REPORT ON DRILLED SHAFT LOAD TESTING (OSTERBERG METHOD)

Test Shaft 2 - I-35 W over Mississippi River Minneapolis, MN (LT-9401)

Prepared for: Case Foundation
1325 West Lake Street
Roselle, IL 60172

Attention: Mr. Eric Risberg

PROJECT NUMBER: LT-9401, November 26, 2007

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LOADTEST

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

November 26, 2007

Case Foundation
1325 West Lake Street
Roselle, IL 60172

Attention: Mr. Eric Risberg

Load Test Report: Test Shaft 2 - I-35 W o/ Mississippi River
Location: Minneapolis, MN (LT-9401)

Dear Mr. Risberg,

The enclosed report contains the data and analysis summary for the O-cell test performed on Test Shaft 2 - I-35 W o/ Mississippi River, on November 22, 2007. For your convenience, we have included an executive summary of the test results in addition to our standard detailed data report. Preliminary results were issued on November 24, 2007.

We 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 800-368-1138.

Best Regards,

William G. Ryan, B.S.C.M.
Regional Manager, LOADTEST, Inc.

EXECUTIVE SUMMARY

On November 22, 2007 we tested a 78-inch (1,981-mm) diameter dedicated test shaft constructed by Case Foundation. Mr. David Jakstis and Mr. Aaron King of LOADTEST, Inc. carried out the test. Case Foundation completed construction of the 97.9-foot (29.85-meter) deep shaft under polymer slurry on November 15, 2007. Sub-surface conditions at the test shaft location consist primarily of sand and gravel overburden soils underlain by weathered and fresh sandstone. Representatives of Minnesota Department of Transportation (MnDOT), Braun Intertec and Federal Highway Administration (FHWA) observed construction and testing of the shaft.

The maximum sustained bi-directional load applied to the end bearing during Stage 1 was 8,532 kips (37.95 MN). At the maximum load, the displacement below the lower O-cell assembly was 2.348 inches (59.63 mm). We calculated a maximum applied end bearing pressure of 257 ksf (12,311 kPa) at the above noted displacement.

The maximum bi-directional load applied to the middle shear section during Stage 2A was 8,000 kips (35.58 MN). At the maximum load, the displacement below the upper O-cell assembly was 0.682 inches (17.31 mm). An average unit side shear of 40.4 ksf (1,934 kPa) was calculated between the O-cell assemblies at the above noted displacement.

The maximum bi-directional load applied to the upper shear section during Stage 2B was 12,563 kips (55.88 MN). At the maximum load, the displacement above the upper O-cell assembly was 0.641 inches (16.29 mm). Unit shear data calculated from strain gages indicated an average net unit side shear of 54.2 ksf (2,595 kPa) between the upper O-cells and Strain Gage Level 2.

Using the procedures described in the report text and in Appendix C, we constructed an equivalent top load curve for the test shaft. For a top loading of 10,500 kips (46.7 MN), the adjusted test data indicate this shaft would settle approximately 0.58 inches (14.7 mm) of which 0.43 inches (11.0 mm) is estimated elastic compression.

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 sand and gravel overburden soils, underlain by weathered and fresh sandstone. The generalized subsurface profile is included in Figure A and a boring log indicating conditions near the shaft is presented in Appendix E. More detailed geologic information can be obtained from Braun Intertec.

Test Shaft Construction: Case Foundation excavated the dedicated test shaft between November 9 and 11, 2007 and performed the final cleanout and concreting on November 15, 2007. We understand that the nominal 78-inch (1,981-mm) diameter test shaft was excavated to a tip elevation of +645.1 feet (+196.62 meters), under polymer slurry. The shaft was started by pre-drilling and inserting a permanent 84-inch (2,134-mm) O.D. casing into the top of bedrock to an approximate tip elevation of +685.0 feet (+208.79 meters). An auger was used for drilling the shaft. The bottom of the shaft was cleaned with a bucket after drilling. After cleaning the base, the reinforcing cage with attached O-cell assemblies was inserted into the excavation and temporarily supported from the steel casing. Concrete was then delivered by pump through a pipe into the base of the shaft until the top of the concrete reached an elevation of +739.0 feet (+225.25 meters). No unusual problems occurred during construction of the shaft. Representatives of MnDOT, Braun Intertec and FHWA observed construction of the shaft.

OSTERBERG CELL TESTING

Shaft Instrumentation: Test shaft instrumentation and assembly was carried out under the direction of Mr. William G. Ryan and Aaron King of LOADTEST, Inc. between November 5 and 14, 2007. The loading assemblies each consisted of four 26-inch diameter, 3600-kip O-cells located 0.3 feet (0.10 meters) and 10.0 feet (3.06 meters) above the tip of shaft, respectively. Calibrations of the O-cells and instrumentation used for this test are included in Appendix B.

O-cell testing instrumentation included five Linear Vibrating Wire Displacement Transducers (LVWDTs) – (Geokon Model 4450 series) positioned between the lower and upper plates of the lower O-cell assembly to measure expansion (Appendix A, Pages 5 and 6). Four LVWDTs were positioned between the lower and upper plates of the upper O-cell assembly to measure expansion (Appendix A, Pages 9 and 10). Two telltale casings (nominal ½-inch steel pipe) were attached to the reinforcing cage, diametrically opposed, extending from the top of the O-cell assembly to beyond the top of concrete. Compression of the shaft between the two O-cell assemblies was measured by one section of Embedded Compression Telltales (ECTs), consisting of telltale rods in nominal ½-inch steel pipe casings, with an

LVWDT attached (Appendix A, Pages 3 and 4). Two lengths of steel pipe were also installed, extending from the top of the shaft to the top of the bottom plate of both O-cell assemblies, to vent the break in the shaft formed by the expansion of the O-cells.

Strain gages were used to assess the side shear load transfer of the shaft above and below the upper Osterberg cell assembly. One level of two sister bar vibrating wire strain gages (Geokon Model 4911 Series) was installed, diametrically opposed, in the shaft between the lower and upper O-cells and three levels of two sister bar vibrating wire strain gages were installed in the shaft above the upper O-cells. Details concerning the strain gage placement appear in Table B and Figures A, B and C. The strain gages were positioned as recommended by LOADTEST, Inc. and Braun Intertec.

Test Arrangement: Throughout the load test, key elements of shaft response were monitored using the equipment and instruments described herein. Shaft compression was measured using ¼-inch telltales installed in the ½-inch steel pipes (described under Shaft Instrumentation) and monitored by LVWDTs. Two LVWDTs attached to a reference system were used to monitor the top of shaft movement. Two automated digital survey levels (Leica NA3003) were used to independently monitor the top of shaft movement during testing from a distance of 32 feet (9.8 meters). Top of shaft readings are listed in Appendix A, Pages 3 and 4.

The reference system consisted of a 40-foot (12-meter) steel wide flange section supported on wood and concrete dunnage. The supports were located approximately one shaft diameter from the center of the test shaft. The reference system was not monitored for vertical movement.

Both Bourdon pressure gages and a vibrating wire pressure transducer were used to measure the pressure applied to the O-cell at each load interval. We used the Bourdon pressure gages for setting and maintaining loads and for data analysis. The transducer readings were used for real time plotting and as a check on the Bourdon gages. There was close agreement between the Bourdon gages and the pressure transducer.

Data Acquisition: All instrumentation were connected through a data logger (Data Electronics - Model 615 Datataker®) 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 synchronized to the data logging system was used to acquire the Leica NA3003 data.

Testing Procedures: As with all of our tests, we begin by pressurizing the O-cells 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 occurs, we immediately release the pressure and then begin the loading procedure. Zero readings for all instrumentation are

taken prior to the preliminary weld-breaking load-unload cycle, which in this case involved a maximum applied pressure of 400 psi (2.76 MPa) to the lower O-cells and 450 psi (3.10 MPa) to the upper O-cells.

The test was carried out in three stages as follows:

Stage1: In the first stage we pressurized the four 26-inch (660-mm) diameter lower O-cells, with their base located 0.3 feet (0.10 meters) above the base of shaft to assess the end bearing below the lower O-cells using the upper side shear above as reaction. We pressurized the O-cell in 15 loading increments to 6,000 psi (41.37 MPa) resulting in a bi-directional gross O-cell load of 8,532 kips (37.95 MN). The loading was halted after the 4-minute reading of load interval 1L-16 because a minor hydraulic leak prevented additional load from being applied. The O-cells were then depressurized in four decrements and Stage 1 of the test was concluded.

Stage 2A: After unloading the lower O-cells, we pressurized the four 26-inch (660-mm) diameter upper O-cells, located 9.7 feet (2.96 meters) above the base of the lower O-cells, to assess the shear characteristics of the shaft between the two levels of O-cells by using the upper side shear as reaction. The lower O-cells were left free to drain (no load transfer through the O-cells to end bearing). We pressurized the upper O-cells in 14 loading increments to 5,600 psi (38.61 MPa) resulting in a bi-directional gross O-cell load of 8,000 kips (35.58 MN) before load transfer to end bearing became apparent.

Stage 2B: After loading increment 2L-14, we continued to pressurize the upper O-cells to assess the shear characteristics of the shaft above upper O-cell by using the side shear below and the end bearing as reaction. The upper O-cells were pressurized in eight additional loading increments to 8,800 psi (60.68 MPa) resulting in a bi-directional gross O-cell load of 12,563 kips (55.88 MN). The loading was halted after load interval 2L-22 because the anticipated ultimate loads had already been exceeded. The upper O-cells were then depressurized in four decrements and the test was concluded.

The following Table A below summarizes the three stages of loading:

TABLE A: Multi Level Testing Stages

Stage	Load Interval	Upper O-cell			Lower O-cell		
		Max Q_{gross} (kips)	O-cell Hydraulics System	Total Expansion (inches)	Final Q_{gross} (kips)	O-cell Hydraulics System	Total Expansion (inches)
1	1L-1 to 1L-16	0	Closed	-0.02	8,957	Pressurized	+2.72
2A	2L-1 to 2L-14	8,000	Pressurized	+0.95	0	Draining	+0.90
2B	2L-15 to 2L-22	12,563	Pressurized	+2.38	0	Engaged	+0.24

We applied the load increments using the Quick Load Test Method for Individual Piles (ASTM D1143 *Standard Test Method for Piles Under Static Axial Load*),

holding each successive load increment constant for eight minutes by manually adjusting the O-cell pressure. The data logger automatically recorded the instrument readings every 30 seconds, but herein we report only the 1, 2, 4 and 8-minute readings (where applicable) during each increment of maintained load.

TEST RESULTS AND ANALYSES

General: The loads applied by the O-cell act in two opposing directions, resisted by the capacity of the shaft above and below. Theoretically, 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-cells and to construct the equivalent top-loaded load-settlement curve. For this test we calculated a buoyant weight of shaft of 375 kips (1.67 MN) above the lower O-cells and 344 kips (1.53 MN) above the upper O-cells.

Upper Side Shear Resistance (Stage 2): The maximum upward applied *net load* to the upper side shear during stage 2B was 12,219 kips (54.35 MN) which occurred at load interval 2L-22 (Appendix A, Page 12, Figure 2). At this loading, the upward movement of the upper O-cell top was 0.641 inches (16.29 mm).

The maximum downward applied load to the isolated middle side shear during stage 2A before load was transferred to end bearing was 8,000 kips (35.58 MN) which occurred at load interval 2L-14 (Appendix A, Page 12, Figure 2). At this loading, the downward movement of the upper O-cell base was 0.682 inches (17.31 mm).

In order to assess the side shear resistance of the test shaft, loads are calculated based on the strain gage data (Appendix A, Pages 13 through 16) and estimates of shaft stiffness (AE) which are presented below. We used the ACI formula ($E_c=57000\sqrt{f'_c}$) to calculate an elastic modulus for the concrete, where f'_c was reported to be 4,819 psi (33.23 MPa) on the day of the test (based on average of both QA and QC cylinder sets). This, combined with the area of reinforcing steel and nominal shaft diameter, provided an average shaft stiffness (AE) of 27,300,000 kips (122,000 MN) in the permanently cased section, 19,400,000 kips (86,400 MN) in the uncased section above the upper O-cells and 22,000,000 kips (97,800 MN) between the O-cell assemblies. Net unit shear curves are presented in Appendix F. Net unit shear values follow in Table A:

TABLE B: Average Net Unit Side Shear Values

Load Transfer Zone	Displacement *	Net Unit Side Shear **
Top of Bedrock to Strain Gage Level 3	↑ 0.641"	0.2 ksf (11 kPa)
Strain Gage Level 3 to Strain Gage Level 2	↑ 0.641"	4.5 ksf (215 kPa)
Strain Gage Level 2 to Upper O-cells	↑ 0.641"	54.2 ksf (2595 kPa)
Top of Bedrock to Upper O-cells (Average)	**↑ 0.641"**	**18.1 ksf (865 kPa)**
Upper O-cells to Lower O-cells (Average)	**↓ 0.682"**	**40.4 ksf (1934 kPa)**

* Average displacement of O-cell assembly.

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

NOTE: Level 1 and 4 strain gage data yielded higher loads than applied by either the O-cells or by strain gage levels in closer proximity to the upper O-cells and are not included in the analysis.

NOTE: Calculated net unit shear values may not be ultimate values. See Appendix F for net unit shear vs. O-cell displacement plots.

End Bearing Resistance (Stage 1): For the purposes of end bearing analyses herein, we use the maximum sustained loading for Stage 1 at 1L-15. The maximum applied load of 8,957 kips (39.84 MN) occurred at the 2-minute reading of increment 1L-16, at which point the displacement below the lower O-cells was 2.513 inches (63.83 mm). The maximum sustained O-cell load applied to the combined end bearing and lower side shear during stage 1 was 8,532 kips (37.95 MN) which occurred at load interval 1L-15 (Appendix A, Page 7, Figure 1). At this loading, the average downward movement of the lower O-cell base was 2.348 inches (59.63 mm). The unit end bearing at the base of the shaft is calculated to be 257 ksf (12,311 kPa) at the above noted displacement, assuming a nominal 78-inch (1,981-mm) diameter loaded base area. A unit end bearing curve is presented in Appendix F.

Creep Limit: See Appendix D for our O-cell method for determining creep limit. The end bearing creep data (Appendix A, Page 7) indicate an indeterminate creep limit (Figure 5). The middle side shear creep data (Appendix A, Pages 11 and 12) indicate that no apparent creep limit was reached at a maximum movement of 0.68 inches (17.3 mm) (Figure 6). The upper side shear creep data (Appendix A, Pages 11 and 12) indicate that no apparent creep limit was reached at a maximum movement of 0.64 inches (16.3 mm) (Figure 7). A top-loaded shaft will not begin significant creep until all components begin creep movement. This will occur at the maximum of the movements required to reach the creep limit for each component. One interpretation of the data herein is that significant creep for this shaft will not begin until a top loading exceeds 22,692 kips (100.9 MN) by some unknown amount.

Equivalent Top Load: Figure 3 presents the equivalent top-loaded load-settlement curves. The lighter curve, described in Procedure Part I of Appendix C, was

generated by using the measured upward top of upper O-cell, measured downward base of upper O-cell and downward base of lower O-cell data. Because it is often an important component of the settlements involved, the equivalent top load curve requires an adjustment for the additional elastic compression that would occur in a top-load test. The darker curve as described in Procedure Part II of Appendix C includes this adjustment.

The test shaft was loaded to a combined side shear and end-bearing load of 22,692 kips (100.9 MN). For a top loading of 10,500 kips (46.7 MN), the adjusted test data indicate this shaft would settle approximately 0.58 inches (14.7 mm) of which 0.43 inches (11.0 mm) is estimated elastic compression. For a top loading of 21,000 kips (93.4 MN) the adjusted test data indicate this shaft would settle approximately 1.37 inches (34.9 mm) of which 0.87 inches (22.1 mm) is estimated elastic compression.

Note that, as explained previously, 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 movement 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.

LIMITATIONS AND STANDARD OF CARE

The instrumentation, testing services and data analysis provided by LOADTEST, Inc., 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. shaft diameter, 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, Inc. 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 800-368-1138.

Prepared for LOADTEST, Inc. by

David J. Jakstis, P.E.
Geotechnical Engineer

Reviewed for LOADTEST, Inc. by

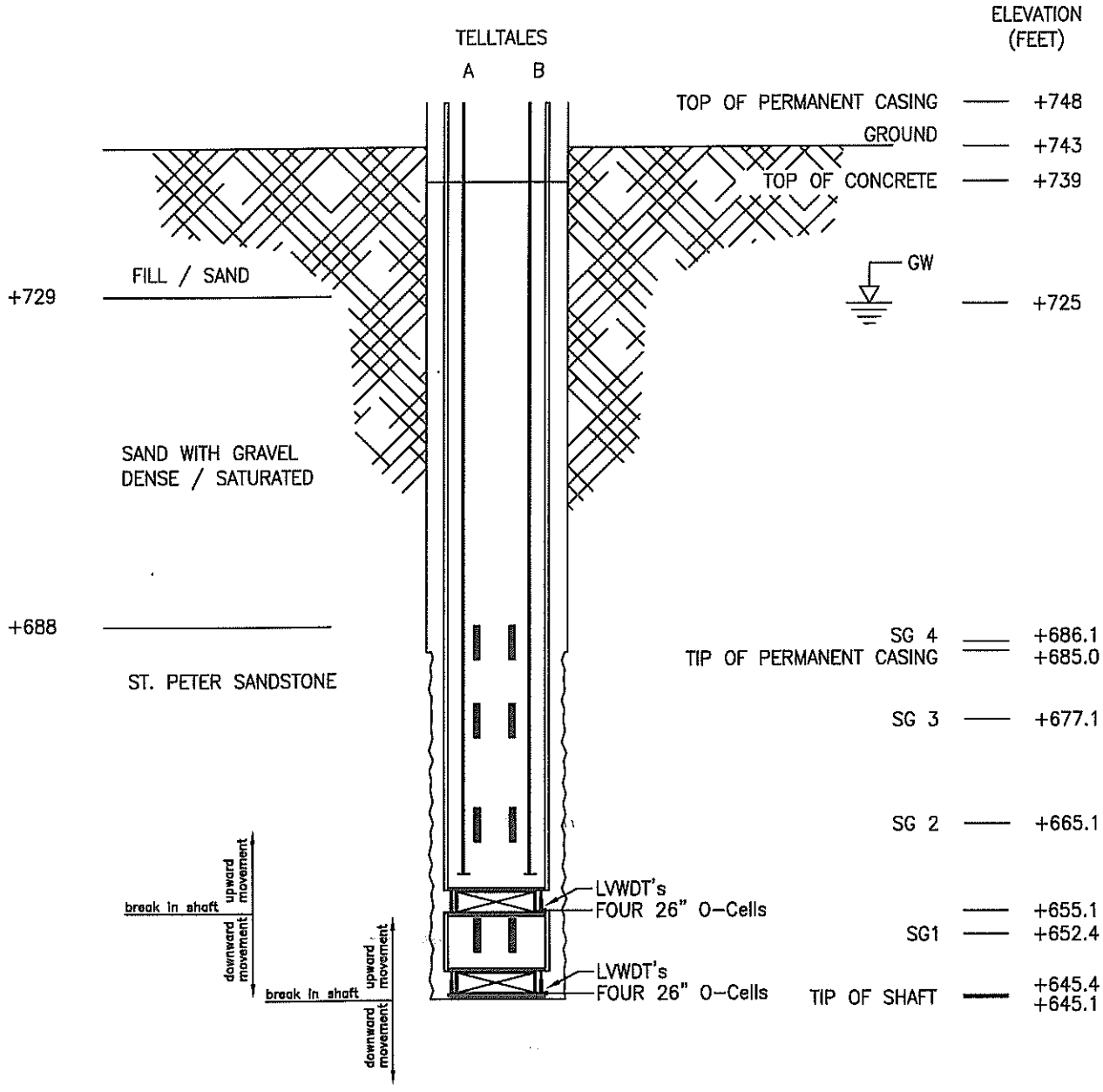
Michael D. Ahrens, M. Eng., P.E.
Geotechnical Engineer

Denton A. Kort, P.E.
Geotechnical Engineer

TABLE C:
SUMMARY OF DIMENSIONS, ELEVATIONS & SHAFT PROPERTIES

Shaft:			
Nominal shaft diameter (EL +739.0 ft to +685.0 ft)	=	84 in	2134 mm
Nominal shaft diameter (EL +685.0 ft to +655.1 ft)	=	78 in	1981 mm
Nominal shaft diameter (EL +655.1 ft to +645.1 ft)	=	78 in	1981 mm
Upper O-cells: 51, 52, 53, 54	=	26 in	660 mm
Lower O-cells: 47, 48, 49, 50	=	26 in	660 mm
Shaft base area	=	33.2 ft²	3.1 m²
Bouyant weight of pile above base of upper O-cell	=	344 kips	1.53 MN
Bouyant weight of pile above base of O-cell	=	375 kips	1.67 MN
Estimated shaft stiffness, AE (EL +739.0 ft to +685.0 ft)	=	27,300,000 kips	122,000 MN
Estimated shaft stiffness, AE (EL +685.0 ft to +655.1 ft)	=	19,400,000 kips	86,400 MN
Estimated shaft stiffness, AE (EL +655.1 ft to +645.1 ft)	=	22,000,000 kips	97,800 MN
Elevation of ground surface	=	+743.0 ft	+226.47 m
Elevation of top of shaft concrete	=	+739.0 ft	+225.25 m
Elevation of water table	=	+725.0 ft	+220.98 m
Elevation of base of upper O-cell (The break between upward and downward movement.)	=	+655.1 ft	+199.68 m
Elevation of base of O-cell (The break between upward and downward movement.)	=	+645.4 ft	+196.72 m
Elevation of shaft tip	=	+645.1 ft	+196.62 m
Casings:			
Elevation of top of permanent casing (84.0 in O.D., 82.5 in I.D.)	=	+748.0 ft	+227.99 m
Elevation of bottom of permanent casing (84.0 in O.D., 82.5 in I.D.)	=	+685.0 ft	+208.79 m
Compression Sections:			
Elevation of top of telltale used for upper shaft compression (assumed zero shear elevation)	=	+688.0 ft	+209.70 m
Elevation of bottom of telltale used for upper shaft compression	=	+656.3 ft	+200.03 m
Elevation of top of ECTs used for level 1 shaft compression	=	+654.9 ft	+199.63 m
Elevation of bottom of ECTs used for level 1 shaft compression	=	+646.6 ft	+197.07 m
Strain Gages:			
Elevation of strain gage Level 4	=	+686.1 ft	+209.13 m
Elevation of strain gage Level 3	=	+677.1 ft	+206.38 m
Elevation of strain gage Level 2	=	+665.1 ft	+202.73 m
Elevation of strain gage Level 1	=	+652.4 ft	+198.86 m
Miscellaneous:			
Top plate diameter (2 in thickness)	=	65.0 in	1651 mm
Bottom plate diameter (2 in thickness)	=	65.0 in	1651 mm
ReBar size (26 No. Bottom Cage / 13 No. Top Cage)	=	# 20 / #11	M 63 / M 36
Spiral size (5 in spacing)	=	# 6	M 19
ReBar cage diameter	=	70 in	1778 mm
Unconfined compressive concrete strength	=	4819 psi	33.2 MPa
O-cell LVWDTs @ 0°, 90°, 180° and 270° with radius	=	32.5 in	826 mm

NOTE:
- NOMINAL CASING 84"ø
- NOMINAL ROCK SOCKET 78"ø



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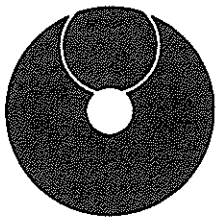
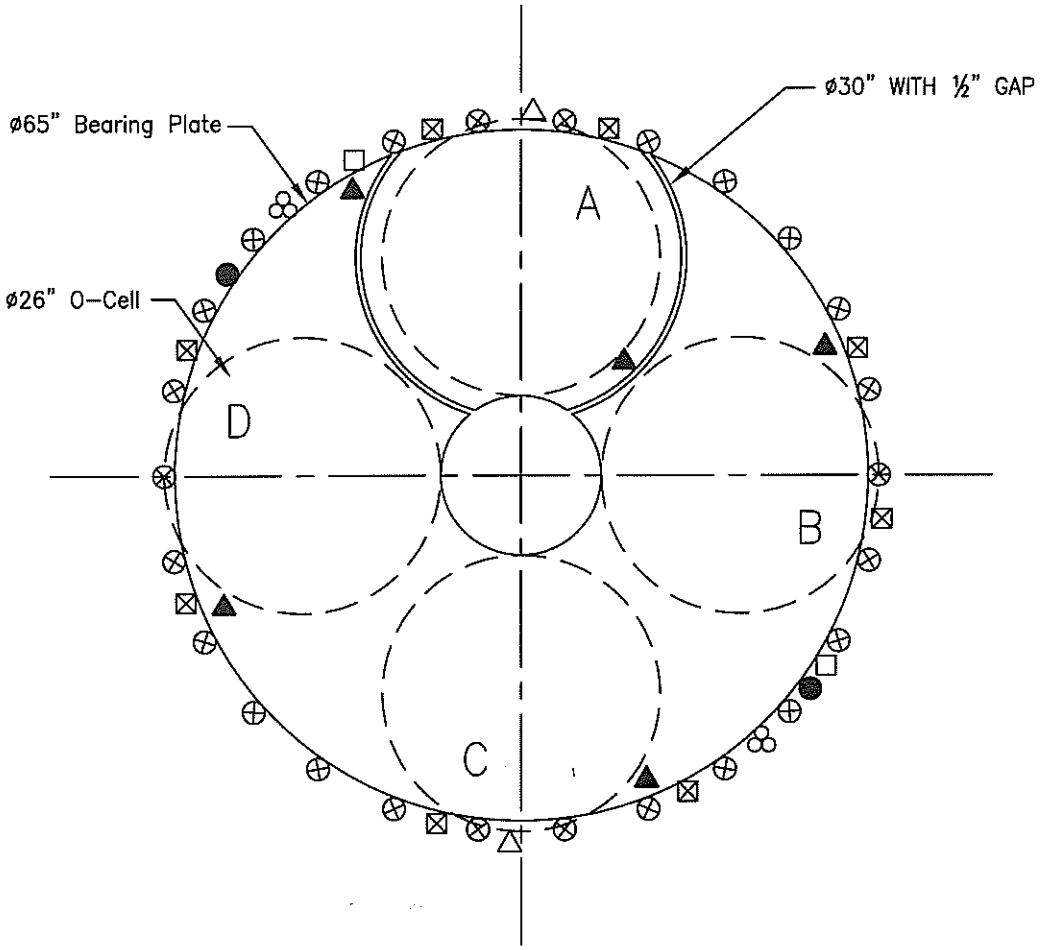
SCHEMATIC SECTION OF TEST SHAFT
135 W over Mississippi Rvr – Minneapolis, MN

DRAWN BY: SCB	DATE: 10/02/07	CHECKED BY: WGR	LT-9401
REVISED BY: DJJ	DATE: 11/26/07	SCALE: NTS	FIGURE A



PLAN



LEGEND:

STRAIN GAGE	△
LVWDT	▲
TELLTALE	○
ECT	●
VENT PIPE	□
HYDRAULIC HOSES	⊠
REBAR	⊗
CABLE BUNDLE	⁂

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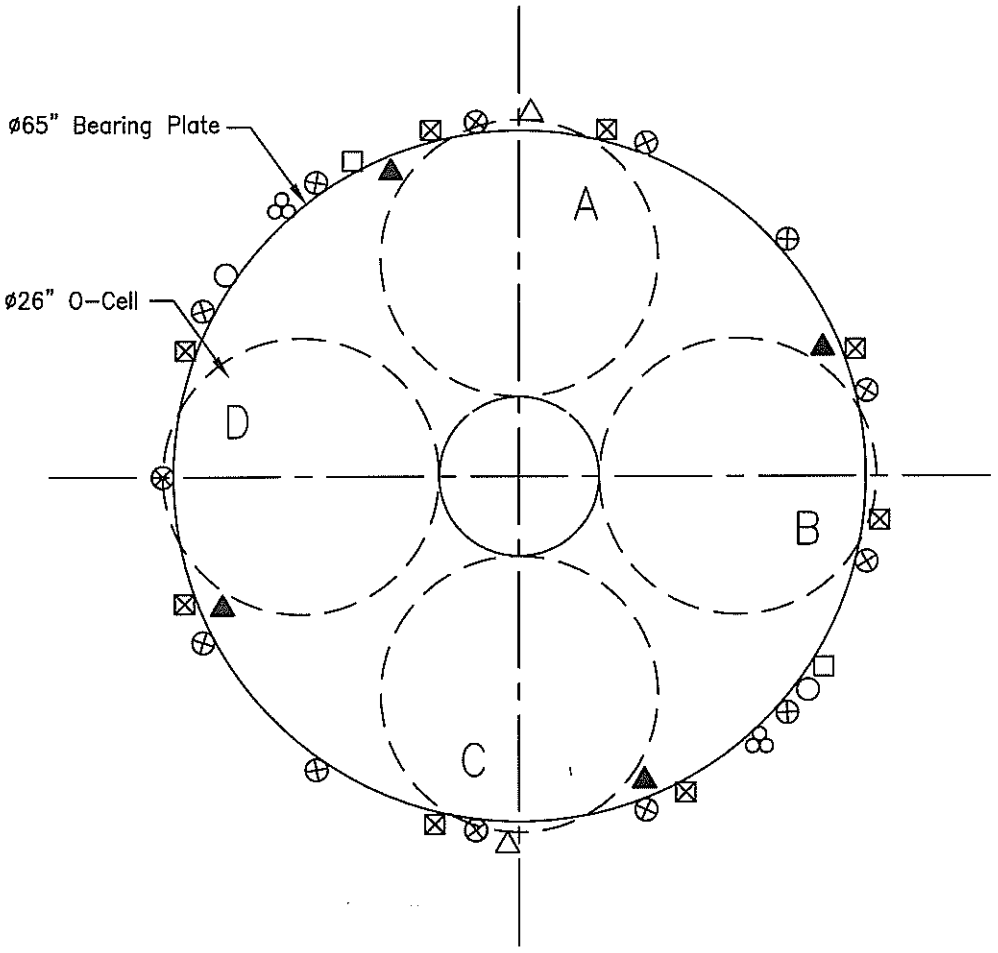
LOWER ASSEMBLY INSTRUMENTATION LAYOUT

I-35W over Mississippi River- Minneapolis, MN

DWN BY: AMK	DATE: 11/26/2007	CHECKED BY:	LT-9401
REVISED BY:	DATE:	SCALE: NTS	**FIGURE B**



LEGEND:

STRAIN GAGE	△
LVWDT	▲
TELLTALE	○
VENT PIPE	□
HYDRAULIC HOSES	⊠
REBAR	⊗
CABLE BUNDLE	8

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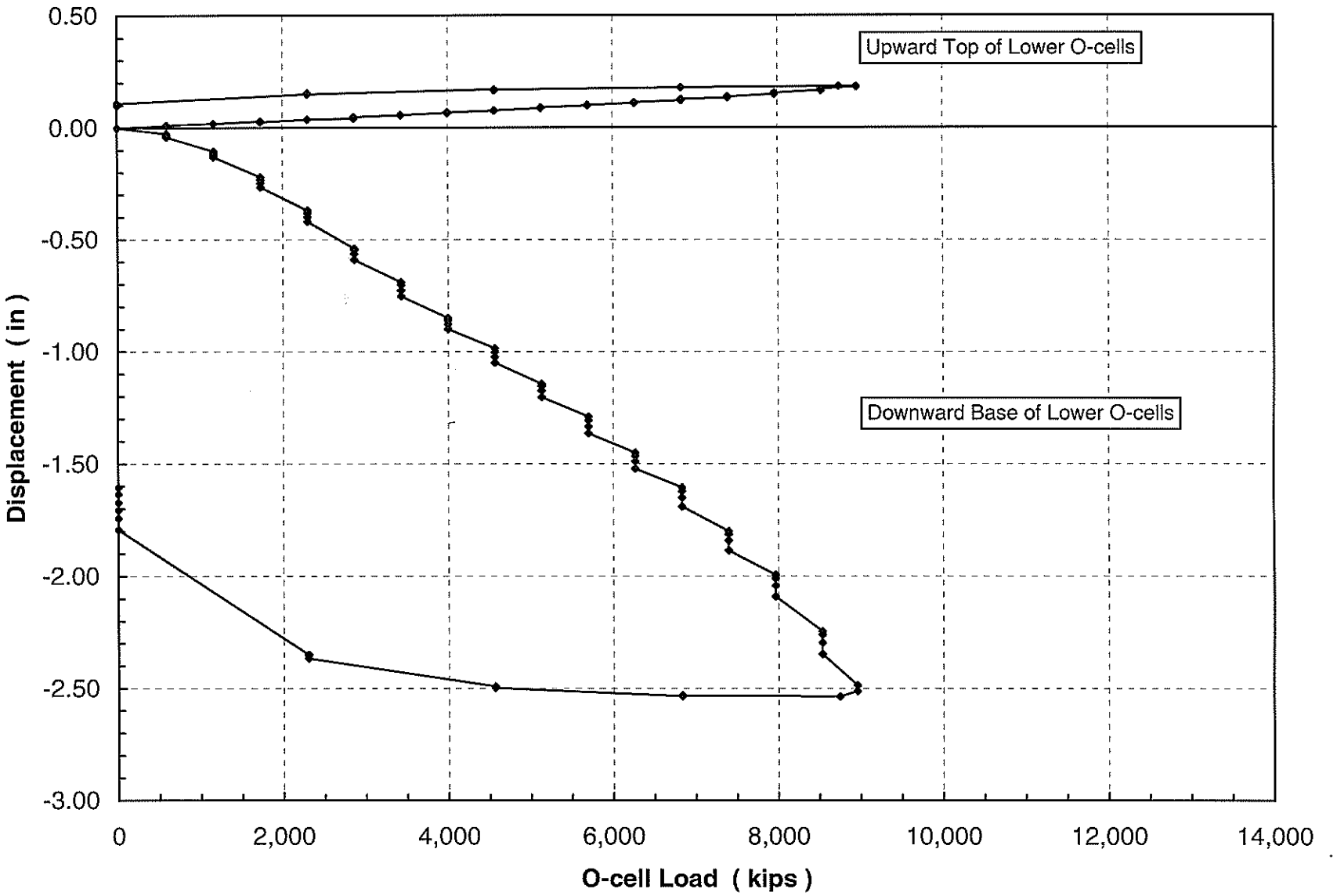
UPPER ASSEMBLY INSTRUMENTATION LAYOUT

I-35W over Mississippi River- Minneapolis, MN

DWN BY: AMK	DATE: 11/26/2007	CHECKED BY:	LT-9401
REVISED BY:	DATE:	SCALE: NTS	FIGURE C

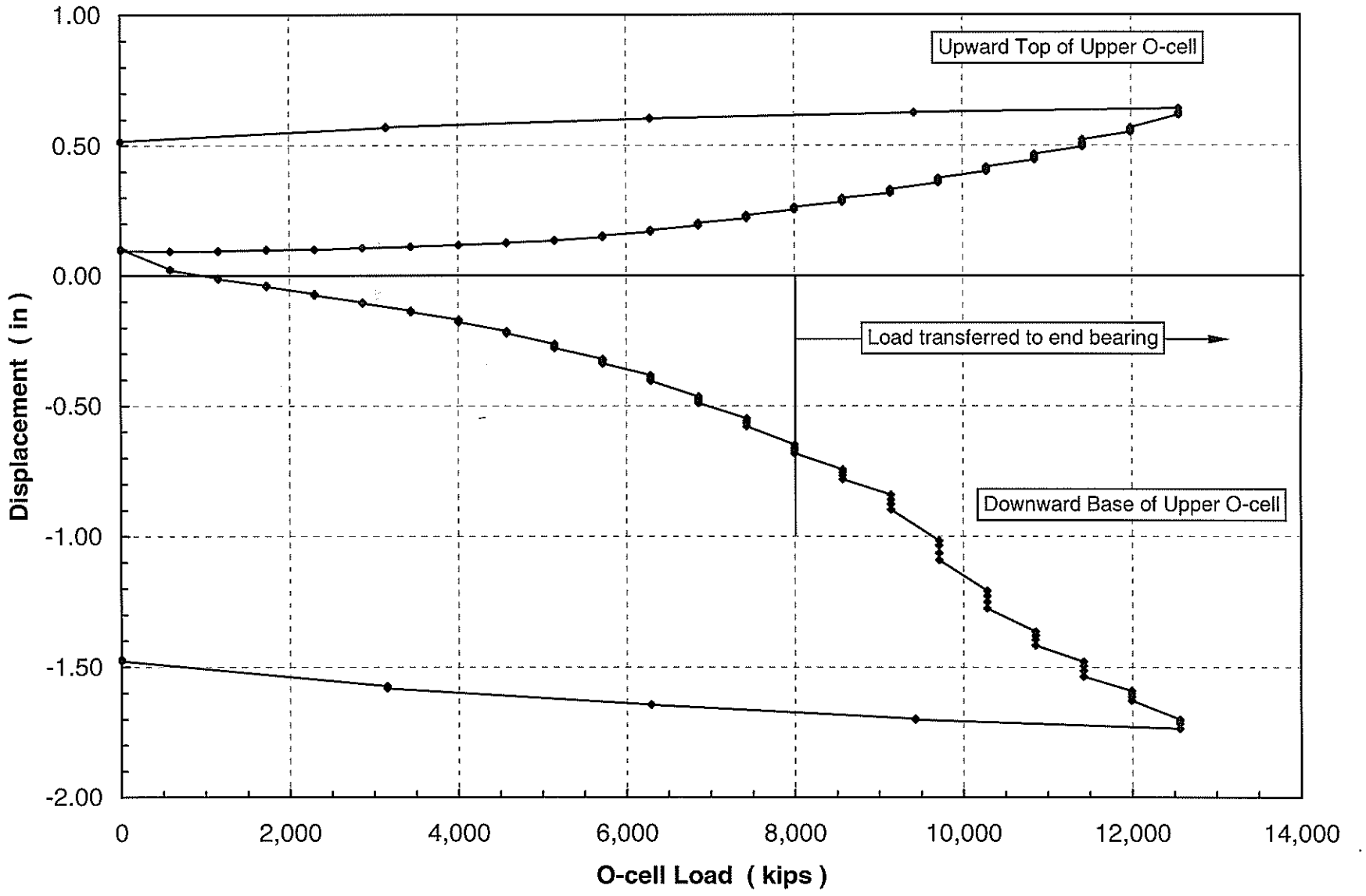
Osterberg Cell Load-Movement Curves - Stage 1

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



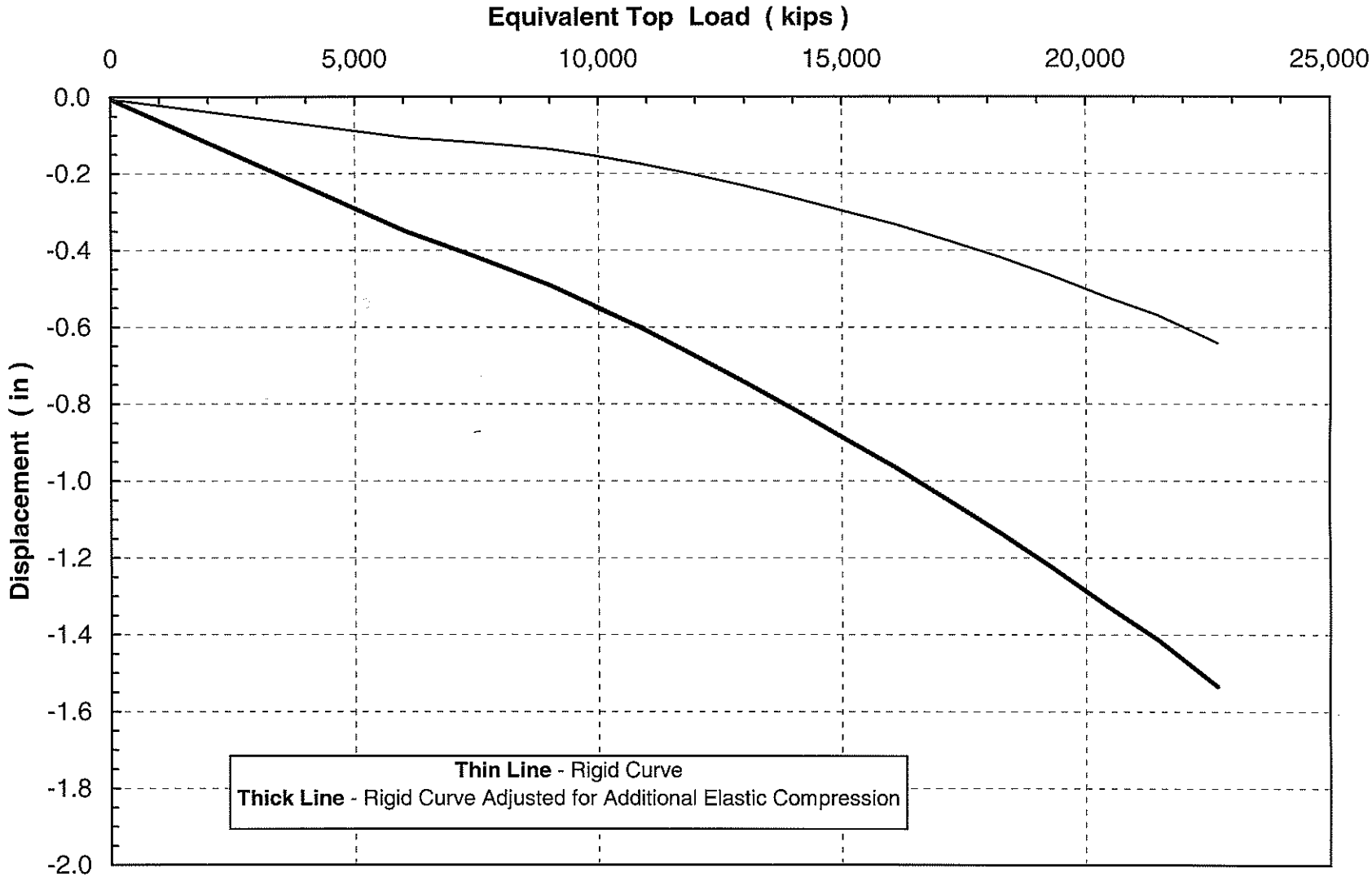
Osterberg Cell Load-Movement Curves - Stage 2

