.9266134	0.0014536	-0.0023039
3.7708573	-60.0000000	CY				
0.0001094	12475.		114057545.	13.8340889	0.0015131	-0.0024244
3.8264933	-60.0000000	CY				
0.0001144	12821.		112094655.	13.7508379	0.0015728	-0.0025447
3.8745065	-60.0000000	CY				
0.0001194	13160.		110241729.	13.6773745	0.0016327	-0.0026648
3.9149672	-60.0000000	CY				
0.0001244	13464.		108252346.	13.6035379	0.0016919	-0.0027856
3.9471988	-60.0000000	CY				
0.0001294	13733.		106150971.	13.5292163	0.0017503	-0.0029072
3.9715013	-60.0000000	CY				
0.0001344	13964.		103921756.	13.4505455	0.0018074	-0.0030301
3.9880635	-60.0000000	CY				
0.0001394	14127.		101359169.	13.3573531	0.0018617	-0.0031558
3.9972256	-60.0000000	CY				
0.0001444	14267.		98821028.	13.2666400	0.0019154	-0.0032821
3.9990241	-60.0000000	CY				
0.0001494	14405.		96431960.	13.1844913	0.0019694	-0.0034081
3.9992162	-60.0000000	CY				
0.0001544	14538.		94173022.	13.1087050	0.0020237	-0.0035338
3.9999973	-60.0000000	CY				
0.0001594	14667.		92030955.	13.0381488	0.0020780	-0.0036595
3.9999063	-60.0000000	CY				
0.0001644	14794.		90001013.	12.9742648	0.0021326	-0.0037849
3.9995542	60.0000000	CY				
0.0001694	14918.		88074107.	12.9164127	0.0021877	-0.0039098
3.9987068	60.0000000	CY				
0.0001744	15036.		86230758.	12.8631956	0.0022430	-0.0040345
3.9970427	60.0000000	CY				
0.0001794	15136.		84379446.	12.8079924	0.0022974	-0.0041601
3.9999173	60.0000000	CY				
0.0001844	15207.		82477201.	12.7455963	0.0023500	-0.0042875
3.9986917	60.0000000	CY				
0.0001894	15255.		80554951.	12.6773978	0.0024008	-0.0044167
3.9989971	60.0000000	CY				
0.0001944	15299.		78706886.	12.6128107	0.0024516	-0.0045459
3.9990254	60.0000000	CY				
0.0001994	15341.		76945865.	12.5525305	0.0025027	-0.0046748
3.9980241	60.0000000	CY				
0.0002044	15382.		75264608.	12.4965442	0.0025540	-0.0048035
3.9989020	60.0000000	CY				
0.0002094	15422.		73659583.	12.4441986	0.0026055	-0.0049320
3.9990059	60.0000000	CY				

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
0.0002144	15461.	72120792.	12.3939556	0.0026570	-0.0050605	
3.9982322	60.0000000	CY				
0.0002194	15498.	70646529.	12.3453028	0.0027083	-0.0051892	
3.9999408	60.0000000	CY				
0.0002244	15534.	69233328.	12.2999555	0.0027598	-0.0053177	
3.9965520	60.0000000	CY				
0.0002294	15570.	67878753.	12.2573963	0.0028115	-0.0054460	
3.9993338	60.0000000	CY				
0.0002344	15604.	66579051.	12.2174569	0.0028635	-0.0055740	
3.9978420	60.0000000	CY				
0.0002394	15638.	65329840.	12.1801748	0.0029156	-0.0057019	
3.9974282	60.0000000	CY				
0.0002444	15672.	64129734.	12.1450324	0.0029679	-0.0058296	
3.9996351	60.0000000	CY				
0.0002494	15704.	62974995.	12.1120789	0.0030204	-0.0059571	
3.9962405	60.0000000	CYT				
0.0002544	15736.	61862806.	12.0812209	0.0030732	-0.0060843	
3.9972595	60.0000000	CYT				
0.0002594	15768.	60791254.	12.0515177	0.0031259	-0.0062116	
3.9995056	60.0000000	CYT				
0.0002644	15798.	59756704.	12.0221337	0.0031784	-0.0063391	
3.9977369	60.0000000	CYT				
0.0002694	15828.	58758062.	11.9946268	0.0032311	-0.0064664	
3.9957678	60.0000000	CYT				
0.0002744	15857.	57794597.	11.9685771	0.0032839	-0.0065936	
3.9986518	60.0000000	CYT				
0.0003044	16023.	52643057.	11.8423846	0.0036045	-0.0073530	
3.9937790	60.0000000	CYT				
0.0003344	16069.	48057694.	11.7735063	0.0039368	-0.0081007	
3.9964660	60.0000000	CYT				

Axial Thrust Force = 525.300 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.1823309	358691729.	202.1432277	0.0001263	0.0001038
0.5174380	3.6605835				
0.000001250	448.3953387	358716271.	110.0909575	0.0001376	0.0000926
0.5614687	3.9842722				
0.000001875	672.5973064	358718563.	79.4154491	0.0001489	0.0000814
0.6052822	4.3084275				
0.000002500	896.7827224	358713089.	64.0841315	0.0001602	0.0000702
0.6488772	4.6330495				
0.000003125	1120.9460742	358702744.	54.8904908	0.0001715	0.0000590
0.6922525	4.9581382				
0.000003750	1345.0818487	358688493.	48.7656889	0.0001829	0.0000479
0.7354069	5.2836937				
0.000004375	1569.1845314	358670750.	44.3945097	0.0001942	0.0000367
0.7783393	5.6097159				
0.000005000	1793.2486067	358649721.	41.1193452	0.0002056	0.0000256
0.8210484	5.9362051				
0.000005625	2017.2685572	358625521.	38.5748577	0.0002170	0.0000145
0.8635329	6.2631612				
0.000006250	2241.2388639	358598218.	36.5418446	0.0002284	0.000003387
0.9057917	6.5905844				
0.000006875	2465.1489065	358567114.	34.8808039	0.0002398	-0.000007694

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
0.9478234	6.9184728					
0.000007500	2688.9124992	358521667.	33.4985983	0.0002512	-0.0000188	
0.9896226	7.2467951					
0.000008125	2912.3801300	358446785.	32.3306282	0.0002627	-0.0000298	
1.0311809	7.5754918					
0.000008750	3135.4210035	358333829.	31.3307631	0.0002741	-0.0000409	
1.0724900	7.9045062					
0.000009375	3357.9333207	358179554.	30.4652072	0.0002856	-0.0000519	
1.1135433	8.2337907					
0.0000100	3579.8419866	357984199.	29.7086481	0.0002971	-0.0000629	
1.1543354	8.5633080					
0.0000106	3801.0897280	357749621.	29.0417517	0.0003086	-0.0000739	
1.1948619	8.8930273					
0.0000113	4021.6340559	357478583.	28.4495007	0.0003201	-0.0000849	
1.2351194	9.2229247					
0.0000119	4241.4428054	357174131.	27.9200532	0.0003316	-0.0000959	
1.2751052	9.5529808					
0.0000125	4460.4901325	356839211.	27.4439435	0.0003430	-0.0001070	
1.3148168	9.8831796					
0.0000131	4460.4901325	339846867.	26.1622696	0.0003434	-0.0001291	
1.3155742	9.8895013	C				
0.0000138	4460.4901325	324399282.	25.6632835	0.0003529	-0.0001421	
1.3480579	10.1614593	C				
0.0000144	4460.4901325	310294966.	25.1992195	0.0003622	-0.0001553	
1.3799261	10.4298872	C				
0.0000150	4460.4901325	297366009.	24.7667391	0.0003715	-0.0001685	
1.4112388	10.6952315	C				
0.0000156	4460.4901325	285471368.	24.3625765	0.0003807	-0.0001818	
1.4420305	10.9577300	C				
0.0000163	4531.9017102	278886259.	23.9839272	0.0003897	-0.0001953	
1.4723325	11.2176007	C				
0.0000169	4624.5527233	274047569.	23.6281868	0.0003987	-0.0002088	
1.5021633	11.4749564	C				
0.0000175	4714.3646447	269392265.	23.2929437	0.0004076	-0.0002224	
1.5315306	11.7298189	C				
0.0000181	4801.5922148	264915433.	22.9763560	0.0004164	-0.0002361	
1.5604561	11.9823346	C				
0.0000188	4886.5136716	260614062.	22.6769158	0.0004252	-0.0002498	
1.5889669	12.2326980	C				
0.0000194	4969.4020446	256485267.	22.3933495	0.0004339	-0.0002636	
1.6170916	12.4811258	C				
0.0000200	5050.5217585	252526088.	22.1245797	0.0004425	-0.0002775	
1.6448608	12.7278563	C				
0.0000206	5129.3211874	248694361.	21.8680259	0.0004510	-0.0002915	
1.6721955	12.9721506	C				
0.0000213	5206.5827535	245015659.	21.6239759	0.0004595	-0.0003055	
1.6991937	13.2148502	C				
0.0000219	5282.6874631	241494284.	21.3920686	0.0004680	-0.0003195	
1.7259083	13.4564061	C				
0.0000225	5356.8227835	238081013.	21.1695909	0.0004763	-0.0003337	
1.7522199	13.6957081	C				
0.0000231	5429.8844751	234805815.	20.9574137	0.0004846	-0.0003479	
1.7782523	13.9338531	C				
0.0000238	5501.8155999	231655394.	20.7546019	0.0004929	-0.0003621	
1.8039985	14.1707571	C				
0.0000244	5572.2765025	228606215.	20.5596375	0.0005011	-0.0003764	
1.8294003	14.4058563	C				
0.0000256	5710.4025478	222844977.	20.1938942	0.0005175	-0.0004050	
1.8794166	14.8728252	C				
0.0000269	5844.7808500	217480218.	19.8563008	0.0005336	-0.0004339	
1.9283683	15.3352170	C				
0.0000281	5975.9069770	212476693.	19.5437277	0.0005497	-0.0004628	
1.9763252	15.7935404	C				

	Bridge 11	Bent 3	Longitudinal	Final Loads.l	lp6o	
0.0000294	6104.2518248	207804317.	19.2536431	0.0005656	-0.0004919	
2.0233602	16.2483598	C				
0.0000306	6229.3719420	203408063.	18.9820996	0.0005813	-0.0005212	
2.0693784	16.6986148	C				
0.0000319	6352.3001275	199287847.	18.7286634	0.0005970	-0.0005505	
2.1145586	17.1459208	C				
0.0000331	6473.5310626	195427353.	18.4921740	0.0006126	-0.0005799	
2.1589960	17.5911322	C				
0.0000344	6592.4900406	191781528.	18.2694837	0.0006280	-0.0006095	
2.2025712	18.0329542	C				
0.0000356	6709.8877688	188347727.	18.0603509	0.0006434	-0.0006391	
2.2454174	18.4726376	C				
0.0000369	6826.0631314	185113576.	17.8640627	0.0006587	-0.0006688	
2.2876103	-19.2016303	C				
0.0000381	6940.4120993	182043596.	17.6779481	0.0006740	-0.0006985	
2.3290077	-20.0583061	C				
0.0000394	7054.0075573	179149398.	17.5032023	0.0006892	-0.0007283	
2.3698509	-20.9154933	C				
0.0000406	7165.9150147	176391754.	17.3367171	0.0007043	-0.0007582	
2.4099178	-21.7756176	C				
0.0000419	7277.0580199	173780490.	17.1796372	0.0007194	-0.0007881	
2.4494272	-22.6363905	C				
0.0000431	7387.0983955	171295035.	17.0303339	0.0007344	-0.0008181	
2.4882901	-23.4988260	C				
0.0000444	7495.9284828	168922332.	16.8879049	0.0007494	-0.0008481	
2.5264841	-24.3632398	C				
0.0000456	7604.4881716	166673713.	16.7537085	0.0007644	-0.0008781	
2.5642391	-25.2270868	C				
0.0000469	7711.3644707	164509109.	16.6240183	0.0007793	-0.0009082	
2.6011925	-26.0945377	C				
0.0000481	7817.8100724	162448002.	16.5011132	0.0007941	-0.0009384	
2.6376698	-26.9619212	C				
0.0000494	7923.9900153	160485874.	16.3848231	0.0008090	-0.0009685	
2.6737125	-27.8287438	C				
0.0000506	8028.5653148	158588944.	16.2717074	0.0008238	-0.0009987	
2.7089586	-28.6993371	C				
0.0000519	8132.8218738	156777289.	16.1642833	0.0008385	-0.0010290	
2.7437598	-29.5695687	C				
0.0000531	8236.8176101	155045979.	16.0622760	0.0008533	-0.0010592	
2.7781305	-30.4392434	C				
0.0000544	8339.8536282	153376618.	15.9637336	0.0008680	-0.0010895	
2.8118705	-31.3108500	C				
0.0000556	8442.1076286	151768227.	15.8687992	0.0008827	-0.0011198	
2.8450341	-32.1837806	C				
0.0000569	8544.1056383	150226033.	15.7783742	0.0008974	-0.0011501	
2.8777712	-33.0561565	C				
0.0000581	8645.8460100	148745738.	15.6921690	0.0009121	-0.0011804	
2.9100802	-33.9279750	C				
0.0000594	8746.6811303	147312524.	15.6084226	0.0009268	-0.0012107	
2.9417657	-34.8018097	C				
0.0000606	8846.8577452	145927550.	15.5275264	0.0009414	-0.0012411	
2.9729051	-35.6767050	C				
0.0000619	8946.7813879	144594447.	15.4502092	0.0009560	-0.0012715	
3.0036202	-36.5510432	C				
0.0000631	9046.4504566	143310106.	15.3762600	0.0009706	-0.0013019	
3.0339093	-37.4248213	C				
0.0000644	9145.8633153	142071663.	15.3054842	0.0009853	-0.0013322	
3.0637708	-38.2980364	C				
0.0000656	9244.2052885	140864081.	15.2357715	0.0009998	-0.0013627	
3.0929469	-39.1743598	C				
0.0000669	9342.2267946	139696849.	15.1687917	0.0010144	-0.0013931	
3.1216782	-40.0504369	C				
0.0000681	9439.9965361	138568756.	15.1045561	0.0010290	-0.0014235	

Bridge 11		Bent 3 Longitudinal Final Loads.lp6o				
3.1499851	-40.9259487	C				
0.0000694	9537.5129488		137477664.	15.0429179	0.0010436	-0.0014539
3.1778661	-41.8008918	C				
0.0000706	9634.7744113		136421585.	14.9837408	0.0010582	-0.0014843
3.2053195	-42.6752631	C				
0.0000719	9731.6098853		135396311.	14.9264767	0.0010728	-0.0015147
3.2322873	-43.5499374	C				
0.0000731	9827.6383609		134395055.	14.8700869	0.0010874	-0.0015451
3.2586449	-44.4269094	C				
0.0000744	9923.4159994		133424081.	14.8158601	0.0011019	-0.0015756
3.2845778	-45.3033040	C				
0.0000794	10304.		129813994.	14.6185709	0.0011603	-0.0016972
3.3840280	-48.8030394	C				
0.0000844	10679.		126562065.	14.4441008	0.0012187	-0.0018188
3.4759662	-52.3041538	C				
0.0000894	11049.		123622491.	14.2917650	0.0012773	-0.0019402
3.5608061	-55.7984939	C				
0.0000944	11414.		120941511.	14.1570678	0.0013361	-0.0020614
3.6383391	-59.2887375	C				
0.0000994	11774.		118479114.	14.0372456	0.0013950	-0.0021825
3.7084985	-60.0000000	CY				
0.0001044	12130.		116211164.	13.9324169	0.0014542	-0.0023033
3.7714717	-60.0000000	CY				
0.0001094	12481.		114107817.	13.8398957	0.0015137	-0.0024238
3.8270538	-60.0000000	CY				
0.0001144	12826.		112142099.	13.7564524	0.0015734	-0.0025441
3.8749884	-60.0000000	CY				
0.0001194	13166.		110287226.	13.6828403	0.0016334	-0.0026641
3.9153702	-60.0000000	CY				
0.0001244	13470.		108297930.	13.6089416	0.0016926	-0.0027849
3.9475258	-60.0000000	CY				
0.0001294	13739.		106194828.	13.5344928	0.0017510	-0.0029065
3.9717451	-60.0000000	CY				
0.0001344	13971.		103968337.	13.4560984	0.0018082	-0.0030293
3.9882358	-60.0000000	CY				
0.0001394	14134.		101406283.	13.3628871	0.0018625	-0.0031550
3.9973111	-60.0000000	CY				
0.0001444	14274.		98866047.	13.2720369	0.0019162	-0.0032813
3.9987798	-60.0000000	CY				
0.0001494	14411.		96475001.	13.1897636	0.0019702	-0.0034073
3.9989693	-60.0000000	CY				
0.0001544	14544.		94214906.	13.1141100	0.0020245	-0.0035330
3.9999994	-60.0000000	CY				
0.0001594	14674.		92071079.	13.0434446	0.0020788	-0.0036587
3.9999228	-60.0000000	CY				
0.0001644	14800.		90039482.	12.9794596	0.0021335	-0.0037840
3.9995916	60.0000000	CY				
0.0001694	14924.		88111018.	12.9215141	0.0021886	-0.0039089
3.9987719	60.0000000	CY				
0.0001744	15043.		86266401.	12.8682240	0.0022439	-0.0040336
3.9971430	60.0000000	CY				
0.0001794	15142.		84415265.	12.8130324	0.0022983	-0.0041592
3.9999339	60.0000000	CY				
0.0001844	15214.		82514130.	12.7509791	0.0023510	-0.0042865
3.9987667	60.0000000	CY				
0.0001894	15262.		80592122.	12.6828169	0.0024018	-0.0044157
3.9986754	60.0000000	CY				
0.0001944	15306.		78743068.	12.6181418	0.0024527	-0.0045448
3.9990928	60.0000000	CY				
0.0001994	15348.		76980868.	12.5577795	0.0025037	-0.0046738
3.9976960	60.0000000	CY				
0.0002044	15389.		75298586.	12.5017006	0.0025550	-0.0048025
3.9989748	60.0000000	CY				

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o						
0.0002094	15429.	73692500.	12.4492819	0.0026066	-0.0049309	
3.9986722	60.0000000	CY				
0.0002144	15468.	72153362.	12.3992828	0.0026581	-0.0050594	
3.9983326	60.0000000	CY				
0.0002194	15505.	70678209.	12.3505463	0.0027094	-0.0051881	
3.9999581	60.0000000	CY				
0.0002244	15541.	69264086.	12.3051340	0.0027610	-0.0053165	
3.9966951	60.0000000	CY				
0.0002294	15577.	67908712.	12.2624969	0.0028127	-0.0054448	
3.9993963	60.0000000	CY				
0.0002344	15611.	66608164.	12.2225004	0.0028646	-0.0055729	
3.9974714	60.0000000	CY				
0.0002394	15645.	65358233.	12.1851454	0.0029168	-0.0057007	
3.9975546	60.0000000	CY				
0.0002444	15678.	64157434.	12.1499339	0.0029691	-0.0058284	
3.9996820	60.0000000	CY				
0.0002494	15711.	63001957.	12.1169311	0.0030217	-0.0059558	
3.9958611	60.0000000	CYT				
0.0002544	15743.	61889141.	12.0860078	0.0030744	-0.0060831	
3.9973930	60.0000000	CYT				
0.0002594	15775.	60817351.	12.0565789	0.0031272	-0.0062103	
3.9995655	60.0000000	CYT				
0.0002644	15805.	59782138.	12.0271527	0.0031797	-0.0063378	
3.9973209	60.0000000	CYT				
0.0002694	15835.	58782941.	11.9995841	0.0032324	-0.0064651	
3.9959500	60.0000000	CYT				
0.0002744	15864.	57818941.	11.9734758	0.0032852	-0.0065923	
3.9987544	60.0000000	CYT				
0.0003044	16030.	52664280.	11.8470569	0.0036059	-0.0073516	
3.9933331	60.0000000	CYT				
0.0003344	16076.	48077265.	11.7784585	0.0039384	-0.0080991	
3.9966716	60.0000000	CYT				

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 3

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	500.200	15529.244	0.00300000
2	524.400	15691.660	0.00300000
3	525.300	15697.652	0.00300000

Note note that the values of moment capacity in the table above are not factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318-08, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial	Resistance	Nominal	Ultimate (Factored)	Ultimate
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Bridge 11 Bent 3 Longitudinal Final Loads.lp6o					
(Factored) Load Capacity No. in-kip	Bending Stiffness Factor at Ult. Mom. Cap. for Moment	Moment Capacity in-kip kip-in ²	Axial Thrust kips	Moment	
1	0.65	15529.244	325.130		
10094.008		128256428.752			
2	0.65	15691.660	340.860		
10199.578		130677912.923			
3	0.65	15697.652	341.445		
10203.473		130767455.377			
1	0.70	15529.244	350.140		
10870.471		122002120.835			
2	0.70	15691.660	367.080		
10984.162		124027273.490			
3	0.70	15697.652	367.710		
10988.356		124102276.853			
1	0.75	15529.244	375.150		
11646.933		116735476.694			
2	0.75	15691.660	393.300		
11768.745		118420185.023			
3	0.75	15697.652	393.975		
11773.239		118483375.774			

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 2321.000 lbs
Applied moment at pile head = 94020.000 in-lbs
Axial thrust load on pile head = 525300.000 lbs

Depth Res. X feet	Soil Es*h lb/inch	Deflect. Spr. y inches lb/inch	Bending Distrib. Load Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in ²	Soil p lb/in
0.000	0.000	0.1541	94020.000	2321.0000	-0.000584	0.000	3.587E+11	
0.000	0.000	0.000	0.000					
0.855	0.000	0.1481	120975.000	2321.0000	-0.000581	0.000	3.587E+11	
0.000	0.000	0.000	0.000					
1.710	0.000	0.1422	147911.000	2321.0000	-0.000577	0.000	3.587E+11	
0.000	0.000	0.000	0.000					
2.565	0.000	0.1363	174824.000	2321.0000	-0.000573	0.000	3.587E+11	
0.000	0.000	0.000	0.000					
3.420	0.000	0.1305	201711.000	2321.0000	-0.000567	0.000	3.587E+11	
0.000	0.000	0.000	0.000					
4.275	0.000	0.1247	228566.000	2321.0000	-0.000561	0.000	3.587E+11	
0.000	0.000	0.000	0.000					
5.130	0.000	0.1189	255386.000	2321.0000	-0.000554	0.000	3.587E+11	

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

0.000	0.000	0.000					
5.985	0.1133	282167.	2321.0000	-0.000547	0.000	3.587E+11	
0.000	0.000	0.000					
6.840	0.1077	308904.	2321.0000	-0.000538	0.000	3.587E+11	
0.000	0.000	0.000					
7.695	0.1022	335594.	2321.0000	-0.000529	0.000	3.587E+11	
0.000	0.000	0.000					
8.550	0.0969	362232.	2321.0000	-0.000519	0.000	3.587E+11	
0.000	0.000	0.000					
9.405	0.0916	388814.	2321.0000	-0.000508	0.000	3.587E+11	
0.000	0.000	0.000					
10.260	0.0864	415336.	2321.0000	-0.000497	0.000	3.587E+11	
0.000	0.000	0.000					
11.115	0.0814	441794.	2321.0000	-0.000484	0.000	3.587E+11	
0.000	0.000	0.000					
11.970	0.0765	468184.	2321.0000	-0.000471	0.000	3.587E+11	
0.000	0.000	0.000					
12.825	0.0717	494502.	2321.0000	-0.000458	0.000	3.587E+11	
0.000	0.000	0.000					
13.680	0.0671	520743.	2321.0000	-0.000443	0.000	3.587E+11	
0.000	0.000	0.000					
14.535	0.0626	546905.	2321.0000	-0.000428	0.000	3.587E+11	
0.000	0.000	0.000					
15.390	0.0583	572982.	2321.0000	-0.000412	0.000	3.587E+11	
0.000	0.000	0.000					
16.245	0.0542	598970.	2321.0000	-0.000395	0.000	3.587E+11	
0.000	0.000	0.000					
17.100	0.0502	624867.	2321.0000	-0.000378	0.000	3.587E+11	
0.000	0.000	0.000					
17.955	0.0464	650667.	2321.0000	-0.000359	0.000	3.587E+11	
0.000	0.000	0.000					
18.810	0.0429	676366.	2321.0000	-0.000340	0.000	3.587E+11	
0.000	0.000	0.000					
19.665	0.0395	701962.	2321.0000	-0.000321	0.000	3.587E+11	
0.000	0.000	0.000					
20.520	0.0363	727449.	2321.0000	-0.000300	0.000	3.587E+11	
0.000	0.000	0.000					
21.375	0.0333	752824.	2314.0800	-0.000284	0.000	6.648E+11	
-1.3489	415.5300	0.000					
22.230	0.0305	777995.	2228.7042	-0.000272	0.000	6.648E+11	
-15.2935	5152.5720	0.000					
23.085	0.0277	801490.	2013.1654	-0.000260	0.000	6.648E+11	
-26.7218	9889.6140	0.000					
23.940	0.0251	822107.	1692.3784	-0.000247	0.000	6.648E+11	
-35.8098	14627.	0.000					
24.795	0.0226	838885.	1289.4219	-0.000235	0.000	6.648E+11	
-42.7393	19364.	0.000					
25.650	0.0203	851094.	825.4845	-0.000222	0.000	6.648E+11	
-47.6969	24101.	0.000					
26.505	0.0181	858212.	319.8259	-0.000208	0.000	6.648E+11	
-50.8720	28838.	0.000					
27.360	0.0160	859903.	-210.6633	-0.000195	0.000	6.648E+11	
-52.5372	33627.	0.000					
28.215	0.0141	855992.	-750.5682	-0.000182	0.000	6.648E+11	
-52.7075	38364.	0.000					
29.070	0.0123	846462.	-1189.4684	-0.000169	0.000	6.648E+11	
-32.8481	27405.	0.000					
29.925	0.0106	833403.	-1520.4777	-0.000156	0.000	6.648E+11	
-31.6761	30563.	0.000					
30.780	0.009101	816941.	-1836.4316	-0.000143	0.000	6.648E+11	
-29.9134	33721.	0.000					
31.635	0.007699	797261.	-2131.8465	-0.000131	0.000	6.648E+11	
-27.6724	36879.	0.000					

Bridge 11 Bent 3 Longitudinal Final Loads.lpf6o

32.490	0.006422	774603.	-2402.3662	-0.000118	0.000	6.648E+11
-25.0605	40037.	0.000				
33.345	0.005268	749242.	-2644.7054	-0.000107	0.000	6.648E+11
-22.1791	43195.	0.000				
34.200	0.004233	721483.	-2856.5874	-9.534E-05	0.000	6.648E+11
-19.1234	46353.	0.000				
35.055	0.003312	691652.	-3190.5325	-8.443E-05	0.000	6.648E+11
-45.9731	142425.	0.000				
35.910	0.002500	656924.	-3616.9286	-7.403E-05	0.000	6.648E+11
-37.1451	152426.	0.000				
36.765	0.001793	618231.	-3953.0816	-6.419E-05	0.000	6.648E+11
-28.3818	162426.	0.000				
37.620	0.001183	576498.	-4200.6883	-5.497E-05	0.000	6.648E+11
-19.8846	172427.	0.000				
38.475	0.000665	532625.	-4363.3439	-4.641E-05	0.000	6.648E+11
-11.8221	182427.	0.000				
39.330	0.000231	487463.	-4446.2098	-3.854E-05	0.000	6.648E+11
-4.3311	192428.	0.000				
40.185	-0.000126	441804.	-4455.6902	-3.136E-05	0.000	6.648E+11
2.4831	202428.	0.000				
41.040	-0.000413	396370.	-4399.1201	-2.490E-05	0.000	6.648E+11
8.5442	212428.	0.000				
41.895	-0.000637	351802.	-4284.4743	-1.912E-05	0.000	6.648E+11
13.8039	222429.	0.000				
42.750	-0.000805	308659.	-4120.0978	-1.403E-05	0.000	6.648E+11
18.2383	232429.	0.000				
43.605	-0.000925	267409.	-3914.4649	-9.581E-06	0.000	6.648E+11
21.8461	242430.	0.000				
44.460	-0.001002	228437.	-3675.9660	-5.755E-06	0.000	6.648E+11
24.6449	252430.	0.000				
45.315	-0.001043	192040.	-3412.7256	-2.510E-06	0.000	6.648E+11
26.6690	262431.	0.000				
46.170	-0.001053	158435.	-3132.4514	1.943E-07	0.000	6.648E+11
27.9654	272431.	0.000				
47.025	-0.001039	127760.	-2842.3132	2.403E-06	0.000	6.648E+11
28.5918	282431.	0.000				
47.880	-0.001004	100085.	-2548.8517	4.161E-06	0.000	6.648E+11
28.6132	292432.	0.000				
48.735	-0.000953	75413.	-2257.9145	5.515E-06	0.000	6.648E+11
28.0997	302432.	0.000				
49.590	-0.000891	53693.	-1974.6174	6.512E-06	0.000	6.648E+11
27.1239	312433.	0.000				
50.445	-0.000820	34824.	-1703.3284	7.195E-06	0.000	6.648E+11
25.7590	322433.	0.000				
51.300	-0.000743	18663.	-1447.6709	7.607E-06	0.000	6.648E+11
24.0768	332434.	0.000				
52.155	-0.000664	5035.6325	-1210.5439	7.790E-06	0.000	6.648E+11
22.1468	342434.	0.000				
53.010	-0.000583	-6261.0744	-994.1549	7.781E-06	0.000	6.648E+11
20.0343	352434.	0.000				
53.865	-0.000504	-15448.	-800.0635	7.613E-06	0.000	6.648E+11
17.8003	362435.	0.000				
54.720	-0.000427	-22760.	-629.2312	7.318E-06	0.000	6.648E+11
15.5004	372435.	0.000				
55.575	-0.000354	-28439.	-482.0755	6.923E-06	0.000	6.648E+11
13.1849	382436.	0.000				
56.430	-0.000285	-32727.	-358.5254	6.451E-06	0.000	6.648E+11
10.8989	392436.	0.000				
57.285	-0.000221	-35865.	-258.0754	5.922E-06	0.000	6.648E+11
8.6820	402436.	0.000				
58.140	-0.000163	-38087.	-179.8354	5.351E-06	0.000	6.648E+11
6.5695	412437.	0.000				
58.995	-0.000112	-39613.	-122.5756	4.752E-06	0.000	6.648E+11

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

4.5923	422437.	0.000					
59.850	-6.592E-05	-40653.	145.3885	3.865E-06	0.000	3.587E+11	
47.6424	7415250.	0.000					
60.705	-3.223E-05	-36672.	512.6991	2.759E-06	0.000	3.587E+11	
23.9581	7625785.	0.000					
61.560	-9.311E-06	-30162.	672.0847	1.803E-06	0.000	3.587E+11	
7.1112	7836320.	0.000					
62.415	4.761E-06	-22900.	689.4108	1.044E-06	0.000	3.587E+11	
-3.7338	8046856.	0.000					
63.270	1.211E-05	-16027.	620.2510	4.872E-07	0.000	3.587E+11	
-9.7476	8257391.	0.000					
64.125	1.476E-05	-10178.	507.7572	1.125E-07	0.000	3.587E+11	
-12.1810	8467926.	0.000					
64.980	1.442E-05	-5609.0010	382.6998	-1.133E-07	0.000	3.587E+11	
-12.1966	8678461.	0.000					
65.835	1.243E-05	-2323.4126	264.8700	-2.268E-07	0.000	3.587E+11	
-10.7721	8888996.	0.000					
66.690	9.766E-06	-171.4240	165.1758	-2.624E-07	0.000	3.587E+11	
-8.6614	9099532.	0.000					
67.545	7.048E-06	1068.8232	87.9333	-2.496E-07	0.000	3.587E+11	
-6.3956	9310067.	0.000					
68.400	4.644E-06	1635.6583	33.0175	-2.109E-07	0.000	3.587E+11	
-4.3093	9520602.	0.000					
69.255	2.720E-06	1748.6156	-2.3222	-1.625E-07	0.000	3.587E+11	
-2.5796	9731137.	0.000					
70.110	1.309E-06	1589.7597	-22.0608	-1.148E-07	0.000	3.587E+11	
-1.2681	9941672.	0.000					
70.965	3.643E-07	1297.1648	-30.4156	-7.350E-08	0.000	3.587E+11	
-0.3605	10152208.	0.000					
71.820	-1.995E-07	966.4242	-31.2313	-4.113E-08	0.000	3.587E+11	
0.2015	10362743.	0.000					
72.675	-4.796E-07	656.7421	-27.6623	-1.791E-08	0.000	3.587E+11	
0.4942	10573278.	0.000					
73.530	-5.670E-07	398.9868	-22.0696	-2.812E-09	0.000	3.587E+11	
0.5959	10783813.	0.000					
74.385	-5.373E-07	203.9041	-16.0587	5.810E-09	0.000	3.587E+11	
0.5758	10994348.	0.000					
75.240	-4.478E-07	69.3992	-10.5964	9.719E-09	0.000	3.587E+11	
0.4890	11204884.	0.000					
76.095	-3.379E-07	-13.6397	-6.1594	1.052E-08	0.000	3.587E+11	
0.3759	11415419.	0.000					
76.950	-2.320E-07	-57.1045	-2.8825	9.505E-09	0.000	3.587E+11	
0.2629	11625954.	0.000					
77.805	-1.428E-07	-72.8907	-0.6888	7.646E-09	0.000	3.587E+11	
0.1648	11836489.	0.000					
78.660	-7.508E-08	-71.3201	0.6088	5.583E-09	0.000	3.587E+11	
0.0882	12047024.	0.000					
79.515	-2.826E-08	-60.4584	1.2343	3.698E-09	0.000	3.587E+11	
0.0338	12257560.	0.000					
80.370	8.128E-10	-46.0331	1.4024	2.175E-09	0.000	3.587E+11	
-0.000988	12468095.	0.000					
81.225	1.638E-08	-31.7047	1.2935	1.064E-09	0.000	3.587E+11	
-0.0202	12678630.	0.000					
82.080	2.264E-08	-19.5018	1.0438	3.313E-10	0.000	3.587E+11	
-0.0284	12889165.	0.000					
82.935	2.318E-08	-10.2898	0.7461	-9.479E-11	0.000	3.587E+11	
-0.0296	13099700.	0.000					
83.790	2.069E-08	-4.1911	0.4566	-3.019E-10	0.000	3.587E+11	
-0.0268	13310236.	0.000					
84.645	1.698E-08	-0.9178	0.2040	-3.750E-10	0.000	3.587E+11	
-0.0224	13520771.	0.000					
85.500	1.300E-08	0.000	0.000	-3.881E-10	0.000	3.587E+11	
-0.0174	6865653.	0.000					

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.

The above values of total stress are computed for combined axial and bending stress in elastic sections and do not equal actual stresses in concrete and steel in the range of nonlinear bending.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.1541283 inches
 Computed slope at pile head = -0.0005842 radians
 Maximum bending moment = 859903. inch-lbs
 Maximum shear force = -4455.6901501 lbs
 Depth of maximum bending moment = 328.3200000 inches below pile head
 Depth of maximum shear force = 482.2200000 inches below pile head
 Number of iterations = 6
 Number of zero deflection points = 4

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 9387.000 lbs
 Applied moment at pile head = 21408.000 in-lbs
 Axial thrust load on pile head = 524400.000 lbs

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
feet	Es*h lb/inch	Lat. Load inches lb/inch	in-lbs	lbs	radians	psi*	lb-in^2	lb/in
0.000	0.00	0.5484	21408.	9387.0000	-0.001982	0.000	3.587E+11	
0.000	0.855	0.5281	128383.	9387.0000	-0.001980	0.000	3.587E+11	
0.000	1.710	0.5078	235338.	9387.0000	-0.001975	0.000	3.587E+11	
0.000	2.565	0.4876	342256.	9387.0000	-0.001967	0.000	3.587E+11	
0.000	3.420	0.4674	449122.	9387.0000	-0.001955	0.000	3.588E+11	
0.000	4.275	0.4474	555919.	9387.0000	-0.001941	0.000	3.588E+11	
0.000	5.130	0.4276	662631.	9387.0000	-0.001924	0.000	3.588E+11	
0.000	5.985	0.4080	769240.	9387.0000	-0.001903	0.000	3.588E+11	
0.000	6.840	0.3886	875731.	9387.0000	-0.001880	0.000	3.588E+11	
0.000	7.695	0.3694	982088.	9387.0000	-0.001853	0.000	3.587E+11	
0.000	8.550	0.3505	1088293.	9387.0000	-0.001823	0.000	3.587E+11	

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9.405	0.3320	1194331.	9387.0000	-0.001791	0.000	3.587E+11	
0.000	0.000	0.000					
10.260	0.3138	1300185.	9387.0000	-0.001755	0.000	3.587E+11	
0.000	0.000	0.000					
11.115	0.2960	1405839.	9387.0000	-0.001716	0.000	3.587E+11	
0.000	0.000	0.000					
11.970	0.2786	1511276.	9387.0000	-0.001675	0.000	3.587E+11	
0.000	0.000	0.000					
12.825	0.2616	1616481.	9387.0000	-0.001630	0.000	3.587E+11	
0.000	0.000	0.000					
13.680	0.2451	1721437.	9387.0000	-0.001582	0.000	3.587E+11	
0.000	0.000	0.000					
14.535	0.2291	1826129.	9387.0000	-0.001532	0.000	3.587E+11	
0.000	0.000	0.000					
15.390	0.2137	1930539.	9387.0000	-0.001478	0.000	3.587E+11	
0.000	0.000	0.000					
16.245	0.1988	2034652.	9387.0000	-0.001421	0.000	3.587E+11	
0.000	0.000	0.000					
17.100	0.1845	2138452.	9387.0000	-0.001361	0.000	3.586E+11	
0.000	0.000	0.000					
17.955	0.1709	2241923.	9387.0000	-0.001299	0.000	3.586E+11	
0.000	0.000	0.000					
18.810	0.1579	2345048.	9387.0000	-0.001233	0.000	3.586E+11	
0.000	0.000	0.000					
19.665	0.1456	2447813.	9387.0000	-0.001165	0.000	3.586E+11	
0.000	0.000	0.000					
20.520	0.1340	2550201.	9387.0000	-0.001093	0.000	3.586E+11	
0.000	0.000	0.000					
21.375	0.1231	2652197.	9361.4167	-0.001036	0.000	6.647E+11	
-4.9870	415.5300	0.000					
22.230	0.1127	2753447.	9045.4466	-0.000994	0.000	6.647E+11	
-56.6056	5152.5720	0.000					
23.085	0.1027	2848509.	8247.0753	-0.000951	0.000	6.647E+11	
-99.0223	9889.6140	0.000					
23.940	0.0932	2932912.	7057.5062	-0.000907	0.000	6.647E+11	
-132.8625	14627.	0.000					
24.795	0.0841	3003084.	5561.3993	-0.000861	0.000	6.647E+11	
-158.7763	19364.	0.000					
25.650	0.0755	3056294.	3836.6449	-0.000814	0.000	6.647E+11	
-177.4331	24101.	0.000					
26.505	0.0674	3090571.	1954.1979	-0.000767	0.000	6.646E+11	
-189.5156	28838.	0.000					
27.360	0.0598	3104642.	-23.5894	-0.000719	0.000	6.646E+11	
-196.0180	33627.	0.000					
28.215	0.0527	3097821.	-2039.6584	-0.000671	0.000	6.646E+11	
-196.9779	38364.	0.000					
29.070	0.0460	3070007.	-3681.0473	-0.000623	0.000	6.647E+11	
-122.9809	27405.	0.000					
29.925	0.0399	3028992.	-4921.5334	-0.000576	0.000	6.647E+11	
-118.8292	30563.	0.000					
30.780	0.0342	2975216.	-6108.0861	-0.000530	0.000	6.647E+11	
-112.4676	33721.	0.000					
31.635	0.0290	2909355.	-7220.1471	-0.000484	0.000	6.647E+11	
-104.3084	36879.	0.000					
32.490	0.0243	2832271.	-8241.2964	-0.000440	0.000	6.647E+11	
-94.7460	40037.	0.000					
33.345	0.0200	2744979.	-9159.0558	-0.000397	0.000	6.647E+11	
-84.1544	43195.	0.000					
34.200	0.0161	2648600.	-9964.6700	-0.000355	0.000	6.647E+11	
-72.8854	46353.	0.000					
35.055	0.0127	2544328.	-11243.	-0.000315	0.000	6.647E+11	
-176.2402	142425.	0.000					
35.910	0.009662	2421293.	-12883.	-0.000277	0.000	6.647E+11	

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-143.5441	152426.	0.000				
36.765	0.007012	2282946.	-14189.	-0.000241	0.000	6.648E+11
-111.0039	162426.	0.000				
37.620	0.004723	2132725.	-15166.	-0.000207	0.000	6.648E+11
-79.3726	172427.	0.000				
38.475	0.002772	1973971.	-15826.	-0.000175	0.000	6.648E+11
-49.2842	182427.	0.000				
39.330	0.001133	1809865.	-16188.	-0.000146	0.000	6.648E+11
-21.2546	192428.	0.000				
40.185	-0.000219	1643371.	-16274.	-0.000119	0.000	6.648E+11
4.3150	202428.	0.000				
41.040	-0.001310	1477195.	-16113.	-9.501E-05	0.000	6.648E+11
27.1326	212428.	0.000				
41.895	-0.002168	1313753.	-15733.	-7.348E-05	0.000	6.648E+11
47.0077	222429.	0.000				
42.750	-0.002818	1155150.	-15164.	-5.442E-05	0.000	6.648E+11
63.8428	232429.	0.000				
43.605	-0.003285	1003172.	-14438.	-3.777E-05	0.000	6.648E+11
77.6229	242430.	0.000				
44.460	-0.003593	859281.	-13587.	-2.340E-05	0.000	6.648E+11
88.4055	252430.	0.000				
45.315	-0.003765	724626.	-12639.	-1.118E-05	0.000	6.648E+11
96.3087	262431.	0.000				
46.170	-0.003823	600048.	-11624.	-9.572E-07	0.000	6.648E+11
101.5009	272431.	0.000				
47.025	-0.003785	486105.	-10569.	7.424E-06	0.000	6.648E+11
104.1894	282431.	0.000				
47.880	-0.003670	383090.	-9497.9557	1.413E-05	0.000	6.648E+11
104.6108	292432.	0.000				
48.735	-0.003495	291055.	-8432.8055	1.933E-05	0.000	6.648E+11
103.0208	302432.	0.000				
49.590	-0.003274	209841.	-7392.9216	2.320E-05	0.000	6.648E+11
99.6856	312433.	0.000				
50.445	-0.003019	139103.	-6394.8267	2.589E-05	0.000	6.648E+11
94.8748	322433.	0.000				
51.300	-0.002742	78341.	-5452.2985	2.757E-05	0.000	6.648E+11
88.8539	332434.	0.000				
52.155	-0.002453	26925.	-4576.4345	2.838E-05	0.000	6.648E+11
81.8798	342434.	0.000				
53.010	-0.002160	-15873.	-3775.7667	2.847E-05	0.000	6.648E+11
74.1958	352434.	0.000				
53.865	-0.001869	-50860.	-3056.4149	2.795E-05	0.000	6.648E+11
66.0288	362435.	0.000				
54.720	-0.001586	-78892.	-2422.2651	2.695E-05	0.000	6.648E+11
57.5872	372435.	0.000				
55.575	-0.001316	-100855.	-1875.1649	2.556E-05	0.000	6.648E+11
49.0600	382436.	0.000				
56.430	-0.001062	-117645.	-1415.1226	2.388E-05	0.000	6.648E+11
40.6168	392436.	0.000				
57.285	-0.000826	-130150.	-1040.5020	2.196E-05	0.000	6.648E+11
32.4086	402436.	0.000				
58.140	-0.000611	-139233.	-748.2051	1.989E-05	0.000	6.648E+11
24.5694	412437.	0.000				
58.995	-0.000418	-145717.	-533.8330	1.769E-05	0.000	6.648E+11
17.2186	422437.	0.000				
59.850	-0.000248	-150377.	474.9850	1.441E-05	0.000	3.587E+11
179.4321	7415250.	0.000				
60.705	-0.000122	-136126.	1862.4224	1.031E-05	0.000	3.587E+11
91.0235	7625785.	0.000				
61.560	-3.661E-05	-112271.	2472.8149	6.763E-06	0.000	3.587E+11
27.9614	7836320.	0.000				
62.415	1.630E-05	-85456.	2550.6677	3.935E-06	0.000	3.587E+11
-12.7854	8046856.	0.000				

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o							
63.270	4.414E-05	-59974.	2302.8537	1.855E-06	0.000	3.587E+11	
-35.5215	8257391.	0.000					
64.125	5.437E-05	-38222.	1890.4212	4.510E-07	0.000	3.587E+11	
-44.8747	8467926.	0.000					
64.980	5.339E-05	-21187.	1428.5377	-3.986E-07	0.000	3.587E+11	
-45.1610	8678461.	0.000					
65.835	4.619E-05	-8903.6532	991.5561	-8.289E-07	0.000	3.587E+11	
-40.0206	8888996.	0.000					
66.690	3.638E-05	-831.5766	620.7186	-9.681E-07	0.000	3.587E+11	
-32.2675	9099532.	0.000					
67.545	2.633E-05	3843.9099	332.6293	-9.250E-07	0.000	3.587E+11	
-23.8903	9310067.	0.000					
68.400	1.740E-05	6003.9298	127.2369	-7.842E-07	0.000	3.587E+11	
-16.1472	9520602.	0.000					
69.255	1.024E-05	6463.2493	-5.4041	-6.059E-07	0.000	3.587E+11	
-9.7088	9731137.	0.000					
70.110	4.968E-06	5899.5570	-79.9060	-4.291E-07	0.000	3.587E+11	
-4.8140	9941672.	0.000					
70.965	1.431E-06	4828.1949	-111.8668	-2.757E-07	0.000	3.587E+11	
-1.4161	10152208.	0.000					
71.820	-6.890E-07	3607.0178	-115.5613	-1.551E-07	0.000	3.587E+11	
0.6959	10362743.	0.000					
72.675	-1.751E-06	2458.5460	-102.7353	-6.832E-08	0.000	3.587E+11	
1.8042	10573278.	0.000					
73.530	-2.091E-06	1499.6239	-82.2047	-1.172E-08	0.000	3.587E+11	
2.1978	10783813.	0.000					
74.385	-1.991E-06	771.8309	-59.9834	2.076E-08	0.000	3.587E+11	
2.1338	10994348.	0.000					
75.240	-1.665E-06	268.5416	-39.7086	3.564E-08	0.000	3.587E+11	
1.8184	11204884.	0.000					
76.095	-1.260E-06	-43.3730	-23.1888	3.886E-08	0.000	3.587E+11	
1.4019	11415419.	0.000					
76.950	-8.676E-07	-207.7104	-10.9537	3.527E-08	0.000	3.587E+11	
0.9831	11625954.	0.000					
77.805	-5.362E-07	-268.5223	-2.7365	2.846E-08	0.000	3.587E+11	
0.6186	11836489.	0.000					
78.660	-2.837E-07	-264.1696	2.1458	2.084E-08	0.000	3.587E+11	
0.3331	12047024.	0.000					
79.515	-1.086E-07	-224.7150	4.5200	1.385E-08	0.000	3.587E+11	
0.1297	12257560.	0.000					
80.370	5.348E-10	-171.5689	5.1822	8.183E-09	0.000	3.587E+11	
-0.000650	12468095.	0.000					
81.225	5.932E-08	-118.4649	4.8028	4.035E-09	0.000	3.587E+11	
-0.0733	12678630.	0.000					
82.080	8.333E-08	-73.0587	3.8897	1.296E-09	0.000	3.587E+11	
-0.1047	12889165.	0.000					
82.935	8.591E-08	-38.6614	2.7900	-3.015E-10	0.000	3.587E+11	
-0.1097	13099700.	0.000					
83.790	7.715E-08	-15.8050	1.7139	-1.080E-09	0.000	3.587E+11	
-0.1001	13310236.	0.000					
84.645	6.374E-08	-3.4815	0.7695	-1.356E-09	0.000	3.587E+11	
-0.0840	13520771.	0.000					
85.500	4.932E-08	0.000	0.000	-1.406E-09	0.000	3.587E+11	
-0.0660	6865653.	0.000					

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.

The above values of total stress are computed for combined axial and bending stress in elastic

sections and do not equal actual stresses in concrete and steel in the range of nonlinear bending.

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o
Output Summary for Load Case No. 2:

Pile-head deflection = 0.5484276 inches
 Computed slope at pile head = -0.0019824 radians
 Maximum bending moment = 3104642. inch-lbs
 Maximum shear force = -16274. lbs
 Depth of maximum bending moment = 328.3200000 inches below pile head
 Depth of maximum shear force = 482.2200000 inches below pile head
 Number of iterations = 6
 Number of zero deflection points = 4

 Computed Values of Pile Loading and Deflection
 for Lateral Loading for Load Case Number 3

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 8909.000 lbs
 Applied moment at pile head = 931200.000 in-lbs
 Axial thrust load on pile head = 500200.000 lbs

Depth Res.	Soil X	Deflect. Spr. y	Distrib. Lat. Load	Bending Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
	Es*h feet lb/inch	inches lb/inch	in-lbs	lbs	radians	psi*	lb-in^2	lb/in	
0.000	0.00	0.7068	931200.	8909.0000	-0.002831	0.000	3.597E+11		
0.000	0.855	0.6779	1037065.	8909.0000	-0.002803	0.000	3.597E+11		
0.000	1.710	0.6493	1142779.	8909.0000	-0.002772	0.000	3.597E+11		
0.000	2.565	0.6210	1248326.	8909.0000	-0.002737	0.000	3.597E+11		
0.000	3.420	0.5931	1353689.	8909.0000	-0.002700	0.000	3.597E+11		
0.000	4.275	0.5656	1458855.	8909.0000	-0.002660	0.000	3.597E+11		
0.000	5.130	0.5386	1563807.	8909.0000	-0.002617	0.000	3.597E+11		
0.000	5.985	0.5119	1668530.	8909.0000	-0.002571	0.000	3.597E+11		
0.000	6.840	0.4858	1773009.	8909.0000	-0.002522	0.000	3.597E+11		
0.000	7.695	0.4602	1877228.	8909.0000	-0.002470	0.000	3.597E+11		
0.000	8.550	0.4351	1981172.	8909.0000	-0.002415	0.000	3.597E+11		
0.000	9.405	0.4106	2084827.	8909.0000	-0.002357	0.000	3.597E+11		
0.000	10.260	0.3868	2188176.	8909.0000	-0.002296	0.000	3.596E+11		
0.000	11.115	0.3635	2291205.	8909.0000	-0.002232	0.000	3.596E+11		
0.000	11.970	0.3410	2393898.	8909.0000	-0.002165	0.000	3.596E+11		
0.000	12.825	0.3191	2496241.	8909.0000	-0.002095	0.000	3.596E+11		

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

0.000	0.000	0.000					
13.680	0.2980	2598218.	8909.0000	-0.002023	0.000	3.596E+11	
0.000	0.000	0.000					
14.535	0.2776	2699815.	8909.0000	-0.001947	0.000	3.595E+11	
0.000	0.000	0.000					
15.390	0.2580	2801016.	8909.0000	-0.001869	0.000	3.595E+11	
0.000	0.000	0.000					
16.245	0.2392	2901807.	8909.0000	-0.001787	0.000	3.594E+11	
0.000	0.000	0.000					
17.100	0.2213	3002173.	8909.0000	-0.001703	0.000	3.594E+11	
0.000	0.000	0.000					
17.955	0.2043	3102100.	8909.0000	-0.001616	0.000	3.593E+11	
0.000	0.000	0.000					
18.810	0.1882	3201571.	8909.0000	-0.001526	0.000	3.592E+11	
0.000	0.000	0.000					
19.665	0.1730	3300574.	8909.0000	-0.001433	0.000	3.592E+11	
0.000	0.000	0.000					
20.520	0.1588	3399092.	8909.0000	-0.001337	0.000	3.591E+11	
0.000	0.000	0.000					
21.375	0.1455	3497112.	8878.7619	-0.001262	0.000	6.658E+11	
-5.8944	415.5300	0.000					
22.230	0.1329	3594235.	8506.2107	-0.001207	0.000	6.657E+11	
-66.7277	5152.5720	0.000					
23.085	0.1208	3684050.	7566.7140	-0.001151	0.000	6.657E+11	
-116.4101	9889.6140	0.000					
23.940	0.1093	3761318.	6170.5379	-0.001094	0.000	6.656E+11	
-155.7490	14627.	0.000					
24.795	0.0983	3821894.	4419.5481	-0.001035	0.000	6.656E+11	
-185.5745	19364.	0.000					
25.650	0.0880	3862633.	2407.0091	-0.000976	0.000	6.655E+11	
-206.7332	24101.	0.000					
26.505	0.0783	3881304.	217.4541	-0.000916	0.000	6.655E+11	
-220.0806	28838.	0.000					
27.360	0.0692	3876500.	-2075.1808	-0.000856	0.000	6.655E+11	
-226.8268	33627.	0.000					
28.215	0.0607	3847512.	-4403.6581	-0.000797	0.000	6.655E+11	
-227.0674	38364.	0.000					
29.070	0.0529	3794317.	-6292.7470	-0.000738	0.000	6.656E+11	
-141.1760	27405.	0.000					
29.925	0.0456	3725960.	-7713.5362	-0.000680	0.000	6.657E+11	
-135.7809	30563.	0.000					
30.780	0.0389	3643016.	-9065.9398	-0.000623	0.000	6.657E+11	
-127.8455	33721.	0.000					
31.635	0.0328	3546325.	-10326.	-0.000568	0.000	6.658E+11	
-117.8666	36879.	0.000					
32.490	0.0272	3436946.	-11477.	-0.000514	0.000	6.659E+11	
-106.3163	40037.	0.000					
33.345	0.0222	3316104.	-12502.	-0.000462	0.000	6.659E+11	
-93.6392	43195.	0.000					
34.200	0.0178	3185142.	-13394.	-0.000412	0.000	6.660E+11	
-80.2506	46353.	0.000					
35.055	0.0138	3045481.	-14788.	-0.000364	0.000	6.660E+11	
-191.3937	142425.	0.000					
35.910	0.0103	2885431.	-16554.	-0.000318	0.000	6.661E+11	
-152.9250	152426.	0.000					
36.765	0.007256	2709056.	-17928.	-0.000275	0.000	6.661E+11	
-114.8645	162426.	0.000					
37.620	0.004646	2520374.	-18918.	-0.000235	0.000	6.661E+11	
-78.0771	172427.	0.000					
38.475	0.002434	2323275.	-19540.	-0.000198	0.000	6.661E+11	
-43.2840	182427.	0.000					
39.330	0.000590	2121435.	-19819.	-0.000163	0.000	6.661E+11	
-11.0658	192428.	0.000					

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40.185	-0.000919	1918263.	-19783.	-0.000132	0.000	6.662E+11
18.1337	202428.	0.000				
41.040	-0.002125	1716848.	-19464.	-0.000104	0.000	6.662E+11
43.9989	212428.	0.000				
41.895	-0.003060	1519929.	-18898.	-7.940E-05	0.000	6.662E+11
66.3338	222429.	0.000				
42.750	-0.003754	1329873.	-18122.	-5.745E-05	0.000	6.662E+11
85.0499	232429.	0.000				
43.605	-0.004239	1148664.	-17171.	-3.837E-05	0.000	6.662E+11
100.1548	242430.	0.000				
44.460	-0.004542	977908.	-16084.	-2.199E-05	0.000	6.662E+11
111.7385	252430.	0.000				
45.315	-0.004690	818837.	-14896.	-8.156E-06	0.000	6.662E+11
119.9604	262431.	0.000				
46.170	-0.004709	672329.	-13639.	3.326E-06	0.000	6.662E+11
125.0360	272431.	0.000				
47.025	-0.004622	538931.	-12345.	1.265E-05	0.000	6.662E+11
127.2244	282431.	0.000				
47.880	-0.004449	418882.	-11042.	2.003E-05	0.000	6.662E+11
126.8156	292432.	0.000				
48.735	-0.004211	312150.	-9754.3826	2.566E-05	0.000	6.662E+11
124.1197	302432.	0.000				
49.590	-0.003923	218459.	-8504.8350	2.974E-05	0.000	6.662E+11
119.4568	312433.	0.000				
50.445	-0.003600	137325.	-7311.5729	3.248E-05	0.000	6.662E+11
113.1479	322433.	0.000				
51.300	-0.003256	68092.	-6189.8715	3.406E-05	0.000	6.662E+11
105.5074	332434.	0.000				
52.155	-0.002901	9959.3652	-5151.8452	3.467E-05	0.000	6.662E+11
96.8369	342434.	0.000				
53.010	-0.002545	-37980.	-4206.6040	3.445E-05	0.000	6.662E+11
87.4206	352434.	0.000				
53.865	-0.002195	-76714.	-3360.4511	3.357E-05	0.000	6.662E+11
77.5215	362435.	0.000				
54.720	-0.001856	-107281.	-2617.1112	3.215E-05	0.000	6.662E+11
67.3791	372435.	0.000				
55.575	-0.001535	-130747.	-1977.9738	3.032E-05	0.000	6.662E+11
57.2091	382436.	0.000				
56.430	-0.001234	-148180.	-1442.3412	2.817E-05	0.000	6.662E+11
47.2027	392436.	0.000				
57.285	-0.000957	-160633.	-1007.6697	2.579E-05	0.000	6.662E+11
37.5286	402436.	0.000				
58.140	-0.000705	-169122.	-669.7944	2.325E-05	0.000	6.662E+11
28.3341	412437.	0.000				
58.995	-0.000480	-174616.	-423.1293	2.061E-05	0.000	6.662E+11
19.7488	422437.	0.000				
59.850	-0.000282	-178016.	723.8773	1.672E-05	0.000	3.597E+11
203.8392	7415250.	0.000				
60.705	-0.000137	-159933.	2290.1106	1.190E-05	0.000	3.597E+11
101.4694	7625785.	0.000				
61.560	-3.780E-05	-131145.	2958.7685	7.751E-06	0.000	3.597E+11
28.8733	7836320.	0.000				
62.415	2.254E-05	-99299.	3016.2156	4.465E-06	0.000	3.597E+11
-17.6750	8046856.	0.000				
63.270	5.382E-05	-69299.	2703.3451	2.061E-06	0.000	3.597E+11
-43.3134	8257391.	0.000				
64.125	6.482E-05	-43847.	2206.6998	4.471E-07	0.000	3.597E+11
-53.4986	8467926.	0.000				
64.980	6.299E-05	-24022.	1658.9151	-5.208E-07	0.000	3.597E+11
-53.2821	8678461.	0.000				
65.835	5.413E-05	-9801.1921	1144.9796	-1.003E-06	0.000	3.597E+11
-46.9003	8888996.	0.000				
66.690	4.241E-05	-516.3776	711.4351	-1.150E-06	0.000	3.597E+11

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-37.6113	9099532.	0.000				
67.545	3.053E-05	4809.2622	376.3681	-1.089E-06	0.000	3.597E+11
-27.7039	9310067.	0.000				
68.400	2.006E-05	7217.8739	138.7520	-9.175E-07	0.000	3.597E+11
-18.6150	9520602.	0.000				
69.255	1.170E-05	7665.8715	-13.6846	-7.053E-07	0.000	3.597E+11
-11.0997	9731137.	0.000				
70.110	5.589E-06	6944.3045	-98.4059	-4.969E-07	0.000	3.597E+11
-5.4151	9941672.	0.000				
70.965	1.506E-06	5651.6831	-133.8311	-3.173E-07	0.000	3.597E+11
-1.4904	10152208.	0.000				
71.820	-9.223E-07	4201.3467	-136.6981	-1.768E-07	0.000	3.597E+11
0.9315	10362743.	0.000				
72.675	-2.121E-06	2848.4527	-120.7050	-7.624E-08	0.000	3.597E+11
2.1861	10573278.	0.000				
73.530	-2.487E-06	1725.2630	-96.0821	-1.102E-08	0.000	3.597E+11
2.6137	10783813.	0.000				
74.385	-2.347E-06	876.9603	-69.7699	2.609E-08	0.000	3.597E+11
2.5154	10994348.	0.000				
75.240	-1.951E-06	293.3160	-45.9339	4.278E-08	0.000	3.597E+11
2.1310	11204884.	0.000				
76.095	-1.469E-06	-66.0417	-26.6143	4.602E-08	0.000	3.597E+11
1.6350	11415419.	0.000				
76.950	-1.007E-06	-253.2815	-12.3736	4.147E-08	0.000	3.597E+11
1.1410	11625954.	0.000				
77.805	-6.185E-07	-320.3738	-2.8597	3.329E-08	0.000	3.597E+11
0.7136	11836489.	0.000				
78.660	-3.239E-07	-312.3034	2.7518	2.427E-08	0.000	3.597E+11
0.3803	12047024.	0.000				
79.515	-1.206E-07	-264.1567	5.4417	1.605E-08	0.000	3.597E+11
0.1441	12257560.	0.000				
80.370	5.378E-09	-200.8050	6.1472	9.414E-09	0.000	3.597E+11
-0.006535	12468095.	0.000				
81.225	7.259E-08	-138.1118	5.6536	4.581E-09	0.000	3.597E+11
-0.0897	12678630.	0.000				
82.080	9.938E-08	-84.8409	4.5529	1.402E-09	0.000	3.597E+11
-0.1248	12889165.	0.000				
82.935	1.013E-07	-44.7000	3.2486	-4.458E-10	0.000	3.597E+11
-0.1294	13099700.	0.000				
83.790	9.023E-08	-18.1741	1.9843	-1.342E-09	0.000	3.597E+11
-0.1171	13310236.	0.000				
84.645	7.380E-08	-3.9683	0.8848	-1.658E-09	0.000	3.597E+11
-0.0973	13520771.	0.000				
85.500	5.621E-08	0.000	0.000	-1.715E-09	0.000	3.597E+11
-0.0752	6865653.	0.000				

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.

The above values of total stress are computed for combined axial and bending stress in elastic sections and do not equal actual stresses in concrete and steel in the range of nonlinear bending.

Output Summary for Load Case No. 3:

Pile-head deflection	=	0.7068226 inches
Computed slope at pile head	=	-0.0028307 radians
Maximum bending moment	=	3881304. inch-lbs
Maximum shear force	=	-19819. lbs
Depth of maximum bending moment	=	318.0600000 inches below pile head
Depth of maximum shear force	=	471.9600000 inches below pile head
Number of iterations	=	6

Bridge 11 Bent 3 Longitudinal Final Loads.lpf60
Number of zero deflection points = 4

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 4

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 9387.000 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 524400.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. Load inches lb/inch	Bending Distrib. Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.00	0.1579	-1848940.	9387.0000	0.000	0.000	3.587E+11	
0.000	0.855	0.1577	-1752487.	9387.0000	-5.151E-05	0.000	3.587E+11	
0.000	1.710	0.1569	-1655765.	9387.0000	-0.000100	0.000	3.587E+11	
0.000	2.565	0.1556	-1558787.	9387.0000	-0.000146	0.000	3.587E+11	
0.000	3.420	0.1539	-1461570.	9387.0000	-0.000189	0.000	3.587E+11	
0.000	4.275	0.1517	-1364128.	9387.0000	-0.000230	0.000	3.587E+11	
0.000	5.130	0.1492	-1266476.	9387.0000	-0.000267	0.000	3.587E+11	
0.000	5.985	0.1462	-1168629.	9387.0000	-0.000302	0.000	3.587E+11	
0.000	6.840	0.1430	-1070602.	9387.0000	-0.000334	0.000	3.587E+11	
0.000	7.695	0.1394	-972410.	9387.0000	-0.000364	0.000	3.587E+11	
0.000	8.550	0.1355	-874069.	9387.0000	-0.000390	0.000	3.588E+11	
0.000	9.405	0.1314	-775593.	9387.0000	-0.000414	0.000	3.588E+11	
0.000	10.260	0.1270	-676998.	9387.0000	-0.000434	0.000	3.588E+11	
0.000	11.115	0.1225	-578299.	9387.0000	-0.000452	0.000	3.588E+11	
0.000	11.970	0.1177	-479511.	9387.0000	-0.000467	0.000	3.588E+11	
0.000	12.825	0.1129	-380649.	9387.0000	-0.000480	0.000	3.587E+11	
0.000	13.680	0.1079	-281728.	9387.0000	-0.000489	0.000	3.587E+11	
0.000	14.535	0.1028	-182764.	9387.0000	-0.000496	0.000	3.587E+11	
0.000	15.390	0.0977	-83772.	9387.0000	-0.000500	0.000	3.587E+11	
0.000		0.000	0.000					

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o							
16.245	0.0926	15233.	9387.0000	-0.000501	0.000	3.587E+11	
0.000	0.000	0.000					
17.100	0.0875	114236.	9387.0000	-0.000499	0.000	3.587E+11	
0.000	0.000	0.000					
17.955	0.0824	213221.	9387.0000	-0.000494	0.000	3.587E+11	
0.000	0.000	0.000					
18.810	0.0773	312173.	9387.0000	-0.000487	0.000	3.587E+11	
0.000	0.000	0.000					
19.665	0.0724	411077.	9387.0000	-0.000476	0.000	3.588E+11	
0.000	0.000	0.000					
20.520	0.0675	509918.	9387.0000	-0.000463	0.000	3.588E+11	
0.000	0.000	0.000					
21.375	0.0629	608680.	9373.9380	-0.000451	0.000	6.648E+11	
-2.5462	415.5300	0.000					
22.230	0.0583	707124.	9210.7039	-0.000441	0.000	6.648E+11	
-29.2733	5152.5720	0.000					
23.085	0.0538	802428.	8794.3878	-0.000429	0.000	6.648E+11	
-51.8799	9889.6140	0.000					
23.940	0.0495	892204.	8166.3600	-0.000416	0.000	6.648E+11	
-70.5426	14627.	0.000					
24.795	0.0453	974480.	7366.0444	-0.000402	0.000	6.648E+11	
-85.4643	19364.	0.000					
25.650	0.0412	1047678.	6430.6638	-0.000386	0.000	6.648E+11	
-96.8711	24101.	0.000					
26.505	0.0374	1110592.	5395.0167	-0.000369	0.000	6.648E+11	
-105.0094	28838.	0.000					
27.360	0.0337	1162359.	4290.4085	-0.000352	0.000	6.648E+11	
-110.3138	33627.	0.000					
28.215	0.0301	1202418.	3146.3683	-0.000334	0.000	6.648E+11	
-112.6960	38364.	0.000					
29.070	0.0268	1230514.	2200.8634	-0.000315	0.000	6.648E+11	
-71.6130	27405.	0.000					
29.925	0.0237	1250968.	1471.6667	-0.000296	0.000	6.648E+11	
-70.5306	30563.	0.000					
30.780	0.0207	1263895.	760.1315	-0.000276	0.000	6.648E+11	
-68.1702	33721.	0.000					
31.635	0.0180	1269540.	78.3945	-0.000257	0.000	6.648E+11	
-64.7220	36879.	0.000					
32.490	0.0155	1268267.	-563.3496	-0.000237	0.000	6.648E+11	
-60.3743	40037.	0.000					
33.345	0.0131	1260533.	-1156.8196	-0.000218	0.000	6.648E+11	
-55.3119	43195.	0.000					
34.200	0.0110	1246872.	-1695.6052	-0.000198	0.000	6.648E+11	
-49.7146	46353.	0.000					
35.055	0.009067	1227874.	-2596.3543	-0.000179	0.000	6.648E+11	
-125.8700	142425.	0.000					
35.910	0.007325	1195524.	-3800.3449	-0.000161	0.000	6.648E+11	
-108.8260	152426.	0.000					
36.765	0.005772	1151619.	-4827.4145	-0.000142	0.000	6.648E+11	
-91.3825	162426.	0.000					
37.620	0.004402	1097998.	-5675.7050	-0.000125	0.000	6.648E+11	
-73.9763	172427.	0.000					
38.475	0.003205	1036499.	-6347.5591	-0.000109	0.000	6.648E+11	
-56.9895	182427.	0.000					
39.330	0.002173	968915.	-6848.9517	-9.316E-05	0.000	6.648E+11	
-40.7479	192428.	0.000					
40.185	0.001293	896961.	-7188.9069	-7.877E-05	0.000	6.648E+11	
-25.5202	202428.	0.000					
41.040	0.000556	822247.	-7378.9189	-6.550E-05	0.000	6.649E+11	
-11.5192	212428.	0.000					
41.895	-5.057E-05	746251.	-7432.3876	-5.340E-05	0.000	6.648E+11	
1.0964	222429.	0.000					
42.750	-0.000539	670309.	-7364.0824	-4.247E-05	0.000	6.648E+11	

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

12.2185	232429.	0.000					
43.605	-0.000922	595597.	-7189.6417	-3.270E-05	0.000	6.648E+11	
21.7856	242430.	0.000					
44.460	-0.001210	523129.	-6925.1184	-2.407E-05	0.000	6.648E+11	
29.7784	252430.	0.000					
45.315	-0.001416	453752.	-6586.5732	-1.653E-05	0.000	6.648E+11	
36.2148	262431.	0.000					
46.170	-0.001550	388150.	-6189.7220	-1.003E-05	0.000	6.648E+11	
41.1441	272431.	0.000					
47.025	-0.001622	326847.	-5749.6382	-4.516E-06	0.000	6.648E+11	
44.6422	282431.	0.000					
47.880	-0.001642	270216.	-5280.5086	9.090E-08	0.000	6.648E+11	
46.8061	292432.	0.000					
48.735	-0.001620	218490.	-4795.4430	3.862E-06	0.000	6.648E+11	
47.7486	302432.	0.000					
49.590	-0.001563	171772.	-4306.3340	6.873E-06	0.000	6.648E+11	
47.5942	312433.	0.000					
50.445	-0.001479	130050.	-3823.7632	9.202E-06	0.000	6.648E+11	
46.4742	322433.	0.000					
51.300	-0.001374	93210.	-3356.9483	1.092E-05	0.000	6.648E+11	
44.5229	332434.	0.000					
52.155	-0.001255	61048.	-2913.7272	1.212E-05	0.000	6.648E+11	
41.8750	342434.	0.000					
53.010	-0.001126	33290.	-2500.5720	1.284E-05	0.000	6.648E+11	
38.6621	352434.	0.000					
53.865	-0.000991	9598.2485	-2122.6272	1.317E-05	0.000	6.648E+11	
35.0113	362435.	0.000					
54.720	-0.000855	-10408.	-1783.7667	1.317E-05	0.000	6.648E+11	
31.0434	372435.	0.000					
55.575	-0.000721	-27146.	-1486.6615	1.288E-05	0.000	6.648E+11	
26.8719	382436.	0.000					
56.430	-0.000591	-41053.	-1232.8554	1.235E-05	0.000	6.648E+11	
22.6030	392436.	0.000					
57.285	-0.000467	-52577.	-1022.8396	1.163E-05	0.000	6.648E+11	
18.3357	402436.	0.000					
58.140	-0.000352	-62167.	-856.1241	1.074E-05	0.000	6.648E+11	
14.1624	412437.	0.000					
58.995	-0.000247	-70261.	-731.2996	9.722E-06	0.000	6.648E+11	
10.1699	422437.	0.000					
59.850	-0.000153	-77278.	-112.5387	8.075E-06	0.000	3.587E+11	
110.4463	7415250.	0.000					
60.705	-8.131E-05	-72657.	764.0750	5.931E-06	0.000	3.587E+11	
60.4336	7625785.	0.000					
61.560	-3.112E-05	-61663.	1196.0426	4.010E-06	0.000	3.587E+11	
23.7706	7836320.	0.000					
62.415	9.696E-07	-48157.	1314.0846	2.439E-06	0.000	3.587E+11	
-0.7605	8046856.	0.000					
63.270	1.893E-05	-34724.	1232.0262	1.254E-06	0.000	3.587E+11	
-15.2353	8257391.	0.000					
64.125	2.670E-05	-22890.	1040.8171	4.301E-07	0.000	3.587E+11	
-22.0374	8467926.	0.000					
64.980	2.776E-05	-13371.	807.3287	-8.848E-08	0.000	3.587E+11	
-23.4769	8678461.	0.000					
65.835	2.489E-05	-6322.2338	576.2879	-3.701E-07	0.000	3.587E+11	
-21.5603	8888996.	0.000					
66.690	2.016E-05	-1541.8407	373.9571	-4.826E-07	0.000	3.587E+11	
-17.8804	9099532.	0.000					
67.545	1.498E-05	1356.5577	212.4820	-4.852E-07	0.000	3.587E+11	
-13.5962	9310067.	0.000					
68.400	1.020E-05	2823.5117	94.1588	-4.254E-07	0.000	3.587E+11	
-9.4688	9520602.	0.000					
69.255	6.253E-06	3293.2743	15.1573	-3.380E-07	0.000	3.587E+11	
-5.9311	9731137.	0.000					

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o							
70.110	3.269E-06	3138.1756	-31.5198	-2.460E-07	0.000	3.587E+11	
-3.1677	9941672.	0.000					
70.965	1.206E-06	2649.1356	-53.8906	-1.632E-07	0.000	3.587E+11	
-1.1931	10152208.	0.000					
71.820	-8.032E-08	2034.0972	-59.5948	-9.626E-08	0.000	3.587E+11	
0.0811	10362743.	0.000					
72.675	-7.695E-07	1427.2851	-55.1108	-4.676E-08	0.000	3.587E+11	
0.7930	10573278.	0.000					
73.530	-1.040E-06	903.7260	-45.4366	-1.342E-08	0.000	3.587E+11	
1.0929	10783813.	0.000					
74.385	-1.045E-06	495.0708	-34.0862	6.581E-09	0.000	3.587E+11	
1.1197	10994348.	0.000					
75.240	-9.047E-07	204.2059	-23.2735	1.658E-08	0.000	3.587E+11	
0.9881	11204884.	0.000					
76.095	-7.047E-07	17.3204	-14.1827	1.975E-08	0.000	3.587E+11	
0.7840	11415419.	0.000					
76.950	-4.995E-07	-87.0364	-7.2572	1.875E-08	0.000	3.587E+11	
0.5660	11625954.	0.000					
77.805	-3.199E-07	-131.7985	-2.4605	1.562E-08	0.000	3.587E+11	
0.3690	11836489.	0.000					
78.660	-1.789E-07	-137.6939	0.5104	1.177E-08	0.000	3.587E+11	
0.2101	12047024.	0.000					
79.515	-7.839E-08	-121.4521	2.0686	8.062E-09	0.000	3.587E+11	
0.0937	12257560.	0.000					
80.370	-1.349E-08	-95.3332	2.6331	4.962E-09	0.000	3.587E+11	
0.0164	12468095.	0.000					
81.225	2.344E-08	-67.4742	2.5686	2.634E-09	0.000	3.587E+11	
-0.0290	12678630.	0.000					
82.080	4.056E-08	-42.6538	2.1586	1.059E-09	0.000	3.587E+11	
-0.0510	12889165.	0.000					
82.935	4.517E-08	-23.1911	1.6013	1.176E-10	0.000	3.587E+11	
-0.0577	13099700.	0.000					
83.790	4.298E-08	-9.7963	1.0194	-3.541E-10	0.000	3.587E+11	
-0.0558	13310236.	0.000					
84.645	3.791E-08	-2.2691	0.4771	-5.267E-10	0.000	3.587E+11	
-0.0500	13520771.	0.000					
85.500	3.217E-08	0.000	0.000	-5.591E-10	0.000	3.587E+11	
-0.0431	6865653.	0.000					

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.

The above values of total stress are computed for combined axial and bending stress in elastic sections and do not equal actual stresses in concrete and steel in the range of nonlinear bending.

Output Summary for Load Case No. 4:

Pile-head deflection	=	0.1579404 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-1848940. inch-lbs
Maximum shear force	=	9387.0000001 lbs
Depth of maximum bending moment	=	0.000000 inches below pile head
Depth of maximum shear force	=	174.4200000 inches below pile head
Number of iterations	=	6
Number of zero deflection points	=	4

Bridge 11 Bent 3 Longitudinal Final Loads.lp6o

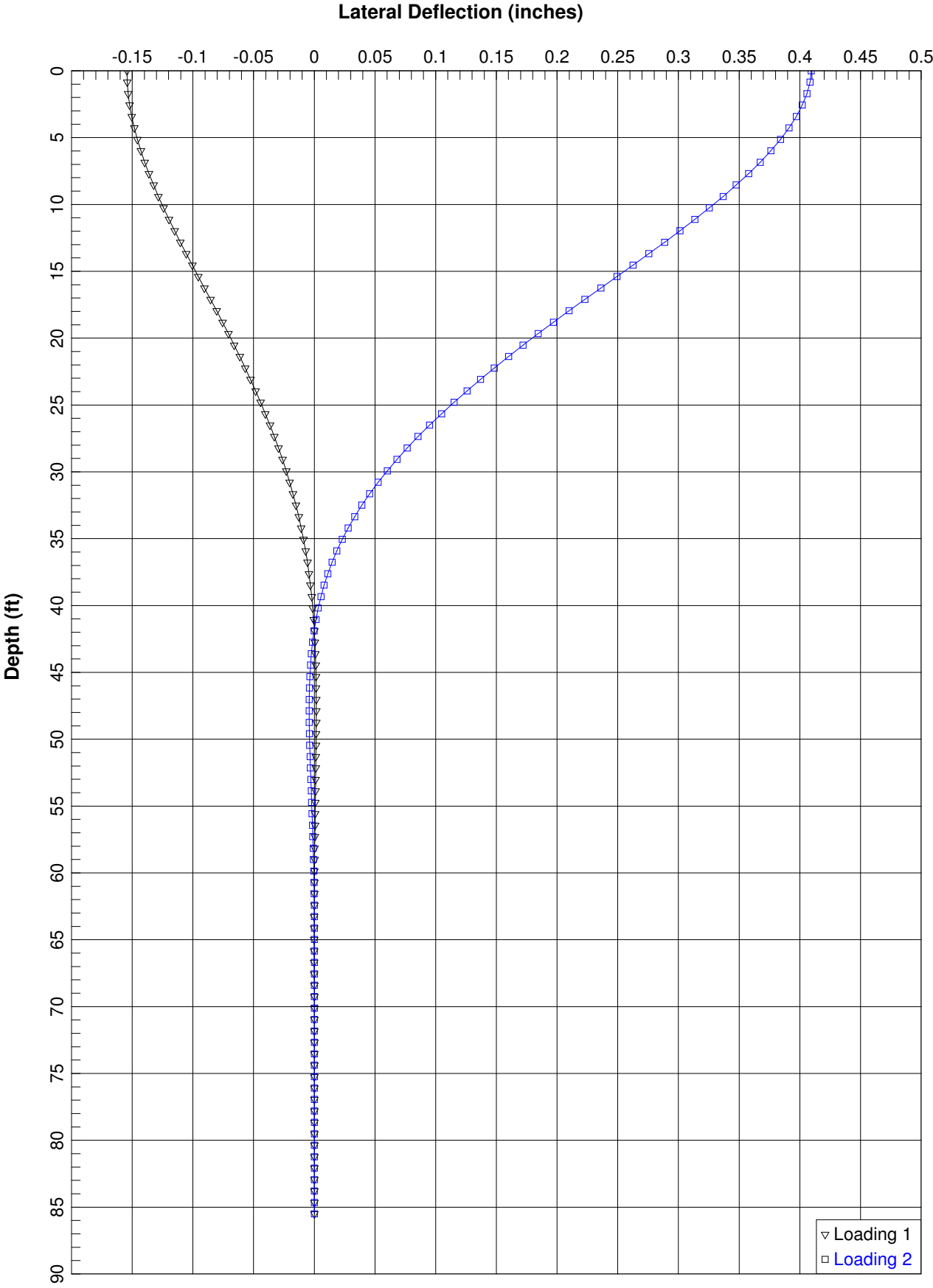
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
 Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
 Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
 Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
 Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

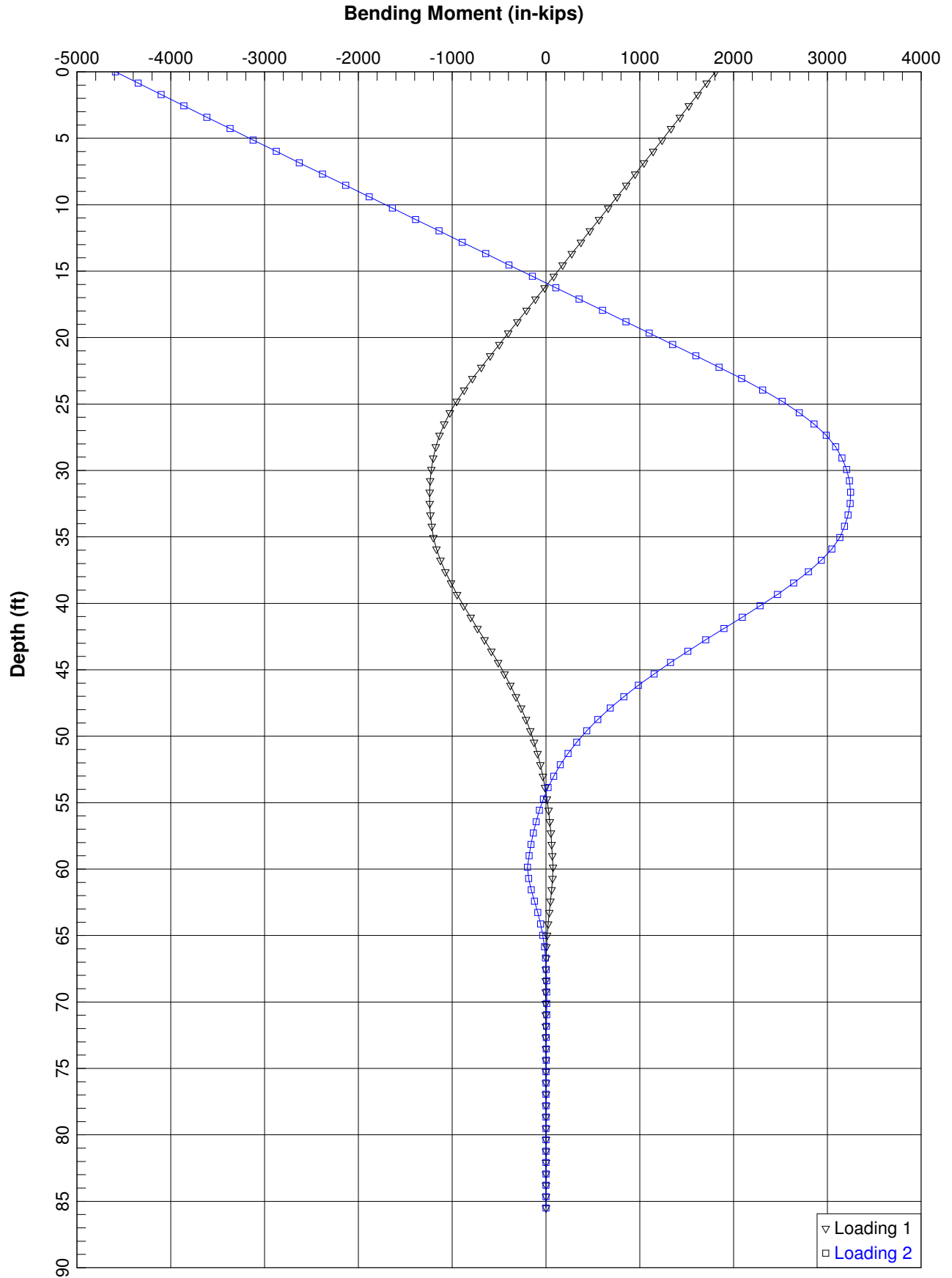
Load Case No.	Maximum Load Type No.	Pile-head		Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
		Condition 1 V(lbs) or y(inches)	Condition 2 Pile-head Rotation in-lb, rad., or in-lb/rad. radians			
1	1	V = 2321.0000	M = 94020.	525300.	0.15412832	
859903.		-4455.6902	-0.00058421			
2	1	V = 9387.0000	M = 21408.	524400.	0.54842760	
3104642.		-16274.	-0.00198235			
3	1	V = 8909.0000	M = 931200.	500200.	0.70682256	
3881304.		-19819.	-0.00283069			
4	2	V = 9387.0000	S = 0.000	524400.	0.15794038	
-1848940.		9387.0000	0.00000000			

The analysis ended normally.

