10.0 **Underground (UG) Construction**

Prior to any trenching, excavation, and boring, the contractor performing the work is responsible to notify "Miss Dig" or the underground locating system for that area. In addition, the local municipality must be notified to locate private services, such as: water, sewer, traffic control, fire alarm, and street lighting. The contractor is responsible for maintaining all marks as detailed in the by-laws set up by the federal, state, and local government. Copies of the by-laws can be requested through the state locating system in your area.

- All established waiting periods must be met before any trenching or excavating can be performed.

- To reduce errors, it is suggested that the contractor conduct a preliminary survey of the work site prior to opening a "Dig Safe" ticket. The proposed trench path or work should be "white-lined" with paint to help the locating company determine the route. In some states this is mandatory.

- The contractor will keep a log of all Utility Locate Ticket Numbers with date and time called. This will be kept for review if needed for utility damage reports and turned in with Project As-built if requested. (Use the One Call Centers Form as needed.

10.1 **Standard Trenching**

- All conduits will be buried with a minimum 24 inches of cover.
- If 24 inches of cover cannot be maintained, due to rock conditions or existing utilities Owner must be notified and the as-built documents must be up-dated.
- Road crossing conduit(s) will be encased concrete; minimum 3 inches on the bottom, and side, with 6 inches encasement on top.
- The trench path should be straight as possible to ease the placement of conduits(s) and cable pulls.
- Smooth the bottom of the trench, removing rocks, large stones, or foreign material, which may damage the conduit.
- Backfill the trench by installing 12 inches of dirt fill that is free of rocks and large stones or other foreign materials.
- Mechanical compacting/tamping is required to ensure all voids around the conduit are filled.
- Warning tape is to be laid flat on top of the first 12 inches of compacted fill.
• The ends of the conduits must be capped or sealed.
• Backfill the trench with clean material that is free of rocks, large stones or debris.
• Mechanical compacting/tamping will be performed; to prevent the trench from receding. Trench restoration will be dictated by the existing landscaping conditions. Restoration should return the area to pre-construction conditions. This may include the placement of new top soil or loam, seed, and fertilizer. Local town/city codes will be checked for restorations requirements.
• Final trench inspection is required after two, but not more than four, weeks to check for trench settlement.
• Sod cutting equipment shall be used prior to trenching areas that have established lawns. The removal and replacement of existing grass will speed the restoration process and reduce potential complaints.
• All trenches and/or excavations will be back-filled the same day.
• It is the contractor's responsibility to ensure exposed/open areas are properly barricaded and temporarily covered to reduce safety hazards.
• Trenching near tree root systems should be avoided. Main tree routes should never be cut, without the approval of the Superintendent of Streets or local tree warden.

10.2 Standard Road Openings

State, and local city/town standards shall be reviewed prior to opening any pavement for the following requirements:

• Trenching requirements
• Backfill material requirements
• Settlement time period procedures
• Pavement restoration
• Traffic control

If the city/town does not specify or if the work is to be performed on private streets, driveways or parking lots, the following minimum standards will be met:

• Saw cut back 6 inches of existing pavement to remove jagged and rough edges.
• Apply a minimum of 1 ½ inches of finish top coat seal.
• Compaction will be done using a steel roller of sufficient weight to establish a uniform density comparable to that of the adjacent surface within the work area.
• Compaction test as required if needed by Municipality or private owner.
• FLOWABLE FILL may be used in all locations if approved by Municipality.
• Finished surface shall be level with no depression retaining. Note: Cold patch mix is temporary and must be replaced when hot-mix plants reopen. They would be subject to state and local city/town approval.
• Pavement restoration should be re-inspected after a period of a month for settlement.
• The contractor is responsible for quick correction to any trip or fall hazards.

