

2009 Project Achievement Award Winner

The First Use of Tunneling Method with Reinforced Concrete Jacking Pipe in DelDOT's History

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Shield that was used to protect the men as they removed the old CMP and excavated for the new pipe.

Microtunneling was used in September 2008 to replace a 48-inch diameter corrugated metal pipe (CMP) culvert that had been in service for 25 years on Route 4 in New Castle County near Newark, DE. This is a heavily traveled feeder route to Interstate 95 and Delaware SR 1. Deterioration of the culvert had led to concerns of road collapse, but [Delaware DOT \(DelDOT\)](#) did not want to disrupt traffic as it had a decade earlier. In October, 1999, a 66-inch CMP culvert failed less than a mile from the 48-inch culvert. It was replaced with a reinforced concrete pipe (RCP) culvert by open-cut. Construction closed the road at the site for three months. DelDOT did not want a repeat of that lengthy disruption.

In addition to the concerns of traffic disruption, the state's largest and only Level One Trauma Center (Christian Hospital) is located approximately 800 feet from the 48-inch culvert. During construction, two east-bound lanes would have to be open to traffic, thereby requiring temporary detour roadway construction, if the open cut method of installation were used. New lanes would cause major traffic congestion around the work site.


DelDOT first considered rehabilitation of the culvert using a lining method. This idea was rejected because the culvert carried a stream under Route 4 and the flow capacity of the crossing needed to be increased, and the culvert needed to be replaced to allow a delayed land development project to proceed. The initial plan was to open-cut Route 4 for the installation. Tunnel and replacement methods were initially rejected due to lack of experience with this type of construction.

After the \$695,000 contract was awarded to Eastern States Construction Services, the contractor performed a value engineering analysis and confirmed that construction by open-cut would be costly to the local economy, a challenge to access to the nearby trauma center, and a disruption to traffic. The [best installation technique](#) was microtunneling and jacking a 54-inch reinforced concrete pipe culvert under Route 4. The cost savings to the state was approximately 30% of the original contract amount. DelDOT and its consulting engineer, RK&K of Baltimore, MD saw the benefits and revised the contract. This was the first use of microtunneling and pipe jacking of storm sewer in DelDOT's history.

[Rinker Materials – Concrete Pipe Division](#) supplied the pipe with steel bell bands and grouting ports to withstand the anticipated 400,000 lb. jacking load. [Tenbusch](#) provided the contractor with a tunnel shield and a hydraulic jacking unit. The tunnel shield protected the men as they excavated the face in the tunnel and manually removed the cut CMP and excavated material.



Culvert carries stream under Route 4.



54-inch diameter reinforced concrete pipe jacked under Route 4.
Photos: Tenbusch, Inc.

Four-foot lengths of CMP were pulled through the RCP and removed from the pit. The hydraulic jacking unit supplied the necessary force to jack the 54-inch reinforced concrete pipe column under the highway. The contractor was able to construct a jacking pit in the median to install the pipe in both directions. This plan satisfied the significant wetlands restrictions in the drainage area served by the culvert. The contractor took 75 days to complete the project, and within that period, only 15 days to jack the pipe. The tunneling progressed at a rate of approximately 8 feet per day.

In summary, there were several benefits realized by DelDOT by using microtunneling instead of the open-cut method.

- The job site was safer for construction workers and motorists.
- Construction traffic was reduced because of the limited amount of earth removal and less bedding and backfill materials having to be brought to the site.
- Construction costs were reduced.
- There was no disruption to traffic flow or emergency vehicles traveling to the trauma center.
- The project was completed on time and budget.

The project proved to Delaware Department of Transportation that microtunneling and jacking using reinforced concrete pipe is a valuable construction alternative to the open-cut method.

ACPA Links to Microtunneling and Jacking

Design Data 4 - Jacking Concrete Pipe

http://www.concrete-pipe.org/pdfs1/DD_4.pdf

You should Know – Technical Paper on Microtunneling

http://www.concrete-pipe.org/ysk_pdfs/ysk109.pdf

Loads and Supporting Strengths

http://www.concrete-pipe.org/pdf/DM_Chp_4.pdf

Keyword search: tunneling or jacking

www.concrete-pipe.org

