CITY OF DULUTH
PURCHASING DIVISION
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Addendum # 1
City Bid # 19-99660
City Project # 0595TR
S.P. 118-090-018
Cross City Trail Phase 2

This addendum serves to notify all bidders of the following changes to the solicitation documents:

Bid Form:

The items and quantities in the Bid Form (Exhibit A) have been revised to add Fiber Optic Pigtail Termination as a bid item and revised the quantity for Fiber Optic Pigtail Cable Splice. Replace Exhibit A with the attached Exhibit A.

Specifications:

SP-5 COMMUNITY BENEFITS POLICY has been deleted from the specifications:

DIVISION SZ covering fiber optic work has been added to the specifications and includes 6 sheets for the testing layout of the fiber optic cable.

Plansheets:

Plan Sheet 5 has been revised to add Fiber Optic Pigtail Termination as a bid item and revised the quantity for Fiber Optic Pigtail Splice. Replace Sheet 5 with the attached Sheet 5.

Plan Sheet 9 has been revised to update the Fiber Optic Pigtail Splicing Quantity. Replace Sheet 9 with the attached Sheet 9.

Plan Sheet 40 has been revised to update Fiber Optic labeling notes. Replace Sheet 40 with the attached Sheet 40.

Plan Sheet 42 has been revised to update Fiber Optic labeling notes and add a note for Fiber Optic Pigtail Cable Termination. Replace Sheet 42 with the attached Sheet 42.

Please acknowledge receipt of this Addendum by checking the acknowledgment box within the www.bidexpress.com solicitation.

Posted: **12/10/2019**

EXHIBIT A - Schedule of Prices
RQ No. 19-99660 / City Proj. No. 0595TR
Project Name: Cross City Phase 2

Line No.	Spec. No.	Description	Unit	Est. Qty	Unit Price	Total Price
1	2021.501	MOBILIZATION	LUMP SUM	1		$ -
2	2101.505	GRUBBING	ACRE	0.47		$ -
3	2102.503	PAVEMENT MARKING REMOVAL	LIN FT	30		$ -
4	2104.502	REMOVE CATCH BASIN	EACH	2		$ -
5	2104.502	REMOVE CASTING	EACH	3		$ -
6	2104.502	REMOVE PIPE APRON	EACH	1		$ -
7	2104.502	REMOVE BOLLARDS	EACH	4		$ -
8	2104.502	REMOVE VEHICULAR GATE	EACH	3		$ -
9	2104.502	REMOVE MISCELLANEOUS STRUCTURES	EACH	1		$ -
10	2104.502	REMOVE FIBER OPTIC VAULT	EACH	1		$ -
11	2104.502	REMOVE POWER POLE	EACH	1		$ -
12	2104.502	SALVAGE BOULDER	EACH	7		$ -
13	2104.502	SALVAGE SIGN PANEL TYPE C	EACH	23		$ -
14	2104.502	SALVAGE SIGN TYPE SPECIAL	EACH	2		$ -
15	2104.502	SALVAGE VEHICULAR GATE	EACH	1		$ -
16	2104.502	REMOVE HYDRANT	EACH	2		$ -
17	2104.503	REMOVE PIPE SEWERS	LIN FT	15		$ -
18	2104.503	REMOVE CONCRETE CULVERT	LIN FT	22		$ -
19	2104.503	REMOVE INTEGRANT CURB	LIN FT	727		$ -
20	2104.503	REMOVE FENCE	LIN FT	1255		$ -
21	2104.503	REMOVE HANDRAIL	LIN FT	116		$ -
22	2104.503	REMOVE RAILROAD TRACK	LIN FT	650		$ -
23	2104.503	REMOVE CURB AND GUTTER	LIN FT	1398		$ -
24	2104.503	SAWING CONCRETE PAVEMENT (FULL DEPTH)	LIN FT	1117		$ -
25	2104.503	SAWING BITUMINOUS PAVEMENT (FULL DEPTH)	LIN FT	1319		$ -
26	2104.504	REMOVE CONCRETE PAVEMENT	SQ YD	555		$ -
27	2104.504	REMOVE BITUMINOUS PAVEMENT	SQ YD	1694		$ -
28	2104.518	REMOVE CONCRETE WALK	SQ FT	440		$ -
29	2104.601	REMOVE RAILROAD TIES	LUMP SUM	1		$ -
30	2104.601	MODIFY MISCELLANEOUS STRUCTURE	LUMP SUM	1		$ -
31	2105.507	COMMON EXCAVATION	CU YD	3793		$ -
32	2105.603	CONSTRUCT DRAINAGE DITCH	LIN FT	352		$ -
33	2112.519	SUBGRADE PREPARATION 6"-12"	ROAD STA	122		$ -
34	2123.610	STREET SWEEPER (WITH PICKUP BROOM)	HOUR	16		$ -
35	2131.506	CALCIUM CHLORIDE SOLUTION	GALLON	4000		$ -
36	2211.507	AGGREGATE BASE (CV) CLASS 5	CU YD	4334		$ -
37	2232.504	MILL BITUMINOUS SURFACE	SQ YD	2160		$ -
38	2232.504	MILL CONCRETE SURFACE	SQ YD	630		$ -
39	2301.503	INTEGRANT CURB DESIGN B6	LIN FT	122		$ -
40	2301.504	CONCRETE PAVEMENT 8.0"	SQ YD	251		$ -
41	2301.602	DRILL AND GROUT REINFORCEMENT BARS (EPOXY COATED)	EACH	840		$ -
42	2360.509	TYPE SP 9.5 WEARING COURSE MIXTURE (3,C)	TON	2525		$ -
43	2360.509	TYPE SP 12.5 NON WEARING COURSE MIXTURE (3,C)	TON	342		$ -
44	2401.602	REINFORCEMENT BARS (EPOXY COATED)	EACH	925		$ -
45	2402.602	INSTALL CANOPY STRUCTURE	LUMP SUM	1		$ -
46	2411.601	STRUCTURAL SLAB	LUMP SUM	1		$ -
47	2501.502	12" CAS PIPE APRON	EACH	2		$ -
48	2501.502	30" RC PIPE APRON	EACH	2		$ -
49	2501.503	12" CP PIPE CULVERT	LIN FT	24		$ -
50	2501.503	30" RC PIPE CULVERT CLASS V	LIN FT	24		$ -
51	2503.503	12" RC PIPE SEWER DES 3006 CLASS V	LIN FT	15		$ -
52	2503.503	15" RC PIPE SEWER DES 3006 CLASS V	LIN FT	9		$ -
53	2503.602	CONNECT TO EXISTING STORM SEWER	EACH	3		$ -
54	2504.602	ADJUST VALVE BOX-FORCE MAIN	EACH	1		$ -
55	2504.602	ADJUST VALVE BOX-WATER	EACH	6		$ -
56	2504.602	ADJUST CURB STOP	EACH	3		$ -
57	2504.602	HYDRANT	EACH	2		$ -
58	2504.602	CONNECT TO EXISTING WATER MAIN	EACH	2		$ -
59	2504.604	3" POLYSTYRENE INSULATION	SQ YD	7		$ -
60	2505.602	ADJUST VALVE BOX-GAS	EACH	2		$ -
61	2506.502	CONSTRUCT DRAINAGE STRUCTURE DESIGN G OR H	EACH	3		$ -
62	2506.502	CASTING ASSEMBLY	EACH	3		$ -
63	2506.502	ADJUST FRAME AND RING CASTING	EACH	4		$ -

Line No.	Spec. No.	Description	Unit	Est. Qty	Unit Price	Total Price
64	2506.503	CONSTRUCT DRAINAGE STRUCTURE DESIGN 48-4020	LIN FT	6		$ -
65	2506.602	CONNECT INTO EXISTING DRAINAGE STRUCTURE	EACH	1		$ -
66	2511.507	RANDOM RIPRAP CLASS III	CU YD	119		$ -
67	2511.602	PLACE BOULDER	EACH	7		$ -
68	2521.518	6" CONCRETE WALK	SQ FT	1794		$ -
69	2531.503	CONCRETE CURB AND GUTTER DESIGN B424	LIN FT	721		$ -
70	2531.503	CONCRETE CURB AND GUTTER DESIGN B612	LIN FT	543		$ -
71	2531.503	CONCRETE CURB AND GUTTER DESIGN B624	LIN FT	1211		$ -
72	2531.504	8" CONCRETE DRIVEWAY PAVEMENT	SQ YD	180		$ -
73	2531.618	TRUNCATED DOMES	SQ FT	487		$ -
74	2533.503	PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337	LIN FT	696		$ -
75	2545.502	HANDHOLE	EACH	1		$ -
76	2545.503	1.5" NON-METALLIC COND (DIRECTIONAL BORE)	LIN FT	2350		$ -
77	2545.503	DIRECT BURIED LIGHTING CABLE 4 COND NO 4	LIN FT	800		$ -
78	2545.602	CONNECT TO EXISTING LIGHT POLE	EACH	1		$ -
79	2550.602	FIBER OPTIC CABLE SPLICING	EACH	2		$ -
80	2550.602	FIBER OPTIC VAULT	EACH	1		$ -
81	2550.601	FIBER OPTIC TESTING	LUMP SUM	1		$ -
82	2550.602	FIBER OPTIC PIGTAIL CABLE SPLICE	EACH	1		$ -
83	2550.602	FIBER OPTIC PIGTAIL TERMINATION	EACH	1		$ -
84	2550.603	FIBER OPTIC PIGTAIL CABLE	LIN FT	1149		$ -
85	2550.603	REROUTE FIBER OPTIC CABLE	LIN FT	1324		$ -
86	2557.503	WIRE FENCE DESIGN 48V-9322	LIN FT	1931		$ -
87	2557.503	WIRE FENCE DESIGN 72V-9322	LIN FT	1432		$ -
88	2557.603	WIRE FENCE DESIGN SPECIAL	LIN FT	1224		$ -
89	2557.502	PEDESTRIAN GATE	EACH	2		$ -
90	2557.502	VEHICULAR GATE-SINGLE	EACH	2		$ -
91	2557.502	VEHICULAR GATE-DOUBLE	EACH	1		$ -
92	2557.602	INSTALL VEHICULAR GATE	EACH	1		$ -
93	2557.603	RECONSTRUCT WIRE FENCE	LIN FT	223		$ -
94	2557.603	BARBED WIRE FENCE	LIN FT	438		$ -
95	2557.603	FENCE DESIGN SPECIAL	LIN FT	310		$ -
96	2563.601	TRAFFIC CONTROL	LUMP SUM	1		$ -
97	2564.502	INSTALL SIGN PANEL TYPE C	EACH	23		$ -
98	2564.518	SIGN PANELS TYPE C	SQ FT	63		$ -
99	2564.602	INSTALL SIGN	EACH	2		$ -
100	2564.602	INSTALL SIGN TYPE SPECIAL	EACH	2		$ -
101	2571.524	CONIFEROUS TREE 6' HT B&B	TREE	20		$ -
102	2573.501	STABILIZED CONSTRUCTION EXIT	LUMP SUM	1		$ -
103	2573.502	STORM DRAIN INLET PROTECTION	EACH	17		$ -
104	2573.503	SILT FENCE, TYPE MS	LIN FT	7558		$ -
105	2573.503	SILT FENCE, TYPE HI	LIN FT	529		$ -
106	2573.503	FLOTATION SILT CURTAIN TYPE MOVING WATER	LIN FT	80		$ -
107	2573.503	SEDIMENT CONTROL LOG TYPE ROCK	LIN FT	30		$ -
108	2574.507	COMMON TOPSOIL BORROW	CU YD	469		$ -
109	2574.508	FERTILIZER TYPE 3	POUND	790		$ -
110	2575.504	EROSION CONTROL BLANKETS CATEGORY 3N	SQ YD	5244		$ -
111	2575.505	SEEDING	ACRE	2		$ -
112	2575.508	SEED MIXTURE 25-131	POUND	896		$ -
113	2575.509	MULCH MATERIAL TYPE 3	TON	2		$ -
114	2582.503	4" SOLID LINE MULTI COMP	LIN FT	435		$ -
115	2582.503	4" DOTTED LINE MULTI COMP	LIN FT	24		$ -
116	2582.503	4" BROKEN LINE MULTI COMP	LIN FT	30		$ -
117	2582.503	4" DOUBLE SOLID LINE MULTI COMP	LIN FT	631		$ -
118	2582.503	6" SOLID LINE MULTI COMP	LIN FT	10		$ -
119	2582.503	24" SOLID LINE MULTI COMP	LIN FT	69		$ -
120	2582.518	PAVEMENT MESSAGE	SQ FT	15		$ -
121	2582.518	CROSSWALK PREFORM THERMOPLASTIC	SQ FT	1800		$ -

TOTAL: **$0.00**

DIVISION SZ

No. Item No.

DIVISION SZ

ATTACHMENTS: FIBER OPTIC TESTING SHEETS

DIVISION SZ

SZ-1 (1102) ABBREVIATIONS

Supplement the provisions of MnDOT 1102 with the following:

SZ-1.1 Add the following to MnDOT 1102:

APL	Approved Product List
ABS	Acrylonitrile Butadiene Styrene
CPVC	Chlorinated Polyvinyl Chloride
DC	Direct Current
EIA	Electronic Industries Alliance
FDF	Fiber Distribution Frame
FNMC	Flexible Non-Metallic Conduit
FO	Fiber Optic
FOTP	Fiber Optic Test Procedure
HDPE	High Density Polyethylene
HOV	High Occupancy Vehicle
JB	Junction Box
KA	Kilo Amperes
LCS	Lane Control Signal
LLDPE	Linear Low Density Polyethylene
LED	Light Emitting Diode
LTU	Line Termination Unit
MDPE	Medium Density Polyethylene
MIL	Military
MM	Multimode
NRTL	Nationally Recognized Testing Laboratory
OTDR	Optical Time Domain Reflectometer
OFSTP	Optical Fiber System Test Procedure
PE	Polyethylene
PTZ	Pan, Tilt, Zoom
RCS	Ramp Control Signal
RTMC	Regional Traffic Management Center
SGU	Sheath Grounding Unit
SM	Single Mode
SNR	Signal to Noise Ratio
SS	Stainless Steel
STP	Shielded Twisted Pair
TIA	Telecommunications Industries Association
TWP	Twisted Wire Pair
XLP	Crosslinked Polyethylene
V	Volt
ZDW	Zero Dispersion Wavelength

SZ-1.2 UNITS

°F	Degree Fahrenheit

SZ-1.3 SYMBOLS

π	pi (3.1416)
<	less than
>	greater than

SZ-1.4 CONVERSIONS

1 inch	25.4 millimeters (mm)
1 $inch^2$	645 mm^2
1 $inch^3$	16,400 mm^3
1 yd3	0.76 m^3
1 liter	61 in^3
1gallon	3.785 liters
1 pound mass	0.4536 kg

SZ-2 (1103) DEFINITIONS

Supplement the provisions of MnDOT 1103 with the following:

SPECIFICATIONS

Detailed descriptions of a device or devices including physical and operating characteristics.

SUBMITTAL

Documentation of proposed, materials, products, equipment or processes. Additionally, it shall include shop drawings, wiring diagrams, and test reports

SCHEMATICS

Diagrams using standard symbols to show the function.

HAS MET

A Manufacturer's product that is in conformance with the specifications required in these Special Provisions. The Contractor may submit any other Manufacturer's product of equal quality for approval.

APL

MnDOT's Approved Product List which contains Manufacturer's products that are in conformance with the specifications required by MnDOT. Use only products contained within the Traffic Management Systems/ ITS section of the APL unless otherwise directed within these Special Provisions. Other Manufacturer's product of equal quality may be submitted for approval. See the following website for the APL:

http://www.dot.state.mn.us/products/index.html

NETWORK CONNECTION POINT (NCP)

When FO cable is connect between a RTMC TMS network Trunk FO Cable and a Signal cabinet, the NCP shall be the point at which the FO Cable Indoor pigtails are attached to the 12 Fiber Bulkhead Drawers within the Signal cabinet. The Signal cabinet that contains this termination shall be called the Head-end Signal Cabinet.

HEAD-END SIGNAL CABINET (HC)

Signal cabinet which contains the NCP.

SZ-3 (1903) COMPENSATION FOR INCREASED OR DECREASED QUANTITIES

Quantities shown in the Plan are estimates only. Increases or decreases in final quantities shall not be grounds for unit bid price adjustment requests. Quantities requested for work not covered by unit bid prices will be paid for as Extra Work in accordance with MnDOT 1904.

SZ-3.1 MnDOT 1402 is modified to the extent that any references to 75 percent shall be construed to read 60 percent and any references to 125 percent shall be construed to read 150 percent for the following items:

2550.602	Fiber Optic Pigtail Cable
2550.602	Reroute Fiber Optic Cable
2550.602	Fiber Optic Cable Splice
2550.602	Fiber Optic Pigtail Cable Splice

SZ-4 (2104) REMOVE FIBER OPTIC VAULT

Remove or salvage internal and external components in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-4.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before removing the Fiber Optic Vault and removing or salvaging internal and external components.

(A) Internal and external components include but are not limited to the following:

a. Outdoor Fiber Splice Enclosure.
b. Concrete Drain Headwall.

SZ-4.2 Salvage internal and external components according to Plan. Give salvaged items to the TMS Integrator.

SZ-4.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (REMOVE FIBER OPTIC VAULT) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited removing internal and external components, salvaging internal and external components, and all materials and labor necessary to construct the Remove Fiber Optic Vault.

SZ-5 (2550) MATERIALS

Supplement MnDOT 2550.2A with the following provisions:

SZ-5.1 Ensure all materials, work methods, and equipment comply with the standards of the National Electrical Manufacturers Association, Electronic Industries Association, Underwriters Laboratory, Inc., National Electrical Code; Telecommunications Industries Association, local codes and ordinances, the requirements of the Contract, these Special Provisions, and the Plan.

SZ-5.2 Warranty all F&I materials and workmanship as well as workmanship on materials that were paid for as an Install item for a minimum of six months after completion and acceptance of the work. Specific items within these Special Provisions may require longer warranty periods. Completion of all construction obligations, documented as the Final Completion Date on the Change in Construction Status report is the beginning of the warranty period.

SZ-5.3 Use stainless steel hardware (e.g. mounting bolts, nuts, washers, and external hinges, etc.) on all outdoor TMS components (vaults, cabinets, TMS Shelter Cabinets, handholes, electrical services, etc.).

SZ-5.4 Round and smooth sharp corners and edges of all F&I TMS components.

SZ-6 STATE FURNISHED MATERIALS

Apply the following provisions to State Furnished Materials (SFM):

SZ-6.1 SFM will be provided to the Contractor with proper notice. Be responsible for any damage once MnDOT has provided access to the SFM.

SZ-6.2 **LOCATOR BALLS**

MnDOT will furnish the 3M 1401 four inch Orange Ball Marker. Perform the following:

(A) Contact the TMS Integrator by TMS construction phone number (651) 331-8370 and arrange to have the Ball Markers delivered. Provide a seven Working day notice prior to ball marker delivery.

(B) Provide the TMS Integrator with an exact count of Locator Balls needed for the Project.

(C) Mount the hardware.

SZ-6.3 **CONTROL CABINETS, FOUNDATION MOUNTED**

MnDOT will furnish Control Cabinets. Install and mount them on a foundation. The cabinets are weatherproof, fully wired, comply with UL 508 and CSA inspected. Perform the following:

(A) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a Control cabinet, or components, from the storage site to the installation site. The storage site shall be on MnDOT property in the Metro area. Inspect the cabinets, in the presence of the TMS Integrator, before the cabinets leave the storage site.

(B) The Control Cabinet will have a MnDOT furnished, one piece, dense neoprene, gasket. Install the gasket between the cabinet and the foundation.

(C) Accept responsibility for any damage to the cabinets and its components during loading and transporting from the storage site to the installation site. Supply all equipment and personnel needed to load, transport, and unload the cabinets.

(D) Handle and secure of the cabinets until installed.

SZ-6.4 **LTU AND SGU**

The LTU or SGU will be furnished by MnDOT with new MnDOT Furnished TMS Control cabinets for mounting on foundations only. Furnish and install the LTU or SGU for all other Cabinets.

SZ-6.5 **FO PATCHING SHELTER**

MnDOT will furnish the FO Patching Shelter for installation. Perform the following:

(A) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a FO Patching Shelter, or components, from the storage site to the job site. The storage site is on MnDOT property in the Metro area.

(B) Inspect the FO Patching shelter, in the presence of the TMS Integrator, before it leaves the storage site.

(C) Accept responsibility for any damage to the FO Patching Shelter and its components during loading and transporting from the storage site to the project site. Supply all equipment and personnel needed to load, transport, and unload the FO Patching Shelter.

(D) Handle and secure the Fiber Optic Patching Shelter until installed.

SZ-6.6 **FIBER OPTIC SPLICE, PATCH, AND SPLICE/PATCH PANEL**

MnDOT will furnish FO Splice, Patch Panels, and Splice/Patch Panels. Perform the following:

(A) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before delivery.

(B) MnDOT will also furnish Splice wheels, Splice decks, and Cable Clamp kits.

