REPORT ON DRILLED SHAFT
LOAD TESTING (OSTERBERG METHOD)

I-215 Airport Connector - Las Vegas, NV - TS-1
Las Vegas, NV (LT - 9289)

Prepared for: **Anderson Drilling**
2545 S. Bruce Street, Suite H1
Las Vegas, NV 89109

Attention: **Mr. John Yusunas**

PROJECT NUMBER: LT - 9289, October 20, 2006

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LOADTEST

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

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October 20, 2006

Anderson Drilling
2545 S. Bruce Street, Suite H1
Las Vegas, NV 89109

Attention: Mr. John Yusunas

Load Test Report: I-215 Airport Connector - Las Vegas, NV - TS-1
Location: Las Vegas, NV

Dear Mr. Yusunas,

The enclosed report contains the data and analysis summary for the O-cell test performed on I-215 Airport Connector - Las Vegas, NV - TS-1 (LTI project LT - 9289) on October 17, 2006. For your convenience, we have included an executive summary of the test results in addition to our standard detailed data report.

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 this information will meet your current project needs. If you have any questions, please do not hesitate to contact us at (800) 368-1138.

Best Regards,

Robert Simpson
LOADTEST, Inc.

EXECUTIVE SUMMARY

LOADTEST, Inc. tested a 48-inch (1219-mm) drilled shaft on October 17, 2006. Mr. Robert Simpson and Mr. John Graman of LOADTEST, Inc. carried out the test. Anderson Drilling completed construction of the 122-foot (37.2-meter) deep shaft (from ground surface) on October 5, 2006. Sub-surface conditions at the test shaft location consist primarily of clays and silty sandy clay with intermittent caliche layers. Representatives of Terracon observed construction of the shaft.

The maximum bi-directional load applied to the shaft was 3316 kips (14.75 MN). At the maximum load, the displacements above and below the O-cell were 0.172 inches (4.36 mm) and 2.14 inches (54.2 mm), respectively. Average unit shear data calculated from strain gages included a calculated net unit side shear of 9.6 ksf (460 kPa), occurring between the O-cell and the Level 2 Strain Gages. We also calculate a negligible applied end bearing pressure.

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 4,000 kips (17.8 MN), the adjusted test data indicate this shaft would settle approximately 0.25 inches (6.35 mm) of which 0.21 inches (5.33 mm) is estimated elastic compression (see Figure 2).

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.

TABLE OF CONTENTS

SITE CONDITIONS AND SHAFT CONSTRUCTION

Site Sub-surface Conditions: The Sub-surface conditions at the test shaft location consist primarily of clays and silty sandy clay with intermittent caliche layers. The generalized subsurface profile is included in Figure A and a boring log indicating conditions near the shaft is presented in Appendix F. More detailed geologic information can be obtained from Terracon.

Test Shaft Construction: Anderson Drilling completed construction of the test shaft on October 5, 2006. The shaft was constructed with a total length of 122.0 feet (37.19 meters). The test shaft was constructed wet using natural water and natural in-situ water level to a tip depth of 122.0 feet (37.19 meters). The shaft was constructed with a rock auger and cleaned with a cleaning bucket after drilling. The carrying frame was inserted in the shaft along with a tremie pipe and the concrete was placed by tremie pipe until the top of the concrete reached a depth of 19.0 feet (5.79 meters). No unusual problems occurred during construction of the shaft. Representatives of Terracon observed construction of the shaft. Table B contains a summary of dimensions, depths and shaft properties used in the data evaluations.

OSTERBERG CELL TESTING

Shaft Instrumentation: Test shaft instrumentation and assembly was carried out under the direction of Robert Simpson and John Graman of LOADTEST, Inc. The loading assembly consisted of a single 26-inch (670-mm) O-cell located 42.0 feet (12.80 meters) above the tip of shaft. The Osterberg cell was calibrated to 3,090 kips (13.74 MN) and welded closed prior to shipping by American Equipment and Fabricating Corporation (see Appendix B).

Standard O-cell instrumentation included four LVWDTs (Linear Vibrating Wire Displacement Transducers - Geokon Model 4450 series) positioned between the lower and upper plates of the O-cell assembly to measure expansion (Appendix A, Page 2). Two lengths of ½-inch steel pipe were attached to the carrying frame, diametrically opposed, to measure compression of the shaft between the O-cell and the top of the shaft with traditional telltales that were installed on the day of the test.

Strain gages were used to assess the side shear load transfer along the shaft. Two levels of two sister bar vibrating wire strain gages were installed, diametrically opposed, in the shaft below the base of the O-cell assembly and one level of two were installed in the shaft above it. Details concerning the strain gage placement appear in Table B and Figures A and B. The strain gages were positioned as directed by Terracon.

The test shaft assembly also included two lines of steel pipe, starting at the top-of-shaft and terminating at the top of the bottom plate to vent the break in the shaft between upward and downward movement and the resulting annular void. If desired they permit the application of excess fluid pressure to reduce the possibility of soil entering the void.

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 telltales (described under Shaft Instrumentation) monitored by Linear Vibrating Wire Displacement Transducers (LVWDTs) (Geokon - 4450). Two automated digital survey levels (Leica NA3003) were used to monitor the top of shaft movement during testing from a distance of approximately 37 feet (11.3 meters) (Appendix A, Page 1).

Both a Bourdon pressure gage 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 gage 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 gage. There was close agreement between the Bourdon gage and the pressure transducer throughout the test.

Data Acquisition: All of the movement indicators, LVWDTs and strain gages were connected to a data logger (Data Electronics - Model 615 Datataker®). The data logger, in turn, was connected to a laptop computer. This arrangement allowed movement indicator, LVWDT and strain gage readings to be recorded and stored automatically at 30 second intervals during the test. It also allowed the automatic importation of all test data into a laptop computer for real-time display and additional data back-up. The Leica (NA3003) data was imported real-time directly to the same lap top computer set to the same time as the data logging system.

Testing Procedures: As with all of our tests, we begin by pressurizing the O-cell in order to break the tack welds that hold it closed (for handling and for placement in the shaft) and to form the fracture plane in the concrete surrounding the base of the O-cell. 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 500 psi (3.4 MPa) to the O-cell.

The Osterberg cell load test was conducted as follows: The 26-inch (670-mm) O-cell located 42.0 feet (12.80 meters) above the tip of shaft was pressurized to assess the base resistance below the O-cell assembly and the side shear above it. The O-cell was pressurized in 15 loading increments to 9000 psi (62.1 MPa) resulting in a bi-directional load of 3316 kips (14.75 MN). The loading was halted after load interval 1L-15 because the base shear resistance was approaching ultimate capacity. The O-cell was then depressurized in four decrements and the test was concluded.

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. We used approximately 60 seconds to move between increments. The data logger automatically recorded the instrument readings every 30 seconds, but herein we report only the one, two, four and eight minute readings during each increment of maintained load. The various plotted results generally use the one, two, four and eight minute readings, but the creep results use the difference between the four and eight minute readings.

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 O-cell and to construct the equivalent top-loaded load-settlement curve. For this test we calculated a buoyant weight of shaft of 116 kips (0.52 MN) above the O-cell.

Side Shear Resistance: The maximum upward ***net load*** applied to the side shear was 3,200 kips (14.2 MN) which occurred at load interval 1L-15 (Appendix A, Page 2, Figure 1). At this loading, the total upward movement of the top of the O-cell assembly was 0.172 inches (4.36 mm). The following net unit side shear estimates are based on the strain gage data which appear in Appendix A, Page 3 and the shaft stiffness computed below.

At the time of testing, the concrete unconfined compressive strength was reported to be 4,880 psi (33.6 MPa). We used the ACI formula ($E_c = 57{,}000\sqrt{f'c}$) to calculate an elastic modulus for the concrete. This, combined with the area of steel, was used to determine a weighted average shaft stiffness of 7,400,000 kips (32,900 MN) for the nominal shaft. Estimated net unit side shear values for the shaft based on the strain gage data, estimated shaft stiffness and shaft area are as follows:

Table A: Average Net Unit Side Shear Values for 1L-15[1]

Load Transfer Zone	Load Direction	Net Unit Side Shear[2]
Top of Shaft to Strain Gage Level 3	↑	2.58 ksf (124 kPa)
Strain Gage Level 3 to O-cell	↑	5.82 ksf (279 kPa)
O-cell to Strain Gage Level 2	↓	9.61 ksf (460 kPa)
Strain Gage Level 2 to Strain Gage Level 1	↓	4.88 ksf (234 kPa)

1. At the maximum displacement either up or down reported herein.
2. For upward loaded shear, the buoyant weight of shaft in each zone has been subtracted from the load shed in the respective zone.

Note: Net unit shear values derived from the strain gages may not be ultimate values. See Figures E-1 and E-2 for net unit shear vs. displacement plots.

Side shear load distribution curves generated from strain gage data are shown in Figure 3. A unit side shear value for the shaft between the Level 2 and Level 1 strain gages was calculated for 1L-15 to obtain an estimate of the base shear component of resistance to the downward movement between the Level 1 strain gages and the tip of shaft.

Combined End Bearing And Lower Side Shear Resistance: The maximum O-cell load applied to the base of the shaft was 3316 kips (14.75 MN) which occurred at load interval 1L-15 (Appendix A, Page 2, Figure 1). At this loading, the total downward movement of the O-cell base was 2.14 inches (54.24 mm). The base resistance includes a small component of base shear (as discussed above) which must be subtracted to obtain unit end bearing values. The shear component of resistance for the shaft section between the Level 1 strain gages and the tip of shaft is calculated to be 735 kips (3.3 MN) assuming a unit side shear value of 4.9 ksf (230 kPa) and a nominal shaft diameter of 48 inches (1219 mm). Since the load calculated at the Level 1 gages was 585 kips (2.6 MN) the applied load to end bearing is negligible at the above noted displacements.

Creep Limit: See Appendix D for our O-cell method for determining creep limit. The upward side shear creep data (Appendix A, Page 2) indicate that no creep limit was reached at a movement of 0.17 inches (4.4 mm) (Figure 4). The combined end bearing and lower side shear creep data (Appendix A, Page 2) indicate that a creep limit of 2200 kips (9.79 MN) was reached at a movement of 0.17 inches (4.3 mm) (Figure 5). A top loaded shaft will begin significant creep when both components begin creep movement. This will occur at the maximum of the movements required to reach the creep limit for each component. We believe that significant creep for this shaft will not begin until a top loading exceeds 6520 kips (29.0 MN) by some unknown amount.

Equivalent Top Load: Figure 2 presents the equivalent top load curve. The unadjusted lighter curve, described in Procedure Part I of Appendix C, was generated by using the measured upward top of O-cell and downward base of O-cell data. Because it can be an important component of the settlements involved, the equivalent top load curve includes an adjustment for the additional elastic compression which would occur in a top-load test. The darker curve as described in Procedure Part II of Appendix C includes such an adjustment.

The test shaft was successfully loaded to a combined side shear and end bearing of more than 6,520 kips (29.0 MN). For a top loading of 4,000 kips (17.79 MN), the adjusted test data indicate this shaft would settle approximately 0.25 inches (6.35 mm) of which 0.21 inches (5.33 mm) is estimated elastic compression (see Figure 2).

Note: The equivalent top load curve applies to a loading duration of eight minutes. Creep effects will reduce the ultimate resistance of both components and increase pile 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. However, our experience suggests that such corrections are small and perhaps negligible for top loadings below the creep limit indicated herein.

Shaft Compression Comparison: The measured maximum shaft compression, averaged from two telltales, is 0.12 inches (2.97 mm). Using the nominal shaft diameter(s) (Table B and Figure A), a weighted average shaft stiffness of 7,400,000 kips (32,900 MN) and the load distribution in Figure 3, we calculated an elastic compression of 0.12 inches (3.10 mm) over the length of the compression telltales. We believe this excellent agreement provides good evidence that the assumed shaft stiffness are reasonable and that the O-cell loaded the shaft in accord with the calibration used herein.

Bottom Plate Tilt: The four LVWDTs measuring O-cell expansion allow us to evaluate the tilt of the bottom plate. Appendix A, Page 2, Figure 1 show these measurements. We calculate a maximum tilt angle of 0.1 degrees and a total tilt of 0.12 inches (3.1 mm) across the nominal 48-inch (1219 -mm) diameter shaft at the 1L-15 maximum loading indicating a likelihood of quality concrete around the O-cell.

