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BUILDING COMMUNITY

Pipe bursting didn't burst their budget

Trenchless water main replacement — a first in the capital of Michigan

By Bruce Kuffer, P.E.

The City of Lansing, Michigan and its local utility refused to stand by and become part of an overwhelming statistic.

According to the American Society of Civil Engineers (ASCE) Report Card 2005, America faces a shortfall of $11 billion annually to replace aging facilities and comply with safe drinking water regulations.

Federal funding for drinking water in 2005 remained level at $850 million, less than 10 percent of the total national requirement. According to ASCE's report card, Michigan's drinking water infrastructure needs $6.79 billion over the next 20 years.

In the fall of 2006, William Erskine, a mechanical engineer with the Lansing Board of Water and Light, facing a recurring problem, managed a water main replacement project along the city's heavily traveled Martin Luther King Blvd. The mainline serviced a growing area of the city, which now houses nearly a half-million residents.

The existing 12-inch ductile iron water main was prone to breaks at the bottom of a hilly section of MLK Blvd. Residential basements in the immediate area had flooded several times during main breaks, and the prospect of digging and replacing the pipe – with resulting disruptions to traffic – was daunting.

Facing mounting budget pressures, Erskine supported a new idea: to use high-density polyethylene (HDPE) pipe and trenchless installation, thus eliminating the ductile iron breaking problems,

One section of the 1,600 total linear feet of 14-inch high-density polyethylene (HDPE) pipe is lowered into the ground. It was the first time in Lansing's history that both HDPE pipe and pipe bursting were utilized.

minimizing gridlock and saving the city hundreds of thousands of dollars in restoration costs.

Erskine turned to Troy Freed of Midwest Trenchless Services (Grant, Mich.), a local utility

From the PPI Director

Pipe made from high density polyethylene – HDPE – is saving communities, now more than ever before as their aging underground infrastructure continues to deteriorate. This highly versatile pipe is found in storm water drains, natural gas lines, potable water systems, sanitary sewers and underground conduit systems.

What do you do when you have a water service line that is cracking? Perhaps, like so many municipal systems that had iron pipe put in 50 to 100 years ago, now its time is up. How do you replace miles and miles of underground systems? Call in the bulldozers and backhoes? Cut up the streets? Tear up traffic patterns and add more hostility to the daily commute for citizens?

Not any more.

Do what Lansing, Michigan did. Leverage the unique features of HDPE pipe allowing it to be inserted into existing pipes and threaded through existing systems. It can also be smoothly slipped under roads, even major highways. That saves taxpayers money.

Traffic keeps moving. Lawns are intact. Streets don't have to be repaved. And best of all, it's such a non-intrusive process that usually no one knows it's being done. That makes your citizens happy.

Because HDPE pipe comes in long coil lengths or sections, there are fewer joints. And what's more, those joints are heat fused together providing a leak-free system – for both infiltration and exfiltration. That's good for the environment.

And since HDPE pipe doesn't corrode, there's no more rust to taint the drinking water. That's good for people.

Just like other cities have done over the years, Lansing, Michigan proved it again: HDPE pipe delivers an optimal solution – it has all the benefits that can help to make heroes of everyone involved in providing safe, dependable water to your community.

For more than 55 years, the Plastics Pipe Institute has been providing impartial assistance to professionals involved in saving underground infrastructure in various cities and towns. Please call us so we can share our vast library of knowledge and resources to help you select dependable solutions that will deliver for you, for your children and for your children's children – we'll even look around for a cape you can borrow so your super-hero status is apparent to all.

Tony Radoszewski

Executive Director

contractor with over 25 years experience in the application of trenchless technology. The technique of pipe bursting was implemented to install nearly 1,600 linear feet of 14-inch high-density polyethylene (HDPE) pipe. It was the first time in Lansing's history that both HDPE pipe and pipe bursting were utilized.

"This is an area with corrosive, hot soils, and we needed a pipe that could handle this environment and still provide a comparable service life. HDPE pipe with its resistance to corrosive soils offers the best option."

Troy Freed
Midwest Trenchless Services

Pipe bursting, which can be either pneumatic, hydraulic expansion or static pull, fractures a pipe and displaces the fragments outwards while a new pipe, of equal or greater diameter, is drawn in to replace the old pipe.

"This is an area with corrosive, hot soils, and we needed a pipe that could handle this environment and still provide a comparable service life," Freed said. "HDPE pipe with its resistance to corrosive soils offers the best option," he added.

"We also were very sensitive to the traffic conditions in this densely populated part of the city. With an open cut pipe installation, the city was concerned about the significant disruption and anxiety it would cause. The pipe bursting method gave us a more efficient installation with less surrounding disruption."

The affected section of MLK Blvd. had been widened to accommodate the growing community. What Freed and his contractors found beneath the surface was a damaged 12-inch water main, and a 6-inch parallel line on the other side of the road that had smaller service lines connected to it. That meant that replacing the 12-inch line could be done without any water service interruptions. The road is bordered on each side by single-family housing and a schoolyard, so continued service was very important.

"It's about city's being willing to take that first leap," said Freed, who works almost exclusively with HDPE pipe. "It was new to this community, but most people who see it done say they'll do it this way again."

Erskine estimated that the project was completed in about 60 percent of the time it would have taken with traditional excavating. Moreover, the resulting re-paving was completed with just two inches of asphalt instead of 10 inches of concrete and four inches of asphalt, due to almost no ground disruption.

The final price tag on this project was about one-third that of open cut excavating using another pipe material, according to Erskine. "When you're talking about a project like this, the dollars saved quickly reach the tens of thousands."

City engineers estimated that using HDPE pipe meant the project was completed in about 60 percent of the time it would have taken with traditional excavating. Moreover, the resulting re-paving was completed with just two inches of asphalt instead of 10 inches of concrete and four inches of asphalt, due to almost no ground disruption.

