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ARPRO®
Expanded Polypropylene (EPP)

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

Asphalt Exposure and Proof-Load Testing
July 15, 2010

Introduction

The following is a summary report of the evaluation of the ARPRO® EPP Manhole Grade Adjustment Ring application for H-20, HS-20 , H-25 and HS-25 Static Loading at elevated temperatures.

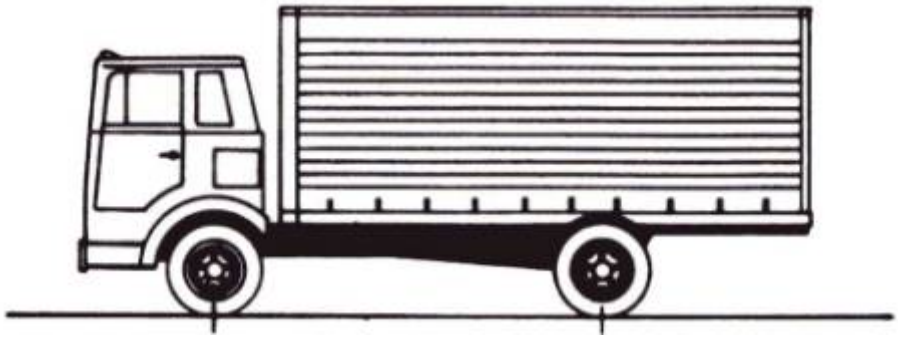
Asphalt Exposure

The asphalt exposure test was performed at an asphalt production plant. A plywood containment box measuring 48" by 48" by 11" was used for containment. One (1) standard ARPRO® Expanded Polypropylene (EPP) PRO-Ring manhole 36-24GF-600 grade-finish ring, with an outer diameter of 36 inches, an inner diameter of 24 inches, and a starting height of 6.0 inches, was set in the center of the containment box. An East Jordan 1045Z cast iron manhole frame, with flange measuring 36” OD and 28” ID, and cover were placed on top of the PRO-Ring adjustment course as it would be during intended usage. T1100 Grade Asphalt was then placed over the adjustment course and hand compacted up to the bottom of the manhole frame. The asphalt temperature was measured at 285º F at the time of placement. There were no unusual visual observations made at the time of placement. After 24 hours, the test assembly was carefully dismantled and the adjusting rings removed. A visual survey of the condition of the adjusting rings determined that there were no visible signs of cracking, although a slight surface deterioration was noted. The adjusting ring stack was then subjected to an AASHTO loading test.

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.

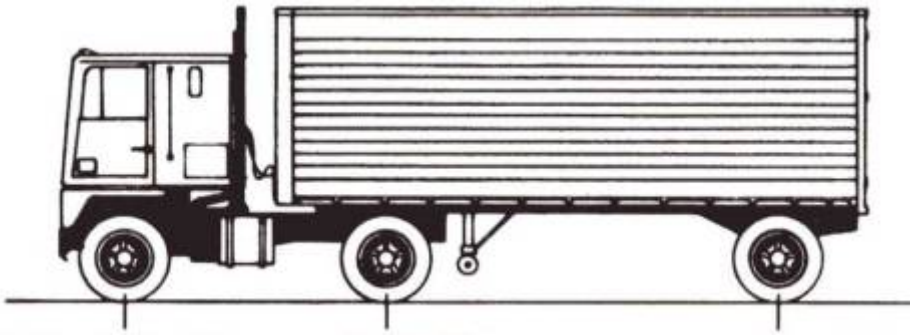
The AASHTO Standard Specifications for Highway Bridges, 17th Edition, Section 3, identifies two types of design vehicle loads. They represent categories of individual vehicles and are routinely referred to as the H or HS truck. The H truck configuration includes only two theoretical axles as in figure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



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

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

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.

Results

After 24 hours exposure to asphalt, a visual survey of the condition of the adjusting ring determined that there were no visible signs of cracking, although a slight surface deterioration was noted (figure 3 and 4).

