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ATTACHMENT A – VENDOR INFORMATION
ATTACHMENT B – REFERENCES

ATTACHMENT C – WisDOT MBE PROGRAM, AWARENESS, COMPLIANCE & ACTION PLAN
ATTACHMENT D – MINORITY BUSINESS DISABLED VETERAN-OWNED BUSINESS
PARTICIPATION REPORT
ATTACHMENT E – BIDDER RESPONSE SHEET
ATTACHMENT F – CONSTRUCTION PLANS
ATTACHMENT G – SPECIFICATIONS
ATTACHMENT H – PRICE SHEET
ATTACHMENT I – BONDING FORM

1 GENERAL INFORMATION AND SCOPE

The Wisconsin Department of Transportation (WisDOT or DOT), through its Purchasing Unit (Purchasing), requests bids to establish a contract for upgrades at the Kenosha SWEF 21 located on NB IH 94 in Kenosha County. Upgrades will be made to the Weigh-In-Motion (WIM) system, static scale, and permanent signing. Warranties on the static scale and WIM systems shall also be included as a part of this contract.

The resulting contract shall be governed by the attached Standard Terms and Conditions unless specifically modified in this Request for Bid document. Conditions of bid that include the word "must" or "shall," describe a mandatory requirement.

1.1 Scope

Work consists of upgrading new electronics in the SWEF building and CMS signs as outlined in SPV.105.001 Weigh-In-Motion System and the static scale deck/electronics as outlined in SPV.105.003 Static Scale System. Permanent signing relating to the SWEF in advance of the site will also be replaced.

1.2 Definitions

The following definitions are used throughout the RFB documents:

Agency: The Wisconsin Department of Transportation

Bidder/Vendor: A company or individual submitting a bid response to this RFB

Contractor: Bidder awarded the contract

Department: The Wisconsin Department of Transportation

DVB: Wisconsin –Disabled Veteran-Owned Business is a business certified by the Department of Commerce under s. 560.0335(3).

DOT or WisDOT: The Wisconsin Department of Transportation

MBE: Wisconsin-certified Minority Business Enterprise is a business certified by the Department of Commerce under s. 560.036(2)

P-Card: Procurement card (State credit card)

State: The State of Wisconsin

1.3 Contract Term

The contract effective date shall be the date of the notice of award letter and will continue for **30 calendar days**. All work, including site restoration and cleanup shall be completed prior to the end of the contract term. Failure to complete all work within the contract term may result in the assessment of liquidated damages in accordance with section 4.5.

2 BIDDER QUALIFICATIONS AND REQUIREMENTS

To be eligible for a contract award, you must be qualified and able to provide the following:

- 2.1 Bidder must supply references as required in section 3.2.2.3 Submittals of SPV.105.001 Weigh-In-Motion System. Use Attachment B to list references.
- 2.2 Bidder must be prepared to provide WisDOT Purchasing a Certificate of Insurance prior to award and maintain the minimum limits specified prior to issuance of a Purchase Order. All policies must be issued with a 30-day cancellation notice, by an insurance company licensed

to do business in the State of Wisconsin, with a minimum AM Best rating of A1, and signed by an authorized agent.

- 2.3 Bidder must disclose if any State of Wisconsin employee would provide services relating to the agreement resulting from this solicitation. See Supplemental Standard Terms and Conditions, section 4.0, Dual Employment or 5.0, Employment.
- 2.4 Insurance Responsibility: The contractor performing services for the State of Wisconsin shall:
 - 2.4.1 Maintain worker's compensation insurance as required by Wisconsin Statutes, for all employees engaged in the work.
 - 2.4.2 Maintain commercial liability, bodily injury and property damage insurance against any claim(s) which might occur in carrying out this contract. Minimum limits shall be one million dollars (\$1,000,000) per occurrence and two million dollars (\$2,000,000) aggregate for bodily injury and property damage including products liability and completed operations. Provide motor vehicle insurance for all owned, non-owned and hired vehicles that are used in carrying out this contract. Minimum limits shall be one million dollars (\$1,000,000) per occurrence combined single limit and two million dollars (\$2,000,000) aggregate for automobile liability and property damage.
 - 2.4.3 The state reserves the right to require higher or lower limits where warranted in the state's discretion.
 - 2.4.4 Name the State of Wisconsin as an additional insured as to the work being performed and provide certificate of insurance prior to start of work.
- 2.5 Bonding: Prior to award of the contract, the contractor shall provide a performance and payment bond in a format provided by the Department. The value of each bond shall be the value of the contract minus the unit prices for the warranty items (SPV.0105.802 and SPV.0105.804). Bonds shall remain in place until 1 year after completion of COT. Use Attachment I to provide proof of bonding.

3 SPECIFICATIONS

Wisconsin DOT Standard Specifications are the minimum acceptable requirements for this contract. All specifications are defined as mandatory minimum requirements unless otherwise stated. Purchasing reserves the right to delete any specification or condition of bid if no bidder is able to comply with a given specification or condition of bid. Failure to meet specification requirements shall disqualify your bid.

3.1 WisDOT Standard Specifications

Bid sheet items listed on the miscellaneous quantities schedule include references to bid items that are covered by Standard Specification and Standardized Special Provision sections. Furnish materials and construct as the plans show and the engineer directs conforming to the requirements of the following sections shown in Attachment G:

Section 635	Structural Steel Sign Supports
Section 636	Concrete Sign Supports
Section 637	Signing
Section 643	Traffic Control
STP-616-030	Fence Safety, Item 616.0700.S

Additionally, the contractor shall furnish materials and construct as the plans/specs show work necessary to complete the contract work of items SPV.105.001 and SPV.105.003. All work completed as a part of these items shall conform to the requirements of the following sections of the Standard Specifications shown in Attachment G:

Section 619	Mobilization
Section 652	Electrical Conduit
Section 653	Pull Boxes and Junction Boxes
Section 654	Bases
Section 655	Electrical Wiring
Section 656	Electrical Service
Section 657	Poles, Arms, Standards, and Bases
Section 670	General Requirements for Intelligent Transportation Systems
Section 671	Intelligent Transportation Systems – Conduit
Section 674	Intelligent Transportation Systems – Cable

3.2 Weigh-In-Motion System, SPV.0105.001

3.2.1 Description

This special provision describes the work to install new OPEN/CLOSED signs as a part of the existing Weigh-In-Motion (WIM) system at the Kenosha Safety and Weight Enforcement Facility (SWEF). The electronics in the existing scale house will also be replaced. The entire system includes OPEN/CLOSED signs, existing ramp WIM, existing static scale signage, and incorporates upgraded static scale electronics (load cells) that will perform auto-calibration of the ramp WIM.

The sorting decisions shall be based on compliance of speed, side to side balance, axle-to-axle balance within tandem, axle spacing, axle weights, axle group weights, bridge formula (front and rear), and gross vehicle weights with the pre-set tolerances.

3.2.2 Materials

3.2.2.1 Introduction

3.2.2.2 Removals/Existing Utilities

3.2.2.3 Submittals

3.2.2.4 WIM System Operational Overview

3.2.2.4.1 Ramp WIM System

3.2.2.4.2 Ramp Lane Control System

3.2.2.5 WIM System Functional Requirements

3.2.2.5.1 Ramp

3.2.2.5.1.1 Ramp

3.2.2.5.1.2 Automatic USDOT Reading System

3.2.2.5.1.3 Enforcement Camera Systems

3.2.2.5.1.3.1 Overview Camera System

3.2.2.5.1.4 Ramp WIM Settings

3.2.2.5.2 Scale House

3.2.2.5.2.1 Weigh Station System Operational Overview

3.2.2.5.2.2 Vehicle Display Windows

- 3.2.2.5.2.3 Virtual Graphics Display
- 3.2.2.5.2.4 Manual Override Console
- 3.2.2.5.3 Weigh Station Computer
- 3.2.2.5.4 Scale Manager
- 3.2.2.6 Conduit and Pull Boxes
- 3.2.2.7 Changeable Message Signs (CMS)
- 3.2.2.8 System Acceptance
 - 3.2.2.8.1 System Review
 - 3.2.2.8.2 Acceptance Tests
 - 3.2.2.8.2.1 Factory Acceptance Tests
 - 3.2.2.8.2.2 Site Acceptance Test
 - 3.2.2.8.2.3 Continuous Operating Test (COT)
- 3.2.2.9 Training
- 3.2.2.10 Warranty
- 3.2.2.11 Materials
- 3.2.2.12 Standard Products
- 3.2.2.13 Lightning Protection

3.2.2.1 Introduction

The WIM System shall include various components that interact together. The components shall include the following:

- WIM sensors
- Axle and loop detection
- Overview image camera
- License Plate Reading (LPR) System with optical character recognition
- Automatic USDOT Reading (AUR) System with optical character recognition
- IIS Smart Roadside Interface
- OPEN/CLOSED Sign inserts
- Weigh Station Computer system
 - o Station PC
 - o Virtual Graphics Display
 - o Scale Manager
 - o Vehicle Display
 - o Override Console
 - o Data Collection System
- Existing Static Scale Signage
- Existing Overheight Detector
- On-site Communication System
- Cellular Modem for remote communication

The IIS Smart Roadside screening system shall be added to this site by others. The WIM Vendor shall coordinate with and successfully interface two-way communication with the IIS Smart Roadside system.

The scope of work is to complete the following work strictly per these provisions and associated plans.

3.2.2.2 Removals/Existing Utilities

The following shall be removed:

1. Existing OPEN/CLOSED CMS sign at station 9+89
2. Existing OPEN/CLOSED CMS sign at station 25+09

The location of the existing wiring/conduit connecting the scale house to the existing CMS signs is assumed to run along the right shoulder of the Kenosha SWEF ramp and WB IH 94 based on existing plan information. The exact location(s) is(are) to be verified in the field during construction.

Supply and install the following:

1. Overview image cameras, License Plate Reading (LPR) system, and Automated USDOT Reading system including support structure
2. New LED OPEN/CLOSED signs as specified in section 3.2.2.7 along with the electronics to control the signs
3. New electronics for the SWEF building utility room
4. New electronics for the SWEF building operations area including printer
5. WIM system software
6. All conduit and wiring as required. Conduit shall be sized to accommodate additional future wiring
7. Cellular modem for remote access of system

3.2.2.3 Submittals

Prior to manufacturer approval and the contract being executed, the Contractor shall provide the following:

1. List a minimum of five Weigh Stations and provide the owner's name, address, persons to contact and telephone numbers of similar enforcement installations in the United States.
2. The Contractor shall furnish electronically collected accuracy performance data from a pre-existing system to the engineer. This data shall be in a common database and include WIM records (axle and gross) and static (platforms and gross) weights that have been electronically collected (manually entered data will not be accepted). This report shall contain at least 20,000 vehicle records.
3. The Contractor shall furnish 3rd party verification of the new static scale system components passing an 80,000 amperes lightning strike test.

At the pre-construction conference, the Contractor shall furnish:

1. The engineer with written documentation and information of the new static scale components
 - a. Manufacturer's name

- b. Model number, supported by descriptive material for, but not limited to, the standard package system
 - c. All accessories identified
2. Submittals shall be supported by descriptive material such as
 - a. Catalogs
 - b. Cuts
 - c. Diagrams
 - d. Other data published by the manufacturer, to demonstrate to the engineer the Contractor's intent to comply with the Technical Special Provisions and plan requirements
3. If the Contractor wishes to replace equipment in addition to what is outlined in this special provision, proper submittals will need to be included on all additional equipment.

The System manufacturer shall submit the following:

1. Equipment drawings
2. General arrangements
3. Foundation requirements including camera reader pole and CMS structure. All new foundations to be stamped by a PE licensed in Wisconsin.
4. Circuit diagrams
5. Field wiring diagrams
6. Instruction manuals
7. Bill of Materials
8. Manufacturer's product data
9. Certified test reports
10. Material certifications

The Contractor shall submit six complete sets of full size drawings. The Contractor shall:

1. Design all overhead structures and foundation supports including camera reader pole and CMS structure. All foundations to be stamped by a PE licensed in Wisconsin.
2. Submit shop drawings along with the supporting calculations to the engineer for review and approval.
3. Obtain a professional engineer licensed in the State of Wisconsin to document, sign, and seal all structural drawings.

Two weeks prior to the Continuous Operating Test (COT), the Contractor shall supply the following to the engineer for the maintenance of the System

1. Narrative description of system operation in detail
2. Narrative technical description of the following:
 - a. Major system component interaction
 - b. Subsystem component interaction
3. Drawings:
 - a. Major system component operation/interconnection
4. Schematics shall reveal diagrams related to troubleshooting/maintenance including:

- a. Jumper and switch settings on all PCB's for normal operation
 - b. As-built drawings shall show type and location of all conduits, pull boxes, junction boxes, loops, traffic signs, and directional signals
5. Technical documentation on all accessories used in the system (OPEN/CLOSED signs, CMS, etc.)
6. Contractor shall provide names and phone numbers of contacts that user may contact for technical help

Acceptance of bid or approval of shop drawings by the engineer does not relieve the Contractor of the responsibility or the necessity of furnishing material and/or performing work as required by the plans and these provisions, nor from the requirements of the Continuous Operating Test (COT) as contained within these provisions.

The equipment approved by the engineer shall be provided and installed according to the plans and these provisions. If the equipment proposed by the Contractor becomes unavailable, the engineer may approve in writing alternate equipment proposed by the Contractor due to the unavailability of the originally specified equipment.

3.2.2.4 WIM Systems Operational Overview

3.2.2.4.1 Ramp WIM System

Commercial vehicles approaching the Weigh Station shall be directed into the right-hand lane by means of a CMS sign along with signing provided by the project. A vehicle approaching the Weigh Station shall enter the site and pass over the existing Ramp Weigh-In-Motion (WIM) system, which is embedded in the exit ramp.

The WIM shall collect axle weight and spacing, vehicle speed, classification and other relevant data to create a vehicle record. An overview camera shall capture an image of the passing vehicle which shall be combined with the vehicle record. Based on a comparison of the vehicle record to the parameters set by the Weigh Station system, the WIM system shall make a sort decision and advise the driver to either proceed to or bypass the static scale via the existing Ramp Lane Control System located over the ramp. However, the actual sorting operation can be overridden by the operator using the virtual graphics display or override control in the Weigh Station. Non-violating vehicles may be randomly selected from the ramp for visual inspection at the scale house.

The automated OPEN/CLOSED signs shall also be able to be controlled by a physical switch on the Override Console.

The system shall be able to collect continuous WIM data for statistical analysis. The data collection system shall save vehicle information in a compressed format complete with a date and time stamp. As a result, the information can be downloaded, and with the aid of commercially available software, the user shall be able to generate reports based on user inputs. The stored data must be remotely accessible by cellular modem communications.

All vehicle information, including violation information, shall be determined in real time and shall be displayed on the scale house operator console in vehicle display windows.

3.2.2.4.2 Ramp Lane Control System

The existing Ramp Lane Control System shall be used to communicate with the driver after the vehicle analysis has been completed. The Ramp Lane Control System shall be controlled by electronics in an interface cabinet, which receives the sort decision from the Weigh Station Computer.

The Virtual Graphics Display shall provide manual control to the Weigh Station for the operation of the Lane Control Sign.

The components of the system shall provide heartbeat communications so the System health can be monitored.

3.2.2.5 WIM Systems Functional Requirements

3.2.2.5.1 Ramp

Once entering the site, an Overview camera, USDOT and License Plate image of the passing vehicle shall be combined to create the vehicle record. Using optical character recognition, the USDOT and license plate read shall be included in the vehicle record. The license plate jurisdiction shall be a part of the license plate read. The combination of USDOT, license plate number, and license plate jurisdiction shall be checked against the IIS Smart Roadside system for non-weight violations.

3.2.2.5.1.1 Automatic USDOT Reading System

The AUR system shall be capable of collecting, storing, and transmitting all commercial vehicle license plate images and OCR data to the Weigh Station Computer for configurable periods. The OCR read accuracy shall meet 77% of readable numbers.

3.2.2.5.1.2 LPR System

The LPR system shall capture an image of the commercial vehicles license plate to be linked with the vehicle record. The camera shall be capable of black-and-white near-infrared images during daytime and nighttime operation. The camera system electronics, which shall be located with the other system electronics, shall store the image and shall link it with the correct vehicle record. The LPR system shall be capable of collecting, storing, and transmitting all commercial vehicle license plate images and OCR data to the Weigh Station Computer for configurable periods. The OCR read accuracy on license plates shall meet 77% of readable plates including jurisdiction at night.

3.2.2.5.1.3 Enforcement Camera Systems

The enforcement camera system shall consist of an overview image camera mounted alongside the roadway on the SWEF ramp. The overview camera system shall capture an image of passing commercial vehicles to be linked with the vehicle record as an identifier. The camera shall be capable of full color photos during daytime operation, and black-and-white near-infrared images during nighttime operation. The camera system electronics, which shall be located with the other system electronics, shall store the image and shall link it with the correct vehicle record.

3.2.2.5.1.3.1 Overview Camera System

The Overview Camera System shall consist of the following system components:

1. Color and Black/White video cameras
2. Illuminator system
3. Video capture system

The video system shall monitor traffic flow on the ramp. It shall capture still images of trucks for identification and enforcement purposes. The images shall be displayed on an operator interface located in the scale house. Each vehicle record number shall be displayed with the vehicle image.

A camera shall be provided and installed on a pole located near the entrance to the ramp. The camera shall provide overview images of the passing commercial vehicles, detailing their cab and side. Color images shall be provided for daylight use, and black/white images shall be provided for night use.

The overview capture system shall be located in one of the System Electronics. The overview capture system shall provide control and display facility to display image outputs from one source to one monitor.

3.2.2.5.1.4 Ramp WIM Settings

Using the Weigh Station Computer, the operator may set the random sort percentage. Random sorting allows the operator to require a set percentage of compliant trucks to report to the static scale. This allows the enforcement officials to perform random safety checks on otherwise compliant trucks.

The Weigh Station Computer system shall receive the WIM record from the roadside WIM electronics at the ramp location. The Weigh Station Computer contains electronic records that shall be used to ascertain weight compliance. After the Weigh Station Computer creates the WIM record, it shall immediately begin to analyze the data contained in the record in order to determine whether the vehicle weights and dimensions are within local compliance regulations. If the measured vehicle weight is within the allowable limits, the driver shall be directed to the bypass lane by the existing lane control signal. If the vehicle is not compliant or if it is randomly selected for inspection, the driver shall receive a message to report to the static scale lane.

The Weigh Station Computer system shall provide safety features to detect and prevent backups and unsafe conditions. These shall include:

1. An audible message to alert operators of a backup of the Weigh Station ramp
2. Automatically close the Weigh Station if a backup occurs on the exit ramp from IH 94. An audible message shall sound to alert operators. Once the backup has cleared the station shall automatically reopen in that direction.

Operators shall have the capability to override the automatic close on the Override console.

3.2.2.5.2 Scale House

3.2.2.5.2.1 Weigh Station System Operational Overview

The Weigh Station system shall be all new and located in the scale house. It shall process data from the ramp WIM electronics and static scale, for central monitoring and control of the

facility operation. The system shall provide two operator displays at the scale house. The operator can monitor vehicle movements, view and print reports and adjust system parameters, alter message signs, etc.

The Weigh Station System shall be made up of the following components:

- Vehicle Display Window (displays will vary by manufacturer)
- A Virtual Graphics Display
- An Override Console
- A Weigh Station Computer
- Static Scale Manager

3.2.2.5.2.2 Vehicle Display Windows

The Vehicle Display Window shall display:

- sequence number
- time and date
- class
- speed
- gross vehicle weight
- lane-time and date
- direction of travel
- OCR read of the vehicles license plate and jurisdiction
- OCR read of the vehicles USDOT number
- violations highlighted in red
- right and left wheel weights per axle with violations highlighted in red
- individual axle weights with violations highlighted in red
- individual, front bridge, rear bridge, and full vehicle spacing
- tandem weights as measured by the WIM electronics with violations highlighted in red
- front and rear bridge weights as measured by the WIM electronics with violations highlighted in red
- thumbnail image of the vehicle from the overview camera.
- thumbnail image of the USDOT number
- thumbnail image of the vehicle license plate

A vehicle record shall be displayable in either graphic form or in text form. Another alternate shall be a tabular view of all records in the queue.

The length from axle to axle shall be shown on a linear scale with axle spacings plotted below the scale line. Red text for an axle shall indicate the location of an overweight axle or axle group.

The display of vehicle record must show the following violation information in addition to dimension and weight violations:

1. Vehicle speeding
2. Credential

The vehicle display windows shall allow the following options at any time without going to alternate screens or menus:

1. Freeze vehicle record
2. Print vehicle record
3. Double click on the overview thumbnail image to see a larger view

Each vehicle record shall contain a digital image of all vehicles and shall be similar to the following acceptable examples:

747 15:21:51 Class:9 Speed:36 Gross:81400 Plate:2VG154 ST:OK USDOT:1202
AxleOverWt BridgeOverWt TndmOverWt GrossOverWt Credential

```

1.....2...3.....4...5
|-----17.5-----|4.3|-----35.1-----|4.0|
|-----21.8-----|
|-----43.4-----|
|-----60.9-----|

```

Axle	1	2	3	4	5
RGHT	5700	8200	8400	7600	10100
LEFT	6100	7800	8300	9000	10200
TOTL	11800	16000	16700	16600	20300
Tndm:		32700		36900	

InBr: 1-3 44500 2-5 69600

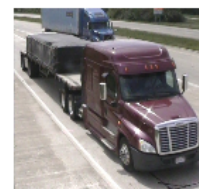
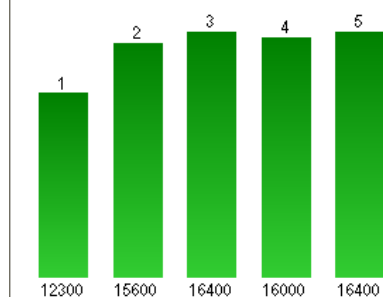


740 15:16:56 Class:9 Speed:38 Gross:76700 Plate:A014978 ST:MS USDOT:237655
Credential

```

1.....2...3.....4.....5
|-----19.0-----|4.3|-----29.8-----|10.0---|
|-----23.3-----|
|-----34.1-----|
|-----63.1-----|

```





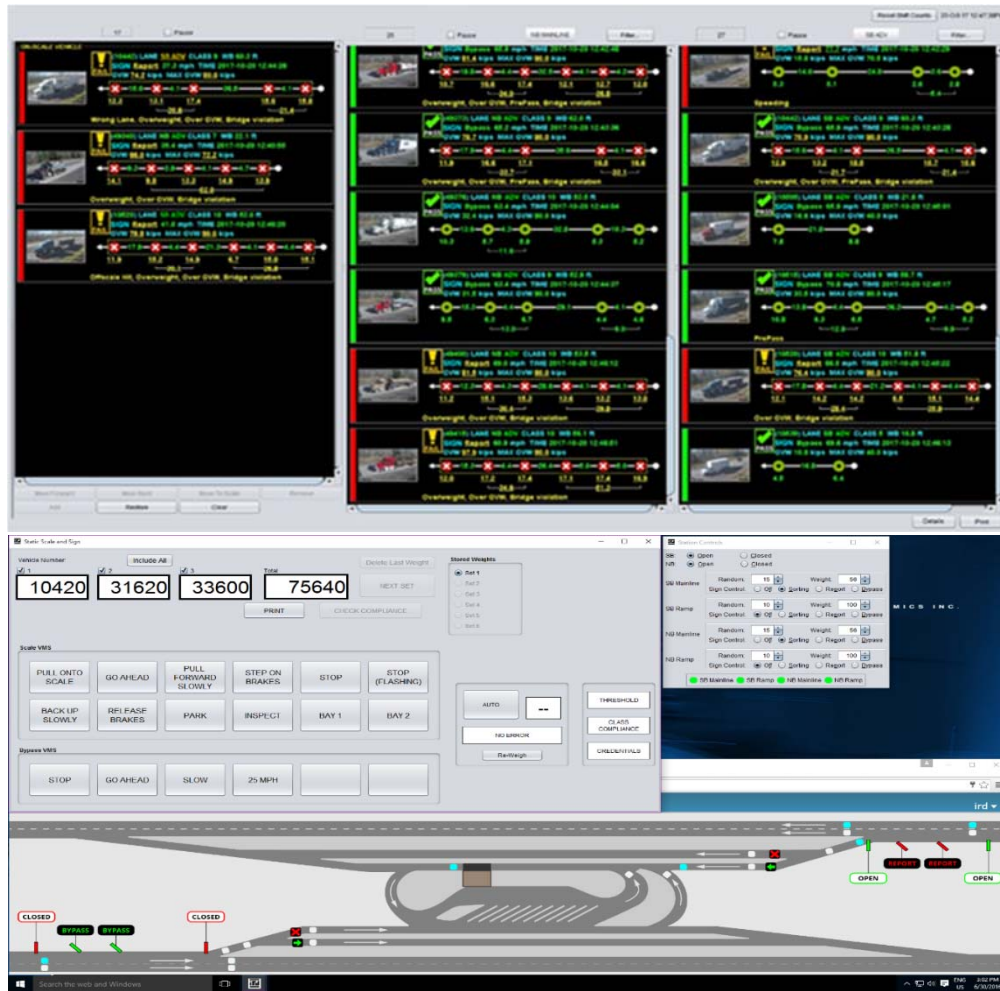
3.2.2.5.2.3 Virtual Graphics Display

The Virtual Graphics Display shall provide software representing the overhead layout of the Weigh Station on the Weigh Station Computer to provide control and monitoring of the Weigh Station. The graphics display must be software based. The Station Console shall provide the ability for an operator in the Weigh Station to select the control operation of the lane control system on the ramp manually. The graphics display shall have visual indicators to identify the mode of control of system signs and signals. In addition, vehicle movement information shall be displayed using indicators on the graphical panel. It shall provide the following functions:

1. Select automatic sort control of each system or the manual control by the operator
2. In manual control of the Ramp Lane Control System by an operator, it can be set for all vehicles to proceed to the static scale or bypass lane
3. Real-Time monitoring of the Weigh Station operation by showing indicators when the appropriate sensors are activated and deactivated including loops
4. Graphics representing the color and status of the directional signals, graphics shall continuously display the status of the overhead signals, OPEN/CLOSED signs, and static scale message sign
5. The Weigh Station system must provide an audible warning for the following conditions:
 - a. WIM scale backup
 - b. Weigh Station violator
 - c. Weigh Station automatically closing because ramp is backed up
 - d. Weigh Station is automatically reopening because ramp has cleared
 - e. Vehicle waiting on the static scale

6. Include a 22-inch (minimum) widescreen flat panel monitor with speakers and shall interface with the Weigh Station Computer. This monitor shall be one of the two monitors located at the Weigh Station Computer
7. Provide a graphical representation of the Weigh Station layout with symbols to indicate the function of vehicle tracking devices
8. Allow for a true manual control of all signs
9. Shall be similar to the acceptable images below with the layout matching site conditions

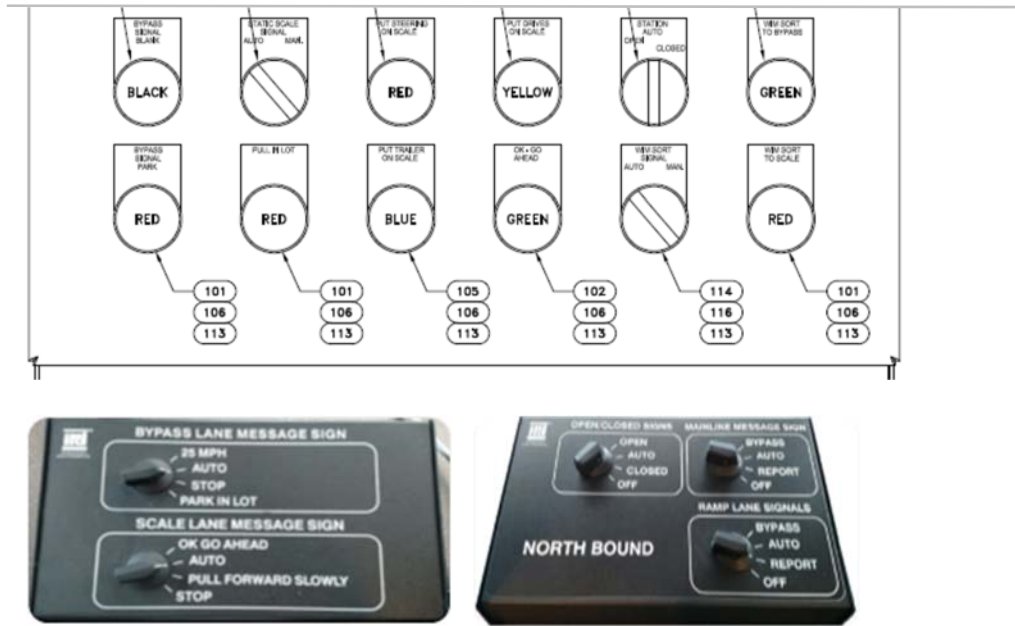




3.2.2.5.2.4 Manual Override Console

A Manual Override Console shall be provided as an interface that allows the operator to override the ramp WIM in order to gain control of various system components. The console shall include control of the OPEN/CLOSED signs. The console shall also include the ability to control the static scale message sign and turn the scoreboards on/off.

The override console shall provide the ability for the operator to manually override all signals and signs. It shall be a minimum of 24" long and 10" wide with large push buttons and switches to allow officers to quickly locate and change signal controls when override is required. The Override Console must be operationally independent of the weigh-in-motion interface electronics, the Virtual Graphics Panel, and the Weigh Station Computer to control all signs and signals. The override console shall remain operational even if the Weigh Station Computer is not functioning.



3.2.2.5.3 Weigh Station Computer

The Weigh Station Computer shall be:

1. An Intel microprocessor-based computer with the Microsoft Windows 8.1 or 10 operating system.
2. Have the following minimum features and configuration:
 - a. Most current PC standards for memory, hard drive, and other hardware
 - b. Two 22-inch (minimum) widescreen flat screen color monitors with non-glare screen
 - c. Keyboard
 - d. Mouse
 - e. System utilities and diagnostic software
 - f. Surge protection
 - g. System password protected lock for user access restriction
 - h. All access ports, cables and accessories to provide a working computer

The Weigh Station Computer shall provide the following functions:

1. Perform mainline and ramp sort operation
2. Weigh all vehicles travelling in the right lane
3. Classify and weigh all vehicles travelling on all instrumented lanes of the highway with WIM sensors
4. Perform weight compliance analysis on vehicles in accordance with Department regulations
5. Monitor safety conditions of the facility these include:
 - a. A WIM scale back up
 - b. Ramp back up
 - c. Static scale lane back up

6. Perform sorter operation in accordance with decisions based on weight compliance analysis, other violations (speeding, improper maneuver, sudden speed change, etc.), Virtual Graphics panel Override console selection, safety conditions, and operator selected action
7. Insert sequence numbers for vehicle records for tracking purposes
8. Display of vehicle record in multiple queue windows
9. Track vehicle movement in the execution of sorter operation
10. Control message display of the lane control system to synchronize with the movement of a vehicle being tracked
11. Provide vehicle records for those that have been sorted to or come to the static scale
12. Provide real time display and control of the static scale
13. Allow operators to automatically sequence vehicles across the static scale or manually weigh by accumulating axles
14. Automatically determine and provide operators feedback based on whether a vehicle is actually overweight based on axle spacing, axle, axle group, gross, and front/rear bridge weights based on Wisconsin regulations
15. Automatically or manually release vehicles that are not overweight based on Wisconsin regulations and do not have other violations
16. Allow operators to print weight tickets
17. Provide audible message alarms to alert operators of conditions that may require their attention
18. Provide reports on system operation
19. Perform data collection, data storage, file management and report generation functions for collected vehicle information
20. Allow adjustment of WIM and system settings

The Weigh Station system shall have application programs to detect prolonged power failure conditions to initiate orderly shutdown operation.

3.2.2.5.4 Scale Manager

The Scale Manager shall be software located on the Weigh Station Computer and facilitate processing vehicles that are sorted or volunteer to come to the static scale. As officers primarily focus on vehicles that are potential violators this shall be the main screen that they work with. The screen shall also give the operator the ability to control system settings and view and run reports. It shall provide the following functions:

1. Interface with the static scale indicator and WIM systems
2. Display and accumulate static scale weights and display WIM data for the vehicle that is positioned on the static scale
3. Provide adjustable thresholds to each steer axle, axle, tandem, front bridge, rear bridge and gross weight based on Wisconsin regulations for axle spacing and weight
4. Automatically check weights to thresholds and release vehicle if in auto mode or alert operator of violation with audio and visual alerts
5. Automatically or manually allow operators to control the static scale sign with buttons matching the sign messages
6. Provide the following features within the display

- a. Selectable auto release
 - b. Display shift counts
 - c. Violations displayed in red
 - d. Zero scale
 - e. Reset Scale
7. Print requirements include
- a. Site identification
 - b. Time and date
 - c. License plate
 - d. USDOT number
 - e. Individual weights (axles and axle groups)
 - f. Gross weight
 - g. WIM axle spacing
 - h. Thumbnail image of vehicle
8. Shall continuously show updated static scale counts for each shift for the day
9. Utilities
- a. View individual live raw counts for static scale load cells
 - b. Allow remote diagnostics access

If a vehicle is not positioned properly or is a weight violator the operator shall be notified by visual and audio alarms and the vehicle shall not be auto-released when in auto-sequencing mode.

To eliminate costly calibrations, the Weigh Station System shall electronically interface with the ramp WIM system for auto-calibration. On a continuous basis the Weigh Station System shall ensure WIM accuracy and calibration of the sensors in the ramp WIM.

Calibration of the ramp WIM shall be automatic and performed by electronic recording of WIM and static weights on 50 vehicles from the vehicle stream which are loaded to within 75% of the legal allowable limit. Auto-calibration shall be done with different factors for speed range and vehicle class to provide more accurate results. The settings shall allow for a minimum of 10 different speed ranges and 13 different classes to be used.

Acceptance testing shall confirm the WIM accuracy performance which shall be verified in a report. This report shall be created by continuous (24/7) electronic recording of vehicles from the vehicle stream. The actual stable static weights and WIM weights shall be saved in a common database to determine WIM scale accuracy compliance, as opposed to the method described in ASTM E 1318-09. This information is to be easily accessible to state personnel in reports and shall be printed on a weekly basis throughout the continuous operating test and in everyday use of the Weigh Station afterwards.

The accuracy requirements required under ASTM E1318 for a Type III WIM shall be met except those listed in the WIM sensors section above.

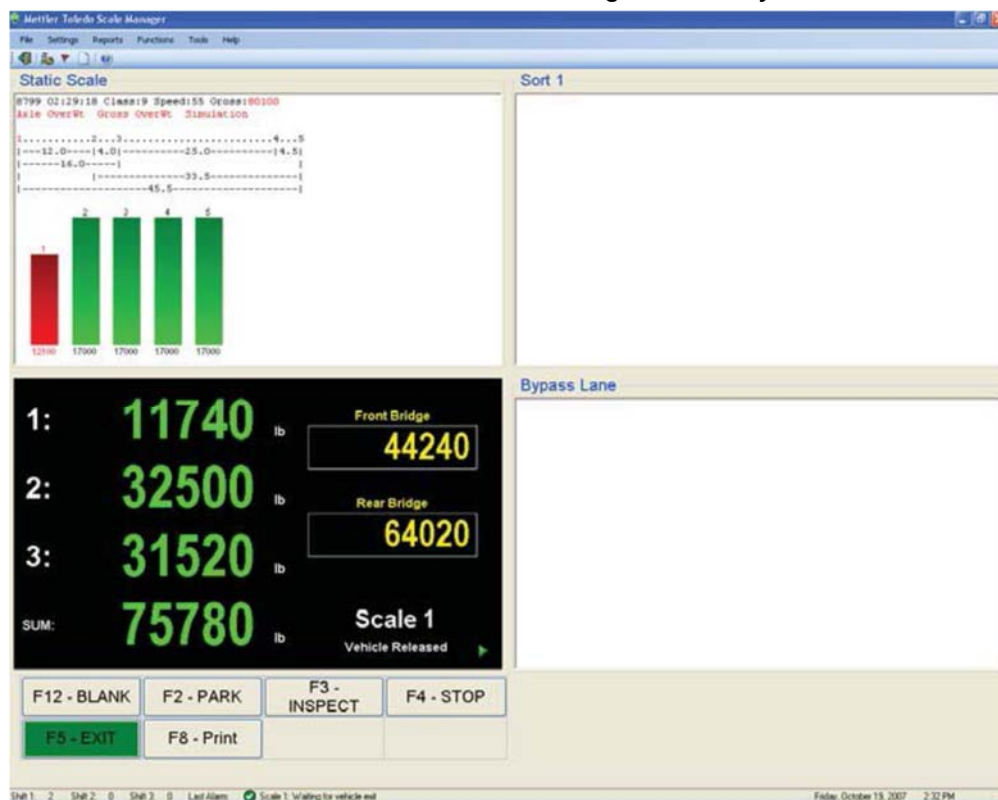
All reports shall be available from the Scale Manager in one central place to view reports. The following reports shall be available:

1. Number of vehicles across the WIM by class, hour, and shift for a selected period
2. Number of vehicles across the WIM by hour, and shift for a selected period
3. Axle and GVW weights by class for a selected period
4. Number of vehicles by weights, by class and by hour for a selected period
5. Number of vehicles across the static scale by class, hour, and shift for a selected period
6. WIM accuracy performance by class for a selected period

A selected period for report generation shall include starting date and ending date. Reports shall be generated manually by operator action. Reports shall have an option to display a chart view, and to be exported into Microsoft Office compatible formats.

The Scale Manager shall have utility programs to do the following:

1. Set up and configure the operation of the ramp WIM system
2. Set up and configure the operation of the ramp sort system
3. Initiate and reset traffic counting operation of the WIM System
4. Perform maintenance functions of the Weigh Station systems



3.2.2.6 Conduit and Pull Boxes

All cables shall be in conduit unless specifically approved by the engineer. All conduit and pull boxes shall meet the requirements of standard spec 652 and 653.

All materials shall comply with the "National Electrical Code" and the current standard specifications, and special requirements by the Department weigh-in-motion and automatic vehicle identification system specifications. Duct seal shall be used to seal all conduits in the cabinets and in all junction boxes. All conduits shall have a polyethylene pull string with at least 210-pound break strength left in place at completion of construction.

Separate conduits shall be used for AC/DC power and low voltage signal cables. Low voltage signal cables shall include video, digital communication, sensor signal cable, and sensor excitation cables where voltage is under +/- 20 volts DC. Conduits for video and RF cables shall be of a large enough size to accommodate the maximum bend radius using factory 90-degree "bends". Conduits shall be sized to accommodate additional future wiring.

All cables shall be in conduits unless specifically approved by the engineer.

3.2.2.7 Changeable Message Signs (CMS)

Furnish and install two OPEN/CLOSED changeable message signs. Each unit to be 2-message, 1-way, LED blank out signs with white illumination.

1. Messages shall be formed by rows of white LED pixels
2. All letters shall be 18-inch series E formed by single rows of LED pixels
3. Dimming option with photocell shall be provided
4. 120 VAC shall be required for activation of messages
5. 2 1/2-inch aluminium angle shall be provided top and bottom for mounting
6. Exterior of sign housings shall be wet painted, semi-gloss black enamel
7. Utilized existing wiring to the maximum extent practicable and install new wiring as required to the new OPEN/CLOSED sign mounted on the existing sign structure S-30-25 and at STA 9+89

8. Communication with the OPEN/CLOSED signs shall have feedback communication to the scale house as to whether the signs are functioning properly.

3.2.2.8 System Acceptance

The complete WIM System shall be accepted subject to fulfilling the following conditions:

1. System review
2. Acceptance tests (meeting WIM, LPR and AUR accuracy on a weekly basis).
3. Training

3.2.2.8.1 System Review

The potential WIM Vendor shall submit six copies of a system layout and cut sheets for each individual site prior to award of their subcontract. These layouts shall be submitted to the engineer for review. Approval shall be either from the engineer or designated representative. If the potential WIM Vendor does not fully meet the specifications the engineer may instruct the prime Contractor to select another vendor.

A preliminary on-site meeting shall be held after all of the old electronics have been removed to verify no equipment is being reused and to discuss Contractors' plans for the routing of conduits, cables, and placement of equipment.

3.2.2.8.2 Acceptance Tests

The complete WIM System, all-inclusive as contracted, shall be designed, built and tested by the Vendor, and as proof of operation, the systems, overall and singularly, shall be tested at various times according to the test specifications. All field tests shall be performed by the WIM Vendor and observed by the engineer with all reports submitted to the engineer.

3.2.2.8.2.1 Factory Acceptance Tests

Prior to shipment of any equipment, Factory Acceptance Tests shall be performed for each system to verify the equipment operating as described in the contract documents and in accordance with the test specifications approved by the engineer. The Factory Acceptance Tests shall include at minimum the following:

1. A physical inspection to verify that the quality of material and workmanship satisfy specified requirements and standards and that the equipment and software under test are complete and ready for delivery.
2. A functional test to verify that the equipment and software operate as described in the contract documents.
3. A performance test to verify that the equipment satisfies performance and operation criteria.

For the purpose of these tests the equipment and software shall be configured as nearly as possible to the final configuration. Any field inputs not available at the factory test site shall be simulated to provide a close approximation to actual site conditions.

3.2.2.8.2.2 Site Acceptance Test

After all the equipment and software have been installed at the site, the Vendor shall run tests to ensure that all equipment shall operate as specified therein contract documents. These

tests shall be witnessed or conducted by the engineer within one week of the manufacturer notifying the engineer that the system is ready for testing.

The camera systems shall be tested at the sites to verify that the images taken at daytime and night time are clear and integrated properly with the vehicle record from the systems. The Vendor shall collect data observed by the engineer and provide the results of the images taken for the duration of the testing during day and night time operation. Success shall be determined by images that are non-blurred, crisp, properly integrated, and correctly read with the vehicle data received by the systems.

3.2.2.8.2.3 Continuous Operating Test (COT)

Following successful completion of the Site Acceptance Test, a Continuous Operating Test shall be conducted for a period of 180 calendar days. Within 5 days of receiving notice from the engineer verifying the Site Acceptance Tests were successful and the COT may begin, the contractor must begin the COT. Once the COT is initiated, the WIM sorting system must pass the COT within 240 calendar days of the initiation date. In no case will the COT be extended beyond 240 days. To successfully pass the COT, the weigh station and its weigh sorter system shall:

1. operate for a period of 180 total calendar days under normal traffic conditions and without being deemed "off-line" as described below
2. perform a reasonable portion of the 180 total calendar days during adverse/cold weather months and
3. accrue less than four (4) strikes

The system will be deemed "off-line" when:

1. The system fails whereas the complete system does not operate fully with the static scale accuracy for a period of 60 consecutive minutes or more after the contractor has been notified and granted access to the system.
2. The system does not provide accurate sorting of vehicles for a period of 60 consecutive minutes or more after the contractor has been notified and granted access to the system.
3. The weekly WIM accuracy test fails to report WIM accuracy of 90% or greater within one calendar week*.

* Note: The Department will endeavor to maintain staffing at SWEF a minimum number of hours to ensure that 80 qualifying vehicles are compliance checked (static scale) per week. If 80 qualifying vehicles are not compliance checked in that week, then those results will roll over to the following week and the combined 2-week period will be evaluated for 90% accuracy per above.

System manufacturer shall perform the in-motion calibration tests of WIM subsystem after installation is completed and prior to beginning the burn-in period. Contractor shall provide the engineer one week's notice of the in-motion calibration tests.

- SYSTEM manufacturer shall provide calibration weights
- COT period begins two weeks after the completion of installation and certification of the static scale
- COT cannot begin until the static scale has been certified

- Contractor shall submit a detailed test plan to the engineer for approval no later than 90 days after notice to proceed
- For the COT period, the SYSTEM shall be fully operational under normal traffic conditions and operate trouble free (defined as any error that shall not reset by means of rebooting PC) for a period of 180 calendar days.
- Only one reboot per shift shall be allowed
- The engineer shall check the accuracy performance by printing an accuracy report from an electronic database which is created and stored on the Weigh Station Computer
- The report for WIM accuracy must be printed from the Weigh Station Computer by the engineer and met weekly during the COT period
- WIM accuracy on all vehicles loaded above 60,000 pounds and traveling between the speeds of 10 to 80 miles per hour shall be as follows:
 - a. Axle weights +/- 15% (95% of trucks)
 - b. Tandem weights + /-10% (95% of trucks)
 - c. Gross weights +/- 6% (95% of trucks)
 - d. Axle spacing +/- 6 inches or 5% (95% of axles), whichever is greater

This database shall be created by continuous electronic recording of vehicles from the vehicle stream, which are loaded to within 75% (60,000 lbs.) of the legal allowable limit.

The actual stable static weights and WIM weights shall be stored in this common database to determine WIM scale accuracy compliance, as opposed to the method described in ASTM E1318.

The images and OCR reads from the LPR and DOT reader shall be captured over a week and a report generated showing how each image was read and total read rate percentages for readable plates including jurisdiction and numbers. The images shall be provided for engineer verification. The read rates must exceed meet or exceed these specifications.

The contractor shall not be allowed onsite nor have remote access during the COT, unless accompanied by a preapproved Department representative and has preapproval from the engineer. Any system maintenance or evaluation of the WIM system during the COT must be requested in writing to the engineer a minimum of 3 calendar days prior to the requested access period. Access will only be allowed by the engineer at their discretion.

If problems of any kind are encountered during the COT, the SYSTEM manufacturer shall be informed, and problem(s) shall be simultaneously witnessed by the engineer and Contractor. If a problem is confirmed by all, a strike shall be assessed, and the problem shall be corrected.

The engineer will notify (by phone and email) the Contractor if the WIM system experiences an interruption in service and is off-line. The Contractor shall immediately acknowledge this formal notification. Upon notification, the Department and Contractor shall follow the procedures outlined as follows:

- Within 24 hours of notification by the engineer, the contractor shall be on-site to investigate and correct the situation.

- Within 48 hours (excluding Saturdays, Sundays and Holidays) of notification by the engineer, the contractor and the engineer shall meet to discuss the failure and probable causes of the failure.

An additional strike will be given for each consecutive 7-day period that the equipment is deemed "off line" due to WIM system failure.

If any strike falls within the final 28 days of the COT, the COT would be extended until one of the following has been met:

- The COT successfully runs for a period of 28 calendar days under normal conditions and achieve a level of service without interruption; or
- The COT fails and the system is rejected due to its failure and four strikes.
- The COT extends beyond 240 days and the system is rejected.

The COT shall demonstrate to the satisfaction of the engineer that the weigh-in-motion/static enforcement system has been constructed and consistently meets the performance requirements of the plans and of these Special Provisions.

The COT shall be the basis for acceptance or rejection of the systems as a result of demonstrated performance. If the system is rejected and there have been more than four strikes and re-starts of the COT, the Department may then exercise its rights as provided in Section 108 of the contract's Standard Specifications. The parties shall negotiate, in good faith, an acceptable resolution. Liquidated damages may be applied between strikes and restarts. Following such negotiations, if the same are unsuccessful, the engineer may execute the performance bond. Notwithstanding the foregoing, the Contractor shall retain/be entitled to receive all amounts paid or payable to the Contractor in accordance with the following payment schedule, agreed-to by the parties:

PAYMENT

- | | |
|--|-----|
| 1. Payment upon safe and secure delivery of all equipment | 20% |
| at a storage location approved by the engineer | |
| 2. Complete installation of the entire SYSTEM | 35% |
| 3. Completion of calibration and burn-in | 35% |
| 4. Completion of the COT to the satisfaction of the engineer | 10% |

The engineer will issue a Certificate of Final Acceptance upon successful completion of the Continuous Operating Test and training program.

The WIM acceptance procedure for the Weigh Station system shall be based off of officers printing the database comparison of mainline WIM and static scale weights and the WIM accuracy meeting project specifications.

3.2.2.9 Training

The Vendor shall set up and conduct formal training programs for the State Patrol personnel on the operation, maintenance and installation of the system components of the complete WIM System. The training shall include the following:

1. Two half-day operator training sessions providing an introduction to the operation and installation of the complete Weigh Station system including the static scale and the functions to be performed. A class size of up to eight individuals per session can be expected.
2. Two one-day "hands-on" guidance sessions for operators in the operation of the systems. A class size of up to four individuals per session can be expected. This training shall occur during the first two days of the Continuous Operating Test.

The training program shall be scheduled the week following the completion of the operations test.

The cost for the first training sessions shall be included in the contract price. The Department will, from time to time review any future training requirements. The WIM Vendor shall agree to provide future and additional training sessions upon receipt of requests from the Department. The Department will reimburse the WIM Vendor the cost of providing additional training sessions on a per diem basis and at a rate agreed upon by the Department at the time of the request. The Department will provide classroom space for the training session.

The vendor shall provide six hard copies and an electronic file of the WIM System Operator's Manual. The manual shall contain detailed information and instructions covering all aspects of the WIM system.

3.2.2.10 Warranties

The WIM vendor shall warrant all new subsystems and system components as supplied and installed for five (5) years from the date of issuance of the Certificate of Final Acceptance of the WIM System by the engineer. This warranty and associated maintenance work are defined and covered under a separate bid item, Weigh-In-Motion System Warranty Maintenance.

3.2.2.11 Materials

Materials for the project shall be new. Materials used in the construction of this equipment shall be of good commercial quality entirely suitable for the intended purpose. Materials shall be free from all defects and imperfections that might affect serviceability of the finished product.

3.2.2.12 Standard Products

The equipment shall be constructed of standard material, so that the prompt and continuing service and delivery of spare parts may be assured. The component parts need not be products of the same manufacturer.

3.2.2.13 Lightning Protection

Ground rod(s) and lightning protection shall be provided as per manufacturer's requirements. All system components and equipment shall be properly grounded.

3.2.3 (Vacant)

3.2.4 Measurement

The Department will measure Weigh-In-Motion System, completed in accordance to the contract and accepted, as a single complete unit of work.

3.2.5 Payment

The Department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.001	Weigh-In-Motion System	LS

Payment is full compensation for furnishing and installing all materials; and for furnishing all labor, supervision, equipment, calibrating and testing, training, tools and incidentals necessary to obtain a Certificate of Final Acceptance of the WIM system.

Weigh-In-Motion System Warranty Maintenance and Signs Type II and their corresponding supports will be paid under separate bid items.

3.3 Weigh-In-Motion System Warranty Maintenance, Item SPV.0105.002.

3.3.1 Description

Provide warranty and maintenance service for the weigh-in-motion scale system for a period of five (5) years. This system includes weigh-in-motion sensors, cameras, system components and ancillary equipment. Provide routine maintenance on all major systems, system components and ancillary equipment at 12-month intervals. Provide emergency repair services on an as-required basis.