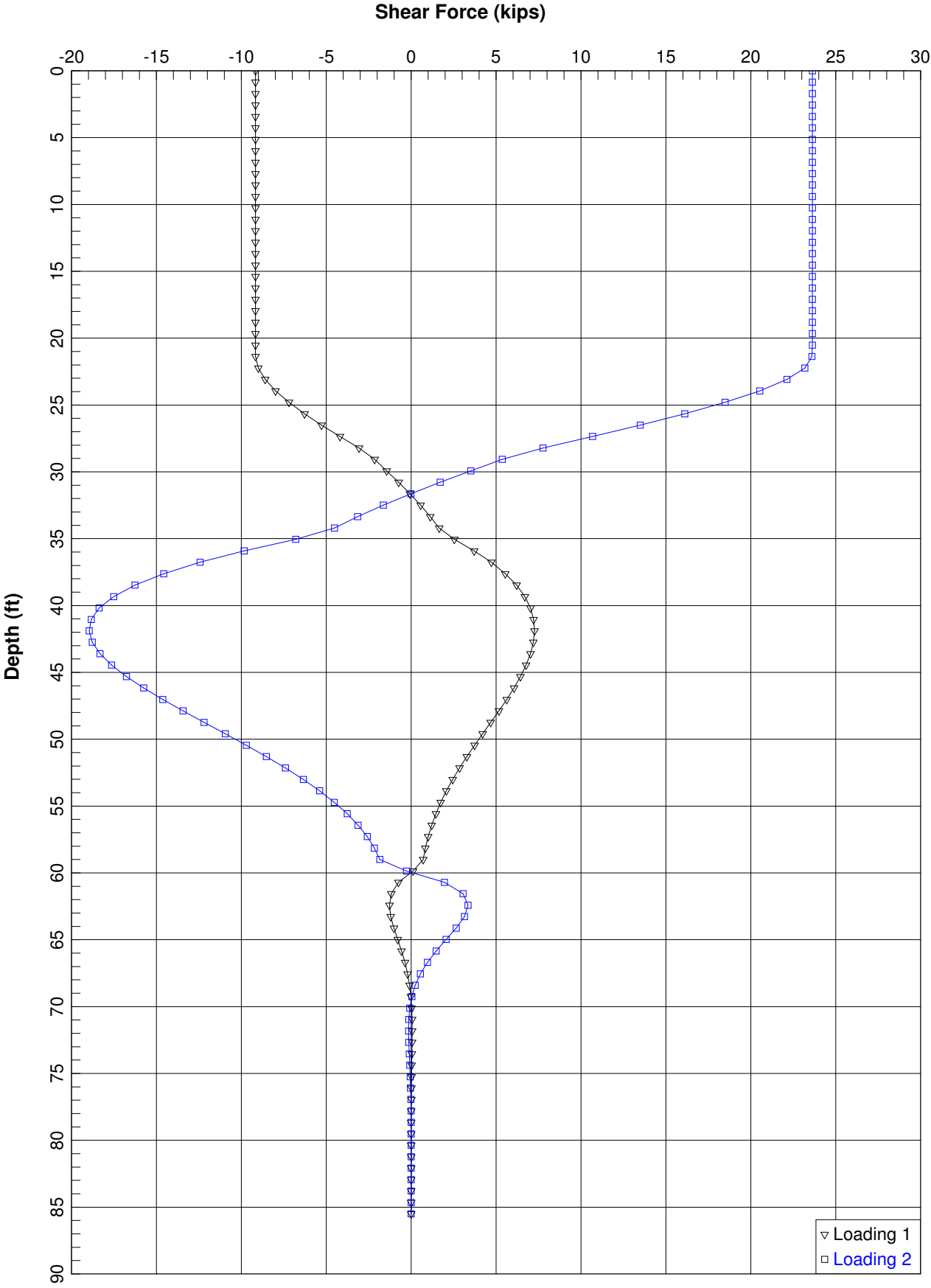
Bridge 11 Bent 3 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-03



Bridge 11 Bent 3 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-03



Bridge 11 Bent 3 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-03



Bridge 11 Bent 3 Transverse Final Loads.lp6o

LPILE Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 Bent 3\Bridge 11 Bent 3 Final Loads\
Name of input data file: Bridge 11 Bent 3 Transverse Final Loads.lp6d
Name of output report file: Bridge 11 Bent 3 Transverse Final Loads.lp6o
Name of plot output file: Bridge 11 Bent 3 Transverse Final Loads.lp6p
Name of runtime message file: Bridge 11 Bent 3 Transverse Final Loads.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:11:32

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 Bent 3 Drilled Shaft (Boring B11-SPT-04)

Bridge 11 Bent 3 Transverse Final Loads.lp6o

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 3

Total length of pile = 85.50 ft

Depth of ground surface below top of pile = 21.30 ft

Pile diameter values used for p-y curve computations are defined using 6 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth x ft	Pile Diameter in
1	0.00000	36.0000000
2	21.300000	36.0000000
3	21.300000	42.0000000
4	59.300000	42.0000000
5	59.300000	36.0000000
6	85.500000	36.0000000

Bridge 11 Bent 3 Transverse Final Loads.lp6o

Input Structural Properties:

Pile Section No. 1:

Section Type	= Drilled Shaft (Bored Pile)
Section Length	= 21.30000000 ft
Section Diameter	= 36.00000000 in

Pile Section No. 2:

Section Type	= Drilled Shaft (Bored Pile)
Section Length	= 38.00000000 ft
Section Diameter	= 42.00000000 in

Pile Section No. 3:

Section Type	= Drilled Shaft (Bored Pile)
Section Length	= 26.20000000 ft
Section Diameter	= 36.00000000 in

Ground Slope and Pile Batter Angles

Ground Slope Angle	= 0.000 degrees
	= 0.000 radians
Pile Batter Angle	= 0.000 degrees
	= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	= 21.30000 ft
Distance from top of pile to bottom of layer	= 26.80000 ft
Effective unit weight at top of layer	= 120.00000 pcf
Effective unit weight at bottom of layer	= 120.00000 pcf
Friction angle at top of layer	= 30.00000 deg.
Friction angle at bottom of layer	= 30.00000 deg.
Subgrade k at top of layer	= 45.00000 pci
Subgrade k at bottom of layer	= 45.00000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	= 26.80000 ft
Distance from top of pile to bottom of layer	= 28.80000 ft
Effective unit weight at top of layer	= 112.00000 pcf
Effective unit weight at bottom of layer	= 112.00000 pcf
Friction angle at top of layer	= 30.00000 deg.
Friction angle at bottom of layer	= 30.00000 deg.
Subgrade k at top of layer	= 45.00000 pci

Bridge 11 Bent 3 Transverse Final Loads.lfp60

Subgrade k at bottom of layer = 45.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	28.80000	ft
Distance from top of pile to bottom of layer	=	34.80000	ft
Effective unit weight at top of layer	=	40.00000	pcf
Effective unit weight at bottom of layer	=	40.00000	pcf
Friction angle at top of layer	=	30.00000	deg.
Friction angle at bottom of layer	=	30.00000	deg.
Subgrade k at top of layer	=	30.00000	pci
Subgrade k at bottom of layer	=	30.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	34.80000	ft
Distance from top of pile to bottom of layer	=	59.30000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	35.00000	deg.
Friction angle at bottom of layer	=	35.00000	deg.
Subgrade k at top of layer	=	95.00000	pci
Subgrade k at bottom of layer	=	95.00000	pci

Layer 5 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	59.30000	ft
Distance from top of pile to bottom of layer	=	90.00000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 4.50 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Layer		Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf
	Strain Factor Epsilon 50	Soil Type kpy (p-y Curve Criteria) pci			
1	Sand (Reese, et al.)		21.300	120.000	--
30.000	--	45.000	26.800	120.000	--
30.000	--	45.000			
2	Sand (Reese, et al.)		26.800	112.000	--
30.000	--	45.000			

Bridge 11 Bent 3 Transverse Final Loads.lp6o					
			28.800	112.000	--
30.000	--	45.000			
3 Sand (Reese, et al.)			28.800	40.000	--
30.000	--	30.000			
			34.800	40.000	--
30.000	--	30.000			
4 Sand (Reese, et al.)			34.800	75.000	--
35.000	--	95.000			
			59.300	75.000	--
35.000	--	95.000			
5 Stiff Clay w/o Free water, using k			59.300	75.000	8000.000
--	0.00400	2000.000			
			90.000	75.000	8000.000
--	0.00400	2000.000			

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	2	V = -9173.00000 lbs	S = 0.0000 in/in	525300.
	No			
2	2	V = 23630. lbs	S = 0.0000 in/in	506800.
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applie to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 3

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Bridge 11 Bent 3 Transverse Final Loads.lp60

Length of Section = 21.30000000 ft
 Shaft Diameter = 36.00000000 in
 Concrete Cover Thickness = 4.75000000 in
 Number of Reinforcing Bars = 12 bars
 Yield Stress of Reinforcing Bars = 60.00000000 ksi
 Modulus of Elasticity of Reinforcing Bars = 29000. ksi
 Gross Area of Shaft = 1017.87601976 sq. in.
 Total Area of Reinforcing Steel = 15.24000000 sq. in.
 Area Ratio of Steel Reinforcement = 1.50 percent
 Edge-to-Edge Bar Spacing = 5.26000451 in
 Maximum Concrete Aggregate Size = 0.75000000 in
 Ratio of Bar Spacing to Aggregate Size = 7.01
 Offset of Rebar Cage Center from Center of Pile = 0.00000000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$ = 4323.363 kips
 Tensile Load for Cracking of Concrete = -467.995 kips
 Nominal Axial Tensile Capacity = -914.400 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.27000	1.27000	12.61500	0.00000
2	1.27000	1.27000	10.92491	6.30750
3	1.27000	1.27000	6.30750	10.92491
4	1.27000	1.27000	0.00000	12.61500
5	1.27000	1.27000	-6.30750	10.92491
6	1.27000	1.27000	-10.92491	6.30750
7	1.27000	1.27000	-12.61500	0.00000
8	1.27000	1.27000	-10.92491	-6.30750
9	1.27000	1.27000	-6.30750	-10.92491
10	1.27000	1.27000	0.00000	-12.61500
11	1.27000	1.27000	6.30750	-10.92491
12	1.27000	1.27000	10.92491	-6.30750

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 5.26000 inches between Bars 7 and 8

Spacing to aggregate size ratio = 7.01334

Concrete Properties:

Compressive Strength of Concrete = 4.00000000 ksi
 Modulus of Elasticity of Concrete = 3604.99653259 ksi
 Modulus of Rupture of Concrete = -0.47434164 ksi
 Compression Strain at Peak Stress = 0.00188627
 Tensile Strain at Fracture of Concrete = -0.00011537
 Maximum Coarse Aggregate Size = 0.75000000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 2

Number	Axial Thrust Force kips
1	506.800
2	525.300

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
 Y = stress in reinforcing steel has reached yield stress.
 T = ACI 318-08 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-08, Section 10.3.4.
 Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
 Position of neutral axis is measured from edge of compression side of pile.
 Compressive stresses and strains are positive in sign.
 Tensile stresses and strains are negative in sign.

Axial Thrust Force = 506.800 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.6594050	359455048.	195.4758926	0.0001222	0.0000997
0.5009278	3.5397381				
0.000001250	449.3481810	359478545.	106.7572490	0.0001334	0.0000884
0.5450629	3.8634253				
0.000001875	674.0259403	359480501.	77.1929314	0.0001447	0.0000772
0.5889808	4.1875781				
0.000002500	898.6871828	359474873.	62.4171956	0.0001560	0.0000660
0.6326802	4.5121967				
0.000003125	1123.3264078	359464450.	53.5568930	0.0001674	0.0000549
0.6761600	4.8372809				
0.000003750	1347.9381137	359450164.	47.6543074	0.0001787	0.0000437
0.7194189	5.1628309				
0.000004375	1572.5167979	359432411.	43.4418464	0.0001901	0.0000326
0.7624558	5.4888468				
0.000005000	1797.0569564	359411391.	40.2857138	0.0002014	0.0000214
0.8052693	5.8153285				
0.000005625	2021.5530834	359387215.	37.8338005	0.0002128	0.0000103
0.8478585	6.1422762				
0.000006250	2245.9996716	359359947.	35.8748414	0.0002242	-0.00000782
0.8902219	6.4696900				
0.000006875	2470.3686662	359326351.	34.2743519	0.0002356	-0.0000119
0.9323573	6.7975614				
0.000007500	2694.5313793	359270851.	32.9424902	0.0002471	-0.0000229
0.9742574	7.1258416				
0.000008125	2918.3370277	359179942.	31.8170011	0.0002585	-0.0000340
1.0159131	7.4544684				
0.000008750	3141.6637748	359047289.	30.8534468	0.0002700	-0.0000450
1.0573166	7.7833872				
0.000009375	3364.4208366	358871556.	30.0192792	0.0002814	-0.0000561

Bridge 11 Bent 3 Transverse Final Loads.lp6o

1.0984619	8.1125541				
0.0000100	3586.5410335	358654103.	29.2901183	0.0002929	-0.0000671
1.1393439	8.4419343				
0.0000106	3807.9738344	358397537.	28.6473429	0.0003044	-0.0000781
1.1799585	8.7715001				
0.0000113	4028.6827234	358105131.	28.0764900	0.0003159	-0.0000891
1.2203028	9.1012299				
0.0000119	4248.6384948	357780084.	27.5661508	0.0003273	-0.0001002
1.2603741	9.4311057				
0.0000125	4467.8180425	357425443.	27.1072066	0.0003388	-0.0001112
1.3001702	9.7611124				
0.0000131	4467.8180425	340405184.	25.7554922	0.0003380	-0.0001345
1.2969924	9.7346718	C			
0.0000138	4467.8180425	324932221.	25.2667218	0.0003474	-0.0001476
1.3291944	10.0033303	C			
0.0000144	4467.8180425	310804733.	24.8126525	0.0003567	-0.0001608
1.3608172	10.2687370	C			
0.0000150	4467.8180425	297854536.	24.3896491	0.0003658	-0.0001742
1.3919037	10.5311974	C			
0.0000156	4467.8180425	285940355.	23.9944874	0.0003749	-0.0001876
1.4224869	10.7909396	C			
0.0000163	4467.8180425	274942649.	23.6241898	0.0003839	-0.0002011
1.4525855	11.0480744	C			
0.0000169	4554.8686133	269918140.	23.2760136	0.0003928	-0.0002147
1.4822059	11.3026117	C			
0.0000175	4642.2564869	265271799.	22.9478527	0.0004016	-0.0002284
1.5113689	11.5546852	C			
0.0000181	4727.2198911	260812132.	22.6379904	0.0004103	-0.0002422
1.5401008	11.8044812	C			
0.0000188	4810.0347497	256535187.	22.3449789	0.0004190	-0.0002560
1.5684299	12.0522073	C			
0.0000194	4890.9686799	252437093.	22.0675938	0.0004276	-0.0002699
1.5963862	12.2980918	C			
0.0000200	4970.0633197	248503166.	21.8043413	0.0004361	-0.0002839
1.6239713	12.5421180	C			
0.0000206	5047.0222303	244704108.	21.5531560	0.0004445	-0.0002980
1.6511367	12.7838190	C			
0.0000213	5122.7194271	241069150.	21.3146209	0.0004529	-0.0003121
1.6779999	13.0242102	C			
0.0000219	5197.1347044	237583301.	21.0875807	0.0004613	-0.0003262
1.7045586	13.2632466	C			
0.0000225	5269.6802216	234208010.	20.8697319	0.0004696	-0.0003404
1.7307185	13.5000501	C			
0.0000231	5341.5341651	230985261.	20.6626681	0.0004778	-0.0003547
1.7566557	13.7361894	C			
0.0000238	5411.7249794	227862104.	20.4634932	0.0004860	-0.0003690
1.7822182	13.9702560	C			
0.0000244	5481.1923251	224869429.	20.2734231	0.0004942	-0.0003833
1.8075493	14.2035385	C			
0.0000256	5616.8905991	219195731.	19.9156816	0.0005103	-0.0004122
1.8573442	14.6660785	C			
0.0000269	5749.1322087	213921198.	19.5856728	0.0005264	-0.0004411
1.9061098	15.1242963	C			
0.0000281	5878.1908962	209002343.	19.2799154	0.0005422	-0.0004703
1.9538805	15.5783686	C			
0.0000294	6004.1462783	204396469.	18.9951141	0.0005580	-0.0004995
2.0006537	16.0281252	C			
0.0000306	6127.7898220	200091096.	18.7300340	0.0005736	-0.0005289
2.0465660	16.4747490	C			
0.0000319	6249.5614884	196064674.	18.4831255	0.0005891	-0.0005584
2.0917004	16.9189517	C			
0.0000331	6369.1210641	192275353.	18.2514723	0.0006046	-0.0005879
2.1359832	17.3599081	C			

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0.0000344	6486.8920758		188709588.	18.0340442	0.0006199	-0.0006176
2.1794883	17.7982504	C				
0.0000356	6603.6565515		185365798.	17.8309468	0.0006352	-0.0006473
2.2223862	-18.5849404	C				
0.0000369	6718.2216542		182189062.	17.6380453	0.0006504	-0.0006771
2.2644046	-19.4433279	C				
0.0000381	6832.3738914		179209807.	17.4580326	0.0006656	-0.0007069
2.3059456	-20.3014501	C				
0.0000394	6944.3552483		176364578.	17.2858460	0.0006806	-0.0007369
2.3465966	-21.1636870	C				
0.0000406	7056.0647379		173687747.	17.1247380	0.0006957	-0.0007668
2.3868067	-22.0253554	C				
0.0000419	7166.0006900		171128375.	16.9704049	0.0007106	-0.0007969
2.4262050	-22.8904771	C				
0.0000431	7275.3859255		168704601.	16.8248558	0.0007256	-0.0008269
2.4650979	-23.7558020	C				
0.0000444	7383.8832212		166397368.	16.6865390	0.0007405	-0.0008570
2.5033928	-24.6223725	C				
0.0000456	7491.1369467		164189303.	16.5540610	0.0007553	-0.0008872
2.5410005	-25.4912454	C				
0.0000469	7598.1298655		162093437.	16.4290550	0.0007701	-0.0009174
2.5781778	-26.3595657	C				
0.0000481	7704.0197065		160083526.	16.3090211	0.0007849	-0.0009476
2.6146926	-27.2300099	C				
0.0000494	7809.0726605		158158434.	16.1941553	0.0007996	-0.0009779
2.6506218	-28.1017562	C				
0.0000506	7913.8695274		156323349.	16.0853353	0.0008143	-0.0010082
2.6861248	-28.9729544	C				
0.0000519	8017.9435177		154562767.	15.9810405	0.0008290	-0.0010385
2.7210651	-29.8452345	C				
0.0000531	8120.9831539		152865565.	15.8802274	0.0008436	-0.0010689
2.7553552	-30.7197119	C				
0.0000544	8223.7714299		151241773.	15.7843952	0.0008583	-0.0010992
2.7892233	-31.5936441	C				
0.0000556	8326.3067305		149686413.	15.6932097	0.0008729	-0.0011296
2.8226676	-32.4670284	C				
0.0000569	8427.9174708		148183164.	15.6047773	0.0008875	-0.0011600
2.8554817	-33.3424829	C				
0.0000581	8528.8747958		146733330.	15.5195326	0.0009021	-0.0011904
2.8877519	-34.2189752	C				
0.0000594	8629.5837676		145340358.	15.4381949	0.0009166	-0.0012209
2.9196022	-35.0949204	C				
0.0000606	8730.0428304		144000706.	15.3605241	0.0009312	-0.0012513
2.9510311	-35.9703159	C				
0.0000619	8830.0791467		142708350.	15.2858798	0.0009458	-0.0012817
2.9819812	-36.8459118	C				
0.0000631	8929.1281673		141451535.	15.2127161	0.0009603	-0.0013122
3.0122716	-37.7242089	C				
0.0000644	9027.9317165		140239716.	15.1426890	0.0009748	-0.0013427
3.0421439	-38.6019547	C				
0.0000656	9126.4882516		139070297.	15.0756209	0.0009893	-0.0013732
3.0715967	-39.4791462	C				
0.0000669	9224.7962151		137940878.	15.0113475	0.0010039	-0.0014036
3.1006282	-40.3557803	C				
0.0000681	9322.8540352		136849234.	14.9497163	0.0010184	-0.0014341
3.1292367	-41.2318540	C				
0.0000694	9420.0340760		135784275.	14.8890114	0.0010329	-0.0014646
3.1572080	-42.1105326	C				
0.0000706	9516.8484301		134751836.	14.8304318	0.0010474	-0.0014951
3.1847196	-42.9892592	C				
0.0000719	9613.4167684		133751885.	14.7741608	0.0010619	-0.0015256
3.2118112	-43.8674209	C				
0.0000731	9709.7375670		132782736.	14.7200816	0.0010764	-0.0015561

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3.2384814	-44.7450142	C				
0.0000744	9805.8092564		131842814.	14.6680853	0.0010909	-0.0015866
3.2647284	-45.6220358	C				
0.0000794	10186.		128331107.	14.4756189	0.0011490	-0.0017085
3.3649985	-49.1320974	C				
0.0000844	10562.		125175730.	14.3072426	0.0012072	-0.0018303
3.4580899	-52.6390281	C				
0.0000894	10932.		122319614.	14.1593751	0.0012655	-0.0019520
3.5440202	-56.1416321	C				
0.0000944	11298.		119712041.	14.0281065	0.0013239	-0.0020736
3.6226515	-59.6416884	C				
0.0000994	11659.		117324872.	13.9135864	0.0013827	-0.0021948
3.6942592	-60.0000000	CY				
0.0001044	12016.		115120158.	13.8117792	0.0014416	-0.0023159
3.7585289	-60.0000000	CY				
0.0001094	12367.		113072180.	13.7209409	0.0015007	-0.0024368
3.8153896	-60.0000000	CY				
0.0001144	12714.		111164619.	13.6414455	0.0015602	-0.0025573
3.8649314	-60.0000000	CY				
0.0001194	13054.		109349789.	13.5708918	0.0016200	-0.0026775
3.9069253	-60.0000000	CY				
0.0001244	13353.		107358649.	13.4982190	0.0016788	-0.0027987
3.9406231	-60.0000000	CY				
0.0001294	13621.		105283730.	13.4233840	0.0017367	-0.0029208
3.9663889	-60.0000000	CY				
0.0001344	13842.		103008796.	13.3424730	0.0017929	-0.0030446
3.9844619	-60.0000000	CY				
0.0001394	13998.		100435951.	13.2496820	0.0018467	-0.0031708
3.9952962	-60.0000000	CY				
0.0001444	14140.		97938279.	13.1616860	0.0019002	-0.0032973
3.9998370	-60.0000000	CY				
0.0001494	14277.		95580037.	13.0792121	0.0019537	-0.0034238
3.9998033	-60.0000000	CY				
0.0001544	14411.		93351931.	13.0036033	0.0020074	-0.0035501
3.9996447	-60.0000000	CY				
0.0001594	14542.		91244338.	12.9351771	0.0020615	-0.0036760
3.9992667	-60.0000000	CY				
0.0001644	14670.		89246820.	12.8732594	0.0021160	-0.0038015
3.9985009	60.0000000	CY				
0.0001694	14795.		87350438.	12.8172265	0.0021709	-0.0039266
3.9971084	60.0000000	CY				
0.0001744	14913.		85520911.	12.7640467	0.0022257	-0.0040518
3.9999621	60.0000000	CY				
0.0001794	15004.		83647912.	12.7044973	0.0022789	-0.0041786
3.9991720	60.0000000	CY				
0.0001844	15069.		81730962.	12.6392619	0.0023304	-0.0043071
3.9967557	60.0000000	CY				
0.0001894	15116.		79822717.	12.5722163	0.0023809	-0.0044366
3.9996857	60.0000000	CY				
0.0001944	15161.		77997952.	12.5093312	0.0024315	-0.0045660
3.9972390	60.0000000	CY				
0.0001994	15204.		76258869.	12.4508303	0.0024824	-0.0046951
3.9997805	60.0000000	CY				
0.0002044	15246.		74596024.	12.3949591	0.0025332	-0.0048243
3.9969585	60.0000000	CY				
0.0002094	15285.		73004445.	12.3409869	0.0025839	-0.0049536
3.9996178	60.0000000	CY				
0.0002144	15324.		71482539.	12.2906235	0.0026348	-0.0050827
3.9957055	60.0000000	CY				
0.0002194	15362.		70025657.	12.2436066	0.0026859	-0.0052116
3.9990172	60.0000000	CY				
0.0002244	15399.		68630593.	12.1995095	0.0027373	-0.0053402
3.9991044	60.0000000	CY				

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0.0002294	15435.	67291637.	12.1584711	0.0027888	-0.0054687	
3.9975130	60.0000000	CY				
0.0002344	15470.	66007402.	12.1198705	0.0028406	-0.0055969	
3.9997126	60.0000000	CY				
0.0002394	15505.	64773430.	12.0837716	0.0028926	-0.0057249	
3.9952127	60.0000000	CY				
0.0002444	15539.	63586016.	12.0492936	0.0029445	-0.0058530	
3.9980720	60.0000000	CY				
0.0002494	15572.	62442431.	12.0152491	0.0029963	-0.0059812	
3.9998339	60.0000000	CY				
0.0002544	15604.	61340950.	11.9833831	0.0030483	-0.0061092	
3.9945714	60.0000000	CYT				
0.0002594	15635.	60279679.	11.9534443	0.0031004	-0.0062371	
3.9975787	60.0000000	CYT				
0.0002644	15666.	59257066.	11.9251510	0.0031527	-0.0063648	
3.9996185	60.0000000	CYT				
0.0002694	15697.	58270398.	11.8985592	0.0032052	-0.0064923	
3.9969460	60.0000000	CYT				
0.0002744	15726.	57317409.	11.8736569	0.0032578	-0.0066197	
3.9958614	60.0000000	CYT				
0.0003044	15896.	52226636.	11.7519824	0.0035770	-0.0073805	
3.9999338	60.0000000	CYT				
0.0003344	15939.	47667185.	11.6779305	0.0039048	-0.0081327	
3.9912890	60.0000000	CYT				

Axial Thrust Force = 525.300 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
-----	-----	---	-----	-----	-----
0.000000625	224.1823309	358691729.	202.1432277	0.0001263	0.0001038
0.5174380	3.6605835				
0.000001250	448.3953387	358716271.	110.0909575	0.0001376	0.0000926
0.5614687	3.9842722				
0.000001875	672.5973064	358718563.	79.4154491	0.0001489	0.0000814
0.6052822	4.3084275				
0.000002500	896.7827224	358713089.	64.0841315	0.0001602	0.0000702
0.6488772	4.6330495				
0.000003125	1120.9460742	358702744.	54.8904908	0.0001715	0.0000590
0.6922525	4.9581382				
0.000003750	1345.0818487	358688493.	48.7656889	0.0001829	0.0000479
0.7354069	5.2836937				
0.000004375	1569.1845314	358670750.	44.3945097	0.0001942	0.0000367
0.7783393	5.6097159				
0.000005000	1793.2486067	358649721.	41.1193452	0.0002056	0.0000256
0.8210484	5.9362051				
0.000005625	2017.2685572	358625521.	38.5748577	0.0002170	0.0000145
0.8635329	6.2631612				
0.000006250	2241.2388639	358598218.	36.5418446	0.0002284	0.000003387
0.9057917	6.5905844				
0.000006875	2465.1489065	358567114.	34.8808039	0.0002398	-0.000007694
0.9478234	6.9184728				
0.000007500	2688.9124992	358521667.	33.4985983	0.0002512	-0.0000188
0.9896226	7.2467951				
0.000008125	2912.3801300	358446785.	32.3306282	0.0002627	-0.0000298
1.0311809	7.5754918				
0.000008750	3135.4210035	358333829.	31.3307631	0.0002741	-0.0000409

Bridge 11 Bent 3 Transverse Final Loads.lp6o					
1.0724900	7.9045062				
0.000009375	3357.9333207	358179554.	30.4652072	0.0002856	-0.0000519
1.1135433	8.2337907				
0.0000100	3579.8419866	357984199.	29.7086481	0.0002971	-0.0000629
1.1543354	8.5633080				
0.0000106	3801.0897280	357749621.	29.0417517	0.0003086	-0.0000739
1.1948619	8.8930273				
0.0000113	4021.6340559	357478583.	28.4495007	0.0003201	-0.0000849
1.2351194	9.2229247				
0.0000119	4241.4428054	357174131.	27.9200532	0.0003316	-0.0000959
1.2751052	9.5529808				
0.0000125	4460.4901325	356839211.	27.4439435	0.0003430	-0.0001070
1.3148168	9.8831796				
0.0000131	4460.4901325	339846867.	26.1622696	0.0003434	-0.0001291
1.3155742	9.8895013	C			
0.0000138	4460.4901325	324399282.	25.6632835	0.0003529	-0.0001421
1.3480579	10.1614593	C			
0.0000144	4460.4901325	310294966.	25.1992195	0.0003622	-0.0001553
1.3799261	10.4298872	C			
0.0000150	4460.4901325	297366009.	24.7667391	0.0003715	-0.0001685
1.4112388	10.6952315	C			
0.0000156	4460.4901325	285471368.	24.3625765	0.0003807	-0.0001818
1.4420305	10.9577300	C			
0.0000163	4531.9017102	278886259.	23.9839272	0.0003897	-0.0001953
1.4723325	11.2176007	C			
0.0000169	4624.5527233	274047569.	23.6281868	0.0003987	-0.0002088
1.5021633	11.4749564	C			
0.0000175	4714.3646447	269392265.	23.2929437	0.0004076	-0.0002224
1.5315306	11.7298189	C			
0.0000181	4801.5922148	264915433.	22.9763560	0.0004164	-0.0002361
1.5604561	11.9823346	C			
0.0000188	4886.5136716	260614062.	22.6769158	0.0004252	-0.0002498
1.5889669	12.2326980	C			
0.0000194	4969.4020446	256485267.	22.3933495	0.0004339	-0.0002636
1.6170916	12.4811258	C			
0.0000200	5050.5217585	252526088.	22.1245797	0.0004425	-0.0002775
1.6448608	12.7278563	C			
0.0000206	5129.3211874	248694361.	21.8680259	0.0004510	-0.0002915
1.6721955	12.9721506	C			
0.0000213	5206.5827535	245015659.	21.6239759	0.0004595	-0.0003055
1.6991937	13.2148502	C			
0.0000219	5282.6874631	241494284.	21.3920686	0.0004680	-0.0003195
1.7259083	13.4564061	C			
0.0000225	5356.8227835	238081013.	21.1695909	0.0004763	-0.0003337
1.7522199	13.6957081	C			
0.0000231	5429.8844751	234805815.	20.9574137	0.0004846	-0.0003479
1.7782523	13.9338531	C			
0.0000238	5501.8155999	231655394.	20.7546019	0.0004929	-0.0003621
1.8039985	14.1707571	C			
0.0000244	5572.2765025	228606215.	20.5596375	0.0005011	-0.0003764
1.8294003	14.4058563	C			
0.0000256	5710.4025478	222844977.	20.1938942	0.0005175	-0.0004050
1.8794166	14.8728252	C			
0.0000269	5844.7808500	217480218.	19.8563008	0.0005336	-0.0004339
1.9283683	15.3352170	C			
0.0000281	5975.9069770	212476693.	19.5437277	0.0005497	-0.0004628
1.9763252	15.7935404	C			
0.0000294	6104.2518248	207804317.	19.2536431	0.0005656	-0.0004919
2.0233602	16.2483598	C			
0.0000306	6229.3719420	203408063.	18.9820996	0.0005813	-0.0005212
2.0693784	16.6986148	C			
0.0000319	6352.3001275	199287847.	18.7286634	0.0005970	-0.0005505
2.1145586	17.1459208	C			

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
0.0000331	6473.5310626		195427353.	18.4921740	0.0006126	-0.0005799
2.1589960	17.5911322	C				
0.0000344	6592.4900406		191781528.	18.2694837	0.0006280	-0.0006095
2.2025712	18.0329542	C				
0.0000356	6709.8877688		188347727.	18.0603509	0.0006434	-0.0006391
2.2454174	18.4726376	C				
0.0000369	6826.0631314		185113576.	17.8640627	0.0006587	-0.0006688
2.2876103	-19.2016303	C				
0.0000381	6940.4120993		182043596.	17.6779481	0.0006740	-0.0006985
2.3290077	-20.0583061	C				
0.0000394	7054.0075573		179149398.	17.5032023	0.0006892	-0.0007283
2.3698509	-20.9154933	C				
0.0000406	7165.9150147		176391754.	17.3367171	0.0007043	-0.0007582
2.4099178	-21.7756176	C				
0.0000419	7277.0580199		173780490.	17.1796372	0.0007194	-0.0007881
2.4494272	-22.6363905	C				
0.0000431	7387.0983955		171295035.	17.0303339	0.0007344	-0.0008181
2.4882901	-23.4988260	C				
0.0000444	7495.9284828		168922332.	16.8879049	0.0007494	-0.0008481
2.5264841	-24.3632398	C				
0.0000456	7604.4881716		166673713.	16.7537085	0.0007644	-0.0008781
2.5642391	-25.2270868	C				
0.0000469	7711.3644707		164509109.	16.6240183	0.0007793	-0.0009082
2.6011925	-26.0945377	C				
0.0000481	7817.8100724		162448002.	16.5011132	0.0007941	-0.0009384
2.6376698	-26.9619212	C				
0.0000494	7923.9900153		160485874.	16.3848231	0.0008090	-0.0009685
2.6737125	-27.8287438	C				
0.0000506	8028.5653148		158588944.	16.2717074	0.0008238	-0.0009987
2.7089586	-28.6993371	C				
0.0000519	8132.8218738		156777289.	16.1642833	0.0008385	-0.0010290
2.7437598	-29.5695687	C				
0.0000531	8236.8176101		155045979.	16.0622760	0.0008533	-0.0010592
2.7781305	-30.4392434	C				
0.0000544	8339.8536282		153376618.	15.9637336	0.0008680	-0.0010895
2.8118705	-31.3108500	C				
0.0000556	8442.1076286		151768227.	15.8687992	0.0008827	-0.0011198
2.8450341	-32.1837806	C				
0.0000569	8544.1056383		150226033.	15.7783742	0.0008974	-0.0011501
2.8777712	-33.0561565	C				
0.0000581	8645.8460100		148745738.	15.6921690	0.0009121	-0.0011804
2.9100802	-33.9279750	C				
0.0000594	8746.6811303		147312524.	15.6084226	0.0009268	-0.0012107
2.9417657	-34.8018097	C				
0.0000606	8846.8577452		145927550.	15.5275264	0.0009414	-0.0012411
2.9729051	-35.6767050	C				
0.0000619	8946.7813879		144594447.	15.4502092	0.0009560	-0.0012715
3.0036202	-36.5510432	C				
0.0000631	9046.4504566		143310106.	15.3762600	0.0009706	-0.0013019
3.0339093	-37.4248213	C				
0.0000644	9145.8633153		142071663.	15.3054842	0.0009853	-0.0013322
3.0637708	-38.2980364	C				
0.0000656	9244.2052885		140864081.	15.2357715	0.0009998	-0.0013627
3.0929469	-39.1743598	C				
0.0000669	9342.2267946		139696849.	15.1687917	0.0010144	-0.0013931
3.1216782	-40.0504369	C				
0.0000681	9439.9965361		138568756.	15.1045561	0.0010290	-0.0014235
3.1499851	-40.9259487	C				
0.0000694	9537.5129488		137477664.	15.0429179	0.0010436	-0.0014539
3.1778661	-41.8008918	C				
0.0000706	9634.7744113		136421585.	14.9837408	0.0010582	-0.0014843
3.2053195	-42.6752631	C				
0.0000719	9731.6098853		135396311.	14.9264767	0.0010728	-0.0015147

Bridge 11 Bent 3 Transverse Final Loads.lp6o

3.2322873	-43.5499374	C				
0.0000731	9827.6383609		134395055.	14.8700869	0.0010874	-0.0015451
3.2586449	-44.4269094	C				
0.0000744	9923.4159994		133424081.	14.8158601	0.0011019	-0.0015756
3.2845778	-45.3033040	C				
0.0000794	10304.		129813994.	14.6185709	0.0011603	-0.0016972
3.3840280	-48.8030394	C				
0.0000844	10679.		126562065.	14.4441008	0.0012187	-0.0018188
3.4759662	-52.3041538	C				
0.0000894	11049.		123622491.	14.2917650	0.0012773	-0.0019402
3.5608061	-55.7984939	C				
0.0000944	11414.		120941511.	14.1570678	0.0013361	-0.0020614
3.6383391	-59.2887375	C				
0.0000994	11774.		118479114.	14.0372456	0.0013950	-0.0021825
3.7084985	-60.0000000	CY				
0.0001044	12130.		116211164.	13.9324169	0.0014542	-0.0023033
3.7714717	-60.0000000	CY				
0.0001094	12481.		114107817.	13.8398957	0.0015137	-0.0024238
3.8270538	-60.0000000	CY				
0.0001144	12826.		112142099.	13.7564524	0.0015734	-0.0025441
3.8749884	-60.0000000	CY				
0.0001194	13166.		110287226.	13.6828403	0.0016334	-0.0026641
3.9153702	-60.0000000	CY				
0.0001244	13470.		108297930.	13.6089416	0.0016926	-0.0027849
3.9475258	-60.0000000	CY				
0.0001294	13739.		106194828.	13.5344928	0.0017510	-0.0029065
3.9717451	-60.0000000	CY				
0.0001344	13971.		103968337.	13.4560984	0.0018082	-0.0030293
3.9882358	-60.0000000	CY				
0.0001394	14134.		101406283.	13.3628871	0.0018625	-0.0031550
3.9973111	-60.0000000	CY				
0.0001444	14274.		98866047.	13.2720369	0.0019162	-0.0032813
3.9987798	-60.0000000	CY				
0.0001494	14411.		96475001.	13.1897636	0.0019702	-0.0034073
3.9989693	-60.0000000	CY				
0.0001544	14544.		94214906.	13.1141100	0.0020245	-0.0035330
3.9999994	-60.0000000	CY				
0.0001594	14674.		92071079.	13.0434446	0.0020788	-0.0036587
3.9999228	-60.0000000	CY				
0.0001644	14800.		90039482.	12.9794596	0.0021335	-0.0037840
3.9995916	60.0000000	CY				
0.0001694	14924.		88111018.	12.9215141	0.0021886	-0.0039089
3.9987719	60.0000000	CY				
0.0001744	15043.		86266401.	12.8682240	0.0022439	-0.0040336
3.9971430	60.0000000	CY				
0.0001794	15142.		84415265.	12.8130324	0.0022983	-0.0041592
3.9999339	60.0000000	CY				
0.0001844	15214.		82514130.	12.7509791	0.0023510	-0.0042865
3.9987667	60.0000000	CY				
0.0001894	15262.		80592122.	12.6828169	0.0024018	-0.0044157
3.9986754	60.0000000	CY				
0.0001944	15306.		78743068.	12.6181418	0.0024527	-0.0045448
3.9990928	60.0000000	CY				
0.0001994	15348.		76980868.	12.5577795	0.0025037	-0.0046738
3.9976960	60.0000000	CY				
0.0002044	15389.		75298586.	12.5017006	0.0025550	-0.0048025
3.9989748	60.0000000	CY				
0.0002094	15429.		73692500.	12.4492819	0.0026066	-0.0049309
3.9986722	60.0000000	CY				
0.0002144	15468.		72153362.	12.3992828	0.0026581	-0.0050594
3.9983326	60.0000000	CY				
0.0002194	15505.		70678209.	12.3505463	0.0027094	-0.0051881
3.9999581	60.0000000	CY				

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
0.0002244	15541.	69264086.	12.3051340	0.0027610	-0.0053165	
3.9966951	60.0000000	CY				
0.0002294	15577.	67908712.	12.2624969	0.0028127	-0.0054448	
3.9993963	60.0000000	CY				
0.0002344	15611.	66608164.	12.2225004	0.0028646	-0.0055729	
3.9974714	60.0000000	CY				
0.0002394	15645.	65358233.	12.1851454	0.0029168	-0.0057007	
3.9975546	60.0000000	CY				
0.0002444	15678.	64157434.	12.1499339	0.0029691	-0.0058284	
3.9996820	60.0000000	CY				
0.0002494	15711.	63001957.	12.1169311	0.0030217	-0.0059558	
3.9958611	60.0000000	CYT				
0.0002544	15743.	61889141.	12.0860078	0.0030744	-0.0060831	
3.9973930	60.0000000	CYT				
0.0002594	15775.	60817351.	12.0565789	0.0031272	-0.0062103	
3.9995655	60.0000000	CYT				
0.0002644	15805.	59782138.	12.0271527	0.0031797	-0.0063378	
3.9973209	60.0000000	CYT				
0.0002694	15835.	58782941.	11.9995841	0.0032324	-0.0064651	
3.9959500	60.0000000	CYT				
0.0002744	15864.	57818941.	11.9734758	0.0032852	-0.0065923	
3.9987544	60.0000000	CYT				
0.0003044	16030.	52664280.	11.8470569	0.0036059	-0.0073516	
3.9933331	60.0000000	CYT				
0.0003344	16076.	48077265.	11.7784585	0.0039384	-0.0080991	
3.9966716	60.0000000	CYT				

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
-----	-----	-----	-----
1	506.800	15573.859	0.00300000
2	525.300	15697.652	0.00300000

Note note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318-08, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial (Factored) Load Capacity No. in-kip	Resistance Bending Factor at Ult. for Moment	Nominal Stiffness Moment Capacity in-kip kip-in^2	Ultimate (Factored) Axial Thrust kips	Ultimate Moment
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Bridge 11 Bent 3 Transverse Final Loads.lp6o				
1	0.65	15573.859	329.420	
10123.008		128915111.380		
2	0.65	15697.652	341.445	
10203.473		130767455.377		
1	0.70	15573.859	354.760	
10901.701		122555541.155		
2	0.70	15697.652	367.710	
10988.356		124102276.853		
1	0.75	15573.859	380.100	
11680.394		117193548.628		
2	0.75	15697.652	393.975	
11773.239		118483375.774		

Pile Section No. 2:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	38.00000000	ft
Shaft Diameter	=	42.00000000	in
Concrete Cover Thickness	=	4.75000000	in
Number of Reinforcing Bars	=	12	bars
Yield Stress of Reinforcing Bars	=	60.00000000	ksi
Modulus of Elasticity of Reinforcing Bars	=	29000.	ksi
Gross Area of Shaft	=	1385.44236023	sq. in.
Total Area of Reinforcing Steel	=	15.24000000	sq. in.
Area Ratio of Steel Reinforcement	=	1.10	percent
Edge-to-Edge Bar Spacing	=	6.81291878	in
Maximum Concrete Aggregate Size	=	0.75000000	in
Ratio of Bar Spacing to Aggregate Size	=	9.08	
Offset of Rebar Cage Center from Center of Pile	=	0.00000000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$	=	5573.088	kips
Tensile Load for Cracking of Concrete	=	-620.869	kips
Nominal Axial Tensile Capacity	=	-914.400	kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.27000	1.27000	15.61500	0.00000
2	1.27000	1.27000	13.52299	7.80750
3	1.27000	1.27000	7.80750	13.52299
4	1.27000	1.27000	0.00000	15.61500
5	1.27000	1.27000	-7.80750	13.52299
6	1.27000	1.27000	-13.52299	7.80750
7	1.27000	1.27000	-15.61500	0.00000
8	1.27000	1.27000	-13.52299	-7.80750
9	1.27000	1.27000	-7.80750	-13.52299
10	1.27000	1.27000	0.00000	-15.61500
11	1.27000	1.27000	7.80750	-13.52299
12	1.27000	1.27000	13.52299	-7.80750

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 6.81292 inches between Bars 7 and 8

Spacing to aggregate size ratio = 9.08389

Concrete Properties:

Compressive Strength of Concrete = 4.00000000 ksi
 Modulus of Elasticity of Concrete = 3604.99653259 ksi
 Modulus of Rupture of Concrete = -0.47434164 ksi
 Compression Strain at Peak Stress = 0.00188627
 Tensile Strain at Fracture of Concrete = -0.00011537
 Maximum Coarse Aggregate Size = 0.75000000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 2

Number	Axial Thrust Force kips
1	506.800
2	525.300

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
 Y = stress in reinforcing steel has reached yield stress.
 T = ACI 318-08 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-08, Section 10.3.4.
 Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
 Position of neutral axis is measured from edge of compression side of pile.
 Compressive stresses and strains are positive in sign.
 Tensile stresses and strains are negative in sign.

Axial Thrust Force = 506.800 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	416.1487603	665838016.	153.3893875	0.0000959	0.0000696
0.3957334	2.7763764				
0.000001250	832.3089589	665847167.	87.2212348	0.0001090	0.0000565
0.4479879	3.1541573				
0.000001875	1248.4410180	665835210.	65.1769692	0.0001222	0.0000435
0.4999485	3.5325790				
0.000002500	1664.5308781	665812351.	54.1636760	0.0001354	0.0000304
0.5516133	3.9116415				

	Bridge 11	Bent 3	Transverse	Final Loads.1p6o		
0.000003125	2080.5644771	665780633.	47.5627727	0.0001486	0.0000174	
0.6029803	4.2913450					
0.000003750	2496.5277502	665740733.	43.1680652	0.0001619	0.000004380	
0.6540476	4.6716896					
0.000004375	2912.3883710	665688771.	40.0340074	0.0001751	-0.000008601	
0.7048126	5.0526710					
0.000005000	3327.8354252	665567085.	37.6873396	0.0001884	-0.0000216	
0.7552636	5.4342143					
0.000005625	3742.3912741	665314004.	35.8648142	0.0002017	-0.0000345	
0.8053821	5.8161916					
0.000006250	4155.7235519	664915768.	34.4086354	0.0002151	-0.0000474	
0.8551539	6.1985027					
0.000006875	4567.6224530	664381448.	33.2185361	0.0002284	-0.0000604	
0.9045687	6.5810769					
0.000007500	4977.9518962	663726919.	32.2277634	0.0002417	-0.0000733	
0.9536193	6.9638636					
0.000008125	5386.6196967	662968578.	31.3901595	0.0002550	-0.0000862	
1.0023003	7.3468251					
0.000008750	5793.5632645	662121516.	30.6727939	0.0002684	-0.0000991	
1.0506078	7.7299340					
0.000009375	6198.7389641	661198823.	30.0515425	0.0002817	-0.0001120	
1.0985385	8.1131694					
0.0000100	6198.7389641	619873896.	27.8432667	0.0002784	-0.0001416	
1.0861292	8.0136474	C				
0.0000106	6198.7389641	583410726.	27.1676608	0.0002887	-0.0001576	
1.1225480	8.3063292	C				
0.0000113	6198.7389641	550999019.	26.5517524	0.0002987	-0.0001738	
1.1581196	8.5939967	C				
0.0000119	6198.7389641	521999071.	25.9876331	0.0003086	-0.0001901	
1.1929198	8.8771724	C				
0.0000125	6198.7389641	495899117.	25.4690961	0.0003184	-0.0002066	
1.2270276	9.1564223	C				
0.0000131	6198.7389641	472284873.	24.9900738	0.0003280	-0.0002233	
1.2604722	9.4319156	C				
0.0000138	6198.7389641	450817379.	24.5451644	0.0003375	-0.0002400	
1.2932613	9.7036467	C				
0.0000144	6198.7389641	431216624.	24.1314580	0.0003469	-0.0002569	
1.3254799	9.9722579	C				
0.0000150	6276.7628103	418450854.	23.7453267	0.0003562	-0.0002738	
1.3571488	10.2378672	C				
0.0000156	6396.4269712	409371326.	23.3834372	0.0003654	-0.0002909	
1.3882730	10.5004637	C				
0.0000163	6513.0289238	400801780.	23.0439377	0.0003745	-0.0003080	
1.4189114	10.7604931	C				
0.0000169	6627.0098713	392711696.	22.7249933	0.0003835	-0.0003253	
1.4491064	11.0182749	C				
0.0000175	6738.7905305	385073745.	22.4250953	0.0003924	-0.0003426	
1.4789037	11.2741609	C				
0.0000181	6847.7798479	377808543.	22.1408953	0.0004013	-0.0003599	
1.5082235	11.5274269	C				
0.0000188	6954.6811510	370916328.	21.8719724	0.0004101	-0.0003774	
1.5371429	11.7786975	C				
0.0000194	7060.3439892	364404851.	21.6185185	0.0004189	-0.0003949	
1.5657729	12.0289114	C				
0.0000200	7163.2894368	358164472.	21.3759279	0.0004275	-0.0004125	
1.5939080	12.2762382	C				
0.0000206	7265.4395159	352263734.	21.1469453	0.0004362	-0.0004301	
1.6218058	12.5229104	C				
0.0000213	7365.7116868	346621726.	20.9281419	0.0004447	-0.0004478	
1.6493136	-12.8561200	C				
0.0000219	7465.1072069	341262044.	20.7205368	0.0004533	-0.0004655	
1.6765692	-13.3659406	C				
0.0000225	7562.8878043	336128347.	20.5216674	0.0004617	-0.0004833	

Bridge 11 Bent 3 Transverse Final Loads.lp6o

1.7034634	-13.8775870	C				
0.0000231	7660.1250067		331248649.	20.3329094	0.0004702	-0.0005011
1.7301540	-14.3896613	C				
0.0000238	7755.5019468		326547450.	20.1507193	0.0004786	-0.0005189
1.7564346	-14.9040545	C				
0.0000244	7850.7678007		322082782.	19.9781273	0.0004870	-0.0005368
1.7825818	-15.4182674	C				
0.0000256	8037.2348100		313648188.	19.6512250	0.0005036	-0.0005727
1.8338585	-16.4518774	C				
0.0000269	8220.6743611		305885558.	19.3502038	0.0005200	-0.0006087
1.8841601	-17.4890162	C				
0.0000281	8401.7415381		298728588.	19.0727759	0.0005364	-0.0006448
1.9335995	-18.5287358	C				
0.0000294	8579.4498050		292066376.	18.8136301	0.0005527	-0.0006811
1.9819828	-19.5729950	C				
0.0000306	8755.2380665		285885325.	18.5731265	0.0005688	-0.0007174
2.0295640	-20.6194857	C				
0.0000319	8929.0524546		280127136.	18.3489270	0.0005849	-0.0007539
2.0763376	-21.6683417	C				
0.0000331	9100.7288597		274738984.	18.1385502	0.0006008	-0.0007904
2.1222512	-22.7201740	C				
0.0000344	9270.9858034		269701405.	17.9419541	0.0006168	-0.0008270
2.1674604	-23.7735206	C				
0.0000356	9439.6093352		264971490.	17.7570235	0.0006326	-0.0008637
2.2119033	-24.8290688	C				
0.0000369	9606.6321503		260518838.	17.5826116	0.0006484	-0.0009004
2.2555922	-25.8867759	C				
0.0000381	9773.1450362		256344788.	17.4198974	0.0006641	-0.0009371
2.2987683	-26.9441946	C				
0.0000394	9937.2428779		252374422.	17.2635804	0.0006798	-0.0009740
2.3409803	-28.0061053	C				
0.0000406	10101.		248639452.	17.1174085	0.0006954	-0.0010109
2.3827195	-29.0673967	C				
0.0000419	10264.		245108722.	16.9795173	0.0007110	-0.0010477
2.4238773	-30.1292298	C				
0.0000431	10425.		241740103.	16.8468350	0.0007265	-0.0010847
2.4641890	-31.1945456	C				
0.0000444	10586.		238553268.	16.7221057	0.0007420	-0.0011217
2.5040335	-32.2592464	C				
0.0000456	10746.		235533222.	16.6046780	0.0007576	-0.0011587
2.5434089	-33.3233291	C				
0.0000469	10905.		232636555.	16.4907368	0.0007730	-0.0011957
2.5819305	-34.3911859	C				
0.0000481	11063.		229878797.	16.3826871	0.0007884	-0.0012328
2.6199326	-35.4590809	C				
0.0000494	11221.		227253594.	16.2805389	0.0008039	-0.0012699
2.6574708	-36.5263594	C				
0.0000506	11378.		224751083.	16.1838573	0.0008193	-0.0013069
2.6945432	-37.5930181	C				
0.0000519	11534.		222340179.	16.0895335	0.0008346	-0.0013441
2.7308113	-38.6631392	C				
0.0000531	11689.		220032521.	15.9995899	0.0008500	-0.0013813
2.7665612	-39.7333504	C				
0.0000544	11844.		217824632.	15.9141757	0.0008653	-0.0014184
2.8018502	-40.8029402	C				
0.0000556	11999.		215709744.	15.8329879	0.0008807	-0.0014555
2.8366762	-41.8719049	C				
0.0000569	12153.		213681685.	15.7557500	0.0008961	-0.0014926
2.8710375	-42.9402408	C				
0.0000581	12306.		211717463.	15.6797443	0.0009114	-0.0015299
2.9046141	-44.0120997	C				
0.0000594	12459.		209828815.	15.6071053	0.0009267	-0.0015671
2.9377054	-45.0836717	C				

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
0.0000606	12611.		208012410.	15.5378225	0.0009420	-0.0016043
2.9703363	-46.1546094	C				
0.0000619	12763.		206263834.	15.4716946	0.0009573	-0.0016414
3.0025047	-47.2249090	C				
0.0000631	12914.		204579021.	15.4085366	0.0009727	-0.0016786
3.0342088	-48.2945663	C				
0.0000644	13065.		202954220.	15.3481774	0.0009880	-0.0017157
3.0654466	-49.3635774	C				
0.0000656	13215.		201377080.	15.2889571	0.0010033	-0.0017529
3.0960173	-50.4347971	C				
0.0000669	13365.		199849860.	15.2316244	0.0010186	-0.0017901
3.1260364	-51.5066494	C				
0.0000681	13514.		198373656.	15.1767282	0.0010339	-0.0018273
3.1555928	-52.5778449	C				
0.0000694	13663.		196945676.	15.1241389	0.0010492	-0.0018645
3.1846844	-53.6483791	C				
0.0000706	13812.		195563327.	15.0737363	0.0010646	-0.0019017
3.2133093	-54.7182475	C				
0.0000719	13960.		194224193.	15.0254084	0.0010800	-0.0019388
3.2414653	-55.7874455	C				
0.0000731	14108.		192926026.	14.9790510	0.0010953	-0.0019759
3.2691504	-56.8559685	C				
0.0000744	14255.		191666728.	14.9345670	0.0011108	-0.0020130
3.2963626	-57.9238118	C				
0.0000794	14840.		186955461.	14.7681290	0.0011722	-0.0021615
3.3997209	-60.0000000	CY				
0.0000844	15418.		182731157.	14.6251833	0.0012340	-0.0023098
3.4953523	-60.0000000	CY				
0.0000894	15990.		178914105.	14.5027379	0.0012962	-0.0024576
3.5832428	-60.0000000	CY				
0.0000944	16527.		175123541.	14.3862348	0.0013577	-0.0026060
3.6619126	-60.0000000	CY				
0.0000994	16979.		170859526.	14.2649156	0.0014176	-0.0027562
3.7305549	-60.0000000	CY				
0.0001044	17323.		165966479.	14.1314713	0.0014750	-0.0029088
3.7890092	-60.0000000	CY				
0.0001094	17568.		160625036.	13.9854494	0.0015297	-0.0030641
3.8380201	-60.0000000	CY				
0.0001144	17808.		155697031.	13.8519433	0.0015843	-0.0032194
3.8805415	-60.0000000	CY				
0.0001194	18044.		151153684.	13.7324385	0.0016393	-0.0033744
3.9168074	-60.0000000	CY				
0.0001244	18276.		146943370.	13.6240642	0.0016945	-0.0035293
3.9466231	-60.0000000	CY				
0.0001294	18503.		143016853.	13.5229373	0.0017495	-0.0036842
3.9697962	-60.0000000	CY				
0.0001344	18704.		139191164.	13.4250102	0.0018040	-0.0038398
3.9862720	-60.0000000	CY				
0.0001394	18828.		135089688.	13.3134683	0.0018556	-0.0039982
3.9959562	-60.0000000	CY				
0.0001444	18923.		131070657.	13.2022535	0.0019061	-0.0041577
3.9998757	-60.0000000	CY				
0.0001494	19014.		127287627.	13.0963082	0.0019563	-0.0043175
3.9993462	-60.0000000	CY				
0.0001544	19101.		123733396.	12.9994350	0.0020068	-0.0044770
3.9980566	-60.0000000	CY				
0.0001594	19187.		120386968.	12.9107464	0.0020577	-0.0046361
3.9987348	-60.0000000	CY				
0.0001644	19269.		117228208.	12.8296328	0.0021089	-0.0047949
3.9995928	60.0000000	CY				
0.0001694	19348.		114232738.	12.7517585	0.0021598	-0.0049539
3.9975628	60.0000000	CY				
0.0001744	19424.		111394522.	12.6789662	0.0022109	-0.0051129

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
3.9999725	60.0000000	CY				
0.0001794	19498.		108701828.	12.6122024	0.0022623	-0.0052714
3.9983497	60.0000000	CY				
0.0001844	19571.		106146454.	12.5505590	0.0023140	-0.0054297
3.9994256	60.0000000	CY				
0.0001894	19641.		103714525.	12.4940203	0.0023661	-0.0055877
3.9984435	60.0000000	CY				
0.0001944	19710.		101400716.	12.4416770	0.0024184	-0.0057454
3.9995497	60.0000000	CY				
0.0001994	19777.		99192724.	12.3936768	0.0024710	-0.0059028
3.9978910	60.0000000	CY				
0.0002044	19841.		97081590.	12.3459982	0.0025232	-0.0060605
3.9999474	60.0000000	CY				
0.0002094	19904.		95062708.	12.3018901	0.0025757	-0.0062180
3.9962140	60.0000000	CY				
0.0002144	19965.		93132813.	12.2609489	0.0026284	-0.0063753
3.9993976	60.0000000	CY				
0.0002194	20026.		91285258.	12.2230662	0.0026814	-0.0065323
3.9962391	60.0000000	CY				
0.0002244	20080.		89493577.	12.1859610	0.0027342	-0.0066895
3.9974846	60.0000000	CY				
0.0002294	20130.		87762197.	12.1497155	0.0027868	-0.0068469
3.9997592	60.0000000	CY				
0.0002344	20166.		86041255.	12.1094080	0.0028381	-0.0070056
3.9947593	60.0000000	CY				
0.0002394	20195.		84365440.	12.0688800	0.0028890	-0.0071648
3.9968508	60.0000000	CY				
0.0002444	20213.		82712763.	12.0253387	0.0029387	-0.0073251
3.9992820	60.0000000	CY				
0.0002494	20229.		81116835.	11.9831638	0.0029883	-0.0074854
3.9992830	60.0000000	CY				
0.0002544	20240.		79566155.	11.9395158	0.0030371	-0.0076466
3.9931974	60.0000000	CYT				
0.0002594	20250.		78072350.	11.8967195	0.0030857	-0.0078080
3.9968014	60.0000000	CYT				
0.0002644	20260.		76634074.	11.8559730	0.0031344	-0.0079693
3.9990689	60.0000000	CYT				
0.0002694	20270.		75248218.	11.8171687	0.0031832	-0.0081305
3.9999811	60.0000000	CYT				
0.0002744	20279.		73910692.	11.7805755	0.0032323	-0.0082915
3.9934808	60.0000000	CYT				
0.0003044	20329.		66790599.	11.5942745	0.0035290	-0.0092547
3.9922422	60.0000000	CYT				
0.0003344	20363.		60897458.	11.4467168	0.0038275	-0.0102163
3.9898285	60.0000000	CYT				

Axial Thrust Force = 525.300 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	415.4932479	664789197.	158.3280282	0.0000990	0.0000727
0.4081493	2.8658893				
0.000001250	830.9988677	664799094.	89.6905973	0.0001121	0.0000596
0.4603136	3.2436717				
0.000001875	1246.4763033	664787362.	66.8232577	0.0001253	0.0000465
0.5121840	3.6220959				

	Bridge 11	Bent 3	Transverse	Final Loads.1p60		
0.000002500	1661.9114728	664764589.	55.3984415	0.0001385	0.0000335	
0.5637585	4.0011620					
0.000003125	2077.2902919	664732893.	48.5506357	0.0001517	0.0000205	
0.6150352	4.3808701					
0.000003750	2492.5986733	664692980.	43.9913359	0.0001650	0.000007468	
0.6660122	4.7612203					
0.000004375	2907.8185648	664644243.	40.7397473	0.0001782	-0.000005514	
0.7166874	5.1422117					
0.000005000	3322.7402497	664548050.	38.3051433	0.0001915	-0.0000185	
0.7670525	5.5237958					
0.000005625	3736.8929797	664336530.	36.4144449	0.0002048	-0.0000314	
0.8170895	5.9058501					
0.000006250	4149.9117018	663985872.	34.9038936	0.0002181	-0.0000444	
0.8667835	6.2882682					
0.000006875	4561.5594360	663499554.	33.6694261	0.0002315	-0.0000573	
0.9161233	6.6709731					
0.000007500	4971.6841421	662891219.	32.6417704	0.0002448	-0.0000702	
0.9651010	7.0539101					
0.000008125	5380.1815624	662176192.	31.7730265	0.0002582	-0.0000831	
1.0137109	7.4370381					
0.000008750	5786.9801518	661369160.	31.0290218	0.0002715	-0.0000960	
1.0619485	7.8203268					
0.000009375	6192.0302832	660483230.	30.3847247	0.0002849	-0.0001089	
1.1098104	8.2037533					
0.0000100	6192.0302832	619203028.	28.2729140	0.0002827	-0.0001373	
1.1016610	8.1382451	C				
0.0000106	6192.0302832	582779321.	27.5832398	0.0002931	-0.0001532	
1.1384094	8.4343795	C				
0.0000113	6192.0302832	550402692.	26.9544763	0.0003032	-0.0001693	
1.1742930	8.7253853	C				
0.0000119	6192.0302832	521434129.	26.3788059	0.0003132	-0.0001855	
1.2093994	9.0118826	C				
0.0000125	6192.0302832	495362423.	25.8497081	0.0003231	-0.0002019	
1.2438026	9.2943942	C				
0.0000131	6192.0302832	471773736.	25.3600006	0.0003329	-0.0002184	
1.2774872	9.5727189	C				
0.0000138	6192.0302832	450329475.	24.9058326	0.0003425	-0.0002350	
1.3105354	9.8474633	C				
0.0000144	6263.7103819	435736374.	24.4834153	0.0003519	-0.0002518	
1.3429971	10.1189800	C				
0.0000150	6390.1225546	426008170.	24.0893396	0.0003613	-0.0002687	
1.3749081	10.3875128	C				
0.0000156	6513.0074009	416832474.	23.7207999	0.0003706	-0.0002856	
1.4063068	10.6533313	C				
0.0000163	6632.1417646	408131801.	23.3740929	0.0003798	-0.0003027	
1.4371570	10.9160788	C				
0.0000169	6748.3090591	399899796.	23.0479708	0.0003889	-0.0003198	
1.4675324	11.1763320	C				
0.0000175	6862.0386823	392116496.	22.7410534	0.0003980	-0.0003370	
1.4974867	11.4345096	C				
0.0000181	6973.7445248	384758319.	22.4520500	0.0004069	-0.0003543	
1.5270662	11.6909776	C				
0.0000188	7082.3911278	377727527.	22.1769460	0.0004158	-0.0003717	
1.5561361	11.9445269	C				
0.0000194	7189.3978987	371065698.	21.9169247	0.0004246	-0.0003891	
1.5848640	12.1965783	C				
0.0000200	7294.8523481	364742617.	21.6707282	0.0004334	-0.0004066	
1.6132631	12.4472224	C				
0.0000206	7397.9407303	358688035.	21.4353062	0.0004421	-0.0004241	
1.6412156	12.6953863	C				
0.0000213	7500.4419937	352961976.	21.2131503	0.0004508	-0.0004417	
1.6689635	12.9431914	C				
0.0000219	7600.4362980	347448516.	20.9992207	0.0004594	-0.0004594	

Bridge 11 Bent 3 Transverse Final Loads.lp6o

1.6962326	-13.1891506	C				
0.0000225	7700.2764862		342234510.	20.7974012	0.0004679	-0.0004771
1.7233574	-13.6976706	C				
0.0000231	7797.8374228		337203780.	20.6024204	0.0004764	-0.0004948
1.7500222	-14.2089206	C				
0.0000238	7895.1980787		332429393.	20.4178062	0.0004849	-0.0005126
1.7765378	-14.7200984	C				
0.0000244	7990.8597680		327830144.	20.2396936	0.0004933	-0.0005304
1.8026690	-15.2333728	C				
0.0000256	8180.1496615		319225353.	19.9069043	0.0005101	-0.0005661
1.8542587	-16.2618755	C				
0.0000269	8365.4822848		311273759.	19.5990333	0.0005267	-0.0006020
1.9047374	-17.2950846	C				
0.0000281	8547.5514552		303912941.	19.3136453	0.0005432	-0.0006381
1.9541987	-18.3322769	C				
0.0000294	8727.5312376		297107446.	19.0499984	0.0005596	-0.0006742
2.0028450	-19.3716388	C				
0.0000306	8904.4909351		290758888.	18.8034036	0.0005759	-0.0007104
2.0505006	-20.4149709	C				
0.0000319	9079.4777342		284846360.	18.5736113	0.0005920	-0.0007467
2.0973441	-21.4606493	C				
0.0000331	9252.5617858		279322620.	18.3588276	0.0006081	-0.0007831
2.1433945	-22.5085699	C				
0.0000344	9423.6999036		274143997.	18.1570637	0.0006241	-0.0008196
2.1886257	-23.5590833	C				
0.0000356	9593.2440290		269284043.	17.9676330	0.0006401	-0.0008562
2.2331158	-24.6114828	C				
0.0000369	9761.5676097		264720478.	17.7898615	0.0006560	-0.0008927
2.2769311	-25.6651480	C				
0.0000381	9927.8942259		260403783.	17.6209624	0.0006718	-0.0009295
2.3199046	-26.7218921	C				
0.0000394	10094.		256351563.	17.4633430	0.0006876	-0.0009661
2.3623948	-27.7780013	C				
0.0000406	10258.		252498105.	17.3123539	0.0007033	-0.0010029
2.4040067	-28.8377269	C				
0.0000419	10421.		248854584.	17.1699048	0.0007190	-0.0010398
2.4450307	-29.8980280	C				
0.0000431	10583.		245413707.	17.0362165	0.0007347	-0.0010766
2.4855771	-30.9577004	C				
0.0000444	10744.		242124859.	16.9072955	0.0007503	-0.0011135
2.5252719	-32.0209304	C				
0.0000456	10904.		239000010.	16.7851003	0.0007658	-0.0011504
2.5644004	-33.0846078	C				
0.0000469	11064.		236034106.	16.6698821	0.0007814	-0.0011873
2.6030569	-34.1476602	C				
0.0000481	11223.		233205749.	16.5601213	0.0007970	-0.0012243
2.6411229	-35.2114493	C				
0.0000494	11380.		230489908.	16.4537929	0.0008124	-0.0012613
2.6784074	-36.2782814	C				
0.0000506	11537.		227901199.	16.3531405	0.0008279	-0.0012984
2.7152249	-37.3444892	C				
0.0000519	11694.		225430386.	16.2577561	0.0008434	-0.0013354
2.7515736	-38.4100693	C				
0.0000531	11851.		223068331.	16.1671741	0.0008589	-0.0013724
2.7874396	-39.4751659	C				
0.0000544	12005.		220784780.	16.0782232	0.0008743	-0.0014095
2.8224659	-40.5442579	C				
0.0000556	12159.		218597598.	15.9936606	0.0008896	-0.0014466
2.8570282	-41.6127199	C				
0.0000569	12313.		216500389.	15.9131991	0.0009051	-0.0014837
2.8911244	-42.6805483	C				
0.0000581	12467.		214487309.	15.8365765	0.0009205	-0.0015207
2.9247526	-43.7477393	C				

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
0.0000594	12620.		212553003.	15.7635525	0.0009360	-0.0015578
2.9579109	-44.8142891	C				
0.0000606	12772.		210678411.	15.6918489	0.0009513	-0.0015949
2.9903315	-45.8838119	C				
0.0000619	12924.		208870674.	15.6229255	0.0009667	-0.0016321
3.0222246	-46.9535442	C				
0.0000631	13075.		207129009.	15.5570856	0.0009820	-0.0016692
3.0536520	-48.0226287	C				
0.0000644	13226.		205449531.	15.4941518	0.0009974	-0.0017063
3.0846116	-49.0910614	C				
0.0000656	13376.		203828651.	15.4339603	0.0010129	-0.0017434
3.1151015	-50.1588379	C				
0.0000669	13526.		202263045.	15.3763594	0.0010283	-0.0017805
3.1451196	-51.2259541	C				
0.0000681	13676.		200747696.	15.3208716	0.0010437	-0.0018175
3.1746196	-52.2930716	C				
0.0000694	13824.		199272036.	15.2660075	0.0010591	-0.0018547
3.2034210	-53.3629572	C				
0.0000706	13973.		197843661.	15.2134137	0.0010744	-0.0018918
3.2317541	-54.4321707	C				
0.0000719	14121.		196460070.	15.1629740	0.0010898	-0.0019289
3.2596167	-55.5007072	C				
0.0000731	14268.		195118932.	15.1145802	0.0011053	-0.0019660
3.2870067	-56.5685620	C				
0.0000744	14415.		193818075.	15.0681313	0.0011207	-0.0020031
3.3139221	-57.6357304	C				
0.0000794	15000.		188976897.	14.8995849	0.0011827	-0.0021511
3.4167420	-60.0000000	CY				
0.0000844	15577.		184615310.	14.7501248	0.0012445	-0.0022992
3.5111081	-60.0000000	CY				
0.0000894	16148.		180675817.	14.6219455	0.0013068	-0.0024469
3.5977005	-60.0000000	CY				
0.0000944	16691.		176858341.	14.5062688	0.0013690	-0.0025947
3.6757363	-60.0000000	CY				
0.0000994	17145.		172531955.	14.3817540	0.0014292	-0.0027446
3.7431840	-60.0000000	CY				
0.0001044	17507.		167729166.	14.2489292	0.0014872	-0.0028965
3.8007819	-60.0000000	CY				
0.0001094	17754.		162324456.	14.1027672	0.0015425	-0.0030513
3.8487864	-60.0000000	CY				
0.0001144	17993.		157318293.	13.9667054	0.0015974	-0.0032063
3.8899682	-60.0000000	CY				
0.0001194	18228.		152696404.	13.8434048	0.0016526	-0.0033612
3.9247123	-60.0000000	CY				
0.0001244	18459.		148418015.	13.7328387	0.0017080	-0.0035157
3.9530455	-60.0000000	CY				
0.0001294	18687.		144439651.	13.6327585	0.0017637	-0.0036700
3.9748056	-60.0000000	CY				
0.0001344	18893.		140597370.	13.5338038	0.0018186	-0.0038251
3.9896640	-60.0000000	CY				
0.0001394	19029.		136532972.	13.4235810	0.0018709	-0.0039828
3.9977609	-60.0000000	CY				
0.0001444	19124.		132461160.	13.3109398	0.0019218	-0.0041420
3.9983768	-60.0000000	CY				
0.0001494	19216.		128639654.	13.2068536	0.0019728	-0.0043010
3.999350	-60.0000000	CY				
0.0001544	19302.		125032997.	13.1074465	0.0020235	-0.0044603
3.9993028	-60.0000000	CY				
0.0001594	19386.		121637187.	13.0164368	0.0020745	-0.0046193
3.9976152	-60.0000000	CY				
0.0001644	19468.		118433849.	12.9329874	0.0021259	-0.0047779
3.999953	60.0000000	CY				
0.0001694	19547.		115404299.	12.8566245	0.0021776	-0.0049362

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
3.9990676	60.0000000	CY				
0.0001744	19623.		112532804.	12.7848802	0.0022294	-0.0050944
3.9959913	60.0000000	CY				
0.0001794	19696.		109802477.	12.7161221	0.0022810	-0.0052528
3.9995649	60.0000000	CY				
0.0001844	19767.		107209979.	12.6528083	0.0023329	-0.0054109
3.9963790	60.0000000	CY				
0.0001894	19836.		104745164.	12.5944215	0.0023851	-0.0055687
3.9996278	60.0000000	CY				
0.0001944	19904.		102398103.	12.5406170	0.0024376	-0.0057262
3.9958209	60.0000000	CY				
0.0001994	19970.		100160824.	12.4909418	0.0024904	-0.0058834
3.9993567	60.0000000	CY				
0.0002044	20034.		98025763.	12.4450470	0.0025435	-0.0060403
3.9957974	60.0000000	CY				
0.0002094	20097.		95985060.	12.4027475	0.0025968	-0.0061969
3.9984681	60.0000000	CY				
0.0002144	20158.		94031388.	12.3613183	0.0026500	-0.0063538
3.9999970	60.0000000	CY				
0.0002194	20217.		92157712.	12.3223451	0.0027032	-0.0065105
3.9961707	60.0000000	CY				
0.0002244	20273.		90352307.	12.2848027	0.0027564	-0.0066673
3.9992903	60.0000000	CY				
0.0002294	20325.		88610437.	12.2487290	0.0028096	-0.0068242
3.9974683	60.0000000	CY				
0.0002344	20364.		86885552.	12.2093179	0.0028616	-0.0069822
3.9961781	60.0000000	CY				
0.0002394	20398.		85212940.	12.1701786	0.0029132	-0.0071405
3.9990754	60.0000000	CY				
0.0002444	20417.		83547858.	12.1260086	0.0029633	-0.0073005
3.9999995	60.0000000	CY				
0.0002494	20434.		81939060.	12.0837906	0.0030134	-0.0074604
3.9932726	60.0000000	CYT				
0.0002544	20446.		80375621.	12.0415415	0.0030631	-0.0076207
3.9969794	60.0000000	CYT				
0.0002594	20457.		78870445.	12.0012739	0.0031128	-0.0077809
3.9992270	60.0000000	CYT				
0.0002644	20468.		77420010.	11.9622656	0.0031625	-0.0079412
3.9999995	60.0000000	CYT				
0.0002694	20477.		76016520.	11.9224905	0.0032116	-0.0081021
3.9923912	60.0000000	CYT				
0.0002744	20486.		74663401.	11.8845415	0.0032608	-0.0082629
3.9951150	60.0000000	CYT				
0.0003044	20533.		67458510.	11.6918446	0.0035587	-0.0092250
3.9967976	60.0000000	CYT				
0.0003344	20533.		61406157.	11.5944056	0.0038769	-0.0101669
3.9976484	60.0000000	CYT				

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 2

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	506.800	20231.178	0.00300000
2	525.300	20429.129	0.00300000

Note note that the values of moment capacity in the table above are not

Bridge 11 Bent 3 Transverse Final Loads.lp60
factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318-08, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial (Factored) Load Capacity No. in-kip	Resistance Bending Factor at Ult. for Moment	Nominal Stiffness Moment Capacity in-kip kip-in ²	Ultimate (Factored) Axial Thrust kips	Ultimate Moment
1	0.65	20231.178	329.420	
13150.265		202060737.525		
2	0.65	20429.129	341.445	
13278.934		204877207.794		
1	0.70	20231.178	354.760	
14161.824		192464057.642		
2	0.70	20429.129	367.710	
14300.390		194833220.511		
1	0.75	20231.178	380.100	
15173.384		184517416.847		
2	0.75	20429.129	393.975	
15321.847		186543816.955		

Pile Section No. 3:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	26.20000000	ft
Shaft Diameter	=	36.00000000	in
Concrete Cover Thickness	=	4.75000000	in
Number of Reinforcing Bars	=	12	bars
Yield Stress of Reinforcing Bars	=	60.00000000	ksi
Modulus of Elasticity of Reinforcing Bars	=	29000.	ksi
Gross Area of Shaft	=	1017.87601976	sq. in.
Total Area of Reinforcing Steel	=	15.24000000	sq. in.
Area Ratio of Steel Reinforcement	=	1.50	percent
Edge-to-Edge Bar Spacing	=	5.26000451	in
Maximum Concrete Aggregate Size	=	0.75000000	in
Ratio of Bar Spacing to Aggregate Size	=	7.01	
Offset of Rebar Cage Center from Center of Pile	=	0.00000000	in

Axial Structural Capacities:

Nom. Axial Structural Capacity = $0.85 F_c A_c + F_y A_s$	=	4323.363	kips
Tensile Load for Cracking of Concrete	=	-467.995	kips
Nominal Axial Tensile Capacity	=	-914.400	kips

Bridge 11 Bent 3 Transverse Final Loads.lp6o

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.27000	1.27000	12.61500	0.00000
2	1.27000	1.27000	10.92491	6.30750
3	1.27000	1.27000	6.30750	10.92491
4	1.27000	1.27000	0.00000	12.61500
5	1.27000	1.27000	-6.30750	10.92491
6	1.27000	1.27000	-10.92491	6.30750
7	1.27000	1.27000	-12.61500	0.00000
8	1.27000	1.27000	-10.92491	-6.30750
9	1.27000	1.27000	-6.30750	-10.92491
10	1.27000	1.27000	0.00000	-12.61500
11	1.27000	1.27000	6.30750	-10.92491
12	1.27000	1.27000	10.92491	-6.30750

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 5.26000 inches between Bars 7 and 8

Spacing to aggregate size ratio = 7.01334

Concrete Properties:

Compressive Strength of Concrete	=	4.00000000 ksi
Modulus of Elasticity of Concrete	=	3604.99653259 ksi
Modulus of Rupture of Concrete	=	-0.47434164 ksi
Compression Strain at Peak Stress	=	0.00188627
Tensile Strain at Fracture of Concrete	=	-0.00011537
Maximum Coarse Aggregate Size	=	0.75000000 in

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 2

Number	Axial Thrust Force kips
1	506.800
2	525.300

Definitions of Run Messages and Notes:

C = concrete in section has cracked in tension.
Y = stress in reinforcing steel has reached yield stress.
T = ACI 318-08 criteria for tension-controlled section met, tensile strain in reinforcement exceeds 0.005 while simultaneously compressive strain in concrete more than 0.003. See ACI 318-08, Section 10.3.4.
Z = depth of tensile zone in concrete section is less than 10 percent of section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.

