



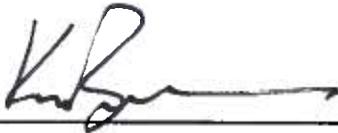
JSP

www.jsp.com

ARPRO[®]
Expanded Polypropylene (EPP)

ARPRO[®] Expanded Polypropylene (EPP) Foam Manhole Grade Adjustment Ring

Proof-Load Testing
October 13, 2009



Kipp Boegner
Manager, Engineering Group
JSP
1443 East 12 Mile Road
Crown Office Village, Building J
Madison Heights, MI 48071 USA
Tel: + 1 248 397 3208

The information contained herein is based upon the results of limited laboratory tests on test samples of material molded from expanded polyolefin resin manufactured by JSP. There can be no assurance that similar results will be achieved in simulated tests or actual use of commercial product molded by customers of JSP. Product performance may vary substantially depending upon the particular application or processing involved. The listed properties are illustrative only and applications of JSP foam products can influence molded part performance in many ways. Consequently, processors and/or users are advised that there may be a need to conduct independent tests and experiments in order for them to determine the extent to which they may choose to rely upon such information in their business operations. JSP disclaims any liability in connection with the use of the information and does not warrant against infringement by reasons of the use of its products in combination with other material or in any process.

Introduction

The following is a summary report of the evaluation of the ARPRO[®] EPP Manhole Grade Adjustment Ring application for HS-25 Static Loading.

Sanitary sewer systems necessitate that a manhole grade adjustment ring bear the load requirements of the installation.

Load Requirements and Standard Testing Methods

The American Association of State Highway and Transportation Officials (AASHTO) Standard Specification M306 identifies the proof-load testing required for drainage, sewer, and related castings intended for use in traffic service. AASHTO M306 was originally developed as a specification for cast iron, but the proof-load testing method can also be applied to ARPRO[®] Expanded Polypropylene (EPP) manhole grade rings. A specifying agency or municipality may have established its own procedure that might differ from this AASHTO specification; however it is likely that any method will require the application of a specific load on a defined area. Any crack or detrimental permanent deformation will cause the cover, grating, frame, or grade ring to be rejected.

The AASHTO Standard Specifications for Highway Bridges, 17th Edition, Section 3, identifies two types of design vehicle loads. They represent categories of individual vehicles and are routinely referred to as the H or HS truck. The H truck configuration includes only two theoretical axles as in figure 1.

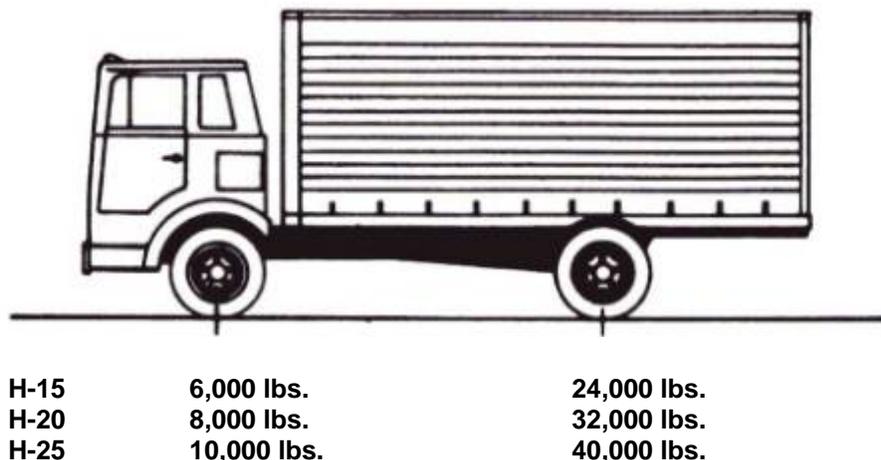
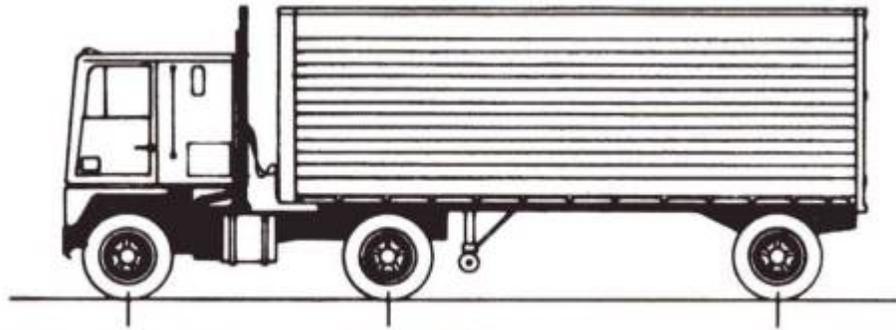


