

Office of Traffic and Maintenance Operations

I hereby certify that Special Provisions for the Traffic Management System (Division SZ), contained in this proposal were 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.

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License # 26530

Date: _____

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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
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SZ-1.3 **SYMBOLS**

p	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 yd ³	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:

AS BUILT PLANS

Copies of the original Plan and Plan Detail sheets with changes and additions to the Contract marked in the color red.

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:

xxxx.xxx XXXXXXXXXXXXXXXXXXXX

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 **(2104) REMOVE UTILITY VAULT**

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

SZ-5.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before removing the Utility 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-5.2 Salvage internal and external components according to Plan. Give salvaged items to the TMS Integrator.

SZ-5.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (REMOVE UTILITY 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 Utility Vault.

SZ-6 **(2104) REMOVE CABINET**

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

SZ-6.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before removing the Cabinet. The TMS Integrator will salvage some components prior to removal.

SZ-6.2 Salvage internal and external components according to Plan. Give salvaged items to the TMS Integrator.

SZ-6.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (REMOVE CABINET) 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, notifying the TMS Integrator, and all materials and labor necessary to construct the Remove Cabinet.

SZ-7 **(2104) REMOVE TMS SHELTER CABINET**

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

SZ-7.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before removing the TMS Shelter Cabinet. The TMS Integrator will salvage some components prior to removal.

SZ-7.2 Salvage internal and external components according to Plan. Give salvaged items to the TMS Integrator.

SZ-7.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (REMOVE TMS SHELTER CABINET) 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, notifying the TMS Integrator, and all materials and labor necessary to construct the Remove TMS Shelter Cabinet.

SZ-8 **(2104) REMOVE DMS**

Remove DMS in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-8.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before the DMS is removed from the support structure.

SZ-8.2 The TMS Integrator will disconnect existing Communication cables.

SZ-8.3 Transport salvaged DMS and components, from the job site to a storage site. Store the DMS for two weeks and MnDOT will salvage some of the parts during the storage period. The DMS may be stored within the project limits outside of the Clear Zone, an Engineer approved location, or at the MnDOT Larpenteur Ave. Maintenance station.

SZ-8.4 Take ownership and dispose of the remaining DMS items according to MnDOT 2104.

SZ-8.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by each DMS removed as specified. Payment will be made under Item 2104.502 (REMOVE DMS) at the Contract bid price per each, which will be payment in full for all costs involved.

SZ-9 (2104) ABANDON HANDHOLE

Abandon Handhole in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-9.1 Remove the handhole frame, cover casting.

SZ-9.2 Remove all debris from the handhole.

SZ-9.3 Cut existing conduits within the handhole and seal the openings with duct seal.

SZ-9.4 Fill handholes located in turf with compacted granular material.

SZ-9.5 Perform the following for handholes located in concrete:

- (A) Sawcut existing pavement and handhole as indicated in the Plan detail.
- (B) Remove all materials resulting from the preparation of the handhole for concrete placement.
- (C) Use either non-shrink grout or an epoxy anchorages for bonding reinforcing tie bars and dowel bars to in-place concrete (For an approved products list, See www.mrr.dot.state.mn.us/pavement/concrete/products.asp). Clean and dry the drilled holes and place bonding agent into the drilled hole in a manner that will completely fill the void, then push the bar into the hole. Fill any voids with grout and finish smooth and check to assure that the bars are fully set prior to placement of concrete.
- (D) Drill No. 25 reinforcement bars with an approved drill assembly and grouted 9 inches into the face of the in-place concrete slab as shown in the Plans.
- (E) Fill with 3G52HE concrete.
- (F) Incorporate concrete mix designs 3G52HE into the work as indicated in the Plans for all repairs.
- (G) As directed by the Engineer, repair any damage to any in-place pavement, roadway structure, or appurtenance caused by the construction prior to final acceptance at no cost to the MnDOT.
- (H) Do not place any concrete mixture after October 15th.
- (I) Provide a repaired surface tolerance that does not vary by more than 0.125 inch from the existing pavement surface as measured with a straight edge placed over the joint. Replace or grind the repair as necessary to correct deficiencies.
- (J) Provide surface texturing for all repairs according to MnDOT 2301.I Surface Finishing,

- (K) Insulate patches in cool weather, (below 15°C [60°F]) or when in-place pavement temperatures are below 10°C [50°F]. When texture planing is required and the temperatures are below 15°C [60°F] (night or day), apply a blanket cure for a minimum of 48 hours after placement and prior to texture planing. Cast beams or cylinders (cured and tested by the Agency) if earlier opening times are required.
- (L) Repair any areas of failure that appear within one (1) month of the original construction or subsequent repair at no cost to MnDOT. Failures include (but are not limited to) the loss of bonding to the in-place concrete or crack apparent in the repair other than the desired crack in the newly constructed joint or re-established crack.
- (M) Immediately after final finishing, cure all concrete in accordance with Spec. 2531.3G2. Use either Membrane Curing Compound meeting Specification 3754 AMS or Extreme Service Membrane Curing Compound meeting Specification 3755. Use only one type of curing compound on the entire project. Hudson sprayers may be used if the coverage rate is doubled and the curing material is from an agitated source.

SZ-9.6 MEASUREMENT AND PAYMENT

Measurement will be made by each handhole abandoned as specified. Payment will be made under Item 2104.502 (ABANDON HANDHOLE) at the Contract bid price per each, which will be payment in full for all costs involved.

SZ-10 (2104) SALVAGE FIBER OPTIC CABLE

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

- SZ-10.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvage Fiber Optic Cable from the job site to the storage site. The storage site is on MnDOT property in the Metro area. Inspect the Salvage Fiber Optic Cable in the presence of the TMS Integrator when the Salvage Fiber Optic Cable arrives at the storage site.
- SZ-10.2 Place the FO cable on a spool for testing, hauling, and storage. Ensure the Salvaged FO Cable is placed on the spool to allow for testing. Test the Salvaged FO Cable when it is on the spool and ready for hauling to the storage site.
- SZ-10.3 Label the storage spool. The label shall denote the meter mark of both ends of the spooled FO cable.
- SZ-10.4 Protect FO cable to ensure it is not damaged. Be responsible for any damage incurred during the Salvage FO Cable operation.

SZ-10.5 MEASUREMENT AND PAYMENT

Measurement will be made by the length of Salvaged Fiber Optic Cable as specified. Payment will be made under Item 2104.503 (SALVAGE 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 protecting FO cable, placing on spool for testing, hauling, and all materials and labor necessary to construct the Salvage Fiber Optic Cable.

SZ-11 **(2104) SALVAGE RAMP CONTROL SIGNAL**

Remove, salvage, and deliver the Ramp Control Signal as directed by the Engineer. Deliver the salvaged ramp control signal to the storage location as specified below, or as directed by the Engineer. Repair any damage to the salvaged materials resulting from the removing, salvaging, and delivering operation.

- SZ-11.1 Install Salvaged ramp control signals in another location as part of this project.
- SZ-11.2 Include the signs attached to the Salvaged Ramp Control Signal in the salvage operation.
- SZ-11.3 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged ramp control signal, or components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.
- SZ-11.4 Remove materials deemed non-salvageable by the Engineer completely and dispose of outside of MnDOT right-of-way according to the provisions of MnDOT 2104.

SZ-11.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE RAMP CONTROL SIGNAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to all materials and labor necessary to construct the Salvage Ramp Control Signal.

SZ-12 **(2104) SALVAGE RAMP CONTROL FLASHER SIGNAL**

Remove, salvage, and deliver the Ramp Control Flasher Signal as directed by the Engineer. Deliver the salvaged ramp control flasher signal to the storage location as specified below, or as directed by the Engineer. Repair any damage to the salvaged materials resulting from the removing, salvaging, and delivering operation.

- SZ-12.1 Install Salvaged ramp control flasher signals in another location as part of this project.
- SZ-12.2 Include the signs attached to the Salvaged Ramp Control Flasher Signal in the salvage operation.
- SZ-12.3 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged ramp control flasher signal, or components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.
- SZ-12.4 Remove materials deemed non-salvageable by the Engineer completely and dispose of outside of MnDOT right-of-way according to the provisions of MnDOT 2104.

SZ-12.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE RAMP CONTROL FLASHER SIGNAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to all materials and labor necessary to construct the Salvage Ramp Control Flasher Signal.

SZ-13 **(2104) SALVAGE FIBER OPTIC VAULT**

Salvage Fiber Optic Vault, internal, and external components as directed by the Engineer for installation on this project. Repair damaged salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

- SZ-13.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvaged Fiber Optic Vault and internal and external

components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

- (A) Internal and external components include but are not limited to the following:
- a. Outdoor Fiber Splice Enclosure. The Contractor shall give this to the TMS Integrator.
 - b. Concrete Drain Headwall.
 - c. FO Vault Marker posts.

SZ-13.2 The Fiber Optic Vault may be stored within the project limits outside of the Clear Zone or an Engineer approved location.

SZ-13.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE 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 to internal and external components and salvaging the Fiber Optic Vault.

SZ-14 (2104) SALVAGE CCTV ASSEMBLY

Salvage CCTV Assembly from the project for installation on this project in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

SZ-14.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged CCTV Assembly, or components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-14.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE CCTV ASSEMBLY) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, salvaging the existing CCTV Camera and Pan/Tilt unit, furnishing and Installing the access handhole cover, salvaging existing cables, delivery of the salvaged items, and all materials and labor necessary to Salvage CCTV Assembly. Repair or replace any damage caused to the Salvage CCTV Assembly items to the satisfaction of the Engineer.

SZ-15 (2104) SALVAGE SERVICE CABINET

Remove, salvage, and deliver the Service Cabinet, internal and external components, the cabinet foundation and sidewalk as directed by the Engineer. Deliver to the storage location as specified below, or as directed by the Engineer. Install the Salvage Cabinet on this project. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

SZ-15.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvaged Service Cabinet and components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-15.2 The Salvage Service Cabinet may be stored within the project limits outside of the Clear Zone or an Engineer approved location.

SZ-15.3 Install the Salvage Service Cabinet foundation and sidewalk on this project.

SZ-15.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE SERVICE CABINET) at the Contract bid price per each, which will be compensation in full

for all costs incidental thereto, including but not limited to salvaging the Service Cabinet including internal and external components, the cabinet foundation, sidewalk, and all materials and labor necessary to construct the Salvage Service Cabinet.

SZ-16 **(2104) SALVAGE SERVICE EQUIPMENT**

Remove, salvage, and deliver the Service Equipment and internal and external components as directed by the Engineer. Deliver the salvaged service equipment to the storage location as specified below, or as directed by the Engineer. Install the Salvage Service Equipment on this project. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

SZ-16.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged service equipment and internal and external components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-16.2 The Service Equipment may be stored within the project limits outside of the Clear Zone or an Engineer approved location.

SZ-16.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE SERVICE EQUIPMENT) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the service equipment including internal and external components, all materials and labor necessary to construct the Salvage Service Equipment.

SZ-17 **(2104) SALVAGE DMS**

Remove, salvage, and deliver the DMS and internal and external components as directed by the Engineer. Deliver the Salvage DMS to the storage location as specified below, or as directed by the Engineer. Install the Salvage DMS on this project. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging and delivering operation.

SZ-17.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged DMS and components, from the job site to the storage site. The TMS Integrator will disconnect existing Communication cables prior to salvaging.

SZ-17.2 The DMS may be stored within the project limits outside of the Clear Zone, an Engineer approved location, or at XXX.

SZ-17.3 Notify xxx (MnDOT) at (xxx) xxx-xxxx two Working days prior to delivering the DMS to the following address:

XXX Truck Station
XXXX XXX Road
XXX, MN 55XXX

SZ-17.4 See Signing Plans and Specifications for support structure salvaging details. OR Salvage the Structural Steel support structure.

SZ-17.5 **SALVAGING REQUIREMENTS**

Apply the following provisions to the Salvaging Requirements for Salvage DMS:

(A) Remove the DMS from the support structure.

- (B) Perform the following:
- a. Prevent damage to internal components by securing them prior to removal from the support structure. Achieve this by tying down or removing the components.
 - b. Disconnect existing Power cables from the DMS and internal components of the DMS control cabinet by removing from terminals.
 - c. Secure the DMS during storage by using a method that shall prevent the DMS from becoming damaged from vehicles, vandalism, collapsing or falling over due to wind, and other natural forces.
 - d. Ensure the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the DMS.
 - e. Ensure the storage site is reasonably level and dry.
 - f. Place the DMS on two pieces of lumber (six inches by six inches by eight feet long) under structural ribs Nos. 2 and 8.
 - g. At a minimum, stabilize the DMS by attaching four tie down straps (two front and two rear) between lumber and lifting eyes.
 - h. Handle the DMS at the storage facilities.
 - i. Transport the DMS from the storage site to the mounting site.

SZ-17.6 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE DMS) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the DMS including Salvaging Requirements, internal and external components, disconnecting existing cables, protection and storage, and all materials and labor necessary to construct the Salvage DMS.

SZ-18 (2104) SALVAGE OUTDOOR FIBER SPLICE ENCLOSURE

Salvage the Outdoor Fiber Splice Enclosure. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

- SZ-18.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvaged Outdoor Fiber Splice Enclosure from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-18.2 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE OUTDOOR FIBER SPLICE ENCLOSURE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the Outdoor Fiber Splice Enclosure.

SZ-19 (2104) SALVAGE FIBEROPTIC SPLICE/PATCH PANEL

Salvage the Fiberoptic Splice/Patch Panel. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

- SZ-19.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvaged Fiberoptic Splice/Patch Panel from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-19.2 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE FIBEROPTIC 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 salvaging the Fiberoptic Splice/Patch Panel.

SZ-20 **(2104) SALVAGE CCTV POLE**

Remove, salvage and deliver the CCTV Pole, internal and external components, as directed by the Engineer. Deliver them to the storage location as specified below, or as directed by the Engineer. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

SZ-20.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged cabinet and components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-20.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE CCTV POLE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the CCTV Pole including internal and external components, and all materials and labor necessary to construct the Salvage CCTV Pole.

SZ-21 **(2104) SALVAGE CCTV HARDWARE**

Salvage CCTV Hardware from the project for completion of the installation of the Salvaged CCTV Hardware. The CCTV Cabinet will become the property of MnDOT. The locations and details are shown in the Plan. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation. Perform this work in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

SZ-21.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before beginning the Salvage CCTV Hardware operation.

SZ-21.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE CCTV HARDWARE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, salvaging the existing CCTV Folding Pole, mounting hardware, CCTV cabinet, removing existing cables, notifying the TMS Integrator, all materials and labor necessary to Salvage CCTV Hardware.

SZ-22 **(2104) SALVAGE NON-INTRUSIVE DETECTION HARDWARE**

Salvage Non-Intrusive Detection Hardware from the project for completion of the installation of the Salvaged Non-Intrusive Detection Hardware. Include the CCTV Cabinet. The locations and details are shown in the Plan. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation. Perform this work in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

SZ-22.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before beginning the Salvage Non-Intrusive Detection Hardware operation.

SZ-22.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE NON-INTRUSIVE DETECTION HARDWARE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, salvaging the existing Non-Intrusive Detection Folding Pole, mounting hardware, CCTV cabinet, removing existing cables, notifying the TMS Integrator, all materials and labor necessary to Salvage Non-Intrusive Detection Hardware.

SZ-23 **(2104) SALVAGE FIBER OPTIC PATCHING SHELTER**

Salvage Fiber Optic Patching Shelter. The Salvage Fiber Optic Patching Shelter will become the property of MnDOT. The locations and details are shown in the Plan. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation. Perform this work in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

SZ-23.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before beginning the Salvage Fiber Optic Patching Shelter operation.

SZ-23.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE FIBER OPTIC PATCHING SHELTER) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, salvaging the existing Fiber Optic Patching Shelter, notifying the TMS Integrator, all materials and labor necessary to Salvage Fiber Optic Patching Shelter.

SZ-24 **(2104) SALVAGE CABINET**

Remove, salvage, and deliver the cabinet, internal and external components, the cabinet foundation and sidewalk. Deliver to the storage location as specified below, or as directed by the Engineer. Install the Salvage Cabinet on this project. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

SZ-24.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged cabinet and components, from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-24.2 The Cabinet may be stored within the project limits outside of the Clear Zone or an Engineer approved location.

SZ-24.3 Salvage the Salvage Cabinet neoprene gasket for installation on this project.

SZ-24.4 Salvage the Salvage Cabinet foundation and sidewalk for installation on this project.

SZ-24.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the cabinet including internal and external components, neoprene gasket, the cabinet foundation, sidewalk, and all materials and labor necessary to construct the Salvage Cabinet.

SZ-25 **(2104) SALVAGE RAMP CONTROL FOUNDATION-SCREW IN**

Salvage the Ramp Control Foundation-Screw In. Repair any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation.

SZ-25.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvaged Ramp Control Foundation-Screw In from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-25.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE RAMP CONTROL FOUNDATION-SCREW IN) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the Ramp Control Foundation-Screw In.

SZ-26 **(2104) SALVAGE PRICING SIGN MODULE**

Remove, salvage, and deliver the Pricing Sign Module and internal and external components as directed by the Engineer. Deliver the Salvage Pricing Sign Module to the storage location as specified below, or as directed by the Engineer. Install the Salvage Pricing Sign Module on this project. Repair or replace any damage to the salvaged materials resulting from the removing, salvaging and delivering.

SZ-26.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged Pricing Sign Module and components, from the job site to the storage site. The TMS Integrator will disconnect existing Communication cables.

SZ-26.2 The Pricing Sign Module may be stored within the project limits outside of the Clear Zone, an Engineer approved location, or at the MnDOT XXX Maintenance station.

SZ-26.3 See Signing Plans and Specifications for support structure salvaging details.

SZ-26.4 **SALVAGING REQUIREMENTS**

Apply the following provisions to the Salvaging Requirements for Salvage Pricing Sign Module:

- (A) Remove the Pricing Sign Module from the support structure.
- (B) Perform the following:
 - a. Prevent damage to internal components by securing them prior to removal from the support structure. Achieve this by tying down or removing the components.
 - b. Disconnect existing Power cables from the Pricing Sign Module and internal components of the Pricing Sign Module control cabinet by removing from terminals.
 - c. Secure the Pricing Sign Module during storage by using a method that shall prevent the DMS from becoming damaged from vehicles, vandalism, collapsing or falling over due to wind, and other natural forces.
 - d. Ensure the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the Pricing Sign Module.
 - e. Ensure the storage site is reasonably level and dry.
 - f. Stabilize the Pricing Sign Module during storage.
 - g. Handle of the Pricing Sign Module at the storage facilities.
 - h. Transport the Pricing Sign Module from the storage site to the mounting site.

SZ-26.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE PRICING SIGN MODULE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to salvaging the Pricing Sign Module including internal and external components, disconnecting existing cables, protection and storage, and all materials and labor necessary to construct the Salvage Pricing Sign Module.

SZ-27 **(2104) SALVAGE TOLL READER**

Salvage the Toll Reader and internal and external components as directed by the Engineer. Any damage to the salvaged materials resulting from the removing, salvaging, storing, and delivering operation shall be repaired or replaced at the Contractor's expense.

SZ-27.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Salvaged Toll Reader from the job site to the storage site. The storage site is on MnDOT property in the Metro area.

SZ-27.2 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before salvaging the Toll Reader.

SZ-27.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2104.502 (SALVAGE TOLL READER) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including but not limited to salvaging the Toll Reader including internal and external components, disconnecting existing cables, protection and storage, and all materials and labor necessary to construct the Salvage Toll Reader.

SZ-28 **(2104) REMOVE CABLES**

Remove Cables in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-28.1 Remove Cables from termination or splice location to termination or splice location by extracting designated cables from existing conduit and end equipment in a manner that is harmless to the cables that shall remain intact.

SZ-28.2 **MEASUREMENT AND PAYMENT**

No measurement will be made of the various Items that constitute Remove Cables but all such work will be construed to be included in the single Lump Sum payment under Item 2104.601 (Remove Cables).

SZ-29 **(2104) REMOVE MISCELLANEOUS STRUCTURES**

Remove Miscellaneous Structures from the project in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

SZ-29.1 Remove items denoted on Sheets XX and XX of the SP XXXX-XXX Plan.

SZ-29.2 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before beginning the removal operation.

SZ-29.3 Remove and dispose of all items according to MnDOT 2104.

SZ-29.4 Repair or replace any damage caused during the removal process to the satisfaction of the Engineer.

SZ-29.5 **MEASUREMENT AND PAYMENT**

No measurement will be made of the individual items, but the removal of all such items will be construed to be included in the single lump sum for which payment is made. Payment will be made under Item 2104.601 (Remove Miscellaneous Structures) at the Contract lump sum bid price, which will be payment in full for all costs relative to removing miscellaneous structures.

SZ-30 **(2104) SALVAGE MISCELLANEOUS STRUCTURES**

Salvage Miscellaneous Structures from the in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

- SZ-30.1 Salvaged items are denoted on Sheets XX and XX of the SP XXXX-XXX Plan.
- SZ-30.2 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged items, from the job site to the storage site. The storage site is located on MnDOT property within the Metro area.
- SZ-30.3 Remove and dispose of all items deemed non-salvageable by MnDOT according to MnDOT 2104.
- SZ-30.4 Repair or replace any damage caused during the salvaging process to the satisfaction of the Engineer.

SZ-30.5 **MEASUREMENT AND PAYMENT**

No measurement will be made of the individual items, but the salvaging of all such items will be construed to be included in the single lump sum for which payment is made. Payment will be made under Item 2104.601 (Salvage Miscellaneous Structures) at the Contract lump sum bid price, which will be payment in full for all costs relative to salvaging miscellaneous structures.

SZ-31 **(2104) HAUL SALVAGED MATERIAL**

Load and haul salvaged materials, not required for installation elsewhere under this Contract, to the designated storage area(s) and deposit said materials in a manner satisfactory to the Engineer.

- SZ-31.1 The planned designated storage area(s) will be the MnDOT TMS Shelter campus located at the junction of TH 394 and TH 94. Verify with the Engineer the current designated storage area is the MnDOT TMS Shelter campus. The Storage area will be within the Metro area.
- SZ-31.2 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the salvaged items, from the job site to the storage site.
- SZ-31.3 Carefully clean and bundle, if appropriate, the salvaged materials to the satisfaction of the Engineer prior to loading.
- SZ-31.4 Give the Engineer at least 24 hour notice before salvaged materials are to be delivered to the storage area so that arrangements can be made available to accept the salvaged materials.
- SZ-31.5 Neatly stockpile the material at the storage site as directed by the Engineer.
- SZ-31.6 Carefully segregate salvaged material into lots at the storage area so that it can be easily and quickly placed in its proper storage location. Unload the salvaged material and place it at designated locations within the yard.

SZ-31.7 **MEASUREMENT AND PAYMENT**

No measurement will be made of the various Items that constitute Haul salvaged Material but all such work will be construed to be included in the single Lump Sum payment under Item 2104.601 (Haul Salvaged Material). Payment will be made under Item 2104.601 (HAUL SALVAGED MATERIAL), which will be compensation in full for all costs incidental thereto, including but not limited to hauling the materials, protecting the salvaged materials, depositing the salvaged materials, and all materials and labor necessary to construct the Haul Salvaged Material.

SZ-32 **(2521) 4" CONCRETE WALK SPECIAL**

Construct 4" Concrete Walk Special in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

- SZ-32.1 Repair or replace any damage caused to the conduit to the satisfaction of the Engineer.
- SZ-32.2 Construct 4" Concrete Walk Special when 1.5 feet of Cover cannot be achieved due to existing shallow rock.
- SZ-32.3 Pre-rip locations designated for 4" Concrete Walk Special in the Plan to determine if 4" Concrete Walk special is required.
- SZ-32.4 Utilize type 3G52HE Concrete
- SZ-32.5 Strip and reuse existing topsoil. Place a minimum of 6" topsoil for turf establishment.
- SZ-32.6 Utilize existing Granular Bedding materials according to MnDOT 3149. Utilize bedding 2 inches beneath the conduit to 2 inches above the conduit.

SZ-32.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the square foot of concrete constructed as specified. Payment will be made under Item 2521.618 (4" CONCRETE WALK SPECIAL) at the Contract bid price per square foot, which will be compensation in full for all costs incidental thereto, including but not limited to, Topsoil Stripping and Stockpiling, Excavation, Backfilling, Granular Bedding, and all materials and labor necessary to protect the conduit and construct the 4" Concrete Walk Special.

SZ-33 **(2545) INSTALL LIGHT FOUNDATION**

This work consists of Install Light Foundation Design E Modified salvaged elsewhere from the project in accordance with the manufacturers recommended installation instructions, details in the Plan, 2545.3 F.2 "Light Foundations", 2451 "Structures Excavations and Backfills":

SZ-33.1 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2545.602 (INSTALL LIGHT FOUNDATION) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including but not limited to, all materials and labor necessary to install the light foundation. Any damage caused to the light foundation shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

SZ-34 **(2550) MATERIALS**

Supplement MnDOT 2550.2A with the following provisions:

- SZ-34.1 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-34.2 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-34.3 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-34.4 Round and smooth sharp corners and edges of all F&I TMS components.

SZ-35 **STATE FURNISHED MATERIALS**

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

SZ-35.1 SFM will be provided to the Contractor with proper notice. Be responsible for any damage once MnDOT has provided access to the SFM.

