

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

1. INTRODUCTION

The City of Austin, hereafter referred to as COA or as the “City”, and Arterial Management Division of the Austin Transportation Department (ATD) is seeking bids for the installation, termination, splicing, testing, rehabilitation, maintenance, and repair of the fiber optic cable network connecting and supporting the City’s Traffic Signals/ITS (Intelligent Transportation System).

2. BACKGROUND

The City of Austin maintains and operates over 950 traffic signals throughout the City. In addition, there are more than 225 CCTV cameras located at different locations providing City staff the capability to monitor and manage traffic flow from the City Traffic Management Center (TMC). These signalized intersections and CCTV cameras are connected by over 200 miles of City owned overhead and underground fiber optic cable network.

The network is constantly being expanded as the City keeps on growing. Further, the existing network will need modifications in order to enhance the operation and reliability of the system. Additionally, the network needs repairing as it gets damaged for many different reasons.

This contract will be for planned or unforeseen needs for the installation and maintenance of single mode fiber optic cable in a timely manner. Qualifications and responsiveness are very crucial for this contract since it has a direct impact on the staff’s ability to monitor and manage traffic as a crucial task for the City and for its citizens.

3. SCOPE OF WORK

A. Normal Work Sequence

1. Proceed with repair or construction of new cable spur, including the termination and labeling of all strands/lightguide boxes. Place jumpers on all fibers at new or reworked location.
2. Notify COA Contract Manager before opening splice and after completion to verify that the ring is properly back in service.
3. Perform bi-directional OTDR (Optical Time Division Reflectometer) and power meter tests through new spur from both adjacent nodes.
4. Promptly email a PDF copy of all testing results to COA Contract Manager.
5. Create as-built document(s) from the workprint(s) and provide a PDF copy by email to COA Contract Manager with the project invoice.
6. Re-test and/or troubleshoot any suspect connector or fiber identified by COA verification testing. Make any necessary corrections and provide updated documentation.

B. Emergency Work Sequence

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

NOTE: Emergency situations will require Section B requirements as well.

As each work site is identified, the Contractor shall:

7. Review plans and visit the site to determine scope of work and prepare a cost estimate,
8. Present quotation and preliminary work print(s) (full size paper copy and electronic) back to the COA Contract Manager for review and approval.
9. Upon notice to proceed from the Contract Manager, provide all necessary material per COA specifications. The Contractor shall be expected to provide all materials necessary at each site.
10. Provide necessary inventory control and warehousing space to stockpile COA emergency repair cable and any racks, lightguides, cable, jumpers and other material items recovered from City installations for reuse. The facility must be available for City of Austin inspection with 24 hour notice.
11. Notify COA's Transportation Management Center at (512) 974-4075 of work commencement, detailed information as to location and scope of work in those situations where traffic communication may be affected, and anticipated completion date.

C. Additional Requirements for Emergency Work

1. Provide emergency replacement and restoration of aerial cable plant, underground cable plant, terminations and/or splicing and testing and re-documentation of damaged plant.
2. Provide twenty-four hour a day, seven days a week coverage on call.
3. Respond within one hour by telephone to all call-outs.
4. Arrive on-site within three (3) hours of an initial notification with field staff arriving onsite within three (3) hours of notification.
5. Evaluate encountered situation, and notify Contract Manager of proposed scope of work and begin restoration as directed by the Contract Manager.
6. If temporary restoration measures are utilized to initially restore service, commence permanent restoration within three (3) working days from the time of initial restoration of service. Permanent repairs that require downtime to network electronic components will be scheduled based on the City's needs. The three (3) day response time is subject to availability of materials required for the permanent repair and cooperation from the affected departments.
7. The Contractor shall maintain two (2) bucket trucks, one (1) trencher, one (1) cable lashing machine, one (1) fusion splicing trailer, and one (1) complete set of OTDR testing equipment on stand-by for three (3) hour

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

response to COA situation. COA may inspect availability of equipment at any point during the contract.