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



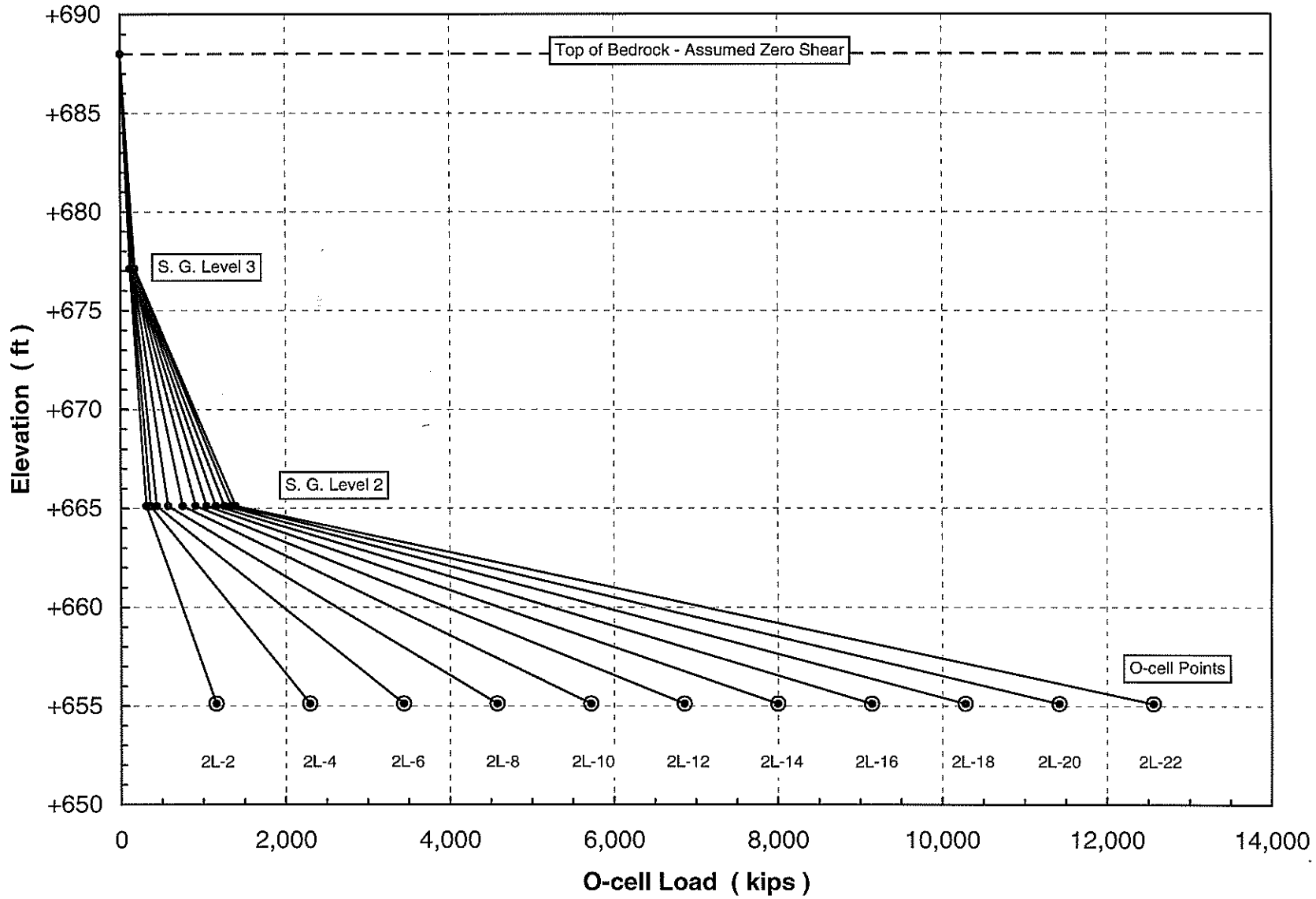
Equivalent Top Load Load-Movement Curve

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



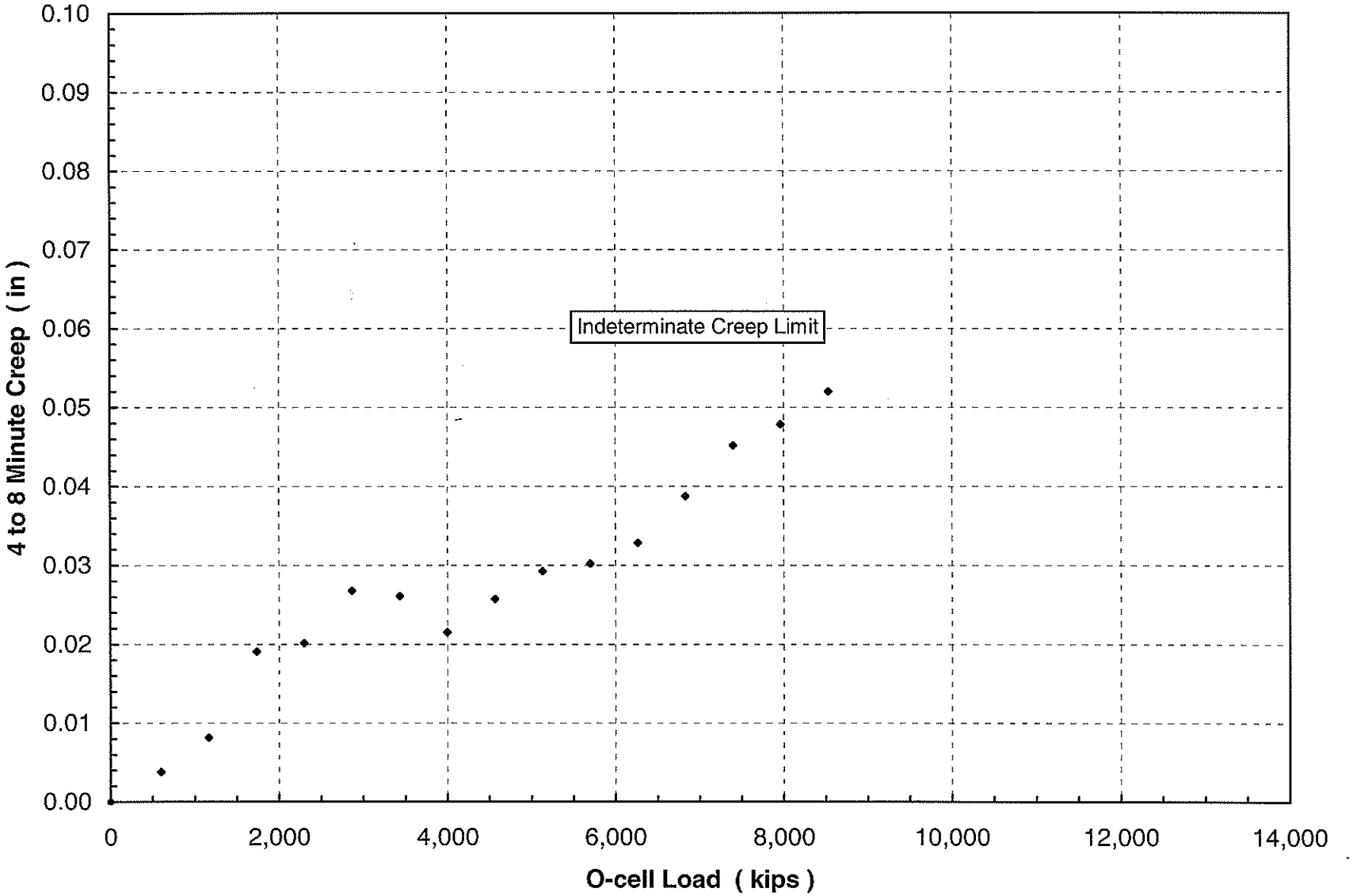
Strain Gage Load Distribution Curves - Stage 2

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



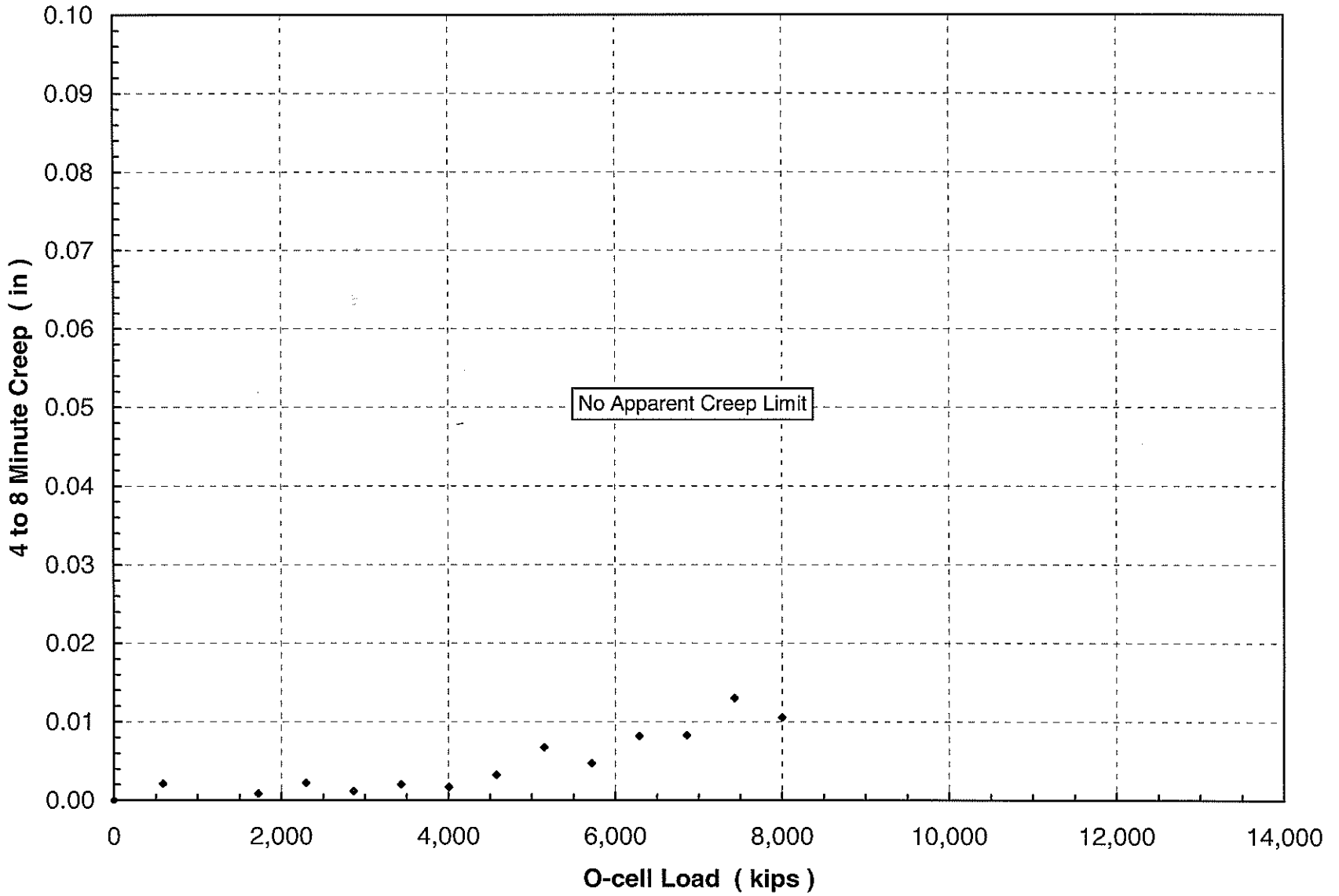
Combined EB and Lower SS Creep Limit - Stage 1

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



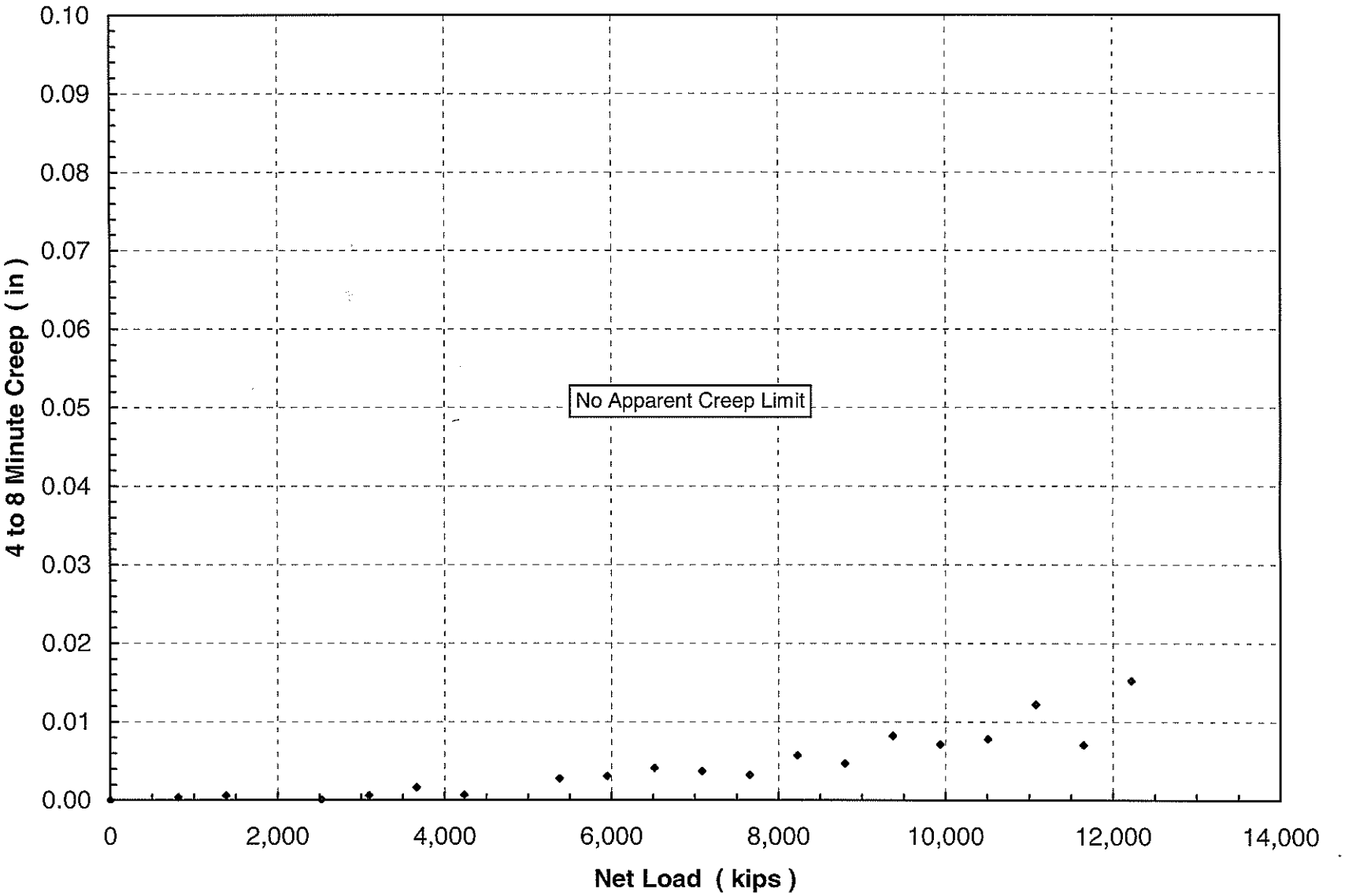
Middle Side Shear Creep Limit - Stage 2

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



Upper Side Shear Creep Limit - Stage 2

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



APPENDIX A

FIELD DATA & DATA REDUCTION

O-cell Loads
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	47 (kips)	48 (kips)	49 (kips)	50 (kips)	Load (kips)	Upper O-cell Pressure (psi)	51 (kips)	52 (kips)	53 (kips)	54 (kips)	Load (kips)	Net (kips)
1 L - 0	-	12:38:00	0	0	0	0	0	0	0	0	0	0	0	0	0
1 L - 1	1	12:53:00	400	147	150	151	150	597	0	0	0	0	0	0	0
1 L - 1	2	12:54:00	400	147	150	151	150	597	0	0	0	0	0	0	0
1 L - 1	4	12:56:00	400	147	150	151	150	597	0	0	0	0	0	0	0
1 L - 1	8	13:00:00	400	147	150	151	150	597	0	0	0	0	0	0	0
1 L - 2	1	13:03:00	800	288	292	292	292	1,164	0	0	0	0	0	0	0
1 L - 2	2	13:04:00	800	288	292	292	292	1,164	0	0	0	0	0	0	0
1 L - 2	4	13:06:00	800	288	292	292	292	1,164	0	0	0	0	0	0	0
1 L - 2	8	13:10:00	800	288	292	292	292	1,164	0	0	0	0	0	0	0
1 L - 3	1	13:13:00	1,200	430	434	434	433	1,731	0	0	0	0	0	0	0
1 L - 3	2	13:14:00	1,200	430	434	434	433	1,731	0	0	0	0	0	0	0
1 L - 3	4	13:16:00	1,200	430	434	434	433	1,731	0	0	0	0	0	0	0
1 L - 3	8	13:20:00	1,200	430	434	434	433	1,731	0	0	0	0	0	0	0
1 L - 4	1	13:24:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 L - 4	2	13:25:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 L - 4	4	13:27:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 L - 4	8	13:31:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 L - 5	1	13:34:30	2,000	713	717	717	716	2,864	0	0	0	0	0	0	0
1 L - 5	2	13:35:30	2,000	713	717	717	716	2,864	0	0	0	0	0	0	0
1 L - 5	4	13:37:30	2,000	713	717	717	716	2,864	0	0	0	0	0	0	0
1 L - 5	8	13:41:30	2,000	713	717	717	716	2,864	0	0	0	0	0	0	0
1 L - 6	1	13:44:30	2,400	855	859	859	858	3,431	0	0	0	0	0	0	0
1 L - 6	2	13:45:30	2,400	855	859	859	858	3,431	0	0	0	0	0	0	0
1 L - 6	4	13:47:30	2,400	855	859	859	858	3,431	0	0	0	0	0	0	0
1 L - 6	8	13:51:30	2,400	855	859	859	858	3,431	0	0	0	0	0	0	0
1 L - 7	1	13:57:00	2,800	997	1,001	1,000	1,000	3,998	0	0	0	0	0	0	0
1 L - 7	2	13:58:00	2,800	997	1,001	1,000	1,000	3,998	0	0	0	0	0	0	0
1 L - 7	4	14:00:00	2,800	997	1,001	1,000	1,000	3,998	0	0	0	0	0	0	0
1 L - 7	8	14:04:00	2,800	997	1,001	1,000	1,000	3,998	0	0	0	0	0	0	0
1 L - 8	1	14:08:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 L - 8	2	14:09:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 L - 8	4	14:11:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 L - 8	8	14:15:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 L - 9	1	14:18:30	3,600	1,280	1,285	1,284	1,283	5,131	0	0	0	0	0	0	0
1 L - 9	2	14:19:30	3,600	1,280	1,285	1,284	1,283	5,131	0	0	0	0	0	0	0
1 L - 9	4	14:21:30	3,600	1,280	1,285	1,284	1,283	5,131	0	0	0	0	0	0	0
1 L - 9	8	14:25:30	3,600	1,280	1,285	1,284	1,283	5,131	0	0	0	0	0	0	0
1 L - 10	1	14:29:00	4,000	1,422	1,427	1,425	1,424	5,698	0	0	0	0	0	0	0
1 L - 10	2	14:30:00	4,000	1,422	1,427	1,425	1,424	5,698	0	0	0	0	0	0	0
1 L - 10	4	14:32:00	4,000	1,422	1,427	1,425	1,424	5,698	0	0	0	0	0	0	0
1 L - 10	8	14:36:00	4,000	1,422	1,427	1,425	1,424	5,698	0	0	0	0	0	0	0
1 L - 11	1	14:39:30	4,400	1,564	1,569	1,567	1,566	6,265	0	0	0	0	0	0	0
1 L - 11	2	14:40:30	4,400	1,564	1,569	1,567	1,566	6,265	0	0	0	0	0	0	0
1 L - 11	4	14:42:30	4,400	1,564	1,569	1,567	1,566	6,265	0	0	0	0	0	0	0
1 L - 11	8	14:46:30	4,400	1,564	1,569	1,567	1,566	6,265	0	0	0	0	0	0	0
1 L - 12	1	14:50:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 L - 12	2	14:51:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 L - 12	4	14:53:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 L - 12	8	14:57:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 L - 13	1	15:02:00	5,200	1,847	1,852	1,850	1,849	7,399	0	0	0	0	0	0	0
1 L - 13	2	15:03:00	5,200	1,847	1,852	1,850	1,849	7,399	0	0	0	0	0	0	0
1 L - 13	4	15:05:00	5,200	1,847	1,852	1,850	1,849	7,399	0	0	0	0	0	0	0
1 L - 13	8	15:09:00	5,200	1,847	1,852	1,850	1,849	7,399	0	0	0	0	0	0	0
1 L - 14	1	15:14:00	5,600	1,989	1,994	1,992	1,991	7,965	0	0	0	0	0	0	0
1 L - 14	2	15:15:00	5,600	1,989	1,994	1,992	1,991	7,965	0	0	0	0	0	0	0
1 L - 14	4	15:17:00	5,600	1,989	1,994	1,992	1,991	7,965	0	0	0	0	0	0	0
1 L - 14	8	15:21:00	5,600	1,989	1,994	1,992	1,991	7,965	0	0	0	0	0	0	0
1 L - 15	1	15:27:00	6,000	2,130	2,136	2,134	2,132	8,532	0	0	0	0	0	0	0
1 L - 15	2	15:28:00	6,000	2,130	2,136	2,134	2,132	8,532	0	0	0	0	0	0	0
1 L - 15	4	15:30:00	6,000	2,130	2,136	2,134	2,132	8,532	0	0	0	0	0	0	0
1 L - 15	8	15:34:00	6,000	2,130	2,136	2,134	2,132	8,532	0	0	0	0	0	0	0
1 L - 16	1	15:38:30	6,300	2,237	2,243	2,240	2,239	8,957	0	0	0	0	0	0	0
1 L - 16	2	15:39:30	6,300	2,237	2,243	2,240	2,239	8,957	0	0	0	0	0	0	0
1 L - 16	4	15:41:30	6,150	2,183	2,189	2,187	2,185	8,745	0	0	0	0	0	0	0
1 U - 1	1	15:47:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 U - 1	2	15:48:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 U - 1	4	15:50:00	4,800	1,705	1,710	1,709	1,708	6,832	0	0	0	0	0	0	0
1 U - 2	1	15:54:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 U - 2	2	15:55:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 U - 2	4	15:57:00	3,200	1,138	1,143	1,142	1,141	4,565	0	0	0	0	0	0	0
1 U - 3	1	16:03:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 U - 3	2	16:04:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 U - 3	4	16:06:00	1,600	572	575	576	575	2,297	0	0	0	0	0	0	0
1 U - 4	1	16:11:00	0	0	0	0	0	0	0	0	0	0	0	0	0
1 U - 4	2	16:12:00	0	0	0	0	0	0	0	0	0	0	0	0	0
1 U - 4	4	16:14:00	0	0	0	0	0	0	0	0	0	0	0	0	0
1 U - 4	8	16:18:00	0	0	0	0	0	0	0	0	0	0	0	0	0
1 U - 4	16	16:26:00	0	0	0	0	0	0	0	0	0	0	0	0	0
1 U - 4	32	16:42:00	0	0	0	0	0	0	0	0	0	0	0	0	0
2 L - 0	1	16:43:00	0	0	0	0	0	0	0	0	0	0	0	0	0
2 L - 1	1	16:53:30	0	0	0	0	0	0	400	146	146	148	145	584	241
2 L - 1	2	16:54:30	0	0	0	0	0	0	400	146	146	148	145	584	241
2 L - 1	4	16:56:30	0	0	0	0	0	0	400	146	146	148	145	584	241
2 L - 1	8	17:00:30	0	0	0	0	0	0	400	146	146	148	145	584	241
2 L - 2	1	17:04:30	0	0	0	0	0	0	800	288	288	290	288	1,155	811
2 L - 2	2	17:05:30	0	0	0	0	0	0	800	288	288	290	288	1,155	811
2 L - 2	4	17:07:30	0	0	0	0	0	0	800	288	288	290	288	1,155	811
2 L - 2	8	17:11:30	0	0	0	0	0	0	800	288	288	290	288	1,155	811
2 L - 3	1	17:14:00	0	0	0	0	0	0	1,200	431	431	433	430	1,725	1,382
2 L - 3	2	17:15:00	0	0	0	0	0	0	1,200	431	431	433	430	1,725	1,382
2 L - 3	4	17:17:00	0	0	0	0	0	0	1,200	431	431	433	430	1,725	1,382
2 L - 3	8	17:21:00	0	0	0	0	0	0	1,200	431	431	433	430	1,725	1,382

O-cell Loads
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (hr:m:s)	Lower O-cell Pressure (psi)	47 (kips)	48 (kips)	49 (kips)	50 (kips)	Load (kips)	Upper O-cell Pressure (psi)	51 (kips)	52 (kips)	53 (kips)	54 (kips)	Load (kips)	Net (kips)
2 L - 4	1	17:23:30	0	0	0	0	0	0	1,600	573	574	576	573	2,296	1,952
2 L - 4	2	17:24:30	0	0	0	0	0	0	1,600	573	574	576	573	2,296	1,952
2 L - 4	4	17:26:30	0	0	0	0	0	0	1,600	573	574	576	573	2,296	1,952
2 L - 4	8	17:30:30	0	0	0	0	0	0	1,600	573	574	576	573	2,296	1,952
2 L - 5	1	17:33:00	0	0	0	0	0	0	2,000	715	716	718	716	2,866	2,522
2 L - 5	2	17:34:00	0	0	0	0	0	0	2,000	715	716	718	716	2,866	2,522
2 L - 5	4	17:36:00	0	0	0	0	0	0	2,000	715	716	718	716	2,866	2,522
2 L - 5	8	17:40:00	0	0	0	0	0	0	2,000	715	716	718	716	2,866	2,522
2 L - 6	1	17:42:30	0	0	0	0	0	0	2,400	857	859	861	859	3,436	3,093
2 L - 6	2	17:43:30	0	0	0	0	0	0	2,400	857	859	861	859	3,436	3,093
2 L - 6	4	17:45:30	0	0	0	0	0	0	2,400	857	859	861	859	3,436	3,093
2 L - 6	8	17:49:30	0	0	0	0	0	0	2,400	857	859	861	859	3,436	3,093
2 L - 7	1	17:51:30	0	0	0	0	0	0	2,800	1,000	1,001	1,004	1,002	4,007	3,663
2 L - 7	2	17:52:30	0	0	0	0	0	0	2,800	1,000	1,001	1,004	1,002	4,007	3,663
2 L - 7	4	17:54:30	0	0	0	0	0	0	2,800	1,000	1,001	1,004	1,002	4,007	3,663
2 L - 7	8	17:58:30	0	0	0	0	0	0	2,800	1,000	1,001	1,004	1,002	4,007	3,663
2 L - 8	1	18:00:30	0	0	0	0	0	0	3,200	1,142	1,144	1,147	1,145	4,577	4,234
2 L - 8	2	18:01:30	0	0	0	0	0	0	3,200	1,142	1,144	1,147	1,145	4,577	4,234
2 L - 8	4	18:03:30	0	0	0	0	0	0	3,200	1,142	1,144	1,147	1,145	4,577	4,234
2 L - 8	8	18:07:30	0	0	0	0	0	0	3,200	1,142	1,144	1,147	1,145	4,577	4,234
2 L - 9	1	18:09:30	0	0	0	0	0	0	3,600	1,284	1,287	1,289	1,288	5,148	4,804
2 L - 9	2	18:10:30	0	0	0	0	0	0	3,600	1,284	1,287	1,289	1,288	5,148	4,804
2 L - 9	4	18:12:30	0	0	0	0	0	0	3,600	1,284	1,287	1,289	1,288	5,148	4,804
2 L - 9	8	18:16:30	0	0	0	0	0	0	3,600	1,284	1,287	1,289	1,288	5,148	4,804
2 L - 10	1	18:18:30	0	0	0	0	0	0	4,000	1,426	1,429	1,432	1,430	5,718	5,374
2 L - 10	2	18:19:30	0	0	0	0	0	0	4,000	1,426	1,429	1,432	1,430	5,718	5,374
2 L - 10	4	18:21:30	0	0	0	0	0	0	4,000	1,426	1,429	1,432	1,430	5,718	5,374
2 L - 10	8	18:25:30	0	0	0	0	0	0	4,000	1,426	1,429	1,432	1,430	5,718	5,374
2 L - 11	1	18:28:00	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 L - 11	2	18:29:00	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 L - 11	4	18:31:00	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 L - 11	8	18:35:00	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 L - 12	1	18:38:00	0	0	0	0	0	0	4,800	1,711	1,714	1,718	1,716	6,859	6,515
2 L - 12	2	18:39:00	0	0	0	0	0	0	4,800	1,711	1,714	1,718	1,716	6,859	6,515
2 L - 12	4	18:41:00	0	0	0	0	0	0	4,800	1,711	1,714	1,718	1,716	6,859	6,515
2 L - 12	8	18:45:00	0	0	0	0	0	0	4,800	1,711	1,714	1,718	1,716	6,859	6,515
2 L - 13	1	18:47:30	0	0	0	0	0	0	5,200	1,853	1,857	1,860	1,859	7,429	7,086
2 L - 13	2	18:48:30	0	0	0	0	0	0	5,200	1,853	1,857	1,860	1,859	7,429	7,086
2 L - 13	4	18:50:30	0	0	0	0	0	0	5,200	1,853	1,857	1,860	1,859	7,429	7,086
2 L - 13	8	18:54:30	0	0	0	0	0	0	5,200	1,853	1,857	1,860	1,859	7,429	7,086
2 L - 14	1	18:58:00	0	0	0	0	0	0	5,600	1,995	2,000	2,003	2,002	8,000	7,656
2 L - 14	2	18:59:00	0	0	0	0	0	0	5,600	1,995	2,000	2,003	2,002	8,000	7,656
2 L - 14	4	19:01:00	0	0	0	0	0	0	5,600	1,995	2,000	2,003	2,002	8,000	7,656
2 L - 14	8	19:05:00	0	0	0	0	0	0	5,600	1,995	2,000	2,003	2,002	8,000	7,656
2 L - 15	1	19:07:30	0	0	0	0	0	0	6,000	2,138	2,142	2,146	2,145	8,570	8,226
2 L - 15	2	19:08:30	0	0	0	0	0	0	6,000	2,138	2,142	2,146	2,145	8,570	8,226
2 L - 15	4	19:10:30	0	0	0	0	0	0	6,000	2,138	2,142	2,146	2,145	8,570	8,226
2 L - 15	8	19:14:30	0	0	0	0	0	0	6,000	2,138	2,142	2,146	2,145	8,570	8,226
2 L - 16	1	19:17:00	0	0	0	0	0	0	6,400	2,280	2,285	2,288	2,287	9,140	8,797
2 L - 16	2	19:18:00	0	0	0	0	0	0	6,400	2,280	2,285	2,288	2,287	9,140	8,797
2 L - 16	4	19:20:00	0	0	0	0	0	0	6,400	2,280	2,285	2,288	2,287	9,140	8,797
2 L - 16	8	19:24:00	0	0	0	0	0	0	6,400	2,280	2,285	2,288	2,287	9,140	8,797
2 L - 17	1	19:27:30	0	0	0	0	0	0	6,800	2,422	2,427	2,431	2,430	9,711	9,367
2 L - 17	2	19:28:30	0	0	0	0	0	0	6,800	2,422	2,427	2,431	2,430	9,711	9,367
2 L - 17	4	19:30:30	0	0	0	0	0	0	6,800	2,422	2,427	2,431	2,430	9,711	9,367
2 L - 17	8	19:34:30	0	0	0	0	0	0	6,800	2,422	2,427	2,431	2,430	9,711	9,367
2 L - 18	1	19:39:30	0	0	0	0	0	0	7,200	2,564	2,570	2,574	2,573	10,281	9,938
2 L - 18	2	19:40:30	0	0	0	0	0	0	7,200	2,564	2,570	2,574	2,573	10,281	9,938
2 L - 18	4	19:42:30	0	0	0	0	0	0	7,200	2,564	2,570	2,574	2,573	10,281	9,938
2 L - 18	8	19:46:30	0	0	0	0	0	0	7,200	2,564	2,570	2,574	2,573	10,281	9,938
2 L - 19	1	19:51:00	0	0	0	0	0	0	7,600	2,707	2,713	2,717	2,716	10,852	10,508
2 L - 19	2	19:52:00	0	0	0	0	0	0	7,600	2,707	2,713	2,717	2,716	10,852	10,508
2 L - 19	4	19:54:00	0	0	0	0	0	0	7,600	2,707	2,713	2,717	2,716	10,852	10,508
2 L - 19	8	19:58:00	0	0	0	0	0	0	7,600	2,707	2,713	2,717	2,716	10,852	10,508
2 L - 20	1	20:04:00	0	0	0	0	0	0	8,000	2,849	2,855	2,859	2,859	11,422	11,078
2 L - 20	2	20:05:00	0	0	0	0	0	0	8,000	2,849	2,855	2,859	2,859	11,422	11,078
2 L - 20	4	20:07:00	0	0	0	0	0	0	8,000	2,849	2,855	2,859	2,859	11,422	11,078
2 L - 20	8	20:11:00	0	0	0	0	0	0	8,000	2,849	2,855	2,859	2,859	11,422	11,078
2 L - 21	1	20:15:00	0	0	0	0	0	0	8,400	2,991	2,998	3,002	3,002	11,992	11,649
2 L - 21	2	20:16:00	0	0	0	0	0	0	8,400	2,991	2,998	3,002	3,002	11,992	11,649
2 L - 21	4	20:18:00	0	0	0	0	0	0	8,400	2,991	2,998	3,002	3,002	11,992	11,649
2 L - 21	8	20:22:00	0	0	0	0	0	0	8,400	2,991	2,998	3,002	3,002	11,992	11,649
2 L - 22	1	20:29:30	0	0	0	0	0	0	8,800	3,133	3,140	3,145	3,144	12,563	12,219
2 L - 22	2	20:30:30	0	0	0	0	0	0	8,800	3,133	3,140	3,145	3,144	12,563	12,219
2 L - 22	4	20:32:30	0	0	0	0	0	0	8,800	3,133	3,140	3,145	3,144	12,563	12,219
2 L - 22	8	20:36:30	0	0	0	0	0	0	8,800	3,133	3,140	3,145	3,144	12,563	12,219
2 U - 1	1	20:40:00	0	0	0	0	0	0	6,600	2,351	2,356	2,360	2,359	9,426	9,082
2 U - 1	2	20:41:00	0	0	0	0	0	0	6,600	2,351	2,356	2,360	2,359	9,426	9,082
2 U - 1	4	20:43:00	0	0	0	0	0	0	6,600	2,351	2,356	2,360	2,359	9,426	9,082
2 U - 2	1	20:45:30	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 U - 2	2	20:46:30	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 U - 2	4	20:48:30	0	0	0	0	0	0	4,400	1,569	1,572	1,575	1,573	6,288	5,945
2 U - 3	1	20:50:30	0	0	0	0	0	0	2,200	786	788	790	788	3,151	2,808
2 U - 3	2	20:51:30	0	0	0	0	0	0	2,200	786	788	790	788	3,151	2,808
2 U - 3	4	20:53:30	0	0	0	0	0	0	2,200	786	788	790	788	3,151	2,808
2 U - 4	1	20:57:30	0	0	0	0	0	0	0	0	0	0	0	0	0
2 U - 4	2	20:58:30	0	0	0	0	0	0	0	0	0	0	0	0	0
2 U - 4	4	21:00:30	0	0	0	0	0	0	0	0	0	0	0	0	0
2 U - 4	8	21:04:30	0	0	0	0	0	0	0	0	0	0	0	0	0

