

Horizontal Pipeline Drilling

Horizontal pipeline construction will be an important component of restoring and expanding water and wastewater infrastructures, saving on construction costs as well as expediting crossings of roadways, waterways, and environmentally sensitive areas.

Many regions of the U.S. are facing a painful and seemingly inestimable task to keep up with the need to restore their aging and increasingly inadequate pipeline infrastructures, particularly when it comes to meeting present and future needs of water and wastewater pipe systems.

One of the keys to replacing and expanding the pipeline infrastructure in an efficient, cost-effective manner will be horizontal directional drilling, auger boring, or pipe jacking. "This capability not only saves time and money, but can also save on disrupting the environment and exposure to potential hazards," says Vince Rice, president and CEO of Aaron Enterprises (www.aaronenterprises.com). Rice adds that advanced horizontal trenchless technology can allow pipeline construction at a very fast pace.

"There is a need for thousands of miles of pipeline to replace or expand the water and wastewater infrastructures in Pennsylvania alone," says Brian Funkhouser, PE, president and CEO of full-service architectural and engineering firm Buchart Horn, Inc (www.bh-ba.com).

According to the American Society of Civil Engineers' 2010 Report Card on Pennsylvania's Infrastructure, aging waste-



There are crossings that must be installed under obstructions such as roadways, waterways, and environmentally sensitive areas that require expertise and knowledge of the local terrain.

water management systems discharge billions of gallons of untreated sewage into Pennsylvania's surface waters each year. Further, it is estimated that the state must invest \$28.3 billion over the next 20 years to repair and upgrade existing systems to meet regulatory requirements. In early May of this year, Pennsylvania's Commonwealth Financing Authority approved \$172 million through the H2O PA program to fund 160 water and sewage infrastructure projects in 51 counties.

Funkhouser says that most of the pipeline work will include subsurface, horizontal pipeline construction, including crossings under roadways, rivers and streambeds, and environmentally sensitive areas such as wetlands and parklands.

Niche Capability

This type of pipeline construction is a sort of niche, requiring special equipment and capabilities. Funkhouser cites for example a major project in which Buchart Horn was a consulting engineer, a crossing of the Susquehanna River in Williamsport, PA.

"Directional boring technology was needed to make this crossing," he explains. "We consider this a more cost-effective approach than using a cofferdam (watertight enclosures across



For a subcontractor to undertake speciality pipeline construction projects, expertise, experience, and geological knowledge are required.

the bottom), which can be compromised if you get heavy rains, for example, and the you have to start over from scratch.”

Because most states will not permit pipeline construction contractors to open cut highways, pipes must be sent under highways to avoid problems such as traffic congestion and safety issues.

Horizontal auger boring and directional drilling are also solutions to pipeline crossings of environmentally- or historically-sensitive areas where temporary trenching or running aboveground pipeline would be undesirable.

Rice explains that there are a number of trenchless technologies that are a form of work performed by specialists such as his firm. Pipe jacking, for example, allows the contractor to push pipe through a horizontally excavated hole. Pipe jacking is usually done for installation of concrete pipes.

“Pilot drill micro tunneling is another horizontal technique for jobs that require precise line and grade control,” he adds. “This technique requires installing a small pilot opening using hollow steel rods. As you install them you monitor their horizontal and vertical positions with a theodolite with a digital camera. Once the small-diameter rod reaches target location, then you attach to it a larger diameter pipe. As you thrust that larger diameter pipe, the smaller one acts as a guide. It gives you the ability to jack pipe 400 feet, for example, and stay within a one-inch tolerance.”

One of the forms of horizontal drilling that will play an important role in replacing or expanding the pipeline infrastructures is directional drilling. As opposed to simple straight-line drilling, when using the directional approach the drill, located on the surface, enters the ground at a predefined angle and is electronically steered around obstacles.

Aaron Enterprises also has extensive experience using directional drilling for gravity sewer installations. Believed to be a world record, the firm used a specially modified, pit-mounted directional drill to complete a 900-ft gravity sewer bore through sandstone and red rock, maintaining a .0097 percent slope, then pulling back a ten-in. diameter HDPE sewer pipe. The use of directional drilling on this project eliminated the necessity of drilling and blasting an open trench alongside existing water and gas mains. This saved the owner substantial dollars by eliminating the need for an additional sewer pump station, which will also save operational costs far into the future.

“Using this method we can’t make 90 degree turns,” says Rice, “but instead make a gradual, arcing turn over the length of the bore.”

Rice adds that unforeseen construction difficulties or inadequate handling of documentation required by local agencies can hamper pipeline construction progress of any type. Whether it concerns infrastructure repair, replacement, or new construction, delays over documentation or other compliance requirements will be costly and time consuming. Yet, experienced horizontal drilling and boring specialists who know the ropes and have the necessary equipment will likely enable pipeline contractors and engineers to save significant time and money.

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Mobile GIS Cuts Costs in Peoria

Originally, Peoria, AZ, was founded by a handful of farmers who journeyed from Peoria, IL, to take advantage of the irrigation potential of the newly completed Arizona Canal. By 1970, the population had grown to 12,000. With an expanding regional economy fueling rapid growth, today the population exceeds 150,000.

With this growth came the need to expand the city’s infrastructure and implement systems to maintain it. Peoria began its use of ArcGIS (ESRI, www.esri.com) in 2001 with the initial goal to automate its mapping procedures. Use of the technology gradually expanded throughout various city departments until 2003, when it was decided to link the GIS with the existing computerized maintenance management system (CMMS) from Hansen Information Technologies (Denver, CO).

The city’s desktop environment uses Hansen’s GeoAdministrator and GeoAssistant to link its GIS to the CMMS database. GeoAssistant lets Peoria users query the GIS and system databases interactively. GeoAdministrator allows the GIS to push new assets into the system. The city can also sync appropriate attributes between the GIS and the system, which lets it manage both databases with a single procedure.

The city’s intermediate GIS application is GeoResults from ESRI Partner Marshall and Associates, Inc. (Boise, ID), which facilitates real-time database connectivity from the field to the GIS and CMMS databases. The application uses ArcGIS to pass information to either the GIS or CMMS, depending on the action type. Asset and attribution updates are performed in the GIS database, while updates to maintenance schedules and service requests are managed by the CMMS. With this implementation, the use of GIS in the city began to expand exponentially, particularly in the public works department.

One of the primary functions of GIS in the public works department is to georeference the city’s assets, such as street signs, manholes, light poles, and valves, for use with the CMMS. This allows the implementation of the CMMS-generated maintenance schedules through the work order process that is managed by ArcGIS. The process includes the generation of digital work orders with an accompanying interactive reference map displayed on the field crews’ devices running ArcGIS Mobile. The crews use high-resolution orthophotography and GIS data layers including parcel, addressing, and streets. This information allows them to easily locate the assets that are scheduled for repair or replacement and provides them with related information about the asset, such as age, maintenance history, and manufacturer.

The implementation of these procedures has allowed Peoria’s public works department to realize a quantifiable return on investment by the sign inventory group. *Courtesy of ESRI (www.esri.com).*