

## **19.0 The IRHTP Project Coordinator Or Representative**

**18.1 Work responsibility** IRHTP Project Coordinator or Representative shall make general observations of work as an agent of IRHTP. IRHTP Project Coordinator or Representative's general observation shall not be construed that it shall direct or control operations of Contractor/subcontractor.

## **20.0 Line And Grade**

**20.1. Benchmarks** Contractor shall provide benchmarks, base lines and other reference points. Contractor shall provide competent men and tools, stakes and other materials as required establishing temporary or permanent reference marks in connection with the work. Contractor shall perform such detailed measurements as required to properly lie out and construct work.

## **21.0 Testing**

**21.1. Cable Quality** The Contractor/Subcontractor shall be responsible for on reel verification of cable quality prior to placement.

**21.2. Testing Requirement** One hundred percent (100%) of the cable's fiber count shall be tested at 1310 nm with an OTDR or approved acceptance sheet by manufactory or proof of testing by others. Test results will be recorded on a form supplied by IRHTP. Completed test forms on each reel shall be handed over to the IRHTP Project Coordinator.

**21.3. Cable Responsibility** Subcontractor assumes responsibility for the cable after testing. This responsibility covers all fibers in the cable.

**21.4. Testing Tools** The Subcontractor shall supply all tools, test equipment, consumables and incidentals necessary to perform quality testing.

**21.5. Cable Ends** The cable ends shall be sealed upon completion of testing.

## **22.0 Decisions By IRHTP Project Coordinator**

**22.1. Decisions** IRHTP Project Coordinator shall make decisions, in writing, on claims between Contractor and IRHTP within a reasonable time after presentation. Such decisions shall be regarded as final except for appropriate legal recourse.

## **23.0 On-Site Review Or Observation**

**23.1. Materials Observation** All materials used and all work done by Contractor shall be subject at all times to review, observation, test and approval by IRHTP Project Coordinator/representative. Contractor shall furnish samples of materials for observation and test as requested by IRHTP Project Coordinator. Contractor shall furnish any information required concerning nature or source of any proposed materials or equipment.

**23.2. Construction Observation** IRHTP Project Coordinator may observe construction, fabrication and manufacture of equipment or materials specified herein at plant or factory.

**23.3. Condemnation** IRHTP Project Coordinator may condemn materials, equipment or work that does not satisfactorily meet specifications by written notice to Contractor. Condemned materials, equipment or work shall be promptly removed and replaced.

**23.4. Rejections** IRHTP Project Coordinator may reject defective materials, equipment or work at any time prior to final acceptance by IRHTP even though said defective items may have been previously overlooked.

#### **24.0 IRHTP Project Coordinator And/Or Engineer Technicians**

**24.1. Plan Adherence** OSP Engineers and/or engineer technicians may be appointed by IRHTP Project Coordinator or IRHTP to insure that work is performed in accordance with plans and specifications.

**24.2. Notification** IRHTP Project Coordinator and/or engineer technicians shall have authority to notify Contractor in writing of work that is not being properly performed. Contractor shall be liable for any work determined by IRHTP Project Coordinator as not being properly performed.

**24.3. Deviations** IRHTP Project Coordinator and/or engineer technicians shall have authority to permit deviation from plans and specifications.

#### **25.0 Time**

**25.1. Specified Time** Contractor shall commence work within time specified and shall complete work within time specified in contract.

**25.2. Normal Hours** Contractor shall work normal working hours defined as ½ hour after sunrise and ½ hour before sunset unless it is an emergency situation or change has been approved by IRHTP Project Coordinator.

#### **26.0 Delays**

**26.1. Time Extensions** Delays caused by injunction or legal actions, damages by elements, or other causes beyond control of Contractor (of which IRHTP shall be sole judge) shall entitle Contractor to a reasonable extension of time within which to complete work.

26.1.1. Application for extension of time shall be made to IRHTP by Contractor and shall state reasons for request for extension of time.

26.1.2. No extension of time shall be valid unless made in writing by IRHTP.

26.1.3. Normal weather conditions shall not form the basis of request for extension of time.

26.1.4. Abnormal weather conditions shall form basis of request for extension of time only to the delay in excess of that resulting from normal weather conditions.

#### **27.0 Ownership Of Materials**

**27.1. Payment Responsibility** All materials and work covered by partial payments shall become sole property of IRHTP, but this provision shall not be construed as relieving Contractor from sole responsibility for all materials and work for which payments have been made, for restoration of damaged work, or as a waiver of rights of IRHTP to require fulfillment of all terms of contract.

## **28.0 Other Contracts**

- 28.1. Coordination of contractors** IRHTP reserves right to let other contracts in connection with this work. Contractor shall afford other contractors reasonable opportunity for introduction and storage of their materials and execution of their work, and shall properly connect and coordinate its work with theirs.
- 28.2. Reports of defects** When proper execution of Contractor's work depends upon work of another contractor, it shall inspect other work and report any defects in writing to IRHTP Project Coordinator. Contractor's failure to inspect and report shall constitute an acceptance of other contractor's work except for defects that may develop after completion.
- 28.3. Discrepancies** To insure proper execution of its subsequent work, Contractor shall measure work already in place and shall at once report in writing to the IRHTP Project Coordinator any discrepancy between the executed work and drawings.

## **29.0 IRHTP Right To Do Work**

- 29.1.** If Contractor neglects to prosecute work properly or fails to perform any provision of this contract, IRHTP, after three (3) days' written notice to Contractor, may, without prejudice to any other remedy it may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor, provided, however, that IRHTP Project Coordinator shall approve both such action and amount charged to Contractor.

## **30.0 IRHTP'S Right To Terminate Contract**

- 30.1. Termination of contract** IRHTP, upon certification of IRHTP Project Coordinator that there is sufficient cause to justify termination of contract, may, without prejudice to any other right or remedy, and after giving Contractor seven (7) days' notice may terminate employment of Contractor for any of following reasons:
- 30.1.1. Contractor makes a general assignment for benefit of its creditors, or is adjudged bankrupt.
  - 30.1.2. Receiver is appointed on account of Contractor's insolvency.
  - 30.1.3. Contractor persistently or repeatedly fails or refuses, except when extension of time to complete is granted, to provide enough skilled people or proper materials.
  - 30.1.4. Contractor fails to make prompt payment to subcontractors/suppliers for materials or labor.
  - 30.1.5. Contractor persistently disregards laws and ordinances or instructions of IRHTP Project Coordinator.
  - 30.1.6. Contractor violates a provision of contract.
- 30.2. Conditions of Termination** If IRHTP terminates employment of Contractor, it shall take possession of premises and all materials, tools and appliances thereon. It shall finish work by whatever method it may deem expedient. In such case Contractor shall not be entitled to receive any further payment until work is finished.

**30.3. Unpaid Balance** If unpaid balance of contract price exceeds expense of finishing the work including compensation for additional managerial and administrative services, excess shall be paid to Contractor. If expense exceeds unpaid balance, Contractor shall pay difference to IRHTP. Expense incurred by IRHTP as herein provided, and damage incurred through Contractor's default, shall be certified by IRHTP Project Coordinator.

**31.0 Contractor's Right To Stop Work Or Terminate Contract**

**31.1. Failure to Pay** If IRHTP Project Coordinator fails to issue any certificate for payment within fifteen (15) days after it is due, or if IRHTP fails to pay to Contractor with thirty (30) days of its maturity and presentation, any sum certified by IRHTP Project Coordinator, then Contractor may, upon seven (7) days simultaneous written notice to IRHTP and IRHTP Project Coordinator, stop work or terminate this contract. If Contractor elects to terminate this contract by written notice it shall recover from IRHTP payment for all work executed to date of notice and any loss sustained upon any plant or materials plus a reasonable profit.

**32.0 Payments Withheld**

**32.1. Nullification of Payment** IRHTP Project Coordinator may withhold or nullify the whole or a portion of payment certificate, based on subsequently discovered evidence, to such extent as may be necessary to protect IRHTP from loss from:

- 32.1.1. Defective work not remedied.
- 32.1.2. Claims filed or reasonable evidence indicating probable filing of claims.
- 32.1.3. Failure of Contractor to make payments properly to subcontractors/suppliers or for materials or labor.
- 32.1.4. A reasonable doubt that contract can be completed for balance then unpaid.
- 32.1.5. Damage to another contractor.
- 32.1.6. Claims of IRHTP for liquidated damages.
- 32.1.7. Payments shall be made for amounts withheld when above grounds are removed.

**33.0 Final Review, Acceptance And Final Payment**

**33.1. Final Statement** When work has been satisfactorily completed, IRHTP Project Coordinator will certify Contractor's final estimate stating that work has been completed in accordance with terms and conditions thereof with qualifications, if any, as stated. Balance found to be due Contractor according to the terms of payment shall be paid by IRHTP as specified in contract, provided, however, that any state laws which designate manner of final payment shall be followed in lieu of manner of final payment outlined above. Prior to receipt of final payment, Contractor shall file with IRHTP a receipt in full from each manufacturer, subcontractor, and dealer for all equipment and materials used on the work and a complete release of all liens, including tax liens, which may have arisen from this contract and required statements from Contractor and all subcontractors of sales and use tax paid. In lieu thereof, IRHTP, at its option, may accept from Contractor a statement showing balance due on all accounts.

**33.2. Notification of Completion** Notify Engineer when project is considered to be complete and ready for final review.

**33.3. Cost of Additional Inspections** IRHTP will not make more than 2 trips to any one site for inspections. If site requires more than 2 trips, OSP Cable Contractor will pay time, material & vehicles charges for additional inspections. This paragraph inclusive of item 13.13 in RESPONSIBILITY OF CONTRACTOR.

**33.4. Certification** When Engineer has certified that he has reviewed the work of Contractor and stated that it is complete and in substantial conformance with the plans and specifications.

When Contractor has submitted to IRHTP and Engineer documents called for in, Annex I, Link Segment OSP Completion Check List.

#### **34.0 Suspension Of Work**

**34.1. Notice to Suspend Work** IRHTP may suspend work, or any part thereof, at any time, by giving ten (10) days' written notice to Contractor. The work shall be resumed by Contractor within ten (10) days after date fixed in written notice from IRHTP to Contractor to do so.

**34.2. Abandonment of work** If work, or any part thereof, shall be suspended and if IRHTP does not give written notice to Contractor to resume work within one (1) year of date of suspension, Contractor may abandon suspended portion of work. Contractor will be entitled to estimates and payments for all work done on the portions so abandoned, if any.

#### **35.0 Cleaning Up**

**35.1. Rubbish** Contractor shall keep premises free from accumulations of waste material or rubbish caused by its employees or work. After completion of work it shall remove all its rubbish and all its tools, scaffolding and surplus materials from work site. It shall leave its work "broom clean" or its equivalent, unless more exactly specified. In case of dispute the IRHTP may remove rubbish and charge cost to Contractor as IRHTP Project Coordinator shall determine to be just.

#### **36.0 Definition Of Terms**

**36.1.0 MERGED AREA** The Numerical designation given to Merged Area HCP Districts and selected numbers given to other Part 1 End Points as below:

**36.1.1. BER** Bit Error Rate is a quality measurement for digital transmissions.

**36.1.2. CAPACITY** The sizing of the transmission links in terms of digital data rate requirements and refers to the traffic-handling capacity.

**36.1.3. CUTOVER OR ACCEPTANCE OF SERVICE** The date on which a specific element of the network has been accepted by the IRHTP and placed into service and the lease commences.

**36.1.4. dB** The abbreviation for decibel used to define relative signal strength.

**36.1.5. ELEMENT** A specific connection including all electronics, equipment and facilities required to provide Gigabit service.

**36.1.6. FACILITIES** Transmission lines or circuits available to provide service.

**36.1.7. FAR END** Refers to the network end point connected to an IRHTP access point.

- 36.1.8. **FCPC** Type of optical fiber connector with low connection loss and high reflection loss characteristics.
- 36.1.9. **F.O.T.** Fiber Optic Termination equipment
- 36.1.10. **IRHTP** Iowa Rural Hospital Telecommunications Program
- 36.1.11. **INTERPRETATION** Words used in the present tense shall include the future, the future tense shall include the present, the plural shall include the singular, and the masculine shall include the feminine.
- 36.1.12. **LINK-SEGMENT** A link-segment is a fiber optic facility that extends from a predetermined point to another predetermined point. For example, the fiber that extends from the "A" Location (the HCP) to the appropriate end point (Z) location. The link-segment includes the appropriate electronics necessary to make it operational.
- 36.1.13. **MEDIA** Channels of communications, i.e., digital signal transport facilities.
- 36.1.14. **MERGED AREA** (refers to locations-educational institutions) Each Iowa County is assigned to a geographic cluster of counties and each geographic cluster of counties is identified as a separate merged area. However, individual counties may be divided between or among more than one merged area.
- 36.1.15. **MTBR** A statistical method for estimating failures of electronic equipment (Mean Time Between Failure)
- 36.1.16. **MTTR** A statistical method for estimating electronics and facilities repair time (Mean Time to Repair)
- 36.1.17. **NEAR END** Refers to the IRHTP access point used to connect an individual network element.
- 36.1.18. **nm** Abbreviation for nanometers, a measure applied to the wavelength of light transmitted over an optical fiber.
- 36.1.19. **ORDERWIRE** A voice circuit with equipment connecting a far (remote) end point and the near end point for maintenance activities.
- 36.1.20. **PART I** All Part I Elements for the entire IRHTP.
- 36.1.21. **PART I END POINT** A State provided facility at which Part I link and Part II links are terminated. Regional switching functions are provided. Serves as the Point of Presence for the county in which it is located.
- 36.1.22. **PART II END POINT** A State provided facility at which Part I and Part II links are terminated. Switching (secondary) is provided. Serves as the Point of Presence for the county in which it is located.
- 36.1.23. **PART III END POINT** The communications connection between secondary switching centers and individual accredited nonpublic schools, public schools and city, regional, HCP's and county libraries.
- 36.1.24. **POP** Point of Presence is the IRHTP part I or Part II in a specific municipality that may be used as an IRHTP access point for interconnecting network elements.