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

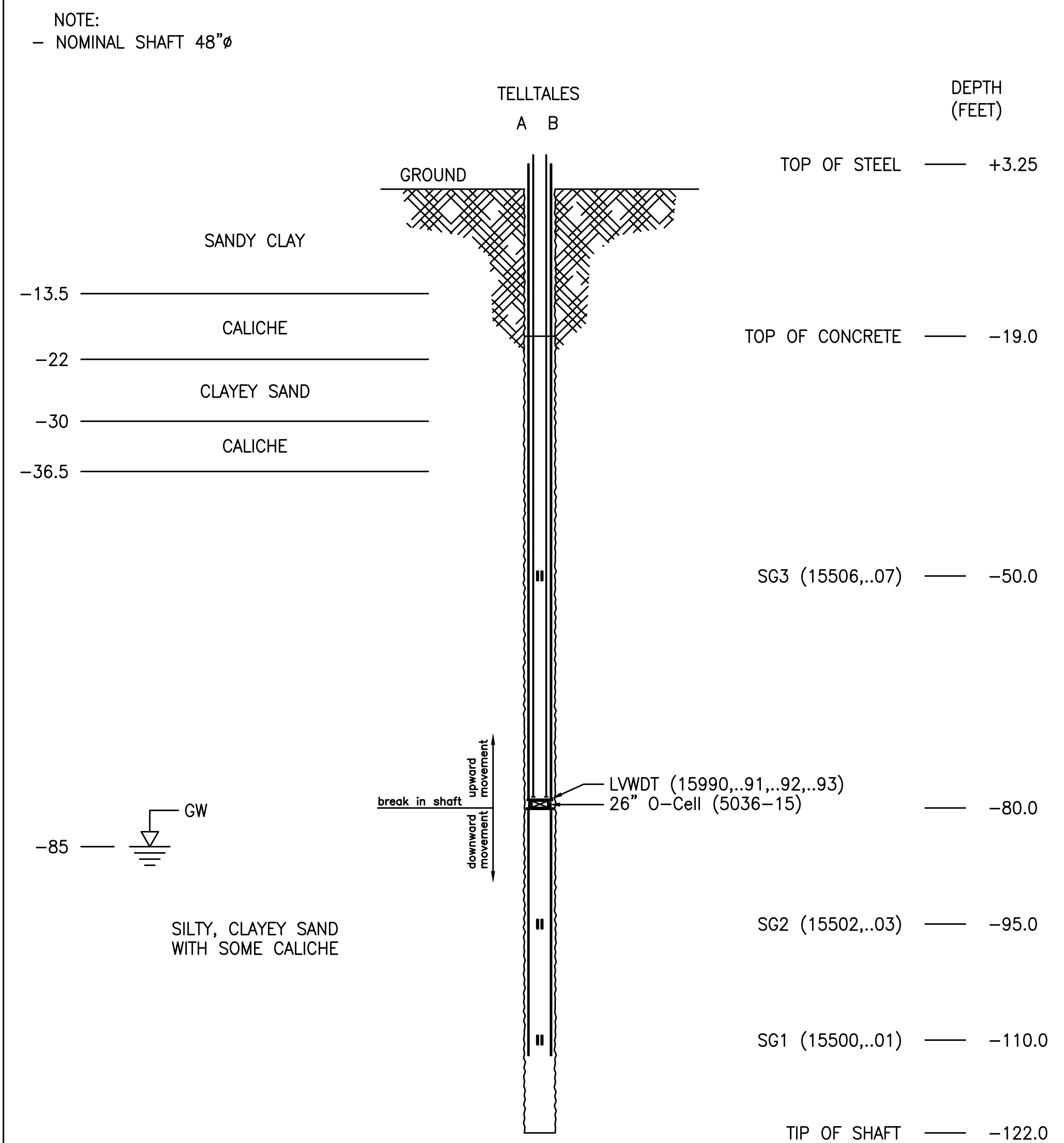
Robert C. Simpson
Project Manager

Reviewed for LOADTEST, Inc. by

Shing K. Pang, P.E.
Geotechnical Engineer

TABLE B: SUMMARY OF DIMENSIONS, DEPTHS, AREAS & PROPERTIES FOR ANALYSIS PURPOSES

Shaft:					
Nominal shaft diameter:	=	48	inches	1219	mm
O-cell size: (Serial no.: 5036-15)	=	34	inches	864	mm
Length of concrete from break at base of cell to tip	=	42.0	feet	12.8	meters
Shaft end area	=	12.6	$feet^2$	1.17	$meters^2$
Weight of shaft from break at base of cell to top of shaft	=	115.9	kips	0.52	MN
Estimated shaft unit stiffness:	=	7.36E+06	kips	32.7	GN
Depth of top of shaft concrete	=	-19.0	feet	-5.8	meters
Depth of ground surface	=	0.0	feet	0.0	meters
Water Depth	=	-85.0	feet	-25.9	meters
Depth of break at base of O-cell	=	-80.0	feet	-24.4	meters
Depth of shaft tip	=	-122.0	feet	-37.2	meters
Measured Compression Zones:					
Depth of top of zone	=	-19.0	feet	-5.8	meters
Depth of bottom of telltale (bottom of zone)	=	-78.7	feet	-24.0	meters
Strain Gages:					
Depth of strain gage Level 3	=	-50.0	feet	-15.2	meters
Depth of strain gage Level 2	=	-95.0	feet	-29.0	meters
Depth of strain gage Level 1	=	-110.0	feet	-33.5	meters
Miscellaneous:					
Top plate diameter	=	42.0	inches	1067	mm
Top plate thickness	=	2.0	inches	50.8	mm
Bottom plate diameter	=	42.0	inches	1067	mm
Bottom plate thickness	=	2.0	inches	50.8	mm
LVWDT radii - no: 15990	=	20.0	inches	508	mm
LVWDT orientation - no.: 15990	=	0	degrees		
LVWDT radii - no: 15991	=	20.0	inches	508	mm
LVWDT orientation - no.: 15991	=	90	degrees		
LVWDT radii - no: 15992	=	20.0	inches	508	mm
LVWDT orientation - no.: 15992	=	180	degrees		
LVWDT radii - no: 15993	=	20	inches	508	mm
LVWDT orientation - no.: 15993	=	270	degrees		
Carrying frame	=	C-4 Channel - 2 vertical pieces			



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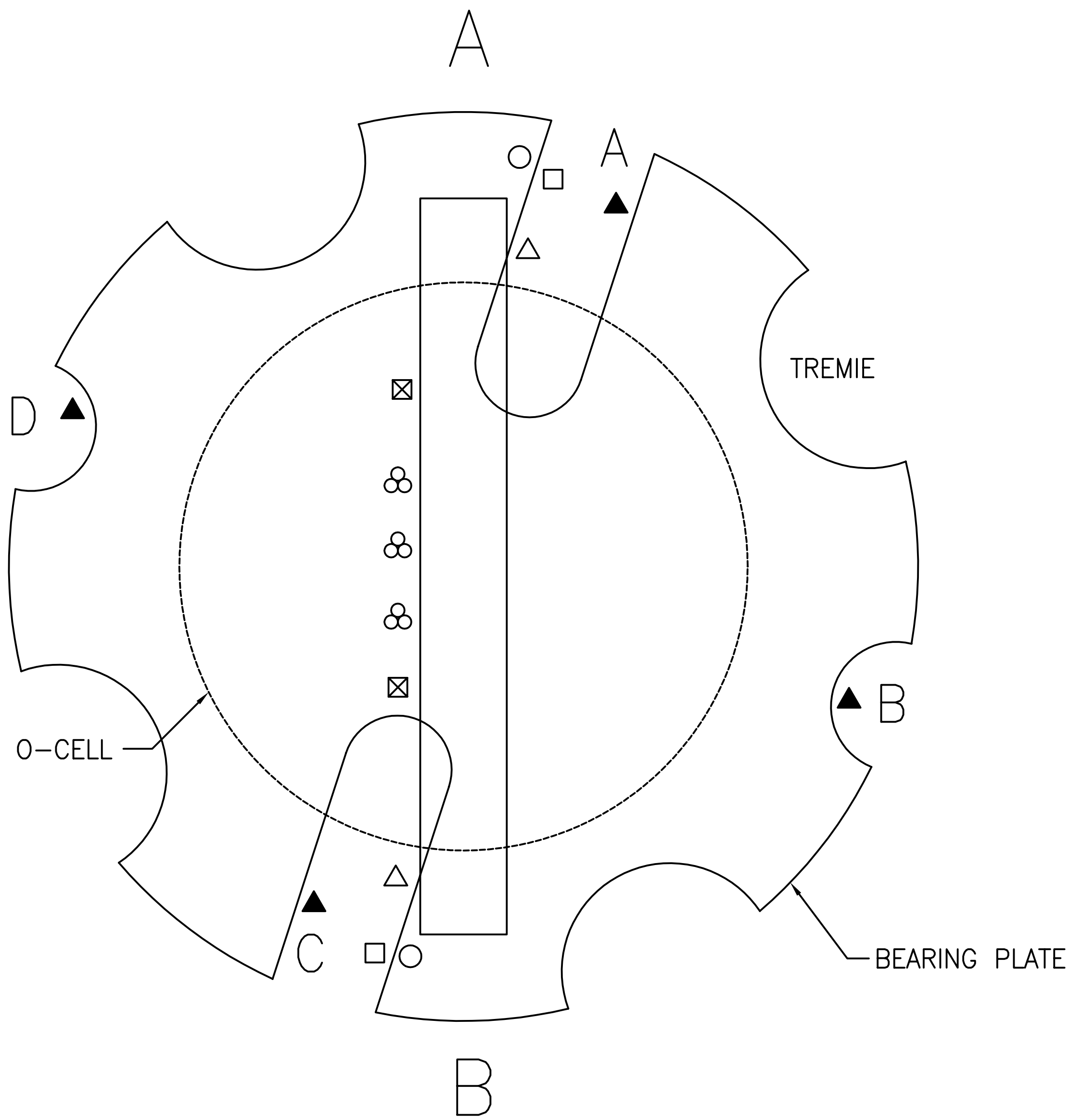
SCHEMATIC SECTION OF TEST SHAFT

I–215 Airport Connector – Las Vegas, NV

DRAWN BY: JAG	DATE: 10/19/06	CHECKED BY:	LT–9289
REVISED BY:	DATE:	SCALE: NTS	**FIGURE A**



LEGEND:

STRAIN GAGE	△
LVWDT	▲
TELLTALE	○
VENT PIPE	□
HYDRAULIC HOSES	⊠
CABLE BUNDLE	&

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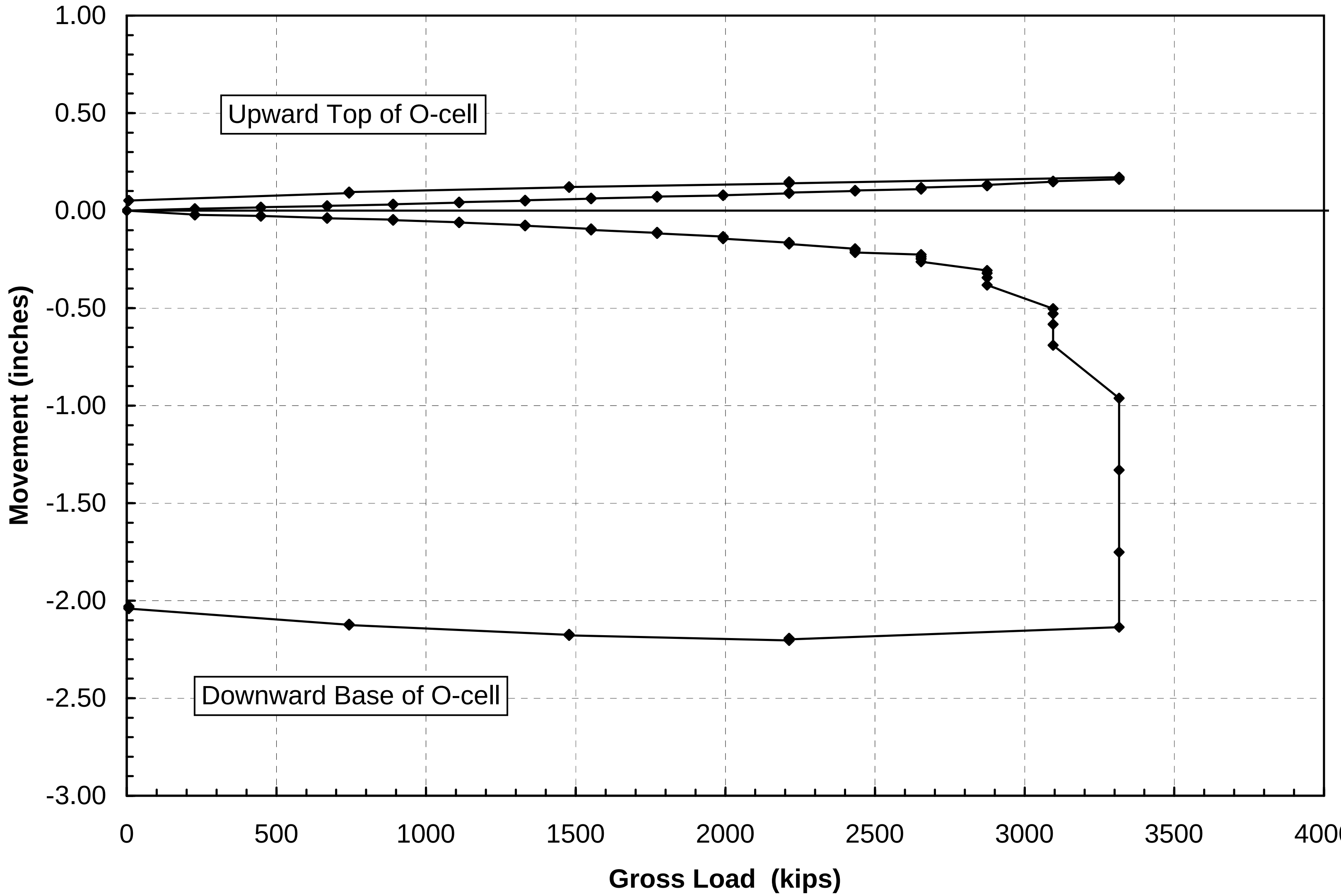
INSTRUMENTATION LAYOUT