SZ-6.7 **ILCS**

MnDOT has a multiyear contract for procurement of LED style Intelligent Lane Control Signal (ILCS). Perform the following:

(A) Coordinate delivery dates with the ILCS Manufacturer.

(B) Store the ILCS at the Larpenteur Ave. MnDOT Truck Station or at the ILCS Manufacturer. Both locations are located within the Metro area.

(C) Use proper equipment for loading/unloading the signs to insure no damage to the ILCS occurs.

(D) Secure unloaded ILCS to prevent damage.

(E) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a ILCS from the storage site to the job site. The storage site is on MnDOT property in the Metro area.

(F) Inspect the ILCS, in the presence of the TMS Integrator, before it leaves the storage site.

SZ-6.8 **PRICING SIGN MODULE**

MnDOT will furnish the Pricing Sign Module (PSM). Perform the following:

(A) Coordinate delivery dates with the Manufacturer.

(B) Store the PSM at the Larpenteur Ave. MnDOT Truck Station..

(C) Use proper equipment for loading/unloading the PSM to insure no damage to the sign occurs.

(D) Secure unloaded PSM to prevent damage.

(E) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a PSM from the storage site to the job site. The storage site is on MnDOT property in the Metro-area.

(F) Inspect the PSM in the presence of the TMS Integrator, before the PSM leaves the storage site.

SZ-6.9 **DMS**

MnDOT has a multiyear contract for procurement of LED style Dynamic Message Signs (DMS). Perform the following:

(A) Coordinate delivery dates with the DMS Manufacturer.

(B) Unload the DMS when they are delivered. Depending on the time of delivery install or store the DMS at MnDOTs facilities.

(C) Use proper equipment to unload the DMS and a splitter bar when lifting to insure no damage to the DMS occurs.

(D) Unload and once on the ground, attach the DMS to other DMS at the lifting eyes or place 10 foot lumber under the DMS and securely strap the DMS down to prevent it from tipping over.

(E) Provide 2 pieces of 6" x 6" lumber and position under structural ribs 2 and 8.

(F) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a DMS from the storage site to the job site. The storage site is on MnDOT property in the Metro area.

(G) Inspect the DMS, in the presence of the TMS Integrator, before the DMS leaves the storage site.

SZ-6.10 **DMS, POST MOUNTED**

MnDOT has a multiyear contract for procurement of LED style Dynamic Message Signs, Post Mounted (DMS PM). Perform the following:

(A) Coordinate delivery dates with the DMS PM Manufacturer.

(B) Unload the DMS PM when they are delivered. Depending on the time of delivery, install or store the DMS PM at MnDOTs facilities.

(C) Use proper equipment to unload the DMS PM and a splitter bar when lifting to insure no damage to the DMS PM occurs.

(D) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a DMS PM from the storage site to the job site. The storage site is on MnDOT property in the Metro area.

(E) Inspect the DMS PM, in the presence of the TMS Integrator, before the DMS PM leaves the storage site.

SZ-6.11 **PTZ CAMERA**

MnDOT will furnish and install PTZ cameras at each of the CCTV Hardware, CCTV Hardware-Special, Non-Intrusive Detection Hardware, and sign structure mounted Camera Bracket locations.

SZ-6.12 **NON-INTRUSIVE DETECTOR**

MnDOT will furnish and install Non-Intrusive Detectors at each of the Non-Intrusive Detection Hardware locations.

SZ-6.13 **PTZ CAMERA**

MnDOT will furnish PTZ cameras at each of the CCTV or Non-Intrusive Detection Hardware locations. Perform the following:

(A) Install the PTZ Camera Assembly.

(B) Deliver the PTZ Camera Assembly to the Project site undamaged.

(C) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a PTZ Camera Assembly from the storage site to the job site. The storage site is on MnDOT property in the Metro area.

(D) Inspect the PTZ Camera Assembly in the presence of the TMS Integrator before it leaves the storage site.

SZ-6.14 **MnDOT FURNISHED POLE MOUNTED CCTV CABINET**

The Pole Mounted CCTV Cabinet is a pole mounted control cabinet and fiber termination point; it has a thermostatically controlled exhaust fan, filtered air intake and exhaust, a circuit breaker, and power receptacles. Perform the following:

(A) See GROUNDING on page 10.

(B) Deliver the Pole Mounted CCTV Cabinets to the Project site undamaged.

(C) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a Pole Mounted CCTV Cabinet from the storage site to the job site. The storage site is on MnDOT property in the Metro area. Inspect the cabinet in the presence of the TMS Integrator before the cabinet leaves the storage site.

SZ-6.15 **MnDOT FURNISHED POLE MOUNTED NON-INTRUSIVE DETECTION CABINET**

This is a pole mounted control cabinet and fiber termination point; it has a thermostatically controlled exhaust fan, filtered air intake and exhaust, a circuit breaker, and power receptacles. Perform the following:

(A) See GROUNDING on page 10.

(B) Deliver the Pole Mounted Non-Intrusive Detection Cabinets to the Project site undamaged.

(C) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting a Pole Mounted Non-Intrusive Detection Cabinet from the storage site to the job site. The storage site is on MnDOT property in the Metro area. Inspect the cabinet in the presence of the TMS Integrator before the cabinet leaves the storage site.

SZ-6.16 **MnDOT FURNISHED 12 FIBER BULKHEAD (SPLICE/PATCH PANEL) DRAWERS**

The rack mounted, 12 Fiber Bulkhead Drawer is pre-loaded with adapters/receptacles and does not include indoor pigtails. It does provide the following:

(A) Pigtail storage, splice protection, and termination.

(B) Storage, splice protection, and termination of up to 12 fibers.

(C) Access to splices and the back of the splice panel.

(D) 19 inch EIA rack compatibility.

SZ-6.17 **STATE FURNISHED FIBER OPTIC SPLICE VAULT MARKER**

Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before delivery is required.

SZ-6.18 **MnDOT FURNISHED CONCRETE ENCASED FO CABLE WARNING SIGN PANELS**

Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before delivery and the following:

(A) MnDOT will furnish two sign panels for the Contractor to install.

SZ-7 TMS INTEGRATION

The Regional Traffic Management Center (RTMC) will assign a Traffic Management System (TMS) Integrator to each project involving construction of the Traffic Management System. The TMS Integrator will serve as a technical resource to MnDOT Construction Administration. Contact information will be provided at the Pre-construction meeting. If the TMS Integrator is not reachable, contact a TMS Integrator by TMS construction phone number (651) 331-8370.

SZ-7.1 TMS INTEGRATOR RESPONSIBILITIES

See Signal Plans and Division SS Special Provisions for Signal Interconnect and infrastructure located downstream from the NCP. The TMS Integrator will be responsible for performing or approving the following tasks:

(A) Recommend acceptance/unacceptance of TMS components and/or TMS construction methods to the project engineer.

(B) Help to resolve Plan and Special Provision discrepancies.

(C) Provide technical guidance to Contractors as directed by the Engineer.

(D) **Contractor Staking Responsibility**

a. Stake or flag proposed FO cable and conduit with trace wire which will be used for future FO cable installation. The stakes or flags shall be every 100 feet and at each change in direction. Acquire Integrator acceptance of these locations prior to installation.
b. Stake or flag in the presence of a TMS Integrator, Vaults, CCTV poles, Non-Intrusive Detection Folding poles, control cabinets, service cabinets, FO Patching Shelters, RCS and Flasher Signals, DMS Post Mounted, TMS shelter cabinets, Ramp Closure Gates, and Wood Poles.
c. Mark locations in the presence of a TMS Integrator Junction Boxes mounted on sign structures. Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before marking the Junction Box locations.
d. Locate all existing utilities prior to installation of any proposed Integrator staked TMS infrastructure locations. Staking done by MnDOT Integrator is not a substitute for existing utility location.

(E) Respond to requests for MnDOT Furnished Materials.

(F) Assist with TMS construction inspection.

(G) Perform the following actions after loop detector installation:

a. Testing.
b. Terminate lead-in conductors.
c. Configure loop detector modules within cabinets.

(H) Splicing Telephone cables in BD cabinets.

SZ-7.2 TMS PROJECT SUBMITTAL AND FO TEST DOCUMENTATION

TMS Project Submittal and FO Test Documentation will be reviewed by a TMS Integration representative assigned to the project. The representative will evaluate and make recommendations to the Engineer regarding acceptance of the required documentation. Contact information will be provided at the Pre-construction meeting.

SZ-8 GROUNDING

Furnish and install Grounding according to the following provisions:

SZ-8.1 **SINGLE POINT GROUNDING**

Connect grounded devices to one single piece ground rod, via the shortest and straightest route. Connect the devices' chassis and electrical grounds at a ground buss before connecting them to the earth ground rod. Connect the ground busses via conductors that meet the requirements of SINGLE POINT GROUNDING.

SZ-8.2 **GROUND RODS AND GROUND ROD CONNECTIONS**

Apply the following provisions to ground rods and ground rod connections:

(A) The ground rod shall be 4.6 m (15 feet) long, one piece, and comply with MnDOT 2545.3R.

(B) Construct the ground rod in the center of cabinet foundations unless otherwise specified in the Plan details.

(C) Apply an oxide inhibitor over bonded connections to ground rods. The Oxide Inhibitor must be U.L. listed. Apply it to the bonded area between the temperatures of -22 °C (-30 °F) and 149 °C (300 °F).

(D) Clean each grounding component with 300-grit emery cloth before bonding and apply a mineral oil based oxide inhibitor to the bond area.

(E) Bond the ground conductor to the ground rod by one of the following bonding methods:

a. Mechanical. The Mechanical Grounding connector shall have the following characteristics:

i. Sized ½ inch diameter for Lightning rods and 0.625 inch diameter for Ground rods.
ii. Includes two stainless steel cap screws to secure the cable to the ground electrode for a positive electrical connection.

b. Exothermic Welding.

(F) **APL**

MnDOT approved Mechanical Grounding connectors for Lightning rods and Ground rods are listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

SZ-8.3 **CABLES**

Apply the following provisions to grounding of Cables:

(A) Ground all Cable shields entering cabinets and splice enclosures.

(B) Maintain the electrical continuity of the Cable shields.

(C) Shield bonding complies with RUS splicing Standard PC-2, Section 3.3.

(D) Bonding connectors comply with RUS standard PE-33 (Cable Shield Connectors).

SZ-8.4 **OUTDOOR FIBER SPLICE ENCLOSURE**

Apply the following provisions to grounding of Outdoor Fiber Splice Enclosure:

(A) Bond all FO cable shields to an internal ground lug within the Outdoor Fiber Splice Enclosure. Bond one LTU or SGU conductor to the ground lug of the splice enclosure and the other conductor to the outside ground rod.

(B) Connect a ground strap to connect all internal ground post to electrically tie them together.

SZ-8.5 **SERVICE CABINETS OR EQUIPMENT**
Apply the following provisions to grounding of Service Cabinets or Equipment:

(A) Furnish and install a ground rod.

(B) Ground the cabinet ground buss to the ground rod with a bare 1/C No. 6 solid copper wire.

(C) Route each ground conductor to the ground buss via the straightest route that does not hinder maintenance or installation activities.

SZ-8.6 **CCTV FOLDING POLE**
Apply the following provisions to grounding of CCTV Folding Poles:

(A) Ground the Pole base ground lug to the ground rod with a bare 1/C No. 6 solid copper wire.

(B) Orient lightning protection for the environmental housing away from the freeway at approximately 90˚ to centerline or as directed by the Engineer.

(C) Attach a lightning protection conductor to the folding pole at seven points with a parallel splicer clamp.

(D) Install the top of the ground rod six inches below the surface.

(E) **APL**
MnDOT approved Lightning Protection Conductor and Parallel Splicer is listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

SZ-8.7 **NON-INTRUSIVE DETECTION FOLDING POLE**
Apply the following provisions grounding of Non-Intrusive Detection Folding Poles:

(A) Ground the Pole base ground lug to the ground rod with a bare 1/C No. 6 solid copper wire.

SZ-8.8 **POLE MOUNTED CCTV CABINET**
Apply the following provisions to grounding of Pole Mounted CCTV Cabinets:

(A) Ground the cabinet ground buss to the pole lug then to the ground rod with a bare 1/C No. 6 solid copper wire.

(B) Connect the LTU or SGU between the cabinet equipment ground buss and the fiber optic pigtail armor.

(C) Route each ground conductor to the ground buss via the straightest route that does not hinder maintenance or installation activities.

SZ-8.9 **NON-INTRUSIVE DETECTION CABINET**
Apply the following provisions to grounding of Non-Intrusive Detection Cabinets:

(A) Ground the cabinet ground buss to the pole lug then to the ground rod with a bare 1/C No. 6 solid copper wire.

(B) Connect the LTU or SGU between the cabinet equipment ground buss and the fiber optic pigtail armor.

(C) Route each ground conductor to the ground buss via the straightest route that does not hinder maintenance or installation activities.

SZ-8.10 **CONTROL CABINET, GROUND MOUNTED**

Apply the following provisions to grounding of Control Cabinet, Ground Mounted:

(A) Ground the cabinet ground buss to the ground rod with a bare 1/C No. 6 solid copper wire.

(B) Connect the LTU or SGU between the cabinet equipment ground buss and the fiber optic pigtail armor.

(C) The LTU or SGU will be provided with new MnDOT furnished Ground mounted Control cabinets. See the Signal Plan and Division SS Special provisions for information and requirements regarding LTU or SGU in Signal Control Cabinets.

(D) Route each ground conductor to the ground buss via the straightest route that does not hinder maintenance or installation activities.

SZ-8.11 **FO PATCHING SHELTER**

Apply the following provisions to grounding of FO Patching Shelter:

(A) Construct the bare 1/C No. 0 copper wire for the FO Patching Shelter ground ring 30 inches deep.

(B) Construct top of the ground rods 6 inches below finished grade.

(C) Place 2-0.625 inch diameter X 15 feet copper coated ground rods (25 ohms or less) on opposite corners of the FO Patching Shelter.

(D) Connect the ground rods to the FO Patching Shelter interior grounding buss bar, at the point closest to the interior ground buss, with the No. 0 conductor.

(E) Weld the conductor to the ground rods. See **GROUND RODS AND GROUND ROD CONNECTIONS** on page 11.

(F) Route each ground conductor to the ground buss via the straightest route that does not hinder maintenance or installation activities.

(G) Construct a 4 inches X 0.25 inch X 24 inches solid copper, single point buss bar with 6 conductor clamps on the FO Patching Shelter wall next to the main conduit entrance and mounted one inch off the FO Patching Shelter wall.

(H) Equalize potential ground differences within and throughout the FO Patching Shelter by bonding the chassis of each piece of FO equipment to a single point (the ground bus bar).

(I) Isolate each EIA rack with insulated stand-offs

(J) Route No.6 stranded insulated conductor from each EIA rack and FDF to the ground buss via the straightest route that does not hinder maintenance or installation activities.

(K) Connect chassis grounds to the "Single Point" ground system only.

(L) Connect the LTU or SGU between the FO Patching Shelter equipment ground buss and the fiber optic cable armor.

SZ-8.12 **TMS SHELTER CABINET**

Apply the following provisions to grounding of TMS Shelter Cabinet:

(A) Construct the bare 1/C No. 0 copper wire for the TMS Shelter Cabinet ground ring 30 inches deep.

(B) Construct the top of the ground rods 6 inches below finished grade.

(C) Place 2-0.625 inch diameter X 15 feet copper coated ground rods (25 ohms or less) on opposite corners of the TMS Shelter Cabinet.

(D) Connect the ground rods to the TMS Shelter Cabinet interior grounding buss bar, at the point closest to the interior ground buss, with the No. 0 conductor.

(E) Weld the conductor to the ground rods. See **GROUND RODS AND GROUND ROD CONNECTIONS** on page 11.

(F) Route each ground conductor to the ground buss via the straightest route that does not hinder maintenance or installation activities.

(G) Construct a 4 inches X 0.25 inch X 24 inches solid copper, single point buss bar with 6 conductor clamps on the TMS Shelter Cabinet wall next to the main conduit entrance and mounted one inch off the TMS Shelter Cabinet wall.

(H) Equalize potential ground differences within and throughout the TMS Shelter Cabinet by bonding the chassis of each piece of FO equipment to a single point (the ground bus bar).

(I) Isolate each EIA rack with insulated stand-offs.

(J) Route No.6 stranded insulated conductor from each EIA rack and FDF to the ground buss via the straightest route that does not hinder maintenance or installation activities.

(K) Connect chassis grounds to the "Single Point" ground system only.

SZ-8.13 **FO CABLE**

Apply following provisions to grounding of Fiber Optic Cable:

(A) Construct the appropriate LTU or SGU for all fiber optic cable ground locations including but not limited to Control cabinets, Signal Control Cabinets, Shelter Cabinets, and vaults. See STATE FURNISHED MATERIALS on page 6 for locations where MnDOT will furnish and install a LTU or SGU. See Has Met to determine the type of LTU or SGU required.

(B) Provide a LTU or SGU in the following locations:

a. Control cabinets require a LTU or SGU to ground the outer shield and armor of the fiber optic cables to the equipment ground buss.
b. Shelters require one LTU or SGU on each FO cable entering/exiting the Shelter.
c. Vaults require one LTU or SGU between the splice enclosure and the ground rod.

(C) Utilize a LTU or SGU to ground the outer shield and armor of the fiber optic cables in control cabinets to the equipment ground buss.

(D) Apply an oxide inhibitor over bonded connections to ground rods. The Oxide Inhibitor must be U.L. listed. Apply it to the bonded area between the temperatures of -22 °C (-30 °F) and 149 °C (300 °F).

(E) Clean each grounding component with 300-grit emery cloth before bonding and apply a mineral oil based oxide inhibitor to the bond area.

(F) In vaults, mount the LTU or SGU to the inner wall of the vault along the upper half. The LTU or SGU shall have the following features:

a. Low impedance ground path for high voltage transients while allowing location and monitoring signals to pass.
b. Automatic reset.
c. Failsafe circuitry design.
d. Hybrid surge suppression circuitry designed for below grade use.
e. No. 6 AWG solid copper lead wires.

(G) Ground fiber optic cables within the first five feet after the conduit entrance.

(H) **LTU AND SGU-APL**
MnDOT LTU and SGU are listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

a. Use LTU in the following locations:
   i. Armored FO Pigtail Cable ends contained within a Control Cabinet.
   ii. Trunk FO Cable ends when the Trunk FO cable end is located in a vault and is the end of the Trunk FO cable run:

b. Use SGU in the following locations:
   i. Armored FO Pigtail Cable ends contained within a vault
   ii. Trunk FO Cable ends except when the Trunk FO cable end is located in a vault and is the end of the Trunk FO cable run:

SZ-8.14 **DMS**
Apply the following provisions to grounding of DMS and DMS POST MOUNTED:

(A) Connect the Lightning Protection conductor to the ground lug located on the rear exterior of the DMS.

(B) Secure the conductor horizontal run along the support structure to the support structure by utilizing stainless steel straps and hardware every three feet.

(C) Secure the conductor vertical run along the support structure to the support structure by utilizing stainless steel straps and hardware at four points.

(D) Construct the top of the ground rod six inches below finished grade.

(E) **APL**
MnDOT approved Lightning Protection Conductor is listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

SZ-8.15 **PRICING SIGN AND OR DMS MODULE**
Apply the following provisions to grounding of Pricing Sign Module:

(A) Connect the grounding conductor to the ground lug located on the rear exterior of the Pricing Sign Module as per the Plan.

SZ-8.16 **RCS AND FLASHER SIGNALS**

Apply following provisions to the grounding of RCS and Flasher Signals:

(A) Accomplish Single Point grounding in RCS and Flasher Signal bases by the following:

a. Ground all blue conductors from the 6/C No. 14 or 3/C No.14 cables to the pedestal base at a single point or grounding all green conductors from the 5/C No. 12 or 3/C No.12 cables to the pedestal base at a single point.
b. Connect the ground lug in the pedestal base to a 0.625 inch by 15 feet one-piece ground rod with a bare No.6 solid copper wire.
c. Apply an oxide inhibitor over bonded connections to ground rods. The Oxide Inhibitor must be U.L. listed. Apply it to the bonded area between the temperatures of -22 °C (-30 °F) and 149 °C (300 °F).
d. Use a conduit ground bushing and a bare No. 6 solid copper wire to connect foundation conduits to the pedestal ground lug for RSC.
e. Use an anti-oxidant compound on the ground lug connector in the breakaway pedestal base.
f. According to Plan Details.

SZ-8.17 **LANE CONTROL SIGNAL**

Apply the following provisions to the grounding of LCS:

(A) Accomplish Single Point grounding by the following:

a. Ground all blue conductors from the 6/C No. 14 cables to the Buss Bar in the Ground Mounted Control Cabinet and LCS Terminal strip at a single point.
b. Apply green tape to all blue conductors used as a ground connection.
c. According to Plan Details.

SZ-8.18 **MEASUREMENT AND PAYMENT**

GROUNDING includes but shall not be limited to Single Point Grounding, Ground Rods and Ground Rod Connections, Cables, Outdoor Fiber Splice Enclosure, Service Cabinet or Equipment, CCTV Folding Pole, Non-Intrusive Detection Folding Pole, Pole Mounted CCTV Cabinet, Non-Intrusive Detection Cabinet, Control Cabinet Ground Mounted, FO Patching Shelter, TMS Shelter Cabinet, FO Cable, DMS, RCS and Flasher Signals, Lane Control Signal, and all materials and labor necessary to complete Grounding. Consider GROUNDING incidental for which no direct compensation will be made.

