Georgia Department of Transportation
Transportation Products
Qualified Products List (QPL)

By signing this form, the applicant declares that he/she has read and understood the provisions of Section 935 of the GDOT Minimum Specifications for Fiber Optic Systems and all implemented modifications. The requirements listed on this matrix are derived from Section 935, which in all cases will be the basis for determining a product's compliance and its acceptability for use on Georgia's roads.

Date: _____

Manufacturer: _____

Item, Model No: _____

Applicant's: Name (print) _____

Signature: _____

GDOT Fiber Optic System Specification Compliance Matrix

Requirement		Item Comply? (Yes/No)	Comments	Evaluation Method[1]
Fiber Optic System Submission Form				
Fiber Optic System Submission Form has been completed and included in product submittal package.		-		-
Fiber Optic System for Application Review				
☐ Outside Plant Fiber Optic Cables	☐ Fiber Patch Panels	-		-
☐ Fiber Optic Closures	☐ Fiber Distribution Units	-		-
Additional Fiber Optic System Components Included in Submittal Package				
☐ Outside Plant Fiber Optic Cable, Loose Tube, Single Mode, __ Fiber	☐ Fiber Patch Panel, Wall Mount, __ Port	-		-
☐ Fiber Optic Connectors, SM	☐ Fiber Distribution Unit, Rack Mount, __ Port			
☐ Fiber Optic Patch Cord, SM	☐ Fiber Distribution Unit, Wall Mount, __ Port			
☐ Fiber Interconnect Cable, SM	☐ Outside Plant Fiber Optic Cable, Loose Tube, Multi Mode, __ Fiber			

Requirement		Item Comply? (Yes/No)	Comments	Evaluation Method[1]
☐ Fiber Pigtail Cable, SM	☐ Fiber Optic Connectors, MM			
☐ Fiber Optic Splice, Fusion	☐ Fiber Optic Patch Cord, MM			
☐ Fiber Optic Closure, Underground, __ Splice	☐ Fiber Interconnect Cable, MM	-		-
☐ Fiber Optic Closure, Aerial, __ Splice	☐ Fiber Pigtail Cable, MM			
☐ Fiber Patch Panel, Rack Mount, __ Port				
935.2.01 Fiber Cable and Optical Requirements				
A. General				
1. Comply with ISO 9001 or Sigma Six quality manufacturing requirements.		-		-
2. Provide only fiber optic cables and components that are new (manufactured no more than one year prior to the Notice to Proceed) and provided by one manufacturer using the same model, part number, and revision. Provide the manufacturer date as part of the submittal process in Section 942.1.04.		-		-
3. Provide SM fiber optic cable that is splice-compatible with the Department's existing legacy G.652 SM fiber and requires no electronic equipment for dispersion compensation between new and existing fiber.		-		-
4. Provide fiber optic cables ranging from 6 strands to 288 strands as shown in the Contract documents.		-		-
5. Provide cables that comply with NFPA 70.		-		-
6. Provide cables that comply with RoHS Directive 2011/65/EU.		-		-
B. Fiber Optical				
1. Provide fiber optic cables that comply with ICEA S-87-640.		-		-
2. Provide fiber optic cables that comply with Telcordia GR-20-CORE.		-		-
3. Provide fiber optic cables that comply with USDA RUS 7 CFR 1755.900, 901, and 902 (PE-90).		-		-
4. Provide SM fiber optic cables that comply with ITU-T G.652.D.		-		-
5. Provide SM fiber optic cables that comply with ITU-T G.657.A1.		-		-
6. Provide SM fiber optic cables that comply with TIA-492-CAAB (OS2).		-		-