Figure 3

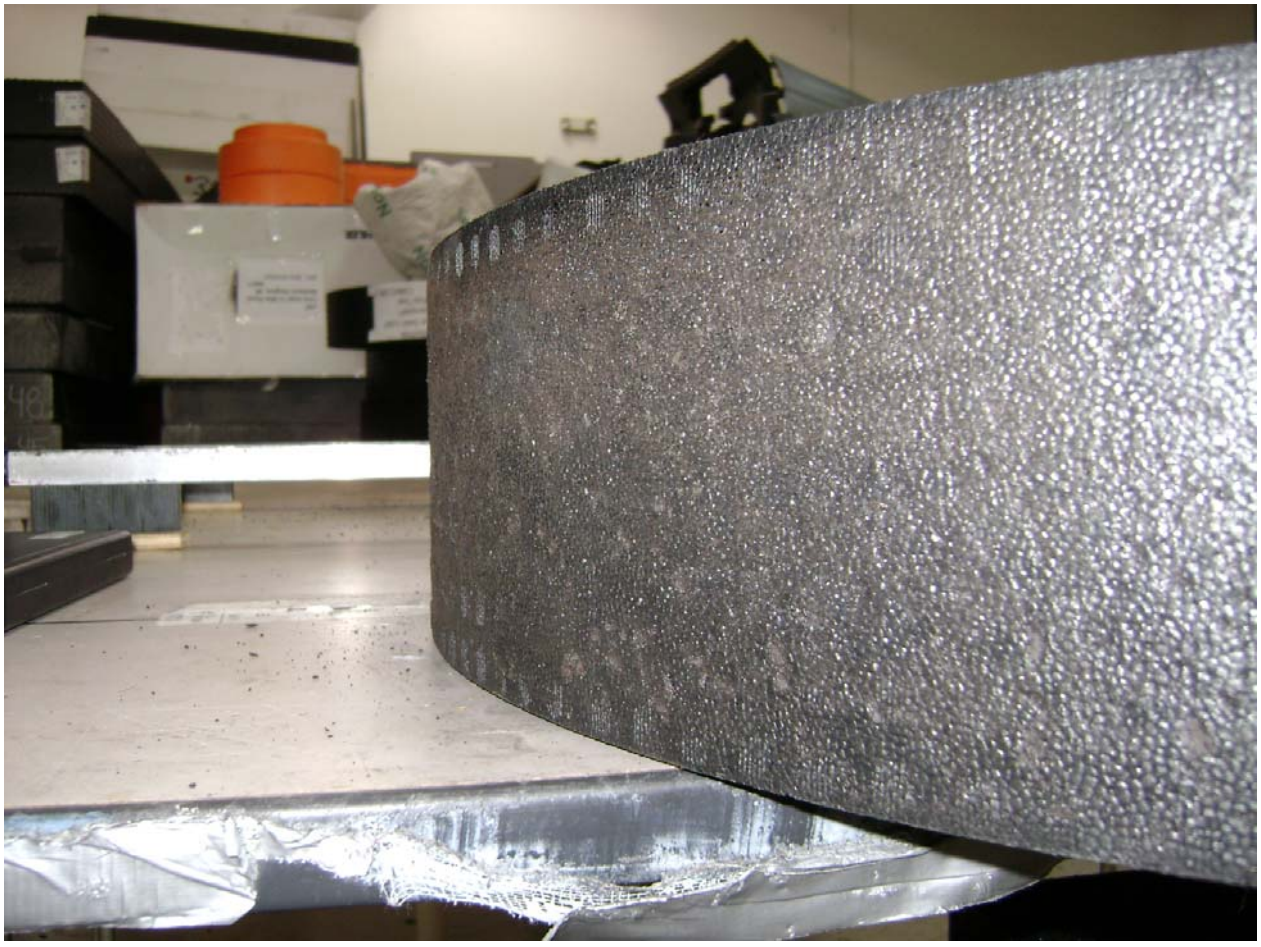


Figure 4

Vehicular load testing was tested for JSP by the MGA Research Corporation, report number C10H7-085.1 (Appendix A), in accordance with the proof-load testing standards outlined by AASHTO M306, Section 6.