I-215 Airport Connector

DWN BY: JAG	DATE: 10/19/06	CHECKED BY:	LT-9289
REVISED BY:	DATE:	SCALE: NTS	FIGURE B

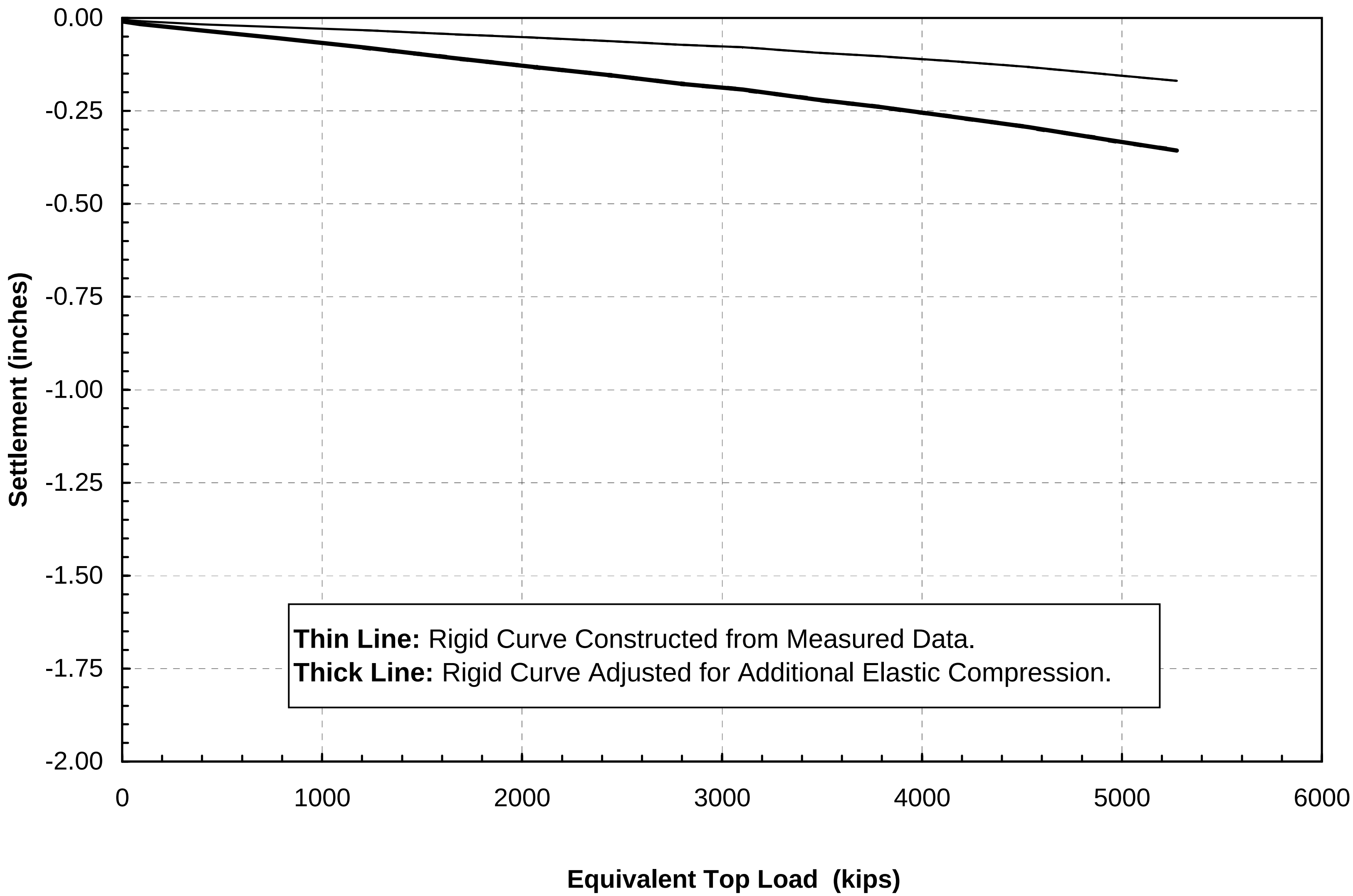
Osterberg Cell Load-Movement Curves

I-215 Airport Connector - Las Vegas, NV - TS-1



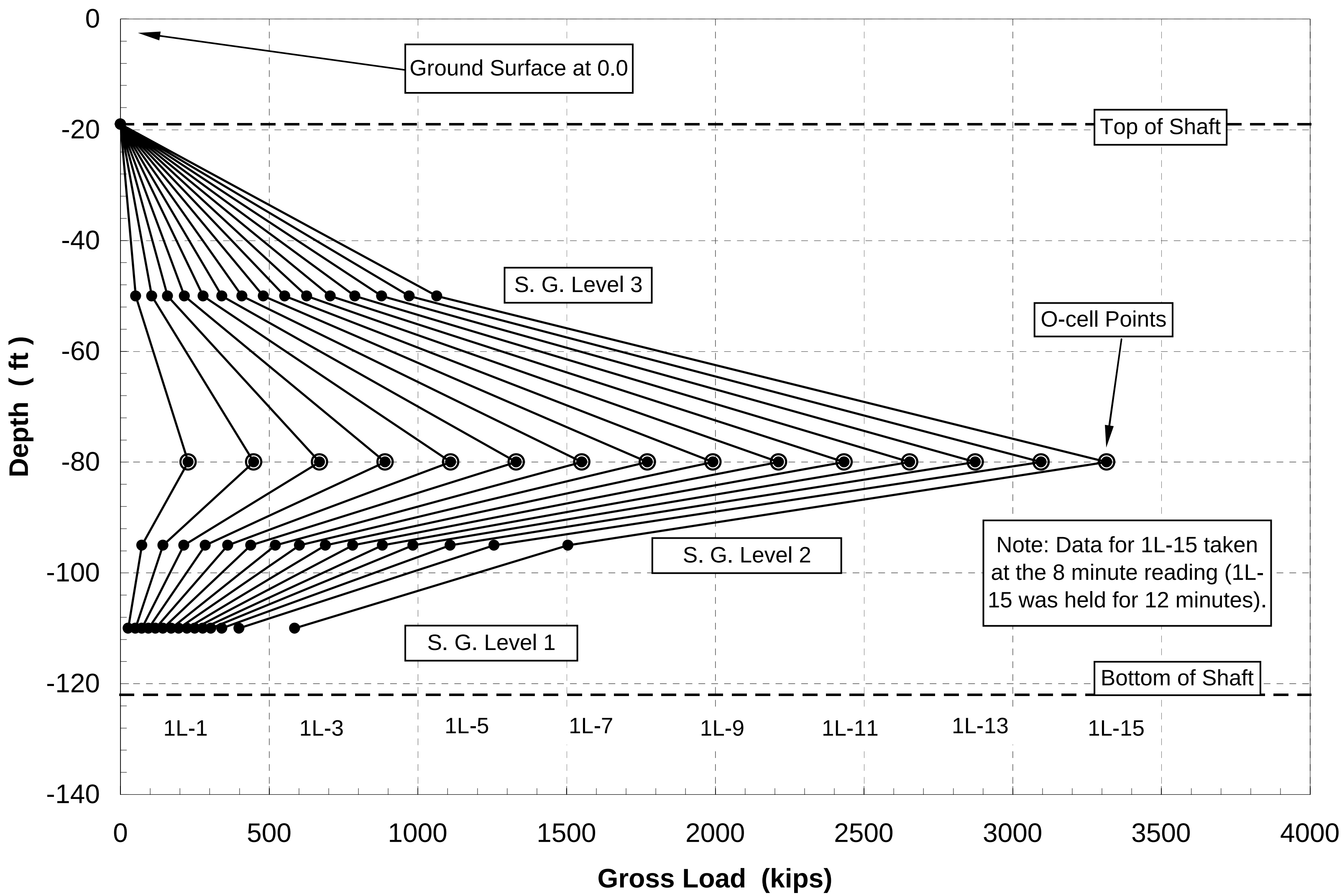
Equivalent Top Load-Movement Curves

I-215 Airport Connector - Las Vegas, NV - TS-1



Strain Gage Load Distribution Curves

I-215 Airport Connector - Las Vegas, NV - TS-1



Side Shear Creep Limit

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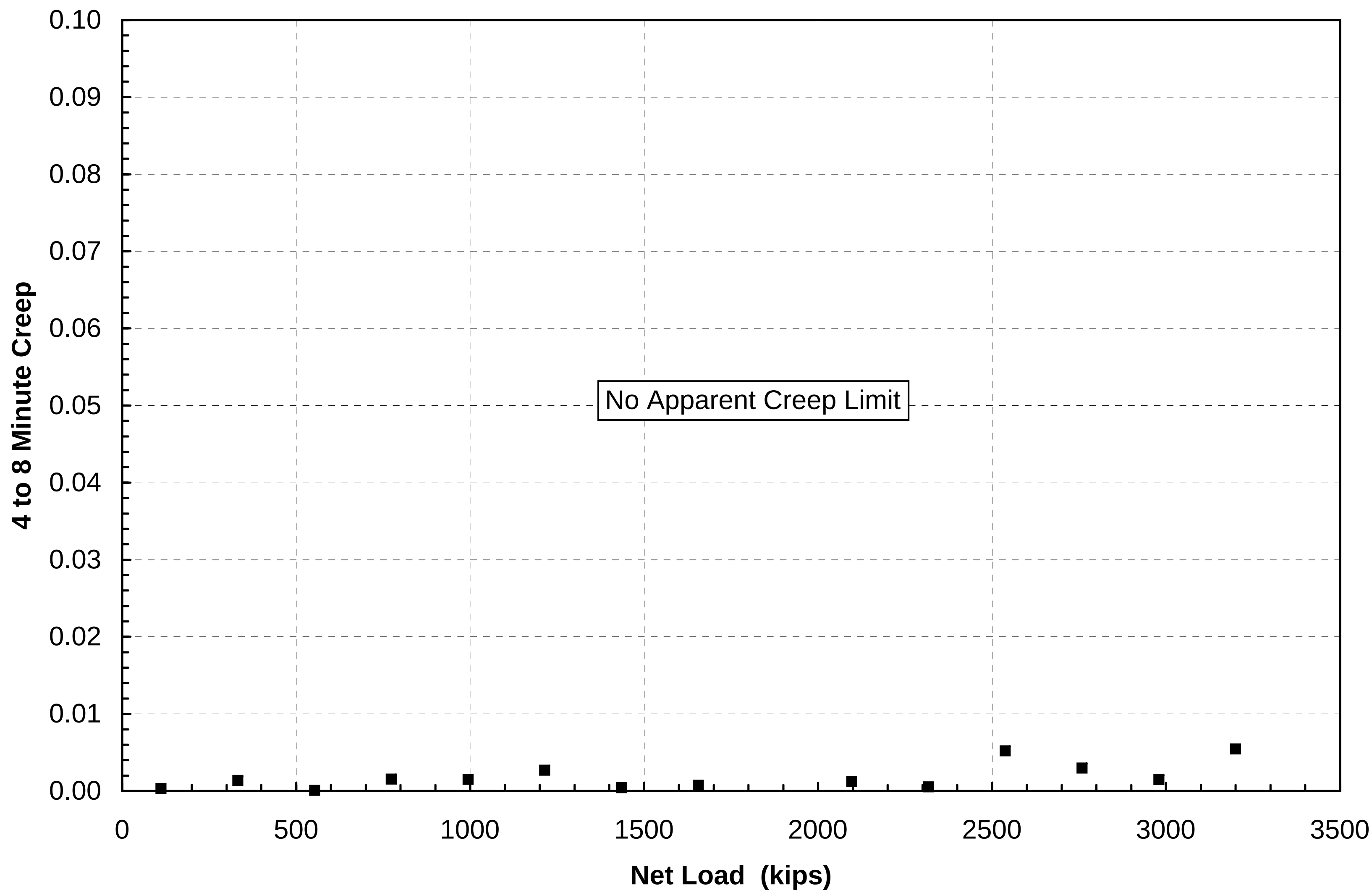
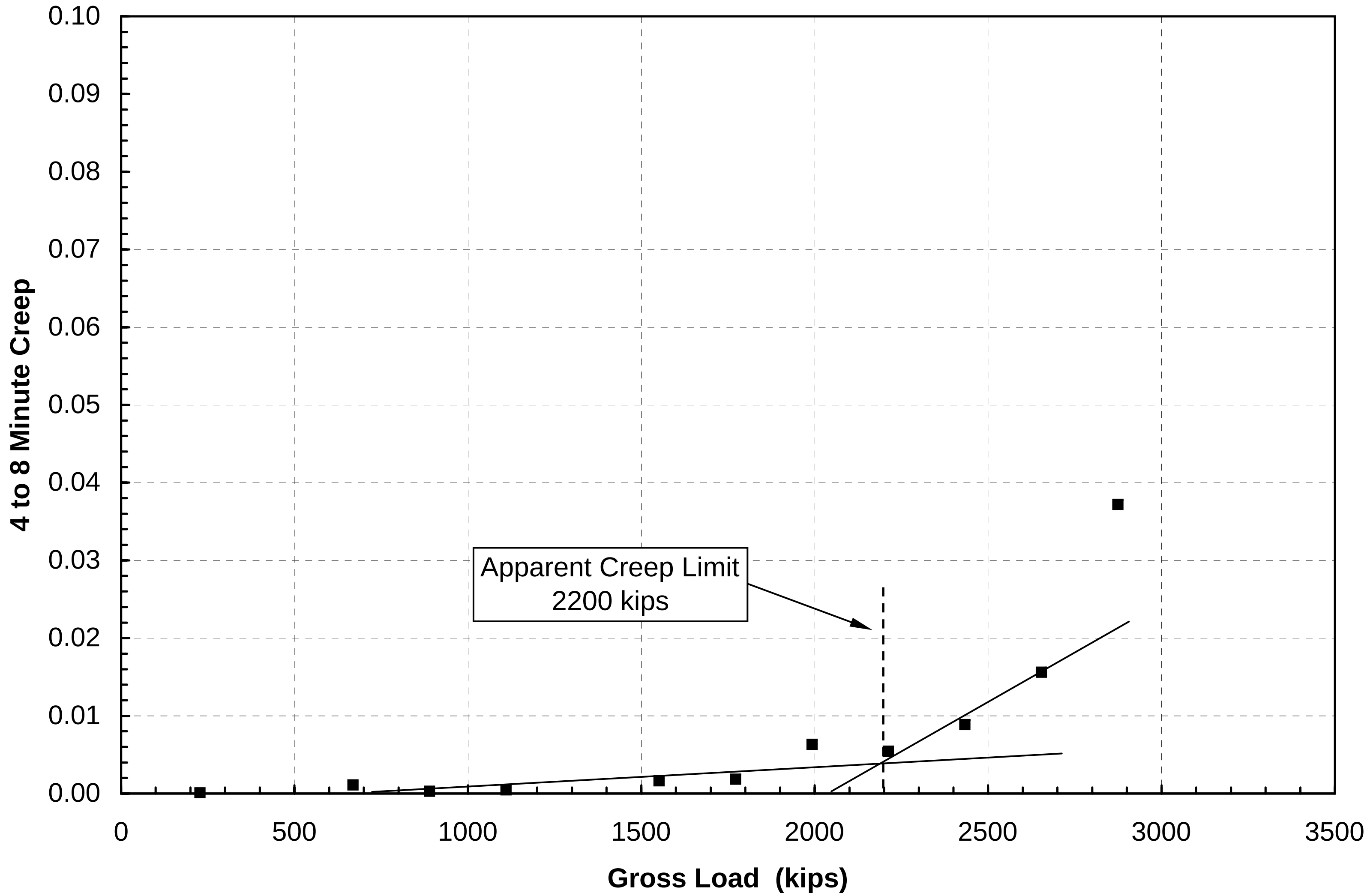