3. INSTALLATION

Experience Requirements. Contractor involved in the installation, splicing, and testing of the fiber optic cable shall meet the following requirements:

- Five (5) years of experience in the installation of fiber optic cables, including fusion splicing, and the terminating and testing of single mode fiber optic cables.
- Three (3) installed systems where fiber optic cables are installed aerially on messenger cable and in outdoor underground conduits and the systems are in continuous satisfactory operation for at least two (2) years. The Contractor shall submit as proof with the bid, photographs and other supporting documents such as the names, addresses, and telephone numbers of the customers' operating and maintenance personnel who can be contacted regarding the fiber optic systems. (Refer to Section 0700, Reference Sheet).
- One (1) fiber optic cable system (which may be one of the three in the preceding paragraph) which the Contractor can arrange for demonstration to the Engineer and/or his representatives.
- One (1) fiber optic cable system (which may be one of the three in the preceding paragraphs) which the Contractor can show the Engineer and/or his representatives a set of as-built drawings.
- Splicers shall have been trained, experienced, and certified on the specific splicing equipment to be used. Experience and certification for all employees to be working on COA projects shall be submitted with bids.

Contractor Requirements:

Installation Requirements. The fiber optic cable installation techniques shall be such that the optical and mechanical characteristics of the cables are not degraded at the time of installation.

Aerial Installation. The cable pulling operation shall be performed so that the minimum bending radius of the cable per manufacturers specifications shall not be exceeded in the unreeling and pulling operations. The Contractor shall be aware of the manufacturers recommended maximum pulling tension and maximum span tension during placement. The cable shall be coiled in a "figure-eight" configuration during unreeling. The pulling tension and span tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable.

Installation of new messenger cable. This item includes furnishing and installation of ¼" messenger cable along the route and on utility poles shown on the plans. The

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

messenger cable will be used as the pathway for lashing the fiber optic cables. All hardware necessary to install the messenger on wood poles is incidental and subsidiary to this item.

Lash cable to messenger. Under this item, the Contractor is required to provide the labor, incidental items, and all other equipment necessary for lashing fiber optic cable to new or existing messenger cable. Cables must be installed continuously from splice point to splice point as specified by the Engineer and on the plans. Splices not identified on the plans and not approved by the Engineer will not be reimbursed.

Installation in Conduit. The cable pulling operation shall be performed so that the minimum bending radius of the cable shall not be exceeded in the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the pull-box conduit ports. Lubricating compound shall be used to minimize cable-to-conduit friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the array is specifically approved by the cable manufacturer. The pulling tension shall be continuously measured and it shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable. Fuse links and breaks shall be used to insure cable tensile strength shall not exceed 2700 N (600 lbs).

When simultaneously pulling fiber optic cable with other cables, separate grooved rollers shall be used for each cable. Conduits shall be sealed with a two part urethane after cable installation.

Cable Installation between Pull-boxes and Cabinets. When pulling the cable from the nearest hand-hole to any hub cabinet, care shall be taken during this procedure to avoid bending the cable beyond its minimum bend radius.

When pulling the cable from the nearest manhole to the fiber hub the cable shall be spliced to a multi-fiber jacketed pigtail to complete the run. All remaining fibers shall remain continuous with no splices. Care shall be taken during this procedure to avoid bending the cable beyond its minimum bend radius.

Mechanical Components. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping screws shall be used unless specifically approved in advance by the Engineer.

All parts shall be made of corrosion resistant material such as plastic, anodized aluminum or brass.

All materials used in construction shall be protected from fungus growth and moisture deterioration.

Dissimilar metals shall be separated by an inert dielectric material.

4. CONSTRUCTION METHODS

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

General. The installation of the cable, splicing of the fibers, attachment of connectors, and mounting of hardware in cabinets and the methods employed in the above "Contractor Requirements" sections shall utilize the latest available installation machinery, jacking equipment, cable pulling machinery with appropriate tension monitors, splicing equipment and testing equipment and other miscellaneous tools.

The inner-duct shall have a smooth outer wall and a permanent pre-lubricated inner wall. All duct runs shall be verified by the Contractor as continuous from hand-hole to hand-hole and suitable for installation of inner-duct. In areas where the inner-duct cannot pass through a manhole or pull-box, the cable shall be racked and covered with an intermediary inner-duct or placed in a manner to protect it from damage during re-entry of the manhole or pull-box. Where a cable run changes directions, the Contractor shall provide for sufficient slack and protect the cable against violating the minimum bend radius in the event slack was pulled from another location. A manufacturer approved cable lubricant shall be used when pulling fiber optic cable in duct. The City of Austin currently uses Prysmian cable. Liquid detergent shall not be used as a lubricant. Intermediate pull points may be used to assist the cable through the duct run to achieve the required cable lengths. All fiber optic cable to be installed aerially shall be lashed to a new messenger cable or to existing City messenger cable as called out in plans. The manufacturer's recommended maximum pulling tension and span tensions shall not be exceeded.