- 36.1.25. **REGIONAL SWITCHING CENTERS** The Part I end points providing interconnectivity for Part II end points and future Part II and Part III and other IRHTP end points.
- 36.1.26. **RESPONSE** Refers to the time expended from receipt of trouble, through the testing process and dispatch of the repair technician if required.
- 36.1.27. **RFP Request** for Proposal.
- 36.1.28. **"SHALL"** Is always mandatory.
- 36.1.29. **SINGLE MODE** Single mode designates an optic fiber which passes only the fundamental or lowest order mode at the light wavelength of interest (namely, 1310nm and 1550 nm for this RFP)
- 36.1.30. **SITE Connection** within or adjacent to a new IRHTP end point.
- 36.1.31. **SONET** Synchronous Optical Network is an American and international transport system utilizing the STS - 1 (Synchronous Transport Signal, level 1) as a root base.
- 36.1.32. **SONET LIGHTWAVE SYSTEM** A digital (SONET based) network element consisting of OC-(n) fiber optic transmission equipment, fiber facilities, batteries, rectifiers, alarm system, and capable of being independently switched and utilizes the overhead for control.

## **SECTION 2 - Special Construction**

### **1. General**

- 1.1. Procedures outlined below are not intended to fully cover all special procedures or emergencies which may arise during construction but are offered as an aid to Contractor in planning work; Contractor will cooperate with City, Hospitals, Schools, and Engineer to minimize inconvenience, construction delays and interruptions to continuous operation of existing fiber facilities.
- 1.2. Determine location of all underground utilities before starting excavation work; locations of underground appurtenances are approximate and not guaranteed by IRHTP. (Reference 13.6, Responsibility of Contractor in PART 1 OF DETAILED SPECS)
- 1.3. Remove and replace all signs and other appurtenances that interfere with construction operations; replace damaged signs at no cost to IRHTP.
- 1.4. Limit construction operations to all provided property, rights-of-way and easements. Provide barricades, lights, signs and detours as necessary to reroute traffic around construction areas. **(Inclusive of 17.0, Safety & 3.0, Right of Way in PART 1 OF DETAILED SPECIFICATIONS.)**
- 1.5. Arrange with operating utilities for relocation or temporary removal of utilities in conflict with construction and for service needed during construction at no cost to IRHTP.
- 1.6. Dispose of materials removed during construction at locations as approved by Engineer.
  - 1.6.1. Dispose of waste products containing prescribed materials at approved landfill.
  - 1.6.2. Dispose of surfacing, broken concrete or rubble, excess excavated materials and spoil.
  - 1.6.3. Place excess excavated material at locations designated by Engineer.
- 1.7. Notify businesses and residents two days in advance, when construction will disrupt or block access to property.
- 1.8. Provide snow fence along boundaries of construction area as specified hereinafter and as directed by IRHTP Project Coordinator.
  - 1.8.1. Install snow fence when area is prepared for excavation; install on steel posts with maximum spacing of 8'; maintain until work is complete.
  - 1.8.2. Provide snow fence around all open trenches or open structures when left unattended.
  - 1.8.3. Provide snow fence to keep livestock away from construction activities.
- 1.9. Backfill trench as construction progresses.
- 1.10. Cleanup and provide surface restoration as work progresses.
- 1.11. Submit complete detailed construction procedure schedule after award of contract for planning, scheduling and controlling construction of project.
- 1.12. Contractor will be expected to provide adequate personnel and equipment to perform work within specified time of construction.

1.13. Extensions of contract period will be given consideration upon written request of Contractor; request must include valid supporting data and bona fide reasons for requesting extension; IRHTP expects work to be complete and ready for final acceptance within completion time specified.

1.14. Protect survey markers of lot corners.

**2. Cooperation With Others**

2.1. Advise all utilities prior to excavating in area where construction might affect underground gas, electrical, telephone, cable or water service.

2.2. Advise Telephone Company of proposed construction schedule as it relates to telephone service.

2.3. Advise Power Company of proposed construction schedule as it relates to electrical power.

2.4. Advise Gas Company of proposed construction schedule as it relates to gas service.

2.5. Advise Water Company of proposed construction schedule as it relates to water service.

2.6. Advise Cable Television Company of proposed construction schedule as it relates to cable television.

**3. Continuity Of Existing Utility Systems**

3.1. Prepare detailed construction procedure schedule after award of contract: show definite and positive action to be taken to minimize disruption to utility systems.

3.2. Meet with all utilities to determine operability of isolation to determine area for which service would be shut off for each utility.

**4. Survey Markers**

4.1. Contractor responsible for hiring registered land surveyor to inventory existing pipe, pins and registered survey lot corners disturbed by construction; land surveyor responsible for setting reference markers required to re-establish location of existing pipe, pins and registered survey lot corners; land surveyor will not be required to certify pins or pipe replace as being lot corners; replace all markers disturbed by construction including where more than one pipe, pin or other marker are present at a location, replace all markers in same location as removed; provide drawing to IRHTP showing locations where markers were found and reset; dimensional data not required on drawing; each pipe, pin or marker replaced must be the identical marker removed at that location

**5. Contaminated Soil Finds**

5.1. If during course of construction evidence of deposits of contaminated soils are found, cease operations affecting find and notify IRHTP who will notify Iowa Department of Natural Resources; no further disturbance of deposits will ensue until notification by IRHTP that work may proceed; IRHTP will issue notice to proceed only after contaminated soils have been identified and procedures for remedial action have been determined and approved by Iowa Department of Natural Resources and IRHTP; compensation to Contractor, if any, for lost time or changes in construction due to changed conditions will be in accordance with change order provisions of specifications.

**6. Payment**

6.1. No separate payment will be made for work covered under this part of the specifications.  
Include all costs in appropriate unit prices.

## **SECTION 3 - Excavation And Backfill**

### **1. General**

- 1.1. Excavation for trenches as specified herein; provide pipe/fiber as specified and shown on Standard Drawings for pipe/fiber installation.
- 1.2. Protect existing pavement from damage during construction if not shown on plans for removal; if damage occurs, replace in kind at no cost to IRHTP.
- 1.3. Remove, replace and repair items such as fences, storm drains, signs, hanging wires and other obstructions to accommodate construction equipment or to facilitate excavation; cost to remove and replace is incidental to construction.
- 1.4. Haul away and stockpile excavated material suitable for backfill; haul remainder of excavated material to an authorized waste site.
- 1.5. Remove soil not suitable for backfill; waste at disposal area specified in PART 2, SPECIAL CONSTRUCTION, Section 1.6 & 5.0; removal is incidental to construction, include cost in unit prices.
- 1.6. Where new work crosses existing utilities or utility services, excavate in advance of construction; determine crossing arrangement including exact construction line and grade. As specified in PART 1 - GENERAL REQUIREMENTS, Section 13.4 - 13.6, Responsibilities of Contractor.
- 1.7. Bore or jack under existing streets, utilities and structures except as noted on plans or as modified by IRHTP Project Coordinator.

### **2. Definitions**

- 2.1. Earth: all materials including clay, silt, sand, gravel, hardpan, rock, shale, debris, junk, and brick, which can be removed by use of suitable excavating equipment and pneumatic tools.

### **3. Excavation For Structures**

- 3.1. Includes excavation for manholes and other appurtenances.
- 3.2. Excavate as required to firm, undisturbed soil for laying conduit. In the case of hand holes/manholes excavate six (6") inches below bottom of structure and fill with six (6") inches of ¾" river rock at no expense to IRHTP.
- 3.3. Provide sheeting, shoring, and bracing where required to hold walls of excavation or to protect existing structures or utilities.
- 3.4. When unstable material is encountered which will not, in opinion of IRHTP Project Coordinator, provide suitable foundation, remove and replace with granular stabilizing material as directed by IRHTP Project Coordinator in writing, cost incidental to construction.

#### **4. Trench Excavation**

- 4.1. Keep width of trench as narrow as possible and still provide adequate room for backfilling and jointing.
- 4.2. Keep sides of trench as nearly vertical as practicable; comply with federal and state safety regulations.
- 4.3. Maximum desirable width of trench at top of fiber; as shown on Standard Drawings.
- 4.4. Excavate by hand:
  - 4.4.1. Under and around utilities.
  - 4.4.2. Where overhead clearance prevents use of machine.
  - 4.4.3. To protect trees and shrubs where shown on plans.
- 4.5. Remove top 18" of topsoil and store in segregated stockpiles for backfill prior to trench excavation.
- 4.6. The trench shall be as straight as practical. The bottom of the trench shall be smooth and free from any sharp edges. The trench shall be kept clear of debris and loose rock. All changes in trench grade shall be gradual.
- 4.7. The length of open trench shall not exceed 100' feet at the end of each working day. Any open trench, bore pit, or pothole shall be fenced, covered or otherwise barricaded to protect the general public at all times. Exceptions are subject to approval by the IRHTP. Good judgment and care must be exercised to prevent persons from falling into the open trench, or other damages

#### **5. Rock Sawing**

- 5.1. Solid rock is defined as a consolidated rock that cannot be plowed to specified depth. Frozen ground is not considered solid rock.
- 5.2. Where solid rock is encountered, the cable will be protected by steel, PVC conduit, high-density polyethylene conduit (HDPE) at the desecration of the IRHTP or its authorized representative.

#### **6. Rock Excavation (Not Recommended)**

- 6.1. Use of explosives; submit detailed plans outlining all proposed blasting operations, locations, methods and use of mats and other safety measures.
  - 6.1.1. Obtain written approval from IRHTP and Engineer before using explosives.
  - 6.1.2. Provide Special Hazard Insurance covering liability for all blasting operations.
  - 6.1.3. Use thoroughly experienced demolition personnel.

#### **7. Rubble Excavation**

- 7.1. Rubble, as specified and defined herein, may be encountered along route.
- 7.2. Removal: as specified for rock.
- 7.3. Use of explosives: as specified for removal of rock.

## **8. Sheeting, Shoring, And Bracing**

- 8.1. Minimum shoring requirement; equivalent construction procedure to use of "sand box" to provide 8' vertical protection; provide stacked sand boxes as required to maintain construction within construction limits.
- 8.2. Construct sheeting, shoring and bracing to hold walls of excavation where shown on plans or at other locations, to provide safety for workmen, to protect existing utilities or structures or to permit construction in the dry, sheeting operations which in the opinion of IRHTP Project Coordinator cause excessive vibration will not be allowed.
- 8.3. Leave sheeting and shoring in place when removal, in the opinion of IRHTP Project Coordinator, might damage new facility, existing utilities or structures.
- 8.4. Sheeting, shoring and bracing is incidental to construction; include cost in appropriate unit cost.

## **9. Dewatering**

- 9.1. All work must be done in a dry environment; obtain IRHTP Project Coordinator's approval on methods of dewatering.
- 9.2. Provide for handling of water encountered during construction.
- 9.3. Lay no pipe/fiber in or pour no concrete on excessively wet soil.
- 9.4. Prevent surface water from flowing into excavation; remove water as it accumulates.
- 9.5. Divert stream flow away from areas of construction.
- 9.6. Do not pump water onto adjacent property without approval of IRHTP Project Coordinator.
- 9.7. Dewatering is incidental to construction; include cost in appropriate unit cost.

## **10. Existing Utilities**

- 10.1. Hold a preconstruction meeting 3 days prior to beginning construction. Document meeting with a sign-in sheet detailing names, addresses, phone & fax numbers of company representatives present. Take minutes of meeting and hand documentation in with as built package.
- 10.2. Locations of utility lines, mains, cables and appurtenances are the responsibility of contractor; confirm locations of underground utilities by excavating ahead of work; Contractor fully responsible for damage to utilities during construction.
- 10.3. Protect services during construction.
  - 10.3.1. If utility services are in direct conflict with line and /or grade of new facility; notify IRHTP immediately; provide all necessary shut-down, repair, and relocation where conflicts occur; furnish labor, equipment, pipe and fittings; repair and relocation will be paid by contractor; when broken due to carelessness, repair is incidental to construction.

10.3.2. Support and protect, by timbers or other means, all utility pipes, conduits, poles, wire and other apparatus not to be moved; protective measures subject to approval of IRHTP Project Coordinator.

10.3.3. No utility or utility service will be moved to accommodate equipment employment; method of operation or for convenience of Contractor when utility or utility services does not conflict directly with line and grade of work.

## **11. Tree Removal**

11.1. Remove trees only in conflict with alignment of trenches or location of structures.

11.2. Removal includes grubbing and removing stump and roots, removal from site, disposal of debris and backfilling.

11.3. Tree and bush removal is incidental to construction; include cost in applicable unit price.

## **12. Backfill For Structures**

12.1. Backfill after concrete, masonry, or glue has cured, and waterproofing, if specified, has been inspected and approved by Engineer.

12.2. Backfill with material removed from excavation; use no debris, frozen earth, large clods, stones or other unsuitable material.

12.3. Backfill simultaneously on all side of structure; save structure from damage at all times.

12.4. Terminate at original grade or at elevation shown on plans; dispose of excess excavation as directed by Engineer.

12.5. Prepare backfill for surface restoration as specified for adjacent trench.

## **13. Trench Backfill**

13.1. Backfill trench immediately after contractor has recorded sequence marking on cable or location of connections and appurtenances or at IRHTP Project Coordinator's direction; backfill with select material excavated from trench.