SZ-35.2 **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-35.3 **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-35.4 **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-35.5 **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) See installation details (2550) INSTALL FIBER OPTIC PATCHING SHELTER on page 88.
- (D) 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.
- (E) Handle and secure the Fiber Optic Patching Shelter until installed.

SZ-35.6 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-35.7 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-35.8 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-35.9 **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 MnDOT's 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-35.10 **DMS, POST MOUNTED**

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

- (A) See (2550) INSTALL DMS, POST MOUNTED on page 118 for installation details.
- (B) Coordinate delivery dates with the DMS PM Manufacturer.
- (C) Unload the DMS PM when they are delivered. Depending on the time of delivery, install or store the DMS PM at MnDOT's facilities.
- (D) Use proper equipment to unload the DMS PM and a splitter bar when lifting to insure no damage to the DMS PM occurs.
- (E) 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.
- (F) Inspect the DMS PM, in the presence of the TMS Integrator, before the DMS PM leaves the storage site.

SZ-35.11 **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-35.12 **NON-INTRUSIVE DETECTOR**

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

SZ-35.13 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-35.14 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 27.
- (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-35.15 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 27.
- (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-35.16 NON-INTRUSIVE DETECTION CABLE

Be responsible for the following in regards to the cable associated with the Non-Intrusive Detection Hardware:

- (A) See page 120 (2550) NON-INTRUSIVE DETECTION HARDWARE for installation details.
- (B) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting Non-Intrusive Detection Cable from the storage site to the job site. The storage site is on MnDOT property in the Metro area. Inspect the cable in the presence of the TMS Integrator before the cable leaves the storage site.

SZ-35.17 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-35.18 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-35.19 CCTV CABLE

The cable associated with CCTV Hardware is a composite video, communications, and power control cable constructed specially for the Pelco Esprit Camera Unit. Perform the following:

- (A) See (2550) CCTV HARDWARE on page 93 for installation details
- (B) See (2550) INSTALL CCTV HARDWARE on page 96 for installation details.
- (C) See (2550) INSTALL CCTV HARDWARE on page 97 for installation details.
- (D) See (2550) CCTV CABINET on page 77 for installation details.
- (E) See (2550) CCTV CABINET on page 78 for installation details.
- (F) See (2550) CCTV CABINET on page 79 for installation details.
- (G) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting CCTV Cable from the storage site to the job site. The storage site is on MnDOT property in the Metro area. Inspect the cable in the presence of the TMS Integrator before the cable leaves the storage site.

SZ-35.20 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-36 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-36.1 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-36.2 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-37 GROUNDING

Furnish and install Grounding according to the following provisions:

SZ-37.1 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-37.2 **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-37.3 **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-37.4 **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-37.5 **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-37.6 **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-37.7 **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-37.8 **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-37.9 **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-37.10 **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-37.11 **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 28.
- (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-37.12 **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 28.
- (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-37.13 **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 22 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-37.14 **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-37.15 **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-37.16 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-37.17 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-37.18 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-38 LABELING

Furnish and install Labeling according to the following provisions:

SZ-38.1 Secure identifying labels to each fiber, cable, component, cabinet in the manner described in the Plan and these Special Provisions.

SZ-38.2 Do not use wire ties for labeling cables.

SZ-38.3 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-38.4 **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-38.5 **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-38.6 **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-38.7 **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-38.8 **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-38.9 **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-38.10 **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-38.11 **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-39 ELECTRICAL SERVICE

Coordinate the installation of Electrical Service in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-39.1 Provide power to the service panel(s) and verify the work to be done including all the associated costs.
- SZ-39.2 Maintain fully operational power Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer power from existing to proposed outside of these hours.
- SZ-39.3 Construct all TMS access gates proposed in the Plan within one month of start of construction. This is to facilitate the Power Utility companies completing their project construction responsibilities timely so contractual construction completion deadlines are met.
- SZ-39.4 Proposed source of power addresses will be identified in the Plan.

SZ-39.5 **POWER UTILITY COMPANY COORDINATION**

Apply the following provisions to the Power Utility Company Coordination requirements for Electrical Service:

- (A) Construct proposed power sources as denoted in the Plan. Contractor responsibilities are as follows:
 - a. Process the **existing** "Application for Electrical Service" for each location.
 - b. Coordinate with the Utility Company to ensure the proper location of electrical services provided by the Utility.
 - c. Coordinate the Utility Company construction with the Project construction schedule to ensure power is available when needed.
 - d. Coordinate with the Utility Company for installation of the power meter and power supply infrastructure.

- (B) Removed or salvaged power sources as denoted in the Plan. Contractor responsibilities are as follows:
- a. Coordinate with the Utility Company to ensure the proper location of electrical services by the Utility.
 - b. Coordinate the Utility Company construction with the Project construction schedule to ensure power is removed as needed.
 - c. Coordinate with the Utility Company for removal of the power meter and power supply infrastructure.
- (C) The Contractor is responsible for the “Application for Electrical Service” payment or any additional fees to the Utility Company for providing the electrical service connections. MnDOT has negotiated estimated costs for providing electrical service connections with the Power Utility Company. This information will be provided to the Contractor upon award of the Contract.
- (D) Secure approval from the Engineer for any changes to the Electrical Service shown in the Plan.
- (E) The Power Utility Company name is _____. Following are the name, phone number, location, premise number, and account number, responsibilities for each of the Project Power Utility Company Designers:
- a. Designer Name, Wk.: Phone Number, Cell: Phone Number,;
PROPOSED
 - i. Location, Premise Number, Account Number
REMOVAL, SALVAGE, OR ABANDON
 - ii. Location, Premise Number, Account Number

SZ-39.6 Notify MnDOT Business Services Section when MnDOT is to assume ownership of the proposed source of power. Following is the contact information:

Brandon Gfrerer (651) 234-7441
Metro Accounts Payable-MnDOT Mailstop 050
Waters Edge Building
1500 County Road B2
Roseville MN 55113

SZ-39.7 **MEASUREMENT AND PAYMENT**

No measurement will be made of the various Items that constitute Electrical Service but all such work will be construed to be included. Provide the Engineer a copy of the invoice from the power company. Payment will be made for the invoice cost paid to the power company plus 10%. This payment will be compensation in full for all costs incidental thereto, including but not limited to providing power to service panels, power company fees, Power Utility Company Coordination, notifying MnDOT of ownership details, and all materials and labor necessary to construct the Electrical Service.

SZ-40 **JOB SPECIFIC SPECIFICATION CONSIDERATIONS**

- SZ-40.1 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-40.2 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-40.3 A maximum of 30 Calendar days will be allowed for outages of Traffic Management System devices located within the project limits.

- SZ-40.4 Perform TMS Shelter Cabinet cutovers during the hours of 7:00 pm Friday to 5:00 am Monday.

- SZ-40.5 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-40.6 Signal Plans and Signal Special Provisions will describe all measurement, payment, quantities, and construction downstream from the NCP.

SZ-41 **PROJECT TESTING AND DOCUMENTATION SUBMITTALS**

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

- SZ-41.1 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, one submittal for Testing, and one submittal for As-builts. Include all required documentation in each submittal. Payment will not be made until a submittal package is received and approved by the Engineer.

- SZ-41.2 Provide Project Testing and Documentation Submittals for the following items:
 - (A) Components
 - (B) FO Cable Testing.
 - (C) As-builts

SZ-41.3 **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 42.
- (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 42.

(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-41.4 **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 85) 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 85.
- (E) Utilize a Manufacturer-recommended "OTDR Trace Analysis" software program. Conform the software to SZ-75.8 (A) (See page 85). 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 86 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-41.5 **AS-BUILTS**

Submit As-built drawings with deviations from the Plan shown in red on the Plan. These sheets do not satisfy the Contractor's responsibilities with regard to Gopher State One Call.

- (A) Submit As-Built Documentation Submittals to the Engineer subsequent to construction completion. Provide As-Built Documentation Submittals reflecting the final location of all items constructed for the project, not just the Components and FO Cable. Additionally, include any roadway or other construction included in the project.

SZ-41.6 **MEASUREMENT AND PAYMENT**

PROJECT TESTING AND DOCUMENTATION SUBMITTALS includes but shall not be limited to Testing and Documentation Submittals, Components, FO Cable Testing, As-BUILTS, 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-41.7 **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.

<i>Product Manufacturer</i>	Material Description	Special Provisions Section	“Has Met” or “APL” Part Number (No Submittal required if “has met” or “APL” part number listed here)	<i>Submittal Provided (P)</i>
	LTU	SZ-37.13		
	SGU	SZ-37.13		
	Ground Rod Connector	SZ-37.2		
	Lightning Rod Connector	SZ-37.2		
	Common Foundation Ground Well & Cover	SZ-47.23		
	Junction Box	SZ-48.4		
	Fiberoptic Splice Vault	SZ-49.9		
	Outdoor Fiber Splice Enclosure	SZ-50.7		
	Outdoor Fiber Splice Enclosure Accessories (Use Accessories which are consistent with the Outdoor Fiber Splice Enclosure part number)	SZ-50.7 SZ-94.13		
	Buried Cable Sign Plastic-Resin Sheath	SZ-51.9 SZ-101.7		
	DMS Control Cable 7.5 Pair Conductor No. 24	SZ-56.13		
	PTZ Cable	SZ-55.7		
	Video Cable RG-11	SZ-56	N/A-Submittal Required	
	Cat 6 Cable	SZ-56.12		
	Splice Encapsulator	SZ-58.7 SZ-117.9 SZ-116.16		
	RCS	SZ-59	N/A-Submittal Required	
	RCS Modified	SZ-60	N/A-Submittal Required	
	Flasher Signal	SZ-61	N/A-Submittal Required	

	RCS Head	SZ-59.10 SZ-60.10 SZ-61.10		
	Lane Control Signal	SZ-62	N/A-Submittal Required	
	Lane Control Signal Mounting Assembly	SZ-62	N/A-Submittal Required	
	MnPass Cabinet		N/A-Submittal Required	
	TMS Shelter Cabinet	SZ-63	N/A-Submittal Required	
	Surge suppressor	SZ-63.28		
	EIA Rack	SZ-63.28 SZ-96.7 SZ-95.3		
	TMS Shelter Cabinet Cable Tray	SZ-63.28		
	External Generator Receptacle	SZ-63.28		
	Splice Cabinet (BD-4)	SZ-70	N/A-Submittal Required	
	Service Cabinet	SZ-71.6		
	Service Cabinet Type Special	SZ-112.3		
	FDF	SZ-77.4		
	FDF Inner-Interbay Management Panel	SZ-77.4		
	FDF Lower Cable Trough	SZ-77.4		
	FDF Upper Horizontal Cable Trough	SZ-77.4		
	CCTV Hardware	SZ-85.10		
	CCTV Folding Pole	SZ-85.10		
	Non-Intrusive Detection Hardware	SZ-111.9		
	Non-Intrusive Detection Folding Pole	SZ-111.9		

	Temporary Communication System	SZ-74	N/A-Submittal Required	
	Lightning Protection Conductor	SZ-37.6 SZ-37.14		
	Parallel Splicer	SZ-37.6		
	CCTV Folding Pole Special	SZ-87.9		
	CCTV Cabinet	SZ-64.6 SZ-65.5 SZ-66.6		
	FO Splice Panel	SZ-92.8		
	FO Patch Panel	SZ-92.8		
	FO Splice/Patch Panel	SZ-92.8		
	Fiber Bulkhead Adapters	SZ-93.3 SZ-94.11		
	Indoor FO Pigtails	SZ-93.4 SZ-94.12		
	Pull Vault	SZ-104.7		
	Loop Preformed	SZ-116.16		
	Loop Sealant	SZ-117.9		
	Control Cabinet	SZ-119.26		
	Gate Arm with LED Indications	SZ-119	N/A-Submittal Required	
	Gate Arm Sheeting	SZ-119.27		
	Generator	SZ-120	N/A-Submittal Required	
	Pre-terminated armored FO Pigtail Cable	SZ-129.3		
	Armored FO Pigtail Cable	SZ-129.3		
	Fiber Optic Trunk Cable	SZ-129.3		
	8 inch LED	SZ-59.9 SZ-61.9 SZ-80.2 SZ-131.3		
	Flashing Beacon System	SZ-132	N/A-Submittal Required	

SZ-42

INDUSTRY ACCEPTED LUBRICANTS FOR ALL CABLES

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

- SZ-42.1 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-42.2 Use lubricants that do not contain wax or grease.
- SZ-42.3 Apply the appropriate lubricant as specified by the manufacturer for its intended use.

SZ-43 **INSPECTION AND CLEANING EXISTING CONDUIT SYSTEMS**

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

- SZ-43.1 Existing TMS conduit systems may consist of stick PVC, stick PE, continuous PE, IMC or RSC.
- SZ-43.2 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-43.3 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-43.4 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-44 **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-44.1 **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-44.2 **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 longevity.
- (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-44.3 **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-44.4 **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-45 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-45.1 Stock approved splice kits to repair any MnDOT cable damaged by construction activities.
- SZ-45.2 Notify the Engineer and TMS Integrator of any damaged cable or damaged conduit that contains cables before starting repair.
- SZ-45.3 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-45.4 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-45.5 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-45.6 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-45.7 Repair and maintain cables severely damaged and not replaced in a timely manner until cable replacement is made.
- SZ-45.8 Furnish and install new cable for cable that has suffered damage caused by contract activities if the damage affects performance or longevity.
- SZ-45.9 Use Engineer and TMS Integrator approved materials to replace cable.
- SZ-45.10 **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-45.11 **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-46 **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-46.1 Provide slack cable within all handholes and Pull Vaults. Provide three feet for each cable entering or exiting a handhole or Pull Vault.
- SZ-46.2 Splices are not allowed in electric or electronic cable. The Engineer and TMS Integrator may approve splices.
- SZ-46.3 Construct Power, Control, and RF cable to be one-piece between termination points.
- SZ-46.4 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-46.5 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-46.6 **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-47 **(2550) FOUNDATIONS**

Furnish and install Foundations in accordance with MnDOT 2565.3, other applicable MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-47.1 Construct foundations in the location as required by the MnDOT Construction inspector and TMS Integrator. The TMS Integrator will stake foundation locations for the Contractor on request. Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before staking is needed.
- SZ-47.2 Use Concrete Mix 3G52 or equal unless otherwise noted on a MnDOT Standard Plan/Plate, the plan, or within these provisions.
- SZ-47.3 Construct conduits internal to the foundation per Plan.
- SZ-47.4 Use NMC conduits within foundations.
- SZ-47.5 Grout all openings around conduits.
- SZ-47.6 Construct typical concrete foundations four inches above and eight inches below the finished grade unless otherwise noted on a MnDOT Standard Plan/Plate, the plan, or within these provisions.
- SZ-47.7 Furnish and install ground rods as per Plan details. Where multiple items are located on the same pad it is acceptable to utilize a common ground rod.
- SZ-47.8 See GROUNDING on page 27 for grounding specifications.
- SZ-47.9 Precast foundations are allowed.
- SZ-47.10 Precast sidewalks are allowed. Remove any lifting loops if installed.
- SZ-47.11 Construct sidewalks as required per plan detail.
- SZ-47.12 Grade foundations, provide fill, and haul spoil as needed.
- SZ-47.13 Construct on concrete foundations after the concrete has cured for a minimum of seven days.
- SZ-47.14 **SPLICE CABINET FOUNDATION**
Apply the following provisions to the Splice Cabinet Foundation:
 - (A) See GROUNDING on page 27 for grounding specifications.
 - (B) Comply with with the Plan and Standard Plate No. 8119 Splice Cabinet (BD-4or BD-7) Foundation, except for the foundation is 24 inches by 24 inches by 12 inches thick.
 - (C) Center two NMC conduits in the Splice Cabinet (BD-4or BD-7) Foundation area (see Plan for sizes).
 - (D) Secure the splice cabinet (BD-4or BD-7) to the Splice Cabinet (BD-4or BD-7) Foundation with 4 inch long, 0.5 inch Stainless Steel Quick Bolts (wedge bolts). Use Manufacturer's recommendations for mounting brackets.

- (E) Furnish and install the Pedestal (BD-4or BD-7) Foundation 4 inches above the finished grade.

SZ-47.15 **RAMP CLOSURE OR CONTROL CABINET (GATE ARM) FOUNDATION**

Apply the following provisions to the Ramp Closure Gate Foundation:

- (A) See GROUNDING on page 27 for grounding specifications.
- (B) Foundation Comply with the Plan and Standard Plate No. 8112 as modified by the Plan details for the Ramp Closure Gate and/or Control Cabinet (Gate Arm) Foundation.
- (C) Secure the Ramp Closure Gate and/or Control Cabinet (Gate Arm) to the Ramp Closure Gate Foundation with 4 inch long, 0.5 inch Stainless Steel Quick Bolts (wedge bolts).
- (D) Furnish and install the Ramp Closure Gate and/or Control Cabinet (Gate Arm) Foundation 4 inches above the finished grade.

SZ-47.16 **SERVICE FOUNDATION**

Apply the following provisions to Service Foundation:

- (A) Secure service components to the service foundation with 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).

SZ-47.17 **COMMON FOUNDATION**

Apply the following provisions to Common Foundation:

- (A) Comply with all applicable specifications designated for furnishing and installation of the separate items upon the Common Foundation.
- (B) **Ground Mounted Control Cabinet**
 - a. Secure Ground Mounted Control Cabinet to the Common Foundation with 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).
 - b. Comply with the Plan detail for the Common Foundation.
- (C) **Service Cabinet**
 - a. Secure Service Cabinet to the Common Foundation with 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).
- (D) **Ground Well and Cover**
 - a. Schedule 80 PVC
 - b. 12" Diameter and 24" Length
 - c. Cast iron cover rated for a 20,000 pound static load
 - d. Fit the cover into a cast iron ring for extra support
 - e. 61 pound weight

SZ-47.18 **CONTROL CABINET, GROUND MOUNTED FOUNDATION**

Apply the following provisions to Cabinet Foundation:

- (A) Secure Control Cabinet to the Foundation with 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).

- (B) Secure service equipment to the service foundation with 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).
- (C) Comply with Plan details for Control cabinet foundation.

SZ-47.19 **CCTV FOUNDATION**

Apply the following provisions to CCTV Foundation:

- (A) Comply with MnDOT Standard Plate 8120 with the following modifications for CCTV Foundations:
 - a. 8 foot depth.
 - b. Use three (3) Heavy Hex Leveling Nuts, as per ASTM A563 Grade DH and two (2) Galvanized Heavy Flat Washers for each Anchor Rod.
- (B) Utilize Concrete Mix 3G52 or equal.
- (C) Furnish and install two sidewalks. Locate each 3 foot by 3 foot by 4 inch sidewalk under the Pole Mounted CCTV Cabinet location and under the pole-crank location.

SZ-47.20 **TMS SHELTER CABINET OR FIBER OPTIC PATCHING SHELTER FOUNDATION**

Apply the following provisions to TMS Shelter Cabinet Foundation:

- (A) Furnish and install the TMS Shelter Cabinet Foundation footing and slab on a compacted aggregate base. Form the foundation to be (9 feet by 9 feet). Form the concrete footing portion of the foundation to be (1.5 feet) deep and one foot wide. Angle the footing up at 45 degrees to intersect the, six inches thick, slab; for a total depth of two feet.
- (B) Reinforce the TMS Shelter Cabinet Foundation with #13 metric (#4 English) rebar. Place two rebar three inches from the bottom of the footing, spaced six inches OC, and three inches from the outside edge. Reinforce the slab in both directions spaced 18 inches OC, with three inches clearance from outside edges.
- (C) Locate anchor bolt as needed to match the MnDOT furnished FO Patching Shelter.
- (D) Box out conduit access openings and cast into the footing. Locate conduit access openings to comply with the Plan conduit access opening details.
- (E) Furnish and install the TMS Shelter Cabinet Foundation sidewalks per the Plan detail..

SZ-47.21 **TMS SHELTER CABINET FOUNDATION**

Apply the following provisions to TMS Shelter Cabinet Foundation:

- (A) Furnish and install the TMS Shelter Cabinet Foundation per the TMS Shelter Cabinet Manufacturer's specifications.
- (B) Locate anchor bolts per manufacturer's recommendations.
- (C) Box out conduit access openings and cast into the footing. Locate conduit access openings to comply with the Plan conduit access opening details.
- (D) Furnish and install a sidewalk centered on all doors.

SZ-47.22 **SHELTER FOUNDATION**

Apply the following provisions to the Shelter Foundation for the FO Patching Shelter:

- (A) Furnish and install the Shelter Foundation per the FO Patching Shelter Cabinet Manufacturer's specifications.
- (B) Furnish and install a sidewalk centered on all doors.
- (C) Furnish and install four, one foot diameter by four feet deep circular footings cast in place. Place the four circular footings in a rectangular pattern.
- (D) Furnish and install grounding ring and rods at the time of foundation installation. See GROUNDING on page 27 for details.

SZ-47.23 **HAS MET**

The following items have met the above specifications:

- (A) Common Foundation Ground Well and Cover: Harger 362PS24CILS80
- (B) RCS and Flasher Signal Screw-in Foundation: Millerbernd Anchor Base with Hardware/Part No. 490A35.

SZ-47.24 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment for FOUNDATIONS for each 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 the costs incidental thereto, including but not limited to internal conduits and conductors, sidewalks, grounding, grouting around conduits, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.502	____ ____ ____ Foundation ____	each

SZ-48 **(2550) JUNCTION BOX**

Furnish and install a Junction Box, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-48.1 UL and NEMA 250 Type 4X rated and constructed with the following requirements:
 - (A) 19.72 inch x 15.72 inch x 8.45 inch.
 - (B) Make it from hot compression molded fiberglass reinforced polyester.
 - (C) Include a poured polyurethane seamless gasket that provides a watertight, dust-tight environmental seal.
 - (D) Aluminum (AL) Back Panel, Grade Aluminum 3003 H14 - No Finish.
- SZ-48.2 Use stainless on all external hardware.
- SZ-48.3 Mount the proposed Junction Box as indicated in the Plan.
- SZ-48.4 **HAS MET**
The following item has met the above specifications:

Junction Box: Stahlin Enclosure J2016HPL
Back Panel: Stahlin BP1210AL

SZ-48.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (JUNCTION BOX) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to all materials and labor necessary to construct Junction Box.

SZ-49 (2550) FIBEROPTIC SPLICE VAULT

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

SZ-49.1 See GROUNDING on page 27 for grounding specifications.

SZ-49.2 Install a MnDOT furnished fiber optic splice vault marker per the Plan detail. See **STATE FURNISHED FIBER OPTIC SPLICE VAULT MARKER** on page 26.

SZ-49.3 **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-49.4 Install a MnDOT furnished locator ball. See **LOCATOR BALLS** on page 22.

SZ-49.5 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-49.6 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-49.7 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-49.8 Coil FO Cables onto the FO coiling brackets within vaults.

SZ-49.9 **APL**

MnDOT approved Fiberoptic Splice Vault will be listed on the following Website:

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

SZ-49.10 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (FIBEROPTIC SPLICE 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 Fiberoptic Splice Vault.

SZ-50 (2550) OUTDOOR FIBER SPLICE ENCLOSURE

Furnish and install an Outdoor Fiber Splice Enclosure, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-50.1 **ENCLOSURE**

Apply the following provisions to the Enclosure part of the Outdoor Fiber Optic Splice Enclosure:

- (A) The enclosure shall have the following characteristics:
 - a. Sufficient desiccant (packaged silica) inside to reduce possible damage from moisture.
 - b. FO Cables enter and exit from the same end of the Outdoor Fiber Splice Enclosure.
 - c. Complete splicing without circuit disruption.
 - d. Insert FO cables without exceeding the minimum bending radius.
 - e. Include cable clamps for bonding to the armor of the FO cable.
 - f. Seals, gaskets, grommets, cable clamps, grounding straps, splice trays, splice sleeves, and any other necessary accessories needed.
- (B) Apply non-oxidizing coating to all connections.

SZ-50.2 Tape the FO Cables together as necessary near the Outdoor FO Splice Enclosure and throughout the slack length.

SZ-50.3 See GROUNDING on page 27 for grounding specifications.

SZ-50.4 **SPLICE TRAY**

Apply the following provisions to the Outdoor Fiber Optic Splice Enclosure Splice Tray:

- (A) Insert FO Cables without exceeding the minimum bending radius.
- (B) Mount splices on the splice chip.

SZ-50.5 See LABELING on page 33 for more details.

SZ-50.6 **MOUNTING**

Apply the following provisions to Mounting of the Outdoor Fiber Optic Splice Enclosure:

(A) **Type Split Case**

- a. Construct a bracket to mount the Outdoor Fiber Splice Enclosure in the splice vault which will fit the opening to the splice vault per plan detail. The objective of this bracket is to keep the splice enclosure off the floor of the vault. Construct the bracket is as follows:
 - i. The main support member is one inch x 1.5 inches variable “C” channel and may be perforated with web-centered holes. Vary the length dimension to fit the diameter of the access cover.
 - ii. Construct “Z” brackets with 0.1875 inch stainless steel 1.5 inches wide at the ends of the main support member. Rest the “Z” brackets on the vault lip of the round access cover.
 - iii. Hang the outdoor fiber splice enclosure from the bracket assembly with 0.125 inch stainless steel cable.

(B) **Type Dome**

- a. Mount the Outdoor Fiber Splice Enclosure to the side of the vault at a 45 degree angle with the cable-entry end pointing down.

SZ-50.7 **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-50.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (OUTDOOR FIBER SPLICE ENCLOSURE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, the enclosure, accessories, grounding, hanger hardware, mounting, pressure testing, and all materials and labor necessary to construct the Outdoor Fiber Splice Enclosure.