All installation techniques and fixtures shall result in ease of maintenance and ready access to all components for testing and measurements.

The installation of the fiber optic cable shall be conducted in a phased manner. The Contractor shall make every effort to protect the delicate fiber optic cable during construction and installation, including protection from vandalism. The Contractor shall perform the cable installation in accordance with the Engineer approved plan. Any deviations from the approved plan must be submitted in writing to the Engineer in advance.

The Contractor shall at all times, conduct the installation of the fiber optic cable in a manner identical to installations found in the telephone industry, and in complete conformance with the recommended practices of the cable manufacturer. The tensile ratings, minimum bending radius, and any other fiber optic cable installation restriction shall not be exceeded.

The Contractor shall give the Engineer five (5) working days' notice of all fiber optic cable installations so that a City authorized representative may be present, if the City feels necessary.

All cable runs shall be continuous from nodal site to nodal site. No splices of any kind shall be accepted between nodal sites or at locations other than approved splice points or as shown on the contract plans. The cable shall not be cut in the field unless otherwise approved by the Engineer or designee. All cable runs shall be continuous between roadside cabinets as shown on the contract plans.

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

All cables shall be clearly marked and tagged to identify the cable origin, destination, function, and COA designated identification number. Such tags shall be of nylon or other approved construction, with permanent mechanically printed markings. This is in addition to the permanent identification marking specified elsewhere.

If the cable must be unreeled during installation, the Contractor shall use the "Figure-8" method to prevent kinking or twisting of the cable. The cable shall not be coiled in a continuous direction except for lengths of less than 10 meters. The minimum bend radius shall not be exceeded at any time during the figure-eight operation. The Contractor shall take steps to relieve pressure on the cable at the crossover of the figure – 8 stack.

All fiber optic cable to be installed in duct runs shall be installed in Maxcell or similar inner-duct within a multi-duct conduit or in a separate inner-duct where a multi-duct conduit does not exist as specified elsewhere.

Fiber optic inner-duct shall be furnished and installed within existing duct, inside cable trays, and manholes, and at any location where fiber optic cable is exterior to dedicated conduit.

Fiber optic inner-duct shall be flexible with a minimum bending radius not less than the minimum bending radius of the fiber optic cable which it supports.

The inner-duct shall be orange in color for ease of identification, and shall have a preinstalled pull rope or pull tape to facilitate cable pulling.

The inner-duct shall have a smooth outer wall and a permanent pre-lubricated ribbed inner wall.

All duct runs shall be verified by the Contractor as continuous from ground-box to ground-box and suitable for installation of inner-duct.

In areas where the inner-duct cannot pass through a manhole or pull-box, the cable shall be racked and covered with an intermediary inner-duct or placed in a manner to protect it from damage during re-entry of the manhole or pull-box.

Where a cable run changes directions, the Contractor shall provide for sufficient slack and protect the cable against violating the minimum bend radius in the event slack was pulled from another location.

A manufacturer approved cable lubricant shall be used when pulling fiber optic cable in duct. Liquid detergent shall not be used as a lubricant.

Intermediate pull points may be used to assist the cable through the duct run to achieve the required cable lengths.

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

The fiber optic cable shall be brought into each Fiber Distribution panel (FDP) and Fiber Patch Panel (FPP) as follows:

The backbone cable shall be brought into the communications ground-box adjacent to each roadside cabinet as shown on the contract plans, and 15 meters of cable slack on each end of the splice shall be coiled in the ground box.

The cable shall be spliced in the ground-box as shown on the contract plans. A factory connectorized (or pre-approved field-installed), multi-strand, jacketed pigtail shall be fusion spliced to the active fibers in the backbone cable for the respective cabinet. The remaining fibers in the backbone cable shall continue uncut (or through-spliced with prior approval by the Engineer) in the ground-box. The pigtail shall be installed in provided conduit to the cabinet and terminated on the fiber patch panel.

At the communication hubs, the single mode cable shall be brought into the node cabinet as shown on the contract plans, and 30 meters of cable slack from each cable shall be coiled at the cable entry point in the FDP.

Each fiber shall be fusion spliced to a factory connectorized (or pre-approved field-installed) pigtail for termination within the FDP.

Patch cords shall be used to connect terminal equipment with the FDP.

