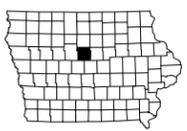
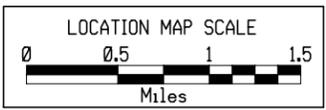
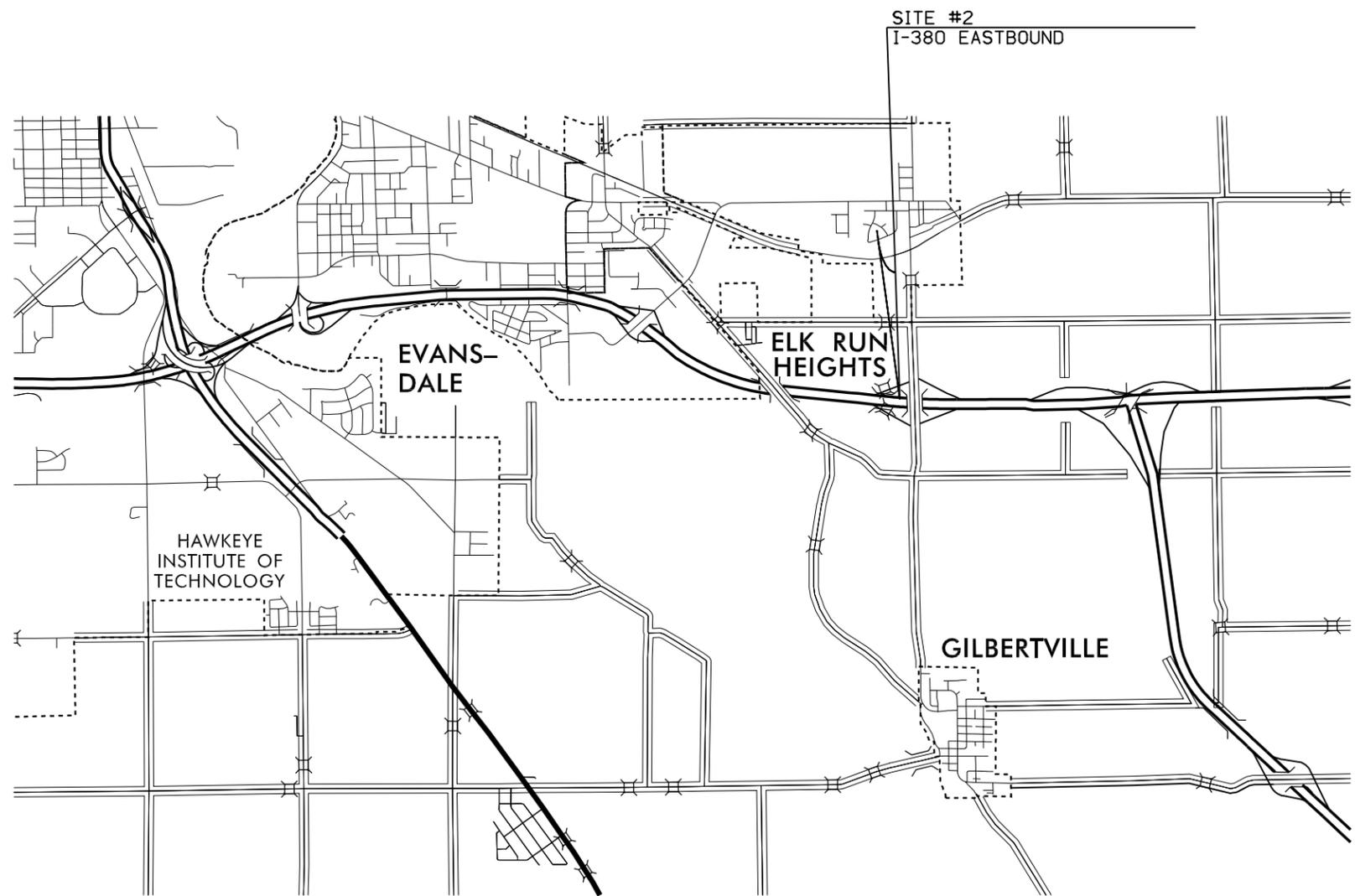


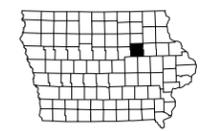
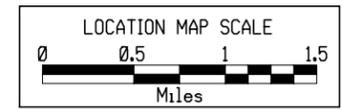
SITE #1  
I-35 NORTHBOUND

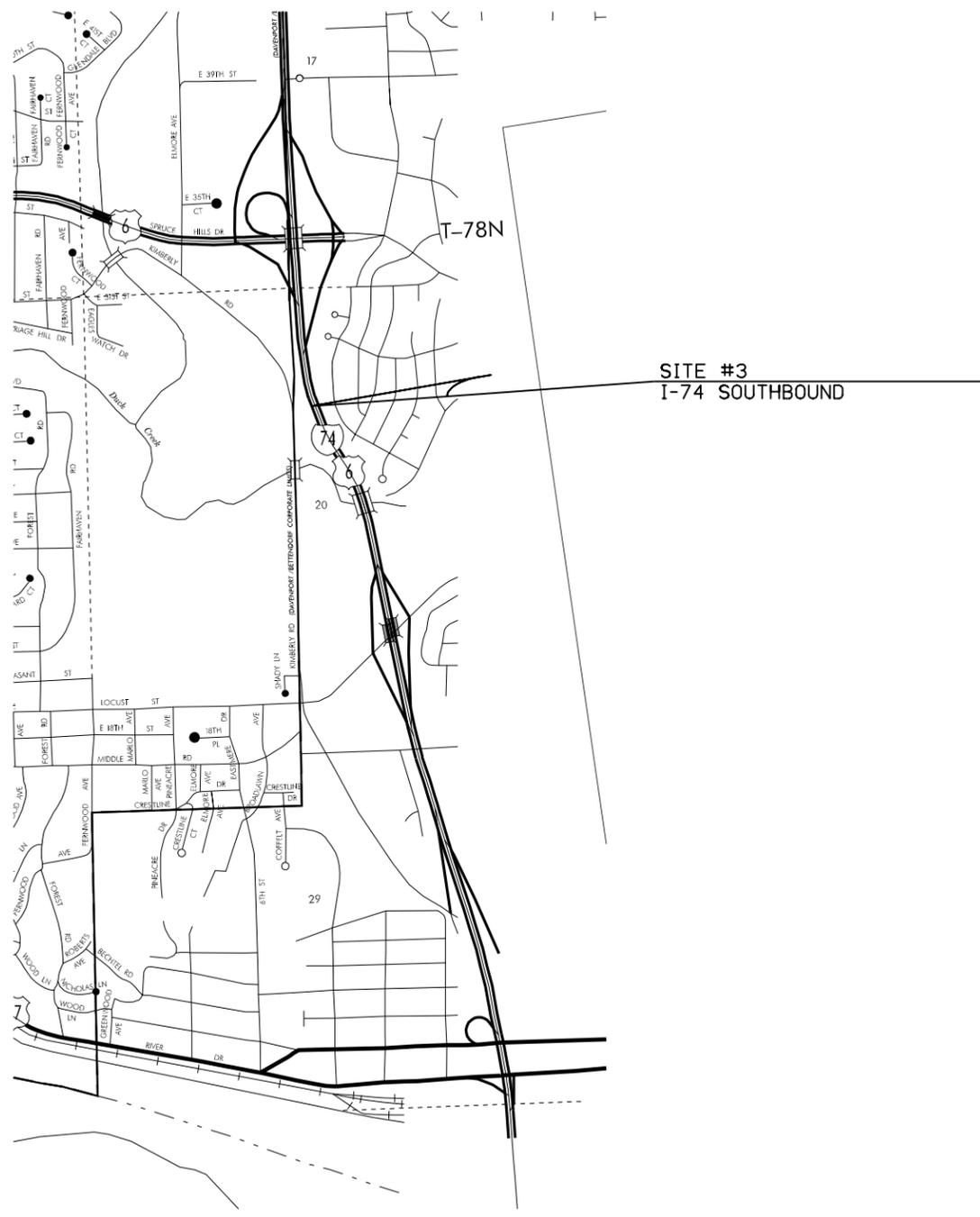
Hamilton County



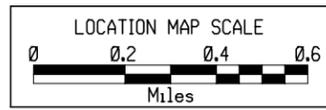


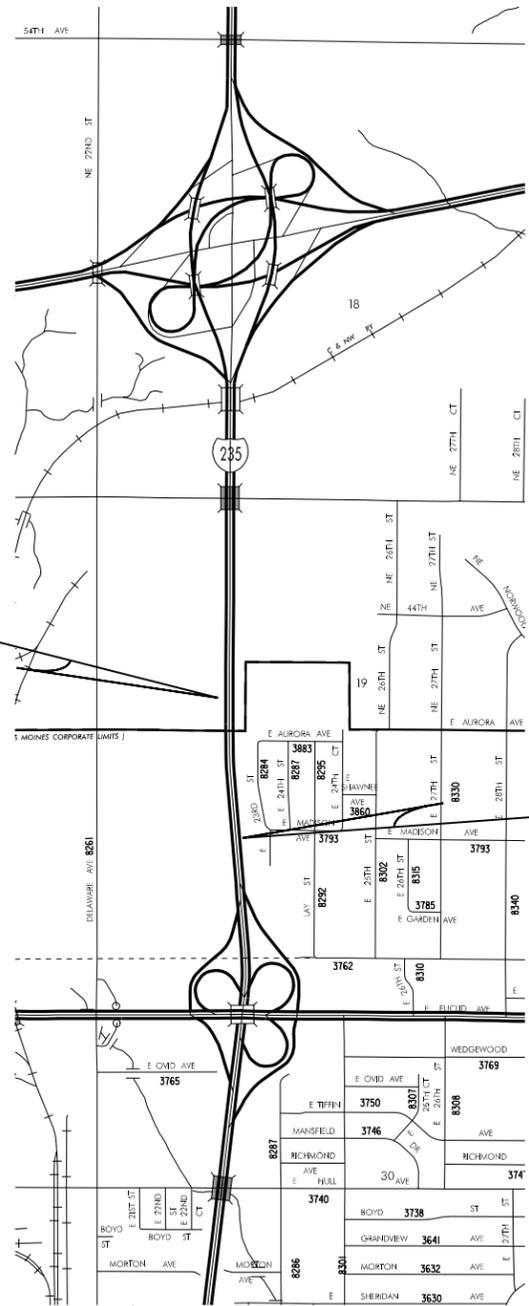
Waterloo  
Blackhawk County





Davenport  
Scott County

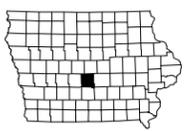
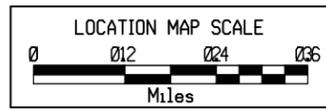


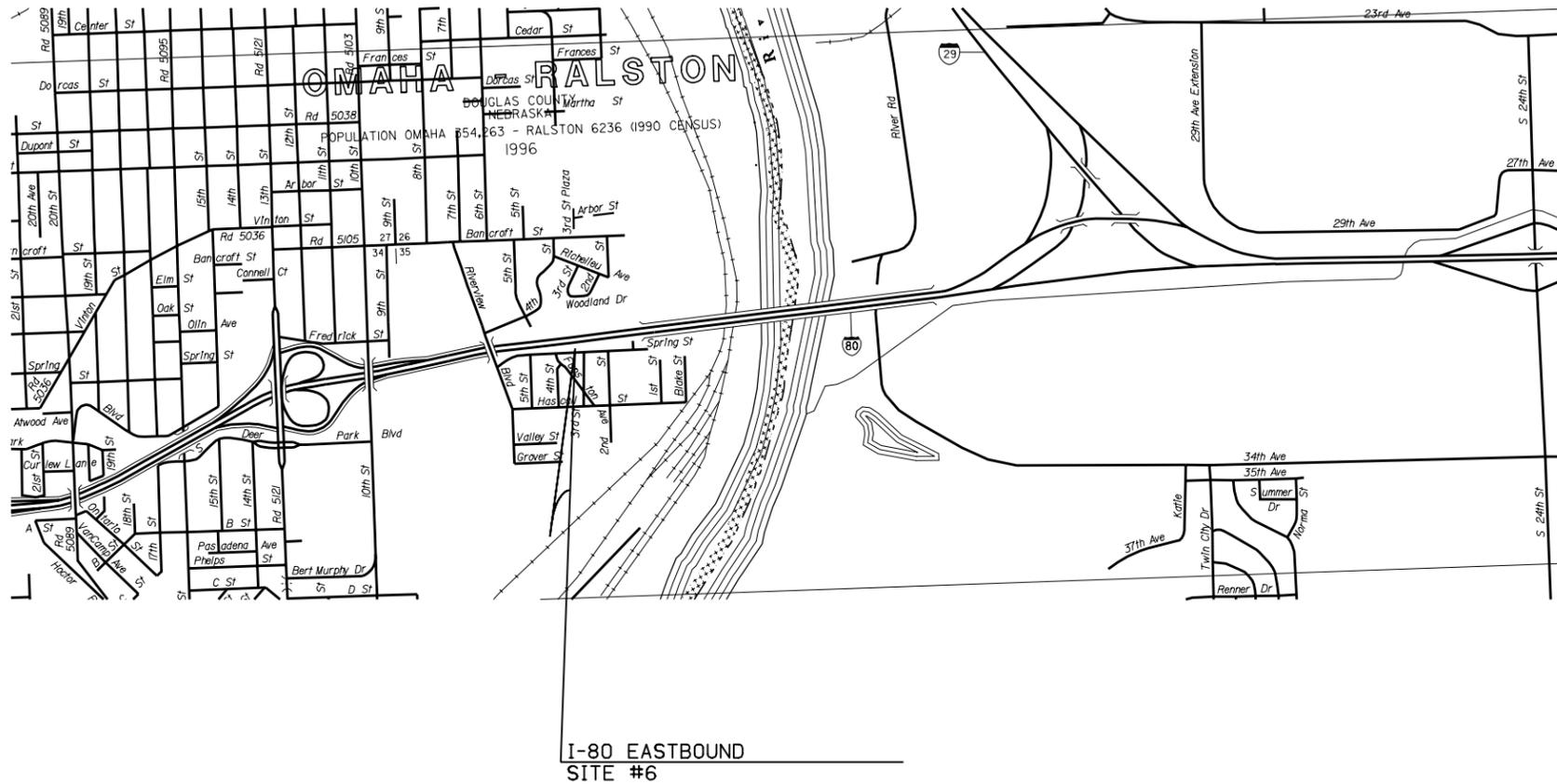


SITE #5  
I-235 SOUTHBOUND

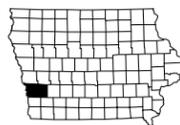
SITE #4  
I-235 NORTHBOUND

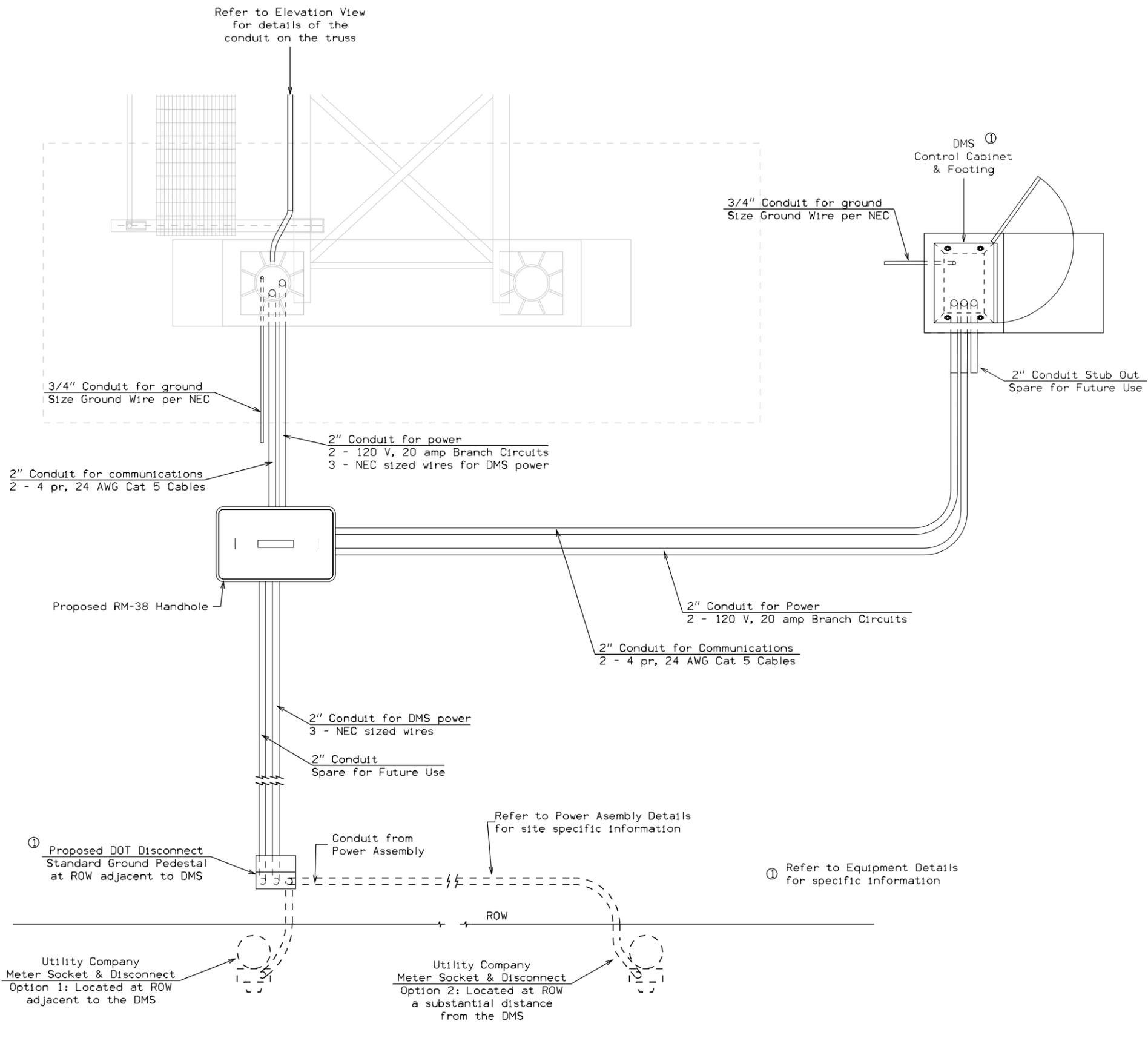
Des Moines  
Polk County





Omaha  
Douglas County, NE





**PLAN VIEW**

**SITE WIRING NOTES:**

High voltage and low voltage wires shall not be run in the same conduit. Use one conduit for power supply and branch circuit wires, and the other conduit for communication wires.

All wires shall be sized per NEC requirements when no size is indicated in the plans.

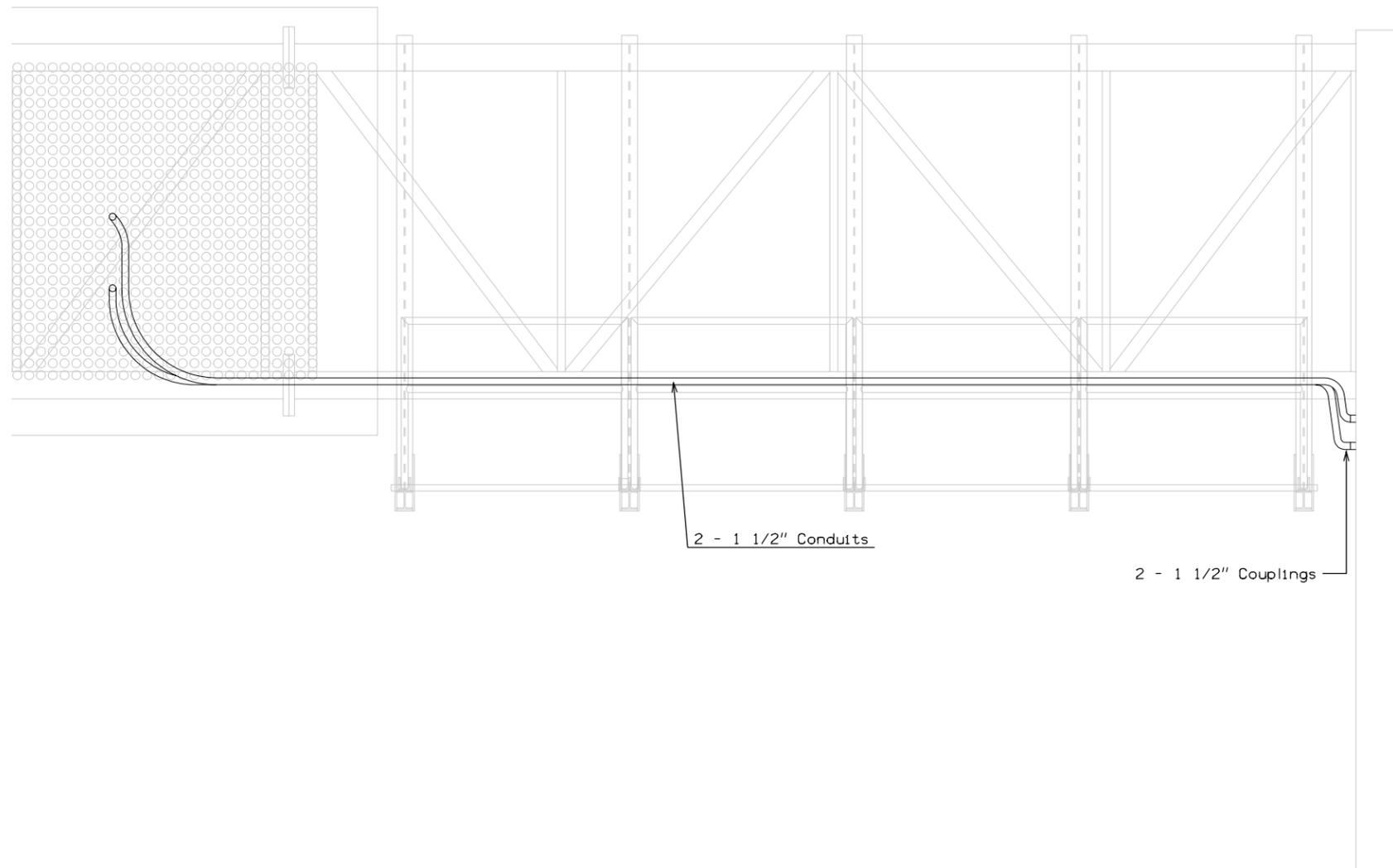
The DMS control cabinet and equipment will be furnished by others; and installed by the Contractor. The DMS control cabinet is designed to accommodate equipment to operate the DMS, including optional communication equipment. No other equipment shall be installed in the DMS control cabinet. The DMS power supply wires shall NOT pass through the DMS control cabinet.

The 4 pair, 24 AWG Cat 5 cables will be furnished by others; and installed by the Contractor. The Contractor shall leave 10 foot of slack on each end of each cable, coiled neatly in the DMS and in the DMS control cabinet.

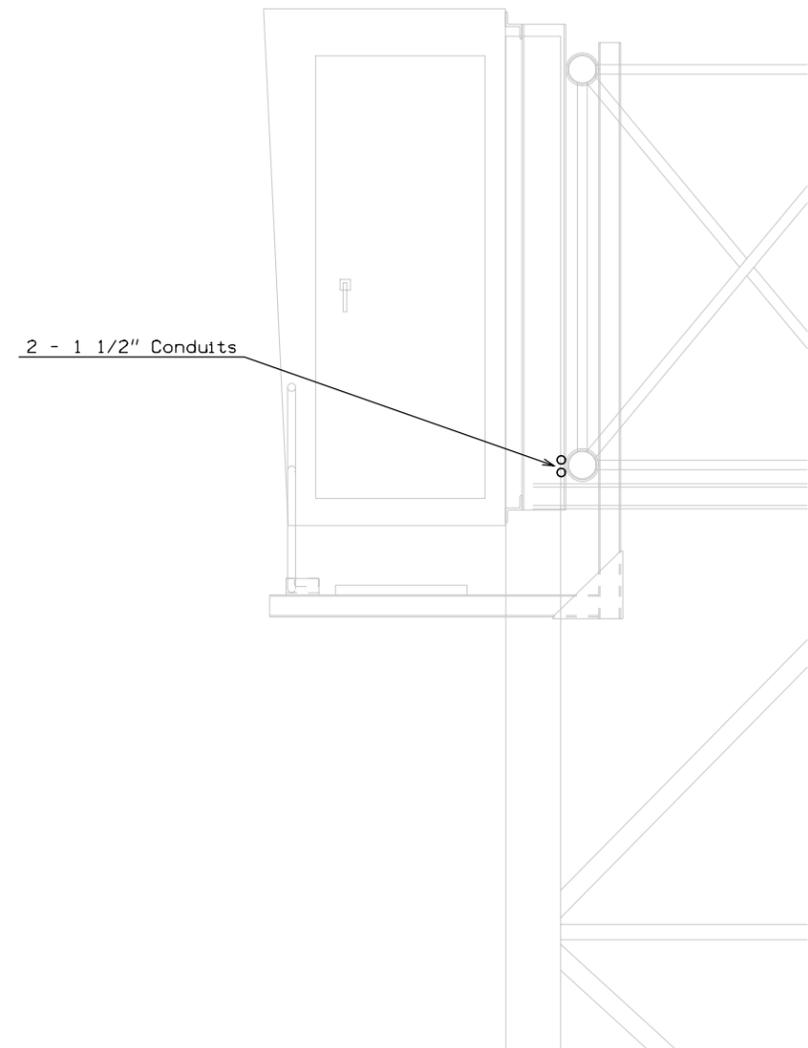
The Contractor shall install the equipment and wiring from the Utility Company's service point to the DOT disconnect pedestal in accordance with the Utility Company's requirements. The DOT requires that all service wires inside the ROW be installed in conduit.

The DMS power supply wires, run from the disconnect pedestal to the DMS power supply, shall NOT pass through the DMS control cabinet.

**SITE WIRING DETAILS**



ELEVATION VIEW



SIDE VIEW

Conduit banded to the truss chord should be rigid. Conduit used to make connections to the truss or DMS couplings may be rigid or flexible.

All conduit, fittings, seals and gaskets shall be weatherproof as per NEC requirements.

Banding material shall be stainless steel. Conduit shall be banded at regular intervals not to exceed 4 feet.

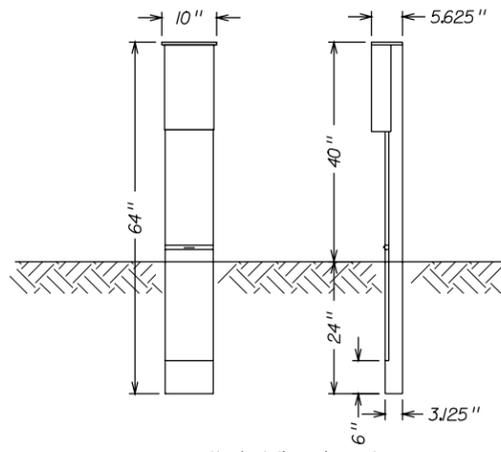
High voltage and low voltage wires shall not be run in the same conduit. Use one conduit for power supply and branch circuit wires, and the other conduit for communication wires.

SITE WIRING DETAILS

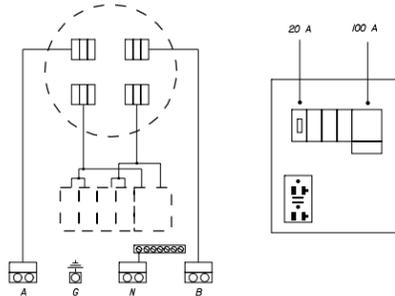
Service:  
 - 100 amp, 120/240 volt 1>

Enclosure Details:  
 - Type 3R  
 - direct buried  
 - lockable, hinged cover  
 - 6 circuit interior to accept standard plug-in type circuit breakers

Features:  
 - one 20 amp, 120 volt GFI receptacle  
 - 100 amp, 120/240 volt circuit breaker (for DMS power)  
 - 20 amp, 120 volt circuit breaker (for receptacle)



Nominal dimensions shown

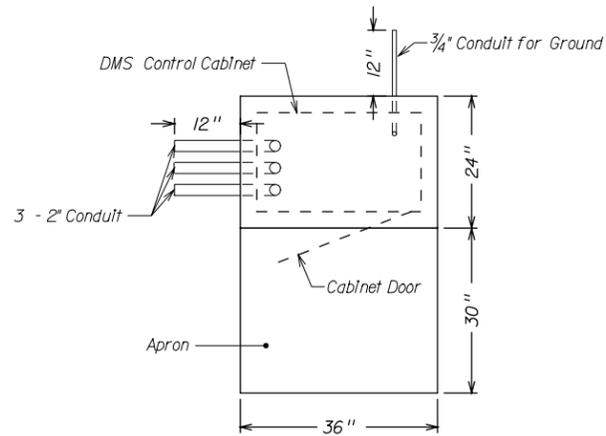


### STANDARD GROUND MOUNTED PEDESTAL

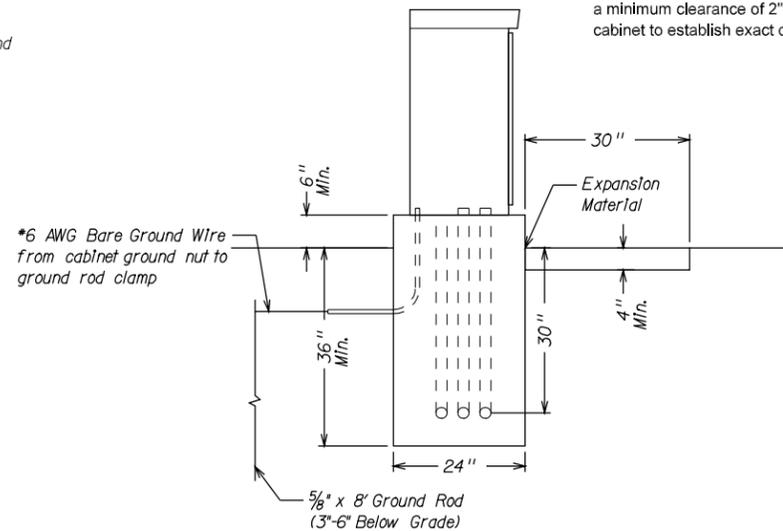
for DOT Disconnect

Center DMS Cabinet on footing and attach with approved pull out anchors. Refer to IM 453.09.

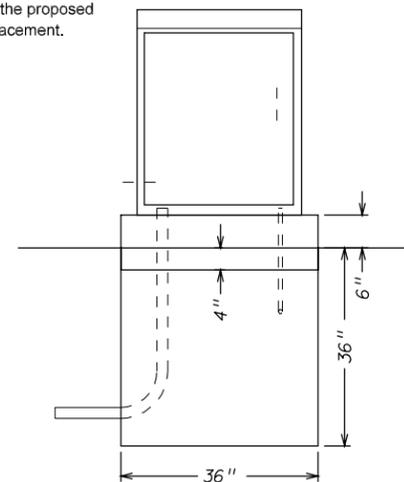
Conduits shall be positioned to fit inside the cabinet with a minimum clearance of 2" to all sides. Use the proposed cabinet to establish exact dimensions and placement.



Top View



Side View



Front View

### DMS Control Cabinet Footing Details

### EQUIPMENT DETAILS

**GENERAL NOTES**

Power service shall be 200 amp, 120/240 volt single phase.

Details of power service shall be coordinated with the Utility Co. All equipment, conduit, and wiring between the service point and the DOT disconnect pedestal shall be as specified by the Utility Co.

**SITE SPECIFIC NOTES**

**Site #1**

At this site, the Utility Co. service pole is located north of the DMS location. The Utility Co. has already installed the service pole, meter socket, and disconnect. The Utility Co. has also trenched the power service wires to the DMS site. The power service is direct buried, and is stubbed out of the ground at the service pole and at the ROW adjacent to the DMS.

The Contractor shall install the DOT disconnect pedestal and connect the power service to the pedestal. The Utility Co will complete the connections to the service pole.

The Contractor shall notify the DOT representative when ready to have the final power connections completed.

**DOT Representative**

Mike Kinyon - Access Utility Specialist  
515-233-3735

**Utility Company Information**

Midland Power Company  
Mike Carson  
800-833-8876

**Site #2**

At this site, the Utility Co. service drop will be located west of the DMS location. The Utility Co. will install the meter socket and disconnect on an existing pole within the interchange.

The Contractor shall install the DOT disconnect pedestal, and run power from the service pole to the disconnect pedestal. The power service shall be installed in conduit of the size specified by the Utility Co. Handholes may be required as specified by the Utility Co.

The Contractor may notify either the DOT representative or the Utility Co. when ready to have the final power connections completed.

**DOT Representative**

Russ Frisch - Maintenance Supervisor  
319-233-3055

**Utility Company Information**

Mid American Energy

**Site #3**

At this site, the Utility Co. service pole is located north of the DMS location. The Utility Co. will install the service pole, meter socket, and disconnect.

The Contractor shall install a 4 ft x 4 ft transformer pad near the DOT disconnect pedestal. Details of the pad are available from the Utility Co.

**Site #3 (cont'd)**

The Contractor shall install 3 inch conduit between the service pole and the transformer pad, and between the transformer pad and the disconnect pedestal. The conduit shall be stubbed out of the ground 6 inches at the service pole. The Contractor shall install one handhole at the midpoint of the conduit run between the service pole and the transformer pad.

The Utility Co. will furnish and install the transformer, and run power from the service pole to the transformer. The Contractor shall make the secondary connections from the transformer to the disconnect pedestal.

The Contractor may notify either the DOT representative or the Utility Co. when ready to have the final power connections completed.

**DOT Representative**

Sheila Lee - Engineering Operations  
563-391-4643

**Utility Company Information**

Mid American Energy  
Denny Berner  
309-793-3875

**Site #4**

At this site, the Utility Co. service pole will be located at the ROW adjacent to the DMS location. The Contractor shall install the service pole, meter socket, and disconnect for the Utility Co.

The Contractor shall install the DOT disconnect pedestal, and run power from the service pole to the disconnect pedestal.

The Contractor may notify either the DOT representative or the Utility Co. when ready to have the final power connections completed.

**DOT Representative**

Jerry Lavine - Utility Coordinator  
515-237-3312

**Utility Company Information**

Mid American Energy  
Bruce Friest  
515-281-2624

**Site #5**

At this site, the Utility Co. service pole will be located north of the DMS location. The Contractor shall install the service pole, meter socket, and disconnect for the Utility Co.

The Contractor shall install the DOT disconnect pedestal, and run power from the service pole to the disconnect pedestal. The power service shall be installed in conduit of the size specified by the Utility Co. Handholes may be required as specified by the Utility Co.

The Contractor may notify either the DOT representative or the Utility Co. when ready to have the final power connections completed.

**DOT Representative**

Jerry Lavine - Utility Coordinator  
515-237-3312

**Utility Company Information**

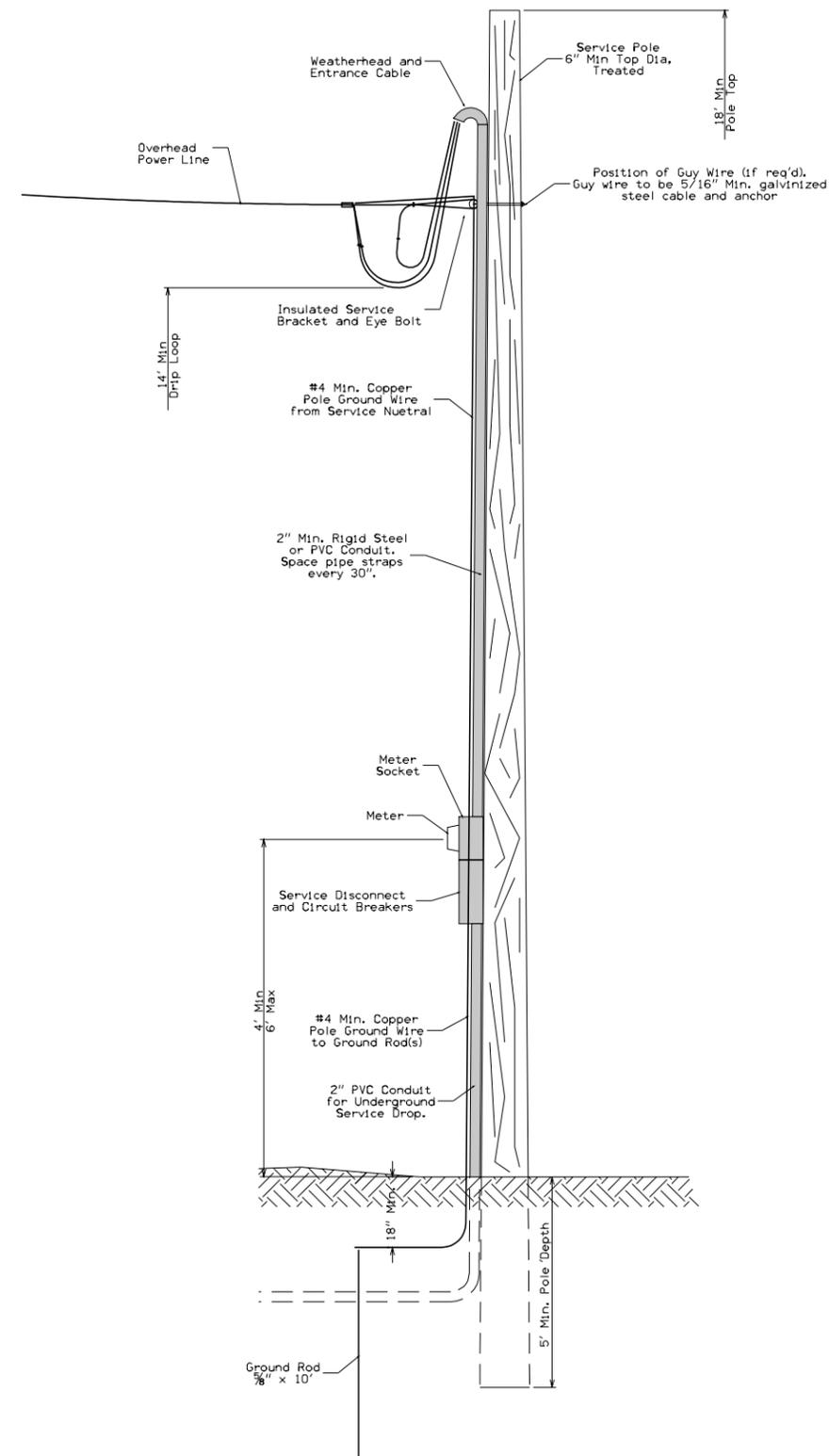
Mid American Energy  
Bruce Friest  
515-281-2624

**Site #6**

No information is available for this site. The Contractor shall coordinate all plans with the Utility Co.

**DOT Representative**

Jeff Owen - Field Services Coordinator  
712-243-3355



**POLE TYPE SERVICE ASSEMBLY**

Nominal dimensions shown. Contractor shall coordinate with the Utility Co. for specific equipment requirements, and to determine who will install the equipment

**POWER SERVICE DETAILS**



ESTIMATE REFERENCE INFORMATION

100-4A  
10-29-02

Item No.	Item Code	Description
1	2102-2625000	EMBANKMENT-IN-PLACE  Item includes 1411.2 cubic yards of material for berms for guardrail and wire rope safety barrier, and 18.2 cubic yards for berms for temporary attenuators. Refer to tabulations 107-23 and 108-30 for locations and details. Refer to site detail sheets for specific site requirements.
2	2401-6745910	RMVL OF SIGN  This item shall consist of removal of Type A Sign Assemblies from the project. There is one sign assembly at Site #3 that needs to be removed on this project.  A Type A Sign Assembly is defined as one or more Type A signs, installed on one or more posts located at the same point. The Type A signs may be directly mounted to the post, or mounted to the post with special sign mounting brackets. Posts may be either wood posts or other material.  The Contractor shall remove each sign assembly identified in the plans. Unless otherwise noted, all signs, special mounting brackets, and wood posts removed shall remain the property of the DOT. All fasteners and non-wood posts removed shall become the property of the Contractor.  The Contractor shall deliver the removed signs, special mounting brackets, and posts to a DOT storage area within 50 miles, as designated by the Engineer.  Each sign assembly shall be completely disassembled prior to delivery to the DOT. The Contractor shall unbolt all signs, special mounting brackets, and posts from each other. Care should be taken not to damage the disassembled materials.  Holes remaining from the removal of posts shall be backfilled with suitable earth to the original level or to the natural ground surface in accordance with Article 2402.09.  Measurement: The Engineer will count each Type A Sign Assembly removed.  Payment: For each Type A Sign Assembly removed, the Contractor shall be paid the contract unit price. This payment shall be full compensation for furnishing all material, equipment, and labor and for the performance of all work necessary for removal of the Type A Sign Assembly from the project and for any backfilling made necessary by these operations.
3 4 5 6	2402-2720000 2403-0100000 2404-7775005 2423-1010700	EXCAVATION, CL 20 STRUCT CONC (MISCELLANEOUS) REINFORC STEEL, EPOXY COATED O'HD SIGN SUPPORT STRUCTURE, ALUM 70'  Items are for the installation of (3) new overhead sign trusses for DMS signs. Refer to tabulation OVERHEAD for locations and details. Refer to site detail sheets for specific site requirements.
7	2505-4008100	RMV G'RAIL  Requires the removal of (56) posts and (2) RE-53 end anchorages which shall be incidental. See tabulation 110-7A for details and disposal. All guardrail materials removed shall become the property of the Contractor.
8 9 10	2505-4008200 2505-4021331 2505-4021762	INSTALL OF G'RAIL G'RAIL, END ANCHOR, BEAM, RE-33A G'RAIL TERMINAL, BEAM, FLARED, RE-76  Items are for proposed W-beam guardrail installations. Refer to tabulations 108-8B for locations and details. Refer to site detail sheets for specific site requirements.
11	2505-6000111	HIGH TENSION CABLE G'RAIL  Refer to tabulation 108-9a for locations and details. Refer to site detail sheets for specific site requirements.
12 13	2528-8400048 2528-8400060	TEMP BARRIER RAIL, CONC TEMP ATTENUATOR, NON-REDIRECTIVE (NR)  Items are for traffic control at various locations. Refer to tabulations 108-33 and 108-30 for locations and details. Refer to site detail sheets for specific site requirements.
14 15	2528-8445110 2533-4980005	TRAFFIC CONTROL MOBILIZATION

ESTIMATE REFERENCE INFORMATION

100-4A  
10-29-02

Item No.	Item Code	Description
16	2599-9999005	DMS INSTALLATION  The work performed under this bid item shall consist of furnishing all labor, apparatus, and materials to construct, install, and place in operation, a complete dynamic message sign (DMS) system. The Contractor shall furnish and install all components of the system not furnished by the DOT or utility company serving the DMS system, including all incidental items appurtenant to the operation of the system.  For general purposes, the installation of the DMS includes, but is not limited to:  - attaching the DMS to the sign truss, - installation of the utility pole including conduit, meter socket, disconnect, and all incidental items appurtenant to the electrical service, - connection of the electrical service from the utility pole to the DMS master power panel including conduit and cabling, - construction of the control cabinet footing, - installation of the conduit between the sign truss footing and the control cabinet footing, - installation of the control cabinet and control cabinet equipment, - and installation of the wiring between the DMS and the control cabinet including two branch circuits and two ethernet cables.  For this project, the DMS vendor is Daktronics, Inc. of Brookings, South Dakota.  The following items will be provided by the DOT, or the DMS vendor: DMS, DMS-to-sign truss attachment brackets, control cabinet, control cabinet equipment, and ethernet cables to connect the DMS to the control cabinet equipment.  All arrangements to initiate and accept delivery of the DOT furnished equipment shall be coordinated with the Engineer. Delivery shall be witness by the Engineer, and proof of delivery shall be required for all items. Proof of delivery shall consist of an invoice that clearly identifies each item being delivered, initialed by the accepting party, the delivering party, and the witness. Upon acceptance of equipment, the Contractor shall be 100% liable for safe handling, storage, and installation of the equipment. Any damaged equipment shall be replaced at the Contractor's expense, without additional compensation.  MEASUREMENT: The Engineer will count the number of signs installed.  PAYMENT: The Contractor shall be paid the contract unit price for each sign installed.
17	2601-2634100	MULCH  Mulch: Rate--1 1/2 tons of dry cereal straw per acre. All mulch to be consolidated into the soil with the mulch stabilizer.
18	2601-2636043	SEED+FERTILIZE (RURAL)  Included for all rural disturbed areas following final construction as designated by the engineer.  Seed Mixture: Fescue, Fawn 45 lbs. per acre Ryegrass, Perennial 35 lbs. per acre Birdsfoot Trefoil (Empire) 5 lbs. per acre  Fertilizer: Rate--750 lbs. of 13-13-13 or equivalent chemically combined commercial fertilizer per acre.
19	2601-2642100	STABILIZE CROP - SEED+FERTILIZE  Included for all rural disturbed areas as designated by the engineer. This item may be deleted if permanent seeding is accomplished by May 31.  Seed Mixture: Spring--March 1 to May 20 Oats 2 bu. per acre Annual Ryegrass 25 lbs. per acre Red Clover 5 lbs. per acre Timothy 5 lbs. per acre  Summer--May 21 to July 20 Oats 3 bu. per acre Annual Ryegrass 25 lbs. per acre Red Clover 10 lbs. per acre Timothy 5 lbs. per acre  Fall--July 21 to September 30 Oats 2 bu. per acre Annual Ryegrass 25 lbs. per acre Red Clover 5 lbs. per acre Timothy 5 lbs. per acre  Fertilizer: Rate--450 lbs. of 13-13-13 or equivalent chemically combined commercial fertilizer per acre.