Base Creep Limit

I-215 Airport Connector - Las Vegas, NV - TS-1



APPENDIX A

FIELD DATA & DATA REDUCTION

Top of Shaft, Compression and Reference Beam Movement

I-215 Airport Connector - Las Vegas, NV - TS-1

Load	Time	Time After	O-cell	Applied	Net Load	TOS Indicator Readings			Telltale Compression			
Test		Start	Pressure	Load	Load	Side A	Side B	Average	Side A	Side A*	Side B	Average
Increment	(h:m:s)	Minutes	(psi)	(kips)	(kips)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)
1L -0	8:35:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1L -1	8:56:00	1	600	228	112	0.002	0.004	0.003	0.005	0.005	0.006	0.006
1L -1	8:57:00	2	600	228	112	0.001	0.004	0.003	0.005	0.005	0.006	0.006
1L -1	8:59:00	4	600	228	112	0.002	0.004	0.003	0.005	0.005	0.006	0.006
1L -1	9:03:00	8	600	228	112	0.000	0.006	0.003	0.006	0.006	0.006	0.006
1L -2	9:05:00	1	1,200	449	333	0.003	0.006	0.005	0.011	0.011	0.012	0.011
1L -2	9:06:00	2	1,200	449	333	0.003	0.006	0.004	0.011	0.011	0.012	0.011
1L -2	9:08:00	4	1,200	449	333	0.002	0.006	0.004	0.011	0.011	0.012	0.011
1L -2	9:12:00	8	1,200	449	333	0.003	0.008	0.006	0.011	0.011	0.012	0.012
1L -3	9:14:00	1	1,800	669	553	0.003	0.009	0.006	0.015	0.015	0.018	0.017
1L -3	9:15:00	2	1,800	669	553	0.004	0.009	0.007	0.016	0.016	0.018	0.017
1L -3	9:17:00	4	1,800	669	553	0.005	0.010	0.007	0.016	0.016	0.018	0.017
1L -3	9:21:00	8	1,800	669	553	0.004	0.010	0.007	0.016	0.016	0.018	0.017
1L -4	9:23:00	1	2,400	890	774	0.007	0.012	0.010	0.020	0.020	0.024	0.022
1L -4	9:24:00	2	2,400	890	774	0.007	0.013	0.010	0.021	0.021	0.024	0.023
1L -4	9:26:00	4	2,400	890	774	0.005	0.012	0.009	0.021	0.021	0.024	0.023
1L -4	9:30:00	8	2,400	890	774	0.006	0.013	0.010	0.021	0.021	0.025	0.023
1L -5	9:32:00	1	3,000	1,110	994	0.007	0.014	0.010	0.030	0.030	0.031	0.030
1L -5	9:33:00	2	3,000	1,110	994	0.007	0.013	0.010	0.030	0.030	0.031	0.031
1L -5	9:35:00	4	3,000	1,110	994	0.008	0.014	0.011	0.031	0.031	0.031	0.031
1L -5	9:39:00	8	3,000	1,110	994	0.009	0.015	0.012	0.031	0.031	0.032	0.031
1L -6	9:41:00	1	3,600	1,331	1,215	0.010	0.017	0.014	0.036	0.036	0.037	0.037
1L -6	9:42:00	2	3,600	1,331	1,215	0.010	0.016	0.013	0.036	0.036	0.038	0.037
1L -6	9:44:00	4	3,600	1,331	1,215	0.010	0.017	0.013	0.036	0.036	0.038	0.037
1L -6	9:48:00	8	3,600	1,331	1,215	0.012	0.019	0.016	0.036	0.036	0.038	0.037
1L -7	9:50:00	1	4,200	1,551	1,435	0.015	0.022	0.018	0.042	0.042	0.045	0.043
1L -7	9:51:00	2	4,200	1,551	1,435	0.015	0.023	0.019	0.043	0.043	0.046	0.044
1L -7	9:53:00	4	4,200	1,551	1,435	0.013	0.021	0.017	0.043	0.043	0.046	0.044
1L -7	9:57:00	8	4,200	1,551	1,435	0.015	0.021	0.018	0.043	0.043	0.045	0.044
1L -8	9:59:00	1	4,800	1,772	1,656	0.018	0.025	0.021	0.049	0.049	0.047	0.048
1L -8	10:00:00	2	4,800	1,772	1,656	0.018	0.026	0.022	0.049	0.049	0.053	0.051
1L -8	10:02:00	4	4,800	1,772	1,656	0.017	0.025	0.021	0.049	0.049	0.052	0.051
1L -8	10:06:00	8	4,800	1,772	1,656	0.018	0.025	0.021	0.050	0.050	0.053	0.051
1L -9	10:08:00	1	5,400	1,992	1,877	0.020	0.027	0.023	0.055	0.055	0.055	0.055
1L -9	10:09:00	2	5,400	1,992	1,877	0.019	0.027	0.023	0.056	0.056	0.055	0.055
1L -9	10:11:00	4	5,400	1,992	1,877	0.020	0.028	0.024	0.056	0.056	0.055	0.056
1L -9	10:15:00	8	5,400	1,992	1,877	0.018	0.027	0.023	0.057	0.057	0.056	0.056
1L -10	10:17:00	1	6,000	2,213	2,097	0.023	0.031	0.027	0.062	0.062	0.061	0.062
1L -10	10:18:00	2	6,000	2,213	2,097	0.025	0.032	0.029	0.062	0.062	0.061	0.062
1L -10	10:20:00	4	6,000	2,213	2,097	0.025	0.033	0.029	0.063	0.063	0.062	0.062
1L -10	10:24:00	8	6,000	2,213	2,097	0.025	0.034	0.030	0.064	0.064	0.063	0.063
1L -11	10:26:00	1	6,600	2,434	2,318	0.028	0.036	0.032	0.070	0.070	0.068	0.069
1L -11	10:27:00	2	6,600	2,434	2,318	0.029	0.036	0.033	0.070	0.070	0.069	0.069
1L -11	10:29:00	4	6,600	2,434	2,318	0.028	0.038	0.033	0.070	0.070	0.069	0.070
1L -11	10:33:00	8	6,600	2,434	2,318	0.028	0.038	0.033	0.070	0.070	0.070	0.070
1L -12	10:35:00	1	7,200	2,654	2,538	0.030	0.040	0.035	0.075	0.075	0.074	0.075
1L -12	10:36:00	2	7,200	2,654	2,538	0.032	0.041	0.037	0.076	0.076	0.075	0.076
1L -12	10:38:00	4	7,200	2,654	2,538	0.033	0.041	0.037	0.074	0.076	0.076	0.076
1L -12	10:42:00	8	7,200	2,654	2,538	0.035	0.044	0.039	0.072	0.079	0.079	0.079
1L -13	10:44:00	1	7,800	2,875	2,759	0.039	0.047	0.043	0.072	0.085	0.085	0.085
1L -13	10:45:00	2	7,800	2,875	2,759	0.038	0.046	0.042	0.071	0.086	0.086	0.086
1L -13	10:47:00	4	7,800	2,875	2,759	0.037	0.046	0.042	0.071	0.087	0.087	0.087
1L -13	10:51:00	8	7,800	2,875	2,759	0.037	0.049	0.043	0.070	0.089	0.089	0.089
1L -14	10:53:00	1	8,400	3,095	2,979	0.043	0.054	0.049	0.068	0.100	0.100	0.100
1L -14	10:54:00	2	8,400	3,095	2,979	0.046	0.053	0.049	0.067	0.099	0.099	0.099
1L -14	10:56:00	4	8,400	3,095	2,979	0.045	0.054	0.050	0.067	0.100	0.100	0.100
1L -14	11:00:00	8	8,400	3,095	2,979	0.045	0.054	0.049	0.067	0.102	0.102	0.102
1L -15	11:03:00	1	9,000	3,316	3,200	0.049	0.056	0.052	0.068	0.109	0.109	0.109
1L -15	11:06:00	4	9,000	3,316	3,200	0.047	0.056	0.052	0.068	0.112	0.112	0.112
1L -15	11:10:00	8	9,000	3,316	3,200	0.050	0.058	0.054	0.067	0.115	0.115	0.115
1L -15	11:14:00	12	9,000	3,316	3,200	0.050	0.059	0.055	0.067	0.117	0.117	0.117
1U -1	11:17:00	1	6,000	2,213	2,097	0.041	0.052	0.047	0.044	0.094	0.094	0.094
1U -1	11:18:00	2	6,000	2,213	2,097	0.042	0.051	0.047	0.044	0.100	0.100	0.100
1U -1	11:19:00	3	6,000	2,213	2,097	0.044	0.052	0.048	0.044	0.100	0.100	0.100
1U -1	11:20:00	4	6,000	2,213	2,097	0.040	0.050	0.045	0.044	0.093	0.093	0.093
1U -2	11:21:00	1	4,000	1,478	1,362	0.033	0.047	0.040	0.032	0.081	0.081	0.081
1U -2	11:22:00	2	4,000	1,478	1,362	0.032	0.047	0.040	0.032	0.081	0.081	0.081
1U -2	11:23:00	3	4,000	1,478	1,362	0.037	0.048	0.042	0.032	0.080	0.080	0.080
1U -2	11:24:00	4	4,000	1,478	1,362	0.033	0.045	0.039	0.032	0.080	0.080	0.080
1U -3	11:27:00	1	2,000	743	627	0.027	0.041	0.034	0.011	0.060	0.060	0.060
1U -3	11:28:00	2	2,000	743	627	0.028	0.042	0.035	0.010	0.059	0.059	0.059
1U -3	11:29:00	3	2,000	743	627	0.027	0.041	0.034	0.010	0.059	0.059	0.059
1U -3	11:30:00	4	2,000	743	627	0.025	0.037	0.031	0.010	0.059	0.059	0.059
1U -4	11:32:00	1	0	0	0	0.014	0.027	0.021	-0.005	0.031	0.031	0.031
1U -4	11:33:00	2	0	0	0	0.013	0.028	0.021	-0.005	0.031	0.031	0.031
1U -4	11:35:00	4	0	0	0	0.015	0.029	0.022	-0.006	0.030	0.030	0.030
1U -4	11:39:00	8	0	0	0	0.017	0.028	0.022	-0.006	0.029	0.029	0.029

* Comp A encountered a possible mechanical error at 10:38AM. Since Comp A and Comp B were almost equal Comp B data replaced Comp A data after 10: 38AM. See report for additional rationale.

O-cell Expansion and Upward and Downward Movement

I-215 Airport Connector - Las Vegas, NV - TS-1

Load Test Increment	Time (h:m:s)	Time After Start Minutes	O-cell Pressure (psi)	Applied Load (kips)	Net Load (kips)	LVWDT Readings (Expansion) 15990 (inches)	15991 (inches)	15992 (inches)	15993 (inches)	Average (inches)	Top O-cell Movement (inches)	Upward Creep (inches)	Bottom O-cell Movement (inches)	Downward Creep (inches)
1L -0	8:35:00	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000		0.000	
1L -1	8:56:00	1	600	228	112	0.018	0.048	0.026	0.025	0.030	0.009		-0.021	
1L -1	8:57:00	2	600	228	112	0.018	0.049	0.027	0.026	0.030	0.008		-0.021	
1L -1	8:59:00	4	600	228	112	0.018	0.049	0.027	0.026	0.030	0.009		-0.021	
1L -1	9:03:00	8	600	228	112	0.018	0.049	0.027	0.026	0.030	0.009	0.000	-0.022	0.000
1L -2	9:05:00	1	1,200	449	333	0.029	0.063	0.043	0.038	0.043	0.016		-0.027	
1L -2	9:06:00	2	1,200	449	333	0.029	0.063	0.043	0.038	0.043	0.016		-0.027	
1L -2	9:08:00	4	1,200	449	333	0.029	0.064	0.043	0.038	0.044	0.016		-0.028	
1L -2	9:12:00	8	1,200	449	333	0.030	0.064	0.044	0.039	0.044	0.017	0.001	-0.027	-0.001
1L -3	9:14:00	1	1,800	669	553	0.044	0.078	0.059	0.060	0.060	0.023		-0.038	
1L -3	9:15:00	2	1,800	669	553	0.045	0.078	0.059	0.060	0.061	0.023		-0.037	
1L -3	9:17:00	4	1,800	669	553	0.046	0.080	0.060	0.061	0.062	0.024		-0.038	
1L -3	9:21:00	8	1,800	669	553	0.047	0.081	0.061	0.062	0.063	0.024	0.000	-0.039	0.001
1L -4	9:23:00	1	2,400	890	774	0.063	0.096	0.078	0.076	0.078	0.032		-0.046	
1L -4	9:24:00	2	2,400	890	774	0.064	0.097	0.078	0.076	0.079	0.033		-0.046	
1L -4	9:26:00	4	2,400	890	774	0.064	0.098	0.078	0.078	0.079	0.031		-0.048	
1L -4	9:30:00	8	2,400	890	774	0.066	0.099	0.080	0.080	0.081	0.033	0.002	-0.049	0.000
1L -5	9:32:00	1	3,000	1,110	994	0.083	0.116	0.098	0.103	0.100	0.041		-0.059	
1L -5	9:33:00	2	3,000	1,110	994	0.084	0.116	0.099	0.105	0.101	0.041		-0.060	
1L -5	9:35:00	4	3,000	1,110	994	0.085	0.118	0.100	0.108	0.103	0.042		-0.061	
1L -5	9:39:00	8	3,000	1,110	994	0.087	0.119	0.102	0.110	0.105	0.043	0.002	-0.061	0.000
1L -6	9:41:00	1	3,600	1,331	1,215	0.105	0.135	0.119	0.140	0.125	0.050		-0.074	
1L -6	9:42:00	2	3,600	1,331	1,215	0.106	0.136	0.121	0.142	0.126	0.050		-0.076	
1L -6	9:44:00	4	3,600	1,331	1,215	0.107	0.138	0.122	0.145	0.128	0.050		-0.078	
1L -6	9:48:00	8	3,600	1,331	1,215	0.109	0.140	0.124	0.149	0.131	0.053	0.003	-0.078	0.000
1L -7	9:50:00	1	4,200	1,551	1,435	0.133	0.159	0.145	0.188	0.156	0.062		-0.094	
1L -7	9:51:00	2	4,200	1,551	1,435	0.136	0.161	0.148	0.190	0.159	0.063		-0.095	
1L -7	9:53:00	4	4,200	1,551	1,435	0.137	0.163	0.148	0.191	0.160	0.062		-0.098	
1L -7	9:57:00	8	4,200	1,551	1,435	0.139	0.165	0.150	0.193	0.162	0.062	0.000	-0.100	0.002
1L -8	9:59:00	1	4,800	1,772	1,656	0.160	0.186	0.171	0.213	0.183	0.069		-0.114	
1L -8	10:00:00	2	4,800	1,772	1,656	0.162	0.188	0.173	0.214	0.184	0.073		-0.112	
1L -8	10:02:00	4	4,800	1,772	1,656	0.166	0.190	0.176	0.216	0.187	0.072		-0.115	
1L -8	10:06:00	8	4,800	1,772	1,656	0.170	0.193	0.178	0.217	0.190	0.073	0.001	-0.117	0.002
1L -9	10:08:00	1	5,400	1,992	1,877	0.193	0.214	0.201	0.236	0.211	0.078		-0.133	
1L -9	10:09:00	2	5,400	1,992	1,877	0.196	0.217	0.204	0.240	0.214	0.078		-0.136	
1L -9	10:11:00	4	5,400	1,992	1,877	0.199	0.220	0.207	0.244	0.218	0.080		-0.138	
1L -9	10:15:00	8	5,400	1,992	1,877	0.204	0.225	0.212	0.250	0.223	0.079	-0.001	-0.144	0.006
1L -10	10:17:00	1	6,000	2,213	2,097	0.231	0.258	0.240	0.282	0.253	0.089		-0.164	
1L -10	10:18:00	2	6,000	2,213	2,097	0.234	0.251	0.243	0.286	0.254	0.091		-0.163	
1L -10	10:20:00	4	6,000	2,213	2,097	0.239	0.255	0.248	0.290	0.258	0.092		-0.166	
1L -10	10:24:00	8	6,000	2,213	2,097	0.246	0.261	0.255	0.297	0.265	0.093	0.001	-0.172	0.005
1L -11	10:26:00	1	6,600	2,434	2,318	0.278	0.293	0.288	0.331	0.297	0.101		-0.196	
1L -11	10:27:00	2	6,600	2,434	2,318	0.282	0.297	0.292	0.335	0.302	0.102		-0.200	
1L -11	10:29:00	4	6,600	2,434	2,318	0.288	0.304	0.299	0.342	0.308	0.103		-0.206	
1L -11	10:33:00	8	6,600	2,434	2,318	0.298	0.313	0.309	0.350	0.318	0.103	0.001	-0.214	0.009
1L -12	10:35:00	1	7,200	2,654	2,538	0.319	0.331	0.330	0.359	0.335	0.110		-0.225	
1L -12	10:36:00	2	7,200	2,654	2,538	0.332	0.347	0.344	0.371	0.349	0.112		-0.236	
1L -12	10:38:00	4	7,200	2,654	2,538	0.345	0.365	0.357	0.373	0.360	0.113		-0.247	
1L -12	10:42:00	8	7,200	2,654	2,538	0.367	0.389	0.381	0.386	0.381	0.118	0.005	-0.263	0.016
1L -13	10:44:00	1	7,800	2,875	2,759	0.420	0.444	0.438	0.439	0.435	0.128		-0.307	
1L -13	10:45:00	2	7,800	2,875	2,759	0.434	0.459	0.452	0.453	0.449	0.128		-0.321	
1L -13	10:47:00	4	7,800	2,875	2,759	0.457	0.484	0.476	0.475	0.473	0.129		-0.344	
1L -13	10:51:00	8	7,800	2,875	2,759	0.497	0.522	0.519	0.514	0.513	0.131	0.003	-0.382	0.037
1L -14	10:53:00	1	8,400	3,095	2,979	0.632	0.647	0.666	0.659	0.651	0.148		-0.503	
1L -14	10:54:00	2	8,400	3,095	2,979	0.656	0.672	0.692	0.687	0.677	0.149		-0.528	
1L -14	10:56:00	4	8,400	3,095	2,979	0.711	0.727	0.747	0.746	0.733	0.150		-0.583	
1L -14	11:00:00	8	8,400	3,095	2,979	0.818	0.834	0.859	0.853	0.841	0.151	0.001	-0.690	0.107
1L -15	11:03:00	1	9,000	3,316	3,200	1.093	1.111	1.148	1.139	1.123	0.161		-0.962	
1L -15	11:06:00	4	9,000	3,316	3,200	1.461	1.478	1.525	1.513	1.494	0.163		-1.331	
1L -15	11:10:00	8	9,000	3,316	3,200	1.885	1.895	1.964	1.939	1.921	0.169	0.005	-1.752	0.421
1L -15	11:14:00	12	9,000	3,316	3,200	2.268	2.286	2.355	2.320	2.307	0.172		-2.136	
1U -1	11:17:00	1	6,000	2,213	2,097	2.297	2.309	2.372	2.380	2.339	0.140		-2.199	
1U -1	11:18:00	2	6,000	2,213	2,097	2.297	2.310	2.377	2.380	2.341	0.147		-2.194	
1U -1	11:19:00	3	6,000	2,213	2,097	2.297	2.311	2.378	2.380	2.341	0.148		-2.193	
1U -1	11:20:00	4	6,000	2,213	2,097	2.297	2.312	2.378	2.380	2.342	0.138		-2.203	
1U -2	11:21:00	1	4,000	1,478	1,362	2.254	2.274	2.327	2.343	2.299	0.121		-2.178	
1U -2	11:22:00	2	4,000	1,478	1,362	2.253	2.272	2.326	2.337	2.297	0.120		-2.177	
1U -2	11:23:00	3	4,000	1,478	1,362	2.252	2.271	2.325	2.332	2.295	0.122		-2.173	
1U -2	11:24:00	4	4,000	1,478	1,362	2.251	2.271	2.324	2.330	2.294	0.119		-2.175	
1U -3	11:27:00	1	2,000	743	627	2.181	2.199	2.247	2.248	2.219	0.095		-2.124	
1U -3	11:28:00	2	2,000	743	627	2.177	2.194	2.245	2.245	2.215	0.094		-2.121	
1U -3	11:29:00	3	2,000	743	627	2.176	2.194	2.242	2.244	2.214	0.092		-2.122	
1U -3	11:30:00	4	2,000	743	627	2.175	2.194	2.240	2.243	2.213	0.090		-2.124	
1U -4	11:32:00	1	0	0	0	2.056	2.069	2.108	2.141	2.093	0.052		-2.041	
1U -4	11:33:00	2	0	0	0	2.052	2.066	2.103	2.137	2.089	0.052		-2.038	
1U -4	11:35:00	4	0	0	0	2.048	2.061	2.098	2.133	2.085	0.052		-2.033	
1U -4	11:39:00	8	0	0	0	2.042	2.057	2.093	2.129	2.080	0.052		-2.028	

