



Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

1109 South Marion Avenue
Lake City, Florida 32025

STEPHANIE C. KOPELOUSOS
SECRETARY

July 30, 2009

To: Prospective Bidders and Plan Holders

Addendum No.: 1, E2L72 , Financial Project # 20916645201

Signal reconstruction to mast arm traffic signals along SR 152 (Baymeadows Road) and the associated intersections at Bayberry Road (MP 2.072), Baymeadows Way (MP 2.460), Freedoms Commerce Parkway (2.583), I-95 Southbound Ramps (2.727), I-95 Northbound Ramps (MP 2.813), Western Way (MP 3.002), and Baymeadows Circle East (MP 3.189), in Duval County. The net project length is 1.272

Attached is Supplemental Specifications Package Number 1 (pages 1-10) to Delete and Substitute Technical Special Provisions for Fiber Optic Cable.

You must sign, date and fax a copy of this addendum back to me by close of business today to indicate receipt. A copy of this addendum must be returned with your bid.

Company Name

Date

Signature

Thanks,

Patsy Elkins, CPPB
Contracts Coordinator
Phone: 386-758-3703
Fax: 386-758-3791



SUPPLEMENTAL SPECIFICATIONS PACKAGE NUMBER ONE
FOR
FINANCIAL PROJECT ID(S). 209166-4-52-01

DISTRICT TWO
DUVAL COUNTY

The 2007 Edition of the Florida Department of Transportation Standard Specifications and the Specifications Package for this project, dated May 22, 2009 thereto, are revised as follows:

I hereby certify that this supplemental specifications package has been properly prepared by me, or under my responsible charge, in accordance with procedures adopted by the Florida Department of Transportation.

The official record of this package is the electronic file signed and sealed under Rule 61G 15-23.003, F.A.C.

Name: Brian D. Kirwan, P.E.

Page(s): 1 – 10

APPENDICES

FIBER OPTIC CABLE.

The Appendix FIBER OPTIC CABLE (Page(s) 596-602 of the Specifications Package) is deleted and the following substituted:

TECHNICAL SPECIAL PROVISION
FOR
FIBER OPTIC CABLE
FINANCIAL PROJECT NO.: 209166-4-52-01
DUVAL COUNTY

The official record of this Technical Special Provision is the electronic file signed and sealed under Rule 61G 15-23.003, F.A.C.

Approved: Juan Camacho, P.E.
Registration No. 60031
Date: May 26, 2009

SECTION T633 FIBER OPTIC CABLE

T633-1 General.

Furnish and install a fiber optic communication system as shown on the plans.

T633-2 Materials.

T633-2.1 Fiber Optic Cable: Provide fiber optic cable that is dielectric, dry-filled, loose-tube, dispersion-unshifted single-mode fiber (SMF) with low water peak and that is suitable for underground (i.e., in conduit) outside plant installation. The fiber-optic cable shall have twenty-four fibers.

T633-2.2 Fiber Optic Termination: The cable shall be terminated at each controller cabinet and JEA demarcation junction box utilizing a spider fan-out kit and ST connectors. All connectors and terminations shall match the wavelength characteristics of the fiber-optic system. The terminations shall take place inside a lockable 48-fiber capacity termination cabinet which shall be mounted on the inside wall of the traffic signal controller cabinet. A complete set of fiber-optic patch cords shall be provided to connect the controller to the termination cabinet. Twelve fibers shall be terminated.

T633-3 Material and Performance Specification.

T633-3.1 General: Ensure that all fiber optic communication system features, functions, and performance measures detailed in this Technical Special Provision are provided. Furnish commercial off the-shelf materials, equipment, and components. Comply with the fiber optic cable shipping and handling requirements described in these Technical Special Provisions.

T633-3.2 Optical Fiber: Ensure that the optical fibers used in the cable meet or exceed the Telecommunications Industry Association (TIA) and Electronic Industries Alliance (EIA) TIA/EIA-492-CAAB specification and ITU-T G.652.D requirements. Use only optical fibers meeting the additional requirements as follows:

Geometry

1. Cladding Diameter: 125 μm , $\pm 0.7 \mu\text{m}$
2. Core-to-Cladding Concentricity: $\leq 0.5 \mu\text{m}$
3. Cladding Noncircularity: $\leq 0.7\%$
4. Mode Field Diameter: 1,550 nm; 10.4 μm , $\pm 0.5 \mu\text{m}$
5. Coating Diameter: 245 μm , $\pm 5 \mu\text{m}$
6. Colored Fiber Nominal Diameter: 253 to 260 μm