3.3.1.1 Warranty Bond

The contractor shall provide a warranty bond for the Weigh-In-Motion System Warranty Maintenance. The bond will be in effect for the entire five-year warranty period beginning when the Weigh-In-Motion Scale System is completed, operational and accepted. The bonding company must have an AM Best rating of "A-" or better and the contractor will provide proof of a five year bond commitment before execution of the contract.

The warranty bond amount will be for \$75,000. The bond will ensure the proper and prompt completion of required warranty work following completion of the contract work, including payments for furnishing all labor, equipment, and materials used according to this specification.

The contract bond, which remains in effect for one year beyond the completion of the project, will also include warranty work as described in this article. For the remaining four-year warranty period, provide documentation that the warranty bond will be provided in a single term four-year warranty bond.

Failure of the contractor or its surety to issue the warranty bond will be considered a default and will result in forfeiture of the face amount of the bond to the Department.

All warranty work will be as prescribed in this article. At the end of the warranty period, the contractor will be relieved of the responsibility to perform further warranty work, provided all previous warranty work has been completed.

Maintain insurance, in the course of performing warranty work, as specified in standard spec 107.26 throughout the five-year warranty period.

3.3.2 (Vacant)

3.3.3 Construction

The WIM vendor shall warrant all subsystems and system components as supplied for five (5) years from the date of issuance of the certificate of final acceptance of WIM System by the engineer.

The warranty shall cover all WIM system components, hardware and software, included in the contract for any defects in material and workmanship. This shall include:

1. All loops and WIM sensors on site
2. Interface operations and system electronics
3. WIM cables, connectors, terminal strips and back-up batteries
4. New notification signs and structures
5. Communication systems
6. All enforcement cameras and equipment
7. New components of the Compliance System
8. Electrical power wiring and conduit
9. Weigh Station computer system
 - a. Scale Manager
 - b. Vehicle Display
 - c. Station PC
 - d. Override Console

The warranty agreement shall include all:

1. Emergency repair service
2. Routine maintenance service at 12-month intervals
3. Mobilization, parts, labor and shipping
4. Equipment updates, upgrades, modifications and recalls
5. System interface and electronics updates, upgrades, modifications and recalls
6. Traffic control
7. Training for major system updates or upgrades
8. Operator refresher courses

The weigh-in-motion system shall be warranted by the WIM vendor, in writing, against defects in or from material, workmanship, lightning, and to perform as required by these technical special provisions, giving proper and continuous service under all conditions required and specified, or which may reasonably be inferred, for a period of five (5) years from the date of acceptance. The written vendor's warranty shall be furnished to the engineer by the vendor at the time the equipment performance supporting data is submitted. The new components of the complete system shall be warranted by the manufacturer, in writing, against defects in or from material, workmanship, lightning, rodents and perform as required by these technical special provisions for the specified period or as described above from the date of final acceptance of the project.

The operation and maintenance of all IIS Smart Roadside equipment, as well as all IIS Smart Roadside-related subsystems, shall be warranted by IIS Smart Roadside. This equipment will not be included within the scope of the warranty as seen in this specification.

3.3.3.1 Scheduled Maintenance Services

The scheduled maintenance service shall include the following:

1. Signal checks and testing measures on all loops

2. Verify proper operation of loops from Virtual Graphics interface in building
3. Visually inspect WIM sensors from shoulder for cracks and unusual damage
4. Visually inspect roadway around WIM sensors for deterioration or issues that could impact the sensors
5. Check and record WIM sensor reading on each sensor in roadside cabinet
6. Visual inspection and cleaning of system cabinets and electronics
7. Ensure each roadside cabinet has rodent protection in place and is pest free
8. Ensure wires are secure and conduit is in place
9. Ensure battery backups are operating
10. Cabinet mechanical condition inspection
11. Clean or replace each roadside cabinet air filter
12. Heating, ventilation and air conditioning check
13. Verify drawings are located in cabinet
14. Verify proper power, ground, and lightning protection
15. Structural integrity check of all new poles and structures
16. Test all message signs and signals are operating
17. Inspection and verification of computer communication systems
18. Camera inspection, testing and maintenance, including cleaning of camera lenses
19. Parts, labor and shipping
20. Mobilization and traffic control necessary to perform the maintenance services
21. Perform WIM accuracy tests and adjust as required to comply with standards
22. Provide WIM accuracy test print outs to WisDOT

A report shall accompany the scheduled maintenance service and shall be submitted to the Department. The report shall include:

1. Pass/Fail grading of all loops and sensors
2. A checklist of all components checked as listed above, as well as the location of the components and comments on their general state
3. A checklist and commentary detailing whether each component (as listed above) met standards or required repairs

3.3.3.2 Emergency Repair Services

Emergency repair services shall be completed on an as-required basis. The maximum response time for emergency repair services shall not exceed 48 hours after written receipt of notice by fax, phone, or email. The vendor shall initiate on-site repairs within 3 business days of notification. Some components of the system are not readily available and require lead time for delivery before being installed. These will be handled on a case by case basis. Emergency repair services shall include all parts, labor, shipping, mobilization and traffic control necessary to perform the work.

3.3.3.3 Operator Refresher Courses

In conjunction with the scheduled maintenance services, the Vendor shall provide Operator Refresher Courses on the operation of the entire WIM system upon request. The courses shall

have a maximum duration of four (4) hours and shall be scheduled before or after the annual maintenance service. The course attendees shall be determined by the Department.

3.3.4 Measurement

The Department will measure Weigh-In-Motion System Warranty Maintenance, completed in accordance to the contract and accepted, as a single complete unit of work.

3.3.5 Payment

The Department will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.802	Weigh-In-Motion System Warranty Maintenance	LS

Payment is full compensation for providing the warranty bond, all warranty maintenance service and emergency repair service for a period of five years and shall include all labor, tools, parts, shipping, mobilization, traffic control and incidentals necessary to perform the maintenance service.

3.4 Static Scale System, Item SPV.0105.003.

3.4.1 General

Upgrade the existing commercial vehicle static scale with new electronics as described in these provisions. In addition, remove and replace the existing static scale concrete deck. Equipment to be from a manufacturer experienced in design, construction, and operation of equipment for the purpose required.

Data acquired from the Static Scale System described in this specification must be such that it may be readily associated with other data for the same vehicle into a record that coherently represents data acquired from weigh-in-motion, static scale, and enforcement camera systems. The following specifications represent the minimum static scale requirements.

3.4.2 Materials

The Static Scale

The existing static scale substructure and superstructure will remain and is to be reused.

Furnish and install one motor truck scale deck with weighing platforms of 42'-11" x 12' wide, 22'-11" x 12' wide and 15'-3" x 12' wide placed end to end. Equipment to consist of parts designed to act as a unit by a manufacture experienced in design, construction, and operation of equipment for the purpose required.

1. The deck surface shall be 10" thick concrete, having a minimum compressive strength of 4000 psi.
 - a. The deck shall be lined along the bottom with 3/16 STM-A36 steel plate or galvanized deck sheeting, a double reinforcing mat shall be set into place the length and width of the scale deck, and the deck channel to have studs welded to the steel to form a composite structure when the concrete is added. The reinforcing mat and deck channel studs are to relieve surface tension in the concrete caused by expansion and contraction.

- b. The color admixture shall be reddish-brown (Federal Standard Color No. 31136) or similar color approved by the engineer. Add colored admixture to the mix per manufacturer's written instructions in a pre-measured bag and not added by weight of cement content. Admixture shall be a colored, water-reducing, admixture containing no calcium chloride with coloring agents that are lime proof and UV resistant.
2. The scale platform shall be treated with a protective surface treatment conforming to standard spec 502.

Load Cells

The load cells for the steer platform (platform 1) shall be replaced. The existing load cells will be removed and left at a designated location on-site. The new load cells shall meet the following:

1. The weighing elements shall be stainless steel hermetically sealed load cells to guard against moisture ingress and barometric effects.
2. The cells shall have moisture protection to IP 68 standards.
3. Load shall be applied to the cells without the use of links, bolts, pins cables or flexure.
4. All load cells shall be self-centering.
5. Load cells shall provide an analog or digital signal output.
6. The load cells shall be a minimum of 50 tons capacity each, and each cell must have stainless steel, braided covering on the load cell cable.
7. All load cells must be manufactured of stainless steel.
8. The scale shall have self-diagnostic capabilities able to identify load cell problems and failure.
9. The scale shall be able to identify each load cell individually.
10. The scale shall have the ability to view all of the load cells in the scale system simultaneously.
11. Diagnostics to have the capability to predict the failure of a cell before it actually happens to prevent down time. The diagnostics are to measure load cell counts (not weight) to determine reliability of the load cells. The following diagnostics shall be available at a minimum:
 - a. Individual cell not responding
 - b. Individual cell negative out of range
 - c. Individual cell command failed
 - d. Individual cell enclosure breach
 - e. Power up Zero
 - f. Major and minor overvoltage or overcurrent
 - g. Major and minor under voltage
 - h. Individual cell not found
 - i. All errors shall be logged in the static scale electronics with the capability to be emailed when an error occurs
12. The design shall permit the individual load cells to be matched and the scale sections to be electronically calibrated.
13. Load cell shall have been tested by a 3rd party lab and have passed a simulated lightning strike up to 80,000 amperes. Documentation to be provided with submittals verifying this.

The load cells for the drive and trailer platforms (2 & 3) shall be reused.

3.4.2.1 Technical Specifications

After upgrades the scale shall have the new electronics shall be capable of meeting the following:

Maximum Capacity (tons)	100 tons
Dual Tandem Axle Capacity (lbs.)	70,000 lbs

(Concentrated Load Capacity (CLC) is not the same as dual tandem axle capacity)	
Scale Accuracy	0.1%

Load Cells:

Load Cell Type	Rocker Column
Rated Capacity	50t (100,000 lbs)
Safe Overload	200 %
Ultimate Overload	300 %
Safe Sideload	100%
Material	Stainless Steel
Load Cell Cable	4 conductor 22 AWG Shielded
Load Cell Cable Protection	Stainless Steel Outer Jacket
NEMA Rating	6P
Rated Excitation	5 to 15 Volts
Temperature Compensation Range	-10 to +40 °C

3.4.2.2 Static Scale Electronics

The existing scale instrument will be removed and returned to WisDOT. Furnish and install one new electronic instrument to drive the upgraded scale. Equipment to consist of parts desired to act as a unit by a manufacturer experienced in design construction, manufacture of electronic components, and operation of equipment for the purpose required.

The scale instrument and all peripheral devices should be designed to function as a unit. The equipment shall have the following specifications:

1. Static scale indicator
2. Microprocessor based item(s) for
 - a. Scale read out
 - b. Control and data handling functions
3. The scale instrumentation shall be compact and approved by the Engineer Manufacturer shall provide proof that the instruments have been in use successfully for at least two years.
4. Provide microprocessor-based digital instrument with Ethernet weight output to the static scale PC and the monitor for totalizing and printer controls.
5. This connection shall provide diagnostics of static scale load cells (load cell raw counts) to the static scale PC.
6. Provide with software diagnostics to facilitate fault finding.
7. Provide a certificate of conformance from the NIST Handbook 44, latest adopted edition.
8. The static scale instruments shall include:
 - a. Must be able to power up to 4 scale platforms
 - b. All instrument setup functions and calibration sequences are programmable through the keyboard/display. No at-scale adjustments required for these functions.

- c. Minimum of 15 updates per second
- d. One display showing individual axle weights and the summation of the individual weights
- e. Shall be suitable for desktop or set-in mounting, level or at angle
- f. Display the raw counts of each individual load cell without disconnecting any of the load cells from the system
- g. Perform all static scale instrument set-up functions via static scale internet explorer web pages. Download to instrument via Ethernet connection.
- h. Selectable increments size from 20 to 50,000.
- i. Display up to 1 part in 10,000
- j. Internal resolution 1 part in 1,000,000
- k. Setup functions stored in nonvolatile RAM memory
- l. Adjustable digital filtering
- m. Adjustable automatic zero maintenance
- n. Serial ASCII output port configuration for connection to computer. Baud rate to be selectable from 300 to 9600
- o. Motion detection should be selectable from ± 0.5 , ± 1.0 , ± 2.0 , ± 3.0 increments
- p. Display verification test
- q. Display height at .5 inches with wide angle view
- r. Static scale instruments shall meet the current specifications of the NIST Handbook 44, current adopted edition
- s. The instrument shall be UL/CSA listed
- t. Provide one button printing of weight ticket or axle accumulation

3.4.2.3 Static Scale Operation Specifications

1. The completed static scale will work along with the WIM system to provide all the functionality described in the Weigh-In-Motion System special provisions.
2. The scale instrument shall be capable of assigning each load cell with its own unique identification number and shall be capable of displaying the weight reading of each individual load cell through the instrument without disconnecting any of the load cells from the system.
3. The scale instrument shall communicate with each individual load cell.
4. The scale instrument shall be capable of being programmed and calibrated in pounds or kilograms.
5. The display shall be a full color graphic, alphanumeric LED back-lit display with the capability to prompt the operator through all operations with true alpha characters. Segmented LED alphanumeric displays are not acceptable.
6. The scale instrument shall communicate static scale weights to the Scale Manager on the central Weigh Station computer to display weights on the computer system screen, and to allow the accurate weighing of the truck on the static scale.
7. The scale instrument shall have a program to accumulate up to 19 axle and axle groups and print 8.5 x 11 weight tickets that is independent of the WIM system. This program should work as a backup in case the Station system is not working.
8. The instrument shall have the capability to run multiple scales as a standard unit. Adding extra boards at a later date is to be considered not meeting specifications. The instrument

shall have self-diagnostics built in that allow the technician to view all load cell outputs simultaneously.

9. Simultaneous viewing of digital load cell output allows for fast easy analysis of the scale operating system. Viewing cell outputs one at a time is not acceptable.
10. The system shall have the ability to be 100% calibrated from within the scale house. Corrections or calibration adjustments at the scale through summing boxes are not acceptable.
11. Surge Voltage Protection on the system shall be optically isolated at each load cell, and transformer coupled from the instrument.
12. Scale shall have the ability to be analyzed via remote software.
13. The scale instrument shall have the ability to be programmed via remote software.
14. Remote software diagnostics shall allow simultaneous viewing of all load cells in counts, and actual weight that each individual load cell is sensing. Viewing of cells one at a time is not acceptable.
15. Remote software service shall be capable of displaying load cell zero calibration counts, current zero counts and actual mV/V output of each cell simultaneously. A printed report of this information is possible from the remote software.
16. Remote software service shall be capable of performing a self-test on all communications ports and report the current setup.
17. Original calibration values shall have the capability to be retrieved and stored via remote software.
18. Original configuration values shall have the capability to be retrieved and stored via remote software.
19. For non-commercial applications, scales shall have the capability to be set up and calibrated via remote software.

3.4.2.4 Ticket Printer Requirements

Provide the following:

1. Provide one laser-type printer
2. Minimum print speed of 12 pages per minute
3. Minimum print quality of 600 dpi
4. Minimum 8 Mb of memory

3.4.2.5 Scoreboard Sign Requirements

The existing scoreboards will remain and be reused. The system shall be capable of utilizing the existing scoreboards.

3.4.3 Construction

The Static Scale System vendor shall warrant and maintain all subsystems and new system components as supplied and installed for five years from the date of acceptance by the engineer. This warranty and associated maintenance work are defined and covered under a separate bid item, Static Scale System Warranty Maintenance

3.4.4 Measurement

The Department will measure Static Scale System, completed in accordance to the contract and accepted, as a single complete unit of work.

3.4.5 Payment

The Department will pay for measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.003	Static Scale System	LS

Payment is full compensation for removal and disposal of old equipment along with furnishing and installing all materials; making the system operational; testing; providing required training and warranties; and for furnishing all labor, supervision, equipment, tools, and incidentals necessary to complete the contract work.

3.5 Static Scale System Warranty Maintenance, Item SPV.0105.004.

3.5.1 Description

Provide warranty and maintenance service for the new Static Scale System components for a period of five years. Upon completion of construction, power wash and remove debris from the entire static scale pit. The sump pits should be protected with fabric or other measures to prevent debris from getting into the pits whenever cleaning is occurring. Provide routine maintenance on all major systems, system components, and ancillary equipment in the spring of the year at annual intervals. This maintenance is to include the existing load cells/equipment remaining in place along with newly installed load cells/equipment. Power washing and debris clean up shall coincide with the annual maintenance schedule. The existing load cells/equipment are not covered under the warranty portion of this item but are covered under the maintenance portion. Provide emergency repair services on an as-required basis.

The static scale equipment shall be warranted by the manufacturer, in writing, against defects in or from material, workmanship, lightning, and to perform as required by these technical special provisions, giving proper and continuous service under all conditions required and specified, or which may reasonably be inferred, for a period of five years from the date of acceptance. The manufacturer's routine maintenance schedule shall be stated. The written manufacturer's warranty shall be furnished to the Department by the Contractor at the time the equipment performance supporting data is submitted. The warranties shall also state they are subject to transfer to the Department.

The new static scale equipment weighing instruments, load cells, and hardware shall be warranted by the manufacturer, in writing, against defects in or from material, workmanship, lightning, and perform as required by these technical special provisions for the period of five years or as described above from the date of final acceptance of the project.

3.5.1.1 Warranty Bond

The contractor shall provide a warranty bond for the Static Scale System Warranty Maintenance. The bond will be in effect for the entire five-year warranty period beginning when the Static Scale System is completed, operational and accepted. The bonding company must have an AM Best rating of "A-" or better and the contractor will provide proof of a five-year bond commitment before execution of the contract.

The warranty bond amount will be for \$25,000. The bond will ensure the proper and prompt completion of required warranty work following completion of the contract work, including payments for furnishing all labor, equipment, and materials used according to this specification.

The contract bond, which remains in effect for one year beyond the completion of the project, will also include warranty work as described in this article. For the remaining four-year warranty period, provide documentation that the warranty bond will be provided in a single term four-year warranty bond.

Failure of the contractor or its surety to issue the warranty bond will be considered a default and will result in forfeiture of the face amount of the bond to the Department.

All warranty work will be as prescribed in this article. At the end of the warranty period, the contractor will be relieved of the responsibility to perform further warranty work, provided all previous warranty work has been completed.

Maintain insurance, in the course of performing warranty work, as specified in standard spec 107.26 throughout the five-year warranty period.

3.5.2 (Vacant)

3.5.3 Construction

3.5.3.1 Maintenance Services

Scheduled maintenance services shall be performed annually. The scheduled maintenance service shall include the following:

1. Visual inspection of the static scale system
2. Calibration of the scale
3. Lubrication of load cells and bumpers (new and existing)
4. Power washing of the scale deck and pit with 2500 psi minimum pressure washer and disposal of debris
5. Parts, labor and shipping
6. Mobilization and traffic control necessary to perform the maintenance services

A report shall accompany the scheduled maintenance service and shall be submitted to the Department. The report shall include:

1. Calibration process and results
2. Work completed
3. Evaluation of the static scale system
4. Other comments

3.5.3.2 Emergency Repair Services

Emergency repair services shall be completed on an as-required basis. The maximum response time for emergency repair services shall not exceed 48 hours after written receipt of notice by email or fax. The vendor shall initiate on-site repairs within three calendar days of notification. Emergency repair services shall include all parts, labor, shipping, mobilization and traffic control necessary to perform the work.

3.5.4 Measurement

The Department will measure Static Scale System Warranty Maintenance, completed in accordance to the contract and accepted, as a single complete unit of work.

3.5.5 Payment

The Department will pay for measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.004	Static Scale System Warranty Maintenance	LS

Payment is full compensation for providing warranty and all maintenance services and emergency service for a period of five years and shall include all labor, tools, parts, shipping, mobilization, traffic control and incidentals necessary to perform the maintenance services.

4 SPECIAL TERMS AND CONDITIONS

4.1 Contract Quantities

The estimated quantities for each item are identified on the "BID PRICE SHEET".

4.2 Warranty

All warranty for the contract work shall be covered as described under items SPV.0105.002 Weigh-In-Motion System Warranty Maintenance and SPV.0105.004 Static Scale System Warranty Maintenance.

4.3 Subcontracting or Third Party Payments

All subcontracting shall be pre-approved by WisDOT. Subcontractors must abide by all terms and conditions of the contract. The prime Contractor shall be responsible for all subcontractor(s) work and payment. The WisDOT will not pay any subcontractor or third parties directly.

4.4 Confidentiality

Contractor acknowledges that some of the data and documentation it may become privy to in the performance of this contract is of a confidential nature. Contractor shall make all reasonable efforts to ensure that it or its employees and subcontractors do not disseminate such confidential information.

Contractor or its employees and subcontractors will not reuse, sell, or make use in any format the data researched or compiled for this contract for any venture, profitable or not, outside this contract.

Contractor agrees to observe complete confidentiality with respect to all aspects of any confidential information, proprietary data and/or trade secrets and any parts thereof, whether such contents are the State's or the manufacturer's, bidder's, or distributor's whereby Contractor or any Contractor's personnel may gain access while engaged by the State or while on State premises.

The restrictions herein shall survive the termination of this contract for any reason and shall continue in full force and effect and shall be binding upon the Contractor or its agents, employees, successors, assigns, subcontractors, or any party claiming an interest in this contract on behalf of or under the rights of Contractor following any termination. Contractor shall advise all Contractors' agents, employees, successors, assigns and subcontractors which are engaged by the State of the restrictions, present and continuing, set forth herein. Contractor shall defend and incur all costs, if any, for actions that arise as a

result of noncompliance by Contractor, its agents, employees, successors, assigns and subcontractors regarding the restrictions herein.

4.5 Liquidated Damages

This shall be surety for fulfillment of the contract(s) including quality, performance and delivery under the terms of this Request for Bid. Liquidated damages shall consist of \$100.00 per calendar day for failure to deliver according to the contract terms. Liquidated damages will be deducted from payments on the invoice covering the late shipments, if the invoice is of sufficient amount to cover the liquidated damages. If the invoice is not of a sufficient amount to cover the liquidated damages on a particular shipment, the agency will request cancellation of the invoice and a credit to cover the balance. Additional liquidated damages may be assessed as outlined in 3.2.2.8.2.3 Continuous Operating Test (COT).

4.6 Invoicing Requirements

Invoices/Purchase Order:

WisDOT must meet a statutory mandate to pay or reject invoices within 30 days of receipt by WISDOT. Before payment is made, WisDOT must verify that all invoiced charges are correct as per this contract. Only properly submitted invoices shall be officially received for payment. Thus, your prompt payment requires that your invoices be clear and complete in conformity with the instructions below.

All invoices must be itemized showing:

- Purchase order number
- Vendor name
- Remit to address
- The complete product description as stated on your bid
- Prices per the contract

Send invoice to the bill-to address shown on the Purchase Order.

4.7 Reporting Requirements

WisDOT shall have the right to audit, review, examine, copy, and transcribe any pertinent records or documents held by the Contractor related to this contract. The Contractor shall establish, maintain, report as needed, and submit upon request records of all transactions conducted under the contract. All records must be kept in accordance with generally accepted accounting procedures. All procedures must be in accordance with federal, State of Wisconsin and local ordinances.

4.8 Order of Precedence

In the event of contract award, the contents of this RFB (including all attachments), RFB addenda and revisions, the bid response from the successful bidder, and additional terms agreed to, in writing, by WisDOT and Contractor shall become part of the contract.

The following priority for contract documents will be used if there are conflicts or disputes:

1. The Contract Award document
2. Official Purchase Order
3. Bid response as accepted by WisDOT

4. WisDOT Request for Bid

4.9 Completion Date

Contract award is expected within 7 calendar days of the bid date and the contractor shall provide the Certificate of Insurance in accordance with Section 2.2 of the Special Conditions. The contractor shall begin work within 14 calendar days of the contract award and shall complete all work within 30 calendar days. Liquidated damages in accordance with Section 4.5 of the Special Conditions may be assessed for failure to complete the work within 30 calendar days.

4.10 Construction Staging Requirements

All shoulder closures along IH 94 shall occur during the permitted times as outlined in XXXXXX. Access to the Kenosha SWEF site and parking lot shall be maintained from IH 94 while the static scale deck is being replaced.

5 BID PROCEDURE AND INSTRUCTIONS

5.1 Reasonable Accommodations

The Department will provide reasonable accommodations, including the provision of informational material in an alternative format, for qualified individuals with disabilities upon request. If you require information in an alternate format in order to respond to this bid or if you need accommodations at a bid opening/vendor conference, contact: Kevin Diehl, 608-261-0124, kevin.diehl@dot.wi.gov. If you think you need accommodations at a bid opening contact Kevin Diehl, 608-261-0124, kevin.diehl@dot.wi.gov or Wisconsin Telecommunications Relay System (TTY) at 1-800-947-3529.

5.2 Questions

If a vendor discovers any significant ambiguity, error, conflict, discrepancy, omission, or other deficiency in this RFB they shall notify the Facilities Engineer named below of such error and request modification or clarification of the bid document.

Any communications or questions regarding the specifications, or special conditions of bid should be written and submitted to the purchasing agent shown on the bid cover sheet and below as soon as possible, but no later than March 16, 2018. Purchasing will respond to questions by issuing an official addendum, posted on VendorNet.

Any correspondence or submitted documents must include the bid number.

Submit in writing via email to: Bill.Wondrachek@wi.gov

5.3 Bid Submission

Bidders must submit the original and 1 copy of all required materials for acceptance of their bid by the date and time listed on the Bid cover sheet. Any bids received after that time and date will be rejected. Receipt of a bid by the State mail system does not constitute receipt of a bid by Purchasing, for purposes of this RFB. Also refer to the Bid Response Instructions. Use one of the options below for return of the bid. Faxed and e-mailed bids are not accepted.

U.S. Mail:

Purchasing

WI Department of Transportation

UPS, Fed Ex, etc.:

Purchasing

WI Department of Transportation

4802 Sheboygan Ave., Room 751
PO Box 7396
Madison, WI 53707-7396

4802 Sheboygan Ave., Room 751
Madison, WI 53705

All bids are to be packaged, sealed, and show the following information on the **outside of the package:**

- Vendor's Name and Address
- Request for Bids Install WIM System Racine SWEF #22
- Request for Bids # XXXXX
- Bid Due Date XXXX

Because of increased building security, access to the WisDOT Purchasing Office is restricted and may cause delay if hand delivering your bid. Allow ample time for security clearance to room 751.

5.4 Method of Bid

Bidder must submit a unit price for each item and a total price as designated. All prices must be quoted in U.S. Dollars.

Bidder must bid on the enclosed bid price sheet. (Attachment H)

5.5 Bid Response Requirements

In order for your bid to be considered, the following information must be provided. Fill out and submit your bid and 1 copy by the due date and time listed on the bid cover page. Include:

- Bid Cover (Signature) Pages
- Addendum Cover (Signature) Page(s), if applicable to this bid request
- Bid Price Sheet(s)
- Vendor Information Sheet, Attachment A
- References Sheet, Attachment B
- MBE Program Awareness, Compliance & Action Plan, Attachment C
- Bidder Response Sheet, Attachment E

Failure to provide the forms/information with your bid submittal may disqualify your bid. WisDOT encourages all bidders to print their submission double-sided to save paper.

5.6 Incurring Costs

The State of Wisconsin is not liable for any cost incurred by a bidder in the process of responding to this RFB.

5.7 VendorNet Registration

Registration on the State of Wisconsin's VendorNet System (<http://vendornet.state.wi.us>) is available free of charge to all businesses and organizations that want to sell to the state. Registration allows a vendor to:

- Register for a bidders list for commodities/services that the vendor wants to sell to the state.
- Receive an automatic e-mail notification each time a state agency, including the University of Wisconsin System campuses, posts a request for bid (RFB) or a request for proposal (RFP) with an estimated value over \$50,000 in their designated commodity/service area(s).
- Receive an e-mail notification of addendums/amendments relative to the RFB or RFP.

Only vendors registered, with a valid e-mail address, at the time the RFB or RFP is posted will receive e-mail notifications of addendums/amendments. Vendors who obtain the RFB or RFP from a third party; through the public notice website <http://publicnotices.wi.gov>; or other means assume responsibility for checking for updates to the RFB or RFP.

Only vendors registered with the State of Wisconsin's VendorNet will receive future official notice for this service/commodity.

To obtain information on the state's bidder registration, please visit the VendorNet Web site at <http://vendornet.state.wi.us>. Assistance is available from the VendorNet Information Center (1-800-482-7813); in the Madison area, 264-7898.

6 BID OPENING, ACCEPTANCE AND AWARD

6.1 Bid Opening

Bids will be opened on the date and time listed on the front cover page. Names of the bidders will be read aloud at that time. WisDOT will issue an official addendum and post on VendorNet should a need to change the bid open date and/or time occur.

6.2 Bid Acceptance

WisDOT shall review all materials submitted in response to this bid in an identical manner to determine specification compliance. Bids which do not comply with specifications contained in this RFB WILL be rejected by the State. The State retains the right to accept or reject any or all bids, or accept or reject any part of a bid deemed to be in the best interest of the State. The State shall be the sole judge as to compliance with the specifications contained in this RFB.

6.3 Method of Award

The contract will be awarded to the lowest cost responsive, responsible bidder that meets the specifications.

6.4 Minority Business Participation

The Wisconsin Department of Transportation is committed to the promotion of minority businesses in the State's purchasing program. Authority for this program is found in Wisconsin Statutes 15.107(2), 16.75(3m), and 16.755.

Bidders who feel that they qualify, should seek certification from the Wisconsin DOA and mark "yes" on page 2 of the RFB. Details of program certification are located at: <http://www.doa.state.wi.us/index.asp?locid=169>.

Bidders are strongly urged to use due diligence to further this policy by setting up subcontracts to state-certified Minority Business Enterprises (MBE) and/or by using such enterprises to provide goods and services incidental to this contract (second-tier suppliers), with a goal of awarding 5% of the contract cost

to such enterprises. An MBE means a business certified, or certifiable, by the Wisconsin Department of Administration under Statute 560.036(2).

Bidders must submit the attached WisDOT MBE / DVB Program Awareness, Compliance & Action Plan (Attachment C) indicating their proposed utilization of state-certified minority businesses for this contract. Contact the State's Minority Business Manager for assistance in locating certified firms at (608) 267-3293 or the WisDOT Minority Business Program Coordinator at (608)-267-3293. A listing of State of Wisconsin certified minority businesses, as well as the services and commodities they provide, is on the State-certified MBE web site: www.doa.wi.gov/mbe

Monthly reports (Attachment D) are requested to be submitted to the WisDOT Minority Business Program Coordinator, itemizing the deliveries and cost of items or services provided by certified firms. Reports should state the costs for the previous contract month. The Department reserves the right to verify with listed firms their involvement as subcontractors or second-tier suppliers.

6.5 Disabled Veteran Owned Business

Wisconsin statutes support purchasing goods/services from Disabled Veteran-owned businesses located in Wisconsin. Bidders are strongly urged to use due diligence to further this policy by setting up subcontracts to state-certified Disabled Veteran-Owned Businesses (DVB) and/or by using such enterprises to provide goods and services incidental to this contract (second-tier suppliers), with a goal of awarding 5% of the contract cost to such enterprises. A DVB means a business certified, or certifiable, by the Wisconsin Department of Administration under Statute 16.283 (3).

"Disabled veteran" means a person who is verified by the Department of Veterans Affairs as being all of the following at the time the person applies for certification:

1. A veteran as defined in s. 45.01(12),
2. A resident of this state, and
3. A person who is in receipt of an award from the U.S. Department of Veterans Affairs of a service-connected disability rating under 38 USC 1114 or 1134 of at least 30%.

Bidders who feel that they qualify, should seek certification from the Wisconsin DOA and mark "yes" on page 2 of the RFB. Details of program certification are located:
<http://www.doa.state.wi.us/section.asp?linkid=191&locid=0>

Monthly reports (Attachment D) are requested to be submitted to the WisDOT, Purchasing Unit, itemizing the deliveries and cost of items or services provided by certified DBV firms. Reports should state the costs for the previous contract month. Any use of DVB firms can be reported via e-mail to DOTTIPSCorrespond@dot.wi.gov. WisDOT reserves the right to verify with listed firms their involvement as subcontractors or second-tier suppliers.

6.6 Contract Cancellation

This Contract may be terminated by either party under the following conditions:

- A. Please review section 13.0 and 24.0 of the Standard terms and Conditions of Bid. WisDOT may terminate the contract at any time at its sole discretion by delivering 30 days written notice to the Contractor.

If the problem is service performance, Contractor will be warned either verbally or in writing of unsatisfactory performance and intent to cancel this contract. Contractor will be given a period of time to 'cure' the performance. If the performance does not improve Contractor will be given 30 days written notice that the contract will be cancelled.

Upon termination, WisDOT's liability will be limited to the pro rata cost of the services performed as of the date of termination.

- A. In the event the Contractor terminates the contract, for any reason whatsoever, it will require written certified letter notification delivered to the Department purchasing agent not less than 30 days prior to said termination. The Contractor will, in turn, refund the Department, within 30 days of said termination, all payments made hereunder by the Department to the Contractor for work not completed.
- B. If at any time the Contractor performance threatens the health and/or safety of WisDOT, WisDOT has the right to cancel and terminate the Contract without notice.
- C. If the Contractor fails to maintain and keep in force the insurance as provided in section 23.0 of the Standard Terms and Conditions, WisDOT has the right to cancel and terminate the Contract without notice. If the Contractor fails to maintain and keep in force required certificates, permits, and licenses will be cause for contract termination.
- D. If at any time a petition in bankruptcy shall be filed against the Contractor and such petition is not dismissed within 90 calendar days, or if a receiver or trustee of Contractor's property is appointed and such appointment is not vacated within 90 calendar days, WisDOT has the right, in addition to any other rights of whatsoever nature that it may have at law or inequity, to terminate this Contract by giving 90 calendar days notice in writing of such termination.

6.7 Certification for Collection of Sales and Use Tax

The State of Wisconsin shall not enter into a contract with a vendor, and reserves the right to cancel any existing contract, if the vendor or Contractor has not met or complied with the requirements of s.77.66, Wis. Stats., and related statutes regarding certification for collection of sales and use tax.

6.8 Timeline of Events

June XX, 2018	Bid available to Vendors
June XX, 2018	Questions Due from Vendors
June XX, 2018	Answers posted to E-Supplier
June XX, 2018	Bid Responses Due

STATE OF WISCONSIN
DOA-3477 (R05/98)

ATTACHMENT A
VENDOR INFORMATION

1. BIDDING COMPANY NAME:

FEIN (Federal Employer ID Number) OR
Social Security # (if Sole Proprietorship) _____

Phone () _____ Toll Free Phone () _____

Fax () _____ Email Address _____

Address: _____

City _____ State _____ Zip + 4 _____

2. Name the person to contact for questions concerning this bid.

Name _____ Title _____

Phone () _____ Toll Free Phone () _____

Fax () _____ Email Address _____

Address: _____

City _____ State _____ Zip + 4 _____

3. Any vendor awarded over \$25,000 on this contract must submit affirmative action information to the Department. Please name the Personnel/Human Resource and Development or other person responsible for affirmative action in the company to contact about this plan.

Name _____ Title _____

Phone () _____ Toll Free Phone () _____

Fax () _____ Email Address _____

Address: _____

City _____ State _____ Zip + 4 _____

4. Mailing address to which state purchase orders are mailed and person the Department may contact concerning orders and billings.

Name _____ Title _____

Phone () _____ Toll Free Phone () _____

Fax () _____ Email Address _____

Address: _____

City _____ State _____ Zip + 4 _____

**ATTACHMENT B
REFERENCES**

Vendor _____

Provide company name, address, contact person, telephone number, and appropriate information on the product(s) and/or service(s) provided to customers similar to those requested in this solicitation document. Potential subcontractors cannot be references. Any subcontractor arrangement for the completion of this work shall be listed on a separate id page.

Company Name _____

Address: _____

City _____ State _____ Zip + 4 _____

Contact Person: _____

Phone (____) _____

Email Address _____

Product(s) Used and/or Service(s) Provided: _____

Company Name _____

Address: _____

City _____ State _____ Zip + 4 _____

Contact Person: _____

Phone (____) _____

Email Address _____

Product(s) Used and/or Service(s) Provided: _____

Company Name _____

Address: _____

City _____ State _____ Zip + 4 _____

Contact Person: _____

Phone (____) _____

Email Address _____

Product(s) Used and/or Service(s) Provided: _____

Company Name _____

Address: _____

City _____ State _____ Zip + 4 _____

Contact Person: _____

Phone (____) _____

Email Address _____

Product(s) Used and/or Service(s) Provided: _____

ATTACHMENT C
WisDOT MINORITY BUSINESS ENTERPRISE (MBE) PROGRAM
AWARENESS, COMPLIANCE & ACTION PLAN

As a matter of sound business practice, the Wisconsin Department of Transportation is committed to “supply diversity” by promoting the use of minority business and disabled veteran-owned business whenever and wherever possible. Additionally, as an agency of the State of Wisconsin, WisDOT shares in the state goal of placing five (5) percent of its total annual purchasing dollars with state-certified minority and disabled veteran-owned businesses.

State of Wisconsin procurement policy provides that Minority Business Enterprises (MBE) and Disabled Veteran-owned Businesses (DVB) certified by the Wisconsin Department of Administration should have the maximum opportunity to participate in the performance of its contracts/projects.

You, as a contractor, are strongly urged to use due diligence to further this policy by awarding subcontracts to MBEs and DVBs by using such enterprises to provide goods and services incidental to this agreement (second-tier suppliers), with a goal of awarding 5% of the contract cost to such enterprises.

Authority for these programs is found in Wisconsin Statutes 15.107(2), 16.283(3), 16.75(3m), 16.755 and 560.036(2), and details about the program can be found at:

<http://www.doa.state.wi.us/category.asp?linkcatid=677&linkid=113&locid=0>

Monthly reports are requested to be submitted to the Department of Transportation Purchasing Unit, itemizing the costs of services and goods provided by certified firms. Reports should state the costs for the previous contract/project month.

Your complete response on the following form must address the following components of your company's/organization's commitment/action plan:

- a) Indication that you understand the **WisDOT's goal**,
- b) Listing of any MBE/DVB vendors with which you intend to subcontract,
- c) Description of the various **second tier MBE/DVB expenses** (goods and services procured that are incidental to the contract/project; *examples are*: specific office supplies to perform the contract, percentage of cost for uniforms for contract staff, travel to perform the contract/project, percentage of facility maintenance services for your facility used directly by your staff during the contract/project period) your company/organization will be able to report that are in direct connection with the administration of this contract,
- d) **Statement expressing your commitment** to complete the required monthly reports that will reflect your subcontracts and second-tier expenditures for the period.

For information on certified State of Wisconsin Minority Business Enterprises, please contact:

June Robinson
MBE Program Coordinator
WisDOT Division of Business Management
4802 Sheboygan Avenue, Room 751
Madison, WI 53705
Phone: 608-267-2886
Fax: 608-267-3609
www.dot.wisconsin.gov/business/mbe
june.robinson@dot.wi.gov

A complete listing of certified minority businesses, as well as the services and commodities they provide, is available on the web at: www.doa.wi.gov/mbe and Information regarding certification of minority businesses is available at: <http://commerce.wi.gov/BD/BD-MBD-Index.html>

ATTACHMENT C
WisDOT MINORITY BUSINESS ENTERPRISE (MBE) PROGRAM
DISABLED VETERAN-OWNED BUSINESS (DVB) PROGRAM
AWARENESS, COMPLIANCE & ACTION PLAN

Complete, sign, and include in your bid response.

Failure to complete this form as a component of your bid may result in rejection of your bid.

Our company/organization is a Wisconsin-certified Minority Business Enterprise (MBE) ☐ Yes ☐ No

Our company/organization is a Wisconsin-certified Disabled Veteran-owned Business (DVB) ☐ Yes ☐ No

Our company/organization is a minority business but has not yet received Wisconsin certification (please provide details): ☐ Yes ☐ No

Our company/organization is a disabled veteran-owned business but has not yet received Wisconsin certification (please provide details): ☐ Yes ☐ No

We are aware of the WisDOT's goal to spend at least 5% of their total annual purchasing dollars with state-certified MBE /DVB firms. ☐ Yes ☐ No

We are aware that if awarded this contract/project our company/organization will provide monthly or quarterly reports to WisDOT reporting all expenditure activity directed to MBE/DVB subcontractors or second-tier MBE/DVB suppliers that directly relate to this contract. (Any non-certified minority or non-certified disabled veteran-owned businesses could be a potential subcontractor/second-tier supplier--indicate these on your plan. WisDOT will work with those businesses for possible certification.) ☐ Yes ☐ No

Subcontractors: Our company/organization intends to subcontract at least 5% dollar volume with certified MBE/DVB firms listed below (names, addresses, telephone numbers): ☐ Yes ☐ No

Second-tier Suppliers: In addition to direct subcontracting efforts, your company/organization can help WisDOT achieve the 5% goal by managing your second-tier MBE/DVB purchases. Second-tier business refers to incidental business expenses your company may spend with Wisconsin-certified MBE/DVB firms as it pursues the normal course of business supplying the WisDOT-contracted products or services. Here are some *examples*:

- Percentage of your office supplies specifically used during the course of this contract/project.
- Percentage of uniform costs for staff performing this contract/project.
- If you travel to perform this contract/project, you could use a state-certified MBE travel agency and report that expense.
- Percentage of facilities maintenance services for facility(ies) directly used by your staff during the course of this contract/project.

These second-tier expenses can only be reported to the extent that they directly relate to your business with WisDOT. The percentage of the expense you can report is determined by the amount of your WisDOT sales as it relates to your total sales volume. Per the terms of your contract, you should actively pursue directing business towards these types of companies, and report your efforts in this regard on a monthly basis.

In paragraph form, describe your company/organization's commitment/action plan with regard to the planned use of state-certified MBE/DVB businesses in subcontracting efforts, as well as developing MBE/DVB second-tier suppliers. Please list your specific commitments (attach sheet, if necessary).

SIGNATURE: _____

COMPANY: _____

DATE: _____ PHONE () _____

EMAIL ADDRESS _____

ATTACHMENT D
MINORITY BUSINESS
DISABLED VETERAN-OWNED BUSINESS
PARTICIPATION REPORT

Wisconsin Department of Transportation
DT1230 8/2006 s.16.75 (3m) Wis. Stats.

Instructions: Complete and submit to Wisconsin Department of Transportation by the 20th of each month.

Return via FAX to: 608-267-3609, ATTN: Purchasing Minority Business Coordinator
OR

Return via e-mail to: DOTTIPSCorrespond@dot.wi.gov

Report Date	Contract / Purchase Order #	Time Period Covered by Report ☐ Monthly: _____ through _____
Project Name / Contract Title		
Prime Vendor / Contractor Name		Federal Employer Identification Number – FEIN

Contractor Name, Address and Telephone Number Indicate if MBE or DVB	Product / Service Purchased	Subcontract \$ Amount	Second Tier \$ Amount

If no business was awarded to Minority Business Enterprises (MBE) or Disabled Veteran-owned Business (DVB) for this period, please describe the efforts made to encourage their business participation. If you have questions, please call the WisDOT Minority Business Program Specialist, 608-267-2886.

I certify that the information contained on this report is true and correct.

I also certify that I am an authorized representative of the above-identified Prime Vendor / Contractor.

(Prime Vendor/Contractor Authorized
Representative Name)

(Title)

ATTACHMENT E
Numbering will change with each final version
BIDDER RESPONSE SHEET

NOTE: THIS FORM SHOULD BE RETURNED WITH YOUR BID RESPONSE SECTION NUMBERS IDENTIFIED CORRESPOND TO THOSE SHOWN IN THE SPECIAL CONDITIONS OF BID.

	YES	NO
Bidder has provided references as required.	☐	☐
Bidder has been in this business the required term.	☐	☐
Bidder will honor manufacturer's warranty.	☐	☐
Bidder will provide Certificate of Insurance if awarded the contract.	☐	☐
Bidder will comply with terms on subcontracting.	☐	☐
Bidder understands and agrees to the confidentiality clauses.	☐	☐
Bidder agrees to terms regarding liquidated damages.	☐	☐
Bidder will hold pricing firm the required term.	☐	☐
Bidder understands invoice requirements.	☐	☐
Bidder agrees to terms regarding audit requirements.	☐	☐
Bidder has completed and returned all forms required.	☐	☐
Bidder agrees to terms regarding contract cancellation.	☐	☐
Bidder must provide proof of, and will maintain current certificates, permits, and licenses.	☐	☐

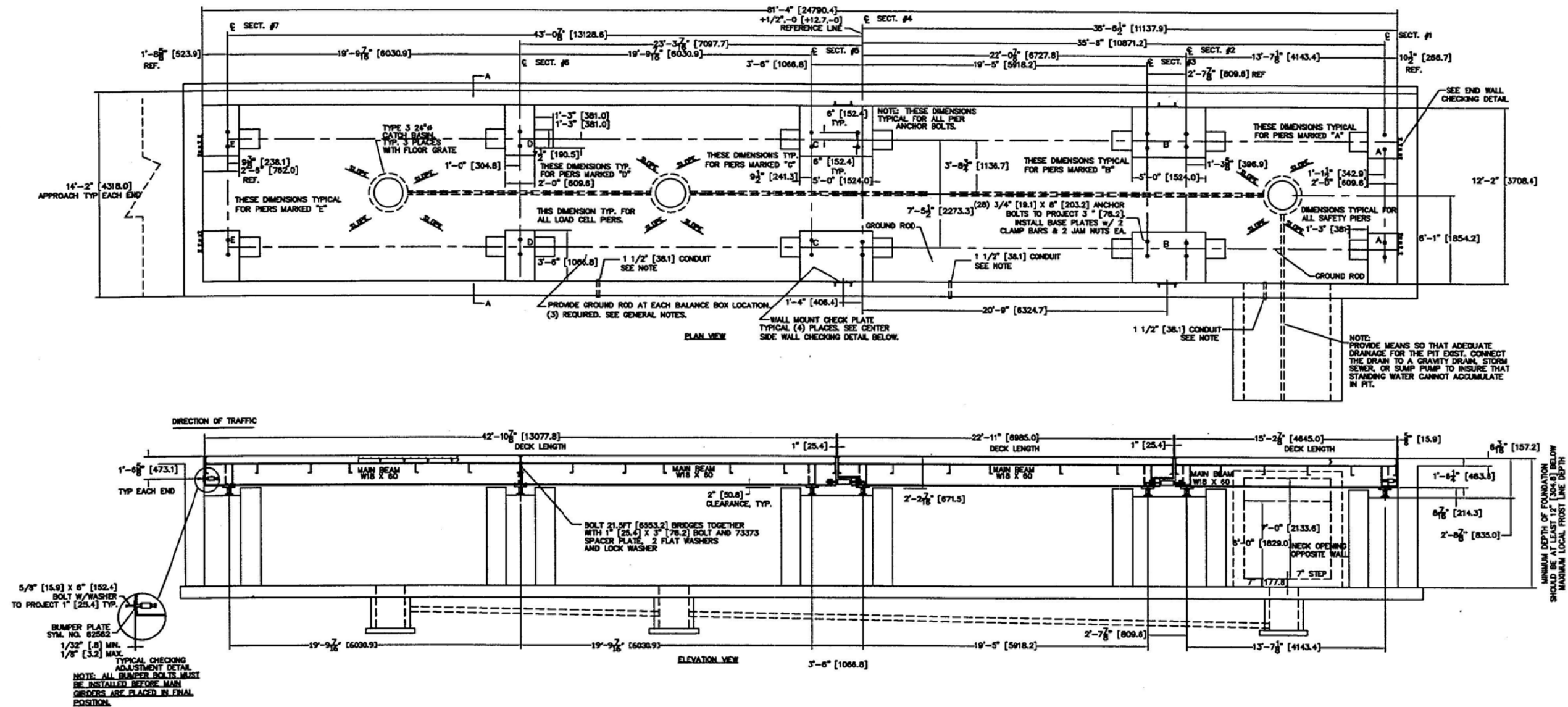
Company Name (print or type)

Bidder's name & title (print or type)

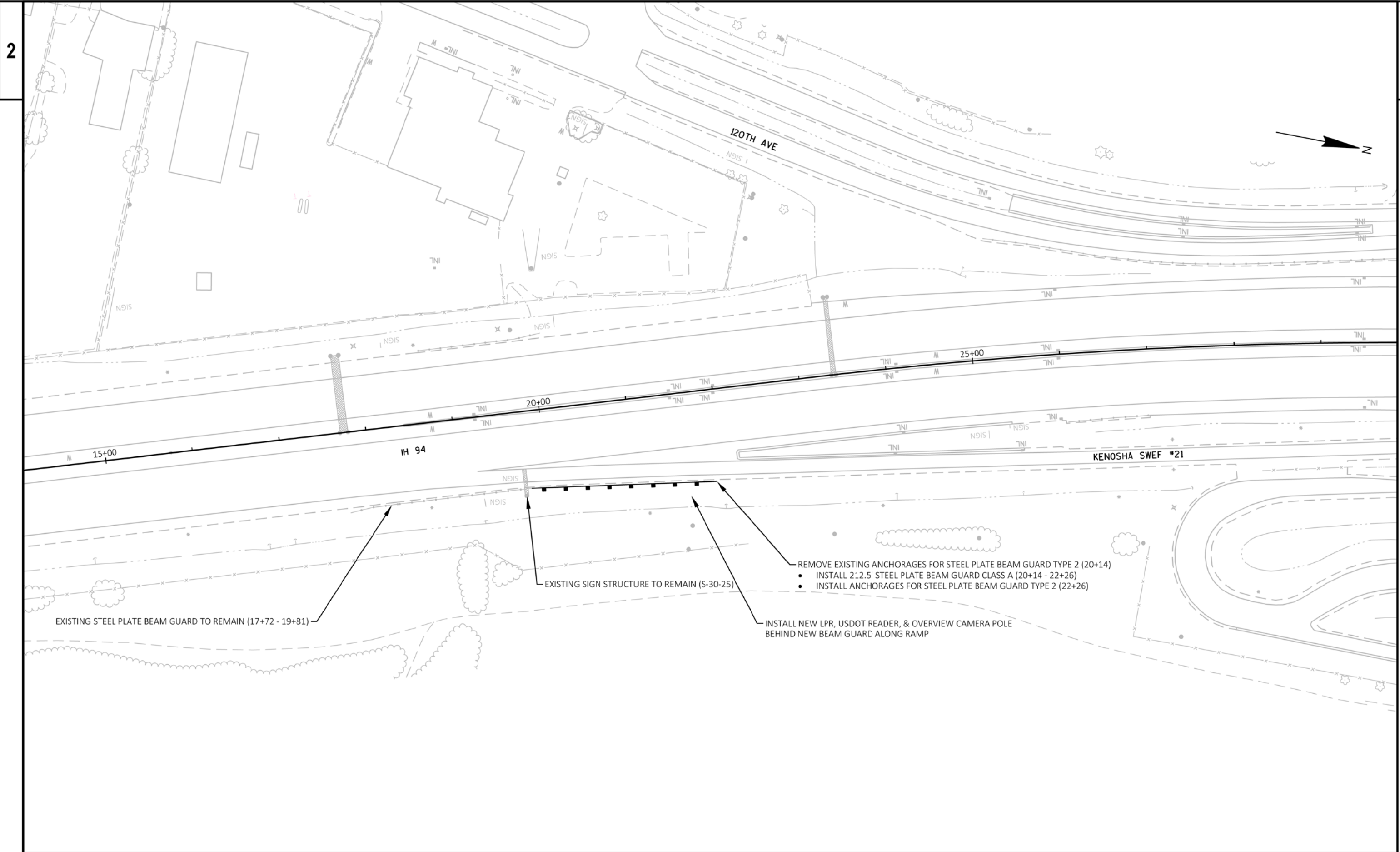
Bidder's Signature

Date

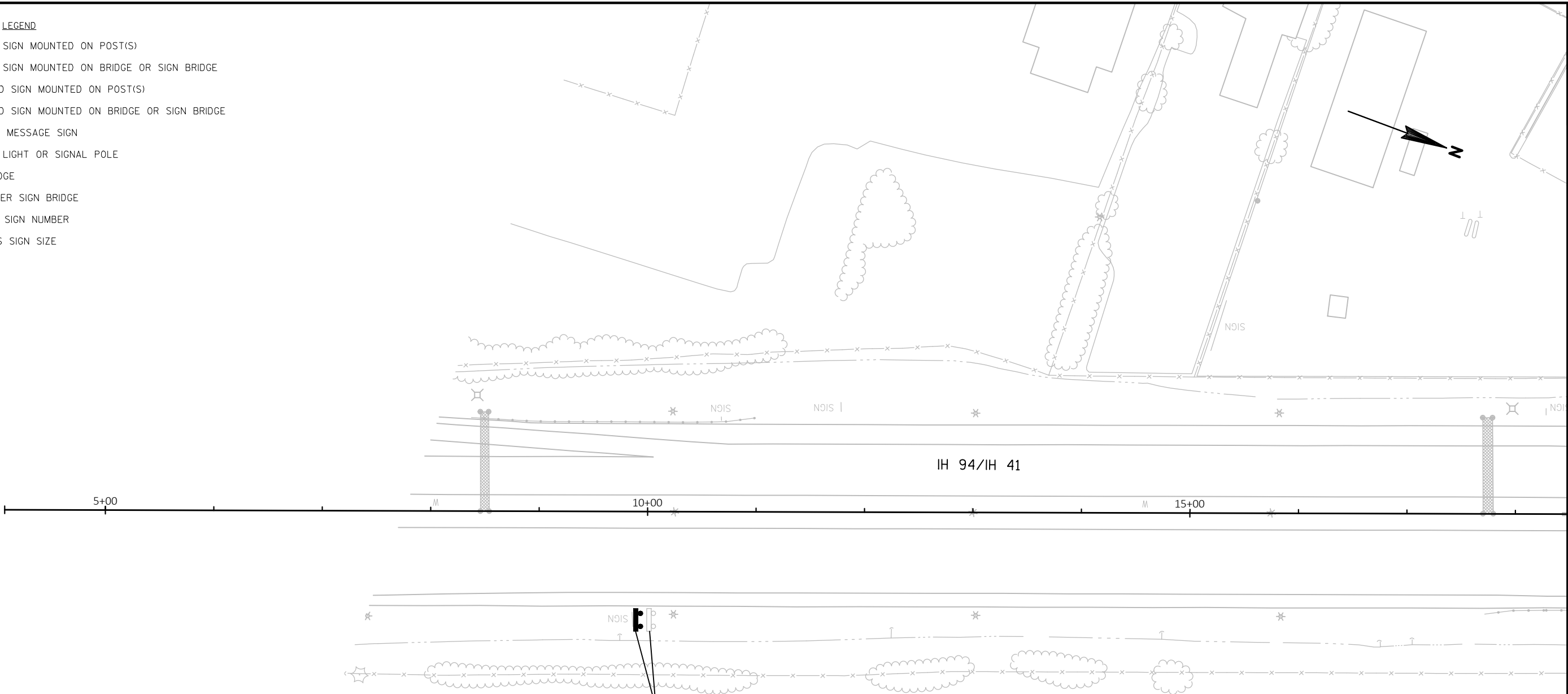
ATTACHMENT F
CONSTRUCTION PLANS



FOR INFORMATION ONLY
EXISTING KENOSHA STATIC SCALE PLANS



- LEGEND
- EXISTING SIGN MOUNTED ON POST(S)
 - EXISTING SIGN MOUNTED ON BRIDGE OR SIGN BRIDGE
 - PROPOSED SIGN MOUNTED ON POST(S)
 - PROPOSED SIGN MOUNTED ON BRIDGE OR SIGN BRIDGE
 - VMS VARIABLE MESSAGE SIGN
 - EXISTING LIGHT OR SIGNAL POLE
 - SIGN BRIDGE
 - CANTILEVER SIGN BRIDGE
 - DENOTES SIGN NUMBER
 - (X) INDICATES SIGN SIZE



Signing notes

Type II aluminum signs removed under the contract shall be delivered to the County sign shop in the County the project is located in. Signs shall be carefully removed from sign supports. The signs shall be palletized for handling with a forklift (see special provision 638.3.4). The Regional sign shop (414-266-1165) shall be notified three working days prior to delivery of the signs.