5. MATERIALS

General Requirements. Unless otherwise noted herein, the City will procure and provide the fiber optic cable. The City of Austin currently uses Prysmian #0048HBS1LAFEAJA and Prysmian #0096HBS1LAFEAJA cable.

All splicing kits, fiber optic cable caps, moisture/water sealants, and other required accessories to complete the fiber optic cable installation, splicing, and termination are considered as incidentals, and are the responsibility of the Contractor to provide.

All other materials furnished, assembled, fabricated or installed under this contract shall be new, corrosion resistant, and in strict accordance with the details shown on the plans and in the Specifications.

Outdoor Splice Enclosure. The outdoor optical splice enclosure, if required and approved by the Engineer, shall be capable of aerial, duct, or buried applications. The splice enclosure shall consist of an outer enclosure, an inner enclosure, and splice trays. The splice enclosure shall be suitable for application in the temperature range of -40 degrees C to +70 degrees C.

The splice enclosure shall provide space, allowing entry of fiber optic cable without exceeding the minimum bend radius of the cable.

CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE

The splice enclosure shall be capable of through, branch, or mid-span type splice locations. The splice enclosure shall be designed to permit selective fiber splicing (looping a backbone cable in and out while only cutting into the desired fibers).

The splice enclosure shall allow splicing of all fibers up to the maximum number specified on the Contract Drawings.

The outer enclosure shall be waterproof, re-enterable and shall utilize an encapsulant between the inner and outer enclosure to prevent the ingress of moisture.

The inner enclosure shall be designed to protect the buffer tubes and the splice trays. The inner enclosure shall be re-enterable. The splice trays within the inner enclosure shall be capable of accommodating the required number of splices, either fusion or mechanical, including storage and protection of slack fiber. All outdoor splice enclosures shall be located within specified communication hand-holes, as shown on the plans.

A maintenance loop of at least 50 feet of cable on each end of the splice closure shall be coiled up in a Figure-8 manner and neatly placed in the communications pullbox. This will allow for future splices in the event of a damaged splice. "Pigtails" shall be used to interconnect equipment. Splice loss shall not exceed 0.1 dB.

Splices that are made between two cables shall be tested using an Optical Time Domain Reflectometer (OTDR) in both directions. These splices shall be tested at the required wavelength and printouts and electronic files of the splice tests shall be provided.

Four (4) feet of the unused buffer tube(s) shall be removed from the fibers and the coiled fibers placed into a splice tray. The water blocking compound shall be cleaned from all fibers destined for the splice tray.

All splice losses shall be recorded in tabular form and submitted to the Engineer for approval. Splices that are made between two cables shall be tested using an Optical Time Domain Reflectometer (OTDR) in both directions. These splices shall be tested at the required wavelength and printouts and electronic files of the splice tests shall be provided.

Termination Requirements. In cabinets where the optical fibers have to be connected to terminal equipment, the Contractor shall provide matching connectors.

The connector loss for complete connection to the terminal equipment shall not exceed 0.5 dB. Connectors will be qualified and accepted on the basis of connector-to-connector mating using similar fibers. At each end of the system, 6 feet of the unused optical fibers shall be removed from the buffer tube(s) and the coiled fibers placed into a splice tray approved by the Engineer. The water blocking compound shall be cleaned from all fibers destined for splice tray usage.

The Contractor is required to contact the Engineer or the Engineer's designee prior to terminating any cable.

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

Fiber Distribution Panel (FDP) / Fiber Patch Panel (FPP). Fiber Distribution Panels shall be furnished and installed at the locations shown on the contract plans and shall consist of two parts: a splice shelf and an optical patch panel.

The FDP shall be SIECOR Landscape 4RU rack mounted unit in 48, 72, 96 or 144 port fiber capacity or equivalent.

The FPP shall be Panduit 24 port modular patch panel rack mounted unit or equivalent.

The splice shelf shall house and protect fusion splices of outside plant OSP fibers to optical fiber pigtails with two (2) meters of pigtail slack on each fiber.

The fiber distribution panel shall house and protect the required quantity of connectors and splices on each pigtail and slack for fiber optic patch cords. The fiber pigtail slack shall be neatly coiled and secured in a manner that does not allow the minimum operational bending radius of the pigtail to be exceeded.

The approved type optical connectors on the end of each pigtail shall screw into a sleeve securely mounted to a patch panel within the FDP enclosure.

The maximum optical loss across the connection shall not exceed 0.5 dB.