Optical

1. Cabled Fiber Attenuation: 1,310 nm, $\leq 0.4 \text{ dB/km}$; 1,383 nm, $\leq 0.4 \text{ dB/km}$; 1,550 nm, $\leq 0.3 \text{ dB/km}$.
2. Point Discontinuity: 1,310 nm, $\leq 0.05 \text{ dB/km}$; 1,550 nm, $\leq 0.05 \text{ dB/km}$.
3. Cable Cutoff Wavelength (λ_{ccf}): $\leq 1,260 \text{ nm}$.
4. Total Dispersion: 1,625 nm $\leq 23.0 \text{ ps}/(\text{nm}\cdot\text{km})$.
5. Macrobend Attenuation: Turns – 100; Outer diameter (OD) of the mandrel –

60 mm, ± 2 mm; ≤ 0.05 dB at 1,625 nm.

6. Cabled Polarization Mode Dispersion: ≤ 0.5 ps/ $\sqrt{\text{km}}$.

T633-3.3 Cable Strength: Ensure that the fiber optic cable is capable of withstanding a pulling tension of 600 pounds [2.7 kilonewtons] during installation without increasing the fiber attenuation more than 0.8 decibel per mile [0.5 decibel per kilometer (km)] and without changing other optical fiber characteristics after the tensile load is removed. Ensure that optical fiber is proof-tested by the fiber manufacturer at a minimum of 100 kilopounds per square inch [689.5 megapascals]. Ensure that the cable will withstand 25 impact cycles and the change in attenuation does not exceed 0.2 decibel at 1,550 nanometers when tested according to the requirements as detailed in the TIA/EIA-455-25B standard. Ensure that the fiber optic cable can withstand a minimum compression load of 125 pounds per square inch [0.9 megapascal] when applied uniformly over the length of the sample at the rate of 0.15 to 0.8 inch [3.8 to 20.3 mm] per minute and maintained for 10 minutes as defined in the TIA/EIA-455-41A standard. Ensure that the change in attenuation will not exceed 0.15 decibel during loading at 1,550 nanometers, and that no fiber displays a measurable change in attenuation after load removal.

T633-3.4 Cable Configuration: Ensure that each optical fiber is glass and consists of a germania-doped silica core surrounded by concentric silica cladding. Ensure that all fiber in the buffer tube is usable fiber that complies with attenuation requirements. Ensure that the fiber is sufficiently free of surface imperfections and inclusions.

T633-3.5 Coating: Ensure that the fiber coating complies with optical and mechanical requirements over an ambient operating temperature range of -40 degrees ($^{\circ}$) to 158° Fahrenheit (F) [-40° to 70° Celsius (C)].

T633-3.6 Outer Cable Jacket: Ensure that the fiber optic cable is jacketed with medium density polyethylene (MDPE) that is free of blisters, cracks, holes, and other deformities. Ensure that the nominal jacket thickness is a minimum of 0.03 inch [0.8 mm]. Apply the jacketing material directly over the tensile strength members and water-blocking material. Ensure that the MDPE contains carbon black to provide ultraviolet (UV) protection and does not promote the growth of fungus. Mark the jacket with the cable manufacturer's name, fiber type, fiber count, date of manufacture, the words "FDOT FIBER OPTIC CABLE," and the sequential cable lengths marked in feet. Ensure that the actual length of the cable is within 1% of the length indicated by the marking. Provide legible marking with contrasting color to that of the cable jacket.

T633-3.7 Loose Buffer Tube: Install the optical fiber inside loose buffer tubes, and include sufficient clearance between the fiber and the inside of the container to allow thermal expansions without constraining the fiber. Ensure that the protective container is manufactured from a material having a friction coefficient low enough to allow free movement of the optical fiber within the container. Ensure that the fiber is loose and does not adhere to the inside of the tube. All protective coverings in any single length of cable shall be continuous and of the same material, with the exception of splice locations. Ensure that buffer tubes are made of a tough, abrasion-resistant material to provide mechanical and environmental protection to the optical fiber, while permitting intentional scoring and breakout without damage to the fiber. Ensure that the fiber optic cable has a loose buffer tube cable with the required number of fibers as detailed

in the plans. Ensure that each fiber optic cable buffer tube contains 12 fibers per tube unless otherwise noted in the plans. Ensure that each drop cable buffer tube contains one set of six fibers.

