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# NC Currents



## Trenchless Technology:

NOT A BORING SUBJECT



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# North Carolina Takes the Lead in Water Main and Force Main Pipe Bursting

By Gary Shepherd, Regional Manager, Underground Solutions

## INTRODUCTION

In 2008, a roundtable discussion occurred at the offices of the Fayetteville Public Works Commission that involved various representatives from municipalities, material supply companies, and consulting firms. The topic was pressure pipe bursting, in particular for the rehabilitation of water distribution pipe. Presentations were offered, municipalities described their needs, and a solid exchange of information made the meeting a success. One attendee, Robbie Bald, water resources engineer with the City of Greensboro, took particular note of the benefits of using water pipe bursting for older, undersized cast iron mains. A year later, the first major effort in North Carolina to rehabilitate pressure pipe through pipe bursting was launched.

Since that time, no fewer than seven communities have utilized this trenchless technology to their advantage. They are Greensboro, Monroe, Charlotte, Ramseur, Roanoke Rapids, Reidsville, and Wilmington. In total, at least 90,000 linear feet of pressure pipe have been replaced by bursting, with some 20,000 feet more slated for 2015.

## PROCUREMENT AND CONTRACTING

Pipe bursting pressure pipe lends itself to several methods of design and procurement. Greensboro had been rehabilitating gravity sewer lines through an annual contract with a local contractor, so the city simply expanded that include to its water lines. The contract renews annually with periodic open bids for qualified contractors. Reidsville Utility Director Kevin Eason chose to follow the same path as Greensboro and actually used the same contractor. Charlotte Water also used its

annual contract for procurement. Monroe, on the other hand, chose to self-perform the work, since the city already had crews capable of installing PVC water mains. The challenge for Russ Colbath, water resources director with the City of Monroe, was to develop the program for in-house equipment purchase, material selection, and training of crews; then, to sell that to the Council as a sound, economic, long-term investment.

The other three municipalities—Roanoke Rapids Sanitary District, Cape Fear Public Utility Authority (CFPUA) and the Town of Ramseur—chose the familiar design-bid-build method to procure the contractor and complete the work. All the methods were successful.

## WHAT IS PRESSURE PIPE BURSTING?

Pressure pipe bursting is not sewer bursting with pneumatic equipment. That process, while fine for manhole entry and retrieval, does not fare well when used for water pipe bursting. One reason is that commonly used product pipe, such as Fusible PVC® pipe or ductile iron pipe, does not lend itself to the severe impacts created by pneumatic equipment. Also, pneumatic tooling requires hoses (feeding air and oil to the hammer) that may contaminate the product pipe, causing future bacterial testing problems. For these reasons, static equipment is typically used.

The basic steps followed for water pipe bursting are:

1. Set up a temporary bypass line in the streets where the pipe will be burst. This is commonly 2-inch Yelomine PVC with locking couplings. Once disinfected,

the services are transferred to the temporary line. Meters may be connected, but it is not required.

2. Pits are dug for the machine location and pipe entry, and services are disconnected at the main.
3. Steel rods of quick/disconnect joints are fed through the host pipe into the pipe entry pipe. The distance typically burst is 300 feet to 700 feet, although much longer distances are possible. Up to 1,700 feet of pipe have been burst in Greensboro.
4. Tooling, consisting of cutting blades and an expander head, is connected to the rods. Product pipe is brought into place and also connected to the tooling for pullback.
5. The machine reverses direction and pulls the tooling into the host pipe, splitting and expanding the burst pipe into the surrounding soil. The annular space thus created allows the product pipe to follow the tooling back into the receiving pit. Pullback can take from less than an hour to a couple of hours.
6. After pressure testing and disinfection, the services are tapped into the new main and the flow transferred to the newly installed water main.

Static equipment is clean, which helps keep pipes clean. Also, it uses brute hydraulic force easily obtained from a power pack on the surface, which is transferred to a compact bursting machine in a small excavation. As shown in **Figure 1**, the basic setup includes a pulling pit where the machine is braced, a pipe entry pit at the proper slope to accommodate the product pipe, and rods threaded through the host pipe. These rods are attached to the tooling shown in **Photo 1**.