13.2. Use no large stones, large clods, organic matter, rubbish, frozen or unsuitable materials in backfill; furnish extra soil from site to complete backfilling at no extra cost to IRHTP; remove and dispose of unsuitable material; backfill simultaneously on both sides of pipe to prevent displacement.

13.3. Hand place and carefully compact backfill to 1' over top of facility.

13.4. Backfill 1' over top of facility in layers not to exceed 18"; where compacted backfill shown on plans, compact to minimum 95% maximum density.

13.5. Backfill above PVC pipes:

13.5.1. Backfill with pipe bedding material to minimum 6" above top of pipe; do not drop pipe bedding material from equipment bucket more than 2' above pipe; all pipe bedding material including backfill material is incidental to construction.

13.5.2. Above pipe bedding material, backfill with excavated material, except frozen material, shale, and other non-suitable material; do not drop backfill material from

equipment bucket more than 2' above bottom of trench until backfill material is in place 18" above bedding backfill material.

- 13.5.3. Consolidate bottom 6" of trench backfill with hand tools and tampers; do not use vibratory plate compactor until above bottom 18" of trench backfill.
- 13.5.4. Cable marking ribbon shall be installed above all trenched direct-buried HDPE/conduits. The ribbon shall generally be placed at a depth of 12" inches below grade and directly above the fiber/HDPE/conduits.
- 13.5.5. Splice boxes/hand holes will be placed at all splice locations. Hand holes will be placed at intervals of approximately 1000' feet, change of direction, greater than 15% and as shown on construction drawings and typical drawings. Hand holes may be moved to locations more practical when necessary upon approval by the IRHTP.

#### **14 Surface Restoration**

- 14.1. All trenches: replace 18" of topsoil removed during excavation.
- 14.2. Grade tops of trenches to smooth, uniform lines without large lumps, clods or debris.
- 14.3. Dispose of all brush and rubbish as directed by IRHTP Project Coordinator.
- 14.4. Sod/seed all areas disturbed by construction unless otherwise shown on plans or as directed by IRHTP Project Coordinator.
- 14.5. Prepare site for seeding by disking, harrowing and had raking or other means following site grading; work soil to depth of 3".
- 14.6. Precede seeding with uniform application of commercial grade fertilizer at rate per acre of 20 lbs. of nitrogen, 40 lbs. of phosphorous and 20 lbs. of potassium (400 lbs. of fertilizer grade 5-10-5 per acre, or approved equal); cultivate area 3" deep and work with harrow within 24 hours before seeding; smooth surface to eliminate clods and lumps before seeding.
- 14.7. Seeding in street parkings, lawns and developed areas (Type 1):
  - 14.7.1. Seed at rate of 85 lbs. per acre with following mixture proportioned by weight.

<b>SEEDING</b>	<b>PERCENT</b>
Kentucky Bluegrass	35%
Annual Rye	25%
Perennial Rye	20%
Creeping Red Fescue	10%
Chewing Fescue	10%

- 14.8 Seeding in City rights-of-way, railroad rights-of-way, pastures, farm fields and creek banks (Type 2):

6.2. 14.9 Seed at rate of 1.25 lbs. per 1000 SF with the following mixture proportioned by weight:

SEEDING	PERCENT
Brome grass	60%
Alfalfa	20%
Red Clover	12%
Alsike Clover	8%

14.10 Add rye to seed mixture at rate of 1 bushel per acre if seeded between August 15 and October 15; add oats at rate of 1-1/2 bushels per acre if seeded between April 1 and May 30.

14.11 Inoculate alfalfa and clover seed not more than 8 hours before sowing.

14.12 Seed between dates of August 15 and October 15 or between dates of April 1 and May 30.

14.13 Cover seed by rolling with cultipacker, or by dragging or hand raking.

14.14 Mulch all seeded areas: mulch: dry oat straw at rate of 4000 lbs. per acre; stabilize mulch with tiller designed to anchor mulch to soil.

14.15 Water seeded area sufficiently to saturate seed bed; continue watering all areas until growth is established.

14.16 Contractor is responsible for turning over to IRHTP full stand of grass; replant or redevelop bare spots or areas not attaining full stand of grass during first growing season.

14.17. No separate payment will be made for work covered in this part of the specifications. Contract unit prices shall include all cost for restoral.

#### **15. Street & Driveway Replacement**

15.1 Replace surface with new surfaces to match construction for type, size and surface texture unless otherwise specified.

15.2 Gravel or crushed stone:

15.2.1 Place 6" compacted crushed stone in top of trench; conform to IDOT Class A crushed stone; place and compact in two lifts.

15.2.2 Place additional compacted crushed stone beyond trench limits to widths shown on plans to restore to existing conditions; minimum thickness: 2".

15.2.3 No separate payment will be made for work covered in this part of the specifications.

#### **16. Field Drain Lines**

- 16.1 Field drain lines may be encountered along route of new sewer; notify IRHTP Project Management if drain conflicts with facility construction.
- 16.2 Where new facility crosses under field drain lines, replace with a length of Schedule 40 PVC pipe; match size of existing drain line; cut 1/8" to 1/4" wide slots at 12" centers transverse to pipe for slots on bottom; replacement paid for by contractor.
- 16.3 Where new facility parallels field drain lines, replace damaged field drain lines; match size and material of existing drain line.
- 16.4 No separate payment will be made for work covered in this part of the specifications.

#### **17. Fence Removal And Replacement**

- 17.1 Remove fence for construction access as required within easements.
- 17.2 Miscellaneous fence removal and replacement is incidental to construction; restore fence to original or better condition; replace wooden fence posts with new posts unless directed otherwise by Engineer.
- 17.3 No separate payment will be made for work covered in this part of the specifications.

#### **18. Directional Boring**

- 18.1 This includes all labor, equipment, and materials to install a minimum of one 1-1/4 inch diameter HDPE using directional boring techniques. The running line of the duct shall be kept straight and level unless otherwise specified in the final construction drawings. Any changes, either vertical or horizontal, shall be gradual and not to exceed 1.5' deviation in less than 6" (inches). Special care shall be taken to insure that the duct connection between bores be kept straight and level. When installing inner-ducts, conduits shall be color coded or marked to aid in identifying the respective ducts. This color-coding shall be observed during connection to assure duct continuity.
- 18.2 This unit also includes any pothole excavation for whatever purpose along with the pothole restoration. The barricading and safeguarding of pothole excavations shall comply with **BACKFILL & EXCAVATION** section. Backfill and restoration of excavation shall comply with Federal, State or local governing agency requirements.
- 18.3 Entrance of HDPE conduits into manholes and hand holes/splice boxes shall be in a level and straight line to facilitate installation of fiber optic cable.
- 18.4 Every effort shall be made to maintain a minimum of twelve (12") inches of clearance between IRHTP conduit and other utilities.
- 18.5 The boring machine shall be grounded at all times during operation. The grounding method shall comply with the manufacturer's guidelines and requirements. Adequate barricades shall be erected to limit access to boring machine operation personnel only.

#### **19. Payment**

- 19.1 No separate payment will be made for work covered in this part of the specifications. Include all costs in appropriate unit prices.

## **SECTION 4 - Pipes And Structures**

### **1. Pipe Materials**

- 1.1. Polyvinylchloride pipe (PVC):
- 1.2. Steel casing pipe: 0.25" under roadway; use for casing pipe where shown on plans.
- 1.3. HDPE
- 1.4. Plenum raceway

### **2. Pipe Joints**

- 2.1. Polyvinylchloride (PVC) schedule 40: couplings and/or integral bell.
- 2.2. HDPE connectors: approved by the manufacture.
- 2.3. Steel pipe
- 2.4. Plenum connectors approved by the manufacture.

### **3. Joint Protection & Inspection**

- 3.1. Carefully protect joints from injury while handling and storing pipe.
- 3.2. Use no deformed, gouged or otherwise impaired joints.
- 3.3. Clean bell and spigot surface of dirt and foreign matter before jointing pipe.
- 3.4. Use cleaner or primer.
- 3.5. Make joints in strict accordance with manufacturer's recommendations.

### **4. Pipe Installation**

- 4.1. All inner-duct, HDPE or conduit shall be tagged or color-coded.
- 4.2. Before laying pipe, verify all measurements at site; make necessary field measurements to accurately determine pipe make-up lengths or closures.
- 4.3. Keep pipe free of all dirt and foreign material
- 4.4. Use no defective pipe; check each length for defects and hairline cracks at ends prior to lowering into trench.
- 4.5. Lower pipe carefully into trench.
- 4.6. Pull joints together with equipment recommended by pipe manufacturer; do not use backhoe or similar equipment to push joints together.

### **5. Connections Between Dissimilar Pipe**

- 5.1. Provide manufactured adaptor or coupling.

### **6. Pipe Conflicts**

- 6.1. Where pipe parallels an existing facility maintain at least 1 foot of separation.
- 6.2. Where pipe crosses an existing facility maintain at least 1 foot of separation.
- 6.3. Provide all necessary shut-down, repair and relocation of existing facilities where conflicts occur; furnish labor, equipment, pipe and fittings; repair and relocation will be

paid by contractor. When existing facility is damaged to carelessness repair is incidental to construction.

6.4. Conflicts as specified in EXCAVATION AND BACKFILL.

7. **Tracer Wire Installation**

7.1. Tracer wire shall be placed with all HDPE conduit installed unless armored or traceable cable is used. The tracer wire shall be provided by the contractor. The contractor that installs the HDPE conduits shall install, splice, and test (for continuity) the tracer wire. If the tracer wire is not placed or is broken during installation, the contractor shall notify IRHTP Project Management immediately. The area of the route that does not have tracer wire installed shall be identified on the as built documents submitted by the contractor. IRHTP will have the tracer wire installed by the subcontractor that installs the fiber optic cable or by other means. If the tracer wire is installed by a contractor other than the contractor that installs the HDPE conduits, the IRHTP will charge the HDPE installation contractor reflecting IRHTP cost to have the tracer wire installed.

7.2. On multi-duct installation install a 5/8" x 8' copper clad ground rod in the hand hole located on public r/w. Place a #12 insulated copper locate wire from the ground rod to the FOTS room or to the outside of the building directly below the pull box and terminated on one side of a Reliance 5533 insulated indoor/outdoor terminal block with copper connectors. Run a #12 copper wire from this terminal block to the master ground bar in the FOTS room or place a ground rod on the outside of the building. Locate block in an accessible location. This is for locate "purposes only". This is not for grounding purposes. Note on as-built where ground is placed and tag locate wire as "locate wire".

8. **Proofing The Duct**

8.1. All inner-duct, conduit/multi-duct will be proofed upon completion to verify continuity and integrity of the duct by pulling a solid rubber mandrel or a mandrel of other solid material such as steel or aluminum. The mandrel shall be at least 6" long and 1" in diameter. An IRHTP representative must be present to witness all duct proofing operations, duct that is not proofed in the presence of an IRHTP representative shall not be considered complete. The preinstalled mule tape of polypropylene rope may be used for this purpose but the tape or rope must be reinstalled upon completion of proofing. The reinstalled tape or rope must be free of damage, equal to its original integrity and free of other defects that would render it unsuitable for cable pulling.

9. **Multiple Duct Installation**

9.1. This item includes all labor, equipment and certain materials required to install four (4) 1.25" I.D. HDPE conduits in controlled access roadways and other locations as provided by in the utility accommodation policy. The HDPE conduits will be of different colors and will be plowed in place in such a manner that the duct to contain the IRHTP cable will be on top. The duct containing the IRHTP cable will be pre-inserted with a .25" nylon rope. All ducts shall have continuity. Refer to Appendix 1.17 on Sleeves.

9.2. Hand holes will be installed every mile to facilitate pulling, preferably at highway mileposts. However, hand holes may be moved to locations more practical when necessary upon approval by the IRHTP. All ducts shall enter and exit the hand holes. Should mid-assist points become necessary when pulling the cable, the ducts shall be

spliced together in a watertight condition. Upon completion of cable placement hand holes will be duct plugged and gopher proofed.

**10. Manholes/Hand Holes**

10.1. Use non-shrink grout between pipe and manhole block out.

**11. Payment**

11.1. No separate payment will be made for work covered under this part of the specifications. Include all costs in applicable unit prices for items to which work pertains.

11.2. Pipe in Place, LF:

11.2.1. Unit price includes furnishing pipe, handling, laying pipe bedding if required, materials, trench excavation, dewatering, connections between dissimilar pipes, connections to existing system, connections of existing pipes and appurtenances, sheeting, shoring and bracing, backfilling, service connections, tree and brush removal, surface restoration including seeding, fencing, and miscellaneous associated work.

11.2.2. Length will be measured along centerline of pipe with no deduction for manholes, including manholes.

11.3. Standard Manholes, Each Unit price includes furnishing, installing, excavating, concrete, frame and cover, connections of or to existing facilities, backfill and miscellaneous associated work for manholes 0 - 10' deep.

11.3.1. Diameter of manhole as shown on plans as specified.

11.4. Hand holes, Each Unit price includes furnishing, installing, excavating, frame and cover, connections of or to existing facilities, backfill and miscellaneous associated work.

**12. Bedding Requirements**

12.1. Bedding for manholes/hand holes: lay manholes/hand holes on 6" deep bedding material (3/4" river rock); fill around perimeter of manholes/hand hole to minimum depth of 6" deep bedding material (3/4" river rock). Compact all bedding material by vibration.

