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## Micro Pipe Bursting

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### ABSTRACT

The City of Greensboro, NC has been contracting with KRG Utility, Inc. for several years to rehabilitate their water distribution system. The selected method for the replacement and upsizing of 4-inch and 6-inch water mains has been the use of static pipe bursting

equipment supplied by TT Technologies. City personnel feel that water main replacement via pipe bursting provides the least disruption and social impact to the community. Following the installation of over 24,000 linear feet of 6-inch and 8-inch water mains, the city of Greensboro decided to expand the diameters replaced via static bursting. Their first target was 2-inch cast iron mains serving residential neighborhoods that distribution system models identified as being undersized. This previously unattainable feat was made



Inserting 1.4-inch rods into existing 2-inch cast iron pipe

possible by a two pass bursting system that used a unique combination of static bursting rods created by KRG Utility and TT Technologies. To date more than 1,500 lf of 2-inch cast iron water main has been upsized with 6-inch fusible PVC. Pipe bursting pull lengths have ranged from 150 lf up to 400 lf. This new technology has provided the City of Greensboro with a trenchless replacement option for maintenance heavy 2-inch water mains. The newly installed 6-inch lines provide increased capacity and also allow for the addition of hydrants for fire protection.

## INTRODUCTION

The City of Greensboro, NC has decided that the water main replacement method of choice is static pipe bursting. The City is moving forward with this approach despite the knowledge that this trenchless technology will more often carry a higher cost per foot than traditional dig and replace methods. The City feels that the small percentage increase in cost is more than offset by the savings in social costs. Water mains that are undersized or have exceeded their design life can be replaced in a matter of days utilizing pipe bursting technology whereas the same effort would take weeks to dig and replace.



Cutter wheel, 4-inch expander head, and 3-inch rod

The City began their replacement efforts on 4-inch and 6-inch cast iron mains. The 4-inch mains were upsized to 6-inch and fire hydrants added to the system. Some of the 6-inch mains were upsized to 8-inch as directed by the distribution system model. Several older neighborhoods had 2-inch cast iron water mains. Due to tuberculation several of these mains had only a 1-inch opening to pass flow through. At that time 2-inch pipe bursting was only being performed in parts of Europe. Those overseas efforts utilized smaller rods that only allowed size on size replacement of 2-inch lines or possible upsizing to 3-inch or 4-inch lines. No consideration had been given to upsizing to 6-inch lines and no one in the United States was bursting 2-inch fracturable lines at all.

Contractor KRG Utilities in collaboration with equipment manufacturer TT Technologies set out to discover a methodology to upsize 2-inch lines to 6-inch to allow for increased flow capacity and the addition of hydrants for fire protection.

## TWO PASS METHOD

The first pass of this system involves the insertion of 1.4-inch diameter rods into the existing 2-inch water main. The 1.4 inch rods have been used on smaller hydraulic bursting units in Europe. For the Greensboro project this was accomplished by modifying a Grundoburst 400G which normally uses 2.13-inch rods to accommodate the smaller diameter rods. While the smaller 1.4-inch rods can be more

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Replacement pipe at insertion pit

easily inserted into the 2-inch mains they also result in a 60% reduction in the allowable pulling force used. Once the 1.4-inch rods have been successfully inserted into the host pipe they are attached to cutting wheels sized for the 2-inch cast iron main. Also attached is a 4-inch expander head and 3-inch bursting rods that are used by the larger 800G



Insertion of replacement pipe with tracer wire

Grundoburst hydraulic unit. This first pass will cut and displace the existing 2-inch main but will only pull in the 3-inch rods which will set the stage for the second pass.

Before the second pass can begin the contractor must remove the 400G hydraulic unit from the bursting pit and install the larger 800G Grundoburst unit. This process will take about one hour to accomplish. This larger machine is sized for the

3-inch rods and can supply a pulling force of over 170,000 pounds. Once

the 800G is in place the replacement pipe is placed at the entrance of the insertion pit. To allow for the insertion of the 6-inch replacement pipe a 9-inch expander head is attached to the 3-inch rods. A tracer wire can be attached to the expander head at this point and will be inserted into the hole along with the replacement pipe to aid in future water main locating efforts. No cutting wheels are needed for this pass since the existing main was cut and displaced on the first pass that installed the 3-inch rods. Both pits are now ready for the second pass.

The second pass will utilize the 800G hydraulic unit and the 3-inch rods to pull the 6-inch replacement pipe into place. To date the longest pull has been 400 feet. A shorter burst of 150 linear feet was accomplished by skipping the first pass of pulling in 3-inch rods and simply attaching the replacement pipe to the 1.4-inch rods and using the 400G to pull in the pipe. Since the smaller rods limit the 400G to around 36,000 pounds of pulling force this does provides some limitations.

### ROOM FOR IMPROVEMENT

The static pull can be hampered by cast iron saddles for water services. Water services can be excavated either before or after the burst. Excavation prior to the burst has the advantage of identifying and removing any



Replacement pipe arrives at burst pit

service saddles that could potentially stop the pullback of the bursting head and replacement pipe. The disadvantage to this approach is the need to either provide steel plating or barricades to protect the service pits for the duration of the burst or the contractor having to fill in the pits and later reexcavating to make the final service connections.

The bursting rods are unsupported laterally inside the bracing frame which is the distance from the hydraulic unit to the face of the pit. On heavily tuberculated pipe sections or ones that have line or grade issues, the 1.4-inch rods can encounter heavy resistance when being inserted into the host pipe. This caused buckling or bending of the small diameter rods on one of the bursting attempts. When this condition is suspected the bracing frame should not be installed until the rods are ready for the first pass pullback and the hydraulic unit should be positioned as close to the face of the pit/host pipe entrance as possible.

The pipe burst can also be halted when encountering pipe break repair efforts that involve bands or concrete poured around the pipe. Investigating past work orders, reviewing asbuilt information, and interviewing City personnel can prove valuable prior to identifying the locations for entry and exit pits for the line section to be burst.



Point repair location that required excavation

When possible the contractor can be greatly aided in his bursting efforts if a sample piece of pipe can be supplied to the pipe bursting equipment manufacturer. This will facilitate proper sizing of hydraulic units, cutting wheels and expander heads.

## CONCLUSIONS

The City of Greensboro has seen many benefits of pipe replacement via static pipe busting. In addition to the social and environmental benefits it is also becoming more cost effective due to its growing popularity among municipalities and more widespread participation by contractors. The two pass system created by KRG Utilities and TT Technologies has provided the City with another viable replacement option for undersized and maintenance heavy 2-inch water mains.