SZ-9 LABELING

Furnish and install Labeling according to the following provisions:

SZ-9.1 Secure identifying labels to each fiber, cable, component, cabinet in the manner described in the Plan and these Special Provisions.

SZ-9.2 Do not use wire ties for labeling cables.

SZ-9.3 **FIBER OPTIC CABLES**

Apply the following provisions to labeling Fiber Optic Cables:

(A) See “Fiber Optic Cable Labeling Detail” in the Plans for additional information.

(B) Apply colored electrical tape at both ends of Trunk FO and pigtail cables to indicate either a pigtail or the direction the majority of the FO Cable travels from a structure. The direction of the cable does not always coincide with the initial direction the cable leaves a structure. Colors of the tape represent the following:

a. Northbound-NB (blue)
b. Southbound-SB (green)
c. Eastbound-EB (yellow)
d. Westbound-WB (orange)
e. Pigtails-(White)

(C) Write descriptive identifiers on the colored tape with a laundry marking pen. Include descriptive identifiers of the following:

a. The nearest meter mark.
b. The FO Cable number.
c. The item that the fiber is traveling to by name. (e.g. Cab. 94-212.64, Cam 808, DMS 94-206.70, ect…)
d. The fiber count and mode.
e. The direction the majority of the FO Cable travels from a structure. The direction of the cable does not always coincide with the initial direction the cable leaves a structure.

(D) Include the following identifiers and apply them to the outer jacket of the FO Cable at the following structures and locations:

a. Control Cabinets and Shelter Cabinets

i. The FO Cable, within 18 inches from the end of the conduits with the following identifiers: FO Cable number, direction, fiber count and mode, and nearest meter mark.
ii. The FO pigtail, within 18 inches from the connection to the splice panel (White tape) with the following identifiers: name, fiber count and mode, and nearest meter mark.

b. Vaults and Handholes

i. The Trunk FO Cable, within 18 inches from the end of the conduits with the following identifiers: FO Cable number, direction, fiber count and mode, and nearest meter mark.
ii. The FO pigtail, within 18 inches from the end of the conduit (White tape) with the following identifiers: name, fiber count and mode, and nearest meter mark.

c. Outdoor FO Splice Enclosure

i. The Trunk FO Cable, within 18 inches from the end with the following identifiers: FO Cable number, direction, fiber count and mode, and nearest meter mark.
ii. The FO pigtail, within 18 inches from the end (White tape) with the following identifiers: name, fiber count and mode, and nearest meter mark.
iii. Splice trays with the FO Cable ID number and each fiber number on the Manufacturer provided cover label.

SZ-9.4 **FIBER DISTRIBUTION COMPONENTS**

Apply the following provisions to labeling Fiber Distribution Components:

(A) Label indoor pigtail six-paks on the outer jacket at the Splice Panel tray/wheel and inside the Patch Panel to indicate the trunk cable ID number and which six fibers are spliced to the six-pak (e.g. 94-12 SM7-12).

(B) Label the front of the patch panels with the fiber optic cable number, direction, and fiber count.

(C) Label the front of the splice panels with the fiber optic cable number, direction, and fiber count.

(D) Label splice trays/splice wheels with the cable ID and fiber numbers contained in the tray/wheel.

SZ-9.5 **ELECTRICAL COMPONENTS**

Apply the following provisions to labeling Electrical Components:

(A) Label the function of each circuit breaker in each circuit breaker enclosure on the front panel below the breaker.

SZ-9.6 **CAT 6 CABLE**

Apply the following provisions to labeling CAT 6 Cable for ILCS:

(A) Label cables in succession from right to left in the direction of travel with the right most ILCS labeled “ILCS 1”.

(B) Utilize white electrical tape with black permanent marker as described in the Plan Detail.

Apply the following provisions to labeling CAT 6 Cable for DMS:

(C) Label cables Northbound, Southbound, Eastbound, or Westbound.

(D) Utilize white electrical tape with black permanent marker as described in the Plan Detail.

SZ-9.7 **POWER CABLE 3/C NO. 14**

Apply the following provisions to labeling Power Cable 3/C No. 14 for ILCS:

(A) Label cables in succession from right to left in the direction of travel with the right most ILCS labeled “ILCS 1”.

(B) Utilize white electrical tape with black permanent marker as described in the Plan Detail.

SZ-9.8 **LOOP DETECTORS AND LOOP DETECTOR SPLICES**

Apply the following provisions to Labeling Loop Detectors and Loop Detector Splices (see TMS Loop Detector Typical in the plans):

(A) Label the following components utilizing white electrical tape with black permanent marker as described in the Plan Detail:

a. Loop detector conductor tail cable
b. Lead-in conductor cable in the handhole that contains the splice to the loop conductor
c. Lead-in conductor cable in the cabinet.

(B) Record the factory test information for the following items:

a. Loop Tail by utilizing a yellow label. Yellow tags may be removed from the loop tail, on installation, and temporarily attached to the loop wire ends in the handhole for information retrieval at the time of splicing.

SZ-9.9 **LED**

Apply the following provisions to labeling LED:

(A) **LED**

a. Affix to the back of each LED indication a permanent label or permanently mark with an oil based paint marker the date of installation. Use markings of a contrasting color to ensure the date can be easily read.

SZ-9.10 **LANE CONTROL SIGNAL**

Apply the following provisions to labeling Lane Control Signal:

(A) Label all of the LCS power and control cable within the Ground Mounted Control Cabinet with black permanent marker on white electrical tape.

(B) Label LCS power and control cables labeled with the right outside lane denoted, "Lane 1" and numbering shall progress upward with each lane toward the center lane.

SZ-9.11 **MEASUREMENT AND PAYMENT**

LABELING includes but shall not be limited to FO Cables, Fiber Distribution Components, Electrical Components, Cat 6 Cable, Power Cable 3/C No. 14, Loop Detectors and Loop Detector Splices, LED, Lane Control Signal, and all materials and labor necessary to complete Labeling. Consider LABELING incidental for which no direct compensation will be made.

SZ-10 JOB SPECIFIC SPECIFICATION CONSIDERATIONS

SZ-10.1 Maintain full operation of the Traffic Management System Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer.

SZ-10.2 Maintain full operation and connectivity to the RTMC network of all Trunk FO Cables located outside the project limits and impacted by the project construction Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Construct temporary connections if Trunk FO Cables will be non-operational during the above required hours of full operation. Acquire MNDOT TMS Integrator approval of the temporary system and and consider it incidental. **The Contractor will be subject to a daily charge assessed at a rate of $1000.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.**

SZ-10.3 A maximum of 30 Calendar days will be allowed for outages of Traffic Management System devices located within the project limits.

SZ-10.4 Perform TMS Shelter Cabinet cutovers during the hours of 7:00 pm Friday to 5:00 am Monday.

SZ-10.5 Stage Loop Detector Design Preformed construction so it is completed prior to the mill and overlay of the roadway lanes. Construct the Loop Detector Design Preformed as shown in the Plan details.

SZ-10.6 Signal Plans and Signal Special Provisions will describe all measurement, payment, quantities, and construction downstream from the NCP.

SZ-11 PROJECT TESTING AND DOCUMENTATION SUBMITTALS

Provide Project Documentation Submittals for Components and FO Cable Testing in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-11.1 Present Project Testing and Documentation Submittals directly to the Engineer. Present Project Testing and Documentation Submittals as three complete packages unless prior authorization is made with the Engineer. Complete packages will be defined as one submittal for Components and

one submittal for Testing. Include all required documentation in each submittal. Payment will not be made until a submittal package is received and approved by the Engineer.

SZ-11.2 Provide Project Testing and Documentation Submittals for the following items:

(A) Components

(B) FO Cable Testing.

SZ-11.3 **COMPONENTS**

Apply the following provisions to project component testing and documentation submittals for Components:

(A) Submit Component Documentation Submittals to the Engineer within two weeks subsequent to contract approval. **The Contractor will be subject to a daily charge assessed at a rate of $200.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied**. The Engineer will reserve the right to allow the Contractor greater than two weeks after contract approval to make submittals.

(B) Submit two sets of component specifications and/or shop drawings for each project component, assembled or whole, to the Engineer. Forward any MnDOT recommended revisions to the Manufacturer.

(C) Two separate copies of project Component documentation shall be submitted as a complete and organized package unless otherwise directed by the Engineer.

(D) The Engineer will approve or reject submittals within two weeks of receipt. The TMS Component Documentation Submittal package will be approved by the Engineer prior to installation or payment for the component.

(E) Include the Manufacturer's name, specifications, and detailed drawings as part of the Project Component Documentation submittals for all items listed on the **COMPONENT CHECK-OFF LIST** on page 23.

(F) Do not submit manufacturer's information for components already identified as meeting the specification as a "Has Met" or is listed on the Traffic Management System/ITS APL. This includes components listed on the TMS/ITS APL when the Contract is advertised and at the time the Testing and Documentation Submittal is submitted.

(G) Complete the check-off list for "Has Met" items and include this list as part of the Project Documentation Component Submittal package. See **COMPONENT CHECK-OFF LIST** on page 23.

(H) **Loop Detectors and Loop Detector Splices**

Apply the following provisions to Project Testing and Documentation Submittals for Loop Detectors and Loop Detector Splices:

a. Submit Loop Detector Splice component specifications for Engineer approval prior to installation or payment for the following Loop Detector Splice components:

   i. Loop lead-in.
   ii. Splice encapsulator.

b. Submit Loop Detector Design Sawcut component specifications for Engineer approval prior to installation or payment for the following Loop Detector Design Sawcut components:

i. Loop assembly.
ii. Loop lead-in.
iii. Loop conductor.
iv. Splice encapsulator.

c. Submit Loop Detector Design Preformed component specifications for Engineer approval prior to installation or payment for the following Loop Detector Design Preformed components:

i. Loop assembly.
ii. Loop lead-in.
iii. Splice encapsulator.

d. Notify the Engineer and TMS Integrator when the Loop Detector tail conductor and lead-in cable have been spliced and are ready for testing and termination.

e. Identify the location on the Plan Detail.

(I) **TMS Shelter Cabinet**
Apply the following provisions to Project Testing and Documentation Submittals for TMS Shelter Cabinet:

a. Provide MnDOT with an Inspection and Testing plan prior to shipment and a report with results when shipped. Have the Manufacturer submit this information to MnDOT and it will be subject to MnDOT approval. Address the following items in the plan and report:

i. Shelter layout & component part numbers match the detail drawings
ii. Shelter construction & components free of defects
iii. Inspection of all labeling
iv. Wire connections tight and wiring matches electrical drawings
v. Electrical outlets & lighting testing
vi. HVAC systems testing
vii. Security & Alarm systems testing

SZ-11.4 **FO CABLE TESTING**
Apply the following provisions to FO Cable Testing Submittals:

(A) Submit Fiber Optic Testing Documentation Submittals to the Engineer within 30 Working days subsequent to the last test. **The Contractor will be subject to a daily charge assessed at a rate of $200.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied**. The Engineer will reserve the right to allow the Contractor greater than 30 Working days after contract approval to provide submittals.

(B) Submit Documentation of test equipment calibration and certification (See (2550) FIBER OPTIC CABLE TESTING on page 32) as part of the Project Documentation Submittal for FO Cable Testing along with the test results. Provide a calibration certificate dated no more than two year prior to the last date of FO Cable Testing. FO cable testing will be rejected if calibration certificates are out of date.

(C) Use the “Fiber Optic Schematic” sheets in the Plan as a template for recording power meter and OTDR test data as well as the physical characteristics of the FO cable and FO cable run.

(D) FO Cable test parameters are identified in a later section of this document. See (2550) FIBER OPTIC CABLE TESTING on page 32.

(E) Utilize a Manufacturer-recommended "OTDR Trace Analysis" software program. Conform the software to SZ-20.8 (A) (See page 32). Provide MnDOT with a "OTDR Trace Analysis" Viewer application.

(F) Notify the Engineer prior to beginning the FO system testing. Provide all test documentation electronically on a CD or USB flash drive. Use the MnDOT's file naming convention for OTDR electronic test files. The Engineer may observe each test.

(G) Store OTDR electronic files under a directory folder named by the Launch Point cable identification (ID) description found on the test schematics. Include the following items in the files:

a. Date of each test completed.
b. The "Index of refraction" for the FO cable as recorded on the cable spool by the manufacturer or for existing FO cable, the Index of Refraction that was utilized.
c. File names and notes as described by the MnDOT file naming convention. See **FO CABLE TEST DOCUMENTATION** on page 34 for file naming convention example.

(H) Provide a test summary describing the following items:

a. Final measurements that are out of range.
b. Engineer and TMS Integrator approved changes in specified methods.
c. OTDR manufacturer, equipment model number, and last date calibrated.
d. Dates of tests performed by both Power Meter & OTDR.
e. The method used to set a launch power reference regarding the additional launching cables used for Power Meter testing.
f. Special circumstances.

(I) Provide the Engineer with the Manufacturer's reel (spool) test documentation. This is required for all Contractor furnished FO cable.

SZ-11.5 **MEASUREMENT AND PAYMENT**

PROJECT TESTING AND DOCUMENTATION SUBMITTALS includes but shall not be limited to Testing and Documentation Submittals, Components, FO Cable Testing, and all materials and labor necessary to prepare and submit the Project Testing and Documentation Submittals. Consider PROJECT TESTING AND DOCUMENTATION SUBMITTALS incidental for which no direct compensation will be made.

SZ-11.6 **COMPONENT CHECK-OFF LIST**

Complete the following Component check-off list for "Has Met" and "APL" items and include this list as part of the submittal package. For "Has Met" components the Contractor may choose to submit components of equal quality to the Engineer for TMS Integrator approval. For "APL" components the Contractor may choose to submit components through the process for listing products on the APL. Provide submittals for items that do not have a Has Met or are not on the APL.

Product Manufacturer	Material Description	Special Provisions Section	"Has Met" or "APL" Part Number *(No Submittal required if "has met" or "APL" part number listed here)*	***Submittal*** Provided (✓)
	LTU	SZ-8.13		
	SGU	SZ-8.13		
	Ground Rod Connector	SZ-8.2		
	Lightning Rod Connector	SZ-8.2		
	Common Foundation Ground Well & Cover			
	Junction Box			
	Fiber Optic Splice Vault	SZ-17.9		
	Outdoor Fiber Splice Enclosure			
	Outdoor Fiber Splice Enclosure Accessories (Use Accessories which are consistent with the Outdoor Fiber Splice Enclosure part number)	SZ-23.13		
	Buried Cable Sign Plastic-Resin Sheath			
	DMS Control Cable 7.5 Pair Conductor No. 24			
	PTZ Cable			
	Video Cable RG-11		N/A-Submittal Required	
	Cat 6 Cable			
	Splice Encapsulator			
	RCS		N/A-Submittal Required	
	RCS Modified		N/A-Submittal Required	
	Flasher Signal		N/A-Submittal Required	
	RCS Head			
	Lane Control Signal		N/A-Submittal Required	

	Lane Control Signal Mounting Assembly		N/A-Submittal Required	
	MnPass Cabinet		N/A-Submittal Required	
	TMS Shelter Cabinet		N/A-Submittal Required	
	Surge suppressor			
	EIA Rack			
	TMS Shelter Cabinet Cable Tray			
	External Generator Receptacle			
	Splice Cabinet (BD-4)		N/A-Submittal Required	
	Service Cabinet			
	Service Cabinet Type Special			
	FDF			
	FDF Inner-Interbay Management Panel			
	FDF Lower Cable Trough			
	FDF Upper Horizontal Cable Trough			
	CCTV Hardware			
	CCTV Folding Pole			
	Non-Intrusive Detection Hardware			
	Non-Intrusive Detection Folding Pole			
	Temporary Communication System		N/A-Submittal Required	
	Lightning Protection Conductor	SZ-8.6 SZ-8.14		
	Parallel Splicer	SZ-8.6		
	CCTV Folding Pole Special			
	CCTV Cabinet			
	FO Splice Panel	SZ-21.8		
	FO Patch Panel	SZ-21.8		
	FO Splice/Patch Panel	SZ-21.8		

	Fiber Bulkhead Adapters	SZ-22.3 SZ-23.11		
	Indoor FO Pigtails	SZ-22.4 SZ-23.12		
	Pull Vault	SZ-24.7		
	Loop Preformed			
	Loop Sealant			
	Control Cabinet			
	Gate Arm with LED Indications		N/A-Submittal Required	
	Gate Arm Sheeting			
	Generator		N/A-Submittal Required	
	Pre-terminated armored FO Pigtail Cable	SZ-28.3		
	Armored FO Pigtail Cable	SZ-28.3		
	Fiber Optic Trunk Cable	SZ-28.3		
	8 inch LED			
	Flashing Beacon System		N/A-Submittal Required	

SZ-12 INDUSTRY ACCEPTED LUBRICANTS FOR ALL CABLES

Apply the following provisions to Industry Accepted Lubricants for all Cables:

SZ-12.1 The “Industry Accepted Lubricants” referenced in 2550.3, used during cable pulling operations shall be UL Listed and be compatible with cable insulation materials. They shall not deteriorate the cable insulation or performance.

SZ-12.2 Use lubricants that do not contain wax or grease.

SZ-12.3 Apply the appropriate lubricant as specified by the manufacturer for its intended use.

SZ-13 INSPECTION AND CLEANING EXISTING CONDUIT SYSTEMS

Apply the following provisions to Inspection and Cleaning Existing Conduit Systems:

SZ-13.1 Existing TMS conduit systems may consist of stick PVC, stick PE, continuous PE, IMC or RSC.

SZ-13.2 When installing copper cable or FO cable in existing conduits through existing hand holes visually check the cable route to ensure that there is a smooth transition between exit and entrance elevations and that the horizontal and vertical angle is not so sharp as to cause damage to the cable as it is being pulled through the existing conduit. If sharp bends are encountered in existing conduit, bring the situation to the Engineer’s attention. Reinstalling existing conduit through a handhole to provide smooth transitions is a potential solution.

SZ-13.3 Clean the existing conduit of any debris that could impede pulling FO or copper cable through it or that could damage the cable if the debris remained, as directed by the Engineer.

SZ-13.4 Inspection And Cleaning Existing Conduit Systems includes but shall not be limited to inspecting the cable route, notifying the Engineer of sharp bends, cleaning, and all materials and labor necessary to Inspect and Clean Existing Conduit Systems. Consider INSPECTION AND CLEANING EXISTING CONDUIT SYSTEMS incidental for which no direct compensation will be made.

SZ-14 FO CABLE REPAIR OR REPLACEMENT

Repair or Replace damaged FO cables in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-14.1 **EXISTING FO CABLE**

Apply the following provisions to Existing FO Cable:

(A) Exercise caution and excavate by hand or vacuum excavation when exposing an existing FO cable.
(B) Report nicks or abrasions to the TMS Integrator prior to making repairs.

(C) Do not exceed the FO Cable bending radius while handling the FO Cable.

SZ-14.2 **DAMAGED FO CABLE**

Apply the following provisions to Damaged FO Cable:

(A) Repair active FO Cable severed or otherwise rendered not useable by Contract activities. **The cost of the Contract will be reduced at the rate of $1,000 per hour until the repair is complete.** The penalty will begin when the Contractor severs the cable or otherwise renders the FO Cable unusable. The penalty will continue until the permanent repair is complete or until an approved temporary splice is installed. A part of an hour shall count as a full hour. Notify the TMS Integrator by TMS construction phone number (651) 331-8370 as soon as the cable damage is discovered.

(B) Stock approved splice kits to repair any MnDOT cable damaged by construction activities.

(C) Comply with the following when constructing splice repairs to Damaged FO Cable:

a. Initial emergency repairs to FO Cable require mechanical splices unless all fibers (severed and not severed) are fusion spliced within 24 hours.
b. Locate splices within existing splice vaults.
c. Comply with the requirements for FO Cable Splicing. See the Engineer for FO Cable splicing requirements.
d. MnDOT will withhold payment until approved FO Cables with fusion splices have been installed.

(D) Construct new cable for cable that has suffered damage caused by contract activities if the damage affects performance or longetivity.

(E) Seal nicks or abrasions caused by exposing any cable by hand digging or vacuum excavation with rubber splicing tape. Seal nicks that penetrate through the cable jacket to the armor with a cast epoxy kit.

SZ-14.3 **HAS MET**

The following items have met the above specifications:

(A) Sealing nicks and abrasions: 3M Scotchcast kits and 3M Scotch #23 rubberized splicing tape.

SZ-14.4 **MEASUREMENT AND PAYMENT**

FO CABLE REPAIR OR REPLACEMENT includes but shall not be limited to devices, enclosures, and all materials and labor necessary to construct the FO Cable Repair or Replacement. Consider FO CABLE REPAIR OR REPLACEMENT incidental for which no direct compensation will be made.

SZ-15 ELECTRIC AND ELECTRONIC CABLE REPAIR OR REPLACEMENT

Repair or Replace Electric and Electronic Cables in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-15.1 Stock approved splice kits to repair any MnDOT cable damaged by construction activities.

