AERIAL FIBER OPTIC CABLE PLACEMENT

CONTENTS PARAGRAPH

1. SCOPE

1.1 This practice covers general information to be used as basic guidelines for the installation of aerial fiber optic cable. It is for personnel with prior experience in the planning, engineering, or placement of aerial fiber optic cable. A working familiarity with aerial cable requirements, practices, and work operations is necessary as this guide does not cover all aspects of aerial cable placement. This practice assumes that the placement of support strand has been completed or that the fiber optic cable will be attached to an existing cable plant.

1.2 FITEL Lucent Technologies' aerial fiber optic cable can be placed using either the moving reel method, or the stationary reel method. The choice will depend on the vehicle access to the pole line, the type of equipment available to the installer, and whether the cable must be pulled into position over existing facilities.

2. GENERAL PRECAUTIONS

2.1 FITEL Lucent Technologies' optical fiber cables are designed to meet the rigors of conventional aerial, direct burial, and underground duct environments. During cable installation, special care should be taken to not violate the minimum cable bend radius or maximum rated cable tensile load.

2.2 Cable minimum bend radii are typically expressed as a multiplier of the cable outer diameter under static and dynamic conditions. The static condition represents an installed cable under a long-term, residual tensile load only. The dynamic condition represents a cable during installation subjected to the full tensile load rating of the cable. For standard loose tube cable designs the minimum bend radius under dynamic conditions (during installation) is 15 times the cable outer diameter. The minimum bend radius under static conditions (installed) is 10 times the cable outer diameter. For Accutube™ loose tube cable designs the minimum bend radius under dynamic conditions (during installation) is 15 times the cable outer diameter. The minimum bend radius under static conditions (installed) is 15 times the cable outer diameter.

2.3 Cable tensile load ratings, also called cable pulling tensions or pulling forces, are specified under short-term and long-term (residual) conditions. The short-term condition represents a cable during installation. The long-term condition represents an installed cable subjected to a permanent load for the life of the cable. FITEL Lucent Technologies' loose tube cable designs have a short term (during installation) tensile rating of 600 pounds (2700N) and a long term tensile rating of 200 pounds (890N). Accutube™ loose tube cable designs have a short term (during installation) tensile rating of 1000 pounds (4448N) and a long term tensile rating of 200 pounds (890N). For self-supporting aerial cable designs (Figure 8 and ADSS) contact FITEL Lucent Technologies' Technical Services "Hotline" at (800) 889-3203.

2.4 Single wheel type stringing blocks (Sherman Reilly type) are recommended for all applications. Multiple wheel quadrant blocks are not recommended. This type of block is often referred to as a "3 block". Cable Stringing Blocks - the sheave (wheel) diameter of the stringing block is determined by the minimum cable bend radius. Standard loose tube cable minimum bend radius is 15 times the outer diameter during installation and 10 times the cable outer diameter after the installation has been completed. Accutube™ loose tube cable designs have a minimum bend radius of 15X the OD during installation and 15X after the installation has been completed. Select stringing blocks for your applications accordingly. Use of permanent attachment hardware as a substitute for stringing blocks is not recommended.

2.5 To assure that the maximum cable tensile load is not exceeded during installation, breakaway pulling swivels and/or calibrated pulling devices are recommended. Cable lubricants are also effective in minimizing cable loads by reducing coefficients of friction. Contact FITEL Lucent Technologies or a pulling lubricant manufacturer for guidance on the proper lubricant to be used with the optical fiber cable being installed.