SZ-51 **(2550) BURIED CABLE SIGN**

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

- SZ-51.1 Modify MnDOT 3973 by substituting the word orange for the word yellow.
- SZ-51.2 Mark all fiber-route changes in direction (see Plan Detail) within seven days of FO cable installation.
- SZ-51.3 Construct the sign bottoms at 1.2 m (4 ft) above ground.
- SZ-51.4 Install the signpost three feet offset from the cable trench between the cable and the Right-of-way.
- SZ-51.5 Construct an orange-colored plastic resin sheath to enhance the visibility of buried cable signposts. The plastic resin sheath is: Triangular in shape, having a wall thickness of 0.08 ± 0.01 inch with a 3.31 ± 0.02 inch width of each side; Temperature stable from -40°C (-40°F) to 65°C (150°F), UV resistant; Made of Polypropylene; Installed on the above ground portion of each post below the bottom of the sign.
- SZ-51.6 Remove any existing buried cable signs currently marking inplace FO Cable proposed for removal or abandonment. Do this according to MnDOT 2104.
- SZ-51.7 **CONCRETE ENCASED FO CABLE WARNING SIGN PANELS**
Apply the following to the two MnDOT furnished, Contractor installed signs. See Plans:
 - (A) See STATE FURNISHED MATERIALS on page 22 for more details.
 - (B) Construct signs to comply with 3973.
 - (C) Construct the sign bottoms at 1.2 m (4 ft) above ground.
 - (D) Construct the signpost three feet offset from the cable trench between the cable and the Right-of-way.
 - (E) Construct an orange-colored plastic resin sheath to enhance the visibility of buried cable signposts. The plastic resin sheath is: Triangular in shape, having a wall thickness of 0.08 ± 0.01 inch with a 3.31 ± 0.02 inch width of each side; Temperature stable from -40°C (-40°F) to 65°C (150°F), UV resistant; Made of Polypropylene; Installed on the above ground portion of each post below the bottom of the sign.

SZ-51.8 **BURIED CABLE WARNING SIGNS**

Comply with MnDOT 3973 for the buried cable signs and the following modifications/supplements:

(A) The telephone number for the sign legend is 811.

SZ-51.9 APL
MnDOT approved Buried Cable Sign Plastic Resin Sheath is listed in the *Traffic Management Systems/ITS* section of the following Website:

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

SZ-51.10 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (BURIED CABLE SIGN) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to installation, the resin sheath, the post, mounting, removing existing signs over abandoned cable, and all materials and labor necessary to construct the Buried Cable Sign.

SZ-52 **(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-52.1 Do not apply the requirement for Red-colored conduit contained in MnDOT 3803.
- SZ-52.2 Use industry standard couplings.
- SZ-52.3 If adhesives and solvents are used, use ones that are compatible with the materials to be adhered.
- SZ-52.4 Connect to existing conduit utilizing standard couplings. Prepare existing conduit for coupling as indicated in the Plans.
- SZ-52.5 Construct all NMC proposed to contain FO cable to be continuous. Do not use stick conduit.
- SZ-52.6 Construct all NMC proposed to contain FO cable a minimum of 0.9 m (36 inches) below the finished grade.
- SZ-52.7 Construct all NMC under roads a minimum of 60 inches below finished grade and construct it continuous without joints.
- SZ-52.8 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-52.9 Construct standard bell ends all NMC ends to prevent damage to cables during installation.
- SZ-52.10 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-52.11 **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-52.12 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.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.503	(__") Non-Metallic Conduit	(linear foot)

SZ-53 (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-53.1 Provide UL listed Power and Control Cables.
- SZ-53.2 Terminate Power and Control cables unless otherwise directed by the Plans.
- SZ-53.3 See GROUNDING on page 27 for grounding details.
- SZ-53.4 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-53.5 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-53.6 Construct Electrical Metallic Tubing (EMT) according to the Plan.
- SZ-53.7 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-53.8 **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-53.9 **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-53.10 **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-53.11 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.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
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-54 (2550) LEAD-IN CABLE 2 CONDUCTOR NO 14

Furnish and install Lead-in Cable 2 Conductor No. 14, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-54.1 Comply with MnDOT 3815.2C4(b).
- SZ-54.2 Use a flat strap to pull cable through conduit to alleviate damage to the NMC bushings in the handhole or pull vault. Pulling cable with round rope will be permitted in conduit if it has an RSC bushing.
- SZ-54.3 Protect the Lead-in Cable 2 Conductor No. 14 ends at the handhole or pull vault if the cable is not spliced immediately.

SZ-54.4 MEASUREMENT AND PAYMENT

Measurement will be made by the length of Lead-in Cable 2 Conductor No. 14 furnished and installed complete in place as specified. Payment will be made under Item 2550.503 (LEAD-IN CABLE 2 CONDUCTOR NO 14) at the Contract bid price per linear foot, which will be compensation in full for all costs incidental thereto, including but not limited to pulling cable, protecting conductor ends, and all materials and labor necessary to construct the Lead-in Cable 2 Conductor No. 14.

SZ-55 (2550) PTZ CABLE

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

- SZ-55.1 Construct the PTZ Cable with the following requirements:
 - (A) Composite Video/Control/Power Cable.
 - (B) Video Cable
 - a. RG-59
 - b. Black PVC jacket.
 - c. 0.227 inch nominal O.D.
 - (C) Control Cable
 - a. STP 18 AWG

- b. Blue PVC jacket.
 - c. 0.219 inch nominal O.D.
- (D) Power Cable
- a. 2/C 18 AWG
 - b. White PVC jacket.
 - c. 0.244 inch nominal O.D.
- SZ-55.2 Pull this cable between the 340 cabinet and the proposed CCTV location on the sign bridge. The cable will be terminated by others.
- SZ-55.3 Provide ten feet of coiled slack cable in the ground control cabinet and 15 feet on the sign bridge adjacent to the proposed CCTV camera location.
- SZ-55.4 Protect the cable coiled on the sign bridge by encapsulating the end within an epoxy enclosure.
- SZ-55.5 Pre-connectorize the PTZ Cables so connecting the camera unit to the composite cable is accomplished by mating two connectors.
- SZ-55.6 A Hook-up drawing will be supplied by the TMS Integrator for termination of the cable.
- SZ-55.7 **HAS MET**
The following items have met the above specifications:
- a. PTZ Cable: Belden 502PTZ

SZ-55.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of PTZ Cable furnished and installed complete in place as specified. Payment will be made under Item 2550.503 (PTZ CABLE) at the Contract bid price per linear foot, which will be compensation in full for all costs incidental thereto, including all materials and labor necessary to construct the PTZ Cable.

SZ-56 (2550) TELEPHONE/COMMUNICATION/VIDEO CABLE

This work shall consist of furnishing and installing Telephone/Communication/Video Cable, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-56.1 Furnish Install, Terminate, and Splice Telephone/Communication/Video Cable according to Plan.
- SZ-56.2 Splice telephone cables in BD-4 and BD-7 cabinets with a weather resistant, crimp connector designed to splice three No. 19 conductors.
- SZ-56.3 Use UL listed Cables.
- SZ-56.4 Comply with MnDOT 3815.2 C6 for Telephone Cables.
- SZ-56.5 See GROUNDING on page 27 for grounding details.
- SZ-56.6 See LABELING on page 33 for labeling details.
- SZ-56.7 Provide ten feet of coiled slack cable in ground control cabinets and 39 feet in DMS cabinets.

SZ-56.8 **LIQUIDTIGHT CONDUIT**

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-56.9 **DMS CONTROL CABLE 7.5 PAIR CONDUCTOR NO. 24**

Apply the following provisions to DMS Control Cable 7.5 Pair Conductor No. 24:

- (A) Construct the DMS Control Cable 7.5 Pair Conductor No. 24 with the following Material requirements:
 - a. Seven, stranded, tinned copper, 24 AWG, PE insulated twisted pairs.
 - b. Individually number each pair with Mylar tape wrap.
 - c. One 20 gauge (AWG) stranded tinned copper drain wire.
 - d. Overall (100 percent shield coverage) aluminum-polyester shield.
 - e. Black-PE jacket with a wall thickness of 0.040 inch.
 - f. Maximum operating voltage of 300 V RMS.
 - g. A balanced characteristic impedance of 110 ohms $\pm 5\%$.
 - h. Nominal capacitance between conductors of 46 pF/m (14 pF/ft.).
 - i. Nominal outside diameter is 0.420 inch
- (B) Pull this cable between the ground control cabinet and the sign cabinet. The cable will be terminated by others.
- (C) Provide ten feet of coiled slack cable in ground control cabinets and 39 feet in DMS cabinets.

SZ-56.10 **CAT 6 CABLE**

Apply the following provisions to Cat 6 Cable:

- (A) Pull Cat 6 Cable for DMS between the ground control cabinet and the sign cabinet. The cable will be terminated by others.
- (B) Furnish and install Cat 6 Cable for Non-Intrusive Detection.

SZ-56.11 **VIDEO CABLE RG-11**

Apply the following provisions to Video Cable RG-11:

- (A) Complies with MnDOT 3815.2C7b
- (B) Center conductor is 14 AWG
- (C) The dielectric surrounding the Center conductor is made of Wall Foam polyethylene 0.1105 inch thick.
- (D) The cable has two layers of Braid shield over the Dielectric. Each shield is 34 AWG Bare copper. The shields are separated by a barrier of 0.03 inch thick wall polyethylene. Each shield provides 90 percent coverage.
- (E) The outer jacket is 0.0365 inch thick and made of High density, Black polyethylene
- (F) Outside diameter is less than 0.475 inch
- (G) Nominal Capacitance is 17.2 pF/foot.
- (H) Nominal Velocity of propagation is 78%
- (I) Nominal Attenuation at 200 MHz is 2.2 dB/100 foot

SZ-56.12 **APL**
 MnDOT approved Cat 6 Cable will be listed in the *Traffic Management Systems/ITS* section of the following Website:

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

SZ-56.13 **HAS MET**
 The following items have met the above specifications:

- (A) DMS Control Cable 7.5 Pair Conductor No. 24: The National Wire & Cable Corp. D-200-7PE with a black PE jacket.

SZ-56.14 **MEASUREMENT AND PAYMENT**
 Measurement will be made by the length of Telephone/communication/Video Cable furnished and installed complete in place as specified. Payment for TELEPHONE/COMMUNICATION/VIDEO CABLE 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 incidental thereto including but not limited to Termination, Liquidtight Conduit, DMS Control Cable 7.5 Pair Conductor No. 24, Cat 6 Cable, Video Cable RG-11 and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.503	Telephone Cable ____ Pair No. ____	linear foot
2550.503	DMS Control Cable ____ Pair CondNo ____	linear foot
2550.503	____ Cable____	linear foot

SZ-57 (2550) COAX CABLE LMR 600

Furnish and install flexible communication Coax Cable LMR 600, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-57.1 Construct the Coax Cable LMR 600 with the following requirements:

- (A) UV resistant, polyethylene jacketed cable, and designed for 20-year service outdoor use.
- (B) Black cable jacket.
- (C) RF shielding shall be greater than 90 dB.
- (D) 11.5 inches minimum bend radius.
- (E) High velocity gas-injected closed cell foam dielectric and bonded aluminum tape outer conductor.
- (F) 350 pound minimum tensile strength.
- (G) Operating temperature of between -40 and 185 degrees Fahrenheit.
- (H) Peak power of 40kW.
- (I) Maximum operating voltage of 300 V RMS.
- (J) A balanced characteristic impedance of 50 Ohms.
- (K) DC resistance of 0.53 ohms/1000 ft for the inner conductor and 1.2 ohms/1000 feet for the outer conductor.
- (L) Nominal outside diameter is 0.59 inch.

SZ-57.2 Pull this cable between the 334 cabinet and the proposed card reader location on the sign bridge. The cable will be terminated by others.

SZ-57.3 Coil ten feet of slack cable in the ground control cabinet and 15 feet on the sign bridge adjacent to the proposed sign reader location.

SZ-57.4 Protect the cable coiled on the sign bridge by encapsulating the end within an epoxy enclosure.

SZ-57.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of Coax Cable LMR 600 furnished and installed complete in place as specified. Payment will be made under Item 2550.503 (COAX CABLE LMR 600) at the Contract bid price per linear foot, which will be compensation in full for all costs incidental thereto, including all materials and labor necessary to construct the Coax Cable LMR 600.

SZ-58 (2550) LOOP DETECTOR SPLICE

Furnish and install Loop Detector Splice, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-58.1 See PROJECT TESTING AND DOCUMENTATION SUBMITTALS on page 38 for project testing and documentation details.

SZ-58.2 Clean existing handholes prior to utilization to the satisfaction of the Engineer and TMS Integrator.

SZ-58.3 **SPLICING LEAD-IN CONDUCTOR CABLE TO LOOP DETECTOR WIRE**

Apply the following provisions to Splicing Lead-in Conductor Cable to Loop Detector Wire for Loop Detector Splice:

- (A) Utilize a rosin core solder or rosin flux and solder to splice the loop conductor and the loop lead-in conductor.
- (B) Create separation between soldered splices by staggering the splices. Do not allow contact between soldered splices.
- (C) Place the splice through the cap into the tube of the splice kit so that the outer jacket of each conductor enters the encapsulator tube to ensure the splice is sealed by the epoxy. Place both loop conductor and lead-in conductor splices into the same end of the encapsulator tube.
- (D) Insert one half inch of roughed surface of the 2/C No. 14 lead-in cable outer jacket and the sawcut loop detector tubing into the epoxy. Provide a minimum one inch sand paper roughened surface protrusion outside the epoxy. Make the sand paper roughed surface protruding outside the epoxy visually verifiable. Cut off the exposed drain wire and the foil shield of the 2/C No. 14 Lead-in cable prior to inserting the outer jacket into the epoxy.
- (E) Attach the splice to the eyebolt near the top of the handhole (install an eyebolt if it is missing).
- (F) Verify that loop conductor cable identification markings (lane and cabinet ID) are correct and consistent with the Plan Detail prior to cutting the existing splices to Lead-in conductor Cable.
- (G) Notify the Engineer following the installation of the splice. A MnDOT representative will test the loop and lead-in system and terminate the lead-in within seven days.

SZ-58.4 **LEAD-IN SPLICE ENCAPSULATOR**

Apply the following provisions to the Lead-in Splice Encapsulator for Loop Detector Splice:

- (A) Splice detector loop and lead-in conductor wires as directed in the Plan Detail “TMS Loop Detector Typical – Part Two”. Include the following characteristics for the splice protection device:
 - a. Design for use in weather exposed or direct burial locations,
 - b. Allow making splices on unshielded synthetic insulated cables,
 - c. UL listed for direct burial and submerged applications up to 600 volts,
 - d. Capable of withstanding temperatures up to 90 °C,
 - e. Capable of accommodating conductor cable and connector outside diameters of up to 0.625 inch.

SZ-58.5 **PROTECT CONDUCTOR ENDS**

Apply the following provisions to Protect Lead Ends for the Loop Detector Splice:

- (A) Protect Loop Tail and Lead conductor ends whenever they are not immediately spliced to the 2/C No.14 in the handhole by performing the following:
 - a. Encapsulate wire ends with an epoxy type encapsulator.
 - b. Attach the encapsulated wires to the eyebolt near the top of the HH (furnish and install an eye bolt if it is missing from an existing handhole).

SZ-58.6 Construct loops and loop circuits including the lead-in cable with insulation resistance greater than 100 megohm to qualify as a good circuit. Troubleshoot and repair the problem if the insulation test is under 100 megohm.

SZ-58.7 **APL**

The following items have met the above specifications:

- (A) MnDOT approved Splice Encapsulator is listed on the following Website:

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

SZ-58.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (LOOP DETECTOR SPLICE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Project Testing and Documentation Submittals, Conductor, Lead-in Splice Encapsulator, Protecting Conductor Cable Ends, Splicing Lead-in Conductor Cable, and all materials and labor necessary to construct the Loop Detector Splice.

SZ-59 (2550) RAMP CONTROL SIGNAL DESIGN ONE-WAY

Furnish and install a Ramp Control Signal Design One-Way, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-59.1 Construct Ramp Control Signal Design One-Way of nonferrous materials, include the proper signing, comply with the Plan, Plan Details, Detail Signing Layout, Applicable Standard Plates, and 2550.

SZ-59.2 Apply anti-corrosive and anti-seizing compound to all threads. Use anti-seizing compound conforming to MIL Specification 907E.

SZ-59.3 Construct the entire RCS assembly plumb and tight.

SZ-59.4 Provide an anodic coating per MIL-A-8625C for Type II, Class I coating for exterior aluminum surfaces with the following exceptions:

(A) Provide 0.0007 inch outer coating

(B) Provide a coating mass of 0.042 mg per square meter,

(C) Seal anodic coated aluminum surfaces by immersing them in a 5 percent nickel acetate solution at 100° C (212° F) for 15 minutes.

SZ-59.5 **PEDESTAL**

The Pedestal consists of a base and shaft. Construct Pedestal in accordance with the applicable provisions of MnDOT Standard Plate No. 8122 and MnDOT 3832. Furnish and install a Pedestal base and shaft with the following characteristics:

(A) **Pedestal Base**

- a. Fabricated from cast aluminum conforming to the requirements of the Aluminum Association for Alloy No. 319.0.
- b. Anodized clear.
- c. Meet or exceed 2001 AASHTO breakaway requirements.
- d. Provide test reports from an FHWA approved independent laboratory certifying that the Manufacturer's pedestal base has been tested and conforms to AASHTO Standard Specifications for Structural Supports for Highway Signs. Conform to testing methods of either NCHRP Report 230, "Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances" or NCHRP 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". Additionally, submit a Manufacturer statement of certification from the FHWA stating such tests have been accepted and approved.

- e. Include a eight inches square anodized aluminum access door with a locking mechanism. Use a locking mechanism that has a 0.25 inch diameter by 1.5 inches stainless steel Allen head cap screw. Face the access door away from traffic.
- f. Use washers with the following characteristics:
 - i. USS flat washer
 - ii. Hardened
 - iii. Galvanized
 - iv. Outside Diameter of two inches.
 - v. Inside Diameter of 0.8125 inch.
 - vi. Thickness of 0.1563 inch.

(B) **Pedestal Shaft**

- a. Consists of clear anodized aluminum.
- b. Outside diameter shall be 4.5 inches.
- c. 11 foot length
- d. 6061-T6 aluminum alloy
- e. Shaft wall 0.337 inch thick and weighing 5.18 lbs./ft..
- f. ANSI B2.1 threads.
- g. Spun finished

SZ-59.6 **RCS HEAD**

Comply with MnDOT 3834 and the following supplements or modifications:

- (A) Construct the RCS Head so wind or vibrations from traffic does not cause movement of it.

SZ-59.7 **LED**

Apply the following provisions to LED:

- (A) Furnish and install 8 inch LED indications according to Manufacturer recommendations and the Plan details.
- (B) See LABELING on page 33 for labeling details.

SZ-59.8 **SIGNAL CONNECTIONS**

Apply the following provisions to Signal Connections:

- (A) Connect cables to the signal head harness in the pedestal base. See the Plan Detail for detailed instructions, materials, and installation procedures.
- (B) See LABELING on page 33 for labeling details.

SZ-59.9 **APL**

MnDOT approved 8 inch LED are listed on the following Website:

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

SZ-59.10 **APL**

MnDOT approved RCS Heads are listed on the following Website:

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

SZ-59.11 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.502 (RAMP CONTROL SIGNAL DESIGN ONE-WAY) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Pedestal, RCS Head, LED, Signal Connections, and all materials and labor necessary to construct the Ramp Control Signal Design One-Way.

SZ-60 **(2550) RAMP CONTROL SIGNAL DESIGN MODIFIED**

Furnish and install Ramp Control Signal Design Modified, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-60.1 Construct Ramp Control Signal Design Modified of nonferrous materials, include the proper signing, comply with the Plan, Plan Details, Detail Signing Layout, Applicable Standard Plates, and 2550.

SZ-60.2 Apply anti-corrosive and anti-seizing compound to all threads. Use anti-seizing compound conforming to MIL Specification 907E.

SZ-60.3 Construct the entire RCS assembly plumb and tight.

SZ-60.4 Provide an anodic coating per MIL-A-8625C for Type II, Class I coating for exterior aluminum surfaces with the following exceptions:

(A) Provide 0.0007 inch outer coating

(B) Provide a coating mass of 0.042 mg per square meter,

(C) Seal anodic coated aluminum surfaces by immersing them in a 5 percent nickel acetate solution at 100° C (212° F) for 15 minutes.

SZ-60.5 **PEDESTAL**

The Pedestal consists of a base and shaft. Construct Pedestal in accordance with the applicable provisions of MnDOT Standard Plate No. 8122 and MnDOT 3832. Furnish and install a Pedestal base and shaft with the following characteristics:

(A) **Pedestal Base**

- a. Fabricated from cast aluminum conforming to the requirements of the Aluminum Association for Alloy No. 319.0.
- b. Anodized clear.
- c. Meet or exceed 2001 AASHTO breakaway requirements.
- d. Provide test reports from an FHWA approved independent laboratory certifying that the Manufacturer's pedestal base has been tested and conforms to AASHTO Standard Specifications for Structural Supports for Highway Signs. Conform to testing methods of either NCHRP Report 230, "Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances" or NCHRP 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". Additionally, submit a Manufacturer statement of certification from the FHWA stating such tests have been accepted and approved.
- e. Include a eight inches square anodized aluminum access door with a locking mechanism. Use a locking mechanism that has a 0.25 inch diameter by 1.5 inches stainless steel Allen head cap screw. Face the access door away from traffic.
- f. Use washers with the following characteristics:

- i. USS flat washer
- ii. Hardened
- iii. Galvanized
- iv. Outside Diameter of two inches.
- v. Inside Diameter of 0.8125 inch.
- vi. Thickness of 0.1563 inch.

(B) **Pedestal Shaft**

- a. Consists of clear anodized aluminum.
- b. Outside diameter shall be 4.5 inches.
- c. 11 foot length
- d. 6061-T6 aluminum alloy
- e. Shaft wall 0.337 inch thick and weighing 5.18 lbs./ft..
- f. ANSI B2.1 threads.
- g. Spun finished

SZ-60.6 **RCS HEAD**

Comply with MnDOT 3834 and the following supplements or modifications:

- (A) Construct the RCS Head so wind or vibrations from traffic does not cause movement of it.

SZ-60.7 **LED**

Apply the following provisions to LED:

- (A) Furnish and install 8 inch LED indications according to Manufacturer recommendations and the Plan details.
- (B) See LABELING on page 33 for labeling details.

SZ-60.8 **SIGNAL CONNECTIONS**

Apply the following provisions to Signal Connections:

- (A) Connect cables to the signal head harness in the pedestal base. See the Plan Detail for detailed instructions, materials, and installation procedures.
- (B) See LABELING on page 33 for labeling details.

SZ-60.9 **APL**

MnDOT approved 8 inch LED is listed on the following Website:

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

SZ-60.10 **APL**

MnDOT approved RCS Heads are listed on the following Website:

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

SZ-60.11 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.502 (RAMP CONTROL SIGNAL DESIGN MODIFIED) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Pedestal, RCS Head, LED, Signal Connections, and all materials and labor necessary to construct the Ramp Control Signal Design Modified.

SZ-61 **(2550) FLASHER SIGNAL**

Furnish and install Flasher Signal, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-61.1 Construct Flasher Signal of nonferrous materials, include the proper signing, comply with the Plan, Plan Details, Detail Signing Layout, Applicable Standard Plates, and MnDOT 2550.
- SZ-61.2 Apply anti-corrosive and anti-seizing compound to all threads. Use anti-seizing compound conforming to MIL Specification 907E.
- SZ-61.3 Construct the entire Flasher Signal assembly plumb and tight.
- SZ-61.4 Provide an anodic coating per MIL-A-8625C for Type II, Class I coating for exterior aluminum surfaces with the following exceptions:
 - (A) Provide 0.0007 inch outer coating
 - (B) Provide a coating mass of 0.042 mg per square meter,
 - (C) Seal anodic coated aluminum surfaces by immersing them in a 5 percent nickel acetate solution at 100° C (212° F) for 15 minutes.

SZ-61.5 **PEDESTAL**

The Pedestal consists of a base and shaft. Construct Pedestal in accordance with the applicable provisions of MnDOT Standard Plate No. 8122 and MnDOT 3832. Furnish and install a Pedestal base and shaft with the following characteristics:

(A) **Pedestal Base**

- a. Fabricated from cast aluminum conforming to the requirements of the Aluminum Association for Alloy No. 319.0.
- b. Anodized clear.
- c. Meet or exceed 2001 AASHTO breakaway requirements.
- d. Provide test reports from an FHWA approved independent laboratory certifying that the Manufacturer's pedestal base has been tested and conforms to AASHTO Standard Specifications for Structural Supports for Highway Signs. Conform to testing methods of either NCHRP Report 230, "Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances" or NCHRP 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". Additionally, submit a Manufacturer statement of certification from the FHWA stating such tests have been accepted and approved.
- e. Include a eight inches square anodized aluminum access door with a locking mechanism. Use a locking mechanism that has a 0.25 inch diameter by 1.5 inches stainless steel Allen head cap screw. Face the access door away from traffic.
- f. Use washers with the following characteristics:
 - i. USS flat washer
 - ii. Hardened
 - iii. Galvanized
 - iv. Outside Diameter of two inches.
 - v. Inside Diameter of 0.8125 inch.
 - vi. Thickness of 0.1563 inch.