Upward Top of Shaft Movement and Shaft Compression
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Top of Shaft A (in)	Top of Shaft B (in)	Top of Shaft C (in)	Top of Shaft D (in)	Top of Shaft Avg* (in)	ECT Level 1 A - 19421 (in)	ECT Level 1 B - 19424 (in)	ECT Level 1 Average (in)	Telltales A (in)	Telltales B (in)	Telltales Average (in)
1 L - 0	-	12:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1 L - 1	1	12:53:00	400	597	0	0	0.001	0.001	0.003	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.001
1 L - 1	2	12:54:00	400	597	0	0	0.001	0.002	0.003	0.001	0.002	0.002	0.000	0.001	0.001	0.001	0.001
1 L - 1	4	12:56:00	400	597	0	0	0.002	0.001	0.003	0.001	0.002	0.002	0.001	0.001	0.002	0.002	0.002
1 L - 1	8	13:00:00	400	597	0	0	0.003	0.002	0.004	0.001	0.003	0.002	0.001	0.001	0.001	0.001	0.001
1 L - 2	1	13:03:00	800	1,164	0	0	0.003	0.003	0.006	0.002	0.003	0.004	0.002	0.003	0.003	0.003	0.003
1 L - 2	2	13:04:00	800	1,164	0	0	0.002	0.002	0.006	0.001	0.002	0.004	0.002	0.003	0.003	0.003	0.003
1 L - 2	4	13:06:00	800	1,164	0	0	0.002	0.002	0.006	0.004	0.002	0.004	0.002	0.003	0.003	0.003	0.003
1 L - 2	8	13:10:00	800	1,164	0	0	0.003	0.003	0.006	0.005	0.003	0.004	0.001	0.003	0.003	0.003	0.003
1 L - 3	1	13:13:00	1,200	1,731	0	0	0.008	0.008	0.009	0.007	0.008	0.006	0.002	0.004	0.005	0.005	0.005
1 L - 3	2	13:14:00	1,200	1,731	0	0	0.007	0.004	0.009	0.007	0.006	0.006	0.002	0.004	0.005	0.005	0.005
1 L - 3	4	13:16:00	1,200	1,731	0	0	0.006	0.007	0.009	0.007	0.006	0.006	0.002	0.004	0.005	0.005	0.005
1 L - 3	8	13:20:00	1,200	1,731	0	0	0.003	0.006	0.009	0.008	0.005	0.006	0.002	0.004	0.005	0.005	0.005
1 L - 4	1	13:24:00	1,600	2,297	0	0	0.011	0.011	0.012	0.016	0.011	0.007	0.003	0.005	0.007	0.007	0.007
1 L - 4	2	13:25:00	1,600	2,297	0	0	0.010	0.011	0.013	0.015	0.011	0.007	0.003	0.005	0.007	0.007	0.007
1 L - 4	4	13:27:00	1,600	2,297	0	0	0.010	0.011	0.013	0.013	0.011	0.007	0.003	0.005	0.007	0.007	0.007
1 L - 4	8	13:31:00	1,600	2,297	0	0	0.010	0.011	0.014	0.015	0.011	0.007	0.004	0.005	0.007	0.007	0.007
1 L - 5	1	13:34:30	2,000	2,864	0	0	0.012	0.011	0.019	0.023	0.011	0.009	0.004	0.007	0.008	0.008	0.008
1 L - 5	2	13:35:30	2,000	2,864	0	0	0.017	0.018	0.019	0.019	0.018	0.009	0.005	0.007	0.008	0.008	0.008
1 L - 5	4	13:37:30	2,000	2,864	0	0	0.018	0.017	0.020	0.019	0.018	0.009	0.005	0.007	0.009	0.009	0.009
1 L - 5	8	13:41:30	2,000	2,864	0	0	0.017	0.017	0.021	0.020	0.017	0.009	0.005	0.007	0.009	0.009	0.009
1 L - 6	1	13:44:30	2,400	3,431	0	0	0.022	0.023	0.026	0.024	0.023	0.010	0.005	0.008	0.010	0.010	0.010
1 L - 6	2	13:45:30	2,400	3,431	0	0	0.023	0.023	0.026	0.024	0.023	0.010	0.005	0.008	0.010	0.010	0.010
1 L - 6	4	13:47:30	2,400	3,431	0	0	0.023	0.023	0.028	0.025	0.023	0.010	0.006	0.008	0.011	0.011	0.011
1 L - 6	8	13:51:30	2,400	3,431	0	0	0.023	0.023	0.028	0.025	0.023	0.010	0.006	0.008	0.010	0.010	0.010
1 L - 7	1	13:57:00	2,800	3,998	0	0	0.029	0.030	0.033	0.031	0.029	0.012	0.006	0.009	0.011	0.011	0.011
1 L - 7	2	13:58:00	2,800	3,998	0	0	0.029	0.030	0.034	0.032	0.029	0.012	0.006	0.009	0.012	0.011	0.011
1 L - 7	4	14:00:00	2,800	3,998	0	0	0.030	0.031	0.034	0.033	0.031	0.012	0.006	0.009	0.012	0.011	0.011
1 L - 7	8	14:04:00	2,800	3,998	0	0	0.030	0.032	0.035	0.034	0.031	0.012	0.006	0.009	0.012	0.011	0.011
1 L - 8	1	14:08:00	3,200	4,565	0	0	0.036	0.037	0.041	0.034	0.037	0.013	0.007	0.010	0.013	0.012	0.013
1 L - 8	2	14:09:00	3,200	4,565	0	0	0.036	0.036	0.042	0.034	0.036	0.013	0.007	0.010	0.013	0.012	0.013
1 L - 8	4	14:11:00	3,200	4,565	0	0	0.037	0.037	0.043	0.033	0.037	0.013	0.007	0.010	0.013	0.012	0.013
1 L - 8	8	14:15:00	3,200	4,565	0	0	0.037	0.037	0.044	0.033	0.037	0.013	0.006	0.010	0.013	0.012	0.013
1 L - 9	1	14:18:30	3,600	5,131	0	0	0.044	0.045	0.052	0.035	0.045	0.014	0.007	0.011	0.014	0.013	0.014
1 L - 9	2	14:19:30	3,600	5,131	0	0	0.047	0.046	0.053	0.036	0.047	0.014	0.007	0.011	0.014	0.013	0.014
1 L - 9	4	14:21:30	3,600	5,131	0	0	0.047	0.047	0.054	0.035	0.047	0.014	0.007	0.010	0.014	0.013	0.014
1 L - 9	8	14:25:30	3,600	5,131	0	0	0.049	0.049	0.054	0.036	0.049	0.014	0.006	0.010	0.014	0.013	0.014
1 L - 10	1	14:29:00	4,000	5,698	0	0	0.054	0.054	0.062	0.038	0.054	0.016	0.007	0.011	0.015	0.014	0.015
1 L - 10	2	14:30:00	4,000	5,698	0	0	0.054	0.055	0.063	0.039	0.055	0.016	0.007	0.011	0.015	0.014	0.015
1 L - 10	4	14:32:00	4,000	5,698	0	0	0.056	0.056	0.064	0.040	0.056	0.016	0.007	0.011	0.015	0.014	0.015
1 L - 10	8	14:36:00	4,000	5,698	0	0	0.057	0.057	0.065	0.040	0.057	0.015	0.006	0.011	0.016	0.015	0.015
1 L - 11	1	14:39:30	4,400	6,265	0	0	0.065	0.063	0.071	0.042	0.064	0.017	0.007	0.012	0.016	0.015	0.016
1 L - 11	2	14:40:30	4,400	6,265	0	0	0.064	0.064	0.072	0.045	0.064	0.017	0.007	0.012	0.016	0.015	0.016
1 L - 11	4	14:42:30	4,400	6,265	0	0	0.066	0.065	0.073	0.044	0.066	0.017	0.007	0.012	0.016	0.016	0.016
1 L - 11	8	14:46:30	4,400	6,265	0	0	0.067	0.068	0.076	0.046	0.067	0.017	0.007	0.012	0.016	0.016	0.016
1 L - 12	1	14:50:00	4,800	6,832	0	0	0.072	0.073	0.082	0.049	0.073	0.018	0.007	0.013	0.017	0.016	0.017
1 L - 12	2	14:51:00	4,800	6,832	0	0	0.074	0.074	0.083	0.049	0.074	0.018	0.007	0.012	0.017	0.016	0.017
1 L - 12	4	14:53:00	4,800	6,832	0	0	0.078	0.077	0.085	0.050	0.078	0.018	0.007	0.012	0.018	0.016	0.017
1 L - 12	8	14:57:00	4,800	6,832	0	0	0.080	0.078	0.088	0.053	0.079	0.018	0.007	0.012	0.017	0.017	0.017
1 L - 13	1	15:02:00	5,200	7,399	0	0	0.083	0.083	0.095	0.057	0.083	0.019	0.007	0.013	0.018	0.017	0.018
1 L - 13	2	15:03:00	5,200	7,399	0	0	0.085	0.086	0.096	0.058	0.086	0.019	0.007	0.013	0.018	0.018	0.018
1 L - 13	4	15:05:00	5,200	7,399	0	0	0.086	0.087	0.097	0.058	0.087	0.019	0.007	0.013	0.018	0.018	0.018
1 L - 13	8	15:09:00	5,200	7,399	0	0	0.088	0.087	0.099	0.061	0.088	0.019	0.007	0.013	0.018	0.018	0.018
1 L - 14	1	15:14:00	5,600	7,965	0	0	0.097	0.095	0.107	0.066	0.096	0.020	0.008	0.014	0.019	0.018	0.019
1 L - 14	2	15:15:00	5,600	7,965	0	0	0.097	0.097	0.110	0.069	0.097	0.020	0.008	0.014	0.019	0.018	0.019
1 L - 14	4	15:17:00	5,600	7,965	0	0	0.099	0.098	0.111	0.071	0.099	0.020	0.008	0.014	0.020	0.018	0.019
1 L - 14	8	15:21:00	5,600	7,965	0	0	0.101	0.100	0.113	0.073	0.101	0.020	0.008	0.014	0.020	0.018	0.019
1 L - 15	1	15:27:00	6,000	8,532	0	0	0.111	0.110	0.124	0.078	0.111	0.022	0.008	0.015	0.020	0.020	0.020
1 L - 15	2	15:28:00	6,000	8,532	0	0	0.109	0.108	0.125	0.078	0.109	0.022	0.008	0.015	0.020	0.020	0.020
1 L - 15	4	15:30:00	6,000	8,532	0	0	0.112	0.111	0.126	0.079	0.112	0.022	0.008	0.015	0.020	0.020	0.020
1 L - 15	8	15:34:00	6,000	8,532	0	0	0.117	0.116	0.128	0.081	0.117	0.022	0.008	0.015	0.020	0.020	0.020
1 L - 16	1	15:38:30	6,300	8,957	0	0	0.125	0.124	0.137	0.090	0.125	0.023	0.009	0.016	0.021	0.021	0.021
1 L - 16	2	15:39:30	6,300	8,957	0	0	0.125	0.123	0.139	0.092	0.124	0.023	0.009	0.016	0.021	0.021	0.021
1 L - 16	4	15:41:30	6,150	8,745	0	0	0.128	0.126	0.140	0.091	0.127	0.023	0.008	0.015	0.021	0.021	0.021
1 U - 1	1	15:47:00	4,800	6,832	0	0	0.125	0.124	0.139	0.091	0.125	0.021	0.007	0.014	0.020	0.020	0.020
1 U - 1	2	15:48:00	4,800	6,832	0	0	0.125	0.124	0.140	0.091	0.125	0.021	0.007	0.014	0.020	0.020	0.020
1 U - 1	4	15:50:00	4,800	6,832	0	0	0.125	0.124	0.140	0.090	0.125	0.021	0.007	0.014	0.020	0.020	0.020
1 U - 2	1	15:54:00	3,200	4,565	0	0	0.121	0.121	0.137	0.088	0.121	0.016	0.006	0.011	0.018	0.019	0.018
1 U - 2	2	15:55:00	3,200	4,565	0	0	0.119	0.117	0.137	0.088	0.118	0.016	0.006	0.011	0.018	0.018	0.018
1 U - 2	4	15:57:00	3,200	4,565	0	0	0.123	0.121	0.137	0.088	0.122	0.016	0.006	0.011	0.018	0.018	0.018
1 U - 3	1	16:03:00	1,600	2,297	0	0	0.111	0.111	0.132	0.084	0.111	0.010	0.004	0.007	0.014	0.016	0.015
1 U - 3	2	16:04:00	1,600	2,297	0	0	0.116	0.116	0.132	0.084	0.116	0.010	0.004	0.007	0.014	0.016	0.015
1 U - 3	4	16:06:00	1,600	2,297	0	0	0.111	0.111	0.132	0.084	0.111	0.010	0.004	0.007	0.014	0.016	0.015
1 U - 4	1	16:11:00	0	0	0	0	0.090	0.091	0.115	0.071	0.090	0.000	-0.002	-0.001	0.009	0.011	0.010
1 U - 4	2	16:12:00	0	0	0	0	0.089	0.089	0.114	0.072	0.089	0.000	-0.002	-0.001	0.009	0.011	0.010
1 U - 4	4	16:14:00	0	0	0	0	0.087	0.089	0.114	0.071	0.088	0.000	-0.002	-0.001	0.009	0.011	0.010
1 U - 4	8	16:18:00	0	0	0	0	0.088	0.088	0.114	0.070	0.088	0.000	-0.002	-0.001	0.009	0.011	0.010
1 U - 4	16	16:26:00	0	0	0	0	0.088	0.088	0.114	0.070	0.088	0.000	-0.002	-0.001	0.009	0.011	0.010
1 U - 4	32	16:42:00	0	0	0	0	0.083	0.085	0.114	0.069	0.084	0.000	-0.002	-0.001	0.009	0.010	0.010
2 L - 0	1	16:43:00	0	0	0	0	0.086	0.086	0.115	0.070	0.086	0.000	-0.002	-0.001	0.009	0.011	0.010
2 L - 1	1	16:53:30	0	0	400	584	0.084	0.085	0.115	0.070	0.085	0.000	-0.002	-0.001	0.007	0.011	0.009
2 L - 1	2	16:54:30	0	0	400	584	0.085	0.085	0.115	0.070	0.085	0.000	-0.002	-0.001	0.007	0.011	0.009
2 L - 1	4	16:56:30	0	0	400	584	0.085	0.086	0.115	0.070	0.086	0.000	-0.001	-0.001	0.007	0.011	0.009
2 L - 1	8	17:00:30	0	0	400	584	0.084	0.085	0.116	0.070	0.085	0.000	-0.001	-0.001	0.008	0.011	0.009
2 L - 2	1	17:04:30	0	0	800	1,155	0.084	0.085	0.117	0.070	0.085	0.001	0.000	0.000	0.008	0.011	0.009
2 L - 2	2	17:05:30	0	0	800	1,155	0.086	0.087	0.117	0.070	0.087	0.001	0.000	0.000	0.008	0.011	0.009
2 L - 2	4	17:07:30	0	0	800	1,155	0.085	0.086	0.118	0.070	0.086	0.001	0.000	0.000	0.008	0.011	0.009
2 L - 2	8	17:11:30	0	0	800	1,155	0.086	0.086	0.118	0.070	0.086	0.001	0.000	0.000	0.008	0.011	0.009
2 L - 3	1	17:14:00	0	0	1,200	1,725	0.089	0.087	0.120	0.070	0.088	0.002	0.001	0.001	0.009	0.011	0.010
2 L - 3	2	17:15:00	0	0	1,200	1,725	0.089	0.091	0.120	0.071	0.090	0.002	0.001	0.001	0.009	0.011	0.010
2 L - 3	4	17:17:00	0	0	1,200	1,725	0.087	0.088	0.119	0.071	0.088	0.002	0.001	0.001	0.009	0.011	0.010
2 L - 3	8	17:21:00	0	0	1,200	1,725	0.088	0.088	0.120	0.071	0.088	0.002	0.001	0.001	0.009	0.011	0.010

Upward Top of Shaft Movement and Shaft Compression
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Top of Shaft A (in)	Top of Shaft B (in)	Top of Shaft C (in)	Top of Shaft D (in)	Top of Shaft Avg* (in)	ECT Level 1 A - 19421 (in)	ECT Level 1 B - 19424 (in)	ECT Level 1 Average (in)	Telltales A (in)	Telltales B (in)	Telltales Average (in)
2L-4	1	17:23:30	0	0	1,600	2,296	0.091	0.090	0.123	0.073	0.091	0.002	0.002	0.002	0.009	0.011	0.010
2L-4	2	17:24:30	0	0	1,600	2,296	0.089	0.089	0.123	0.072	0.089	0.002	0.002	0.002	0.009	0.011	0.010
2L-4	4	17:26:30	0	0	1,600	2,296	0.089	0.090	0.123	0.073	0.090	0.002	0.002	0.002	0.009	0.011	0.010
2L-4	8	17:30:30	0	0	1,600	2,296	0.089	0.089	0.123	0.074	0.089	0.002	0.002	0.002	0.009	0.011	0.010
2L-5	1	17:33:00	0	0	2,000	2,866	0.096	0.095	0.126	0.073	0.096	0.002	0.002	0.002	0.010	0.012	0.011
2L-5	2	17:34:00	0	0	2,000	2,866	0.095	0.095	0.126	0.073	0.095	0.002	0.002	0.002	0.010	0.012	0.011
2L-5	4	17:36:00	0	0	2,000	2,866	0.095	0.095	0.126	0.073	0.095	0.002	0.002	0.002	0.010	0.012	0.011
2L-5	8	17:40:00	0	0	2,000	2,866	0.095	0.095	0.127	0.073	0.095	0.002	0.002	0.002	0.010	0.012	0.011
2L-6	1	17:42:30	0	0	2,400	3,436	0.099	0.099	0.131	0.073	0.099	0.003	0.003	0.003	0.011	0.013	0.012
2L-6	2	17:43:30	0	0	2,400	3,436	0.099	0.100	0.132	0.074	0.099	0.003	0.003	0.003	0.011	0.013	0.012
2L-6	4	17:45:30	0	0	2,400	3,436	0.099	0.100	0.132	0.074	0.099	0.003	0.003	0.003	0.011	0.013	0.012
2L-6	8	17:49:30	0	0	2,400	3,436	0.100	0.100	0.132	0.074	0.100	0.003	0.003	0.003	0.011	0.013	0.012
2L-7	1	17:51:30	0	0	2,800	4,007	0.104	0.104	0.136	0.075	0.104	0.003	0.004	0.004	0.012	0.014	0.013
2L-7	2	17:52:30	0	0	2,800	4,007	0.104	0.105	0.137	0.075	0.105	0.003	0.004	0.004	0.012	0.014	0.013
2L-7	4	17:54:30	0	0	2,800	4,007	0.103	0.104	0.137	0.076	0.104	0.003	0.004	0.004	0.012	0.014	0.013
2L-7	8	17:58:30	0	0	2,800	4,007	0.105	0.105	0.138	0.077	0.105	0.003	0.004	0.004	0.012	0.015	0.013
2L-8	1	18:00:30	0	0	3,200	4,577	0.110	0.110	0.143	0.078	0.110	0.003	0.005	0.004	0.013	0.016	0.015
2L-8	2	18:01:30	0	0	3,200	4,577	0.110	0.111	0.144	0.077	0.111	0.003	0.005	0.004	0.013	0.016	0.015
2L-8	4	18:03:30	0	0	3,200	4,577	0.111	0.112	0.144	0.078	0.112	0.003	0.005	0.004	0.013	0.016	0.015
2L-8	8	18:07:30	0	0	3,200	4,577	0.112	0.112	0.145	0.080	0.112	0.003	0.005	0.004	0.013	0.017	0.015
2L-9	1	18:09:30	0	0	3,600	5,148	0.117	0.118	0.151	0.082	0.118	0.004	0.006	0.005	0.014	0.018	0.016
2L-9	2	18:10:30	0	0	3,600	5,148	0.118	0.119	0.152	0.082	0.119	0.004	0.006	0.005	0.014	0.019	0.017
2L-9	4	18:12:30	0	0	3,600	5,148	0.119	0.121	0.153	0.083	0.120	0.004	0.006	0.005	0.015	0.019	0.017
2L-9	8	18:16:30	0	0	3,600	5,148	0.119	0.119	0.155	0.085	0.119	0.004	0.006	0.005	0.015	0.019	0.017
2L-10	1	18:18:30	0	0	4,000	5,718	0.128	0.130	0.163	0.091	0.129	0.004	0.006	0.005	0.016	0.020	0.018
2L-10	2	18:19:30	0	0	4,000	5,718	0.130	0.131	0.164	0.094	0.131	0.004	0.006	0.005	0.016	0.021	0.018
2L-10	4	18:21:30	0	0	4,000	5,718	0.132	0.133	0.167	0.096	0.133	0.004	0.006	0.005	0.017	0.021	0.019
2L-10	8	18:25:30	0	0	4,000	5,718	0.135	0.135	0.169	0.098	0.135	0.004	0.007	0.005	0.017	0.021	0.019
2L-11	1	18:28:00	0	0	4,400	6,288	0.149	0.148	0.183	0.112	0.149	0.004	0.007	0.006	0.018	0.023	0.020
2L-11	2	18:29:00	0	0	4,400	6,288	0.151	0.150	0.185	0.113	0.151	0.005	0.007	0.006	0.018	0.023	0.020
2L-11	4	18:31:00	0	0	4,400	6,288	0.152	0.152	0.189	0.117	0.152	0.004	0.007	0.006	0.018	0.023	0.020
2L-11	8	18:35:00	0	0	4,400	6,288	0.154	0.156	0.191	0.121	0.155	0.005	0.007	0.006	0.018	0.023	0.020
2L-12	1	18:38:00	0	0	4,800	6,859	0.170	0.171	0.208	0.135	0.171	0.005	0.008	0.007	0.019	0.024	0.021
2L-12	2	18:39:00	0	0	4,800	6,859	0.175	0.175	0.210	0.137	0.175	0.005	0.008	0.007	0.019	0.024	0.021
2L-12	4	18:41:00	0	0	4,800	6,859	0.176	0.178	0.214	0.140	0.177	0.005	0.008	0.007	0.019	0.024	0.022
2L-12	8	18:45:00	0	0	4,800	6,859	0.180	0.182	0.219	0.147	0.181	0.005	0.008	0.007	0.019	0.024	0.022
2L-13	1	18:47:30	0	0	5,200	7,429	0.197	0.198	0.235	0.164	0.198	0.006	0.008	0.007	0.020	0.026	0.023
2L-13	2	18:48:30	0	0	5,200	7,429	0.200	0.201	0.238	0.166	0.201	0.006	0.008	0.007	0.020	0.026	0.023
2L-13	4	18:50:30	0	0	5,200	7,429	0.206	0.206	0.242	0.168	0.206	0.006	0.008	0.007	0.020	0.026	0.023
2L-13	8	18:54:30	0	0	5,200	7,429	0.209	0.210	0.248	0.176	0.210	0.006	0.008	0.007	0.020	0.026	0.023
2L-14	1	18:58:00	0	0	5,600	8,000	0.228	0.230	0.266	0.194	0.228	0.007	0.009	0.008	0.021	0.028	0.024
2L-14	2	18:59:00	0	0	5,600	8,000	0.231	0.233	0.269	0.196	0.232	0.007	0.009	0.008	0.021	0.028	0.024
2L-14	4	19:01:00	0	0	5,600	8,000	0.236	0.237	0.274	0.203	0.237	0.007	0.009	0.008	0.021	0.028	0.024
2L-14	8	19:05:00	0	0	5,600	8,000	0.239	0.240	0.278	0.206	0.240	0.007	0.009	0.008	0.021	0.028	0.025
2L-15	1	19:07:30	0	0	6,000	8,570	0.257	0.258	0.296	0.225	0.258	0.008	0.010	0.009	0.022	0.029	0.026
2L-15	2	19:08:30	0	0	6,000	8,570	0.261	0.262	0.301	0.230	0.262	0.008	0.010	0.009	0.022	0.029	0.026
2L-15	4	19:10:30	0	0	6,000	8,570	0.267	0.267	0.305	0.235	0.267	0.008	0.010	0.009	0.022	0.030	0.026
2L-15	8	19:14:30	0	0	6,000	8,570	0.272	0.273	0.310	0.241	0.273	0.008	0.010	0.009	0.022	0.030	0.026
2L-16	1	19:17:00	0	0	6,400	9,140	0.288	0.290	0.328	0.259	0.289	0.008	0.011	0.010	0.023	0.031	0.027
2L-16	2	19:18:00	0	0	6,400	9,140	0.293	0.295	0.332	0.264	0.294	0.009	0.011	0.010	0.023	0.031	0.027
2L-16	4	19:20:00	0	0	6,400	9,140	0.299	0.300	0.337	0.269	0.300	0.009	0.011	0.010	0.024	0.031	0.028
2L-16	8	19:24:00	0	0	6,400	9,140	0.304	0.304	0.344	0.276	0.304	0.009	0.011	0.010	0.024	0.032	0.028
2L-17	1	19:27:30	0	0	6,800	9,711	0.327	0.329	0.368	0.300	0.328	0.010	0.012	0.011	0.025	0.033	0.029
2L-17	2	19:28:30	0	0	6,800	9,711	0.329	0.332	0.372	0.303	0.331	0.011	0.013	0.012	0.026	0.033	0.029
2L-17	4	19:30:30	0	0	6,800	9,711	0.337	0.337	0.378	0.308	0.337	0.011	0.013	0.012	0.026	0.033	0.029
2L-17	8	19:34:30	0	0	6,800	9,711	0.344	0.346	0.385	0.293	0.345	0.011	0.013	0.012	0.026	0.033	0.030
2L-18	1	19:39:30	0	0	7,200	10,281	0.369	0.371	0.410	0.307	0.370	0.013	0.015	0.014	0.027	0.034	0.031
2L-18	2	19:40:30	0	0	7,200	10,281	0.373	0.374	0.414	0.310	0.374	0.013	0.015	0.014	0.027	0.034	0.031
2L-18	4	19:42:30	0	0	7,200	10,281	0.379	0.381	0.421	0.316	0.380	0.013	0.015	0.014	0.027	0.035	0.031
2L-18	8	19:46:30	0	0	7,200	10,281	0.386	0.388	0.426	0.319	0.387	0.013	0.015	0.014	0.027	0.035	0.031
2L-19	1	19:51:00	0	0	7,600	10,852	0.412	0.414	0.453	0.344	0.413	0.014	0.016	0.015	0.028	0.035	0.032
2L-19	2	19:52:00	0	0	7,600	10,852	0.418	0.420	0.459	0.351	0.419	0.015	0.017	0.016	0.028	0.035	0.032
2L-19	4	19:54:00	0	0	7,600	10,852	0.428	0.426	0.464	0.358	0.427	0.015	0.017	0.016	0.029	0.035	0.032
2L-19	8	19:58:00	0	0	7,600	10,852	0.433	0.436	0.474	0.360	0.435	0.015	0.017	0.016	0.029	0.035	0.033
2L-20	1	20:04:00	0	0	8,000	11,422	0.461	0.462	0.500	0.380	0.462	0.016	0.018	0.017	0.030	0.037	0.033
2L-20	2	20:05:00	0	0	8,000	11,422	0.465	0.469	0.507	0.387	0.467	0.016	0.018	0.017	0.030	0.037	0.034
2L-20	4	20:07:00	0	0	8,000	11,422	0.476	0.477	0.515	0.394	0.477	0.016	0.018	0.017	0.030	0.037	0.034
2L-20	8	20:11:00	0	0	8,000	11,422	0.488	0.489	0.527	0.405	0.489	0.016	0.018	0.017	0.031	0.037	0.034
2L-21	1	20:15:00	0	0	8,400	11,992	0.516	0.516	0.556	0.436	0.516	0.017	0.019	0.018	0.032	0.038	0.035
2L-21	2	20:16:00	0	0	8,400	11,992	0.520	0.521	0.562	0.439	0.521	0.018	0.019	0.018	0.032	0.038	0.035
2L-21	4	20:18:00	0	0	8,400	11,992	0.526	0.526	0.568	0.442	0.526	0.018	0.020	0.019	0.032	0.038	0.035
2L-21	8	20:22:00	0	0	8,400	11,992	0.533	0.533	0.576	0.450	0.533	0.018	0.020	0.019	0.032	0.038	0.035
2L-22	1	20:29:30	0	0	8,800	12,563	0.579	0.580	0.621	0.494	0.580	0.019	0.021	0.020	0.033	0.042	0.038
2L-22	2	20:30:30	0	0	8,800	12,563	0.582	0.582	0.623	0.497	0.582	0.019	0.021	0.020	0.033	0.042	0.038
2L-22	4	20:32:30	0	0	8,800	12,563	0.588	0.588	0.631	0.505	0.588	0.019	0.021	0.020	0.033	0.042	0.038
2L-22	8	20:36:30	0	0	8,800	12,563	0.602	0.604	0.645	0.517	0.603	0.020	0.021	0.020	0.034	0.043	0.038
2U-1	1	20:40:00	0	0	6,600	9,426	0.593	0.594	0.638	0.512	0.594	0.016	0.016	0.016	0.030	0.037	0.033
2U-1	2	20:41:00	0	0	6,600	9,426	0.592	0.593	0.638	0.511	0.593	0.015	0.016	0.016	0.029	0.037	0.033
2U-1	4	20:43:00	0	0	6,600	9,426	0.591	0.592	0.638	0.511	0.592	0.015	0.016	0.016	0.029	0.036	0.033
2U-2	1	20:45:30	0	0	4,400	6,288	0.575	0.577	0.623	0.497	0.576	0.011	0.010	0.011	0.021	0.034	0.027
2U-2	2	20:46:30	0	0	4,400	6,288	0.576	0.578	0.623	0.497	0.577	0.011	0.011	0.011	0.021	0.034	0.027
2U-2	4	20:48:30	0	0	4,400	6,288	0.575	0.575	0.623	0.498	0.575	0.011	0.011	0.011	0.021	0.034	0.027
2U-3	1	20:50:30	0	0	2,200	3,151	0.551	0.553	0.603	0.482	0.552	0.007	0.005	0.006	0.012	0.026	0.019
2U-3	2	20:51:30	0	0	2,200	3,151	0.553	0.553	0.603	0.482	0.553	0.007	0.005	0.006	0.012	0.025	0.019
2U-3	4	20:53:30	0	0	2,200	3,151	0.551	0.550	0.602	0.481	0.551	0.006	0.004	0.005	0.011	0.025	0.018
2U-4	1	20:57:30	0	0	0	0	0.506	0.507	0.560	0.450	0.507	0.001	-0.003	-0.001	0.005	0.017	0.011
2U-4	2	20:58:30	0	0	0	0	0.504	0.506	0.559	0.450	0.505	0.001	-0.003	-0.001	0.005	0.017	0.011
2U-4	4	21:00:30	0	0	0	0	0.504	0.505	0.558	0.449	0.505	0.001	-0.003	-0.001	0.004	0.017	0.011
2U-4	8	21:04:30	0	0	0	0	0.502	0.504	0.557	0.448	0.503	0.001	-0.003	-0.001	0.004	0.017	0.010

Top of Shaft A and B measured directly with digital survey levels.
*Top of Shaft C and D measured with LVWDTs referenced to the beam are not included in the average.

Lower O-cell Expansion
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Lower O-cell Expansion A - 20367 (in)	B - 20368 (in)	C - 20369 (in)	D - 20370 (in)	E - 405 (in)	Average (in)
1 L - 0	-	12:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
1 L - 1	1	12:53:00	400	597	0	0	0.039	0.047	0.021	0.031	0.036	0.035
1 L - 1	2	12:54:00	400	597	0	0	0.046	0.055	0.026	0.037	0.043	0.041
1 L - 1	4	12:56:00	400	597	0	0	0.051	0.061	0.034	0.041	0.049	0.047
1 L - 1	8	13:00:00	400	597	0	0	0.056	0.067	0.040	0.046	0.054	0.052
1 L - 2	1	13:03:00	800	1,164	0	0	0.132	0.145	0.107	0.108	0.127	0.124
1 L - 2	2	13:04:00	800	1,164	0	0	0.139	0.152	0.114	0.115	0.134	0.131
1 L - 2	4	13:06:00	800	1,164	0	0	0.150	0.163	0.124	0.124	0.144	0.141
1 L - 2	8	13:10:00	800	1,164	0	0	0.160	0.173	0.134	0.133	0.153	0.150
1 L - 3	1	13:13:00	1,200	1,731	0	0	0.271	0.275	0.229	0.222	0.251	0.249
1 L - 3	2	13:14:00	1,200	1,731	0	0	0.281	0.286	0.239	0.231	0.260	0.259
1 L - 3	4	13:16:00	1,200	1,731	0	0	0.296	0.302	0.257	0.246	0.275	0.275
1 L - 3	8	13:20:00	1,200	1,731	0	0	0.313	0.319	0.277	0.264	0.292	0.293
1 L - 4	1	13:24:00	1,600	2,297	0	0	0.437	0.431	0.393	0.372	0.400	0.407
1 L - 4	2	13:25:00	1,600	2,297	0	0	0.449	0.444	0.407	0.384	0.412	0.419
1 L - 4	4	13:27:00	1,600	2,297	0	0	0.465	0.460	0.427	0.401	0.428	0.436
1 L - 4	8	13:31:00	1,600	2,297	0	0	0.486	0.480	0.449	0.420	0.447	0.456
1 L - 5	1	13:34:30	2,000	2,864	0	0	0.622	0.601	0.592	0.536	0.562	0.582
1 L - 5	2	13:35:30	2,000	2,864	0	0	0.634	0.611	0.603	0.547	0.573	0.593
1 L - 5	4	13:37:30	2,000	2,864	0	0	0.653	0.630	0.621	0.565	0.590	0.612
1 L - 5	8	13:41:30	2,000	2,864	0	0	0.680	0.655	0.646	0.598	0.614	0.639
1 L - 6	1	13:44:30	2,400	3,431	0	0	0.814	0.761	0.754	0.698	0.711	0.748
1 L - 6	2	13:45:30	2,400	3,431	0	0	0.831	0.774	0.766	0.710	0.722	0.760
1 L - 6	4	13:47:30	2,400	3,431	0	0	0.857	0.797	0.791	0.734	0.746	0.785
1 L - 6	8	13:51:30	2,400	3,431	0	0	0.882	0.824	0.819	0.760	0.771	0.811
1 L - 7	1	13:57:00	2,800	3,998	0	0	0.995	0.929	0.927	0.865	0.869	0.917
1 L - 7	2	13:58:00	2,800	3,998	0	0	1.006	0.941	0.939	0.876	0.879	0.928
1 L - 7	4	14:00:00	2,800	3,998	0	0	1.025	0.958	0.956	0.894	0.896	0.946
1 L - 7	8	14:04:00	2,800	3,998	0	0	1.048	0.982	0.977	0.915	0.917	0.968
1 L - 8	1	14:08:00	3,200	4,565	0	0	1.149	1.075	1.071	1.010	1.005	1.062
1 L - 8	2	14:09:00	3,200	4,565	0	0	1.167	1.091	1.087	1.026	1.018	1.078
1 L - 8	4	14:11:00	3,200	4,565	0	0	1.192	1.114	1.111	1.049	1.042	1.101
1 L - 8	8	14:15:00	3,200	4,565	0	0	1.218	1.140	1.136	1.074	1.066	1.127
1 L - 9	1	14:18:30	3,600	5,131	0	0	1.323	1.249	1.243	1.179	1.163	1.232
1 L - 9	2	14:19:30	3,600	5,131	0	0	1.335	1.261	1.256	1.191	1.174	1.243
1 L - 9	4	14:21:30	3,600	5,131	0	0	1.357	1.282	1.277	1.212	1.194	1.265
1 L - 9	8	14:25:30	3,600	5,131	0	0	1.388	1.312	1.308	1.243	1.223	1.295
1 L - 10	1	14:29:00	4,000	5,698	0	0	1.483	1.408	1.406	1.340	1.312	1.390
1 L - 10	2	14:30:00	4,000	5,698	0	0	1.502	1.424	1.423	1.357	1.328	1.407
1 L - 10	4	14:32:00	4,000	5,698	0	0	1.535	1.455	1.451	1.384	1.354	1.436
1 L - 10	8	14:36:00	4,000	5,698	0	0	1.574	1.480	1.481	1.412	1.383	1.466
1 L - 11	1	14:39:30	4,400	6,265	0	0	1.671	1.576	1.576	1.508	1.474	1.561
1 L - 11	2	14:40:30	4,400	6,265	0	0	1.690	1.593	1.591	1.522	1.489	1.577
1 L - 11	4	14:42:30	4,400	6,265	0	0	1.720	1.617	1.614	1.544	1.512	1.602
1 L - 11	8	14:46:30	4,400	6,265	0	0	1.765	1.650	1.646	1.576	1.545	1.636
1 L - 12	1	14:50:00	4,800	6,832	0	0	1.866	1.741	1.735	1.668	1.629	1.728
1 L - 12	2	14:51:00	4,800	6,832	0	0	1.888	1.758	1.751	1.684	1.644	1.745
1 L - 12	4	14:53:00	4,800	6,832	0	0	1.929	1.790	1.780	1.714	1.673	1.777
1 L - 12	8	14:57:00	4,800	6,832	0	0	1.984	1.825	1.817	1.750	1.712	1.818
1 L - 13	1	15:02:00	5,200	7,399	0	0	2.128	1.938	1.926	1.863	1.813	1.933
1 L - 13	2	15:03:00	5,200	7,399	0	0	2.149	1.951	1.940	1.876	1.829	1.949
1 L - 13	4	15:05:00	5,200	7,399	0	0	2.189	1.979	1.967	1.902	1.854	1.978
1 L - 13	8	15:09:00	5,200	7,399	0	0	2.246	2.023	2.011	1.945	1.897	2.024
1 L - 14	1	15:14:00	5,600	7,965	0	0	2.383	2.141	2.124	2.063	2.003	2.143
1 L - 14	2	15:15:00	5,600	7,965	0	0	2.396	2.157	2.143	2.082	2.025	2.161
1 L - 14	4	15:17:00	5,600	7,965	0	0	2.447	2.189	2.174	2.114	2.049	2.194
1 L - 14	8	15:21:00	5,600	7,965	0	0	2.495	2.243	2.223	2.165	2.096	2.244
1 L - 15	1	15:27:00	6,000	8,532	0	0	2.694	2.399	2.390	2.332	2.240	2.411
1 L - 15	2	15:28:00	6,000	8,532	0	0	2.708	2.403	2.408	2.350	2.255	2.425
1 L - 15	4	15:30:00	6,000	8,532	0	0	2.753	2.452	2.443	2.384	2.284	2.463
1 L - 15	8	15:34:00	6,000	8,532	0	0	2.807	2.507	2.504	2.445	2.340	2.521
1 L - 16	1	15:38:30	6,300	8,957	0	0	2.972	2.648	2.661	2.600	2.463	2.669
1 L - 16	2	15:39:30	6,300	8,957	0	0	3.003	2.672	2.688	2.626	2.491	2.696
1 L - 16	4	15:41:30	6,150	8,745	0	0	3.029	2.700	2.712	2.650	2.510	2.721
1 U - 1	1	15:47:00	4,800	6,832	0	0	3.014	2.685	2.703	2.641	2.512	2.711
1 U - 1	2	15:48:00	4,800	6,832	0	0	3.017	2.686	2.704	2.644	2.509	2.712
1 U - 1	4	15:50:00	4,800	6,832	0	0	3.017	2.689	2.705	2.644	2.511	2.713
1 U - 2	1	15:54:00	3,200	4,565	0	0	3.018	2.648	2.648	2.582	2.447	2.669
1 U - 2	2	15:55:00	3,200	4,565	0	0	3.016	2.647	2.644	2.578	2.439	2.665
1 U - 2	4	15:57:00	3,200	4,565	0	0	3.016	2.646	2.641	2.576	2.432	2.662
1 U - 3	1	16:03:00	1,600	2,297	0	0	2.883	2.515	2.491	2.420	2.273	2.517
1 U - 3	2	16:04:00	1,600	2,297	0	0	2.849	2.507	2.488	2.417	2.272	2.507
1 U - 3	4	16:06:00	1,600	2,297	0	0	2.849	2.498	2.479	2.407	2.262	2.499
1 U - 4	1	16:11:00	0	0	0	0	2.201	1.919	1.879	1.752	1.756	1.901
1 U - 4	2	16:12:00	0	0	0	0	2.187	1.836	1.787	1.701	1.726	1.847
1 U - 4	4	16:14:00	0	0	0	0	2.163	1.792	1.733	1.668	1.698	1.811
1 U - 4	8	16:18:00	0	0	0	0	2.135	1.757	1.693	1.636	1.669	1.778
1 U - 4	16	16:26:00	0	0	0	0	2.080	1.720	1.653	1.604	1.636	1.739
1 U - 4	32	16:42:00	0	0	0	0	2.074	1.682	1.607	1.564	1.599	1.705
2 L - 0	1	16:43:00	0	0	0	0	2.074	1.679	1.605	1.562	1.598	1.704
2 L - 1	1	16:53:30	0	0	400	584	1.961	1.587	1.502	1.465	1.508	1.605
2 L - 1	2	16:54:30	0	0	400	584	1.962	1.584	1.501	1.464	1.507	1.603
2 L - 1	4	16:56:30	0	0	400	584	1.961	1.582	1.496	1.461	1.505	1.601
2 L - 1	8	17:00:30	0	0	400	584	1.948	1.577	1.491	1.455	1.499	1.594
2 L - 2	1	17:04:30	0	0	800	1,155	1.934	1.544	1.456	1.422	1.470	1.565
2 L - 2	2	17:05:30	0	0	800	1,155	1.913	1.541	1.453	1.419	1.463	1.558
2 L - 2	4	17:07:30	0	0	800	1,155	1.913	1.536	1.448	1.415	1.460	1.554
2 L - 2	8	17:11:30	0	0	800	1,155	1.914	1.533	1.444	1.411	1.456	1.552
2 L - 3	1	17:14:00	0	0	1,200	1,725	1.889	1.508	1.418	1.386	1.429	1.526
2 L - 3	2	17:15:00	0	0	1,200	1,725	1.888	1.505	1.415	1.384	1.429	1.524
2 L - 3	4	17:17:00	0	0	1,200	1,725	1.888	1.502	1.412	1.381	1.426	1.522
2 L - 3	8	17:21:00	0	0	1,200	1,725	1.887	1.497	1.406	1.377	1.422	1.518

