Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

STEPHANIE KOPELOUSOS
SECRETARY

January 22, 2010

Monica Gourdine
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 783
Proposed Specification: **7830102 ITS – Fiber Optic Cable and Interconnect.**

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

These changes were proposed by Trey Tillander of the State Traffic Engineering and Operations Office to incorporate Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) minimal diameter requirements, to remove orientation references from overall dimensions for patch panels, and to clarify end to end testing requirements.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to ST986RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4280.

Sincerely,

Signature on File

Rudy Powell, Jr., P.E.
State Specifications Engineer

RP/ft
Attachment
cc: Gregory Jones, Chief Civil Litigation
Florida Transportation Builders' Assoc.
State Construction Engineer

INTELLIGENT TRANSPORTATION SYSTEMS-FIBER OPTIC CABLE AND INTERCONNECT.

(REV *~~11-04-09~~1-21-10~~1-22-09~~*) ~~(FA 2-4-09) (7-09)~~

SUBARTICLE 783-1.2.1.1 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.2.1.1 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, the U.S. Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900, and International Telecommunication Union ITU-T G.652.D requirements. Use only optical fibers meeting the additional requirements as follows:

Geometry
Cladding Diameter: 125µm, ±0.7 µm
Core-to-Cladding Concentricity: ≤0.5 µm
Cladding Noncircularity: ≤0.7%
Mode Field Diameter: 1,550 nm; 10.4 µm, ±0.5 µm
Coating Diameter: 245 µm, ±5 µm
Colored Fiber Nominal Diameter: 250~~3~~ *±15*~~to 260~~ µm
Optical
Cabled Fiber Attenuation: 1,310 nm, ≤0.4 dB/km; 1,550 nm, ≤0.3 dB/km
Point Discontinuity: 1,310 nm, ≤0.05 dB/km; 1,550 nm, ≤0.05 dB/km
Cable Cutoff Wavelength (λ_{ccf}): ≤1,260 nm.
Total Dispersion: 1,625 nm ≤23.0 ps/(nm•km)
Macrobend Attenuation: Turns – 100; Outer diameter (OD) of the mandrel – 60 mm, ±2 mm; ≤0.05 dB at 1,550 nm
Cabled Polarization Mode Dispersion: $\leq 0.5\ ps/\sqrt{km}$

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 fibers do not adhere to each other. Ensure that the fiber is free of surface imperfections and inclusions. Ensure that all fiber optic core glass is from the same manufacturer.

SUBARTICLE 783-1.2.1.5 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.2.1.5 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 *materials*~~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~~ *material* 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.

SUBARTICLE 783-1.2.4 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.2.4 Patch Panels: Ensure that the patch panel is compatible with the fiber optic cable being terminated and color-coded to match the optical fiber color scheme. Ensure that the patch panel *dimensions* do~~es~~ not exceed ~~a~~ 14 *x 6 x 4* ~~inches~~ *inches for fiber counts of twelve or less.* ~~length by a 6 inches width by a 4 inch depth,~~. *Ensure the patch panel* ~~and~~ is suitable for mounting within an approved cabinet at the field device location. *Ensure patch panels are sized to accommodate specified coupler housings and maintain sufficient bend radius for cables to maintain their specified optical performance. Ensure the patch panel is sized to occupy the minimum space required to adequately accommodate fiber capacity.*

SUBARTICLE 783-1.4.2.1 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.4.2.1 End to End Attenuation Testing: Perform test*ing* on all fibers to ensure that ~~no discontinuities greater than 0.2 decibel per 300 feet exist~~*end to end attenuation does not exceed allowable loss (0.4 db/km for 1310nm wavelength, 0.3 db/km for 1550nm wavelength, plus 0.5 db for any connectors and 0.1 db for splices)*. Repair or replace cable sections exceeding allowable attenuation at no cost to the Department.