(B) **Pedestal Shaft**

- a. Consists of clear anodized aluminum.
- b. Outside diameter shall be 4.5 inches.
- c. 11 foot length
- d. 6061-T6 aluminum alloy
- e. Shaft wall 0.337 inch thick and weighing 5.18 lbs./ft..
- f. ANSI B2.1 threads.
- g. Spun finished

SZ-61.6 **RCS HEAD**

Comply with MnDOT 3834 and the following supplements or modifications:

- (A) Construct the RCS Head so wind or vibrations from traffic does not cause movement of it.

SZ-61.7 **LED**

Apply the following provisions to LED:

- (A) Furnish and install 8 inch LED indications according to Manufacturer recommendations and the Plan details.
- (B) See LABELING on page 33 for labeling details.

SZ-61.8 **SIGNAL CONNECTIONS**

Apply the following provisions to Signal Connections:

- (A) Connect cables to the signal head harness in the pedestal base. See the Plan Detail for detailed instructions, materials, and installation procedures.
- (B) See LABELING on page 33 for labeling details.

SZ-61.9 **APL**

MnDOT approved 8 inch LED is listed on the following Website:

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

SZ-61.10 **APL**

MnDOT approved RCS Heads are listed on the following Website:

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

SZ-61.11 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.502 (FLASHER SIGNAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Pedestal, RSC Head, LED, Signal Connections, and all materials and labor necessary to construct the Flasher Signal.

SZ-62 **(2550) LANE CONTROL SIGNAL**

Furnish and install a Lane Control Signal, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-62.1 Construct Lane Control Signal of nonferrous materials, include the proper signing, comply with the Plan, Plan Details, Detail Signing Layout, Applicable Standard Plates, and MnDOT 2550.

SZ-62.2 **LCS**

Apply the following provisions to the LCS:

- (A) Use UL listed LCS.
- (B) Use stainless steel ardware and fasteners.
- (C) Provide LCS with a minimum lamp life of 50,000 hours and a service life of 10 years.
- (D) See GROUNDING on page 27 for grounding details.
- (E) See LABELING on page 33 for labeling details
- (F) Warranty the LCS for 2 years. Begin the warranty period when the Certificate of Final Acceptance has been executed according to MnDOT 1516. Provide MnDOT with all Manufacturer warranty claim information.
- (G) Construct the LCS plumb and tight.
- (H) Construct the LCS so wind or vibrations from traffic does not cause movement of it.
- (I) Use transformers or LED drivers to reduce the incoming 120V to the Manufacturer recommended voltage and current.
- (J) Use a LCS capable of continuous operation in a temperature range of -35 to 140 degrees Fahrenheit (-37 to 60 degrees Celsius).
- (K) Use a LCS with a weight no greater than 70 pounds.
- (L) Use a LCS with a visor depth no greater than 6 inches and a total depth of the LCS assembly including the visor depth no greater than 14 inches.

SZ-62.3 **HOUSING AND DOORS**

Apply the following provisions to the LCS Housing:

- (A) Use a housing with a horizontal width from outside corner to outside corner no greater than 27 inches and a vertical height from outside corner to outside corner no greater than 27 inches.
- (B) Use a housing with continuous stainless steel hinges and dimensions 1.25 inches by 24 inches to attach the housing to the doors.
- (C) Construct with extruded aluminum.
- (D) Include a 1.5 inches diameter National Pipe Thread aluminum mounting hub on the top of the housing.
- (E) Use housing and doors with gaskets that create a watertight seal.
- (F) Use doors with one or more stainless steel locks to secure the door and make a weatherproof seal with the gasket.
- (G) Include drainage holes and locate them on the housing bottom.

SZ-62.4 **LED, PIXELS, AND DISPLAY**

Apply the following provisions to LED and pixels:

- (A) 4 LED per pixel.
- (B) Yellow, Green, and Red LED shall be steady, non-flashing
- (C) Use a conformal coated LED.
- (D) Protect LED points with a clear matte polycarbonate lens to minimize reflection.
- (E) Use a display with an illumination for 3-way models.
- (F) Include the following 3 models in the display:
 - a. Yellow arrow
 - b. Green arrow
 - c. Red X
- (G) Use a display with a horizontal width from outside corner to outside corner no greater than 24 inches and a vertical height from outside corner to outside corner no greater than 24 inches.
- (H) Use display colors conforming to AASHTO.
- (I) Make the Display message blank when not energized.
- (J) Make the message visible anywhere within a 65 degree cone centered on the optic axis.

SZ-62.5 **SIGNAL CONNECTIONS**

Apply the following provisions to Signal Connections:

- (A) Terminate LCS cables in the Ground Mounted Control Cabinet. See the Plan Detail for detailed instructions, materials, and installation procedures.
- (B) Terminate LCS cables at the LCS. Match inplace cable connections.

SZ-62.6 **MOUNTING ASSEMBLY**

Apply the following provisions to the Mounting Assembly:

- (A) Furnish and install the required supports and mounting hardware. Submit shop drawings for these items to the Engineer for approval.

SZ-62.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.502 (LANE CONTROL SIGNAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, LCS, Housing and Doors, LED Pixels and Display, Signal Connections, Mounting Assembly, and all materials and labor necessary to construct the Lane Control Signal.

SZ-63 (2550) TMS SHELTER CABINET

Furnish and install a TMS Shelter Cabinet, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, and the Plans. Provide the TMS Shelter Cabinet with a climate controlled environment for electric, electronic, FO devices, and comply with the following:

- SZ-63.1 Conform to the following additional specifications:

Latest Edition of the International Building Code (IBC)
MN Energy Code, Chapter 1323
- SZ-63.2 MnDOT will provide a wiring diagram.
- SZ-63.3 See GROUNDING on page 27 for Grounding details.
- SZ-63.4 See LABELING on page 33 for labeling details.
- SZ-63.5 Attach the TMS Shelter Cabinet to the TMS Shelter Cabinet Foundation per the Manufacturer's recommendations.
- SZ-63.6 Use Pre-assembled concrete or natural stone fiberglass composite panels for construction.
- SZ-63.7 Join panels together vertically and horizontally to form a complete dustproof and watertight assembly. Seal all panel joints (wall-to-ceiling, wall-to-wall, and wall-to-floor) with a permanent weather seal.
- SZ-63.8 Use a step joint for the wall-to-floor joint. Use a step/groove joint for all other joints. Seal joints with precompressed sealant tape. Use a step-joint threshold and a drip cap over the door frame for all doorways.
- SZ-63.9 Conform welding to AWS D1.1 and AWS D1.4 and only use qualified welders.
- SZ-63.10 Cover the interior walls with 0.5 inch thick plywood and faced with white, fiberglass reinforced, plastic coating.
- SZ-63.11 Insulate with polyurethane foam or fiberglass batt insulation. Use insulation for the walls with a minimum R-value of 11 and a minimum R-value of 19 for the ceiling.
- SZ-63.12 Dimension the exterior of the TMS Shelter Cabinet to be (12 foot OD) wide X (18 foot OD) deep X (9.0 foot ID) high or (10 foot OD) wide X (12 foot OD) deep X (9.0 foot ID) high and have two doors. See Plan to determine which dimensions are applicable.
- SZ-63.13 Conduit access openings in the TMS Shelter Cabinet floor are as shown in the Plan Detail.
- SZ-63.14 Include the following with the TMS Shelter Cabinet:
- (A) Use a distribution panel that is 120/240 VAC, 100 A, and 32 position with the following additional features:
 - a. Provide a main breaker that is 100 A and 120/240 VAC.
 - b. Include circuit breakers according to the Plan detail.
 - c. Provide each branch circuit rated according to Plan requirements.
 - (B) Electrical transfer switch and external generator receptacle rated for 100A and compatible with MnDOT generator cable plugs.
 - (C) Two 24 Volt power supplies. One main 24 VAC with a plug-in cord for the Alarm circuits and one Secondary 24 VDC for the Access Controller.

- (D) An enclosure with a hinged cover containing but not limited to the following components:
- a. Access Controller.
 - b. The Main and Secondary power supplies for the Security Card-Key Access and Alarm systems
 - c. High and Low temperature relay
 - d. Tamper switch
 - e. Duplex receptacle

SZ-63.15 **SURGE SUPPRESSOR**

- (A) Include a surge suppressor with the following features:
- a. UL 1449 Second Edition listed and UL 1283 Listed filter.
 - b. Protects against transient voltage.
 - c. Provides a minimum of 150 kA dedicated discrete, all-mode: L-N, L-L, L-G, and N-G protection (L = Line, N = Neutral, G = Ground).
 - d. Provides Electromagnetic Interference and Radio Frequency Interference filtering.
 - e. Isolated the circuit by high-dielectric encapsulation.
 - f. 10 year free-replacement warranty shall be included.
 - g. Mounted on the TMS Shelter Cabinet load center.
 - h. A 2-Pole, 100 A circuit breaker.
 - i. LED status indicator with solid state diagnostics.

SZ-63.16 **19" E.I.A. RACK**

Apply the following provisions to 19" E.I.A. Rack:

- (A) Include the following features with the Manufacturer installed 19" E.I.A. Rack:
- a. EIA/ (TIA) 310-D compliant.
 - b. 18.31 inch on center mounting holes.
 - c. Gangable.
 - d. Four 16 gauge steel mounting rails, and are
 - e. Finished in black powder coat.
 - f. Drill and tap the front and back rails to accommodate #10-32 screws spaced for standard EIA equipment mounting.
 - g. Height is 76.125 inches.
 - h. Fit with two 15 A power strips; one horizontal rack-mount and one vertical mount with clips.
 - i. **Shelves**
 - i. Three 16 gauge, black powder coated shelves.
 - ii. Shelves with a solid bottom.
 - iii. Dimensions of 17.375 inches wide by 14.75 inches deep.
 - iv. 3 RU shelves racking height.
 - v. Each shelf supports up to 70 lbs.
- (B) Electrically isolate the 19" E.I.A. Racks from each other and the floor by utilizing aluminum "T" racks and insulators.

SZ-63.17 **ELECTRICAL CONDUIT**

Apply the following provisions to Electrical Conduit:

- (A) Use galvanized steel or corrosion resistant metal for Conduit raceways, fittings, and hardware.
- (B) Do not attach to cable trays.
- (C) Ream and secure ends to boxes or raceways with compression type connections.

SZ-63.18 **ELECTRICAL WIRING**

Apply the following provisions to Electrical Wiring:

- (A) Contain electrical wiring in conduit and raceways
- (B) Use copper wire.
- (C) Make all wire runs continuous.

SZ-63.19 **LIGHTING**

Apply the following provisions to Lighting:

- (A) Provide a minimum illumination at floor level of 150 fe.
- (B) Place light switches as close to the door frame as possible.

SZ-63.20 **RECEPTACLES**

Apply the following provisions to Duplex and Quadplex Receptacles:

- (A) 20 A and 120 VAC.
- (B) Locate per plan and at a minimum of every 4 running feet of horizontal wall area and 4 feet above the finished floor surface.
- (C) Equip the TMS Shelter Cabinet with individual circuits for the overhead rack receptacles (two circuits per quadplex receptacle) and one Outdoor Ground Fault Indicator (GFI) receptacle rated 20 A and 120 VAC. Place the Outdoor GFI receptacle near the Heating Ventilation Air Conditioning (HVAC) (See Plan Detail).
- (D) Electrical transfer switch and external generator receptacle rated for 100A and compatible with MnDOT generator cable plugs.
- (E) Provide a duplex within the alarm enclosure.

SZ-63.21 **CABLE TRAY**

Apply the following provisions to Cable Tray:

- (A) 12 inches wide and 4 inches deep.
- (B) Mount eight feet above the floor.
- (C) Center above the equipment racks.
- (D) Make continuous from the cable entry point to the last rack.

SZ-63.22 **FRONT AND REAR ACCESS DOORS**

Apply the following provisions to the Front and Rear Access Doors:

- (A) Dimensions are three feet wide by seven feet tall.
- (B) Commercial grade, insulated, minimum 24-gauge steel.
- (C) Include:

- a. Latch bolt with tamper protective guards and door position monitor switches.
 - b. A heavy duty parallel arm door closer mounted on the push-side with a lock-open option.
 - c. Small Form Interchangeable Core (SFIC) locking mechanism compatible to MnDOT keys.
- (D) Provide access to internal wiring connections.
- (E) Key to match MnDOT's standard TMS Shelter Cabinet key. Provide the key at time of manufacturing by MnDOT.
- (F) Include with the front door an electronically locked (fail secure) lever handle lockset which allows immediate exit.
- (G) Include with the front door a request to exit motion detector.
- (H) Include with the rear door a one way exit handle to allow opening from the inside only.

SZ-63.23 **SECURITY CARD-KEY ACCESS SYSTEM**

Apply the following provisions to the Security Card-Key Access System:

- (A) Compatible and fully expandable with a Johnson Control, S321-IP Network controller (latest revision)
- (B) Normally operates by card access with the ability to operate lock with a key if the power should fail.
- (C) Mount the card reader unit adjacent to the front door handle. Place the center of the card reader unit 36 inches above the top of the foundation.
- (D) Provide a door that defaults to the locked position during a power outage

SZ-63.24 **ALARM REQUIREMENTS**

Apply the following provisions to Alarm Requirements:

- (A) Connect all devices required to provide 24 VDC open contact alarm sensors which will be monitored by the security card-key access network controller.
- (B) Include an alarm panel enclosure tamper alarm.
- (C) Provide high/low temperature alarm contacts for the equipment space. The high/low temperature alarm sensors are independent of alarm sensors furnished as part of the HVAC package. Provide adjustable set points for the high and low temperature limits. Make the low temperature adjustable from 0-70 degrees F and high temperature adjustable from 40-180 degrees F.
- (D) Label dry contact switches for the following indications:
 - a. HVAC failure
 - b. Building high and low temperature
 - c. Access doors
 - i. Open or closed
 - ii. Bolt latched or unlatched
 - iii. Forced door
 - iv. Propped door
 - d. VDC powered Smoke detector
 - e. Motion detector

- f. Tamper

SZ-63.25 **ENVIRONMENTAL CONTROL SYSTEM**

The environmental control system consists of a Ventilation, Air Conditioning, and Heating systems. Govern these systems with a single thermostat that automatically exercises control of each system as needed. Govern them to prevent Ventilation, Air conditioning, and Heating systems from operating simultaneously. Apply the following additional provisions and requirements to Environmental Control System:

(A) **Ventilation**

- a. Use automatically thermostat actuated exhaust louver motors.
- b. Air exchange rate of at least 5.34 m³ (188.58 ft³) per minute.
- c. Filter and protect the intake portion of the Ventilation System on the outside with a weather hood secured to the exterior surface of the TMS Shelter Cabinet. Use a stainless steel screen to prevent the intrusion of insects and birds.
- d. Protect the exhaust portion of the Ventilation System by a weather hood secured to the exterior of the TMS Shelter Cabinet.
- e. Attach a stainless steel screen to the exterior of the exhaust portion of the Ventilation System to prevent insect intrusion.

(B) **Air Conditioning**

- a. Equip with a high-energy efficient air-conditioner.
- b. Includes a minimum 5-year warranty on the compressor.
- c. Size to provide a safety factor of 2 times the volume, when maintaining an interior temperature of 80 degrees F (exclusive of equipment heat loading) when exterior temperature is 100 degree F.

(C) **Heating**

- a. Size to provide a safety factor of 2 times the volume, when maintaining an interior temperature of 70° F when the exterior temperature is -30° F with a 30 mph wind.

SZ-63.26 **WARRANTY**

Apply the following to the TMS Shelter Cabinet Warranty:

- (A) Have the Manufacturer warrant to the Owner (MnDOT) the equipment to be delivered conforms to the specifications and is free from materials and workmanship defects.
- (B) Have the Manufacturer warrant all materials and workmanship supplied under their standard warranty program or for a period of one year, whichever is greater, from the date of final completion and acceptance of the total completed work by the Owner (MnDOT).
- (C) If any defect or malfunction occurs in any TMS Shelter Cabinet or included equipment within the warranty period, have the Manufacturer remove the malfunctioning unit at the site, determine the cause, repair or replace, and reinstall the unit at the Manufacturer's sole cost and expense. Accomplish the repair or replacement work on a timely basis in according response to the effects resulting from the defect or malfunction.
- (D) Accomplish repairs or replacements in accordance with this section, even if the repair or replacement period exceeds the specified warranty time, if the Manufacturer was alerted to the problem during the warranty period.
- (E) Place a sticker depicting warranty information on the wall underneath the front door light switch. Denote on the sticker the shipping and warranty expiration date.

SZ-63.27 **SUBMITTAL REQUIREMENTS**

Apply the following provisions to Submittal Requirements:

- (A) Provide a full submittal for all TMS Shelter Cabinets, even if a Has Met is used. See PROJECT TESTING AND DOCUMENTATION SUBMITTALS on page 38 for additional details.
- (B) Submit Manufacturer's information on how the air conditioner and heater size was determined to the Engineer.

SZ-63.28 **HAS MET**

The following items have met the above specifications:

- (A) Surge Suppressor: MTL Surge Technologies Model No. ZD16200
- (B) External Generator receptacle: Appleton No. AJA1034-2001
- (C) SFIC Locking mechanism: Schlage ND80PDEU.
- (D) **19" E.I.A Rack**
 - a. 19 inches E.I.A. Rack: Middle Atlantic 19" WRK Series Rack, Part No. WRK-40-27.
 - b. Rack shelves: Middle Atlantic rack accessory shelf, Part No. U3.
 - c. Horizontal Rack Mount and Vertical Mount Power Strips: Middle Atlantic PD-915R and PD-1415C-NS.
- (E) Cable Tray: CABLOFIL No. CF105/300

SZ-63.29 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.502 (TMS SHELTER CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Surge Suppressor, 19" E.I.A Rack(s), Electrical Conduit, Electrical Wiring, Lighting, Duplex and/or Quadplex Receptacles, Cable Tray, Environmental Control System, Access Door(s), Alarm Requirements, Grounding, Labeling, Warranty, Submittal Requirements, Inspection and Testing Requirements, and all materials and labor necessary to construct the TMS Shelter Cabinet.

SZ-64 **(2550) CCTV CABINET**

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

- SZ-64.1 MnDOT will furnish and install PTZ cameras. See STATE FURNISHED MATERIALS on page 22.
- SZ-64.2 Notify the TMS Integrator when the construction of the CCTV Cabinet is complete.
- SZ-64.3 See GROUNDING on page 27 for grounding specifications.

SZ-64.4 **CCTV ASSEMBLY CABLES**

Deliver CCTV Assembly Cables in accordance with the following:

- (A) MnDOT will furnish CCTV Assembly Cables. See STATE FURNISHED MATERIALS on page 22 for additional details.

- (B) At the request of the TMS System Integrator, furnish and install a flat pull rope in the CCTV Standard in lieu of installing the CCTV Assembly Cable.
- (C) CCTV Assembly Cables are pre-connectorized so the connection between the camera unit and composite cable is accomplished by mating two connectors.
- (D) Install the CCTV Assembly Cables or furnish and install flat pull rope while the pole is on the ground.

SZ-64.5 **POLE MOUNTED CCTV CABINETS**

Furnish and install the Pole Mounted CCTV Cabinet in accordance with the following:

- (A) Furnish and install mounting brackets and hardware.
- (B) Be responsible for the terminal adapter, the 1.5 inch conduit, and creating the knockout opening for connection per plan detail. Place the conduit in a location where it does not obstruct the use of the pole crank or access to the base access door.

SZ-64.6 **APL**

MnDOT approved CCTV Cabinet is listed on the following Website:

<http://www.dot.state.mn.us/products/trafficmgtsystems/cctvmaterials.html>

SZ-64.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (CCTV CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, Grounding, CCTV Assembly Cables, Pole Mounted CCTV Cabinets, and all materials and labor necessary to Install CCTV Cabinet.

SZ-65 **(2550) CCTV CABINET**

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

SZ-65.1 Non-Intrusive detection units will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.

SZ-65.2 Notify the TMS Integrator when the installation of the CCTV Cabinet is complete.

SZ-65.3 See GROUNDING on page 27 for grounding specifications.

SZ-65.4 **NON-INTRUSIVE DETECTION CABLE**

Install Non-Intrusive Detection Cable in accordance with the following:

- (A) Non-Intrusive Detection Cable will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- (B) At the request of the TMS System Integrator, furnish and install a flat pull rope in the Non-Intrusive Detection Folding Pole in lieu of installing the Non-Intrusive Detection Cable.
- (C) Non-Intrusive Detection Cables are pre-connectorized so connecting the Non-Intrusive Detection unit to the composite cable is accomplished by mating two connectors.

SZ-65.5 **APL**
MnDOT approved CCTV Cabinet is listed on the following Website:

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

SZ-65.6 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (CCTV CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, Grounding, Non-Intrusive Detection Cable, Pole Mounted CCTV Cabinets, and all materials and labor necessary to Install CCTV Cabinet.

SZ-66 (2550) CCTV CABINET

Furnish and Install CCTV Cabinet, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-66.1 PTZ cameras will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.

SZ-66.2 Non-Intrusive detection units will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.

SZ-66.3 Notify the TMS Integrator when the installation of the CCTV Cabinet is complete.

SZ-66.4 See GROUNDING on page 27 for grounding specifications.

SZ-66.5 **POLE MOUNTED CCTV CABINETS**

Furnish and install Pole Mounted CCTV in accordance with the following:

- a. Furnish and install mounting brackets and hardware.
- b. Be responsible for the terminal adapter, the 1.5 inch conduit, and creating the knockout opening for connection per plan detail. Place the conduit in a location where it does not obstruct the use of the pole crank or access to the base access door.

SZ-66.6 **APL**
MnDOT approved CCTV Cabinet is listed on the following Website:

<http://www.dot.state.mn.us/products/trafficmgtsystems/cctvmaterials.html>

SZ-66.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (CCTV CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, Grounding, Pole Mounted CCTV Cabinets, and all materials and labor necessary to Install CCTV Cabinet.

SZ-67 (2550) INSTALL CCTV CABINET

Install CCTV Cabinet, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-67.1 PTZ cameras will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.

SZ-67.2 Notify the TMS Integrator when the installation of the CCTV Cabinet is complete.

SZ-67.3 See GROUNDING on page 27 for grounding specifications.

SZ-67.4 **CCTV ASSEMBLY CABLES**

Deliver CCTV Assembly Cables in accordance with the following:

- (A) CCTV Assembly Cables will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- (B) At the request of the TMS System Integrator, furnish and install a flat pull rope in the CCTV Standard in lieu of installing the CCTV Assembly Cable.
- (C) CCTV Assembly Cables are pre-connectorized so the connection between the camera unit and composite is accomplished by mating two connectors.
- (D) Install the CCTV Assembly Cables or furnish and install flat pull rope while the pole is on the ground.

SZ-67.5 **POLE MOUNTED CCTV CABINETS**

Install the Pole Mounted CCTV Cabinet in accordance with the following:

- (A) Pole Mounted CCTV Cabinets will be furnished by MnDOT. See **MnDOT FURNISHED POLE MOUNTED CCTV CABINET** on page 25 for additional details.
- (B) Furnish and install mounting brackets and hardware.
- (C) Be responsible for the terminal adapter, the 1.5 inch conduit, and creating the knockout opening for connection per plan detail. Place the conduit in a location where it does not obstruct the use of the pole crank or access to the base access door.

SZ-67.6 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (INSTALL CCTV CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to , Grounding, CCTV Assembly Cables, Pole Mounted CCTV Cabinets, and all materials and labor necessary to Install CCTV Cabinet.

SZ-68 **(2550) INSTALL CABINET**

Install Cabinet in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-68.1 MnDOT will furnish Control cabinets for foundation mounting and/or salvage them from the project. See STATE FURNISHED MATERIALS on page 22 for additional details.

SZ-68.2 See GROUNDING on page 27 for grounding specifications.

SZ-68.3 Construct conductors internal to the foundation according to the Plan.

SZ-68.4 Maintain full operation of existing Control cabinets Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer.

SZ-68.5 Secure Control cabinets to the foundation by utilizing 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).

SZ-68.6 Provide rodent control poison packets for all Control cabinets.

SZ-68.7 **RACKS**

Salvage and install Racks in accordance with the following:

- (A) Salvage the racks for installation from the Cabinet shell.
- (B) Salvage the ground mounted control cabinet rack from within the ground mounted control cabinet outer shell. Mount and isolate the ground mounted control cabinet rack in the shelter cabinet and provide electrical connections to an overhead outlet.
- (C) Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before transporting the Cabinet shell from the job site to the storage site. The storage site will be located on MnDOT property in the Metro area. Inspect the Cabinet shell in the presence of the TMS Integrator when the Cabinet shell arrives at the storage site.
- (D) Furnish and install the necessary unistruts to accommodate rack installation. Ensure that all existing and proposed unistruts are the same height.

SZ-68.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment for INSTALL CABINET for each 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 the costs incidental thereto, including but not limited to conductors internal to the foundation, mounting on a foundation, rodent control packets, Racks, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.502	Install ____ Cabinet	each

SZ-69 (2550) INSTALL NON-INTRUSIVE DETECTION CABINET

Install Non-Intrusive Detection Cabinet, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-69.1 Non-Intrusive Detectors will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.

SZ-69.2 Notify the TMS Integrator when the installation of the Non-Intrusive Detection Cabinet is complete.

SZ-69.3 See GROUNDING on page 27 for grounding specifications.