The proof-load test was conducted on one (1) standard ARPRO® Expanded Polypropylene (EPP) manhole 36-24GF-600 grade-finish ring exposed to asphalt for 24 hours. 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. 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.

Table 1 – Proof-Load Test Results @ 50,000 Lbf – Exposed Ring

Measurement Location	Pre-Test Measurement (in.)	Post Test Measurement (in.)	Post Test + 1 Hr. Measurement (in.)	Permanent Set (in.)	Remarks
1	6.072	6.0485	6.067	0.005	No cracking
2	6.096	5.9485	5.97	0.126	No cracking
3	6.1165	5.927	5.944	0.173	No cracking

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

Measurement Location	Pre-Test Measurement (in.)	Post Test Measurement (in.)	Post Test + 1 Hr. Measurement (in.)	Permanent Set (in.)	Remarks
1	6.053	5.969	6.004	0.049	No cracking
2	6.031	5.966	6.027	0.004	No cracking
3	6.058	6.01	6.049	0.009	No cracking

Conclusions

In comparing the load/deflection performance of the ring exposed to asphalt with a similar unexposed ring, the permanent set of the exposed ring stack was similar to the unexposed stack. The stack exposed to the asphalt recording an average permanent set 0.08” greater than that of an unexposed stack. Note that these results are for only one test of each ring.

Based upon the above proof load test results, it is apparent that exposure of the adjusting rings to asphaltic concrete does not appear to adversely affect the compressive strength of the rings within the AASHTO wheel load limits. However some surface deterioration can be expected and can be considered negligible.

APPENDIX 1

mga research corporation

JSP
MAN-HOLE CONSTRUCTION
VERTICAL STATIC LOAD TEST SERIES
(PO# P42309)

446 executive drive • troy, mi 48083
248 / 577-5001 • fax 248 / 577-5025
www.mgaresearch.com

mga research corporation

TEST REPORT

MGA REPORT NO.:	C10H7-085.1 Rev. 1 (Revised 7/15/10)
TEST (S) PERFORMED ON:	July 2, 2010
TEST DESCRIPTION:	Vertical Static Load
ITEM DESCRIPTION:	Man-Hole Construction (PO# P42309)
MGA PROCEDURE:	MGATPDUR_HF Revision date: 1/22/2009
TEST REFERENCE NUMBER (S):	W10499-504
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:	July 12, 2010
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.

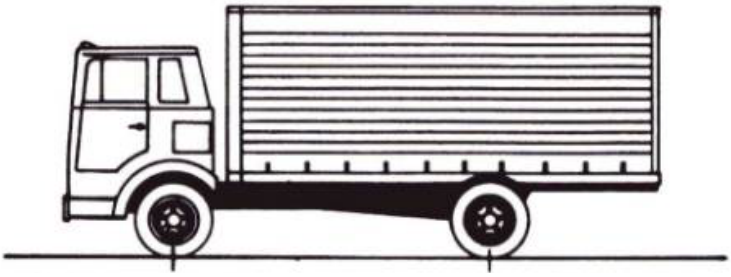


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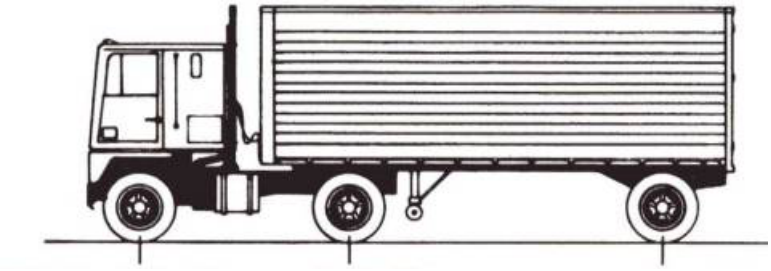
Figure 1 – Standard H Trucks