## **SECTION 5 - Specifications For Buried Installation Of Fiber Optic Cable**

### **1. General**

- 1.1. This specification covers the buried installation of a fiber optic cable by various methods for the IRHTP Network. Methods of direct burial are plowing, trenching or boring. Sections designated by the Contractor and crossings such as roads and streams shall be installed with external protection as specified herein. Installation of hand holes for use as pull boxes and splice boxes is covered herein, as is any work required at regenerator sites.
- 1.2. As required, the cable shall be removed from the reel by approved methods and pulled through the pipe crossings or under other utilities and replaced on the reel to continue the installation operation. The cable will be installed in various lengths up to 12 kilometers as determined by the Contractor.
- 1.3. Hand holes will be installed per the applicable Standard Drawing at intervals or locations called for in the specifications or drawings. Bends of small radii and twists that might damage cable shall be avoided. During the placing operation, cable shall not be bent in a radius less than 20 times the outside diameter of the cable.

### **2. Material**

- 2.1. IRHTP Compatible/Specified Material: Contractor will furnish the materials listed below:
  - 2.1.1 Armored Fiber Optic Cable meeting SMF-28/GR/253 fiber specifications
    - Single Jacket
    - Loose Tubes, Three tubes of 12 fibers each (Dri-Core)
    - 36 total fibers
    - Color coded Buffer Tubes
  - 2.1.2 Non-Armored Cable (Kevlar)
    - Kevlar Cable must be in duct and must include a #10 AWG tracer wire inside the duct.
  - 2.1.3 All rack mounted bulkheads or FDP's shall be equipped with SC style connectors
  - 2.1.4 Warning Tape
  - 2.1.5 Hand Holes
  - 2.1.6 S.I.P. Peds
  - 2.1.7 Sign Post & Signs
  - 2.1.8 Ground Rods & Clamps, Bare #6 Wire
  - 2.1.9 PVC Pipe - Schedule 40
  - 2.1.10 GIP
  - 2.1.11 BIP
  - 2.1.12 Cable Lubricant
  - 2.1.13 Pulling Rope - 600 lb test

### **3. Definition Of Terms**

- 3.1. Road Gravel. Material used for restoration of all gravel surfaces shall conform to IDOT spec. 4120, Class A road stone, Standard Specifications for Highways and Bridge Construction.
- 3.2. Erosion Control Fencing. Erosion control materials must conform to Section 4169 of the Standard Specifications for Highway and Bridge Construction.
- 3.3. Rip Rap. When riprap is needed it shall be Class "E". It shall conform to IDOT spec. 4130 Rip Rap Standard Specification for Highway and Bridge Construction.
- 3.4. Pea Gravel. Pea gravel used for bedding under manholes shall comply with IDOT Spec. 4131 Porous Backfill Standard Specifications for Highway and Bridge Construction.
- 3.5. Asphalt. Material used for asphalt restoration shall conform to IDOT Spec. 4126 of Standard Specifications for Highway and Bridge Construction.
- 3.6. Concrete. Concrete for sidewalk, curb and gutter replacement shall be class "C" 3000 lb. and shall conform to IDOT Spec. 2403 of Standard Specifications for Highway and Bridge Construction.
- 3.7. Cable Lubricant. Contractor shall supply a cable lubricant approved by the Contractor for installation of fiber optic cable.
- 3.8. Pulling Rope. Contractor shall supply pull rope with 600 LB proper tensile strength.
- 3.9. Bridge Attachments. Pipe for bridge attachments shall be hot-dipped galvanized rigid steel. Attachments to steel bridges will be accomplished by the use of approved galvanized beam clamps and hangers. Drilling steel bridge structures is not allowed. The attachment to concrete bridge structures will be accomplished by the use of expanding anchor bolts in drilled holes. The use of driven or explosive set anchors will not be permitted when not shown on plans. Exposed ducts shall be supported at intervals of 6' or less. Approved expansion joints will be installed at all bridge structure joints and in no case will exceed 100 LF intervals. Weep holes of 1/4" diameter will be drilled at 20' intervals, and 12" above ground level.
- 3.10. Duct Plug. Contractor shall supply a "JACKMOON PLUGS" blank plugs and Simplex to seal all conduit and casing openings.
- 3.11. Hardware Cloth. Contractor shall supply 2" x 2" mesh - 19-gauge wire for use over pea gravel and under manholes.

### **4. Protection Of Material**

- 4.1. Contractor shall be responsible at all times for protecting the exposed portions of the cable from damage, including intrusion of water. Cable ends will be left at splice locations with sufficient protection to prevent water from entering the cable ends. The contractor shall replace or repair at the IRHTP's option, and damage that occurs to the cable as a result of insufficient or improper protection of the cable.

### **5. Reporting Cable Damage**

- 5.1. The cable shall be carefully inspected by the IRHTP during the plowing or trenching operation prior to its installation in the project to be certain that it is free from defects. Cable damage due to the contractor negligence will be the responsibility of the contractor. Every instance of damaged cable observed at any time shall be immediately called to the

attention of the Contractor; whether prior to installation, during construction, or during test or observation subsequent to installation. The method of repair or correction of such damage shall be in accordance with the written instructions of an authorized IRHTP's representative. The contractor shall make repairs or corrections promptly.

## **6. Cable Repairs**

- 6.1. Minor damage to the outer jacket of the cable observed prior to or occurring during construction shall be repaired in accordance with instructions from an authorized IRHTP's representative.
- 6.2. Cable damage in excess of minor damage to the outer jacket, which is observed prior to or during construction, shall be corrected as follows:
  - 6.2.1. The damaged section of cable shall be enclosed in (1) a buried housing located as specified by the IRHTP or in (2) a buried cable splice enclosure if approved by the IRHTP, buried to the same depth as that specified for the cable. If the shield has been broken or the conductor insulation damaged, the cable shall be restored to the equivalent of new condition. This may require cutting out the damaged section of cable if required by the IRHTP. It may also require the replacement of an entire section between two existing hand holes. Determination of the method of correction will be at the IRHTP's sole discretion.
- 6.3. Damage to cable discovered after burial, either through test or observation, shall be repaired as follows:
  - 6.3.1. The damaged section of the cable shall be repaired as approved by the IRHTP. This may require cutting out the damaged section and replacing it with a short section of new cable with splices made in (1) buried hand holes or (2) buried cable splice enclosures, if approved by the IRHTP, which are buried to the same depth as required for the cable. It may also require the replacement of an entire section between two splice points. Determination of the method of correction will be at the IRHTP's sole discretion.

## **7. Depth Of Burial (Refer To Appendix 1.18)**

- 7.1. Except where otherwise specified, the cable shall be placed to a minimum depth of 36 inches unless otherwise approved by the IRHTP. Greater cable depth will be required at the following location.
- 7.2. Where cable route crosses roads, the cable shall be placed at a minimum depth of 48" below the pavement or 36" below the paralleling drainage ditch, whichever is greater; unless the controlling authority requires additional depth in which case the greatest depth will be maintained.
- 7.3. Where the cable route crosses railroad rights-of-way the cable shall be placed at a minimum depth of 60" below the railroad surface or 36" below the paralleling drainage ditch, whichever is greater; unless the controlling authority requires additional depth in which case the greatest depth will be maintained.
- 7.4. Where cable crosses existing sub-surface pipes, cables, or other structures. At foreign object crossings the cable will be placed to maintain a minimum of 12" clearance from the object or the minimum clearance required by the objects owner, whichever is greater.

- 7.5. Where cable crosses small gullies, ditches, and washes, the cable will be placed at a minimum depth of 48" below the flow line of the waterway unless IRHTP specifically waives this requirement. Such determination shall be made by the Contractor's field representative and recorded on the as-built drawings. In no case shall the cable be placed at less than the 36" minimum depth.
- 7.6. Where cable crosses large/major gullies, ditches, streams, rivers, washes or areas prone to flooding, the cable will be placed at a minimum depth of 10' below the flow line of the waterway unless IRHTP specifically waives this requirement. Such determination shall be made by the IRHTP field representative and recorded on the as-built drawings. In no case shall the cable be placed at less than the 36" minimum depth.
- 7.7. Additional cable depth required to satisfy the preceding items shall not be construed as Extra Work.
- 7.8. Where rock excavation is required, a minimum depth of the cable of 24 inches may be allowed, with IRHTP's written approval, when the cable has additional protection of Contractor-provided PVC or HDPE conduit. Otherwise, the minimum depth for placement in rock will be 36".
- 7.9. Where there is a layer of soil over rock, the minimum depth that the contractor may be allowed, shall be the shallower of: 1) the minimum depth of trench in rock, measured to the soil-rock interface; or 2) the minimum depth in soil, measured to the surface.
- 7.10. At other locations as may be specified by the IRHTP.

#### **8. Cable Marking Ribbon**

- 8.1. The cable marking ribbon shall be installed above all direct-buried cable and conduit. The ribbon shall generally be placed at a depth of 12 inches below grade and directly above the cable or conduit.

#### **9. Hand Holes (Splice Boxes)**

- 9.1. At all splice locations, hand holes will be placed as splice vaults. Hand holes may also be placed at the end of conduit runs to serve as pull boxes for the cable, at the option of the Contractor.
- 9.2. Hand holes will be set at all regeneration stations, at entrances to terminal stations, and at other locations required by the Contractor and/or shown on the drawings.
- 9.3. Hand holes shall be of the type shown on the applicable Standard Drawing. Hand holes shall be installed in accordance with the Standard Drawing.
- 9.4. Hand holes shall be spaced to allow sufficient length (75') of cable at each end of the reel to be coiled in the hand hole.
- 9.5. After placing the hand hole, contractor shall backfill to a level even with the top of the hand hole. The excavation shall be left in the above condition until after the splice has been completed by others. Upon notification by IRHTP that the hand hole is ready, the contractor shall complete the backfill of hand hole pit in accordance with the drawings and with Clause 22.0 of these Specifications.

## **10. Cable Plowing**

### **10.1. General**

- 10.1.1. The contractor shall be familiar with general guidelines covering the construction of buried communications cable.
- 10.1.2. The equipment and construction methods used by the contractor shall be such as to cause minimum displacement of the soil.
- 10.1.3. Damage to banks, ditches, driveways and roads caused by the equipment shall be immediately repaired to the satisfaction of the IRHTP and public authorities having jurisdiction over highway and road rights-of-way.
- 10.1.4. Where cable is buried near the edge of pavements, the contractor shall take particular care to avoid damaging the pavement. If such damage does occur, repairs shall be made immediately to meet the complete satisfaction of state or local authorities having jurisdiction over the pavement.

### **10.2. Plowing Equipment Requirements**

- 10.2.1. The plowing equipment shall be subject to the approval of the Contractor and the public authorities having jurisdiction over highway and road rights-of-way.
- 10.2.2. Plowing shall be performed by a prime mover with hydrostatic type steering and a static plow.
- 10.2.3. The design of the plowshare shall be such that the buried cable passing through the plow will not bind and shall not be bent in a radius less than 20 times the outside diameter of the cable. The feed chute must be a removable gate for the purpose of inspection and to allow the cable to be removed from or inserted into the feed chute at any intermediate point between splice locations. The cable path inside the feed chute must have low friction surfaces and be free of burrs and sharp edges to prevent damage to the cable as it passes through. Any welds must be smoothed. Internal guide rollers shall not be used.
- 10.2.4. The equipment shall be capable of extending the plow in order to maintain the required minimum depths under all terrain conditions.
- 10.2.5. The reel carrier shall be of adequate size and be configured so that the reel sizes being used can be safely handled.

### **10.3. Plowing Requirements**

- 10.3.1. The slot made in the soil by the cable plows shall be closed immediately by driving a vehicle track of sufficient weight over the plow slot, to thoroughly compact the plow slot or by other suitable means approved by the Contractor.
- 10.3.2. Start and finish pits and pits at points of intersection, as needed must be excavated in advance of plowing cable. Ends of casings and crossings of foreign utilities shall be exposed prior to start of cable plowing operations.
- 10.3.3. The contractor shall exercise particular care in the use of trenching equipment and shovels in joining trenches to the slots made by the plow to be certain that the cable is not damaged.

- 10.3.4. To avoid possible damage to buried cable from exposure to traffic, livestock and other hazards, trenching of laterals, trenching around culverts, construction of aerial inserts and similar operations shall be completed as soon as practicable behind the plowing operation, but never more than 48 hours behind the plowing operation unless additional protective measures, as approved by the contractor, are employed. Notwithstanding this provision, the contractor remains responsible for the cable throughout the placing and acceptance intervals.
- 10.3.5. Care is to be exercised during the plowing operation, to feed the cable into the ground through the plow loose and at no tension. Equipment and construction methods shall be such as to assure compliance with this requirement. The contractor shall furnish competent supervision at all times at the site of plowing operations to assure compliance with this requirement.
- 10.3.6. If during the plowing operation, the plow should strike a buried object or rock that stops the equipment and necessitates removal of the plow from the ground, the precautions detailed in Section 9.4 shall be observed to avoid damage to the cable. Should it be necessary to back the plow to remove it from the ground, the cable shall be uncovered by hand a sufficient distance back for inspection by the IRHTP to determine whether the cable has been damaged.
- 10.3.7. Where casing pipe or foreign utility is encountered, the cable shall be unrolled and placed in a figure 8 configuration. After the cable is pulled through the casing pipe(s) or under the foreign utility (ies), it shall be replaced on the reel and the plowing operation restarted. EXTREME CARE must be used whenever the cable is handled so that it will not be kinked or damaged in any manner.
- 10.3.8. The plowing precautions detailed in Section 9.4 shall be strictly observed.