SZ-69.4 **NON-INTRUSIVE DETECTION CABLE**

Deliver Non-Intrusive Detection Cable in accordance with the following:

- (A) Non-Intrusive Detection Cable will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- (B) At the request of the TMS System Integrator, furnish and install a flat pull rope in the Non-Intrusive Detection Folding Pole in lieu of installing the Non-Intrusive Detection Cable.

- (C) The Non-Intrusive Detection Cables are be pre-connectorized so the connection between the Non-Intrusive Detection unit and the composite cable is accomplished by mating two connectors.

SZ-69.5 POLE MOUNTED NON-INTRUSIVE DETECTION CABINET

Install Pole Mounted Non-Intrusive Detection Cabinet in accordance with the following:

- (A) Pole Mounted Non-Intrusive Detection Cabinet will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- (B) Furnish and install mounting brackets and hardware.
- (C) Be responsible for the terminal adapter, the 1.5 inch conduit, and creating the knockout opening for connection per plan detail. Place the conduit in a location where it does not obstruct the use of the pole crank or access to the base access door.

SZ-69.6 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (INSTALL NON-INTRUSIVE DETECTION CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to , Grounding, Non-Intrusive Detection Cable, Pole Mounted Non-Intrusive Detection Cabinet, and all materials and labor necessary to Install Non-Intrusive Detection Cabinet.

SZ-70 (2550) SPLICE CABINET (BD-4)

Furnish and install Splice Cabinet (BD-4), in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-70.1 See GROUNDING on page 27 for grounding specifications.
- SZ-70.2 Provide a Splice Cabinet (BD-4) that complies with USDA RUS 1755.910, Specification for plant housings.
- SZ-70.3 Grout around all conduits coming through openings in the foundation.
- SZ-70.4 Provide rodent control poison packets for all Cabinets.

SZ-70.5 MEASUREMENT AND PAYMENT

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.502 (SPLICE CABINET (BD-4)) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, conductors internal to the foundation, mounting on a foundation, rodent control packets, grouting around conduits, grounding, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

SZ-71 (2550) SERVICE CABINET

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

- SZ-71.1 Maintain full operation of power service Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer existing to proposed service outside of these hours
- SZ-71.2 Mark conduit stubs leaving the service cabinet with a two-inch by two-inch wooden stake placed at the end of the stub. Expose five feet of the stake above ground and paint it orange.

- SZ-71.3 See GROUNDING on page 27 for grounding specifications.
- SZ-71.4 Service Cabinet circuit breaker sizes and quantities will be defined in the Plan details.
- SZ-71.5 Notify MnDOT Business Services Section when MnDOT is to assume ownership of the proposed source of power. Following is the contact information:

Brandon Gfrerer (651) 234-7441
Metro Accounts Payable-MnDOT Mailstop 050
Waters Edge Building
1500 County Road B2
Roseville MN 55113

- SZ-71.6 **APL**
MnDOT approved Service Cabinet is listed on the following Website:

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

- SZ-71.7 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.502 (SERVICE CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to the Service Cabinet, grounding, marking conduit stubs, installation, breakers, and all materials and labor necessary to construct the Service Cabinet.

SZ-72 (2550) SERVICE EQUIPMENT

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

- SZ-72.1 Use service components made of non-ferrous or stainless steel materials, with the exception of the meter socket, unless otherwise specified in the Plan.
- SZ-72.2 Maintain full operation of power service Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer existing to proposed service outside of these hours
- SZ-72.3 See GROUNDING on page 27 for grounding specifications.

- SZ-72.4 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified. Payment for SERVICE EQUIPMENT 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.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.502	Service Equipment	each
2550.502	Service Equipment Type ____	each

SZ-73 (2550) SERVICE INSTALLATION

Furnish and install a Service Installation, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-73.1 See Plan for proposed power source locations, addresses, and Service Installation details.

SZ-73.2 See GROUNDING on page 27 for grounding specifications.

SZ-73.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment for SERVICE INSTALLATION 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 Grounding, materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.502	Service Installation Type ____	each

SZ-74 (2550) TEMPORARY COMMUNICATION SYSTEM

Furnish and install Temporary Communication System. Construct the Temporary Communication to maintain existing Trunk FO Cable Communications during project construction, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-74.1 Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before beginning any interruption in Trunk Fiber Communications.

SZ-74.2 Comply with the National Electric Code (NEC) and National Electric Safety Code (NESC) requirements.

SZ-74.3 Provide Roadside Hazard Protection as required by the MnDOT Road Design Manual.

SZ-74.4 A Temporary 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”. Do not include FO Pigtail Cables located within the project limits that are impacted by the project roadway construction.

Provide FO Cable Schematics depicting the impact of the Temporary Communication System to the existing FO Trunk Cables and Temporary FO Links. Submit the FO Cable Schematics to MnDOT in a pdf format similar to the FO Cable Schematics shown in the Plan. Additionally, include all fibers from each location where FO splices are made to construct the Temporary Communication System.

SZ-74.5 Do not use wireless communication components unless approved by the Engineer.

SZ-74.6 Provide protection for components from voltage surges entering thru power or communication cabling. See GROUNDING on page 27 for Grounding requirements.

SZ-74.7 Maintain, troubleshoot, and repair the Temporary Communication system until the permanent proposed TMS is constructed and able to be utilized.

SZ-74.8 Provide MnDOT Plans for Approval. MnDOT will respond with comments or approval within 7 Calendar days.

SZ-74.9 **MEASUREMENT AND PAYMENT**

No measurement will be made of the various Items that constitute Temporary Communication System but all such work will be construed to be included in the single Lump Sum payment under Item 2550.601 (TEMPORARY COMMUNICATION SYSTEM), which will be compensation in full for all costs incidental thereto, including but not limited to maintaining all existing Trunk FO Communication for the duration of the project, and all materials and labor necessary to construct the Temporary Communication System.

SZ-75 **(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-75.1 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-75.2 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-75.3 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-75.4 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-75.5 Provide a calibration certificate dated no more than two years prior to the last dates of FO cable testing.

SZ-75.6 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-75.7 FO Cable Testing will be rejected if calibration certificates are out of date.

SZ-75.8 **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 86 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-75.9 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:

$$0.4 * [\text{Link length of FO Cable in kilometers}] + 1$$

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

$$[\text{Link length of FO Cable in kilometers}] + 1$$

- (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-75.10 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) preceded by a period.

Fiber Optic OTDR File Naming Convention

LAUNCH DIRECTION
┌ ----- CABLE I.D. ----- ┤ ┌ FIBER ┤ ┌ EXT ┤
C A B 6 9 4 - 5 0 . 4 7 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-75.11 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-76 (2550) INSTALL FIBER OPTIC PATCHING SHELTER

Install FO Patching Shelter in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-76.1 MnDOT will furnish the FO Patching Shelter. See STATE FURNISHED MATERIALS on page 22 for additional details.

SZ-76.2 See GROUNDING on page 27 for grounding specifications.

SZ-76.3 Maintain full operation of FO Patching Shelters Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer existing to proposed service outside of these hours

SZ-76.4 Determine the bolt spacing for a six feet by eight feet FO Patching Shelter. Duplicate the bolt spacing of the MnDOT Furnished FO Patching Shelter.

SZ-76.5 Use 0.625 inch diameter anchor bolts with a minimum of seven inches embedded or grouted in the concrete foundation.

SZ-76.6 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (INSTALL FIBER OPTIC PATCHING SHELTER) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to installation, grounding, attaching to the foundation, and all materials and labor necessary to construct the Install FO Patching Shelter.

SZ-77 (2550) FIBER DISTRIBUTION FRAME

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

SZ-77.1 Place the Fiber Distribution Frame within the TMS Shelter Cabinet.

SZ-77.2 Include the following FDF features:

(A) Inner-Interbay management for storage between bays and strain relief.

- (B) Upper/lower cable troughs.
- (C) A 23 inches frame assembly drilled and tapped to fit splice and patch panel modules.
- (D) Provide a frame assembly with 84 inches of panel space, with upper and lower horizontal cable troughs as necessary.

SZ-77.3 Route trunk cables to the frame as directed by the TMS Integrator and fasten them to the cable strain relief supports.

SZ-77.4 **HAS MET**

The following items have met the above specifications:

- (A) 23” Fiber Distribution Frame: TELECT/02043-01+51
- (B) Below are ADC FL2000 products that meet the above specifications:

FL2000 Fiber Distribution Frame “*Has Met*” Products

FL2000 Items

23” Fiber Distribution Frame	ADC # PWUEF-7ERN
(2) Inner-Interbay Management Panels	ADC # FL2-INIMP-22RU
Lower Cable Trough	ADC # FL2-ACC012
Upper Horizontal Cable Trough	ADC # ADCCMTG02W

SZ-77.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (FIBER DISTRIBUTION FRAME) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, and all materials and labor necessary to construct the Fiber Distribution Frame.

SZ-78 **(2550) MODIFY SPLICE VAULT**

Furnish and install Modify Splice vault, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-78.1 **CONSTRUCTION REQUIREMENTS**

Construct Modify splice Vault in accordance with the following:

- (A) Install a 4 inch PVC pipe from the vault to daylight according to Plan details.
- (B) Maintain a minimum grade of 1% on the PVC outlet pipe.
- (C) Grout around the PVC pipe where it enters the splice vault.
- (D) Construct a concrete headwall with rodent guard at the outlet end of the PVC pipe.
- (E) Install a marker post at the concrete headwall.

SZ-78.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (MODIFY SPLICE VAULT) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Items shown on the Plan Details, Construction Requirements, and all materials and labor necessary to construct Modify Splice Vault.

SZ-79 **(2550) MODIFY SERVICE EQUIPMENT**

Furnish and install Modify Service Equipment in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-79.1 The location of the Modify Service Equipment is on TH XX near XXX.
- SZ-79.2 Remove a 100 A 2-pole breaker.
- SZ-79.3 Furnish and install 40 A 2-pole breaker.

SZ-79.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (MODIFY SERVICE EQUIPMENT) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Items shown on the Plan Details, Construction Requirements, and all materials and labor necessary to construct Modify Service Equipment.

SZ-80 **(2550) MODIFY FLASHER**

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

SZ-80.1 **CONSTRUCTION REQUIREMENTS**

Construct Modify Flasher in accordance with the following:

- (A) Replace indications between 9:00 am and 3:00 pm, Monday-Friday or between 7:00 pm Friday and 5:00am Monday unless approved by the Engineer.
- (B) Notify the TMS Integrator of any damage discovered prior to beginning any work.
- (C) Visually confirm the correct fuse for the indication prior to beginning the replacement of any indication. Accomplish this by removing the fuse in the Ground Mounted Control Cabinet and visually observing the behavior of the corresponding indication.
- (D) Remove existing Flasher Signal incandescent indication. The removed are the property of the Contractor, including but not limited to the incandescent bulbs and the lenses.
- (E) Furnish and Install new 8 inch LED indication according to locations and details shown in the Plan and according to Manufacturer recommendations.
- (F) See LABELING on page 33 for labeling details.
- (G) Replace the fuse and verify operation of the LED indications prior to leaving each site.

SZ-80.2 **APL**

MnDOT approved 8 inch LED is listed on the following Website:

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

SZ-80.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by each Signal Head with LED indications installed as specified. Payment will be made under Item 2550.602 (MODIFY FLASHER) at the Contract bid price per each, which will be

compensation in full for all costs incidental thereto, including but not limited to Items shown on the Plan Details, Construction Requirements, and all materials and labor necessary to construct Modify Flasher.

SZ-81 **(2550) INSTALL SPLICE CABINET**

Install the previously salvaged from the project Splice cabinet, internal and external components, and the cabinet foundation. Repair or replace any installed materials damaged from the removing, salvaging and delivering operation.

Install Splice Cabinet in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-81.1 See GROUNDING on page 27 for grounding specifications.
- SZ-81.2 Grout around all conduits coming through openings in the foundation.
- SZ-81.3 Construct conductors internal to the foundation per Plan.
- SZ-81.4 Construct two NMC conduits (see Plan for sizes) centered in the foundation face.
- SZ-81.5 Secure the pedestal to the foundation with 0.25 inch Stainless Steel Quick Bolts (wedge bolts). See pedestal manufacturer's recommendations for mounting brackets.
- SZ-81.6 Provide rodent control poison packets for all Cabinets.

SZ-81.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (INSTALL SPLICE CABINET) at the Contract bid price per each, will be compensation in full for all costs incidental thereto, including but not limited to installing splice cabinets salvaged elsewhere under this contract in new locations as specified in the Plan, furnishing and installing any other Splice Cabinet hardware components as may be required for the complete installation in addition to those materials available from the salvage operations, conductors internal to the foundation, mounting on a foundation, rodent control packets, Foundation, grouting around conduits, grounding, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

SZ-82 **(2550) WOOD POLE**

Furnish and install Wood Poles for mounting service equipment in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-82.1 **REQUIREMENTS**

Apply the following Requirements to Wood Poles:

- (A) Furnish wood poles as follows:
 - a. Conform to the American Standard Specifications and Dimensions for Wood Poles (ANSI 05.1).
 - b. Of the length specified in the Plans.
 - c. Of Class II unless otherwise specified in the Contract.
 - d. Of the species in Table 3491-1 Product and Usage D Poles, Lighting.
 - e. Treated with preservative in accordance with 3491, lighting poles. Do not use creosote.

SZ-82.2 **CONSTRUCTION REQUIREMENTS**

Apply the following Construction Requirements to Wood Poles:

- (A) Construct Wood Poles in the ground to a depth of approximately 20 percent of the pole length.

- (B) Excavate eight inches larger than the diameter of the base of the pole and free from loose material for placement.
- (C) Hoist the Wood Pole into place without damage and plumb or rake as directed by the Engineer.
- (D) Backfill with material consisting of selected earth or sand, free from rocks and excessive organic material and place in several lifts. Moisten and compact each lift. Construct the wood pole to eliminate any void area between the wood pole and backfill at the ground plane when placed under load.

SZ-82.3 MEASUREMENT AND PAYMENT

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (WOOD POLE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Requirements, Construction Requirements, and all materials and labor necessary to construct Wood Pole.

SZ-83 (2550) INSTALL WOOD POLE

Install Wood Pole with wood poles previously salvaged from this project in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-83.1 CONSTRUCTION REQUIREMENTS

Apply the following Construction Requirements to Wood Poles:

- (A) Construct Wood Poles in the ground to a depth of approximately 20 percent of the pole length.
- (B) Excavate eight inches larger than the diameter of the base of the pole and free from loose material for placement.
- (C) Hoist the Wood Pole into place without damage and plumb or rake as directed by the Engineer.
- (D) Backfill with material consisting of selected earth or sand, free from rocks and excessive organic material and place in several lifts. Moisten and compact each lift. Construct the wood pole to eliminate any void area between the wood pole and backfill at the ground plane when placed under load.

SZ-83.2 MEASUREMENT AND PAYMENT

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (INSTALL WOOD POLE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Construction Requirements, and all materials and labor necessary to construct Install Wood Pole.

SZ-84 (2550) INSTALL FIBER OPTIC SPLICE, PATCH, AND SPLICE/PATCH PANEL

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-84.1 MnDOT will furnish Splice, Patch, or Splice/Patch Panels. See STATE FURNISHED MATERIALS on page 22 for additional details.
- SZ-84.2 See GROUNDING on page 27 for grounding details.

SZ-84.3 See LABELING on page 33 for labeling details.

SZ-84.4 Install flush mounting kits and five inches recess rack mounting as needed.

SZ-84.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.602 (INSTALL 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 the installation of Fiber Optic Splice Panel, Splice Wheels, Splice Decks, Locks, Cable Clamps, Fiber Optic Patch Panel, and all materials and labor necessary to construct the Install Fiber Optic Splice, Patch, or Splice/Patch Panel.

SZ-85 **(2550) CCTV HARDWARE**

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

SZ-85.1 MnDOT will furnish and install PTZ cameras. See STATE FURNISHED MATERIALS on page 22.

SZ-85.2 MnDOT will furnish and install Non-Intrusive Detectors. See STATE FURNISHED MATERIALS on page 22.

SZ-85.3 Notify the TMS Integrator when the installation of the CCTV hardware is complete.

SZ-85.4 See GROUNDING on page 27 for grounding specifications.

SZ-85.5 **CCTV FOLDING POLE**

Include the following requirements:

(A) Install the CCTV Folding Pole per Plan details and Manufacturer's recommendations.

SZ-85.6 **CCTV CABLE**

Install CCTV Cable in accordance with the following:

(A) MnDOT will furnish CCTV Cable. See STATE FURNISHED MATERIALS on page 22 for additional details.

(B) Furnish and install a flat pull rope in the CCTV Standard instead of installing the CCTV Cable if the TMS Integrator makes this request.

(C) CCTV Cable will be pre-connectorized so connecting the camera unit to the composite cable will be accomplished by mating two connectors.

(D) Install the CCTV Cable or flat pull rope while the pole is on the ground.

SZ-85.7 **NON-INTRUSIVE DETECTION CABLE**

Install Non-Intrusive Detection Cable in accordance with the following:

(A) MnDOT will furnish Non-Intrusive Detection Cable. See STATE FURNISHED MATERIALS on page 22 for additional details.

(B) Furnish and install a flat pull rope in the Non-Intrusive Detection Folding Pole instead of installing the Non-Intrusive Detection Cable if the TMS Integrator makes this request.

- (C) Non-Intrusive Detection Cable will be pre-connectorized so connecting the Non-Intrusive Detection unit to the composite cable will be accomplished by mating two connectors.
- (D) Install the Non-Intrusive Detection Cable or flat pull rope while the pole is on the ground.

SZ-85.8 **POLE MOUNTED CCTV CABINETS**

Install Pole Mounted CCTV Cabinet in accordance with the following:

- (A) MnDOT will furnish Pole Mounted CCTV Cabinets. See MnDOT FURNISHED POLE MOUNTED CCTV CABINET on page 25 for additional details.
- (B) Construct the terminal adapter, the 1.5 inch conduit, and create the knockout opening for connection per plan detail. Do not construct the conduit in a way that obstructs the use of the pole crank or access to the base access door.

SZ-85.9 **RODENT ENTRY PROTECTION**

Apply the following provisions to Rodent Entry Protection:

- (A) Provide a means to prevent rodent entry into the base of the CCTV Folding Pole.
- (B) Propose a method of Rodent Entry Protection to the Engineer for approval.
- (C) Place Rodent Entry Protection at the same time the CCTV Folding Pole is installed
- (D) Rodent Entry Protection shall be stainless steel or non-ferrous.
- (E) Potential methods of Rodent Entry Protection include, but are not limited to, stainless wire cloth or flexible roofing ridge vent material.

SZ-85.10 **APL**

MnDOT approved CCTV Folding Pole is listed on the following Website:

<http://www.dot.state.mn.us/products/trafficmgtsystems/cctvmaterials.html>

SZ-85.11 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (CCTV HARDWARE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to CCTV Folding Pole, Grounding, CCTV Assembly Cables, Non-Intrusive Detection Cables, Pole Mounted CCTV Cabinets, Rodent Entry Protection, and all materials and labor necessary to construct the CCTV Hardware.

SZ-86 (2550) CCTV HARDWARE-SPECIAL

Furnish and install CCTV Hardware-Special in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-86.1 Include the same requirements as CCTV Hardware. However, vary the height of the CCTV Folding Poles according to the Plan.

SZ-86.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (CCTV HARDWARE-SPECIAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to CCTV Folding Pole, Grounding, CCTV Assembly

Cables, Pole Mounted CCTV Cabinets, Rodent Entry Protection, and all materials and labor necessary to construct the CCTV Hardware-Special.

SZ-87 **(2550) CCTV HARDWARE-SPECIAL**

Furnish and install CCTV Hardware-Special in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-87.1 Vary the CCTV Hardware-Special height of the CCTV Folding Pole according to the Plan.

SZ-87.2 MnDOT will furnish and install PTZ cameras. See STATE FURNISHED MATERIALS on page 22.

SZ-87.3 Notify the TMS Integrator when the installation of the CCTV Hardware-Special is complete.

SZ-87.4 See GROUNDING on page 27 for grounding specifications.

SZ-87.5 **CCTV FOLDING POLE**

Include the following requirements:

(A) Install the CCTV Folding Pole per Plan details and Manufacturer's recommendations.

SZ-87.6 **CCTV ASSEMBLY CABLES**

Install CCTV Assembly Cables in accordance with the following:

(A) MnDOT will furnish CCTV Assembly Cables. See STATE FURNISHED MATERIALS on page 22 for additional details.

(B) Furnish and install a flat pull rope in the CCTV Standard instead of installing the CCTV Assembly Cable if the TMS Integrator makes this request.

(C) CCTV Assembly Cable will be pre-connectorized so connecting the camera unit to the composite cable will be accomplished by mating two connectors.

(D) Install the CCTV Assembly Cables or flat pull rope while the pole is on the ground.

SZ-87.7 **POLE MOUNTED CCTV CABINETS**

Install Pole Mounted CCTV Cabinets in accordance with the following:

(A) MnDOT will furnish Pole Mounted CCTV Cabinets. See **MnDOT FURNISHED POLE MOUNTED CCTV CABINET** on page 25 for additional details.

(B) Construct the terminal adapter, the 1.5 inch conduit, and create the knockout opening for connection per plan detail. Do not construct the conduit in a way that obstructs the use of the pole crank or access to the base access door.

SZ-87.8 **RODENT ENTRY PROTECTION**

Apply the following provisions to Rodent Entry Protection:

(A) Provide a means to prevent rodent entry into the base of the CCTV Folding Pole.

(B) Propose a method of Rodent Entry Protection to the Engineer for approval.

(C) Place Rodent Entry Protection at the same time the CCTV Folding Pole is installed

- (D) Rodent Entry Protection shall be stainless steel or non-ferrous.
- (E) Potential methods of Rodent Entry Protection include, but are not limited to, stainless wire cloth or flexible roofing ridge vent material.

SZ-87.9 **APL**
MnDOT approved CCTV Folding Pole is listed on the following Website:

<http://www.dot.state.mn.us/products/trafficmgtsystems/cctvmaterials.html>

SZ-87.10 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (CCTV HARDWARE-SPECIAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to CCTV Folding Pole, Grounding, CCTV Assembly Cables, Pole Mounted CCTV Cabinets, Rodent Entry Protection, and all materials and labor necessary to construct the CCTV Hardware-Special.

SZ-88 **(2550) INSTALL CCTV HARDWARE**

Install salvaged CCTV Hardware and furnish and install CCTV Hardware as needed to complete the installation in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-88.1 MnDOT will furnish and install PTZ cameras. See STATE FURNISHED MATERIALS on page 22.

SZ-88.2 Notify the TMS Integrator when the installation of the CCTV hardware is complete.

SZ-88.3 See GROUNDING on page 27 for grounding specifications.

SZ-88.4 **CCTV FOLDING POLE**
Include the following requirements:

- (A) Install the CCTV Folding Pole per Plan details and Manufacturer's recommendations.

SZ-88.5 **CCTV ASSEMBLY CABLES**
Install CCTV Assembly Cables in accordance with the following:

- (A) MnDOT will furnish CCTV Assembly Cables. See STATE FURNISHED MATERIALS on page 22.
- (B) Furnish and install a flat pull rope in the CCTV Standard instead of installing the CCTV Assembly Cable if the TMS Integrator makes this request.
- (C) CCTV Assembly Cable will be pre-connectorized so connecting the camera unit to the composite cable will be accomplished by mating two connectors.
- (D) Install the CCTV Assembly Cables or flat pull rope while the pole is on the ground.

SZ-88.6 **CCTV POLE MOUNTED CONTROL CABINETS**
CCTV Pole Mounted Control Cabinet shall be installed by the Contractor in accordance with the following:

- (A) MnDOT will furnish Pole Mounted CCTV Cabinets. See STATE FURNISHED MATERIALS on page 22. Install salvaged CCTV Pole Mounted Cabinets.
- (B) Construct the terminal adapter, the 1.5 inch conduit, and create the knockout opening for connection per plan detail. Do not construct the conduit in a way that obstructs the use of the pole crank or access to the base access door.

SZ-88.7 **RODENT ENTRY PROTECTION**

Apply the following provisions to Rodent Entry Protection:

- (A) Provide a means to prevent rodent entry into the base of the CCTV Folding Pole.
- (B) Propose a method of Rodent Entry Protection to the Engineer for approval.
- (C) Place Rodent Entry Protection at the same time the CCTV Folding Pole is installed
- (D) Rodent Entry Protection shall be stainless steel or non-ferrous.
- (E) Potential methods of Rodent Entry Protection include, but are not limited to, stainless wire cloth or flexible roofing ridge vent material.

SZ-88.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (INSTALL CCTV HARDWARE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to installing salvaged CCTV hardware in new locations as specified in the Plan, furnishing and installing any other CCTV hardware components required for the complete installation in addition to those materials available from salvage operations, CCTV Folding Pole, Grounding, CCTV Assembly Cables, Pole Mounted CCTV Cabinets, Rodent Entry Protection, and all materials and labor necessary to Install CCTV Hardware.

SZ-89 **(2550) INSTALL CCTV HARDWARE**

Install salvaged CCTV Hardware in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-89.1 See (2550) CCTV HARDWARE on page 93 for additional details.

SZ-89.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (INSTALL CCTV HARDWARE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to installing salvaged CCTV hardware in new locations as specified in the Plan, furnishing and installing any other CCTV hardware components required for the complete installation in addition to those materials available from salvage operations, CCTV Folding Pole, Grounding, CCTV Assembly Cables, Pole Mounted CCTV Cabinets, Grounding, Rodent Entry Protection, and all materials and labor necessary to Install CCTV Hardware.