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

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 lb rear axel / 2 tire patches * 2.5 safety factor = 40,000 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 lb rear axel / 2 tire patches * 2.5 safety factor = 50,000 lbf proof load

Test Procedure

1. Sample #1 was exposed to asphault for 24 hours prior to testing.
2. Test Samples were loaded under compression
3. Sample #1 was loaded to 50,000 lbf @ 400 lbf/sec. load was held for 1 minute.
4. Sample #2 was loaded to 50,000 lbf @ 400 lbf/sec. load was held for 1 minute.
5. Pre, instant post and 1 hour post test deflection measurements were taken.
6. Pre and Post test photos were taken.

1-Containment box material	Ply Wood
2-Containment box dimensions	48"x48" and 11" Depth
3-Asphalt Grade	T1100 Material
4-Asphalt source	Bennet Paving 248-588-2250
5-Asphalt temperature	285 deg F
6-Method and equipment used for temperature readings	Thermocouple and P-dec data acquisition system
7-Method of asphalt compaction	Hand Tamping
8-Visual observations of the rings during asphalt placement	Normal
9-Visual observations of the rings 24 hrs after asphalt placement	Normal, no signs of wear or crack.

Test Results

W10499 Sample#1 @ 50K Lbf			
Location	**Pre-Test Measurements (in)**	**Post-Test Measurements (in)**	**1-Hour Post-Test Measurements (in)**
1	6.0725	6.0485	6.067
2	6.096	5.9485	5.97
3	6.1165	5.927	5.944

W10499 Sample#2 @ 50K Lbf			
Location	**Pre-Test Measurements (in)**	**Post-Test Measurements (in)**	**1-Hour Post-Test Measurements (in)**
1	6.053	5.969	6.004
2	6.031	5.966	6.027
3	6.058	6.01	6.049

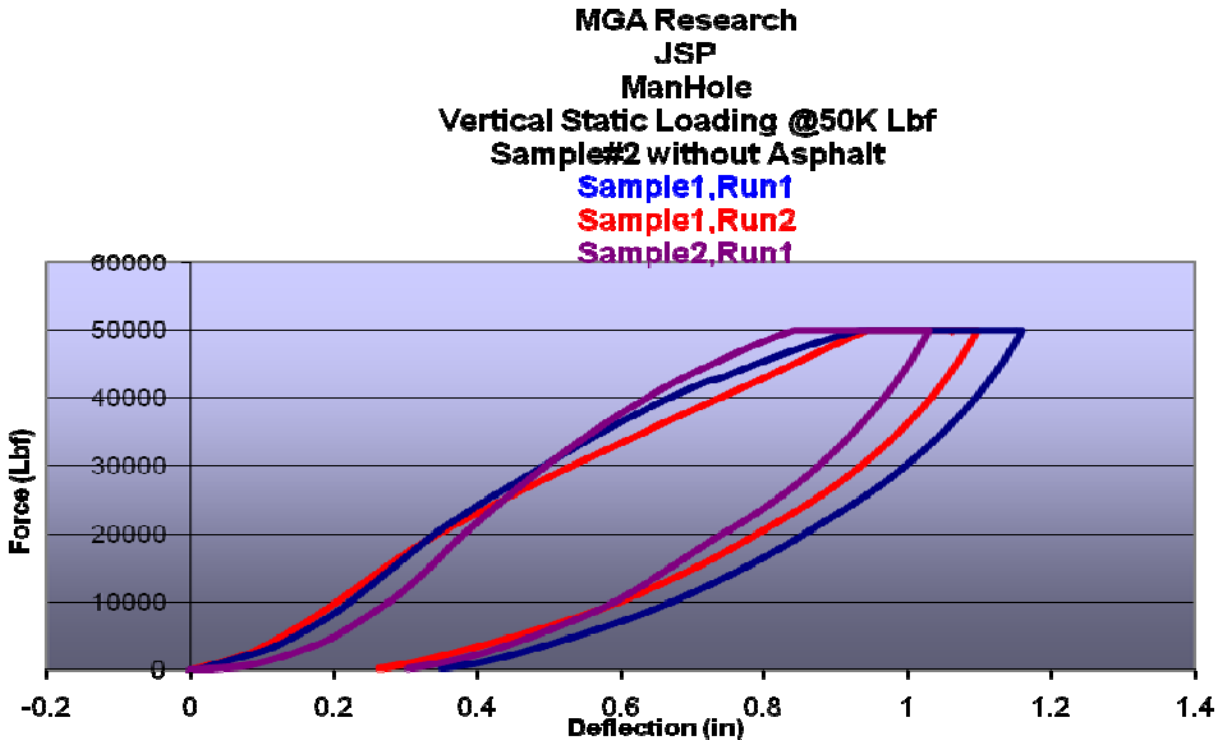
Additional Information can be found in the following appendices