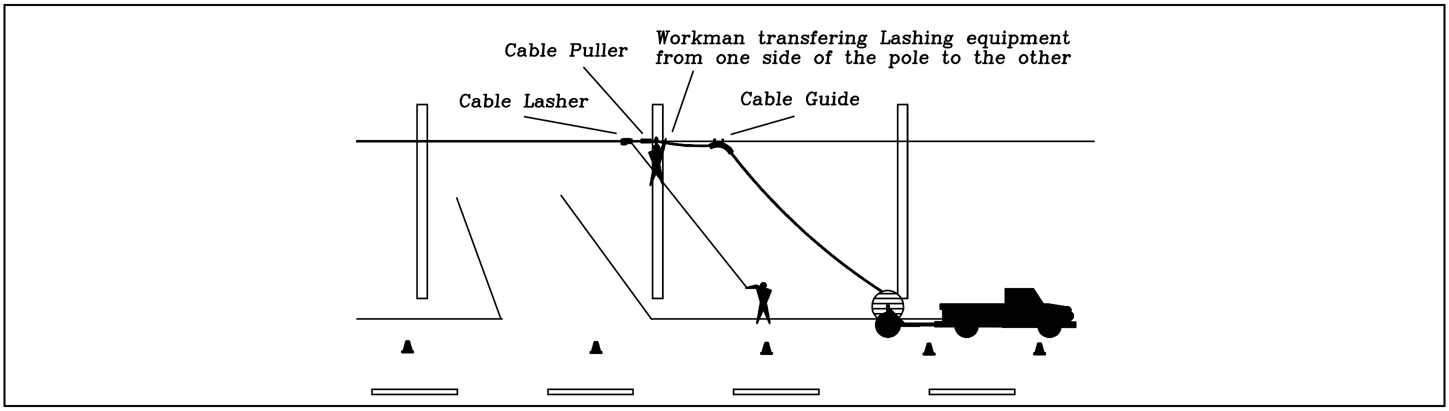

Figure 1

2.6 Safety cones, signs, flags, etc., should be used to channel traffic where required.

2.7 A site survey of the entire run should be performed before cable placement begins.

2.8 A dynamometer or equivalent (600 lb. breakaway swivel) can be used to monitor cable pulling tensions.

3. GENERAL DESCRIPTION OF CABLE

3.1 FITEL Lucent Technologies offers a wide selection of high quality fiber optic loose tube cables designs. FITEL Lucent Technologies' fiber optic cables are engineered to provide a superior operating environment for optimum fiber performance.

3.2 In FITEL Lucent Technologies' loose tube cables, fibers are placed in buffer tubes and suspended in a filling compound that mechanically decouples the fiber from the cable structure. This protects the fibers from strain during installation and service. Loose tube cables can be armored or non-armored.

4. TOOLS AND CONSTRUCTION APPARATUS

A. Moving Reel Method and Stationary Method

4.1 Bucket Truck: Facilitates cable installation.

4.2 Cable Reel Trailer with Friction Adjustable Payoff Assembly: Provides necessary back tension on cable during installation.

4.3 Cable Roller Blocks (Stringing Blocks): Supports cable at poles and intermediate locations during stationary reel cable installation. Stringing blocks used at all pole locations must be of adequate size to meet the minimum bend radius for the cable which is being installed. One piece stringing blocks are recommended for Fitel Lucent Technologies loose tube cable designs. Multiple roller quadrant blocks are not recommended. Insure that the proper size stringing blocks are used in relation to line angles that occur due to changes in direction or elevation.

4.4 Cable Lashing Machine: Lashes cable to stand.

4.5 Aerial Cable Guide: Protects cable from harmful bend radius during lashing operations.

4.6 Catch Off Clamp: Temporarily holds the lashing wire in place while the lineman transfers or removes the lashing machine from poles.

4.7 Cable Support Straps: Used in conjunction with spacers to guide and protect cable at the beginning and end of each span.

B. Stationary Reel Method Only

4.8 Corner Roller Blocks (45 and 90 degree): These corner roller blocks guide cable through bends and corners.

4.9 Cable Block Pusher: Placed on the strand immediately in front of the lashing machine. The block pusher spaces and pushes the cable roller blocks located at the midspan locations to the pole for removal as the cable is being lashed.

4.10 Cable Pulling Device: A cable pulling take up winch may be used if a pulling rope is first placed in all stringing blocks throughout the run.

4.11 Assist wheel: A self powered winch or assist wheel(s) placed at intermittent location(s) along the cable route can eliminate the time consuming practice of "figure-eighting" large amounts of cable.

4.12 Cable Chute Bracket: Used in conjunction with a 45 degree corner roller block at the strand level, where the cable pulling process begins.

4.13 Wire mesh Grip: This is a wire mesh pulling grip with a swivel that provides effective coupling of pulling loads to the jacket, aramid yarn, and central member of fiber optic cables.

4.14 Cable puller: Used to pull cable into place. The cable puller rides on the strand between the wire mesh grip and the pulling apparatus.