SZ-90 **(2550) INSTALL NON-INTRUSIVE DETECTION HARDWARE**

Install salvaged Non-Intrusive Detection Hardware and furnish and install Non-Intrusive Detection Hardware as needed to complete the installation in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-90.1 MnDOT will furnish and install Non-Intrusive Detectors. See STATE FURNISHED MATERIALS on page 22.

- SZ-90.2 Notify the TMS Integrator when the installation of the Non-Intrusive Detection Hardware is complete.
- SZ-90.3 See GROUNDING on page 27 for grounding specifications.
- SZ-90.4 **NON-INTRUSIVE DETECTION FOLDING POLE**
Include the following requirements:
- (A) Install the Non-Intrusive Detection Folding Pole per Plan details and Manufacturer's recommendations.
- SZ-90.5 **NON-INTRUSIVE DETECTION ASSEMBLY CABLES**
Install Non-Intrusive Detection Assembly Cables in accordance with the following:
- (A) MnDOT will furnish Non-Intrusive Detection Assembly Cables. See STATE FURNISHED MATERIALS on page 22.
 - (B) Furnish and install a flat pull rope in the Non-Intrusive Detection Folding Pole instead of installing the Non-Intrusive Detection Assembly Cable if the TMS Integrator makes this request.
 - (C) Non-Intrusive Detection Assembly Cables will be pre-connectorized so connecting the camera unit to the composite cable will be accomplished by mating two connectors.
 - (D) Install the Non-Intrusive Detection Assembly Cables or flat pull rope while the pole is on the ground.
- SZ-90.6 **CCTV POLE MOUNTED CONTROL CABINETS**
CCTV Pole Mounted Control Cabinet shall be installed by the Contractor in accordance with the following:
- (A) MnDOT will furnish Pole Mounted CCTV Cabinets. See STATE FURNISHED MATERIALS on page 22. Install salvaged CCTV Pole Mounted Cabinets.
 - (B) Construct the terminal adapter, the 1.5 inch conduit, and create the knockout opening for connection per plan detail. Do not construct the conduit in a way that obstructs the use of the pole crank or access to the base access door.
- SZ-90.7 **RODENT ENTRY PROTECTION**
Apply the following provisions to Rodent Entry Protection:
- (A) Provide a means to prevent rodent entry into the base of the CCTV Folding Pole.
 - (B) Propose a method of Rodent Entry Protection to the Engineer for approval.
 - (C) Place Rodent Entry Protection at the same time the CCTV Folding Pole is installed
 - (D) Rodent Entry Protection shall be stainless steel or non-ferrous.
 - (E) Potential methods of Rodent Entry Protection include, but are not limited to, stainless wire cloth or flexible roofing ridge vent material.
- SZ-90.8 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (INSTALL NON-INTRUSIVE DETECTION HARDWARE) at the Contract bid price per each, which

will be compensation in full for all costs incidental thereto, including but not limited to installing salvaged Non-Intrusive Detection Hardware in new locations as specified in the Plan, furnishing and installing any other Non-Intrusive Detection Hardware components required for the complete installation in addition to those materials available from salvage operations, Non-Intrusive Detection Folding Pole, Grounding, Non-Intrusive Detection Assembly Cables, Pole Mounted CCTV Cabinets, Rodent Entry Protection, and all materials and labor necessary to Install Non-Intrusive Detection Hardware.

SZ-91 **(2550) INSTALL NON-INTRUSIVE DETECTION HARDWARE**

Install salvaged Non-Intrusive Detection Hardware in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-91.1 See (2550) NON-INTRUSIVE DETECTION HARDWARE on page 120 for additional details.

SZ-91.2 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each installed as specified. Payment will be made under Item 2550.602 (INSTALL NON-INTRUSIVE DETECTION HARDWARE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to installing salvaged Non-Intrusive Detection Hardware in new locations as specified in the Plan, furnishing and installing any other Non-Intrusive Detection Hardware components required for the complete installation in addition to those materials available from salvage operations, Non-Intrusive Detection Folding Pole, Grounding, Non-Intrusive Detection Assembly Cables, Pole Mounted CCTV Cabinets, Grounding, Rodent Entry Protection, and all materials and labor necessary to Install Non-Intrusive Detection Hardware.

SZ-92 **(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-92.1 FO Splice/Patch Panel is a combination FO Splice Panel and FO Patch Panel unit.

SZ-92.2 See GROUNDING on page 27 for grounding specifications.

SZ-92.3 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-92.4 Mount five inch recess rack mounting.

SZ-92.5 **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-92.6 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-92.7 Mount five inch recess rack mounting.

SZ-92.8 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-92.9 **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-93 (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-93.1 Use the field termination method.

SZ-93.2 **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-93.3 **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-93.4 **APL**

MnDOT approved Indoor Pigtails are listed on the following Website:

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

SZ-93.5 **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-93.6 **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-94 (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-94.1 **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-94.2 **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-94.3 Use fusion type splices. Mechanical splices are prohibited.

- SZ-94.4 Locations of FO Cable Splicing are denoted in the Plan. Acquire the approval of the Engineer and TMS Integrator for additional locations.
- SZ-94.5 FO Cable Splicing locations are within cabinets and splice vaults.
- SZ-94.6 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-94.7 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-94.8 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-94.9 **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 27 for grounding specifications.
- SZ-94.10 **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-94.11 **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-94.12 **APL**

MnDOT approved products for Indoor Pigtails are listed on the following Website:

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

SZ-94.13 **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-94.14 **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) 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-95 **(2550) 19" E.I.A. RACK**

Apply the following provisions to 19" E.I.A. Rack, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-95.1 Furnish and install 19" E.I.A. Rack including the following features:

- (A) EIA/TIA compliant.
- (B) 19 inches
- (C) Gangable
- (D) Four 11 gauge steel mounting rails
- (E) Finished in black powder coat.
- (F) Both the front and back rails shall be drilled and tapped with 0.3125 inch holes spaced for a standard EIA mounting.

- (G) Height is 76.125 inches.
- (H) Fitted with two 15 A power strips; one horizontal rack-mount and one vertical mount with clips.

SZ-95.2 **SHELVES**

Furnish and install three shelves and apply the following provisions to the shelves for 19" E.I.A. Rack:

- (A) Use shelves with the following features:
 - a. UL listed, 16 gauge, black powder coated shelves.
 - b. Solid bottoms
 - c. Dimensions are 17.375 inches wide by 14.75 inches deep.
 - d. Racking height of 3 RU.
 - e. Supports up to 70 lbs.

SZ-95.3 **HAS MET**

The following items have met the above specifications:

- (A) 19 inches E.I.A. Rack: Middle Atlantic 19" WRK Series Rack, Part No. WRK-40-27.
- (B) 19 inches E.I.A. Rack: Middle Atlantic 19" WRK Series Rack, Part No. WRK-24-27.
- (C) Rack shelves: Middle Atlantic rack accessory shelf, Part No. U3.
- (D) Horizontal Rack Mount and Vertical Mount Power Strips: Middle Atlantic PD-915R and PD-1415C-NS.

SZ-95.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (19" E.I.A. RACK) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Shelves, and all materials and labor necessary to construct the 19" E.I.A. Rack.

SZ-96 (2550) 19" E.I.A. RACK

Apply the following provisions to 19" E.I.A. Rack, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-96.1 See GROUNDING on Page 27 for grounding requirements.
- SZ-96.2 Furnish and install two ground lugs for connection to the buss bar. Additionally two spare ground lugs shall also be furnished and installed.
- SZ-96.3 Furnish and install 19" E.I.A. Rack including the following features:
 - (A) EIA/TIA compliant.
 - (B) 19 inches
 - (C) Gangable
 - (D) Four 11 gauge steel mounting rails

- (E) Finished in black powder coat.
- (F) Both the front and back rails shall be drilled and tapped with 0.3125 inch holes spaced for a standard EIA mounting.
- (G) Height is 48.125 inches.
- (H) Fitted with one 15 A horizontal rack-mount power strip.

SZ-96.4 **RACK SHELVES**

Furnish and install shelves and apply the following provisions to the shelves for 19" E.I.A Rack:

- (A) Use shelves with the following features:
 - a. One UL listed, 16 gauge, black powder coated shelf shall be included.
 - b. The shelves shall have a solid bottom.
 - c. Dimensions shall be 17.44 inches wide by 10.72 inches deep.
 - d. The racking height for the shelves shall be 1 SP.
 - e. Each shelf shall be able to support up to 35 lbs.

SZ-96.5 **SLIDING SHELVES**

Furnish and install sliding shelves and apply the following provisions to the shelves for 19" E.I.A Rack:

- (A) Use sliding shelves with the following features:
 - a. One UL listed, 16 gauge, black laminate material shelf shall be included.
 - b. The shelves shall have a solid bottom.
 - c. Dimensions shall be 16 inches wide by 13.79 inches deep.
 - d. The racking height for the shelves shall be 1 SP.
 - e. Each shelf shall be able to support up to 35 lbs.

SZ-96.6 **DRAWERS**

Furnish and install drawers and apply the following provisions to the shelves for 19" E.I.A Rack:

- (A) Use drawers with the following features:
 - a. Two UL listed, 20 gauge, black powder coated drawers shall be included. One of the drawers shall be mounted as a writing shelf.
 - b. The drawers shall have a solid bottom.
 - c. Dimensions shall be 15.93 inches wide by 13.43 inches deep.
 - d. The racking height for the shelves shall be 1 SP.
 - e. Each shelf shall be able to support up to 50 lbs.

SZ-96.7 **HAS MET**

The following items have met the above specifications:

- (A) 19 inches E.I.A. Rack: Middle Atlantic 19" WRK Series Rack, Part No. WRK-24-27.
- (B) Rack shelves: Middle Atlantic rack accessory shelf, Part No. U1.
- (C) Sliding shelves: Middle Atlantic rack accessory shelf, Part No. SSL.

- (D) Drawers: Middle Atlantic utility drawer, Part No. UD1.
- (E) Horizontal Rack Mount Power Strip: Middle Atlantic PD-915R.

SZ-96.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (19" E.I.A. RACK) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Grounding, Rack Shelves, Sliding Shelves, Drawers, and all materials and labor necessary to construct the 19" E.I.A. Rack.

SZ-97 **(2550) CORE DRILLED HOLE**

Core drill holes in concrete foundations to provide access for conduits to enter cabinets, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-97.1 **REQUIREMENTS**

Core drill holes in accordance with the following:

- (A) Core drill holes on the foundation in the location directed by the Engineer. Ensure the location on the foundation is compatible with the cabinet layout.

SZ-97.2 **CONSTRUCTION REQUIREMENTS**

Core drill holes in accordance with the following Construction Requirements:

- (A) Core drill existing foundation to accommodate conduit size as indicated in Plan.
- (B) Remove all debris resulting from the core drilling.

SZ-97.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (CORE DRILLED HOLE) at the Contract bid price per each, which will compensation in full for all costs incidental thereto, including but not limited to, Requirements, Construction Requirements, and all materials and labor necessary to construct Core Drilled Hole.

SZ-98 **(2550) ADJUST HANDHOLE**

Adjust Handhole to ensure that Traffic Management System handholes are constructed to the required grade, in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-98.1 **REQUIREMENTS**

Construct Adjust Handhole accordance with the following Requirements:

- (A) Locate all handholes for adjustment.
- (B) Mark all existing handholes for adjustment prior to the Grading and Turf Establishment operations by placing a three inch diameter PVC stake or a two inch by two inch wooden stake in the ground adjacent to each handhole planned for adjustment. Paint the top of the stake orange and expose four feet above ground. Remove the stakes from the project after adjusting the handhole.
- (C) Adjust handholes within the Clear zone first and during the period Traffic Control is established for the Grading and Turf Establishment operations. After adjustment of the handhole, remove location marking stakes as soon as possible to minimize the chance of a motorist leaving the Roadway and hitting one of the stakes.

- (D) Modify handholes to accommodate existing conduit per plan.
- (E) Furnish and install the following:
 - a. Equally space three 0.375 inch threaded eyebolts located nine inches from the top of the handhole.
 - b. Stainless steel hardware, extension rings, frames, and covers as needed.
- (F) Salvage existing frames and covers as approved by the Engineer.
- (G) Conform to UL Tier 10 loading requirements when adjusting handholes.

SZ-98.2 **CONSTRUCTION REQUIREMENTS**

Adjust Handhole in accordance with the following Construction Requirements:

- (A) Install a MnDOT furnished locator ball per the Plan detail in all Handholes. See **LOCATOR BALLS** on page 22.
- (B) Construct handhole extensions or excavate and place handhole as needed to adjust to the required grade.
- (C) Place handhole on a 12 inches thick layer of coarse filter aggregate per MnDOT 3149.2H. This Construction Requirement is for handholes requiring a lower elevation to achieve the required grade.
- (D) Backfill any required excavation.
- (E) Install the handhole support ring, frame, and cover prior to backfilling the handhole. This is to help the handhole remain round during the backfilling process.
- (F) Place the up-slope edge of the metal frame casting (see Standard Plate No. 8114) at the final grade.
- (G) Place compacted fill around the down-slope portion of the casting/handhole such that a slope of 1:4 or flatter is maintained to match the existing slope.
- (H) Restore disturbed area to original conditions.

SZ-98.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (ADJUST HANDHOLE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, Handholes, Requirements, Construction Requirements, and all materials and labor necessary to construct Adjust Handhole.

SZ-99 (2550) ADJUST FIBER OPTIC VAULT

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

SZ-99.1 See GROUNDING on page 27 for grounding specifications.

SZ-99.2 **REQUIREMENTS**

Adjust Fiber Optic Vault in accordance with the following Requirements:

- (A) Locate all fiber optic vaults for adjustment.

- (B) Mark all existing fiber optic vaults for adjustment prior to the Grading and Turf Establishment operations by placing a three inch diameter PVC stake or a two inch by two inch wooden stake in the ground adjacent to each fiber optic vault planned for adjustment. Paint the top of the stake orange and expose four feet above ground. Remove the stakes from the project after adjusting the handhole.
- (C) Adjust fiber optic vaults within the Clear zone first and during the period Traffic Control is established for the Grading and Turf Establishment operations. After adjustment of the fiber optic vault, remove location marking stakes as soon as possible to minimize the chance of a motorist leaving the Roadway and hitting one of the stakes.
- (D) Modify fiber optic vaults to accommodate existing conduit per plan.
- (E) Furnish and install stainless steel hardware, extension rings, frames, and covers as needed.
- (F) Salvage existing frames and covers as approved by the Engineer.
- (G) Conform to UL Tier 10 loading requirements when adjusting fiber optic vaults.

SZ-99.3 **CONSTRUCTION REQUIREMENTS**

Construction Requirements for Adjust Fiber Optic Vault shall be in accordance with the following:

- (A) Install a MnDOT furnished locator ball per the Plan detail in all fiber optic vaults. See **LOCATOR BALLS** on page 22.
- (B) Install fiber optic vault extensions or excavate and place fiber optic vault as needed to adjust to the required grade.
- (C) Place fiber optic vault on a 12 inches thick layer of coarse filter aggregate per MnDOT 3149.2H. This Construction Requirement is for fiber optic vaults requiring a lower elevation to achieve the required grade.
- (D) Backfill any required excavation.
- (E) Install the fiber optic vault support ring, frame, and cover prior to backfilling the fiber optic vault. This is to help the fiber optic vault maintain the original shape during the backfilling process.
- (F) Place the up-slope edge of the metal frame casting at the final grade. Std. Plate 8114 apply?
- (G) Place compacted fill around the down-slope portion of the casting/fiber optic vault such that a slope of 1:4 or flatter is maintained to match the existing slope.
- (H) Restore disturbed area to original conditions.

SZ-99.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (ADJUST FIBER OPTIC VAULT) at the Contract bid price per each, will be compensation in full for all costs incidental thereto, including but not limited to, Grounding, Requirements, Construction Requirements, and all materials and labor necessary to construct Adjust Fiber Optic Vault.

SZ-100 **(2550) RELOCATE HANDHOLE**

Relocate Handholes in the specified locations, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-100.1 **REQUIREMENTS**

Relocate handholes in accordance with the following Requirements:

- (A) Furnish and install stainless steel hardware, extension rings, frames, and covers as needed.
- (B) Salvage existing frames and covers as approved by the Engineer.
- (C) Conform to UL Tier 10 loading requirements.

SZ-100.2 **CONSTRUCTION REQUIREMENTS**

Construction Requirements for Relocate Handhole shall be in accordance with the following:

- (A) Install a MnDOT furnished locator ball per the Plan detail in all Handholes. See **LOCATOR BALLS** on page 22.
- (B) Relocate handhole as needed to the required grade.
- (C) Place handhole on a 12 inches thick layer of coarse filter aggregate per MnDOT 3149.2H.
- (D) Backfill any required excavation.
- (E) The handhole support ring, frame, and cover shall be installed prior to backfilling the handhole. This is to help the handhole remain round during the backfilling process.
- (F) Place the up-slope edge of the metal frame casting (see Standard Plate No. 8114) at the final grade.
- (G) Place compacted fill around the down-slope portion of the casting/handhole such that a slope of 1:4 or flatter is maintained to match the existing slope.
- (H) Restore disturbed area to original conditions.

SZ-100.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (RELOCATE HANDHOLE) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, Handholes, Requirements, Construction Requirements, and all materials and labor necessary to construct Relocate Handhole.

SZ-101 **(2550) RELOCATE SIGN**

This work consists of Relocating existing Buried Cable Signs from the project for completion of the installation of the Relocate Sign. The locations and details are shown in the Plan. This work shall be in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

- SZ-101.1 Modify MnDOT 3973 by substituting the word orange for the word yellow.
- SZ-101.2 Mark all fiber-route changes in direction (see Plan Detail) within seven days of FO cable installation.
- SZ-101.3 Install the sign bottoms at 1.2 m (4 ft) above ground.

SZ-101.4 Install the signpost three feet offset from the cable trench between the cable and the Right-of-way.

SZ-101.5 Construct an orange-colored plastic resin sheath to enhance the visibility of buried cable signposts. The plastic resin sheath is: Triangular in shape, having a wall thickness of 0.08 ± 0.01 inch with a 3.31 ± 0.02 inch width of each side; Temperature stable from -40°C (-40°F) to 65°C (150°F), UV resistant; Made of Polypropylene; Installed on the above ground portion of each post below the bottom of the sign.

SZ-101.6 **BURIED CABLE WARNING SIGNS**

Comply with 3973 and the following modifications/supplements for Buried Cable Warning Signs:

(A) Indicate the telephone number for the sign legend is 811.

(B) Construct the sign on 7 feet X 2 lb/ft, galvanized, steel posts, and spaced 500 ft apart along the FO cable (trunk cables and armored pigtails) route.

SZ-101.7 **APL**

MnDOT approved Buried Cable Sign Plastic Resin Sheath is listed in the *Traffic Management Systems/ITS* section of the following Website:

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

SZ-101.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (RELOCATE SIGN) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Buried Cable Sign Requirements and all materials and labor necessary to construct Relocate Sign. Repair or replace any damaged Relocate Sign items to the satisfaction of the Engineer.

SZ-102 (2550) INSTALL RAMP CONTROL SIGNAL

Install Ramp Control Signal, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-102.1 Install Ramp Control Signals salvaged from this project in another location as part of this project.

SZ-102.2 Install Ramp Control Signal to include the proper signing, comply with the Plan, Plan Details, Detail Signing Layout, and Applicable Standard Plates.

SZ-102.3 Apply anti-corrosive and anti-seizing compound to all threads exposed during the installation process. Conform to MIL Specification 907E.

SZ-102.4 Install the entire RCS assembly plumb and tight.

SZ-102.5 Construct so wind or vibrations from traffic do not cause movement of the signal head.

SZ-102.6 **SIGNAL CONNECTIONS**

Apply the following provisions to Signal Connections:

(A) Connect cables with the signal head harness in the pedestal base. See the Plan Detail for detailed instructions, materials, and installation procedures.

SZ-102.7 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.602 (INSTALL RAMP CONTROL SIGNAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Pedestal, Signal Head Assembly, Signal Connections, Signs, and all materials and labor necessary to construct the Ramp Control Signal Design One-Way.

SZ-103 (2550) INSTALL RAMP CONTROL FLASHER SIGNAL

Install Ramp Control Flasher Signal, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-103.1 Include the proper signing, comply with the Plan, Plan Details, Detail Signing Layout, and Applicable Standard Plates.

SZ-103.2 Apply anti-corrosive and anti-seizing compound to all threads exposed during the installation process. Conform to MIL Specification 907E.

SZ-103.3 Install the entire RCFS assembly plumb and tight.

SZ-103.4 Construct so wind or vibrations from traffic do not cause movement of the signal head.

SZ-103.5 SIGNAL CONNECTIONS

Apply the following provisions to Signal Connections:

(A) Connect cables with the signal head harness in the pedestal base. See the Plan Detail for detailed instructions, materials, and installation procedures.

SZ-103.6 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.602 (INSTALL RAMP CONTROL FLASHER SIGNAL) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including but not limited to Pedestal, Signal Head Assembly, Signal Connections, Signs, and all materials and labor necessary to construct the Ramp Control Flasher Signal.

SZ-104 (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-104.1 SPLICING REQUIREMENTS

Apply the following provisions when FO cable splicing is required within the Pull Vault:

(A) See GROUNDING on page 27 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 26.

(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-104.2 Place on a 12 inches thick layer of coarse filter aggregate per MnDOT 3149.2H.

SZ-104.3 **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-104.4 Install a MnDOT furnished locator ball in the Pull Vault. See **LOCATOR BALLS** on page 22.

SZ-104.5 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-104.6 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-104.7 **APL**

MnDOT approved Pull Vault is listed on the following Website:

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

SZ-104.8 **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-105 (2550) INSTALL CCTV ASSEMBLY

Install CCTV Assembly and furnish additional items required to complete the installation of the CCTV Assembly. The locations and details are shown in the Plan. Do the work in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

SZ-105.1 Install the MnDOT Furnished PTZ Camera Assembly including the CCTV video/power/control cable. See STATE FURNISHED MATERIALS on page 22 for additional details.

SZ-105.2 All existing CCTV standards are not the folding type. A bucket truck will be required for some of the installations.

SZ-105.3 Furnish and install the following items:

(A) Grounding components per plan. See **GROUNDING** on page 27 for additional details.

(B) Tie wrap cable to J-hook to provide strain relief.

(C) Stainless steel straps to secure ground braid to pole at eight foot intervals.

SZ-105.4 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (INSTALL CCTV ASSEMBLY) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to removing the existing CCTV Camera and Pan/Tilt unit, furnishing and installing the access handhole cover, removing existing cables, and all materials and labor necessary to Install the CCTV Assembly. Repair or replace Install CCTV Assembly items that have been to the satisfaction of the Engineer and TMS Integrator.

SZ-106 (2550) INSTALL DMS

Install DMS provided by MnDOT or salvaged from the project according to the Plan. Construct in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-106.1 See GROUNDING on page 27 for grounding specifications.

SZ-106.2 LIQUID-TIGHT 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-106.3 INSTALLATION REQUIREMENTS

Apply the following provisions to the Installation Requirements for Install Dynamic Message Sign:

- (A) Mount the DMS to the support structure. Furnish and install mounting hardware as necessary.
- (B) Furnish and install power and communication cable conduits and two inch diameter Type C hot dipped galvanized conduit bodies on the support structure. Face conduit body openings toward the walkway.
- (C) Install power and communication cables between the DMS and the DMS ground control cabinet. Manufacturer markings on the DMS will show general areas for power and communication cable conduit openings. Cut the conduit openings as directed by the Manufacturer unless directed differently by the TMS Integrator. Install duct-seal in the DMS openings.
- (D) Install ten feet of slack communications cable coiled in the DMS ground control cabinet and 39 feet in the DMS.

MNDOT FURNISHED DMS

SZ-106.4 MnDOT will furnish DMS. See STATE FURNISHED MATERIALS on page 22 for additional details.

SZ-106.5 INSTALLATION REQUIREMENTS

Apply the following provisions to the Installation Requirements for Install DMS:

- (A) Mount the DMS to the support structure.
- (B) Terminate power cables in the DMS and DMS ground control cabinets per the DMS manufacturer's instructions. A Manufacturer representative will connectorize and terminate communication cables during commissioning.
- (C) Coordinate the delivery of the DMS and DMS ground control cabinet with the DMS Manufacturer.
- (D) Delivery of the DMS ground control cabinet and DMS is expected during the month of XXXXXX 20XX. The DMS ground control cabinet will arrive with the DMS unless otherwise negotiated with the DMS Manufacturer. A preliminary schedule for delivery of the DMS and DMS ground control cabinet will be identified at the pre-construction meeting. Provide the TMS Integrator a final delivery and mounting schedule four weeks prior to the expected initial delivery date.
- (E) Off-load the DMS and DMS ground control cabinet within six hours from the time of the arrival in the Twin Cities. The Contractor has the following options:
 - a. May off-load the sign at the Contractor's secure, storage facility.
 - b. May off-load the sign at a MnDOT staging area; (Maplewood Truck Station, Larpenteur Ave. and 35E, lower level).
- (F) Additional Contractor responsibilities are as follows:
 - a. Ensuring the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the DMS and DMS ground control cabinet.
 - b. Ensuring the storage site is reasonably level and dry.
 - c. Placing the DMS on two pieces of lumber (six inches by six inches by eight feet long) under structural ribs Nos. 2 and 8.
 - d. Attaching four tie down straps (two front and two rear) between lumber and lifting eyes.
 - e. Handling of the sign at the storage facilities.
 - f. Transporting the DMS and DMS ground control cabinet from the storage site to the mounting site.

