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I hereby certify that the Special Provisions for traffic sign construction (Division ST) 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.

  
\_\_\_\_\_  
Scott A. Petersen

## DIVISION SZ

### SZ-1

#### (1102) ABBREVIATIONS

The provisions of MnDOT 1102 are hereby supplemented with the following:

SZ-1.1 The following is added to MnDOT 1102.1 GLOSSARY OF ACRONYMS AND ABBREVIATIONS:

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

SZ-1.2 UNITS

°F Degree Fahrenheit

SZ-1.3 SYMBOLS

$\pi$	pi (3.1416)
<	less than
>	greater than

SZ-1.4 CONVERSIONS

1 inch	25.4 millimeters (mm)
1 inch <sup>2</sup>	645 mm <sup>2</sup>
1 inch <sup>3</sup>	16,400 mm <sup>3</sup>
1 yd <sup>3</sup>	0.76 m <sup>3</sup>
1 liter	61 in <sup>3</sup>
1 gallon	3.785 liters
1 pound mass	0.4536 kg

SZ-2 **(1103) DEFINITIONS**

The provisions of MnDOT 1103 are hereby supplemented 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 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 (APL) which contains manufacturer's products that are in conformance with the specifications required by MnDOT. The Contractor shall only use products contained within the Traffic Management Systems / ITS section of the APL unless otherwise directed within these Special Provisions. The Contractor may submit any other manufacturer's product of equal quality for approval. See the following website for the APL:

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

SZ-3 **(1903) COMPENSATION FOR ALTERED 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 shall be paid for as Extra Work in accordance with MnDOT 1904.

SZ-3.1 MnDOT 1402.3 is modified to the extent that any references to 75 percent shall be construed to read 60 percent and any references to 125 percent shall be construed to read 150 percent for the following items:

2550.603      \_\_\_ " BORED CONDUIT

**SZ-4**            **(2550) MATERIALS**

The following provisions shall supplement MnDOT 2550.2A:

- SZ-4.1        All Materials, work methods, and equipment shall 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-4.2        The Contractor warranties all furnish and install (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. The warranty period begins when the Contractor completes all construction obligations, documented as the Final Completion Date on the Change in Construction Status report.
- SZ-4.3        Use stainless steel hardware (e.g. mounting bolts, nuts, washers, and external hinges, etc.) on all outdoor TMS components (vaults, cabinets, electrical services, etc.).
- SZ-4.4        The Contractor is responsible for rounding and smoothing sharp corners and edges of all F&I TMS components.

**SZ-5**            **MNDOT FURNISHED MATERIALS**

The following provisions shall apply to State provided materials:

- SZ-5.1        State provided materials are procured and stored by MnDOT, unless otherwise stated and are provided to the Contractor with proper notice. The Contractor is responsible for any damage to the equipment once MnDOT has provided the materials to the Contractor.

SZ-5.2        **PTZ CAMERA**

MnDOT will be furnishing PTZ cameras at each of the Non-Intrusive Detection Hardware locations. MnDOT will also furnish an appropriate power supply device to power the provided camera for each of the Non-Intrusive Detection Hardware locations. The Contractor shall be responsible for the following:

- (A)        Installing the PTZ Camera Assembly.
- (B)        Delivering the PTZ Camera Assembly to the Project site undamaged.
- (C)        The Contractor notifies the Engineer by construction phone number (651) 234-7059, a minimum of two business 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. The Contractor shall inspect the PTZ Camera Assembly in the presence of both the Engineer and Integrator before it leaves the storage site.

SZ-5.3        **CCTV CABLE**

The cable(s) associated with the camera is a composite (or combination of) video, communications, and power control cable(s) constructed specially for the Infinova Camera Unit. The Contractor shall be responsible for the following:

- (A)        For installation details see (2550) NON-INTRUSIVE DETECTION HARDWARE on page 19.

- (B) The Contractor notifies the Engineer by construction phone number (651) 234-7059, a minimum of two business days before transporting CCTV Cable from the storage site to the job site. The storage site is on MnDOT property in the Metro area. The Contractor shall inspect the cable in the presence of both the Engineer and Integrator before the cable leaves the storage site.

**SZ-5.4**      **CELLULAR NETWORK MODEM**

MnDOT will furnish a cellular network modem at each Non-Intrusive Detection Hardware location. MnDOT will furnish an activated modem to the contractor upon request under the provisions below. The Contractor shall be responsible for the following:

- (A) Installing the modem in the pole-mounted cabinet as indicated on the Plan.
- (B) The Contractor notifies the Engineer by construction phone number (651) 234-7059, a minimum of two business days before transporting Cellular Network Modem from the storage site to the job site. The storage site is on MnDOT property in the Metro area. The Contractor shall inspect the modem in the presence of both the Engineer and Integrator before it leaves the storage site.

**SZ-6**      **SYSTEM INTEGRATION**

An Integrator is assigned to each project involving construction of a Traffic Management System. The Integrator shall serve as a technical resource to MnDOT Construction Administration. Contact information will be provided at the Pre-construction meeting. If the Integrator is not reachable, contact the Engineer by construction phone number (651) 234-7059.

**SZ-6.1**      **INTEGRATOR RESPONSIBILITIES**

The Integrator will be responsible for performing the following tasks:

- (A) Recommend approval/disapproval of TMS components and/or TMS construction methods to the Engineer.
- (B) Help to resolve Plan and Special Provision discrepancies.
- (C) Provide technical guidance to Contractors as directed by the Engineer.
- (D) **Staking**
  - a. The Contractor shall stake or flag proposed cable and conduit with trace wire which will be used for future cable installation. The stakes or flags shall be every 100 feet and at each change in direction. The Contractor shall acquire Integrator approval of these locations prior to installation.
  - b. An Integrator shall be present when locations are staked or flagged for, Vaults, CCTV poles, Non-Intrusive Detection Folding poles, control cabinets, service cabinets, and Wood Poles.
  - c. The Contractor shall be responsible for locating all existing utilities prior to installation of any proposed Integrator staked TMS infrastructure locations. Staking done by the Integrator is not a substitute for existing utility location.
- (E) Assist with TMS construction inspection.

**SZ-6.2**      **PROJECT SUBMITTAL AND TEST DOCUMENTATION**

TMS Project Submittal shall be reviewed by the Integrator 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-7**      **GROUNDING**

The following provisions shall apply to Grounding:

**SZ-7.1 SINGLE POINT GROUNDING**

All grounded devices shall connect 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-7.2 GROUND RODS AND GROUND ROD CONNECTIONS**

The following provisions shall apply 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) An oxide inhibitor shall be applied over bonded connections to ground rods. The Oxide Inhibitor must be U.L. listed and applied to the bonded area between the temperatures of -22 °C (-30 °F) and 149 °C (300 °F).
- (C) The Contractor shall clean each grounding component with 300-grit emery cloth before bonding and apply a mineral oil based oxide inhibitor to the bond area.
- (D) Bonding the ground conductor to the ground rod shall be accomplished by one of the following bonding methods:
  - a. Mechanical. The Mechanical Grounding connector shall have the following characteristics:
    - i. Shall be sized ½ inch diameter for Lightning rods and 0.625 inch diameter for Ground rods.
    - ii. Shall include two stainless steel cap screws to secure the cable to the ground electrode for a positive electrical connection.
  - b. Exothermic Welding.

(E) **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-7.3 CABLES**

The following provisions shall apply to the grounding of Cables:

- (A) Ground all Cable shields entering cabinets.
- (B) Maintain the electrical continuity of the Cable shields.
- (C) Shield bonding shall comply with RUS splicing Standard PC-2, Section 3.3.
- (D) Bonding connectors shall comply with RUS standard PE-33 (Cable Shield Connectors).

**SZ-7.4 SERVICE CABINETS OR EQUIPMENT**

The following provisions shall apply to the 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-7.5 NON-INTRUSIVE DETECTION HARDWARE**

The following provisions shall apply to the 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.
- (B) Ground the cabinet ground buss to the pole lug then 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-7.6 MEASUREMENT AND PAYMENT**

GROUNDING includes but shall not be limited to Single Point Grounding, Ground Rods and Ground Rod Connections, Cables, Service Cabinet or Equipment, Non-Intrusive Detection Hardware, and all materials and labor necessary to complete Grounding. GROUNDING shall be considered incidental for which no direct compensation will be made.

**SZ-8 LABELING**

The following provisions shall apply to Labeling:

- SZ-8.1 Secure identifying labels to each cable, component, cabinet in the manner described in the Plan and these Special Provisions.
- SZ-8.2 Contractor shall not use wire ties for labeling cables.

**SZ-8.3 ELECTRICAL COMPONENTS**

The following provisions shall apply 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-8.4 CAT 6 CABLE**

The following provisions shall apply to labeling CAT 6 Cable:

- (A) Utilize white electrical tape with black permanent marker.

**SZ-8.5 MEASUREMENT AND PAYMENT**

LABELING includes but shall not be limited to Electrical Components, Cat 6 Cable, and all materials and labor necessary to complete Labeling. LABELING shall be considered incidental for which no direct compensation will be made.

**SZ-9 ELECTRICAL SERVICE**

This work shall consist of coordinating the installation of Electrical Service, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-9.1 The Contractor shall provide power to the service installation(s) and verify the actual work to be done and all the associated costs.

SZ-9.2 Proposed sources of power are identified in the Plan.

SZ-9.3 **POWER UTILITY COMPANY COORDINATION**

The following provisions shall apply to the Power Utility Company Coordination requirements for Electrical Service:

- (A) Proposed power sources shall be required as denoted in the Plan. The Contractor shall be responsible for the following:
  - 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) Fees for the "Application for Electrical Service" and payment to the Utility Company for providing the electrical service connections shall be the responsibility of the Contractor. 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.
- (C) The Contractor shall secure approval from the Engineer for any changes to the Electrical Service shown in the Plan.
- (D) The Power Utility Company name is Xcel Energy. Following are the name, phone number, location, premise number, and account number, responsibilities for each of the Project Power Utility Company Designers:
  - a. Derek Anderson, Office: (763) 271-6419, Cell: (612) 227-0022
    - i. Location: Existing Transformer at US-12
    - ii. Premise Number: 304424897
    - iii. Account Number: 10392478

SZ-9.4 Notify MnDOT Business Services Section when MnDOT is to assume ownership of the proposed source of power. Following is the contact information:

(320) 231-5195  
MnDOT District 8 - Accounts Payable  
2505 Transportation Road  
Willmar, MN 56201

SZ-9.5 Compliance with NEC Article 110.24

- (A) Available Fault Current Calculations
  - a. Calculations for the available fault current at the line side of the meter socket must be provided for each electrical service.
  - b. Provide and install labels for the calculation results meeting the following requirements:
    - 1. Self-adhering label.
    - 2. Machine printed numbers and letters.
    - 3. Suitable for placement in damp locations
    - 4. Paper based labels are not acceptable.

5. Placed in the inside of the service cabinet on the dead front door so it is visible when the dead front door is closed.
6. Containing the following information:
  - a) Transformer Size in KVA
  - b) Available fault current in amps at the terminations of the utility transformer
  - c) Available fault current in amps at the line side of the meter socket.
  - d) The date the calculations were made

SZ-9.6 Provide to the Engineer, prior to final acceptance of the project, four (4) copies of the electric service information form for lighting systems. The Engineer will distribute copies as follows::

MnDOT Central Electrical Services Unit  
MnDOT Traffic Electrical Systems Engineer  
MnDOT District 8 Traffic Engineer  
Wright County

Provide an "Electrical Service Information Form for TMS systems". This form is considered incidental work.

SZ-9.7 **MEASUREMENT AND PAYMENT**

No measurement is made of the various items that constitute Electrical Service, however this work is included as part of the project (the electrical service costs will not be paid for as part of the pay item). Provide the Engineer a copy of the invoice from the electric utility. Payment is the power company invoice cost plus 10%. The payment is compensation in full for all costs incidental thereto, including, but not limited to, providing power to service cabinets, electric utility fees, electric utility coordination, notifying MnDOT of ownership details, and all materials and labor necessary to construct the Electrical Service.

### Electric Service Information Form For TMS Systems

Project Number:

Contractor:

Date:

System	MN/DOT Feed Point Number	Meter Address	Electric Utility Transformer Size In KVA	Length of conductors in feet from transformer connection to meter socket connection.		
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =
				L1 =	L2 =	Neutral =

**SZ-10**      **PROJECT TESTING AND DOCUMENTATION SUBMITTALS**

This work shall consist of Project Documentation Submittals for Components and As-builts which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-10.1      Project Testing and Documentation Submittals shall be presented directly to the Engineer. Project Testing and Documentation Submittals shall be presented as two complete packages unless prior authorization is made with the Engineer. The complete packages shall be defined as one submittal for Components and one submittal for As-builts. Each submittal shall include all required documentation. No payment shall be made until a submittal package is received and approved by the Engineer.

SZ-10.2      Project Testing and Documentation Submittals are required for the following items:

(A)      Components

(B)      As-builts

SZ-10.3      **COMPONENTS**

The following provisions shall apply to project component testing and documentation submittals for Components:

(A)      Component Documentation Submittals shall be submitted to the Engineer within two weeks subsequent to contract approval. **The Contractor shall 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 reserves the right to allow the Contractor greater than two weeks after contract approval to make submittals.

(B)      The Contractor shall submit two sets of component specifications and/or shop drawings for each project component, assembled or whole, to the Engineer. The Contractor shall 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 shall be approved by the Engineer prior to installation or payment for the component.

(E)      Project Component documentation submittals shall include the manufacturer's name, manufacturer's specification, and/or detailed drawings for all items listed on the **COMPONENT CHECK-OFF LIST** on page 12.

(F)      It is not necessary to submit manufacturer's information for components already identified as meeting the specification in the "has met" statement.

(G)      The Contractor shall 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 12.

SZ-10.4      **AS-BUILTS**

The Contractor shall 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) As-Built Documentation Submittals shall be submitted to the Engineer subsequent to construction completion. As-Built Documentation Submittals shall reflect the final location of all items constructed for the project, not just the Components and Cable. It shall also include any roadway or other construction included in the project.

**SZ-10.5 MEASUREMENT AND PAYMENT**

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

**SZ-10.6 COMPONENT CHECK-OFF LIST**

The Contractor shall 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 Integrator approval. For “APL” components, the Contractor may choose to submit components through the process for listing products on the APL. The Contractor shall 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 <i>(No Submittal required if “has met” or “APL” listed here)</i>	<i>Submittal Provided</i> (✓)
	Ground Rod Connector	SZ-7.2		
	Cable Repair Butt Connector	SZ-12.10		
	Cable Repair Enclosure	SZ-12.10		
	Cable Repair Sealing Nicks and Abrasions	SZ-12.10		
	Service Cabinet	SZ-18.5		
	Pull Vault	SZ-20.5		
	Non-Intrusive Detection Hardware	SZ-22.6		
	Non-Intrusive Detection Folding Pole	SZ-22.6		
	Non-Intrusive Detection Pole Cabinet	SZ-22.6		
	Flashing Beacon System	SZ-25.7	N/A-Submittal Required	

**SZ-11 INDUSTRY ACCEPTED LUBRICANTS FOR ALL CABLES**

The following provisions shall apply to Industry Accepted Lubricants for all Cables:

- SZ-11.1 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-11.2 Lubricants shall not contain wax or grease.

SZ-11.3 The appropriate lubricant shall be applied as specified by the manufacturer for its intended use.

**SZ-12 ELECTRIC AND ELECTRONIC CABLE REPAIR OR REPLACEMENT**

Electric and Electronic Cable Repair or Replacement shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-12.1 The Contractor shall stock approved splice kits to repair any MnDOT cable damaged by construction activities.

SZ-12.2 Notify the Engineer and Integrator of any damaged cable or damaged conduit that contains cables before starting repair.

SZ-12.3 Electric, electronic, video and telephone cables are found within the project limits and may be impacted or are replaced by construction activities. The Contractor shall exercise caution when working near existing cables. Exercise caution and dig by hand or use vacuum excavator when within two feet of exposing the existing cables.

SZ-12.4 Nicks or abrasions caused by exposing any cable by hand digging or vacuum excavation shall be sealed with rubber splicing tape. Seal nicks that penetrate through the cable jacket to the armor with a cast epoxy kit.

SZ-12.5 Above ground, temporary, twisted pair, control cable splices shall be repaired with button style, gel filled, crimp-on butt splices enclosed in zippered poly bags. Splices shall be protected in a manner approved by the Engineer and Integrator until the permanent splices are installed.

SZ-12.6 Permanent repairs to twisted pair cables shall utilize 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. Rubber tape shall be used to seal the ends of the enclosure. The enclosure is available in 4-pr, 18-pr, and 50 pr sizes.

SZ-12.7 Cables severely damaged and not replaced in a timely manner, shall be repaired and maintained until cable replacement is made.

SZ-12.8 New cable shall be furnished and installed for cable that has suffered damage caused by contract activities if the damage affects performance or longevity.

SZ-12.9 Engineer and Integrator approved materials shall be used to replace cable.

SZ-12.10 **HAS MET**

The following items have met 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-12.11 **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. ELECTRIC AND ELECTRONIC CABLE REPAIR OR REPLACEMENT shall be considered incidental for which no direct compensation will be made.

**SZ-13**      **ELECTRIC AND ELECTRONIC CABLE**

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

- SZ-13.1      The Contractor shall provide slack cable within all Pull Vaults. Provide three feet for each cable entering or exiting a Pull Vault.
- SZ-13.2      Splices are not allowed in electric or electronic cable without Engineer and Integrator approval.
- SZ-13.3      Power, Control, and RF cable shall be one-piece between termination points.
- SZ-13.4      When using crimp-on connectors, the Contractor shall execute the following operations:
  - (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-13.5      Protect non-terminated Electric and Electronic Cable, located in Pull Vaults 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-13.6      **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. **ELECTRIC AND ELECTRONIC CABLES** shall be considered incidental for which no direct compensation will be made.

**SZ-14**      **(2550) FOUNDATIONS**

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

- SZ-14.1      Foundations are located as required by the MnDOT Construction inspector and Integrator. The Integrator will stake foundation locations for the Contractor on request. Provide the Integrator with two business days' notice.
- SZ-14.2      Concrete Mix 3A32 or equal shall be utilized unless otherwise noted on a MnDOT Standard Plan/Plate, the plan, or within these provisions.
- SZ-14.3      Conduits internal to the foundation shall be constructed per Plan.
- SZ-14.4      Conduits within foundations shall be NMC.
- SZ-14.5      Grout all openings around conduits.
- SZ-14.6      Typically concrete foundations shall be constructed 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-14.7      The contractor shall 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-14.8 See GROUNDING on page 5 for grounding specifications.
- SZ-14.9 Precast foundations are allowed.
- SZ-14.10 Precast sidewalks are allowed. Remove any lifting loops.
- SZ-14.11 Sidewalks shall be constructed as required per plan detail.
- SZ-14.12 Grade foundations, provide fill, and haul spoil as needed.
- SZ-14.13 Construct on concrete foundations after the concrete has cured for a minimum of seven days.