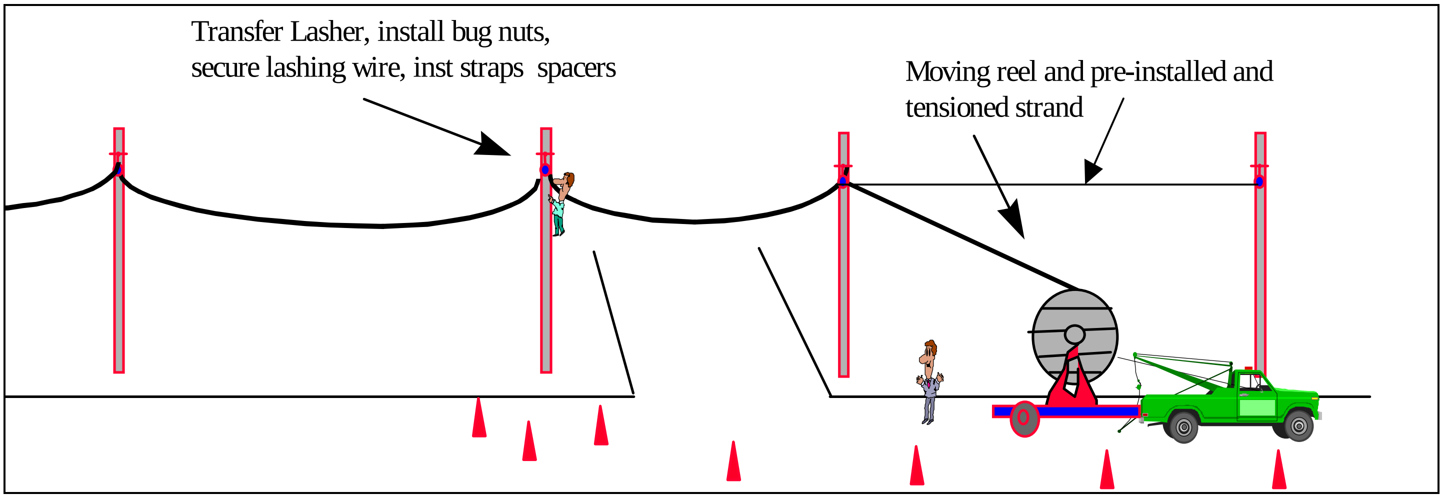

Figure 1

4.15 Dynamometer: A gauge which measures pounds of tension; a dynamometer can be used on cable pulls where cable pulls may exceed the recommended maximum pulling tension.

4.16 Pulling Rope: When using the stationary reel method

4.17 Breakaway Swivel: A swivel with a load limit breaking capability, attached between the wire mesh grip and pulling rope when using the stationary reel method.

5. CABLE INSTALLATION, MOVING REEL METHOD

5.1 Using the moving reel method, the cable is paid off its reel from the placement vehicle, raised to strand level, and lashed to the strand as the placement vehicle moves along each span. The cable route must be accessible by vehicle, and the cable path clear of tree limbs, guy wires, and other obstructions (see Figure 1).

5.2 There are no cable blocks or other temporary support hardware when using the moving reel method. This requires only one pass down the cable route, thus offering production and cost advantages.

5.3 Begin the placement operation by leaving enough slack cable at the beginning of the run, to reach down the pole to the splice location or end termination. The reel carrying vehicle should be at least 50 feet in front of the lasher to assure proper cable minimum bend radius between the reel and strand level.

5.4 This procedure assumes that an aerial lift or bucket truck will be used in the installation.

5.5 Attach a lashing wire clamp (bug nut) to the strand 16 inches from the pole centerline.

5.6 Place the lasher and the aerial cable guide on the strand.

5.7 Using an aerial lift, raise the cable end to strand level.

5.8 Position the cable under the strand with a strap and spacer mounted approximately 14 inches from the centerline of the pole, or 2 inches from the lashing wire clamp-toward the pole

5.9 Position the cable in the cable guide and lasher. Adjust the lasher per the instruction manual provided with the lasher.

5.10 Attach separate pulling lines to the lasher and cable guide.

5.11 Pull the cable lasher and its accessories with a constant tension to prevent the lashing wire from wrapping the fiber optic cable around the strand.

5.12 The cable pay-off must be surge free. Reel rotation should be monitored to prevent free running or too slow a pay-off, that could result in damage to the cable.

5.13 The reel carrying vehicle must follow as close to the pole line as possible during cable placement operations. The vehicle must maintain a 50 feet distance in front of the cable lashing machine.