SZ-15.2 Notify the Engineer and TMS Integrator of any damaged cable or damaged conduit that contains cables before starting repair.

SZ-15.3 Electric, electronic, video and telephone cables are found within the project limits. Exercise caution when working near existing cables. Dig by hand or use vacuum excavator when within two feet of an existing cable.

SZ-15.4 Seal nicks or abrasions caused by exposing any cable by hand digging or vacuum with rubber splicing tape. Seal nicks that penetrate through the cable jacket to the armor with a cast epoxy kit.

SZ-15.5 Repair above ground, temporary, twisted pair, control cable splices with button style, gel filled, crimp-on butt splices and enclose in zippered poly bags. Protect splices in a manner approved by the Engineer and TMS Integrator until permanent splices are installed.

SZ-15.6 Use button style crimp-on Butt splices within an enclosure that is rigid-body, non-re-enterable, made of translucent polypropylene, and packed with a urethane compound for permanent repairs to twisted pair cables. Use rubber tape to seal the ends of the enclosure. Enclosures are available in 4-pr, 18-pr, and 50 pr sizes.

SZ-15.7 Repair and maintain cables severely damaged and not replaced in a timely manner until cable replacement is made.

SZ-15.8 Furnish and install new cable for cable that has suffered damage caused by contract activities if the damage affects performance or longevity.

SZ-15.9 Use Engineer and TMS Integrator approved materials to replace cable.

SZ-15.10 **HAS MET**

The following items have met with the above specifications:

(A) Butt Connector: 3M UY2 or UR2 as appropriate

(B) Enclosure for permanent repairs to twisted pair cables: 3M Better Buried Closure with 3M Scotchlok Shield Connector and 3M High Gel Encapsulating Compound.

(C) Sealing nicks and abrasions: 3M Scotchcast kits and 3M Scotch #23 rubberized splicing tape.

SZ-15.11 **MEASUREMENT AND PAYMENT**

ELECTRIC AND ELECTRONIC CABLE REPAIR OR REPLACEMENT includes but shall not be limited to devices, enclosures, and all materials and labor necessary to construct the Electric and Electronic Cable Repair or Replacement. Consider ELECTRIC AND ELECTRONIC CABLE REPAIR OR REPLACEMENT incidental for which no direct compensation will be made.

SZ-16 ELECTRIC AND ELECTRONIC CABLE

Furnish and install Electric and Electronic Cable in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-16.1 Provide slack cable within all handholes and Pull Vaults. Provide three feet for each cable entering or exiting a handhole or Pull Vault.

SZ-16.2 Splices are not allowed in electric or electronic cable. The Engineer and TMS Integrator may approve splices.

SZ-16.3 Construct Power, Control, and RF cable to be one-piece between termination points.

SZ-16.4 Execute the following operations when using crimp-on connectors:

(A) Install the insulation of cables deep enough into lugs to ensure that the insulation acts as a strain relief.

(B) Crimp both the conductor and the insulation to the lug.

(C) Form the crimps with an appropriate ratchet style crimp tool.

SZ-16.5 Protect non-terminated Electric and Electronic Cable, located in handholes from moisture intrusion by providing epoxy encapsulation for cable ends. It is not necessary to provide epoxy protection for non-terminated cable ends in control/splice cabinets.

SZ-16.6 **MEASUREMENT AND PAYMENT**

ELECTRIC AND ELECTRONIC CABLE includes but shall not be limited to crimping connectors, grounding, maintaining electrical continuity, protecting non-terminated cables, and all materials and labor necessary for the construction of Electric and Electronic Cable. Consider ELECTRIC AND ELECTRONIC CABLES incidental for which no direct compensation will be made.

SZ-17 (2550) FIBER OPTIC SPLICE VAULT

Furnish and install a Fiber Optic Splice Vault, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-17.1 See GROUNDING on page 10 for grounding specifications.

SZ-17.2 Install a MnDOT furnished fiber optic splice vault marker per the Plan detail. See **STATE FURNISHED FIBER OPTIC SPLICE VAULT MARKER** on page 9.

SZ-17.3 **COVER**

Apply the following provisions to the Cover of the FO Splice Vault:

(A) Provide one ferrous device to lift the Cover from the body of the FO Splice Vault for every three FO Splice Vaults. The ferrous device must be >28 inches in length.

SZ-17.4 Install a MnDOT furnished locator ball. See **LOCATOR BALLS** on page 6.

SZ-17.5 Near the FO Splice Vault, sweep the FO cables up to meet the conduit entrance to the FO Splice Vault and do not to exceed minimum bend radius of the FO cables.

SZ-17.6 Construct a drainage system for the FO Splice Vault (see the FO Splice Vault detail in the Plans). The Engineer may approve deviation from the drainage system shown on the FO Splice Vault detail in the Plans.

SZ-17.7 Clean FO Splice Vaults after installation and splicing of cable. Clean all areas including the flange that the Cover rests on and the bolt holes for the Cover.

SZ-17.8 Coil FO Cables onto the FO coiling brackets within vaults.

SZ-17.9 **APL**
MnDOT approved Fiber Optic Splice Vault will be listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

SZ-17.10 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (FIBER OPTIC VAULT) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including but not limited to grounding, installing the marker, Cover, the drainage system, restoration, cleaning, and all materials and labor necessary to construct the Fiber Optic Splice Vault.

SZ-18 (2550) NON-METALLIC CONDUIT

Furnish and install UL listed Non-Metallic Conduit, in accordance with the MnDOT Standard Specifications, MnDOT 3803, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-18.1 Do not apply the requirement for Red-colored conduit contained in MnDOT 3803.

SZ-18.2 Use industry standard couplings.

SZ-18.3 If adhesives and solvents are used, use ones that are compatible with the materials to be adhered.

SZ-18.4 Connect to existing conduit utilizing standard couplings. Prepare existing conduit for coupling as indicated in the Plans.

SZ-18.5 Construct all NMC proposed to contain FO cable to be continuous. Do not use stick conduit.

SZ-18.6 Construct all NMC proposed to contain FO cable a minimum of 0.9 m (36 inches) below the finished grade.

SZ-18.7 Construct all NMC under roads a minimum of 60 inches below finished grade and construct it continuous without joints.

SZ-18.8 Construct NMC with PVC or HDPE, Schedule 40, with the exception of conduit above ground or under roadway surfaces. Construct heavy-wall rigid PVC or HDPE, Schedule 80 for conduit above ground or under roadway surfaces.

SZ-18.9 Construct standard bell ends all NMC ends to prevent damage to cables during installation.

SZ-18.10 Construct 3.15 inches wide, stretchable, orange warning tape between 18 inches and 12 inches below the surface over all NMC bearing communication cable (including FO cable). Provide the following permanent legend: **CAUTION: MnDOT CABLE BELOW**.

SZ-18.11 **NMC FOR BLOWN FO CABLE**
Apply the following provisions to Non-Metallic conduit for Blown FO Cable:

(A) Construct NMC complying to the following material characteristics:

a. 1.5 inches diameter or as called out in Plan.

b. Construct couplings with a minimum pressure rating of 130-psi for the 1.5 inch diameter NMC.

(B) Construct flexible and direct buried conduit which is continuous. Plowed duct is preferred over trenched duct.

(C) Backfill open trench installations of NMC for Blown FO Cable with granular material to six inches over the top of conduit elevation.

SZ-18.12 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of NMC furnished and installed as specified. Payment for NON-METALLIC CONDUIT will be made in accordance with the schedule set forth below at the appropriate Contract unit bid price for each separate item of work, which will, in each instance, be compensation in full for the costs of all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

Item No.	Description	Unit
2545.503	1.5" Non-Metallic Conduit (Directional Bore)	(**linear foot**)

SZ-19 (2550) POWER AND CONTROL CABLES

Furnish and install Power and Control Cables, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-19.1 Provide UL listed Power and Control Cables.

SZ-19.2 Terminate Power and Control cables unless otherwise directed by the Plans.

SZ-19.3 See GROUNDING on page 10 for grounding details.

SZ-19.4 Some power cables may require protection within handholes as denoted in the Plan. Protect these power cables by enclosing them in two inch diameter split conduit within the handhole. Use red colored split conduit.

SZ-19.5 Terminate Power and Control Cables for signs at the service cabinet. Leave the breaker in the off position until the sign is commissioned by a factory representative.

SZ-19.6 Construct Electrical Metallic Tubing (EMT) according to the Plan.

SZ-19.7 The Contractor shall furnish two inch diameter Type C hot dipped galvanized conduit bodies on the DMS support structure. Conduit body openings shall face the walkway.

SZ-19.8 **LIQUIDTIGHT CONDUIT (LFMC)**

Apply the following provisions to Liquidtight Conduit (LFMC):

(A) Encase all cable exiting any DMS support structures for connection to external components within LFMC to protect the cable from the elements.

(B) Use LFMC with the following material properties.

a. UL listed and CSA certified.
b. Working temperature range of -20°C to 60°C

c. Galvanized steel core, corrosion resistant.
d. PVC jacket.
e. Flexible
f. Flame retardant.

SZ-19.9 **POWER CABLE 3 CONDUCTOR NO 8**

Apply the following provisions to Power Cable 3 Conductor No 8:

(A) Use Power Cable 3 Conductor No. 8 cable rated 600 volt and has cross-linked thermo set XLPE insulated circuit conductors with an overall PVC jacket.

(B) Use a cable with the following additional characteristics:

a. Seven strand, soft drawn, bare copper conductors.
b. Average thickness of the PE insulation is 45 mils.

(C) The No. 10 ground conductor if supplied is also seven strand, soft drawn bare copper; **do not use this conductor;**

(D) Cable circuit and ground conductors within the cable with non-hygroscopic fillers and wrapped with Mylar binding tape.

(E) Use identifiable conductor insulation color codes by either Method 1 E-1 (insulation is colored "Black, White, Red, and bare ground") or Method 3 E-1 (surface printing of number and color designations, e.g. "1-Black, 2-White, 3-Red, and bare ground") of NEMA WC 57-1990, ICEA S-73-532.

(F) The jacket is heat, moisture, and sunlight resistant black PVC meeting ICEA S-95-658 with an average thickness of 60 mils.

(G) Include the following printed information on the jacket, the number of conductors; the gauge of the conductors; conductor insulation type; voltage rating.

SZ-19.10 **SIGNAL CONTROL CABLE**

Apply the following provisions to Signal Control Cable for RCS, Non-Intrusive Detection, Flasher Signal, LCS, DMS Post Mounted, Pricing Sign or DMS modules, and CCTV:

(A) Use Signal Control Cable that is general purpose, rated for 600 V, and conforms to ICEA T-29-520, T-30-520, and S-73-532 (NEMA WC 57).

(B) Color code 6 Conductor No. 14 black, white, red, blue, orange, and black with red stripe.

(C) Color code 3 Conductor No. 14 and 3 Conductor No. 12 black, red, and white.

(D) Include the following characteristics for Signal Control Cable Conductor:

a. Class B (7 strand) soft drawn, bare or tinned copper per ASTM B3, ASTM B8, and ASTM B33.

b. Minimum average insulation wall thickness of 30 mils. Insulation wall thickness of 0.02 inch polyethylene and 0.01 inch polyvinyl chloride

c. Assembled to be compact as a round core wrapped with clear polyester tape. Jacket them with a maximum 0.56 inch black polyvinyl chloride

(E) Terminate Signal Control Cable by using a wire nut that has been pre-filled with 100 % silicone sealant.

SZ-19.11 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of Power and Control Cables furnished and installed as specified. Payment for POWER AND CONTROL CABLES will be made in accordance with the schedule set forth below at the appropriate Contract unit bid price for each separate item of work, which will be compensation in full for the costs incidental thereto including but not limited to Termination, Grounding, EMT, Conduit Bodies, Liquidtight Conduit, Power Cable 3 Conductor No 8, Signal Control Cable, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

Item No.	Description	Unit
2550.503	Control Cable ___ Pair No. ___	**(linear foot)**
2550.503	_____ Cable ___ Pair No. ___	**(linear foot)**
2550.503	Power Cable ___ Conductor No. ___	**(linear foot)**
2550.503	___Control Cable ___ Conductor No. ___	**(linear foot)**

SZ-20 (2550) FIBER OPTIC CABLE TESTING

Perform Fiber Optic Cable Testing, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-20.1 A FO Link will be defined as "any fiber with a connector at one end originating in a cabinet, TMS shelter cabinet, or building; and the other end with a connector in another location within a cabinet, TMS shelter cabinet, or building.

SZ-20.2 Acquire from the TMS Integrator example of Fiber Optic Cable testing from previous projects and additional details for the Fiber Optic Cable Testing submittal.

SZ-20.3 Notify the Engineer and TMS System Integrator prior to FO system splicing and testing. The Engineer, or a representative, may observe splicing or testing. Provide test documentation electronically.

SZ-20.4 Use an OTDR and Power Meter with current calibration certificates to perform the FO Cable testing required. Submit test equipment calibration information and certification documentation as part of the Project Documentation Package (with test results).

SZ-20.5 Provide a calibration certificate dated no more than two years prior to the last dates of FO cable testing.

SZ-20.6 Notify the TMS Integrator of problems encountered with existing cable plant or hardware before testing is completed. Notify the TMS Integrator by email within two Working days of noticing the problem.

SZ-20.7 FO Cable Testing will be rejected if calibration certificates are out of date.

SZ-20.8 **OPTICAL TIME DOMAIN REFLECTOMETER "OTDR" TESTING**

Apply the following provisions to OTDR Testing:

(A) Comply with the latest issue of Telcordia Document GR-196. In addition, comply the OTDR performance with the following minimum requirements:

a. Event dead zone shall be less than or equal to three meters.
b. Attenuation of the dead zone is less than or equal to 5 meters.
c. Provide a dynamic range of 25 dB or greater.

d. Set the test pulse width to the shortest value allowed by the OTDR.

(B) **OTDR Test files**

a. Use MnDOT's file naming convention for test files. See **FO CABLE TEST DOCUMENTATION** on page 34 for file naming convention and example.
b. Include the date of testing and the "Index of refraction" for the FO cable as recorded on the cable spool by the manufacturer or for existing FO cable, the Index of Refraction that was utilized, as part of the test files.

(C) Test FO Links bi-directionally per EIA/TIA 455-59, FOTP-59, except as otherwise noted. Use a 500 m (1650 foot) patch cord as a launch cable when testing.

(D) Measure and record each FO Signature for the completed SM FO Link at 1550 nm or 1300 nm for MM. (See FO Schematics Plan Sheets).

(E) Test each FO Link. Test each fusion splice in the forward and backward direction, record, and denote by FO Splice Vault location. Record all events which indicate a loss greater than or equal to 0.01 dB, within the FO Signature as "Event Notes" describing the corresponding vault location. Event Notes will not be required for splices indicating loss less than 0.01 dB. Provide an explanation for all events that do not align with a vault.

(F) The OTDR measured insertion loss of the launch connector shall be less than 0.8 dB and the OTDR measured back reflection loss shall be less than -40dB. Typical back reflection loss is between -40dB and -60dB. Acquire approval from the TMS Integrator for any exceptions and document them at the time of testing.

(G) The acceptable average loss through a fusion splice, when measured at wavelengths of 1550 nm for SM and 1300 nm for MM, will be no more than 0.15 dB. Calculate the average by adding the bi-directional testing values and dividing by 2.

(H) Test each FO Link after splices are sealed within their enclosure or panel. If a FO Link fails, re-splice that FO Link and retest all FO Links within the enclosure or panel. A maximum of three splice attempts to achieve passing results will be allowed.

SZ-20.9 **POWER METER TESTING**

Apply the following provisions to Power Meter Testing of FO Links:

(A) Use a light source and power meter conforming to EIA/TIA 455-171, FOTP-171, and OFSTP-14, except as otherwise noted, to bi-directionally test the cable plant.

(B) Measure and record each directional value for the completed SM optical link at 1550 nm or 1300 nm for MM. (See FO Schematics Plan Sheets).

(C) Provide power meter measurements in dB.

a. Do not exceed the result of the following formula for SM link measurements:

0.4*[Link length of FO Cable in kilometers]+1

b. Do not exceed the result of the following formula for MM links:

[Link length of FO Cable in kilometers]+1

(D) Correct out of range measurements on the constructed FO Links. If after performing corrective action an acceptable measurement has not been achieved, notify the TMS Integrator.

SZ-20.10 **FO CABLE TEST DOCUMENTATION**

Document OTDR and Power Meter test results to verify specifications are met, document the FO Link loss, FO cable distance between splices and terminations, and the fusion splice losses. A TMS System Integrator representative will review this documentation for approval and apply the following provisions to FO Cable Test Documentation:

(A) Provide post installation documentation on a CD or USB flash drive.

a. Use the "Fiber Optic Schematic" Plan sheets as a template for recording power meter and OTDR test data, fiber count, and fiber routing of the cable and cable run.
b. Store measurements recorded on copies of FO schematics as PDF formatted files. The Engineer will supply a PDF if one is requested. Type the text font legibly as determined by the MnDOT representative reviewing the measurements. Repeat and record again any measurements MnDOT determines are illegible.
c. Store OTDR files in a separate folder on the CD or USB flash drive if resplicing is required to achieve passing results.

(B) Measure and record the following values for all FO cables:

a. FO cable length markings at all splice and termination locations on the FO schematics.
b. Show on the FIBER OPTIC SCHEMATICS in the Plan fiber distances derived from OTDR testing and the FO Index of Refraction (usually included on FO cable spool documentation). Provide the Index of Refraction utilized for existing FO cable,.
c. Attenuation of each FO Link measured in each direction.
d. Event notes for each splice indicating loss greater than or equal to 0.01dB. Identify each splice location and be consistent with each FO schematic vault location. Provide an explanation for all events that do not align with a vault.
e. Signatures of the FO cable span and events using MnDOT file naming convention. See below in this section for file naming convention example.
f. Attenuation of each FO link, in both directions, as measured with a light source and power meter at 1550 nm wavelength for SM and 1300 nm wavelength for MM.
g. Provide Fiber Optic Schematics indicating power meter and splice loss results, power meter test reports as pdf files, and OTDR trace files on the MnDOT provided FO Schematics on the Contractor provided CD or USB flash drive.

(C) Name OTDR files as follows:

a. Derive the FO trunk cable ID and FO Pigtail cable ID numbers from the FO Schematic plan sheets.
b. Develop the OTDR file name from left to right in the following order:

i. FO cable launch point (trunk or pigtail FO cables).
ii. Add the designation North, South, East, or West (N, S, E, or W) after the FO Trunk ID or FO Pigtail ID; this is the direction of the optical test pulse traveling from the OTDR launch point along the majority of cable under test. This will not always be the direction the cable leaves the OTDR launch point.
iii. FO cable type (S=Single Mode, M=Multimode) and strand count.
iv. Filename extension (data format) proceeded by a period.

Fiber Optic OTDR File Naming Convention

LAUNCH DIRECTION

CABLE I.D		FIBER	EXT
C A B 6 9 4 – 50 . 47	**W**	**S 0 4**	***. XXX***

CABLE I.D. = Trunk or pigtail FO cable I.D. number as shown on the plan schematics. Number of characters may vary.

LAUNCH DIRECTION = Direction in which the OTDR is launching (N, S, E or W). This is the direction of the optical test pulse traveling from the OTDR launch point along the majority of cable under test. This will not always be the direction the cable leaves the OTDR launch point.

FIBER = Fiber Type, (S= Single mode), (M= Multimode) and Fiber Number (example: 01...04...08...48...76...100...144). Number of characters may vary.

EXT = Data file format

The OTDR file **"Fiber Notes"** field includes the State Project Number and the origin of the test launch (i.e. the complete name of the building, TMS Shelter Cabinet, cabinet, camera, or temporary termination point).

SZ-20.11 **MEASUREMENT AND PAYMENT**

No measurement will be made of the various Items that constitute Fiber Optic Cable Testing but all such work will be construed to be included in the single Lump Sum payment under Item 2550.601 (FIBER OPTIC CABLE TESTING).

SZ-21 (2550) FIBER OPTIC SPLICE, PATCH, AND SPLICE/PATCH PANEL

Furnish and install Fiber Optic Splice, Patch, or Splice/Patch Panel in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-21.1 FO Splice/Patch Panel is a combination FO Splice Panel and FO Patch Panel unit.

SZ-21.2 See GROUNDING on page 10 for grounding specifications.

SZ-21.3 Furnish and install a flush mounting kit for FO Panels with the following features:

(A) Compatible with 19 inch wide and 14 inch tall racks.

(B) Allows for one, two, or three inch recess mounting.

(C) Includes vertical cable guide and mounting flanges.

SZ-21.4 Mount five inch recess rack mounting.