Strain Gage Readings and Loads at Levels 1, 2 and 3

I-215 Airport Connector - Las Vegas, NV - TS-1

Load Test Increment	Time (h:m:s)	Time After Start Minutes	O-cell Pressure (psi)	Applied Load (kips)	Net Load (kips)	Level 1 15500 με	Level 1 15501 με	Level 1 Av. Load (kips)	Level 2 15502 με	Level 2 15503 με	Level 2 Av. Load (kips)	Level 3 15506 με	Level 3 15507 με	Level 3 Av. Load (kips)
1L -0	8:35:00	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1L -1	8:56:00	1	600	228	112	4.3	2.9	26.3	8.8	10.5	71.1	6.5	7.1	49.9
1L -1	8:57:00	2	600	228	112	4.1	3.0	26.1	8.8	10.4	70.6	6.5	7.0	49.8
1L -1	8:59:00	4	600	228	112	4.0	3.1	26.2	8.9	10.9	72.9	6.5	7.2	50.2
1L -1	9:03:00	8	600	228	112	4.0	3.0	25.8	8.9	10.7	72.1	6.6	7.4	51.3
1L -2	9:05:00	1	1,200	449	333	7.2	5.6	47.0	17.1	20.8	139.6	13.3	14.1	100.6
1L -2	9:06:00	2	1,200	449	333	7.4	5.9	48.7	17.2	20.6	138.9	13.1	14.2	100.6
1L -2	9:08:00	4	1,200	449	333	7.2	5.7	47.4	17.4	20.9	140.9	13.5	14.5	102.8
1L -2	9:12:00	8	1,200	449	333	7.8	5.9	50.3	17.6	21.4	143.4	13.7	14.8	104.9
1L -3	9:14:00	1	1,800	669	553	10.7	8.3	69.7	25.1	30.6	205.0	19.7	21.2	150.6
1L -3	9:15:00	2	1,800	669	553	10.9	8.1	69.7	25.4	31.0	207.2	19.9	21.5	152.2
1L -3	9:17:00	4	1,800	669	553	11.0	8.5	71.4	25.8	31.6	211.2	20.4	21.9	155.4
1L -3	9:21:00	8	1,800	669	553	11.1	8.4	71.7	25.9	32.0	212.9	20.8	22.3	158.5
1L -4	9:23:00	1	2,400	890	774	14.4	10.9	93.2	34.1	42.0	280.1	27.3	29.5	209.0
1L -4	9:24:00	2	2,400	890	774	14.4	10.9	93.2	34.1	42.0	280.1	27.5	29.5	209.6
1L -4	9:26:00	4	2,400	890	774	14.5	10.8	92.8	34.0	41.9	279.2	27.6	29.7	211.0
1L -4	9:30:00	8	2,400	890	774	14.8	11.0	94.9	34.7	42.9	285.3	28.2	30.3	215.2
1L -5	9:32:00	1	3,000	1,110	994	18.3	13.5	116.7	42.5	53.3	352.1	35.2	37.9	268.9
1L -5	9:33:00	2	3,000	1,110	994	18.2	13.5	116.5	42.8	53.5	354.3	35.4	38.1	270.4
1L -5	9:35:00	4	3,000	1,110	994	18.2	13.6	117.0	43.1	53.9	356.7	35.7	38.6	273.3
1L -5	9:39:00	8	3,000	1,110	994	18.4	13.8	118.2	43.4	54.7	361.0	36.3	39.2	278.0
1L -6	9:41:00	1	3,600	1,331	1,215	21.9	16.0	139.1	51.0	64.8	426.1	43.0	46.4	328.8
1L -6	9:42:00	2	3,600	1,331	1,215	22.0	16.1	140.2	52.1	65.5	432.4	43.5	47.1	333.2
1L -6	9:44:00	4	3,600	1,331	1,215	22.0	16.2	140.8	51.7	65.9	432.5	44.0	47.2	335.3
1L -6	9:48:00	8	3,600	1,331	1,215	22.4	16.4	142.8	52.2	67.0	438.5	44.6	48.1	340.9
1L -7	9:50:00	1	4,200	1,551	1,435	26.5	19.2	167.8	61.0	78.3	512.3	52.0	56.0	397.4
1L -7	9:51:00	2	4,200	1,551	1,435	27.0	19.3	170.1	61.6	79.5	518.9	53.0	56.9	404.0
1L -7	9:53:00	4	4,200	1,551	1,435	27.0	19.1	169.5	61.3	79.4	517.2	52.9	56.8	403.3
1L -7	9:57:00	8	4,200	1,551	1,435	27.1	19.3	170.8	61.6	80.1	521.0	53.4	57.6	408.1
1L -8	9:59:00	1	4,800	1,772	1,656	31.0	21.8	194.3	70.0	91.0	591.9	61.3	66.0	468.3
1L -8	10:00:00	2	4,800	1,772	1,656	31.0	21.9	194.7	69.8	91.2	592.3	61.5	66.3	470.0
1L -8	10:02:00	4	4,800	1,772	1,656	31.3	21.9	195.6	70.6	92.2	598.6	62.3	67.1	475.7
1L -8	10:06:00	8	4,800	1,772	1,656	31.3	22.0	196.2	70.8	93.0	602.3	63.0	67.7	480.5
1L -9	10:08:00	1	5,400	1,992	1,877	35.1	24.5	219.1	78.8	103.5	670.5	70.0	75.4	534.9
1L -9	10:09:00	2	5,400	1,992	1,877	35.3	24.5	219.9	79.6	104.7	677.7	70.7	76.4	540.9
1L -9	10:11:00	4	5,400	1,992	1,877	35.5	24.7	221.4	79.5	105.4	680.1	71.0	77.0	544.3
1L -9	10:15:00	8	5,400	1,992	1,877	36.1	24.8	223.9	80.6	106.7	688.9	72.1	78.1	552.5
1L -10	10:17:00	1	6,000	2,213	2,097	39.7	27.3	246.6	89.5	118.5	764.8	79.6	86.5	611.0
1L -10	10:18:00	2	6,000	2,213	2,097	40.1	27.3	248.1	89.9	119.4	769.7	80.2	86.8	614.2
1L -10	10:20:00	4	6,000	2,213	2,097	40.1	27.3	248.1	90.2	120.2	773.8	80.8	87.6	619.2
1L -10	10:24:00	8	6,000	2,213	2,097	40.6	27.3	249.9	90.9	121.6	781.5	81.8	88.6	626.5
1L -11	10:26:00	1	6,600	2,434	2,318	44.8	30.2	275.7	100.6	135.2	867.1	90.0	97.8	690.6
1L -11	10:27:00	2	6,600	2,434	2,318	44.6	30.0	274.2	100.5	135.4	867.5	90.2	98.0	692.0
1L -11	10:29:00	4	6,600	2,434	2,318	44.6	29.8	273.8	100.7	136.5	872.3	90.7	98.7	696.5
1L -11	10:33:00	8	6,600	2,434	2,318	45.5	30.0	277.4	101.4	138.1	880.9	91.9	99.8	705.2
1L -12	10:35:00	1	7,200	2,654	2,538	48.6	31.9	295.8	107.7	146.6	935.5	97.3	105.5	746.0
1L -12	10:36:00	2	7,200	2,654	2,538	49.9	32.5	302.9	109.8	150.4	957.2	99.2	107.8	761.1
1L -12	10:38:00	4	7,200	2,654	2,538	50.1	32.2	303.0	110.1	152.3	964.9	100.4	109.5	771.7
1L -12	10:42:00	8	7,200	2,654	2,538	50.6	32.2	304.6	111.2	156.1	983.3	102.5	111.8	788.1
1L -13	10:44:00	1	7,800	2,875	2,759	56.3	34.8	335.2	120.2	172.5	1076.2	111.0	121.3	854.5
1L -13	10:45:00	2	7,800	2,875	2,759	56.4	34.6	334.4	119.8	173.9	1080.0	111.2	121.7	856.7
1L -13	10:47:00	4	7,800	2,875	2,759	56.6	34.4	334.4	119.9	176.4	1089.7	112.3	122.9	864.9
1L -13	10:51:00	8	7,800	2,875	2,759	58.0	34.7	340.8	120.4	181.1	1108.6	114.1	124.9	878.7
1L -14	10:53:00	1	8,400	3,095	2,979	66.8	37.2	382.4	126.8	205.1	1220.9	123.5	136.1	954.8
1L -14	10:54:00	2	8,400	3,095	2,979	67.1	37.2	383.6	126.4	207.1	1226.8	124.2	136.6	959.0
1L -14	10:56:00	4	8,400	3,095	2,979	68.0	37.2	386.9	125.8	210.6	1237.3	124.8	137.3	964.0
1L -14	11:00:00	8	8,400	3,095	2,979	69.5	38.9	398.8	125.2	216.3	1255.9	125.7	138.3	971.0
1L -15	11:03:00	1	9,000	3,316	3,200	81.1	45.9	467.0	132.9	244.5	1388.0	134.4	147.6	1037.0
1L -15	11:06:00	4	9,000	3,316	3,200	89.5	52.6	522.4	132.2	261.3	1447.2	136.0	150.0	1051.7
1L -15	11:10:00	8	9,000	3,316	3,200	97.2	62.0	585.4	133.8	275.4	1504.7	137.7	151.7	1064.1
1L -15	11:14:00	12	9,000	3,316	3,200	101.7	71.0	635.2	133.8	282.1	1529.7	138.0	152.3	1067.6
1U -1	11:17:00	1	6,000	2,213	2,097	80.0	57.8	506.6	96.5	242.0	1244.9	110.1	121.6	852.2
1U -1	11:18:00	2	6,000	2,213	2,097	78.9	57.8	502.7	96.3	241.3	1241.4	109.9	121.8	852.1
1U -1	11:19:00	3	6,000	2,213	2,097	77.9	57.8	499.0	96.1	240.5	1237.8	109.7	121.5	850.5
1U -1	11:20:00	4	6,000	2,213	2,097	77.0	57.7	495.3	95.6	239.7	1233.0	109.7	121.5	850.5
1U -2	11:21:00	1	4,000	1,478	1,362	64.3	49.0	416.5	73.1	213.0	1052.0	90.8	101.1	705.7
1U -2	11:22:00	2	4,000	1,478	1,362	63.7	49.0	414.2	73.1	212.5	1050.2	90.6	100.7	703.4
1U -2	11:23:00	3	4,000	1,478	1,362	63.7	49.3	415.6	72.9	212.1	1048.1	90.5	100.6	702.9
1U -2	11:24:00	4	4,000	1,478	1,362	63.7	49.7	417.0	72.8	211.7	1046.1	90.5	100.5	702.4
1U -3	11:27:00	1	2,000	743	627	45.7	39.5	313.3	44.2	171.9	794.9	65.6	72.8	509.1
1U -3	11:28:00	2	2,000	743	627	45.2	38.5	307.9	42.3	169.1	777.3	63.9	71.6	498.5
1U -3	11:29:00	3	2,000	743	627	45.1	38.8	308.7	42.4	169.0	777.5	64.2	71.4	498.6
1U -3	11:30:00	4	2,000	743	627	44.6	38.9	307.2	42.6	168.7	777.2	63.9	71.2	497.1
1U -4	11:32:00	1	0	0	0	21.5	27.0	178.7	11.3	106.0	431.3	36.5	40.7	283.7
1U -4	11:33:00	2	0	0	0	21.2	27.4	178.9	11.2	104.7	426.3	35.9	40.0	279.3
1U -4	11:35:00	4	0	0	0	21.1	27.5	178.7	11.2	103.1	420.1	35.5	39.6	276.0
1U -4	11:39:00	8	0	0	0	20.9	27.8	178.8	11.3	101.6	415.0	34.8	38.8	270.9

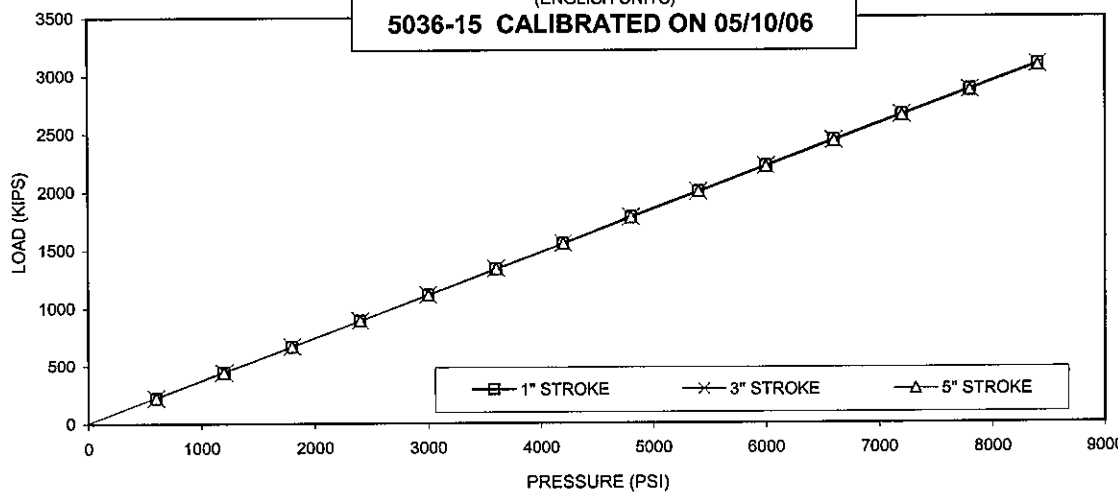
APPENDIX B

O-CELL AND INSTRUMENTATION CALIBRATION SHEETS

GRAPH of CALIBRATION DATA

(ENGLISH UNITS)

5036-15 CALIBRATED ON 05/10/06



STROKE:	1 INCH	3 INCH	5 INCH
PRESSURE PSI	LOAD KIPS	LOAD KIPS	LOAD KIPS
0	0	0	0
600	223	223	221
1200	441	442	441
1800	669	669	667
2400	892	892	891
3000	1112	1112	1111
3600	1336	1336	1336
4200	1555	1553	1551
4800	1782	1777	1775
5400	1998	1997	1996
6000	2219	2215	2211
6600	2440	2435	2430
7200	2659	2656	2648
7800	2873	2868	2864
8400	3094	3088	3080

26 inch" O-CELL, SERIAL # 5036-15

LOAD CONVERSION FORMULA

LOAD = PRESSURE * 0.3676 + (7.41)
{KIPS} {PSI}

Regression Output:

Constant	7.4120 kips
X Coefficient	0.3676 kip / psi
R Square	1.0000
No. of Observations	42
Degrees of Freedom	40
Std Err of Y Est	5.47
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.: ANDERSON DRILLING
* AE & FC JOB NO: SO1200	* JOB LOCATION: N. LAS VEGAS, NV
* CUSTOMER P.O. NO.: LT-9289	* DATED: 09/22/06

SERVICE ENGINEER: [signature] DATE: 26 Sept 2006

9289

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

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Serial Number: 06-15990

Cal. Std. Control Numbers: 529, 406, 344, 057

Calibration Date: September 15, 2006

Temperature: 22.9 °C

Calibration Instruction: CI-4400 Rev: C

Technician: K.D. 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	2663	2662	2663	-0.28	-0.19	0.00	0.00
30.0	3679	3679	3679	30.07	0.05	30.02	0.01
60.0	4689	4688	4689	60.22	0.15	60.00	0.00
90.0	5690	5690	5690	90.13	0.09	89.91	-0.06
120.0	6698	6694	6696	120.17	0.11	120.12	0.08
150.0	7684	7684	7684	149.68	-0.22	149.95	-0.03