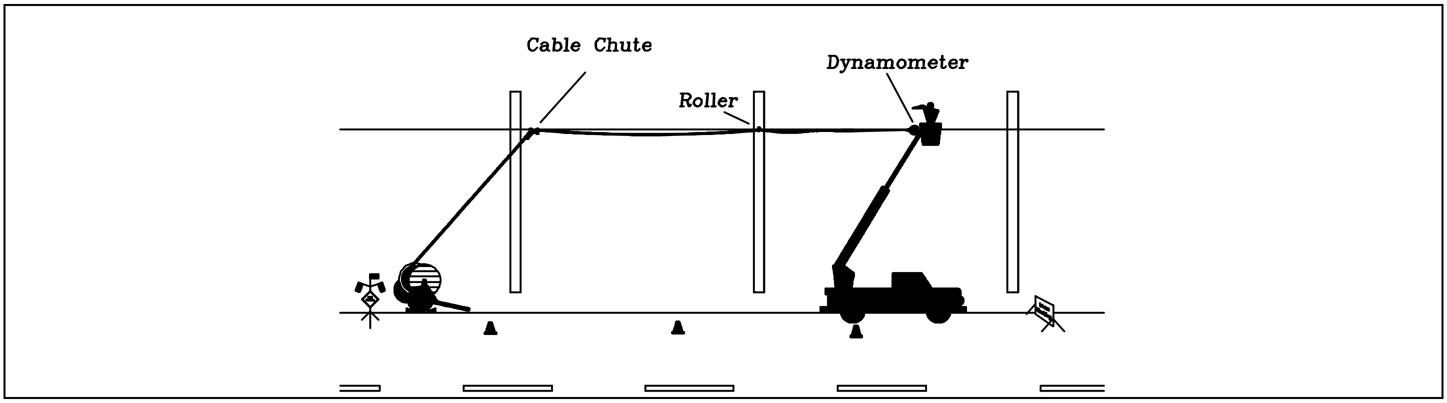

Figure 2

5.14 Upon reaching a pole, stop the vehicle to transfer the lasher and its accessories around the pole.

5.15 Temporarily clamp the lashing wire to strand using a catch off clamp.

5.16 Transfer the cable guide and lasher around the pole to the next span.

5.17 Attach straps and spacers on both sides of the pole

5.18 Make permanent lashing wire termination's on the strand before moving to the next pole.

5.19 Continue the cable installation span by span until the entire run is permanently lashed and properly sagged.

6. CABLE INSTALLATION, STATIONARY REEL METHOD

6.1 In the stationary reel method, the cable is pulled into place beneath the strand through cable blocks (figure 2). The lashing procedure then begins at the far end of the run, and the lasher is pulled towards the stationary cable reel location.

6.2 The distance of the cable reel from the first pole should be approximately two times the height of the pole attachment from the ground.

6.3 The cable should pay-off from the top of the reel.

6.4 The cable reel should be as near in line with the pole line as possible.

6.5 Attach a wire mesh pulling grip, and a breakaway swivel (600 pound limit) on the end of the cable. A Dynamometer can also be used here to monitor pulling tensions (Refer to Installation Practice for Pulling Grip Attachment for FITEL Lucent Technologies' Fiber Optic Cable, Document #IP013). FITEL Lucent Technologies' fiber optic cables can be ordered with factory installed pulling grips.

6.6 Attach a 45 degree corner roller block to the cable chute bracket at the first pole.

6.7 Attach pulling apparatus (dynamometer, swivel, etc.) to the bucket on the bucket truck and begin pulling the cable at the strand height. Attach cable roller blocks to the strand between poles to maintain clearances. Make sure that the cable does not scrap or bind at poles or on existing hardware as the cable is pulled in.

6.8 Insufficient cable blocks can result in excess sagging of the fiber optic cable, higher pulling tension, and increased chances of damage to the cable.

6.9 Heavy corners can cause the cable to jump out of a normal cable block. At such locations, a one-piece pulling block should be used to prevent cable from riding out of the block.

6.10 Corner blocks are used when pulling through outside and inside corners (see Figure 3).

6.11 If the pole line contains many hard turns, it may be advantageous to begin the installation somewhere in the middle of the route. The stationary reel method may be used to pull the first part of the job. It can then be sagged, from the cable end to the reel. The second part can then be completed by taking the remaining cable off the reel (placing in a Figure Eight pattern on the ground) and proceeding to the other end of the route, or by using the moving reel method to complete the second part of the job if possible.

