AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
· ENVIRONMENTAL
· GEOTECHNICAL
· MATERIALS
· FORENSICS

REPORT OF STATIC LOAD TESTING

PROJECT:
HDPE ADJUSTING RINGS
STATIC LOAD TESTING

REPORTED TO:
LADTECH, INC.
6704 MEADOWLARK CT.
LINO LAKES, MN 55038

ATTN: DWIGHT WIEDRICH

AET PROJECT NO: 05-04911

DATE: OCTOBER 11, 2010

INTRODUCTION

This report presents the results of testing performed on high-density polyethylene (HDPE) adjusting rings used in conjunction with concrete manhole structures. This scope of our work was limited to the following:

- Perform static load testing of three (3) sets of adjusting ring stacks
- Measure deflection of the ring stacks under load and observe ring performance
- Prepare a report detailing the results of the testing

Our work was requested and authorized by Mr. Dwight Wiedrich of LADTECH, Inc. on September 8, 2010 and performed in general accordance with AET Proposal No. 05-04911, dated August 31, 2010

BACKGROUND INFORMATION

The adjusting rings are manufactured from 100% recycled plastic. Per LADTECH, the predominant source product for the raw plastic is curbside collected, post-consumer, blow-molded milk and detergent bottles. The bottles are initially manufactured from a high density polyethylene as identified by ASTM Standard D-1248. Following shredding and cleaning of the bottles, the rings are manufactured by injection molding techniques.

TEST PROCEDURES

The static load testing was performed in the American Engineering Testing (AET) laboratory. The loading apparatus consisted of a 100,000 pound capacity load frame and a 20 ton Ram-Pac hydraulic ram with a Simplex hand pump. Deflection measurements were obtained with dial extensometers accurate to 0.001".

A steel manhole frame and cast iron grate were provided by LADTECH to facilitate loading of the adjusting rings. During Test #1, the grate cracked at a load of approximately 20,000 lbs. AET fabricated a new loading plate in lieu of the cast iron grate which fit inside the steel frame assembly as the grate did (see attached drawing). The testing was then performed with the new loading plate.

A 4' diameter x 4 ¾" thick concrete slab, with a center hole of 24" x 36" was used as the base of the test assembly. The slab was centered in the load frame, the adjusting ring stacks were placed directly on the slab followed by the manhole frame and cover.

Three (3) adjusting ring stacks were tested as follows:

Test Number	Ring Configuration	Total Stack Height
1	Two (2) 1 ½" and one (1) 2 ¾"	5 ¾"
2	Two (2) 2" and Two (2) 2 ¾"	9 ½"
3	Three (3) 2" and Three (3) 2 ¾"	14 ¼"

For each ring stack, compressive load was steadily applied in 5,000 lb. increments. The load point was offset from the center line of the manhole cover for all three tests. At each increment, deflection readings were obtained after a five minute hold period. This procedure was followed up to 150% of the 16,000 lb. AASHTO HS-20 wheel load or, 24,000 lbs. The maximum test load was then held for ten minutes. Visual observation of the rings under load was made and photographs taken.

The load was slowly released, followed by a ten minute rest period, to allow the ring assembly to rebound. Final visual observations and deflection readings were obtained.

Representative photographs and a sketch of the test assembly are attached to this report.

RESULTS

The load tests were performed on September 13, 2010. Results of the testing are detailed below.

Test #1 – Two (2) 1 ½" and one (1) 2 ¾" Rings

Load (kips)	Deflection, Loaded Side	Deflection, Non-Loaded Side
0	0	0
5 5 minutes	-0.148	-0.102
10 5 minutes	-0.236	-0.165
15 5 minutes	-0.293	-0.198
20 5 minutes	-0.368	-0.232
24 10 minutes	-0.429	-0.253
0 10 minutes	-0.124	-0.077

The load/deflection data are also shown in the attached graph. Deformation (bulging and dimpling) was minimal during loading; no cracking occurred within the ring structures during the test.

Test #2 - Two (2) 2" and Two (2) 2 ¾" Rings

Load (kips)	Deflection, Loaded Side	Deflection, Non-Loaded Side
0	0	0
5 5 minutes	-0.203	-0.120
10 5 minutes	-0.309	-0.204
15 5 minutes	-0.362	-0.234
20 5 minutes	-0.429	-0.269
24 10 minutes	-0.477	-0.291
0 10 minutes	-0.159	-0.125

The load/deflection data are also shown in the attached graph. Deformation (bulging and dimpling) was minimal during loading; no cracking occurred within the ring structures during the test.

Test #3 - Three (3) 2" and Three (3) 2 ¾" Rings

Load (kips)	Deflection, Loaded Side	Deflection, Non-Loaded Side
0	0	0
5 5 minutes	-0.320	-0.211
10 5 minutes	-0.456	-0.315
15 5 minutes	-0.522	-0.360
20 5 minutes	-0.593	-0.404
24 10 minutes	-0.656	-0.438
0 10 minutes	-0.269	-0.184

The load/deflection data are also shown in the attached graph. Slight permanent deformation of the lower rings occurred on the inner vertical surface. During the ten minute hold at 24,000 lbs., a "pop" was heard, however no pressure loss occurred in the hydraulic ram. Post-testing observations did not find any cracks in the ring structure. The sound was likely from the interface of the concrete base and cast-in-place concrete floor.

DISCUSSION

From the graph, it is apparent the load/deflection relationship for the adjusting rings is relatively linear following an initial "seating" period. No failure and minimal plastic yielding occurred under test loads as evidenced by the lack of visible distress and the rebound following removal of the load. It is likely some additional rebound would have occurred beyond the ten (10) minute rebound period.