When an existing stop sign support is to be removed and a new stop sign and support erected, the work shall be done concurrently. For other signs and supports that are to be removed and new signs and supports erected, the removal of the existing sign/support and erection of the new sign/support should be done as concurrently as possible. In no case shall a new sign/support be down for more than 24 hours and there shall not be more than one sign of the same legend missing in a row.

Wood posts sizes, for type II signs are estimated lengths and the actual length will be determined in the field.

Street name signs are property of the municipality (city, village or town). The municipality shall be contacted to remove their street name signs prior to construction and it is their responsibility to reinstall the old signs or replace them following construction. WisDOT does not furnish or install street name signs. The street name signs shall not be placed on top of the STOP signs.

Locate no passing pennants based on establishing no passing zones pay item. Place signs based on where the pavement marking for no passing zones begin

**WEIGH
STATION
RIGHT LANE**

E5-57E
144" X 60"
TYPE I SIGN & STEEL POSTS
REMOVE EXISTING SIGN & SUPPORTS

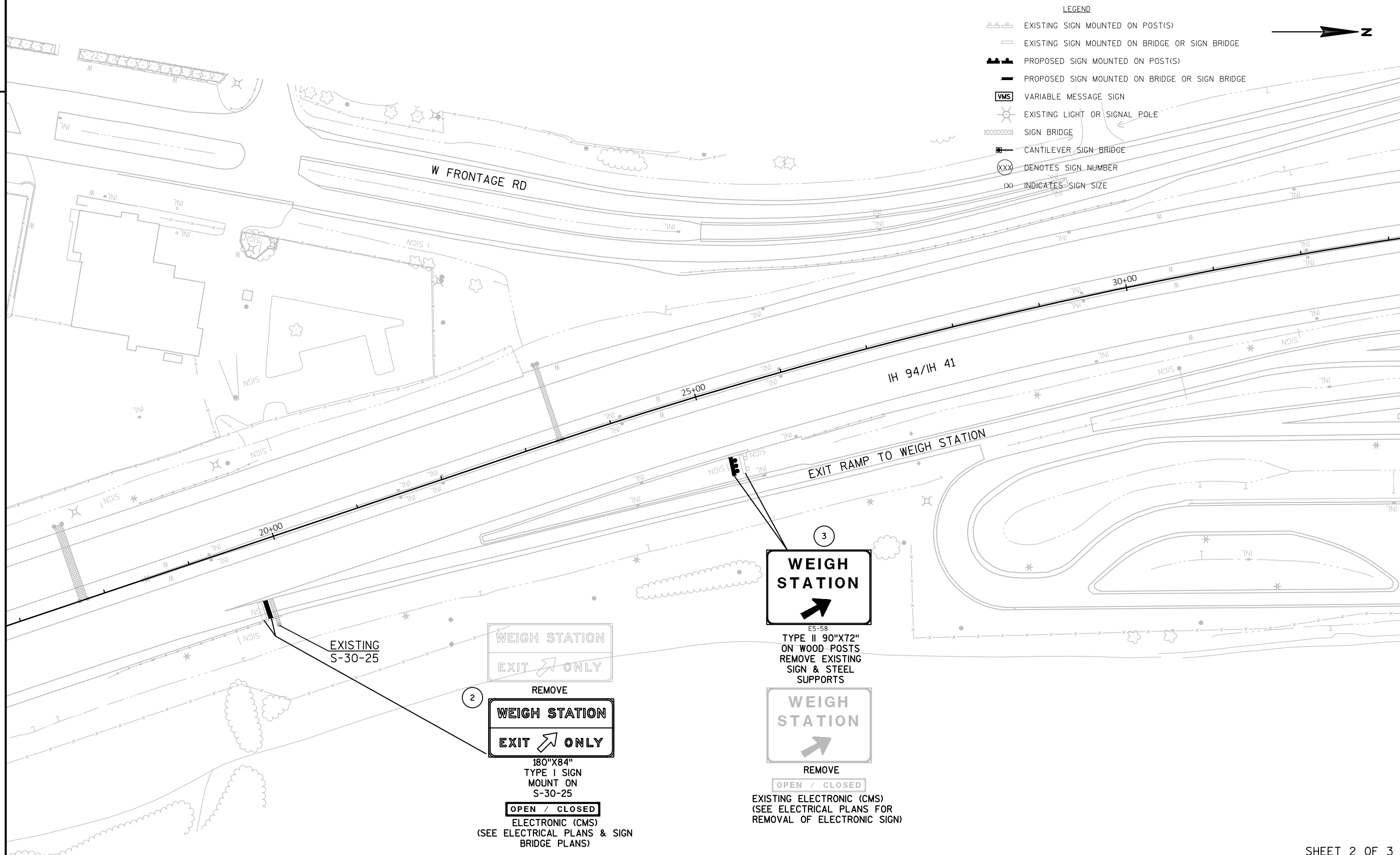
OPEN / CLOSED

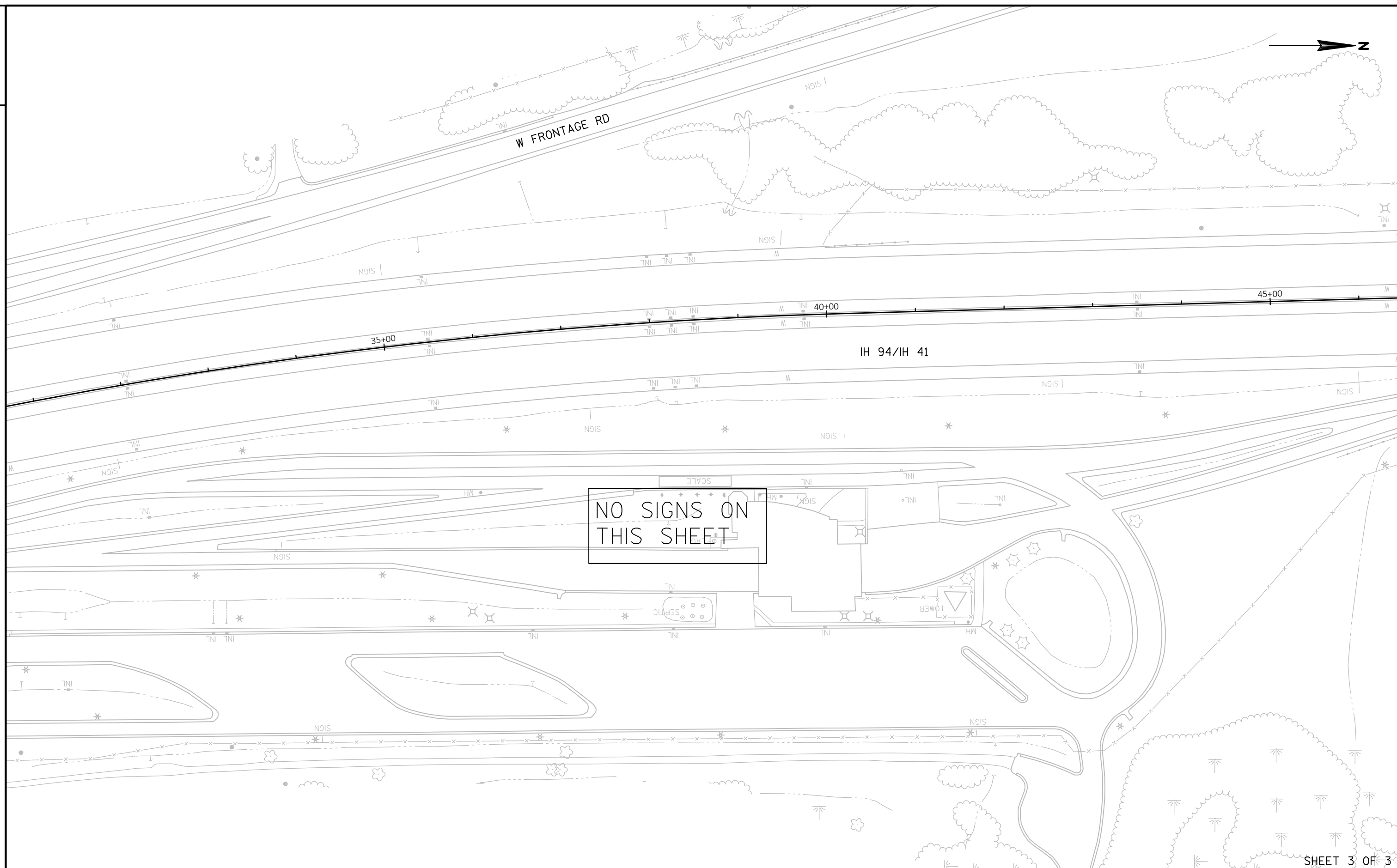
ELECTRONIC CMS PLAQUE
(SEE ELECTRICAL PLANS)

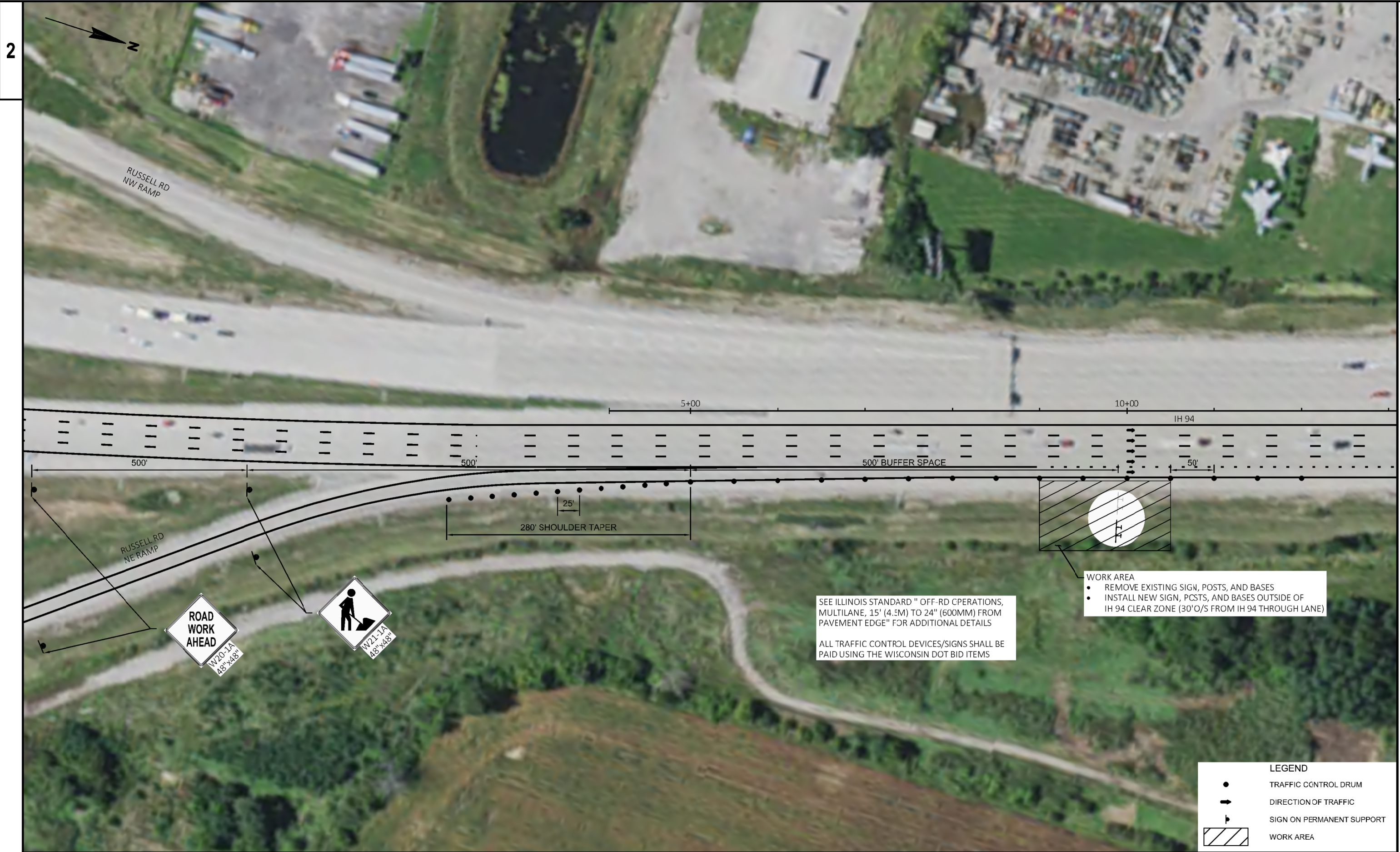
**WEIGH
STATION
RIGHT LANE**

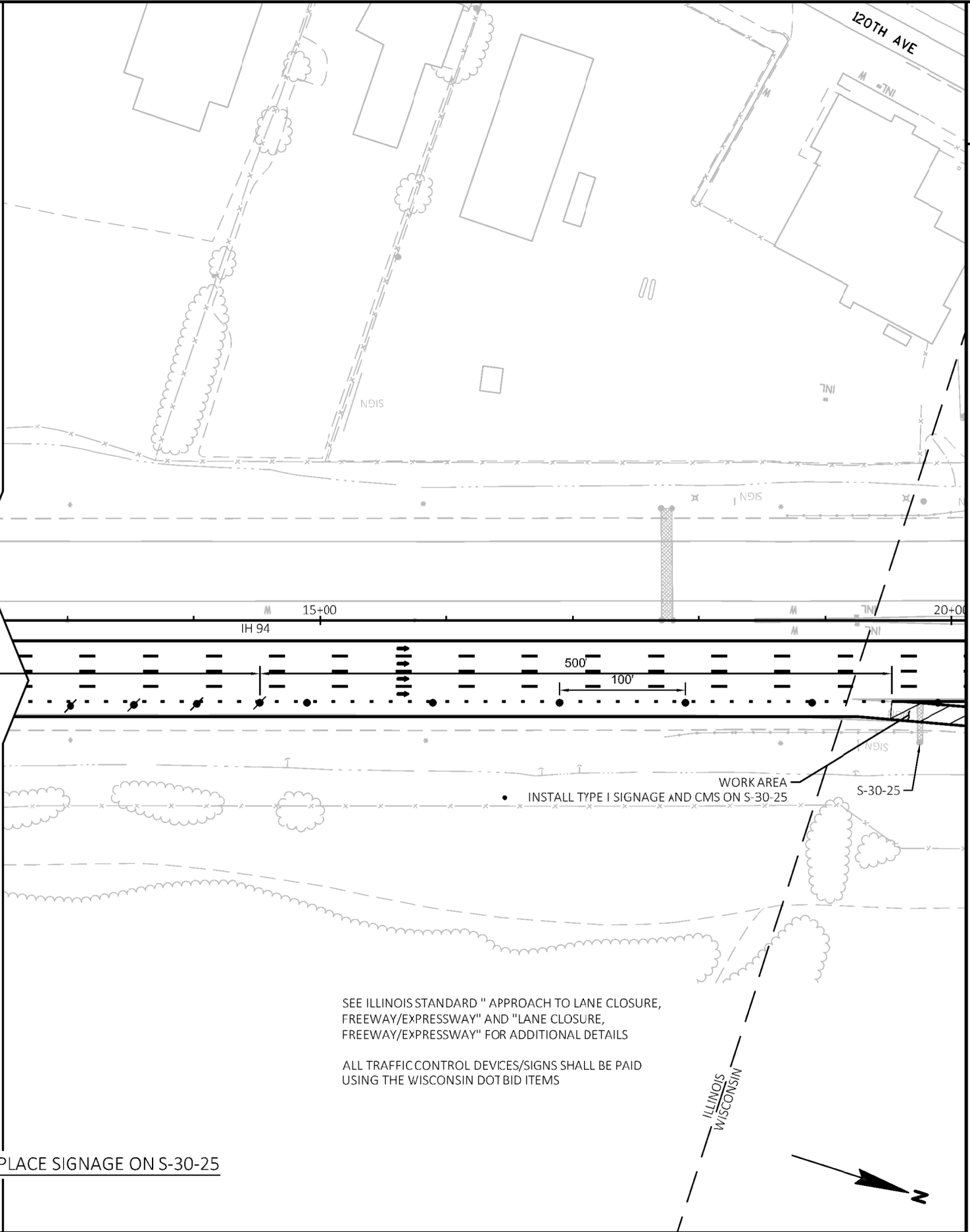
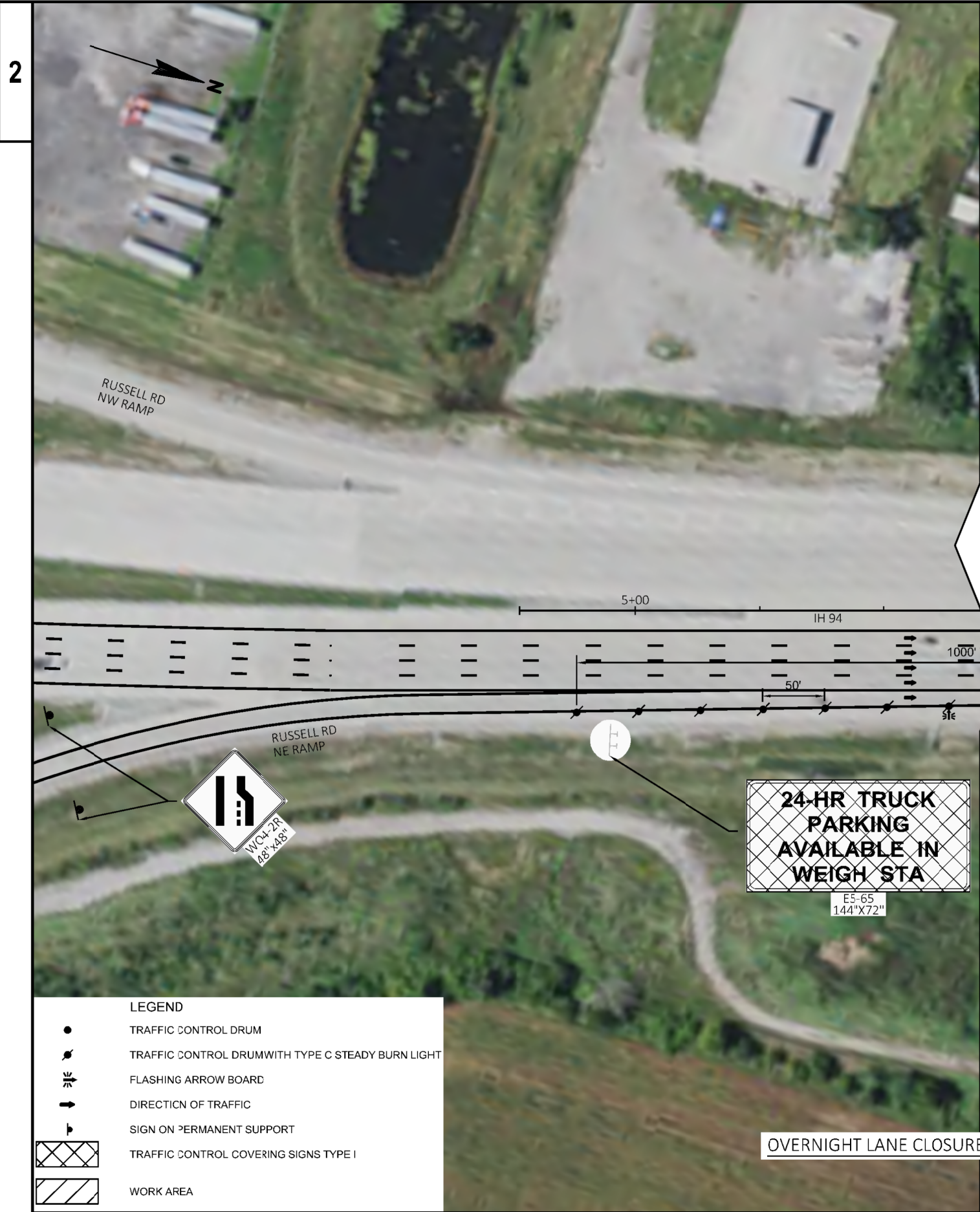
OPEN / CLOSED

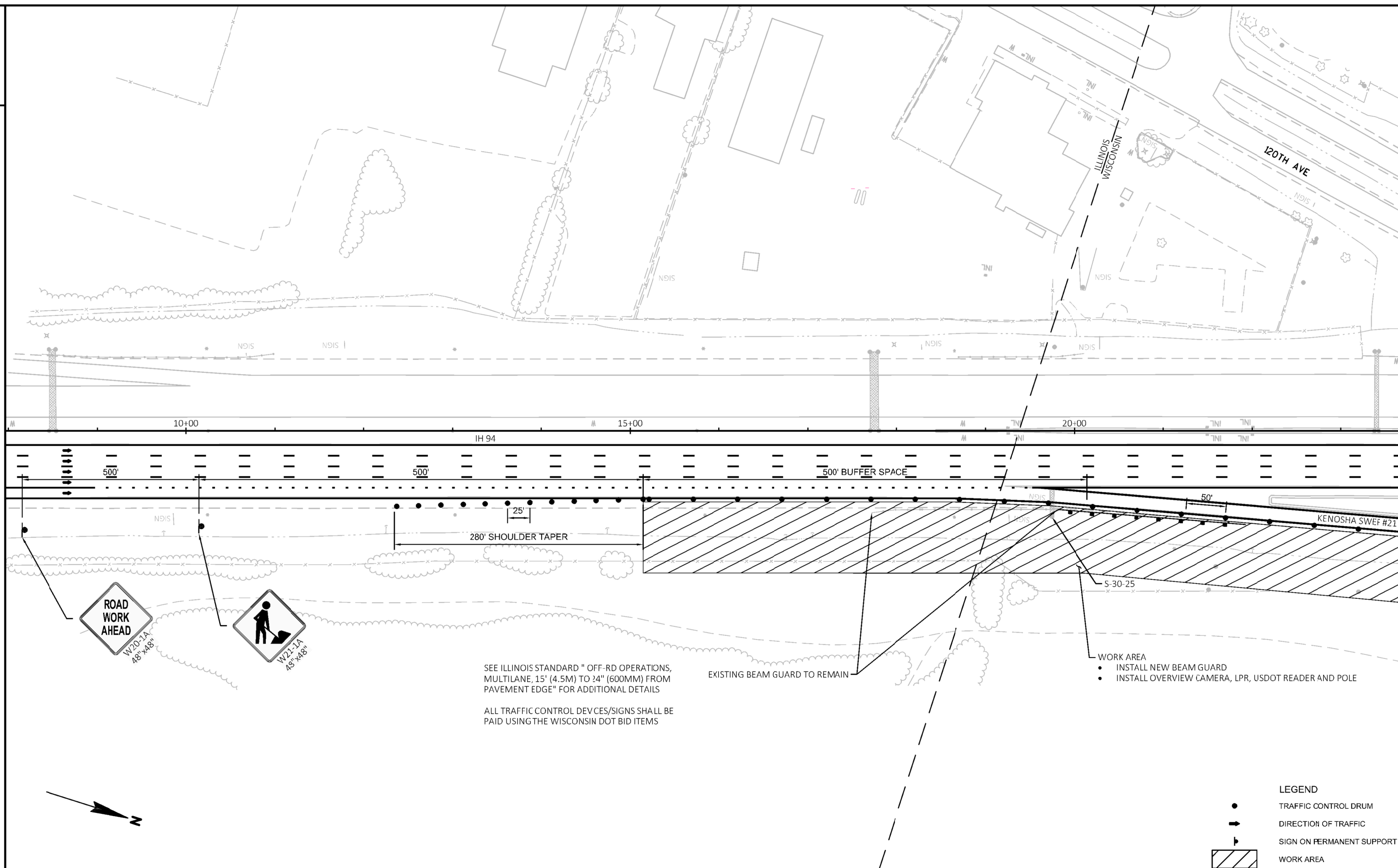
REMOVE
(SEE ELEC PLAN FOR REMOVAL
OF ELECTRONIC SIGN)











PROJECT NO: 1030-31-72

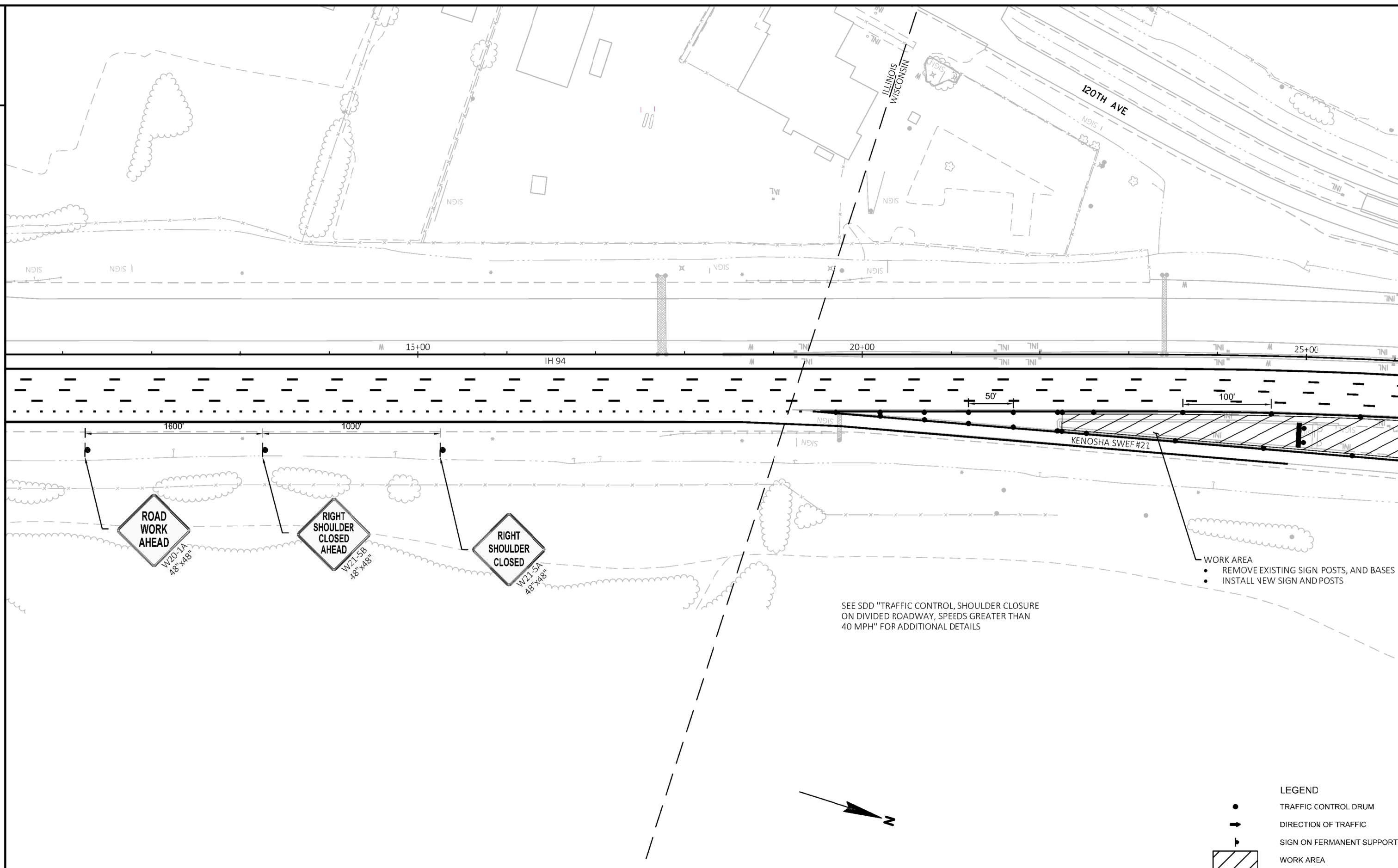
HWY: IH 94

COUNTY: KENOSHA

TRAFFIC CONTROL

SHEET

E



PROJECT NO: 1030-31-72

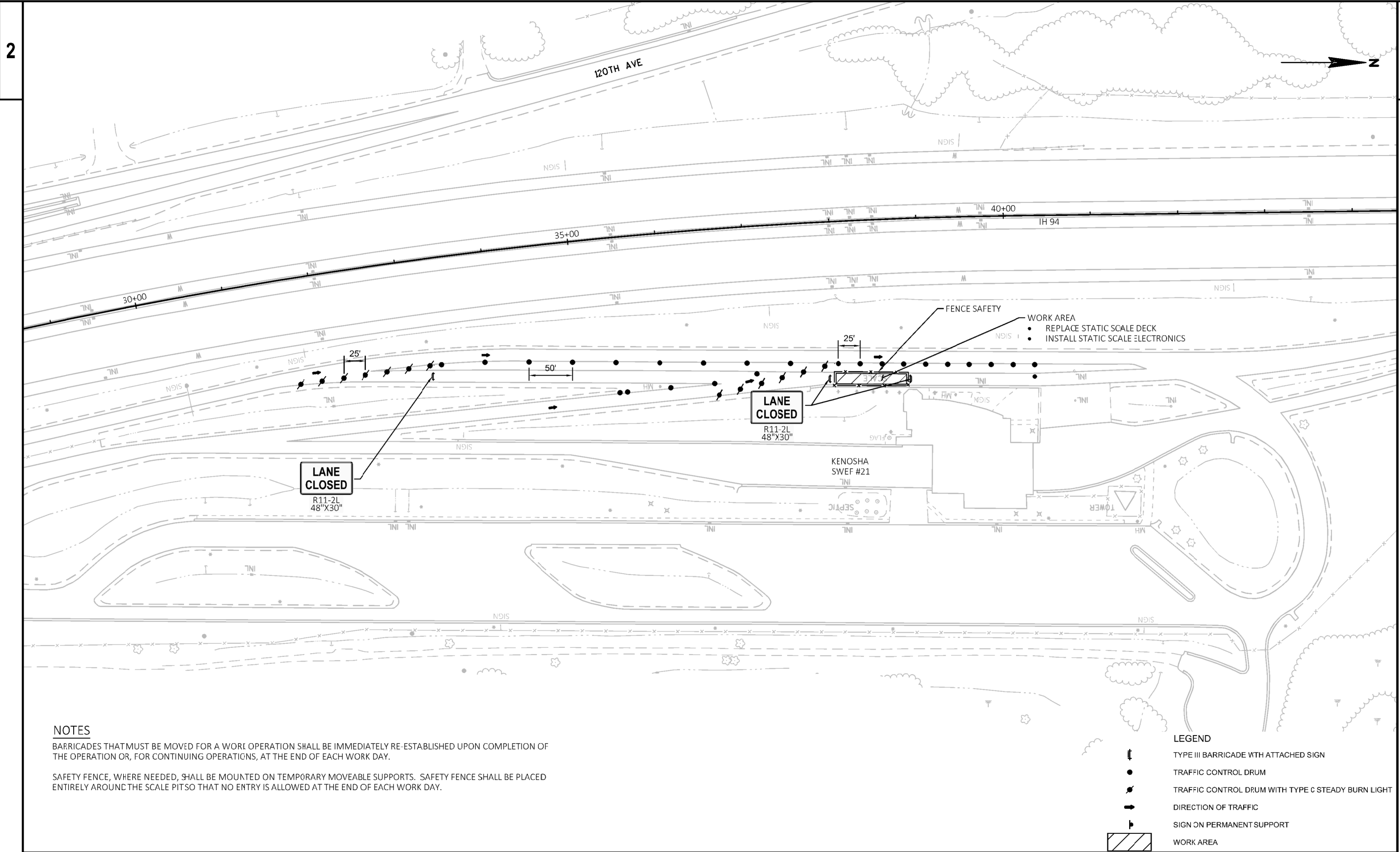
HWY: IH 94

COUNTY: KENOSHA

TRAFFIC CONTROL

SHEET

E



NOTES

BARRICADES THAT MUST BE MOVED FOR A WORK OPERATION SHALL BE IMMEDIATELY RE-ESTABLISHED UPON COMPLETION OF THE OPERATION OR, FOR CONTINUING OPERATIONS, AT THE END OF EACH WORK DAY.

SAFETY FENCE, WHERE NEEDED, SHALL BE MOUNTED ON TEMPORARY MOVEABLE SUPPORTS. SAFETY FENCE SHALL BE PLACED ENTIRELY AROUND THE SCALE PIT SO THAT NO ENTRY IS ALLOWED AT THE END OF EACH WORK DAY.

LEGEND

- TYPE III BARRICADE WITH ATTACHED SIGN
- TRAFFIC CONTROL DRUM
- TRAFFIC CONTROL DRUM WITH TYPE C STEADY BURN LIGHT
- DIRECTION OF TRAFFIC
- SIGN ON PERMANENT SUPPORT
- WORK AREA

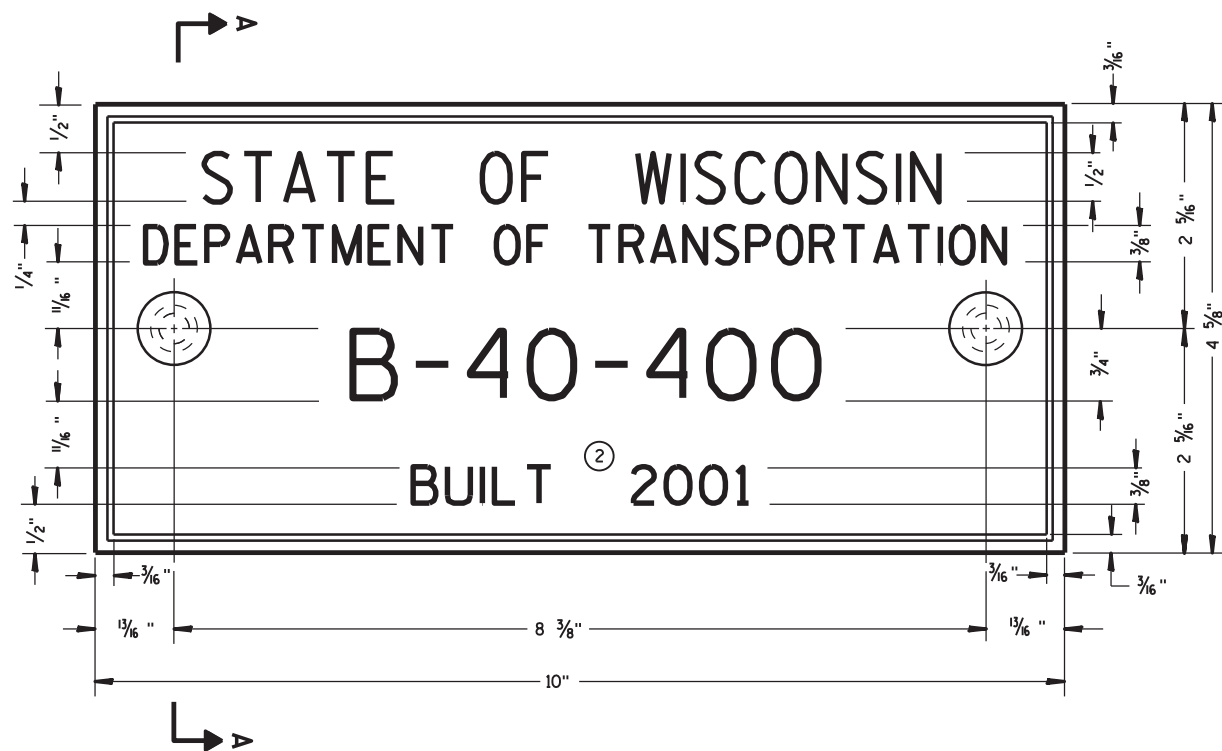
TYPE I & II PERMANENT SIGNING -

1030-31-72 Kenosha Weigh station signing IH 41 -94

SIGN NO.	SIGN CODE & SIZE	SIGN TYPE	SIGN MESSAGE	TYPE II SIGN SIZE W x H [IN.] x [IN.]	637.2210	638.2602	638.3000	634.0622	638.2102	MOUNT ON SAME POST AS SIGN #	REMARKS / NEW SIGN LOCATION	TYPE I SIGN SIZE W x H [FT.] x [FT.]	637.1220	638.2601	638.3100	STEEL POST TYPE	636.0100	636.0500	635.0200	INFO ONLY-POST LENGTHS TO BE VERIFIED BY CONTRACTOR			
					SIGNS	REMOVING	REMOVING	POSTS	MOVE				SIGNS	REMOVING	REMOVING		SIGN	SIGN	SUPPORTS	POST NO 1 LENGTH [FT]	POST NO 2 LENGTH [FT]	OFF SET DISTANCE [FT]	DIST BTWN POSTS "S" [FT]
					TYPE II REFLC H [SF]	SIGNS TYPE II [EA]	SMALL SIGN SUPPORTS [EA]	WOOD 4" X 6" X 22' EA	SIGNS TYPE II [EA]				SIGNS TYPE I REFLC SH [SF]	STR STEEL SIGN SUPPORTS [EA]	SUPPORTS CONCRETE MASONRY [CY]		SUPPORTS STEEL REINF. [LBS]	SUPPORTS STEEL HS [EST.LBS]					
1	E5-57E (5)	I	WEIGH STATION RIGHT LANE								SEE ELECTRICAL PLANS FOR REMOVAL OF DMS AND CONDUIT AND WIRE. I BEAM CONNECTIONS TO DMS INCIDENTAL TO THIS SIGN. OFFSET DISTANCE SHALL BE 30 FEET	12 x 5	60.000	1	2	B	1.6	98	1000				
2	NONE	I	WEIGH STATION EXIT ONLY (TILT ARROW RIGHT)								SEE ELECTRICAL PLANS FOR INSTALLATION OF DMS AND CONDUIT AND WIRE. I BEAM CONNECTIONS LONG ENOUGH TO ACCOUNT FOR DMS SHALL BE FURNISHED INCIDENTAL TO THIS SIGN. REPLACE I BEAMS- INCIDENTAL. S-30-25 EXISTING CANTILEVER SIGN BRIDGE TRUSS	15 x 7	105.00	1									
3	E5-58(5)	II	WEIGH STATION TILT ARROW RIGHT	90 x 72	45.000			3			EXISTING SIGN IS TYPE I, NEW SIGN IS TYPE II AND WIL BE ON WOOD POSTS EXISTING POSTS ARE I BEAMS			1	2								
UNDISTRIBUTED						10	2		1														
TOTALS					45.000	10	2	3	1				165.000	3	4		1.6	98	1000				

FENCE SAFETY	
	616.0700.S
LOCATION	(LF)
KENOSHA SWEF 21	250
TOTAL	250

TRAFFIC CONTROL							
	643.0300	643.0420	643.0705	643.0715	643.0800	643.0900	643.0910
			WARNING	WARNING			COVERING
		BARRICADES	LIGHTS	LIGHTS	ARROW		SIGNS
		TYPE III	TYPE A	TYPE C	BOARDS	SIGNS	TYPE I
LOCATION	DRUMS	(DAY)	(DAY)	(DAY)	(DAY)	(DAY)	(EACH)
KENOSHA SWEF 21	2,000	150	300	700	1	200	1
TOTAL	2,000	150	300	700	1	200	1



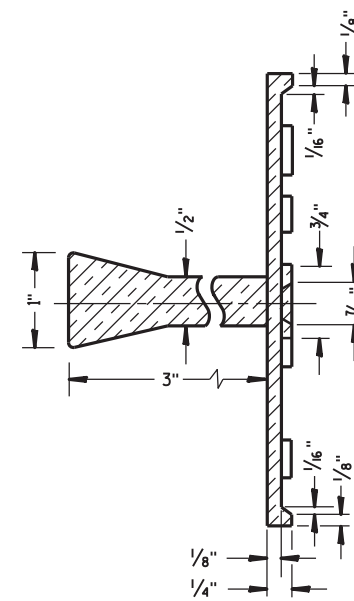
TYPICAL NAME PLATE
(BRIDGES, CULVERTS, AND RETAINING WALLS)

GENERAL NOTES

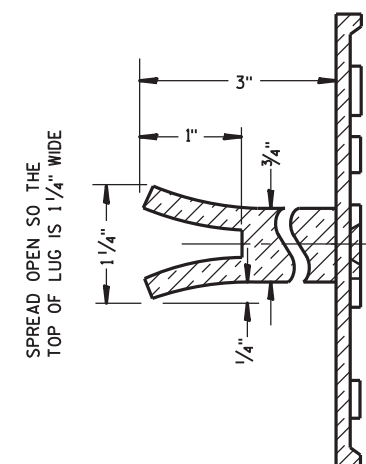
NAME PLATES TO BE INSTALLED ON BRIDGES, CULVERTS, AND RETAINING WALLS SHALL CONFORM TO THE REQUIREMENTS OF SECTION 502.3.11 OF THE STANDARD SPECIFICATIONS.

THE BRIDGE NUMBER AND YEAR BUILT SHOWN ON THIS DRAWING ARE EXAMPLES ONLY. SEE CONSTRUCTION PLANS FOR INDIVIDUAL NUMBERING AND YEAR BUILT.

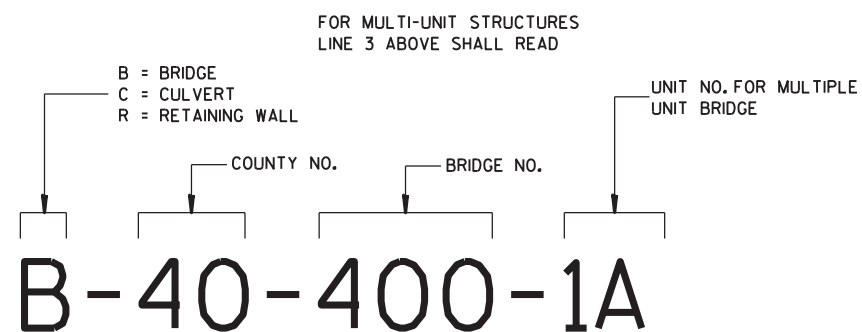
- 1 EPOXY RESIN SHALL BE FROM AN APPROVED MANUFACTURER AND USED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
- 2 REHABILITATION OF AN EXISTING STRUCTURE SHOULD USE THE DATE OF ORIGINAL STRUCTURE CONSTRUCTION.



SECTION A-A

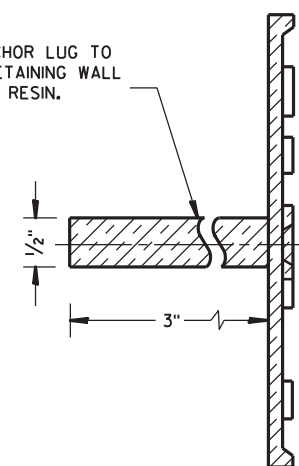


ALTERNATE LUG



**NUMBERING DESIGNATION
MULTI-UNIT STRUCTURES**

- 1 ADHERE ANCHOR LUG TO PRECAST RETAINING WALL WITH EPOXY RESIN.



ALTERNATE LUG
(FOR ATTACHMENT TO PRECAST STRUCTURES)

**NAME PLATE
(STRUCTURES)**

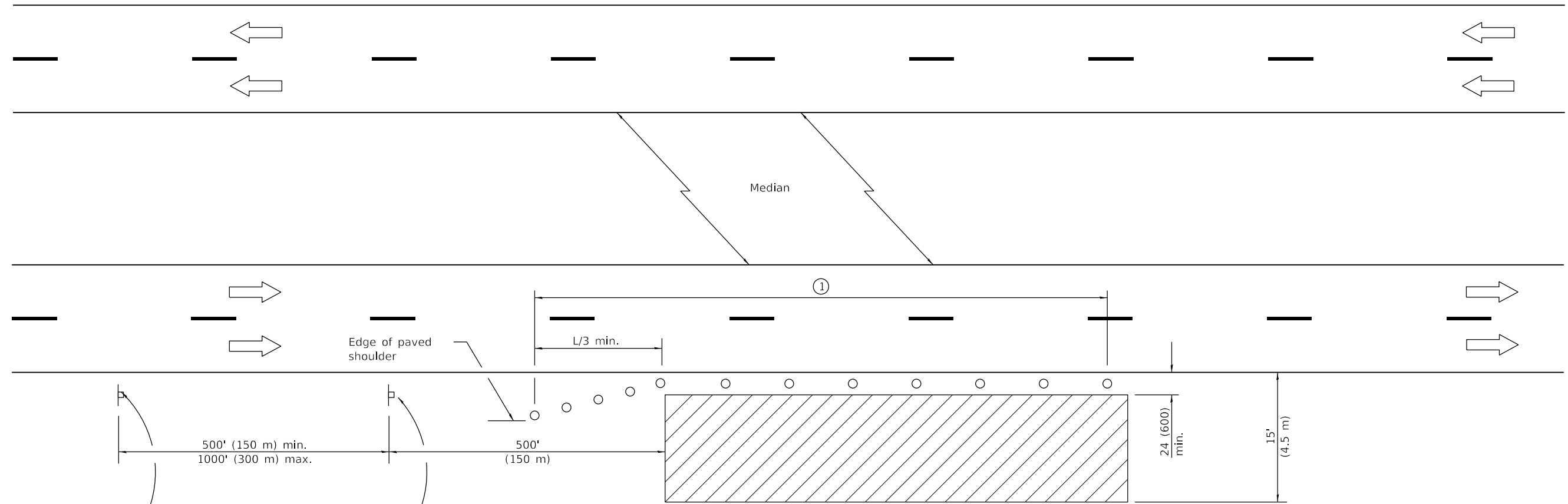
STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

APPROVED

3/26/10
DATE

FHWA

/S/ Scot Becker
CHIEF STRUCTURAL DEVELOPMENT ENGINEER



For contract construction projects



W20-1103(0)-48



W21-1(0)-48

For maintenance and utility projects



W20-1(0)-48

TYPICAL APPLICATIONS

- Utility operations
- Culvert extensions
- Side slope changes
- Guardrail installation and maintenance
- Delineator installation
- Landscaping operations
- Shoulder repair
- Sign installation and maintenance

① When the work operation exceeds one hour, cones, drums or barricades shall be placed at 25' (8 m) centers for L/3 distance, and at 50' (15 m) centers through the remainder of the work area.