#### **10.4. Plowing Precautions**

- 10.4.1. Failure to observe precautions concerning proper operation of the prime mover and plow contributes to unnecessary cable damages. The following precautions shall be reviewed with equipment operators and shall be strictly observed.
  - 10.4.1.1. The tractor shall always be started slowly and speed increased gradually after all cable slack is removed from the cable delivery system.
  - 10.4.1.2. Plow attitude and depth shall be changed gradually. Such changes shall be made only while prime mover is moving.
  - 10.4.1.3. Should it be necessary to raise the plow share to the surface when the plow is not moving, the cable to the rear of the feed chute shall be excavated and slack pulled so that the cable is not kinked over the feed chute exit.
  - 10.4.1.4. Do not plow with the share set at extreme forward rake angles without a share specifically designed for this purpose.
  - 10.4.1.5. When rigging for off-set plowing, the cable shall be re-routed over the cable feed systems to conform with the new configuration.
  - 10.4.1.6. Abrupt changes in terrain along the cable path shall be graded off ahead of the plow. Such grading must be approved by IRHTP and IDOT.

10.4.1.7. The plowing operation shall be observed continuously for obstructions, proper feeding of cable, maintaining proper depth, etc.

10.4.1.8. Under no circumstances shall the plow be backed or the share moved to the rear with cable in the chute.

10.4.1.9. At no time shall the plow be wobbled either vertically or horizontally to break through an obstruction.

10.4.1.10. At no time shall the plow deviate from the normal route to seek an "on grade" crossing level for farm roads. Unless the road is bored, contractor shall level the plow train path in order to make a level crossing of the road. Subcontractor shall repair the road after passage, including repaving or gravelling, as required

10.4.1.11. No practice will be allowed that will cause an abrupt change in direction of the plowed in cable.

### **10.5. Cable Plowing In Rock Areas**

10.5.1. Solid rock is defined as a consolidated rock that cannot be plowed to specified depth. Frozen ground is not considered as solid rock.

10.5.2. Where solid rock is encountered, the cable will be installed by the trench method described in Section 10.0, while also being protected by steel PVC conduit, high-density polyethylene conduit (HDPE), at the discretion of the Contractor.

### **11. Placing Cable At Reel Ends**

11.1. The cable will be placed to provide sufficient cable for splicing at ground level. This should be a minimum of 75 feet. Inside the regenerator station buildings, sufficient cable will be allowed to connect to the equipment.

### **12. Cable In Trench**

#### **12.1. Excavation**

12.1.1. The trench shall be as straight as practicable. The bottom of the trench shall be smooth and free from any sharp edges. The trench shall be kept clear of debris and loose rock. All changes in trench grade shall be gradual.

12.1.2. The length of open trench shall not exceed 100' at the end of each working day. Any open trench shall be fenced. Exceptions are subject to approval by the IRHTP. Good judgment and care must be exercised to prevent livestock or persons from falling into the open trench.

12.1.3. Driveways, lanes, or roadways, which are open cut, shall be opened just prior to the conduit and/or cable placing. In no case shall the driveway, lane, or roadway be left impassable at the end of the day. The general public safety is paramount and appropriate steps shall be taken to ensure safety at all times.

#### **12.2. Backfill**

12.2.1. The trench shall be backfilled and compacted to the satisfaction of the IRHTP or local authorities, promptly behind the pipe and/or cable placing, except at splice

locations. In general, the backfill shall consist of the earth removed from the trench.

- 12.2.2. Where a carrier, pipe, conduit, duct, or cable is placed by trenched construction beneath a roadway or a driveway or within five feet of the edge of an existing or proposed pavement or base course, the backfill within the roadway shall be placed and compacted in not more than 6" lifts, from the top of the installation to the ground line. The backfill shall be of suitable material free from boulders, frozen clods or roots or excessive sod or other vegetation. The fill shall be carefully hand tamped under and around the installation in lifts not to exceed 4" in loose thickness.
- 12.2.3. In areas inaccessible to tamping-type rollers where compaction is required, a mechanical tamper of a size suitable for the work involved shall be used.
- 12.2.4. Pneumatic tampers shall be operated at pressures no less than those recommended by the manufacturer.
- 12.2.5. Compaction of backfill shall be to the satisfaction of the IRHTP, and consistent with good highway construction methods.
- 12.2.6. On public right-of-way all backfilling must conform to the requirements of the authority having jurisdiction.

### **12.3. Trenched Road and Driveway**

- 12.3.1. Generally all hard surfaced areas will be bored. The backfill at crossings of driveways, lanes, or roadways shall be the same as 10.2.
- 12.3.2. Pavement replacement shall match existing paving in type of pavement appearance, wear surface, and durability to the maximum extent practical. Replacement shall match existing structure and shall include curbing, walkways, or any other concrete structure damaged during construction. Pavement repair shall be subject to approval by the IRHTP and must conform to the requirements of the local governing authority having jurisdiction including required cutbacks, or "T" topping. Pavement repair not installed in accordance with the requirements of these Specifications shall be removed and replaced.

### **12.4. Trench In Rock**

- 12.4.1. See Section 9.5 for a definition of solid rock.
- 12.4.2. Where solid rock is encountered, the trench may be excavated using a rock saw or other rock cutting equipment. The excavation, backfill and road crossings in solid rock areas shall conform to sections 10.1, 10.2 and 10.3 of these specifications unless specifically exempted in this section.

### **12.5. Placing Cable**

- 12.5.1. The cable will be placed to provide sufficient cable for splicing at ground level. This should be a minimum of 75 feet. Inside the regenerator station buildings, sufficient cable will be allowed to connect to the equipment.

## **13. Multiple Duct Installation**

- 13.1. This item includes all labor, equipment and certain materials required to install four (4) 1.25" I.D. HDPE conduits in controlled access roadways and other locations as provided by in the utility accommodation policy. The HDPE conduits will be of different colors

and will be plowed in place in such a manner that the duct to contain the IRHTP cable will be on top. The duct that will contain the IRHTP cable will be pre-inserted with a .25" nylon rope. All ducts shall have continuity.

- 13.2. Hand holes will be installed every mile to facilitate pulling, preferably at highway mile posts. . However, when necessary and upon approval by the IRHTP, hand holes may be moved to locations more practical. The duct containing the IRHTP cable shall enter and exit hand holes and the empty ducts shall pass around the hand hole on the field side rejoining the IRHTP duct as soon as practical without causing severe bending.
- 13.3. Should mid-assist points become necessary when pulling cable, the ducts shall be spliced together in a water-tight condition. Upon completion of cable placement hand holes will be duct plugged and gopher proofed.

#### **14. Cable Pulling**

- 14.1. The optical fiber cable provides high capacity transmission channels. To ensure that the cable's qualities and characteristics are not degraded, excessive pulling tensions or excessively short bending radii should be avoided. The maximum pulling tension is 600 lbs. and the minimum bending radius is: dynamic (cable in movement) = 20 times outside diameter of the cable and static (cable in place) = 10 times outside diameter of the cable. These rules should be followed at all times when placing excess cable in hand holes for splicing and slack coils.
- 14.2. When pulling fiber, a break-away swivel, along with a Slip Clutch Capstan Winch that shows the dynamometer reading at all times shall be used.
- 14.3. Cable lubrication shall be used to reduce the pulling tension on longer segments of the cable placement operation. Contractor approved lubricants shall be used.
- 14.4. At each pulling hand hole a 35' coil of fiber will be left coiled in the bottom of the box. At each splice location 75' will be left on each cable end for splicing. Tags will be placed on fiber showing the direction of the cable. The cable ends will be sealed watertight to keep water from entering the cable.

#### **15. Subsurface Obstructions**

- 15.1. Contractor is responsible to locate and avoid all subsurface obstructions. It is the contractor's responsibility to verify the locations of subsurface obstructions shown on the drawings as well as any additional obstructions not identified on the drawings. Contractor shall notify owners and operators of foreign pipelines or other utilities at least 48 hours prior to excavation near the utility. Contractor shall keep a log of all telephone contacts to notify foreign utilities of excavation. Such log shall include date, time of day, name of individual contacted, name of Company contacted, telephone number, and confirmation number.
- 15.2. When crossing buried pipes, cables, and other utility lines, the cable shall be placed under the foreign utility line with a minimum separation of 12 inches. However, if the foreign utility line is 55 inches or more deep, the cable may be placed over the utility at the normal placing depth unless the utility owner specifically requires placing of facilities

below their lines. In this situation the new facilities will be placed a minimum of 12" below the existing line (see Section 6.0).

## **16. Inspection Of Buried Cable**

16.1. The installed cable will be tested as a part of the cable splicing operation. Contractor shall be liable for the cost of any and all repairs or replacement necessary to correct any defect in the installed cable which can be attributed to actions by the contractor which are disallowed by these specifications, by the Cable manufacturer or by good industry practice, as determined by the IRHTP. The term "defect" as used in the preceding sentence shall mean any defect that the IRHTP determines to have an effect on current or future operations of the completed fiber optic communication system.

## **17. Highway, Railroad And Other Bored Crossings**

- 17.1. All crossings of state or federal highways and railroads rights-of-way shall be made by boring and placing a pipe casing. The cable shall be placed through the pipe casing. Country roads and other roadways shall be bored, trenched or plowed, as directed by the IRHTP and approved by the appropriate local authority.
- 17.2. All work performed on public right-of-way or railroad right-of-way shall be done in accordance with requirements and regulations of the authority having jurisdiction there under.
- 17.3. At anytime the pipe casing bored under the roadway exits below the prescribed depth, a backhoe will be used to gradually return the bored ditch to plowed grade.
- 17.4. In no case shall the completed crossing be less than 48" deep at its shallowest point.
- 17.5. Certain roadways may be allowed to be crossed by trenching. In those cases, it shall be the contractor's option to split conduit and place it around the cable in lieu of placing whole conduit and pulling the cable through the conduit. Contractor shall split the casing and install it around the cable in a manner approved by the Contractor. Split conduit will be secured after cable placement in such a fashion as to prohibit collapsing to less than its un-split diameter. Split conduit shall be sealed or plugged to prevent entry of dirt, water and rodents.
- 17.6. In areas that the cable is being laid in conduit, the ends of the conduit shall be capped or plugged to prevent entry of dirt, water and rodents.
- 17.7. Under railroads rights-of-way, the bore shall extend from toe of fill to toe of fill.
- 17.8. In no case shall an encasement extend less than toe of slope to toe of slope except along freeway rights-of-way in which locations the encasement shall extend from right of way to right of way.

## **18. Stream And Canal Crossings**

### **18.1. General**

- 18.1.1. In general, the cable shall be placed by direct bury methods (plow or trench) with additional conduit protection when directed by the IRHTP, across small streams

and washes. Stream or river crossings may be made on non-freeways, through conduit attached to a highway or railroad bridge. Where required by local authorities, irrigation canals will be bored in the same manner as a road crossing.

## **18.2. Buried Crossings**

- 18.2.1. Lake, canal, stream and river crossings shall be installed and restored in accordance with the Standard Drawings and the applicable Construction Drawings, and in accordance with the requirements of the permit, if any, and in accordance with the requirements of respective Federal, State and Local agencies, including those agencies concerned with water pollution and the protection of sport fisheries. Cable shall be laid across lakes, canals, streams and rivers as nearly level as practicable. Extreme care shall be taken to prevent damage to the cable during these installations.
- 18.2.2. The cable is to be installed in accordance with Clause 6.0, Depth of Burial. The banks of stream crossings shall be graded as necessary to provide the required burial depth under the stream and to provide a proper pathway for the plow train or trencher to traverse the bank and make a smooth transition to the stream bottom. Transitions from normal depth to stream-crossing depth shall be made smoothly without sharp bends in the cable. All cuts in banks and diversion berms shall be re-graded to match existing facilities and re-compacted to not less than 90% of maximum cf density at plus or minus 5% of optimum moisture content as determined by ASTM D698.
- 18.2.3. The banks of all canals, streams and rivers shall be restored to their former condition and bank protection materials or bulkheads will be installed where required. The methods of restoration and erosion control shall be as required by the landowner or agency having jurisdiction and as approved by IRHTP. IRHTP reserves the option to change the erosion control method in the field. Banks will be reseeded and mulched with grass seed and mulching material as required by the local governing authority. Berms will be constructed, where practicable, to divert water away from the trench line and disturbed bank areas. Costs for restoration of banks and installation of bank protection material and bulkheads shall be included in the price for completing the work.
- 18.2.4. As nearly as possible, the beds of all lakes, canals, streams and rivers shall be restored to their former elevation and grade, and spoil, debris, piling, cofferdams, false work, excavation, construction materials and obstructions resulting from installation of the cable shall be removed from the crossing to prevent interference with normal water flow and interference with any normal use of such canals, streams and rivers and shall be disposed of in a manner and at locations satisfactory to IRHTP. Underwater spoil shall be spread to a height not to exceed six inches above the bed of lakes, canals, streams and rivers.
- 18.2.5. Contractors shall not begin work on lake, canal, stream or river crossings before obtaining approval from the IRHTP.
- 18.2.6. It is the intent of these specifications to require contractor to install the cable underneath the bed of the lake, canal, stream, river or water course at a depth of ten feet below the flow line that shall prevent flood waters from affecting the cable by reason of the scouring action of the water. Particular attention shall be given to the

location of sag bends in the cable so that they shall be located back in the lake, canal, stream or riverbanks beyond any point that would be affected by a change due to erosion of the banks.

18.2.7. Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn.

