

## FTTH Council Whitepaper

**Introduction:** Contractors who specialize in fiber-to-the-home (FTTH) installation can face many challenges on job sites. Many of these challenges can be tackled before the project even begins through selection of the best suited installation method. The following document is targeted to contractors who specialize in FTTH installation and provides recommendations for selecting the most efficient method of installation based on key factors such as job site location, other utilities installed, and whether the cable will be direct buried or installed in conduit.

### **Underground Installation Methods for Fiber Optic Cables**

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A key component of fiber-based broadband systems is the method of installation. This discussion will relate to the options available for the underground installation of fiber cables.

How is an installation method chosen?

- Determine if the installation project is located in an existing neighborhood, new development site, or rural area. Typically, existing neighborhoods have more utilities currently installed underground.
- Decide how deep the cable/conduit must be installed. Depth of installation will vary depending on ground conditions, existing utility depth, job specifications, and individual city preference.
- Determine whether the fiber cable will be installed in a conduit or direct buried. Fiber is typically installed in conduit, adding protection to the cable and making future replacement of cable easier. The minimum diameter of conduit normally used is 1.25" in diameter. There are some underground installation projects that allow the fiber cable to be direct buried.
- Confirm the minimum bend radius of the fiber cable and the conduit (if installing in conduit). The minimum bend radius will assist operators with job planning, regardless of the installation method chosen.

- Locate all existing underground utilities following each state's regulations. This process typically starts with a phone call to the local "One Call" utility locator service. One Call gives an approximate location of the existing utility(s), however One Call does not provide utility depth measurement(s). One Call will typically mark the utility locations with colored flags. These flag markers have specific colors which represent the following utilities:
  - Electric is red
  - Gas/oil is yellow
  - Telephone/cable TV is orange
  - Water is blue
  - Sewer is green
- Expose existing utilities prior to installing the new cable above, below, or close to existing utilities.

Exposing utilities, known as potholing, is typically performed using a vacuum excavation unit. This process is also referred to as soft excavation as it reduces the risk of causing damage to existing utility(s). A shovel, backhoe or excavator may also be utilized to expose the utility, but is more intrusive than using a vacuum excavation unit. A vacuum excavation unit, shown below, typically utilizes water pressure to break up the soil, and a vacuum to move the resulting slurry into its spoil tank.



- Choosing the best installation method.

If fiber cable is to be installed in rural areas or new development sites, there are two efficient methods of installation.

- One method is vibratory plowing. This method installs the cable or conduit with a narrow blade that has a shaker box attached to it. The cable may be fed through a chute, shown below, or it may be pulled in behind the blade. Vibratory plows cause very little surface damage and typically require no backfilling of the ditch. Depending on the soil conditions, vibratory plows normally achieve above average production rates. When there are few underground obstacles present, vibratory plowing is an efficient method for installing cable in city work sites.



- Open cut trenching is another method best suited for rural areas or new development sites, due to the ground restoration required. On fiber-to-the-home (FTTH) projects, a walk-behind trencher, shown below, is typically the machine used. Once the trench is made and the cable or conduit is installed, the trench must be backfilled, leveled, and new sod installed. Again, depending on soil conditions, trenching may also achieve good production rates.



- When installing cable or conduit in developed areas or where underground utilities already exist, horizontal directional drilling (HDD) is the preferred installation method as it causes minimal surface damage. A mini-HDD unit, shown below, is the preferred machine size for FTTH projects.
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The HDD method is normally surface launched and is detected underground so operators can steer around obstacles. Steering allows operators the capability to maneuver around existing underground utilities. Another advantage of HDD is the ability to place the product deeper than a small plow, allowing the operator to place the new line under existing utilities.

Steering is accomplished with the drill head. The drill head has a slanted cutting bit on the front, shown below.



When pushing the drill head without rotation, the slanted bit causes the head to steer. If you rotate the drill head while pushing it forward, the head will follow a straight course.

- Pneumatic piercing tools, shown below, are another trenchless installation method best utilized for bores of 100 feet or less. Unlike HDD, piercing tools cannot be steered, and are typically launched by the operator from a small pit. Pneumatic piercing tools are powered by portable air compressors and are an economical method for boring under driveways, streets, and sidewalks.



Of the four methods discussed, HDD requires the most operator training. An operator on the drill rack and an operator with the locator that runs the directional drill head locating equipment are both required to efficiently operate an HDD machine. Because of the skills necessary to perform these duties, it is important to train and keep the same operators on HDD machines. The other three installation methods are less training intensive.

**Conclusion:** There are many variable factors to consider when contractors are selecting the most efficient method of installation at a FTTH job site. Whether installation is performed using a horizontal directional drilling unit, open-cut trencher, or other method, deciding the most efficient method of installation is one of the critical aspects of a successfully completed FTTH project.