SZ-21.5 **FIBER OPTIC SPLICE PANEL**

Apply the following provisions to the FO Splice Panel and FO Splice/Patch Panel:

(A) Include FO Splice Panels with the following features:

a. Splice Wheels, locks, and cable clamps.
b. Provide splicing protections and associated pigtail/fiber storage complying with bend radius requirements.
c. Compatible splice wheel or splice deck.
d. Splice capacity as needed. See "Has Met" chart near end of this FO Splice, Patch, or Splice/Patch Panel section.
e. Front loading.
f. Accommodations for a 19 inches EIA rack or a 23 inches rack. Construct brackets as needed to accommodate a 2 inch rack.

g. Hinges located on the bottom front corner for access to both the front and back of the front plate and the interior of the panel.
h. Accommodations for five inch recess rack mounting.
i. Provide splice wheels with bend radius control for roll-up of pigtail and buffer tube lengths.

SZ-21.6 **FIBER OPTIC PATCH PANEL**
Apply the following provisions to the FO Patch Panel and FO Splice/Patch Panel:

(A) Splice the armored pigtails to the indoor pigtails.

(B) Include the following features:

a. Provide accessibility to single fibers for maintenance.
b. Compose of high-strength aluminum.
c. Metal doors with Plexiglas windows.
d. Termination capacity as needed. See "Has Met" chart near end of this FO Splice, Patch, or Splice/Patch Panel section.
e. Accommodate front loading.
f. Accommodate a 19 inch EIA rack and a 23 inch rack Construct brackets to accommodate a 23 inch rack as needed.
g. Hinge on the left front side for access to both the front and back of the front plate and the interior of the panel.
h. Provide storage for pigtails to allow enough slack to fully open the door.
i. Five inch recess rack mounting.
j. Equip with designation labels.
k. 6-pak adapter plug-ins as required for proposed fibers.

SZ-21.7 Mount five inch recess rack mounting.

SZ-21.8 **HAS MET**
The following items have met the above specifications:

(A) Flush Mounting Kit: ADC/FL2-FLMT1400

(B) Patch Panels:

FL2000 Rack Mount Empty, Patch (Termination) Panels

Fiber Count	ADC Part #	# of Rack units, height in inches
12	FL2-12RPNL	1 , 1.75"
24	FL2-24RPNL	2 , 3.50"
36	FL2-36RPNL	3 , 5.25"
48	FL2-48RPNL	3 , 5.25"
72	FL2-72RPNL	5 , 8.75"
96	FL2-96RPNL	6 , 10.50"
Cable clamp kit, one per cable. .2" to .8" dia. as needed		ADC #FL2-ACC007
Cable clamp kit, one per cable. .7" to 1.0" dia. as needed		ADC #FL2-ACC021
6Pak blank plug-in as needed		ADC #FL2-6PBLNK

(C) Splice Panels:

FL2000 Rack Mount Empty, Splice Panels For Splice Wheels

Fiber Count	ADC Part #	# of Rack units, height in inches
48	FL2-48SPNL2	2 , 3.50"
96	FL2-96SPNL2	4 , 7.00"

144	FL2-144SPNL2	5 , 8.75”
Splice wheel with splice chip “Heat shrink fusion”		ADC #FST-DRS12-HS
Cable clamp kit, one per cable. .2” to .8” dia. as needed		ADC #FL2-ACC007
Cable clamp kit, one per cable. .7” to 1.0” dia. as needed		ADC #FL2-ACC021

(D) Splice/Patch Panels:

FL2000 Rack Mount Empty Patch (Termination)/Splice Panels
Splice Wheel or Splice Deck

Fiber Count	ADC Part #	# of Rack units, height in inches
12	FL2-12TS350	2 , 3.50”
24	FL2-24TS525	3 , 5.25”
48	FL2-48TS875	5 , 8.75”
72	FL2-72TS140	8 , 14.00”
96	FL2-96TS175	10 , 17.50”
Cable clamp kit, one per cable. .2” to .8” dia. as needed.		ADC #FL2-ACC007
Cable clamp kit, one per cable. .7” to 1.0” dia. as needed.		ADC #FL2-ACC021
6Pak blank plug-in as needed.		ADC #FL2-6PBLNK

SZ-21.9 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.602 (FIBER OPTIC SPLICE, PATCH, or SPLICE/PATCH PANEL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Fiber Optic Splice Panel, Splice Wheels, Splice Decks, Locks, Cable Clamps, Fiber Optic Patch Panel, and all materials and labor necessary to construct the Fiber Optic Splice, Patch, or Splice/Patch Panel.

SZ-22 (2550) FIBER OPTIC PIGTAIL TERMINATION

Furnish and install Fiber Optic Pigtail Termination in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-22.1 Use the field termination method.

SZ-22.2 **INDOOR PIGTAILS**

Apply the following provisions to the Indoor Pigtails for FO Pigtail Termination:

(A) Do not reuse existing Indoor Pigtails.

(B) Secure boots to the jacket with a pliable adhesive.

(C) Land connectors on Patch Panel Bulkhead Adapters

SZ-22.3 **FIBER BULKHEAD ADAPTERS**

Apply the following provisions to the SM FC-PC and MM ST Fiber Bulkhead Adapters for Pigtail Termination:

(A) Use Fiber Bulkhead Adapters with the following features:

a. One-piece construction.
b. Metallic bodies.
c. Zirconia ceramic sleeves.

SZ-22.4 **APL**

MnDOT approved Indoor Pigtails are listed on the following Website:

http://www.dot.state.mn.us/products/index.html

SZ-22.5 **HAS MET**

The following items have met the above specifications:

(A) FC Fiber Bulkhead Adapters: ADC/FL2-6PSMFC-Z.

(B) ST Fiber Bulkhead Adapters: ADC/FL2-6PMMST-Z.

(C) 6 Fiber FC SM Indoor Pigtails with FC Fiber Bulkhead Adapters: ADC/FL2-6PLSC605R.

(D) 6 Fiber ST MM Indoor Pigtails with ST Fiber Bulkhead Adapters: ADC/FL2-6PTBC605R.

SZ-22.6 **MEASUREMENT AND PAYMENT**

Measurement will be made by each end of the FO cable terminated in the cabinet splice/patch panel constructed as specified. Payment will be made under Item 2550.602 (FIBER OPTIC PIGTAIL TERMINATION) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Indoor Pigtails, Fiber Bulkhead Adapters, FO Cable splicing, and all materials and labor necessary to construct the Fiber Optic Pigtail Termination.

SZ-23 (2550) FIBER OPTIC CABLE SPLICING

This work consists of Fiber Optic Cable Splicing, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-23.1 **INDOOR PIGTAILS**

Apply the following provisions to the Indoor Pigtails for FO Pigtail Termination:

(A) Do not reuse existing Indoor Pigtails.

(B) Secure boots to the jacket with a pliable adhesive.

(C) Land connectors on Patch Panel Bulkhead Adapters

SZ-23.2 **FIBER BULKHEAD ADAPTERS**

Apply the following provisions to the SM FC-PC and MM ST Fiber Bulkhead Adapters for FO Cable Splicing within Cabinets:

(A) Use Fiber Bulkhead Adapters with the following features:

a. One-piece construction.
b. Metallic bodies.
c. Zirconia ceramic sleeves.

SZ-23.3 Use fusion type splices. Mechanical splices are prohibited.

SZ-23.4 Locations of FO Cable Splicing are denoted in the Plan. Acquire the approval of the Engineer and TMS Integrator for additional locations.

SZ-23.5 FO Cable Splicing locations are within cabinets and splice vaults.

SZ-23.6 Adhere to the FO cable manufacturer's methods, recommendations, materials, and techniques for splicing. Use splicing equipment in good working order, properly calibrated, and meeting all industry standards and safety regulations.

SZ-23.7 Construct the FO cable preparation, splice enclosure installation, and splicing in accordance with industry standards. Minimize mechanical stress and splicing locations by training the FO cable into final position, concurrently observing the minimum bending radii of the FO cable. The minimum bending radii of the FO cable is 20 times the diameter of the cable or as per the manufacturer's requirements, whichever is greater.

SZ-23.8 Strictly observe cleanliness and freedom from contamination with respect to splicing materials and joint construction. Upon completion of the splicing operation, deposit all waste material in suitable containers, remove from the job site, and dispose in an environmentally acceptable manner.

SZ-23.9 **EXISTING OR INSTALLED OUTDOOR FIBER SPLICE ENCLOSURE**

Apply the following provisions when entering an Existing or Installed Outdoor Fiber Splice Enclosure for FO Cable Splicing:

(A) **Cables**

a. FO Cables enter and exit from the same end of the Outdoor Fiber Splice Enclosure.

(B) **Testing**

a. Be responsible for all existing and proposed splices within an Existing or Installed Outdoor Fiber Splice Enclosure.

(C) **Adjustments**

a. Make adjustments to the size of Existing or Installed Outdoor Fiber Splice Enclosures to accommodate additional cables. Use Outdoor Fiber Splice Enclosure Accessories as required to complete the installation.

(D) **Grounding**

a. See GROUNDING on page 10 for grounding specifications.

SZ-23.10 **PRESSURE TEST**

Use the following test procedure to ensure that the outdoor fiber splice enclosure is properly sealed:

(A) Perform testing in the presence of the TMS Integrator when the Outdoor Fiber Splice Enclosure is in its final hanging position.

(B) Pressurize the enclosure to between 8 to 10 psi and wait 45 seconds. During the 45 second wait, spray soapy water around the seal to check for leaks.

(C) Recheck the pressure. The enclosure should not have lost more than 2.5 psi.

(D) If the pressure loss is not greater than 2.5 psi and no leaks were detected when soapy water was sprayed around the seal, the enclosure requires no further testing.

(E) If the pressure loss is greater than 2.5 psi or leaks were detected when soapy water was sprayed around the seal, repair any leaks and retest the enclosure.

SZ-23.11 **HAS MET**

The following items have met the above specifications:

(A) FC Fiber Bulkhead Adapters: ADC/FL2-6PSMFC-Z.

(B) ST Fiber Bulkhead Adapters: ADC/FL2-6PMMST-Z.

(C) 6 Fiber FC SM Indoor Pigtails with FC Fiber Bulkhead Adapters: ADC/FL2-6PLSC605R.

(D) 6 Fiber ST MM Indoor Pigtails with ST Fiber Bulkhead Adapters: ADC/FL2-6PTBC605R.

SZ-23.12 **APL**
MnDOT approved products for Indoor Pigtails are listed on the following Website:

http://www.dot.state.mn.us/products/index.html

SZ-23.13 **APL**
MnDOT approved products for Outdoor Fiber Splice Enclosures and Accessories are listed on the following Website:

http://www.dot.state.mn.us/products/index.html

SZ-23.14 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified per location. Payment will be made under Item 2550.602 (FIBER OPTIC CABLE SPLICING AND FIBER OPTIC PIGTAIL CABLE SPLICE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Indoor Pigtails, Fiber Bulkhead Adapters, Existing or Installed Outdoor FO Splice Enclosure, Pressure Test, and all materials and labor necessary to construct the Fiber Optic Cable Splicing.

SZ-24 (2550) PULL VAULT

Furnish and install Pull Vault, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-24.1 **SPLICING REQUIREMENTS**
Apply the following provisions when FO cable splicing is required within the Pull Vault:

(A) See GROUNDING on page 10 for grounding specifications.

(B) Install a State furnished fiber optic splice vault marker per the Plan detail. See STATE FURNISHED FIBER OPTIC SPLICE VAULT MARKER on page 9.

(C) Construct a drainage system for the Pull Vault (see the Pull Vault detail in the Plans). The Engineer may approve deviation from the drainage system shown on the FO Splice Vault detail in the Plans.

(D) Clean Pull Vaults after installation and splicing of cable. Clean all areas including the flange that the Cover rests on and the bolt holes for the Cover.

(E) Coil FO Cables onto the FO coiling brackets within vaults.

SZ-24.2 Place on a 12 inches thick layer of coarse filter aggregate per MnDOT 3149.2H.

SZ-24.3 **COVER**
Apply the following provisions to the Cover of the Pull Vault:

(A) Provide one ferrous device to lift the Cover from the body of the Pull Vault for every three Pull Vaults. The ferrous device must be >28 inches in length.

SZ-24.4 Install a MnDOT furnished locator ball in the Pull Vault. See **LOCATOR BALLS** on page 6.

SZ-24.5 Sweep the FO cables near the Pull Vault up to meet the conduit entrance to the Pull Vault. Take care not to exceed minimum bend radius.

SZ-24.6 Clean Pull Vaults after installation. Clean all area including but not limited to the flange that the cover rests on and the bolt holes for the cover.

SZ-24.7 **APL**
MnDOT approved Pull Vault is listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

SZ-24.8 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (PULL VAULT) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including Splicing Requirements, Cover, and all materials and labor necessary to construct the Pull Vault.

SZ-25 (2550) RELOCATE FIBER OPTIC CABLE

Relocate Fiber Optic Cable, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-25.1 Utilize a vacuum excavator for exposing all fiber optic cables designated for relocation. Hand digging will only be allowed as specified in the plan.

SZ-25.2 Protect FO cable and conduit to ensure it is not damaged when exposed. Be responsible for any damage incurred during the Relocate FO Cable operation.

SZ-25.3 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before exposing or backfilling the FO cable or conduit.

SZ-25.4 Visually inspect the FO cable and conduit immediately after exposing them. Perform the inspection in the presence of a TMS Integrator. Notify the TMS Integrator of any damage found.

SZ-25.5 Prior to backfilling the FO cable and conduit the contact the TMS Integrator. The TMS Integrator will then inspect the FO cable and conduit to determine if any damage occurred during the relocation process.

SZ-25.6 **MEASUREMENT AND PAYMENT**
Measurement will be made by the length of Fiber Optic Cable Relocated as specified. Payment will be made under Item 2550.603 (RELOCATE FIBER OPTIC CABLE) at the Contract bid price per linear foot, which shall be compensation in full for all costs incidental thereto, including but not limited to Vacuum Excavation, and all materials and labor necessary to construct the Relocate Fiber Optic Cable.

SZ-26 (2550) REROUTE CABLE

Reroute Cable, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-26.1 Utilize a vacuum excavator for exposing all cables and conduit that require excavation for rerouting. Hand digging will only be allowed as specified in the plan.

SZ-26.2 Disconnect and terminate cables unless otherwise directed by the Plans.

SZ-26.3 Pull back cables prior to rerouting as directed by the Plan.

SZ-26.4 Remove existing conduit and cables to adjust to the proposed design.

SZ-26.5 Protect cable to ensure it is not damaged when exposed. Be responsible for any damage incurred during the Reroute Cable operation.

SZ-26.6 See GROUNDING on page 10 for Grounding requirements.

SZ-26.7 See LABELING on page 16 for Labeling requirements.

SZ-26.8 **FO CABLE INSTALLATION REQUIREMENTS**

Comply with MnDOT 2550.3 and the following provisions for FO Cable Installation Requirements:

(A) Store additional lengths FO Cable in end-equipment Control cabinets, FO Patching Shelters, and TMS Shelter Cabinets.

(B) Remove the following lengths of outer jacket and armor from field terminated FO Cable for fiber management:

a. Remove eight to 15 feet of the outer jacket of cable terminating an Outdoor FO Splice Enclosure.
b. Remove 15 feet of the outer jacket of cable terminating in in a CCTV Pole mounted Control cabinet.
c. Remove 13 feet of the outer jacket of cable terminating in the new, 19 inches rack compatible control cabinet for CCTV.
d. Remove 33 feet of the outer jacket of cable terminating in a ground mounted control Cabinet or Signal Cabinet.
e. Remove 33 feet of the outer jacket of cable terminating in a FO Patching Shelter.
f. Remove 50 feet of the outer jacket of cable terminating in a TMS Shelter Cabinet.
g. Remove 50 feet of the outer jacket of cable terminating in an Anti-icing Building.

(C) Place FO Cable a minimum of 36 inches below finished grade.

(D) Place FO cable a minimum of 60 inches below finished grade when it is placed under a road.

(E) Employ the Air Assisted installation method for lengths of FO Cable over 600 feet.

(F) See **GROUNDING** on page 10 for grounding requirements.

(G) Calculate expected tension on the FO Cable and pulling tape prior to installing the FO Cable in conduit runs. Distibute the pulling force between the inner strength member and the aramid fibers by securing both to the main pulling device.

(H) Utilize a “break-away” type pulling attachment to protect against over stressing the FO Cable. Do not use a cable grip that pulls only on the outer jacket to pull FO Cable.

(I) Damage to the FO Cable from any source or exceeding the manufacturer’s recommended tensile strength limits or cable-bending radius is cause for the cables to be rejected. Ensure a minimum bend radius of ten inches during installation (loaded cable) and minimum bend radius of eight inches after installation (static cable).

(J) Often, FO Cable is pulled through conduit/handhole networks. Using the 24 inches diameter handholes as a fiber pull box, is likely to exceed the minimum loaded bend radius and cause damage to the cable fibers. Do not use the handhole as a fiber pull box.

(K) Provide slack FO cable for FO cables spliced within vaults. Provide 70 feet of slack FO Cable coiled in these vaults per each vault entrance/exit. Provide other lengths of Slack FO Cable if called for in the Plan.

(L) Provide 33 feet of slack cable when installing Pre-terminated armored FO Pigtail cable in a ground mounted control Cabinet or Signal Cabinet.

(M) Backfill open trench installations with granular material six inches over the FO Cable conduit elevation.

(N) **Air Assisted FO Cable**

a. Long radius bends shall be utilized in equipment foundations and other situations requiring the negotiation of sharp angles.
b. Place the conduit utilizing pressure tight splices.

   i. Seal one end of the conduit and pressurize the conduit utilizing a sealed blowing machine.
   ii. Maintain 130 psi in the conduit without realizing significant pressure loss
   iii. Use care near pressurized ducts.

c. High air speed blowing shall require the front end of the FO Cable to be endcapped to prevent the cable from getting hung up in the duct.
d. Utilize proper air seals to fit the OD of the FO Cable.
e. Provide proof that the duct is properly spliced and not crushed by blowing a hard mandrel through the duct.
f. Clean and dry the duct utilizing the following procedures

   i. Blow a tight fitting foam carrier through the duct at high pressure. Blow the foam carrier at an approximate velocity of 100 fps.
   ii. If excess water and/or dirt is expelled from the duct, repeat the process until minimal water and/or dirt is observed.
   iii. Dry the duct with airflow.

g. For high speed air machines (no missile), inject the recommended amount of approved lubricant and spread it with a foam carrier. For piston type machines, inject the majority of the lubricant in front of the missile with some placed behind the missile.

h. For push/pull machines, attach the piston to the FO Cable and insert the piston into the duct.

i. For high air speed machines, hand push approximately 100 feet of FO Cable into the duct prior to activating the machine.

j. Use caution in bringing up the air and hydraulic pressure.

SZ-26.9 **MEASUREMENT AND PAYMENT**

Measurement will be made by the affected length of Cable Rerouted as specified. If groups of cable pulled to the same location are designated for rerouting within the Plan, measurement shall apply to an average length for the group of cables not individual cable lengths. Installation of the rerouted cable will be considered incidental. Payment will be made under Item 2550.603 (REROUTE FIBER OPTIC CABLE) at the Contract bid price per linear foot, which will be compensation in full for all costs incidental thereto, including but not limited to Disconnecting and Terminating cables, FO Cable Installation Requirements, rerouting the cable, removing and relocating existing conduit as necessary, protecting the cable, Grounding, Labeling, and all materials and labor necessary to construct the Reroute Cable.

SZ-27 (2550) BORED CONDUIT

Furnish and install Bored Conduit, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-27.1 Conform but do not be limited to the following MnDOT Specifications except as modified by these provisions:

(A) Installation: MnDOT 2565.3.

(B) NMC: MnDOT 3803. Do not apply the requirement for Red-colored conduit contained in MnDOT 3803.

(C) RSC: MnDOT 3801.

(D) Expansion Fittings: MnDOT 3839.

SZ-27.2 Use schedule 80 Heavy-wall rigid PVC or HDPE for installation under an existing roadway or paved surface.

SZ-27.3 Place all conduit under roadways continuous without joints.

SZ-27.4 Place Bored Conduit under slope paving without damaging the slope paving.

SZ-27.5 Place Bored Conduit 1.5 m (60 inches) below the bottom of the finished driving surface. Extend Bored Conduit under roadway surfaces 10 feet beyond the pavement edge or curb line. Do not exceed one foot vertical per five feet horizontal transition slope from the routine 0.9 m (36 inches) depth of direct-buried cable to the 1.5 m (60 inches) depth under a roadway or paved shoulder.

SZ-27.6 Place Bored Conduit at depths according to the Plan if the Plan calls out for deviations from these specifications.

SZ-27.7 Use standard bell ends on all conduit ends to prevent damage to cables during installation.

SZ-27.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of Bored Conduit furnished and installed as specified. Payment for BORED CONDUIT of each size will be made in accordance with the schedule set forth below at the appropriate Contract unit bid price for each separate item of work, which will, in each instance, be compensation in full for the costs of all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

Item No.	Description	Unit
2545.503	1.5” Bored Conduit (Directionally Bored)	**linear foot**

SZ-28 (2550) FIBER OPTIC CABLE

Furnish and install Fiber Optic Cable, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-28.1 PRE-TERMINATED ARMORED FO PIGTAIL CABLE

Apply the following provisions to Pre-terminated Armored FO Pigtail Cable:

(A) Do not include potting material in the patch enclosure of the Pre-terminated armored FO Pigtail Cable. Notify the Manufacturer of this requirement when ordering the parts.

