HDPE ADJUSTING RING
STATIC TESTING

INTRODUCTION

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

- Perform a static load testing of five (5) 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. Gale Jacobsen of LADTECH, Inc. on September 4, 1998, and performed in general accordance with AET Proposal No. 5-98-039, dated July 13, 1998.

BACKGROUND INFORMATION

The adjusting rings are manufactured from 100% recycled plastic. Per LADTECH, the predominant source product for the raw plastic curbside collected, post-consumer, blow-molded milk and detergent bottles. The bottles are initially manufactured from 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 60,000 pound load frame and 20 ton Ram-Pac hydraulic ram with a Simplex pump. The loads were measured with a 100,000 pound capacity Rice Lake RLCSP1 load cell and Virtual VC-505 controller. Deflection measurements were obtained with dial gauges accurate to 0.001".

A 4' x 4' x 4 3/4" concrete manhole slab with a 24" diameter hole was used as the base of the test assembly. The slab was centered in the load frame, set on a gypsum mortar bed and leveled. The adjusting ring stacks were placed directly on the slab followed by the manhole frame and cover.

Five (5) adjusting ring stacks were tested as follows:

Test Number	Ring Configuration	Total Stack Height
1	One(1) - 4" and 6"	one(1) - 2"
2	Two(2) - 4" and 10"	one(1) - 2"
3	Three(3) - 4" and 16"	two(2) - 2"
4	One(1) - 4" and NA	one - 2"-Slope
5	One(1) - 4" and NA	two(2) - 2"-Slope

For each ring stack, compressive load was steadily applied in 5,000 lb increments. The load point was offset from the centerline of the manhole cover for Tests #2 - #5 and centered on the manhole cover for Test #1. At each increment, deflection readings were obtained followed by a five (5) minute rest period. This procedure was followed up to the AASHTO HS-25 wheel load (21,300 LBS) where the assembly was allowed to rest for 10 minutes while deflection readings were obtained every two minutes. Visual documentation of the rings under load was made and photographs taken.

The load was slowly released, followed by a 10 minute rest period, to allow the ring assembly to rebound. Final visual documentation was made and deflection readings were obtained.

TEST RESULTS

The HDPE adjusting ring static load tests were performed on November 10 and 11, 1998. Results of the testing are detailed below:

Test#1 - One (1) - 4" and One (1) - 2" Rings

Load (lbs)*	Deflection (inches)
21,300	0.181
31,950	0.226

* 5,000 lb load increment not used on this test

Minor deformation in the form of localized bulging (outward) and dimpling (inward) was observed at 21,300 lbs. The deformation was moderate at 31,950 lbs. No cracking occurred within the 2" and 4" ring structure during the test.

Test #2 Two (2) - 4" and One (1) - 2" Rings

Load (lbs)	Deflection (inches)
5,000	0.144

10,000	0.178
15,000	0.230
21,300	0.295
25,000	0.338
31,950	0.383
0*	0.094

*Net deflection after unloading and 5 minute rebound period

Deformation (bulging and dimpling) was more pronounced than in Test #1 at both the 21,300 and 31,950 pound loads, though still in the moderate range. No cracking occurred within the 2" and 4" ring structures during the test.

Test #3 Three (3) - 4" and Two (2) - 2" Rings

Load (lbs)	Deflection (inches)
5,000	0.133
10,000	0.215
15,000	0.270
21,300	0.342
25,000	0.397
31,950	0.473
0*	0.138

*Net deflection after unloading and 5 minute rebound period

Deformation (bulging and dimpling) was more pronounced than in Test #2 at both the 21,300 and 31,950 pound loads, though still in the moderate range. No cracking occurred within the 2" and 4" ring structures during the test.

Test #4 One (1) - 4" and One (1) - Slope Rings

Load (lbs)	Deflection (inches)
5,000	0.066
10,000	0.094
15,000	0.125
21,300	0.154
25,000	0.182
31,950	0.209
0*	0.041

*Net deflection after unloading and 5 minute rebound period

Minor deformation (bulging and dimpling) was observed at 21,300 and 31,950 pound loads. No cracking occurred within the 2" and 4" ring structure during the test. The slope ring did not induce perceptible lateral movement in the ring stack.

Test #5 One (1) - 4" and Two (2) - Slope Rings

Load (lbs)	Deflection (inches)
5,000	0.073
10,000	0.107
15,000	0.135
21,300	0.168
25,000	0.192
31,950	0.223
0*	0.048

*Net deflection after unloading and 5 minute rebound period

Minor deformation (bulging and dimpling) was observed at the 31,950 pound load. No cracking occurred within the 2" and 4" ring structure during the test. The slope ring did not induce perceptible lateral movement in the ring stack.

DISCUSSION

It is apparent the load/deflection relationship for the adjusting ring 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 rebound following removal of the load. It is likely some additional rebound would have occurred beyond the five (5) minute period of the test. The test procedure did not consider the effects of subgrade confinement as will occur in actual field applications. The confining pressure of the soil, base aggregate, or pavement against the rings will reduce overall deformation of the ring stack, resulting in less actual deflection than obtained in the laboratory testing.

For more information about testing procedures and existing test results, contact LADTECH, Inc. at testing@ladtech.com