(mm) Linear Gage Factor (G): 0.02986 (mm/ digit) **Regression Zero: 2672**

Polynomial Gage Factors: A: 8.26431E-08 B: 0.02901 C: -77.820

(inches) Linear Gage Factor (G): 0.001176 (inches/ digit)

Polynomial Gage Factors: A: 3.25366E-09 B: 0.001142 C: -3.0638

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 : 5217 Temp(T_0): 23.5 °C Date: September 28, 2006

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Serial Number: 06-15991

Cal. Std. Control Numbers: 529, 406, 344, 057

Calibration Date: September 15, 2006

Temperature: 22.9 °C

Calibration Instruction: CI-4400 Rev: C

Technician: K. 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	2655	2656	2656	-0.24	-0.16	-0.03	-0.02
30.0	3673	3669	3671	30.08	0.05	30.03	0.02
60.0	4682	4680	4681	60.23	0.15	60.06	0.04
90.0	5682	5681	5682	90.09	0.06	89.93	-0.05
120.0	6685	6683	6684	120.02	0.01	119.98	-0.01
150.0	7683	7682	7683	149.82	-0.12	150.03	0.02

(mm) Linear Gage Factor (G): 0.02985 (mm/ digit) **Regression Zero: 2663**

Polynomial Gage Factors: A: 6.06956E-08 B: 0.02922 C: -78.063

(inches) Linear Gage Factor (G): 0.001175 (inches/ digit)

Polynomial Gage Factors: A: 2.38959E-09 B: 0.001151 C: -3.0733

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 : 5222 Temp(T_0): 23.1 °C Date: September 28, 2006

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

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

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Serial Number: 06-15992

Cal. Std. Control Numbers: 529, 406, 344, 057

Calibration Date: September 15, 2006

Temperature: 22.9 °C

Calibration Instruction: CI-4400 Rev: C

Technician: K.D. 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	2743	2749	2746	-0.19	-0.13	0.01	0.00
30.0	3751	3750	3751	30.04	0.03	30.00	0.00
60.0	4749	4753	4751	60.16	0.10	59.99	0.00
90.0	5745	5747	5746	90.10	0.07	89.95	-0.04
120.0	6742	6745	6744	120.13	0.09	120.09	0.06
150.0	7725	7731	7728	149.76	-0.16	149.96	-0.03

(mm) Linear Gage Factor (G): 0.03010 (mm/ digit) **Regression Zero: 2752**

Polynomial Gage Factors: A: 6.05684E-08 B: 0.02946 C: -81.361

(inches) Linear Gage Factor (G): 0.001185 (inches/ digit)

Polynomial Gage Factors: A: 2.38458E-09 B: 0.001160 C: -3.2032

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 : 5159 Temp(T_0): 23.6 °C Date: September 28, 2006

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.
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GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Vibrating Wire Displacement Transducer Calibration Report

Range: 150 mm

Calibration Date: September 15, 2006

Serial Number: 06-15993

Temperature: 22.9 °C

Cal. Std. Control Numbers: 529, 406, 344, 057

Calibration Instruction: CI-4400 Rev: C

Technician: KLBellavance

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	2657	2655	2656	-0.29	-0.20	-0.05	-0.03
30.0	3672	3673	3673	30.11	0.07	30.06	0.04
60.0	4680	4679	4680	60.23	0.16	60.04	0.03
90.0	5682	5680	5681	90.19	0.13	90.00	0.00
120.0	6676	6674	6675	119.93	-0.05	119.88	-0.08
150.0	7675	7674	7675	149.82	-0.12	150.07	0.05

(mm) Linear Gage Factor (G): 0.02991 (mm/ digit) **Regression Zero: 2666**

Polynomial Gage Factors: A: 7.27189E-08 B: 0.02916 C: -78.015

(inches) Linear Gage Factor (G): 0.001178 (inches/ digit)

Polynomial Gage Factors: A: 2.86295E-09 B: 0.001148 C: -3.0714

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 : 5245 Temp(T_0): 23.6 °C Date: September 28, 2006

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.
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GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Sister Bar Calibration Report

Model Number : 4911-4

Date of Calibration: September 22, 2006

Serial Number: 06-15500

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

Prestress: 35,000 psi

Cable Length: 120 ft.

Temperature: 19.5 °C

Factory Zero Reading: 7016

Calibration Instruction: CI-VW Rebar Rev: C

Regression Zero: 7027

Technician: KlBellavance

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7084	7083	7084		
1,500	7753	7750	7752	668	-0.19
3,000	8483	8483	8483	732	-0.14
4,500	9219	9218	9219	736	0.05
6,000	9952	9950	9951	733	0.14
100	7083				

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.

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

Sister Bar Calibration Report

Model Number : 4911-4

Date of Calibration: September 22, 2006

Serial Number: 06-15501

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

Prestress: 35,000 psi

Cable Length: 120 ft.

Temperature: 19.6 °C

Factory Zero Reading: 7081

Calibration Instruction: CI-VW Rebar Rev: C

Regression Zero: 7091

Technician: KLBellavance

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7146	7147	7147		
1,500	7825	7821	7823	677	-0.18
3,000	8566	8562	8564	741	-0.05
4,500	9304	9303	9304	740	0.03
6,000	10044	10042	10043	740	0.10
100	7147				

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.

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

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 06-15502

Prestress: 35,000 psi

Temperature: 19.7 °C

Calibration Instruction: CI-VW Rebar Rev: C

Date of Calibration: September 22, 2006

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

Cable Length: 110 ft.

Factory Zero Reading: 7000

Regression Zero: 7007

Technician: K.L.Bellavance

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7068	7065	7067		
1,500	7748	7744	7746	680	-0.37
3,000	8508	8502	8505	759	-0.08
4,500	9264	9259	9262	757	0.13
6,000	10013	10006	10010	748	0.05
100	7066				

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

Gage Factor: 0.340 microstrain/ digit (GK-401 Pos."B")

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

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

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

The above instrument was found to be In Tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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

Sister Bar Calibration Report

Model Number : 4911-4

Date of Calibration: September 22, 2006

Serial Number: 06-15503

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

Prestress: 35,000 psi

Cable Length: 110 ft.

Temperature: 19.5 °C

Factory Zero Reading: 6992

Calibration Instruction: CI-VW Rebar Rev: C

Regression Zero: 6989

Technician: *[signature]*

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7050	7048	7049		
1,500	7730	7731	7731	682	-0.16
3,000	8470	8473	8472	741	-0.34
4,500	9229	9234	9232	760	0.12
6,000	9978	9982	9980	749	0.19
100	7049				

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

Gage Factor: 0.341 microstrain/ digit (GK-401 Pos."B")

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

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

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

The above instrument was found to be In Tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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

Sister Bar Calibration Report

Model Number : 4911-4

Date of Calibration: September 22, 2006

Serial Number: 06-15506

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

Prestress: 35,000 psi

Cable Length: 90 ft.

Temperature: 19.8 °C

Factory Zero Reading: 7057

Calibration Instruction: CI-VW Rebar Rev: C

Regression Zero: 7063

Technician: KLBellavance

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7124	7123	7124		
1,500	7791	7789	7790	667	-0.25
3,000	8525	8521	8523	733	-0.29
4,500	9271	9267	9269	746	0.11
6,000	10010	10002	10006	737	0.20
100	7125				

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

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

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

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

Linearity: ((Calculated Load-Applied Load)/ Max.Applied Load) X 100 percent
The above instrument was found to be In Tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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

Sister Bar Calibration Report

Model Number : 4911-4

Serial Number: 06-15507

Prestress: 35,000 psi

Temperature: 19.7 °C

Calibration Instruction: CI-VW Rebar Rev: C

Date of Calibration: September 22, 2006

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

Cable Length: 90 ft.

Factory Zero Reading: 6934

Regression Zero: 6942

Technician: [signature]

Applied Load: (pounds)	Readings				Linearity % Max.Load
	Cycle #1	Cycle #2	Average	Change	
100	7003	6999	7001		
1,500	7677	7676	7677	676	-0.48
3,000	8442	8439	8441	764	0.03
4,500	9192	9194	9193	753	0.16
6,000	9934	9938	9936	743	-0.03
100	7000				

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

Gage Factor: 0.341 microstrain/ digit (GK-401 Pos."B")

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

Note: The above calibration uses the linear regression method.

Users are advised to establish their own zero conditions.

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

The above instrument was found to be In Tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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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

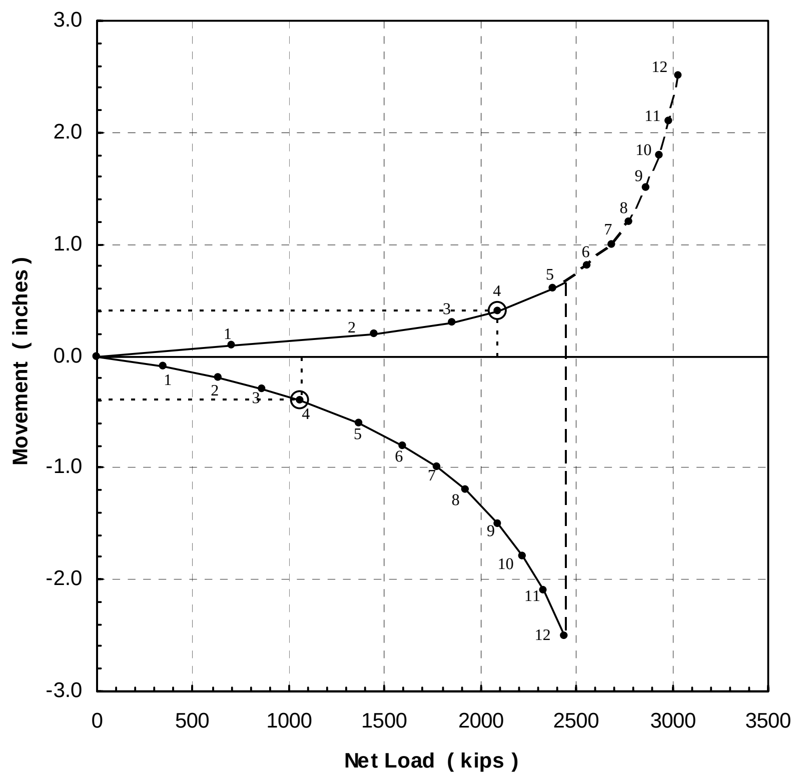
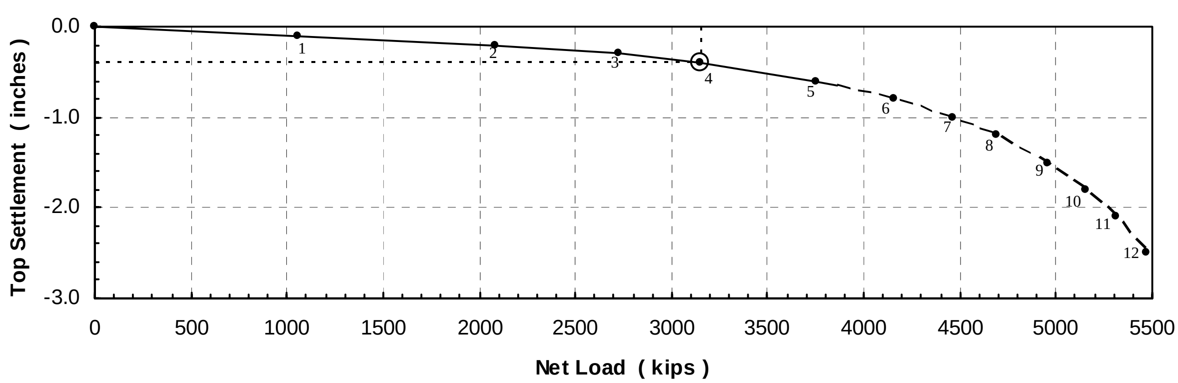
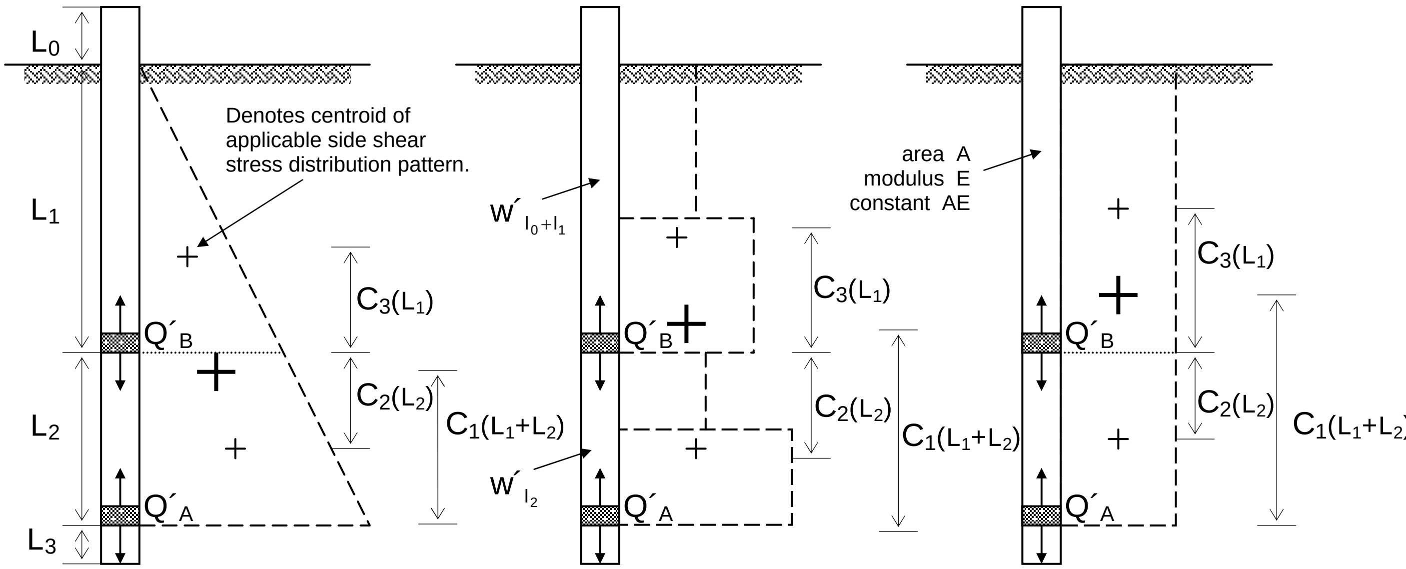


