



# Use Of Ductile Iron Pipe With HDD, Pipebursting Growing

by Jeff Griffin • Senior Editor

The number of potable water system and sanitary sewer projects that include the installation of ductile iron pipe made by horizontal directional drilling (HDD) is steadily increasing, say representatives of the ductile iron pipe industry.

Trenchless installation of ductile iron pipe in various sizes is being stimulated by a growing awareness that ductile iron pipe can be efficiently installed by HDD technology and is supported by information about successful HDD ductile iron pipe projects, says Gregg Horn, P.E., director of regional engineers for the Ductile Iron Pipe Research Association.

"Directional drilling installations are definitely on the increase," says Horn. "Because early equipment was designed to install cable and small-diameter pipe, HDD technology wasn't initially considered as an option for installing ductile iron pipe. There also was the concern that sections of pipe would come apart when a drill unit pulled a string of pipe back through a pilot bore."

Advances in equipment, including introduction of larger drill models with the capabilities of accommodating ductile iron pipe in sizes used in water and sewer systems, together with the development of restrained joints that hold pipe joints firm-

ly together during pull-in, make directional drilling and ductile iron pipe compatible.

However, many public works officials and consulting engineers are not aware of these developments. Horn says that while many engineers have a preference for ductile iron pipe, they still mistakenly believe it cannot be installed by directional drilling.

HDD is becoming an industry standard because it can eliminate major excavation, increase productivity and reduce operational risks during pipe installation, Horn observes.

"People we talk to these days are very pleased to learn that ductile iron pipe can be put in place by directional drilling," he continues. "They say they simply hadn't thought of it that way before. It makes sense that directional drilling be used to install ductile iron pipe, a modern improvement of the cast iron pipe that has been in service for hundreds of years. We believe interest will continue to grow as we make information available and more HDD jobs are completed."

## Long job

What is believed to be the longest directionally-drilled installation of ductile iron pipe was made in Riverwoods, IL, where 4,700 feet of 12-inch diameter U.S. Pipe TR Flex

ductile iron water main was placed in a right-of-way adjacent to a street.

The Village of Riverwoods specified the installation be made by directional drilling to protect trees lining the road. General contractor was Tires 'N Tracks Inc., Lombard, IL.

The town has used directional drilling on other installations, but pipe installed previously has always been PVC, says Daniel Carlquist, Tires 'N Tracks estimator. "Riverside job specifications called for PVC pipe with ductile iron included as an option. Ductile iron pipe was chosen due to the soft ground conditions. We were concerned that ground pressures would deflect the joint of the PVC pipe and felt more confident in the strength of the joint using ductile iron pipe."

It was the first HDD installation of ductile iron pipe for the community. The contractor previously had completed a 300-foot-long sanitary sewer grade bore using 8-inch ductile iron pipe. The job was in a residential area which was heavily wooded and had low areas with standing water. Subsurface soil conditions were a wet mixture of clay and sand.

Tires 'N Tracks used a Barbcoc drilling machine with 120,000 pounds of pullback. The installation was broken into three segments.



## Ductile Iron

Connection of each new joint could be completed in about the same amount of time required to remove a length of pulling rod. Pulling speeds averaged about 200 feet per hour.

The bursting system is manufactured by Trenchless Replacement Services, Ltd., Calgary, AB, Canada.

A key to successful HDD installation of ductile iron pipe is the restrained joint pipe. American Ductile Iron Pipe Co., Birmingham, AL, developed the Flex-Ring joint for situations when axial thrust restraint is required for restraining bend and other fitting configurations.

The joint is designed to provide liberal joint deflections, up to 4 degrees for 14- to 36-inch pipe, while maintaining full thrust capabilities, explains Ralph Carpenter, American Ductile iron marketing specialist.

"When deflection or articulation of the joint occurs, wedge-shaped flexing ring segments slide up or down the mating 'wedge-shaped' slope of the inside of the flex-ring bell, maintaining joint restraint and effectively redistributing the thrust or pulling force around the face of the bell," says Carpenter. "This functionality is what makes flex-ring ideal for trenchless applications such as horizontal directional drilling and pipe bursting of water and sewer lines. In 4-inch to 12-inch Flex-Ring pipe, a similar flexible wedge-shaped design provides a greater joint deflection of 5 degrees."