Bridge 11 Bent 3 Transverse Final Loads.lp6o
Tensile stresses and strains are negative in sign.

Axial Thrust Force = 506.800 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.6594050	359455048.	195.4758926	0.0001222	0.0000997
0.5009278	3.5397381				
0.000001250	449.3481810	359478545.	106.7572490	0.0001334	0.0000884
0.5450629	3.8634253				
0.000001875	674.0259403	359480501.	77.1929314	0.0001447	0.0000772
0.5889808	4.1875781				
0.000002500	898.6871828	359474873.	62.4171956	0.0001560	0.0000660
0.6326802	4.5121967				
0.000003125	1123.3264078	359464450.	53.5568930	0.0001674	0.0000549
0.6761600	4.8372809				
0.000003750	1347.9381137	359450164.	47.6543074	0.0001787	0.0000437
0.7194189	5.1628309				
0.000004375	1572.5167979	359432411.	43.4418464	0.0001901	0.0000326
0.7624558	5.4888468				
0.000005000	1797.0569564	359411391.	40.2857138	0.0002014	0.0000214
0.8052693	5.8153285				
0.000005625	2021.5530834	359387215.	37.8338005	0.0002128	0.0000103
0.8478585	6.1422762				
0.000006250	2245.9996716	359359947.	35.8748414	0.0002242	-0.000000782
0.8902219	6.4696900				
0.000006875	2470.3686662	359326351.	34.2743519	0.0002356	-0.0000119
0.9323573	6.7975614				
0.000007500	2694.5313793	359270851.	32.9424902	0.0002471	-0.0000229
0.9742574	7.1258416				
0.000008125	2918.3370277	359179942.	31.8170011	0.0002585	-0.0000340
1.0159131	7.4544684				
0.000008750	3141.6637748	359047289.	30.8534468	0.0002700	-0.0000450
1.0573166	7.7833872				
0.000009375	3364.4208366	358871556.	30.0192792	0.0002814	-0.0000561
1.0984619	8.1125541				
0.0000100	3586.5410335	358654103.	29.2901183	0.0002929	-0.0000671
1.1393439	8.4419343				
0.0000106	3807.9738344	358397537.	28.6473429	0.0003044	-0.0000781
1.1799585	8.7715001				
0.0000113	4028.6827234	358105131.	28.0764900	0.0003159	-0.0000891
1.2203028	9.1012299				
0.0000119	4248.6384948	357780084.	27.5661508	0.0003273	-0.0001002
1.2603741	9.4311057				
0.0000125	4467.8180425	357425443.	27.1072066	0.0003388	-0.0001112
1.3001702	9.7611124				
0.0000131	4467.8180425	340405184.	25.7554922	0.0003380	-0.0001345
1.2969924	9.7346718	C			
0.0000138	4467.8180425	324932221.	25.2667218	0.0003474	-0.0001476
1.3291944	10.0033303	C			
0.0000144	4467.8180425	310804733.	24.8126525	0.0003567	-0.0001608
1.3608172	10.2687370	C			
0.0000150	4467.8180425	297854536.	24.3896491	0.0003658	-0.0001742
1.3919037	10.5311974	C			
0.0000156	4467.8180425	285940355.	23.9944874	0.0003749	-0.0001876
1.4224869	10.7909396	C			

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0.0000163	4467.8180425		274942649.	23.6241898	0.0003839	-0.0002011
1.4525855	11.0480744	C				
0.0000169	4554.8686133		269918140.	23.2760136	0.0003928	-0.0002147
1.4822059	11.3026117	C				
0.0000175	4642.2564869		265271799.	22.9478527	0.0004016	-0.0002284
1.5113689	11.5546852	C				
0.0000181	4727.2198911		260812132.	22.6379904	0.0004103	-0.0002422
1.5401008	11.8044812	C				
0.0000188	4810.0347497		256535187.	22.3449789	0.0004190	-0.0002560
1.5684299	12.0522073	C				
0.0000194	4890.9686799		252437093.	22.0675938	0.0004276	-0.0002699
1.5963862	12.2980918	C				
0.0000200	4970.0633197		248503166.	21.8043413	0.0004361	-0.0002839
1.6239713	12.5421180	C				
0.0000206	5047.0222303		244704108.	21.5531560	0.0004445	-0.0002980
1.6511367	12.7838190	C				
0.0000213	5122.7194271		241069150.	21.3146209	0.0004529	-0.0003121
1.6779999	13.0242102	C				
0.0000219	5197.1347044		237583301.	21.0875807	0.0004613	-0.0003262
1.7045586	13.2632466	C				
0.0000225	5269.6802216		234208010.	20.8697319	0.0004696	-0.0003404
1.7307185	13.5000501	C				
0.0000231	5341.5341651		230985261.	20.6626681	0.0004778	-0.0003547
1.7566557	13.7361894	C				
0.0000238	5411.7249794		227862104.	20.4634932	0.0004860	-0.0003690
1.7822182	13.9702560	C				
0.0000244	5481.1923251		224869429.	20.2734231	0.0004942	-0.0003833
1.8075493	14.2035385	C				
0.0000256	5616.8905991		219195731.	19.9156816	0.0005103	-0.0004122
1.8573442	14.6660785	C				
0.0000269	5749.1322087		213921198.	19.5856728	0.0005264	-0.0004411
1.9061098	15.1242963	C				
0.0000281	5878.1908962		209002343.	19.2799154	0.0005422	-0.0004703
1.9538805	15.5783686	C				
0.0000294	6004.1462783		204396469.	18.9951141	0.0005580	-0.0004995
2.0006537	16.0281252	C				
0.0000306	6127.7898220		200091096.	18.7300340	0.0005736	-0.0005289
2.0465660	16.4747490	C				
0.0000319	6249.5614884		196064674.	18.4831255	0.0005891	-0.0005584
2.0917004	16.9189517	C				
0.0000331	6369.1210641		192275353.	18.2514723	0.0006046	-0.0005879
2.1359832	17.3599081	C				
0.0000344	6486.8920758		188709588.	18.0340442	0.0006199	-0.0006176
2.1794883	17.7982504	C				
0.0000356	6603.6565515		185365798.	17.8309468	0.0006352	-0.0006473
2.2223862	-18.5849404	C				
0.0000369	6718.2216542		182189062.	17.6380453	0.0006504	-0.0006771
2.2644046	-19.4433279	C				
0.0000381	6832.3738914		179209807.	17.4580326	0.0006656	-0.0007069
2.3059456	-20.3014501	C				
0.0000394	6944.3552483		176364578.	17.2858460	0.0006806	-0.0007369
2.3465966	-21.1636870	C				
0.0000406	7056.0647379		173687747.	17.1247380	0.0006957	-0.0007668
2.3868067	-22.0253554	C				
0.0000419	7166.0006900		171128375.	16.9704049	0.0007106	-0.0007969
2.4262050	-22.8904771	C				
0.0000431	7275.3859255		168704601.	16.8248558	0.0007256	-0.0008269
2.4650979	-23.7558020	C				
0.0000444	7383.8832212		166397368.	16.6865390	0.0007405	-0.0008570
2.5033928	-24.6223725	C				
0.0000456	7491.1369467		164189303.	16.5540610	0.0007553	-0.0008872
2.5410005	-25.4912454	C				
0.0000469	7598.1298655		162093437.	16.4290550	0.0007701	-0.0009174

Bridge 11 Bent 3 Transverse Final Loads.lp6o

2.5781778	-26.3595657	C				
0.0000481	7704.0197065		160083526.	16.3090211	0.0007849	-0.0009476
2.6146926	-27.2300099	C				
0.0000494	7809.0726605		158158434.	16.1941553	0.0007996	-0.0009779
2.6506218	-28.1017562	C				
0.0000506	7913.8695274		156323349.	16.0853353	0.0008143	-0.0010082
2.6861248	-28.9729544	C				
0.0000519	8017.9435177		154562767.	15.9810405	0.0008290	-0.0010385
2.7210651	-29.8452345	C				
0.0000531	8120.9831539		152865565.	15.8802274	0.0008436	-0.0010689
2.7553552	-30.7197119	C				
0.0000544	8223.7714299		151241773.	15.7843952	0.0008583	-0.0010992
2.7892233	-31.5936441	C				
0.0000556	8326.3067305		149686413.	15.6932097	0.0008729	-0.0011296
2.8226676	-32.4670284	C				
0.0000569	8427.9174708		148183164.	15.6047773	0.0008875	-0.0011600
2.8554817	-33.3424829	C				
0.0000581	8528.8747958		146733330.	15.5195326	0.0009021	-0.0011904
2.8877519	-34.2189752	C				
0.0000594	8629.5837676		145340358.	15.4381949	0.0009166	-0.0012209
2.9196022	-35.0949204	C				
0.0000606	8730.0428304		144000706.	15.3605241	0.0009312	-0.0012513
2.9510311	-35.9703159	C				
0.0000619	8830.0791467		142708350.	15.2858798	0.0009458	-0.0012817
2.9819812	-36.8459118	C				
0.0000631	8929.1281673		141451535.	15.2127161	0.0009603	-0.0013122
3.0122716	-37.7242089	C				
0.0000644	9027.9317165		140239716.	15.1426890	0.0009748	-0.0013427
3.0421439	-38.6019547	C				
0.0000656	9126.4882516		139070297.	15.0756209	0.0009893	-0.0013732
3.0715967	-39.4791462	C				
0.0000669	9224.7962151		137940878.	15.0113475	0.0010039	-0.0014036
3.1006282	-40.3557803	C				
0.0000681	9322.8540352		136849234.	14.9497163	0.0010184	-0.0014341
3.1292367	-41.2318540	C				
0.0000694	9420.0340760		135784275.	14.8890114	0.0010329	-0.0014646
3.1572080	-42.1105326	C				
0.0000706	9516.8484301		134751836.	14.8304318	0.0010474	-0.0014951
3.1847196	-42.9892592	C				
0.0000719	9613.4167684		133751885.	14.7741608	0.0010619	-0.0015256
3.2118112	-43.8674209	C				
0.0000731	9709.7375670		132782736.	14.7200816	0.0010764	-0.0015561
3.2384814	-44.7450142	C				
0.0000744	9805.8092564		131842814.	14.6680853	0.0010909	-0.0015866
3.2647284	-45.6220358	C				
0.0000794	10186.		128331107.	14.4756189	0.0011490	-0.0017085
3.3649985	-49.1320974	C				
0.0000844	10562.		125175730.	14.3072426	0.0012072	-0.0018303
3.4580899	-52.6390281	C				
0.0000894	10932.		122319614.	14.1593751	0.0012655	-0.0019520
3.5440202	-56.1416321	C				
0.0000944	11298.		119712041.	14.0281065	0.0013239	-0.0020736
3.6226515	-59.6416884	C				
0.0000994	11659.		117324872.	13.9135864	0.0013827	-0.0021948
3.6942592	-60.0000000	CY				
0.0001044	12016.		115120158.	13.8117792	0.0014416	-0.0023159
3.7585289	-60.0000000	CY				
0.0001094	12367.		113072180.	13.7209409	0.0015007	-0.0024368
3.8153896	-60.0000000	CY				
0.0001144	12714.		111164619.	13.6414455	0.0015602	-0.0025573
3.8649314	-60.0000000	CY				
0.0001194	13054.		109349789.	13.5708918	0.0016200	-0.0026775
3.9069253	-60.0000000	CY				

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
0.0001244	13353.		107358649.	13.4982190	0.0016788	-0.0027987
3.9406231	-60.0000000	CY				
0.0001294	13621.		105283730.	13.4233840	0.0017367	-0.0029208
3.9663889	-60.0000000	CY				
0.0001344	13842.		103008796.	13.3424730	0.0017929	-0.0030446
3.9844619	-60.0000000	CY				
0.0001394	13998.		100435951.	13.2496820	0.0018467	-0.0031708
3.9952962	-60.0000000	CY				
0.0001444	14140.		97938279.	13.1616860	0.0019002	-0.0032973
3.9998370	-60.0000000	CY				
0.0001494	14277.		95580037.	13.0792121	0.0019537	-0.0034238
3.9998033	-60.0000000	CY				
0.0001544	14411.		93351931.	13.0036033	0.0020074	-0.0035501
3.9996447	-60.0000000	CY				
0.0001594	14542.		91244338.	12.9351771	0.0020615	-0.0036760
3.9992667	-60.0000000	CY				
0.0001644	14670.		89246820.	12.8732594	0.0021160	-0.0038015
3.9985009	60.0000000	CY				
0.0001694	14795.		87350438.	12.8172265	0.0021709	-0.0039266
3.9971084	60.0000000	CY				
0.0001744	14913.		85520911.	12.7640467	0.0022257	-0.0040518
3.9999621	60.0000000	CY				
0.0001794	15004.		83647912.	12.7044973	0.0022789	-0.0041786
3.9991720	60.0000000	CY				
0.0001844	15069.		81730962.	12.6392619	0.0023304	-0.0043071
3.9967557	60.0000000	CY				
0.0001894	15116.		79822717.	12.5722163	0.0023809	-0.0044366
3.9996857	60.0000000	CY				
0.0001944	15161.		77997952.	12.5093312	0.0024315	-0.0045660
3.9972390	60.0000000	CY				
0.0001994	15204.		76258869.	12.4508303	0.0024824	-0.0046951
3.9997805	60.0000000	CY				
0.0002044	15246.		74596024.	12.3949591	0.0025332	-0.0048243
3.9969585	60.0000000	CY				
0.0002094	15285.		73004445.	12.3409869	0.0025839	-0.0049536
3.9996178	60.0000000	CY				
0.0002144	15324.		71482539.	12.2906235	0.0026348	-0.0050827
3.9957055	60.0000000	CY				
0.0002194	15362.		70025657.	12.2436066	0.0026859	-0.0052116
3.9990172	60.0000000	CY				
0.0002244	15399.		68630593.	12.1995095	0.0027373	-0.0053402
3.9991044	60.0000000	CY				
0.0002294	15435.		67291637.	12.1584711	0.0027888	-0.0054687
3.9975130	60.0000000	CY				
0.0002344	15470.		66007402.	12.1198705	0.0028406	-0.0055969
3.9997126	60.0000000	CY				
0.0002394	15505.		64773430.	12.0837716	0.0028926	-0.0057249
3.9952127	60.0000000	CY				
0.0002444	15539.		63586016.	12.0492936	0.0029445	-0.0058530
3.9980720	60.0000000	CY				
0.0002494	15572.		62442431.	12.0152491	0.0029963	-0.0059812
3.9998339	60.0000000	CY				
0.0002544	15604.		61340950.	11.9833831	0.0030483	-0.0061092
3.9945714	60.0000000	CYT				
0.0002594	15635.		60279679.	11.9534443	0.0031004	-0.0062371
3.9975787	60.0000000	CYT				
0.0002644	15666.		59257066.	11.9251510	0.0031527	-0.0063648
3.9996185	60.0000000	CYT				
0.0002694	15697.		58270398.	11.8985592	0.0032052	-0.0064923
3.9969460	60.0000000	CYT				
0.0002744	15726.		57317409.	11.8736569	0.0032578	-0.0066197
3.9958614	60.0000000	CYT				
0.0003044	15896.		52226636.	11.7519824	0.0035770	-0.0073805

Bridge 11 Bent 3 Transverse Final Loads.lp60
 3.9999338 60.0000000 CYT
 0.0003344 15939. 47667185. 11.6779305 0.0039048 -0.0081327
 3.9912890 60.0000000 CYT

Axial Thrust Force = 525.300 kips

Bending Max Concrete Curvature Stress rad/in. ksi	Bending Max Steel Moment Stress in-kip ksi	Bending Run Stiffness Msg kip-in2	Depth to N Axis in	Max Comp Strain in/in	Max Tens Strain in/in
0.000000625	224.1823309	358691729.	202.1432277	0.0001263	0.0001038
0.5174380	3.6605835				
0.000001250	448.3953387	358716271.	110.0909575	0.0001376	0.0000926
0.5614687	3.9842722				
0.000001875	672.5973064	358718563.	79.4154491	0.0001489	0.0000814
0.6052822	4.3084275				
0.000002500	896.7827224	358713089.	64.0841315	0.0001602	0.0000702
0.6488772	4.6330495				
0.000003125	1120.9460742	358702744.	54.8904908	0.0001715	0.0000590
0.6922525	4.9581382				
0.000003750	1345.0818487	358688493.	48.7656889	0.0001829	0.0000479
0.7354069	5.2836937				
0.000004375	1569.1845314	358670750.	44.3945097	0.0001942	0.0000367
0.7783393	5.6097159				
0.000005000	1793.2486067	358649721.	41.1193452	0.0002056	0.0000256
0.8210484	5.9362051				
0.000005625	2017.2685572	358625521.	38.5748577	0.0002170	0.0000145
0.8635329	6.2631612				
0.000006250	2241.2388639	358598218.	36.5418446	0.0002284	0.000003387
0.9057917	6.5905844				
0.000006875	2465.1489065	358567114.	34.8808039	0.0002398	-0.000007694
0.9478234	6.9184728				
0.000007500	2688.9124992	358521667.	33.4985983	0.0002512	-0.0000188
0.9896226	7.2467951				
0.000008125	2912.3801300	358446785.	32.3306282	0.0002627	-0.0000298
1.0311809	7.5754918				
0.000008750	3135.4210035	358333829.	31.3307631	0.0002741	-0.0000409
1.0724900	7.9045062				
0.000009375	3357.9333207	358179554.	30.4652072	0.0002856	-0.0000519
1.1135433	8.2337907				
0.0000100	3579.8419866	357984199.	29.7086481	0.0002971	-0.0000629
1.1543354	8.5633080				
0.0000106	3801.0897280	357749621.	29.0417517	0.0003086	-0.0000739
1.1948619	8.8930273				
0.0000113	4021.6340559	357478583.	28.4495007	0.0003201	-0.0000849
1.2351194	9.2229247				
0.0000119	4241.4428054	357174131.	27.9200532	0.0003316	-0.0000959
1.2751052	9.5529808				
0.0000125	4460.4901325	356839211.	27.4439435	0.0003430	-0.0001070
1.3148168	9.8831796				
0.0000131	4460.4901325	339846867.	26.1622696	0.0003434	-0.0001291
1.3155742	9.8895013	C			
0.0000138	4460.4901325	324399282.	25.6632835	0.0003529	-0.0001421
1.3480579	10.1614593	C			
0.0000144	4460.4901325	310294966.	25.1992195	0.0003622	-0.0001553
1.3799261	10.4298872	C			
0.0000150	4460.4901325	297366009.	24.7667391	0.0003715	-0.0001685
1.4112388	10.6952315	C			

Bridge 11 Bent 3 Transverse Final Loads.lp6o						
0.0000156	4460.4901325		285471368.	24.3625765	0.0003807	-0.0001818
1.4420305	10.9577300	C				
0.0000163	4531.9017102		278886259.	23.9839272	0.0003897	-0.0001953
1.4723325	11.2176007	C				
0.0000169	4624.5527233		274047569.	23.6281868	0.0003987	-0.0002088
1.5021633	11.4749564	C				
0.0000175	4714.3646447		269392265.	23.2929437	0.0004076	-0.0002224
1.5315306	11.7298189	C				
0.0000181	4801.5922148		264915433.	22.9763560	0.0004164	-0.0002361
1.5604561	11.9823346	C				
0.0000188	4886.5136716		260614062.	22.6769158	0.0004252	-0.0002498
1.5889669	12.2326980	C				
0.0000194	4969.4020446		256485267.	22.3933495	0.0004339	-0.0002636
1.6170916	12.4811258	C				
0.0000200	5050.5217585		252526088.	22.1245797	0.0004425	-0.0002775
1.6448608	12.7278563	C				
0.0000206	5129.3211874		248694361.	21.8680259	0.0004510	-0.0002915
1.6721955	12.9721506	C				
0.0000213	5206.5827535		245015659.	21.6239759	0.0004595	-0.0003055
1.6991937	13.2148502	C				
0.0000219	5282.6874631		241494284.	21.3920686	0.0004680	-0.0003195
1.7259083	13.4564061	C				
0.0000225	5356.8227835		238081013.	21.1695909	0.0004763	-0.0003337
1.7522199	13.6957081	C				
0.0000231	5429.8844751		234805815.	20.9574137	0.0004846	-0.0003479
1.7782523	13.9338531	C				
0.0000238	5501.8155999		231655394.	20.7546019	0.0004929	-0.0003621
1.8039985	14.1707571	C				
0.0000244	5572.2765025		228606215.	20.5596375	0.0005011	-0.0003764
1.8294003	14.4058563	C				
0.0000256	5710.4025478		222844977.	20.1938942	0.0005175	-0.0004050
1.8794166	14.8728252	C				
0.0000269	5844.7808500		217480218.	19.8563008	0.0005336	-0.0004339
1.9283683	15.3352170	C				
0.0000281	5975.9069770		212476693.	19.5437277	0.0005497	-0.0004628
1.9763252	15.7935404	C				
0.0000294	6104.2518248		207804317.	19.2536431	0.0005656	-0.0004919
2.0233602	16.2483598	C				
0.0000306	6229.3719420		203408063.	18.9820996	0.0005813	-0.0005212
2.0693784	16.6986148	C				
0.0000319	6352.3001275		199287847.	18.7286634	0.0005970	-0.0005505
2.1145586	17.1459208	C				
0.0000331	6473.5310626		195427353.	18.4921740	0.0006126	-0.0005799
2.1589960	17.5911322	C				
0.0000344	6592.4900406		191781528.	18.2694837	0.0006280	-0.0006095
2.2025712	18.0329542	C				
0.0000356	6709.8877688		188347727.	18.0603509	0.0006434	-0.0006391
2.2454174	18.4726376	C				
0.0000369	6826.0631314		185113576.	17.8640627	0.0006587	-0.0006688
2.2876103	-19.2016303	C				
0.0000381	6940.4120993		182043596.	17.6779481	0.0006740	-0.0006985
2.3290077	-20.0583061	C				
0.0000394	7054.0075573		179149398.	17.5032023	0.0006892	-0.0007283
2.3698509	-20.9154933	C				
0.0000406	7165.9150147		176391754.	17.3367171	0.0007043	-0.0007582
2.4099178	-21.7756176	C				
0.0000419	7277.0580199		173780490.	17.1796372	0.0007194	-0.0007881
2.4494272	-22.6363905	C				
0.0000431	7387.0983955		171295035.	17.0303339	0.0007344	-0.0008181
2.4882901	-23.4988260	C				
0.0000444	7495.9284828		168922332.	16.8879049	0.0007494	-0.0008481
2.5264841	-24.3632398	C				
0.0000456	7604.4881716		166673713.	16.7537085	0.0007644	-0.0008781

Bridge 11 Bent 3 Transverse Final Loads.lp6o

2.5642391	-25.2270868	C				
0.0000469	7711.3644707		164509109.	16.6240183	0.0007793	-0.0009082
2.6011925	-26.0945377	C				
0.0000481	7817.8100724		162448002.	16.5011132	0.0007941	-0.0009384
2.6376698	-26.9619212	C				
0.0000494	7923.9900153		160485874.	16.3848231	0.0008090	-0.0009685
2.6737125	-27.8287438	C				
0.0000506	8028.5653148		158588944.	16.2717074	0.0008238	-0.0009987
2.7089586	-28.6993371	C				
0.0000519	8132.8218738		156777289.	16.1642833	0.0008385	-0.0010290
2.7437598	-29.5695687	C				
0.0000531	8236.8176101		155045979.	16.0622760	0.0008533	-0.0010592
2.7781305	-30.4392434	C				
0.0000544	8339.8536282		153376618.	15.9637336	0.0008680	-0.0010895
2.8118705	-31.3108500	C				
0.0000556	8442.1076286		151768227.	15.8687992	0.0008827	-0.0011198
2.8450341	-32.1837806	C				
0.0000569	8544.1056383		150226033.	15.7783742	0.0008974	-0.0011501
2.8777712	-33.0561565	C				
0.0000581	8645.8460100		148745738.	15.6921690	0.0009121	-0.0011804
2.9100802	-33.9279750	C				
0.0000594	8746.6811303		147312524.	15.6084226	0.0009268	-0.0012107
2.9417657	-34.8018097	C				
0.0000606	8846.8577452		145927550.	15.5275264	0.0009414	-0.0012411
2.9729051	-35.6767050	C				
0.0000619	8946.7813879		144594447.	15.4502092	0.0009560	-0.0012715
3.0036202	-36.5510432	C				
0.0000631	9046.4504566		143310106.	15.3762600	0.0009706	-0.0013019
3.0339093	-37.4248213	C				
0.0000644	9145.8633153		142071663.	15.3054842	0.0009853	-0.0013322
3.0637708	-38.2980364	C				
0.0000656	9244.2052885		140864081.	15.2357715	0.0009998	-0.0013627
3.0929469	-39.1743598	C				
0.0000669	9342.2267946		139696849.	15.1687917	0.0010144	-0.0013931
3.1216782	-40.0504369	C				
0.0000681	9439.9965361		138568756.	15.1045561	0.0010290	-0.0014235
3.1499851	-40.9259487	C				
0.0000694	9537.5129488		137477664.	15.0429179	0.0010436	-0.0014539
3.1778661	-41.8008918	C				
0.0000706	9634.7744113		136421585.	14.9837408	0.0010582	-0.0014843
3.2053195	-42.6752631	C				
0.0000719	9731.6098853		135396311.	14.9264767	0.0010728	-0.0015147
3.2322873	-43.5499374	C				
0.0000731	9827.6383609		134395055.	14.8700869	0.0010874	-0.0015451
3.2586449	-44.4269094	C				
0.0000744	9923.4159994		133424081.	14.8158601	0.0011019	-0.0015756
3.2845778	-45.3033040	C				
0.0000794	10304.		129813994.	14.6185709	0.0011603	-0.0016972
3.3840280	-48.8030394	C				
0.0000844	10679.		126562065.	14.4441008	0.0012187	-0.0018188
3.4759662	-52.3041538	C				
0.0000894	11049.		123622491.	14.2917650	0.0012773	-0.0019402
3.5608061	-55.7984939	C				
0.0000944	11414.		120941511.	14.1570678	0.0013361	-0.0020614
3.6383391	-59.2887375	C				
0.0000994	11774.		118479114.	14.0372456	0.0013950	-0.0021825
3.7084985	-60.0000000	CY				
0.0001044	12130.		116211164.	13.9324169	0.0014542	-0.0023033
3.7714717	-60.0000000	CY				
0.0001094	12481.		114107817.	13.8398957	0.0015137	-0.0024238
3.8270538	-60.0000000	CY				
0.0001144	12826.		112142099.	13.7564524	0.0015734	-0.0025441
3.8749884	-60.0000000	CY				

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0.0001194	13166.	110287226.	13.6828403	0.0016334	-0.0026641	
3.9153702	-60.0000000	CY				
0.0001244	13470.	108297930.	13.6089416	0.0016926	-0.0027849	
3.9475258	-60.0000000	CY				
0.0001294	13739.	106194828.	13.5344928	0.0017510	-0.0029065	
3.9717451	-60.0000000	CY				
0.0001344	13971.	103968337.	13.4560984	0.0018082	-0.0030293	
3.9882358	-60.0000000	CY				
0.0001394	14134.	101406283.	13.3628871	0.0018625	-0.0031550	
3.9973111	-60.0000000	CY				
0.0001444	14274.	98866047.	13.2720369	0.0019162	-0.0032813	
3.9987798	-60.0000000	CY				
0.0001494	14411.	96475001.	13.1897636	0.0019702	-0.0034073	
3.9989693	-60.0000000	CY				
0.0001544	14544.	94214906.	13.1141100	0.0020245	-0.0035330	
3.9999994	-60.0000000	CY				
0.0001594	14674.	92071079.	13.0434446	0.0020788	-0.0036587	
3.9999228	-60.0000000	CY				
0.0001644	14800.	90039482.	12.9794596	0.0021335	-0.0037840	
3.9995916	60.0000000	CY				
0.0001694	14924.	88111018.	12.9215141	0.0021886	-0.0039089	
3.9987719	60.0000000	CY				
0.0001744	15043.	86266401.	12.8682240	0.0022439	-0.0040336	
3.9971430	60.0000000	CY				
0.0001794	15142.	84415265.	12.8130324	0.0022983	-0.0041592	
3.9999339	60.0000000	CY				
0.0001844	15214.	82514130.	12.7509791	0.0023510	-0.0042865	
3.9987667	60.0000000	CY				
0.0001894	15262.	80592122.	12.6828169	0.0024018	-0.0044157	
3.9986754	60.0000000	CY				
0.0001944	15306.	78743068.	12.6181418	0.0024527	-0.0045448	
3.9990928	60.0000000	CY				
0.0001994	15348.	76980868.	12.5577795	0.0025037	-0.0046738	
3.9976960	60.0000000	CY				
0.0002044	15389.	75298586.	12.5017006	0.0025550	-0.0048025	
3.9989748	60.0000000	CY				
0.0002094	15429.	73692500.	12.4492819	0.0026066	-0.0049309	
3.9986722	60.0000000	CY				
0.0002144	15468.	72153362.	12.3992828	0.0026581	-0.0050594	
3.9983326	60.0000000	CY				
0.0002194	15505.	70678209.	12.3505463	0.0027094	-0.0051881	
3.9999581	60.0000000	CY				
0.0002244	15541.	69264086.	12.3051340	0.0027610	-0.0053165	
3.9966951	60.0000000	CY				
0.0002294	15577.	67908712.	12.2624969	0.0028127	-0.0054448	
3.9993963	60.0000000	CY				
0.0002344	15611.	66608164.	12.2225004	0.0028646	-0.0055729	
3.9974714	60.0000000	CY				
0.0002394	15645.	65358233.	12.1851454	0.0029168	-0.0057007	
3.9975546	60.0000000	CY				
0.0002444	15678.	64157434.	12.1499339	0.0029691	-0.0058284	
3.9996820	60.0000000	CY				
0.0002494	15711.	63001957.	12.1169311	0.0030217	-0.0059558	
3.9958611	60.0000000	CYT				
0.0002544	15743.	61889141.	12.0860078	0.0030744	-0.0060831	
3.9973930	60.0000000	CYT				
0.0002594	15775.	60817351.	12.0565789	0.0031272	-0.0062103	
3.9995655	60.0000000	CYT				
0.0002644	15805.	59782138.	12.0271527	0.0031797	-0.0063378	
3.9973209	60.0000000	CYT				
0.0002694	15835.	58782941.	11.9995841	0.0032324	-0.0064651	
3.9959500	60.0000000	CYT				
0.0002744	15864.	57818941.	11.9734758	0.0032852	-0.0065923	

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3.9987544	60.0000000	CYT				
0.0003044	16030.		52664280.	11.8470569	0.0036059	-0.0073516
3.9933331	60.0000000	CYT				
0.0003344	16076.		48077265.	11.7784585	0.0039384	-0.0080991
3.9966716	60.0000000	CYT				

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 3

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
-----	-----	-----	-----
1	506.800	15573.859	0.00300000
2	525.300	15697.652	0.00300000

Note note that the values of moment capacity in the table above are not factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to ACI 318-08, Section 9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding bending stiffnesses computed for common resistance factor values used for reinforced concrete sections.

Axial (Factored) Load Capacity No. in-kip	Resistance Bending Factor at Ult. for Moment	Stiffness Moment Cap. kip-in ²	Nominal Moment Capacity in-kip	Ultimate (Factored) Axial Thrust kips	Ultimate Moment
-----	-----	-----	-----	-----	-----
1	0.65		15573.859		
10123.008		128915111.380		329.420	
2	0.65		15697.652		
10203.473		130767455.377		341.445	
1	0.70		15573.859		
10901.701		122555541.155		354.760	
2	0.70		15697.652		
10988.356		124102276.853		367.710	
1	0.75		15573.859		
11680.394		117193548.628		380.100	
2	0.75		15697.652		
11773.239		118483375.774		393.975	

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

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Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	-9173.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	525300.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. inches lb/inch	Bending Distrib. Load Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.00	-0.1544	1806829.	-9173.0000	0.000	0.000	3.586E+11	
0.000	0.855	-0.1541	1712575.	-9173.0000	5.034E-05	0.000	3.586E+11	
0.000	1.710	-0.1533	1618056.	-9173.0000	9.798E-05	0.000	3.587E+11	
0.000	2.565	-0.1521	1523288.	-9173.0000	0.000143	0.000	3.587E+11	
0.000	3.420	-0.1504	1428286.	-9173.0000	0.000185	0.000	3.587E+11	
0.000	4.275	-0.1483	1333063.	-9173.0000	0.000225	0.000	3.587E+11	
0.000	5.130	-0.1458	1237635.	-9173.0000	0.000261	0.000	3.587E+11	
0.000	5.985	-0.1429	1142016.	-9173.0000	0.000295	0.000	3.587E+11	
0.000	6.840	-0.1397	1046220.	-9173.0000	0.000327	0.000	3.587E+11	
0.000	7.695	-0.1362	950264.	-9173.0000	0.000355	0.000	3.587E+11	
0.000	8.550	-0.1324	854161.	-9173.0000	0.000381	0.000	3.587E+11	
0.000	9.405	-0.1284	757926.	-9173.0000	0.000404	0.000	3.587E+11	
0.000	10.260	-0.1241	661575.	-9173.0000	0.000424	0.000	3.587E+11	
0.000	11.115	-0.1197	565121.	-9173.0000	0.000442	0.000	3.587E+11	
0.000	11.970	-0.1151	468581.	-9173.0000	0.000457	0.000	3.587E+11	
0.000	12.825	-0.1103	371968.	-9173.0000	0.000469	0.000	3.587E+11	
0.000	13.680	-0.1054	275298.	-9173.0000	0.000478	0.000	3.587E+11	
0.000	14.535	-0.1005	178585.	-9173.0000	0.000485	0.000	3.587E+11	
0.000	15.390	-0.0955	81845.	-9173.0000	0.000488	0.000	3.587E+11	
0.000	16.245	-0.0905	-14907.	-9173.0000	0.000489	0.000	3.587E+11	
0.000	17.100	-0.0855	-111658.	-9173.0000	0.000487	0.000	3.587E+11	
0.000	17.955	-0.0805	-208391.	-9173.0000	0.000483	0.000	3.587E+11	
0.000	18.810	-0.0756	-305092.	-9173.0000	0.000475	0.000	3.587E+11	

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0.000	0.000	0.000				
19.665	-0.0707	-401746.	-9173.0000	0.000465	0.000	3.587E+11
0.000	0.000	0.000				
20.520	-0.0660	-498338.	-9173.0000	0.000452	0.000	3.587E+11
0.000	0.000	0.000				
21.375	-0.0614	-594854.	-9160.2347	0.000441	0.000	6.648E+11
2.4884	415.5300	0.000				
22.230	-0.0570	-691058.	-9000.7093	0.000431	0.000	6.648E+11
28.6082	5152.5720	0.000				
23.085	-0.0526	-784192.	-8593.8525	0.000419	0.000	6.648E+11
50.7011	9889.6140	0.000				
23.940	-0.0484	-871925.	-7980.0954	0.000407	0.000	6.648E+11
68.9396	14627.	0.000				
24.795	-0.0443	-952328.	-7197.9672	0.000393	0.000	6.648E+11
83.5220	19364.	0.000				
25.650	-0.0403	-1023859.	-6283.8454	0.000377	0.000	6.648E+11
94.6694	24101.	0.000				
26.505	-0.0365	-1085340.	-5271.7386	0.000361	0.000	6.648E+11
102.6224	28838.	0.000				
27.360	-0.0329	-1135927.	-4192.2410	0.000344	0.000	6.648E+11
107.8060	33627.	0.000				
28.215	-0.0295	-1175072.	-3074.2113	0.000326	0.000	6.648E+11
110.1336	38364.	0.000				
29.070	-0.0262	-1202525.	-2150.2057	0.000308	0.000	6.648E+11
69.9845	27405.	0.000				
29.925	-0.0231	-1222512.	-1437.5927	0.000289	0.000	6.648E+11
68.9264	30563.	0.000				
30.780	-0.0203	-1235141.	-742.2424	0.000270	0.000	6.648E+11
66.6194	33721.	0.000				
31.635	-0.0176	-1240654.	-76.0154	0.000251	0.000	6.648E+11
63.2494	36879.	0.000				
32.490	-0.0151	-1239406.	551.1252	0.000232	0.000	6.648E+11
59.0003	40037.	0.000				
33.345	-0.0128	-1231844.	1131.0868	0.000213	0.000	6.648E+11
54.0527	43195.	0.000				
34.200	-0.0108	-1218489.	1657.6052	0.000194	0.000	6.648E+11
48.5825	46353.	0.000				
35.055	-0.008861	-1199919.	2537.8365	0.000175	0.000	6.648E+11
123.0026	142425.	0.000				
35.910	-0.007158	-1168301.	3714.3927	0.000157	0.000	6.648E+11
106.3456	152426.	0.000				
36.765	-0.005641	-1125391.	4718.0466	0.000139	0.000	6.648E+11
89.2984	162426.	0.000				
37.620	-0.004301	-1072988.	5546.9835	0.000122	0.000	6.648E+11
72.2877	172427.	0.000				
38.475	-0.003132	-1012885.	6203.4943	0.000106	0.000	6.648E+11
55.6871	182427.	0.000				
39.330	-0.002123	-946836.	6693.4190	9.104E-05	0.000	6.648E+11
39.8148	192428.	0.000				
40.185	-0.001264	-876518.	7025.5780	7.697E-05	0.000	6.648E+11
24.9335	202428.	0.000				
41.040	-0.000543	-803501.	7211.2051	6.401E-05	0.000	6.648E+11
11.2511	212428.	0.000				
41.895	4.969E-05	-729234.	7263.3966	5.218E-05	0.000	6.648E+11
-1.0773	222429.	0.000				
42.750	0.000527	-655019.	7196.5869	4.150E-05	0.000	6.648E+11
-11.9460	232429.	0.000				
43.605	0.000901	-582007.	7026.0598	3.195E-05	0.000	6.648E+11
-21.2951	242430.	0.000				
44.460	0.001183	-511189.	6767.5036	2.352E-05	0.000	6.648E+11
-29.1057	252430.	0.000				
45.315	0.001384	-443391.	6436.6142	1.615E-05	0.000	6.648E+11
-35.3951	262431.	0.000				

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46.170	0.001514	-379283.	6048.7507	9.802E-06	0.000	6.648E+11
-40.2118	272431.	0.000				
47.025	0.001585	-319377.	5618.6436	4.411E-06	0.000	6.648E+11
-43.6298	282431.	0.000				
47.880	0.001605	-264036.	5160.1571	-9.100E-08	0.000	6.648E+11
-45.7438	292432.	0.000				
48.735	0.001583	-213489.	4686.1027	-3.776E-06	0.000	6.648E+11
-46.6644	302432.	0.000				
49.590	0.001527	-167837.	4208.1024	-6.719E-06	0.000	6.648E+11
-46.5130	312433.	0.000				
50.445	0.001445	-127067.	3736.4965	-8.994E-06	0.000	6.648E+11
-45.4179	322433.	0.000				
51.300	0.001343	-91067.	3280.2928	-1.068E-05	0.000	6.648E+11
-43.5107	332434.	0.000				
52.155	0.001226	-59640.	2847.1501	-1.184E-05	0.000	6.648E+11
-40.9226	342434.	0.000				
53.010	0.001100	-32516.	2443.3930	-1.255E-05	0.000	6.648E+11
-37.7825	352434.	0.000				
53.865	0.000969	-9366.1406	2074.0482	-1.287E-05	0.000	6.648E+11
-34.2145	362435.	0.000				
54.720	0.000836	10183.	1742.9007	-1.287E-05	0.000	6.648E+11
-30.3366	372435.	0.000				
55.575	0.000705	26537.	1452.5605	-1.259E-05	0.000	6.648E+11
-26.2599	382436.	0.000				
56.430	0.000577	40125.	1204.5353	-1.207E-05	0.000	6.648E+11
-22.0881	392436.	0.000				
57.285	0.000457	51384.	999.3049	-1.136E-05	0.000	6.648E+11
-17.9179	402436.	0.000				
58.140	0.000344	60753.	836.3898	-1.050E-05	0.000	6.648E+11
-13.8395	412437.	0.000				
58.995	0.000241	68660.	714.4123	-9.501E-06	0.000	6.648E+11
-9.9378	422437.	0.000				
59.850	0.000149	75515.	109.7872	-7.891E-06	0.000	3.587E+11
-107.9228	7415250.	0.000				
60.705	7.945E-05	70998.	-746.7822	-5.795E-06	0.000	3.587E+11
-59.0498	7625785.	0.000				
61.560	3.041E-05	60254.	-1168.8415	-3.918E-06	0.000	3.587E+11
-23.2230	7836320.	0.000				
62.415	-9.534E-07	47055.	-1284.1398	-2.383E-06	0.000	3.587E+11
0.7477	8046856.	0.000				
63.270	-1.850E-05	33929.	-1203.9121	-1.225E-06	0.000	3.587E+11
14.8912	8257391.	0.000				
64.125	-2.609E-05	22364.	-1017.0363	-4.201E-07	0.000	3.587E+11
21.5368	8467926.	0.000				
64.980	-2.712E-05	13064.	-788.8582	8.658E-08	0.000	3.587E+11
22.9423	8678461.	0.000				
65.835	-2.432E-05	6176.0829	-563.0828	3.618E-07	0.000	3.587E+11
21.0685	8888996.	0.000				
66.690	-1.970E-05	1505.3407	-365.3705	4.716E-07	0.000	3.587E+11
17.4719	9099532.	0.000				
67.545	-1.464E-05	-1326.4040	-207.5873	4.742E-07	0.000	3.587E+11
13.2850	9310067.	0.000				
68.400	-9.970E-06	-2759.4615	-91.9740	4.157E-07	0.000	3.587E+11
9.2517	9520602.	0.000				
69.255	-6.110E-06	-3218.1917	-14.7858	3.302E-07	0.000	3.587E+11
5.7948	9731137.	0.000				
70.110	-3.194E-06	-3066.4263	30.8163	2.404E-07	0.000	3.587E+11
3.0946	9941672.	0.000				
70.965	-1.178E-06	-2588.4323	52.6685	1.595E-07	0.000	3.587E+11
1.1651	10152208.	0.000				
71.820	7.896E-08	-1987.3874	58.2366	9.404E-08	0.000	3.587E+11
-0.0798	10362743.	0.000				
72.675	7.522E-07	-1394.4314	53.8509	4.567E-08	0.000	3.587E+11

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-0.7752	10573278.	0.000					
73.530	1.016E-06	-882.8590	44.3952	1.310E-08	0.000	3.587E+11	
-1.0681	10783813.	0.000					
74.385	1.021E-06	-483.5825	33.3031	-6.439E-09	0.000	3.587E+11	
-1.0942	10994348.	0.000					
75.240	8.840E-07	-199.4105	22.7372	-1.621E-08	0.000	3.587E+11	
-0.9655	11204884.	0.000					
76.095	6.885E-07	-16.8396	13.8547	-1.930E-08	0.000	3.587E+11	
-0.7660	11415419.	0.000					
76.950	4.880E-07	85.0954	7.0881	-1.832E-08	0.000	3.587E+11	
-0.5530	11625954.	0.000					
77.805	3.125E-07	128.8066	2.4020	-1.526E-08	0.000	3.587E+11	
-0.3605	11836489.	0.000					
78.660	1.748E-07	134.5483	-0.5002	-1.150E-08	0.000	3.587E+11	
-0.2052	12047024.	0.000					
79.515	7.655E-08	118.6667	-2.0221	-7.877E-09	0.000	3.587E+11	
-0.0915	12257560.	0.000					
80.370	1.314E-08	93.1400	-2.5732	-4.848E-09	0.000	3.587E+11	
-0.0160	12468095.	0.000					
81.225	-2.292E-08	65.9175	-2.5098	-2.573E-09	0.000	3.587E+11	
0.0283	12678630.	0.000					
82.080	-3.965E-08	41.6668	-2.1090	-1.034E-09	0.000	3.587E+11	
0.0498	12889165.	0.000					
82.935	-4.414E-08	22.6528	-1.5643	-1.141E-10	0.000	3.587E+11	
0.0564	13099700.	0.000					
83.790	-4.199E-08	9.5680	-0.9958	3.467E-10	0.000	3.587E+11	
0.0545	13310236.	0.000					
84.645	-3.703E-08	2.2159	-0.4660	5.152E-10	0.000	3.587E+11	
0.0488	13520771.	0.000					
85.500	-3.142E-08	0.000	0.000	5.469E-10	0.000	3.587E+11	
0.0420	6865653.	0.000					

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.

The above values of total stress are computed for combined axial and bending stress in elastic

sections and do not equal actual stresses in concrete and steel in the range of nonlinear bending.

Output Summary for Load Case No. 1:

Pile-head deflection	=	-0.1543555 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	1806829. inch-lbs
Maximum shear force	=	-9173.000000 lbs
Depth of maximum bending moment	=	0.000000 inches below pile head
Depth of maximum shear force	=	30.7800000 inches below pile head
Number of iterations	=	6
Number of zero deflection points	=	4

Computed values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	23630.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	506800.000 lbs

Bridge 11 Bent 3 Transverse Final Loads.lp6o

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. inches lb/inch	Bending Distrib. Load Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.000	0.000	0.000	23630.	0.000	0.000	2.680E+11	
0.000	0.855	0.000	0.000	23630.	-0.000171	0.000	2.680E+11	
0.000	1.710	0.000	0.000	23630.	-0.000313	0.000	3.580E+11	
0.000	2.565	0.000	0.000	23630.	-0.000427	0.000	3.583E+11	
0.000	3.420	0.000	0.000	23630.	-0.000534	0.000	3.586E+11	
0.000	4.275	0.000	0.000	23630.	-0.000634	0.000	3.589E+11	
0.000	5.130	0.000	0.000	23630.	-0.000727	0.000	3.591E+11	
0.000	5.985	0.000	0.000	23630.	-0.000812	0.000	3.592E+11	
0.000	6.840	0.000	0.000	23630.	-0.000891	0.000	3.593E+11	
0.000	7.695	0.000	0.000	23630.	-0.000962	0.000	3.593E+11	
0.000	8.550	0.000	0.000	23630.	-0.001027	0.000	3.594E+11	
0.000	9.405	0.000	0.000	23630.	-0.001084	0.000	3.594E+11	
0.000	10.260	0.000	0.000	23630.	-0.001135	0.000	3.594E+11	
0.000	11.115	0.000	0.000	23630.	-0.001178	0.000	3.594E+11	
0.000	11.970	0.000	0.000	23630.	-0.001214	0.000	3.595E+11	
0.000	12.825	0.000	0.000	23630.	-0.001243	0.000	3.595E+11	
0.000	13.680	0.000	0.000	23630.	-0.001265	0.000	3.595E+11	
0.000	14.535	0.000	0.000	23630.	-0.001280	0.000	3.595E+11	
0.000	15.390	0.000	0.000	23630.	-0.001287	0.000	3.595E+11	
0.000	16.245	0.000	0.000	23630.	-0.001288	0.000	3.595E+11	
0.000	17.100	0.000	0.000	23630.	-0.001281	0.000	3.595E+11	
0.000	17.955	0.000	0.000	23630.	-0.001268	0.000	3.595E+11	
0.000	18.810	0.000	0.000	23630.	-0.001247	0.000	3.595E+11	
0.000	19.665	0.000	0.000	23630.	-0.001219	0.000	3.595E+11	
0.000	20.520	0.000	0.000	23630.	-0.001184	0.000	3.595E+11	
0.000	21.375	0.000	0.000	23597.	-0.001153	0.000	6.658E+11	
-6.4811	415.5300		0.000					

Bridge 11 Bent 3 Transverse Final Loads.lp6o

22.230	0.1483	1845311.	23181.	-0.001126	0.000	6.658E+11
-74.4905	5152.5720	0.000				
23.085	0.1369	2085012.	22122.	-0.001096	0.000	6.658E+11
-131.9780	9889.6140	0.000				
23.940	0.1258	2310654.	20525.	-0.001062	0.000	6.658E+11
-179.4017	14627.	0.000				
24.795	0.1151	2517225.	18490.	-0.001025	0.000	6.657E+11
-217.2856	19364.	0.000				
25.650	0.1048	2700721.	16112.	-0.000985	0.000	6.657E+11
-246.2124	24101.	0.000				
26.505	0.0949	2858083.	13480.	-0.000942	0.000	6.657E+11
-266.8152	28838.	0.000				
27.360	0.0855	2987128.	10674.	-0.000897	0.000	6.657E+11
-280.2045	33627.	0.000				
28.215	0.0765	3086438.	7768.5544	-0.000850	0.000	6.656E+11
-286.1615	38364.	0.000				
29.070	0.0681	3155377.	5368.0153	-0.000802	0.000	6.656E+11
-181.7798	27405.	0.000				
29.925	0.0601	3204927.	3517.3813	-0.000753	0.000	6.656E+11
-178.9675	30563.	0.000				
30.780	0.0526	3235381.	1712.2438	-0.000703	0.000	6.656E+11
-172.9111	33721.	0.000				
31.635	0.0457	3247373.	-16.6030	-0.000653	0.000	6.656E+11
-164.0960	36879.	0.000				
32.490	0.0392	3241832.	-1643.3166	-0.000603	0.000	6.656E+11
-153.0021	40037.	0.000				
33.345	0.0333	3219924.	-3146.9305	-0.000553	0.000	6.656E+11
-140.1000	43195.	0.000				
34.200	0.0279	3183010.	-4511.2407	-0.000504	0.000	6.656E+11
-125.8474	46353.	0.000				
35.055	0.0229	3132594.	-6790.2397	-0.000455	0.000	6.656E+11
-318.4019	142425.	0.000				
35.910	0.0185	3048409.	-9834.6400	-0.000408	0.000	6.656E+11
-275.0484	152426.	0.000				
36.765	0.0146	2935026.	-12429.	-0.000361	0.000	6.657E+11
-230.7046	162426.	0.000				
37.620	0.0111	2797122.	-14569.	-0.000317	0.000	6.657E+11
-186.4783	172427.	0.000				
38.475	0.008062	2639364.	-16261.	-0.000275	0.000	6.657E+11
-143.3387	182427.	0.000				
39.330	0.005444	2466305.	-17520.	-0.000236	0.000	6.657E+11
-102.1112	192428.	0.000				
40.185	0.003217	2282300.	-18370.	-0.000199	0.000	6.658E+11
-63.4758	202428.	0.000				
41.040	0.001351	2091430.	-18839.	-0.000166	0.000	6.658E+11
-27.9704	212428.	0.000				
41.895	-0.000185	1897448.	-18962.	-0.000135	0.000	6.658E+11
4.0043	222429.	0.000				
42.750	-0.001420	1703735.	-18776.	-0.000107	0.000	6.658E+11
32.1764	232429.	0.000				
43.605	-0.002387	1513273.	-18322.	-8.252E-05	0.000	6.658E+11
56.3924	242430.	0.000				
44.460	-0.003114	1328626.	-17640.	-6.062E-05	0.000	6.658E+11
76.6056	252430.	0.000				
45.315	-0.003631	1151937.	-16770.	-4.151E-05	0.000	6.658E+11
92.8633	262431.	0.000				
46.170	-0.003965	984931.	-15754.	-2.505E-05	0.000	6.658E+11
105.2929	272431.	0.000				
47.025	-0.004145	828930.	-14628.	-1.107E-05	0.000	6.658E+11
114.0889	282431.	0.000				
47.880	-0.004193	684872.	-13430.	5.908E-07	0.000	6.658E+11
119.4989	292432.	0.000				
48.735	-0.004132	553339.	-12192.	1.013E-05	0.000	6.658E+11

Bridge 11 Bent 3 Transverse Final Loads.lp6o

121.8109	302432.	0.000					
49.590	-0.003985	434584.	-10945.	1.774E-05	0.000	6.658E+11	
121.3417	312433.	0.000					
50.445	-0.003768	328568.	-9714.7549	2.362E-05	0.000	6.658E+11	
118.4254	322433.	0.000					
51.300	-0.003500	234992.	-8525.4697	2.796E-05	0.000	6.658E+11	
113.4041	332434.	0.000					
52.155	-0.003195	153335.	-7396.7470	3.096E-05	0.000	6.658E+11	
106.6198	342434.	0.000					
53.010	-0.002865	82889.	-6344.9579	3.278E-05	0.000	6.658E+11	
98.4073	352434.	0.000					
53.865	-0.002522	22795.	-5383.1015	3.359E-05	0.000	6.658E+11	
89.0891	362435.	0.000					
54.720	-0.002176	-27922.	-4520.9496	3.355E-05	0.000	6.658E+11	
78.9717	372435.	0.000					
55.575	-0.001834	-70324.	-3765.2221	3.279E-05	0.000	6.658E+11	
68.3436	382436.	0.000					
56.430	-0.001503	-105525.	-3119.7782	3.144E-05	0.000	6.658E+11	
57.4739	392436.	0.000					
57.285	-0.001188	-134668.	-2585.8090	2.959E-05	0.000	6.658E+11	
46.6136	402436.	0.000					
58.140	-0.000895	-158894.	-2162.0184	2.733E-05	0.000	6.658E+11	
35.9966	412437.	0.000					
58.995	-0.000628	-179317.	-1844.7815	2.472E-05	0.000	6.658E+11	
25.8429	422437.	0.000					
59.850	-0.000388	-197006.	-272.8931	2.053E-05	0.000	3.595E+11	
280.5681	7415250.	0.000					
60.705	-0.000206	-185130.	1953.5498	1.507E-05	0.000	3.595E+11	
153.4364	7625785.	0.000					
61.560	-7.889E-05	-157076.	3049.7802	1.019E-05	0.000	3.595E+11	
60.2538	7836320.	0.000					
62.415	2.659E-06	-122655.	3348.1818	6.198E-06	0.000	3.595E+11	
-2.0858	8046856.	0.000					
63.270	4.829E-05	-88435.	3138.1124	3.185E-06	0.000	3.595E+11	
-38.8634	8257391.	0.000					
64.125	6.802E-05	-58294.	2650.7525	1.091E-06	0.000	3.595E+11	
-56.1385	8467926.	0.000					
64.980	7.068E-05	-34053.	2056.0729	-2.268E-07	0.000	3.595E+11	
-59.7834	8678461.	0.000					
65.835	6.336E-05	-16101.	1467.7604	-9.426E-07	0.000	3.595E+11	
-54.8974	8888996.	0.000					
66.690	5.134E-05	-3925.0648	952.5713	-1.228E-06	0.000	3.595E+11	
-45.5293	9099532.	0.000					
67.545	3.816E-05	3458.6149	541.3820	-1.235E-06	0.000	3.595E+11	
-34.6245	9310067.	0.000					
68.400	2.599E-05	7196.9388	240.0287	-1.083E-06	0.000	3.595E+11	
-24.1188	9520602.	0.000					
69.255	1.593E-05	8395.2662	38.7706	-8.605E-07	0.000	3.595E+11	
-15.1128	9731137.	0.000					
70.110	8.335E-06	8001.4598	-80.1896	-6.265E-07	0.000	3.595E+11	
-8.0763	9941672.	0.000					
70.965	3.079E-06	6756.2908	-137.2502	-4.159E-07	0.000	3.595E+11	
-3.0466	10152208.	0.000					
71.820	-1.984E-07	5189.4098	-151.8513	-2.454E-07	0.000	3.595E+11	
0.2004	10362743.	0.000					
72.675	-1.956E-06	3642.8532	-140.4825	-1.193E-07	0.000	3.595E+11	
2.0158	10573278.	0.000					
73.530	-2.647E-06	2307.9497	-115.8702	-3.439E-08	0.000	3.595E+11	
2.7820	10783813.	0.000					
74.385	-2.662E-06	1265.5544	-86.9666	1.661E-08	0.000	3.595E+11	
2.8523	10994348.	0.000					
75.240	-2.306E-06	523.2218	-59.4151	4.214E-08	0.000	3.595E+11	
2.5184	11204884.	0.000					

Bridge 11 Bent 3 Transverse Final Loads.lp6o							
76.095	-1.797E-06	45.9186	-36.2383	5.026E-08	0.000	3.595E+11	
1.9995	11415419.	0.000					
76.950	-1.275E-06	-220.9106	-18.5710	4.776E-08	0.000	3.595E+11	
1.4444	11625954.	0.000					
77.805	-8.170E-07	-335.6555	-6.3257	3.982E-08	0.000	3.595E+11	
0.9426	11836489.	0.000					
78.660	-4.576E-07	-351.1282	1.2663	3.002E-08	0.000	3.595E+11	
0.5374	12047024.	0.000					
79.515	-2.011E-07	-309.9832	5.2553	2.058E-08	0.000	3.595E+11	
0.2402	12257560.	0.000					
80.370	-3.530E-08	-243.5039	6.7077	1.268E-08	0.000	3.595E+11	
0.0429	12468095.	0.000					
81.225	5.917E-08	-172.4731	6.5526	6.746E-09	0.000	3.595E+11	
-0.0731	12678630.	0.000					
82.080	1.031E-07	-109.1142	5.5128	2.728E-09	0.000	3.595E+11	
-0.1296	12889165.	0.000					
82.935	1.151E-07	-59.3780	4.0940	3.229E-10	0.000	3.595E+11	
-0.1470	13099700.	0.000					
83.790	1.098E-07	-25.1086	2.6094	-8.829E-10	0.000	3.595E+11	
-0.1424	13310236.	0.000					
84.645	9.703E-08	-5.8248	1.2229	-1.324E-09	0.000	3.595E+11	
-0.1279	13520771.	0.000					
85.500	8.259E-08	0.000	0.000	-1.407E-09	0.000	3.595E+11	
-0.1105	6865653.	0.000					

* This analysis makes computations of pile response using nonlinear moment-curvature relationships.

The above values of total stress are computed for combined axial and bending stress in elastic

sections and do not equal actual stresses in concrete and steel in the range of nonlinear bending.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.4093171 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-4589815. inch-lbs
Maximum shear force	=	23630. lbs
Depth of maximum bending moment	=	0.000000 inches below pile head
Depth of maximum shear force	=	174.420000 inches below pile head
Number of iterations	=	16
Number of zero deflection points	=	4

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs

Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians

Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian

Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs

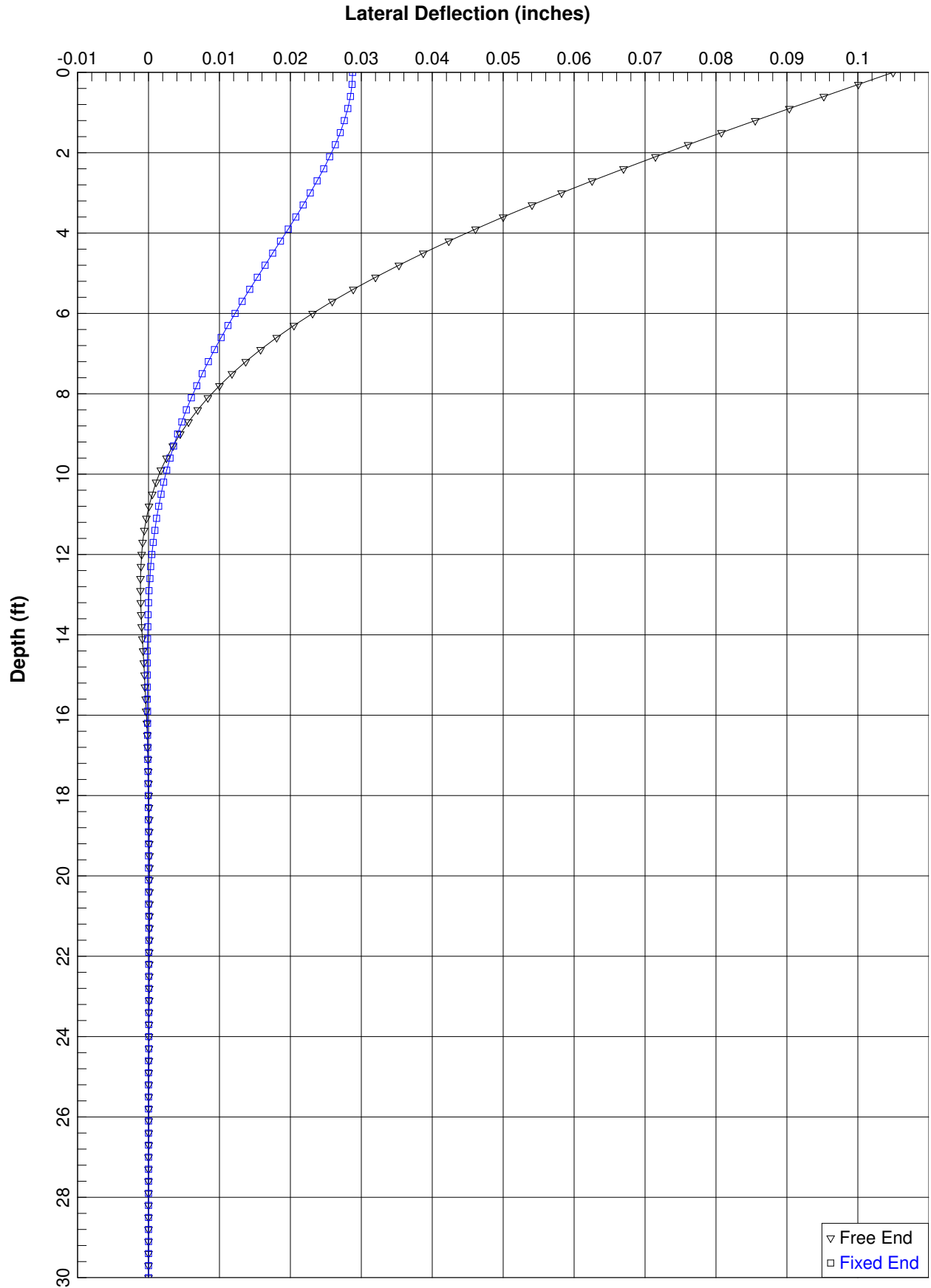
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

	Pile-head	Pile-head	Maximum
Maximum			

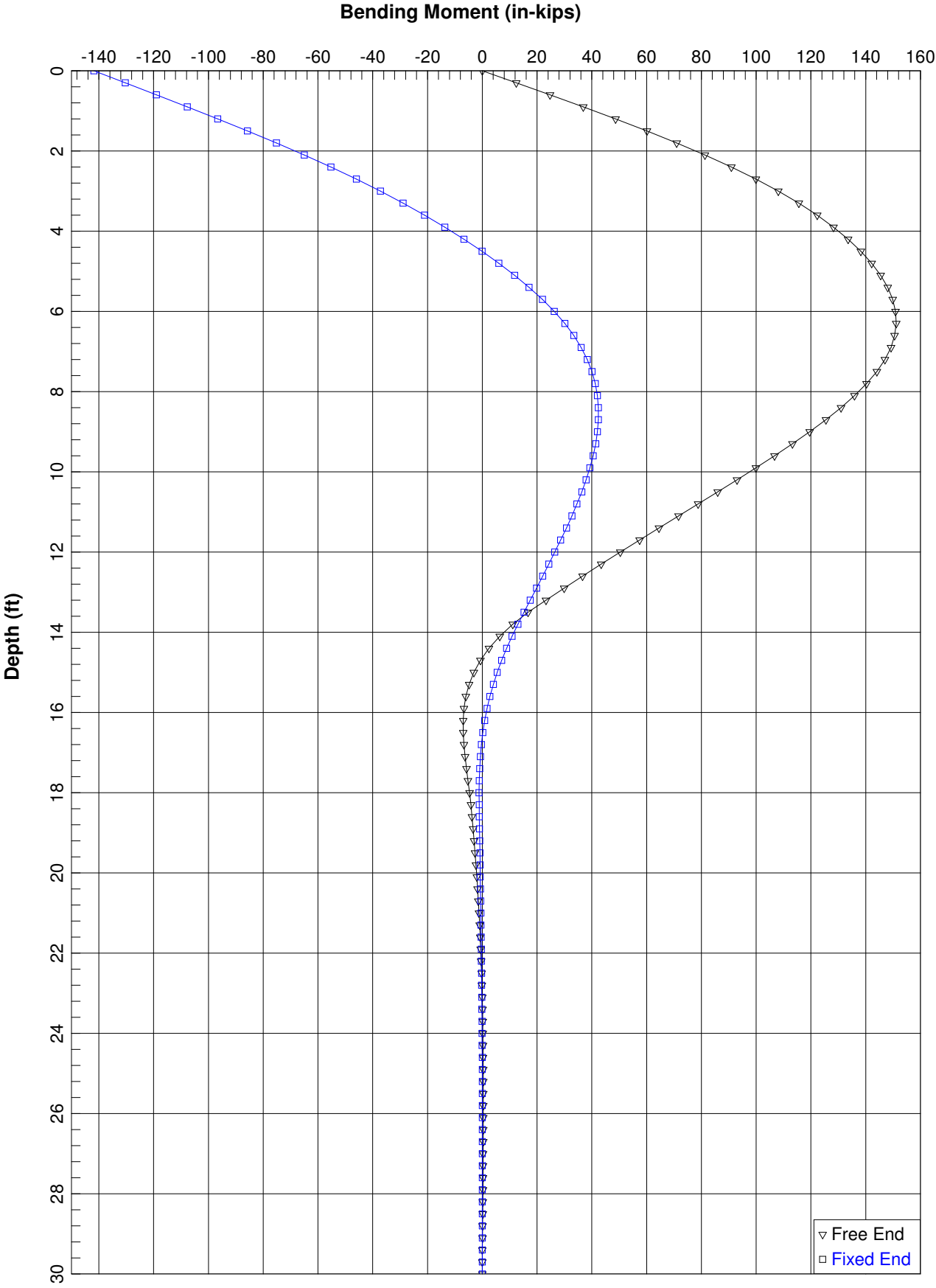
Bridge 11 Bent 3 Transverse Final Loads.lp60							
Load	Load	Condition 1	Condition 2	Axial	Pile-head		Moment
Case	Type	V(lbs)	Pile-head				
No.	No.	y(inches)	Rotation	Loading	Deflection		in Pile
			or in-lb, rad.,	lbs	inches		in-lbs
			or in-lb/rad.				
			radians				
1	2	V = -9173.0000	S = 0.000	525300.	-0.15435552		
1806829.		-9173.0000	0.00000000				
2	2	V = 23630.	S = 0.000	506800.	0.40931706		
-4589815.		23630.	0.00000000				

The analysis ended normally.

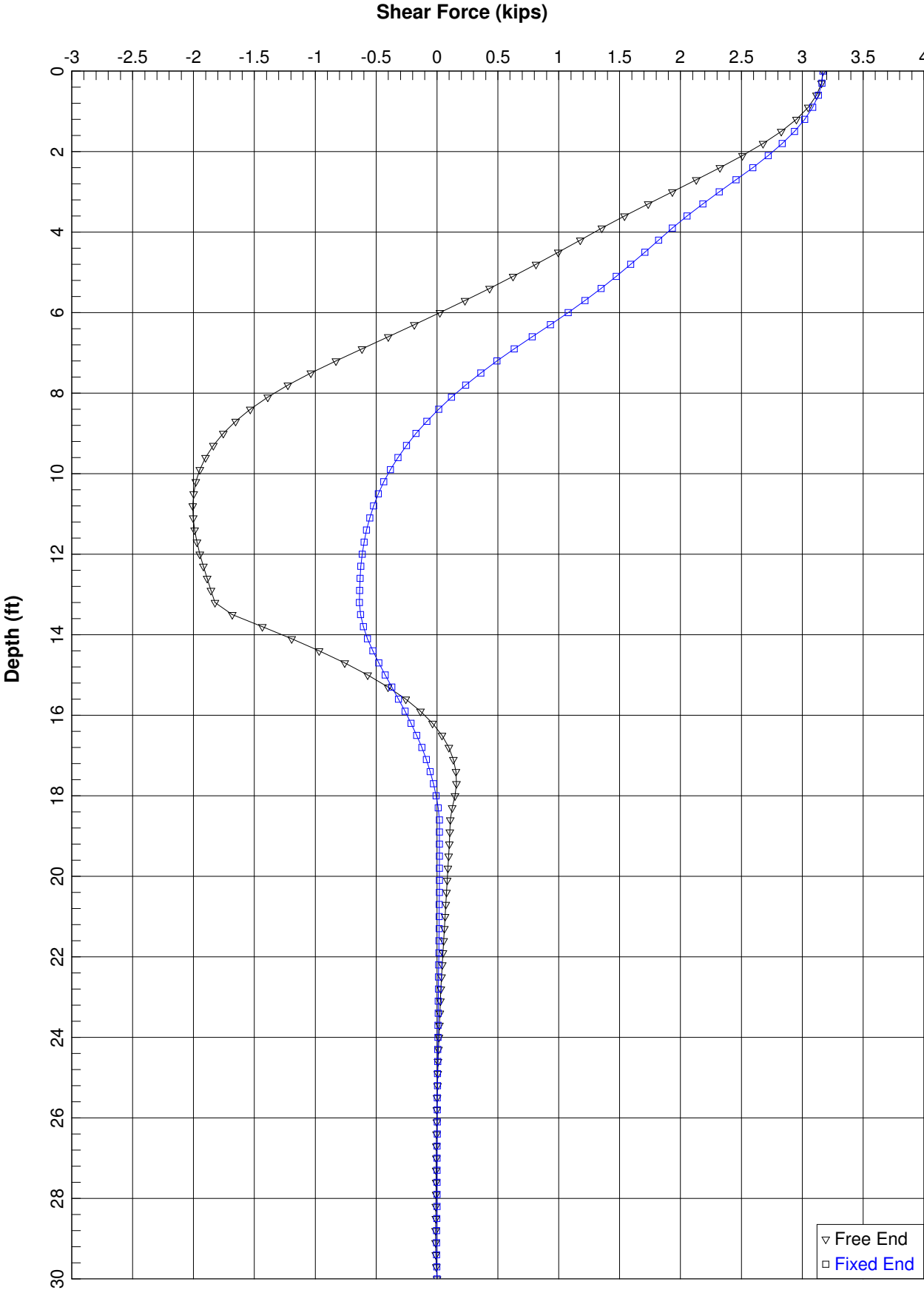
Bridge 11 Bent 4 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-04



Bridge 11 Bent 4 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-04



Bridge 11 Bent 4 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-04



Bridge 11 Bent 4 Longitudinal.lp6o

LPILE Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 Bent 4\
Name of input data file: Bridge 11 Bent 4 Longitudinal.lp6d
Name of output report file: Bridge 11 Bent 4 Longitudinal.lp6o
Name of plot output file: Bridge 11 Bent 4 Longitudinal.lp6p
Name of runtime message file: Bridge 11 Bent 4 Longitudinal.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:18:42

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 Bent 4 (Boring B11-SPT-05)

Bridge 11 Bent 4 Longitudinal.lp6o

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 30.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth x ft	Pile Diameter in
1	0.00000	12.0450000
2	30.000000	12.0450000

Input Structural Properties:

Bridge 11 Bent 4 Longitudinal.lp6o

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	30.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	393.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	13.50000 ft
Effective unit weight at top of layer	=	75.00000 pcf
Effective unit weight at bottom of layer	=	75.00000 pcf
Friction angle at top of layer	=	36.00000 deg.
Friction angle at bottom of layer	=	36.00000 deg.
Subgrade k at top of layer	=	105.00000 pci
Subgrade k at bottom of layer	=	105.00000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	13.50000 ft
Distance from top of pile to bottom of layer	=	18.50000 ft
Effective unit weight at top of layer	=	75.00000 pcf
Effective unit weight at bottom of layer	=	75.00000 pcf
Undrained cohesion at top of layer	=	8000.00000 psf
Undrained cohesion at bottom of layer	=	8000.00000 psf
Epsilon-50 at top of layer	=	0.00400
Epsilon-50 at bottom of layer	=	0.00400
Subgrade k at top of layer	=	2000.00000 pci
Subgrade k at bottom of layer	=	2000.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	18.50000 ft
Distance from top of pile to bottom of layer	=	28.50000 ft

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Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	28.50000	ft
Distance from top of pile to bottom of layer	=	39.10000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 9.10 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor Epsilon 50	Layer Soil Type kpy (p-y Curve Criteria) pci	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	75.000	--
36.000	--	105.000	13.500	75.000	--
36.000	--	105.000	13.500	75.000	8000.000
2	Stiff Clay w/o Free Water, using k	0.00400 2000.000	18.500	75.000	8000.000
--	0.00400	2000.000	18.500	75.000	--
3	Sand (Reese, et al.)		28.500	75.000	--
36.000	--	105.000	39.100	75.000	8000.000
36.000	--	105.000	39.100	75.000	8000.000
4	Stiff Clay w/o Free Water, using k	0.00400 2000.000			
--	0.00400	2000.000			
--	0.00400	2000.000			

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth x ft	Bridge 11 Bent 4 p-mult	Longitudinal.1p6o y-mult
1	0.000	0.5000	1.0000
2	30.000	0.5000	1.0000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	1	V = 3170.00000 lbs	M = 0.0000 in-lbs	205900.
	No			
2	2	V = 3170.00000 lbs	S = 0.0000 in/in	205900.
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Bridge 11 Bent 4 Longitudinal.lp6o

Shear force at pile head = 3170.000 lbs
 Applied moment at pile head = 0.000 in-lbs
 Axial thrust load on pile head = 205900.000 lbs

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. inches lb/inch	Bending Distrib. Load Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.00	0.1050	8.543E-08	3170.0000	-0.001361	13284.	1.140E+10	
-6.9410	0.300	0.1001	12421.	3157.5062	-0.001359	13474.	1.140E+10	
-14.9116	0.600	0.0952	24748.	3118.1716	-0.001353	13663.	1.140E+10	
-23.2334	0.900	0.0903	36877.	3049.5106	-0.001343	13849.	1.140E+10	
-31.2148	1.200	0.0855	48696.	2951.5038	-0.001330	14030.	1.140E+10	
-38.1749	1.500	0.0808	60099.	2826.6024	-0.001312	14205.	1.140E+10	
-44.4855	1.800	0.0761	70993.	2677.8138	-0.001292	14372.	1.140E+10	
-49.3416	2.100	0.0715	81294.	2508.9251	-0.001268	14530.	1.140E+10	
-53.0186	2.400	0.0670	90936.	2324.6769	-0.001240	14677.	1.140E+10	
-54.9865	2.700	0.0625	99870.	2130.2676	-0.001210	14814.	1.140E+10	
-54.8459	3.000	0.0582	108068.	1932.5692	-0.001177	14940.	1.140E+10	
-55.0864	3.300	0.0541	115530.	1734.6911	-0.001142	15054.	1.140E+10	
-53.4273	3.600	0.0500	122251.	1539.3665	-0.001105	15157.	1.140E+10	
-49.7164	3.900	0.0461	128251.	1353.7079	-0.001065	15249.	1.140E+10	
-49.0673	4.200	0.0423	133577.	1175.8972	-0.001024	15331.	1.140E+10	
-50.6784	4.500	0.0387	138235.	996.3549	-0.000981	15402.	1.140E+10	
-51.6337	4.800	0.0353	142204.	812.1930	-0.000936	15463.	1.140E+10	
-52.5715	5.100	0.0320	145471.	624.6236	-0.000891	15513.	1.140E+10	
-54.8181	5.400	0.0289	148022.	431.3223	-0.000845	15552.	1.140E+10	
-56.6817	5.700	0.0259	149829.	230.6226	-0.000798	15580.	1.140E+10	
-58.1308	6.000	0.0231	150865.	23.9600	-0.000750	15596.	1.140E+10	
-59.1382	6.300	0.0205	151113.	-187.1242	-0.000702	15600.	1.140E+10	
-59.6802	6.600	0.0181	150559.	-400.9974	-0.000655	15591.	1.140E+10	
-59.7373	6.900	0.0158	149196.	-615.9488	-0.000607	15570.	1.140E+10	
-59.2933	7.200	0.0137	147025.	-830.2038	-0.000561	15537.	1.140E+10	
	7.500	0.0118	144050.	-1036.9885	-0.000515	15491.	1.140E+10	

		Bridge 11 Bent 4 Longitudinal.lp6o				
-55.5870	17010.	0.000				
7.800	0.009994	140321.	-1225.4412	-0.000470	15434.	1.140E+10
-49.1089	17690.	0.000				
8.100	0.008382	135923.	-1390.8335	-0.000426	15367.	1.140E+10
-42.7757	18371.	0.000				
8.400	0.006926	130939.	-1533.8023	-0.000384	15290.	1.140E+10
-36.6514	19051.	0.000				
8.700	0.005618	125449.	-1655.2014	-0.000343	15206.	1.140E+10
-30.7926	19732.	0.000				
9.000	0.004453	119531.	-1756.0750	-0.000305	15116.	1.140E+10
-25.2483	20412.	0.000				
9.300	0.003424	113257.	-1837.6297	-0.000268	15019.	1.140E+10
-20.0599	21092.	0.000				
9.600	0.002523	106697.	-1901.2083	-0.000233	14919.	1.140E+10
-15.2615	21773.	0.000				
9.900	0.001744	99914.	-1948.2619	-0.000201	14815.	1.140E+10
-10.8794	22453.	0.000				
10.200	0.001079	92967.	-1980.3243	-0.000170	14709.	1.140E+10
-6.9330	23134.	0.000				
10.500	0.000519	85908.	-1998.9854	-0.000142	14600.	1.140E+10
-3.4343	23814.	0.000				
10.800	5.714E-05	78785.	-2005.8669	-0.000116	14491.	1.140E+10
-0.3888	24494.	0.000				
11.100	-0.000315	71638.	-2002.5978	-9.214E-05	14382.	1.140E+10
2.2050	25175.	0.000				
11.400	-0.000606	64503.	-1990.7909	-7.064E-05	14272.	1.140E+10
4.3544	25855.	0.000				
11.700	-0.000824	57409.	-1972.0213	-5.139E-05	14164.	1.140E+10
6.0732	26536.	0.000				
12.000	-0.000976	50380.	-1947.8044	-3.436E-05	14056.	1.140E+10
7.3807	27216.	0.000				
12.300	-0.001071	43435.	-1919.5759	-1.955E-05	13949.	1.140E+10
8.3018	27896.	0.000				
12.600	-0.001117	36588.	-1888.6722	-6.908E-06	13845.	1.140E+10
8.8669	28577.	0.000				
12.900	-0.001121	29847.	-1856.3120	3.585E-06	13741.	1.140E+10
9.1110	29257.	0.000				
13.200	-0.001091	23217.	-1823.5781	1.197E-05	13640.	1.140E+10
9.0745	29938.	0.000				
13.500	-0.001035	16700.	-1681.7810	1.827E-05	13540.	1.140E+10
69.7017	242458.	0.000				
13.800	-0.000960	11082.	-1433.7607	2.266E-05	13454.	1.140E+10
68.0873	255418.	0.000				
14.100	-0.000872	6343.1253	-1194.2186	2.541E-05	13381.	1.140E+10
64.9916	268378.	0.000				
14.400	-0.000777	2445.5068	-967.9746	2.680E-05	13321.	1.140E+10
60.6995	281338.	0.000				
14.700	-0.000679	-666.0185	-758.8235	2.708E-05	13294.	1.140E+10
55.4955	294298.	0.000				
15.000	-0.000582	-3058.1659	-569.5587	2.649E-05	13331.	1.140E+10
49.6516	307258.	0.000				
15.300	-0.000488	-4806.1131	-402.0340	2.525E-05	13358.	1.140E+10
43.4178	320218.	0.000				
15.600	-0.000400	-5990.2408	-257.2538	2.354E-05	13376.	1.140E+10
37.0157	333178.	0.000				
15.900	-0.000319	-6693.2431	-135.4849	2.154E-05	13386.	1.140E+10
30.6337	346138.	0.000				
16.200	-0.000245	-6997.6652	-36.3787	1.938E-05	13391.	1.140E+10
24.4253	359098.	0.000				
16.500	-0.000179	-6983.8970	40.9018	1.717E-05	13391.	1.140E+10
18.5083	372058.	0.000				
16.800	-0.000121	-6728.6259	97.5575	1.500E-05	13387.	1.140E+10
12.9671	385018.	0.000				