18.2.8. Unless specified otherwise, at individual stream crossings, the contractor shall be required to:

18.2.8.1. Grade banks of stream crossings by pulling the spoil back from the bank. Subcontractor shall not push the spoil out into the stream to grade the approaches.

18.2.8.2. Refrain from the use of cofferdams or from diverting the stream in any way in order to construct a stream crossing.

### **18.3. Attachment to Bridges (Non-Freeway)**

18.3.1. Pipe for bridge attachments shall be hot-dipped galvanized rigid steel. Attachments to steel bridges will be accomplished by the use of approved galvanized beam clamps and hangers. Drilling steel bridge structures is not allowed. The attachment to concrete bridge structures will be accomplished by the use of expanding anchor bolts in drilled holes. The use of driven or explosive set anchors will not be permitted when not shown on plans. Exposed ducts shall be supported at intervals of 6' or less. Approved expansion joints will be installed at all bridge structure joints and in no case will exceed 100 LF intervals. Weep holes of 1/4" diameter will be drilled at 20' intervals, and 12" above ground level.

### **18.4. Bored Canal Crossings**

18.4.1. Irrigation canals requiring boring shall be bored in accordance with Paragraph 13.0, Highway, Railroad and Other Bored Crossings.

## **19. Cable Markers**

### **19.1. Location**

19.1.1. Cable markers will be furnished by the IRHTP and shall be placed within 48 hours of cable installation. Cable markers shall be placed at all change in directions, splices, fence line crossings, at road and stream crossings, and at other points on the route not more than 1,000 feet apart.

19.1.2. Cable markers shall be located as directed by the IRHTP.

19.1.3. In addition, on highway (non-freeway) right-of-way, the markers shall be located at the highway right-of-way line. Markers shall always be located so that they can be seen from the location of the cable.

19.1.4. In addition, in freeway right-of-way, the markers shall be placed not more than 1000 feet apart in rural areas and 500 feet apart in urban areas. Signs will be required on each side of all transversing public roads on streets at a point where the freeway right of way line intersects the transversing public road or street right of way line. Signs shall be placed within the right of way fence line, at line of sight.

## **20. Right-Of-Way Protection And Restoration**

### **20.1. General**

- 20.1.1. The contractor shall protect the right-of-way and minimize the damage from construction operation.
- 20.1.2. Good soil erosion practices shall be practiced during all construction operations.
- 20.1.3. Depending on the location of the work, the Federal Environmental Protection Agency, the State Environmental Protection Agency or others may stipulate construction practices and crew behavior requirements in or around environmentally sensitive areas, such as cultural resource sites. Contractor shall adhere to any such stipulated construction practices and crew behavior requirements.

### **20.2. Restoration**

- 20.2.1. Contractor shall keep the premises where work is being performed in a neat, clean, and orderly condition, and on completion of the work hereunder, contractor shall remove from the premises all of its tools and equipment, and any debris shall be removed and disposed of by contractor.
- 20.2.2. The right-of-way shall be restored to its original or better condition within 24 hours or as soon as practicable, in the IRHTP's opinion, following cable placing operations.
- 20.2.3. Where the cable is plowed in place, restoration shall be accomplished by driving a tractor or heavy truck over the plow furrow until the plowed area conforms to the surrounding terrain. A vibratory roller having a weight of three tons and a width of 4-6' may also be used.
- 20.2.4. In areas where open trench methods were used and backfill mounded over the trench, grading or filling will be required for final restoration of the right-of-way.
- 20.2.5. All rock and debris brought to the surface and left after backfilling shall be removed and disposed of, as directed by the IRHTP.
- 20.2.6. Improved landscape, lawns, shrubs, and hedge removed or damaged on the right-of-way shall be replaced. Lawns shall be repaired by re-sodding with like grasses.
- 20.2.7. The contractor shall promptly repair or replace any other property damaged during construction.

## **21. Coexistence On Highway Right-Of-WaY**

- 21.1. The cable route will parallel public highways and the cable will be laid within the highway right-of-way.
- 21.2. All work performed on public road right-of-way shall be completed in accordance with requirements and regulations of the authority having jurisdiction. It is the contractor's responsibility to be aware of, and comply with, all regulations and requirements pertaining to his work. The contractor shall be familiar with the location of "scenic enhancement areas" and with special requirements for construction on highway rights-of-way in such areas.

- 21.3. Unless otherwise specified on the drawings or by the Contractor, the cable shall be installed as close as practicable to the highway Right-of-Way line. If terrain or man-made obstruction(s) block the route, contractor shall modify the route with approval of IRHTP and the proper governmental authorities to avoid the obstruction.
- 21.4. Generally, the cable shall be buried in accordance with section 6.0, Depth of Burial. At particular locations, the cable depth will be controlled by depths of the facilities crossed (i.e. drainage, bridge structures, buried cables and/or other facilities.)

## **22. Fencing**

- 22.1. The temporary fencing erected around contractor's excavations located outside of city limits shall be type 47 field fence or as approved by IRHTP. Temporary fencing around excavations inside the city shall be installed utilizing safety fencing to the satisfaction of the IRHTP.
- 22.2. Contractor, having first ascertained from IRHTP that permission has been secured from the landowner and/or tenant, shall build suitable temporary fencing and/or wire gaps in the fences crossing the route of the cable and maintain the same so that livestock shall be prevented from entering or leaving the property. Before cutting such fences to make these gates, contractor shall brace the fence to prevent damage. Gates shall be so constructed that they can be securely closed, and where necessary contractor shall furnish a watchman to maintain gates to prevent livestock from entering or leaving property and shall also furnish watchmen in any instance where required to do so by Contractor. Such temporary fences or gates shall be provided with suitable fasteners and shall be kept closed at all times except when necessary to be opened for construction purposes.
- 22.3. Following the completion of the cable construction, temporary gates shall be removed. All fences which have been cut or removed during the construction work shall be repaired by contractor in a first class and substantial manner and to match the original style of the fence, so far as possible. Where there is any doubt in the opinion of the IRHTP as to the usability of old fence material, contractor, at its own expense, shall furnish new wire and suitable post to rebuild said fence. Fence repairs shall be subject to approval of both the property owner and IRHTP.

## **23. Building Specifications**

### **23.1. Installation Requirements**

- 23.1.1. Installation shall comply with the latest edition of The National Electrical Code and other national, state and local codes as applicable.
- 23.1.2. Pull boxes will be required after 180 degrees of directional change and after every 120 feet of vertical rise (10 floors). Pull boxes will be mounted securely to the building structure and will not depend on the conduit for support. Pull boxes shall have removable covers and will be installed in such a way that the covers will be accessible.
- 23.1.3. Relocating and/disconnecting of any existing equipment within the building shall be coordinated with building management.
- 23.1.4. All metallic conduits shall be bonded to the building ground system.

23.1.5. All conduits shall be sealed (plugged), after cable installation at the point of interface and will be clearly marked to facilitate location.

23.1.6. Pull boxes should be clearly marked "IRHTP" on the cover for identification.

### **23.2. Material Requirements**

23.2.1. Materials will comply with those standards as established by UL or NEMA and shall be commercial grade. All materials will be new and free from defects.

23.2.2. Conduits shall be one and one quarter inch (1 1/4") EMT (Electrical Metallic Tubing). EMT fitting shall be gland or set screw type, and each conduit shall be equipped with a graduated pull tape or rope. The exact requirements for location of conduit within the building shall be verified with the building owner.

23.2.3. Large radius sweeps shall be provided where required for offset or change in direction of conduit. The minimum radius recommended is 36", and the minimum radius acceptable is 24". If it is not possible to provide 24" minimum radius sweeps, pull boxes providing the same radii capability will be required.

23.2.4. Pull through pull boxes will be typically 6" high x 6" wide x 24" long with the conduit entering at each end. Pull boxes shall meet code requirements and will generally be placed to improve ease of pulling cable and inner-duct.

23.2.5. The cable will be secured at pull boxes on vertical runs with IRHTP-approved split Kellum grip as determined by the IRHTP representative.

### **24. Splicing**

24.1. Direct Buried Splices - At points where the IRHTP determines a buried splice should be placed, the contractor will excavate, secure, fence, and protect a splice pit to accommodate placing the cable splice (by others) at the same depth as the cable installation. The splice pit will be left open until the splice is completed at which time contractor will return and complete backfill and restoration work as required by the authority with jurisdiction in the area. Slack cable footage will be coiled and placed vertically in line with the cable route at sufficient depth that the highest point in the loop and splice closure is a minimum of 36" below the surface. The coil diameter will be a minimum of 30". The contractor shall backfill with selected fines to a level 6" above the closure and coil and continue the backfill as required.

24.2. Splicing at Hand holes - At points where branch splicing occurs, as shown on drawings, or directed by IRHTP, the contractor will place a hand hole as per the specifications and manufacturer's suggested methods. Contractor will secure, fence and protect the hand hole excavation and maintain a safe open pit to allow a splice to be completed (by others) and placed in the hand hole. After splice is placed, contractor will return and complete backfill and restoration work as required by the authorities with jurisdiction in the area.

24.3. At all splicing locations contractor shall also install a SIP 40 pedestal, an 8' ground rod and connect the two via a #6 ground wire. Contractor shall also install a 1-1/4" HDPE conduit at 36" depth between the hand hole/splice pit and the SIP 40 for use by others.

## **25. Concrete**

### **25.1. Description**

- 25.1.1. This section covers the material requirements and placing of Portland cement concrete for roadways, driveways, sidewalks and other planned concrete works.
- 25.1.2. Concrete shall consist of a mixture of Portland cement, water, fine aggregate, coarse aggregate and approved additives, when required, mixed in the proportions as specified below or approved by Contractor.
- 25.1.3. Where permits apply to Work, concrete shall conform to the permit requirements.

## **26. Material Requirements**

### **26.1. Concrete Materials**

- 26.1.1. Portland cement shall conform to the requirements of AASHTO M85 and shall be Type II (low alkali).
- 26.1.2. Aggregate shall conform to the requirements of the IDOT for the specific use.
- 26.1.3. Water used in mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, organic vegetation, or other substance injurious to the finished product. Water may be tested in accordance with and all requirements of AASHTO T-26. Water known to be of potable quality may be used without test.
- 26.1.4. Air-entraining mixtures, when required, shall conform to the requirements of AASHTO M-154 (ASTM C-260).
- 26.1.5. Reinforcing steel for concrete reinforcement shall meet Grade 60 requirements for of ASTM A-615. Welded wire fabric for concrete shall conform to AASHTO M-55 (ASTM A-185). All bars and welded wire fabric shall be properly bundled and tagged with weather resistant tags.
- 26.1.6. The Subcontractor shall submit a supplier's mix design and material certifications for the mix being supplied one (1) week in advance for review and approval. No concrete shall be used on the project before mix design has been submitted and approved.

### **26.2. Concrete Classes**

- 26.2.1. Concrete shall be of the class specified and as appropriate for the item for which it is being placed. Water content shall be controlled to produce a slump between two (2) and four and one-half (4 1/2) inches.
- 26.2.2. Classes of concrete and minimum strength and cement content shall be as follows:
  - 26.2.2.1. Encasement Concrete. Class 3000 S&G shall be as sand/gravel mix with not less than 5.5 sacks (516 lbs) Portland cement per cubic yard to produce a twenty-eight (28) day compressive strength of 3000 psi. This class may be used for bedding concrete and encasement concrete in most locations.

26.2.2.2. Sidewalk and Driveway Concrete. Class 3000 CA shall be fine aggregate/coarse aggregate mix with not less than 5.5 sacks (516 lbs) of Portland cement to produce a twenty-eight (28) day compressive strength of 3000 psi. This class may be used for bedding, encasement concrete, sidewalks, and driveways.

26.2.2.3. Paving Concrete. Class 4000 CA shall be a fine aggregate/coarse aggregate with not less than 6.5 sacks (610 lbs) of Portland cement to produce a twenty-eight (28) day compressive strength of 4000 psi. This class may be used in structures or roadway pavement. The mix proportions including air entrainment and other additives shall meet the requirements of Highway Department of the State in which concrete is being placed.

### **26.3. Placing**

26.3.1. The Subcontractor shall notify the Contractor at least twenty-four (24) hours in advance of placing concrete to permit proper inspection and approval of forms and reinforcement by the Contractor.

26.3.2. Concrete and reinforcing steel shall be placed at the locations and in accordance with the details shown on the Plans.

26.3.3. No concrete work shall be done when the air temperature is below forty (40) degrees F, or if freezing weather is predicted before final set of the concrete, unless special means of heating and/or protecting the work are used for a period of at least seventy-two hours after it is poured. Concrete shall not be placed on frozen sub-grade.

26.3.4. Where splices in reinforcing steel are necessary, the bars shall be lapped twenty-four (24) times their least diameter.

26.3.5. Concrete shall be of workable consistency with slump between two (2) and four and one-half (4 1/2) inches when placed. It shall be compacted by spading or by mechanical vibrator to prevent honeycomb. The concrete shall be spouted so that the total free drop will not exceed six (6) feet. No concrete shall be used which has partially set before final placing or which has segregated in transport. Re-tempering will not be permitted.

26.3.6. All concrete shall be placed monolithically so that fresh concrete shall not be placed against concrete that has taken initial set except where construction joints are required.

26.3.7. All surface concrete shall be cured for a period of seven (7) days with a water saturated covering or by other approved methods that will keep all surfaces continuously wet.

### **26.4. Measurement and Pavement**

26.4.1. Concrete shall not be measured and paid as a separate item but shall be subsidiary to the cost of applicable item for which the concrete is placed.

26.4.2. The furnishing and installation of reinforcing steel shall not be measured separately but shall be considered subsidiary to concrete work.

