Installation Guideline for Direct Burying of Fiber Optic Cable

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A. Purpose

A.1 This procedure applies to the direct burying of Superior Essex fiber optic cable into the ground. The objectives of this guideline are:

- Provide to the cable installer a general guideline for direct burying the fiber optic cable into the ground. (It is not the intent of this procedure to cover all possible installation scenarios or conditions. Special circumstances or questions can be addressed by contacting Superior Essex Applications Engineering.)
- Prevent damage to the fiber optic cable during the set up, handling, and installation.

A.2 It is intended that this guideline be used in conjunction with procedures that describe the detailed operation of handling equipment. Equipment procedures are provided by the equipment suppliers.

B. Introduction

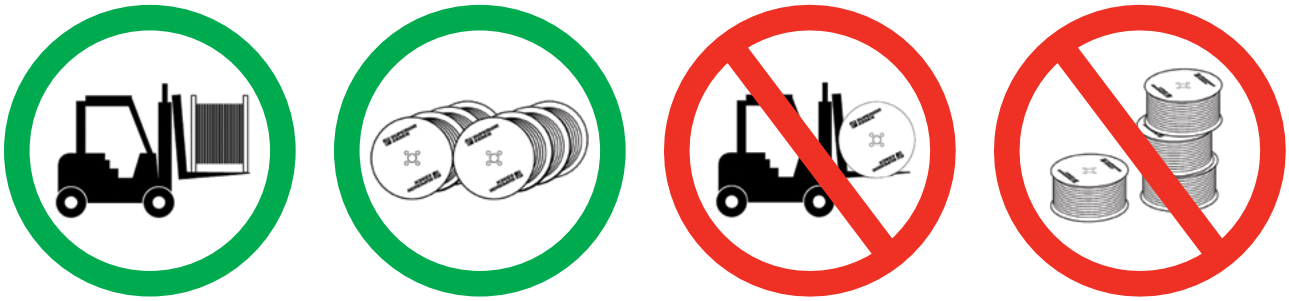
B.1 The practice of handling fiber optic cables has become much more common in recent years. Fiber optic cables are designed to withstand all typical installation and environmental stresses expected in the specific application.

B.2 Fiber optic cables can be damaged if not handled properly during the installation process. In fact, the cable installation process is the most aggressive event the cable will most likely ever be exposed to. Adherence to the cable's design limits of **pull tension, minimum bend, and crush force** during installation will ensure that the cable will perform properly throughout its full design lifetime. The greatest mistake when handling fiber optic cable is assuming that all outside plant (OSP) handling equipment is suitable for use—it is not. If in doubt prior to, or during, any fiber cable installation, contact **Superior Essex Technical Support by calling 1-877-263-2818.**

C. General Precautions

C.1 The following precautions always apply when handing fiber optic cable.

- DO NOT exceed the cable's stated **maximum pulling tension**.
- DO NOT exceed the cable's stated **minimum bending radius**.
- DO NOT exceed the cable's **maximum crush load**.
- NEVER set a cable reel on a flange side (to prevent cable crossings during payoff).



- DO adhere to local personnel safety practices.
- DO review and follow equipment safety practices.
- ALWAYS apply caps over free cable ends to prevent water intrusion.
- ALWAYS follow local grounding practices regarding the safe grounding of metallic components inside the fiber optic cable.

NOTE: Always check specific product data sheet for cable design limitations. Cables are designed based on applications. Typical Bellcore GR-20 cable designs are to the following:

Maximum Pulling Tension	600 lbs		2700 N
Maximum Long Term Tension	200 lbs		890 N
Minimum Bend Radius, under tension		20 x O.D.	
Minimum Bend Radius, zero tension		10 x O.D.	
Maximum Crush Load, for one minute	125 lbs/in		220 N/cm
Maximum Crush Load, for ten minutes	63 lbs/in		110 N/cm

C.2 Additional general safety precautions exist when trenching in or plowing in cable:

- If in congested areas, proper safety cones and traffic control devices should always be used. The project manager should coordinate his work with local traffic officials. Safety zones utilizing traffic signs and cones should be placed at all working locations.
- Guard and protect work areas with barricades or cones to prevent accidental entry by vehicles or pedestrians. Use flagmen where necessary.
- When feeding cable into a cable chute, personnel should never stand inside a cable loop to prevent entanglement with equipment and injury.
- Hearing protection may be required around equipment to prevent long-term hearing impairment.