SZ-14.14 **SERVICE FOUNDATION**

The following provisions shall apply 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-14.15 **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 shall, 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>
2550.511	_____ Foundation _____	each

**SZ-15** **(2550) NON-METALLIC CONDUIT**

This work shall consist of furnishing and installing Non-Metallic Conduit, which shall be UL listed and in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-15.1 The requirement for Red-colored conduit in MnDOT 3803 does not apply.
- SZ-15.2 Industry standard couplings shall be used.
- SZ-15.3 If adhesives and solvents are used they shall be compatible with the materials to be adhered.
- SZ-15.4 The Contractor shall connect to existing conduit utilizing standard couplings. Prepare existing conduit for coupling as indicated in the Plans.
- SZ-15.5 All conduit under roads shall be placed a minimum of 60 inches below finished grade and shall be continuous without joints.
- SZ-15.6 All conduit used shall be placed a minimum of 0.9 m (36 inches) below the finished grade.
- SZ-15.7 Non-metallic conduit shall be PVC or HDPE and shall be Schedule 40, with the exception of conduit above ground or under roadway surfaces. Conduit above ground or under roadway surfaces shall be heavy-wall rigid PVC or HDPE and shall be Schedule 80.

SZ-15.8 Standard bell ends shall be installed on all NMC ends to prevent damage to cables during installation.

SZ-15.9 3.15 inches wide, stretchable, orange warning tape shall be installed between 18 inches and 12 inches below the surface over all NMC bearing communication cable. The tape shall bare the following permanent legend: **CAUTION: MnDOT CABLE BELOW.**

SZ-15.10 **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 shall, 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>
2550.523	(__") Non-Metallic Conduit	linear foot

**SZ-16** **(2550) POWER AND CONTROL CABLES**

This work shall consist of furnishing and installing Power and Control Cables, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-16.1 All Power and Control Cables shall be UL listed.

SZ-16.2 Terminate Power and Control cables unless otherwise directed by the Plans.

SZ-16.3 See GROUNDING on page 5 for grounding details.

SZ-16.4 Some power cables may require protection within Pull Vaults as denoted in the Plan. The Contractor shall protect these power cables by enclosing them in two inch diameter split conduit within the Pull Vault. The split conduit shall be colored red.

SZ-16.5 Electrical Metallic Tubing (EMT) shall be furnished and installed according to the Plan.

SZ-16.6 **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 shall, in each instance, be compensation in full for the costs incidental thereto including but not limited to Termination, Grounding, EMT, Liquidtight Conduit, Power Cable \_ Conductor No \_\_, 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>
2550.532	Power Cable ___ Conductor No. ___	linear foot

**SZ-17** **(2550) SERVICE INSTALLATION**

This work shall consist of furnishing and installing a Service Installation, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-17.1 See Plan for proposed power source locations, addresses, and Service Installation details.

SZ-17.2 Service Installation shall consist of furnishing and installing RSC and a weatherhead to the in-place Xcel Energy pole as shown in the Plan. This item shall include any materials and labor necessary to connect the source of power to the electrical service cabinet.

SZ-17.3 See GROUNDING on page 5 for grounding specifications.

SZ-17.4 **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 shall, 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>
2550.572	Service Installation Type ____	each

**SZ-18 (2550) SERVICE CABINET**

This work shall consist of furnishing and installing a Service Cabinet, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-18.1 Any conduit stubs leaving the service cabinet shall be marked. Marking shall consist of a two-inch by two-inch wooden stake placed at the end of the stub. This stake shall have five feet exposed above ground and be painted orange.

SZ-18.2 See GROUNDING on page 5 for grounding specifications.

SZ-18.3 The Service Cabinet circuit breaker sizes and quantities shall be defined in the standard specifications.

SZ-18.4 Notify MnDOT Business Services Section when MnDOT is to assume ownership of the proposed source of power. Following is the contact information:

(320) 231-5195  
MnDOT District 8 - Accounts Payable  
2505 Transportation Road  
Willmar, MN 56201

SZ-18.5 **APL**

MnDOT approved Service Cabinet is listed on the following Website:

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

SZ-18.6 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.572 (SERVICE CABINET) at the Contract bid price per each, which shall 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-19 (2550) ROAD/WEATHER SENSOR AND CABLE**

This work shall consist of furnishing and installing Road/Weather Sensor and Cable at each location indicated in the Plan, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-19.1 Road/Weather Sensor and Cable shall comprise of in-pavement road condition monitor, sensor enclosure designed and manufactured by the sensor manufacturer, and cable from the sensor manufacturer (lengths provided below), compatible with the furnished sensor. Contractor shall order sensor cable at the lengths specified below. Sensor cables shall be pre-terminated. Contractor shall not splice or cut sensor cable unless approved by the Integrator and Engineer.

Sensor	Length of Cable
West Sensor	1850 ft
Central Sensor	200 ft
East Sensor	1200 ft

SZ-19.2 Road/Weather Sensor and Cable road condition sensor shall:

- (A) Meet IP 68 enclosure rating standards.
- (B) Be capable of operating within a temperature range of -40°C to 80°C.
- (C) Report a surface state condition utilizing a number-based system through an open protocol method of communication.
- (D) Not exceed a diameter of 100mm.
- (E) House all processing within the in-pavement sensor. Sensor should receive only power and output only communication.

SZ-19.3 Road/Weather Sensor and Cable shall be installed following manufacturer's installation instructions and as approved by the Engineer.

SZ-19.4 Contractor is to furnish and install a manufacturer-provided enclosure for each Road/Weather Sensor and Cable location indicated on the Plan. Enclosure shall be water tight and conform to the requirements of IP 68. Install enclosure as instructed by the manufacturer.

SZ-19.5 Road/Weather Sensor and Cable shall be placed within the lane as indicated in the plans or as staked/marked by the Engineer or Integrator.

SZ-19.6 Road/Weather Sensor Cable shall be a composite cable capable of delivering power to and communication from the Road/Weather Sensors. Sensor cable shall not be cut or spliced by the Contractor unless approved by the Integrator and Engineer.

SZ-19.7 See GROUNDING on page 5 for grounding specifications.

SZ-19.8 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2550.602 (ROAD/WEATHER SENSOR AND CABLE) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including sensors, enclosure, cable, grounding, and all materials, equipment, and labor required to complete the work as specified, to the satisfaction of the Engineer.

**SZ-20 (2550) PULL VAULT**

This work shall consist of furnishing and installing a Pull Vault, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-20.1 Shall be placed on a 12 inches thick layer of coarse filter aggregate per MnDOT 3149.2H.

SZ-20.2 **COVER**

The following provisions shall apply to the Cover part 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.

(B) Pull Vault label should read "MnDOT Signals" as shown in the plans.

SZ-20.3 Pull Vaults shall be installed as indicated in the Plans. Follow site restoration procedures as outlined in the Plans.

SZ-20.4 Clean Pull Vaults after installation. All areas shall be cleaned including the flange that the cover rests on and the bolt holes for the cover.

SZ-20.5 APL  
MnDOT approved Pull Vault is listed on the following Website:

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

SZ-20.6 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 shall be compensation in full for all costs incidental thereto, including Cover, and all materials and labor necessary to construct the Pull Vault.

## **SZ-21** (2550) INSTALL CCTV ASSEMBLY

This work consists of Installing CCTV Assembly and furnishing additional items required to complete the installation of the CCTV Assembly. 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-21.1 The Contractor shall install the MnDOT Furnished PTZ Camera Assembly including the CCTV video/power/control cable. See MNDOT FURNISHED MATERIALS on page 4 for additional details.

SZ-21.2 Furnish and install the following items:

(A) Grounding components per plan. See GROUNDING on page 5 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-21.3 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 shall be compensation in full for all costs incidental thereto, including but not limited to furnishing and installing the access handhole cover and all materials and labor necessary to Install the CCTV Assembly. Any damage caused to the Install CCTV Assembly items shall be repaired or replaced at the Contractor's expense to the satisfaction of the Engineer and Integrator.

## **SZ-22** (2550) NON-INTRUSIVE DETECTION HARDWARE

This work shall consist of furnishing and installing Non-Intrusive Detection Hardware, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

SZ-22.1 Notify the Integrator when the installation of the Non-Intrusive Detection Hardware is complete.

SZ-22.2 See GROUNDING on page 5 for grounding specifications.

SZ-22.3 **NON-INTRUSIVE DETECTION FOLDING POLE**

The Non-Intrusive Detection Folding Pole shall have the following requirements:

- (A) Install the Non-Intrusive Detection Folding Pole per Plan details and Manufacturer's recommendations.
- (B) Folding pole shall be 35'.

SZ-22.4 **CCTV CABLE**

CCTV Cable shall be installed by the Contractor in accordance with the following:

- (A) CCTV Cable shall be furnished by MnDOT. See MNDOT FURNISHED MATERIALS on page 4 for additional details.
- (B) At the request of the Integrator, the Contractor shall furnish and install a flat pull rope in lieu of installing the CCTV Cable.
- (C) The CCTV Cable will be pre-connectorized such that connecting the camera unit to the composite cable shall be accomplished by mating two connectors.
- (D) Install the CCTV Cable or flat pull rope while the pole is on the ground.

SZ-22.5 **POLE MOUNTED NON-INTRUSIVE DETECTION (CCTV) CABINETS**

Pole Mounted Non-Intrusive Detection Cabinets shall be furnished and installed by the Contractor in accordance with the following:

- (A) A MnDOT approved cabinet shall be furnished and installed by the contractor with the electronic sensor equipment as detailed in the Plans. The Contractor may ship a MnDOT approved cabinet to Road/Weather Sensor Manufacturer for electronic component installation.
- (B) The Contractor shall furnish and install mounting brackets and hardware.
- (C) The Contractor shall be responsible for the terminal adapters, the conduit, and creating the knockout openings for connection per plan detail. Conduit shall not obstruct the use of the pole crank or access to the base access door.

SZ-22.6 **APL**

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

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

SZ-22.7 **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, which shall be compensation in full for all costs incidental thereto, including but not limited to Non-Intrusive Detection Folding Pole, Grounding, CCTV Cable, Pole Mounted Non-Intrusive Detection Cabinets, Sensor Equipment to be installed in the Cabinet, and all materials and labor necessary to construct the Non-Intrusive Detection Hardware.

**SZ-23**      **(2550) BORED CONDUIT**

This work shall consist of furnishing and installing Bored Conduit, which shall be in accordance with the MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-23.1      Bored Conduit shall conform to, but not be limited to the following MnDOT Specifications except as modified by these provisions:
- (A)      Installation: MnDOT 2565.3.
  - (B)      NMC: MnDOT 3803.
  - (C)      RSC: 3801.
  - (D)      Expansion Fittings: 3839.
- SZ-23.2      For installation under an existing roadway or paved surface, Bored Conduit shall be Heavy-wall rigid PVC or HDPE and shall be Schedule 80.
- SZ-23.3      All conduit under roadways shall be continuous without joints.
- SZ-23.4      Bored Conduit installed under slope paving shall be accomplished without damage to the slope paving.
- SZ-23.5      Bored Conduit shall be installed 1.5 m (60 inches) below the bottom of the finished driving surface. Bored Conduit under roadway surfaces shall extend 10 feet beyond the pavement edge or curb line. The transition 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 shall not exceed one foot vertical per five feet horizontal.
- SZ-23.6      Bored conduit shall be installed at depths according to the Plan if the Plan calls out for deviations from these specifications.
- SZ-23.7      Standard bell ends shall be installed on all conduit ends to prevent damage to cables during installation.
- SZ-23.8      **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 shall, 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-24**      **(2565) PEDESTAL POLE & BASE**

This work consists of furnishing and installing the Pedestal Pole & Base and additional items required to complete the installation of the Pedestal Pole & Base. 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-24.1      Approved Pedestal Pole & Base shall be furnished and installed per MnDOT 8122.

- SZ-24.2 Approved Pedestal Pole & Base shall be aluminum.
- SZ-24.3 Approved Pedestal Pole shall be sized according to the Plan.
- SZ-24.4 Pedestal Base shall be furnished and installed at the locations indicated on the plans.
- SZ-24.5 Pedestal Base shall be compatible with the Pedestal Foundation.
- SZ-24.6 Provide terminal block in pedestal base for cable termination.

SZ-24.7 **MEASUREMENT AND PAYMENT**

Measurement will be made by the each constructed as specified. Payment will be made under Item 2565.602 (PEDESTAL POLE & BASE) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto and all materials and labor necessary to furnish and install the Pedestal Pole & Base.

**SZ-25 (2565) FLASHING BEACON SYSTEM**

This work shall consist of furnishing and installing Flashing Beacon System, which shall be in accordance with the MUTCD, MnDOT Standard Specifications, MnDOT Standard Plans/Plates, the Plans, and the following:

- SZ-25.1 Hardware and fasteners shall be aluminum.
- SZ-25.2 See GROUNDING on page 5 for grounding details
- SZ-25.3 The beacon shall flash at a rate of 50-60 times per minute.

SZ-25.4 **BEACON HEAD ASSEMBLY**

The Beacon Head Assembly shall comply with MnDOT 3834 and the following supplements or modifications.

- (A) Flashing Beacon housings shall have the following characteristics:
  - a. Constructed of black polycarbonate.
  - b. The top and bottom shall have internal ribbing for extra strength.
  - c. The polycarbonate housing doors shall have a gasket groove containing a weather proof and mildew resistant gasket. Closing the door shall create a weatherproof and dustproof seal by ensuring that the gasket contacts a raised bead formed on the edge of the housing where it contacts the door.
- (B) Each flashing beacon assembly must include a cut away visor and background shield. Visors and background shields shall be constructed of black polycarbonate. Background shield shall be constructed of vacuum formed 0.125 inch thick ABS plastic and have a 0.625 inch flange on the outside perimeter of the shield.

SZ-25.5 **FLASHING BEACON ASSEMBLY BRACKETING**

The following provisions shall apply to the flashing beacon assembly bracketing:

- (A) Provide aluminum flashing beacon assembly bracketing with anodic coating as per MIL-A-8625C for Type II, Class I Coating.

SZ-25.6 **LED**

The following provisions shall apply to LED:

- (B) Furnish and install 12 inch LED Yellow Ball Flashing indications according to Manufacturer recommendations and the Plan details.
- (C) See LABELING on page 7 for labeling details.

SZ-25.7 **APL**  
MnDOT approved 12 inch LED is listed on the following Website:

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

SZ-25.8 **HAS MET**  
The following items have met the above specifications:

- (A) Signal Head Assembly: Chapel Hill/ Traffic Parts Inc. model EPC-307-CCP-EVN-00.
- (B) Background Shield: Pelco model BK-1006-E

SZ-25.9 **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 shall be compensation in full for all costs incidental thereto, including but not limited to Fittings, RSC, Mounting Hardware, Beacon Head Assembly, LED, Signal Connections, delivery, and all materials and labor necessary to construct the Flashing Beacon System.

DIVISION ST

Section		Page
No.	Item	No.
ST-1	(2564) TRAFFIC SIGNS AND DEVICES.....	1-ST
ST-2	(3352) SIGNS, DELINEATORS AND MARKERS .....	4-ST

I hereby certify that the Special Provisions for traffic sign construction (Division ST) 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.



\_\_\_\_\_  
Scott A. Petersen

Lic. No. 47177

Date 5/16/2014

## DIVISION ST

### **ST-1      (2564) TRAFFIC SIGNS AND DEVICES**

#### **ST-1.1      DESCRIPTION**

The Contractor shall furnish and install traffic signs according to 2564, "*Traffic Signs and Devices*," except as modified in these Special Provisions.

#### **ST-1.2      MATERIALS**

Fabricate all standard signs, markers, and delineators according to the standard sign drawings in the MnDOT Standard Signs Manual.

Fabricate all signs, markers, and delineators with material according to 3352, "Signs, Delineators, and Markers."

Fabricate all rigid permanent signs, markers, and delineators with materials from the MnDOT Approved/Qualified Products List.

Fabricate all permanent signs, markers, and delineators with Sign Sheeting Type IX or Sign Sheeting Type XI, except if otherwise indicated in 2564, "*Traffic Signs and Devices*" or in the 2564, "*Traffic Signs and Devices: Materials*" section of these Special Provisions.

Provide all warning signs, yellow markers, yellow delineators, E11-X1 sign panels Type Overlay, and the yellow background on Type A and Type OH sign panels with fluorescent yellow reflective sheeting.

When warning sign plaques are mounted on the same structure as a warning sign, match the plaque color and sheeting type with the primary warning sign color and sheeting type.

Provide black sign legend material according to 3352.2.A.5.c, "*Signs, Delineators, and Markers: Requirements: Materials: Screen Processed Painted Legend*" or 3352.2.A.5.d, "*Signs, Delineators, and Markers: Requirements: Materials: Pigmented Plastic Film Legend*."

#### **ST-1.3      CONSTRUCTION REQUIREMENTS**

##### **A      As-Built Signing Data**

Submit to the Department an electronic data table containing GPS coordinates and sign attribute data for all new signs, as well as signs that change location.

Contact the Department 15 working days prior to field collection to obtain tables containing the attribute and plan spreadsheet data to be collected.

MnDOT District 8 Maintenance Facility  
2505 Transportation Road  
Willmar, MN 56201  
320-231-5195  
ryan.barney@state.mn.us

Provide the electronic data table in standard geospatial vector data format. The format must be accepted by MnDOT prior to commencement of field work.

Collect the data in the 1996 adjustment to the UTM15N North American Datum (NAD83), unless otherwise specified.

Ensure that the GPS receiver uses a minimum of 5 satellites during data collection.

Ensure that the geospatial data collected is accurate to less than 1 meter.

Collect 1 GPS coordinate per sign support structure.

Sign support structures include but are not limited to the following types: flanged channel sign post, square tube sign post, I-beam, signal mast arm, signal post, guardrail end treatment, wall mounting, cantilever, sign bridge.

If the support consists of a guardrail end treatment or multiple sign posts or I-beams,

Collect the GPS coordinate at the center of the support.

If the sign is located on a signal mast arm or signal post,

Collect the GPS coordinate at the signal post.

If the sign is located on a cantilever or sign bridge,

Collect the GPS coordinate at the support pole located exterior to the roadway.

Use the following support structure data definitions:

Route – MnDOT route where the sign is located.