Lower O-cell Expansion
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Lower O-cell Expansion A - 20367 (in)	B - 20368 (in)	C - 20369 (in)	D - 20370 (in)	E - 405 (in)	Average (in)
2L-4	1	17:23:30	0	0	1,600	2,296	1.864	1.470	1.377	1.349	1.395	1.491
2L-4	2	17:24:30	0	0	1,600	2,296	1.864	1.469	1.375	1.348	1.395	1.490
2L-4	4	17:26:30	0	0	1,600	2,296	1.843	1.466	1.373	1.346	1.390	1.483
2L-4	8	17:30:30	0	0	1,600	2,296	1.842	1.462	1.368	1.342	1.387	1.480
2L-5	1	17:33:00	0	0	2,000	2,866	1.816	1.434	1.337	1.311	1.358	1.451
2L-5	2	17:34:00	0	0	2,000	2,866	1.810	1.432	1.335	1.310	1.356	1.449
2L-5	4	17:36:00	0	0	2,000	2,866	1.809	1.429	1.333	1.308	1.354	1.447
2L-5	8	17:40:00	0	0	2,000	2,866	1.803	1.426	1.329	1.305	1.351	1.443
2L-6	1	17:42:30	0	0	2,400	3,436	1.770	1.400	1.302	1.278	1.327	1.415
2L-6	2	17:43:30	0	0	2,400	3,436	1.770	1.397	1.299	1.276	1.323	1.413
2L-6	4	17:45:30	0	0	2,400	3,436	1.770	1.395	1.296	1.273	1.321	1.411
2L-6	8	17:49:30	0	0	2,400	3,436	1.769	1.392	1.292	1.269	1.316	1.408
2L-7	1	17:51:30	0	0	2,800	4,007	1.764	1.366	1.264	1.242	1.292	1.385
2L-7	2	17:52:30	0	0	2,800	4,007	1.742	1.362	1.260	1.238	1.288	1.378
2L-7	4	17:54:30	0	0	2,800	4,007	1.742	1.359	1.255	1.235	1.284	1.375
2L-7	8	17:58:30	0	0	2,800	4,007	1.737	1.354	1.250	1.230	1.280	1.370
2L-8	1	18:00:30	0	0	3,200	4,577	1.709	1.325	1.216	1.197	1.249	1.339
2L-8	2	18:01:30	0	0	3,200	4,577	1.709	1.321	1.211	1.193	1.246	1.336
2L-8	4	18:03:30	0	0	3,200	4,577	1.698	1.318	1.207	1.190	1.243	1.331
2L-8	8	18:07:30	0	0	3,200	4,577	1.698	1.313	1.197	1.185	1.237	1.326
2L-9	1	18:09:30	0	0	3,600	5,148	1.661	1.278	1.157	1.147	1.204	1.289
2L-9	2	18:10:30	0	0	3,600	5,148	1.660	1.273	1.152	1.142	1.196	1.285
2L-9	4	18:12:30	0	0	3,600	5,148	1.653	1.267	1.145	1.137	1.191	1.278
2L-9	8	18:16:30	0	0	3,600	5,148	1.652	1.263	1.139	1.131	1.187	1.274
2L-10	1	18:18:30	0	0	4,000	5,718	1.595	1.225	1.098	1.090	1.149	1.231
2L-10	2	18:19:30	0	0	4,000	5,718	1.593	1.218	1.091	1.084	1.140	1.225
2L-10	4	18:21:30	0	0	4,000	5,718	1.593	1.212	1.085	1.078	1.136	1.221
2L-10	8	18:25:30	0	0	4,000	5,718	1.590	1.206	1.078	1.072	1.128	1.215
2L-11	1	18:28:00	0	0	4,400	6,288	1.543	1.165	1.034	1.028	1.087	1.172
2L-11	2	18:29:00	0	0	4,400	6,288	1.542	1.162	1.029	1.024	1.082	1.168
2L-11	4	18:31:00	0	0	4,400	6,288	1.536	1.153	1.021	1.016	1.074	1.160
2L-11	8	18:35:00	0	0	4,400	6,288	1.535	1.146	1.012	1.007	1.067	1.153
2L-12	1	18:38:00	0	0	4,800	6,859	1.486	1.096	0.955	0.950	1.015	1.101
2L-12	2	18:39:00	0	0	4,800	6,859	1.464	1.086	0.948	0.943	1.004	1.089
2L-12	4	18:41:00	0	0	4,800	6,859	1.462	1.079	0.940	0.935	0.997	1.083
2L-12	8	18:45:00	0	0	4,800	6,859	1.443	1.071	0.931	0.926	0.986	1.071
2L-13	1	18:47:30	0	0	5,200	7,429	1.405	1.020	0.878	0.873	0.940	1.023
2L-13	2	18:48:30	0	0	5,200	7,429	1.396	1.011	0.870	0.861	0.929	1.013
2L-13	4	18:50:30	0	0	5,200	7,429	1.390	1.002	0.860	0.851	0.919	1.004
2L-13	8	18:54:30	0	0	5,200	7,429	1.367	0.992	0.848	0.839	0.908	0.991
2L-14	1	18:58:00	0	0	5,600	8,000	1.298	0.928	0.786	0.780	0.843	0.927
2L-14	2	18:59:00	0	0	5,600	8,000	1.289	0.917	0.775	0.767	0.832	0.916
2L-14	4	19:01:00	0	0	5,600	8,000	1.275	0.905	0.764	0.756	0.818	0.904
2L-14	8	19:05:00	0	0	5,600	8,000	1.269	0.895	0.758	0.752	0.811	0.897
2L-15	1	19:07:30	0	0	6,000	8,570	1.208	0.837	0.732	0.737	0.759	0.855
2L-15	2	19:08:30	0	0	6,000	8,570	1.207	0.830	0.728	0.734	0.750	0.850
2L-15	4	19:10:30	0	0	6,000	8,570	1.205	0.822	0.723	0.730	0.740	0.844
2L-15	8	19:14:30	0	0	6,000	8,570	1.171	0.814	0.708	0.725	0.729	0.829
2L-16	1	19:17:00	0	0	6,400	9,140	1.125	0.775	0.678	0.693	0.682	0.791
2L-16	2	19:18:00	0	0	6,400	9,140	1.094	0.761	0.668	0.684	0.667	0.775
2L-16	4	19:20:00	0	0	6,400	9,140	1.080	0.745	0.655	0.673	0.649	0.760
2L-16	8	19:24:00	0	0	6,400	9,140	1.055	0.727	0.639	0.660	0.633	0.743
2L-17	1	19:27:30	0	0	6,800	9,711	0.948	0.625	0.524	0.561	0.527	0.637
2L-17	2	19:28:30	0	0	6,800	9,711	0.930	0.612	0.510	0.546	0.511	0.622
2L-17	4	19:30:30	0	0	6,800	9,711	0.907	0.589	0.486	0.520	0.487	0.598
2L-17	8	19:34:30	0	0	6,800	9,711	0.877	0.564	0.461	0.496	0.460	0.572
2L-18	1	19:39:30	0	0	7,200	10,281	0.776	0.477	0.374	0.406	0.358	0.478
2L-18	2	19:40:30	0	0	7,200	10,281	0.758	0.465	0.362	0.392	0.346	0.464
2L-18	4	19:42:30	0	0	7,200	10,281	0.741	0.450	0.347	0.375	0.326	0.448
2L-18	8	19:46:30	0	0	7,200	10,281	0.725	0.436	0.333	0.360	0.309	0.433
2L-19	1	19:51:00	0	0	7,600	10,852	0.662	0.392	0.289	0.315	0.252	0.382
2L-19	2	19:52:00	0	0	7,600	10,852	0.657	0.385	0.283	0.309	0.245	0.376
2L-19	4	19:54:00	0	0	7,600	10,852	0.636	0.377	0.275	0.303	0.236	0.366
2L-19	8	19:58:00	0	0	7,600	10,852	0.631	0.370	0.269	0.297	0.227	0.359
2L-20	1	20:04:00	0	0	8,000	11,422	0.583	0.344	0.244	0.276	0.197	0.329
2L-20	2	20:05:00	0	0	8,000	11,422	0.578	0.337	0.239	0.272	0.193	0.324
2L-20	4	20:07:00	0	0	8,000	11,422	0.577	0.329	0.232	0.266	0.184	0.318
2L-20	8	20:11:00	0	0	8,000	11,422	0.552	0.321	0.225	0.260	0.174	0.306
2L-21	1	20:15:00	0	0	8,400	11,992	0.525	0.298	0.204	0.243	0.151	0.284
2L-21	2	20:16:00	0	0	8,400	11,992	0.522	0.293	0.201	0.240	0.146	0.280
2L-21	4	20:18:00	0	0	8,400	11,992	0.517	0.289	0.197	0.237	0.143	0.277
2L-21	8	20:22:00	0	0	8,400	11,992	0.514	0.285	0.193	0.233	0.139	0.273
2L-22	1	20:29:30	0	0	8,800	12,563	0.469	0.256	0.171	0.212	0.115	0.245
2L-22	2	20:30:30	0	0	8,800	12,563	0.467	0.254	0.170	0.211	0.113	0.243
2L-22	4	20:32:30	0	0	8,800	12,563	0.466	0.251	0.167	0.208	0.111	0.241
2L-22	8	20:36:30	0	0	8,800	12,563	0.463	0.245	0.162	0.203	0.105	0.236
2U-1	1	20:40:00	0	0	6,600	9,426	0.461	0.247	0.166	0.208	0.106	0.237
2U-1	2	20:41:00	0	0	6,600	9,426	0.456	0.248	0.166	0.208	0.107	0.237
2U-1	4	20:43:00	0	0	6,600	9,426	0.455	0.247	0.166	0.208	0.107	0.237
2U-2	1	20:45:30	0	0	4,400	6,288	0.462	0.245	0.171	0.214	0.107	0.240
2U-2	2	20:46:30	0	0	4,400	6,288	0.461	0.245	0.171	0.214	0.107	0.239
2U-2	4	20:48:30	0	0	4,400	6,288	0.459	0.246	0.171	0.213	0.107	0.239
2U-3	1	20:50:30	0	0	2,200	3,151	0.461	0.256	0.177	0.221	0.109	0.245
2U-3	2	20:51:30	0	0	2,200	3,151	0.460	0.255	0.177	0.221	0.108	0.244
2U-3	4	20:53:30	0	0	2,200	3,151	0.463	0.256	0.177	0.222	0.111	0.246
2U-4	1	20:57:30	0	0	0	0	0.465	0.268	0.186	0.234	0.130	0.256
2U-4	2	20:58:30	0	0	0	0	0.464	0.268	0.185	0.233	0.129	0.256
2U-4	4	21:00:30	0	0	0	0	0.463	0.268	0.185	0.233	0.128	0.256
2U-4	8	21:04:30	0	0	0	0	0.463	0.268	0.185	0.232	0.127	0.255

LVWDTs A, B, C and D are oriented 90° opposed.
LVWDTs D and E are oriented 180° opposed on the 30-inch diameter cut-out plate (see Figure B).

Upward and Downward Lower O-cell Plate Movement and Creep (calculated)
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Top of Shaft (in)	Total Comp. * (in)	Top Plate Movement (in)	O-cell Expansion (in)	Bot. Plate Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
1L-0	-	12:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000		
1L-1	1	12:53:00	400	597	0	0	0.001	0.007	0.008	0.035	-0.027		
1L-1	2	12:54:00	400	597	0	0	0.002	0.008	0.010	0.041	-0.032	0.001	0.005
1L-1	4	12:56:00	400	597	0	0	0.002	0.009	0.010	0.047	-0.037	0.001	0.005
1L-1	8	13:00:00	400	597	0	0	0.003	0.009	0.012	0.052	-0.041	0.001	0.004
1L-2	1	13:03:00	800	1,164	0	0	0.003	0.016	0.019	0.124	-0.105		
1L-2	2	13:04:00	800	1,164	0	0	0.002	0.016	0.018	0.131	-0.112	-0.001	0.008
1L-2	4	13:06:00	800	1,164	0	0	0.002	0.017	0.019	0.141	-0.122	0.000	0.010
1L-2	8	13:10:00	800	1,164	0	0	0.003	0.017	0.020	0.150	-0.130	0.001	0.008
1L-3	1	13:13:00	1,200	1,731	0	0	0.008	0.021	0.029	0.249	-0.220		
1L-3	2	13:14:00	1,200	1,731	0	0	0.006	0.021	0.027	0.259	-0.233	-0.002	0.012
1L-3	4	13:16:00	1,200	1,731	0	0	0.006	0.022	0.028	0.275	-0.247	0.001	0.014
1L-3	8	13:20:00	1,200	1,731	0	0	0.005	0.022	0.026	0.293	-0.266	-0.002	0.019
1L-4	1	13:24:00	1,600	2,297	0	0	0.011	0.026	0.037	0.407	-0.370		
1L-4	2	13:25:00	1,600	2,297	0	0	0.011	0.026	0.037	0.419	-0.382	0.000	0.013
1L-4	4	13:27:00	1,600	2,297	0	0	0.011	0.026	0.037	0.436	-0.399	0.000	0.017
1L-4	8	13:31:00	1,600	2,297	0	0	0.011	0.026	0.037	0.456	-0.419	0.000	0.020
1L-5	1	13:34:30	2,000	2,864	0	0	0.011	0.030	0.042	0.582	-0.541		
1L-5	2	13:35:30	2,000	2,864	0	0	0.018	0.030	0.048	0.593	-0.546	0.006	0.005
1L-5	4	13:37:30	2,000	2,864	0	0	0.018	0.030	0.048	0.612	-0.564	0.000	0.018
1L-5	8	13:41:30	2,000	2,864	0	0	0.017	0.031	0.048	0.639	-0.591	0.000	0.027
1L-6	1	13:44:30	2,400	3,431	0	0	0.023	0.034	0.057	0.748	-0.691		
1L-6	2	13:45:30	2,400	3,431	0	0	0.023	0.034	0.057	0.760	-0.703	0.001	0.012
1L-6	4	13:47:30	2,400	3,431	0	0	0.023	0.035	0.058	0.785	-0.727	0.000	0.024
1L-6	8	13:51:30	2,400	3,431	0	0	0.023	0.035	0.058	0.811	-0.753	0.000	0.026
1L-7	1	13:57:00	2,800	3,998	0	0	0.029	0.037	0.067	0.917	-0.850		
1L-7	2	13:58:00	2,800	3,998	0	0	0.029	0.037	0.067	0.928	-0.862	0.000	0.011
1L-7	4	14:00:00	2,800	3,998	0	0	0.031	0.037	0.068	0.946	-0.878	0.001	0.016
1L-7	8	14:04:00	2,800	3,998	0	0	0.031	0.037	0.068	0.968	-0.900	0.000	0.022
1L-8	1	14:08:00	3,200	4,565	0	0	0.037	0.040	0.076	1.062	-0.986		
1L-8	2	14:09:00	3,200	4,565	0	0	0.036	0.040	0.076	1.078	-1.002	0.000	0.016
1L-8	4	14:11:00	3,200	4,565	0	0	0.037	0.040	0.077	1.101	-1.024	0.001	0.022
1L-8	8	14:15:00	3,200	4,565	0	0	0.037	0.040	0.077	1.127	-1.050	0.000	0.026
1L-9	1	14:18:30	3,600	5,131	0	0	0.045	0.043	0.087	1.232	-1.144		
1L-9	2	14:19:30	3,600	5,131	0	0	0.047	0.043	0.089	1.243	-1.154	0.002	0.010
1L-9	4	14:21:30	3,600	5,131	0	0	0.047	0.043	0.090	1.265	-1.175	0.001	0.021
1L-9	8	14:25:30	3,600	5,131	0	0	0.049	0.042	0.091	1.295	-1.204	0.001	0.029
1L-10	1	14:29:00	4,000	5,698	0	0	0.054	0.045	0.099	1.390	-1.291		
1L-10	2	14:30:00	4,000	5,698	0	0	0.055	0.045	0.099	1.407	-1.307	0.000	0.017
1L-10	4	14:32:00	4,000	5,698	0	0	0.056	0.044	0.100	1.436	-1.335	0.001	0.028
1L-10	8	14:36:00	4,000	5,698	0	0	0.057	0.043	0.100	1.466	-1.366	0.000	0.030
1L-11	1	14:39:30	4,400	6,265	0	0	0.064	0.046	0.110	1.561	-1.451		
1L-11	2	14:40:30	4,400	6,265	0	0	0.064	0.046	0.110	1.577	-1.467	0.000	0.016
1L-11	4	14:42:30	4,400	6,265	0	0	0.066	0.046	0.111	1.602	-1.490	0.001	0.023
1L-11	8	14:46:30	4,400	6,265	0	0	0.067	0.046	0.113	1.636	-1.523	0.002	0.033
1L-12	1	14:50:00	4,800	6,832	0	0	0.073	0.048	0.121	1.728	-1.607		
1L-12	2	14:51:00	4,800	6,832	0	0	0.074	0.048	0.122	1.745	-1.623	0.001	0.016
1L-12	4	14:53:00	4,800	6,832	0	0	0.078	0.048	0.125	1.777	-1.652	0.004	0.029
1L-12	8	14:57:00	4,800	6,832	0	0	0.079	0.048	0.127	1.818	-1.691	0.002	0.039
1L-13	1	15:02:00	5,200	7,399	0	0	0.083	0.050	0.133	1.933	-1.800		
1L-13	2	15:03:00	5,200	7,399	0	0	0.086	0.050	0.136	1.949	-1.813	0.002	0.013
1L-13	4	15:05:00	5,200	7,399	0	0	0.087	0.050	0.137	1.978	-1.841	0.001	0.028
1L-13	8	15:09:00	5,200	7,399	0	0	0.088	0.051	0.138	2.024	-1.886	0.001	0.045
1L-14	1	15:14:00	5,600	7,965	0	0	0.096	0.053	0.149	2.143	-1.994		
1L-14	2	15:15:00	5,600	7,965	0	0	0.097	0.053	0.150	2.161	-2.010	0.001	0.017
1L-14	4	15:17:00	5,600	7,965	0	0	0.099	0.053	0.152	2.194	-2.043	0.002	0.032
1L-14	8	15:21:00	5,600	7,965	0	0	0.101	0.053	0.154	2.244	-2.091	0.002	0.048
1L-15	1	15:27:00	6,000	8,532	0	0	0.111	0.056	0.166	2.411	-2.245		
1L-15	2	15:28:00	6,000	8,532	0	0	0.109	0.056	0.164	2.425	-2.260	-0.002	0.016
1L-15	4	15:30:00	6,000	8,532	0	0	0.112	0.056	0.168	2.463	-2.296	0.003	0.036
1L-15	8	15:34:00	6,000	8,532	0	0	0.117	0.056	0.173	2.521	-2.348	0.005	0.052
1L-16	1	15:38:30	6,300	8,957	0	0	0.125	0.059	0.183	2.669	-2.485		
1L-16	2	15:39:30	6,300	8,957	0	0	0.124	0.059	0.183	2.696	-2.513	-0.001	0.028
1L-16	4	15:41:30	6,150	8,745	0	0	0.127	0.058	0.185	2.721	-2.536	0.002	0.023
1U-1	1	15:47:00	4,800	6,832	0	0	0.125	0.055	0.179	2.711	-2.532		
1U-1	2	15:48:00	4,800	6,832	0	0	0.125	0.055	0.179	2.712	-2.533		
1U-1	4	15:50:00	4,800	6,832	0	0	0.125	0.054	0.179	2.713	-2.535		
1U-2	1	15:54:00	3,200	4,565	0	0	0.121	0.049	0.170	2.669	-2.499		
1U-2	2	15:55:00	3,200	4,565	0	0	0.118	0.049	0.167	2.665	-2.498		
1U-2	4	15:57:00	3,200	4,565	0	0	0.122	0.049	0.171	2.662	-2.492		
1U-3	1	16:03:00	1,600	2,297	0	0	0.111	0.039	0.150	2.517	-2.367		
1U-3	2	16:04:00	1,600	2,297	0	0	0.116	0.039	0.155	2.507	-2.352		
1U-3	4	16:06:00	1,600	2,297	0	0	0.111	0.038	0.149	2.499	-2.350		
1U-4	1	16:11:00	0	0	0	0	0.090	0.018	0.109	1.901	-1.793		
1U-4	2	16:12:00	0	0	0	0	0.089	0.017	0.106	1.847	-1.741		
1U-4	4	16:14:00	0	0	0	0	0.088	0.017	0.105	1.811	-1.706		
1U-4	8	16:18:00	0	0	0	0	0.088	0.017	0.105	1.778	-1.673		
1U-4	16	16:26:00	0	0	0	0	0.088	0.017	0.105	1.739	-1.634		
1U-4	32	16:42:00	0	0	0	0	0.084	0.016	0.100	1.705	-1.605		
2L-0	1	16:43:00	0	0	0	0	0.086	0.016	0.102	1.704	-1.602		
2L-1	1	16:53:30	0	0	400	584	0.085	-0.061	0.024	1.605	-1.581		
2L-1	2	16:54:30	0	0	400	584	0.085	-0.062	0.023	1.603	-1.580		
2L-1	4	16:56:30	0	0	400	584	0.086	-0.063	0.023	1.601	-1.578		
2L-1	8	17:00:30	0	0	400	584	0.085	-0.064	0.020	1.594	-1.574		
2L-2	1	17:04:30	0	0	800	1,155	0.085	-0.094	-0.010	1.565	-1.575		
2L-2	2	17:05:30	0	0	800	1,155	0.087	-0.097	-0.010	1.558	-1.568		
2L-2	4	17:07:30	0	0	800	1,155	0.086	-0.099	-0.013	1.554	-1.568		
2L-2	8	17:11:30	0	0	800	1,155	0.086	-0.099	-0.013	1.552	-1.565		
2L-3	1	17:14:00	0	0	1,200	1,725	0.088	-0.126	-0.038	1.526	-1.563		
2L-3	2	17:15:00	0	0	1,200	1,725	0.090	-0.127	-0.037	1.524	-1.561		
2L-3	4	17:17:00	0	0	1,200	1,725	0.088	-0.128	-0.041	1.522	-1.563		
2L-3	8	17:21:00	0	0	1,200	1,725	0.088	-0.130	-0.042	1.518	-1.559		

Upward and Downward Lower O-cell Plate Movement and Creep (calculated)
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Top of Shaft (in)	Total Comp. * (in)	Top Plate Movement (in)	O-cell Expansion (in)	Bot. Plate Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
2 L - 4	1	17:23:30	0	0	1,600	2,296	0.091	-0.159	-0.069	1.491	-1.560		
2 L - 4	2	17:24:30	0	0	1,600	2,296	0.089	-0.160	-0.071	1.490	-1.561		
2 L - 4	4	17:26:30	0	0	1,600	2,296	0.090	-0.162	-0.072	1.483	-1.555		
2 L - 4	8	17:30:30	0	0	1,600	2,296	0.089	-0.163	-0.074	1.480	-1.554		
2 L - 5	1	17:33:00	0	0	2,000	2,866	0.096	-0.196	-0.100	1.451	-1.552		
2 L - 5	2	17:34:00	0	0	2,000	2,866	0.095	-0.196	-0.101	1.449	-1.550		
2 L - 5	4	17:36:00	0	0	2,000	2,866	0.095	-0.198	-0.103	1.447	-1.550		
2 L - 5	8	17:40:00	0	0	2,000	2,866	0.095	-0.199	-0.104	1.443	-1.547		
2 L - 6	1	17:42:30	0	0	2,400	3,436	0.099	-0.230	-0.131	1.415	-1.546		
2 L - 6	2	17:43:30	0	0	2,400	3,436	0.099	-0.231	-0.132	1.413	-1.545		
2 L - 6	4	17:45:30	0	0	2,400	3,436	0.099	-0.234	-0.135	1.411	-1.545		
2 L - 6	8	17:49:30	0	0	2,400	3,436	0.100	-0.237	-0.137	1.408	-1.544		
2 L - 7	1	17:51:30	0	0	2,800	4,007	0.104	-0.269	-0.165	1.385	-1.551		
2 L - 7	2	17:52:30	0	0	2,800	4,007	0.105	-0.273	-0.169	1.378	-1.546		
2 L - 7	4	17:54:30	0	0	2,800	4,007	0.104	-0.276	-0.173	1.375	-1.548		
2 L - 7	8	17:58:30	0	0	2,800	4,007	0.105	-0.279	-0.174	1.370	-1.545		
2 L - 8	1	18:00:30	0	0	3,200	4,577	0.110	-0.318	-0.208	1.339	-1.547		
2 L - 8	2	18:01:30	0	0	3,200	4,577	0.111	-0.322	-0.211	1.336	-1.547		
2 L - 8	4	18:03:30	0	0	3,200	4,577	0.112	-0.325	-0.214	1.331	-1.545		
2 L - 8	8	18:07:30	0	0	3,200	4,577	0.112	-0.329	-0.217	1.326	-1.543		
2 L - 9	1	18:09:30	0	0	3,600	5,148	0.118	-0.375	-0.258	1.289	-1.547		
2 L - 9	2	18:10:30	0	0	3,600	5,148	0.119	-0.380	-0.262	1.285	-1.546		
2 L - 9	4	18:12:30	0	0	3,600	5,148	0.120	-0.386	-0.266	1.278	-1.545		
2 L - 9	8	18:16:30	0	0	3,600	5,148	0.119	-0.392	-0.273	1.274	-1.547		
2 L - 10	1	18:18:30	0	0	4,000	5,718	0.129	-0.444	-0.315	1.231	-1.546		
2 L - 10	2	18:19:30	0	0	4,000	5,718	0.131	-0.451	-0.321	1.225	-1.546		
2 L - 10	4	18:21:30	0	0	4,000	5,718	0.133	-0.459	-0.327	1.221	-1.548		
2 L - 10	8	18:25:30	0	0	4,000	5,718	0.135	-0.467	-0.332	1.215	-1.546		
2 L - 11	1	18:28:00	0	0	4,400	6,288	0.149	-0.525	-0.376	1.172	-1.548		
2 L - 11	2	18:29:00	0	0	4,400	6,288	0.151	-0.532	-0.381	1.168	-1.549		
2 L - 11	4	18:31:00	0	0	4,400	6,288	0.152	-0.542	-0.390	1.160	-1.551		
2 L - 11	8	18:35:00	0	0	4,400	6,288	0.155	-0.554	-0.399	1.153	-1.552		
2 L - 12	1	18:38:00	0	0	4,800	6,859	0.171	-0.629	-0.458	1.101	-1.559		
2 L - 12	2	18:39:00	0	0	4,800	6,859	0.175	-0.640	-0.465	1.089	-1.554		
2 L - 12	4	18:41:00	0	0	4,800	6,859	0.177	-0.652	-0.475	1.083	-1.557		
2 L - 12	8	18:45:00	0	0	4,800	6,859	0.181	-0.664	-0.483	1.071	-1.554		
2 L - 13	1	18:47:30	0	0	5,200	7,429	0.198	-0.738	-0.541	1.023	-1.564		
2 L - 13	2	18:48:30	0	0	5,200	7,429	0.201	-0.750	-0.549	1.013	-1.563		
2 L - 13	4	18:50:30	0	0	5,200	7,429	0.206	-0.764	-0.558	1.004	-1.562		
2 L - 13	8	18:54:30	0	0	5,200	7,429	0.210	-0.781	-0.571	0.991	-1.562		
2 L - 14	1	18:58:00	0	0	5,600	8,000	0.229	-0.870	-0.641	0.927	-1.567		
2 L - 14	2	18:59:00	0	0	5,600	8,000	0.232	-0.884	-0.652	0.916	-1.568		
2 L - 14	4	19:01:00	0	0	5,600	8,000	0.237	-0.899	-0.663	0.904	-1.567		
2 L - 14	8	19:05:00	0	0	5,600	8,000	0.240	-0.913	-0.673	0.897	-1.570		
2 L - 15	1	19:07:30	0	0	6,000	8,570	0.258	-0.992	-0.735	0.855	-1.590		
2 L - 15	2	19:08:30	0	0	6,000	8,570	0.262	-1.007	-0.746	0.850	-1.596		
2 L - 15	4	19:10:30	0	0	6,000	8,570	0.267	-1.025	-0.758	0.844	-1.602		
2 L - 15	8	19:14:30	0	0	6,000	8,570	0.273	-1.045	-0.773	0.829	-1.602		
2 L - 16	1	19:17:00	0	0	6,400	9,140	0.289	-1.120	-0.831	0.791	-1.622		
2 L - 16	2	19:18:00	0	0	6,400	9,140	0.294	-1.143	-0.849	0.775	-1.623		
2 L - 16	4	19:20:00	0	0	6,400	9,140	0.300	-1.166	-0.866	0.760	-1.627		
2 L - 16	8	19:24:00	0	0	6,400	9,140	0.304	-1.192	-0.888	0.743	-1.631		
2 L - 17	1	19:27:30	0	0	6,800	9,711	0.328	-1.332	-1.004	0.637	-1.641		
2 L - 17	2	19:28:30	0	0	6,800	9,711	0.331	-1.353	-1.023	0.622	-1.645		
2 L - 17	4	19:30:30	0	0	6,800	9,711	0.337	-1.388	-1.051	0.598	-1.649		
2 L - 17	8	19:34:30	0	0	6,800	9,711	0.345	-1.424	-1.079	0.572	-1.650		
2 L - 18	1	19:39:30	0	0	7,200	10,281	0.370	-1.565	-1.195	0.478	-1.673		
2 L - 18	2	19:40:30	0	0	7,200	10,281	0.374	-1.587	-1.214	0.464	-1.678		
2 L - 18	4	19:42:30	0	0	7,200	10,281	0.380	-1.616	-1.236	0.448	-1.684		
2 L - 18	8	19:46:30	0	0	7,200	10,281	0.387	-1.649	-1.262	0.433	-1.694		
2 L - 19	1	19:51:00	0	0	7,600	10,852	0.413	-1.762	-1.349	0.382	-1.731		
2 L - 19	2	19:52:00	0	0	7,600	10,852	0.419	-1.782	-1.363	0.376	-1.739		
2 L - 19	4	19:54:00	0	0	7,600	10,852	0.427	-1.806	-1.379	0.365	-1.744		
2 L - 19	8	19:58:00	0	0	7,600	10,852	0.435	-1.835	-1.401	0.359	-1.760		
2 L - 20	1	20:04:00	0	0	8,000	11,422	0.462	-1.924	-1.462	0.329	-1.791		
2 L - 20	2	20:05:00	0	0	8,000	11,422	0.467	-1.944	-1.477	0.324	-1.801		
2 L - 20	4	20:07:00	0	0	8,000	11,422	0.477	-1.973	-1.496	0.318	-1.814		
2 L - 20	8	20:11:00	0	0	8,000	11,422	0.489	-2.007	-1.518	0.306	-1.825		
2 L - 21	1	20:15:00	0	0	8,400	11,992	0.516	-2.088	-1.572	0.284	-1.856		
2 L - 21	2	20:16:00	0	0	8,400	11,992	0.521	-2.102	-1.582	0.280	-1.862		
2 L - 21	4	20:18:00	0	0	8,400	11,992	0.526	-2.120	-1.594	0.277	-1.871		
2 L - 21	8	20:22:00	0	0	8,400	11,992	0.533	-2.142	-1.609	0.273	-1.882		
2 L - 22	1	20:29:30	0	0	8,800	12,563	0.580	-2.259	-1.679	0.245	-1.924		
2 L - 22	2	20:30:30	0	0	8,800	12,563	0.582	-2.266	-1.684	0.243	-1.927		
2 L - 22	4	20:32:30	0	0	8,800	12,563	0.588	-2.283	-1.695	0.241	-1.935		
2 L - 22	8	20:36:30	0	0	8,800	12,563	0.603	-2.318	-1.715	0.236	-1.950		
2 U - 1	1	20:40:00	0	0	6,600	9,426	0.594	-2.278	-1.685	0.237	-1.922		
2 U - 1	2	20:41:00	0	0	6,600	9,426	0.593	-2.275	-1.683	0.237	-1.920		
2 U - 1	4	20:43:00	0	0	6,600	9,426	0.592	-2.273	-1.682	0.237	-1.919		
2 U - 2	1	20:45:30	0	0	4,400	6,288	0.576	-2.210	-1.634	0.240	-1.874		
2 U - 2	2	20:46:30	0	0	4,400	6,288	0.577	-2.209	-1.632	0.239	-1.871		
2 U - 2	4	20:48:30	0	0	4,400	6,288	0.575	-2.208	-1.633	0.239	-1.872		
2 U - 3	1	20:50:30	0	0	2,200	3,151	0.552	-2.128	-1.576	0.245	-1.821		
2 U - 3	2	20:51:30	0	0	2,200	3,151	0.553	-2.128	-1.575	0.244	-1.819		
2 U - 3	4	20:53:30	0	0	2,200	3,151	0.551	-2.118	-1.568	0.246	-1.814		
2 U - 4	1	20:57:30	0	0	0	0	0.507	-1.985	-1.479	0.256	-1.735		
2 U - 4	2	20:58:30	0	0	0	0	0.505	-1.982	-1.477	0.256	-1.733		
2 U - 4	4	21:00:30	0	0	0	0	0.505	-1.979	-1.475	0.256	-1.730		
2 U - 4	8	21:04:30	0	0	0	0	0.503	-1.975	-1.472	0.255	-1.727		

* Elastic compression above the lower O-cells (Telltales + ECTs - upper O-cell expansion).

Upper O-cell Expansion
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Upper O-cell Expansion A - 19369* (in)	B - 19370 (in)	C - 19371 (in)	D - 19372 (in)	Average (in)
1 L - 0	-	12:38:00	0	0	0	0	-	0.000	0.000	0.000	0.000
1 L - 1	1	12:53:00	400	597	0	0	-	-0.004	-0.007	-0.004	-0.005
1 L - 1	2	12:54:00	400	597	0	0	-	-0.005	-0.008	-0.004	-0.006
1 L - 1	4	12:56:00	400	597	0	0	-	-0.005	-0.009	-0.004	-0.006
1 L - 1	8	13:00:00	400	597	0	0	-	-0.005	-0.010	-0.005	-0.006
1 L - 2	1	13:03:00	800	1,164	0	0	-	-0.007	-0.017	-0.007	-0.011
1 L - 2	2	13:04:00	800	1,164	0	0	-	-0.007	-0.018	-0.007	-0.011
1 L - 2	4	13:06:00	800	1,164	0	0	-	-0.007	-0.018	-0.007	-0.011
1 L - 2	8	13:10:00	800	1,164	0	0	-	-0.008	-0.018	-0.007	-0.011
1 L - 3	1	13:13:00	1,200	1,731	0	0	-	-0.009	-0.019	-0.009	-0.012
1 L - 3	2	13:14:00	1,200	1,731	0	0	-	-0.009	-0.020	-0.009	-0.013
1 L - 3	4	13:16:00	1,200	1,731	0	0	-	-0.009	-0.020	-0.009	-0.013
1 L - 3	8	13:20:00	1,200	1,731	0	0	-	-0.009	-0.020	-0.009	-0.013
1 L - 4	1	13:24:00	1,600	2,297	0	0	-	-0.010	-0.021	-0.011	-0.014
1 L - 4	2	13:25:00	1,600	2,297	0	0	-	-0.010	-0.021	-0.011	-0.014
1 L - 4	4	13:27:00	1,600	2,297	0	0	-	-0.010	-0.022	-0.011	-0.014
1 L - 4	8	13:31:00	1,600	2,297	0	0	-	-0.010	-0.021	-0.011	-0.014
1 L - 5	1	13:34:30	2,000	2,864	0	0	-	-0.011	-0.022	-0.012	-0.015
1 L - 5	2	13:35:30	2,000	2,864	0	0	-	-0.011	-0.022	-0.012	-0.015
1 L - 5	4	13:37:30	2,000	2,864	0	0	-	-0.011	-0.022	-0.012	-0.015
1 L - 5	8	13:41:30	2,000	2,864	0	0	-	-0.011	-0.023	-0.012	-0.015
1 L - 6	1	13:44:30	2,400	3,431	0	0	-	-0.012	-0.023	-0.013	-0.016
1 L - 6	2	13:45:30	2,400	3,431	0	0	-	-0.012	-0.023	-0.013	-0.016
1 L - 6	4	13:47:30	2,400	3,431	0	0	-	-0.012	-0.023	-0.013	-0.016
1 L - 6	8	13:51:30	2,400	3,431	0	0	-	-0.012	-0.023	-0.013	-0.016
1 L - 7	1	13:57:00	2,800	3,998	0	0	-	-0.012	-0.024	-0.014	-0.017
1 L - 7	2	13:58:00	2,800	3,998	0	0	-	-0.013	-0.024	-0.014	-0.017
1 L - 7	4	14:00:00	2,800	3,998	0	0	-	-0.013	-0.024	-0.014	-0.017
1 L - 7	8	14:04:00	2,800	3,998	0	0	-	-0.013	-0.024	-0.014	-0.017
1 L - 8	1	14:08:00	3,200	4,565	0	0	-	-0.013	-0.024	-0.015	-0.017
1 L - 8	2	14:09:00	3,200	4,565	0	0	-	-0.013	-0.025	-0.015	-0.018
1 L - 8	4	14:11:00	3,200	4,565	0	0	-	-0.013	-0.025	-0.016	-0.018
1 L - 8	8	14:15:00	3,200	4,565	0	0	-	-0.013	-0.024	-0.016	-0.018
1 L - 9	1	14:18:30	3,600	5,131	0	0	-	-0.014	-0.025	-0.017	-0.019
1 L - 9	2	14:19:30	3,600	5,131	0	0	-	-0.014	-0.025	-0.017	-0.019
1 L - 9	4	14:21:30	3,600	5,131	0	0	-	-0.014	-0.025	-0.017	-0.019
1 L - 9	8	14:25:30	3,600	5,131	0	0	-	-0.014	-0.022	-0.017	-0.017
1 L - 10	1	14:29:00	4,000	5,698	0	0	-	-0.014	-0.025	-0.018	-0.019
1 L - 10	2	14:30:00	4,000	5,698	0	0	-	-0.014	-0.025	-0.018	-0.019
1 L - 10	4	14:32:00	4,000	5,698	0	0	-	-0.014	-0.023	-0.018	-0.018
1 L - 10	8	14:36:00	4,000	5,698	0	0	-	-0.014	-0.020	-0.018	-0.017
1 L - 11	1	14:39:30	4,400	6,265	0	0	-	-0.015	-0.022	-0.019	-0.018
1 L - 11	2	14:40:30	4,400	6,265	0	0	-	-0.015	-0.022	-0.019	-0.018
1 L - 11	4	14:42:30	4,400	6,265	0	0	-	-0.015	-0.021	-0.019	-0.018
1 L - 11	8	14:46:30	4,400	6,265	0	0	-	-0.015	-0.021	-0.019	-0.018
1 L - 12	1	14:50:00	4,800	6,832	0	0	-	-0.015	-0.023	-0.020	-0.019
1 L - 12	2	14:51:00	4,800	6,832	0	0	-	-0.015	-0.021	-0.020	-0.019
1 L - 12	4	14:53:00	4,800	6,832	0	0	-	-0.015	-0.021	-0.020	-0.019
1 L - 12	8	14:57:00	4,800	6,832	0	0	-	-0.015	-0.021	-0.020	-0.019
1 L - 13	1	15:02:00	5,200	7,399	0	0	-	-0.015	-0.021	-0.021	-0.019
1 L - 13	2	15:03:00	5,200	7,399	0	0	-	-0.016	-0.021	-0.021	-0.019
1 L - 13	4	15:05:00	5,200	7,399	0	0	-	-0.016	-0.021	-0.021	-0.019
1 L - 13	8	15:09:00	5,200	7,399	0	0	-	-0.016	-0.021	-0.021	-0.019
1 L - 14	1	15:14:00	5,600	7,965	0	0	-	-0.016	-0.022	-0.022	-0.020
1 L - 14	2	15:15:00	5,600	7,965	0	0	-	-0.016	-0.022	-0.022	-0.020
1 L - 14	4	15:17:00	5,600	7,966	0	0	-	-0.016	-0.022	-0.022	-0.020
1 L - 14	8	15:21:00	5,600	7,965	0	0	-	-0.016	-0.022	-0.022	-0.020
1 L - 15	1	15:27:00	6,000	8,532	0	0	-	-0.017	-0.023	-0.023	-0.021
1 L - 15	2	15:28:00	6,000	8,532	0	0	-	-0.017	-0.023	-0.023	-0.021
1 L - 15	4	15:30:00	6,000	8,532	0	0	-	-0.017	-0.023	-0.023	-0.021
1 L - 15	8	15:34:00	6,000	8,532	0	0	-	-0.017	-0.023	-0.023	-0.021
1 L - 16	1	15:38:30	6,300	8,957	0	0	-	-0.017	-0.024	-0.024	-0.022
1 L - 16	2	15:39:30	6,300	8,957	0	0	-	-0.017	-0.024	-0.024	-0.022
1 L - 16	4	15:41:30	6,150	8,745	0	0	-	-0.017	-0.022	-0.024	-0.021
1 U - 1	1	15:47:00	4,800	6,832	0	0	-	-0.017	-0.021	-0.023	-0.020
1 U - 1	2	15:48:00	4,800	6,832	0	0	-	-0.017	-0.021	-0.023	-0.020
1 U - 1	4	15:50:00	4,800	6,832	0	0	-	-0.017	-0.020	-0.023	-0.020
1 U - 2	1	15:54:00	3,200	4,565	0	0	-	-0.016	-0.020	-0.021	-0.019
1 U - 2	2	15:55:00	3,200	4,565	0	0	-	-0.016	-0.021	-0.021	-0.019
1 U - 2	4	15:57:00	3,200	4,565	0	0	-	-0.016	-0.021	-0.021	-0.019
1 U - 3	1	16:03:00	1,600	2,297	0	0	-	-0.014	-0.019	-0.018	-0.017
1 U - 3	2	16:04:00	1,600	2,297	0	0	-	-0.014	-0.019	-0.018	-0.017
1 U - 3	4	16:06:00	1,600	2,297	0	0	-	-0.014	-0.019	-0.018	-0.017
1 U - 4	1	16:11:00	0	0	0	0	-	-0.008	-0.009	-0.010	-0.009
1 U - 4	2	16:12:00	0	0	0	0	-	-0.008	-0.008	-0.010	-0.009
1 U - 4	4	16:14:00	0	0	0	0	-	-0.008	-0.008	-0.010	-0.008
1 U - 4	8	16:18:00	0	0	0	0	-	-0.007	-0.008	-0.010	-0.008
1 U - 4	16	16:26:00	0	0	0	0	-	-0.007	-0.007	-0.010	-0.008
1 U - 4	32	16:42:00	0	0	0	0	-	-0.007	-0.007	-0.010	-0.008
2 L - 0	1	16:43:00	0	0	0	0	-	-0.007	-0.007	-0.009	-0.008
2 L - 1	1	16:53:30	0	0	400	584	-	0.075	0.066	0.067	0.069
2 L - 1	2	16:54:30	0	0	400	584	-	0.076	0.067	0.067	0.070
2 L - 1	4	16:56:30	0	0	400	584	-	0.077	0.068	0.069	0.071
2 L - 1	8	17:00:30	0	0	400	584	-	0.078	0.070	0.070	0.073
2 L - 2	1	17:04:30	0	0	800	1,155	-	0.110	0.100	0.101	0.104
2 L - 2	2	17:05:30	0	0	800	1,155	-	0.113	0.103	0.104	0.107
2 L - 2	4	17:07:30	0	0	800	1,155	-	0.114	0.106	0.106	0.109
2 L - 2	8	17:11:30	0	0	800	1,155	-	0.115	0.106	0.106	0.109
2 L - 3	1	17:14:00	0	0	1,200	1,725	-	0.144	0.134	0.132	0.137
2 L - 3	2	17:15:00	0	0	1,200	1,725	-	0.145	0.136	0.133	0.138
2 L - 3	4	17:17:00	0	0	1,200	1,725	-	0.146	0.137	0.134	0.139
2 L - 3	8	17:21:00	0	0	1,200	1,725	-	0.147	0.139	0.135	0.141

