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Pre-chlorinated Pipe Bursting Project: Largest Ever in North America

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Replacing water mains in urban areas presents challenges to all stake holders. Easement issues, street closures, traffic congestion, disturbing surface works and customer inconvenience are all areas of concern that communities must address. City administrators, engineers and residents are starting to demand more efficient and less disruptive methods of replacement to ease these concerns. As water pipelines are coming to an end of their useful life, replacement methods such as pre-chlorinated pipe bursting are being selected to add value to all stake holders involved.

The method of pre-chlorinated pipe bursting has a history that extends many decades as the process was first adapted by water companies in the U.K. The method utilizes HDPE pipe and entails the pre-assembly and testing of approximately 300 to 600 foot lengths of pipe above grade at a nearby staging location. This work is completed in advance of pipe bursting operations. Once the pipe string is proven to be sound by the testing and disinfection procedures, bursting operations can begin. In the area of water main being replaced, a series of small excavations are made and the new pipe is pulled into place by pipe bursting the existing main. A post-chlorination and flushing of the main is then performed and the new line is connected into the distribution system. Ultimately, all services are connected into the new main and the surface area is backfilled to preconstruction grade. The entire process is completed within a single day, 7 to 10 hours, thereby minimizing the disruption to area residents.



The pre-chlorinated pipe bursting process was first introduced to North America by Andy Mayer, President of Murphy Pipelines Contractors, Inc. Jacksonville, FL in 1999. The following year, the FL DEP in conjunction with AWWA approved the method in which is now a standard replacement process utilized across North America. The versatility and capability of the static pipe bursting method continues to accelerate thanks in large part to contractors like Murphy Pipelines that continue to push the method to achieve better, more effective results. The project in Livonia, MI would prove to be the largest pre-chlorinated pipe bursting project in North America so far.

The city of Livonia receives water and wastewater services from the Detroit Water and Sewerage Department (DWSD). According to its Web site, the DWSD is the third largest water and sewer utility in the United States. With its beginnings dating back to the early 1800s, the department's original water system included wooden logs, brick and stone. Today, the utility has a 1,079-square-mile water service area and provides water services for approximately one million people in Detroit and three million people in the surrounding areas of southeastern Michigan.

With a population just over 100,000, Livonia is the eighth largest city in Michigan. Its average daily water demand is approximately 16 million gallons for its 38,000 residential, commercial and industrial users. As typical with many communities in the Detroit area, Livonia's infrastructure was constructed in 1940s, 50s and 60s and is beginning to deteriorate. A majority of the system was composed of cast iron and ductile iron pipe. The city of Livonia needed to replace approximately 24,000 feet of its undersized and

deteriorated 6- and 8-inch cast iron and ductile iron water mains and the installation of about 3,000 feet of new main to loop dead ends. The aged and undersized system had a history of breaks, along 14 different streets.

Pre-Planning

Well before construction began, Murphy Pipelines worked closely with all stake holders involved. Educational meetings were first held to ensure all parties fully understood the method, materials and planning steps to ensure the project would be successful. During this process, the pre-chlorination method, static pipe bursting, material selection and feasibility analysis were all discussed. Dan Mitchell with Hubbell, Roth and Clark, Detroit, MI was the lead engineer on the project. A pipe bursting schematics plan was then developed to detail the sequencing of work. The bursting program included the lengths of each burst, pipe sizes, pit locations, valve and hydrant locations and a detailed report of which customers would be affected on each burst. Just before construction began, a public seminar was held to educate the community further on the process, answer questions and address any concerns. Each resident then received letters in the mail informing them when anticipated construction would begin on their street. 24 to 48 hours prior to work commencing, a representative was sent to each dwelling to alert of construction work beginning in the coming days.

Staging Area

When a community uses static pipe bursting to replace water main, two options are available. The first is to set up above ground temporary services to all affected customers. While the temporary services can be manageable, they have proven to increase cost and reduce efficiency. They will also limit construction during cold/hot months and many times viewed as cumbersome by the residents.