## BENEFITS OF PRESSURE PIPE BURSTING

Each of the end users listed previously in this article enjoyed a slightly different mix of benefits, but the common threads were cost savings, minimizing disruptions, and reducing the time needed to install new pipe through direct bury. In cases such as CFPUA's Northeast Interceptor Rehabilitation in Wilmington, there was simply no room in the right of way to accept another 20-inch force main. Replacing pipe in the same trench, although possible, certainly would have created major traffic disruptions and lengthened the construction time and cost considerably.

## PRODUCT PIPE

In general, a restrained pipe is necessary for bursting a water main or force main. Jointed and gasketed pipe such as restrained joint ductile iron pipe (RJDIP) and spline and groove PVC have been used. More common in North Carolina is butt fused polyvinyl chloride pipe made in conformance with AWWA C-900 and C-905. Of the 90,000 feet installed in North Carolina to date, most has been the butt fused PVC. The main advantage of a fused pipe is the uniform outside diameter, which has a standard DIP dimension. Also, connections and tapping can occur in the same fashion typical for bell and spigot PVC water pipe. Municipal maintenance crews are generally quite familiar with PVC.

The typical requirement to bed pipe when installing pipe in an open trench is not possible, or necessary, for pipe bursting. The external load is generally minimal due to arching. In addition, the pipe utilized has high stiffness. Thus, any concerns about over deflecting or over stressing the product pipe are misplaced.

## THEIR STORIES

Greensboro began its pipe bursting pilot program in 2009, when the city burst 4-inch and 12-inch cast iron pipe, replacing it with 6-inch Fusible PVC® pipe and 12-inch ductile iron, respectively. KRG Utility has performed all the pipe bursting in Greensboro, most of which has been 4-inch and 6-inch upsized to 6-inch and 8-inch Fusible PVC® pipe and

Figure 1: Static pipe bursting setup.

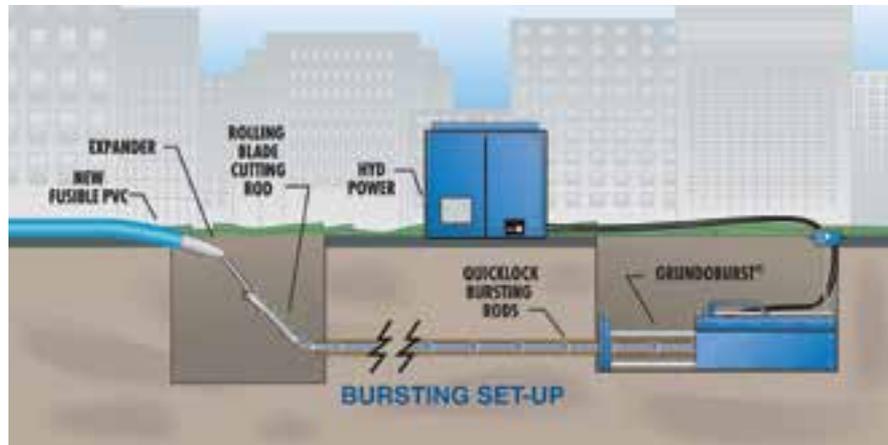


Photo 1: Tooling cuts and bursts host pipe.



Photo 2: In Wilmington – Back end of TT Technologies 1900G with rod removal during pullback.



Photo 3: In Greensboro, long side and short side services tapped at same pit location.



Photo 4: In Monroe – Pipe attached to expander head, in turn attached to cutting wheel tooling.



Photo 5: In Roanoke Rapids, 6" DR18 Fusible PVC® pipe entering pit for pullback.



totaling around 50,000 feet. Greensboro's Bald continues to budget for water pipe bursting, saying, "From a social impact the bursting process is much less disruptive and much quicker to install. With ongoing in-situ replacement, we also have the luxury of being very flexible in where we burst and can respond to our needs much quicker than [with] design-bid build-methods."