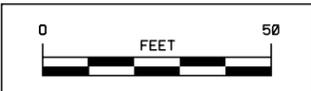
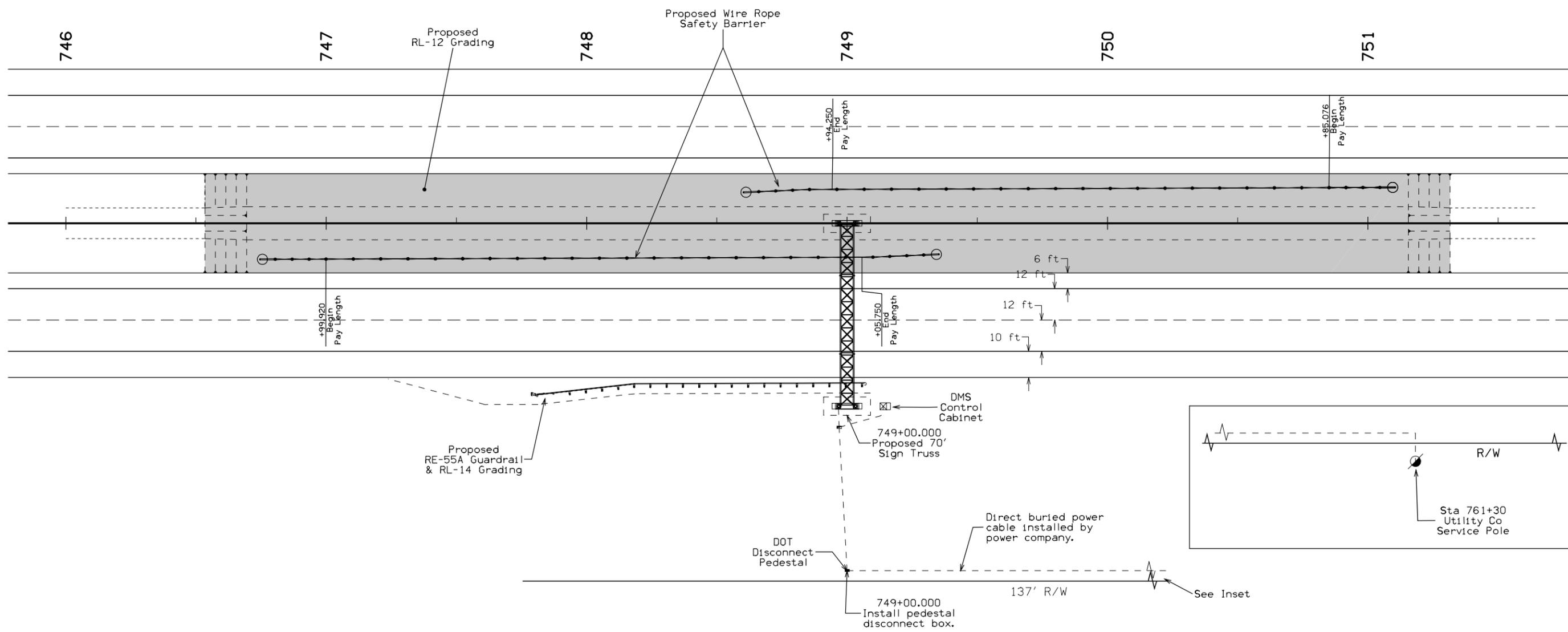
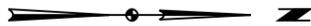
GRADING FOR GUARDRAIL INSTALLATIONS															107-23							
Refer to Standard Road Plans RL-12, RL-14A(1), RL-14A(2), RL-14B, and Typical 4303															04-19-05							
Location				Dimensions (Feet)										Pipe			Remarks					
Site No.	Direction of Traffic	Station	Side	Type	BY		Z		X1	Y1	X2	Y2	X3	Y3	X4	Y4		Class 10 Excavation Cu. Yds.	Embankment In Place Cu. Yds.	Size Inches	Type	Length Lin. Ft.
					A	T	A	T														
1a	NB	747+81.0	RT	1	10		60		76	6					113	10		59.3				RL-14 for W-beam
1b	NB	749+00.0	MED	4														431.2				RL-12 for Wire Rope
2a	SB	6853+50.0	RT	n/a														13.1				RL-12 for Wire Rope
2b	SB	6853+50.0	MED	4														451.2				RL-12 for Wire Rope
3a	SB	2188+27.3	RT	1	10		60		25.5	6					62	10		48.4				RL-14 for W-beam
3b	SB	2187+60.0	MED	4														408				RL-12 for Wire Rope
Totals																	1411.2					

WIRE ROPE SAFETY BARRIER					108-9A
Refer to Standard Road Plan RE-56					04-19-05
Location			Bid Item		Remarks
Site No.	Station to Station	Direction of Traffic	L (Lin. Ft.)	End Anchor No.	
1a	746+99.9 to 749+05.8	NB	205.9	2	Site #1 - NB Median
1b	750+85.1 to 748+94.3	SB	190.8	2	Site #1 - SB Median
2a	6852+14.8 to 6853+55.7	SB	140.9	2	Site #2 - SB Outside
2b	6851+36.6 to 6854+33.7	SB	297.1	2	Site #2 - SB Median
2c	6855+42.7 to 6853+83.2	NB	159.5	2	Site #2 - NB Median
3a	2189+52.7 to 2187+54.3	SB	198.4	2	Site #3 - SB Median
3b	2186+40.6 to 2187+65.8	NB	125.2	2	Site #3 - NB Median
Totals			1317.8	14	

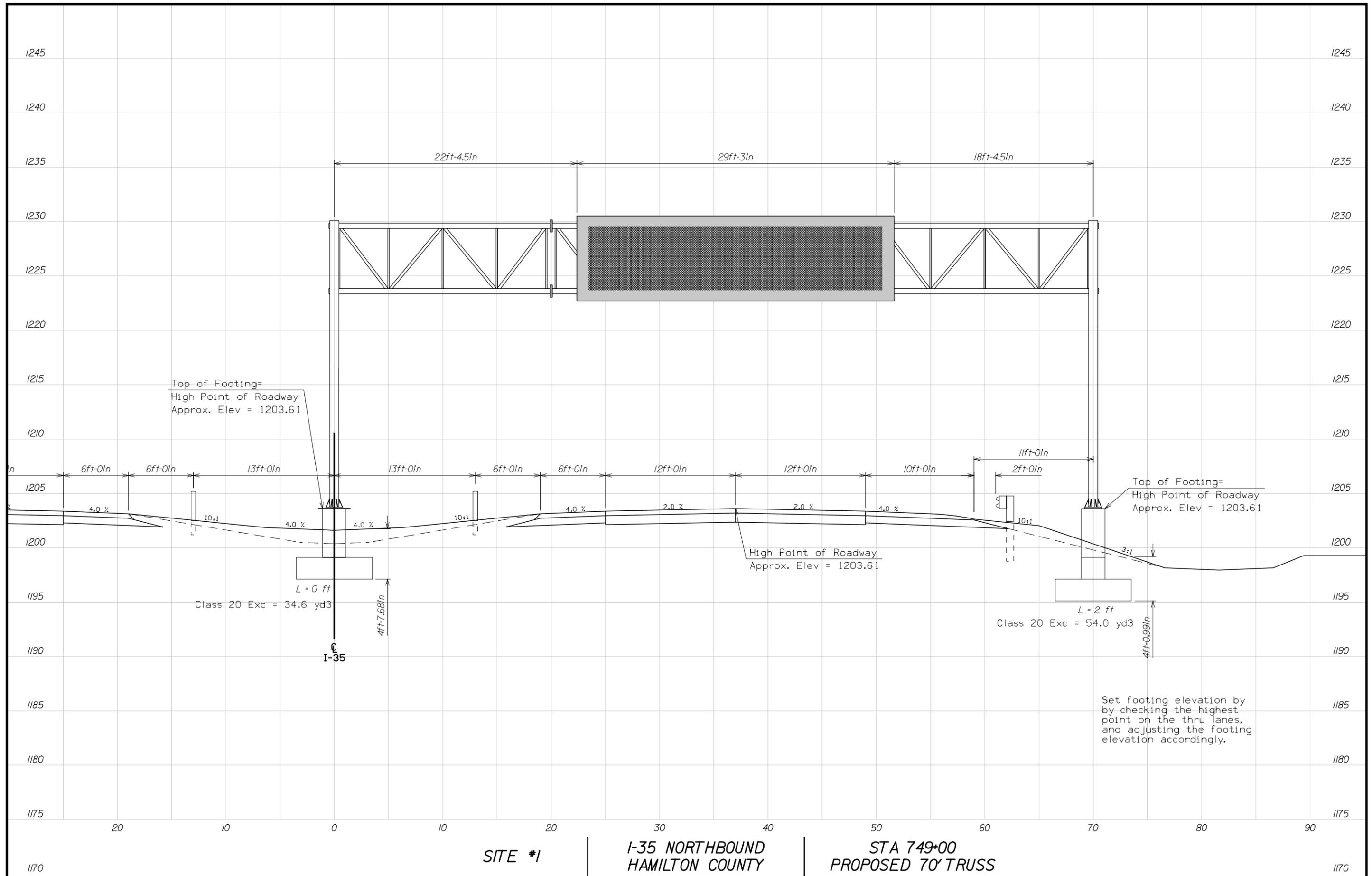
TABULATION OF STEEL BEAM GUARDRAIL FOR SIDE OBSTACLE																				108-8B							
See Standard Road Plans RE-48A-B, RE-54A, RE-54B, RE-55A, RE-55B, or RE-66C.																				10-21-03							
Location				Standard Road Plan	L2	Layout Lengths								Culvert Spanning	Materials Required			Delineators and Object Markers				Bid Items			Remarks		
Site No.	Direction of Traffic	Side	Station			Approach Side (A)				Trailing Side (T)					'W' Beam Guardrail	CRT Posts	Posts (4)	Type	Delineator		Object Marker		Installation of Guardrail	Anchorage and Terminal Systems		Adaptor	
						ET	VF	VT	H	VT	VF	ET	Single White D-1W						Type 2	Type 3		RE-33A		RE-76			RE-37
			Terminal (37.5')	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	Lin. Ft.	No.	No.	No.	No.	Lin. Ft.	No.	No.	No.					
1	NB	0	749+00	RE-55A	12	37.5	0	75	12.5					137	5	14	7					137	1	1		Site #1 - NB Outside	
3	SB	0	2187+60	RE-55A	12	37.5	0	25	12.5					87	5	6	7					87	1	1		Site #3 - SB Outside	
Totals														224	10	20						224	2	2			

**LEGEND**

█ Proposed Grading



**PROPOSED LAYOUT  
for DMS SITE #1  
I-35 NB - HAMILTON COUNTY**



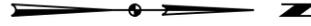
SITE #1

I-35 NORTHBOUND  
HAMILTON COUNTY

STA 749+00  
PROPOSED 70' TRUSS

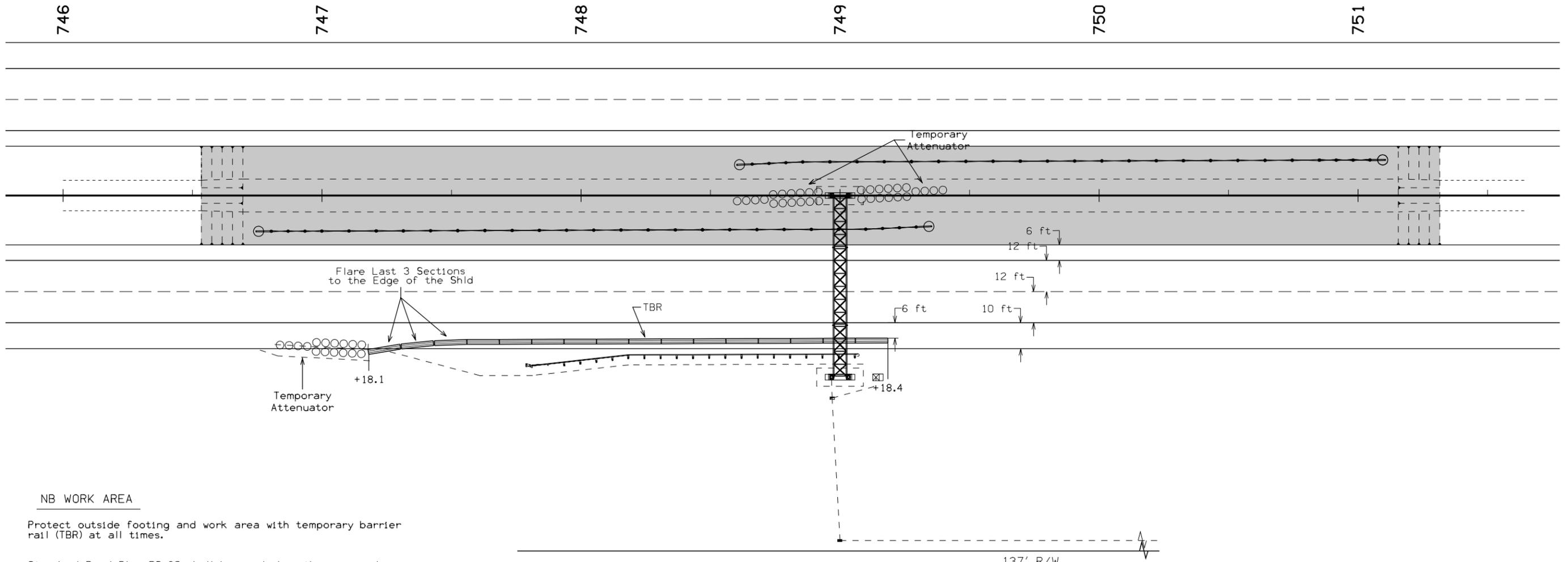
SAMPLE STAGING SEQUENCE

- Setup initial traffic control
- Footing construction
- Guardrail grading
- Seed newly graded areas
- Modify traffic control
  - set up temporary attenuators in the median
  - take down median RS-62 if next activity is scheduled several weeks from present date
- Install sign truss and DMS
- Complete guardrail installations
- Final seeding



MEDIAN WORK AREA

Standard Road Plan RS-62 shall be used when there are ongoing construction activities in the median (i.e. - footing construction, grading, guardrail installation, etc.) This setup shall remain in place until the median footing and grading are complete and the temporary attenuators have been setup on each end of the footing.



NB WORK AREA

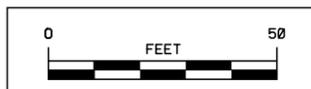
Protect outside footing and work area with temporary barrier rail (TBR) at all times.

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.

Standard Road Plan RS-69 shall be used to install the sign truss and DMS. Times of closure shall be coordinated with the Engineer.

STANDARD ROAD PLANS

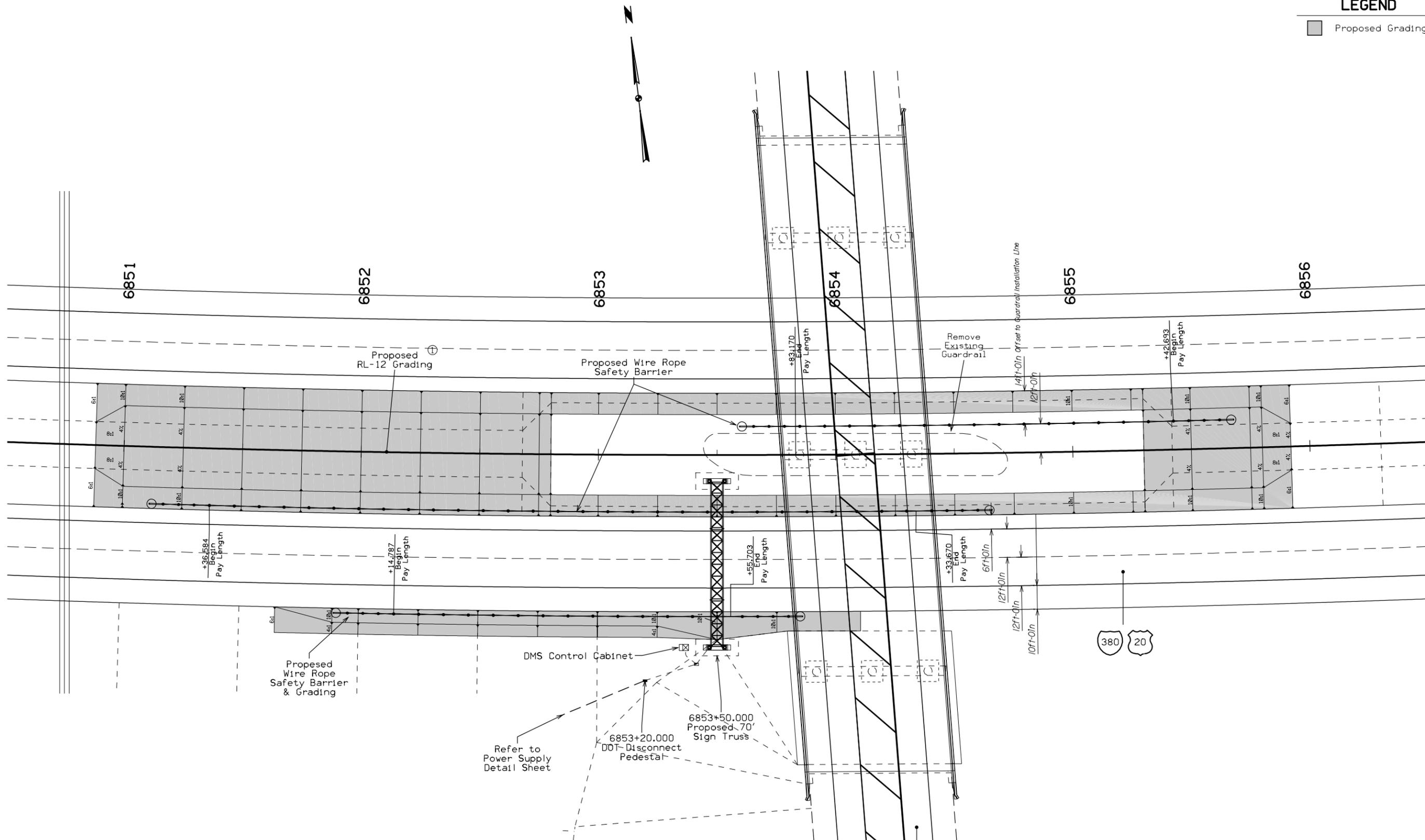
- RS-61
- RS-62
- RS-69
- RE-71



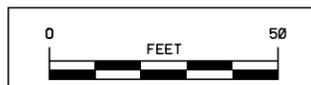
**TRAFFIC CONTROL  
for DMS SITE #1  
I-35 NB - HAMILTON COUNTY**

**LEGEND**

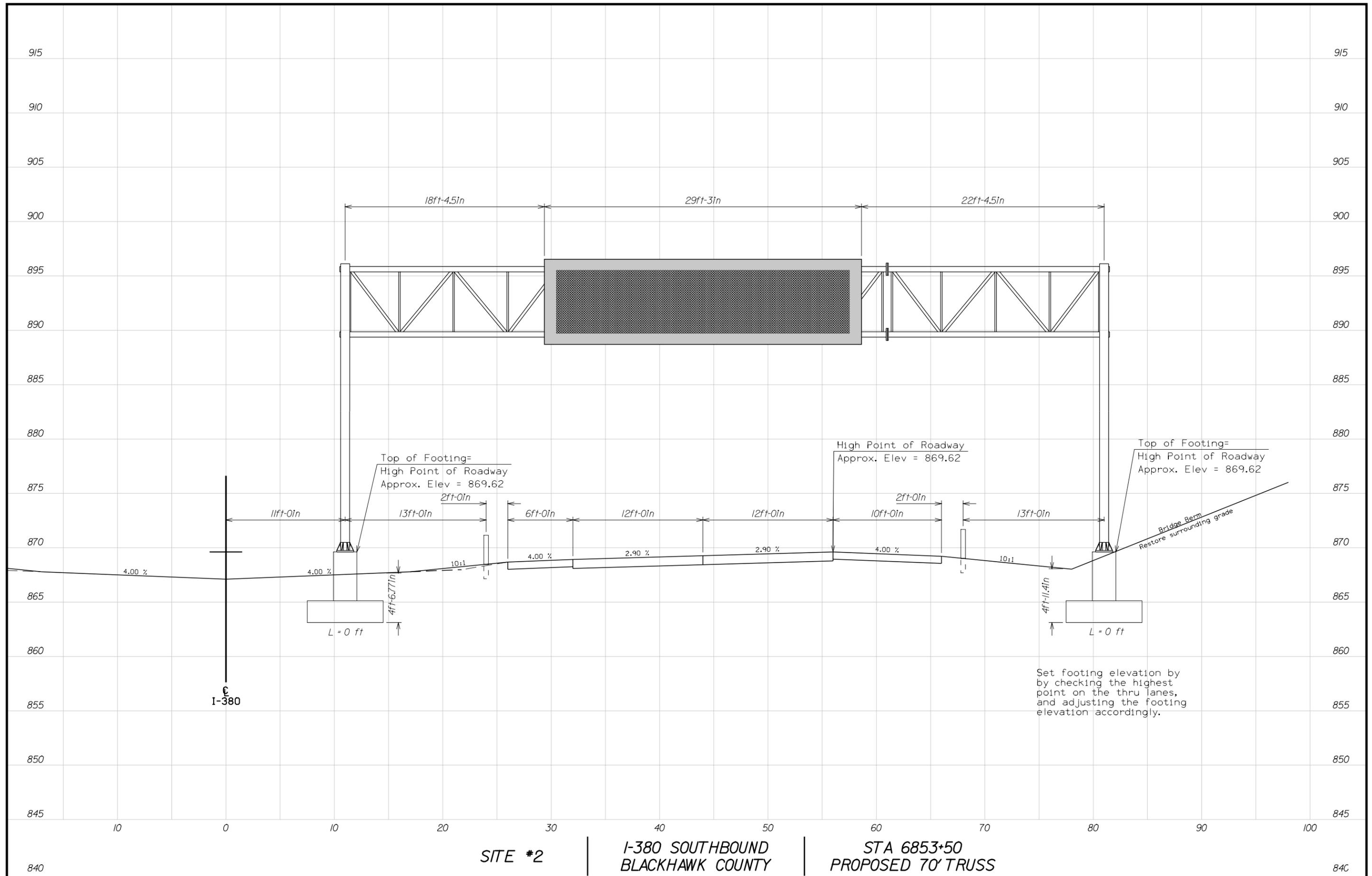
█ Proposed Grading



① Grading from the existing guardrail should create a 2 ft ditch for a significant area defined by the RL-12. Slopes from the edge of the shoulder in this area will need to be flattened from 6:1 to 10:1.



**PROPOSED LAYOUT  
for DMS SITE #2  
I-380 SB - BLACKHAWK COUNTY**



SITE #2

I-380 SOUTHBOUND  
BLACKHAWK COUNTY

STA 6853+50  
PROPOSED 70' TRUSS

**SAMPLE STAGING SEQUENCE**

- Setup initial traffic control
- Footing construction
- Guardrail grading
- Seed newly graded areas
- Modify traffic control
  - set up temporary attenuator in median
  - take down median RS-62 if next activity is scheduled several weeks from present date
- Install sign truss and DMS
- Complete guardrail installations
- Final seeding

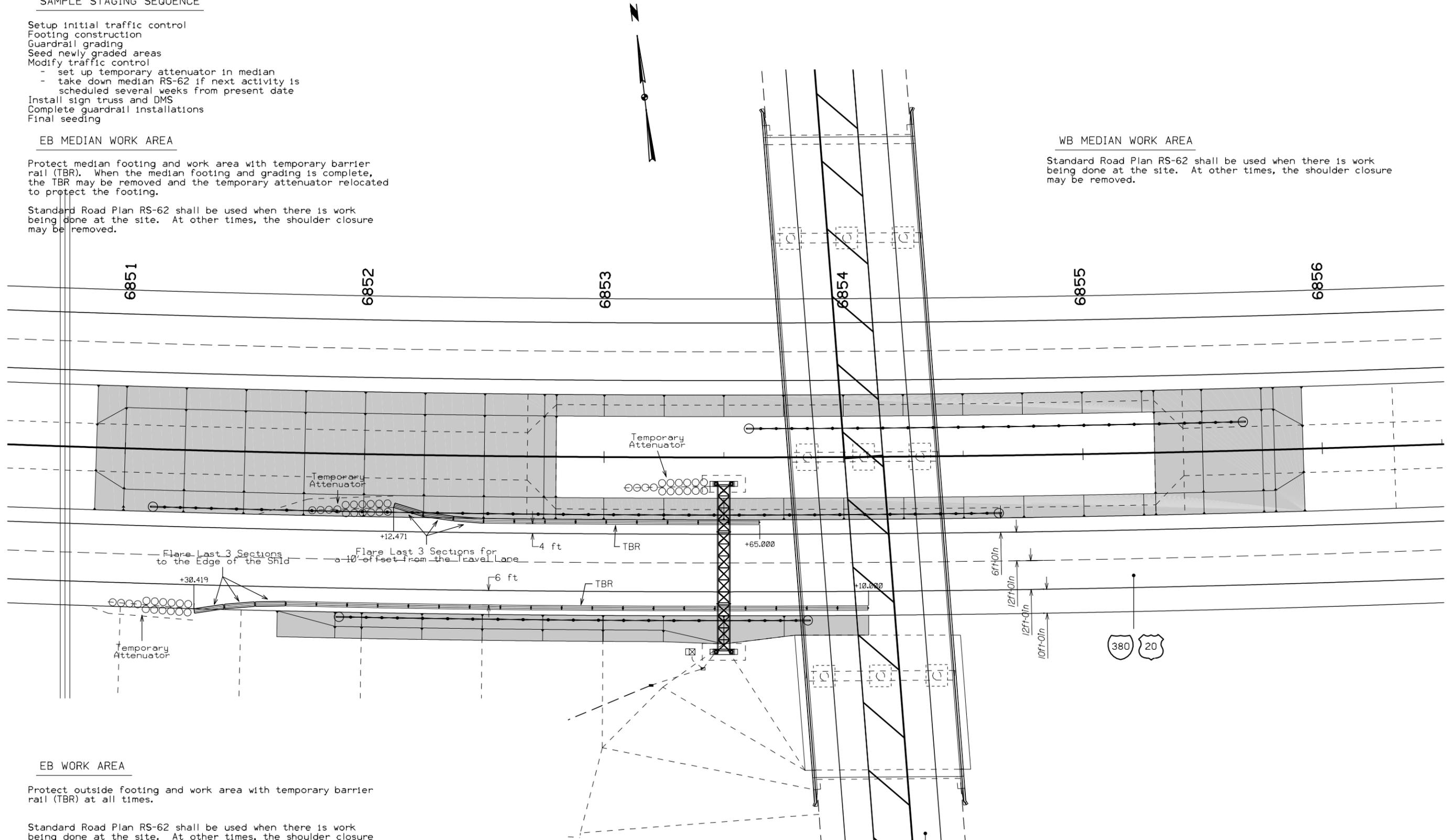
**EB MEDIAN WORK AREA**

Protect median footing and work area with temporary barrier rail (TBR). When the median footing and grading is complete, the TBR may be removed and the temporary attenuator relocated to protect the footing.

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.

**WB MEDIAN WORK AREA**

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.



Protect outside footing and work area with temporary barrier rail (TBR) at all times.

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.

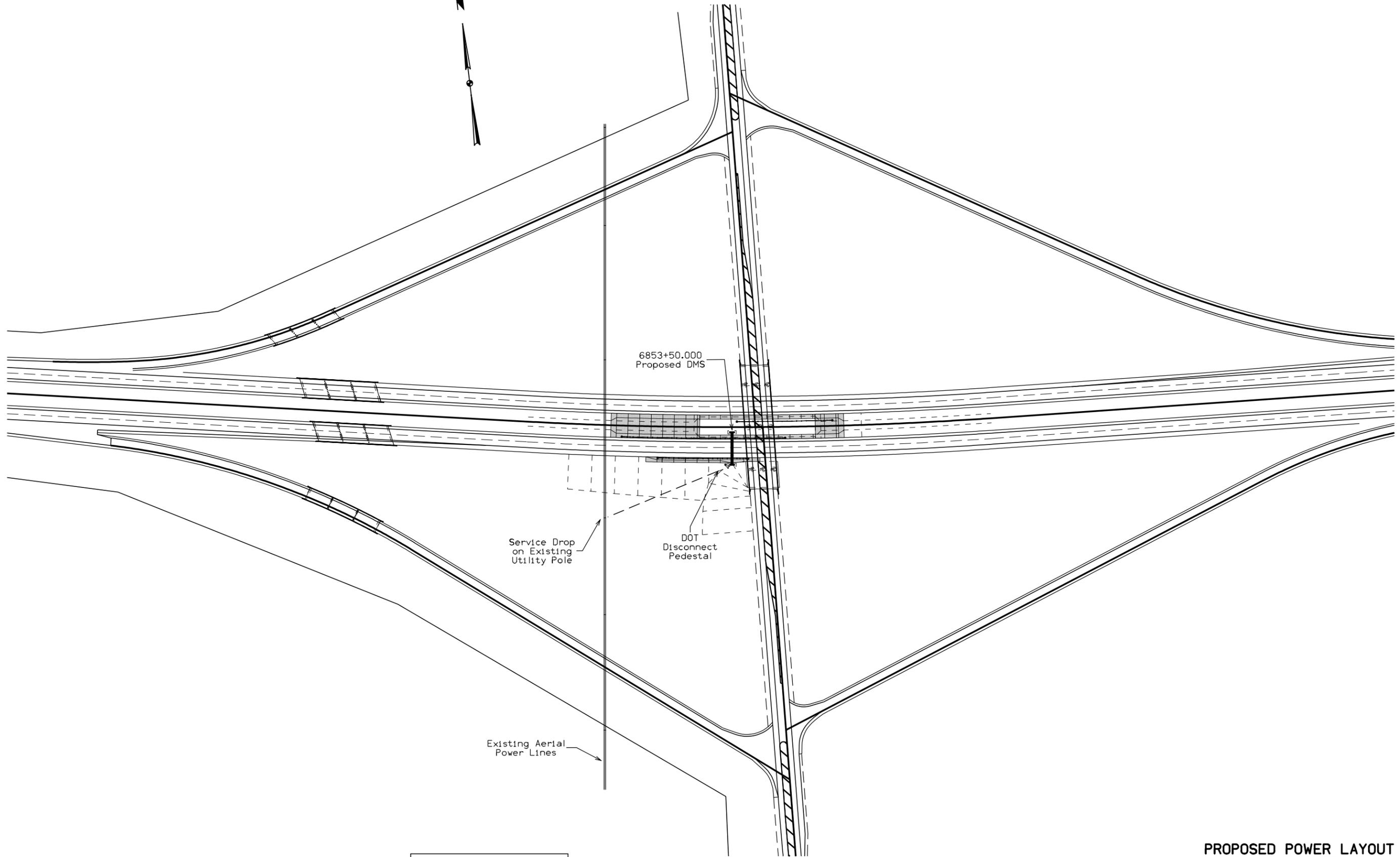
Standard Road Plan RS-69 shall be used to install the sign truss and DMS. Times of closure shall be coordinated with the Engineer.

**STANDARD ROAD PLANS**

- RS-61
- RS-62
- RS-69
- RE-71

**TRAFFIC CONTROL  
for DMS SITE #2  
I-380 SB - BLACKHAWK COUNTY**

27-MAR-2006 15:21 jvorthem v:\Projects\0000001005\TrafEng\00-0005-306\00000306.n04

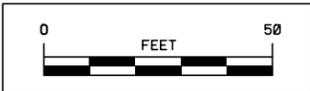


6853+50.000  
Proposed DMS

Service Drop  
on Existing  
Utility Pole

DOT  
Disconnect  
Pedestal

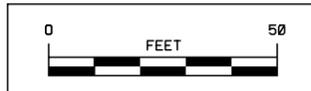
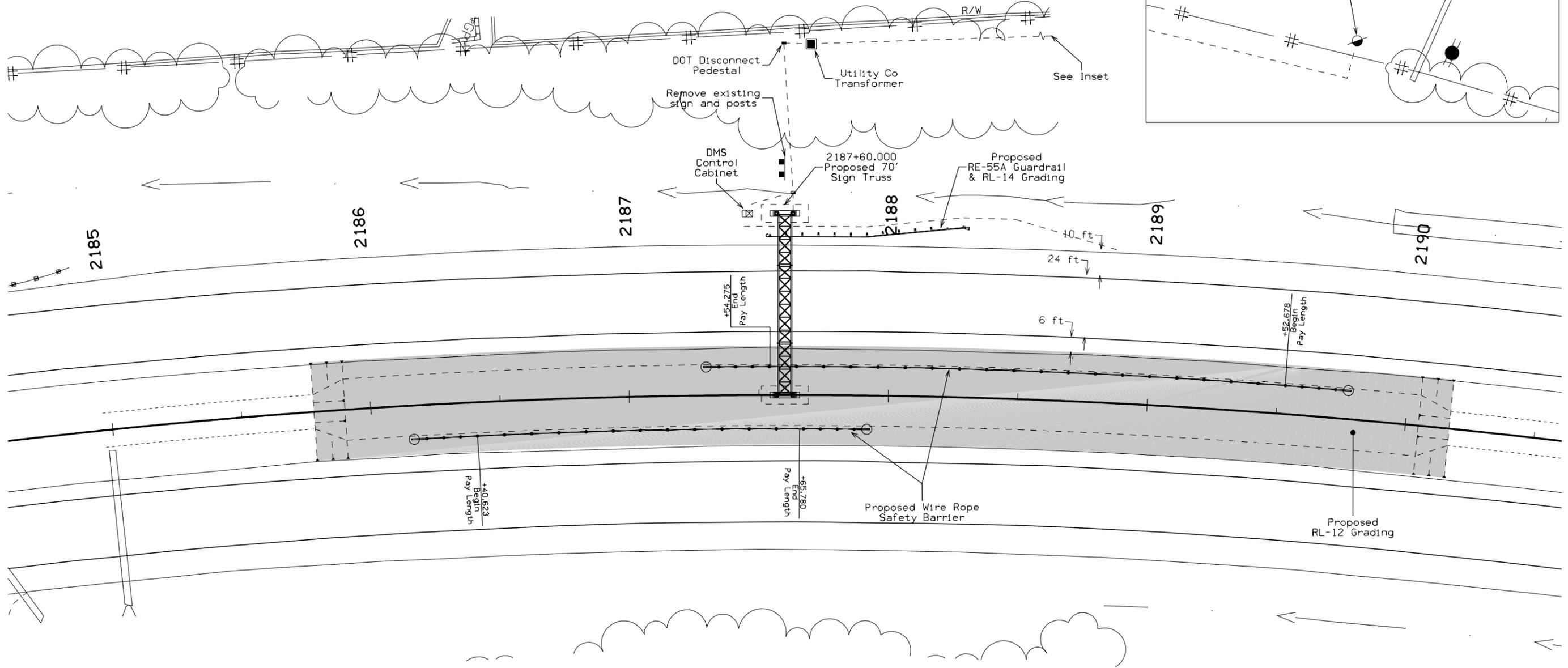
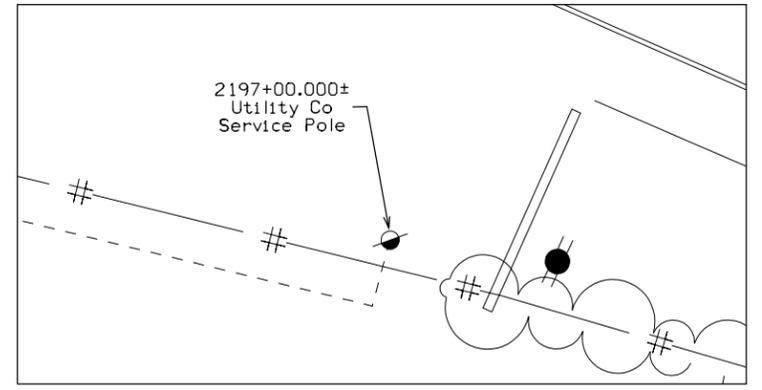
Existing Aerial  
Power Lines



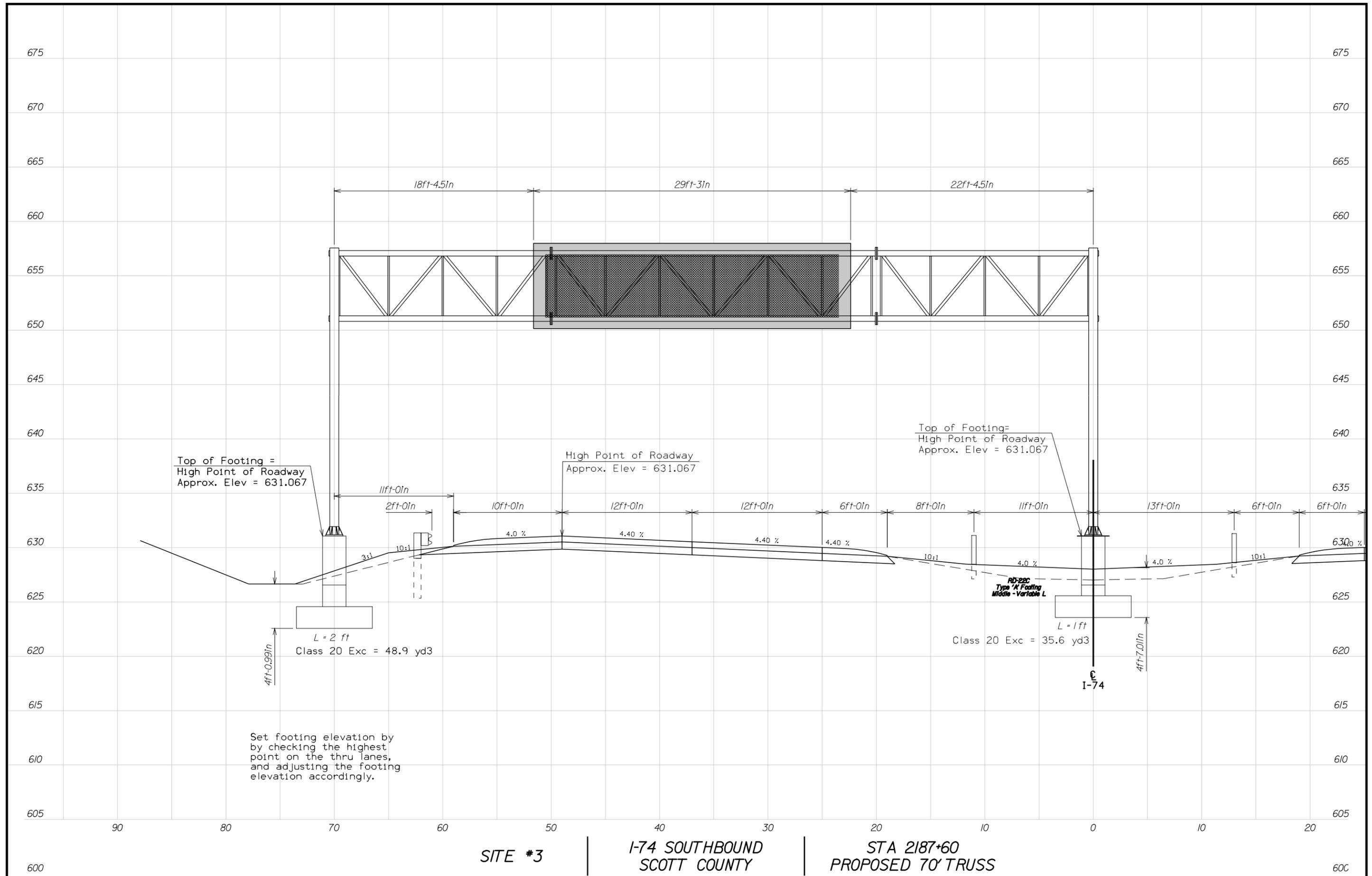
PROPOSED POWER LAYOUT  
for DMS SITE #2  
I-380 SB - BLACKHAWK COUNTY

**LEGEND**

█ Proposed Grading



**PROPOSED LAYOUT  
for DMS SITE #3  
I-74 SB - SCOTT COUNTY**

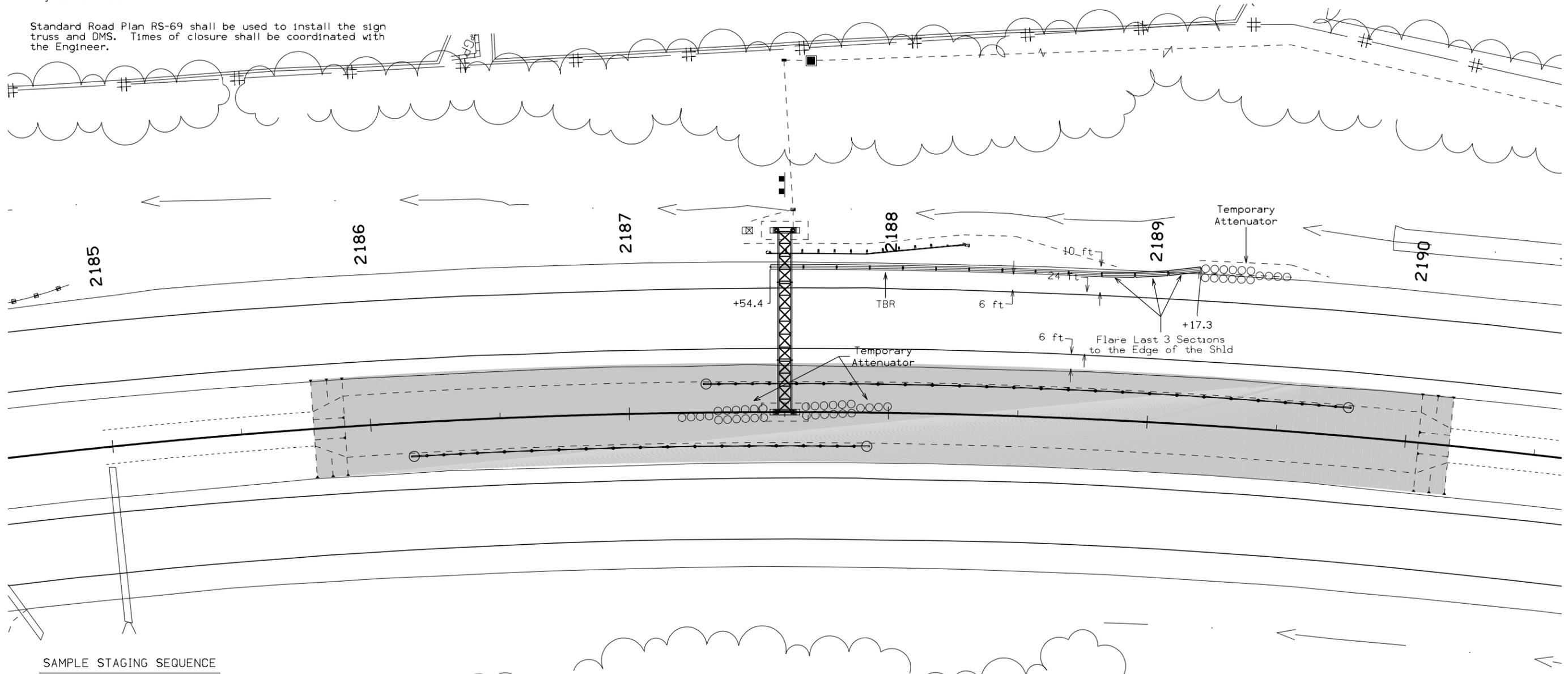


**SB WORK AREA**

Protect outside footing and work area with temporary barrier rail (TBR) at all times.