Bridge 11			Bent 4 Longitudinal.lp6o			
17.100	-7.106E-05	-6303.7262	135.0376	1.295E-05	13380.	1.140E+10
7.8552	397978.	0.000				
17.400	-2.804E-05	-5775.5467	154.9376	1.104E-05	13372.	1.140E+10
3.2003	410938.	0.000				
17.700	8.417E-06	-5204.5393	158.9141	9.304E-06	13364.	1.140E+10
-0.9911	423898.	0.000				
18.000	3.895E-05	-4645.1576	148.6221	7.748E-06	13355.	1.140E+10
-4.7267	436858.	0.000				
18.300	6.420E-05	-4145.9466	125.6741	6.360E-06	13347.	1.140E+10
-8.0222	449818.	0.000				
18.600	8.474E-05	-3749.7325	109.4597	5.113E-06	13341.	1.140E+10
-0.9858	41879.	0.000				
18.900	0.000101	-3365.4165	105.5357	3.989E-06	13335.	1.140E+10
-1.1942	42559.	0.000				
19.200	0.000113	-2995.7894	100.9330	2.984E-06	13330.	1.140E+10
-1.3628	43240.	0.000				
19.500	0.000123	-2643.1228	95.7898	2.094E-06	13324.	1.140E+10
-1.4945	43920.	0.000				
19.800	0.000129	-2309.2065	90.2333	1.312E-06	13319.	1.140E+10
-1.5925	44601.	0.000				
20.100	0.000132	-1995.3877	84.3795	6.317E-07	13314.	1.140E+10
-1.6596	45281.	0.000				
20.400	0.000133	-1702.6104	78.3338	4.767E-08	13310.	1.140E+10
-1.6991	45961.	0.000				
20.700	0.000132	-1431.4549	72.1903	-4.473E-07	13306.	1.140E+10
-1.7139	46642.	0.000				
21.000	0.000130	-1182.1769	66.0325	-8.601E-07	13302.	1.140E+10
-1.7071	47322.	0.000				
21.300	0.000126	-954.7458	59.9333	-1.198E-06	13299.	1.140E+10
-1.6814	48003.	0.000				
21.600	0.000121	-748.8818	53.9556	-1.467E-06	13295.	1.140E+10
-1.6396	48683.	0.000				
21.900	0.000116	-564.0911	48.1528	-1.674E-06	13293.	1.140E+10
-1.5842	49363.	0.000				
22.200	0.000109	-399.7000	42.5690	-1.826E-06	13290.	1.140E+10
-1.5178	50044.	0.000				
22.500	0.000102	-254.8866	37.2402	-1.930E-06	13288.	1.140E+10
-1.4426	50724.	0.000				
22.800	9.530E-05	-128.7101	32.1941	-1.990E-06	13286.	1.140E+10
-1.3607	51405.	0.000				
23.100	8.806E-05	-20.1384	27.4516	-2.014E-06	13284.	1.140E+10
-1.2740	52085.	0.000				
23.400	8.080E-05	71.9266	23.0267	-2.006E-06	13285.	1.140E+10
-1.1842	52765.	0.000				
23.700	7.362E-05	148.6271	18.9278	-1.971E-06	13286.	1.140E+10
-1.0929	53446.	0.000				
24.000	6.661E-05	211.1285	15.1579	-1.914E-06	13287.	1.140E+10
-1.0014	54126.	0.000				
24.300	5.984E-05	260.6016	11.7156	-1.839E-06	13288.	1.140E+10
-0.9110	54807.	0.000				
24.600	5.336E-05	298.2077	8.5954	-1.751E-06	13288.	1.140E+10
-0.8225	55487.	0.000				
24.900	4.723E-05	325.0843	5.7885	-1.653E-06	13289.	1.140E+10
-0.7369	56167.	0.000				
25.200	4.146E-05	342.3349	3.2836	-1.547E-06	13289.	1.140E+10
-0.6548	56848.	0.000				
25.500	3.609E-05	351.0197	1.0669	-1.438E-06	13289.	1.140E+10
-0.5767	57528.	0.000				
25.800	3.111E-05	352.1482	-0.8766	-1.327E-06	13289.	1.140E+10
-0.5031	58209.	0.000				
26.100	2.654E-05	346.6747	-2.5635	-1.216E-06	13289.	1.140E+10
-0.4341	58889.	0.000				
26.400	2.235E-05	335.4943	-4.0107	-1.109E-06	13289.	1.140E+10

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-0.3699	59569.	0.000				
26.700	1.855E-05	319.4415	-5.2354	-1.005E-06	13289.	1.140E+10
-0.3105	60250.	0.000				
27.000	1.512E-05	299.2894	-6.2549	-9.075E-07	13288.	1.140E+10
-0.2559	60930.	0.000				
27.300	1.202E-05	275.7514	-7.0858	-8.166E-07	13288.	1.140E+10
-0.2057	61611.	0.000				
27.600	9.237E-06	249.4826	-7.7438	-7.337E-07	13288.	1.140E+10
-0.1598	62291.	0.000				
27.900	6.738E-06	221.0840	-8.2436	-6.594E-07	13287.	1.140E+10
-0.1179	62971.	0.000				
28.200	4.490E-06	191.1061	-8.5987	-5.943E-07	13287.	1.140E+10
-0.0794	63652.	0.000				
28.500	2.459E-06	160.0546	-10.0021	-5.388E-07	13286.	1.140E+10
-0.7003	1025121.	0.000				
28.800	6.106E-07	119.8897	-11.5796	-4.946E-07	13286.	1.140E+10
-0.1761	1038081.	0.000				
29.100	-1.102E-06	77.4150	-11.3175	-4.634E-07	13285.	1.140E+10
0.3217	1051041.	0.000				
29.400	-2.726E-06	39.0908	-9.2882	-4.450E-07	13284.	1.140E+10
0.8057	1064001.	0.000				
29.700	-4.306E-06	11.1995	-5.5193	-4.371E-07	13284.	1.140E+10
1.2882	1076961.	0.000				
30.000	-5.873E-06	0.000	0.000	-4.353E-07	13284.	1.140E+10
1.7781	544960.	0.000				

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.1049791 inches
Computed slope at pile head	=	-0.0013606 radians
Maximum bending moment	=	151113. inch-lbs
Maximum shear force	=	3170.000000 lbs
Depth of maximum bending moment	=	75.600000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	11
Number of zero deflection points	=	3

----- Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2 -----

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	3170.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	205900.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil
Res. Soil	Spr. Distrib.	Moment	Force	S	Stress	Stiffness	p
X	y	Lat. Load					
Es*h	Lat. Load						
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/in
lb/inch	lb/inch						
-----	-----	-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----	-----	-----

Bridge 11 Bent 4 Longitudinal.lp6o							
0.00	0.0288	-141822.	3170.0000	0.000	15457.	1.140E+10	
0.000	0.000	0.000					
0.300	0.0287	-130393.	3161.1121	-4.299E-05	15282.	1.140E+10	
-4.9377	619.4673	0.000					
0.600	0.0285	-118998.	3133.2237	-8.238E-05	15107.	1.140E+10	
-10.5558	1334.9361	0.000					
0.900	0.0281	-107712.	3085.5422	-0.000118	14934.	1.140E+10	
-15.9340	2041.2000	0.000					
1.200	0.0276	-96607.	3019.2819	-0.000150	14764.	1.140E+10	
-20.8773	2721.6000	0.000					
1.500	0.0270	-85750.	2935.7436	-0.000179	14598.	1.140E+10	
-25.5329	3402.0000	0.000					
1.800	0.0263	-75204.	2836.0501	-0.000205	14436.	1.140E+10	
-29.8524	4082.4000	0.000					
2.100	0.0255	-65027.	2721.4823	-0.000227	14280.	1.140E+10	
-33.7964	4762.8000	0.000					
2.400	0.0247	-55273.	2593.4479	-0.000246	14131.	1.140E+10	
-37.3339	5443.2000	0.000					
2.700	0.0238	-45990.	2456.4407	-0.000262	13989.	1.140E+10	
-38.7812	5872.1572	0.000					
3.000	0.0228	-37198.	2318.3359	-0.000275	13854.	1.140E+10	
-37.9437	5989.3602	0.000					
3.300	0.0218	-28890.	2183.0885	-0.000285	13727.	1.140E+10	
-37.1938	6143.3210	0.000					
3.600	0.0208	-21057.	2053.0256	-0.000293	13607.	1.140E+10	
-35.0634	6082.7507	0.000					
3.900	0.0197	-13673.	1933.1197	-0.000299	13493.	1.140E+10	
-31.5511	5770.3540	0.000					
4.200	0.0186	-6695.5148	1820.9400	-0.000302	13386.	1.140E+10	
-30.7710	5955.4605	0.000					
4.500	0.0175	-114.9012	1708.0748	-0.000303	13286.	1.140E+10	
-31.9319	6565.1863	0.000					
4.800	0.0164	6051.9022	1591.7210	-0.000302	13377.	1.140E+10	
-32.7091	7171.8889	0.000					
5.100	0.0153	11793.	1472.3365	-0.000299	13465.	1.140E+10	
-33.6156	7891.7618	0.000					
5.400	0.0143	17096.	1347.5586	-0.000295	13546.	1.140E+10	
-35.7055	9011.6824	0.000					
5.700	0.0132	21933.	1215.5505	-0.000289	13620.	1.140E+10	
-37.6323	10254.	0.000					
6.000	0.0122	26276.	1076.9401	-0.000281	13687.	1.140E+10	
-39.3734	11632.	0.000					
6.300	0.0112	30103.	932.4331	-0.000272	13745.	1.140E+10	
-40.9082	13162.	0.000					
6.600	0.0102	33393.	782.8051	-0.000262	13796.	1.140E+10	
-42.2185	14861.	0.000					
6.900	0.009303	36128.	634.0211	-0.000251	13838.	1.140E+10	
-40.4393	15649.	0.000					
7.200	0.008420	38330.	492.4862	-0.000239	13871.	1.140E+10	
-38.1912	16330.	0.000					
7.500	0.007580	40029.	359.2749	-0.000227	13897.	1.140E+10	
-35.8151	17010.	0.000					
7.800	0.006786	41253.	234.7861	-0.000214	13916.	1.140E+10	
-33.3454	17690.	0.000					
8.100	0.006039	42036.	119.2978	-0.000201	13928.	1.140E+10	
-30.8148	18371.	0.000					
8.400	0.005339	42410.	12.9726	-0.000188	13934.	1.140E+10	
-28.2548	19051.	0.000					
8.700	0.004688	42408.	-84.1364	-0.000174	13934.	1.140E+10	
-25.6947	19732.	0.000					
9.000	0.004085	42063.	-172.0782	-0.000161	13928.	1.140E+10	
-23.1619	20412.	0.000					
9.300	0.003530	41407.	-250.9960	-0.000148	13918.	1.140E+10	

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-20.6814	21092.	0.000					
9.600	0.003022	40474.	-321.1189	-0.000135	13904.	1.140E+10	
-18.2758	21773.	0.000					
9.900	0.002560	39295.	-382.7528	-0.000122	13886.	1.140E+10	
-15.9653	22453.	0.000					
10.200	0.002142	37900.	-436.2712	-0.000110	13865.	1.140E+10	
-13.7672	23134.	0.000					
10.500	0.001768	36317.	-482.1059	-9.822E-05	13840.	1.140E+10	
-11.6965	23814.	0.000					
10.800	0.001435	34574.	-520.7371	-8.703E-05	13814.	1.140E+10	
-9.7653	24494.	0.000					
11.100	0.001142	32697.	-552.6843	-7.640E-05	13785.	1.140E+10	
-7.9832	25175.	0.000					
11.400	0.000885	30708.	-578.4968	-6.639E-05	13754.	1.140E+10	
-6.3571	25855.	0.000					
11.700	0.000664	28630.	-598.7442	-5.702E-05	13723.	1.140E+10	
-4.8915	26536.	0.000					
12.000	0.000475	26482.	-614.0076	-4.831E-05	13690.	1.140E+10	
-3.5882	27216.	0.000					
12.300	0.000316	24281.	-624.8708	-4.029E-05	13656.	1.140E+10	
-2.4469	27896.	0.000					
12.600	0.000185	22042.	-631.9116	-3.298E-05	13622.	1.140E+10	
-1.4647	28577.	0.000					
12.900	7.833E-05	19780.	-635.6938	-2.637E-05	13587.	1.140E+10	
-0.6366	29257.	0.000					
13.200	-5.370E-06	17504.	-636.7592	-2.048E-05	13552.	1.140E+10	
0.0447	29938.	0.000					
13.500	-6.916E-05	15225.	-628.2946	-1.532E-05	13517.	1.140E+10	
4.6579	242458.	0.000					
13.800	-0.000116	13003.	-605.1423	-1.086E-05	13483.	1.140E+10	
8.2045	255418.	0.000					
14.100	-0.000147	10884.	-570.6043	-7.084E-06	13451.	1.140E+10	
10.9833	268378.	0.000					
14.400	-0.000167	8905.4414	-527.3928	-3.958E-06	13420.	1.140E+10	
13.0231	281338.	0.000					
14.700	-0.000176	7093.1085	-478.0780	-1.432E-06	13393.	1.140E+10	
14.3740	294298.	0.000					
15.000	-0.000177	5465.4023	-425.0198	5.517E-07	13368.	1.140E+10	
15.1027	307258.	0.000					
15.300	-0.000172	4032.1477	-370.3189	2.052E-06	13346.	1.140E+10	
15.2867	320218.	0.000					
15.600	-0.000162	2796.0644	-315.7856	3.130E-06	13327.	1.140E+10	
15.0096	333178.	0.000					
15.900	-0.000149	1753.8508	-262.9255	3.849E-06	13311.	1.140E+10	
14.3571	346138.	0.000					
16.200	-0.000134	897.2950	-212.9390	4.267E-06	13298.	1.140E+10	
13.4131	359098.	0.000					
16.500	-0.000119	214.3634	-166.7332	4.443E-06	13287.	1.140E+10	
12.2568	372058.	0.000					
16.800	-0.000102	-309.7706	-124.9429	4.428E-06	13289.	1.140E+10	
10.9600	385018.	0.000					
17.100	-8.671E-05	-691.7901	-87.9597	4.270E-06	13294.	1.140E+10	
9.5862	397978.	0.000					
17.400	-7.174E-05	-949.4104	-55.9650	4.011E-06	13298.	1.140E+10	
8.1887	410938.	0.000					
17.700	-5.784E-05	-1100.6834	-28.9667	3.687E-06	13301.	1.140E+10	
6.8104	423898.	0.000					
18.000	-4.519E-05	-1163.4360	-6.8368	3.329E-06	13302.	1.140E+10	
5.4840	436858.	0.000					
18.300	-3.387E-05	-1154.8439	10.6515	2.963E-06	13302.	1.140E+10	
4.2318	449818.	0.000					
18.600	-2.386E-05	-1091.1377	18.7683	2.608E-06	13301.	1.140E+10	
0.2775	41879.	0.000					

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18.900	-1.509E-05	-1023.5792	19.5889	2.274E-06	13300.	1.140E+10
0.1784	42559.	0.000				
19.200	-7.482E-06	-953.4693	20.0717	1.962E-06	13298.	1.140E+10
0.0899	43240.	0.000				
19.500	-9.608E-07	-881.9715	20.2546	1.672E-06	13297.	1.140E+10
0.0117	43920.	0.000				
19.800	4.558E-06	-810.1152	20.1741	1.405E-06	13296.	1.140E+10
-0.0565	44601.	0.000				
20.100	9.155E-06	-738.8011	19.8651	1.160E-06	13295.	1.140E+10
-0.1152	45281.	0.000				
20.400	1.291E-05	-668.8064	19.3611	9.380E-07	13294.	1.140E+10
-0.1649	45961.	0.000				
20.700	1.591E-05	-600.7915	18.6934	7.375E-07	13293.	1.140E+10
-0.2061	46642.	0.000				
21.000	1.822E-05	-535.3072	17.8912	5.581E-07	13292.	1.140E+10
-0.2395	47322.	0.000				
21.300	1.993E-05	-472.8019	16.9818	3.989E-07	13291.	1.140E+10
-0.2657	48003.	0.000				
21.600	2.109E-05	-413.6295	15.9901	2.589E-07	13290.	1.140E+10
-0.2853	48683.	0.000				
21.900	2.179E-05	-358.0572	14.9388	1.370E-07	13289.	1.140E+10
-0.2988	49363.	0.000				
22.200	2.208E-05	-306.2735	13.8484	3.207E-08	13289.	1.140E+10
-0.3069	50044.	0.000				
22.500	2.202E-05	-258.3960	12.7374	-5.712E-08	13288.	1.140E+10
-0.3103	50724.	0.000				
22.800	2.167E-05	-214.4794	11.6220	-1.318E-07	13287.	1.140E+10
-0.3094	51405.	0.000				
23.100	2.107E-05	-174.5226	10.5162	-1.932E-07	13287.	1.140E+10
-0.3049	52085.	0.000				
23.400	2.028E-05	-138.4761	9.4324	-2.427E-07	13286.	1.140E+10
-0.2972	52765.	0.000				
23.700	1.933E-05	-106.2492	8.3810	-2.813E-07	13285.	1.140E+10
-0.2869	53446.	0.000				
24.000	1.825E-05	-77.7157	7.3706	-3.104E-07	13285.	1.140E+10
-0.2744	54126.	0.000				
24.300	1.709E-05	-52.7206	6.4083	-3.310E-07	13285.	1.140E+10
-0.2602	54807.	0.000				
24.600	1.587E-05	-31.0852	5.4997	-3.442E-07	13284.	1.140E+10
-0.2446	55487.	0.000				
24.900	1.461E-05	-12.6124	4.6491	-3.511E-07	13284.	1.140E+10
-0.2280	56167.	0.000				
25.200	1.334E-05	2.9086	3.8595	-3.526E-07	13284.	1.140E+10
-0.2107	56848.	0.000				
25.500	1.207E-05	15.6985	3.1330	-3.497E-07	13284.	1.140E+10
-0.1929	57528.	0.000				
25.800	1.082E-05	25.9844	2.4707	-3.431E-07	13284.	1.140E+10
-0.1750	58209.	0.000				
26.100	9.603E-06	33.9962	1.8729	-3.337E-07	13284.	1.140E+10
-0.1571	58889.	0.000				
26.400	8.421E-06	39.9641	1.3394	-3.220E-07	13284.	1.140E+10
-0.1393	59569.	0.000				
26.700	7.285E-06	44.1169	0.8691	-3.087E-07	13285.	1.140E+10
-0.1219	60250.	0.000				
27.000	6.199E-06	46.6792	0.4608	-2.944E-07	13285.	1.140E+10
-0.1049	60930.	0.000				
27.300	5.165E-06	47.8709	0.1128	-2.794E-07	13285.	1.140E+10
-0.0884	61611.	0.000				
27.600	4.187E-06	47.9058	-0.1767	-2.643E-07	13285.	1.140E+10
-0.0724	62291.	0.000				
27.900	3.262E-06	46.9906	-0.4098	-2.493E-07	13285.	1.140E+10
-0.0571	62971.	0.000				
28.200	2.392E-06	45.3248	-0.5886	-2.347E-07	13285.	1.140E+10

```

Bridge 11 Bent 4 Longitudinal.lp6o
-0.0423      63652.      0.000
  28.500    1.572E-06    43.1004    -1.4707 -2.208E-07    13285.  1.140E+10
-0.4478    1025121.      0.000
  28.800    8.022E-07    35.0628    -2.6931 -2.084E-07    13284.  1.140E+10
-0.2313    1038081.      0.000
  29.100    7.187E-08    24.0189    -3.1473 -1.991E-07    13284.  1.140E+10
-0.0210    1051041.      0.000
  29.400   -6.312E-07    12.6975    -2.8493 -1.933E-07    13284.  1.140E+10
0.1865     1064001.      0.000
  29.700   -1.320E-06     3.7908    -1.8028 -1.907E-07    13284.  1.140E+10
0.3948     1076961.      0.000
  30.000   -2.004E-06     0.000      0.000 -1.901E-07    13284.  1.140E+10
0.6067      544960.      0.000

```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```

Pile-head deflection          =      0.0287760 inches
Computed slope at pile head  =      0.000000 radians
Maximum bending moment        =     -141822. inch-lbs
Maximum shear force           =    3170.000000 lbs
Depth of maximum bending moment =      0.000000 inches below pile head
Depth of maximum shear force  =      0.000000 inches below pile head
Number of iterations          =              7
Number of zero deflection points =          3

```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

```

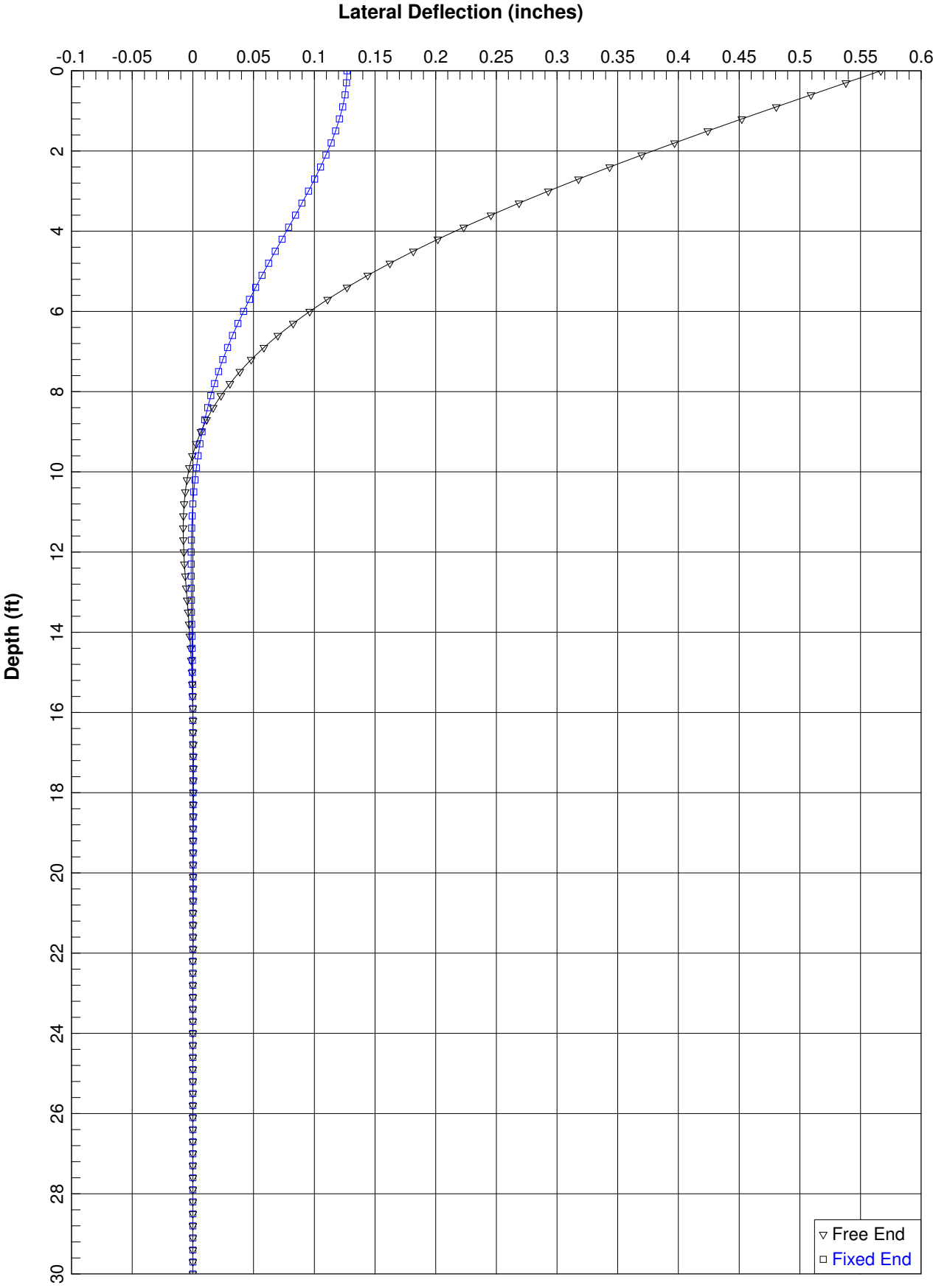
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

```

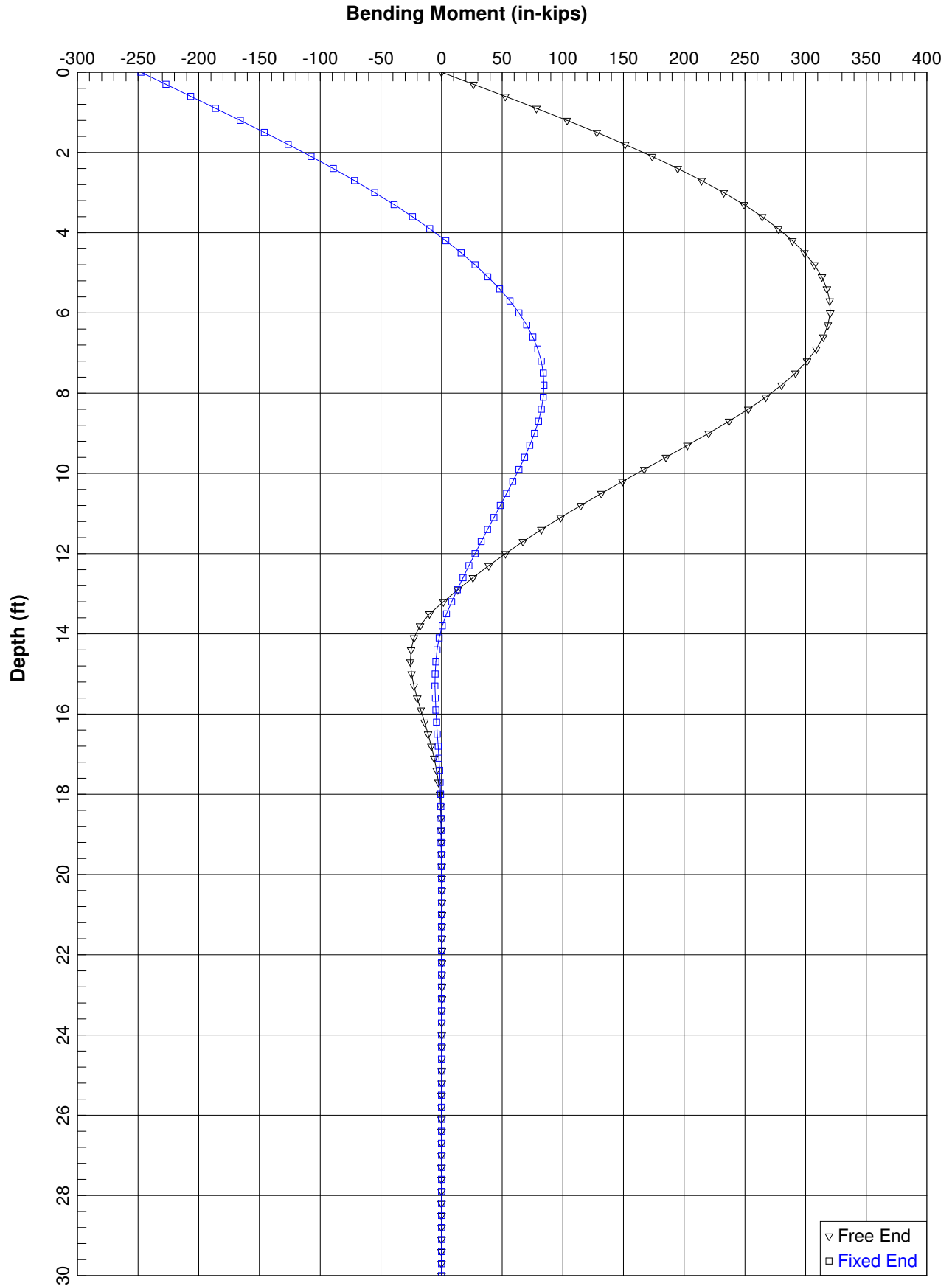
Load Case No.	Maximum Load Type	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 M or Rotation in-lb, rad., or in-lb/rad. radians	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in-lbs
1	1	V = 3170.0000	M = 0.000	205900.	0.10497908	
151113.		3170.0000	-0.00136059			
2	2	V = 3170.0000	S = 0.000	205900.	0.02877598	
-141822.		3170.0000	0.00000000			

The analysis ended normally.

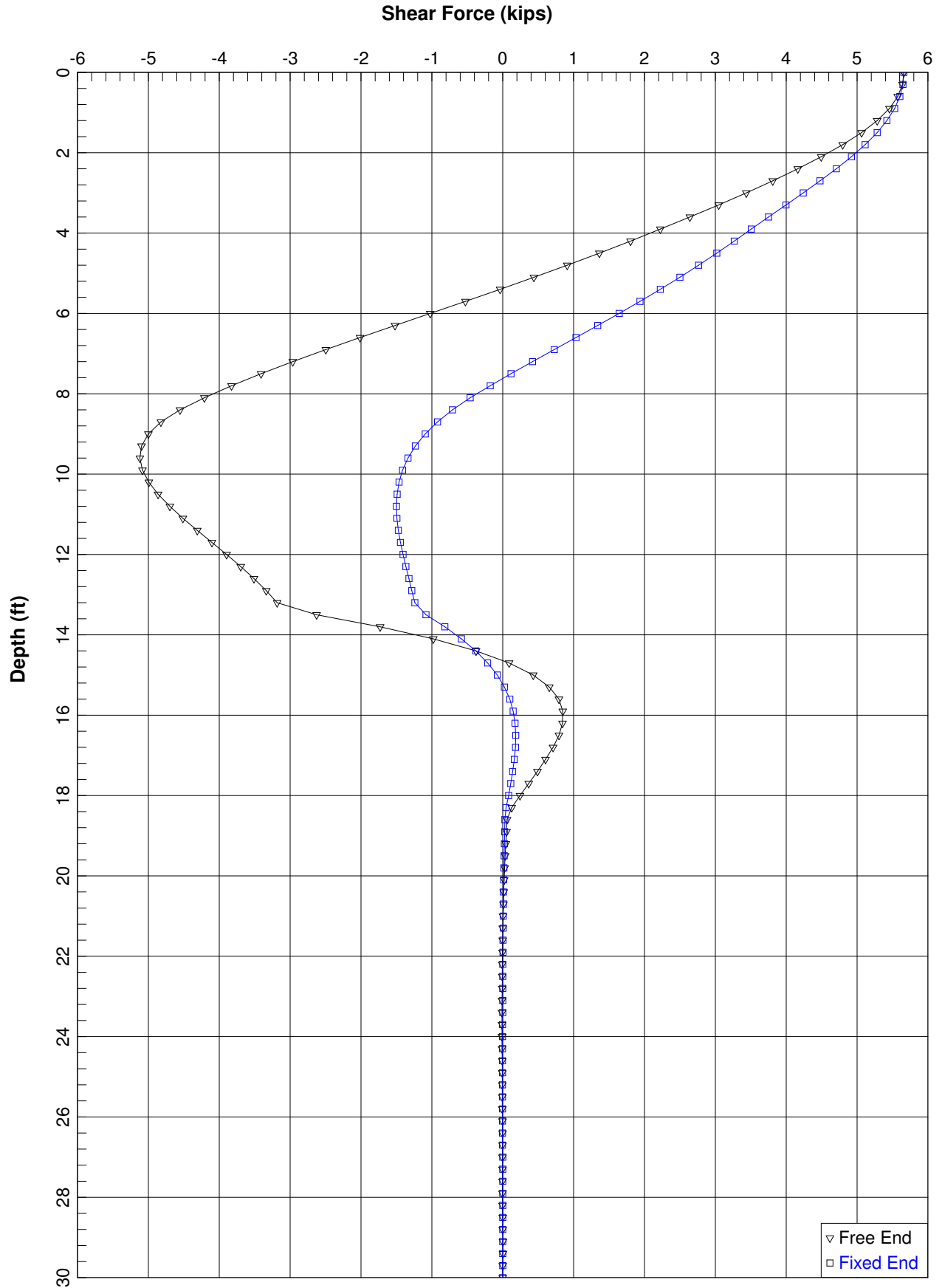
Bridge 11 Bent 4 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-04



Bridge 11 Bent 4 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-04



Bridge 11 Bent 4 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-04



Bridge 11 Bent 4 Transverse.lp6o

LPile Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 Bent 4\
Name of input data file: Bridge 11 Bent 4 Transverse.lp6d
Name of output report file: Bridge 11 Bent 4 Transverse.lp6o
Name of plot output file: Bridge 11 Bent 4 Transverse.lp6p
Name of runtime message file: Bridge 11 Bent 4 Transverse.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:21:10

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 Bent 4 (Boring B11-SPT-05)

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 30.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	12.0450000
2	30.000000	12.0450000

Input Structural Properties:

Bridge 11 Bent 4 Transverse.lp6o

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	30.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	127.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 4 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	13.50000 ft
Effective unit weight at top of layer	=	75.00000 pcf
Effective unit weight at bottom of layer	=	75.00000 pcf
Friction angle at top of layer	=	36.00000 deg.
Friction angle at bottom of layer	=	36.00000 deg.
Subgrade k at top of layer	=	105.00000 pci
Subgrade k at bottom of layer	=	105.00000 pci

Layer 2 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	13.50000 ft
Distance from top of pile to bottom of layer	=	18.50000 ft
Effective unit weight at top of layer	=	75.00000 pcf
Effective unit weight at bottom of layer	=	75.00000 pcf
Undrained cohesion at top of layer	=	8000.00000 psf
Undrained cohesion at bottom of layer	=	8000.00000 psf
Epsilon-50 at top of layer	=	0.00400
Epsilon-50 at bottom of layer	=	0.00400
Subgrade k at top of layer	=	2000.00000 pci
Subgrade k at bottom of layer	=	2000.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	18.50000 ft
Distance from top of pile to bottom of layer	=	28.50000 ft

Bridge 11 Bent 4 Transverse.lp6o

Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 4 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	28.50000	ft
Distance from top of pile to bottom of layer	=	39.10000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 9.10 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor (p-y Curve Criteria) Epsilon 50	Layer Soil Type kpy (pci)	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	75.000	--
36.000	--	105.000	13.500	75.000	--
36.000	--	105.000	13.500	75.000	8000.000
2	Stiff Clay w/o Free Water, using k		18.500	75.000	8000.000
--	0.00400	2000.000	18.500	75.000	8000.000
--	0.00400	2000.000	18.500	75.000	--
3	Sand (Reese, et al.)		28.500	75.000	--
36.000	--	105.000	28.500	75.000	--
36.000	--	105.000	28.500	75.000	8000.000
4	Stiff Clay w/o Free Water, using k		39.100	75.000	8000.000
--	0.00400	2000.000	39.100	75.000	8000.000
--	0.00400	2000.000			

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth x ft	Bridge 11 Bent 4 Transverse.lp60 p-mult	y-mult
1	0.000	0.5000	1.0000
2	30.000	0.5000	1.0000

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y vs. Pile Length				
1	1	V = 5660.00000 lbs	M = 0.0000 in-lbs	205900.
	No			
2	2	V = 5660.00000 lbs	S = 0.0000 in/in	205900.
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Bridge 11 Bent 4 Transverse.lp6o

Shear force at pile head = 5660.000 lbs
 Applied moment at pile head = 0.000 in-lbs
 Axial thrust load on pile head = 205900.000 lbs

Depth Res.	Soil X Es*h feet lb/inch	Deflect. Spr. y Lat. inches lb/inch	Bending Distrib. Load Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil p lb/in
0.000	0.00	0.5668	-2.524E-07	5660.0000	-0.008022	13284.	3.683E+09	
	0.300	0.5380	26322.	5639.7496	-0.008009	14532.	3.683E+09	
-11.2502	0.600	0.5092	52480.	5574.3842	-0.007971	15773.	3.683E+09	
-25.0638	0.900	0.4806	78275.	5457.0416	-0.007907	16996.	3.683E+09	
-40.1265	1.200	0.4522	103493.	5284.9463	-0.007818	18192.	3.683E+09	
-55.4820	1.500	0.4243	127917.	5062.8315	-0.007705	19350.	3.683E+09	
-67.9151	1.800	0.3968	151368.	4797.5079	-0.007569	20462.	3.683E+09	
-79.4870	2.100	0.3698	173679.	4494.8027	-0.007410	21520.	3.683E+09	
-88.6826	2.400	0.3434	194715.	4163.0700	-0.007230	22518.	3.683E+09	
-95.6133	2.700	0.3177	214371.	3808.4537	-0.007030	23450.	3.683E+09	
-101.3957	3.000	0.2928	232557.	3436.4590	-0.006811	24312.	3.683E+09	
-105.2680	3.300	0.2687	249211.	3046.5488	-0.006576	25102.	3.683E+09	
-111.3487	3.600	0.2454	264241.	2639.1189	-0.006325	25815.	3.683E+09	
-115.0013	3.900	0.2231	277589.	2224.0476	-0.006060	26448.	3.683E+09	
-115.5939	4.200	0.2018	289238.	1801.8504	-0.005783	27000.	3.683E+09	
-118.9602	4.500	0.1815	299136.	1363.7232	-0.005496	27469.	3.683E+09	
-124.4438	4.800	0.1622	307204.	908.7578	-0.005199	27852.	3.683E+09	
-128.3148	5.100	0.1441	313387.	441.5712	-0.004896	28145.	3.683E+09	
-131.2334	5.400	0.1270	317641.	-37.4871	-0.004587	28347.	3.683E+09	
-134.9101	5.700	0.1110	319918.	-527.4449	-0.004276	28455.	3.683E+09	
-137.2886	6.000	0.0962	320183.	-1023.4776	-0.003963	28467.	3.683E+09	
-138.2851	6.300	0.0825	318424.	-1520.4804	-0.003651	28384.	3.683E+09	
-137.8276	6.600	0.0699	314648.	-2013.1107	-0.003342	28205.	3.683E+09	
-135.8559	6.900	0.0584	308883.	-2495.8253	-0.003037	27931.	3.683E+09	
-132.3189	7.200	0.0481	301180.	-2962.9103	-0.002739	27566.	3.683E+09	
-127.1728	7.500	0.0387	291610.	-3408.4956	-0.002449	27112.	3.683E+09	

Bridge 11 Bent 4 Transverse.lp6o						
-120.3746	11189.	0.000				
7.800	0.0304	280269.	-3826.5427	-0.002169	26575.	3.683E+09
-111.8738	13237.	0.000				
8.100	0.0231	267275.	-4210.7849	-0.001902	25958.	3.683E+09
-101.5941	15826.	0.000				
8.400	0.0167	252771.	-4553.0506	-0.001648	25271.	3.683E+09
-88.5535	19051.	0.000				
8.700	0.0112	236936.	-4823.4036	-0.001408	24520.	3.683E+09
-61.6426	19732.	0.000				
9.000	0.006593	220130.	-5001.6533	-0.001185	23723.	3.683E+09
-37.3850	20412.	0.000				
9.300	0.002715	202681.	-5097.5789	-0.000978	22895.	3.683E+09
-15.9070	21092.	0.000				
9.600	-0.000450	184878.	-5121.3090	-0.000789	22051.	3.683E+09
2.7236	21773.	0.000				
9.900	-0.002965	166977.	-5083.1187	-0.000617	21202.	3.683E+09
18.4932	22453.	0.000				
10.200	-0.004892	149194.	-4993.2433	-0.000462	20359.	3.683E+09
31.4376	23134.	0.000				
10.500	-0.006294	131711.	-4861.7080	-0.000325	19530.	3.683E+09
41.6376	23814.	0.000				
10.800	-0.007233	114672.	-4698.1746	-0.000205	18722.	3.683E+09
49.2142	24494.	0.000				
11.100	-0.007768	98187.	-4511.8061	-0.000101	17940.	3.683E+09
54.3239	25175.	0.000				
11.400	-0.007958	82336.	-4311.1454	-1.245E-05	17188.	3.683E+09
57.1543	25855.	0.000				
11.700	-0.007858	67166.	-4104.0099	6.062E-05	16469.	3.683E+09
57.9209	26536.	0.000				
12.000	-0.007522	52697.	-3897.3989	0.000119	15783.	3.683E+09
56.8629	27216.	0.000				
12.300	-0.007000	38928.	-3697.4122	0.000164	15130.	3.683E+09
54.2408	27896.	0.000				
12.600	-0.006341	25833.	-3509.1773	0.000196	14509.	3.683E+09
50.3341	28577.	0.000				
12.900	-0.005591	13372.	-3336.7847	0.000215	13918.	3.683E+09
45.4396	29257.	0.000				
13.200	-0.004794	1489.5701	-3183.2267	0.000222	13355.	3.683E+09
39.8704	29938.	0.000				
13.500	-0.003992	-9876.8199	-2627.4650	0.000218	13752.	3.683E+09
268.8861	242458.	0.000				
13.800	-0.003225	-17751.	-1731.5896	0.000204	14126.	3.683E+09
228.8225	255418.	0.000				
14.100	-0.002520	-22647.	-981.5047	0.000185	14358.	3.683E+09
187.8913	268378.	0.000				
14.400	-0.001895	-25092.	-376.6958	0.000161	14474.	3.683E+09
148.1136	281338.	0.000				
14.700	-0.001358	-25599.	89.8048	0.000137	14498.	3.683E+09
111.0533	294298.	0.000				
15.000	-0.000912	-24648.	429.7699	0.000112	14453.	3.683E+09
77.8162	307258.	0.000				
15.300	-0.000552	-22671.	658.1785	8.892E-05	14359.	3.683E+09
49.0775	320218.	0.000				
15.600	-0.000272	-20041.	791.7518	6.804E-05	14234.	3.683E+09
25.1299	333178.	0.000				
15.900	-6.183E-05	-17071.	847.6873	4.991E-05	14093.	3.683E+09
5.9454	346138.	0.000				
16.200	8.779E-05	-14011.	842.6262	3.471E-05	13948.	3.683E+09
-8.7571	359098.	0.000				
16.500	0.000188	-11055.	791.8693	2.246E-05	13808.	3.683E+09
-19.4412	372058.	0.000				
16.800	0.000250	-8343.2738	708.8383	1.298E-05	13680.	3.683E+09
-26.6871	385018.	0.000				

		Bridge 11 Bent 4 Transverse.lp6o			
17.100	0.000282	-5970.9893	604.7683	5.987E-06	13567. 3.683E+09
-31.1296	397978.	0.000			
17.400	0.000293	-3997.8179	488.6070	1.115E-06	13473. 3.683E+09
-33.4045	410938.	0.000			
17.700	0.000290	-2454.6720	367.0945	-2.038E-06	13400. 3.683E+09
-34.1025	423898.	0.000			
18.000	0.000278	-1351.7155	244.9952	-3.899E-06	13348. 3.683E+09
-33.7305	436858.	0.000			
18.300	0.000262	-684.9271	125.4557	-4.894E-06	13316. 3.683E+09
-32.6803	449818.	0.000			
18.600	0.000243	-441.1794	61.5485	-5.444E-06	13305. 3.683E+09
-2.8236	41879.	0.000			
18.900	0.000222	-233.7064	51.7345	-5.774E-06	13295. 3.683E+09
-2.6286	42559.	0.000			
19.200	0.000201	-60.1311	42.6541	-5.918E-06	13287. 3.683E+09
-2.4160	43240.	0.000			
19.500	0.000180	82.1760	34.3581	-5.907E-06	13288. 3.683E+09
-2.1928	43920.	0.000			
19.800	0.000159	196.0044	26.8737	-5.771E-06	13293. 3.683E+09
-1.9651	44601.	0.000			
20.100	0.000138	284.2224	20.2078	-5.536E-06	13297. 3.683E+09
-1.7381	45281.	0.000			
20.400	0.000119	349.7082	14.3500	-5.227E-06	13300. 3.683E+09
-1.5162	45961.	0.000			
20.700	0.000101	395.2909	9.2758	-4.863E-06	13303. 3.683E+09
-1.3028	46642.	0.000			
21.000	8.375E-05	423.7027	4.9492	-4.462E-06	13304. 3.683E+09
-1.1009	47322.	0.000			
21.300	6.843E-05	437.5404	1.3253	-4.041E-06	13305. 3.683E+09
-0.9124	48003.	0.000			
21.600	5.465E-05	439.2360	-1.6473	-3.613E-06	13305. 3.683E+09
-0.7390	48683.	0.000			
21.900	4.242E-05	431.0355	-4.0245	-3.187E-06	13304. 3.683E+09
-0.5816	49363.	0.000			
22.200	3.170E-05	414.9850	-5.8646	-2.774E-06	13304. 3.683E+09
-0.4407	50044.	0.000			
22.500	2.244E-05	392.9230	-7.2270	-2.379E-06	13303. 3.683E+09
-0.3162	50724.	0.000			
22.800	1.457E-05	366.4779	-8.1707	-2.008E-06	13301. 3.683E+09
-0.2080	51405.	0.000			
23.100	7.986E-06	337.0710	-8.7531	-1.664E-06	13300. 3.683E+09
-0.1155	52085.	0.000			
23.400	2.588E-06	305.9226	-9.0293	-1.350E-06	13298. 3.683E+09
-0.0379	52765.	0.000			
23.700	-1.734E-06	274.0609	-9.0513	-1.066E-06	13297. 3.683E+09
0.0257	53446.	0.000			
24.000	-5.091E-06	242.3343	-8.8672	-8.141E-07	13295. 3.683E+09
0.0765	54126.	0.000			
24.300	-7.595E-06	211.4240	-8.5213	-5.923E-07	13294. 3.683E+09
0.1156	54807.	0.000			
24.600	-9.355E-06	181.8591	-8.0536	-4.001E-07	13292. 3.683E+09
0.1442	55487.	0.000			
24.900	-1.048E-05	154.0311	-7.4999	-2.359E-07	13291. 3.683E+09
0.1634	56167.	0.000			
25.200	-1.105E-05	128.2098	-6.8915	-9.800E-08	13290. 3.683E+09
0.1746	56848.	0.000			
25.500	-1.118E-05	104.5578	-6.2557	1.576E-08	13289. 3.683E+09
0.1787	57528.	0.000			
25.800	-1.094E-05	83.1457	-5.6156	1.075E-07	13288. 3.683E+09
0.1769	58209.	0.000			
26.100	-1.041E-05	63.9660	-4.9908	1.794E-07	13287. 3.683E+09
0.1702	58889.	0.000			
26.400	-9.649E-06	46.9463	-4.3969	2.336E-07	13286. 3.683E+09

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0.1597	59569.	0.000				
26.700	-8.725E-06	31.9618	-3.8467	2.722E-07	13285.	3.683E+09
0.1460	60250.	0.000				
27.000	-7.689E-06	18.8467	-3.3496	2.970E-07	13285.	3.683E+09
0.1301	60930.	0.000				
27.300	-6.587E-06	7.4045	-2.9124	3.098E-07	13284.	3.683E+09
0.1127	61611.	0.000				
27.600	-5.458E-06	-2.5821	-2.5395	3.122E-07	13284.	3.683E+09
0.0944	62291.	0.000				
27.900	-4.339E-06	-11.3428	-2.2329	3.054E-07	13284.	3.683E+09
0.0759	62971.	0.000				
28.200	-3.260E-06	-19.1115	-1.9925	2.905E-07	13285.	3.683E+09
0.0576	63652.	0.000				
28.500	-2.248E-06	-26.1195	-0.7368	2.684E-07	13285.	3.683E+09
0.6400	1025121.	0.000				
28.800	-1.327E-06	-24.8141	1.1042	2.435E-07	13285.	3.683E+09
0.3827	1038081.	0.000				
29.100	-4.943E-07	-18.5305	2.0529	2.223E-07	13285.	3.683E+09
0.1443	1051041.	0.000				
29.400	2.734E-07	-10.3629	2.1672	2.082E-07	13284.	3.683E+09
-0.0808	1064001.	0.000				
29.700	1.005E-06	-3.2351	1.4808	2.015E-07	13284.	3.683E+09
-0.3005	1076961.	0.000				
30.000	1.725E-06	0.000	0.000	2.000E-07	13284.	3.683E+09
-0.5221	544960.	0.000				

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.5668334 inches
Computed slope at pile head	=	-0.0080223 radians
Maximum bending moment	=	320183. inch-lbs
Maximum shear force	=	5660.000000 lbs
Depth of maximum bending moment	=	72.0000000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	14
Number of zero deflection points	=	4

----- Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2 -----

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	5660.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	205900.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth	Deflect.	Bending	Shear	Slope	Total	Bending	Soil
Res. Soil	Spr. Distrib.	Moment	Force	S	Stress	Stiffness	p
X	y	Lat. Load					
Es*h	Lat. Load						
feet	inches	in-lbs	lbs	radians	psi*	lb-in^2	lb/in
lb/inch	lb/inch						
-----	-----	-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----	-----	-----

		Bridge 11 Bent 4 Transverse.lp6o			
0.00	0.1270	-247637.	5660.0000	0.000	25027. 3.683E+09
0.000	0.000	0.000			
0.300	0.1266	-227171.	5646.6811	-0.000232	24057. 3.683E+09
-7.3994	210.4880	0.000			
0.600	0.1253	-206637.	5604.3249	-0.000444	23083. 3.683E+09
-16.1318	463.4182	0.000			
0.900	0.1234	-186162.	5529.4682	-0.000636	22112. 3.683E+09
-25.4552	742.8830	0.000			
1.200	0.1207	-165882.	5421.3307	-0.000808	21150. 3.683E+09
-34.6212	1032.2843	0.000			
1.500	0.1175	-145930.	5281.8681	-0.000960	20204. 3.683E+09
-42.8580	1312.6797	0.000			
1.800	0.1138	-126428.	5113.6742	-0.001094	19279. 3.683E+09
-50.5831	1599.8476	0.000			
2.100	0.1097	-107490.	4920.3244	-0.001208	18381. 3.683E+09
-56.8335	1865.7135	0.000			
2.400	0.1051	-89211.	4706.7718	-0.001304	17514. 3.683E+09
-61.8069	2116.5587	0.000			
2.700	0.1003	-71668.	4478.1518	-0.001383	16682. 3.683E+09
-65.2042	2340.9346	0.000			
3.000	0.0952	-54919.	4241.0454	-0.001445	15888. 3.683E+09
-66.5215	2516.3020	0.000			
3.300	0.0899	-38991.	3997.7814	-0.001490	15133. 3.683E+09
-68.6251	2748.8730	0.000			
3.600	0.0844	-23925.	3750.6836	-0.001521	14418. 3.683E+09
-68.6514	2926.9018	0.000			
3.900	0.0789	-9731.3118	3507.8597	-0.001538	13745. 3.683E+09
-66.2508	3022.0539	0.000			
4.200	0.0734	3610.9694	3267.9841	-0.001541	13455. 3.683E+09
-67.0135	3288.1927	0.000			
4.500	0.0678	16082.	3021.0039	-0.001531	14047. 3.683E+09
-70.1978	3725.7685	0.000			
4.800	0.0623	27632.	2764.1209	-0.001510	14594. 3.683E+09
-72.5150	4187.2631	0.000			
5.100	0.0570	38222.	2499.2263	-0.001477	15096. 3.683E+09
-74.6486	4718.0722	0.000			
5.400	0.0517	47817.	2224.2343	-0.001435	15551. 3.683E+09
-78.1247	5439.2746	0.000			
5.700	0.0466	56364.	1937.8029	-0.001384	15957. 3.683E+09
-81.0039	6254.6338	0.000			
6.000	0.0417	63821.	1642.1833	-0.001326	16310. 3.683E+09
-83.2292	7178.6019	0.000			
6.300	0.0371	70153.	1339.8181	-0.001260	16611. 3.683E+09
-84.7515	8228.6978	0.000			
6.600	0.0327	75336.	1033.3112	-0.001189	16856. 3.683E+09
-85.5301	9426.3589	0.000			
6.900	0.0285	79356.	725.3969	-0.001114	17047. 3.683E+09
-85.5334	10798.	0.000			
7.200	0.0246	82210.	418.9071	-0.001035	17182. 3.683E+09
-84.7387	12377.	0.000			
7.500	0.0211	83906.	116.7395	-0.000953	17263. 3.683E+09
-83.1322	14206.	0.000			
7.800	0.0178	84464.	-178.1732	-0.000871	17289. 3.683E+09
-80.7082	16339.	0.000			
8.100	0.0148	83915.	-459.3436	-0.000789	17263. 3.683E+09
-75.4976	18371.	0.000			
8.400	0.0121	82326.	-710.5233	-0.000708	17188. 3.683E+09
-64.0467	19051.	0.000			
8.700	0.009700	79848.	-921.5059	-0.000628	17070. 3.683E+09
-53.1659	19732.	0.000			
9.000	0.007579	76623.	-1094.5509	-0.000552	16917. 3.683E+09
-42.9702	20412.	0.000			
9.300	0.005727	72785.	-1232.2911	-0.000479	16735. 3.683E+09

Bridge 11 Bent 4 Transverse.lp6o

-33.5522	21092.	0.000					
9.600	0.004131	68460.	-1337.6549	-0.000410	16530.	3.683E+09	
-24.9832	21773.	0.000					
9.900	0.002776	63762.	-1413.7892	-0.000345	16308.	3.683E+09	
-17.3136	22453.	0.000					
10.200	0.001645	58793.	-1463.9861	-0.000285	16072.	3.683E+09	
-10.5736	23134.	0.000					
10.500	0.000722	53644.	-1491.6132	-0.000230	15828.	3.683E+09	
-4.7748	23814.	0.000					
10.800	-1.305E-05	48395.	-1500.0480	-0.000180	15579.	3.683E+09	
0.0888	24494.	0.000					
11.100	-0.000578	43111.	-1492.6176	-0.000136	15328.	3.683E+09	
4.0392	25175.	0.000					
11.400	-0.000990	37849.	-1472.5425	-9.619E-05	15079.	3.683E+09	
7.1136	25855.	0.000					
11.700	-0.001270	32651.	-1442.8859	-6.173E-05	14832.	3.683E+09	
9.3623	26536.	0.000					
12.000	-0.001435	27552.	-1406.5073	-3.231E-05	14590.	3.683E+09	
10.8481	27216.	0.000					
12.300	-0.001503	22573.	-1366.0199	-7.810E-06	14354.	3.683E+09	
11.6449	27896.	0.000					
12.600	-0.001491	17728.	-1323.7528	1.189E-05	14125.	3.683E+09	
11.8368	28577.	0.000					
12.900	-0.001417	13024.	-1281.7151	2.692E-05	13901.	3.683E+09	
11.5174	29257.	0.000					
13.200	-0.001297	8459.6710	-1241.5637	3.742E-05	13685.	3.683E+09	
10.7889	29938.	0.000					
13.500	-0.001148	4029.1554	-1082.9987	4.352E-05	13475.	3.683E+09	
77.3028	242458.	0.000					
13.800	-0.000984	597.5643	-818.1844	4.578E-05	13312.	3.683E+09	
69.8163	255418.	0.000					
14.100	-0.000818	-1929.6409	-582.7260	4.513E-05	13375.	3.683E+09	
60.9940	268378.	0.000					
14.400	-0.000659	-3664.9664	-380.2223	4.240E-05	13458.	3.683E+09	
51.5081	281338.	0.000					
14.700	-0.000513	-4730.0916	-212.0316	3.829E-05	13508.	3.683E+09	
41.9312	294298.	0.000					
15.000	-0.000383	-5248.3615	-77.6551	3.342E-05	13533.	3.683E+09	
32.7225	307258.	0.000					
15.300	-0.000272	-5338.7458	24.8483	2.824E-05	13537.	3.683E+09	
24.2238	320218.	0.000					
15.600	-0.000180	-5111.3210	98.4468	2.313E-05	13526.	3.683E+09	
16.6643	333178.	0.000					
15.900	-0.000106	-4664.2241	146.7478	1.836E-05	13505.	3.683E+09	
10.1696	346138.	0.000					
16.200	-4.789E-05	-4081.9495	173.6523	1.408E-05	13477.	3.683E+09	
4.7773	359098.	0.000					
16.500	-4.381E-06	-3434.8035	183.0664	1.041E-05	13447.	3.683E+09	
0.4528	372058.	0.000					
16.800	2.704E-05	-2779.3012	178.6750	7.371E-06	13416.	3.683E+09	
-2.8924	385018.	0.000					
17.100	4.869E-05	-2159.2711	163.7798	4.957E-06	13386.	3.683E+09	
-5.3827	397978.	0.000					
17.400	6.274E-05	-1607.4362	141.2002	3.116E-06	13360.	3.683E+09	
-7.1615	410938.	0.000					
17.700	7.113E-05	-1147.2495	113.2339	1.770E-06	13338.	3.683E+09	
-8.3754	423898.	0.000					
18.000	7.548E-05	-794.7765	81.6705	8.210E-07	13322.	3.683E+09	
-9.1598	436858.	0.000					
18.300	7.704E-05	-560.4387	47.8559	1.587E-07	13310.	3.683E+09	
-9.6261	449818.	0.000					
18.600	7.663E-05	-450.4495	28.9243	-3.354E-07	13305.	3.683E+09	
-0.8914	41879.	0.000					

		Bridge 11	Bent 4	Transverse.l	p6o		
18.900	7.463E-05	-351.6862	25.7318	-7.274E-07	13301.	3.683E+09	
-0.8822	42559.	0.000					
19.200	7.139E-05	-264.1019	22.6004	-1.028E-06	13296.	3.683E+09	
-0.8574	43240.	0.000					
19.500	6.722E-05	-187.4388	19.5808	-1.249E-06	13293.	3.683E+09	
-0.8201	43920.	0.000					
19.800	6.240E-05	-121.2684	16.7132	-1.400E-06	13290.	3.683E+09	
-0.7730	44601.	0.000					
20.100	5.714E-05	-65.0285	14.0280	-1.491E-06	13287.	3.683E+09	
-0.7187	45281.	0.000					
20.400	5.166E-05	-18.0563	11.5471	-1.532E-06	13285.	3.683E+09	
-0.6595	45961.	0.000					
20.700	4.611E-05	20.3812	9.2845	-1.530E-06	13285.	3.683E+09	
-0.5975	46642.	0.000					
21.000	4.064E-05	51.0608	7.2474	-1.496E-06	13286.	3.683E+09	
-0.5342	47322.	0.000					
21.300	3.535E-05	74.7798	5.4374	-1.434E-06	13287.	3.683E+09	
-0.4713	48003.	0.000					
21.600	3.032E-05	92.3363	3.8511	-1.352E-06	13288.	3.683E+09	
-0.4100	48683.	0.000					
21.900	2.561E-05	104.5127	2.4811	-1.256E-06	13289.	3.683E+09	
-0.3512	49363.	0.000					
22.200	2.127E-05	112.0622	1.3167	-1.150E-06	13289.	3.683E+09	
-0.2957	50044.	0.000					
22.500	1.733E-05	115.6982	0.3450	-1.039E-06	13289.	3.683E+09	
-0.2442	50724.	0.000					
22.800	1.379E-05	116.0861	-0.4490	-9.257E-07	13289.	3.683E+09	
-0.1969	51405.	0.000					
23.100	1.066E-05	113.8378	-1.0812	-8.133E-07	13289.	3.683E+09	
-0.1543	52085.	0.000					
23.400	7.936E-06	109.5075	-1.5682	-7.042E-07	13289.	3.683E+09	
-0.1163	52765.	0.000					
23.700	5.593E-06	103.5905	-1.9270	-6.000E-07	13289.	3.683E+09	
-0.0830	53446.	0.000					
24.000	3.615E-06	96.5223	-2.1744	-5.022E-07	13288.	3.683E+09	
-0.0544	54126.	0.000					
24.300	1.977E-06	88.6796	-2.3264	-4.117E-07	13288.	3.683E+09	
-0.0301	54807.	0.000					
24.600	6.512E-07	80.3826	-2.3986	-3.291E-07	13288.	3.683E+09	
-0.0100	55487.	0.000					
24.900	-3.921E-07	71.8973	-2.4057	-2.546E-07	13287.	3.683E+09	
0.006117	56167.	0.000					
25.200	-1.182E-06	63.4392	-2.3611	-1.885E-07	13287.	3.683E+09	
0.0187	56848.	0.000					
25.500	-1.749E-06	55.1771	-2.2771	-1.305E-07	13286.	3.683E+09	
0.0280	57528.	0.000					
25.800	-2.122E-06	47.2372	-2.1651	-8.048E-08	13286.	3.683E+09	
0.0343	58209.	0.000					
26.100	-2.329E-06	39.7079	-2.0347	-3.799E-08	13286.	3.683E+09	
0.0381	58889.	0.000					
26.400	-2.396E-06	32.6435	-1.8948	-2.629E-09	13285.	3.683E+09	
0.0396	59569.	0.000					
26.700	-2.348E-06	26.0692	-1.7527	2.607E-08	13285.	3.683E+09	
0.0393	60250.	0.000					
27.000	-2.208E-06	19.9852	-1.6147	4.857E-08	13285.	3.683E+09	
0.0374	60930.	0.000					
27.300	-1.998E-06	14.3711	-1.4859	6.537E-08	13285.	3.683E+09	
0.0342	61611.	0.000					
27.600	-1.737E-06	9.1897	-1.3703	7.688E-08	13284.	3.683E+09	
0.0301	62291.	0.000					
27.900	-1.444E-06	4.3913	-1.2707	8.352E-08	13284.	3.683E+09	
0.0253	62971.	0.000					
28.200	-1.136E-06	-0.0829	-1.1890	8.562E-08	13284.	3.683E+09	

```

                                Bridge 11 Bent 4 Transverse.lp6o
0.0201      63652.      0.000
  28.500 -8.280E-07    -4.2967    -0.7285    8.348E-08    13284.    3.683E+09
0.2358      1025121.    0.000
  28.800 -5.350E-07    -5.4518    -0.0264    7.872E-08    13284.    3.683E+09
0.1543      1038081.    0.000
  29.100 -2.612E-07    -4.6038     0.3885    7.380E-08    13284.    3.683E+09
0.0763      1051041.    0.000
  29.400 -3.584E-09    -2.7642     0.5276    7.020E-08    13284.    3.683E+09
0.001059    1064001.    0.000
  29.700  2.443E-07    -0.9089     0.3980    6.841E-08    13284.    3.683E+09
-0.0731    1076961.    0.000
  30.000  4.890E-07     0.000     0.000    6.796E-08    13284.    3.683E+09
-0.1480     544960.    0.000

```

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

```

Pile-head deflection          =      0.1269886 inches
Computed slope at pile head  =      0.000000 radians
Maximum bending moment       =      -247637. inch-lbs
Maximum shear force          =      5660.000000 lbs
Depth of maximum bending moment =      0.000000 inches below pile head
Depth of maximum shear force  =      0.000000 inches below pile head
Number of iterations         =      11
Number of zero deflection points =      4

```

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