T633-3.8 Water-Blocking Compound: Ensure that the fiber optic cable contains a dry water-blocking material to prevent the ingress of water within the outer cable jacket. Ensure that the water-blocking tapes and yarns are non-nutritive, dielectric, and homogeneous, and free from dirt and foreign matter. Use dry water-blocking material for fiber optic cables used for either aerial or underground installations. Apply dry water-blocking compound longitudinally around the outside of the central buffer tubes. Construct all cables with water-blocking tape that complies with the requirements of the EIA/TIA-455-81B standard and is subjected to water penetration tests as defined in the EIA/TIA-455-82B standard.

T633-3.9 Strength Member: Ensure that the fiber optic cable contains a central antibuckling member, such as a glass-reinforced plastic rod, to prevent buckling of the cable. Fillers or rods may be included in the cable core to lend symmetry to the cable cross section if required. Ensure that the fiber optic cable can withstand a pulling tension of 600 pounds [2.7 kilonewtons] during installation without increasing the fiber attenuation more than 0.8 decibel per mile [0.5 decibel per km] and without changing other optical fiber characteristics after the tensile load is removed.

T633-3.10 Ripcord: Ensure that the cable contains at least one ripcord under the sheath for easy sheath removal.

T633-3.11 Color-Coding: Ensure that the marking and color-coding of the fibers and buffer tubes conforms to telecommunication industry requirements as detailed in the TIA/EIA-598-B standard, along with the following:

- Blue
- Orange
- Green
- Brown
- Slate
- White
- Red
- Black
- Yellow
- Violet
- Rose
- Aqua

In buffer tubes containing multiple fibers, ensure that the colors are stable during temperature cycling, and not subject to fading or smearing onto each other or into the water-blocking material. Ensure that the color-coding of fibers does not cause the fibers to stick together. Color the fibers with UV curable inks that are clearly distinguishable from one another.

T633-3.12 Bend Radius: Ensure that the fiber optic cable is capable of withstanding a

minimum long-term bend radius of 10 times the cable diameter under no load and a minimum bend radius of 20 times the cable diameter when loaded to the maximum recommended installation load. Test the cable as required in the EIA-455-33A standard. Ensure that fiber optic cable, installed according to the minimum bend radius requirements, does not affect the optical characteristics of the fiber.

T633-3.13 Temperature Specifications: Ensure that the fiber optic cable's shipping, storage, and operating temperature range is -40° to 158° F [-40° to 70° C]. Ensure that the cable's installation temperature range is -22° to 140° F [-30° to 60° C].

T633-4 Installation Requirements.

T633-4.1 General: Furnish all tools, equipment, materials, supplies, and hardware necessary to install a fully operational fiber optic cable system as depicted in the plans. Install the fiber optic cable according to the latest version of the manufacturer's cable installation procedures and the industry-accepted installation standards, codes, and practices, or as directed by the Engineer.

Ensure that all materials and installation practices are in accordance with the applicable OSHA requirements as found in 29 Code of Federal Regulations (CFR) Part 1926, Safety and Health Standards for Construction.

Install all equipment according to the manufacturer's recommendations or as directed by the Engineer. In addition, perform the following:

1. Clean and test the conduit prior to installing the fiber optic cable in it.
2. Install cable tags within 1 foot [0.3 m] of each splice and/or termination point indicating the cable type, fiber count, and each fiber optic cable's origination and termination points. Ensure that the cable tags are permanent plastic labels suitable for outside plant applications and are affixed to all fiber optic cables. Ensure that lettering is in permanent ink and displays the phrase "FDOT FIBER OPTIC CABLE".
3. Assign each fiber optic cable a nomenclature indicating the cable's origination and termination points. Submit the nomenclature to be used for the Engineer's approval prior to its use. Use the nomenclature to mark the cable tags and on the optical time domain reflectometer (OTDR) sweep test results as detailed in Section 9 of this Technical Special Provision.
4. Document the sequential cable length markings at each access point or pull box wall that the cable passes through, and include the information with the as-built documentation.

Provide all incidental parts needed to complete the installation, but not specified in the plans, as necessary for a complete and properly operating system.

T633-4.2 Fiber Optic Cable Handling and Shipping: Ensure that the handling and shipping equipment for fiber optic cable is designed and manufactured to prevent harm to humans when used according to the manufacturer's recommendations.

T633-4.2.1 Cable End-Sealing: Ensure that fiber optic cable ends are capped or

sealed to prevent the entry of moisture during shipping, handling, storage, and installation. Equip one end of the fiber optic cable with flexible pulling eyes.

T633-4.2.2 Thermal Wrap: Securely apply a thermal protective wrap over the outer turns of the fiber optic cable on each reel. Ensure that the wrap is weather resistant and limits solar heating of the cable so that the cable surface temperature does not exceed 15°F [-9.4°C] above the ambient operating temperature under solar radiation of 100 watts per 1.2 square yards [1 square meter] in still air. Label the wrap, “DO NOT REMOVE WRAP UNTIL CABLE IS TO BE PLACED.” The thermal wrap may be omitted if lags or other approved mechanical reel protection devices are used.