Figure 1 – Standard H Trucks

The HS truck configuration represents the conventional semi- or tractor-trailer. It is identical to the H truck, but with an extra axle representing the rear axle of the trailer, as in figure 2.



H-15	6,000 lbs.	24,000 lbs.	24,000 lbs.
H-20	8,000 lbs.	32,000 lbs.	32,000 lbs.
H-25	10,000 lbs.	40,000 lbs.	40,000 lbs.

Figure 2 – Standard HS Trucks

Results

Vehicular load testing was tested for JSP by the MGA Research Corporation, report number C09H7-084.1 (Appendix A), in accordance with the proof-load testing standards outlined by AASHTO M306, Section 6. Per AASHTO M306, Section 6, a proof-load shall be applied to the drainage, sewer, utility, and all related castings. This proof load represents a safety factor of 2.5 for H-20 or HS- 20 loading. A 50,000 lb. proof load will be used to represent a safety factor of 2.5 for H-25 or HS-25 loading.

The proof-load test was conducted on one (1) standard ARPRO[®] Expanded Polypropylene (EPP) manhole 36-24GF-600 grade-finish ring. A standard 36-24GF-600 grade-finish ring has an outer diameter of 36 inches, an inner diameter of 24 inches, and a starting height of 6.0 inches. The ring was placed onto a flat metal surface with an East Jordan cast iron manhole frame and cover placed on top as it would be during intended usage (figure 1). A servo hydraulic actuator was mounted to a crosshead attached to two stanchions. The specified force was applied and held for a minimum of 1 minute at which time a maximum deflection was recorded at three locations on the ring. Upon removal of the load, the sample was allowed to recover for 60 minutes then the sample was inspected for cracks and detrimental permanent deformation. The results are recorded in tables 1 and 2.