SYMBOLS

- Work area
- Sign
- Cone, drum or barricade

GENERAL NOTES

This Standard is used where any vehicles, equipment, workers or their activities will encroach in the area 15' (4.5 m) to 24' (600) from the edge of pavement.

Calculate L as follows:

SPEED LIMIT	FORMULAS	
	English	(Metric)
40 mph (70 km/h) or less:	$L = \frac{WS^2}{60}$	$L = \frac{WS^2}{150}$
45 mph (80 km/h) or greater:	$L = (W)(S)$	$L = 0.65(W)(S)$
W = Width of offset in feet (meters).		
S = Normal posted speed mph (km/h).		

All dimensions are in inches (millimeters) unless otherwise shown.

Illinois Department of Transportation

PASSED
April 1, 2016

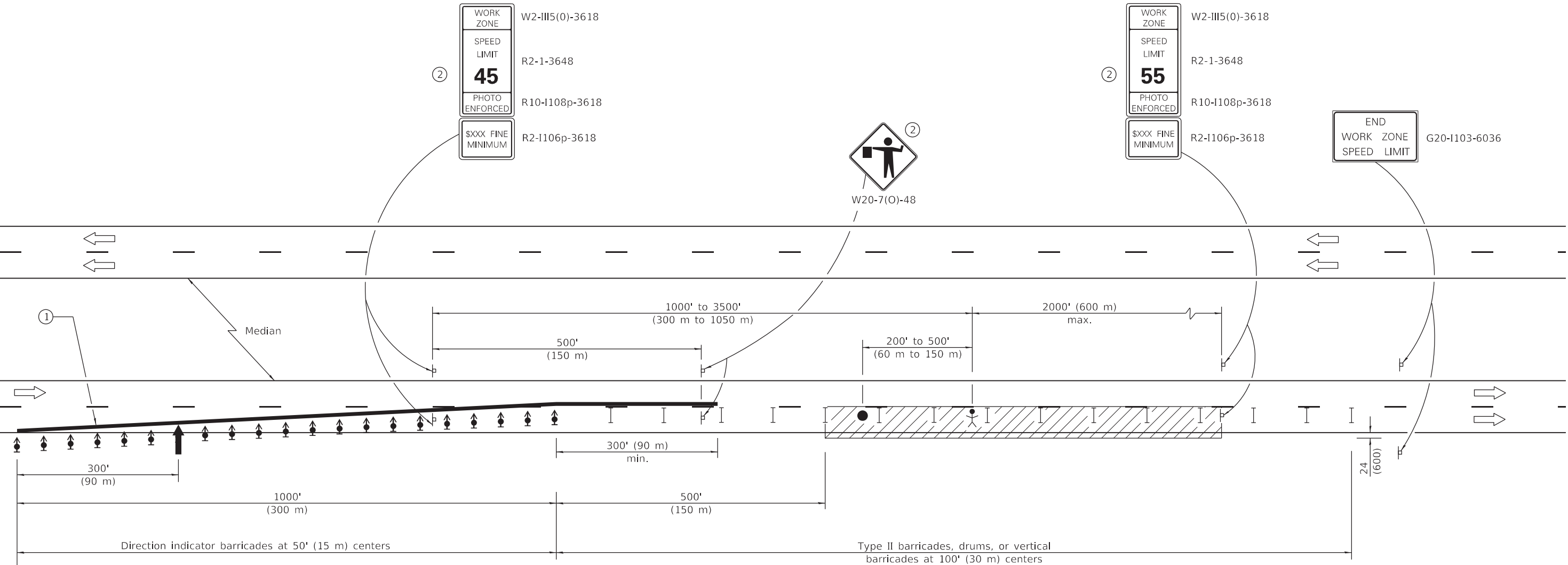
APPROVED
April 1, 2016

ISSUED 1-1-97
ENGINEER OF SAFETY ENGINEERING
ENGINEER OF DESIGN AND ENVIRONMENT

DATE	REVISIONS
4-1-16	Corrected typo in title.
1-1-14	Revised workers sign number to agree with current MUTCD.

OFF-RD OPERATIONS, MULTILANE,
15' (4.5 m) TO 24" (600 mm)
FROM PAVEMENT EDGE

STANDARD 701101-05



SYMBOLS

- ↑ Arrow board
- ▨ Work area
- ⚓ Worker
- ⌋ Sign
- ⬆ Direction indicator barricade with steady burn monodirectional light
- ⌈ Type II barricade, drum, or vertical barricade
- Flagger with traffic control sign

- ① ReflectORIZED temporary pavement marking tape shall be placed throughout the taper and for 300' (90 m) along-side the work area when the closure time is greater than fourteen days. The edge line shall be white for right lane closure and yellow for left lane closures.
- ② Work Zone speed limit signs and FLAGGER signs shall be moved as necessary to maintain the required spacing between the signs and the workers in each separate work activity. Work Zone Speed Limit 55 Photo Enforced sign shall be omitted when the work area dictates placement of the sign array within 500' (150 m) of the End Work Zone Speed Limit Sign.

GENERAL NOTES

This Standard is used where at any time any vehicle, equipment, workers or their activities will encroach on the lane adjacent to the shoulder, or on the shoulder within 24 (600) of the edge of pavement.

This Standard must always be used in combination with Standard 701400.

This Standard also applies when work is being performed in the left lane. Under these conditions, the setup would be a mirror image to what is shown.

A check barricade shall be placed in the middle of the closed lane and at the shoulder at 1000' (300 m) centers.

All dimensions are in inches (millimeters) unless otherwise shown.

DATE	REVISIONS	LANE CLOSURE, FREEWAY / EXPRESSWAY
1-1-18	Omitted lights in tangent.	
		STANDARD 701401-11
1-1-17	Revised END WORK ZONE	
	SPEED LIMIT sign from	
	orange to white background.	

Illinois Department of Transportation

PASSED

January 1, 2018

ENGINEER OF SAFETY PROG. AND ENGINEERING

APPROVED

January 1, 2018

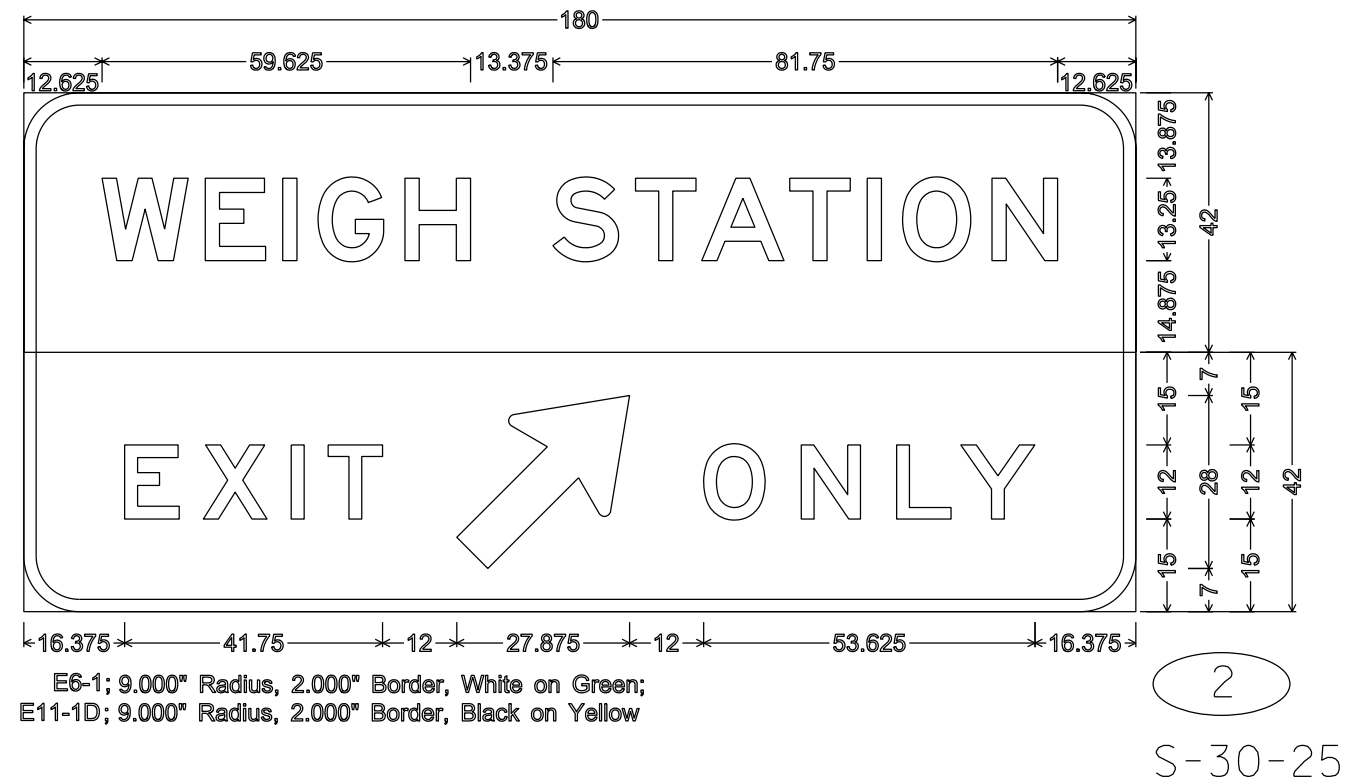
ENGINEER OF DESIGN AND ENVIRONMENT

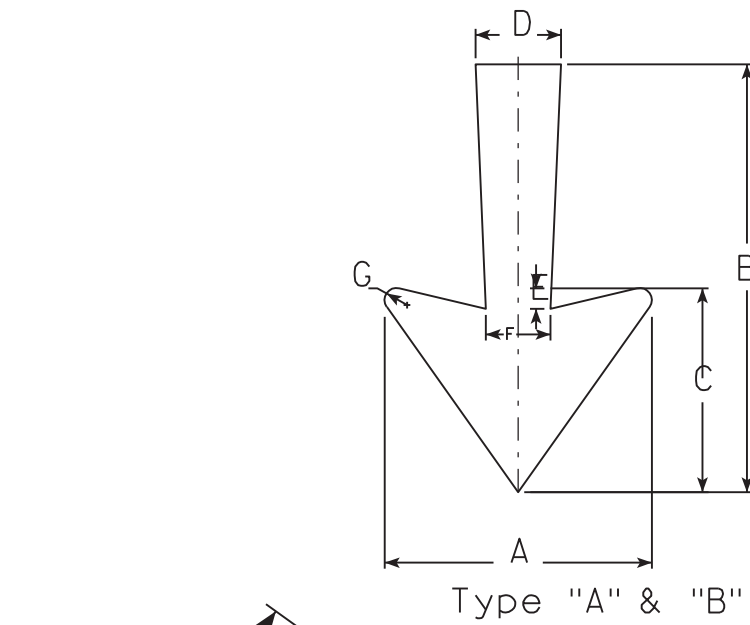
ISSUED 1-1-97

See Standard 701400 for approach
Start of lane closure taper

NOTES

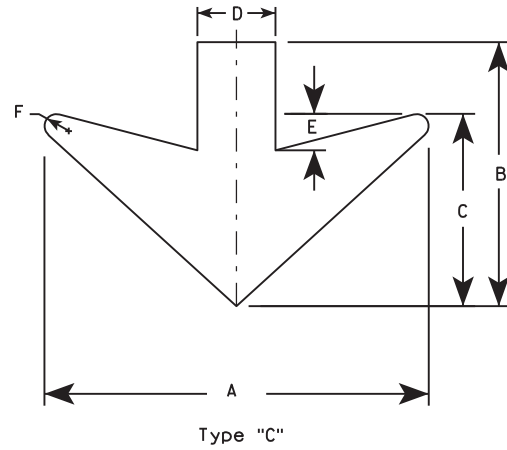
1. All Signs Type I - Type SH Reflective
2. Color:
Background - Green
Message - White
3. Message Series - E
4. Exit Only Panel is on Type F Yellow Reflective Sheeting
with Black Non-Reflective message



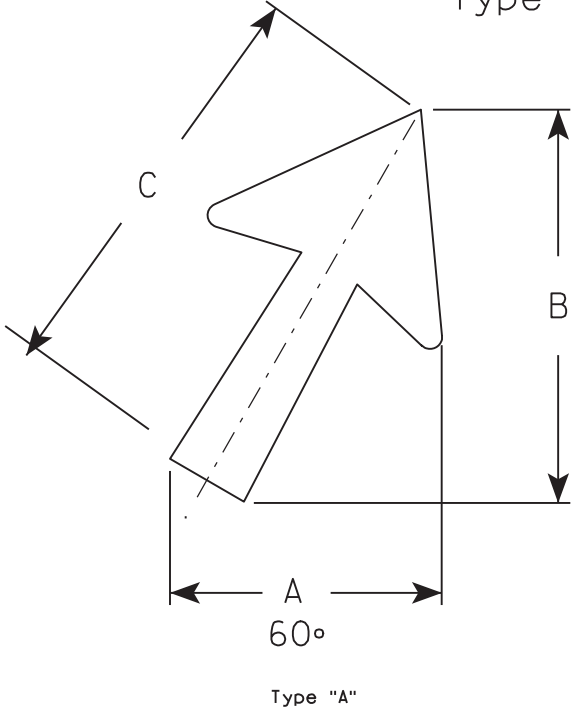


Type "A"							
Copy Size	A	B	C	D	E	F	G
13.33 u.c. 10", 12" Caps	18 ¼	29 ¼	14	6	1 ½	4 ½	¾
16" U. C.	22 ¼	35 ⅝	17	7 ⅛	1 ¾	5 ⅜	1

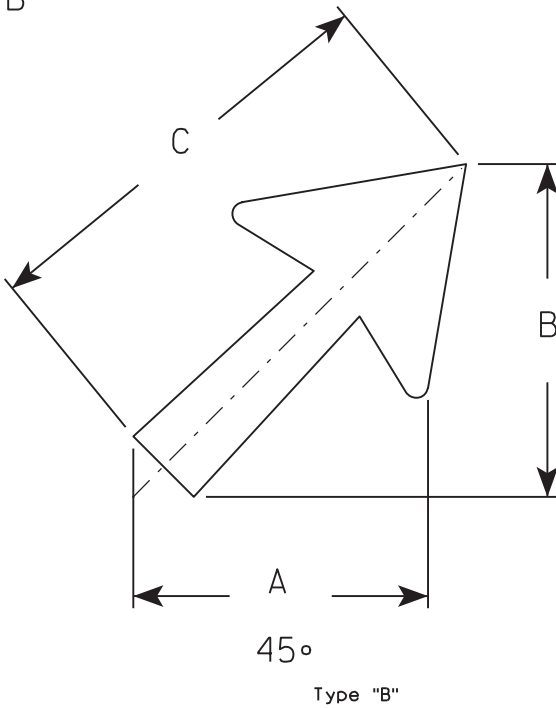
Type "B"							
Copy Size	A	B	C	D	E	F	G
10" Caps	14 ¼	17 ¼	9 ⅞	4 ½	1 ⅜	3 ⅜	¾
13.33 u.c. 12" Caps	17 ½	20 ¼	11 ¾	5 ⅝	1 ½	4 ⅜	⅞
16" U. C.	21 ⅞	25	14 ¼	6 ¾	1 ¾	5	1



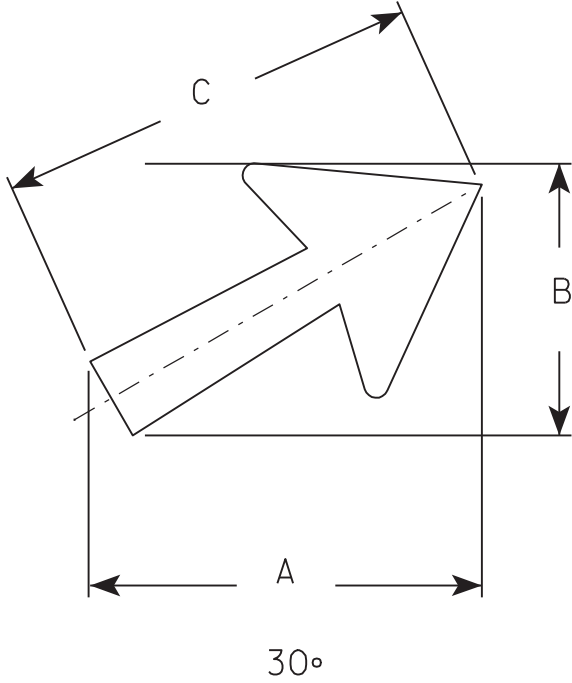
Type "C"						
Copy Size	A	B	C	D	E	F
Overhead	32	22	16	6 ½	3	1
Minimum	24	16	12 ¼	5	1 ⅝	¾



Angle	Arrow Size	A	B	C
60°	10.67" - 13" U.C. 10"- 12" Caps	18 ½	27	29 ¼
	15" Caps - 16" U.C.	22 ⅝	32 ¾	35 ⅝
45°	10.67" - 13" U.C. 10"- 12" Caps	23	23	29 ¼
	15" Caps - 16" U.C.	28	28	35 ⅝
30°	10.67" - 13" U.C. 10"- 12" Caps	27	18 ½	29 ¼
	15" Caps - 16" U.C.	32 ¾	22 ⅝	35 ⅝



Angle	Arrow Size	A	B	C
60°	8" - 10" Caps, 10.67 U.C.	12 ½	16 ⅛	17 ¼
	12" Caps - 13" U.C.	15 ½	19	20 ¼
	15" Caps - 16" U.C.	19 ⅛	23 ½	25
45°	8" - 10" Caps, 10.67 U.C.	14	14	17 ¼
	12" Caps - 13" U.C.	16 ⅝	16 ⅝	20 ¼
	15" Caps - 16" U.C.	20 ⅜	20 ⅜	25
30°	8" - 10" Caps, 10.67 U.C.	16 ⅛	12 ½	17 ¼
	12" Caps - 13" U.C.	19	15 ½	20 ¼
	15" Caps - 16" U.C.	23 ½	19 ⅛	25



NOTES

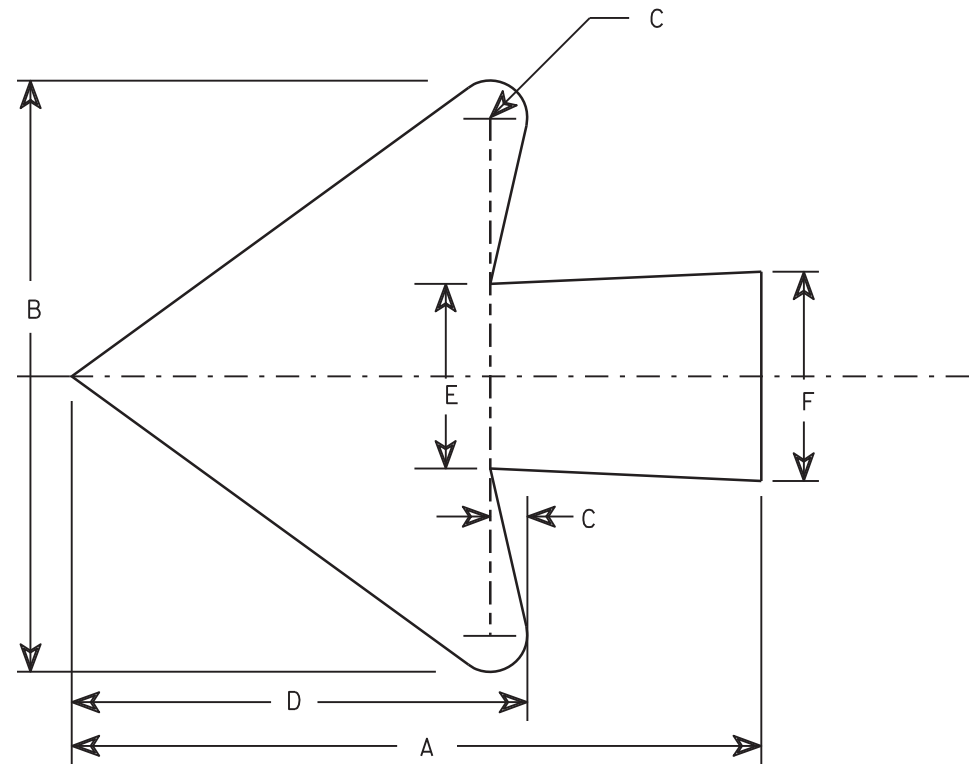
- Arrows to be of same material as other message units on each sign.
- Taper should be held constant for longer or shorter shaft lengths on Type "A" & "B" arrows.

STANDARD ARROWS
FOR LARGE GUIDE SIGNS

WISCONSIN DEPT OF TRANSPORTATION

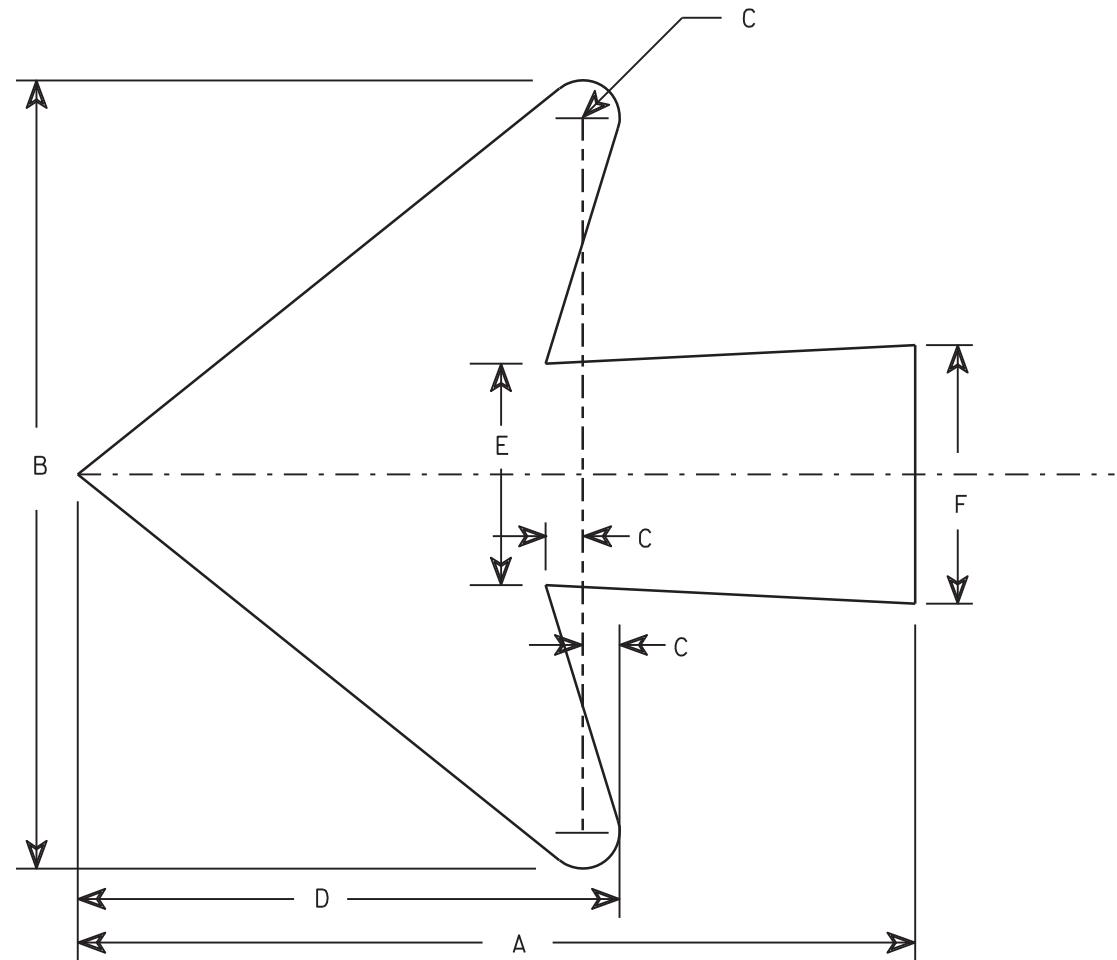
APPROVED 
for State Traffic Engineer

DATE 10/8/82 PLATE NO. A1-1.4



Lower Case Copy Size	Right or Left	A		B	C	D	E	F
		* 2 Town	* 3 Town					
3¾ Series C	7	11	18	6	¾	4⅝	1⅞	2⅛

* Indicates Ahead and Tilt for
2 & 3 Town applications.

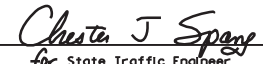


Lower Case Copy Size	Right or Left	A		B	C	D	E	F
		* 2 Town	* 3 Town					
4½ Series D&E	8½	11	18	8	¾	5½	2¼	2⅝
6 Series D&E	12	18	24	10¾	½	7⅜	3¼	3½
8 Series E	15½	24	30	14¼	¾	9¾	4¼	4½

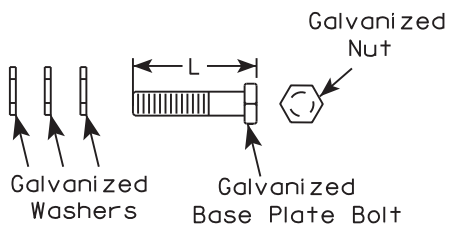
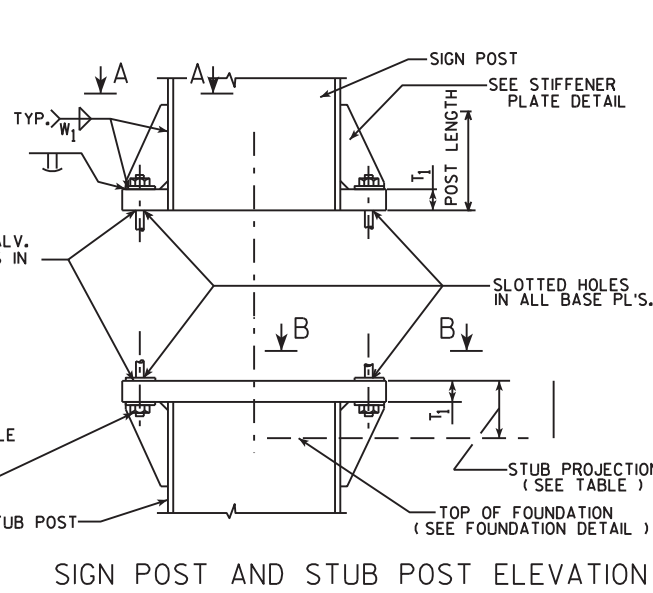
* Indicates Ahead and Tilt for
2 & 3 Town applications.

STANDARD ARROWS
FOR D1 GUIDE SIGNS

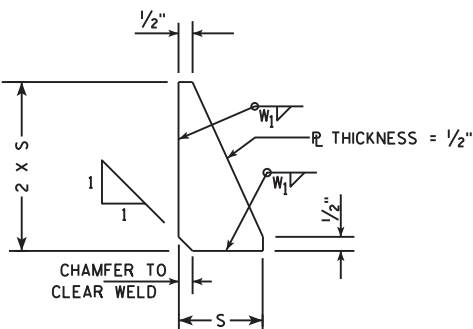
WISCONSIN DEPT OF TRANSPORTATION

APPROVED 
for State Traffic Engineer

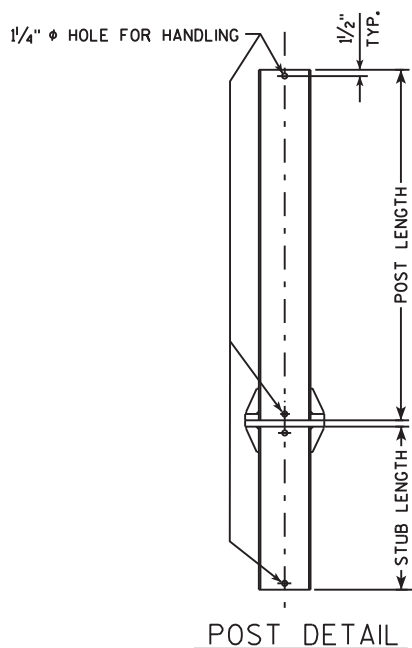
DATE 8/10/92 PLATE NO. A1-2.3



H. S. BOLT WITH HEX HD. HEX NUT & 3 WASHERS WITH EACH BOLT. SEE TABLE FOR BOLT DIAMETER AND TORQUE. SEE BOLTING PROCEDURE.



STIFFENER PLATE DETAIL
(SEE TABLE FOR DIMENSIONS)



POST DETAIL

FURNISH 2 @ .012" ± THICK AND 2 @ .032" ± THICK SHIMS PER POST. SHIMS SHALL BE FABRICATED FROM BRASS SHIM STOCK OR STRIP CONFORMING TO A.S.T.M. - B36.

SHIM DETAIL

QUANTITIES FOR 1 FOOTING			
	CONC. MASONRY C.Y.	REINF. STEEL LBS.	
A	0.6	34	
B	0.8	49	
C	0.9	50	
D	0.9	56	
E	1.0	62	

⑦

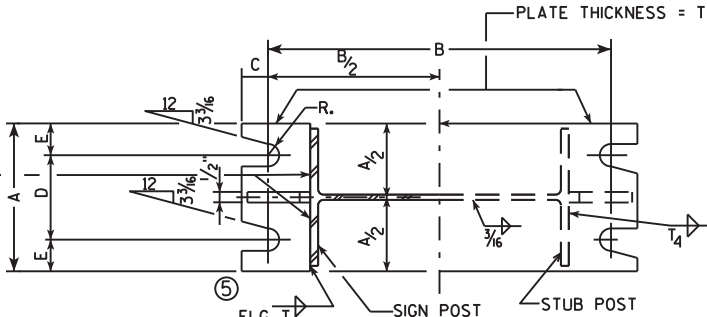
REINF.	TYPE	#3		#4	
		8 @ 4'-5"	5 @ 6'-3"	8 @ 6'-3"	7 @ 6'-3"
⑦	A	8 @ 4'-5"	5 @ 6'-3"	8 @ 6'-3"	7 @ 6'-3"
	B	8 @ 6'-5"	7 @ 6'-3"	8 @ 6'-3"	7 @ 6'-3"
	C	8 @ 6'-11"	7 @ 6'-3"	8 @ 6'-3"	7 @ 6'-3"
	D	8 @ 7'-5"	8 @ 6'-3"	8 @ 6'-3"	7 @ 6'-3"
⑦	E	8 @ 7'-11"	9 @ 6'-3"	8 @ 6'-3"	7 @ 6'-3"

					BASE CONNECTION DATA TABLE											FOUNDATION DATA			
L	X	TYPE	POST SIZE	WEIGHT PER FT	BOLT SIZE & TORQUE	A	B	C	D	E	T ₁	T ₄	W ₁	R	S	STUB LENGTH	STUB PROJECTION	SHAFT DIAMETER	SHAFT LENGTH
3 ¾	④	A	W10"X12.0	12.0 LBS	¾" φ @ 75"-FT.	5¼"	1'-0 ⅜"	⅞"	3½"	⅞"	1"	⅜"	⅝"	⅓₂"	2⅝"	3'-6"	3"	2'-0 φ	5'-0"
4 ¾	④	B	W12"X16.0	16.0 LBS	⅞" φ @ 85"-FT.	5½"	1'-4¼"	1"	3½"	1"	1¼"	¼"	⅝"	⅓₂"	3"	5'-6"	3"	2'-0 φ	7'-0"
5		C	W12"X19.0	19.0 LBS	⅞" φ @ 85"-FT.	5½"	1'-4¼"	1"	3½"	1"	1½"	⅝"	⅝"	⅓₂"	3"	6'-0"	3"	2'-0 φ	7'-6"
5		D	W12"X22.0	22.0 LBS	⅞" φ @ 85"-FT.	5½"	1'-4¼"	1"	3½"	1"	1½"	⅜"	⅝"	⅓₂"	3"	6'-6"	3"	2'-0 φ	8'-0"
5	③	E	W12"X26.0	26.0 LBS	1" φ @ 90"-FT.	7"	1'-4¼"	1¼"	4"	1½"	1½"	⅜"	⅝"	⅓₂"	3"	7'-0"	3"	2'-0 φ	8'-6"

① ⑥ ①

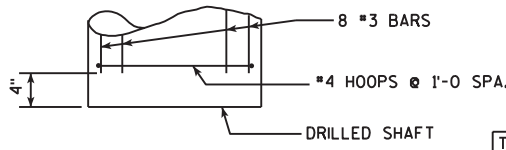
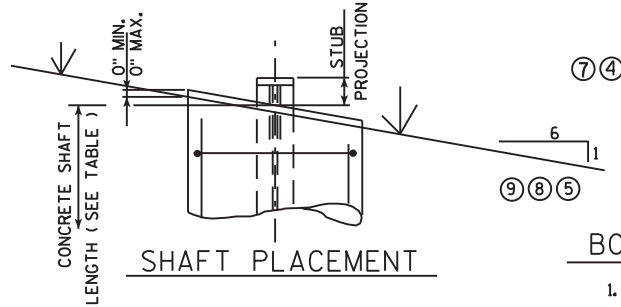
STRUCTURAL CARBON STEEL PAY WTS. (1POST) = K + (POST LENGTH X POST WT.)
"K" INCLUDES STUB, BASE PLATES, STIFFS., BOLTS, AND WASHERS.

FTG. T + 1/16"
FTG. T + 1/16"

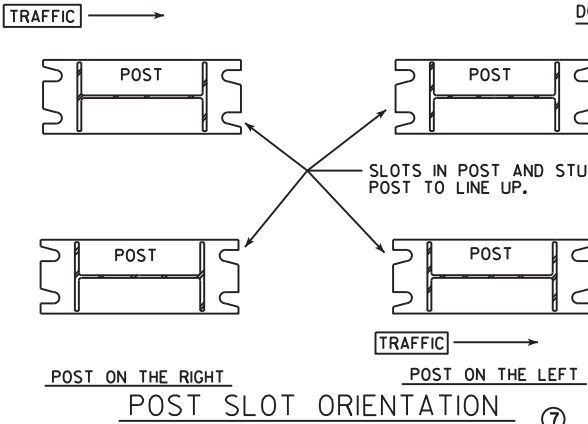


SECTION A-A

SECTION B-B



FOUNDATION DETAIL



POST SLOT ORIENTATION

DESIGN DATA

WIND PRESSURE = 75 M.P.H.
WIND COMPONENTS - NORMAL = 1.0 TRANSVERSE = 0.0
ICE LOAD = 3 P.S.F.
GROUP LOADS
1. DEAD 100
2. DEAD & WIND 140
3. DEAD, ICE & 1/2 WIND 140
ALLOWABLE SOIL PRESSURE = 1/2 T / SO. FT.
WIND LOAD WAS APPLIED TO THE AREA OF THE SIGN AND TO THE SUPPORTING MEMBERS.
ICE LOAD WAS APPLIED TO ONE FACE OF THE SIGN AND AROUND THE SURFACE OF THE SUPPORTING MEMBERS.

GENERAL NOTES

DRAWINGS SHALL NOT BE SCALED.
DESIGN CONFORMS WITH A.A.S.H.T.O. SPECIFICATIONS 1985.
ALL POSTS, POST STUBS & ATTACHMENTS SHALL BE A.S.T.M. A709 GRADE 50, GALVANIZED IN ACCORDANCE WITH ASTM A123.
THE POST, BASE PLATES, UPPER SIX INCHES OF STUB POST FLANGE SPLICE PLATE AND FUSE PLATE SHALL BE GALVANIZED AFTER FABRICATION.
FURNISH STEEL BOLTS, NUTS, AND WASHERS IN ACCORDANCE WITH SECTION 635 OF THE STANDARD SPECIFICATIONS.

BOLTING PROCEDURE - BASE CONNECTION

- ASSEMBLE SIGN POST TO STUB POST WITH BOLTS AND ONE OF THE FLAT WASHERS ON EACH BOLT BETW. PLATES.
 - SHIM AS REQ'D. TO PLUMB POST.
 - PRIOR TO BOLT TIGHTENING LUBRICATE BASE CONNECTION BOLTS WITH BEESWAX OR OTHER HIGH-WAX LUBRICANT.
 - TIGHTEN ALL BOLTS THE MAXIMUM POSSIBLE WITH 12" OR 15" WRENCH TO BED WASHERS & SHIMS AND TO CLEAN BOLT THREADS, THEN LOOSEN EACH BOLT IN TURN AND RETIGHTEN IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE. (SEE TABLE)
 - BURR THREADS AT JUNCTION WITH NUT USING A CENTER PUNCH TO PREVENT NUT LOOSENING.
- NOTE:
TIGHTEN THE HIGH STRENGTH BOLTS TO THE TORQUE SHOWN. DO NOT OVERTIGHTEN.

WISCONSIN DEPT OF TRANSPORTATION	
APPROVED	<i>Matthew R. Rauch</i> for State Traffic Engineer
DATE 8/22/17	PLATE NO. A3-1.17
⑩ 1-21-14	LUBRICATION OF BASE BOLTS
⑨ 4-26-11	REMOVE NON-GALVANIZED
⑧ 10-30-96	NOT GALVANIZED/GALVANIZED
⑦ 10-30-92	QUANT., A588 EXCEPT., ADD SLOT VIEW
⑥ 8-24-87	BASE CONN. WELD
⑤ 10-13-81	BASE CONN. WELD & FUSE R WASHERS
④ 10-19-79	POST A & B, A572 GR. 50, & K
② 11-28-78	"K" ③ 4-23-79 TYPE "E"
① 5-4-78	T ₁ · T ₂ & W ₁
NO.	DATE
REVISION	
STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS	
TYPE A, B, C, D, & E	
CONST. SPEC.	2011
DRAWN BY	JPH
PLANS CK'D.	
FTG. & SIGN SUPPORT DETAILS GROUND MOUNT BREAK-AWAY SIGNS	
SHEET	

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VERITCAL DIMENSION ⇄

HORIZONTAL DIMENSION ⇄

	2.5 ft.	3 ft.	3.5 ft.	4 ft.	4.5 ft.	5 ft.	5.5 ft.	6 ft.	6.5 ft.	7 ft.	7.5 ft.	8 ft.	8.5 ft.	9 ft.	9.5 ft.	10 ft.	10.5 ft.	11 ft.	11.5 ft.	12 ft.	12.5 ft.	13 ft.	13.5 ft.	14 ft.	14.5 ft.	15 ft.	15.5 ft.	16 ft.		
10 ft.	25 Sq. Ft	30 Sq. Ft	35 Sq. Ft	40 Sq. Ft	45 Sq. Ft	50 Sq. Ft	55 Sq. Ft	60 Sq. Ft	65 Sq. Ft	70 Sq. Ft	75 Sq. Ft	80 Sq. Ft	85 Sq. Ft	90 Sq. Ft	95 Sq. Ft	100 Sq. Ft	105 Sq. Ft	110 Sq. Ft	115 Sq. Ft	120 Sq. Ft	125 Sq. Ft	130 Sq. Ft	135 Sq. Ft	140 Sq. Ft	145 Sq. Ft	150 Sq. Ft	155 Sq. Ft	160 Sq. Ft		
11 ft.	27.5 Sq. Ft	33 Sq. Ft	38.5 Sq. Ft	44 Sq. Ft	49.5 Sq. Ft	55 Sq. Ft	60.5 Sq. Ft	66 Sq. Ft	71.5 Sq. Ft	77 Sq. Ft	82.5 Sq. Ft	88 Sq. Ft	93.5 Sq. Ft	99 Sq. Ft	104.5 Sq. Ft	110 Sq. Ft	115.5 Sq. Ft	121 Sq. Ft	126.5 Sq. Ft	132 Sq. Ft	137.5 Sq. Ft	143 Sq. Ft	148.5 Sq. Ft	154 Sq. Ft	159.5 Sq. Ft	165 Sq. Ft	170.5 Sq. Ft	176 Sq. Ft		
12 ft.	30 Sq. Ft	36 Sq. Ft	42 Sq. Ft	48 Sq. Ft	54 Sq. Ft	60 Sq. Ft	66 Sq. Ft	72 Sq. Ft	78 Sq. Ft	84 Sq. Ft	90 Sq. Ft	96 Sq. Ft	102 Sq. Ft	108 Sq. Ft	114 Sq. Ft	120 Sq. Ft	126 Sq. Ft	132 Sq. Ft	138 Sq. Ft	144 Sq. Ft	150 Sq. Ft	156 Sq. Ft	162 Sq. Ft	168 Sq. Ft	174 Sq. Ft	180 Sq. Ft	186 Sq. Ft	192 Sq. Ft		
13 ft.	32.5 Sq. Ft	39 Sq. Ft	45.5 Sq. Ft	52 Sq. Ft	58.5 Sq. Ft	65 Sq. Ft	71.5 Sq. Ft	78 Sq. Ft	84.5 Sq. Ft	91 Sq. Ft	97.5 Sq. Ft	104 Sq. Ft	110.5 Sq. Ft	117 Sq. Ft	123.5 Sq. Ft	130 Sq. Ft	136.5 Sq. Ft	143 Sq. Ft	149.5 Sq. Ft	156 Sq. Ft	162.5 Sq. Ft	169 Sq. Ft	175.5 Sq. Ft	182 Sq. Ft	188.5 Sq. Ft	195 Sq. Ft	201.5 Sq. Ft	208 Sq. Ft		
14 ft.	35 Sq. Ft	42 Sq. Ft	49 Sq. Ft	56 Sq. Ft	63 Sq. Ft	70 Sq. Ft	77 Sq. Ft	84 Sq. Ft	91 Sq. Ft	98 Sq. Ft	105 Sq. Ft	112 Sq. Ft	119 Sq. Ft	126 Sq. Ft	133 Sq. Ft	140 Sq. Ft	147 Sq. Ft	154 Sq. Ft	161 Sq. Ft	168 Sq. Ft	175 Sq. Ft	182 Sq. Ft	189 Sq. Ft	196 Sq. Ft	203 Sq. Ft	210 Sq. Ft	217 Sq. Ft	224 Sq. Ft		
15 ft.	37.5 Sq. Ft	45 Sq. Ft	52.5 Sq. Ft	60 Sq. Ft	67.5 Sq. Ft	75 Sq. Ft	82.5 Sq. Ft	90 Sq. Ft	97.5 Sq. Ft	105 Sq. Ft	112.5 Sq. Ft	120 Sq. Ft	127.5 Sq. Ft	135 Sq. Ft	142.5 Sq. Ft	150 Sq. Ft	157.5 Sq. Ft	165 Sq. Ft	172.5 Sq. Ft	180 Sq. Ft	187.5 Sq. Ft	195 Sq. Ft	202.5 Sq. Ft	210 Sq. Ft	217.5 Sq. Ft	225 Sq. Ft	232.5 Sq. Ft	240 Sq. Ft		
16 ft.	40 Sq. Ft	48 Sq. Ft	56 Sq. Ft	64 Sq. Ft	72 Sq. Ft	80 Sq. Ft	88 Sq. Ft	96 Sq. Ft	104 Sq. Ft	112 Sq. Ft	120 Sq. Ft	128 Sq. Ft	136 Sq. Ft	144 Sq. Ft	152 Sq. Ft	160 Sq. Ft	168 Sq. Ft	176 Sq. Ft	184 Sq. Ft	192 Sq. Ft	200 Sq. Ft	208 Sq. Ft	216 Sq. Ft	224 Sq. Ft	232 Sq. Ft	240 Sq. Ft	248 Sq. Ft	256 Sq. Ft		
17 ft.	42.5 Sq. Ft	51 Sq. Ft	59.5 Sq. Ft	68 Sq. Ft	76.5 Sq. Ft	85 Sq. Ft	93.5 Sq. Ft	102 Sq. Ft	110.5 Sq. Ft	119 Sq. Ft	127.5 Sq. Ft	136 Sq. Ft	144.5 Sq. Ft	153 Sq. Ft	161.5 Sq. Ft	170 Sq. Ft	178.5 Sq. Ft	187 Sq. Ft	195.5 Sq. Ft	204 Sq. Ft	212.5 Sq. Ft	221 Sq. Ft	229.5 Sq. Ft	238 Sq. Ft	246.5 Sq. Ft	255 Sq. Ft	263.5 Sq. Ft	272 Sq. Ft		
18 ft.	45 Sq. Ft	54 Sq. Ft	63 Sq. Ft	72 Sq. Ft	81 Sq. Ft	90 Sq. Ft	99 Sq. Ft	108 Sq. Ft	117 Sq. Ft	126 Sq. Ft	135 Sq. Ft	144 Sq. Ft	153 Sq. Ft	162 Sq. Ft	171 Sq. Ft	180 Sq. Ft	189 Sq. Ft	198 Sq. Ft	207 Sq. Ft	216 Sq. Ft	225 Sq. Ft	234 Sq. Ft	243 Sq. Ft	252 Sq. Ft	261 Sq. Ft	270 Sq. Ft	279 Sq. Ft	288 Sq. Ft		
19 ft.	47.5 Sq. Ft	57 Sq. Ft	66.5 Sq. Ft	76 Sq. Ft	85.5 Sq. Ft	95 Sq. Ft	104.5 Sq. Ft	114 Sq. Ft	123.5 Sq. Ft	133 Sq. Ft	142.5 Sq. Ft	152 Sq. Ft	161.5 Sq. Ft	171 Sq. Ft	180.5 Sq. Ft	190 Sq. Ft	199.5 Sq. Ft	209 Sq. Ft	218.5 Sq. Ft	228 Sq. Ft	237.5 Sq. Ft	247 Sq. Ft	256.5 Sq. Ft	266 Sq. Ft	275.5 Sq. Ft	285 Sq. Ft	294.5 Sq. Ft	304 Sq. Ft		
20 ft.	50 Sq. Ft	60 Sq. Ft	70 Sq. Ft	80 Sq. Ft	90 Sq. Ft	100 Sq. Ft	110 Sq. Ft	120 Sq. Ft	130 Sq. Ft	140 Sq. Ft	150 Sq. Ft	160 Sq. Ft	170 Sq. Ft	180 Sq. Ft	190 Sq. Ft	200 Sq. Ft	210 Sq. Ft	220 Sq. Ft	230 Sq. Ft	240 Sq. Ft	250 Sq. Ft	260 Sq. Ft	270 Sq. Ft	280 Sq. Ft	290 Sq. Ft	300 Sq. Ft	310 Sq. Ft	320 Sq. Ft		
21 ft.	52.5 Sq. Ft	63 Sq. Ft	73.5 Sq. Ft	84 Sq. Ft	94.5 Sq. Ft	105 Sq. Ft	115.5 Sq. Ft	126 Sq. Ft	136.5 Sq. Ft	147 Sq. Ft	157.5 Sq. Ft	168 Sq. Ft	178.5 Sq. Ft	189 Sq. Ft	199.5 Sq. Ft	210 Sq. Ft	220.5 Sq. Ft	231 Sq. Ft	241.5 Sq. Ft	252 Sq. Ft	262.5 Sq. Ft	273 Sq. Ft	283.5 Sq. Ft	294 Sq. Ft	304.5 Sq. Ft	315 Sq. Ft	325.5 Sq. Ft	336 Sq. Ft		
Type "A" (2 Posts) 1.2 CY Conc. 68 LBs Bar Steel					Type "B" (2 Posts) 1.6 CY Conc. 98 LBs Bar Steel										Type "C" (2 Posts) 1.8 CY Conc. 100 LBs Bar Steel					Type "D" (2 Posts) 1.8 CY Conc. 112 LBs Bar Steel					Type "C" (3 Posts) 2.7 CY Conc. 150 LBs Bar Steel					
STEEL POST SIZE "A" - W10" x 12" "B" - W12" x 16" "C" - W12" x 19" "D" - W12 x 22"																														

7

DETERMINATION OF HIGH STRENGTH
STRUCTURAL STEEL SIGN SUPPORT TYPE

WISCONSIN DEPT OF TRANSPORTATION

APPROVED Matthew R. Rauch
for State Traffic Engineer

DATE 3/03/10 PLATE NO. A3-2.2

PROJECT NO:

SHEET NO:

E

FILE NAME : C:\users\PROJECTS\tr_stdplate\A32.DGN

PLOT DATE : 05-MAR-2010 10:10

PLOT BY : di+jph

WISDOT/CADDs SHEET 42

VERTICAL DIMENSION ⇄

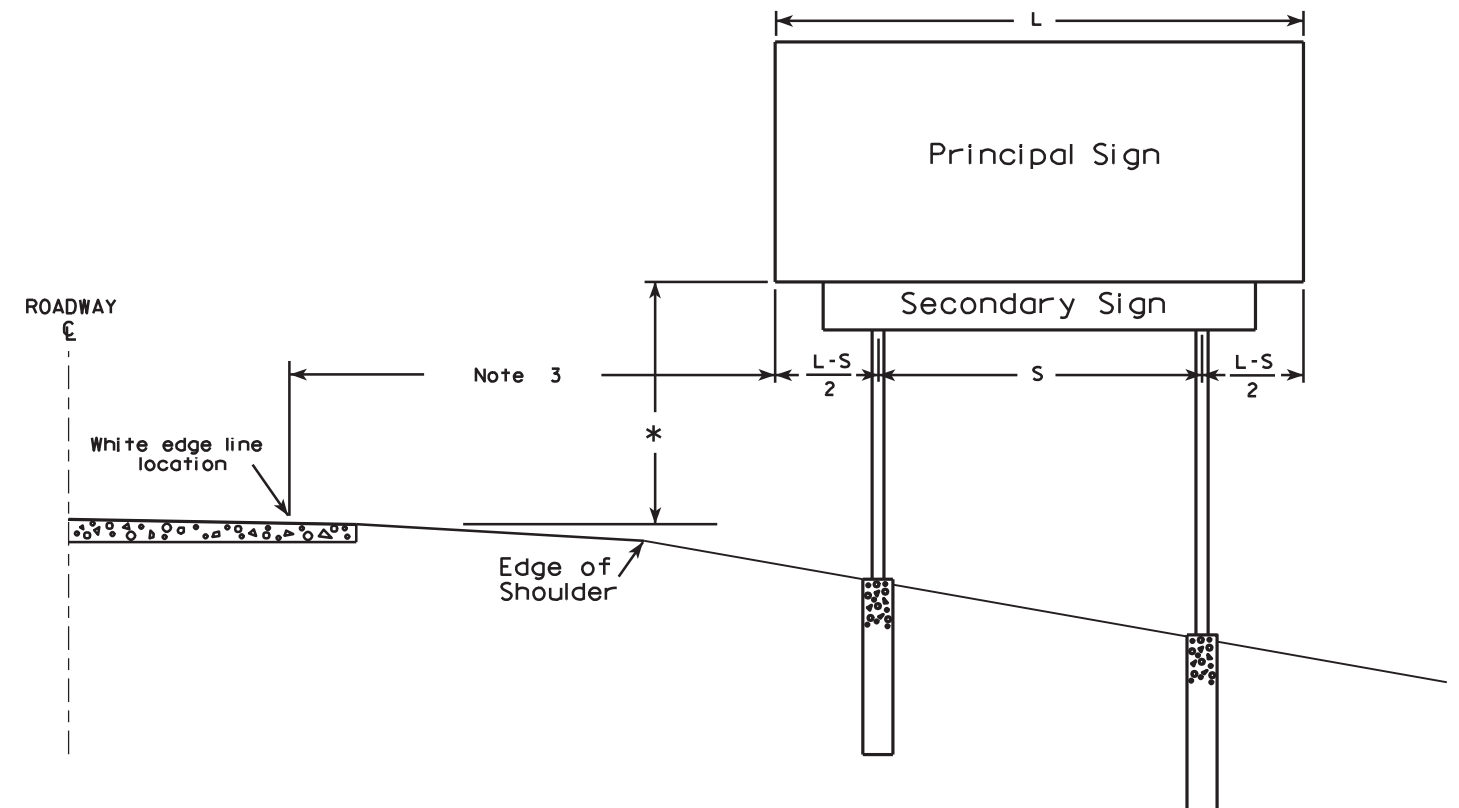
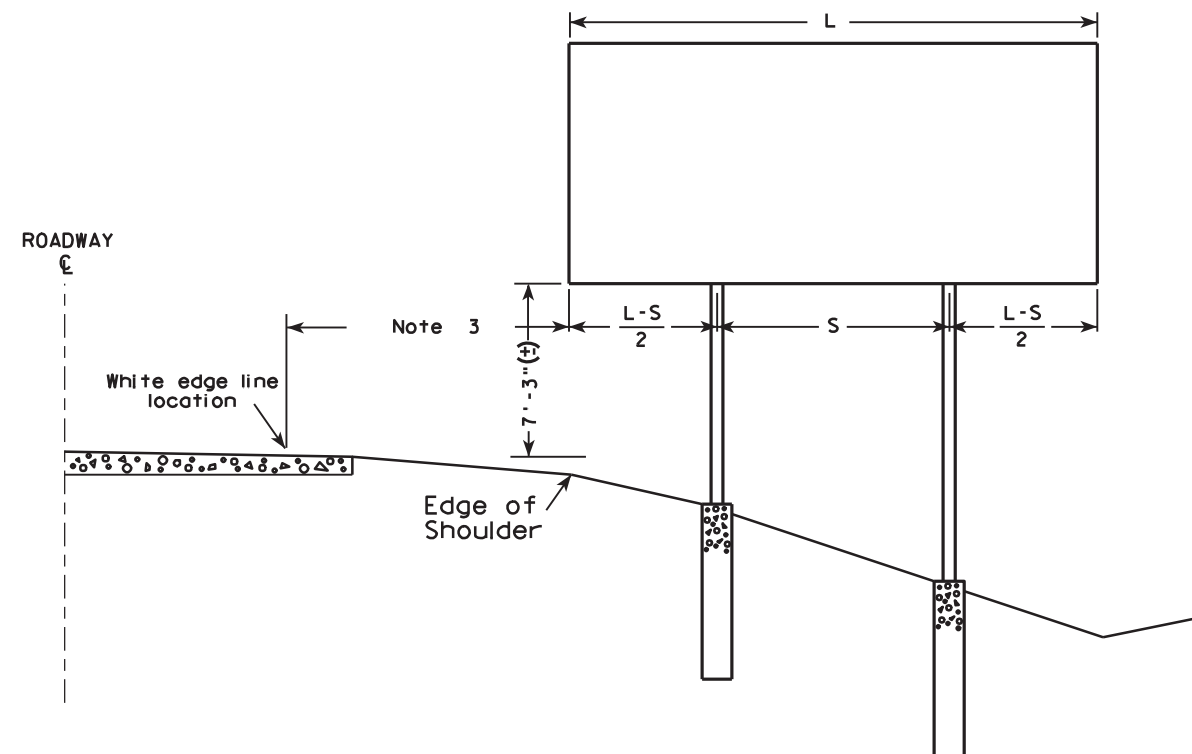
HORIZONTAL DIMENSION 	Type "A" (2 Posts)																														
		2.5 ft.	3 ft.	3.5 ft.	4 ft.	4.5 ft.	5 ft.	5.5 ft.	6 ft.	6.5 ft.	7 ft.	7.5 ft.	8 ft.	8.5 ft.	9 ft.	9.5 ft.	10 ft.	10.5 ft.	11 ft.	11.5 ft.	12 ft.	12.5 ft.	13 ft.	13.5 ft.	14 ft.	14.5 ft.	15 ft.	15.5 ft.	16 ft.		
	22 ft.	55 Sq. Ft	66 Sq. Ft	77 Sq. Ft	88 Sq. Ft	99 Sq. Ft	110 Sq. Ft	121 Sq. Ft	132 Sq. Ft	143 Sq. Ft	154 Sq. Ft	165 Sq. Ft	176 Sq. Ft	187 Sq. Ft	198 Sq. Ft	209 Sq. Ft	220 Sq. Ft	231 Sq. Ft	242 Sq. Ft	253 Sq. Ft	264 Sq. Ft	275 Sq. Ft	286 Sq. Ft	297 Sq. Ft	308 Sq. Ft	319 Sq. Ft	330 Sq. Ft	341 Sq. Ft	352 Sq. Ft		
	23 ft.	57.5 Sq. Ft	69 Sq. Ft	80.5 Sq. Ft	92 Sq. Ft	103.5 Sq. Ft	115 Sq. Ft	126.5 Sq. Ft	138 Sq. Ft	149.5 Sq. Ft	161 Sq. Ft	172.5 Sq. Ft	184 Sq. Ft	195.5 Sq. Ft	207 Sq. Ft	218.5 Sq. Ft	230 Sq. Ft	241.5 Sq. Ft	253 Sq. Ft	264.5 Sq. Ft	276 Sq. Ft	287.5 Sq. Ft	299 Sq. Ft	310.5 Sq. Ft	322 Sq. Ft	333.5 Sq. Ft	345 Sq. Ft	356.5 Sq. Ft	368 Sq. Ft		
	24 ft.	60 Sq. Ft	72 Sq. Ft	84 Sq. Ft	96 Sq. Ft	108 Sq. Ft	120 Sq. Ft	132 Sq. Ft	144 Sq. Ft	156 Sq. Ft	168 Sq. Ft	180 Sq. Ft	192 Sq. Ft	204 Sq. Ft	216 Sq. Ft	228 Sq. Ft	240 Sq. Ft	252 Sq. Ft	264 Sq. Ft	276 Sq. Ft	288 Sq. Ft	300 Sq. Ft	312 Sq. Ft	324 Sq. Ft	336 Sq. Ft	348 Sq. Ft	360 Sq. Ft	372 Sq. Ft	384 Sq. Ft		
	25 ft.	62.5 Sq. Ft	75 Sq. Ft	87.5 Sq. Ft	100 Sq. Ft	112.5 Sq. Ft	125 Sq. Ft	137.5 Sq. Ft	150 Sq. Ft	162.5 Sq. Ft	175 Sq. Ft	187.5 Sq. Ft	200 Sq. Ft	212.5 Sq. Ft	225 Sq. Ft	237.5 Sq. Ft	250 Sq. Ft	262.5 Sq. Ft	275 Sq. Ft	287.5 Sq. Ft	300 Sq. Ft	312.5 Sq. Ft	325 Sq. Ft	337.5 Sq. Ft	350 Sq. Ft	362.5 Sq. Ft	375 Sq. Ft	387.5 Sq. Ft	400 Sq. Ft		
	26 ft.	65 Sq. Ft	78 Sq. Ft	91 Sq. Ft	104 Sq. Ft	117 Sq. Ft	130 Sq. Ft	143 Sq. Ft	156 Sq. Ft	169 Sq. Ft	182 Sq. Ft	195 Sq. Ft	208 Sq. Ft	221 Sq. Ft	234 Sq. Ft	247 Sq. Ft	260 Sq. Ft	273 Sq. Ft	286 Sq. Ft	299 Sq. Ft	312 Sq. Ft	325 Sq. Ft	338 Sq. Ft	351 Sq. Ft	364 Sq. Ft	377 Sq. Ft	390 Sq. Ft	403 Sq. Ft	416 Sq. Ft		
	27 ft.	67.5 Sq. Ft	81 Sq. Ft	94.5 Sq. Ft	108 Sq. Ft	121.5 Sq. Ft	135 Sq. Ft	148.5 Sq. Ft	162 Sq. Ft	175.5 Sq. Ft	189 Sq. Ft	202.5 Sq. Ft	216 Sq. Ft	229.5 Sq. Ft	243 Sq. Ft	256.5 Sq. Ft	270 Sq. Ft	283.5 Sq. Ft	297 Sq. Ft	310.5 Sq. Ft	324 Sq. Ft	337.5 Sq. Ft	351 Sq. Ft	364.5 Sq. Ft	378 Sq. Ft	391.5 Sq. Ft	405 Sq. Ft	418.5 Sq. Ft	432 Sq. Ft		
	28 ft.	70 Sq. Ft	84 Sq. Ft	98 Sq. Ft	112 Sq. Ft	126 Sq. Ft	140 Sq. Ft	154 Sq. Ft	168 Sq. Ft	182 Sq. Ft	196 Sq. Ft	210 Sq. Ft	224 Sq. Ft	238 Sq. Ft	252 Sq. Ft	266 Sq. Ft	280 Sq. Ft	294 Sq. Ft	308 Sq. Ft	322 Sq. Ft	336 Sq. Ft	350 Sq. Ft	364 Sq. Ft	378 Sq. Ft	392 Sq. Ft	406 Sq. Ft	420 Sq. Ft	434 Sq. Ft	448 Sq. Ft		
	29 ft.	72.5 Sq. Ft	87 Sq. Ft	101.5 Sq. Ft	116 Sq. Ft	130.5 Sq. Ft	145 Sq. Ft	159.5 Sq. Ft	174 Sq. Ft	188.5 Sq. Ft	203 Sq. Ft	217.5 Sq. Ft	232 Sq. Ft	246.5 Sq. Ft	261 Sq. Ft	275.5 Sq. Ft	290 Sq. Ft	304.5 Sq. Ft	319 Sq. Ft	333.5 Sq. Ft	348 Sq. Ft	362.5 Sq. Ft	377 Sq. Ft	391.5 Sq. Ft	406 Sq. Ft	420.5 Sq. Ft	435 Sq. Ft	449.5 Sq. Ft	464 Sq. Ft		
	30 ft.	75 Sq. Ft	90 Sq. Ft	105 Sq. Ft	120 Sq. Ft	135 Sq. Ft	150 Sq. Ft	165 Sq. Ft	180 Sq. Ft	195 Sq. Ft	210 Sq. Ft	225 Sq. Ft	240 Sq. Ft	255 Sq. Ft	270 Sq. Ft	285 Sq. Ft	300 Sq. Ft	315 Sq. Ft	330 Sq. Ft	345 Sq. Ft	360 Sq. Ft	375 Sq. Ft	390 Sq. Ft	405 Sq. Ft	420 Sq. Ft	435 Sq. Ft	450 Sq. Ft	465 Sq. Ft	480 Sq. Ft		
Type "A" (2 Posts) 1.2 CY Conc. 68 Lbs Bar Steel	31 ft.	77.5 Sq. Ft	93 Sq. Ft	108.5 Sq. Ft	124 Sq. Ft	139.5 Sq. Ft	155 Sq. Ft	170.5 Sq. Ft	186 Sq. Ft	201.5 Sq. Ft	217 Sq. Ft	232.5 Sq. Ft	248 Sq. Ft	263.5 Sq. Ft	279 Sq. Ft	294.5 Sq. Ft	310 Sq. Ft	325.5 Sq. Ft	341 Sq. Ft	356.5 Sq. Ft	372 Sq. Ft	387.5 Sq. Ft	403 Sq. Ft	418.5 Sq. Ft	434 Sq. Ft	449.5 Sq. Ft	465 Sq. Ft	480.5 Sq. Ft	496 Sq. Ft		
	32 ft.	80 Sq. Ft	96 Sq. Ft	112 Sq. Ft	128 Sq. Ft	144 Sq. Ft	160 Sq. Ft	176 Sq. Ft	192 Sq. Ft	208 Sq. Ft	224 Sq. Ft	240 Sq. Ft	256 Sq. Ft	272 Sq. Ft	288 Sq. Ft	304 Sq. Ft	320 Sq. Ft	336 Sq. Ft	352 Sq. Ft	368 Sq. Ft	384 Sq. Ft	400 Sq. Ft	416 Sq. Ft	432 Sq. Ft	448 Sq. Ft	464 Sq. Ft	480 Sq. Ft	496 Sq. Ft	512 Sq. Ft		
	33 ft.	82.5 Sq. Ft	99 Sq. Ft	115.5 Sq. Ft	132 Sq. Ft	148.5 Sq. Ft	165 Sq. Ft	181.5 Sq. Ft	198 Sq. Ft	214.5 Sq. Ft	231 Sq. Ft	247.5 Sq. Ft	264 Sq. Ft	280.5 Sq. Ft	297 Sq. Ft	313.5 Sq. Ft	330 Sq. Ft	346.5 Sq. Ft	363 Sq. Ft	379.5 Sq. Ft	396 Sq. Ft	412.5 Sq. Ft	429 Sq. Ft	445.5 Sq. Ft	462 Sq. Ft	478.5 Sq. Ft	495 Sq. Ft	511.5 Sq. Ft	528 Sq. Ft		
	34 ft.	85 Sq. Ft	102 Sq. Ft	119 Sq. Ft	136 Sq. Ft	153 Sq. Ft	170 Sq. Ft	187 Sq. Ft	204 Sq. Ft	221 Sq. Ft	238 Sq. Ft	255 Sq. Ft	272 Sq. Ft	289 Sq. Ft	306 Sq. Ft	323 Sq. Ft	340 Sq. Ft	357 Sq. Ft	374 Sq. Ft	391 Sq. Ft	408 Sq. Ft	425 Sq. Ft	442 Sq. Ft	459 Sq. Ft	476 Sq. Ft	493 Sq. Ft	510 Sq. Ft	527 Sq. Ft	544 Sq. Ft		
	35 ft.	87.5 Sq. Ft	105 Sq. Ft	122.5 Sq. Ft	140 Sq. Ft	157.5 Sq. Ft	175 Sq. Ft	192.5 Sq. Ft	210 Sq. Ft	227.5 Sq. Ft	245 Sq. Ft	262.5 Sq. Ft	280 Sq. Ft	297.5 Sq. Ft	315 Sq. Ft	332.5 Sq. Ft	350 Sq. Ft	367.5 Sq. Ft	385 Sq. Ft	402.5 Sq. Ft	420 Sq. Ft	437.5 Sq. Ft	455 Sq. Ft	472.5 Sq. Ft	490 Sq. Ft	507.5 Sq. Ft	525 Sq. Ft	542.5 Sq. Ft	560 Sq. Ft		
	36 ft.	90 Sq. Ft	108 Sq. Ft	126 Sq. Ft	144 Sq. Ft	162 Sq. Ft	180 Sq. Ft	198 Sq. Ft	216 Sq. Ft	234 Sq. Ft	252 Sq. Ft	270 Sq. Ft	288 Sq. Ft	306 Sq. Ft	324 Sq. Ft	342 Sq. Ft	360 Sq. Ft	378 Sq. Ft	396 Sq. Ft	414 Sq. Ft	432 Sq. Ft	450 Sq. Ft	468 Sq. Ft	486 Sq. Ft	504 Sq. Ft	522 Sq. Ft	540 Sq. Ft	558 Sq. Ft	576 Sq. Ft		
Type "B" (2 Posts) 1.6 CY Conc. 98 Lbs Bar Steel													Type "C" (2 Posts) 1.8 CY Conc. 100 Lbs Bar Steel					Type "D" (2 Posts) 1.8 CY Conc. 112 Lbs Bar Steel			Type "C" (3 Posts) 2.7 CY Conc. 150 Lbs Bar Steel			Type "D" (3 Posts) 2.7 CY Conc. 168 Lbs Bar Steel							
STEEL POST SIZE "A" - W10" x 12" "B" - W12" x 16" "C" - W12" x 19" "D" - W12 x 22"																															

DETERMINATION OF HIGH STRENGTH
STRUCTURAL STEEL SIGN SUPPORT TYPE

WISCONSIN DEPT OF TRANSPORTATION

APPROVED *Matthew R. Rauch*
for State Traffic Engineer

DATE 3/5/10 PLATE NO. A3-3.2



GENERAL NOTES

1. For a 2 post installation, S equals $3L/5$, but shall not be less than 9 ft.
2. For a 3 post installation, S equals $5L/7$, but shall not be less than 18 ft., and the space between any two posts shall not be less than 9 ft.
3. Unless noted in the plan, the sign offset distance shall be a minimum of 17'-6", desirable 30'-0".
4. The (±) tolerance shown on this sheet is 3 in.
5. The vertical sign height clearance detailed is measured from the bottom of the sign to the near edge of pavement.
6. Post lengths shown in the miscellaneous quantities are estimated lengths. The contractor shall verify post lengths at the time of final grading.
7. Refer to the Traffic Guidelines Manual for further guidance on minimum vertical clearance requirements.

* Clearance is 8'-3" (±) when the secondary sign is 3 ft. or less in height. For secondary signs larger than 3 ft., the clearance to the bottom of the secondary sign shall be 5'-3" (±).

TYPICAL INSTALLATION OF TYPE I SIGNS

WISCONSIN DEPT OF TRANSPORTATION

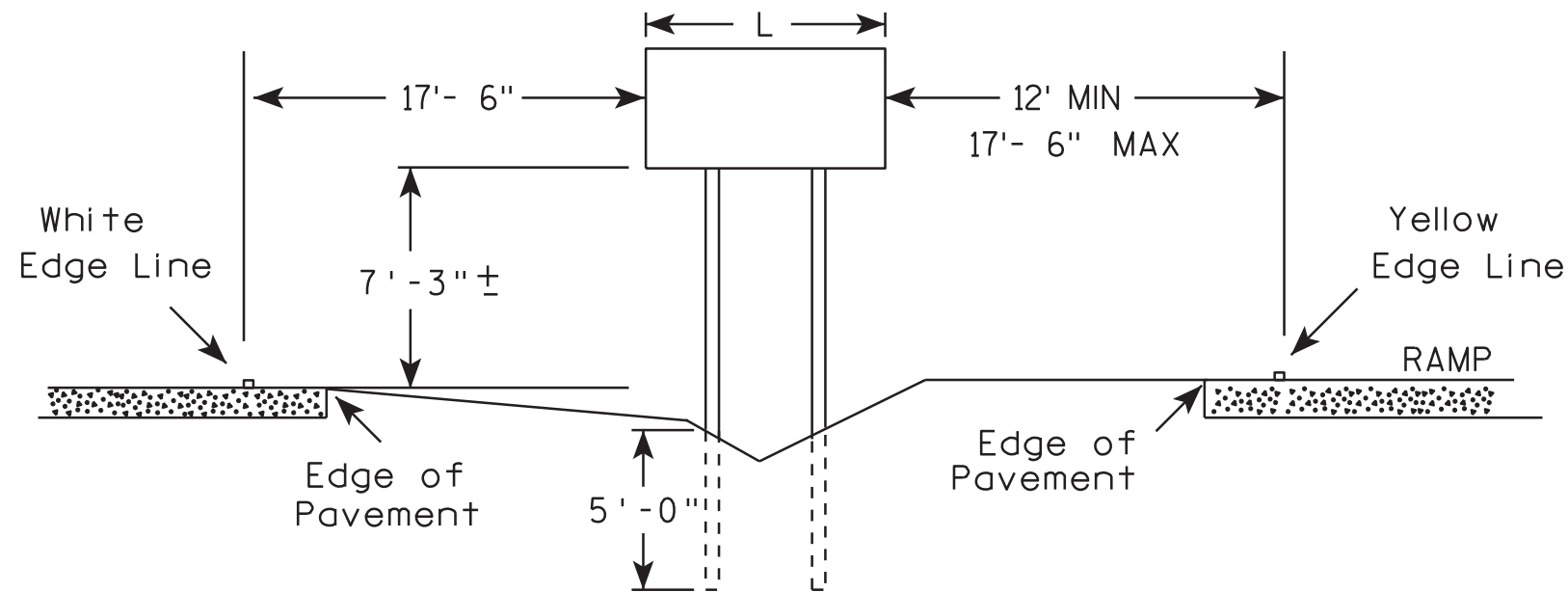
APPROVED *Matthew R. Rauch*
for State Traffic Engineer

DATE 4/02/08 PLATE NO. A4-1.9

PROJECT NO:

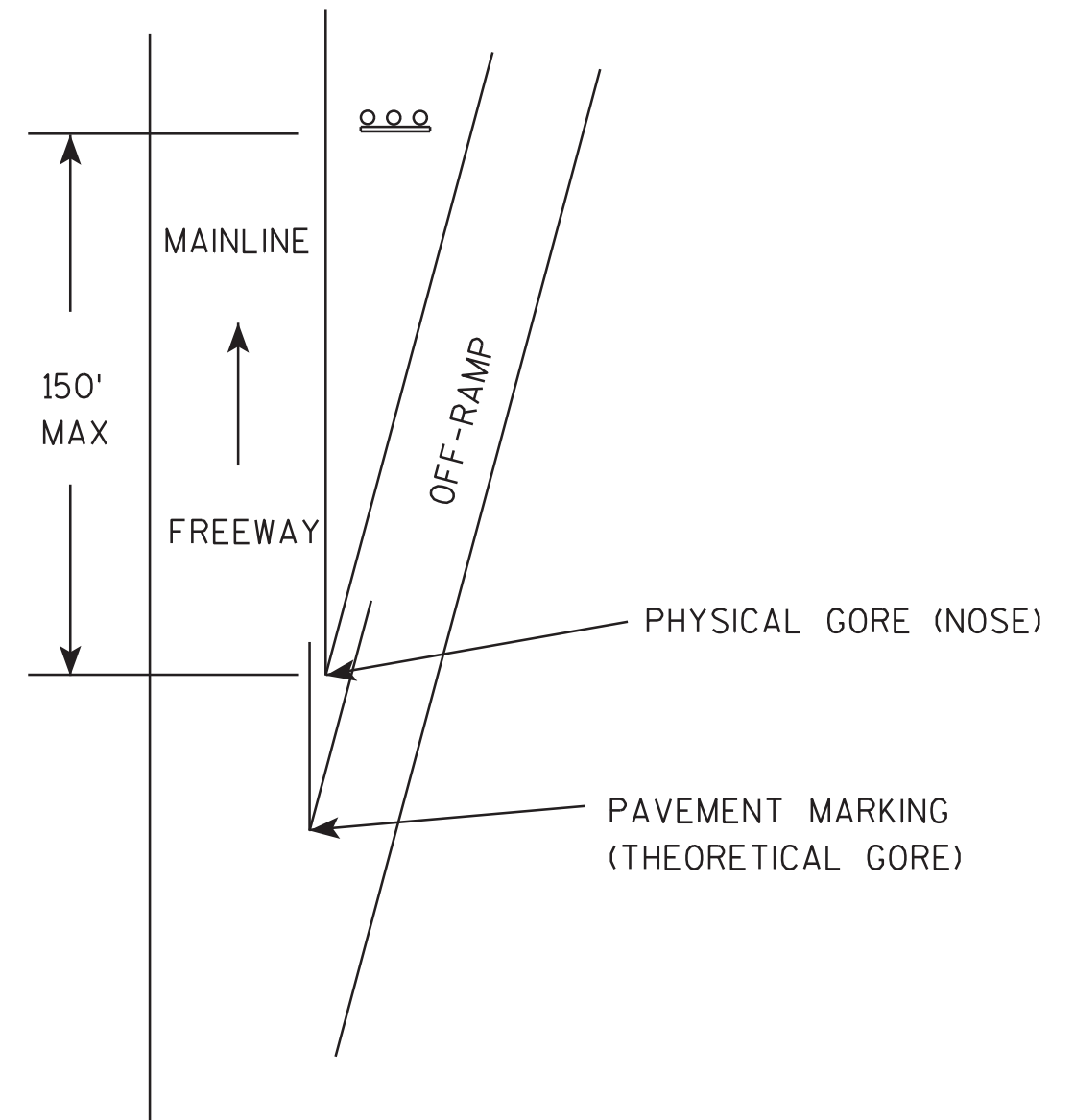
SHEET NO:

E



GENERAL NOTES

1. The 150 foot distance from the physical gore (where pavement ends) will normally provide the offsets as shown.
2. If roadway geometrics permit, the sign may be closer than the 150 foot distance as long as the offsets are maintained.
3. At no time shall the location be greater than 150 feet. If the normal offsets cannot be maintained, they can be reduced to 6 feet from the edge of the paved shoulder (both freeway and ramp).
4. The offset from edge of sign to the yellow edge line on the ramp is shown as a minimum of 12 feet and a maximum of 17 feet, 6 inches. Preference is adhering to the maximum rather than the minimum dimension.
5. When L is equal to or exceeds 10 feet, use 3 posts as per A4-4.
6. The ($\pm$) tolerance for the mounting height is 3 inches.



TYPICAL INSTALLATION
OF TYPE II SIGNS ON
WOOD POSTS IN GORE

WISCONSIN DEPT OF TRANSPORTATION

APPROVED *Matthew R. Rauch*
for State Traffic Engineer

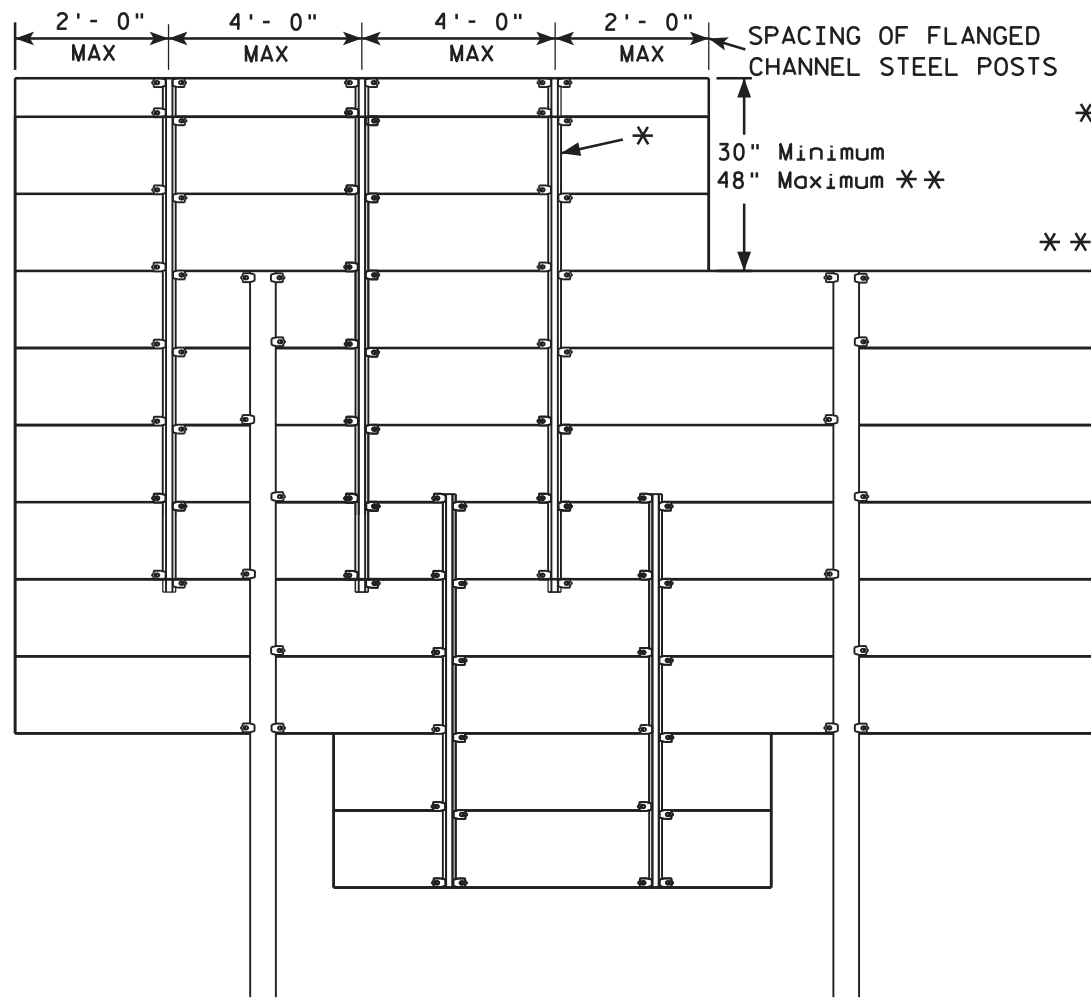
DATE 2/06/14 PLATE NO. A4-2.3

PROJECT NO:

SHEET NO:

E

GROUND MOUNTED SIGN

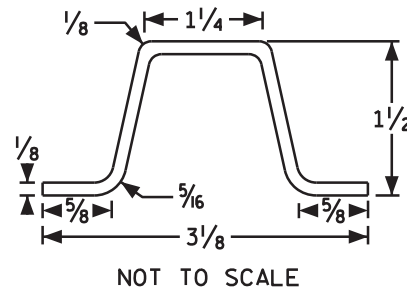


* = 2.00 lb/ft FLANGED CHANNEL, MIN. YIELD STRENGTH = 60,000 PSI (GRADE 60) GALVANIZED

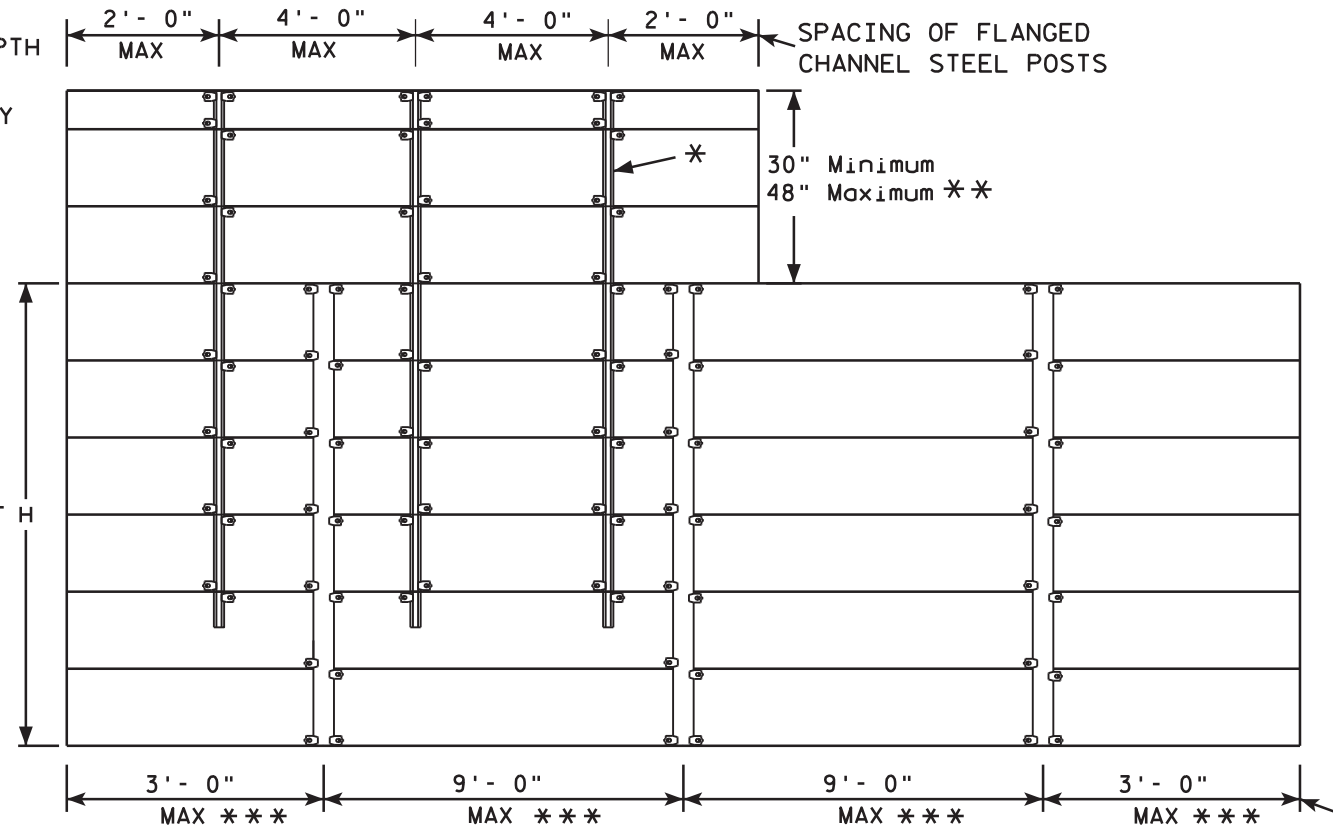
** = FOR 48" HEIGHT PANELS ON OVERHEAD STRUCTURES, ENTIRE SIGN SHALL BE CENTERED VERTICALLY ABOUT THE DEPTH OF THE TRUSS.

*** THESE SPACING DISTANCES SHALL ONLY BE USED WHEN THE MAIN SIGN HAS A MAXIMUM HEIGHT (DIMENSION H) OF 16 FT OR LESS. FOR SIGNS WITH A HEIGHT OF GREATER THAN 16 FT, STRUCTURAL CALCULATIONS SHALL BE PERFORMED.

FLANGE CHANNEL DETAIL



SIGN BRIDGE MOUNTED SIGN



SPACING OF ALUMINUM SIGN SUPPORTS 5" X 3.5" X 3.7 LBS./ft.

GENERAL NOTES

1. Flanged channel steel posts shall conform to size and material above, and shall be considered as incidental to other items in the contract.
2. Number of Flanged channel steel supports varies with length of panel and shall be spaced as shown:
PANEL LENGTH 8'-0" OR LESS = 2 CHANNELS
PANEL LENGTH 9'-0" - 12'-0" = 3 CHANNELS
PANEL LENGTH 13'-0" OR MORE = 4 CHANNELS
If the flanged channel steel posts can not be horizontally spaced as shown, they can be moved so as to securely hold the sign.

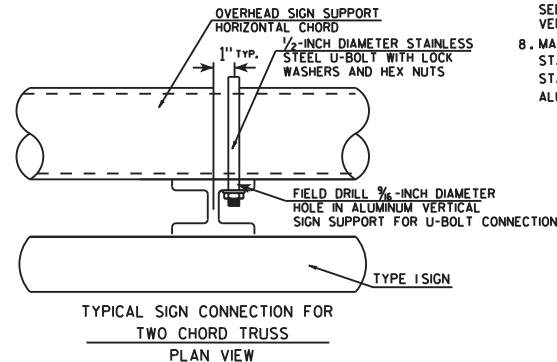
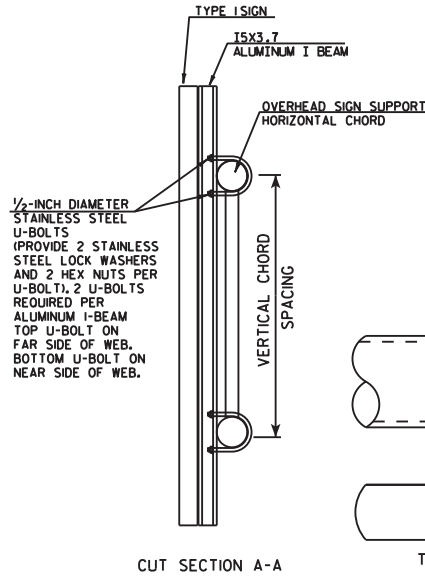
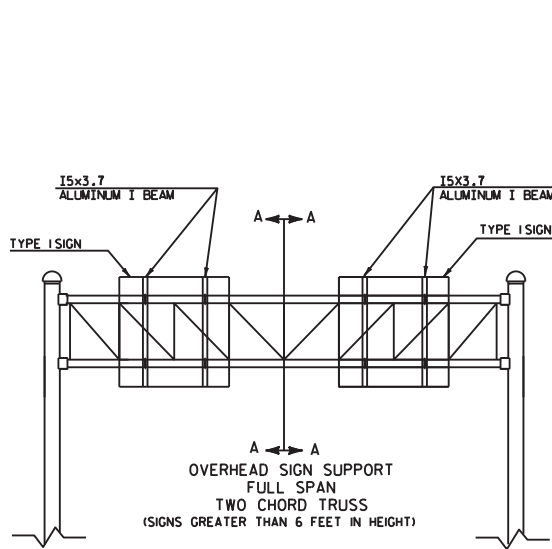
3. The EXIT NUMBER PANEL shall normally be positioned above the guide sign aligned with the right edge of the guide sign. If the guide sign indicates a left exit, the EXIT NUMBER PANEL shall be aligned with the left edge of the guide sign.
4. If the bolt holes in the top panel (EXIT NUMBER), or sub panel (NEXT EXIT) line up with holes in main sign panel, stitch bolts shall be used in addition to the channels.
5. Provide post clips for each sign as shown. (Please note the differences between a ground mounted versus Sign bridge mounted sign as far as number of clips required on the main supports or beams)
6. Structural steel sign supports shall extend to the top of the main signs, as shown on the above details.

ATTACHMENT OF GUIDE SIGNS TO SUPPORTS

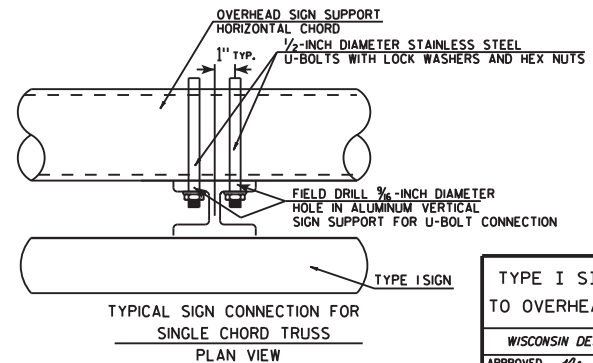
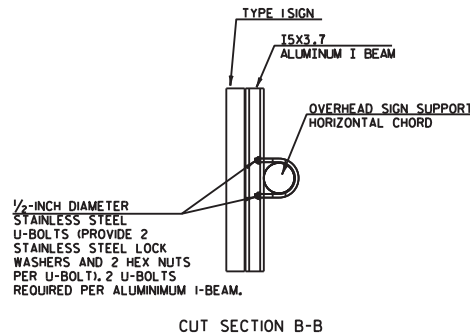
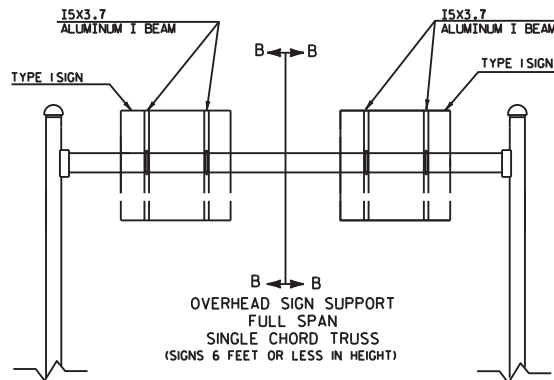
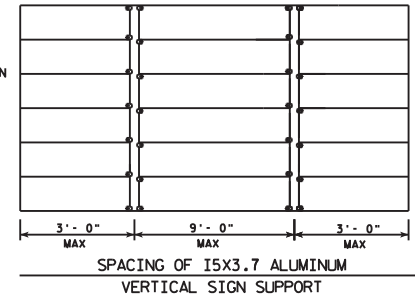
WISCONSIN DEPT OF TRANSPORTATION

APPROVED *Matthew R. Rauch*
for State Traffic Engineer

DATE 12/05/13 PLATE NO. A4-6.12



- GENERAL NOTES**
1. USE STAINLESS STEEL U-BOLTS, WASHERS, AND NUTS.
 2. USE CLIPS ON EVERY EXTRUDED PANEL JOINT PER SIGN PLATE A4-6.
 3. USE ALUMINUM VERTICAL SIGN SUPPORT BEAMS HAVING A 5 INCH BEAM DEPTH AND WEIGHT OF 3.7 LBS PER FOOT.
 4. U-BOLTS SHALL BE STAINLESS STEEL AND MANUFACTURED TO THE PROPER SIZE TO FIT THE CHORDS OF THE OVERHEAD SIGN STRUCTURE.
 5. DIAMETER OF U-BOLTS SHALL BE AS SHOWN.
 6. THE LENGTH OF THE ALUMINUM VERTICAL SIGN SUPPORT BEAMS SHALL BE THE SAME AS THE HEIGHT OF THE SIGN THEY ARE SUPPORTING. BEAM LENGTHS MAY BE LONGER FOR PROPER ATTACHMENT TO CHORDS.
 7. MINIMUM NUMBER OF BRACKETS PER SIGN IS TWO. SEE DETAIL BELOW FOR SPACING OF ALUMINUM VERTICAL SIGN SUPPORTS
 8. MATERIAL NOTES:
STAINLESS STEEL U-BOLTS AND LOCKWASHERS ASTM 304.
STAINLESS STEEL HEX NUTS ASTM A276.
ALUMINUM I-BEAMS ARE 6061-T6.



TYPE I SIGN CONNECTION
TO OVERHEAD SIGN SUPPORT

WISCONSIN DEPT OF TRANSPORTATION

APPROVED *Matthew R. Rauch*
State Traffic Engineer

DATE 11/10/15 PLATE NO. A4-7.4

PROJECT NO:

HWY:

COUNTY:

PLOT DATE : 10-NOV-2015 17:50

PLOT BY : ss...plotuser...ss PLOT NAME :

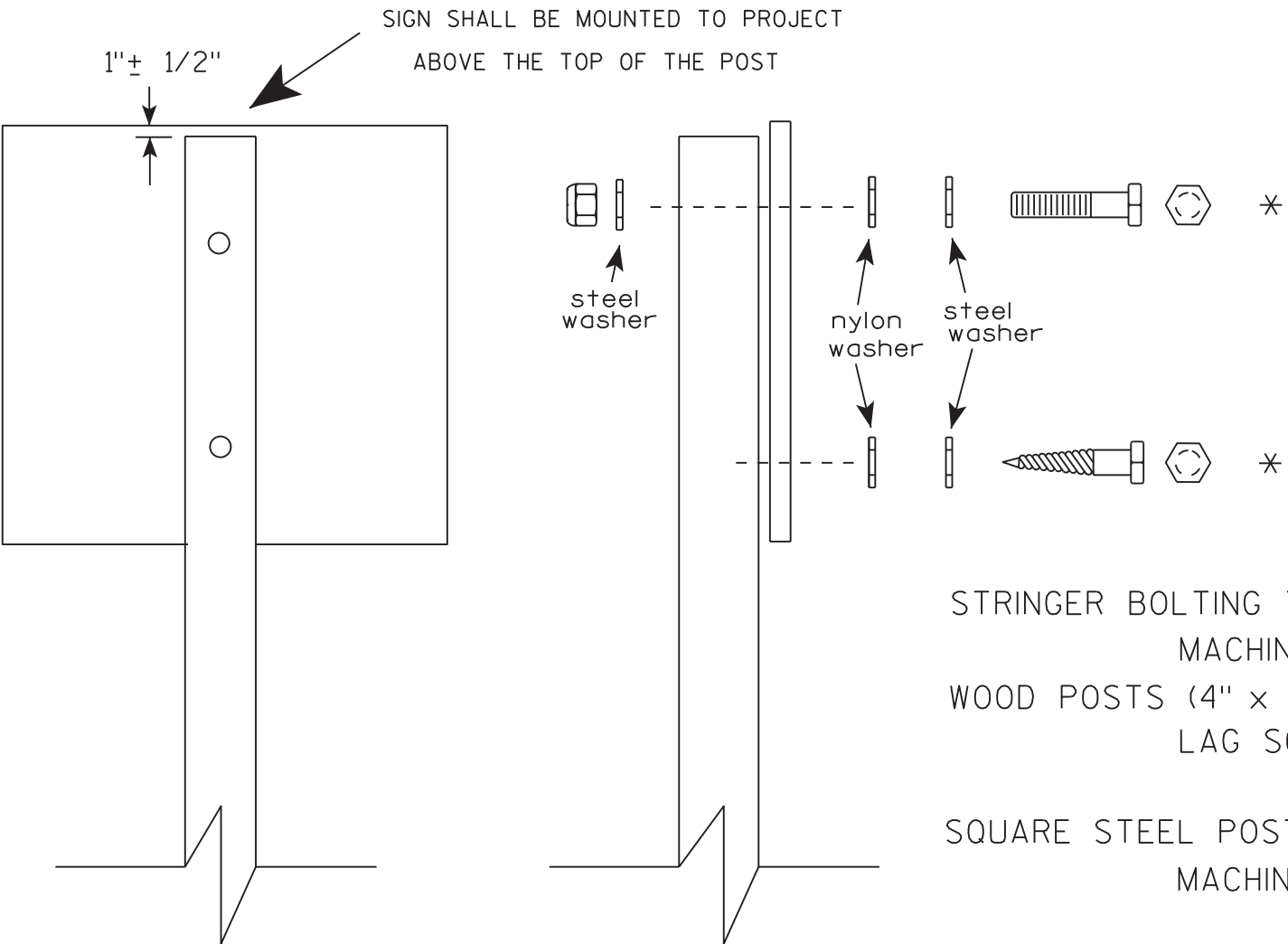
PLOT SCALE : 62.023711:1.000000

SHEET NO:

E

FILE NAME : C:\CAEfiles\Projects\tr_std\plate\A47.DGN

WISDOT/CADDs SHEET 42



Nuts, bolts and lags used for mounting signs shall have hexagonal heads and shall be either :

- a. Hot dip galvanized in accordance with ASTM Designation: A 153, Class D, or SC 3
- b. Electro-galvanized in accordance with ASTM Designation : B 633, TYPE III, SC 3.

Threads on bolts and nuts shall be manufactured with sufficient allowance for the cadmium plate or galvanized coating to permit the nuts to run freely on the bolts.

- STRINGER BOLTING TO ALUMINUM SIGNS (SEE SIGN PLATE A4-18)
- MACHINE BOLTS - 5/16" X 1-3/4" Length w/ lock nuts
- WOOD POSTS (4" x 4" or 4" x 6")
- LAG SCREWS - 3/8" X 3" (NO STRINGERS ON BACK OF SIGN)
 - 3/8" X 4" (STRINGERS ON BACK OF SIGN)
- SQUARE STEEL POSTS (2" x 2")
- MACHINE BOLTS - 3/8" X 3-1/4" Length w/ nuts (NO STRINGER ON BACK OF SIGN)
 - 3/8" X 5" Length w/ nuts (STRINGERS ON BACK OF SIGN)
- RIVETS - 9/32" (6605-9-6) BULB-TITE, TRI-FOLD, ALUMINUM BODY/MANDREL
- O.D. FLANGE .720-.765 INCH, GRIP RANGE .042-.375 INCH
- WASHERS (ALL POSTS) -
- 1-1/4" O.D. X 3/8" I.D. X 1/16" STEEL
 - 1-1/4" O.D. X 3/8" I.D. X .080 NYLON

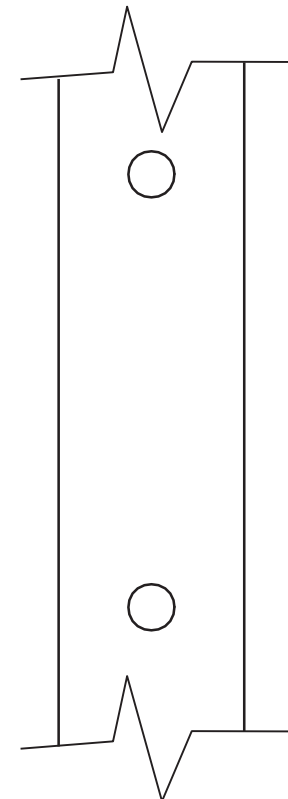
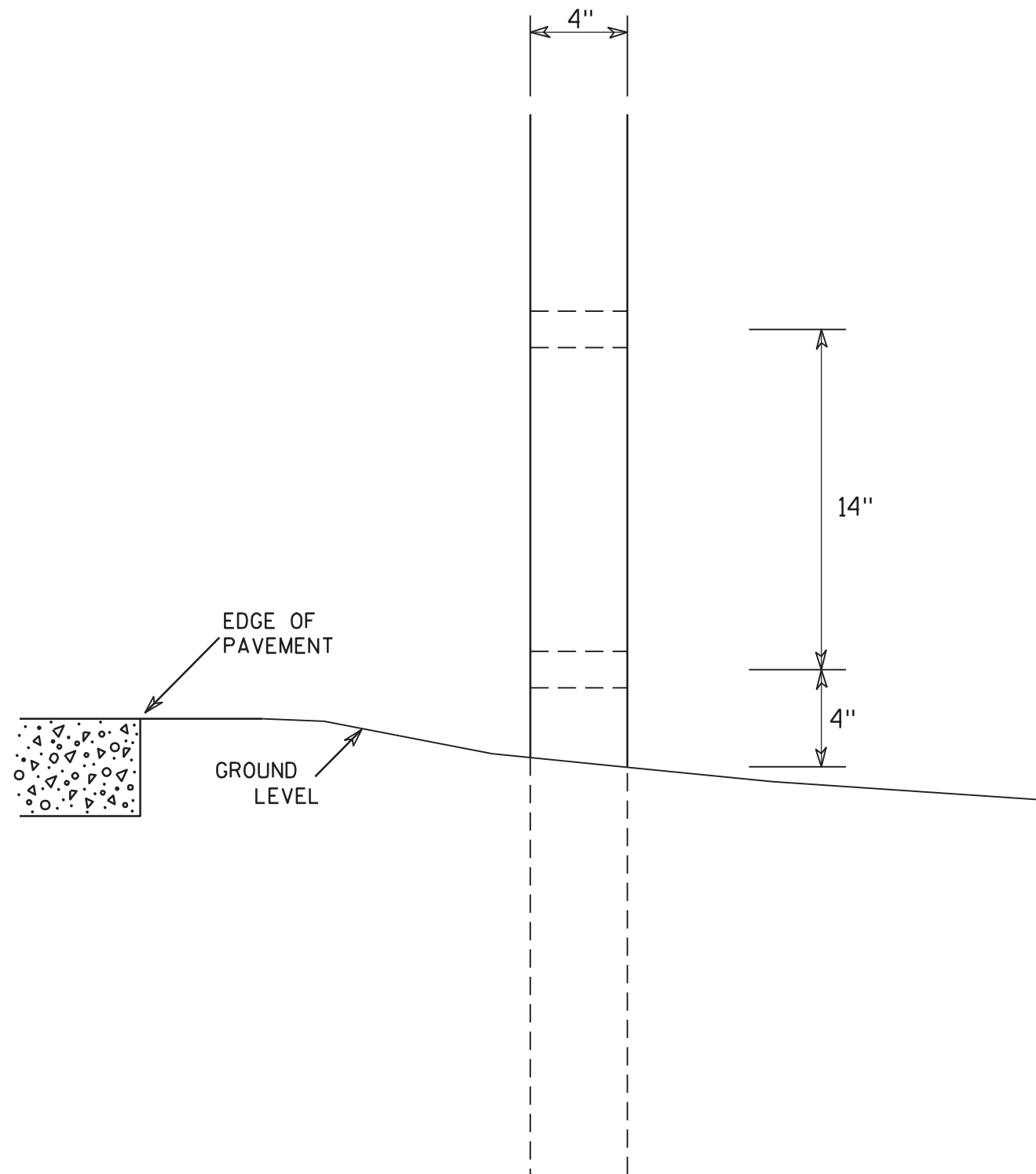
* Two different fastening systems are shown for illustration purposes. On any individual sign, either one or the other system shall be used. Actual number of fasteners per sign varies with the sign area, but normally there are two. For a single post installation, all signs greater than 9 sq. ft. require the use of 3 fasteners.