The Contractor is required to contact the Engineer or the Engineer's designee prior to installing FDP in any cabinet.

HLC-Single-Mode connectors shall only be used on this project. The FDP shall be capable of singlemode terminations. The FDP housings shall be rack mounted in standard EIA 19 inch equipment racks, as shown on the Contract Drawings. The housing shall have OSP cable entrances with cable sheath strain relief.

The Fiber Patch Panel (FPP) shall act as the demarcation point between the OSP cable via the fiber pigtail from the splice closure and the terminal equipment via the fiber patch cords.

The approved type optical connectors on the end of each pigtail shall screw into a sleeve securely mounted to a patch panel within the FPP enclosure. The maximum optical Loss across the connection shall not exceed 0.5 dB.

The FPP housings shall be surface or shelf mounted in the outdoor traffic signal controller cabinets, as shown on the contract plans. The FPP shall accept a minimum of four (4) fiber terminations (in and out). Multiple FPP's may be used to accommodate specific fiber requirements at a given location. The cabinet shall have OSP cable entrances with cable sheath strain relief, leading to the FPP.

Pigtails.

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

The Contractor shall consist of two (2) types of optical pigtailed provided under this contract. The first type shall consist of a section of single fiber, jacketed cable, equipped with an approved factory installed connector at one end, and the other end shall be stripped and prepared for fusion splicing.

The second type shall consist of multiple fibers, factory connectorized on one end, suitable for installation in an outdoor duct run. Each fiber shall be individually jacketed, with aramid yarn fibers between the fiber and the sub-jacket. The fibers shall then be contained in a medium density polyethylene outer jacket. The multi-fiber pigtail shall be provided in: twelve (12) singlemode fibers configurations.

The approved connectors furnished on the pigtailed shall meet or exceed the requirements for approved connectors specified herein.

The fiber portion of each pigtail shall be a single, jacketed fiber with optical properties identical to the optical cable furnished under this Contract.

Each jacketed fiber shall have a tensile strength in excess of 50 lbs.

Splicing Requirements. All optical fibers shall be spliced or terminated by the Contractor as shown on the Splicing diagrams in the plans assigned for each job. Splices shall be allowed only in locations as shown on the plans or as directed by the Engineer.

All splices shall use the fusion technique. Fusion splicing equipment shall be provided by the Contractor and shall be cleaned, calibrated and specifically adjusted to the fiber and environmental conditions at the start of each shift. Fusion splicing equipment used shall be approved by the Engineer. Splice enclosures, organizers and incidentals, and cable end preparation tools and procedures, shall be compatible with the cable type being delivered and approved by the Engineer.

Each spliced fiber shall be packaged in protective sleeving or housing. Bare fiber shall be completely re-coated, with a protective 8 RTV, gel or similar substance, prior to application of the sleeve or housing, so as to protect the fiber from scoring, dirt or microbending.

Optical Connectors. All permanent connector installations shall utilize factory installed/tested connectors. Field installed connectors shall not be allowed.

The optical connectors furnished for installation on optical patch cords and pigtailed shall be compatible with the connector sleeves on the fiber distribution panels.

The connectors shall meet, as a minimum, the following specifications:

- Type: SC (singlemode)

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

- Attenuation: (Average, 3 readings, 120 degree spacing): 0.5 dB, maximum @ 1300 nm
- Mechanical Stability: 0.3 dB change, maximum
- Tensile Stability: 0.3 dB change, maximum
- Thermal Stability: (5 cycles, -20 degrees C to +60 degrees C) 0.4 dB change, maximum

Submittals. The Contractor shall use industry standard equipment and materials. All material shall be Sicores, Corning or Engineer approved equal. Shop drawings and specifications for all material to be used must be submitted in writing and approved by the Engineer. Request for substitution must be submitted and approved the Engineer.

6. TESTING REQUIREMENTS

General. It is the policy of the City to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval by the City, samples may be requested for testing by the Engineer or designee. The contract period will not be extended for time lost or delays caused by testing prior to final City approval of any items.

Demonstration Tests at the equipment manufacturer's facility to determine conformance with all the specification requirements, except those that the Engineer or designee accepts by certification from an independent testing lab in lieu of the Design Approval Tests, shall verify that the Design Approval Tests have previously been satisfactorily completed. The Contractor shall arrange for and conduct the tests in accordance with the testing requirements stated herein.