Travel Direction – Cardinal direction of the roadway

Type – Support Type

Material – The physical properties/description of which the support is made.

Mounting Kit - Means of attaching or mounting a sign panel or support.

Assign each sign panel to a support structure and use the following attribute definitions:

Code – Specify the MN MUTCD code of standard signs. If the panel is a uniquely designed sign, use the panel number as specified on plan sheet (i.e. D-101 or OH100-001).

Size – width x height for rectangular and octagonal panels, diameter for circular panels, length of a side for triangular panels, and length of the bottom side for pentagonal panels (inches).

Facing Direction – Direction the sign panel is facing.

Sheeting Material – Manufacturer's brand name (DG3, OmniCube)

If the submitted data does not meet the criteria of this specification,

The Department may reject the data and require the Contractor to repeat the data collection. No direct payment will be made for this work.

## **B Fabrication & Warning Stickers**

The provisions of 2564.3H, "Traffic Signs and Devices: Construction Requirements: Sign Panels" are hereby modified as follows:

The Sign Fabricator shall provide and affix fabrication stickers to all furnished sign panels.

Install Department-provided warning stickers on new Type A, C, and D sign panels according to 2564.3H, "Traffic Signs and Devices: Construction Requirements: Sign Panels."

Give 30 days advance notice to the Department prior to picking up the Department-provided warning stickers:

MnDOT District 8 Maintenance Facility  
 2505 Transportation Road  
 Willmar, MN 56201  
 320-231-5195  
 ryan.barney@state.mn.us

**C Install Sign Type C and D**

Install signs with 3/8" stainless steel bolts and zinc-plated nylon insert lock nuts on the L-Bracket assembly when a knee brace is used.

**D Post-Award Data**

SignCAD Millennium (Program Version 8.24) panel layout files for panel layouts shown in the plan are available electronically upon project award. To request these files, please contact:

MnDOT District 8 Maintenance Facility  
 2505 Transportation Road  
 Willmar, MN 56201  
 320-231-5195  
 ryan.barney@state.mn.us

MnDOT believes the electronic data it will provide is accurate, but MnDOT provides no guarantee or warranty, express or implied, concerning the accuracy of the data and the Contractor shall not act in reliance on the data without verifying the data against the contract documents. The documents originally provided with the Contract remain the basis of the Contract, and the electronic data that will be provided at the Request of the Contractor is provided only for the convenience of the Contractor. Therefore, if use of this data causes an error, omission, unacceptable work, or work not in conformance with the contract documents, then any costs to the Contractor to make corrections as a result of this error will not be considered "extra work", and the Contractor will not be entitled to an adjustment of contract time.

**ST-1.4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

The Engineer will measure each item according to the Contract and the 2564, "Traffic Signs and Devices: Construction Requirements" section of these Special Provisions.

The Department will include all work described in the Contract and the 2564, "Traffic Signs and Devices: Construction Requirements" section of these Special Provisions as part of the contract unit price per unit of measure.

The Department will pay for traffic signs and devices on the basis of the following schedule:

<u>Item No.:</u>	<u>Item:</u>	<u>Unit:</u>
2564.531	Sign Panels Type C	Square foot
2564.536	Install Sign Panel Type C	Each

The Department's payment for each item shall be compensation in full for all work, material, and costs involved in performing the work specified in the Plan and these Special Provisions.

**ST-2            (3352) SIGNS, DELINEATORS AND MARKERS**

**ST-2.1            SCOPE**

The Contractor shall fabricate traffic signs, delineators, and markers consisting of sign panels 3352, "*Signs, Delineators and Markers*" and these Special Provisions.

**ST-2.2            REQUIREMENTS**

The Contractor shall use materials according to 3352, "*Signs, Delineators and Markers*" and these Special Provisions.

Splice retroreflective sheeting according to the following:

Do not splice retroreflective sheeting on panels with dimensions smaller than 48 inches in height and 48 inches in width.

If the retroreflective sheeting material is not available in this width, use the widest width material available for that type.

Splice the retroreflective sheeting so that all sheeting joints are vertical.

Use the least number of seams possible.

Butt-joint roller-applied and reverse-screened sheeting types so that joint gaps do not exceed 1/32 inch.

Match colors of adjacent sheets of retroreflective sheeting on sign panels so that there is no noticeable difference in color.

Do not splice vinyl cuttable film (EC film) except on signs where the background changes color.

# MINNESOTA DEPARTMENT OF TRANSPORTATION WRIGHT COUNTY, MINNESOTA

CONSTRUCTION PLAN FOR ICE SENSOR WARNING SYSTEM  
LOCATED ON T.H. 12 FROM R.P. 115+00.950 TO R.P. 116+00.900

FED. PROJ. NO. STATE FUNDS

### GOVERNING SPECIFICATIONS

THE 2014 EDITION OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION 'STANDARD SPECIFICATIONS FOR CONSTRUCTION' AND THE 2014 EDITION OF THE 'MATERIALS LAB SUPPLEMENTAL SPECIFICATIONS FOR CONSTRUCTION' SHALL GOVERN. ALL TRAFFIC CONTROL DEVICES SHALL CONFORM AND BE INSTALLED IN ACCORDANCE TO THE 'MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES' (MN MUTCD) AND PART VI, 'FIELD MANUAL FOR TEMPORARY TRAFFIC CONTROL ZONE LAYOUTS'.

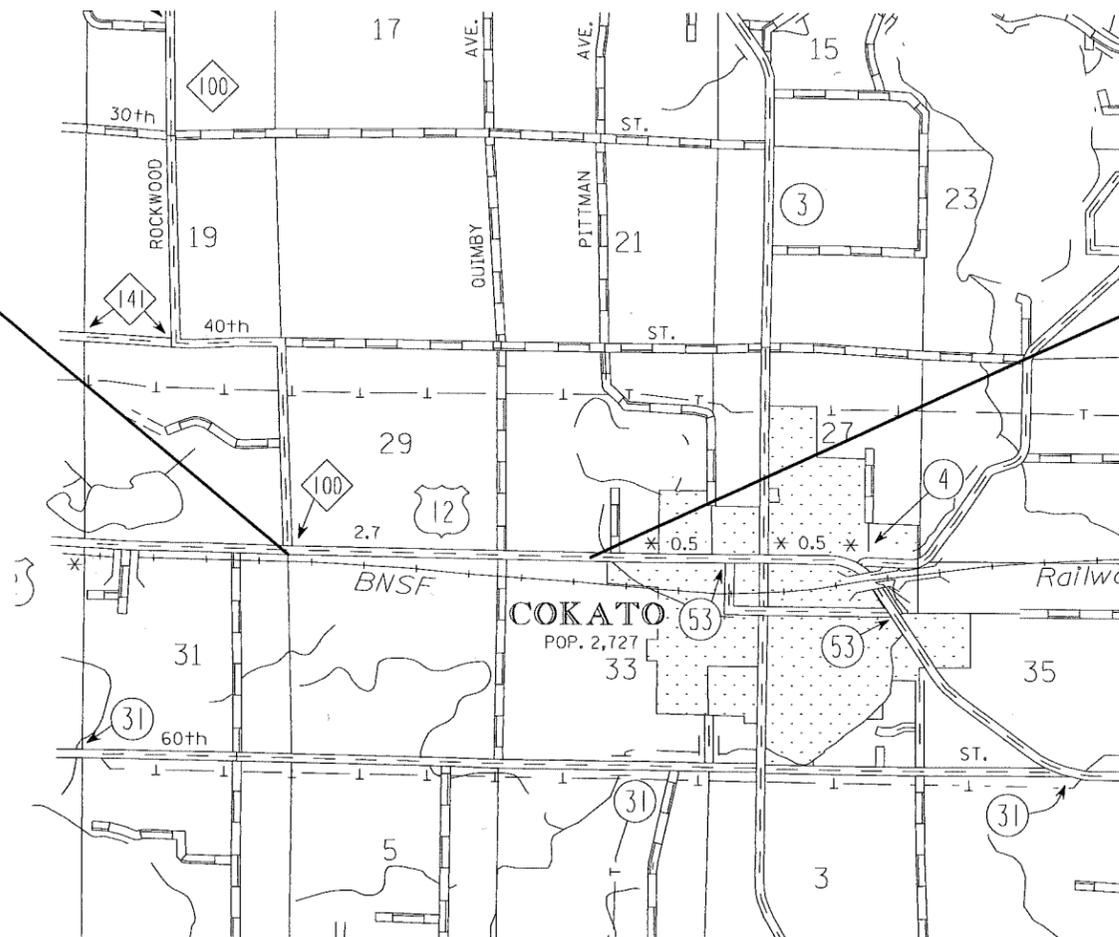
### INDEX

SHEET NO.	SHEET DESCRIPTION
1	TITLE SHEET
2	STATEMENT OF ESTIMATED QUANTITIES
3	LEGEND, UTILITY INFO, AND GENERAL NOTES
4	GENERAL LAYOUT
5-8	CONSTRUCTION PLANS
9-14	CONSTRUCTION DETAILS
15	DEVICE AND COMMUNICATION OVERVIEW
16-19	SIGNING CONSTRUCTION DETAILS



BEGIN S.P. 8601-60  
R.P. 115+00.950

END S.P. 8601-60  
R.P. 116+00.900



THIS PLAN CONTAINS 19 SHEETS



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

SIGNATURE *Scott A. Petersen*  
DATE 5/16/14 LIC. NO. 47177 PRINT NAME SCOTT A. PETERSEN

RECOMMENDED FOR APPROVAL *Ryan J. Barney* 5/16/2014  
DISTRICT TRAFFIC ENGINEER

RECOMMENDED FOR APPROVAL \_\_\_\_\_  
MNDOT PROJECT MANAGER 20

SCALE  
PLAN  100'

PLAN REVISIONS		
DATE	SHEET NO.	APPROVED BY

STATE PROJ. NO. CHARGE IDENTIFIER  
8601-60



PROJECT LOCATION  
COUNTY : WRIGHT  
DISTRICT : 08

FOR PLANS AND UTILITIES SYMBOLS SEE TECHNICAL MANUAL

THIS PLAN AND/OR SPECIFICATION WAS PREPARED SPECIFICALLY FOR THIS PROJECT, AND ANY RE-USE OF DETAILS OR SPECIFICATIONS ON OTHER PROJECTS IS NOT INTENDED OR AUTHORIZED BY THE DESIGNER. LIABILITY FOR ANY RE-USE ON OTHER PROJECTS IS THE RESPONSIBILITY OF THE PERSON, AGENCY, OR CORPORATION USING PLAN OR SPECIFICATION DATA FROM THIS PROJECT.

THE SUBSURFACE UTILITY INFORMATION IN THIS PLAN IS UTILITY QUALITY LEVEL D. THIS QUALITY LEVEL WAS DETERMINED ACCORDING TO GUIDELINES OF C1/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA".

I HEREBY CERTIFY THAT THE FINAL FIELD CHANGES, IF ANY, OF THIS PLAN WERE MADE BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE \_\_\_\_\_  
DATE \_\_\_\_\_ LIC. NO. \_\_\_\_\_ PRINT NAME \_\_\_\_\_

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# MINNESOTA DEPARTMENT OF TRANSPORTATION WRIGHT COUNTY, MINNESOTA

CONSTRUCTION PLAN FOR ICE SENSOR WARNING SYSTEM  
 LOCATED ON T.H. 12 FROM R.P. 115+00.950 TO R.P. 116+00.900

FED. PROJ. NO. STATE FUNDS

### GOVERNING SPECIFICATIONS

THE 2014 EDITION OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION 'STANDARD SPECIFICATIONS FOR CONSTRUCTION' AND THE 2014 EDITION OF THE 'MATERIALS LAB SUPPLEMENTAL SPECIFICATIONS FOR CONSTRUCTION' SHALL GOVERN. ALL TRAFFIC CONTROL DEVICES SHALL CONFORM AND BE INSTALLED IN ACCORDANCE TO THE 'MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES' (MN MUTCD) AND PART VI, 'FIELD MANUAL FOR TEMPORARY TRAFFIC CONTROL ZONE LAYOUTS'.

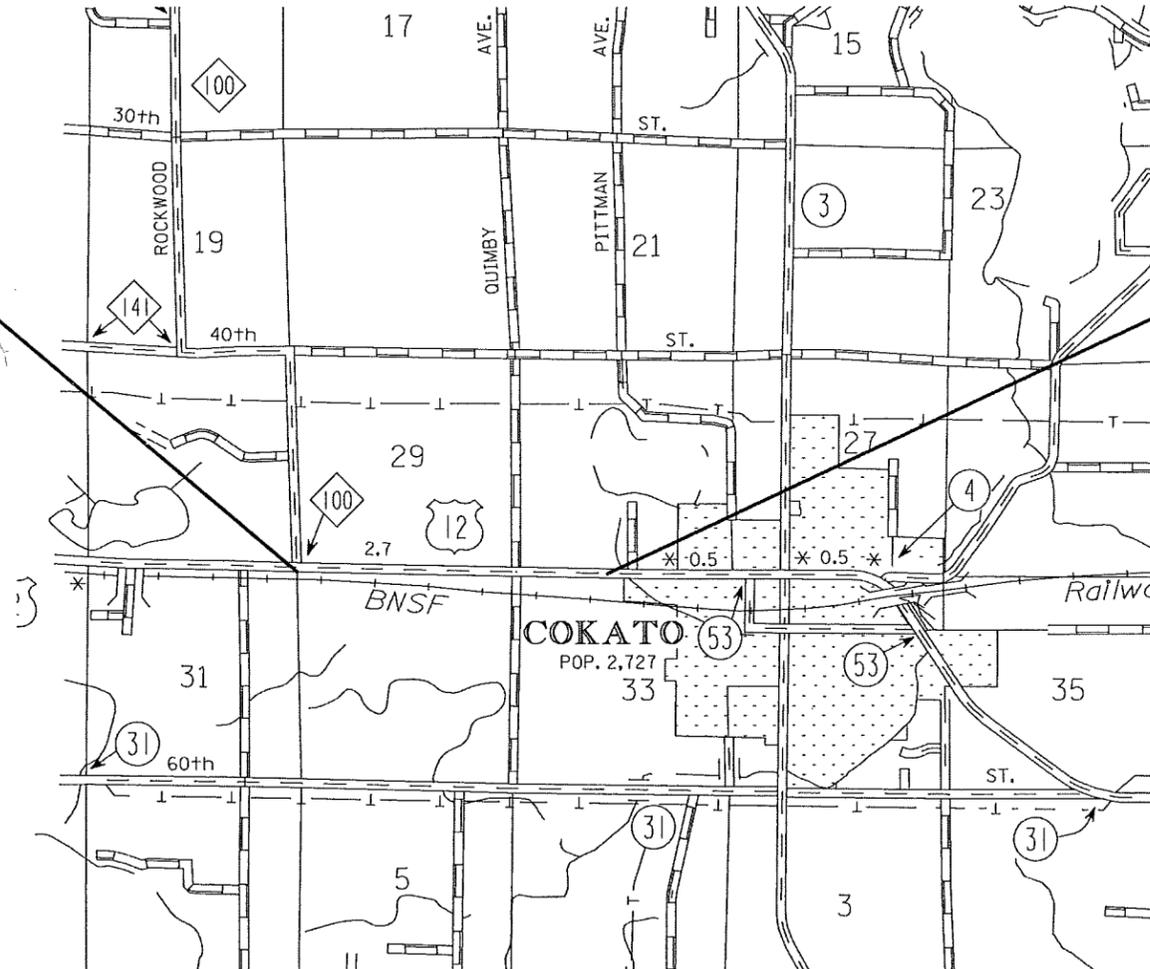
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SIGNATURE Scott A. Petersen  
 DATE 05/16/2014 LIC. NO. 47177 PRINT NAME SCOTT A. PETERSEN

RECOMMENDED FOR APPROVAL ..... DISTRICT TRAFFIC ENGINEER ..... 20.....

RECOMMENDED FOR APPROVAL ..... MNDOT PROJECT MANAGER ..... 20.....



