

INTRODUCTION TO HORIZONTAL DIRECTIONAL DRILLING

One construction method Williams utilizes to minimize environmental or community impacts is a procedure known as horizontal directional drilling. Horizontal directional drilling is a form of trenchless technology that allows pipelines to be installed underground while minimizing surface disruption. Directional drilling is used when trenching or excavating is not practical, such as in sensitive environmental areas.



Horizontal directional drilling technology can be utilized for short or great distances. Installation lengths of up to 6,500 feet have been successfully installed with pipe diameters as large as 48 inches. Although directional drilling was originally used primarily through loose soils, more and more crossings are being undertaken through gravel, cobble, glacial till and hard rock.

Horizontal directional drilling is an advanced construction technique that Williams utilizes to install pipelines in a safe and environmentally responsible manner.

The concept is easy to explain. From an entry point on the one side of the crossing, a steerable drill bit is pushed through the ground to the exit point on the other side of the obstacle. The pilot bore is then enlarged with one or more reaming passes until the bore hole has reached the desired diameter. In the final step, the steel pipe is pulled by the drill rig into the hole and placed safely in the ground.

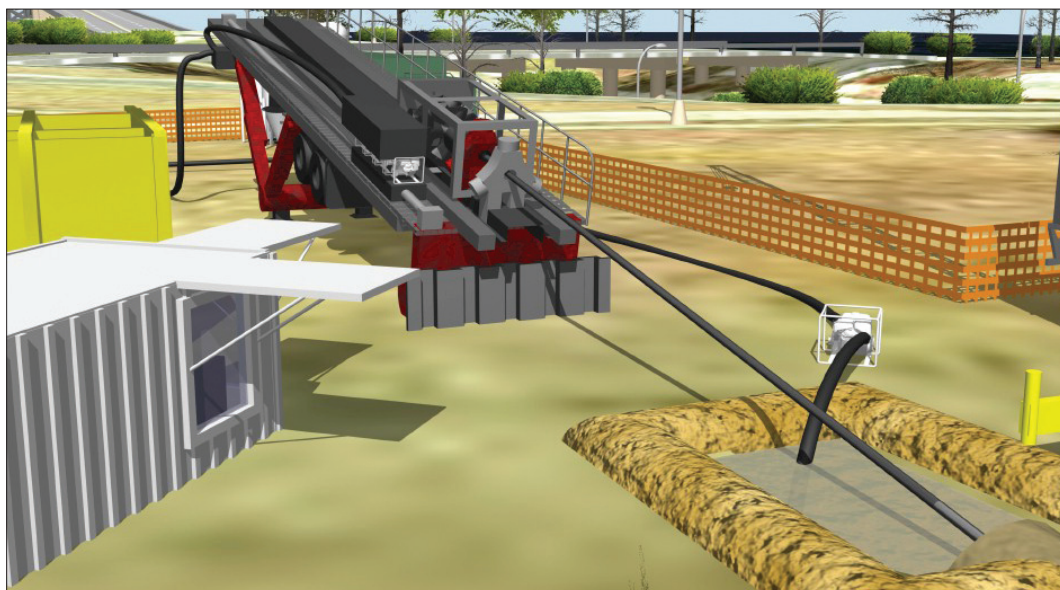
PILOT HOLE

The following illustration shows a typical pipeline river crossing. On both sides of the river, a limited working area is prepared. On the rig site, a small entry pit with a depth of about 6 feet is installed. Nearby, a larger storage pit for the drilling

suspension is constructed. Separation plants, a buffer tank, a mixing unit, pump and power packs, a pipe skid and control cabin complete the basic set-up on the rig site.

Pipe connected to a drill bit is pushed forward into the entry pit. One after another, the pipes are connected and pushed into the ground. A mixture of water and bentonite is continuously pumped to the drill bit to facilitate the removal of cuttings, stabilize the bore hole, cool the cutting head and lubricate the product pipe. This mixture, known as drilling mud, flows back to the entry pit on the surface. From here, the cutting mixture is pumped to the separation plant.

Inside a control cabin, the driller carefully controls the exact position of the drill bit. When the drill bit punches through the other side of the obstacle, the pilot hole is completed and the drill bit is disconnected.



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(continued from front)

PREREAM

Once the pilot hole is complete, the hole must be enlarged to a suitable diameter for the pipeline. For instance, if the pipeline to be installed is 36 inches in diameter, the hole may be enlarged to 48 inches in diameter or larger. This is accomplished by “prereaming” the hole to successively larger diameters. Generally, the reamer is attached to the drill string on the bank opposite the drilling rig and pulled back into the pilot hole. Joints of drill pipe are added as the reamer makes its way back to the drilling rig. Large quantities of drilling mud are pumped into the hole to maintain the integrity of the hole and to flush out cuttings.

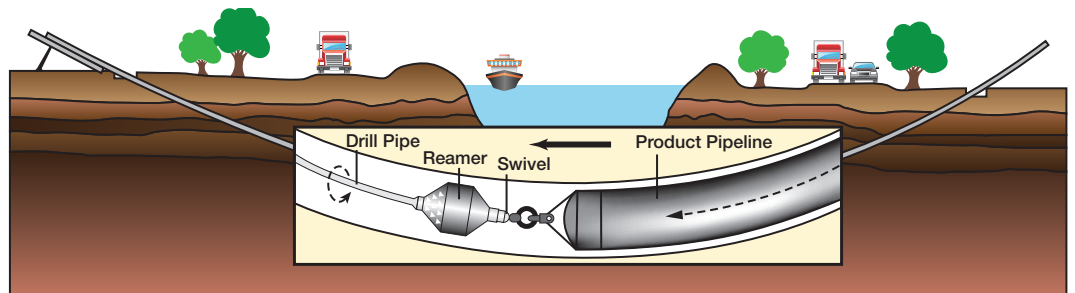
PULLBACK

Once the drilled hole is enlarged, the pipeline can be pulled through. The pipeline is prefabricated on the bank opposite the drilling rig. A reamer is attached to the drill string, and then connected

to the pipeline. The drilling rig begins the pullback operation, rotating and pulling on the drill string while circulating high volumes of drilling mud. The pullback continues until the reamer and pipeline break ground at the drilling rig.

DEVELOPMENT AND USES

Originally used in the 1970s, modern horizontal directional drilling technology is a combination of conventional road boring and directional drilling methods developed for drilling oil wells. Crossings have been installed for pipelines carrying oil, natural gas, petrochemicals, water, sewage and other products. Ducts have been installed to carry electric and fiber optic cables. Besides crossing under rivers and waterways, installations have been made crossing under highways, railroads, airport runways, shore approaches, islands, areas congested with buildings, pipeline corridors and future water channels.



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