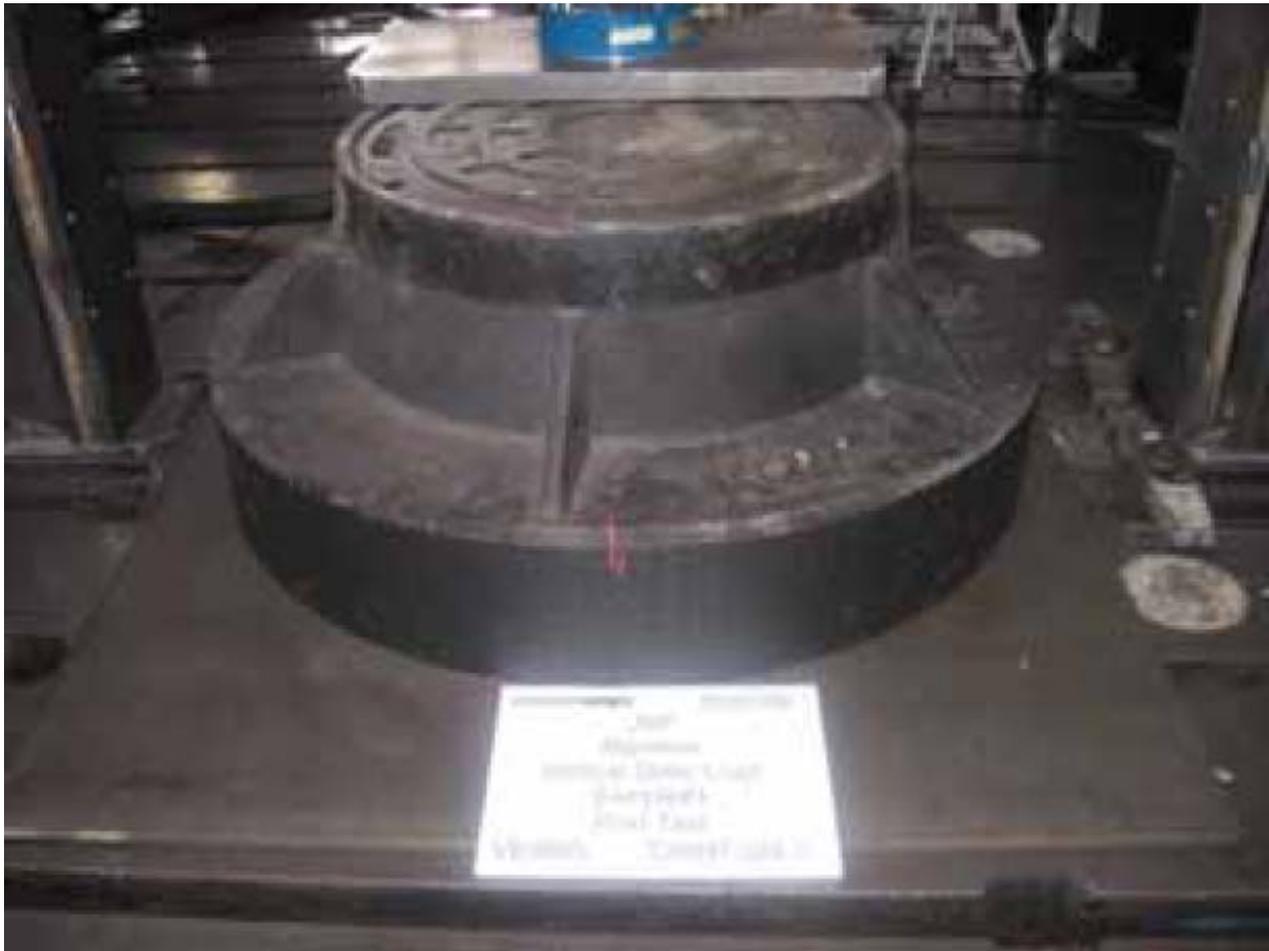


Figure 1 – Proof-Load Test Set-up

Table 1 – Proof-Load Test Results @ 40,000 Lbf

Measurement Location	Pre-Test Measurement (in.)	Post Test Measurement (in.)	Post Test + 1 Hr. Measurement (in.)	Permanent Set (in.)	Remarks
1	5.693	5.658	5.693	0.000	No visible deterioration
2	5.660	5.639	5.660	0.000	No visible deterioration
3	5.735	5.704	5.734	0.001	No visible deterioration

Table 2 – Proof-Load Test Results @ 50,000 Lbf

Measurement Location	Pre-Test Measurement (in.)	Post Test Measurement (in.)	Post Test + 1 Hr. Measurement (in.)	Permanent Set (in.)	Remarks
1	5.698	5.656	5.673	0.025	No visible deterioration
2	5.703	5.657	5.673	0.030	No visible deterioration
3	5.687	5.651	5.656	0.031	No visible deterioration

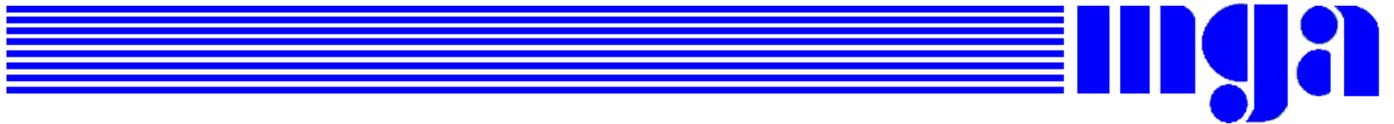
Conclusions

Per ASSHTO M306, Section 6, upon removal of the proof load, the test specimen shall be examined for cracks or detrimental permanent deformation. Permanent deformation shall not exceed 3.2 mm (0.125 inch). Any cracks shall be cause for rejection.