PROJECT LOCATION  
 COUNTY : WRIGHT  
 DISTRICT : 08

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SIGNATURE \_\_\_\_\_  
 DATE \_\_\_\_\_ LIC. NO. \_\_\_\_\_ PRINT NAME \_\_\_\_\_

#### SCALE

PLAN  100'

PLAN REVISIONS		
DATE	SHEET NO.	APPROVED BY

STATE PROJ. NO. 8601-60 CHARGE IDENTIFIER \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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STATE PROJ. NO. 8601-60 (T.H. 12 = 010) SHEET NO. 1 OF 19 SHEETS

**STATEMENT OF ESTIMATED QUANTITIES**

ITEM NO.	ITEM	NOTES	UNIT	TOTAL ESTIMATED QUANTITY
2011.601	AS-BUILTS		LUMP SUM	1
2021.501	MOBILIZATION		LUMP SUM	1
2545.515	LIGHT FOUNDATION DESIGN E MODIFIED	(1)	EACH	1
2550.511	SERVICE FOUNDATION		EACH	1
2550.523	2" NON-METALLIC CONDUIT		LIN FT	4400
2550.532	POWER CABLE 1 CONDUCTOR NO 4		LIN FT	4600
2550.532	POWER CABLE 1 CONDUCTOR NO 8		LIN FT	14400
2550.572	SERVICE INSTALLATION TYPE A	(2)	EACH	1
2550.572	SERVICE CABINET		EACH	1
2550.602	ROAD/WEATHER SENSOR AND CABLE		EACH	3
2550.602	PULL VAULT		EACH	13
2550.602	INSTALL CCTV ASSEMBLY	(3)	EACH	1
2550.602	NON-INTRUSIVE DETECTION HARDWARE	(4)	EACH	1
2550.603	2" BORED CONDUIT		LIN FT	550
2563.601	TRAFFIC CONTROL		LUMP SUM	1
2564.531	SIGN PANELS TYPE C	(5)	SQ FT	18.5
2565.602	PEDESTAL FOUNDATION		EACH	2
2565.602	PEDESTAL POLE & BASE		EACH	2
2565.616	FLASHING BEACON SYSTEM	(6)	SYSTEM	2

NOTES:

- (1) ANCHOR BOLTS TO EXTEND 5 INCHES ABOVE FOUNDATION
- (2) INSTALL RISER AND WEATHERHEAD ON EXISTING UTILITY POLE
- (3) INSTALL STATE FURNISHED CCTV ASSEMBLY
- (4) F&I 35' FOLDING POLE  
F&I POLE-MOUNTED CABINET WITH SENSOR EQUIPMENT  
INSTALL CCTV CABLE (STATE FURNISHED)
- (5) F&I SIGNS ON PEDESTAL POLE & BASE
- (6) F&I 12" LED BEACON ASSEMBLY AND MOUNTING  
HARDWARE TO PEDESTAL POLE & BASE

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NO.	DATE	BY	CKD	APPR	REVISION
*FILES*					

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Pr Int Name: SCOTT A. PETERSEN  
  
 Date: 05/16/2014 License # 47177

STATE PROJECT NO. 8601-60

DRAWN BY Z. HANSON  
 DESIGNED BY Z. HANSON  
 CHECKED BY S. PETERSEN  
 COMM. NO. 0138221



ENGINEERS  
 PLANNERS  
 DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 STATEMENT OF ESTIMATED QUANTITIES  
 ICE SENSOR WARNING SYSTEM  
 TRAFFIC MANAGEMENT SYSTEM

SHEET 2 OF 19

# STANDARD PLATES

THE FOLLOWING STANDARD PLATES, APPROVED BY THE FEDERAL HIGHWAY ADMINISTRATION, SHALL APPLY ON THIS PROJECT	
PLATE NO.	DESCRIPTION
8111	TRAFFIC SIGNAL BRACKETING (PEDESTAL MOUNTED)
8112	PEDESTAL FOUNDATION
8122	PEDESTAL AND PEDESTAL BASE
8127	LIGHT FOUNDATION DESIGN E

LEGEND OF SYMBOLS	
-----	CONDUIT - INPLACE
=====	CONDUIT - F&I
--- • • ---	CONDUIT FIBER ONLY - INPLACE
===== • =====	CONDUIT FIBER ONLY - F&I
--- • • ---	DIRECT BURIED COMMUNICATION CABLE - INPLACE
----- • -----	DIRECT BURIED POWER CABLE - INPLACE
□	LOOP DETECTOR-DESIGN
P	LOOP DETECTOR- DESIGN PREFORMED
S	LOOP DETECTOR- DESIGN SAWCUT
N	LOOP DETECTOR- DESIGN NMC
V	LOOP DETECTOR- DESIGN VIRTUAL
⊠→	WARNING FLASHER - INPLACE
⊠→	WARNING FLASHER - F&I
⌋	GATE ARM - INPLACE
⌋	FOUNDATION INPLACE, GATE ARM - F&I
⌋	FOUNDATION - F&I, GATE ARM - F&I
☀	TOLLING BEACON - INPLACE
☀	TOLLING BEACON - F&I
🌲	TOLLING READER
Ⓜ	HANDHOLE - INPLACE
Ⓜ	HANDHOLE - F&I
⊠	JUNCTION BOX OR CONDULET - INPLACE
⊠	JUNCTION BOX OR CONDULET - F&I
⌋	OVERHEAD SIGN STRUCTURE - INPLACE
⌋	OVERHEAD SIGN STRUCTURE - F&I
T	SIGN (TYPE DMS)
□	FOUNDATION/CABINET - INPLACE
■	FOUNDATION/CABINET - F&I

LEGEND OF SYMBOLS	
⊠	PEDESTAL - INPLACE
⊠	PEDESTAL - F&I
⊠→	RAMP CONTROL SIGNAL (DESIGN ONE-WAY) - INPLACE
⊠→	RAMP CONTROL SIGNAL (DESIGN ONE-WAY) - F&I
⊠→	RAMP CONTROL SIGNAL (DESIGN TWO-WAY) - INPLACE
⊠→	RAMP CONTROL SIGNAL (DESIGN TWO-WAY) - F&I
⊠→	RAMP CONTROL SIGNAL (DESIGN ONE-WAY)(SCREW IN BASE) - INPLACE
□	SHELTER CABINET (TMS) - INPLACE
■	SHELTER CABINET (TMS) - F&I
Ⓜ	SPLICE CABINET
Ⓜ	SPLICE VAULT (FIBER OPTIC)
TV	TELEVISION CAMERA (CCTV) - NON-INTRUSIVE DETECTION HARDWARE
⊠	NON-INTRUSIVE DETECTION/POLE
TV ⊠	NON-INTRUSIVE DETECTION/POLE & CAMERA
I	INTELLIGENT LANE CONTROL SIGN - INPLACE
I	INTELLIGENT LANE CONTROL SIGN - F&I
LCS	LANE CONTROL SIGNAL
○	WOOD POLE - INPLACE
●	WOOD POLE - F&I
●	WOOD POLE - F&I, SERVICE INSTALLATION - F&I
○	WOOD POLE INPLACE, SERVICE INSTALLATION - INPLACE
○	WOOD POLE INPLACE, SERVICE INSTALLATION - F&I
PV	PULL VAULT - F&I
E	ELECTRICAL SERVICE - INPLACE
E	ELECTRICAL SERVICE - F&I
T	POWER COMPANY TRANSFORMER/PEDESTAL
GEN	GENERATOR
⊠	PEDESTRIAN GATE - F&I
T	SIGN PANELS TYPE C WITH FLASHING BEACON SYSTEM
○	ROAD/WEATHER SENSOR

## UTILITY

## NOTE

MNDOT	LEAVE AS IS
CENTER POINT ENERGY	LEAVE AS IS
CENTURYLINK	LEAVE AS IS
XCEL ENERGY	LEAVE AS IS
WRIGHT-HENNEPIN REA CO-OP	LEAVE AS IS
KOCH PIPELINES	LEAVE AS IS
CITY OF COKATO	LEAVE AS IS
CHARTER COMMUNICATIONS	LEAVE AS IS
WINDSTREAM COMMUNICATIONS	LEAVE AS IS

### NOTE:

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NO UTILITIES WILL BE AFFECTED BY THIS PROJECT.

THE CONTRACTOR SHALL CALL GOPHER STATE ONE CALL FOR UTILITY LOCATES PRIOR TO BEGINNING ANY CONSTRUCTION.

GOPHER STATE ONE CALL IS MINNESOTA'S UNDERGROUND FACILITY NOTIFICATION CENTER (1-800-252-1166 OR 651-454-0002). IT SHOULD BE NOTED THAT IN ACCORDANCE WITH MINNESOTA STATUTE 216D, IT IS REQUIRED THAT ALL CONSTRUCTION PROJECTS INVOLVING MAINTENANCE ACTIVITY REQUIRES THE PARTY DOING THE EXCAVATION TO CALL GOPHER STATE ONE CALL 48 HOURS PRIOR TO EXCAVATION.

TURF ESTABLISHMENT & EROSION CONTROL FOR TRAFFIC MANAGEMENT SYSTEM PLACEMENT SHALL BE CONSIDERED INCIDENTAL, APPLIED TO ALL DISTURBED AREAS, IN ACCORDANCE WITH MNDOT 2575.1, 2575.2, 2575.3, AND THE FOLLOWING:

1. SEED, MIXTURE 25-131.
2. MULCH MATERIAL, TYPE 1
3. COMMERCIAL FERTILIZER, TYPE 1 ANALYSIS 24-12-24 (NPK) APPLIED AT A RATE OF 300 POUNDS/ACRE.
4. DISC ANCHORING OF MULCH MATERIAL TYPE 1

-----GPS-----  
LINESYLES WITH GPS DESIGNATION  
HAVE BEEN FIELD LOCATED

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NO.	DATE	BY	CKD	APPR	REVISION

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I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Pr Int Name: SCOTT A. PETERSEN  
*Scott Petersen*  
Date: 05/16/2014 License #: 47177

STATE PROJECT NO. 8601-60

DRAWN BY Z. HANSON  
DESIGNED BY Z. HANSON  
CHECKED BY S. PETERSEN  
COMM. NO. 0138221



ENGINEERS  
PLANNERS  
DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
LEGEND, UTILITY INFO, AND GENERAL NOTES  
ICE SENSOR WARNING SYSTEM  
TRAFFIC MANAGEMENT SYSTEM

SHEET 3 OF 19



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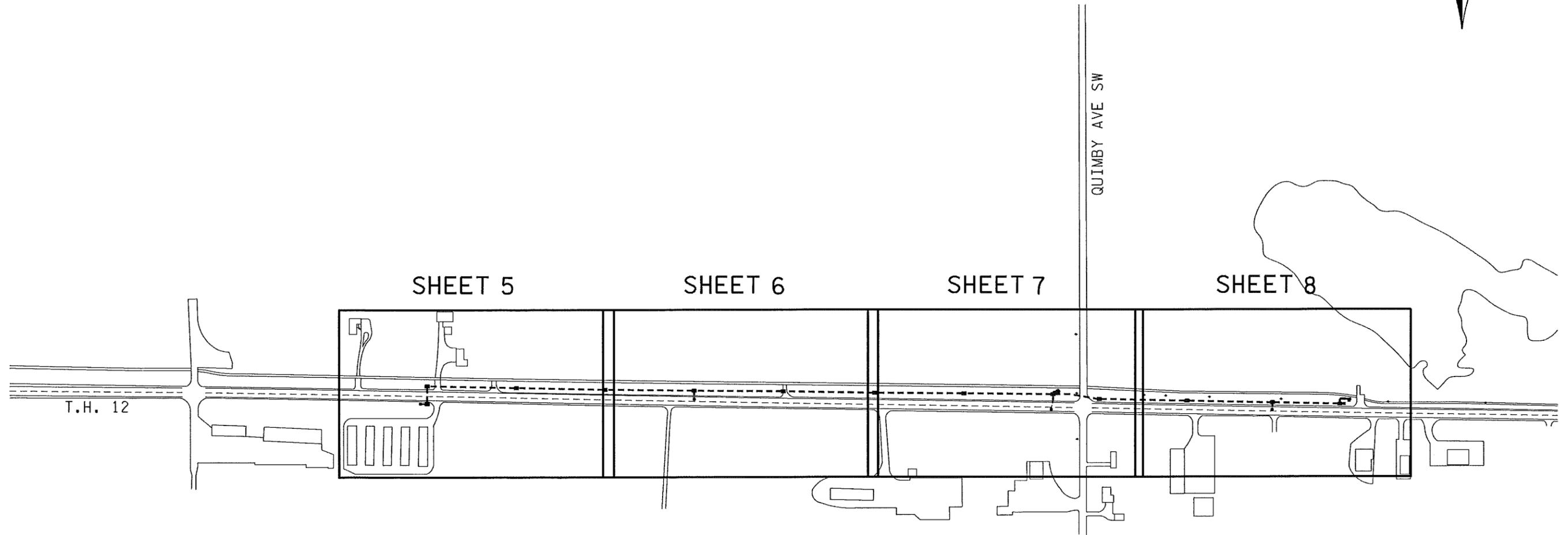
SHEET 5

SHEET 6

SHEET 7

SHEET 8

T.H. 12



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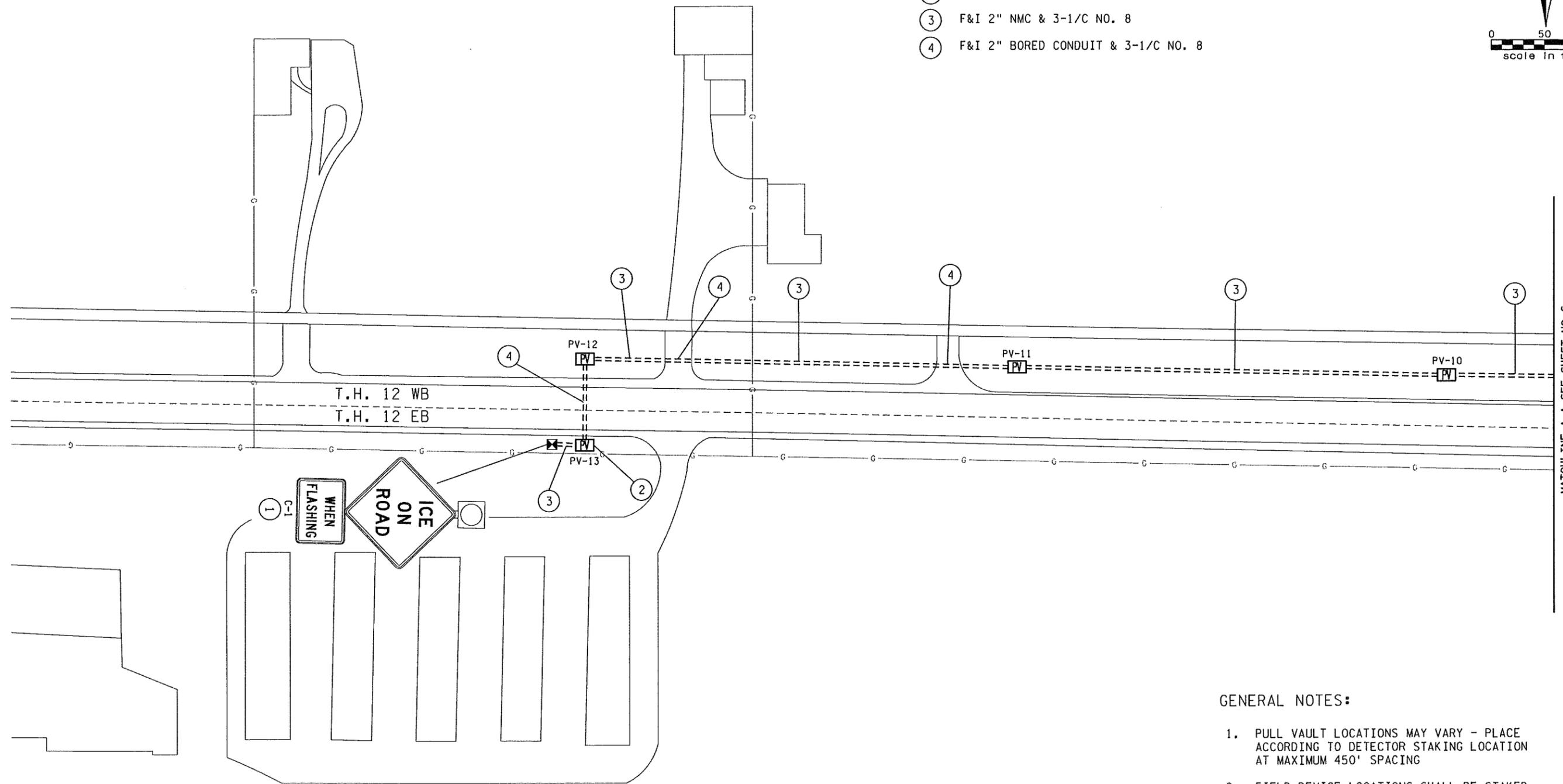
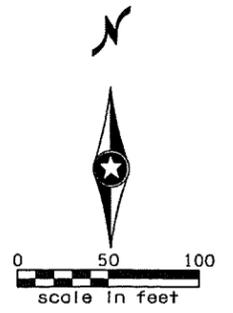


ENGINEERS  
PLANNERS  
DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 GENERAL LAYOUT  
 ICE SENSOR WARNING SYSTEM  
 TRAFFIC MANAGEMENT SYSTEM

SHEET 4 OF 19

- ① F&I PEDESTAL FOUNDATION  
F&I PEDESTAL POLE & BASE  
F&I SIGN PANELS TYPE C  
F&I FLASHING BEACON SYSTEM
- ② COIL 20 FEET OF 3-1/8 NO. 8 IN PV-13 (SLACK CABLE)
- ③ F&I 2" NMC & 3-1/8 NO. 8
- ④ F&I 2" BORED CONDUIT & 3-1/8 NO. 8



GENERAL NOTES:

- 1. PULL VAULT LOCATIONS MAY VARY - PLACE ACCORDING TO DETECTOR STAKING LOCATION AT MAXIMUM 450' SPACING
- 2. FIELD DEVICE LOCATIONS SHALL BE STAKED BY THE ENGINEER FOR FINAL PLACEMENT

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Pr. Lic. Name: **SCOTT A. PETERSEN**  
*Scott Petersen*  
 Date: 05/16/2014 License #: 47177

STATE PROJECT NO. 8601-60

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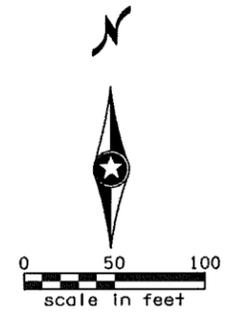


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MINNESOTA DEPARTMENT OF TRANSPORTATION  
 CONSTRUCTION PLANS  
 ICE SENSOR WARNING SYSTEM  
 TRAFFIC MANAGEMENT SYSTEM

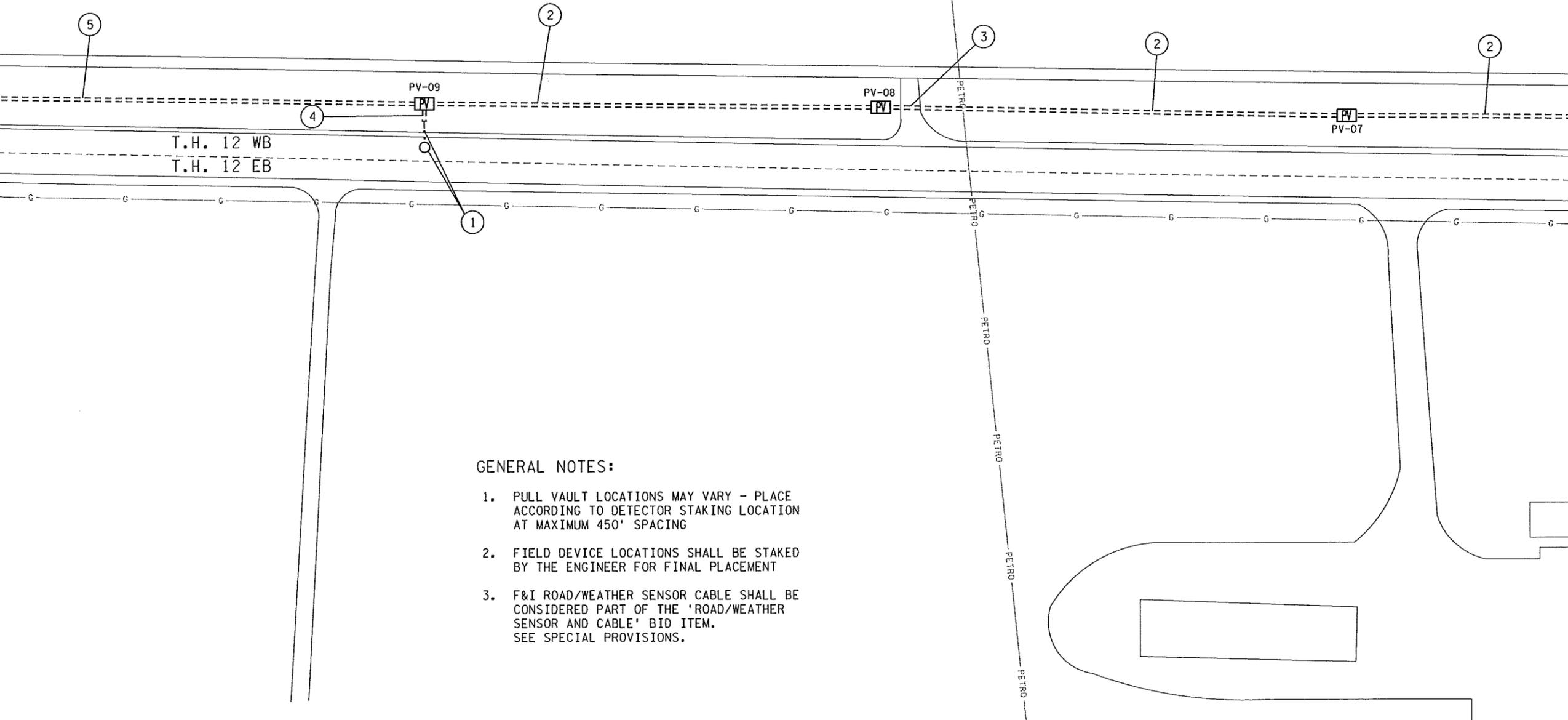
SHEET 5 OF 19

- ① F&I ROAD/WEATHER SENSOR AND CABLE
- ② F&I 2" NMC & 3-1/C NO. 8  
F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ③ F&I 2" BORED CONDUIT & 3-1/C NO. 8  
F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ④ F&I 2" NMC  
F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ⑤ F&I 2" NMC & 3-1/C NO. 8



MATCHLINE A-A SEE SHEET NO. 5

MATCHLINE B-B SEE SHEET NO. 7



**GENERAL NOTES:**

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3. F&I ROAD/WEATHER SENSOR CABLE SHALL BE CONSIDERED PART OF THE 'ROAD/WEATHER SENSOR AND CABLE' BID ITEM. SEE SPECIAL PROVISIONS.