Upper O-cell Expansion
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Upper O-cell Expansion A - 19369* (in)	B - 19370 (in)	C - 19371 (in)	D - 19372 (in)	Average (in)
2L-4	1	17:23:30	0	0	1,600	2,296	-	0.180	0.172	0.162	0.171
2L-4	2	17:24:30	0	0	1,600	2,296	-	0.180	0.173	0.162	0.172
2L-4	4	17:26:30	0	0	1,600	2,296	-	0.182	0.175	0.163	0.173
2L-4	8	17:30:30	0	0	1,600	2,296	-	0.183	0.178	0.165	0.175
2L-5	1	17:33:00	0	0	2,000	2,866	-	0.220	0.213	0.195	0.209
2L-5	2	17:34:00	0	0	2,000	2,866	-	0.220	0.214	0.195	0.210
2L-5	4	17:36:00	0	0	2,000	2,866	-	0.222	0.215	0.197	0.211
2L-5	8	17:40:00	0	0	2,000	2,866	-	0.223	0.216	0.198	0.213
2L-6	1	17:42:30	0	0	2,400	3,436	-	0.257	0.248	0.229	0.245
2L-6	2	17:43:30	0	0	2,400	3,436	-	0.258	0.250	0.230	0.246
2L-6	4	17:45:30	0	0	2,400	3,436	-	0.261	0.253	0.233	0.249
2L-6	8	17:49:30	0	0	2,400	3,436	-	0.263	0.258	0.235	0.252
2L-7	1	17:51:30	0	0	2,800	4,007	-	0.298	0.293	0.267	0.286
2L-7	2	17:52:30	0	0	2,800	4,007	-	0.302	0.297	0.271	0.290
2L-7	4	17:54:30	0	0	2,800	4,007	-	0.305	0.301	0.274	0.293
2L-7	8	17:58:30	0	0	2,800	4,007	-	0.308	0.304	0.277	0.296
2L-8	1	18:00:30	0	0	3,200	4,577	-	0.349	0.346	0.317	0.337
2L-8	2	18:01:30	0	0	3,200	4,577	-	0.352	0.349	0.320	0.340
2L-8	4	18:03:30	0	0	3,200	4,577	-	0.356	0.353	0.324	0.344
2L-8	8	18:07:30	0	0	3,200	4,577	-	0.360	0.356	0.327	0.348
2L-9	1	18:09:30	0	0	3,600	5,148	-	0.409	0.406	0.375	0.397
2L-9	2	18:10:30	0	0	3,600	5,148	-	0.414	0.411	0.380	0.402
2L-9	4	18:12:30	0	0	3,600	5,148	-	0.420	0.418	0.386	0.408
2L-9	8	18:16:30	0	0	3,600	5,148	-	0.426	0.424	0.392	0.414
2L-10	1	18:18:30	0	0	4,000	5,718	-	0.480	0.479	0.444	0.468
2L-10	2	18:19:30	0	0	4,000	5,718	-	0.487	0.486	0.452	0.475
2L-10	4	18:21:30	0	0	4,000	5,718	-	0.495	0.496	0.459	0.483
2L-10	8	18:25:30	0	0	4,000	5,718	-	0.503	0.503	0.467	0.491
2L-11	1	18:28:00	0	0	4,400	6,288	-	0.563	0.563	0.526	0.551
2L-11	2	18:29:00	0	0	4,400	6,288	-	0.570	0.570	0.533	0.558
2L-11	4	18:31:00	0	0	4,400	6,288	-	0.581	0.581	0.543	0.569
2L-11	8	18:35:00	0	0	4,400	6,288	-	0.592	0.592	0.555	0.580
2L-12	1	18:38:00	0	0	4,800	6,859	-	0.668	0.671	0.631	0.657
2L-12	2	18:39:00	0	0	4,800	6,859	-	0.680	0.683	0.643	0.668
2L-12	4	18:41:00	0	0	4,800	6,859	-	0.691	0.694	0.654	0.680
2L-12	8	18:45:00	0	0	4,800	6,859	-	0.703	0.707	0.667	0.692
2L-13	1	18:47:30	0	0	5,200	7,429	-	0.778	0.784	0.743	0.768
2L-13	2	18:48:30	0	0	5,200	7,429	-	0.790	0.797	0.754	0.780
2L-13	4	18:50:30	0	0	5,200	7,429	-	0.804	0.811	0.768	0.794
2L-13	8	18:54:30	0	0	5,200	7,429	-	0.821	0.828	0.784	0.811
2L-14	1	18:58:00	0	0	5,600	8,000	-	0.912	0.919	0.875	0.902
2L-14	2	18:59:00	0	0	5,600	8,000	-	0.926	0.934	0.891	0.917
2L-14	4	19:01:00	0	0	5,600	8,000	-	0.941	0.950	0.905	0.932
2L-14	8	19:05:00	0	0	5,600	8,000	-	0.955	0.964	0.919	0.946
2L-15	1	19:07:30	0	0	6,000	8,570	-	1.036	1.045	1.000	1.027
2L-15	2	19:08:30	0	0	6,000	8,570	-	1.051	1.060	1.015	1.042
2L-15	4	19:10:30	0	0	6,000	8,570	-	1.069	1.078	1.033	1.060
2L-15	8	19:14:30	0	0	6,000	8,570	-	1.090	1.098	1.053	1.080
2L-16	1	19:17:00	0	0	6,400	9,140	-	1.164	1.175	1.133	1.157
2L-16	2	19:18:00	0	0	6,400	9,140	-	1.187	1.197	1.155	1.180
2L-16	4	19:20:00	0	0	6,400	9,140	-	1.211	1.221	1.178	1.203
2L-16	8	19:24:00	0	0	6,400	9,140	-	1.236	1.247	1.205	1.229
2L-17	1	19:27:30	0	0	6,800	9,711	-	1.380	1.389	1.349	1.373
2L-17	2	19:28:30	0	0	6,800	9,711	-	1.401	1.411	1.370	1.394
2L-17	4	19:30:30	0	0	6,800	9,711	-	1.437	1.447	1.405	1.430
2L-17	8	19:34:30	0	0	6,800	9,711	-	1.473	1.483	1.441	1.466
2L-18	1	19:39:30	0	0	7,200	10,281	-	1.616	1.628	1.583	1.609
2L-18	2	19:40:30	0	0	7,200	10,281	-	1.638	1.650	1.606	1.631
2L-18	4	19:42:30	0	0	7,200	10,281	-	1.668	1.680	1.635	1.661
2L-18	8	19:46:30	0	0	7,200	10,281	-	1.700	1.713	1.667	1.694
2L-19	1	19:51:00	0	0	7,600	10,852	-	1.815	1.830	1.782	1.809
2L-19	2	19:52:00	0	0	7,600	10,852	-	1.836	1.850	1.804	1.830
2L-19	4	19:54:00	0	0	7,600	10,852	-	1.860	1.874	1.828	1.854
2L-19	8	19:58:00	0	0	7,600	10,852	-	1.888	1.903	1.861	1.884
2L-20	1	20:04:00	0	0	8,000	11,422	-	1.977	1.992	1.952	1.974
2L-20	2	20:05:00	0	0	8,000	11,422	-	1.998	2.014	1.973	1.995
2L-20	4	20:07:00	0	0	8,000	11,422	-	2.025	2.041	2.004	2.023
2L-20	8	20:11:00	0	0	8,000	11,422	-	2.059	2.075	2.040	2.058
2L-21	1	20:15:00	0	0	8,400	11,992	-	2.142	2.158	2.124	2.142
2L-21	2	20:16:00	0	0	8,400	11,992	-	2.157	2.172	2.139	2.156
2L-21	4	20:18:00	0	0	8,400	11,992	-	2.175	2.190	2.157	2.174
2L-21	8	20:22:00	0	0	8,400	11,992	-	2.196	2.212	2.179	2.196
2L-22	1	20:29:30	0	0	8,800	12,563	-	2.316	2.334	2.300	2.316
2L-22	2	20:30:30	0	0	8,800	12,563	-	2.324	2.341	2.307	2.324
2L-22	4	20:32:30	0	0	8,800	12,563	-	2.340	2.357	2.324	2.341
2L-22	8	20:36:30	0	0	8,800	12,563	-	2.376	2.393	2.360	2.376
2U-1	1	20:40:00	0	0	6,600	9,426	-	2.327	2.344	2.313	2.328
2U-1	2	20:41:00	0	0	6,600	9,426	-	2.323	2.340	2.308	2.324
2U-1	4	20:43:00	0	0	6,600	9,426	-	2.321	2.338	2.306	2.322
2U-2	1	20:45:30	0	0	4,400	6,288	-	2.246	2.263	2.234	2.248
2U-2	2	20:46:30	0	0	4,400	6,288	-	2.245	2.262	2.234	2.247
2U-2	4	20:48:30	0	0	4,400	6,288	-	2.244	2.261	2.233	2.246
2U-3	1	20:50:30	0	0	2,200	3,151	-	2.151	2.166	2.141	2.153
2U-3	2	20:51:30	0	0	2,200	3,151	-	2.151	2.165	2.140	2.152
2U-3	4	20:53:30	0	0	2,200	3,151	-	2.140	2.155	2.130	2.142
2U-4	1	20:57:30	0	0	0	0	-	1.993	2.003	1.989	1.995
2U-4	2	20:58:30	0	0	0	0	-	1.989	2.000	1.987	1.992
2U-4	4	21:00:30	0	0	0	0	-	1.985	1.997	1.983	1.989
2U-4	8	21:04:30	0	0	0	0	-	1.981	1.993	1.979	1.984

* LVWDT A did not function properly during the test and is not included in the average.
LVWDTs A, B, C and D are oriented 90° opposed.

Upward and Downward Upper O-cell Plate Movement and Creep (calculated)
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Top of Shaft (in)	Total Comp. * (in)	Top Plate Movement (in)	O-cell Expansion (in)	Bot. Plate Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
1L - 0	-	12:38:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000		
1L - 1	1	12:53:00	400	597	0	0	0.001	0.001	0.002	-0.005	0.007		
1L - 1	2	12:54:00	400	597	0	0	0.002	0.001	0.003	-0.006	0.009		
1L - 1	4	12:56:00	400	597	0	0	0.002	0.002	0.003	-0.006	0.009		
1L - 1	8	13:00:00	400	597	0	0	0.003	0.001	0.004	-0.006	0.010		
1L - 2	1	13:03:00	800	1,164	0	0	0.003	0.003	0.006	-0.011	0.017		
1L - 2	2	13:04:00	800	1,164	0	0	0.002	0.003	0.005	-0.011	0.016		
1L - 2	4	13:06:00	800	1,164	0	0	0.002	0.003	0.005	-0.011	0.016		
1L - 2	8	13:10:00	800	1,164	0	0	0.003	0.003	0.006	-0.011	0.017		
1L - 3	1	13:13:00	1,200	1,731	0	0	0.008	0.005	0.013	-0.012	0.025		
1L - 3	2	13:14:00	1,200	1,731	0	0	0.006	0.005	0.010	-0.013	0.023		
1L - 3	4	13:16:00	1,200	1,731	0	0	0.006	0.005	0.011	-0.013	0.024		
1L - 3	8	13:20:00	1,200	1,731	0	0	0.005	0.005	0.009	-0.013	0.022		
1L - 4	1	13:24:00	1,600	2,297	0	0	0.011	0.007	0.018	-0.014	0.032		
1L - 4	2	13:25:00	1,600	2,297	0	0	0.011	0.007	0.017	-0.014	0.031		
1L - 4	4	13:27:00	1,600	2,297	0	0	0.011	0.007	0.017	-0.014	0.031		
1L - 4	8	13:31:00	1,600	2,297	0	0	0.011	0.007	0.018	-0.014	0.032		
1L - 5	1	13:34:30	2,000	2,864	0	0	0.011	0.008	0.020	-0.015	0.035		
1L - 5	2	13:35:30	2,000	2,864	0	0	0.018	0.008	0.026	-0.015	0.041		
1L - 5	4	13:37:30	2,000	2,864	0	0	0.018	0.009	0.026	-0.015	0.041		
1L - 5	8	13:41:30	2,000	2,864	0	0	0.017	0.009	0.026	-0.015	0.041		
1L - 6	1	13:44:30	2,400	3,431	0	0	0.023	0.010	0.033	-0.016	0.049		
1L - 6	2	13:45:30	2,400	3,431	0	0	0.023	0.010	0.033	-0.016	0.049		
1L - 6	4	13:47:30	2,400	3,431	0	0	0.023	0.011	0.034	-0.016	0.050		
1L - 6	8	13:51:30	2,400	3,431	0	0	0.023	0.010	0.033	-0.016	0.050		
1L - 7	1	13:57:00	2,800	3,998	0	0	0.029	0.011	0.041	-0.017	0.057		
1L - 7	2	13:58:00	2,800	3,998	0	0	0.029	0.011	0.041	-0.017	0.058		
1L - 7	4	14:00:00	2,800	3,998	0	0	0.031	0.011	0.042	-0.017	0.059		
1L - 7	8	14:04:00	2,800	3,998	0	0	0.031	0.011	0.042	-0.017	0.059		
1L - 8	1	14:08:00	3,200	4,565	0	0	0.037	0.013	0.049	-0.017	0.067		
1L - 8	2	14:09:00	3,200	4,565	0	0	0.036	0.013	0.049	-0.018	0.066		
1L - 8	4	14:11:00	3,200	4,565	0	0	0.037	0.013	0.050	-0.018	0.067		
1L - 8	8	14:15:00	3,200	4,565	0	0	0.037	0.013	0.050	-0.018	0.067		
1L - 9	1	14:18:30	3,600	5,131	0	0	0.045	0.014	0.058	-0.019	0.077		
1L - 9	2	14:19:30	3,600	5,131	0	0	0.047	0.014	0.060	-0.019	0.079		
1L - 9	4	14:21:30	3,600	5,131	0	0	0.047	0.014	0.061	-0.019	0.079		
1L - 9	8	14:25:30	3,600	5,131	0	0	0.049	0.014	0.063	-0.017	0.080		
1L - 10	1	14:29:00	4,000	5,698	0	0	0.054	0.015	0.069	-0.019	0.088		
1L - 10	2	14:30:00	4,000	5,698	0	0	0.055	0.015	0.069	-0.019	0.088		
1L - 10	4	14:32:00	4,000	5,698	0	0	0.056	0.015	0.071	-0.018	0.089		
1L - 10	8	14:36:00	4,000	5,698	0	0	0.057	0.015	0.072	-0.017	0.089		
1L - 11	1	14:39:30	4,400	6,265	0	0	0.064	0.016	0.080	-0.018	0.098		
1L - 11	2	14:40:30	4,400	6,265	0	0	0.064	0.016	0.080	-0.018	0.098		
1L - 11	4	14:42:30	4,400	6,265	0	0	0.066	0.016	0.081	-0.018	0.100		
1L - 11	8	14:46:30	4,400	6,265	0	0	0.067	0.016	0.083	-0.018	0.102		
1L - 12	1	14:50:00	4,800	6,832	0	0	0.073	0.017	0.089	-0.019	0.108		
1L - 12	2	14:51:00	4,800	6,832	0	0	0.074	0.017	0.091	-0.019	0.110		
1L - 12	4	14:53:00	4,800	6,832	0	0	0.078	0.017	0.095	-0.019	0.113		
1L - 12	8	14:57:00	4,800	6,832	0	0	0.079	0.017	0.096	-0.019	0.115		
1L - 13	1	15:02:00	5,200	7,399	0	0	0.083	0.018	0.101	-0.019	0.120		
1L - 13	2	15:03:00	5,200	7,399	0	0	0.086	0.018	0.103	-0.019	0.123		
1L - 13	4	15:05:00	5,200	7,399	0	0	0.087	0.018	0.104	-0.019	0.124		
1L - 13	8	15:09:00	5,200	7,399	0	0	0.088	0.018	0.106	-0.019	0.125		
1L - 14	1	15:14:00	5,600	7,965	0	0	0.096	0.019	0.115	-0.020	0.135		
1L - 14	2	15:15:00	5,600	7,965	0	0	0.097	0.019	0.116	-0.020	0.136		
1L - 14	4	15:17:00	5,600	7,965	0	0	0.099	0.019	0.117	-0.020	0.138		
1L - 14	8	15:21:00	5,600	7,965	0	0	0.101	0.019	0.120	-0.020	0.140		
1L - 15	1	15:27:00	6,000	8,532	0	0	0.111	0.020	0.130	-0.021	0.151		
1L - 15	2	15:28:00	6,000	8,532	0	0	0.109	0.020	0.129	-0.021	0.149		
1L - 15	4	15:30:00	6,000	8,532	0	0	0.112	0.020	0.132	-0.021	0.153		
1L - 15	8	15:34:00	6,000	8,532	0	0	0.117	0.020	0.137	-0.021	0.158		
1L - 16	1	15:38:30	6,300	8,957	0	0	0.125	0.021	0.146	-0.022	0.167		
1L - 16	2	15:39:30	6,300	8,957	0	0	0.124	0.021	0.145	-0.022	0.167		
1L - 16	4	15:41:30	6,150	8,745	0	0	0.127	0.021	0.148	-0.021	0.169		
1U - 1	1	15:47:00	4,800	6,832	0	0	0.125	0.020	0.145	-0.020	0.165		
1U - 1	2	15:48:00	4,800	6,832	0	0	0.125	0.020	0.145	-0.020	0.165		
1U - 1	4	15:50:00	4,800	6,832	0	0	0.125	0.020	0.145	-0.020	0.165		
1U - 2	1	15:54:00	3,200	4,565	0	0	0.121	0.018	0.139	-0.019	0.158		
1U - 2	2	15:55:00	3,200	4,565	0	0	0.118	0.018	0.136	-0.019	0.156		
1U - 2	4	15:57:00	3,200	4,565	0	0	0.122	0.018	0.140	-0.019	0.159		
1U - 3	1	16:03:00	1,600	2,297	0	0	0.111	0.015	0.126	-0.017	0.143		
1U - 3	2	16:04:00	1,600	2,297	0	0	0.116	0.015	0.131	-0.017	0.148		
1U - 3	4	16:06:00	1,600	2,297	0	0	0.111	0.015	0.126	-0.017	0.143		
1U - 4	1	16:11:00	0	0	0	0	0.090	0.010	0.100	-0.009	0.109		
1U - 4	2	16:12:00	0	0	0	0	0.089	0.010	0.099	-0.009	0.107		
1U - 4	4	16:14:00	0	0	0	0	0.088	0.010	0.098	-0.008	0.106		
1U - 4	8	16:18:00	0	0	0	0	0.088	0.010	0.098	-0.008	0.106		
1U - 4	16	16:26:00	0	0	0	0	0.088	0.010	0.098	-0.008	0.106		
1U - 4	32	16:42:00	0	0	0	0	0.084	0.010	0.094	-0.008	0.101		
2L - 0	1	16:43:00	0	0	0	0	0.086	0.010	0.096	-0.008	0.103		
2L - 1	1	16:53:30	0	0	400	584	0.085	0.009	0.094	0.069	0.024		
2L - 1	2	16:54:30	0	0	400	584	0.085	0.009	0.094	0.070	0.024	0.001	0.000
2L - 1	4	16:56:30	0	0	400	584	0.086	0.009	0.095	0.071	0.023	0.000	0.001
2L - 1	8	17:00:30	0	0	400	584	0.085	0.009	0.094	0.073	0.021	-0.001	0.002
2L - 2	1	17:04:30	0	0	800	1,155	0.085	0.009	0.094	0.104	-0.010		
2L - 2	2	17:05:30	0	0	800	1,155	0.087	0.009	0.096	0.107	-0.011	0.002	0.001
2L - 2	4	17:07:30	0	0	800	1,155	0.086	0.009	0.095	0.109	-0.014	-0.001	0.003
2L - 2	8	17:11:30	0	0	800	1,155	0.086	0.009	0.095	0.109	-0.013	0.000	0.000
2L - 3	1	17:14:00	0	0	1,200	1,725	0.088	0.010	0.098	0.137	-0.039		
2L - 3	2	17:15:00	0	0	1,200	1,725	0.090	0.010	0.100	0.138	-0.038	0.002	-0.001
2L - 3	4	17:17:00	0	0	1,200	1,725	0.088	0.010	0.097	0.139	-0.042	-0.003	0.004
2L - 3	8	17:21:00	0	0	1,200	1,725	0.088	0.010	0.098	0.141	-0.043	0.001	0.001

Upward and Downward Upper O-cell Plate Movement and Creep (calculated)
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Top of Shaft (in)	Total Comp. * (in)	Top Plate Movement (in)	O-cell Expansion (in)	Bot. Plate Movement (in)	Creep Up Per Hold (in)	Creep Dn Per Hold (in)
2L-4	1	17:23:30	0	0	1,600	2,296	0.091	0.010	0.101	0.171	-0.070		
2L-4	2	17:24:30	0	0	1,600	2,296	0.089	0.010	0.099	0.172	-0.073	-0.002	0.002
2L-4	4	17:26:30	0	0	1,600	2,296	0.090	0.010	0.100	0.173	-0.074	0.000	0.001
2L-4	8	17:30:30	0	0	1,600	2,296	0.089	0.010	0.099	0.175	-0.076	0.000	0.002
2L-5	1	17:33:00	0	0	2,000	2,866	0.096	0.011	0.106	0.209	-0.103		
2L-5	2	17:34:00	0	0	2,000	2,866	0.095	0.011	0.106	0.210	-0.104	-0.001	0.001
2L-5	4	17:36:00	0	0	2,000	2,866	0.095	0.011	0.106	0.211	-0.105	0.000	0.002
2L-5	8	17:40:00	0	0	2,000	2,866	0.095	0.011	0.106	0.213	-0.107	0.000	0.001
2L-6	1	17:42:30	0	0	2,400	3,436	0.099	0.012	0.111	0.245	-0.134		
2L-6	2	17:43:30	0	0	2,400	3,436	0.099	0.012	0.111	0.246	-0.135	0.001	0.001
2L-6	4	17:45:30	0	0	2,400	3,436	0.099	0.012	0.111	0.249	-0.138	0.000	0.003
2L-6	8	17:49:30	0	0	2,400	3,436	0.100	0.012	0.112	0.252	-0.140	0.001	0.002
2L-7	1	17:51:30	0	0	2,800	4,007	0.104	0.013	0.117	0.286	-0.169		
2L-7	2	17:52:30	0	0	2,800	4,007	0.105	0.013	0.118	0.290	-0.172	0.001	0.003
2L-7	4	17:54:30	0	0	2,800	4,007	0.104	0.013	0.117	0.293	-0.176	-0.001	0.004
2L-7	8	17:58:30	0	0	2,800	4,007	0.105	0.013	0.118	0.296	-0.178	0.002	0.002
2L-8	1	18:00:30	0	0	3,200	4,577	0.110	0.015	0.125	0.337	-0.213		
2L-8	2	18:01:30	0	0	3,200	4,577	0.111	0.015	0.125	0.340	-0.215	0.001	0.002
2L-8	4	18:03:30	0	0	3,200	4,577	0.112	0.015	0.126	0.344	-0.218	0.001	0.003
2L-8	8	18:07:30	0	0	3,200	4,577	0.112	0.015	0.127	0.348	-0.221	0.001	0.003
2L-9	1	18:09:30	0	0	3,600	5,148	0.118	0.016	0.134	0.397	-0.263		
2L-9	2	18:10:30	0	0	3,600	5,148	0.119	0.017	0.135	0.402	-0.267	0.001	0.004
2L-9	4	18:12:30	0	0	3,600	5,148	0.120	0.017	0.137	0.408	-0.271	0.002	0.005
2L-9	8	18:16:30	0	0	3,600	5,148	0.119	0.017	0.136	0.414	-0.278	-0.001	0.007
2L-10	1	18:18:30	0	0	4,000	5,718	0.129	0.018	0.147	0.468	-0.320		
2L-10	2	18:19:30	0	0	4,000	5,718	0.131	0.018	0.149	0.475	-0.326	0.002	0.006
2L-10	4	18:21:30	0	0	4,000	5,718	0.133	0.019	0.151	0.483	-0.332	0.002	0.006
2L-10	8	18:25:30	0	0	4,000	5,718	0.135	0.019	0.154	0.491	-0.337	0.003	0.005
2L-11	1	18:28:00	0	0	4,400	6,288	0.149	0.020	0.169	0.551	-0.382		
2L-11	2	18:29:00	0	0	4,400	6,288	0.151	0.020	0.171	0.558	-0.387	0.002	0.005
2L-11	4	18:31:00	0	0	4,400	6,288	0.152	0.020	0.172	0.569	-0.396	0.002	0.009
2L-11	8	18:35:00	0	0	4,400	6,288	0.155	0.020	0.175	0.580	-0.404	0.003	0.008
2L-12	1	18:38:00	0	0	4,800	6,859	0.171	0.021	0.192	0.657	-0.465		
2L-12	2	18:39:00	0	0	4,800	6,859	0.175	0.021	0.196	0.668	-0.472	0.005	0.007
2L-12	4	18:41:00	0	0	4,800	6,859	0.177	0.022	0.199	0.680	-0.481	0.002	0.009
2L-12	8	18:45:00	0	0	4,800	6,859	0.181	0.022	0.203	0.692	-0.490	0.004	0.008
2L-13	1	18:47:30	0	0	5,200	7,429	0.198	0.023	0.220	0.768	-0.548		
2L-13	2	18:48:30	0	0	5,200	7,429	0.201	0.023	0.223	0.780	-0.557	0.003	0.009
2L-13	4	18:50:30	0	0	5,200	7,429	0.206	0.023	0.229	0.794	-0.565	0.006	0.009
2L-13	8	18:54:30	0	0	5,200	7,429	0.210	0.023	0.233	0.811	-0.578	0.004	0.013
2L-14	1	18:58:00	0	0	5,600	8,000	0.229	0.024	0.253	0.902	-0.649		
2L-14	2	18:59:00	0	0	5,600	8,000	0.232	0.024	0.256	0.917	-0.660	0.003	0.012
2L-14	4	19:01:00	0	0	5,600	8,000	0.237	0.024	0.261	0.932	-0.671	0.005	0.011
2L-14	8	19:05:00	0	0	5,600	8,000	0.240	0.025	0.264	0.946	-0.682	0.003	0.011
2L-15	1	19:07:30	0	0	6,000	8,570	0.258	0.026	0.283	1.027	-0.744		
2L-15	2	19:08:30	0	0	6,000	8,570	0.262	0.026	0.287	1.042	-0.755	0.004	0.011
2L-15	4	19:10:30	0	0	6,000	8,570	0.267	0.026	0.293	1.060	-0.767	0.006	0.012
2L-15	8	19:14:30	0	0	6,000	8,570	0.273	0.026	0.299	1.080	-0.782	0.006	0.015
2L-16	1	19:17:00	0	0	6,400	9,140	0.289	0.027	0.316	1.157	-0.841		
2L-16	2	19:18:00	0	0	6,400	9,140	0.294	0.027	0.321	1.180	-0.858	0.005	0.017
2L-16	4	19:20:00	0	0	6,400	9,140	0.300	0.028	0.327	1.203	-0.876	0.006	0.018
2L-16	8	19:24:00	0	0	6,400	9,140	0.304	0.028	0.332	1.229	-0.898	0.005	0.021
2L-17	1	19:27:30	0	0	6,800	9,711	0.328	0.029	0.357	1.373	-1.016		
2L-17	2	19:28:30	0	0	6,800	9,711	0.331	0.029	0.360	1.394	-1.034	0.003	0.019
2L-17	4	19:30:30	0	0	6,800	9,711	0.337	0.029	0.366	1.430	-1.063	0.007	0.029
2L-17	8	19:34:30	0	0	6,800	9,711	0.345	0.030	0.375	1.466	-1.091	0.008	0.027
2L-18	1	19:39:30	0	0	7,200	10,281	0.370	0.031	0.401	1.609	-1.208		
2L-18	2	19:40:30	0	0	7,200	10,281	0.374	0.031	0.404	1.631	-1.227	0.004	0.019
2L-18	4	19:42:30	0	0	7,200	10,281	0.380	0.031	0.411	1.661	-1.250	0.007	0.023
2L-18	8	19:46:30	0	0	7,200	10,281	0.387	0.031	0.418	1.694	-1.276	0.007	0.026
2L-19	1	19:51:00	0	0	7,600	10,852	0.413	0.032	0.445	1.809	-1.364		
2L-19	2	19:52:00	0	0	7,600	10,852	0.419	0.032	0.451	1.830	-1.379	0.006	0.015
2L-19	4	19:54:00	0	0	7,600	10,852	0.427	0.032	0.459	1.854	-1.394	0.008	0.015
2L-19	8	19:58:00	0	0	7,600	10,852	0.435	0.033	0.467	1.884	-1.417	0.008	0.022
2L-20	1	20:04:00	0	0	8,000	11,422	0.462	0.033	0.495	1.974	-1.479		
2L-20	2	20:05:00	0	0	8,000	11,422	0.467	0.034	0.501	1.995	-1.495	0.006	0.015
2L-20	4	20:07:00	0	0	8,000	11,422	0.477	0.034	0.510	2.023	-1.513	0.010	0.019
2L-20	8	20:11:00	0	0	8,000	11,422	0.489	0.034	0.522	2.058	-1.536	0.012	0.022
2L-21	1	20:15:00	0	0	8,400	11,992	0.516	0.035	0.551	2.142	-1.591		
2L-21	2	20:16:00	0	0	8,400	11,992	0.521	0.035	0.555	2.156	-1.600	0.005	0.010
2L-21	4	20:18:00	0	0	8,400	11,992	0.526	0.035	0.561	2.174	-1.613	0.005	0.012
2L-21	8	20:22:00	0	0	8,400	11,992	0.533	0.035	0.568	2.196	-1.628	0.007	0.015
2L-22	1	20:29:30	0	0	8,800	12,563	0.580	0.038	0.617	2.316	-1.699		
2L-22	2	20:30:30	0	0	8,800	12,563	0.582	0.038	0.620	2.324	-1.704	0.002	0.005
2L-22	4	20:32:30	0	0	8,800	12,563	0.588	0.038	0.626	2.341	-1.715	0.006	0.010
2L-22	8	20:36:30	0	0	8,800	12,563	0.603	0.038	0.641	2.376	-1.735	0.015	0.021
2U-1	1	20:40:00	0	0	6,600	9,426	0.594	0.033	0.627	2.328	-1.701		
2U-1	2	20:41:00	0	0	6,600	9,426	0.593	0.033	0.625	2.324	-1.698		
2U-1	4	20:43:00	0	0	6,600	9,426	0.592	0.033	0.624	2.322	-1.698		
2U-2	1	20:45:30	0	0	4,400	6,288	0.576	0.027	0.603	2.248	-1.644		
2U-2	2	20:46:30	0	0	4,400	6,288	0.577	0.027	0.604	2.247	-1.643		
2U-2	4	20:48:30	0	0	4,400	6,288	0.575	0.027	0.602	2.246	-1.644		
2U-3	1	20:50:30	0	0	2,200	3,151	0.552	0.019	0.571	2.153	-1.582		
2U-3	2	20:51:30	0	0	2,200	3,151	0.553	0.019	0.572	2.152	-1.580		
2U-3	4	20:53:30	0	0	2,200	3,151	0.551	0.018	0.569	2.142	-1.573		
2U-4	1	20:57:30	0	0	0	0	0.507	0.011	0.517	1.995	-1.478		
2U-4	2	20:58:30	0	0	0	0	0.505	0.011	0.516	1.992	-1.476		
2U-4	4	21:00:30	0	0	0	0	0.505	0.011	0.515	1.989	-1.474		
2U-4	8	21:04:30	0	0	0	0	0.503	0.010	0.513	1.984	-1.471		

* Elastic compression above the upper O-cell.

Strain Gage Readings and Loads at Levels 1 and 2
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Level 1 A - 26697 (με)	Level 1 B - 26698 (με)	Level 1 Av. Load (kips)	Level 2 A - 10521 (με)	Level 2 B - 10522 (με)	Level 2 Av. Load (kips)
1 L - 0	-	12:38:00	0	0	0	0	0.0	0.0	0	0.0	0.0	0
1 L - 1	1	12:53:00	400	597	0	0	21.9	10.3	356	1.5	2.4	37
1 L - 1	2	12:54:00	400	597	0	0	25.2	11.6	406	2.1	2.4	44
1 L - 1	4	12:56:00	400	597	0	0	27.1	13.1	445	2.3	2.6	48
1 L - 1	8	13:00:00	400	597	0	0	28.2	12.7	452	3.0	2.8	56
1 L - 2	1	13:03:00	800	1,164	0	0	55.0	27.7	914	5.4	4.5	95
1 L - 2	2	13:04:00	800	1,164	0	0	56.3	28.7	940	6.0	4.6	103
1 L - 2	4	13:06:00	800	1,164	0	0	58.0	29.3	964	6.2	5.0	109
1 L - 2	8	13:10:00	800	1,164	0	0	58.4	29.6	972	6.2	5.1	110
1 L - 3	1	13:13:00	1,200	1,731	0	0	85.1	45.2	1440	8.3	6.3	142
1 L - 3	2	13:14:00	1,200	1,731	0	0	86.1	45.5	1454	8.4	6.5	145
1 L - 3	4	13:16:00	1,200	1,731	0	0	87.1	46.5	1476	8.6	6.5	147
1 L - 3	8	13:20:00	1,200	1,731	0	0	88.1	47.0	1493	8.9	6.8	153
1 L - 4	1	13:24:00	1,600	2,297	0	0	113.8	61.3	1935	12.0	8.6	196
1 L - 4	2	13:25:00	1,600	2,297	0	0	115.4	62.0	1960	12.2	8.7	203
1 L - 4	4	13:27:00	1,600	2,297	0	0	116.3	62.6	1976	11.8	9.0	202
1 L - 4	8	13:31:00	1,600	2,297	0	0	117.1	62.3	1982	11.9	9.0	203
1 L - 5	1	13:34:30	2,000	2,864	0	0	147.0	77.7	2483	13.4	11.4	241
1 L - 5	2	13:35:30	2,000	2,864	0	0	148.0	77.9	2496	13.4	11.6	243
1 L - 5	4	13:37:30	2,000	2,864	0	0	150.0	77.7	2516	13.6	11.8	246
1 L - 5	8	13:41:30	2,000	2,864	0	0	151.5	78.2	2538	14.7	12.2	262
1 L - 6	1	13:44:30	2,400	3,431	0	0	177.3	93.1	2987	17.5	14.8	313
1 L - 6	2	13:45:30	2,400	3,431	0	0	177.8	93.8	3001	16.8	14.9	307
1 L - 6	4	13:47:30	2,400	3,431	0	0	179.8	95.1	3037	16.8	15.1	309
1 L - 6	8	13:51:30	2,400	3,431	0	0	180.9	95.2	3052	17.6	15.5	321
1 L - 7	1	13:57:00	2,800	3,998	0	0	205.6	109.9	3486	19.5	17.7	361
1 L - 7	2	13:58:00	2,800	3,998	0	0	206.9	110.4	3506	20.1	17.8	367
1 L - 7	4	14:00:00	2,800	3,998	0	0	207.6	110.4	3514	20.0	17.9	368
1 L - 7	8	14:04:00	2,800	3,998	0	0	208.6	110.3	3523	20.5	18.2	375
1 L - 8	1	14:08:00	3,200	4,565	0	0	232.9	124.7	3951	23.1	20.0	418
1 L - 8	2	14:09:00	3,200	4,565	0	0	235.2	126.0	3991	22.9	20.3	419
1 L - 8	4	14:11:00	3,200	4,565	0	0	237.3	126.8	4023	23.4	20.5	426
1 L - 8	8	14:15:00	3,200	4,565	0	0	238.2	126.5	4030	23.0	20.7	423
1 L - 9	1	14:18:30	3,600	5,131	0	0	264.6	142.8	4501	25.6	22.7	469
1 L - 9	2	14:19:30	3,600	5,131	0	0	265.0	143.1	4510	25.5	22.6	467
1 L - 9	4	14:21:30	3,600	5,131	0	0	265.7	143.8	4525	25.8	23.0	473
1 L - 9	8	14:25:30	3,600	5,131	0	0	268.3	144.2	4557	26.1	23.0	476
1 L - 10	1	14:29:00	4,000	5,698	0	0	293.8	160.1	5016	27.9	25.0	513
1 L - 10	2	14:30:00	4,000	5,698	0	0	294.6	160.9	5033	27.9	25.1	514
1 L - 10	4	14:32:00	4,000	5,698	0	0	297.4	162.0	5077	27.4	25.3	511
1 L - 10	8	14:36:00	4,000	5,698	0	0	298.2	161.6	5081	28.3	25.5	523
1 L - 11	1	14:39:30	4,400	6,265	0	0	322.2	175.7	5502	28.9	27.1	544
1 L - 11	2	14:40:30	4,400	6,265	0	0	324.2	176.5	5532	29.6	27.5	554
1 L - 11	4	14:42:30	4,400	6,265	0	0	325.6	176.8	5552	28.8	27.5	546
1 L - 11	8	14:46:30	4,400	6,265	0	0	327.5	176.3	5566	29.1	27.7	551
1 L - 12	1	14:50:00	4,800	6,832	0	0	350.6	190.8	5983	30.9	29.5	587
1 L - 12	2	14:51:00	4,800	6,832	0	0	350.3	190.3	5973	31.0	29.4	586
1 L - 12	4	14:53:00	4,800	6,832	0	0	352.9	191.8	6019	31.3	29.9	592
1 L - 12	8	14:57:00	4,800	6,832	0	0	354.8	191.4	6035	31.3	29.9	594
1 L - 13	1	15:02:00	5,200	7,399	0	0	379.5	205.5	6464	32.5	31.6	622
1 L - 13	2	15:03:00	5,200	7,399	0	0	379.3	205.0	6457	32.6	31.8	625
1 L - 13	4	15:05:00	5,200	7,399	0	0	381.8	206.2	6498	33.0	32.0	630
1 L - 13	8	15:09:00	5,200	7,399	0	0	384.4	206.5	6529	33.4	32.2	637
1 L - 14	1	15:14:00	5,600	7,965	0	0	408.0	220.9	6949	34.9	34.0	669
1 L - 14	2	15:15:00	5,600	7,965	0	0	409.1	221.5	6969	35.2	34.2	673
1 L - 14	4	15:17:00	5,600	7,965	0	0	412.1	222.7	7014	35.3	34.5	677
1 L - 14	8	15:21:00	5,600	7,965	0	0	413.9	223.9	7048	35.9	34.6	684
1 L - 15	1	15:27:00	6,000	8,532	0	0	438.2	242.6	7523	38.0	36.6	723
1 L - 15	2	15:28:00	6,000	8,532	0	0	438.8	243.3	7537	37.5	36.7	720
1 L - 15	4	15:30:00	6,000	8,532	0	0	441.5	244.7	7582	37.2	36.9	719
1 L - 15	8	15:34:00	6,000	8,532	0	0	443.1	247.5	7631	37.8	37.2	727
1 L - 16	1	15:38:30	6,300	8,957	0	0	465.8	264.7	8073	39.1	38.9	757
1 L - 16	2	15:39:30	6,300	8,957	0	0	467.1	265.4	8093	39.2	39.0	758
1 L - 16	4	15:41:30	6,150	8,745	0	0	459.9	262.0	7977	38.5	38.6	748
1 U - 1	1	15:47:00	4,800	6,832	0	0	429.5	243.6	7438	35.3	35.4	686
1 U - 1	2	15:48:00	4,800	6,832	0	0	428.8	243.4	7428	35.3	35.3	685
1 U - 1	4	15:50:00	4,800	6,832	0	0	425.9	241.9	7380	35.2	35.0	681
1 U - 2	1	15:54:00	3,200	4,565	0	0	365.5	207.6	6333	29.5	29.2	569
1 U - 2	2	15:55:00	3,200	4,565	0	0	364.3	207.2	6315	29.5	29.1	568
1 U - 2	4	15:57:00	3,200	4,565	0	0	362.9	206.1	6287	29.5	29.0	567
1 U - 3	1	16:03:00	1,600	2,297	0	0	260.1	136.5	4382	20.5	20.0	393
1 U - 3	2	16:04:00	1,600	2,297	0	0	262.8	137.9	4427	20.9	20.1	398
1 U - 3	4	16:06:00	1,600	2,297	0	0	260.0	135.3	4367	20.0	19.8	386
1 U - 4	1	16:11:00	0	0	0	0	78.5	0.3	871	12.4	15.2	268
1 U - 4	2	16:12:00	0	0	0	0	76.4	-2.0	822	12.6	15.1	269
1 U - 4	4	16:14:00	0	0	0	0	74.8	-3.4	788	12.5	15.0	267
1 U - 4	8	16:18:00	0	0	0	0	72.8	-4.5	754	12.5	14.9	266
1 U - 4	16	16:26:00	0	0	0	0	71.8	-5.5	732	13.1	14.6	269
1 U - 4	32	16:42:00	0	0	0	0	69.4	-6.6	694	12.6	14.7	265
2 L - 0	1	16:43:00	0	0	0	0	69.4	-6.6	694	12.6	14.5	263
2 L - 1	1	16:53:30	0	0	400	584	50.1	10.2	666	13.6	15.5	282
2 L - 1	2	16:54:30	0	0	400	584	50.4	10.6	674	14.1	15.6	287
2 L - 1	4	16:56:30	0	0	400	584	50.1	10.4	668	13.4	15.6	281
2 L - 1	8	17:00:30	0	0	400	584	49.6	10.5	663	14.0	15.7	288
2 L - 2	1	17:04:30	0	0	800	1,155	57.2	25.2	911	15.5	16.4	310
2 L - 2	2	17:05:30	0	0	800	1,155	57.4	26.9	932	15.7	16.8	315
2 L - 2	4	17:07:30	0	0	800	1,155	56.4	26.6	917	15.3	16.5	309
2 L - 2	8	17:11:30	0	0	800	1,155	55.9	25.7	902	15.3	16.5	309
2 L - 3	1	17:14:00	0	0	1,200	1,725	60.8	43.3	1150	17.1	17.5	336
2 L - 3	2	17:15:00	0	0	1,200	1,725	59.8	42.4	1129	16.9	17.3	332
2 L - 3	4	17:17:00	0	0	1,200	1,725	59.8	43.3	1139	17.1	17.4	335
2 L - 3	8	17:21:00	0	0	1,200	1,725	59.2	43.2	1132	17.0	17.4	334