Based upon the above proof load test results, it is apparent that the ARPRO® Expanded Polypropylene (EPP) Manhole Grade Adjustment Rings, when installed properly, can be utilized in traffic environments where H-20, HS-20, H-25, and HS-25 vehicle loading is expected.

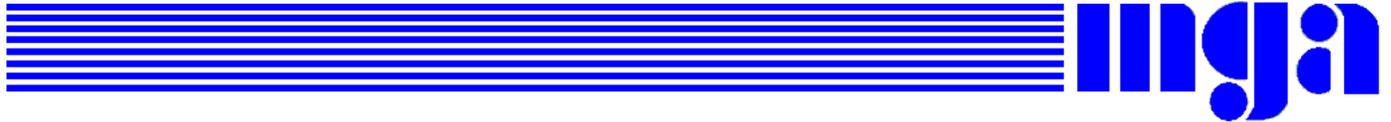


Appendix A



mga research corporation

**JSP
MAN-HOLE CONSTRUCTION
VERTICAL STATIC LOAD TEST SERIES
(PO# P39807)**



mga research corporation

TEST REPORT

MGA REPORT NO.: C09H7-084.1 Rev. 1 (Revised 10/13/09)

TEST (S) PERFORMED ON: October 7, 2009

TEST DESCRIPTION: Vertical Static Load

ITEM DESCRIPTION: Man-Hole Construction
(PO# P39807)

MGA PROCEDURE: MGATPDUR_HF

TEST REFERENCE NUMBER (S): VE9655 – 656

TEST LABORATORY: MGA Research Corporation
446 Executive Drive
Troy, Michigan 48083

SUBMITTED TO: Rob Doerr
JSP
1443 East 12 Mile Road
Madison Heights, MI 48071

TEST REPORT DATE: October 12, 2009

MGA PERSONNEL: 

Gerald Roesser
Project Leader

Test Personnel:
Ali Kaafarani

* The results presented in this report relate only to the specified test items.

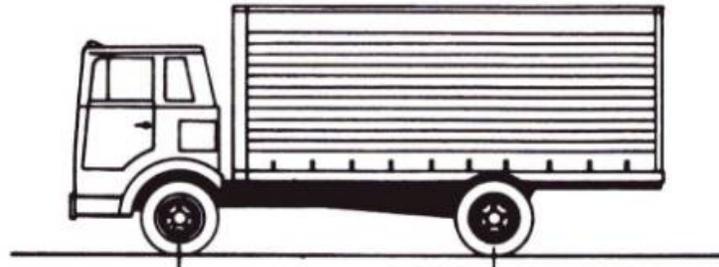
** This report shall not be reproduced except in full, without the written approval of the laboratory.

Introduction

MGA Research is to perform test and provide testing results for the JSP Expanded Polypropylene manhole grade adjustment ring. The test is to prove that the manhole construction will withstand typical ASHTO HS 20 and HS 25 loading conditions.

ASHTO Loading Conditions

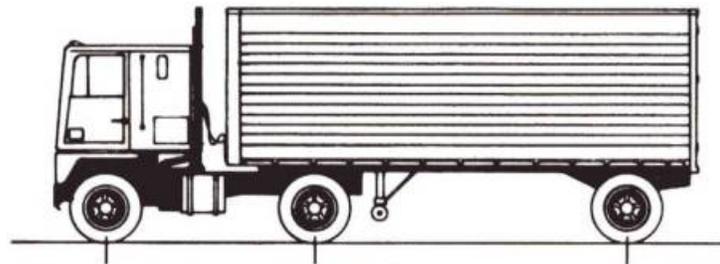
The AASHTO Standard Specifications for Highway Bridges, 17th Edition, Section 3, identifies two types of design vehicle loads. They represent categories of individual vehicles and are routinely referred to as the H or HS truck. The H truck configuration includes only two theoretical axles as in figure 1.