**SECTION 6 - Specifications For Aerial Placement Of Fiber Optic Cable**

**1. General**

- 1.1 General. All IRHTP owned poles and/or cable will be identified with ID tags. All cables will meet all standards set up by NESC, agencies of cities, state, county, federal government, railroads or other entities which provide for the placement of IRHTP facilities within their respective rights of way.
- 1.2 Lengths. Use the longest lengths to facilitate construction costs, placement, and splicing. Entire reels can be placed without splice points to minimize transmission loss and reduce splicing costs.
- 1.3 As-builts. Will reflect span measurements, size, class & ownership (percent of ownership if applicable) of all poles joint use and IRHTP owned. All IRHTP owned/leased poles shall be identified with ID tags and size of messenger. If over-lashing is used: who owns messenger and/or other cables (type, size, gauge if applicable) involved in over-lashing. The clearance height at mid-span at the completion of construction, all sequence numbers at each pole will be recorded as well as: location of all MGN grounds, size and lead of guying and size and type of anchor.

**2. Placement**

2.1 Minimum Bending Radius

Nominal Cable Diameter	Minimum Bend Radius (No Tension) Installed	Minimum Bend Radius (Under Tension)
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143.1 Millimeters	143.2 Inches	143.3 Millimeters	143.4 Inches	143.5 Millimeters	143.6 Inches
6.0-10.0	¼ -3/8	10.0	4.0	15.0	4.0
10.1 - 15.0	4/10 - 6/10	15.0	6.0	22.5	9.0
15.1 - 20.0	10/16 - 8/10	20.0	8.0	25.0	10.0
20.1 - 23.0	13/16 - 9/10	23.0	9.0	25.0	10.0
23.1 - 25.0	15/16 - 1.0	25.0	10.0	30.0	12.0

2.2 Figure – Eighting Cable. If the cable must be unreeled during installation, use the “figure - eight” configuration to prevent kinking or twisting. Fiber optic cable should not be coiled in a continuous direction except for lengths of 30 meters (100 ft) or less. The preferred size of the “figure - eight” is about 4.5 m / 15 feet in length, with each loop about 1.5 m / 5 feet to 2.4 m / 8 feet in diameter. Do not cut the cable under any circumstances without consulting the IRHTP field engineer on the job.

2.3 Dip Pole. At a dip pole, form a minimum of a 100-foot expansion loop using “snowshoes”. Identify the cable with a caution tag. Protect the cable on the pole with “U guards,” 18” inches below the strand to just above ground level.

2.4 Planning and Preparation.

2.4.1 Poles. Determine the ability of existing pole lines and guys to support the new cable plant, as well as any restrictions imposed by the pole owner. The guying should remove all of the lateral stress on each pole so that the pole simply supports the weight of the cables, hardware and equipment attached to it. Stated another way the facility being constructed should be supported independent of all other facilities on the pole line. Obtain a written contract from the owner of poles with IRHTP as the owner of the facility being placed on the pole line. Contract will state all the fees associated with the attachment either on a one time or annual basis. The written contact with owner of poles will also state the pole/strand replacement policy/cost involved. Obtain all necessary permits from the governing bodies involved. Contact the Iowa One Call system when placing new poles and anchors.

2.4.2 Clearances and Separations. On a case-by-case basis determine the clearances between the proposed fiber optic cable and the existing facilities. Be certain that the proposed facility is constructed according to the National Electrical Safety Code (NESC) and the appropriate local safety codes. See Example 1.29. The fiber optic cable should occupy the uppermost available communication space on the pole due to its small weight and resultant sag.

ITEM	URBAN
	<b>Feet at Maximum sag</b>
Where cables guys, line, or drop wires run along and within the limits of : a) Public highways, streets, and roads b) Public alleys c) Ways accessible to pedestrians only	18' 15.5' 12'
Where cables, guys, line or drop wires cross over private property or ground a) Accessible to pedestrians only b) Accessible to people on horses or loaded farm vehicles	9.5' 16'
Where cables, guys, line or drop wires cross over: a) Public highways, streets and roads b) Public alleys c) Driveways in general unless height of loaded vehicles or equipment using drive requires extra clearance.	18' +15.5'

d) Farm driveway - accessible to combines	+15.5'
e) Driveways---residential garages	18'
f) Ways accessible to pedestrians only.	15.5'
g) Obstacles (billboards, roofs)	12'
h) Flat roofs which may be used by tenants or workmen.	2'
i) Railroads --- cable on messenger	9.5'
j) Waterways (rivers, canals, etc.) provide clearance specified by proper authorities and on work plans. (Human with fishing pole)	27'
+ Secure additional clearance on new construction when warranted at specific locations.	14'

**MINIMUM CLEARANCE ABOVE GROUND FOR TELEPHONE FACILITIES**

<i>TYPE OF CROSSING WIRES &amp; CABLE</i>	<i>TELEPHONE CABLES, MESSENGER, DROPS, AND GUYS</i>	
	<b>CROSSING OVER CROSSING UNDER</b>	
Open supply wires 0-750 volts & supply cables having effectively grounded sheath or messenger - all voltages.		
a) Line wires	4'	
b) Service wires	2'	4'
Open supply, line or service wires		
a) 750 - 8700 volts	6'	
b) 8700 - 50,000 volts	6'	
Foreign guys, span wires, lightning protection wires	2'	2'
Foreign communication wires, cables, and fire alarm wires	2'	2'
Trolley contact conductors.		
a) 750 volts or less		4'
b) 750 - 8700 volts	-----	6'
* Clearance for (a) may be reduced to 4 feet if crossing is more than 6' from communication pole.		
Note: The above clearances apply where the crossing span length of the upper conductor or wire does not exceed 175		

feet. For greater span lengths, increase clearances in accordance with NESC.

### 3. Lashed Aerial Plant

3.1 General. Fiber optic cables must be installed without loose lashing, twisting, or weaving along the strand.

#### 3.2 Suspension Strands

3.2.1 Suspension strands are susceptible to fatigue failure near pole-mounted suspension clamps if left under critical stringing tensions without supporting a load. Refer to the table below for the rated breaking strength and the type of steel used.

#### DIAMETER

146 RATINGS	147 EHS	148 UG
6M	¼"	5/16"
10M	5/16"	3/8"
16M	3/8"	7/16"
20M	7/16"	½"

“M” indicates the approximate breaking strength in thousands of pounds. “UG” or EHS indicates the tensile strength of the steel used in the messenger.

3.2.2 Refer to the table below for the minimum tensions stringing tensions for a particular cable weight using different messenger grades. Messenger tensions listed are the minimum tensions required for each span to reduce cable strain.

#### Minimum & Critical Messenger Tensions in Pounds Prior to Aerial Installation of Fiber Optic Cable

Maximum 0.18 lb/ft, 0.80 Inches Diameter Cable, (Using EHS Messenger, Not UG)

149 Messenger	150 Span
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	Up to 200'	200 - 300'	300 -400'	Critical Tension
6M EHS ¼"	1200 lbs	1600 lbs	----	2000 lbs
10M EHS 5/16"	1500 lbs	1800 lbs	2400 lbs	3000 lbs
16M EHS 3/8"	1800 lbs	2200 lbs	2600 lbs	6000 lbs

Maximum 0.16 lb/ft, 0.68 Inches Diameter Cable  
(Using UG Messenger, Not EHS)

6M UG 5/16"	1600 lbs	---	---	---
10M UG 3/8"	1800 lbs	2200 lbs	2500 lbs	---

3.2.3 When specifying a strand for fiber optic cable, the two most important considerations are; (1) strength of strand and (2) excess cable stretch does not occur. When the diameter of a strand is enlarged to increase its strength, its weight and the effect of wind and ice loading is affected, which increases cable strain. Normally the "best" stand is not the question, but rather if the normal strand is satisfactory. Technically, the smallest EHS messenger with a satisfactory strength is "best". When installing a dedicated suspension strand for fiber optic cable, standard hardware (eyebolts, clamps, etc) should be used.

### 3.3 Overlashing.

#### 3.3.1 Considerations

- 3.3.1.1 Maximum span length (pole spacing)
- 3.3.1.2 Size of the existing messenger
- 3.3.1.3 Messenger- EHS or UG?
- 3.3.1.4 Weight & diameter of the existing copper (or fiber) cable(s)
- 3.3.1.5 Initial messenger tension (If not available, what is the present messenger tension? Measured at what temperature?)
- 3.3.1.6 Age of the existing copper (or fiber) cables
- 3.3.1.7 Loading conditions. In the Midwest IRHTP will consider only a heavy loading.
- 3.3.1.8 Size of the fiber cable being installed (cable, weight, O.D., etc).

### 3.4 Bonding and Grounding

- 3.4.1 If dielectric aerial cable is used, maintain the dielectric properties by using non-metallic lashing materials.
- 3.4.2 If using a metallic messenger or non-dielectric aerial cable on a joint use pole and/or a separate pole line form a continuous bond between all metallic items being placed and the MGN (multi-grounded neutral) used by the power company and/or any other

entity occupying the same pole line use. The purpose behind the aforementioned is to eliminate different electric potentials between independently owned facilities occupying the same pole line. No communication cable on a MGN system will have less than 4 grounds per mile. A non-dielectric aerial cable must occupy the communication space as defined by the National Electrical Safety Code. A dielectric fiber optic cable may occupy either the supply or the communication space on joint use construction. No communication cable shall occupy the space between what is defined as the communication and the supply space. Refer to NESC Section 224, par. 4 & 230F. Quote from NESC: Section 235C, E3; Note that a fully dielectric fiber optic cable carried on a nonmetallic messenger is considered as a supply neutral meeting Rule 230E1 (if located in the supply space) or an ordinary communication cable (if located in the communication space). Such cables must be located either in the supply space or the communication space, not in the safety zone between the two spaces.

- 3.5 Drip Loops Definition. A smooth-curve type loop form at each pole. The use of the 3" drip loop at each pole is required by the IRHTP for two reasons: 1) the extra slack provides for expansion and contraction by the messenger, 2) it provides extra slack if object falls on the messenger. Example: Prevents cable damage if a tree falls on the strand. Do not exceed the minimum bending radius of the cable. If contact is likely between the loop and the pole a cable guard will be required. Refer to Example for drip loop. Each drip loop will have the cable sequence numbers recorded and the IRHTP cable will be identified with an IRHTP ownership tag.
- 3.6 Lashing. Fiber optic cables must be installed without loose lashing, twisting, or weaving along the strand. Contractor will replace any cable showing a deformation. Example: Rippling, or kinking. REQUIREMENTS: Contractor will provide one wrap of lashing wire per linear foot when lashing IRHTP fiber optic cable to messenger. Cable will be double lashed in 3 different circumstances: 1) over-lashing over existing aerial cables, 2) right of way to right of way over railroads, 3) right of way to right of way over roadways. Cable will be lashed up on a span by span basis. All lashing wire should be terminated at each pole with a lashing wire clamp. Lashing wire will be terminated by placing a cable spacer between the fiber optic cable and strand. Locate the lashing wire clamp 2 inches from the strap and spacer. Pull out enough lashing wire for termination on to the lashing wire clamp. Wrap the lashing wire 3 times around only the strand between the lashing wire clamp and the planned location of the first wrap around both the strand and the fiber optic cable. Lashing wire should follow the spiral of the strand wires.
- 3.7 Splicing and Slack Storage. All cables will be butt spliced. All slack-cable loops will be placed a minimum of 4 feet from the pole using snowshoes. The minimum cable coil required at a splice location will be from the strand to ground level plus 20 feet on each side of the splice. In no case shall the splicing be done from a bucket. All splicing will be done on the ground in a protected environment (tent, van, or trailer). A minimum of a 100 foot cable coil (placed in snowshoes) will be required in the following circumstances: 1) railroad crossings, highway crossings, 3) Interstate crossings, 4) main thoroughfares in cities.

## **SECTION 7 - Splicing And Testing**

1. **General.** This document addresses the IRHTP requirements for splicing, testing, documenting and enclosing fiber optic cable for use as part of the IRHTP system.
2. **Access To Work.**
  - 2.1 The Cable installer is required to provide their access to all splice locations.
  - 2.2 Access to splice points at all locations other than the freeways can be made from the shoulder of the road. In no case is access from freeways allowed from the shoulder of the road or ramps. No stopping or parking is allowed on the freeway.
  - 2.3 The Cable installer shall be responsible to repair any damages that it may cause to the right-of-way.
  - 2.4 The cable will be stored in hand holes at all splice locations. The Cable installer shall be responsible to access the cable at the splice locations and shall have equipment for removal of loose dirt and water or the removal of other obstructions to the performance of the Cable installer's work.
3. **Material.** The Cable installer shall be required to supply all material, tools, test equipment, splicing equipment, consumable items, and incidentals necessary to access the cable at the splice locations, perform quality splicing, termination, and testing to include, but not necessarily be limited to the following:
  - 3.1 Enclosure, inner-closure, splice trays, heat shrink sleeves and encapsulate.
    - 3.1.1 The splice closure shall be the Raychem FOSC 450 Fiber Optic Gel Closure or equivalent.
    - 3.1.2 Wire tags with clear heat shrink tubing for #6 insulated ground wire such as Panduit #HSDL9-50-31 or approved equal.
  - 3.2 #6 green insulated ground wire, mechanical lugs and bolts, nuts and washers for grounding terminations and cable sheath bonds.
4. **Pre-Placement Cable Testing.** In order to minimize the amount of rework in the right-of-way, which may be required and to check for fiber optic cable defects, the Cable installer shall be responsible for on reel verification of cable quality prior to placement.
  - 4.1 One hundred percent (100%) of the cable's fiber count shall be tested at 1310 and 1550nm with a Tektronix TFP2 or equivalent Optical Time Domain Reflectometer (OTDR), a stabilized light source and optical power meter, or, equivalent test equipment. Test results will be recorded on a form supplied by the IRHTP. Completed test forms on each reel shall be handed over to the IRHTP field engineer.
  - 4.2 Cable ends shall be sealed upon completion of testing.
5. **Ultimate Responsibility.** The Cable installer shall be ultimately responsible for providing installed fiber cable in which each fiber meets the specifications set forth in this standard.
6. **Splices.**
  - 6.1 All splices shall be placed in hand holes. There are to be no direct buried splices.