SZ-28.2 FO CABLE INSTALLATION REQUIREMENTS

Comply with MnDOT 2550.3 and the following provisions for FO Cable Installation Requirements:

(A) Store additional lengths FO Cable in end-equipment Control cabinets, FO Patching Shelters, and TMS Shelter Cabinets.

(B) Remove the following lengths of outer jacket and armor from field terminated FO Cable for fiber management:

a. Remove eight to 15 feet of the outer jacket of cable terminating an Outdoor FO Splice Enclosure.
b. Remove 15 feet of the outer jacket of cable terminating in in a CCTV Pole mounted Control cabinet.
c. Remove 13 feet of the outer jacket of cable terminating in the new, 19 inches rack compatible control cabinet for CCTV.
d. Remove 33 feet of the outer jacket of cable terminating in a ground mounted control Cabinet or Signal Cabinet.
e. Remove 33 feet of the outer jacket of cable terminating in a FO Patching Shelter.
f. Remove 50 feet of the outer jacket of cable terminating in a TMS Shelter Cabinet.
g. Remove 50 feet) of the outer jacket of cable terminating in an Anti-icing Building.

(C) Place FO Cable a minimum of 36 inches below finished grade.

(D) Place FO cable a minimum of 60 inches below finished grade when it is placed under a road.

(E) Employ the Air Assisted installation method for lengths of FO Cable over 600 feet.

(F) See **GROUNDING** on page 10 for grounding requirements.

(G) Calculate expected tension on the FO Cable and pulling tape prior to installing the FO Cable in conduit runs. Distibute the pulling force between the inner strength member and the aramid fibers by securing both to the main pulling device.

(H) Utilize a “break-away” type pulling attachment to protect against over stressing the FO Cable. Do not use a cable grip that pulls only on the outer jacket to pull FO Cable.

(I) Damage to the FO Cable from any source or exceeding the manufacturer’s recommended tensile strength limits or cable-bending radius is cause for the cables to be rejected. Ensure a minimum bend radius of ten inches during installation (loaded cable) and minimum bend radius of eight inches after installation (static cable).

(J) Often, FO Cable is pulled through conduit/handhole networks. Using the 24 inches diameter handholes as a fiber pull box, is likely to exceed the minimum loaded bend radius and cause damage to the cable fibers. Do not use the handhole as a fiber pull box.

(K) Provide slack FO cable for FO cables spliced within vaults. Provide 70 feet of slack FO Cable coiled in these vaults per each vault entrance/exit. Provide other lengths of Slack FO Cable if called for in the Plan.

(L) Backfill open trench installations with granular material six inches over the FO Cable conduit elevation.

(M) **Air Assisted FO Cable**

a. Long radius bends shall be utilized in equipment foundations and other situations requiring the negotiation of sharp angles.
b. Place the conduit utilizing pressure tight splices.

   i. Seal one end of the conduit and pressurize the conduit utilizing a sealed blowing machine.
   ii. Maintain 130 psi in the conduit without realizing significant pressure loss
   iii. Use care near pressurized ducts.

c. High air speed blowing shall require the front end of the FO Cable to be endcapped to prevent the cable from getting hung up in the duct.
d. Utilize proper air seals to fit the OD of the FO Cable.
e. Provide proof that the duct is properly spliced and not crushed by blowing a hard mandrel through the duct.
f. Clean and dry the duct utilizing the following procedures

   i. Blow a tight fitting foam carrier through the duct at high pressure. Blow the foam carrier at an approximate velocity of 100 fps.
   ii. If excess water and/or dirt is expelled from the duct, repeat the process until minimal water and/or dirt is observed.
   iii. Dry the duct with airflow.

g. For high speed air machines (no missile), inject the recommended amount of approved lubricant and spread it with a foam carrier. For piston type machines, inject the majority of the lubricant in front of the missile with some placed behind the missile.

h. For push/pull machines, attach the piston to the FO Cable and insert the piston into the duct.

i. For high air speed machines, hand push approximately 100 feet of FO Cable into the duct prior to activating the machine.

j. Use caution in bringing up the air and hydraulic pressure.

SZ-28.3 **APL**

MnDOT approved Pre-terminated Armored FO Pigtail Cable, FO Trunk, and Armored FO Pigtail Cable is listed on the following Website:

http://www.dot.state.mn.us/products/trafficmgtsystems/index.html

SZ-28.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of Fiber Optic Cable furnished and installed as specified. Payment for FIBER OPTIC CABLE and FIBER OPTIC PIGTAIL CABLE of each size and type will be made in accordance with the schedule set forth below at the appropriate Contract unit bid price for each separate item of work, which will, in each instance, be compensation in full for all costs incidental thereto, including but not limited to FO Cables, Pre-terminated armored FO Pigtail Cable, Installation Requirements, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

Item No.	Description	Unit
2550.603	Fiber Optic Pigtail Cable	**linear foot**

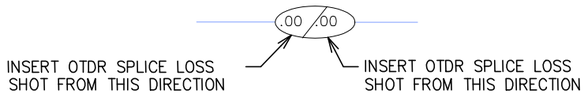
INDEX OF REFRACTION

PROVIDE CABLE MANUFACTURERS INDEX OF REFRACTION USED FOR TESTING ON PROJECT.

◡ = FURNISHED SPLICE, NO SPLICE OTDR READING REQUIRED AT THIS LOCATION

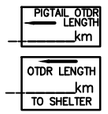
POWER METER TEST POINT

INSERT OPTICAL LINK LOSS IN dB
(TEST MULTI MODE FIBER AT 1300)
(TEST SINGLE MODE FIBER AT 1550)



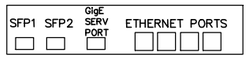
= FO CABLE SPLICE POINT & OTDR TEST SPLICE READING

= OTDR TEST SPLICE READING ON INPLACE CABLE

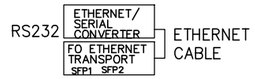


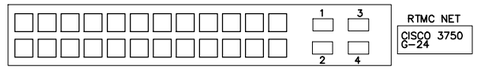
PROVIDE TRUNK AND PIGTAIL OTDR FIBER LENGTH MEASUREMENTS USING OTDR READINGS FROM CONNECTORS AT SHELTER OR CABINETS TO SPLICE POINTS IN VAULTS

FACTORY PRE-TERMINATED/ARMORED FIBER OPTIC PIGTAIL



FO ETHERNET TRANSPORT

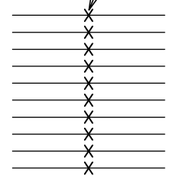


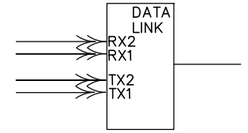


ETHERNET SWITCH

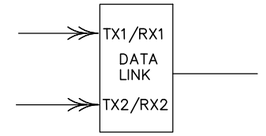
COMMON ETHERNET EQUIPMENT

EXISTING FO CABLE SPLICE POINT

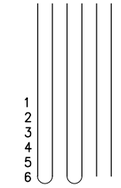




FORCE TRANS. MODEL 2869 DATA LINK



OPTELECOM MODEM DATA LINK



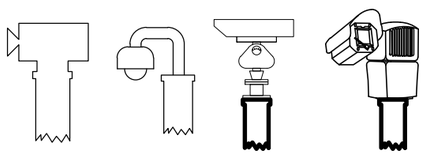
FIBER OPTIC PIGTAIL SPLICE DIAGRAM

(SPLICE UNUSED FIBERS TOGETHER IN THE SPLICE VAULT SO THAT THE FIBERS CAN BE TESTED)

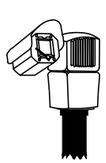
VIDEO & DATA TRANSCEIVER TRANSMITTER

FIBER OPTIC CABLE MARKINGS
SPLICE ENCLOSURE
VAULT ENTRY

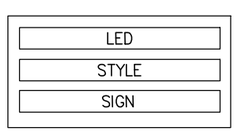
PROVIDE TRUNK CABLE OUTER JACKET LENGTH MARKINGS AT ENTRY TO VAULT AND AT ENTRY TO OUTDOOR FIBER SPLICE ENCLOSURE



EXISTING CAMERA WITH PAN AND TILT UNIT



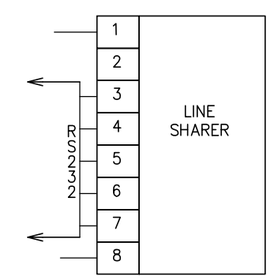
CAMERA WITH PAN AND TILT UNIT (BY OTHERS)



DYNAMIC MESSAGE SIGN

FIBER OPTIC PATCHCORD

TWISTED PAIR INTERCONNECT



RS 232 LINE SHARER

170	170 CONTROLLER
DMS	CHANGEABLE MESSAGE SIGN
FLS	FLASHER
RCS	RAMP CONTROL SIGNAL
LDS	LOOP DETECTOR STATION
LD	LOOP DETECTOR(S)
ILCS	INTELLIGENT LANE CONTROL SIGN

REVISED 6/27/18

LEGEND FOR COMMUNICATION SCHEMATICS

DRAWN BY: ACO
DESIGNER: ACO
CHECKED BY: MJB
DESIGN TEAM

NO.	BY	DATE	REVISIONS

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
Matthew J. Bolf P.E.
Date: 06/25/2019 Lic. No. 43913

SEH
PHONE: 218.279.3000
418 W SUPERIOR ST STE 200
DULUTH, MN 55802-1512
www.sehinc.com

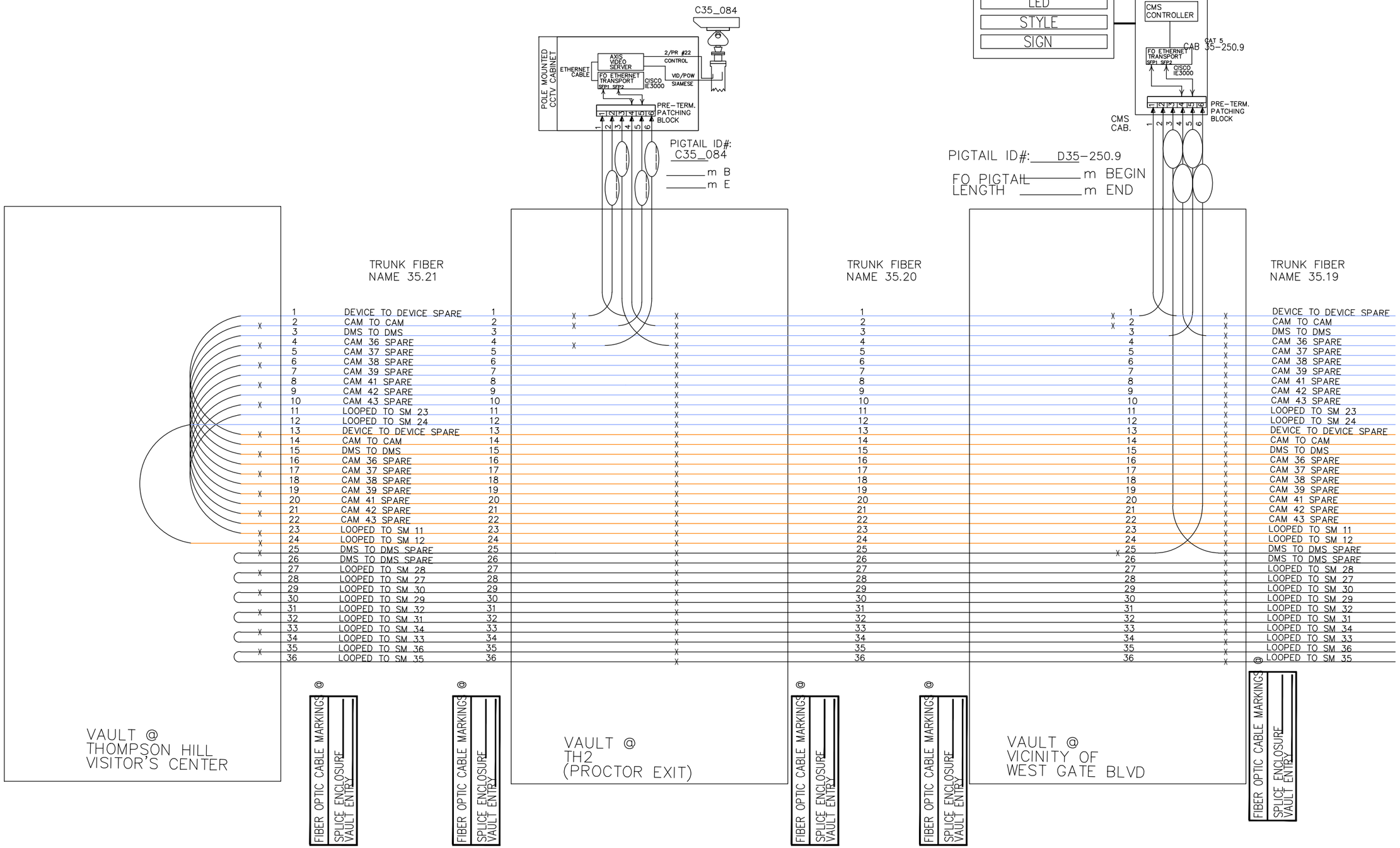
CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118-090-018

DIVISION SZ
TESTING EXHIBIT

FILE NO. DULUT-109680

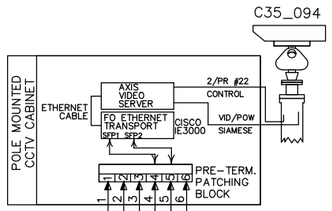
1/6

S:\AE\D\DULUT\109680\5-final-dsgn\53-dsgn-info\received\2019-11-18 Fiber DGN from MnDOT\Duluth Trail Schematics.dwg 12/10/2019 11:37 AM aorteskie

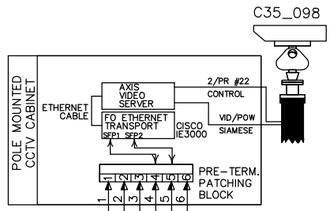


S:\AE\D\DULUT\109680\5-final-dsgn\53-dsgn-info\received\2019-11-18 Fiber DGN from MnDOT\Duluth Trail Schematics.dwg 12/10/2019 11:37 AM aorleskie

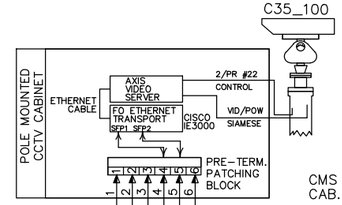
DRAWN BY: ACO DESIGNER: ACO CHECKED BY: MJB DESIGN TEAM	NO.	BY	DATE	REVISIONS	I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. Matthew J. Bolf P.E. Date: 06/25/2019 Lic. No. 43913	SEH PHONE: 218.279.3000 418 W SUPERIOR ST STE 200 DULUTH, MN 55802-1512 www.sehinc.com	CITY OF DULUTH CITY PROJECT NO. 0595TR S.P. 118-090-018	DIVISION SZ TESTING EXHIBIT	FILE NO. DULUT 109680	2/6



PIGTAIL ID#:
C35_094
_____m B
_____m E

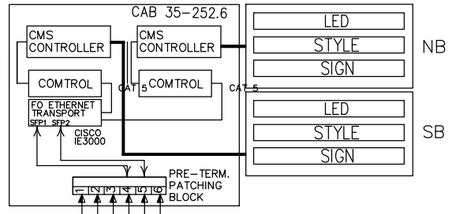


PIGTAIL ID#:
C35_098
_____m B
_____m E



PIGTAIL ID#:
C35_100
_____m B
_____m E

SB 35 SO. OF 50TH ST



CMS CAB.

PIGTAIL ID#:D35-252.6

FO PIGTAIL LENGTH
_____m BEGIN
_____m END

TRUNK FIBER NAME 35.19

1	DEVICE TO DEVICE SPARE	X
2	CAM TO CAM	X
3	DMS TO DMS	
4	CAM 36 SPARE	
5	CAM 37 SPARE	
6	CAM 38 SPARE	X
7	CAM 39 SPARE	
8	CAM 41 SPARE	
9	CAM 42 SPARE	
10	CAM 43 SPARE	
11	LOOPED TO SM 23	
12	LOOPED TO SM 24	
13	DEVICE TO DEVICE SPARE	
14	CAM TO CAM	
15	DMS TO DMS	
16	CAM 36 SPARE	
17	CAM 37 SPARE	
18	CAM 38 SPARE	
19	CAM 39 SPARE	
20	CAM 41 SPARE	
21	CAM 42 SPARE	
22	CAM 43 SPARE	
23	LOOPED TO SM 11	
24	LOOPED TO SM 12	
25	DMS TO DMS SPARE	
26	DMS TO DMS SPARE	
27	LOOPED TO SM 28	
28	LOOPED TO SM 27	
29	LOOPED TO SM 30	
30	LOOPED TO SM 29	
31	LOOPED TO SM 32	
32	LOOPED TO SM 31	
33	LOOPED TO SM 34	
34	LOOPED TO SM 33	
35	LOOPED TO SM 36	
36	LOOPED TO SM 35	

@ FIBER OPTIC CABLE MARKINGS
@ SPLICE ENCLOSURE VAULT ENTRY

VAULT @
CODY ST EXIT RAMP

TRUNK FIBER NAME 35.18

1		X
2		X
3		
4		
5		
6		X
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@ FIBER OPTIC CABLE MARKINGS
@ SPLICE ENCLOSURE VAULT ENTRY

@ FIBER OPTIC CABLE MARKINGS
@ SPLICE ENCLOSURE VAULT ENTRY

VAULT @
NO. 63RD AVE W

TRUNK FIBER NAME 35.17

1		
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@ FIBER OPTIC CABLE MARKINGS
@ SPLICE ENCLOSURE VAULT ENTRY

@ FIBER OPTIC CABLE MARKINGS
@ SPLICE ENCLOSURE VAULT ENTRY

VAULT
NO. OF
CENTRAL AVE

TRUNK FIBER NAME 35.15

1		DEVICE TO DEVICE SPARE
2		CAM TO CAM
3		DMS TO DMS
4		CAM 36 SPARE
5		CAM 37 SPARE
6		CAM 38 SPARE
7		CAM 39 SPARE
8		CAM 41 SPARE
9		CAM 42 SPARE
10		CAM 43 SPARE
11		LOOPED TO SM 23
12		LOOPED TO SM 24
13		DEVICE TO DEVICE SPARE
14		CAM TO CAM
15		DMS TO DMS
16		CAM 36 SPARE
17		CAM 37 SPARE
18		CAM 38 SPARE
19		CAM 39 SPARE
20		CAM 41 SPARE
21		CAM 42 SPARE
22		CAM 43 SPARE
23		LOOPED TO SM 11
24		LOOPED TO SM 12
25		DMS TO DMS SPARE
26		DMS TO DMS SPARE
27		LOOPED TO SM 28
28		LOOPED TO SM 27
29		LOOPED TO SM 30
30		LOOPED TO SM 29
31		LOOPED TO SM 32
32		LOOPED TO SM 31
33		LOOPED TO SM 34
34		LOOPED TO SM 33
35		LOOPED TO SM 36
@36		LOOPED TO SM 35

@ FIBER OPTIC CABLE MARKINGS
@ SPLICE ENCLOSURE VAULT ENTRY

DRAWN BY: ACD
DESIGNER: ACD
CHECKED BY: MJB
DESIGN TEAM

NO.	BY	DATE	REVISIONS

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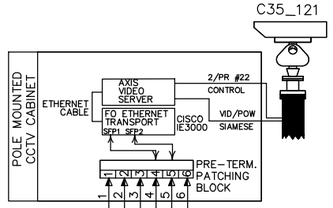
CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118-090-018

DIVISION SZ TESTING EXHIBIT

FILE NO.
DULUT-109680

3/6

S:\AE\D\DULUT\109680\5-final-dsgn\53-dsgn-info\received\2019-11-18 Fiber DGN from MnDOT\Duluth Trail Schematics.dwg 12/10/2019 11:37 AM aorteskie



FOR FUTURE CAM 040

TRUNK FIBER
NAME 35.15

1	DEVICE TO DEVICE SPARE	
2	CAM TO CAM	
3	DMS TO DMS	
4	CAM 36 SPARE	
5	CAM 37 SPARE	
6	CAM 38 SPARE	
7	CAM 39 SPARE	
8	CAM 41 SPARE	
9	CAM 42 SPARE	
10	CAM 43 SPARE	
11	LOOPED TO SM 23	
12	LOOPED TO SM 24	
13	DEVICE TO DEVICE SPARE	
14	CAM TO CAM	
15	DMS TO DMS	
16	CAM 36 SPARE	
17	CAM 37 SPARE	
18	CAM 38 SPARE	
19	CAM 39 SPARE	
20	CAM 41 SPARE	
21	CAM 42 SPARE	
22	CAM 43 SPARE	
23	LOOPED TO SM 11	
24	LOOPED TO SM 12	
25	DMS TO DMS SPARE	
26	DMS TO DMS SPARE	
27	LOOPED TO SM 28	
28	LOOPED TO SM 27	
29	LOOPED TO SM 30	
30	LOOPED TO SM 29	
31	LOOPED TO SM 32	
32	LOOPED TO SM 31	
33	LOOPED TO SM 34	
34	LOOPED TO SM 33	
35	LOOPED TO SM 36	
36	LOOPED TO SM 35	