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.

Standard Road Plan RS-69 shall be used to install the sign truss and DMS. Times of closure shall be coordinated with the Engineer.



**SAMPLE STAGING SEQUENCE**

- Setup initial traffic control
- Footing construction
- Guardrail grading
- Seed newly graded areas
- Modify traffic control
  - set up temporary attenuators in the median
  - take down median RS-62 if next activity is scheduled several weeks from present date
- Install sign truss and DMS
- Complete guardrail installations
- Final seeding

**MEDIAN WORK AREA**

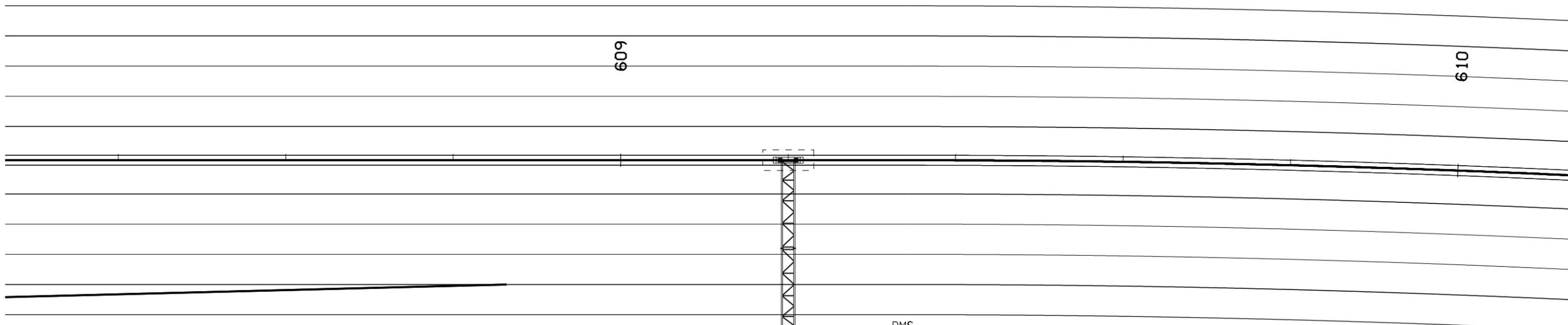
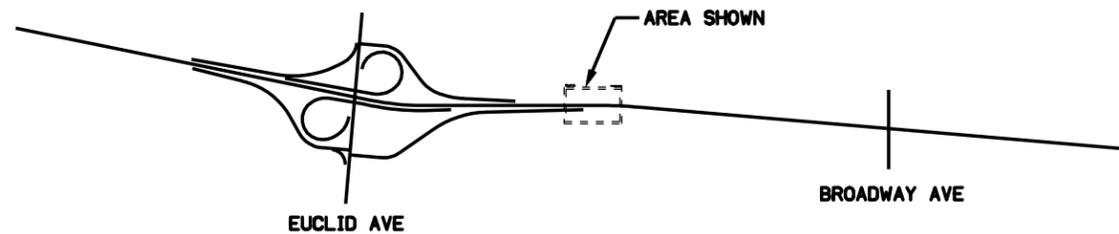
Standard Road Plan RS-62 shall be used when there are ongoing construction activities in the median (i.e. - footing construction, grading, guardrail installation, etc.) This setup shall remain in place until the median footing and grading are complete and the temporary attenuators have been setup on each end of the footing.

**STANDARD ROAD PLANS**

- RS-61
- RS-62
- RS-69
- RE-71



**TRAFFIC CONTROL  
for DMS SITE #3  
I-74 SB - SCOTT COUNTY**



**SAMPLE STAGING SEQUENCE**

- Setup initial traffic control (if necessary)
- Power & misc site work
- Install DMS on existing sign truss

**TRAFFIC CONTROL NOTES**

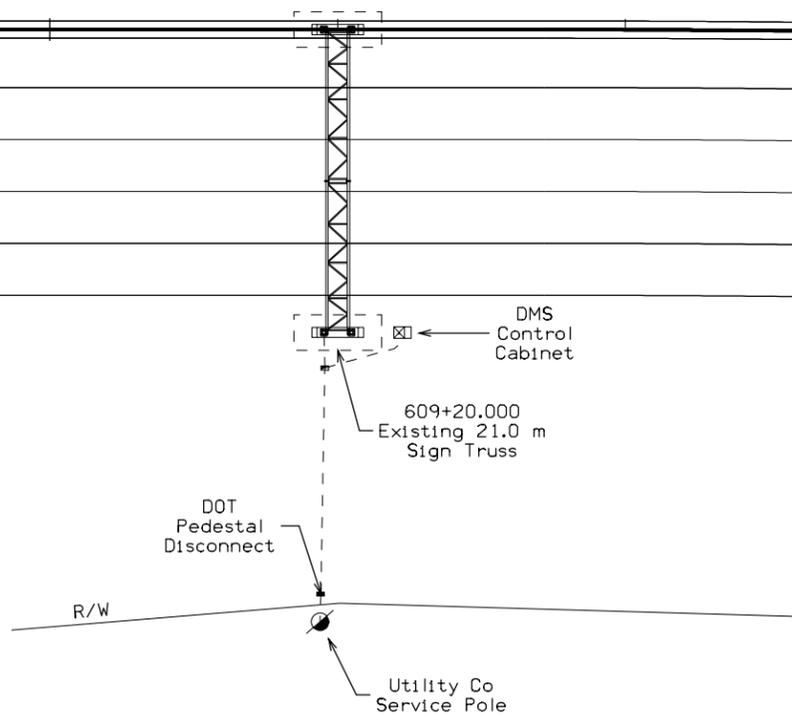
The Contractor shall coordinate the installation of the DMS with other work in the vicinity. It may be advantageous for the Contractor to install the DMS on the truss when the traffic control for other work in the vicinity has been setup.

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.

Standard Road Plan RS-69 shall be used to install the DMS. Times of closure shall be coordinated with the Engineer.

**STANDARD ROAD PLANS**

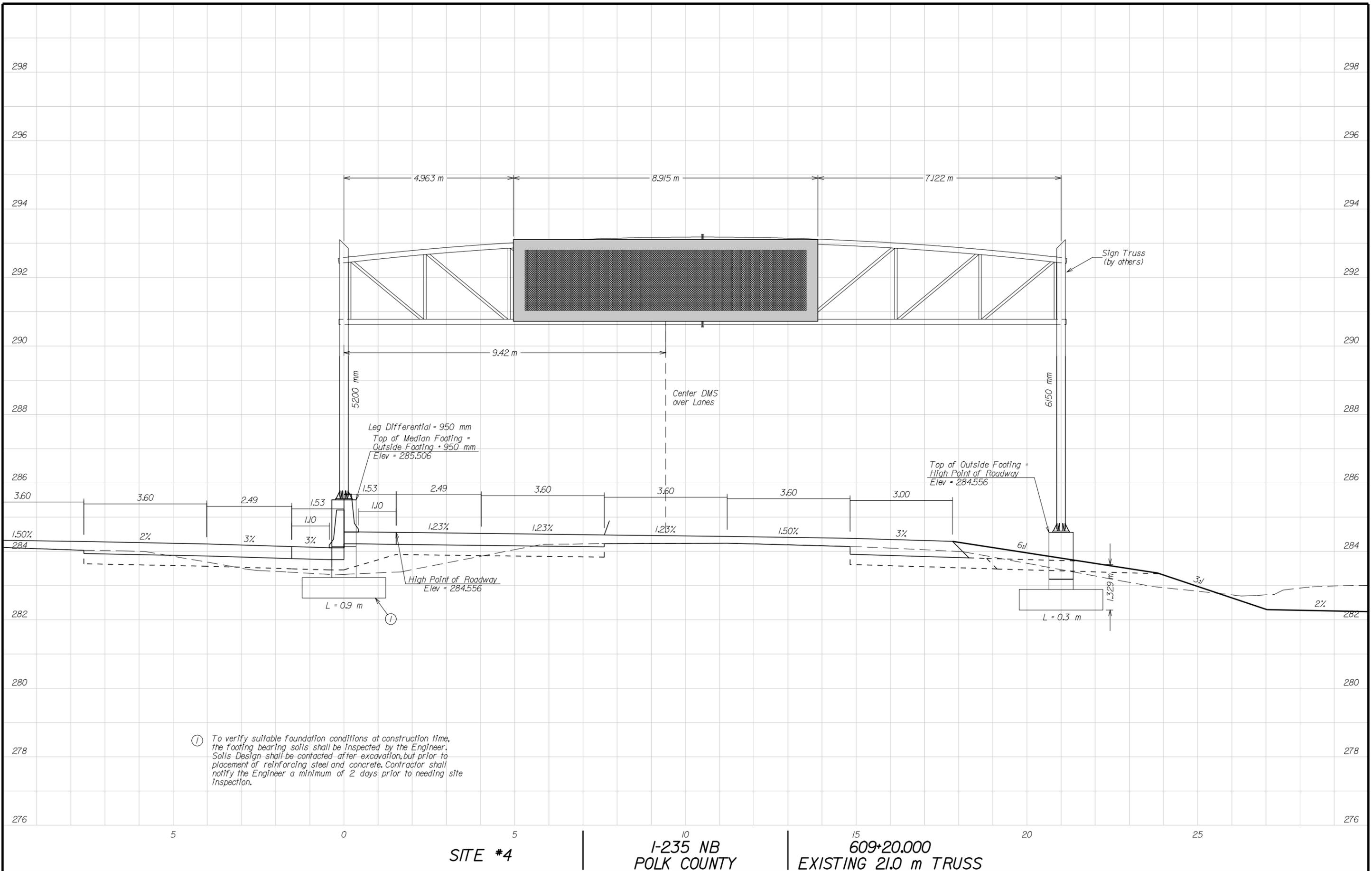
- RS-61
- RS-62
- RS-69



- Existing sign truss and roadway stationing are in metric units.
- Contractor shall install a DMS and ancillary equipment at the existing sign truss.



**PROPOSED LAYOUT  
for DMS SITE #4  
I-235 NB - POLK COUNTY**

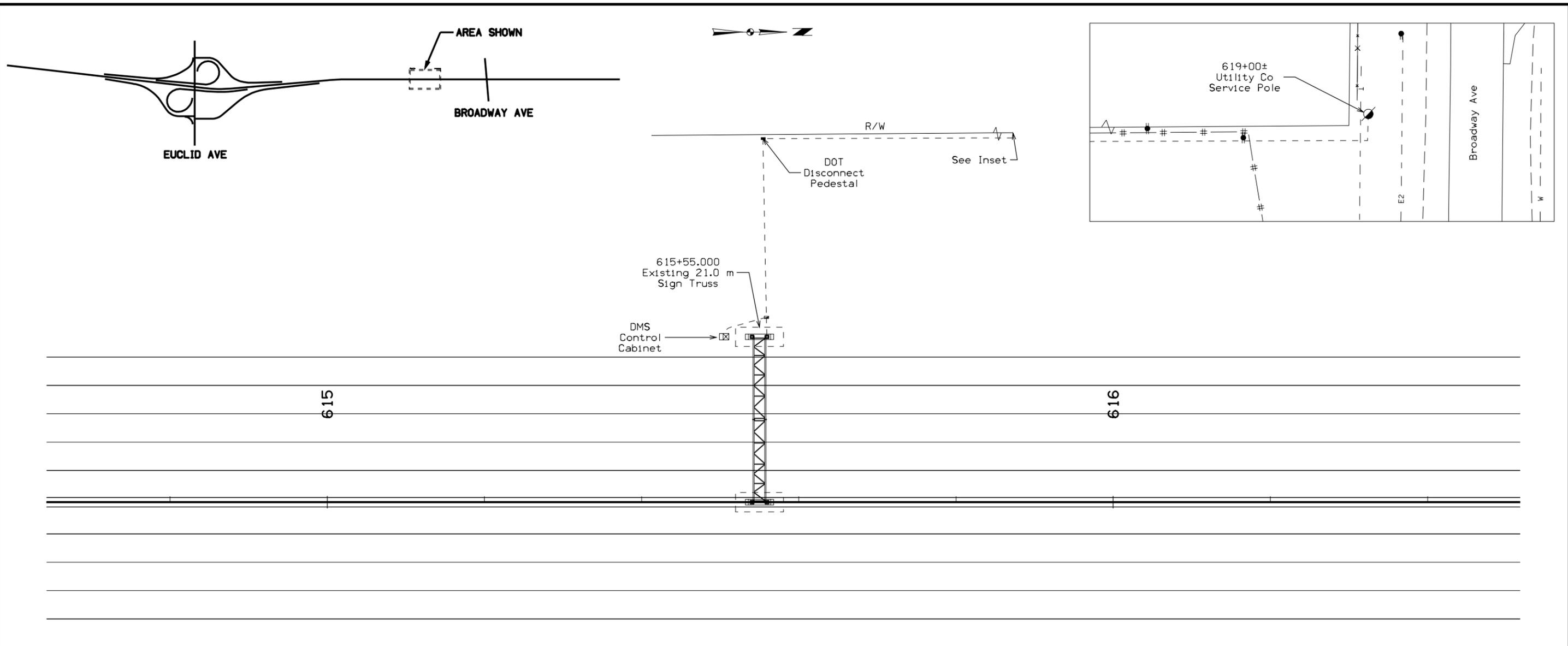


① To verify suitable foundation conditions at construction time, the footing bearing soils shall be inspected by the Engineer. Soils Design shall be contracted after excavation, but prior to placement of reinforcing steel and concrete. Contractor shall notify the Engineer a minimum of 2 days prior to needing site inspection.

SITE #4

I-235 NB  
POLK COUNTY

609+20.000  
EXISTING 21.0 m TRUSS



SAMPLE STAGING SEQUENCE

Setup initial traffic control (if necessary)  
 Power & misc site work  
 Install DMS on existing sign truss

TRAFFIC CONTROL NOTES

The Contractor shall coordinate the installation of the DMS with other work in the vicinity. It may be advantageous for the Contractor to install the DMS on the truss when the traffic control for other work in the vicinity has been setup.

Standard Road Plan RS-62 shall be used when there is work being done at the site. At other times, the shoulder closure may be removed.

Standard Road Plan RS-69 shall be used to install the DMS. Times of closure shall be coordinated with the Engineer.

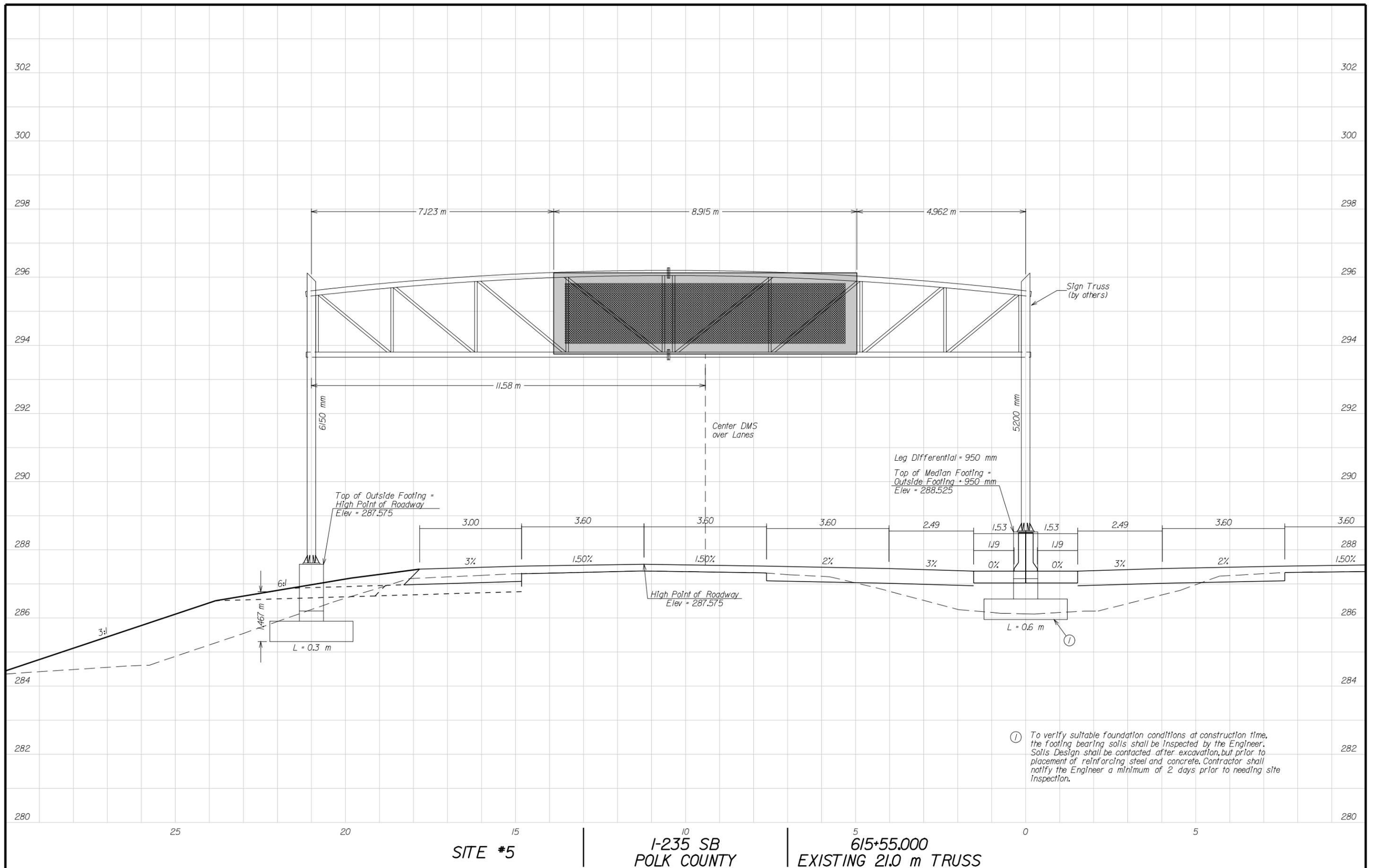
STANDARD ROAD PLANS

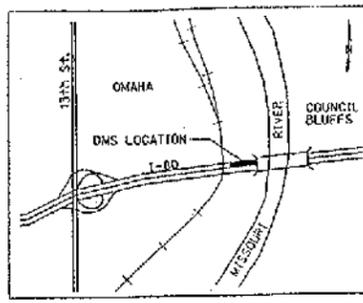
RS-61  
 RS-62  
 RS-69

- Existing sign truss and roadway stationing are in metric units.
- Contractor shall install a DMS and ancillary equipment at the existing sign truss.



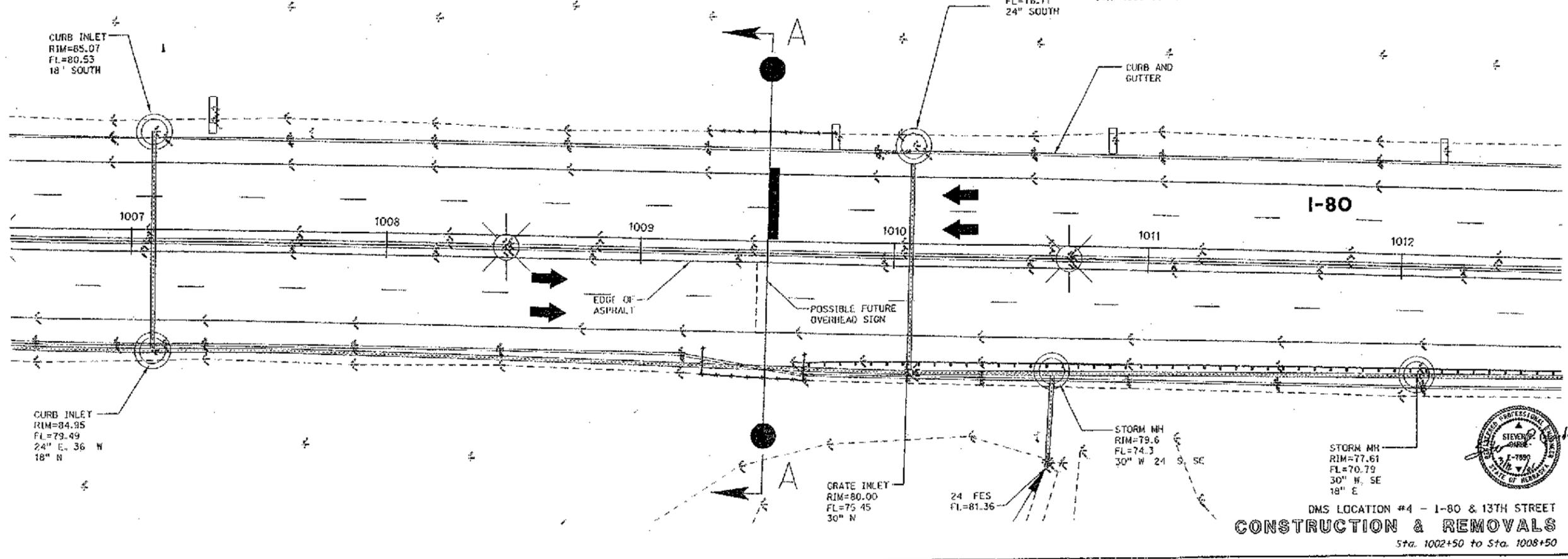
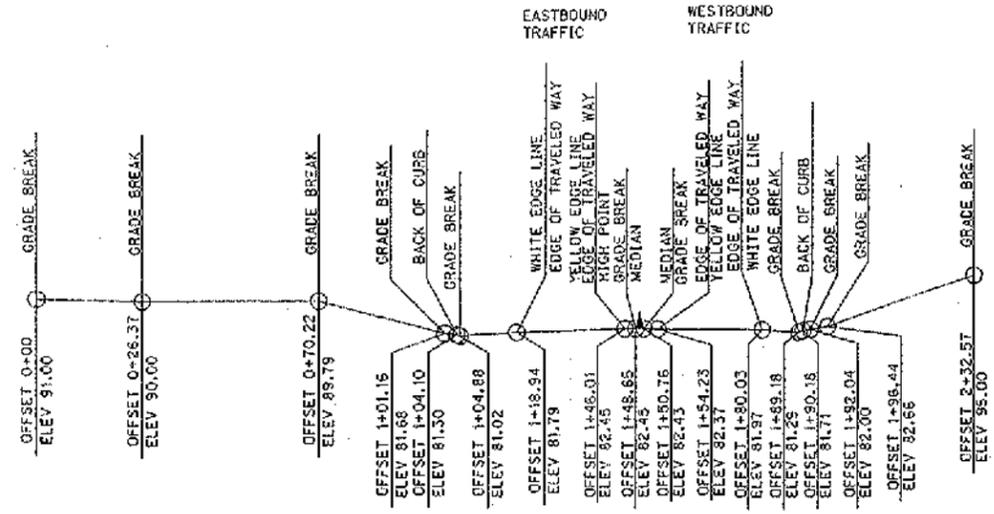
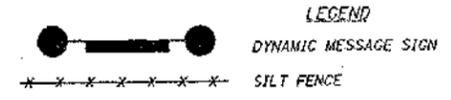
**PROPOSED LAYOUT  
 for DMS SITE #5  
 I-235 SB - POLK COUNTY**





SEEDING, TYPE "B" 0.10 ACRES

BUILD SILT FENCE - SPECIAL PLAN SC					
STATION	TO STATION	SIDE	TYPE	DESCRIPTION	LIN. FT.
1009+24.94	- 1009+64.92	RT	LOW POROSITY	TIE INTO BANK	60
1009+25.57	- 1009+75.57	LT	LOW POROSITY		50

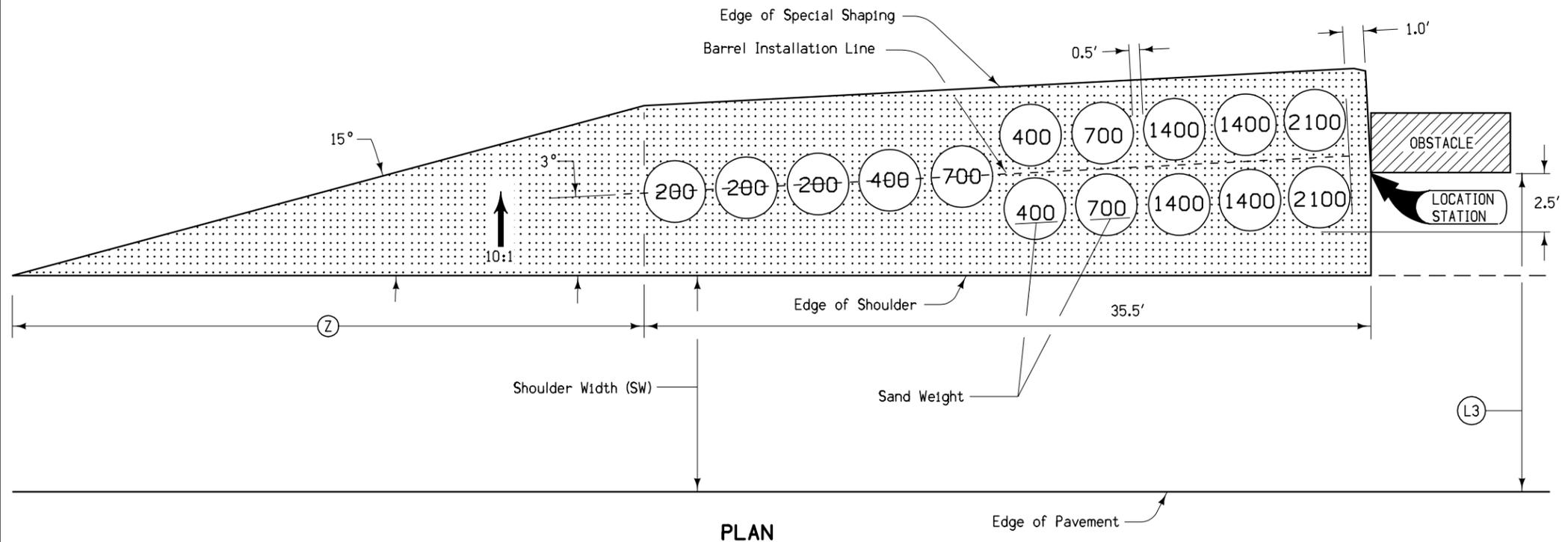


DMS LOCATION #4 - I-80 & 13TH STREET  
**CONSTRUCTION & REMOVALS**  
 Sta. 1002+50 to Sta. 1008+50

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS

PROPOSED LAYOUT  
 for DMS SITE #6  
 I-80 EB - POTT COUNTY

Refer to U Sheets for Details of  
 Traffic Control to be used in Nebraska

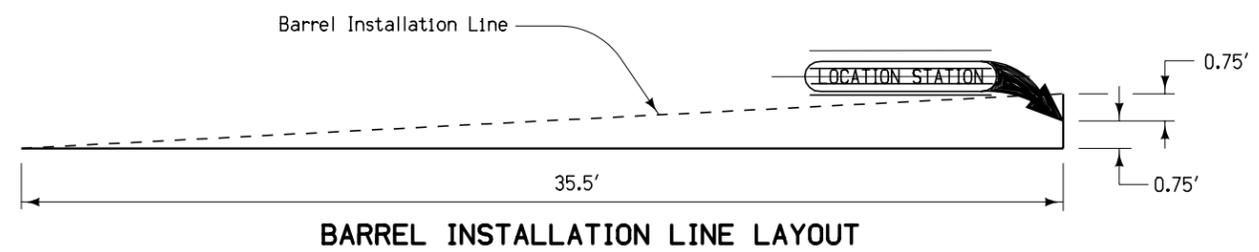


PLAN

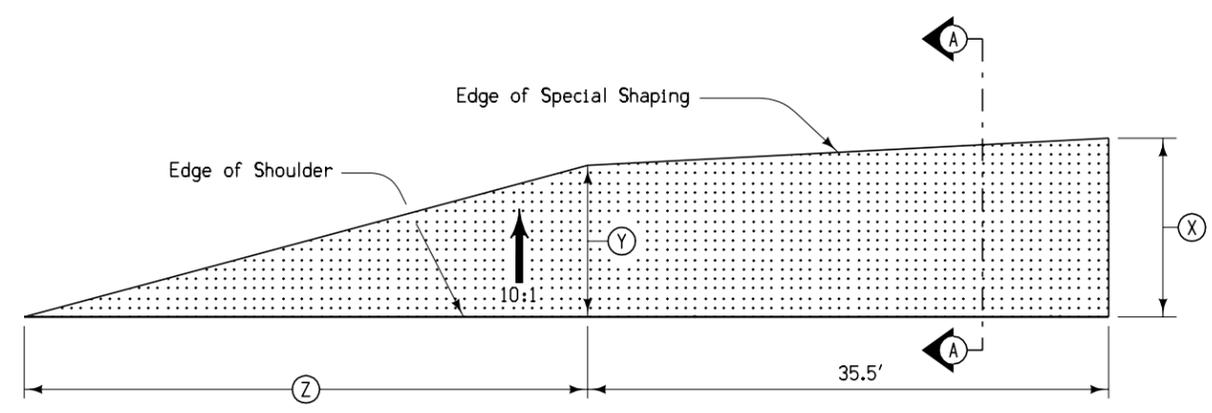
This sheet shows typical installation details for the sand-filled barrel type of Non-Redirective Temporary Attenuator. A complete list of approved Non-Redirective Temporary Attenuators is located in Materials I.M. 455.

Non-Redirective Temporary Attenuators shall be installed in accordance with the manufacturer's recommendations.

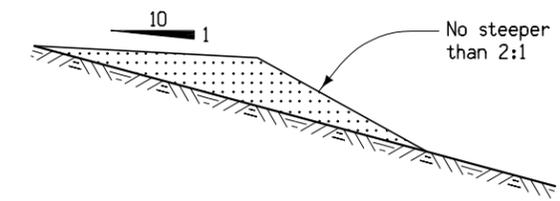
Contract Items:  
 Temporary Attenuators, Non-Redirective (NR)  
 Embankment In Place  
 Tabulation: 108-30



BARREL INSTALLATION LINE LAYOUT

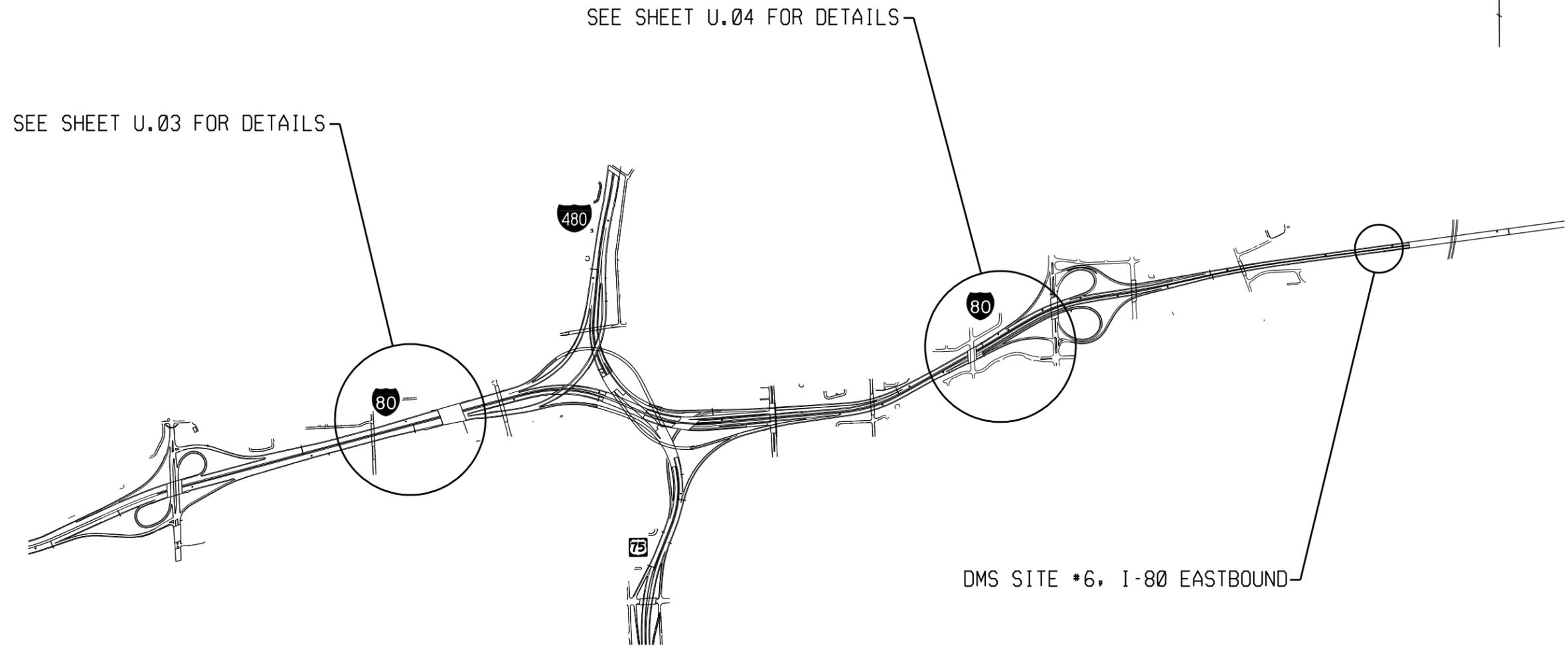


SPECIAL SHAPING LAYOUT DETAILS



SECTION A-A

DETAILS OF  
 TEMPORARY NON-REDIRECTIVE  
 ATTENUATOR (SAND-FILLED BARRELS)



**GENERAL NOTES**

1. SHEETS U.02 THROUGH U.07 ARE FOR THE TEMPORARY TRAFFIC CONTROL ASSOCIATED WITH INSTALLATION OF DMS SITE #6 ON THE EXISTING NDOR SIGN STRUCTURE.
2. ALL PLACEMENT AND MAINTENACE OF TEMPORARY TRAFFIC CONTROL DEVICES SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), LATEST EDITION.
3. CONTRACTOR SHALL NOTIFY NDOR DISTRICT 2 STAFF A MINIMUM OF TWO WEEKS PRIOR TO CONSTRUCTION ACTIVITY SO THAT COORDINATION OF POTENTIAL ALTERNATIVE TRAFFIC CONTROL PLACEMENT AND PROGRAMMING OF MESSAGES FOR EXISTING, PERMANENT DMS LOCATIONS IN THE VICINITY CAN OCCUR. CONTACT AT NDOR IS DALE BUTLER - (402-595-2534).



**TRAFFIC CONTROL**

L:\PROJECTS\19-06-1903\PHASE 002\NDOR SHEETS\SHEET U02.DGN  
 11:08:57 AM



701 P STREET, SUITE 302  
LINCOLN, NE 68508

PROJECT NO.

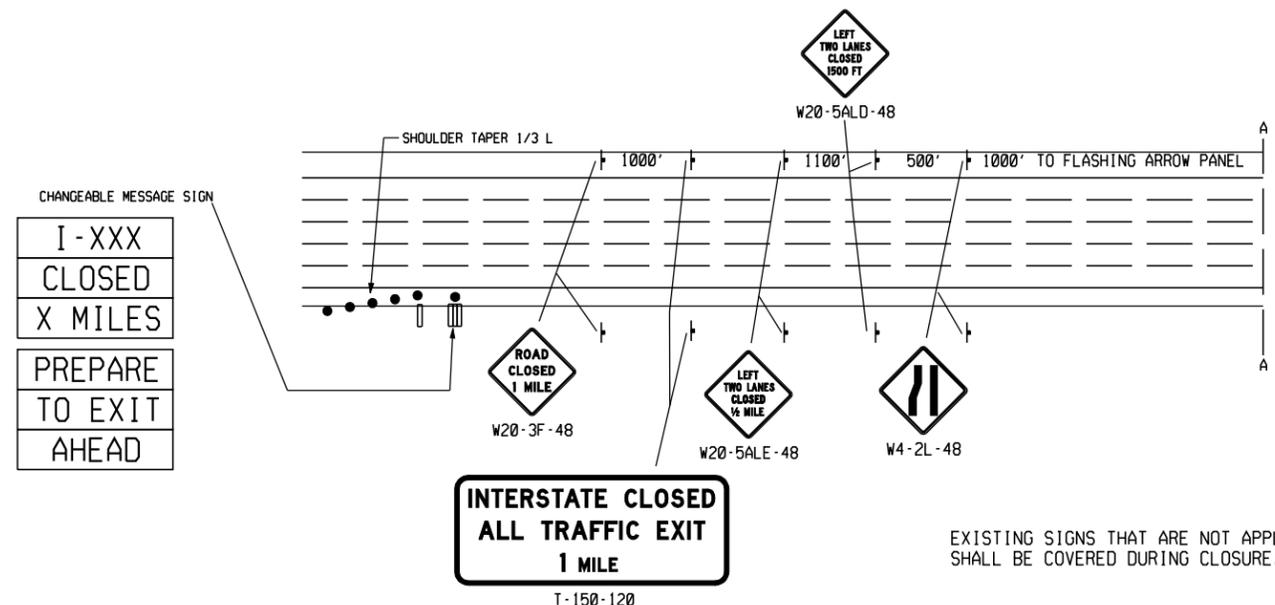
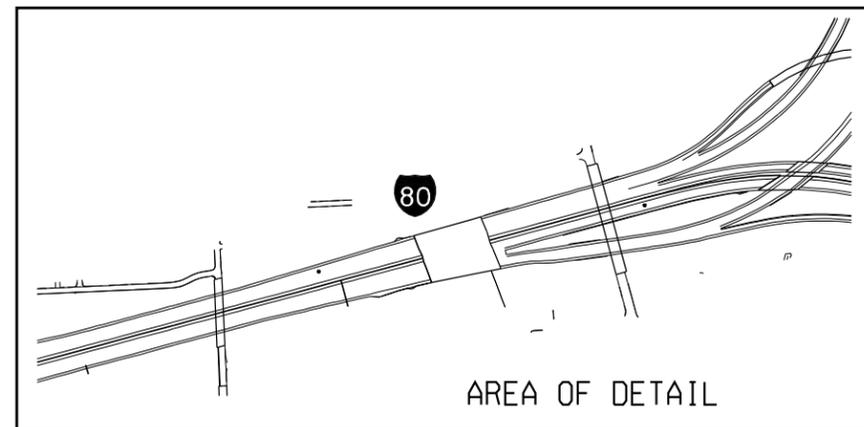
STP-A-060-S(306)--0A-00

SHEET NO.