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The HS truck configuration represents the conventional semi- or tractor-trailer. It is identical to the H truck, but with an extra axle representing the rear axle of the trailer, as in figure 2.



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H-25	10,000 lbs.	40,000 lbs.	40,000 lbs.

Figure 2 – Standard HS Trucks

Load Calculations

The 40,000 lbf proof loads represent a safety factor of 2.5 for H-20 or HS- 20 loading on one tire patch.

$$36,600 \text{ lb rear axel} / 2 \text{ tire patches} * 2.5 \text{ safety factor} = 40,000 \text{ lbf proof load}$$

A 50,000 lb. proof load will be used to represent a safety factor of 2.5 for H-25 or HS-25 loading on one tire patch.

$$40,000 \text{ lb rear axel} / 2 \text{ tire patches} * 2.5 \text{ safety factor} = 50,000 \text{ lbf proof load}$$

Test Procedure

1. Test Samples were loaded under compression
2. Sample #1 was loaded to 40,000 lbf @ 400 lbf/sec. load was held for 1 minute.
3. Sample #2 was loaded to 50,000 lbf @ 400 lbf/sec. load was held for 1 minute.
4. Pre, instant post and 1 hour post test deflection measurements were taken.
5. Pre and Post test photos were taken.

Test Results

VE9655 Sample#1 @ 40K Lbf			
Location	Pre-Test Measurements (in)	Post-Test Measurements (in)	1-Hour Post-Test Measurements (in)
1	5.693	5.658	5.693
2	5.66	5.639	5.66
3	5.735	5.704	5.734

VE9656 Sample#2 @ 50K Lbf			
Location	Pre-Test Measurements (in)	Post-Test Measurements (in)	1-Hour Post-Test Measurements (in)
1	5.698	5.656	5.673
2	5.703	5.657	5.673
3	5.687	5.651	5.656

Additional Information can be found in the following appendices

Appendix A System Calibration Information4

Appendix B Test Data Plots and Photographs7

Appendix A
System Calibration Information

MICHIGAN OPERATIONS
 DATE: 2/7/04
 SUPERCEDES: MGATPTMC.5

DOC. NO.: MGATPTMC
 REVISION NO.: 6
 PAGE 3 OF 3

Tape Measure Calibration Certificate

Reference Steel Rule

Brand: BEI
 S/N: MBA 00067
 Calibration Date: 1/23/09

Subject Tape Measure

Brand: GW SHALE
 S/N: TPM 938
 Calibration Date: 5/26/09

Reference in (mm)	Subject Tape Measure	Difference	Reference in (mm)	Subject Tape Measure	Difference
0 (0)	0	0	18 (450)	450	0
1 (25)	25	0	19 (475)	475	0
2 (50)	50	0	20 (500)	500	0
3 (75)	75	0	21 (525)	525	0
4 (100)	100	0	22 (550)	550	0
5 (125)	125	0	23 (575)	575	0
6 (150)	150	0	24 (600)	600	0
7 (175)	175	0	25 (625)	625	0
8 (200)	200	0	26 (650)	650	0
9 (225)	225	0	27 (675)	675	0
10 (250)	250	0	28 (700)	700	0
11 (275)	275	0	29 (725)	725	0
12 (300)	300	0	30 (750)	750	0
13 (325)	325	0	31 (775)	775	0
14 (350)	350	0	32 (800)	800	0
15 (375)	375	0	33 (825)	825	0
16 (400)	400	0	34 (850)	850	0
17 (425)	425	0	35 (875)	875	0

If all differences are $\pm 1/32$ of an inch (1 mm), then the tape measure is acceptable.
 Pass Fail Maximum Difference = 0

Date: 5/26/09 Performed By: [Signature]

All calibrations are traceable to the National Institute of Standards and Technology. Estimated uncertainty of the measurement is $\pm 0.2\%$. All certification data and equipment are on file for inspection at your request. Best uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor $k=2$.