SALVAGED DMS

SZ-106.6 Install DMS previously salvaged from this project. See Signing Plans and Specifications for structure installation details.

- (A) Terminate power cables in the DMS and DMS ground control cabinet. Communication cables will be terminated by the TMS Integrator.
 - a. Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum of two Working days before completing termination of the Power cables.

SZ-106.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment for INSTALL DMS for each 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 be compensation in full for the costs incidental thereto, including but not limited to Grounding, Liquid-tight Conduit (LFMC), Installation Requirements, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.602	Install DMS	each
2550.602	Install DMS ____ ____	each

SZ-107 **(2550) INSTALL DMS**

Install DMS, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-107.1 DMS will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.

SZ-107.2 See GROUNDING on page 27 for grounding specifications.

SZ-107.3 **LIQUID-TIGHT 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-107.4 **INSTALLATION REQUIREMENTS**
Apply the following provisions to the Installation Requirements for Install Dynamic Message Sign:

- (A) Mount the DMS to the support structure. Furnish and install mounting hardware as necessary.
- (B) Furnish and install power and communication cable conduits and two inch diameter Type C hot dipped galvanized conduit bodies on the support structure. Face conduit body openings toward the walkway.
- (C) Install power and communication cables between the DMS and the DMS ground control cabinet. Manufacturer markings on the DMS will show general areas for power and communication cable conduit openings. Cut the openings as directed by the Manufacturer unless directed differently by the TMS Integrator. Install duct-seal in the DMS openings.
- (D) Install ten feet of slack communication cable coiled in the DMS ground control cabinet and 39 feet in the DMS.
- (E) Terminate power cables in the DMS and DMS control cabinet per the DMS manufacturer instructions. A manufacturer representative will connectorize and terminate communication cables during commissioning.
- (F) Coordinate the delivery of the DMS and ground control cabinet with the DMS Sign Manufacturer.
- (G) Delivery of the DMS ground control cabinet and DMS is expected during the month of XXXXXXXX 200X. The DMS ground control cabinet will arrive with the DMS unless otherwise negotiated with the DMS Manufacturer. A preliminary schedule for delivery of the DMS and ground control cabinet will be identified at the pre-construction meeting. Provide the TMS Integrator a final delivery and mounting schedule for the DMS four weeks prior to the expected initial delivery date.

- (H) From the time of the arrival of the sign in the Twin Cities, the Contractor has 6 hours to off-load the sign. The Contractor has the following options:
 - a. May off-load the sign at the Contractor's secure, storage facility.
 - b. May off-load the sign at a MnDOT staging area; (XXX).

- (I) Additional Contractor responsibilities are as follows:
 - a. Ensuring the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the DMS and DMS ground control cabinet.
 - b. Ensuring the storage site is reasonably level and dry.
 - c. Placing the DMS on two pieces of lumber (six inches by six inches by eight feet long) under structural ribs Nos. 2 and 8.
 - d. Attaching four tie down straps (two front and two rear) between lumber and lifting eyes.
 - e. Handling of the sign at the storage facilities.
 - f. Transporting the DMS and DMS ground control cabinet from the storage site to the mounting site.

SZ-107.5 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment for INSTALL DMS for each 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 be compensation in full for the costs incidental thereto, including but not limited to Grounding, Liquid-tight Conduit (LFMC), Installation Requirements, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.602	Install DMS	each

SZ-108 (2550) INSTALL DMS

Install DMS, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-108.1 Install DMS previously salvaged from this project. See Signing Plans and Specifications for structure installation details.
- SZ-108.2 See GROUNDING on page 27 for grounding specifications.
- SZ-108.3 **LIQUID-TIGHT 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-108.4 **INSTALLATION REQUIREMENTS**

Apply the following provisions to the Installation Requirements for Install DMS:

- (A) Mount the DMS to the support structure. Furnish and install mounting hardware as necessary.
- (B) Furnish and install power and communication cable conduits and two inch diameter Type C hot dipped galvanized conduit bodies on the support structure. Face conduit body openings toward the walkway.
- (C) Install power and communication cables between the DMS and the DMS control cabinet. Utilize existing power and communication cable conduit openings or cut openings as directed by the TMS Integrator. Install duct-seal in the DMS openings.
- (D) Install ten feet of slack communications cable coiled in the DMS Control cabinet and 39 feet in the DMS. Power cables shall be terminated in the DMS and DMS control cabinet. Communication cables will be terminated by the TMS Integrator.
 - a. Notify the TMS Integrator by TMS construction phone number (651) 331-8370, a minimum two Working days before completing termination of the Power cables.

SZ-108.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment for INSTALL DMS for each 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 the costs incidental thereto, including but not limited to Grounding, Liquid-tight Conduit (LFMC), Installation Requirements, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.602	Install DMS	each
2550.602	Install DMS ____ ____	each

SZ-109 (2550) INSTALL DMS, POST MOUNTED

Install DMS, Post Mounted in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-109.1 DMS will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- SZ-109.2 See GROUNDING on page 27 for grounding specifications.

SZ-109.3 **FOUNDATION AND SUPPORT POSTS**

Apply the following provisions to the Foundation and Support Posts for Install DMS, Post Mounted:

- (A) F&I the required foundations, mounting hardware, and support posts according to Plan details. and/or F&I the required foundations, mounting hardware, and support posts. Submit shop drawings for these items to the Engineer for approval. Provide shop drawings signed by a licensed Structural Engineer prior to submittal to the Engineer for approval.

SZ-109.4 **INSTALLATION REQUIREMENTS**

Apply following provisions to the Installation Requirements for Install DMS, Post Mounted:

- (A) Mount the DMS to the support structure. Furnish and install mounting hardware as necessary.
- (B) Install power, grounding, and communications cable conduits on the support structure.
- (C) Install power and communication cables between the DMS ground control Cabinet and the DMS. Manufacturer markings on the DMS will show general areas for power and communication cable conduit openings. Cut the openings as directed by the Manufacturer unless directed differently by the TMS Integrator. Install duct-seal in the DMS openings.
- (D) Install ten feet of slack communication cable coiled in the DMS ground control cabinet and 39 feet in the DMS.
- (E) Terminate power cables in the DMS and DMS control cabinet per the DMS manufacturer instructions. A manufacturer representative will connectorize and terminate communication cables during commissioning.
- (F) Coordinate the delivery of the DMS and ground control cabinet with the DMS Manufacturer.
- (G) Delivery of the DMS ground control cabinet and DMS is expected during the month of XXXXXX 20XX. The DMS ground control cabinet will arrive with the DMS unless otherwise negotiated with the DMS Manufacturer. A preliminary schedule for delivery of the DMS and DMS ground control cabinet will be identified at the pre-construction meeting. Provide the TMS Integrator a final delivery and mounting schedule four weeks prior to the expected initial delivery date.
- (H) Off-load the DMS and DMS ground control cabinet within six hours from the time of the arrival in the Twin Cities. The Contractor has the following options:
 - a. May off-load the sign at the Contractor's secure, storage facility.
 - b. May off-load the sign at a MnDOT staging area; (XXX).
- (I) Additional Contractor responsibilities are as follows:
 - a. Ensuring the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the DMS and DMS ground control cabinet.
 - b. Ensuring the storage site is reasonably level and dry.
 - c. Handling of the sign at the storage facilities.
 - d. Transporting the DMS and DMS ground control cabinet from the storage site to the mounting site.
- (J) Should the Contractor choose to temporarily store the sign at either site, the Contractor shall be responsible for the following:
 - a. Ensuring the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the DMS, Post Mounted.
 - b. Ensures the storage site is reasonably level and dry.
 - c. Handling of the sign at the storage facilities.
 - d. Transportation of the sign from the storage site to the mounting site.

SZ-109.5 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment for INSTALL DMS, POST MOUNTED for each 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 be compensation in full for the costs incidental thereto, including but not limited to Grounding, Foundations and Support Posts, Installation Requirements, and all materials, equipment, and labor necessary to construct the Install DMS, Post Mounted.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
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2550.602

Install DMS ____ ____

each

SZ-110 **(2550) INSTALL FIBER OPTIC VAULT**

Install the FO Vault, internal and external components. Install FO Vault salvaged from this project. Repair or replace damaged installed materials resulting from the removing, salvaging and delivering operation. Install Fiber Optic Vault, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-110.1 Install FO Vaults salvaged from this project in another location.
- SZ-110.2 See GROUNDING on page 27 for grounding specifications.
- SZ-110.3 Install a MnDOT furnished fiber optic splice vault marker per the Plan detail. See **STATE FURNISHED FIBER OPTIC SPLICE VAULT MARKER** on page 26.
- SZ-110.4 Install a MnDOT furnished locator ball. See **LOCATOR BALLS** on page 22.
- SZ-110.5 Near the FO Vault, sweep the FO cables up to meet the conduit entrance to the FO Vault and do not to exceed minimum bend radius of the FO cables.
- SZ-110.6 Construct a drainage system for the FO 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-110.7 Clean FO 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-110.8 Coil FO Cables onto the FO coiling brackets within vaults.
- SZ-110.9 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (INSTALL 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 to grounding, installing the salvaged Outdoor FO Splice Enclosure, installing the marker, the drainage system, restoration, cleaning, and all materials and labor necessary to complete Install Fiber Optic Vault.

SZ-111 **(2550) NON-INTRUSIVE DETECTION HARDWARE**

Furnish and install Non-Intrusive Detection Hardware, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-111.1 Non-Intrusive Detectors will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.
- SZ-111.2 PTZ Cameras will be furnished and installed by MnDOT. See STATE FURNISHED MATERIALS on page 22.
- SZ-111.3 Notify the TMS Integrator when the installation of the Non-Intrusive Detection Hardware is complete.
- SZ-111.4 See GROUNDING on page 27 for grounding specifications.

SZ-111.5 **NON-INTRUSIVE DETECTION FOLDING POLE**

Furnish and install a Non-Intrusive Detection Folding Pole with the following requirements:

- (A) Install the Non-Intrusive Detection Folding Pole per Plan details and Manufacturer's recommendations.

SZ-111.6 **NON-INTRUSIVE DETECTION CABLE**

Install Non-Intrusive Detection Cable in accordance with the following:

- (A) Non-Intrusive Detection Cable will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- (B) Furnish and install a flat pull rope in the CCTV Standard instead of installing the Non-intrusive Detection Cable if the TMS Integrator makes this request.
- (C) The Non-intrusive Detection Cable will be pre-connectorized so connecting the Non-intrusive Detector to the composite cable will be accomplished by mating two connectors.
- (D) Install the Non-intrusive Detection Cables or flat pull rope while the pole is on the ground.

SZ-111.7 **CCTV CABLE**

Install CCTV Cable in accordance with the following:

- (A) MnDOT will furnish CCTV Cable. See STATE FURNISHED MATERIALS on page 22 for additional details.
- (B) Furnish and install a flat pull rope in the CCTV Standard instead of installing the CCTV Cable if the TMS Integrator makes this request.
- (C) CCTV Cable will be pre-connectorized so connecting the camera unit to the composite cable will be accomplished by mating two connectors.
- (D) Install the CCTV Cable or flat pull rope while the pole is on the ground.

SZ-111.8 **POLE MOUNTED NON-INTRUSIVE DETECTION (CCTV) CABINETS**

Install Pole Mounted Non-Intrusive Detection Cabinets in accordance with the following:

- (A) Pole Mounted Non-Intrusive Detection Cabinets will be furnished by MnDOT. See **MnDOT FURNISHED POLE MOUNTED CCTV CABINET** on page 25 for additional details.
- (B) Furnish and install mounting brackets and hardware.
- (C) Be responsible for the terminal adapter, the 1.5 inch conduit, and creating the knockout opening for connection per plan detail. Place the conduit in a location where it does not obstruct the use of the pole crank or access to the base access door.

SZ-111.9 **APL**

MnDOT approved Non-Intrusive Detection Folding Pole is listed on the following Website:

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

SZ-111.10 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (NON-INTRUSIVE DETECTION HARDWARE) at the Contract bid price per each, will be

compensation in full for all costs incidental thereto, including but not limited to Non-Intrusive Detection Folding Pole, Grounding, Non-Intrusive Detection Cable, CCTV Cable, Pole Mounted Non-Intrusive Detection Cabinets, and all materials and labor necessary to construct the Non-Intrusive Detection Hardware.

SZ-112 **(2550) SERVICE CABINET TYPE SPECIAL**

Furnish and install Service Cabinet Type Special, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-112.1 Include the same requirements as “Service Cabinet”. However, “Metering Equipment” is not required.
- SZ-112.2 See (2550) SERVICE CABINET on page 82 for additional details.
- SZ-112.3 Maintain fully operational power Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer power from existing to proposed outside of these hours.
- SZ-112.4 Mark conduit stubs leaving the service cabinet with a two-inch by two-inch wooden stake placed at the end of the stub. Expose five feet of the stake above ground and paint it orange.
- SZ-112.5 See GROUNDING on page 27 for grounding specifications.
- SZ-112.6 The Service Cabinet Type Special circuit breaker sizes and quantities will be defined in the Plan details.
- SZ-112.7 **APL**
MnDOT approved Service Cabinet Type Special is listed on the following Website:

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

- SZ-112.8 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (SERVICE CABINET TYPE SPECIAL) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to the Service Cabinet Type Special, grounding, marking conduit stubs, installation, breakers, and all materials and labor necessary to construct the Service Cabinet Type Special.

SZ-113 **(2550) INSTALL ILCS**

Install ILCS, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-113.1 ILCS will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- SZ-113.2 **INSTALLATION REQUIREMENTS**
Apply the following provisions to the Installation Requirements for Install ILCS:
 - (A) Mount the ILCS to the support structure per Plan details and Manufacturer recommendations.
 - (B) Furnish and install power and communication cable conduits and two inch diameter Type C hot dipped galvanized conduit bodies on the support structure. Face conduit body openings toward the walkway.

- (C) Install power, grounding, and communications cable conduits on the support structure.
- (D) Install power and communication cables between the ILCS and the ILCS ground control cabinet. Manufacturer markings on the ILCS will show general areas for power and communication cable conduit openings. Cut the conduit openings as directed by the Manufacturer unless directed differently by the TMS Integrator. Install duct-seal in the ILCS openings.
- (E) Delivery of the ILCS ground control cabinet and ILCS is expected during the month of XXXXXX 20XX. The ILCS ground control cabinet will arrive with the ILCS unless otherwise negotiated with the ILCS Manufacturer. A preliminary schedule for delivery of the ILCS and ILCS ground control cabinet will be identified at the pre-construction meeting. Provide the TMS Integrator a final delivery and mounting schedule four weeks prior to the expected initial delivery date.
- (F) Off-load the ILCS and ILCS ground control cabinet within six hours from the time of the arrival in the Twin Cities. The Contractor has the following options:
 - a. May off-load the ILCS and ILCS ground control cabinet at the Contractor's secure, storage facility.
 - b. May off-load the ILCS and ILCS ground control cabinet at a MnDOT staging area; (XXX).
- (G) Additional Contractor responsibilities are as follows:
 - a. Ensuring the storage site (indoor or outdoor) is secure and has adequate room for unloading and loading the DMS and DMS ground control cabinet.
 - b. Ensuring the storage site is reasonably level and dry.
 - c. Handling of the sign at the storage facilities.
 - d. Transporting the DMS and DMS ground control cabinet from the storage site to the mounting site.

SZ-113.3 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment for INSTALL ILCS for each 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 be compensation in full for the costs incidental thereto, including but not limited to Installation of the ILCS and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.602	Install ILCS	each

SZ-114 (2550) INSTALL PRICING SIGN OR DMS MODULE

Install Pricing Sign or DMS Module, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-114.1 Salvage two of the Pricing Sign Modules from the project. Any additional Pricing Sign Modules will be furnished by MnDOT. See STATE FURNISHED MATERIALS on page 22 for additional details.
- SZ-114.2 See GROUNDING on page 27 for Grounding requirements.

SZ-114.3 INSTALLATION REQUIREMENTS

Apply the following provisions to the Installation Requirements for Install Pricing Sign or DMS Module:

- (A) Mount the Pricing Sign or DMS Module to the support structure per Plan details and Manufacturer recommendations.
- (B) Furnish and install power and communication cable conduits and two inch diameter Type C hot dipped galvanized conduit bodies on the support structure. Face conduit body openings toward the walkway.
- (C) Install power and communication cables between the Pricing Sign and Pricing Sign ground control cabinet and between the DMS module and the DMS module ground control cabinet. Manufacturer markings on the Pricing Sign and DMS Module will show general areas for power and communication cable conduit openings. Cut the conduit openings as directed by the Manufacturer unless directed differently by the TMS Integrator. Install duct-seal in the Pricing Sign and DMS module openings.
- (D) Delivery of the Pricing Sign and DMS Module ground control cabinet and Pricing Sign and DMS Module is expected during the month of XXXXXX 20XX. The Pricing Sign and DMS Module ground control cabinet will arrive with the Pricing Sign and DMS Module unless otherwise negotiated with the Pricing Sign and DMS Module Manufacturer. A preliminary schedule for delivery of the Pricing Sign and DMS Module and Pricing Sign and DMS Module ground control cabinet will be identified at the pre-construction meeting. Provide the TMS Integrator a final delivery and mounting schedule four weeks prior to the expected initial delivery date.
- (E) The Contractor shall be responsible for the following:
 - a. Handling of the Pricing Sign and DMS Module at the storage facilities.
 - b. Transportation of the Pricing Sign and DMS Module from the XXX MnDOT Truck Station storage site to the mounting site.

SZ-114.4 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment for INSTALL PRICING SIGN OR DMS MODULE for each 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 be compensation in full for the costs incidental thereto, including but not limited to Installation of the Pricing Sign or DMS Module and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.602	Install Pricing Sign Module	each
2550.602	Install DMS Module	each

SZ-115 (2550) INSTALL RAMP CONTROL SIGNAL FOUNDATION-SCREW IN

Install Ramp Control Signal Foundation-Screw In and furnish additional items required to complete the installation of the Ramp Control Signal Foundation-Screw In. The locations and details are shown in the Plan. Perform this work in accordance with the details shown in the Plan, the applicable MnDOT Standard Specifications, and the following:

- SZ-115.1 Install the Ramp Control Signal Foundation-Screw In.
- SZ-115.2 Construct foundations in locations as required by the MnDOT Construction inspector and TMS Integrator. The TMS Integrator will stake foundation locations for the Contractor on request. Provide the TMS Integrator with two Working days notice.
- SZ-115.3 Construct conduits internal to the foundation per Plan.
- SZ-115.4 Use NMC conduits within foundations.

SZ-115.5 Grade foundations, provide fill, and haul spoil as needed.

SZ-115.6 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (INSTALL RAMP CONTROL FOUNDATION-SCREW IN) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto and all materials and labor necessary to Install the Ramp Control Foundation-Screw In. Repair or replace any damage caused to Ramp Control Foundation-Screw In to the satisfaction of the Engineer and TMS Integrator.

SZ-116 (2550) LOOP DETECTOR DESIGN PREFORMED

Furnish and install Loop Detector Design Preformed, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-116.1 See PROJECT TESTING AND DOCUMENTATION SUBMITTALS on page 38 for project testing and documentation details.

SZ-116.2 See LABELING on page 33 for Labeling details.

SZ-116.3 The Loop Detector, Design Preformed, consists of three parts: the head, the tail, and the conductor. The conductor is continuous throughout all parts. See the Plan for detailed drawing of the parts.

SZ-116.4 Be responsible for ordering loops with the proper dimensions and grades of materials. Note that the preformed loop detector, installed in the grade (below the pavement), requires four turns of No. 16 XHHW insulated wire.

SZ-116.5 Locate Loop Detector Design Preformed loops in the center of the lane and approximately one meter from transverse pavement panel joints.

SZ-116.6 Coordinate the installation of detector loops with the Roadway Contractor.

SZ-116.7 Loops and loop circuits including the lead-in cable must have insulation resistance greater than 100 megohm to qualify as a good circuit. Troubleshoot and repair the problem if the insulation test is under 100 megohm.

SZ-116.8 **LOOP CONDUCTOR**

Apply the following provisions to the Loop Conductor for the Loop Detector Design Preformed:

(A) Provide a continuous system through the loop head, tail, and entrance conduit to the handhole.

(B) Twist unencased tail wire three (3) turns per foot.

SZ-116.9 **LOOP DETECTOR HEAD CONDUIT**

Apply the following provisions to the Loop Detector Head Conduit for the Loop Detector Design Preformed:

(A) Provide Loop Detector Head Conduit with the following properties:

- a. Flexibility.
- b. Protection from moisture.
- c. Protection from pavement expansion/contraction,
- d. Binded loop conductor firmly in place.
- e. 0.375 inch I.D. and 0.625 inch O.D. polypropylene.

- f. Two five inch expansion/contraction joints with each joint protected by a nine inch, schedule 80, polypropylene slide cover.
- (B) Fill the Loop Detector Head Conduit and the PVC Loop Tail Encasement with hot rubberized asphalt.

SZ-116.10 **TEE CONNECTOR**

Attach Loop Detector Head Conduit attached to the PVC Loop Tail Encasement with a schedule 80 CPVC tee (shown as the “TEE CONNECTOR” in the Plan detail).

SZ-116.11 **LOOP TAIL**

The Loop Tail is the part of the Loop Detector Design Preformed that runs from the “Tee Connector” to the handhole. Apply the following provisions to the Loop Tail for the Loop Detector Design Preformed:

- (A) The following description of the Loop Tail differentiates between which parts are encased and which parts not non-encased:
 - a. Place the encased portion in the first five feet from the Tee Connector.
 - b. Place the 90 foot non-encased portion from the encased portion to the splice encapsulator in the handhole.
- (B) Place one foot minimum of the encased portion of the Loop Tail into the NMC that runs to the handhole.
- (C) Provide an encased Loop tail wire including the following properties:
 - a. Seamless.
 - b. Urethane.
 - c. Non-perforated jacket reinforced with extruded polyester fiber braid.
 - d. Nonconductive
 - e. Completely filled with hot rubberized asphalt. The length of the flex hose tail encasement is the distance from the loop head tee connector and the handhole entrance conduit plus one foot (length varies, see Plan).
- (D) Vary the loop tail length depending on lane location (see Plans).

SZ-116.12 **LOOP INSTALLATION**

Construct the Loop Installation for Loop Detector Design Preformed according to MnDOT 2550.3, Plan details, and the following provisions:

- (A) Furnish and install NMC conduit as shown in the plan detail.
- (B) Place the loop tail within a ¾ inch handhole entrance conduit (see Plan Detail).

SZ-116.13 **LEAD-IN SPLICE ENCAPSULATOR**

Apply the following provisions to the Lead-in Splice Encapsulator for Loop Detector Design Preformed:

- (A) Splice detector loop and lead-in conductor wires as directed in the Plan Detail “TMS Loop Detector Typical – Part Two”. Provide the following features for the Splice protection device:
 - a. Designed for use in weather exposed or direct burial locations,
 - b. Splices are made on unshielded synthetic insulated cables,
 - c. UL listed for direct burial and submerged applications up to 600 volts,

- d. Capable of withstanding temperatures up to 90 °C,
- e. Capable of accommodating conductor cable and connector outside diameters of up to 0.625 inch.

SZ-116.14 **PROTECT CONDUCTOR ENDS**

Apply the following provisions to Protect Lead Ends for the Loop Detector Design Preformed:

- (A) Protect Loop Tail and Lead conductor ends whenever they are not immediately spliced to the 2/C No.14 in the handhole by performing the following:
 - a. Encapsulate wire ends with an epoxy type encapsulator.
 - b. Attach the encapsulated wires to the eyebolt near the top of the HH (install an eye bolt if it is missing from an existing handhole).

SZ-116.15 **SPlicing LEAD-IN CONDUCTOR CABLE TO LOOP DETECTOR WIRE**

Apply the following provisions to Splicing Lead-in Conductor Cable to Loop Detector Wire for Loop Detector Design Preformed:

- (A) Utilize a rosin core solder or rosin flux and solder to splice the loop conductor and the loop lead-in conductor.
- (B) Create separation between soldered splices by staggering the splices. Prevent contact between soldered splices.
- (C) Place the splice through the cap into the tube of the splice kit so that the outer jacket of each conductor enters the encapsulator tube to ensure the splice is sealed by the epoxy. Place both loop conductor and lead-in conductor splices into the same end of the encapsulator tube.
- (D) Insert one half inch of roughed surface of the 2/C No. 14 lead-in cable outer jacket and the sawcut loop detector tubing into the epoxy. Provide a minimum one inch sand paper roughened surface protrusion outside the epoxy. Make the sand paper roughed surface protruding outside the epoxy visually verifiable. Cut off the exposed drain wire and the foil shield of the 2/C No. 14 Lead-in cable prior to inserting the outer jacket into the epoxy.
- (E) Attach the splice to the eyebolt near the top of the handhole (install an eyebolt if it is missing).
- (F) Verify that loop conductor cable identification markings (lane and cabinet ID) are correct and consistent with the Plan Detail prior to cutting any existing splices to Lead-in conductor Cable.
- (G) Notify the Engineer following the installation of the splice. A MnDOT representative will test the loop and lead-in system and terminate the lead-in within seven days.