U03

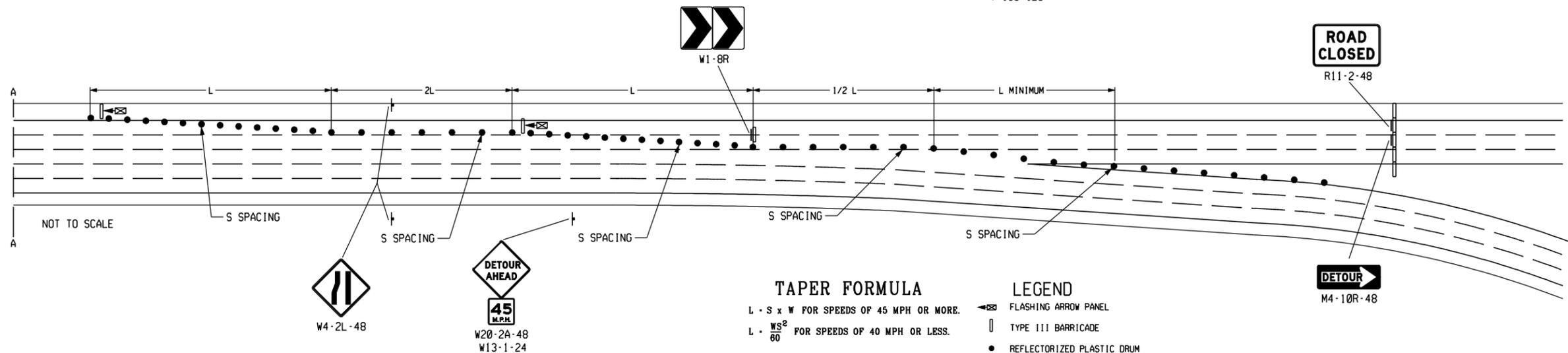
NOTES

1. I-80 EASTBOUND THROUGH TRAFFIC WILL BE CLOSED - TRAFFIC WILL BE ALLOWED TO ACCESS I-480 NB AND US-75 SB.
2. CLOSURE SHALL OCCUR BETWEEN THE HOURS OF 11:00 PM TO 6:00 AM, MONDAY THROUGH THURSDAY.
3. CLOSURE SHALL BE LIMITED TO LENGTH OF TIME AS DETERMINED BY ENGINEER



CHANGEABLE MESSAGE SIGN  
I-XXX  
CLOSED  
X MILES  
PREPARE  
TO EXIT  
AHEAD

EXISTING SIGNS THAT ARE NOT APPLICABLE SHALL BE COVERED DURING CLOSURE.



TAPER FORMULA

$L = S \times W$  FOR SPEEDS OF 45 MPH OR MORE.  
 $L = \frac{WS^2}{60}$  FOR SPEEDS OF 40 MPH OR LESS.  
 WHERE:  
 L - MINIMUM LENGTH OF TAPER.  
 S - NUMERICAL VALUE OF POSTED SPEED LIMIT PRIOR TO WORK IN MPH.  
 W - WIDTH OF OFFSET (LANE WIDTH) IN FEET.

LEGEND

- FLASHING ARROW PANEL
- TYPE III BARRICADE
- REFLECTORIZED PLASTIC DRUM
- CHANGEABLE MESSAGE SIGN
- SIGN

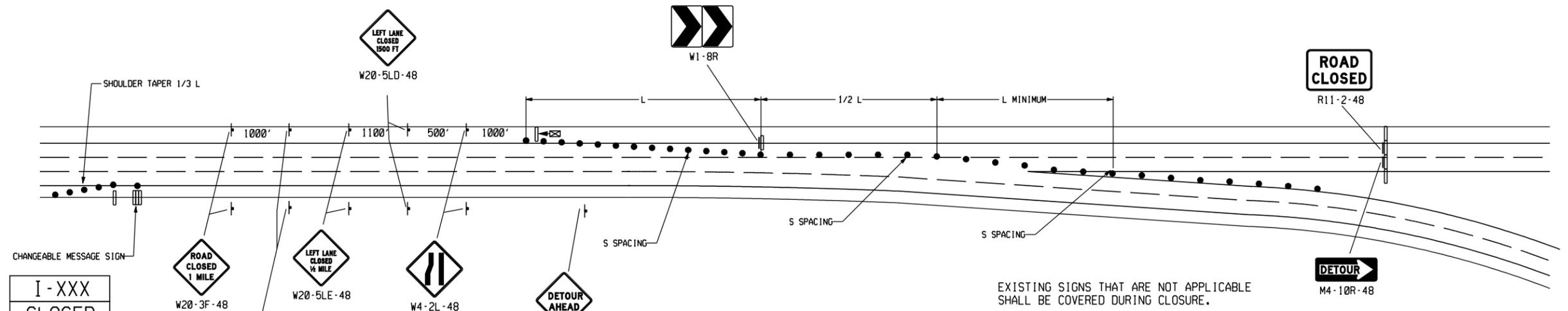
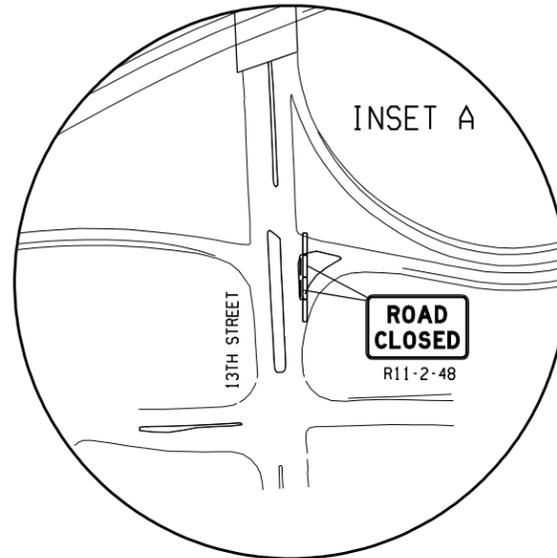
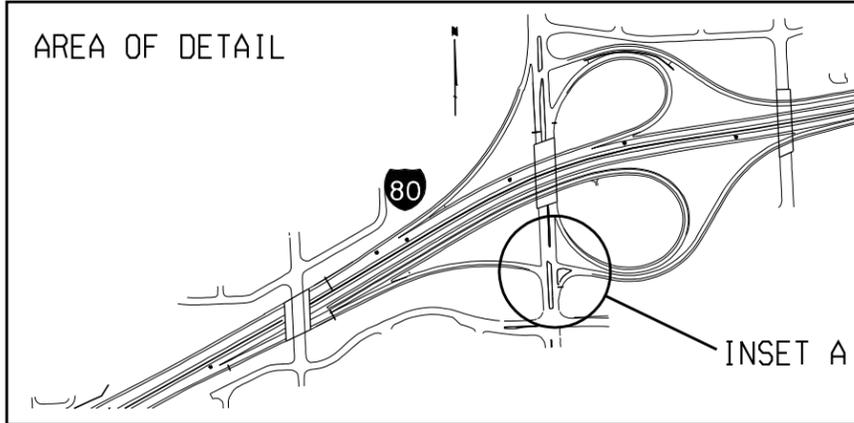
L:\PROJECTS\119-066-1903\PHASE 002\DOWN SHEETS SHEET U03.DGN  
11/11/03 11:11:48 AM



TRAFFIC CONTROL

**NOTES**

1. I-80 EASTBOUND THROUGH TRAFFIC WILL BE CLOSED - TRAFFIC WILL BE ALLOWED TO ACCESS 13TH STREET NB & SB. NO TRAFFIC WILL BE ALLOWED ONTO I-80 EASTBOUND FROM 13TH STREET.
2. CLOSURE SHALL OCCUR BETWEEN THE HOURS OF 11:00 PM TO 6:00 AM, MONDAY THROUGH THURSDAY.
3. CLOSURE SHALL BE LIMITED TO LENGTH OF TIME AS DETERMINED BY ENGINEER



CHANGEABLE MESSAGE SIGN  
I-XXX  
CLOSED  
X MILES  
AHEAD  
TO EXIT  
PREPARE

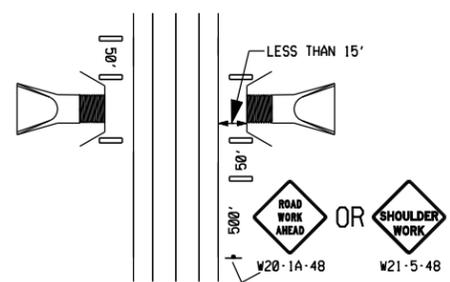
**INTERSTATE CLOSED  
ALL TRAFFIC EXIT  
1 MILE**  
T-150-120

**TAPER FORMULA**  
L · S x W FOR SPEEDS OF 45 MPH OR MORE.  
L ·  $\frac{WS^2}{60}$  FOR SPEEDS OF 40 MPH OR LESS.  
**WHERE:**  
L - MINIMUM LENGTH OF TAPER.  
S - NUMERICAL VALUE OF POSTED SPEED LIMIT PRIOR TO WORK IN MPH.  
W - WIDTH OF OFFSET (LANE WIDTH) IN FEET.

**LEGEND**  
 FLASHING ARROW PANEL  
 TYPE III BARRICADE  
 REFLECTORIZED PLASTIC DRUM  
 CHANGEABLE MESSAGE SIGN  
 SIGN

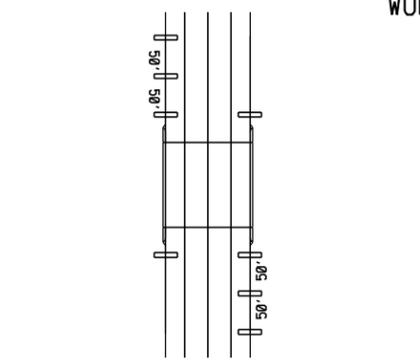
EXISTING SIGNS THAT ARE NOT APPLICABLE SHALL BE COVERED DURING CLOSURE.



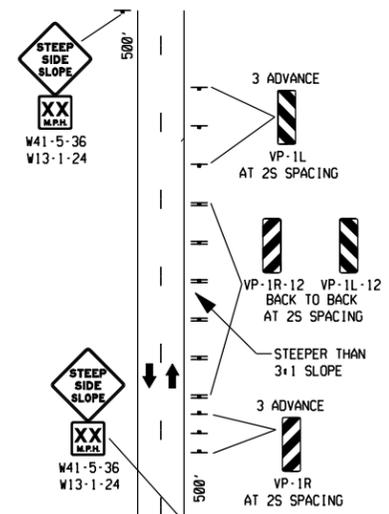


**CULVERT PROTECTION**  
WHEN GUARDRAIL IS REMOVED AND/OR EXCAVATION IS LESS THAN 15 FEET FROM SHOULDER

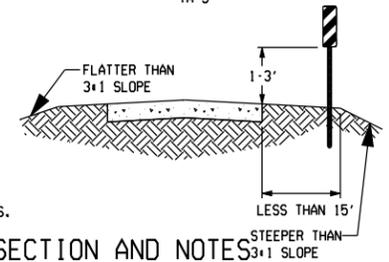
**WORK BEYOND THE SHOULDER**  
TA-1



**BRIDGE RAIL END PROTECTION**  
WHEN GUARDRAIL IS REMOVED

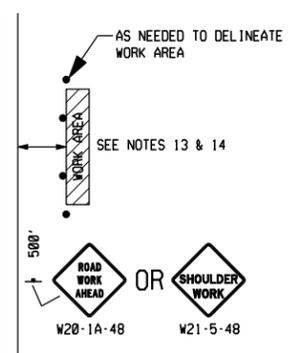


**SLOPE PROTECTION**

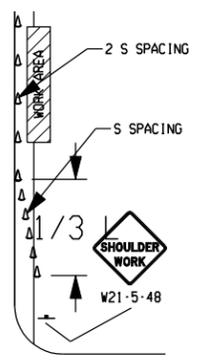


SLOPE PROTECTION SHOULD BE USED FOR AREAS WHERE GUARD RAIL IS REMOVED, OR PROJECT GRADING HAS CREATED A DROP-OFF SLOPE STEEPER THAN 3:1, AND WITHIN 15 FEET OF THE TRAVEL LANE. NOT USED FOR CULVERT OR BRIDGE END PROTECTION. VERTICAL PANEL SPACING MAY BE REDUCED FOR HORIZONTAL CURVES.

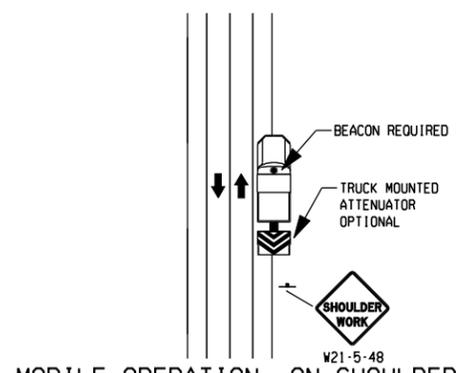
**SLOPE PROTECTION CROSS SECTION AND NOTES**



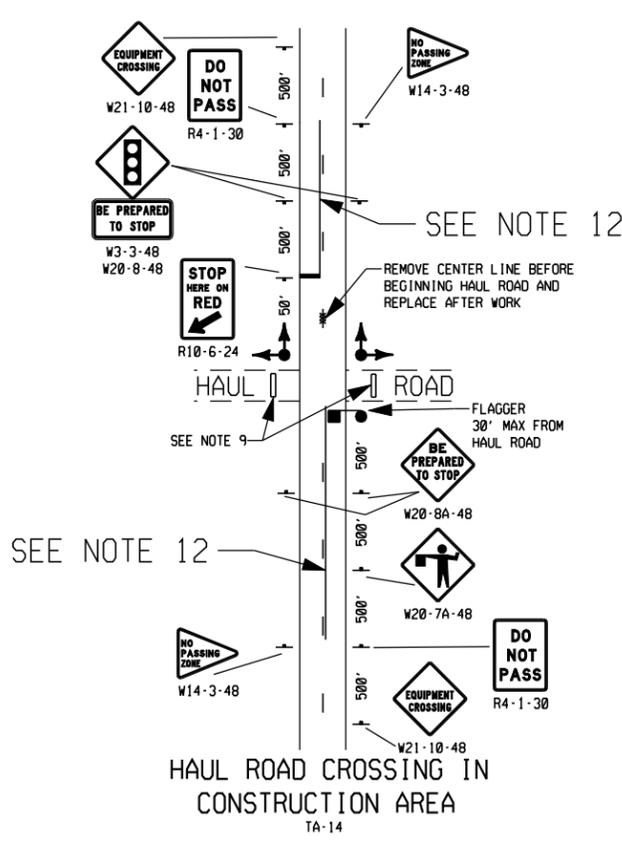
**WORK BEYOND THE SHOULDER**  
TA-1



**WORK ON SHOULDER**  
TA-3



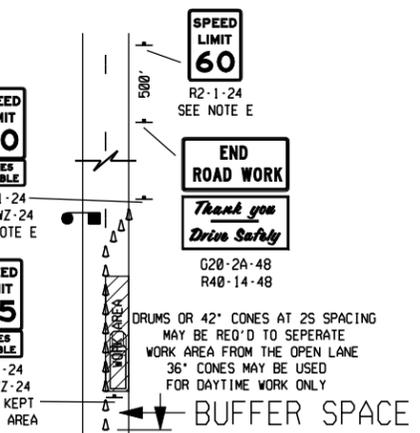
**MOBILE OPERATION ON SHOULDER**  
NO ENCRoACHMENT ON TRAVEL LANE  
TA-4



**HAUL ROAD CROSSING IN CONSTRUCTION AREA**  
TA-14

**WORK ZONE SPEED LIMIT NOTES**

- WORK ZONE SPEED LIMITS SHALL NOT BE INSTALLED WITHOUT A SPEED ZONE AUTHORIZATION COMPLETED BY THE DEPARTMENT. REDUCED SPEED ZONING SHOULD BE KEPT TO A MINIMUM AS MUCH AS PRACTICABLE.
- WORK ZONE SPEED LIMITS SHOWN ARE TYPICAL APPLICATIONS ONLY, AND ARE NOT TO BE ASSUMED AS THE SPEED LIMITS REQ'D FOR THE WORK.
- EXISTING SPEED LIMIT SIGNS SHALL BE REMOVED OR COVERED WHEN A REDUCED WORK ZONE LIMIT IS IN EFFECT IN THE SAME AREA.
- WORK ZONE SPEED LIMIT SIGNS SHALL BE INSTALLED EVERY MILE THROUGH THE WORK AREA WHEN SPEED ZONE IS REDUCED.
- A SPEED LIMIT SIGN ENDING THE REDUCED SPEED ZONE SHALL BE INSTALLED AT THE END OF EACH ZONE.

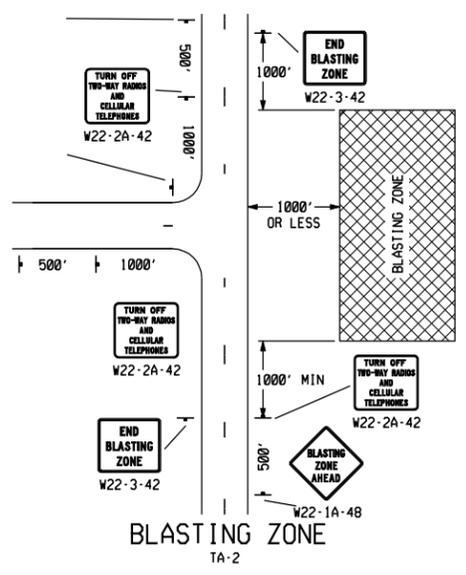


**LANE CLOSURE**  
TA-10

**TAPER FORMULA**

$L \cdot S \times W$  FOR SPEEDS OF 45 MPH OR MORE.  
 $L \cdot \frac{WS^2}{60}$  FOR SPEEDS OF 40 MPH OR LESS.

WHERE:  
L - MINIMUM LENGTH OF TAPER.  
S - NUMERICAL VALUE OF POSTED SPEED LIMIT PRIOR TO WORK.  
W - WIDTH OF OFFSET (LANE WIDTH).



**BLASTING ZONE**  
TA-2

**NOTES**

- SIGNS SHOWN ARE USUALLY FOR ONE DIRECTION OF TRAVEL ONLY.
- DESIGNATION OF SPEED SHOWN ON ADVISORY SPEED SIGNS W13-1 SHALL BE DETERMINED BY THE ENGINEER IN ACCORDANCE WITH MUTCD. THE SPEED DESIGNATION SHALL BE AS HIGH AS PRACTICAL AND FEASIBLE.
- FLAGGER AHEAD SYMBOL SIGN (W20-7A) SHALL BE USED WHEN A FLAGGER IS PRESENT, AND REMOVED WHEN NOT APPLICABLE.
- ALL SIGNS SHALL BE INSTALLED, MAINTAINED IN A CLEAN CONDITION AND REMOVED BY THE CONTRACTOR EXCEPT SIGNS WHICH SHALL BE INSTALLED AND MAINTAINED BY THE DEPARTMENT OF ROADS OR APPROPRIATE GOVERNMENT AGENCY.
- G20-1 "ROAD WORK NEXT X MILES" SHALL BE USED ON ANY CONSTRUCTION OR MAINTENANCE PROJECT LONGER THAN 2 MILES.
- WHEN MESSAGE IS NOT PERTINENT, SIGNS SHALL BE TAKEN DOWN, COVERED OR FOLDED. TAPE IS NOT PERMITTED ON THE FACE OF THE SIGN.
- VEHICLES OR EQUIPMENT SHALL NOT BE PARKED SO AS TO OBSCURE OR DISTRACT FROM TRAFFIC CONTROL DEVICES.
- FLAGS MAY BE USED TO CALL ATTENTION TO WARNING SIGNS.
- TA-14 WHEN THE HAUL ROAD IS NOT IN USE, TYPE III BARRICADES SHALL BE IN PLACE. THE FLAGGER, SIGNAL AHEAD AND BE PREPARED TO STOP SIGNS SHALL BE COVERED OR REMOVED, AND THE TRAFFIC SIGNAL SHALL BE PUT INTO FLASH YELLOW ON THE HIGHWAY, RED ON THE HAUL ROAD.
- DOUBLE FINE AND REDUCED SPEED ZONE SIGNING NOT REQ'D FOR SHORT-DURATION WORK LESS THAN 1/2 WORK DAY.
- CULVERT, BRIDGE AND SLOPE PROTECTION. EXISTING GUARDRAIL SHOULD REMAIN IN PLACE AS LONG AS PRACTICAL FOR THE PROTECTION IT PROVIDES, AND REINSTALLED AS SOON AS PRACTICAL.
- TA-14 THE NO PASSING SIGNS AND PAVEMENT MARKINGS ARE NOT REQ'D IF HAULING OPERATION IS IN EFFECT ONLY DURING DAYLIGHT HOURS.
- TA-1 AND TA-3 FOR SHORT-DURATION OPERATIONS 60 MINUTES OR LESS, ALL SIGNS AND CHANNELIZING DEVICES MAY BE ELIMINATED IF A VEHICLE WITH AN ACTIVATED FLASHING OR REVOLVING YELLOW LIGHT IS USED, AND THE WORK DOES NOT ENCRoACH ONTO THE OPEN TRAVEL LANE.
- TA-1 AND CULVERT PROTECTION SIGNING IS NOT REQUIRED IF THE WORK SPACE IS 15 FEET OR MORE BEYOND THE EDGE OF THE SHOULDER.
- REFER TO STANDARD PLAN NO. 920 FOR GENERAL INFORMATION NOT SHOWN.

REFERENCED FROM NDOR  
STANDARD PLAN NO. 921-R4

**LEGEND**

- TYPE III BARRICADE
- TYPE II BARRICADE OR REFLECTORIZED PLASTIC DRUM
- SIGN
- FLAGGER
- CONE
- TRAFFIC SIGNAL



### CHANNELIZATION DEVICES

THE FUNCTION OF CHANNELIZATION DEVICES IS TO WARN DRIVERS OF CONDITIONS CREATED BY WORK ACTIVITIES IN OR NEAR THE TRAVELED WAY, TO PROTECT WORKERS IN THE TEMPORARY TRAFFIC CONTROL ZONE, AND TO GUIDE DRIVERS AND PEDESTRIANS SAFELY. CHANNELIZING DEVICES INCLUDE BUT ARE NOT LIMITED TO CONES, TUBULAR MARKERS, VERTICAL PANELS, DRUMS, BARRICADES, TEMPORARY RAISED ISLANDS, AND BARRIERS.

DEVICES USED FOR CHANNELIZATION SHOULD PROVIDE FOR SMOOTH AND GRADUAL TRAFFIC MOVEMENT FROM ONE LANE TO ANOTHER, ONTO A BYPASS OR DETOUR, OR TO REDUCE THE WIDTH OF THE TRAVELED WAY. THEY MAY ALSO BE USED TO SEPARATE TRAFFIC FROM THE WORK SPACE, PAVEMENT DROP-OFFS, PEDESTRIAN PATHS, OR OPPOSING DIRECTIONS OF TRAFFIC.

CHANNELIZING DEVICES SHOULD BE CONSTRUCTED AND BALLASTED TO PERFORM IN A PREDICTABLE MANNER WHEN INADVERTENTLY STRUCK BY A VEHICLE. IF STRUCK, THE DEVICE SHOULD YIELD OR BREAK AWAY, AND FRAGMENTS OR OTHER DEBRIS FROM THE DEVICE SHOULD NOT PENETRATE THE PASSENGER COMPARTMENT OF THE VEHICLE OR BE A POTENTIAL HAZARD TO WORKERS OR PEDESTRIANS IN THE IMMEDIATE AREA.

SPACING OF CHANNELIZING DEVICES SHOULD NOT EXCEED A DISTANCE IN FEET EQUAL TO THE SPEED WHEN USED FOR THE TAPER CHANNELIZATION, AND A DISTANCE IN FEET OF TWICE THE SPEED WHEN USED FOR TANGENT CHANNELIZATION.

SPACING OF CHANNELIZATION DEVICES		
SPEED (MPH)	SPACING OF DEVICES IN FEET	
	TAPER	TANGENT
25	25 FT	50 FT
35	35 FT	70 FT
45	45 FT	90 FT
55	55 FT	110 FT
65	65 FT	130 FT
70	70 FT	140 FT
75	75 FT	150 FT

WARNING LIGHTS ON CHANNELIZING DEVICES. CONSIDERATION SHOULD BE GIVEN TO FOG OR SNOW AREAS, SEVERE ROADWAY CURVATURE, AND USUALLY CLUTTERED ENVIRONMENTS. FLASHING WARNING LIGHTS SHALL BE PLACED ON CHANNELIZING DEVICES USED SINGLY OR IN GROUPS TO MARK A SPOT CONDITION. STEADY-BURN WARNING LIGHTS MAY BE USED ON CHANNELIZING DEVICES USED IN A SERIES.

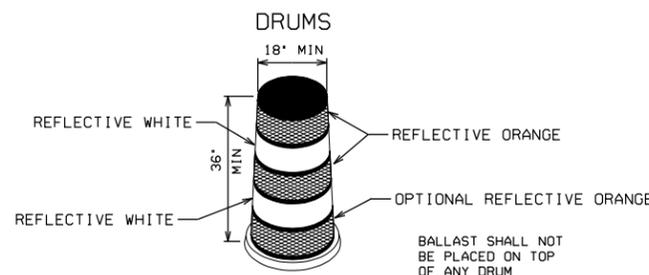
THE RETROREFLECTIVE MATERIAL USED ON CHANNELIZING DEVICES SHALL HAVE A SMOOTH, SEALED OUTER SURFACE, MEETING THE REQUIREMENTS OF THE ASTM SPECIFICATION, D4956, FOR TYPE III SHEETING. THE COEFFICIENT OF RETROREFLECTION OF CHANNELIZING DEVICES SHALL HAVE THE FOLLOWING MINIMUM BRIGHTNESS VALUES MEASURED AT 0.2° OBSERVATION ANGLE AND -4° ENTRANCE ANGLE. CANDELAS PER LUX PER SQUARE METER.

COEFFICIENT OF RETROREFLECTION			
WHITE	ORANGE	RED	YELLOW
125	50	22.5	85

IN ADDITION TO THE MINIMUM COEFFICIENT OF RETROREFLECTION, THE AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION (ATSSA) "QUALITY STANDARD FOR WORK ZONE TRAFFIC CONTROL DEVICES" MAY BE USED AS A VISUAL GUIDE FOR DETERMINING IF A TRAFFIC CONTROL DEVICE IS ACCEPTABLE, MARGINAL OR UNACCEPTABLE.

THE NAME AND TELEPHONE NUMBER OF THE AGENCY, CONTRACTOR, OR SUPPLIER MAY BE SHOWN ON THE CHANNELIZING DEVICE BACK OR SUPPORT, BUT NOT ON THE DEVICES FACE. THE LETTERS AND NUMBERS SHALL BE A NON-REFLECTIVE COLOR AND NOT OVER 100 SQUARE CENTIMETERS IN TOTAL AREA.

PARTICULAR ATTENTION SHOULD BE GIVEN TO ASSURING THAT CHANNELIZING DEVICES ARE MAINTAINED AND KEPT CLEAN, VISIBLE, AND PROPERLY POSITIONED AT ALL TIMES. DEVICES SHALL BE REPLACED THAT ARE DAMAGED AND HAVE LOST A SIGNIFICANT AMOUNT OF THEIR RETROREFLECTIVITY AND EFFECTIVENESS.



### DESIGN

DRUMS USED FOR TRAFFIC WARNING OR CHANNELIZATION SHALL BE CONSTRUCTED OF LIGHT-WEIGHT, FLEXIBLE, AND DEFORMABLE MATERIALS AND BE A MINIMUM OF 36 INCHES IN HEIGHT AND HAVE AT LEAST A 18 INCHES MINIMUM WIDTH, REGARDLESS OF ORIENTATION. THE PREDOMINANT COLOR OF THE DRUM SHALL BE ORANGE. STEEL DRUMS SHALL NOT BE USED. THE MARKINGS ON DRUMS SHALL BE HORIZONTAL, CIRCUMFERENTIAL, ALTERNATING ORANGE AND WHITE RETROREFLECTIVE STRIPES 6 INCHES TO 8 INCHES WIDE. EACH DRUM SHALL HAVE A MINIMUM OF TWO ORANGE AND TWO WHITE STRIPES. ANY NON-RETROREFLECTIVE SPACES BETWEEN THE HORIZONTAL ORANGE AND WHITE STRIPES, SHALL NOT EXCEED 2 INCHES WIDE. DRUMS SHALL HAVE CLOSED TOPS THAT WILL NOT ALLOW COLLECTION OF ROADWORK OR OTHER DEBRIS.

### APPLICATION

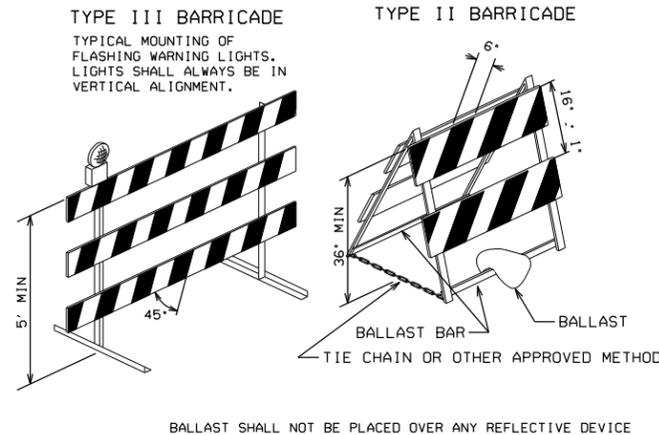
DRUMS ARE MOST COMMONLY USED TO CHANNELIZE OR DELINEATE TRAFFIC FLOW BUT MAY ALSO BE USED SINGLY OR IN GROUPS TO MARK SPECIFIC LOCATIONS. DRUMS ARE HIGHLY VISIBLE AND HAVE GOOD TARGET VALUE, GIVEN THE APPEARANCE OF BEING FORMIDABLE OBSTACLES AND, THEREFORE, COMMAND THE RESPECT OF DRIVERS.

DRUMS SHOULD NOT BE WEIGHED WITH SAND, WATER, OR ANY MATERIAL TO AN EXTENT THAT WOULD MAKE THEM HAZARDOUS TO MOTORISTS, PEDESTRIANS, OR WORKERS. WHEN THEY ARE USED IN REGIONS SUSCEPTIBLE TO FREEZING, THEY SHOULD HAVE DRAINAGE HOLES IN THE BOTTOM SO WATER WILL NOT ACCUMULATE AND FREEZE, CAUSING A HAZARD IF STRUCK BY A MOTORIST. BALLAST SHALL NOT BE PLACED ON TOP OF THE DRUM.

### BARRICADES

BARRICADE TYPE	TYPE II	TYPE III
WIDTH OF RAIL	8 INCHES MIN - 12 INCHES MAX	8 INCHES MIN - 12 INCHES MAX
LENGTH OF RAIL	36 INCHES	8 FEET
WIDTH OF STRIPES	6 INCHES	6 INCHES
HEIGHT	36 INCHES	5 FEET
REFLECTIVE SHEETING	TYPE III	TYPE III
NUMBER OF REFLECTORIZED RAIL FACES	4 (TWO EACH DIRECTION)	6 (THREE EACH DIRECTION)

- \* NOMINAL DIMENSIONS ARE PERMISSIBLE WHEN CONSTRUCTED FROM LUMBER.
- \*\* WHEN LATERAL SPACE IS LIMITED, SOME TYPE III BARRICADES WITH A 4 FOOT LENGTH OF RAIL, MAY BE ALLOWED WHEN APPROVED BY THE ENGINEER.



### DESIGN

A BARRICADE IS A PORTABLE OR FIXED DEVICE HAVING TWO OR THREE RAILS WITH APPROPRIATE MARKINGS. IT IS USED TO CONTROL TRAFFIC BY CLOSING, RESTRICTING, OR DELINEATING ALL OR A PORTION OF THE RIGHT-OF-WAY.

BARRICADES SHALL BE ONE OF TWO TYPES: TYPE II, OR TYPE III.

STRIPES ON BARRICADE RAILS SHALL BE ALTERNATING ORANGE AND WHITE RETROREFLECTIVE STRIPES (SLOPING DOWNWARD AT AN ANGLE OF 45 DEGREES IN THE DIRECTION TRAFFIC IS TO PASS). THE STRIPES SHALL BE 6 INCHES WIDE. THE MINIMUM RAIL LENGTH IS 36 INCHES.

WHERE A BARRICADE EXTENDS ENTIRELY ACROSS A ROADWAY, THE STRIPES SHOULD SLOPE DOWNWARD IN THE DIRECTION TOWARD WHICH TRAFFIC MUST TURN. WHERE BOTH RIGHT AND LEFT TURNS ARE PROVIDED, THE STRIPES MAY SLOPE DOWNWARD IN BOTH DIRECTIONS FROM THE CENTER OF THE BARRICADE OR BARRICADES. WHERE NO TURNS ARE INTENDED, THE STRIPES SHOULD SLOPE DOWNWARD TOWARD THE CENTER OF THE BARRICADE OR BARRICADES. BARRICADE RAILS SHOULD BE SUPPORTED IN A MANNER THAT WILL ALLOW THEM TO BE SEEN BY THE MOTORIST AND PROVIDE A STABLE SUPPORT NOT EASILY BLOWN OVER BY THE WIND OR TRAFFIC.

BARRICADES ARE LOCATED ADJACENT TO TRAFFIC AND ARE THEREFORE SUBJECT TO IMPACT BY ERRANT VEHICLES. BECAUSE OF THEIR VULNERABLE POSITION AND THE HAZARD THEY CREATE, THEY SHOULD BE CONSTRUCTED OF LIGHTWEIGHT MATERIALS AND HAVE NO RIGID STAY BRACING FOR A-FRAME DESIGNS. TYPE II BARRICADES SHALL BE BUILT WITH LEGS OR SUPPORTS THAT WILL COLLAPSE WHEN THE BARRICADE IS TIPPED OVER OR HAS BEEN LAID DOWN.

ON HIGH-SPEED ROADWAYS OR IN OTHER SITUATIONS WHERE BARRICADES MAY BE SUSCEPTIBLE TO OVERTURNING IN THE WIND, SANDBAGS SHOULD BE USED FOR BALLASTING. SANDBAGS MAY BE PLACED ON LOWER PARTS OF THE FRAME OR STAYS TO PROVIDE THE REQUIRED BALLAST BUT SHALL NOT BE PLACED ON TOP OF ANY STRIPED RAIL. BARRICADES SHALL NOT BE BALLASTED BY HEAVY OBJECTS SUCH AS ROCKS OR CHUNKS OF CONCRETE.

ON THE INTERSTATE, FREEWAY AND EXPRESSWAY SYSTEM, TYPE II BARRICADES SHALL NOT BE USED FOR CHANNELIZATION.

THE BARRICADE OWNERS NAME, NOT TO EXCEED 15 SQUARE INCHES SHALL BE SHOWN ON THE BARRICADE BACK OR SUPPORT, BUT NOT ON ITS FACE.

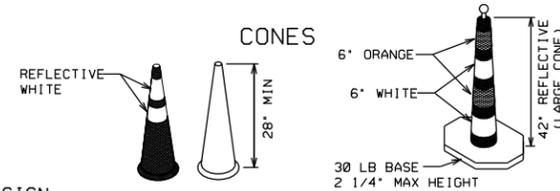
### APPLICATION

TYPE II BARRICADES ARE INTENDED FOR USE IN SITUATIONS WHERE TRAFFIC IS MAINTAINED THROUGH THE TEMPORARY TRAFFIC CONTROL ZONE. THEY MAY BE USED SINGLY OR IN GROUPS TO MARK A SPECIFIC CONDITION, OR THEY MAY BE USED IN A SERIES FOR CHANNELIZING TRAFFIC. TYPE III BARRICADES SHALL BE SUPPLEMENTED, WITH A LIGHTING DEVICE UNLESS SPECIFICALLY DELETED BY THE ENGINEER TO USE SOME BARRICADES WITHOUT LIGHTS.

TYPE III BARRICADES USED AT A ROAD CLOSURE MAY EXTEND COMPLETELY ACROSS A ROADWAY OR FROM CURB TO CURB, WHERE PROVISION IS MADE FOR ACCESS OF AUTHORIZED EQUIPMENT AND VEHICLES, THE RESPONSIBILITY FOR THE TYPE III BARRICADES SHOULD BE ASSIGNED TO A PERSON TO ENSURE PROPER CLOSURE AT THE END OF EACH WORK DAY.

WHEN A HIGHWAY IS LEGALLY CLOSED BUT ACCESS MUST STILL BE ALLOWED FOR LOCAL TRAFFIC, THE TYPE III BARRICADE SHOULD NOT BE EXTENDED COMPLETELY ACROSS A ROADWAY. A SIGN WITH THE APPROPRIATE LEGEND CONCERNING PERMISSIBLE USE BY LOCAL TRAFFIC SHALL BE MOUNTED.

NORMALLY PERMANENT SIGNS MOUNTED ON BARRICADES SHALL BE ERRECTED ABOVE THE BARRICADE. THE SIGNS "ROAD CLOSED", OR "ROAD CONSTRUCTION AHEAD", FOR EXAMPLE CAN EFFECTIVELY BE MOUNTED ABOVE THE BARRICADE THAT CLOSURES THE ROADWAY. TYPE III BARRICADES SHALL BE SUPPLEMENTED WITH A LIGHTING DEVICE UNLESS SPECIFICALLY OMITTED BY THE ENGINEER. DETOUR ARROW AND LARGE WARNING ARROW SIGNS SHOULD BE PLACED ON THE FACE OF BARRICADE.



### DESIGN

CONES SHALL BE PREDOMINANTLY ORANGE, FLOURESCENT RED-ORANGE, OR FLOURESCENT YELLOW/ORANGE, NOT LESS THAN 28 INCHES IN HEIGHT, AND SHALL BE MADE OF A MATERIAL THAT CAN BE STRUCK WITHOUT DAMAGING VEHICLES ON IMPACT. CONES WHEN ALLOWED ON THE INTERSTATE, FREEWAY OR EXPRESSWAY SYSTEM SHALL BE A MINIMUM OF 36 INCHES IN HEIGHT.

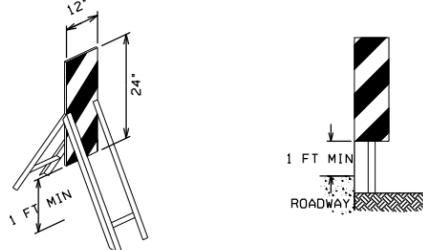
FOR NIGHTTIME USE, CONES SHALL BE RETROREFLECTIVE OR EQUIPPED WITH LIGHTING DEVICES FOR MAXIMUM VISIBILITY. RETROREFLECTION OF 28 INCH OR 36 INCH CONES SHALL BE PROVIDED BY A WHITE BAND 6 INCHES WIDE, NO MORE THAN 3 INCHES TO 4 INCHES FROM THE TOP OF THE CONE, AND AN ADDITIONAL 4 INCHES WIDE WHITE BAND A MINIMUM OF 2 INCHES BELOW THE 6 INCHES BAND. LARGE REFLECTIVE CONES SHALL BE PROVIDED WITH FOUR REFLECTIVE BANDS 6 INCHES EACH, ALTERNATING FROM THE TOP, ORANGE, WHITE, ORANGE, WHITE, WITH A TWO INCH SEPARATION BETWEEN BANDS. WHEN APPROVED BY THE ENGINEER, LARGE CONES MAY BE USED IN PLACE OF REFLECTIVE PANELS. LARGE CONES SHALL NOT BE USED IN PLACE OF DRUMS OR TYPE II BARRICADES.

### APPLICATION

TRAFFIC CONES ARE USED TO CHANNELIZE TRAFFIC, DIVIDE OPPOSING TRAFFIC LANES, DIVIDE TRAFFIC LANES WHEN TWO OR MORE LANES ARE KEPT OPEN IN THE SAME DIRECTION, AND DELINEATE SHORT-DURATION MAINTENANCE AND UTILITY WORK. CONES SHALL NOT BE USED AT NIGHT ON RURAL HIGHWAYS, UNLESS SHOWN ON THE PLANS OR AS APPROVED OR DIRECTED BY THE ENGINEER.

STEPS SHOULD BE TAKEN TO ENSURE THAT CONES WILL NOT BE BLOWN OVER OR DISPLACED BY WIND OR MOVING TRAFFIC. CONES CAN BE DOUBLED UP TO INCREASE THEIR WEIGHT. SOME CONES ARE CONSTRUCTED WITH BASES THAT CAN BE FILLED WITH BALLAST. OTHERS HAVE SPECIAL WEIGHTED BASES, OR WEIGHTS SUCH AS SANDBAG RINGS THAT CAN BE DROPPED OVER THE CONES AND ONTO THE BASE TO PROVIDE ADDED STABILITY. BALLAST, HOWEVER, SHOULD NOT PRESENT A HAZARD IF THE CONES ARE INADVERTENTLY STRUCK.

### VERTICAL PANELS



### DESIGN

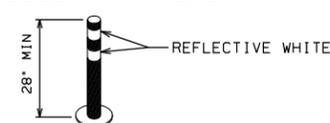
VERTICAL PANELS SHALL BE 12 INCHES WIDE AND AT LEAST 24 INCHES HIGH. THEY SHALL HAVE ORANGE AND WHITE STRIPES, AND BE RETROREFLECTIVE. PANEL STRIPE WIDTHS SHALL BE 6 INCHES, EXCEPT WHERE PANEL HEIGHTS ARE LESS THAN 36 INCHES, THEN 4 INCHES STRIPES MAY BE USED. IF USED FOR TWO-WAY TRAFFIC, BACK-TO-BACK PANELS SHALL BE USED. MARKINGS FOR VERTICAL PANELS SHALL BE ALTERNATING ORANGE AND WHITE RETROREFLECTORIZED STRIPES (SLOPING DOWNWARD AT AN ANGLE OF 45 DEGREES IN THE DIRECTION TRAFFIC IS TO PASS).

VERTICAL PANELS SHALL BE MOUNTED UPRIGHT WITH THE TOP A MINIMUM OF 36 INCHES ABOVE THE ROADWAY. VERTICAL PANELS NOT MOUNTED ABOVE CONCRETE BARRIERS SHALL HAVE LEGS OR SUPPORTS THAT WILL BREAK AWAY UPON IMPACT.

### APPLICATION

VERTICAL PANELS MAY BE USED TO CHANNEL TRAFFIC, DIVIDE OPPOSING LANES OF TRAFFIC, DIVIDE TRAFFIC LANES OR IN PLACE OF BARRICADES WHERE SPACE IS LIMITED. WHEN APPROVED BY THE ENGINEER, VERTICAL PANELS MAY BE POST-MOUNTED ALONG THE SIDE OF THE ROADWAY.