D. Reference Documents

- **D.1** Bellcore GR-20-CORE, *(General Requirements for Optical Fiber and Fiber Cable)*
- **D.2** USDA Rural Utilities Service Bulletin 1753F-601 (PE-90), *(Specification for Filled Fiber Optic Cables)*
- **D.3** USDA Rural Utilities Service Bulletin 1751F-641, *(Construction of Buried Plant)*
- **D.4** USDA Rural Utilities Service Bulletin 1753F-401 (PC-2), *(RUS Standard for Splicing Copper and Fiber Optic Cables)*
- **D.5** ANSI/TIA/EIA-590-A-1996, *(Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant)*

E. Direct Burying of Fiber Optic Cable

E.1 Limitations

E.1.1 Fiber optic cables must be handled in compliance with their stated design ratings to prevent short or long-term damage to the optical fibers. Handling crews must be familiar with the cable's design ratings and the critical events during installation where design limits may be approached. Review this entire procedure with operating crew prior to installation day.

E.1.2 For direct burying applications, either armored or non-armored fiber cables may be specified. Typically, armored type cables are selected which offer higher crush resistance and additional protection from ground rodents. Armored cables may be of single armor or dual armor designs.

E.2 Construction Planning

E.2.1 A site survey and route analysis must be performed to evaluate the local conditions of where the fiber system is to be installed. The site survey should be done early enough in the planning phase to allow for re planning of the installation project, should conditions warrant. Several items should be checked and verified in conjunction with the site survey.

- Selected install method and route is most efficient.
- All property issues and rights-of-way are resolved.
- Existing facilities are clearly identified.
- Environmental planning is taken into account.
- Locations of fiber splice points are defined with consideration for splice vehicle access.

E.2.2 Once the route is selected, a detailed study should be performed to analyze soil content, rock content, erosion concerns, and to identify all obstacles and water crossings. Also review equipment placement and its impact on the success of the route. Identify any affects on local traffic and associated concerns.

E.2.3 Determine if federal and state regulations require an Environmental Impact Study of the affected areas. If so, file the required paperwork.

E.2.4 Once the cable placement plan is complete, a final joint survey should be performed by engineering personnel, construction personnel, and all individuals with an interest in the property to be modified. All potential issues and concerns need to be resolved prior to commencing the actual cable system buried installation.

E.2.5 Develop final route map indicating all obstacles, existing facilities, rights-of-way, fiber splice locations, and land mark references. Indicate on the final route map the depth at which the cable is to be buried. Buried cable depth should be in accordance with local practices. Refer to ANSI/TIA/EIA-590-A-1996, *(Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant)* for specific recommendations.

E.2.6 Survey the route as appropriate and mark with identification stakes.

E.2.7 Procure permits/licenses for all rights-of-way associated with the project. Permits must be on site during installation and all conditions of the permit adhered to throughout the project. Any deviations from the restrictions of the permit must be brought to the attention of the Project Manager and property owner.

E.3 Equipment and Materials

E.3.1 A cable plow may be either static or a vibratory type. The overall configuration of the plow should be accommodating to the fiber optic cable to be buried. Review ratings of the fiber cable and do not exceed the maximum pulling tension, minimum bend radius, or crush resistance of the cable. Particular attention should be put on the travel of the cable from payoff, over sheaves and guides, and into cable feed chute to ensure bend radius of the cable is not exceeded.

E.3.2 The plow cable feed chute must be checked to accommodate the fiber optic cable. The curvature radius of the chute path must be greater than the minimum bend radius for the specified cable. The cross sectional area of the chute path channel must be sized for the fiber cable. Ensure that the area of the cable does not exceed 50% the area of the feed chute to allow ease of cable movement. Inspect to ensure the feed chute channel is free of burrs or sharp edges that could damage the fiber cable.

E.3.3 If a trencher is used, ensure the proper trencher is selected for the soil type to be worked.