Strain Gage Readings and Loads at Levels 1 and 2
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Level 1 A - 26697 (με)	Level 1 B - 26698 (με)	Level 1 Av. Load (kips)	Level 2 A - 10521 (με)	Level 2 B - 10522 (με)	Level 2 Av. Load (kips)
2L-4	1	17:23:30	0	0	1,600	2,296	62.8	59.4	1350	18.8	18.5	363
2L-4	2	17:24:30	0	0	1,600	2,296	61.9	58.5	1330	18.6	18.4	359
2L-4	4	17:26:30	0	0	1,600	2,296	61.4	58.9	1329	18.6	18.4	359
2L-4	8	17:30:30	0	0	1,600	2,296	60.8	59.2	1326	18.8	18.5	362
2L-5	1	17:33:00	0	0	2,000	2,866	63.1	76.0	1536	20.4	19.7	388
2L-5	2	17:34:00	0	0	2,000	2,866	62.4	75.5	1525	20.3	19.7	388
2L-5	4	17:36:00	0	0	2,000	2,866	62.9	76.6	1542	20.5	19.9	392
2L-5	8	17:40:00	0	0	2,000	2,866	62.6	77.0	1543	20.5	19.9	392
2L-6	1	17:42:30	0	0	2,400	3,436	68.0	92.9	1778	22.7	21.9	433
2L-6	2	17:43:30	0	0	2,400	3,436	67.5	93.0	1774	22.8	21.9	434
2L-6	4	17:45:30	0	0	2,400	3,436	67.3	93.9	1782	22.8	22.1	435
2L-6	8	17:49:30	0	0	2,400	3,436	66.7	93.5	1770	22.8	22.1	435
2L-7	1	17:51:30	0	0	2,800	4,007	71.2	112.4	2028	26.2	24.8	495
2L-7	2	17:52:30	0	0	2,800	4,007	70.5	114.0	2038	26.2	25.1	498
2L-7	4	17:54:30	0	0	2,800	4,007	70.1	114.4	2040	26.2	25.2	498
2L-7	8	17:58:30	0	0	2,800	4,007	69.4	115.9	2047	26.3	25.3	501
2L-8	1	18:00:30	0	0	3,200	4,577	75.3	140.9	2388	29.4	28.6	563
2L-8	2	18:01:30	0	0	3,200	4,577	73.0	140.9	2363	28.7	28.5	554
2L-8	4	18:03:30	0	0	3,200	4,577	73.2	143.1	2390	29.4	28.9	565
2L-8	8	18:07:30	0	0	3,200	4,577	72.4	144.8	2400	29.8	29.1	571
2L-9	1	18:09:30	0	0	3,600	5,148	80.9	170.1	2774	32.9	33.0	639
2L-9	2	18:10:30	0	0	3,600	5,148	82.1	171.8	2806	33.0	33.4	644
2L-9	4	18:12:30	0	0	3,600	5,148	81.6	173.3	2817	33.2	33.7	648
2L-9	8	18:16:30	0	0	3,600	5,148	83.6	174.8	2854	33.9	34.1	659
2L-10	1	18:18:30	0	0	4,000	5,718	95.8	202.8	3300	37.2	37.9	728
2L-10	2	18:19:30	0	0	4,000	5,718	96.9	204.5	3331	37.3	38.3	734
2L-10	4	18:21:30	0	0	4,000	5,718	97.4	206.7	3360	37.7	38.6	740
2L-10	8	18:25:30	0	0	4,000	5,718	98.6	209.7	3406	38.1	39.2	750
2L-11	1	18:28:00	0	0	4,400	6,288	112.3	238.2	3874	41.4	42.4	813
2L-11	2	18:29:00	0	0	4,400	6,288	113.4	239.4	3899	41.6	42.6	816
2L-11	4	18:31:00	0	0	4,400	6,288	114.4	243.9	3960	41.6	42.9	820
2L-11	8	18:35:00	0	0	4,400	6,288	117.1	248.1	4035	42.4	43.5	833
2L-12	1	18:38:00	0	0	4,800	6,859	135.7	284.1	4640	45.5	46.2	890
2L-12	2	18:39:00	0	0	4,800	6,859	137.5	289.0	4713	45.9	46.6	898
2L-12	4	18:41:00	0	0	4,800	6,859	138.2	291.6	4749	46.0	46.9	901
2L-12	8	18:45:00	0	0	4,800	6,859	138.6	296.2	4805	46.2	47.3	907
2L-13	1	18:47:30	0	0	5,200	7,429	154.9	341.8	5489	49.6	49.9	966
2L-13	2	18:48:30	0	0	5,200	7,429	156.6	348.6	5582	49.7	50.2	970
2L-13	4	18:50:30	0	0	5,200	7,429	157.1	355.6	5666	49.9	50.4	973
2L-13	8	18:54:30	0	0	5,200	7,429	158.1	364.3	5772	50.4	50.7	981
2L-14	1	18:58:00	0	0	5,600	8,000	179.5	417.0	6591	53.8	52.8	1034
2L-14	2	18:59:00	0	0	5,600	8,000	180.9	424.5	6689	54.1	52.9	1038
2L-14	4	19:01:00	0	0	5,600	8,000	181.2	430.8	6762	54.2	53.0	1040
2L-14	8	19:05:00	0	0	5,600	8,000	181.0	435.3	6810	54.1	53.1	1040
2L-15	1	19:07:30	0	0	6,000	8,570	197.6	489.6	7594	57.3	55.2	1092
2L-15	2	19:08:30	0	0	6,000	8,570	198.4	495.8	7670	57.8	55.5	1099
2L-15	4	19:10:30	0	0	6,000	8,570	201.2	502.9	7780	58.0	55.6	1102
2L-15	8	19:14:30	0	0	6,000	8,570	204.5	510.3	7899	58.6	55.9	1111
2L-16	1	19:17:00	0	0	6,400	9,140	224.0	560.4	8668	60.9	57.1	1145
2L-16	2	19:18:00	0	0	6,400	9,140	229.8	570.8	8846	61.4	57.3	1151
2L-16	4	19:20:00	0	0	6,400	9,140	233.4	570.5	8884	61.5	57.4	1153
2L-16	8	19:24:00	0	0	6,400	9,140	239.6	574.7	8998	61.6	57.2	1153
2L-17	1	19:27:30	0	0	6,800	9,711	282.0	643.2	10224	64.6	58.6	1196
2L-17	2	19:28:30	0	0	6,800	9,711	286.8	653.7	10392	64.9	58.8	1200
2L-17	4	19:30:30	0	0	6,800	9,711	291.2	663.7	10551	65.1	59.2	1205
2L-17	8	19:34:30	0	0	6,800	9,711	294.3	671.4	10670	65.3	59.4	1210
2L-18	1	19:39:30	0	0	7,200	10,281	326.4	720.0	11563	67.5	60.9	1245
2L-18	2	19:40:30	0	0	7,200	10,281	329.9	720.4	11606	68.0	61.0	1251
2L-18	4	19:42:30	0	0	7,200	10,281	333.5	721.7	11659	68.0	61.3	1254
2L-18	8	19:46:30	0	0	7,200	10,281	337.5	724.4	11734	68.0	61.5	1256
2L-19	1	19:51:00	0	0	7,600	10,852	366.0	753.6	12372	69.8	63.4	1292
2L-19	2	19:52:00	0	0	7,600	10,852	370.2	754.7	12429	69.8	63.8	1295
2L-19	4	19:54:00	0	0	7,600	10,852	372.7	752.6	12435	69.7	63.9	1296
2L-19	8	19:58:00	0	0	7,600	10,852	376.8	753.7	12493	70.3	64.4	1306
2L-20	1	20:04:00	0	0	8,000	11,422	398.9	777.9	13003	71.5	66.0	1334
2L-20	2	20:05:00	0	0	8,000	11,422	403.1	784.1	13118	71.5	66.4	1338
2L-20	4	20:07:00	0	0	8,000	11,422	402.6	784.6	13118	71.2	66.5	1336
2L-20	8	20:11:00	0	0	8,000	11,422	405.6	792.3	13237	71.4	67.0	1342
2L-21	1	20:15:00	0	0	8,400	11,992	421.4	826.6	13790	72.1	69.1	1370
2L-21	2	20:16:00	0	0	8,400	11,992	423.4	830.2	13852	72.2	69.3	1372
2L-21	4	20:18:00	0	0	8,400	11,992	419.0	830.6	13808	71.8	69.1	1367
2L-21	8	20:22:00	0	0	8,400	11,992	416.5	832.5	13802	71.6	69.4	1368
2L-22	1	20:29:30	0	0	8,800	12,563	438.3	882.1	14591	71.2	71.7	1386
2L-22	2	20:30:30	0	0	8,800	12,563	436.6	879.9	14547	70.9	71.7	1383
2L-22	4	20:32:30	0	0	8,800	12,563	439.5	886.1	14647	71.0	72.2	1389
2L-22	8	20:36:30	0	0	8,800	12,563	445.0	898.8	14849	70.8	72.9	1394
2U-1	1	20:40:00	0	0	6,600	9,426	354.8	796.8	12725	52.2	55.8	1048
2U-1	2	20:41:00	0	0	6,600	9,426	348.8	789.0	12572	50.8	54.6	1023
2U-1	4	20:43:00	0	0	6,600	9,426	348.4	785.6	12531	50.7	54.5	1021
2U-2	1	20:45:30	0	0	4,400	6,288	251.8	664.5	10125	31.1	38.0	670
2U-2	2	20:46:30	0	0	4,400	6,288	252.9	664.2	10134	31.3	38.1	673
2U-2	4	20:48:30	0	0	4,400	6,288	253.9	663.3	10134	31.0	38.2	671
2U-3	1	20:50:30	0	0	2,200	3,151	151.7	512.4	7337	11.3	27.7	378
2U-3	2	20:51:30	0	0	2,200	3,151	154.0	513.1	7372	11.4	27.8	380
2U-3	4	20:53:30	0	0	2,200	3,151	140.4	494.7	7018	8.6	26.3	339
2U-4	1	20:57:30	0	0	0	0	7.8	233.1	2662	-8.2	27.4	186
2U-4	2	20:58:30	0	0	0	0	7.3	229.6	2617	-8.5	27.6	185
2U-4	4	21:00:30	0	0	0	0	6.2	225.1	2555	-8.3	27.6	187
2U-4	8	21:04:30	0	0	0	0	5.3	220.0	2490	-9.1	27.6	180

Strain Gage Readings and Loads at Levels 3 and 4
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

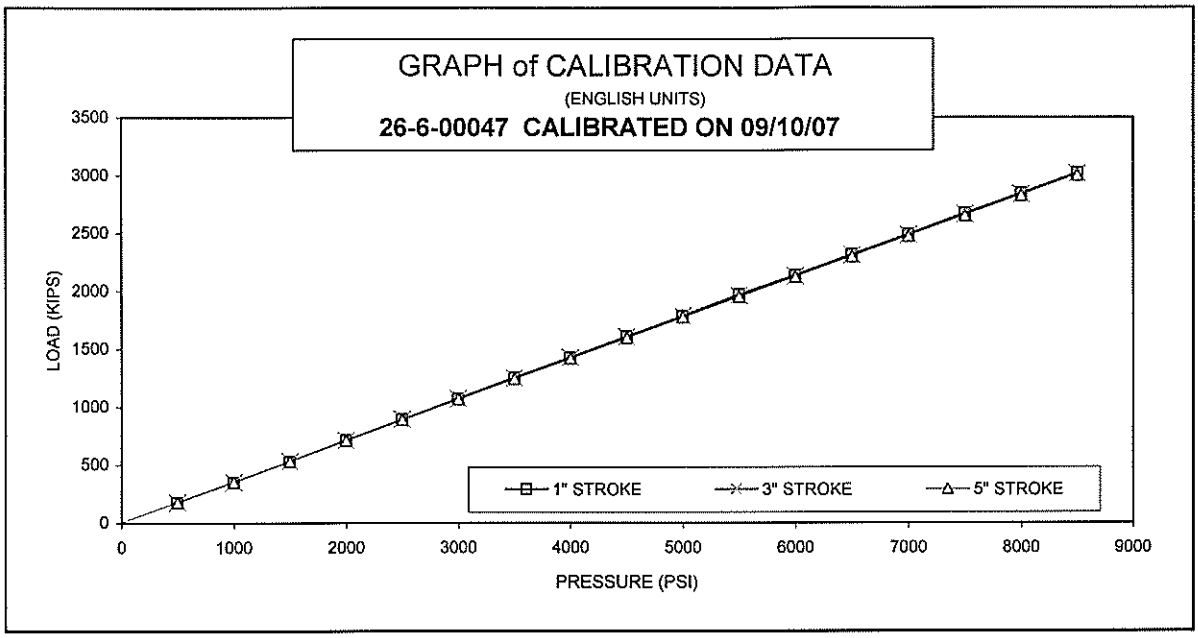
Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell Pressure (psi)	Lower O-cell Load (kips)	Upper O-cell Pressure (psi)	Upper O-cell Load (kips)	Level 3 A - 10245 (με)	Level 3 B - 10246 (με)	Level 3 Av. Load (kips)	Level 4 A - 13607 (με)	Level 4 B - 13608 (με)	Level 4 Av. Load (kips)
1 L - 0	-	12:38:00	0	0	0	0	0.0	0.0	0	0.0	0.0	0
1 L - 1	1	12:53:00	400	597	0	0	0.0	0.5	5	0.3	0.8	16
1 L - 1	2	12:54:00	400	597	0	0	0.1	0.5	6	0.6	0.5	14
1 L - 1	4	12:56:00	400	597	0	0	0.1	0.6	7	0.5	0.6	15
1 L - 1	8	13:00:00	400	597	0	0	0.1	0.7	7	0.5	0.5	13
1 L - 2	1	13:03:00	800	1,164	0	0	1.2	1.3	24	1.3	2.4	50
1 L - 2	2	13:04:00	800	1,164	0	0	1.1	1.4	24	1.3	2.2	47
1 L - 2	4	13:06:00	800	1,164	0	0	0.6	1.5	21	1.4	2.5	52
1 L - 2	8	13:10:00	800	1,164	0	0	0.8	1.5	22	1.5	2.6	55
1 L - 3	1	13:13:00	1,200	1,731	0	0	1.6	2.6	41	2.5	4.7	98
1 L - 3	2	13:14:00	1,200	1,731	0	0	1.8	2.8	44	2.7	4.1	93
1 L - 3	4	13:16:00	1,200	1,731	0	0	1.8	2.8	44	2.7	5.0	105
1 L - 3	8	13:20:00	1,200	1,731	0	0	1.9	2.9	47	2.8	4.8	105
1 L - 4	1	13:24:00	1,600	2,297	0	0	3.3	4.1	72	4.6	7.4	165
1 L - 4	2	13:25:00	1,600	2,297	0	0	2.9	4.3	70	4.5	7.6	166
1 L - 4	4	13:27:00	1,600	2,297	0	0	3.2	4.4	74	4.8	7.8	172
1 L - 4	8	13:31:00	1,600	2,297	0	0	3.4	4.5	76	4.6	7.3	163
1 L - 5	1	13:34:30	2,000	2,864	0	0	4.1	5.6	94	6.4	9.5	217
1 L - 5	2	13:35:30	2,000	2,864	0	0	4.4	5.6	97	6.4	9.5	217
1 L - 5	4	13:37:30	2,000	2,864	0	0	4.3	5.7	97	6.2	9.7	217
1 L - 5	8	13:41:30	2,000	2,864	0	0	4.2	6.0	98	6.5	10.2	228
1 L - 6	1	13:44:30	2,400	3,431	0	0	4.9	6.6	111	7.2	11.5	255
1 L - 6	2	13:45:30	2,400	3,431	0	0	4.8	6.9	114	7.4	11.1	253
1 L - 6	4	13:47:30	2,400	3,431	0	0	5.1	7.0	117	7.8	11.5	263
1 L - 6	8	13:51:30	2,400	3,431	0	0	5.1	7.0	117	7.6	11.8	265
1 L - 7	1	13:57:00	2,800	3,998	0	0	5.4	7.6	126	8.3	13.1	291
1 L - 7	2	13:58:00	2,800	3,998	0	0	5.5	7.7	128	8.3	13.1	292
1 L - 7	4	14:00:00	2,800	3,998	0	0	5.4	7.8	128	8.4	13.2	295
1 L - 7	8	14:04:00	2,800	3,998	0	0	5.2	7.9	127	8.5	13.4	298
1 L - 8	1	14:08:00	3,200	4,565	0	0	5.5	8.2	132	8.8	13.6	305
1 L - 8	2	14:09:00	3,200	4,565	0	0	5.7	8.3	136	9.0	14.0	314
1 L - 8	4	14:11:00	3,200	4,565	0	0	5.6	8.4	136	8.8	14.0	312
1 L - 8	8	14:15:00	3,200	4,565	0	0	5.9	8.6	140	8.7	14.2	313
1 L - 9	1	14:18:30	3,600	5,131	0	0	5.9	8.8	143	9.0	14.6	321
1 L - 9	2	14:19:30	3,600	5,131	0	0	5.5	8.7	138	9.1	14.4	321
1 L - 9	4	14:21:30	3,600	5,131	0	0	5.4	8.9	139	8.9	14.4	319
1 L - 9	8	14:25:30	3,600	5,131	0	0	5.9	9.0	144	9.0	14.6	321
1 L - 10	1	14:29:00	4,000	5,698	0	0	5.7	9.2	145	8.9	14.9	325
1 L - 10	2	14:30:00	4,000	5,698	0	0	5.3	9.0	139	9.0	14.8	325
1 L - 10	4	14:32:00	4,000	5,698	0	0	5.2	9.2	140	9.0	15.0	327
1 L - 10	8	14:36:00	4,000	5,698	0	0	5.4	9.3	143	9.0	15.2	329
1 L - 11	1	14:39:30	4,400	6,265	0	0	5.5	9.5	145	9.0	15.3	332
1 L - 11	2	14:40:30	4,400	6,265	0	0	5.5	9.4	145	9.1	15.4	335
1 L - 11	4	14:42:30	4,400	6,265	0	0	5.5	9.5	145	9.1	15.3	333
1 L - 11	8	14:46:30	4,400	6,265	0	0	5.3	9.6	145	9.0	15.3	332
1 L - 12	1	14:50:00	4,800	6,832	0	0	5.2	9.7	145	9.0	15.5	334
1 L - 12	2	14:51:00	4,800	6,832	0	0	5.4	9.7	147	9.0	15.8	338
1 L - 12	4	14:53:00	4,800	6,832	0	0	5.4	9.7	147	9.0	15.8	338
1 L - 12	8	14:57:00	4,800	6,832	0	0	5.5	9.7	147	9.0	15.7	338
1 L - 13	1	15:02:00	5,200	7,399	0	0	5.3	9.9	147	8.7	15.8	335
1 L - 13	2	15:03:00	5,200	7,399	0	0	5.2	10.1	148	9.0	15.9	339
1 L - 13	4	15:05:00	5,200	7,399	0	0	5.4	10.0	149	8.6	16.1	337
1 L - 13	8	15:09:00	5,200	7,399	0	0	5.2	10.0	148	8.9	16.1	341
1 L - 14	1	15:14:00	5,600	7,965	0	0	5.0	10.3	149	8.7	16.2	340
1 L - 14	2	15:15:00	5,600	7,965	0	0	5.1	10.2	148	8.6	16.4	342
1 L - 14	4	15:17:00	5,600	7,965	0	0	5.4	10.2	151	8.6	16.3	340
1 L - 14	8	15:21:00	5,600	7,965	0	0	4.8	10.4	147	8.6	16.3	341
1 L - 15	1	15:27:00	6,000	8,532	0	0	4.8	10.6	149	8.6	16.6	344
1 L - 15	2	15:28:00	6,000	8,532	0	0	5.1	10.5	151	8.5	16.4	340
1 L - 15	4	15:30:00	6,000	8,532	0	0	4.6	10.6	147	8.6	16.6	344
1 L - 15	8	15:34:00	6,000	8,532	0	0	4.6	10.6	147	8.6	16.7	346
1 L - 16	1	15:38:30	6,300	8,957	0	0	4.7	10.6	149	8.6	16.9	349
1 L - 16	2	15:39:30	6,300	8,957	0	0	4.5	10.7	147	8.6	16.8	347
1 L - 16	4	15:41:30	6,150	8,745	0	0	4.7	10.7	150	8.5	16.9	347
1 U - 1	1	15:47:00	4,800	6,832	0	0	4.8	10.4	147	8.0	16.4	334
1 U - 1	2	15:48:00	4,800	6,832	0	0	4.5	10.4	144	8.0	16.4	334
1 U - 1	4	15:50:00	4,800	6,832	0	0	4.3	10.5	143	8.1	16.4	335
1 U - 2	1	15:54:00	3,200	4,565	0	0	4.1	10.0	137	7.4	15.7	315
1 U - 2	2	15:55:00	3,200	4,565	0	0	4.2	10.0	138	7.5	15.5	314
1 U - 2	4	15:57:00	3,200	4,565	0	0	4.0	10.1	137	7.4	15.8	317
1 U - 3	1	16:03:00	1,600	2,297	0	0	3.8	9.5	128	6.4	14.6	287
1 U - 3	2	16:04:00	1,600	2,297	0	0	3.4	9.4	124	6.5	14.6	288
1 U - 3	4	16:06:00	1,600	2,297	0	0	3.5	9.5	125	6.4	14.5	285
1 U - 4	1	16:11:00	0	0	0	0	2.7	8.4	108	5.1	12.6	241
1 U - 4	2	16:12:00	0	0	0	0	2.7	8.3	107	5.1	12.5	240
1 U - 4	4	16:14:00	0	0	0	0	2.7	8.6	109	5.1	12.6	242
1 U - 4	8	16:18:00	0	0	0	0	2.7	8.6	109	5.3	12.6	244
1 U - 4	16	16:26:00	0	0	0	0	2.7	8.4	107	5.2	12.5	241
1 U - 4	32	16:42:00	0	0	0	0	2.4	8.3	104	5.0	12.3	235
2 L - 0	1	16:43:00	0	0	0	0	2.5	8.4	105	5.0	12.4	237
2 L - 1	1	16:53:30	0	0	400	584	2.4	8.3	104	5.2	12.5	241
2 L - 1	2	16:54:30	0	0	400	584	2.7	8.3	107	5.1	12.7	243
2 L - 1	4	16:56:30	0	0	400	584	2.6	8.4	106	5.2	12.6	242
2 L - 1	8	17:00:30	0	0	400	584	2.6	8.3	105	5.1	12.6	241
2 L - 2	1	17:04:30	0	0	800	1,155	2.7	8.8	112	5.5	13.2	255
2 L - 2	2	17:05:30	0	0	800	1,155	2.9	8.8	113	5.3	13.3	254
2 L - 2	4	17:07:30	0	0	800	1,155	2.7	8.7	111	5.3	13.3	254
2 L - 2	8	17:11:30	0	0	800	1,155	2.7	8.8	111	5.3	13.1	251
2 L - 3	1	17:14:00	0	0	1,200	1,725	2.9	9.2	118	5.9	13.9	271
2 L - 3	2	17:15:00	0	0	1,200	1,725	3.1	9.1	118	6.0	14.1	274
2 L - 3	4	17:17:00	0	0	1,200	1,725	2.9	9.3	118	6.0	13.9	273
2 L - 3	8	17:21:00	0	0	1,200	1,725	3.1	9.0	118	5.9	14.2	274

Strain Gage Readings and Loads at Levels 3 and 4
Test Shaft 2 - I-35 W over Mississippi River - Minneapolis, MN

Load Test Increment	Hold Time (minutes)	Time (h:m:s)	Lower O-cell		Upper O-cell		Level 3			Level 4		
			Pressure (psi)	Load (kips)	Pressure (psi)	Load (kips)	A - 10245 (με)	B - 10246 (με)	Av. Load (kips)	A - 13607 (με)	B - 13608 (με)	Av. Load (kips)
2L-4	1	17:23:30	0	0	1,600	2,296	3.0	9.5	121	6.5	14.7	290
2L-4	2	17:24:30	0	0	1,600	2,296	3.4	9.4	124	6.6	14.9	293
2L-4	4	17:26:30	0	0	1,600	2,296	3.4	9.6	126	6.7	14.8	294
2L-4	8	17:30:30	0	0	1,600	2,296	3.5	9.5	126	6.7	15.0	296
2L-5	1	17:33:00	0	0	2,000	2,866	3.4	10.2	131	7.2	15.6	311
2L-5	2	17:34:00	0	0	2,000	2,866	3.5	10.2	133	7.1	15.6	310
2L-5	4	17:36:00	0	0	2,000	2,866	3.6	10.1	133	7.2	15.6	311
2L-5	8	17:40:00	0	0	2,000	2,866	3.3	10.1	130	7.1	15.5	309
2L-6	1	17:42:30	0	0	2,400	3,436	4.0	10.5	141	7.8	16.1	326
2L-6	2	17:43:30	0	0	2,400	3,436	4.0	10.4	140	7.6	16.1	324
2L-6	4	17:45:30	0	0	2,400	3,436	4.0	10.5	141	7.8	16.1	327
2L-6	8	17:49:30	0	0	2,400	3,436	3.6	10.5	137	7.6	16.0	322
2L-7	1	17:51:30	0	0	2,800	4,007	3.8	10.9	143	7.9	16.2	330
2L-7	2	17:52:30	0	0	2,800	4,007	3.9	10.9	143	7.9	16.2	329
2L-7	4	17:54:30	0	0	2,800	4,007	3.8	10.9	143	7.9	16.1	328
2L-7	8	17:58:30	0	0	2,800	4,007	3.8	11.0	143	7.9	16.4	333
2L-8	1	18:00:30	0	0	3,200	4,577	3.8	11.0	143	8.1	16.4	335
2L-8	2	18:01:30	0	0	3,200	4,577	4.2	11.0	148	8.0	16.4	333
2L-8	4	18:03:30	0	0	3,200	4,577	3.9	11.2	147	8.1	16.4	335
2L-8	8	18:07:30	0	0	3,200	4,577	3.9	11.1	146	7.9	16.4	333
2L-9	1	18:09:30	0	0	3,600	5,148	4.3	11.0	149	8.2	17.0	343
2L-9	2	18:10:30	0	0	3,600	5,148	4.2	11.0	147	8.1	16.9	342
2L-9	4	18:12:30	0	0	3,600	5,148	4.3	11.0	148	8.0	16.9	341
2L-9	8	18:16:30	0	0	3,600	5,148	4.3	11.2	150	8.1	16.7	338
2L-10	1	18:18:30	0	0	4,000	5,718	4.0	11.5	150	7.9	17.3	344
2L-10	2	18:19:30	0	0	4,000	5,718	4.3	11.3	151	7.8	17.2	342
2L-10	4	18:21:30	0	0	4,000	5,718	4.0	11.4	150	7.8	17.3	343
2L-10	8	18:25:30	0	0	4,000	5,718	4.3	11.4	152	8.0	17.3	346
2L-11	1	18:28:00	0	0	4,400	6,288	4.1	11.7	153	7.7	17.7	347
2L-11	2	18:29:00	0	0	4,400	6,288	3.9	11.8	152	7.6	17.7	346
2L-11	4	18:31:00	0	0	4,400	6,288	3.8	11.9	153	7.5	17.5	341
2L-11	8	18:35:00	0	0	4,400	6,288	3.7	11.8	150	7.6	17.8	347
2L-12	1	18:38:00	0	0	4,800	6,859	3.8	12.2	155	7.3	18.0	345
2L-12	2	18:39:00	0	0	4,800	6,859	3.8	11.9	152	7.2	18.1	346
2L-12	4	18:41:00	0	0	4,800	6,859	3.8	12.2	155	7.3	18.4	351
2L-12	8	18:45:00	0	0	4,800	6,859	3.4	12.2	152	7.1	18.1	345
2L-13	1	18:47:30	0	0	5,200	7,429	3.6	12.6	157	6.9	18.6	347
2L-13	2	18:48:30	0	0	5,200	7,429	3.6	12.3	154	6.9	19.0	353
2L-13	4	18:50:30	0	0	5,200	7,429	3.6	12.6	157	6.7	18.7	348
2L-13	8	18:54:30	0	0	5,200	7,429	3.7	12.6	157	6.8	19.1	354
2L-14	1	18:58:00	0	0	5,600	8,000	2.9	12.9	153	6.5	19.4	353
2L-14	2	18:59:00	0	0	5,600	8,000	3.1	12.9	156	6.4	19.6	355
2L-14	4	19:01:00	0	0	5,600	8,000	3.0	12.9	155	6.4	19.6	355
2L-14	8	19:05:00	0	0	5,600	8,000	3.1	13.1	157	6.4	19.4	352
2L-15	1	19:07:30	0	0	6,000	8,570	2.7	13.3	155	6.1	19.8	354
2L-15	2	19:08:30	0	0	6,000	8,570	3.0	13.4	159	6.0	19.9	354
2L-15	4	19:10:30	0	0	6,000	8,570	2.6	13.4	154	5.9	19.9	353
2L-15	8	19:14:30	0	0	6,000	8,570	2.7	13.5	157	6.0	20.2	358
2L-16	1	19:17:00	0	0	6,400	9,140	2.6	13.8	159	5.6	20.5	357
2L-16	2	19:18:00	0	0	6,400	9,140	2.4	13.6	155	5.7	20.8	362
2L-16	4	19:20:00	0	0	6,400	9,140	2.6	14.0	161	5.7	20.8	361
2L-16	8	19:24:00	0	0	6,400	9,140	2.5	13.9	159	5.4	20.9	360
2L-17	1	19:27:30	0	0	6,800	9,711	2.4	14.1	159	5.2	21.4	363
2L-17	2	19:28:30	0	0	6,800	9,711	2.2	14.2	159	5.3	21.5	366
2L-17	4	19:30:30	0	0	6,800	9,711	2.0	14.3	158	5.2	21.6	367
2L-17	8	19:34:30	0	0	6,800	9,711	2.2	14.4	161	5.1	21.4	362
2L-18	1	19:39:30	0	0	7,200	10,281	2.0	14.6	162	4.8	22.1	367
2L-18	2	19:40:30	0	0	7,200	10,281	2.1	14.7	163	4.8	22.2	369
2L-18	4	19:42:30	0	0	7,200	10,281	1.8	14.8	161	4.8	22.6	374
2L-18	8	19:46:30	0	0	7,200	10,281	1.7	14.9	161	4.6	22.5	370
2L-19	1	19:51:00	0	0	7,600	10,852	1.7	15.2	163	4.3	22.9	372
2L-19	2	19:52:00	0	0	7,600	10,852	1.5	15.3	163	4.3	23.1	373
2L-19	4	19:54:00	0	0	7,600	10,852	1.8	15.2	164	4.1	23.3	374
2L-19	8	19:58:00	0	0	7,600	10,852	1.7	15.3	165	4.1	23.2	372
2L-20	1	20:04:00	0	0	8,000	11,422	1.5	15.6	166	3.9	23.9	379
2L-20	2	20:05:00	0	0	8,000	11,422	1.3	15.6	165	3.7	23.9	377
2L-20	4	20:07:00	0	0	8,000	11,422	1.4	15.6	165	3.8	24.1	381
2L-20	8	20:11:00	0	0	8,000	11,422	1.1	15.7	163	3.8	24.1	381
2L-21	1	20:15:00	0	0	8,400	11,992	0.8	16.0	164	3.5	24.6	383
2L-21	2	20:16:00	0	0	8,400	11,992	0.9	16.1	165	3.4	24.7	383
2L-21	4	20:18:00	0	0	8,400	11,992	1.2	16.1	168	3.6	24.9	388
2L-21	8	20:22:00	0	0	8,400	11,992	0.7	16.1	163	3.5	24.9	388
2L-22	1	20:29:30	0	0	8,800	12,563	0.6	16.4	165	3.2	25.6	392
2L-22	2	20:30:30	0	0	8,800	12,563	0.4	16.4	163	3.2	25.6	393
2L-22	4	20:32:30	0	0	8,800	12,563	0.7	16.5	167	3.2	25.6	394
2L-22	8	20:36:30	0	0	8,800	12,563	0.6	16.7	167	3.5	25.7	399
2U-1	1	20:40:00	0	0	6,600	9,426	-0.1	15.3	148	2.0	23.5	348
2U-1	2	20:41:00	0	0	6,600	9,426	0.0	15.4	150	1.9	23.3	345
2U-1	4	20:43:00	0	0	6,600	9,426	-0.3	15.4	146	2.0	23.4	346
2U-2	1	20:45:30	0	0	4,400	6,288	-0.8	14.4	133	1.0	21.7	310
2U-2	2	20:46:30	0	0	4,400	6,288	-0.6	14.5	134	1.1	21.7	311
2U-2	4	20:48:30	0	0	4,400	6,288	-0.6	14.5	135	1.0	21.8	312
2U-3	1	20:50:30	0	0	2,200	3,151	-0.5	13.7	128	0.1	20.4	279
2U-3	2	20:51:30	0	0	2,200	3,151	-0.7	13.8	128	0.2	20.3	281
2U-3	4	20:53:30	0	0	2,200	3,151	-0.9	13.5	122	-0.1	20.0	272
2U-4	1	20:57:30	0	0	0	0	-0.6	12.0	110	-0.9	17.9	232
2U-4	2	20:58:30	0	0	0	0	-0.5	12.0	111	-1.0	18.0	231
2U-4	4	21:00:30	0	0	0	0	-0.4	12.2	114	-1.0	18.1	234
2U-4	8	21:04:30	0	0	0	0	-0.4	12.2	114	-0.9	18.1	235

APPENDIX B

O-CELL AND INSTRUMENTATION CALIBRATION SHEETS



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00047

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	178	178	177
1000	353	352	353
1500	533	531	531
2000	713	711	712
2500	895	893	890
3000	1075	1071	1068
3500	1254	1249	1245
4000	1430	1427	1419
4500	1610	1606	1597
5000	1787	1783	1775
5500	1967	1960	1951
6000	2138	2130	2122
6500	2316	2310	2299
7000	2490	2485	2472
7500	2669	2662	2651
8000	2841	2832	2824
8500	3019	3010	2999

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3542 + (5.04)
{KIPS} {PSI}

Regression Output:

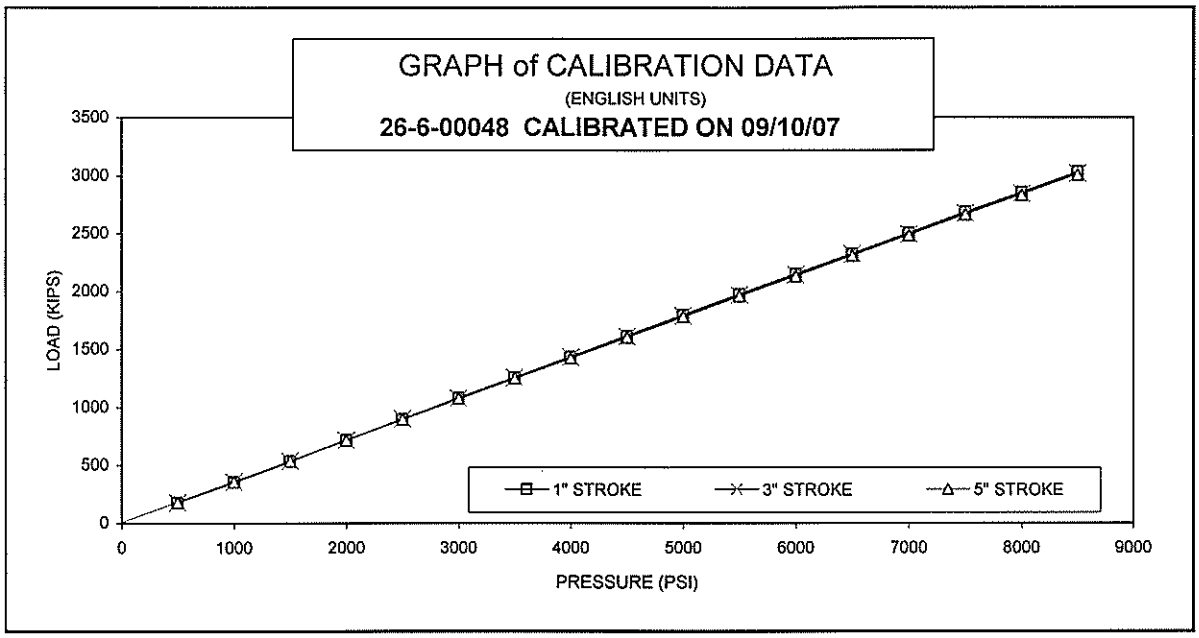
Constant	5.0437 kips
X Coefficient	0.3542 kip / psi
R Square	0.9999
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	6.99
Std Err of X Coeff	0.0004

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	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00048

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	178	178	179
1000	354	357	357
1500	534	537	537
2000	718	715	715
2500	897	899	895
3000	1080	1078	1075
3500	1257	1256	1249
4000	1434	1431	1424
4500	1615	1610	1603
5000	1793	1788	1781
5500	1973	1967	1957
6000	2145	2139	2129
6500	2322	2317	2305
7000	2497	2490	2479
7500	2677	2669	2658
8000	2848	2840	2827
8500	3026	3016	3004

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3547 + (7.91)
{KIPS} {PSI}

Regression Output:

Constant	7.9127 kips
X Coefficient	0.3547 kip / psi
R Square	0.9999
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	7.40
Std Err of X Coeff	0.0004

CALIBRATION STANDARDS:

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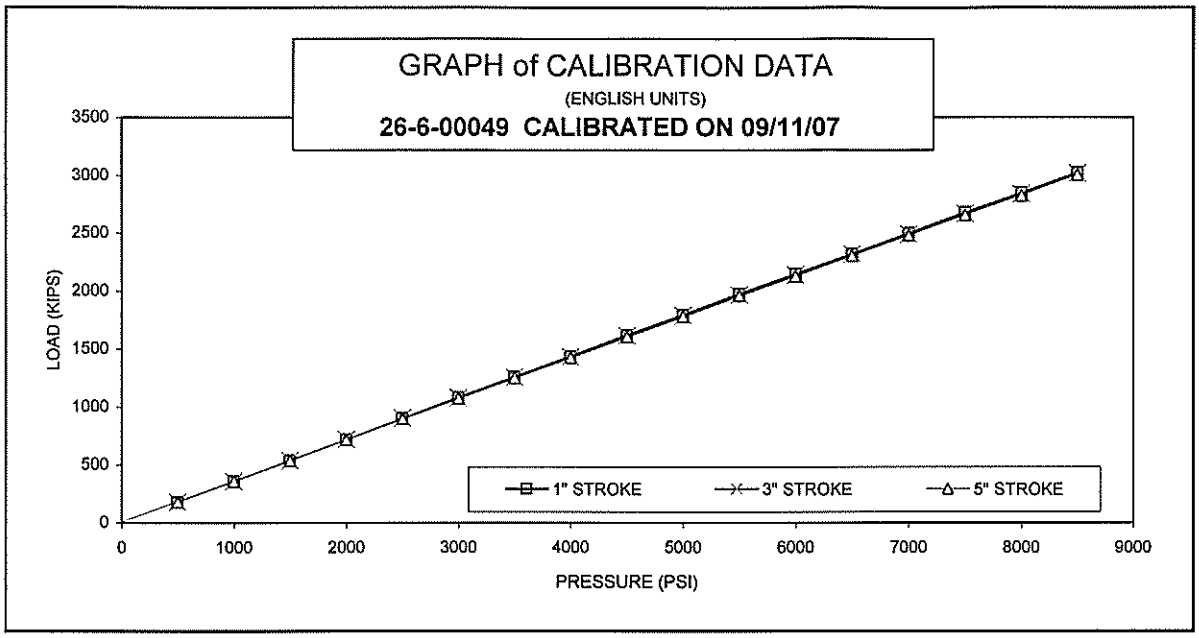
* AE & FC CUSTOMER: LOADTEST Inc	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00049