Requirement		Item Comply? (Yes/No)	Comments	Evaluation Method[1]
7. Provide fibers that are 100% usable.		-		-
8. Provide SM fibers that meet the optical performance requirements when tested according to TIA-455:				
☐ Provide a fiber section that has attenuation of ≤0.35 dB/km at 1,310 nm with a variability of ≤0.03 dB/km between 1,285 nm and 1,330 nm. Test according to FOTP-78-B.	☐ Provide a fiber section attenuation of ≤0.25 dB/km at 1,550 nm with a variability of ≤0.02 dB/km between 1,525 nm and 1,575 nm. Test according to FOTP-78-B.	-		-
☐ Provide fiber that has a mode field diameter of 9.2 µm ±0.4 µm at 1,310 nm and 10.4 µm ±0.5 µm at 1,550 nm. Test according to FOTP-191-B.	☐ Provide fiber that has uniform attenuation with no point discontinuities >0.05 dB at both 1,310 nm and 1,550 nm.			
9. Provide a mechanically strippable, dual-layer, UV acrylate, color-coded protective coating.		-		-
C. Fiber Optic Cable Construction				
1. Provide OSP fiber optic cables with the following characteristics:				
a. Provide cable suitable for underground (i.e., in conduit) and aerial installation.		-		-
b. Provide cable with a single jacket that is unarmored.		-		-
c. Provide cable with an outside diameter of no greater than one inch.		-		-
d. Provide all-dielectric (no metal or electrically conductive) materials.		-		-
e. Provide water-blocking materials that are gel-free, dry-type, non-nutritive to fungus, electrically non-conductive, and homogenous.		-		-
f. Provide loose tube design that is SZ-stranded around an anti-buckling central strength member.		-		-
g. Provide buffer tubes that contain 12 optical fibers placed inside each tube for cables 24 count and higher.		-		-
h. Provide fibers and buffer tubes that are color coded according to TIA-598-D.				
☐ Colors shall be stable during temperature cycling and aging.	☐ Colors shall not fade or smear onto each other.	-		-
2. Provide cable outer jacket or sheath meeting the following minimum requirements:				
☐ Provide a minimum medium-density polyethylene black outer jacket as defined by ASTM D1248, Type II, Class C, Category 4 or 5 and Grades J4, E7, and E8.	☐ Provide a track-resistant polyethylene black outer jacket if the fiber optic cable is installed in an aerial application and the space potential is >12 kV.	-		-

Requirement		Item Comply? (Yes/No)	Comments	Evaluation Method[1]
☐ Provide jacket that is smooth; concentric; free from holes; consistent thickness; free of splits, blisters, and any other surface flaws; and contains carbon black to provide UV protection and prevent the growth of fungus.	☐ Provide a method for removal of the sheath.	-		-
3. Provide labeling for the fiber optic cable meeting the following minimum requirements:				
a. Label fiber optic cables (trunk and drop) using the following template, unless otherwise listed in the Contract:				
☐ Manufacturer's name – Optical Cable – Year – Telecommunication Handset Symbol – GA DOT (or as required by the AHJ) – Description (which consists of XX SM or MM, where XX denotes the fiber count).	☐ Sequentially mark the cable length reflecting the distance from the cable origin point in English units every 2 ft (0.6 m). Cable length markings shall be within 1% of the actual length of the cable.	-		-
☐ Provide cable marking that is contrasting in color to the cable jacket. Marking font height shall be no less than 0.10 in (2.5 mm).				
b. Use cable marking that meets the following minimum requirements:				
☐ Use 2.5 in (64 mm) wide, 4 in (100 mm) long, wrap-around type cable markers suitable for underground and aerial use.	☐ Use UV-stabilized marker material and printing inks to provide an aerial durability of at least five years.	-		-
☐ Print text in bold black type on orange or yellow PVC markers.	☐ Fabricate markers from PVC base material with a minimum thickness of 0.015 in (0.38 mm).			
☐ Pre-print the following text, or alternate text shown in the Contract documents, legibly on markers used for the cables: Cable ID: XXXXXXX GA DOT Optical Cable Where XXXXXX is the cable ID as defined in the Contract documents.				
☐ Print the text specified above twice on every cable marker with the text of the second image reversed and abutting the first image so that the text "reads right" when either short edge of the cable marker is held horizontally upright.				
D. Cable Performance				
1. Provide fiber optic cable that has been tested in accordance with TIA-455 as shown in Table 1, resulting in no permanent change in attenuation, no signs of water leakage, no mechanical damage to the cable, and no adverse effects to the jacket or fibers. Upon the request of the Department, provide certification from an independent testing laboratory certifying the cable conforms to the following specifications and test procedures.		-		-