E.3.4 Ensure all support vehicles selected for the project will have adequate and safe accessibility to the designated area.

E.4 Initial Conditions for Direct Bury Installation

E.4.1 Prior to commencing a cable installation event, the following actions must be accomplished:

- All construction planning activities are complete.
- Final route map is complete and reviewed.
- Final route map shows equipment setup locations.
- All permits and required licenses are on site and reviewed.
- Locations of all existing facilities are clearly marked.
- Limitations of cable are reviewed with the handling crew.
- Installation equipment is reviewed for adequacy.
- The event is reviewed and briefed, at least one day prior, with install crew.
- All required equipment is on site day of installation event.

E.5 Direct Bury Installation Procedure

E.5.1 Prior to installation, all traffic safety zones, work area barricades, and flagmen must be in place, as appropriate. Observe all local safety ordinances and practices.

E.5.2 Superior Essex recommends the use of a buried warning tape. The buried warning tape should be located about 12" (30 cm) below the existing grade and clearly alert the presence of fiber optic cable. The warning tape can be placed during plowing if the plow equipment has a tape-laying feature, or the tape can be placed manually.

E.5.3 Plowing in Fiber Optic Cable

E.5.3.1 Review final route map and clearly mark the route for the plowing operator.

E.5.3.2 Establish communications between plow operator and placement supervisor.

E.5.3.3 The plow starting point should be a hole dug to the proper depth and dimensions.

E.5.2.4 Make a ripping pass to the proper depth up to the next splice location. The ripping pass is made to ensure no surprise obstacles exist that could damage the fiber cable. The ripping should be made in the same direction that the cable is to be plowed.

E.5.3.5 Return to plow start location. Remove sufficient cable slack for future splicing (30 feet (9 meters) minimum). If buried warning tape is to be placed during the plowing process, ensure it is properly loading onto the plow payoff and set for a depth of 12" (30 cm).

E.5.3.6 Begin plowing in the fiber cable at the required depth. Start plowing slowly and monitor closely the movement of cable from payoff to cable feed chute. Ensure cable pays off smoothly and minimum bend radius is not exceeded.

E.5.3.7 Perform all depth and direction changes gradually.

E.5.3.8 Abrupt changes in the terrain along the cable path should be graded off ahead of the plow to prevent abrupt changes in cable placement conditions.

E.5.3.9 Do not operate vibratory plows in the same location for excessive periods of time in order to prevent kinking or damage to the fiber cable.

E.5.3.10 Complete the placement of the cable using the plow. Carefully excavate the area around the cable to safely remove it from the cable feed chute.

E.5.3.11 Back fill, as needed, the plowed trench to restore a level grade.

E.5.3.12 Make a passing run over the filled trench to ensure fill is compacted.

E.5.4 Trenching in Fiber Optic Cable

E.5.4.1 Review the final route map and clearly mark the route for the trenching equipment operator.

E.5.4.2 Begin trenching the route at a depth that will allow the addition of 6–9" (15–25 cm) of clean backfill (no large rocks) prior to the installation of the fiber cable.

E.5.4.3 Add clean backfill (no large rocks) to the trench so that placed cable will be at the proper depth.

E.5.4.4 Place cable in trench. Ensure, as much as possible, a level cable run with gradual angles. Ensure minimum bend radius is not exceeded. Remove any large rocks.

E.5.4.5 Add 6–9" (15–25 cm) of clean backfill (no large rocks) over the fiber cable.

E.5.4.6 Add remaining backfill to trench to restore a level grade. If buried warning tape is to be placed, lay it during the backfill process so it is at a depth of about 12" (30 cm).

E.5.4.7 Make a passing run over the filled trench to ensure fill is compacted.

E.5.5 Mark the exact position of the buried cable with buried cable markers in accordance with local procedures. Update final route map, as appropriate, with "as built" conditions.

E.5.6 Restore environmental conditions. Verify conditions are in compliance with any applicable permits or licenses associated with the project.

E.5.7 Any free ends of cable must be capped and taped to prevent water entry into the cable. Bury any free end or place free end where it will be protected until cable splicing/termination is complete.

If you have any further questions or need additional information, please call **Superior Essex Technical Support at 1-877-263-2818.**