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	178	177	177
1000	358	357	357
1500	537	538	535
2000	717	716	715
2500	900	899	894
3000	1079	1076	1071
3500	1257	1254	1248
4000	1434	1429	1423
4500	1616	1611	1602
5000	1792	1787	1778
5500	1973	1962	1955
6000	2143	2135	2124
6500	2319	2314	2302
7000	2496	2487	2477
7500	2675	2664	2654
8000	2843	2835	2821
8500	3022	3014	3001

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3541 + (8.95)
{KIPS} {PSI}

Regression Output:

Constant	8.9465 kips
X Coefficient	0.3541 kip / psi
R Square	0.9999
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	7.87
Std Err of X Coeff	0.0005

CALIBRATION STANDARDS:

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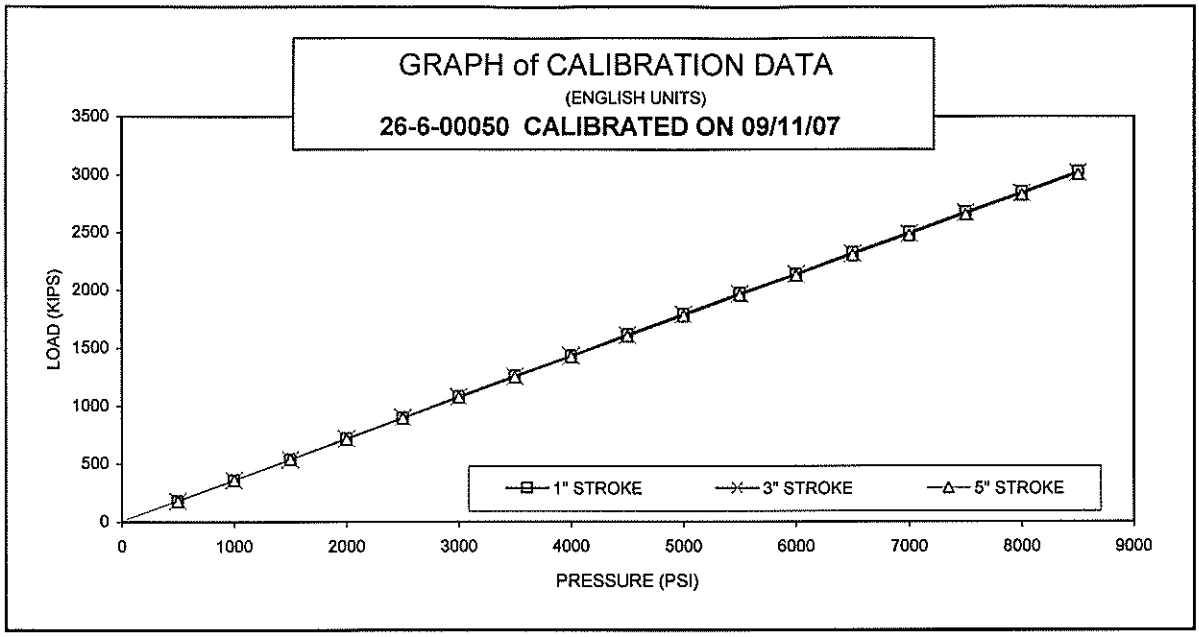
* AE & FC CUSTOMER: LOADTEST Inc	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00050

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	178	177	178
1000	356	356	356
1500	537	537	536
2000	718	714	712
2500	898	896	894
3000	1079	1076	1073
3500	1257	1252	1248
4000	1431	1431	1423
4500	1615	1608	1600
5000	1792	1785	1775
5500	1968	1963	1954
6000	2139	2134	2124
6500	2320	2312	2301
7000	2494	2485	2471
7500	2673	2666	2651
8000	2845	2835	2823
8500	3022	3013	2999

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3540 + (8.35)
{KIPS} {PSI}

Regression Output:

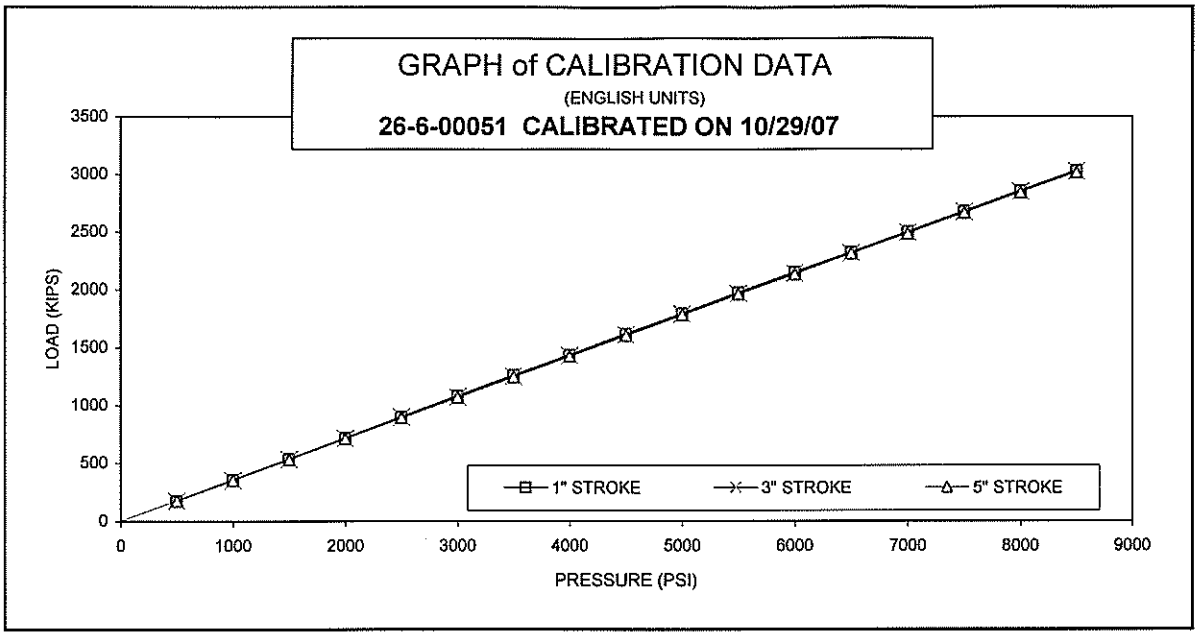
Constant	8.3505 kips
X Coefficient	0.3540 kip / psi
R Square	0.9999
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	7.82
Std Err of X Coeff	0.0004

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	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00051

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	175	174	174
1000	357	351	354
1500	537	534	532
2000	717	715	712
2500	900	896	891
3000	1080	1073	1070
3500	1259	1252	1247
4000	1434	1429	1424
4500	1616	1610	1604
5000	1792	1788	1782
5500	1970	1966	1961
6000	2148	2139	2133
6500	2320	2316	2313
7000	2497	2491	2484
7500	2675	2672	2662
8000	2853	2846	2835
8500	3027	3020	3010

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3556 + (3.97)
{KIPS} {PSI}

Regression Output:

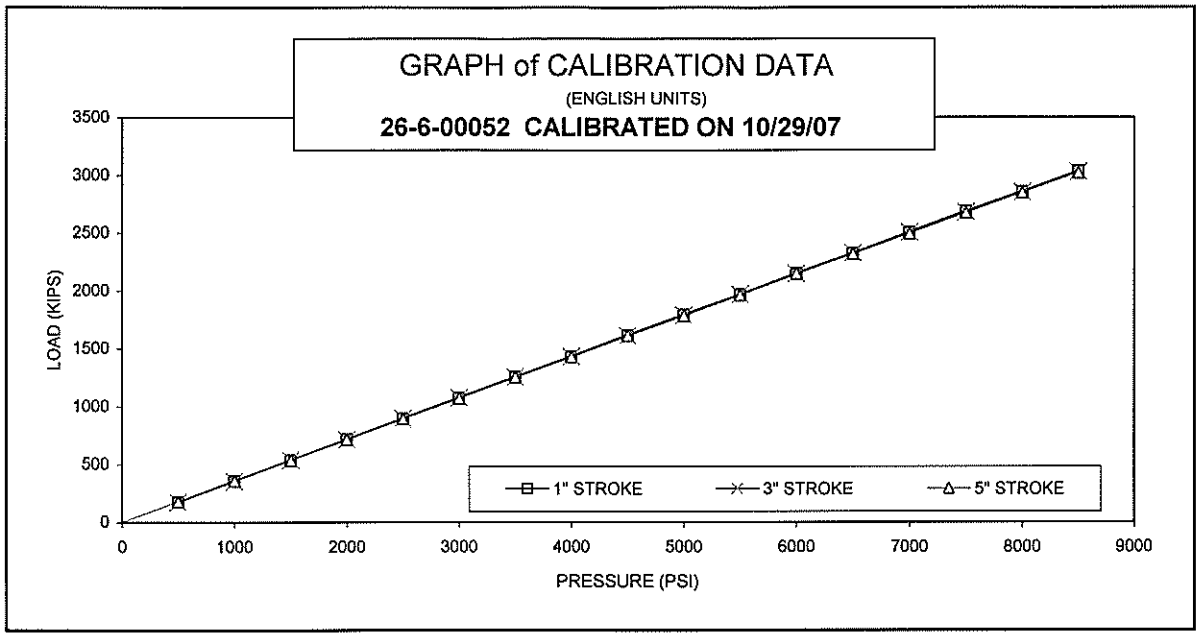
Constant	3.9736 kips
X Coefficient	0.3556 kip / psi
R Square	0.9999
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	6.43
Std Err of X Coeff	0.0004

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	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00052

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	176	176	178
1000	360	354	357
1500	537	536	535
2000	717	712	713
2500	896	895	891
3000	1078	1074	1070
3500	1258	1254	1251
4000	1434	1431	1428
4500	1618	1612	1611
5000	1794	1789	1784
5500	1969	1970	1960
6000	2152	2145	2148
6500	2326	2326	2317
7000	2505	2503	2491
7500	2686	2677	2670
8000	2855	2849	2844
8500	3033	3026	3015

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3565 + (3.23)
{KIPS} {PSI}

Regression Output:

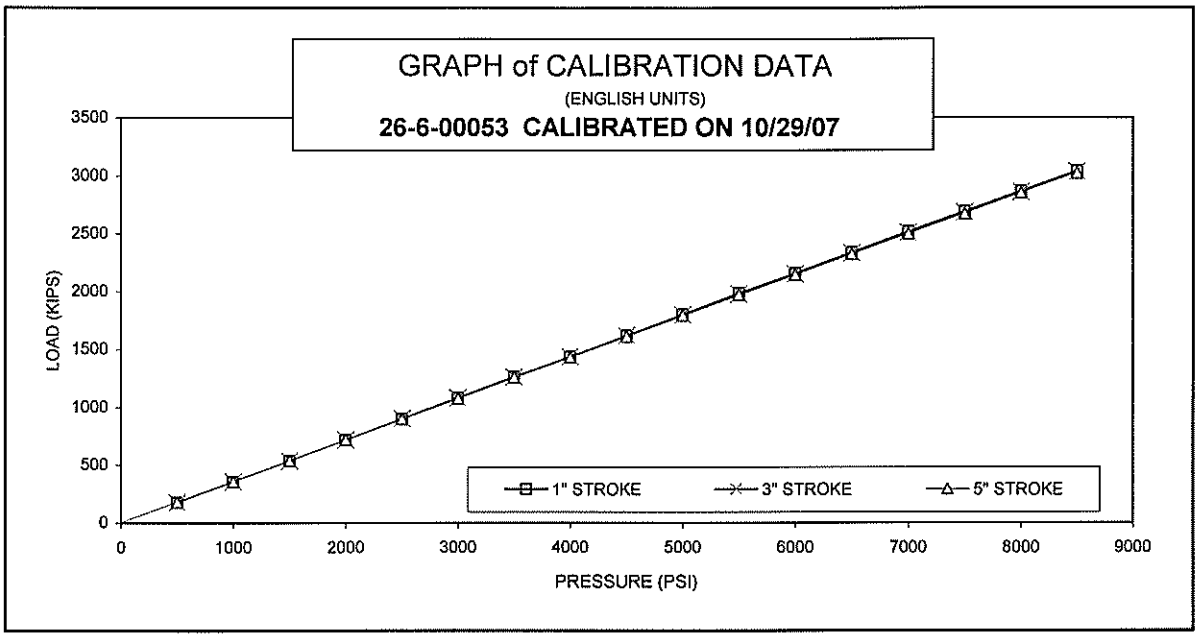
Constant	3.2323 kips
X Coefficient	0.3565 kip / psi
R Square	1.0000
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	5.77
Std Err of X Coeff	0.0003

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	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00053

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	178	178	181
1000	357	357	357
1500	537	537	537
2000	718	717	717
2500	899	899	896
3000	1079	1076	1074
3500	1259	1258	1256
4000	1435	1434	1429
4500	1618	1616	1610
5000	1796	1795	1792
5500	1980	1975	1967
6000	2152	2145	2139
6500	2333	2326	2317
7000	2511	2503	2494
7500	2687	2680	2666
8000	2864	2855	2848
8500	3037	3032	3020

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3568 + (4.86)
{KIPS} {PSI}

Regression Output:

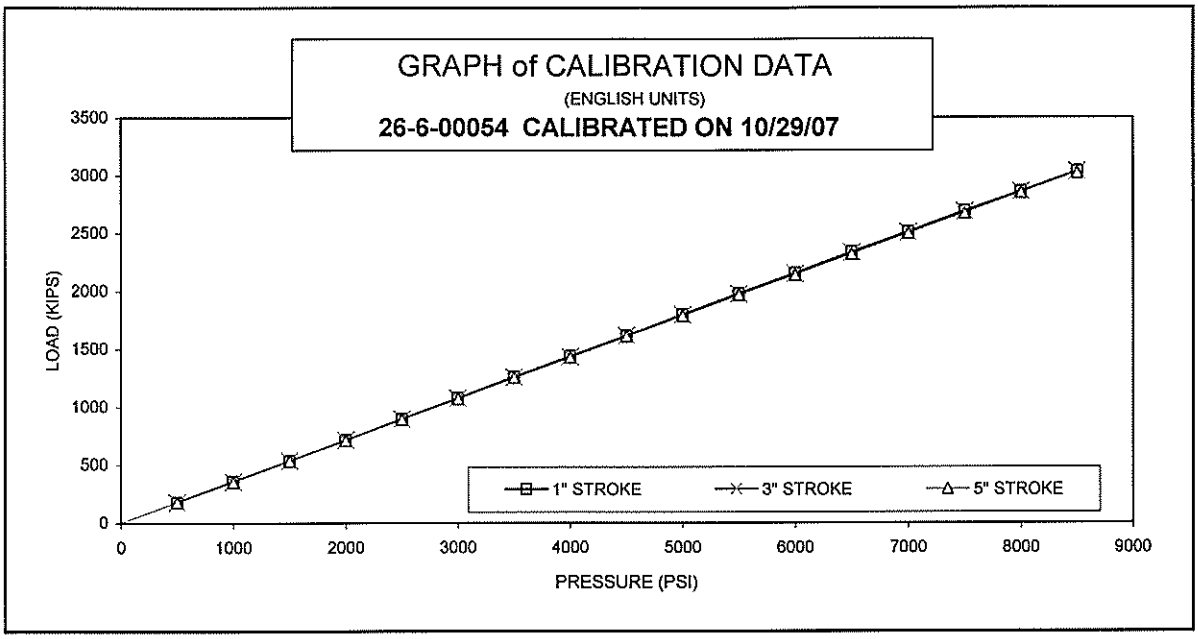
Constant	4.8566 kips
X Coefficient	0.3568 kip / psi
R Square	1.0000
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	6.05
Std Err of X Coeff	0.0003

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	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07



STROKE: 1 INCH 3 INCH 5 INCH

26" O-CELL, SERIAL # 26-6-00054

PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
500	179	177	176
1000	359	356	351
1500	536	536	534
2000	714	713	709
2500	897	895	892
3000	1077	1076	1068
3500	1259	1254	1251
4000	1436	1433	1426
4500	1618	1616	1610
5000	1798	1794	1787
5500	1977	1974	1965
6000	2151	2147	2135
6500	2334	2330	2316
7000	2508	2504	2495
7500	2689	2683	2666
8000	2858	2857	2847
8500	3033	3032	3019

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3571 + (1.94)
{KIPS} {PSI}

Regression Output:

Constant	1.9368 kips
X Coefficient	0.3571 kip / psi
R Square	0.9999
No. of Observations	51
Degrees of Freedom	49
Std Err of Y Est	6.48
Std Err of X Coeff	0.0004

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	* CONTRACTOR.: CASE FOUNDATION
* AE & FC JOB NO: SO2799	* JOB LOCATION: ROSELLE, IL
* CUSTOMER P.O. NO.: LT-9401	* DATED: 10/25/07

SERVICE ENGINEER: _____ DATE: 10-30-07

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: October 2, 2007

Serial Number: 07-20367

Temperature: 24.2 °C

Calibration Instruction: CI-4400

Technician: K S Rogers

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	2646	2646	2646	0.25	0.17	-0.16	-0.11
30.0	3564	3564	3564	30.11	0.08	30.20	0.13
60.0	4478	4478	4478	59.84	-0.10	60.18	0.12
90.0	5391	5391	5391	89.54	-0.31	89.88	-0.08
120.0	6317	6315	6316	119.63	-0.25	119.73	-0.18
150.0	7273	7263	7268	150.59	0.40	150.18	0.12

(mm) Linear Gage Factor (G): 0.03253 **(mm/ digit)** **Regression Zero:** 2638

Polynomial Gage Factors: **A:** -1.4628E-07 **B:** 0.03398 **C:** -89.039

(inches) Linear Gage Factor (G): 0.001281 **(inches/ digit)**

Polynomial Gage Factors: **A:** -5.7589E-09 **B:** 0.001338 **C:** -3.5055

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4978 Temp(T_0): 21.4 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: October 2, 2007

Serial Number: 07-20368

Temperature: 24.2 °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	2592	2591	2592	-0.16	-0.11	0.03	0.02
30.0	3525	3524	3525	30.03	0.02	29.99	-0.01
60.0	4454	4453	4454	60.09	0.06	59.94	-0.04
90.0	5383	5382	5383	90.15	0.10	90.00	0.00
120.0	6309	6310	6310	120.14	0.10	120.11	0.07
150.0	7223	7226	7225	149.75	-0.17	149.94	-0.04

(mm) Linear Gage Factor (G): 0.03236 **(mm/ digit)** **Regression Zero:** 2597

Polynomial Gage Factors: **A:** 6.58327E-08 **B:** 0.03171 **C:** -82.598

(inches) Linear Gage Factor (G): 0.001274 **(inches/ digit)**

Polynomial Gage Factors: **A:** 2.59184E-09 **B:** 0.001248 **C:** -3.2519

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4979 Temp(T_0): 21.1 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: October 2, 2007

Serial Number: 07-20369

Temperature: 24.2 °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	2528	2528	2528	0.13	0.09	-0.03	-0.02
30.0	3465	3464	3465	30.07	0.05	30.10	0.07
60.0	4394	4394	4394	59.78	-0.14	59.92	-0.05
90.0	5334	5333	5334	89.82	-0.12	89.95	-0.03
120.0	6278	6281	6280	120.06	0.04	120.09	0.06
150.0	7220	7221	7221	150.14	0.09	149.97	-0.02

(mm) Linear Gage Factor (G): 0.03197 (mm/ digit) **Regression Zero: 2524**

Polynomial Gage Factors: A: -5.7344E-08 B: 0.03253 C: -81.891

(inches) Linear Gage Factor (G): 0.001259 (inches/ digit)

Polynomial Gage Factors: A: -2.2576E-09 B: 0.001281 C: -3.2240

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4961 Temp(T_0): 21.7 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: October 2, 2007

Serial Number: 07-20370

Temperature: 24.2 °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	2641	2642	2642	0.38	0.26	0.03	0.02
30.0	3555	3556	3556	29.94	-0.04	30.01	0.00
60.0	4473	4473	4473	59.60	-0.27	59.89	-0.07
90.0	5406	5403	5405	89.72	-0.19	90.01	0.01
120.0	6344	6342	6343	120.06	0.04	120.14	0.09
150.0	7280	7275	7278	150.28	0.19	149.92	-0.05

(mm) Linear Gage Factor (G): 0.03233 (mm/ digit) **Regression Zero: 2630**

Polynomial Gage Factors: **A: -1.2516E-07** **B: 0.03357** **C: -87.784**

(inches) Linear Gage Factor (G): 0.001273 (inches/ digit)

Polynomial Gage Factors: **A: -4.9274E-09** **B: 0.001322** **C: -3.4561**

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4999 Temp(T_0): 21.8 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: January 17, 2007

Serial Number: 07-405

Temperature: 21.8 °C

Cal. Std. Control Numbers: 057, 529, 406

Calibration Instruction: CI-4400

Technician: K.L.Bellavance

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	2561	2561	2561	-0.46	-0.31	-0.04	-0.03
30.0	3544	3543	3544	30.20	0.13	30.11	0.07
60.0	4507	4506	4507	60.25	0.17	59.91	-0.06
90.0	5471	5470	5471	90.33	0.22	90.00	0.00
120.0	6424	6424	6424	120.09	0.06	120.01	0.01
150.0	7369	7369	7369	149.58	-0.28	150.00	0.00

(mm) Linear Gage Factor (G): 0.03121 (mm/ digit) **Regression Zero: 2576**

Polynomial Gage Factors: A: 1.36028E-07 B: 0.02986 C: -77.392

(inches) Linear Gage Factor (G): 0.001229 (inches/ digit)

Polynomial Gage Factors: A: 5.35544E-09 B: 0.001175 C: -3.0469

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 5003 Temp(T_0): 26.4 °C Date: February 27, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: September 25, 2007

Serial Number: 07-19369

Temperature: 24 °C

Calibration Instruction: CI-4400

Technician: KS Rogers

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	2592	2592	2592	-0.21	-0.14	0.00	0.00
30.0	3541	3541	3541	30.05	0.03	30.01	0.01
60.0	4484	4486	4485	60.15	0.10	59.99	-0.01
90.0	5426	5427	5427	90.17	0.11	90.01	0.00
120.0	6364	6363	6364	120.04	0.03	120.00	0.00
150.0	7298	7295	7297	149.79	-0.14	150.00	0.00

(mm) Linear Gage Factor (G): 0.03188 **(mm/ digit)** **Regression Zero:** 2599

Polynomial Gage Factors: **A:** 6.94579E-08 **B:** 0.03120 **C:** -81.331

(inches) Linear Gage Factor (G): 0.001255 **(inches/ digit)**

Polynomial Gage Factors: **A:** 2.73456E-09 **B:** 0.001228 **C:** -3.2020

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4983 Temp(T_0): 21.6 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: September 25, 2007

Serial Number: 07-19370

Temperature: 24 °C

Calibration Instruction: CI-4400

Technician: K S Rogers

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	2598	2598	2598	-0.06	-0.04	0.00	0.00
30.0	3542	3541	3542	30.05	0.03	30.04	0.02
60.0	4480	4479	4480	59.97	-0.02	59.93	-0.05
90.0	5421	5421	5421	90.01	0.01	89.97	-0.02
120.0	6365	6365	6365	120.13	0.09	120.12	0.08
150.0	7298	7297	7298	149.88	-0.08	149.94	-0.04

(mm) Linear Gage Factor (G): 0.03191 (mm/ digit) **Regression Zero: 2600**

Polynomial Gage Factors: A: 1.99243E-08 B: 0.03171 C: -82.509

(inches) Linear Gage Factor (G): 0.001256 (inches/ digit)

Polynomial Gage Factors: A: 7.84422E-10 B: 0.001248 C: -3.2484

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4983 Temp(T_0): 20.9 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: September 25, 2007

Serial Number: 07-19371

Temperature: 24 °C

Calibration Instruction: CI-4400

Technician: KStogsdill

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	2628	2627	2628	-0.06	-0.04	-0.03	-0.02
30.0	3567	3565	3566	30.05	0.03	30.04	0.03
60.0	4502	4500	4501	60.05	0.03	60.02	0.01
90.0	5435	5433	5434	89.98	-0.01	89.96	-0.03
120.0	6370	6369	6370	120.00	0.00	119.99	-0.01
150.0	7304	7304	7304	149.98	-0.01	150.02	0.01

(mm) Linear Gage Factor (G): 0.03208 **(mm/ digit)** **Regression Zero:** 2629

Polynomial Gage Factors: **A:** 1.18022E-08 **B:** 0.03197 **C:** -84.103

(inches) Linear Gage Factor (G): 0.001263 **(inches/ digit)**

Polynomial Gage Factors: **A:** 4.64655E-10 **B:** 0.001259 **C:** -3.3111

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 5002 Temp(T_0): 20.7 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: September 25, 2007

Serial Number: 07-19372

Temperature: 24 °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	2624	2624	2624	-0.03	-0.02	-0.09	-0.06
30.0	3567	3565	3566	30.11	0.07	30.12	0.08
60.0	4503	4501	4502	60.05	0.04	60.10	0.07
90.0	5434	5431	5433	89.83	-0.12	89.87	-0.09
120.0	6374	6372	6373	119.92	-0.05	119.93	-0.05
150.0	7317	7317	7317	150.12	0.08	150.07	0.05

(mm) Linear Gage Factor (G): 0.03200 **(mm/ digit)** **Regression Zero:** 2625

Polynomial Gage Factors: **A:** -1.8165E-08 **B:** 0.03218 **C:** -84.393

(inches) Linear Gage Factor (G): 0.001260 **(inches/ digit)**

Polynomial Gage Factors: **A:** -7.1515E-10 **B:** 0.001267 **C:** -3.3226

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4996 Temp(T_0): 20.9 °C Date: October 30, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 25 mm

Calibration Date: September 7, 2007

Serial Number: 07-19421

Temperature: 24.5 °C

Cal. Std. Control Numbers: 529, 057, 406

Calibration Instruction: CI-4400

Technician: J. Ouellette

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	2156	2155	2156	-0.06	-0.23	-0.01	-0.02
5.0	3411	3408	3410	5.02	0.07	5.01	0.03
10.0	4653	4650	4652	10.05	0.18	10.00	0.01
15.0	5885	5884	5885	15.04	0.15	15.00	-0.02
20.0	7112	7111	7112	20.00	0.01	19.99	-0.02
25.0	8334	8334	8334	24.95	-0.19	25.00	0.02

(mm) Linear Gage Factor (G): 0.004048 (mm/ digit) **Regression Zero: 2169.8**

Polynomial Gage Factors: **A: 1.03047E-08** **B: 0.003940** **C: -8.5451**

(inches) Linear Gage Factor (G): 0.0001594 (inches/ digit)

Polynomial Gage Factors: **A: 4.05699E-10** **B: 0.0001551** **C: -0.33642**

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 4955 Temp(T_0): 22.0 °C Date: September 10, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 25 mm

Calibration Date: September 7, 2007

Serial Number: 07-19424

Temperature: 24.5 °C

Cal. Std. Control Numbers: 529, 057, 406

Calibration Instruction: CI-4400

Technician: J. Ouellette

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	2216	2214	2215	-0.07	-0.27	-0.01	-0.03
5.0	3485	3483	3484	5.02	0.10	5.01	0.05
10.0	4737	4735	4736	10.05	0.20	10.00	0.00
15.0	5981	5980	5981	15.04	0.17	15.00	-0.02
20.0	7217	7217	7217	20.00	0.02	19.99	-0.03
25.0	8448	8448	8448	24.94	-0.22	25.01	0.02

(mm) Linear Gage Factor (G): 0.004013 (mm/ digit) **Regression Zero: 2231.9**

Polynomial Gage Factors: A: 1.16334E-08 B: 0.003889 C: -8.6777

(inches) Linear Gage Factor (G): 0.0001580 (inches/ digit)

Polynomial Gage Factors: A: 4.58007E-10 B: 0.0001531 C: -0.34164

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

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

Refer to manual for temperature correction information.

Function Test at Shipment:

GK-401 Pos. B : 5143 Temp(T_0): 22.4 °C Date: September 10, 2007

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Date of Calibration: January 17, 2007

Serial Number: 06-26697

Cal. Std. Control Numbers: 85888-1, 098

Prestress: 35,000 psi

Cable Length: 131 ft.

Temperature: 23.5 °C

Factory Zero Reading: 6922

Calibration Instruction: CI-VW Rebar Rev: C

Regression Zero: 6916

Technician: Elisa

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	6973	6974	6974		
1,500	7645	7646	7646	672	-0.26
3,000	8381	8385	8383	738	-0.24
4,500	9128	9135	9132	749	0.14
6,000	9865	9868	9867	735	0.07
100	6974				

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

Gage Factor: 0.344 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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 06-26698

Prestress: 35,000 psi

Temperature: 23.5 °C

Calibration Instruction: CI-VW Rebar Rev: C

Date of Calibration: January 17, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 131 ft.

Factory Zero Reading: 7056

Regression Zero: 7064

Technician: Elise

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7129	7128	7129		
1,500	7798	7800	7799	671	-0.35
3,000	8541	8547	8544	745	-0.36
4,500	9298	9299	9299	755	-0.05
6,000	10057	10053	10055	757	0.32
100	7129				

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

Gage Factor: 0.342 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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 07-10521

Prestress: 35,000 psi

Temperature: 23.8 °C

Calibration Instruction: CI-VW Rebar

Date of Calibration: May 9, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 90 ft.

Factory Zero Reading: 7339

Regression Zero: 7355

Technician: Elise

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7412	7410	7411		
1,500	8065	8064	8065	654	-0.17
3,000	8779	8777	8778	714	-0.21
4,500	9500	9499	9500	722	0.04
6,000	10216	10220	10218	719	0.18
100	7410				

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 07-10522

Prestress: 35,000 psi

Temperature: 24.2 °C

Calibration Instruction: CI-VW Rebar

Date of Calibration: May 9, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 90 ft.

Factory Zero Reading: 6959

Regression Zero: 6969

Technician: Elice

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7032	7028	7030		
1,500	7687	7684	7686	656	-0.32
3,000	8413	8415	8414	729	-0.23
4,500	9148	9145	9147	733	0.00
6,000	9878	9881	9880	733	0.25
100	7029				

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 07-10245

Prestress: 35,000 psi

Temperature: 22.3 °C

Calibration Instruction: CI-VW Rebar

Date of Calibration: May 04, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 71 ft.

Factory Zero Reading: 6816

Regression Zero: 6812

Technician: J. Ouellette

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	6870	6873	6872		
1,500	7535	7536	7536	664	-0.34
3,000	8275	8273	8274	739	-0.16
4,500	9013	9013	9013	739	0.03
6,000	9749	9751	9750	737	0.16
7500	6872				

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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 07-10246

Prestress: 35,000 psi

Temperature: 22.0 °C

Calibration Instruction: CI-VW Rebar

Date of Calibration: May 04, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 71 ft.

Factory Zero Reading: 6630

Regression Zero: 6637

Technician: J. Ouellette

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	6687	6687	6687		
1,500	7362	7364	7363	676	-0.11
3,000	8097	8098	8098	735	0.07
4,500	8830	8832	8831	734	0.22
6,000	9550	9551	9551	720	-0.12
7500	6688				

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

Gage Factor: 0.347 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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 07-13607

Prestress: 35,000 psi

Temperature: 23.3 °C

Calibration Instruction: CI-VW Rebar

Date of Calibration: June 18, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 70 ft.

Factory Zero Reading: 6968

Regression Zero: 6971

Technician: Elice

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7024	7021	7023		
1,500	7694	7698	7696	674	-0.11
3,000	8430	8426	8428	732	0.02
4,500	9159	9161	9160	732	0.15
6,000	9884	9882	9883	723	-0.03
100	7022				

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

Gage Factor: 0.347 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.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 07-13608

Prestress: 35,000 psi

Temperature: 23.2 °C

Calibration Instruction: CI-VW Rebar

Date of Calibration: June 18, 2007

Cal. Std. Control Numbers: 85888-1, 098

Cable Length: 70 ft.

Factory Zero Reading: 6932

Regression Zero: 6944

Technician: Elice

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	6994	6992	6993		
1,500	7656	7657	7657	664	0.05
3,000	8367	8363	8365	709	-0.05
4,500	9081	9076	9079	714	0.03
6,000	9789	9792	9791	712	0.06
100	6993				

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

Gage Factor: 0.353 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.

APPENDIX C

CONSTRUCTION OF THE EQUIVALENT TOP-LOADED LOAD-SETTLEMENT CURVE

CONSTRUCTION OF THE EQUIVALENT TOP-LOADED LOAD-SETTLEMENT CURVE FROM THE RESULTS OF AN O-CELL TEST (August, 2000)

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 end bearing load-movement curve in a top-loaded shaft has the same loads for a given movement as the net (subtract buoyant weight of pile above O-cell) end bearing load-movement curve developed by the bottom of the O-cell when placed at or near the bottom of the shaft.

2. The side shear load-movement curve in a top-loaded shaft has the same net shear, multiplied by an adjustment factor 'F', for a given downward movement as occurred in the O-cell test for that same movement at the top of the cell in the upward direction. The same applies to the upward movement in a top-loaded tension test. 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.

3. We initially assume the pile behaves as a rigid body, but include the elastic compressions that are part of the movement data obtained from an O-cell test (OLT). Using this assumption, we construct an equivalent top-load test (TLT) movement curve by the method described below in Procedure Part I. We then use the following Procedure Part II to correct for the effects of the additional elastic compressions in a TLT.

4. Consider the case with the O-cell, or the bottom O-cell of more than one level of cells, placed some distance above the bottom of the shaft. We assume the part of the shaft below the cell, now top-loaded, has the same load-movement behavior as when top-loading the entire shaft. For this case the subsequent "end bearing movement curve" refers to the movement of the entire length of shaft below the cell.

Procedure Part I: Please refer to the attached Figure A showing O-cell test results and to Figure B, the constructed equivalent top loaded settlement curve. Note that each of the curves shown has points numbered from 1 to 12 such that the same point number on each curve has the same magnitude of movement. For example, point 4 has an upward and downward movement of 0.40 inches in Figure A and the same 0.40 inches downward in Figure B.

Note: This report shows the O-cell movement data in a Figure similar to Fig. A, but uses the gross loads as obtained in the field. Fig. A uses net loads to make it easier for the reader to convert Fig. A into Fig. B without the complication of first converting gross to net loads. For conservative reconstruction of the top loaded

settlement curve we first convert both of the O-cell components to net load.

Using the above assumptions, construct the equivalent curve as follows: Select an arbitrary movement such as the 0.40 inches to give point 4 on the shaft side shear load movement curve in Figure A and record the 2,090 ton load in shear at that movement. Because we have initially assumed a rigid pile, the top of pile moves downward the same as the bottom. Therefore, find point 4 with 0.40 inches of upward movement on the end bearing load movement curve and record the corresponding load of 1,060 tons. Adding these two loads will give the total load of 3,150 tons due to side shear plus end bearing at the same movement and thus gives point 4 on the Figure B load settlement curve for an equivalent top-loaded test.

One can use the above procedure to obtain all the points in Figure B up to the component that moved the least at the end of the test, in this case point 5 in side shear. To take advantage of the fact that the test produced end bearing movement data up to point 12, we need to make an extrapolation of the side shear curve. We usually use a convenient and suitable hyperbolic curve fitting technique for this extrapolation. Deciding on the maximum number of data points to provide a good fit (a high r^2 correlation coefficient) requires some judgment. In this case we omitted point 1 to give an $r^2 = 0.999$ (including point 1 gave an $r^2 = 0.966$) with the result shown as points 6 to 12 on the dotted extension of the measured side shear curve. Using the same movement matching procedure described earlier we can then extend the equivalent curve to points 6 to 12. The results, shown in Figure B as a dashed line, signify that this part of the equivalent curve depends partly on extrapolated data.

Sometimes, if the data warrants, we will use extrapolations of both side shear and end bearing to extend the equivalent curve to a greater movement than the maximum measured (point 12). An appendix in this report gives the details of the extrapolation(s) used with the present O-cell test and shows the fit with the actual data.

Procedure Part II: The elastic compression in the equivalent top load test always exceeds that in the O-cell test. It not only produces more top movement, but also additional side shear movement, which then generates more side shear, which produces more compression, etc . . . An exact solution of this load transfer problem requires knowing the side shear vs. vertical movement (t-y) curves for a large number of pile length increments and solving the resulting set of simultaneous equations or using finite element or finite difference simulations to obtain an approximate solution for these equations. We usually do not have the data to obtain the many accurate t-y curves required. Fortunately, the approximate solution described below usually suffices.

The attached analysis p. 6 gives the equations for the elastic compressions that occur in the OLT with one or two levels of O-cells. Analysis p. 7 gives the equations for the elastic compressions that occur in the equivalent TLT. Both sets of equations do not include the elastic compression below the O-cell because the same compression takes place in both the OLT and the TLT. This is equivalent to taking $L_3 = 0$. Subtracting the OLT from the TLT compression gives the desired additional elastic compression at the top of the TLT. We then add the additional elastic compression to the 'rigid' equivalent curve obtained from Part I to obtain the final, corrected equivalent load-settlement curve for the TLT on the same pile as the actual OLT.

Note that the above pp. 6 and 7 give equations for each of three assumed patterns of developed side shear stress along the pile. The pattern shown in the center of the three applies to any approximately determined side shear distribution. Experience has shown the initial solution for the additional elastic compression, as described above, gives an adequate and slightly conservative (high) estimate of the additional compression versus more sophisticated load-transfer analyses as described in the first paragraph of this Part II.

The analysis p. 8 provides an example of calculated results in English units on a hypothetical 1-stage, single level OLT using the simplified method in Part II with the centroid of the side shear distribution 44.1% above the base of the O-cell. Figure C compares the corrected with the rigid curve of Figure B. Page 9 contains an example equivalent to that above in SI units.

The final analysis p. 10 provides an example of calculated results in English units on a hypothetical 3-stage, multi level OLT using the simplified method in Part II with the centroid of the combined upper and middle side shear distribution 44.1% above the base of the bottom O-cell. The individual centroids of the upper and middle side shear distributions lie 39.6% and 57.9% above and below the middle O-cell, respectively. Figure E compares the corrected with the rigid curve. Page 11 contains an example equivalent to that above in SI units.

Other Tests: The example illustrated in Figure A has the maximum component movement in end bearing. The procedures remain the same if the maximum test movement occurred in side shear. Then we would have extrapolated end bearing to produce the dashed-line part of the reconstructed top-load settlement curve.

The example illustrated also assumes a pile top-loaded in compression. For a pile top-loaded in tension we would, based on Assumptions 2. and 3., use the upward side shear load curve in Figure A, multiplied by the F = 0.80 noted in Assumption 2., for the equivalent top-loaded displacement curve.

Expected Accuracy: We know of only five series of tests that provide the data needed to make a direct comparison between actual, full scale, top-loaded pile movement behavior and the equivalent behavior obtained from an O-cell test by the method described herein. These involve three sites in Japan and one in Singapore, in a variety of soils, with three compression tests on bored piles (drilled shafts), one compression test on a driven pile and one tension test on a bored pile. The largest bored pile had a 1.2-m diameter and a 37-m length. The driven pile had a 1-m increment modular construction and a 9-m length. The largest top loading = 28 MN (3,150 tons).

The following references detail the aforementioned Japanese tests and the results therefrom:

Kishida H. et al., 1992, "Pile Loading Tests at Osaka Amenity Park Project," Paper by Mitsubishi Co., also briefly described in Schmertmann (1993, see bibliography). Compares one drilled shaft in tension and another in compression.

Ogura, H. et al., 1995, "Application of Pile Toe Load Test to Cast-in-place

Concrete Pile and Precast Pile," special volume 'Tsuchi-to-Kiso' on Pile Loading Test, Japanese Geotechnical Society, Vol. 3, No. 5, Ser. No. 448. Original in Japanese. Translated by M. B. Karkee, GEOTOP Corporation. Compares one drilled shaft and one driven pile, both in compression.

We compared the predicted equivalent and measured top load at three top movements in each of the above four Japanese comparisons. The top movements ranged from ¼ inch (6 mm) to 40 mm, depending on the data available. The (equiv./meas.) ratios of the top load averaged 1.03 in the 15 comparisons with a coefficient of variation of less than 10%. We believe that these available comparisons help support the practical validity of the equivalent top load method described herein.

L. S. Peng, A. M. Koon, R. Page and C. W. Lee report the results of a class-A prediction by others of the TLT curve from an Osterberg cell test on a 1.2 m diameter, 37.2 m long bored pile in Singapore, compared to an adjacent pile with the same dimensions actually top-loaded by kentledge. They report about a 4% difference in ultimate capacity and less than 8% difference in settlements over the 1.0 to 1.5 times working load range -- comparable to the accuracy noted above. Their paper has the title "OSTERBERG CELL TESTING OF PILES", and was published in March 1999 in the Proceedings of the International Conference on Rail Transit, held in Singapore and published by the Association of Consulting Engineers Singapore.

B. H. Fellenius has made several finite element method (FEM) studies of an OLT in which he adjusted the parameters to produce good load-deflection matches with the OLT up and down load-deflection curves. He then used the same parameters to predict the TLT deflection curve. We compared the FEM-predicted curve with the equivalent load-deflection predicted by the previously described Part I and II procedures, with the results again comparable to the accuracy noted above. The ASCE has published a paper by Fellenius et. al. titled "O-Cell Testing and FE Analysis of 28-m-Deep Barrette in Manila, Philippines" in the Journal of Geotechnical and Geoenvironmental Engineering, Vol. 125, No. 7, July 1999, p. 566. It details one of his comparison studies.