### TUBULAR MARKERS



### DESIGN

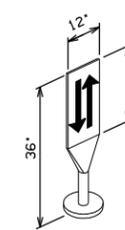
TUBULAR MARKERS SHALL BE PREDOMINANTLY ORANGE, NOT LESS THAN 28 INCHES HIGH, MINIMUM 2 INCHES WIDE WHEN FACING TRAFFIC, AND MADE OF A MATERIAL THAT CAN BE STRUCK WITHOUT DAMAGING IMPACTING VEHICLES.

FOR NIGHTTIME USE, TUBULAR MARKERS SHALL BE RETROREFLECTIVE. RETROREFLECTION OF TUBULAR MARKERS SHALL BE PROVIDED BY TWO 3 INCHES WIDE WHITE BANDS PLACED A MAXIMUM OF 2 INCHES FROM THE TOP, WITH A MAXIMUM OF 6 INCHES BETWEEN THE BANDS. THE BASE SHALL NOT BE WIDER THAN 12 INCHES OR HIGHER THAN 2 INCHES.

### APPLICATION

TUBULAR MARKERS HAVE LESS VISIBLE AREA THAN OTHER DEVICES AND SHOULD BE USED ONLY WHERE SPACE RESTRICTIONS DO NOT ALLOW FOR THE USE OF OTHER MORE VISIBLE DEVICES. THEY MAY BE USED EFFECTIVELY TO DIVIDE OPPOSING LANES OF TRAFFIC OR TO DIVIDE TRAFFIC LANES WHEN TWO OR MORE LANES ARE KEPT OPEN IN THE SAME DIRECTION. STEPS SHOULD BE TAKEN TO ASSURE THAT TUBULAR MARKERS WILL NOT BE BLOWN OVER OR DISPLACED BY TRAFFIC BY EITHER AFFIXING THEM TO THE PAVEMENT WITH ANCHOR BOLTS OR ADHESIVE, USING WEIGHTED BASES, OR WEIGHTS THAT CAN BE DROPPED OVER THE TUBULAR MARKERS AND ONTO THE BASE TO PROVIDE ADDED STABILITY. BALLAST, HOWEVER, SHOULD NOT BE ALLOWED TO PRESENT A HAZARD IF THE TUBULAR MARKERS ARE INADVERTENTLY STRUCK. IF A NONCYLINDRICAL DEVICE IS USED, AND IT COULD BE DISPLAYED WITH A WIDTH LESS THAN THE MINIMUM FACING TRAFFIC, IT SHALL BE ATTACHED TO THE PAVEMENT TO ENSURE THAT THE WIDTH FACING TRAFFIC MEETS THE MINIMUM REQUIREMENTS.

### OPPOSING TRAFFIC LANE DIVIDERS



### DESIGN

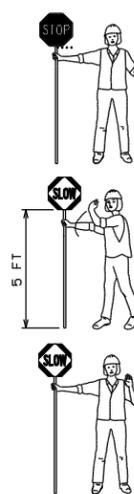
OPPOSING TRAFFIC LANE DIVIDER SHALL BE A TWO SIDED UPRIGHT REFLECTORIZED ORANGE PANEL, WITH A 12 INCHES WIDTH AND 18 INCHES HEIGHT. THE TOP OF THE PANEL SHALL BE 36 INCHES ABOVE THE PAVEMENT. THE SYMBOL ON EACH SIDE SHALL BE TWO OPPOSING BLACK ARROWS. THE LANE DIVIDER SHALL BE MADE OF LIGHTWEIGHT MATERIAL THAT WILL YIELD UPON IMPACT BY A VEHICLE. THE LANE DIVIDER BASE SHALL NOT BE WIDER THAN 12 INCHES OR HIGHER THAN 2 INCHES. THE BASE SHALL BE ATTACHED TO THE EXISTING SURFACE BY EPOXY OR OTHER SUITABLE ADHESIVE, TO ENSURE THAT THE PANEL REMAINS FACING TRAFFIC.

### APPLICATION

OPPOSING TRAFFIC LANE DIVIDERS ARE DELINEATION DEVICES USED AS CENTER LANE DIVIDERS TO SEPARATE OPPOSING TRAFFIC ON A TWO-LANE, TWO-WAY OPERATION.

### FLAGGERS

#### REQUIRED METHOD



#### EMERGENCY USE ONLY



TO STOP TRAFFIC

TRAFFIC PROCEED

TO ALERT AND SLOW TRAFFIC

### FLAGGER PADDLES

FLAGGER PADDLES SHALL BE A MINIMUM 18 INCH WIDE OCTAGON WITH LETTERS AT LEAST 6 INCHES HIGH, WITH A 5 FOOT RIGID HANDLE. FLAGS AND PADDLES SHALL NOT BE USED AT THE SAME TIME. IN EMERGENCIES WHERE THE STANDARD SIGN IS NOT AVAILABLE, A RED FLAG MAY BE USED BY FLAGGERS IN ACCORDANCE WITH THE FLAGGERS HANDBOOK. TO IMPROVE CONSPICUITY, THE STOP/SLOW PADDLES MAY BE SUPPLEMENTED BY ONE OR TWO SYMMETRICALLY POSITIONED FLASHING WHITE HIGH-INTENSITY LAMPS.

### FLAGGERS

A FLAGGER MUST BE DRESSED FOR SAFETY. TO BE EASILY VISIBLE A FLAGGER MUST WEAR A VEST, SHIRT, OR JACKET, AND A CAP OR HARD HAT THAT IS BRIGHT ORANGE, YELLOW, YELLOW GREEN OR FLOURESCENT VERSIONS OF THESE COLORS (FADED OR SOILED GARMENT WILL NOT BE ALLOWED). FOR NIGHTTIME FLAGGING THE GARMENT SHALL BE REFLECTORIZED.

FLAGGERS SHALL BE INSTRUCTED IN THE PROPER LOCATION, DUTIES AND PROCEDURES FOR FLAGGERS AS OUTLINED IN THE CURRENT MUTCD AND THE DEPARTMENT OF ROADS FLAGGER'S HANDBOOK. AS REQUIRED BY THE DEPARTMENT OF ROADS, THE FLAGGER SHALL BE CERTIFIED, AND HAVE IN THEIR POSSESSION, A VALID FLAGGER CERTIFICATION CARD.

REFERENCED FROM NDOR  
STANDARD PLAN NO. 920-R5  
1 OF 2



**LIGHTING DEVICES**

**FUNCTION**

CONSTRUCTION AND MAINTENANCE ACTIVITIES OFTEN CREATE CONDITIONS ON OR NEAR THE TRAVELED WAY THAT ARE PARTICULARLY HAZARDOUS AT NIGHT. IT IS OFTEN DESIRABLE AND NECESSARY TO SUPPLEMENT THE REFLECTORIZED SIGNS, BARRIERS, AND CHANNELIZING DEVICES WITH LIGHTING DEVICES. STROBE TYPE LIGHTS ARE NOT PERMITTED.

**BARRICADE WARNING LIGHTS DESIGN (BATTERY OPERATED)**

TYPE "A" LOW INTENSITY FLASHING WARNING LIGHTS ARE MOST COMMONLY MOUNTED ON BARRICADES, OR WITH SIGNS AND ARE INTENDED TO WARN THE DRIVER THAT THEY ARE PROCEEDING IN A HAZARDOUS AREA. THESE LIGHTS SHALL NOT BE USED FOR DELINEATION, AS A SERIES OF FLASHING LIGHTS IN A ROW WOULD TEND TO OBSCURE THE DESIRED PATH.

TYPE "B" HIGH INTENSITY FLASHING WARNING LIGHTS ARE NORMALLY MOUNTED ON THE ADVANCE WARNING SIGNS. EXTREMELY HAZARDOUS SITE CONDITIONS WITHIN THE CONSTRUCTION AREA MAY REQUIRE THAT THE LIGHTS BE MOUNTED ON TYPE III BARRICADES, SIGNS, OR OTHER SUPPORTS. AS THESE LIGHTS ARE EFFECTIVE IN DAYLIGHT, THEY ARE DESIGNED TO OPERATE 24 HOURS PER DAY.

TYPE "C" STEADY BURN LIGHTS AS USED HEREIN, SHALL MEAN A SERIES OF LOW WATTAGE YELLOW ELECTRIC LIGHTS. WHERE LIGHTS ARE NEEDED TO DELINEATE OR MARK THE TRAVELED WAY THROUGH AND AROUND OBSTRUCTIONS IN A CONSTRUCTION MAINTENANCE AREA, THE DELINEATION SHALL BE ACCOMPLISHED BY USE OF STEADY BURNING LIGHTS.

**FLASHING ARROW PANEL (DISPLAY)**

AN ARROW PANEL IS A SIGN WITH A MATRIX OF ELEMENTS. THE MATRIX, CAPABLE OF EITHER FLASHING OR SEQUENTIAL DISPLAYS, IS INTENDED TO PROVIDE ADDITIONAL WARNING AND DIRECTIONAL INFORMATION TO ASSIST IN MERGING AND CONTROLLING TRAFFIC THROUGH OR AROUND A TEMPORARY TRAFFIC CONTROL ZONE. AN ARROW PANEL SHOULD BE USED IN COMBINATION WITH APPROPRIATE SIGNS, BARRICADES, OR OTHER TRAFFIC CONTROL DEVICES.

**DESIGN**

ARROW PANELS SHALL MEET THE SIZE AND SPECIFICATIONS OF THE MUTCD FOR TYPE C ARROW DISPLAYS.

FLASHING ARROW PANEL SHALL BE RECTANGULAR, OF SOLID APPEARANCE AND FINISHED IN NONREFLECTIVE BLACK. THE PANEL SHALL BE MOUNTED ON A VEHICLE, TRAILER OR OTHER SUITABLE SUPPORT. MINIMUM MOUNTING HEIGHT SHALL BE 7 FEET FROM THE ROADWAY TO THE BOTTOM OF THE PANEL, EXCEPT ON VEHICLE-MOUNTED PANELS, WHICH SHOULD BE AS HIGH AS PRACTICABLE.

THE FOLLOWING SELECTIONS SHALL BE PROVIDED ON THE ARROW PANEL	
OPERATING MODE	PANEL DISPLAY
FLASHING ARROW	RIGHT SHOWN+LEFT OPPOSITE
SEQUENTIAL ARROW	RIGHT SHOWN+LEFT OPPOSITE
SEQUENTIAL CHEVRON	RIGHT SHOWN+LEFT OPPOSITE
FLASHING DOUBLE ARROW	
FLASHING OR ALTERNATING CAUTION	OR

THE ARROW PANEL SHALL HAVE A MINIMUM SIZE OF 96 INCHES WIDE AND 48 INCHES HIGH. THE MINIMUM LEGIBILITY DISTANCE SHALL BE 1 MILE. THE PANEL SHALL CONTAIN 25 LAMP ELEMENTS. ARROW PANEL ELEMENTS SHALL BE CAPABLE OF A MINIMUM 50 PERCENT DIMMING, AUTOMATICALLY WHEN AMBIENT LIGHT FALLS BELOW 50 LUX.

THE MINIMUM ELEMENT "ON TIME" SHALL BE 50 PERCENT FOR THE FLASHING MODE AND EQUAL INTERVALS OF 25 PERCENT FOR EACH SEQUENTIAL CHEVRON PHASE. THE FLASHING RATE SHALL BE NO FEWER THAN 25 NOR MORE THAN 40 FLASHES PER MINUTE.

**APPLICATION**

A FLASHING ARROW OR SEQUENTIAL CHEVRON MAY BE USED FOR STATIONARY OR MOVING LANE CLOSURES. AN ARROW DISPLAY IN THE CAUTION MODE SHALL BE USED ONLY FOR SHOULDER WORK, BLOCKING THE SHOULDER, OR ROADSIDE WORK NEAR THE SHOULDER. AN ARROW DISPLAY SHALL NOT BE USED ON A TWO-LANE TWO-WAY ROADWAY FOR TEMPORARY ONE-LANE OPERATION OR LANE SHIFTS. AN ARROW DISPLAY SHALL NOT BE USED ON A MULTILANE ROADWAY TO LATERALLY SHIFT ALL LANES OF TRAFFIC, BECAUSE UNNECESSARY LANE CHANGING MAY RESULT.

**TRAFFIC SIGNALS**

TRAFFIC SIGNALS MAY BE ALLOWED AT CERTAIN EQUIPMENT CROSSINGS WHERE THE VOLUME OF FILL MATERIAL AND THE NUMBER OF EQUIPMENT CROSSINGS PER HOUR IS HIGH. TRAFFIC SIGNALS MAY BE ALLOWED AT CERTAIN BRIDGE CONSTRUCTION SITES WHERE A COMBINATION OF ONE-WAY TRAFFIC AND HIGH TRAFFIC VOLUMES WOULD BE BEST SERVED WITH THIS TYPE OF TRAFFIC CONTROL.

ALL TRAFFIC SIGNAL REQUESTS AND METHOD OF INSTALLATION ON THE STATE HIGHWAY SYSTEM SHALL BE IN COMPLIANCE WITH THE MUTCD AND MUST BE APPROVED BY THE STATE TRAFFIC ENGINEER.

**FLOOD LIGHTS**

WHEN NIGHTTIME WORK IS REQUIRED, FLOODLIGHTS SHOULD BE USED TO ILLUMINATE FLAGGER STATIONS, EQUIPMENT CROSSINGS, AND OTHER AREAS WHERE EXISTING LIGHT IS NOT ADEQUATE FOR THE WORK TO BE PERFORMED SAFELY.

IN NO CASE SHALL FLOODLIGHTING BE PERMITTED TO CREATE A DISABLING GLARE FOR DRIVERS. THE ADEQUACY OF THE FLOODLIGHT PLACEMENT AND ELIMINATION OF POTENTIAL GLARE SHOULD BE CHECKED BY DRIVING THROUGH THE PROJECT.

**PAVEMENT MARKING**

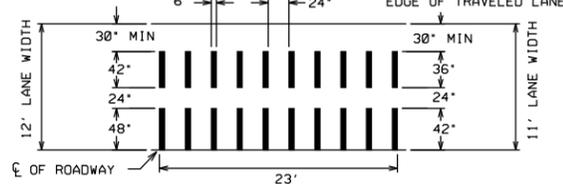
IT IS INTENDED TO THE EXTENT POSSIBLE, THAT MOTORISTS BE PROVIDED MARKINGS WITHIN A WORK AREA COMPARABLE TO THE MARKINGS NORMALLY MAINTAINED ALONG ADJACENT ROADWAYS, PARTICULARLY AT EITHER END OF THE WORK AREA.

ALL MARKINGS AND DEVICES USED TO DELINEATE VEHICLE AND PEDESTRIAN PATHS SHALL BE CAREFULLY REVIEWED DURING DAYTIME AND NIGHTTIME PERIODS TO AVOID INADVERTENTLY LEADING DRIVERS OR PEDESTRIANS FROM THE INTENDED PATH.

PAVEMENT MARKINGS NO LONGER APPLICABLE SHALL BE REMOVED UNLESS OTHERWISE APPROVED BY THE ENGINEER.

**RUMBLE STRIPS**

EACH SECTION SHALL CONSIST OF 10 SEGMENTS.



**DESIGN**

RUMBLE STRIPS MAY BE MADE OF ASPHALT PAVING MATERIAL, EPOXY AND AGGREGATE OR OTHER SUITABLE MATERIAL WHICH WILL MAINTAIN A DESIRABLE RUMBLE EFFECT. THE RUMBLE STRIP SHOULD HAVE AN INSTALLED HEIGHT OF 5/8". PREFORMED RUMBLE STRIPS MAY BE USED PROVIDED THEY HAVE A MINIMUM 1/2" HEIGHT.

**TAPERS**

TAPERS ARE CREATED USING A SERIES OF CHANNELIZING DEVICES OR PAVEMENT MARKINGS PLACED TO MOVE TRAFFIC OUT OF OR INTO ITS NORMAL PATH.

**MERGING TAPER**

A MERGING TAPER REQUIRES THE LONGEST DISTANCE BECAUSE DRIVERS ARE REQUIRED TO MERGE WITH AN ADJACENT LANE OF TRAFFIC AT THE PREVAILING SPEED. THE TAPER SHOULD BE LONG ENOUGH TO ENABLE MERGING DRIVERS TO ADJUST THEIR SPEEDS AND MERGE INTO A SINGLE LANE BEFORE THE END OF THE TRANSITION.

**SHIFTING TAPER**

A SHIFTING TAPER IS USED WHEN MERGING IS NOT REQUIRED, BUT A LATERAL SHIFT IS NEEDED. APPROXIMATELY ONE-HALF L HAS BEEN FOUND TO BE ADEQUATE. WHERE MORE SPACE IS AVAILABLE, IT MAY BE BENEFICIAL TO USE LONGER TAPERS. GUIDANCE FOR CHANGES IN ALIGNMENT MAY ALSO BE ACCOMPLISHED BY USING HORIZONTAL CURVES DESIGNED FOR NORMAL HIGHWAY SPEEDS.

**SHOULDER TAPERS**

A SHOULDER TAPER MAY BE BENEFICIAL ON HIGH-SPEED ROADWAYS WITH IMPROVED SHOULDERS THAT MAY BE MISTAKEN FOR DRIVING LANES (WHEN WORK IS OCCURRING IN THE SHOULDER AREAS). IF USED, SHOULDER TAPERS APPROACHING THE ACTIVITY AREA SHOULD HAVE A LENGTH OF ABOUT ONE-THIRD L.

**DOWNSTREAM TAPERS**

THE DOWNSTREAM TAPER MAY BE USEFUL IN TERMINATION AREAS TO PROVIDE A VISUAL CUE TO THE DRIVER THAT ACCESS IS AVAILABLE TO THE ORIGINAL LANE/PATH THAT WAS CLOSED. WHEN USED, IT SHOULD HAVE A MINIMUM LENGTH OF ABOUT 100 FEET PER LANE, WITH DEVICES SPACED ABOUT 20 FEET APART.

**ONE LANE, TWO WAY TAPER**

THE ONE-LANE, TWO-WAY TRAFFIC TAPER IS USED IN ADVANCE OF AN ACTIVITY AREA THAT OCCUPIES PART OF A TWO-WAY ROADWAY IN SUCH A WAY THAT A PORTION OF THE ROAD IS USED ALTERNATELY BY TRAFFIC IN EACH DIRECTION. A SHORT TAPER HAVING A MAXIMUM LENGTH OF 100 FEET WITH CHANNELIZING DEVICES AT APPROXIMATELY 20-FOOT SPACINGS SHOULD BE USED TO GUIDE TRAFFIC INTO THE ONE-WAY SECTION.

TAPER LENGTH CRITERIA FOR TEMPORARY TRAFFIC CONTROL ZONES	
TYPE OF TAPER	TAPER LENGTH (FEET)
MERGING TAPER	L MINIMUM
SHIFTING TAPER	1/2 L MINIMUM
SHOULDER TAPER	1/3 L MINIMUM
TWO-WAY TAPER	100 FEET MAXIMUM

FORMULAS FOR L	
SPEED	FORMULA
40 MPH OR LESS	$L = \frac{WS^2}{60}$
45 MPH OR GREATER	$L = WS$

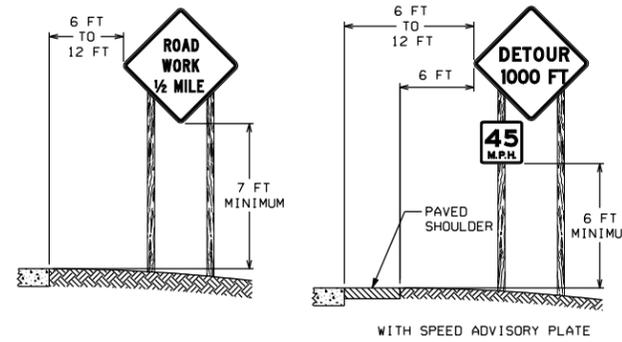
L = TAPER LENGTH IN FEET  
W = WIDTH OF OFFSET IN FEET  
S = POSTED SPEED LIMIT PRIOR TO WORK IN MPH

SPEED (MPH)	TAPER LENGTH L (FEET)		
	10 FT	11 FT	12 FT
25	105	115	125
30	150	165	180
35	205	225	245
40	270	295	320
45	450	495	540
50	500	550	600
55	550	605	660
65	650	715	780
70	700	770	840
75	750	825	900

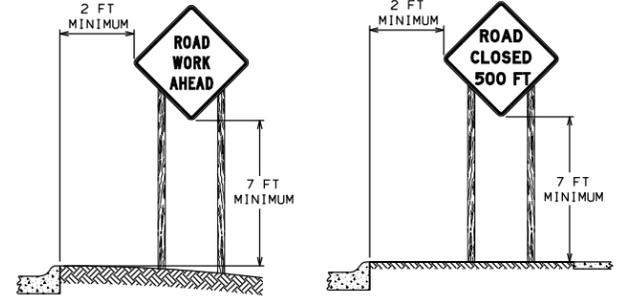
**ROADSIDE SIGNS**

**HEIGHT AND LATERAL LOCATION OF SIGNS**

**RURAL AREA**

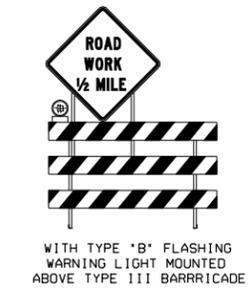


**URBAN AREA**



TYPICAL FIRST SIGN AT CONSTRUCTION SITE

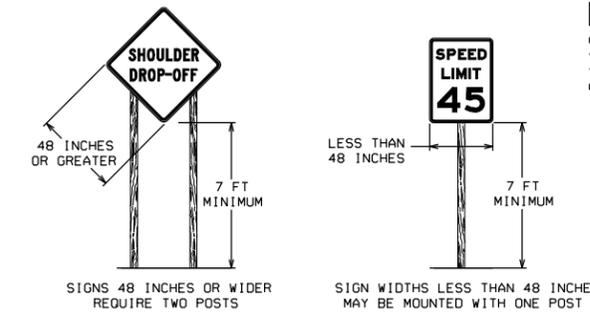
PORTABLE AND TEMPORARY MOUNTING



WITH TYPE "B" FLASHING WARNING LIGHT MOUNTED ABOVE TYPE III BARRICADE



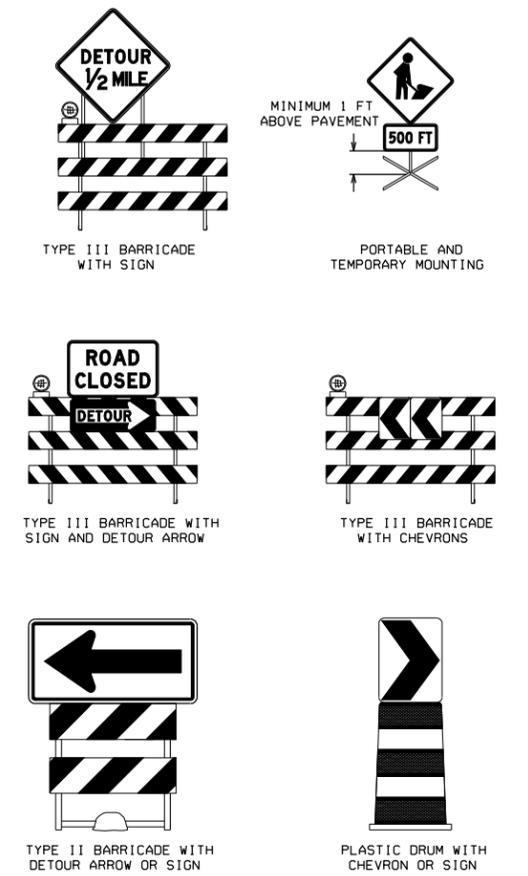
**TYPICAL SIGN MOUNTINGS POST MOUNTED**



SIGNS 48 INCHES OR WIDER REQUIRE TWO POSTS

SIGN WIDTHS LESS THAN 48 INCHES MAY BE MOUNTED WITH ONE POST

**TYPICAL SIGN MOUNTINGS OTHER THAN POST MOUNTED**



TYPE II BARRICADE WITH DETOUR ARROW OR SIGN

PLASTIC DRUM WITH CHEVRON OR SIGN

**GENERAL NOTES**

- ALL TRAFFIC CONTROL DEVICES SHALL MEET THE APPLICABLE STANDARDS AND SPECIFICATIONS PRESCRIBED IN PART VI OF THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, (MUTCD)" AND THE STATE OF NEBRASKA SUPPLEMENT TO THE MUTCD.
- TRAFFIC CONTROL PLANS AND DEVICES SHOULD FOLLOW THE PRINCIPLES SET FORTH, BUT MAY DEVIATE FROM THE TYPICAL DRAWINGS TO ALLOW FOR CONDITIONS AND REQUIREMENTS OF THE PROJECT.
- TRAFFIC CONTROL DEVICES SHALL BE INSTALLED SO AS NOT TO OBSTRUCT THE VIEW OF OTHER TRAFFIC CONTROL DEVICES.
- THE ENGINEER SHALL HAVE THE AUTHORITY TO REQUIRE THE USE, AND APPROVE THE LOCATION OF ANY OF THE DEVICES SHOWN IN THESE PLANS.
- UNPROTECTED TEMPORARY AND POST MOUNTED SIGNS SHOULD BE CRASHWORTHY (REFER TO THE ROADSIDE DESIGN GUIDE, CHAPTER NINE, FOR ADDITIONAL GUIDANCE).

REFERENCED FROM NDOR  
STANDARD PLAN NO. 920-R5  
2 OF 2



L:\PROJECTS\19-06-1903\PHASE 002\DOWN SHEETS\SHEET U07.DGN  
1/27/2008 10:38 AM  
5/15/08 3:38 PM

## ALUMINUM WELDING NOTES:

- 1) FABRICATION SHALL CONFORM TO SECTION 6.9 OF AASHTO 2001 STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, EXCEPT AS MODIFIED BY THE FOLLOWING NOTES.
- 2) ALL WELDING SHALL BE DONE BY GAS METAL-ARC WELDING (GMAW) PROCESS.
- 3) ONLY STRINGER BEAD TECHNIQUE SHALL BE USED IN WELDING. NO WEAVE BEAD TECHNIQUE IS ALLOWED.
- 4) INTERPASS TEMPERATURE SHALL NOT EXCEED 200°F.
- 5) TACK WELD ENDS SHALL BE FILLED AND NOT TERMINATE IN CRATERS. IF A TACK WELD IS CRACKED, THE CRACK SHALL BE REMOVED BEFORE WELDING BEGINS.
- 6) ALL INITIAL ROOT PASSES SHALL NOT EXCEED  $\frac{5}{16}$  INCH AND MUST PENETRATE THE ROOT.
- 7) THE CONVEXITY OF FILLET WELD SHALL NOT EXCEED  $\frac{1}{16}$  INCH.
- 8) THE ENTIRE STRUCTURE SHALL BE CLEANED BEFORE SHIPPING.
- 9) TUBES SHOULD BE MILLED TO THE REQUIRED RADII WITH THE MAXIMUM GAP AT ANY POINT NOT GREATER THAN  $\frac{1}{16}$  INCH
- 10) ALL AREAS OF WELDING MUST BE BRUSHED WITH STAINLESS STEEL BRUSHES IMMEDIATELY PRIOR TO MAKING THE WELDS.
- 11) ONLY MICROSCOPICALLY CLEAN WELDING WIRES (THOSE WHICH HAVE BEEN SHAVED AFTER DRAWING) SHOULD BE USED AND SPOOLS OF WIRE REMAINING AT THE END OF THE DAY'S PRODUCTION SHOULD BE SEALED IN POLYETHYLENE BAGS. WIRE NOT SO PROTECTED SHOULD BE DISCARDED. THIS INCLUDES WIRE IN THE DRIVE ROLLS AND GUN.
- 12) FORCED FITS MUST BE AVOIDED AND ONLY DOWN HAND WELDING IS ALLOWED.
- 13) ALL WELD CRATERS MUST BE ELIMINATED AND WELDS SHOULD CARRY THROUGH TIGHT AREAS WITHOUT STOPPING WHEN POSSIBLE.
- 14) ALUMINUM FILLER ALLOY ER5356 OR ER5556 SHALL BE USED.

## STAINLESS STEEL BOLTING NOTES:

- 1) UNLESS OTHERWISE NOTED ON THE PLAN, ALL STAINLESS STEEL BOLTS AND U-BOLTS SHALL BE FURNISHED WITH STAINLESS STEEL REGULAR HEXAGONAL NUTS, JAM NUTS AND WASHERS UNDER BOTH HEADS AND NUTS.
- 2) IN CASE STAINLESS STEEL LOCK WASHERS ARE USED IN LIEU OF JAM NUTS, THE REGULAR WASHERS UNDER NUTS ARE TO BE OMITTED.

## STEEL NOTES:

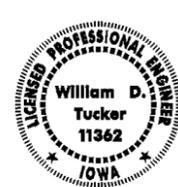
ALL STEEL SHAPES, BARS, AND PLATES SHALL COMPLY WITH ASTM A36 EXCEPT MINOR PARTS APPROVED BY THE ENGINEER MAY COMPLY WITH ASTM A575 GRADE M1020. ALL STEEL PIPE SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A53 GRADE B, TYPE E OR S. STAINLESS STEEL BOLTS SHALL COMPLY WITH ASTM A-320 OR F593 AS PER STANDARD SPECIFICATIONS.

ALL STEEL SECTIONS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123. PROVIDE VENT HOLES FOR GALVANIZING.

STEEL WELDING SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE AWS SPECIFICATIONS D1.1, STRUCTURAL WELDING CODE-STEEL.

MAGNETIC PARTICLE TESTING SHALL BE PERFORMED ON THE POST TO BASE PLATE AND STIFFENER FILLET WELDS.

## STRUCTURAL DESIGN



I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

*William D. Tucker* 3-2-2006  
Signature Date

Printed or Typed Name **William D. Tucker**

My license renewal date is December 31, 2007

Pages or sheets covered by this seal: SHEET V.01 THRU V.09

## GENERAL NOTES:

ALL SIGN TRUSSES ARE DESIGNED FOR 30 lb/ft<sup>2</sup> WIND PRESSURE ON TRUSS MEMBERS AND SIGN PANELS.

ALL ROUND TUBES, SIGN SUPPORT, BARS, AND PLATES FOR THE OVERHEAD SIGN TRUSS SHALL BE ALUMINUM ALLOY 6061-T6 UNLESS OTHERWISE NOTED OR SHOWN.

ALL DIAMETERS OF ALUMINUM TUBING SHOWN ARE OUTSIDE DIAMETERS.

ALL PIPES, SHAPES, AND PLATES FOR THE END SUPPORT FRAMES SHALL BE STRUCTURAL STEEL COMPLYING WITH THE ASTM SPECIFICATIONS NOTED.

SHOP DRAWINGS SHALL BE SUBMITTED FOR APPROVAL.

SHOP DRAWINGS SHALL INDICATE LEFT AND RIGHT SUPPORTS.

THE PRECISE ALIGNING AND ERECTING OF ALL COMPONENTS OF THE OVERHEAD SIGN TRUSS AND ITS SUPPORTS SHALL BE CONSIDERED ESSENTIAL. THE CONTRACTOR SHALL SUBMIT DOCUMENTATION TO THE ENGINEER SHOWING THAT THE VARIOUS COMPONENTS HAVE BEEN MEASURED AND ARE LOCATED WITHIN THE TOLERANCES LISTED BELOW.

FOUNDATIONS AND ANCHOR BOLTS:

- 1) EACH FOUNDATION SHALL BE ACCURATELY LOCATED, WITH THE CENTER OF THE TWO ANCHOR BOLT GROUPS NOT MORE THAN 1 INCH FROM THE PLAN LOCATION IN THE DIRECTION PARALLEL WITH AND PERPENDICULAR TO THE OVERHEAD TRUSS.
- 2) THE TWO FOUNDATIONS SHALL BE PARALLEL, WITH THE DISTANCES ALONG THE OVERHEAD TRUSS BETWEEN CENTERS OF FRONT AND REAR ANCHOR BOLT GROUPS DIFFERING BY NOT MORE THAN 1 INCH.
- 3) ELEVATIONS OF THE TOP OF EACH FOUNDATION SHALL BE WITHIN 1 INCH OF PLAN ELEVATION.
- 4) ANCHOR BOLT GROUPS SHALL BE LOCATED ACCURATELY BY TEMPLATE OR OTHER POSITIVE MEANS, WITH CENTERS OF ADJACENT ANCHOR BOLT GROUPS WITHIN  $\frac{3}{16}$  INCH OF THE CORRECT DISTANCE APART.
- 5) ANCHOR BOLTS SHALL BE PLUMB WITHIN  $\frac{1}{4}$  INCH PER FOOT FROM VERTICAL.
- 6) ANCHOR BOLTS SHALL PROJECT ABOVE TOP OF FOUNDATION WITHIN  $\frac{1}{4}$  INCH OF THE PLAN DIMENSION.

COMPLETED ALUMINUM AND STEEL STRUCTURE:

- 1) EACH TRUSS SUPPORT COLUMN SHALL BE PLUMB WITHIN  $\frac{1}{16}$  INCH PER FOOT OF VERTICAL IN TWO PERPENDICULAR DIRECTIONS.
- 2) STICK-OUT OF EACH TRUSS LOWER CHORD SHALL BE WITHIN 2 $\frac{3}{4}$  AND 5 $\frac{1}{2}$  INCHES MEASURED FROM OUTER U-BOLT TO INSIDE OF CHORD END PLATE.
- 3) THE TRUSS SHALL BE SQUARE WITHIN SUPPORTS. HORIZONTAL LINE BETWEEN CHORDS SHALL BE LEVEL WITHIN  $\frac{1}{16}$  INCH PER FOOT OF HORIZONTAL, AND VERTICAL LINE BETWEEN CHORDS SHALL BE PLUMB WITHIN  $\frac{1}{16}$  INCH PER FOOT OF VERTICAL.

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0
206	SCOTT	S.B. 1-74	2187+60	70'-0

FILE NO. 30150



**Iowa Department of Transportation**  
**Highway Division**

STANDARD DESIGN

**ALUMINUM OVERHEAD SIGN TRUSS**  
**WITH GALVANIZED STEEL SUPPORTS**

FEBRUARY, 2006

**NOTES**

**STOH-01-06**

50' TO 100' SPANS

## SPECIFICATIONS:

DESIGN: A.A.S.H.T.O. STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, SERIES OF 2001 WITH 2002 AND 2003 INTERIMS; STATE STANDARD FATIGUE DESIGN. CONSTRUCTION: IOWA D.O.T. STANDARD SPECIFICATIONS, SERIES 2001 PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT.

## DESIGN STRESSES:

DESIGN STRESSES FOR MATERIALS ARE IN ACCORDANCE WITH A.A.S.H.T.O. STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGN, LUMINAIRES AND TRAFFIC SIGNALS, SERIES OF 2001 WITH 2002 AND 2003 INTERIMS.

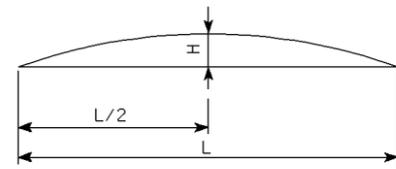
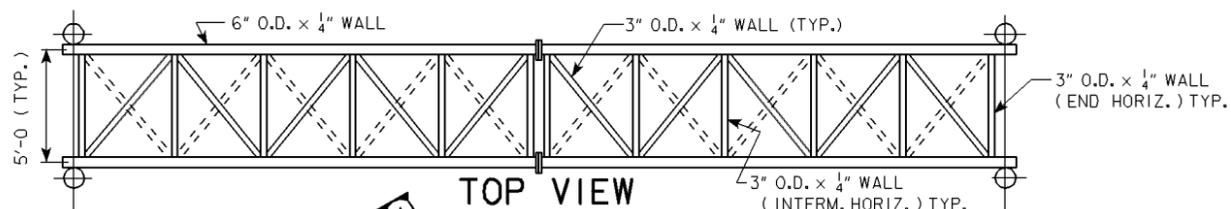
## ANCHOR BOLT NOTES:

PROCEDURE FOR TIGHTENING ANCHOR BOLT NUTS ON OVERHEAD SIGN TRUSS.

- 1) THIS WORK SHALL BE PERFORMED ONLY ON DAYS WITH WINDS LESS THAN 15 MPH. ALL TIGHTENING OF THE NUTS IS TO BE DONE IN THE PRESENCE OF THE INSPECTOR. ONCE THE TIGHTENING PROCEDURE IS STARTED IT MUST BE COMPLETED ON ALL OF THE BASE PLATE NUTS WITHOUT PAUSE OR DELAY.
- 2) PROPERLY SIZED WRENCHES DESIGNED FOR TIGHTENING NUTS AND/OR BOLTS SHALL BE USED TO AVOID ROUNDING OR OTHER DAMAGE TO THE NUTS. ADJUSTABLE END OR PIPE WRENCHES MAY NOT BE USED.
- 3) BASE PLATE, ANCHOR RODS AND NUTS ARE TO BE FREE OF ANY DIRT OR DEBRIS.
- 4) APPLY STICK WAX OR BEES WAX TO THE THREADS AND BEARING SURFACES OF THE ANCHOR BOLT, NUTS, AND WASHERS.
- 5) TIGHTEN TOP NUTS SO THEY FULLY CONTACT THE BASE PLATE. TIGHTEN LEVELING NUTS TO SNUG TIGHT CONDITION. SNUG TIGHT IS DEFINED AS THE FULL EFFORT OF ONE PERSON ON A WRENCH WITH A LENGTH EQUAL TO 14 TIMES THE BOLT DIAMETER BUT NOT LESS THAN 18 INCHES. APPLY THE FULL EFFORT AS CLOSE TO THE END OF THE WRENCH AS POSSIBLE. PULL FIRMLY BY LEANING BACK AND USING ENTIRE BODY WEIGHT ON THE END OF THE WRENCH UNTIL THE NUT STOPS ROTATING. USE A MINIMUM OF TWO SEPARATE PASSES OF TIGHTENING. SEQUENCE THE TIGHTENING IN EACH PASS SO THAT THE NUT ON THE OPPOSITE SIDE, TO THE EXTENT POSSIBLE, WILL BE SUBSEQUENTLY TIGHTENED UNTIL ALL OF THE NUTS IN THAT PASS HAVE BEEN TIGHTENED.
- 6) TIGHTEN TOP NUTS TO SNUG TIGHT AS DESCRIBED FOR THE LEVELING NUTS.
- 7) MATCH-MARK THE TOP NUTS AND BASE PLATE USING PAINT, CRAYON, OR OTHER APPROVED MEANS TO PROVIDE A REFERENCE FOR DETERMINING THE RELATIVE ROTATION OF THE NUT AND BASE PLATE DURING TIGHTENING. USING A STRIKING OR HYDRAULIC WRENCH, FURTHER TIGHTEN THE TOP NUTS IN TWO PASSES AS LISTED IN THE FOLLOWING TABLE. USE A SEQUENCE OF TIGHTENING IN EACH PASS SO THAT THE NUT ON THE OPPOSITE SIDE, TO THE EXTENT POSSIBLE, WILL BE SUBSEQUENTLY TIGHTENED UNTIL ALL NUTS IN THAT PASS HAVE BEEN TURNED. DO NOT ROTATE THE LEVELING NUT DURING THE TOP NUT TIGHTENING.

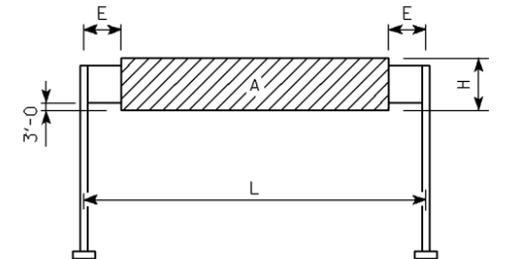
ANCHOR BOLT SIZE	FIRST PASS	SECOND PASS	TOTAL ROTATION
LESS THAN OR EQUAL TO 1 $\frac{1}{2}$ "	1/6 TURN	1/6 TURN	1/3 TURN
GREATER THAN 1 $\frac{1}{2}$ "	1/12 TURN	1/12 TURN	1/6 TURN

- 8) LUBRICATE, PLACE AND TIGHTEN THE JAM NUTS TO SNUG TIGHT.



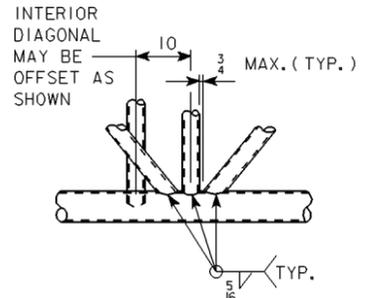
ALLOWABLE SIGN AREA			
L	H, MAX.	E, MIN.	A, MAX.
70'	14'-9"	7'-0"	826 S.F.
65'	14'-9"	4'-6"	826 S.F.
60'	14'-9"	2'-6"	811 S.F.
55'	14'-9"	2'-6"	737 S.F.
50'	14'-9"	2'-6"	663 S.F.

NOTE: ALLOWABLE DMS SIGN DIMENSIONS 11' x 30' WITH MAXIMUM SIGN WEIGHT OF 5000 POUNDS.

