
FUGRO CONSULTANTS, INC.



2631-D NW 41st Street
Gainesville, Florida, 32606
Phone: 352-378-3717

6 June 2013

Mr. Sonny DuPre
Cape Romain Contractors
612 Cape Romain Road
Wando, SC 29492

**Re: Revised Loadtest USA Report for Test Shaft 1
Horry County, SC (LT-1212)**

Dear Mr. DuPre,

The attached Loadtest USA Report contains the revised data and analysis summary for the Osterberg Cell (O-cell) test performed by Loadtest USA for Test Shaft 1 at the US 701 Bridge over Great Pee Dee River on May 16, 2013 and reviewed by Fugro Consultants, Inc. (FCI). For your convenience, it includes an executive summary of the test results in addition to our standard detailed data report. FCI and Loadtest USA would like to express our gratitude for the on-site and off-site assistance provided by your team and we look forward to working with you on future projects. We trust that the information contained herein will suit your current project needs. If you have any questions or require further technical assistance, please do not hesitate to contact us at 352-378-3717.

Respectfully submitted,

Fugro Consultants, Inc.

SC Engineering Firm 4223



Paul J. Bullock, PhD, PE
Principal Engineer

DATA REPORT

REPORT ON DRILLED SHAFT LOAD TESTING (OSTERBERG METHOD) REVISION 01

Shaft Profile by **SONICALIPER**

Test Shaft 1 - US 701 over Great Pee Dee River
Horry County, SC (LT-1212)

Prepared for: Cape Romain Contractors
612 Cape Romain Rd.
Wando, SC

Attention: Mr. Sonny Dupre

PROJECT NO: LT-1212, June 06, 2013

Americas

LOADTEST USA

2631-D NW 41st St
Gainesville, FL 32606, USA
Phone: +1 352 378 3717
Fax: +1 352 378 3934

Europe & Africa

Fugro LOADTEST Ltd.

14 Scotts Avenue, Sunbury Upon Thames
Middlesex, TW16 7HZ, UK
Phone: +44 (0) 1932 784807
Fax: +44 (0) 1932 784807

Middle East

FUGRO LOADTEST MIDDLE EAST BV

P.O. Box 2863, Dubai, UAE.
Phone: +971 4 3474060
Fax: +971 4 3474069

Asia

Fugro LOADTEST Asia Pte. Ltd.

159 Sin Ming Road, #05-07 Amtech Building
Singapore, 575625
Phone: +65 6377 5665
Fax: +65 6377 3359



DEEP FOUNDATION TESTING, EQUIPMENT & SERVICES • SPECIALIZING IN OSTERBERG CELL (O-Cell®) TECHNOLOGY

LOADTEST USA is a division of Fugro Consultants Inc.

www.loadtest.com

EXECUTIVE SUMMARY

On May 16, 2013, Loadtest USA performed an O-cell test on the nominal 60.0-inch diameter Test Shaft 1. Construction of the 99.23-foot deep shaft was completed on May 09, 2013. Sub-surface conditions at the test shaft location consist primarily of soft clay and sandy silt to a depth of 16 feet, underlain by roughly 48 feet of very loose to dense poorly graded sand. Below these strata, stiff to hard sandy clay was encountered. Representatives of the South Carolina Department of Transportation (SCDOT) observed construction and testing of the shaft.

The maximum sustained bi-directional load applied to the shaft during Stage 1 was 1,874 kips which occurred at load increment 1L-19. At the maximum load, the displacement below the lower O-cell assembly was 3.177 inches. The maximum applied unit end bearing is calculated to be 78.5 ksf corresponding to the displacement listed above.

The maximum sustained bi-directional load applied to the shaft during Stage 2 was 2,309 kips which occurred at load increment 2L-23. At the maximum load, the displacements above and below the upper O-cell assembly were 1.363 inches and 0.504 inches, respectively. Unit side shear data calculated from strain gages indicated a maximum mobilized net unit side shear of 7.9 ksf between the upper O-cell and Strain Gage Level 2.

Using the procedures described in the report text and in [Appendix C](#), an equivalent top load curve for the test shaft was constructed. For a top loading of 2,500 kips, the adjusted test data indicate this shaft would displace approximately 0.374 inches. For a top loading of 5,000 kips, the adjusted test data indicate this shaft would displace approximately 0.892 inches.

A sonar caliper (**SONICALIPER**) was used to generate profiles of the shaft excavation sidewalls prior to installation of the O-cell assemblies. A summary of the caliper data and the dimensions used in the analyses are included in [Appendix E](#).

LIMITATIONS OF EXECUTIVE SUMMARY

We include this executive summary to provide a very brief presentation of some of the key elements of this O-cell test. It is by no means intended to be a comprehensive or stand-alone representation of the test results. The full text of the report and the attached appendices contain important information which the engineer can use to come to more informed conclusions about the data presented herein.



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SITE CONDITIONS AND SHAFT CONSTRUCTION

Site Sub-surface Conditions: The sub-surface stratigraphy at the general location of the test shaft is reported to consist of soft clay and sandy silt to a depth of 16 feet, underlain by roughly 48 feet of very loose to dense poorly graded sand. Below these strata, stiff to hard sandy clay was encountered. The generalized subsurface profile is included in [Figure A](#) and a boring log indicating conditions near the shaft is presented in [Appendix F](#). More detailed geologic information can be obtained from the SCDOT.

Test Shaft Construction: Cape Romain Contractors and Lee & Sims completed construction of the dedicated test shaft on May 09, 2013. The nominal 60.0-inch diameter test shaft was excavated to a base elevation of -95.21 feet under bentonite slurry. The shaft was started by advancing a 65.75-inch O.D. permanent casing into the ground using a vibratory hammer. A digging bucket and a rock auger were used for drilling the shaft. The bottom of the shaft was cleaned using a cleanout bucket and then airlifted after drilling was complete. After cleaning, the **SONICALIPER** was used to profile the shaft excavation ([Appendix E](#)). After the shaft was approved for concrete placement, the reinforcing cage with attached O-cell assemblies was inserted into the excavation and rested on the bottom. Concrete was then delivered by pump through a 6-inch O.D. pipe into the base of the shaft until the top of the concrete reached an elevation of +4.02 ft. Representatives of the SCDOT observed construction of the shaft.

OSTERBERG CELL TESTING

Shaft Instrumentation: Test shaft instrumentation and assembly was carried out under the direction of Loadtest USA. The loading assemblies consisted of one 21-inch diameter O-cell each, located 4.38 feet and 27.38 feet above the shaft base, respectively. The Osterberg cells were calibrated to 2,500 kips and then welded closed prior to shipping by American Equipment and Fabricating Corporation. Calibrations of the O-cells and instrumentation used for this test are included in [Appendix B](#).

O-cell testing instrumentation included the following:

- Paired upper compression telltale casing (nominal ½-inch steel pipe) attached diametrically opposed to the reinforcing cage, extending from the top of the upper O-cell assembly to ground level.
- Paired middle shaft section Embedded Compression Telltales (ECTs), consisting of ¼-inch telltale rods in nominal ½-inch steel pipe casings, attached diametrically opposed to the reinforcing cage, with a Linear Vibrating Wire



Displacement Transducer (LVWDT, Geokon Model 4450 Series) attached, positioned between the upper and lower O-cell assemblies.

- Four Linear Vibrating Wire Displacement Transducers (LVWDTs, Geokon Model 4450 series) positioned between the lower and upper plates of each O-cell assembly.
- Two levels of two sister bar vibrating wire strain gages (Geokon Model 4911 Series) attached diametrically opposed to the reinforcing cage between the upper and lower O-cell assemblies.
- Three levels of two sister bar vibrating wire strain gages (Geokon Model 4911 Series) attached diametrically opposed to the reinforcing cage above the top of the upper O-cell assembly.
- Two lengths of steel pipe, extending from the top of the shaft to the top of the each O-cell assembly bottom plate, to vent the break in the pile formed by the expansion of the O-cells.

Details concerning the instrumentation placement appear in Table C and Figures A & B. The strain gages were positioned as specified by SCDOT.

Test Arrangement: Throughout the load test, key elements of shaft displacement response were monitored using the equipment and instruments described herein:

- Top of shaft displacement was monitored using a pair of automated digital survey levels (Leica NA3000 series) from a distance of approximately 40.2 feet (Appendix A, Pages 1 through 3).
- Upper compression displacement was measured using two ¼-inch telltale rods positioned inside the casing and monitored by LVWDTs attached to the top of the shaft (Appendix A, Pages 1 through 3).
- Middle shaft section compression and compression below the upper O-cell assembly was measured using the paired ECTs described under the Shaft Instrumentation section above (Appendix A, Pages 1 through 3).
- Expansion of each O-cell assembly was measured using the four Expansion LVWDTs described under Shaft Instrumentation (Appendix A, Pages 4 through 9).

Both a Bourdon pressure gage and a vibrating wire pressure transducer were used to measure the pressure applied to the O-cells at each load interval. The pressure transducer was used for automatically setting and maintaining loads, real time

plotting and for data analysis. The Bourdon pressure gage readings were used as a check on the transducer. There was close agreement between the Bourdon gage and the pressure transducer.

Data Acquisition: All instrumentation were connected through a data logger (Data Electronics 615 GeoLogger) to a laptop computer allowing data to be recorded and stored automatically at 30-second intervals and displayed in real time. The same laptop computer was used to acquire the Leica NA3000 data.

Testing Procedures: Each stage of testing was begun by pressurizing the appropriate O-cell in order to break the tack welds that hold them closed (for handling and for placement in the shaft) and to form the fracture plane in the concrete surrounding the base of the O-cells. After the break occurred, the pressure was immediately released and the testing commenced. Zero readings for all instrumentation were taken prior to the preliminary weld-breaking load-unload cycle, which in this case involved a maximum applied load of 475 kips to the lower O-cell and 193 kips to the upper O-cell.

The test was carried out in three stages as follows:

Stage 1: In the first stage, the 21-inch diameter lower O-cell, with its base located 4.38 feet above the shaft base, was loaded to assess the combined end bearing and lower side shear resistance of the shaft section below the lower O-cell using the side shear above as reaction. The lower O-cell was loaded in 19 nominally equal increments to a bi-directional gross O-cell load of 1,874 kips. The loading was halted after increment 1L-19 because the combined end bearing and lower side shear was approaching ultimate capacity. The lower O-cell was then unloaded in four decrements.

Stage 2: After unloading the lower O-cell, the 21-inch diameter upper O-cell, located 23.00 feet above the base of the lower O-cell, was loaded to assess the side shear characteristics of the shaft section between the two levels of O-cells and the upper side shear above. The lower O-cell was left free to drain (no hydraulic load transfer through the O-cell to end bearing). The upper O-cell was loaded in 23 nominally equal increments to a bi-directional gross O-cell load of 2,309 kips. The loading was halted after load interval 2L-23 because the upper side shear was approaching ultimate capacity. The upper O-cell was then unloaded in four decrements.

Stage 3: In the third stage both O-cell assemblies were loaded simultaneously to conduct a confined compression test on the middle shaft section. The O-cells were loaded in six equal increments to an average bi-directional gross O-cell load of 1,515 kips. The loading was halted after load interval 3L-6 because six data points are sufficient for the confined compression analysis (see [Appendix G](#)). The O-cells were then unloaded in one decrement and the test was concluded.

The following [Table A](#) below summarizes the three stages of loading:



TABLE A: Multi Level Testing Stages

Stage	See Fig.	Load Interval	Upper O-cell			Lower O-cell		
			Max Q_{gross} (kips)	O-cell Hydraulics System	Total Expansion (in)	Max Q_{gross} (kips)	O-cell Hydraulics System	Total Expansion (in)
1	1	1L-1 to 1L-19	0	Closed	-0.001	1,874	Pressurized	+3.297
2	2	2L-1 to 2L-23	2,309	Pressurized	+1.867	0	Draining	+2.060
3	-	3L-1 to 3L-6	1,515	Pressurized	+1.721	1,515	Pressurized	+2.818

The load increments were applied using the Quick Load Test Method for Individual Piles (ASTM D1143 *Standard Test Method for Piles Under Static Axial Load*). Each successive load increment was held constant for eight minutes by automatically adjusting the O-cell pressure. Approximately one minute was used to move between increments. The data logger automatically recorded the instrument readings every 30 seconds, but herein only the 1, 2, 4 and 8 minute readings during each increment of maintained load are reported.

TEST RESULTS AND ANALYSES

General: The loads applied by the O-cell assembly act in two opposing directions, resisted by the capacity of the shaft above and below. For the purpose of the analysis herein, it is assumed that the O-cell does not impose an additional upward load until its expansion force exceeds the buoyant weight of the shaft above the O-cell. Therefore, *net load*, which is defined as gross O-cell load minus the buoyant weight of the shaft above, is used to determine side shear resistance above the upper O-cell and to construct the equivalent top load displacement curve. For this test a shaft buoyant weight of 186 kips above the lower O-cell and 146 kips above the upper O-cell was calculated.

Shaft Profile and Dimensions: **SONICALIPER** profiles were taken of the excavation to determine the geometry of the shaft. In the analyses, we use a combination of the nominal shaft dimensions and those obtained from the sonar caliper profile between elevations -5.88 ft and -93.88 ft. A summary of the sonar caliper data and the dimensions used in the analyses are included in Appendix E.

Combined End Bearing and Lower Side Shear Resistance: The maximum downward load applied during Stage 1 was 1,874 kips which occurred at load interval 1L-19 (Appendix A, Page 11, Figures 1, 3 and 4). At this loading, the average downward displacement of the lower O-cell base was 3.177 inches. The side shear capacity of the 4.38-foot shaft section below the lower O-cell is calculated to be 258 kips assuming a maximum unit side shear value of 3.7 ksf (see below) and a calipered shaft diameter of 61.4 inches. The maximum applied load to end bearing

is then 1,616 kips and the unit end bearing at the base of the shaft is calculated to be 78.5 ksf at the above noted displacement. A mobilized unit end bearing curve is presented in [Figure 11](#).

Middle Side Shear Resistance: The maximum downward load applied to the middle side shear during stage 2 was 2,309 kips which occurred at load interval 2L-23 ([Appendix A, Page 15, Figures 2 through 4](#)). At this loading, the downward displacement of the base of the upper O-cell was 0.504 inches. Note that although the lower O-cell had been expanded to 3.297 inches during Stage 1, and was left free to drain during Stage 2, downward movement of the base of the lower O-cell assembly indicates possible mechanical load transfer through the lower O-cell during Stage 2. Based on the shape of the subsequent Stage 3 reload curve, a transfer load is estimated on the lower O-cell assembly during Stage 2 loading (see [Appendix A](#)). The maximum *net* load applied to the middle shear section is therefore estimated to be 2,037 kips.

Upper Side Shear Resistance: The maximum upward *net load* applied to the upper side shear during stage 2 was 2,163 kips which occurred at load interval 2L-23 ([Appendix A, Page 15, Figures 2 through 4](#)). At this loading, the upward displacement of the top of the upper O-cell was 1.363 inches.

The strain gage data appear in [Appendix A, Pages 16 through 24](#). On the day of the test, the concrete unit weight γ_c was assumed to be 145 pcf and the unconfined compressive strength f'_c was reported to be 4,040 psi. The ACI formula ($E_c = 0.033 \times \gamma_c^{1.5} \times \sqrt{f'_c}$) was used to calculate an elastic modulus for the concrete. This, combined with the area of reinforcing steel and calipered shaft diameters, provided an average shaft stiffness (AE) of 15,178,000 kips in the upper cased shaft section and 12,057,000 kips in the uncased shaft section. A confined compression stiffness (AE) of 15,238,000 kips is estimated using the analysis presented in [Appendix G](#) for the shaft section between elevations -67.83 feet and -90.83 feet. It was determined after completing the analysis that the middle shear section had not been mobilized sufficiently during Stage 2 testing to fully isolate the confined compression shaft zone, and the results of the Stage 3 test over-predicted the shaft stiffness. The ACI stiffness is therefore used in the subsequent analyses presented herein. Mobilized net unit side shear curves based on the strain gage data and estimated shaft stiffness are presented in [Figures 9 and 10](#). Shear values for loading increment 2L-23 follow in [Table B](#):

TABLE B: Average Net Unit Side Shear Values for 2L-23

Load Transfer Zone	Displacement ¹	Net Unit Side Shear ²
7 - Zero Shear to Strain Gage Level 5	↑ 1.34 in	0.2 ksf
6 - Strain Gage Level 5 to Strain Gage Level 4	↑ 1.34 in	1.3 ksf
5 - Strain Gage Level 4 to Strain Gage Level 3	↑ 1.35 in	3.5 ksf
4 - Strain Gage Level 3 to Upper O-cell	↑ 1.36 in	7.3 ksf (10.2 ksf at 2L-17)
3 - Upper O-cell to Strain Gage Level 2	↓ 0.50 in	7.9 ksf
2 - Strain Gage Level 2 to Strain Gage Level 1	↓ 0.49 in	5.1 ksf
1 - Strain Gage Level 1 to Lower O-cell ³	↓ 0.49 in	3.6 ksf (4.0 ksf at 2L-6)

¹ Average displacement of load transfer zone. Note that net unit shear values derived from the strain gages may not be ultimate. See [Figures 9 & 10](#) for unit shear vs. displacement plots.

² For upward-loaded shear, the buoyant weight of shaft in each zone has been subtracted from the load shed in the respective zone.

³ NOTE: Unit shear in Zone 1 computed considering the estimated mechanical load transfer through the lower O-cell during Stage 2. See [Middle Shear Section](#) above for details.

Equivalent Top Load-Displacement: [Figure 12](#) presents the equivalent top load curves. The curve represents the output of a t-z analysis ([Appendix C](#)). The input for the t-z analysis was the computed unit side shear curves ([Figures 9 and 10](#)), measured downward base of lower O-cell load-displacement ([Figure 1](#)) and the shaft properties given in [Table C](#). The displacement curves are calculated assuming the top load is applied at top of shaft (+4.02 ft). The test shaft was loaded to a combined side shear and end-bearing load of 6,354 kips. For a top loading of 2,500 kips, the adjusted test data indicate this shaft would displace approximately 0.374 inches. For a top loading of 5,000 kips, the adjusted test data indicate this shaft would displace approximately 0.892 inches. Note that the equivalent top load curve applies to incremental loading durations of eight minutes. Creep effects will reduce the ultimate resistance of both components and increase shaft top displacement for a given loading over longer times. The Engineer can estimate such additional creep effects by suitable extrapolation of time effects using the creep data presented herein.

Creep Limit: See [Appendix D](#) for our O-cell method for determining creep limit loading. The combined end bearing and lower side shear creep data ([Appendix A, Page 10, Figure D-1](#)) indicate that a creep limit of 1,540 kips was reached at a displacement of 0.95 inches. The middle side shear creep data ([Appendix A, Pages 14 and 15, Figure D-2](#)) indicate that no apparent creep limit was reached at a maximum displacement of 0.50 inches. The upper side shear creep data ([Appendix A, Pages 14 and 15, Figure D-3](#)) indicate that a creep limit of 1,935 kips was reached at a displacement of 0.40 inches. A top loaded shaft will not begin creep until all components begin creep displacement. This will occur at the maximum of the displacements required to reach the creep limit for each component. Due to the absence of a clearly defined middle side shear creep limit, a creep limit for the equivalent top-loaded shaft cannot be estimated.

Shaft Compression Comparison: The measured maximum total shaft compression, averaged from two telltales, is 0.040 inches at 1L-19 (Appendix A, Page 10). Using a weighted average shaft stiffness of 13,073,400 kips and the load distribution in Figure 7 at 1L-19, an elastic compression of 0.038 inches over the length of the compression telltales is calculated. The measured maximum upper shaft compression at the end of Stage 2, averaged from two telltales, is 0.026 inches at 2L-23 (Appendix A, Page 15). Using a weighted upper shaft stiffness of 13,561,900 kips and the load distribution in Figure 8 at 2L-23, an elastic compression of 0.029 inches over the length of the compression telltales is calculated. These agreements provide evidence that the values of the estimated shaft stiffness are reasonable.

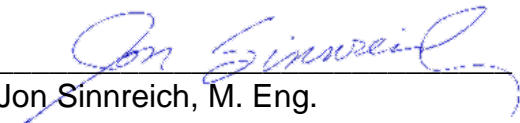
LIMITATIONS AND STANDARD OF CARE


The instrumentation, testing services and data analysis provided by Loadtest USA, outlined in this report, were performed in accordance with the accepted standards of care recognized by professionals in the drilled shaft and foundation engineering industry.

Please note that some of the information contained in this report is based on data (i.e. elevations and concrete strength) provided by others. The engineer, therefore, should come to his or her own conclusions with regard to the analyses as they depend on this information. In particular, Loadtest USA typically does not observe and record drilled shaft construction details to the level of precision that the project engineer may require. In many cases, we may not be present for the entire duration of shaft construction. Since construction technique can play a significant role in determining the load bearing capacity of a drilled shaft, the engineer should pay close attention to the drilled shaft construction details that were recorded elsewhere.

We trust that this information will meet your current project needs. If you have any questions, please do not hesitate to contact us at 352-378-3717.

Prepared for Loadtest USA by


Jon Sinnreich, M. Eng.


David J. Jakstis, P.E.

Reviewed for Loadtest USA by


Robert C. Simpson, M.S.

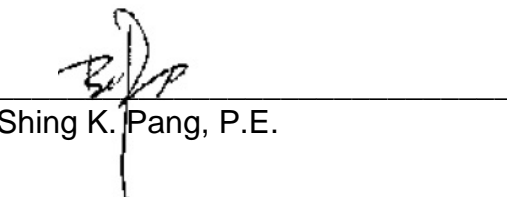

Shing K. Pang, P.E.



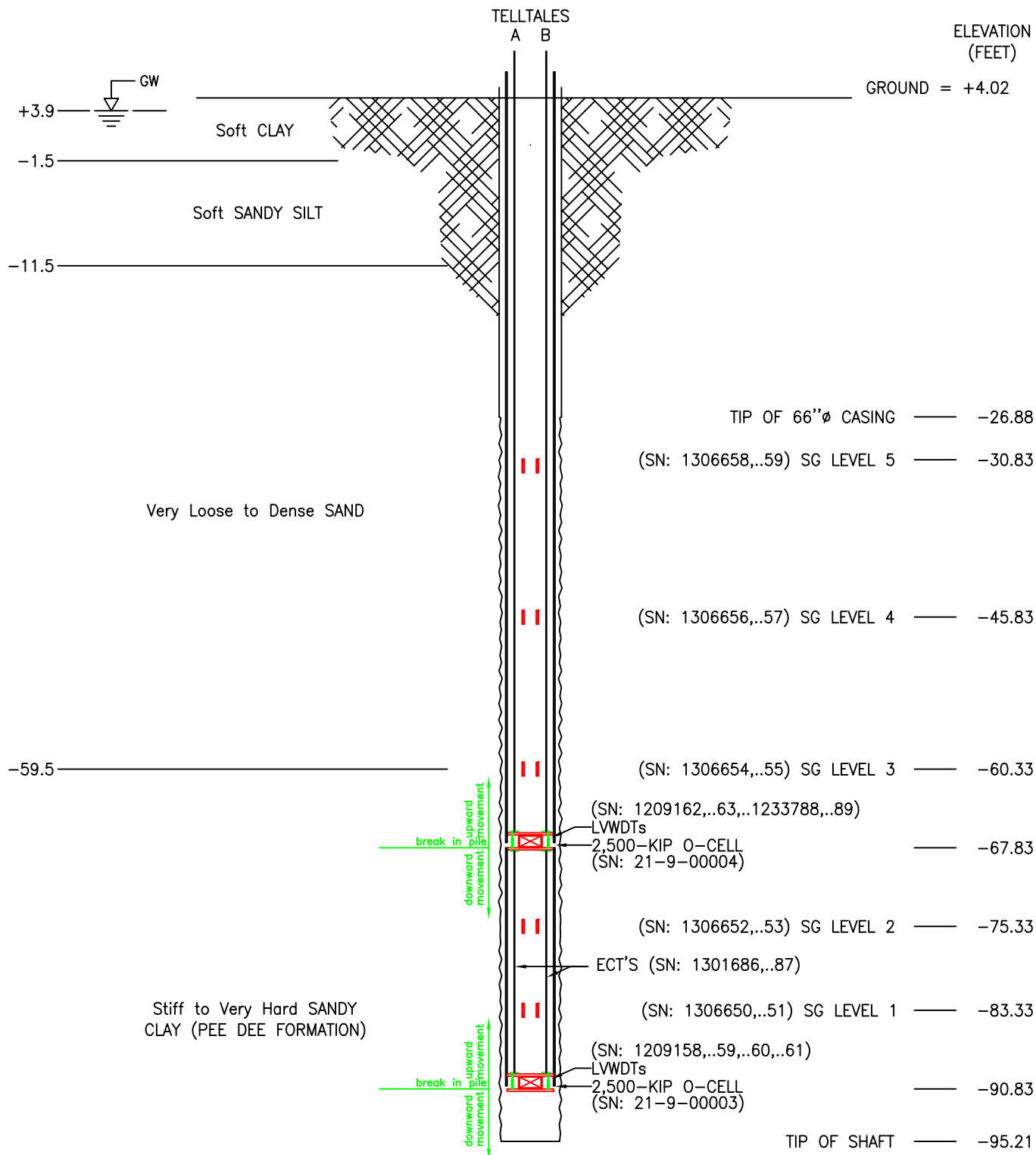


TABLE C
SUMMARY OF DIMENSIONS, ELEVATIONS & SHAFT PROPERTIES

Shaft: (Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC)		
Nominal shaft diameter (EL +4.02 ft to -26.88 ft)	=	65.75 in
Nominal shaft diameter (EL -26.88 ft to -95.21 ft)	=	60.00 in
Calipered shaft diameters (EL -5.88 ft to -93.88 ft)	=	<u>Appendix E</u>
Upper O-cell: 21-9-0004	=	21 in
Lower O-cell: 21-9-0003	=	21 in
Length of shaft zone above break at base of upper O-cell	=	71.85 ft
Length of shaft zone between lower and upper O-cells	=	23.00 ft
Length of shaft zone below break at base of lower O-cell	=	4.38 ft
Side shear area above upper O-cell base	=	1211.0 ft ²
Side shear area between lower and upper O-cells	=	368.3 ft ²
Side shear area below lower O-cell base	=	70.3 ft ²
Shaft base area	=	20.6 ft ²
Bouyant weight of shaft above base of upper O-cell	=	146 kips
Bouyant weight of shaft above base of lower O-cell	=	186 kips
Estimated shaft stiffness, AE (EL +4.02 ft to -26.88 ft)	=	15,178,000 kips
Estimated shaft stiffness, AE (EL -26.88 ft to -90.83 ft)	=	12,057,000 kips
Estimated shaft stiffness, AE (EL -90.83 ft to -95.21 ft)	=	11,618,000 kips
Elevation of top of shaft concrete and ground surface	=	+4.02 ft
Elevation of water table	=	+3.90 ft
Elevation of base of upper O-cell assembly ¹	=	-67.83 ft
Elevation of base of lower O-cell assembly ¹	=	-90.83 ft
Elevation of shaft base	=	-95.21 ft
Casings:		
Elevation of top of casing (65.75 in O.D., 65.00 in I.D.)	=	+5.07 ft
Elevation of bottom of casing (65.75 in O.D., 65.00 in I.D.)	=	-26.88 ft
Telltale Sections:		
Elevation of top of telltale used for upper shaft compression	=	+4.02 ft
Elevation of bottom of telltale used for upper shaft compression	=	-89.43 ft
Elevation of top of embedded telltale used for middle shaft compression	=	-67.83 ft
Elevation of bottom of embedded telltale used for middle shaft compression	=	-89.43 ft
Strain Gages:		
Elevation of Strain Gage Level 5 (AE = 13,343,000 kips)	=	-30.83 ft
Elevation of Strain Gage Level 4 (AE = 12,024,000 kips)	=	-45.83 ft
Elevation of Strain Gage Level 3 (AE = 12,288,000 kips)	=	-60.33 ft
Elevation of Strain Gage Level 2 (AE = 11,339,000 kips)	=	-75.33 ft
Elevation of Strain Gage Level 1 (AE = 11,550,000 kips)	=	-83.33 ft
Miscellaneous:		
Top plate diameter (2.0 inch thick)	=	47.25 in
Bottom plate diameter (2.0 inch thick)	=	47.25 in
Reinforcing Cage Vertical Bar Size (EL. +4.34 ft to -95.21, 20 No.)	=	# 11
Spiral size (6 in spacing)	=	# 6
Rebar Cage Diameter	=	52 in
Estimated 7 day unconfined compressive concrete strength	=	4,040 psi
Assumed concrete unit weight	=	145 pcf
O-cell LVWDTs @ 0°, 90°, 180° and 270° with radius	=	23.0 in

¹ The break between upward and downward movement at each O-cell assembly

NOTE: NOMINAL SHAFT DIAMETER 60"Ø
 PERMANENT CASING DIAMETER 66"Ø
 TOP OF PERMANENT CASING +5.07



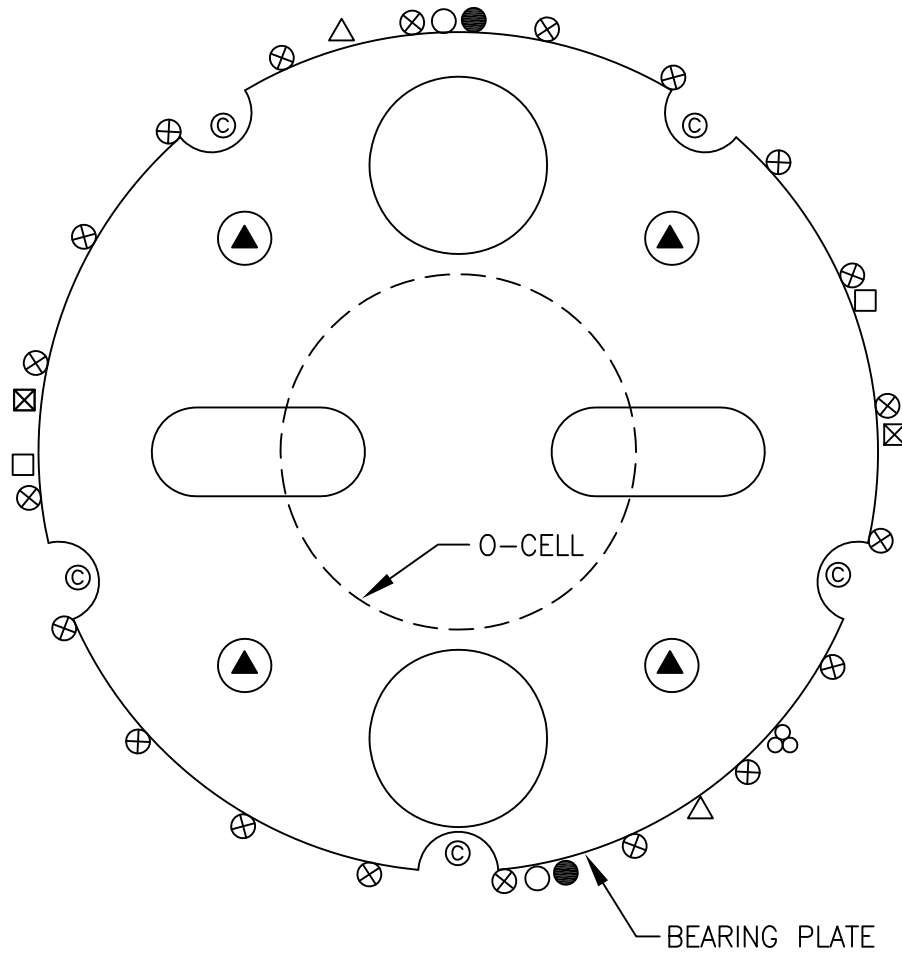
NOTE: SOIL BASED ON BORING # B-1



2631-D NW 41st St.
 Gainesville, FL 32606
 Phone: 800-368-1138
 FAX: 352-378-3934

AS BUILT SECTION OF TEST SHAFT US 701 over Great Pee Dee River - Horry County, SC

DWN BY: BDH	DATE: 06 Mar 2013	CHECKED BY: DJJ	LT-1212-1
REVISED BY: AJ5	DATE: 15 May 2013	SCALE: NTS	FIGURE A



LEGEND:

STRAIN GAGE
 LVWDT
 TELLTALE
 VENT PIPE
 HYDRAULIC HOSES
 REBAR
 CABLE BUNDLE
 ECT
 CSL PIPE



INSTRUMENTATION LAYOUT

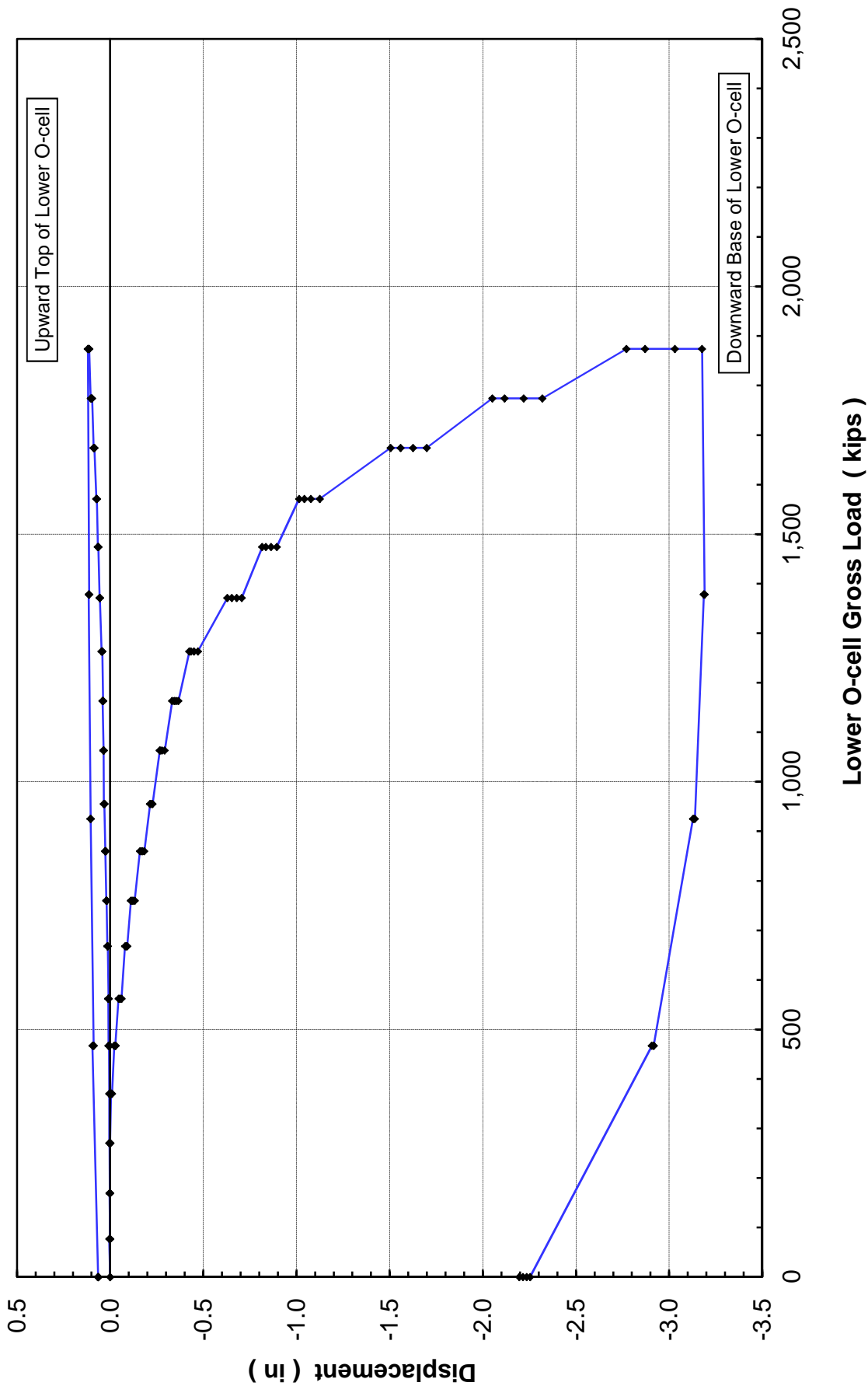
US 701 Over Great Pee Dee River – Horry County, SC

DWN BY: JAS	DATE: 05/13/2013	CHECKED BY:	LT-1212
REVISED BY:	DATE:	SCALE: NTS	FIGURE B



Lower Osterberg Cell Load-Displacement - Stage 1

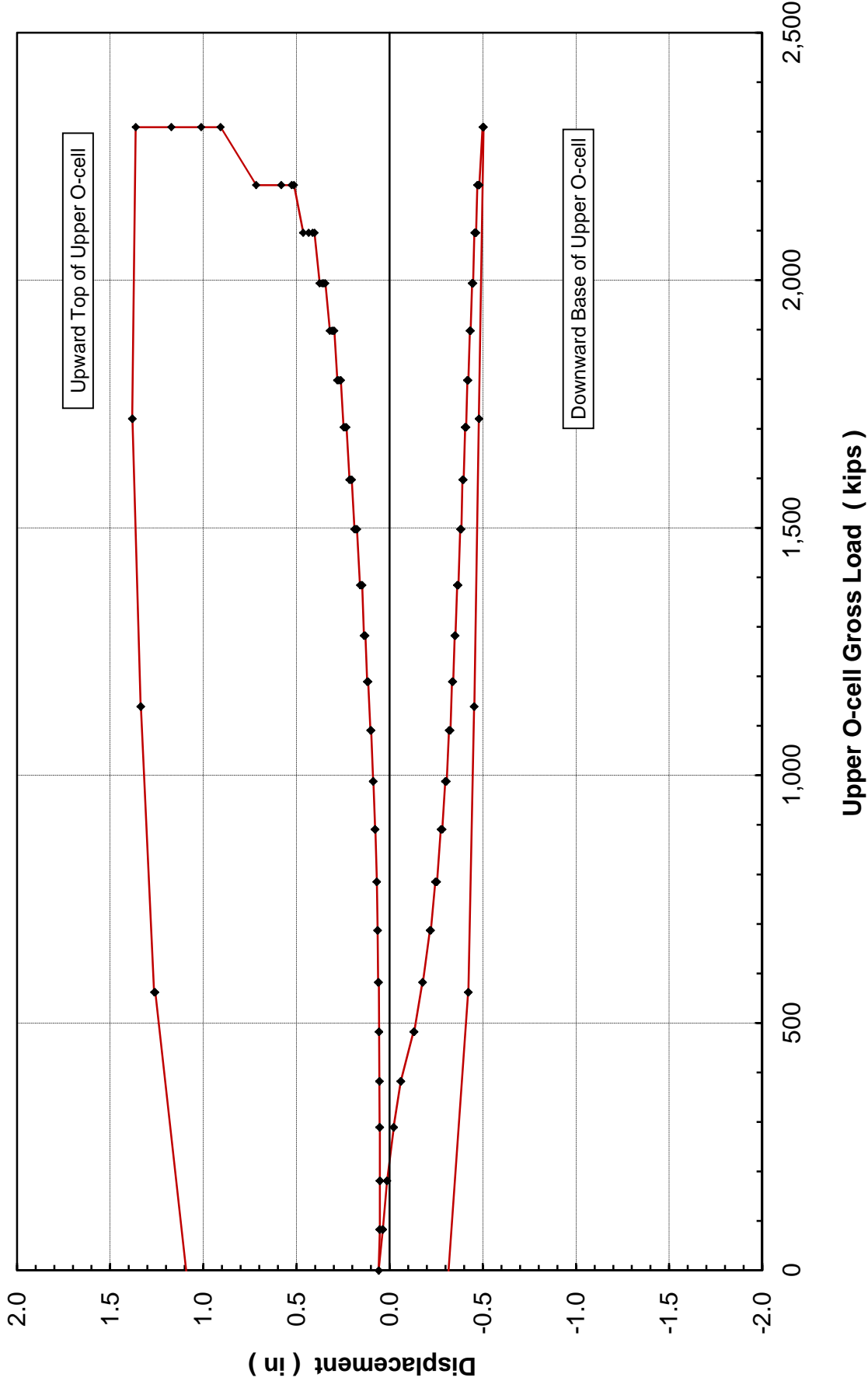
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Upper Osterberg Cell Load-Displacement - Stage 2

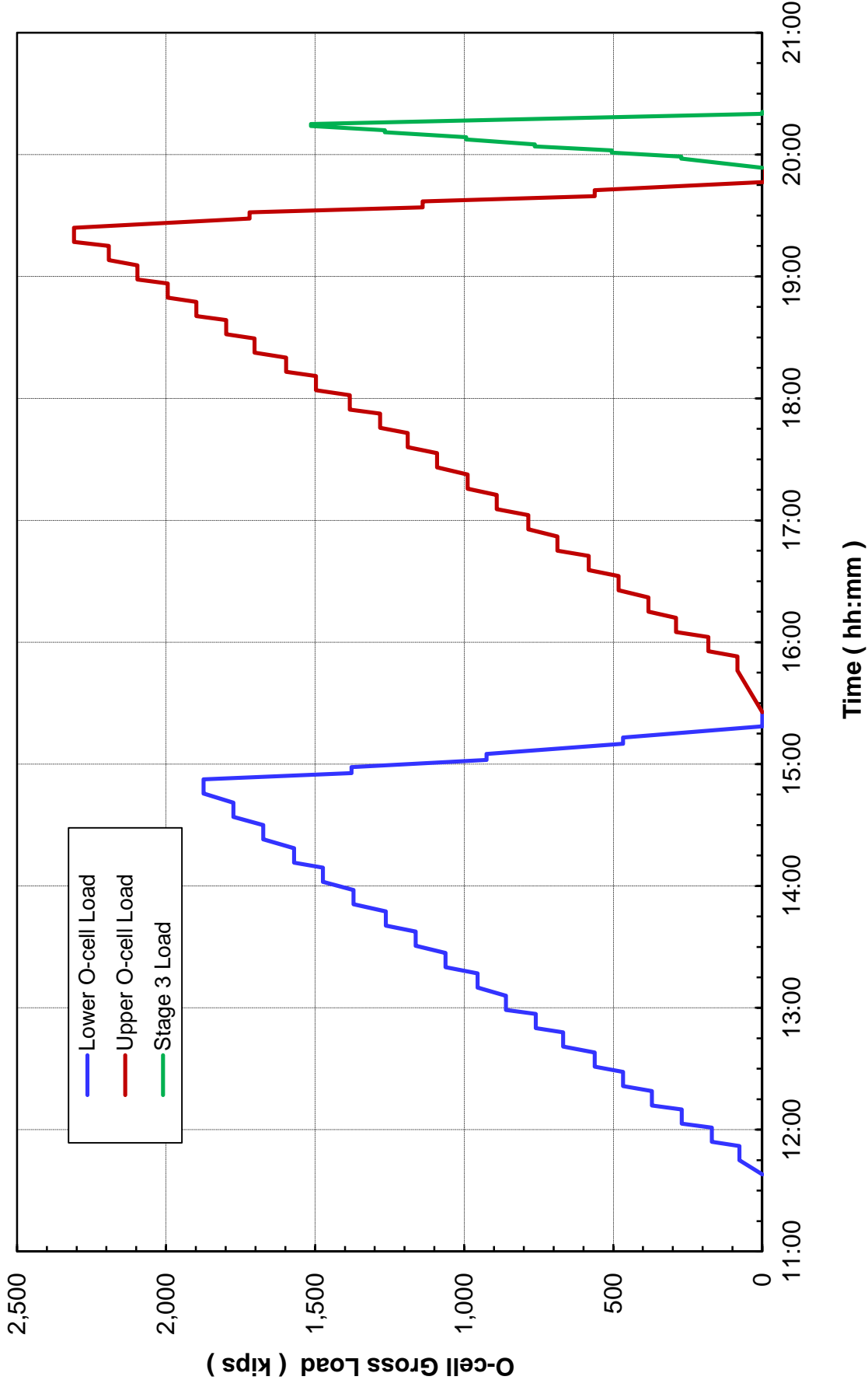
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Time-Osterberg Cell Load

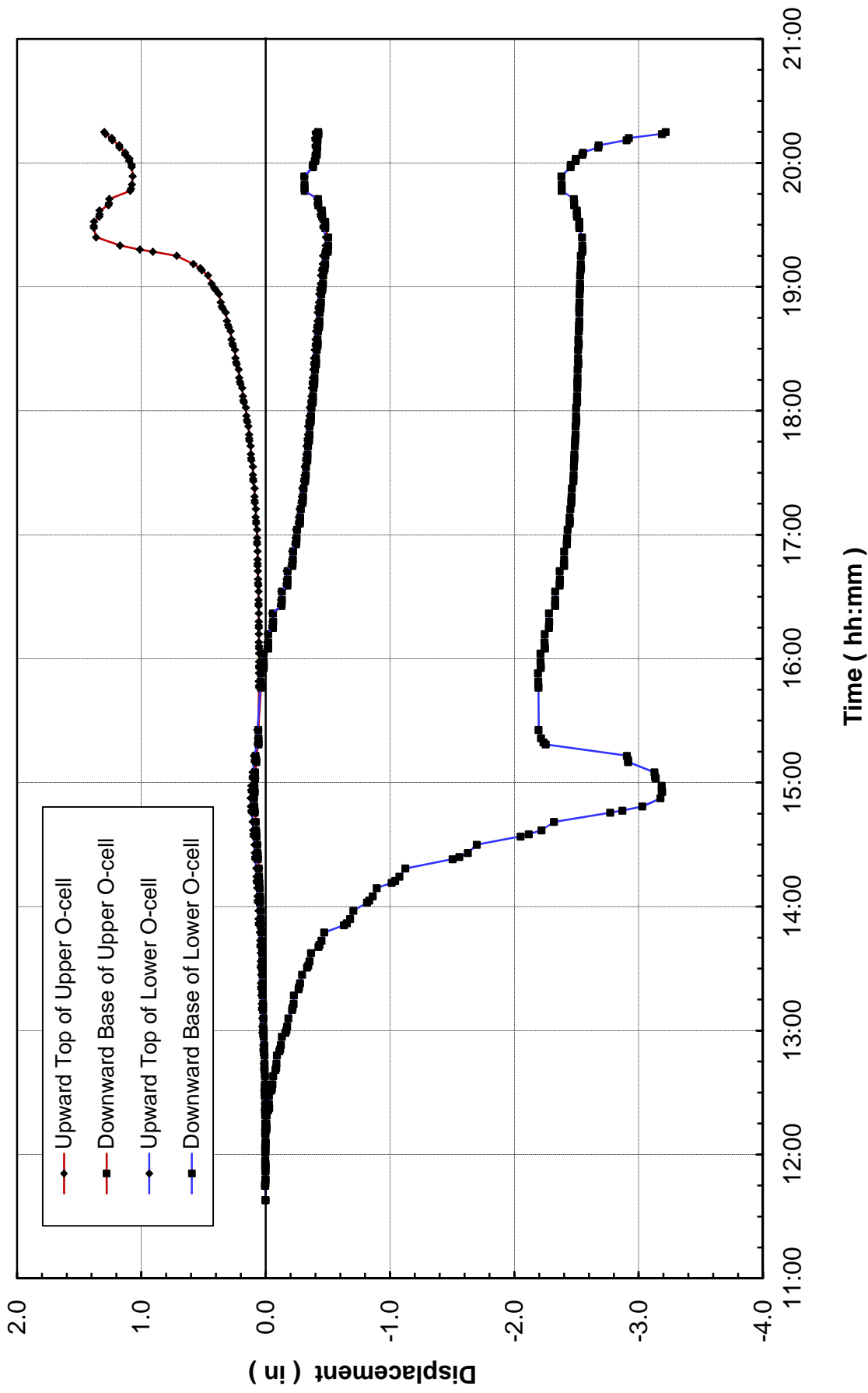
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Time-Osterberg Cell Displacement

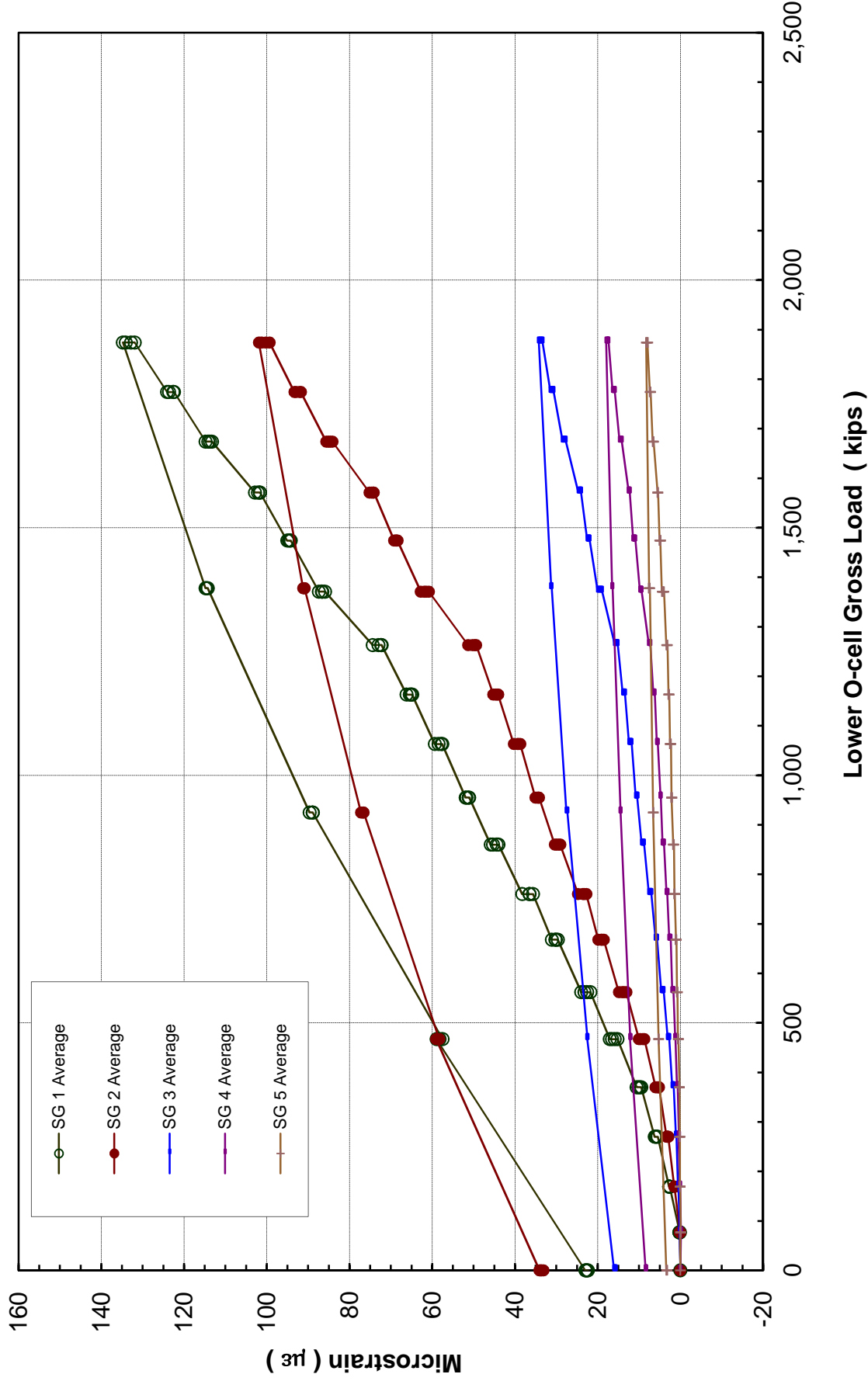
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