- 6.1.1 Cable and closure preparation shall conform to the manufacturer's standards and installation manuals.
- 6.1.2 Hand holes and pedestals shall be compatible with existing IRHTP components
- 6.2 All fibers are to be spliced according to the splice assignment sheets provided by the IRHTP.
- 6.3 All fibers are to be fusion spliced and placed in a Raychem FOSC 450 Fiber Optic Gel enclosure according to the manufactures technical installation instructions and a workmanlike manner.
- 6.4 All spliced fibers shall be protected by using the appropriate organizer tray and associated incidental items. If fiber optic heat shrink sleeves are used, a heat oven shall be used to shrink all sleeves. Care must be exercised to prevent damage to exposed fibers by overheating.
- 6.5 To insure acceptable splices prior to closing and encapsulating the splice case, the Cable installer shall monitor the splicing while it is being performed using an OTDR or a splicer with some type of optimizing capability, such as an LID unit or an optimizing alignment screen, or equivalent.
- 6.6 Splice Grounds (Refer to Example 1.26 - 1.27)
  - 6.6.1 A number six (#6) insulated ground wire shall be installed from the SIP (pedestal) through the existing conduit to the splice enclosure and terminated at both ends. SIP termination nuts shall have a 3/8 inch head.
  - 6.6.2 The ground wire at the SIP shall be identified with major direction associated with the running line of each of the links, e.g., WEST, on heat-shrink ID tags.
- 6.7 The IRHTP reserves the right to accept a splice at any time and waive the above requirements on a case by case basis as relates to splice loss. A waiver at any time shall not be construed to be a relinquishment of any requirements as spelled out in this specification.
- 6.8 Vendor must verify that all fibers are compatible end-to-end. That is fiber number 24 at location A is fiber number 24 at location Z.
7. **Loss Specifications.**
  - 7.1 The maximum acceptable loss for the cable shall be:
    - 7.1.1 0.35 dB/km @ 1310 nm
    - 7.1.2 0.25 dB/km @ 1550 nm
  - 7.2 The maximum acceptable loss per splice shall be:
    - 7.2.1 Maximum splice loss in one direction shall be 0.2 dB.
    - 7.2.2 Maximum bi-directional average splice loss shall be 0.2 dB.
  - 7.3 Maintenance splice loss allocation. Each link shall have sufficient reserve loss margin at acceptance to accept the loss associated with six (6) future maintenance splices and still meet the link unallocated gain margin.
8. **Splicing At Active Locations.**

- 8.1 The Cable installer shall be notified of fibers in the area that are active. It shall be the Cable installer's responsibility to coordinate and supervise all work so that there is no interruption of service on these active fibers during cable/closure prep, splicing, testing, and so on at end points.
- 8.2 The Cable installer shall notify the IRHTP or its authorized representative at least five (5) working days prior to the commencement of any work at splice points with active fibers.
- 8.3 The Cable installer shall have a responsible supervisor monitoring all work being done at all splice locations having active fibers present.
- 8.4 Unless IRHTP or another governing agency (such as the ICN) grants an exception, all splicing on fiber sheaths containing active fibers will be done between the hours of midnight (00:00) and 6:00 AM local.
- 8.5 The Cable installer shall have all the materials required to make a temporary and or a permanent repair in the event a fiber is damaged in the course of work. The materials shall be at the site of the work prior to any work beginning. The Cable installer shall notify the IRHTP immediately in the event an active fiber is damaged.
- 8.6 In the event that active fibers are damaged by the Cable installer, the Cable installer shall supply all resources necessary and directed by the IRHTP to reestablish service on the active fibers. All costs relating to the damage of the active fibers shall be the responsibility of the Cable installer.

## 9. Testing

- 9.1 All test equipment shall be calibrated within ninety (90) days prior to testing. A sticker with the date of calibration shall be fixed to the equipment. A calibration certificate shall be presented to the IRHTP or its authorized representative upon request.
- 9.2 Each span shall be tested bi-directionally from end point to end point. Each span trace shall be recorded so that each splice can be clearly expanded (long range, mid range or high resolution). Some spans will need all three traces. A span map shall be filled out recording each splice loss from each direction and the optical length between splices as well as any other information required by the span map.
- 9.3 The Cable installer shall be required to perform the following tests:
  - 9.3.1 Damaged Cable. In the event it is suspected that the cable has been damaged by the Cable installer at any time, the Cable installer will be required to test the cable with an OTDR. A hard copy of the OTDR test shall be submitted to the IRHTP representative. The Cable installer shall be prepared to test the damaged cable within 24 hours of notification by the IRHTP's representative.
  - 9.3.2 End to End Bi-directional OTDR Span & Splice Test. Each fiber of each span is to be tested bi-directionally at 1310 nm and or 1550 nm as directed by IRHTP from end point to end point and record of results submitted to IRHTP for acceptance.
  - 9.3.3 Cable Sheath. The cable sheath of each installed reel of cable shall be tested for continuity and the results recorded on the span map.

**10. Acceptance Criteria.** The acceptance criteria shall satisfy, as applicable, the requirements of this standard which includes:

10.1 Verifying, and documenting, that at least a 3 dB unallocated margin of gain exists, at 1310 nm, on each link.

10.2. All as-built drawings as specified in the Iowa Communications Network As-Built Drawing Conventions and Symbols Standard.

**11. Markers.** All splice hand holes shall be marked with an IRHTTP Cable signs (furnished by IRHTTP) at the top of the post and an IRHTTP Splice sign mounted on the post just below the IRHTTP Cable sign.

**12. Documentation**

12.1 Splice Identification

12.1.1 Link Splices. Splices interconnecting one or more links will be defined by IRHTTP by the characters LS (link splice) and two or more identification characters, e.g., LS-13A.

12.1.2 Backbone Splices. Splices placed at the end of reels are referred to as backbone splices and numbered by the Cable installer in sequence for a given link, e.g., B1210-1, B1210-2, and so on.

12.1.3 Maintenance Splices. Splices that are required because of a maintenance or repair to the cable are referred to a maintenance splices and shall be identified as Maintenance Splice, MS"LINK #"- "x", with "x" identifying the time sequence that the splice was made, e.g., MS1210-1 is the first maintenance splice made on Link 1210. The Cable installer will assign MS identification codes to maintenance splices all unaccepted links. On accepted links, the Cable installer will identify the time sequence that the splice was made and request a splice identification code from the IRHTTP.

12.2 Documentation Package

12.2.1 The following hard copy documentation package shall be submitted to the IRHTTP on the applicable forms within five (5) working days after completion of the span splicing and testing, or a minimum, of thirty days prior to the commencement of acceptance testing. Each package shall be neatly organized, with dividers in a separate loose leaf, 3 ring binder or other IRHTTP approved binder. All forms shall be completely filled out. All forms and OTDR shall be legible and reproducible. All sheets/forms shall have a revision log and be titled and dated.

12.2.1.1 A splice identification sheet.

12.2.1.2 A span map for each span.

12.2.1.3 The splice assignment sheets.

12.2.1.4 Reproducible copies of each span trace.

12.2.1.5 Reproducible copies of splice traces.

## **SECTION 8 - As-Built Drawing**

### **1. Introduction**

- 1.1 Delivery Method. Two sets of legible, reproducible as-built drawings on 11 X 17 inch, white paper, in a hard cover binder shall be provided for each link. If available, it would be desirable to also have a set on a 3.5 inch diskette in a format compatible with the IRHTP's computer aided design (CAD) system. The IRHTP's current CAD system is an AutoCAD, Release 2002 or newer.
- 1.2 Symbols and Conventions. The as-built drawings are to use symbols and conventions specified in this document. If not specifically stated, the symbols and conventions to be used are those considered required by good engineering drawing practices. The vendor is to provide to the IRHTP, any symbol, icon, model, block, and so on that is used on, or as part of, the as-built drawings provided for any part of the IRHTP. These symbols, icons, models, blocks, and so on, are to be provided as defined in section 1.1.0.
- 1.3 Consistency. A key requirement is for the symbols, conventions, practices, scale, and so on, to be consistent from one drawing to the next.
- 1.4 Governing/Authorization Agency Permits. Where there is a governing agency permit associated with one or more as-built drawings, there shall be correlation between the method of showing project from and to points on the permit and the as-built drawings. For example, where an Iowa Department of Transportation (IDOT) permit uses highway stationing (HWY STA.), the as-built drawings, which includes these particular permit points will, as a minimum, show HWY STA. numbers at the start and end of the particular drawing.
- 1.5 Link As-Built Drawings. The IRHTP consists of a series of spans, segments, and links. The specific start and end point of each span, segment, and link has been or will be defined by the IRHTP or its' authorized representative. Each link is identified by a unique set of characters. A set of as-built drawings is to be provided for each link.
  - 1.5.1 Each as-built drawing shall use the unique link identifier as part of the title, e.g., Link 1234, and will be included in the drawing number, e.g., DWG 1234-08 of 20.
  - 1.5.2 Drawing Revisions. As part of the title and status blocks, each drawing shall list the reason(s) that an individual drawing was changed.
  - 1.5.3 The first sheet of a set of link drawings shall be numbered DWG 0. It is a title page and shall contain:
    - 1.5.3.1 Link name/title.
    - 1.5.3.2 A revision table for each of the link drawings listing the current revision of each drawing.
    - 1.5.3.3 Cable specifications.
    - 1.5.3.4 To-from information, including start and end point identification such as mile post numbers, highway station numbers, and or other readily recognizable identifiers.

1.5.3.5 A table listing each splice associated with the link, and, the drawing number containing that splice.

1.5.3.6 A revision record for DWG 0.

1.6. Scale. While drawings scale is specified as "none", to achieve consistency, the typical landscape drawing has 14 to 15 inches of running line, covering about 0.5 miles. Where appropriate, a single 17 X 11 sheet may contain 2 drawings. No specific scale is required for the direction perpendicular to the running line except that it shall be consistent and, reasonable distance differences shall be obvious. Individual drawings may deviate from the above scale requirements for the sake of clarity.

1.7 Link Drawing Order/Sequence. Each set of link drawings shall read from left to right. That is, when the major direction of the link is east/west, the left side or edge of a drawing will show the match line for a more westerly/lower numbered drawing. When the major direction of the link is north/south, the left side or edge of a drawing will show the match line for a more southerly/lower numbered drawing.

1.8 Highway Plan Drawings. If available, highway plan drawings from IDOT may be used as part of an as-built drawing for additional information.

## **2. Specific Requirements**

2.1 Highway Location Signs/Markers. When available, drawings shall show highway mile post numbers and highway stationing numbers.

2.2 Street, Road, Highway Identification

2.2.1 The highway marker number, e.g., county E-16, I-80, and so on, will be shown on all county, state, or federal highways that are on a drawing.

2.2.2 Most counties in Iowa have or are in the process of acquiring Extended 911 capability. Individual addresses are a requirement for this capability. Therefore, most, if not all, Iowa counties have assigned names to all county roads which are to be included on the drawings.

2.2.3 Multiple Identifiers: Where there is more than one identifying name and or number for a street, road or highway, all identifiers shall be shown on the drawing, e.g., V-24, OLD HOME ROAD, and so on.

2.3 County, Township, Range, Section(s). As a minimum, the first and last drawing of a set of link as-built drawings shall show the county, township name and identifier, range identifier and section number(s) peculiar to that particular drawing. When the county, township, or range changes in a link drawing sequence, the previous and the new county, township, range, or section shall be shown. The city, county, state boundary symbol shown on the LEGEND AND SYMBOL sheet is to be used. The preference is to have the county, township, range, and section specified on each drawing.

2.4 Fiber Cable Specifications. The fiber cable specification shall be shown on each page. See example drawings and the LEGEND and SYMBOL sheet.

- 2.5 Link Continuity. The first and last page of each set of link drawings shall show the connections/splices to the connecting link(s). The connecting links shall be shown with their respective link identification.
- 2.6 Revision Log. Each drawing shall include a revision table that is used once a drawing has been distributed and or released, whether it be a pre release, bid issue, as-built, and so on. The reason for the change shall be included in the table.
- 2.7 Splice Identification
- 2.7.1 Link Splices. Splices interconnecting one or more links will be defined by the IRHTP by the characters LS (link splice) and two or more identification characters, e.g., LS-A.
- 2.7.2 Backbone Splices. Splices placed at the end of reels are referred to as backbone splices and numbered in sequence for a given link, e.g., B1210-1, B1210-2, and so on.
- 2.7.3 Maintenance Splices. Splices that are required because of a maintenance or repair to the cable are referred to as maintenance splices and shall be identified as Maintenance Splice, MS"LINK #"- "x", with "x" identifying the time sequence that the splice was made, e.g., MS1210-1 is the first maintenance splice made on Link 1210. The cable installer will assign MS identification codes to all unaccepted links. On all links that have been accepted by the IRHTP, the cable installer will identify the time sequence that the splice was made and request a splice identification code from the IRHTP.