```

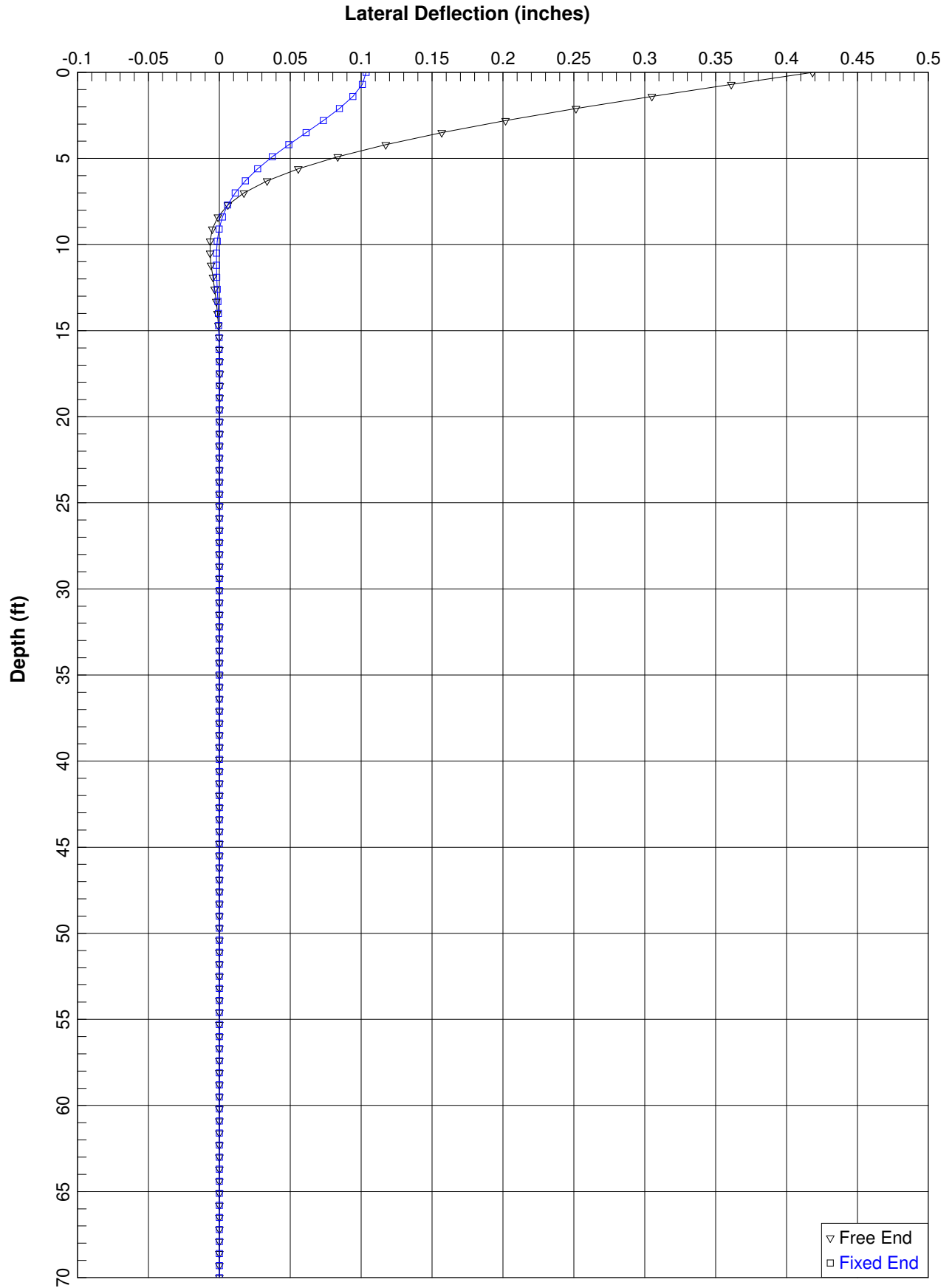
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

```

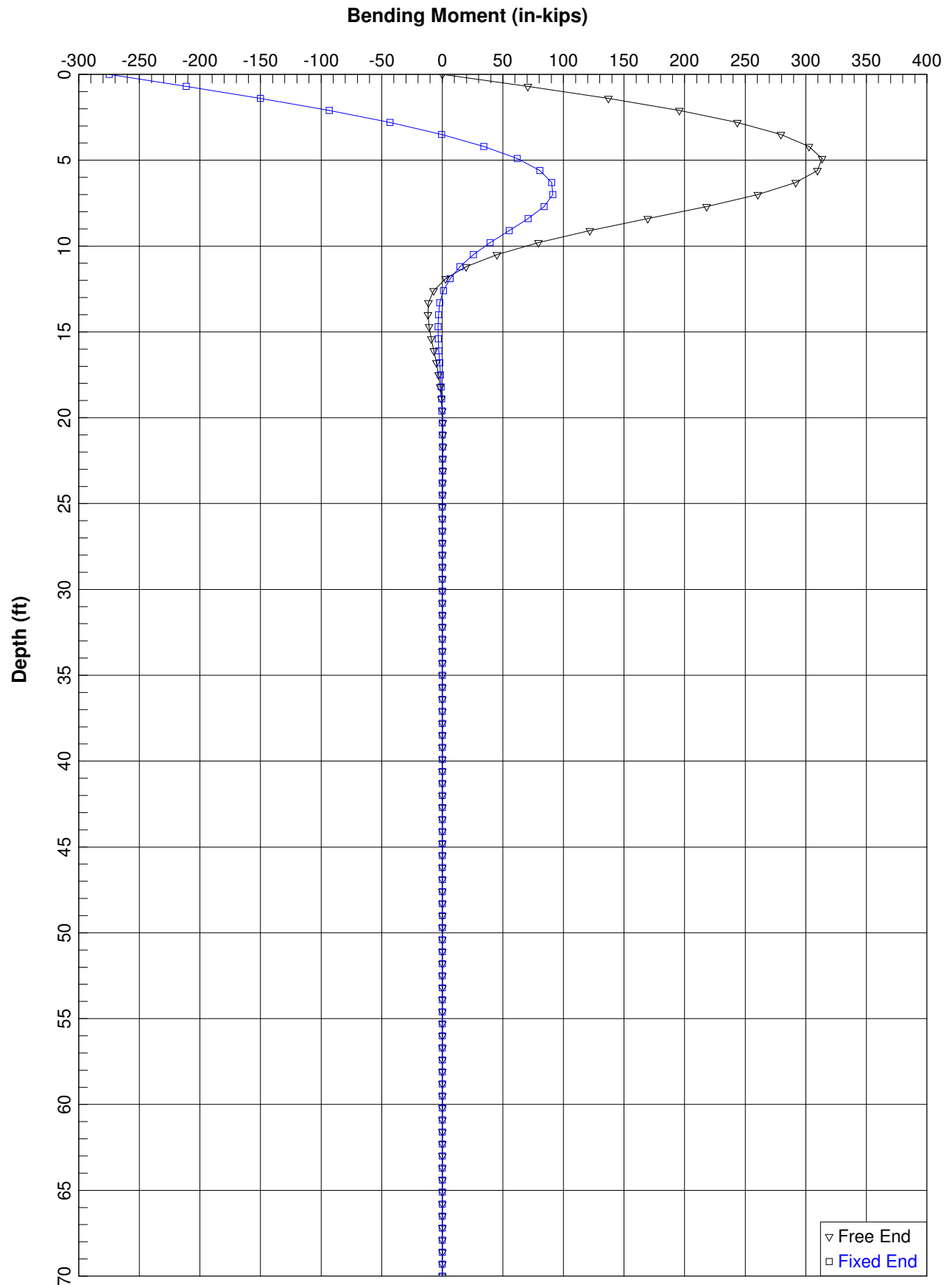
Load Case No.	Maximum Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 M = or in-lb, rad., or in-lb/rad. radians	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
1	1	V = 5660.0000	M = 0.000	205900.	0.56683340	
320183.		5660.0000	-0.00802230			
2	2	V = 5660.0000	S = 0.000	205900.	0.12698861	
-247637.		5660.0000	0.00000000			

The analysis ended normally.

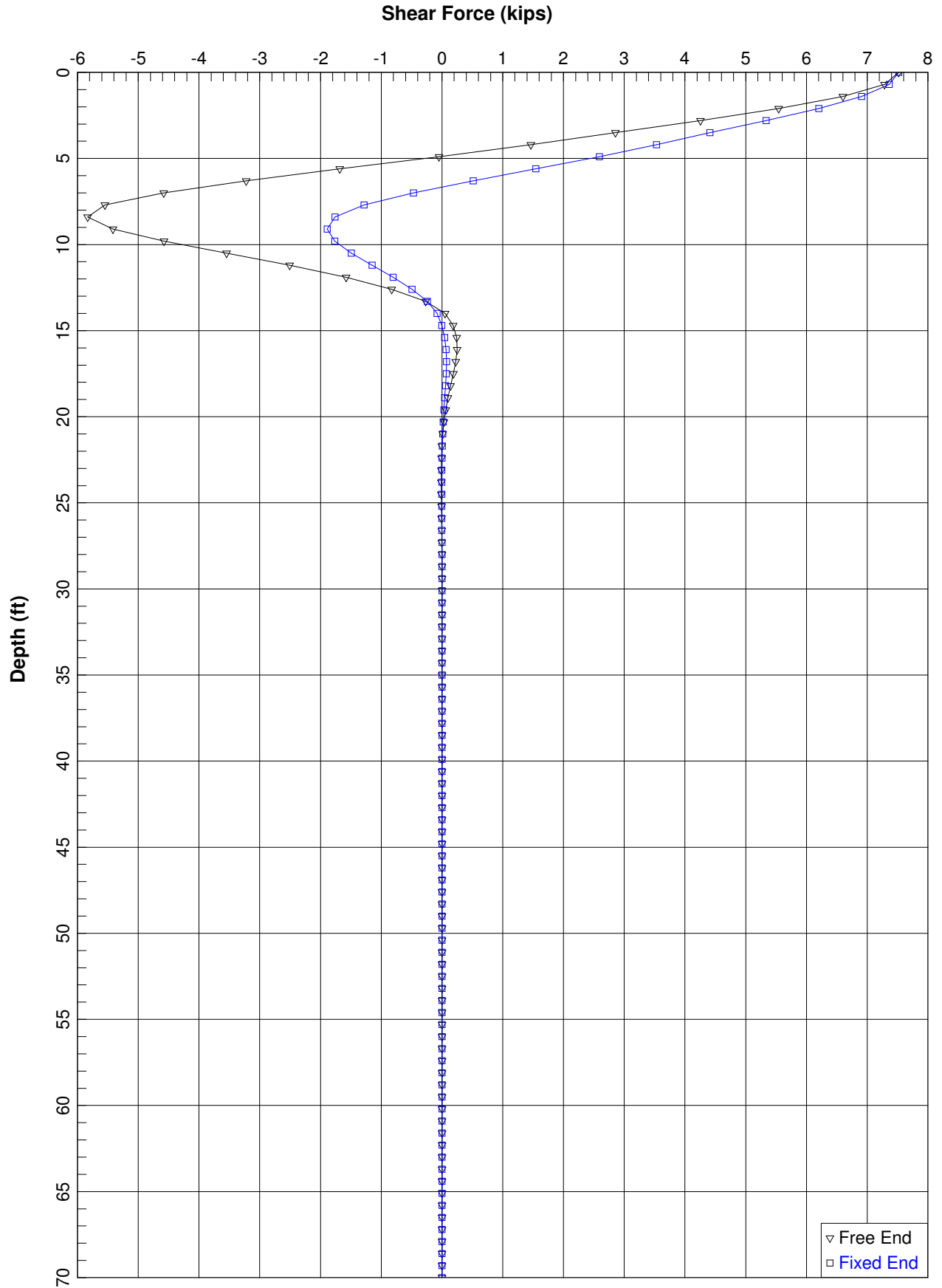
Bridge 11 End Bent 1 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-01



Bridge 11 End Bent 1 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-01



Bridge 11 End Bent 1 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-01



Bridge 11 End Bent 1 Longitudinal Provided.lp6o

LPile Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 End Bent 1\Bridge 11 End Bent 1 Provided Loads\
Name of input data file: Bridge 11 End Bent 1 Longitudinal Provided.lp6d
Name of output report file: Bridge 11 End Bent 1 Longitudinal Provided.lp6o
Name of plot output file: Bridge 11 End Bent 1 Longitudinal Provided.lp6p
Name of runtime message file: Bridge 11 End Bent 1 Longitudinal Provided.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:24:08

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 End Bent 1 (Boring B11-SPT-01)

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 70.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	12.0450000
2	70.000000	12.0450000

Input Structural Properties:

Bridge 11 End Bent 1 Longitudinal Provided.lp6o

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	70.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	127.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.30000 ft
Effective unit weight at top of layer	=	112.00000 pcf
Effective unit weight at bottom of layer	=	112.00000 pcf
Friction angle at top of layer	=	30.00000 deg.
Friction angle at bottom of layer	=	30.00000 deg.
Subgrade k at top of layer	=	45.00000 pci
Subgrade k at bottom of layer	=	45.00000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	4.30000 ft
Distance from top of pile to bottom of layer	=	13.30000 ft
Effective unit weight at top of layer	=	112.00000 pcf
Effective unit weight at bottom of layer	=	112.00000 pcf
Friction angle at top of layer	=	35.00000 deg.
Friction angle at bottom of layer	=	35.00000 deg.
Subgrade k at top of layer	=	165.00000 pci
Subgrade k at bottom of layer	=	165.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	13.30000 ft
Distance from top of pile to bottom of layer	=	26.30000 ft
Effective unit weight at top of layer	=	112.00000 pcf
Effective unit weight at bottom of layer	=	112.00000 pcf

Bridge 11 End Bent 1 Longitudinal Provided.lp6o

Friction angle at top of layer	=	32.00000	deg.
Friction angle at bottom of layer	=	32.00000	deg.
Subgrade k at top of layer	=	90.00000	pci
Subgrade k at bottom of layer	=	90.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	26.30000	ft
Distance from top of pile to bottom of layer	=	47.30000	ft
Effective unit weight at top of layer	=	57.00000	pcf
Effective unit weight at bottom of layer	=	57.00000	pcf
Friction angle at top of layer	=	34.00000	deg.
Friction angle at bottom of layer	=	34.00000	deg.
Subgrade k at top of layer	=	80.00000	pci
Subgrade k at bottom of layer	=	80.00000	pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	47.30000	ft
Distance from top of pile to bottom of layer	=	67.40000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	67.40000	ft
Distance from top of pile to bottom of layer	=	74.40000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 4.40 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor Epsilon 50	Layer Soil Type (p-y Curve Criteria) kpy pci	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf
1		Sand (Reese, et al.)	0.00	112.000	--
30.000	--	45.000	4.300	112.000	--

Bridge 11 End Bent 1 Longitudinal Provided.lp6o						
30.000	--	45.000				
2	Sand (Reese, et al.)		4.300	112.000	--	
35.000	--	165.000				
			13.300	112.000	--	
35.000	--	165.000				
3	Sand (Reese, et al.)		13.300	112.000	--	
32.000	--	90.000				
			26.300	112.000	--	
32.000	--	90.000				
4	Sand (Reese, et al.)		26.300	57.000	--	
34.000	--	80.000				
			47.300	57.000	--	
34.000	--	80.000				
5	Sand (Reese, et al.)		47.300	75.000	--	
36.000	--	105.000				
			67.400	75.000	--	
36.000	--	105.000				
6	Stiff clay w/o Free water, using k		67.400	75.000	8000.000	
--	0.00400	2000.000				
			74.400	75.000	8000.000	
--	0.00400	2000.000				

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	1	V = 7516.00000 lbs	M = 0.0000 in-lbs	129700.
	No			
2	2	V = 7516.00000 lbs	S = 0.0000 in/in	129700.
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applie to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Bridge 11 End Bent 1 Longitudinal Provided.lp6o
Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 7516.000 lbs
Applied moment at pile head = 0.000 in-lbs
Axial thrust load on pile head = 129700.000 lbs

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Load	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
feet	Es*h lb/inch	Lat. inches	Moment in-lbs	lbs	radians	psi*	lb-in^2	lb/in
0.000	0.00	0.4184	5.795E-09	7516.0000	-0.006831	8367.7419	3.683E+09	
-55.3567	0.700	0.3610	70576.	7283.5017	-0.006750	11715.	3.683E+09	
-107.5287	1.400	0.3050	137072.	6599.3827	-0.006514	14868.	3.683E+09	
-144.2373	2.100	0.2515	195639.	5541.9655	-0.006134	17645.	3.683E+09	
-162.5776	2.800	0.2019	243543.	4253.3429	-0.005633	19917.	3.683E+09	
-169.9396	3.500	0.1569	279370.	2856.7706	-0.005037	21616.	3.683E+09	
-162.2637	4.200	0.1173	302512.	1461.5168	-0.004373	22713.	3.683E+09	
-197.9029	4.900	0.0834	313453.	-51.1830	-0.003671	23232.	3.683E+09	
-190.6610	5.600	0.0556	309651.	-1683.1512	-0.002960	23052.	3.683E+09	
-176.4261	6.300	0.0337	291626.	-3224.9169	-0.002275	22197.	3.683E+09	
-146.5483	7.000	0.0174	260429.	-4581.4096	-0.001645	20718.	3.683E+09	
-83.8580	7.700	0.006062	218244.	-5549.1161	-0.001099	18717.	3.683E+09	
16.4643	8.400	-0.001082	169599.	-5832.1695	-0.000657	16410.	3.683E+09	
82.6341	9.100	-0.004976	121695.	-5415.9561	-0.000325	14139.	3.683E+09	
117.6531	9.800	-0.006539	79319.	-4574.7498	-9.563E-05	12129.	3.683E+09	
127.5587	10.500	-0.006583	45047.	-3544.8603	4.620E-05	10504.	3.683E+09	
119.6651	11.200	-0.005763	19665.	-2506.5203	0.000120	9300.2585	3.683E+09	
	11.900	-0.004567	2676.3778	-1579.0749	0.000145	8494.6591	3.683E+09	

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101.1552	186055.	0.000					
12.600	-0.003319	-7180.9095	-826.1096	0.000140	8708.2697	3.683E+09	
78.1223	197698.	0.000					
13.300	-0.002209	-11508.	-266.7460	0.000119	8913.4680	3.683E+09	
55.0595	209340.	0.000					
14.000	-0.001320	-11922.	50.5189	9.230E-05	8933.0786	3.683E+09	
20.4797	130347.	0.000					
14.700	-0.000659	-10860.	181.5502	6.632E-05	8882.7584	3.683E+09	
10.7182	136698.	0.000					
15.400	-0.000206	-9016.0580	241.2685	4.366E-05	8795.2948	3.683E+09	
3.5004	143048.	0.000					
16.100	7.480E-05	-6902.2702	250.3826	2.550E-05	8695.0563	3.683E+09	
-1.3304	149399.	0.000					
16.800	0.000223	-4865.2015	227.4359	1.208E-05	8598.4559	3.683E+09	
-4.1331	155749.	0.000					
17.500	0.000278	-3107.6784	187.5598	2.992E-06	8515.1120	3.683E+09	
-5.3612	162099.	0.000					
18.200	0.000273	-1720.7173	142.0341	-2.514E-06	8449.3405	3.683E+09	
-5.4783	168450.	0.000					
18.900	0.000236	-716.0269	98.4356	-5.293E-06	8401.6968	3.683E+09	
-4.9023	174800.	0.000					
19.600	0.000184	-55.4667	61.1560	-6.173E-06	8370.3722	3.683E+09	
-3.9737	181151.	0.000					
20.300	0.000132	324.8443	32.1023	-5.865E-06	8383.1465	3.683E+09	
-2.9438	187501.	0.000					
21.000	8.573E-05	496.6320	11.4293	-4.929E-06	8391.2928	3.683E+09	
-1.9783	193851.	0.000					
21.700	4.908E-05	527.5949	-1.7929	-3.761E-06	8392.7612	3.683E+09	
-1.1698	200202.	0.000					
22.400	2.255E-05	474.7052	-9.0347	-2.618E-06	8390.2531	3.683E+09	
-0.5544	206552.	0.000					
23.100	5.107E-06	381.5151	-11.9070	-1.641E-06	8385.8339	3.683E+09	
-0.1294	212903.	0.000					
23.800	-5.024E-06	278.2435	-11.8999	-8.888E-07	8380.9366	3.683E+09	
0.1311	219253.	0.000					
24.500	-9.825E-06	183.5334	-10.2409	-3.622E-07	8376.4453	3.683E+09	
0.2639	225603.	0.000					
25.200	-1.111E-05	106.9854	-7.8443	-3.089E-08	8372.8153	3.683E+09	
0.3068	231954.	0.000					
25.900	-1.034E-05	51.8163	-5.3235	1.502E-07	8370.1991	3.683E+09	
0.2934	238304.	0.000					
26.600	-8.585E-06	17.2235	-3.3232	2.289E-07	8368.5587	3.683E+09	
0.1828	178868.	0.000					
27.300	-6.497E-06	-4.5124	-1.9559	2.434E-07	8367.9559	3.683E+09	
0.1427	184513.	0.000					
28.000	-4.496E-06	-16.1666	-0.9290	2.198E-07	8368.5086	3.683E+09	
0.1018	190158.	0.000					
28.700	-2.804E-06	-20.5993	-0.2271	1.779E-07	8368.7188	3.683E+09	
0.0654	195803.	0.000					
29.400	-1.507E-06	-20.3689	0.1992	1.312E-07	8368.7079	3.683E+09	
0.0361	201447.	0.000					
30.100	-5.999E-07	-17.5381	0.4131	8.797E-08	8368.5736	3.683E+09	
0.0148	207092.	0.000					
30.800	-2.890E-08	-13.6202	0.4783	5.244E-08	8368.3878	3.683E+09	
0.000732	212737.	0.000					
31.500	2.811E-07	-9.6168	0.4507	2.594E-08	8368.1980	3.683E+09	
-0.007309	218382.	0.000					
32.200	4.069E-07	-6.1052	0.3744	8.012E-09	8368.0315	3.683E+09	
-0.0109	224027.	0.000					
32.900	4.157E-07	-3.3442	0.2811	-2.764E-09	8367.9005	3.683E+09	
-0.0114	229671.	0.000					
33.600	3.605E-07	-1.3770	0.1909	-8.148E-09	8367.8072	3.683E+09	
-0.0101	235316.	0.000					

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34.300	2.789E-07	-0.1189	0.1149	-9.854E-09	8367.7476	3.683E+09
-0.007999	240961.	0.000				
35.000	1.949E-07	0.5752	0.0573	-9.333E-09	8367.7692	3.683E+09
-0.005723	246606.	0.000				
35.700	1.221E-07	0.8639	0.0179	-7.692E-09	8367.7829	3.683E+09
-0.003665	252251.	0.000				
36.400	6.572E-08	0.8919	-0.006013	-5.690E-09	8367.7842	3.683E+09
-0.002018	257895.	0.000				
37.100	2.647E-08	0.7753	-0.0180	-3.789E-09	8367.7787	3.683E+09
-0.000830	263540.	0.000				
37.800	2.068E-09	0.5982	-0.0217	-2.222E-09	8367.7703	3.683E+09
-6.626E-05	269185.	0.000				
38.500	-1.087E-08	0.4149	-0.0205	-1.067E-09	8367.7616	3.683E+09
0.000356	274830.	0.000				
39.200	-1.586E-08	0.2557	-0.0168	-3.025E-10	8367.7541	3.683E+09
0.000530	280475.	0.000				
39.900	-1.595E-08	0.1332	-0.0123	1.409E-10	8367.7483	3.683E+09
0.000543	286119.	0.000				
40.600	-1.349E-08	0.0487	-0.008050	3.484E-10	8367.7442	3.683E+09
0.000469	291764.	0.000				
41.300	-1.010E-08	-0.002810	-0.004579	4.007E-10	8367.7421	3.683E+09
0.000358	297409.	0.000				
42.000	-6.761E-09	-0.0291	-0.002053	3.643E-10	8367.7433	3.683E+09
0.000244	303054.	0.000				
42.700	-3.980E-09	-0.0381	-0.000414	2.877E-10	8367.7437	3.683E+09
0.000146	308699.	0.000				
43.400	-1.928E-09	-0.0367	0.000503	2.025E-10	8367.7437	3.683E+09
7.214E-05	314343.	0.000				
44.100	-5.785E-10	-0.0301	0.000899	1.263E-10	8367.7434	3.683E+09
2.204E-05	319988.	0.000				
44.800	1.947E-10	-0.0218	0.000960	6.712E-11	8367.7430	3.683E+09
-7.547E-06	325633.	0.000				
45.500	5.492E-10	-0.0141	0.000837	2.613E-11	8367.7426	3.683E+09
-2.166E-05	331278.	0.000				
46.200	6.337E-10	-0.007843	0.000639	1.108E-12	8367.7423	3.683E+09
-2.542E-05	336923.	0.000				
46.900	5.679E-10	-0.003362	0.000435	-1.167E-11	8367.7421	3.683E+09
-2.316E-05	342567.	0.000				
47.600	4.376E-10	-0.000505	0.000258	-1.608E-11	8367.7420	3.683E+09
-1.901E-05	364850.	0.000				
48.300	2.977E-10	0.001011	0.000123	-1.550E-11	8367.7420	3.683E+09
-1.319E-05	372258.	0.000				
49.000	1.772E-10	0.001593	3.387E-05	-1.253E-11	8367.7420	3.683E+09
-8.008E-06	379667.	0.000				
49.700	8.716E-11	0.001607	-1.663E-05	-8.884E-12	8367.7420	3.683E+09
-4.016E-06	387076.	0.000				
50.400	2.792E-11	0.001333	-3.901E-05	-5.531E-12	8367.7420	3.683E+09
-1.311E-06	394485.	0.000				
51.100	-5.769E-12	0.000964	-4.336E-05	-2.912E-12	8367.7420	3.683E+09
2.760E-07	401894.	0.000				
51.800	-2.100E-11	0.000611	-3.790E-05	-1.116E-12	8367.7420	3.683E+09
1.023E-06	409302.	0.000				
52.500	-2.451E-11	0.000329	-2.850E-05	0.000	8367.7420	3.683E+09
1.216E-06	416711.	0.000				
53.200	-2.172E-11	0.000133	-1.878E-05	0.000	8367.7419	3.683E+09
1.097E-06	424120.	0.000				
53.900	-1.639E-11	1.282E-05	-1.064E-05	0.000	8367.7419	3.683E+09
8.418E-07	431529.	0.000				
54.600	-1.081E-11	-4.758E-05	-4.733E-06	0.000	8367.7419	3.683E+09
5.647E-07	438938.	0.000				
55.300	-6.139E-12	-6.803E-05	-9.917E-07	0.000	8367.7419	3.683E+09
3.262E-07	446346.	0.000				
56.000	-2.774E-12	-6.529E-05	1.008E-06	0.000	8367.7419	3.683E+09

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1.499E-07	453755.	0.000					
56.700	0.000	-5.181E-05	1.789E-06	0.000	8367.7419	3.683E+09	
3.624E-08	461164.	0.000					
57.400	0.000	-3.564E-05	1.834E-06	0.000	8367.7419	3.683E+09	
-2.572E-08	468573.	0.000					
58.100	0.000	-2.121E-05	1.511E-06	0.000	8367.7419	3.683E+09	
-5.098E-08	475982.	0.000					
58.800	0.000	-1.031E-05	1.072E-06	0.000	8367.7419	3.683E+09	
-5.362E-08	483390.	0.000					
59.500	0.000	-3.179E-06	6.588E-07	0.000	8367.7419	3.683E+09	
-4.478E-08	490799.	0.000					
60.200	0.000	8.044E-07	3.362E-07	0.000	8367.7419	3.683E+09	
-3.203E-08	498208.	0.000					
60.900	0.000	2.526E-06	1.185E-07	0.000	8367.7419	3.683E+09	
-1.981E-08	505617.	0.000					
61.600	0.000	2.844E-06	-7.346E-09	0.000	8367.7419	3.683E+09	
-1.017E-08	513026.	0.000					
62.300	0.000	2.438E-06	-6.526E-08	0.000	8367.7419	3.683E+09	
-3.621E-09	520434.	0.000					
63.000	0.000	1.770E-06	-7.970E-08	0.000	8367.7419	3.683E+09	
1.829E-10	527843.	0.000					
63.700	0.000	1.111E-06	-7.081E-08	0.000	8367.7419	3.683E+09	
1.934E-09	535252.	0.000					
64.400	0.000	5.848E-07	-5.278E-08	0.000	8367.7419	3.683E+09	
2.359E-09	542661.	0.000					
65.100	0.000	2.240E-07	-3.422E-08	0.000	8367.7419	3.683E+09	
2.061E-09	550070.	0.000					
65.800	0.000	8.030E-09	-1.939E-08	0.000	8367.7419	3.683E+09	
1.469E-09	557478.	0.000					
66.500	0.000	-1.043E-07	-9.651E-09	0.000	8367.7419	3.683E+09	
8.506E-10	564887.	0.000					
67.200	0.000	-1.563E-07	-4.602E-09	0.000	8367.7419	3.683E+09	
3.516E-10	572296.	0.000					
67.900	0.000	-1.832E-07	5.958E-09	0.000	8367.7419	3.683E+09	
2.163E-09	27259303.	0.000					
68.600	0.000	-5.693E-08	1.068E-08	0.000	8367.7419	3.683E+09	
-1.039E-09	27400423.	0.000					
69.300	0.000	-3.862E-09	3.386E-09	0.000	8367.7419	3.683E+09	
-6.975E-10	27541543.	0.000					
70.000	0.000	0.000	0.000	0.000	8367.7419	3.683E+09	
-1.088E-10	13841331.	0.000					

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.4183560 inches
Computed slope at pile head	=	-0.0068308 radians
Maximum bending moment	=	313453. inch-lbs
Maximum shear force	=	7516.000000 lbs
Depth of maximum bending moment	=	58.800000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	13
Number of zero deflection points	=	11

Computed values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

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Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 7516.000 lbs
Rotation of pile head = 0.000E+00 radians
Axial load at pile head = 129700.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Load	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
	Es*h feet lb/inch	Lat. Load inches lb/inch	Moment in-lbs	lbs	radians	psi*	lb-in^2	lb/in
	0.00	0.1035	-274879.	7516.0000	0.000	21403.	3.683E+09	
0.000		0.000	0.000					
	0.700	0.1009	-211403.	7361.0230	-0.000555	18393.	3.683E+09	
-36.8993	3073.1699		0.000					
	1.400	0.0942	-150005.	6907.0222	-0.000967	15481.	3.683E+09	
-71.1962	6350.4000		0.000					
	2.100	0.0846	-93259.	6204.9810	-0.001244	12790.	3.683E+09	
-95.9565	9525.6000		0.000					
	2.800	0.0733	-43051.	5336.6444	-0.001400	10409.	3.683E+09	
-110.7903	12701.		0.000					
	3.500	0.0611	-553.4765	4409.8195	-0.001449	8393.9885	3.683E+09	
-109.8823	15105.		0.000					
	4.200	0.0489	34192.	3533.2112	-0.001411	9989.1693	3.683E+09	
-98.8340	16968.		0.000					
	4.900	0.0374	61879.	2590.4986	-0.001301	11302.	3.683E+09	
-125.6214	28213.		0.000					
	5.600	0.0271	80548.	1543.4157	-0.001139	12187.	3.683E+09	
-123.6840	38389.		0.000					
	6.300	0.0183	90290.	513.2526	-0.000944	12649.	3.683E+09	
-121.5929	55910.		0.000					
	7.000	0.0112	91228.	-468.6482	-0.000737	12694.	3.683E+09	
-112.1930	84125.		0.000					
	7.700	0.005885	84023.	-1281.7672	-0.000537	12352.	3.683E+09	
-81.4068	116201.		0.000					
	8.400	0.002177	70865.	-1762.8107	-0.000361	11728.	3.683E+09	
-33.1274	127843.		0.000					
	9.100	-0.000174	55193.	-1889.8229	-0.000217	10985.	3.683E+09	
2.8864	139486.		0.000					
	9.800	-0.001467	39588.	-1766.8556	-0.000109	10245.	3.683E+09	
26.3915	151128.		0.000					
	10.500	-0.002002	25747.	-1493.1177	-3.428E-05	9588.7040	3.683E+09	
38.7842	162771.		0.000					
	11.200	-0.002043	14579.	-1152.0733	1.170E-05	9059.0787	3.683E+09	
42.4168	174413.		0.000					
	11.900	-0.001805	6366.8135	-806.0161	3.559E-05	8669.6643	3.683E+09	
39.9777	186055.		0.000					
	12.600	-0.001445	960.0104	-495.2750	4.394E-05	8413.2668	3.683E+09	
34.0082	197698.		0.000					
	13.300	-0.001067	-2049.5570	-240.7932	4.270E-05	8464.9345	3.683E+09	
26.5826	209340.		0.000					
	14.000	-0.000728	-3178.3600	-81.7256	3.674E-05	8518.4638	3.683E+09	
11.2906	130347.		0.000					
	14.700	-0.000449	-3502.6010	-3.5866	2.912E-05	8533.8397	3.683E+09	
7.3139	136698.		0.000					
	15.400	-0.000238	-3302.0665	44.1818	2.136E-05	8524.3301	3.683E+09	
4.0595	143048.		0.000					
	16.100	-9.058E-05	-2806.8907	67.9978	1.439E-05	8500.8482	3.683E+09	

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1.6110	149399.	0.000				
16.800	3.443E-06	-2191.0670	74.4960	8.695E-06	8471.6451	3.683E+09
-0.0638	155749.	0.000				
17.500	5.549E-05	-1574.3026	69.7307	4.401E-06	8442.3973	3.683E+09
-1.0708	162099.	0.000				
18.200	7.737E-05	-1029.1808	58.7167	1.432E-06	8416.5470	3.683E+09
-1.5516	168450.	0.000				
18.900	7.954E-05	-590.9820	45.2482	-4.159E-07	8395.7670	3.683E+09
-1.6552	174800.	0.000				
19.600	7.038E-05	-268.1047	31.9213	-1.396E-06	8380.4558	3.683E+09
-1.5179	181151.	0.000				
20.300	5.609E-05	-51.6630	20.2874	-1.760E-06	8370.1919	3.683E+09
-1.2521	187501.	0.000				
21.000	4.081E-05	76.5599	11.0730	-1.732E-06	8371.3725	3.683E+09
-0.9418	193851.	0.000				
21.700	2.700E-05	138.1363	4.4148	-1.487E-06	8374.2925	3.683E+09
-0.6434	200202.	0.000				
22.400	1.583E-05	153.9680	0.0775	-1.154E-06	8375.0433	3.683E+09
-0.3892	206552.	0.000				
23.100	7.611E-06	141.9526	-2.3675	-8.165E-07	8374.4735	3.683E+09
-0.1929	212903.	0.000				
23.800	2.112E-06	115.9728	-3.4093	-5.224E-07	8373.2415	3.683E+09
-0.0551	219253.	0.000				
24.500	-1.164E-06	85.8144	-3.5095	-2.922E-07	8371.8114	3.683E+09
0.0313	225603.	0.000				
25.200	-2.797E-06	57.6494	-3.0538	-1.286E-07	8370.4757	3.683E+09
0.0772	231954.	0.000				
25.900	-3.326E-06	34.7913	-2.3331	-2.322E-08	8369.3918	3.683E+09
0.0943	238304.	0.000				
26.600	-3.187E-06	18.5037	-1.6518	3.755E-08	8368.6194	3.683E+09
0.0679	178868.	0.000				
27.300	-2.695E-06	6.9592	-1.1181	6.659E-08	8368.0719	3.683E+09
0.0592	184513.	0.000				
28.000	-2.069E-06	-0.4262	-0.6729	7.404E-08	8367.7621	3.683E+09
0.0468	190158.	0.000				
28.700	-1.451E-06	-4.5063	-0.3342	6.842E-08	8367.9556	3.683E+09
0.0338	195803.	0.000				
29.400	-9.192E-07	-6.1891	-0.0995	5.622E-08	8368.0354	3.683E+09
0.0220	201447.	0.000				
30.100	-5.062E-07	-6.3011	0.0455	4.198E-08	8368.0407	3.683E+09
0.0125	207092.	0.000				
30.800	-2.140E-07	-5.5168	0.1206	2.850E-08	8368.0035	3.683E+09
0.005420	212737.	0.000				
31.500	-2.745E-08	-4.3363	0.1464	1.726E-08	8367.9476	3.683E+09
0.000714	218382.	0.000				
32.200	7.603E-08	-3.0947	0.1409	8.789E-09	8367.8887	3.683E+09
-0.002028	224027.	0.000				
32.900	1.202E-07	-1.9885	0.1186	2.992E-09	8367.8362	3.683E+09
-0.003287	229671.	0.000				
33.600	1.263E-07	-1.1093	0.0899	-5.402E-10	8367.7945	3.683E+09
-0.003538	235316.	0.000				
34.300	1.111E-07	-0.4770	0.0617	-2.349E-09	8367.7646	3.683E+09
-0.003188	240961.	0.000				
35.000	8.683E-08	-0.0684	0.0376	-2.971E-09	8367.7452	3.683E+09
-0.002549	246606.	0.000				
35.700	6.122E-08	0.1605	0.0191	-2.866E-09	8367.7495	3.683E+09
-0.001838	252251.	0.000				
36.400	3.868E-08	0.2592	0.006419	-2.387E-09	8367.7542	3.683E+09
-0.001188	257895.	0.000				
37.100	2.111E-08	0.2735	-0.001351	-1.780E-09	8367.7549	3.683E+09
-0.000662	263540.	0.000				
37.800	8.780E-09	0.2404	-0.005314	-1.194E-09	8367.7533	3.683E+09
-0.000281	269185.	0.000				

Bridge 11 End Bent 1 Longitudinal Provided.lp6o							
38.500	1.054E-09	0.1868	-0.006641	-7.067E-10	8367.7508	3.683E+09	
-3.448E-05	274830.	0.000					
39.200	-3.093E-09	0.1304	-0.006352	-3.450E-10	8367.7481	3.683E+09	
0.000103	280475.	0.000					
39.900	-4.742E-09	0.0809	-0.005240	-1.041E-10	8367.7458	3.683E+09	
0.000162	286119.	0.000					
40.600	-4.842E-09	0.0426	-0.003855	3.666E-11	8367.7440	3.683E+09	
0.000168	291764.	0.000					
41.300	-4.126E-09	0.0160	-0.002535	1.035E-10	8367.7427	3.683E+09	
0.000146	297409.	0.000					
42.000	-3.103E-09	-0.000250	-0.001451	1.215E-10	8367.7419	3.683E+09	
0.000112	303054.	0.000					
42.700	-2.085E-09	-0.008623	-0.000659	1.114E-10	8367.7423	3.683E+09	
7.664E-05	308699.	0.000					
43.400	-1.233E-09	-0.0116	-0.000144	8.833E-11	8367.7425	3.683E+09	
4.613E-05	314343.	0.000					
44.100	-6.016E-10	-0.0112	0.000146	6.233E-11	8367.7425	3.683E+09	
2.292E-05	319988.	0.000					
44.800	-1.856E-10	-0.009244	0.000273	3.898E-11	8367.7424	3.683E+09	
7.193E-06	325633.	0.000					
45.500	5.335E-11	-0.006730	0.000294	2.077E-11	8367.7423	3.683E+09	
-2.104E-06	331278.	0.000					
46.200	1.633E-10	-0.004347	0.000258	8.136E-12	8367.7421	3.683E+09	
-6.551E-06	336923.	0.000					
46.900	1.900E-10	-0.002415	0.000198	0.000	8367.7421	3.683E+09	
-7.750E-06	342567.	0.000					
47.600	1.705E-10	-0.001025	0.000134	-3.498E-12	8367.7420	3.683E+09	
-7.404E-06	364850.	0.000					
48.300	1.313E-10	-0.000154	7.863E-05	-4.842E-12	8367.7419	3.683E+09	
-5.817E-06	372258.	0.000					
49.000	8.911E-11	0.000307	3.729E-05	-4.667E-12	8367.7420	3.683E+09	
-4.028E-06	379667.	0.000					
49.700	5.285E-11	0.000483	1.014E-05	-3.766E-12	8367.7420	3.683E+09	
-2.435E-06	387076.	0.000					
50.400	2.584E-11	0.000486	-5.184E-06	-2.662E-12	8367.7420	3.683E+09	
-1.213E-06	394485.	0.000					
51.100	8.129E-12	0.000402	-1.191E-05	-1.650E-12	8367.7420	3.683E+09	
-3.889E-07	401894.	0.000					
51.800	-1.887E-12	0.000289	-1.316E-05	0.000	8367.7419	3.683E+09	
9.195E-08	409302.	0.000					
52.500	-6.365E-12	0.000182	-1.145E-05	0.000	8367.7419	3.683E+09	
3.158E-07	416711.	0.000					
53.200	-7.350E-12	9.743E-05	-8.563E-06	0.000	8367.7419	3.683E+09	
3.711E-07	424120.	0.000					
53.900	-6.468E-12	3.848E-05	-5.609E-06	0.000	8367.7419	3.683E+09	
3.323E-07	431529.	0.000					
54.600	-4.849E-12	2.875E-06	-3.149E-06	0.000	8367.7419	3.683E+09	
2.534E-07	438938.	0.000					
55.300	-3.175E-12	-1.486E-05	-1.377E-06	0.000	8367.7419	3.683E+09	
1.687E-07	446346.	0.000					
56.000	-1.786E-12	-2.065E-05	-2.628E-07	0.000	8367.7419	3.683E+09	
9.646E-08	453755.	0.000					
56.700	0.000	-1.958E-05	3.249E-07	0.000	8367.7419	3.683E+09	
4.347E-08	461164.	0.000					
57.400	0.000	-1.540E-05	5.479E-07	0.000	8367.7419	3.683E+09	
9.649E-09	468573.	0.000					
58.100	0.000	-1.050E-05	5.526E-07	0.000	8367.7419	3.683E+09	
-8.541E-09	475982.	0.000					
58.800	0.000	-6.174E-06	4.506E-07	0.000	8367.7419	3.683E+09	
-1.573E-08	483390.	0.000					
59.500	0.000	-2.944E-06	3.165E-07	0.000	8367.7419	3.683E+09	
-1.622E-08	490799.	0.000					
60.200	0.000	-8.511E-07	1.921E-07	0.000	8367.7419	3.683E+09	

Bridge 11 End Bent 1 Longitudinal Provided.lp6o							
-1.338E-08	498208.	0.000					
60.900	0.000	2.999E-07	9.624E-08	0.000	8367.7419	3.683E+09	
-9.458E-09	505617.	0.000					
61.600	0.000	7.828E-07	3.229E-08	0.000	8367.7419	3.683E+09	
-5.770E-09	513026.	0.000					
62.300	0.000	8.566E-07	-4.127E-09	0.000	8367.7419	3.683E+09	
-2.900E-09	520434.	0.000					
63.000	0.000	7.237E-07	-2.042E-08	0.000	8367.7419	3.683E+09	
-9.779E-10	527843.	0.000					
63.700	0.000	5.199E-07	-2.403E-08	0.000	8367.7419	3.683E+09	
1.162E-10	535252.	0.000					
64.400	0.000	3.231E-07	-2.104E-08	0.000	8367.7419	3.683E+09	
5.975E-10	542661.	0.000					
65.100	0.000	1.676E-07	-1.564E-08	0.000	8367.7419	3.683E+09	
6.865E-10	550070.	0.000					
65.800	0.000	6.017E-08	-1.039E-08	0.000	8367.7419	3.683E+09	
5.646E-10	557478.	0.000					
66.500	0.000	-7.580E-09	-6.498E-09	0.000	8367.7419	3.683E+09	
3.617E-10	564887.	0.000					
67.200	0.000	-4.979E-08	-4.294E-09	0.000	8367.7419	3.683E+09	
1.632E-10	572296.	0.000					
67.900	0.000	-8.037E-08	1.371E-09	0.000	8367.7419	3.683E+09	
1.186E-09	27259303.	0.000					
68.600	0.000	-2.708E-08	4.643E-09	0.000	8367.7419	3.683E+09	
-4.069E-10	27400423.	0.000					
69.300	0.000	-2.431E-09	1.611E-09	0.000	8367.7419	3.683E+09	
-3.150E-10	27541543.	0.000					
70.000	0.000	0.000	0.000	0.000	8367.7419	3.683E+09	
-6.862E-11	13841331.	0.000					

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.1034911 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-274879. inch-lbs
Maximum shear force	=	7516.000000 lbs
Depth of maximum bending moment	=	0.000000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	7
Number of zero deflection points	=	11

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

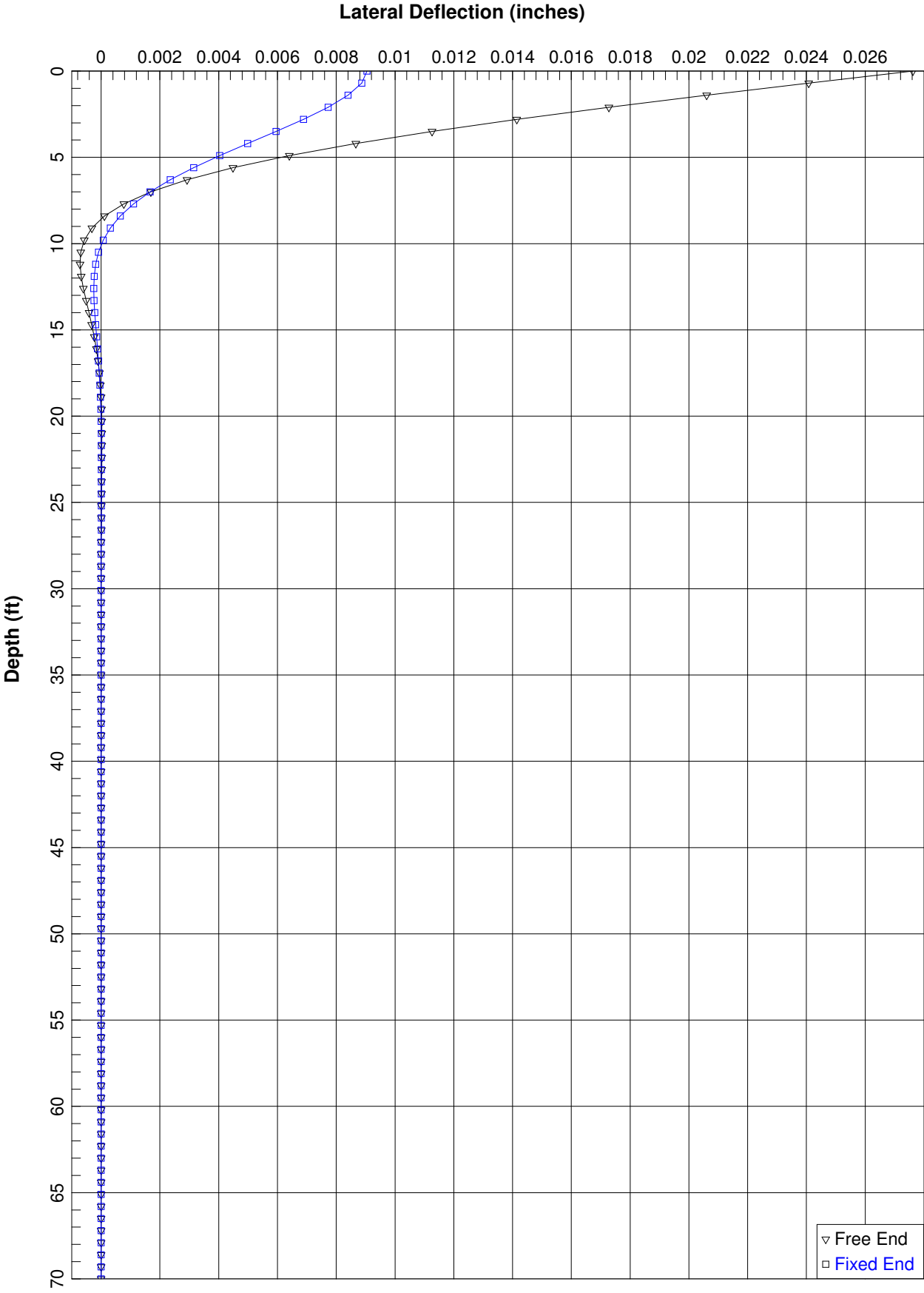
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
 Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
 Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
 Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
 Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

	Pile-head	Pile-head	Maximum
Maximum			

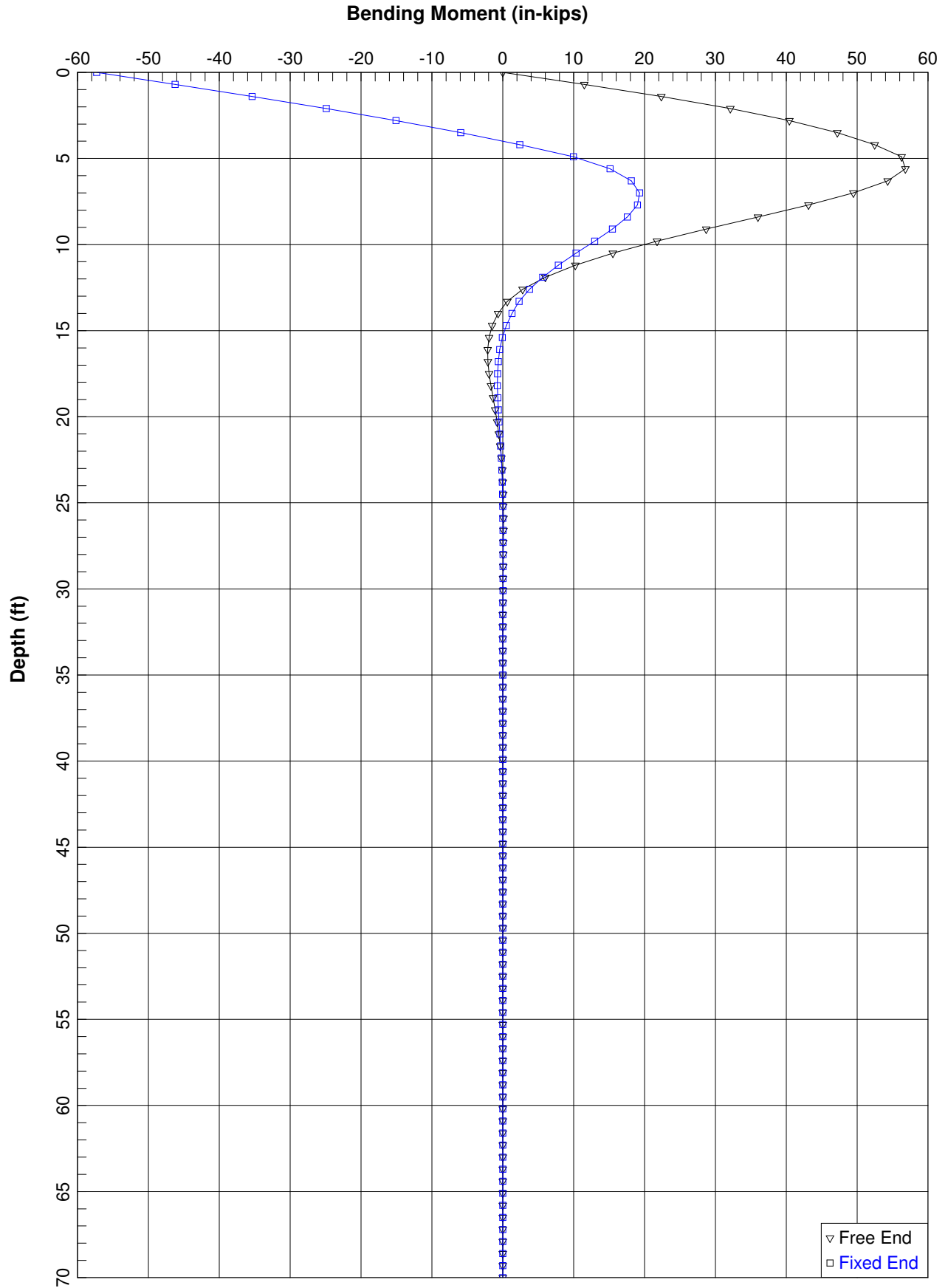
Bridge 11 End Bent 1 Longitudinal Provided.lp6o						
Load	Load	Condition 1	Condition 2	Axial	Pile-head	Moment
Case	Shear	Pile-head				
No.	Type	V(lbs) or	in-lb, rad.,	Loading	Deflection	in Pile
	in Pile	Rotation	or in-lb/rad.			
No.	No.	y(inches)	radians	lbs	inches	in-lbs
----	----	-----	-----	-----	-----	-----
1	1	V = 7516.0000	M = 0.000	129700.	0.41835605	
313453.		7516.0000	-0.00683083			
2	2	V = 7516.0000	S = 0.000	129700.	0.10349115	
-274879.		7516.0000	0.00000000			

The analysis ended normally.

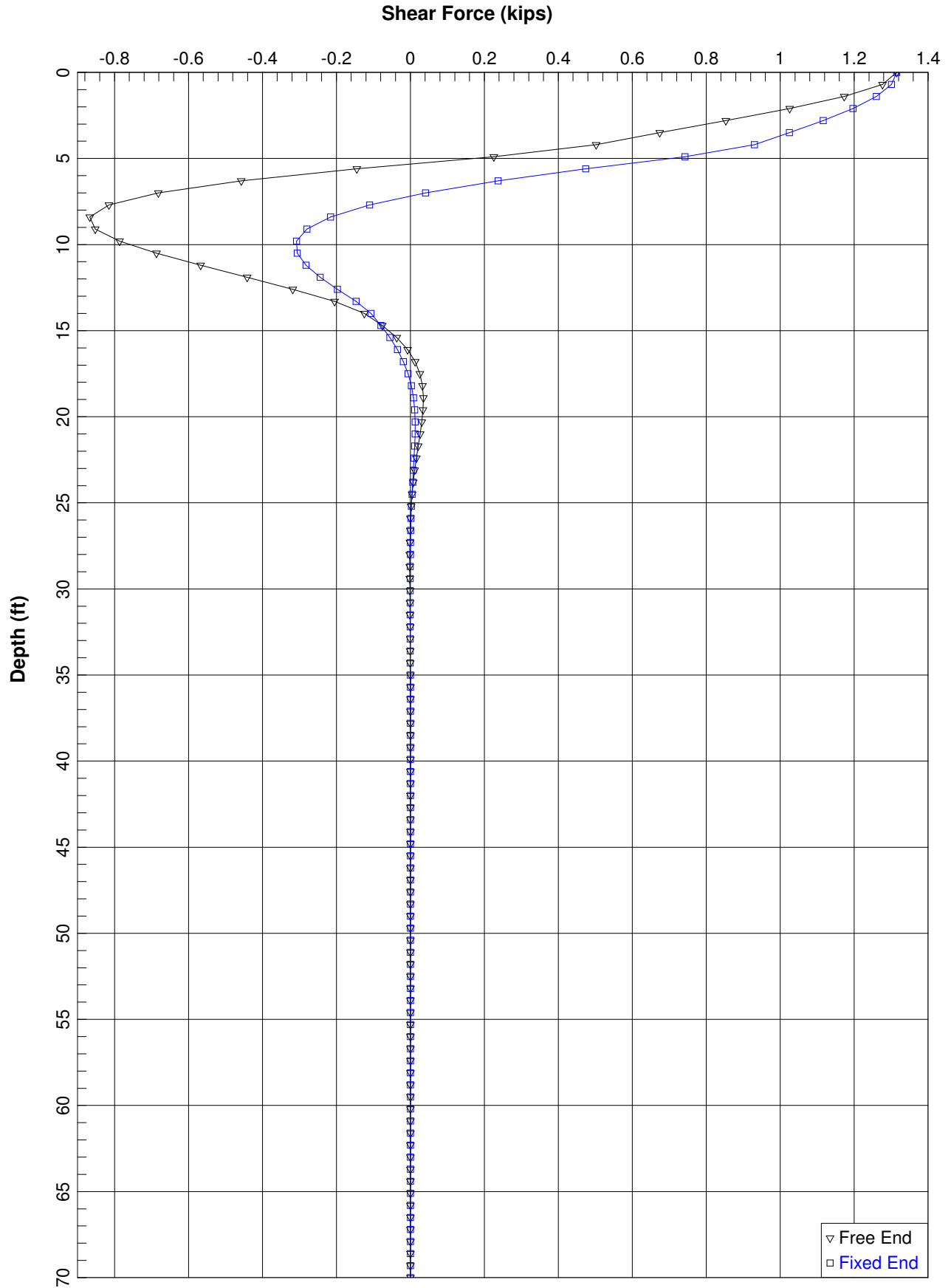
Bridge 11 End Bent 1 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-01



Bridge 11 End Bent 1 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-01



Bridge 11 End Bent 1 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-01



Bridge 11 End Bent 1 Transverse Provided.lp6o

LPile Plus for windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 End Bent 1\Bridge 11 End Bent 1 Provided Loads\
Name of input data file: Bridge 11 End Bent 1 Transverse Provided.lp6d
Name of output report file: Bridge 11 End Bent 1 Transverse Provided.lp6o
Name of plot output file: Bridge 11 End Bent 1 Transverse Provided.lp6p
Name of runtime message file: Bridge 11 End Bent 1 Transverse Provided.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:26:11

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 End Bent 1 (Boring B11-SPT-01)

Bridge 11 End Bent 1 Transverse Provided.lp6o

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 70.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth x ft	Pile Diameter in
1	0.00000	12.0450000
2	70.000000	12.0450000

Input Structural Properties:

Bridge 11 End Bent 1 Transverse Provided.lp6o

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	70.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	393.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	4.30000 ft
Effective unit weight at top of layer	=	112.00000 pcf
Effective unit weight at bottom of layer	=	112.00000 pcf
Friction angle at top of layer	=	30.00000 deg.
Friction angle at bottom of layer	=	30.00000 deg.
Subgrade k at top of layer	=	45.00000 pci
Subgrade k at bottom of layer	=	45.00000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	4.30000 ft
Distance from top of pile to bottom of layer	=	13.30000 ft
Effective unit weight at top of layer	=	112.00000 pcf
Effective unit weight at bottom of layer	=	112.00000 pcf
Friction angle at top of layer	=	35.00000 deg.
Friction angle at bottom of layer	=	35.00000 deg.
Subgrade k at top of layer	=	165.00000 pci
Subgrade k at bottom of layer	=	165.00000 pci

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	13.30000 ft
Distance from top of pile to bottom of layer	=	26.30000 ft
Effective unit weight at top of layer	=	112.00000 pcf
Effective unit weight at bottom of layer	=	112.00000 pcf

Bridge 11 End Bent 1 Transverse Provided.lp60

Friction angle at top of layer = 32.00000 deg.
 Friction angle at bottom of layer = 32.00000 deg.
 Subgrade k at top of layer = 90.00000 pci
 Subgrade k at bottom of layer = 90.00000 pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 26.30000 ft
 Distance from top of pile to bottom of layer = 47.30000 ft
 Effective unit weight at top of layer = 57.00000 pcf
 Effective unit weight at bottom of layer = 57.00000 pcf
 Friction angle at top of layer = 34.00000 deg.
 Friction angle at bottom of layer = 34.00000 deg.
 Subgrade k at top of layer = 80.00000 pci
 Subgrade k at bottom of layer = 80.00000 pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 47.30000 ft
 Distance from top of pile to bottom of layer = 67.40000 ft
 Effective unit weight at top of layer = 75.00000 pcf
 Effective unit weight at bottom of layer = 75.00000 pcf
 Friction angle at top of layer = 36.00000 deg.
 Friction angle at bottom of layer = 36.00000 deg.
 Subgrade k at top of layer = 105.00000 pci
 Subgrade k at bottom of layer = 105.00000 pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer = 67.40000 ft
 Distance from top of pile to bottom of layer = 74.40000 ft
 Effective unit weight at top of layer = 75.00000 pcf
 Effective unit weight at bottom of layer = 75.00000 pcf
 Undrained cohesion at top of layer = 8000.00000 psf
 Undrained cohesion at bottom of layer = 8000.00000 psf
 Epsilon-50 at top of layer = 0.00400
 Epsilon-50 at bottom of layer = 0.00400
 Subgrade k at top of layer = 2000.00000 pci
 Subgrade k at bottom of layer = 2000.00000 pci

(Depth of lowest soil layer extends 4.40 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor Epsilon 50	Layer Soil Type kpy (p-y Curve Criteria) pci	Layer Depth ft	Effective Unit Wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	112.000	--
30.000	--	45.000	4.300	112.000	--

Bridge 11 End Bent 1 Transverse Provided.lp6o						
30.000	--	45.000				
2	Sand (Reese, et al.)		4.300	112.000	--	
35.000	--	165.000				
			13.300	112.000	--	
35.000	--	165.000				
3	Sand (Reese, et al.)		13.300	112.000	--	
32.000	--	90.000				
			26.300	112.000	--	
32.000	--	90.000				
4	Sand (Reese, et al.)		26.300	57.000	--	
34.000	--	80.000				
			47.300	57.000	--	
34.000	--	80.000				
5	Sand (Reese, et al.)		47.300	75.000	--	
36.000	--	105.000				
			67.400	75.000	--	
36.000	--	105.000				
6	Stiff clay w/o Free water, using k		67.400	75.000	8000.000	
--	0.00400	2000.000				
			74.400	75.000	8000.000	
--	0.00400	2000.000				

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	1	V = 1315.00000 lbs	M = 0.0000 in-lbs	129700.
	No			
2	2	V = 1315.00000 lbs	S = 0.0000 in/in	129700.
	No			

V = perpendicular shear force applied to pile head
M = bending moment applied to pile head
y = lateral deflection relative to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applie to pile head
Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Bridge 11 End Bent 1 Transverse Provided.lp6o

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1315.000 lbs
Applied moment at pile head = 0.000 in-lbs
Axial thrust load on pile head = 129700.000 lbs

Depth Res.	Soil X	Deflect. Spr.	Bending Distrib.	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
	Es*h feet lb/inch	y Lat. Load inches lb/inch	Moment in-lbs	lbs	radians	psi*	lb-in ²	lb/in
0.000	0.00	0.0276	0.000	1315.0000	-0.000422	8367.7419	1.140E+10	
-9.1010	0.700	0.0241	11505.	1276.7760	-0.000417	8544.0536	1.140E+10	
-15.5788	1.400	0.0206	22359.	1173.1211	-0.000405	8710.3830	1.140E+10	
-19.5903	2.100	0.0173	32096.	1025.4109	-0.000385	8859.5920	1.140E+10	
-21.3839	2.800	0.0141	40424.	853.3192	-0.000358	8987.2232	1.140E+10	
-21.2821	3.500	0.0113	47212.	674.1221	-0.000326	9091.2348	1.140E+10	
-19.6642	4.200	0.008670	52459.	502.1477	-0.000289	9171.6532	1.140E+10	
-46.2203	4.900	0.006405	56278.	225.4330	-0.000249	9230.1634	1.140E+10	
-41.9937	5.600	0.004488	56789.	-145.0658	-0.000207	9238.0035	1.140E+10	
-32.3297	6.300	0.002923	54292.	-457.2241	-0.000166	9199.7374	1.140E+10	
-21.0804	7.000	0.001694	49470.	-681.5463	-0.000128	9125.8453	1.140E+10	
-10.6606	7.700	0.000771	43121.	-814.8581	-9.398E-05	9028.5505	1.140E+10	
-1.7456	8.400	0.000115	35985.	-866.9639	-6.483E-05	8919.1979	1.140E+10	
5.2882	9.100	-0.000318	28698.	-852.0849	-4.099E-05	8807.5150	1.140E+10	
10.3261	9.800	-0.000574	21760.	-786.5050	-2.240E-05	8701.1970	1.140E+10	
13.4617	10.500	-0.000695	15533.	-686.5962	-8.653E-06	8605.7768	1.140E+10	
14.9354	11.200	-0.000719	10244.	-567.3282	8.464E-07	8524.7215	1.140E+10	
	11.900	-0.000680	6000.0762	-441.2949	6.833E-06	8459.6897	1.140E+10	

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15.0725	186055.	0.000					
12.600	-0.000605	2815.1054	-318.2335	1.008E-05	8410.8818	1.140E+10	
14.2278	197698.	0.000					
13.300	-0.000511	631.7869	-204.9767	1.135E-05	8377.4237	1.140E+10	
12.7381	209340.	0.000					
14.000	-0.000414	-653.2375	-124.5062	1.134E-05	8377.7524	1.140E+10	
6.4215	130347.	0.000					
14.700	-0.000321	-1484.6340	-75.6257	1.056E-05	8390.4931	1.140E+10	
5.2167	136698.	0.000					
15.400	-0.000236	-1946.7499	-36.8009	9.291E-06	8397.5748	1.140E+10	
4.0273	143048.	0.000					
16.100	-0.000164	-2123.1343	-7.6002	7.791E-06	8400.2778	1.140E+10	
2.9252	149399.	0.000					
16.800	-0.000106	-2091.4097	12.9092	6.238E-06	8399.7916	1.140E+10	
1.9580	155749.	0.000					
17.500	-5.967E-05	-1919.8521	25.9691	4.760E-06	8397.1626	1.140E+10	
1.1515	162099.	0.000					
18.200	-2.563E-05	-1665.5003	32.9645	3.439E-06	8393.2648	1.140E+10	
0.5140	168450.	0.000					
18.900	-1.905E-06	-1373.5408	35.2899	2.319E-06	8388.7907	1.140E+10	
0.0396	174800.	0.000					
19.600	1.332E-05	-1077.6816	34.2500	1.415E-06	8384.2568	1.140E+10	
-0.2873	181151.	0.000					
20.300	2.187E-05	-801.2253	30.9930	7.229E-07	8380.0203	1.140E+10	
-0.4882	187501.	0.000					
21.000	2.546E-05	-558.5750	26.4742	2.218E-07	8376.3018	1.140E+10	
-0.5877	193851.	0.000					
21.700	2.560E-05	-356.9415	21.4436	-1.156E-07	8373.2119	1.140E+10	
-0.6101	200202.	0.000					
22.400	2.352E-05	-198.0703	16.4519	-3.201E-07	8370.7772	1.140E+10	
-0.5784	206552.	0.000					
23.100	2.022E-05	-79.8526	11.8701	-4.225E-07	8368.9656	1.140E+10	
-0.5125	212903.	0.000					
23.800	1.642E-05	2.2675	7.9171	-4.511E-07	8367.7767	1.140E+10	
-0.4287	219253.	0.000					
24.500	1.264E-05	54.1377	4.6907	-4.304E-07	8368.5716	1.140E+10	
-0.3395	225603.	0.000					
25.200	9.194E-06	82.0084	2.1984	-3.802E-07	8368.9987	1.140E+10	
-0.2539	231954.	0.000					
25.900	6.254E-06	91.8998	0.3870	-3.161E-07	8369.1502	1.140E+10	
-0.1774	238304.	0.000					
26.600	3.884E-06	89.1980	-0.7056	-2.494E-07	8369.1088	1.140E+10	
-0.0827	178868.	0.000					
27.300	2.065E-06	80.5896	-1.2434	-1.868E-07	8368.9769	1.140E+10	
-0.0454	184513.	0.000					
28.000	7.456E-07	68.7158	-1.5048	-1.318E-07	8368.7950	1.140E+10	
-0.0169	190158.	0.000					
28.700	-1.485E-07	55.5959	-1.5612	-8.595E-08	8368.5939	1.140E+10	
0.003462	195803.	0.000					
29.400	-6.984E-07	42.6757	-1.4763	-4.974E-08	8368.3959	1.140E+10	
0.0167	201447.	0.000					
30.100	-9.841E-07	30.9031	-1.3040	-2.262E-08	8368.2155	1.140E+10	
0.0243	207092.	0.000					
30.800	-1.078E-06	20.8176	-1.0874	-3.561E-09	8368.0610	1.140E+10	
0.0273	212737.	0.000					
31.500	-1.044E-06	12.6425	-0.8587	8.769E-09	8367.9357	1.140E+10	
0.0271	218382.	0.000					
32.200	-9.311E-07	6.3724	-0.6404	1.578E-08	8367.8396	1.140E+10	
0.0248	224027.	0.000					
32.900	-7.789E-07	1.8493	-0.4467	1.881E-08	8367.7703	1.140E+10	
0.0213	229671.	0.000					
33.600	-6.152E-07	-1.1726	-0.2848	1.906E-08	8367.7599	1.140E+10	
0.0172	235316.	0.000					

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34.300	-4.587E-07	-2.9775	-0.1572	1.753E-08	8367.7876	1.140E+10
0.0132	240961.	0.000				
35.000	-3.207E-07	-3.8515	-0.0624	1.501E-08	8367.8010	1.140E+10
0.009416	246606.	0.000				
35.700	-2.066E-07	-4.0580	0.003236	1.210E-08	8367.8041	1.140E+10
0.006204	252251.	0.000				
36.400	-1.175E-07	-3.8235	0.0444	9.191E-09	8367.8005	1.140E+10
0.003609	257895.	0.000				
37.100	-5.218E-08	-3.3313	0.0665	6.554E-09	8367.7930	1.140E+10
0.001637	263540.	0.000				
37.800	-7.433E-09	-2.7209	0.0744	4.324E-09	8367.7836	1.140E+10
0.000238	269185.	0.000				
38.500	2.046E-08	-2.0915	0.0725	2.550E-09	8367.7740	1.140E+10
-0.000670	274830.	0.000				
39.200	3.541E-08	-1.5077	0.0648	1.224E-09	8367.7650	1.140E+10
-0.001182	280475.	0.000				
39.900	4.102E-08	-1.0061	0.0539	2.975E-10	8367.7574	1.140E+10
-0.001397	286119.	0.000				
40.600	4.041E-08	-0.6024	0.0422	-2.953E-10	8367.7512	1.140E+10
-0.001404	291764.	0.000				
41.300	3.606E-08	-0.2971	0.0309	-6.268E-10	8367.7465	1.140E+10
-0.001277	297409.	0.000				
42.000	2.988E-08	-0.0817	0.0210	-7.664E-10	8367.7432	1.140E+10
-0.001078	303054.	0.000				
42.700	2.319E-08	0.0577	0.0129	-7.752E-10	8367.7428	1.140E+10
-0.000852	308699.	0.000				
43.400	1.686E-08	0.1369	0.006683	-7.035E-10	8367.7440	1.140E+10
-0.000631	314343.	0.000				
44.100	1.137E-08	0.1715	0.002214	-5.899E-10	8367.7446	1.140E+10
-0.000433	319988.	0.000				
44.800	6.945E-09	0.1754	-0.000736	-4.621E-10	8367.7446	1.140E+10
-0.000269	325633.	0.000				
45.500	3.607E-09	0.1601	-0.002464	-3.385E-10	8367.7444	1.140E+10
-0.000142	331278.	0.000				
46.200	1.259E-09	0.1347	-0.003273	-2.298E-10	8367.7440	1.140E+10
-5.050E-05	336923.	0.000				
46.900	-2.545E-10	0.1056	-0.003442	-1.413E-10	8367.7436	1.140E+10
1.038E-05	342567.	0.000				
47.600	-1.114E-09	0.0772	-0.003195	-7.389E-11	8367.7431	1.140E+10
4.839E-05	364850.	0.000				
48.300	-1.496E-09	0.0521	-0.002713	-2.625E-11	8367.7427	1.140E+10
6.629E-05	372258.	0.000				
49.000	-1.555E-09	0.0317	-0.002140	4.621E-12	8367.7424	1.140E+10
7.029E-05	379667.	0.000				
49.700	-1.418E-09	0.0161	-0.001570	2.224E-11	8367.7422	1.140E+10
6.535E-05	387076.	0.000				
50.400	-1.181E-09	0.005234	-0.001063	3.012E-11	8367.7420	1.140E+10
5.549E-05	394485.	0.000				
51.100	-9.123E-10	-0.001768	-0.000646	3.140E-11	8367.7420	1.140E+10
4.365E-05	401894.	0.000				
51.800	-6.540E-10	-0.005690	-0.000329	2.865E-11	8367.7420	1.140E+10
3.187E-05	409302.	0.000				
52.500	-4.310E-10	-0.007358	-0.000105	2.384E-11	8367.7420	1.140E+10
2.138E-05	416711.	0.000				
53.200	-2.536E-10	-0.007511	3.826E-05	1.836E-11	8367.7421	1.140E+10
1.280E-05	424120.	0.000				
53.900	-1.226E-10	-0.006755	0.000118	1.310E-11	8367.7420	1.140E+10
6.298E-06	431529.	0.000				
54.600	-3.345E-11	-0.005549	0.000152	8.568E-12	8367.7420	1.140E+10
1.748E-06	438938.	0.000				
55.300	2.135E-11	-0.004215	0.000155	4.970E-12	8367.7420	1.140E+10
-1.134E-06	446346.	0.000				
56.000	5.004E-11	-0.002958	0.000139	2.326E-12	8367.7420	1.140E+10

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-2.703E-06	453755.	0.000					
56.700	6.042E-11	-0.001890	0.000113	0.000	8367.7420	1.140E+10	
-3.317E-06	461164.	0.000					
57.400	5.911E-11	-0.001053	8.567E-05	0.000	8367.7420	1.140E+10	
-3.297E-06	468573.	0.000					
58.100	5.127E-11	-0.000449	5.962E-05	-1.099E-12	8367.7419	1.140E+10	
-2.905E-06	475982.	0.000					
58.800	4.065E-11	-4.939E-05	3.760E-05	-1.282E-12	8367.7419	1.140E+10	
-2.339E-06	483390.	0.000					
59.500	2.972E-11	0.000185	2.048E-05	-1.232E-12	8367.7419	1.140E+10	
-1.737E-06	490799.	0.000					
60.200	1.995E-11	0.000297	8.213E-06	-1.054E-12	8367.7419	1.140E+10	
-1.183E-06	498208.	0.000					
60.900	1.201E-11	0.000326	2.079E-07	0.000	8367.7419	1.140E+10	
-7.229E-07	505617.	0.000					
61.600	6.089E-12	0.000303	-4.390E-06	0.000	8367.7419	1.140E+10	
-3.719E-07	513026.	0.000					
62.300	2.041E-12	0.000253	-6.483E-06	0.000	8367.7419	1.140E+10	
-1.264E-07	520434.	0.000					
63.000	0.000	0.000195	-6.898E-06	0.000	8367.7419	1.140E+10	
2.765E-08	527843.	0.000					