The Contractor is responsible for satisfying all inspection requirements prior to submission for the Engineer's inspection and acceptance. The Engineer or designee reserves the right to have a representative witness all tests.

The results of each test shall be compared with the requirements specified herein. Failure to conform to the requirements of any tests shall be counted as a defect, and equipment shall be subject to rejection by the Engineer or designee. Rejected equipment may be offered again for retests provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer or designee.

Final inspection and acceptance of the fiber optic cable shall be made after the completion of the installation, testing, and approval of the documentation described in Section 6 (Testing Requirements).

Pre-installation Tests. The fiber optic cable shall be tested at the City's storage area currently located at either the City Traffic Signal Shop located at 1501 Toomey Rd. or the Traffic warehouse at IH 35 & St. Johns prior to installation. It is the Contractor's responsibility to test reels of cables before transporting to the job site.

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

Each optical fiber in the cable shall be tested from one end with an OTDR compatible with wavelength and fiber type. Testing shall check for continuity, length, anomalies, and approximate attenuation.

Reels of fiber optic cables that fail the test are reported to the Project Engineer or Engineer's designee immediately. It is the responsibility of the City to take care of the failed fiber optic cables.

The Contractor will only use the fiber reels that have passed the test and transferred to the field for installation. Any damage to the fiber during transportation is the responsibility of the Contractor. Damaged and unusable fiber optics cable must be replaced by the Contractor at their expense. It must be the same fiber optic cable part number as the damaged cable.

Post-installation Tests. After installation, each optical fiber in the cable shall be tested again for the loss characteristics. Both directions of operation of the fiber shall be tested.

After each splice and connector installation, the cable shall also be tested and the data shall be submitted to the Engineer or designee as basis for acceptance. OTDR and/or power meter/optical light source testing equipment, as specified by the cable manufacturer, shall be used for this testing.

The Contractor shall notify the Engineer or designee in writing five (5) working days in advance of the testing of the cable so that the Engineer, or its representative, may be present for the tests, if the Engineer so elects. Optical testing shall be performed on all fibers within each cable in order to meet the 100 percent fiber quality warranty as outlined in the specifications.

Testing shall be performed on the fibers, as terminated on the FDP's or FPP's. All necessary test equipment shall be provided by the Contractor to perform tests to include, the following:

Optical attenuation 1,300 and 1,500 nm for the single mode cable.

Optical Time Domain Reflectometer (OTDR) records (labeled and identified), electronic file and computer printer/plotter output. Test shall be conducted for both directions of transmission. All OTDR tests shall be made with an OTDR approved by the Engineer or the Engineer's Designee.

All testing equipment required for proper installation of the fiber optic cable shall be turned over to the City of Austin after acceptance of the communication system.

Testing Procedure. The Contractor shall prepare and submit all testing procedures and data forms for the pre-installation and post-installation tests to the Engineer or Engineer's designee for approval. The Contractor shall furnish data forms containing all of the data taken, as well as quantitative results for all tests. The data forms shall be

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

signed by an authorized representative of the Contractor. One copy of the data forms shall be emailed to the Engineer or designee in PDF format.

Test Equipment. The Contractor shall furnish the following test equipment for proper installation and testing of the fiber optic cable system.

A. Optical Loss Test Set/Power Meter - The optical loss test set shall be a portable hand-held unit capable of measuring single-mode fibers. The test set shall be capable of operation as a power meter, light source, and a loss test set.

The test set shall be portable and capable of operating in a temperature range of -10 to +50 degrees C. It shall be provided with a padded carrying case, rechargeable batteries, a 120VAC power adapter/battery charger, and all necessary connectors.

The test set shall meet the following specifications:

a. Power Meter:

- Wavelength Range: 200 to 1700 nm
- Fiber Type: singlemode (8.3 um)
- Measurement Range: +10 to -70 dBm, 1 pW to 2 mW
- Sensor Element: InGaAs
- Noise Floor: <3pW pp
- Calibrated Wavelength: 1300, 1550 nm

b. Loss Test Set/Source:

Wave1ength: 1300+/-20 nm 1550+/-20 nm

Spectral BW: <140 nm <200 nm

OutputPower: >-20 dBm >-25 dBm

DynamicRange: >50dB >45dB

Stability: +/-0.03dB +/-0.03dB

B. Optical Time Domain Reflectometer (OTDR). The optical time domain reflectometer (OTDR) furnished under this contract shall be capable of measuring single-mode fibers.