Requirement				Item Comply? (Yes/No)	Comments	Evaluation Method[1]
Table 1 – Cable Performance Testing						
ID	**Parameter**	**Test Performed**	**Test Condition/ Specification**			
Testing requirements that apply to all fiber optic cable						
1	Bend Test (Low and High Temperature)	FOTP-37-A	Four full turns around mandrel of 20 times cable outer diameter at 4 hours of −22°F and +140°F (−30°C and +60°C)	-		-
2	Impact Resistance	FOTP-25-D	25 impact cycles (at 4.4 nm) at different points along the sample	-		-
3	Compressive Strength (Crush Resistance)	FOTP-41-A	125 lb/in (220 N/cm) (short)	-		-
4	Tensile and Fiber Strain (Macro-bending)	FOTP-33-B	Maximum 600 lb (2,700 N) – during tensile load, Maximum 180 lb (800 N) – without tensile load	-		-
5	Cable Twist-Bend	FOTP-85-A	10 cycles ±180 degrees of mechanical twisting	-		-
6	Cable Cyclic Flexing	FOTP-104-B	25 times mechanical flexing cycles around a sheave of 20 times cable outer diameter	-		-
7	Temperature-Humidity Cycling	FOTP-3-B	−40°F to +158°F (−40°C to +70°C)	-		-
8	Water (Fluid) Penetration	FOTP-82-B	1 m static head for 1 hour	-		-
9	Cable Freezing	FOTP-98	Frozen on ice	-		-
Testing requirements that apply to aerial fiber optic cable						
1	High Frequency (Aeolian) Vibration	IEEE P1222	100 million vibration cycles	-		-
2	Low Frequency (Galloping) Vibration	IEEE P1222	100 thousand vibration cycles	-		-

Requirement	Item Comply? (Yes/No)	Comments	Evaluation Method[1]
E. Fiber Patch Cord			
1. Provide the same glass type and performance requirements as the manufacturer of the backbone and drop fiber optic cable provided in the Contract.	-		-
2. Provide factory pre-assembled, riser-rated, factory-tested, pre-terminated duplex patch cords with two fibers with connectors as described in Section 935.2.03.A on each end.	-		-
3. Provide patch cords that meet UL 94-V0 flammability requirements.	-		-
4. Provide lengths as listed in the Contract with a minimum of 1 ft (30 cm) slack between connected equipment.	-		-
5. Provide optical fiber within the body of fiber optic connectors that are mechanically isolated from cable tension, bending, and twisting.	-		-
6. Use yellow outer jackets for SM and orange for MM fiber optic cables.	-		-
7. Use connector boots of two colors for all duplex patch cords, zip cord, or round to distinguish between the two zip legs of the duplex cord.	-		-
8. Label duplex patch cords to distinguish between the two zip legs of the duplex cord. .	-		-
9. Provide protective dust caps on the connector ferrules.	-		-
10. No splices of any type shall be within a patch cord assembly.	-		-
11. Provide qualification or certification data from the manufacturer upon request by the Department.	-		-
12. Package each assembly individually within a plastic bag and clearly mark on the outside of that bag the submitted manufacturer's part number.	-		-
F. Environmental			
1. Provide fiber optic cables, connectors, and splice trays that meet Telcordia GR-20-CORE and ICEA S-87-640 temperature and humidity requirements.	-		-
935.2.02 Fiber Optic Components Requirements			
A. Fiber Optic Splice Closure			
1. House optical fiber splices within a fiber optic splice closure, complete with fiber splice trays and expressed buffer tube organizer, dome, grommets, end plate, mounting hardware and bracket, cable restraint hardware, buffer tube storage, splice protection, sealant materials, and any other materials and components needed to provide a completely sealed fiber splice closure installation.	-		-
2. Provide splice closures, organizers, cable end preparation tools, and procedures that are compatible with the fiber optic cable.	-		-