T633-4.2.3 Preshipping: All fiber optic cable reels shall comply with the following minimum requirements:

1. Ship the cable on reels of marked continuous length.
2. Ship each cable on a separate, strongly constructed reel designed to prevent damage to the cable during shipment and installation.
3. Cover the cable and reel in a solar-resistant thermal wrap that includes waterproof properties.
4. Each reel shall have a minimum of 6 feet [1.83 m] on each end of the cable available for testing. Securely fasten the ends to the reel and properly sealed during shipment to prevent the ingress of moisture.
5. All cable installed on a reel shall be continuous and free from slices or breaks in the fiber or cable jacket.
6. No point discontinuities greater than 0.1 decibel will be permitted.
7. All cable delivered shall be manufactured within 6 months of the delivery date.
8. All fiber optic core glass shall be obtained from the same manufacturer.
9. Provide the Engineer with a written inventory of all cable reels received and the condition in which they were received.
10. Provide a copy of the transmission loss data results from the OTDR attenuation tests as required by the EIA/TIA-455-61 standard, as well as factory reports on tests performed prior to shipping. These test reports shall be enclosed under the thermal wrap.
11. Ensure that the manufacturer provides the date of manufacture; product and serial numbers; factory test data, including the reel length, total end-to-end attenuation, and refraction index; the project name and location; type of fiber and quantity of strands used; technical product data sheet(s); and reel number(s).

T633-4.3 Fiber Optic Cable Installation Specifications: Install all fiber optic cable in approved conduit by the cable pulling method detailed in this Technical Special Provision.

T633-4.3.1 Cable Pulling Installation Specifications: Installation of fiber optic cable using the cable pulling method is by hand or by an approved mechanical pulling machine. If a mechanical pulling machine is used, equip the machine with a monitored or recording tension meter. Ensure that at no time the manufacturer’s recommended maximum pulling tension is exceeded. Where pulling through access points, approved pulleys and sheaves will be used, or

the excess cable will be coiled in a figure eight and fed by hand. If sheaves are to be used, provide a drawing of the proposed layout showing that the cable will never be pulled through a radius less than the manufacturer's minimum bend radius. Use large diameter wheels, pulling sheaves, and cable guides to maintain the appropriate bend radius. Provide tension monitoring at all times during the pulling operation and accomplish using commercial dynamometers or load-cell instruments. When installing the fiber cable through any conduit or duct, use a cable pulling lubricant recommended by the optical fiber cable manufacturer.

T633-4.4 Slack Cable Storage Specifications: Coil the slack fiber optic cable and neatly store at each access point to allow for future splices, additions, or repairs to the fiber network. The coiled fiber optic cable lengths shall also provide the following:

1. Store 50 feet of spare fiber optic cable in the oversized fiber pull box located at each controller cabinet.

T633-5 Testing and Certification.

The Engineer reserves the right to require certifications for materials and equipment that may not require formal testing to ensure compliance with this Technical Special Provision, and to require testing on questionable materials or equipment at no additional expense to the Department. The Engineer reserves the right to withhold any payments due if a determination is made that the materials or equipment do not comply with the requirements or evaluation criteria as detailed herein.

T633-5.1 Fiber Optic Cable Testing Specifications: Notify the Engineer of cable testing

at least 14 calendar days in advance. Provide the testing procedures to the Engineer for approval prior to commencement of testing. Perform all tests at 1,310/1,550 nanometer wavelengths, and include the last calibration date of all test equipment with the test parameters set on the equipment in the test documentation.

The following procedures shall be used in the post-installation testing process:

1. Test all fibers from both cable end points with an OTDR. Test fibers that are not terminated at the time of installation using a bare fiber adapter;
2. Present the results of the OTDR testing (i.e., traces for each fiber), and a loss table showing each termination to the Engineer in an electronic format approved by the Engineer.
3. No active devices shall be connected for this test and cap all fiber optic connectors.
4. Any discontinuities greater than 0.2 decibel per 300 feet [91.4 m] shall not be allowed, and repair or replace the cable section at the Contractor's expense.

T633-6 Basis of Payment.

Payment to furnish and install the fiber optic cable, all termination items and patch cords shall be made under pay item 633-121-1, Signals-Fiber Optic Cable (F&I) (Underground) (Single Mode) (1-25 Fibers) Linear Foot.

**THIS
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SPECIFICATIONS
PACKAGE**