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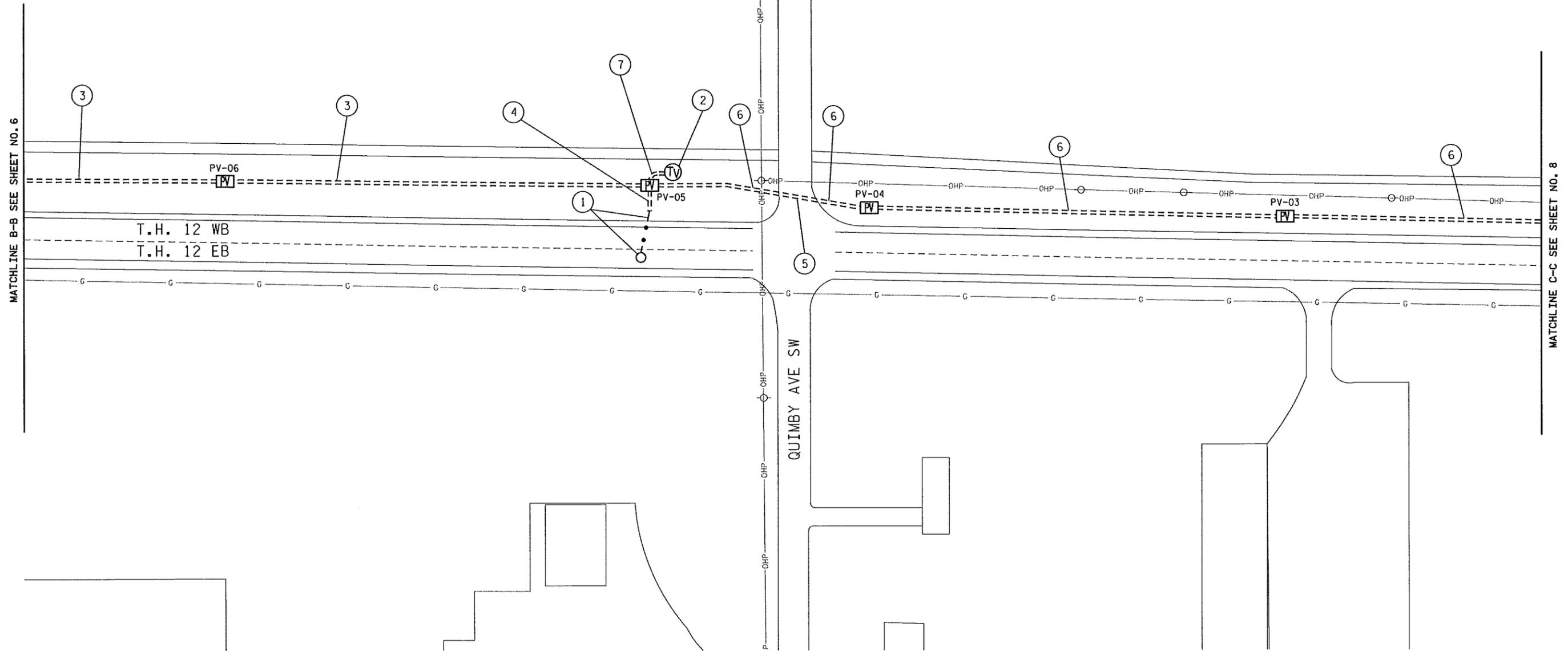
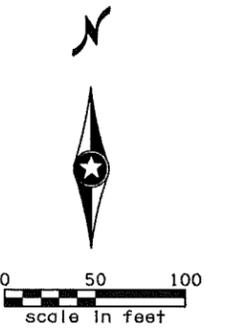
MINNESOTA DEPARTMENT OF TRANSPORTATION  
 CONSTRUCTION PLANS  
 ICE SENSOR WARNING SYSTEM  
 TRAFFIC MANAGEMENT SYSTEM

SHEET 6 OF 19

GENERAL NOTES:

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2. FIELD DEVICE LOCATIONS SHALL BE STAKED BY THE ENGINEER FOR FINAL PLACEMENT
3. F&I ROAD/WEATHER SENSOR CABLE SHALL BE CONSIDERED PART OF THE 'ROAD/WEATHER SENSOR AND CABLE' BID ITEM. SEE SPECIAL PROVISIONS.

- ① F&I ROAD/WEATHER SENSOR AND CABLE
- ② F&I LIGHT FOUNDATION DESIGN E MODIFIED F&I NON-INTRUSIVE DETECTION HARDWARE INSTALL CCTV ASSEMBLY (STATE FURNISHED)
- ③ F&I 2" NMC & 3-1/C NO. 8 F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ④ F&I 2" NMC F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ⑤ F&I 2" BORED CONDUIT, 3-1/C NO. 8 & 3-1/C NO. 4 F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ⑥ F&I 2" NMC, 3-1/C NO. 8 & 3-1/C NO. 4 F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ⑦ F&I 2" NMC, 3-1/C NO. 8 & 3-1/C NO. 4 F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)  
F&I 2" NMC & 3-1/C NO. 8  
F&I 2-ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)



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NO.	DATE	BY	CKD	APPR	REVISION

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Print Name: SCOTT A. PETERSEN  
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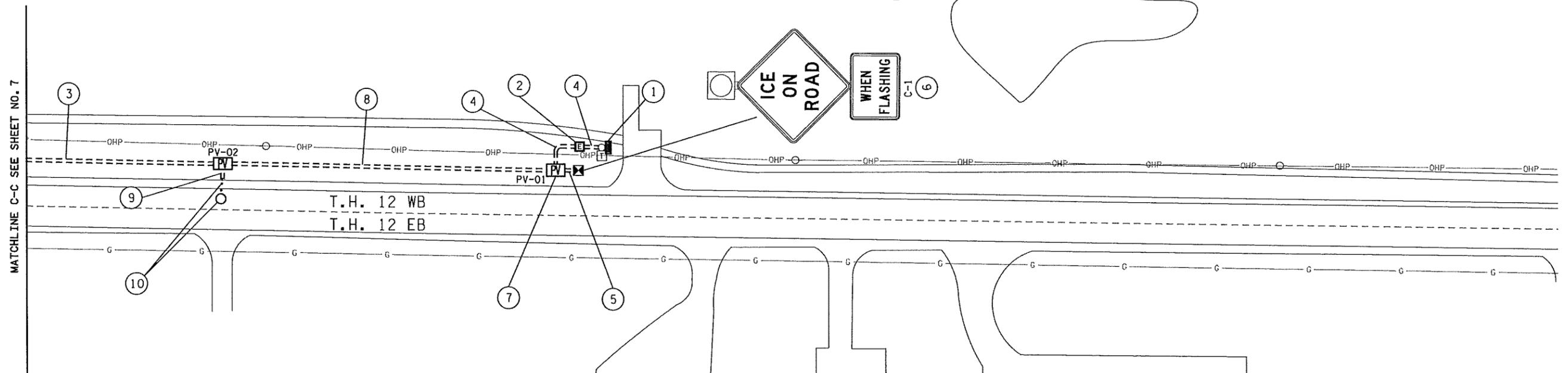
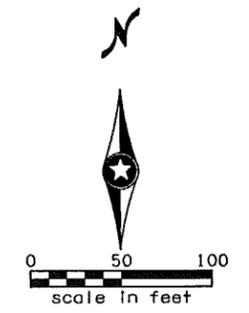
ENGINEERS  
 PLANNERS  
 DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 CONSTRUCTION PLANS  
 ICE SENSOR WARNING SYSTEM  
 TRAFFIC MANAGEMENT SYSTEM

SHEET 7 OF 19

- ① INPLACE WOOD POLE AND POLE-MOUNTED TRANSFORMER  
F&I SERVICE INSTALLATION TYPE A (ON INPLACE UTILITY POLE)
- ② F&I SERVICE FOUNDATION  
F&I SERVICE CABINET
- ③ F&I 2" NMC, 3-1/C NO. 8 & 3-1/C NO. 4  
F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ④ F&I 2" NMC & 3-1/C NO. 4
- ⑤ F&I 2" NMC & 3-1/C NO. 8
- ⑥ F&I PEDESTAL FOUNDATION  
F&I PEDESTAL POLE & BASE  
F&I SIGN PANELS TYPE C  
F&I FLASHING BEACON SYSTEM
- ⑦ COIL 20 FEET OF 3-1/C NO. 8 IN PV-01 (SLACK CABLE)
- ⑧ F&I 2" NMC, 3-1/C NO. 8 & 3-1/C NO. 4
- ⑨ F&I 2" NMC  
F&I ROAD/WEATHER SENSOR CABLE (SEE GENERAL NOTE 3)
- ⑩ F&I ROAD/WEATHER SENSOR AND CABLE

POND



GENERAL NOTES:

- 1. PULL VAULT LOCATIONS MAY VARY - PLACE ACCORDING TO DETECTOR STAKING LOCATION AT MAXIMUM 450' SPACING
- 2. FIELD DEVICE LOCATIONS SHALL BE STAKED BY THE ENGINEER FOR FINAL PLACEMENT
- 3. F&I ROAD/WEATHER SENSOR CABLE SHALL BE CONSIDERED PART OF THE 'ROAD/WEATHER SENSOR AND CABLE' BID ITEM. SEE SPECIAL PROVISIONS.

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NO.	DATE	BY	CKD	APPR	REVISION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: SCOTT A. PETERSEN  
*Scott Petersen*  
 Date: 05/16/2014 License #: 47177

STATE PROJECT NO. 8601-60

DRAWN BY Z. HANSON  
 DESIGNED BY Z. HANSON  
 CHECKED BY S. PETERSEN  
 COMM. NO. 0138221

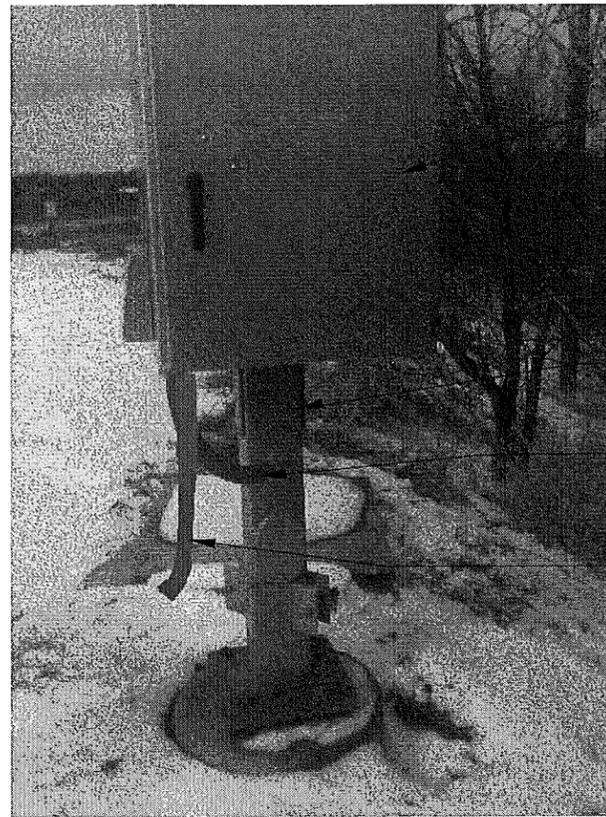


ENGINEERS  
 PLANNERS  
 DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 CONSTRUCTION PLANS  
 ICE SENSOR WARNING SYSTEM  
 TRAFFIC MANAGEMENT SYSTEM

SHEET 8 OF 19

INSTALL CCTV ASSEMBLY  
(STATE FURNISHED)



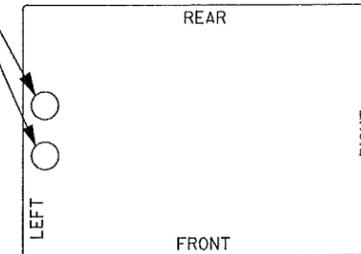
POLE MOUNTED CABINET

35' FOLDING POLE

1.5" FLEX CONDUIT

2" CONDUIT

PROPOSED OPENINGS FOR 1.5" & 2" SCH. 80  
CONDUIT- PLACE OPENINGS SO THEY  
DO NOT INTERFERE WITH SHELF.  
CONTRACTOR TO VERIFY  
LOCATIONS & F&I OPENINGS IN FIELD.



CAB. BOTTOM VIEW

35' FOLDING POLE

MOUNT POLE CABINET TO POLE, IF A  
MANUFACTURES GASKET IS NOT  
PROVIDED CAULK POLE BOX OPENING  
AT POLE TO ELIMINATE WATER INTRUSION

2" NMC FOR CABLES.  
USE SCH.80 CONDUIT  
FOR EXPOSED PORTION.  
DO NOT BLOCK ACCESS  
DOOR

EXTEND ANCHOR BOLTS  
5" ABOVE FOUNDATION

PROVIDE LONG  
RADIUS BEND

2" NMC FOR  
CABLES

FRONT VIEW

1.5" FLEX CONDUIT

EXOTHERMICALLY WELD OR  
MECHANICALLY CLAMP NO.6 AWG WIRE  
FROM POLE MOUNTED CAB. GROUND  
BUSS, POLE GROUND LUG AND 7/16"  
GROUND CONDUCTOR TO GROUND ROD  
LOCATED NEXT TO FOUNDATION

KEEP EXCESS CONDUCTOR  
TO A MINIMUM USING  
SHORTEST ROUTE TO  
GROUND ROD

3.0' X 3.0' X 4"  
SIDEWALK UNDER CRANK OPENING  
(INCIDENTAL)

TOP OF GRADE

ONE-PIECE 15' GROUND ROD

1" CONDUIT FOR  
ELECTRICAL GROUND

LIGHT BASE DESIGN E MODIFIED  
SEE STD PLATE 8127

MOUNT POLE CABINET TO POLE,  
CAULK POLE BOX OPENING AT POLE  
TO ELIMINATE WATER INTRUSION

1.5" FLEX CONDUIT

EXOTHERMICALLY WELD OR  
MECHANICALLY CLAMP NO.6 AWG WIRE  
FROM POLE MOUNTED CAB. GROUND  
BUSS, POLE GROUND LUG AND 7/16"  
GROUND CONDUCTOR TO GROUND ROD  
LOCATED NEXT TO FOUNDATION

KEEP EXCESS CONDUCTOR  
TO A MINIMUM USING  
SHORTEST ROUTE TO  
GROUND ROD

3.0' X 3.0' X 4"  
SIDEWALK UNDER POLE CABINET  
(INCIDENTAL)

2" NMC FOR  
CABLES

ONE-PIECE 15' GROUND ROD

POSITION SIDEWALKS 4" BELOW  
TOP OF FOUNDATION, BACK FILL  
AS NEEDED TO CREATE A SMOOTH  
TRANSITION FROM INPLACE GRADE  
TO SIDEWALKS