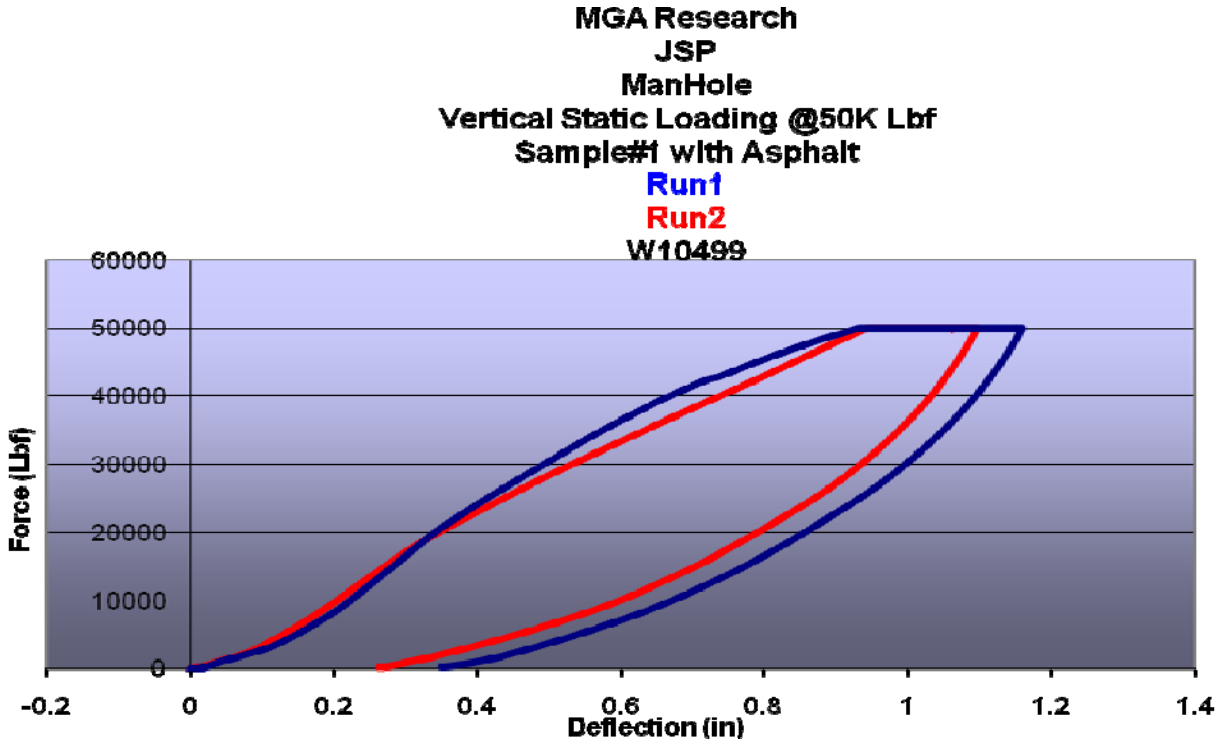
Appendix A
System Calibration Information