Limitations: The engineer using these results should judge the conservatism, or lack thereof, of the aforementioned assumptions and extrapolation(s) before utilizing the results for design purposes. For example, brittle failure behavior may produce movement curves with abrupt changes in curvature (not hyperbolic). However, we believe the hyperbolic fit method and our assumptions used usually produce reasonable equivalent top load settlement curves.

August, 2000

Example of the Construction of an Equivalent Top-Loaded Settlement Curve (Figure B) From Osterberg Cell Test Results (Figure A)

Figure A

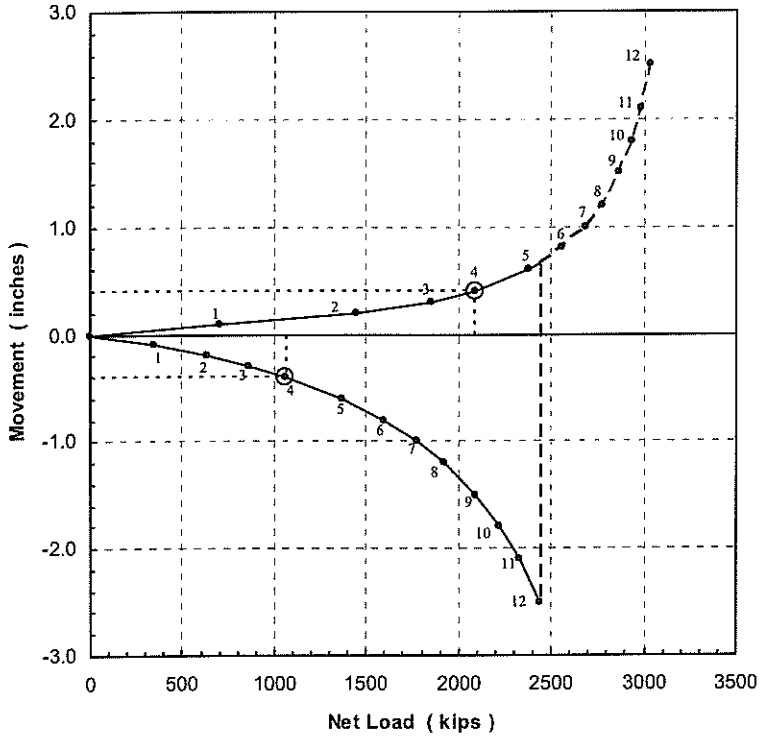
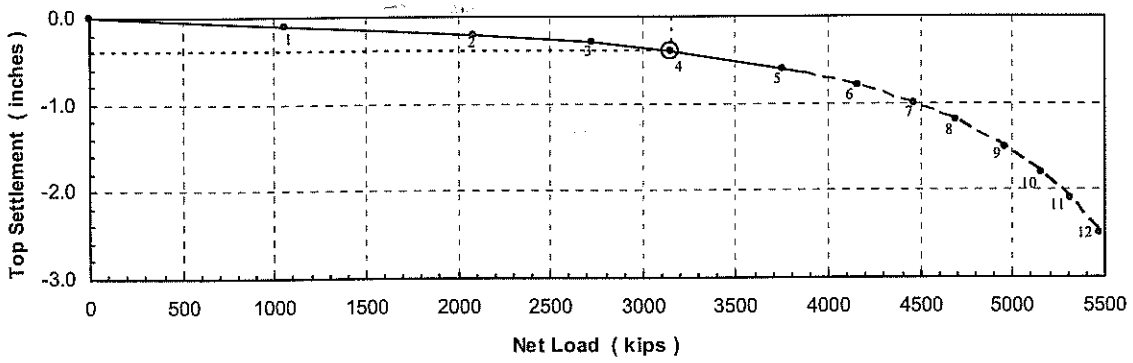
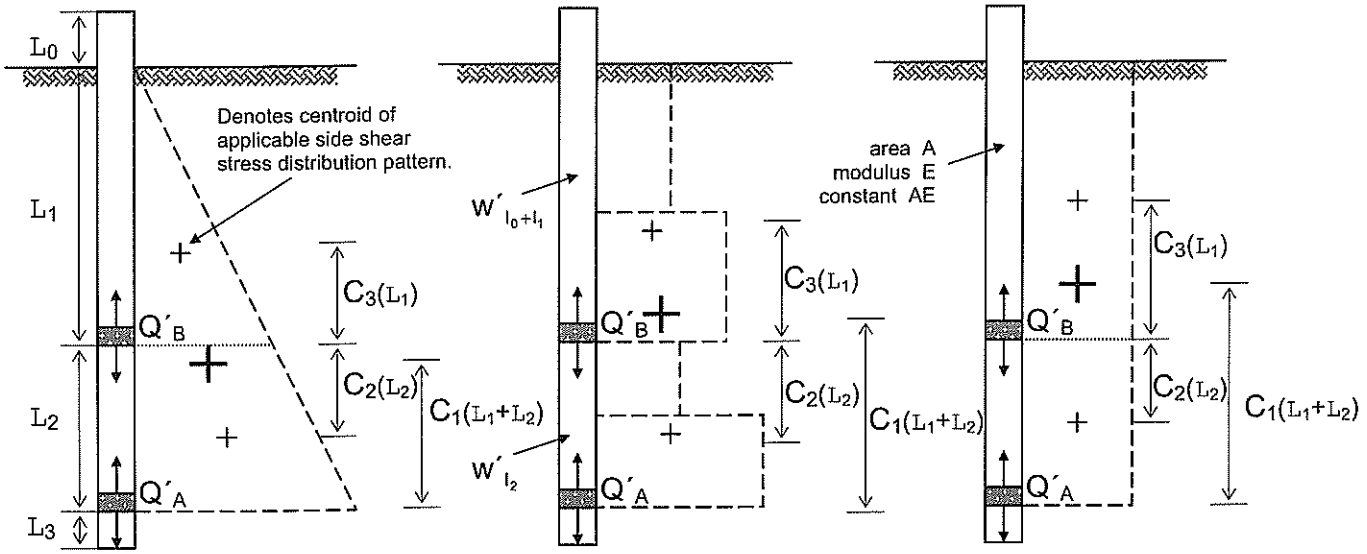


Figure B



Theoretical Elastic Compression in O-cell Test Based on Pattern of Developed Side Shear Stress



1-Stage Single Level Test (Q'_A only):

$$\delta_{OLT} = \delta_{\uparrow(l_1+l_2)}$$

$C_1 = \frac{1}{3}$	Centroid Factor = C_1	$C_1 = \frac{1}{2}$
$\delta_{\uparrow(l_1+l_2)} = \frac{1}{3}\frac{Q'_{\uparrow A}(l_1+l_2)}{AE}$	$\delta_{\uparrow(l_1+l_2)} = C_1\frac{Q'_{\uparrow A}(l_1+l_2)}{AE}$	$\delta_{\uparrow(l_1+l_2)} = \frac{1}{2}\frac{Q'_{\uparrow A}(l_1+l_2)}{AE}$

3-Stage Multi Level Test (Q'_A and Q'_B): $\delta_{OLT} = \delta_{\uparrow l_1} + \delta_{\downarrow l_2}$

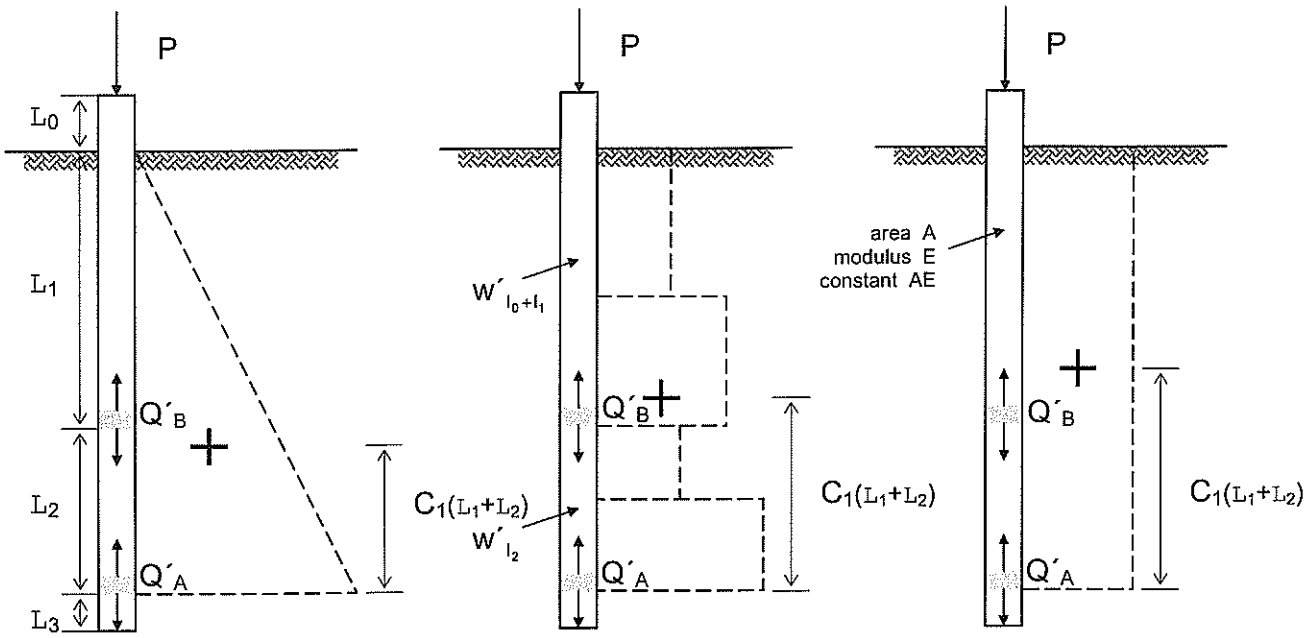
$C_3 = \frac{1}{3}$	Centroid Factor = C_3	$C_3 = \frac{1}{2}$
$\delta_{\uparrow l_1} = \frac{1}{3}\frac{Q'_{\uparrow B} l_1}{AE}$	$\delta_{\uparrow l_1} = C_3\frac{Q'_{\uparrow B} l_1}{AE}$	$\delta_{\uparrow l_1} = \frac{1}{3}\frac{Q'_{\uparrow B} l_1}{AE}$
$C_2 = \frac{1}{3}\left(\frac{3l_1+2l_2}{2l_1+l_2}\right)$	Centroid Factor = C_2	$C_2 = \frac{1}{2}$
$\delta_{\downarrow l_2} = \frac{1}{3}\left(\frac{3l_1+2l_2}{2l_1+l_2}\right)\frac{Q'_{\downarrow B} l_2}{AE}$	$\delta_{\downarrow l_2} = C_2\frac{Q'_{\downarrow B} l_2}{AE}$	$\delta_{\downarrow l_2} = \frac{1}{2}\frac{Q'_{\downarrow B} l_2}{AE}$

Net Loads:

$Q'_{\uparrow A} = Q_{\uparrow A} - w'_{l_0+l_1+l_2}$ $\quad$ $Q'_{\uparrow B} = Q_{\uparrow B} - w'_{l_0+l_1}$ $\quad$ $Q'_{\downarrow B} = Q'_{\downarrow B} + w'_{l_2}$

w' = pile weight, buoyant where below water table

Theoretical Elastic Compression in Top Loaded Test Based on Pattern of Developed Side Shear Stress



Top Loaded Test: $\delta_{TLT} = \delta_{\downarrow I_0} + \delta_{\downarrow I_1+I_2}$

$\delta_{\downarrow I_0} = \frac{PI_0}{AE}$	$\delta_{\downarrow I_0} = \frac{PI_0}{AE}$	$\delta_{\downarrow I_0} = \frac{PI_0}{AE}$
$C_1 = \frac{1}{3}$	Centroid Factor = C_1	$C_1 = \frac{1}{2}$
$\delta_{\downarrow I_1+I_2} = \frac{(Q'_{\downarrow A}+2P)}{3}\frac{(I_2+I_2)}{AE}$	$\delta_{\downarrow I_1+I_2} = [(C_1)Q'_{\downarrow A}+(1-C_1)P]\frac{(I_1+I_2)}{AE}$	$\delta_{\downarrow I_1+I_2} = \frac{(Q'_{\downarrow A}+P)}{2}\frac{(I_1+I_2)}{AE}$

Net and Equivalent Loads:

$$Q'_{\downarrow A} = Q_{\downarrow A} - W'_{I_0+I_1+I_2} \qquad P_{single} = Q'_{\downarrow A} + Q'_{\uparrow A} \qquad P_{multi} = Q'_{\downarrow A} + Q'_{\uparrow B} + Q'_{\downarrow B}$$

Component loads Q selected at the same (±) Δ_{OLT}.

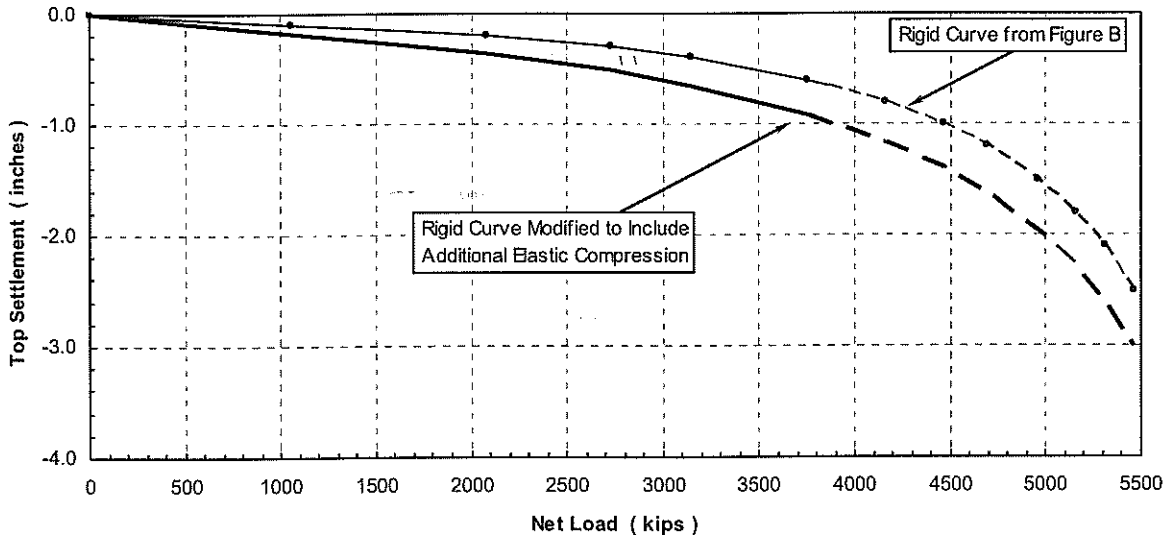
Example Calculation for the Additional Elastic Compression Correction For Single Level Test (English Units)

Given:

C_1	=	0.441	
AE	=	3,820,000 kips	(assumed constant throughout test)
I_0	=	5.9 ft	
I_1	=	30.0 ft	(embedded length of shaft above O-cell)
I_2	=	0.00 ft	
I_3	=	0.0 ft	
Shear reduction factor	=	1.00	(cohesive soil)

Δ_{OLT} (in)	$Q'_{\downarrow A}$ (kips)	$Q'_{\uparrow A}$ (kips)	P (kips)	δ_{TLT} (in)	δ_{OLT} (in)	Δ_{δ} (in)	$\Delta_{OLT} + \Delta_{\delta}$ (in)
0.000	0	0	0	0.000	0.000	0.000	0.000
0.100	352	706	1058	0.133	0.047	0.086	0.186
0.200	635	1445	2080	0.257	0.096	0.160	0.360
0.300	867	1858	2725	0.339	0.124	0.215	0.515
0.400	1061	2088	3149	0.396	0.139	0.256	0.656
0.600	1367	2382	3749	0.478	0.159	0.319	0.919
0.800	1597	2563	4160	0.536	0.171	0.365	1.165
1.000	1777	2685	4462	0.579	0.179	0.400	1.400
1.200	1921	2773	4694	0.613	0.185	0.427	1.627
1.500	2091	2867	4958	0.651	0.191	0.460	1.960
1.800	2221	2933	5155	0.680	0.196	0.484	2.284
2.100	2325	2983	5308	0.703	0.199	0.504	2.604
2.500	2434	3032	5466	0.726	0.202	0.524	3.024

Figure C

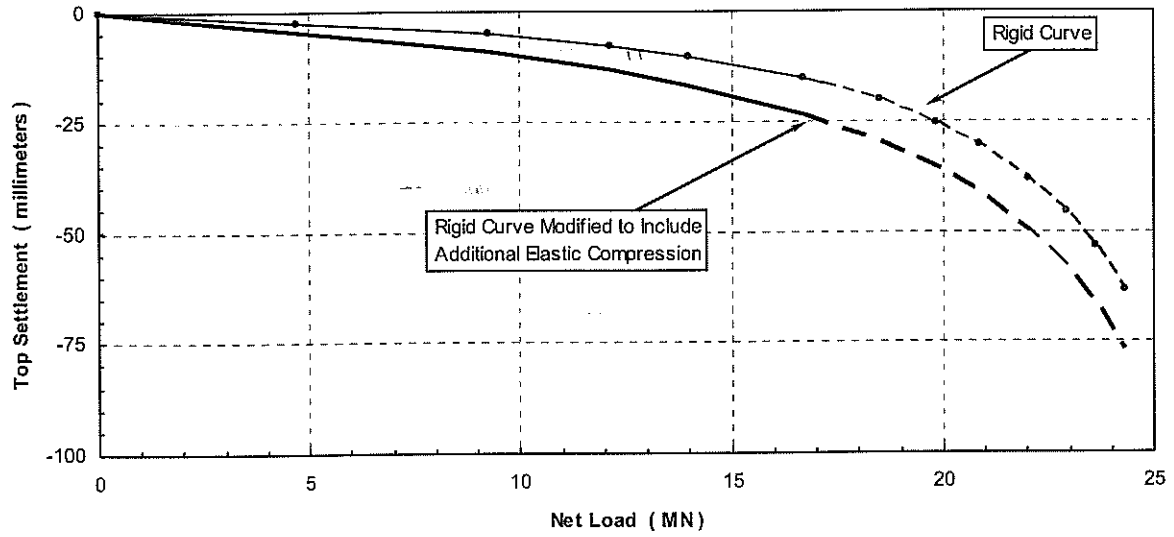


Example Calculation for the Additional Elastic Compression Correction For Single Level Test (SI Units)

Given:	C_1	=	**0.441**	
	AE	=	**17,000**	**MN (assumed constant throughout test)**
	I_0	=	**1.80**	**m**
	I_1	=	**14.69**	**m (embedded length of shaft above mid-cell)**
	I_2	=	**0.00**	**m**
	I_3	=	**0.0**	**m**
Shear reduction factor		=	**1.00**	**(cohesive soil)**

Δ_{OLT} (mm)	$Q'_{\downarrow A}$ (MN)	$Q'_{\uparrow A}$ (mm)	P (MN)	δ_{TLT} (mm)	δ_{OLT} (mm)	Δ_{δ} (mm)	$\Delta_{OLT} + \Delta_{\delta}$ (mm)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.54	1.57	3.14	4.71	3.37	1.20	2.17	4.71
5.08	2.82	6.43	9.25	6.52	2.45	4.07	9.15
7.62	3.86	8.27	12.12	8.61	3.15	5.46	13.08
10.16	4.72	9.29	14.01	10.05	3.54	6.51	16.67
15.24	6.08	10.60	16.68	12.14	4.04	8.10	23.34
20.32	7.11	11.40	18.50	13.60	4.34	9.26	29.58
25.40	7.90	11.94	19.85	14.70	4.55	10.15	35.55
30.48	8.55	12.33	20.88	15.55	4.70	10.85	41.33
38.10	9.30	12.75	22.05	16.53	4.86	11.67	49.77
45.72	9.88	13.05	22.93	17.27	4.97	12.29	58.01
53.34	10.34	13.27	23.61	17.84	5.06	12.79	66.13
63.50	10.83	13.48	24.31	18.44	5.14	13.30	76.80

Figure D



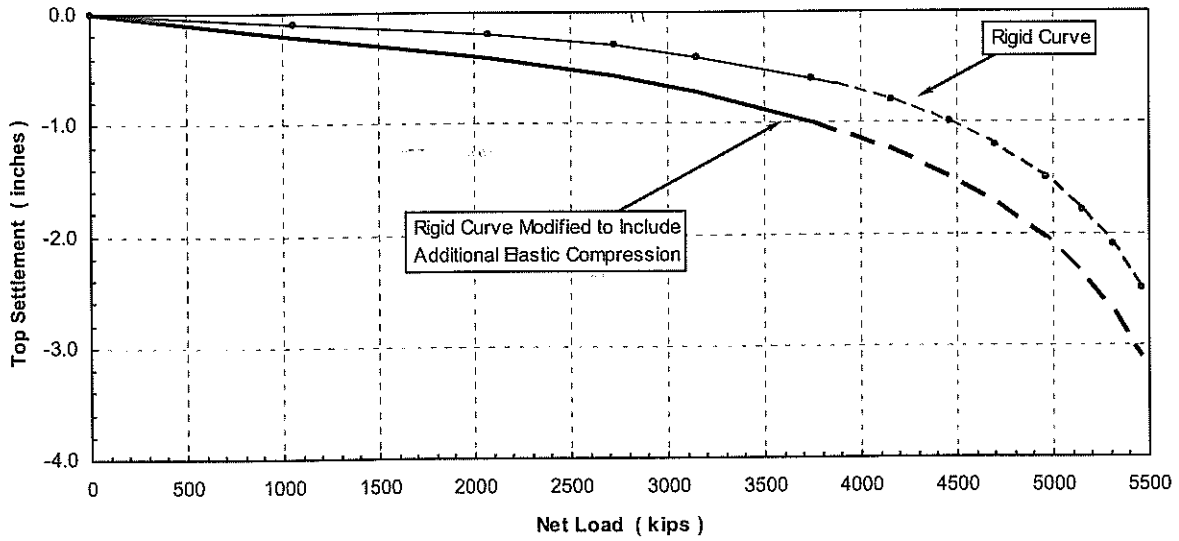
Example Calculation for the Additional Elastic Compression Correction For Multi Level Test (English Units)

Given:

C_1	=	0.441	
C_2	=	0.579	
C_3	=	0.396	
AE	=	3,820,000 kips	(assumed constant throughout test)
I_0	=	5.9	ft
I_1	=	30.0	ft (embedded length of shaft above mid-cell)
I_2	=	18.2	ft (embedded length of shaft between O-cells)
I_3	=	0.0	ft
Shear reduction factor	=	1.00	(cohesive soil)

Δ_{OLT} (in)	$Q'_{\downarrow A}$ (kips)	$Q'_{\downarrow B}$ (kips)	$Q'_{\uparrow A}$ (kips)	P (kips)	δ_{TLT} (in)	δ_{OLT} (in)	Δ_{δ} (in)	$\Delta_{OLT} + \Delta_{\delta}$ (in)
0.000	0	0	0	0	0.000	0.000	0.000	0.000
0.100	352	247	459	1058	0.133	0.025	0.107	0.207
0.200	635	506	939	2080	0.257	0.052	0.205	0.405
0.300	867	650	1208	2725	0.339	0.067	0.272	0.572
0.400	1061	731	1357	3149	0.396	0.075	0.321	0.721
0.600	1367	834	1548	3749	0.478	0.085	0.393	0.993
0.800	1597	897	1666	4160	0.536	0.092	0.444	1.244
1.000	1777	940	1745	4462	0.579	0.096	0.483	1.483
1.200	1921	971	1802	4694	0.613	0.099	0.513	1.713
1.500	2091	1003	1864	4958	0.651	0.103	0.548	2.048
1.800	2221	1027	1907	5155	0.680	0.105	0.575	2.375
2.100	2325	1044	1939	5308	0.703	0.107	0.596	2.696
2.500	2434	1061	1971	5466	0.726	0.109	0.618	3.118

Figure E

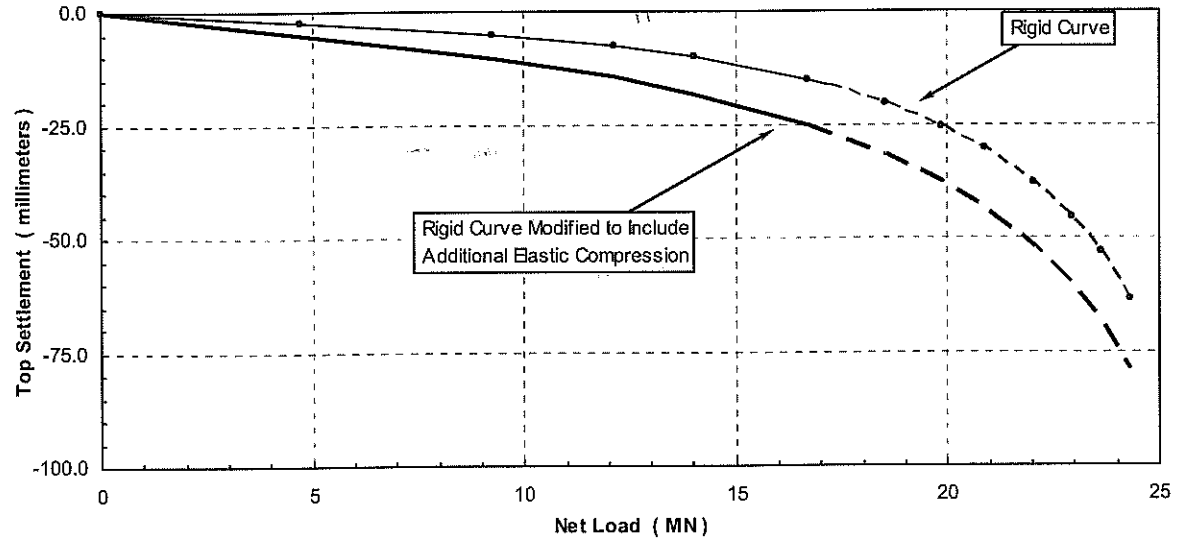


Example Calculation for the Additional Elastic Compression Correction For Multi Level Test (SI Units)

Given:	C_1	=	**0.441**	
	C_2	=	**0.579**	
	C_3	=	**0.396**	
	AE	=	**17,000**	**MN (assumed constant throughout test)**
	I_0	=	**1.80**	**m**
	I_1	=	**9.14**	**m (embedded length of shaft above mid-cell)**
	I_2	=	**5.55**	**m (embedded length of shaft between O-cells)**
	I_3	=	**0.00**	**m**
Shear reduction factor		=	**1.00**	**(cohesive soil)**

Δ_{OLT} (mm)	$Q'_{\downarrow A}$ (MN)	$Q'_{\downarrow B}$ (MN)	$Q'_{\uparrow B}$ (mm)	P (MN)	δ_{TLT} (mm)	δ_{OLT} (mm)	Δ_{δ} (mm)	$\Delta_{OLT} + \Delta_{\delta}$ (mm)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.54	1.57	1.10	2.04	4.71	3.37	0.64	2.73	5.27
5.08	2.82	2.25	4.18	9.25	6.52	1.31	5.21	10.29
7.62	3.86	2.89	5.37	12.12	8.61	1.69	6.92	14.54
10.16	4.72	3.25	6.04	14.01	10.05	1.90	8.15	18.31
15.24	6.08	3.71	6.89	16.68	12.14	2.17	9.97	25.21
20.32	7.11	3.99	7.41	18.50	13.60	2.33	11.27	31.59
25.40	7.90	4.18	7.76	19.85	14.70	2.44	12.26	37.66
30.48	8.55	4.32	8.02	20.88	15.55	2.52	13.03	43.51
38.10	9.30	4.46	8.29	22.05	16.53	2.61	13.92	52.02
45.72	9.88	4.57	8.48	22.93	17.27	2.67	14.60	60.32
53.34	10.34	4.64	8.62	23.61	17.84	2.71	15.13	68.47
63.50	10.83	4.72	8.76	24.31	18.44	2.76	15.68	79.18

Figure F



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 2 to 4 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.

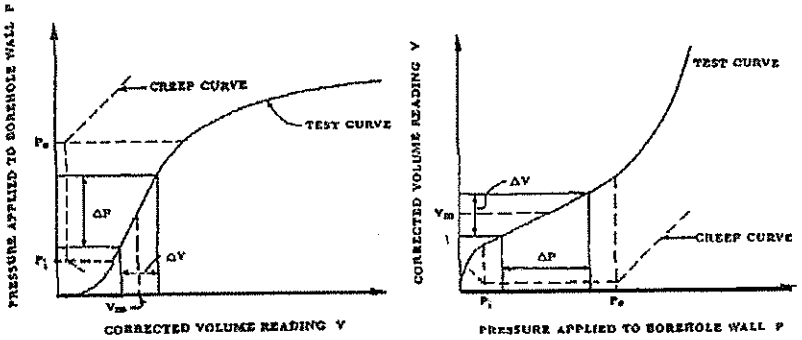


FIG. 8 Pressuremeter Test Curves for Procedure A

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 Levillian, J-P (1988), "force portante des rideaux plans metalliques charges verticalmement," 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.

APPENDIX E

SOIL BORING LOG

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN INTERTEC

This boring was taken by Braun Intertec under a consultant contract for Mn/DOT

UNIQUE NUMBER

U.S. Customary Units

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Boring No.	Ground Elevation
2783-120		Interstate Highway I-35W	Test Shaft	743.0 (Surveyed)

Location 70+23.00, -85.75

Co. Coordinate: X= Y= (ft.)

Latitude (North)= Longitude (West)=

Drill Machine 755 CME Truck Mount

Hammer 110# Auto Hammer

SHEET 1 of 6

Drilling Completed 10/11/07

DEPTH	Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} / REC (%)	MC (%) / RQD (%)	COH (psf) / ACL (ft)	γ (pcf) / Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
			Sandy Loam, F to Cr-grained, dk brn, wet. fill			7				
	2.0 / 741.0									
			Loamy Sand, F to Cr-grained, brn, moist, medium dense. fill		20	5				
	4.0 / 739.0									
5			Sand, F to Cr-grained, brn, moist, loose to medium dense. fill		7	7				
					6	6				
10					20	5				
	11.0 / 732.0		Loamy Fine Sand, Cobbles encountered, brn, moist, medium dense fill		16	3				
	14.0 / 729.0									
15			Sand, F to Cr-grained, w/ G, brn, wet, dense fill		44	3				
	17.0 / 726.0									
▼					78	7				
20			Coarse Gravelly Sand, Cr-grained, w/ G and Bldrs, brn, wet, dense to very dense fill		70	7				
					44	9				
25										

Index Sheet Code 3.0

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Soil Class:P. Martin Rock Class: P. Martin Edit: Date: 10/23/07

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MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN INTERTEC

This boring was taken by Braun Intertec under a consultant contract for Mn/DOT

UNIQUE NUMBER

U.S. Customary Units

Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS — *SHEET 2 of 6*

State Project	*Bridge No. or Job Desc.*	*Trunk Highway/Location*	*Boring No.*	*Ground Elevation*
2783-120		**Interstate Highway I-35W**	**Test Shaft**	**743.0** *(Surveyed)*

DEPTH	Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} / REC (%)	MC (%) / RQD (%)	COH (psf) / ACL (ft)	γ (pcf) / Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
30	31.0 712.0		Coarse Gravelly Sand, Cr-grained, w/ G and Bldrs, brn, wet, dense to very dense fill *(continued)*		44 67 55/1"	10 8 13				
	34.0 709.0		Sand and Gravel, brn, sat, very dense		60/6"	7				
35	36.0 707.0		Gravel, w/ Sand, lt gry, sat, very dense		52 78	7 11				
	39.0 704.0		Gravel, w/ Sand, brn, sat, very dense	PD						
40	41.0 702.0		Coarse Sand and Gravel, brn, sat		37	9				Grain Size Accumulation Curve: #200 = 8%, #100 = 11%, #60 = 14%, #40 = 18%, #20 = 28%, #10 = 43%, #4 = 56%, 3/8" = 70%, 1/2" = 78%, 1" = 85%, 3" = 100%
			Fine Sand, w/ G, lmst Bldr 51 to 54 1/2', brn, sat, medium dense to very dense	PD PD PD PD	20 15 13	25 22 21				
45										
50										

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Soil Class:P. Martin Rock Class: P. Martin Edit: Date: 10/23/07

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MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN INTERTEC

This boring was taken by Braun Intertec under a consultant contract for Mn/DOT

UNIQUE NUMBER

U.S. Customary Units

Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS — *SHEET 3 of 6*

State Project	*Bridge No. or Job Desc.*	*Trunk Highway/Location*	*Boring No.*	*Ground Elevation*
2783-120		**Interstate Highway I-35W**	**Test Shaft**	**743.0** *(Surveyed)*

DEPTH	Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} / REC (%)	MC (%) / RQD (%)	COH (psf) / ACL (ft)	γ (pcf) / Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
					59/9"	16				P200 = 6.1% Limestone boulders 51 to 54 1/2'
			Fine Sand, w/ G, lmst Bldr 51 to 54 1/2', brn, sat, medium dense to very dense *(continued)*	PD						
55	55.0 688.0				100/3"	24				
			Top of Bedrock							ST PETER SANDSTONE
			Sandstone, wx, wht, F-grained, sat, very dense	PD						
	59.0 684.0									
60			Sandstone, highly wx, wht, F-grained		13	0	0.00			
	64.0 679.0									
65			Sandstone, highly wx, wht, F-grained		38	0	0.00			
	69.0 674.0									
70			Sandstone, wx, wht, F-grained		0	0	0.00			
	74.0 669.0									
75			Sandstone, wx, wht, F-grained							

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Soil Class:P. Martin Rock Class: P. Martin Edit: Date: 10/23/07

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MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN INTERTEC

This boring was taken by Braun Intertec under a consultant contract for Mn/DOT

UNIQUE NUMBER

U.S. Customary Units

Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS *SHEET 4 of 6*

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Boring No.	Ground Elevation
2783-120		Interstate Highway I-35W	Test Shaft	743.0 (Surveyed)

DEPTH / Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N60 (%) REC	MC (%) RQD	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
		Sandstone, wx, wht, F-grained *(continued)*		72	50	0.42			
79.0 / 664.0									
80		Sandstone, wx, wht w/ brn banding, F-grained		5	0	0.00			
84.0 / 659.0									
85		Sandstone, fresh, wht w/ brn banding, F-grained		47	74	0.60			Note: Core slipped out of barrel, re-core produced only 3".
89.0 / 654.0									
90		Sandstone, fresh, tan, F-grained		98	92	0.65			
94.0 / 649.0									
95		Sandstone, fresh, lt gry, F-grained, shaly layers 98-99'		85	36	0.46			
99.0 / 644.0		Sandstone, w/ gry Sand Shale layers from partings to 10 inch, fresh, wht to lt gry, reddish-brn 103' to 104'							
100									

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Soil Class:P. Martin Rock Class: P. Martin Edit: Date: 10/23/07

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MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN INTERTEC

This boring was taken by Braun Intertec under a consultant contract for Mn/DOT

UNIQUE NUMBER

U.S. Customary Units

Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS — *SHEET 5 of 6*

State Project	*Bridge No. or Job Desc.*	*Trunk Highway/Location*	*Boring No.*	*Ground Elevation*
2783-120		**Interstate Highway I-35W**	**Test Shaft**	**743.0** *(Surveyed)*

DEPTH	Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} / REC (%)	MC (%) / RQD (%)	COH (psf) / ACL (ft)	γ (pcf) / Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
			Sandstone, w/ gry Sand Shale layers from partings to 10 inch, fresh, wht to lt gry, reddish-brn 103' to 104' *(continued)*		8	5	0.70			
	104.0 639.0									
105			Shale, gry, fissile		93	76	0.54			
	109.0 634.0									
110			Sandstone, fresh to slightly wx, lt gry with lt IOS at joints, F-grained		93	70	0.88			
	114.0 629.0									
115			Sandstone, fresh, lt gry, F-grained		93	84	1.10			
	119.0 624.0									
120			Sandstone, fresh, lt gry, F-grained		98	90	1.50			
	124.0 619.0									
125			Sandstone, fresh, lt gry to 125', gry to 128', then lt gry, F-grained							

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Soil Class:P. Martin Rock Class: P. Martin Edit: Date: 10/23/07

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MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

BRAUN INTERTEC

This boring was taken by Braun Intertec under a consultant contract for Mn/DOT

UNIQUE NUMBER

U.S. Customary Units

Mn/DOT GEOTECHNICAL SECTION - LOG & TEST RESULTS *SHEET 6 of 6*

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Boring No.	Ground Elevation
2783-120		**Interstate Highway I-35W**	**Test Shaft**	**743.0** *(Surveyed)*

DEPTH / Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} / REC (%)	MC (%) / RQD (%)	COH (psf) / ACL (ft)	γ (pcf) / Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
		Sandstone, fresh, lt gry to 125', gry to 128', then lt gry, F-grained *(continued)*		94	94	2.30			
129.0 / 614.0		Bottom of Hole - 129'							

Water measured at 18 while sampling and/or drilling

Boring then grouted.

Soil Class:P. Martin Rock Class: P. Martin Edit: Date: 10/23/07

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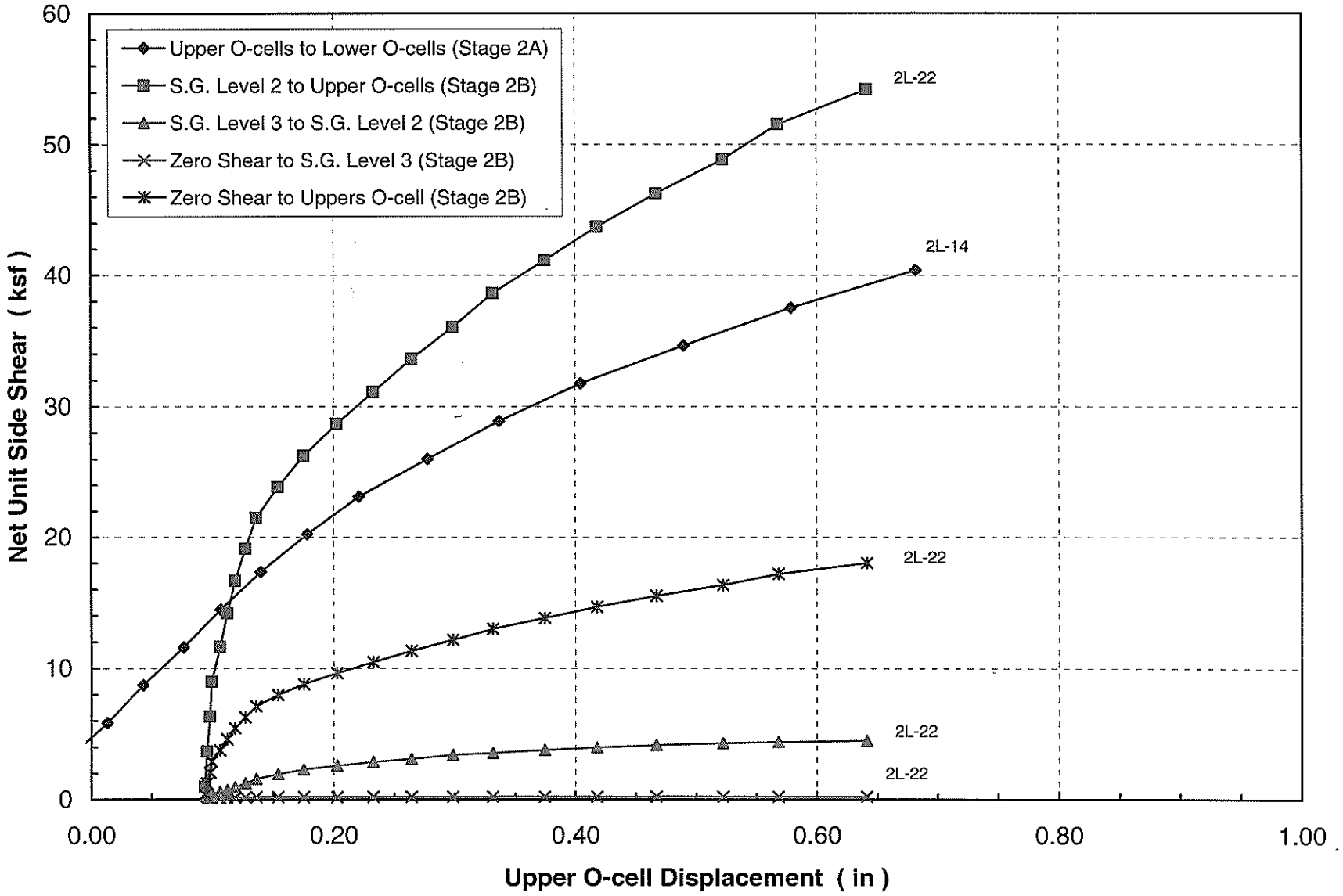
APPENDIX F

NET UNIT SHEAR CURVES AND UNIT END BEARING CURVE

Net Unit Side Shear Curves

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN



Unit End Bearing

Test Shaft 2 - I-35 W o/ Mississippi River - Minneapolis, MN