Requirement	Item Comply? (Yes/No)	Comments	Evaluation Method[1]
3. Provide splice closures that are stand-alone.	-		-
4. Use splice closures that are either “cylindrical dome” or “rectangular dome” type with cable entries at one end only and sealed, one-piece, high-density black UV-resistant polyethylene (thermoplastic) dome bodies.	-		-
5. Provide splice closures that are designed and tested in accordance with Telcordia GR-771-CORE requirements.	-		-
6. Use only RUS-listed splice closures.	-		-
7. Provide splice closures consisting of three types depending on the number of splices required that meet the following requirements:			
☐ Up to 48 fiber splice capacity (including both trunk and drop cable splices): determine the number and type of splice trays by the number of splices required in the Contract documents. Provide splice closures that support up to four cable entries of at least 0.75 in (19 mm) diameter. These splice closures shall have maximum dimensions of 10 in (254 mm) diameter and 22 in (580 mm) length (smaller physical size is preferred).	-		-
☐ Greater than 48 and up to 144 fiber splice capacity (including both trunk and drop cable splices): determine the number and type of splice trays by the number of splices required in the Contract documents. Provide splice closures that support up to four cable entries of at least 1.0 in (25 mm) and at least two additional cable entries of at least 0.75 in (19 mm) diameters. These splice closures shall have maximum dimensions of 10 in (254 mm) diameter and 22 in (580 mm) length (smaller physical size is preferred).			
☐ Greater than 144 and up to 288 fiber splice capacity (including both trunk and drop cable splices): determine the number and type of splice trays shall by the number of splices required in the Contract documents. Provide splice closures that support up to four cable entries of at least 1.0 in (25 mm) and at least two additional cable entries of at least 0.75 in (19 mm) diameters. These splice closures shall have maximum dimensions of 10 in (254 mm) diameter and 28 in (711 mm) length (smaller physical size is preferred).			
8. Provide splice closures that are capable of storage and expressing through all unopened buffer tubes when configured for any number of splices as specified above.	-		-
9. Provide a flexible thermoplastic compression seal grommet for each end plate cable port that matches the required number and size of cables coming in and out of the splice closure without jeopardizing the weathertight characteristics of the splice closure.	-		-
10. Hermetically seal closures to protect fiber, splices, and internal components from water entry, including being submerged in standing water, without the use of an encapsulate material.	-		-
11. Provide splice closures that are sealed from insects, rodent proof, airtight, crush resistant, chemical-resistant, and corrosion resistant.	-		-
12. Provide an external pressurization air valve or port for flash testing the splice closure.	-		-

Requirement	Item Comply? (Yes/No)	Comments	Evaluation Method[1]
13. Provide fiber organizers that comply with Telcordia GR-769-CORE and splice trays that organize fiber buffers, protect fiber splices, and provide fiber and buffer slack storage.	-		-
14. Provide splice closures that can be re-entered and resealed using no special tools.	-		-
15. Provide reusable sealing materials (grommets, O-rings, etc.) that allow multiple re-entries and closures without removal of any component and without disruption to the surrounding cables.	-		-
16. Provide splice closures that are suitable for mounting on the inside wall of an underground buried ECB, pull box, or aerial messenger or strand as listed in the Contract documents.			-
17. Use corrosion-resistant aluminum, hot-dipped steel, or stainless steel mounting brackets and hardware.			-
18. For aerial installation, provide closure that also meets the following minimum requirements:			
☐ Provide universal mounting bracket with features to permit aerial strand mounting with strand clamps or as approved by the Department. ☐ Provide a product that is designed to eliminate the need for drip collars and sealing collars. ☐ Package the closure with all hardware required for aerial mounting.			-
B. Fiber Splice Tray			
1. Hold each fiber strand and buffer tube in the tray so that no stress or tensile force is placed on completed and finished fusion splices within the tray.			-
2. Loop individual fibers one full turn within the splice tray to avoid micro bending.	-		-
3. Maintain minimum bend radius of fiber at all times.	-		-
4. Provide slack storage for exposed fibers and buffer tubes to prevent damage to fibers.	-		-
5. Provide splice trays that include a cover with a locking mechanism to hold it in place.	-		-
6. Provide access to individual fibers without disrupting other fibers in the tray.	-		-
7. Provide fiber that is capable of being visually inspected.	-		-
8. Package and protect each fusion-spliced fiber housed within the splice tray with a minimum 1.5 in (40 mm) reinforced, heat shrink, and weathertight sleeve.	-		-
C. Fiber Optic Connector			
1. Provide certified LC fiber optic connectors for SFP optical transceivers for network switches and for FPPs and FDUs with greater than 12-port terminations.	-		-