4700 Barden Court SE, Kentwood, MI 49512, Telephone: 616-898-3124, Fax: 616-898-2364, www.metrocal.com

Certificate of Calibration

Customer:	MGA Research 446 Executive Drive Troy, MI 48083	Certificate No.:	MGA00814MGA:1247482688
		Work Order:	64974
		Customer P.O.:	N/A
Gauge Number:	MGA00814	Calibration Date:	7/13/09
Description:	12" Digital Caliper	Due Date:	7/13/10
Manufacturer:	Fowler		
Model:	N/A	Technician:	Shannon Shoemaker
Serial Number:	SH7A003663	Temperature:	68.0 °F
Result:	PASS	Humidity:	41 %
Condition:	FOUND-LEFT	Calibration Site:	MetroCal
Procedure Used:	Caliper (CP005)		

MetroCal, Inc. certifies that the above listed instrument has been calibrated using measurement standards traceable to the National Institute of Standards and Technology (NIST), or to NIST accepted intrinsic standards of measurement, or derived by the ratio type of self-calibration techniques. This calibration complies with ISO 17025 and ANSI/NCCL Z540.1.

This report may not be reproduced, except in full, without the written approval of MetroCal, Inc. Results relate only to the item(s) calibrated. Any number of factors may cause the calibration item to drift out of calibration before the recommended interval has expired. Statement of compliance made using simple acceptance rules.

The condition that could be found in this certificate must be interpreted as:

- * As Found - Calibration data collected before the unit is adjusted and/or repaired.
- * As Left - Calibration data collected after the unit is adjusted and/or repaired.
- * Found-Left - Calibration data collected without any adjustment and/or repair performed.

Note: Process Uncertainty for this calibration is based upon approximately 95% (2 sigma) confidence limits.

REMARKS:

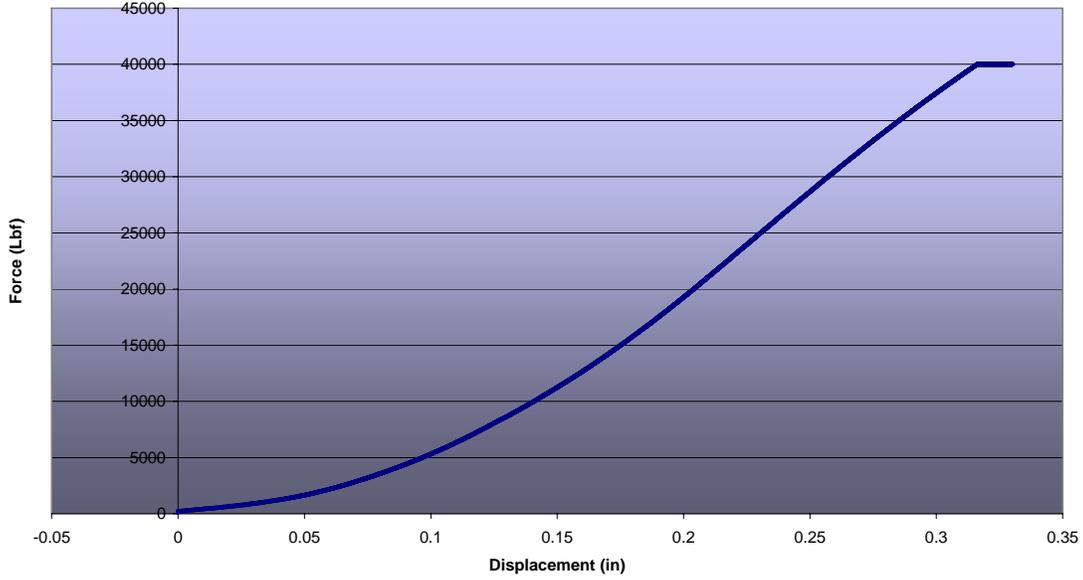
Standards Used						
Asset #	Nomenclature	Traceable No.	Cal Date	Due Date	Process Uncertainty	
105	82pc Rect. Gauge Block Set Gra	821/276493-08	6/1/09	6/1/10	(0.6R+2L) μ m	
16900	8pc Long Gnge Block Set Type:I	821/274921-07	7/23/08	7/23/10	(0.6R + 2L) μ m	
8063	9pc Master Ring Gage Set	090109203	1/9/09	1/9/10		