SZ-116.16 **APL**

The following items have met the above specifications:

- (A) MnDOT approved Splice Encapsulator is listed on the following Website:
<http://www.dot.state.mn.us/products/trafficmgtssystem/index.html>
- (B) MnDOT approved Preformed Loop Detector is listed on the following Website:
<http://www.dot.state.mn.us/products/trafficmgtssystem/index.html>

SZ-116.17 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (LOOP DETECTOR DESIGN PREFORMED) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Project Testing and documentation Submittals, Labeling, Loop Conductor, Loop Detector Head Conduit, Tee Connector, Loop Tail, Loop Installation, Splice Encapsulator, Protect Conductor Ends, Splicing Requirements, and all materials and labor necessary to construct the Loop Detector Design Preformed.

SZ-117 **(2550) LOOP DETECTOR DESIGN SAWCUT**

Furnish and install Loop Detector Design Sawcut, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-117.1 See PROJECT TESTING AND DOCUMENTATION SUBMITTALS on page 38 for project testing and documentation details.

SZ-117.2 See LABELING on page 33 for labeling details.

SZ-117.3 **INSTALLATION REQUIREMENTS**

Apply the following provisions to the Installation requirements for Loop Detector Design Sawcut:

- (A) Detector loops vary in size. Loop sizes given in the Plan are approximate. The size of the detector loop is dependent upon the service location. Loops on freeway ramps may be wider than loops in mainline lanes. Change loop sizes in the field to the actual size needed to comply with the Plan detail.
- (B) Place each loop in the center of the lane and approximately three feet from any transverse pavement joints.
- (C) Prior to utilization of existing handholes they shall be cleaned to the satisfaction of the Engineer and TMS Integrator.
- (D) Mark proposed loop detector placement locations prior to the milling operation. Indicate minimum pavement degradation areas with the markings. Place the loops within these areas.
- (E) Seal the Loop Detector Design Sawcut within the pavement.

SZ-117.4 **CONDUCTOR**

Apply the following provisions to the Conductor for Loop Detector Design Sawcut:

- (A) Provide a conductor conforming to MnDOT 3815.2B2(b).
- (B) 0.25 inch in diameter; Encased with a flexible, black, 0.032 inch thick polyethylene jacket; and is spliced to the 2/C No.14 in the handhole.

SZ-117.5 **LEAD-IN SPLICE ENCAPSULATOR**

Apply the following provisions to the Lead-in Splice Encapsulator for Loop Detector Design Preformed:

- (A) Splice detector loop and lead-in conductor wires as directed in the Plan Detail "TMS Loop Detector Typical – Part Two". Provide the following features for the Splice protection device:
 - a. Designed for use in weather exposed or direct burial locations,
 - b. Splices are made on unshielded synthetic insulated cables,

- c. UL listed for direct burial and submerged applications up to 600 volts,
- d. Capable of withstanding temperatures up to 90 °C,
- e. Capable of accommodating conductor cable and connector outside diameters of up to 0.625 inch.

SZ-117.6 **NMC CONDUIT**

Apply the following provisions to the NMC Conduit for Loop Detector Design Sawcut:

- (A) Size NMC conduit per NEC code for the Handhole Entrance Conduit (see Plan detail for installation requirements).
- (B) Seal openings cut in the handhole to insert conduit with a compound that is compatible for adherence to both the PVC HH and the conduit material to make the opening watertight.
- (C) Cut and remove shoulder material as needed to place conduit.

SZ-117.7 **PROTECT CONDUCTOR ENDS**

Apply the following provisions to Protect Lead Ends for the Loop Detector Design Sawcut:

- (A) Protect the Loop Tail and Lead conductor ends whenever they are not immediately spliced to the 2/C No.14 in the handhole by performing the following:
 - a. Encapsulate tire ends with an epoxy type encapsulator.
 - b. Attach the encapsulated wires to the eyebolt near the top of the HH (install an eye bolt if it is missing from an existing handhole).

SZ-117.8 **SPLICING LEAD-IN CONDUCTOR CABLE TO LOOP DETECTOR WIRE**

Apply the following provisions to Splicing Lead-in Conductor Cable to Loop Detector Wire for Loop Detector Design Preformed:

- (A) Utilize a rosin core solder or rosin flux and solder to splice the loop conductor and the loop lead-in conductor.
- (B) Create separation between soldered splices by staggering the splices. Prevent contact between soldered splices.
- (C) Place the splice through the cap into the tube of the splice kit so that the outer jacket of each conductor enters the encapsulator tube to ensure the splice is sealed by the epoxy. Place both loop conductor and lead-in conductor splices into the same end of the encapsulator tube.
- (D) Insert one half inch of roughed surface of the 2/C No. 14 lead-in cable outer jacket and the sawcut loop detector tubing into the epoxy. Provide a minimum one inch sand paper roughened surface protrusion outside the epoxy. Make the sand paper roughed surface protruding outside the epoxy visually verifiable. Cut off the exposed drain wire and the foil shield of the 2/C No. 14 Lead-in cable prior to inserting the outer jacket into the epoxy.
- (E) Attach the splice to the eyebolt near the top of the handhole (install an eyebolt if it is missing).
- (F) Verify that loop conductor cable identification markings (lane and cabinet ID) are correct and consistent with the Plan Detail prior to cutting any existing splices to Lead-in conductor Cable.
- (G) Notify the Engineer following the installation of the splice. A MnDOT representative will test the loop and lead-in system and terminate the lead-in within seven days.

SZ-117.9 **APL**

The following items have met the above specifications:

- (A) MnDOT approved Loop Sealant and Splice Encapsulator are listed on the following Website:

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

SZ-117.10 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (LOOP DETECTOR DESIGN SAWCUT) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Project and Documentation Submittals, Labeling, Installation Requirements, Conductor, Loop Sealant, Lead-in Splice Encapsulator, NMC Conduit, Protecting Conductor Cable Ends, Splicing Lead-in Conductor Cable to Loop Detector Wire, and all materials and labor necessary to construct the Loop Detector Design Sawcut.

SZ-118 (2550) INSTALL SERVICE EQUIPMENT

Install the service equipment, internal and external components. Install Service Equipment previously salvaged from this project. Repair or replace damage to the installed materials resulting from the removing, salvaging and delivering operation.

Install Service Equipment in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-118.1 Install salvaged Service Equipment from the project.
- SZ-118.2 See GROUNDING on page 27 for grounding specifications.
- SZ-118.3 Construct conductors internal to the foundation per Plan.
- SZ-118.4 Maintain full operation of power service Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer existing to proposed service outside of these hours.
- SZ-118.5 Secure Installed Service Equipment to the foundation by utilizing four inches long, 0.375 inch diameter, Stainless Steel Quick Bolts (wedge bolts).
- SZ-118.6 **MEASUREMENT AND PAYMENT**
Measurement will be made by the each constructed as specified. Payment will be made under item 2550.602 (INSTALL SERVICE EQUIPMENT) at the Contract unit bid price for each, which will, be compensation in full for the costs incidental thereto, including but not limited to conductors internal to the foundation, mounting on a foundation, grounding, and all materials, equipment, and all materials and labor necessary to construct the Install Service Equipment.

SZ-119 (2550) CONTROL CABINET

Furnish and install a gate arm Control Cabinet with a gate arm to provide a barrier which prevents traffic from entering the reversible roadway, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, and the Plans, and the following:

- SZ-119.1 Pre-wire the Control Cabinet, complete with all pumps, valves, cylinders, and electrical devices to move gate arm and limit its travel in both directions.
- SZ-119.2 Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the Control Cabinet. Show the size and location of the concrete mounting pad on the drawings. Submit two copies of manufacturer's installation instructions for this specific project.

- SZ-119.3 Submit affidavits from the manufacturer demonstrating that the gate mechanism has been tested to 200,000 cycles without breakdown. Affix a label to each Control Cabinet indicating that the Control Cabinet has been tested for full power and pressure of all hydraulic components, full stress tests of all mechanical components and electrical tests of all overload devices.
- SZ-119.4 Build Control Cabinets conforming to UL325 standards listed by a NRTL testing laboratory. Complete all electrical work according to local codes and National Electrical code. Perform construction in a neat and professional manner, completed to Journeyman standards.
- SZ-119.5 Design and label Control Cabinets for specific usage classes according to current safety standards.
- SZ-119.6 Provide a five-year limited warranty against all defects in materials or workmanship. Replace defective materials with comparable materials furnished by the manufacturer. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner. Issue a warranty certificate to MnDOT. Start the warranty six-months before system acceptance.
- SZ-119.7 Provide a Control Cabinet which operates by means of a hydraulic cylinder pulling a crank arm that rotates the output through ninety degrees.
- SZ-119.8 The arm travel time varies, depending upon version ordered.
- SZ-119.9 Galvanize the body and chassis of the Control Cabinet and provide a stainless steel door. Prevent twisting in strong winds.
- SZ-119.10 Limit operation to the fully open and fully closed position by cam-operated switches that accurately read the position of the shaft and arm.
- SZ-119.11 A spring counterbalance is not required. Do not incorporate gears, sprockets, or belts in the operator.
- SZ-119.12 Include two brake valves to gradually stop and hold the arm without applying a shock load to the arm or operator assembly.
- SZ-119.13 Provide a means for manual operation, in case of power failure, by the use of a "pull to release" bypass valve, which unlocks the operator and allows the arm to be moved by hand.
- SZ-119.14 Provide a maximum of five seconds of travel time to open from fully closed or six seconds to close from fully open. Provide a maximum arm length of 25 feet for five inches rectangular tubular designs.
- SZ-119.15 See Plan for table indicating required arm lengths by location.
- SZ-119.16 Provide grounding per manufacturer recommendations.
- SZ-119.17 Include the following standard components as a minimum:
- (A) Five inches rectangular tubular gate arm located 3 feet nine inches plus or minus three inches above the roadway pavement. Provide red LED indications on the gate arm. Place the surface of the foundation four inches above finished grade. Customize each gate arm Control height per location to meet the previous requirement. Provide a control Cabinet and gate arm which allows the gate arm to be adjusted to specific heights per location as necessary.

- (B) Attach the gate arm to the Control Cabinet utilizing double spring swing away returns. Subsequent to impact the gate arm may suffer minor damage and shall swing back to the original position prior to impact.
- (C) Provide 6" wide reflective orange and white diagonal gate arm striping using Barricade Sheeting Type XI.
- (D) Galvanize the chassis and ground edges smooth.
- (E) Provide a cover which is 14 gauge galvanized sheet steel, with all joints welded, filled and ground smooth.
- (F) Output shaft: shall be 1.25 inches diameter, high strength steel alloy.
- (G) Make the gate arm using 0.75 inch plate steel.
- (H) Heavy duty sealed 1.25 inches bearings, with cast iron flanges.
- (I) Adjustable physical stop limiting close travel to prevent arm from sagging below a level position.
- (J) Uses counterweights for balancing the gate arm per manufacturer recommendations.
- (K) A synthetic 0.25" hydraulic hose, rated to 2750 psi.
- (L) Galvanize the finish of the Control Cabinet.

SZ-119.18 Include the following standard electrical components as a minimum:

- (A) Pump motor: 3/4 HP minimum, 56C.
- (B) Internal overload protection for the motor.
- (C) Electrical enclosure rated NEMA 1 with a hinged door.
- (D) Include the following controls:
 - a. Smart Touch Controller Board with 128K memory containing:
 - b. built in timer to close
 - c. liquid crystal display for reporting of functions
 - d. 19 programmable output relay options
 - e. bi-directional toggle mode
 - f. built-in power surge/lightning strike protection
 - g. capable, with optional software, of event logging EEPROM for trouble shooting diagnostics
 - h. RS232 port for connection to laptop or other computer peripheral and RS485 connection of Master/Slave systems
- (E) Control circuit shall be 24 VDC.
- (F) AC power loss operation can be programmed to open immediately, stay open after next normal operation, or maintain current position.
- (G) Limit switches shall be adjustable to control maximum travel.
- (H) 120VAC

SZ-119.19 Fully assemble and test, at the factory, each gate operator to assure smooth operation, sequencing and electrical connection integrity. Include the following:

- (A) Apply physical loads to the Control Cabinet to simulate field conditions.
- (B) Provide tests to simulate physical and electrical loads equal to the fully rated capacity of the Control Cabinet components.
- (C) Check all mechanical connections for tightness and alignment.
- (D) Check all welds for completeness and continuity. Check welded corners and edges to assure they are square and straight.
- (E) Check all hydraulic hoses and electrical wires to assure that chafing cannot occur during shipping or operation.

SZ-119.20 Place concrete mounting pad in accordance with approved shop drawings.

SZ-119.21 Construct the Control Cabinet in accordance with the manufacturer's printed instructions, current at the time of installation.

SZ-119.22 Coordinate locations of Control Cabinet with contract drawings and shop drawings.

SZ-119.23 Test control Cabinet through ten full cycles and adjust to eliminate binding, scraping, or uneven motion.

SZ-119.24 Test limit switches for proper "at rest" gate position.

SZ-119.25 Conceal all anchor bolts in the finished installation.

SZ-119.26 **HAS MET**

The following items have met the above specifications:

- (A) Control Cabinet: Hy-Security gate Operator, model HTG320-6 ST.

SZ-119.27 **APL**

MnDOT approved reflective Type XI orange and white sheeting is listed on the following Website:

<http://www.dot.state.mn.us/products/signing/sheeting.html>

SZ-119.28 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2550.602 (CONTROL CABINET) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to control cabinet, gate arm, and all materials and labor necessary to construct the Control Cabinet.

SZ-120 (2550) GENERATOR

Furnish and install a natural gas Generator in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-120.1 Ground the Generator per manufacturer recommendations.

SZ-120.2 Use a Generator with the following features:

- (A) Foundation, cables for operation, and termination of cables per manufacturer recommendations
- (B) Alarm and monitoring from local and remote locations. Provides alarms and monitoring for the following items at a minimum:
 - a. Generator running
 - b. Generator failed
 - c. Generator oil pressure
 - d. Generator temperature
- (C) Natural gas connection
- (D) Cold weather package ensuring operability between -40 to 120 degrees Fahrenheit
- (E) Transfer switch rated for the generator wattage. See Plan for minimum required wattage.

SZ-120.3 Connect wiring and mount transfer switches inside MnDOT provided service cabinets

SZ-120.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (GENERATOR) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including all materials and labor necessary to construct the Generator.

SZ-121 (2550) RELOCATE GENERATOR

Relocate Generator including the in-place foundation to ensure that Traffic Management System Generators relocated in the specified location, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-121.1 See (2550) GENERATOR on page 133 for additional requirements.

SZ-121.2 **REQUIREMENTS**

Relocate Generator in accordance with the following:

- (A) Contact the TMS Integrator prior to relocating the generator at least two Working days in advance. The TMS Integrator will then inspect the generator to determine if any damage occurred during the relocation process.

SZ-121.3 **CONSTRUCTION REQUIREMENTS**

Conform to the following Construction Requirements in accordance with the following:

- (A) Furnish and install mounting hardware as needed.
- (B) Relocate Generator to the required grade.
- (C) Backfill any required excavation.
- (D) Restore disturbed area to original conditions.

SZ-121.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (RELOCATE GENERATOR) at the Contract bid price per each, which will be compensation in full for all

costs incidental thereto, including but not limited to, Requirements, Construction Requirements, and all materials and labor necessary to construct Relocate Generator.

SZ-122 **(2550) INSTALL CABLE**

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

SZ-122.1 Conform to the requirements for installing new Cable of the same type when placing the cable.

SZ-122.2 Cable will be supplied by MnDOT. A minimum notice of two Working days is required.

SZ-122.3 **MEASUREMENT AND PAYMENT**

Measurement will be made by the length of Install Cable as specified. Payment will be made under Item 2550.603 (INSTALL 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 all materials and labor necessary to construct the Install Cable.

SZ-123 **(2550) INSTALL SERVICE CABINET**

Install Service Cabinet, internal and external components. The Install Service Cabinet is previously salvaged from this project. Repair or replace any damage to the installed materials resulting from the removing, salvaging and delivering operation.

Install Service Cabinet in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-123.1 Install Service Cabinet salvaged from the project. Or MnDOT provided

SZ-123.2 Maintain full operation of power service Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm unless approved by the Engineer. Transfer existing to proposed service outside of these hours

SZ-123.3 Mark conduit stubs leaving the service cabinet with a two-inch by two-inch wooden stake placed at the end of the stub. Expose five feet of the stake above ground and paint it orange.

SZ-123.4 See GROUNDING on page 27 for grounding specifications.

SZ-123.5 Place conductors internal to the foundation per Plan.

SZ-123.6 Service Cabinet shall be secured to the foundation by utilizing 4 inch long, 0.5 inch diameter, Stainless Steel Quick Bolts (wedge bolts).

SZ-123.7 The Service Cabinet circuit breaker sizes and quantities shall be defined in the Plan details.

SZ-123.8 Notify MnDOT Business Services Section when MnDOT is to assume ownership of the proposed source of power. Following is the contact information:

Brandon Gfrerer (651) 234-7441
Metro Accounts Payable-MnDOT Mailstop 050
Waters Edge Building
1500 County Road B2
Roseville MN 55113

SZ-123.9 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under item 2550.602 (INSTALL SERVICE CABINET) at the Contract unit bid price for each, which will, be compensation in full for the costs incidental thereto, including but not limited to conductors internal to the foundation, mounting on a foundation, grounding, breakers, and all materials, equipment, and all materials and labor necessary to construct the Install Service Cabinet.

SZ-124 (2550) INSTALL TOLL READER

Install Toll Reader, including internal and external components. The Toll Reader is previously salvaged from this project. Repair or replace any damage to the installed materials resulting from the removing, salvaging and delivering operation. Install Toll Reader in accordance with MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-124.1 Install Toll Readers previously salvaged from the project.

SZ-124.2 See GROUNDING on page 27 for grounding specifications.

SZ-124.3 Maintain full operation of existing Toll Readers during the weekday peak periods of 5:00 a.m. to 9:00 a.m. and 3:00 p.m. to 7:00 p.m. or as approved by the Engineer.

SZ-124.4 Notify the TMS Integrator when the installation of the Toll Reader is complete.

SZ-124.5 Furnish and install mounting hardware as needed.

SZ-124.6 MEASUREMENT AND PAYMENT

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (INSTALL TOLL READER) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to, installing toll readers, grounding, keeping toll readers operational during weekday periods, notifying the TMS Integrator, and all materials and labor necessary to Install Toll Reader.

SZ-125 (2550) REMOVE CONDUIT

Remove Conduit, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-125.1 Cut existing conduit as required for removal.

SZ-125.2 Remove the existing 2 inch NMC in the location shown on sheet 231 of 275. Remove and pull the existing 2 inch NMC from the existing pull vault.

SZ-125.3 Cover the opening in the pull vault to prevent material from entering during the backfilling operation. Cover the opening in the pull vault in a manner that will enable removal of the cover so the hole in the pull vault can be utilized for proposed conduit.

SZ-125.4 Backfill the excavation with suitable grading material and compact utilizing the Quality Compaction method.

SZ-125.5 Pay for any damage to the existing pull vault.

SZ-125.6 Dispose of all materials and debris outside the Right of Way according to MnDOT 2104.

SZ-125.7 MEASUREMENT AND PAYMENT

Measurement will be made by the length of Conduit Removed as specified. Payment will be made under Item 2550.603 (REMOVE CONDUIT) at the Contract bid price per linear foot, which will be compensation in full for all costs incidental thereto, including but not limited to excavation, covering of the pull vault opening, backfilling, compaction, and all materials and labor necessary to construct the Remove Conduit.

SZ-126 (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-126.1 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-126.2 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-126.3 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-126.4 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-126.5 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-126.6 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-127 (2550) REROUTE CABLE

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

- SZ-127.1 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-127.2 Disconnect and terminate cables unless otherwise directed by the Plans.
- SZ-127.3 Pull back cables prior to rerouting as directed by the Plan.
- SZ-127.4 Remove existing conduit and cables to adjust to the proposed design.
- SZ-127.5 Protect cable to ensure it is not damaged when exposed. Be responsible for any damage incurred during the Reroute Cable operation.
- SZ-127.6 See GROUNDING on page 27 for Grounding requirements.
- SZ-127.7 See LABELING on page 33 for Labeling requirements.

SZ-127.8 **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 27 for grounding requirements.
- (G) Calculate expected tension on the FO Cable and pulling tape prior to installing the FO Cable in conduit runs. Distribute 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-127.9 **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 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-128 (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-128.1 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-128.2 Use schedule 80 Heavy-wall rigid PVC or HDPE for installation under an existing roadway or paved surface.

SZ-128.3 Place all conduit under roadways continuous without joints.

SZ-128.4 Place Bored Conduit under slope paving without damaging the slope paving.

SZ-128.5 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-128.6 Place Bored Conduit at depths according to the Plan if the Plan calls out for deviations from these specifications.

SZ-128.7 Use standard bell ends on all conduit ends to prevent damage to cables during installation.

SZ-128.8 **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.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.603	___ Bored Conduit	linear foot

SZ-129 (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-129.1 **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-129.2 **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 27 for grounding requirements.
- (G) Calculate expected tension on the FO Cable and pulling tape prior to installing the FO Cable in conduit runs. Distribute 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 encapped 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-129.3 **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/trafficmgtssystem/index.html>

SZ-129.4 **MEASUREMENT AND PAYMENT**
 Measurement will be made by the length of Fiber Optic Cable furnished and installed as specified. Payment for FIBER OPTIC CABLE 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.

<u>Item No.</u>	<u>Description</u>	<u>Unit</u>
2550.503	Fiberoptic Trunk Cable ____ ____	linear foot
2550.603	Fiber Optic Trunk Cable ____ ____	linear foot
2550.603	Armored Fiber Optic Pigtail Cable ____ ____	linear foot
2550.603	Pre-terminated/Armored Fiber Optic Pigtail Cable ____ ____	linear

foot

SZ-130 **(2564) SIGN FRAME**
 Furnish and install a Sign Frame, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-130.1 **MEASUREMENT AND PAYMENT**
 Measurement will be made by the each constructed as specified. Payment will be made under Item 2564.602 (SIGN FRAME) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to all materials and labor necessary to construct the Sign Frame.

SZ-131 **(2565) SIGNAL INDICATION RELAMP**

Signal Indication Relamp, in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-131.1 **CONSTRUCTION REQUIREMENTS**

Signal Indication Relamp in accordance with the following Construction Requirements:

SZ-131.2 Maintain full operation of signal indications Monday-Friday from 5:00 am to 9:00 am and 3:00 pm to 7:00 pm. Perform Signal Indication Relamp outside of these hours, unless approved by the Engineer.

- (A) Notify the TMS Integrator of any damage discovered prior to beginning any work.
- (B) Visually confirm the correct fuse for the indication Prior to beginning the replacement of each indication. Accomplish this by removing the fuse in the Ground Mounted Control Cabinet and visually observing the behavior of the corresponding indication.
- (C) Remove existing Ramp Control Signal (RCS) incandescent indications. Dispose of removed parts according to MnDOT 2104, including but not limited to the incandescent bulbs and the lenses.
- (D) Furnish and Install new eight inch LED indications according to locations and details shown in the Plan and according to Manufacturer recommendations.
- (E) See LABELING on page 33 for labeling details.
- (F) Replace the fuse and verify operation of the LED indications prior to leaving each site.

SZ-131.3 **APL**

MnDOT approved 8 inch LED is listed on the following Website:

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

SZ-131.4 **MEASUREMENT AND PAYMENT**

Measurement will be made by each Signal Head with LED indications installed as specified.

Payment will be made under Item 2565.602 (SIGNAL INDICATION RELAMP) at the Contract bid price per each, which will be compensation in full for all costs incidental thereto, including but not limited to Items shown on the Plan Details, Construction Requirements, and all materials and labor necessary to construct Signal Indication Relamp.

SZ-132 **(2565) FLASHING BEACON SYSTEM**

Furnish and install a Flashing Beacon System, in accordance with the MUTCD, MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-132.1 Use stainless steel hardware and fasteners.

SZ-132.2 See GROUNDING on page 27 for grounding details

SZ-132.3 Use a beacon that flashes at a rate of 50-60 times per minute.

SZ-132.4 **BEACON HEAD ASSEMBLY**

Comply with MnDOT 3834 and the following supplements or modifications for the Beacon Head Assembly.

- (A) Use Flashing Beacon housings with the following characteristics:
 - a. Constructed of black polycarbonate.
 - b. The top and bottom have internal ribbing for extra strength.
 - c. Polycarbonate housing doors with a gasket groove containing a weather proof and mildew resistant gasket. Create a weatherproof and dust proof seal when the door is closed by ensuring the gasket contacts a raised bead formed on the edge of the housing where it contacts the door.

SZ-132.5 **LED**

Apply the following provisions to LED:

- (A) Furnish and install 12 inches LED Yellow Ball Flashing indications according to Manufacturer recommendations and the Plan details.
- (B) See LABELING on page 33 for labeling details.

SZ-132.6 **SIGNAL CONNECTIONS**

Apply the following provisions to Signal Connections:

- (A) See the Plan Detail for detailed instructions, materials, and installation procedures.

SZ-132.7 **APL**

MnDOT approved 12 inches LED Yellow Ball is listed on the following Website:

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

SZ-132.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed design as specified. Payment will be made under Item 2565.616 (FLASHING BEACON SYSTEM) at the Contract bid price per system, which will be compensation in full for all costs incidental thereto, including but not limited to Fittings, RSC, Mounting Hardware, Beacon Head Assembly, LED, Signal Connections, and all materials and labor necessary to construct the Flashing Beacon System.