6.12 Reliable communication between the construction foreman, the cable pay-off, and the pulling end, must be established (see Figure 5).

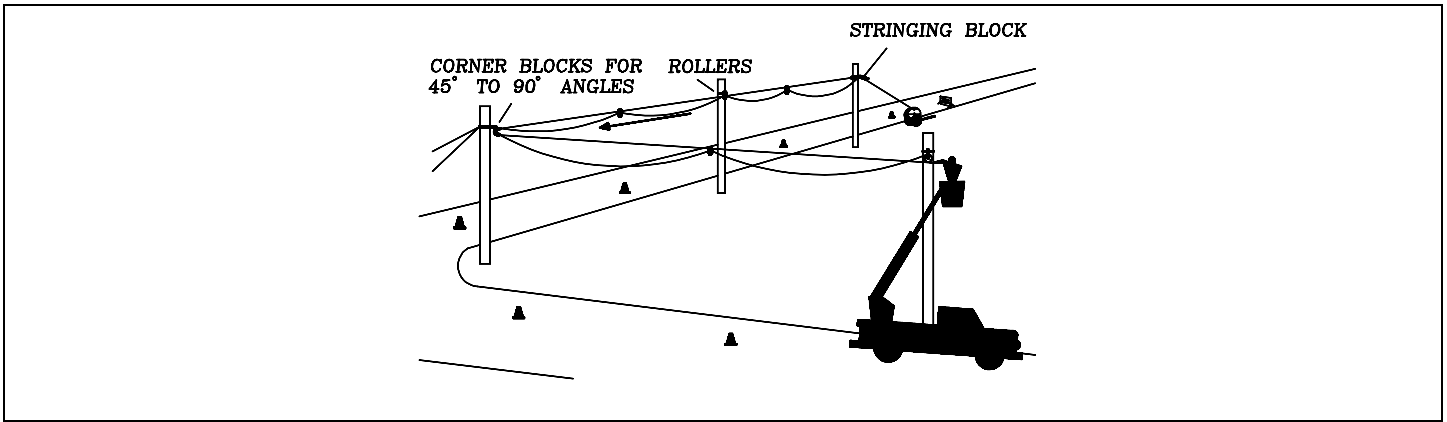

Figure 3

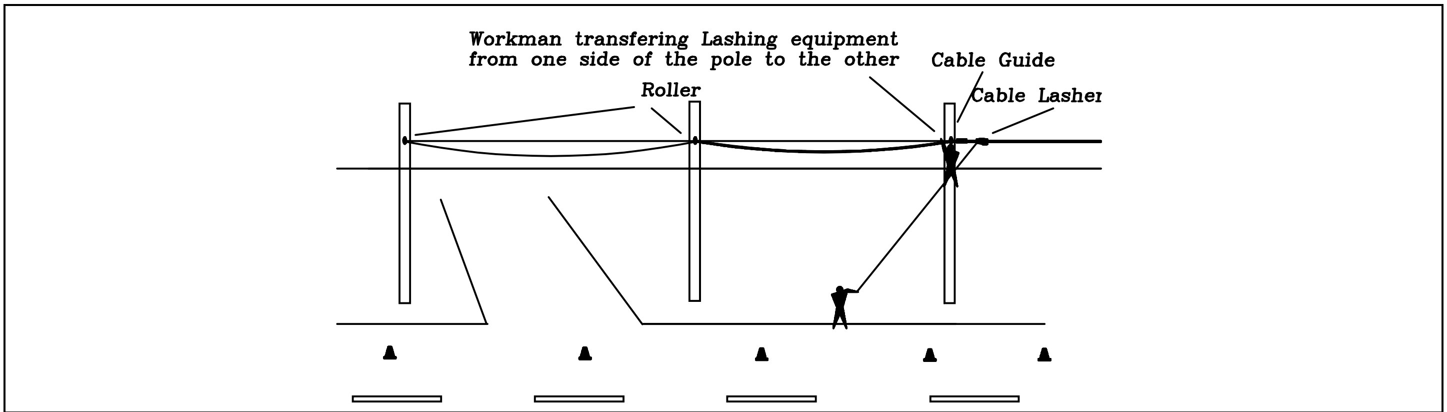

Figure 4

6.13 Sufficient back tension on the payoff reel should be maintained to prevent the cable from running free.

6.14 A self powered winch or assist wheel can be used at intermittent locations along the route where pulling tension approaches the 600 pound limit. This practice eliminates the need for the time consuming task of "figure-eighting". If an assist wheel is used, it should have a tension monitor or threshold setting.