Figure B



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

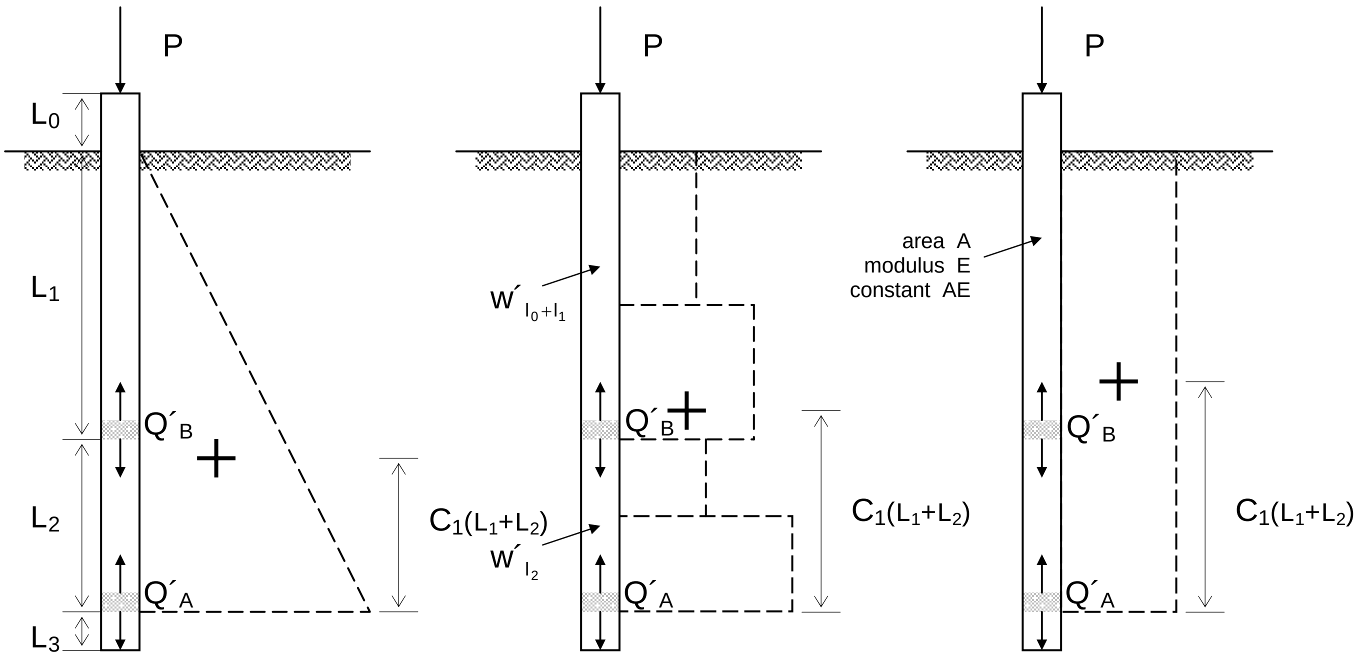
$C_3 = \frac{1}{3}$	Centroid Factor $= C_3$	$C_3 = \frac{1}{2}$
$\delta_{\uparrow l_1} = \frac{1}{3}\frac{Q'_{\uparrow B} l_1}{AE}$	$\delta_{\uparrow l_1} = C_3\frac{Q'_{\uparrow B} l_1}{AE}$	$\delta_{\uparrow l_1} = \frac{1}{3}\frac{Q'_{\uparrow B} l_1}{AE}$
$C_2 = \frac{1}{3}\left(\frac{3l_1+2l_2}{2l_1+l_2}\right)$	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: $\delta_{TLT} = \delta_{\downarrow l_0} + \delta_{\downarrow l_1 + l_2}$

$\delta_{\downarrow l_0} = \dfrac{Pl_0}{AE}$	$\delta_{\downarrow l_0} = \dfrac{Pl_0}{AE}$	$\delta_{\downarrow l_0} = \dfrac{Pl_0}{AE}$
$C_1 = \dfrac{1}{3}$	$\text{Centroid Factor} = C_1$	$C_1 = \dfrac{1}{2}$
$\delta_{\downarrow l_1+l_2} = \dfrac{(Q'_{\downarrow A} + 2P)}{3} \dfrac{(l_2 + l_2)}{AE}$	$\delta_{\downarrow l_1+l_2} = \left[(C_1)Q'_{\downarrow A} + (1 - C_1)P\right]\dfrac{(l_1 + l_2)}{AE}$	$\delta_{\downarrow l_1+l_2} = \dfrac{(Q'_{\downarrow A} + P)}{2} \dfrac{(l_1 + l_2)}{AE}$

Net and Equivalent Loads:

$Q'_{\downarrow A} = Q_{\downarrow A} - W'_{l_0+l_1+l_2}$ $\quad$ $P_{single} = Q'_{\downarrow A} + Q'_{\uparrow A}$ $\quad$ $P_{multi} = Q'_{\downarrow A} + Q'_{\uparrow B} + Q'_{\downarrow B}$

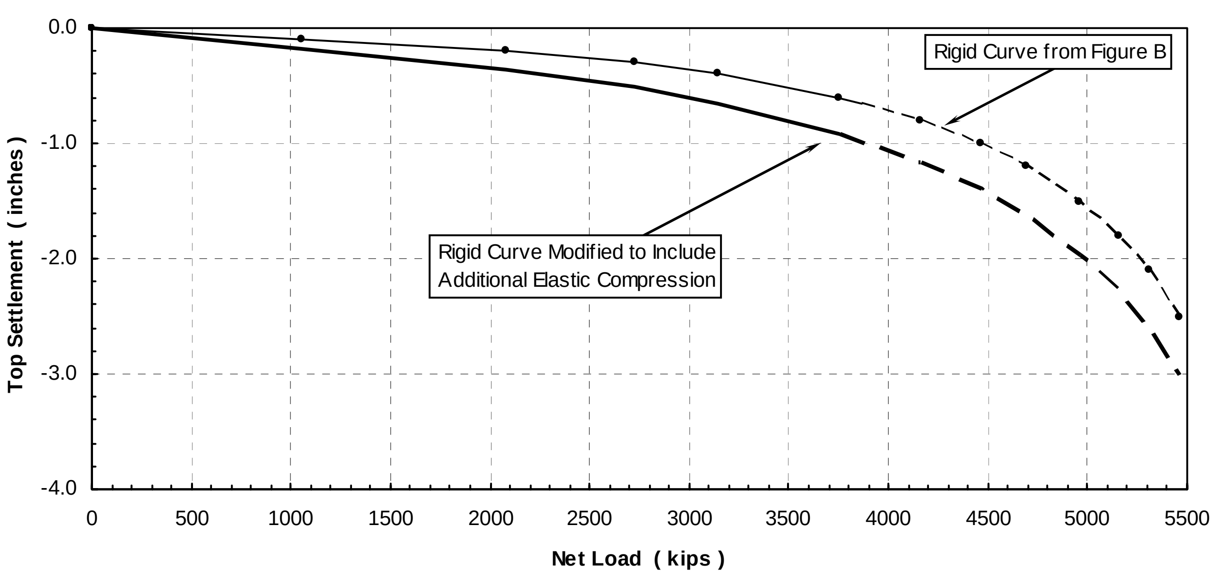
Component loads Q selected at the same (±) Δ_{OLT}.

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



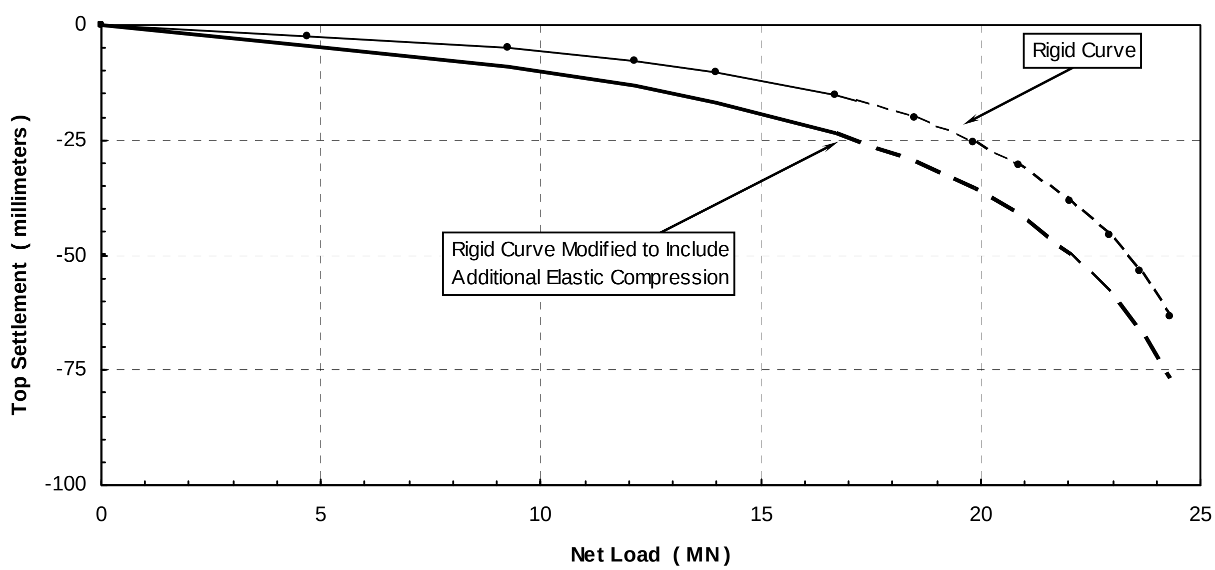
Example Calculation for the Additional Elastic Compression Correction For Single Level Test (SI Units)

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

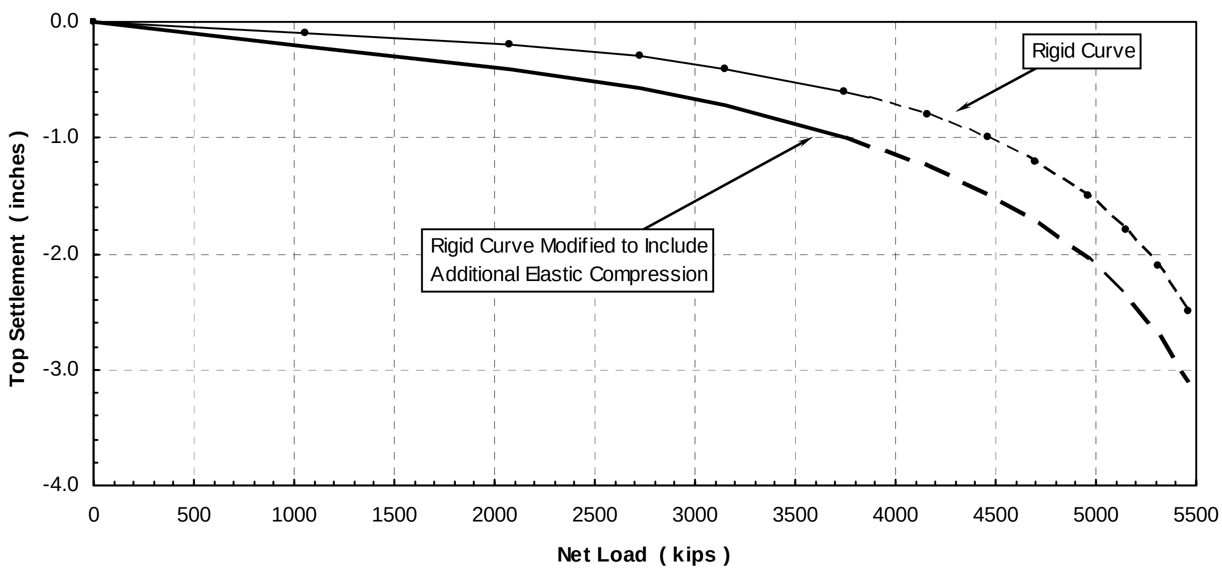


Example Calculation for the Additional Elastic Compression Correction For Multi Level Test (English Units)

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



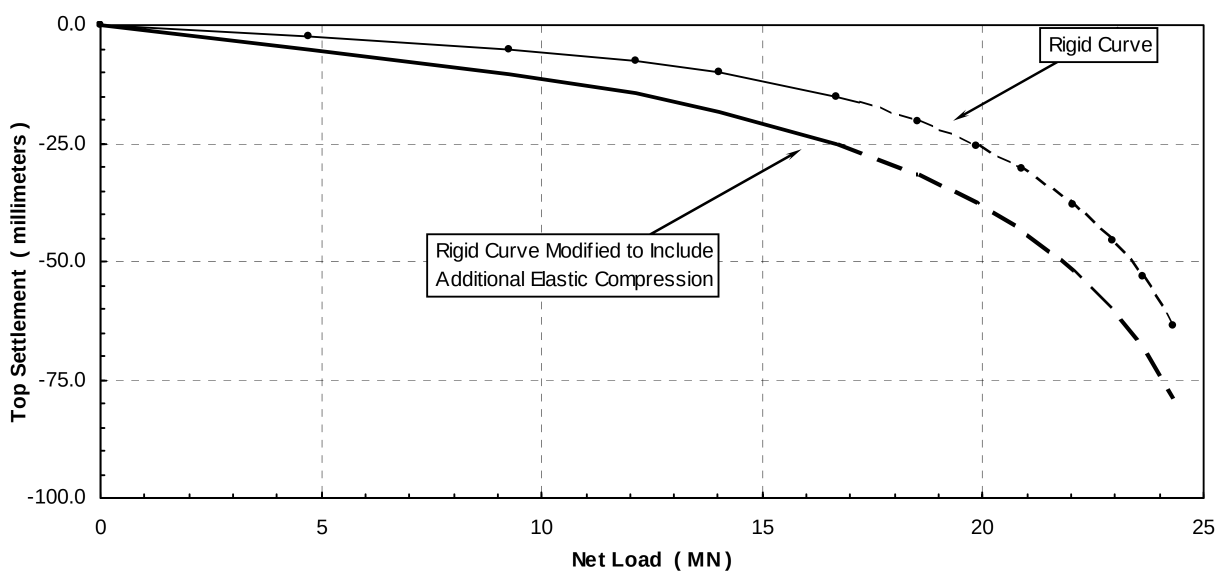
Example Calculation for the Additional Elastic Compression Correction For Multi Level Test (SI Units)

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 4 to 8 minutes. A break in the curve of load vs. movement (as at P_e with the PMT) indicates the creep limit.

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

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

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

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

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

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

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

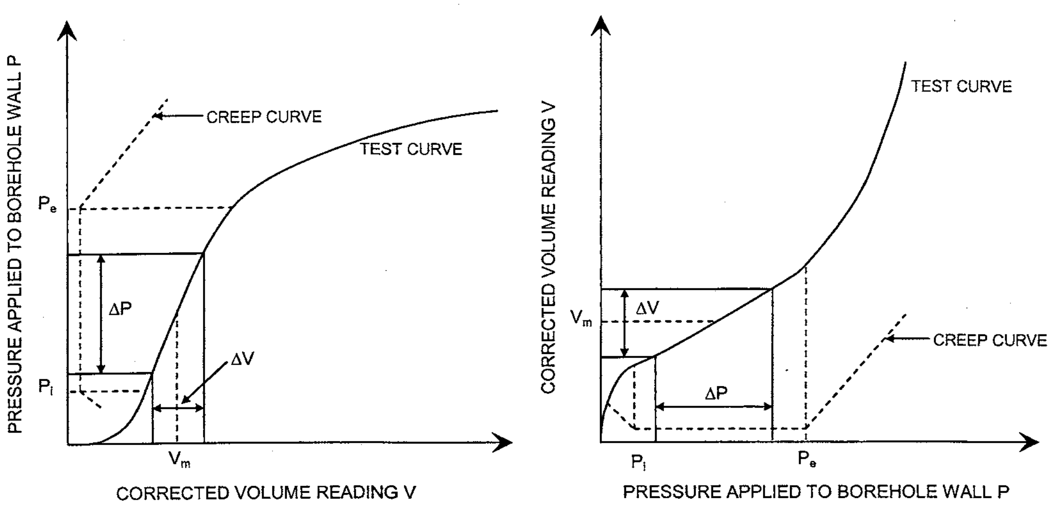


FIG. 8 Pressuremeter Test Curves for Procedure A

References

Housel, W.S. (1959), "Dynamic & Static Resistance of Cohesive Soils", ASTM STP 254, pp. 22-23.