SUBARTICLE 783-2.2.2 (of the Supplemental Specifications) is deleted and the following substituted:

783-2.2.2 Warning Tape: Ensure that the buried cable warning tape is flexible, elastic material 3 inches wide, 6 mil thick, intended for burial and use as ~~a~~*an* underground utility warning notice. Ensure that the surface of the warning tape is coated and sealed to prevent deterioration caused by harsh soil elements. Ensure that the tape material and ink colors do not change when exposed to acids, alkalis, and other destructive chemical variances commonly found in Florida soils. Ensure that the warning tape color is orange as required by the American Public Works Association (APWA) Uniform Color Code, and has “CAUTION: FDOT FIBER OPTIC CABLE BURIED BELOW,” or other wording approved by the Engineer, permanently printed on its surface.

Include buried cable warning tape with all conduit.

SUBARTICLE 783-2.2.3.1 (of the Supplemental Specifications) is deleted and the following substituted:

783-2.2.3.1 Locate Wire Surge Protection:

Furnish and install a locate wire surge protection system as shown in the plans or directed by the Engineer. Ensure that locate wires are attached to a surge protection system dedicated to safely dissipating high transient voltages or other foreign electrical surges induced into the designating system. Provide this grounding through a stand-alone system that does not include electric power or ITS device grounding. Ensure that the surge protection system ~~normally~~ allows signals generated by locate system transmitters to pass through the protection system without going to ground. Ensure that the protection system automatically resets and passes locate system transmitter signals after the unit has grounded to dissipate over-voltages. Ensure that the locate wire surge protection is intended for below- or above-grade applications. Ensure that the locate wire surge protection system is grounded to a driven rod within 10 feet of the system using a AWG #6 single conductor wire with green insulation. Ensure that the locate wire surge protection is enclosed for protection from environmental hazards and accessible for connection of portable locate system transmitters.

Ensure that the locate wire surge protection system meets the following minimum standards for surge protection:

Surge Element	3-element maximum duty fail-safe gas tube.
Rating	40,000 A surge capacity (single-cycle, 8 by 20 microsecond waveform).
Life	Minimum 1,000 surges (1000 A to ground).
Fail-Safe	Integral fail-shorted device.
Insulation Resistance	1,000 megohm minimum at 100 volts of direct current (V_{DC}).
Clamp Voltages	a. Impulse at 100 Volts per Microsecond: Typically 500 volts. b. Direct Current: 300 to 500 volts.

SUBARTICLE 783-2.2.4.1.2 (of the Supplemental Specifications) is deleted and the following substituted:

783-2.2.4.1.4.~~1~~ *2* Output Frequency

Requirements: Ensure that RF frequencies produced for locate operations are user-selectable. Ensure that the transmitter produces consistent, stable, and defined frequencies normally associated with locating and marking equipment. Ensure that the transmitter can transmit at least three different user-selectable frequencies, with at least one frequency in each of three general ranges, defined here as low (0-1 kHz), mid-range (1 kHz – 40 kHz), and high (40 kHz – 85 kHz) bands.

SUBARTICLE 783-3.2.4 (of the Supplemental Specifications) is deleted and the following substituted:

783-3.2.4 Marking: Ensure that all pull box and splice box covers include the words “FDOT FIBER OPTIC CABLE” *or text shown in plans* permanently cast into their top surface. Ensure that the manufacturer’s logo is stamped on each pull box cover, along with the Department’s approval number. Ensure that markings are permanently affixed and clearly visible after installation.

SUBARTICLE 783-3.3 (of the Supplemental Specifications) is deleted and the following substituted:

783-3.3 Installation Requirements. Install all pull boxes and splice boxes according to the manufacturer’s recommendations; as shown in the plans; and in compliance with Section 635 and Design Standards Index No. ~~17721~~*18204*. Complete the installation of pull boxes, splice boxes, and conduit prior to cable installation. Provide all pull boxes and splice boxes a final finish grade elevation as shown in the plans. Excavate pull box and splice box installation sites to a depth of 1 foot below the bottom of the box, and replace with a 1 foot bed of pearock or crushed stone at the excavation base prior to installing the box.

Ensure that the box cover is flush with the existing finish grade after installation. Taper the finish grade contour to provide drainage from the splice box.