ATTACHMENT OF SIGNS
TO POSTS

WISCONSIN DEPT OF TRANSPORTATION

APPROVED *Matthew R. Rauch*
For State Traffic Engineer

DATE 8/11/16 PLATE NO. A4-8.8



SIDE VIEW

GENERAL NOTES

1. All 4 x 6 Wood Posts shall be modified by having two 1 1/2" diameter holes drilled perpendicular to the roadway centerline.

4 X 6 WOOD POST MODIFICATIONS

WISCONSIN DEPT OF TRANSPORTATION

APPROVED

Chester J. Spang
for State Traffic Engineer

DATE 3/27/97

PLATE NO. A4-11.2

PROJECT NO:

HWY:

COUNTY:

SHEET NO:

E

7

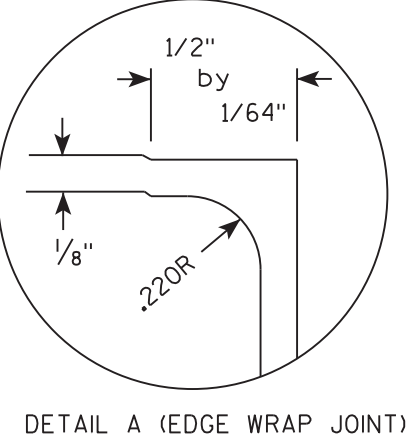


Punch 7/16" x 7/8" oval holes beginning 6" in from end of extrusion 12" CC on both edges of 6" and 12" panels.

Diagram illustrating Detail A (Edge Wrap Joint). The joint is shown with dimensions: 1/2" by 1/64" and 1/8". A note indicates a 220R radius for the curved section.

Diagram illustrating Detail A (Edge Wrap Joint). The joint is shown with dimensions: 1/2" by 1/64" and 1/8". A note indicates a 220R radius for the curved section.

Diagram illustrating Detail A (Edge Wrap Joint). The joint is shown with dimensions: 1/2" by 1/64" and 1/8". A note indicates a 220R radius for the curved section.



POST CLIP, POST CLIP BOLT, WASHER & NUT

POST CLIP, POST CLIP BOLT, WASHER & NUT



1. The contractor may select any brand of extrusion that conforms to the illustrations or meets with the approval of the engineer, but all extrusions used on this contract shall be of the same brand.
2. Panel Stitch Bolts shall be used to assemble adjacent panels. Maximum stitch bolt spacing shall be 24" C-C, and a minimum of 4 bolts shall be used to connect any two extrusions.
3. Post Clips shall be used to attach the sign panel to the sign support.
4. Edge wrapping of sign sheeting required on all extrusions joints shown in Detail A.

ALUMINUM EXTRUSIONS FOR
TYPE I SIGNS

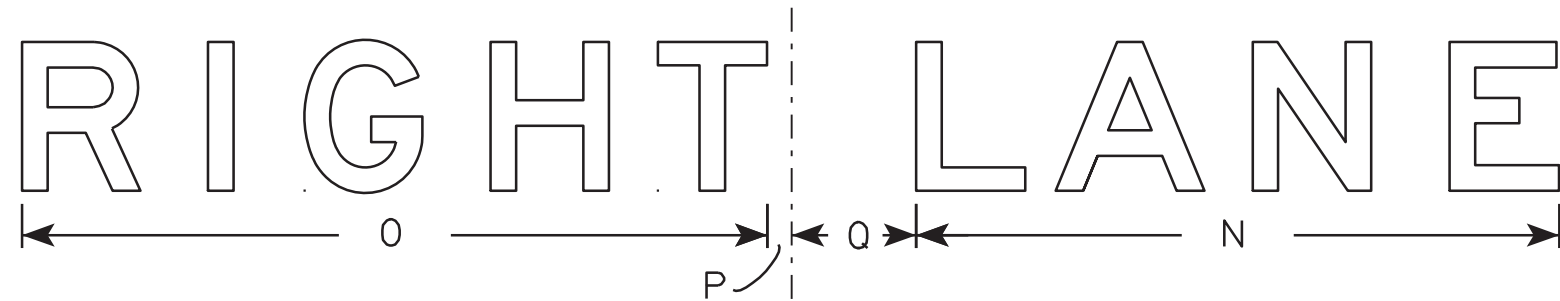
ALUMINUM EXTRUSIONS FOR
TYPE I SIGNS

ALUMINUM EXTRUSIONS FOR
TYPE I SIGNS

PROJECT NO:

SHEET NO:

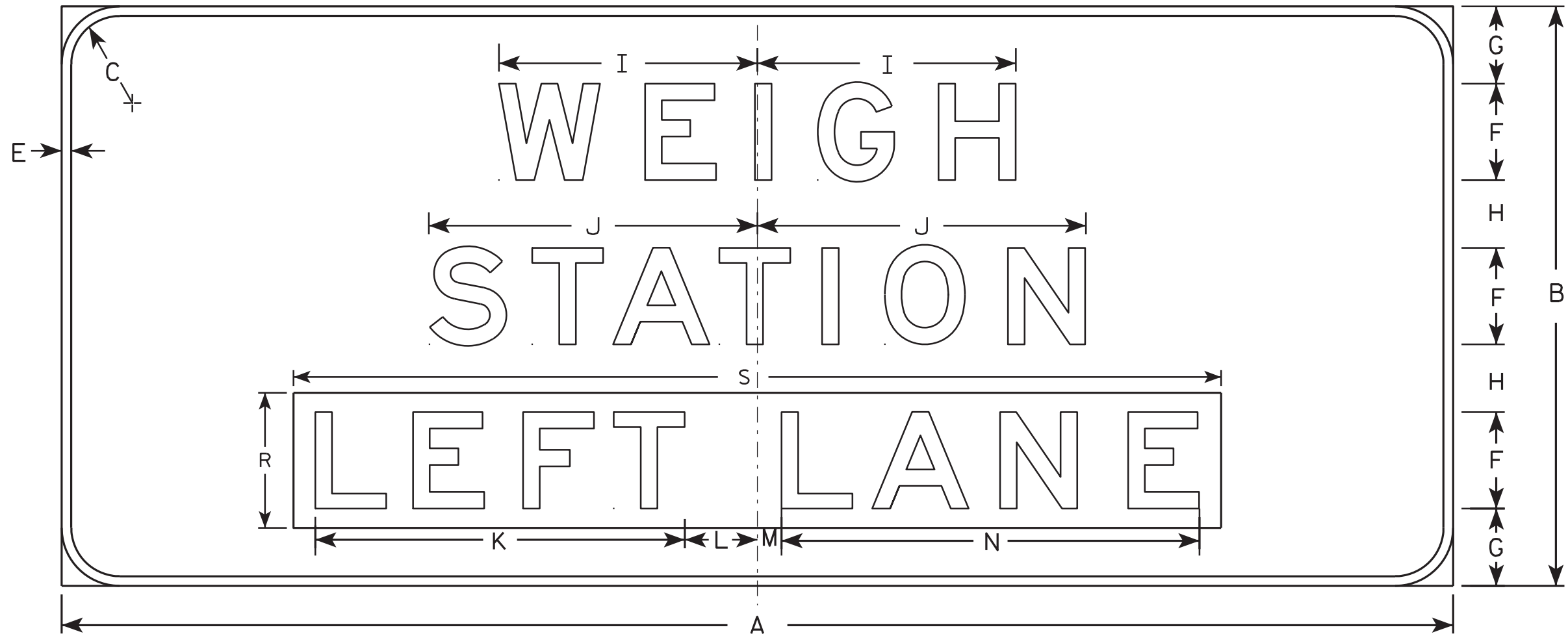
11



E5-57E

NOTES

- 1. Sign is Type I - Type SH Reflective - reference WIS DOT Standard Specification for HIGHWAY and STRUCTURE CONSTRUCTION latest edition.
- 2. Color:
Background - Green
Message - White
- 3. Message Series - E
- 4. LEFT LANE PLAQUE COLOR:
Background - Yellow - Type F Reflective
Message - Black
- 5. RIGHT LANE is on Green Background with White Message



E5-57D

SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Area sq. ft.
1																											
2																											
3																											
4	144	60	6		1	10	8	7	26 ¾	34	38 ¼	7 ½	2 ½	43 ¼	50 ⅛	1 ⅝	8 ⅜	14	96								60.0
5	144	60	6		1	10	8	7	26 ¾	34	38 ¼	7 ½	2 ½	43 ¼	50 ⅛	1 ⅝	8 ⅜	14	96								60.0

STANDARD SIGN
E5-57D & E

WISCONSIN DEPT OF TRANSPORTATION

APPROVED *Matthew R. Rauch*
for State Traffic Engineer

DATE 3/5/2012 PLATE NO. E5-57D.5

PROJECT NO:

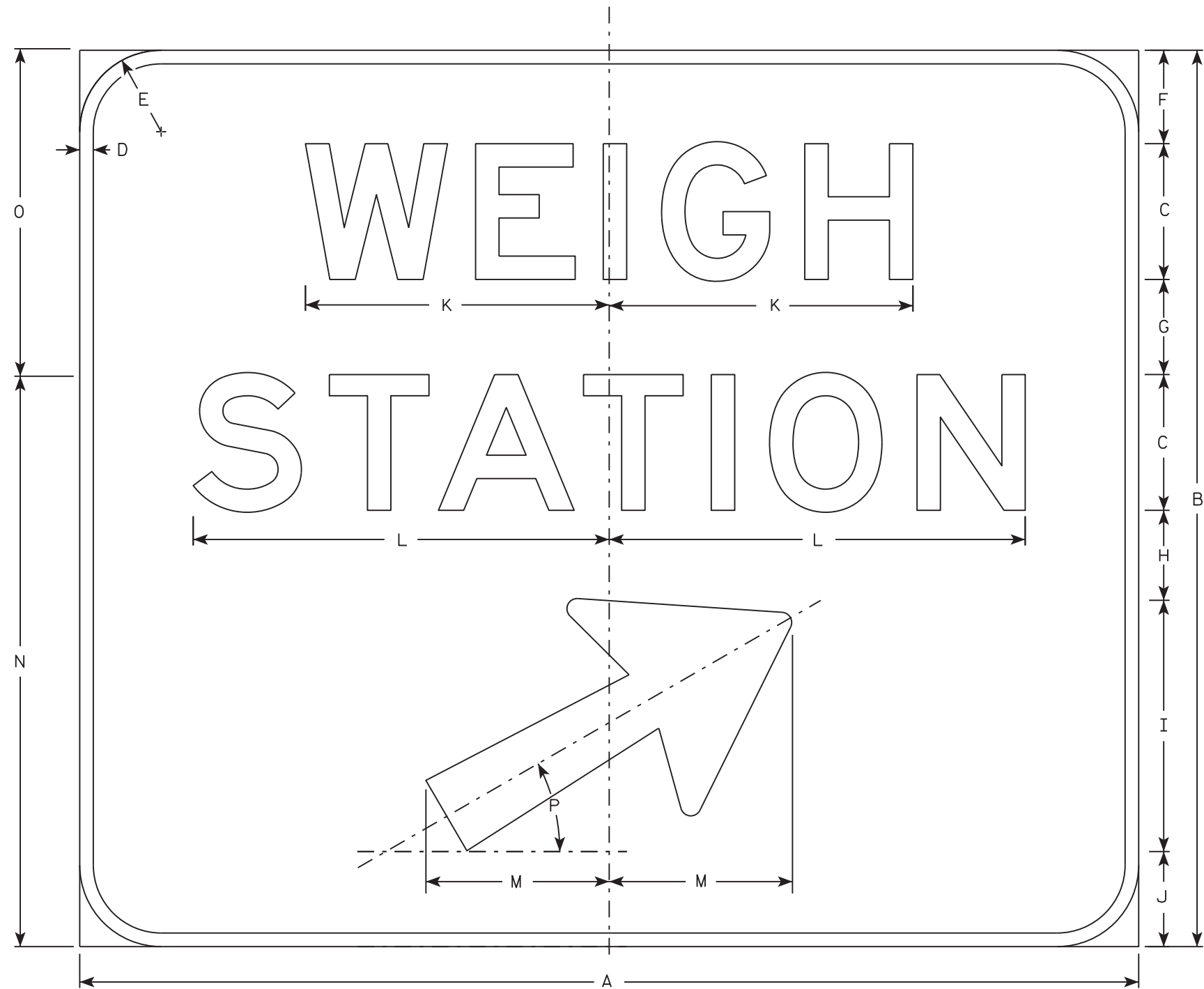
HWY:

COUNTY:

SHEET NO:

E

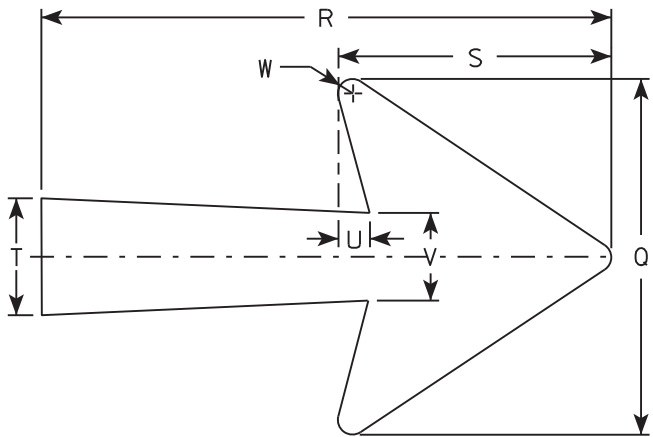
7



E5-58

NOTES

1. Sign is Type II - Type H Reflective
2. Color:
Background - Green
Message - White
3. Message Series - E
4. Arrow is Type A as per A1-1 standard
5. Dimensions N & O Indicate cutting lines for panels



Arrow Detail

7

SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Area sq. ft.
1																											
2																											
3																											
4	78	66	10	1	6	7	7	6 1/2	18 1/2	7	22 3/8	30 5/8	13 1/2	42	24	30°	18 1/4	29 1/4	14	6	1 1/2	4 1/2	3/4				35.75
5	90	72	12	1	9	7 1/4	7	8	18 1/2	7 1/4	26 7/8	36 3/4	13 1/2	48	24	30°	18 1/4	29 1/4	14	6	1 1/2	4 1/2	3/4				45.0

PROJECT NO:

HWY:

COUNTY:

SHEET NO:

E

STANDARD SIGN
E5-58

WISCONSIN DEPT OF TRANSPORTATION

APPROVED
Matthew R. Rauch
for State Traffic Engineer

DATE 2/6/17 PLATE NO. E5-58.1

DESIGN DATA (FOR REFERENCE ONLY)

SIGN STR. 5-30-25
DESIGN SIGN AREA 264 SF
MAX. SIGN DEPTH 12 FT

DESIGNED ACCORDING TO A.A.S.H.T.O. "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS", 2001 4TH EDITION INCLUDING 2002, 2003 AND 2006 INTERIMS.

DEAD LOAD - WT. OF SIGN AND SUPPORTING STRUCTURE.
ICE LOAD - 3 PSF TO 1 FACE OF SIGN & AROUND SURFACE MEMBERS.
WIND VELOCITY - 90 MPH (3-SECOND WIND GUST) TO SIGN AREA & EXPOSED MEMBERS.

WIND COMPONENTS	NORMAL	TRANSVERSE
COMBINATION 1	1.0	0.2
COMBINATION 2	0.6	0.3

GROUP LOADS	% OF ALLOWABLE STRESS
1. DEAD	100
2. DEAD + WIND	133
3. DEAD + ICE + 1/2 WIND	133

NOTE: WIND LOAD FOR GROUP 3 LOADING SHALL NOT BE LESS THAN 25 PSF.

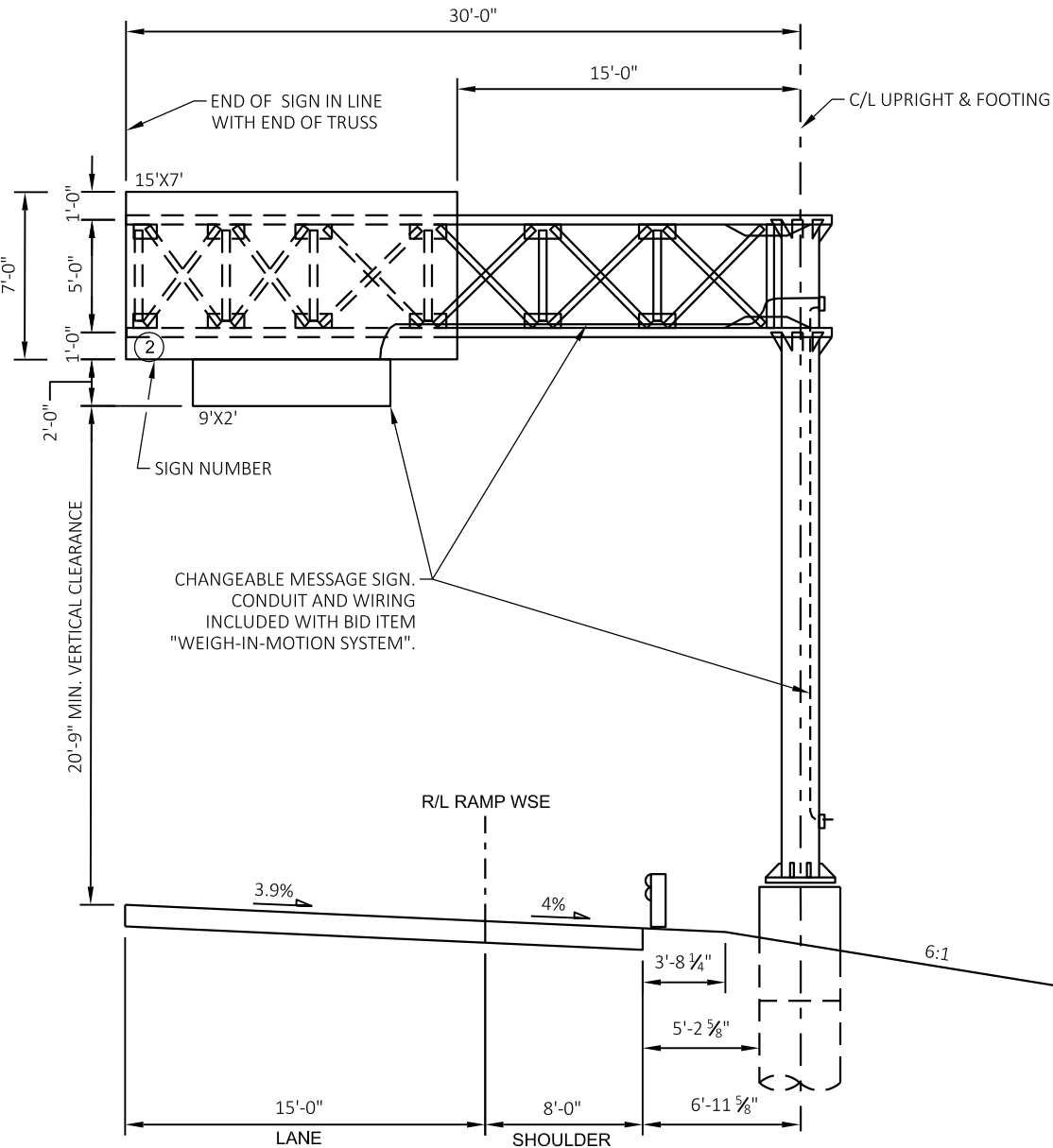
GENERAL NOTES

DRAWINGS SHALL NOT BE SCALED.

CENTER SIGNS VERTICALLY ON TRUSS.

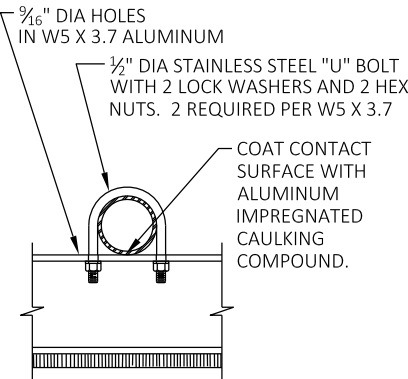
ELEVATIONS ARE IN FEET UNLESS OTHERWISE SHOWN OR NOTED.

DETAILS SHOWN FOR INFORMATION ONLY. WORK INCLUDED UNDER BID ITEMS "SIGNS TYPE I REFLECTIVE SH" AND "REMOVING SIGNS TYPE I" AND "WEIGH-IN-MOTION SYSTEM".



ELEVATION

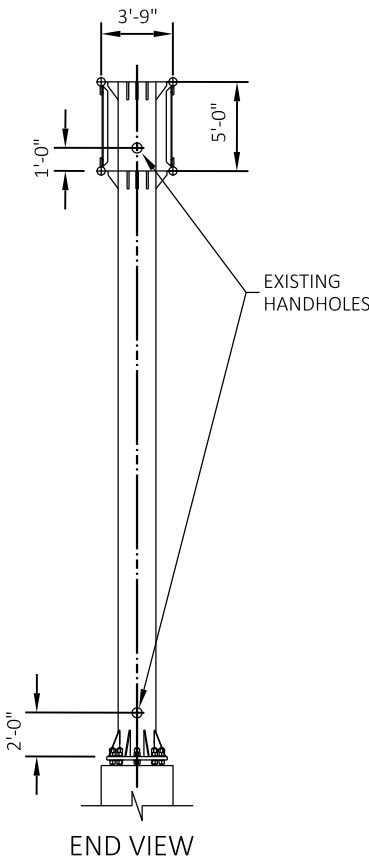
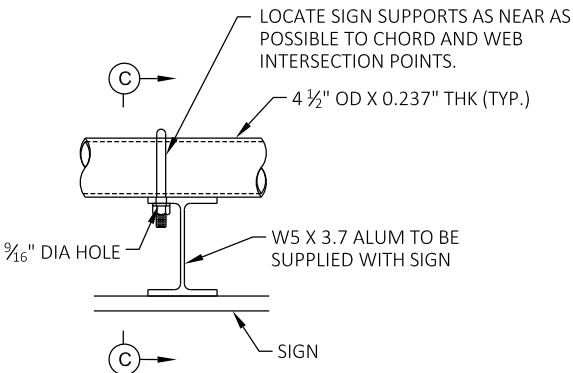
STRUCTURE S-30-25
IH 94 NB, EXIT TO WEIGH STATION
(LOOKING NORTH AT FRONT FACE OF SIGN)
STA. 19+73
(SIGN REPLACEMENT)



SECTION C-C

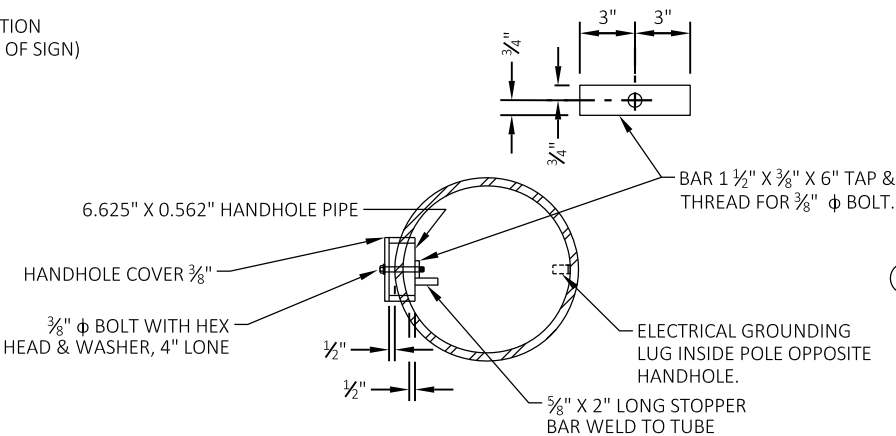
TYPICAL SIGN CONNECTION

(INCLUDED WITH BID ITEM "SIGNS TYPE I REFLECTIVE SH")



LIST OF DRAWINGS

1. SIGN BRIDGE LAYOUT



SECTION L-L

EXISTING HANDHOLE DETAILS

STRUCTURE DESIGN CONTACTS

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STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

ACCEPTED _____
CHIEF STRUCTURES DESIGN ENGINEER DATE

STRUCTURE S-30-25

IH 94 NB EXIT TO WEIGH STATION

COUNTY KENOSHA TOWN/CITY/VILLAGE PLEASANT PRAIRIE

DESIGN SPEC. AASHTO STD. SPEC. FOR STRUCTURE SUPPORTS 2001 LOAD 90 MPH 3 SEC. SP.

DESIGNED BY CAH DESIGN CK'D CDH DRAWN BY STD PLANS CK'D CDH

SIGN BRIDGE
LAYOUT

SHEET 1 OF 1

ATTACHMENT G SPECIFICATIONS

Section 619 Mobilization

619.1 Description

- (1) This section describes the work and operations necessary to move personnel, equipment, supplies, and incidentals to the project site and to establish all of the contractor's offices, buildings, sanitary accommodations, and other facilities necessary to work on the project. It also includes all other work and operations whose performance is required, or for costs necessarily incurred before beginning work on various items on the project site.

619.2 (Vacant)

619.3 (Vacant)

619.4 Measurement

- (1) The department will measure Mobilization once for each contract acceptably completed.

619.5 Payment

- (1) The department will pay for the measured quantity at the contract unit price under the following bid item:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
619.1000	Mobilization	EACH

- (2) Payment for Mobilization is full compensation for supplying and providing materials, facilities, and services, and for performing all work necessary to complete this contract bid item. The department will make incremental payments as determined using department form WS6191 available at:
<http://wisconsin.gov/Documents/doing-bus/eng-consultants/cnslt-rsrcs/tools/estimating/ws6191.xls>
- (3) If the contract does not include a separate Mobilization bid item, the work necessary for mobilization is incidental to work included under other contract bid items.

Section 635 Structural Steel Sign Supports

635.1 Description

- (1) This section describes providing breakaway steel sign supports and replacing base connection bolts.

635.2 Materials

- (1) Furnish [ASTM A709](#), grade 50 for steel sign supports. Hot-dip zinc coat the sign support posts and stubs according to [ASTM A123](#) after completing cutting, drilling, punching, and welding. Furnish mill inspection and testing certifications for posts and stubs conforming to [506.3.21](#).
- (2) Furnish supplier-certified [ASTM F3125](#) A325, type 1 steel bolts, [ASTM A563](#) nuts, and [ASTM F436](#) washers all hot-dip galvanized according to [ASTM A153](#) supplemented by [ASTM F2329](#).

635.3 Construction

635.3.1 Structural Steel Sign Supports

- (1) Locate and erect the supports as specified for placement and orientation in [637.3.3.2](#). Construct concrete footings conforming to [636](#).
- (2) Lubricate base connection bolts and nuts with a wax-based lubricant. Follow the tightening procedure the plan details specify. Use a calibrated torque wrench to establish the final required torque.
- (3) Protect materials from damage to the zinc coating during transportation, storage, and erection. Paint cuts and other areas of damaged zinc coating with 2 coats of zinc dust/zinc oxide paint. Clean damaged and adjacent areas by sanding, scraping, chipping, or wire brushing before painting.
- (4) Perform shop welding for structural steel sign supports as the plans show and conforming to AWS D 1.1, Structural Welding Code - Steel. Do not weld in the field without the engineer's written approval. The engineer will only allow field welding for repairs in noncritical locations and when a department-approved individual competent to perform inspections is present during the welding. Perform field welding using personnel qualified under AWS D 1.5, Bridge Welding Code.

635.3.2 Replacing Base Connection Bolts

- (1) Install new bolts at locations the contract specifies conforming to torque requirements in the plan details. Repair or replace existing posts, base plates, and stiffener plates damaged during bolt replacement.

635.4 Measurement

- (1) The department will measure Sign Supports Structural Steel HS by the pound acceptably completed, measured using the pay weights the plan details show.
- (2) The department will measure Sign Supports Replacing Base Connection Bolts as each individual sign location acceptably completed.

635.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
635.0200	Sign Supports Structural Steel HS	LB
635.0300	Sign Supports Replacing Base Connection Bolts	EACH

- (2) Payment for Sign Supports Structural Steel HS is full compensation for providing sign supports including base connection bolts, nuts, and washers. The department will pay separately for concrete footings under [636.5](#) and for signs under [637.5](#).
- (3) Payment for Sign Supports Replacing Base Connection Bolts is full compensation for providing new bolts for each contract designated sign; and for repairing damage done during bolt replacement.

Section 636 Concrete Sign Supports

636.1 Description

- (1) This section describes constructing drilled shaft concrete footings for structural steel sign supports constructed under [635](#) and for sign bridges and overhead sign supports constructed under [641](#).

636.2 Materials

- (1) Use materials conforming to the following requirements:

Concrete[501](#)

Steel reinforcement.....[505](#)

- (2) Furnish grade A, A-FA, A-S, A-T, A-IS, A-IP, or A-IT concrete conforming to [501](#) as modified in [716](#). Provide QMP for class II ancillary concrete as specified in [716](#).

636.3 Construction

636.3.1 General

- (1) Construct drilled shaft footings and associated wings as specified for footings in [502.3](#). Cure exposed portions of concrete footings as specified in [502.3.8.1](#). Wait until the concrete has attained 3500 psi compressive strength or 7 equivalent days as specified in [502.3.10](#) before erecting any portion of the structure on the footing.
- (2) The contractor shall locate the footing so that after properly erecting the sign support or sign bridge and after installing the sign or signs they are at the position, elevation, and orientation the plans, and specifications specify, or as the engineer directs.
- (3) If the contract requires, install a 5/8-inch by 10-foot copper clad ground rod at the sign support. Install the rod next to the support or as the engineer directs.

636.3.2 Excavation

- (1) Before beginning any excavation, locate existing underground cable, utility, or drainage structures in the vicinity and conduct operations to avoid damaging them.
- (2) Excavate the footing to the required depth and diameter with minimal disturbance to adjacent soil.

636.3.3 Placing Concrete

- (1) Place the concrete for the footing in the excavation, against the soil without forming, except as specified otherwise below.
- (2) Place concrete to the initial height the plans show. Form the portion of the sign bridge footing that extends above the ground.
- (3) If steel reinforcement is required, secure it in place before placing the concrete.
- (4) Set and secure the anchor rod assemblies and post stubs at their proper location until the concrete hardens. Protect anchor rod threads above the top of the foundation level from concrete splash.
- (5) Construct drilled shafts to extend above the finished ground elevation according to plan details. Do not place construction joints without the engineer's written approval. Line the upper 18 inches with a disposable casing to ensure a uniform diameter. Remove the disposable casing before backfilling. For the upper surface, provide a level plane finished true to grade.
- (6) If the engineer determines the possibility of cave-ins, or soil displacement from the walls exists, or if necessary to shut off seepage water, then line the remaining depth of the footing shaft with a suitable casing. Ensure casings are of ample strength to withstand handling stresses, concrete pressure, and the pressure of surrounding soil materials. If removing the casings, withdraw them while placing the footing concrete or immediately following concrete operations. If removing the casing during the concrete operation, place at least 2 feet of concrete before starting to pull the casing, and maintain a head of concrete of from one to 2 feet during the pulling operation. Take care when pulling the casing to prevent moving the stub posts or anchor rod assembly, reinforcement steel, and upper casing, and to prevent any appreciable quantity of soil from mixing with the concrete.
- (7) If required, cast the electrical conduit in the footing according to the plan details.

636.3.4 (Vacant)

636.3.5 Clean-Up

- (1) After completing work and before acceptance, remove and dispose of excess excavation and surplus or discarded materials, and restore work or property damaged during operations.

636.4 Measurement

636.4.1 Concrete

- (1) The department will measure Sign Supports Concrete Masonry by the cubic yard acceptably completed. The department will base measurement on the dimensions the plans show or that the engineer orders in writing. The department will not measure concrete placed outside the designated dimensions.

636.4.2 Steel Reinforcement

- (1) The department will measure the Sign Supports Steel bid items by the pound acceptably completed. The department will compute the weight as specified for bar steel reinforcement under [505.4](#).

636.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
636.0100	Sign Supports Concrete Masonry	CY
636.0500	Sign Supports Steel Reinforcement	LB
636.1000	Sign Supports Steel Reinforcement HS	LB
636.1500	Sign Supports Steel Coated Reinforcement HS	LB

- (2) Payment for Sign Supports Concrete Masonry is full compensation for providing concrete; for providing and removing casing; for providing required ground rods; for excavating and backfilling; for placing post stubs or anchor rods; for providing electrical conduit; for cleaning-up, repairing damage, and for disposing of excavation and surplus materials.
- (3) Payment for the Sign Supports Steel bid items is full compensation for providing sign supports.

Section 637 Signing

637.1 Description

- (1) This section describes providing signs, of the type or types specified, on supports in place or erected under the contract.

637.2 Materials

637.2.1 Sign Base Materials

637.2.1.1 Aluminum Extrusions

- (1) Use the style of aluminum extrusions specified in the plans. The engineer will accept any shape reasonably close to the shape illustrated, with no interlocking arrangement, and conforming to the minimum weight requirements the plans specify. Use the same style and brand of extrusion required for all the work under the contract. Use aluminum extrusions conforming to [ASTM B221](#), alloy 6061-T6, 6063-T5, or 6063-T6.
- (2) Perform shearing, cutting, punching, drilling, or other fabrication procedures on extruded panels before preparing the aluminum to receive reflective material.
- (3) The department will allow a maximum deviation from flat on the face of extrusions of 0.004 inches per one inch of extrusion width.
- (4) The engineer will not require sign edge molding.

637.2.1.2 High-Density Overlaid Plywood

- (1) Use base material conforming to the U.S. Product Standard PS 1 for construction and industrial plywood. Use 7-ply material manufactured from a group 1 wood and conforming to the requirements for B-B or better high-density overlay exterior plywood intended for use in highway signs, and suitable for applying reflective sheeting to without further surface preparation other than as specified below in [637.3.2](#).
- (2) Make plywood sign panels from material not less than 5/8 inch thick, except that for signs with a face 2 feet by 2 feet or less with the horizontal dimension no greater than the vertical dimension, the contractor may use 1/2 inch thick material.

637.2.1.3 Sheet Aluminum

- (1) For this base material, use aluminum alloy 5052-H38 complying with [ASTM B209](#).
- (2) Ensure sign blanks are free from laminations, blisters, slivers, open seams, pits from heavy rolled-in scale, ragged edges, holes, turned-down corners, or other defects that might affect their appearance or intended use. Use blanks conforming to the Aluminum Association, Inc., requirements for commercial flatness and uniformity of thickness. Perform shearing, cutting, and punching before coating and applying reflective or other surface material.
- (3) Ensure that the sheared edges of sign blanks are straight and free from tears or raggedness. Round corners unless the plans show otherwise. Ensure punched or drilled holes are round; free from tears, raggedness, and distortion of the metal; and of the diameter and location the plans show.
- (4) Degrease, etch, and coat the sign blank on both sides with a chromate treatment conforming to [ASTM B921](#), class 2.
- (5) For other than stop signs, furnish material that equals or exceeds the following nominal thickness for the indicated sign width:

WIDTH	NOMINAL THICKNESS
30 inches and under	0.080 inch
Greater than 30 through 36 inches	0.100 inch
Over 36 inches	0.125 inch

- (6) For stop signs, furnish material that equals or exceeds the following nominal thickness for the indicated sign size:

SIZE	NOMINAL THICKNESS
24 inches x 24 inches	0.080 inch
30 inches x 30 inches	0.100 inch
36 inches x 36 inches and larger	0.125 inch

637.2.2 Sign Face Materials

637.2.2.1 General

- (1) Sign sheeting material acceptance is subject to the performance criteria specified in [637.3.3.4](#).

637.2.2.2 Reflective Sheeting

- (1) Furnish type H, SH and F reflective sheeting from the department's [APL](#). If the manufacturer provides a warranty for the reflective sheeting, turn the warranty over to the department.

637.2.2.3 Nonreflective Sheeting

- (1) Furnish nonreflective sheeting consisting of a flexible sign face material precoated with adhesive and with a protective liner. Ensure that sheeting thickness, without liner, is from 0.003 to 0.005 inches inclusive.
- (2) Provide test data showing that the sheeting has no appreciable shrinkage, discoloration, cracking, crazing, chalking, blistering, delamination, or loss of adhesion.

637.2.3 Sign Message Material

637.2.3.1 (Vacant)

637.2.3.2 Stencil Paste

- (1) Furnish stencil paste of a type the manufacturer of the underlying face material approves for that application.

637.2.3.3 Electronic Cuttable Overlay Film

637.2.3.3.1 General

- (1) Furnish transparent colored electronic cuttable film for shop application over reflective sheeting. Use overlay film from the same manufacturer and with the same warranty as the underlying reflective sheeting.

637.2.3.3.2 Performance Requirements

- (1) After overlaying, the composite shall conform to the same [ASTM D4956](#) color specification limits and daytime luminance factors applicable to an equivalent background sheeting material of the same color with no overlay.
- (2) Furnish film coated with a pressure-sensitive adhesive capable of adhering without using additional adhesive. Ensure that the protective lining for the adhesive is removable without soaking in water or other solvents.
- (3) Furnish film with a coefficient of retroreflection that equals or exceeds 70 percent of that required by [ASTM D4956](#) for similar colored retroreflective sheeting. For blue films, 55 percent or greater is acceptable.

637.2.3.4 Vandalism Sticker

- (1) Affix a vandalism sticker to the face of type I and II signs. Obtain stickers from the department's sign shop located at:

3609 Pierstorff St.
Madison, WI 53704

- (2) Position the stickers on the signs according to the following procedures:

1. Attach the sticker at the extreme lower left corner of square or rectangular signs, horizontally and typically outside the sign border, or just inside the sign border if the space between the edge of the sign and the border is not sufficient to accommodate the sticker.
2. On signs of other shapes, for example stop, yield, and no passing zone pennants, place the sticker at the lowest edge or corner of the sign, parallel with the border or edge of the sign, and at the left corner or left side of the sign.
3. On signs with a white border, place the sticker within the white border at the locations designated.

637.2.3.5 Sheeting Material Identification Code and Installation Date

- (1) Affix identification code and installation date stickers on the back of signs as follows:
 - On type I signs, in the lower right corner.
 - On type II signs, in the upper right corner.
- (2) Obtain stickers from the department's sign shop located at:

3609 Pierstorff St.
Madison, WI 53704

637.2.4 Sign Mounting Hardware

637.2.4.1 Type I Signs

- (1) Connect individual aluminum extrusion panels together to form a completed sign assembly. For panel stitch hardware, use self-locking nuts, bolts, washers, and other hardware as follows:

1. Stainless steel conforming to [513.2.1](#).
2. Aluminum that the panel manufacturer either supplies or approves.
- (2) Mount the sign assembly using aluminum post clips, stainless steel bolts with self-locking nuts, and a protective stainless steel flat washer against each post clip. Provide the following:
 1. Stainless steel bolts and washers conforming to [513.2.1](#).
 2. **Stainless steel self-locking nuts conforming to ASME B18.16.6.**
 3. Aluminum post clips conforming to [ASTM B221](#) alloy 6061-T6, **ASTM B26 alloy 356.0-T6**, or [ASTM B108](#) alloy 356.0-T6.

637.2.4.2 Type II Signs

637.2.4.2.1 Ground-Mounted Signs

- (1) Furnish components to attach signs to ground mounted wood or steel posts using hex head nuts and bolts, washers, and other steel hardware treated in one of the following ways:
 1. Hot dipped coated according to [ASTM A153](#).
 2. Electrically zinc coated according to [ASTM B633](#), type III, SC 3.
- (2) Use only nuts and bolts manufactured with sufficient clearance to allow the nuts to run freely on the bolts after plating or coating.

637.2.4.2.2 Overhead-Mounted Signs

- (1) Furnish a sign mounting system from the department's [APL](#).

637.2.5 Color

- (1) For sign face and sign message materials provide the color the plans show.

Add 637.2.6 to specify material requirements for permanent barricades.

637.2.6 Permanent Barricades

- (1) **Furnish 8-foot barricades as well as red and white barricade sheeting from the department's [APL](#). If the plans show installing on wood posts, fabricate conforming to the following:**

Plywood	637.2.1.2
Wood posts	634.2.1
Mounting hardware	637.2.4.2.1

637.3 Construction

637.3.1 Definitions

- (1) Type I signs consist of guide signs having extruded aluminum base material, reflective backgrounds, and non-removable messages. They are ground mounted on steel posts and are used in unlighted overhead locations.
- (2) Type II signs consist of miscellaneous warning, regulatory, informational, and standard size guide signs, having sheet aluminum or plywood base material, and reflective or non-reflective backgrounds, and non-removable messages.

637.3.2 Manufacture and Assembly

637.3.2.1 General

- (1) Manufacture signs to conform to the dimensions and details the plans show. Letter series refer to the standard series approved by the FHWA. Ensure that the corners of type I signs are square, but make the borders as the plans show.
- (2) Where the department uses the term "message" in these specifications or on the plans, it includes letters, numerals, symbols, and borders.

637.3.2.2 Preparing Sign Panels for Reflectorization

637.3.2.2.1 Aluminum Panels

- (1) If applying reflective sheeting to aluminum panels, prepare the panels as follows:
- (2) Perform the preliminary cleaning of the sign blanks by completely submerging them in a 3 percent solution of inhibited alkaline cleanser at 160 to 180 F for 3 minutes, followed by a thorough rinse in clean running cold water. Instead of this method the contractor may use a grease solvent, such as naphtha, provided it applies the cleanser according to the manufacturer's directions.
- (3) After this preliminary cleaning, immerse the panels for at least 3 minutes in a 6 percent to 8 percent solution of phosphoric acid at 100 F. Then rinse the panels in a spray of cold water, followed by immersing for one minute in circulating hot water at 180 F. Dry the panels with forced warm air.

- (4) If using extrusions, and the panel length prohibits total immersion, then the contractor may apply 6 percent to 8 percent phosphoric acid at 100 F to the surface by swabbing, brushing, or spraying, and allowing it to remain for 5 minutes, then remove the acid using a cold water rinse and dry with forced warm air.

637.3.2.2.2 High-Density Overlaid Plywood Panels

- (1) Ensure that the plywood blank surfaces are smooth, clean, and free from any oils, edge sealant, dust, or solvent. If the reflective sheeting manufacturer recommends, lightly sand the sign face surface then wipe with a solvent before applying the sheeting.

637.3.2.2.3 Handling Panels

- (1) If reflectorizing the surface of aluminum or plywood sign blanks, handle the surface with devices or clean canvas gloves between cleaning and etching operations and when applying the reflective sheeting.

637.3.2.3 Applying Reflective Sheeting

- (1) Prepare sign panels and blanks as specified above and according to the reflective material manufacturer's recommendations. Apply reflective sheeting according to the manufacturer's recommendations.
- (2) After curing for 48 hours at 70 F, the bond between the reflective sheeting and the sign panel or blank must resist stripping from the panel with a stiff putty knife; and must withstand 8 hours of soaking in water at 75 F without appreciable loss of adhesion.
- (3) Ensure that no line of separation exists between adjacent panels due to lack of reflective material. The contractor shall not extend the reflective sheeting from one panel to adjacent panels. Wrap the sheeting a minimum of 1/4 inch around the top and bottom edges of each panel.

637.3.2.4 Applying Messages on Type II Signs

637.3.2.4.1 Signs with Black or Dark Message on a White, Yellow, or Orange Background

- (1) Apply messages using either of the following methods:
 1. Use a silkscreen stencil process with a black or dark stencil paste of a type the manufacturer of the underlying reflective sheeting approves for that application.
 2. Use an electronic cuttable overlay film shop-applied over underlying white reflective sheeting. Apply according to the manufacturer's recommended procedures. Ensure that the resultant composite produces the required background color.

637.3.2.4.2 Signs with White Message on a Red, Blue, Brown, or Green Background

- (1) Apply messages using any of the following methods:
 1. Individually cut the borders, letters, numerals, and symbols from white reflective sheeting and apply them to a background of colored reflective sheeting from the same manufacturer. Apply according to the manufacturer's recommended procedures.
 2. Use the reverse screening process with a transparent stencil paste applied to white reflective sheeting. Ensure that the resultant background is uniform and has the required background color. Use the brand of transparent paste that the reflective sheeting manufacturer recommends.
 3. Use an electronic cuttable overlay film shop applied over underlying white reflective sheeting. Apply according to the manufacturer's recommended procedures. Ensure that the resultant composite produces the required background color.

637.3.2.4.3 Signs with Yellow Message on a Brown Background

- (1) Apply messages using either of the following methods:
 1. Individually cut the borders, letters, numerals, and symbols from yellow reflective sheeting and apply them to a background of brown reflective sheeting from the same manufacturer. Apply according to the manufacturer's recommended procedures.
 2. Use the reverse screening process with an opaque stencil paste applied to yellow reflective sheeting. Ensure that the resultant background is uniform and has the required background color. Use the brand of opaque paste that the reflective sheeting manufacturer recommends.

637.3.2.5 Applying Clear Finish

- (1) If the reflecting material manufacturer recommends a clear finish, apply the finish to the face of the sign panel according to the manufacturer's instructions after applying the background and message for reflective type I and II signs and allowing them to dry completely.

637.3.2.6 Applying Messages on Type I Signs

- (1) Completely assemble each sign in the shop before applying the sign message. Cut the applied message between each aluminum extrusion.

- (2) For signs with a black or dark message on a white, yellow, or orange background, conform to item 2 of [637.3.2.4.1\(1\)](#).
- (3) For signs with a white message on a red, blue, brown, green, or black background, conform to item 1 of [637.3.2.4.2\(1\)](#). Use type SH sheeting for the message.
- (4) For route markers, use type SH sheeting in the shape the plans show. Apply letters and numbers as specified in [637.3.2.4](#).

637.3.2.7 Assembling Type I Signs

- (1) For type I signs use aluminum extrusion sign base material.
- (2) Assemble individual aluminum extrusions into signs the size the plans show, according to the extrusion fabricator's recommendations and in a manner the engineer approves.
- (3) Make each extension the full width of the sign without joint or splice.

637.3.2.8 Assembling Type II Signs

637.3.2.8.1 General

Revise 637.3.2.8.1(1) to require sheet aluminum sign base for all type II signs.

- (1) Provide type II signs of the size and shape the plans show. **Unless the plans show otherwise, use sheet aluminum for permanent type II signs.**
- (2) Do not use horizontal joints on a type II sign with a vertical dimension of 48 inches or less.
- (3) Do not use vertical joints on a type II sign with a horizontal dimension of 144 inches or less. Do not use more than one vertical joint on wider type II signs.
- (4) Mount permanent flags to type II signs if the plans show.

637.3.2.8.2 Battens Over Joints

Revise 637.3.2.8.2 to eliminate the requirement for battens on sheet aluminum signs.

- (1) If using 2 or more sheets of sign base material **other than sheet aluminum** to make a single type II sign, attach a 6-inch batten of the same material as the sign base by screws or rivets to the back of the sign and covering the joint.
- (2) Use screws to attach battens to plywood signs. Drive the screws into the sign from the back and do not cut the face of the sign. For battens on plywood signs, the contractor may use one inch by 6-inch lumber pressure treated conforming to [507.2.2.6](#) using one of the waterborne preservatives specified in [507.2.3](#). Use battens that extend the full length of the joint, except stop horizontal battens within 10 inches of each sign post to allow mounting of the sign base material directly on the post, and stop vertical battens within 10 inches of horizontal stiffeners or stringers to allow mounting the sign base material directly on them. Additionally, the contractor shall not use horizontal battens if locating a horizontal stiffener or stringer as specified below properly battens the joint.

637.3.2.8.3 Horizontal Stiffeners

Revise 637.3.2.8.3 to eliminate the requirement for 2 x 6 stiffeners for sheet aluminum signs.

- (1) **For plywood signs**, provide stiffeners made of 2 x 6 lumber pressure treated as specified for wood sign posts in [634.2.1\(3\)](#). Screw 2 horizontal stiffeners to the back of each type II sign with one or more of the following:
 1. Vertical joints between adjacent panels of sign base material.
 2. Plywood base material and a horizontal dimension exceeding 80 inches and a vertical dimension less than 36 inches.
 3. Aluminum base material and a horizontal dimension exceeding 80 inches regardless of vertical dimension.
 Horizontal stiffeners are not required for the following:
 1. Signs mounted on bridges with either continuous bearing on the bridge or mounted on spacer blocks at both the top and the bottom of the sign.
 2. Signs mounted on horizontal stringers.
- (2) On plywood signs, drive the screws from the back of the sign and do not cut the face of the sign. Position the center of the stiffeners 9 inches above the bottom of the sign and 9 inches below the top of the sign, respectively. Except on signs having a vertical dimension of 27 inches or less, then center only one stiffener on the back of the sign. Ensure that stiffeners extend the full length of the sign.

637.3.2.8.4 Horizontal Stringers

Revise 637.3.2.8.4 require horizontal stringers for sheet aluminum signs wider than 77 inches.