O-cell Load-Strain Gage Microstrain - Stage 1

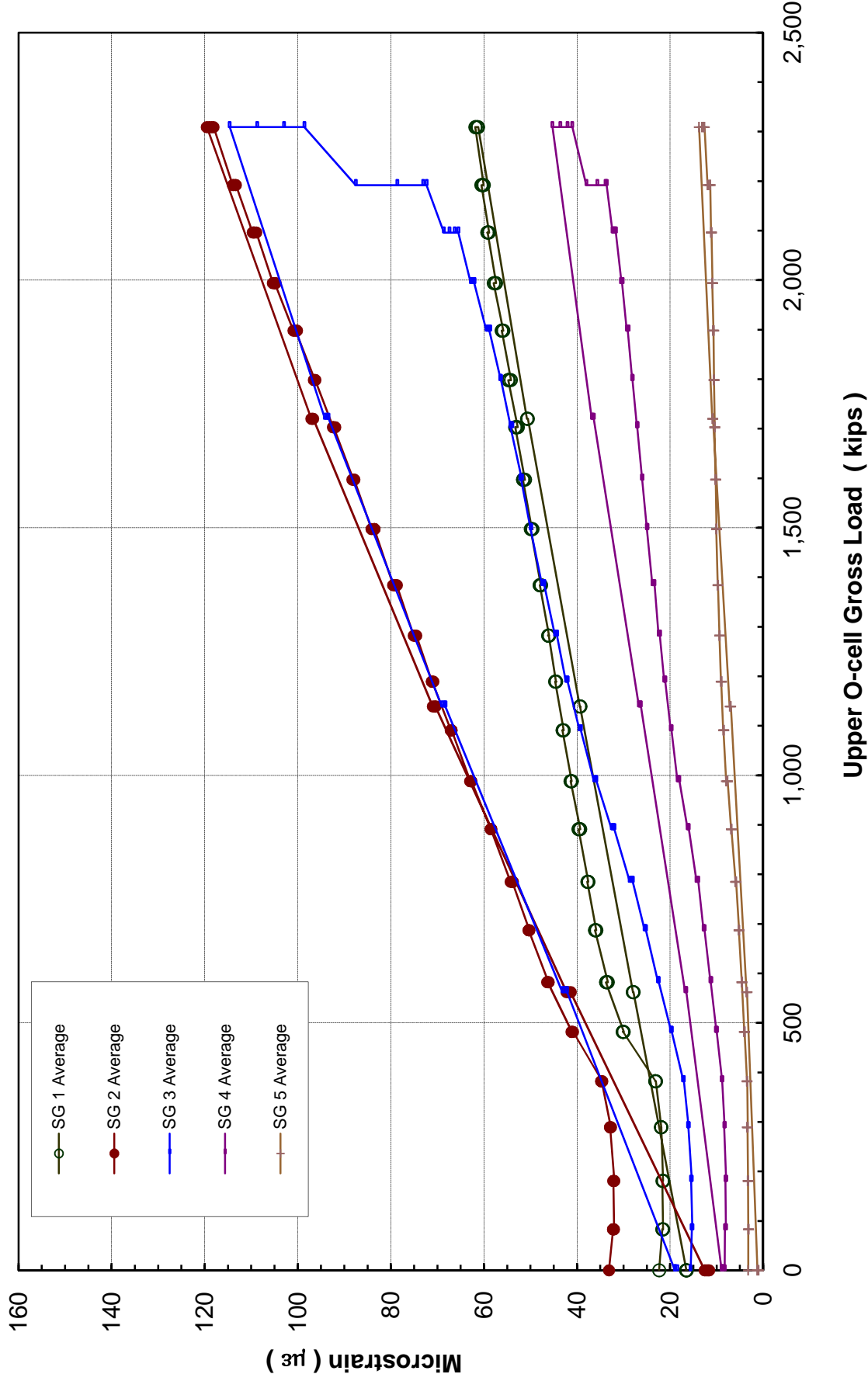
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





O-cell Load-Strain Gage Microstrain - Stage 2

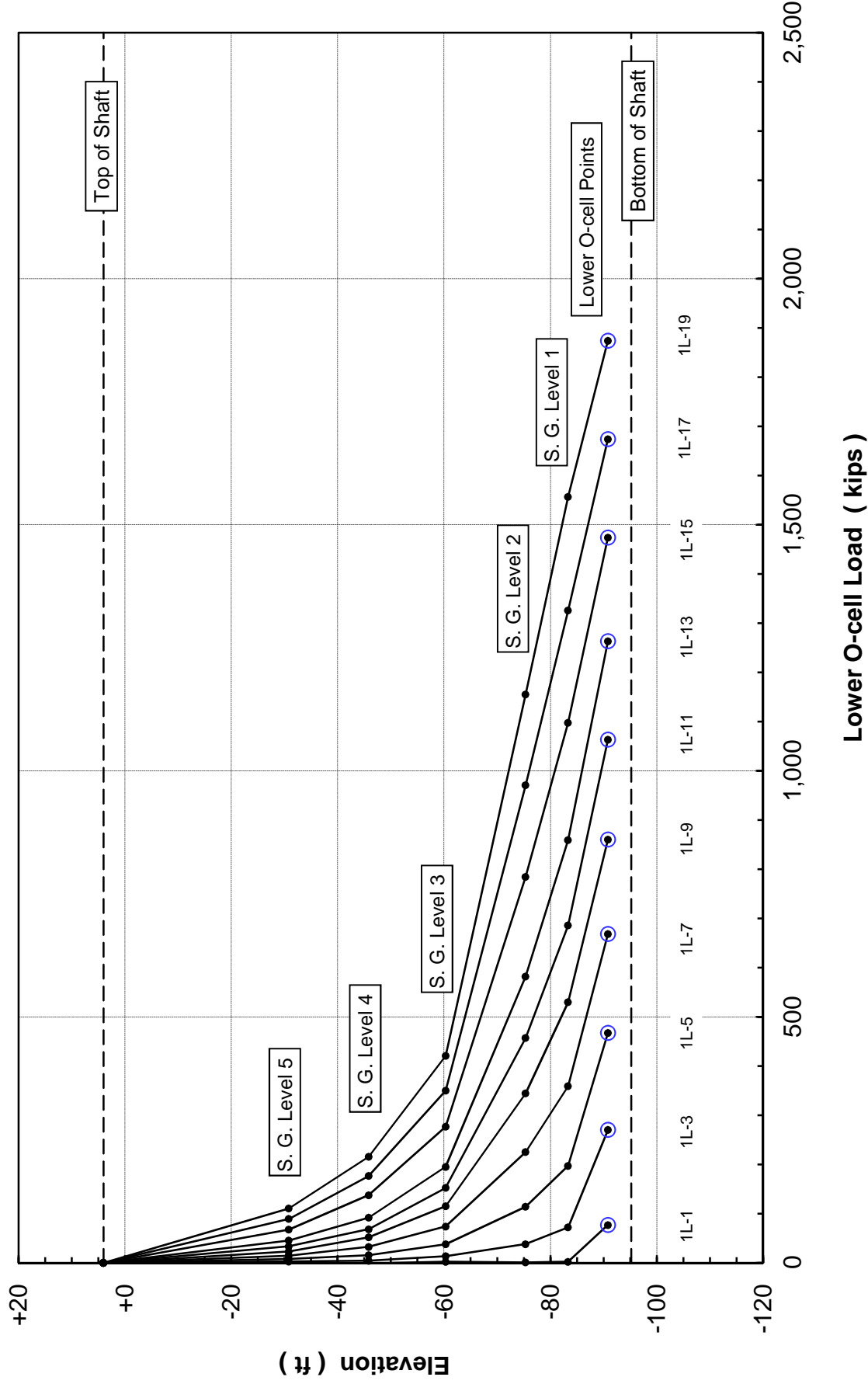
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Strain Gage Load Distribution - Stage 1

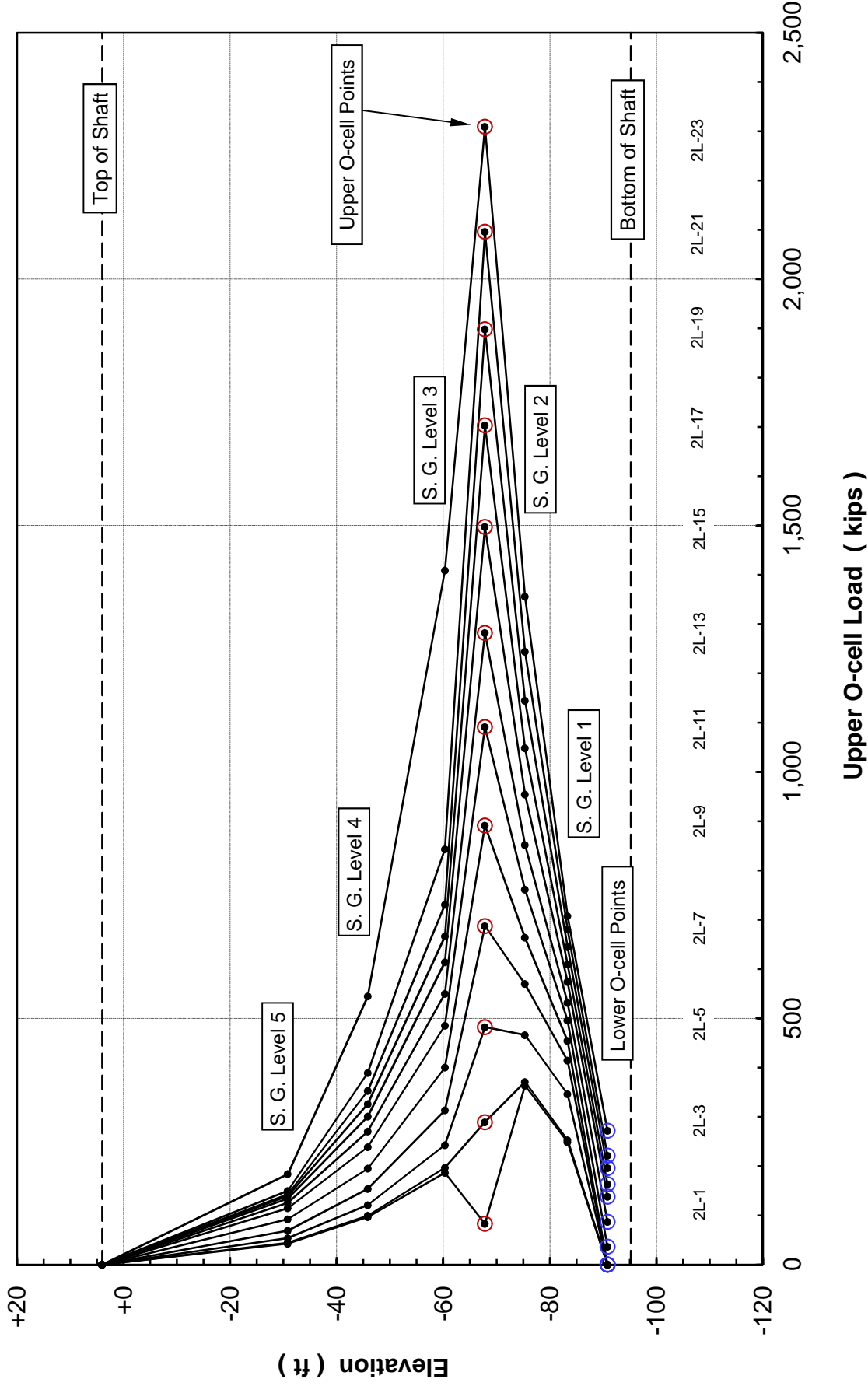
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Strain Gage Load Distribution - Stage 2

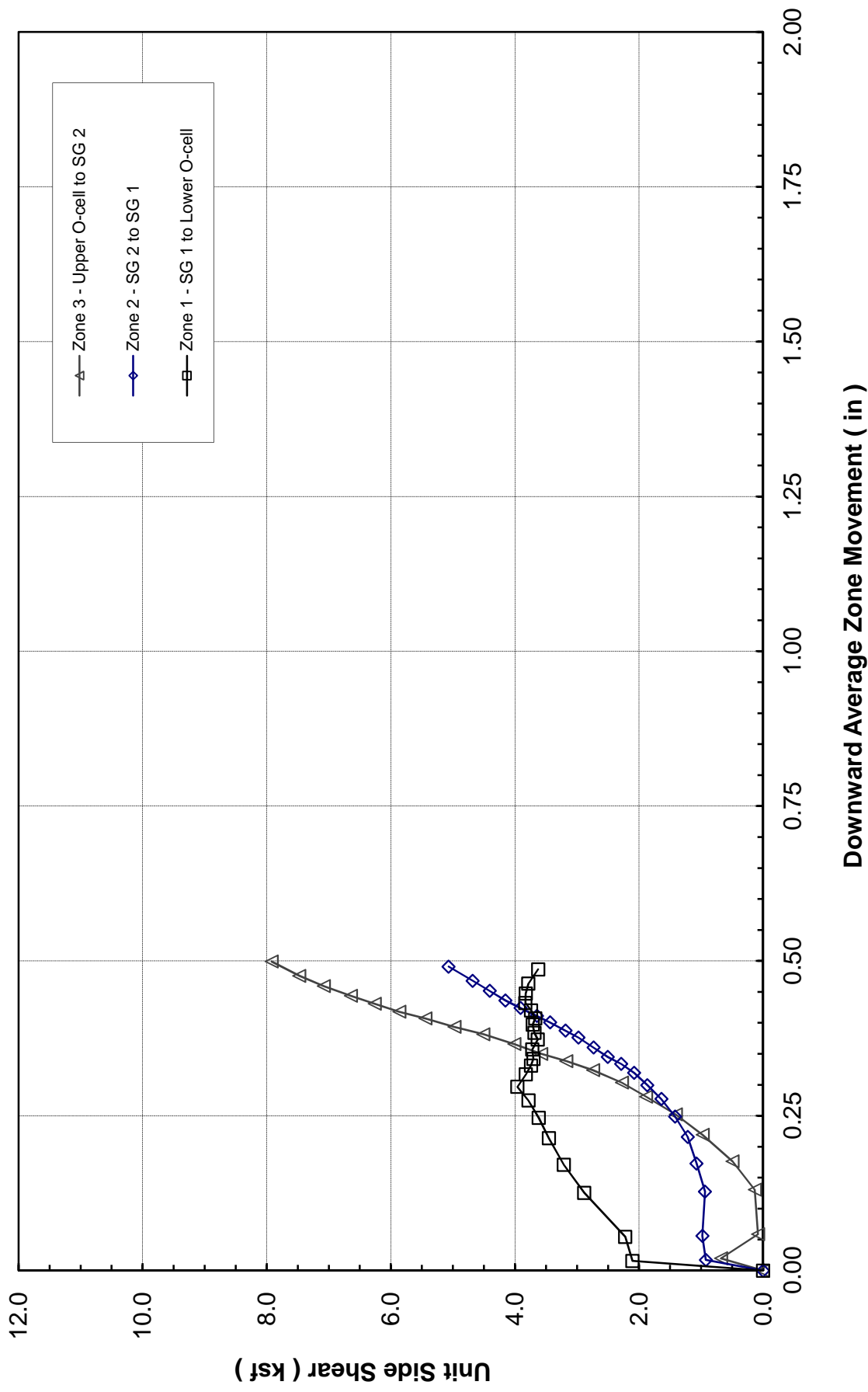
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Mobilized Downward Unit Side Shear - Stage 2

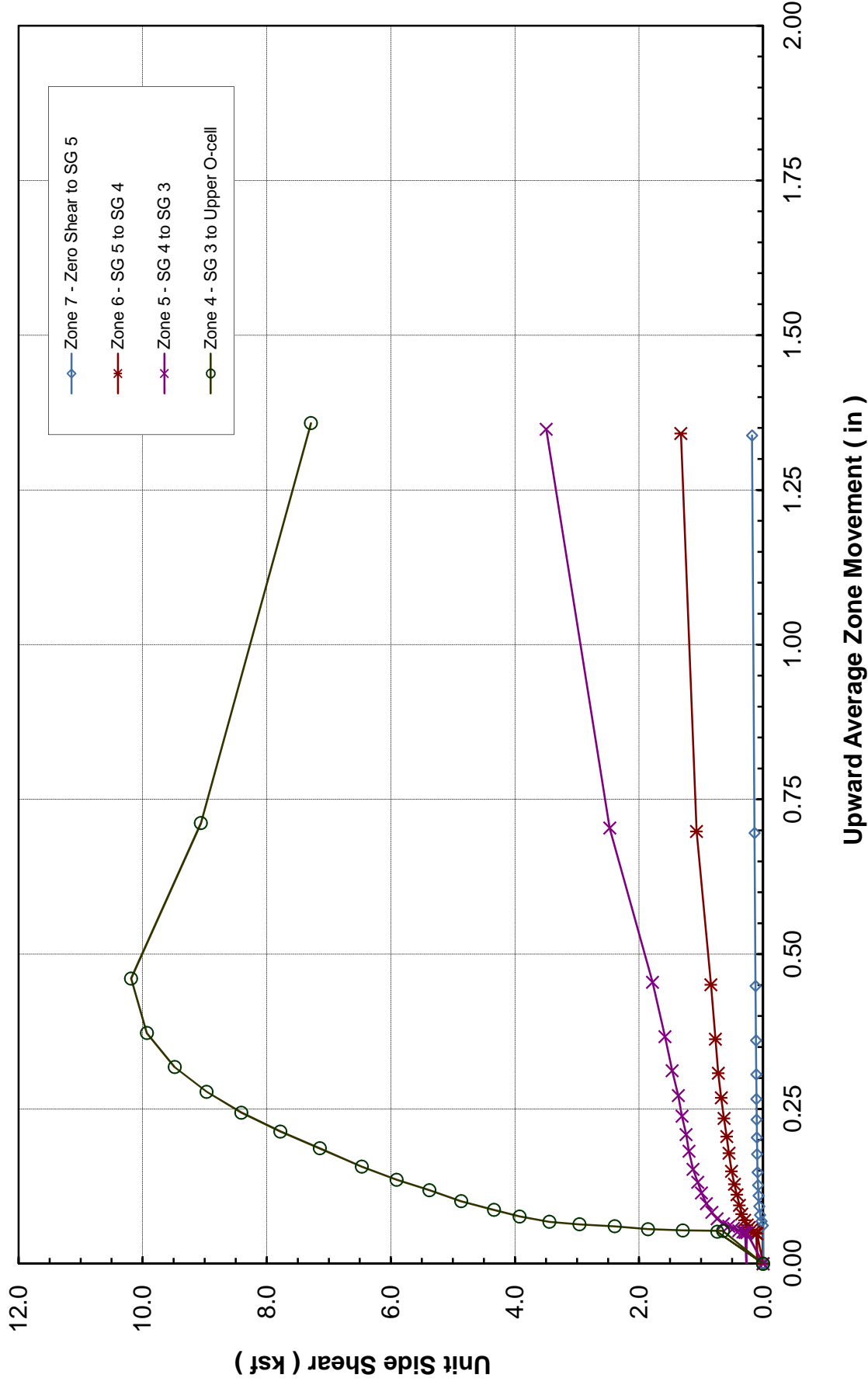
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Mobilized Upward Unit Side Shear - Stage 2

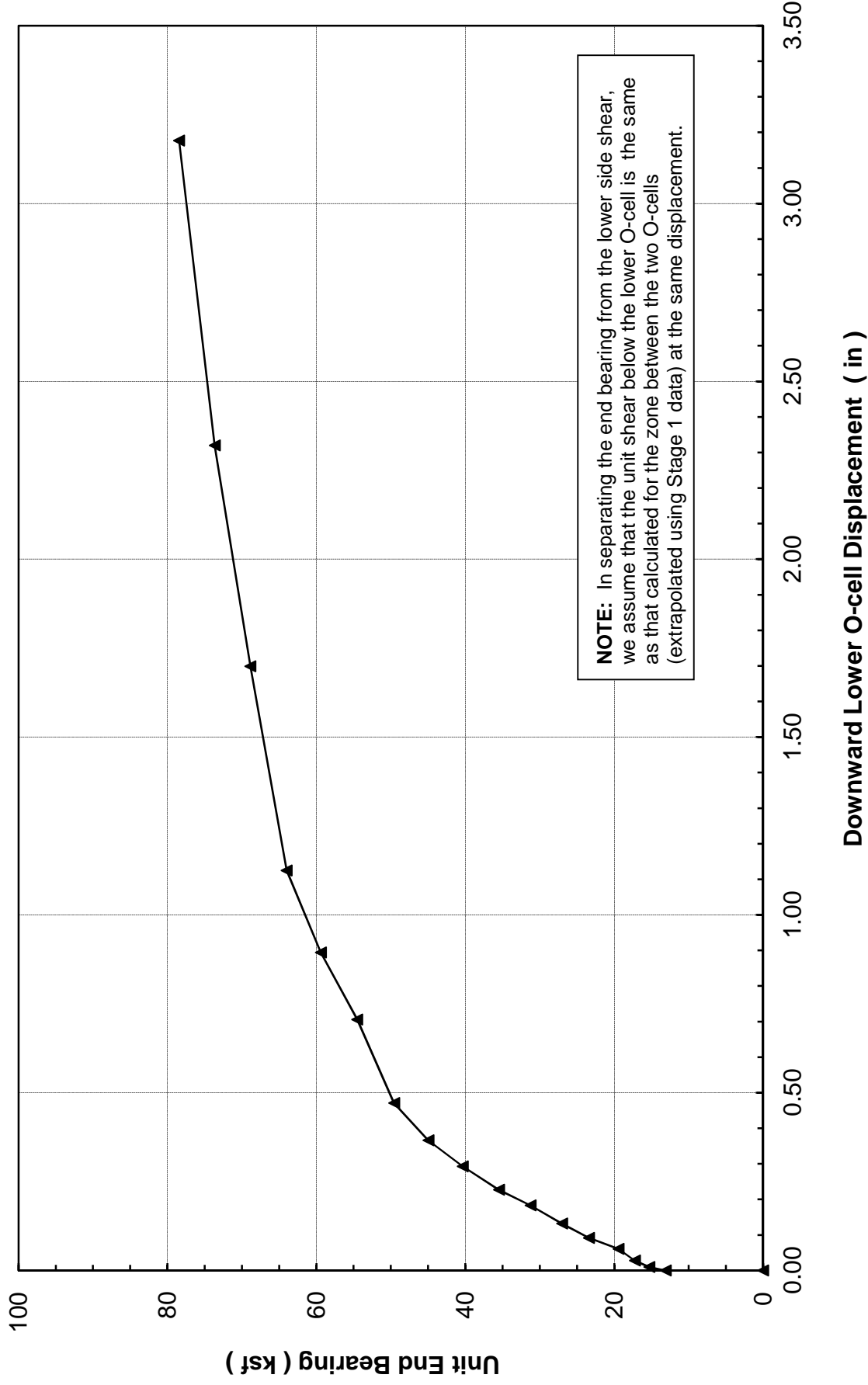
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Mobilized Unit End Bearing

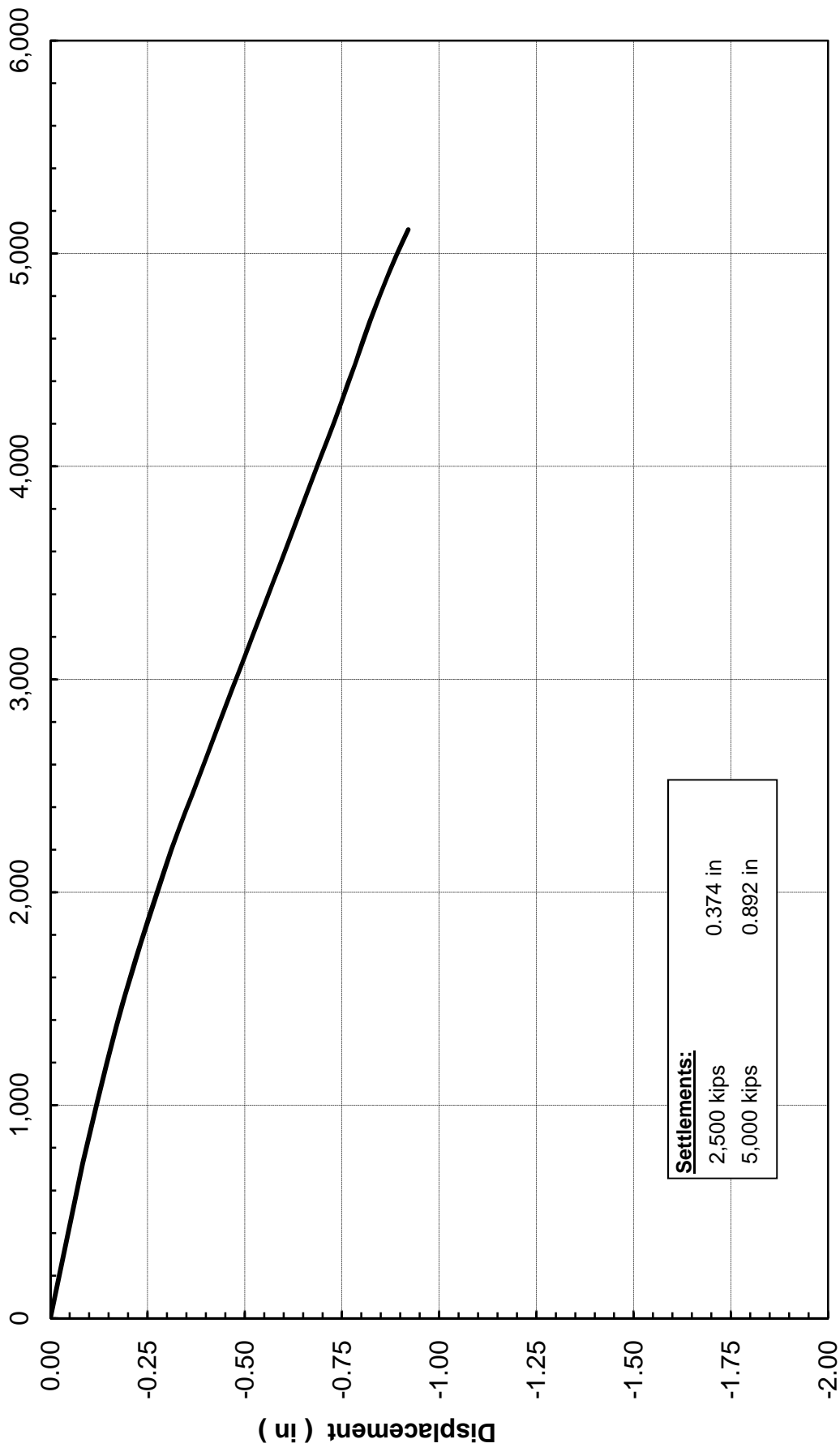
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Equivalent Top Load-Displacement

Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC



APPENDIX A

FIELD DATA & DATA REDUCTION





Upward Top of Shaft Movement and Shaft Compression
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Top of Shaft			Upper Compression Telltales			Embedded Compression Telltales		
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	A - 92244 (in)	C - 282439 (in)	Average (in)	A - 81926 (in)	C - 84453 (in)	Average (in)	1A - 1301686 (in)	1C - 1301687 (in)	Average (in)
1 L - 0	-	11:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1 L - 1	1	11:45:00	350	77	0	0	0.005	0.002	0.003	0.000	0.000	0.000	0.000	0.000	0.000
1 L - 1	2	11:46:00	350	77	0	0	0.004	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000
1 L - 1	4	11:48:00	350	77	0	0	0.003	-0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1 L - 1	8	11:52:00	350	77	0	0	0.001	-0.002	-0.001	0.000	0.001	0.001	0.000	0.000	0.000
1 L - 2	1	11:54:00	720	169	0	0	0.002	0.003	0.003	0.000	0.001	0.000	0.000	0.000	0.000
1 L - 2	2	11:55:00	720	169	0	0	0.004	-0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000
1 L - 2	4	11:57:00	720	169	0	0	0.001	0.003	0.002	0.000	0.001	0.001	0.000	0.000	0.000
1 L - 2	8	12:01:00	720	169	0	0	0.002	0.000	0.001	0.000	0.002	0.001	0.000	0.000	0.000
1 L - 3	1	12:03:00	1,120	270	0	0	0.002	0.002	0.002	0.000	0.001	0.001	0.000	0.001	0.000
1 L - 3	2	12:04:00	1,120	270	0	0	0.003	0.000	0.002	0.000	0.001	0.001	0.000	0.001	0.001
1 L - 3	4	12:06:00	1,120	270	0	0	0.001	0.000	0.000	0.000	0.001	0.001	0.000	0.001	0.001
1 L - 3	8	12:10:00	1,120	270	0	0	0.002	0.002	0.002	0.001	0.002	0.001	0.000	0.001	0.001
1 L - 4	1	12:12:00	1,520	370	0	0	0.001	0.003	0.002	0.000	0.001	0.001	0.001	0.001	0.001
1 L - 4	2	12:13:00	1,520	370	0	0	0.001	-0.002	-0.001	0.000	0.001	0.001	0.001	0.002	0.001
1 L - 4	4	12:15:00	1,520	370	0	0	0.003	-0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001
1 L - 4	8	12:19:00	1,520	370	0	0	0.003	0.001	0.002	0.001	0.002	0.001	0.001	0.002	0.001
1 L - 5	1	12:21:30	1,910	467	0	0	0.004	0.002	0.003	0.001	0.001	0.001	0.002	0.003	0.002
1 L - 5	2	12:22:30	1,910	467	0	0	0.000	-0.002	-0.001	0.001	0.001	0.001	0.002	0.003	0.002
1 L - 5	4	12:24:30	1,910	467	0	0	0.003	0.001	0.002	0.001	0.002	0.001	0.002	0.003	0.003
1 L - 5	8	12:28:30	1,910	467	0	0	0.005	0.003	0.004	0.001	0.002	0.002	0.002	0.003	0.003
1 L - 6	1	12:31:00	2,290	562	0	0	0.006	0.003	0.005	0.001	0.002	0.001	0.003	0.004	0.004
1 L - 6	2	12:32:00	2,290	562	0	0	-0.002	0.008	0.003	0.001	0.002	0.002	0.003	0.004	0.004
1 L - 6	4	12:34:00	2,290	562	0	0	0.005	0.001	0.003	0.001	0.002	0.002	0.003	0.004	0.004
1 L - 6	8	12:38:00	2,290	562	0	0	0.003	0.001	0.002	0.001	0.002	0.002	0.004	0.005	0.004
1 L - 7	1	12:41:00	2,710	668	0	0	0.007	0.006	0.006	0.002	0.003	0.002	0.005	0.006	0.005
1 L - 7	2	12:42:00	2,710	668	0	0	0.005	0.006	0.005	0.002	0.003	0.003	0.005	0.006	0.005
1 L - 7	4	12:44:00	2,710	668	0	0	0.008	0.006	0.007	0.002	0.003	0.002	0.005	0.006	0.005
1 L - 7	8	12:48:00	2,710	668	0	0	0.011	0.004	0.007	0.002	0.003	0.002	0.005	0.006	0.006
1 L - 8	1	12:50:00	3,080	760	0	0	0.009	0.010	0.010	0.002	0.003	0.003	0.006	0.007	0.006
1 L - 8	2	12:51:00	3,080	760	0	0	0.011	0.008	0.009	0.002	0.003	0.003	0.006	0.007	0.007
1 L - 8	4	12:53:00	3,080	760	0	0	0.012	0.005	0.008	0.003	0.003	0.003	0.006	0.007	0.007
1 L - 8	8	12:57:00	3,080	760	0	0	0.024	-0.001	0.011	0.003	0.003	0.003	0.006	0.008	0.007
1 L - 9	1	12:59:00	3,480	860	0	0	0.019	0.008	0.013	0.003	0.004	0.004	0.007	0.009	0.008
1 L - 9	2	13:00:00	3,480	860	0	0	0.014	0.009	0.011	0.003	0.004	0.004	0.007	0.009	0.008
1 L - 9	4	13:02:00	3,480	860	0	0	0.018	0.009	0.013	0.003	0.004	0.004	0.008	0.009	0.008
1 L - 9	8	13:06:00	3,480	860	0	0	0.011	0.013	0.012	0.003	0.004	0.004	0.008	0.009	0.009
1 L - 10	1	13:10:00	3,860	955	0	0	0.019	0.013	0.016	0.004	0.004	0.004	0.009	0.010	0.010
1 L - 10	2	13:11:00	3,860	955	0	0	0.020	0.013	0.016	0.004	0.004	0.004	0.009	0.010	0.010
1 L - 10	4	13:13:00	3,860	955	0	0	0.019	0.011	0.015	0.004	0.004	0.004	0.009	0.011	0.010
1 L - 10	8	13:17:00	3,860	955	0	0	0.023	0.015	0.019	0.004	0.005	0.004	0.009	0.011	0.010
1 L - 11	1	13:20:00	4,290	1,063	0	0	0.024	0.012	0.018	0.004	0.005	0.005	0.010	0.012	0.011
1 L - 11	2	13:21:00	4,290	1,063	0	0	0.024	0.015	0.019	0.004	0.005	0.005	0.010	0.012	0.011
1 L - 11	4	13:23:00	4,290	1,063	0	0	0.024	0.015	0.019	0.004	0.005	0.005	0.010	0.012	0.011
1 L - 11	8	13:27:00	4,290	1,063	0	0	0.022	0.013	0.018	0.005	0.005	0.005	0.010	0.012	0.011
1 L - 12	1	13:30:30	4,690	1,163	0	0	0.026	0.021	0.023	0.005	0.005	0.005	0.011	0.013	0.012
1 L - 12	2	13:31:30	4,690	1,163	0	0	0.025	0.014	0.019	0.005	0.005	0.005	0.011	0.013	0.012
1 L - 12	4	13:33:30	4,690	1,163	0	0	0.024	0.017	0.020	0.005	0.005	0.005	0.011	0.013	0.012
1 L - 12	8	13:37:30	4,690	1,163	0	0	0.026	0.015	0.020	0.005	0.005	0.005	0.012	0.013	0.012
1 L - 13	1	13:40:30	5,090	1,263	0	0	0.027	0.018	0.022	0.005	0.006	0.005	0.013	0.015	0.014
1 L - 13	2	13:41:30	5,090	1,263	0	0	0.026	0.019	0.023	0.005	0.006	0.005	0.013	0.015	0.014
1 L - 13	4	13:43:30	5,090	1,263	0	0	0.027	0.019	0.023	0.005	0.006	0.005	0.013	0.015	0.014
1 L - 13	8	13:47:30	5,090	1,263	0	0	0.030	0.021	0.025	0.005	0.006	0.006	0.013	0.015	0.014
1 L - 14	1	13:51:00	5,520	1,371	0	0	0.035	0.025	0.030	0.006	0.008	0.007	0.016	0.018	0.017
1 L - 14	2	13:52:00	5,520	1,371	0	0	0.036	0.026	0.031	0.006	0.008	0.007	0.016	0.018	0.017
1 L - 14	4	13:54:00	5,520	1,371	0	0	0.035	0.026	0.031	0.006	0.008	0.007	0.016	0.018	0.017
1 L - 14	8	13:58:00	5,520	1,371	0	0	0.037	0.026	0.031	0.007	0.008	0.007	0.016	0.018	0.017
1 L - 15	1	14:02:00	5,930	1,474	0	0	0.040	0.031	0.035	0.007	0.008	0.008	0.018	0.019	0.019
1 L - 15	2	14:03:00	5,930	1,474	0	0	0.041	0.031	0.036	0.007	0.008	0.008	0.018	0.020	0.019
1 L - 15	4	14:05:00	5,930	1,474	0	0	0.042	0.031	0.036	0.007	0.008	0.008	0.018	0.020	0.019
1 L - 15	8	14:09:00	5,930	1,474	0	0	0.044	0.032	0.038	0.008	0.008	0.008	0.018	0.020	0.019
1 L - 16	1	14:11:30	6,320	1,571	0	0	0.047	0.035	0.041	0.008	0.009	0.009	0.019	0.021	0.020
1 L - 16	2	14:12:30	6,320	1,571	0	0	0.047	0.036	0.042	0.008	0.009	0.009	0.019	0.021	0.020
1 L - 16	4	14:14:30	6,320	1,571	0	0	0.048	0.038	0.043	0.008	0.009	0.009	0.019	0.021	0.020
1 L - 16	8	14:18:30	6,320	1,571	0	0	0.050	0.038	0.044	0.008	0.009	0.009	0.020	0.021	0.020
1 L - 17	1	14:23:00	6,730	1,674	0	0	0.057	0.045	0.051	0.009	0.010	0.010	0.022	0.023	0.022
1 L - 17	2	14:24:00	6,730	1,674	0	0	0.059	0.046	0.052	0.009	0.010	0.010	0.022	0.023	0.022
1 L - 17	4	14:26:00	6,730	1,674	0	0	0.059	0.048	0.053	0.009	0.010	0.010	0.022	0.023	0.023
1 L - 17	8	14:30:00	6,730	1,674	0	0	0.061	0.048	0.055	0.010	0.011	0.010	0.022	0.023	0.023
1 L - 18	1	14:34:00	7,130	1,774	0	0	0.068	0.055	0.061	0.010	0.011	0.011	0.023	0.025	0.024
1 L - 18	2	14:35:00	7,130	1,774	0	0	0.068	0.057	0.062	0.010	0.011	0.011	0.024	0.025	0.024
1 L - 18	4	14:37:00	7,130	1,774	0	0	0.070	0.059	0.064	0.010	0.012	0.011	0.024	0.025	0.024
1 L - 18	8	14:41:00	7,130	1,774	0	0	0.074	0.060	0.067	0.011	0.011	0.011	0.024	0.025	0.025
1 L - 19	1	14:45:30	7,530	1,874	0	0	0.080	0.067	0.073	0.011	0.012	0.012	0.025	0.027	0.026
1 L - 19	2	14:46:30	7,530	1,874	0	0	0.089	0.062	0.075	0.012	0.012	0.012	0.026	0.027	0.026
1 L - 19	4	14:48:30	7,530	1,874	0	0	0.085	0.072	0.078	0.012	0.012	0.012	0.026	0.027	0.027
1 L - 19	8	14:52:30	7,530	1,874	0	0	0.090	0.070	0.08						



Upward Top of Shaft Movement and Shaft Compression
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Top of Shaft			Upper Compression Telltales			Embedded Compression Telltales		
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	A - 92244 (in)	C - 282439 (in)	Average (in)	A - 81926 (in)	C - 84453 (in)	Average (in)	1A - 1301686 (in)	1C - 1301687 (in)	Average (in)
1 U - 1	1	14:55:30	5,550	1,378	0	0	0.083	0.066	0.074	0.012	0.013	0.012	0.023	0.027	0.025
1 U - 1	2	14:56:30	5,550	1,378	0	0	0.082	0.071	0.077	0.012	0.013	0.012	0.023	0.027	0.025
1 U - 1	4	14:58:30	5,550	1,378	0	0	0.082	0.072	0.077	0.012	0.013	0.012	0.023	0.026	0.025
1 U - 2	1	15:02:00	3,740	925	0	0	0.077	0.064	0.071	0.011	0.013	0.012	0.019	0.022	0.020
1 U - 2	2	15:03:00	3,740	925	0	0	0.079	0.065	0.072	0.011	0.013	0.012	0.019	0.021	0.020
1 U - 2	4	15:05:00	3,740	925	0	0	0.078	0.066	0.072	0.011	0.013	0.012	0.019	0.021	0.020
1 U - 3	1	15:10:00	1,910	467	0	0	0.070	0.058	0.064	0.010	0.011	0.010	0.013	0.015	0.014
1 U - 3	2	15:11:00	1,910	467	0	0	0.069	0.057	0.063	0.010	0.011	0.010	0.013	0.015	0.014
1 U - 3	4	15:13:00	1,910	467	0	0	0.076	0.064	0.070	0.010	0.011	0.010	0.013	0.015	0.014
1 U - 4	1	15:18:30	0	0	0	0	0.055	0.043	0.049	0.007	0.009	0.008	0.007	0.008	0.007
1 U - 4	2	15:19:30	0	0	0	0	0.055	0.042	0.048	0.007	0.009	0.008	0.007	0.007	0.007
1 U - 4	4	15:21:30	0	0	0	0	0.055	0.042	0.048	0.007	0.009	0.008	0.007	0.007	0.007
1 U - 4	8	15:25:30	0	0	0	0	0.057	0.045	0.051	0.007	0.008	0.008	0.006	0.007	0.007
2 L - 1	1	15:46:00	0	0	380	83	0.053	0.039	0.046	0.007	0.008	0.007	0.006	0.007	0.007
2 L - 1	2	15:47:00	0	0	380	83	0.053	0.039	0.046	0.007	0.008	0.007	0.006	0.007	0.007
2 L - 1	4	15:49:00	0	0	380	83	0.055	0.040	0.047	0.007	0.007	0.007	0.006	0.007	0.007
2 L - 1	8	15:53:00	0	0	380	83	0.053	0.038	0.045	0.007	0.007	0.007	0.006	0.007	0.007
2 L - 2	1	15:55:30	0	0	770	181	0.053	0.039	0.046	0.007	0.008	0.007	0.006	0.007	0.007
2 L - 2	2	15:56:30	0	0	770	181	0.053	0.038	0.045	0.007	0.007	0.007	0.006	0.007	0.007
2 L - 2	4	15:58:30	0	0	770	181	0.055	0.038	0.046	0.006	0.007	0.007	0.006	0.007	0.007
2 L - 2	8	16:02:30	0	0	770	181	0.053	0.038	0.045	0.006	0.007	0.007	0.006	0.007	0.007
2 L - 3	1	16:05:00	0	0	1,200	289	0.053	0.038	0.045	0.006	0.007	0.007	0.006	0.007	0.007
2 L - 3	2	16:06:00	0	0	1,200	289	0.053	0.039	0.046	0.006	0.008	0.007	0.006	0.007	0.007
2 L - 3	4	16:08:00	0	0	1,200	289	0.054	0.039	0.047	0.006	0.008	0.007	0.006	0.007	0.007
2 L - 3	8	16:12:00	0	0	1,200	289	0.054	0.040	0.047	0.006	0.008	0.007	0.006	0.007	0.006
2 L - 4	1	16:15:00	0	0	1,570	382	0.055	0.041	0.048	0.006	0.008	0.007	0.006	0.006	0.006
2 L - 4	2	16:16:00	0	0	1,570	382	0.055	0.041	0.048	0.006	0.008	0.007	0.006	0.006	0.006
2 L - 4	4	16:18:00	0	0	1,570	382	0.055	0.040	0.047	0.006	0.008	0.007	0.006	0.006	0.006
2 L - 4	8	16:22:00	0	0	1,570	382	0.056	0.040	0.048	0.006	0.007	0.007	0.006	0.006	0.006
2 L - 5	1	16:25:30	0	0	1,970	482	0.059	0.042	0.050	0.006	0.008	0.007	0.007	0.007	0.007
2 L - 5	2	16:26:30	0	0	1,970	482	0.057	0.043	0.050	0.006	0.008	0.007	0.007	0.007	0.007
2 L - 5	4	16:28:30	0	0	1,970	482	0.058	0.042	0.050	0.006	0.007	0.007	0.007	0.007	0.007
2 L - 5	8	16:32:30	0	0	1,970	482	0.058	0.042	0.050	0.006	0.007	0.007	0.007	0.007	0.007
2 L - 6	1	16:35:30	0	0	2,370	582	0.059	0.044	0.051	0.006	0.008	0.007	0.008	0.007	0.008
2 L - 6	2	16:36:30	0	0	2,370	582	0.060	0.045	0.053	0.006	0.008	0.007	0.008	0.007	0.008
2 L - 6	4	16:38:30	0	0	2,370	582	0.061	0.045	0.053	0.006	0.007	0.007	0.008	0.007	0.008
2 L - 6	8	16:42:30	0	0	2,370	582	0.061	0.045	0.053	0.006	0.011	0.009	0.008	0.007	0.008
2 L - 7	1	16:45:00	0	0	2,790	687	0.064	0.049	0.056	0.007	0.009	0.008	0.009	0.007	0.008
2 L - 7	2	16:46:00	0	0	2,790	687	0.064	0.050	0.057	0.007	0.008	0.008	0.009	0.007	0.008
2 L - 7	4	16:48:00	0	0	2,790	687	0.064	0.048	0.056	0.007	0.008	0.008	0.009	0.007	0.008
2 L - 7	8	16:52:00	0	0	2,790	687	0.065	0.049	0.057	0.007	0.008	0.008	0.009	0.007	0.008
2 L - 8	1	16:55:30	0	0	3,180	785	0.068	0.053	0.060	0.008	0.010	0.009	0.010	0.007	0.008
2 L - 8	2	16:56:30	0	0	3,180	785	0.068	0.053	0.060	0.008	0.010	0.009	0.010	0.007	0.008
2 L - 8	4	16:58:30	0	0	3,180	785	0.069	0.053	0.061	0.008	0.009	0.008	0.010	0.007	0.008
2 L - 8	8	17:02:30	0	0	3,180	785	0.069	0.054	0.061	0.008	0.009	0.008	0.010	0.007	0.008
2 L - 9	1	17:05:30	0	0	3,600	891	0.075	0.059	0.067	0.009	0.011	0.010	0.010	0.008	0.009
2 L - 9	2	17:06:30	0	0	3,600	891	0.075	0.060	0.067	0.009	0.011	0.010	0.010	0.008	0.009
2 L - 9	4	17:08:30	0	0	3,600	891	0.078	0.062	0.070	0.009	0.010	0.010	0.010	0.008	0.009
2 L - 9	8	17:12:30	0	0	3,600	891	0.077	0.060	0.068	0.009	0.011	0.010	0.010	0.008	0.009
2 L - 10	1	17:15:30	0	0	3,990	988	0.084	0.068	0.076	0.010	0.012	0.011	0.011	0.008	0.010
2 L - 10	2	17:16:30	0	0	3,990	988	0.085	0.069	0.077	0.010	0.012	0.011	0.011	0.008	0.010
2 L - 10	4	17:18:30	0	0	3,990	988	0.086	0.070	0.078	0.010	0.012	0.011	0.011	0.008	0.010
2 L - 10	8	17:22:30	0	0	3,990	988	0.087	0.070	0.078	0.010	0.011	0.011	0.011	0.008	0.010
2 L - 11	1	17:26:00	0	22	4,400	1,091	0.095	0.078	0.087	0.010	0.013	0.012	0.012	0.009	0.010
2 L - 11	2	17:27:00	0	25	4,400	1,091	0.097	0.080	0.088	0.010	0.013	0.012	0.012	0.009	0.010
2 L - 11	4	17:29:00	0	33	4,400	1,091	0.098	0.082	0.090	0.011	0.013	0.012	0.012	0.009	0.010
2 L - 11	8	17:33:00	0	36	4,400	1,091	0.100	0.084	0.092	0.011	0.012	0.011	0.012	0.009	0.010
2 L - 12	1	17:36:00	0	47	4,790	1,189	0.111	0.094	0.103	0.011	0.014	0.012	0.012	0.010	0.011
2 L - 12	2	17:37:00	0	51	4,790	1,189	0.112	0.096	0.104	0.011	0.014	0.013	0.012	0.010	0.011
2 L - 12	4	17:39:00	0	54	4,790	1,189	0.114	0.098	0.106	0.011	0.014	0.012	0.012	0.010	0.011
2 L - 12	8	17:43:00	0	65	4,790	1,189	0.118	0.100	0.109	0.011	0.013	0.012	0.012	0.010	0.011
2 L - 13	1	17:45:30	0	76	5,160	1,282	0.125	0.110	0.118	0.011	0.013	0.012	0.013	0.011	0.012
2 L - 13	2	17:46:30	0	80	5,160	1,282	0.128	0.112	0.120	0.011	0.013	0.012	0.013	0.011	0.012
2 L - 13	4	17:48:30	0	87	5,160	1,282	0.129	0.113	0.121	0.011	0.013	0.012	0.013	0.011	0.012
2 L - 13	8	17:52:30	0	87	5,160	1,282	0.134	0.117	0.126	0.011	0.012	0.012	0.013	0.011	0.012
2 L - 14	1	17:54:30	0	102	5,570	1,384	0.144	0.126	0.135	0.011	0.013	0.012	0.014	0.011	0.013
2 L - 14	2	17:55:30	0	109	5,570	1,384	0.148	0.129	0.139	0.011	0.013	0.012	0.014	0.011	0.013
2 L - 14	4	17:57:30	0	105	5,570	1,384	0.152	0.133	0.142	0.011	0.013	0.012	0.014	0.011	0.013
2 L - 14	8	18:01:30	0	105	5,570	1,384	0.155	0.138	0.147	0.012	0.012	0.012	0.014	0.011	0.013



