



HDD - Horizontal Directional Drilling

Vladimir Grozdanovic

When building an optical network, installers often need to cross major roads, parks, railways, or bodies of water. In these cases, regular trench digging is disruptive if not impossible, so a channel must be made by horizontal directional drilling (HDD) beneath these surfaces. This is done using different types of machines, including manual, pneumatic, and hydraulic drilling, which creates the underground channel in the surrounding soil.

The majority of construction of the route is typically done using standard trench excavation, with HDD used only when necessary. The use of HDD technology can pose significant risks due to the presence of underground infrastructure such as gas pipelines and electrical cables—particularly in cases where up-to-date records of underground utilities are unavailable or inaccurate. It is important that the contractor have extensive experience with HDD and do extensive location themselves along the drill path before and during the drilling.

The HDD technology, unlike trench excavation, does not require extensive landscape restoration afterward. Two working pits at entry and exit and an underground channel are formed in the ground, enabling installation of fiber ducts. The process takes place in three phases:

- inspection of the terrain for existing underground utilities before starting the work,
- formation of the horizontal channel, i.e., drilling, and
- pulling the duct back through the formed channel.

Before beginning the work, it is necessary to know the locations and depths of existing underground utilities to determine the exact route and prevent potential damage. All projects must begin by contacting the “Call Before You Dig – Call 811” service and local authorities to clear the work being done.



Figure 1. HDD Machine

Horizontal Directional Drilling begins with the entry of the probe head into the entry pit. The entry pit is used to retain and manage drilling fluids, e.g. bentonite - a mixture of water and clay powder. During drilling, it's possible to monitor and control the drilling head's progress. One technician operates the machine, while another uses a locator to track the drilling head (depth, direction, and orientation) and guides the machine operator to steer the drilling.

HDD rods are automatically added following the drilling head's path until they appear in the exit pit. These rods are designed to allow slight bending, but excessive bending can damage them.



Figure 2. Horizontal Directional Drilling. The tech at right is tracking the drill head and looking for underground utilities. (source: FOA)

During drilling, drilling fluid (bentonite) flows to the drilling head, where it mixes with soil and crushed stone before returning to the entry pit. This fluid is crucial for stabilizing operations, cooling cutting tools, and lubricating pipes.

When the head emerges in the exit pit, it is removed, and a pulling head, approximately 20% larger than the pipe, is installed to pull the duct back through the formed channel in the opposite direction.

If drilling beneath a water surface, the distance between the waterway bottom and the underground channel must be at least ten times the nominal pipe diameter, and in any case, typically no less than 3 meters.

Besides the risk of damaging underground utilities, there is also the danger of damaging the HDD machine itself, specifically the drilling head, if it gets stuck on an underground obstacle. In such cases, the drilling head must be located and an excavation pit dug to free the drilling head. Additionally, when pulling PVC pipes, they can sometimes get stuck during the pulling process, which also requires excavation.

Once the duct is installed, the fiber optic cable can be pulled through the duct, often in a continuation of the laying of the cable in the trenches on either side of the HDD channel.

Vladimir Grozdanovic is a graduate electrical engineer for telecommunications with more than 10 years of experience in access networks (HFC and FTTH) in large cable operators in Serbia (SBB and Jotel).

(C)2025, The Fiber Optic Association, Inc.