The OTDR shall be portable and capable of operating in a temperature range of -10 to +50 degrees C. It shall be provided with a padded carrying case, rechargeable Nickel Metal Hydride batteries, and a 120VAC power adapter.

The OTDR shall be capable of storing and exporting all test measurements to an external storage device such as a USB storage device.

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

The OTDR shall be equipped with additional test features built in to the unit. This shall include an optical power meter, a visual fault locator, and a singlemode laser source.

The OTDR shall meet the following specifications:

a. dB Readout Resolution	0.01 dB
b. Refractive Index Range	1.4000 to 1.7000.
c. Data Acquisition windows	5,10,20,40,60,160 km
d. Display Type	Backlit LCD, 5 inch diag.
e. Units of Length Measurement	meters and feet
f. Connector Types	SC, ST, minimum
g. Single-mode:	
	<u>1310nm</u> <u>1550nm</u>
Wavelength	1310+/-20nm 1550+/-20nm
Dynamic Range	30dB 28dB
Dead Zone-Event	5 m 10 m
Dead Zone-Atten	15 m 15 m
Distance Window	160km max. 160km max.

If the OTDR supplied exhibits “dead zones” which prevent examination of optical cable immediately adjacent to the OTDR, the Contractor shall supply a length of known quality fiber optic cable, coiled and enclosed within a commercial container, which shall act as the “dead zone” and allow OTDR examination of adjacent cables.

C. Fusion Splicer. The fusion splicer furnished under this contract shall be capable of splicing single-mode fibers. The fusion splicer shall be a microprocessor controlled unit, which allows for automatic operation.

The fusion splicer shall be equipped with a minimum of two cameras to allow for simultaneous viewing of the X axis and the Y axis of each fiber end to be viewed on a high resolution video display (minimum 3.5”), integral to the unit. The splicer shall be based on a on a one-button operation, such that the splicer will automatically clean, align, and fuse the fiber upon activation of the button. The splicer shall use a 3 dimensional alignment of the fibers (X,Y,Z).

The splicer shall be capable of performing an instant splice loss measurement and tensile strength. The splicer shall be capable of storing this information in memory.

The splicer shall be a portable unit, capable of use in outdoor environments. The splicer shall be furnished with a protective carrying case, batteries, power supply, and a heat shrink oven.

The splicer shall be equipped with a precision diamond cleaver which shall provide smooth, flat, perpendicular fiber end faces (< 1.0 degree).

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

Nominal splice loss shall be less than 0.04 dB for single-mode fiber.

The splicer shall be equipped with an external video display port, and an RS232 printer port.

The splicer shall be capable of operation between 0 and +45 degrees C, with a storage temperature range from -20 to +70 degrees C. Operating humidity range shall be 0 to 95% non-condensing.

The splicer shall be capable of operation from a rechargeable 12V DC battery, 12V car battery, and 120VAC. The splicer shall be furnished with all necessary components for proper operation, including but not limited to, batteries, power supplies, car adapters, tools, etc.

7. APPLICABLE STANDARDS LIST

1. American National Standards Institute (ANSI)
2. American Society for Testing and Materials (ASTM)
3. Alliance for Telecommunications Industry Solutions (ATIS)
4. Electronics Industry Alliance (EIA)
5. Federal Communications Commission (FCC)
 - a. FCC Part 15, Radiated Emissions Limits, revised 1998
 - b. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998
 - c. FCC Part 76, Cable Television Service, revised 1998
6. International Electrotechnical Commission (IEC)
7. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 - a. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
 - b. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive
 - c. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
8. International Organization for Standardization (ISO)
9. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
10. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995
11. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999
12. National Cable Television Association (NCTA)
13. National Electrical Code (NEC)
14. National Electrical Manufacturers Association (NEMA)
15. National Fire Protection Association (NFPA)
 - a. NFPA-70, National Electrical Code
 - b. NFPA-75, Protection of Electronic Computer Data Processing Equipment

CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE

- c. NFPA-101, Life Safety Code
- d. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
- e. NFPA-780, Standard for the Installation of Lightning Protection Systems
- 16. National Institute Standards and Technology (NIST)
- 17. Occupational Safety and Health Administration (OSHA)
- 18. Rural Utility Services (RUS)
- 19. Telecommunications Industry Association (TIA)
- 20. ANSI/TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard, 2000
- 21. ANSI/TIA/EIA-568-A, Propagations Delay and Delay Skew Specifications for 100-OHM 4-Pair Cable, 1997
- 22. ANSI/TIA/EIA-568-A-2, Corrections and Additions to ANSI/TIA/EIA-568-A, 1998
- 23. ANSI/TIA/EIA-568-A-3, Hybrid Cables, 1998
- 24. ANSI/TIA/EIA-568-A-4, Production Modular Cord NEXT Loss Test Method and Requirements for Unshielded Twisted Pair Cabling, 1999
- 25. ANSI/TIA/EIA-568-A-5, Transmission Performance Specifications for 4-Pair 100-OHM Category 5e Cabling, 1999
- 26. ANSI/TIA/EIA-569-A, Commercial Building Telecommunications Pathways and Spaces, 1998
- 27. ANSI/TIA/EIA-569-A-1 Addendum 1, 2000. Replaces Section 4.7, Perimeter Pathways, 1998
- 28. ANSI/TIA/EIA-569-A-2, Addendum 2, 2000 Replaces Sections 6.3.3, Furniture Pathways, 1999
- 29. ANSI/TIA/EIA-569-A-3, Addendum 3, 2000. Revision to Sub clause 4.3, Access Floors, 1999
- 30. ANSI/TIA/EIA-569-A-4, Addendum 4, Poke Thru Devices, 2000
- ANSI/TIA/EIA-570-A, Residential Telecommunications Cabling Standard, 1999
- 31. ANSI/TIA/EIA-606, (1993), Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 1993
- 32. ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications, 1994
- 33. ANSI/TIA/EIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard, 1999
- 34. ANSI/TIA/EIA-758-1 Addendum 1, OSP Optical Fiber Cabling Practices, 1999
- 35. ANSI/TIA/EIA-729, Technical Specifications for 100 OHM Screened Twisted –Pair Cabling, 1999
- 36. ANSI/TIA/EIA-TSB67, Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems, 1995
- 37. ANSI/TSI/EIA-TSB72, Centralized Optical Fiber Cabling Guidelines, 1995
- 38. ANSI/TIA/EIA-TSB75, Additional Horizontal Cabling Practices for Open Offices, 1996
- 39. ANSI/TIA/EIA-TSB95, Additional Transmission Performance Guidelines for 4-Pair 100-OHM Category 5 Cabling, 1999

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

40. Underwriters Laboratories, Inc. (UL)

8. TRAFFIC CONTROL

Traffic control is subsidiary to all other items in this contract. Payment for traffic control setup shall only be paid separately when City of Austin Standard Detail COA 804S -1 (01-09) and COA 804S-2(1-4) are not applicable. Examples of this would be if a direction of traffic needs to be closed down and detoured or if police officers are required to direct traffic. Such conditions would allow the contractor to use the traffic control bid item. The use of this item shall be approved by the Engineer or his designee prior to the beginning of work. It shall be the contractor's responsibility to provide the City of Austin's Right-of-Way Division with a traffic control plan when required.

The Contractor may use police officers to direct traffic for highway crossings. The use of police officers shall be approved by the Engineer or designee prior to scheduling the work.

7. WARRANTY

Any work performed by the contractor and under this contract will carry a five year warranty including parts and labor at no cost to the City. The type of work and items that will require warranty includes splicing, termination, patch panels, splicing trays, lashing of wire, etc.

8. MEASUREMENT

The contractor will be paid according to Section 0600 Bid Sheet for emergency repair items.

9. PAYMENT

The pricing for all bid items shall be full compensation for all materials, labor, tools, equipment, documentation, training and incidentals necessary to complete the work for that bid item.

As an example the following items are considered 'incidental', and will not be paid for separately. Cost of all 'incidental' items shall be rolled into appropriate items that will be paid under this contract.

1. Pull Rope
2. Consumables
3. As-built drawings
4. Standard traffic control
5. Test results

**CITY OF AUSTIN
ARTERIAL MANAGEMENT DIVISION
SPECIFICATIONS FOR THE INSTALLATION AND MAINTENANCE OF SINGLE
MODE FIBER OPTIC CABLE**

Payment will be made after the job has been completed and all testing have been done and results are satisfactory. There will be only one invoice per job/work order. Partial billing is not acceptable and will not be processed.

Documentation. Further, as-built drawings and test results shall be submitted along with the invoice in order to consider the job as complete. Please note that invoices will not be processed for payment until all deliverable requirements in the scope of work have been met and approved by Engineer or designee.