Upward Top of Shaft Movement and Shaft Compression
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Top of Shaft			Upper Compression Telltales			Embedded Compression Telltales		
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	A - 92244 (in)	C - 282439 (in)	Average (in)	A - 81926 (in)	C - 84453 (in)	Average (in)	1A - 1301686 (in)	1C - 1301687 (in)	Average (in)
2 L - 15	1	18:04:00	0	131	6,020	1,497	0.171	0.153	0.162	0.012	0.014	0.013	0.015	0.012	0.013
2 L - 15	2	18:05:00	0	131	6,020	1,497	0.174	0.156	0.165	0.012	0.014	0.013	0.015	0.012	0.013
2 L - 15	4	18:07:00	0	134	6,020	1,497	0.178	0.160	0.169	0.012	0.014	0.013	0.015	0.012	0.013
2 L - 15	8	18:11:00	0	138	6,020	1,497	0.184	0.167	0.176	0.012	0.014	0.013	0.015	0.012	0.013
2 L - 16	1	18:13:00	0	141	6,420	1,597	0.198	0.181	0.190	0.012	0.014	0.013	0.015	0.013	0.014
2 L - 16	2	18:14:00	0	141	6,420	1,597	0.202	0.185	0.193	0.012	0.015	0.014	0.016	0.013	0.014
2 L - 16	4	18:16:00	0	145	6,420	1,597	0.207	0.189	0.198	0.013	0.015	0.014	0.015	0.013	0.014
2 L - 16	8	18:20:00	0	149	6,420	1,597	0.213	0.193	0.203	0.012	0.014	0.013	0.015	0.013	0.014
2 L - 17	1	18:22:30	0	167	6,840	1,703	0.226	0.209	0.217	0.013	0.017	0.015	0.016	0.014	0.015
2 L - 17	2	18:23:30	0	167	6,840	1,703	0.231	0.212	0.222	0.013	0.015	0.014	0.016	0.013	0.015
2 L - 17	4	18:25:30	0	160	6,840	1,703	0.237	0.218	0.228	0.013	0.017	0.015	0.016	0.013	0.015
2 L - 17	8	18:29:30	0	163	6,840	1,703	0.241	0.224	0.232	0.013	0.016	0.015	0.016	0.014	0.015
2 L - 18	1	18:31:30	0	174	7,220	1,798	0.256	0.239	0.248	0.014	0.015	0.014	0.017	0.014	0.016
2 L - 18	2	18:32:30	0	181	7,220	1,798	0.260	0.244	0.252	0.014	0.015	0.014	0.017	0.014	0.016
2 L - 18	4	18:34:30	0	167	7,220	1,798	0.268	0.249	0.259	0.014	0.017	0.016	0.017	0.014	0.016
2 L - 18	8	18:38:30	0	185	7,220	1,798	0.274	0.256	0.265	0.014	0.017	0.016	0.017	0.014	0.016
2 L - 19	1	18:40:30	0	192	7,620	1,898	0.291	0.273	0.282	0.014	0.015	0.015	0.018	0.015	0.016
2 L - 19	2	18:41:30	0	192	7,620	1,898	0.296	0.278	0.287	0.014	0.017	0.016	0.018	0.015	0.016
2 L - 19	4	18:43:30	0	196	7,620	1,898	0.303	0.286	0.294	0.014	0.018	0.016	0.018	0.015	0.016
2 L - 19	8	18:47:30	0	196	7,620	1,898	0.314	0.296	0.305	0.015	0.018	0.016	0.018	0.015	0.016
2 L - 20	1	18:49:30	0	196	8,000	1,994	0.340	0.320	0.330	0.015	0.015	0.015	0.018	0.016	0.017
2 L - 20	2	18:50:30	0	196	8,000	1,994	0.346	0.327	0.337	0.015	0.016	0.016	0.018	0.016	0.017
2 L - 20	4	18:52:30	0	203	8,000	1,994	0.355	0.337	0.346	0.015	0.017	0.016	0.018	0.016	0.017
2 L - 20	8	18:56:30	0	203	8,000	1,994	0.370	0.351	0.360	0.015	0.017	0.016	0.018	0.016	0.017
2 L - 21	1	18:58:30	0	214	8,410	2,096	0.396	0.376	0.386	0.016	0.018	0.017	0.019	0.016	0.018
2 L - 21	2	18:59:30	0	221	8,410	2,096	0.407	0.388	0.398	0.016	0.017	0.016	0.019	0.016	0.018
2 L - 21	4	19:01:30	0	218	8,410	2,096	0.428	0.408	0.418	0.016	0.018	0.017	0.019	0.016	0.018
2 L - 21	8	19:05:30	0	221	8,410	2,096	0.459	0.438	0.448	0.016	0.016	0.016	0.019	0.016	0.018
2 L - 22	1	19:08:00	0	232	8,790	2,192	0.506	0.486	0.496	0.017	0.018	0.017	0.020	0.017	0.018
2 L - 22	2	19:09:00	0	247	8,790	2,192	0.517	0.498	0.507	0.017	0.019	0.018	0.020	0.017	0.019
2 L - 22	4	19:11:00	0	243	8,790	2,192	0.574	0.553	0.563	0.016	0.022	0.019	0.021	0.016	0.019
2 L - 22	8	19:15:00	0	239	8,790	2,192	0.705	0.684	0.695	0.016	0.027	0.021	0.021	0.016	0.019
2 L - 23	1	19:17:00	0	290	9,260	2,309	0.894	0.874	0.884	0.016	0.029	0.023	0.022	0.016	0.019
2 L - 23	2	19:18:00	0	297	9,260	2,309	1.000	0.978	0.989	0.017	0.029	0.023	0.022	0.017	0.019
2 L - 23	4	19:20:00	0	284	9,260	2,309	1.158	1.137	1.148	0.018	0.030	0.024	0.022	0.017	0.019
2 L - 23	8	19:24:00	0	272	9,260	2,309	1.348	1.326	1.337	0.020	0.031	0.026	0.022	0.017	0.019
2 U - 1	1	19:28:30	0	196	6,910	1,720	1.369	1.348	1.359	0.017	0.028	0.023	0.018	0.013	0.016
2 U - 1	2	19:29:30	0	196	6,910	1,720	1.368	1.347	1.358	0.017	0.028	0.023	0.018	0.013	0.016
2 U - 1	4	19:31:30	0	196	6,910	1,720	1.368	1.348	1.358	0.017	0.028	0.022	0.018	0.013	0.016
2 U - 2	1	19:34:00	0	134	4,590	1,139	1.331	1.312	1.322	0.011	0.020	0.015	0.013	0.009	0.011
2 U - 2	2	19:35:00	0	127	4,590	1,139	1.331	1.311	1.321	0.010	0.020	0.015	0.013	0.009	0.011
2 U - 2	4	19:37:00	0	127	4,590	1,139	1.330	1.310	1.320	0.010	0.020	0.015	0.013	0.009	0.011
2 U - 3	1	19:39:30	0	47	2,290	562	1.264	1.245	1.255	0.004	0.014	0.009	0.008	0.004	0.006
2 U - 3	2	19:40:30	0	47	2,290	562	1.261	1.241	1.251	0.004	0.013	0.009	0.008	0.004	0.006
2 U - 3	4	19:42:30	0	40	2,290	562	1.258	1.240	1.249	0.004	0.013	0.009	0.008	0.004	0.006
2 U - 4	1	19:46:30	0	0	10	-9	1.094	1.075	1.085	-0.001	0.010	0.004	0.001	0.001	0.001
2 U - 4	2	19:47:30	0	0	10	-9	1.088	1.069	1.079	-0.001	0.010	0.004	0.001	0.001	0.001
2 U - 4	4	19:49:30	0	0	10	-9	1.082	1.061	1.072	-0.001	0.009	0.004	0.001	0.001	0.001
2 U - 4	8	19:53:30	0	0	10	-9	1.075	1.054	1.065	-0.001	0.009	0.004	0.001	0.001	0.001
3 L - 1	1	19:58:00	1,130	272	1,130	271	1.083	1.060	1.072	-0.001	0.010	0.005	0.004	0.004	0.004
3 L - 1	2	19:59:00	1,130	272	1,130	271	1.081	1.062	1.072	0.000	0.010	0.005	0.004	0.004	0.004
3 L - 2	1	20:01:00	2,060	505	2,060	504	1.100	1.078	1.089	0.003	0.013	0.008	0.008	0.006	0.007
3 L - 2	2	20:02:00	2,060	505	2,060	504	1.100	1.078	1.089	0.003	0.012	0.007	0.008	0.006	0.007
3 L - 3	1	20:04:00	3,090	763	3,090	763	1.129	1.108	1.119	0.005	0.015	0.010	0.012	0.010	0.011
3 L - 3	2	20:05:00	3,090	763	3,090	763	1.132	1.108	1.120	0.005	0.015	0.010	0.012	0.010	0.011
3 L - 4	1	20:07:30	4,010	993	4,010	993	1.173	1.152	1.163	0.008	0.016	0.012	0.016	0.014	0.015
3 L - 4	2	20:08:30	4,010	993	4,010	993	1.174	1.158	1.166	0.008	0.016	0.012	0.016	0.014	0.015
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	1.226	1.210	1.218	0.010	0.022	0.016	0.021	0.018	0.019
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	1.230	1.214	1.222	0.010	0.021	0.016	0.021	0.018	0.020
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	1.284	1.258	1.271	0.012	0.023	0.017	0.024	0.022	0.023
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	1.292	1.266	1.279	0.012	0.023	0.018	0.025	0.022	0.023
3 U - 1	1	20:20:00	0	0	0	0	1.258	1.232	1.245	-0.001	0.010	0.004	0.003	0.003	0.003
3 U - 1	2	20:21:00	0	0	0	0	1.258	1.232	1.245	-0.001	0.010	0.004	0.003	0.003	0.003

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Lower O-cell Expansion
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Lower O-cell Expansion				
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	1A - 1209158 (in)	1B - 1209159 (in)	1C - 1209160 (in)	1D - 1209161 (in)	Average (in)
1 L - 0	-	11:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 1	1	11:45:00	350	77	0	0	-0.001	-0.001	-0.002	0.000	-0.001
1 L - 1	2	11:46:00	350	77	0	0	-0.001	-0.001	-0.002	0.000	-0.001
1 L - 1	4	11:48:00	350	77	0	0	-0.001	-0.001	-0.002	0.001	-0.001
1 L - 1	8	11:52:00	350	77	0	0	-0.001	-0.001	-0.002	0.001	-0.001
1 L - 2	1	11:54:00	720	169	0	0	-0.001	-0.001	-0.002	0.008	0.001
1 L - 2	2	11:55:00	720	169	0	0	-0.001	-0.001	-0.002	0.008	0.001
1 L - 2	4	11:57:00	720	169	0	0	-0.001	-0.001	-0.002	0.009	0.001
1 L - 2	8	12:01:00	720	169	0	0	-0.001	-0.001	-0.002	0.009	0.001
1 L - 3	1	12:03:00	1,120	270	0	0	-0.001	-0.001	-0.001	0.017	0.003
1 L - 3	2	12:04:00	1,120	270	0	0	-0.001	-0.001	-0.002	0.018	0.003
1 L - 3	4	12:06:00	1,120	270	0	0	-0.001	-0.001	-0.001	0.019	0.004
1 L - 3	8	12:10:00	1,120	270	0	0	-0.001	-0.002	0.000	0.020	0.004
1 L - 4	1	12:12:00	1,520	370	0	0	0.000	0.001	0.005	0.029	0.009
1 L - 4	2	12:13:00	1,520	370	0	0	0.002	0.001	0.007	0.031	0.010
1 L - 4	4	12:15:00	1,520	370	0	0	0.002	0.001	0.010	0.033	0.011
1 L - 4	8	12:19:00	1,520	370	0	0	0.004	0.003	0.012	0.035	0.014
1 L - 5	1	12:21:30	1,910	467	0	0	0.018	0.016	0.033	0.051	0.028
1 L - 5	2	12:22:30	1,910	467	0	0	0.024	0.016	0.033	0.053	0.031
1 L - 5	4	12:24:30	1,910	467	0	0	0.027	0.017	0.034	0.058	0.034
1 L - 5	8	12:28:30	1,910	467	0	0	0.030	0.018	0.039	0.061	0.037
1 L - 6	1	12:31:00	2,290	562	0	0	0.048	0.039	0.055	0.081	0.055
1 L - 6	2	12:32:00	2,290	562	0	0	0.053	0.043	0.058	0.084	0.060
1 L - 6	4	12:34:00	2,290	562	0	0	0.059	0.044	0.063	0.088	0.064
1 L - 6	8	12:38:00	2,290	562	0	0	0.063	0.055	0.066	0.094	0.069
1 L - 7	1	12:41:00	2,710	668	0	0	0.088	0.070	0.093	0.121	0.093
1 L - 7	2	12:42:00	2,710	668	0	0	0.093	0.079	0.097	0.124	0.098
1 L - 7	4	12:44:00	2,710	668	0	0	0.094	0.083	0.101	0.127	0.101
1 L - 7	8	12:48:00	2,710	668	0	0	0.103	0.086	0.106	0.134	0.107
1 L - 8	1	12:50:00	3,080	760	0	0	0.125	0.114	0.125	0.155	0.130
1 L - 8	2	12:51:00	3,080	760	0	0	0.129	0.121	0.132	0.161	0.136
1 L - 8	4	12:53:00	3,080	760	0	0	0.136	0.125	0.140	0.165	0.141
1 L - 8	8	12:57:00	3,080	760	0	0	0.149	0.136	0.150	0.178	0.153
1 L - 9	1	12:59:00	3,480	860	0	0	0.180	0.169	0.183	0.212	0.186
1 L - 9	2	13:00:00	3,480	860	0	0	0.185	0.175	0.187	0.216	0.191
1 L - 9	4	13:02:00	3,480	860	0	0	0.193	0.185	0.197	0.224	0.200
1 L - 9	8	13:06:00	3,480	860	0	0	0.203	0.197	0.204	0.233	0.209
1 L - 10	1	13:10:00	3,860	955	0	0	0.238	0.235	0.240	0.268	0.245
1 L - 10	2	13:11:00	3,860	955	0	0	0.241	0.237	0.243	0.271	0.248
1 L - 10	4	13:13:00	3,860	955	0	0	0.246	0.245	0.254	0.277	0.255
1 L - 10	8	13:17:00	3,860	955	0	0	0.253	0.250	0.259	0.284	0.261
1 L - 11	1	13:20:00	4,290	1,063	0	0	0.290	0.292	0.299	0.322	0.301
1 L - 11	2	13:21:00	4,290	1,063	0	0	0.297	0.294	0.303	0.327	0.305
1 L - 11	4	13:23:00	4,290	1,063	0	0	0.306	0.301	0.312	0.336	0.314
1 L - 11	8	13:27:00	4,290	1,063	0	0	0.320	0.317	0.327	0.348	0.328
1 L - 12	1	13:30:30	4,690	1,163	0	0	0.366	0.362	0.371	0.395	0.374
1 L - 12	2	13:31:30	4,690	1,163	0	0	0.372	0.369	0.380	0.403	0.381
1 L - 12	4	13:33:30	4,690	1,163	0	0	0.385	0.378	0.391	0.413	0.392
1 L - 12	8	13:37:30	4,690	1,163	0	0	0.394	0.390	0.405	0.427	0.404
1 L - 13	1	13:40:30	5,090	1,263	0	0	0.460	0.450	0.468	0.488	0.467
1 L - 13	2	13:41:30	5,090	1,263	0	0	0.472	0.462	0.477	0.498	0.477
1 L - 13	4	13:43:30	5,090	1,263	0	0	0.488	0.480	0.492	0.513	0.493
1 L - 13	8	13:47:30	5,090	1,263	0	0	0.511	0.501	0.517	0.538	0.517
1 L - 14	1	13:51:00	5,520	1,371	0	0	0.677	0.669	0.683	0.705	0.684
1 L - 14	2	13:52:00	5,520	1,371	0	0	0.704	0.695	0.708	0.732	0.709
1 L - 14	4	13:54:00	5,520	1,371	0	0	0.728	0.723	0.736	0.756	0.736
1 L - 14	8	13:58:00	5,520	1,371	0	0	0.751	0.748	0.766	0.783	0.762
1 L - 15	1	14:02:00	5,930	1,474	0	0	0.873	0.855	0.884	0.902	0.879
1 L - 15	2	14:03:00	5,930	1,474	0	0	0.890	0.883	0.901	0.923	0.899
1 L - 15	4	14:05:00	5,930	1,474	0	0	0.922	0.905	0.932	0.949	0.927
1 L - 15	8	14:09:00	5,930	1,474	0	0	0.953	0.942	0.963	0.981	0.960
1 L - 16	1	14:11:30	6,320	1,571	0	0	1.078	1.065	1.087	1.108	1.085
1 L - 16	2	14:12:30	6,320	1,571	0	0	1.111	1.097	1.117	1.136	1.115
1 L - 16	4	14:14:30	6,320	1,571	0	0	1.148	1.129	1.153	1.172	1.150
1 L - 16	8	14:18:30	6,320	1,571	0	0	1.192	1.184	1.197	1.221	1.199
1 L - 17	1	14:23:00	6,730	1,674	0	0	1.580	1.566	1.601	1.609	1.589
1 L - 17	2	14:24:00	6,730	1,674	0	0	1.632	1.627	1.655	1.662	1.644
1 L - 17	4	14:26:00	6,730	1,674	0	0	1.700	1.700	1.723	1.728	1.713
1 L - 17	8	14:30:00	6,730	1,674	0	0	1.777	1.768	1.799	1.806	1.788
1 L - 18	1	14:34:00	7,130	1,774	0	0	2.136	2.127	2.161	2.168	2.148
1 L - 18	2	14:35:00	7,130	1,774	0	0	2.199	2.194	2.232	2.235	2.215
1 L - 18	4	14:37:00	7,130	1,774	0	0	2.306	2.300	2.332	2.336	2.319
1 L - 18	8	14:41:00	7,130	1,774	0	0	2.415	2.402	2.439	2.439	2.424
1 L - 19	1	14:45:30	7,530	1,874	0	0	2.864	2.869	2.904	2.897	2.883
1 L - 19	2	14:46:30	7,530	1,874	0	0	2.959	2.973	3.012	2.996	2.985
1 L - 19	4	14:48:30	7,530	1,874	0	0	3.122	3.139	3.177	3.157	3.149
1 L - 19	8	14:52:30	7,530	1,874	0	0	3.271	3.297	3.322	3.299	3.297



Lower O-cell Expansion
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Lower O-cell Expansion				Average (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	1A - 1209158 (in)	1B - 1209159 (in)	1C - 1209160 (in)	1D - 1209161 (in)	
1 U - 1	1	14:55:30	5,550	1,378	0	0	3.290	3.314	3.341	3.267	3.303
1 U - 1	2	14:56:30	5,550	1,378	0	0	3.290	3.314	3.341	3.263	3.302
1 U - 1	4	14:58:30	5,550	1,378	0	0	3.290	3.314	3.340	3.261	3.301
1 U - 2	1	15:02:00	3,740	925	0	0	3.245	3.314	3.244	3.163	3.242
1 U - 2	2	15:03:00	3,740	925	0	0	3.242	3.314	3.235	3.158	3.237
1 U - 2	4	15:05:00	3,740	925	0	0	3.236	3.314	3.229	3.153	3.233
1 U - 3	1	15:10:00	1,910	467	0	0	2.999	3.115	2.995	2.916	3.006
1 U - 3	2	15:11:00	1,910	467	0	0	2.995	3.115	2.992	2.914	3.004
1 U - 3	4	15:13:00	1,910	467	0	0	2.993	3.115	2.988	2.913	3.002
1 U - 4	1	15:18:30	0	0	0	0	2.311	2.411	2.304	2.246	2.318
1 U - 4	2	15:19:30	0	0	0	0	2.288	2.393	2.285	2.229	2.299
1 U - 4	4	15:21:30	0	0	0	0	2.269	2.371	2.265	2.211	2.279
1 U - 4	8	15:25:30	0	0	0	0	2.252	2.350	2.250	2.195	2.262
2 L - 1	1	15:46:00	0	0	380	83	2.231	2.325	2.227	2.173	2.239
2 L - 1	2	15:47:00	0	0	380	83	2.229	2.325	2.227	2.172	2.238
2 L - 1	4	15:49:00	0	0	380	83	2.229	2.325	2.228	2.172	2.238
2 L - 1	8	15:53:00	0	0	380	83	2.227	2.321	2.223	2.170	2.235
2 L - 2	1	15:55:30	0	0	770	181	2.227	2.321	2.223	2.169	2.235
2 L - 2	2	15:56:30	0	0	770	181	2.225	2.321	2.223	2.169	2.235
2 L - 2	4	15:58:30	0	0	770	181	2.225	2.321	2.221	2.168	2.234
2 L - 2	8	16:02:30	0	0	770	181	2.225	2.317	2.222	2.167	2.233
2 L - 3	1	16:05:00	0	0	1,200	289	2.224	2.317	2.222	2.166	2.232
2 L - 3	2	16:06:00	0	0	1,200	289	2.224	2.313	2.220	2.165	2.230
2 L - 3	4	16:08:00	0	0	1,200	289	2.224	2.313	2.220	2.165	2.230
2 L - 3	8	16:12:00	0	0	1,200	289	2.222	2.313	2.220	2.164	2.230
2 L - 4	1	16:15:00	0	0	1,570	382	2.220	2.307	2.216	2.162	2.226
2 L - 4	2	16:16:00	0	0	1,570	382	2.220	2.307	2.216	2.163	2.226
2 L - 4	4	16:18:00	0	0	1,570	382	2.220	2.307	2.217	2.162	2.226
2 L - 4	8	16:22:00	0	0	1,570	382	2.219	2.307	2.212	2.161	2.225
2 L - 5	1	16:25:30	0	0	1,970	482	2.202	2.291	2.197	2.142	2.208
2 L - 5	2	16:26:30	0	0	1,970	482	2.202	2.287	2.194	2.141	2.206
2 L - 5	4	16:28:30	0	0	1,970	482	2.202	2.287	2.196	2.140	2.206
2 L - 5	8	16:32:30	0	0	1,970	482	2.197	2.288	2.196	2.139	2.205
2 L - 6	1	16:35:30	0	0	2,370	582	2.188	2.282	2.186	2.132	2.197
2 L - 6	2	16:36:30	0	0	2,370	582	2.188	2.283	2.187	2.132	2.197
2 L - 6	4	16:38:30	0	0	2,370	582	2.188	2.283	2.187	2.131	2.197
2 L - 6	8	16:42:30	0	0	2,370	582	2.188	2.277	2.185	2.129	2.195
2 L - 7	1	16:45:00	0	0	2,790	687	2.188	2.277	2.182	2.125	2.193
2 L - 7	2	16:46:00	0	0	2,790	687	2.183	2.277	2.181	2.124	2.191
2 L - 7	4	16:48:00	0	0	2,790	687	2.183	2.272	2.181	2.124	2.190
2 L - 7	8	16:52:00	0	0	2,790	687	2.183	2.272	2.178	2.122	2.189
2 L - 8	1	16:55:30	0	0	3,180	785	2.179	2.271	2.174	2.119	2.186
2 L - 8	2	16:56:30	0	0	3,180	785	2.177	2.269	2.175	2.119	2.185
2 L - 8	4	16:58:30	0	0	3,180	785	2.177	2.269	2.172	2.118	2.184
2 L - 8	8	17:02:30	0	0	3,180	785	2.176	2.269	2.172	2.117	2.183
2 L - 9	1	17:05:30	0	0	3,600	891	2.173	2.261	2.170	2.113	2.179
2 L - 9	2	17:06:30	0	0	3,600	891	2.173	2.262	2.170	2.113	2.179
2 L - 9	4	17:08:30	0	0	3,600	891	2.173	2.262	2.164	2.112	2.178
2 L - 9	8	17:12:30	0	0	3,600	891	2.171	2.261	2.165	2.111	2.177
2 L - 10	1	17:15:30	0	0	3,990	988	2.163	2.253	2.161	2.108	2.171
2 L - 10	2	17:16:30	0	0	3,990	988	2.163	2.249	2.161	2.108	2.170
2 L - 10	4	17:18:30	0	0	3,990	988	2.163	2.249	2.158	2.106	2.169
2 L - 10	8	17:22:30	0	0	3,990	988	2.160	2.249	2.158	2.105	2.168
2 L - 11	1	17:26:00	0	22	4,400	1,091	2.160	2.248	2.156	2.102	2.167
2 L - 11	2	17:27:00	0	25	4,400	1,091	2.160	2.249	2.156	2.101	2.166
2 L - 11	4	17:29:00	0	33	4,400	1,091	2.160	2.244	2.155	2.101	2.165
2 L - 11	8	17:33:00	0	36	4,400	1,091	2.154	2.244	2.153	2.099	2.163
2 L - 12	1	17:36:00	0	47	4,790	1,189	2.151	2.238	2.150	2.095	2.158
2 L - 12	2	17:37:00	0	51	4,790	1,189	2.151	2.238	2.150	2.095	2.158
2 L - 12	4	17:39:00	0	54	4,790	1,189	2.149	2.236	2.148	2.094	2.157
2 L - 12	8	17:43:00	0	65	4,790	1,189	2.149	2.237	2.148	2.093	2.157
2 L - 13	1	17:45:30	0	76	5,160	1,282	2.146	2.233	2.145	2.090	2.153
2 L - 13	2	17:46:30	0	80	5,160	1,282	2.146	2.233	2.143	2.089	2.153
2 L - 13	4	17:48:30	0	87	5,160	1,282	2.146	2.233	2.141	2.088	2.152
2 L - 13	8	17:52:30	0	87	5,160	1,282	2.146	2.233	2.141	2.087	2.152
2 L - 14	1	17:54:30	0	102	5,570	1,384	2.144	2.225	2.139	2.084	2.148
2 L - 14	2	17:55:30	0	109	5,570	1,384	2.144	2.225	2.140	2.083	2.148
2 L - 14	4	17:57:30	0	105	5,570	1,384	2.144	2.220	2.136	2.081	2.145
2 L - 14	8	18:01:30	0	105	5,570	1,384	2.136	2.220	2.131	2.080	2.142



Lower O-cell Expansion
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Lower O-cell Expansion				Average (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	1A - 1209158 (in)	1B - 1209159 (in)	1C - 1209160 (in)	1D - 1209161 (in)	
2 L - 15	1	18:04:00	0	131	6,020	1,497	2.134	2.217	2.130	2.076	2.139
2 L - 15	2	18:05:00	0	131	6,020	1,497	2.131	2.217	2.129	2.074	2.138
2 L - 15	4	18:07:00	0	134	6,020	1,497	2.130	2.217	2.128	2.074	2.137
2 L - 15	8	18:11:00	0	138	6,020	1,497	2.126	2.214	2.128	2.072	2.135
2 L - 16	1	18:13:00	0	141	6,420	1,597	2.122	2.213	2.120	2.068	2.131
2 L - 16	2	18:14:00	0	141	6,420	1,597	2.121	2.212	2.120	2.067	2.130
2 L - 16	4	18:16:00	0	145	6,420	1,597	2.120	2.209	2.120	2.065	2.129
2 L - 16	8	18:20:00	0	149	6,420	1,597	2.119	2.209	2.117	2.064	2.127
2 L - 17	1	18:22:30	0	167	6,840	1,703	2.119	2.206	2.114	2.060	2.125
2 L - 17	2	18:23:30	0	167	6,840	1,703	2.119	2.206	2.111	2.059	2.124
2 L - 17	4	18:25:30	0	160	6,840	1,703	2.117	2.205	2.112	2.058	2.123
2 L - 17	8	18:29:30	0	163	6,840	1,703	2.111	2.202	2.105	2.055	2.118
2 L - 18	1	18:31:30	0	174	7,220	1,798	2.111	2.196	2.107	2.052	2.116
2 L - 18	2	18:32:30	0	181	7,220	1,798	2.108	2.196	2.107	2.051	2.116
2 L - 18	4	18:34:30	0	167	7,220	1,798	2.108	2.197	2.103	2.049	2.114
2 L - 18	8	18:38:30	0	185	7,220	1,798	2.108	2.197	2.103	2.048	2.114
2 L - 19	1	18:40:30	0	192	7,620	1,898	2.102	2.186	2.098	2.044	2.108
2 L - 19	2	18:41:30	0	192	7,620	1,898	2.102	2.187	2.096	2.043	2.107
2 L - 19	4	18:43:30	0	196	7,620	1,898	2.102	2.183	2.097	2.042	2.106
2 L - 19	8	18:47:30	0	196	7,620	1,898	2.099	2.183	2.093	2.039	2.104
2 L - 20	1	18:49:30	0	196	8,000	1,994	2.091	2.178	2.088	2.035	2.098
2 L - 20	2	18:50:30	0	196	8,000	1,994	2.091	2.178	2.088	2.034	2.098
2 L - 20	4	18:52:30	0	203	8,000	1,994	2.091	2.175	2.085	2.032	2.096
2 L - 20	8	18:56:30	0	203	8,000	1,994	2.088	2.175	2.082	2.031	2.094
2 L - 21	1	18:58:30	0	214	8,410	2,096	2.085	2.174	2.078	2.026	2.091
2 L - 21	2	18:59:30	0	221	8,410	2,096	2.085	2.174	2.076	2.025	2.090
2 L - 21	4	19:01:30	0	218	8,410	2,096	2.079	2.165	2.075	2.023	2.086
2 L - 21	8	19:05:30	0	221	8,410	2,096	2.079	2.163	2.073	2.020	2.084
2 L - 22	1	19:08:00	0	232	8,790	2,192	2.077	2.160	2.069	2.017	2.081
2 L - 22	2	19:09:00	0	247	8,790	2,192	2.077	2.156	2.070	2.015	2.080
2 L - 22	4	19:11:00	0	243	8,790	2,192	2.070	2.156	2.066	2.013	2.076
2 L - 22	8	19:15:00	0	239	8,790	2,192	2.067	2.150	2.063	2.010	2.073
2 L - 23	1	19:17:00	0	290	9,260	2,309	2.061	2.146	2.061	2.005	2.068
2 L - 23	2	19:18:00	0	297	9,260	2,309	2.058	2.146	2.057	2.004	2.066
2 L - 23	4	19:20:00	0	284	9,260	2,309	2.057	2.141	2.054	2.000	2.063
2 L - 23	8	19:24:00	0	272	9,260	2,309	2.052	2.141	2.050	1.996	2.060
2 U - 1	1	19:28:30	0	196	6,910	1,720	2.052	2.142	2.050	1.997	2.060
2 U - 1	2	19:29:30	0	196	6,910	1,720	2.052	2.142	2.050	1.997	2.060
2 U - 1	4	19:31:30	0	196	6,910	1,720	2.052	2.142	2.050	1.997	2.060
2 U - 2	1	19:34:00	0	134	4,590	1,139	2.052	2.141	2.050	2.004	2.062
2 U - 2	2	19:35:00	0	127	4,590	1,139	2.052	2.141	2.050	2.005	2.062
2 U - 2	4	19:37:00	0	127	4,590	1,139	2.052	2.141	2.050	2.005	2.062
2 U - 3	1	19:39:30	0	47	2,290	562	2.052	2.141	2.050	2.015	2.065
2 U - 3	2	19:40:30	0	47	2,290	562	2.052	2.142	2.051	2.015	2.065
2 U - 3	4	19:42:30	0	40	2,290	562	2.052	2.141	2.051	2.016	2.065
2 U - 4	1	19:46:30	0	0	10	-9	2.052	2.142	2.051	2.028	2.068
2 U - 4	2	19:47:30	0	0	10	-9	2.052	2.142	2.051	2.029	2.069
2 U - 4	4	19:49:30	0	0	10	-9	2.052	2.142	2.051	2.029	2.069
2 U - 4	8	19:53:30	0	0	10	-9	2.052	2.141	2.051	2.029	2.068
3 L - 1	1	19:58:00	1,130	272	1,130	271	2.052	2.140	2.059	2.054	2.076
3 L - 1	2	19:59:00	1,130	272	1,130	271	2.052	2.140	2.060	2.055	2.077
3 L - 2	1	20:01:00	2,060	505	2,060	504	2.068	2.140	2.102	2.090	2.100
3 L - 2	2	20:02:00	2,060	505	2,060	504	2.068	2.140	2.104	2.092	2.101
3 L - 3	1	20:04:00	3,090	763	3,090	763	2.128	2.142	2.165	2.157	2.148
3 L - 3	2	20:05:00	3,090	763	3,090	763	2.134	2.143	2.172	2.162	2.152
3 L - 4	1	20:07:30	4,010	993	4,010	993	2.249	2.272	2.291	2.283	2.274
3 L - 4	2	20:08:30	4,010	993	4,010	993	2.259	2.279	2.297	2.288	2.281
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	2.482	2.500	2.525	2.515	2.505
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	2.501	2.521	2.543	2.532	2.524
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	2.757	2.782	2.808	2.792	2.785
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	2.792	2.811	2.845	2.825	2.818
3 U - 1	1	20:20:00	0	0	0	0	2.171	2.270	2.168	2.114	2.181
3 U - 1	2	20:21:00	0	0	0	0	2.160	2.256	2.160	2.104	2.170

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Upper O-cell Expansion
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Upper O-cell Expansion				
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	2A - 1209162 (in)	2B - 1209163 (in)	2C - 1233788 (in)	2D - 1233789 (in)	Average (in)
1 L - 0	-	11:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 1	1	11:45:00	350	77	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 1	2	11:46:00	350	77	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 1	4	11:48:00	350	77	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 1	8	11:52:00	350	77	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 2	1	11:54:00	720	169	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 2	2	11:55:00	720	169	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 2	4	11:57:00	720	169	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 2	8	12:01:00	720	169	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 3	1	12:03:00	1,120	270	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 3	2	12:04:00	1,120	270	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 3	4	12:06:00	1,120	270	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 3	8	12:10:00	1,120	270	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 4	1	12:12:00	1,520	370	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 4	2	12:13:00	1,520	370	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 4	4	12:15:00	1,520	370	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 4	8	12:19:00	1,520	370	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 5	1	12:21:30	1,910	467	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 5	2	12:22:30	1,910	467	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 5	4	12:24:30	1,910	467	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 5	8	12:28:30	1,910	467	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 6	1	12:31:00	2,290	562	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 6	2	12:32:00	2,290	562	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 6	4	12:34:00	2,290	562	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 6	8	12:38:00	2,290	562	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 7	1	12:41:00	2,710	668	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 7	2	12:42:00	2,710	668	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 7	4	12:44:00	2,710	668	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 7	8	12:48:00	2,710	668	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 8	1	12:50:00	3,080	760	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 8	2	12:51:00	3,080	760	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 8	4	12:53:00	3,080	760	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 8	8	12:57:00	3,080	760	0	0	0.000	0.000	0.000	0.000	0.000
1 L - 9	1	12:59:00	3,480	860	0	0	0.000	-0.001	0.000	-0.001	-0.001
1 L - 9	2	13:00:00	3,480	860	0	0	0.000	-0.001	0.000	0.000	0.000
1 L - 9	4	13:02:00	3,480	860	0	0	0.000	-0.001	-0.001	-0.001	-0.001
1 L - 9	8	13:06:00	3,480	860	0	0	-0.001	0.000	0.000	-0.001	-0.001
1 L - 10	1	13:10:00	3,860	955	0	0	-0.001	0.000	0.000	-0.001	-0.001
1 L - 10	2	13:11:00	3,860	955	0	0	0.000	-0.001	-0.001	-0.001	-0.001
1 L - 10	4	13:13:00	3,860	955	0	0	0.000	-0.001	0.000	-0.001	-0.001
1 L - 10	8	13:17:00	3,860	955	0	0	0.000	-0.001	0.000	-0.001	-0.001
1 L - 11	1	13:20:00	4,290	1,063	0	0	0.000	0.000	-0.001	-0.001	-0.001
1 L - 11	2	13:21:00	4,290	1,063	0	0	-0.001	-0.001	-0.001	-0.002	-0.001
1 L - 11	4	13:23:00	4,290	1,063	0	0	0.000	0.000	-0.001	-0.002	-0.001
1 L - 11	8	13:27:00	4,290	1,063	0	0	0.000	0.000	-0.001	-0.001	-0.001
1 L - 12	1	13:30:30	4,690	1,163	0	0	0.000	-0.001	-0.001	-0.001	-0.001
1 L - 12	2	13:31:30	4,690	1,163	0	0	0.000	-0.001	0.000	-0.001	-0.001
1 L - 12	4	13:33:30	4,690	1,163	0	0	-0.001	-0.001	-0.001	-0.001	-0.001
1 L - 12	8	13:37:30	4,690	1,163	0	0	0.000	-0.001	-0.001	-0.001	-0.001
1 L - 13	1	13:40:30	5,090	1,263	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 13	2	13:41:30	5,090	1,263	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 13	4	13:43:30	5,090	1,263	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 13	8	13:47:30	5,090	1,263	0	0	-0.001	0.000	-0.001	0.000	-0.001
1 L - 14	1	13:51:00	5,520	1,371	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 14	2	13:52:00	5,520	1,371	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 14	4	13:54:00	5,520	1,371	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 14	8	13:58:00	5,520	1,371	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 15	1	14:02:00	5,930	1,474	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 15	2	14:03:00	5,930	1,474	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 15	4	14:05:00	5,930	1,474	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 15	8	14:09:00	5,930	1,474	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 16	1	14:11:30	6,320	1,571	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 16	2	14:12:30	6,320	1,571	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 16	4	14:14:30	6,320	1,571	0	0	-0.001	-0.001	-0.001	-0.001	-0.001
1 L - 16	8	14:18:30	6,320	1,571	0	0	-0.001	-0.001	-0.001	-0.001	-0.001
1 L - 17	1	14:23:00	6,730	1,674	0	0	-0.001	-0.001	-0.001	-0.001	-0.001
1 L - 17	2	14:24:00	6,730	1,674	0	0	-0.001	-0.001	-0.001	-0.001	-0.001
1 L - 17	4	14:26:00	6,730	1,674	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 17	8	14:30:00	6,730	1,674	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 18	1	14:34:00	7,130	1,774	0	0	-0.001	-0.001	-0.002	0.000	-0.001
1 L - 18	2	14:35:00	7,130	1,774	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 18	4	14:37:00	7,130	1,774	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 L - 18	8	14:41:00	7,130	1,774	0	0	-0.001	-0.001	-0.001	-0.001	-0.001
1 L - 19	1	14:45:30	7,530	1,874	0	0	-0.001	-0.001	-0.002	-0.001	-0.001
1 L - 19	2	14:46:30	7,530	1,874	0	0	-0.001	-0.001	-0.002	-0.001	-0.001
1 L - 19	4	14:48:30	7,530	1,874	0	0	-0.001	-0.002	-0.002	-0.001	-0.001
1 L - 19	8	14:52:30	7,530	1,874	0	0	-0.001	-0.001	-0.002	-0.001	-0.001



Upper O-cell Expansion
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Upper O-cell Expansion				Average (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	2A - 1209162 (in)	2B - 1209163 (in)	2C - 1233788 (in)	2D - 1233789 (in)	
1 U - 1	1	14:55:30	5,550	1,378	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 1	2	14:56:30	5,550	1,378	0	0	-0.001	-0.002	-0.001	0.000	-0.001
1 U - 1	4	14:58:30	5,550	1,378	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 2	1	15:02:00	3,740	925	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 2	2	15:03:00	3,740	925	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 2	4	15:05:00	3,740	925	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 3	1	15:10:00	1,910	467	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 3	2	15:11:00	1,910	467	0	0	-0.001	-0.001	-0.001	0.000	-0.001
1 U - 3	4	15:13:00	1,910	467	0	0	0.000	-0.001	-0.001	0.000	-0.001
1 U - 4	1	15:18:30	0	0	0	0	0.000	-0.001	0.000	0.000	0.000
1 U - 4	2	15:19:30	0	0	0	0	0.000	-0.001	-0.001	0.000	0.000
1 U - 4	4	15:21:30	0	0	0	0	0.000	-0.001	0.000	0.000	0.000
1 U - 4	8	15:25:30	0	0	0	0	0.000	0.000	0.000	0.000	0.000
2 L - 1	1	15:46:00	0	0	380	83	0.017	0.016	0.016	0.016	0.016
2 L - 1	2	15:47:00	0	0	380	83	0.016	0.016	0.016	0.016	0.016
2 L - 1	4	15:49:00	0	0	380	83	0.016	0.016	0.016	0.016	0.016
2 L - 1	8	15:53:00	0	0	380	83	0.016	0.016	0.016	0.016	0.016
2 L - 2	1	15:55:30	0	0	770	181	0.040	0.038	0.037	0.040	0.039
2 L - 2	2	15:56:30	0	0	770	181	0.040	0.038	0.036	0.039	0.038
2 L - 2	4	15:58:30	0	0	770	181	0.039	0.038	0.036	0.039	0.038
2 L - 2	8	16:02:30	0	0	770	181	0.039	0.038	0.036	0.039	0.038
2 L - 3	1	16:05:00	0	0	1,200	289	0.076	0.074	0.070	0.076	0.074
2 L - 3	2	16:06:00	0	0	1,200	289	0.077	0.074	0.071	0.077	0.075
2 L - 3	4	16:08:00	0	0	1,200	289	0.077	0.075	0.071	0.078	0.075
2 L - 3	8	16:12:00	0	0	1,200	289	0.077	0.075	0.071	0.077	0.075
2 L - 4	1	16:15:00	0	0	1,570	382	0.118	0.114	0.107	0.117	0.114
2 L - 4	2	16:16:00	0	0	1,570	382	0.119	0.114	0.107	0.117	0.114
2 L - 4	4	16:18:00	0	0	1,570	382	0.120	0.115	0.108	0.118	0.115
2 L - 4	8	16:22:00	0	0	1,570	382	0.120	0.115	0.108	0.118	0.115
2 L - 5	1	16:25:30	0	0	1,970	482	0.195	0.185	0.174	0.186	0.185
2 L - 5	2	16:26:30	0	0	1,970	482	0.197	0.186	0.175	0.188	0.187
2 L - 5	4	16:28:30	0	0	1,970	482	0.199	0.188	0.177	0.189	0.188
2 L - 5	8	16:32:30	0	0	1,970	482	0.200	0.189	0.177	0.190	0.189
2 L - 6	1	16:35:30	0	0	2,370	582	0.250	0.234	0.218	0.236	0.234
2 L - 6	2	16:36:30	0	0	2,370	582	0.252	0.236	0.220	0.238	0.236
2 L - 6	4	16:38:30	0	0	2,370	582	0.254	0.238	0.222	0.239	0.238
2 L - 6	8	16:42:30	0	0	2,370	582	0.256	0.240	0.223	0.241	0.240
2 L - 7	1	16:45:00	0	0	2,790	687	0.299	0.279	0.259	0.282	0.280
2 L - 7	2	16:46:00	0	0	2,790	687	0.302	0.281	0.261	0.284	0.282
2 L - 7	4	16:48:00	0	0	2,790	687	0.304	0.283	0.263	0.286	0.284
2 L - 7	8	16:52:00	0	0	2,790	687	0.307	0.285	0.265	0.288	0.286
2 L - 8	1	16:55:30	0	0	3,180	785	0.337	0.313	0.290	0.318	0.314
2 L - 8	2	16:56:30	0	0	3,180	785	0.339	0.315	0.292	0.320	0.316
2 L - 8	4	16:58:30	0	0	3,180	785	0.342	0.317	0.294	0.322	0.319
2 L - 8	8	17:02:30	0	0	3,180	785	0.346	0.322	0.298	0.326	0.323
2 L - 9	1	17:05:30	0	0	3,600	891	0.376	0.349	0.324	0.357	0.352
2 L - 9	2	17:06:30	0	0	3,600	891	0.379	0.352	0.326	0.360	0.354
2 L - 9	4	17:08:30	0	0	3,600	891	0.382	0.354	0.329	0.363	0.357
2 L - 9	8	17:12:30	0	0	3,600	891	0.386	0.358	0.333	0.367	0.361
2 L - 10	1	17:15:30	0	0	3,990	988	0.410	0.382	0.354	0.393	0.385
2 L - 10	2	17:16:30	0	0	3,990	988	0.413	0.385	0.357	0.396	0.388
2 L - 10	4	17:18:30	0	0	3,990	988	0.417	0.388	0.360	0.400	0.391
2 L - 10	8	17:22:30	0	0	3,990	988	0.421	0.392	0.365	0.404	0.395
2 L - 11	1	17:26:00	0	22	4,400	1,091	0.443	0.413	0.385	0.428	0.417
2 L - 11	2	17:27:00	0	25	4,400	1,091	0.446	0.416	0.388	0.431	0.420
2 L - 11	4	17:29:00	0	33	4,400	1,091	0.450	0.421	0.392	0.436	0.425
2 L - 11	8	17:33:00	0	36	4,400	1,091	0.455	0.425	0.396	0.440	0.429
2 L - 12	1	17:36:00	0	47	4,790	1,189	0.477	0.446	0.416	0.463	0.450
2 L - 12	2	17:37:00	0	51	4,790	1,189	0.479	0.448	0.418	0.465	0.453
2 L - 12	4	17:39:00	0	54	4,790	1,189	0.483	0.453	0.420	0.469	0.456
2 L - 12	8	17:43:00	0	65	4,790	1,189	0.489	0.457	0.426	0.474	0.462
2 L - 13	1	17:45:30	0	76	5,160	1,282	0.505	0.474	0.443	0.492	0.479
2 L - 13	2	17:46:30	0	80	5,160	1,282	0.509	0.478	0.446	0.496	0.482
2 L - 13	4	17:48:30	0	87	5,160	1,282	0.513	0.482	0.450	0.500	0.486
2 L - 13	8	17:52:30	0	87	5,160	1,282	0.519	0.487	0.455	0.505	0.491
2 L - 14	1	17:54:30	0	102	5,570	1,384	0.537	0.505	0.473	0.524	0.509
2 L - 14	2	17:55:30	0	109	5,570	1,384	0.542	0.510	0.478	0.529	0.515
2 L - 14	4	17:57:30	0	105	5,570	1,384	0.548	0.515	0.482	0.534	0.520
2 L - 14	8	18:01:30	0	105	5,570	1,384	0.556	0.523	0.490	0.543	0.528