SIDE VIEW

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STATE PROJECT NO. 8601-60

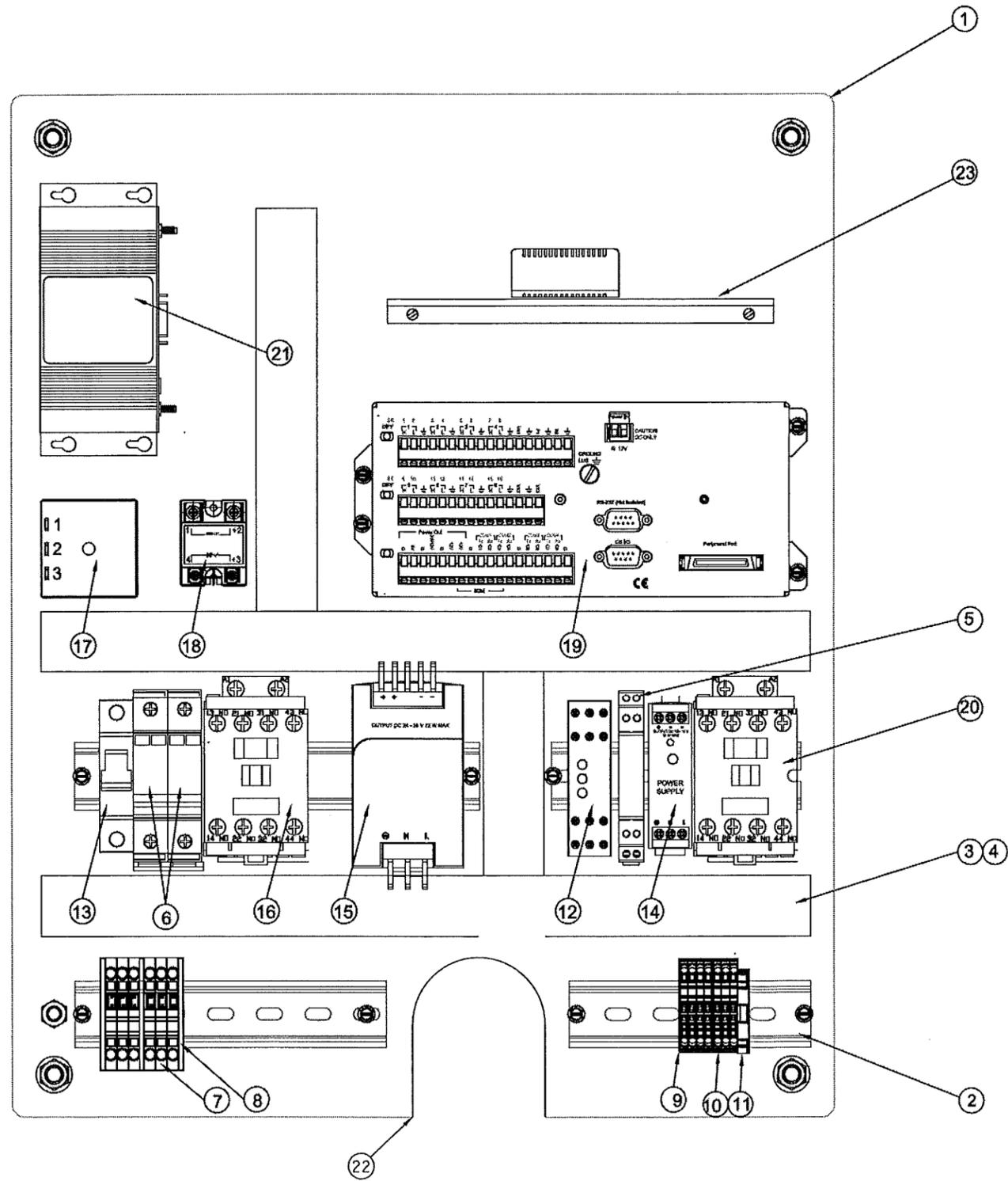
DRAWN BY Z. HANSON  
 DESIGNED BY Z. HANSON  
 CHECKED BY S. PETERSEN  
 COMM. NO. 0138221



ENGINEERS  
PLANNERS  
DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 NON-INTRUSIVE DETECTION HARDWARE  
 ICE SENSOR WARNING SYSTEM  
 CONSTRUCTION DETAILS

SHEET 9 OF 19



CABINET EQUIPMENT		
ITEM	QTY	DESCRIPTION
1	1	STEEL ENCLOSURE PANEL
2	24 IN.	DIN RAIL, DIN 35
3	48 IN.	WIRING DUCT
4	48 IN.	WIRING DUCT COVER
5	1	CONTROL SURGE PROTECTION
6	1	POWER SURGE PROTECTION
7	6	10-24 AWG TERMINAL BLOCKS
8	3	TERMINAL BLOCK END ANCHOR/BARRIER - GRAY
9	7	FEED THROUGH TERMINAL BLOCK - GRAY
10	3	END BARRIER - GRAY
11	1	TERMINAL BLOCK END ANCHOR/BARRIER - GRAY
12	1	RS-232 TO RS-422/485 ISOLATED CONVERTER
13	1	SUPPLEMENTARY PROTECTOR 6.0 AMP - 1 POLE
14	1	POWER SUPPLY INPUT - 120 VAC, OUTPUT - 24 VDC
15	1	POWER SUPPLY INPUT - 120 VAC, OUTPUT - 12 VDC
16	1	CONTROL RELAY WITH 4 POLE 24 VDC COIL
17	1	SOLID STATE AC/DC FLASHER - 120 VAC
18	1	DC SOLID STATE RELAY 5 VDC CONTROL
19	1	DATA LOGGER
20	1	CONTROL RELAY WITH 4 POLE 12 VDC COIL
21	1	CELLULAR MODEM (STATE FURNISHED)
22	1	CUT OUT ACCESS HOLE TO MATCH CABINET
23	1	SHELF - 1/8" X 8" X 4" X 1/2"

GENERAL NOTES:

1. CONTRACTOR IS TO FURNISH AND INSTALL ALL EQUIPMENT INDICATED ON THIS SHEET UNLESS OTHERWISE NOTED.
2. PANEL SHALL BE MOUNTED SUCH THAT IT DOES NOT BLOCK ACCESS TO THE POLE ACCESS HOLE OR CABINET POWER RECEPTACLES. RELOCATE CABINET OUTLET STRIP TO ENSURE EASY ACCESS TO BACK OF PANEL AND POLE ACCESS HOLE
3. SENSOR MANUFACTURER MAY PROVIDE/INSTALL CABINET COMPONENTS IN CONTRACTOR-SUPPLIED CABINET.
4. MNDOT WILL SUPPLY A CELL MODEM AND CCTV POWER SUPPLY TO BE INSTALLED IN CABINET.
5. COPIES OF ANY DOCUMENTATION RELATED TO SYSTEM COMPONENTS SHALL BE PLACED IN THE DOCUMENT FOLDER INSIDE THE CABINET DOOR.

NOT TO SCALE

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NO.	DATE	BY	CKD	APPR	REVISION

\*FILES\*

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Print Name: SCOTT A. PETERSEN

*Scott Petersen*

Date: 05/16/2014 License # 47177

STATE PROJECT NO. 8601-60

DRAWN BY Z. HANSON  
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 CHECKED BY S. PETERSEN  
 COMM. NO. 0138221

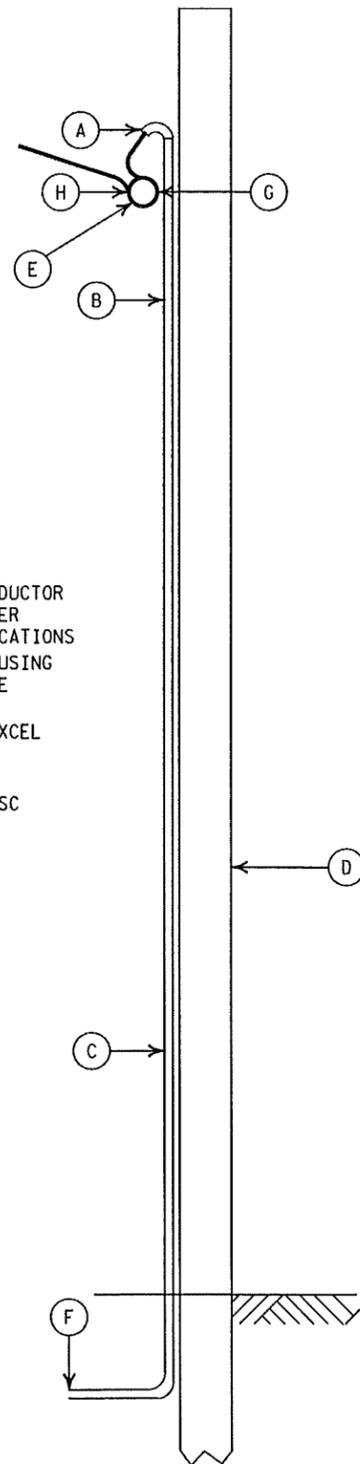


ENGINEERS  
 PLANNERS  
 DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION

CABINET ELECTRONICS OVERVIEW  
 ICE SENSOR WARNING SYSTEM  
 CONSTRUCTION DETAILS

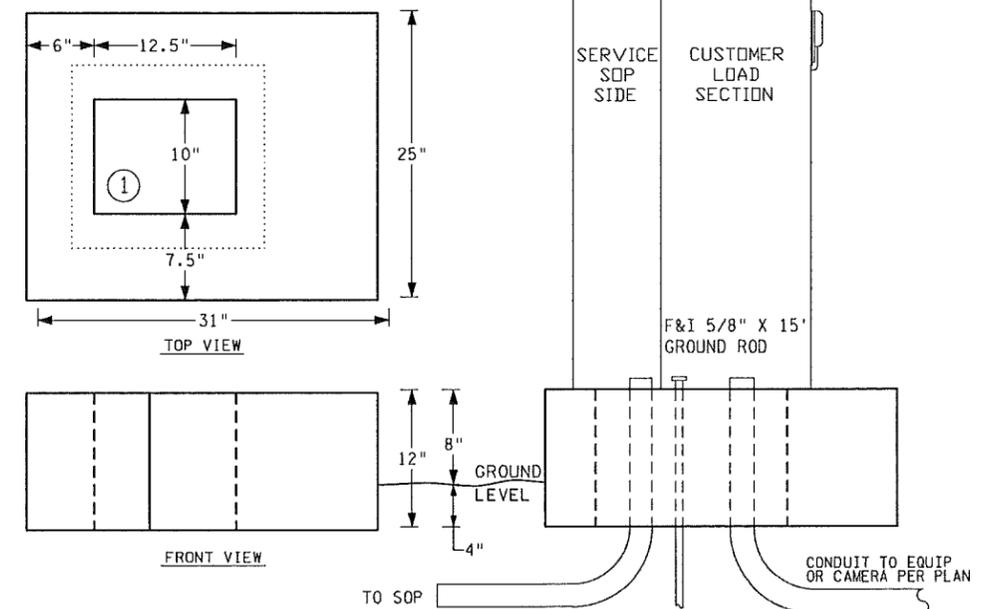
SHEET 10 OF 19



- (A) WEATHERHEAD
- (B) RISER
- (C) 2.0" RSC
- (D) INPLACE WOOD POLE
- (E) NEUTRAL/GROUNDING CONDUCTOR MAY BE CLAMPED TO RISER AT UTILITY SERVICE LOCATIONS
- (F) COUPLE RSC TO 2" NMC USING METHOD APPROVED BY THE ENGINEER
- (G) PROVIDE 5' SLACK FOR XCEL ENERGY CONNECTION TO EXISTING TRANSFORMER
- (H) DRIP LOOP, CLAMP TO RSC

SERVICE INSTALLATION  
TYPE A

① AFTER FOUNDATION AND CONDUITS ARE SET, FILL OPENING WITH SAND AND PLACE 1 INCH OF GROUT FLUSH WITH SURFACE OF FOUNDATION.



STAND ALONE  
SERVICE FOUNDATION

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 CHECKED BY S. PETERSEN  
 COMM. NO. 0138221

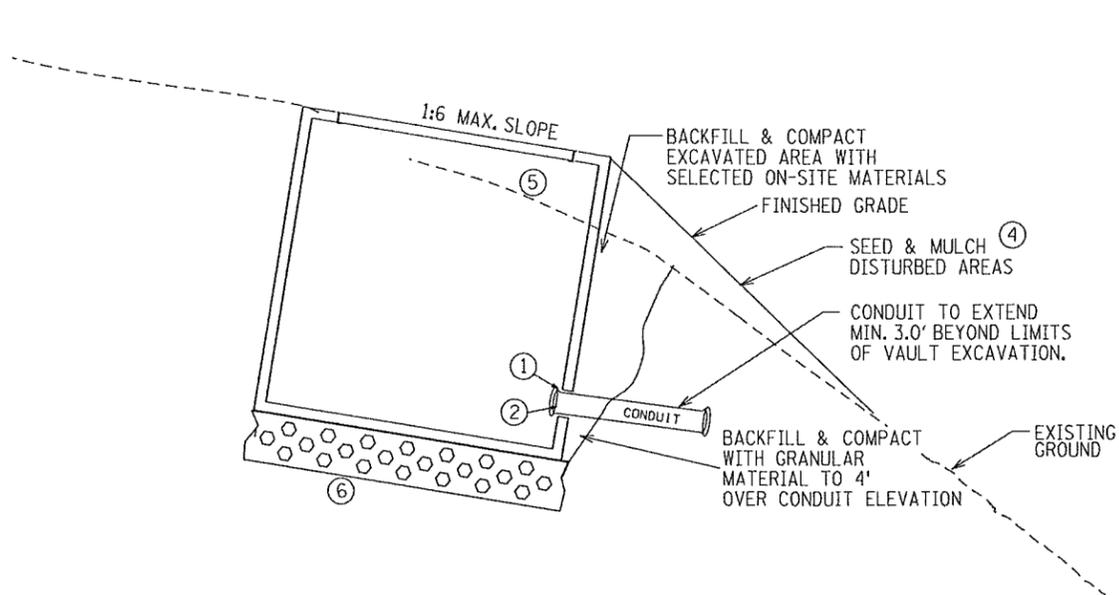


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PLANNERS  
DESIGNERS

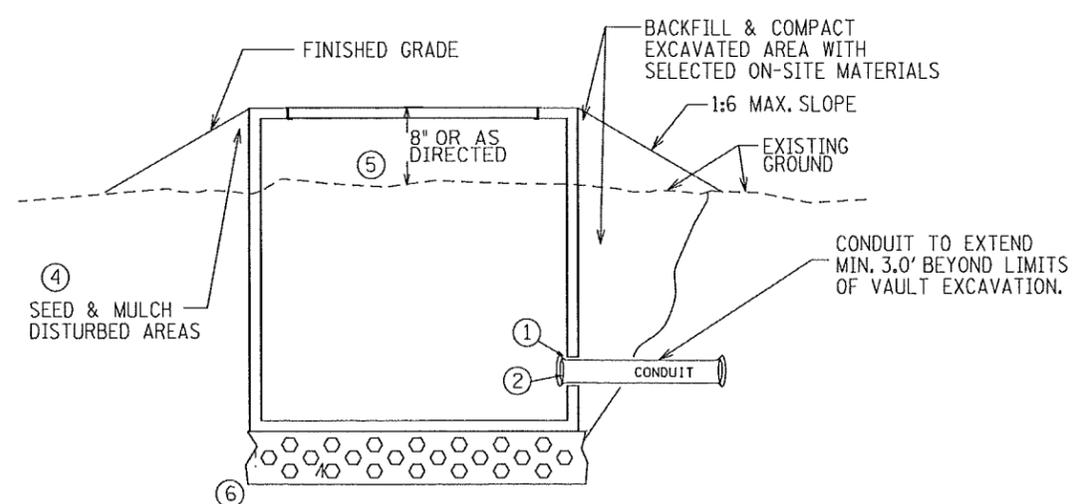
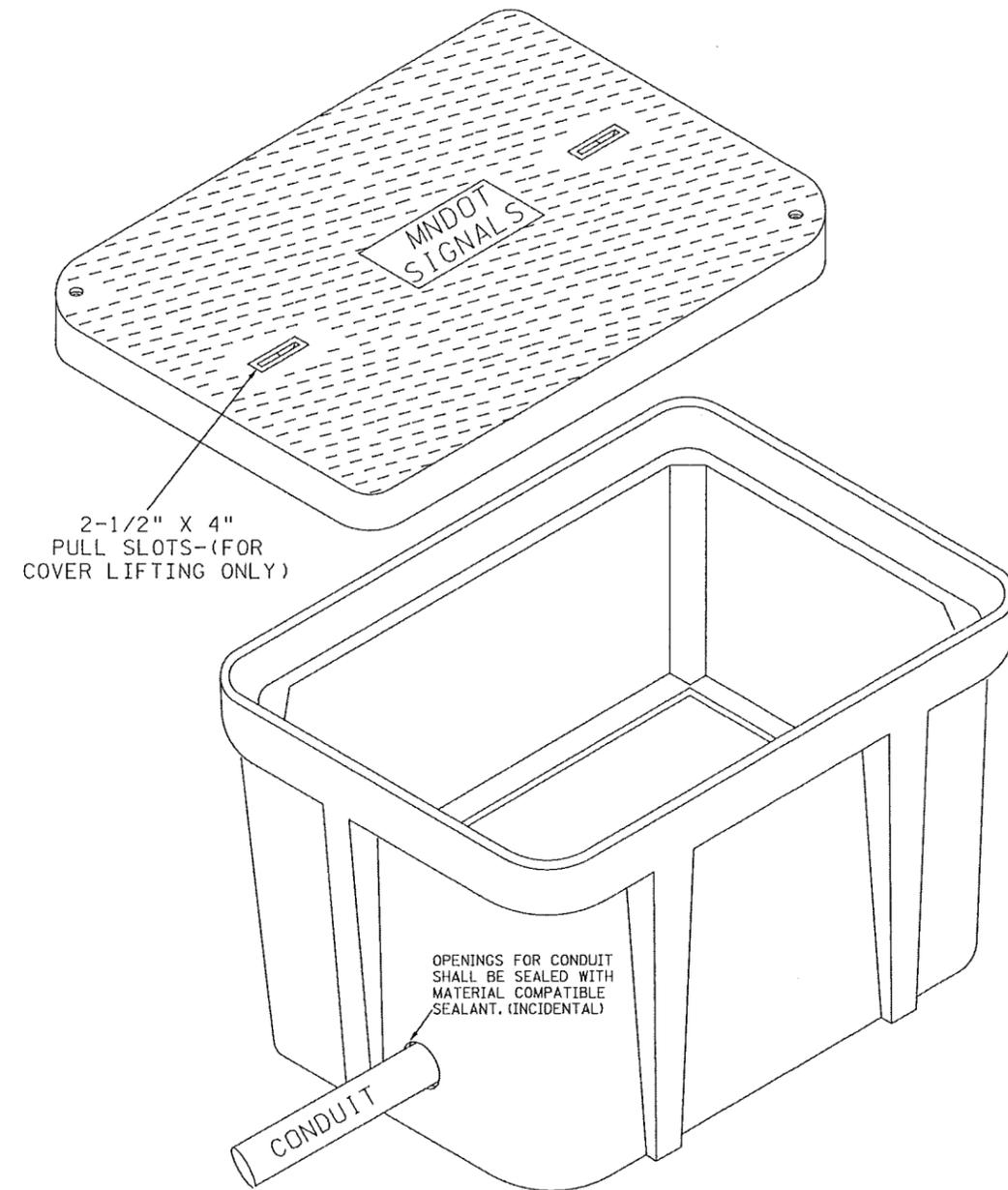
MINNESOTA DEPARTMENT OF TRANSPORTATION  
 ELECTRICAL SERVICE DETAILS  
 ICE SENSOR WARNING SYSTEM  
 CONSTRUCTION DETAILS

SHEET 11 OF 19





VAULT INSTALLATION (SLOPED AREAS)



VAULT INSTALLATION (LEVEL GROUND)

SPECIFIC NOTES

- ① OPENINGS FOR CONDUIT SHALL BE SEALED WITH MATERIAL COMPATIBLE SEALANT. (INCIDENTAL)
- ② PLUG CONDUIT OPENING WITH A DRAINABLE COMPOUND (INCIDENTAL)
- ③ REMOVED
- ④ RESTORE DISTURBED AREAS FOR TMS INSTALLATION WITH SEED AND TYPE I MULCH PER MNDOT 2575.3 (INCIDENTAL)
- ⑤ STRIP TOPSOIL FROM VAULT AND SLOPE AREAS PRIOR TO VAULT INSTALLATION (INCIDENTAL)
- ⑥ F&I 1.0' COARSE FILTER AGGREGATE UNDER BASE COMPLYING WITH MNDOT 3149.2H.