Lansing Job Overview

Project:
Replacement of a 12-inch ductile iron water main with approximately 1,600 linear feet of 14-inch high-density polyethylene (HDPE) pipe using pipe bursting techniques. It was along a primary urban road (Martin Luther King Blvd.) in a large city, so minimal disruption was important.

Contractor:
Midwest Trenchless Services, Grant, Mich.

Customer:
The City of Lansing, Mich.

Equipment:
HB-125 HAMMERHEAD static pipe bursting machine (125 tons of power)

Result:
Damaged water main replaced. Residential flooding due to heavy rain in this area has stopped.

Planning the technique

Pipe bursting was developed in Europe in the early 1980s to replace the aging gas and water infrastructure. A piercing tool or bursting head is guided through a deteriorating service line. As the tool travels through the line it breaks apart the existing or host pipe and displaces the fragments into the surrounding soil. Typically HDPE pipe is then attached to the head and is pulled directly behind it making for a smooth and concise installation.

When upsizing pipe diameters, pipe bursting may create outward ground displacements adjacent to the pipe alignment. Although the ground displacements tend to be localized and dissipate rapidly away from the bursting operation, it is a potential outcome for which plans should be made.

"The biggest challenge was some heaving in the road surface as a result of increasing the pipe size," Erskine said. "That did happen in a few spots. But we were planning for that, and knew we'd just have to mill that area. You just need to plan for these potential scenarios."

"It was something to see. I was impressed with how easy they opened up the hole and how easily the pipe was pulled through. We haven't had any trouble or calls since the job has been complete."

William Erskine
Lansing Board of Water and Light

As Erskine pointed out in Lansing, proper planning and design of a pipe-bursting project is essential for the project's success, as in any infrastructure project. "You have to know the soil conditions, condition of the existing pipeline and if there is a close proximity to other service lines. A thorough knowledge of what's already there is a must," he stipulated.

Specifications and Qualifications

Specifications for the installation of a pipe utility using pipe bursting must be written to address specific concerns of the project such as ground

heave or settlement. Key items often specified by the owner are type of replacement pipe, surface heave/subsidence limits, and bypass pumping requirements.

The contractor typically must submit qualifications, verification of nearby utilities, installation calculations (such as thrust block bearing capacity for static bursting and wall thickness calculations for polyethylene pipe), pulling force calculations, service line locations and the reconnection method.

"It was something to see," Erskine said. "I was impressed with how easy they opened up the hole and how easily the pipe was pulled through. We haven't had any trouble or calls since the job has been complete.

"It's refreshing to find not only economical alternatives, but also ones that make life easier for our citizens when aging pipelines have to be replaced," he added. "Let's face it, nobody wants to have their streets torn up for days and even weeks, much less have to pay for that level of frustration. I'm sure we'll be considering this method in the future."

Resources

The Plastics Pipe Institute (PPI) has developed a comprehensive handbook to assist designers, contractors and owners in designing and installing HDPE piping applications. The handbook is available online at http://plasticpipe.org/general/ppi_handbook.php.

Another key resource is Pipe Bursting Projects (ASCE Manuals and Reports on Engineering Practice No. 112), which provides best practices for the design and construction of pipelines using pipe-bursting methods, with a special focus on building pipelines under roads, railroads, and streets. The manual covers both introductory and advanced topics, including history, recent innovations, documentation, typical applications, and terminology from the planning through construction phases.

About the Author

Bruce Kuffer, P.E. is a staff member of the Plastics Pipe Institute (PPI), the major trade association representing all segments of the plastics piping industry. Member companies share a common interest in broadening market opportunities that make effective use of plastics piping for water and gas distribution, sewer and wastewater, oil and gas production, industrial and mining uses, power and communications duct and irrigation. More information is available online at www.plasticpipe.org.

HDPE Pipe for Pipe Bursting/Directional Drilling – a primer to savings and satisfaction

Critical to the implementation of a pipe bursting/directional drilling application is the use of plastic pipe. Because it is both flexible and strong it can be pushed into the soil as deeply underground as needed. Without pipe made from industrial-grade high density polyethylene (HDPE) plastic, this convenient method of quickly and economically installing a new or re-placing a water system would not exist.

The simple upside to pipe bursting/directional drilling is cost savings in time and materials for the water system itself and also for the remediation of roads, sidewalks and other surface areas.

First used in the 1960's, pipe made from HDPE is also –

- Leak Proof – joining a continuous run of HDPE pipe is done with heat fusion so the joints are sealed and will not leak. Service tees are imbedded to the pipe wall using electrofusion. This eliminates infiltration and exfiltration problems experienced with metal pipes.
- A Higher Standard – water systems using pipe such as PVC or ductile iron bell and spigot connections are planned using industry acceptable standards of allowing water loss. HDPE pipe systems have Zero Allowable Leakage, and do not require this additional compensation.
- Economically Sound – with the inherent ability to be bent to a radius of 25 times the nominal pipe diameter, HDPE pipe can be provided from the supplier on large spools, with some holding as much as 1,000 feet. This long run of continuous pipe eliminates joints and reduces labor costs.
- HDPE pipe will not corrode, tuberculate or support biological growth.
- A smooth inner diameter maintains a system's flow capacity over a long life span.
- Has superb chemical resistance.
- Easy to handle because polyethylene is about one-eighth the density of steel, and does not require the use of heavy lifting equipment for installation.
- Polyethylene is structurally better suited to withstand impact than PVC, especially in cold weather installations and where other pipes would be more prone to cracks and breaks.
- Meets or exceeds industry standards including AWWA C901 and C906; ASTM; NSF and CSA specifications.