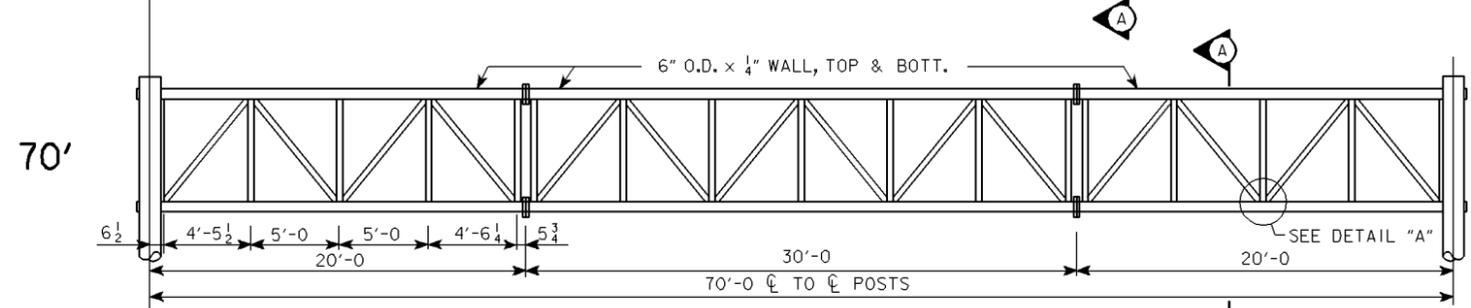
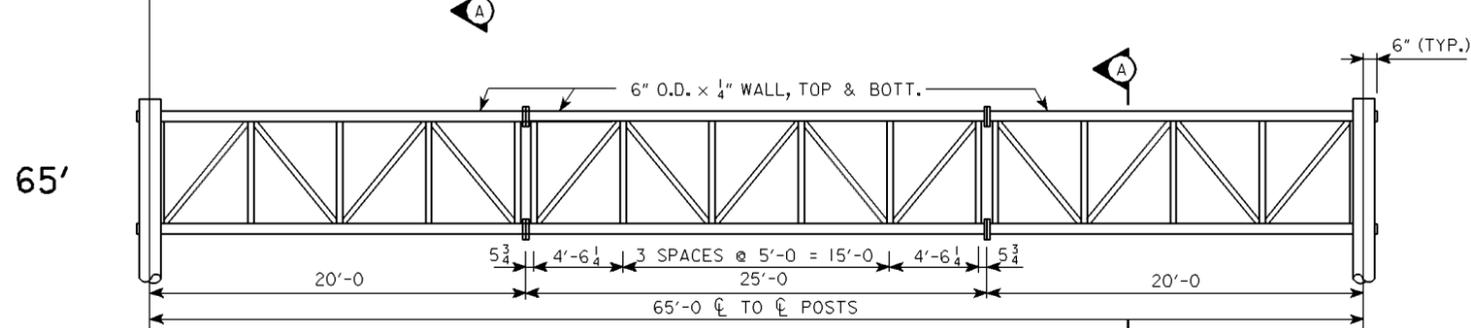
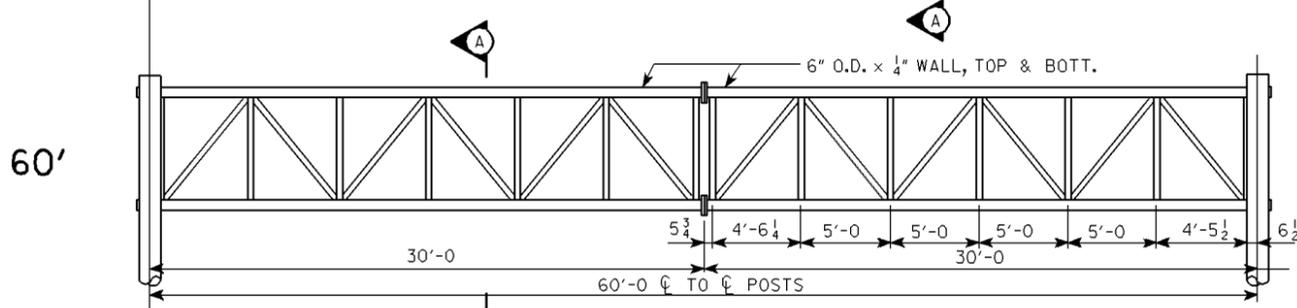
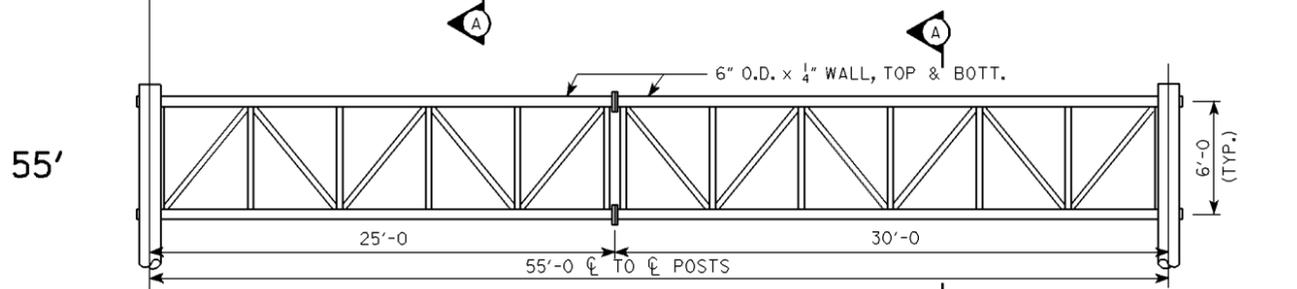
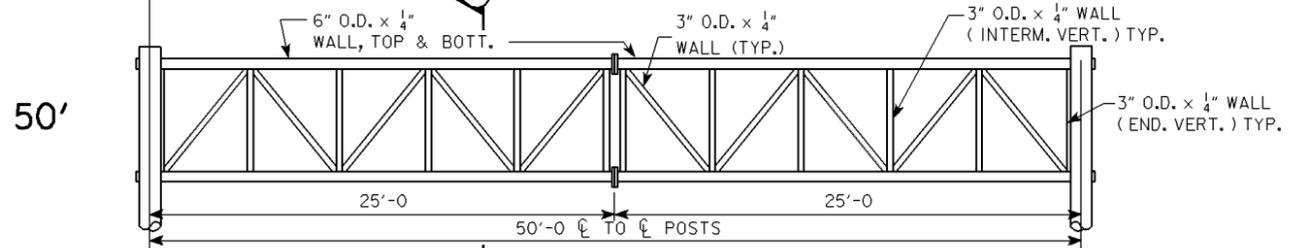


SIGN AREA FOR SIGN TRUSS DESIGN

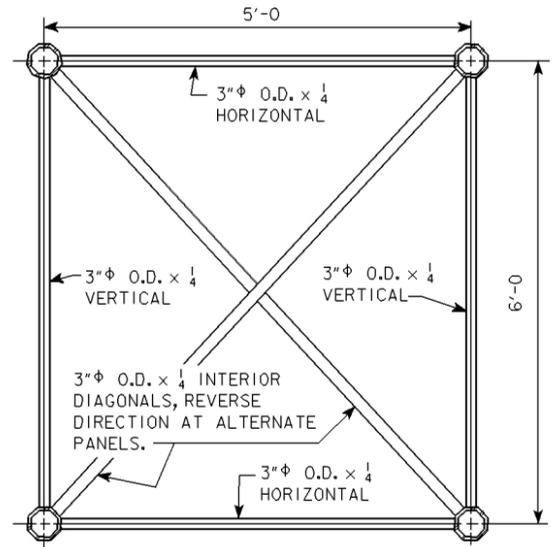
SPAN L	CAMBER H
50'	1 1/16"
55'	7/8"
60'	1"
65'	1 3/16"
70'	1 3/8"



DETAIL "A"



PART ELEVATION



SECTION A-A

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0"
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0"
206	SCOTT	S.B. 1-74	2187+60	70'-0"

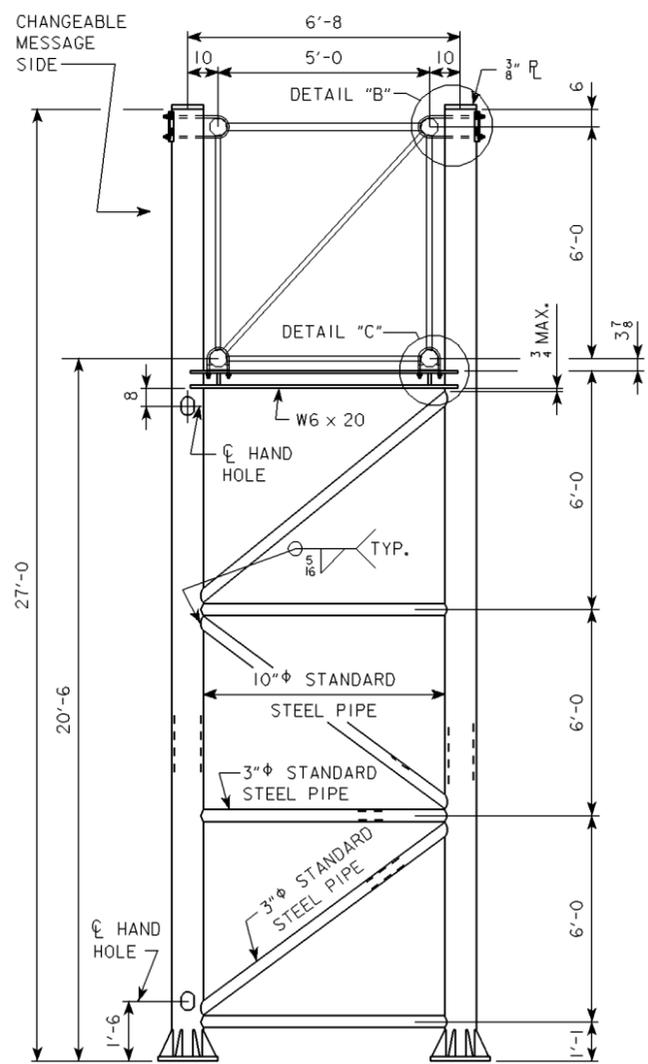
FILE NO. 30150

**Iowa Department of Transportation**  
**Highway Division**

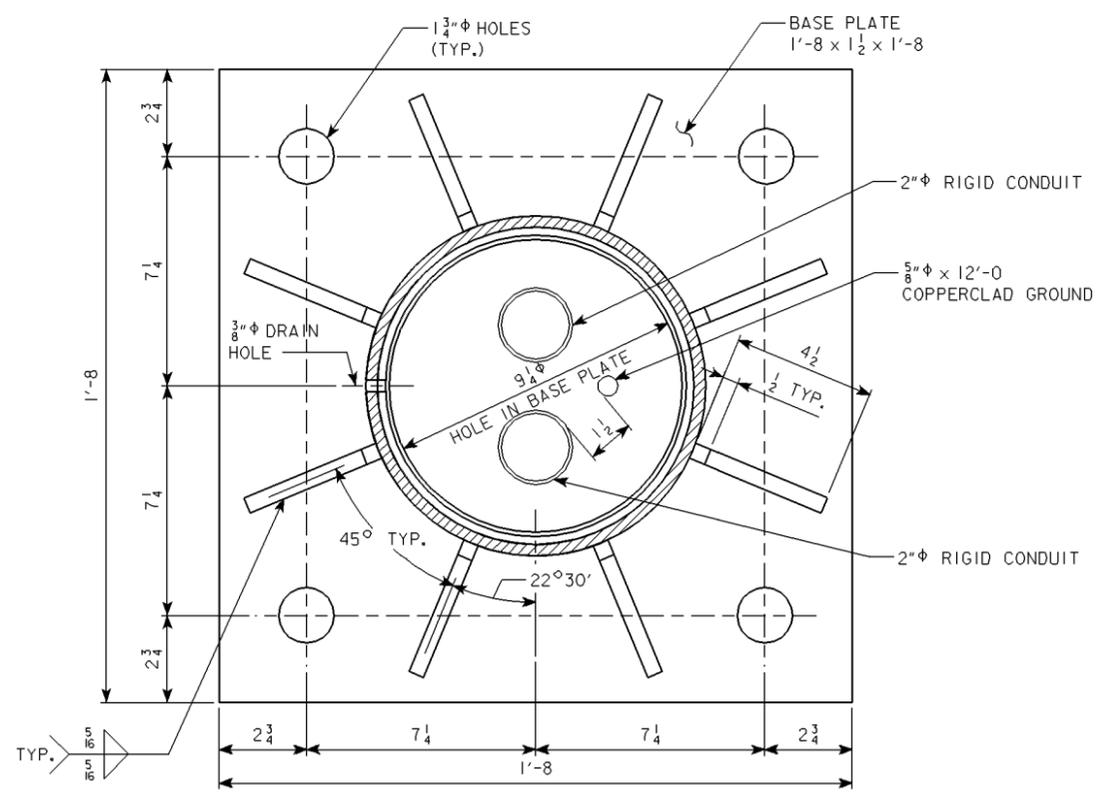
STANDARD DESIGN  
**ALUMINUM OVERHEAD SIGN TRUSS**  
**WITH GALVANIZED STEEL SUPPORTS**  
FEBRUARY, 2006

ELEVATION VIEWS      STO-H-02-06

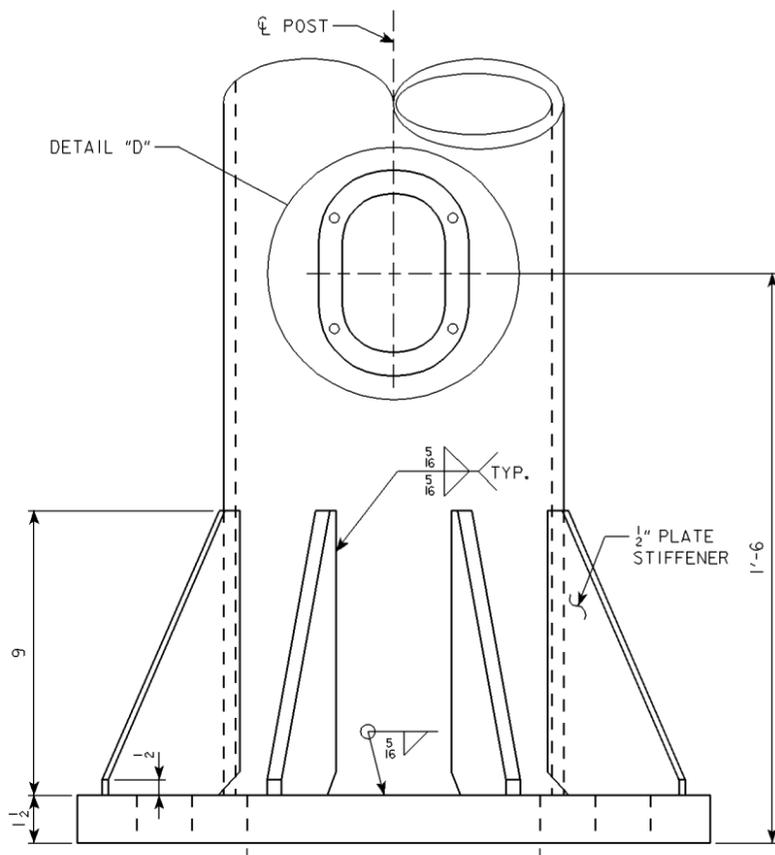
50' TO 70' SPANS



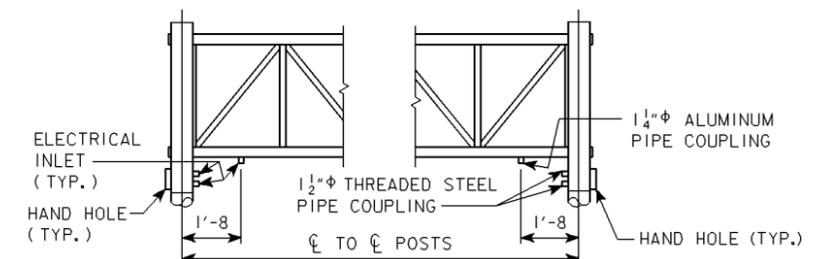
END VIEW OF TRUSS SUPPORT



BASE PLATE PLAN

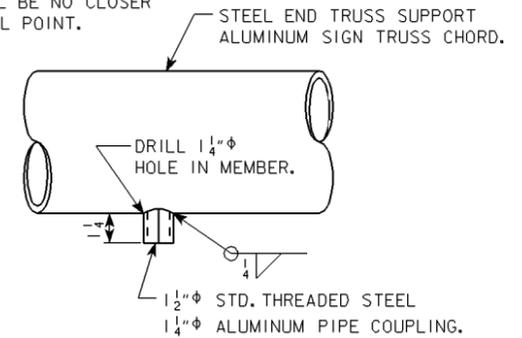


BASE SIDE VIEW



PART ELEVATION

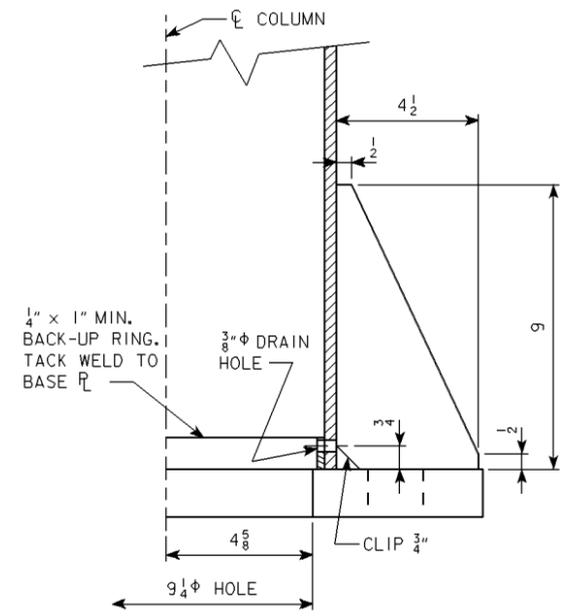
NOTE: PROVIDE ELECTRICAL INLETS AT CHANGEABLE MESSAGE SIGN. INLETS SHALL BE NO CLOSER THAN 1'-2 TO A TRUSS PANEL POINT.



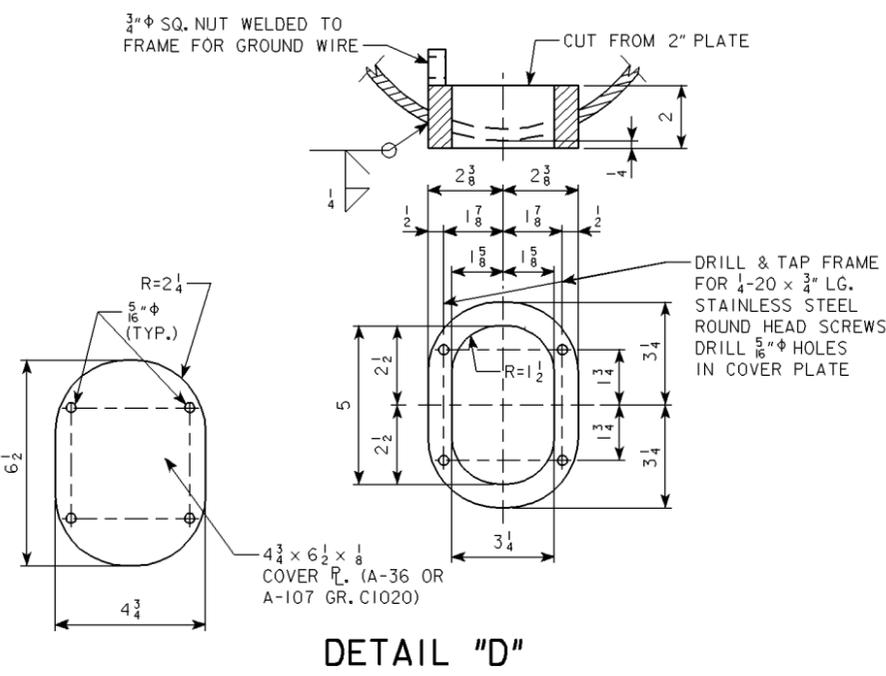
ELECTRICAL INLET

NOTE: INLET COUPLING IS TO BE STEEL OR ALUMINUM FOR FASTENING TO STEEL OR ALUMINUM MEMBERS RESPECTIVELY AND SHALL BE FITTED WITH STANDARD PLUGS UNTIL CONDUIT IS INSTALLED.

NOTE: HAND HOLES AND ELECTRICAL INLET HOLES IN BOTH END TRUSS SUPPORTS AND ELECTRICAL INLET HOLES IN BOTH END OVERHEAD TRUSS SECTIONS AND ON DYNAMIC MESSAGE SIDE ONLY.



BASE CROSS-SECTION



DETAIL "D"

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0
206	SCOTT	S.B. 1-74	2187+60	70'-0

FILE NO. 30150

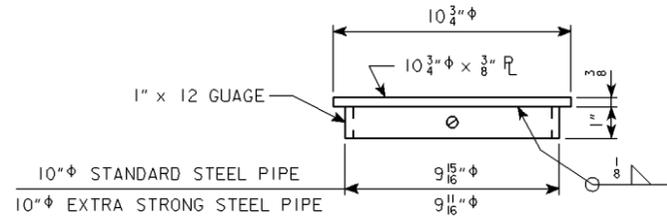
Iowa Department of Transportation Highway Division

STANDARD DESIGN  
ALUMINUM OVERHEAD SIGN TRUSS WITH GALVANIZED STEEL SUPPORTS  
FEBRUARY, 2006

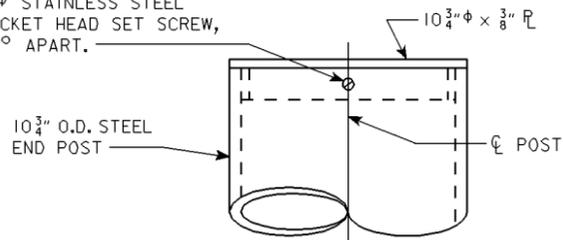
ELECTRICAL ACCESS & BASE PLATE DETAILS  
50' TO 70' SPANS

STOH-04-06 DMS

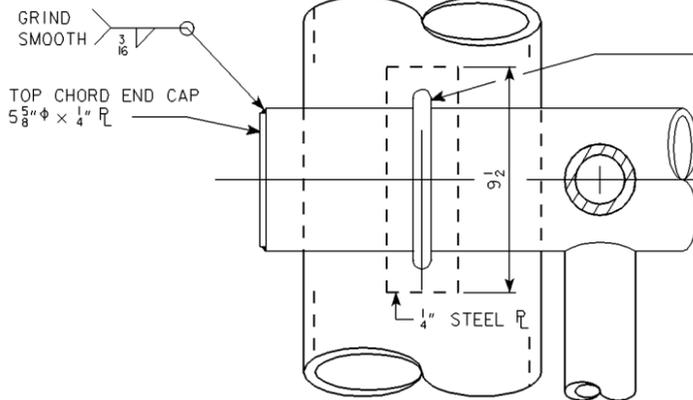
NOTE: SEE STD. SHEET STOH-09-09 FOR DETAILS OF DETAIL "B" & "C".



DRILL AND TAP FOR FOUR 1/4" STAINLESS STEEL SOCKET HEAD SET SCREW, 90° APART.



END POST TOP DETAIL

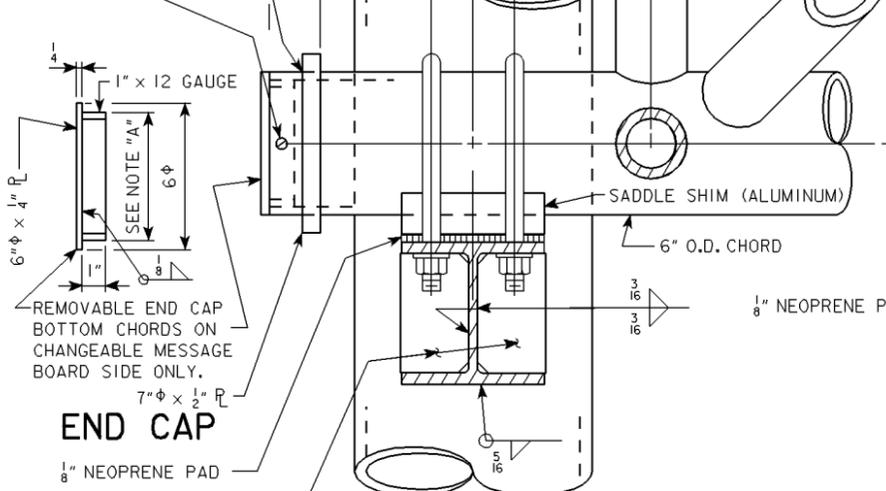


VIEW B-B

DETAIL "B" (TOP CHORD)

NOTE "A": 5 5/8"  $\phi$  FOR 6" O.D. x 5/16" WALL  
5 7/16"  $\phi$  FOR 6" O.D. x 1/4" WALL

DRILL AND TAP FOR FOUR 1/4" STAINLESS STEEL SOCKET HEAD SET SCREWS, 90° APART.



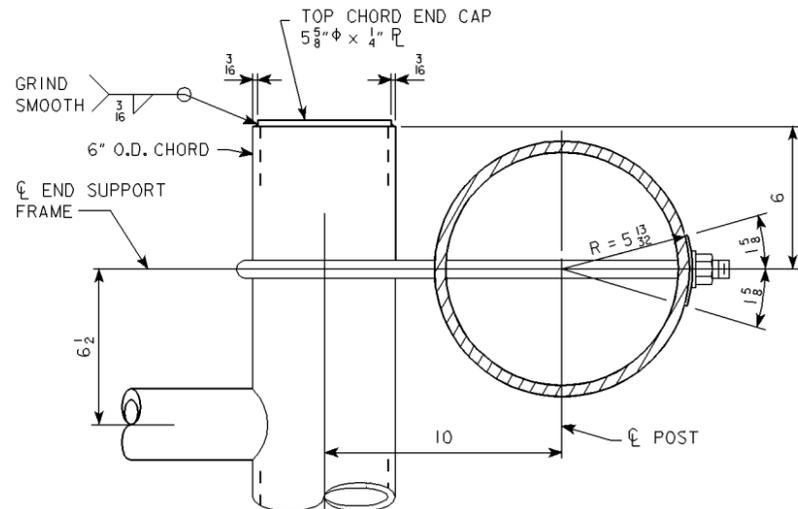
END CAP

1/8" NEOPRENE PAD

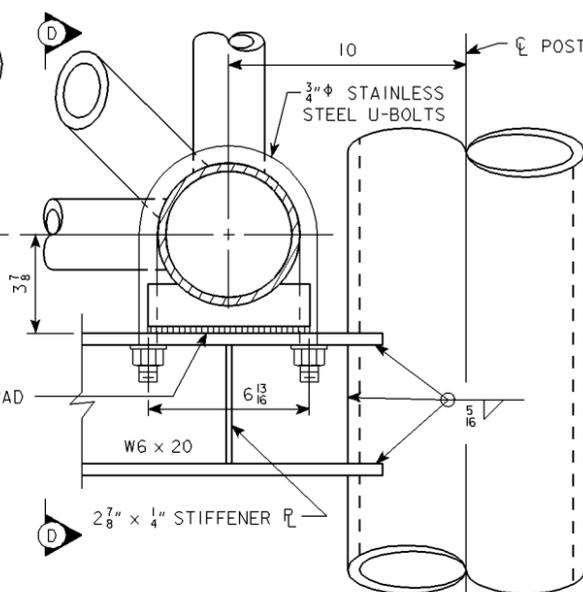
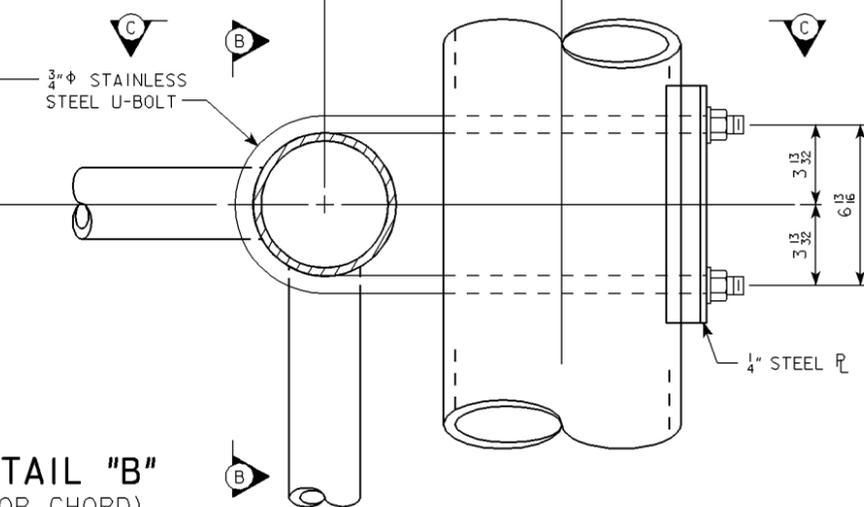
2 7/8" x 1/4" STIFFENER PLATE CLOSE FIT TOP AND BOTTOM (NO WELD)

VIEW D-D

DETAIL "C" (BOTTOM CHORD)



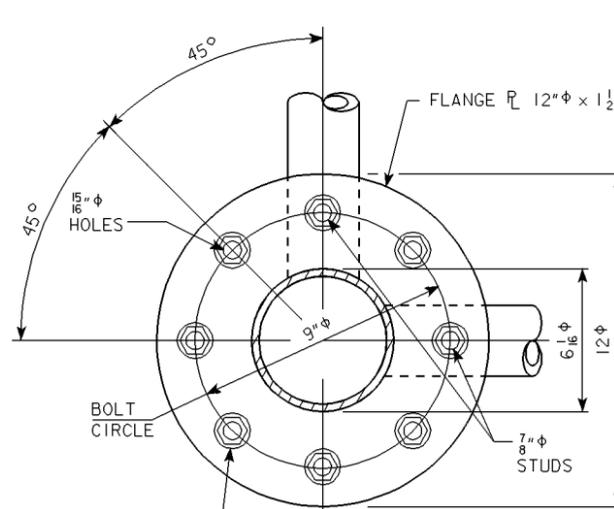
VIEW C-C



DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0"
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0"
206	SCOTT	S.B. 1-74	2187+60	70'-0"

FILE NO. 30150

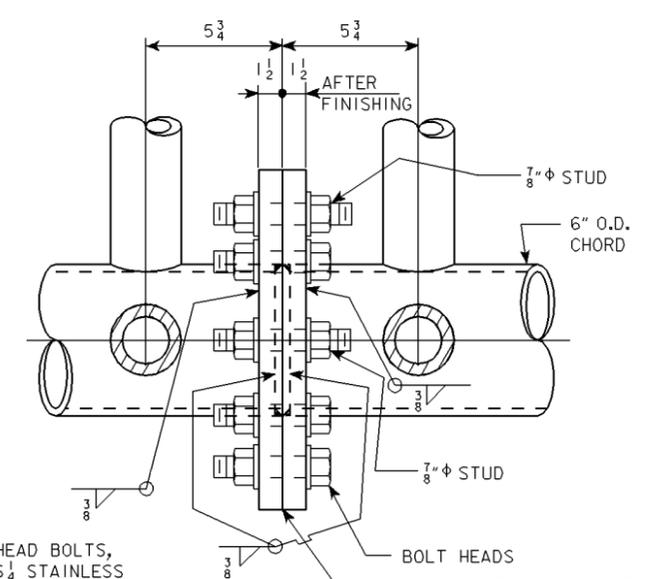
NOTE: SEE STD. SHEETS STO-04-06 OR STO-07-06 FOR LOCATION OF DETAILS "B" & "C".



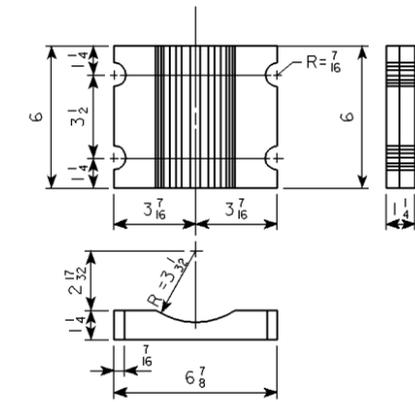
CHORD SPLICE

7/8" x 4 3/4" STAINLESS STEEL HEXAGONAL HEAD BOLTS, 24 REQUIRED PER TRUSS SPLICE, 7/8" x 6 1/4" STAINLESS STEEL STUDS THREADED 2" FROM EACH END, PLACED AT HORIZONTAL MEMBERS, 8 REQUIRED PER TRUSS SPLICE. 64 WASHERS REQUIRED PER TRUSS SPLICE. 44 STAINLESS STEEL 7/8" REGULAR HEX NUTS & JAM NUTS REQUIRED PER TRUSS SPLICE. DRILL EIGHT (8) 15/16" DIA. HOLES IN EACH FLANGE. TORQUE 7/8" BOLTS TO 200 FT-LB.

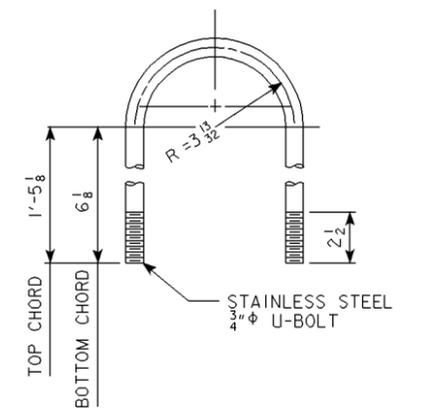
NOTE: FLANGES MAY BE WELDED TO CHORD MEMBERS AFTER FINISHING PROVIDED PROPER ALIGNMENT IS SECURED.



ALUMINUM SADDLE SHIM DETAIL



STAINLESS STEEL U-BOLT DETAIL



Iowa Department of Transportation Highway Division

STANDARD DESIGN

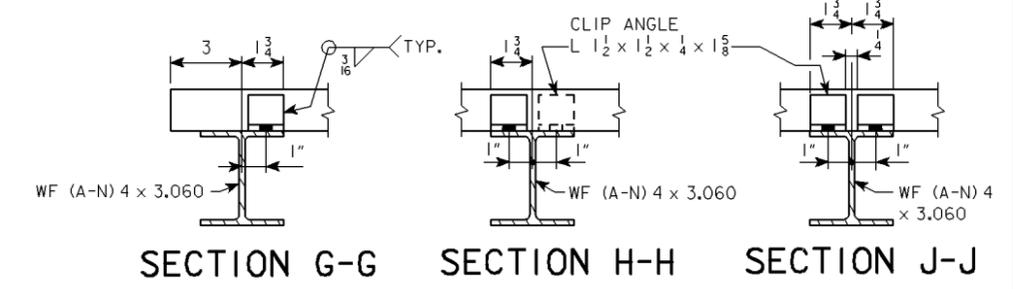
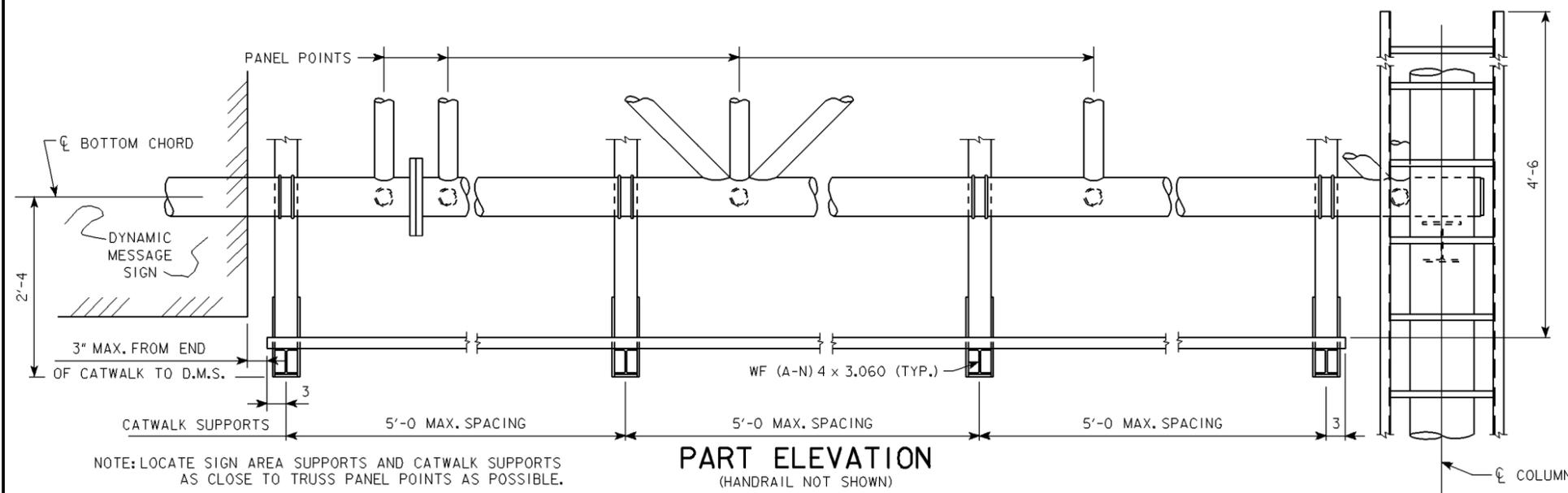
ALUMINUM OVERHEAD SIGN TRUSS WITH GALVANIZED STEEL SUPPORTS

FEBRUARY, 2006

TRUSS SUPPORT AND CHORD SPLICE DETAILS

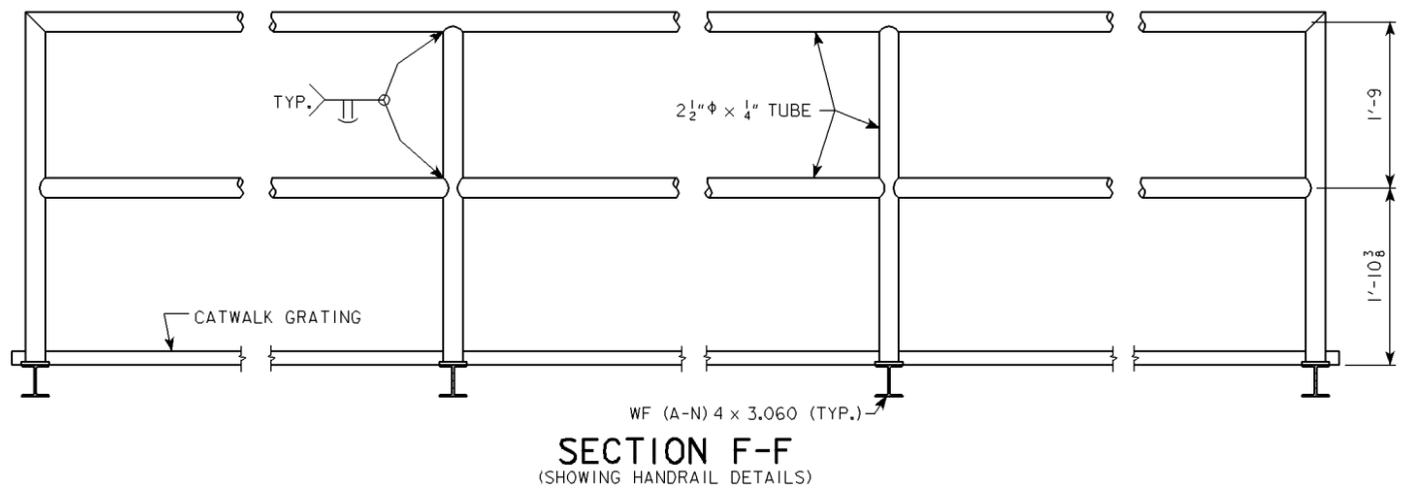
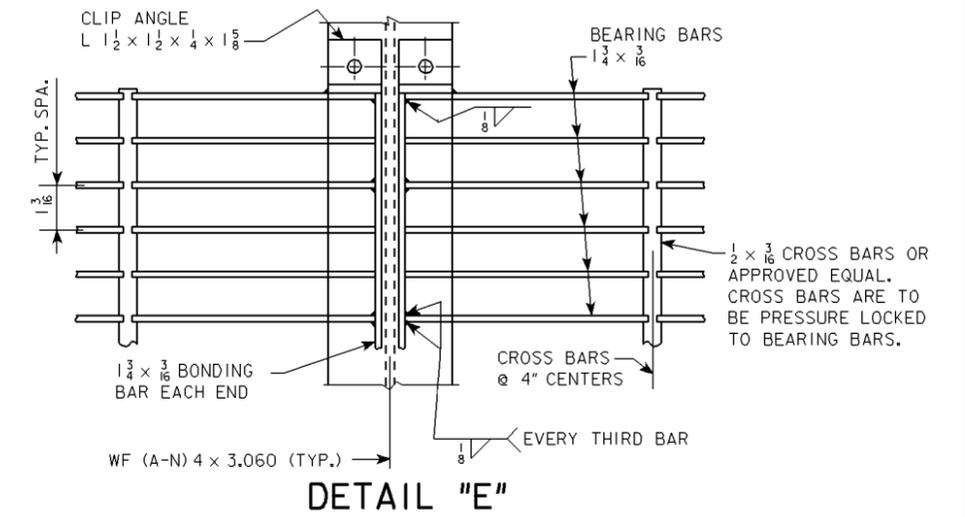
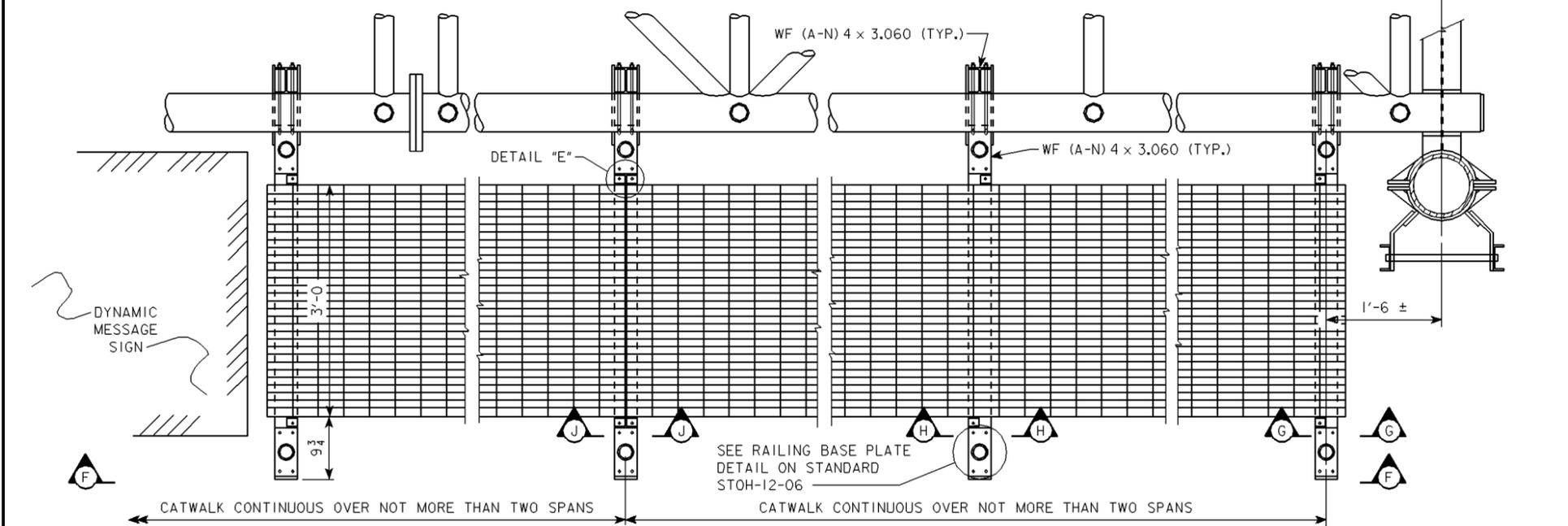
STOH-09-06 DMS

50' TO 100' SPANS



NOTE:  $\frac{7}{16}$ "  $\phi$  HOLE IN CLIP ANGLE AND  $\frac{7}{16}$ "  $\phi$  HOLE IN WF (A-N) 4 x 3.060 (ALUMINUM) FOR  $\frac{3}{8}$ "  $\phi$  STAINLESS STEEL BOLT. ADJUST CLIP SO GRATING BEARS ON BEAM.