SUBARTICLE 783-3.3.2 (of the Supplemental Specifications) is deleted and the following substituted:

783-3.3.2 Bonding and Grounding: Ensure that pull box and splice box installation includes a bonding and grounding system including a driven rod that is a minimum of 10 feet in length and *5/8”*~~0.75~~ inch in diameter. Ensure that grounding rod is constructed of copper clad steel and complies with the UL 467 standard. Ensure that bonding conductors are bare solid AWG #6 copper wire as required in the ASTM B1 standard. Ensure that splice and termination components meet or exceed the UL 467 requirements, and are clearly marked with the manufacturer, catalog number, and conductor size. Ensure that grounding system complies with the NEC.

INTELLIGENT TRANSPORTATION SYSTEMS-FIBER OPTIC CABLE AND INTERCONNECT.
(REV 1-21-10)

SUBARTICLE 783-1.2.1.1 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.2.1.1 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, the U.S. Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900, and International Telecommunication Union ITU-T G.652.D requirements. Use only optical fibers meeting the additional requirements as follows:

Geometry
Cladding Diameter: 125µm, ±0.7 µm
Core-to-Cladding Concentricity: ≤0.5 µm
Cladding Noncircularity: ≤0.7%
Mode Field Diameter: 1,550 nm; 10.4 µm, ±0.5 µm
Coating Diameter: 245 µm, ±5 µm
Colored Fiber Nominal Diameter: 250 ±15 µm
Optical
Cabled Fiber Attenuation: 1,310 nm, ≤0.4 dB/km; 1,550 nm, ≤0.3 dB/km
Point Discontinuity: 1,310 nm, ≤0.05 dB/km; 1,550 nm, ≤0.05 dB/km
Cable Cutoff Wavelength (λ_{ccf}): ≤1,260 nm.
Total Dispersion: 1,625 nm ≤23.0 ps/(nm•km)
Macrobend Attenuation: Turns – 100; Outer diameter (OD) of the mandrel – 60 mm, ±2 mm; ≤0.05 dB at 1,550 nm
Cabled Polarization Mode Dispersion: $\leq 0.5\ ps/\sqrt{km}$

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 fibers do not adhere to each other. Ensure that the fiber is free of surface imperfections and inclusions. Ensure that all fiber optic core glass is from the same manufacturer.

SUBARTICLE 783-1.2.1.5 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.2.1.5 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 water-blocking materials 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 material 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.

SUBARTICLE 783-1.2.4 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.2.4 Patch Panels: Ensure that the patch panel is compatible with the fiber optic cable being terminated and color-coded to match the optical fiber color scheme. Ensure that the patch panel has a minimum of twelve ST-type panel connectors. Ensure that the patch panel dimensions do not exceed 14 x 6 x 4 inches for fiber counts of twelve or less.. Ensure the patch panel is suitable for mounting within an approved cabinet at the field device location. Ensure patch panels are sized to accommodate specified coupler housings and maintain sufficient bend radius for cables to maintain their specified optical performance. Ensure the patch panel is sized to occupy the minimum space required to adequately accommodate fiber capacity.

SUBARTICLE 783-1.4.2.1 (of the Supplemental Specifications) is deleted and the following substituted:

783-1.4.2.1 End to End Attenuation Testing: Perform testing on all fibers to ensure that end to end attenuation does not exceed allowable loss (0.4 db/km for 1310nm wavelength, 0.3 db/km for 1550nm wavelength, plus 0.5 db for any connectors and 0.1 db for splices). Repair or replace cable sections exceeding allowable attenuation at no cost to the Department.

SUBARTICLE 783-2.2.2 (of the Supplemental Specifications) is deleted and the following substituted:

783-2.2.2 Warning Tape: Ensure that the buried cable warning tape is flexible, elastic material 3 inches wide, 6 mil thick, intended for burial and use as an underground utility warning notice. Ensure that the surface of the warning tape is coated and sealed to prevent deterioration caused by harsh soil elements. Ensure that the tape material and ink colors do not change when exposed to acids, alkalis, and other destructive chemical variances commonly found in Florida soils. Ensure that the warning tape color is orange as required by the American Public Works Association (APWA) Uniform Color Code, and has “CAUTION: FDOT FIBER OPTIC CABLE BURIED BELOW,” or other wording approved by the Engineer, permanently printed on its surface.