GENERAL NOTES

- 1. GROUND CONNECTIONS SHALL BE COATED WITH OXIDATION PROHIBITING COMPOUND.
- 2. DO NOT LIFT ENTIRE PULL VAULT WITH COVER ATTACHED BY COVER LIFTING SLOTS.

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•FILES\*

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*Scott A. Petersen*  
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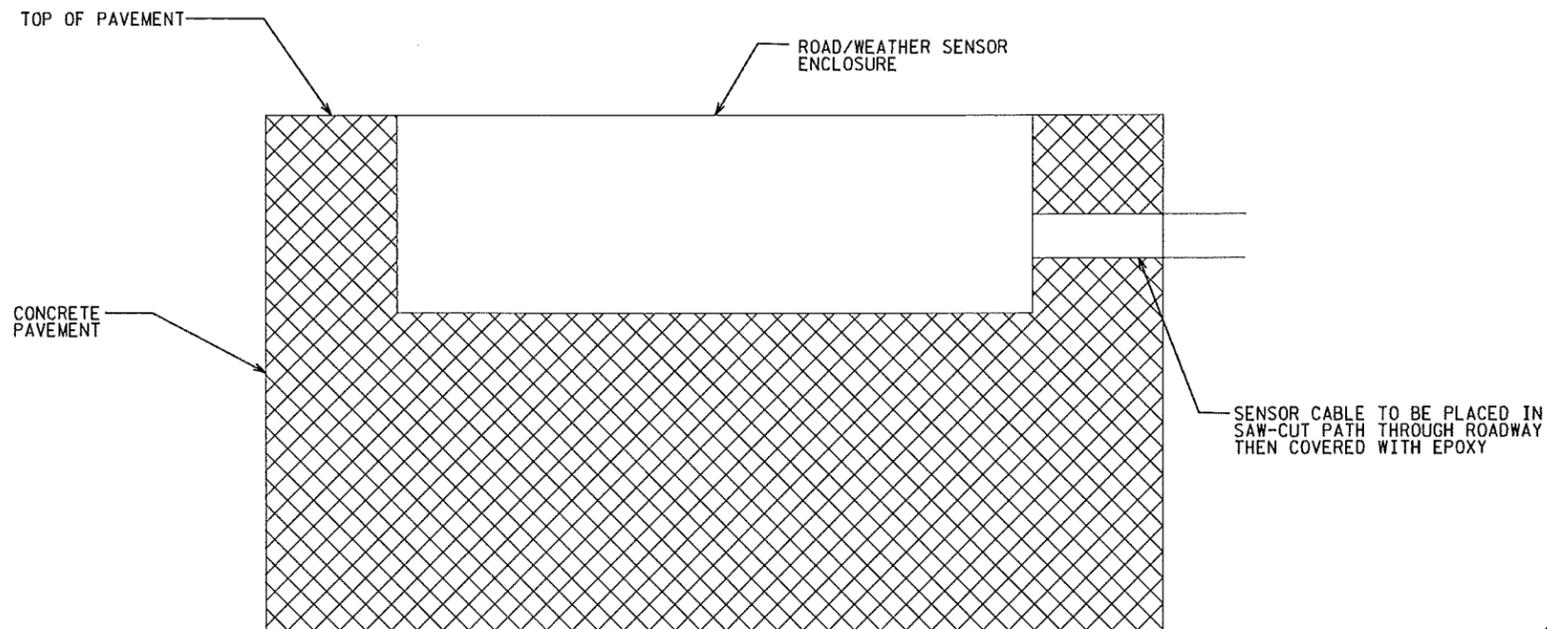


ENGINEERS PLANNERS DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 PULL VAULT INSTALLATION  
 ICE SENSOR WARNING SYSTEM  
 CONSTRUCTION DETAILS

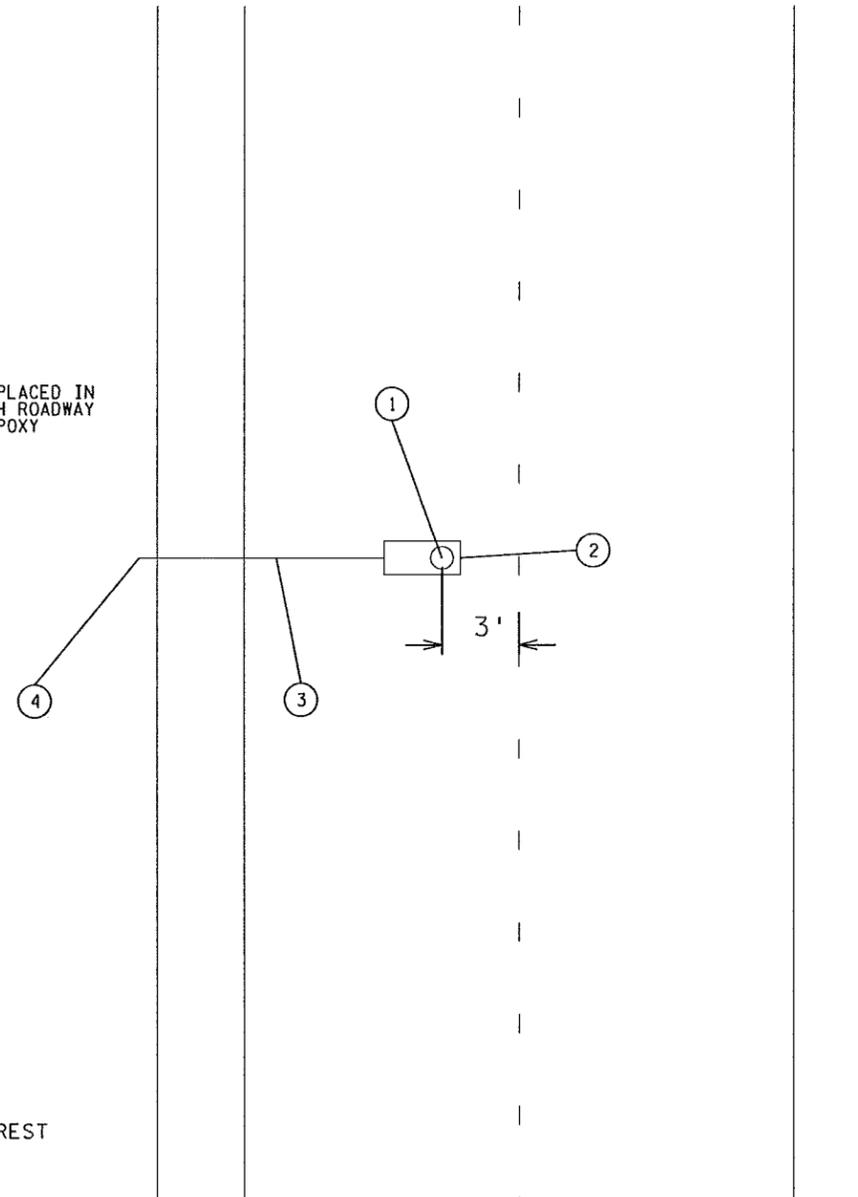
SHEET 13 OF 19

ROAD/WEATHER SENSOR  
DEPTH PLACEMENT



CROSS SECTION

ROAD/WEATHER SENSOR  
LANE PLACEMENT



GENERAL NOTES:

1. CONTRACTOR SHALL SUBMIT INSTALLATION PROCEDURES TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION
2. INSTALL SENSOR PER MANUFACTURER'S SPECIFICATIONS

NOTES:

- ① SENSOR SHALL BE INSTALLED IN ENCLOSURE ACCORDING TO MANUFACTURER'S SPECIFICATIONS
- ② ENCLOSURE SHALL BE INSTALLED IN PAVEMENT ACCORDING TO MANUFACTURER'S SPECIFICATIONS
- ③ SAWCUT AND INSTALL SENSOR CABLE ACCORDING TO MANUFACTURER'S SPECIFICATIONS
- ④ SENSOR CABLE IS DIRECT-BURIAL CABLE AND SHOULD ENTER CONDUIT PRIOR TO ENTERING THE NEAREST PULL VAULT

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Pr Int Name: SCOTT A. PETERSEN  
*Scott Petersen*  
 Date: 05/16/2014 License # 47177

STATE PROJECT NO. 8601-60

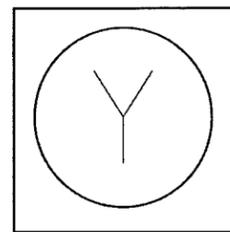
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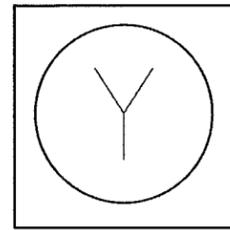
ENGINEERS  
PLANNERS  
DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 ROAD/WEATHER SENSOR PLACEMENT  
 ICE SENSOR WARNING SYSTEM  
 CONSTRUCTION DETAILS

SHEET 14 OF 19



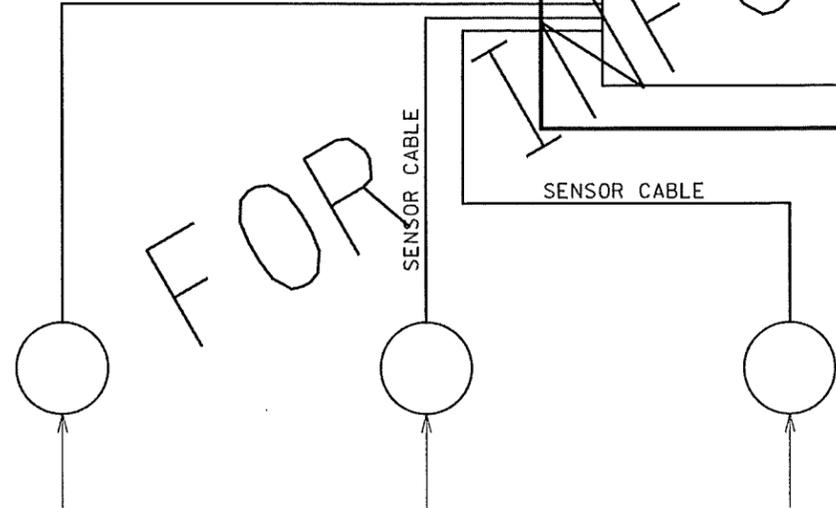
WEST BEACON



EAST BEACON

3-1/C NO. 8

SENSOR CABLE



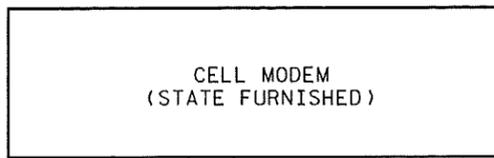
WEST SENSOR

CENTRAL SENSOR

EAST SENSOR

SENSOR CABLE

EAST SENSOR

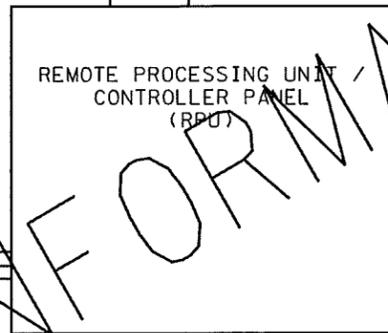


CELL MODEM  
(STATE FURNISHED)

SERIAL CABLE (RS-232)



FLASHER  
RELAY



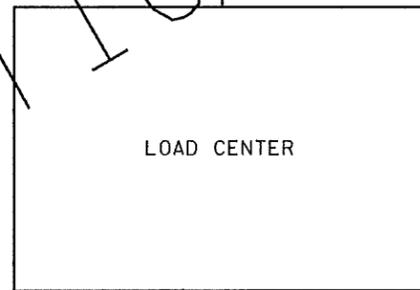
REMOTE PROCESSING UNIT /  
CONTROLLER PANEL  
(RPU)



ETHERNET SURGE SUPPRESSOR  
(STATE FURNISHED)



CCTV POWER SUPPLY  
(STATE FURNISHED)



LOAD CENTER

CABINET

CELL ANTENNA



IP CCTV  
(STATE FURNISHED)



CAT 6 CABLE  
(STATE FURNISHED)

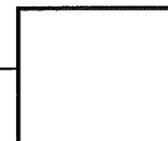
CCTV POWER CABLE  
(STATE FURNISHED)

ONLY

GENERAL NOTES:

1. INTEGRATOR TO TERMINATE ALL IN-CABINET CABLES EXCEPT POWER CONDUCTORS CONNECTING SERVICE INSTALLATION TO LOAD CENTER. CONTRACTOR TO TERMINATE ALL OTHER FIELD CABLES.
2. THIS SCHEMATIC HAS BEEN PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

3-1/C NO. 4



SERVICE  
INSTALLATION TYPE A &  
SERVICE CABINET

SOURCE OF  
POWER  
(XCEL ENERGY)

FOR INFORMATION ONLY

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Pr Int: SCOTT A. PETERSEN

Date: 05/16/2014 License #: 47177

STATE  
PROJECT  
NO.  
8601-60

DRAWN BY  
Z. HANSON  
DESIGNED BY  
Z. HANSON  
CHECKED BY  
S. PETERSEN  
COMM. NO. 0138221



ENGINEERS  
PLANNERS  
DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION

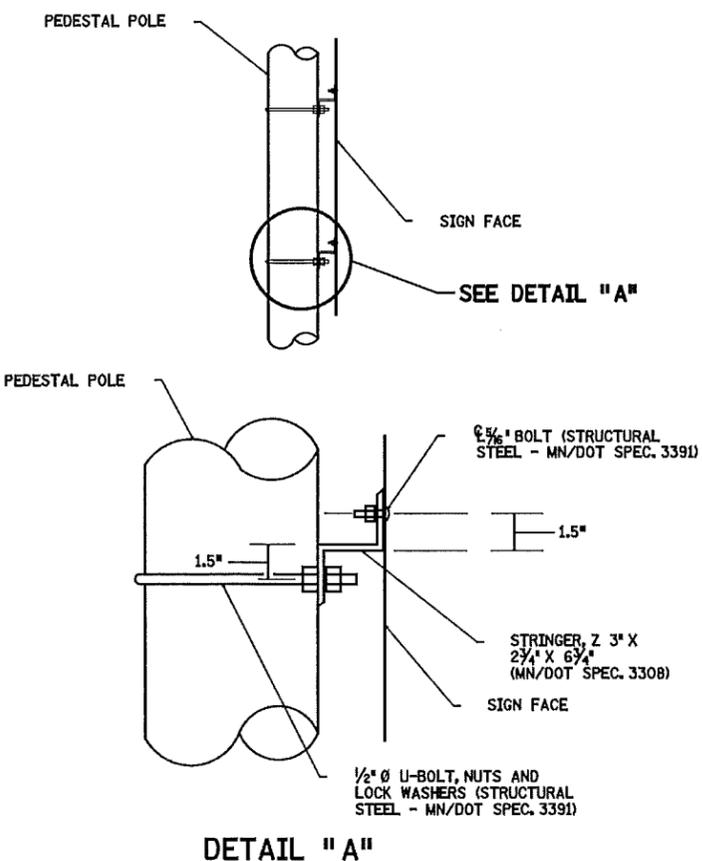
DEVICE AND COMMUNICATION OVERVIEW  
ICE SENSOR WARNING SYSTEM  
TRAFFIC MANAGEMENT SYSTEM

SHEET  
15  
OF  
19

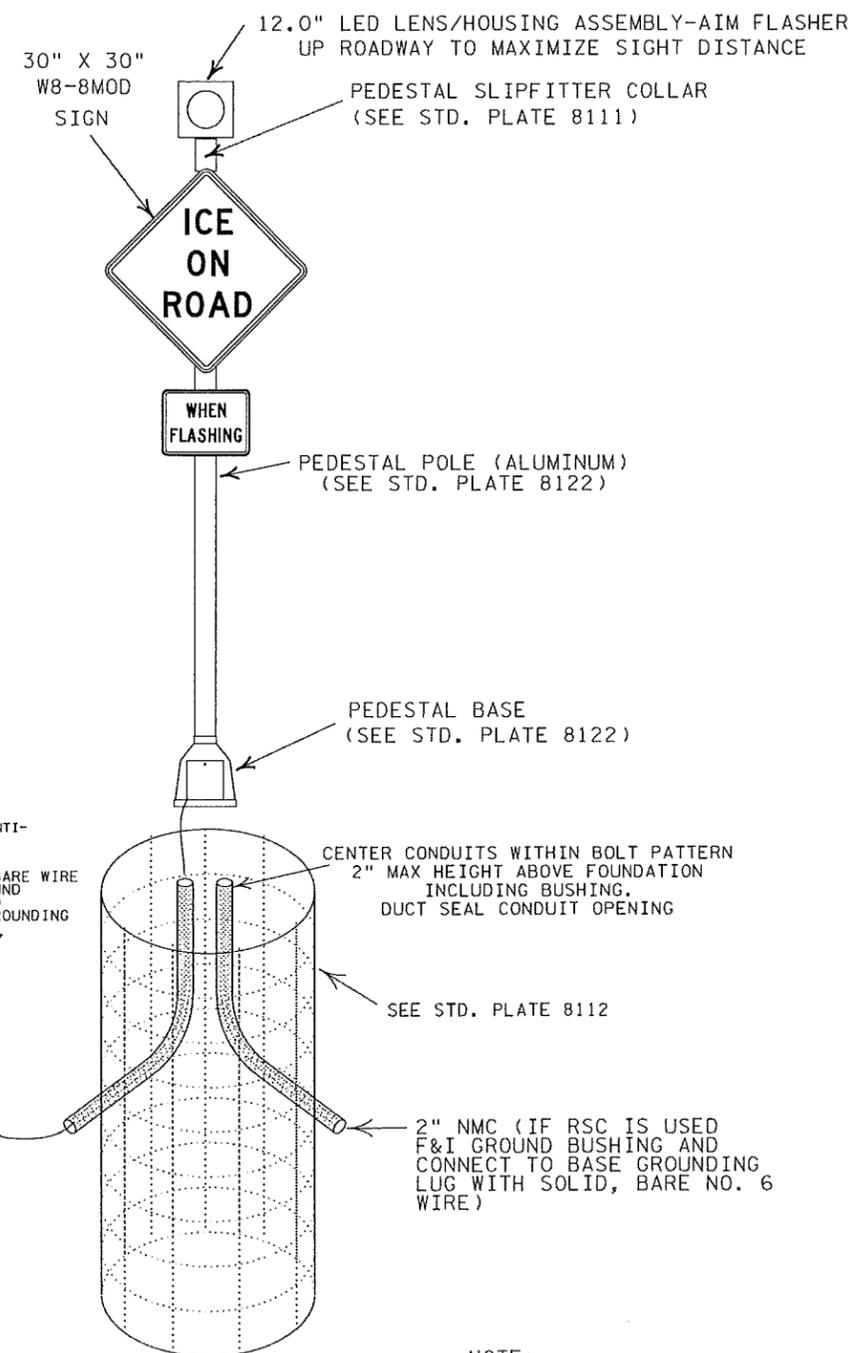
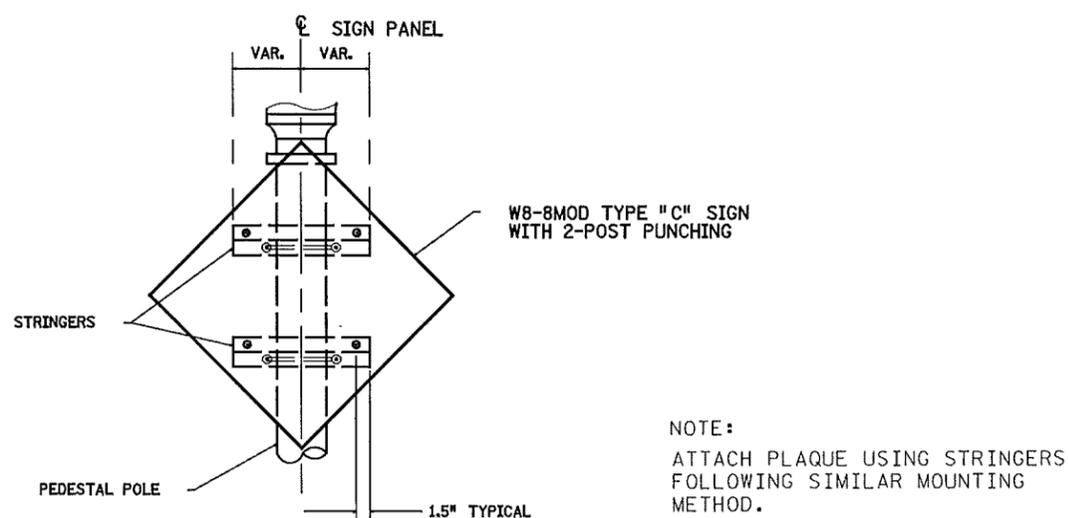
NO.	DATE	BY	CHKD	APPR	REVISION