FIBER OPTIC CABLE MARKINGS
SPLICE ENCLOSURE
VAULT ENTRY

PULL VAULT IN
SE QUAD OF TH 2 /
TH 35 INTERCHANGE

TRUNK FIBER
NAME 35.15

1	
2	
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35	
36	

FIBER OPTIC CABLE MARKINGS
SPLICE ENCLOSURE
VAULT ENTRY

VAULT IN
SE QUAD OF
40TH AVE W

FIBER OPTIC CABLE MARKINGS
SPLICE ENCLOSURE
VAULT ENTRY

TRUNK FIBER
NAME 35.14

DEVICE TO DEVICE SPARE	1	
CAM TO CAM	2	
DMS TO DMS	3	
CAM 36 SPARE	4	
CAM 37 SPARE	5	
CAM 38 SPARE	6	
CAM 39 SPARE	7	
CAM 41 SPARE	8	
CAM 42 SPARE	9	
CAM 43 SPARE	10	
LOOPED TO SM 23	11	
LOOPED TO SM 24	12	
DEVICE TO DEVICE SPARE	13	
CAM TO CAM	14	
DMS TO DMS	15	
CAM 36 SPARE	16	
CAM 37 SPARE	17	
CAM 38 SPARE	18	
CAM 39 SPARE	19	
CAM 41 SPARE	20	
CAM 42 SPARE	21	
CAM 43 SPARE	22	
LOOPED TO SM 11	23	
LOOPED TO SM 12	24	
DMS TO DMS SPARE	25	
DMS TO DMS SPARE	26	
LOOPED TO SM 28	27	
LOOPED TO SM 27	28	
LOOPED TO SM 30	29	
LOOPED TO SM 29	30	
LOOPED TO SM 32	31	
LOOPED TO SM 31	32	
LOOPED TO SM 34	33	
LOOPED TO SM 33	34	
LOOPED TO SM 36	35	
LOOPED TO SM 35	36	

FIBER OPTIC CABLE MARKINGS
SPLICE ENCLOSURE
VAULT ENTRY

DRAWN BY: ACO
DESIGNER: ACO
CHECKED BY: MJB
DESIGN TEAM

NO.	BY	DATE	REVISIONS

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Date: 06/25/2019 Lic. No. 43913

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CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118-090-018

DIVISION SZ
TESTING EXHIBIT

FILE NO.
DULUT-109680

4
6

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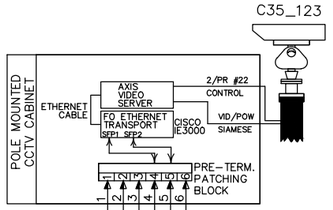
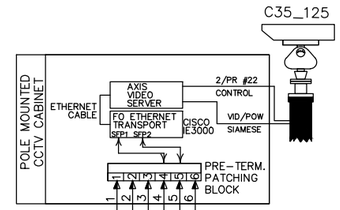


PIGTAIL ID#:
C35_123
_____m B
_____m E



PIGTAIL ID#:
C35_125
_____m B
_____m E

TRUNK FIBER
NAME 35.14

DEVICE TO DEVICE SPARE	1
CAM TO CAM	2
DMS TO DMS	3
CAM 36 SPARE	4
CAM 37 SPARE	5
CAM 38 SPARE	6
CAM 39 SPARE	7
CAM 41 SPARE	8
CAM 42 SPARE	9
CAM 43 SPARE	10
LOOPED TO SM 23	11
LOOPED TO SM 24	12
DEVICE TO DEVICE SPARE	13
CAM TO CAM	14
DMS TO DMS	15
CAM 36 SPARE	16
CAM 37 SPARE	17
CAM 38 SPARE	18
CAM 39 SPARE	19
CAM 41 SPARE	20
CAM 42 SPARE	21
CAM 43 SPARE	22
LOOPED TO SM 11	23
LOOPED TO SM 12	24
DMS TO DMS SPARE	25
DMS TO DMS SPARE	26
LOOPED TO SM 28	27
LOOPED TO SM 27	28
LOOPED TO SM 30	29
LOOPED TO SM 29	30
LOOPED TO SM 32	31
LOOPED TO SM 31	32
LOOPED TO SM 34	33
LOOPED TO SM 33	34
LOOPED TO SM 36	35
LOOPED TO SM 35	36

FIBER OPTIC CABLE MARKINGS @
SPLICE ENCLOSURE
VAULT ENTRY

VAULT @
CN R/R OVERPASS

TRUNK FIBER
NAME 35.13

1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
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12	12
13	13
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31	31
32	32
33	33
34	34
35	35
36	36

FIBER OPTIC CABLE MARKINGS @
SPLICE ENCLOSURE
VAULT ENTRY

FIBER OPTIC CABLE MARKINGS @
SPLICE ENCLOSURE
VAULT ENTRY

VAULT @
29TH AVE W (MAY BE
MOVED TO 27TH)

TRUNK FIBER
NAME 35.12

1	1
2	2
3	3
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6	6
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26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36

FIBER OPTIC CABLE MARKINGS @
SPLICE ENCLOSURE
VAULT ENTRY

FIBER OPTIC CABLE MARKINGS @
SPLICE ENCLOSURE
VAULT ENTRY

VAULT SO.
OF 22ND AVE W

TRUNK FIBER
NAME 35.11

1	DEVICE TO DEVICE SPARE
2	CAM TO CAM
3	DMS TO DMS
4	CAM 36 SPARE
5	CAM 37 SPARE
6	CAM 38 SPARE
7	CAM 39 SPARE
8	CAM 41 SPARE
9	CAM 42 SPARE
10	CAM 43 SPARE
11	LOOPED TO SM 23
12	LOOPED TO SM 24
13	DEVICE TO DEVICE SPARE
14	CAM TO CAM
15	DMS TO DMS
16	CAM 36 SPARE
17	CAM 37 SPARE
18	CAM 38 SPARE
19	CAM 39 SPARE
20	CAM 41 SPARE
21	CAM 42 SPARE
22	CAM 43 SPARE
23	LOOPED TO SM 11
24	LOOPED TO SM 12
25	DMS TO DMS SPARE
26	DMS TO DMS SPARE
27	LOOPED TO SM 28
28	LOOPED TO SM 27
29	LOOPED TO SM 30
30	LOOPED TO SM 29
31	LOOPED TO SM 32
32	LOOPED TO SM 31
33	LOOPED TO SM 34
34	LOOPED TO SM 33
35	LOOPED TO SM 36
36	LOOPED TO SM 35

FIBER OPTIC CABLE MARKINGS @
SPLICE ENCLOSURE
VAULT ENTRY

S:\AE\D\DULUT\109680\S-final-dsgn\53-dsgn-info\received\2019-11-18 Fiber DGN from MnDOT\Duluth Trail Schematics.dwg 12/10/2019 11:37 AM aorteskie

DRAWN BY: ACO
DESIGNER: ACO
CHECKED BY: MJB
DESIGN TEAM

NO.	BY	DATE	REVISIONS

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DIVISION SZ
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FILE NO.
DULUT 109680

5/6

◡ = FURNISHED SPLICE NO SPLICE OTDR READING REQUIRED AT THIS LOCATION

POWER METER TEST POINT

INSERT OPTICAL LINK LOSS IN dB (TEST MULTI MODE FIBER AT 1310) (TEST SINGLE MODE FIBER AT 1550)

FURNISHED SPLICE–OTDR TEST

INSERT OTDR SPLICE LOSS SHOT FROM THIS DIRECTION → ← INSERT OTDR SPLICE LOSS SHOT FROM THIS DIRECTION

INPLACE SPLICE–OTDR TEST

INSERT OTDR SPLICE LOSS SHOT FROM THIS DIRECTION → ← INSERT OTDR SPLICE LOSS SHOT FROM THIS DIRECTION

(TOP OF POLE) (SIDE OF POLE)

(DOUBLE CAMERAS ON POLE)

C35–132 C35–131

CAT 5 RG–11 CAT 5 RG–11

INPL. AXIS INPL. AXIS

CAT 5 CAT 5

FO ETHERNET TRANSPORT SFP1 SFP2 CISCO IE3000

CAT 5

INPLACE M–CAB. WITH CABLE CONNECTION

(CAB. NO. 35–255.24)

AXIS

POLE BOX

RG–59 POWER / CTRL

2/PR #22 CONTROL

VID/POW SIAMESE

C35–136

(SIGNAL POLE–CAN OF WORMS)

REPLACED AUTOSCOPE CAMERA USING RG–11 CONNECTION

CMS CABINET NO. OF GARFIELD AVE OVER TH 35 BRIDGE

NB 35 @ GARFIELD

ADDCO
BRICK
SIGN

INPL. NEMA 3R VMS CAB.

CMS CONTROLLER

CAB 35–???.??

C35_174

VID/POW SIAMESE PTZ502

2/PR #22 – CONTROL

SB 35 NO. OF GARFIELD

LED
STYLE
SIGN

CAT 6

CAT 6

CAT 5 COMTROL

FO ETHERNET TRANSPORT SFP1 SFP2 CISCO IE3000

CAT 5 INPL. AXIS

FO ETHERNET TRANSPORT SFP1 SFP2 CISCO IE3000

CAT 5

CMS CONTROLLER

COMTROL

PRE–TERM. PATCHING BLOCK

1 2 3 4 5 6 7 8 9 10 11 12

(CAB. NO. 35–255.8)

PIGTAIL ID#C35_174

FO PIGTAIL LENGTH ____ m BEGIN ~~m~~ km ____ m END

PIGTAIL OTDR LENGTH

TRUNK FIBER NAME 35.04

OTDR LENGTH ____ TO SHELTER

OTDR LENGTH ____ TO SHELTER

TRUNK FIBER NAME 35.11

1	DEVICE TO DEVICE SPARE	1
2	CAM TO CAM	2
3	DMS TO DMS	3
4	CAM 36 SPARE	4
5	CAM 37 SPARE	5
6	CAM 38 SPARE	6
7	CAM 39 SPARE	7
8	CAM 41 SPARE	8
9	CAM 42 SPARE	9
10	CAM 43 SPARE	10
11	LOOPED TO SM 23	11
12	LOOPED TO SM 24	12
13	DEVICE TO DEVICE SPARE	13
14	CAM TO CAM	14
15	DMS TO DMS	15
16	CAM 36 SPARE	16
17	CAM 37 SPARE	17
18	CAM 38 SPARE	18
19	CAM 39 SPARE	19
20	CAM 41 SPARE	20
21	CAM 42 SPARE	21
22	CAM 43 SPARE	22
23	LOOPED TO SM 11	23
24	LOOPED TO SM 12	24
25	DMS TO DMS SPARE	25
26	DMS TO DMS SPARE	26
27	LOOPED TO SM 28	27
28	LOOPED TO SM 27	28
29	LOOPED TO SM 30	29
30	LOOPED TO SM 29	30
31	LOOPED TO SM 32	31
32	LOOPED TO SM 31	32
33	LOOPED TO SM 34	33
34	LOOPED TO SM 33	34
35	LOOPED TO SM 36	35
36	LOOPED TO SM 35	36

FIBER OPTIC CABLE MARKINGS @

SHELTER FIBER RACK SHELTER ENTRY

FO ETHERNET TRANSPORT SFP1 SFP2 CISCO IE3000

CAM TO CAM
CAM TO CAM
DMS TO DMS
DMS TO DMS

12–POS. PATCH/ SPLICE DRAWER

1 2 3 4 5 6 7 8 9 10 11 12

TRUNK FIBER NAME 535.01

PATCHING CABINET UNDER 22ND AVE W. 334–MP CAB NO. 35–255.24

EAST TO GARFIELD AVE. (SEE NEXT SHEET FOR FIBER CONTINUATION & TEST BUBBLES)

TRUNK FIBER NAME 35.10

1	DEVICE TO DEVICE	1
2	CAM TO CAM	2
3	DMS TO DMS	3
4	CAM 009 BU	4
5	CAM 010 BU	5
6	CAM 022 BU	6
7		7
8		8
9	SALT SHED BU	9
10		10
11		11
12		12
13	2ND AVE BU	13
14		14
15	DMS TO DMS	15
16		16
17		17
18		18
19		19
20		20
21	CAM TO CAM BU	21
22		22
23		23
24		24
25	DMS TO DMS SPARE	25
26		26
27		27
28		28
29		29
30		30
31		31
32		32
33		33
34		34
35		35
36		36

FIBER OPTIC CABLE MARKINGS @

SHELTER FIBER RACK SHELTER ENTRY

FIBER OPTIC CABLE MARKINGS @

SPLICE ENCLOSURE VAULT ENTRY

CHANGED FROM ORIGINAL PLAN

VAULT NEXT TO OH SIGN STRUCTURE NO. OF GARFIELD AVE

1	DEVICE TO DEVICE	1
2	CAM TO CAM	2
3	DMS TO DMS	3
4	CAM 009 SPARE	4
5	CAM 010 BU	5
6	CAM 022 BU	6
7		7
8		8
9	SALT SHED BU	9
10		10
11		11
12		12
13	2ND AVE BU	13
14		14
15	DMS TO DMS	15
16		16
17		17
18		18
19		19
20		20
21	CAM TO CAM BU	21
22		22
23		23
24		24
25	DMS TO DMS SPARE	25
26		26
27		27
28		28
29		29
30		30
31		31
32		32
33		33
34		34
35		35
36		36

FIBER OPTIC CABLE MARKINGS @

SPLICE ENCLOSURE VAULT ENTRY

DRAWN BY: ACD
DESIGNER: ACD
CHECKED BY: MJB
DESIGN TEAM

NO.	BY	DATE	REVISIONS

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

Matthew J. Bolf P.E.
Date: 06/25/2019 Lic. No. 43913

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CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118–090–018

DIVISION SZ TESTING EXHIBIT

FILE NO. DULUT 109680

6/6

S:\AE\D\DULUT\109680\5-final-dsgn\53-dsgn-info\received\2019-11-18 Fiber DGN from MnDOT\Duluth Trail Schematics.dwg 12/10/2019 11:37 AM aorleskie

STATEMENT OF ESTIMATED QUANTITIES

NOTE	TAB	SHEET NO.	ITEM NO.	ITEM DESCRIPTION		UNIT	TOTAL PROJECT ESTIMATED QUANTITIES	CROSS CITY TRAIL S.P. 118-090-018	
								PARTICIPATING ESTIMATED QUANTITIES	NON-PARTICIPATING ESTIMATED QUANTITIES
	E	9	2504.602	ADJUST VALVE BOX-WATER		EACH	6	6	
	E	9	2504.602	ADJUST CURB STOP		EACH	3	3	
21	L	13	2504.602	HYDRANT		EACH	2	2	
24	L	13	2504.602	CONNECT TO EXISTING WATER MAIN		EACH	2	2	
	L	13	2504.604	3" POLYSTYRENE INSULATION		SQ YD	7	7	
	E	9	2505.602	ADJUST VALVE BOX-GAS		EACH	2	2	
31	F	10	2506.502	CONSTRUCT DRAINAGE STRUCTURE DESIGN G OR H		EACH	3	3	
	F	10	2506.502	CASTING ASSEMBLY		EACH	3	3	
	E	9	2506.502	ADJUST FRAME AND RING CASTING		EACH	4	4	
	F	10	2506.503	CONSTRUCT DRAINAGE STRUCTURE DESIGN 48-4020		LIN FT	6	6	
	F	10	2506.602	CONNECT INTO EXISTING DRAINAGE STRUCTURE		EACH	1	1	
	F	10	2511.507	RANDOM RIPRAP CLASS III		CU YD	119	119	
	C	8	2511.602	PLACE BOULDER		EACH	7	7	
6	I,K	11,13	2521.518	6" CONCRETE WALK		SQ FT	1794	1754	40
	D	9	2531.503	CONCRETE CURB AND GUTTER DESIGN B424		LIN FT	721	721	
	D	9	2531.503	CONCRETE CURB AND GUTTER DESIGN B612		LIN FT	543	543	
	D	9	2531.503	CONCRETE CURB AND GUTTER DESIGN B624		LIN FT	1211	1211	
	D	9	2531.504	8" CONCRETE DRIVEWAY PAVEMENT		SQ YD	180	180	
	K	13	2531.618	TRUNCATED DOMES		SQ FT	487	487	
4	D	9	2533.503	PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337		LIN FT	696	696	
27	E	9	2545.502	HANDHOLE		EACH	1	1	
	E	9	2545.503	1.5" NON-METALLIC COND (DIRECTIONAL BORE)		LIN FT	2350	2350	
	E	9	2545.503	DIRECT BURIED LIGHTING CABLE 4 COND NO 4		LIN FT	800	800	
	E	9	2545.602	CONNECT TO EXISTING LIGHT POLE		EACH	1	1	
	E	9	2550.602	FIBER OPTIC CABLE SPLICING		EACH	2	2	
	E	9	2550.602	FIBER OPTIC VAULT		EACH	1	1	
	E	9	2550.601	FIBER OPTIC TESTING		LUMP SUM	1	1	
	E	9	2550.602	FIBER OPTIC PIGTAIL CABLE SPLICE		EACH	1	1	
			2550.602	FIBER OPTIC PIGTAIL TERMINATION		EACH	1	1	
	E	9	2550.603	FIBER OPTIC PIGTAIL CABLE		LIN FT	1149	1149	
	E	9	2550.603	REROUTE FIBER OPTIC CABLE		LIN FT	1324	1324	
11,28	G	10	2557.503	WIRE FENCE DESIGN 48V-9322		LIN FT	1931	1931	
11,28	G	10	2557.503	WIRE FENCE DESIGN 72V-9322		LIN FT	1432	1432	
11,28	G	10	2557.603	WIRE FENCE DESIGN SPECIAL		LIN FT	1224	1224	
11,28	G	10	2557.502	PEDESTRIAN GATE		EACH	2	2	
28	G	10	2557.502	VEHICULAR GATE-SINGLE		EACH	2	2	
28	G	10	2557.502	VEHICULAR GATE-DOUBLE		EACH	1	1	
	G	10	2557.602	INSTALL VEHICULAR GATE		EACH	1	1	
	G	10	2557.603	RECONSTRUCT WIRE FENCE		LIN FT	223	223	
26,28	G	10	2557.603	BARBED WIRE FENCE		LIN FT	438	438	
28	G	10	2557.603	FENCE DESIGN SPECIAL		LIN FT	310	310	
			2563.601	TRAFFIC CONTROL		LUMP SUM	1	0.99	0.01
8	J	12	2564.502	INSTALL SIGN PANEL TYPE C		EACH	23	23	
	J	12	2564.518	SIGN PANELS TYPE C		SQ FT	63	63	
9	J	12	2564.602	INSTALL SIGN		EACH	2	2	
7	J	12	2564.602	INSTALL SIGN TYPE SPECIAL		EACH	2	2	
10			2571.524	CONIFEROUS TREE 6' HT B&B		TREE	20	20	
			2573.501	STABILIZED CONSTRUCTION EXIT		LUMP SUM	1	1	
	M	13	2573.502	STORM DRAIN INLET PROTECTION		EACH	17	17	
	M	13	2573.503	SILT FENCE, TYPE MS		LIN FT	7558	7558	
	M	13	2573.503	SILT FENCE, TYPE HI		LIN FT	529	529	
	M	13	2573.503	FLOTATION SILT CURTAIN TYPE MOVING WATER		LIN FT	80	80	
	M	13	2573.503	SEDIMENT CONTROL LOG TYPE ROCK		LIN FT	30	30	
25	N	14	2574.507	COMMON TOPSOIL BORROW		CU YD	469	469	
17	N	14	2574.508	FERTILIZER TYPE 3		POUND	790	790	
	N	14	2575.504	EROSION CONTROL BLANKETS CATEGORY 3N		SQ YD	5244	5244	
	N	14	2575.505	SEEDING	(P)	ACRE	2	2	
14	N	14	2575.508	SEED MIXTURE 25-131		POUND	896	896	
16	N	14	2575.509	MULCH MATERIAL TYPE 3		TON	2	2	
12	H	11	2582.503	4" SOLID LINE MULTI COMP		LIN FT	435	435	
12	H	11	2582.503	4" DOTTED LINE MULTI COMP		LIN FT	24	24	
12	H	11	2582.503	4" BROKEN LINE MULTI COMP		LIN FT	30	30	
23	H	11	2582.503	4" DOUBLE SOLID LINE MULTI COMP		LIN FT	631	631	
12	H	11	2582.503	6" SOLID LINE MULTI COMP		LIN FT	10	10	
12,23	H	11	2582.503	24" SOLID LINE MULTI COMP		LIN FT	69	69	
12	H	11	2582.518	PAVEMENT MESSAGE		SQ FT	15	15	
12	H	11	2582.518	CROSSWALK PREFORM THERMOPLASTIC		SQ FT	1800	1800	

NOTES:

1	INCLUDES REMOVAL OF HYDRANT LEAD PIPE TO EXISTING HYDRANT GATE VALVE
2	INCLUDES REMOVAL OF CASTING ASSEMBLY
3	INCLUDES REMOVAL OF ANY SIGN FOOTINGS
4	BARRIERS SHALL BE SET ON GRADE AND SHALL NOT BE ANCHORED.
5	SEE SHEETS 24-25 FOR DETAILS
6	INCLUDES STEEL REINFORCEMENT PER MNDOT STANDARD PLANS FOR CURB RAMPS
7	INCLUDES SIGN FOOTING. SEE DETAIL.
8	INCLUDES NEW POST AND FASTENERS
9	TO BE SUPPLIED BY THE CITY. LOCATION TO BE DIRECTED BY THE ENGINEER IN THE FIELD.
10	TO BE PLACED AS DIRECTED BY THE ENGINEER. WHITE SPRUCE
11	INCLUDES CONNECTION TO EXISTING FENCE POSTS
12	WHITE COLOR
13	ASSUMED 3520 TIES PER MILE. APPROX. 0.12 MILES.
14	APPLIED AT 400 POUNDS PER ACRE
15	APPLIED AT 0.2 GALLONS PER SQUARE YARD
16	APPLIED AT 2 TONS PER ACRE
17	22-5-10 APPLIED AT 350 POUNDS PER ACRE
18	INCLUDES STEEL REINFORCEMENT PER DETAILS
19	COMPUTED AT A RATE OF 120 LBS/SQ YD/INCH
20	BITUMINOUS TACK COAT BETWEEN LAYERS INCIDENTAL. APPLIED AT A RATE OF 0.05 GALLONS PER SQUARE YARD.
21	INCLUDES ZINC COATED 6" DUCTILE IRON PIPE CL 52 HYDRANT LEAD PER CITY OF DULUTH CONSTRUCTION STANDARDS
22	2.5" DEPTH ALONG CENTERLINE AND DOWN TO EXISTING CONCRETE PAVEMENT ADJACENT TO CURB
23	YELLOW COLOR
24	CONNECT TO EXISTING HYDRANT VALVE
25	CALCULATED AT 4" THICKNESS
26	72" HEIGHT CHAIN LINK FENCE WITH BARBED WIRE TOP. SEE DETAIL.
27	INCLUDES CONNECTION TO EXISTING CABLE
28	HAND DIG FENCE POSTS AT UTILITY CROSSINGS. SEE PLANS FOR LOCATIONS.
29	EXISTING ABANDONDED ELECTRIC VAULT
30	EXISTING BRIDGE AT STATION 242+20. SEE SHEET 21 FOR DETAILS
31	INCLUDES CASTING AND GRATE/LID
32	MILL CONCRETE PAVEMENT VARIABLE, APPROXIMATELY 1.0"
33	ALL TREES HAVE BEEN CUT AND REMOVED, TREE ROOTS AND BRUSH TO BE GRUBBED
34	INCLUDES CUTTING & RE-WELDING GATE ARM TO POST

STANDARD PLATES

THESE STANDARD PLATES AS APPROVED BY THE FHWA SHALL APPLY

PLATE NO.	DESCRIPTION
3000L	REINFORCED CONCRETE PIPE
3006G	GASKET JOINT FOR R.C. PIPE
3100G	CONCRETE APRON FOR REINFORCED CONCRETE PIPE
3129A	METAL APRON FOR CORRUGATED POLYETHYLENE PIPE
3133D	RIPRAP AT RCP OUTLETS
3134D	RIPRAP AT CSP OUTLETS
4006L	MANHOLE OR CATCH BASIN PRECAST - DESIGNS G & H
4011E	PRECAST CONCRETE BASE
4020J	MANHOLE OR CATCH BASIN FOR USE WITH OR WITHOUT TRAFFIC LOADS
4152C	CATCH BASIN GRATE CASTING
4160D	CURB BOX CASTING FOR CATCH BASIN
7000E	INTEGRANT CURBS
7038A	DETECTABLE WARNING SURFACE TRUNCATED DOMES
7100H	CONCRETE CURB & GUTTER
7111J	INSTALLATION OF CATCH BASIN CASTINGS
8000J	CHANNELIZERS
8337C	TEMPORARY PORTABLE PRECAST CONCRETE BARRIER
9322K	CHAIN LINK FENCE

EXISTING UTILITIES

COMPANY	SERVICE
GOPHER STATE ONE CALL	LOCATORS
CITY OF DULUTH	STREET LIGHTS, WATER, GAS, SANITARY SEWER AND STORM SEWER
MINNESOTA DEPARTMENT OF TRANSPORTATION	STREET LIGHTS
MINNESOTA POWER	ELECTRIC POWER
NORTHEAST SERVICE COOPERATIVE	FIBER OPTIC
CONSOLIDATED COMMUNICATIONS	FIBER OPTIC
CENTURY LINK	TELEPHONE
CHARTER COMMUNICATIONS	CABLE TV
WESTERN LAKE SUPERIOR SANITARY DISTRICT	SANITARY FORCE MAIN

DRAWN BY: ACO
DESIGNER: ACO
CHECKED BY: MJB
DESIGN TEAM

NO.	BY	DATE	REVISIONS
1	ACO	12/19	UPDATED FIBER OPTIC CABLE SPLICE QUANTITY
			UPDATED FIBER OPTIC PIGTAIL CABLE QUANTITY
			ADDED FIBER OPTIC PIGTAIL TERMINATION QUANTITY

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
Matthew J. Bolf P.E.
Date: 06/25/2019 Lic. No. 43913

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CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118-090-018

ESTIMATED QUANTITIES

FILE NO.
DULUT 109680

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D - CONCRETE & AGGREGATE

		SPEC. 2211	SPEC. 2232	SPEC. 2301	SPEC. 2301	SPEC. 2301	SPEC. 2401	SPEC. 2531	SPEC. 2531	SPEC. 2531	SPEC. 2531	SPEC. 2533
STATION TO STATION	LOCATION	AGGREGATE BASE (CV) CLASS 5	MILL CONCRETE SURFACE	INTEGRANT CURB DESIGN B6	CONCRETE PAVEMENT 8.0"	DRILL AND GROUT REINFORCEMENT BARS (EPOXY COATED)	REINFORCEMENT BARS (EPOXY COATED)	CONCRETE CURB AND GUTTER DESIGN B424	CONCRETE CURB AND GUTTER DESIGN B612	CONCRETE CURB AND GUTTER DESIGN B624	8" CONCRETE DRIVEWAY PAVEMENT	PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337
		CU YD	SQ YD	LIN FT	SQ YD	EACH	EACH	LIN FT	LIN FT	LIN FT	SQ YD	LIN FT
206+97.0 - 207+11.6	8 LT - 8 RT	15		34	46							
207+61.0 - 207+77.1	9 RT - 9 LT	5		26	15							
211+79.2 - 211+93.4	9 LT - 8 RT	5		37	15							
212+21.8 - 212+37.1	9 RT - 9 LT	5		25	15							
233+95.8 - 235+83.5	RT	3							182			
237+04.0	8 LT - 8 RT	1								17		
237+29.2 - 237+39.3	8 RT - 10 LT	1								21		
239+11.8 - 239+26.7	9 RT - 8 LT	1								36		
239+63.9 - 239+84.1	8 LT - 12 RT	1								39		
278+18.0 - 285+31.0	RT											696
285+91.2 - 286+04.1	18 LT - 1 RT									35		
285+91.5 - 286+86.0	16 LT	53			160							
286+66.7 - 286+86.0	49 RT - 15 LT									77		
286+67.3 - 287+02.4	8 RT - 30 RT	29									87	
286+69.0 - 290+25.0	RT	13							361			
290+62.3	8 LT - 8 RT	1								16		
290+87.0 - 298+70.0	LT & RT	44								900		
299+17.1 - 299+31.1	7 LT - 9 RT	1								21		
321+80.0 - 323+15.6	LT & RT	2								49		
323+59.2 - 330+67.6	LT	36	630					721				
324+18.2 - 324+46.2	LT & RT	16									47	
327+90.2 - 328+18.2	LT & RT	15									46	
RECYCLE WAY	RECYCLE WAY											
PROJECT ITEM TOTALS		**247**	**630**	**122**	**251**	**840**	**925**	**721**	**543**	**1211**	**180**	**696**

E - UTILITY ADJUSTMENTS

		SPEC. 2104	SPEC. 2504	SPEC. 2504	SPEC. 2504	SPEC. 2505	SPEC. 2506	SPEC. 2545	SPEC. 2545	SPEC. 2545	SPEC. 2545	SPEC. 2550	SPEC. 2550	SPEC. 2550	SPEC. 2550	SPEC. 2550	SPEC. 2550
STATION TO STATION	LOCATION	REMOVE FIBER OPTIC VAULT	ADJUST VALVE BOX-FORCE MAIN	ADJUST VALVE BOX-WATER	ADJUST CURB STOP	ADJUST VALVE BOX-GAS	ADJUST FRAME AND RING CASTING	1.5" NON-METALLIC COND (DIRECTIONAL BORE)	HANDHOLE	DIRECT BURIED LIGHTING CABLE 4 COND NO 4	CONNECT TO EXISTING LIGHT POLE	FIBER OPTIC CABLE SPLICING	FIBER OPTIC PIGTAIL CABLE SPLICE	FIBER OPTIC VAULT	FIBER OPTIC TESTING	FIBER OPTIC PIGTAIL CABLE	REROUTE FIBER OPTIC CABLE
		EACH	EACH	EACH	EACH	EACH	EACH	LIN FT	EACH	LIN FT	EACH	EACH	EACH	EACH	EACH	LIN FT	LIN FT
206+93.9	16 LT			1													
207+00.3	18 LT			1													
211+73.3	12 LT			1													
213+48.0 - 236+62.0	LT							2350				1	1	1	1	1149	1324
224+32.1	4 RT					1											
228+25.0 - 236+25.0	LT								1	800							
231+70	LT																
235+15.3	4 LT			1													
235+78.0	RT	1															
236+18.0	LT										1						
236+28	LT											1					
238+74.5	4 RT				1												
241+04.2	CL						1										
281+54.1	11 LT		1														
286+36.8	9 LT						1										
291+11.0	1 RT			1													
291+99.9	10 RT						1										
296+01.1	2 RT						1										
323+91.3	11 LT			1													
326+90.2	4 LT					1											
327+06.7	4 LT				1												
330+04.2	1 RT				1												
PROJECT ITEM TOTALS		**1**	**1**	**6**	**3**	**2**	**4**	**2350**	**1**	**800**	**1**	**2**	**1**	**1**	**1**	**1149**	**1324**

	NO.	BY	DATE	REVISIONS
DRAWN BY: ACO	1	ACO	12/19	UPDATED FIBER OPTIC CABLE SPLICE QUANTITY
DESIGNER: ACO				UPDATED FIBER OPTIC PIGTAIL CABLE QUANTITY
CHECKED BY: MJB				
DESIGN TEAM				

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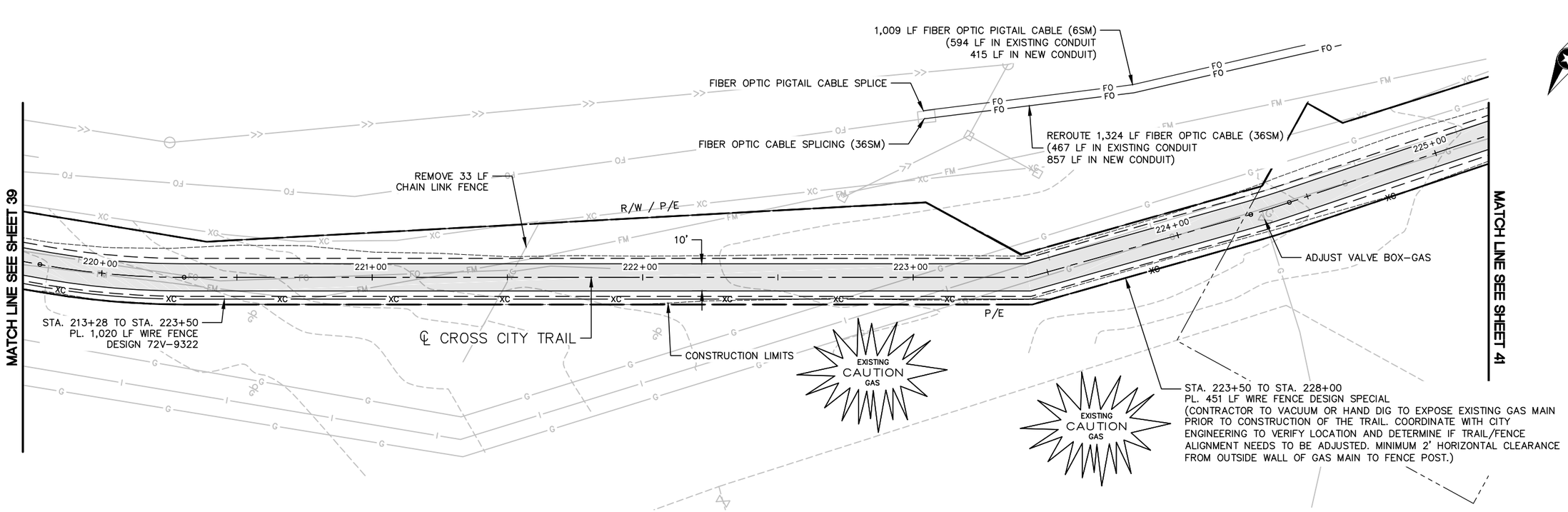
CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118-090-018

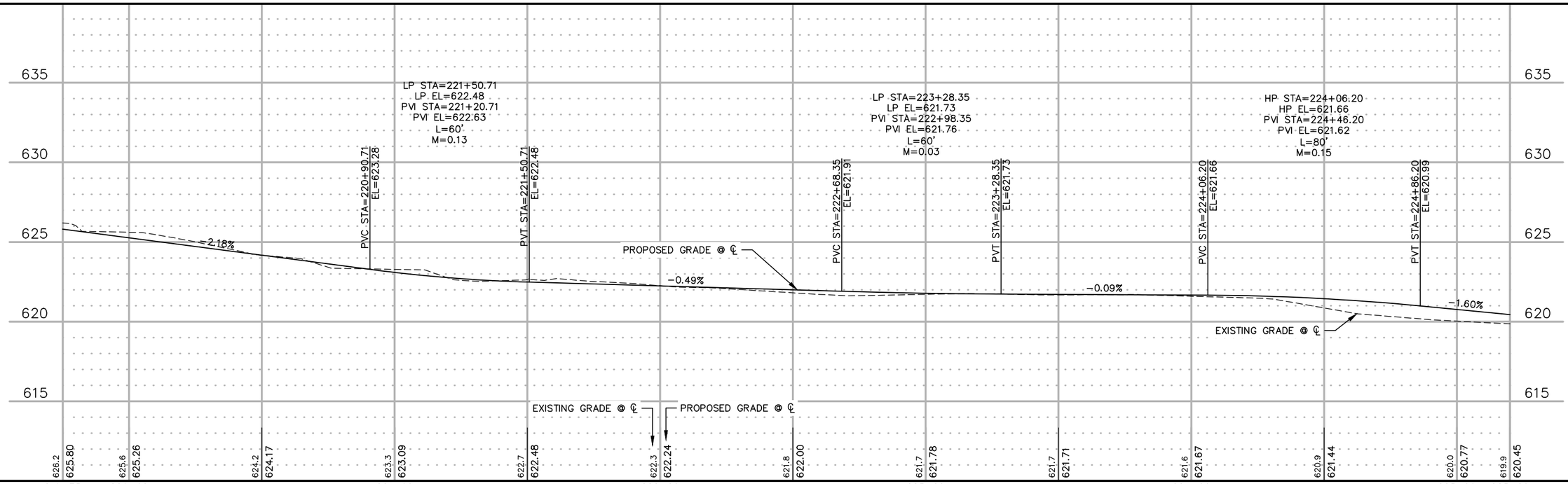
TABULATIONS

FILE NO. DULUT 109680



CROSS CITY TRAIL - PHASE 2

scale 10 (20 0 20 40) feet



DRAWN BY:	ACO
DESIGNER:	ACO
CHECKED BY:	MJB
DESIGN TEAM	

NO.	BY	DATE	REVISIONS
1	ACO	12/19	UPDATED FIBER OPTIC CABLE SPLICING

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

Matthew J. Bolf, P.E.
Date: 06/25/2019 Lic. No. 43913

SEH
PHONE: 218.279.3000
418 W SUPERIOR ST STE 200
DULUTH, MN 55802-1512
www.sehinc.com

CITY OF DULUTH
CITY PROJECT NO. 0595TR
S.P. 118-090-018

PLAN AND PROFILE

FILE NO.
DULUT 109680

40
167

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MATCH LINE SEE DETAIL A

MATCH LINE SEE SHEET 41

1,009 LF FIBER OPTIC PIGTAIL CABLE (6SM)
(594 LF IN EXISTING CONDUIT
415 LF IN NEW CONDUIT)

415 LF 1.5" NON-METALLIC CONDUIT FOR PIGTAIL
(DIRECTIONAL BORE)

857 LF 1.5" NON-METALLIC CONDUIT
(DIRECTIONAL BORE)

CONNECT TO EXISTING CONDUIT

CONSTRUCTION LIMITS

℄ CROSS CITY TRAIL

EXISTING CAUTION GAS

I-35

REMOVE 192 LF C&G

PL. 790 LF WIRE FENCE DESIGN 48-9322
(CONTRACTOR TO VACUUM OR HAND DIG TO EXPOSE EXISTING GAS MAIN PRIOR TO CONSTRUCTION OF THE TRAIL. COORDINATE WITH CITY ENGINEERING TO VERIFY LOCATION AND DETERMINE IF TRAIL/FENCE ALIGNMENT NEEDS TO BE ADJUSTED. MINIMUM 2' HORIZONTAL CLEARANCE FROM OUTSIDE WALL OF GAS MAIN TO FENCE POST.)

ADJUST VALVE BOX

REROUTE 1,324 LF (36SM)
FIBER OPTIC CABLE

SALVAGE FIBER OPTIC VAULT

INSTALL
FIBER OPTIC
VAULT

BEGIN FIBER
OPTIC CABLE
RE-ROUTE

STA. 223+43 TO STA. 235+74
PL. 773 LF WIRE FENCE
DESIGN SPECIAL

REMOVE 645 LF
CHAIN LINK FENCE

REMOVE POWER POLE

R/W

STA. 233+96 TO STA. 235+84
REMOVE CURB & GUTTER
CONST. B612 C&G
REMOVE BITUMINOUS PAVEMENT
SAWING BIT PAVEMENT (FULL DEPTH)

REMOVE VEHICULAR GATE

RAMSEY ST.

43 LF WIRE FENCE DESIGN 72V-9322

VEHICULAR GATE DOUBLE

PLACE 10 LF
WIRE FENCE DESIGN 72V-9322

MATCH LINE SEE SHEET 43

DETAIL A

EXISTING FIBER OPTIC VAULT

FIBER OPTIC PIGTAIL
CABLE TERMINATION

I-35

MATCH LINE SEE ABOVE

CROSS CITY TRAIL - PHASE 2

FO FIBER OPTIC IN EXISTING CONDUIT
FO FIBER OPTIC IN NEW CONDUIT

scale 10 feet

HP STA=232+78.61
HP EL=628.38
PVI STA=232+43.61
PVI EL=628.33
L=70'
M=0.14

PVC STA=232+08.61
EL=627.73

PVT STA=232+78.61
EL=628.38

HP STA=233+63.31
HP EL=628.48
PVI STA=233+81.68
PVI EL=628.50
L=40'
M=0.15

PVC STA=233+61.68
EL=628.47

PVT STA=234+01.68
EL=627.94

LP STA=234+70.00
LP EL=626.47
PVI STA=234+50.00
PVI EL=626.57
L=40'
M=0.12

PVC STA=234+30.00
EL=627.14

PVT STA=234+70.00
EL=626.47

HP STA=234+79.78
HP EL=626.42
PVI STA=234+99.78
PVI EL=626.32
L=40'
M=0.03

PVC STA=234+79.78
EL=626.42

LP STA=235+70.00
LP EL=625.66
PVI STA=235+50.00
PVI EL=625.76
L=40'
M=0.03

PVT STA=235+19.78
EL=626.10

PVC STA=235+30.00
EL=625.98

PVT STA=235+70.00
EL=625.66

1.72% 0.12% -2.82% -0.50% -1.13% -0.47%

PROPOSED GRADE @ ℄

EXISTING GRADE @ ℄

EXISTING GRADE @ ℄ PROPOSED GRADE @ ℄

640 635 630 625 620

624.5 625.35 | 625.2 625.87 | 625.9 626.73 | 626.3 627.58 | 627.7 628.25 | 628.4 628.40 | 628.2 628.46 | 626.8 627.98 | 626.2 626.69 | 625.7 626.29 | 625.1 625.79 | 624.9 625.52 | 625.1 625.41

230+70 231+00 232+00 233+00 234+00 235+00 236+00 236+25

NO.	BY	DATE	REVISIONS
1	ACO	12/19	UPDATED FIBER OPTIC CABLE SPLICE
			UPDATED FIBER OPTIC PIGTAIL TERMINATION

DRAWN BY: ACO
DESIGNER: ACO
CHECKED BY: MJB
DESIGN TEAM

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Matthew J. Bolf, P.E.
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