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BUILDING COMMUNITY



TESTING COMPLETED FOR CORRUGATED HDPE PIPE IN SHALLOW COVER RAILROAD APPLICATIONS

*157-Ton Rail Cars Used in
Study of 48-Inch Diameter Corrugated Pipe;
Report Now Available*

A study funded by the Plastics Pipe Institute, Inc. (PPI) that evaluated the successful use of corrugated, high-density polyethylene (HDPE) pipe for use under heavy rail car loads with shallow cover, is now available on-line at:
www.plasticpipe.org/drainage/cppa_technical.html

The test was conducted by the Transportation Technology Center, Inc. at the Facility for Accelerated Service Testing (FAST) in Pueblo, Colorado where it operates a test bed for railroad track. The methodology of the project included repeatedly running a train consisting of four locomotives with eighty, 315,000 pound rail cars over 48-inch corrugated HDPE pipe with just four-feet of cover from the top of the pipe to the bottom of the rail. In addition to the dynamic performance evaluation, the long-term impact of heavy, static loads on the pipe was assessed by parking the cars, with one set of wheels on the track directly over the same pipe for six weeks. The corrugated HDPE pipe used in the test was manufactured by Advanced Drainage Systems, Inc. (Hilliard, Ohio), a PPI-member company.

"The instrumented pipes performed perfectly after 96 million gross tons of heavy axle loading, with measured strains and deflections well below the material limits." stated Michael

Plumier, director of engineering for the PPI's Corrugated Plastic Pipe Division. "The maximum measured combined deflection from construction and dynamic loading was less than 1.5 percent and the maximum deflection due to dynamic loads alone was 0.14 percent. The maximum measured tensile strains were negligible, and the maximum measured compressive strains were less than one percent. Operators noted that track ride quality was acceptable, and no track geometry maintenance was required at the conclusion of the test."



The FAST program has been providing the railroad industry with valuable information since 1976, with the operation of 315,000-pound cars beginning in 1988. The Federal Railroad Administration and the Association of American Railroads jointly fund the FAST program with contributions from individual railroads and the supply industry. The study's results were published in 2010.



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Test Preparation Pipe Instrumentation

Short (58-inch) sections of the pipes were instrumented inside in a controlled temperature environment prior to in-track installation. The 58-inch length was selected so the joints would be nearly directly under the rails when the pipe was installed.

Pipe Installation

The pipes were installed in two adjacent locations in a fill on the High Tonnage Loop (HTL) at FAST.



The HTL is the 2.7-mile test loop where HAL tests are conducted at FAST. It is comprised of various curved, spiral, and tangent test sections. The height of the fill facilitated excavation and allowed access to both ends of the pipes after installation. There is no water flow at the fill location, and the pipes remained dry for the duration of the test. The pipes were installed 50 feet apart, center-to-center. The variable between the two sites was the composition and preparation of the backfill material. The excavations were sloped to comply with OSHA regulations.



ADS constructed its standard watertight (WT) inline bell spigot joint, and its standard fabric wrapped split coupler connection for each pipe. The connections in each pipe were placed just outside the centerline of the rails. Pipe installation followed standards outlined in ASTM D2321 and in the study.

Results of Leaving Loaded Cars Parked over the Pipes for 6 Weeks

One of the unknowns at the start of the test was the response of the pipes to long-term static loads. Two loaded cars at FAST were parked over the pipes for six weeks. One set of wheels from each car was directly over one of the pipes. There were slight depressions in the rails under the wheels at the end of the 6-week period. The rails rebounded when the cars were moved, and no track geometry maintenance was needed.

SUMMARY

Transportation Technology Center, Inc. conducted a test of corrugated high-density polyethylene pipe for PPI in the HTL at FAST. The pipes were supplied by ADS. Two pipes were installed 50 feet apart under tangent track in a fill on the HTL. There was a 4-foot cover,

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including the typical granular layer at FAST, between the pipes and the bottoms of the ties. The backfill for one pipe was fractured rock; it was native soil for the other pipe. The pipes were instrumented to allow data collection before and during train operations. Gages were installed at various locations on the pipes to measure lateral, vertical, diagonal, and circumferential deflections; and pipe wall strains.

The train that was operated over the pipes typically consists of three to four locomotives and approximately 80 315,000-pound GRL cars.

Test results include:

- The pipes performed acceptably through 96 MGT.
- No track geometry maintenance was required at the test site due to pipe deflection or fill settlement.
- Locomotive engineers who operated the FAST train during the test period reported that ride quality over the pipes was satisfactory.
- A locomotive-mounted, accelerometer-based, ride quality measurement system recorded no exceptions over the pipes during the test period.
- One loaded car was parked over each of the pipes continuously for six weeks during a scheduled pause in train operations. The minor track settlement that occurred did not require track geometry maintenance.
- The maximum strain (compressive) from construction loads was 7,300 microstrain.

- The maximum horizontal deflection from construction loads was 0.7-inch horizontal shortening.
- The maximum vertical shortening from construction loads was less than 0.1 inch.
- The maximum circumferential shortening from construction loads was 0.4 inch.
- The maximum strain (compressive) from the combination of construction loads and dynamic train loading after 96 MGT was 8,800 microstrain.
- The maximum measured deflection in any direction caused by dynamic loads was less than 0.065 inch.

For additional information about corrugated HDPE pipe, go to:
www.plasticpipe.org/drainage.

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About the PPI

The Plastics Pipe Institute Inc. (PPI) is the major trade association representing all segments of the plastic pipe industry and is dedicated to promoting plastics as the material of choice for pipe applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in development and design of plastic pipe systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.