Test Results						
Test Description	True Value	Test Result	Lower limit	Upper limit	Units	Result
Preliminary Inspection						Pass
Outside Jaw Calibration	0.35000	0.3500	0.3485	0.3515	inch	Pass
	0.65000	0.6500	0.6485	0.6515	inch	Pass
	0.80000	0.8000	0.7985	0.8015	inch	Pass
	3.00000	2.9995	2.9985	3.0015	inch	Pass

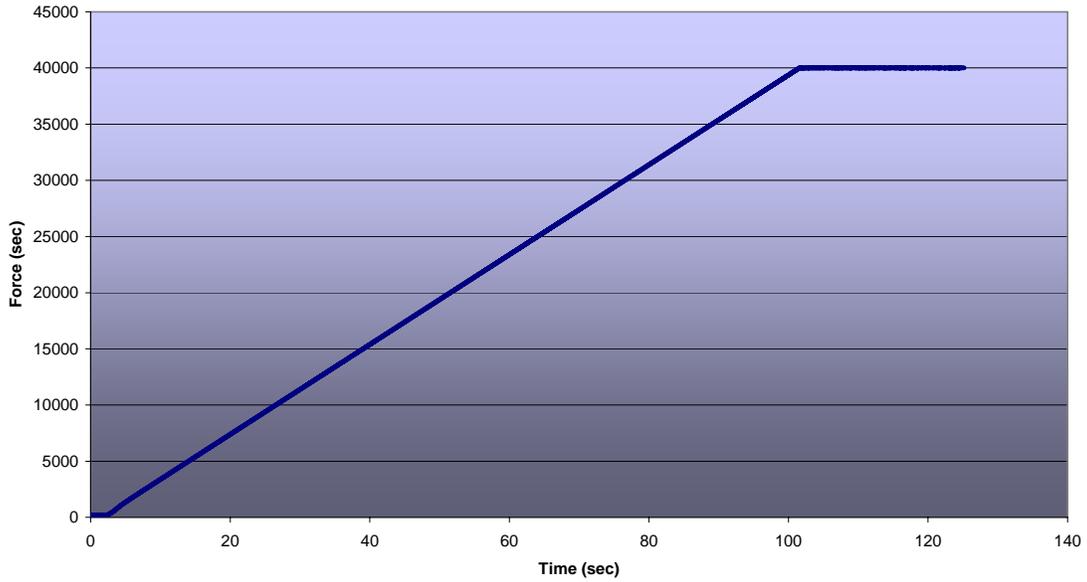
(Signature) 7/15/09

Appendix B
Test Data Plots and Photographs

MGA Research
JSP
ManHole
Vertical Static Loading @40K Lbf
Sample#1
VE9655



MGA Research
JSP
ManHole