10.3 Standard Horizontal Directional Boring

Directional Boring may be accomplished by a mechanical boring machine that drills / pushes a drill stem the length of crossing or a pneumatically driven piston (If approved) which basically does the same task. In either case, local standards should be checked for accepted practices.
Road crossing bores should be made perpendicular to the roadway centerline to minimize bore distance.
All conduits will be provisioned with a tone able “Mule-Tape” for locating purposes.
• The tunnel of the crossing can be enlarged by using reamers or cones.
• Conduit size should be placed to support the tunnel wall and to minimize settlement.
• Boring pits are to be a minimum of three feet below grade to ensure the bore depth maintains 24 inch cover.
• All bores are to be drilled prior to the start of trenching.
• Utilities crossing the bore path are to be located using local "Dig Safe" procedures.
• Utilities can also be located by digging test pits or pot holes to expose their facilities.
• Directional Bore Log of the Running Line and Depth will be kept on all Dept. of Highway bores that are over standards depth because of existing field conditions. The will also include Flowing Water Crossings that cannot be done Aerial.
• Directional Bore Reamer Size shall not be over two (2) inches larger than the pipe being pulled back for the FOC to be placed in. (1 ¼” & 1 ½” = 3” Reamer – 2” & 3” = 4” Reamer – 4” = 6” Reamer). Unless the Municipality has other standards.
• Pneumatically driven piston may be used with depth being a minimum of 4 feet to top of pipe unless otherwise governed by the Municipality.
• All Directional bore casing shall be HPDE Poly pipe unless authorized by the onsite engineer in writing.
10.4 Standard Manhole/Vault

Manhole standards may vary due to different size manholes and their capacity.

- The fiber cable will be protected with innerduct and properly identified with owner ID tubes and tags.
- The fiber cable will be secured around the inside walls of the manhole.
- Use the center racks as an attachment location for cable and FOSC.
- Do not wrap or box in other cables.
- At the splice and slack locations, fiber must be accessible, and must be able to be brought out of the manhole for splicing, then returned to the manhole, and reattached.
- Bond the FOSC to the manhole grounding system. This must be approved by the local Regional Bell Operating Companies (RBOCs) or Telecom engineer.
- Bonding is not needed at pull through manholes where there is no existing FOSC.
- Place HDPE/Inner Duct at least one (1) ft. inside wall of Manhole/Vault.
- All Grounds to be Megged.

10.5 Conduit Size Standards

There shall be at least one spare conduit placed from the Hub Location out to the fiber back bone and at all major road/railroad crossings.

- Conduit shall be sized per fiber cable being placed:
  - 12 count thru 288 counts to be placed in a 1.25” HDPE Conduit
  - Larger than 288 count thru 432 counts to be placed in a 1.5” HDPE Conduit
  - Multiple cables in the same running line shall be placed in its own conduit or cell in a MaxCell type of cable path. Example of a 4” conduit with 3-1.25” sub-ducts or 1-1.25” & 2-1.5” sub-ducts or 2-1.25” with 1-3 cell MaxCell.

10.6 Standard Handhole

Handhole standard will consist of a “Quazite” type precast polymer concrete
designed product and be Underwriters Laboratories (UL) Listed. The standard size would be determined by the number of fibers and the size of the fiber cable. Handhole size will be as follows:

- 24”X36” – Non splice locations
- 30”X48 – Fiber splice locations

- The standard size would be 24 inches by 36 inches by 30 inches deep.
- The handholes will be installed at a minimum of every 500 feet.
- The handholes must be installed flush and level with grade at all times.
- The handhole locations must be reviewed by the city/town engineer for approval and restoration requirements.
- The position of the handholes must be away from the road or curb to prevent damages from vehicles and snow plows.
- The handhole placement should blend in with the surrounding conditions.
- There must be 50 feet of slack fiber cable at each handhole location.
- The slack coil must be tagged and neatly coiled.
- The handholes will have 3 inches of ½ inch pea stone installed inside for drainage purposes.
- Marker Post to be placed at all Handholes unless Customer does not want them placed.

10.7 **Standard Riser Pole**

Riser Pole selection shall be based on available climbing space on the pole. Avoid installing a riser to a pole that already has multiple risers attached.

- Riser poles must be approved by the local Regional Bell Operating companies (RBOCs) engineer, the local power company and, be applied for during licensing.
- When possible, position the riser on field side of the pole away from vehicle traffic.
- PVC conduit must be sealed at base of pole to prevent debris and water from entering the underground (UG) plant.
- Riser cable(s) shall be protected by one, ten foot, section of heavy gauge galvanized steel U-Guard attached with the proper hardware.
- Install innerduct up to the strand secured by 2-hole clamps once it exits the U-Guard.
- A slack location is required in the span before the riser dip and in the span after the riser.
- Spare conduits must be capped at the sweep at the base of the pole.
11 Materials

- Fiber optic cable Corning ALTOS® Gel-Free, Low-Temperature, Single-Jacket/Single-Armored, 12-288 Fibers Single mode 1310/1383/1550 0.35/0.35/0.25
- Splice Enclosures Corning SCF-4C18-01
- PCH –Pretium® Connector Housings with SC UPC factory pig tails