- (1) **Provide horizontal stringers made of flanged channel section posts conforming to [633.2.1](#). Bolt 2 stringers to the back of each sheet aluminum sign panel with a horizontal dimension greater than 77**

inches. If mounted on one or more posts; fasten the sign, each stringer, and each post at their points of intersection with a bolt or lag screw passing through or into all 3 parts of the assembly.

637.3.3 Installing Signs

637.3.3.1 General

- (1) If erecting signs before their message becomes applicable, cover the sign faces conforming to [643.3.4.3](#) to make their messages unreadable during both daytime and nighttime. Maintain the covering in good condition until the message becomes applicable and the engineer orders the covering removed or until the contract expires.
- (2) The contractor shall not install stop signs and yield signs before the time that they are applicable.

637.3.3.2 Placing and Orienting

- (1) Establish and stake, or mark on the pavement, the longitudinal location of each sign, including signs on the main line roadways, frontage roads, ramps, and intersecting roads as the plans show or as the engineer directs.
- (2) Laterally position the sign from the shoulder edge or curb as the plans show or as the engineer directs.
- (3) The proper elevation, offset, level, and orientation of signs erected are the contractor's responsibility. Exercise care to preserve stakes. Reset stakes lost, damaged, displaced, or removed.
- (4) Generally, erect signs so the edge and face of the sign are truly vertical and the face is normal to the centerline of the roadway that the sign serves, and so the sign faces slightly away from the motorists line of sight in order to avoid specular reflection and glare.

637.3.3.3 Fastening Signs to Supports

- (1) If the plans require the contractor to mount signs on utility poles or highway lighting poles installed by others, then follow the method of mounting the plans show.
- (2) Fasten type II signs to wood sign posts with bolts or lag screws. For signs with type H, type SH, or type F Reflective Sheeting, place a fiber, nylon, or clear plastic washer between the head of the bolt or screw and the face of the sign. For signs, place a metal washer on the bolt beneath the nut.
- (3) Fasten overhead-mounted type II signs using a mounting system from the department's [APL](#). Conform to torque limitations and other installation instructions provided by the sign mounting system manufacturer. Provide a copy of those instructions to the engineer.
- (4) Fasten signs to flanged beam sign supports and sign bridges according to the plans and the sign manufacturer's recommendations.

637.3.3.4 Performance

- (1) Under [105.11.2.3](#) the department may revoke acceptance and direct the contractor to repair or replace previously accepted sign installations if the department subsequently discovers evidence of defective materials or improper installation. Deficiencies that warrant department action include but are not limited to the following:
 - Sign posts more than five degrees out of plumb.
 - Signs twisted by more than 5 degrees from plan orientation.
 - Signs with delaminated or warped plywood.
 - Signs with bubbling, fading, delaminating, or buckling sheeting.

Add 637.3.4 to specify construction requirements for permanent barricades.

637.3.4 Permanent Barricades

- (1) Provide permanent barricades in the locations the plans show. Fasten barricades to pavement using an engineer-approved method. If fabricating barricades as allowed under [637.2.6](#), conform to:
 - Install wood posts [634.3](#)
 - Attach barricade boards to the posts [637.3.3.3](#)

637.4 Measurement

- (1) The department will measure the Sign Flags Permanent bid items as each individual flag acceptably completed.
- (2) The department will measure the Signs bid items by the square foot acceptably completed, measured as the area of sign face for individually mounted signs and the area of the entire base panel for multiple signs mounted as an assembly.

Add 637.4(3) to specify measurement for permanent barricades.

- (3) The department will measure the Barricades Permanent bid items as each individual barricade acceptably completed.

637.5 Payment

Revise 637.5 to move the permanent barricades bid item from 643 to 637.

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
637.0600-0699	Sign Flags Permanent (type)	EACH
637.1000 - 1999	Signs Type I (reflectivity)	SF
637.2000 - 2999	Signs Type II (reflectivity) (folding)	SF
637.5450 - 5455	Barricades Permanent (type)	EACH

- (2) Payment for the Sign Flags Permanent bid items is full compensation for providing permanent flags.
- (3) Payment for the Signs bid items is full compensation for providing signs including mounting hardware and temporary flags; and for preserving and resetting sign location stakes.
- (4) Payment for the Barricades Permanent bid items is full compensation for providing barricades. The department will pay separately for associated signs.
- (5) The department will pay separately for required sign supports, sign bridges, and electrical cable.

Section 643 Traffic Control

Rewrite section 643 to do the following:

- *Require that most of the devices be from the department's approved products list.*
- *Add a bid item for 42-inch traffic control cones.*
- *Retire bid items for detours and detour signs now covered under the Traffic Control Signs bid item.*
- *Move the bid item for permanent barricades to 637.*
- *Add a new bid item for Traffic Control paid by the contract to cover costs not under other 643 bid items.*

643.1 Description

- (1) This section describes providing, maintaining, repositioning, and removing temporary traffic control devices as follows:

Drums	Warning lights	42-inch cones
Barricades	Arrow boards	Portable changeable message signs
Flexible tubular markers	Signs	

643.2 Materials

643.2.1 General

- (1) Furnish materials and devices conforming to the WMUTCD that are acceptable according to the ATSSA publication Quality Guidelines for Temporary Traffic Control Devices and Features.
- (2) Place the name and telephone number of the agency, contractor, supplier, or person responsible for 24-hour emergency service on each drum, a rail of each barricade, arrow board, the back of each sign, Portable Changeable Message Sign, and cone. Use non-reflective letters at least 3/4 inch but no more than 2 inches high.
- (3) Traffic control devices remain the contractor's property upon completion of the work unless the contract specifies otherwise.

643.2.2 Department's Approved Products List (APL)

- (1) Furnish materials from the department's [APL](#) as follows:
- Drums
 - Barricades
 - Flexible tubular marker posts including bases
 - Warning lights and attachment hardware
 - Arrow boards
 - Sign sheeting
 - 42-inch cone assemblies
 - Portable changeable message signs

643.2.3 Signs

643.2.3.1 General

- (1) Layout signs according to the plans. If the plans do not show the layout, conform to the department's Sign Plate Book. If neither the plans nor the Sign Plate Book shows the layout, conform to the FHWA Manual of Standard Highway Signs.
- (2) If the contract does not specify the size, provide signs as large or larger than the size the WMUTCD specifies for higher-speed locations. The engineer may allow smaller signs if space is limited and the WMUTCD allows.
- (3) Use the materials and methods specified in [637](#), for type II signs, to manufacture and assemble signs. In addition, the contractor may use the following:
1. For all signs, one or more of the following:
 - 1.1. An exterior grade B-B or better overlay plywood sign base 1/2-inch or thicker.
 - 1.2. For signs 24 inches or less wide, corrugated polypropylene or polyethylene plastic sign base.
 - 1.2.1. Provide a 0.4-inch thick base with a 0.035-inch wall thickness and 0.4-inch cell size.
 - 1.3. An aluminum/plastic laminate sign base.
 - 1.3.1. Provide an aluminum faced composite base 0.080 - 0.100 inches thick, with aluminum outer layers 0.010 - 0.020 inches thick surrounding a polyethylene or other thermoplastic core.
 2. For signs mounted on portable sign supports or barricades, in addition to the materials and methods specified above, the contractor may also use one or more of the following:
 - For signs wider than 24 inches, corrugated polypropylene or polyethylene plastic sign base.
 - A retroreflective roll-up sign.
 - A sheet aluminum sign base 0.080 inches or thicker.
- (4) Prepare the sign base as the sheeting manufacturer recommends.
- (5) If using plywood sign bases with prismatic sheeting, use new plywood. For other sign base types, the contractor may use a reconditioned base if previous sheeting materials are removed before applying

new prismatic sheeting. Do not remove messages and reapply new messages to existing signs with prismatic sheeting, except as specified for overlays in [643.2.3.2](#).

(6) Provide a sign support system as follows:

1. For signs mounted on posts, use posts from the FHWA list of accepted breakaway sign supports.
2. For signs mounted on portable sign supports or barricades, use signs and supports from the departments approved products list.

643.2.3.2 Sign Message Overlays

643.2.3.2.1 General

- (1) The contractor may alter the message on standard construction signs by applying demountable plaque overlays or direct-applied pressure-sensitive sheeting overlays. Do not apply more than one overlay per sign. Do not encompass more than one line of the sign message with the overlay. On W20-5 or W20-58 series signs, the contractor may use 2 overlays to independently alter the right/left lane message and the ahead/distance message.
- (2) Match the specified letter height, letter series, and letter stroke width of the message on the sign on which mounting plaques or overlays.
- (3) Ensure that the reflectivity and the color of the sheeting on plaques or sheeting overlays and base signs are similar enough that the composite sign exhibits the visual impact of one integral sign during both daytime and nighttime.
- (4) Match the sign face material for overlays to the base sign reflective sheeting material.
- (5) Do not use sign overlays for symbol messages, except for the lane reduction transition sign, WO4-2.

643.2.3.2.2 Demountable Plaque Overlays

- (1) For the base material, furnish sheet aluminum conforming to [637.2.1.3](#). Furnish reflective sheeting for sign face material conforming to [643.2.3.1](#). Apply the sign message using stencil paste conforming to [637.2.3.2](#) and clear finish conforming to [637.3.2.5](#).

643.2.3.3 Sign Covering Material

- (1) Furnish sheet aluminum, plywood, or corrugated plastic sign covers conforming to the requirements for sign base materials specified in [643.2.3.1](#), except the minimum thickness for aluminum covers is 0.040 inches. With the engineer's approval, the contractor may use systems specifically manufactured to cover highway signs or other weather resistant materials that will not damage the sign's reflective face. Do not use tape or other adhesives to fabricate or attach covers.
- (2) Ensure that covers are blank, opaque, and match the sign face color or are flat black. Use only one color per sign.
- (3) Furnish spacers, 0.08-inch nylon washers that will not damage the sign's reflective face.

643.2.4 Cellular Communication for Portable Changeable Message Signs (PCMS)

- (1) Furnish a cellular modem registered to a cellular carrier with a 12 volt DC power supply, a built-in security, port forwarding, and IP pass-through capabilities. Ensure that the modem can handle -30 C to +75 C temperatures.
- (2) Provide the department with an IP address, serial port settings, and passwords.

643.3 Construction

643.3.1 General

- (1) Provide and maintain traffic control devices located where the plans show or engineer directs to maintain a safe work zone throughout the contract duration. Relocate as required to accommodate changing work operations and remove after the work is completed.
- (2) Attach warning lights to traffic control devices with vandal resistant hardware.
- (3) Do not power PCMS and arrow boards with a generator.
- (4) Perform traffic control work according to part VI of the WMUTCD for temporary traffic control unless the contract specifies or engineer directs otherwise. Ensure the proper placement and operation of signs and traffic control devices before beginning associated work. Relocate signs and traffic control devices concurrently with moving work operations.
- (5) Review signs and traffic control devices for location, position, visibility, and appropriateness for job conditions immediately after each setup. Do additional reviews as necessary to provide a safe work zone and ensure signs and traffic control devices conform to the contract. Perform work zone reviews from the direction of approaching traffic. Include temporary pavement marking placed under [649](#).

- (6) Replace devices the ATSSA guide defines as unacceptable. Maintain traffic control devices on the project at or above the quality the ATSSA guide defines as marginal by doing the following:
 1. Keep sheeting on drums, barricades, and other devices clean.
 2. Promptly repair sheeting scratches, rips, and tears.
 3. Repair or replace devices that have large areas of abrasion or missing sheeting.
 4. Replace devices that have excessive color fading.
 5. Do not use devices fractured, punctured, dented, or deformed severely enough to affect the overall dimensions, stability, visibility, or reflectivity.
 6. Maintain the retro-reflectance of signs, drums, posts, and barricades at a level not less than 50 percent of the minimum value specified for type III reflective sheeting in [ASTM D4956](#).
- (7) Promptly restore traffic control devices damaged or disturbed within 2 hours of becoming aware of a deficiency.
- (8) If, in the engineer's judgment, the contractor fails to provide the traffic control required to maintain a safe work zone under the contract, the engineer may restrict construction operations.

643.3.2 Flexible Tubular Markers

- (1) Attach bases to the pavement as the plan details show.
- (2) Attach the posts to the base using a locking pin or other engineer-approved system. Use new marker posts with reflective sheeting for installation in new locations. The contractor may furnish used posts, in like-new condition with new reflective marking, as replacement posts.
- (3) Remove bases in a way that minimizes damage to the pavement. If bolted, remove the bolts below the pavement surface. Repair damage done during removal as the engineer directs.

643.3.3 Arrow Boards

- (1) The contractor may use solar arrow boards only in stationary setups.
- (2) Operate arrow boards during the hours of darkness at an illumination level of not more than 50 percent of the daytime level. Ensure the following:
 - The arrow board is continuously visible and identifiable for a distance of one mile in advance of the beginning of the lane closure taper.
 - The lamps are visible at a minimum 18 degrees horizontal angle and 8 degrees vertical angle, measured from a perpendicular to the arrow board plane.
 - The minimum lamp "on" time is 50 percent and no lamps remain illuminated during "off" time.
- (3) Do not display arrows or chevrons by lighting in sequence from left to right, or right to left.

643.3.4 Signs

643.3.4.1 General

- (1) Install post mounted signs as the plans show. Trim posts neatly with top of sign, so that no portion of the post protrudes above the sign. Do not install signs on existing posts unless the plans show or the engineer or post owner allows. Do not install signs or sign posts on guardrail posts.
- (2) Use spacers when fastening a sign or sign cover on existing signs and attach at a minimum of four points per panel as follows:
 - For aluminum signs: use 3/16 inch diameter aluminum rivets or aluminum self-tapping screws.
 - For plywood signs: use 3/16 inch diameter wood screws.
 - Space screws or rivets at least 12 inches apart and at least 1/4 inch from the edge of the cover.
- (3) Repair or replace damaged permanent signs resulting from covering as the engineer directs. Remove covers when no longer necessary.

643.3.4.2 Sign Message Overlays

- (1) Fasten plaque overlays to base signs with 4 bolts or screws, one in each corner of the plaque. Apply sheeting overlays so that no curling or lifting of the overlay occurs during use. Promptly replace the sign if any part of the overlay curls or lifts.
- (2) Position plaques or sheeting overlays on base signs so that they appear to be an integral part of the message. Ensure that plaques or sheeting overlays completely cover the underlying sign message that is no longer applicable. Do not overlay any other part of base sign messages, or let the overlay extend beyond the base sign border.

643.3.4.3 Covering Signs

- (1) If a sign message is no longer relevant, promptly remove the sign or cover all or, if the engineer allows, part of the sign with materials conforming to [643.2.3.3](#).

- Make Type I sign covers square or rectangular and sized in increments of 12 inches.
- Cover Type II signs completely.

643.3.4.4 Fixed Message Signs

- (1) Custom signs, or standard signs with a dimension greater than 60 inches are fixed message signs. If fastening a fixed message sign to an existing sign, completely cover the underlying sign message that is not applicable.

643.3.5 Portable Changeable Message Signs

643.3.5.1 General

- (1) Ensure that the PCMS is level and operating satisfactorily before activating. Maintain the PCMS in good working condition. Repair damaged or malfunctioning PCMS units within 2 hours after discovering a problem.
- (2) Place the sign so that in the operating mode the bottom of the message panel is 7 feet or higher above the top of curb or near edge of pavement. In rural areas with no view obstructions, the contractor may reduce the minimum mounting height to 5 feet. Orient the message panel so the message is legible from 850 feet under both day and night conditions.
- (3) Store predetermined messages in the controller memory for recall on demand. In addition, store other messages as the engineer directs. Display messages using all upper case alphanumeric characters 18 inch high by 11 inch wide.
- (4) Provide password protection to the PCMS control unit unique to the project.

643.3.5.2 Cellular Communication

- (1) Install the cellular modem in a lockable, weatherproof compartment in the PCMS trailer. Mount the antenna at the highest practical location on the PCMS.
- (2) A minimum of 14 days before deployment, demonstrate to the department that the cellular modem is capable of communications with the State Traffic Operations Center. If remote communications are interrupted or temporarily unavailable, the department will notify the contractor to change messages manually. Update messages within 2 hours of receiving notification.

643.3.6 Traffic Control

- (1) Under the Traffic Control bid item, install and reposition traffic control devices as required to restrict access to a portion or all of the roadway to public traffic. This work includes initial set up, stage changes, and removal after the work is completed.

643.4 Measurement

643.4.1 Items Measured by the Day

- (1) The department will measure the number of calendar days acceptably completed that each sign or each device under a bid item is in use. The department will not measure a sign or a device on days it is not required. The department will deduct one day for each calendar day a sign or a device is required but out of service for more than 2 hours.
- (2) The department will only measure the Traffic Control PCMS bid items on days the PCMS is available for exclusive use under the contract.

643.4.2 Flexible Tubular Markers

- (1) The department will measure the Traffic Control Flexible Tubular Marker bid items as each individual installation and removal acceptably completed. The department will measure replacement posts and bases damaged by public traffic.

643.4.3 Fixed Message Signs

- (1) The department will measure Traffic Control Signs Fixed Message by the square foot acceptably completed, measured as the area of the sign face.

643.4.4 Covering Signs

- (1) The department will measure the Traffic Control Covering Signs bid items as each individual cover/uncover cycle acceptably completed per location, measured as the number of cover/uncover cycles for existing signs. The department will not measure additional cover/uncover cycles as might be required to accommodate the contractor's operations.

643.4.5 Traffic Control

- (1) The department will measure Traffic Control once for each contract acceptably completed and will not include any work performed under other specific traffic control contract bid items.

643.5 Payment

643.5.1 General

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
643.0300	Traffic Control Drums	DAY
643.0400 - 0449	Traffic Control Barricades (type)	DAY
643.0500	Traffic Control Flexible Tubular Marker Posts	EACH
643.0600	Traffic Control Flexible Tubular Marker Bases	EACH
643.700 - 0799	Traffic Control Warning Lights (type)	DAY
643.0800	Traffic Control Arrow Boards	DAY
643.0900	Traffic Control Signs	DAY
643.0910	Traffic Control Covering Signs Type I	EACH
643.0920	Traffic Control Covering Signs Type II	EACH
643.1000	Traffic Control Signs Fixed Message	SF
643.1050	Traffic Control PCMS	DAY
643.1051	Traffic Control PCMS with Cellular Communications	DAY
643.1070 - 1079	Traffic Control Cones (height)	DAY
643.5000	Traffic Control	EACH

643.5.2 Signs and Devices

- (1) Payment for the signs and devices bid items is full compensation for furnishing and maintaining those signs and devices. Payment also includes the following:
- Repairing pavement damaged by removing bases under Traffic Control Flexible Tubular Marker Bases.
 - Posts or other sign supports as well as partially or fully covering or uncovering signs under Traffic Control Signs and Traffic Control Signs Fixed Message.

643.5.3 Covering Signs

- (1) Payment for the Traffic Control Covering Signs bid items is full compensation for providing full or partial sign covers, for removing covers, and for repairing or replacing damaged signs.

643.5.4 Traffic Control

- (1) Payment for Traffic Control is full compensation for costs associated with traffic control required under 643 but not included in other 643 contract bid items.

Section 652 Electrical Conduit

652.1 Description

- (1) This section describes providing rigid metallic or rigid nonmetallic conduit for traffic signals, lighting, and other electrical work, and rigid nonmetallic conduit for traffic signal detectors.

652.2 Materials

652.2.1 General

- (1) Furnish electrical conduit and fittings with a UL or NRTL label on each piece installed.

652.2.2 Rigid Metallic Conduit

- (1) Furnish conduit and fittings conforming to ANSI C 80.1 for rigid metallic conduit.

652.2.3 Rigid Nonmetallic Conduit

- (1) Furnish PVC electrical conduit conforming to UL 651. Use schedule 40 heavy wall type for enclosed locations. Use schedule 80 extra-heavy wall type for locations exposed to the elements.

652.2.4 Reinforced Thermosetting Resin Conduit

- (1) Furnish reinforced thermosetting resin conduit (RTRC) electrical conduit marked type AG conforming to UL 2515. Ensure that wall thickness, coupling type or method, fittings, and hanger system conform to manufacturer recommendations for installation on the outside of structures.

652.2.5 Loop Detector Conduit

- (1) Furnish one-inch schedule 40 PVC electrical conduit conforming to [652.2.3](#). Use PVC fittings and attachments designed specifically for the conduit furnished to join and terminate PVC conduit. Use engineer-approved PVC terminal adaptor fittings to connect cast iron T-condulets to PVC conduit.
- (2) Furnish cast iron T-condulets made by a department-approved manufacturer. Use steel, domed-type, wedge-nut style covers with neoprene gaskets on cast iron condulets.

652.3 Construction

652.3.1 Installation of Conduit

652.3.1.1 General

- (1) Under the Conduit Special bid item, the contractor may use either rigid metallic or rigid nonmetallic conduit.
- (2) Use conduit of the nominal inside diameter the plans show. Make each run of conduit the distance the plans show or as the engineer directs. Install each run of conduit between adjacent access points using one size for its entire length. A run is the conduit from pull box to pull box, junction box to junction box, or pull box to junction box. If the engineer approves, the contractor may substitute a larger size of conduit than the contract shows for that run.
- (3) Pitch conduit for drainage as the plans show. If unable to provide plan pitch for PVC or RTRC conduit, drill one 1/4-inch-diameter drain hole in the conduit at each low point and place sumps under the drain holes as the plans show.
- (4) Install tracer wire in each conduit run that will receive future conductors as the conduit is laid. Unless the contract specifies wire or cable, install a 12 AWG. XLP insulated, stranded, copper, 600-volt AC, wire. Provide wire 4 feet longer than the conduit run and double it back at least 2 feet at each raceway access point. Anchor the tracer wire at each access point.
- (5) Ream and thread the ends of rigid metallic conduit and use WSEC-approved bushings. If not installing wire or cable, install engineer-approved threaded caps with anti-seize compound applied to the threads.
- (6) Cap or plug rigid nonmetallic conduit immediately after installation, unless the conduit terminates in a pull box, and keep capped or plugged until installing the wire or cable. Install end bells on rigid nonmetallic conduit raceway access points before installing wire or cable. Ream non-metallic conduits to eliminate internal sharp edges before installing end bells. Use only UL or NRTL listed adapter fittings to connect rigid nonmetallic conduit to rigid metallic conduit.

652.3.1.2 Installing Underground

- (1) Unless the plans specify otherwise, install conduit in trenches excavated with vertical sides and of a depth and width sufficient to accommodate the outside diameter of the conduit couplings. Lay the conduit at the depth below grade the plans show. Backfill the trench with select material passing a one-inch sieve.
- (2) Excavate trenches true to line and grade to provide the conduit uniform bearing throughout its length. Do not backfill the trench before inspecting the conduit. Carefully tamp the backfill in place as specified.

for placing backfill in layers in [651.3](#). Place at least 0.7 cubic feet of size No. 2 coarse aggregate, as specified in [501.2.5.4.5](#), directly under each drainage hole.

- (3) If cinders are present when laying rigid conduit, encase the conduit in at least 2 inches of concrete, or remove for at least 12 inches below the conduit and backfill the excavation with suitable material.
- (4) Apply an engineer-approved zinc-rich paint to field-cut threads not covered by fittings and to other areas with damaged or missing zinc coating. Clean application and adjacent areas before painting.

652.3.1.3 Installing Conduit Special Underground

- (1) Under the Conduit Special bid items, conform to [652.3.1.2](#) except install by jacking, boring, auguring, or other engineer-approved methods that do not disturb the existing overlying pavement, curb and gutter, or sidewalk. Use conduit suitable for the installation method used. Repair pavement, curb and gutter, or sidewalk that the engineer determines damaged by the installation.

652.3.1.4 Installing on Structures

- (1) Install conduit on structures as the plans show either by embedding in concrete or mounting on the outside of the structure. Unless specifically provided otherwise, do not leave openings in the structure for subsequent conduit placement. Install engineer-approved expansion fittings where the conduit crosses an expansion joint in a structure. Install additional expansion fittings conforming to the WSEC and adjust for the ambient temperature at the time of concrete pour.
- (2) If embedding conduit in concrete, hold it rigidly in place while pouring the concrete. Provide drainage for embedded raceways.
- (3) If mounting on the outside of the structure, use reinforced thermosetting resin conduit (RTRC) and hardware conforming to manufacturer recommendations. Use only manufactured bends and sweeps. Do not make field bends. Ensure that the installer is certified by the manufacturer of the conduit and conforms to manufacturer recommendations for installation on the outside of structures. Provide evidence of installer certification to the engineer before installation.

652.3.1.5 Constructing Loop Detector Slots

- (1) Under the Loop Detector Slots bid item, construct slots in existing asphalt or concrete pavement for loop detector conduit, as the plans show or the engineer directs.
- (2) Construct by sawing the full width and depth of the slot, or by sawing both edges of the slot full depth and removing the remainder by chipping, or other engineer-approved methods. Clean the slots with jets of water and compressed air; remove dirt, dust, and debris; and thoroughly dry before installing the detector loop conduit. Remove and dispose of surplus material.

652.3.1.6 Installing Loop Detector Conduit

- (1) Under the Conduit Loop Detector bid item, provide loop detector conduit and related fittings as the plans show.
- (2) After installation, protect the loop detector conduit from any damage that could occur. Repair or replace damaged loop detector conduit at no expense to the department. The engineer will approve the replacement or repair method, and the resulting finished work.

652.3.2 Marking and Inspecting

- (1) Mark the location of each conduit as the plans show.
- (2) After the conduit installation is complete, inspect each installed conduit before any wire is pulled. During this inspection, ensure that the conduit raceway is fully open for its entire length. Replace any conduit that the engineer determines is crushed, damaged, or unsatisfactory.
- (3) If the engineer directs, expose the conduit at a randomly selected conduit arrow mark. If the distance from that conduit's centerline to a plumb line projected down from the tip of the arrow mark is more than six inches, expose all arrow marked conduits. Destroy arrow marks not meeting the six-inch limit and remark the conduit.

652.4 Measurement

- (1) The department will measure the Conduit Rigid Metallic, Conduit Rigid Nonmetallic, and Conduit Reinforced Thermosetting Resin bid items by the linear foot acceptably completed, measured along the conduit centerline from the centerline of fittings or, where there are no fittings, from the free ends of the conduit. The department will measure engineer-specified drain duct from a pull box to a ditch or sewer.
- (2) The department will measure the Conduit Special bid items by the linear foot acceptably completed, measured from pull box to pull box.

- (3) The department will measure Conduit Loop Detector by the linear foot acceptably completed, measured around the loop and from the loop to the nearest pull box.
- (4) The department will measure Loop Detector Slots by the linear foot acceptably completed.

652.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
652.0100 -0199	Conduit Rigid Metallic (size)	LF
652.0200 - 0399	Conduit Rigid Nonmetallic (schedule) (size)	LF
652.0400 - 0599	Conduit Reinforced Thermosetting Resin (size)	LF
652.0600 - 0699	Conduit Special (size)	LF
652.0800	Conduit Loop Detector	LF
652.0900	Loop Detector Slots	LF

- (2) Payment for the Conduit Rigid Metallic, Conduit Rigid Nonmetallic, Conduit Reinforced Thermosetting Resin, and Conduit Special bid items is full compensation for providing the conduit, conduit bodies, and fittings; for providing conduit hangers, clips, attachments, and fittings used to support conduit on structures; for pull wires or ropes; for expansion fittings and caps; for excavating, bedding, and backfilling, including any sand, concrete, or other required materials; for disposing of surplus materials; and for making inspections.
- (3) Payment for the Conduit Special bid items also includes repairing overlying pavement, curb and gutter, or sidewalk the contractor disturbs or damages.
- (4) Payment for the Conduit Rigid Nonmetallic bid items also includes pull box drain duct the engineer directs under the [653](#) Pull Box bid items.
- (5) Payment for Conduit Loop Detector is full compensation for providing materials, including conduit, compacted backfill, surface sealer, pull wire, condulets, and conduit fittings.
- (6) Payment for Loop Detector Slots is full compensation for sawing; for chipping; for removing and disposing of surplus material; and for cleaning the slot.
- (7) The department will not pay extra for conduit the contractor substitutes under [652.3.1.1](#). The department will pay separately for tracer wires under the appropriate Electrical Wire bid items specified in [655.5](#).

Section 653 Pull Boxes and Junction Boxes

653.1 Description

- (1) This section describes providing, adjusting, and removing pull boxes and providing junction boxes.

653.2 Materials

Revise 653.2 to combine pull and junction boxes and add material specifications for non-conductive boxes.

- (1) Furnish **steel** pull boxes made of corrugated steel pipe conforming to the material requirements of [521.2](#) with annular corrugations.
- (2) **Furnish non-conductive pull boxes and junction boxes from department approved product list. The contractor may field trim to customize pull box lengths.**
- (3) Furnish manhole frames and solid lids conforming to [611.2](#). Use locking covers in pavement roadway locations and on 12-inch pull boxes.
- (4) Furnish grounding lugs and copper or stainless steel mechanical connectors. Use stainless steel for mechanical connections to **pull boxes and junction boxes**.

653.3 Construction

- (1) Provide pull boxes with manhole frames and solid lids. The contractor may extend pull boxes as the plans show using the same material as the pull box. Saw extensions parallel to the annular ring and clamp to the pull box using a band manufactured for this purpose. Excavate, place coarse aggregate drain material, and backfill as the plans show. Dispose of surplus or unsuitable material as specified under [205.3.12](#). Use covers stamped "**WISDOT ITS**" for communications pull boxes or "ELECTRIC" for other pull boxes.
- (2) Under the Junction Boxes bid items, provide junction boxes mounted and connected as the plans show. Grounding lugs are not required in junction boxes with less than 50 volt AC.
- (3) Under the Adjusting Pull Boxes bid item, move existing pull boxes to grade level. Excavate, adjust subsurface components as required, and backfill as the plan details show. Dispose of surplus or unsuitable material as specified under [205.3.12](#).
- (4) Under the Removing Pull Boxes bid item, excavate and remove existing pull boxes. Backfill with material similar to the surrounding material. Dispose of surplus or unsuitable material as specified under [205.3.12](#).

653.4 Measurement

- (1) The department will measure the bid items under this section as each individual box acceptably completed.

653.5 Payment

Revise 653.5 to add bid items for non-conductive pull boxes.

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
653.0100 - 0149	Pull Boxes Steel (size)	EACH
653.0150 - 0179	Pull Boxes Nonconductive (size)	EACH
653.0180	Pull Boxes Steel Communications (inch)	EACH
653.0200 - 0299	Junction Boxes (size)	EACH
653.0900	Adjusting Pull Boxes	EACH
653.0905	Removing Pull Boxes	EACH

- (2) Payment for the Pull Boxes bid items is full compensation for providing pull boxes; for materials including grounding lugs; for aggregate, manhole frames and covers; for required pull box extensions; conduit extensions less than 10 feet long including fittings; and for excavating, backfilling, and disposing of surplus material. The department will pay separately for engineer-directed pull box drain duct under the Conduit Rigid Nonmetallic bid items as specified in [652.5](#).
- (3) Payment for the Junction Boxes bid items is full compensation for providing materials including grounding lugs and stainless steel mounting hardware, wiring, supports, grout, and temporary asphalt; for any pavement cutting and grouting; and for disposing of surplus material.
- (4) Payment for Adjusting Pull Boxes is full compensation resetting the box elevation; for required materials; and for excavating, backfilling, and disposing of surplus material.
- (5) Payment for Removing Pull Boxes is full compensation for removal, and for excavating, backfilling, and disposing of surplus material.

Section 654 Bases

654.1 Description

- (1) This section describes constructing concrete bases for traffic signals, street lights, and control cabinets.

654.2 Materials

- (1) Furnish bar steel reinforcement conforming to [505.2.4](#).
- (2) Furnish grade A, A-FA, A-S, A-T, A-IS, A-IP, or A-IT concrete conforming to [501](#) as modified in [716](#). Provide QMP for class III ancillary concrete as specified in [716](#).
- (3) Furnish anchor rods conforming to [ASTM F1554](#) grade 105 and Supplementary Specification S4, [ASTM A563](#) nuts, and [ASTM F436](#) washers for type 1 and 2 traffic signal bases; for type 5, 6, 7, and 8 street light bases; for type 10 control cabinet bases; and for type 11 walkway lighting unit bases. Hot-dip zinc coat according to [ASTM A153](#), class C, supplemented by [ASTM F2329](#).

Revise 654.2(4) to require the contractor to furnish all anchor rods.

- (4) **Furnish anchor rods, nuts, and washers as conforming to [641.2.2.3](#) for type 10 and 13 concrete monotube pole bases.**
- (5) For control cabinet bases furnish either mechanical or adhesive stainless steel masonry anchors and stainless steel bolts or studs, nuts, and washers.
- (6) Use schedule 40 PVC electrical conduit conforming to [652](#).

654.3 Construction

- (1) Construct drilled shaft concrete bases conforming to [636.3](#). Cure exposed portions of concrete footings as specified in [502.3.8.1](#). Wait until the concrete has attained 3500 psi compressive strength or 7 equivalent days as specified in [502.3.10](#) before erecting any portion of the structure on the footing.
- (2) Construct rectangular concrete bases for control cabinets as specified for footings in [502.3](#) except cure exposed portions of concrete bases as specified in [502.3.8.1](#). Wait until the concrete has attained the anchor manufacturer recommended compressive strength or 7 calendar days before installing masonry anchors.

654.4 Measurement

- (1) The department will measure the Bases bid items as each individual base acceptably completed.

654.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
654.0100 - 0199	Concrete Bases (type)	EACH
654.0200 - 0299	Concrete Control Cabinet Bases (type)	EACH

- (2) Payment for the Bases bid items is full compensation for providing concrete bases; for embedded conduit and electrical components; for anchor rods, nuts, and washers except under the Concrete Bases type 10 and type 13 bid items; for bar steel reinforcement; and for excavating, backfilling, and disposing of surplus materials.

Section 655 Electrical Wiring

655.1 Description

- (1) This section describes providing electrical wire and cable for traffic signal, highway/roadway lighting, and other underground installations.

655.2 Materials

655.2.1 Cable In Duct

- (1) Furnish conductors conforming to electrical wire, lighting specified in [655.2.6](#).
- (2) Furnish conductors enclosed in a red, or black with a red stripe, coilable polyethylene duct, suitable for direct earth burial, and manufactured from high density polyethylene conforming to the applicable requirements of [ASTM D3350](#).
- (3) Use UL or NRTL listed Cable in Duct (CID) conforming to the WSEC specifications for nonmetallic underground conduit with conductors, type NUCC.

655.2.2 Traffic Signal Cable

- (1) Furnish solid copper conductor traffic signal cables conforming to IMSA Specification Number 20-1. Provide wire size and number of conductors as the plans show.
- (2) For wiring that extends from the terminal strip in each signal head to the mounting base, use an IMSA, 20-1 cable, 14 AWG 4, 5, or 7 conductor as required.

655.2.3 Type UF Cable

- (1) Furnish type UF cable with ground including the number and size of conductors as the plans show. Use cable conforming to ANSI/UL 493.

655.2.4 Communication Cable

- (1) Furnish communication cable conforming to IMSA Specification 20-6. Use 6 pairs of 18 AWG in each cable. Twist conductors 12 turns per foot by the individual pair.

655.2.5 Grounded Conductor and Equipment Grounding Conductor for Traffic Signals

- (1) Use green insulation or green insulation with a yellow tracer applied by thermoset method.
- (2) Furnish 10 AWG or 8 AWG, or both, XLP, USE rated, 600 volt AC, single conductor, stranded copper for conductors.

655.2.6 Electrical Wire for Lighting

- (1) For underground networks, unless the contract specifies a multi-conductor cable, furnish single conductor, stranded copper, XLP insulated, USE rated wire sized as the plans show.
- (2) For underground network to luminaire connections, furnish single conductor, stranded copper, XLP insulated, USE rated wire. Use 12 AWG unless plans show otherwise.
- (3) Identify insulated conductors by covering the insulation surface with a tough, strongly adhered color coating conforming to Method I, or by surface printing conforming to Method III of IPCEA (Insulated Power Cable Engineers Association)-NEMA Standard S-19-81. Do not use white coatings on ungrounded conductors.
- (4) **Color code as required by WSEC using the insulation color the plans show.**
- (5) When there is more than one circuit, bundle the circuit conductors with nylon cable ties or engineer-approved electrical tape at all access points. At each hand-hole, identify the line side of each circuit with a tape colored as the plans specify.

655.2.7 Loop Detector Lead In Cable

- (1) Furnish shielded, 14 AWG, 2 conductor, polyethylene insulated, with 16 AWG drain wire, conforming to IMSA Specification Number 50-2 for loop detector lead-in cable.

655.2.8 Loop Detector Wire

- (1) Furnish black 12 AWG, XLP insulated, USE rated, single conductor, 7-strand copper for loop detector wire.

655.2.9 Emergency Vehicle Preemption Detector Cable for Traffic Signals

- (1) Furnish 3-conductor shielded, 600 volt, type B control cable conforming to IPCEA-5-61-402/NEMA WC5 with a foil shield, 20 AWG stranded conductors and ground wire, and rated for 75 degrees C. Ensure that the conductors are color coded with 1 blue, 1 orange, and 1 yellow conductor.

655.3 Construction

655.3.1 General

- (1) Do not splice underground in pull boxes or conduit, except that the contractor may splice underground loop detector lead-in cable to loop wire. Do not leave wire or cable ends uncovered or submerged in water. If the engineer observes this condition, the engineer may reject the entire length of cable or wire. Make electrical connections and splices with a UL or NRTL approved mechanical type connector.
- (2) Cover tape with a liberal coating of an engineer-approved electrical varnish or sealant providing flexible protection from oil, moisture, and corrosion. Make electrical connections in the traffic signal base with spring wound wire nuts, insulated with a soft flexible covering or as detailed on the plans. Extend wire for termination 18 inches beyond the pole or traffic signal standard access point. Provide 60 inches of cable wire to be pulled into cabinets and left for terminations.
- (3) For cables entering each pull box, except loop detector lead in cables, provide an extra loop, approximately 16 feet long, to remain in each pull box. This loop of cable is in addition to the quantity needed to reach from the entrance conduit raceway end to the opening in the exiting conduit raceway.
- (4) Install conductors in continuous lengths without splices from termination to termination. The contractor may splice only at hand-holes in the bases of the traffic signal standards or poles. At locations where no transformer bases exist, splice at the hand-holes in poles.

655.3.2 Cable In Duct

- (1) Under the Cable In Duct bid items, provide underground cable in duct of the specified quantity and wire size of conductors.
- (2) Locate the cable as the plans show. Locate underground cable to preclude damage resulting from other construction operations.
- (3) Install cable in duct at least 30 inches below the finished grade or within the protection of conduit as the plans show. Should physical conditions at the cable location preclude placing to this depth, the contractor may modify the depth requirement as the WSEC allows. Place the cable in rigid steel conduit conforming to [652.2.2](#) for metallic conduit.
- (4) Set the underground cable in duct assembly 3 feet above the top of each light base or finished grade. Cap or seal the duct until completion of the electrical connections.
- (5) Continue the polyethylene duct to within 6 inches of a terminal connection.
- (6) If the size of the cable in duct prevents insertion through the conduit in a concrete base, the contractor may cut the duct off the assembly to allow for wire installation. In this case, after placing the wire, ensure at least one foot of intact duct remains in the conduit to protect the wires at the conduit entrance.
- (7) It is the intent of this specification that the cable duct will form a usable raceway as well as protection for the cable. Unreel the cable in duct, do not take off the side of the reel. Install the duct so it is free of kinks, sharp radii, and unnecessary wiggles. At the engineer's request, demonstrate free movement of the conductors within the duct after installation, and demonstrate the easy removal and replacement of the conductors within the duct.
- (8) If installing cable in duct by plowing, use round duct free of kinks or constrictions while fed into the plowing mechanism. At the engineer's request, excavate the cable in duct to check for depth violations. Correct depth variations as specified in [105.3.2](#). Do not splice the cable in duct; replace it to the previous termination point.
- (9) Before installing cable in duct by trenching, remove rocks, stones, and concrete chunks from the trench, and place a layer of foundation backfill conforming to [520.2](#) from 6 inches below to 12 inches above the duct. Use select backfill material, with 100 percent passing a one-inch sieve.
- (10) Install ungrounded conductors or grounded circuit conductors in continuous lengths without splices from terminal to terminal. Splice only in hand-holes of poles, transformer bases, sign bridge columns, or junction boxes as the plans show. Do not splice in pull boxes.

655.3.3 Traffic Signal Cable

- (1) Under the Traffic Signal Cable bid item, provide multi-conductor cable for traffic signals and make all connections.
- (2) Numbers of conductors, in excess of those required are for future use.
- (3) Wrap back the conductors from spare multi-conductor cables along the multi-conductor cable and tape to the cable.

- (4) Effectively ground spare or unused conductors in the signal control cabinet to the equipment grounding terminal strip.
- (5) Group and identify sets of conductors in signal cables, per signal phase, whether insulated with red, yellow, green, or other colors at each pertinent termination. Unless the plans show otherwise, use conductors colored to match lens colors.
- (6) Tag traffic signal cables terminating in the signal control cabinet with waterproof tape and mark with indelible ink. Tape a plastic coated copy of the cable routing diagrams to the inside cabinet wall. Ensure markings indicate the geographical location. Indicate NW quadrant, S median, etc. The engineer will approve the method of identification.
- (7) Ensure that the grounded conductor in feeder cables is 12 inches longer than the ungrounded conductors. Also ensure that the pole cable from the signal heads to the signal base extends 24 inches beyond the access door.
- (8) If mounting more than one signal head on a standard or pole, wire each head with a separate cable from the mounting base to the appropriate terminal strips.

655.3.4 Type UF Cable

- (1) Under the Cable Type UF bid items, provide the underground cable network for highway lighting at traffic signal installations.
- (2) If installing lighting in conjunction with traffic signals, use type UF, 2 conductor with ground, solid or stranded copper conductor cable, sized as the plans show, from the traffic signal control cabinet to the pertinent light pole base or bases.
- (3) Strip the minimum length of jacket necessary to make terminations in a neat and technically proficient manner.

655.3.5 Communication Cable

- (1) Under the Communication Cable Plowed bid item, furnish communication cable for interconnecting traffic signals, and install the cable by plowing.
- (2) If installing communication cable by plowing, install at least 32 inches below finished grade.
- (3) Under the Communication Cable Trenched bid item, furnish communication cable for interconnecting traffic signals, construct a trench, and install the cable in the trench.
- (4) Install trenched communication cable as specified in [652.3.1.2](#) for underground installation except do not install less than 32 inches below finished grade.
- (5) During installation, prevent damage to the communication cable.
- (6) Under the Communication Cable Installed in Conduit bid item, furnish communication cable for interconnecting traffic signals, and install the cable in new or in existing, in place traffic signal conduit.
- (7) If installing communication cable in conduit, do not damage or disturb existing cable within the conduit. Use wire lube on the full length of installed communication cable, if wire or cables exist in conduit.
- (8) Install communication cable without splices between traffic signal control cabinets. Extend cable into each signal control cabinet for 6 feet. Provide an extra loop, approximately 4 feet in length, to remain in each pull box.
- (9) Test the communication cable following installation. Use a megger to perform ground resistance testing of conductors including the shield, and conductor-to-conductor, including individual conductors to the shield. Ensure that all conductor tests, including the shield, read greater than 500 mega ohms to ground, and from conductor to conductor and individual conductors to the shield, read greater than 500 mega ohms. Replace cable with one or more failing tests.

655.3.6 Grounded Conductor and Equipment Grounding Conductor for Traffic Signals

- (1) Connect the white 14 AWG wires in the signal head mounting base to the white grounded conductor in the feeder cable.
- (2) Terminate grounded conductors on a bus mounted in the cabinet and isolated from the cabinet and equipment grounding conductor. Terminate the grounded conductor bus at the grounding lug in the electrical service meter pedestal or meter socket.
- (3) Terminate equipment grounding conductors on the equipment grounding bus that is isolated from the grounded conductor bus. Terminate the equipment grounding bus at the grounding lug in the electrical service meter breaker pedestal service disconnect, or meter socket, or terminate at the grounding lug of the breaker enclosure if the service is unmetered.
- (4) Make the equipment grounding connection in the signal pedestal base, or in a pole transformer base, with a pigtail and wire nut or split bolt to an equipment grounding conductor. Extend the equipment

grounding conductor from the equipment grounding bus in the traffic signal cabinet, from base to base around the intersection in a complete closed circuit. Ensure that the pull box is bonded to the frame and the cover is bonded to the frame with a jumper from the nearest signal base.

- (5) Under the Electrical Wire Traffic Signals bid items, provide electrical wire for traffic signals and make all connections.
- (6) Make electrical connections in the traffic signal base with spring wound wire nuts, insulated with a soft flexible covering.
- (7) For the pigtail, use 10 AWG, bare copper wire or green XLP insulated, a minimum 16 inches in length. Attach one end of the pigtail to an engineer-approved mechanical connector, lug, and place the connector inside the base under the head of a 1/4" -20 x 3/4" hex-head stainless steel cap screw tapped into the base.

655.3.7 Electrical Wiring for Lighting

- (1) Under the Electrical Wire Lighting bid items, provide electrical wire of the specified conductor size for lighting, and make all connections.
- (2) Provide an 18 inch length of wire in each hand-hole for termination. For all wires entering each pull box, provide an extra loop, approximately 6 feet in length, to remain in each pull box. This loop of wire is in addition to the quantity needed to reach from the entrance conduit raceway end to the opening in the exiting conduit raceway.
- (3) Install conductors in continuous lengths without splices from the cabinet terminal to pole hand-hole or transformer base. Do not splice in pull boxes.
- (4) Install conductors from the luminaire to the fuse assembly using a continuous length of 12 AWG, XLP wire without splices. Provide sufficient length in the pole shaft to allow easy removal and subsequent servicing of the fuse assembly through the pole hand-hole.

655.3.8 Loop Detector Lead In Cable

- (1) Under the Loop Detector Lead In Cable bid item, provide loop detector lead in cable as well as splice loop and lead in cable together in the pull box. Connect the lead in cable to proper terminals in the control cabinet.
- (2) Install the loop detector lead in cable in electrical conduit furnished under other bid items. For lead in cable from the pull box to the control cabinet, install lead in cable in conduit either with or without other cables. Do not provide an extra length of loop lead in cable in pull boxes. For each loop, use a separate lead in cable to the control cabinet. Cut the drain wire flush with the lead in cable jacket.
- (3) Splice cables using cast in place splice kits from an engineer-approved manufacturer. Make splices as soon as possible after installing loop detector lead in cable.
- (4) If unable to splice to the lead in cable the day installing the wire, seal the cable ends with tar or electrical sealant to keep water out of the insulating jacket of the cable. If water does enter the insulating jacket, remove the cable and replace with new cable at no expense to the department.
- (5) A splice consists of a non-insulated butt connector connecting one loop wire to one loop lead-in cable wire. Crimp and solder this connection with electrical multi-flux core. Crimp and solder the second 2 wires in the same manner. Half lap tape the solder connections with an engineer-approved rubber high voltage tape. Half lap tape each connection with an engineer-approved vinyl electrical tape and insulate connections from each other before placing in the splice kit. Coat each connection with an engineer-approved electrical varnish and allow the coating to dry. After drying, install the splice capsule conforming to the manufacturer's instructions.
- (6) If the engineer directs, open one randomly selected loop detector splice and inspect it for compliance with installation specifications. If the engineer determines the splice is non-compliant with the specifications, replace all loop detector splices on the project at no expense to the department.
- (7) After splicing the loop wire to the loop lead in cable, measure inductance, ground resistance, and wire resistance at the cabinet end of the lead in cable. Furnish a copy of the readings to the engineer for evaluation.

655.3.9 Loop Detector Wire

- (1) Under the Loop Detector Wire bid item, provide loop detector wire.
- (2) Install the loop detector wire in one-inch loop detector PVC conduit furnished under another bid item. The contractor may install loop wire before placing the conduit.
- (3) Do not provide an extra length of loop detector wire in the pull boxes.

- (4) Install the loop wire from the pull box at the side of the road, around the loop in the number of turns the plans show, and back to the pull box at the side of the road, in one continuous non-spliced length.
- (5) If unable to splice to the lead in cable the day installing the wire, seal the wire ends with tar or electrical sealant to keep water out of the insulating jacket of the wire. If water does get into the insulating jacket, remove the wire and replace with new wire at no expense to the department.
- (6) Measure the loop inductance, ground resistance, and loop wire resistance at the pull box end of the loop wire immediately after installation. Furnish a copy of the readings to the engineer for evaluation.
- (7) Measure ground resistance using a megger. Replace loop wire not attaining greater than 500 mega ohms to ground.

655.3.10 Emergency Vehicle Preemption (EVP) Detector Cable for Traffic Signals

- (1) Under the Traffic Signal EVP Detector Cable bid item, provide the EVP cable and mount department-furnished brackets. The department will determine the exact location to ensure that the installation does not create a sight obstruction. The department will mount the heads, terminate the ends, and install the discriminators and card rack in the cabinet.
- (2) Ensure that the cable runs continuously without splicing from the pull box closest to the cabinet including the specified extra cable. Do not splice EVP cable from the detector assembly to the controller terminations. Provide 8.5 feet of extra cable at the mounting bracket with 6 feet at the bracket and 2.5 feet extending out of the mounting bracket. Provide 6 feet of extra cable in each pull box plus an additional 20 feet at the nearest pull box to signal base where the EVP detector head is mounted.
- (3) Mark each end of the lead as the plans show. Notify the department to gain access to the control cabinet. The department will only provide access while a department electrician is present.
- (4) Notify the engineer upon completion of the installation at each intersection.

655.4 Measurement

- (1) The department will measure the Cable In Duct bid items by the linear foot acceptably completed. This measurement includes conductors that had the duct cut away.
- (2) The department will measure the Cable Traffic Signal bid items, the Cable Type UF bid items, Communication Cable Plowed, Communication Cable Trenched, Communication Cable Installed in Conduit, and Traffic Signal EVP Detector Cable by the linear foot acceptably completed.
- (3) The department will measure the Electrical Wire Traffic Signals and Electrical Wire Lighting bid items by the linear foot acceptably completed, measured separately for each conductor.
- (4) The department will measure Loop Detector Lead In Cable by the linear foot acceptably completed, measured from the splice with the loop lead in wire along the centerline of the conduit to its connection with terminals in the control cabinet.
- (5) The department will measure Loop Detector Wire by the linear foot acceptably completed, measured around the loop, including the number of turns and its lead to and from the splice with the lead in cable.