The second option is pre-chlorination. During the method pressure and disinfection testing are completed above ground, eliminating the installation of a temporary water distribution system.

When crews arrived in Livonia, a staging area was selected located centrally of the 16 project sites. To further minimize the impact of construction to the residents, the staging area was located away from actual burst locations. 40 foot sections of HDPE pipe were then delivered and butt fused according to the burst program that was developed. After the HDPE was fused according to the burst distances of 300 to 600 feet, each pipe string was pressure tested and chlorinated. During the method, all AWWA guidelines are followed. After each pipe string received 2 passing bacteriological tests, the mains were capped and sealed, in which bursting operations could then begin.

Pipe bursting Operations

For the Livonia project, 16 priority areas were identified and grouped into five separate project areas. 12 of the project areas were located in residential neighborhoods with lot lines between 40 to 90 feet apart. The areas had mature landscaping and historic oak trees. The 4 remaining project areas were in main thorough ways of the city with heavy traffic flow and business customers.

The goal for each burst was to only be in front of a customer's home for one day. To accomplish this, the bursting program included replacing a standard city block each day of 300 to 600 feet. By 7 a.m., launch and exit pits were excavated and measured approximately 5 feet wide by 12 feet long. Crews positioned pits as close as possible to proposed valves or hydrants, to limit the amount of total excavation. Typical pit depths ranged between 5 and 6 feet. Temporary shoring and bracing was also used throughout the project and open areas were fully surrounded with construction fencing.

By 8 a.m., the main was decommissioned as bursting equipment was set in place. To complete the project, Murphy Pipelines utilized a Grundoburst 800G static pipe bursting system from trenchless equipment manufacturer TT Technologies, Aurora, IL. Next, rods were shuttled through the existing main until they reached the launch pit. The tooling, expander and new HDPE were then attached and the pull back process began. During the static bursting process a blade set or bladed rollers are pulled through the existing line by a hydraulically powered bursting unit. As the blade set or bladed rollers are pulled



through, the host pipe is split. An expander attached to the tooling forces the fragmented pipe into the surrounding soil while simultaneously pulling in the new pipe.

On average, the new HDPE was installed by Noon each day. This allowed the crews to then make service and cross connections in the early afternoon. To make connections, all standard Ductile Iron fittings and mega lugs were used.

“Communities are beginning to understand that when working with HDPE, they can use standard Ductile Iron fittings with mega lugs to make connections to tees, crosses, valves and hydrants. The transition for their operations and maintenance department will be seamless.” - Andy Mayer, Murphy Pipelines

Residents connected to the main being replaced that day only experienced a 6- to 8-hour interruption in water service before being reconnected. Crews typically began preparations around 7 a.m. and by noon the new pre-chlorinated HDPE was in place. Between 3 p.m. and 4 p.m., residents were reconnected to the water system. At the end of each day, pits were backfilled to grade. By the end of each week, a restoration crew completed final grass and road restoration.



The experience by Murphy Pipelines crews proved to be critical on the project. As with any construction method, challenges can and will arise on projects. “It is vital to have a contingency plan in place when things don’t go as planned out on the job site. Unfortunately, many of the challenges that can arise on a pipe bursting project can’t be included in a standard bid document. The experience of Murphy Pipelines crews to handle challenges as they occurred helped to make this project as successful as it was.” - Patrick Hogan, Livonia PW Director

The cost savings to the city by using this technique were significant, enabling them to replace more pipe than originally anticipated. Due to the savings of the process, in total the city was able to replace 29,450 feet of undersized and deteriorated water mains, over a mile more than originally planned. The project also received the APWA Environmental Project of the Year Award.



“Looking back, the success of the project was determined by the feedback from the homeowners. In total, after replacing around 30,000 feet of water main, we received only 3 customer complaints. Of which were actually rather trivial. To affect as many residents and businesses as the project did, and to have that few concerns was a testament to Murphy Pipelines crews and the method as a whole” - Dan Mitchell, P.E. Hubbell Roth & Clark