63.700	-1.717E-12	0.000138	-6.322E-06	0.000	8367.7419	1.140E+10	
1.094E-07	535252.	0.000					
64.400	-2.141E-12	8.852E-05	-5.282E-06	0.000	8367.7419	1.140E+10	
1.383E-07	542661.	0.000					
65.100	-2.017E-12	4.902E-05	-4.147E-06	0.000	8367.7419	1.140E+10	
1.321E-07	550070.	0.000					
65.800	-1.589E-12	1.879E-05	-3.149E-06	0.000	8367.7419	1.140E+10	
1.055E-07	557478.	0.000					
66.500	-1.045E-12	-4.015E-06	-2.411E-06	0.000	8367.7419	1.140E+10	
7.029E-08	564887.	0.000					
67.200	0.000	-2.185E-05	-1.965E-06	0.000	8367.7419	1.140E+10	
3.585E-08	572296.	0.000					
67.900	0.000	-3.715E-05	1.275E-07	0.000	8367.7419	1.140E+10	
4.624E-07	27259303.	0.000					
68.600	0.000	-1.978E-05	1.916E-06	0.000	8367.7419	1.140E+10	
-3.658E-08	27400423.	0.000					
69.300	0.000	-4.982E-06	1.178E-06	0.000	8367.7419	1.140E+10	
-1.392E-07	27541543.	0.000					
70.000	0.000	0.000	0.000	0.000	8367.7419	1.140E+10	
-1.412E-07	13841331.	0.000					

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.0276177 inches
Computed slope at pile head	=	-0.0004216 radians
Maximum bending moment	=	56789. inch-lbs
Maximum shear force	=	1315.000000 lbs
Depth of maximum bending moment	=	67.200000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	6
Number of zero deflection points	=	8

Computed values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 2

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Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head = 1315.000 lbs
 Rotation of pile head = 0.000E+00 radians
 Axial load at pile head = 129700.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Load	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
	Es*h feet lb/inch	Lat. Load inches lb/inch	Moment in-lbs	lbs	radians	psi*	lb-in ²	lb/in
0.000	0.00	0.009044	-57296.	1315.0000	0.000	9245.7708	1.140E+10	
-3.3517	0.700	0.008867	-46227.	1300.9230	-3.815E-05	9076.1446	1.140E+10	
-6.3529	1.400	0.008403	-35357.	1260.1638	-6.822E-05	8909.5738	1.140E+10	
-8.7554	2.100	0.007721	-24908.	1196.7088	-9.042E-05	8749.4372	1.140E+10	
-10.4089	2.800	0.006884	-15056.	1116.2188	-0.000105	8598.4612	1.140E+10	
-11.2536	3.500	0.005954	-5926.0377	1025.2363	-0.000113	8458.5551	1.140E+10	
-11.3122	4.200	0.004988	2414.2833	930.4600	-0.000114	8404.7394	1.140E+10	
-33.4572	4.900	0.004036	9954.4790	742.4287	-0.000110	8520.2886	1.140E+10	
-30.4402	5.600	0.003146	15126.	474.0598	-0.000100	8599.5383	1.140E+10	
-25.9920	6.300	0.002350	18137.	237.0448	-8.812E-05	8645.6872	1.140E+10	
-20.7340	7.000	0.001666	19300.	40.7955	-7.432E-05	8663.5080	1.140E+10	
-15.2329	7.700	0.001101	18985.	-110.2656	-6.021E-05	8658.6718	1.140E+10	
-9.9556	8.400	0.000654	17579.	-216.0573	-4.674E-05	8637.1307	1.140E+10	
-5.2464	9.100	0.000316	15457.	-279.9056	-3.456E-05	8604.6084	1.140E+10	
-1.3214	9.800	7.345E-05	12952.	-307.4902	-2.410E-05	8566.2231	1.140E+10	
1.7220	10.500	-8.887E-05	10343.	-305.8076	-1.551E-05	8526.2495	1.140E+10	
3.8857	11.200	-0.000187	7848.1744	-282.2554	-8.807E-06	8488.0107	1.140E+10	
5.2455	11.900	-0.000237	5620.7595	-243.9043	-3.844E-06	8453.8769	1.140E+10	
5.9241	12.600	-0.000252	3758.9570	-196.9916	-3.869E-07	8425.3458	1.140E+10	
6.0640	13.300	-0.000243	2312.1434	-146.6413	1.850E-06	8403.1742	1.140E+10	
3.4236	14.000	-0.000221	1291.3508	-106.7935	3.178E-06	8387.5311	1.140E+10	
3.0908	14.700	-0.000190	511.0876	-79.4330	3.843E-06	8375.5741	1.140E+10	
2.6578	15.400	-0.000156	-51.4971	-55.2888	4.012E-06	8368.5311	1.140E+10	
	16.100	-0.000123	-426.5059	-34.9732	3.836E-06	8374.2779	1.140E+10	

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2.1792	149399.	0.000				
16.800	-9.163E-05	-647.4044	-18.6848	3.440E-06	8377.6630	1.140E+10
1.6989	155749.	0.000				
17.500	-6.474E-05	-747.9056	-6.3023	2.926E-06	8379.2032	1.140E+10
1.2493	162099.	0.000				
18.200	-4.248E-05	-759.6582	2.5221	2.370E-06	8379.3833	1.140E+10
0.8518	168450.	0.000				
18.900	-2.492E-05	-710.6993	8.2773	1.828E-06	8378.6330	1.140E+10
0.5185	174800.	0.000				
19.600	-1.176E-05	-624.5842	11.5200	1.336E-06	8377.3133	1.140E+10
0.2536	181151.	0.000				
20.300	-2.466E-06	-520.0759	12.8162	9.145E-07	8375.7118	1.140E+10
0.0551	187501.	0.000				
21.000	3.606E-06	-411.2655	12.6979	5.713E-07	8374.0443	1.140E+10
-0.0832	193851.	0.000				
21.700	7.131E-06	-307.9962	11.6346	3.062E-07	8372.4618	1.140E+10
-0.1700	200202.	0.000				
22.400	8.750E-06	-216.4721	10.0170	1.129E-07	8371.0592	1.140E+10
-0.2152	206552.	0.000				
23.100	9.029E-06	-139.9561	8.1522	-1.840E-08	8369.8867	1.140E+10
-0.2288	212903.	0.000				
23.800	8.441E-06	-79.4747	6.2657	-9.927E-08	8368.9598	1.140E+10
-0.2203	219253.	0.000				
24.500	7.361E-06	-34.4754	4.5100	-1.413E-07	8368.2703	1.140E+10
-0.1977	225603.	0.000				
25.200	6.068E-06	-3.3982	2.9760	-1.552E-07	8367.7940	1.140E+10
-0.1676	231954.	0.000				
25.900	4.753E-06	15.8592	1.7059	-1.506E-07	8367.9850	1.140E+10
-0.1349	238304.	0.000				
26.600	3.537E-06	25.5886	0.8231	-1.354E-07	8368.1341	1.140E+10
-0.0753	178868.	0.000				
27.300	2.480E-06	29.9827	0.2780	-1.149E-07	8368.2014	1.140E+10
-0.0545	184513.	0.000				
28.000	1.607E-06	30.5097	-0.1036	-9.258E-08	8368.2095	1.140E+10
-0.0364	190158.	0.000				
28.700	9.242E-07	28.4446	-0.3469	-7.085E-08	8368.1778	1.140E+10
-0.0215	195803.	0.000				
29.400	4.171E-07	24.8365	-0.4794	-5.122E-08	8368.1225	1.140E+10
-0.0100	201447.	0.000				
30.100	6.373E-08	20.5028	-0.5280	-3.451E-08	8368.0561	1.140E+10
-0.001571	207092.	0.000				
30.800	-1.627E-07	16.0417	-0.5173	-2.104E-08	8367.9878	1.140E+10
0.004120	212737.	0.000				
31.500	-2.898E-07	11.8585	-0.4683	-1.076E-08	8367.9237	1.140E+10
0.007534	218382.	0.000				
32.200	-3.435E-07	8.1974	-0.3982	-3.370E-09	8367.8676	1.140E+10
0.009161	224027.	0.000				
32.900	-3.464E-07	5.1761	-0.3199	1.558E-09	8367.8213	1.140E+10
0.009472	229671.	0.000				
33.600	-3.173E-07	2.8190	-0.2428	4.504E-09	8367.7851	1.140E+10
0.008889	235316.	0.000				
34.300	-2.708E-07	1.0868	-0.1729	5.944E-09	8367.7586	1.140E+10
0.007767	240961.	0.000				
35.000	-2.175E-07	-0.0982	-0.1134	6.308E-09	8367.7434	1.140E+10
0.006384	246606.	0.000				
35.700	-1.648E-07	-0.8327	-0.0658	5.965E-09	8367.7547	1.140E+10
0.004948	252251.	0.000				
36.400	-1.173E-07	-1.2173	-0.0299	5.209E-09	8367.7606	1.140E+10
0.003600	257895.	0.000				
37.100	-7.726E-08	-1.3469	-0.004636	4.264E-09	8367.7626	1.140E+10
0.002424	263540.	0.000				
37.800	-4.561E-08	-1.3045	0.0117	3.287E-09	8367.7619	1.140E+10
0.001462	269185.	0.000				

Bridge 11 End Bent 1 Transverse Provided.lp6o

38.500	-2.203E-08	-1.1578	0.0209	2.380E-09	8367.7597	1.140E+10
0.000721	274830.	0.000				
39.200	-5.626E-09	-0.9594	0.0247	1.600E-09	8367.7566	1.140E+10
0.000188	280475.	0.000				
39.900	4.842E-09	-0.7469	0.0248	9.710E-10	8367.7534	1.140E+10
-0.000165	286119.	0.000				
40.600	1.069E-08	-0.5455	0.0225	4.947E-10	8367.7503	1.140E+10
-0.000371	291764.	0.000				
41.300	1.315E-08	-0.3698	0.0190	1.575E-10	8367.7476	1.140E+10
-0.000466	297409.	0.000				
42.000	1.333E-08	-0.2266	0.0150	-6.232E-11	8367.7454	1.140E+10
-0.000481	303054.	0.000				
42.700	1.211E-08	-0.1173	0.0111	-1.891E-10	8367.7437	1.140E+10
-0.000445	308699.	0.000				
43.400	1.016E-08	-0.0392	0.007667	-2.467E-10	8367.7425	1.140E+10
-0.000380	314343.	0.000				
44.100	7.962E-09	0.0121	0.004797	-2.567E-10	8367.7421	1.140E+10
-0.000303	319988.	0.000				
44.800	5.842E-09	0.0419	0.002572	-2.369E-10	8367.7426	1.140E+10
-0.000226	325633.	0.000				
45.500	3.983E-09	0.0558	0.000961	-2.008E-10	8367.7428	1.140E+10
-0.000157	331278.	0.000				
46.200	2.468E-09	0.0585	-0.000115	-1.587E-10	8367.7428	1.140E+10
-9.900E-05	336923.	0.000				
46.900	1.316E-09	0.0542	-0.000756	-1.172E-10	8367.7428	1.140E+10
-5.367E-05	342567.	0.000				
47.600	4.994E-10	0.0461	-0.001072	-8.025E-11	8367.7426	1.140E+10
-2.169E-05	364850.	0.000				
48.300	-3.212E-11	0.0364	-0.001157	-4.987E-11	8367.7425	1.140E+10
1.424E-06	372258.	0.000				
49.000	-3.385E-10	0.0267	-0.001087	-2.663E-11	8367.7423	1.140E+10
1.530E-05	379667.	0.000				
49.700	-4.794E-10	0.0182	-0.000930	-1.009E-11	8367.7422	1.140E+10
2.209E-05	387076.	0.000				
50.400	-5.080E-10	0.0111	-0.000737	0.000	8367.7421	1.140E+10
2.386E-05	394485.	0.000				
51.100	-4.677E-10	0.005764	-0.000543	6.920E-12	8367.7420	1.140E+10
2.238E-05	401894.	0.000				
51.800	-3.918E-10	0.001982	-0.000369	9.774E-12	8367.7420	1.140E+10
1.909E-05	409302.	0.000				
52.500	-3.035E-10	-0.000455	-0.000225	1.034E-11	8367.7419	1.140E+10
1.506E-05	416711.	0.000				
53.200	-2.181E-10	-0.001828	-0.000116	9.495E-12	8367.7420	1.140E+10
1.101E-05	424120.	0.000				
53.900	-1.440E-10	-0.002424	-3.865E-05	7.928E-12	8367.7420	1.140E+10
7.397E-06	431529.	0.000				
54.600	-8.490E-11	-0.002495	1.105E-05	6.116E-12	8367.7420	1.140E+10
4.436E-06	438938.	0.000				
55.300	-4.125E-11	-0.002251	3.889E-05	4.367E-12	8367.7420	1.140E+10
2.192E-06	446346.	0.000				
56.000	-1.154E-11	-0.001851	5.071E-05	2.855E-12	8367.7420	1.140E+10
6.234E-07	453755.	0.000				
56.700	6.709E-12	-0.001406	5.178E-05	1.655E-12	8367.7420	1.140E+10
-3.683E-07	461164.	0.000				
57.400	1.626E-11	-0.000985	4.643E-05	0.000	8367.7420	1.140E+10
-9.068E-07	468573.	0.000				
58.100	1.971E-11	-0.000627	3.793E-05	0.000	8367.7419	1.140E+10
-1.117E-06	475982.	0.000				
58.800	1.927E-11	-0.000348	2.858E-05	0.000	8367.7419	1.140E+10
-1.109E-06	483390.	0.000				
59.500	1.668E-11	-0.000147	1.983E-05	0.000	8367.7419	1.140E+10
-9.748E-07	490799.	0.000				
60.200	1.319E-11	-1.403E-05	1.245E-05	0.000	8367.7419	1.140E+10

Bridge 11 End Bent 1 Transverse Provided.lp6o							
-7.822E-07	498208.	0.000					
60.900	9.605E-12	6.344E-05	6.738E-06	0.000	8367.7419	1.140E+10	
-5.782E-07	505617.	0.000					
61.600	6.415E-12	0.000100	2.664E-06	0.000	8367.7419	1.140E+10	
-3.918E-07	513026.	0.000					
62.300	3.845E-12	0.000109	1.828E-08	0.000	8367.7419	1.140E+10	
-2.382E-07	520434.	0.000					
63.000	1.948E-12	0.000101	-1.496E-06	0.000	8367.7419	1.140E+10	
-1.224E-07	527843.	0.000					
63.700	0.000	8.422E-05	-2.192E-06	0.000	8367.7419	1.140E+10	
-4.314E-08	535252.	0.000					
64.400	0.000	6.438E-05	-2.353E-06	0.000	8367.7419	1.140E+10	
4.702E-09	542661.	0.000					
65.100	0.000	4.483E-05	-2.217E-06	0.000	8367.7419	1.140E+10	
2.777E-08	550070.	0.000					
65.800	0.000	2.719E-05	-1.961E-06	0.000	8367.7419	1.140E+10	
3.304E-08	557478.	0.000					
66.500	0.000	1.187E-05	-1.709E-06	0.000	8367.7419	1.140E+10	
2.712E-08	564887.	0.000					
67.200	0.000	-1.548E-06	-1.528E-06	0.000	8367.7419	1.140E+10	
1.602E-08	572296.	0.000					
67.900	0.000	-1.383E-05	-4.160E-07	0.000	8367.7419	1.140E+10	
2.486E-07	27259303.	0.000					
68.600	0.000	-8.566E-06	6.798E-07	0.000	8367.7419	1.140E+10	
1.226E-08	27400423.	0.000					
69.300	0.000	-2.426E-06	5.101E-07	0.000	8367.7419	1.140E+10	
-5.267E-08	27541543.	0.000					
70.000	0.000	0.000	0.000	0.000	8367.7419	1.140E+10	
-6.878E-08	13841331.	0.000					

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.0090442 inches
Computed slope at pile head	=	0.000000 radians
Maximum bending moment	=	-57296. inch-lbs
Maximum shear force	=	1315.000000 lbs
Depth of maximum bending moment	=	0.000000 inches below pile head
Depth of maximum shear force	=	0.000000 inches below pile head
Number of iterations	=	6
Number of zero deflection points	=	8

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

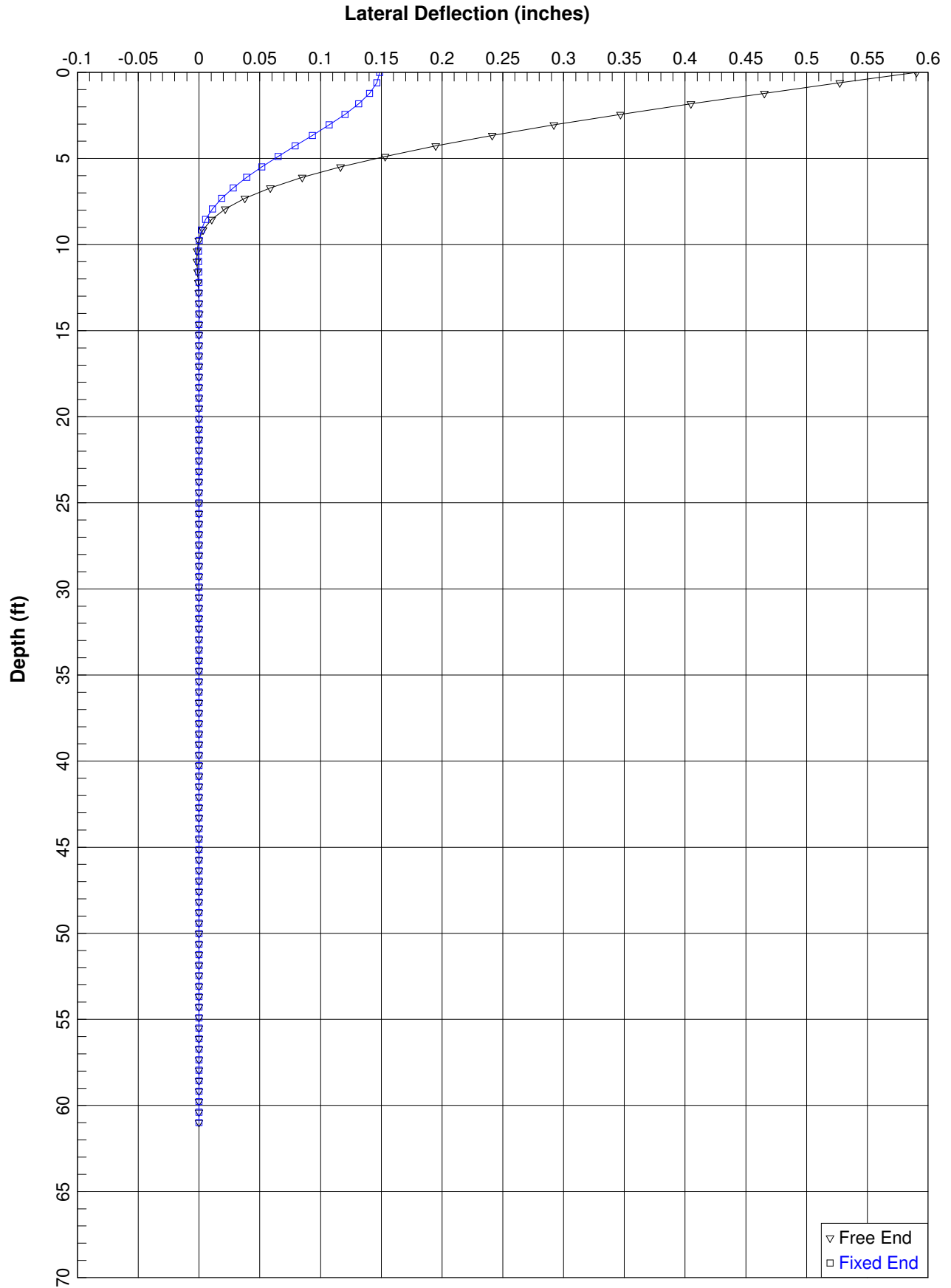
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
 Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
 Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
 Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
 Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

	Pile-head	Pile-head	Maximum
Maximum			

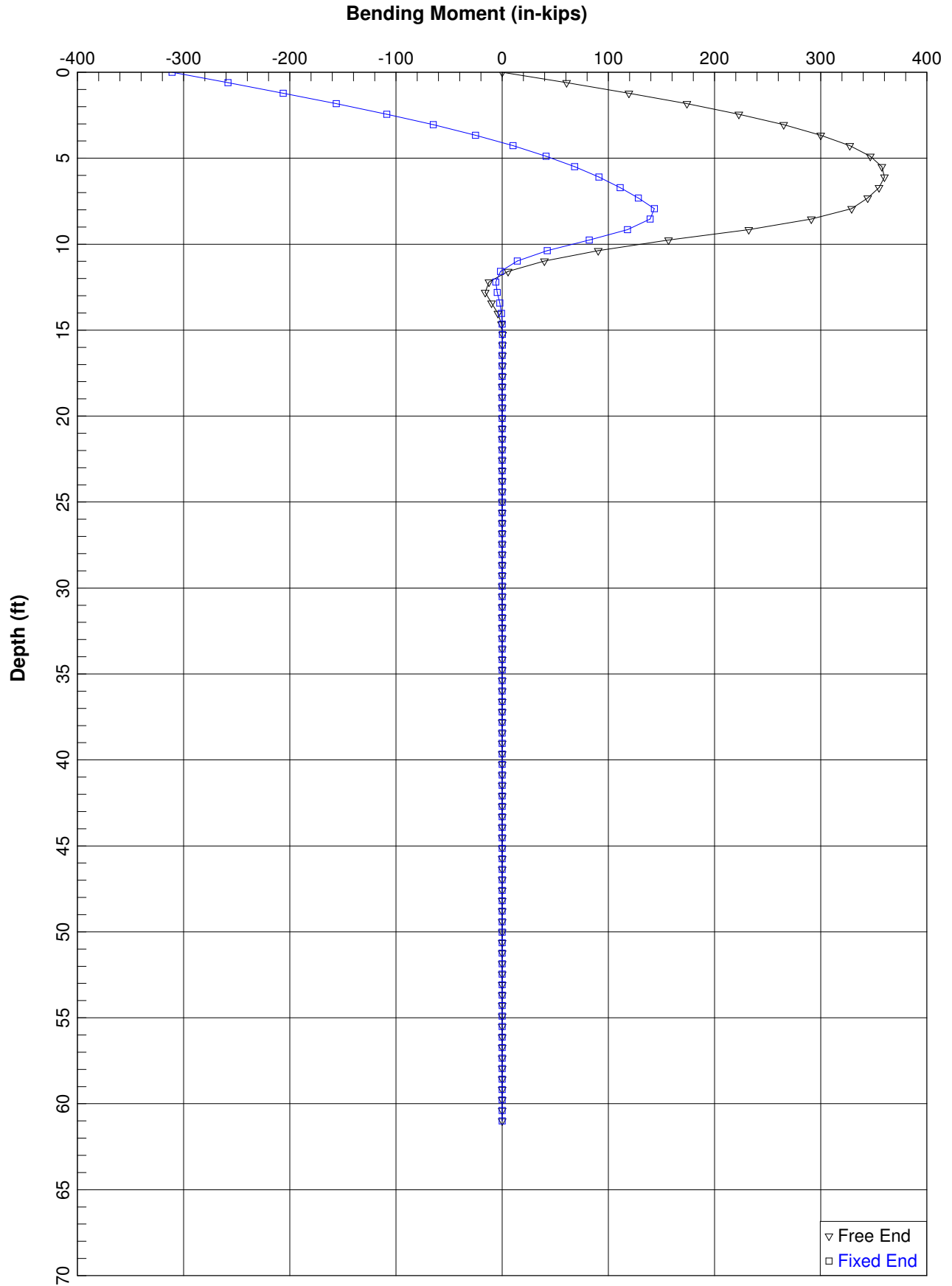
Bridge 11 End Bent 1 Transverse Provided.lp6o						
Load	Load	Condition 1	Condition 2	Axial	Pile-head	Moment
Case	Shear	Pile-head	Pile-head	Loading	Deflection	in Pile
No.	Type	V(lbs) or	in-lb, rad.,	lbs	inches	in-lbs
	in Pile	Rotation	or in-lb/rad.			
No.	No.	y(inches)	radians			
----	----	-----	-----	-----	-----	-----
1	1	V = 1315.0000	M = 0.000	129700.	0.02761766	
56789.		1315.0000	-0.00042155			
2	2	V = 1315.0000	S = 0.000	129700.	0.00904422	
-57296.		1315.0000	0.00000000			

The analysis ended normally.

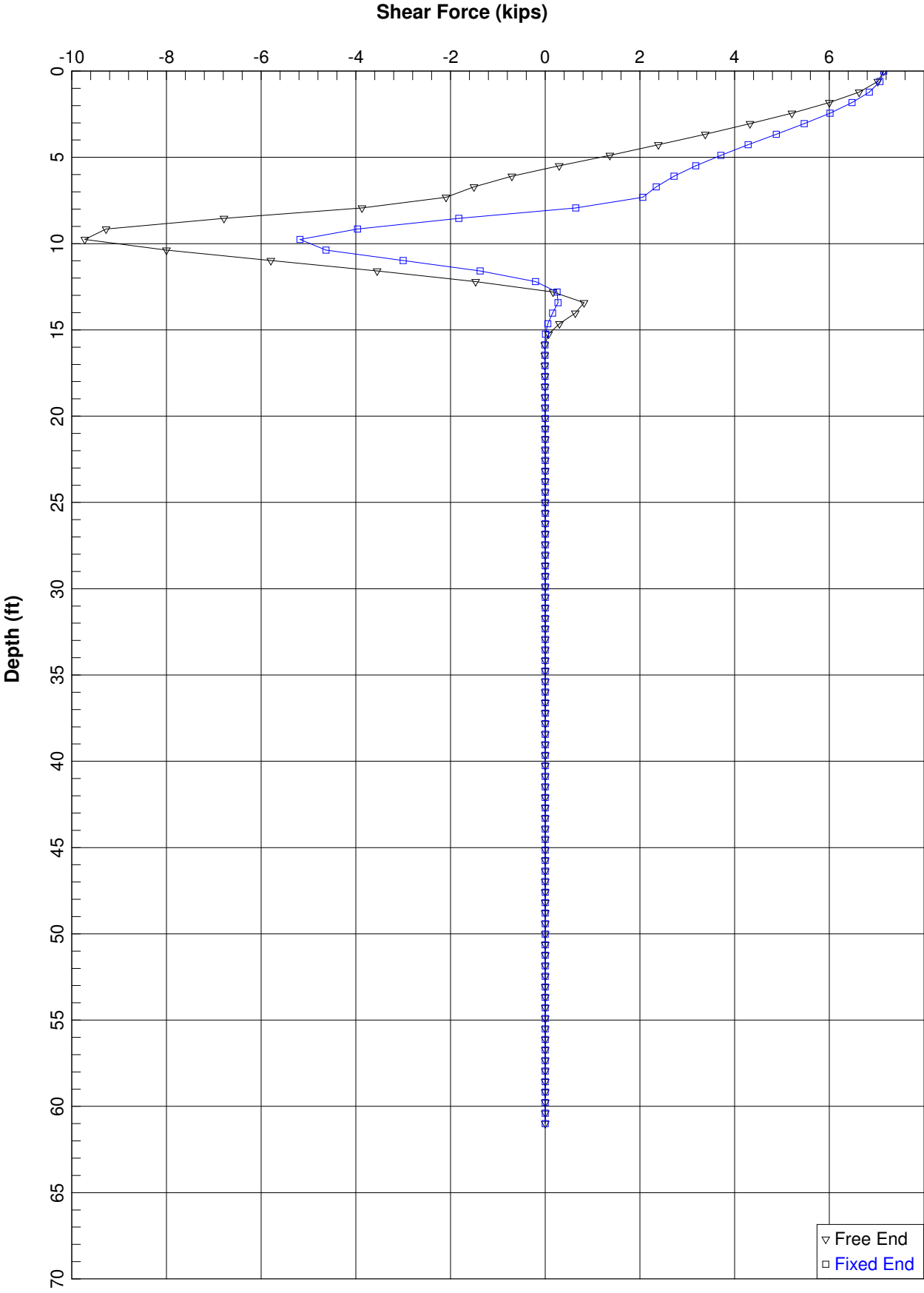
Bridge 11 End Bent 5 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-05



Bridge 11 End Bent 5 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-05



Bridge 11 End Bent 5 - Provided Loading - Longitudinal
Subsurface Based on Boring B11-SPT-05



Bridge 11 Bent 5 Longitudinal Provided.lp6o

LPILE Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 End Bent 5\Bridge 11 End Bent 5 Provided Loads\
Name of input data file: Bridge 11 Bent 5 Longitudinal Provided.lp6d
Name of output report file: Bridge 11 Bent 5 Longitudinal Provided.lp6o
Name of plot output file: Bridge 11 Bent 5 Longitudinal Provided.lp6p
Name of runtime message file: Bridge 11 Bent 5 Longitudinal Provided.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:28:40

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 End Bent 5 (Boring B11-SPT-06)

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 61.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	12.0450000
2	61.000000	12.0450000

Input Structural Properties:

Bridge 11 Bent 5 Longitudinal Provided.lp6o

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	61.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	127.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	7.50000 ft
Effective unit weight at top of layer	=	95.00000 pcf
Effective unit weight at bottom of layer	=	95.00000 pcf
Friction angle at top of layer	=	26.00000 deg.
Friction angle at bottom of layer	=	26.00000 deg.
Subgrade k at top of layer	=	20.00000 pci
Subgrade k at bottom of layer	=	20.00000 pci

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	7.50000 ft
Distance from top of pile to bottom of layer	=	15.50000 ft
Effective unit weight at top of layer	=	120.00000 pcf
Effective unit weight at bottom of layer	=	120.00000 pcf
Undrained cohesion at top of layer	=	4000.00000 psf
Undrained cohesion at bottom of layer	=	4000.00000 psf
Epsilon-50 at top of layer	=	0.00500
Epsilon-50 at bottom of layer	=	0.00500

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	15.50000 ft
Distance from top of pile to bottom of layer	=	19.50000 ft
Effective unit weight at top of layer	=	130.00000 pcf
Effective unit weight at bottom of layer	=	130.00000 pcf

Bridge 11 Bent 5 Longitudinal Provided.lp6o

Friction angle at top of layer	=	30.00000	deg.
Friction angle at bottom of layer	=	30.00000	deg.
Subgrade k at top of layer	=	45.00000	pci
Subgrade k at bottom of layer	=	45.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	19.50000	ft
Distance from top of pile to bottom of layer	=	24.50000	ft
Effective unit weight at top of layer	=	130.00000	pcf
Effective unit weight at bottom of layer	=	130.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	185.00000	pci
Subgrade k at bottom of layer	=	185.00000	pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	24.50000	ft
Distance from top of pile to bottom of layer	=	40.50000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	40.50000	ft
Distance from top of pile to bottom of layer	=	45.50000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

Layer 7 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	45.50000	ft
Distance from top of pile to bottom of layer	=	60.50000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 8 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	60.50000	ft
Distance from top of pile to bottom of layer	=	76.10000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf

Bridge 11 Bent 5 Longitudinal Provided.lp60
 Undrained cohesion at bottom of layer = 8000.00000 psf
 Epsilon-50 at top of layer = 0.00400
 Epsilon-50 at bottom of layer = 0.00400
 Subgrade k at top of layer = 2000.00000 pci
 Subgrade k at bottom of layer = 2000.00000 pci

(Depth of lowest soil layer extends 15.10 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor (p-y Curve Epsilon 50	Layer Soil Type kpy (Criteria) pci	Layer Depth ft	Effective Unit wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	95.000	--
26.000	--	20.000	7.500	95.000	--
26.000	--	20.000	7.500	120.000	4000.000
2	Stiff Clay w/o Free Water		15.500	120.000	4000.000
--	0.00500	--	15.500	130.000	--
3	Sand (Reese, et al.)		19.500	130.000	--
30.000	--	45.000	19.500	130.000	--
30.000	--	45.000	24.500	130.000	--
4	Sand (Reese, et al.)		24.500	75.000	--
36.000	--	185.000	40.500	75.000	--
36.000	--	185.000	40.500	75.000	8000.000
5	Sand (Reese, et al.)		45.500	75.000	8000.000
36.000	--	105.000	45.500	75.000	--
36.000	--	105.000	60.500	75.000	--
6	Stiff Clay w/o Free Water, using k		60.500	75.000	8000.000
--	0.00400	2000.000	76.100	75.000	8000.000
--	0.00400	2000.000			
7	Sand (Reese, et al.)				
36.000	--	105.000			
36.000	--	105.000			
8	Stiff Clay w/o Free Water, using k				
--	0.00400	2000.000			
--	0.00400	2000.000			

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.
 Page 5

Bridge 11 Bent 5 Longitudinal Provided.lp6o

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	1	V = 7150.00000 lbs	M = 0.0000 in-lbs	131800.
2	2	V = 7150.00000 lbs	S = 0.0000 in/in	131800.
	No			
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	7150.000 lbs
Applied moment at pile head	=	0.000 in-lbs
Axial thrust load on pile head	=	131800.000 lbs

Depth Res.	Soil	Deflect. Spr.	Bending Distrib. Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
X	Es*h	y	Lat. Load					
feet	lb/inch	inches	lb/inch	lbs	radians	psi*	lb-in^2	lb/in
0.00		0.5905	-3.052E-08	7150.0000	-0.008618	8503.2258	3.683E+09	

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0.000	0.000	0.000	60652.	7023.0190	-0.008557	11379.	3.683E+09
-34.6943	0.610	0.5274	0.000				
	481.5608	0.000					
	1.220	0.4652	119329.	6632.3480	-0.008378	14162.	3.683E+09
-72.0464	1133.7254	0.000					
	1.830	0.4047	173916.	6002.3939	-0.008087	16751.	3.683E+09
-100.0722	1809.9990	0.000					
	2.440	0.3468	222808.	5210.9090	-0.007693	19069.	3.683E+09
-116.1806	2452.3968	0.000					
	3.050	0.2921	265048.	4326.8156	-0.007208	21072.	3.683E+09
-125.3750	3142.0026	0.000					
	3.660	0.2413	300061.	3379.2786	-0.006646	22732.	3.683E+09
-133.5149	4051.0264	0.000					
	4.270	0.1948	327345.	2390.0728	-0.006023	24026.	3.683E+09
-136.7599	5139.4081	0.000					
	4.880	0.1531	346673.	1362.9647	-0.005353	24943.	3.683E+09
-143.8707	6879.6773	0.000					
	5.490	0.1164	357628.	293.4386	-0.004653	25462.	3.683E+09
-148.3495	9327.9281	0.000					
	6.100	0.0850	359948.	-704.7340	-0.003940	25572.	3.683E+09
-124.3752	10716.	0.000					
	6.710	0.0587	354913.	-1506.1197	-0.003230	25334.	3.683E+09
-94.5826	11788.	0.000					
	7.320	0.0377	344130.	-2094.5221	-0.002535	24822.	3.683E+09
-66.1830	12860.	0.000					
	7.930	0.0216	329141.	-3871.3031	-0.001866	24112.	3.683E+09
-419.2762	141962.	0.000					
	8.540	0.0104	291055.	-6782.9125	-0.001250	22305.	3.683E+09
-376.2454	265983.	0.000					
	9.150	0.003324	232250.	-9272.7121	-0.000730	19517.	3.683E+09
-304.0277	669488.	0.000					
	9.760	-0.000327	156710.	-9725.5247	-0.000343	15935.	3.683E+09
180.3084	4033212.	0.000					
	10.370	-0.001699	90531.	-7999.0502	-9.740E-05	12796.	3.683E+09
291.4059	1255690.	0.000					
	10.980	-0.001753	39792.	-5792.7135	3.211E-05	10390.	3.683E+09
311.4183	1300286.	0.000					
	11.590	-0.001229	5663.4879	-3551.0131	7.728E-05	8771.7955	3.683E+09
301.0682	1793734.	0.000					
	12.200	-0.000622	-12344.	-1470.0009	7.064E-05	9088.5911	3.683E+09
267.5144	3149723.	0.000					
	12.810	-0.000194	-15994.	164.6856	4.248E-05	9261.6643	3.683E+09
179.1213	6745375.	0.000					
	13.420	2.621E-07	-10015.	819.3429	1.664E-05	8978.1459	3.683E+09
-0.2532	7071910.	0.000					
	14.030	4.920E-05	-4030.5626	636.4064	2.680E-06	8694.3602	3.683E+09
-49.7295	7398533.	0.000					
	14.640	3.950E-05	-703.1011	301.8149	-2.024E-06	8536.5677	3.683E+09
-41.6890	7725230.	0.000					
	15.250	1.957E-05	391.9121	70.4297	-2.333E-06	8521.8108	3.683E+09
-21.5310	8051995.	0.000					
	15.860	5.347E-06	332.4907	-8.5282	-1.613E-06	8518.9929	3.683E+09
-0.0422	57736.	0.000					
	16.470	-4.043E-06	270.1721	-8.5610	-1.014E-06	8516.0377	3.683E+09
0.0332	60147.	0.000					
	17.080	-9.501E-06	209.1153	-8.1422	-5.379E-07	8513.1423	3.683E+09
0.0812	62558.	0.000					
	17.690	-1.192E-05	152.0085	-7.4578	-1.791E-07	8510.4342	3.683E+09
0.1058	64969.	0.000					
	18.300	-1.212E-05	100.2781	-6.6622	7.164E-08	8507.9811	3.683E+09
0.1116	67381.	0.000					
	18.910	-1.087E-05	54.3349	-5.8745	2.253E-07	8505.8024	3.683E+09
0.1036	69792.	0.000					

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19.520	-8.825E-06	13.8404	-4.4357	2.930E-07	8503.8821	3.683E+09
0.2895	240135.	0.000				
20.130	-6.579E-06	-11.1684	-2.5535	2.957E-07	8503.7554	3.683E+09
0.2247	250048.	0.000				
20.740	-4.496E-06	-24.1136	-1.1466	2.606E-07	8504.3693	3.683E+09
0.1597	259961.	0.000				
21.350	-2.764E-06	-28.4572	-0.1893	2.084E-07	8504.5753	3.683E+09
0.1019	269873.	0.000				
21.960	-1.445E-06	-27.2869	0.3858	1.530E-07	8504.5198	3.683E+09
0.0552	279786.	0.000				
22.570	-5.237E-07	-23.1045	0.6638	1.029E-07	8504.3215	3.683E+09
0.0207	289699.	0.000				
23.180	6.153E-08	-17.7673	0.7305	6.230E-08	8504.0684	3.683E+09
-0.002519	299612.	0.000				
23.790	3.883E-07	-12.5309	0.6611	3.219E-08	8503.8200	3.683E+09
-0.0164	309524.	0.000				
24.400	5.328E-07	-8.1503	0.5159	1.164E-08	8503.6123	3.683E+09
-0.0233	319437.	0.000				
25.010	5.587E-07	-4.9998	0.3799	-1.430E-09	8503.4629	3.683E+09
-0.0139	182376.	0.000				
25.620	5.119E-07	-2.5857	0.2808	-8.968E-09	8503.3484	3.683E+09
-0.0131	188002.	0.000				
26.230	4.274E-07	-0.8710	0.1913	-1.240E-08	8503.2671	3.683E+09
-0.0113	193628.	0.000				
26.840	3.303E-07	0.2396	0.1171	-1.303E-08	8503.2372	3.683E+09
-0.008990	199254.	0.000				
27.450	2.366E-07	0.8680	0.0599	-1.193E-08	8503.2670	3.683E+09
-0.006623	204881.	0.000				
28.060	1.556E-07	1.1399	0.0193	-9.935E-09	8503.2799	3.683E+09
-0.004475	210507.	0.000				
28.670	9.118E-08	1.1698	-0.006929	-7.640E-09	8503.2813	3.683E+09
-0.002692	216133.	0.000				
29.280	4.377E-08	1.0532	-0.0216	-5.430E-09	8503.2757	3.683E+09
-0.001326	221759.	0.000				
29.890	1.168E-08	0.8635	-0.0278	-3.526E-09	8503.2668	3.683E+09
-0.000363	227385.	0.000				
30.500	-7.847E-09	0.6527	-0.0282	-2.019E-09	8503.2568	3.683E+09
0.000250	233011.	0.000				
31.110	-1.788E-08	0.4541	-0.0252	-9.191E-10	8503.2473	3.683E+09
0.000583	238637.	0.000				
31.720	-2.130E-08	0.2858	-0.0204	-1.838E-10	8503.2394	3.683E+09
0.000711	244264.	0.000				
32.330	-2.057E-08	0.1551	-0.0153	2.544E-10	8503.2332	3.683E+09
0.000702	249890.	0.000				
32.940	-1.758E-08	0.0617	-0.0105	4.698E-10	8503.2287	3.683E+09
0.000614	255516.	0.000				
33.550	-1.369E-08	0.001025	-0.006428	5.321E-10	8503.2259	3.683E+09
0.000488	261142.	0.000				
34.160	-9.787E-09	-0.0335	-0.003335	4.999E-10	8503.2274	3.683E+09
0.000357	266768.	0.000				
34.770	-6.371E-09	-0.0488	-0.001162	4.182E-10	8503.2281	3.683E+09
0.000237	272394.	0.000				
35.380	-3.665E-09	-0.0513	0.000215	3.188E-10	8503.2282	3.683E+09
0.000139	278021.	0.000				
35.990	-1.705E-09	-0.0462	0.000966	2.218E-10	8503.2280	3.683E+09
6.606E-05	283647.	0.000				
36.600	-4.171E-10	-0.0376	0.001268	1.386E-10	8503.2276	3.683E+09
1.648E-05	289273.	0.000				
37.210	3.239E-10	-0.0279	0.001281	7.347E-11	8503.2271	3.683E+09
-1.305E-05	294899.	0.000				
37.820	6.585E-10	-0.0190	0.001134	2.687E-11	8503.2267	3.683E+09
-2.704E-05	300525.	0.000				
38.430	7.173E-10	-0.0114	0.000925	-3.278E-12	8503.2263	3.683E+09

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-3.000E-05	306151.	0.000				
39.040	6.105E-10	-0.005401	0.000720	-1.996E-11	8503.2261	3.683E+09
-2.600E-05	311777.	0.000				
39.650	4.251E-10	-0.000799	0.000558	-2.612E-11	8503.2258	3.683E+09
-1.843E-05	317404.	0.000				
40.260	2.281E-10	0.002816	0.000453	-2.412E-11	8503.2259	3.683E+09
-1.007E-05	323030.	0.000				
40.870	7.206E-11	0.005886	5.851E-05	-1.547E-11	8503.2261	3.683E+09
-9.785E-05	9940049.	0.000				
41.480	1.638E-12	0.003702	-0.000308	-5.941E-12	8503.2260	3.683E+09
-2.248E-06	10047214.	0.000				
42.090	-1.492E-11	0.001391	-0.000240	0.000	8503.2259	3.683E+09
2.070E-05	10154379.	0.000				
42.700	-1.125E-11	0.000186	-0.000107	0.000	8503.2258	3.683E+09
1.577E-05	10261543.	0.000				
43.310	-4.870E-12	-0.000175	-2.391E-05	0.000	8503.2258	3.683E+09
6.899E-06	10368708.	0.000				
43.920	-1.041E-12	-0.000166	6.790E-06	0.000	8503.2258	3.683E+09
1.489E-06	10475873.	0.000				
44.530	0.000	-7.629E-05	1.024E-05	0.000	8503.2258	3.683E+09
-5.467E-07	10583038.	0.000				
45.140	0.000	-1.602E-05	4.567E-06	0.000	8503.2258	3.683E+09
-1.003E-06	10690203.	0.000				
45.750	0.000	-9.478E-06	7.799E-07	0.000	8503.2258	3.683E+09
-3.155E-08	302839.	0.000				
46.360	0.000	-4.607E-06	5.563E-07	0.000	8503.2258	3.683E+09
-2.952E-08	308465.	0.000				
46.970	0.000	-1.308E-06	3.586E-07	0.000	8503.2258	3.683E+09
-2.451E-08	314091.	0.000				
47.580	0.000	6.796E-07	2.012E-07	0.000	8503.2258	3.683E+09
-1.848E-08	319717.	0.000				
48.190	0.000	1.676E-06	8.729E-08	0.000	8503.2258	3.683E+09
-1.265E-08	325344.	0.000				
48.800	0.000	1.991E-06	1.272E-08	0.000	8503.2258	3.683E+09
-7.721E-09	330970.	0.000				
49.410	0.000	1.888E-06	-2.997E-08	0.000	8503.2258	3.683E+09
-3.944E-09	336596.	0.000				
50.020	0.000	1.571E-06	-4.924E-08	0.000	8503.2258	3.683E+09
-1.320E-09	342222.	0.000				
50.630	0.000	1.180E-06	-5.295E-08	0.000	8503.2258	3.683E+09
3.059E-10	347848.	0.000				
51.240	0.000	8.024E-07	-4.760E-08	0.000	8503.2258	3.683E+09
1.156E-09	353474.	0.000				
51.850	0.000	4.858E-07	-3.802E-08	0.000	8503.2258	3.683E+09
1.461E-09	359101.	0.000				
52.460	0.000	2.465E-07	-2.746E-08	0.000	8503.2258	3.683E+09
1.423E-09	364727.	0.000				
53.070	0.000	8.291E-08	-1.786E-08	0.000	8503.2258	3.683E+09
1.201E-09	370353.	0.000				
53.680	0.000	-1.643E-08	-1.013E-08	0.000	8503.2258	3.683E+09
9.102E-10	375979.	0.000				
54.290	0.000	-6.696E-08	-4.522E-09	0.000	8503.2258	3.683E+09
6.224E-10	381605.	0.000				
54.900	0.000	-8.402E-08	-8.628E-10	0.000	8503.2258	3.683E+09
3.772E-10	387231.	0.000				
55.510	0.000	-8.070E-08	1.214E-09	0.000	8503.2258	3.683E+09
1.903E-10	392857.	0.000				
56.120	0.000	-6.703E-08	2.137E-09	0.000	8503.2258	3.683E+09
6.176E-11	398484.	0.000				
56.730	0.000	-4.992E-08	2.302E-09	0.000	8503.2258	3.683E+09
-1.665E-11	404110.	0.000				
57.340	0.000	-3.361E-08	2.034E-09	0.000	8503.2258	3.683E+09
-5.662E-11	409736.	0.000				

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57.950	0.000	-2.027E-08	1.571E-09	0.000	8503.2258	3.683E+09	
-6.992E-11	415362.	0.000					
58.560	0.000	-1.064E-08	1.071E-09	0.000	8503.2258	3.683E+09	
-6.660E-11	420988.	0.000					
59.170	0.000	-4.552E-09	6.291E-10	0.000	8503.2258	3.683E+09	
-5.415E-11	426614.	0.000					
59.780	0.000	-1.358E-09	2.939E-10	0.000	8503.2258	3.683E+09	
-3.743E-11	432241.	0.000					
60.390	0.000	-1.679E-10	8.708E-11	0.000	8503.2258	3.683E+09	
-1.908E-11	437867.	0.000					
61.000	0.000	0.000	0.000	0.000	8503.2258	3.683E+09	
-4.707E-12	10224246.	0.000					

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.5904536 inches
Computed slope at pile head	=	-0.0086176 radians
Maximum bending moment	=	359948. inch-lbs
Maximum shear force	=	-9725.5246548 lbs
Depth of maximum bending moment	=	73.2000000 inches below pile head
Depth of maximum shear force	=	117.1200000 inches below pile head
Number of iterations	=	19
Number of zero deflection points	=	11

Computed values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	7150.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	131800.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Load	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
	Es*h feet lb/inch	Lat. inches lb/inch	Moment in-lbs	lbs	radians	psi*	lb-in^2	lb/in
0.000	0.00	0.1486	-310942.	7150.0000	0.000	23248.	3.683E+09	
		0.000	0.000					
-21.4311	0.610	0.1464	-258306.	7071.5621	-0.000566	20752.	3.683E+09	
-41.0996	1.220	0.1404	-206323.	6842.6997	-0.001027	18287.	3.683E+09	
-57.6871	1.830	0.1313	-156146.	6481.1402	-0.001388	15908.	3.683E+09	
-70.3028	2.440	0.1201	-108762.	6012.6969	-0.001651	13661.	3.683E+09	
-78.4536	3.050	0.1072	-64935.	5468.2483	-0.001823	11583.	3.683E+09	
	3.660	0.0934	-25188.	4880.9714	-0.001913	9697.6684	3.683E+09	

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-82.0046	6429.8880	0.000					
4.270	0.0792	10214.	4283.8866	-0.001928	8987.5683	3.683E+09	
-81.1334	7501.5360	0.000					
4.880	0.0651	41248.	3707.7450	-0.001877	10459.	3.683E+09	
-76.2823	8573.1840	0.000					
5.490	0.0517	68116.	3179.2631	-0.001768	11733.	3.683E+09	
-68.1116	9644.8320	0.000					
6.100	0.0392	91204.	2719.6816	-0.001610	12828.	3.683E+09	
-57.4571	10716.	0.000					
6.710	0.0281	111039.	2343.6096	-0.001409	13769.	3.683E+09	
-45.2948	11788.	0.000					
7.320	0.0186	128233.	2058.0949	-0.001171	14584.	3.683E+09	
-32.7146	12860.	0.000					
7.930	0.0110	143429.	642.7268	-0.000901	15305.	3.683E+09	
-353.9980	235943.	0.000					
8.540	0.005430	139381.	-1824.8455	-0.000620	15113.	3.683E+09	
-320.2021	431641.	0.000					
9.150	0.001906	117909.	-3964.8934	-0.000364	14095.	3.683E+09	
-264.5104	1016107.	0.000					
9.760	9.630E-05	82038.	-5179.2635	-0.000166	12394.	3.683E+09	
-67.2847	5114561.	0.000					
10.370	-0.000519	42405.	-4632.2061	-4.197E-05	10514.	3.683E+09	
216.7539	3054827.	0.000					
10.980	-0.000518	14304.	-2998.1790	1.438E-05	9181.5269	3.683E+09	
229.7016	3245053.	0.000					
11.590	-0.000309	-1516.5464	-1376.9090	2.709E-05	8575.1423	3.683E+09	
213.2684	5055319.	0.000					
12.200	-0.000122	-5906.4869	-206.2906	1.971E-05	8783.3189	3.683E+09	
106.5727	6418939.	0.000					
12.810	-2.019E-05	-4574.6804	251.8549	9.299E-06	8720.1629	3.683E+09	
18.6037	6745375.	0.000					
13.420	1.460E-05	-2237.2735	268.3161	2.529E-06	8609.3201	3.683E+09	
-14.1060	7071910.	0.000					
14.030	1.684E-05	-651.4125	154.3882	-3.413E-07	8534.1166	3.683E+09	
-17.0218	7398533.	0.000					
14.640	9.604E-06	23.6287	54.9910	-9.652E-07	8504.3463	3.683E+09	
-10.1359	7725230.	0.000					
15.250	2.711E-06	155.5187	6.9789	-7.871E-07	8510.6007	3.683E+09	
-2.9822	8051995.	0.000					
15.860	-1.919E-06	127.3182	-3.8805	-5.061E-07	8509.2634	3.683E+09	
0.0151	57736.	0.000					
16.470	-4.698E-06	99.6847	-3.6838	-2.805E-07	8507.9530	3.683E+09	
0.0386	60147.	0.000					
17.080	-6.026E-06	73.9284	-3.3541	-1.080E-07	8506.7316	3.683E+09	
0.0515	62558.	0.000					
17.690	-6.278E-06	50.7897	-2.9616	1.599E-08	8505.6343	3.683E+09	
0.0557	64969.	0.000					
18.300	-5.792E-06	30.5393	-2.5626	9.681E-08	8504.6740	3.683E+09	
0.0533	67381.	0.000					
18.910	-4.861E-06	13.0870	-2.1978	1.402E-07	8503.8464	3.683E+09	
0.0463	69792.	0.000					
19.520	-3.740E-06	-1.9070	-1.5792	1.513E-07	8503.3162	3.683E+09	
0.1227	240135.	0.000					
20.130	-2.646E-06	-10.3237	-0.7993	1.391E-07	8503.7154	3.683E+09	
0.0904	250048.	0.000					
20.740	-1.703E-06	-13.8768	-0.2470	1.151E-07	8503.8839	3.683E+09	
0.0605	259961.	0.000					
21.350	-9.618E-07	-14.1625	0.1041	8.720E-08	8503.8974	3.683E+09	
0.0355	269873.	0.000					
21.960	-4.265E-07	-12.5210	0.2935	6.069E-08	8503.8196	3.683E+09	
0.0163	279786.	0.000					
22.570	-7.331E-08	-9.9822	0.3638	3.832E-08	8503.6992	3.683E+09	
0.002901	289699.	0.000					

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23.180	1.346E-07	-7.2688	0.3543	2.118E-08	8503.5705	3.683E+09
-0.005509	299612.	0.000				
23.790	2.368E-07	-4.8366	0.2975	9.150E-09	8503.4552	3.683E+09
-0.0100	309524.	0.000				
24.400	2.686E-07	-2.9316	0.2179	1.431E-09	8503.3648	3.683E+09
-0.0117	319437.	0.000				
25.010	2.577E-07	-1.6489	0.1515	-3.121E-09	8503.3040	3.683E+09
-0.006421	182376.	0.000				
25.620	2.229E-07	-0.7072	0.1071	-5.463E-09	8503.2593	3.683E+09
-0.005724	188002.	0.000				
26.230	1.777E-07	-0.0708	0.0689	-6.236E-09	8503.2292	3.683E+09
-0.004702	193628.	0.000				
26.840	1.316E-07	0.3139	0.0386	-5.994E-09	8503.2407	3.683E+09
-0.003582	199254.	0.000				
27.450	8.999E-08	0.5060	0.0163	-5.179E-09	8503.2498	3.683E+09
-0.002519	204881.	0.000				
28.060	5.576E-08	0.5622	0.001190	-4.118E-09	8503.2525	3.683E+09
-0.001603	210507.	0.000				
28.670	2.970E-08	0.5313	-0.007888	-3.031E-09	8503.2510	3.683E+09
-0.000877	216133.	0.000				
29.280	1.138E-08	0.4525	-0.0124	-2.053E-09	8503.2473	3.683E+09
-0.000345	221759.	0.000				
29.890	-3.600E-10	0.3544	-0.0136	-1.252E-09	8503.2426	3.683E+09
1.118E-05	227385.	0.000				
30.500	-6.944E-09	0.2561	-0.0127	-6.449E-10	8503.2380	3.683E+09
0.000221	233011.	0.000				
31.110	-9.802E-09	0.1692	-0.0108	-2.222E-10	8503.2338	3.683E+09
0.000320	238637.	0.000				
31.720	-1.020E-08	0.0991	-0.008337	4.446E-11	8503.2305	3.683E+09
0.000340	244264.	0.000				
32.330	-9.151E-09	0.0471	-0.005948	1.898E-10	8503.2280	3.683E+09
0.000312	249890.	0.000				
32.940	-7.419E-09	0.0117	-0.003857	2.482E-10	8503.2264	3.683E+09
0.000259	255516.	0.000				
33.550	-5.517E-09	-0.009857	-0.002189	2.500E-10	8503.2263	3.683E+09
0.000197	261142.	0.000				
34.160	-3.759E-09	-0.0208	-0.000967	2.195E-10	8503.2268	3.683E+09
0.000137	266768.	0.000				
34.770	-2.304E-09	-0.0244	-0.000152	1.745E-10	8503.2270	3.683E+09
8.572E-05	272394.	0.000				
35.380	-1.204E-09	-0.0234	0.000329	1.270E-10	8503.2269	3.683E+09
4.573E-05	278021.	0.000				
35.990	-4.447E-10	-0.0199	0.000560	8.398E-11	8503.2267	3.683E+09
1.723E-05	283647.	0.000				
36.600	2.549E-11	-0.0154	0.000619	4.896E-11	8503.2265	3.683E+09
-1.007E-06	289273.	0.000				
37.210	2.721E-10	-0.0109	0.000575	2.286E-11	8503.2263	3.683E+09
-1.096E-05	294899.	0.000				
37.820	3.601E-10	-0.006995	0.000481	5.075E-12	8503.2261	3.683E+09
-1.478E-05	300525.	0.000				
38.430	3.464E-10	-0.003869	0.000374	-5.721E-12	8503.2260	3.683E+09
-1.449E-05	306151.	0.000				
39.040	2.764E-10	-0.001512	0.000278	-1.107E-11	8503.2259	3.683E+09
-1.177E-05	311777.	0.000				
39.650	1.844E-10	0.000217	0.000205	-1.235E-11	8503.2258	3.683E+09
-7.994E-06	317404.	0.000				
40.260	9.551E-11	0.001518	0.000161	-1.063E-11	8503.2259	3.683E+09
-4.215E-06	323030.	0.000				
40.870	2.873E-11	0.002589	2.389E-06	-6.549E-12	8503.2259	3.683E+09
-3.902E-05	9940049.	0.000				
41.480	0.000	0.001565	-0.000139	-2.420E-12	8503.2259	3.683E+09
5.040E-07	10047214.	0.000				
42.090	-6.696E-12	0.000565	-0.000103	0.000	8503.2258	3.683E+09

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9.289E-06	10154379.	0.000				
42.700	-4.801E-12	6.183E-05	-4.411E-05	0.000	8503.2258	3.683E+09
6.730E-06	10261543.	0.000				
43.310	-2.007E-12	-8.107E-05	-9.070E-06	0.000	8503.2258	3.683E+09
2.842E-06	10368708.	0.000				
43.920	0.000	-7.153E-05	3.384E-06	0.000	8503.2258	3.683E+09
5.604E-07	10475873.	0.000				
44.530	0.000	-3.182E-05	4.468E-06	0.000	8503.2258	3.683E+09
-2.642E-07	10583038.	0.000				
45.140	0.000	-6.207E-06	1.929E-06	0.000	8503.2258	3.683E+09
-4.295E-07	10690203.	0.000				
45.750	0.000	-3.596E-06	3.093E-07	0.000	8503.2258	3.683E+09
-1.304E-08	302839.	0.000				
46.360	0.000	-1.677E-06	2.178E-07	0.000	8503.2258	3.683E+09
-1.197E-08	308465.	0.000				
46.970	0.000	-3.961E-07	1.381E-07	0.000	8503.2258	3.683E+09
-9.797E-09	314091.	0.000				
47.580	0.000	3.607E-07	7.560E-08	0.000	8503.2258	3.683E+09
-7.290E-09	319717.	0.000				
48.190	0.000	7.262E-07	3.090E-08	0.000	8503.2258	3.683E+09
-4.923E-09	325344.	0.000				
48.800	0.000	8.266E-07	2.100E-09	0.000	8503.2258	3.683E+09
-2.947E-09	330970.	0.000				
49.410	0.000	7.674E-07	-1.401E-08	0.000	8503.2258	3.683E+09
-1.454E-09	336596.	0.000				
50.020	0.000	6.289E-07	-2.090E-08	0.000	8503.2258	3.683E+09
-4.309E-10	342222.	0.000				
50.630	0.000	4.661E-07	-2.178E-08	0.000	8503.2258	3.683E+09
1.915E-10	347848.	0.000				
51.240	0.000	3.126E-07	-1.922E-08	0.000	8503.2258	3.683E+09
5.068E-10	353474.	0.000				
51.850	0.000	1.857E-07	-1.514E-08	0.000	8503.2258	3.683E+09
6.089E-10	359101.	0.000				
52.460	0.000	9.111E-08	-1.079E-08	0.000	8503.2258	3.683E+09
5.793E-10	364727.	0.000				
53.070	0.000	2.736E-08	-6.910E-09	0.000	8503.2258	3.683E+09
4.815E-10	370353.	0.000				
53.680	0.000	-1.065E-08	-3.830E-09	0.000	8503.2258	3.683E+09
3.600E-10	375979.	0.000				
54.290	0.000	-2.935E-08	-1.624E-09	0.000	8503.2258	3.683E+09
2.427E-10	381605.	0.000				
54.900	0.000	-3.499E-08	-2.078E-10	0.000	8503.2258	3.683E+09
1.443E-10	387231.	0.000				
55.510	0.000	-3.284E-08	5.779E-10	0.000	8503.2258	3.683E+09
7.036E-11	392857.	0.000				
56.120	0.000	-2.684E-08	9.094E-10	0.000	8503.2258	3.683E+09
2.021E-11	398484.	0.000				
56.730	0.000	-1.972E-08	9.474E-10	0.000	8503.2258	3.683E+09
-9.816E-12	404110.	0.000				
57.340	0.000	-1.308E-08	8.214E-10	0.000	8503.2258	3.683E+09
-2.463E-11	409736.	0.000				
57.950	0.000	-7.737E-09	6.249E-10	0.000	8503.2258	3.683E+09
-2.905E-11	415362.	0.000				
58.560	0.000	-3.936E-09	4.194E-10	0.000	8503.2258	3.683E+09
-2.711E-11	420988.	0.000				
59.170	0.000	-1.580E-09	2.405E-10	0.000	8503.2258	3.683E+09
-2.176E-11	426614.	0.000				
59.780	0.000	-3.862E-10	1.063E-10	0.000	8503.2258	3.683E+09
-1.491E-11	432241.	0.000				
60.390	0.000	8.888E-12	2.410E-11	0.000	8503.2258	3.683E+09
-7.539E-12	437867.	0.000				
61.000	0.000	0.000	0.000	0.000	8503.2258	3.683E+09
0.000	10224246.	0.000				

Bridge 11 Bent 5 Longitudinal Provided.lp6o

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.1486493 inches
 Computed slope at pile head = 0.000000 radians
 Maximum bending moment = -310942. inch-lbs
 Maximum shear force = 7150.000000 lbs
 Depth of maximum bending moment = 0.000000 inches below pile head
 Depth of maximum shear force = 0.000000 inches below pile head
 Number of iterations = 11
 Number of zero deflection points = 11

Summary of Pile Response(s)

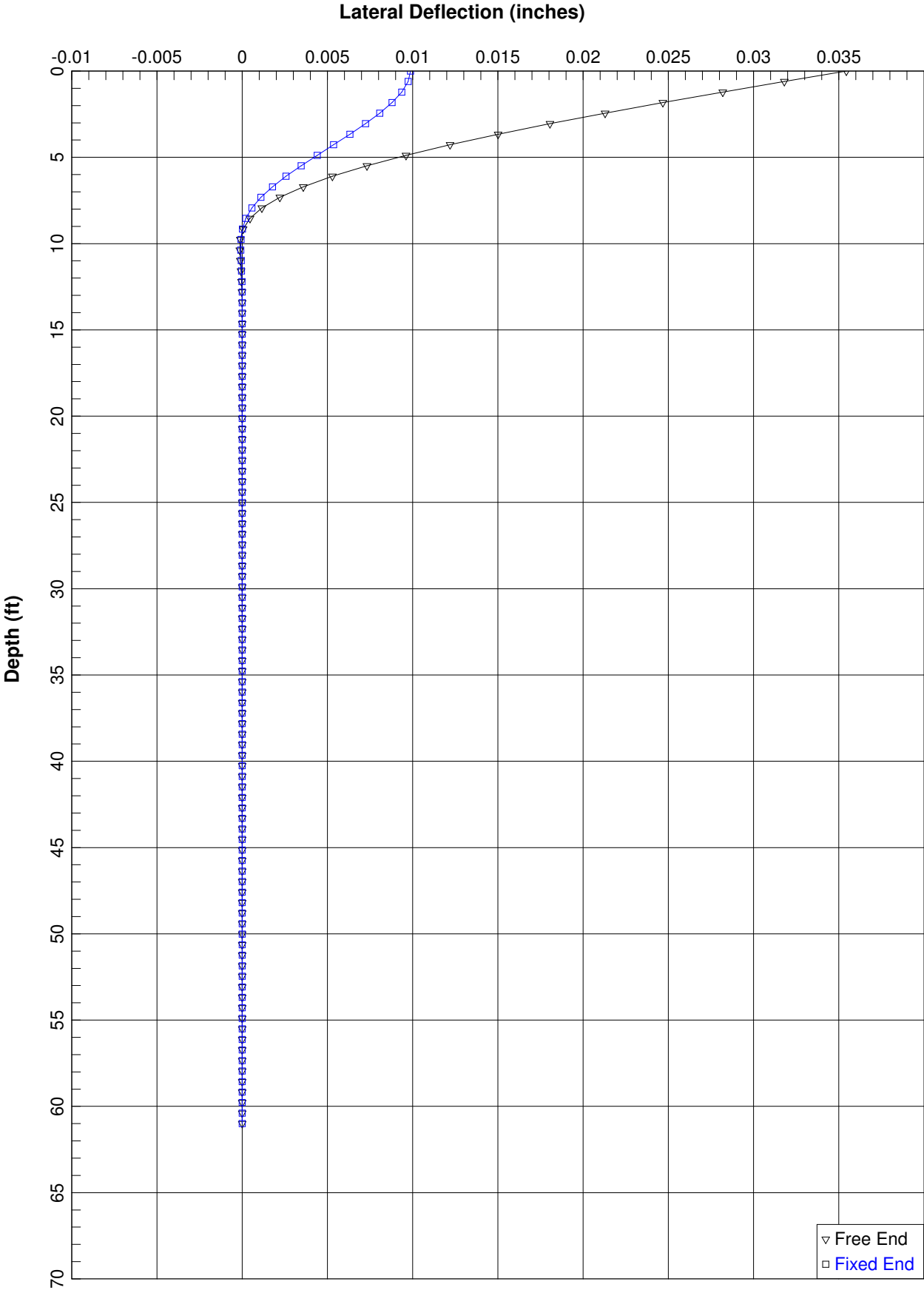
Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
 Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
 Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
 Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
 Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

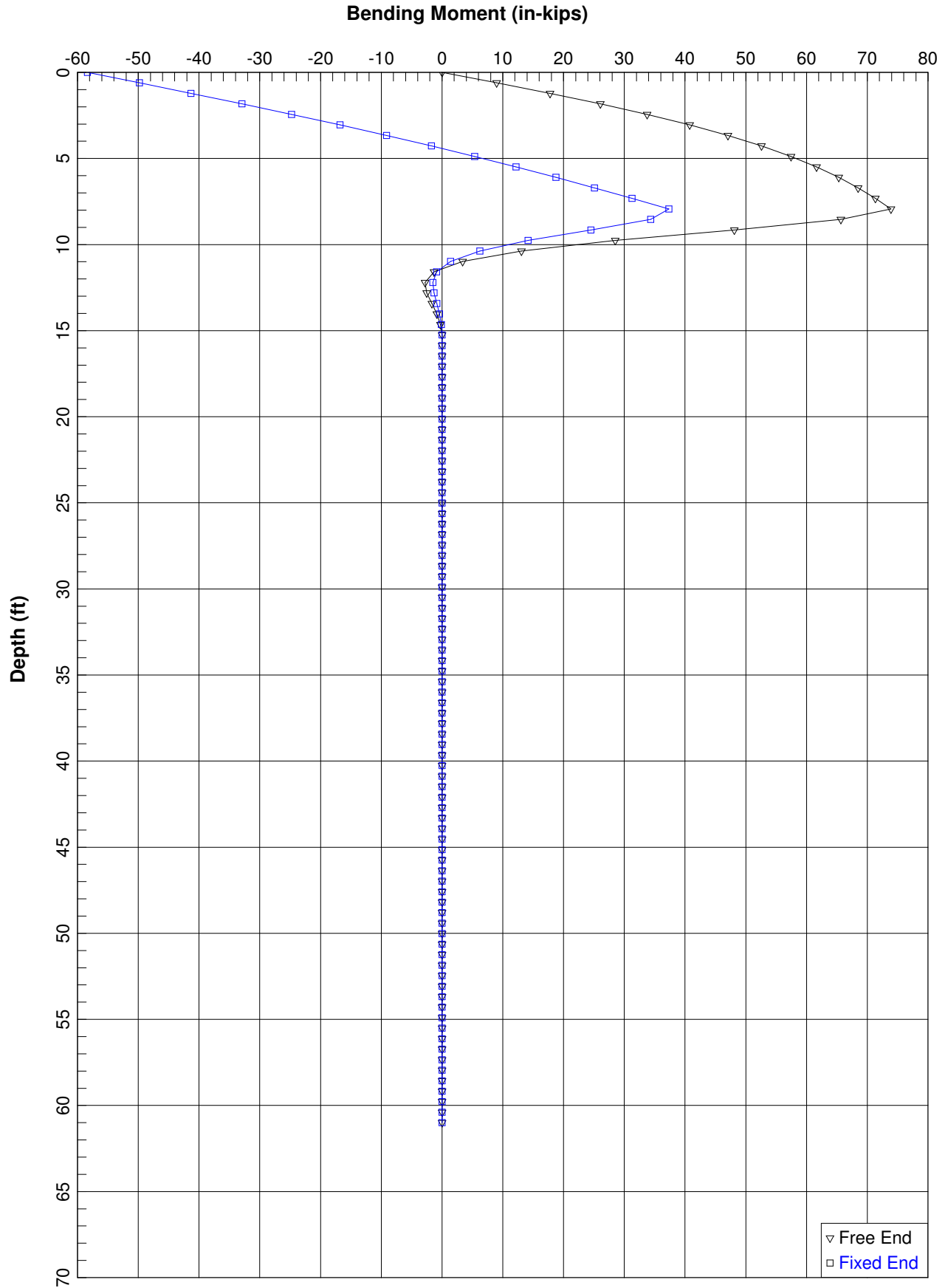
Load Case No.	Maximum Load Type No.	Pile-head Condition 1 Maximum Shear V(lbs) or in Pile y(inches) lbs	Pile-head Condition 2 Pile-head Rotation in-lb, rad., or in-lb/rad. radians	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
1	1	V = 7150.0000	M = 0.000	131800.	0.59045361	
359948.		-9725.5247	-0.00861760			
2	2	V = 7150.0000	S = 0.000	131800.	0.14864927	
-310942.		7150.0000	0.00000000			

The analysis ended normally.

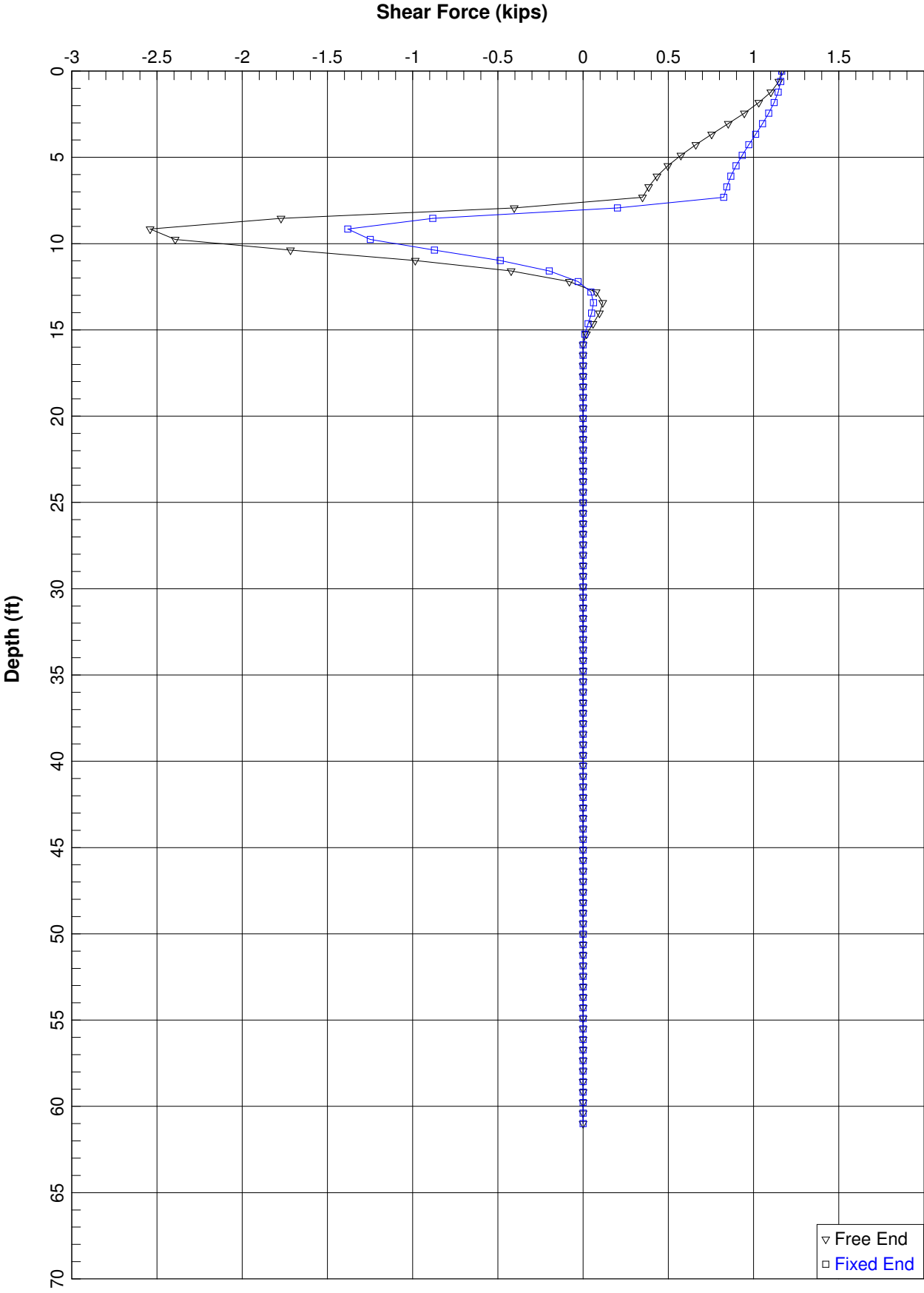
Bridge 11 End Bent 5 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-05



Bridge 11 End Bent 5 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-05



Bridge 11 End Bent 5 - Provided Loading - Transverse
Subsurface Based on Boring B11-SPT-05



Bridge 11 Bent 5 Transverse Provided.lp6o

LPILE Plus for Windows, Version 2012-06.037

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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Serial Number of Security Device: 160709431
Company Name Stored in Security Device: ECS Carolinas, LLP

Files Used for Analysis

Path to file locations: I:\2GEOTECH\02-PROJECTS\9200\9283-B - I-85 & I- 385
Interchange Design\01 Final Reports\11 Bridge 11\05 Lateral Capacity (L-Pile)\Bridge
11 End Bent 5\Bridge 11 End Bent 5 Provided Loads\
Name of input data file: Bridge 11 Bent 5 Transverse Provided.lp6d
Name of output report file: Bridge 11 Bent 5 Transverse Provided.lp6o
Name of plot output file: Bridge 11 Bent 5 Transverse Provided.lp6p
Name of runtime message file: Bridge 11 Bent 5 Transverse Provided.lp6r

Date and Time of Analysis

Date: July 22, 2015 Time: 10:30:35

Problem Title

Project Name: I-85/385 Design Build

Job Number: 08-9283

Client: CECS

Engineer: ECS

Description: Bridge 11 End Bent 5 (Boring B11-SPT-06)

Bridge 11 Bent 5 Transverse Provided.lp6o

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes pile response to lateral loading and will compute nonlinear moment-curvature and nominal moment capacity for section types with nonlinear properties.

Computation Options:

- Analysis does not use p-y multipliers (individual pile or shaft only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix values