Upper O-cell Expansion
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Upper O-cell Expansion				Average (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	2A - 1209162 (in)	2B - 1209163 (in)	2C - 1233788 (in)	2D - 1233789 (in)	
2 L - 15	1	18:04:00	0	131	6,020	1,497	0.581	0.549	0.515	0.569	0.554
2 L - 15	2	18:05:00	0	131	6,020	1,497	0.586	0.553	0.520	0.573	0.558
2 L - 15	4	18:07:00	0	134	6,020	1,497	0.592	0.559	0.525	0.579	0.564
2 L - 15	8	18:11:00	0	138	6,020	1,497	0.602	0.569	0.534	0.589	0.574
2 L - 16	1	18:13:00	0	141	6,420	1,597	0.623	0.590	0.555	0.610	0.594
2 L - 16	2	18:14:00	0	141	6,420	1,597	0.628	0.595	0.559	0.616	0.599
2 L - 16	4	18:16:00	0	145	6,420	1,597	0.635	0.601	0.565	0.622	0.606
2 L - 16	8	18:20:00	0	149	6,420	1,597	0.642	0.609	0.572	0.630	0.613
2 L - 17	1	18:22:30	0	167	6,840	1,703	0.666	0.633	0.596	0.653	0.637
2 L - 17	2	18:23:30	0	167	6,840	1,703	0.671	0.638	0.601	0.659	0.642
2 L - 17	4	18:25:30	0	160	6,840	1,703	0.677	0.643	0.607	0.664	0.648
2 L - 17	8	18:29:30	0	163	6,840	1,703	0.688	0.653	0.617	0.673	0.658
2 L - 18	1	18:31:30	0	174	7,220	1,798	0.709	0.675	0.637	0.696	0.679
2 L - 18	2	18:32:30	0	181	7,220	1,798	0.715	0.681	0.643	0.702	0.685
2 L - 18	4	18:34:30	0	167	7,220	1,798	0.723	0.688	0.650	0.709	0.692
2 L - 18	8	18:38:30	0	185	7,220	1,798	0.733	0.698	0.659	0.720	0.703
2 L - 19	1	18:40:30	0	192	7,620	1,898	0.757	0.722	0.684	0.746	0.727
2 L - 19	2	18:41:30	0	192	7,620	1,898	0.764	0.729	0.691	0.753	0.734
2 L - 19	4	18:43:30	0	196	7,620	1,898	0.774	0.738	0.698	0.762	0.743
2 L - 19	8	18:47:30	0	196	7,620	1,898	0.786	0.751	0.712	0.774	0.756
2 L - 20	1	18:49:30	0	196	8,000	1,994	0.818	0.783	0.743	0.806	0.787
2 L - 20	2	18:50:30	0	196	8,000	1,994	0.826	0.791	0.751	0.814	0.795
2 L - 20	4	18:52:30	0	203	8,000	1,994	0.839	0.803	0.763	0.825	0.808
2 L - 20	8	18:56:30	0	203	8,000	1,994	0.855	0.820	0.779	0.841	0.824
2 L - 21	1	18:58:30	0	214	8,410	2,096	0.889	0.854	0.812	0.876	0.858
2 L - 21	2	18:59:30	0	221	8,410	2,096	0.903	0.869	0.827	0.890	0.872
2 L - 21	4	19:01:30	0	218	8,410	2,096	0.927	0.893	0.851	0.913	0.896
2 L - 21	8	19:05:30	0	221	8,410	2,096	0.958	0.926	0.883	0.944	0.928
2 L - 22	1	19:08:00	0	232	8,790	2,192	1.013	0.981	0.939	1.000	0.983
2 L - 22	2	19:09:00	0	247	8,790	2,192	1.030	0.997	0.957	1.018	1.001
2 L - 22	4	19:11:00	0	243	8,790	2,192	1.089	1.055	1.018	1.081	1.061
2 L - 22	8	19:15:00	0	239	8,790	2,192	1.224	1.187	1.153	1.223	1.197
2 L - 23	1	19:17:00	0	290	9,260	2,309	1.434	1.394	1.363	1.436	1.406
2 L - 23	2	19:18:00	0	297	9,260	2,309	1.542	1.502	1.470	1.544	1.514
2 L - 23	4	19:20:00	0	284	9,260	2,309	1.702	1.663	1.630	1.703	1.675
2 L - 23	8	19:24:00	0	272	9,260	2,309	1.894	1.858	1.823	1.894	1.867
2 U - 1	1	19:28:30	0	196	6,910	1,720	1.890	1.854	1.818	1.882	1.861
2 U - 1	2	19:29:30	0	196	6,910	1,720	1.889	1.853	1.817	1.881	1.860
2 U - 1	4	19:31:30	0	196	6,910	1,720	1.888	1.851	1.817	1.880	1.859
2 U - 2	1	19:34:00	0	134	4,590	1,139	1.820	1.783	1.750	1.814	1.792
2 U - 2	2	19:35:00	0	127	4,590	1,139	1.818	1.780	1.748	1.810	1.789
2 U - 2	4	19:37:00	0	127	4,590	1,139	1.816	1.779	1.746	1.810	1.788
2 U - 3	1	19:39:30	0	47	2,290	562	1.717	1.674	1.649	1.705	1.687
2 U - 3	2	19:40:30	0	47	2,290	562	1.714	1.671	1.646	1.703	1.683
2 U - 3	4	19:42:30	0	40	2,290	562	1.710	1.667	1.643	1.699	1.679
2 U - 4	1	19:46:30	0	0	10	-9	1.421	1.391	1.385	1.417	1.404
2 U - 4	2	19:47:30	0	0	10	-9	1.414	1.385	1.377	1.411	1.397
2 U - 4	4	19:49:30	0	0	10	-9	1.406	1.377	1.369	1.402	1.389
2 U - 4	8	19:53:30	0	0	10	-9	1.397	1.370	1.361	1.395	1.381
3 L - 1	1	19:58:00	1,130	272	1,130	271	1.484	1.445	1.425	1.481	1.459
3 L - 1	2	19:59:00	1,130	272	1,130	271	1.484	1.446	1.425	1.480	1.459
3 L - 2	1	20:01:00	2,060	505	2,060	504	1.524	1.485	1.460	1.517	1.497
3 L - 2	2	20:02:00	2,060	505	2,060	504	1.524	1.486	1.460	1.517	1.497
3 L - 3	1	20:04:00	3,090	763	3,090	763	1.569	1.531	1.500	1.561	1.540
3 L - 3	2	20:05:00	3,090	763	3,090	763	1.570	1.532	1.501	1.563	1.542
3 L - 4	1	20:07:30	4,010	993	4,010	993	1.620	1.583	1.549	1.613	1.591
3 L - 4	2	20:08:30	4,010	993	4,010	993	1.621	1.584	1.550	1.614	1.592
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	1.681	1.643	1.608	1.675	1.652
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	1.685	1.647	1.613	1.678	1.656
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	1.742	1.705	1.670	1.737	1.714
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	1.750	1.713	1.678	1.743	1.721
3 U - 1	1	20:20:00	0	0	0	0	1.423	1.394	1.386	1.421	1.406
3 U - 1	2	20:21:00	0	0	0	0	1.418	1.390	1.382	1.416	1.402

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Lower O-cell Plate Movements and Creep (calculated)
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell			Upper O-cell		Top of Shaft Movement (in)	Total Comp. (in)	Upward Movement (in)	O-cell Expansion (in)	Downward Movement (in)	Creep Dn Per Hold (in)
			Pressure (psi)	Load (kips)	Net Load (kips)	Pressure (psi)	Load (kips)						
1 L - 0	-	11:38:00	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000	
1 L - 1	1	11:45:00	350	77	0	0	0	0.003	0.000	0.003	-0.001	0.004	
1 L - 1	2	11:46:00	350	77	0	0	0	0.002	0.000	0.002	-0.001	0.003	
1 L - 1	4	11:48:00	350	77	0	0	0	0.000	0.000	0.000	-0.001	0.001	
1 L - 1	8	11:52:00	350	77	0	0	0	-0.001	0.001	0.000	-0.001	0.001	0.000
1 L - 2	1	11:54:00	720	169	0	0	0	0.003	0.000	0.003	0.001	0.002	
1 L - 2	2	11:55:00	720	169	0	0	0	0.001	0.000	0.001	0.001	0.000	
1 L - 2	4	11:57:00	720	169	0	0	0	0.002	0.001	0.003	0.001	0.002	
1 L - 2	8	12:01:00	720	169	0	0	0	0.001	0.001	0.002	0.001	0.001	0.001
1 L - 3	1	12:03:00	1,120	270	84	0	0	0.002	0.001	0.003	0.003	0.000	
1 L - 3	2	12:04:00	1,120	270	84	0	0	0.002	0.002	0.004	0.003	0.001	
1 L - 3	4	12:06:00	1,120	270	84	0	0	0.000	0.002	0.002	0.004	-0.002	
1 L - 3	8	12:10:00	1,120	270	84	0	0	0.002	0.002	0.004	0.004	0.000	0.000
1 L - 4	1	12:12:00	1,520	370	184	0	0	0.002	0.002	0.004	0.009	-0.005	
1 L - 4	2	12:13:00	1,520	370	184	0	0	-0.001	0.002	0.001	0.010	-0.009	
1 L - 4	4	12:15:00	1,520	370	184	0	0	0.001	0.002	0.003	0.011	-0.008	
1 L - 4	8	12:19:00	1,520	370	184	0	0	0.002	0.002	0.004	0.014	-0.010	0.002
1 L - 5	1	12:21:30	1,910	467	281	0	0	0.003	0.003	0.006	0.028	-0.022	
1 L - 5	2	12:22:30	1,910	467	281	0	0	-0.001	0.003	0.002	0.031	-0.029	
1 L - 5	4	12:24:30	1,910	467	281	0	0	0.002	0.004	0.006	0.034	-0.028	
1 L - 5	8	12:28:30	1,910	467	281	0	0	0.004	0.005	0.009	0.037	-0.028	0.000
1 L - 6	1	12:31:00	2,290	562	376	0	0	0.005	0.005	0.010	0.055	-0.045	
1 L - 6	2	12:32:00	2,290	562	376	0	0	0.003	0.006	0.009	0.060	-0.051	
1 L - 6	4	12:34:00	2,290	562	376	0	0	0.003	0.006	0.009	0.064	-0.055	
1 L - 6	8	12:38:00	2,290	562	376	0	0	0.002	0.006	0.008	0.069	-0.061	0.006
1 L - 7	1	12:41:00	2,710	668	482	0	0	0.006	0.007	0.013	0.093	-0.080	
1 L - 7	2	12:42:00	2,710	668	482	0	0	0.005	0.008	0.013	0.098	-0.085	
1 L - 7	4	12:44:00	2,710	668	482	0	0	0.007	0.007	0.014	0.101	-0.087	
1 L - 7	8	12:48:00	2,710	668	482	0	0	0.007	0.008	0.015	0.107	-0.092	0.005
1 L - 8	1	12:50:00	3,080	760	574	0	0	0.010	0.009	0.019	0.130	-0.111	
1 L - 8	2	12:51:00	3,080	760	574	0	0	0.009	0.010	0.019	0.136	-0.117	
1 L - 8	4	12:53:00	3,080	760	574	0	0	0.008	0.010	0.018	0.141	-0.123	
1 L - 8	8	12:57:00	3,080	760	574	0	0	0.011	0.010	0.021	0.153	-0.132	0.009
1 L - 9	1	12:59:00	3,480	860	674	0	0	0.013	0.013	0.026	0.186	-0.160	
1 L - 9	2	13:00:00	3,480	860	674	0	0	0.011	0.012	0.023	0.191	-0.168	
1 L - 9	4	13:02:00	3,480	860	674	0	0	0.013	0.013	0.026	0.200	-0.174	
1 L - 9	8	13:06:00	3,480	860	674	0	0	0.012	0.014	0.026	0.209	-0.183	0.009
1 L - 10	1	13:10:00	3,860	955	769	0	0	0.016	0.015	0.031	0.245	-0.214	
1 L - 10	2	13:11:00	3,860	955	769	0	0	0.016	0.015	0.031	0.248	-0.217	
1 L - 10	4	13:13:00	3,860	955	769	0	0	0.015	0.015	0.030	0.255	-0.225	
1 L - 10	8	13:17:00	3,860	955	769	0	0	0.019	0.015	0.034	0.261	-0.227	0.002
1 L - 11	1	13:20:00	4,290	1,063	877	0	0	0.018	0.017	0.035	0.301	-0.266	
1 L - 11	2	13:21:00	4,290	1,063	877	0	0	0.019	0.017	0.036	0.305	-0.269	
1 L - 11	4	13:23:00	4,290	1,063	877	0	0	0.019	0.017	0.036	0.314	-0.278	
1 L - 11	8	13:27:00	4,290	1,063	877	0	0	0.018	0.017	0.035	0.328	-0.293	0.015
1 L - 12	1	13:30:30	4,690	1,163	977	0	0	0.023	0.018	0.041	0.374	-0.333	
1 L - 12	2	13:31:30	4,690	1,163	977	0	0	0.019	0.018	0.037	0.381	-0.344	
1 L - 12	4	13:33:30	4,690	1,163	977	0	0	0.020	0.018	0.038	0.392	-0.354	
1 L - 12	8	13:37:30	4,690	1,163	977	0	0	0.020	0.018	0.038	0.404	-0.366	0.012
1 L - 13	1	13:40:30	5,090	1,263	1,077	0	0	0.022	0.020	0.042	0.467	-0.425	
1 L - 13	2	13:41:30	5,090	1,263	1,077	0	0	0.023	0.020	0.043	0.477	-0.434	
1 L - 13	4	13:43:30	5,090	1,263	1,077	0	0	0.023	0.020	0.043	0.493	-0.450	
1 L - 13	8	13:47:30	5,090	1,263	1,077	0	0	0.025	0.021	0.046	0.517	-0.471	0.021
1 L - 14	1	13:51:00	5,520	1,371	1,185	0	0	0.030	0.025	0.055	0.684	-0.629	
1 L - 14	2	13:52:00	5,520	1,371	1,185	0	0	0.031	0.025	0.056	0.709	-0.653	
1 L - 14	4	13:54:00	5,520	1,371	1,185	0	0	0.031	0.025	0.056	0.736	-0.680	
1 L - 14	8	13:58:00	5,520	1,371	1,185	0	0	0.031	0.025	0.056	0.762	-0.706	0.026
1 L - 15	1	14:02:00	5,930	1,474	1,288	0	0	0.035	0.028	0.063	0.879	-0.816	
1 L - 15	2	14:03:00	5,930	1,474	1,288	0	0	0.036	0.028	0.064	0.899	-0.835	
1 L - 15	4	14:05:00	5,930	1,474	1,288	0	0	0.036	0.028	0.064	0.927	-0.863	
1 L - 15	8	14:09:00	5,930	1,474	1,288	0	0	0.038	0.028	0.066	0.960	-0.894	0.031
1 L - 16	1	14:11:30	6,320	1,571	1,385	0	0	0.041	0.030	0.071	1.085	-1.014	
1 L - 16	2	14:12:30	6,320	1,571	1,385	0	0	0.042	0.030	0.072	1.115	-1.043	
1 L - 16	4	14:14:30	6,320	1,571	1,385	0	0	0.043	0.030	0.073	1.150	-1.077	
1 L - 16	8	14:18:30	6,320	1,571	1,385	0	0	0.044	0.030	0.074	1.199	-1.125	0.048
1 L - 17	1	14:23:00	6,730	1,674	1,488	0	0	0.051	0.033	0.084	1.589	-1.505	
1 L - 17	2	14:24:00	6,730	1,674	1,488	0	0	0.052	0.033	0.085	1.644	-1.559	
1 L - 17	4	14:26:00	6,730	1,674	1,488	0	0	0.053	0.034	0.087	1.713	-1.626	
1 L - 17	8	14:30:00	6,730	1,674	1,488	0	0	0.055	0.034	0.089	1.788	-1.699	0.073
1 L - 18	1	14:34:00	7,130	1,774	1,588	0	0	0.061	0.036	0.097	2.148	-2.051	
1 L - 18	2	14:35:00	7,130	1,774	1,588	0	0	0.062	0.036	0.098	2.215	-2.117	
1 L - 18	4	14:37:00	7,130	1,774	1,588	0	0	0.064	0.036	0.100	2.319	-2.219	
1 L - 18	8	14:41:00	7,130	1,774	1,588	0	0	0.067	0.037	0.104	2.424	-2.320	0.101
1 L - 19	1	14:45:30	7,530	1,874	1,688	0	0	0.073	0.039	0.112	2.883	-2.771	
1 L - 19	2	14:46:30	7,530	1,874	1,688	0	0	0.075	0.039	0.114	2.985	-2.871	
1 L - 19	4	14:48:30	7,530	1,874	1,688	0	0	0.078	0.040	0.118	3.149	-3.031	
1 L - 19	8	14:52:30	7,530	1,874	1,688	0	0	0.080	0.040	0.120	3.297	-3.177	0.146



Lower O-cell Plate Movements and Creep (calculated)
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell			Upper O-cell		Top of Shaft Movement (in)	Total Comp. (in)	Upward Movement (in)	O-cell Expansion (in)	Downward Movement (in)	Creep Dn Per Hold (in)
			Pressure (psi)	Load (kips)	Net Load (kips)	Pressure (psi)	Load (kips)						
1 U - 1	1	14:55:30	5,550	1,378	1,192	0	0	0.074	0.038	0.112	3.303	-3.191	
1 U - 1	2	14:56:30	5,550	1,378	1,192	0	0	0.077	0.038	0.115	3.302	-3.187	
1 U - 1	4	14:58:30	5,550	1,378	1,192	0	0	0.077	0.038	0.115	3.301	-3.186	
1 U - 2	1	15:02:00	3,740	925	739	0	0	0.071	0.033	0.104	3.242	-3.138	
1 U - 2	2	15:03:00	3,740	925	739	0	0	0.072	0.033	0.105	3.237	-3.132	
1 U - 2	4	15:05:00	3,740	925	739	0	0	0.072	0.033	0.105	3.233	-3.128	
1 U - 3	1	15:10:00	1,910	467	281	0	0	0.064	0.025	0.089	3.006	-2.917	
1 U - 3	2	15:11:00	1,910	467	281	0	0	0.063	0.025	0.088	3.004	-2.916	
1 U - 3	4	15:13:00	1,910	467	281	0	0	0.070	0.025	0.095	3.002	-2.907	
1 U - 4	1	15:18:30	0	0	0	0	0	0.049	0.015	0.064	2.318	-2.254	
1 U - 4	2	15:19:30	0	0	0	0	0	0.048	0.015	0.063	2.299	-2.236	
1 U - 4	4	15:21:30	0	0	0	0	0	0.048	0.015	0.063	2.279	-2.216	
1 U - 4	8	15:25:30	0	0	0	0	0	0.051	0.015	0.066	2.262	-2.196	
2 L - 1	1	15:46:00	0	0	0	380	83	0.046	-0.002	0.044	2.239	-2.195	
2 L - 1	2	15:47:00	0	0	0	380	83	0.046	-0.002	0.044	2.238	-2.194	
2 L - 1	4	15:49:00	0	0	0	380	83	0.047	-0.002	0.045	2.238	-2.193	
2 L - 1	8	15:53:00	0	0	0	380	83	0.045	-0.002	0.043	2.235	-2.192	
2 L - 2	1	15:55:30	0	0	0	770	181	0.046	-0.025	0.021	2.235	-2.214	
2 L - 2	2	15:56:30	0	0	0	770	181	0.045	-0.024	0.021	2.235	-2.214	
2 L - 2	4	15:58:30	0	0	0	770	181	0.046	-0.024	0.022	2.234	-2.212	
2 L - 2	8	16:02:30	0	0	0	770	181	0.045	-0.024	0.021	2.233	-2.212	
2 L - 3	1	16:05:00	0	0	0	1,200	289	0.045	-0.060	-0.015	2.232	-2.247	
2 L - 3	2	16:06:00	0	0	0	1,200	289	0.046	-0.061	-0.015	2.230	-2.245	
2 L - 3	4	16:08:00	0	0	0	1,200	289	0.047	-0.061	-0.014	2.230	-2.244	
2 L - 3	8	16:12:00	0	0	0	1,200	289	0.047	-0.062	-0.015	2.230	-2.245	
2 L - 4	1	16:15:00	0	0	0	1,570	382	0.048	-0.101	-0.053	2.226	-2.279	
2 L - 4	2	16:16:00	0	0	0	1,570	382	0.048	-0.101	-0.053	2.226	-2.279	
2 L - 4	4	16:18:00	0	0	0	1,570	382	0.047	-0.102	-0.055	2.226	-2.281	
2 L - 4	8	16:22:00	0	0	0	1,570	382	0.048	-0.102	-0.054	2.225	-2.279	
2 L - 5	1	16:25:30	0	0	0	1,970	482	0.050	-0.171	-0.121	2.208	-2.329	
2 L - 5	2	16:26:30	0	0	0	1,970	482	0.050	-0.173	-0.123	2.206	-2.329	
2 L - 5	4	16:28:30	0	0	0	1,970	482	0.050	-0.174	-0.124	2.206	-2.330	
2 L - 5	8	16:32:30	0	0	0	1,970	482	0.050	-0.175	-0.125	2.205	-2.330	
2 L - 6	1	16:35:30	0	0	0	2,370	582	0.051	-0.219	-0.168	2.197	-2.365	
2 L - 6	2	16:36:30	0	0	0	2,370	582	0.053	-0.221	-0.168	2.197	-2.365	
2 L - 6	4	16:38:30	0	0	0	2,370	582	0.053	-0.223	-0.170	2.197	-2.367	
2 L - 6	8	16:42:30	0	0	0	2,370	582	0.053	-0.223	-0.170	2.195	-2.365	
2 L - 7	1	16:45:00	0	0	0	2,790	687	0.056	-0.264	-0.208	2.193	-2.401	
2 L - 7	2	16:46:00	0	0	0	2,790	687	0.057	-0.266	-0.209	2.191	-2.400	
2 L - 7	4	16:48:00	0	0	0	2,790	687	0.056	-0.268	-0.212	2.190	-2.402	
2 L - 7	8	16:52:00	0	0	0	2,790	687	0.057	-0.270	-0.213	2.189	-2.402	
2 L - 8	1	16:55:30	0	0	0	3,180	785	0.060	-0.297	-0.237	2.186	-2.423	
2 L - 8	2	16:56:30	0	0	0	3,180	785	0.060	-0.299	-0.239	2.185	-2.424	
2 L - 8	4	16:58:30	0	0	0	3,180	785	0.061	-0.303	-0.242	2.184	-2.426	
2 L - 8	8	17:02:30	0	0	0	3,180	785	0.061	-0.307	-0.246	2.183	-2.429	
2 L - 9	1	17:05:30	0	0	0	3,600	891	0.067	-0.333	-0.266	2.179	-2.445	
2 L - 9	2	17:06:30	0	0	0	3,600	891	0.067	-0.335	-0.268	2.179	-2.447	
2 L - 9	4	17:08:30	0	0	0	3,600	891	0.070	-0.338	-0.268	2.178	-2.446	
2 L - 9	8	17:12:30	0	0	0	3,600	891	0.068	-0.342	-0.274	2.177	-2.451	
2 L - 10	1	17:15:30	0	0	0	3,990	988	0.076	-0.364	-0.288	2.171	-2.459	
2 L - 10	2	17:16:30	0	0	0	3,990	988	0.077	-0.367	-0.290	2.170	-2.460	
2 L - 10	4	17:18:30	0	0	0	3,990	988	0.078	-0.370	-0.292	2.169	-2.461	
2 L - 10	8	17:22:30	0	0	0	3,990	988	0.078	-0.374	-0.296	2.168	-2.464	
2 L - 11	1	17:26:00	0	22	22	4,400	1,091	0.087	-0.395	-0.308	2.167	-2.475	
2 L - 11	2	17:27:00	0	25	25	4,400	1,091	0.088	-0.398	-0.310	2.166	-2.476	
2 L - 11	4	17:29:00	0	33	33	4,400	1,091	0.090	-0.403	-0.313	2.165	-2.478	
2 L - 11	8	17:33:00	0	36	36	4,400	1,091	0.092	-0.408	-0.316	2.163	-2.479	
2 L - 12	1	17:36:00	0	47	47	4,790	1,189	0.103	-0.427	-0.324	2.158	-2.482	
2 L - 12	2	17:37:00	0	51	51	4,790	1,189	0.104	-0.429	-0.325	2.158	-2.483	
2 L - 12	4	17:39:00	0	54	54	4,790	1,189	0.106	-0.433	-0.327	2.157	-2.484	
2 L - 12	8	17:43:00	0	65	65	4,790	1,189	0.109	-0.439	-0.330	2.157	-2.487	
2 L - 13	1	17:45:30	0	76	76	5,160	1,282	0.118	-0.455	-0.337	2.153	-2.490	
2 L - 13	2	17:46:30	0	80	80	5,160	1,282	0.120	-0.458	-0.338	2.153	-2.491	
2 L - 13	4	17:48:30	0	87	87	5,160	1,282	0.121	-0.462	-0.341	2.152	-2.493	
2 L - 13	8	17:52:30	0	87	87	5,160	1,282	0.126	-0.467	-0.341	2.152	-2.493	
2 L - 14	1	17:54:30	0	102	102	5,570	1,384	0.135	-0.484	-0.349	2.148	-2.497	
2 L - 14	2	17:55:30	0	109	109	5,570	1,384	0.139	-0.490	-0.351	2.148	-2.499	
2 L - 14	4	17:57:30	0	105	105	5,570	1,384	0.142	-0.495	-0.353	2.145	-2.498	
2 L - 14	8	18:01:30	0	105	105	5,570	1,384	0.147	-0.503	-0.356	2.142	-2.498	



Lower O-cell Plate Movements and Creep (calculated)
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell			Upper O-cell		Top of Shaft Movement (in)	Total Comp. (in)	Upward Movement (in)	O-cell Expansion (in)	Downward Movement (in)	Creep Dn Per Hold (in)
			Pressure (psi)	Load ¹ (kips)	Net Load (kips)	Pressure (psi)	Load (kips)						
2 L - 15	1	18:04:00	0	131	131	6,020	1,497	0.162	-0.528	-0.366	2.139	-2.505	
2 L - 15	2	18:05:00	0	131	131	6,020	1,497	0.165	-0.532	-0.367	2.138	-2.505	
2 L - 15	4	18:07:00	0	134	134	6,020	1,497	0.169	-0.538	-0.369	2.137	-2.506	
2 L - 15	8	18:11:00	0	138	138	6,020	1,497	0.176	-0.548	-0.372	2.135	-2.507	
2 L - 16	1	18:13:00	0	141	141	6,420	1,597	0.190	-0.567	-0.377	2.131	-2.508	
2 L - 16	2	18:14:00	0	141	141	6,420	1,597	0.193	-0.571	-0.378	2.130	-2.508	
2 L - 16	4	18:16:00	0	145	145	6,420	1,597	0.198	-0.578	-0.380	2.129	-2.509	
2 L - 16	8	18:20:00	0	149	149	6,420	1,597	0.203	-0.586	-0.383	2.127	-2.510	
2 L - 17	1	18:22:30	0	167	167	6,840	1,703	0.217	-0.607	-0.390	2.125	-2.515	
2 L - 17	2	18:23:30	0	167	167	6,840	1,703	0.222	-0.613	-0.391	2.124	-2.515	
2 L - 17	4	18:25:30	0	160	160	6,840	1,703	0.228	-0.618	-0.390	2.123	-2.513	
2 L - 17	8	18:29:30	0	163	163	6,840	1,703	0.232	-0.628	-0.396	2.118	-2.514	
2 L - 18	1	18:31:30	0	174	174	7,220	1,798	0.248	-0.649	-0.401	2.116	-2.517	
2 L - 18	2	18:32:30	0	181	181	7,220	1,798	0.252	-0.655	-0.403	2.116	-2.519	
2 L - 18	4	18:34:30	0	167	167	7,220	1,798	0.259	-0.660	-0.401	2.114	-2.515	
2 L - 18	8	18:38:30	0	185	185	7,220	1,798	0.265	-0.671	-0.406	2.114	-2.520	
2 L - 19	1	18:40:30	0	192	192	7,620	1,898	0.282	-0.696	-0.414	2.108	-2.522	
2 L - 19	2	18:41:30	0	192	192	7,620	1,898	0.287	-0.702	-0.415	2.107	-2.522	
2 L - 19	4	18:43:30	0	196	196	7,620	1,898	0.294	-0.711	-0.417	2.106	-2.523	
2 L - 19	8	18:47:30	0	196	196	7,620	1,898	0.305	-0.724	-0.419	2.104	-2.523	
2 L - 20	1	18:49:30	0	196	196	8,000	1,994	0.330	-0.755	-0.425	2.098	-2.523	
2 L - 20	2	18:50:30	0	196	196	8,000	1,994	0.337	-0.762	-0.425	2.098	-2.523	
2 L - 20	4	18:52:30	0	203	203	8,000	1,994	0.346	-0.775	-0.429	2.096	-2.525	
2 L - 20	8	18:56:30	0	203	203	8,000	1,994	0.360	-0.791	-0.431	2.094	-2.525	
2 L - 21	1	18:58:30	0	214	214	8,410	2,096	0.386	-0.823	-0.437	2.091	-2.528	
2 L - 21	2	18:59:30	0	221	221	8,410	2,096	0.398	-0.838	-0.440	2.090	-2.530	
2 L - 21	4	19:01:30	0	218	218	8,410	2,096	0.418	-0.861	-0.443	2.086	-2.529	
2 L - 21	8	19:05:30	0	221	221	8,410	2,096	0.448	-0.894	-0.446	2.084	-2.530	
2 L - 22	1	19:08:00	0	232	232	8,790	2,192	0.496	-0.948	-0.452	2.081	-2.533	
2 L - 22	2	19:09:00	0	247	247	8,790	2,192	0.507	-0.964	-0.457	2.080	-2.537	
2 L - 22	4	19:11:00	0	243	243	8,790	2,192	0.563	-1.023	-0.460	2.076	-2.536	
2 L - 22	8	19:15:00	0	239	239	8,790	2,192	0.695	-1.157	-0.462	2.073	-2.535	
2 L - 23	1	19:17:00	0	290	290	9,260	2,309	0.884	-1.364	-0.480	2.068	-2.548	
2 L - 23	2	19:18:00	0	297	297	9,260	2,309	0.989	-1.472	-0.483	2.066	-2.549	
2 L - 23	4	19:20:00	0	284	284	9,260	2,309	1.148	-1.632	-0.484	2.063	-2.547	
2 L - 23	8	19:24:00	0	272	272	9,260	2,309	1.337	-1.822	-0.485	2.060	-2.545	
2 U - 1	1	19:28:30	0	196	196	6,910	1,720	1.359	-1.822	-0.463	2.060	-2.523	
2 U - 1	2	19:29:30	0	196	196	6,910	1,720	1.358	-1.821	-0.463	2.060	-2.523	
2 U - 1	4	19:31:30	0	196	196	6,910	1,720	1.358	-1.821	-0.463	2.060	-2.523	
2 U - 2	1	19:34:00	0	134	134	4,590	1,139	1.322	-1.766	-0.444	2.062	-2.506	
2 U - 2	2	19:35:00	0	127	127	4,590	1,139	1.321	-1.763	-0.442	2.062	-2.504	
2 U - 2	4	19:37:00	0	127	127	4,590	1,139	1.320	-1.762	-0.442	2.062	-2.504	
2 U - 3	1	19:39:30	0	47	47	2,290	562	1.255	-1.672	-0.417	2.065	-2.482	
2 U - 3	2	19:40:30	0	47	47	2,290	562	1.251	-1.668	-0.417	2.065	-2.482	
2 U - 3	4	19:42:30	0	40	40	2,290	562	1.249	-1.664	-0.415	2.065	-2.480	
2 U - 4	1	19:46:30	0	0	0	10	-9	1.085	-1.399	-0.314	2.068	-2.382	
2 U - 4	2	19:47:30	0	0	0	10	-9	1.079	-1.392	-0.313	2.069	-2.382	
2 U - 4	4	19:49:30	0	0	0	10	-9	1.072	-1.384	-0.312	2.069	-2.381	
2 U - 4	8	19:53:30	0	0	0	10	-9	1.065	-1.376	-0.311	2.068	-2.379	
3 L - 1	1	19:58:00	1,130	272	86	1,130	271	1.072	-1.450	-0.378	2.076	-2.454	
3 L - 1	2	19:59:00	1,130	272	86	1,130	271	1.072	-1.450	-0.378	2.077	-2.455	
3 L - 2	1	20:01:00	2,060	505	319	2,060	504	1.089	-1.482	-0.393	2.100	-2.493	
3 L - 2	2	20:02:00	2,060	505	319	2,060	504	1.089	-1.483	-0.394	2.101	-2.495	
3 L - 3	1	20:04:00	3,090	763	577	3,090	763	1.119	-1.519	-0.400	2.148	-2.548	
3 L - 3	2	20:05:00	3,090	763	577	3,090	763	1.120	-1.521	-0.401	2.152	-2.553	
3 L - 4	1	20:07:30	4,010	993	807	4,010	993	1.163	-1.564	-0.401	2.274	-2.675	
3 L - 4	2	20:08:30	4,010	993	807	4,010	993	1.166	-1.565	-0.399	2.281	-2.680	
3 L - 5	1	20:11:00	5,100	1,266	1,080	5,100	1,267	1.218	-1.617	-0.399	2.505	-2.904	
3 L - 5	2	20:12:00	5,100	1,266	1,080	5,100	1,267	1.222	-1.620	-0.398	2.524	-2.922	
3 L - 6	1	20:14:00	6,090	1,514	1,328	6,090	1,515	1.271	-1.674	-0.403	2.785	-3.188	
3 L - 6	2	20:15:00	6,090	1,514	1,328	6,090	1,515	1.279	-1.680	-0.401	2.818	-3.219	
3 U - 1	1	20:20:00	0	0	0	0	0	1.245	-1.399	-0.154	2.181	-2.335	
3 U - 1	2	20:21:00	0	0	0	0	0	1.245	-1.395	-0.150	2.170	-2.320	

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Upper O-cell Plate Movements and Creep (calculated)
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell			Top of Shaft Movement (in)	Upper Comp. (in)	Upward Movement (in)	O-cell Expansion (in)	Downward Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	Net Load (kips)							
1 L - 0	-	11:38:00	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000		
1 L - 1	1	11:45:00	350	77	0	0	0	0.003	0.000	0.003	0.000	0.003		
1 L - 1	2	11:46:00	350	77	0	0	0	0.002	0.000	0.002	0.000	0.002		
1 L - 1	4	11:48:00	350	77	0	0	0	0.000	0.000	0.000	0.000	0.000		
1 L - 1	8	11:52:00	350	77	0	0	0	-0.001	0.001	0.000	0.000	0.000		
1 L - 2	1	11:54:00	720	169	0	0	0	0.003	0.000	0.003	0.000	0.003		
1 L - 2	2	11:55:00	720	169	0	0	0	0.001	0.000	0.001	0.000	0.001		
1 L - 2	4	11:57:00	720	169	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 2	8	12:01:00	720	169	0	0	0	0.001	0.001	0.002	0.000	0.002		
1 L - 3	1	12:03:00	1,120	270	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 3	2	12:04:00	1,120	270	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 3	4	12:06:00	1,120	270	0	0	0	0.000	0.001	0.001	0.000	0.001		
1 L - 3	8	12:10:00	1,120	270	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 4	1	12:12:00	1,520	370	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 4	2	12:13:00	1,520	370	0	0	0	-0.001	0.001	0.000	0.000	0.000		
1 L - 4	4	12:15:00	1,520	370	0	0	0	0.001	0.001	0.002	0.000	0.002		
1 L - 4	8	12:19:00	1,520	370	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 5	1	12:21:30	1,910	467	0	0	0	0.003	0.001	0.004	0.000	0.004		
1 L - 5	2	12:22:30	1,910	467	0	0	0	-0.001	0.001	0.000	0.000	0.000		
1 L - 5	4	12:24:30	1,910	467	0	0	0	0.002	0.001	0.003	0.000	0.003		
1 L - 5	8	12:28:30	1,910	467	0	0	0	0.004	0.002	0.006	0.000	0.006		
1 L - 6	1	12:31:00	2,290	562	0	0	0	0.005	0.001	0.006	0.000	0.006		
1 L - 6	2	12:32:00	2,290	562	0	0	0	0.003	0.002	0.005	0.000	0.005		
1 L - 6	4	12:34:00	2,290	562	0	0	0	0.003	0.002	0.005	0.000	0.005		
1 L - 6	8	12:38:00	2,290	562	0	0	0	0.002	0.002	0.004	0.000	0.004		
1 L - 7	1	12:41:00	2,710	668	0	0	0	0.006	0.002	0.008	0.000	0.008		
1 L - 7	2	12:42:00	2,710	668	0	0	0	0.005	0.003	0.008	0.000	0.008		
1 L - 7	4	12:44:00	2,710	668	0	0	0	0.007	0.002	0.009	0.000	0.009		
1 L - 7	8	12:48:00	2,710	668	0	0	0	0.007	0.002	0.009	0.000	0.009		
1 L - 8	1	12:50:00	3,080	760	0	0	0	0.010	0.003	0.013	0.000	0.013		
1 L - 8	2	12:51:00	3,080	760	0	0	0	0.009	0.003	0.012	0.000	0.012		
1 L - 8	4	12:53:00	3,080	760	0	0	0	0.008	0.003	0.011	0.000	0.011		
1 L - 8	8	12:57:00	3,080	760	0	0	0	0.011	0.003	0.014	0.000	0.014		
1 L - 9	1	12:59:00	3,480	860	0	0	0	0.013	0.004	0.017	-0.001	0.018		
1 L - 9	2	13:00:00	3,480	860	0	0	0	0.011	0.004	0.015	0.000	0.015		
1 L - 9	4	13:02:00	3,480	860	0	0	0	0.013	0.004	0.017	-0.001	0.018		
1 L - 9	8	13:06:00	3,480	860	0	0	0	0.012	0.004	0.016	-0.001	0.017		
1 L - 10	1	13:10:00	3,860	955	0	0	0	0.016	0.004	0.020	-0.001	0.021		
1 L - 10	2	13:11:00	3,860	955	0	0	0	0.016	0.004	0.020	-0.001	0.021		
1 L - 10	4	13:13:00	3,860	955	0	0	0	0.015	0.004	0.019	-0.001	0.020		
1 L - 10	8	13:17:00	3,860	955	0	0	0	0.019	0.004	0.023	-0.001	0.024		
1 L - 11	1	13:20:00	4,290	1,063	0	0	0	0.018	0.005	0.023	-0.001	0.024		
1 L - 11	2	13:21:00	4,290	1,063	0	0	0	0.019	0.005	0.024	-0.001	0.025		
1 L - 11	4	13:23:00	4,290	1,063	0	0	0	0.019	0.005	0.024	-0.001	0.025		
1 L - 11	8	13:27:00	4,290	1,063	0	0	0	0.018	0.005	0.023	-0.001	0.024		
1 L - 12	1	13:30:30	4,690	1,163	0	0	0	0.023	0.005	0.028	-0.001	0.029		
1 L - 12	2	13:31:30	4,690	1,163	0	0	0	0.019	0.005	0.024	-0.001	0.025		
1 L - 12	4	13:33:30	4,690	1,163	0	0	0	0.020	0.005	0.025	-0.001	0.026		
1 L - 12	8	13:37:30	4,690	1,163	0	0	0	0.020	0.005	0.025	-0.001	0.026		
1 L - 13	1	13:40:30	5,090	1,263	0	0	0	0.022	0.005	0.027	-0.001	0.028		
1 L - 13	2	13:41:30	5,090	1,263	0	0	0	0.023	0.005	0.028	-0.001	0.029		
1 L - 13	4	13:43:30	5,090	1,263	0	0	0	0.023	0.005	0.028	-0.001	0.029		
1 L - 13	8	13:47:30	5,090	1,263	0	0	0	0.025	0.006	0.031	-0.001	0.032		
1 L - 14	1	13:51:00	5,520	1,371	0	0	0	0.030	0.007	0.037	-0.001	0.038		
1 L - 14	2	13:52:00	5,520	1,371	0	0	0	0.031	0.007	0.038	-0.001	0.039		
1 L - 14	4	13:54:00	5,520	1,371	0	0	0	0.031	0.007	0.038	-0.001	0.039		
1 L - 14	8	13:58:00	5,520	1,371	0	0	0	0.031	0.007	0.038	-0.001	0.039		
1 L - 15	1	14:02:00	5,930	1,474	0	0	0	0.035	0.008	0.043	-0.001	0.044		
1 L - 15	2	14:03:00	5,930	1,474	0	0	0	0.036	0.008	0.044	-0.001	0.045		
1 L - 15	4	14:05:00	5,930	1,474	0	0	0	0.036	0.008	0.044	-0.001	0.045		
1 L - 15	8	14:09:00	5,930	1,474	0	0	0	0.038	0.008	0.046	-0.001	0.047		
1 L - 16	1	14:11:30	6,320	1,571	0	0	0	0.041	0.009	0.050	-0.001	0.051		
1 L - 16	2	14:12:30	6,320	1,571	0	0	0	0.042	0.009	0.051	-0.001	0.052		
1 L - 16	4	14:14:30	6,320	1,571	0	0	0	0.043	0.009	0.052	-0.001	0.053		
1 L - 16	8	14:18:30	6,320	1,571	0	0	0	0.044	0.009	0.053	-0.001	0.054		
1 L - 17	1	14:23:00	6,730	1,674	0	0	0	0.051	0.010	0.061	-0.001	0.062		
1 L - 17	2	14:24:00	6,730	1,674	0	0	0	0.052	0.010	0.062	-0.001	0.063		
1 L - 17	4	14:26:00	6,730	1,674	0	0	0	0.053	0.010	0.063	-0.001	0.064		
1 L - 17	8	14:30:00	6,730	1,674	0	0	0	0.055	0.010	0.065	-0.001	0.066		
1 L - 18	1	14:34:00	7,130	1,774	0	0	0	0.061	0.011	0.072	-0.001	0.073		
1 L - 18	2	14:35:00	7,130	1,774	0	0	0	0.062	0.011	0.073	-0.001	0.074		
1 L - 18	4	14:37:00	7,130	1,774	0	0	0	0.064	0.011	0.075	-0.001	0.076		
1 L - 18	8	14:41:00	7,130	1,774	0	0	0	0.067	0.011	0.078	-0.001	0.079		
1 L - 19	1	14:45:30	7,530	1,874	0	0	0	0.073	0.012	0.085	-0.001	0.086		
1 L - 19	2	14:46:30	7,530	1,874	0	0	0	0.075	0.012	0.087	-0.001	0.088		
1 L - 19	4	14:48:30	7,530	1,874	0	0	0	0.078	0.012	0.090	-0.001	0.091		
1 L - 19	8	14:52:30	7,530	1,874	0	0	0	0.080	0.012	0.092	-0.001	0.093		



Upper O-cell Plate Movements and Creep (calculated)
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell			Top of Shaft Movement (in)	Upper Comp. (in)	Upward Movement (in)	O-cell Expansion (in)	Downward Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	Net Load (kips)							
1 U - 1	1	14:55:30	5,550	1,378	0	0	0	0.074	0.012	0.086	-0.001	0.087		
1 U - 1	2	14:56:30	5,550	1,378	0	0	0	0.077	0.012	0.089	-0.001	0.090		
1 U - 1	4	14:58:30	5,550	1,378	0	0	0	0.077	0.012	0.089	-0.001	0.090		
1 U - 2	1	15:02:00	3,740	925	0	0	0	0.071	0.012	0.083	-0.001	0.084		
1 U - 2	2	15:03:00	3,740	925	0	0	0	0.072	0.012	0.084	-0.001	0.085		
1 U - 2	4	15:05:00	3,740	925	0	0	0	0.072	0.012	0.084	-0.001	0.085		
1 U - 3	1	15:10:00	1,910	467	0	0	0	0.064	0.010	0.074	-0.001	0.075		
1 U - 3	2	15:11:00	1,910	467	0	0	0	0.063	0.010	0.073	-0.001	0.074		
1 U - 3	4	15:13:00	1,910	467	0	0	0	0.070	0.010	0.080	-0.001	0.081		
1 U - 4	1	15:18:30	0	0	0	0	0	0.049	0.008	0.057	0.000	0.057		
1 U - 4	2	15:19:30	0	0	0	0	0	0.048	0.008	0.056	0.000	0.056		
1 U - 4	4	15:21:30	0	0	0	0	0	0.048	0.008	0.056	0.000	0.056		
1 U - 4	8	15:25:30	0	0	0	0	0	0.051	0.008	0.059	0.000	0.059		
2 L - 1	1	15:46:00	0	0	380	83	0	0.046	0.007	0.053	0.016	0.037		
2 L - 1	2	15:47:00	0	0	380	83	0	0.046	0.007	0.053	0.016	0.037		
2 L - 1	4	15:49:00	0	0	380	83	0	0.047	0.007	0.054	0.016	0.038		
2 L - 1	8	15:53:00	0	0	380	83	0	0.045	0.007	0.052	0.016	0.036	0.000	0.002
2 L - 2	1	15:55:30	0	0	770	181	35	0.046	0.007	0.053	0.039	0.014		
2 L - 2	2	15:56:30	0	0	770	181	35	0.045	0.007	0.052	0.038	0.014		
2 L - 2	4	15:58:30	0	0	770	181	35	0.046	0.007	0.053	0.038	0.015		
2 L - 2	8	16:02:30	0	0	770	181	35	0.045	0.007	0.052	0.038	0.014	0.000	0.001
2 L - 3	1	16:05:00	0	0	1,200	289	143	0.045	0.007	0.052	0.074	-0.022		
2 L - 3	2	16:06:00	0	0	1,200	289	143	0.046	0.007	0.053	0.075	-0.022		
2 L - 3	4	16:08:00	0	0	1,200	289	143	0.047	0.007	0.054	0.075	-0.021		
2 L - 3	8	16:12:00	0	0	1,200	289	143	0.047	0.007	0.054	0.075	-0.021	0.000	0.000
2 L - 4	1	16:15:00	0	0	1,570	382	236	0.048	0.007	0.055	0.114	-0.059		
2 L - 4	2	16:16:00	0	0	1,570	382	236	0.048	0.007	0.055	0.114	-0.059		
2 L - 4	4	16:18:00	0	0	1,570	382	236	0.047	0.007	0.054	0.115	-0.061		
2 L - 4	8	16:22:00	0	0	1,570	382	236	0.048	0.007	0.055	0.115	-0.060	0.001	0.000
2 L - 5	1	16:25:30	0	0	1,970	482	336	0.050	0.007	0.057	0.185	-0.128		
2 L - 5	2	16:26:30	0	0	1,970	482	336	0.050	0.007	0.057	0.187	-0.130		
2 L - 5	4	16:28:30	0	0	1,970	482	336	0.050	0.007	0.057	0.188	-0.131		
2 L - 5	8	16:32:30	0	0	1,970	482	336	0.050	0.007	0.057	0.189	-0.132	0.000	0.001
2 L - 6	1	16:35:30	0	0	2,370	582	436	0.051	0.007	0.058	0.234	-0.176		
2 L - 6	2	16:36:30	0	0	2,370	582	436	0.053	0.007	0.060	0.236	-0.176		
2 L - 6	4	16:38:30	0	0	2,370	582	436	0.053	0.007	0.060	0.238	-0.178		
2 L - 6	8	16:42:30	0	0	2,370	582	436	0.053	0.009	0.062	0.240	-0.178	0.002	0.000
2 L - 7	1	16:45:00	0	0	2,790	687	541	0.056	0.008	0.064	0.280	-0.216		
2 L - 7	2	16:46:00	0	0	2,790	687	541	0.057	0.008	0.065	0.282	-0.217		
2 L - 7	4	16:48:00	0	0	2,790	687	541	0.056	0.008	0.064	0.284	-0.220		
2 L - 7	8	16:52:00	0	0	2,790	687	541	0.057	0.008	0.065	0.286	-0.221	0.001	0.001
2 L - 8	1	16:55:30	0	0	3,180	785	639	0.060	0.009	0.069	0.314	-0.245		
2 L - 8	2	16:56:30	0	0	3,180	785	639	0.060	0.009	0.069	0.316	-0.247		
2 L - 8	4	16:58:30	0	0	3,180	785	639	0.061	0.008	0.069	0.319	-0.250		
2 L - 8	8	17:02:30	0	0	3,180	785	639	0.061	0.008	0.069	0.323	-0.254	0.000	0.004
2 L - 9	1	17:05:30	0	0	3,600	891	745	0.067	0.010	0.077	0.352	-0.275		
2 L - 9	2	17:06:30	0	0	3,600	891	745	0.067	0.010	0.077	0.354	-0.277		
2 L - 9	4	17:08:30	0	0	3,600	891	745	0.070	0.010	0.080	0.357	-0.277		
2 L - 9	8	17:12:30	0	0	3,600	891	745	0.068	0.010	0.078	0.361	-0.283	0.000	0.006
2 L - 10	1	17:15:30	0	0	3,990	988	842	0.076	0.011	0.087	0.385	-0.298		
2 L - 10	2	17:16:30	0	0	3,990	988	842	0.077	0.011	0.088	0.388	-0.300		
2 L - 10	4	17:18:30	0	0	3,990	988	842	0.078	0.011	0.089	0.391	-0.302		
2 L - 10	8	17:22:30	0	0	3,990	988	842	0.078	0.011	0.089	0.395	-0.306	0.000	0.004
2 L - 11	1	17:26:00	0	22	4,400	1,091	945	0.087	0.012	0.099	0.417	-0.318		
2 L - 11	2	17:27:00	0	25	4,400	1,091	945	0.088	0.012	0.100	0.420	-0.320		
2 L - 11	4	17:29:00	0	33	4,400	1,091	945	0.090	0.012	0.102	0.425	-0.323		
2 L - 11	8	17:33:00	0	36	4,400	1,091	945	0.092	0.011	0.103	0.429	-0.326	0.001	0.003
2 L - 12	1	17:36:00	0	47	4,790	1,189	1,043	0.103	0.012	0.115	0.450	-0.335		
2 L - 12	2	17:37:00	0	51	4,790	1,189	1,043	0.104	0.013	0.117	0.453	-0.336		
2 L - 12	4	17:39:00	0	54	4,790	1,189	1,043	0.106	0.012	0.118	0.456	-0.338		
2 L - 12	8	17:43:00	0	65	4,790	1,189	1,043	0.109	0.012	0.121	0.462	-0.341	0.003	0.003
2 L - 13	1	17:45:30	0	76	5,160	1,282	1,136	0.118	0.012	0.130	0.479	-0.349		
2 L - 13	2	17:46:30	0	80	5,160	1,282	1,136	0.120	0.012	0.132	0.482	-0.350		
2 L - 13	4	17:48:30	0	87	5,160	1,282	1,136	0.121	0.012	0.133	0.486	-0.353		
2 L - 13	8	17:52:30	0	87	5,160	1,282	1,136	0.126	0.012	0.138	0.491	-0.353	0.005	0.000
2 L - 14	1	17:54:30	0	102	5,570	1,384	1,238	0.135	0.012	0.147	0.509	-0.362		
2 L - 14	2	17:55:30	0	109	5,570	1,384	1,238	0.139	0.012	0.151	0.515	-0.364		
2 L - 14	4	17:57:30	0	105	5,570	1,384	1,238	0.142	0.012	0.154	0.520	-0.366		
2 L - 14	8	18:01:30	0	105	5,570	1,384	1,238	0.147	0.012	0.159	0.528	-0.369	0.005	0.003