Requirement	Item Comply? (Yes/No)	Comments	Evaluation Method[1]
2. Provide only ST-compatible, ceramic-insert couplers where barrel couplers are used in passive termination applications such as FPPs and FDUs with 6 and 12-fiber port terminations.	-		-
3. Provide connectors that comply with TIA-568-B.3.	-		-
4. Provide connectors that comply with TIA-604-10B (Type LC) and TIA-604-2B (Type ST) intermateability requirements.	-		-
5. Test connectors according to Telcordia GR-326-CORE.	-		-
6. Provide ceramic ferrule UPCs that are polished.	-		-
7. Mechanically isolate the optical fiber within the body of connectors from cable tension, bending, and twisting.	-		-
8. Provide connectors that are factory-assembled and tested. No field installed connectors are permitted.	-		-
9. Provide unmated connectors with protective dust caps installed. Provide dust caps for both sides of couplers at all times until permanent connector installation.	-		-
10. Provide industry standard approved connector for optical fiber that meets or exceeds the applicable provisions of TIA-455-X related to fiber optic connectors and interfaces and meets the following requirements:			
☐ Insertion loss of ≤0.25 dB (typical) and ≤0.5 dB (maximum). ☐ Return loss (back reflection) ≤−55 dB (UPC) for SM and ≤−25 dB (UPC) for MM, typical. ☐ Mating durability ≤0.2 dB (typical) change, 500 mating cycles.	-		-
D. FPP and FDU			
1. Provide FPPs (6 to 36 connectors) and FDUs (48 to 288 connectors) that meet the requirements presented in this section.	-		-
2. Provide FPPs and FDUs that comply with TIA-310-D standard 19-in rack-mounted or wall or panel-mounted installation.	-		-
3. For 6 to 36 connectors, use FPP enclosures that integrate the splice trays and connector modules into one compartment within one enclosure. For 48 connectors and larger, use FDU enclosures as one integrated compartment or house the splice trays and connector modules in separate compartments integrated into one enclosure.	-		-
4. Provide splice trays for storing the number of fusion splices as listed in the Contract documents. For FPPs with 12 connectors or less, splice holders within the FPP compartment may be used in lieu of splice trays.	-		-
5. Provide FPPs and FDUs that meet UL 94-V0 flammability requirements.	-		-
6. Provide wire management system at every FPP and FDU location for fiber optic cables and patch cords.	-		-

