HDPE ADJUSTING RINGS
HIGH TEMPERATURE TEST

INTRODUCTION

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

- Subject a stack of HDPE rings to direct contact with hot-mix asphalt concrete.
- Document the temperature of the rings at selected locations and times.
- Document the condition of the ring stack following removal of the asphalt concrete.
- Perform a static load test on the ring stack.
- 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 high temperature test was performed at an asphalt concrete production plant. A concrete spigot measuring 72" outside diameter (o.d.) and 64" inside diameter (i.d.) at the bottom and 68" o.d. and 54" i.d. at the top was used for containment. A concrete pipe section measuring 33 1/4" o.d., 24" i.d. and 12" in length was set in the center of the spigot. Recycled Class 5 material (MnDOT 3138.2A1) was then placed and compacted between the confinement spigot and the pipe section up to the top of the pipe. The adjusting ring configuration consisted of one (1) 4" and one (1) 2" ring. Two thermocouples were placed on the outside of the 4" adjusting ring 180 degrees from each other. Two thermocouples were placed on the outside of the 2" ring 180 degrees from each other and 90 degrees from the thermocouples of the 4" ring. One (1) thermocouple was placed on the inside of the 4" ring. A 1/4" bead of butyl sealant was applied between

the top of the pipe section and 4" ring, between the 4" and 2" rings, and between the 2" ring and manhole casting. The thermocouple wires were brought together and protected from the hot asphaltic concrete with a pvc pipe. Monitoring of the temperature change was done using a Kane-May 1242, 5 channel recording thermometer. Asphaltic concrete conforming to MnDOT Specification 2340 was then placed between the confinement spigot and the adjusting ring assembly up to the top of the manhole casting. Compaction was achieved using a WP 1550 Wacker vibrating compactor. The thermometer was set to record at 5 minute intervals. After 24 hours, the test assembly was carefully dismantled and the adjusting rings removed. A visual survey of the condition of the adjusting rings was made. The adjusting ring stack was then subjected to a static compression test.

TEST RESULTS

The HDPE adjusting ring high temperature test utilizing asphaltic concrete was performed on September 25 and 26, 1998.

Visual Observations

The asphaltic concrete temperature was 287 degrees F on delivery which was within the normal placement range. The asphaltic concrete was placed and compacted in three (3) lifts.

The asphaltic concrete was allowed to cool overnight. Prior to dismantling theassembly, the manhole cover was removed for visual observation of the insidesurface of the rings. The inside surface did not exhibit any deformation orcracking.

The rings were separated from the asphaltic concrete test assembly. The outsidesurface of the 4" ring that was subjected to direct contact with the asphalticconcrete exhibited random vertical cracking at the web intersections. The 2" ring did not exhibit similar cracking. Of 24 web/flange intersections, eight (8) exhibited cracking that varied from 1/4" to 4" in length and up to 1/8" in width. Though most were less than 1/16" in width. Minor deformation of the outside flange of both rings was noticed. The butyl sealant between the rings showed signs of distress due to the elevated temperature.

Temperature Readings

The temperature was monitored via the five (5) thermocouples for 22 hours. The recorded temperatures ranged from a maximum of 265 degrees to a minimum of 88 degrees F.

Static Load Test

The ring stack (one (1)-4" and one (1)-2" ring) was tested in the laboratory to 150% of AASHTO HS-25 wheel loads (1.5 x 21,300 lbs = 31,950 lbs). The deflation of the ring stack under load was as follows:

Load (lbs)	**Deflection (inches)**
5,000	0.049
10,000	0.076
15,000	0.112
21,300	0.145
25,000	0.163
31,950	0.173

No additional cracking or propagation of existing cracks from the asphaltic concrete test was observed. Minor deformation in the form of localized dimpling and bulging was observed at load above 21,300 lbs. Of note, some of the cracks caused by the asphaltic concrete test narrowed during the load test.

The 21,300 lb test load (AASHTO HS-25) was held for 10 minutes and the deflection of the ring stack monitored. Additional deflection of 0.003" (2%) occurred during the 10 minute hold period.

The load was removed and the ring stack was allowed to rebound for a period of five (5) minutes. The deflection in the ring stack after the rebound period was 0.058".

DISCUSSION

In comparing the load/deflection performance of the ring stack exposed to asphaltic concrete with a similar unexposed ring stack, the deflection of the exposed ring stack was actually less than the unexposed stack (0.173" v 0.226"). Note that these results are for only one test of each stack.

Overall, 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. Consideration should be given to using a heat resistant caulk for adjusting rings that will be subjected to elevated temperatures.

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