Upper O-cell Plate Movements and Creep (calculated)
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell			Top of Shaft Movement (in)	Upper Comp. (in)	Upward Movement (in)	O-cell Expansion (in)	Downward Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	Net Load (kips)							
2 L - 15	1	18:04:00	0	131	6,020	1,497	1,351	0.162	0.013	0.175	0.554	-0.379		
2 L - 15	2	18:05:00	0	131	6,020	1,497	1,351	0.165	0.013	0.178	0.558	-0.380		
2 L - 15	4	18:07:00	0	134	6,020	1,497	1,351	0.169	0.013	0.182	0.564	-0.382		
2 L - 15	8	18:11:00	0	138	6,020	1,497	1,351	0.176	0.013	0.189	0.574	-0.385	0.007	0.003
2 L - 16	1	18:13:00	0	141	6,420	1,597	1,451	0.190	0.013	0.203	0.594	-0.391		
2 L - 16	2	18:14:00	0	141	6,420	1,597	1,451	0.193	0.014	0.207	0.599	-0.392		
2 L - 16	4	18:16:00	0	145	6,420	1,597	1,451	0.198	0.014	0.212	0.606	-0.394		
2 L - 16	8	18:20:00	0	149	6,420	1,597	1,451	0.203	0.013	0.216	0.613	-0.397	0.004	0.003
2 L - 17	1	18:22:30	0	167	6,840	1,703	1,557	0.217	0.015	0.232	0.637	-0.405		
2 L - 17	2	18:23:30	0	167	6,840	1,703	1,557	0.222	0.014	0.236	0.642	-0.406		
2 L - 17	4	18:25:30	0	160	6,840	1,703	1,557	0.228	0.015	0.243	0.648	-0.405		
2 L - 17	8	18:29:30	0	163	6,840	1,703	1,557	0.232	0.015	0.247	0.658	-0.411	0.004	0.006
2 L - 18	1	18:31:30	0	174	7,220	1,798	1,652	0.248	0.014	0.262	0.679	-0.417		
2 L - 18	2	18:32:30	0	181	7,220	1,798	1,652	0.252	0.014	0.266	0.685	-0.419		
2 L - 18	4	18:34:30	0	167	7,220	1,798	1,652	0.259	0.016	0.275	0.692	-0.417		
2 L - 18	8	18:38:30	0	185	7,220	1,798	1,652	0.265	0.016	0.281	0.703	-0.422	0.006	0.005
2 L - 19	1	18:40:30	0	192	7,620	1,898	1,752	0.282	0.015	0.297	0.727	-0.430		
2 L - 19	2	18:41:30	0	192	7,620	1,898	1,752	0.287	0.016	0.303	0.734	-0.431		
2 L - 19	4	18:43:30	0	196	7,620	1,898	1,752	0.294	0.016	0.310	0.743	-0.433		
2 L - 19	8	18:47:30	0	196	7,620	1,898	1,752	0.305	0.016	0.321	0.756	-0.435	0.011	0.002
2 L - 20	1	18:49:30	0	196	8,000	1,994	1,848	0.330	0.015	0.345	0.787	-0.442		
2 L - 20	2	18:50:30	0	196	8,000	1,994	1,848	0.337	0.016	0.353	0.795	-0.442		
2 L - 20	4	18:52:30	0	203	8,000	1,994	1,848	0.346	0.016	0.362	0.808	-0.446		
2 L - 20	8	18:56:30	0	203	8,000	1,994	1,848	0.360	0.016	0.376	0.824	-0.448	0.014	0.002
2 L - 21	1	18:58:30	0	214	8,410	2,096	1,950	0.386	0.017	0.403	0.858	-0.455		
2 L - 21	2	18:59:30	0	221	8,410	2,096	1,950	0.398	0.016	0.414	0.872	-0.458		
2 L - 21	4	19:01:30	0	218	8,410	2,096	1,950	0.418	0.017	0.435	0.896	-0.461		
2 L - 21	8	19:05:30	0	221	8,410	2,096	1,950	0.448	0.016	0.464	0.928	-0.464	0.029	0.003
2 L - 22	1	19:08:00	0	232	8,790	2,192	2,046	0.496	0.017	0.513	0.983	-0.470		
2 L - 22	2	19:09:00	0	247	8,790	2,192	2,046	0.507	0.018	0.525	1.001	-0.476		
2 L - 22	4	19:11:00	0	243	8,790	2,192	2,046	0.563	0.019	0.582	1.061	-0.479		
2 L - 22	8	19:15:00	0	239	8,790	2,192	2,046	0.695	0.021	0.716	1.197	-0.481	0.134	0.002
2 L - 23	1	19:17:00	0	290	9,260	2,309	2,163	0.884	0.023	0.907	1.406	-0.499		
2 L - 23	2	19:18:00	0	297	9,260	2,309	2,163	0.989	0.023	1.012	1.514	-0.502		
2 L - 23	4	19:20:00	0	284	9,260	2,309	2,163	1.148	0.024	1.172	1.675	-0.503		
2 L - 23	8	19:24:00	0	272	9,260	2,309	2,163	1.337	0.026	1.363	1.867	-0.504	0.191	0.001
2 U - 1	1	19:28:30	0	196	6,910	1,720	1,574	1.359	0.023	1.382	1.861	-0.479		
2 U - 1	2	19:29:30	0	196	6,910	1,720	1,574	1.358	0.023	1.381	1.860	-0.479		
2 U - 1	4	19:31:30	0	196	6,910	1,720	1,574	1.358	0.022	1.380	1.859	-0.479		
2 U - 2	1	19:34:00	0	134	4,590	1,139	993	1.322	0.015	1.337	1.792	-0.455		
2 U - 2	2	19:35:00	0	127	4,590	1,139	993	1.321	0.015	1.336	1.789	-0.453		
2 U - 2	4	19:37:00	0	127	4,590	1,139	993	1.320	0.015	1.335	1.788	-0.453		
2 U - 3	1	19:39:30	0	47	2,290	562	416	1.255	0.009	1.264	1.687	-0.423		
2 U - 3	2	19:40:30	0	47	2,290	562	416	1.251	0.009	1.260	1.683	-0.423		
2 U - 3	4	19:42:30	0	40	2,290	562	416	1.249	0.009	1.258	1.679	-0.421		
2 U - 4	1	19:46:30	0	0	10	-9	0	1.085	0.004	1.089	1.404	-0.315		
2 U - 4	2	19:47:30	0	0	10	-9	0	1.079	0.004	1.083	1.397	-0.314		
2 U - 4	4	19:49:30	0	0	10	-9	0	1.072	0.004	1.076	1.389	-0.313		
2 U - 4	8	19:53:30	0	0	10	-9	0	1.065	0.004	1.069	1.381	-0.312		
3 L - 1	1	19:58:00	1,130	272	1,130	271	125	1.072	0.005	1.077	1.459	-0.382		
3 L - 1	2	19:59:00	1,130	272	1,130	271	125	1.072	0.005	1.077	1.459	-0.382		
3 L - 2	1	20:01:00	2,060	505	2,060	504	358	1.089	0.008	1.097	1.497	-0.400		
3 L - 2	2	20:02:00	2,060	505	2,060	504	358	1.089	0.007	1.096	1.497	-0.401		
3 L - 3	1	20:04:00	3,090	763	3,090	763	617	1.119	0.010	1.129	1.540	-0.411		
3 L - 3	2	20:05:00	3,090	763	3,090	763	617	1.120	0.010	1.130	1.542	-0.412		
3 L - 4	1	20:07:30	4,010	993	4,010	993	847	1.163	0.012	1.175	1.591	-0.416		
3 L - 4	2	20:08:30	4,010	993	4,010	993	847	1.166	0.012	1.178	1.592	-0.414		
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	1,121	1.218	0.016	1.234	1.652	-0.418		
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	1,121	1.222	0.016	1.238	1.656	-0.418		
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	1,369	1.271	0.017	1.288	1.714	-0.426		
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	1,369	1.279	0.018	1.297	1.721	-0.424		
3 U - 1	1	20:20:00	0	0	0	0	0	1.245	0.004	1.249	1.406	-0.157		
3 U - 1	2	20:21:00	0	0	0	0	0	1.245	0.004	1.249	1.402	-0.153		

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Strain Gage Readings and Loads at Levels 1 and 2
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 1				Strain Gage Level 2			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	1A - 1306650 (µε)	1C - 1306651 (µε)	Av. Strain (µε)	Load (kips)	2A - 1306652 (µε)	2C - 1306653 (µε)	Av. Strain (µε)	Load (kips)
1 L - 0	-	11:38:00	0	0	0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0
1 L - 1	1	11:45:00	350	77	0	0	0.5	-0.1	0.2	2	0.0	0.2	0.1	1
1 L - 1	2	11:46:00	350	77	0	0	0.6	-0.1	0.2	3	0.0	0.2	0.1	1
1 L - 1	4	11:48:00	350	77	0	0	0.5	-0.1	0.2	2	0.0	0.3	0.1	1
1 L - 1	8	11:52:00	350	77	0	0	0.5	-0.1	0.2	2	0.0	0.2	0.1	1
1 L - 2	1	11:54:00	720	169	0	0	3.2	2.0	2.6	29	1.2	1.7	1.4	16
1 L - 2	2	11:55:00	720	169	0	0	3.2	2.0	2.6	30	1.1	1.7	1.4	16
1 L - 2	4	11:57:00	720	169	0	0	3.4	2.1	2.7	32	1.1	1.7	1.4	16
1 L - 2	8	12:01:00	720	169	0	0	3.4	2.1	2.7	32	1.2	1.8	1.5	17
1 L - 3	1	12:03:00	1,120	270	0	0	6.6	4.4	5.5	63	2.5	3.3	2.9	33
1 L - 3	2	12:04:00	1,120	270	0	0	6.9	4.6	5.8	67	2.8	3.5	3.1	36
1 L - 3	4	12:06:00	1,120	270	0	0	7.1	4.8	6.0	69	2.8	3.5	3.2	36
1 L - 3	8	12:10:00	1,120	270	0	0	7.4	5.0	6.2	72	3.0	3.8	3.4	38
1 L - 4	1	12:12:00	1,520	370	0	0	11.1	7.8	9.5	109	4.6	5.8	5.2	59
1 L - 4	2	12:13:00	1,520	370	0	0	11.5	8.1	9.8	113	4.8	5.9	5.3	60
1 L - 4	4	12:15:00	1,520	370	0	0	11.9	8.5	10.2	118	5.0	6.3	5.7	64
1 L - 4	8	12:19:00	1,520	370	0	0	12.2	8.9	10.6	122	5.4	6.6	6.0	68
1 L - 5	1	12:21:30	1,910	467	0	0	17.6	12.8	15.2	176	7.9	9.5	8.7	99
1 L - 5	2	12:22:30	1,910	467	0	0	18.2	13.5	15.9	183	8.3	9.9	9.1	103
1 L - 5	4	12:24:30	1,910	467	0	0	19.0	14.1	16.6	191	8.9	10.4	9.6	109
1 L - 5	8	12:28:30	1,910	467	0	0	19.5	14.7	17.1	197	9.1	11.0	10.0	114
1 L - 6	1	12:31:00	2,290	562	0	0	24.8	18.7	21.7	251	12.1	14.1	13.1	148
1 L - 6	2	12:32:00	2,290	562	0	0	25.7	19.4	22.5	260	12.5	14.8	13.6	155
1 L - 6	4	12:34:00	2,290	562	0	0	26.3	20.1	23.2	268	13.0	15.3	14.1	160
1 L - 6	8	12:38:00	2,290	562	0	0	27.1	20.8	24.0	277	13.8	16.0	14.9	169
1 L - 7	1	12:41:00	2,710	668	0	0	33.7	25.6	29.7	342	17.0	20.1	18.6	210
1 L - 7	2	12:42:00	2,710	668	0	0	34.1	26.1	30.1	347	17.5	20.4	19.0	215
1 L - 7	4	12:44:00	2,710	668	0	0	34.2	26.2	30.2	349	17.7	20.6	19.2	217
1 L - 7	8	12:48:00	2,710	668	0	0	35.1	27.0	31.1	359	18.4	21.3	19.8	225
1 L - 8	1	12:50:00	3,080	760	0	0	40.2	31.0	35.6	411	21.1	24.4	22.7	258
1 L - 8	2	12:51:00	3,080	760	0	0	41.2	31.8	36.5	421	21.6	25.0	23.3	264
1 L - 8	4	12:53:00	3,080	760	0	0	41.1	31.8	36.5	421	21.9	25.2	23.6	267
1 L - 8	8	12:57:00	3,080	760	0	0	42.9	33.6	38.2	442	23.1	26.4	24.7	281
1 L - 9	1	12:59:00	3,480	860	0	0	49.3	38.6	44.0	508	27.2	30.9	29.1	329
1 L - 9	2	13:00:00	3,480	860	0	0	49.7	39.1	44.4	513	27.6	31.2	29.4	333
1 L - 9	4	13:02:00	3,480	860	0	0	50.7	39.9	45.3	523	28.0	31.9	29.9	339
1 L - 9	8	13:06:00	3,480	860	0	0	51.2	40.5	45.9	530	28.5	32.3	30.4	344
1 L - 10	1	13:10:00	3,860	955	0	0	57.1	45.1	51.1	590	32.1	36.3	34.2	388
1 L - 10	2	13:11:00	3,860	955	0	0	57.2	45.2	51.2	591	32.2	36.4	34.3	389
1 L - 10	4	13:13:00	3,860	955	0	0	57.7	45.7	51.7	597	32.5	36.7	34.6	393
1 L - 10	8	13:17:00	3,860	955	0	0	58.0	45.9	51.9	600	33.0	37.1	35.1	398
1 L - 11	1	13:20:00	4,290	1,063	0	0	64.4	50.7	57.6	665	36.4	41.1	38.7	439
1 L - 11	2	13:21:00	4,290	1,063	0	0	64.6	51.0	57.8	667	36.8	41.4	39.1	443
1 L - 11	4	13:23:00	4,290	1,063	0	0	65.4	51.5	58.4	675	37.2	41.7	39.4	447
1 L - 11	8	13:27:00	4,290	1,063	0	0	66.3	52.4	59.4	686	37.9	42.7	40.3	457
1 L - 12	1	13:30:30	4,690	1,163	0	0	72.5	57.2	64.8	749	41.4	46.7	44.1	499
1 L - 12	2	13:31:30	4,690	1,163	0	0	72.8	57.3	65.1	752	41.8	46.9	44.3	503
1 L - 12	4	13:33:30	4,690	1,163	0	0	73.1	57.8	65.4	756	42.1	47.3	44.7	507
1 L - 12	8	13:37:30	4,690	1,163	0	0	74.0	58.4	66.2	764	42.6	47.9	45.2	513
1 L - 13	1	13:40:30	5,090	1,263	0	0	80.6	63.9	72.2	834	46.6	52.1	49.4	560
1 L - 13	2	13:41:30	5,090	1,263	0	0	80.7	64.0	72.4	836	46.8	52.6	49.7	564
1 L - 13	4	13:43:30	5,090	1,263	0	0	81.5	64.5	73.0	843	47.4	53.2	50.3	570
1 L - 13	8	13:47:30	5,090	1,263	0	0	82.9	65.8	74.4	859	48.4	54.3	51.3	582
1 L - 14	1	13:51:00	5,520	1,371	0	0	95.5	76.3	85.9	992	57.1	64.5	60.8	689
1 L - 14	2	13:52:00	5,520	1,371	0	0	96.2	76.9	86.6	1,000	57.9	65.1	61.5	697
1 L - 14	4	13:54:00	5,520	1,371	0	0	96.4	77.0	86.7	1,001	58.3	65.6	61.9	702
1 L - 14	8	13:58:00	5,520	1,371	0	0	97.2	77.6	87.4	1,009	59.0	66.5	62.8	712
1 L - 15	1	14:02:00	5,930	1,474	0	0	104.7	83.7	94.2	1,088	64.2	72.5	68.4	775
1 L - 15	2	14:03:00	5,930	1,474	0	0	104.9	83.9	94.4	1,090	64.4	72.9	68.6	778
1 L - 15	4	14:05:00	5,930	1,474	0	0	105.1	84.2	94.7	1,093	64.6	73.0	68.8	780
1 L - 15	8	14:09:00	5,930	1,474	0	0	105.5	84.6	95.0	1,098	65.0	73.3	69.2	784
1 L - 16	1	14:11:30	6,320	1,571	0	0	112.4	90.8	101.6	1,174	69.5	78.8	74.1	840
1 L - 16	2	14:12:30	6,320	1,571	0	0	112.4	90.8	101.6	1,174	69.7	79.0	74.3	843
1 L - 16	4	14:14:30	6,320	1,571	0	0	113.0	91.2	102.1	1,179	70.0	79.3	74.6	846
1 L - 16	8	14:18:30	6,320	1,571	0	0	114.0	91.8	102.9	1,188	70.5	79.8	75.2	852
1 L - 17	1	14:23:00	6,730	1,674	0	0	124.9	101.6	113.2	1,308	78.6	89.7	84.1	954
1 L - 17	2	14:24:00	6,730	1,674	0	0	125.4	102.0	113.7	1,313	79.0	90.2	84.6	960
1 L - 17	4	14:26:00	6,730	1,674	0	0	125.7	102.5	114.1	1,318	79.4	90.7	85.1	965
1 L - 17	8	14:30:00	6,730	1,674	0	0	126.5	103.1	114.8	1,326	79.8	91.4	85.6	971
1 L - 18	1	14:34:00	7,130	1,774	0	0	134.5	110.3	122.4	1,414	85.3	98.2	91.7	1,040
1 L - 18	2	14:35:00	7,130	1,774	0	0	134.7	110.5	122.6	1,416	85.7	98.4	92.1	1,044
1 L - 18	4	14:37:00	7,130	1,774	0	0	135.8	111.4	123.6	1,427	86.4	99.4	92.9	1,053
1 L - 18	8	14:41:00	7,130	1,774	0	0	136.4	111.7	124.1	1,433	86.7	99.9	93.3	1,058
1 L - 19	1	14:45:30	7,530	1,874	0	0	145.0	118.8	131.9	1,524	92.1	106.5	99.3	1,126
1 L - 19	2	14:46:30	7,530	1,874	0	0	145.9	119.7	132.8	1,534	92.9	107.5	100.2	1,136
1 L - 19	4	14:48:30	7,530	1,874	0	0	147.4	120.8	134.1	1,548	93.7	108.7	101.2	1,148
1 L - 19	8	14:52:30	7,530	1,874	0	0	148.1	121.5	134.8	1,557	94.2	109.5	101.9	1,155



Strain Gage Readings and Loads at Levels 1 and 2
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 1				Strain Gage Level 2			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	1A - 1306650 (µε)	1C - 1306651 (µε)	Av. Strain (µε)	Load (kips)	2A - 1306652 (µε)	2C - 1306653 (µε)	Av. Strain (µε)	Load (kips)
1 U - 1	1	14:55:30	5,550	1,378	0	0	128.3	101.4	114.8	1,326	84.0	98.4	91.2	1,034
1 U - 1	2	14:56:30	5,550	1,378	0	0	128.1	101.0	114.5	1,323	83.9	98.0	90.9	1,031
1 U - 1	4	14:58:30	5,550	1,378	0	0	127.8	100.7	114.3	1,320	83.8	97.9	90.8	1,030
1 U - 2	1	15:02:00	3,740	925	0	0	102.0	77.3	89.6	1,035	70.8	83.6	77.2	875
1 U - 2	2	15:03:00	3,740	925	0	0	101.0	76.8	88.9	1,026	70.3	83.1	76.7	870
1 U - 2	4	15:05:00	3,740	925	0	0	101.2	76.6	88.9	1,027	70.2	83.0	76.6	868
1 U - 3	1	15:10:00	1,910	467	0	0	66.4	48.6	57.5	664	53.2	63.4	58.3	661
1 U - 3	2	15:11:00	1,910	467	0	0	67.2	49.3	58.2	672	53.6	63.8	58.7	666
1 U - 3	4	15:13:00	1,910	467	0	0	68.0	50.0	59.0	681	53.9	64.2	59.0	670
1 U - 4	1	15:18:30	0	0	0	0	27.0	19.0	23.0	265	32.2	35.9	34.1	386
1 U - 4	2	15:19:30	0	0	0	0	26.8	18.9	22.8	264	32.0	35.5	33.8	383
1 U - 4	4	15:21:30	0	0	0	0	26.4	18.7	22.6	261	31.8	35.3	33.5	380
1 U - 4	8	15:25:30	0	0	0	0	26.1	18.6	22.4	258	31.4	34.8	33.1	376
2 L - 1	1	15:46:00	0	0	380	83	25.2	18.1	21.7	250	30.7	33.8	32.3	366
2 L - 1	2	15:47:00	0	0	380	83	25.2	18.1	21.6	250	30.6	33.8	32.2	365
2 L - 1	4	15:49:00	0	0	380	83	25.1	18.0	21.6	249	30.7	33.7	32.2	365
2 L - 1	8	15:53:00	0	0	380	83	25.0	18.0	21.5	248	30.5	33.5	32.0	363
2 L - 2	1	15:55:30	0	0	770	181	25.2	18.1	21.7	250	30.6	33.8	32.2	365
2 L - 2	2	15:56:30	0	0	770	181	25.1	18.0	21.6	249	30.5	33.8	32.2	365
2 L - 2	4	15:58:30	0	0	770	181	24.9	18.1	21.5	248	30.5	33.6	32.1	363
2 L - 2	8	16:02:30	0	0	770	181	25.0	18.0	21.5	248	30.4	33.6	32.0	363
2 L - 3	1	16:05:00	0	0	1,200	289	25.3	18.5	21.9	253	31.1	34.6	32.9	373
2 L - 3	2	16:06:00	0	0	1,200	289	25.3	18.6	22.0	254	31.1	34.8	32.9	373
2 L - 3	4	16:08:00	0	0	1,200	289	25.2	18.6	21.9	253	31.0	34.8	32.9	373
2 L - 3	8	16:12:00	0	0	1,200	289	25.2	18.6	21.9	253	30.8	34.6	32.7	371
2 L - 4	1	16:15:00	0	0	1,570	382	26.3	19.8	23.1	266	32.4	36.9	34.7	393
2 L - 4	2	16:16:00	0	0	1,570	382	26.3	20.0	23.1	267	32.6	37.1	34.8	395
2 L - 4	4	16:18:00	0	0	1,570	382	26.4	19.9	23.2	268	32.6	37.0	34.8	395
2 L - 4	8	16:22:00	0	0	1,570	382	26.2	20.0	23.1	267	32.4	36.7	34.6	392
2 L - 5	1	16:25:30	0	0	1,970	482	32.3	27.9	30.1	348	35.6	46.1	40.8	463
2 L - 5	2	16:26:30	0	0	1,970	482	32.3	28.0	30.2	348	35.8	46.4	41.1	466
2 L - 5	4	16:28:30	0	0	1,970	482	32.1	28.1	30.1	348	35.9	46.5	41.2	467
2 L - 5	8	16:32:30	0	0	1,970	482	31.9	28.1	30.0	346	35.9	46.3	41.1	466
2 L - 6	1	16:35:30	0	0	2,370	582	34.9	32.7	33.8	390	38.2	54.3	46.3	525
2 L - 6	2	16:36:30	0	0	2,370	582	34.8	32.6	33.7	390	38.2	54.6	46.4	526
2 L - 6	4	16:38:30	0	0	2,370	582	34.6	32.5	33.5	387	38.0	54.3	46.2	523
2 L - 6	8	16:42:30	0	0	2,370	582	34.2	32.5	33.4	385	38.0	54.2	46.1	523
2 L - 7	1	16:45:00	0	0	2,790	687	36.4	35.9	36.1	417	40.4	60.4	50.4	571
2 L - 7	2	16:46:00	0	0	2,790	687	36.2	35.9	36.1	417	40.4	60.5	50.4	572
2 L - 7	4	16:48:00	0	0	2,790	687	36.1	35.9	36.0	416	40.2	60.3	50.2	570
2 L - 7	8	16:52:00	0	0	2,790	687	35.8	35.9	35.9	414	40.3	60.2	50.2	570
2 L - 8	1	16:55:30	0	0	3,180	785	37.4	38.2	37.8	436	43.2	64.5	53.9	611
2 L - 8	2	16:56:30	0	0	3,180	785	37.1	38.2	37.6	435	43.3	64.3	53.8	610
2 L - 8	4	16:58:30	0	0	3,180	785	37.1	38.1	37.6	435	43.5	64.4	53.9	611
2 L - 8	8	17:02:30	0	0	3,180	785	36.9	38.2	37.6	434	44.0	64.5	54.3	615
2 L - 9	1	17:05:30	0	0	3,600	891	38.8	40.5	39.7	458	48.4	68.6	58.5	663
2 L - 9	2	17:06:30	0	0	3,600	891	38.6	40.6	39.6	457	48.5	68.3	58.4	663
2 L - 9	4	17:08:30	0	0	3,600	891	38.4	40.5	39.4	456	48.7	68.1	58.4	662
2 L - 9	8	17:12:30	0	0	3,600	891	38.3	40.3	39.3	454	49.0	68.0	58.5	664
2 L - 10	1	17:15:30	0	0	3,990	988	40.1	42.7	41.4	478	53.8	71.6	62.7	711
2 L - 10	2	17:16:30	0	0	3,990	988	40.0	42.6	41.3	477	54.1	71.5	62.8	712
2 L - 10	4	17:18:30	0	0	3,990	988	39.8	42.5	41.1	475	54.5	71.2	62.9	713
2 L - 10	8	17:22:30	0	0	3,990	988	40.0	42.3	41.1	475	54.8	71.1	63.0	714
2 L - 11	1	17:26:00	0	22	4,400	1,091	41.7	44.5	43.1	498	59.5	74.4	66.9	759
2 L - 11	2	17:27:00	0	25	4,400	1,091	41.5	44.3	42.9	495	59.9	74.1	67.0	759
2 L - 11	4	17:29:00	0	33	4,400	1,091	41.9	44.3	43.1	497	60.4	73.8	67.1	761
2 L - 11	8	17:33:00	0	36	4,400	1,091	41.7	44.1	42.9	495	60.5	73.7	67.1	761
2 L - 12	1	17:36:00	0	47	4,790	1,189	43.3	46.0	44.7	516	65.4	76.8	71.1	807
2 L - 12	2	17:37:00	0	51	4,790	1,189	43.1	45.9	44.5	514	65.3	76.4	70.9	804
2 L - 12	4	17:39:00	0	54	4,790	1,189	43.3	46.0	44.6	515	65.7	76.6	71.2	807
2 L - 12	8	17:43:00	0	65	4,790	1,189	43.3	45.8	44.5	514	66.0	76.3	71.2	807
2 L - 13	1	17:45:30	0	76	5,160	1,282	44.8	47.3	46.1	532	70.1	79.0	74.5	845
2 L - 13	2	17:46:30	0	80	5,160	1,282	44.9	47.6	46.2	534	70.5	79.2	74.8	849
2 L - 13	4	17:48:30	0	87	5,160	1,282	45.0	47.3	46.2	533	70.5	79.4	74.9	850
2 L - 13	8	17:52:30	0	87	5,160	1,282	44.8	47.3	46.0	531	70.7	79.5	75.1	852
2 L - 14	1	17:54:30	0	102	5,570	1,384	46.7	49.3	48.0	554	75.1	82.4	78.7	893
2 L - 14	2	17:55:30	0	109	5,570	1,384	46.7	49.3	48.0	554	75.5	82.7	79.1	896
2 L - 14	4	17:57:30	0	105	5,570	1,384	46.4	49.1	47.7	551	75.1	82.7	78.9	895
2 L - 14	8	18:01:30	0	105	5,570	1,384	46.5	49.0	47.8	552	75.7	83.2	79.5	901



Strain Gage Readings and Loads at Levels 1 and 2
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 1				Strain Gage Level 2			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	1A - 1306650 (µε)	1C - 1306651 (µε)	Av. Strain (µε)	Load (kips)	2A - 1306652 (µε)	2C - 1306653 (µε)	Av. Strain (µε)	Load (kips)
2 L - 15	1	18:04:00	0	131	6,020	1,497	48.6	51.3	49.9	577	80.9	86.2	83.6	947
2 L - 15	2	18:05:00	0	131	6,020	1,497	48.5	51.1	49.8	575	80.8	86.3	83.6	948
2 L - 15	4	18:07:00	0	134	6,020	1,497	48.3	50.8	49.6	572	80.8	86.3	83.5	947
2 L - 15	8	18:11:00	0	138	6,020	1,497	48.5	50.9	49.7	574	81.2	87.1	84.1	954
2 L - 16	1	18:13:00	0	141	6,420	1,597	50.3	52.9	51.6	596	85.8	90.0	87.9	996
2 L - 16	2	18:14:00	0	141	6,420	1,597	50.3	52.8	51.6	596	86.1	90.1	88.1	999
2 L - 16	4	18:16:00	0	145	6,420	1,597	50.2	52.7	51.5	594	86.1	90.5	88.3	1,001
2 L - 16	8	18:20:00	0	149	6,420	1,597	50.0	52.3	51.2	591	85.8	90.3	88.0	998
2 L - 17	1	18:22:30	0	167	6,840	1,703	52.1	54.5	53.3	615	90.9	93.7	92.3	1,047
2 L - 17	2	18:23:30	0	167	6,840	1,703	51.9	54.3	53.1	614	91.0	93.7	92.4	1,047
2 L - 17	4	18:25:30	0	160	6,840	1,703	51.8	53.9	52.9	611	90.6	93.4	92.0	1,043
2 L - 17	8	18:29:30	0	163	6,840	1,703	51.8	53.6	52.7	609	90.8	94.0	92.4	1,048
2 L - 18	1	18:31:30	0	174	7,220	1,798	53.7	55.8	54.8	633	95.6	96.8	96.2	1,091
2 L - 18	2	18:32:30	0	181	7,220	1,798	53.7	55.7	54.7	632	95.8	97.0	96.4	1,093
2 L - 18	4	18:34:30	0	167	7,220	1,798	53.7	55.5	54.6	630	95.8	97.2	96.5	1,094
2 L - 18	8	18:38:30	0	185	7,220	1,798	53.4	55.0	54.2	626	95.4	97.2	96.3	1,092
2 L - 19	1	18:40:30	0	192	7,620	1,898	55.2	57.1	56.2	649	100.6	100.3	100.5	1,139
2 L - 19	2	18:41:30	0	192	7,620	1,898	55.3	56.8	56.0	647	100.3	100.0	100.2	1,136
2 L - 19	4	18:43:30	0	196	7,620	1,898	55.4	56.8	56.1	648	100.9	100.7	100.8	1,143
2 L - 19	8	18:47:30	0	196	7,620	1,898	55.3	56.3	55.8	645	100.9	101.0	100.9	1,145
2 L - 20	1	18:49:30	0	196	8,000	1,994	57.4	58.4	57.9	669	106.1	103.8	105.0	1,190
2 L - 20	2	18:50:30	0	196	8,000	1,994	57.0	58.1	57.5	665	105.8	103.7	104.8	1,188
2 L - 20	4	18:52:30	0	203	8,000	1,994	57.1	57.8	57.5	664	105.8	104.1	105.0	1,190
2 L - 20	8	18:56:30	0	203	8,000	1,994	57.3	57.5	57.4	663	105.9	104.7	105.3	1,194
2 L - 21	1	18:58:30	0	214	8,410	2,096	59.0	59.4	59.2	684	110.1	107.7	108.9	1,235
2 L - 21	2	18:59:30	0	221	8,410	2,096	59.2	59.4	59.3	685	110.3	108.5	109.4	1,240
2 L - 21	4	19:01:30	0	218	8,410	2,096	58.9	59.2	59.0	682	109.7	109.3	109.5	1,241
2 L - 21	8	19:05:30	0	221	8,410	2,096	58.7	59.1	58.9	680	108.7	110.7	109.7	1,244
2 L - 22	1	19:08:00	0	232	8,790	2,192	60.1	61.0	60.6	699	111.9	114.7	113.3	1,285
2 L - 22	2	19:09:00	0	247	8,790	2,192	59.9	60.9	60.4	698	111.3	115.5	113.4	1,286
2 L - 22	4	19:11:00	0	243	8,790	2,192	59.2	61.4	60.3	696	108.2	119.4	113.8	1,290
2 L - 22	8	19:15:00	0	239	8,790	2,192	59.0	61.1	60.0	693	107.6	120.3	114.0	1,292
2 L - 23	1	19:17:00	0	290	9,260	2,309	60.6	63.1	61.9	714	112.2	124.0	118.1	1,339
2 L - 23	2	19:18:00	0	297	9,260	2,309	60.8	62.7	61.7	713	113.9	123.1	118.5	1,343
2 L - 23	4	19:20:00	0	284	9,260	2,309	60.7	62.2	61.4	709	116.1	121.9	119.0	1,349
2 L - 23	8	19:24:00	0	272	9,260	2,309	61.1	61.3	61.2	707	117.3	121.8	119.5	1,355
2 U - 1	1	19:28:30	0	196	6,910	1,720	50.1	51.4	50.8	586	94.8	99.4	97.1	1,101
2 U - 1	2	19:29:30	0	196	6,910	1,720	50.0	51.2	50.6	585	94.5	99.2	96.8	1,098
2 U - 1	4	19:31:30	0	196	6,910	1,720	50.0	51.1	50.6	584	94.3	99.1	96.7	1,096
2 U - 2	1	19:34:00	0	134	4,590	1,139	38.7	40.1	39.4	455	69.5	72.5	71.0	805
2 U - 2	2	19:35:00	0	127	4,590	1,139	38.5	40.0	39.2	453	69.1	71.8	70.4	799
2 U - 2	4	19:37:00	0	127	4,590	1,139	38.6	40.0	39.3	454	69.0	71.9	70.4	799
2 U - 3	1	19:39:30	0	47	2,290	562	27.6	28.3	28.0	323	43.6	40.9	42.2	479
2 U - 3	2	19:40:30	0	47	2,290	562	27.6	28.3	28.0	323	43.4	40.5	41.9	476
2 U - 3	4	19:42:30	0	40	2,290	562	27.4	28.3	27.8	322	42.8	40.0	41.4	469
2 U - 4	1	19:46:30	0	0	10	-9	17.8	15.2	16.5	190	22.4	2.7	12.6	142
2 U - 4	2	19:47:30	0	0	10	-9	18.0	15.1	16.6	191	22.2	2.3	12.2	139
2 U - 4	4	19:49:30	0	0	10	-9	17.9	15.1	16.5	191	22.0	1.7	11.9	134
2 U - 4	8	19:53:30	0	0	10	-9	17.8	15.0	16.4	190	21.9	1.3	11.6	131
3 L - 1	1	19:58:00	1,130	272	1,130	271	33.1	28.2	30.6	354	32.8	17.5	25.2	286
3 L - 1	2	19:59:00	1,130	272	1,130	271	33.4	28.6	31.0	358	33.1	18.0	25.6	290
3 L - 2	1	20:01:00	2,060	505	2,060	504	47.5	42.5	45.0	520	41.9	36.9	39.4	447
3 L - 2	2	20:02:00	2,060	505	2,060	504	47.8	42.8	45.3	523	42.1	37.4	39.7	450
3 L - 3	1	20:04:00	3,090	763	3,090	763	63.9	57.8	60.9	703	54.8	55.5	55.2	625
3 L - 3	2	20:05:00	3,090	763	3,090	763	64.4	58.3	61.4	709	55.2	56.2	55.7	631
3 L - 4	1	20:07:30	4,010	993	4,010	993	80.7	73.0	76.9	888	68.6	72.9	70.8	802
3 L - 4	2	20:08:30	4,010	993	4,010	993	80.9	73.3	77.1	890	68.7	73.1	70.9	804
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	100.4	90.6	95.5	1,103	84.8	92.4	88.6	1,005
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	101.0	91.2	96.1	1,110	85.2	93.1	89.2	1,011
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	118.5	106.8	112.6	1,301	100.1	109.9	105.0	1,190
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	119.4	107.6	113.5	1,311	100.9	110.8	105.9	1,200
3 U - 1	1	20:20:00	0	0	0	0	28.2	23.0	25.6	296	23.6	11.0	17.3	196
3 U - 1	2	20:21:00	0	0	0	0	27.6	22.5	25.1	290	23.3	10.4	16.8	191

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Strain Gage Readings and Loads at Levels 3 and 4
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 3			Load (kips)	Strain Gage Level 4			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	3A - 1306654 ($\mu\epsilon$)	3C - 1306655 ($\mu\epsilon$)	Av. Strain ($\mu\epsilon$)		4A - 1306657 ($\mu\epsilon$)	4C - 1306656 ($\mu\epsilon$)	Av. Strain ($\mu\epsilon$)	Load (kips)
1 L - 0	-	11:38:00	0	0	0	0	0.0	0.0	0.0	0	0.0	0.0	0.0	0
1 L - 1	1	11:45:00	350	77	0	0	0.1	0.2	0.2	2	-0.1	-0.1	-0.1	-2
1 L - 1	2	11:46:00	350	77	0	0	0.1	0.1	0.1	1	-0.1	-0.2	-0.2	-2
1 L - 1	4	11:48:00	350	77	0	0	-0.1	0.3	0.1	1	-0.1	-0.1	-0.1	-1
1 L - 1	8	11:52:00	350	77	0	0	0.1	0.2	0.2	2	-0.1	-0.1	-0.1	-1
1 L - 2	1	11:54:00	720	169	0	0	0.5	0.5	0.5	6	0.0	0.1	0.1	1
1 L - 2	2	11:55:00	720	169	0	0	0.3	0.6	0.4	5	0.0	0.2	0.1	1
1 L - 2	4	11:57:00	720	169	0	0	0.4	0.6	0.5	6	0.2	0.2	0.2	3
1 L - 2	8	12:01:00	720	169	0	0	0.5	0.7	0.6	7	0.0	0.1	0.1	1
1 L - 3	1	12:03:00	1,120	270	0	0	0.9	1.0	1.0	12	0.4	0.5	0.5	5
1 L - 3	2	12:04:00	1,120	270	0	0	0.9	1.1	1.0	13	0.2	0.4	0.3	4
1 L - 3	4	12:06:00	1,120	270	0	0	1.1	1.1	1.1	13	0.2	0.4	0.3	4
1 L - 3	8	12:10:00	1,120	270	0	0	1.1	1.1	1.1	13	0.2	0.4	0.3	4
1 L - 4	1	12:12:00	1,520	370	0	0	1.6	1.7	1.6	20	0.4	0.9	0.7	8
1 L - 4	2	12:13:00	1,520	370	0	0	1.8	1.6	1.7	21	0.5	0.8	0.7	8
1 L - 4	4	12:15:00	1,520	370	0	0	1.8	1.9	1.8	23	0.4	0.8	0.6	7
1 L - 4	8	12:19:00	1,520	370	0	0	2.0	1.9	2.0	24	0.7	1.0	0.8	10
1 L - 5	1	12:21:30	1,910	467	0	0	2.8	2.6	2.7	33	0.8	1.6	1.2	14
1 L - 5	2	12:22:30	1,910	467	0	0	3.0	2.6	2.8	34	0.9	1.4	1.2	14
1 L - 5	4	12:24:30	1,910	467	0	0	3.1	2.7	2.9	36	0.9	1.4	1.2	14
1 L - 5	8	12:28:30	1,910	467	0	0	3.3	2.9	3.1	38	1.0	1.6	1.3	15
1 L - 6	1	12:31:00	2,290	562	0	0	4.3	3.8	4.0	50	1.4	2.0	1.7	20
1 L - 6	2	12:32:00	2,290	562	0	0	4.4	3.8	4.1	50	1.3	2.1	1.7	21
1 L - 6	4	12:34:00	2,290	562	0	0	4.7	4.1	4.4	54	1.3	2.2	1.8	22
1 L - 6	8	12:38:00	2,290	562	0	0	4.9	4.3	4.6	56	1.5	2.4	2.0	24
1 L - 7	1	12:41:00	2,710	668	0	0	6.1	5.2	5.6	69	2.0	2.8	2.4	28
1 L - 7	2	12:42:00	2,710	668	0	0	6.2	5.3	5.7	70	2.0	3.0	2.5	30
1 L - 7	4	12:44:00	2,710	668	0	0	6.3	5.5	5.9	72	2.0	3.1	2.6	31
1 L - 7	8	12:48:00	2,710	668	0	0	6.5	5.5	6.0	74	2.2	3.2	2.7	33
1 L - 8	1	12:50:00	3,080	760	0	0	7.5	6.5	7.0	86	2.5	3.8	3.2	38
1 L - 8	2	12:51:00	3,080	760	0	0	7.7	6.7	7.2	88	2.4	3.8	3.1	37
1 L - 8	4	12:53:00	3,080	760	0	0	7.8	6.6	7.2	88	2.5	3.8	3.1	38
1 L - 8	8	12:57:00	3,080	760	0	0	8.2	7.0	7.6	93	2.7	4.0	3.4	41
1 L - 9	1	12:59:00	3,480	860	0	0	9.6	8.0	8.8	108	3.1	4.8	4.0	48
1 L - 9	2	13:00:00	3,480	860	0	0	9.7	8.2	9.0	110	3.3	4.7	4.0	48
1 L - 9	4	13:02:00	3,480	860	0	0	10.1	8.3	9.2	113	3.3	5.0	4.2	50
1 L - 9	8	13:06:00	3,480	860	0	0	10.2	8.5	9.4	115	3.4	5.2	4.3	52
1 L - 10	1	13:10:00	3,860	955	0	0	11.4	9.4	10.4	128	3.8	5.7	4.7	57
1 L - 10	2	13:11:00	3,860	955	0	0	11.3	9.4	10.3	127	3.9	5.7	4.8	58
1 L - 10	4	13:13:00	3,860	955	0	0	11.6	9.7	10.6	131	3.9	5.8	4.8	58
1 L - 10	8	13:17:00	3,860	955	0	0	11.8	9.8	10.8	133	3.8	5.9	4.8	58
1 L - 11	1	13:20:00	4,290	1,063	0	0	12.9	10.7	11.8	145	4.4	6.5	5.5	66
1 L - 11	2	13:21:00	4,290	1,063	0	0	13.1	11.0	12.0	148	4.4	6.8	5.6	67
1 L - 11	4	13:23:00	4,290	1,063	0	0	13.2	10.7	12.0	147	4.5	6.8	5.7	68
1 L - 11	8	13:27:00	4,290	1,063	0	0	13.6	11.1	12.4	152	4.6	6.8	5.7	68
1 L - 12	1	13:30:30	4,690	1,163	0	0	14.6	12.1	13.4	164	4.9	7.5	6.2	74
1 L - 12	2	13:31:30	4,690	1,163	0	0	15.0	12.1	13.5	166	5.2	7.5	6.4	76
1 L - 12	4	13:33:30	4,690	1,163	0	0	15.0	12.3	13.7	168	5.1	7.9	6.5	78
1 L - 12	8	13:37:30	4,690	1,163	0	0	15.4	12.4	13.9	171	5.2	7.9	6.5	79
1 L - 13	1	13:40:30	5,090	1,263	0	0	16.7	13.6	15.1	186	5.8	8.7	7.3	87
1 L - 13	2	13:41:30	5,090	1,263	0	0	16.8	13.7	15.3	188	5.8	9.0	7.4	89
1 L - 13	4	13:43:30	5,090	1,263	0	0	17.2	13.7	15.5	190	5.7	8.9	7.3	88
1 L - 13	8	13:47:30	5,090	1,263	0	0	17.6	14.2	15.9	195	6.0	9.3	7.6	92
1 L - 14	1	13:51:00	5,520	1,371	0	0	21.0	16.9	18.9	233	7.4	11.3	9.4	113
1 L - 14	2	13:52:00	5,520	1,371	0	0	21.4	17.1	19.2	236	7.3	11.5	9.4	113
1 L - 14	4	13:54:00	5,520	1,371	0	0	21.7	17.5	19.6	241	7.6	11.5	9.6	115
1 L - 14	8	13:58:00	5,520	1,371	0	0	22.4	17.6	20.0	245	7.7	11.8	9.8	118
1 L - 15	1	14:02:00	5,930	1,474	0	0	24.3	19.5	21.9	269	8.7	13.1	10.9	131
1 L - 15	2	14:03:00	5,930	1,474	0	0	24.6	19.5	22.0	271	8.7	13.3	11.0	132
1 L - 15	4	14:05:00	5,930	1,474	0	0	24.8	19.7	22.3	273	8.8	13.5	11.1	134
1 L - 15	8	14:09:00	5,930	1,474	0	0	25.1	19.9	22.5	277	9.1	13.8	11.4	137
1 L - 16	1	14:11:30	6,320	1,571	0	0	26.8	21.2	24.0	295	9.7	14.8	12.2	147
1 L - 16	2	14:12:30	6,320	1,571	0	0	26.9	21.2	24.1	296	9.8	14.7	12.2	147
1 L - 16	4	14:14:30	6,320	1,571	0	0	27.2	21.4	24.3	298	10.1	14.9	12.5	150
1 L - 16	8	14:18:30	6,320	1,571	0	0	27.6	21.7	24.7	303	10.1	15.0	12.5	150
1 L - 17	1	14:23:00	6,730	1,674	0	0	30.9	24.5	27.7	340	11.4	16.9	14.2	170
1 L - 17	2	14:24:00	6,730	1,674	0	0	31.2	24.6	27.9	343	11.5	17.2	14.4	173
1 L - 17	4	14:26:00	6,730	1,674	0	0	31.6	24.8	28.2	346	11.7	17.3	14.5	175
1 L - 17	8	14:30:00	6,730	1,674	0	0	32.2	24.8	28.5	350	12.0	17.4	14.7	177
1 L - 18	1	14:34:00	7,130	1,774	0	0	34.4	26.9	30.6	376	12.9	18.8	15.8	191
1 L - 18	2	14:35:00	7,130	1,774	0	0	34.7	27.0	30.8	379	12.9	19.0	15.9	192
1 L - 18	4	14:37:00	7,130	1,774	0	0	35.0	27.2	31.1	383	13.2	19.2	16.2	195
1 L - 18	8	14:41:00	7,130	1,774	0	0	35.5	27.4	31.4	386	13.3	19.5	16.4	197
1 L - 19	1	14:45:30	7,530	1,874	0	0	37.7	29.0	33.3	410	14.2	20.5	17.4	209
1 L - 19	2	14:46:30	7,530	1,874	0	0	38.0	29.2	33.6	413	14.2	20.8	17.5	211
1 L - 19	4	14:48:30	7,530	1,874	0	0	38.5	29.4	34.0	417	14.2	21.0	17.6	211
1 L - 19	8	14:52:30	7,530	1,874	0	0	38.8	29.6	34.2	421	14.7	21.1	17.9	216



Strain Gage Readings and Loads at Levels 3 and 4
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 3				Strain Gage Level 4			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	3A - 1306654 (µε)	3C - 1306655 (µε)	Av. Strain (µε)	Load (kips)	4A - 1306657 (µε)	4C - 1306656 (µε)	Av. Strain (µε)	Load (kips)
1 U - 1	1	14:55:30	5,550	1,378	0	0	35.8	26.7	31.3	384	13.5	19.5	16.5	198
1 U - 1	2	14:56:30	5,550	1,378	0	0	35.6	26.9	31.3	384	13.4	19.6	16.5	198
1 U - 1	4	14:58:30	5,550	1,378	0	0	35.6	26.7	31.1	383	13.4	19.4	16.4	197
1 U - 2	1	15:02:00	3,740	925	0	0	31.8	23.3	27.5	338	11.7	17.2	14.5	174
1 U - 2	2	15:03:00	3,740	925	0	0	31.5	23.3	27.4	337	11.8	17.3	14.5	175
1 U - 2	4	15:05:00	3,740	925	0	0	31.4	23.2	27.3	336	11.7	17.2	14.5	174
1 U - 3	1	15:10:00	1,910	467	0	0	26.2	18.7	22.5	276	9.7	14.5	12.1	146
1 U - 3	2	15:11:00	1,910	467	0	0	26.2	18.9	22.5	277	9.5	14.5	12.0	145
1 U - 3	4	15:13:00	1,910	467	0	0	26.2	18.9	22.5	277	9.7	14.7	12.2	146
1 U - 4	1	15:18:30	0	0	0	0	19.2	12.9	16.0	197	6.5	10.3	8.4	101
1 U - 4	2	15:19:30	0	0	0	0	19.0	12.8	15.9	195	6.5	10.1	8.3	100
1 U - 4	4	15:21:30	0	0	0	0	18.9	12.7	15.8	194	6.8	10.1	8.4	101
1 U - 4	8	15:25:30	0	0	0	0	18.7	12.5	15.6	192	6.4	10.1	8.3	99
2 L - 1	1	15:46:00	0	0	380	83	18.2	12.4	15.3	189	6.3	10.1	8.2	99
2 L - 1	2	15:47:00	0	0	380	83	18.1	12.4	15.3	188	6.2	10.1	8.1	98
2 L - 1	4	15:49:00	0	0	380	83	18.1	12.5	15.3	188	6.2	9.7	8.0	96
2 L - 1	8	15:53:00	0	0	380	83	18.2	12.2	15.2	187	6.2	9.8	8.0	96
2 L - 2	1	15:55:30	0	0	770	181	18.5	12.5	15.5	190	6.4	9.8	8.1	97
2 L - 2	2	15:56:30	0	0	770	181	18.4	12.3	15.4	189	6.3	9.9	8.1	97
2 L - 2	4	15:58:30	0	0	770	181	18.3	12.5	15.4	190	6.2	9.7	7.9	95
2 L - 2	8	16:02:30	0	0	770	181	18.3	12.3	15.3	188	6.1	9.8	8.0	96
2 L - 3	1	16:05:00	0	0	1,200	289	19.1	13.0	16.1	197	6.5	10.2	8.4	100
2 L - 3	2	16:06:00	0	0	1,200	289	19.2	13.0	16.1	198	6.4	10.2	8.3	99
2 L - 3	4	16:08:00	0	0	1,200	289	19.1	13.2	16.2	199	6.5	10.1	8.3	99
2 L - 3	8	16:12:00	0	0	1,200	289	19.0	13.0	16.0	197	6.3	10.2	8.3	99
2 L - 4	1	16:15:00	0	0	1,570	382	19.7	14.4	17.1	210	6.9	10.8	8.8	106
2 L - 4	2	16:16:00	0	0	1,570	382	19.7	14.5	17.1	210	6.9	10.9	8.9	107
2 L - 4	4	16:18:00	0	0	1,570	382	19.7	14.7	17.2	211	6.7	10.9	8.8	105
2 L - 4	8	16:22:00	0	0	1,570	382	19.8	14.5	17.2	211	6.8	10.9	8.8	106
2 L - 5	1	16:25:30	0	0	1,970	482	23.0	16.3	19.6	241	7.8	12.1	10.0	120
2 L - 5	2	16:26:30	0	0	1,970	482	23.1	16.4	19.8	243	7.8	12.1	10.0	120
2 L - 5	4	16:28:30	0	0	1,970	482	23.1	16.5	19.8	243	8.0	12.4	10.2	122
2 L - 5	8	16:32:30	0	0	1,970	482	23.1	16.3	19.7	243	7.8	12.3	10.1	121
2 L - 6	1	16:35:30	0	0	2,370	582	26.0	18.9	22.4	276	8.9	13.6	11.2	135
2 L - 6	2	16:36:30	0	0	2,370	582	26.1	18.9	22.5	276	9.1	13.5	11.3	136
2 L - 6	4	16:38:30	0	0	2,370	582	26.1	19.0	22.5	277	8.8	13.5	11.1	134
2 L - 6	8	16:42:30	0	0	2,370	582	26.1	19.1	22.6	277	9.0	13.6	11.3	136
2 L - 7	1	16:45:00	0	0	2,790	687	29.4	21.0	25.2	309	10.2	15.0	12.6	151
2 L - 7	2	16:46:00	0	0	2,790	687	29.5	21.3	25.4	312	10.3	15.2	12.8	154
2 L - 7	4	16:48:00	0	0	2,790	687	29.4	21.3	25.3	311	10.4	15.2	12.8	154
2 L - 7	8	16:52:00	0	0	2,790	687	29.6	21.3	25.5	313	10.4	15.2	12.8	154
2 L - 8	1	16:55:30	0	0	3,180	785	32.1	23.9	28.0	344	11.4	16.5	14.0	168
2 L - 8	2	16:56:30	0	0	3,180	785	32.2	24.2	28.2	347	11.5	16.5	14.0	168
2 L - 8	4	16:58:30	0	0	3,180	785	32.2	24.4	28.3	347	11.6	16.8	14.2	171
2 L - 8	8	17:02:30	0	0	3,180	785	32.5	24.9	28.7	352	11.8	16.9	14.3	172
2 L - 9	1	17:05:30	0	0	3,600	891	35.6	28.4	32.0	393	13.2	18.8	16.0	192
2 L - 9	2	17:06:30	0	0	3,600	891	35.7	28.6	32.1	395	13.3	18.9	16.1	193
2 L - 9	4	17:08:30	0	0	3,600	891	35.8	28.9	32.3	397	13.4	19.0	16.2	195
2 L - 9	8	17:12:30	0	0	3,600	891	36.0	29.1	32.6	400	13.3	19.1	16.2	195
2 L - 10	1	17:15:30	0	0	3,990	988	39.5	32.2	35.8	440	15.0	21.0	18.0	216
2 L - 10	2	17:16:30	0	0	3,990	988	39.6	32.3	35.9	442	15.1	21.1	18.1	218
2 L - 10	4	17:18:30	0	0	3,990	988	39.7	32.4	36.0	443	15.1	21.4	18.3	220
2 L - 10	8	17:22:30	0	0	3,990	988	40.0	32.7	36.3	447	15.4	21.4	18.4	221
2 L - 11	1	17:26:00	0	22	4,400	1,091	42.9	35.5	39.2	481	16.4	22.9	19.7	237
2 L - 11	2	17:27:00	0	25	4,400	1,091	43.1	35.5	39.3	483	16.5	23.0	19.7	237
2 L - 11	4	17:29:00	0	33	4,400	1,091	43.1	35.7	39.4	484	16.5	23.2	19.8	238
2 L - 11	8	17:33:00	0	36	4,400	1,091	43.2	35.8	39.5	485	16.5	23.2	19.8	239
2 L - 12	1	17:36:00	0	47	4,790	1,189	46.0	38.1	42.0	516	17.5	24.5	21.0	253
2 L - 12	2	17:37:00	0	51	4,790	1,189	45.8	38.2	42.0	516	17.6	24.6	21.1	254
2 L - 12	4	17:39:00	0	54	4,790	1,189	46.2	38.4	42.3	520	17.6	24.6	21.1	254
2 L - 12	8	17:43:00	0	65	4,790	1,189	46.4	38.4	42.4	521	17.8	24.7	21.3	256
2 L - 13	1	17:45:30	0	76	5,160	1,282	48.9	39.7	44.3	544	18.6	25.8	22.2	267
2 L - 13	2	17:46:30	0	80	5,160	1,282	49.1	39.8	44.5	547	18.4	25.9	22.2	267
2 L - 13	4	17:48:30	0	87	5,160	1,282	49.4	39.7	44.6	548	18.7	26.0	22.4	269
2 L - 13	8	17:52:30	0	87	5,160	1,282	49.7	39.7	44.7	550	18.9	26.0	22.5	270
2 L - 14	1	17:54:30	0	102	5,570	1,384	52.4	41.6	47.0	578	19.7	27.0	23.3	281
2 L - 14	2	17:55:30	0	109	5,570	1,384	52.9	41.4	47.2	579	19.9	27.3	23.6	283
2 L - 14	4	17:57:30	0	105	5,570	1,384	53.1	41.2	47.1	579	19.8	27.2	23.5	283
2 L - 14	8	18:01:30	0	105	5,570	1,384	53.8	41.2	47.5	584	20.2	27.4	23.8	286