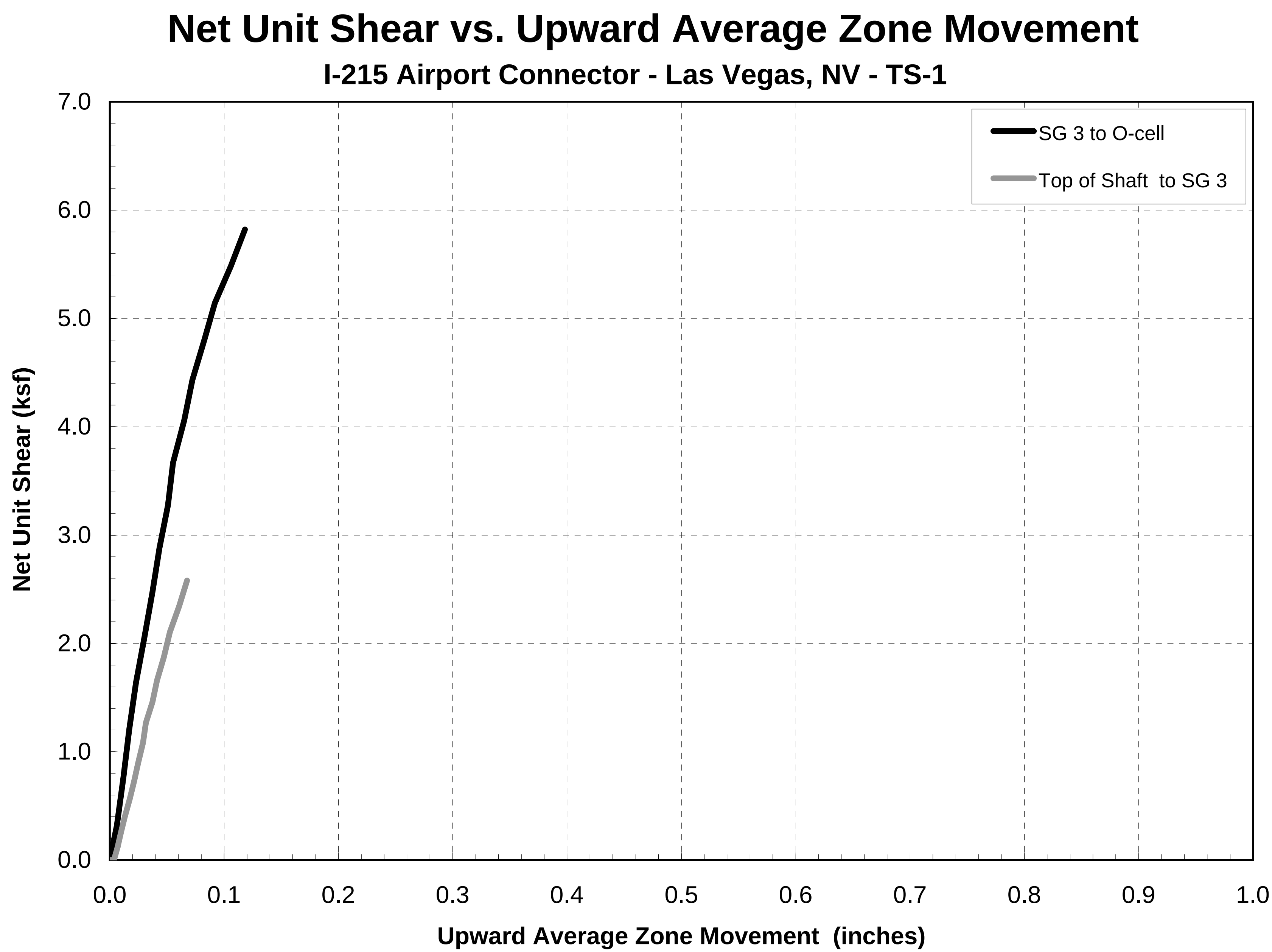
Stoll, M.U.W. (1961, Discussion, Proc. 5th ICSMFE, Paris, Vol. III, pp. 279-281.

Bourges, F. and 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.

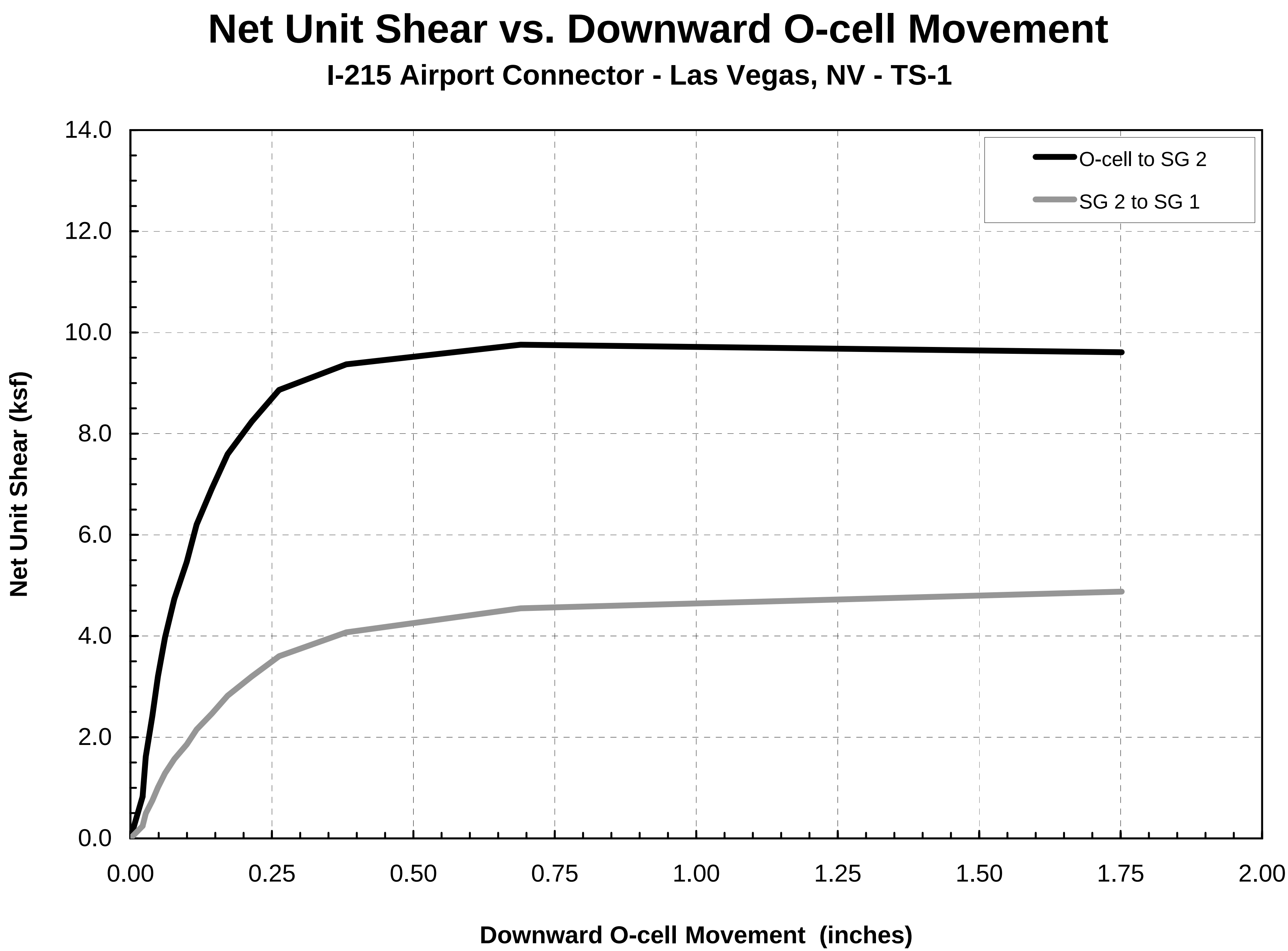
APPENDIX E

NET UNIT SHEAR CURVES



LOADTEST, Inc. Project No. 9289

Figure E-1



LOADTEST, Inc. Project No. 9289

Figure E-2

APPENDIX F

SOIL BORING LOG

LOG OF BORING NO. 06B-06

CLIENT:	PROJECT:
Parsons Brinckerhoff Quade & Douglas	**Interstate Route 215 / State Route 171**

BORING LOCATION:	ELEVATION:	SITE:
See Plot Plan		**Airport Connector Interchange**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
FILL - SANDY GRAVEL -w/ clay, lt. brown			FILL	0–2						
CLAYEY SAND -w/ silt, wet, reddish brown	med. dense		SC	2–4						
SANDY CLAY -w/ gypsum, moist, brown	very stiff		CL	4–8	4–5.5	19	SPT			
CLAYEY GRAVEL -w/ sand, moist, brown	dense		GC	8–11.5	9–10.5	39	SPT			
SANDY CLAY -partially cemented, dry to sl. moist, lt. brown **-w/ caliche lenses**	very stiff to mod. hard		CL	11.5–13.5						
CALICHE -dry, lt. brown	hard			13.5–15	14	50/0"	SPT			

Continued Next Page

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Measured @ 41 ft. after 24 hours

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED:	PAGE NUMBER:
3-19-06	**Page 1 of 7**
PROJECT NO.:	PLATE:
64065013	**A-1**

LOG OF BORING NO. 06B-06

CLIENT: Parsons Brinckerhoff Quade & Douglas		PROJECT: Interstate Route 215 / State Route 171
BORING LOCATION: See Plot Plan	ELEVATION:	SITE: Airport Connector Interchange

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
CALICHE -dry, lt. brown	hard			16						
CLAY -moist, reddish brown	stiff		CH	17						
CALICHE -dry, lt. reddish brown	hard			18, 19, 20, 21	19	50/0"	SPT			
CLAYEY SAND -w/ gravel, sl. moist to moist, lt. reddish brown	med. dense		SC	22, 23, 24, 25, 26	24–25.5	21	SPT			
-w/ occ. partially cemented lenses										
-partially cemented, sl. moist	v.s.-m.h.			27						
- very moist, reddish brown	very stiff		CL	28, 29	29–30	8/6" 25/6" 50/3"	SPT			
-partially cemented, sl. moist, lt. reddish brown	v.s.-m.h.			30						

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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:		DATE DRILLED:	PAGE NUMBER:
Groundwater Measured @ 41 ft. after 24 hours	Terracon	**3-19-06**	**Page 2 of 7**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64065013**	PLATE: **A-2**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. 06B-06

CLIENT: Parsons Brinckerhoff Quade & Douglas		PROJECT: Interstate Route 215 / State Route 171
BORING LOCATION: See Plot Plan	ELEVATION:	SITE: Airport Connector Interchange

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
CALICHE - partially cemented, dry to sl. moist, lt. reddish brown	very stiff to mod. hard			31–36						
				34	X	50/3"	SPT	11.2		
CLAY -w/ sand, tr. gravel, very moist, dark reddish brown (groundwater ▼ at 41 ft.)	firm		CH	37–42						
				39	X	6	SPT			
SILTY, CLAYEY SAND - w/ gravel, wet, reddish brown	med. dense		SC-SM	42–45						
				44	X	16	SPT	33.2		

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test *SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Measured @ 41 ft. after 24 hours**

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-19-06**

PAGE NUMBER: **Page 3 of 7**

PROJECT NO.: **64065013**

PLATE: **A-3**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. 06B-06

CLIENT: **Parsons Brinckerhoff Quade & Douglas**		PROJECT: **Interstate Route 215 / State Route 171**
BORING LOCATION: **See Plot Plan**	ELEVATION:	SITE: **Airport Connector Interchange**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
SILTY, CLAYEY SAND -wet, reddish brown			SC-SM	46						
CLAYEY SAND -w/ occ. partially cemented lenses, wet, reddish brown			SC	47						
-w/ tr. caliche gravel				48						
				49		10	SPT			
				50						
	med. dense			51						
-w/ clay lenses				52						
				53						
				54		20	SPT	21.0		
				55						
				56						
SANDY CLAY -very moist to wet, reddish brown			CL	57						
	firm to stiff			58						
				59		60	SPT			
-partially cemented, sl. moist, white	v.s.-m.h.			60						

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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:		DATE DRILLED:	PAGE NUMBER:
Groundwater Measured @ 41 ft. after 24 hours	Terracon	**3-19-06**	**Page 4 of 7**
HAMMER WEIGHT (lbs): **140**		PROJECT NO.: **64065013**	PLATE: **A-4**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. 06B-06

CLIENT: **Parsons Brinckerhoff Quade & Douglas**	PROJECT: **Interstate Route 215 / State Route 171**
BORING LOCATION: **See Plot Plan** ELEVATION:	SITE: **Airport Connector Interchange**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
CALICHE -partially cemented, sl. moist, white	very stiff to mod. hard			61						
CLAYEY SAND -w/ gravel, wet, reddish brown	med. dense		SC	62, 63, 64		24	SPT			
SANDY CLAY -very moist, reddish brown	very stiff		CL							
CLAYEY SAND -very moist, reddish brown	med. dense		SC	65, 66, 67, 68						
CALICHE -partially cemented, sl. moist, white	very dense to mod. hard			69		50/4"	SPT			
SANDY CLAY -very moist, reddish brown **-w/ tr. caliche gravel**	firm to stiff		CL	70, 71, 72, 73, 74		19	SPT	31.4		
SILTY CLAY -w/ sand, very moist, reddish brown	st.-v.st.		CL	75						

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THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Measured @ 41 ft. after 24 hours

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-19-06**	PAGE NUMBER: **Page 5 of 7**
PROJECT NO.: **64065013**	PLATE: **A-5**

LOG OF BORING NO. 06B-06

CLIENT: Parsons Brinckerhoff Quade & Douglas	PROJECT: Interstate Route 215 / State Route 171
BORING LOCATION: See Plot Plan / ELEVATION:	SITE: Airport Connector Interchange

SOIL DESCRIPTION	CONSISTENCY	USCS SYMBOL	DEPTH (FT.)	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
SILTY CLAY -w/ sand, tr. caliche gravel, very moist, reddish brown	stiff to very stiff	CL-ML	76					
			77					
			78					
			79	18	SPT			
SANDY CLAY -w/ tr. caliche gravel, very moist, reddish brown to lt. reddish brown		CL	80					
			81					
			82					
-w/ occ. partially cemented lenses			83					
			84	40	SPT	18.8		
-w/ caliche, moist to very moist	very stiff		85					
CLAYEY SAND -wet, reddish brown	med. dense	SC	86					
			87					
SILTY SAND -wet, reddish brown		SM	88					
			89	11	SPT			
CLAYEY SAND -wet, reddish brown		SC	90					

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THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test *SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES: **Groundwater Measured @ 41 ft. after 24 hours**

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-19-06**

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PROJECT NO.: **64065013**

PLATE: **A-6**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

LOG OF BORING NO. 06B-06

CLIENT: **Parsons Brinckerhoff Quade & Douglas**	PROJECT: **Interstate Route 215 / State Route 171**
BORING LOCATION: **See Plot Plan** ELEVATION:	SITE: **Airport Connector Interchange**

SOIL DESCRIPTION	CONSISTENCY	GRAPHIC	USCS SYMBOL	DEPTH (FT.)	SAMPLES: SAMPLE	SAMPLES: BLOWS/FT.	SAMPLES: SMP. TYPE*	TESTS: MOISTURE %	TESTS: DRY DENSITY PCF	TESTS: ORGANIC VAPOR METER
SANDY CLAY - very moist, brown	firm to stiff		CL	91, 92, 93						
-moist to very moist, brown to lt. brown	stiff to very stiff			94, 95, 96		25	SPT	13.0		
CLAYEY SAND -wet, brown	med. dense		SC	97						
SILTY SAND -wet, brown	loose		SM	98, 99		8	SPT			
CLAYEY SAND -wet, brown			SC							
SANDY CLAY -very moist, brown	firm		CL	100						
Bottom Depth at Approximately 100.5 feet				101, 102, 103, 104, 105						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

*SAMPLE TYPES: R = Ring B = Bag CPT = Cone penetration test
*SPT = Standard Penetration Test C = Core T = Shelby Tube

NOTES:
Groundwater Measured @ 41 ft. after 24 hours

HAMMER WEIGHT (lbs): **140**

Terracon

DATE DRILLED: **3-19-06**

PAGE NUMBER: **Page 7 of 7**

PROJECT NO.: **64065013**

PLATE: **A-7**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.