U.S. Pipe promotes the ease of assembly of TR Flex joint under severe and harsh conditions such as encountered during directional drilling. The joint is assembled by inserting the ductile iron locking segments through a slot (or slots), providing a positive axial lock between the bell interior surface and a retainer weldment on the spigot end of the pipe.

"All across the United States, there is a need to rehabilitate and upgrade water and sewer systems," concludes Horn. "But citizens do not want the inconvenience of major excavations to get the job done. That's why more and more municipalities are specifying horizontal directional drilling. And because proven, dependable ductile iron pipe is perfectly suited to HDD and pipebursting technologies, more and more installations are being made with ductile iron pipe, rather than substitute products."

"Due to our concerns with the ground conditions and the weight of the ductile iron pipe, we decided to attempt the first segment at 800 feet," says Carlquist. "The installation went so well, we decided to double the length of the next one to 1,600 feet. And it went so smoothly, we decided to finish the job with one more 2,300-foot pull."

To minimize disturbance in the area, pipe was stacked beside the trench box. The pipe was assembled in the trench using the box "cartridge method," one joint at a time. Pipe was required to have a minimum of 5 feet, 5 inches of cover, but it frequently averaged around 7 feet in area crossing existing utilities.

While soil conditions made it difficult to steer the drill head and to maintain the pilot bore for pullback, the project went very well, and all parties involved are happy with the results, says Carlquist.

"Because of the success of this project, we have since completed several others using HDD with ductile iron pipe," he concludes.

### Force main installation

For another project in Georgetown, SC, directional drilling was used to install a 500-foot segment of 20-inch diameter American Ductile Iron Flex-Ring pipe for a wastewater force main adjacent to a railroad track.

The project's owner, Georgetown County Water and Sewer District, wanted to install the pipe by directional drilling because its route crossed several streams in an environmentally-sensitive area. Due to the pipe's proximity to the rail line, planners wanted to use ductile iron because of its strength, but were unaware the pipe could be installed by directional drilling until general contractor Seaside Utilities, Moncks Corner, SC, and HDD subcontractor Steele Excavating, Prosperity, SC, advised them that it could be done.

Because there was plenty of space on the right-of-way, the full length of pipe was laid out on site, assembled, and double wrapped with two layers of 8 mil LDPE encasements. Each joint was air tested before the length of pipe was placed in the ground.

A 70,000-pound pullback Ditch Witch JT7020 drilled a 7-inch-diameter pilot hole which was enlarged by backreaming to 32 inches in diameter in one pass. To expedite

pulling pipe into the pilot hole, Seaside Utilities constructed a 400-foot-long sloped entrance ramp starting at ground level and sloping downward to the pilot hole about seven feet below the surface. A sheet of LDPE was laid on the top of the entry ramp and drilling mud and soap were added to lubricate the pipe as it was pulled into place.

It required approximately four hours to drill the pilot hole and complete backreaming. Pulling in the pipe took another 7½ hours.

### Pipebursting with ductile iron

Restrained joint ductile iron pipe also can be installed by conventional pipebursting methods. During this procedure, a bursting tool is winched through a section of host pipe, breaking it into pieces in the process. New pipe, connected to the rear of the bursting tool, is pulled into place behind it. One of the benefits of pipebursting is that old pipe can be replaced with pipe of larger diameters.

The city of Tulsa, OK, had used a variation of the process to jack bell-less or conventionally-belled ductile iron pipe behind a bursting head. However, T-G Excavating, Catoosa, OK, took advantage of restrained joint technology to install 2,500 feet of American Ductile Iron Flex-Ring pipe, pulling it in behind the bursting head. Deteriorating 8-inch VCP (vitrified clay pipe) was replaced by 8- and 10-inch ductile iron pipe. Existing pipe was approximately 21-feet deep.

The project was divided into three sections: 1,000 feet of new 8-inch pipe; up sizing of 1,100 feet with 10-inch replacement pipe; up sizing of another 400 feet with 10-inch pipe. The three segments were divided into seven installations ranging from 260 to 500 feet.

A TRS Hydrahaul H110XS system with a maximum pulling force of 220,000 pounds was used. To make each installation, pull rods were pushed through the existing pipe into a receiving pit, usually located at a replacement manhole location. A 16-inch bursting head was attached to the end rod and new ductile iron pipe connected to the rear of the tool. To avoid blocking drives in the residential area where work occurred, new pipe was installed one joint at a time.