655.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
655.0100 - 0199	Cable In Duct (# of conductors) (AWG)	LF
655.0200 - 0299	Cable Traffic Signal (# of conductors) (AWG)	LF
655.0300 - 0399	Cable Type UF (# of conductors) (AWG)	LF
655.0400	Communication Cable Plowed	LF
655.0405	Communication Cable Trenched	LF
655.0410	Communication Cable Installed in Conduit	LF
655.0500 - 0599	Electrical Wire Traffic Signals (AWG)	LF
655.0600 - 0699	Electrical Wire Lighting (AWG)	LF
655.0700	Loop Detector Lead In Cable	LF
655.0800	Loop Detector Wire	LF
655.0900	Traffic Signal EVP Detector Cable	LF

- (2) Payment for the Cable In Duct bid items is full compensation for providing materials, including cables and duct; for excavating trenches; for placing cable in duct; for providing rigid steel conduit as needed;

for backfilling; for restoring disturbed or damaged areas, including seeding and sodding; for making connections and testing installed cable system; and for disposing of surplus material.

- (3) Payment for the Cable Traffic Signal bid items, is full compensation for providing cable; for making connections; for providing connectors, including wire nuts; and for testing the circuits. The department will pay for wiring from the signal head terminal strip to the mounting base under the Cable Traffic Signal bid items appropriate for the conductor number and wire size the plans show.
- (4) Payment for the Cable Type UF bid items is full compensation for providing the cable; for making connections; for providing connectors, including wire nuts, splices, tape, insulating varnish, or sealant; and for testing the circuits.
- (5) Payment for Communication Cable Plowed is full compensation for providing materials including cable; for plowing in the cable; for making connections; for testing the installed cable; for restoring damaged or disturbed areas, including seeding or sodding; and for disposing of surplus material.
- (6) Payment for Communication Cable Trenched is full compensation for providing materials including cable and backfill material; for constructing the trench, installing the cable in the trench, and backfilling; for making connections; for testing the installed cable; for restoring disturbed or damaged areas, including seeding or sodding; and for disposal of surplus material.
- (7) Payment for Communication Cable Installed in Conduit is full compensation for providing materials including cable; for installing the cable in existing conduit; for making connections; and for testing the installed cable.
- (8) Payment for the Electrical Wire Traffic Signals bid items is full compensation for providing electrical wire; for making connections; for providing connectors, including wire nuts and lugs; and for testing the circuits.
- (9) Payment for the Electrical Wire Lighting bid items is full compensation for providing electrical wire; for making connections; for providing connectors, including wire nuts, fuses, fuse holders, splices, tape, insulating varnish or sealant; and for testing the circuits. The department will pay for wiring from the underground feeder system to the luminaire under the Electrical Wire Lighting bid item appropriate for the wire size the plans show.
- (10) Payment for Loop Detector Lead In Cable is full compensation for providing the lead-in cable; for making necessary cabinet connections; and for furnishing splice kits and splicing to the loop detector wire.
- (11) Payment for Loop Detector Wire is full compensation for providing loop detector wire.
- (12) Payment for Traffic Signal EVP Detector Cable is full compensation for providing emergency vehicle preemption detector cable for traffic signals.
- (13) The department will not pay for replacing cable or wire not attaining a required resistance greater than 500 mega ohms.
- (14) Pedestrian push button wiring is incidental to the Pedestrian Push Buttons bid item under [658](#).

Section 656 Electrical Service

656.1 Description

- (1) This section describes providing an electrical service, of the specified type.

656.2 Materials

656.2.1 General

- (1) Install the electrical service conforming to local utility requirements. Furnish the utility with a wiring affidavit certifying that the service conforms to the WSEC and then verbally notify the engineer that the utility received the wiring affidavit.
- (2) For grounding electrodes for the electrical service, use engineer-approved 5/8-inch diameter copper clad grounding electrodes. Furnish the number and length of grounding electrodes as required to install the service conforming to the WSEC and the local utility.
- (3) If required by the local utility, provide a manual bypass meter socket. Obtain the local utility's approval of the manual bypass meter socket.
- (4) If an overhead service is required, provide the riser, weatherhead, wiring, and necessary fittings as incidental to the electrical service bid item.

656.2.2 Meter Socket Service

- (1) Furnish an engineer-approved service having a meter socket, NEMA 3R breaker enclosure, 22,000-AIC circuit breakers unless the local utility requires otherwise, grounding electrodes and connections, conduit and fittings, and necessary conductors and equipment required by the WSEC and the utility for a service connection. Use circuit breakers with an amperage capacity of 50 A, unless specified otherwise in the contract.

656.2.3 Meter Breaker Pedestal Service

- (1) Furnish an engineer-approved service having a meter breaker pedestal, 22,000-AIC circuit breakers unless the local utility requires otherwise, grounding electrodes and connections, conduit and fittings, and necessary conductors and equipment required by the WSEC and the utility for a service connection. Use circuit breakers with an amperage capacity 50 A, unless specified otherwise in the contract. When the meter breaker pedestal is energized, install an engineer-approved meter seal at access points on the meter trough.

656.2.4 Unmetered Service

- (1) Furnish an engineer-approved service conforming to [656.2.2](#), except do not supply a meter socket.

656.2.5 Main Lugs Only Meter Pedestal Service

- (1) Furnish an engineer-approved service having grounding electrodes and connections, conduit and fittings, and necessary conductors and equipment required by the WSEC and the utility for a service connection. Provide a lug amperage capacity, and the number of phases, and service voltage rating as the plans show.

656.2.6 Breaker Disconnect Box Service

- (1) Furnish a 100 A outside rated breaker box with space for 6 circuits, but no main breaker; to 50 A single circuit breaker (22, 000 AIC or larger as required by power companies), conduit fittings, grounding electrodes, and connections and necessary conductors and equipment required to provide power to the cabinet.

656.3 Construction

656.3.1 General

- (1) Install the electrical service conforming to local utility requirements. Furnish the utility with a wiring affidavit, certifying that the service was installed conforming to the WSEC.
- (2) All above ground electrical service conduit and fittings shall be rigid metal conduit.

656.3.2 Service Lateral

- (1) The local utility will provide a 100 A, 120/240 volt AC, single phase, 3-wire underground electrical service lateral, unless specified otherwise in the contract documents. Arrange and assume responsibility for the timely installation of the service lateral by the utility. Terminate the lateral at a meter socket, meter breaker pedestal, a NEMA 3R Breaker Enclosure, or a main lugs only meter pedestal, as the plans show.

656.3.3 Meter Socket Service

- (1) If 2 or more grounding electrodes are required, space them at least 6 feet apart and drive them near the termination point. Run a grounding conductor, from grounding electrode to grounding electrode if

more than one is required. Then, connect to the meter socket and terminate at the grounding lug in the NEMA 3R Breaker Enclosure. Provide connections and wiring to provide 120 volt AC power, or as the plans show, to the circuit breakers in the cabinets. If only one grounding electrode is required, exothermically weld the stranded copper wire to it and then connect to the grounding lug in the NEMA 3R Breaker Enclosure.

- (2) Provide an appropriately sized equipment grounding conductor from the grounding lug in the NEMA 3R Breaker Enclosure to an equipment grounding bus mounted in the control cabinet.
- (3) If installing intersection lighting along with the signal installation, feed lighting power to street lights from a separate circuit breaker. Use a common trip breaker rated at 15 amps or more.

656.3.4 Meter Breaker Pedestal Service

- (1) If 2 or more grounding electrodes are required, space them 6 feet apart and drive them outside the concrete base and near the electrical service meter breaker pedestal. Run a grounding conductor, from grounding electrode to grounding electrode if more than one is required. Then, terminate at the grounding lug in the meter breaker pedestal. Provide connections and wiring to provide 120 volt AC power, or as the plans show, to the circuit breakers in the cabinet. If only one grounding electrode is required, exothermically weld the stranded copper wire to it and then connect to the grounding lug in the meter breaker pedestal.
- (2) Provide an equipment grounding conductor, appropriately sized. Run the conductor from the grounding lug in the meter breaker pedestal to an equipment grounding bus mounted in the control cabinet.
- (3) If providing intersection lighting along with the signal installation, feed lighting power to street lights from a separate circuit breaker. Use a common trip breaker for 240 volt AC installations. Size the breaker conforming to code requirements, 15 amp, minimum.

656.3.5 Unmetered Service

- (1) Conform to [656.3.3](#), except no meter is required.

656.3.6 Main Lugs Only Meter Pedestal Service

- (1) Conform to [656.3.4](#).

656.3.7 Breaker Disconnect Box Service

- (1) Furnish connections and wiring to provide 120 volt AC power to the circuit breaker in the cabinet from the bus located within the breaker disconnect box.
- (2) Furnish connections and wiring to provide 120 volt AC power from the bus bar located within the meter breaker pedestal to the 50 amp single circuit breaker within the breaker disconnect box and then to the circuit breaker in the control cabinet.
- (3) Mount the breaker disconnect box to the cabinet as the plans show.

656.4 Measurement

- (1) The department will measure the Electrical Service bid items as a single lump sum for each service acceptably completed.

656.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
656.0100	Electrical Service Meter Socket (location)	LS
656.0200	Electrical Service Meter Breaker Pedestal (location)	LS
656.0300	Electrical Service Unmetered (location)	LS
656.0400	Electrical Service Main Lugs Only Meter Pedestal (location)	LS
656.0500	Electrical Service Breaker Disconnect Box (location)	LS

- (2) Payment for Electrical Service Meter Socket is full compensation for providing the meter socket; and for manual bypass meter socket, NEMA 3R breaker enclosure, conduit and fittings, circuit breakers, grounding electrodes and connections.
- (3) Payment for Electrical Service Meter Breaker Pedestal is full compensation for providing materials including the meter breaker pedestal, manual bypass meter socket, conduit and fittings, circuit breakers, grounding electrodes and connections.

- (4) Payment for Electrical Service Unmetered is full compensation for providing materials including the NEMA 3R breaker enclosure, conduit and fittings, circuit breakers, grounding electrodes and connections.
- (5) Payment for Electrical Service Main Lugs Only Meter Pedestal is full compensation for providing materials including the main lugs only meter pedestal, disconnect, manual bypass meter socket, grounding electrodes and connections.
- (6) Payment for Electrical Service Breaker Disconnect Box is full compensation for providing materials including the breaker box, circuit breakers, 10 AWG wire, grounding electrodes, cadwelding, conduit, fittings, wiring, connections, grounding electrodes and connections; for excavating, bedding, backfilling, and restoration of ground to original condition including any sand, concrete, or other required materials; for disposing of surplus materials.
- (7) Coordinate with the engineer to determine how to handle the electrical service lateral installation costs. If the electrical utility bills the contractor directly, pay the utility promptly. The department will reimburse the contractor for invoice costs under the Electrical Service Lateral administrative item.

Section 657 Poles, Arms, Standards, and Bases

657.1 Description

- (1) This section describes providing poles, arms, standards, and bases for lighting and traffic signals. This section also describes installing department-furnished components for lighting and traffic signals.

657.2 Materials

657.2.1 Department-Furnished Materials

- (1) The department will furnish the following as specified in the contract special provisions:
 - Type 9, 10, 12, and 13 poles and associated mounting hardware, hand hole covers, and pole caps.
 - Monotube arms.
 - Steel luminaire arms.

657.2.2 Contractor-Furnished Materials

657.2.2.1 Poles

657.2.2.1.1 General

- (1) Furnish shop drawings as specified in [506.3.2](#), except submit 5 copies with the materials list. Ensure the drawings contain sufficient detail to allow satisfactory review and show the outside diameters of the pole at the butt, top, and splice locations the plans show. Show the width, depth, length, and thickness of all material, and list pertinent ASTM specification designations and metal alloy designations together with the tensile strength of metallic members. **If not using department form DT2322**, provide tightening procedures for arm-to-pole connections on the shop drawings.
- (2) Furnish poles from a department-approved manufacturer. Submit a materials list and accompanying certificate of compliance certifying that the poles incorporated into the work conform to the specified design criteria and other contract requirements. Also send a copy of the certificate and a copy of the pole shop drawings to the department electrical engineer.
- (3) Include hand holes with a bolt-on access cover as the plans show. Provide a grounding L-clip welded directly opposite the hand hole on the inside wall of the pole.
- (4) Weld base plates to the pole shaft. Identify the pole type and wall thickness using 1/2-inch lettering stamped under the hand-hole before galvanizing steel poles.
- (5) Complete welding before galvanizing steel poles. Clean exterior surfaces of steel poles after welding to ensure they are free of loose rust and mill scale, dirt, oil or grease, and other contaminants before zinc coating. Zinc coat as specified in [641.2.8](#). Ensure that the coating is tight, free from rough areas or slag, and presents a uniform appearance. Clean after manufacturing is complete to remove loose and foreign material.
- (6) Furnish aluminum or galvanized steel shims matching the pole material.
- (7) Furnish identification plaques as the plans show.

657.2.2.1.2 Type 2 and 3 Poles

- (1) For Types 2 and 3 poles, design support structures conforming to the AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals as published in the 1994, Third Edition. Design for the following:
 - A wind speed of 80 mph with a 1.3 gust factor.
 - Dead and live load related to a 25-foot trombone mast arm with 5-section signal head and a pair of twin 15-foot luminaire arms mounted on the pole as the plans show.

657.2.2.1.3 Other Pole Types

- (1) Except for type 2 and 3 poles, design support structures, consisting of poles and arms, conforming to the minimum wall thickness the plan details show and to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 6th Edition, and Interim Revisions. Use a design life of 50 years. Design to withstand a 3 second gust wind speed of 90 mph. Do not use the alternative method for wind pressures described in appendix C of those AASHTO standard specifications. No fatigue analysis is required.
- (2) Construct poles of materials having sufficient rigidity that, with material installed as the plans show, the centerline of the shaft is vertical. Ensure that lighting poles nominally 40 feet or less in length are made of one piece and round in cross-section.
- (3) Incorporate vibration dampeners as the plans show.

657.2.2.2 Trombone Arms

- (1) Design aluminum trombone arms as specified in [657.2.2.1.2](#) based on the completed maximum loading configuration the plans show. Furnish shop drawings conforming to [657.2.2.1.1](#) that show the width, depth, length, and thickness of all members. Also list the ASTM alloy designation and strength of each aluminum member on the shop drawings.
- (2) Submit a materials list and accompanying certificate of compliance certifying that the trombone arms incorporated into the work conform to the specified design criteria and other contract requirements. Also send a copy of the certificate of compliance and a copy of the shop drawings to the department's electrical engineer for informational review.
- (3) Ensure that the design incorporates all of the following:
 1. Round or oval upper and lower aluminum members welded to one or more tubular vertical struts.
 2. A mounting clamp welded to the pole end of the trombone arm for attachment to a round pole.
 3. Gussets at the joints between the main arm tubes and the arm clamps designed to resist side loads.
 4. A horizontally adjustable strut to allow mounting five 12-inch signal faces with backplates.
 5. A clean, uniform, natural aluminum finish. Do not paint or apply other anti-corrosion coatings.
 6. A wiring raceway entrance through the upper mounting bracket.
 7. Vertically adjustable through plus or minus 10 degrees as the plans show.

657.2.2.3 Aluminum Luminaire Arms

- (1) Design aluminum luminaire arms as specified in [657.2.2.1.2](#) to withstand in-service field loadings including loads imposed by components attached to the arms. Furnish shop drawings conforming to [657.2.2.1.1](#). Include the dimensions of all members, list the ASTM alloy designation of aluminum members, and show weld details.
- (2) Submit a materials list and accompanying certificate of compliance certifying that the luminaire arms incorporated into the work conform to the specified design criteria and other contract requirements. Also send a copy of the certificate of compliance and a copy of the shop drawings to the department's electrical engineer.
- (3) Make luminaire arms out of extruded aluminum. Ensure that the arms are clean with a uniform natural aluminum finish. Do not paint or apply other anti-corrosion coatings.
- (4) Furnish an extruded aluminum fixture welded to the pole end of the luminaire arm that allows the arm to be clamped to a round pole dimensioned as the plans show. Furnish mounting clamps with stainless steel bolts, nuts, and washers conforming to [ASTM A320](#).

657.2.2.4 Traffic Signal Standards

- (1) Furnish standards consisting of extruded seamless aluminum alloy 6061-T6 manufactured conforming to [ASTM B241](#), or porthole extruded aluminum alloy 6061-T6 manufactured conforming to [ASTM B429](#). Also conform to the following:
 1. Threaded on one end, tapered, and conforming to national pipe threading dimensions and normal practice.
 2. Outside dimension of 4 1/2 inches.
 3. Schedule 80 aluminum pipe.
- (2) Ensure that the manufacturer has indent printed the ASTM and alloy designations 2 inches above the threading on the outside of each standard using 1/4-inch dies.

657.2.2.5 Bases

- (1) Furnish cast aluminum alloy pedestal and transformer bases from the department's [QPL](#) and meeting the design criteria specified in [657.2.2.1.2](#). Ensure that castings are true to pattern in form and dimensions and free from defects affecting strength or service life.
- (2) Submit a materials list and accompanying certificate of compliance certifying that the bases incorporated into the work conform to the specified design criteria and other contract requirements.
- (3) If the engineer requests, provide one randomly selected sample pedestal base per traffic signal location. The department will base acceptance of all pedestal bases at that traffic signal location on destructive tests of that sample base.
- (4) Thread casting collars for pedestal bases to mate with the traffic signal standards furnished under the contract.
- (5) Use mounting washers for transformer bases conforming to the manufacturer's instructions.

657.2.2.6 High-Strength Bolts

- (1) Furnish zinc-coated type 1 bolt/nut/washer assemblies conforming to [506.2.5](#) and as follows:

- Furnish 2 flat washers with each bolt/nut/washer assembly. Use the size, number, type, and configuration of hardened flat washers the DTI manufacturer recommends for bolt diameters greater than 1 1/8 inches.
 - Ensure that all bolt/nut/washer assemblies of a given size come from the same rotational-capacity lot, are shipped in sealed and labeled containers, and are accompanied by a certified report of test or analysis giving the results of the supplier's rotational-capacity testing. No field rotational-capacity testing is required.
 - Furnish 3 or more additional bolt/nut/washer assemblies of each size for pre-installation testing.
 - Submit 2 or more additional bolts and 3 or more additional nuts and washers of each size for department mechanical testing. The contractor need not submit components from a lot and heat the department previously approved.
- (2) Furnish zinc-coated direct tension indicating (DTI) washers conforming to [ASTM F959](#) type 325. Ensure that DTIs have identifying marks applied by the manufacturer. Provide the engineer with 2 copies of the DTI manufacturer's instructions showing acceptable installation configurations. Provide 3 or more additional DTIs as required for pre-installation testing. Also provide the engineer with at least two 0.005-inch metal feeler gauges.

Add 657.2.2.7 to specify materials for anchor assemblies used for light poles on structures.

657.2.2.7 Anchor Assemblies for Light Poles on Structures

- (1) Furnish anchor rods conforming to [ASTM F1554](#), grade 55 and Supplementary Specification S4, [ASTM A563](#) heavy hex nuts, and [ASTM F436](#) washers all hot-dip galvanized according to [ASTM A153](#), class C, supplemented by [ASTM F2329](#).
- (2) For each rod, furnish 4 nuts for securing the top and bottom anchor plate-templates, a leveling nut, bottom washer, top washer, and 2 top nuts. Do not use lock washers.
- (3) Furnish a steel top and bottom anchor plate-template as part of each anchor assembly. Provide a top template of sufficient gauge to hold the anchor rods securely in position at the top, and resist racking or twisting during the pour. Do not weld templates to anchor rods.

657.3 Construction

657.3.1 General

657.3.1.1 Installation

- (1) Under the contractor-provided bid items numbered from 657.0100 - 0999 provide everything required to complete the installation as the plans show.
- (2) Under the install bid items numbered from 657.1000 - 1999 install the department-furnished components indicated in the bid item names. Also provide high-strength bolts and DTIs, fittings, either aluminum or galvanized steel shims, hardware, and other components the department does not furnish but that are required to complete the installation as the plans show.
- (3) Install a grounding lug either inside the base or pole as required to connect equipment grounding conductors.

657.3.1.2 Welding

- (1) Perform shop welding as the plans show and conforming to the following:
 - For steel poles and arms: AWS D 1.1, Structural Welding Code - Steel.
 - For aluminum poles and arms: AWS D 1.2, Structural Welding Code - Aluminum.
- (2) Do not weld in the field without the engineer's written approval. The engineer will only allow field welding for repairs in noncritical locations and when a department-approved individual competent to perform inspections is present during the welding. Perform field welding using personnel qualified under AWS D 1.5, Bridge Welding Code for steel or AWS D 1.2, Structural Welding Code - Aluminum for aluminum.

657.3.2 Poles

- (1) Clean each pole before installation.
- (2) Secure type 9, 10, 12, and 13 structures to anchor assemblies conforming to the procedures enumerated in department form [DT2321](#). Complete department form [DT2321](#) for each structure. Indicate the parties responsible for the installation and submit the form to the engineer for inclusion in the permanent project record.
- (3) After completing erection using normal pole shaft raking techniques, ensure that the centerline of the shaft is vertical.
- (4) Install identification plaques as the plans show.

657.3.3 Arms

657.3.3.1 General

- (1) Install trombone, monotube, and luminaire arms to supporting structures at the height and alignment the plans show. Clamp luminaire arms to the pole and rake so the initial level of the luminaire tenon is plus 3 degrees.
- (2) Install traffic signal heads within 5 days after monotube arms are erected to control vibration. Contact the bureau of structures if signal heads cannot be installed within those 5 days.

657.3.3.2 High-Strength Bolts for Monotube Arms

657.3.3.2.1 Handling and Storage

- (1) Store bolts/nut/washer assemblies and DTIs in closed containers in a protected shelter to protect them from dirt and moisture until used. Maintain fastener system components as nearly as possible in the as-manufactured condition until installed. Remove from storage only as needed and promptly return unused components to storage.

657.3.3.2.2 Pre-installation Testing

- (1) Notify the engineer before performing the required field pre-installation testing.
- (2) Lubricate high-strength bolt threads with a wax-based lubricant before testing. Test bolt/nut/washer assemblies with DTIs in all the configurations used for installation.
- (3) Perform pre-installation testing in the field conforming to the procedures enumerated in department form [DT2322](#) for each bolt/nut/washer/DTI size and configuration installed. Provide the engineer with the test results by submitting 2 copies of department form [DT2322](#).

657.3.3.2.3 Bolt Installation

- (1) Do not begin bolt installation without the engineer's approval.
- (2) Lubricate high-strength bolt threads with a wax-based lubricant before installation.
- (3) Tension high-strength bolts using DTIs. Install the DTI on the bolt with the protrusions facing away from the connected materials. Install bolt/nut/washer assemblies with DTIs in the same configuration used for pre-installation testing.
- (4) Tighten conforming to department form [DT2322](#) to provide the correct installation tension. During the operation, ensure no rotation of the part not turned by the wrench. Snug systematically from the most rigid part of the connection to the free edges. Repeat until the full connection is in a snug condition and the faying surfaces are in firm contact. Systematically tighten the connection required number of refusals is achieved. If the gaps on the DTI are completely closed, discontinue tightening.
- (5) Perform QC testing as specified in [506.3.12.3.3.3](#) for tensioning with DTIs. The engineer may verify bolt installation by periodically testing with a feeler gauge.

657.3.4 Standards

- (1) Thread traffic signal standards into their pedestal bases without damaging the threads. Ensure that the base is level on its concrete foundation and the standard is vertical after all connections are tight.

657.3.5 Bases

- (1) Before installing, clean the mill scale, oil, and foreign material off transformer bases, traffic signal pedestal bases, and other aluminum bases.
- (2) Install transformer bases conforming to the manufacturer's instructions.

Add 657.3.6 to specify construction requirements for anchor assemblies used for light poles on structures.

657.3.6 Anchor Assemblies for Light Poles on Structures

- (1) Install anchor rods and templates conforming to plan details and the light standard manufacturer's recommendations.

657.4 Measurement

- (1) The department will measure the bid items under this section as each individual unit acceptably completed.

657.5 Payment

Revise 657.5 to add Install bid items for department-furnished over height poles and monotube arms. Also add the Anchor Assemblies Light Poles on Structures bid item to incorporate STSP 657-060.

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER

DESCRIPTION

UNIT

657.0100	Pedestal Bases	EACH
657.0200 - 0299	Transformer Bases Breakaway (size)	EACH
657.0300 - 0399	Poles (type)	EACH
657.0400 - 0499	Traffic Signal Standards Aluminum (length)	EACH
657.0560 - 0599	Trombone Arms (length)	EACH
657.0600 - 0699	Luminaire Arms Single Member (clamp size) (length)	EACH
657.0700 - 0799	Luminaire Arms Truss (type) (clamp size) (length)	EACH
657.1300 - 1399	Install Poles (type)	EACH
657.1400 - 1499	Install Poles Over Height (type)	EACH
657.1500 - 1599	Install Monotube Arms (length)	EACH
657.1800 - 1899	Install Luminaire Arms Steel (length)	EACH
657.6005	Anchor Assemblies Light Poles on Structures	EACH

- (2) Payment for Pedestal Bases and the Transformer Bases bid items is full compensation for providing the pedestal base including grounding lugs and related mounting hardware; for leveling shims; and for corrosion prevention. The department will pay for sample pedestal bases, provided under [657.2.2.5](#), at the contract unit price for Pedestal Bases.
- (3) Payment for the Poles bid items is full compensation for providing poles including grounding lugs and related mounting hardware; for hardware and fittings necessary to install the pole; for leveling shims; and for corrosion prevention.
- (4) Payment for the Traffic Signal Standards Aluminum bid items is full compensation for providing the standards.
- (5) Payment for the Trombone Arms and Luminaire Arms bid items is full compensation for providing arms including related mounting hardware and leveling shims.
- (6) Payment for the Install Poles bid items is full compensation for installing department-furnished poles and for providing grounding lugs, fittings, shims, hardware, and other required components the department does not furnish.
- (7) Payment for the Install Monotube Arms and Install Luminaire Arms Steel bid items is full compensation for installing department-furnished arms; for providing high-strength bolt/nut/washer assemblies and DTIs including those required for testing; and for providing related mounting hardware, leveling shims, and other required components the department does not furnish.
- (8) Payment for Anchor Assemblies Light Poles on Structures is full compensation for furnishing and installing the anchors assemblies on structures. For other installations, the department will either furnish anchor assemblies or include them as incidental the Concrete Bases bid items as specified in [654](#).
- (9) The department will pay separately for concrete foundations under [654](#).

Section 670 General Requirements for Intelligent Transportation Systems (ITS)

670.1 Description

- (1) This section describes additional personnel qualifications, construction methods, and testing requirements used to perform ITS work.

670.2 Materials

- (1) Furnish ITS materials conforming to the general requirements for electrical work as specified in [651.2](#).

670.3 Construction

670.3.1 General

- (1) Perform ITS work conforming to the general requirements for electrical work as specified in [651.3](#).

670.3.2 Personnel Qualifications

670.3.2.1 Field System Integrator

Revise 670.3.2.1(1) to include traffic signal communications as a part of the field system integrator responsibilities.

- (1) Perform ITS work with onsite assistance and under the supervision of a qualified field system integrator selected from the department's approved field system integrator list. The field system integrator provides assistance and expertise to the contractor in the areas of equipment installation, operation, integration with existing equipment, testing, and network management **for ITS installations including traffic signal communications**.
- (2) The field system integrator is responsible for ensuring that equipment is installed as the plans show and functions properly. The field system integrator also helps submit material lists, shop drawings, documentation, as-builts, test results, training and operation manuals as well as associated presentations, wiring schematics, and equipment test procedures.
- (3) Ensure that the field system integrator schedules, manages, and documents periodic ITS focused progress meetings beginning within one month after ITS work under the contract begins. Hold additional meetings at least monthly while ITS work under the contract is scheduled. The department defines ITS work as operations required under the contract related to electrical work.

670.3.2.2 Certified Fiber Optic Technician

- (1) Have a certified fiber optic technician perform work for fiber optic terminations, splicing, and testing. Have a certified fiber optic technician supervise all fiber optic cable installation.
- (2) Submit material to certify technicians meet the following requirements:
 - Education: attend and successfully complete at least one 4-day class on installation of fiber optic products conducted by major manufacturer and have FOA certification.
 - Work history: demonstrate a minimum of 2 years work experience in the last 5 years with splicing, termination, and testing of fiber optic cable.
- (3) Remove, replace, and reinstall work performed by non-certified technicians for fiber optic communications equipment and material.

670.3.3 Testing

670.3.3.1 Contractor-Furnished Equipment and Materials

- (1) Furnish equipment necessary to test the completed installation. Test and demonstrate to the engineer's satisfaction that equipment is calibrated and in working order.
- (2) Submit documentation required that demonstrates component performance and operation as specified in contract.
- (3) The field system integrator will approve final set up and testing of all equipment and materials.
- (4) Perform tests on weekdays during normal working hours. Obtain the engineer's approval for test times and dates.
- (5) Resubmittal of rejected equipment or material is allowed for consideration with proof of correction and testing. The department may approve rejected material but is not considered acceptance for equipment or material until final post-installation testing.

670.3.3.2 Department-Furnished Equipment and Materials

- (1) Have the field system integrator inspect department-furnished equipment and materials to ensure that they conform to contract requirements and function properly. Notify the department within 3 days if the inspection identifies defective equipment or materials. The department will replace whatever is defective.
- (2) Do not take possession of defective equipment or materials. Once possession is taken, the contractor is responsible for replacing defective equipment and materials.

670.3.3.3 Post-Installation Testing

- (1) Furnish test procedures for each component in the contract. A component is defined as a subsystem confined to the end functionality of the device. Components include field devices, processor, assemblies, cabling, connections, communications, and any additional elements associated with proper operation and full functionality of the field device.

Revise 670.3.3.3(2) to require electronic submittals.

- (2) Submit **1 hard copy and 1 electronic copy** of component test procedures to the department. The field system integrator and contractor shall develop test procedures 30 days before initial installation. The department will approve test procedure within 30 days of the date received and provide a written approval.
- (3) Resubmit rejected test procedures within 15 days of notification. The department will provide written approval of resubmitted test procedures within 30 days of the date received.

670.3.4 ITS Documentation

670.3.4.1 Preconstruction Work

Revise 670.3.4.1 to clarify that contractors only submit electronic equipment lists for contractor-provided equipment.

- (1) **For contractor furnished equipment, submit 1 hard copy and 1 electronic copy** of equipment list, catalog cut-sheets, and drawings within 28 days after notice of award to the engineer. The engineer will review the equipment list and drawings within 30 days of submittal. Obtain the engineer's written approval before procuring equipment and beginning the work.
- (2) Include bid item names, the name and address of the manufacturer, catalog tear sheets showing catalog numbers, and manufacturer specifications. Resubmit a new alternative for partial or totally rejected equipment within 15 days of written notice. The engineer will review within 30 days of submittal.
- (3) Do not make substitutions or changes to engineer-approved materials without the engineer's written approval. Check the availability, price, and delivery date before making submittal of equipment or material.

670.3.4.2 Post-Construction Work

Revise 670.3.4.2(1) to include traffic signal communications as a part of the post- construction work submittals.

- (1) **Submit 1 hard copy and 1 electronic copy of ITS installation including traffic signal communications documentation** including but not limited to the following:
 - Operator's manual: for contractor furnished equipment, submit a manual containing detailed operating instructions for each different type or model of equipment and or operation performed.
 - Maintenance procedures manuals: for contractor furnished equipment, submit a manual containing detailed preventive and corrective maintenance procedures for each type or model of equipment furnished.
 - Cabinet fiber optic wiring diagram: submit a cabinet wiring diagram, identified by location for each cabinet. Include both electrical wiring and fiber optic conductor and cable connections. Place one copy of the fiber optic wiring diagram in a weatherproof holder in the cabinet. Deliver the other copies to the engineer.
 - As-built drawings: submit final as-built drawings that detail the final placement of conduit, cabling, equipment, and geometric modifications within the contract. Provide documentation in an electronic format adhering to the region's ITS computer aided drafting standards and according to the department's as-built requirements. The department will review the as-built drawings for content and electronic format. Modify both the content and format of as-built drawings until meeting all requirements.
 - Equipment inventory list: submit an inventory list including serial number, make, model, date installed, and location installed of equipment installed under the contract.

670.4 Measurement

- (1) The department will measure Field System Integrator and ITS Documentation as a single lump sum unit for all services acceptably completed under the contract.

670.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
670.0100	Field System Integrator	LS
670.0200	ITS Documentation	LS

- (2) Payment for Field System Integrator and ITS Documentation is full compensation for providing specified expertise, assistance, and documents. The department will pay separately for other ITS work under the various ITS bid items of 671 through 678.

- (3) The department will not pay for removing, replacing, and reinstalling work performed by non-certified technicians as required under [670.3.2.2](#).

Section 671 Intelligent Transportation Systems - Conduit

671.1 Description

- (1) This section describes providing conduit for ITS work and providing permanent flexible above ground markers along a path of any fiber optic cabling and new or existing manholes.

671.2 Materials

671.2.1 Conduit

- (1) Furnish orange, smooth, high-density polyethylene (HDPE), solid-wall conduit rated for outdoor and underground use conforming to [ASTM F2160](#). Use the size the plans show with a size-to-diameter ratio (SDR) of 11 and conforming to the following:

NOMINAL INSIDE DIAMETER	NOMINAL OUTSIDE DIAMETER
1.25 inches	1.660 inches
2 inches	2.375 inches
3 inches	3.50 inches

- (2) The construction and testing of the conduit shall comply with applicable EIA/TIA, ANSI, and ASTM standards.
- (3) Furnish bends, adapters, couplings, fittings, and other materials used to install conduits. Meet of the duct manufacturer's installation recommendations. Furnish anodized aluminum reverse threaded couplers sized as appropriate.

671.2.2 Woven Pull Tape

- (1) Provide woven pull tape for empty ducts in the run. The woven pull tape shall have documentation as duct cutting resistant, tensile strength of greater than 1100 pounds, nominal width of 1/2 inch, and maximum allowable elongation under pulling tension of 10 percent.

671.2.3 Fiber Optic Cable Marker

- (1) Furnish fiber optic cable markers as the plans show.

Add 671.2.4 to require ITS conduit tracer wire.

671.2.4 Tracer Wire

- (1) Furnish 12 AWG stranded copper tracer wire conforming to [655](#) in at least one conduit for each run. Connect the tracer wire using a wire nut at each pull box, manhole, or other access point. Alternatively, use a single wire through the access points.

671.3 Construction

671.3.1 Installing Conduit

- (1) Install conduit by plowing or trenching.
- (2) Do not exceed the minimum bending radius of the cable installed in the conduit. Do not pull cable over edges or corners, over or around obstructions, or through unnecessary curves or bends.
- (3) Use directional bore installations if the contract specifies.
- (4) Repairs are not allowed. Remove broken, chipped, cracked, or impaired lengths of fittings or conduit and replace with new materials. Do not install conduit above ground or on structures.
- (5) Provide information to the engineer as specified in [107.22](#). Expose the main to provide visual inspection by the utility owner for gas mains of 100 psi or greater, or 12 inches in diameter or greater.

671.3.2 Woven Pull Tape

- (1) Provide woven pull tape at each raceway point in acceptable to the engineer. If cables are blown directly through the ducts, woven pull tape for those sections of individual ducts is not required. Spare conduits shall have woven pull tape installed in the duct.

671.3.3 Fiber Optic Cable Marker

- (1) Provide installation at locations the plans show and as the engineer directs. Installation should be adequate so that marker cannot be pulled out or removed manually. The marker should self erect after vehicle impact.
- (2) Install markers so that all lengths of installed fiber optic cables in new conduit have a minimum of one marker. Install a minimum of 2 markers along each fiber optic cable path in new conduit so that one forward and one behind are always visible. Install a marker at each point along the fiber optic cable path where a 45-degree or greater change in direction occurs.

- (3) Install a marker at each handhole at locations where the fiber optic cabling is installed into existing conduit networks. Install markers a maximum of 24 inches lateral displacement from the actual placement of the conduit and fiber optic cabling.
- (4) Install markers no later than 3 days following the installation of conduit to contain fiber optic cables, or of direct buried fiber optic cables. Safeguard the conduit and cables during the installation of the markers. Remove and replace any conduit or cables as the plans show that are damaged during marker installation at no additional cost to contract.

671.4 Measurement

- (1) The department will measure the Conduit HDPE and Conduit HDPE Directional Bore bid items by the linear foot acceptably completed, measured along the centerline of the conduit from centerline of fitting to centerline of fitting or end of conduit, or between ends of conduit, or between ducts.
- (2) The department will measure Fiber Optic Cable Marker as each individual marker acceptably completed.

671.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
671.0100 - 0199	Conduit HDPE (duct) (size)	LF
671.0200 - 0299	Conduit HDPE Directional Bore (duct) (size)	LF
671.0300	Fiber Optic Cable Marker	EACH

- (2) Payment for the Conduit HDPE and Conduit HDPE Directional Bore bid items is full compensation for providing, hauling, and installing materials including conduit, fittings, couplers, and bends; for pull wires or ropes; for expansion fittings and caps; for excavating, bedding, backfilling, and restoration of ground to original condition including sand, concrete, or other required materials; for disposing of surplus materials; and for making inspections.
- (3) Payment for Fiber Optic Cable Marker is full compensation for providing and installing materials including restoration of ground to original condition including topsoil, sand, concrete, or other required materials; and for disposing of surplus materials.

Add 671.5(4) to specify payment for tracer wire under the appropriate 655 bid item.

- (4) The department will pay separately for conduit tracer wire as specified in [671.2.4](#) under the appropriate [655](#) bid item.

Section 674 Intelligent Transportation Systems - Cable

674.1 Description

- (1) This section describes providing, removing, and reinstalling ITS electrical wire and communications cable.

674.2 Materials

674.2.1 ITS Communication Cable

- (1) Furnish communication cable conforming to IMSA 20-6. Use 6 pairs of 18 AWG in each cable. Turn individual pairs 12 turns per foot within the cable.
- (2) Furnish ITS communication cable and terminations conforming to Rural Electrification Administration (REA) specification PE-22. Use 6-pair, 12-pair, or 25-pair communications cable 19 AWG solid copper with color-coded polyethylene insulation, black polyethylene outer jacket, and aluminum tape shield between jackets required to connect ramp meter and detector processor assemblies.

674.2.2 Microwave Detector Cable

- (1) Furnish 12 twisted pairs, 19 AWG, solid copper or color-coded polyethylene insulation, black polyethylene outer jacket, aluminum tape shield between jackets, and gel filled. The pair-utilization shall be as follows:

Pair 1: power.

Pairs 2 and 3: RS-232 bus for laptop computer.

Pair 4: detection zone contact closure.

Pair 5: detection zone contact closure.

Pair 6: detection zone contact closure.

Pair 7: detection zone contact closure.

Pair 8: detection zone contact closure.

Pair 9: detection zone contact closure.

Pairs 10 through 12: spare.

674.3 Construction

674.3.1 ITS Communication Cable

- (1) Under the Cable ITS Communication bid items, install 6 pair, 12 pair, and 25 pair copper communication cable as the plans show.
- (2) Install, terminate, and test twisted pair copper communications cable in the processor cabinets in order to transmit and share data communications between cabinets.
- (3) Prevent copper communication cable from damage during installation and storage. Do not step on or run over by any vehicle or equipment. Do not pull along the ground, or over or around obstructions.
- (4) Seal copper communication cable ends during installation using a heat shrinkable end cap. Do not use tape. Keep sealed until termination. For cable not immediately terminated, provide a 4-foot length of cable extending out of the cabinet opening.
- (5) Use cable grip to pull cable through conduit designed to provide a firm hold on exterior covering of cable.
- (6) Do not pull copper communication cable through any intermediate junction box, pull box, or any other opening in conduit or duct, unless the engineer approves. Pull the necessary length to be installed from the pull box or cabinet to the immediate next downstream pull box or cabinet. Carefully store remaining length of copper communication cable to prevent damage and in a manner not hazardous to pedestrian or vehicular traffic. Cable shall enter a pull box or cabinet directly from the cable reel or storage directly out of the immediate downstream pull box or cabinet.
- (7) Install copper communication cable without splices between hub or processor assembly cabinets.
- (8) Do not exceed the minimum bending radius at anytime during installation. Do not pull over edges or corners, over or around obstructions, or through unnecessary curves or bends. Copper communication cable shall be looped in and out of cabinets and pull boxes to provide adequate slack and minimize stress on conductors.
- (9) Use manufacturer's recommended pulling tension for pulling copper communication cable by the outer jacket or 80 percent of the manufacturer's maximum pulling tension whichever is smaller.
- (10) Use engineer-approved lubricant at manufacturer's recommended quantity to facilitate pulling cable. Lubricate as it is fed off of the cable reel or storage stack into the cable feeder. Place lubricator funnel around the cable just ahead of the feeder. After installation, clean the copper communication cable with a cloth at a pull box or cabinet before leaving.
- (11) Unless the plans show otherwise, provide slack in the cable of one full turn in box for pull boxes and a minimum of 6 feet for cabinets.

- (12) Terminate cable pairs entering a cabinet on termination blocks located in cabinets in a neat and orderly fashion and according to the REA color code. Ground cable shield for each run at only one of the termination locations. Attach 8 AWG grounding wire to the shield with an engineer-approved clamp according to REA PC-2.
- (13) Test the copper communication cable following installation:
 - Use a megger to test the ground resistance of all conductors including the shield, and conductor-to-conductor, including all individual conductors to the shield. Ensure that conductor tests, including the shield, read greater than 500 mega ohms to ground, and from conductor to conductor and all individual conductors to the shield, read greater than 500 mega ohms. Replace cable with one or more failing tests.
 - Test continuity of each pair to show a resistance of not more than 8 ohms per 1000 feet of conductor. Use meter with a minimum input resistance measurement of 20,000 ohms per volt.

674.3.2 Microwave Detector Cable

- (1) Install and test cables and connectors required to connect the microwave detector assembly with the processor assembly as the plans show.
- (2) Prevent cable from damage during installation and storage. Do not step on or run over by any vehicle or equipment. Do not pull along the ground, or over or around obstructions.
- (3) Seal cable ends at all times during installation using a heat shrinkable end cap. Do not use tape. Keep sealed until connectors are installed.
- (4) Install cable without splices between microwave detectors and processor.
- (5) Provide slack in the cable as the plans show. Provide a minimum of 6 feet for cabinets.
- (6) Test the cable following installation as follows:
 - Use a megger to test the ground resistance of conductors including the shield, and conductor-to-conductor, including all individual conductors to the shield. Ensure that all conductor tests, including the shield, read greater than 500 mega ohms to ground, and from conductor to conductor and all individual conductors to the shield, read greater than 500 mega ohms. Replace cable with one or more failing tests.
 - Test continuity of each pair to show a resistance of not more than 8 ohms per 1000 feet of conductor. Use meter with a minimum input resistance measurement of 20,000 ohms per volt.

674.3.3 Removing Cable

- (1) Remove the existing group of cables within a section of existing conduit as the plans show.
- (2) Use caution not to damage any remaining cables from existing conduits as the plans show. Remove existing cable connections from the cabinet or remove splices.
- (3) Test cable continuity, and identify and mark cables before removal to ensure proper reconnection.
- (4) Demonstrate and document existing damage to engineer. Non-compliance to demonstrate and document existing damage shall make repair the responsibility of the contractor.

674.3.4 Reinstalling Cable

- (1) Reinstall existing group of cables removed within a section of conduit as the plans show.
- (2) Provide a liberal coating of an engineer-approved electrical varnish or sealant to allow flexible protection from oil, moisture, and corrosion.
- (3) Provide a pressure or compression fitting for electrical splices and connections from the department's [QPL](#).
- (4) Replace damaged cables in kind at no additional expense to the department.
- (5) Remake all cable connections.

674.4 Measurement

- (1) The department will measure the Cable ITS Communication bid items by the linear foot acceptably completed, measured along the centerline of the conduit, including slack between terminations within the ramp meter processor assemblies.
- (2) The department will measure Cable Microwave Detector by the linear foot acceptably completed, measured along the centerline of the conduit, including slack to its connection with the proper terminals in the processor assembly cabinet.
- (3) The department will measure Remove Cable by the linear foot acceptably completed, measured along the centerline of the conduits removed between 2 points such as pull boxes, manholes, or other points defined.
- (4) The department will measure Reinstall Cable by the linear foot acceptably completed, measured along the centerline of the conduit run in which the group of cables was reinstalled.

674.5 Payment

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
674.0100 - 0199	Cable ITS Communication (pairs)	LF
674.0200	Cable Microwave Detector	LF
674.0300	Remove Cable	LF
674.0400	Reinstall Cable	LF

- (2) Payment for the Cable ITS Communication bid items is full compensation for providing cables; for making connections and testing installed cable system; and for disposing of surplus material.
- (3) Payment for Cable Microwave Detector is full compensation for providing cable and connectors; for making necessary connections; and for testing.
- (4) Payment for Remove Cable is full compensation for removing existing cables; for undoing connections and terminations, including wire nuts, splice kits, tape, insulating varnish or sealant, and ground lug fasteners; and for testing.
- (5) Payment for Reinstall Cable is full compensation for reinstalling existing cables; for remaking connections, including wire nuts, splice kits, tape, insulating varnish or sealant, and ground lug fasteners; and for testing.
- (6) The department will not pay for replacing cable not attaining a required resistance greater than 500 mega ohms.

Fence Safety, Item 616.0700.S.

A Description

This special provision describes providing plastic fence at locations the plans show.

B Materials

Furnish notched conventional metal "T" or "U" shaped fence posts.

Furnish fence fabric meeting the following requirements.

Color:	International orange (UV stabilized)
Roll Height:	4 feet
Mesh Opening:	1 inch min to 3 inch max
Resin/Construction:	High density polyethylene mesh
Tensile Yield:	Avg. 2000 lb per 4 ft. width (ASTM D638)
Ultimate Tensile Strength:	Avg. 3000 lb per 4 ft. width (ASTM D638)
Elongation at Break (%):	Greater than 100% (ASTM D638)
Chemical Resistance:	Inert to most chemicals and acids

C Construction

Drive posts into the ground 12 to 18 inches. Space posts at 7 feet.

Use a minimum of three wire ties to secure the fence at each post. Weave tension wire through the top row of strands to provide a top stringer that prevents sagging.

Overlap two rolls at a post and secure with wire ties.

D Measurement

The department will measure Fence Safety by the linear foot along the base of the fence, center-to-center of posts acceptably completed.

E Payment

The department will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
616.0700.S	Fence Safety	LF

Payment is full compensation for furnishing and installing fence and posts; maintaining the fence and posts in satisfactory condition; and for removing and disposing of fence and posts at project completion.

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ATTACHMENT H - BID PRICE SHEET

ITEM #	DESCRIPTION	QUANTITY	UNIT OF MEASURE	UNIT PRICE	TOTAL PRICE
616.0700.S	FENCE SAFETY	250	LF		
635.0200	SIGN SUPPORTS STRUCTURAL STEEL HS	1,000	LB		
636.0100	SIGN SUPPORTS CONCRETE MASONRY	2	CY		
636.0500	SIGN SUPPORTS STRUCTURAL STEEL REINFORCEMENT	98	LB		
637.1220	SIGNS TYPE I REFLECTIVE SH	165	SF		
638.2601	REMOVING SIGNS TYPE I	3	EACH		
638.3100	REMOVING STRUCTURAL STEEL SIGN SUPPORTS	4	EACH		
643.0300	TRAFFIC CONTROL DRUMS	2,000	DAY		
643.0420	TRAFFIC CONTROL BARRICADES TYPE III	150	DAY		
643.0705	TRAFFIC CONTROL WARNING LIGHTS TYPE A	300	DAY		
643.0715	TRAFFIC CONTROL WARNING LIGHTS TYPE C	700	DAY		
643.0800	TRAFFIC CONTROL ARROW BOARDS	1	DAY		
643.0900	TRAFFIC CONTROL SIGNS	200	DAY		
643.0910	TRAFFIC CONTROL COVERING SIGNS TYPE I	1	EACH		
SPV.0105.001	WEIGH-IN-MOTION SYSTEM	1	LS		
SPV.0105.002	WEIGH-IN-MOTION SYSTEM WARRANTY MAINTENANCE	1	LS		
SPV.0105.003	STATIC SCALE SYSTEM	1	LS		
SPV.0105.004	STATIC SCALE SYSTEM WARRANTY MAINTENANCE	1	LS		
				Total	

**ATTACHMENT I
BONDING FORM**

CONTRACT BOND PERFORMANCE AND PAYMENT

PART A: PERFORMANCE

We, the undersigned Contractor as Principal, and Surety are firmly bound to the State of Wisconsin for the performance amount specified below as Part A Performance for the faithful performance of this contract. The condition of this obligation is such that if the Principal shall perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of this contract and its subsequent amendments, notice of such amendments to the Surety being waived, then this obligation shall be void; otherwise it is binding.

PART B: PAYMENT

We, the Principal and Surety are firmly bound to the State of Wisconsin in the additional amount specified below as Part B Payment, for all claims, costs and charges. The condition of this obligation is such that if the Principal shall promptly make payment pursuant to section 779.14 Wisconsin Statutes, to all persons who supply labor and material directly to the Principal in the prosecution of the work provided for in this contract and its subsequent amendments, notice of such amendments to the Surety being waived, then this obligation shall be void; otherwise it is binding.

The total liability for Part A Performance shall not exceed that amount specified below and shall accrue to the sole benefit of the Wisconsin Department of Transportation. The total liability for Part B Payment shall not exceed that amount specified below. The total liability of this contract bond, identified below, is the sum of the Part A Performance and the Part B Payment. We bind ourselves, our heirs, executors, and administrators for the total contract bond liability.

Attorney-In-Fact for Surety - Print Name	Date Bond Executed
Attorney-In-Fact Area Code – Telephone Number	Bond Number - REQUIRED
Surety Name and Address	Part A: Performance \$
	Part B: Payment \$
	Total Contract Bond Liability \$

Surety: Please attach ONE copy of Power of Attorney.

_____ (Signature of Attorney-In-Fact for Surety)	_____ (Contractor Name and Seal)
	_____ (Signature of Contractor)
	_____ (Witness)
	_____ (Witness)

Surety Seal

	_____ (Date)
On the above date, the identified Attorney-In-Fact for the identified surety, personally appeared before me, the Notary Public, and upon oath declared that:	State of Wisconsin)
1. The corporate seal affixed to this document is the seal of the identified surety;	) ss.
2. The Attorney-In-Fact, affixed the seal and executed this document as the free act and deed of the surety;	_____ County)
3. The Attorney-In-Fact is expressly authorized to do so and his/her authority has not been revoked;	On the above date, this instrument was acknowledged before me by the named person(s).
4. This surety bond was written through a licensed agent.	_____ (Signature, Notary Public, State of Wisconsin)
	_____ (Print or Type Name, Notary Public, State of Wisconsin)
	_____ (Date Commission Expires)

Notary Seal