NOTE: THE FOLLOWING ALUMINUM ALLOYS ARE TO BE USED IN THE FABRICATION OF CATWALK GRATING AND HANDRAIL:  
 CATWALK GRATING:  
 BEARING BARS - 6061-T6  
 CROSS BARS - 6063-T5 OR 6061-T6  
 HANDRAILS:  
 2 1/2"  $\phi$  TUBE - 6061-T6



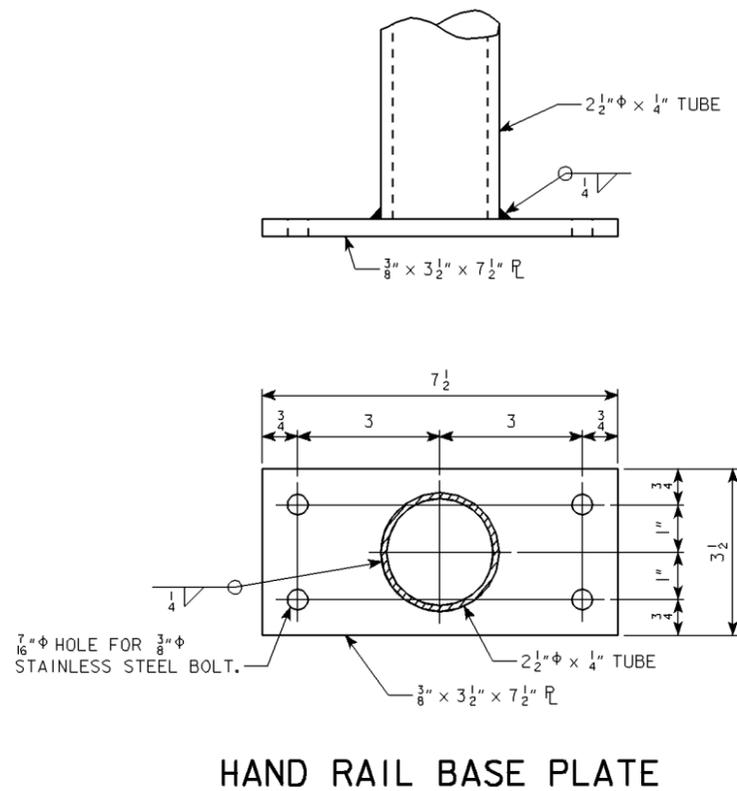
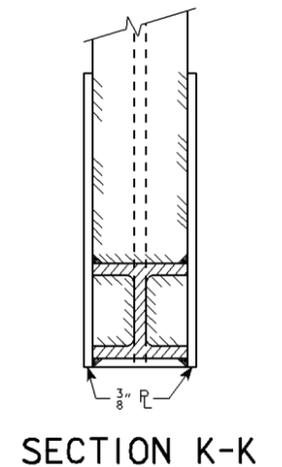
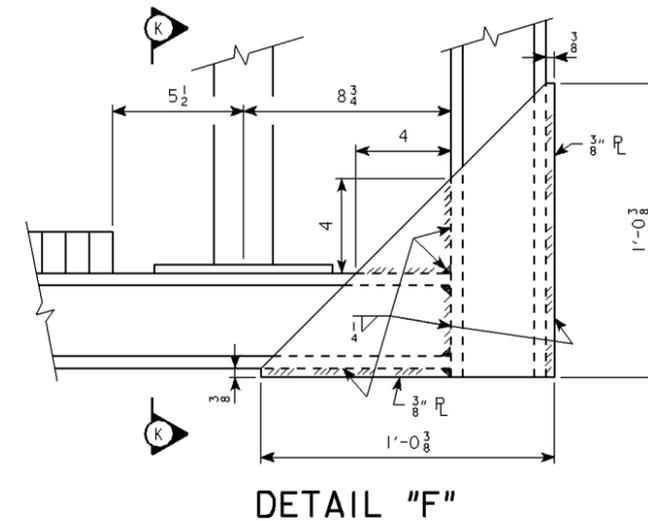
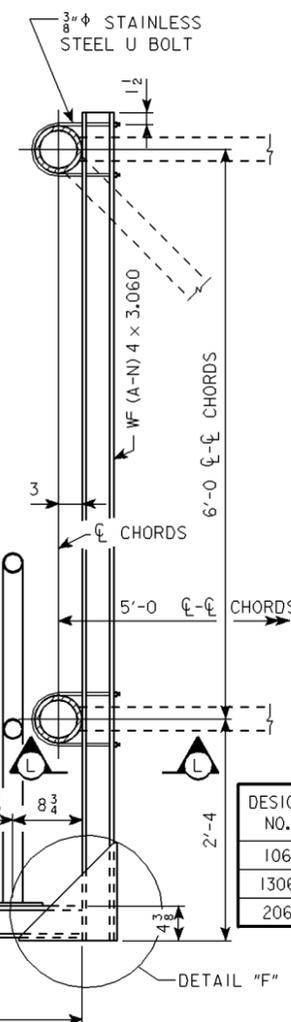
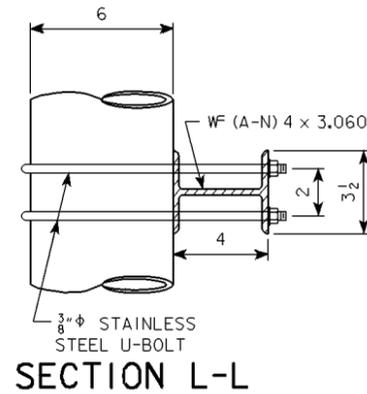
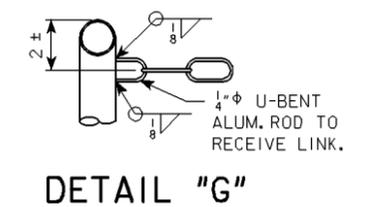
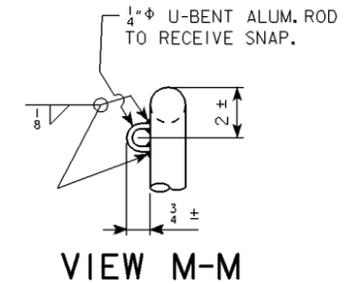
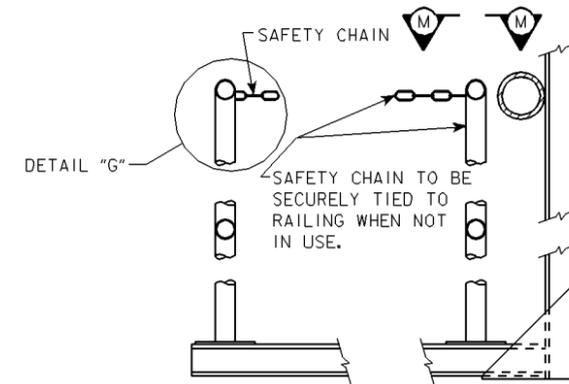
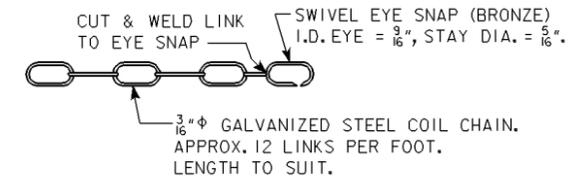
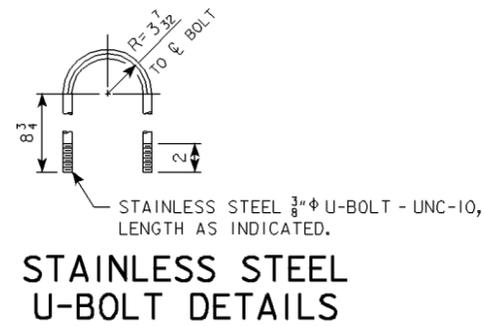
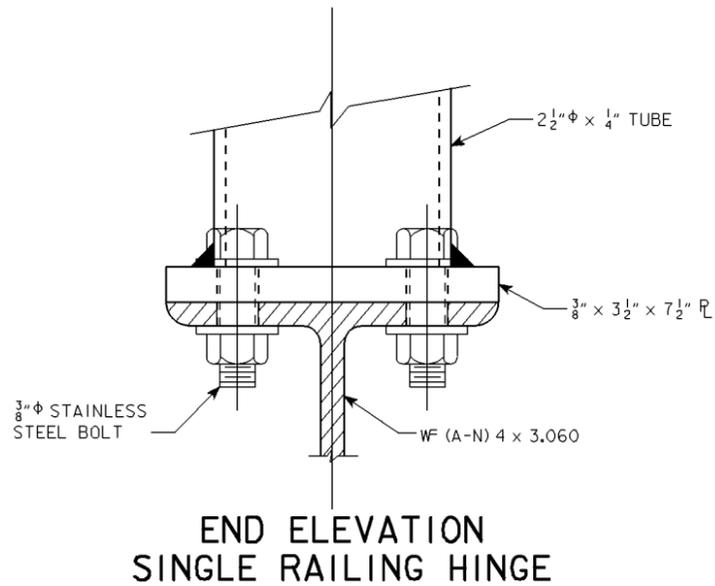
DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0"
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0"
206	SCOTT	S.B. 1-74	2187+60	70'-0"

FILE NO. 30150

**Iowa Department of Transportation**  
**Highway Division**

STANDARD DESIGN  
**ALUMINUM OVERHEAD SIGN TRUSS**  
**WITH GALVANIZED STEEL SUPPORTS**  
 FEBRUARY, 2006

<b>CATWALK (ALUMINUM) DETAILS</b> 50' TO 100' SPANS	<b>STOH-11-06 DMS</b>
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**TYPICAL CATWALK AND SIGN PANEL SECTION**  
NOTE: ONE CHAIN AND SNAP ASSEMBLY IS REQUIRED AT THE OPEN END OF CATWALK.

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0"
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0"
206	SCOTT	S.B. 1-74	2187+60	70'-0"

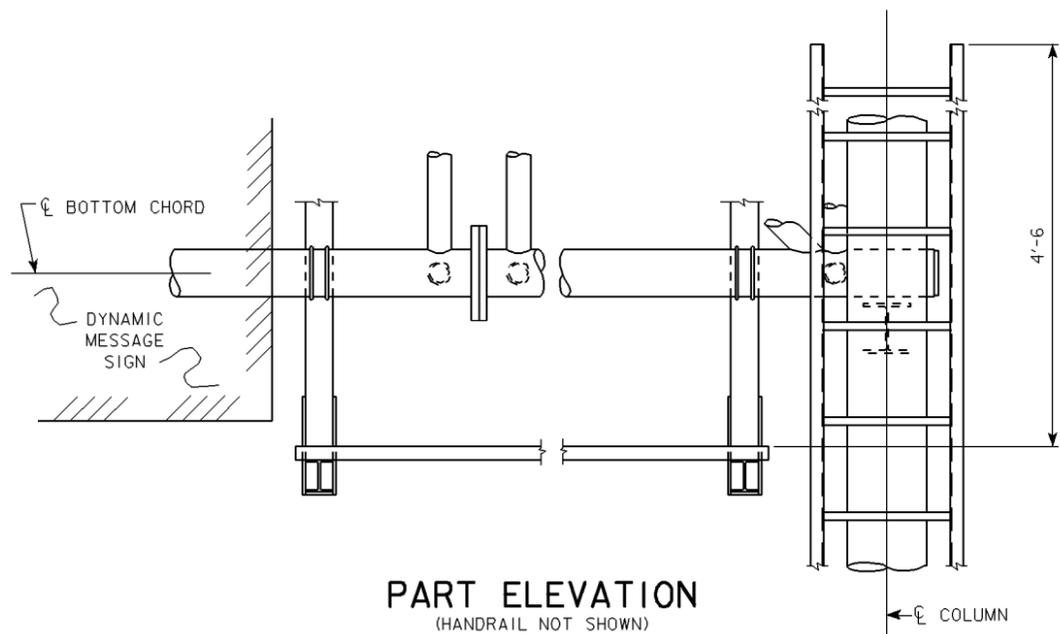
FILE NO. 30150

**Iowa Department of Transportation  
Highway Division**

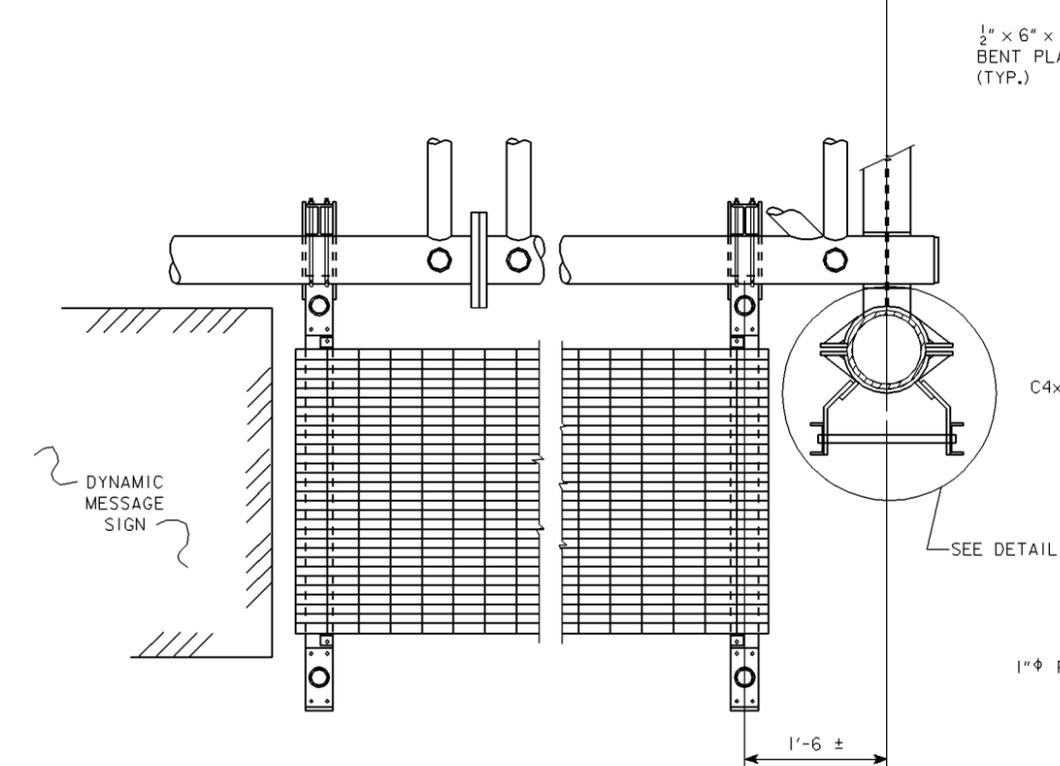
STANDARD DESIGN  
**ALUMINUM OVERHEAD SIGN TRUSS  
WITH GALVANIZED STEEL SUPPORTS**  
FEBRUARY, 2006

**CATWALK AND  
SIGN SUPPORT DETAILS**  
50' TO 100' SPANS

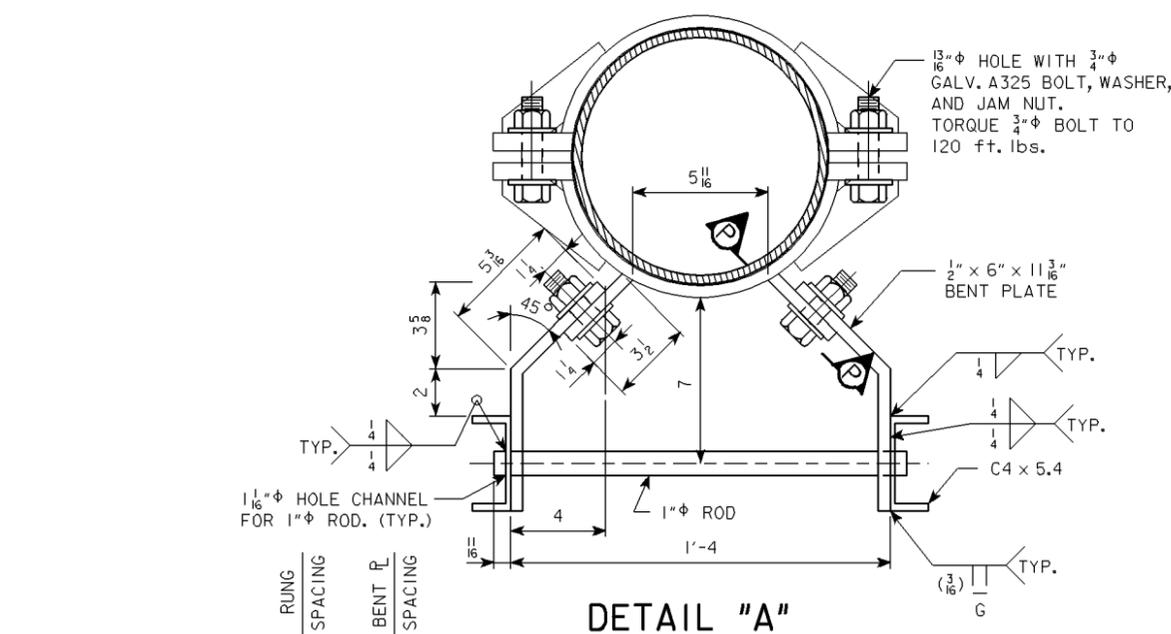
**STOH-12-06  
DMS**



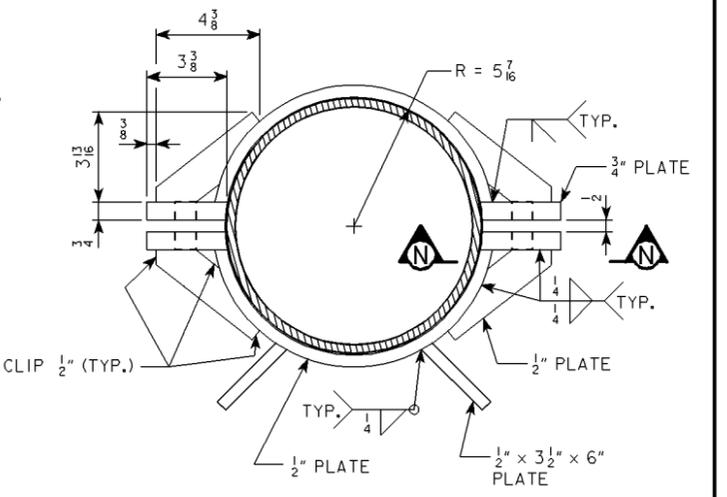
**PART ELEVATION**  
(HANDRAIL NOT SHOWN)



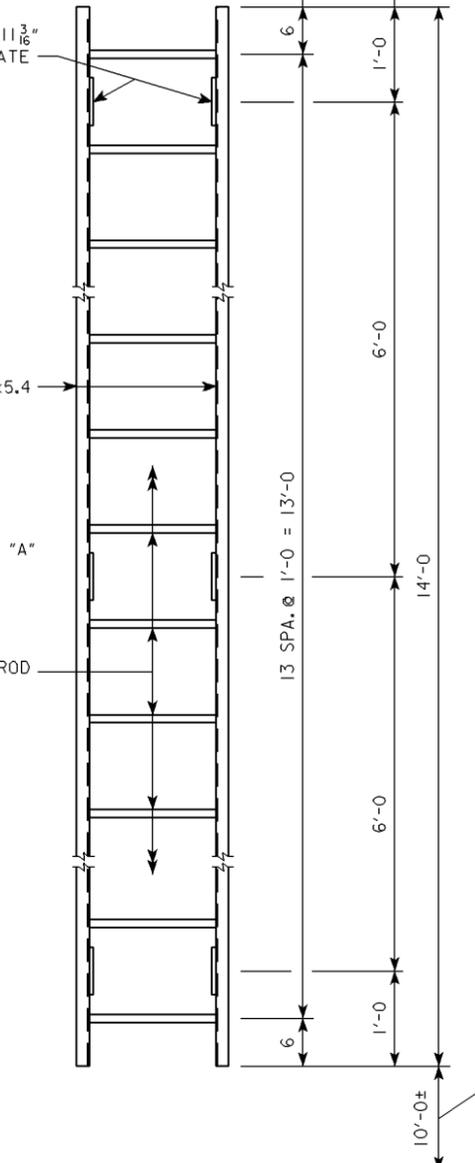
**PART PLAN**  
(HANDRAIL NOT SHOWN)



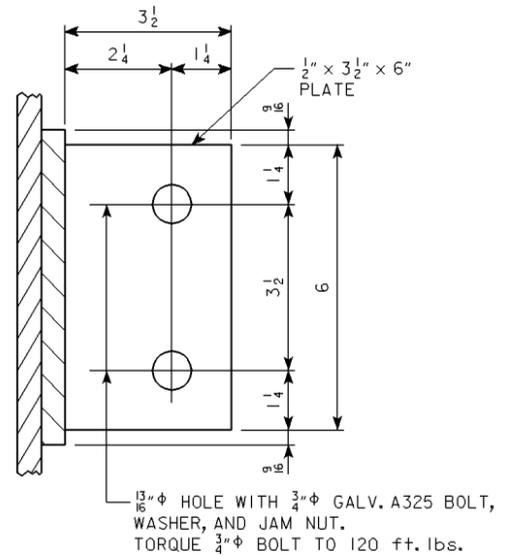
**DETAIL "A"**



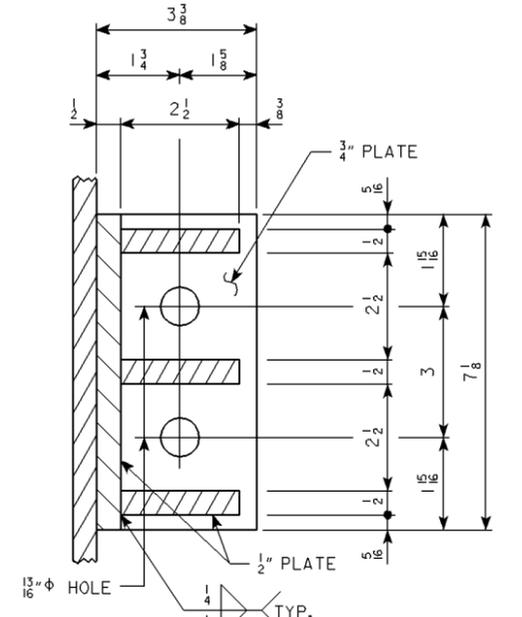
**CLAMP ASSEMBLY**  
(3 REQUIRED PER LADDER)



**LADDER ELEVATION**  
(CLAMP ASSEMBLY NOT SHOWN)



**SECTION P-P**



**SECTION N-N**

**LADDER NOTES:**

ALL STEEL SHAPES, BARS AND PLATES SHALL COMPLY WITH ASTM A36. GALVANIZED BOLT SHALL COMPLY WITH ASTM 325 AS PER STANDARD SPECIFICATION.

ALL STEEL SECTION SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.

STEEL WELDING SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE AWS SPECIFICATION D1.1, STRUCTURAL WELDING CODE-STEEL.

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0
206	SCOTT	S.B. 1-74	2187+60	70'-0

FILE NO. 30150

DIMENSION IS FROM BOTTOM OF LADDER TO BASE OF TRUSS SUPPORT.

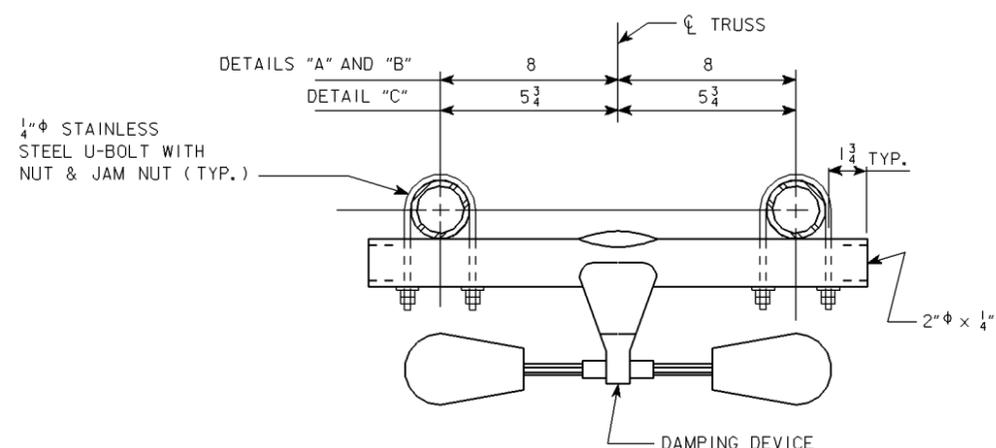
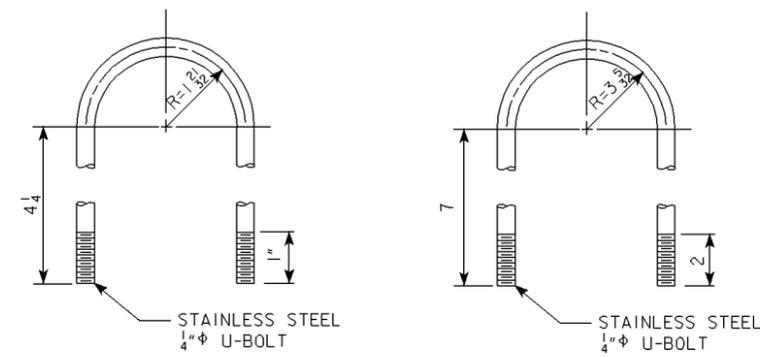
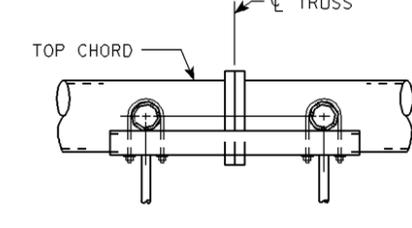
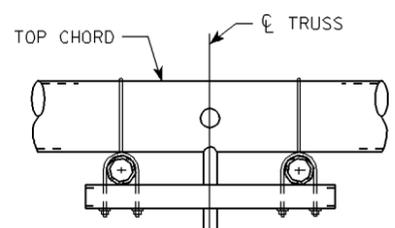
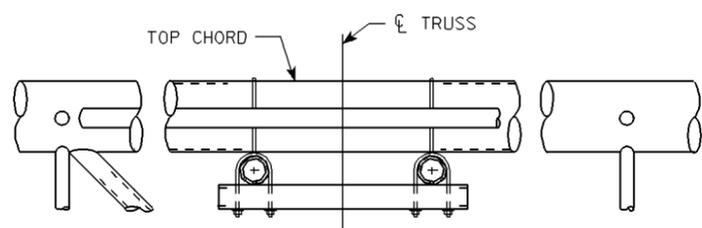
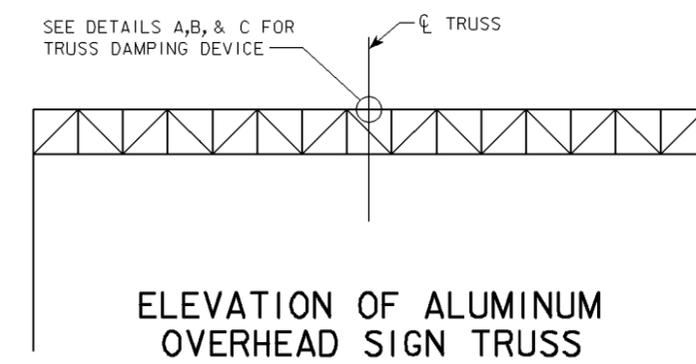
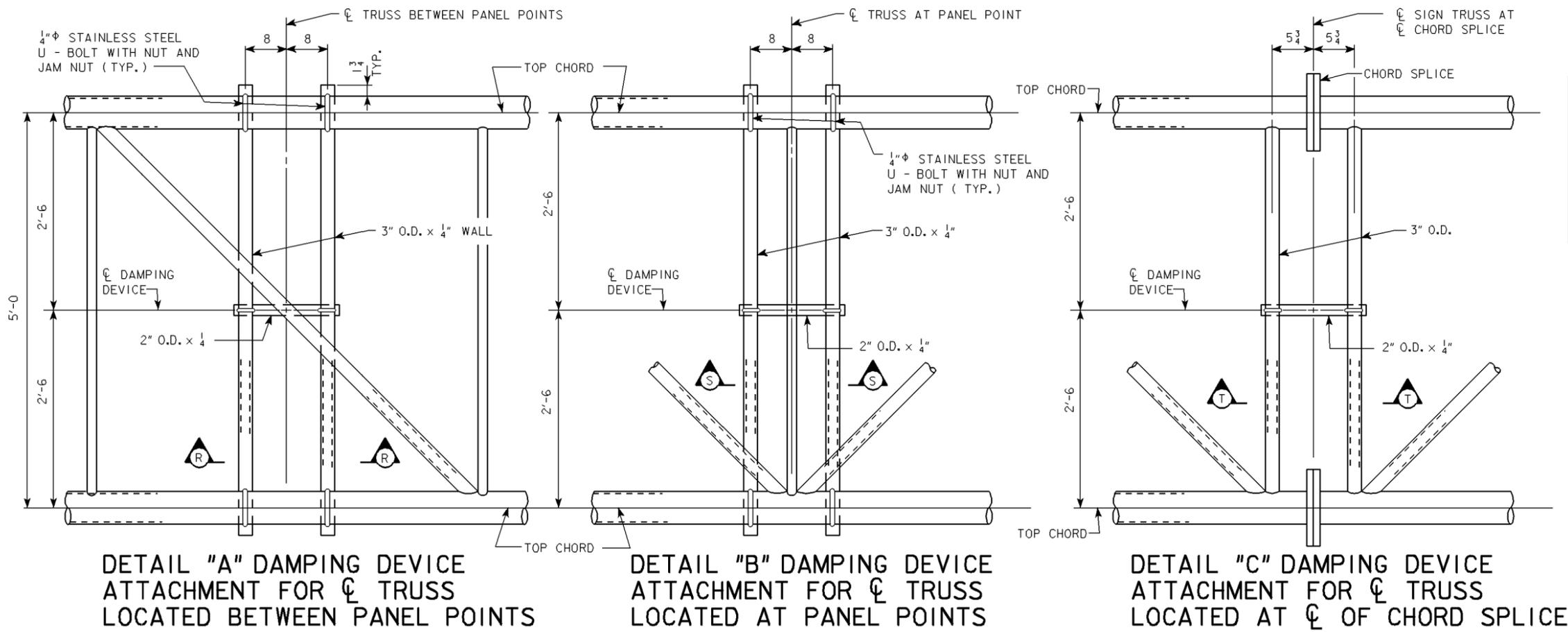
**Iowa Department of Transportation**  
**Highway Division**

STANDARD DESIGN

**ALUMINUM OVERHEAD SIGN TRUSS**  
**WITH GALVANIZED STEEL SUPPORTS**

FEBRUARY, 2006

**LADDER DETAILS**      **STOH-13-06**  
50' TO 100' SPANS      **DMS**



NOTE:  
IN SECTIONS A-A, B-B AND C-C, THE DAMPING DEVICE IS NOT SHOWN.

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'-0
1306	BLACK HAWK	S.B. 1-380	6853+50	70'-0
206	SCOTT	S.B. 1-74	2187+60	70'-0

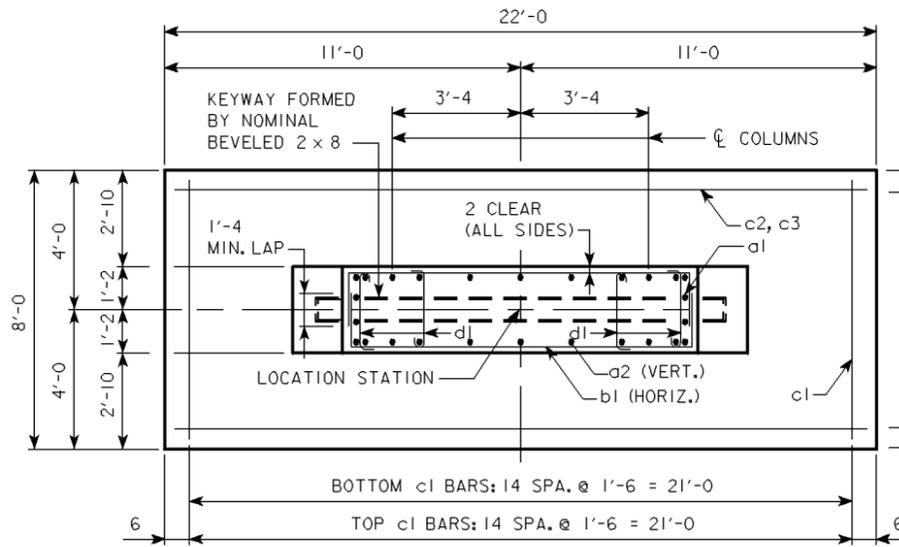
FILE NO. 30150

**Iowa Department of Transportation**  
**Highway Division**

STANDARD DESIGN  
**ALUMINUM OVERHEAD SIGN TRUSS WITH GALVANIZED STEEL SUPPORTS**  
FEBRUARY, 2006

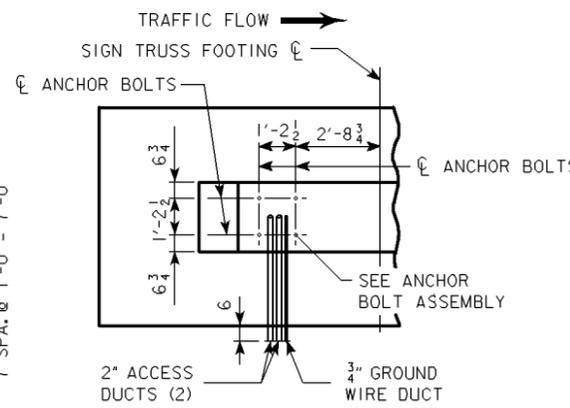
**DAMPING DEVICE DETAILS**  
50' TO 100' SPANS

**STOH-14-06**

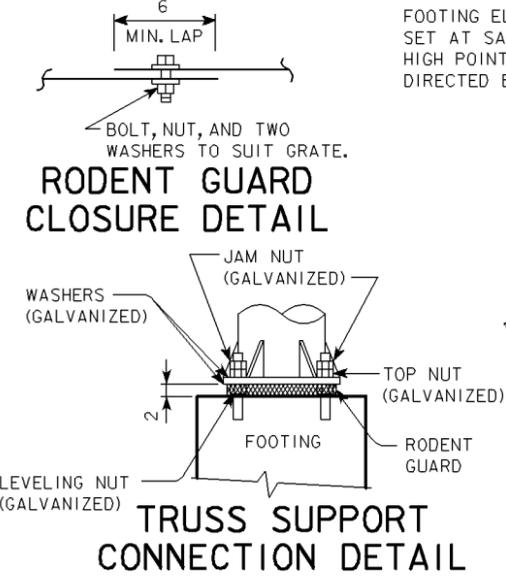


**PLAN**

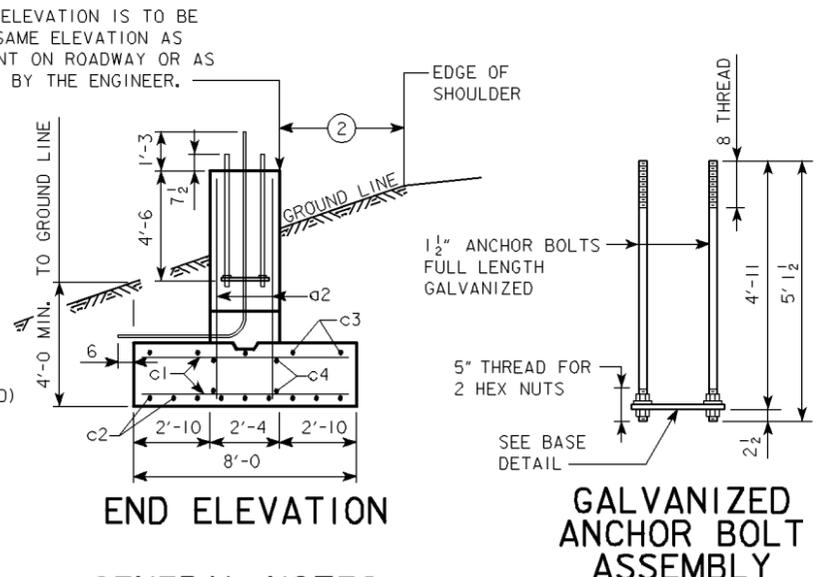
(ANCHOR BOLT ASSEMBLIES AND WIRE DUCTS NOT SHOWN.)



**WIRE DUCT AND ANCHOR BOLT PLACEMENT DETAILS**

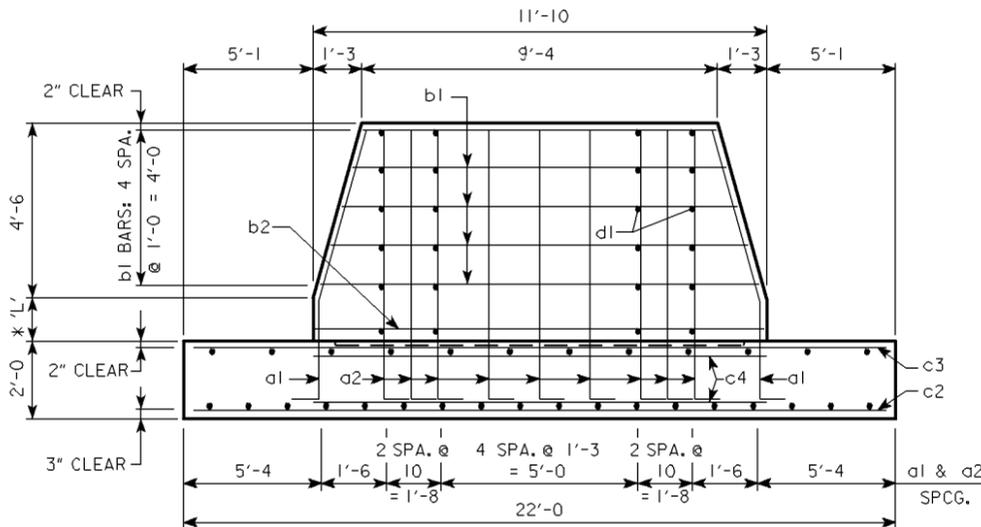


**TRUSS SUPPORT CONNECTION DETAIL**



**END ELEVATION**  
**GENERAL NOTES:**

- STRUCTURAL CONCRETE, CLASS C, SHALL BE USED FOR THE FOOTING.
- EXCAVATION FOR FOOTING SHALL BE TO NEAT LINES AND CONCRETE SHALL BE PLACED AGAINST THE UNDISTURBED MATERIAL. ALL EXCAVATION FOR THE FOOTING SHALL BE DISPOSED OF IN THE AREA ADJACENT TO THE FOOTING AND SHAPED TO NORMAL GROUND CONTOUR, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. MAXIMUM DESIGN BEARING CAPACITY IS 1.5 TONS PER SQUARE FOOT.
- THE REQUIREMENTS PER FOOTING ARE TWO ANCHOR BOLT ASSEMBLIES INCLUDING SHIMS, NUTS (5 PER BOLT) AND WASHERS. REFER TO HARDWARE CLASSIFICATION TABLE FOR MATERIALS AND GALVANIZING REQUIREMENTS.
- A RODENT GUARD SHALL BE PLACED BETWEEN THE CONCRETE FOOTING AND THE BASE PLATE, SEE MATERIALS I.M. 443.01.
- PRICE BID FOR CONTRACT ITEMS SHALL INCLUDE ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT OVERHEAD SIGN FOOTING AS DETAILED HEREON. THE COST OF FURNISHING AND INSTALLING ANCHOR BOLT ASSEMBLIES, CONDUITS AND RODENT GUARD ARE TO BE INCLUDED IN THE UNIT PRICE BID FOR STRUCTURAL CONCRETE. CONTRACT ITEMS FOR OVERHEAD SIGN FOOTING CONSTRUCTION ARE:  
 REINFORCING STEEL, POUNDS  
 EPOXY COATED REINFORCING STEEL, POUNDS  
 STRUCTURAL CONCRETE (MISCELLANEOUS), CUBIC YARDS  
 EXCAVATION, CUBIC YARDS OF CLASS SPECIFIED
- ALL ANCHOR BOLT MATERIAL SHALL COMPLY WITH THE REQUIREMENTS OF IOWA DOT MATERIALS IM 453.08.



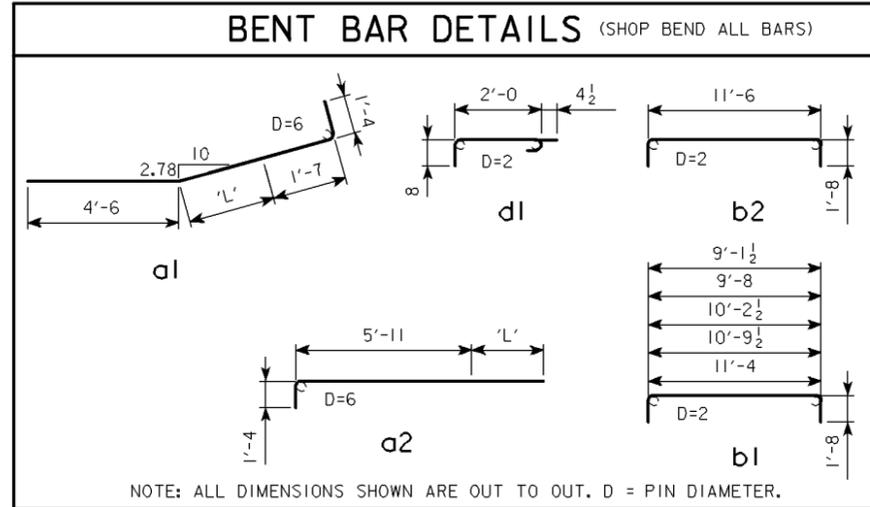
**SIDE ELEVATION**

(ANCHOR BOLT ASSEMBLIES AND WIRE DUCTS NOT SHOWN.)