Requirement	Item Comply? (Yes/No)	Comments	Evaluation Method[1]
7. Provide access to fiber splicing trays and fiber termination couplers meeting the following minimum requirements:			
☐ Provide access from the front or rear with removable, fold-down or swing-out doors, drawers, and covers. ☐ Provide physical protection when doors, drawers, and covers are in the closed position that encloses the fiber splicing trays, fiber interconnection cables, fiber pigtail cables, and fiber termination couplers. ☐ Provide storage space to house and protect the number of splice trays required to splice and terminate the fibers. ☐ Provide rubber grommets or similar material to prevent the cable from coming in contact with bare metal. ☐ Provide radius guides and strain relief for the incoming fiber optic cable(s) to maintain bend radius and protect the fibers. ☐ Provide bulkhead-mounted, termination coupling connectors that include locknuts for mounting the connectors in predrilled or punched holes in the connector panel. ☐ Provide bulkhead-mounted coupling connectors with dust caps.	-		-
8. Provide fiber interconnect cables and fiber pigtail cables meeting the following minimum requirements:			
☐ Provide 12-fiber interconnect cables for FDUs with 12-splice capacity trays, and 24-fiber interconnect cables with FDUs with 24-splice capacity trays. ☐ Use only fiber-interconnect cables for FPPs and FDUs with 24 connectors or more. ☐ Provide single fiber pigtail cables or fiber interconnection cables for FPPs with less than 24 connectors. ☐ Provide cables with factory installed connectors in accordance with Section 935.2.03.A. ☐ Provide fiber pigtail cables with 900 micron tubing or 0.12 in (3 mm) fan out tubing as required for the application. ☐ Use fiber pigtail cables with 900 micron tubing only when fully enclosed within the FPP from splice tray to the back of the bulkhead connector panel.	-		-
E. Aerial Cable Lashing Materials			
1. Provide minimum 0.038 in (0.96 mm) diameter lashing wire to attach aerial fiber optic cable to the messenger or strand.	-		-
2. Provide lashing wire, attachment, and mounting hardware with sufficient tensile strength for the application and meeting the requirements of ASTM F593/F594 for corrosion resistance.	-		-
3. Use Type 302 stainless steel lashing materials in non-coastal regions and Type 316 along coastal regions within 5 miles (8 km) of the coast line.	-		-

Requirement	Item Comply? (Yes/No)	Comments	Evaluation Method[1]
F. Aerial Snowshoe Storage			
1. Provide a factory-manufactured, UV-stabilized, snowshoe fiber storage unit that is designed to store excess or slack fiber optic cable or fiber optic cable and a splice closure in the span.	-		-
2. Provide fiber optic snowshoe that is constructed with plastic or aluminum bodies that maintain the minimum cable bend radius and have integral cable lashing strap slots or holes to secure cable attachments to the storage bracket.	-		-
3. Provide galvanized or stainless steel hanging and attachment hardware (bolts, nuts, washers) and strand clamps for attachment to messenger or strand according to ASTM A135 and ASTM B695.	-		-
4. Provide cable protection bracket that minimizes cable abrasion and organizes cable against the pole.	-		-
5. Provide cable channel to secure the cable that minimizes ice and leaf loading.	-		-
6. Provide snowshoe design that minimizes the number of cable ties needed.	-		-
7. Provide weathertight, UV-resistant cable ties designed for continuous outdoor use.	-		-
G. Environmental			
1. Provide fiber splice closures that meet Telcordia GR-771-CORE temperature and humidity requirements.	-		-
935.2.03 MM Fiber Optic Cable Requirements			
A. General			
1. Meet the fiber optic cable and environmental requirements as specified herein.	-		-
2. Provide fiber optic cable that is splice-compatible with the Department's existing legacy 62.5/125 µm MM fiber optic cable as required.	-		-
B. Fiber Optical			
1. Provide standard 62.5/125 µm graded index MM fiber optic cables that comply with TIA-492AAAA-A (OM1).	-		-
2. Comply with IEC EN 60793-2-10, Type A1b product specifications.	-		-
3. Provide MM fibers that meet the optical performance requirements when tested according to TIA-455:			
☐ Provide a fiber section attenuation of ≤3.5 dB/km at 850 nm. Test according to FOTP-78-B. / ☐ Provide a fiber section attenuation of ≤1.0 dB/km at 1,300 nm. Test according to FOTP-78-B. / ☐ Provide fibers that have uniform attenuation with no point discontinuities >0.2 dB at both 850 nm and 1,300 nm.	-		-
4. Provide an OFL bandwidth ≥200 MHz/km at 850 nm and ≥500 MHz/km at 1,300 nm.	-		-

Note 1:

Evaluation Method:

1. **Physical Inspection** – a vision inspection of the product
2. **Compliance Matrix Review** – a review of the matrix comments column itself to see if all required statements were made
3. **Document Review** – a review of all specs, lab test reports, etc.
    a. Independent 3rd Party Facility Test results
    b. 1st Party (Manufacturer) Test results
4. **Functional Review / Inspection –** GDOT Lab and/or Field Trial testing