The Reidsville story really piggybacks on Greensboro. Eason was familiar with the success of the Greensboro program and saw some areas in his city that required similar rehabilitation. "Due to the cost of the proposed work being within the range for informal construction contracts, Reidsville was able to utilize Greensboro's contractor, KRG, who agreed to perform the Reidsville work using Greensboro's unit prices for bursting 6-inch and 8-inch cast iron and replacing with the same size Fusible PVC® pipe. The first phase is complete and the second is under way," said Eason.

Charlotte Water had an existing contract with Dallas One Construction & Development to upgrade water mains through dig and replace. In 2011, the utility directed Dallas One to replace an existing 3-inch cast iron main by bursting and pulling in a 6-inch Fusible PVC® pipe. The upsize was completed without incident under and adjacent to a sidewalk and specimen trees with cover of 3 feet or less.

The City of Monroe began investigating the pipe bursting method of renewal in 2012, and began its 10-year program in 2014, using city crews exclusively. Following the lead of Colorado-based Consolidated Mutual Water Company, which was the first major utility to pipe burst with its own staff, Monroe publicly bid and awarded the equipment contract to TT Technologies. TT and Consolidated helped train Monroe's crews, and in that year, Monroe successfully replaced almost 10,000 feet of 6-inch and 8-inch pipe size on size with Fusible PVC® pipe. The city's plan, according to Colbath, is to replace 16,000 feet of aging cast iron and galvanized steel water mains each year for 10 years, predominantly using the pipe bursting method.

The Town of Ramseur took a slightly different approach. When it needed a trenchless solution to replace some roughly 2,000 feet of 12-inch water main,

the officials asked The Wooten Company for assistance in evaluating the options. Wooten recommended pipe bursting with either Fusible PVC® pipe or RJDIP, and the town chose RJDIP due to its maintenance crews' familiarity with the product. John Grey, project manager with The Wooten Company, designed the project and commented on its success: "The project cost was reduced by an estimated 10% due to using trenchless replacement. The largest expense that was avoided was flowable fill that was required by the NCDOT for the open excavations."

Roanoke Rapids Sanitary District took a traditional path to its project. Hazen & Sawyer was familiar with the Greensboro work and suggested that the District might be better served to go trenchless rather than face the extra time and disruption of direct bury. At the time, permitting efforts required by NCDENR included a full review and approval from the Public Water Supply Section, but now the regulatory agency considers pipe-bursting size on size to be maintenance and no longer requires a permit. Once bid, Portland Utility Construction Company of Portland, Tennessee performed the work between July and December 2014. Included were 10,000 feet of 6-inch replacement with Fusible PVC® pipe, plus numerous valves, fittings, and hydrants. At the time of this writing, a second phase was scheduled to start in late summer of 2015.

The only departure from the story lies with CFPUA. The Northeast Interceptor project finished early this year was a pipe burst of a 20-inch ductile iron force main that had corroded and leaked in certain high points due to hydrogen sulfide generation and subsequent sulfuric acid production. Having tried pressure cured-in-place pipe (CIPP) in 2008, CFPUA chose to pipe burst with 20-inch Fusible PVC® pipe and 24-inch HDPE pipe, each having a nominal 20-inch inside diameter. The project length of more than 5,000 feet makes this trenchless project a first of its kind, due to the large diameter, long length, and the fact that the host pipe was ductile iron pipe. Kimley-Horn & Associates designed the project and State Utility of Monroe was the contractor. The team consisted of KRG Utility for the pipe bursting and Underground Solutions

of Poway, California for the 20-inch DR18 Fusible PVC® pipe and fusion services. The project went smoothly, with State Utility turning the project over to CFPUA in only five months. Craig Wilson, project manager for CFPUA, stated, "With narrow rights of way and other utilities adjacent to the Northeast Interceptor, a trenchless solution was the most economical and least invasive project approach."

### CONCLUSION

Although pipe bursting is a familiar term to most in the water industry, we tend to associate it with gravity sewers and pneumatic equipment. These days, though, the process most on the rise is pressure pipe bursting with static equipment. When it comes to pipe bursting, North Carolina is well ahead of many other states in the United States. For that, we can be proud, and the ratepayers and residents can be happy.

View a pipe bursting video online at <https://youtu.be/JTBUwykj09M>

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