- Report pile response for full length of pile
- Analysis assumes no loading by soil movements acting on pile
- No p-y curves to be computed and reported for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total number of pile sections = 1

Total length of pile = 61.00 ft

Depth of ground surface below top of pile = 0.00 ft

Pile diameter values used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	12.0450000
2	61.000000	12.0450000

Input Structural Properties:

Bridge 11 Bent 5 Transverse Provided.lp60

Pile Section No. 1:

Section Type	=	Elastic Pile
Cross-sectional Shape	=	Strong H-Pile
Section Length	=	61.00000000 ft
Flange width	=	12.04500000 in
Section Depth	=	11.78000000 in
Flange Thickness	=	0.43500000 in
Web Thickness	=	0.43500000 in
Section Area	=	15.50000000 Sq. in
Moment of Inertia	=	393.00000000 in^4
Elastic Modulus	=	29000000. lbs/in^2

Ground Slope and Pile Batter Angles

Ground Slope Angle	=	0.000 degrees
	=	0.000 radians
Pile Batter Angle	=	0.000 degrees
	=	0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 8 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	0.0000 ft
Distance from top of pile to bottom of layer	=	7.50000 ft
Effective unit weight at top of layer	=	95.00000 pcf
Effective unit weight at bottom of layer	=	95.00000 pcf
Friction angle at top of layer	=	26.00000 deg.
Friction angle at bottom of layer	=	26.00000 deg.
Subgrade k at top of layer	=	20.00000 pci
Subgrade k at bottom of layer	=	20.00000 pci

Layer 2 is stiff clay without free water

Distance from top of pile to top of layer	=	7.50000 ft
Distance from top of pile to bottom of layer	=	15.50000 ft
Effective unit weight at top of layer	=	120.00000 pcf
Effective unit weight at bottom of layer	=	120.00000 pcf
Undrained cohesion at top of layer	=	4000.00000 psf
Undrained cohesion at bottom of layer	=	4000.00000 psf
Epsilon-50 at top of layer	=	0.00500
Epsilon-50 at bottom of layer	=	0.00500

Layer 3 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	15.50000 ft
Distance from top of pile to bottom of layer	=	19.50000 ft
Effective unit weight at top of layer	=	130.00000 pcf
Effective unit weight at bottom of layer	=	130.00000 pcf

Bridge 11 Bent 5 Transverse Provided.lp60

Friction angle at top of layer	=	30.00000	deg.
Friction angle at bottom of layer	=	30.00000	deg.
Subgrade k at top of layer	=	45.00000	pci
Subgrade k at bottom of layer	=	45.00000	pci

Layer 4 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	19.50000	ft
Distance from top of pile to bottom of layer	=	24.50000	ft
Effective unit weight at top of layer	=	130.00000	pcf
Effective unit weight at bottom of layer	=	130.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	185.00000	pci
Subgrade k at bottom of layer	=	185.00000	pci

Layer 5 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	24.50000	ft
Distance from top of pile to bottom of layer	=	40.50000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 6 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	40.50000	ft
Distance from top of pile to bottom of layer	=	45.50000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf
Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

Layer 7 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer	=	45.50000	ft
Distance from top of pile to bottom of layer	=	60.50000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Friction angle at top of layer	=	36.00000	deg.
Friction angle at bottom of layer	=	36.00000	deg.
Subgrade k at top of layer	=	105.00000	pci
Subgrade k at bottom of layer	=	105.00000	pci

Layer 8 is stiff clay with water-induced erosion

Distance from top of pile to top of layer	=	60.50000	ft
Distance from top of pile to bottom of layer	=	76.10000	ft
Effective unit weight at top of layer	=	75.00000	pcf
Effective unit weight at bottom of layer	=	75.00000	pcf
Undrained cohesion at top of layer	=	8000.00000	psf

Bridge 11 Bent 5 Transverse Provided.lp60

Undrained cohesion at bottom of layer	=	8000.00000	psf
Epsilon-50 at top of layer	=	0.00400	
Epsilon-50 at bottom of layer	=	0.00400	
Subgrade k at top of layer	=	2000.00000	pci
Subgrade k at bottom of layer	=	2000.00000	pci

(Depth of lowest soil layer extends 15.10 ft below pile tip)

Summary of Soil Properties

Angle of Layer Friction Num. deg.	Strain Factor (p-y Curve Epsilon 50	Layer Soil Type kpy Criteria) pci	Layer Depth ft	Effective Unit wt. pcf	Undrained Cohesion psf
1	Sand (Reese, et al.)		0.00	95.000	--
26.000	--	20.000			
			7.500	95.000	--
26.000	--	20.000			
2	Stiff Clay w/o Free Water		7.500	120.000	4000.000
--	0.00500	--			
			15.500	120.000	4000.000
--	0.00500	--			
3	Sand (Reese, et al.)		15.500	130.000	--
30.000	--	45.000			
			19.500	130.000	--
30.000	--	45.000			
4	Sand (Reese, et al.)		19.500	130.000	--
36.000	--	185.000			
			24.500	130.000	--
36.000	--	185.000			
5	Sand (Reese, et al.)		24.500	75.000	--
36.000	--	105.000			
			40.500	75.000	--
36.000	--	105.000			
6	Stiff Clay w/o Free Water, using k		40.500	75.000	8000.000
--	0.00400	2000.000			
			45.500	75.000	8000.000
--	0.00400	2000.000			
7	Sand (Reese, et al.)		45.500	75.000	--
36.000	--	105.000			
			60.500	75.000	--
36.000	--	105.000			
8	Stiff Clay w/o Free Water, using k		60.500	75.000	8000.000
--	0.00400	2000.000			
			76.100	75.000	8000.000
--	0.00400	2000.000			

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

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Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Compute Type	Condition 1	Condition 2	Axial Thrust Force, lbs
Top y	vs. Pile Length			
1	1	V = 1165.00000 lbs	M = 0.0000 in-lbs	131800.
2	2	V = 1165.00000 lbs	S = 0.0000 in/in	131800.
	No			
	No			

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applied to pile head

Axial thrust is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head	=	1165.000 lbs
Applied moment at pile head	=	0.000 in-lbs
Axial thrust load on pile head	=	131800.000 lbs

Depth Res.	Soil	Deflect. Spr.	Bending Distrib. Moment	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
X	Es*h	y	Lat. Load					
feet	lb/inch	inches	lb/inch	lbs	radians	psi*	lb-in^2	lb/in
0.00		0.0354	-2.952E-09	1165.0000	-0.000498	8503.2258	1.140E+10	

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0.000	0.000	0.000	9007.7912	1147.9609	-0.000495	8641.2651	1.140E+10
-4.6555	1071.6480	0.000	0.000				
1.220	0.0282	17761.	1100.7009	-0.000486	8775.3960	1.140E+10	
-8.2571	2143.2960	0.000					
1.830	0.0247	26060.	1030.8006	-0.000472	8902.5783	1.140E+10	
-10.8414	3214.9440	0.000					
2.440	0.0213	33762.	945.4883	-0.000453	9020.6111	1.140E+10	
-12.4680	4286.5920	0.000					
3.050	0.0181	40775.	851.4806	-0.000429	9128.0856	1.140E+10	
-13.2172	5358.2400	0.000					
3.660	0.0150	47055.	754.8391	-0.000401	9224.3199	1.140E+10	
-13.1876	6429.8880	0.000					
4.270	0.0122	52599.	660.8451	-0.000369	9309.2789	1.140E+10	
-12.4938	7501.5360	0.000					
4.880	0.009617	57441.	573.8939	-0.000333	9383.4795	1.140E+10	
-11.2634	8573.1840	0.000					
5.490	0.007313	61644.	497.4059	-0.000295	9447.8860	1.140E+10	
-9.6350	9644.8320	0.000					
6.100	0.005298	65292.	433.7545	-0.000254	9503.7958	1.140E+10	
-7.7561	10716.	0.000					
6.710	0.003590	68485.	384.2059	-0.000211	9552.7168	1.140E+10	
-5.7817	11788.	0.000					
7.320	0.002205	71325.	348.8696	-0.000166	9596.2400	1.140E+10	
-3.8730	12860.	0.000					
7.930	0.001154	73913.	-403.8066	-0.000120	9635.9057	1.140E+10	
-201.7762	1279634.	0.000					
8.540	0.000451	65644.	-1772.8424	-7.494E-05	9509.1871	1.140E+10	
-172.2772	2793704.	0.000					
9.150	5.718E-05	48104.	-2540.2912	-3.841E-05	9240.3850	1.140E+10	
-37.4082	4788945.	0.000					
9.760	-0.000111	28529.	-2393.6486	-1.380E-05	8940.4094	1.140E+10	
77.4745	5114561.	0.000					
10.370	-0.000145	13087.	-1716.1574	-4.333E-07	8703.7788	1.140E+10	
107.6323	5440402.	0.000					
10.980	-0.000117	3404.8365	-984.2366	4.863E-06	8555.4030	1.140E+10	
92.3460	5766431.	0.000					
11.590	-7.363E-05	-1331.4617	-421.9649	5.529E-06	8523.6297	1.140E+10	
61.2801	6092618.	0.000					
12.200	-3.628E-05	-2783.3978	-81.2246	4.207E-06	8545.8798	1.140E+10	
31.8183	6418939.	0.000					
12.810	-1.203E-05	-2528.7079	75.8051	2.501E-06	8541.9768	1.140E+10	
11.0860	6745375.	0.000					
13.420	3.355E-07	-1678.4377	115.1935	1.150E-06	8528.9469	1.140E+10	
-0.3241	7071910.	0.000					
14.030	4.810E-06	-844.4949	96.2127	3.401E-07	8516.1672	1.140E+10	
-4.8619	7398533.	0.000					
14.640	5.315E-06	-270.5398	57.8896	-1.797E-08	8507.3717	1.140E+10	
-5.6089	7725230.	0.000					
15.250	4.547E-06	3.0438	19.0540	-1.039E-07	8503.2725	1.140E+10	
-5.0019	8051995.	0.000					
15.860	3.794E-06	8.6112	0.6375	-1.001E-07	8503.3578	1.140E+10	
-0.0299	57736.	0.000					
16.470	3.081E-06	12.5698	0.4353	-9.333E-08	8503.4184	1.140E+10	
-0.0253	60147.	0.000					
17.080	2.428E-06	15.1640	0.2667	-8.442E-08	8503.4582	1.140E+10	
-0.0207	62558.	0.000					
17.690	1.845E-06	16.6371	0.1308	-7.421E-08	8503.4808	1.140E+10	
-0.0164	64969.	0.000					
18.300	1.341E-06	17.2223	0.0257	-6.334E-08	8503.4897	1.140E+10	
-0.0123	67381.	0.000					
18.910	9.181E-07	17.1352	-0.0516	-5.230E-08	8503.4884	1.140E+10	
-0.008754	69792.	0.000					

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19.520	5.756E-07	16.5685	-0.1527	-4.148E-08	8503.4797	1.140E+10
-0.0189	240135.	0.000				
20.130	3.109E-07	14.9797	-0.2607	-3.135E-08	8503.4554	1.140E+10
-0.0106	250048.	0.000				
20.740	1.167E-07	12.8126	-0.3147	-2.242E-08	8503.4222	1.140E+10
-0.004143	259961.	0.000				
21.350	-1.736E-08	10.4156	-0.3275	-1.496E-08	8503.3854	1.140E+10
0.000640	269873.	0.000				
21.960	-1.024E-07	8.0465	-0.3109	-9.033E-09	8503.3491	1.140E+10
0.003914	279786.	0.000				
22.570	-1.496E-07	5.8820	-0.2749	-4.561E-09	8503.3159	1.140E+10
0.005921	289699.	0.000				
23.180	-1.692E-07	4.0312	-0.2279	-1.377E-09	8503.2876	1.140E+10
0.006924	299612.	0.000				
23.790	-1.698E-07	2.5489	-0.1762	7.361E-10	8503.2649	1.140E+10
0.007178	309524.	0.000				
24.400	-1.584E-07	1.4496	-0.1247	2.020E-09	8503.2480	1.140E+10
0.006912	319437.	0.000				
25.010	-1.402E-07	0.7198	-0.0866	2.717E-09	8503.2368	1.140E+10
0.003493	182376.	0.000				
25.620	-1.186E-07	0.1766	-0.0627	3.005E-09	8503.2285	1.140E+10
0.003046	188002.	0.000				
26.230	-9.620E-08	-0.2033	-0.0422	2.996E-09	8503.2289	1.140E+10
0.002545	193628.	0.000				
26.840	-7.475E-08	-0.4469	-0.0254	2.787E-09	8503.2327	1.140E+10
0.002035	199254.	0.000				
27.450	-5.540E-08	-0.5811	-0.0123	2.457E-09	8503.2347	1.140E+10
0.001550	204881.	0.000				
28.060	-3.878E-08	-0.6319	-0.002556	2.068E-09	8503.2355	1.140E+10
0.001115	210507.	0.000				
28.670	-2.513E-08	-0.6225	0.004240	1.665E-09	8503.2353	1.140E+10
0.000742	216133.	0.000				
29.280	-1.440E-08	-0.5730	0.008553	1.281E-09	8503.2346	1.140E+10
0.000436	221759.	0.000				
29.890	-6.374E-09	-0.4998	0.0109	9.364E-10	8503.2335	1.140E+10
0.000198	227385.	0.000				
30.500	-6.938E-10	-0.4156	0.0117	6.425E-10	8503.2322	1.140E+10
2.208E-05	233011.	0.000				
31.110	3.032E-09	-0.3300	0.0114	4.030E-10	8503.2309	1.140E+10
-9.885E-05	238637.	0.000				
31.720	5.206E-09	-0.2495	0.0104	2.169E-10	8503.2296	1.140E+10
-0.000174	244264.	0.000				
32.330	6.208E-09	-0.1781	0.008990	7.959E-11	8503.2285	1.140E+10
-0.000212	249890.	0.000				
32.940	6.372E-09	-0.1180	0.007400	-1.553E-11	8503.2276	1.140E+10
-0.000222	255516.	0.000				
33.550	5.980E-09	-0.0698	0.005805	-7.584E-11	8503.2269	1.140E+10
-0.000213	261142.	0.000				
34.160	5.261E-09	-0.0329	0.004322	-1.088E-10	8503.2263	1.140E+10
-0.000192	266768.	0.000				
34.770	4.387E-09	-0.006288	0.003023	-1.214E-10	8503.2259	1.140E+10
-0.000163	272394.	0.000				
35.380	3.484E-09	0.0116	0.001941	-1.197E-10	8503.2260	1.140E+10
-0.000132	278021.	0.000				
35.990	2.635E-09	0.0224	0.001083	-1.088E-10	8503.2261	1.140E+10
-0.000102	283647.	0.000				
36.600	1.891E-09	0.0277	0.000436	-9.274E-11	8503.2262	1.140E+10
-7.473E-05	289273.	0.000				
37.210	1.277E-09	0.0289	-2.565E-05	-7.457E-11	8503.2262	1.140E+10
-5.145E-05	294899.	0.000				
37.820	7.993E-10	0.0274	-0.000334	-5.647E-11	8503.2262	1.140E+10
-3.282E-05	300525.	0.000				
38.430	4.504E-10	0.0241	-0.000523	-3.991E-11	8503.2262	1.140E+10

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-1.884E-05	306151.	0.000				
39.040	2.151E-10	0.0198	-0.000626	-2.578E-11	8503.2261	1.140E+10
-9.161E-06	311777.	0.000				
39.650	7.301E-11	0.0150	-0.000671	-1.458E-11	8503.2260	1.140E+10
-3.166E-06	317404.	0.000				
40.260	1.639E-12	0.0101	-0.000683	-6.522E-12	8503.2260	1.140E+10
-7.231E-08	323030.	0.000				
40.870	-2.248E-11	0.005057	-0.000571	-1.670E-12	8503.2259	1.140E+10
3.052E-05	9940049.	0.000				
41.480	-2.282E-11	0.001694	-0.000345	0.000	8503.2258	1.140E+10
3.132E-05	10047214.	0.000				
42.090	-1.520E-11	7.709E-06	-0.000153	1.044E-12	8503.2258	1.140E+10
2.108E-05	10154379.	0.000				
42.700	-7.537E-12	-0.000549	-3.722E-05	0.000	8503.2258	1.140E+10
1.057E-05	10261543.	0.000				
43.310	-2.459E-12	-0.000539	1.420E-05	0.000	8503.2258	1.140E+10
3.484E-06	10368708.	0.000				
43.920	0.000	-0.000342	2.651E-05	0.000	8503.2258	1.140E+10
-1.222E-07	10475873.	0.000				
44.530	1.023E-12	-0.000151	2.065E-05	0.000	8503.2258	1.140E+10
-1.479E-06	10583038.	0.000				
45.140	1.249E-12	-3.976E-05	8.559E-06	0.000	8503.2258	1.140E+10
-1.824E-06	10690203.	0.000				
45.750	1.288E-12	-2.598E-05	1.688E-06	0.000	8503.2258	1.140E+10
-5.330E-08	302839.	0.000				
46.360	1.206E-12	-1.504E-05	1.307E-06	0.000	8503.2258	1.140E+10
-5.080E-08	308465.	0.000				
46.970	1.052E-12	-6.809E-06	9.560E-07	0.000	8503.2258	1.140E+10
-4.514E-08	314091.	0.000				
47.580	0.000	-9.961E-07	6.522E-07	0.000	8503.2258	1.140E+10
-3.785E-08	319717.	0.000				
48.190	0.000	2.789E-06	4.037E-07	0.000	8503.2258	1.140E+10
-3.006E-08	325344.	0.000				
48.800	0.000	4.962E-06	2.110E-07	0.000	8503.2258	1.140E+10
-2.258E-08	330970.	0.000				
49.410	0.000	5.922E-06	7.018E-08	0.000	8503.2258	1.140E+10
-1.589E-08	336596.	0.000				
50.020	0.000	6.026E-06	-2.559E-08	0.000	8503.2258	1.140E+10
-1.027E-08	342222.	0.000				
50.630	0.000	5.576E-06	-8.445E-08	0.000	8503.2258	1.140E+10
-5.806E-09	347848.	0.000				
51.240	0.000	4.812E-06	-1.147E-07	0.000	8503.2258	1.140E+10
-2.455E-09	353474.	0.000				
51.850	0.000	3.913E-06	-1.241E-07	0.000	8503.2258	1.140E+10
-1.047E-10	359101.	0.000				
52.460	0.000	3.006E-06	-1.193E-07	0.000	8503.2258	1.140E+10
1.404E-09	364727.	0.000				
53.070	0.000	2.173E-06	-1.059E-07	0.000	8503.2258	1.140E+10
2.245E-09	370353.	0.000				
53.680	0.000	1.458E-06	-8.826E-08	0.000	8503.2258	1.140E+10
2.585E-09	375979.	0.000				
54.290	0.000	8.813E-07	-6.937E-08	0.000	8503.2258	1.140E+10
2.578E-09	381605.	0.000				
54.900	0.000	4.419E-07	-5.133E-08	0.000	8503.2258	1.140E+10
2.350E-09	387231.	0.000				
55.510	0.000	1.282E-07	-3.540E-08	0.000	8503.2258	1.140E+10
2.002E-09	392857.	0.000				
56.120	0.000	-7.834E-08	-2.218E-08	0.000	8503.2258	1.140E+10
1.611E-09	398484.	0.000				
56.730	0.000	-1.985E-07	-1.178E-08	0.000	8503.2258	1.140E+10
1.229E-09	404110.	0.000				
57.340	0.000	-2.526E-07	-4.037E-09	0.000	8503.2258	1.140E+10
8.871E-10	409736.	0.000				

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57.950	0.000	-2.591E-07	1.417E-09	0.000	8503.2258	1.140E+10	
6.030E-10	415362.	0.000					
58.560	0.000	-2.331E-07	5.018E-09	0.000	8503.2258	1.140E+10	
3.810E-10	420988.	0.000					
59.170	0.000	-1.865E-07	7.206E-09	0.000	8503.2258	1.140E+10	
2.166E-10	426614.	0.000					
59.780	0.000	-1.283E-07	8.363E-09	0.000	8503.2258	1.140E+10	
9.958E-11	432241.	0.000					
60.390	0.000	-6.457E-08	8.784E-09	0.000	8503.2258	1.140E+10	
1.550E-11	437867.	0.000					
61.000	0.000	0.000	0.000	0.000	8503.2258	1.140E+10	
-2.416E-09	10224246.	0.000					

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.0354416 inches
Computed slope at pile head	=	-0.0004975 radians
Maximum bending moment	=	73913. inch-lbs
Maximum shear force	=	-2540.2912000 lbs
Depth of maximum bending moment	=	95.1600000 inches below pile head
Depth of maximum shear force	=	109.8000000 inches below pile head
Number of iterations	=	8
Number of zero deflection points	=	8

Computed values of Pile Loading and Deflection for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Pile-head Rotation (Loading Type 2)

Shear force at pile head	=	1165.000 lbs
Rotation of pile head	=	0.000E+00 radians
Axial load at pile head	=	131800.000 lbs

(Zero slope for this load indicates fixed-head conditions)

Depth Res.	Soil X	Deflect. Spr. y	Bending Distrib. Load	Shear Force	Slope S	Total Stress	Bending Stiffness	Soil p
feet	Es*h lb/inch	Lat. inches	Moment in-lbs	lbs	radians	psi*	lb-in^2	lb/in
		lb/inch						
0.000	0.00	0.009871	-58373.	1165.0000	0.000	9397.7515	1.140E+10	
		0.000	0.000					
	0.610	0.009734	-49827.	1159.7844	-3.475E-05	9266.7907	1.140E+10	
-1.4250	1071.6480	0.000	0.000					
	1.220	0.009362	-41326.	1144.5358	-6.402E-05	9136.5268	1.140E+10	
-2.7413	2143.2960	0.000	0.000					
	1.830	0.008796	-32947.	1120.3627	-8.787E-05	9008.1215	1.140E+10	
-3.8634	3214.9440	0.000	0.000					
	2.440	0.008076	-24755.	1088.9137	-0.000106	8882.5756	1.140E+10	
-4.7292	4286.5920	0.000	0.000					
	3.050	0.007239	-16800.	1052.2113	-0.000120	8760.6779	1.140E+10	
-5.2988	5358.2400	0.000	0.000					
	3.660	0.006323	-9119.1518	1012.4905	-0.000128	8642.9716	1.140E+10	

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-5.5539	6429.8880	0.000					
	4.270	0.005364	-1730.1324	972.0448	-0.000132	8529.7391	1.140E+10
-5.4968	7501.5360	0.000					
	4.880	0.004397	5365.4247	933.0791	-0.000130	8585.4479	1.140E+10
-5.1495	8573.1840	0.000					
	5.490	0.003455	12182.	897.5706	-0.000125	8689.9039	1.140E+10
-4.5523	9644.8320	0.000					
	6.100	0.002570	18747.	867.1364	-0.000115	8790.5063	1.140E+10
-3.7631	10716.	0.000					
	6.710	0.001774	25098.	842.9073	-0.000101	8887.8407	1.140E+10
-2.8569	11788.	0.000					
	7.320	0.001096	31281.	825.4065	-8.263E-05	8982.5910	1.140E+10
-1.9248	12860.	0.000					
	7.930	0.000564	37342.	201.1244	-6.060E-05	9075.4638	1.140E+10
-168.6441	2187784.	0.000					
	8.540	0.000208	34343.	-881.3833	-3.758E-05	9029.5050	1.140E+10
-127.1230	4463603.	0.000					
	9.150	1.415E-05	24511.	-1380.5283	-1.868E-05	8878.8369	1.140E+10
-9.2554	4788945.	0.000					
	9.760	-6.494E-05	14168.	-1248.3249	-6.255E-06	8720.3362	1.140E+10
45.3766	5114561.	0.000					
	10.370	-7.743E-05	6247.2041	-871.6337	3.010E-07	8598.9606	1.140E+10
57.5445	5440402.	0.000					
	10.980	-6.054E-05	1406.3057	-486.4803	2.759E-06	8524.7766	1.140E+10
47.6887	5766431.	0.000					
	11.590	-3.704E-05	-880.1904	-199.1155	2.928E-06	8516.7142	1.140E+10
30.8263	6092618.	0.000					
	12.200	-1.767E-05	-1514.3942	-29.5666	2.159E-06	8526.4330	1.140E+10
15.4985	6418939.	0.000					
	12.810	-5.432E-06	-1317.2108	45.4777	1.249E-06	8523.4113	1.140E+10
5.0054	6745375.	0.000					
	13.420	6.178E-07	-851.0113	61.6128	5.532E-07	8516.2671	1.140E+10
-0.5969	7071910.	0.000					
	14.030	2.666E-06	-416.2664	49.5645	1.462E-07	8509.6049	1.140E+10
-2.6950	7398533.	0.000					
	14.640	2.758E-06	-125.6690	29.0478	-2.785E-08	8505.1516	1.140E+10
-2.9106	7725230.	0.000					
	15.250	2.259E-06	9.0475	9.3015	-6.530E-08	8503.3645	1.140E+10
-2.4845	8051995.	0.000					
	15.860	1.802E-06	10.6309	0.1561	-5.898E-08	8503.3887	1.140E+10
-0.0142	57736.	0.000					
	16.470	1.395E-06	11.4462	0.0621	-5.189E-08	8503.4012	1.140E+10
-0.0115	60147.	0.000					
	17.080	1.042E-06	11.6402	-0.0125	-4.448E-08	8503.4042	1.140E+10
-0.008907	62558.	0.000					
	17.690	7.440E-07	11.3497	-0.0692	-3.710E-08	8503.3997	1.140E+10
-0.006603	64969.	0.000					
	18.300	4.991E-07	10.6983	-0.1102	-3.002E-08	8503.3898	1.140E+10
-0.004594	67381.	0.000					
	18.910	3.045E-07	9.7941	-0.1377	-2.344E-08	8503.3759	1.140E+10
-0.002904	69792.	0.000					
	19.520	1.560E-07	8.7283	-0.1670	-1.749E-08	8503.3596	1.140E+10
-0.005118	240135.	0.000					
	20.130	4.853E-08	7.3828	-0.1918	-1.231E-08	8503.3389	1.140E+10
-0.001658	250048.	0.000					
	20.740	-2.424E-08	5.9440	-0.1947	-8.033E-09	8503.3169	1.140E+10
0.000861	259961.	0.000					
	21.350	-6.908E-08	4.5475	-0.1823	-4.664E-09	8503.2955	1.140E+10
0.002547	269873.	0.000					
	21.960	-9.253E-08	3.2847	-0.1600	-2.149E-09	8503.2761	1.140E+10
0.003537	279786.	0.000					
	22.570	-1.005E-07	2.2094	-0.1325	-3.846E-10	8503.2597	1.140E+10
0.003979	289699.	0.000					

Bridge 11 Bent 5 Transverse Provided.lp6o

23.180	-9.816E-08	1.3459	-0.1032	7.571E-10	8503.2464	1.140E+10
0.004018	299612.	0.000				
23.790	-8.945E-08	0.6968	-0.0747	1.413E-09	8503.2365	1.140E+10
0.003782	309524.	0.000				
24.400	-7.747E-08	0.2500	-0.0485	1.717E-09	8503.2296	1.140E+10
0.003381	319437.	0.000				
25.010	-6.431E-08	-0.0158	-0.0302	1.792E-09	8503.2260	1.140E+10
0.001602	182376.	0.000				
25.620	-5.123E-08	-0.1958	-0.0195	1.724E-09	8503.2288	1.140E+10
0.001316	188002.	0.000				
26.230	-3.907E-08	-0.3051	-0.0109	1.564E-09	8503.2305	1.140E+10
0.001033	193628.	0.000				
26.840	-2.834E-08	-0.3589	-0.004331	1.350E-09	8503.2313	1.140E+10
0.000771	199254.	0.000				
27.450	-1.930E-08	-0.3712	0.000469	1.116E-09	8503.2315	1.140E+10
0.000540	204881.	0.000				
28.060	-1.200E-08	-0.3542	0.003710	8.829E-10	8503.2312	1.140E+10
0.000345	210507.	0.000				
28.670	-6.374E-09	-0.3185	0.005662	6.668E-10	8503.2307	1.140E+10
0.000188	216133.	0.000				
29.280	-2.241E-09	-0.2726	0.006599	4.770E-10	8503.2300	1.140E+10
6.790E-05	221759.	0.000				
29.890	6.092E-10	-0.2229	0.006779	3.179E-10	8503.2292	1.140E+10
-1.892E-05	227385.	0.000				
30.500	2.412E-09	-0.1740	0.006428	1.904E-10	8503.2285	1.140E+10
-7.678E-05	233011.	0.000				
31.110	3.397E-09	-0.1291	0.005742	9.310E-11	8503.2278	1.140E+10
-0.000111	238637.	0.000				
31.720	3.775E-09	-0.0901	0.004876	2.270E-11	8503.2272	1.140E+10
-0.000126	244264.	0.000				
32.330	3.729E-09	-0.0578	0.003949	-2.479E-11	8503.2267	1.140E+10
-0.000127	249890.	0.000				
32.940	3.412E-09	-0.0322	0.003047	-5.370E-11	8503.2263	1.140E+10
-0.000119	255516.	0.000				
33.550	2.943E-09	-0.0131	0.002226	-6.825E-11	8503.2260	1.140E+10
-0.000105	261142.	0.000				
34.160	2.413E-09	0.000484	0.001520	-7.229E-11	8503.2258	1.140E+10
-8.794E-05	266768.	0.000				
34.770	1.885E-09	0.009326	0.000942	-6.914E-11	8503.2259	1.140E+10
-7.014E-05	272394.	0.000				
35.380	1.401E-09	0.0144	0.000490	-6.152E-11	8503.2260	1.140E+10
-5.320E-05	278021.	0.000				
35.990	9.843E-10	0.0166	0.000156	-5.156E-11	8503.2261	1.140E+10
-3.814E-05	283647.	0.000				
36.600	6.459E-10	0.0168	-7.708E-05	-4.083E-11	8503.2261	1.140E+10
-2.553E-05	289273.	0.000				
37.210	3.865E-10	0.0156	-0.000228	-3.044E-11	8503.2260	1.140E+10
-1.557E-05	294899.	0.000				
37.820	2.003E-10	0.0135	-0.000315	-2.110E-11	8503.2260	1.140E+10
-8.225E-06	300525.	0.000				
38.430	7.768E-11	0.0110	-0.000357	-1.322E-11	8503.2260	1.140E+10
-3.249E-06	306151.	0.000				
39.040	6.772E-12	0.008319	-0.000370	-7.016E-12	8503.2259	1.140E+10
-2.884E-07	311777.	0.000				
39.650	-2.503E-11	0.005610	-0.000367	-2.543E-12	8503.2259	1.140E+10
1.085E-06	317404.	0.000				
40.260	-3.046E-11	0.002956	-0.000358	0.000	8503.2259	1.140E+10
1.344E-06	323030.	0.000				
40.870	-2.198E-11	0.000372	-0.000244	1.277E-12	8503.2258	1.140E+10
2.985E-05	9940049.	0.000				
41.480	-1.176E-11	-0.000612	-7.525E-05	1.200E-12	8503.2258	1.140E+10
1.614E-05	10047214.	0.000				
42.090	-4.411E-12	-0.000732	6.210E-06	0.000	8503.2258	1.140E+10

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6.119E-06	10154379.	0.000					
42.700	0.000	-0.000523	3.119E-05	0.000	8503.2258	1.140E+10	
7.059E-07	10261543.	0.000					
43.310	0.000	-0.000276	2.886E-05	0.000	8503.2258	1.140E+10	
-1.341E-06	10368708.	0.000					
43.920	1.101E-12	-0.000100	1.819E-05	0.000	8503.2258	1.140E+10	
-1.576E-06	10475873.	0.000					
44.530	0.000	-9.340E-06	8.266E-06	0.000	8503.2258	1.140E+10	
-1.134E-06	10583038.	0.000					
45.140	0.000	2.083E-05	1.850E-06	0.000	8503.2258	1.140E+10	
-6.188E-07	10690203.	0.000					
45.750	0.000	1.783E-05	-4.389E-07	0.000	8503.2258	1.140E+10	
-6.655E-09	302839.	0.000					
46.360	0.000	1.446E-05	-4.605E-07	0.000	8503.2258	1.140E+10	
7.666E-10	308465.	0.000					
46.970	0.000	1.113E-05	-4.374E-07	0.000	8503.2258	1.140E+10	
5.546E-09	314091.	0.000					
47.580	0.000	8.082E-06	-3.870E-07	0.000	8503.2258	1.140E+10	
8.210E-09	319717.	0.000					
48.190	0.000	5.471E-06	-3.230E-07	0.000	8503.2258	1.140E+10	
9.277E-09	325344.	0.000					
48.800	0.000	3.355E-06	-2.553E-07	0.000	8503.2258	1.140E+10	
9.212E-09	330970.	0.000					
49.410	0.000	1.730E-06	-1.908E-07	0.000	8503.2258	1.140E+10	
8.414E-09	336596.	0.000					
50.020	0.000	5.545E-07	-1.337E-07	0.000	8503.2258	1.140E+10	
7.204E-09	342222.	0.000					
50.630	0.000	-2.351E-07	-8.597E-08	0.000	8503.2258	1.140E+10	
5.826E-09	347848.	0.000					
51.240	0.000	-7.123E-07	-4.835E-08	0.000	8503.2258	1.140E+10	
4.453E-09	353474.	0.000					
51.850	0.000	-9.505E-07	-2.035E-08	0.000	8503.2258	1.140E+10	
3.198E-09	359101.	0.000					
52.460	0.000	-1.017E-06	-8.740E-10	0.000	8503.2258	1.140E+10	
2.123E-09	364727.	0.000					
53.070	0.000	-9.686E-07	1.149E-08	0.000	8503.2258	1.140E+10	
1.256E-09	370353.	0.000					
53.680	0.000	-8.526E-07	1.827E-08	0.000	8503.2258	1.140E+10	
5.949E-10	375979.	0.000					
54.290	0.000	-7.041E-07	2.089E-08	0.000	8503.2258	1.140E+10	
1.227E-10	381605.	0.000					
54.900	0.000	-5.487E-07	2.065E-08	0.000	8503.2258	1.140E+10	
-1.886E-10	387231.	0.000					
55.510	0.000	-4.030E-07	1.861E-08	0.000	8503.2258	1.140E+10	
-3.705E-10	392857.	0.000					
56.120	0.000	-2.769E-07	1.559E-08	0.000	8503.2258	1.140E+10	
-4.544E-10	398484.	0.000					
56.730	0.000	-1.750E-07	1.221E-08	0.000	8503.2258	1.140E+10	
-4.686E-10	404110.	0.000					
57.340	0.000	-9.814E-08	8.894E-09	0.000	8503.2258	1.140E+10	
-4.370E-10	409736.	0.000					
57.950	0.000	-4.460E-08	5.910E-09	0.000	8503.2258	1.140E+10	
-3.782E-10	415362.	0.000					
58.560	0.000	-1.129E-08	3.407E-09	0.000	8503.2258	1.140E+10	
-3.055E-10	420988.	0.000					
59.170	0.000	5.653E-09	1.456E-09	0.000	8503.2258	1.140E+10	
-2.277E-10	426614.	0.000					
59.780	0.000	1.039E-08	7.569E-11	0.000	8503.2258	1.140E+10	
-1.493E-10	432241.	0.000					
60.390	0.000	7.119E-09	-7.333E-10	0.000	8503.2258	1.140E+10	
-7.172E-11	437867.	0.000					
61.000	0.000	0.000	0.000	0.000	8503.2258	1.140E+10	
2.721E-10	10224246.	0.000					

Bridge 11 Bent 5 Transverse Provided.lp6o

* The above values of total stress are combined axial and bending stress.

Output Summary for Load Case No. 2:

Pile-head deflection = 0.0098709 inches
 Computed slope at pile head = 0.000000 radians
 Maximum bending moment = -58373. inch-lbs
 Maximum shear force = -1380.5282817 lbs
 Depth of maximum bending moment = 0.000000 inches below pile head
 Depth of maximum shear force = 109.8000000 inches below pile head
 Number of iterations = 6
 Number of zero deflection points = 9

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

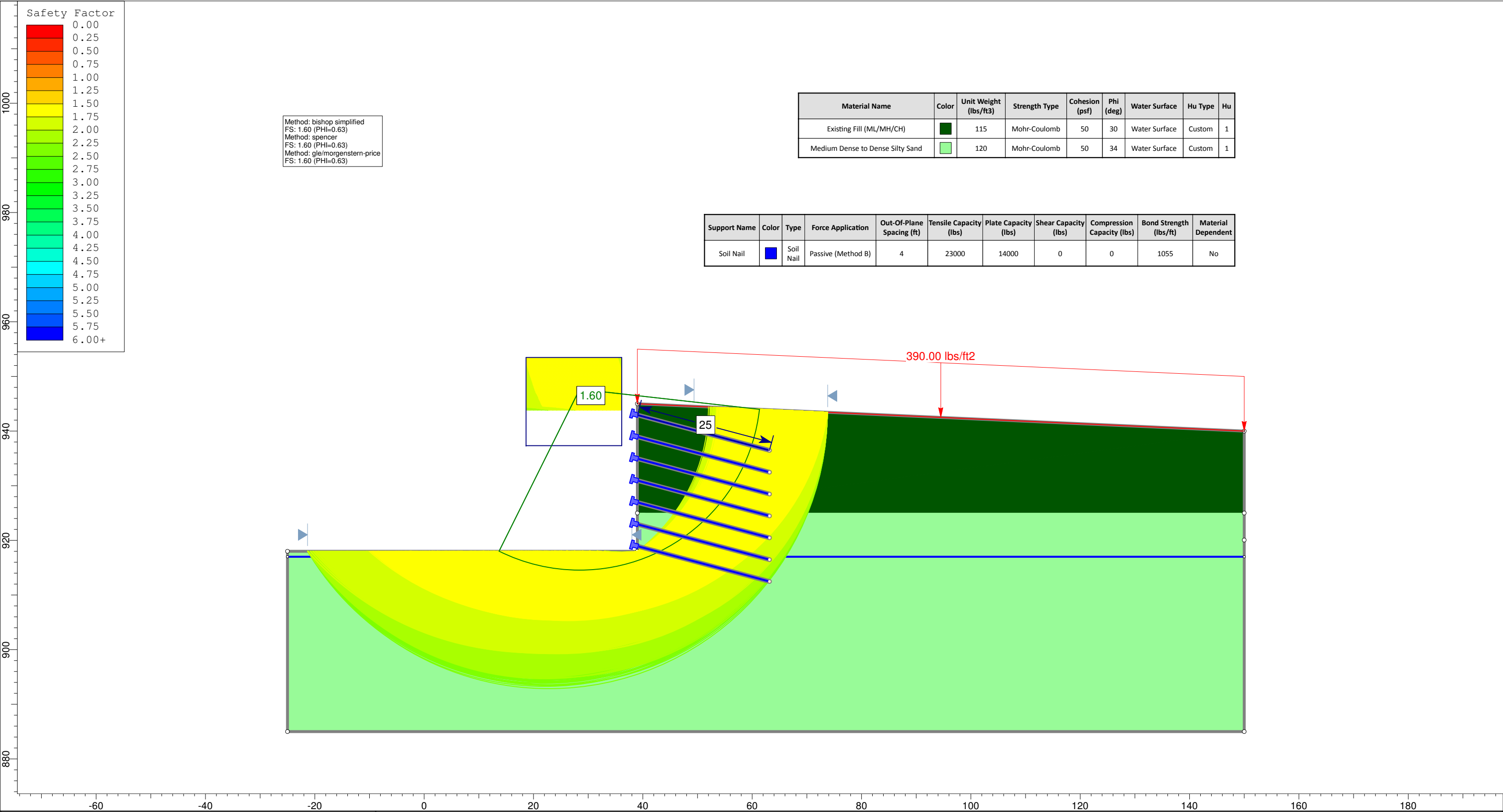
Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
 Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
 Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
 Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
 Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

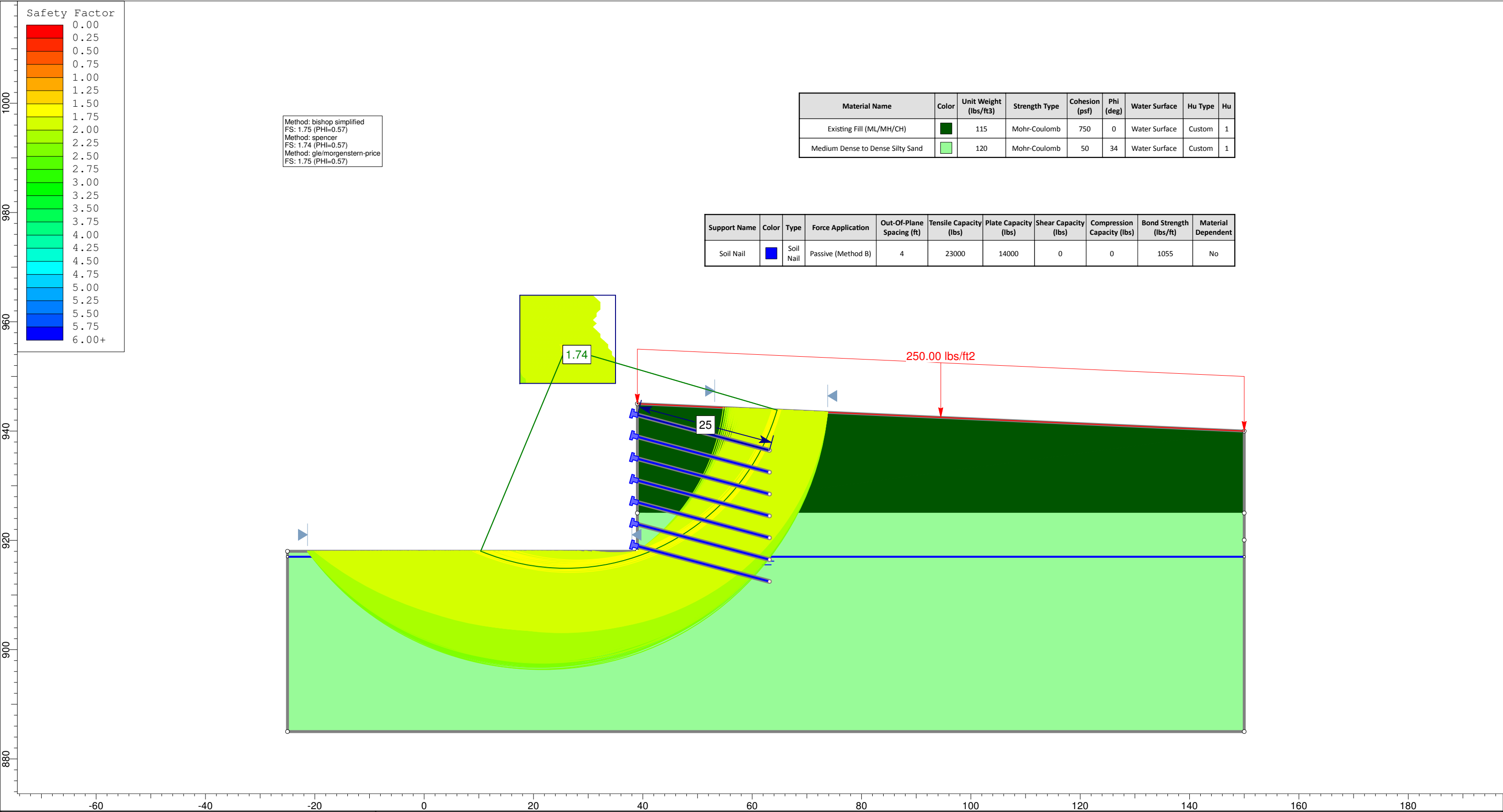
Load Case No.	Maximum Load Type No.	Pile-head Condition 1 V(lbs) or y(inches) or lbs	Pile-head Condition 2 M = in-lb, rad., Rotation or in-lb/rad. radians	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in Pile in-lbs
1	1	V = 1165.0000	M = 0.000	131800.	0.03544165	
73913.		-2540.2912	-0.00049752			
2	2	V = 1165.0000	S = 0.000	131800.	0.00987095	
-58373.		-1380.5283	0.00000000			

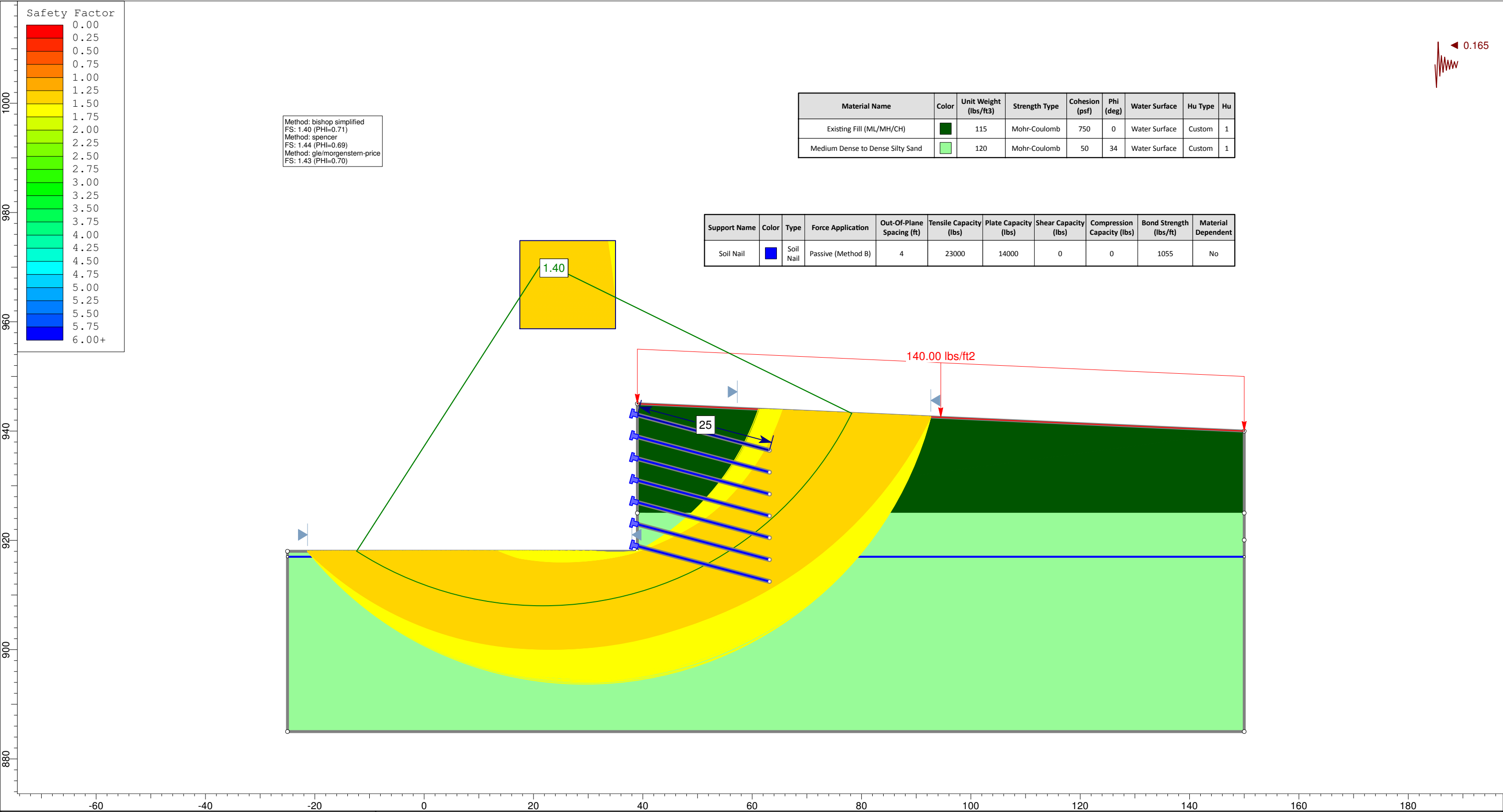
The analysis ended normally.

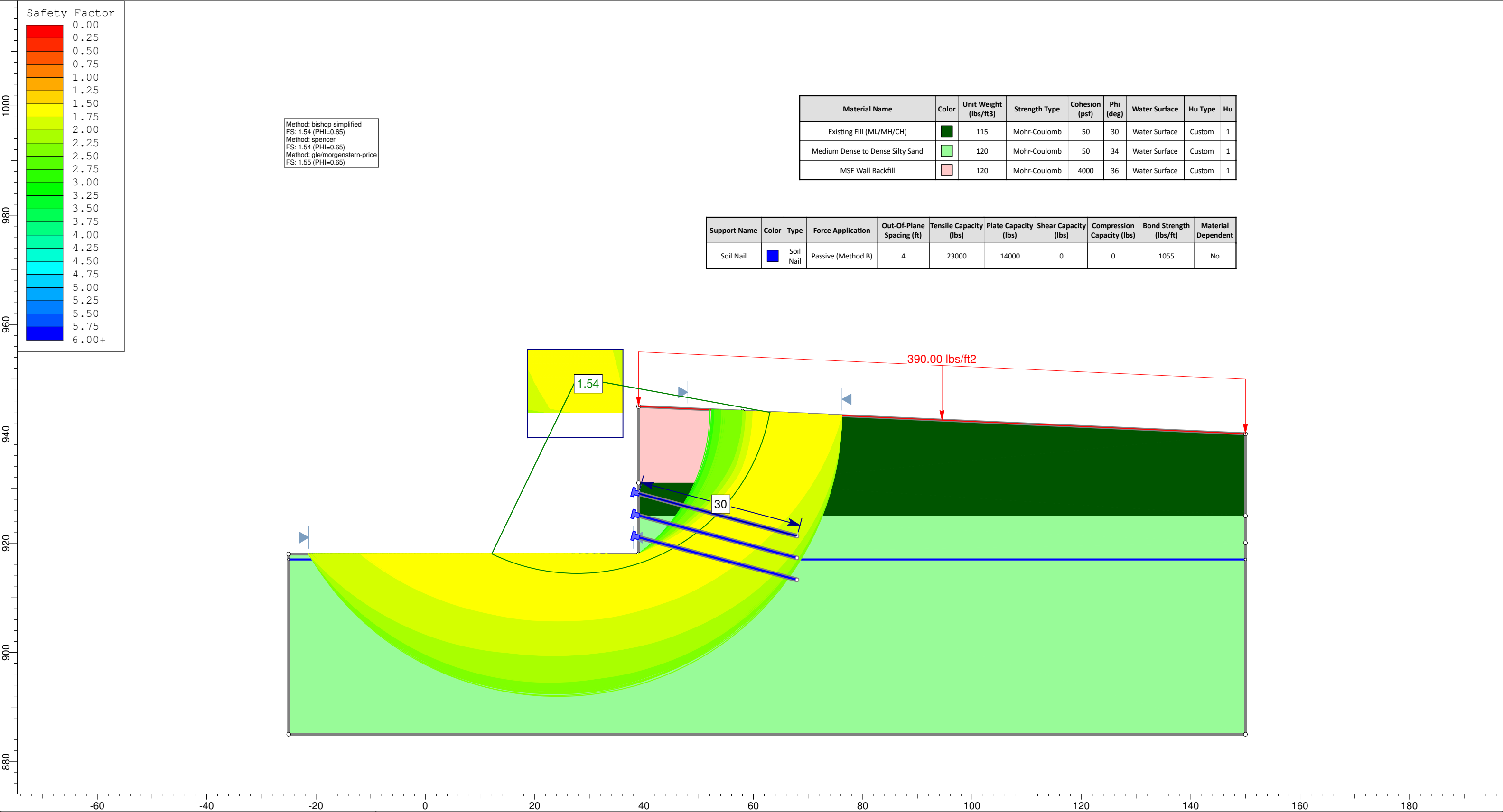
Appendix I

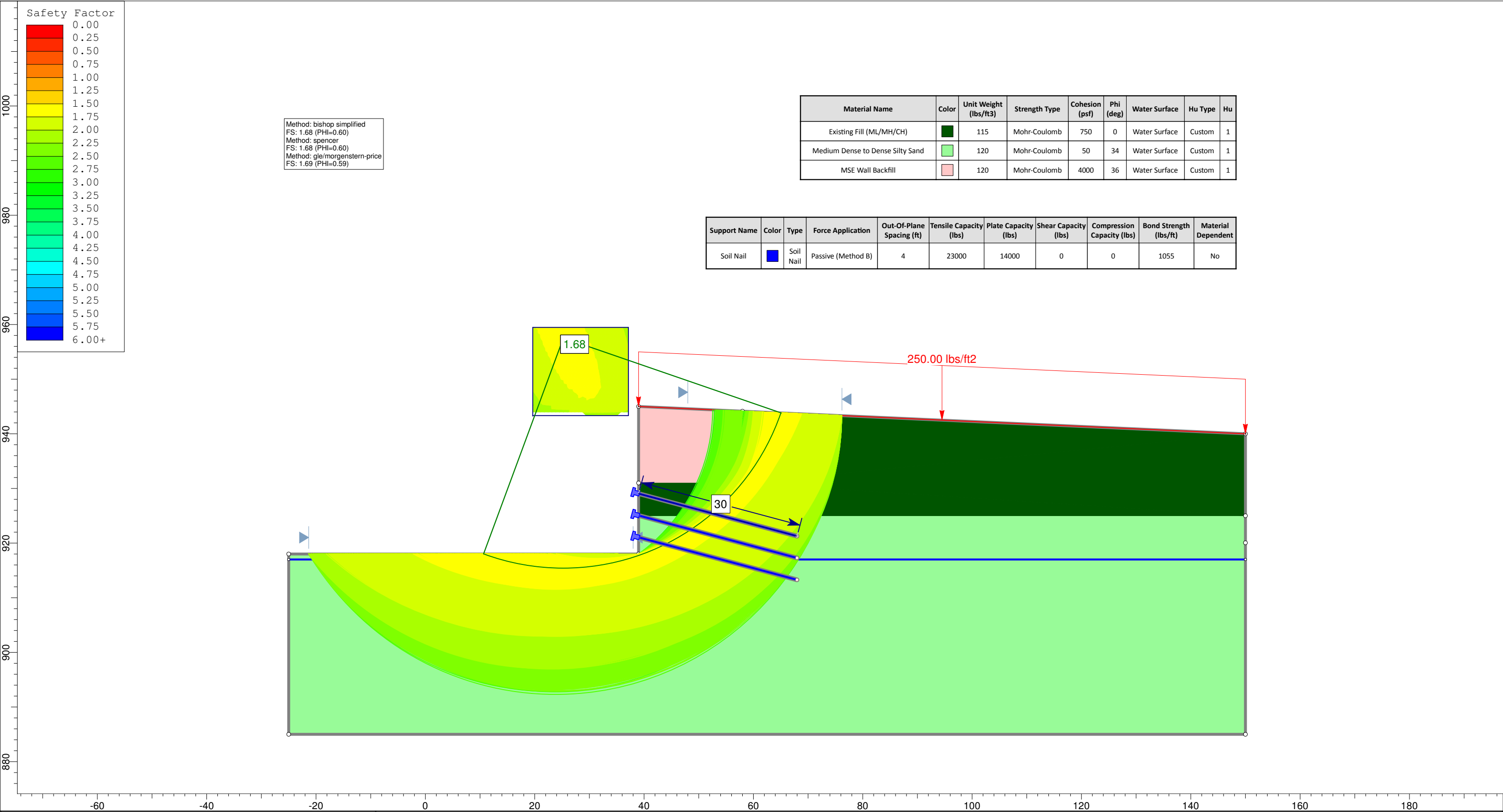
Global Stability Analysis





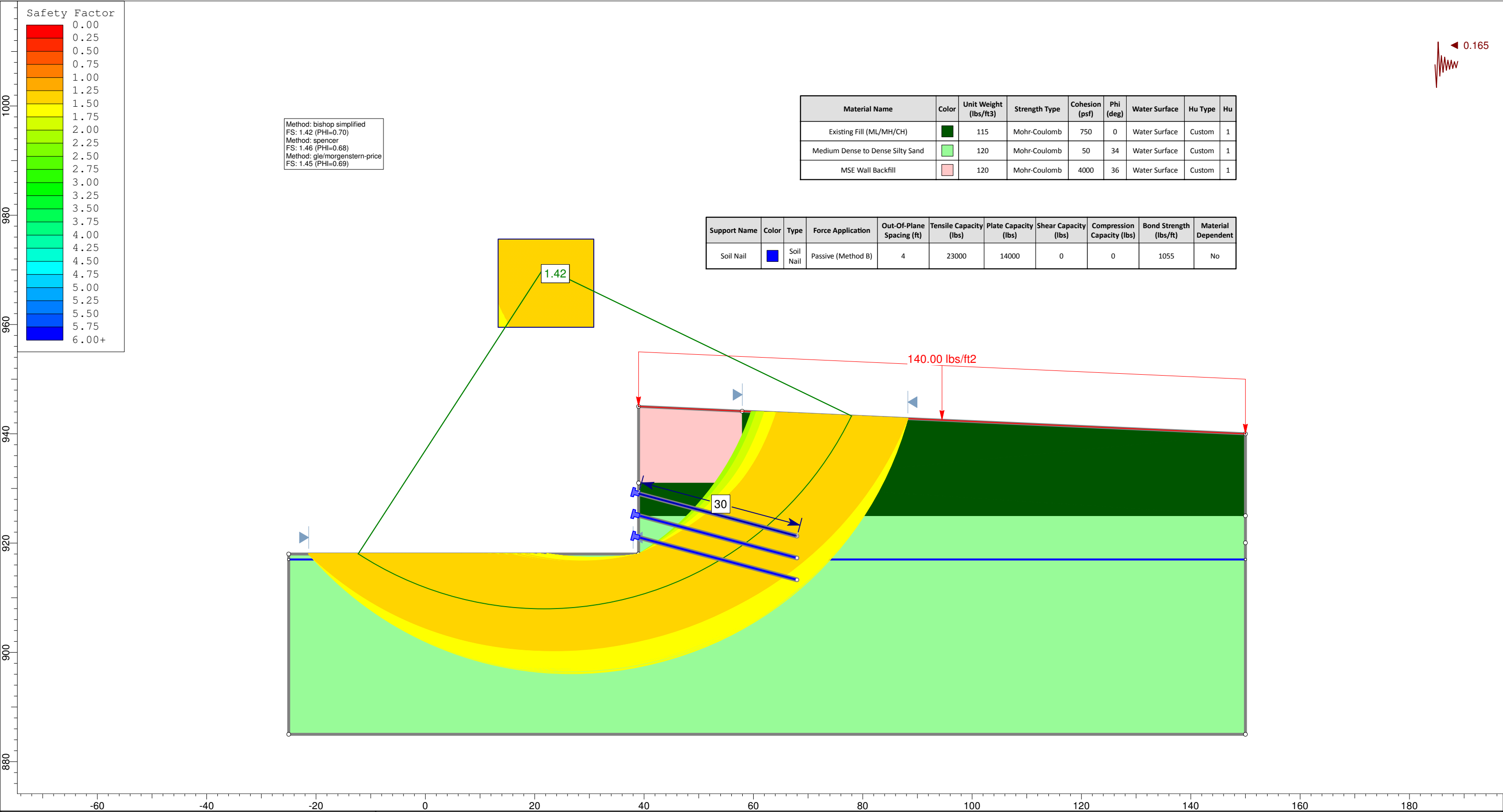


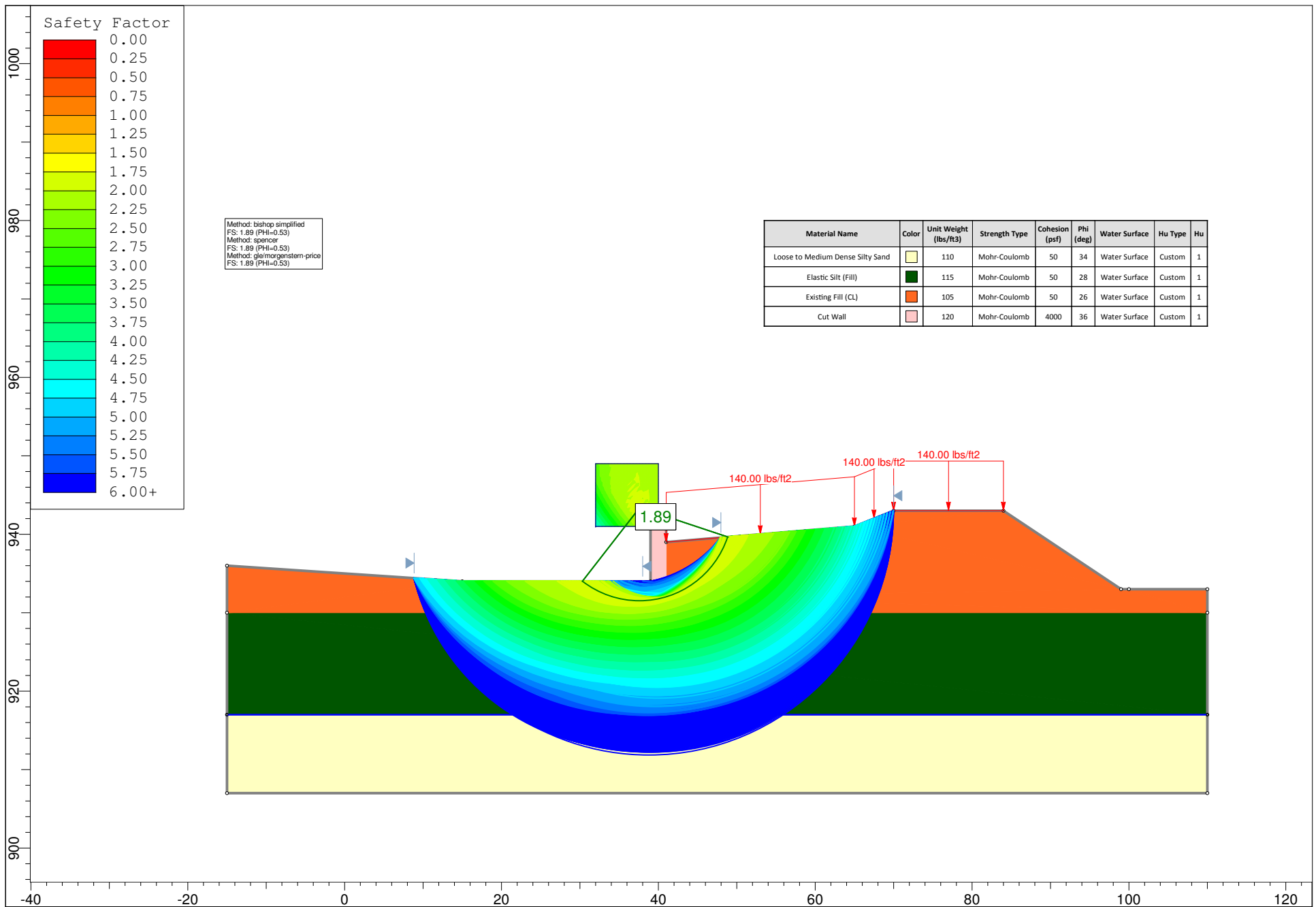





Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Existing Fill (ML/MH/CH)	Dark Green	115	Mohr-Coulomb	750	0	Water Surface	Custom	1
Medium Dense to Dense Silty Sand	Light Green	120	Mohr-Coulomb	50	34	Water Surface	Custom	1
MSE Wall Backfill	Pink	120	Mohr-Coulomb	4000	36	Water Surface	Custom	1

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent
Soil Nail	Blue	Soil Nail	Passive (Method B)	4	23000	14000	0	0	1055	No

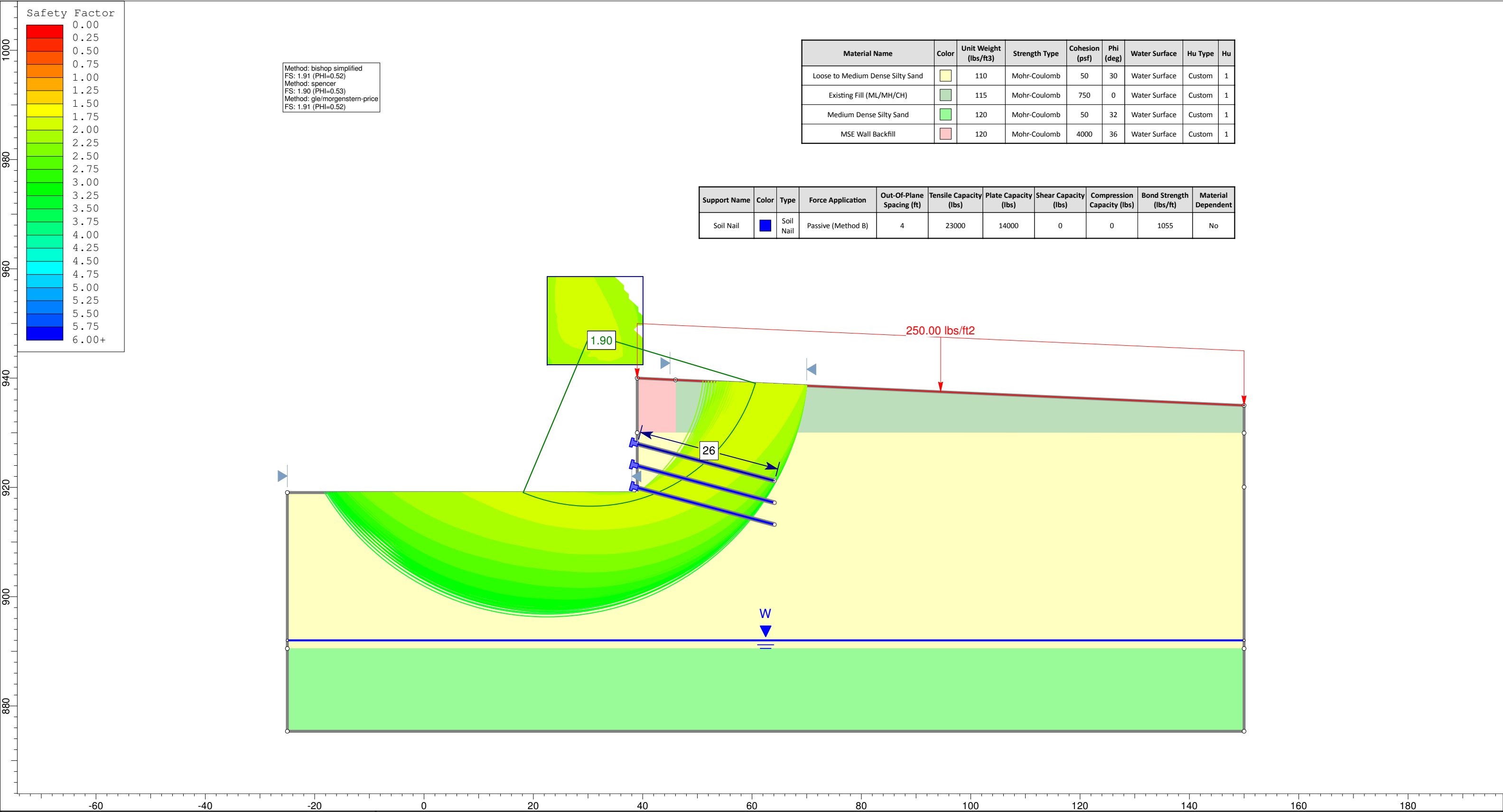


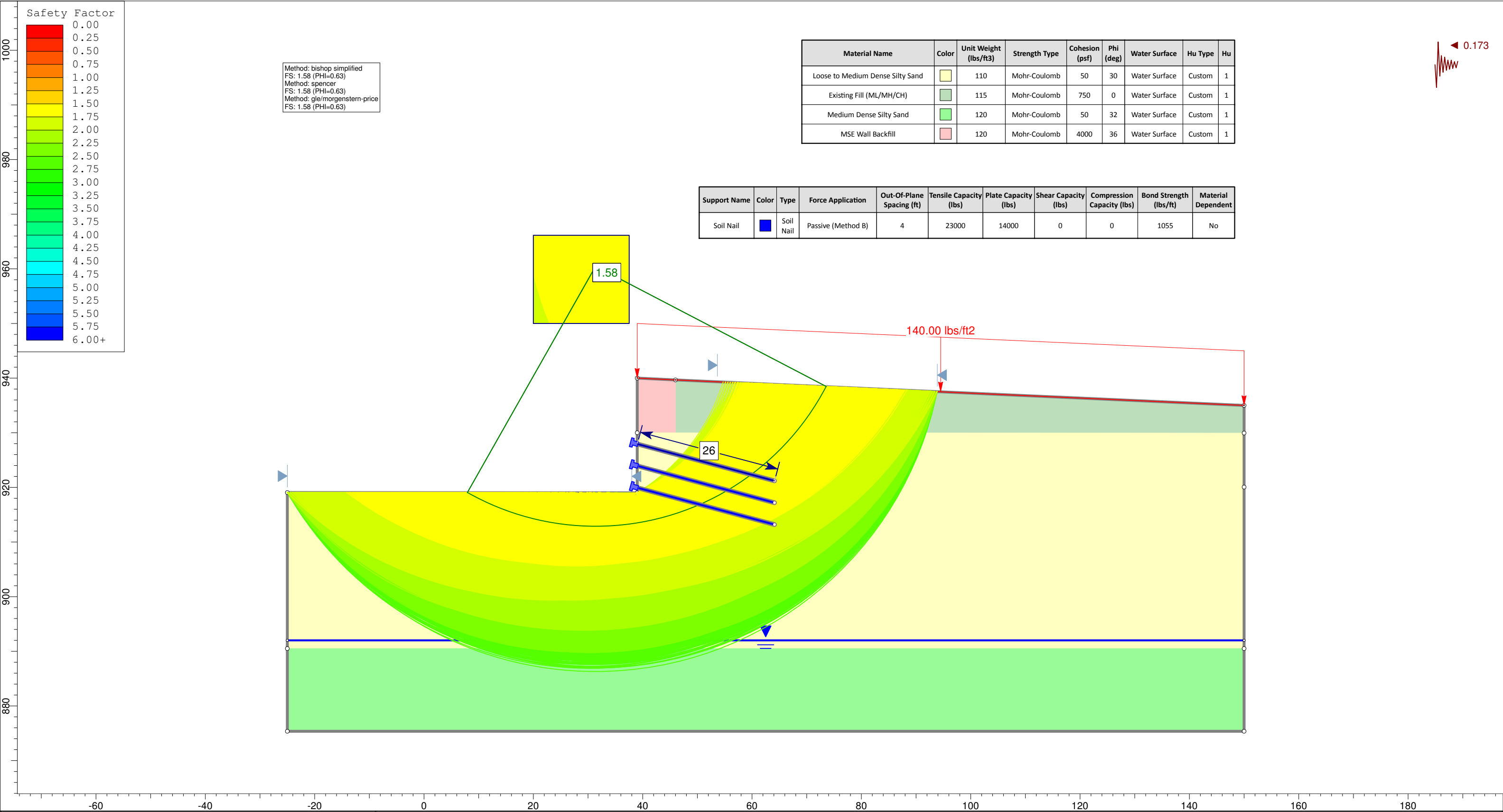




SLIDEINTERPRET 6.035

Project		I-85/385 Interchange Improvements - Project ID: 00381; ECS Project No. 9283			
Analysis Description		Ramp 1A - Station 53+00 - ESA			
Drawn By	RLH	Scale	1:200	Company	ECS Carolinas LLP
Date	5/26/2015			File Name	Ramp 1A - Sta 53+00 - ESA.slim





Method: bishop simplified
FS: 1.58 (PHI=0.63)
Method: spencer
FS: 1.58 (PHI=0.63)
Method: gle/morgenstern-price
FS: 1.58 (PHI=0.63)

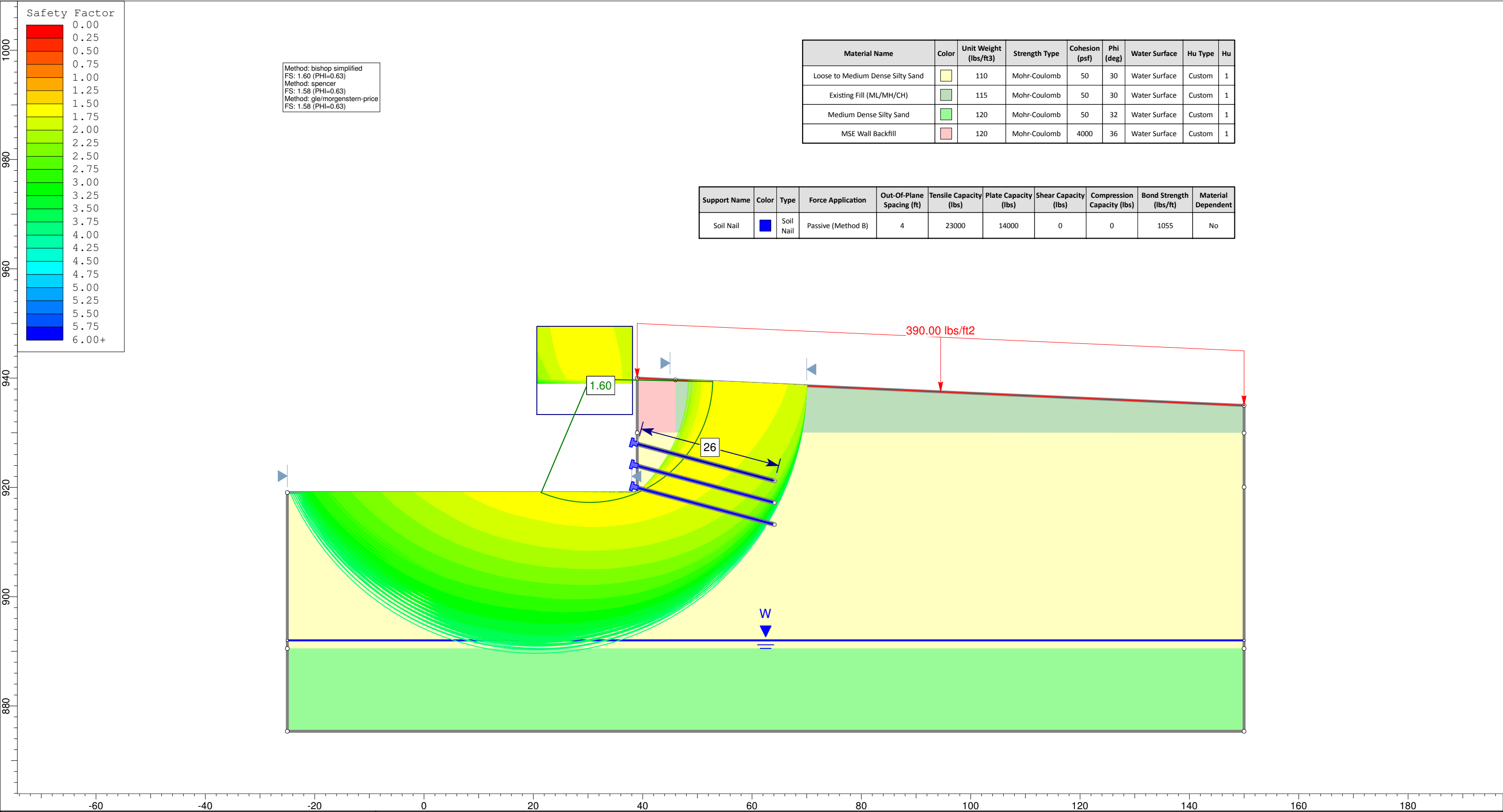
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Loose to Medium Dense Silty Sand		110	Mohr-Coulomb	50	30	Water Surface	Custom	1
Existing Fill (ML/MH/CH)		115	Mohr-Coulomb	750	0	Water Surface	Custom	1
Medium Dense Silty Sand		120	Mohr-Coulomb	50	32	Water Surface	Custom	1
MSE Wall Backfill		120	Mohr-Coulomb	4000	36	Water Surface	Custom	1

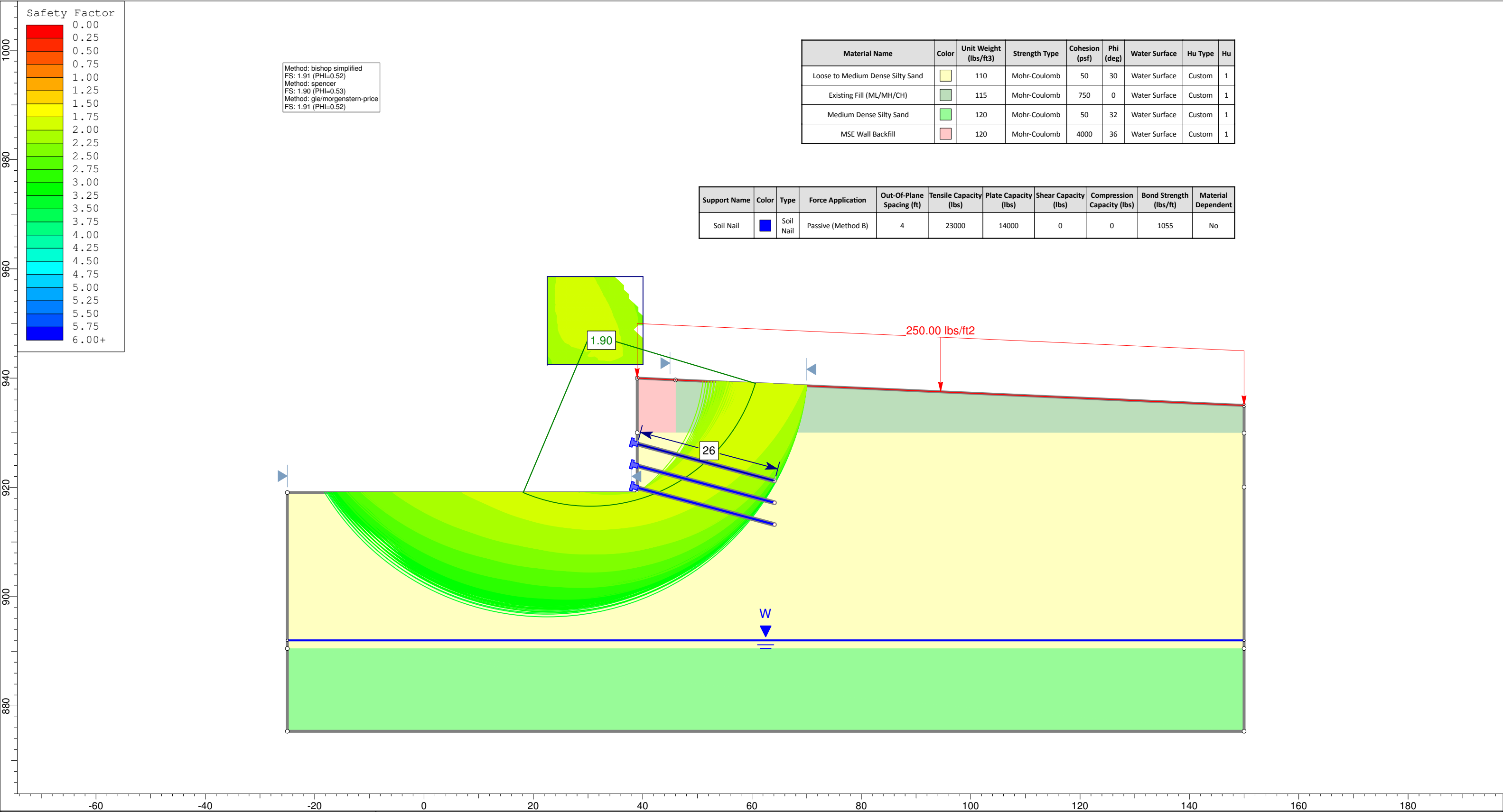
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent
Soil Nail		Soil Nail	Passive (Method B)	4	23000	14000	0	0	1055	No

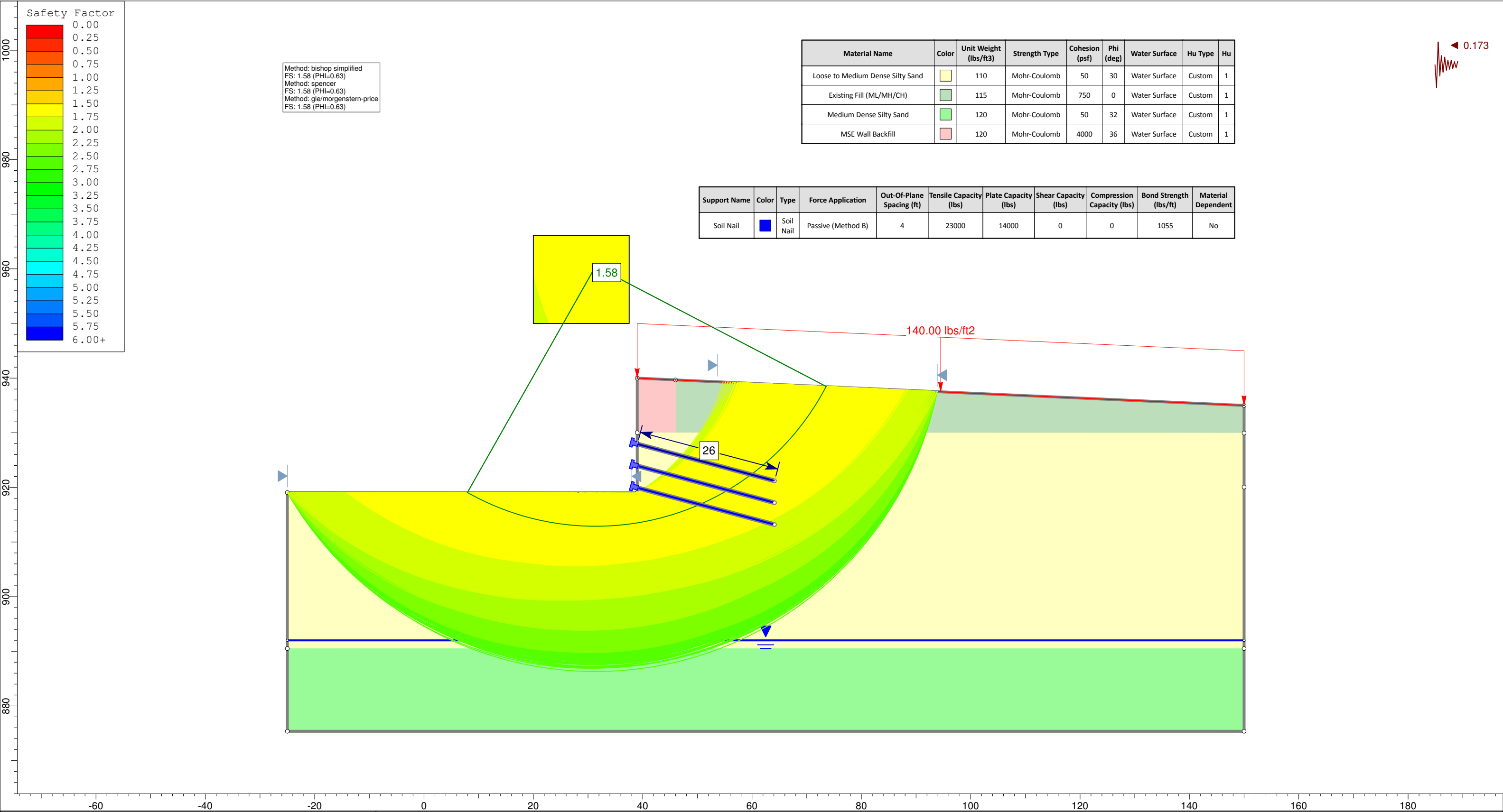


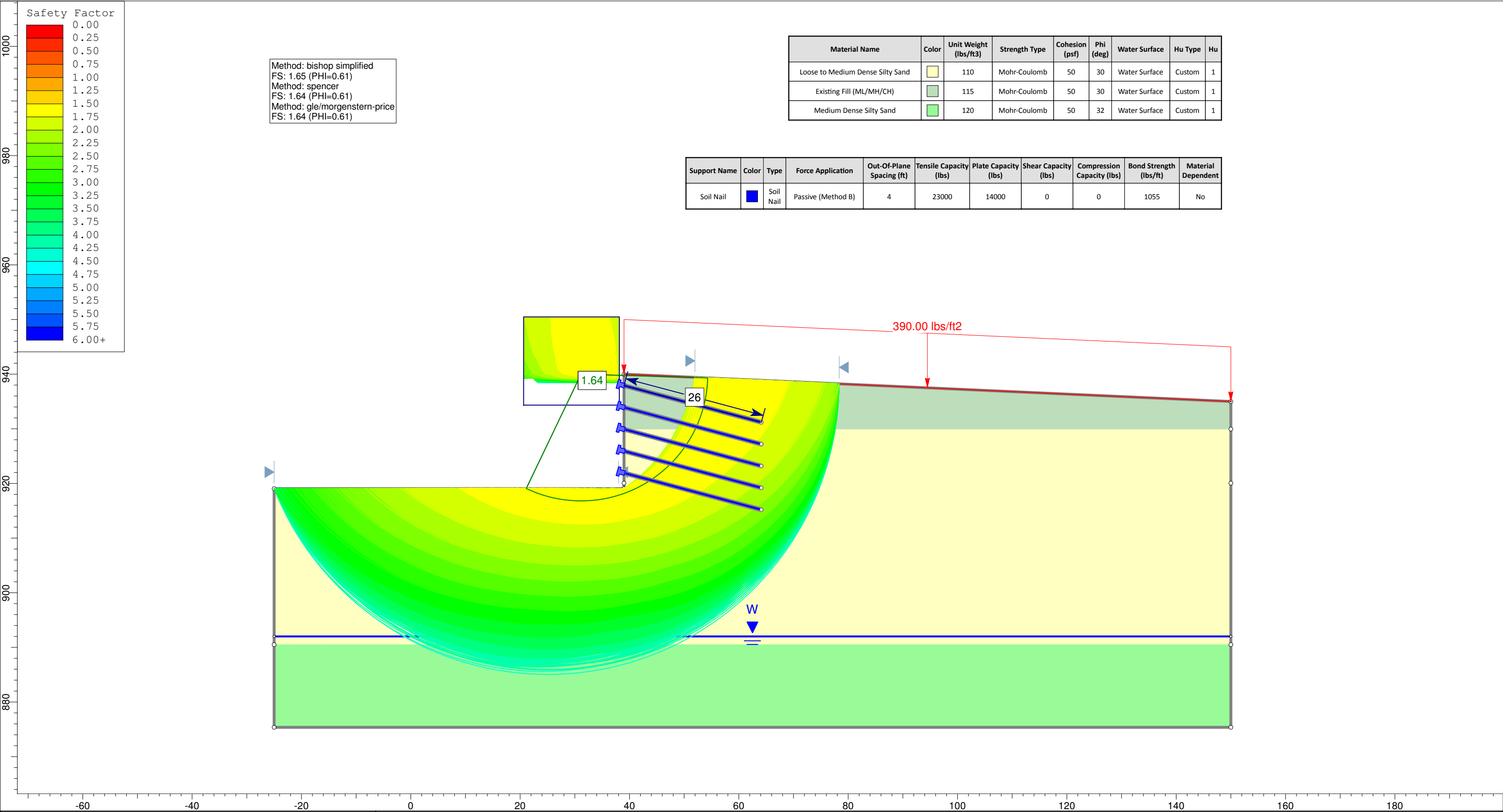
SLIDEINTERPRET 6.035

Project	I-85/385 Interchange Improvements - Project ID: 003811; ECS Project No. 9283		
Analysis Description	Ramp 2A - Station 109+50 - Longitudinal - Earthquake Analysis: kh=0.173		
Drawn By	RLH	Scale	1:200
Date	5/20/2015	Company	ECS Carolinas LLP
		File Name	Ramp 2A - Sta 109+50 - TSA - EQ.slim









Method: bishop simplified
FS: 1.65 (PHI=0.61)
Method: spencer
FS: 1.64 (PHI=0.61)
Method: gle/morgenstern-price
FS: 1.64 (PHI=0.61)

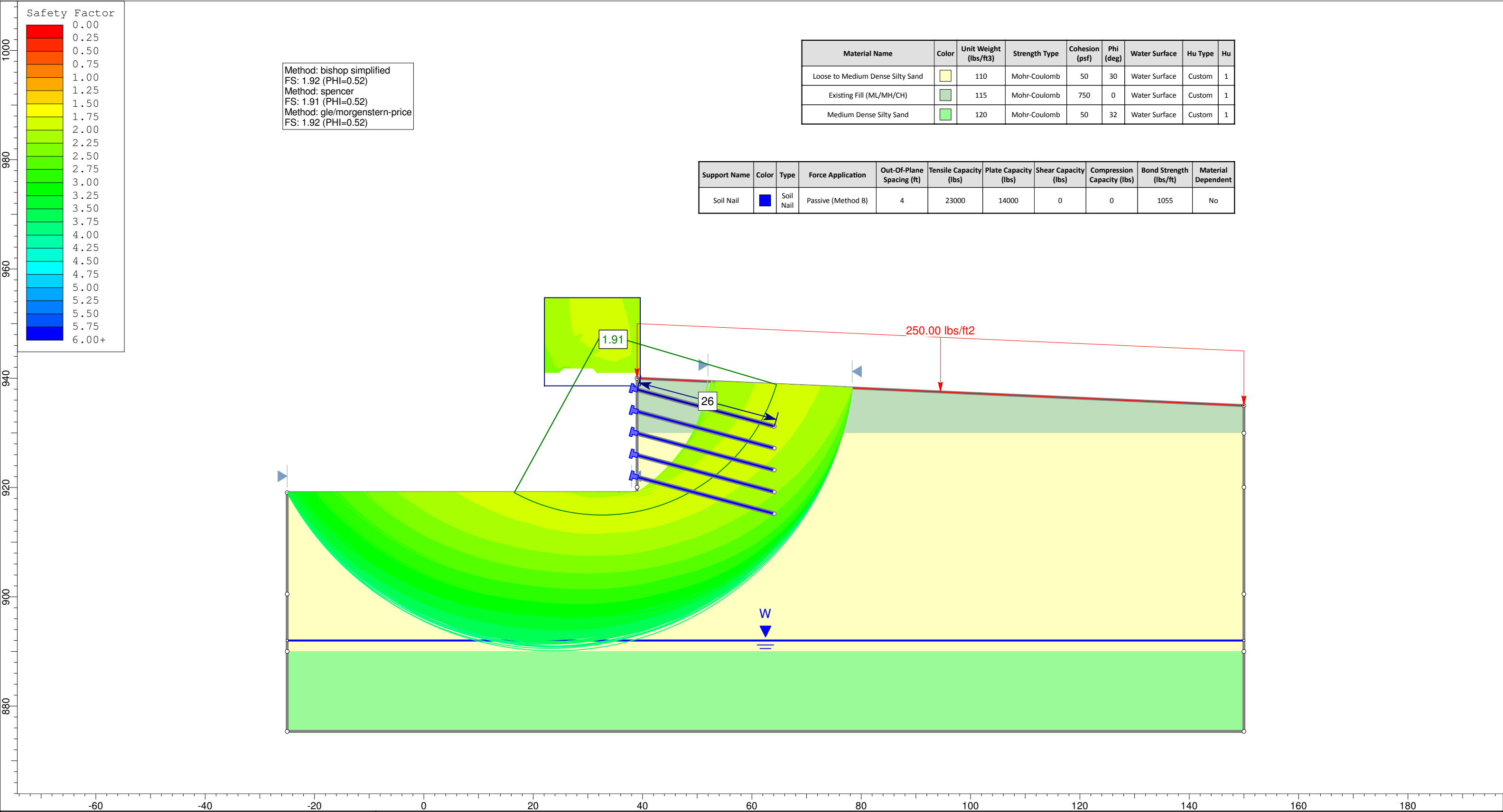
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Loose to Medium Dense Silty Sand		110	Mohr-Coulomb	50	30	Water Surface	Custom	1
Existing Fill (ML/MH/CH)		115	Mohr-Coulomb	50	30	Water Surface	Custom	1
Medium Dense Silty Sand		120	Mohr-Coulomb	50	32	Water Surface	Custom	1

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent
Soil Nail		Soil Nail	Passive (Method B)	4	23000	14000	0	0	1055	No



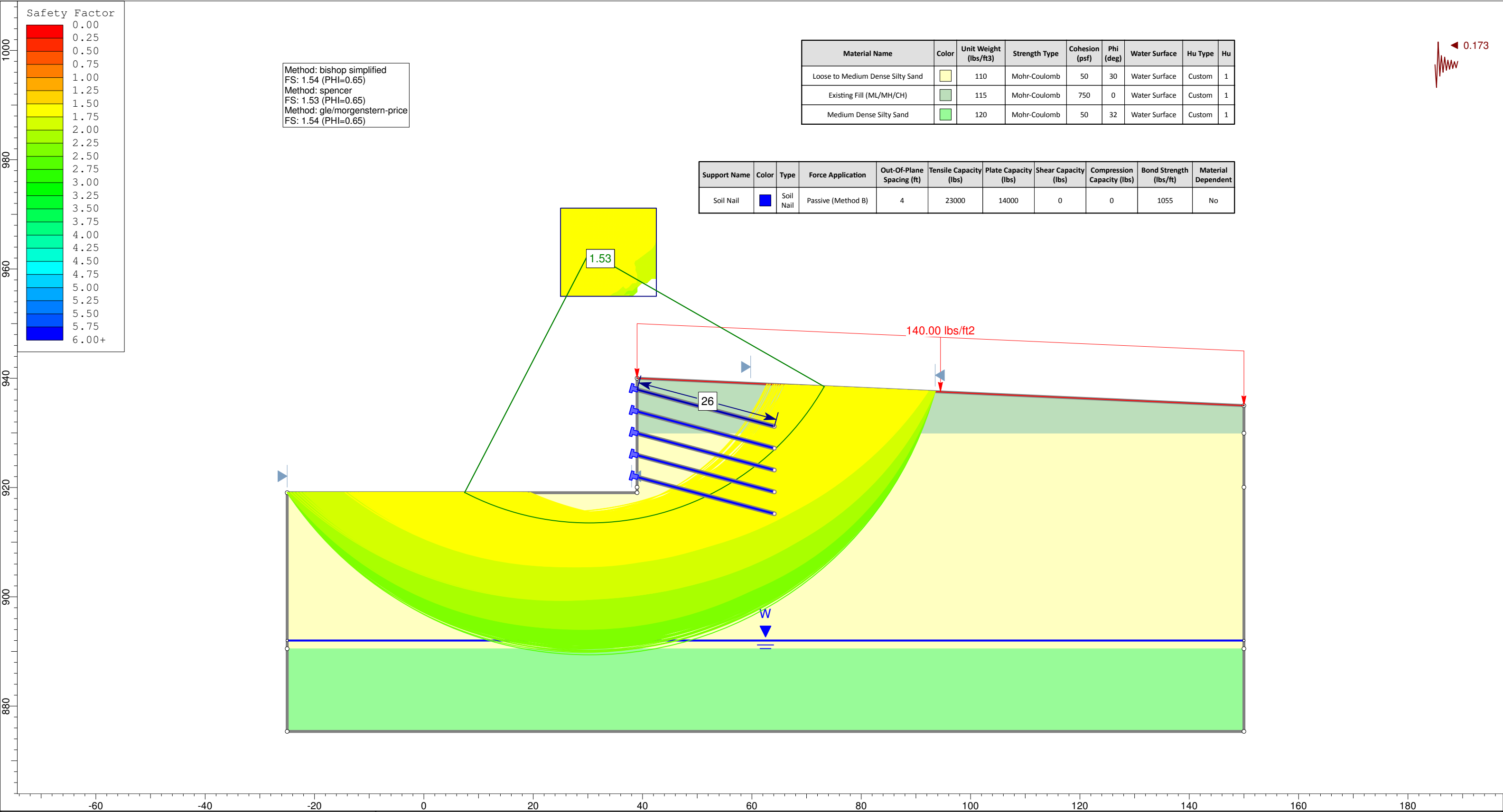
SLIDEINTERPRET 6.035

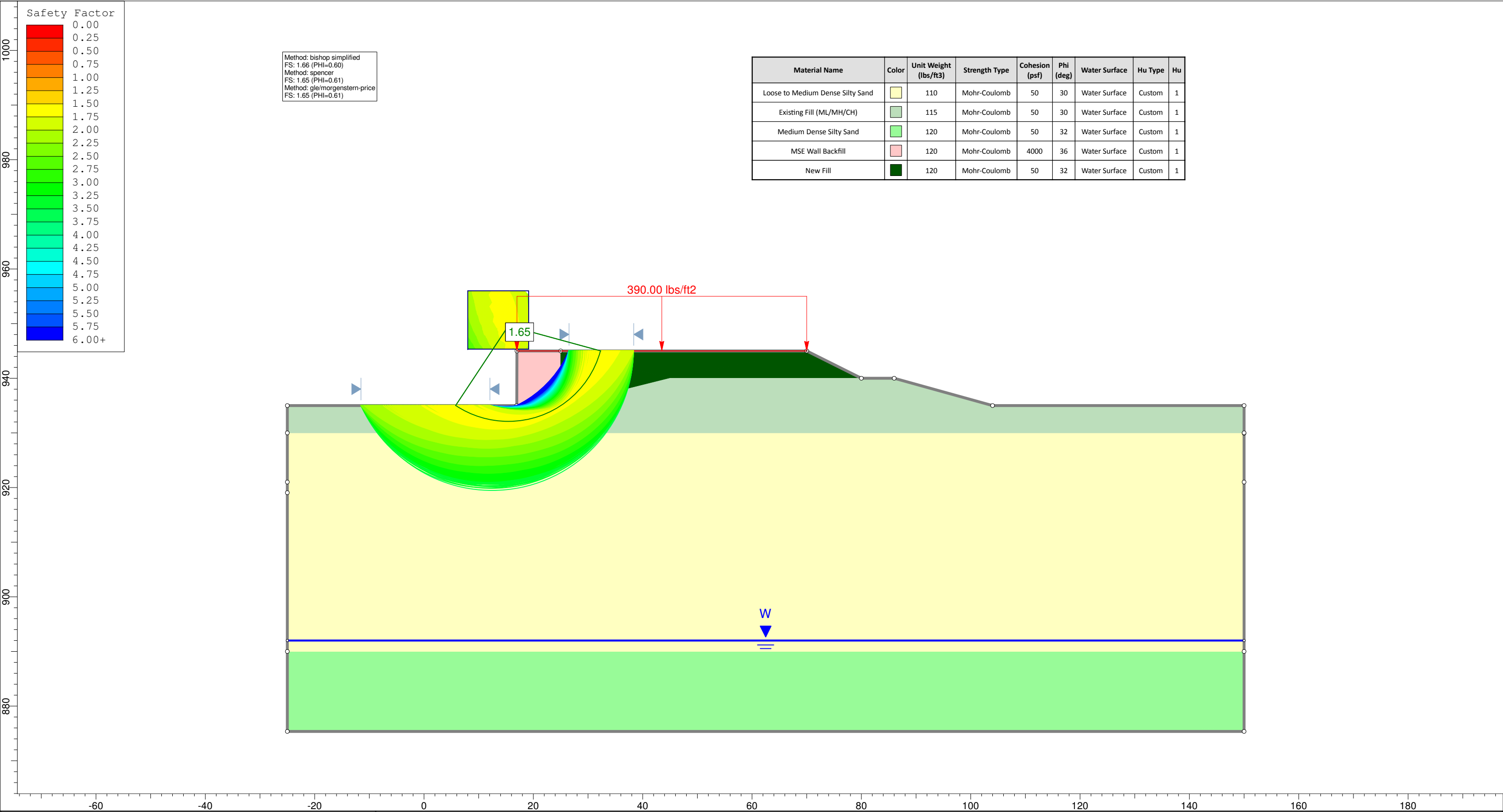
Project			I-85/385 Interchange Improvements - Project ID: 003811; ECS Project No. 9283		
Analysis Description			Ramp 2A - Station 110+00 - Longitudinal - ESA		
Drawn By		RLH	Scale		1:200
Date		5/20/2015	Company		ECS Carolinas LLP
			File Name		Ramp 2A - Sta 110+00 - ESA.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Loose to Medium Dense Silty Sand	■	110	Mohr-Coulomb	50	30	Water Surface	Custom	1
Existing Fill (ML/MH/CH)	■	115	Mohr-Coulomb	750	0	Water Surface	Custom	1
Medium Dense Silty Sand	■	120	Mohr-Coulomb	50	32	Water Surface	Custom	1

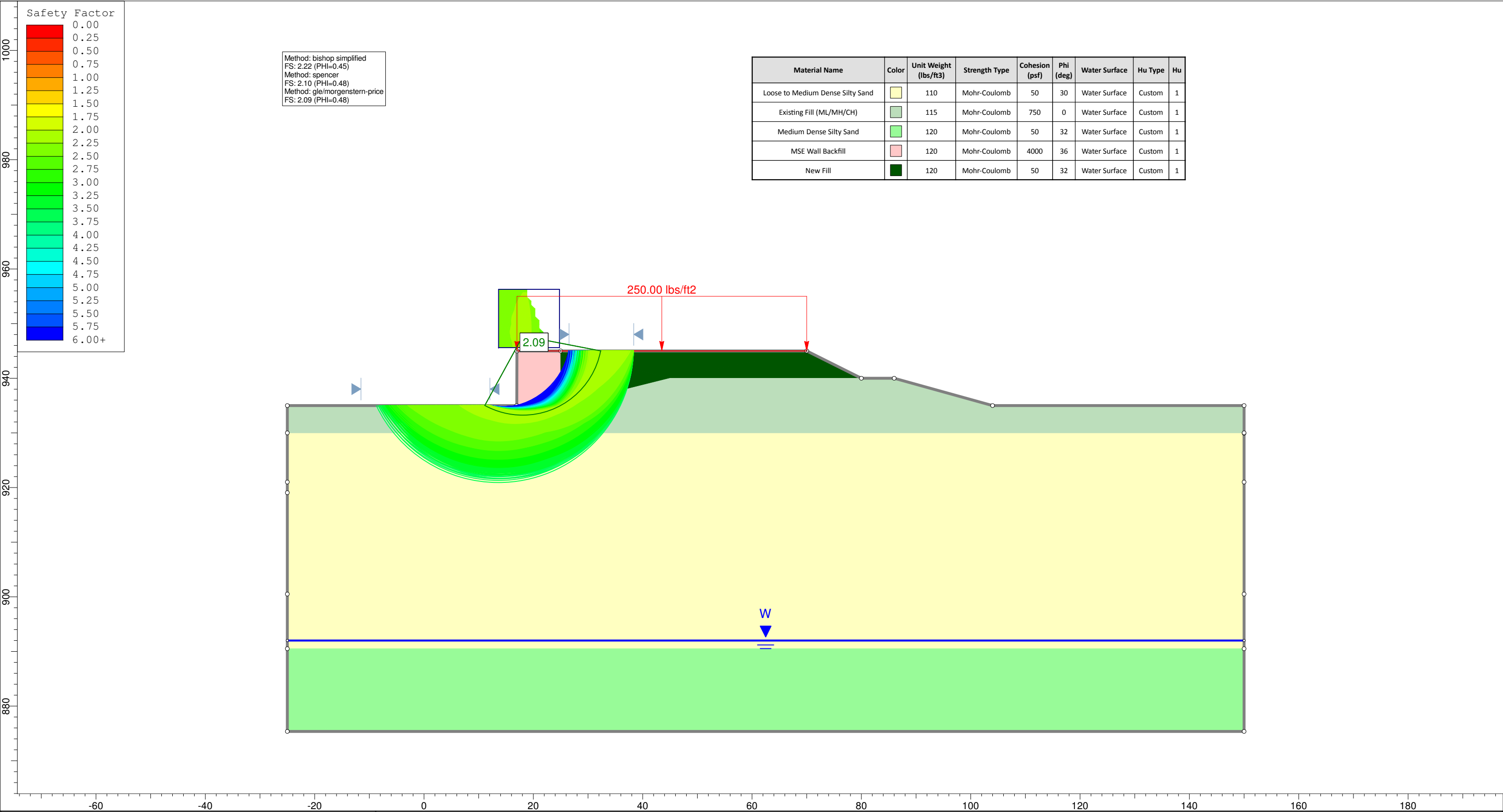
Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (ft)	Tensile Capacity (lbs)	Plate Capacity (lbs)	Shear Capacity (lbs)	Compression Capacity (lbs)	Bond Strength (lbs/ft)	Material Dependent
Soil Nail	■	Soil Nail	Passive (Method B)	4	23000	14000	0	0	1055	No

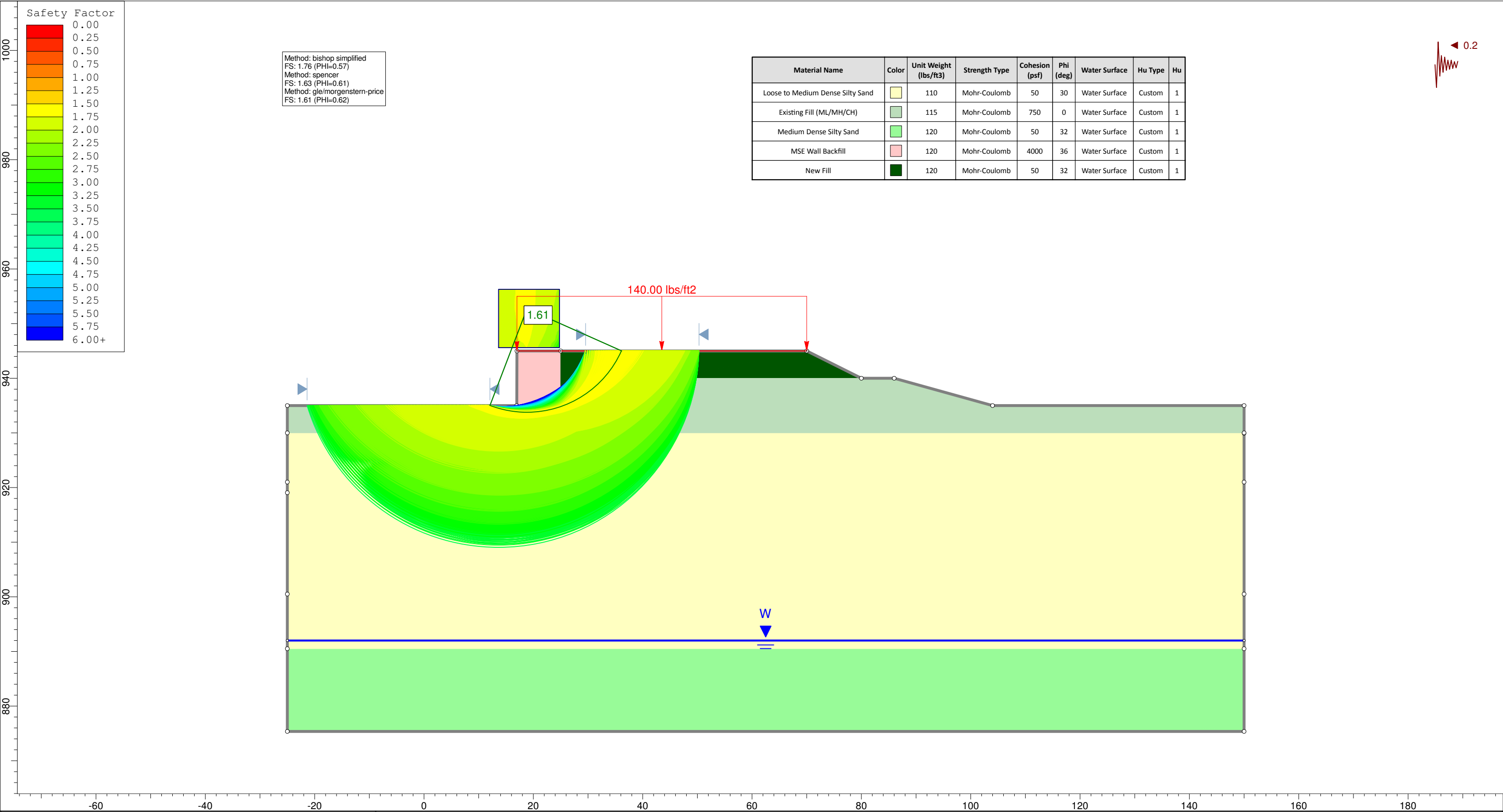


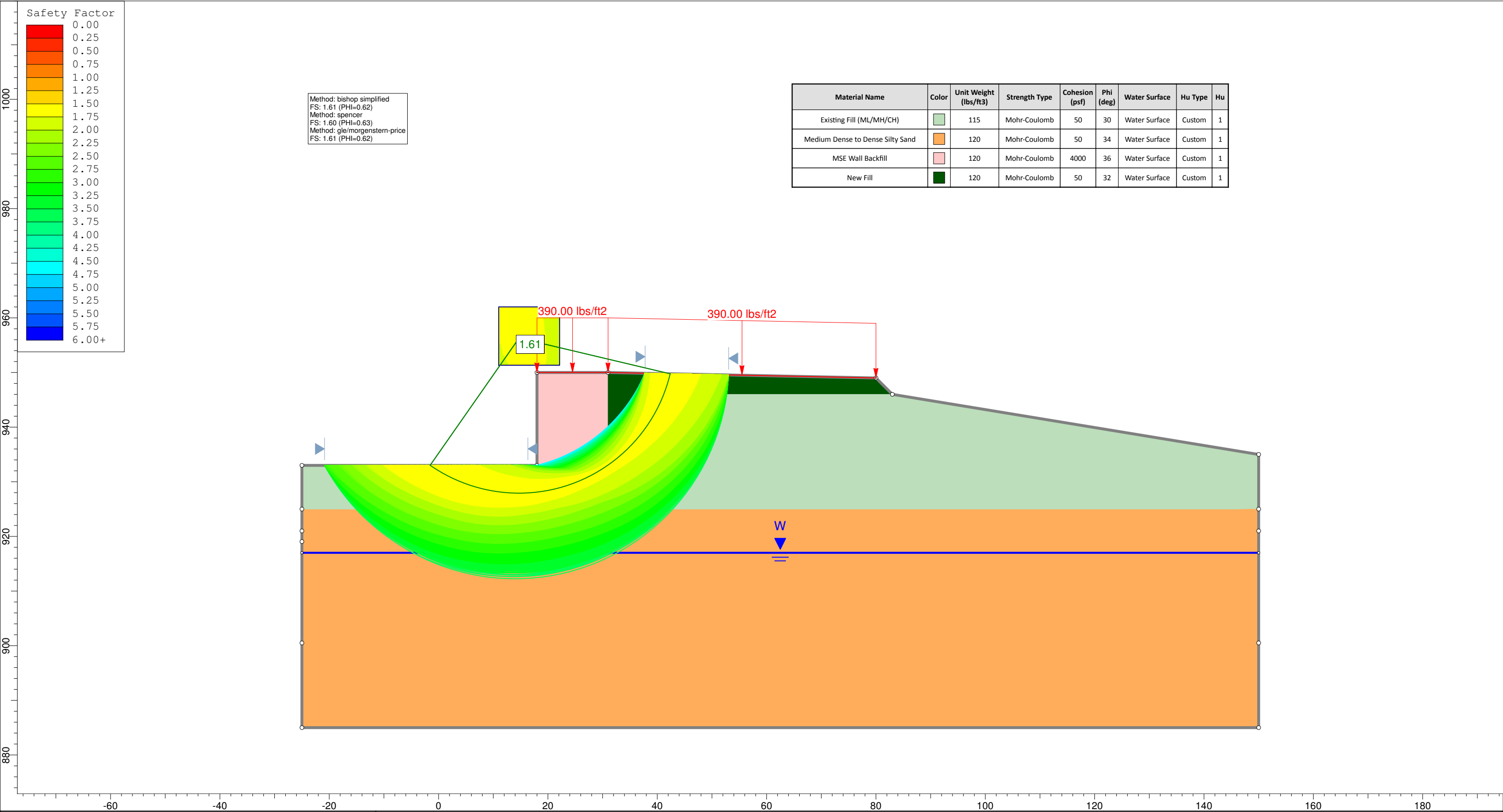


Method: bishop simplified
FS: 1.66 (PHI=0.60)
Method: spencer
FS: 1.65 (PHI=0.61)
Method: gle/morgenstern-price
FS: 1.65 (PHI=0.61)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Loose to Medium Dense Silty Sand		110	Mohr-Coulomb	50	30	Water Surface	Custom	1
Existing Fill (ML/MH/CH)		115	Mohr-Coulomb	50	30	Water Surface	Custom	1
Medium Dense Silty Sand		120	Mohr-Coulomb	50	32	Water Surface	Custom	1
MSE Wall Backfill		120	Mohr-Coulomb	4000	36	Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	32	Water Surface	Custom	1

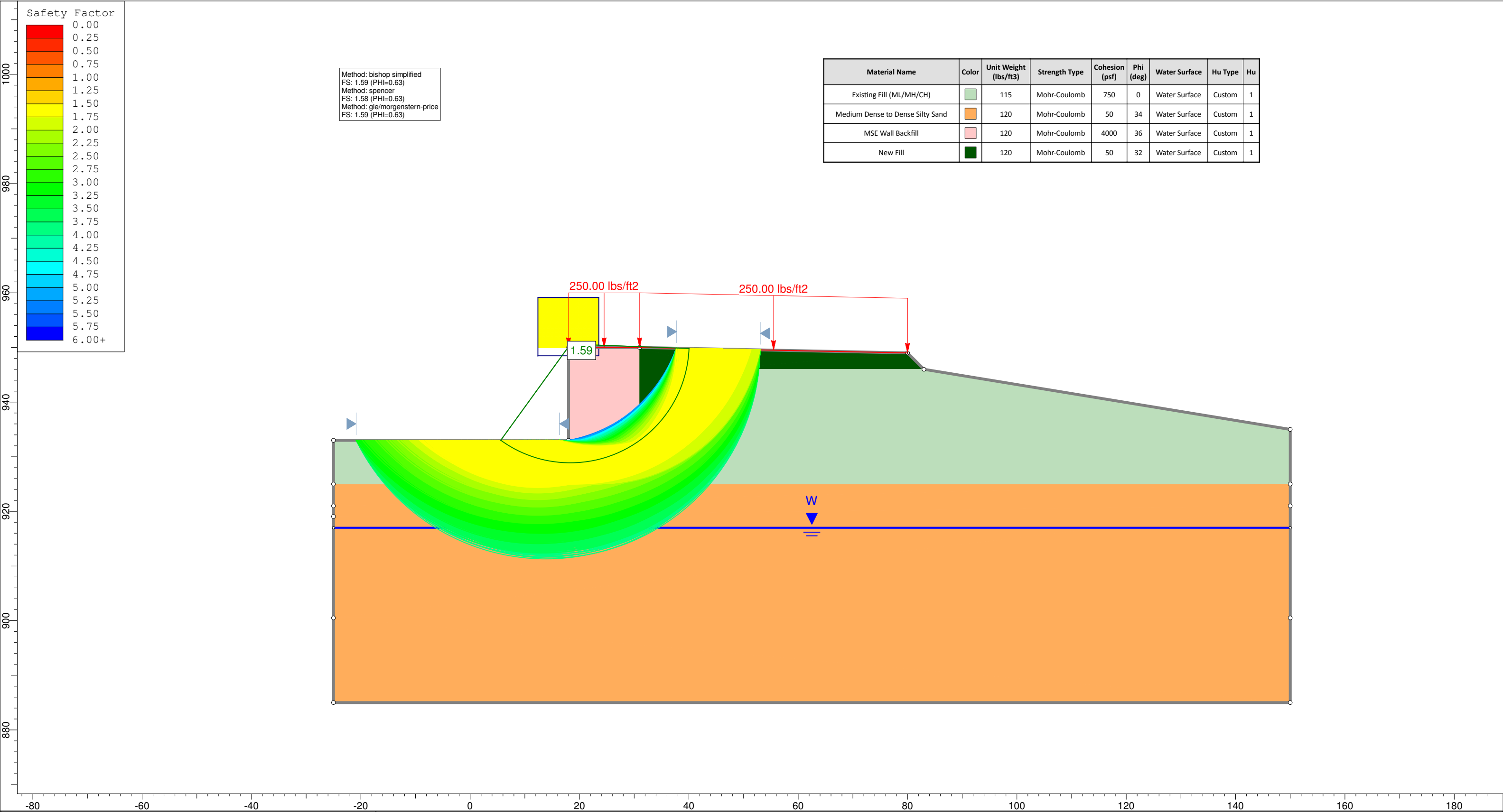





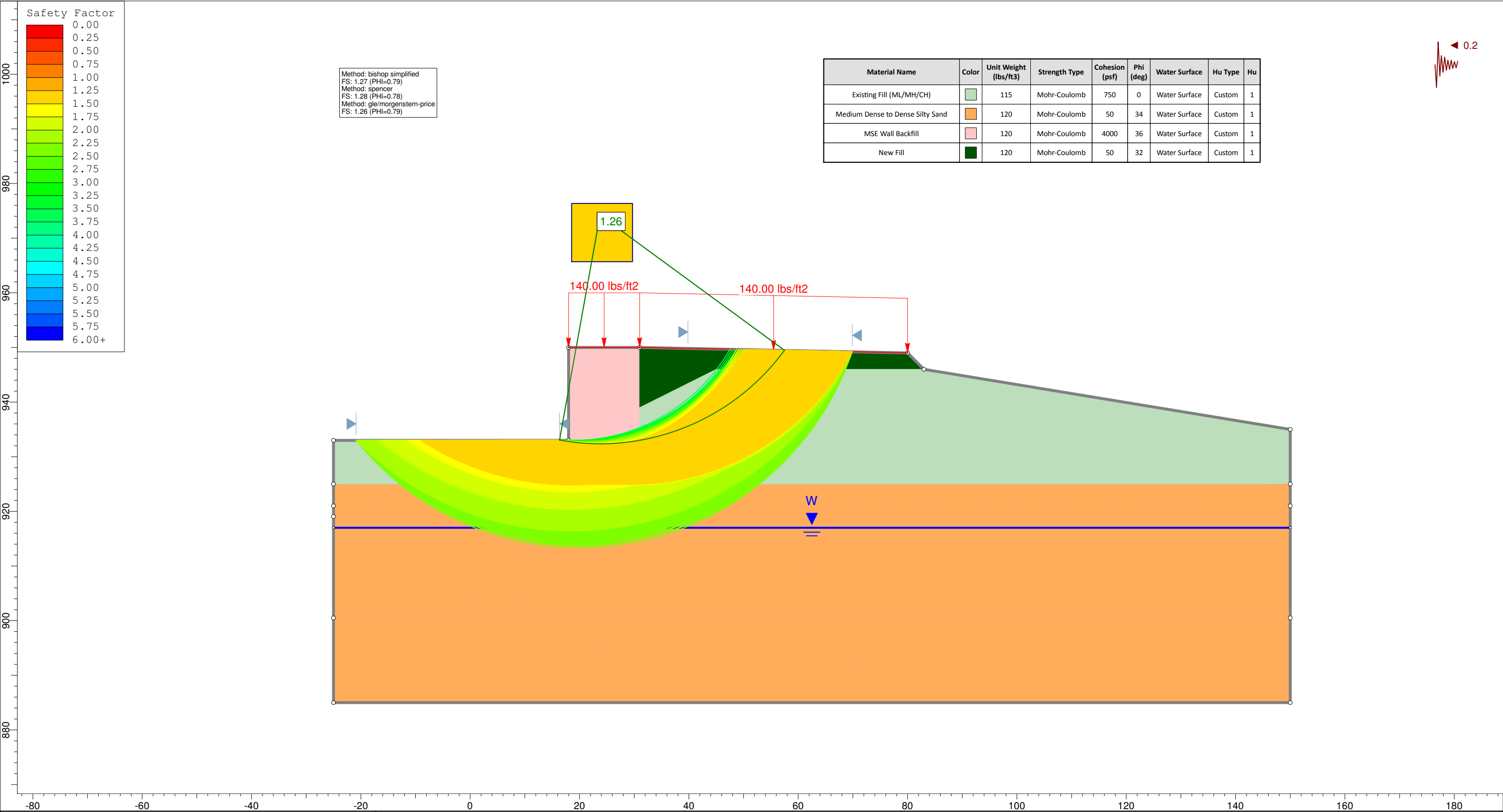



Method: bishop simplified
FS: 1.61 (PHI=0.62)
Method: spencer
FS: 1.60 (PHI=0.63)
Method: gle/morgenstern-price
FS: 1.61 (PHI=0.62)

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Existing Fill (ML/MH/CH)		115	Mohr-Coulomb	50	30	Water Surface	Custom	1
Medium Dense to Dense Silty Sand		120	Mohr-Coulomb	50	34	Water Surface	Custom	1
MSE Wall Backfill		120	Mohr-Coulomb	4000	36	Water Surface	Custom	1
New Fill		120	Mohr-Coulomb	50	32	Water Surface	Custom	1



 <small>SLIDEINTERPRET 6.035</small>	Project			I-85/385 Interchange Improvements - Project ID: 003811; ECS Project No. 9283			
	Analysis Description			Roper Mtn. Rd - Station 40+00 - Transverse - TSA			
	Drawn By		RLH	Scale	1:200	Company	ECS Carolinas LLP
	Date		5/20/2015		File Name	Roper Mtn. Road Sta 40+00 - Transverse - TSA.slim	



	Project			I-85/385 Interchange Improvements - Project ID: 003811; ECS Project No. 9283		
	Analysis Description			Roper Mtn. Rd - Station 40+00 - Transverse - Earthquake Analysis: kh=0.20		
	Drawn By		RLH	Scale	1:200	Company
	Date		5/20/2015	File Name		Roper Mtn. Road Sta 40+00 - Transverse - TSA - EQ.slim
				ECS Carolinas LLP		

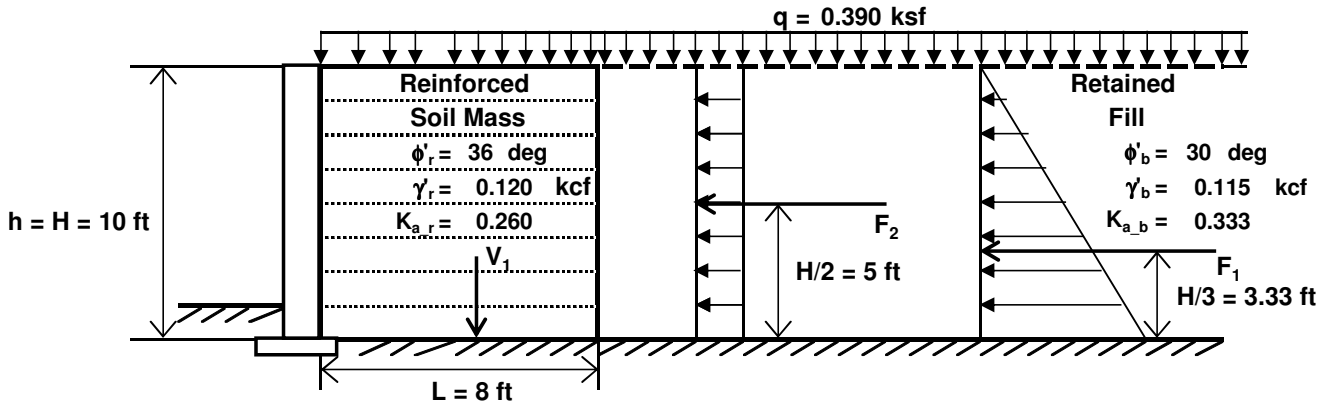
Appendix I-1

MSE Wall External Stability Analysis Results



WBS NO.: _____ TIP NO.: _____ COUNTY: _____
SUBJECT: _____ LRFD External Stability Analysis for MSE Walls
Roper Mountain Road
PREPARED BY: CLB DATE: 07/24/15 STATION: 36+50
CHECKED BY: _____ DATE: _____ STR. NO.: _____ SHEET: 2 OF 6

Calculate Forces acting on Wall



External Stability for MSE Walls: Earth Pressure - Level Backslope with Surcharge Case
(Based on FHWA Figure 4-2 and AASHTO Figure 11.10.5.2-1)
All Forces are Calculated per Unit Length of Wall
Figure Not Drawn to Scale

Forces from Vertical Earth Loads

$$V_1 = \text{Total Vertical Force from the Reinforced Soil Mass} = (\gamma_r)(H)(L) \\ = (0.120 \text{ kcf})(10.00 \text{ ft})(8.00 \text{ ft}) = \underline{9.600 \text{ kips}}$$

Forces from Lateral Earth Pressure

$$F_1 = \text{Total Force Generated from Lateral Earth Pressure} = 0.5(\gamma_b)(H^2)(K_{ab}) \\ = (0.5)(0.115 \text{ kcf})(10.00 \text{ ft})^2(0.333) = \underline{1.915 \text{ kips}}$$

FHWA Eqn. 4-5

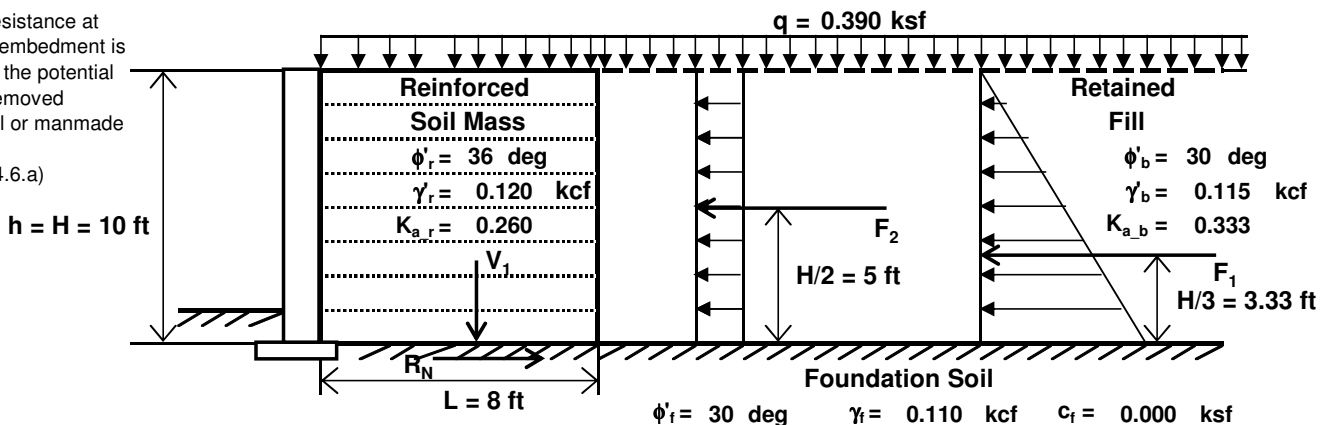
Horizontal Force from Traffic Surcharge

$$F_2 = \text{Force Generated from Traffic Surcharge} = (q)(H)(K_{ab}) \\ = (0.390 \text{ ksf})(10.00 \text{ ft})(0.333) = \underline{1.299 \text{ kips}}$$

FHWA Eqn. 4-6

Sliding Stability - AASHTO 11.10.5.3, AASHTO 10.6.3.4, and FHWA 4.4.6.a

The passive resistance at the toe due to embedment is ignored due to the potential for soil to be removed through natural or manmade processes.
(per FHWA 4.4.6.a)



External Stability for MSE Walls: Sliding Stability - Level Backslope with Surcharge Case
(Based on FHWA Figure 4-2 and AASHTO Figure 11.10.5.2-1)
All Forces are Calculated per Unit Length of Wall
Figure Not Drawn to Scale

Calculate Factored Sliding Resistance (R_R)

$$R_R = \phi R_N = \phi_r R_r$$

AASHTO Eqn. 10.6.3.4-1



WBS NO.: _____ TIP NO.: _____ COUNTY: _____
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Sliding Stability Continued - AASHTO 11.10.5.3, AASHTO 10.6.3.4, and FHWA 4.4.6.a

$\phi_r = \text{Resistance Factor for Sliding} = \underline{1.00}$ AASHTO Table 11.5.6-1
 $R_r = \text{Nominal Sliding Resistance between Reinforced Soil Mass and Foundation Soil}$
 $= \Psi_{EV}(V_1)\mu + (c_f)(L)$ FHWA Eqn. 4-12 and AASHTO 10.6.3.4
 $\Psi_{EV} = \text{Load Factor for Dead Load of Earth Fill} = \underline{1.00}$ AASHTO Table 3.4.1-1
 (Use the Min Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)
 $V_1 = \text{Total Vertical Force from the Reinforced Soil Mass} = \underline{9.600 \text{ kips}}$
 $\mu = \text{Coefficient of Friction between Reinforced Soil Mass and Foundation Soil} = \underline{0.58}$ AASHTO 11.10.5.3
 $c_f = \text{Cohesion for Foundation Soil} = \underline{0.000 \text{ ksf}}$
 $L = \text{Reinforcement Length} = \underline{8.00 \text{ ft}}$
 $R_r = (1.00)(9.60 \text{ kips})(0.58) + (0.000 \text{ ksf})(8.00 \text{ ft}) = \underline{5.57 \text{ kips}}$
 $R_R = (1.00)(5.57 \text{ kips}) = \underline{5.57 \text{ kips}}$

Calculate Factored Horizontal Driving Force (P_d)

$P_d = (\Psi_{EHA})(F_1) + (\Psi_{LS})(F_2)$ FHWA Eqn. 4-9
 $\Psi_{EHA} = \text{Load Factor for Horizontal (Active) Earth Pressure} = \underline{1.50}$ AASHTO Table 3.4.1-1
 $F_1 = \text{Force Generated from Lateral Earth Pressure} = \underline{1.915 \text{ kips}}$ FHWA Eqn. 4-5
 $\Psi_{LS} = \text{Load Factor for Horizontal (Active) Earth Pressure} = \underline{1.75}$ AASHTO Table 3.4.1-1
 $F_2 = \text{Force Generated from Traffic Surcharge} = \underline{1.299 \text{ kips}}$ FHWA Eqn. 4-6
 $P_d = (1.50)(1.915 \text{ kips}) + (1.75)(1.299 \text{ kips}) = \underline{5.145 \text{ kips}}$

Check Sliding

Calculated Resistance Factor

R_R must be greater than or equal to P_d

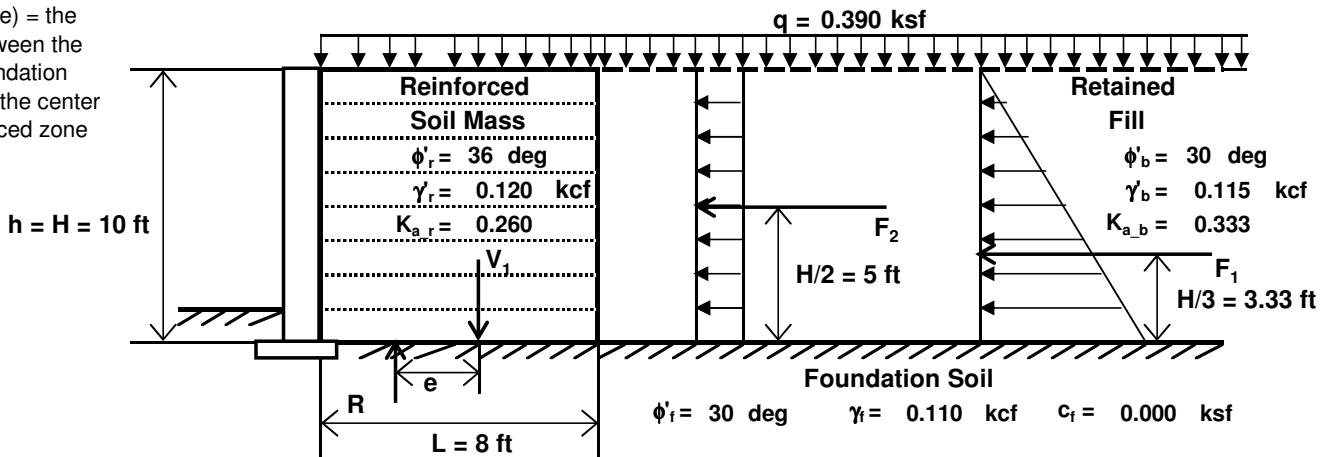
$P_d / (R_r / \phi_r) = \underline{0.92}$

5.568 kips \geq 5.145 kips

OK

Overturning (Limiting Eccentricity) - AASHTO 11.6.3.3, AASHTO 11.10.5.5 and FHWA 4.4.6.b

Eccentricity (e) = the distance between the resultant foundation load (R) and the center of the reinforced zone



External Stability for MSE Walls: Overturning - Level Backslope with Surcharge Case

(Based on FHWA Figure 4-7 and AASHTO Figure 11.10.5.2-1)

Figure Not Drawn to Scale - All Forces are Calculated per Unit Length of Wall

Figure Not Drawn to Scale

Calculate Eccentricity (e)

$$e = \frac{\Psi_{EHA}F_1(H/3) + \Psi_{LS}F_2(H/2)}{\Psi_{EV}V_1}$$

FHWA Eqn. 4-15



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 SUBJECT: _____ LRFD External Stability Analysis for MSE Walls
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Overturning (Limiting Eccentricity) Continued - AASHTO 11.6.3.3, AASHTO 11.10.5.5 and FHWA 4.4.6.b

Ψ_{EHA} = Load Factor for Horizontal (Active) Earth Pressure = 1.50
 Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.00
 (Use the Min Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)
 Ψ_{LS} = Load Factor for Surcharge = 1.75
 F_1 = Force Generated from Lateral Earth Pressure = 1.915 kips
 F_2 = Force Generated from Traffic Surcharge = 1.299 kips
 V_1 = Total Vertical Force from the Reinforced Soil Mass = 9.600 kips
 H = MSE Wall Height = 10.00 ft

$$e = \frac{(1.50)(1.915 \text{ kips})(3.33 \text{ ft}) + (1.75)(1.299 \text{ kips})(5.00 \text{ ft})}{(1.00)(9.600 \text{ kips})}$$

$$= \underline{2.18 \text{ ft}}$$

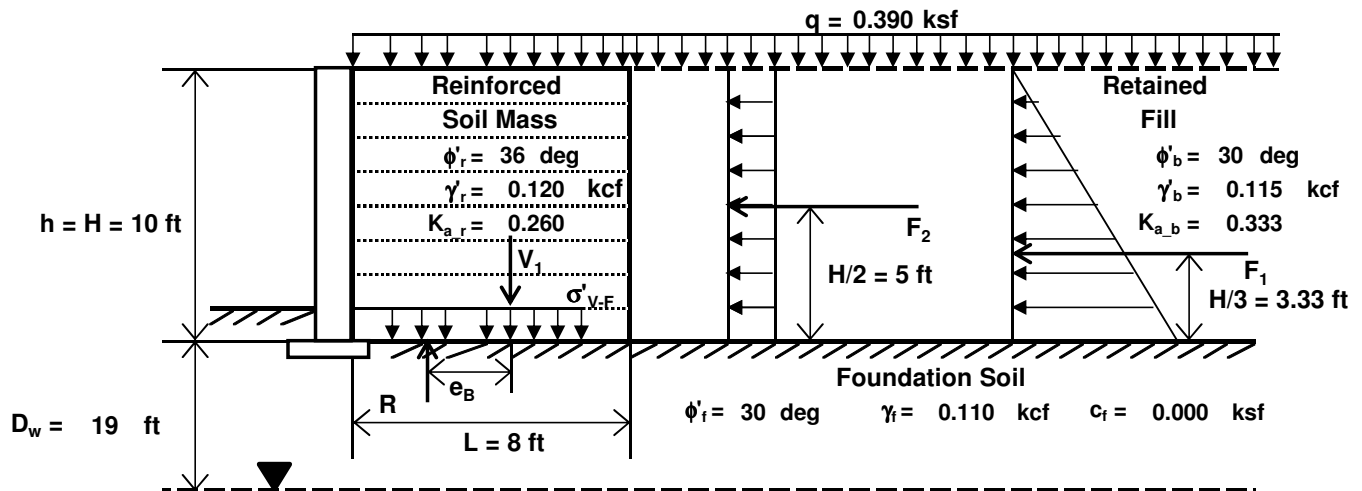
Check Eccentricity

e must be less than or equal to L/4 per AASHTO 11.6.3.3

2.18 ft > 2 ft

NOT OK

Bearing Resistance (General Shear) - AASHTO 11.10.5.4, AASHTO 10.6.3.1, and FHWA 4.4.6.c



External Stability for MSE Walls: Bearing Resistance - Level Backslope with Surcharge Case
 (Based on FHWA Figure 4-7 and AASHTO Figure 11.10.5.2-1)
 All Forces are Calculated per Unit Length of Wall
 Figure Not Drawn to Scale

Calculate Eccentricity for Bearing. (e_B)

$$e_B = \frac{\Psi_{EHA}F_1(H/3) + \Psi_{LS}F_2(H/2)}{\Psi_{EV}V_1 + \Psi_{LS}qL}$$

FHWA Eqn. 4-19

Ψ_{EHA} = Load Factor for Horizontal (Active) Earth Pressure = 1.50

AASHTO Table 3.4.1-1

Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.35

AASHTO Table 3.4.1-1 and FHWA 4.4.6.a

(Use the Max Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)

Ψ_{LS} = Load Factor for Surcharge = 1.75

AASHTO Table 3.4.1-1

F_1 = Force Generated from Lateral Earth Pressure = 1.915 kips

FHWA Eqn. 4-5

F_2 = Force Generated from Traffic Surcharge = 1.299 kips

FHWA Eqn. 4-6

V_1 = Total Vertical Force from the Reinforced Soil Mass = 9.600 kips



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Bearing Resistance Continued (General Shear) - AASHTO 11.10.5.4, AASHTO 10.6.3.1, and FHWA 4.4.6.c

q = Live Load Traffic Surcharge = 0.390 ksf

H = MSE Wall Height = 10.00 ft

L = Reinforcement Length = 8.00 ft

$$e_B = \frac{(1.50)(1.915 \text{ kips})(3.33 \text{ ft}) + (1.75)(1.299 \text{ kips})(5.00 \text{ ft})}{(1.35)(9.6 \text{ kips}) + (1.75)(0.390 \text{ ksf})(8.00 \text{ ft})}$$