#FILES#

# SIGN MOUNTING DETAILS SIDE ELEVATION



# SIGN MOUNTING DETAILS FRONT ELEVATION



NOTE:  
ALL METAL FITTINGS SHALL BE ANODIZED ALUMINUM  
USE ANTI-SEIZE COMPOUND ON ALL FITTINGS  
PLACE FOUNDATION ACCORDING TO SIGN PLACEMENT DETAIL ON SHEET 18.

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DESIGNED BY Z. HANSON  
CHECKED BY S. PETERSEN  
CGMM. NO. 0138221

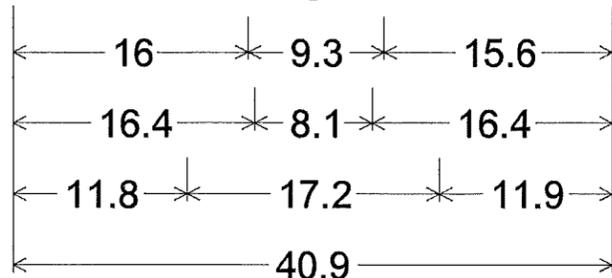
**SRF**  
Consulting Group, Inc.

ENGINEERS  
PLANNERS  
DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION

PEDESTAL FOUNDATION, BASE & POLE  
ICE SENSOR WARNING SYSTEM  
SIGNING CONSTRUCTION DETAILS

SHEET 16 OF 19



W8-8MOD\_ICE ON ROAD\_30x30;

30.0" across sides 1.88" Radius, 0.75" Border, 0.5" Margin, Black on Yellow;

[ICE] D; [ON] D; [ROAD] D;



W16-13P\_24x18;  
1.5" Radius, 0.63" Border, 0.38" Margin, Black on Yellow;  
[WHEN] C; [FLASHING] C;

A SIGN PANELS TYPE C											
SIGN NO.	QTY	POSTS				MTG HT	PANEL			CODE NO.	PANEL LEGEND
		NO. AND TYPE	KNEE BRACES QTY	LEN FEET	SIZE INCH		AREA SQ FT	TOTAL AREA SQ FT			
									FEET		
(1) C-1	2	1-0	(2)	(2)	(3)	30 x 30	6.25	12.50	W8-8MOD	ICE ON ROAD	
						24 x 18	3.00	6.00	W16-13P	WHEN FLASHING (PLAQUE)	
<b>TOTAL</b>							<b>18.50</b>				

NOTES:

1. MOUNT ON SIGNAL PEDESTAL POLE. SEE SHEET NO.16.
2. SIGNS WILL BE PEDESTAL MOUNTED - NO POSTS REQUIRED
3. SEE SHEET NO.18 FOR TYPICAL MOUNTING.
4. FOR PUNCHING AND MOUNTING DETAILS, SEE SHEET NO.19.
5. SEE ABOVE FOR SIGN PANEL DETAILS.

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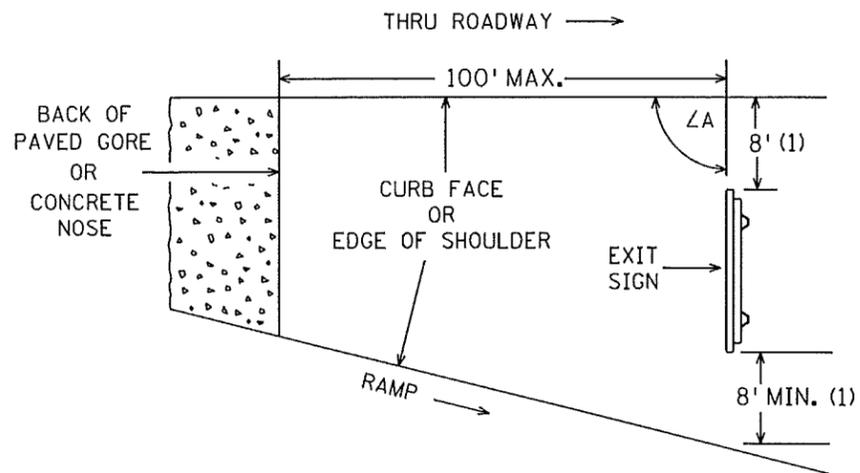


ENGINEERS PLANNERS DESIGNERS

MINNESOTA DEPARTMENT OF TRANSPORTATION  
 SIGN PANELS TYPE C  
 ICE SENSOR WARNING SYSTEM  
 SIGNING CONSTRUCTION DETAILS

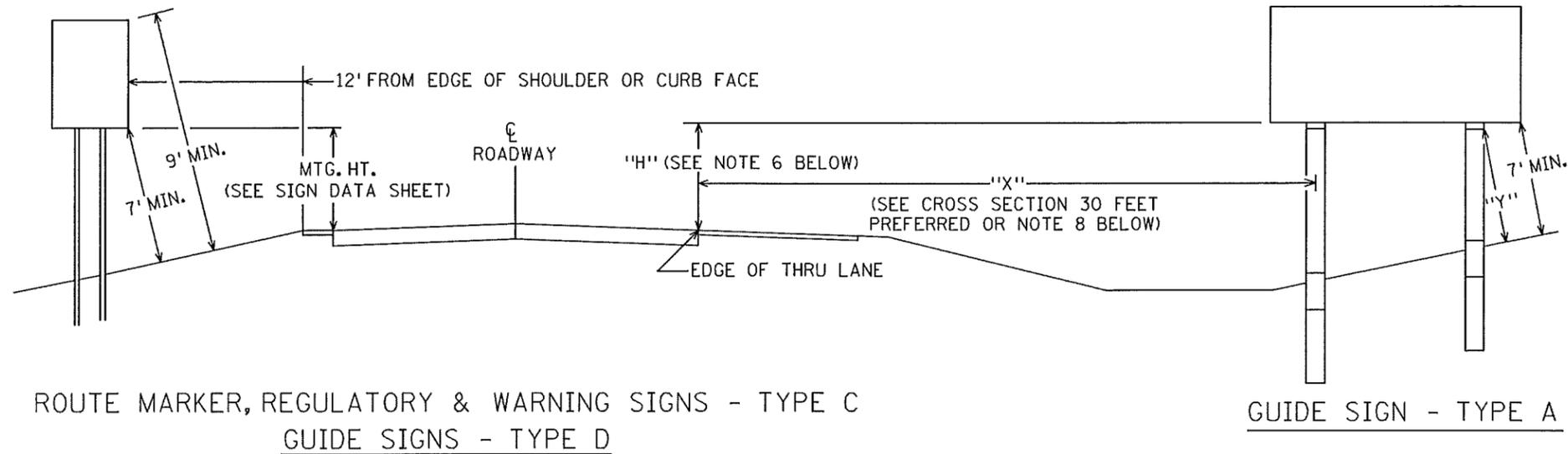
SHEET 17 OF 19

GORE PLACEMENT



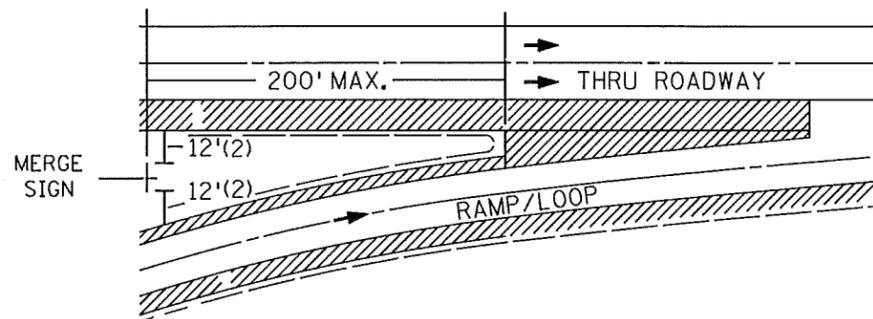
PLOTTED/REVISED: 5/19/2014

ROADSIDE PLACEMENT



ROUTE MARKER, REGULATORY & WARNING SIGNS - TYPE C  
GUIDE SIGNS - TYPE D

GUIDE SIGN - TYPE A



**SPECIFIC NOTES:**

(1) EXIT SIGNS

IF THESE OFFSETS CANNOT BE ATTAINED WITHIN 100 FEET OF THE PAVED GORE, A 4 FOOT OFFSET IS ACCEPTABLE. IF THE 4 FOOT OFFSETS CANNOT BE ATTAINED WITHIN 100 FEET OF THE PAVED GORE, CONTACT THE PROJECT ENGINEER WHO WILL CONSULT WITH THE STATE SIGNING ENGINEER.

(2) MERGE SIGNS

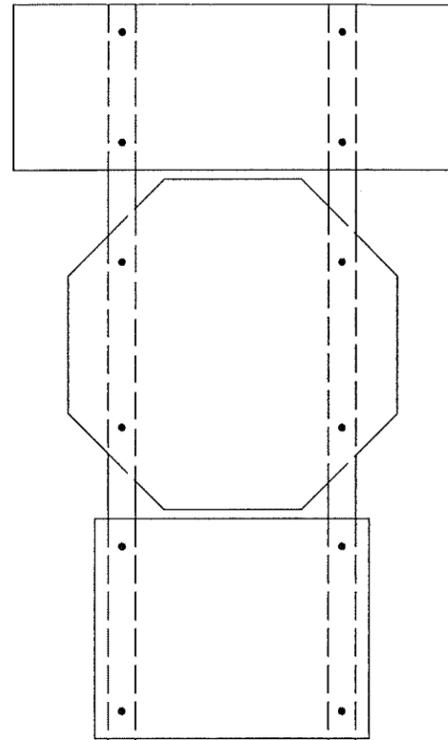
IF THESE OFFSETS CANNOT BE ATTAINED WITHIN 200 FEET OF THE PAVED GORE, A 4 FOOT OFFSET IS ACCEPTABLE. IF THE 4 FOOT OFFSETS CANNOT BE ATTAINED WITHIN 200 FEET OF THE PAVED GORE, CONTACT THE PROJECT ENGINEER WHO WILL CONSULT WITH THE STATE SIGNING ENGINEER.

**NOTES:**

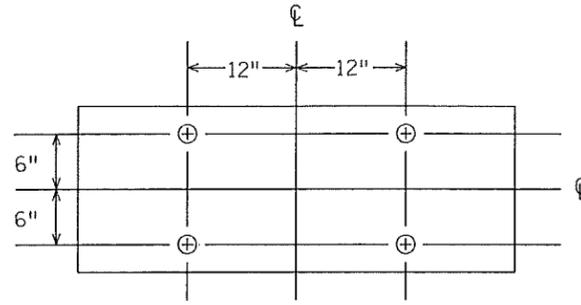
1. ALL ROUTE MARKERS, WARNING & REGULATORY SIGNS SHALL BE AT LEAST 7' ABOVE EDGE OF THRU LANE.
2. SIGN FACES SHALL BE VERTICAL.
3. OVERHEAD SIGNS SHALL BE POSITIONED AT RIGHT ANGLES TO THE THRU ROADWAY UNLESS OTHERWISE NOTED.
4. TO AVOID SPECULAR GLARE,  $\angle A$  SHALL BE APPROXIMATELY  $93^\circ$  FOR SIGNS LOCATED LESS THAN 30' FROM THE EDGE OF THRU LANE AND APPROXIMATELY  $92^\circ$  FOR SIGNS LOCATED 30' OR MORE FROM EDGE OF THRU LANE. THIS APPLIES TO SIGNS TYPE A, C, & D AND INCLUDES SIGNS IN THE GORE.
5. "Y" IS THE PERPENDICULAR DISTANCE FROM THE GROUND LINE TO THE FRICTION FUSE ON THE POST. THIS DISTANCE SHALL BE AT LEAST 7'.
6. WHERE "X" IS LESS THAN 30', "H" SHALL BE  $7' \pm 6"$ . WHERE "X" IS 30' OR GREATER, MINIMUM AND PREFERRED "H" IS 5'.
7. LATERAL CLEARANCES GIVEN APPLY TO RIGHT AND OR LEFT SIDE INSTALLATION.
8. WHEN A TYPE A SIGN IS INSTALLED DIRECTLY BEHIND TRAFFIC BARRIER, THE LEFT EDGE OF THE SIGN PANEL SHALL BE LOCATED A MINIMUM OF 8 FEET BEHIND THE FACE OF THE TRAFFIC BARRIER.

SIGN PLACEMENT

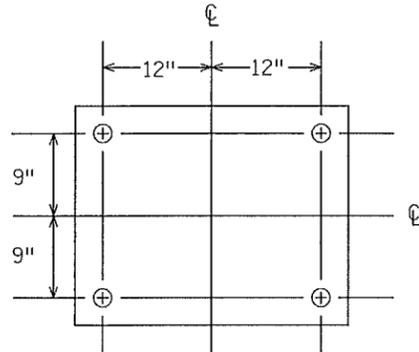
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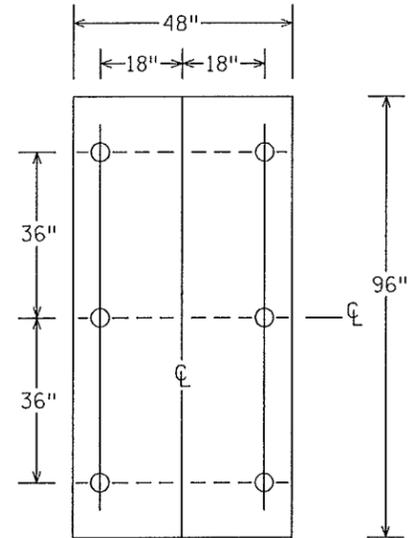
R6-1, R1-1 & (R6-3 OR R6-3a)  
MOUNTING



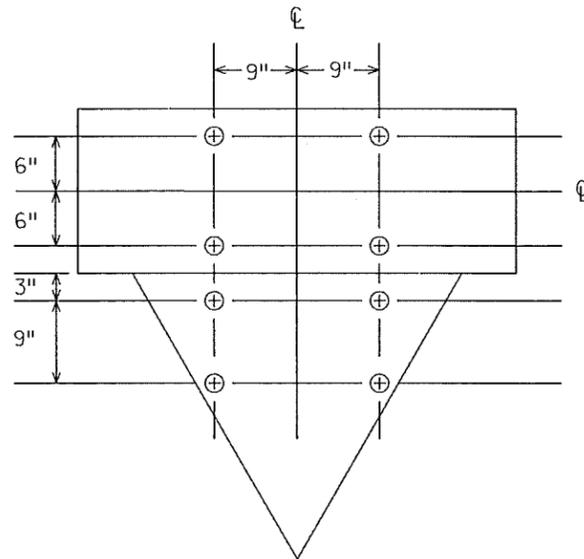
PUNCHING FOR R6-1(54" x 18")



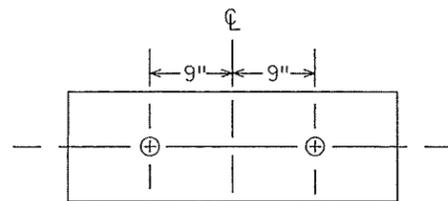
PUNCHING FOR R6-3 OR R6-3a(30" x 24")



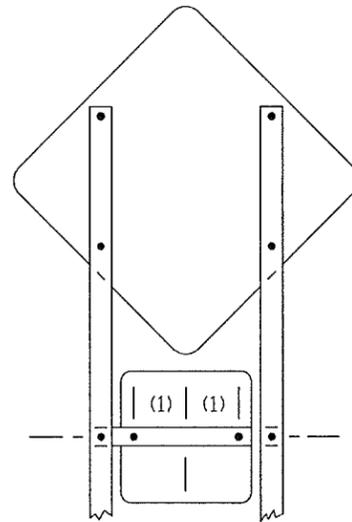
PUNCHING FOR R2-4b  
SPEED LIMIT



PUNCHING FOR R6-1(54" x 18")  
& R1-2(36" x 36" x 36")



PUNCHING FOR R6-1(36" x 12")



WARNING SIGN [30" x 30 OR 48" x 48"] AND  
WARNING PLAQUE [18" x 18" OR 30" x 30"]  
PUNCHING AND MOUNTING

- (1) 6" FOR WARNING PLAQUE (18" x 18")
- 12" FOR WARNING PLAQUE (30" x 30")

TYPE C & D SIGN  
STRUCTURAL DETAILS