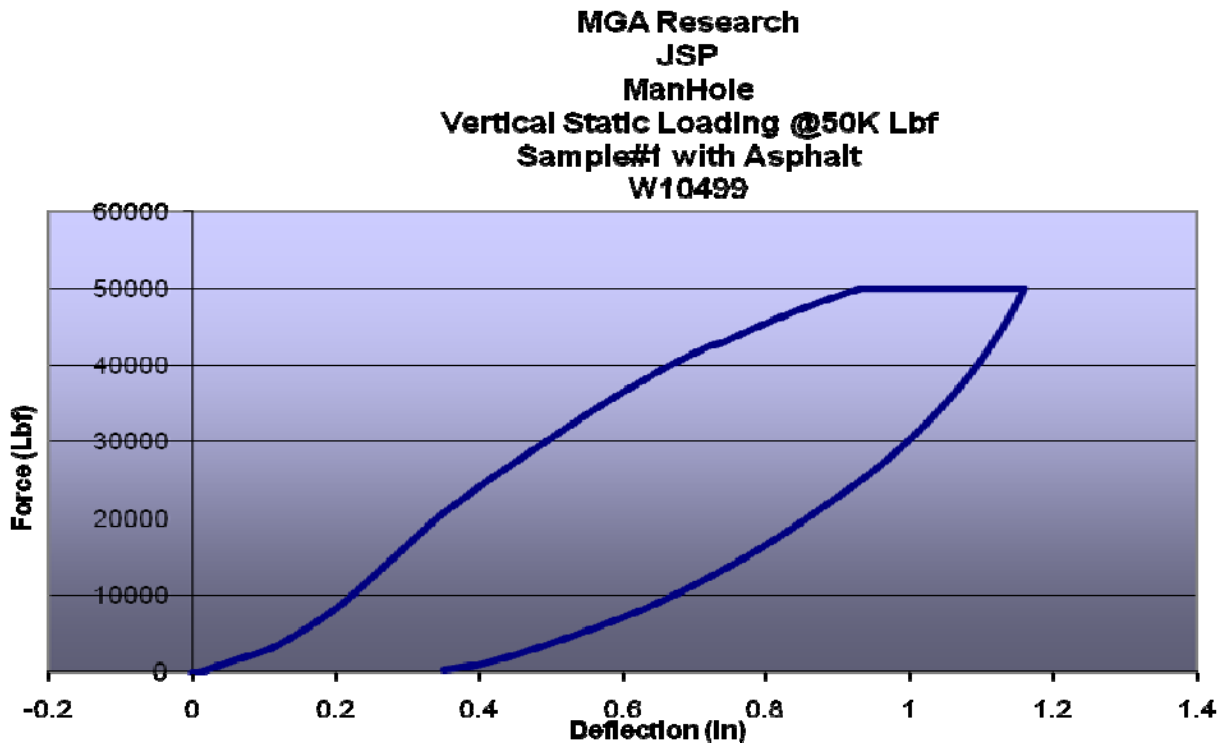
FATIGUE TESTS

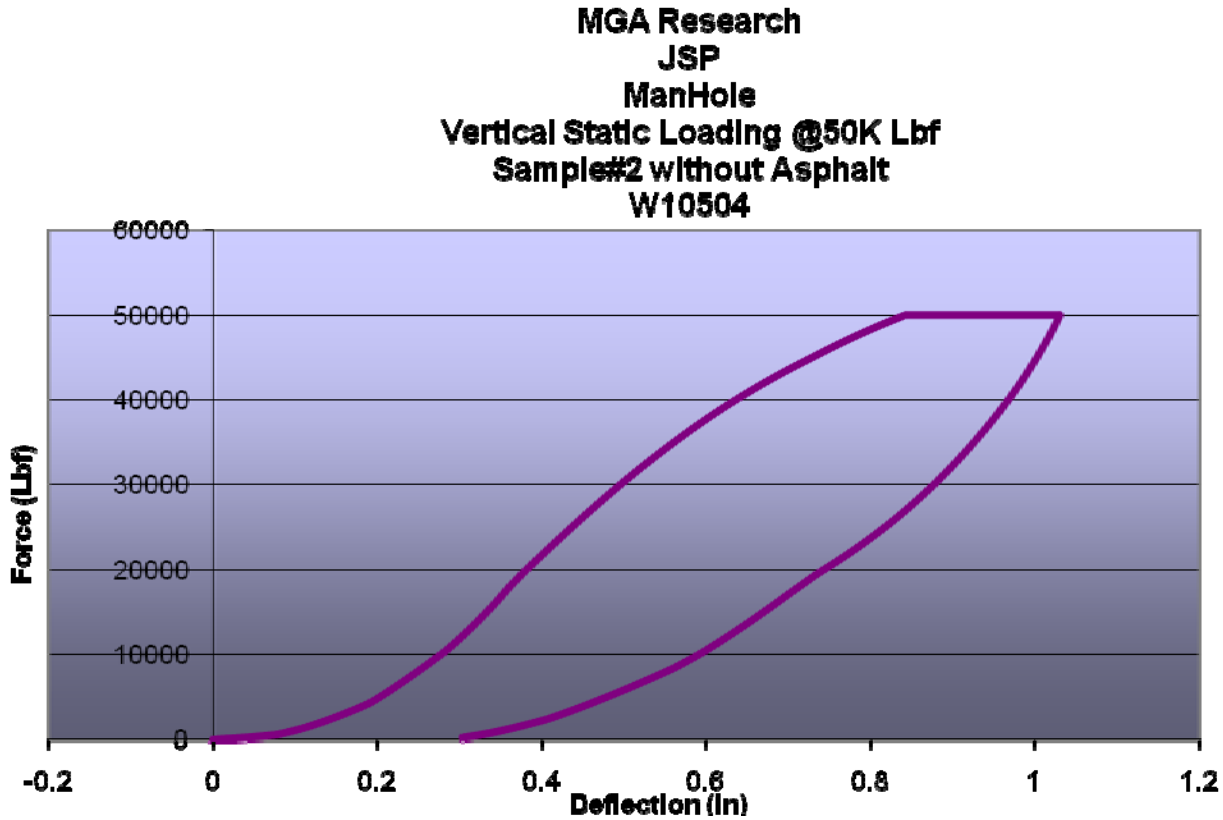
Sensor ID	Item Description	Purpose	Calibration Due Date	Accredited Laboratory Name / #
335994A	Load Cell	Measure load	12/7/2010	MGA / 0850.01
MGA00814	Caliper	Measure length	7/13/2010	MetroCal / 0513.01

Appendix B
Test Data Plots and Photographs


MGA Research
JSP
ManHole
Vertical Static Loading @50K Lbf
Sample#2 without Asphalt
Sample1,Run1
Sample1,Run2
Sample2,Run1
Force (Lbf)
60000
50000
40000
30000
20000
10000
0
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Deflection (in)


MGA Research
JSP
ManHole
Vertical Static Loading @50K Lbf
Sample#1 with Asphalt
Run1
Run2
W10499
Force (Lbf)
60000
50000
40000
30000
20000
10000
0
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Deflection (in)


MGA Research
JSP
ManHole
Vertical Static Loading @50K Lbf
Sample#1 with Asphalt
W10499
Force (Lbf)
60000
50000
40000
30000
20000
10000
0
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Deflection (in)


MGA Research
JSP
ManHole
Vertical Static Loading @50K Lbf
Sample#2 without Asphalt
W10504
Force (Lbf)
60000
50000
40000
30000
20000
10000
0
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
Deflection (in)

Test #W10499 Pre-Test Photos


Photo #1


Photo #2


Photo #3


Photo #4


Photo #5


Photo #6

Photo #7

Photo #8

Photo #9

Test #W10499 Post-Test Photos

Photo #1

Photo #2