$$= \underline{1.14 \text{ ft}}$$

Calculate Nominal Bearing Resistance, (q_n)

AASHTO Eqn. 10.6.3.1.2a-1

$$q_n = c_f N_c + 0.5 \gamma B' N_\gamma C_{wy}$$

AASHTO Eqn. 10.6.3.1.2a-1

c_f = Cohesion for Foundation Soil = 0.000 ksf

N_c = Bearing Capacity Factor (based on ϕ'_f) = 30.10

AASHTO Table 10.6.3.1.2a-1

γ_f = Total Unit Weight for Foundation Soil = 0.110 kcf

B' = Effective Foundation Width = $L - 2e_B$

AASHTO C11.10.5.4

$$= 8.0 \text{ ft} - 2(1.14 \text{ ft}) = \underline{5.72 \text{ ft}}$$

N_γ = Bearing Capacity Factor (based on ϕ'_f) = 22.40

AASHTO Table 10.6.3.1.2a-1

C_{wy} = Correction Factor to Account for Location of Groundwater Table = 1.0

AASHTO Table 10.6.3.1.2a-2

$$q_n = (0.000 \text{ ksf})(30.10) + (0.5)(0.110 \text{ kcf})(5.72 \text{ ft})(22.40)(1.00)$$

$$= \underline{7.047 \text{ ksf}}$$

Calculate Factored Bearing Resistance, (q_r)

AASHTO Eqn. 10.6.3.1.1-1

$$q_r = \phi_b q_n$$

ϕ_b = Resistance Factor for Bearing = 0.65

AASHTO Table 11.5.6-1

q_n = Nominal Bearing Resistance = 7.047 ksf

AASHTO Eqn. 10.6.3.1.2a-1

$$q_r = (0.65)(7.047 \text{ ksf}) = \underline{4.581 \text{ ksf}}$$

Calculate Factored Vertical Bearing Pressure at the base, (q_{v-F})

$$\sigma_{v-F} = \frac{\Psi_{EV} V_1 + \Psi_{LS} q L}{L - 2e_B}$$

FHWA Eqn. 4-20

Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.35

AASHTO Table 3.4.1-1 and FHWA 4.4.6.a

(Use the Max Value of Ψ_{EV} per FHWA 4.4.6.c, AASHTO C3.4.1, and AASHTO C11.5.5)

V_1 = Total Vertical Force from the Reinforced Soil Mass = 9.600 kips

Ψ_{LS} = Load Factor for Surcharge = 1.75

AASHTO Table 3.4.1-1

q = Live Load Traffic Surcharge = 0.390 ksf

L = Reinforcement Length = 8.00 ft

e_B = Eccentricity for Bearing = 1.14 ft

FHWA Eqn. 4-19

$$\sigma_{v-F} = \frac{(1.35)(9.60 \text{ kips ft}) + (1.75)(0.390 \text{ ksf})(8.00 \text{ ft})}{8.00 \text{ ft} - 2(1.14 \text{ ft})}$$

$$= \underline{3.220 \text{ ksf}}$$

Check Bearing

Calculated Resistance Factor

q_R must be greater than or equal to q_{v-F}

$$\sigma_{v-F}/q_n = \underline{0.46}$$

4.581 ksf \geq 3.22 ksf

OK



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_____ Roper Mountain Road
PREPARED BY: CLB DATE: 07/24/15 STATION: 36+50
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Bearing Resistance (Local/Punching Shear) - AASHTO 11.10.5.4, AASHTO 10.6.3.1.2b, and FHWA 4.4.6.c

Local and Punching shear failure occurs in loose or compressible soils and in weak soils under slow (drained) loading. This mode of failure will only be considered for foundation material that is cohesive.

The Foundation Material for this Project is not Cohesive.



WBS NO.: _____ TIP NO.: _____ COUNTY: _____
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 Roper Mountain Road
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Seismic Stability - SCDOT GDM Section 14.12

Calculate Wave Scattering Effects

Wave Scattering Coefficient, $\alpha_w = 1 + 0.01H((0.5\beta) - 1) < 1.0$ SCDOT Equation 13-103

$$\alpha_w = \underline{0.935}$$

Ground Motion Index, $\beta = k_{max}/S_{d1} = \underline{0.70}$ SCDOT Equation 13-104

Average seismic horizontal coefficient due to wave scattering

$$k_h = \alpha_w * k_{max} = \underline{0.2}$$
 SCDOT Equation 13-102

Calculate Seismic Active Earth Pressure Coefficient (Mononobe -Kobe Method) SCDOT GDM Section 14.4.1

Seismic Active Earth Pressure Coefficient Reinforced Soils, $K_{AEr} = \underline{0.584}$

Seismic Active Earth Pressure Coefficient Retained, $K_{AEb} = \underline{0.5}$

$$K_{ae} = \frac{\cos^2(\phi - \Psi - \theta)}{\cos(\Psi) \cos^2(\theta) \cos(\delta + \theta + \Psi) \left[1 + \sqrt{\frac{\sin(\phi + \delta) \sin(\phi - \Psi - \beta)}{\cos(\delta + \theta + \Psi) \cos(\beta - \theta)}} \right]^2} \quad \text{Equation 14-2}$$

Where,

γ	=	unit weight of soil
H	=	height of wall or effective height of wall (h_{eff})
ϕ	=	angle of internal friction of soil
Ψ	=	$\tan^{-1}[k_h/(1-k_v)]$
δ	=	angle of friction between soil and wall
k_h	=	horizontal acceleration coefficient
k_v	=	vertical acceleration coefficient, typically set to zero.
β	=	backfill slope angle
θ	=	angle of backface of the wall with the vertical

Reinforced Soil

$$\varphi = \underline{36.0} \text{ deg}$$

$$\Psi = \underline{11.3} \text{ deg}$$

$$\theta = \underline{0} \text{ deg}$$

$$\delta = \underline{0} \text{ deg}$$

$$\beta = \underline{0} \text{ deg}$$

Retained Soil

$$\varphi = \underline{30.0} \text{ deg}$$

$$\Psi = \underline{0.0} \text{ deg}$$

$$\theta = \underline{0} \text{ deg}$$

$$\delta = \underline{0.00} \text{ deg}$$

$$\beta = \underline{0} \text{ deg}$$

Calculate Inertial Wall Width, $B_{inertial} = \omega H$ 7

$$\text{coefficient, } \omega = \underline{0.70}$$

Calculate Active Earth Thrust Force, $P_{AE} = \gamma_p * 0.5 K_{AEr} * \gamma_p * H^2 = \underline{2.9} \text{ kips}$ GDM Eq. 14-40

Calculate Inertial Reinforced Soil Mass Force, $P_{IR} = \gamma_p * k_{avg} * B_{inertial} * H_{wall} = \underline{0.17} \text{ kips}$ GDM Eq. 14-41

Dead Load Surcharge Force, $P_{DC} = \underline{0.7} \text{ kips}$ GDM Eq. 14-45

Live Load Surcharge Force, $P_{LL} = \underline{0.625} \text{ kips}$ GDM Eq. 14-46

Total Seismic Driving Force, $F_H = \underline{4.4} \text{ kip}$ Calculated Resistance Factor, $\varphi = F_H/R_t = \underline{0.78}$



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 Roper Mountain Road
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Calculate Eccentricity for Bearing. (e_B)

$$e_B = \frac{\Psi_{EQ-P} F_{1s}(H/2) + \Psi_{EQ-LL} F_{2s}(H/2)}{\Psi_{EV} V_1 + \Psi_{EQ-LL} qL}$$

FHWA Eqn. 4-19

$$\Psi_{EHAeq} = \Psi_{EQ-P} = \text{Load Factor for Horizontal (Active) Earth Pressure} = \underline{1.00}$$

AASHTO Table 3.4.1-1

$$\Psi_{EV} = \text{Load Factor for Dead Load of Earth Fill} = \underline{1.00}$$

AASHTO Table 3.4.1-1 and FHWA 4.4.6.a

(Use the Min Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)

$$\Psi_{LSeq} = \Psi_{EQ-P} = \text{Load Factor for Surcharge} = \underline{1.00}$$

AASHTO Table 3.4.1-1

$$F_{1s} = \text{Force Generated from Lateral Earth Pressure} = \underline{3.743 \text{ kips}}$$

FHWA Eqn. 4-5

$$F_{2s} = \text{Force Generated from Traffic Surcharge} = \underline{0.625 \text{ kips}}$$

FHWA Eqn. 4-6

$$V_1 = \text{Total Vertical Force from the Reinforced Soil Mass} = \underline{9.600 \text{ kips}}$$

$$q = \text{Live Load Traffic Surcharge} = \underline{0.250 \text{ ksf}}$$

FHWA Eqn. 4-19

$$H = \text{MSE Wall Height} = \underline{10.00 \text{ ft}}$$

$$L = \text{Reinforcement Length} = \underline{8.00 \text{ ft}}$$

$$e_B = \frac{(1.00)(3.743 \text{ kips})(5.00 \text{ ft}) + (1.00)(0.625 \text{ kips})(5.00 \text{ ft})}{(1.00)(9.6 \text{ kips}) + (1.00)(0.250 \text{ ksf})(8.00 \text{ ft})}$$

$$= \underline{1.88 \text{ ft}}$$

Calculate Factored Vertical Bearing Pressure at the base. (q_{V-F})

$$\sigma_{V-F} = \frac{\Psi_{EQ-P} V_1 + \Psi_{EQ-LS} qL}{L - 2e_B} \quad \text{FHWA Eqn. 4-20}$$

$$\Psi_{EQ-P} = \text{Load Factor for Dead Load of Earth Fill} = \underline{1.00}$$

$$V_1 = \text{Total Vertical Force from the Reinforced Soil Mass} = \underline{9.600 \text{ kips}}$$

$$\Psi_{LSeq} = \Psi_{EQ-LL} = \text{Load Factor for Surcharge} = \underline{1.00}$$

$$q = \text{Live Load Traffic Surcharge} = \underline{0.250 \text{ ksf}}$$

$$L = \text{Reinforcement Length} = \underline{8.00 \text{ ft}}$$

$$e_B = \text{Eccentricity for Bearing} = \underline{1.88 \text{ ft}}$$

$$\sigma_{V-F} = \frac{(1.00)(9.60 \text{ kips})(\text{ft}) + (1.00)(0.250 \text{ ksf})(8.00 \text{ ft})}{8.0 \text{ ft} - 2(1.88 \text{ ft})}$$

$$= \underline{3.000 \text{ ksf}}$$

Calculated Resistance Factor

$$\sigma_{V-F}/q_n = \underline{0.43}$$

Input Traffic Surcharge, Backslope, Wall Geometry, and Soil Parameters

Traffic and Overlay Surcharge

$q =$ 390 psf *Live Load Traffic Surcharge and Pavement Overlay*
35.9 % Surcharge due to overlay
 $q_{ol} =$ 140 psf *Pavement overlay surcharge*

Backslope

Horizontal Backslope

(d = horizontal distance from back of wall face to top of backslope)

Wall Geometry

$H =$ 14.00 ft *Wall Height*
 $L/H =$ 0.80 *Ratio of Reinforcement Length to Wall Height*
($L/H \geq 0.7$ per NCDOT MSE Wall Standard Provision)
 $L =$ 11.20 ft *Reinforcement Length*
($L \geq 6$ ft per NCDOT MSE Wall Standard Provision)
 $h =$ 14.00 ft *Height of Wall & Slope at the back of Reinforced Zone*
 $D_w =$ 14.00 ft *Distance of Water Table below the Bottom of the Wall*

Soil Parameters for Reinforced Zone

$\phi'_r =$ 36 deg *Effective Friction Angle*
 $\gamma'_r =$ 120 pcf *Effective Unit Weight*
 $K_{a,r} =$ 0.260 *Active Earth Pressure Coefficient (AASHTO Eqn 3.11.5.3-2)*

Soil Parameters for Retained Backfill

$\phi'_b =$ 30 deg *Effective Friction Angle*
 $\gamma'_b =$ 115 pcf *Effective Unit Weight*
 $K_{a,b} =$ 0.333 *Active Earth Pressure Coefficient (AASHTO Eqn 3.11.5.3-2)*

Soil Parameters for Foundation Soil

$\phi'_f =$ 30 deg *Effective Friction Angle*
 $\gamma_f =$ 115 pcf *Total Unit Weight*
 $c_f =$ 0 psf *Undrained Shear Strength (Cohesion)*
 $\mu =$ 0.58 *Coefficient of Friction (AASHTO 11.10.5.3)*
The coefficient of friction shall be based on the lesser of ϕ'_r and ϕ'_f .

Input Load and Resistance Factors

Load Factors (See AASHTO Table 3.4.1-1 and 2)

$\Psi_{LS} =$ 1.75 *Live Load Surcharge*
 $\Psi_{EH(A)} =$ 1.50 *Horizontal (Active) Earth Pressure Load*
 $\Psi_{EV} =$ 1.00 min *Vertical Dead Load Generated from Earth Fill*
1.35 max
 $\Psi_{EQ-p} =$ 1.00
 $\Psi_{EQ-LL} =$ 0.50

Resistance Factors (See AASHTO Table 11.5.6-1)

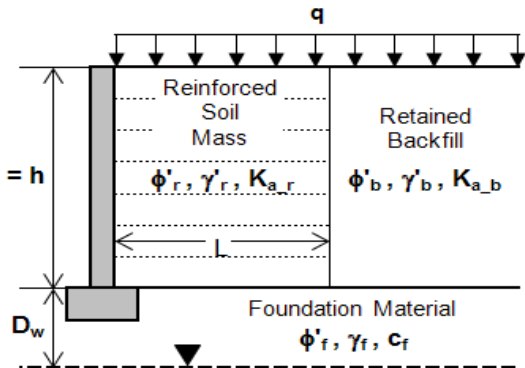
$\phi_b =$ 0.65 *Bearing Resistance for MSE Walls*
 $\phi_\tau =$ 1.00 *Sliding Resistance for MSE Walls*

Seismic Design Acceleration Parameters

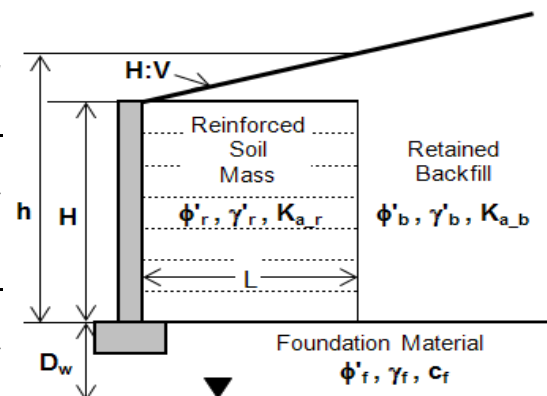
$k_{max} =$ 0.20 *Maximum Horizontal Ground Acceration (PGA)*
 $S_{d1} =$ 0.14 *Peak spectral acceleration at 1 second*

References:

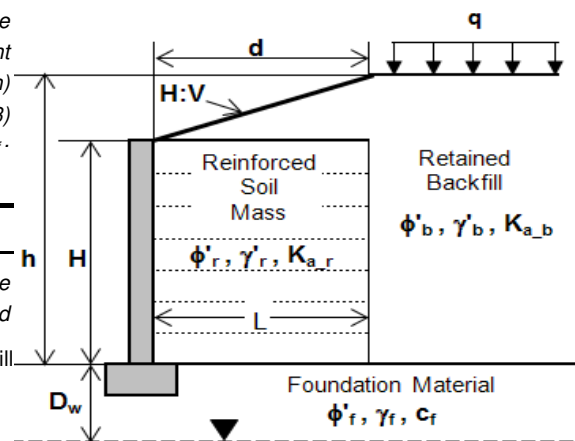
1. AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010
2. FHWA-NHI-10-024 Design and Construction of MSE Walls and Reinforced Soil Slopes - Vol I, 2009
3. SCDOT Geotechnical Design Manual version 1.1, 2010



Typical MSE Wall with Level Backslope and Traffic Surcharge



Typical MSE Wall with Infinite Backslope

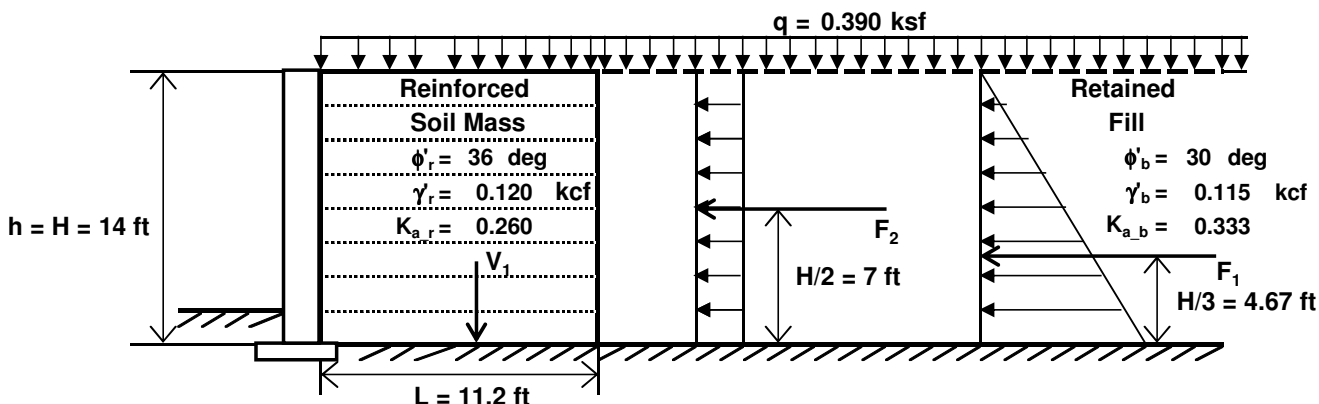


Typical MSE Wall with Broken Backslope and Traffic Surcharge



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Calculate Forces acting on Wall



External Stability for MSE Walls: Earth Pressure - Level Backslope with Surcharge Case
(Based on FHWA Figure 4-2 and AASHTO Figure 11.10.5.2-1)
All Forces are Calculated per Unit Length of Wall
Figure Not Drawn to Scale

Forces from Vertical Earth Loads

$$V_1 = \text{Total Vertical Force from the Reinforced Soil Mass} = (\gamma_r)(H)(L) \\ = (0.120 \text{ kcf})(14.00 \text{ ft})(11.20 \text{ ft}) = \underline{18.816 \text{ kips}}$$

Forces from Lateral Earth Pressure

$$F_1 = \text{Total Force Generated from Lateral Earth Pressure} = 0.5(\gamma_b)(H^2)(K_{ab}) \\ = (0.5)(0.115 \text{ kcf})(14.00 \text{ ft})^2(0.333) = \underline{3.753 \text{ kips}}$$

FHWA Eqn. 4-5

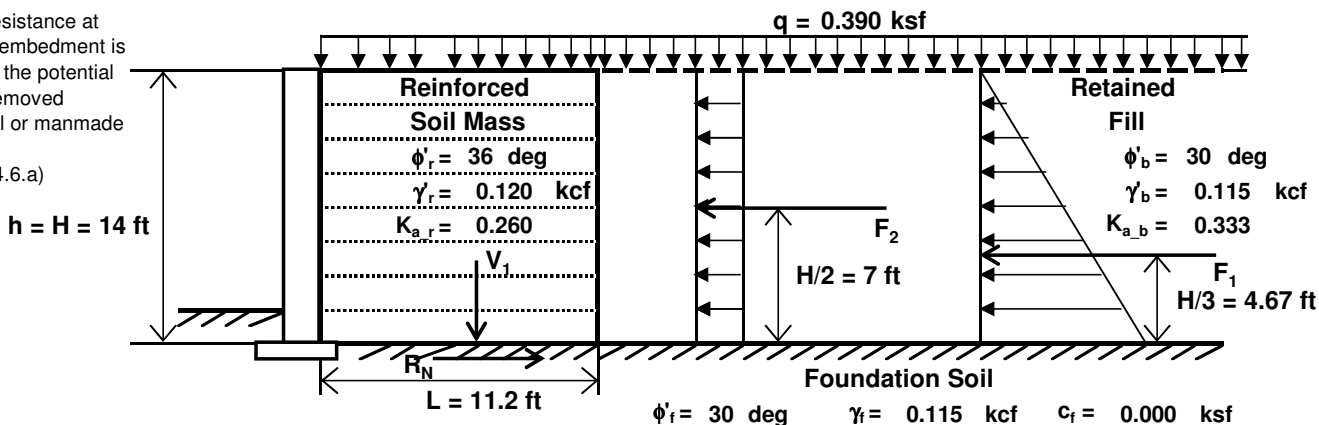
Horizontal Force from Traffic Surcharge

$$F_2 = \text{Force Generated from Traffic Surcharge} = (q)(H)(K_{ab}) \\ = (0.390 \text{ ksf})(14.00 \text{ ft})(0.333) = \underline{1.818 \text{ kips}}$$

FHWA Eqn. 4-6

Sliding Stability - AASHTO 11.10.5.3, AASHTO 10.6.3.4, and FHWA 4.4.6.a

The passive resistance at the toe due to embedment is ignored due to the potential for soil to be removed through natural or manmade processes.
(per FHWA 4.4.6.a)



External Stability for MSE Walls: Sliding Stability - Level Backslope with Surcharge Case
(Based on FHWA Figure 4-2 and AASHTO Figure 11.10.5.2-1)
All Forces are Calculated per Unit Length of Wall
Figure Not Drawn to Scale

Calculate Factored Sliding Resistance (R_R)

$$R_R = \phi R_N = \phi_r R_r$$

AASHTO Eqn. 10.6.3.4-1



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Sliding Stability Continued - AASHTO 11.10.5.3, AASHTO 10.6.3.4, and FHWA 4.4.6.a

$\phi_r = \text{Resistance Factor for Sliding} = \underline{1.00}$ AASHTO Table 11.5.6-1
 $R_r = \text{Nominal Sliding Resistance between Reinforced Soil Mass and Foundation Soil}$
 $= \Psi_{EV}(V_1)\mu + (c_f)(L)$ FHWA Eqn. 4-12 and AASHTO 10.6.3.4
 $\Psi_{EV} = \text{Load Factor for Dead Load of Earth Fill} = \underline{1.00}$ AASHTO Table 3.4.1-1
 (Use the Min Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)
 $V_1 = \text{Total Vertical Force from the Reinforced Soil Mass} = \underline{18.816 \text{ kips}}$
 $\mu = \text{Coefficient of Friction between Reinforced Soil Mass and Foundation Soil} = \underline{0.58}$ AASHTO 11.10.5.3
 $c_f = \text{Cohesion for Foundation Soil} = \underline{0.000 \text{ ksf}}$
 $L = \text{Reinforcement Length} = \underline{11.20 \text{ ft}}$
 $R_r = (1.00)(18.82 \text{ kips})(0.58) + (0.000 \text{ ksf})(11.20 \text{ ft}) = \underline{10.91 \text{ kips}}$
 $R_R = (1.00)(10.91 \text{ kips}) = \underline{10.91 \text{ kips}}$

Calculate Factored Horizontal Driving Force (P_d)

$P_d = (\Psi_{EHA})(F_1) + (\Psi_{LS})(F_2)$ FHWA Eqn. 4-9
 $\Psi_{EHA} = \text{Load Factor for Horizontal (Active) Earth Pressure} = \underline{1.50}$ AASHTO Table 3.4.1-1
 $F_1 = \text{Force Generated from Lateral Earth Pressure} = \underline{3.753 \text{ kips}}$ FHWA Eqn. 4-5
 $\Psi_{LS} = \text{Load Factor for Horizontal (Active) Earth Pressure} = \underline{1.75}$ AASHTO Table 3.4.1-1
 $F_2 = \text{Force Generated from Traffic Surcharge} = \underline{1.818 \text{ kips}}$ FHWA Eqn. 4-6
 $P_d = (1.50)(3.753 \text{ kips}) + (1.75)(1.818 \text{ kips}) = \underline{8.811 \text{ kips}}$

Check Sliding

Calculated Resistance Factor

R_R must be greater than or equal to P_d

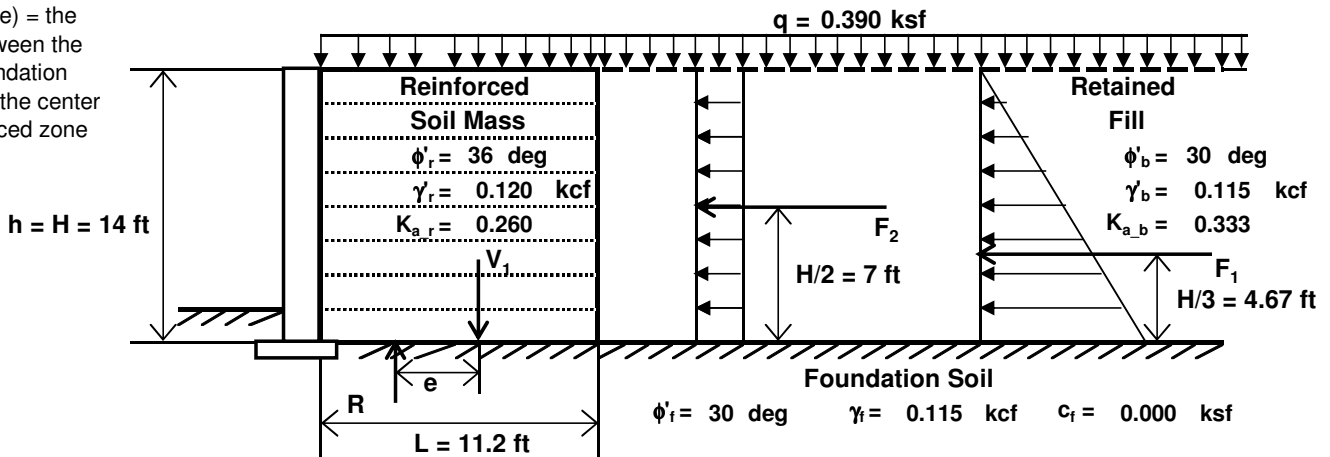
$P_d/(R_r/\phi_r) = \underline{0.81}$

10.913 kips \geq 8.811 kips

OK

Overturning (Limiting Eccentricity) - AASHTO 11.6.3.3, AASHTO 11.10.5.5 and FHWA 4.4.6.b

Eccentricity (e) = the distance between the resultant foundation load (R) and the center of the reinforced zone



External Stability for MSE Walls: Overturning - Level Backslope with Surcharge Case

(Based on FHWA Figure 4-7 and AASHTO Figure 11.10.5.2-1)

Figure Not Drawn to Scale - All Forces are Calculated per Unit Length of Wall

Figure Not Drawn to Scale

Calculate Eccentricity (e)

$$e = \frac{\Psi_{EHA}F_1(H/3) + \Psi_{LS}F_2(H/2)}{\Psi_{EV}V_1}$$

FHWA Eqn. 4-15



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Overturning (Limiting Eccentricity) Continued - AASHTO 11.6.3.3, AASHTO 11.10.5.5 and FHWA 4.4.6.b

Ψ_{EHA} = Load Factor for Horizontal (Active) Earth Pressure = 1.50
 Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.00
 (Use the Min Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)
 Ψ_{LS} = Load Factor for Surcharge = 1.75
 F_1 = Force Generated from Lateral Earth Pressure = 3.753 kips
 F_2 = Force Generated from Traffic Surcharge = 1.818 kips
 V_1 = Total Vertical Force from the Reinforced Soil Mass = 18.816 kips
 H = MSE Wall Height = 14.00 ft

$$e = \frac{(1.50)(3.753 \text{ kips})(4.67 \text{ ft}) + (1.75)(1.818 \text{ kips})(7.00 \text{ ft})}{(1.00)(18.816 \text{ kips})}$$

$$= \underline{2.58 \text{ ft}}$$

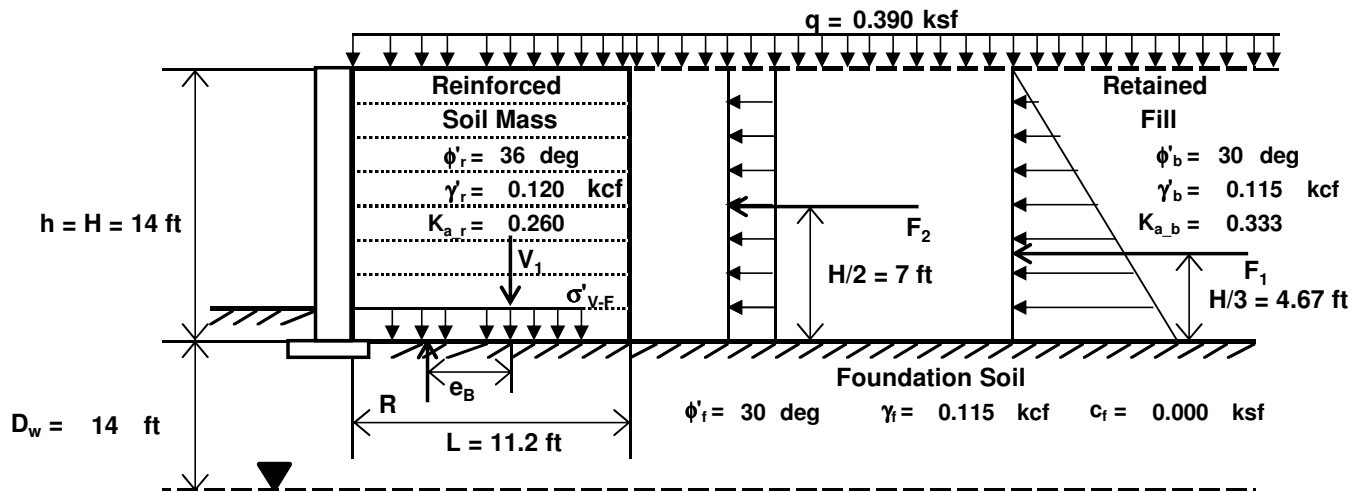
Check Eccentricity

e must be less than or equal to L/4 per AASHTO 11.6.3.3

2.58 ft ≤ 2.8 ft

OK

Bearing Resistance (General Shear) - AASHTO 11.10.5.4, AASHTO 10.6.3.1, and FHWA 4.4.6.c



External Stability for MSE Walls: Bearing Resistance - Level Backslope with Surcharge Case
 (Based on FHWA Figure 4-7 and AASHTO Figure 11.10.5.2-1)
 All Forces are Calculated per Unit Length of Wall
 Figure Not Drawn to Scale

Calculate Eccentricity for Bearing. (e_B)

$$e_B = \frac{\Psi_{EHA}F_1(H/3) + \Psi_{LS}F_2(H/2)}{\Psi_{EV}V_1 + \Psi_{LS}qL}$$

FHWA Eqn. 4-19

Ψ_{EHA} = Load Factor for Horizontal (Active) Earth Pressure = 1.50

AASHTO Table 3.4.1-1

Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.35

AASHTO Table 3.4.1-1 and FHWA 4.4.6.a

(Use the Max Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)

Ψ_{LS} = Load Factor for Surcharge = 1.75

AASHTO Table 3.4.1-1

F_1 = Force Generated from Lateral Earth Pressure = 3.753 kips

FHWA Eqn. 4-5

F_2 = Force Generated from Traffic Surcharge = 1.818 kips

FHWA Eqn. 4-6

V_1 = Total Vertical Force from the Reinforced Soil Mass = 18.816 kips



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Bearing Resistance Continued (General Shear) - AASHTO 11.10.5.4, AASHTO 10.6.3.1, and FHWA 4.4.6.c

q = Live Load Traffic Surcharge = 0.390 ksf

H = MSE Wall Height = 14.00 ft

L = Reinforcement Length = 11.20 ft

$$e_B = \frac{(1.50)(3.753 \text{ kips})(4.67 \text{ ft}) + (1.75)(1.818 \text{ kips})(7.00 \text{ ft})}{(1.35)(18.8 \text{ kips}) + (1.75)(0.390 \text{ ksf})(11.20 \text{ ft})}$$

$$= 1.47 \text{ ft}$$

Calculate Nominal Bearing Resistance, (q_n)

AASHTO Eqn. 10.6.3.1.2a-1

$$q_n = c_f N_c + 0.5 \gamma B' N_{\gamma} C_{wy}$$

AASHTO Eqn. 10.6.3.1.2a-1

c_f = Cohesion for Foundation Soil = 0.000 ksf

N_c = Bearing Capacity Factor (based on ϕ'_f) = 30.10

AASHTO Table 10.6.3.1.2a-1

γ_f = Total Unit Weight for Foundation Soil = 0.115 kcf

B' = Effective Foundation Width = $L - 2e_B$

AASHTO C11.10.5.4

$$= 11.2 \text{ ft} - 2(1.47 \text{ ft}) = 8.26 \text{ ft}$$

N_{γ} = Bearing Capacity Factor (based on ϕ'_f) = 22.40

AASHTO Table 10.6.3.1.2a-1

C_{wy} = Correction Factor to Account for Location of Groundwater Table = 0.9

AASHTO Table 10.6.3.1.2a-2

$$q_n = (0.000 \text{ ksf})(30.10) + (0.5)(0.115 \text{ kcf})(8.26 \text{ ft})(22.40)(0.90)$$

$$= 9.575 \text{ ksf}$$

Calculate Factored Bearing Resistance, (q_r)

AASHTO Eqn. 10.6.3.1.1-1

$$q_r = \phi_b q_n$$

ϕ_b = Resistance Factor for Bearing = 0.65

AASHTO Table 11.5.6-1

q_n = Nominal Bearing Resistance = 9.575 ksf

AASHTO Eqn. 10.6.3.1.2a-1

$$q_r = (0.65)(9.575 \text{ ksf}) = 6.224 \text{ ksf}$$

Calculate Factored Vertical Bearing Pressure at the base, (q_{v-F})

$$\sigma_{v-F} = \frac{\Psi_{EV} V_1 + \Psi_{LS} q L}{L - 2e_B}$$

FHWA Eqn. 4-20

Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.35

AASHTO Table 3.4.1-1 and FHWA 4.4.6.a

(Use the Max Value of Ψ_{EV} per FHWA 4.4.6.c, AASHTO C3.4.1, and AASHTO C11.5.5)

V_1 = Total Vertical Force from the Reinforced Soil Mass = 18.816 kips

Ψ_{LS} = Load Factor for Surcharge = 1.75

AASHTO Table 3.4.1-1

q = Live Load Traffic Surcharge = 0.390 ksf

L = Reinforcement Length = 11.20 ft

e_B = Eccentricity for Bearing = 1.47 ft

FHWA Eqn. 4-19

$$\sigma_{v-F} = \frac{(1.35)(18.82 \text{ kips ft}) + (1.75)(0.390 \text{ ksf})(11.20 \text{ ft})}{11.20 \text{ ft} - 2(1.47 \text{ ft})}$$

$$= 4.001 \text{ ksf}$$

Check Bearing

Calculated Resistance Factor

q_R must be greater than or equal to q_{v-F}

$$\sigma_{v-F}/q_n = 0.42$$

6.224 ksf \geq 4.001 ksf

OK



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Bearing Resistance (Local/Punching Shear) - AASHTO 11.10.5.4, AASHTO 10.6.3.1.2b, and FHWA 4.4.6.c

Local and Punching shear failure occurs in loose or compressible soils and in weak soils under slow (drained) loading. This mode of failure will only be considered for foundation material that is cohesive.

The Foundation Material for this Project is not Cohesive.



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Seismic Stability - SCDOT GDM Section 14.12

Calculate Wave Scattering Effects

Wave Scattering Coefficient, $\alpha_w = 1 + 0.01H((0.5\beta) - 1) < 1.0$ SCDOT Equation 13-103

$$\alpha_w = \underline{0.909}$$

Ground Motion Index, $\beta = k_{max}/S_{d1} = \underline{0.70}$ SCDOT Equation 13-104

Average seismic horizontal coefficient due to wave scattering

$$k_h = \alpha_w * k_{max} = \underline{0.2}$$
 SCDOT Equation 13-102

Calculate Seismic Active Earth Pressure Coefficient (Mononobe -Kobe Method) SCDOT GDM Section 14.4.1

Seismic Active Earth Pressure Coefficient Reinforced Soils, $K_{AEr} = \underline{0.584}$

Seismic Active Earth Pressure Coefficient Retained, $K_{AEb} = \underline{0.5}$

$$K_{ae} = \frac{\cos^2(\phi - \Psi - \theta)}{\cos(\Psi) \cos^2(\theta) \cos(\delta + \theta + \Psi) \left[1 + \sqrt{\frac{\sin(\phi + \delta) \sin(\phi - \Psi - \beta)}{\cos(\delta + \theta + \Psi) \cos(\beta - \theta)}} \right]^2} \quad \text{Equation 14-2}$$

Where,

γ	=	unit weight of soil
H	=	height of wall or effective height of wall (h_{eff})
ϕ	=	angle of internal friction of soil
Ψ	=	$\tan^{-1}[k_h/(1-k_v)]$
δ	=	angle of friction between soil and wall
k_h	=	horizontal acceleration coefficient
k_v	=	vertical acceleration coefficient, typically set to zero.
β	=	backfill slope angle
θ	=	angle of backface of the wall with the vertical

Reinforced Soil

$$\varphi = \underline{36.0} \text{ deg}$$

$$\Psi = \underline{11.3} \text{ deg}$$

$$\theta = \underline{0} \text{ deg}$$

$$\delta = \underline{0} \text{ deg}$$

$$\beta = \underline{0} \text{ deg}$$

Retained Soil

$$\varphi = \underline{30.0} \text{ deg}$$

$$\Psi = \underline{0.0} \text{ deg}$$

$$\theta = \underline{0} \text{ deg}$$

$$\delta = \underline{0.00} \text{ deg}$$

$$\beta = \underline{0} \text{ deg}$$

Calculate Inertial Wall Width, $B_{inertial} = \omega H$ 10

$$\text{coefficient, } \omega = \underline{0.70}$$

Calculate Active Earth Thrust Force, $P_{AE} = \gamma_p * 0.5 K_{AEr} * \gamma_p * H^2 = \underline{5.6} \text{ kips}$ GDM Eq. 14-40

Calculate Inertial Reinforced Soil Mass Force, $P_{IR} = \gamma_p * k_{avg} * B_{inertial} * H_{wall} = \underline{0.24} \text{ kips}$ GDM Eq. 14-41

Dead Load Surcharge Force, $P_{DC} = \underline{0.98} \text{ kips}$ GDM Eq. 14-45

Live Load Surcharge Force, $P_{LL} = \underline{0.875} \text{ kips}$ GDM Eq. 14-46

Total Seismic Driving Force, $F_H = \underline{7.7} \text{ kip}$ Calculated Resistance Factor, $\varphi = F_H/R_t = \underline{0.71}$



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Calculate Eccentricity for Bearing. (e_B)

$$e_B = \frac{\Psi_{EQ-P} F_{1s}(H/2) + \Psi_{EQ-LL} F_{2s}(H/2)}{\Psi_{EV} V_1 + \Psi_{EQ-LL} qL} \quad \text{FHWA Eqn. 4-19}$$

$\Psi_{EHAeq} = \Psi_{EQ-P}$ = Load Factor for Horizontal (Active) Earth Pressure = 1.00 AASHTO Table 3.4.1-1
 Ψ_{EV} = Load Factor for Dead Load of Earth Fill = 1.00 AASHTO Table 3.4.1-1 and FHWA 4.4.6.a
(Use the Min Value of Ψ_{EV} per FHWA 4.4.6.a, AASHTO C3.4.1, and AASHTO C11.5.5)

$\Psi_{LSeq} = \Psi_{EQ-P}$ = Load Factor for Surcharge = 1.00 AASHTO Table 3.4.1-1
 F_{1s} = Force Generated from Lateral Earth Pressure = 6.850 kips FHWA Eqn. 4-5
 F_{2s} = Force Generated from Traffic Surcharge = 0.875 kips FHWA Eqn. 4-6
 V_1 = Total Vertical Force from the Reinforced Soil Mass = 18.816 kips
 q = Live Load Traffic Surcharge = 0.250 ksf FHWA Eqn. 4-19
 H = MSE Wall Height = 14.00 ft
 L = Reinforcement Length = 11.20 ft

$$e_B = \frac{(1.00)(6.850 \text{ kips})(7.00 \text{ ft}) + (1.00)(0.875 \text{ kips})(7.00 \text{ ft})}{(1.00)(18.8 \text{ kips}) + (1.00)(0.250 \text{ ksf})(11.20 \text{ ft})}$$
$$= \underline{2.50 \text{ ft}}$$

Calculate Factored Vertical Bearing Pressure at the base. (q_{V-F})

$$\sigma_{V-F} = \frac{\Psi_{EQ-P} V_1 + \Psi_{EQ-LL} qL}{L - 2e_B} \quad \text{FHWA Eqn. 4-20}$$

Ψ_{EQ-P} = Load Factor for Dead Load of Earth Fill = 1.00
 V_1 = Total Vertical Force from the Reinforced Soil Mass = 18.816 kips
 $\Psi_{LSeq} = \Psi_{EQ-LL}$ = Load Factor for Surcharge = 1.00
 q = Live Load Traffic Surcharge = 0.250 ksf
 L = Reinforcement Length = 11.20 ft
 e_B = Eccentricity for Bearing = 2.50 ft

$$\sigma_{V-F} = \frac{(1.00)(18.82 \text{ kips})(ft) + (1.00)(0.250 \text{ ksf})(11.20 \text{ ft})}{11.2 \text{ ft} - 2(2.50 \text{ ft})}$$
$$= \underline{3.739 \text{ ksf}}$$

Calculated Resistance Factor

$$\sigma_{V-F}/q_n = \underline{0.39}$$

Appendix J

Settlement Analysis

License number FoSSA-200356

*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

*Note: Final Z is calculated assuming only 'Ultimate Settlement' exists.

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*Note: Final Z is calculated assuming only 'Immediate Settlement' exists.

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Case #	Location of ID Section :		Ultimate Settlement, Sc [ft.]	After... [days]	Actual Settlement, [ft.]	U-ave (min.for all consol.layers) [%]	USER 'S DESCRIPTION
	(X) [ft.]	(Y) [ft.]					
1	---	---	---	---	---	---	
2	---	---	---	---	---	---	
3	---	---	---	---	---	---	
4	---	---	---	---	---	---	
5	---	---	---	---	---	---	
6	---	---	---	---	---	---	
7	---	---	---	---	---	---	
8	---	---	---	---	---	---	
9	---	---	---	---	---	---	
10	---	---	---	---	---	---	
11	---	---	---	---	---	---	
12	---	---	---	---	---	---	
13	---	---	---	---	---	---	
14	---	---	---	---	---	---	
15	---	---	---	---	---	---	

Appendix K

Test America Analytical Report

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.

TestAmerica Pensacola

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Pensacola, FL 32514

Tel: (850)474-1001

TestAmerica Job ID: 400-100392-1

Client Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

For:

Thompson Engineering Inc

2970 Cottage Hill Rd.

Suite 190

Mobile, Alabama 36606

Attn: Chris Dugger



Authorized for release by:

1/12/2015 9:25:06 AM

Mike Nance, Service Center Manager

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Definitions/Glossary

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
□	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Job ID: 400-100392-1

Laboratory: TestAmerica Pensacola

Narrative

Job Narrative 400-100392-1

Comments

No additional comments.

Receipt

The samples were received on 1/2/2015 11:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 22.1° C.

HPLC/IC

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry

Method(s) 9050A: The procedure for Resistivity by Method 9050A is applicable to liquid samples and has been modified to provide the enclosed results on the soil matrix. The modification involves a DI Leach of the soil followed by electrometric measurement of the leachate. The values provided are a measure of the leachable component's resistance for a given mass to volume of water, rather than the resistivity of the soil itself.

B05-SPT-01 SAMPLE #4-#5-#6 (400-100392-9), B06-SPT-01 SAMPLE#6-#7-#8 (400-100392-7), B06-SPT-12 SAMPLE#14-#15-#16 (400-100392-8), B10-SPT-01 SAMPLE#3-#4-#5 (400-100392-3), B10-SPT-02 SAMPLE#4-#5-#6 (400-100392-4), B11-SPT-06 SAMPLE#6-#7-#8 (400-100392-1), B4-SPT-01 SAMPLE#6-#7-#8 (400-100392-2), B9 SPT-01 SAMPLE #8-#9-#10 (400-100392-5), B9 SPT-05 SAMPLE#12-#13-#14 (400-100392-6)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Lab Admin

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Client Sample Results

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Client Sample ID: B11-SPT-06 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-1

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 85.0

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<23		23		mg/Kg	☼		01/06/15 18:08	1
Sulfate	<23		23		mg/Kg	☼		01/06/15 18:08	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.42				SU			01/08/15 09:55	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	<100		100		umhos/cm			01/07/15 12:10	1
Resistivity	96000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B4-SPT-01 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-2

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 83.6

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<23		23		mg/Kg	☼		01/06/15 18:31	1
Sulfate	<23		23		mg/Kg	☼		01/06/15 18:31	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	4.95				SU			01/08/15 09:54	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	<100		100		umhos/cm			01/07/15 12:10	1
Resistivity	54000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B10-SPT-01 SAMPLE#3-#4-#5

Lab Sample ID: 400-100392-3

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 81.9

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	38		24		mg/Kg	☼		01/06/15 19:40	1
Sulfate	<24		24		mg/Kg	☼		01/06/15 19:40	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.13				SU			01/08/15 09:54	1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	180		100		umhos/cm			01/07/15 12:10	1
Resistivity	23000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B10-SPT-02 SAMPLE#4-#5-#6

Lab Sample ID: 400-100392-4

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 77.2

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<25		25		mg/Kg	☼		01/06/15 20:03	1
Sulfate	<25		25		mg/Kg	☼		01/06/15 20:03	1

TestAmerica Pensacola

Client Sample Results

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Client Sample ID: B10-SPT-02 SAMPLE#4-#5-#6

Lab Sample ID: 400-100392-4

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.15				SU			01/08/15 09:54	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	100		100		umhos/cm			01/07/15 12:10	1
Resistivity	38000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B9 SPT-01 SAMPLE #8-#9-#10

Lab Sample ID: 400-100392-5

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 84.3

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<24		24		mg/Kg	☼		01/06/15 20:25	1
Sulfate	<24		24		mg/Kg	☼		01/06/15 20:25	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.28				SU			01/08/15 09:54	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	<100		100		umhos/cm			01/07/15 12:10	1
Resistivity	62000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B9 SPT-05 SAMPLE#12-#13-#14

Lab Sample ID: 400-100392-6

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 67.6

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<29		29		mg/Kg	☼		01/06/15 20:48	1
Sulfate	<29		29		mg/Kg	☼		01/06/15 20:48	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.51				SU			01/08/15 09:54	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	<100		100		umhos/cm			01/07/15 12:10	1
Resistivity	54000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B06-SPT-01 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-7

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 74.9

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<26		26		mg/Kg	☼		01/06/15 21:11	1
Sulfate	60		26		mg/Kg	☼		01/06/15 21:11	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.38				SU			01/08/15 09:54	1

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Client Sample Results

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Client Sample ID: B06-SPT-01 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-7

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	240		100		umhos/cm			01/07/15 12:10	1
Resistivity	17000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B06-SPT-12 SAMPLE#14-#15-#16

Lab Sample ID: 400-100392-8

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 76.0

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<26		26		mg/Kg	☼		01/06/15 21:34	1
Sulfate	<26		26		mg/Kg	☼		01/06/15 21:34	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.10				SU			01/08/15 09:54	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	<100		100		umhos/cm			01/07/15 12:10	1
Resistivity	96000		20		ohm-m			01/07/15 12:10	1

Client Sample ID: B05-SPT-01 SAMPLE #4-#5-#6

Lab Sample ID: 400-100392-9

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 81.5

Method: 9056 - Anions, Ion Chromatography - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<24		24		mg/Kg	☼		01/06/15 21:57	1
Sulfate	<24		24		mg/Kg	☼		01/06/15 21:57	1

General Chemistry - Soluble

Analyte	Result	Qualifier	NONE	NONE	Unit	D	Prepared	Analyzed	Dil Fac
pH	5.43				SU			01/08/15 09:54	1
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	110		100		umhos/cm			01/07/15 12:10	1
Resistivity	36000		20		ohm-m			01/07/15 12:10	1

QC Sample Results

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Method: 9056 - Anions, Ion Chromatography

Lab Sample ID: MB 400-242118/1-A

Matrix: Solid

Analysis Batch: 242281

Client Sample ID: Method Blank

Prep Type: Soluble

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<20		20		mg/Kg			01/06/15 15:05	1
Sulfate	<20		20		mg/Kg			01/06/15 15:05	1

Lab Sample ID: LCS 400-242118/2-A

Matrix: Solid

Analysis Batch: 242281

Client Sample ID: Lab Control Sample

Prep Type: Soluble

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	100	94.2		mg/Kg		94	80 - 120
Sulfate	100	93.3		mg/Kg		93	80 - 120

Lab Sample ID: LCSD 400-242118/3-A

Matrix: Solid

Analysis Batch: 242281

Client Sample ID: Lab Control Sample Dup

Prep Type: Soluble

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	100	94.0		mg/Kg		94	80 - 120	0	15
Sulfate	100	92.3		mg/Kg		92	80 - 120	1	15

Method: 9045C - pH

Lab Sample ID: 400-100392-9 DU

Matrix: Solid

Analysis Batch: 242437

Client Sample ID: B05-SPT-01 SAMPLE #4-#5-#6

Prep Type: Soluble

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
pH	5.43		5.430		SU		0	30

Method: 9050A - Specific Conductance

Lab Sample ID: MB 400-242390/1-A

Matrix: Solid

Analysis Batch: 242393

Client Sample ID: Method Blank

Prep Type: Soluble

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	<100		100		umhos/cm			01/07/15 12:10	1
Resistivity	NA		20		Mohm-cm			01/07/15 12:10	1

Lab Sample ID: LCS 400-242390/2-A

Matrix: Solid

Analysis Batch: 242393

Client Sample ID: Lab Control Sample

Prep Type: Soluble

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Specific Conductance	200	201		umhos/cm		101	98 - 102

TestAmerica Pensacola

QC Sample Results

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Method: 9050A - Specific Conductance (Continued)

Lab Sample ID: 400-100392-1 DU

Matrix: Solid

Analysis Batch: 242393

Client Sample ID: B11-SPT-06 SAMPLE#6-#7-#8

Prep Type: Soluble

Analyte	Sample	Sample	DU		Unit	D	RPD	RPD
	Result	Qualifier	Result	Qualifier				Limit
Specific Conductance	<100		<100		umhos/cm		NC	2
Resistivity	96000		93900		ohm-m		2	2

Lab Chronicle

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Client Sample ID: B11-SPT-06 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-1

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 85.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 18:08	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:39	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:55	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B4-SPT-01 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-2

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 83.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 18:31	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B10-SPT-01 SAMPLE#3-#4-#5

Lab Sample ID: 400-100392-3

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 81.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 19:40	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B10-SPT-02 SAMPLE#4-#5-#6

Lab Sample ID: 400-100392-4

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 77.2

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 20:03	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN

TestAmerica Pensacola

Lab Chronicle

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Client Sample ID: B10-SPT-02 SAMPLE#4-#5-#6

Lab Sample ID: 400-100392-4

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B9 SPT-01 SAMPLE #8-#9-#10

Lab Sample ID: 400-100392-5

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 84.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 20:25	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B9 SPT-05 SAMPLE#12-#13-#14

Lab Sample ID: 400-100392-6

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 67.6

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 20:48	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B06-SPT-01 SAMPLE#6-#7-#8

Lab Sample ID: 400-100392-7

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 74.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 21:11	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

TestAmerica Pensacola

Lab Chronicle

Client: Thompson Engineering Inc
Project/Site: SCDOT I-85/ I-385 Interchange/ 14-1101-0

TestAmerica Job ID: 400-100392-1

Client Sample ID: B06-SPT-12 SAMPLE#14-#15-#16

Lab Sample ID: 400-100392-8

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 76.0

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 21:34	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Client Sample ID: B05-SPT-01 SAMPLE #4-#5-#6

Lab Sample ID: 400-100392-9

Date Collected: 01/02/15 00:00

Matrix: Solid

Date Received: 01/02/15 11:45

Percent Solids: 81.5

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Soluble	Leach	DI Leach			242118	01/05/15 14:49	TAJ	TAL PEN
Soluble	Analysis	9056		1	242281	01/06/15 21:57	TAJ	TAL PEN
Soluble	Leach	DI Leach			242428	01/08/15 09:17	LSS	TAL PEN
Soluble	Analysis	9045C		1	242437	01/08/15 09:54	LSS	TAL PEN
Soluble	Leach	DI Leach			242390	01/07/15 09:36	CAC	TAL PEN
Soluble	Analysis	9050A		1	242393	01/07/15 12:10	CAC	TAL PEN
Total/NA	Analysis	Moisture		1	242103	01/05/15 11:39	SCA	TAL PEN

Laboratory References:

TAL PEN = TestAmerica Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

CHAIN-OF-CUSTODY

PAGE 1 OF 2

JOB NO.: CLIENT: CIVIL ENGINEERING CONSULT.

14-1101-0376 THOMPSON ENGINEERING

PROJECT: SCDOT I-85/I-385

INTERCHANGE DESIGN

NUMBER OF
CONTAINERS

LAB USE ONLY	DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	TOTAL SULFATES	TOTAL CHLORIDES	PH	RESISTIVITY	REMARKS
	1/2/15		✓		B11-SPT-06	✓	✓	✓	✓	
					SAMPLE #6-#7-#8					
			✓		B34-SPT-01					
					SAMPLE #6-#7-#8	✓	✓	✓	✓	
			✓		B10-SPT-01					
					SAMPLE #3-#4-#5	✓	✓	✓	✓	
			✓		B10-SPT-02	✓	✓	✓	✓	
					SAMPLE #4-#5-#6					
			✓		B9 SPT-01					
					SAMPLE #8-#9-#10	✓	✓	✓	✓	
					B39 SPT-05					
					SAMPLE #12-#13-#14	✓	✓	✓	✓	
					B 00 SPT-01	✓	✓	✓	✓	
					SAMPLE #6-#7-#8					

TESTS ASSIGNED



ENGINEERING

3707 Cottage Hill Rd.

Mobile, Alabama 36609

(251) 666-2443



400-100392 COC

SAMPLED BY AND TITLE: (SIGNATURE)		DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
REMARKS: CONTACT CHRIS DUGGER @ CDUGGER@THOMPSONENGINEERING.COM			SAMPLE SHIPPED VIA CUPS CBUS COTHER		AIR/BUS BILL NUMBER 22.1°C # 5592	

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CHAIN-OF-CUSTODY

PAGE 2 OF 2

[illegible]

SAMPLED BY AND TITLE: (SIGNATURE)		DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME
		10/15 11:45	Beth Miller		10/15 11:45	Michael
RELINQUISHED BY: (SIGNATURE)		DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY LAB: (SIGNATURE)	DATE/TIME
REMARKS			AIR/BUS BILL NUMBER			
CONTACT CHRIS DOGGER			SAMPLE SHIPPED VIA			
			<input type="checkbox"/> UPS <input type="checkbox"/> BUS <input type="checkbox"/> OTHER			
CRISSEY @ THE MDSANTFUNG/FFRINKS.COM						

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COPY 2 - CLIENT

2710 #5592

Appendix L

Florence and Hutchenson Geotechnical Data Report

Geotechnical Data Report

I-85/I-385 Interchange Improvements

Greenville County, SC

January 25, 2013

Prepared For:



South Carolina
Department of Transportation



Prepared By:



Florence & Hutcheson

An **ICA** Company

flohut.com

The complete F&H Geotechnical Data Report is not bound in this document to limit report size. Complete data report is available through the SCDOT.

Appendix M

Thompson Engineering Geotechnical Data Report

Report of Geotechnical Consulting Services

Geotechnical Subsurface Data Report (GSDR)

Interstate 85/385 Interchange
Improvements

CECS, Inc. Revised Priority 1:
Bridge 11 (Roper Mt. Road),
Retaining Wall (I-85 NB/CD)
and Roper Mt. Road

Greenville County, South Carolina

SCDOT Project No.: IM23(009)
File No.: 23.038111

Thompson Engineering
Project No.: 14-1101-0276

Submitted By:

Thompson Engineering
May 16, 2015

Celebrating over 60 years in business.



thompson
ENGINEERING

**The complete TE Geotechnical Subsurface Data Report
(GSDR) is not bound in this document to limit report size.
Complete data report is available upon request.**