Include buried cable warning tape with all conduit.

SUBARTICLE 783-2.2.3.1 (of the Supplemental Specifications) is deleted and the following substituted:

783-2.2.3.1 Locate Wire Surge Protection:

Furnish and install a locate wire surge protection system as shown in the plans or directed by the Engineer. Ensure that locate wires are attached to a surge protection system dedicated to safely dissipating high transient voltages or other foreign electrical surges induced into the designating system. Provide this grounding through a stand-alone system that does not include electric power or ITS device grounding. Ensure that the surge protection system allows signals generated by locate system transmitters to pass through the protection system without going to ground. Ensure that the protection system automatically resets and passes locate system transmitter signals after the unit has grounded to dissipate over-voltages. Ensure that the locate wire surge protection is intended for below- or above-grade applications. Ensure that the locate wire surge protection system is grounded to a driven rod within 10 feet of the system using a AWG #6 single conductor wire with green insulation. Ensure that the locate wire surge protection is enclosed for protection from environmental hazards and accessible for connection of portable locate system transmitters.

Ensure that the locate wire surge protection system meets the following minimum standards for surge protection:

Surge Element	3-element maximum duty fail-safe gas tube.
Rating	40,000 A surge capacity (single-cycle, 8 by 20 microsecond waveform).
Life	Minimum 1,000 surges (1000 A to ground).
Fail-Safe	Integral fail-shorted device.
Insulation Resistance	1,000 megohm minimum at 100 volts of direct current (V_{DC}).
Clamp Voltages	a. Impulse at 100 Volts per Microsecond: Typically 500 volts. b. Direct Current: 300 to 500 volts.

SUBARTICLE 783-2.2.4.1.2 (of the Supplemental Specifications) is deleted and the following substituted:

783-2.2.4.1.4.2 Output Frequency Requirements:

Ensure that RF frequencies produced for locate operations are user-selectable. Ensure that the transmitter produces consistent, stable, and defined frequencies normally associated with locating and marking equipment. Ensure that the transmitter can transmit at least three different user-selectable frequencies, with at least one frequency in each of three general ranges, defined here as low (0-1 kHz), mid-range (1 kHz – 40 kHz), and high (40 kHz – 85 kHz) bands.

SUBARTICLE 783-3.2.4 (of the Supplemental Specifications) is deleted and the following substituted:

783-3.2.4 Marking: Ensure that all pull box and splice box covers include the words “FDOT FIBER OPTIC CABLE” or text shown in plans permanently cast into their top surface. Ensure that the manufacturer’s logo is stamped on each pull box cover, along with the Department’s approval number. Ensure that markings are permanently affixed and clearly visible after installation.

SUBARTICLE 783-3.3 (of the Supplemental Specifications) is deleted and the following substituted:

783-3.3 Installation Requirements. Install all pull boxes and splice boxes according to the manufacturer’s recommendations; as shown in the plans; and in compliance with Section 635 and Design Standards Index No. 18204. Complete the installation of pull boxes, splice boxes, and conduit prior to cable installation. Provide all pull boxes and splice boxes a final finish grade elevation as shown in the plans. Excavate pull box and splice box installation sites to a depth of 1 foot below the bottom of the box, and replace with a 1 foot bed of pearock or crushed stone at the excavation base prior to installing the box.

Ensure that the box cover is flush with the existing finish grade after installation. Taper the finish grade contour to provide drainage from the splice box.

SUBARTICLE 783-3.3.2 (of the Supplemental Specifications) is deleted and the following substituted:

783-3.3.2 Bonding and Grounding: Ensure that pull box and splice box installation includes a bonding and grounding system including a driven rod that is a minimum of 10 feet in length and 5/8” inch in diameter. Ensure that grounding rod is constructed of copper clad steel and complies with the UL 467 standard. Ensure that bonding conductors are bare solid AWG #6 copper wire as required in the ASTM B1 standard. Ensure that splice and termination components meet or exceed the UL 467 requirements, and are clearly marked with the manufacturer, catalog number, and conductor size. Ensure that grounding system complies with the NEC.