BACK PULLING BY HAND

6.15 When back pulling by hand, a cable puller should be used. The cable is hand pulled along the strand and stringing blocks are positioned on the strand as the cable puller passes. At each pole, a crew member must transfer the cable puller from one side of the pole to the other.

6.16 At the end of the pull, leave enough cable for splicing needs, and temporarily secure cable on the final pole.

6.17 The cable is now ready for lashing, which should be done from the cable end, towards the cable reel.

6.18 Straps, spacers, and bug nuts should be installed on the pole as the lashing proceeds.

6.19 Continue the lashing process span by span until the entire run is lashed into placed.

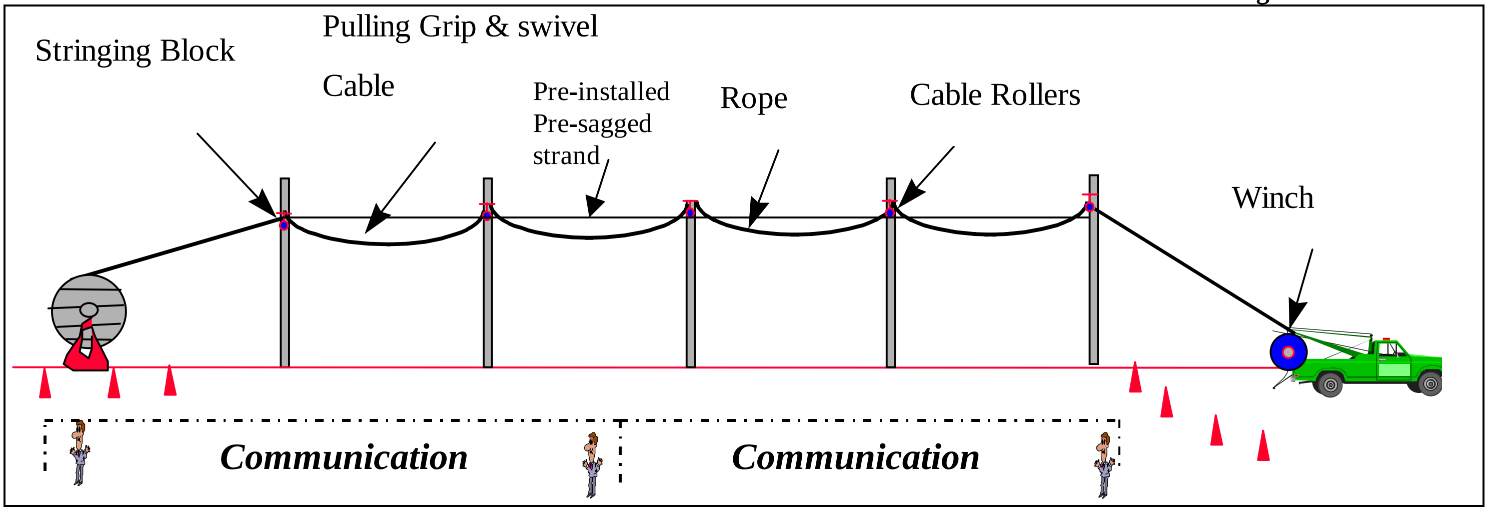

Figure 5

WINCH ASSISTED PULLS

6.20 When using a pulling device, (winch or equivalent), a pull line should be placed in the stringing blocks for the entire length of the run to the cable reel (see Figure 5).

6.21 The cable is pulled into place beneath the strand by taking up the pull line with the winch.

6.22 The cable is then lashed to the strand, starting at the cable end, and proceeding toward the cable reel.

7. CABLE PROTECTION, MECHANICAL

7.1 A tree guard should be used for protecting the cable from a guy, tree, or limb, where necessary.

7.2 To protect cable against abrasion from prolonged contact with a strand attachment or other metallic hardware, a cable guard may be installed over the strand and the cable.

If you have any questions or need additional information, please contact FITEL Lucent Technologies at (800) 889-3203.