Strain Gage Readings and Loads at Levels 3 and 4
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 3				Strain Gage Level 4			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	3A - 1306654 (µε)	3C - 1306655 (µε)	Av. Strain (µε)	Load (kips)	4A - 1306657 (µε)	4C - 1306656 (µε)	Av. Strain (µε)	Load (kips)
2 L - 15	1	18:04:00	0	131	6,020	1,497	56.5	43.4	50.0	614	21.6	28.4	25.0	300
2 L - 15	2	18:05:00	0	131	6,020	1,497	56.8	43.1	49.9	614	21.4	28.4	24.9	300
2 L - 15	4	18:07:00	0	134	6,020	1,497	57.0	42.6	49.8	612	21.4	28.3	24.8	299
2 L - 15	8	18:11:00	0	138	6,020	1,497	57.6	42.3	50.0	614	21.6	28.4	25.0	300
2 L - 16	1	18:13:00	0	141	6,420	1,597	60.3	43.7	52.0	639	22.8	29.2	26.0	312
2 L - 16	2	18:14:00	0	141	6,420	1,597	60.5	43.4	52.0	639	22.7	29.2	26.0	312
2 L - 16	4	18:16:00	0	145	6,420	1,597	61.1	43.2	52.2	641	22.9	29.2	26.0	313
2 L - 16	8	18:20:00	0	149	6,420	1,597	61.3	42.4	51.8	637	23.0	29.0	26.0	313
2 L - 17	1	18:22:30	0	167	6,840	1,703	64.6	43.9	54.3	667	24.2	30.0	27.1	325
2 L - 17	2	18:23:30	0	167	6,840	1,703	64.8	43.8	54.3	667	24.2	29.9	27.1	326
2 L - 17	4	18:25:30	0	160	6,840	1,703	64.7	43.1	53.9	662	24.3	29.6	27.0	325
2 L - 17	8	18:29:30	0	163	6,840	1,703	65.5	42.9	54.2	666	24.5	29.7	27.1	326
2 L - 18	1	18:31:30	0	174	7,220	1,798	68.3	44.3	56.3	692	25.7	30.5	28.1	338
2 L - 18	2	18:32:30	0	181	7,220	1,798	68.7	44.0	56.4	693	25.7	30.4	28.1	337
2 L - 18	4	18:34:30	0	167	7,220	1,798	69.2	43.9	56.5	694	25.8	30.4	28.1	338
2 L - 18	8	18:38:30	0	185	7,220	1,798	69.4	43.4	56.4	693	26.0	30.3	28.1	338
2 L - 19	1	18:40:30	0	192	7,620	1,898	72.7	44.9	58.8	723	27.2	31.0	29.1	350
2 L - 19	2	18:41:30	0	192	7,620	1,898	72.7	44.6	58.6	721	27.0	30.8	28.9	347
2 L - 19	4	18:43:30	0	196	7,620	1,898	73.6	44.9	59.3	728	27.6	30.8	29.2	351
2 L - 19	8	18:47:30	0	196	7,620	1,898	73.9	45.0	59.4	730	27.7	30.9	29.3	352
2 L - 20	1	18:49:30	0	196	8,000	1,994	77.2	47.0	62.1	763	28.7	31.9	30.3	364
2 L - 20	2	18:50:30	0	196	8,000	1,994	77.1	47.0	62.0	762	28.8	31.6	30.2	363
2 L - 20	4	18:52:30	0	203	8,000	1,994	77.4	47.4	62.4	767	29.1	32.0	30.6	367
2 L - 20	8	18:56:30	0	203	8,000	1,994	77.9	47.7	62.8	772	29.2	31.8	30.5	366
2 L - 21	1	18:58:30	0	214	8,410	2,096	80.5	50.5	65.5	805	30.3	33.0	31.6	380
2 L - 21	2	18:59:30	0	221	8,410	2,096	80.8	51.8	66.3	815	30.3	33.3	31.8	383
2 L - 21	4	19:01:30	0	218	8,410	2,096	80.3	54.4	67.4	828	30.3	34.0	32.2	387
2 L - 21	8	19:05:30	0	221	8,410	2,096	79.7	57.5	68.6	843	30.0	34.8	32.4	389
2 L - 22	1	19:08:00	0	232	8,790	2,192	80.7	63.9	72.3	889	30.2	37.1	33.6	404
2 L - 22	2	19:09:00	0	247	8,790	2,192	80.1	66.0	73.0	897	30.1	37.6	33.9	407
2 L - 22	4	19:11:00	0	243	8,790	2,192	78.1	79.1	78.6	966	29.6	41.6	35.6	429
2 L - 22	8	19:15:00	0	239	8,790	2,192	88.1	86.9	87.5	1,076	30.6	45.4	38.0	457
2 L - 23	1	19:17:00	0	290	9,260	2,309	101.0	96.2	98.6	1,212	32.2	49.8	41.0	493
2 L - 23	2	19:18:00	0	297	9,260	2,309	109.6	96.3	102.9	1,265	33.3	50.8	42.1	506
2 L - 23	4	19:20:00	0	284	9,260	2,309	117.1	100.3	108.7	1,336	34.9	52.3	43.6	524
2 L - 23	8	19:24:00	0	272	9,260	2,309	120.7	108.6	114.6	1,409	36.1	54.4	45.3	544
2 U - 1	1	19:28:30	0	196	6,910	1,720	100.1	88.2	94.2	1,157	28.6	45.1	36.8	443
2 U - 1	2	19:29:30	0	196	6,910	1,720	99.5	88.0	93.7	1,152	28.5	44.6	36.6	440
2 U - 1	4	19:31:30	0	196	6,910	1,720	98.8	87.9	93.4	1,148	28.3	44.4	36.4	438
2 U - 2	1	19:34:00	0	134	4,590	1,139	74.3	63.7	69.0	848	19.9	33.4	26.7	321
2 U - 2	2	19:35:00	0	127	4,590	1,139	73.6	63.5	68.5	842	19.7	33.1	26.4	317
2 U - 2	4	19:37:00	0	127	4,590	1,139	73.1	63.5	68.3	839	19.6	32.9	26.3	316
2 U - 3	1	19:39:30	0	47	2,290	562	46.4	39.9	43.1	530	11.0	22.4	16.7	201
2 U - 3	2	19:40:30	0	47	2,290	562	45.8	39.5	42.7	524	10.9	22.3	16.6	199
2 U - 3	4	19:42:30	0	40	2,290	562	45.1	39.1	42.1	518	10.9	22.1	16.5	198
2 U - 4	1	19:46:30	0	0	10	-9	12.3	25.6	19.0	233	2.4	15.4	8.9	107
2 U - 4	2	19:47:30	0	0	10	-9	12.2	25.7	18.9	233	2.3	15.3	8.8	106
2 U - 4	4	19:49:30	0	0	10	-9	12.0	25.7	18.8	232	2.2	15.3	8.7	105
2 U - 4	8	19:53:30	0	0	10	-9	11.6	25.3	18.5	227	2.3	15.2	8.7	105
3 L - 1	1	19:58:00	1,130	272	1,130	271	22.7	32.5	27.6	339	5.9	19.5	12.7	153
3 L - 1	2	19:59:00	1,130	272	1,130	271	22.8	32.5	27.7	340	5.9	19.6	12.7	153
3 L - 2	1	20:01:00	2,060	505	2,060	504	35.5	38.1	36.8	452	10.2	23.7	16.9	204
3 L - 2	2	20:02:00	2,060	505	2,060	504	35.5	38.2	36.9	453	10.2	23.7	16.9	204
3 L - 3	1	20:04:00	3,090	763	3,090	763	47.9	46.1	47.0	577	14.4	28.2	21.3	256
3 L - 3	2	20:05:00	3,090	763	3,090	763	48.0	46.3	47.2	579	14.5	28.3	21.4	257
3 L - 4	1	20:07:30	4,010	993	4,010	993	58.4	54.1	56.3	691	17.7	31.6	24.7	296
3 L - 4	2	20:08:30	4,010	993	4,010	993	58.4	54.3	56.3	692	17.8	31.7	24.7	297
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	70.0	63.4	66.7	820	21.1	35.6	28.4	341
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	69.8	63.1	66.4	816	21.2	35.9	28.5	343
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	79.5	71.9	75.7	930	24.0	39.7	31.9	383
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	79.8	71.8	75.8	931	24.2	39.9	32.0	385
3 U - 1	1	20:20:00	0	0	0	0	12.1	23.3	17.7	218	2.4	16.4	9.4	113
3 U - 1	2	20:21:00	0	0	0	0	11.8	23.5	17.7	217	2.3	16.5	9.4	113

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer



Strain Gage Readings and Loads at Level 5
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 5			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	5A - 1306658 ($\mu\epsilon$)	5C - 1306659 ($\mu\epsilon$)	Av. Strain ($\mu\epsilon$)	Load (kips)
1 L - 0	-	11:38:00	0	0	0	0	0.0	0.0	0.0	0
1 L - 1	1	11:45:00	350	77	0	0	0.1	0.0	0.0	0
1 L - 1	2	11:46:00	350	77	0	0	0.1	0.0	0.1	1
1 L - 1	4	11:48:00	350	77	0	0	0.1	-0.1	0.0	0
1 L - 1	8	11:52:00	350	77	0	0	0.0	-0.2	-0.1	-1
1 L - 2	1	11:54:00	720	169	0	0	0.1	0.1	0.1	1
1 L - 2	2	11:55:00	720	169	0	0	0.1	0.1	0.1	1
1 L - 2	4	11:57:00	720	169	0	0	0.1	0.1	0.1	1
1 L - 2	8	12:01:00	720	169	0	0	0.1	0.1	0.1	1
1 L - 3	1	12:03:00	1,120	270	0	0	0.1	0.1	0.1	2
1 L - 3	2	12:04:00	1,120	270	0	0	0.2	0.3	0.2	3
1 L - 3	4	12:06:00	1,120	270	0	0	0.2	0.2	0.2	2
1 L - 3	8	12:10:00	1,120	270	0	0	0.2	0.1	0.2	3
1 L - 4	1	12:12:00	1,520	370	0	0	0.2	0.3	0.3	3
1 L - 4	2	12:13:00	1,520	370	0	0	0.2	0.3	0.3	4
1 L - 4	4	12:15:00	1,520	370	0	0	0.3	0.4	0.3	4
1 L - 4	8	12:19:00	1,520	370	0	0	0.3	0.2	0.3	3
1 L - 5	1	12:21:30	1,910	467	0	0	0.4	0.5	0.5	7
1 L - 5	2	12:22:30	1,910	467	0	0	0.6	0.5	0.5	7
1 L - 5	4	12:24:30	1,910	467	0	0	0.6	0.5	0.5	7
1 L - 5	8	12:28:30	1,910	467	0	0	0.6	0.6	0.6	8
1 L - 6	1	12:31:00	2,290	562	0	0	0.8	0.7	0.7	10
1 L - 6	2	12:32:00	2,290	562	0	0	0.8	0.8	0.8	10
1 L - 6	4	12:34:00	2,290	562	0	0	0.9	0.8	0.9	11
1 L - 6	8	12:38:00	2,290	562	0	0	0.8	0.8	0.8	11
1 L - 7	1	12:41:00	2,710	668	0	0	0.9	1.0	1.0	13
1 L - 7	2	12:42:00	2,710	668	0	0	1.1	1.0	1.0	14
1 L - 7	4	12:44:00	2,710	668	0	0	1.1	1.3	1.2	16
1 L - 7	8	12:48:00	2,710	668	0	0	1.1	1.1	1.1	14
1 L - 8	1	12:50:00	3,080	760	0	0	1.3	1.5	1.4	18
1 L - 8	2	12:51:00	3,080	760	0	0	1.3	1.5	1.4	19
1 L - 8	4	12:53:00	3,080	760	0	0	1.4	1.4	1.4	19
1 L - 8	8	12:57:00	3,080	760	0	0	1.4	1.5	1.4	19
1 L - 9	1	12:59:00	3,480	860	0	0	1.5	1.7	1.6	21
1 L - 9	2	13:00:00	3,480	860	0	0	1.7	1.9	1.8	24
1 L - 9	4	13:02:00	3,480	860	0	0	1.7	1.9	1.8	24
1 L - 9	8	13:06:00	3,480	860	0	0	1.6	1.8	1.7	23
1 L - 10	1	13:10:00	3,860	955	0	0	2.0	2.3	2.2	29
1 L - 10	2	13:11:00	3,860	955	0	0	2.0	2.1	2.1	28
1 L - 10	4	13:13:00	3,860	955	0	0	2.0	2.1	2.1	28
1 L - 10	8	13:17:00	3,860	955	0	0	2.0	2.3	2.2	29
1 L - 11	1	13:20:00	4,290	1,063	0	0	2.0	2.6	2.3	31
1 L - 11	2	13:21:00	4,290	1,063	0	0	2.4	2.5	2.4	33
1 L - 11	4	13:23:00	4,290	1,063	0	0	2.4	2.7	2.5	34
1 L - 11	8	13:27:00	4,290	1,063	0	0	2.3	2.7	2.5	34
1 L - 12	1	13:30:30	4,690	1,163	0	0	2.6	2.8	2.7	36
1 L - 12	2	13:31:30	4,690	1,163	0	0	2.7	3.1	2.9	38
1 L - 12	4	13:33:30	4,690	1,163	0	0	2.6	3.0	2.8	37
1 L - 12	8	13:37:30	4,690	1,163	0	0	2.6	3.2	2.9	39
1 L - 13	1	13:40:30	5,090	1,263	0	0	2.9	3.4	3.1	42
1 L - 13	2	13:41:30	5,090	1,263	0	0	3.0	3.6	3.3	44
1 L - 13	4	13:43:30	5,090	1,263	0	0	3.1	3.4	3.2	43
1 L - 13	8	13:47:30	5,090	1,263	0	0	3.1	3.7	3.4	45
1 L - 14	1	13:51:00	5,520	1,371	0	0	3.8	4.2	4.0	53
1 L - 14	2	13:52:00	5,520	1,371	0	0	3.9	4.5	4.2	56
1 L - 14	4	13:54:00	5,520	1,371	0	0	4.0	4.6	4.3	57
1 L - 14	8	13:58:00	5,520	1,371	0	0	4.1	4.9	4.5	60
1 L - 15	1	14:02:00	5,930	1,474	0	0	4.6	5.2	4.9	65
1 L - 15	2	14:03:00	5,930	1,474	0	0	4.4	5.3	4.9	65
1 L - 15	4	14:05:00	5,930	1,474	0	0	4.4	5.3	4.8	64
1 L - 15	8	14:09:00	5,930	1,474	0	0	4.7	5.4	5.1	67
1 L - 16	1	14:11:30	6,320	1,571	0	0	4.9	6.0	5.4	72
1 L - 16	2	14:12:30	6,320	1,571	0	0	5.0	6.0	5.5	73
1 L - 16	4	14:14:30	6,320	1,571	0	0	5.0	5.9	5.5	73
1 L - 16	8	14:18:30	6,320	1,571	0	0	5.0	6.1	5.5	74
1 L - 17	1	14:23:00	6,730	1,674	0	0	5.8	7.2	6.5	87
1 L - 17	2	14:24:00	6,730	1,674	0	0	6.0	7.1	6.5	87
1 L - 17	4	14:26:00	6,730	1,674	0	0	5.8	7.4	6.6	88
1 L - 17	8	14:30:00	6,730	1,674	0	0	5.8	7.6	6.7	89
1 L - 18	1	14:34:00	7,130	1,774	0	0	6.4	8.0	7.2	96
1 L - 18	2	14:35:00	7,130	1,774	0	0	6.4	8.1	7.2	96
1 L - 18	4	14:37:00	7,130	1,774	0	0	6.6	8.1	7.3	98
1 L - 18	8	14:41:00	7,130	1,774	0	0	6.6	8.2	7.4	99
1 L - 19	1	14:45:30	7,530	1,874	0	0	7.1	9.0	8.0	107
1 L - 19	2	14:46:30	7,530	1,874	0	0	7.1	8.7	7.9	105
1 L - 19	4	14:48:30	7,530	1,874	0	0	7.3	9.1	8.2	110
1 L - 19	8	14:52:30	7,530	1,874	0	0	7.4	9.2	8.3	111



Strain Gage Readings and Loads at Level 5
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 5			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	5A - 1306658 (με)	5C - 1306659 (με)	Av. Strain (με)	Load (kips)
1 U - 1	1	14:55:30	5,550	1,378	0	0	6.7	8.4	7.6	101
1 U - 1	2	14:56:30	5,550	1,378	0	0	6.7	8.5	7.6	102
1 U - 1	4	14:58:30	5,550	1,378	0	0	6.6	8.2	7.4	99
1 U - 2	1	15:02:00	3,740	925	0	0	5.8	7.4	6.6	88
1 U - 2	2	15:03:00	3,740	925	0	0	5.8	7.5	6.6	89
1 U - 2	4	15:05:00	3,740	925	0	0	5.8	7.4	6.6	88
1 U - 3	1	15:10:00	1,910	467	0	0	4.4	6.2	5.3	71
1 U - 3	2	15:11:00	1,910	467	0	0	4.5	6.0	5.3	70
1 U - 3	4	15:13:00	1,910	467	0	0	4.6	6.0	5.3	71
1 U - 4	1	15:18:30	0	0	0	0	2.8	4.0	3.4	45
1 U - 4	2	15:19:30	0	0	0	0	2.6	3.9	3.2	43
1 U - 4	4	15:21:30	0	0	0	0	2.8	3.8	3.3	44
1 U - 4	8	15:25:30	0	0	0	0	2.8	3.7	3.2	43
2 L - 1	1	15:46:00	0	0	380	83	2.8	3.6	3.2	42
2 L - 1	2	15:47:00	0	0	380	83	2.7	3.6	3.1	42
2 L - 1	4	15:49:00	0	0	380	83	2.7	3.7	3.2	42
2 L - 1	8	15:53:00	0	0	380	83	2.8	3.6	3.2	43
2 L - 2	1	15:55:30	0	0	770	181	2.8	3.7	3.2	43
2 L - 2	2	15:56:30	0	0	770	181	2.9	3.7	3.3	44
2 L - 2	4	15:58:30	0	0	770	181	2.8	3.6	3.2	43
2 L - 2	8	16:02:30	0	0	770	181	2.8	3.7	3.2	43
2 L - 3	1	16:05:00	0	0	1,200	289	2.8	3.8	3.3	44
2 L - 3	2	16:06:00	0	0	1,200	289	2.8	3.8	3.3	44
2 L - 3	4	16:08:00	0	0	1,200	289	3.0	4.0	3.5	47
2 L - 3	8	16:12:00	0	0	1,200	289	2.9	3.8	3.3	44
2 L - 4	1	16:15:00	0	0	1,570	382	3.1	3.7	3.4	46
2 L - 4	2	16:16:00	0	0	1,570	382	3.1	3.9	3.5	46
2 L - 4	4	16:18:00	0	0	1,570	382	3.0	4.0	3.5	47
2 L - 4	8	16:22:00	0	0	1,570	382	3.1	3.9	3.5	46
2 L - 5	1	16:25:30	0	0	1,970	482	3.5	4.5	4.0	53
2 L - 5	2	16:26:30	0	0	1,970	482	3.5	4.5	4.0	53
2 L - 5	4	16:28:30	0	0	1,970	482	3.7	4.5	4.1	55
2 L - 5	8	16:32:30	0	0	1,970	482	3.6	4.5	4.0	54
2 L - 6	1	16:35:30	0	0	2,370	582	4.2	5.0	4.6	61
2 L - 6	2	16:36:30	0	0	2,370	582	4.2	5.1	4.6	62
2 L - 6	4	16:38:30	0	0	2,370	582	4.1	5.0	4.5	60
2 L - 6	8	16:42:30	0	0	2,370	582	4.2	5.0	4.6	61
2 L - 7	1	16:45:00	0	0	2,790	687	4.8	5.7	5.3	70
2 L - 7	2	16:46:00	0	0	2,790	687	4.7	5.6	5.1	69
2 L - 7	4	16:48:00	0	0	2,790	687	4.7	5.8	5.2	70
2 L - 7	8	16:52:00	0	0	2,790	687	4.6	5.8	5.2	69
2 L - 8	1	16:55:30	0	0	3,180	785	5.3	6.3	5.8	78
2 L - 8	2	16:56:30	0	0	3,180	785	5.4	6.6	6.0	80
2 L - 8	4	16:58:30	0	0	3,180	785	5.3	6.4	5.9	78
2 L - 8	8	17:02:30	0	0	3,180	785	5.5	6.4	5.9	79
2 L - 9	1	17:05:30	0	0	3,600	891	6.3	7.4	6.8	91
2 L - 9	2	17:06:30	0	0	3,600	891	6.2	7.4	6.8	91
2 L - 9	4	17:08:30	0	0	3,600	891	6.3	7.5	6.9	92
2 L - 9	8	17:12:30	0	0	3,600	891	6.3	7.6	6.9	92
2 L - 10	1	17:15:30	0	0	3,990	988	6.9	8.3	7.6	102
2 L - 10	2	17:16:30	0	0	3,990	988	7.1	8.3	7.7	103
2 L - 10	4	17:18:30	0	0	3,990	988	7.3	8.2	7.7	103
2 L - 10	8	17:22:30	0	0	3,990	988	7.4	8.5	8.0	106
2 L - 11	1	17:26:00	0	22	4,400	1,091	7.9	9.1	8.5	114
2 L - 11	2	17:27:00	0	25	4,400	1,091	7.7	9.2	8.5	113
2 L - 11	4	17:29:00	0	33	4,400	1,091	7.7	9.2	8.5	113
2 L - 11	8	17:33:00	0	36	4,400	1,091	7.8	9.3	8.6	115
2 L - 12	1	17:36:00	0	47	4,790	1,189	8.2	9.8	9.0	120
2 L - 12	2	17:37:00	0	51	4,790	1,189	8.2	9.6	8.9	119
2 L - 12	4	17:39:00	0	54	4,790	1,189	8.3	9.6	9.0	120
2 L - 12	8	17:43:00	0	65	4,790	1,189	8.5	9.7	9.1	121
2 L - 13	1	17:45:30	0	76	5,160	1,282	8.7	10.1	9.4	125
2 L - 13	2	17:46:30	0	80	5,160	1,282	8.7	10.0	9.3	125
2 L - 13	4	17:48:30	0	87	5,160	1,282	8.7	10.0	9.4	125
2 L - 13	8	17:52:30	0	87	5,160	1,282	8.7	10.1	9.4	125
2 L - 14	1	17:54:30	0	102	5,570	1,384	9.1	10.3	9.7	130
2 L - 14	2	17:55:30	0	109	5,570	1,384	9.1	10.3	9.7	130
2 L - 14	4	17:57:30	0	105	5,570	1,384	8.9	10.4	9.7	129
2 L - 14	8	18:01:30	0	105	5,570	1,384	9.1	10.4	9.8	130



Strain Gage Readings and Loads at Level 5
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

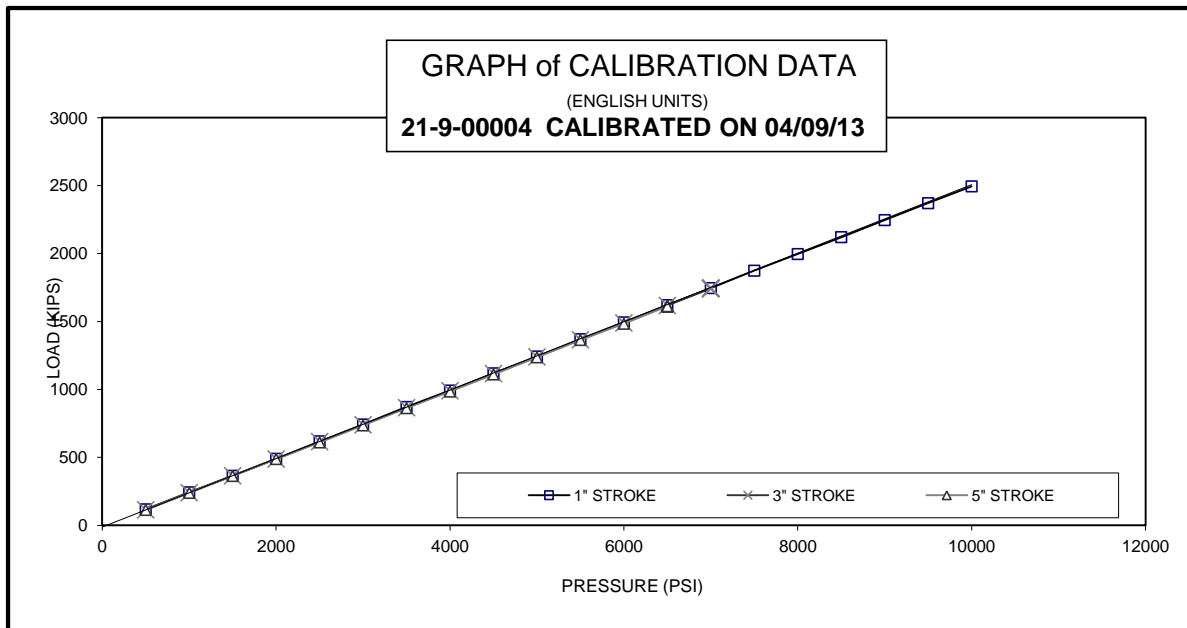
Load Test Increment	Hold Time (minutes)	Time (hh:mm:ss)	Lower O-cell		Upper O-cell		Strain Gage Level 5			
			Pressure (psi)	Load ¹ (kips)	Pressure (psi)	Load (kips)	5A - 1306658 ($\mu\epsilon$)	5C - 1306659 ($\mu\epsilon$)	Av. Strain ($\mu\epsilon$)	Load (kips)
2 L - 15	1	18:04:00	0	131	6,020	1,497	9.5	10.7	10.1	135
2 L - 15	2	18:05:00	0	131	6,020	1,497	9.4	10.7	10.1	134
2 L - 15	4	18:07:00	0	134	6,020	1,497	9.4	10.7	10.0	134
2 L - 15	8	18:11:00	0	138	6,020	1,497	9.3	10.8	10.0	134
2 L - 16	1	18:13:00	0	141	6,420	1,597	9.4	11.0	10.2	136
2 L - 16	2	18:14:00	0	141	6,420	1,597	9.4	10.9	10.2	136
2 L - 16	4	18:16:00	0	145	6,420	1,597	9.5	11.1	10.3	137
2 L - 16	8	18:20:00	0	149	6,420	1,597	9.5	11.0	10.3	137
2 L - 17	1	18:22:30	0	167	6,840	1,703	9.6	11.3	10.5	140
2 L - 17	2	18:23:30	0	167	6,840	1,703	9.4	11.3	10.4	138
2 L - 17	4	18:25:30	0	160	6,840	1,703	9.5	11.3	10.4	139
2 L - 17	8	18:29:30	0	163	6,840	1,703	9.5	11.4	10.4	139
2 L - 18	1	18:31:30	0	174	7,220	1,798	9.6	11.5	10.6	141
2 L - 18	2	18:32:30	0	181	7,220	1,798	9.7	11.6	10.7	142
2 L - 18	4	18:34:30	0	167	7,220	1,798	9.6	11.5	10.5	140
2 L - 18	8	18:38:30	0	185	7,220	1,798	9.6	11.5	10.6	141
2 L - 19	1	18:40:30	0	192	7,620	1,898	9.6	11.7	10.7	143
2 L - 19	2	18:41:30	0	192	7,620	1,898	9.6	11.6	10.6	141
2 L - 19	4	18:43:30	0	196	7,620	1,898	9.7	11.8	10.8	144
2 L - 19	8	18:47:30	0	196	7,620	1,898	9.6	11.7	10.7	142
2 L - 20	1	18:49:30	0	196	8,000	1,994	9.8	12.1	10.9	146
2 L - 20	2	18:50:30	0	196	8,000	1,994	9.7	12.0	10.9	145
2 L - 20	4	18:52:30	0	203	8,000	1,994	9.8	12.0	10.9	146
2 L - 20	8	18:56:30	0	203	8,000	1,994	9.8	12.0	10.9	145
2 L - 21	1	18:58:30	0	214	8,410	2,096	10.0	12.2	11.1	148
2 L - 21	2	18:59:30	0	221	8,410	2,096	10.0	12.2	11.1	148
2 L - 21	4	19:01:30	0	218	8,410	2,096	10.1	12.2	11.2	149
2 L - 21	8	19:05:30	0	221	8,410	2,096	10.1	12.3	11.2	150
2 L - 22	1	19:08:00	0	232	8,790	2,192	10.2	12.6	11.4	152
2 L - 22	2	19:09:00	0	247	8,790	2,192	10.2	12.6	11.4	152
2 L - 22	4	19:11:00	0	243	8,790	2,192	10.4	13.1	11.7	156
2 L - 22	8	19:15:00	0	239	8,790	2,192	10.1	13.8	12.0	160
2 L - 23	1	19:17:00	0	290	9,260	2,309	10.4	14.8	12.6	168
2 L - 23	2	19:18:00	0	297	9,260	2,309	10.5	15.2	12.8	171
2 L - 23	4	19:20:00	0	284	9,260	2,309	10.8	15.5	13.2	176
2 L - 23	8	19:24:00	0	272	9,260	2,309	11.7	15.8	13.8	184
2 U - 1	1	19:28:30	0	196	6,910	1,720	9.1	12.7	10.9	146
2 U - 1	2	19:29:30	0	196	6,910	1,720	9.0	12.7	10.8	145
2 U - 1	4	19:31:30	0	196	6,910	1,720	9.1	12.5	10.8	144
2 U - 2	1	19:34:00	0	134	4,590	1,139	5.7	8.7	7.2	96
2 U - 2	2	19:35:00	0	127	4,590	1,139	5.5	8.5	7.0	94
2 U - 2	4	19:37:00	0	127	4,590	1,139	5.5	8.4	7.0	93
2 U - 3	1	19:39:30	0	47	2,290	562	2.5	4.7	3.6	48
2 U - 3	2	19:40:30	0	47	2,290	562	2.5	4.7	3.6	48
2 U - 3	4	19:42:30	0	40	2,290	562	2.3	4.6	3.4	46
2 U - 4	1	19:46:30	0	0	10	-9	0.2	2.3	1.2	17
2 U - 4	2	19:47:30	0	0	10	-9	0.1	2.3	1.2	16
2 U - 4	4	19:49:30	0	0	10	-9	-0.1	2.3	1.1	15
2 U - 4	8	19:53:30	0	0	10	-9	-0.2	2.2	1.0	13
3 L - 1	1	19:58:00	1,130	272	1,130	271	1.4	4.3	2.9	38
3 L - 1	2	19:59:00	1,130	272	1,130	271	1.5	4.2	2.9	38
3 L - 2	1	20:01:00	2,060	505	2,060	504	3.3	6.6	5.0	66
3 L - 2	2	20:02:00	2,060	505	2,060	504	3.3	6.6	5.0	66
3 L - 3	1	20:04:00	3,090	763	3,090	763	4.9	8.7	6.8	91
3 L - 3	2	20:05:00	3,090	763	3,090	763	5.0	8.9	7.0	93
3 L - 4	1	20:07:30	4,010	993	4,010	993	6.0	10.2	8.1	108
3 L - 4	2	20:08:30	4,010	993	4,010	993	5.9	10.2	8.1	107
3 L - 5	1	20:11:00	5,100	1,266	5,100	1,267	6.9	11.3	9.1	121
3 L - 5	2	20:12:00	5,100	1,266	5,100	1,267	7.1	11.3	9.2	123
3 L - 6	1	20:14:00	6,090	1,514	6,090	1,515	7.8	12.3	10.1	134
3 L - 6	2	20:15:00	6,090	1,514	6,090	1,515	7.9	12.3	10.1	134
3 U - 1	1	20:20:00	0	0	0	0	0.0	3.2	1.6	21
3 U - 1	2	20:21:00	0	0	0	0	-0.1	3.0	1.5	20

1 - Lower O-cell load in italics indicates estimate of mechanical load transfer

APPENDIX B

O-CELL AND INSTRUMENTATION CALIBRATION SHEETS





STROKE: 1 INCH 3 INCH 5 INCH

21" O-CELL, SERIAL # 21-9-00004

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	118	114	113
1000	243	240	239
1500	365	365	363
2000	490	488	488
2500	618	616	610
3000	742	740	735
3500	871	866	862
4000	992	990	984
4500	1119	1117	1110
5000	1242	1239	1236
5500	1370	1365	1364
6000	1494	1489	1483
6500	1620	1618	1612
7000	1746	1744	
7500	1874		
8000	1996		
8500	2121		
9000	2246		
9500	2371		
10000	2494		

LOAD CONVERSION FORMULA

$$\text{LOAD (KIPS)} = \text{PRESSURE (PSI)} * 0.2507 + (-12.00)$$

Regression Output:

Constant	-12.0040 kips
X Coefficient	0.2507 kip / psi
R Square	1.0000
No. of Observations	47
Degrees of Freedom	45
Std Err of Y Est	3.22
Std Err of X Coeff	0.0002

CALIBRATION STANDARDS:

All data presented are derived from 6" dia. certified hydraulic pressure gauges and electronic load transducer, manufactured and calibrated by the University of Illinois at Champaign, Illinois. All calibrations and certifications are traceable through the Laboratory Master Deadweight Gauges directly to the National Institute of Standards and Technology. No specific guidelines exist for calibration of load test jacks and equipment but procedures comply with similar guidelines for calibration of gages, ANSI specifications B40.1.

* AE & FC CUSTOMER: LOADTEST Inc
* AE & FC JOB NO: SO10260
* CUSTOMER P.O. NO.: LT-1212

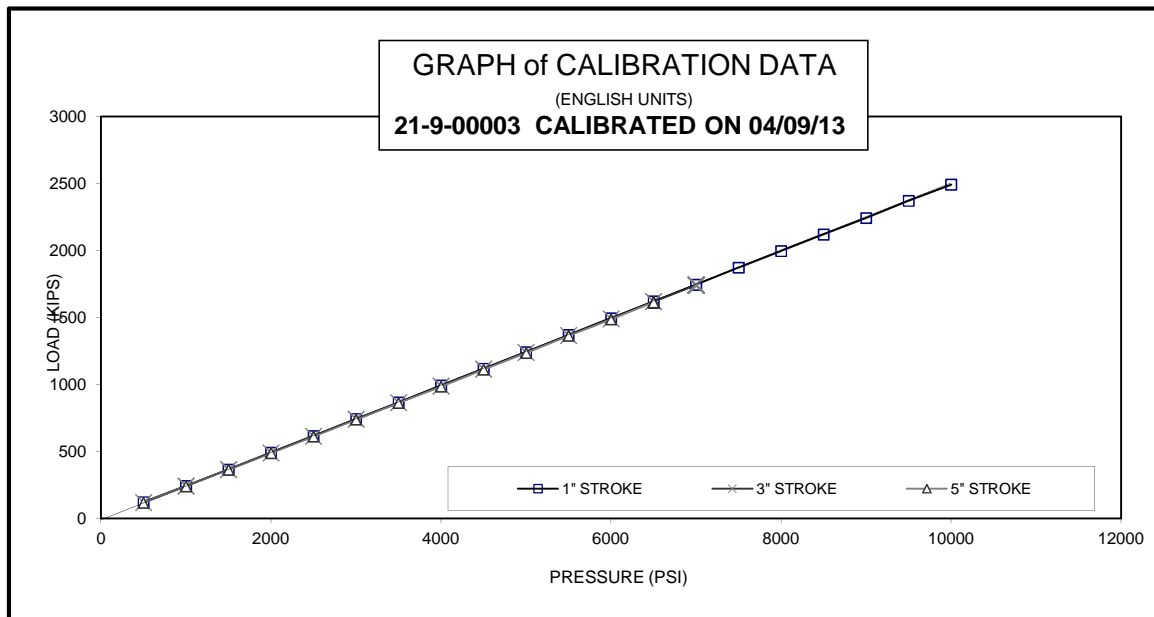
* CONTRACTOR.: CAPE ROMAIN CONTRACTOR
* JOB LOCATION: WENDCO, SC
* DATED: 04/09/13

SERVICE ENGINEER:

[Signature]

DATE:

4-9-13



STROKE: 1 INCH 3 INCH 5 INCH

21" O-CELL, SERIAL # 21-9-00003

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	122	119	116
1000	242	242	239
1500	365	365	364
2000	491	489	488
2500	615	614	612
3000	743	741	738
3500	865	864	861
4000	992	988	984
4500	1118	1115	1111
5000	1242	1239	1235
5500	1369	1366	1363
6000	1494	1490	1486
6500	1620	1618	1613
7000	1744	1741	
7500	1872		
8000	1996		
8500	2119		
9000	2242		
9500	2371		
10000	2492		

LOAD CONVERSION FORMULA

$$\text{LOAD (KIPS)} = \text{PRESSURE (PSI)} * 0.2503 + (-10.72)$$

Regression Output:

Constant	-10.7241 kips
X Coefficient	0.2503 kip / psi
R Square	1.0000
No. of Observations	47
Degrees of Freedom	45
Std Err of Y Est	2.98
Std Err of X Coeff	0.0002

CALIBRATION STANDARDS:

All data presented are derived from 6" dia. certified hydraulic pressure gauges and electronic load transducer, manufactured and calibrated by the University of Illinois at Champaign, Illinois. All calibrations and certifications are traceable through the Laboratory Master Deadweight Gauges directly to the National Institute of Standards and Technology. No specific guidelines exist for calibration of load test jacks and equipment but procedures comply with similar guidelines for calibration of gages, ANSI specifications B40.1.

* AE & FC CUSTOMER: LOADTEST Inc
* AE & FC JOB NO: SO10260
* CUSTOMER P.O. NO.: LT-1212

* CONTRACTOR.: CAPE ROMAIN CONTRACTOR
* JOB LOCATION: WENDCO, SC
* DATED: 04/09/13

SERVICE ENGINEER:

[Signature]

DATE:

4-9-13



48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306650

Cable Length: 104 feet

Prestress: 35,000 psi

Regression Zero: 7041

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7095	7094	7095		
1500	7768	7766	7767	672	-0.20
3000	8504	8503	8504	737	-0.03
4500	9242	9237	9240	736	0.11
6000	9969	9967	9968	728	0.00
100	7094	7088	7091		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.346 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306651

Cable Length: 104 feet

Prestress: 35,000 psi

Regression Zero: 7046

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7106	7101	7104		
1500	7765	7760	7763	659	-0.24
3000	8491	8484	8488	725	-0.20
4500	9218	9216	9217	729	0.01
6000	9950	9941	9946	729	0.18
100	7101	7092	7097		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.349 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306652

Cable Length: 96 feet

Prestress: 35,000 psi

Regression Zero: 6863

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	6916	6915	6916		
1500	7582	7587	7585	669	-0.15
3000	8309	8312	8311	726	-0.15
4500	9040	9042	9041	730	0.01
6000	9767	9769	9768	727	0.05
100	6914	6917	6916		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.348 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306653

Cable Length: 96 feet

Prestress: 35,000 psi

Regression Zero: 7114

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7171	7159	7165		
1500	7823	7814	7819	654	-0.18
3000	8535	8530	8533	714	-0.02
4500	9248	9240	9244	711	0.05
6000	9956	9949	9953	709	0.01
100	7160	7157	7159		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.354 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306654

Cable Length: 79 feet

Prestress: 35,000 psi

Regression Zero: 6782

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	6837	6832	6835		
1500	7513	7508	7511	676	-0.18
3000	8251	8248	8250	739	0.00
4500	8983	8985	8984	734	0.02
6000	9719	9716	9718	734	0.02
100	6832	6830	6831		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.346 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306655

Cable Length: 79 feet

Prestress: 35,000 psi

Regression Zero: 7144

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7199	7194	7197		
1500	7860	7855	7858	661	-0.20
3000	8584	8577	8581	723	-0.06
4500	9304	9300	9302	721	0.02
6000	10026	10018	10022	720	0.04
100	7194	7189	7192		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.351 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306656

Cable Length: 64 feet

Prestress: 35,000 psi

Regression Zero: 7233

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7289	7288	7289		
1500	7962	7965	7964	675	-0.19
3000	8701	8702	8702	738	-0.12
4500	9443	9443	9443	741	0.07
6000	10180	10179	10180	737	0.08
100	7288	7291	7290		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.345 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306657

Cable Length: 64 feet

Prestress: 35,000 psi

Regression Zero: 7193

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7249	7252	7251		
1500	7902	7901	7902	651	-0.27
3000	8619	8615	8617	715	-0.29
4500	9340	9342	9341	724	-0.01
6000	10065	10061	10063	722	0.20
100	7252	7248	7250		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.352 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306658

Cable Length: 49 feet

Prestress: 35,000 psi

Regression Zero: 6828

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	6882	6885	6884		
1500	7555	7552	7554	670	-0.26
3000	8295	8290	8293	739	-0.06
4500	9030	9030	9030	737	0.09
6000	9763	9760	9762	732	0.04
100	6884	6875	6880		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.346 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Sister Bar Calibration Report

Model Number: 4911-4

Date of Calibration: April 01, 2013


Serial Number: 1306659

Cable Length: 49 feet

Prestress: 35,000 psi

Regression Zero: 7231

Temperature: 22.3 °C

Technician: 

Calibration Instruction: CI-VW Rebar

Applied Load (pounds)	Readings				Linearity % Max. Load
	Cycle #1	Cycle #2	Average	Change	
100	7287	7288	7288		
1500	7940	7940	7940	652	-0.25
3000	8657	8659	8658	718	-0.19
4500	9379	9380	9380	722	-0.01
6000	10103	10099	10101	721	0.17
100	7288	7288	7288		

For conversion factor, load to strain, refer to table C-2 of the Installation Manual

Gage Factor: 0.352 microstrain/ digit (GK-401 Pos. "B")

Calculated Strain = Gage Factor(Current Reading - Zero Reading)

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load - Applied Load)/Max. Applied Load) X 100 percent

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 250 mm

Calibration Date: July 10, 2012

Serial Number: 1209158

Temperature: 23.1 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2090	2095	2093	-0.19	-0.08	0.04	0.02
50.0	3021	3019	3020	50.03	0.01	49.99	0.00
100.0	3944	3946	3945	100.11	0.04	99.93	-0.03
150.0	4867	4866	4867	150.00	0.00	149.83	-0.07
200.0	5800	5795	5798	200.41	0.16	200.37	0.15
250.0	6708	6704	6706	249.60	-0.16	249.83	-0.07

(mm) Linear Gage Factor (G): 0.05414 (mm/ digit)

Regression Zero: 2096

Polynomial Gage Factors: A: 8.0133E-08 B: 0.05344 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002132 (inches/digit)

Polynomial Gage Factors: A: 3.1549E-09 B: 0.002104 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 250 mm

Calibration Date: July 10, 2012

Serial Number: 1209159

Temperature: 23.1 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2062	2057	2060	-0.79	-0.31	-0.11	-0.04
50.0	3003	3006	3005	50.39	0.15	50.22	0.09
100.0	3930	3930	3930	100.50	0.20	99.93	-0.03
150.0	4855	4853	4854	150.54	0.22	149.98	-0.01
200.0	5771	5766	5769	200.06	0.02	199.91	-0.03
250.0	6680	6679	6680	249.39	-0.24	250.07	0.03

(mm) Linear Gage Factor (G): 0.05415 (mm/ digit)

Regression Zero: 2074

Polynomial Gage Factors: A: 2.4283E-07 B: 0.05203 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002132 (inches/digit)

Polynomial Gage Factors: A: 9.5603E-09 B: 0.002048 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 250 mm

Calibration Date: July 10, 2012

Serial Number: 1209160

Temperature: 23.1 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2057	2055	2056	-0.54	-0.22	-0.05	-0.02
50.0	2995	2991	2993	50.13	0.05	50.05	0.02
100.0	3925	3924	3925	100.51	0.20	100.14	0.06
150.0	4845	4842	4844	150.21	0.09	149.85	-0.06
200.0	5766	5764	5765	200.05	0.02	199.97	-0.01
250.0	6681	6680	6681	249.56	-0.17	250.05	0.02

(mm) Linear Gage Factor (G): 0.05408 (mm/ digit)

Regression Zero: 2066

Polynomial Gage Factors: A: 1.6666E-07 B: 0.05263 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002129 (inches/digit)

Polynomial Gage Factors: A: 6.5616E-09 B: 0.002072 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 250 mm

Calibration Date: July 10, 2012

Serial Number: 1209161

Temperature: 23.1 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2083	2084	2084	-0.51	-0.21	0.01	0.00
50.0	3019	3019	3019	50.04	0.02	49.96	-0.02
100.0	3951	3951	3951	100.41	0.16	100.03	0.01
150.0	4877	4876	4877	150.42	0.17	150.05	0.02
200.0	5794	5794	5794	200.00	0.00	199.93	-0.03
250.0	6708	6712	6710	249.50	-0.20	250.03	0.01

(mm) Linear Gage Factor (G): 0.05404 (mm/ digit)

Regression Zero: 2093

Polynomial Gage Factors: A: 1.7528E-07 B: 0.05250 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002128 (inches/digit)

Polynomial Gage Factors: A: 6.9007E-09 B: 0.002067 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 250 mm

Calibration Date: July 10, 2012

Serial Number: 1209162

Temperature: 23.1 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2043	2042	2043	-0.08	-0.03	0.09	0.04
50.0	2964	2961	2963	49.88	-0.05	49.88	-0.05
100.0	3888	3884	3886	100.04	0.01	99.94	-0.02
150.0	4809	4807	4808	150.11	0.04	150.01	0.00
200.0	5731	5730	5731	200.21	0.08	200.20	0.08
250.0	6644	6640	6642	249.71	-0.12	249.88	-0.05

(mm) Linear Gage Factor (G): 0.05431 (mm/ digit)

Regression Zero: 2044

Polynomial Gage Factors: A: 5.3139E-08 B: 0.05385 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002138 (inches/digit)

Polynomial Gage Factors: A: 2.0921E-09 B: 0.002120 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 250 mm

Calibration Date: July 10, 2012

Serial Number: 1209163

Temperature: 23.1 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2086	2084	2085	-0.49	-0.19	-0.03	-0.01
50.0	3025	3024	3025	50.20	0.08	50.08	0.03
100.0	3954	3954	3954	100.34	0.14	99.95	-0.02
150.0	4882	4882	4882	150.41	0.16	150.01	0.01
200.0	5804	5802	5803	200.09	0.04	199.98	-0.01
250.0	6719	6721	6720	249.56	-0.18	250.01	0.00

(mm) Linear Gage Factor (G): 0.05395 (mm/ digit)

Regression Zero: 2094

Polynomial Gage Factors: A: 1.6431E-07 B: 0.05250 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002124 (inches/digit)

Polynomial Gage Factors: A: 6.469E-09 B: 0.002067 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report


Range: 250 mm

Calibration Date: January 29, 2013

Serial Number: 1233788

Temperature: 22 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2012	2012	2012	-0.37	-0.15	-0.02	-0.01
50.0	2975	2976	2976	50.18	0.07	50.11	0.04
100.0	3928	3925	3927	100.06	0.03	99.79	-0.08
150.0	4888	4885	4887	150.42	0.17	150.16	0.06
200.0	5832	5832	5832	200.02	0.01	199.96	-0.02
250.0	6779	6777	6778	249.65	-0.14	250.00	0.00

(mm) Linear Gage Factor (G): 0.05246 (mm/ digit)

Regression Zero: 2019

Polynomial Gage Factors: A: 1.1294E-07 B: 0.05147 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002065 (inches/digit)

Polynomial Gage Factors: A: 4.4465E-09 B: 0.002026 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report


Range: 250 mm

Calibration Date: January 29, 2013

Serial Number: 1233789

Temperature: 22 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2025	2025	2025	-0.53	-0.21	-0.01	0.00
50.0	2985	2986	2986	50.13	0.05	49.99	0.00
100.0	3941	3941	3941	100.52	0.21	100.06	0.03
150.0	4887	4887	4887	150.41	0.16	149.96	-0.02
200.0	5829	5829	5829	200.09	0.04	199.97	-0.01
250.0	6768	6764	6766	249.51	-0.20	250.02	0.01

(mm) Linear Gage Factor (G): 0.05274 (mm/ digit)

Regression Zero: 2035

Polynomial Gage Factors: A: 1.797E-07 B: 0.05116 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.002076 (inches/digit)

Polynomial Gage Factors: A: 7.0747E-09 B: 0.002014 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement:

Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 50 mm

Calibration Date: March 27, 2013

Serial Number: 1301686

Temperature: 22.3 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2755	2754	2755	-0.11	-0.22	-0.01	-0.02
10.0	3541	3539	3540	10.04	0.07	10.02	0.03
20.0	4318	4317	4318	20.08	0.15	20.00	0.00
30.0	5091	5091	5091	30.07	0.13	29.99	-0.02
40.0	5861	5861	5861	40.01	0.02	40.00	-0.01
50.0	6627	6627	6627	49.90	-0.19	50.01	0.01

(mm) Linear Gage Factor (G): 0.01292 (mm/ digit)

Regression Zero: 2763

Polynomial Gage Factors: A: 4.9056E-08 B: 0.01246 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.0005085 (inches/digit)

Polynomial Gage Factors: A: 1.9313E-09 B: 0.0004904 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 50 mm

Calibration Date: March 27, 2013

Serial Number: 1301687

Temperature: 22.3 °C

Calibration Instruction: CI-4400

Technician: 

GK-401 Reading Position B

Actual Displacement (mm)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2655	2655	2655	-0.10	-0.21	-0.01	-0.01
10.0	3437	3433	3435	10.04	0.07	10.01	0.02
20.0	4209	4207	4208	20.09	0.17	20.00	0.00
30.0	4977	4975	4976	30.07	0.14	29.99	-0.02
40.0	5742	5741	5742	40.02	0.05	40.00	0.00
50.0	6502	6501	6502	49.91	-0.19	50.00	0.00

(mm) Linear Gage Factor (G): 0.01300 (mm/ digit)

Regression Zero: 2663

Polynomial Gage Factors: A: 5.102E-08 B: 0.01253 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gage Factor (G): 0.0005119 (inches/digit)

Polynomial Gage Factors: A: 2.0087E-09 B: 0.0004935 C:

Calculate C by setting $D = 0$ and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: Linear, $D = G (R_1 - R_0)$

Polynomial, $D = AR_1^2 + BR_1 + C$

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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APPENDIX C

CONSTRUCTION OF THE EQUIVALENT TOP LOAD-DISPLACEMENT CURVE

CONSTRUCTION OF THE LOADTEST TOP LOAD PLOT FROM THE RESULTS OF AN O-CELL TEST (March, 2009)

Introduction: Some engineers find it useful to see the results of an O-cell load test in the form of a curve showing the load versus settlement of a top-loaded driven or bored pile (drilled shaft). We believe that an O-cell test can provide a good estimate of this curve when using the method described herein.