Vertical Static Loading @40K Lbf
Sample#1
VE9655



Test #VE9655 Pre-Test Photos



Photo #1



Photo #2

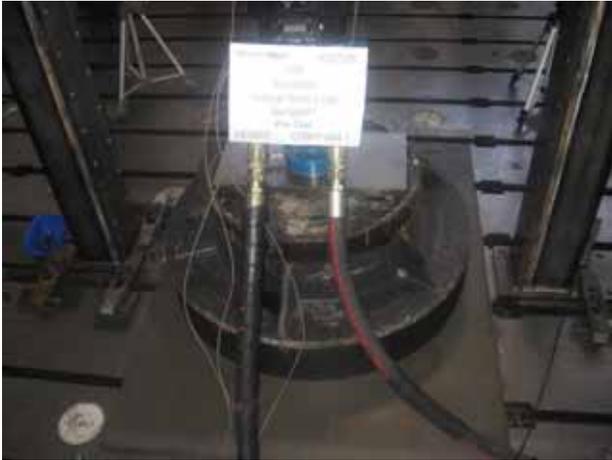


Photo #3



Photo #4

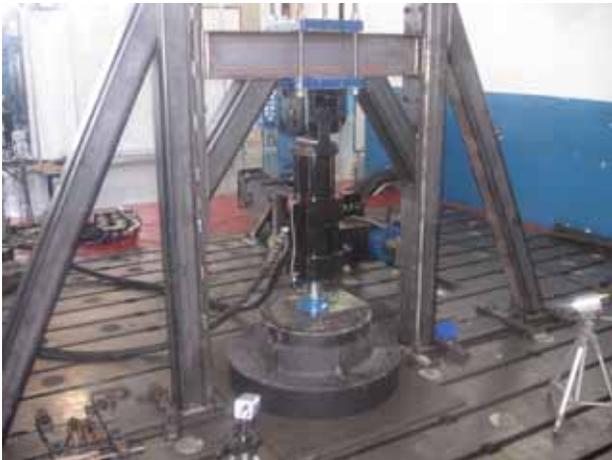


Photo #5

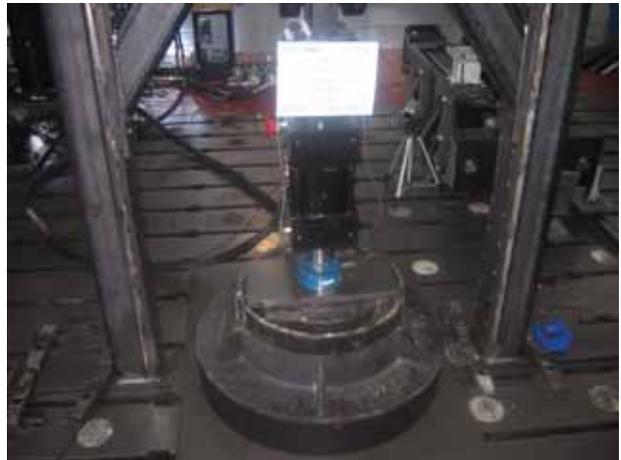


Photo #6

Test #VE6955 Post-Test Photos



Photo #1



Photo #2



Photo #3



Photo #4



Photo #5



Photo #6

Test #VE9556 Post-Test Photos

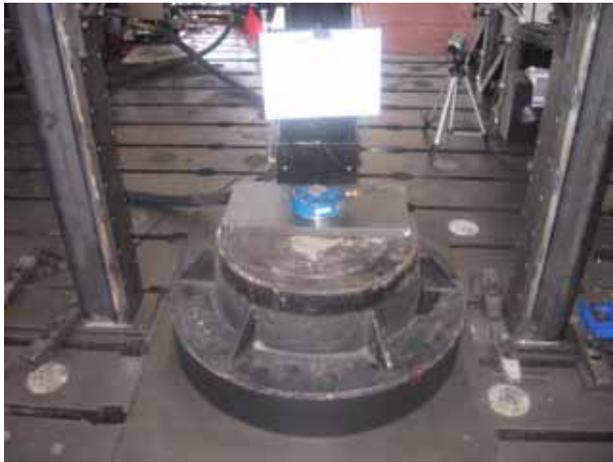


Photo #1



Photo #2

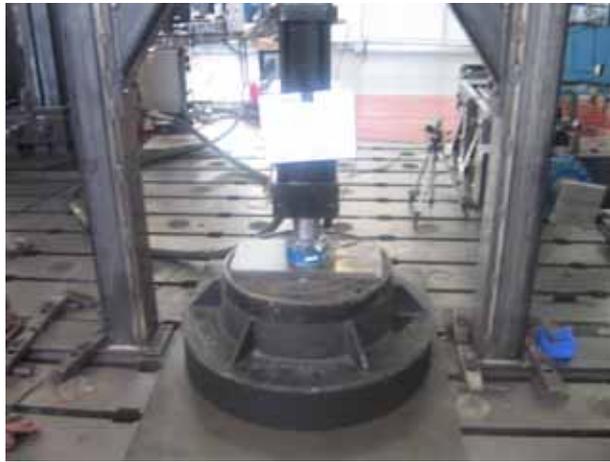


Photo #3