HDPE ADJUSTING RING
CYCLICAL 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:

- Subject a stack of HDPE rings to 1,000,000 cycles of a simulated AASHTO HS-25 wheel load.
- Document the condition of the ring stack following completion on the test.
- 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 cyclic load testing was preformed at the University of Minnesota Civil Engineering Structures Lab. The test apparatus consisted of an MTS Model 311 Material Test Frame with 600-kip servo controlled hydraulic actuator. An MTS Model 458 controller was used to control the actuator and generate the signal to continually load and unload the adjusting ring assembly. The load applied to the ring assembly was cycled with the load path following a 1 Hz sine wave.

The strain gages used for the test were Model FLA-3-23-3LT (3mm gage length) from Tokyo Sokki Kenkyujo Co., Ltd and affixed with a cyanoacrylate adhesive. An additional strain gage was affixed to an unloaded adjusting ring for temperature correction. An OPTIM data acquisition system was used to collect the data. Data was collected at a rate of 50Hz. Readings were taken once or more each day, except on weekends.

The adjusting ring stack used for the test consisted of two (2) ‹ 4" and one (1) ‹ 2" rings with the 2" ring being the uppermost. A 54" diameter x 5" thick concrete manhole slab with a 24 1/4" diameter hole was used as the base of the test assembly. The slab was placed on the strong floor of the lab with the hole centered over the load frame, and was set on a mortar bed. The adjusting ring stack was placed on the slab followed by the manhole frame. A 1/4" bead of butyl caulk was placed between the slab and first ring, between each subsequent ring, and before placement of the manhole frame. The ten strain gages were mounted in various locations on the middle adjusting ring. The manhole cover, which was bolted to the hydraulic actuator, was then lowered in-place. Once loading began, the adjusting ring assembly was subjected to a 21.3 kip (21,300 pounds) load range to simulate an AASHTO HS-25 wheel load and the impact from a 3/4" grade difference. A daily log was kept and information recorded included date, time, cycle count, maximum and minimum actuator load and stroke values, and any pertinent information.

TEST RESULTS

The cyclic test was run continuously from July 31, 1998 to August 12, 1998, except for brief shutdowns on August 5 and 11. Test data on the behavior of the 10 strain gages was also collected continuously between these dates.

The adjusting rings did not show any visible cracking or significant permanent deformation after being subjected to 1,005,334 cycles of a 21.3 kip (average) load. The strain gage data indicated the rings deformed elastically.

DISCUSSION

The cyclic testing was performed to document the ability of the adjusting rings to resist repeated dynamic loading without failing (e.g., cracking, buckling, etc.). The results show the rings performed satisfactorily in this regard.

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 and resist lateral loads exerted by vehicles moving across the manhole cover. To this end, the load conditions in the laboratory cyclic test were more severe than what would be encountered in actual field installations.

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