Assumptions: We make the following assumptions, which we consider both reasonable and usually conservative:

1. The upward and downward load displacement plots generated by the O-cell test accurately represent the load bearing capacity for the given pile installation technique and dimensions, and are similar to load displacement plots which would be generated by a traditional compression or tension load test. For upward O-cell loading, the net load is used to compute the load displacement plot for a given zone (subtract buoyant weight of the given pile zone above the O-cell).
2. The load displacement plot in a top loaded pile has the same net shear multiplied by an adjustment factor 'F', for a given downward displacement as occurred in the O-cell test for that same displacement at the top of the O-cell in the upward direction. Unless noted otherwise, we use the following adjustment factors: (a) $F = 1.00$ in all rock sockets and for primarily cohesive soils in compression (b) $F = 0.95$ in primarily cohesionless soils (c) $F = 0.80$ for all soils in top load tension tests.

t-z Method: Using the separate pile section data generated by the O-cell load test method to full benefit, a solution of the calculated top load displacement plot can be derived using the t-z method (see references below). The pile is sub-divided into a number of distinct zones, based on data collected from the embedded strain gauges and load displacement plots. The input for the t-z analysis is the unit shear and end bearing plots presented in Figures 6 & 7 of the Data Report.



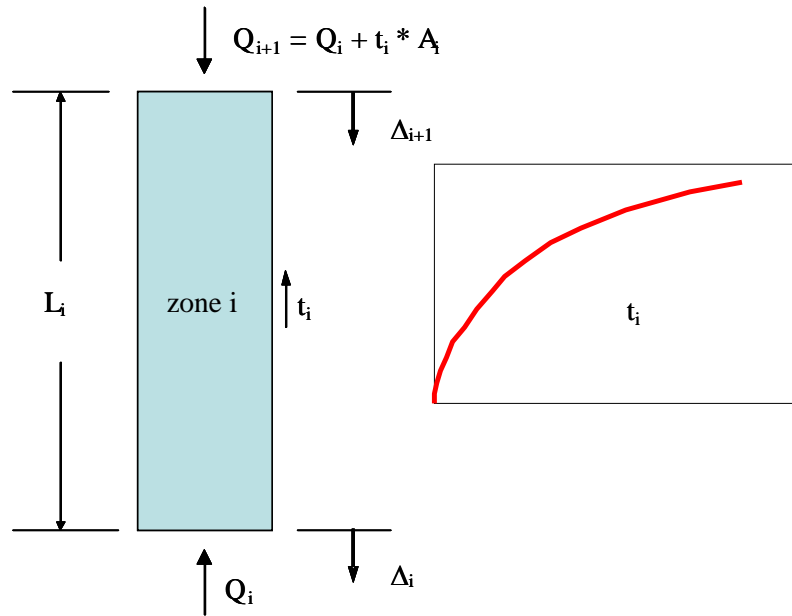


Figure C- 1

Figure C-1 above illustrates a sample pile segment zone. The zone has an associated unit shear capacity plot t_i (which is a non-linear function of displacement), pile dimensions and properties L_i and AE_i , computed elastic compression δ_i , and computed loads and displacements at the top and bottom of the zone, Δ_i , Q_i and Δ_{i+1} , Q_{i+1} , respectively. For each zone i , the following three equations are solved in an iterative fashion until the output displacement and load Δ_{i+1} and Q_{i+1} match the input.

$$\text{I) } \delta_i = \frac{(Q_i + Q_{i+1})}{2} \cdot \frac{L_i}{AE_i} \quad \text{II) } \Delta_{i+1} = \Delta_i + \delta_i \quad \text{III) } Q_{i+1} = Q_i + t\left(\frac{\Delta_i + \Delta_{i+1}}{2}\right) \cdot A_i$$

The next zone $i+1$ is then analyzed, until the load transfer mechanism of the full pile length is modeled. Additionally, there is an end-bearing capacity plot $q-z$ which must also be considered.

References:

Lee, Jong-Sub and Park, Yung-Ho "Equivalent Pile Load-Head Settlement Curve Using a Bi-Directional Pile Load Test", *Computers and Geotechnics*, Volume 35, Issue 2, March 2008, Pages 124-133.

Meyer, P. L., Holmquist, D. V. and Matlock, H. "Computer predictions for axially-loaded Piles with Non-linear Supports", *Proceedings of the 7th Offshore Technology Conference*, Paper No. 2186, Houston, Texas 1975.

APPENDIX D

O-CELL METHOD FOR DETERMINING CREEP LIMIT LOADING



O-CELL METHOD FOR DETERMINING A CREEP LIMIT LOADING ON THE EQUIVALENT TOP-LOADED SHAFT (September, 2000)

Background: O-cell testing provides a sometimes useful method for evaluating that load beyond which a top-loaded drilled shaft might experience significant unwanted creep behavior. We refer to this load as the “creep limit,” also sometimes known as the “yield limit” or “yield load”.

To our knowledge, Housel (1959) first proposed the method described below for determining the creep limit. Stoll (1961), Bourges and Levillian (1988), and Fellenius (1996) provide additional references. This method also follows from long experience with the pressuremeter test (PMT). Figure 8 and section 9.4 from ASTM D4719-94, reproduced below, show and describe the creep curve routinely determined from the PMT. The creep curve shows how the movement or strain obtained over a fixed time interval, 30 to 60 seconds, changes versus the applied pressure. One can often detect a distinct break in the curve at the pressure P_e in Figure 8. Plastic deformations may become significant beyond this break loading and progressively more severe creep can occur.

Definition: Similarly with O-cell testing using the ASTM Quick Method, one can conveniently measure the additional movement occurring over the final time interval at each constant load step, typically 4 to 8 minutes. A break in the curve of load vs. movement (as at P_e with the PMT) indicates the creep limit.

We usually indicate such a creep limit in the O-cell test for either one, or both, of the side shear and end bearing components, and herein designate the corresponding movements as M_{CL1} and M_{CL2} . We then combine the creep limit data to predict a creep limit load for the equivalent top loaded shaft.

Procedure if both M_{CL1} and M_{CL2} available: Creep cannot begin until the shaft movement exceeds the M_{CL} values. A conservative approach would assume that creep begins when movements exceed the lesser of the M_{CL} values. However, creep can occur freely only when the shaft has moved the greater of the two M_{CL} values. Although less conservative, we believe the latter to match behavior better and therefore set the creep limit as that load on the equivalent top-loaded movement curve that matches the greater M_{CL} .

Procedure if only M_{CL1} available: If we cannot determine a creep limit in the second component before it reaches its maximum movement M_x , we treat M_x as M_{CL2} . From the above method one can say that the creep limit load exceeds, by some unknown amount, that obtained when using $M_{CL2} = M_x$.

Procedure if no creep limit observed: Then, according to the above, the creep limit for the equivalent top-loaded shaft will exceed, again by some unknown amount, that load on the equivalent curve that matches the movement of the component with the maximum movement.



Limitations: The accuracy in estimating creep limits depends, in part, on the scatter of the data in the creep limit plots. The more scatter, the more difficult to define a limit. The user should make his or her own interpretation if he or she intends to make important use of the creep limit interpretations. Sometimes we obtain excessive scatter of the data and do not attempt an interpretation for a creep limit and will indicate this in the report.

Excerpts from ASTM D4719
 “Standard Test Method for Pressuremeter Testing in Soils”

9.4 For Procedure A, plot the volume increase readings (V_{60}) between the 30 s and 60 s reading on a separate graph. Generally, a part of the same graph is used, see Fig. 8. For Procedure B, plot the pressure decrease reading between the 30 s and 60 s reading on a separate graph. The test curve shows an almost straight line section within the range of either low volume increase readings (V_{60}) for Procedure A or low pressure decrease for Procedure B. In this range, a constant soil deformation modulus can be measured. Past the so-called creep pressure, plastic deformations become prevalent.

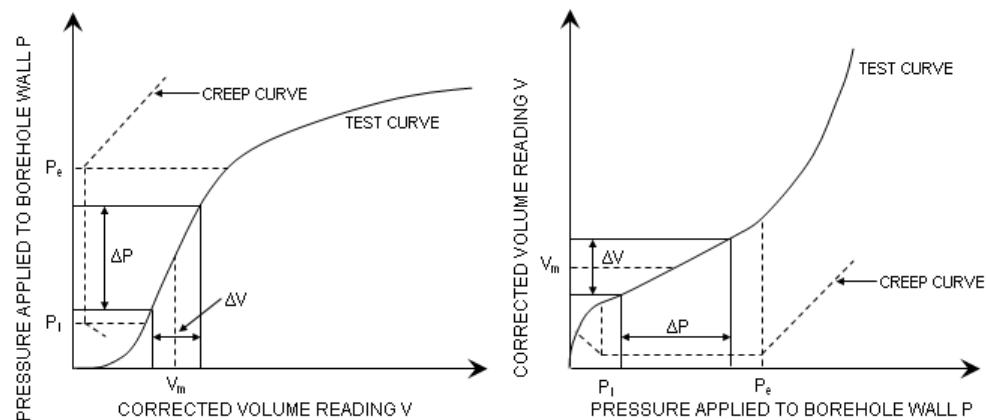


FIG. 8 Pressuremeter Test Curves for Procedure A

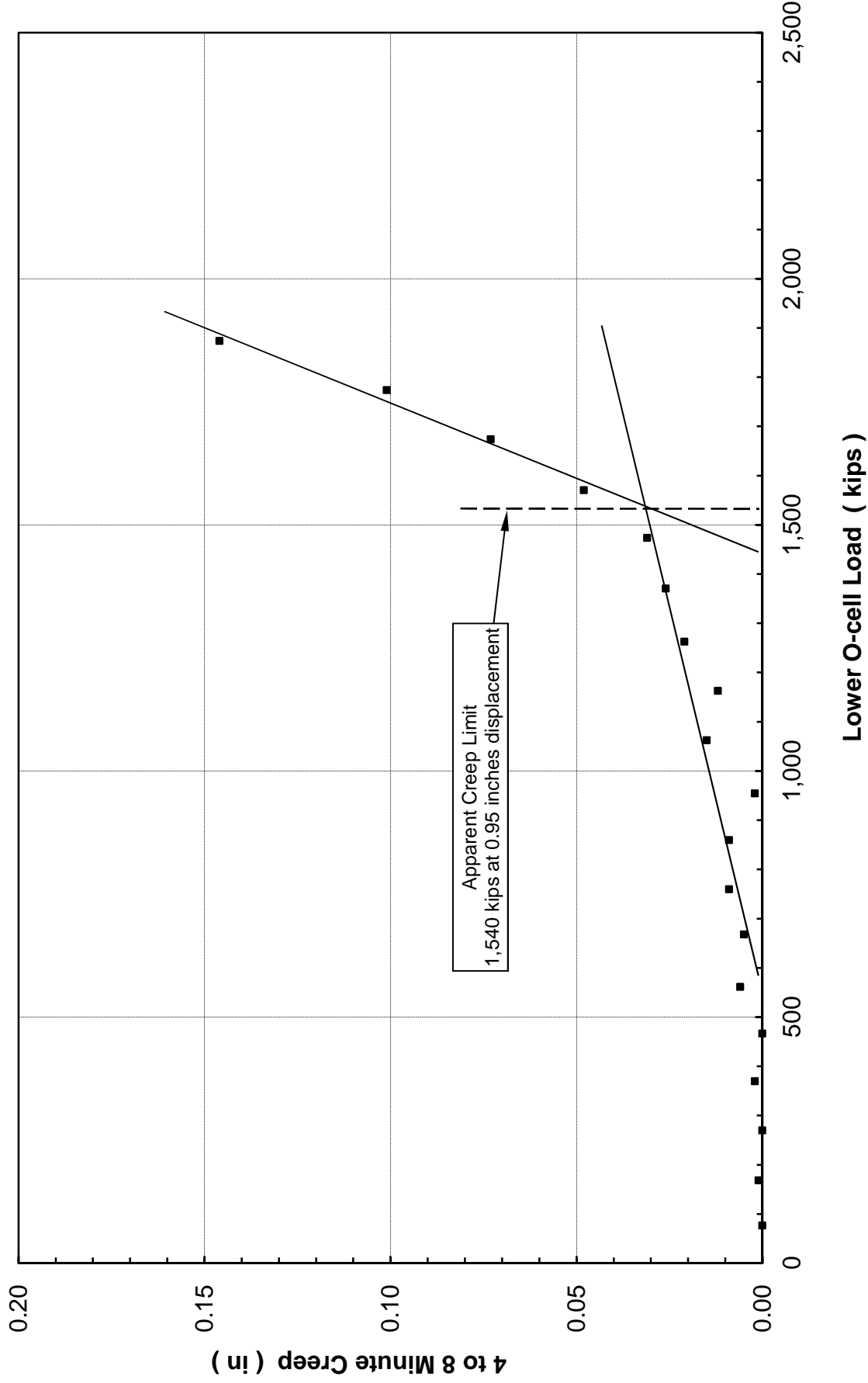
References

- Housel, W.S. (1959), “Dynamic & Static Resistance of Cohesive Soils”, ASTM STP 254, pp. 22-23.
- Stoll, M.U.W. (1961, Discussion, Proc. 5th ICSMFE, Paris, Vol. III, pp. 279-281.
- Bourges, F. and Levillain, J-P (1988), “force portante des rideaux plans metalliques charges verticalement,” Bull. No. 158, Nov.-Dec., des laboratoires des ponts et chaussees, p. 24.
- Fellenius, Bengt H. (1996), Basics of Foundation Design, BiTech Publishers Ltd., p.79.



Combined End Bearing and Lower Side Shear Creep Limit

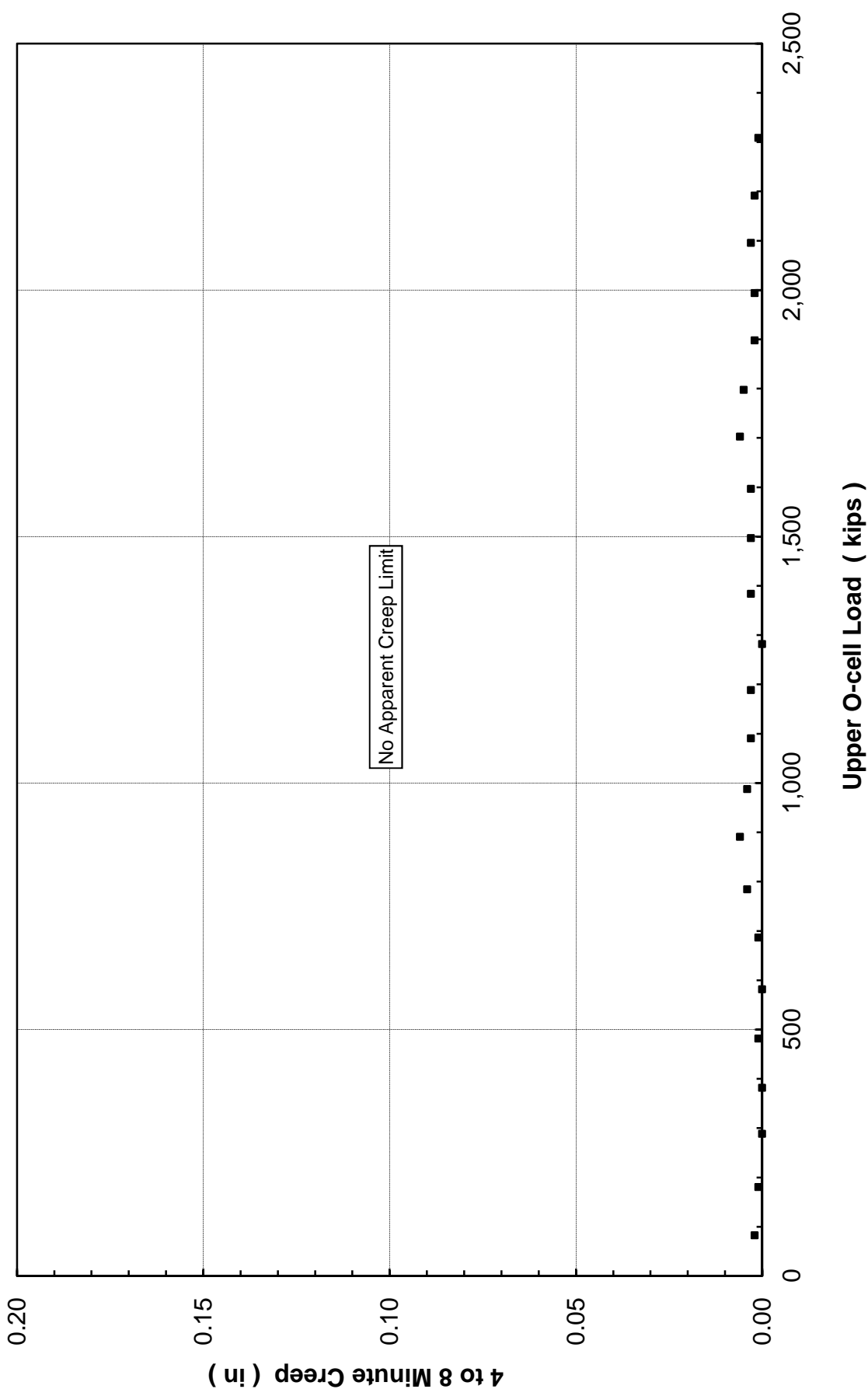
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Middle Side Shear Creep Limit

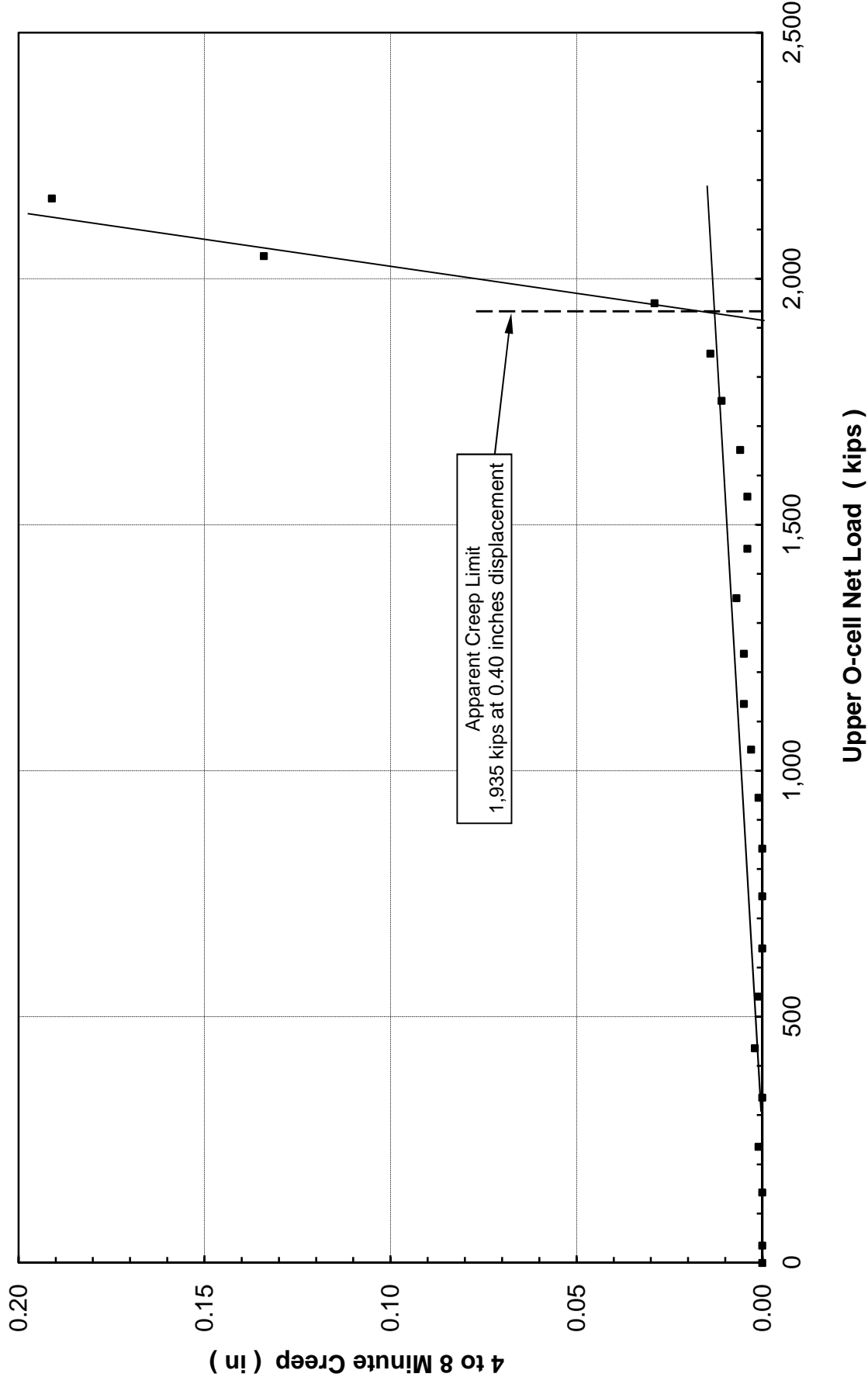
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC





Upper Side Shear Creep Limit

Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC



Test Shaft 1 - US 701 over Great Pee Dee River
Horry County, SC (LT-1212)

APPENDIX E

SONICALIPER PROFILE



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Calipered and Nominal Shaft Dimensions
Test Shaft 1 - US 701 over Great Pee Dee River - Horry County, SC

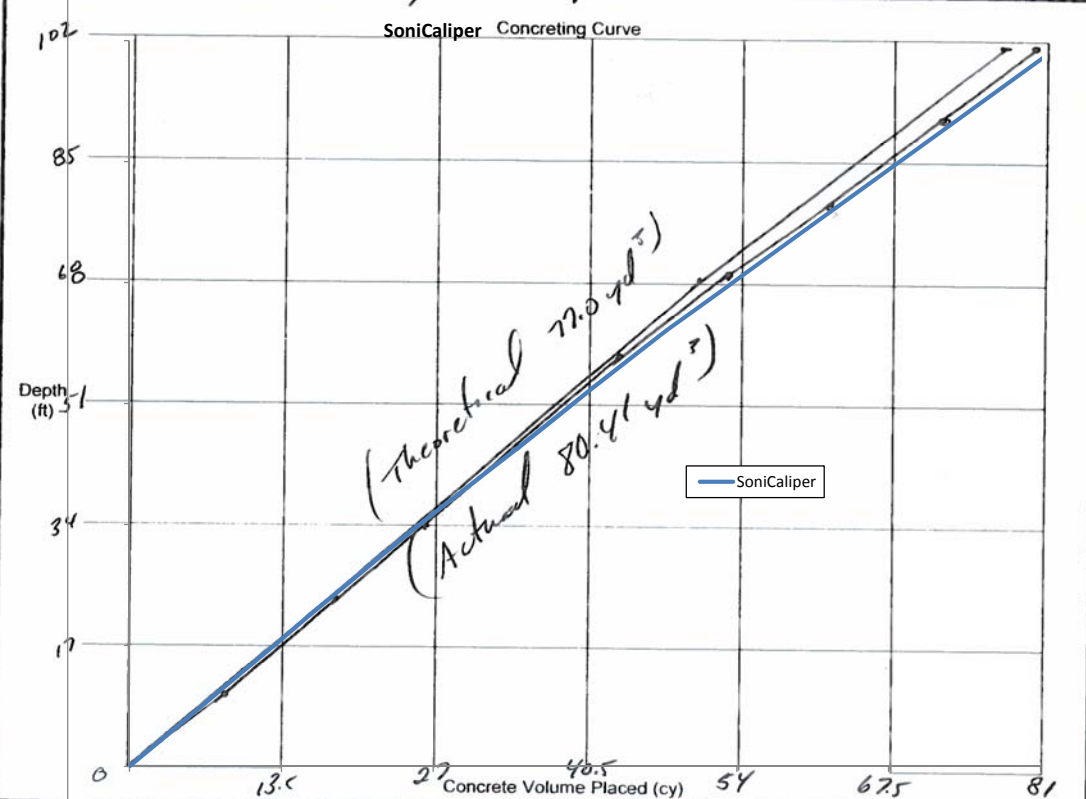
I.D.	Depth (ft)	Calipered Diameter (in)	Casing Diameter (in)	Elevation		Perimeter (in)	Cross Section (ft ²)	Cumulative Shear (ft ²)	Cumulative Volume (yd ³)
				From (ft)	To (ft)				
Top of Casing	0.00	65.0	65.75	10.12	-5.88	206.6	23.58	275.4	14.0
Caliper 1	16.00	65.0	65.75	-5.88	-25.88	206.6	23.58	619.7	31.4
Caliper 2	36.00	65.0	65.75	-25.88	-27.88	206.6	23.58	654.1	33.2
Caliper 3	38.00	65.4	-	-27.88	-29.88	205.3	23.30	688.5	34.9
Caliper 4	40.00	66.0	-	-29.88	-33.88	207.5	23.80	757.0	38.4
Caliper 5	44.00	63.6	-	-33.88	-37.88	199.7	22.00	826.1	41.7
Caliper 6	48.00	63.3	-	-37.88	-41.88	199.0	21.90	892.7	44.9
Caliper 7	52.00	62.5	-	-41.88	-45.88	196.3	21.30	959.0	48.1
Caliper 8	56.00	62.4	-	-45.88	-49.88	196.2	21.30	1024.5	51.3
Caliper 9	60.00	63.4	-	-49.88	-53.88	199.3	21.90	1089.9	54.5
Caliper 10	64.00	63.3	-	-53.88	-57.88	198.7	21.80	1156.3	57.7
Caliper 11	68.00	63.2	-	-57.88	-61.88	198.5	21.80	1222.5	61.0
Caliper 12	72.00	61.9	-	-61.88	-65.88	194.3	20.90	1288.7	64.1
Caliper 13	76.00	61.3	-	-65.88	-69.88	192.5	20.50	1353.5	67.1
Caliper 14	80.00	61.6	-	-69.88	-73.88	193.6	20.70	1417.6	70.2
Caliper 15	84.00	60.5	-	-73.88	-77.88	190.1	20.00	1482.2	73.1
Caliper 16	88.00	61.3	-	-77.88	-81.88	192.7	20.50	1545.5	76.2
Caliper 17	92.00	61.2	-	-81.88	-85.88	192.3	20.40	1609.8	79.2
Caliper 18	96.00	61.0	-	-85.88	-89.88	191.7	20.30	1673.9	82.2
Caliper 19	100.00	61.2	-	-89.88	-93.88	192.4	20.50	1737.8	85.2
Caliper 20	104.00	61.4	-	-93.88	-95.21	193.0	20.60	1759.1	86.2
Shaft base	105.33	-	-	-95.21					

Note: Cumulative shear and volume calculated by method of cylinders in descending order of depth.
Diameter immediately below tip of casing assumed to be same as first caliper profile recorded below casing.
Nominal diameter of cased shaft length assumed same as O.D. of casing.



DRILLED SHAFT CONCRETE VOLUMES LOG (REV 06-03-02)

Project Name Load Test for replacement of 701 bridges Page 6 of 6
 File No. 2226.030683 Bent No. test shaft
 Contractor Lee & Sims Shaft No. _____
 Completed By Contractor DS Foreman - John Sims Date 5/9/13 Station _____
 Reviewed By SCDOT Inspector Henry Lee Date 1/1 Offset _____



Volume Delivered	VD	<u>84</u>	cy
Volume In Pump Truck + Lines	VPTL	<u>0.85</u>	cy
Volume of CSL Tubes	VCSLT	<u>0.42</u>	cy
Wastage	VW	<u>2.32</u>	cy
Volume Placed			
= VD-VPTL-VCSLT-VW =	VP	<u>80.41</u>	cy
Theoretical Volume	VTh	<u>77.0</u>	cy
Over Pour (VP-VTh \geq 1.00)	OP	<u>3.41</u>	cy
Under Pour (VP-VTh < 1.00)	UP		cy

US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013

The enclosed report contains the data and analysis summary for the SoniCaliper shaft caliper, performed at US 701 over PeeDee River (Test Pile), Horry County, SC on Thursday, May 09, 2013 by David J. Jakstis. The shaft was calipered from a reference depth of 16.0 feet to a depth of 104.0 feet. The shaft excavation was supported by a permanent, 37.0 feet deep, 65.0 inches I.D., 0.4 inches thick steel casing. The thickness of the casing itself, if temporary, was added to the total volume calculation.

The minimum concrete volume is calculated to be 80.7 yd³, based on the area of the calipered cross-sections and a Top of Concrete depth of 5.5 feet. (Note that this includes theoretical volume based on a nominal shaft cross-sectional area between depths of 104.0 feet and 105.5 feet, which was not calipered.)

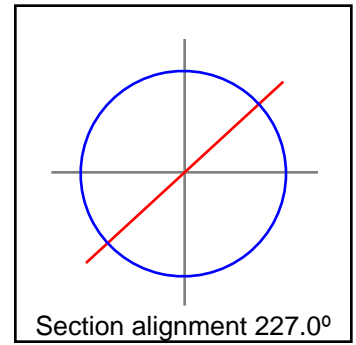
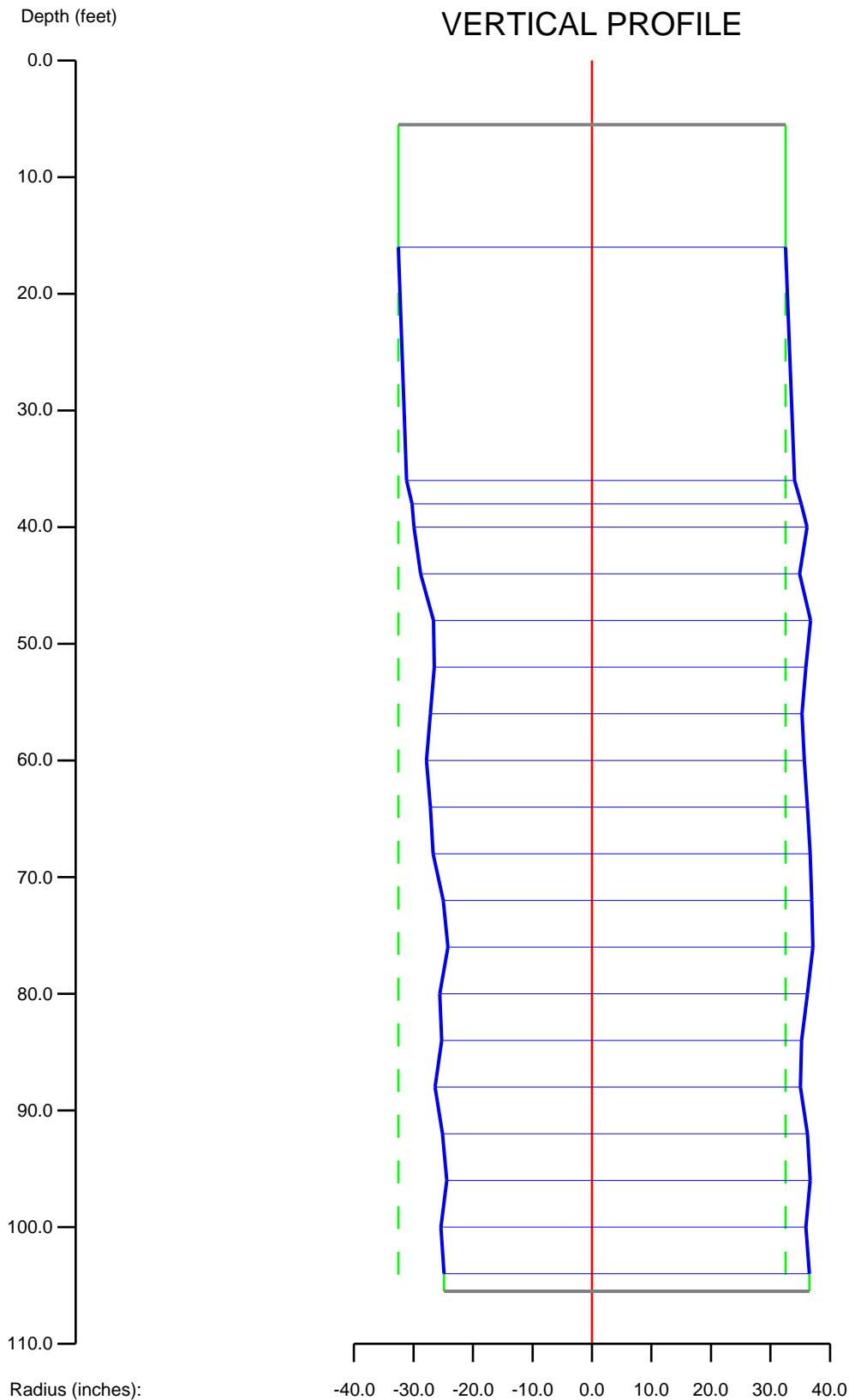
Note that significant wall encroachment (greater than 6.0 inches) was calculated at the depths listed below:

Depth (feet)	Encroachment (inches)	Page #
52.0	6.0	6
68.0	6.0	7
72.0	7.6	7
76.0	8.5	8
80.0	7.3	8
84.0	7.4	8
88.0	6.3	8
92.0	7.5	9
96.0	8.4	9
100.0	7.3	9
104.0	7.7	9



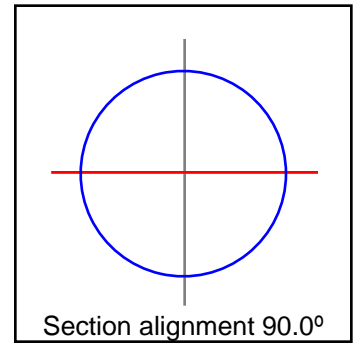
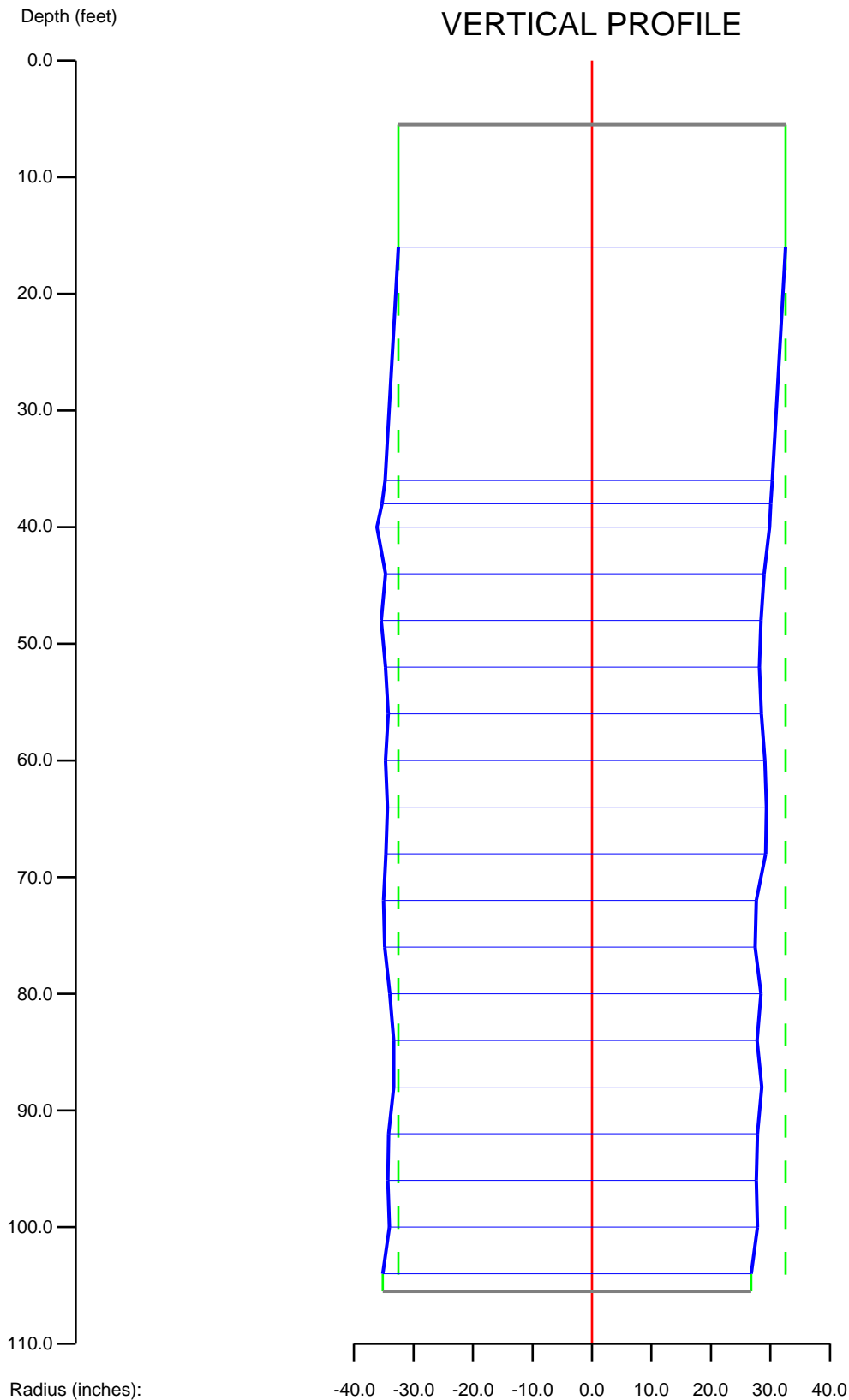
US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



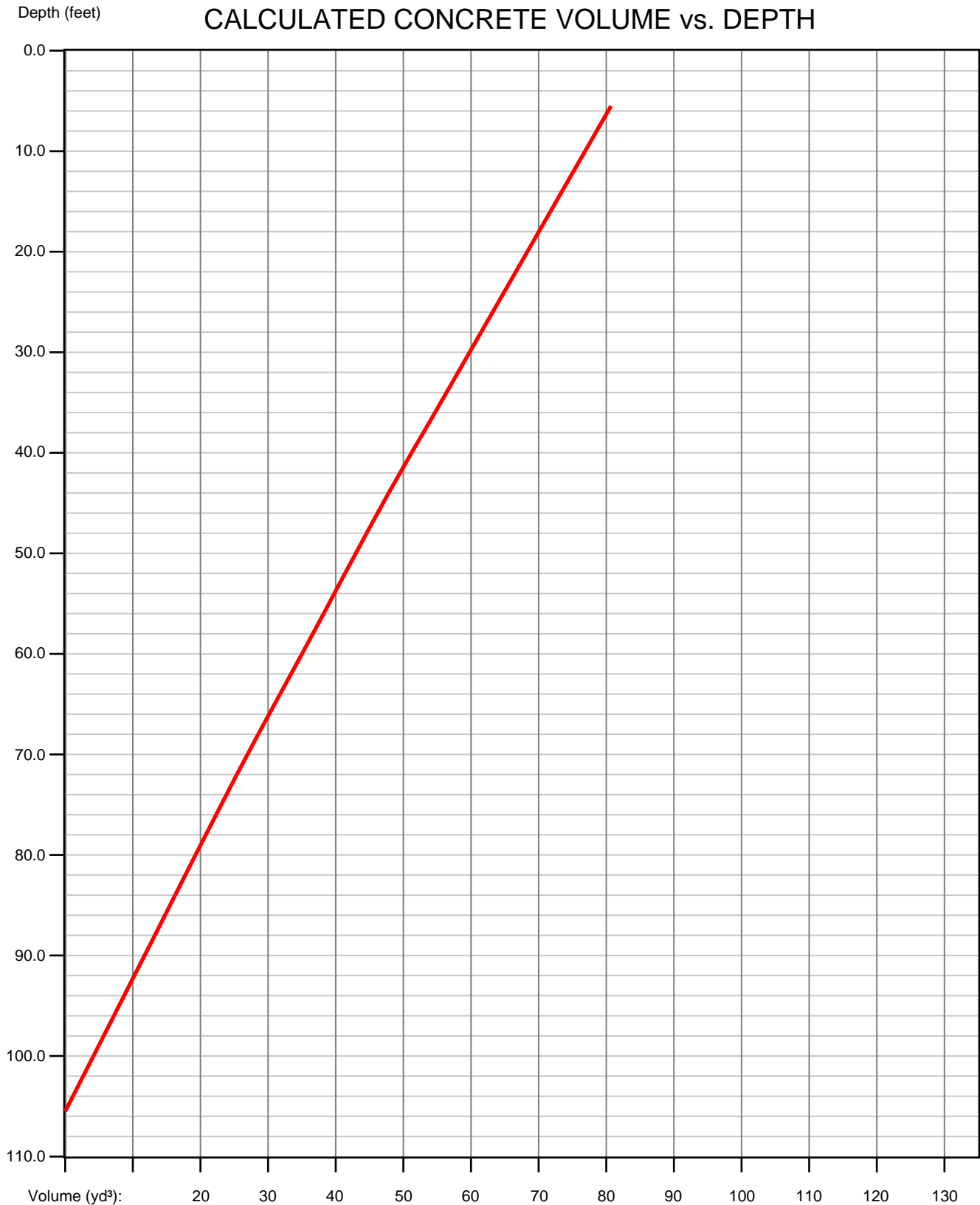
US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013

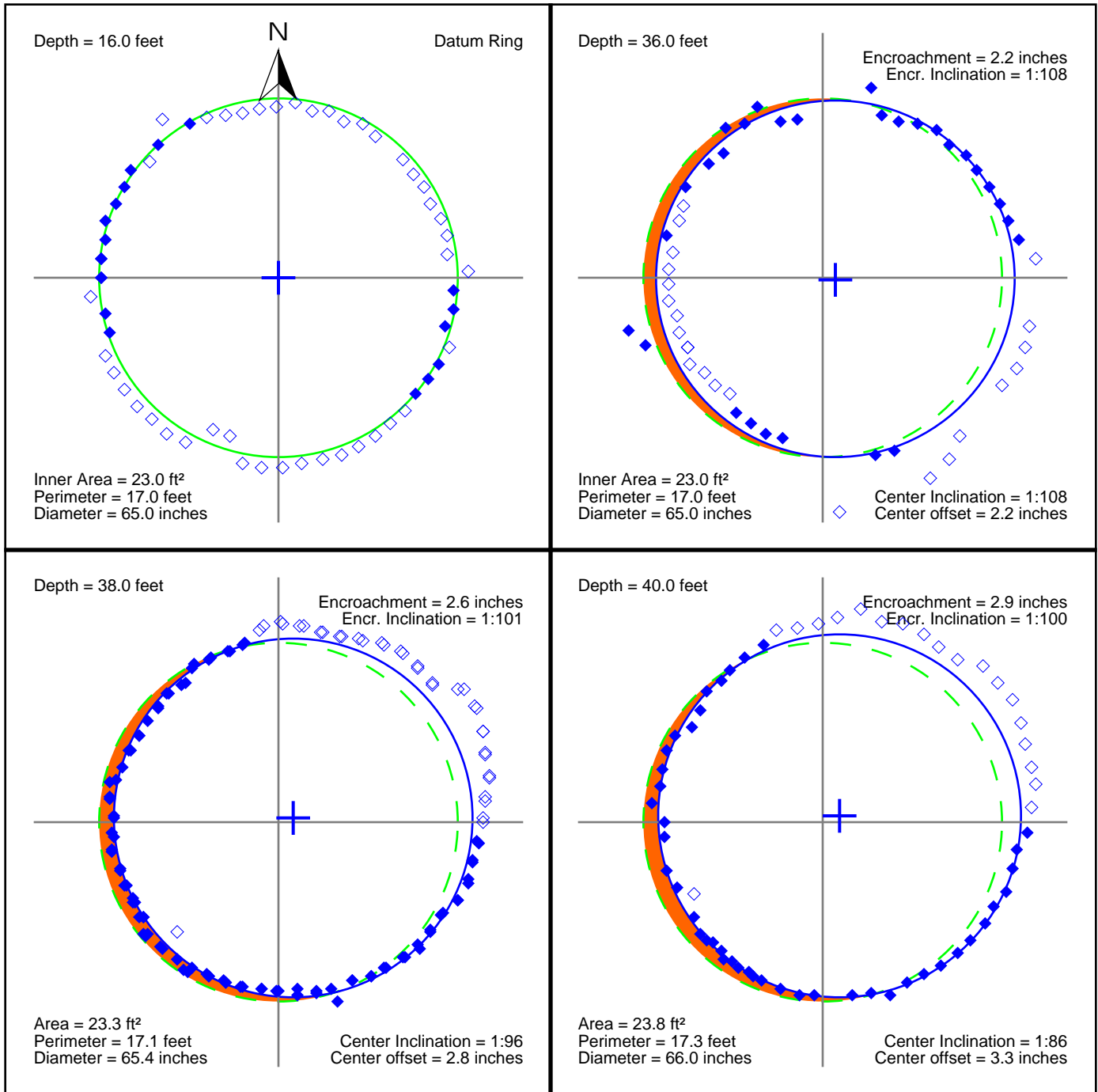


Project Number: 1212

SONICALIPER

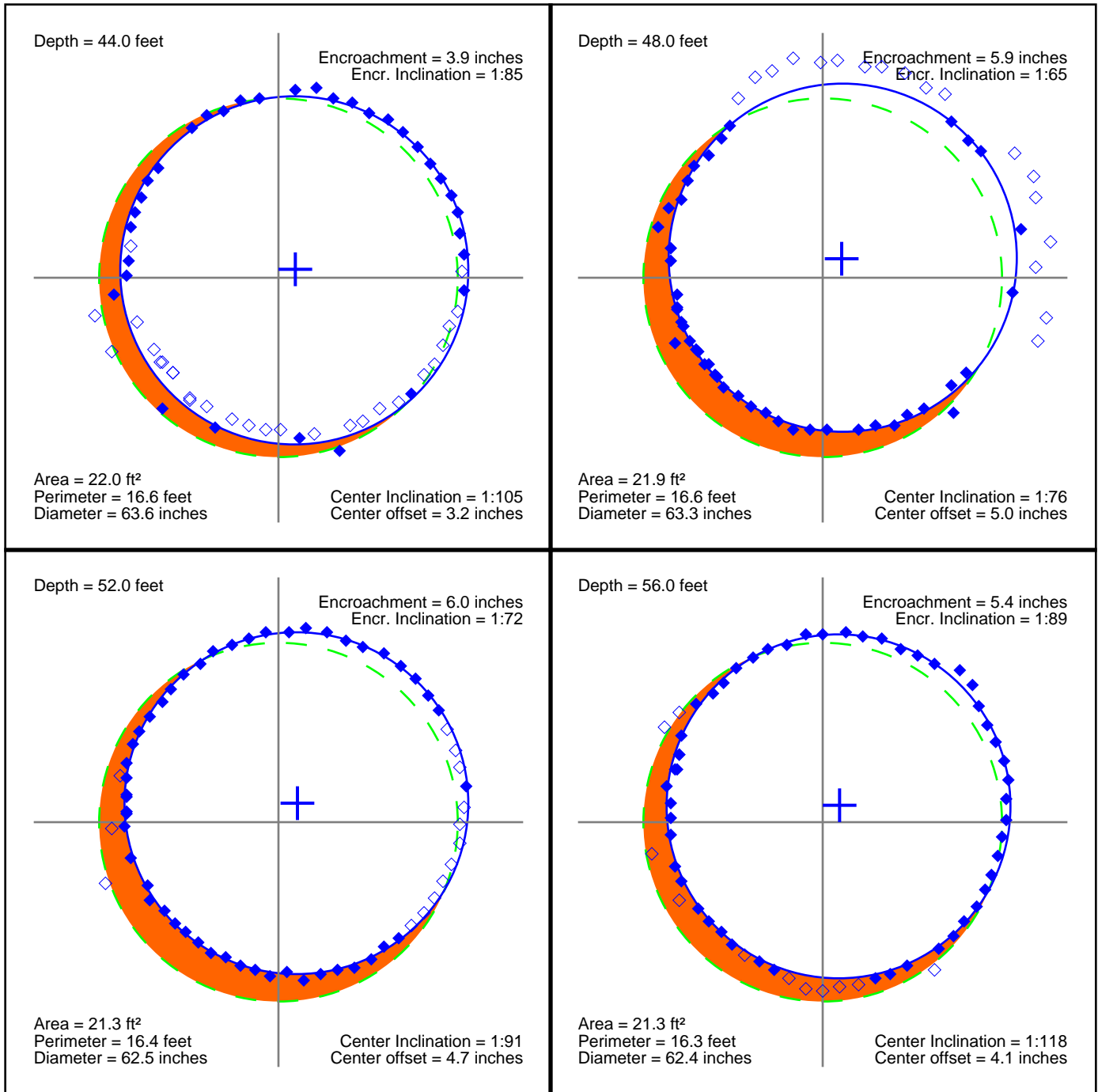
US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



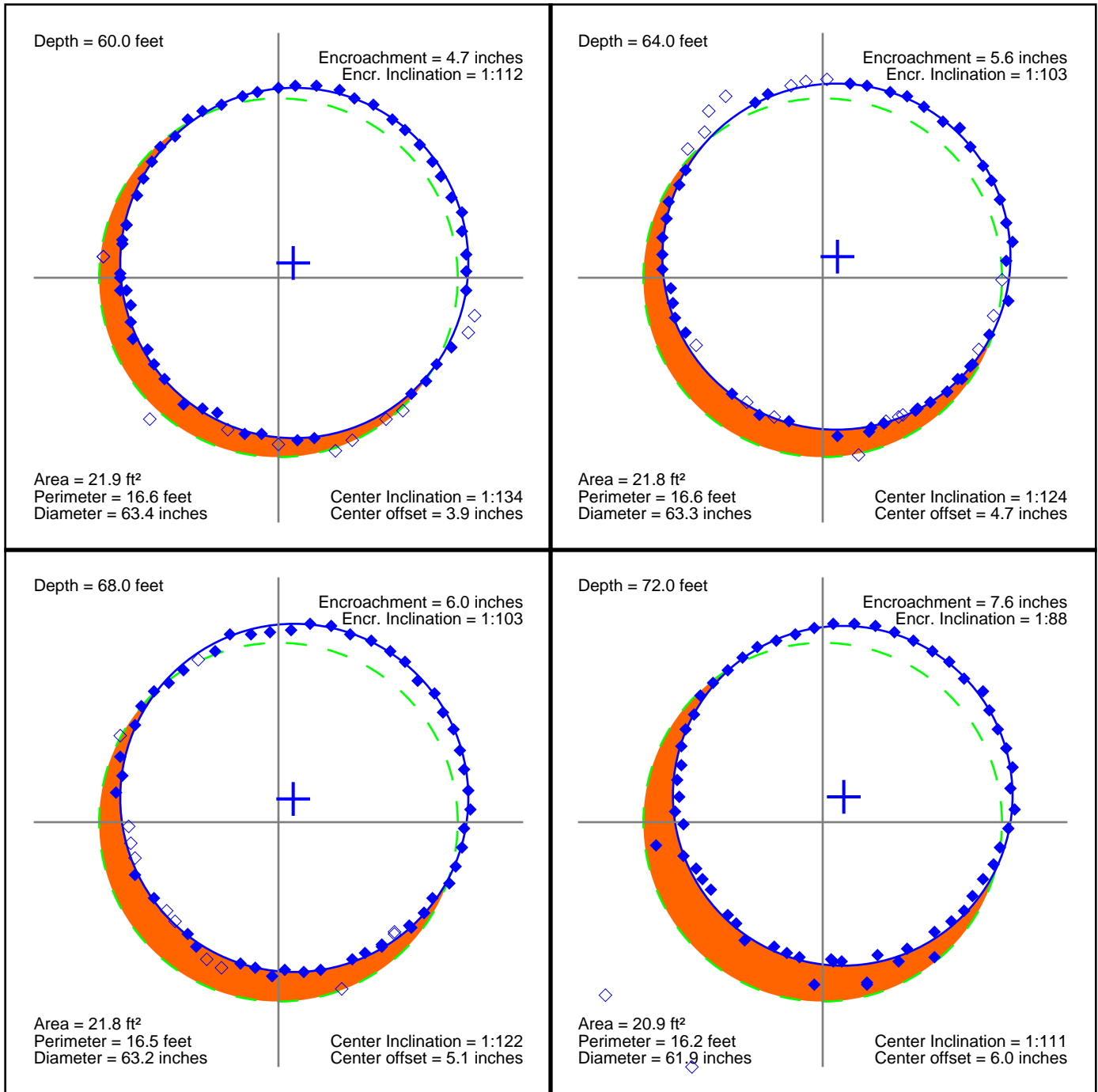
US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



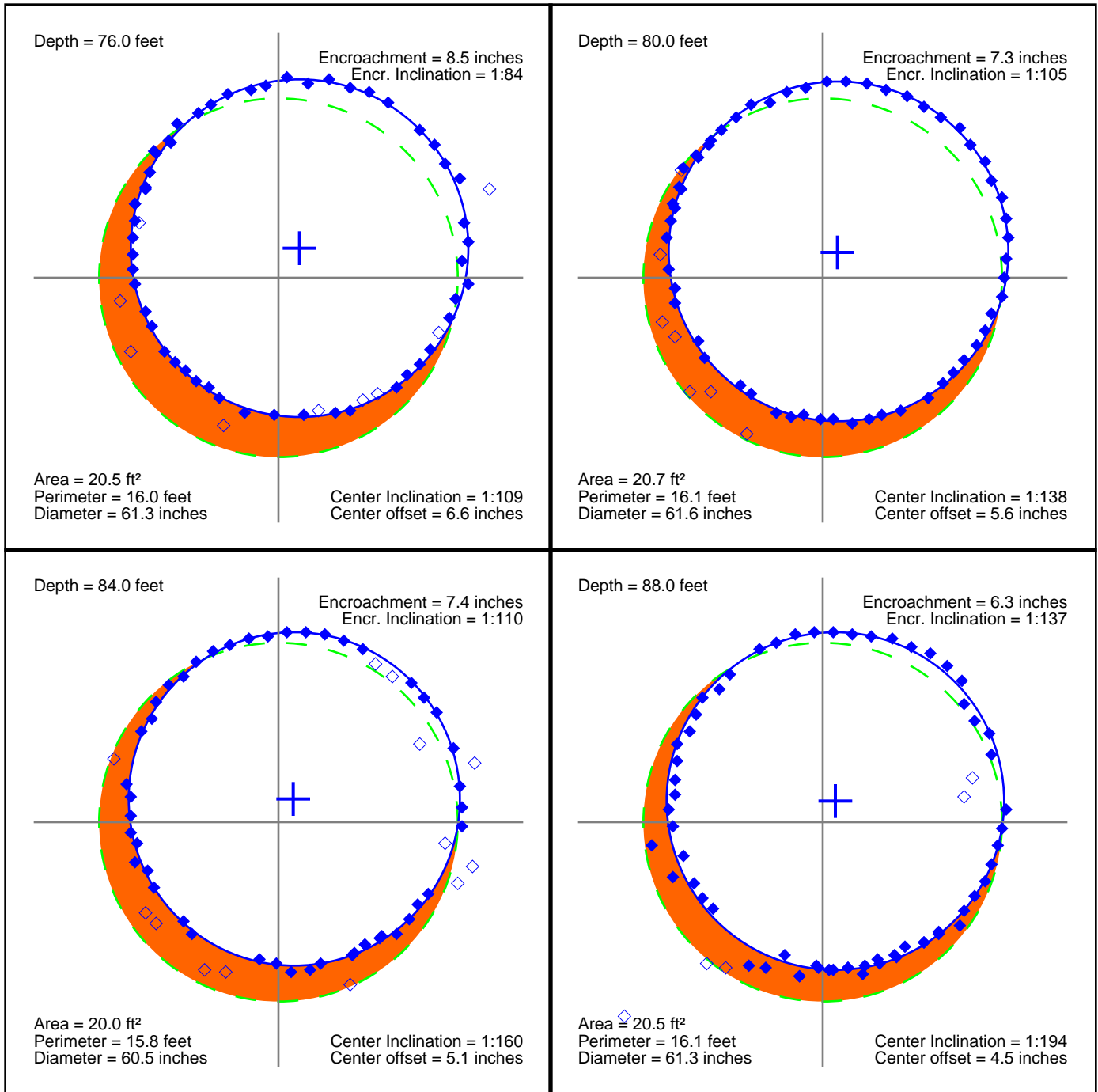
US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



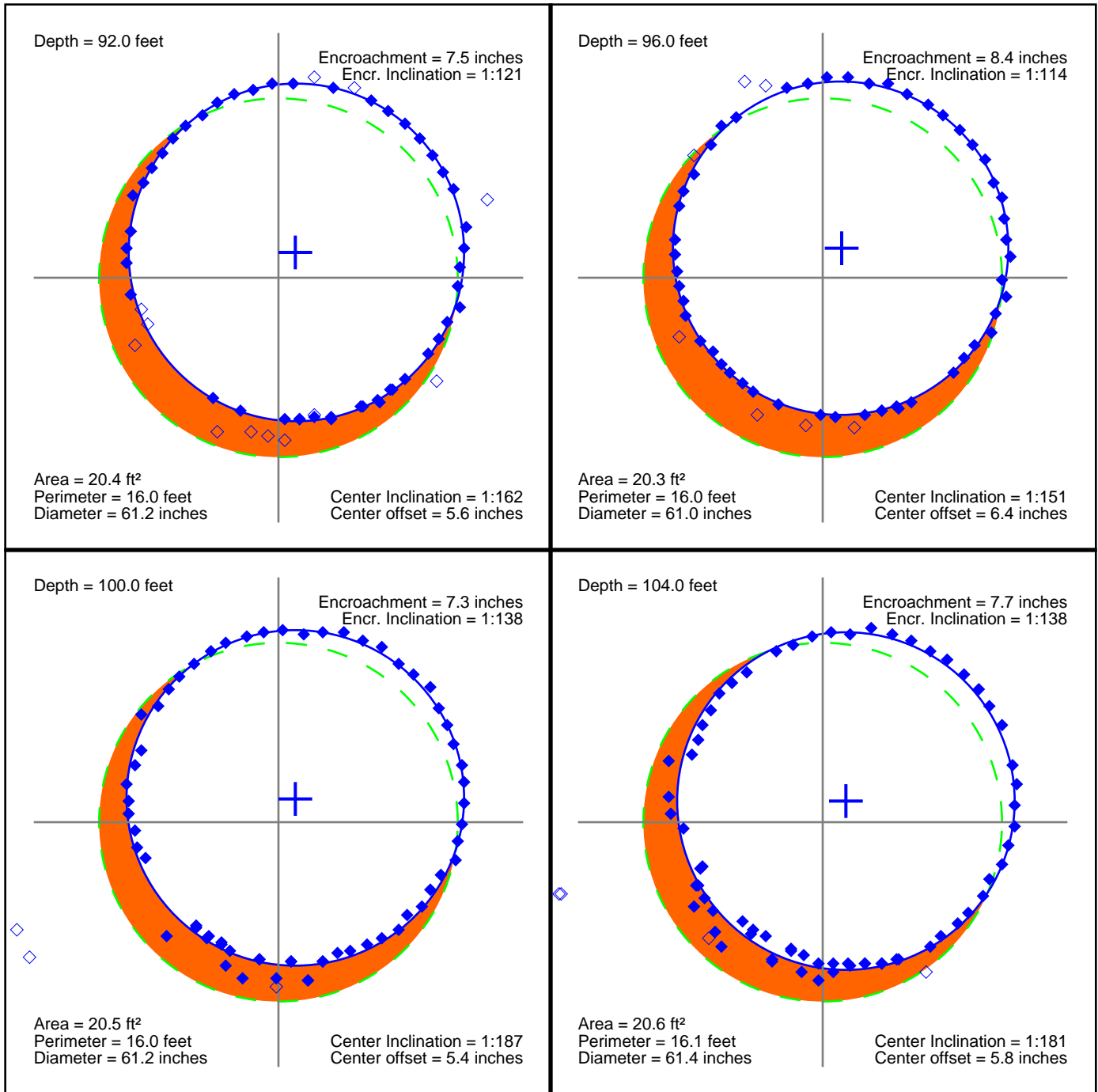
US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



US 701 over PeeDee River - Test Pile

Horry County, SC, 05/09/2013



INTERPRETATION OF SONICALIPER FIELD DATA REPORT

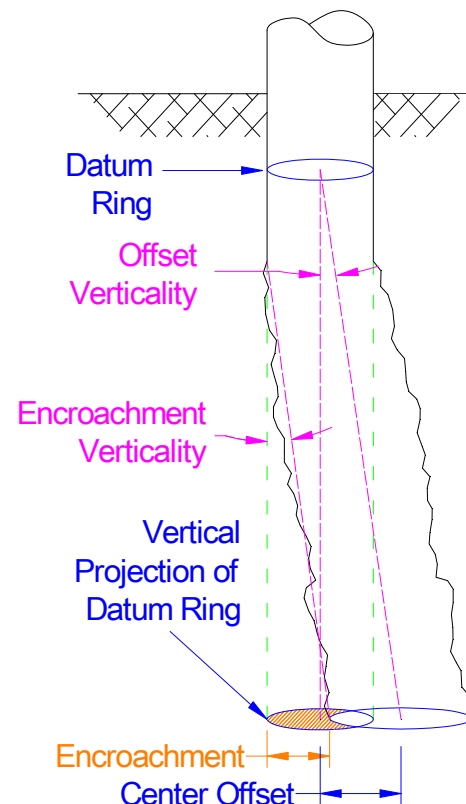
General: The SoniCaliper is a profiling sonar device, specially adapted to function in drilling fluids. Each 360° pass generated with the SoniCaliper device produces up to one hundred twenty individual echo returns (profile data points). In the preceding figures (profile ring plots), the diamond points represent individual profile data points. A geometric shape is fitted to the data points using the non-linear least-squares technique (see Gander et al) to approximate the cross-sectional profile of the shaft for verticality, perimeter area and volume calculations. Hollow diamonds designate rejected points which are not used in the data fitting.

Deployment: The device is lowered into the shaft excavation in incremental depths. At each depth, a 360° sweep of the shaft wall is performed. The device is assumed to hang vertically in the shaft (any deviation from verticality can be noted using onboard pitch and roll sensors). Any twist in the device relative to its initial orientation is compensated by onboard compass and/or gyroscope sensors.

Calibration: Because the properties of drilling fluids vary widely, a calibration must be performed for each shaft to determine fluid wavespeed. This is done by selecting a profile ring of known diameter (drilled shaft) or length & width (panel / barrette) as the “calibration ring”. The data analysis then back-calculates the fluid wavespeed based on the known dimensions of this ring. The fluid wavespeed is assumed to be constant over the entire column of fluid depth.

Shaft Verticality: To determine shaft verticality, a profile ring (usually, but not always the calibration ring) is selected as the “datum ring”. The geometric centers of the datum ring and all other profile rings are compared. The “center offset” listed on the figures indicates the divergence of each profile ring center point from the datum ring center point. “Encroachment” is presented graphically as the shaded area representing the portion of the shaft wall which would encroach into the perfectly vertical projection of the datum ring to the depth in question. For circular shafts, the maximum encroachment value for each profile ring is also given numerically. The user may also choose to display computed values for the vertical inclination of the shaft between each ring and the datum ring, for both encroachment and center offset. Verticality is computed as the maximum encroachment or center offset (the “deviation”) divided by change in depth, and may be expressed as an angle, a percentage or as a deviation:depth ratio.

Calipered Volume: The cross sectional area of each profile ring is determined and a cumulative volume for the calipered portion of the shaft is calculated. Note that this volume is a minimum.



Test Shaft 1 - US 701 over Great Pee Dee River
Horry County, SC (LT-1212)

APPENDIX F

SOIL BORING LOG & SHAFT CONSTRUCTION LOG



DEEP FOUNDATION TESTING, EQUIPMENT & SERVICES • SPECIALIZING IN OSTERBERG CELL (O-CELL) TECHNOLOGY
Osterberg Cell® and O-cell® are registered trademarks.

SCDOT Soil Test Boring Log

File No.:	2226	Project No. (PIN):	030683	County:	Horry/Georgetown	Eng./Geo.:	Worth King
Site Description:	Drilled Shaft Load Test (S&ME #1633-13-093)					Route:	US 701
Boring No.:	B-1	Boring Location:	Test Shaft	Offset:	N/A	Alignment:	N/A
Elev.:	Unknown ft	Latitude:		Longitude:		Date Started:	4/12/13
Total Depth:	120 ft	Soil Depth:	120 ft	Core Depth:	N/A ft	Date Completed:	4/18/2013
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 45	Drill Method:	Mud Rotary	Hammer Type:	Gravity	Energy Ratio:	83%
Core Size:	N/A	Driller:	Matt Wiggins	Groundwater:	TOB	3.5 ft	24HR

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE ●</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%)</div> </div>
	0.0	LEAN CLAY (CL) - very soft to soft, wet to saturated, brown, mostly low to medium plasticity fines, trace fine sand.		0.0	SS-1	4	2	0	2	●
	2.0			2.0	SS-2	0	2	2	4	●
	4.0			4.0	SS-3	3	2	2	4	●
	6.0	SANDY SILT (ML) - very soft to soft, saturated, gray, mostly low to medium plasticity fines, some fine to medium sand.		6.0	SS-4	0	1	1	2	●
	8.0			8.0	SS-5	1	2	1	3	●
	10.0	SILTY SAND (SM) - very loose, saturated, gray, mostly fine to medium sand, some low to medium plasticity fines.								
		SANDY SILT (ML) - soft to stiff, saturated, gray, mostly low to medium plasticity fines, some fine to medium sand.								
	13.5			13.5	SS-6	0	0	4	4	●
	16.0	@16 ft. --- organics observed.								
		POORLY GRADED SAND (SP) - very loose to dense, saturated, tan/gray, mostly fine to medium sand.		18.5	SS-7	3	5	4	9	●
				23.5	SS-8	3	4	5	9	●
				28.5	SS-9	3	2	2	4	●
				33.5	SS-10	2	3	4	7	●

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.:	2226	Project No. (PIN):	030683	County:	Horry/Georgetown	Eng./Geo.:	Worth King
Site Description:		Drilled Shaft Load Test (S&ME #1633-13-093)				Route:	US 701
Boring No.:	B-1	Boring Location:	Test Shaft	Offset:	N/A	Alignment:	N/A
Elev.:	Unknown ft	Latitude:		Longitude:		Date Started:	4/12/13
Total Depth:	120 ft	Soil Depth:	120 ft	Core Depth:	N/A ft	Date Completed:	4/18/2013
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 45	Drill Method:	Mud Rotary	Hammer Type:	Gravity	Energy Ratio:	83%
Core Size:	N/A	Driller:	Matt Wiggins	Groundwater:	TOB 3.5 ft	24HR	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE ●</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%)</div> </div>
				38.5	SS-11	7	4	8	12	●
				43.5	SS-12	7	9	12	21	●
				48.5	SS-13	10	15	17	32	●
				53.5	SS-14	12	17	26	43	●
				58.5	SS-15	12	19	23	42	●
	64.0	SANDY LEAN CLAY (CL) - stiff to very hard, saturated, gray, mostly low to medium plasticity fines, some fine to medium sand.		63.5	SS-16	12	5	5	10	●
				68.5	SS-17	5	6	7	13	●

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.:	2226	Project No. (PIN):	030683	County:	Horry/Georgetown	Eng./Geo.:	Worth King
Site Description:		Drilled Shaft Load Test (S&ME #1633-13-093)				Route:	US 701
Boring No.:	B-1	Boring Location:	Test Shaft	Offset:	N/A	Alignment:	N/A
Elev.:	Unknown ft	Latitude:		Longitude:		Date Started:	4/12/13
Total Depth:	120 ft	Soil Depth:	120 ft	Core Depth:	N/A ft	Date Completed:	4/18/2013
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 45	Drill Method:	Mud Rotary	Hammer Type:	Gravity	Energy Ratio:	83%
Core Size:	N/A	Driller:	Matt Wiggins	Groundwater:	TOB 3.5 ft	24HR	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div> ● SPT N VALUE ● </div> <div> PL MC LL </div> <div> ▲ FINES CONTENT (%) </div> </div>
				73.5	SS-18	18	11	10	22	●
				78.5	SS-19	8	50/2	50/2"		>>●
				83.5	SS-20	50/1		50/1"		>>●
				88.5	SS-21	5	9	9	18	●
				93.5	SS-22	22	20	19	39	●
				98.5	SS-23	6	8	12	20	●
				103.5	SS-24	6	9	10	19	●

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.:	2226	Project No. (PIN):	030683	County:	Horry/Georgetown	Eng./Geo.:	Worth King
Site Description:		Drilled Shaft Load Test (S&ME #1633-13-093)				Route:	US 701
Boring No.:	B-1	Boring Location:	Test Shaft	Offset:	N/A	Alignment:	N/A
Elev.:	Unknown ft	Latitude:		Longitude:		Date Started:	4/12/13
Total Depth:	120 ft	Soil Depth:	120 ft	Core Depth:	N/A ft	Date Completed:	4/18/2013
Bore Hole Diameter (in):	4	Sampler Configuration		Liner Required:	Y (N)	Liner Used:	Y (N)
Drill Machine:	CME 45	Drill Method:	Mud Rotary	Hammer Type:	Gravity	Energy Ratio:	83%
Core Size:	N/A	Driller:	Matt Wiggins	Groundwater:	TOB 3.5 ft	24HR	

Elevation (ft)	Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample Depth (ft)	Sample No./Type	1st 6"	2nd 6"	3rd 6"	N Value	<div> <div>● SPT N VALUE ●</div> <div> <div>PL</div> <div>MC</div> <div>LL</div> </div> <div>▲ FINES CONTENT (%)</div> </div>
				108.5	SS-25	8	50/4		50/4"	>>●
				113.5	SS-26	7	9	11	20	●
				118.5	SS-27	6	9	10	19	●
	120.0	- Boring terminated at 120 feet.								

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	

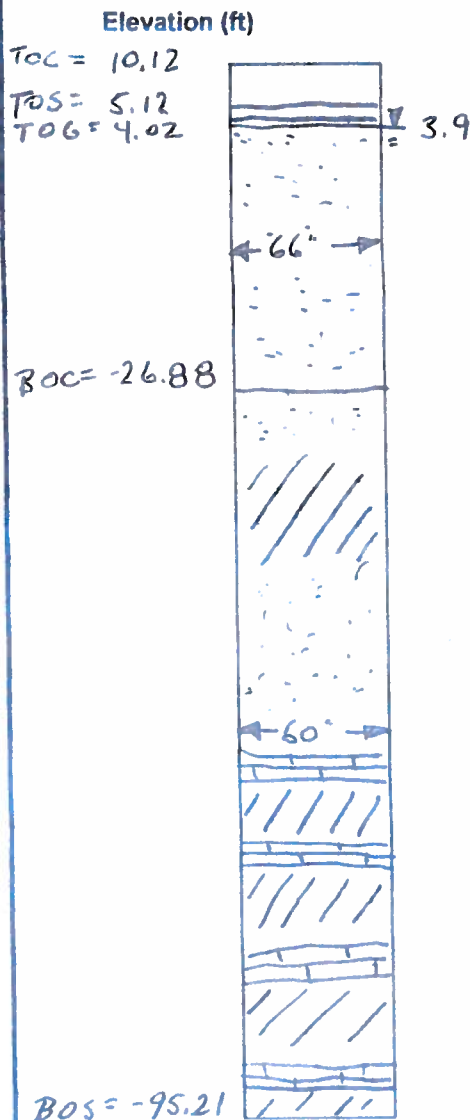
SC_DOT 1633-13-093.GPJ SC_DOT.GDT 4/19/13

SCDOT

DRILLED SHAFT LOG (REV 06-03-02)

Project Name Load Test for replacement of 701 Bridges Page 1 of 6
 File No. 2226.030683 Bent No. Test Shaft
 Contractor Lee & Sims Shaft No. _____
 Completed By Contractor DS Foreman - John Sims Date 5/9/13 Station _____
 Reviewed By SCDOT Inspector George A. Lee Date 1/1 Offset _____

		Construction	Temporary
Date Cased <u>5-6-13</u>	Casing Type	<u>Steel</u>	
Date Opened <u>5-7-13</u>	Casing Dimension (OD):	<u>66"</u>	
Date Poured <u>5-9-13</u>	Bottom of Casing Elevation (FT)	<u>-26.88</u>	
	Top of Casing Elevation (FT)	<u>10.12</u>	
	Diameter of Rock Socket (IN)	<u>N/A</u>	
	Diameter of Shaft (IN)	<u>66"/60"</u>	
	Mud-line/Ground Surface Elevation (FT)	<u>4.02</u>	
	Wet & Dry Shaft Length (FT)	<u>100.33'</u>	
	Rock Socket Length (FT)	<u>N/A</u>	
	Top of Shaft Elevation (FT)	<u>5.12</u>	
	Tip Elevation (FT)	<u>-95.21</u>	
	Constructed Shaft Length (FT)	<u>100.33'</u>	
	Testing/Other: <u>CSC/SLUMP/TEMP/CYLINDERS</u>		
	Volume of Concrete	Theoretical (VT) CY <u>77.0</u>	
	OP = VP - VT = <u>3.14</u> UP = VT - VP =	Actual (VP) CY <u>80.14</u>	
	Reinforcement Cage Installed:	Type <u>welded hoops</u>	
	Duration of Pour (min)	<u>93 min</u>	
Legend TOC Top of Casing Sand TOG Top of Ground Silt TOR Top of Rock //// Clay BOC Bottom of Casing Rock BOS Bottom of Shaft BOR Bottom of Rock 			
Water Level			
Completed by	<u>John Sims</u>		
Contractor	DS Foreman/Engineer		
Reviewed by	<u>George A. Lee</u>		
SCDOT	Inspector/Engineer		
Notes			
Shaft location variance at top	<u>N/A</u>		





DRILLED SHAFT EXCAVATION LOG (REV 06-03-02)

Project Name Load Test Shaft for Replacement of 701 Bridge Page 2 of 6
 File No. 2226.030683 Bent No. Test Shaft
 Contractor Lee & Sims Shaft No. _____
 Completed By Contractor DS Foreman - John Sims Date 5/19/13 Station _____
 Reviewed By SCDOT Inspector - George A. Lee Date 1/1 Offset _____

Note: Preaugering not allowed when using construction casing.

Casing Information

ID	OD	Top Elev.	Length	Bot. Elev.
65"	66"	10.12	37.0'	-26.88

Soil Auger Diam. 60"
 Rock Core Diam. N/A
 Ground Surface Elev. 4.02
 Water Table Elev. 3.9
 Reference Elev. 10.12
 Drilling Mud mineral slurry

Notes _____

Depth ()	Elev. ()	Time		Soil Description and Notes
		14:00	In	VIBRATE CASING NO MATERIAL REMOVED
		15:00	Out	
13 0	5.12	9:30	In	60" bucket tan, gray silty sand & organics
40.12	-35	11:12	Out	
40.12	-35	11:20	In	60" bucket gray fat sandy clay
50.12	-45	11:45	Out	
50.12	-44	12:30	In	60" bucket gray med loose sand
61.62	-56.5	15:15	Out	
61.62	-56.5	15:15	In	60" rock auger hard drilling layers of limestone with clay seams Dark gray
67.12	-62	16:20	Out	
17 67.12	-62	7:40	In	60" rock auger hard drilling layered limestone with clay seams - dark gray
98.12	-93	17:20	Out	
113 98.12	-93	7:15	In	60" rock auger 60" clean-out bucket gray stiff clay
100.33	-95.21	8:00	Out	
		8:25	In	desand & pump bottom
		9:25	Out	
			In	
			Out	



SLURRY INSPECTION LOG (REV 06-03-02)

Project Name Load Test for Replacement of 701 Bridges

File Number 2226.030683

Bent No. test shaft

Water Source: Pec Dee River

Date of Initial Hydration 5-16-13 Time 13:00

Composition:	Brand	Type	Proportions
Mineral Type	Wyo-Ben	Hydro-gel	2.5 lbs / ft ³
Additives	FMAC	Soda Ash	50 lbs / 24,000 g

TEST PROPERTIES

Sampling	Before Introduction of Slurry	First 8 Hours During Construction **				Additional Testing		At End of Excavation	Before Concreting	
		Test 1	Test 2	Test 3	Test 4	Test 1	Test 2		Test 1	Test 2
Date:	5-7-13	5-7-13	5-7-13	5-7-13	5-7-13	5-8-13	5-8-13	5-9-13	5-9-13	5-9-13
Time:	7:40	10:15	11:15	13:10	15:00	8:00	12:15	8:30	9:30	13:45
Test Depth at Levels:	Holding Tank	20	36	52	66	88'	84'	At Bottom	At Bottom	At Bottom
Density	65.5	65.5	66	65.5	65.5	66	66	66	65.5	65
Viscosity	32	32	32	32	32	33	32	32	33	32
% Sand	-	1	1	1.5	3.5	1/2	3 1/2	1	1/2	1/4
pH	9.5	9.5	9.5	9.5	9.5	9.0	9.0	9	9	9.5
Cake / Filtrate	N/A	-	-	-	-	-	-	-	-	-

Notes: * Salt water shall not be used to hydrate the slurry or stabilize the excavation.

** A minimum of 4 sets of tests shall be made during the first 8 hours of slurry use. Slurry sampling and testing shall be observed by the Engineer. When the results show consistent behavior, the testing frequency may be decreased to 1 set every 4 hours of slurry use.

Desand 5-9-13 8:20 - 9:20

Contractor DS Foreman: [Signature]

SCDOT Inspector: [Signature]

Date: 5-19-13

Date: 1-1

Page 3 of 6



DRILLED SHAFT INSPECTION LOG (REV 06-03-02)

Project Name Load Test For replacement of 701 Bridges Page 4 of 6
File No. 2226.030683 Bent No. test shaft
Contractor Lee & Sims Shaft No. _____
Completed By Contractor DS Foreman - John Sims Date 5-9-13 Station _____
Reviewed By SCDOT Inspector George Lee Date _____ Offset _____

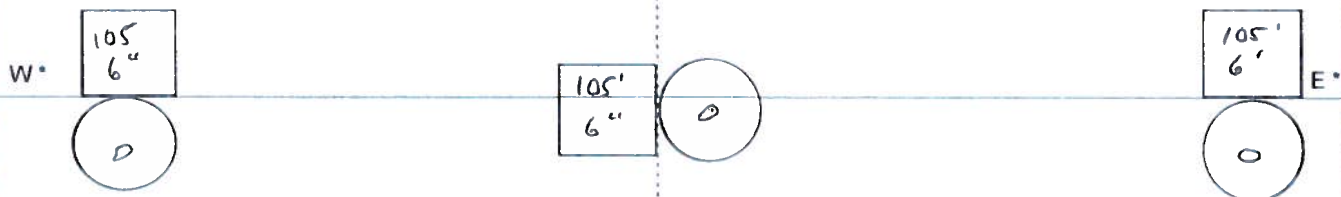
Type of Drilling Fluid mineral slurry Shaft Plumbness Check/4' 1/4"/4'
DS Location Variance at Top N/A Rebar Cage: Proper # Vert. Bars ✓
Bottom Cleanout Method clean-out bucket/sub pump Proper # Horiz. Bars ✓
Time/Date Final Cleanout 9:25 5-9-13 Side Spacers ✓
Shaft Bottom Elev. 95.21 Bottom Spacers ✓
Est. Shaft Bottom Dia. 60" Ties & Connections ✓

Inspected By: JB5/Foreman Visual _____ Sounding ✓ N*
Time Test Started 9:34
Time Test Finished 9:43
Time Test Started 13:25
Time Test Finished 13:45

Test just prior to placing Rebar cage (inches)Test just prior to placing concrete (inches)

* Direction

* Based on Compass Direction



Note: 50% of base shall have < 1/2 Inch of sediment.

No area of shaft bottom shall be more than 1 1/2 Inches.

Notes

Comments/Recommendations

clean hard bottom

Results: ✓ Satisfactory DS Foreman John A. Lee
Unsatisfactory SCDOT Inspector George Lee Time 14:00 Date 5-9-13

NOTE: Specification Tolerances - Location Variance at Top = 3 inches Max. Vertical (Plumbness) = 1 inch per 4 Ft. Max.



DRILLED SHAFT CONCRETE PLACEMENT LOG (REV 06-03-02)

Project Name Load Test for replacement of 701 Bridges Page 5 of 6
File No. 2226.030683 Bent No. test shaft
Contractor Lee & Sims Shaft No. _____
Completed By Contractor DS Foreman - John Sims Date 5-9-13 Station _____
Reviewed By SCDOT Inspector Glen A. Lee Date _____ Offset _____

Placement Method ☒ Tremie Volume in Pump Truck # ID Length Volume
☒ Pumped Pump Truck Lines 5' 128' .65
De-airing Method Relief Valve Pump Truck 39m .2
☒ Plug
Cap
Total Volume in Lines + Pump Truck $\Sigma =$.85

Reference Elev. 10.12
Shaft Top Elev. 5.12 Time First Truck Batched: 13:17
Top of Rock Elev. N/A Depth of Water Per Hr. Inside Shaft (Dry Hole Check) N/A
Shaft Bottom Elev. -95.21 Rebar Cage Top Elev. At Start ref mark At Finish ref mark

Truck No.	Concrete Volume	Arrival Time	Start Time	Finish Time	Tremie Depth	Depth To Concrete	Notes
2226	9	14:19	14:41	14:49	105'	95	(10'1/2)
2270	9	14:26	14:51	14:58	105'	83.5	(22)
2228	9	14:29	15:00	15:07	93.5'	71.5	(34)
2276	9	14:35	15:08	15:15	81.5	60	(45.5)
2227	9	14:53	15:17	15:24	70	48.5	(57)
2362	9	14:55	15:26	15:33	58.5	37	(68.5)
2267	10	15:04	15:35	15:43	47	26.5	(79)
2280	10	15:14	15:46	15:53	36.5	14	(91.5)
2279	10	15:23	15:55	16:14	24	7.5	(105.5)

84 Concrete Volume Delivered Total Placement Time (Temp. Casing Removed) 93 min

T Casing Removal**
OD Top Elev. Bot. Elev. Start Finish Rebar Cage Centered* YES NO
Rebar Cage Re-centered ✓

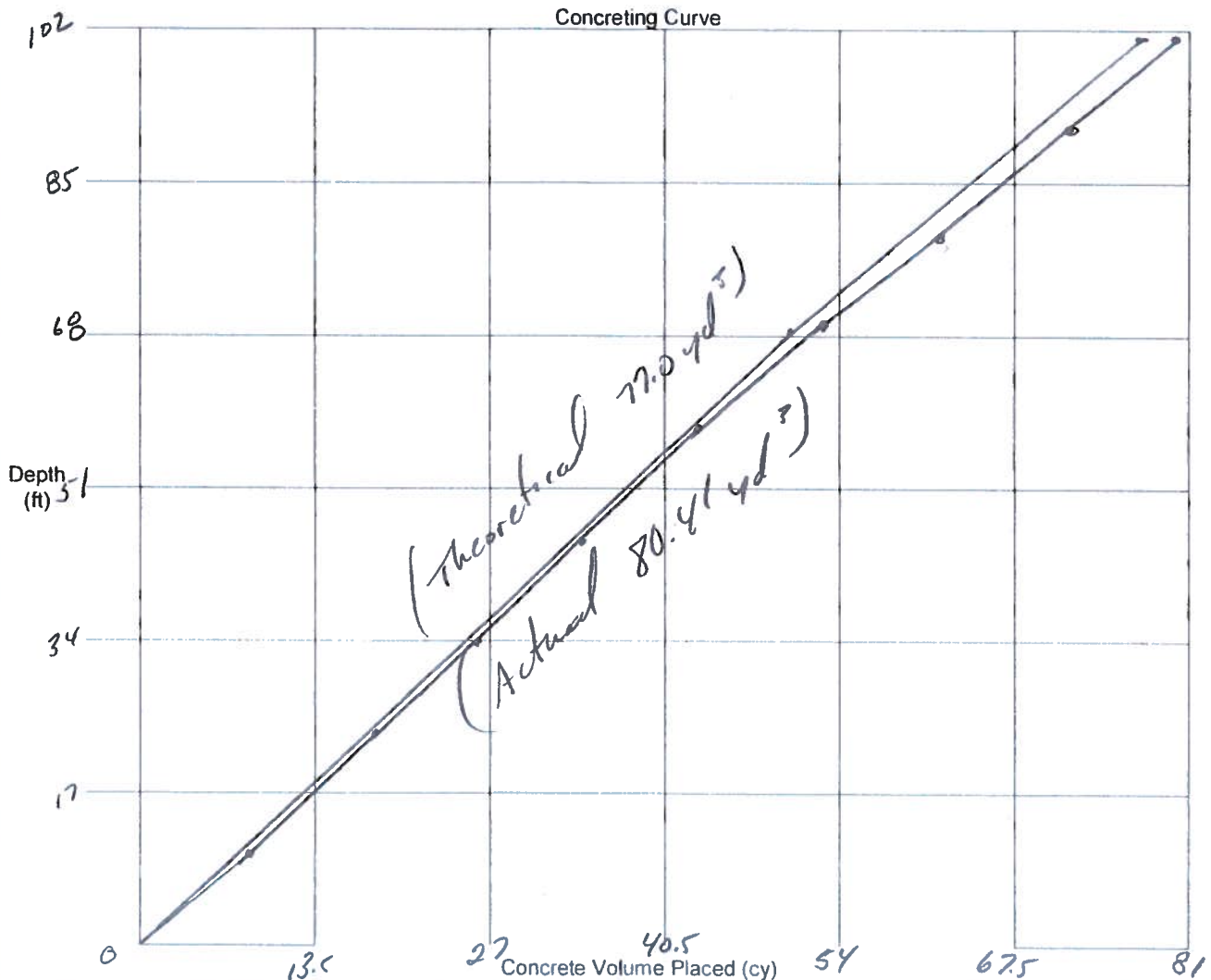
Notes * If no, then re-center rebar cage. ** If unable to remove temporary casing, then call Bridge Construction Office.

* Sponge not returned



DRILLED SHAFT CONCRETE VOLUMES LOG (REV 06-03-02)

Project Name Load Test for replacement of 701 bridges Page 6 of 6
File No. 2226.030683 Bent No. test shaft
Contractor Lee & Sims Shaft No. _____
Completed By Contractor DS Foreman - John Sims Date 5/9/13 Station _____
Reviewed By SCDOT Inspector Henry Lee Date 1/1 Offset _____



Volume Delivered	VD	<u>84</u>	cy
Volume In Pump Truck + Lines	VPTL	<u>.85</u>	cy
Volume of CSL Tubes	VCSLT	<u>.72</u>	cy
Wastage	VW	<u>2.32</u>	cy
Volume Placed			
= VD-VPTL-VCSLT-VW =	VP	<u>80.41</u>	cy
Theoretical Volume	VTh	<u>77.0</u>	cy
Over Pour (VP-VTh ≥ 1.00)	OP	<u>3.41</u>	cy
Under Pour (VP-VTh < 1.00)	UP		cy

APPENDIX G

CONFINED COMPRESSION SHAFT STIFFNESS ESTIMATION

DETERMINATION OF PILE STIFFNESS BY THE CONFINED COMPRESSION STIFFNESS METHOD

Introduction: Estimated pile stiffness values based on empirical relationships such as the ACI formula result in a single value of stiffness (**AE**). The calculations are based on many assumptions, including average concrete strength and pile diameter, which may be only nominally correct. In addition, confinement effects are not considered.

This confined compression stiffness analysis computes the stiffness **AE** directly as opposed to computing the modulus **E** and then multiplying by area **A**. In many cases **A** is also a variable which in general cannot be separated from the analytically determined **AE** (unless a very detailed callipering of the shaft is available).

Procedure: This analytical method requires that the test pile has two levels of O-cells™ embedded within it, which are both pressurized simultaneously. The stiffness **AE** of the pile section between the O-cells is then determined directly, using the familiar formula for axial deformation from elastic theory:

$$\delta = \frac{PL}{AE} \quad [\text{Equation 1}]$$

In theory, the stiffness **AE** could be easily extracted from a single compression measurement at any positive load **P** using **Equation 1**, since the ratio **P/δ** should remain constant. However, because the confined compression test is almost always carried out at the end of a load test, there is likely to be non-zero residual compression **β** locked into the Embedded Compression Telltales (ECTs) which are used to measure the value **δ**. This additional residual compression value results in the observed values shown in **Figure 1**, below, as opposed to the expected theoretical behavior (dashed line).

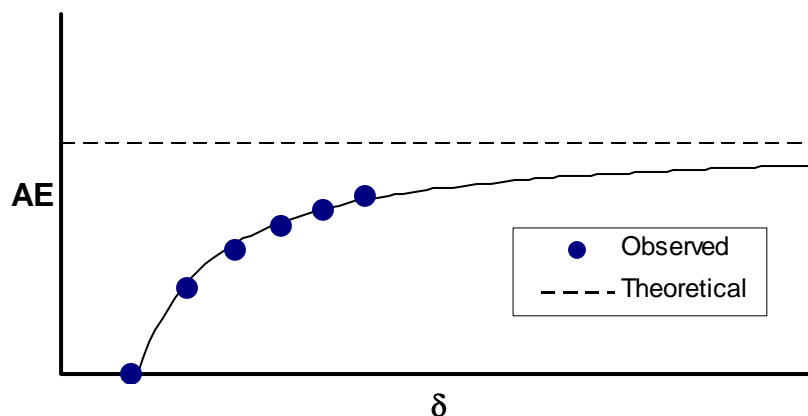


Figure 1 – Theoretical and Observed AE vs. δ

If the same data is plotted as δ vs. P (**Figure 2**, below), the effect of the residual compression β becomes obvious:

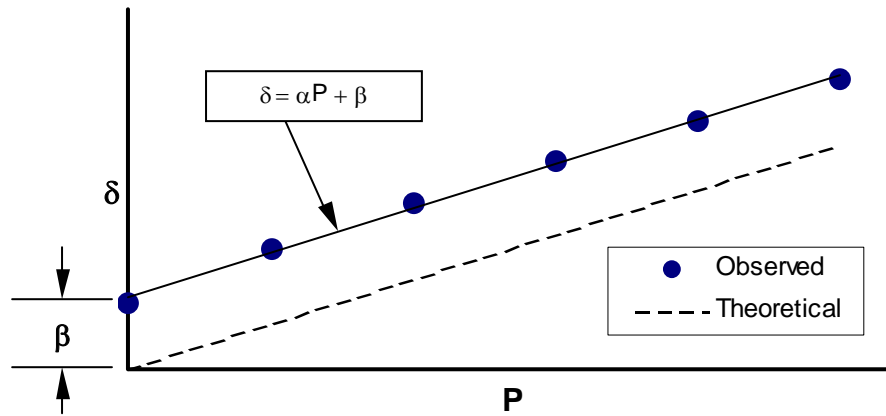


Figure 2 – Theoretical and Observed δ vs. P

Assuming that the stress-strain relationship is linear (elastic range), δ can be defined as:

$$\delta = \alpha P + \beta \quad [\text{Equation 2}]$$

and therefore:

$$P = \frac{\delta - \beta}{\alpha} \quad [\text{Equation 3}]$$

The values α (slope) and β (offset) can be extracted from the observed data using linear regression. Combining **Equations 1** and **3**, **AE** is computed as:

$$\begin{aligned} AE &= \frac{PL}{\delta} = \frac{L(\delta - \beta)}{\alpha\delta} \\ &= \left(\frac{L}{\alpha} \right) \left(1 - \frac{\beta}{\delta} \right) \end{aligned} \quad [\text{Equation 4}]$$

It is assumed that a proper curve-fit through the observed data points in **Figure 1** will approach the theoretical value asymptotically. Therefore, to calculate the desired stiffness **AE**, the function is evaluated at infinity. As δ becomes very large (β remains constant), the last term of **Equation 4** approaches 1, and therefore:

$$AE_{\infty} = \frac{L}{\alpha} \quad [\text{Equation 5}]$$

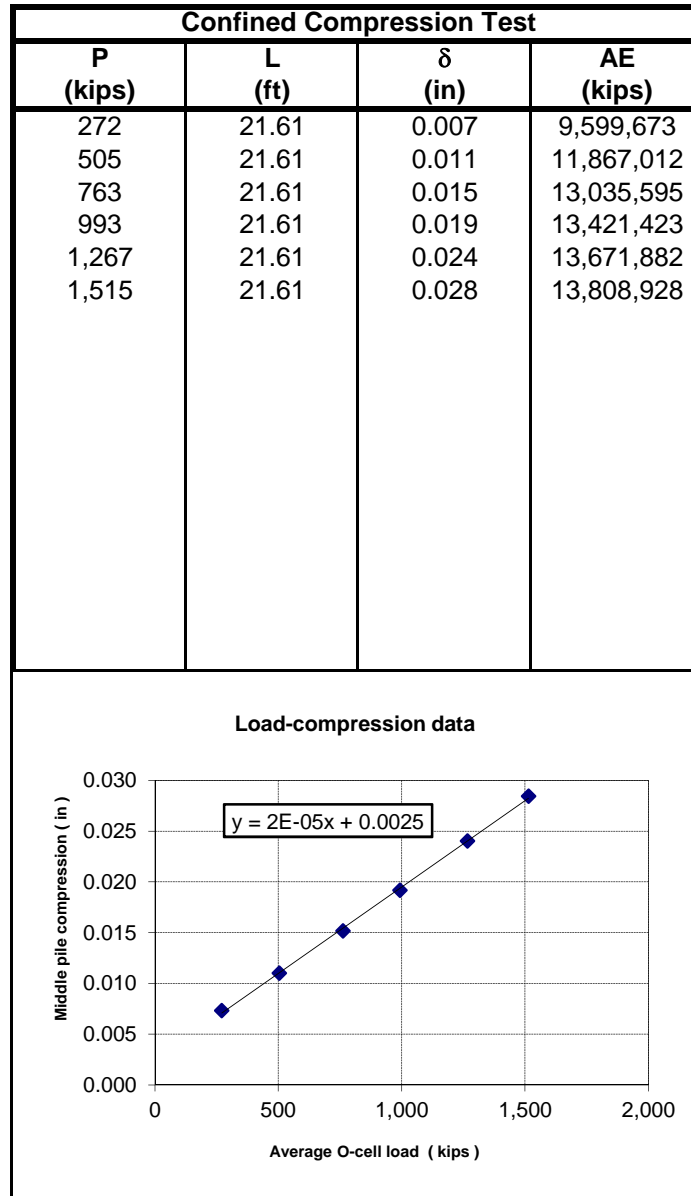


Figure G-1

Asymptotic Pile Stiffness: 15,237,935 kips