\* 'L' SHALL NOT EXCEED 6'-0"

HARDWARE CLASSIFICATION				
BOLT SIZE	BOLT GRADE	NUTS	WASHERS	GALVANIZING
1 1/2" φ	ASTM F-1554	ASTM A-563	ASTM F-436	ASTM A-153
FULL LENGTH GALVANIZED ZINC COATED	GRADE 105 GALVANIZED	GALVANIZED	GALVANIZED	CLASS C

CONCRETE PLACEMENT QUANTITIES		
(ONE FOOTING)		
ITEM	'L' = 0	EACH 1'-0 OF 'L'
WALL	4.12	1.02
FOOTING	13.04	
TOTAL (C.Y.)	17.16	1.02



REINFORCING BAR LIST - EPOXY COATED									
(ONE FOOTING)									
	SIZE	SHAPE	'L' = 0				EACH 1'-0 OF 'L'		
			NO.	LENGTH	WEIGHT	SPACING	NO.	LENGTH	WEIGHT
a1	8		8	7'-5	158	SEE DETAIL	8	1'-0 (A)	21
a2	8		18	7'-3	348	SEE DETAIL	18	1'-0 (A)	48
b1	4		10	Varies	91	1'-0	---	---	---
b2	4		---	---	---	---	2 (B)	14'-10	20
c1	6		30	7'-6	338	1'-6	---	---	---
c2	8		8	21'-6	459	1'-0	---	---	---
c3	6		8	21'-6	258	1'-0	---	---	---
c4	4		4	11'-10	32	SEE DETAIL	---	---	---
d1	4		20	3'-0 1/2	41	SEE DETAIL	4 (C)	3'-0 1/2	8
TOTAL 1725 lbs					TOTAL 97 lbs				

- (A) ADDITIONAL LENGTH TO BAR a1 OR a2 FOR 'L' > 0
- (B) TWO IN EACH 1'-0 OF 'L'
- (C) FOUR IN EACH 1'-0 OF 'L'

DESIGN NO.	COUNTY	ROUTE NO.	STATION	STRUCTURE SIZE
106	HAMILTON	N.B. 1-35	749+00	70'
1306	BLACK HAWK	S.B. 1-380	6853+50	70'
206	SCOTT	S.B. 1-74	2187+60	70'

FILE NO. 30150

**Iowa Department of Transportation**  
**Highway Division**

STANDARD DESIGN

**ALUMINUM OVERHEAD SIGN TRUSS WITH GALVANIZED STEEL SUPPORTS**

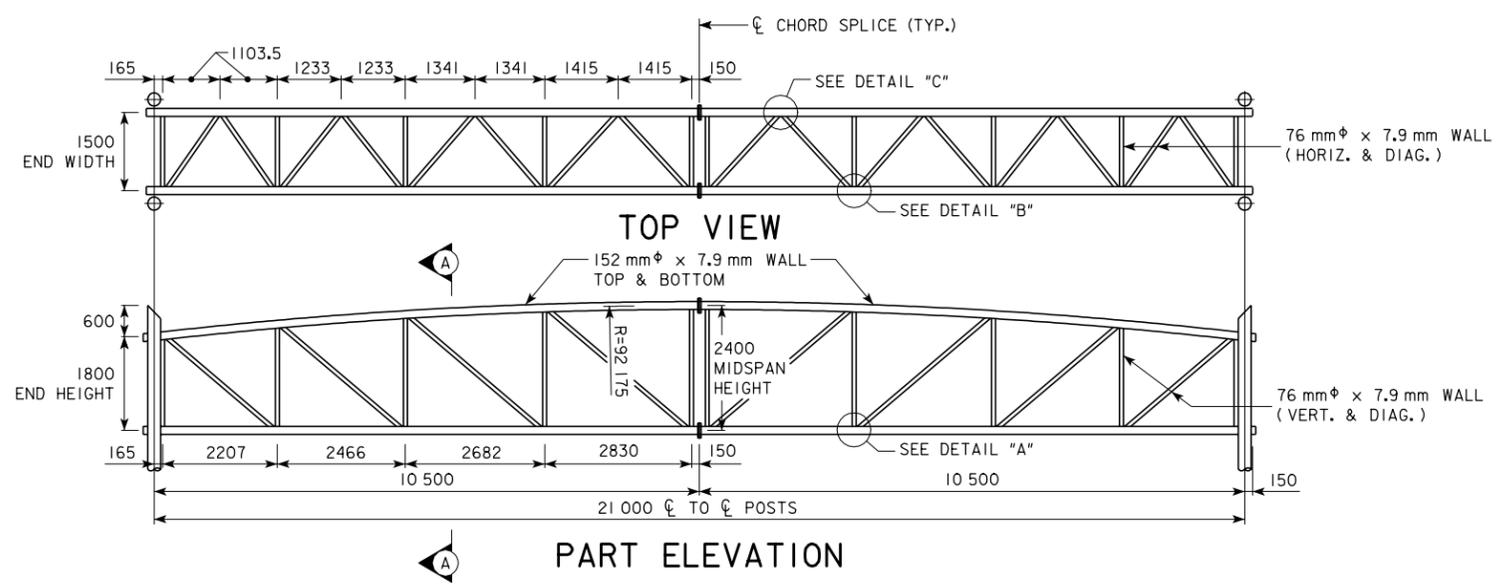
FEBRUARY, 2006

**FOOTING DETAILS**      **STOH-15-06**

50' TO 100' SPANS

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS

21.0m



DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE $\phi$ TO $\phi$ POSTS
3806	595+15	1235 WB	21.0 m
4206	609+20	1235 EB	21.0 m
4306	612+45	1235 EB	21.0 m
4406	612+55	1235 WB	21.0 m
4506	615+55	1235 WB	21.0 m

SEE DESIGN SHEET NO. 3 FOR NOTES AND DETAILS "A", "B" & "C".  
SEE DESIGN SHEET NO. 4 FOR SECTION A-A.

**STRUCTURAL DESIGN**

LICENSED PROFESSIONAL ENGINEER

William D. Tucker

11362

IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

*William D. Tucker* 11/10/05  
Signature Date

William D. Tucker  
Printed or Typed Name

My license renewal date is December 31, 2005

Pages or sheets covered by this seal: V.01 THRU V.15

DESIGN FOR  
**ALUMINUM CANTILEVER TRUSS  
AND STEEL POST**

OCTOBER, 2005

**POLK COUNTY**

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

DESIGN SHEET NO. 1 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

DESIGN TEAM JRH/DAW	ALUMINUM OVERHEAD SIGN TRUSS (ARCHED) - 15.0 m TO 21.0 m SPANS	I-235 SIGN TRUSS 101	POLK COUNTY	PROJECT NUMBER IM-235-2(553)12--13-77	SHEET NUMBER V.01
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DESIGN TEAM JRH/DAW	STATE WIDE	PROJECT NUMBER STP-A-060-S(306)0--0A-00	SHEET NUMBER V.10
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**ANCHOR BOLT NOTES:**

PROCEDURE FOR TIGHTENING ANCHOR BOLT NUTS ON OVERHEAD SIGN TRUSS.

- 1) THIS WORK SHALL BE PERFORMED ONLY ON DAYS WITH WINDS LESS THAN 15 MPH. ALL TIGHTENING OF THE NUTS IS TO BE DONE IN THE PRESENCE OF THE INSPECTOR. ONCE THE TIGHTENING PROCEDURE IS STARTED IT MUST BE COMPLETED ON ALL OF THE NUTS FOR A POLE WITHOUT PAUSE OR DELAY.
- 2) PROPERLY SIZED WRENCHES DESIGNED FOR TIGHTENING NUTS AND/OR BOLTS SHALL BE USED TO AVOID ROUNDING OR OTHER DAMAGE TO THE NUTS. ADJUSTABLE END OR PIPE WRENCHES MAY NOT BE USED.
- 3) BASE PLATE, ANCHOR RODS AND NUTS ARE TO BE FREE OF ANY DIRT OR DEBRIS.
- 4) APPLY STICK WAX OR BEES WAX TO THE THREADS AND BEARING SURFACES OF THE ANCHOR BOLT, NUTS, AND WASHERS.
- 5) TIGHTEN TOP NUTS SO THEY FULLY CONTACT THE BASE PLATE. TIGHTEN LEVELING NUTS TO SNUG TIGHT CONDITION. SNUG TIGHT IS DEFINED AS THE FULL EFFORT OF ONE PERSON ON A WRENCH WITH A LENGTH EQUAL TO 14 TIMES THE BOLT DIAMETER BUT NOT LESS THAN 450 mm. APPLY THE FULL EFFORT AS CLOSE TO THE END OF THE WRENCH AS POSSIBLE. PULL FIRMLY BY LEANING BACK AND USING ENTIRE BODY WEIGHT ON THE END OF THE WRENCH UNTIL THE NUT STOPS ROTATING. USE A MINIMUM OF TWO SEPARATE PASSES OF TIGHTENING. SEQUENCE THE TIGHTENING IN EACH PASS SO THAT THE NUT ON THE OPPOSITE SIDE, TO THE EXTENT POSSIBLE, WILL BE SUBSEQUENTLY TIGHTENED UNTIL ALL OF THE NUTS IN THAT PASS HAVE BEEN TIGHTENED.
- 6) TIGHTEN TOP NUTS TO SNUG TIGHT AS DESCRIBED FOR THE LEVELING NUTS.
- 7) MATCH-MARK THE TOP NUTS AND BASE PLATE USING PAINT, CRAYON, OR OTHER APPROVED MEANS TO PROVIDE A REFERENCE FOR DETERMINING THE RELATIVE ROTATION OF THE NUT AND BASE PLATE DURING TIGHTENING. USING A STRIKING OR HYDRAULIC WRENCH, FURTHER TIGHTEN THE TOP NUTS IN TWO PASSES AS LISTED IN THE FOLLOWING TABLE. USE A SEQUENCE OF TIGHTENING IN EACH PASS SO THAT THE NUT ON THE OPPOSITE SIDE, TO THE EXTENT POSSIBLE, WILL BE SUBSEQUENTLY TIGHTENED UNTIL ALL NUTS IN THAT PASS HAVE BEEN TURNED. DO NOT ROTATE THE LEVELING NUT DURING THE TOP NUT TIGHTENING.

ANCHOR BOLT SIZE	FIRST PASS	SECOND PASS	TOTAL ROTATION
LESS THAN OR EQUAL TO 38.1 mm $\phi$ "	1/6 TURN	1/6 TURN	1/3 TURN
GREATER THAN 38.1 mm $\phi$ "	1/12 TURN	1/12 TURN	1/6 TURN

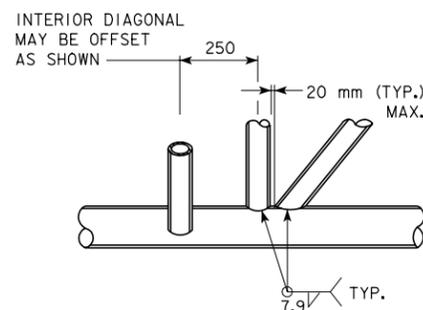
- 8) LUBRICATE, PLACE AND TIGHTEN THE LOCK NUTS TO SNUG TIGHT.

**SPECIFICATIONS:**

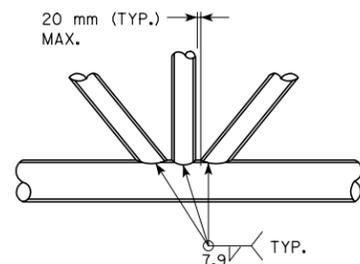
DESIGN: A.A.S.H.T.O. STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, SERIES OF 2001 WITH 2002 AND 2003 INTERIMS; STATE STANDARD FATIGUE DESIGN.  
 CONSTRUCTION: IOWA D.O.T. STANDARD SPECIFICATIONS, SERIES 2001 PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT.

**DESIGN STRESSES:**

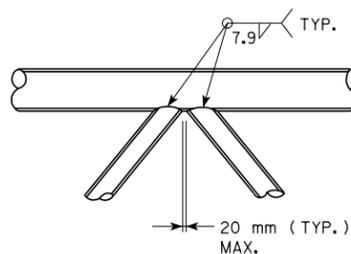
DESIGN STRESSES FOR MATERIALS ARE IN ACCORDANCE WITH A.A.S.H.T.O. STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGN, LUMINAIRES AND TRAFFIC SIGNALS, SERIES OF 2001 WITH 2002 AND 2003 INTERIMS.



**DETAIL "A"**  
SEE DESIGN SHEET NO. 1 FOR LOCATION



**DETAIL "B"**  
SEE DESIGN SHEET NO. 1 FOR LOCATION



**DETAIL "C"**  
SEE DESIGN SHEET NO. 1 FOR LOCATION

**ALUMINUM WELDING NOTES:**

ALUMINUM WELDING SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF AWS SPECIFICATION D1.2 STRUCTURAL WELDING CODE-ALUMINUM WITH WORKMANSHIP REQUIREMENTS FOR CLASS II STRUCTURES EXCEPT AS MODIFIED BY THE FOLLOWING NOTES.

- (1) ALL WELDING SHALL BE DONE BY GAS METAL-ARC WELDING (GMAW) PROCESS.
- (2) ONLY STRINGER BEAD TECHNIQUE SHALL BE USED IN WELDING. NO WEAVE BEAD TECHNIQUE IS ALLOWED.
- (3) INTERPASS TEMPERATURE SHALL NOT EXCEED 93° C.
- (4) TACK WELD ENDS SHALL BE FILLED AND NOT TERMINATE IN CRATERS. IF A TACK WELD IS CRACKED, THE CRACK SHALL BE REMOVED BEFORE WELDING BEGINS.
- (5) ALL INITIAL ROOT PASSES SHALL NOT EXCEED 8 mm AND MUST PENETRATE THE ROOT.
- (6) THE CONVEXITY OF FILLET WELD SHALL NOT EXCEED 1.6 mm.
- (7) THE ENTIRE STRUCTURE SHALL BE CLEANED BEFORE SHIPPING.
- (8) TUBES SHOULD BE MILLED TO THE REQUIRED RADII WITH THE MAXIMUM GAP AT ANY POINT NOT GREATER THAN 1.6 mm.
- (9) ALL AREAS OF WELDING MUST BE BRUSHED WITH STAINLESS STEEL BRUSHES IMMEDIATELY PRIOR TO MAKING THE WELDS.
- (10) ONLY MICROSCOPICALLY CLEAN WELDING WIRES (THOSE WHICH HAVE BEEN SHAVED AFTER DRAWING) SHOULD BE USED AND SPOOLS OF WIRE REMAINING AT THE END OF THE DAY'S PRODUCTION SHOULD BE SEALED IN POLYETHYLENE BAGS. WIRE NOT SO PROTECTED SHOULD BE DISCARDED. THIS INCLUDES WIRE IN THE DRIVE ROLLS AND GUN.
- (11) FORCED FITS MUST BE AVOIDED AND ONLY DOWN HAND WELDING IS ALLOWED.
- (12) ALL WELD CRATERS MUST BE ELIMINATED AND WELDS SHOULD CARRY THROUGH TIGHT AREAS WITHOUT STOPPING WHEN POSSIBLE.
- (13) ALUMINUM FILLER ALLOY ER5356 OR ER5556 SHALL BE USED.

**NOTE:**

1. UNLESS OTHERWISE NOTED ON THE PLAN, ALL STAINLESS STEEL BOLTS AND U-BOLTS SHALL BE FURNISHED WITH STAINLESS STEEL REGULAR HEXAGONAL NUTS, JAM NUTS, AND WASHERS UNDER BOTH HEADS AND NUTS.
2. IN CASE THE STAINLESS STEEL LOCK WASHERS ARE USED IN LIEU OF JAM NUTS, THE REGULAR WASHERS UNDER NUTS ARE TO BE OMITTED.

**STEEL NOTES:**

ALL STEEL SHAPES, BARS, AND PLATES SHALL COMPLY WITH ASTM A36 EXCEPT MINOR PARTS APPROVED BY THE ENGINEER MAY COMPLY WITH ASTM A575 GRADE M1020. ALL STEEL PIPE SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A53 GRADE B, TYPE E OR S. STAINLESS STEEL BOLTS SHALL COMPLY WITH ASTM A-320 OR F593 AS PER STANDARD SPECIFICATIONS.

ALL STEEL SECTIONS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123. PROVIDE VENT HOLES FOR GALVANIZING.

STEEL WELDING SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE AWS SPECIFICATIONS D1.1, STRUCTURAL WELDING CODE-STEEL.

MAGNETIC PARTICLE TESTING SHALL BE PERFORMED ON THE POST TO BASE PLATE FILLET WELDS.

**GENERAL NOTES:**

ALL SIGN TRUSSES ARE DESIGNED FOR 145 kg/m<sup>2</sup> WIND PRESSURE ON TRUSS MEMBERS AND SIGN PANELS.

ALL ROUND TUBES, SIGN SUPPORT, BARS, AND PLATES FOR THE OVERHEAD SIGN TRUSS SHALL BE ALUMINUM ALLOY 6061-T6 UNLESS OTHERWISE NOTED OR SHOWN.

ALL DIAMETERS OF ALUMINUM TUBING SHOWN ARE OUTSIDE DIAMETERS.

ALL PIPES, SHAPES, AND PLATES FOR THE END SUPPORT FRAMES SHALL BE STRUCTURAL STEEL COMPLYING WITH THE ASTM SPECIFICATIONS NOTED.

EACH TRUSS WILL HAVE ONE SHORT STEEL SUPPORT AT THE MEDIAN AND ONE LONG STEEL SUPPORT AT THE OUTSIDE SHOULDER.

ALL DIMENSIONS IN MILLIMETERS (mm) UNLESS OTHERWISE NOTED OR SHOWN.

SHOP DRAWINGS SHALL BE SUBMITTED FOR APPROVAL.

SHOP DRAWINGS SHALL INDICATE LEFT AND RIGHT SUPPORTS.

THE PRECISE ALIGNING AND ERECTING OF ALL COMPONENTS OF THE OVERHEAD SIGN TRUSS AND ITS SUPPORTS SHALL BE CONSIDERED ESSENTIAL. THE CONTRACTOR SHALL SUBMIT DOCUMENTATION TO THE ENGINEER SHOWING THAT THE VARIOUS COMPONENTS HAVE BEEN MEASURED AND ARE LOCATED WITHIN THE TOLERANCES LISTED BELOW.

**FOUNDATIONS AND ANCHOR BOLTS:**

1. EACH FOUNDATION SHALL BE ACCURATELY LOCATED, WITH CENTER OF THE TWO ANCHOR BOLT GROUPS NOT MORE THAN 25 mm FROM THE PLAN LOCATION IN THE DIRECTION PARALLEL WITH AND PERPENDICULAR TO THE OVERHEAD TRUSS.
2. THE TWO FOUNDATIONS SHALL BE PARALLEL, WITH THE DISTANCES ALONG THE OVERHEAD TRUSS BETWEEN CENTERS OF FRONT AND REAR ANCHOR BOLT GROUPS DIFFERING BY NOT MORE THAN 25 mm.
3. ELEVATION OF THE TOP OF EACH FOUNDATION SHALL BE WITHIN 25 mm OF PLAN ELEVATION.
4. ANCHOR BOLT GROUPS SHALL BE LOCATED ACCURATELY BY TEMPLATE OR OTHER POSITIVE MEANS, WITH CENTERS OF ADJACENT ANCHOR BOLT GROUPS WITHIN 5 mm OF THE CORRECT DISTANCE APART.
5. ANCHOR BOLTS SHALL BE PLUMB WITHIN 1 mm PER 50 mm FROM VERTICAL.
6. ANCHOR BOLTS SHALL PROJECT ABOVE TOP OF FOUNDATION WITHIN 6 mm OF THE PLAN DIMENSION.

**COMPLETED ALUMINUM AND STEEL STRUCTURE:**

1. EACH TRUSS SUPPORT COLUMN SHALL BE PLUMB WITHIN 1 mm PER 200 mm OF VERTICAL IN TWO PERPENDICULAR DIRECTIONS.
2. STICK-OUT OF EACH TRUSS LOWER CHORD SHALL BE WITHIN 70 AND 140 mm MEASURED FROM OUTER U-BOLT TO INSIDE OF CHORD END PLATE.
3. THE TRUSS SHALL BE SQUARE WITHIN SUPPORTS. HORIZONTAL LINE BETWEEN CHORDS SHALL BE LEVEL WITHIN 1 mm PER 200 mm OF HORIZONTAL, AND VERTICAL LINE BETWEEN CHORDS SHALL BE PLUMB WITHIN 1mm PER 200 mm OF VERTICAL.

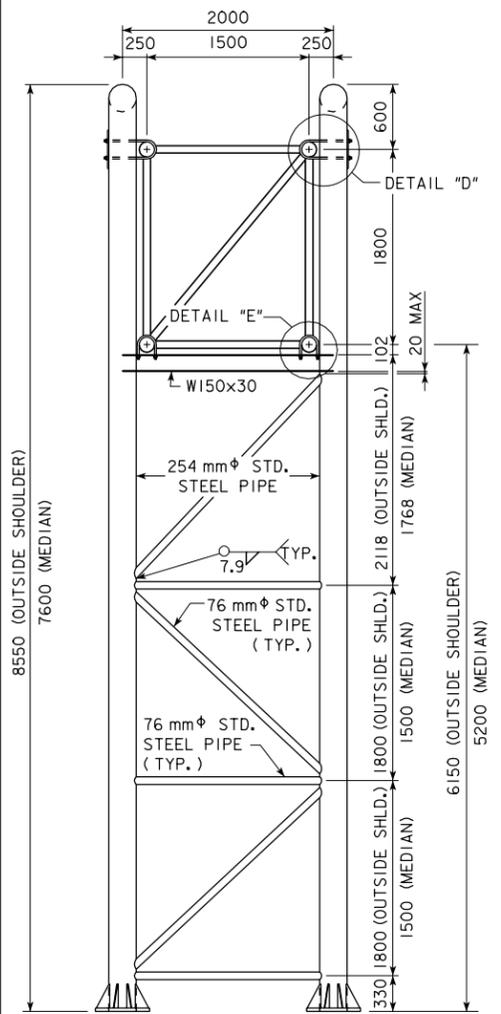
DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE $\phi$ TO $\phi$ POSTS
3306	579+55	I235 EB	27.0 m
3406	579+90	I235 WB	22.5 m
3706	592+15	I235 EB	22.5 m
3806	595+15	I235 WB	21.0 m
4006	600+70	I235 EB	24.0 m
4206	609+20	I235 EB	21.0 m
4306	612+45	I235 EB	21.0 m
4406	612+55	I235 WB	21.0 m
4506	615+55	I235 WB	21.0 m

DESIGN FOR  
**ALUMINUM CANTILEVER TRUSS  
 AND STEEL POST**

OCTOBER, 2005

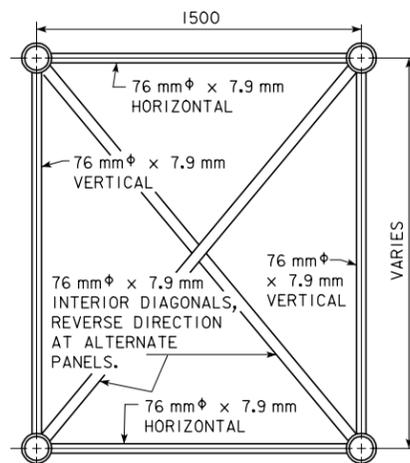
**POLK COUNTY**  
 IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 3 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS



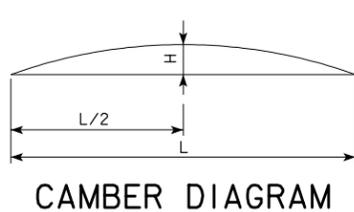
END VIEW OF STEEL TRUSS SUPPORT

(SEE DESIGN SHEET NO. 4 FOR DETAILS OF DETAIL "D" & "E")



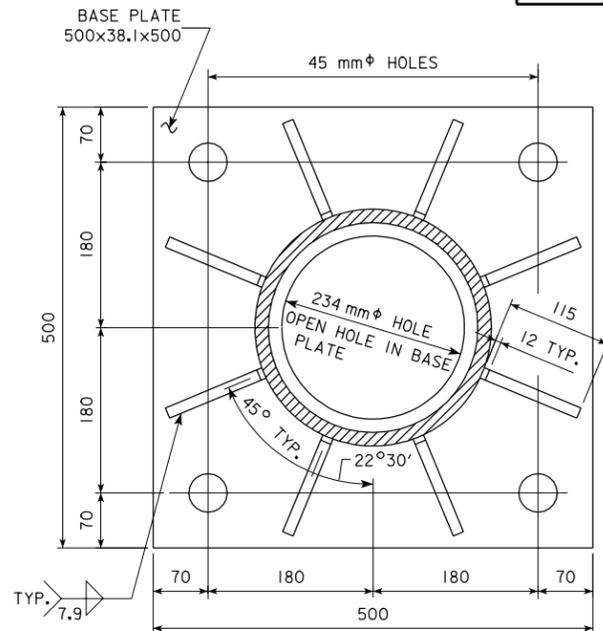
SECTION A-A

(SEE DESIGN SHEET NO. 1 FOR LOCATION OF SECTION A-A)

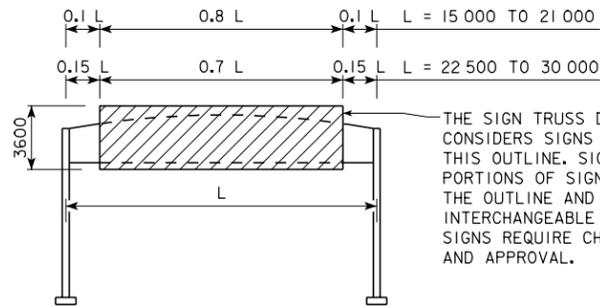


CAMBER DIAGRAM

SPAN L (m)	CAMBER H (mm)
15.0	15
16.5	17
18.0	19
19.5	21
21.0	23
22.5	25
24.0	27
25.5	29
27.0	31
28.5	34
30.0	36

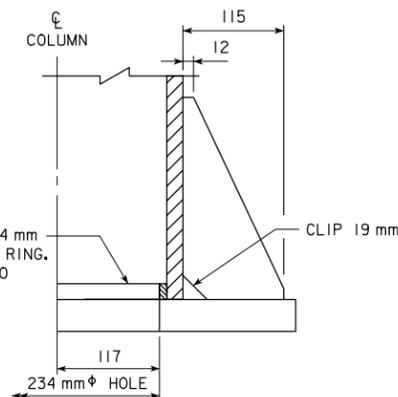


BASE PLATE PLAN

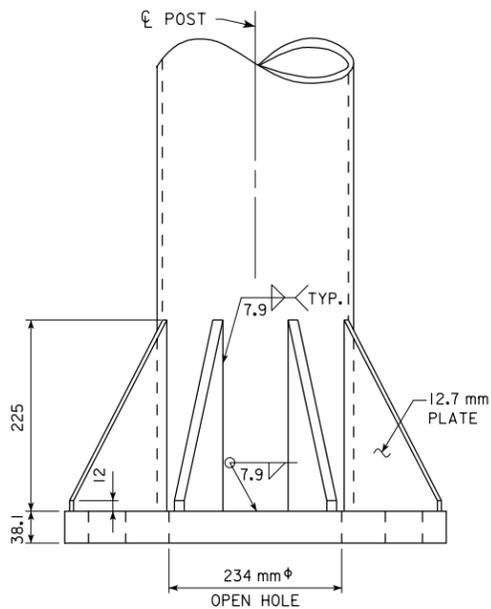


SIGN AREA FOR SIGN TRUSS DESIGN

THE SIGN TRUSS DESIGN CONSIDERS SIGNS WITHIN THIS OUTLINE. SIGNS AND PORTIONS OF SIGNS BEYOND THE OUTLINE AND ALL INTERCHANGEABLE MESSAGE SIGNS REQUIRE CHECKING AND APPROVAL.



BASE CROSS-SECTION



BASE SIDE VIEW

DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE $\phi$ TO $\phi$ POSTS
3306	579+55	1235 EB	27.0 m
3406	579+90	1235 WB	22.5 m
3706	592+15	1235 EB	22.5 m
3806	595+15	1235 WB	21.0 m
4006	600+70	1235 EB	24.0 m
4206	609+20	1235 EB	21.0 m
4306	612+45	1235 EB	21.0 m
4406	612+55	1235 WB	21.0 m
4506	615+55	1235 WB	21.0 m

STEEL NOTES:

ALL STEEL SHAPES, BARS, AND PLATES SHALL COMPLY WITH ASTM A36 EXCEPT MINOR PARTS APPROVED BY THE ENGINEER MAY COMPLY WITH ASTM A575 GRADE M1020. ALL STEEL PIPE SHALL COMPLY WITH THE REQUIREMENTS OF ASTM A53 GRADE B, TYPE E OR S. STAINLESS STEEL BOLTS SHALL COMPLY WITH ASTM A-320 OR F593 AS PER STANDARD SPECIFICATIONS.

ALL STEEL SECTIONS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123. PROVIDE VENT HOLES FOR GALVANIZING.

STEEL WELDING SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE AWS SPECIFICATIONS D1.1, STRUCTURAL WELDING CODE-STEEL.

DESIGN FOR  
ALUMINUM CANTILEVER TRUSS  
AND STEEL POST

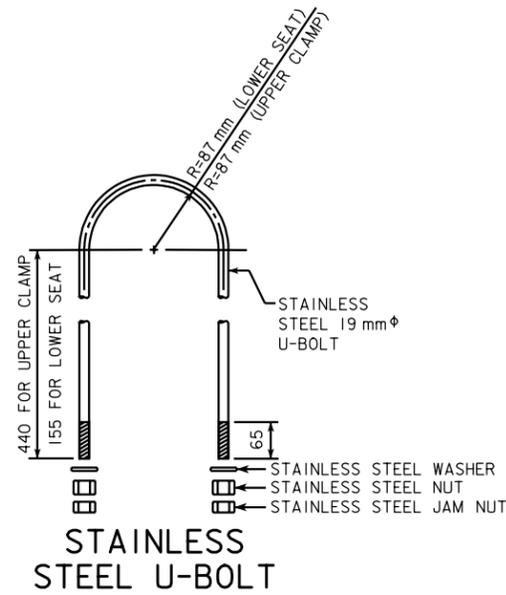
POLK COUNTY

OCTOBER, 2005

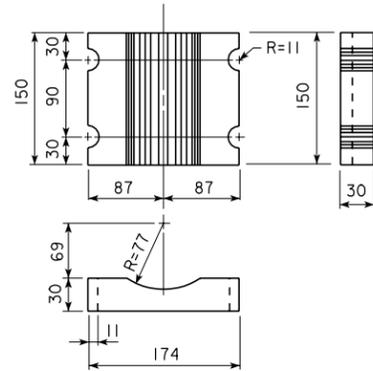
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
DESIGN SHEET NO. 4 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS

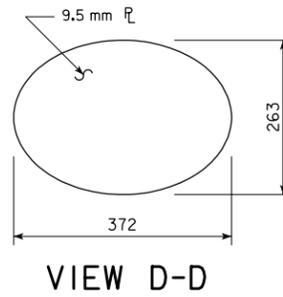
FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS



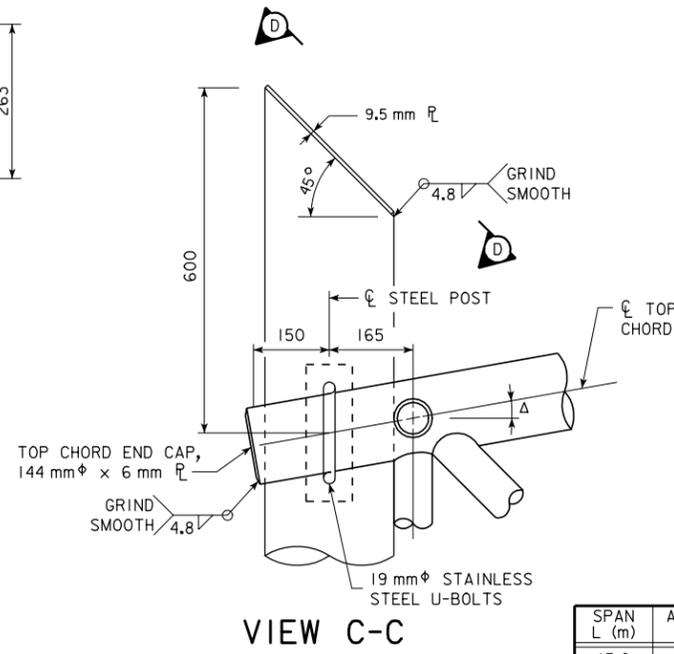
**STAINLESS STEEL U-BOLT**



**ALUMINUM SADDLE SHIM DETAIL**

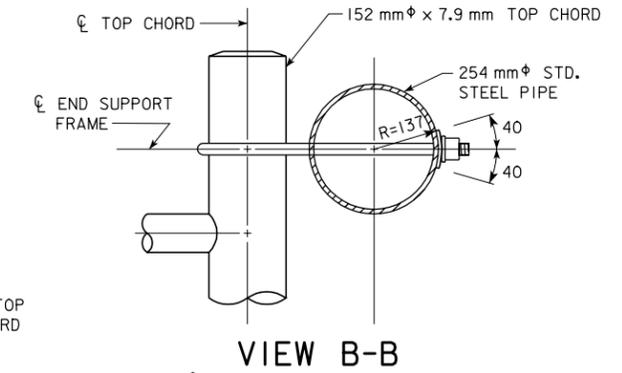


**VIEW D-D**

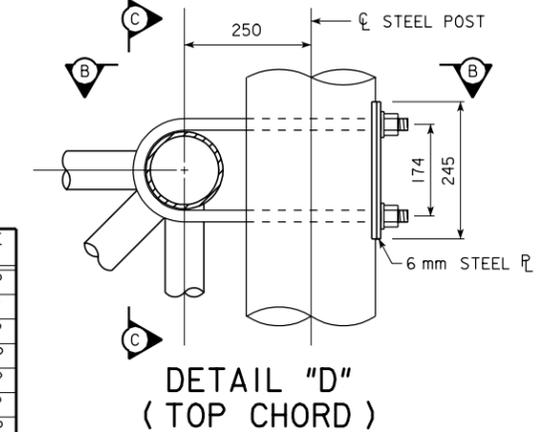


**VIEW C-C**

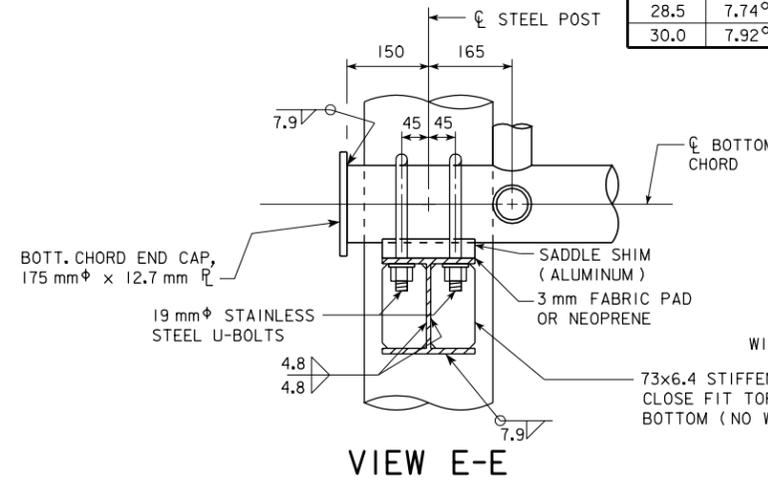
SPAN L (m)	ANGLE Δ
15.0	4.48°
16.5	5.10°
18.0	5.62°
19.5	6.06°
21.0	6.44°
22.5	6.77°
24.0	7.05°
25.5	7.31°
27.0	7.53°
28.5	7.74°
30.0	7.92°



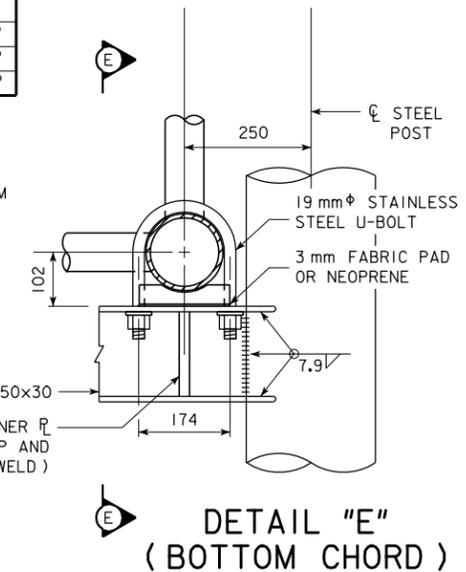
**VIEW B-B**



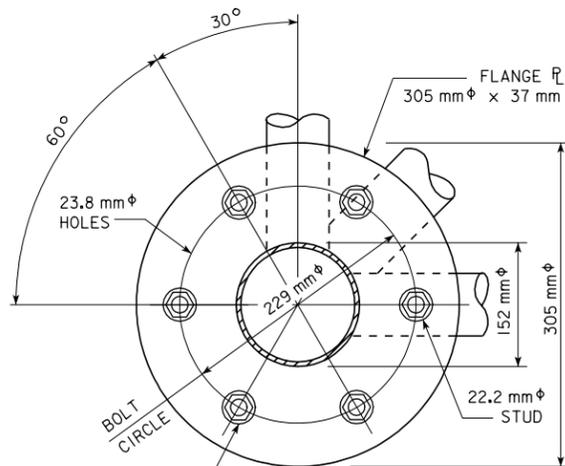
**DETAIL "D" (TOP CHORD)**



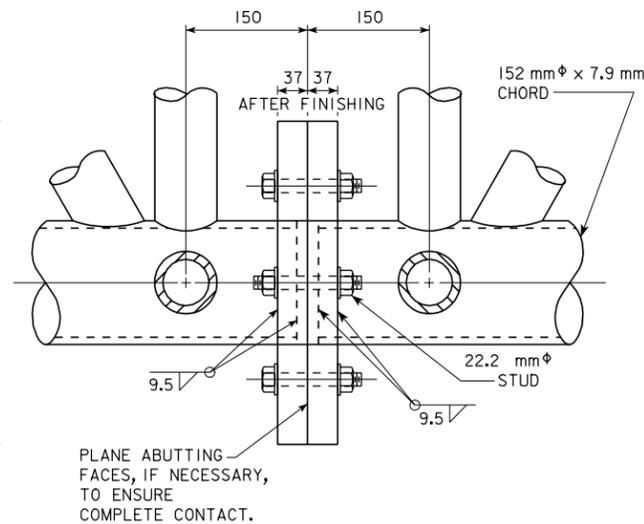
**VIEW E-E**



**DETAIL "E" (BOTTOM CHORD)**



**CHORD SPLICE**



20 - 22.2 mm φ x 121 mm STAINLESS STEEL HEXAGONAL HEAD BOLTS REQUIRED PER TRUSS SPLICE.  
 4 - 22.2 mm φ x 159 mm STAINLESS STEEL STUDS THREADED 50 mm FROM EACH END, PLACED AT HORIZONTAL MEMBERS REQUIRED PER TRUSS SPLICE. 48 WASHERS REQUIRED PER TRUSS SPLICE.  
 28 - 22.2 mm REGULAR HEXAGONAL NUTS AND JAM NUTS REQUIRED PER TRUSS SPLICE. DRILL SIX (6) 23.8 mm φ HOLES IN EACH FLANGE. TORQUE 22.2 mm BOLTS TO 270 N·m.

NOTE:  
 FLANGES MAY BE WELDED TO CHORD MEMBERS AFTER FINISHING PROVIDED PROPER ALIGNMENT IS SECURED.

DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE φ TO φ POSTS
3306	579+55	1235 EB	27.0 m
3406	579+90	1235 WB	22.5 m
3706	592+15	1235 EB	22.5 m
3806	595+15	1235 WB	21.0 m
4006	600+70	1235 EB	24.0 m
4206	609+20	1235 EB	21.0 m
4306	612+45	1235 EB	21.0 m
4406	612+55	1235 WB	21.0 m
4506	615+55	1235 WB	21.0 m

(SEE DESIGN SHEET NO. 3 FOR LOCATION OF DETAILS "D" & "E")

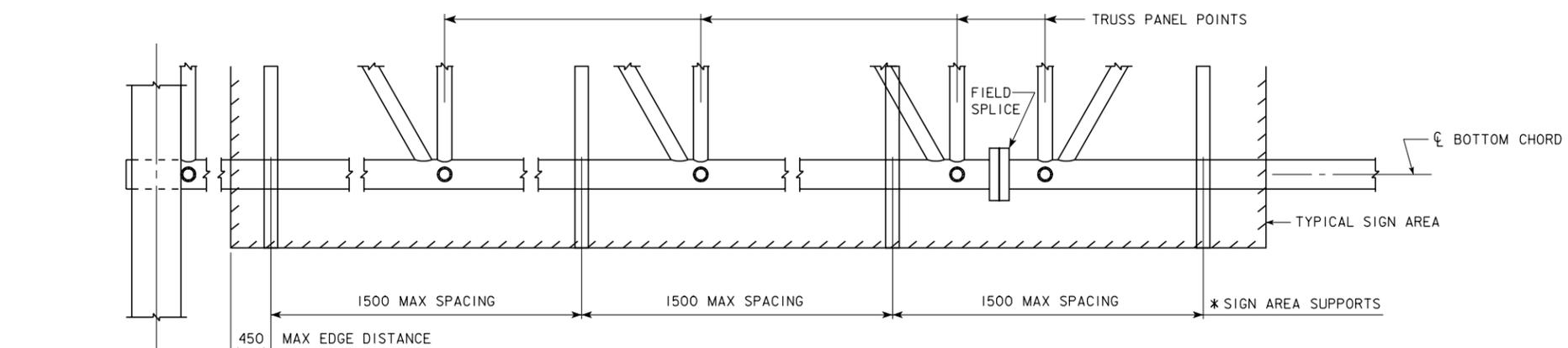
DESIGN FOR  
**ALUMINUM CANTILEVER TRUSS AND STEEL POST**

**POLK COUNTY**

OCTOBER, 2005

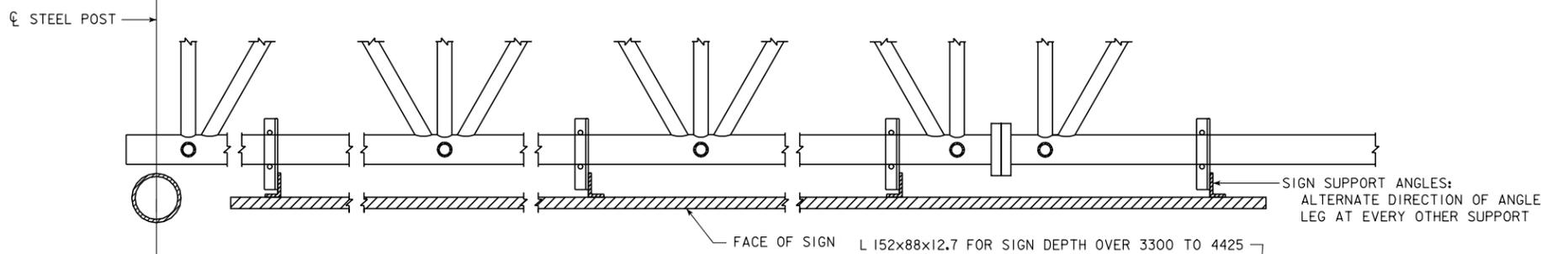
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 5 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS



**PART ELEVATION**

\* LOCATE SUPPORTS AS CLOSE TO TRUSS PANEL POINTS AS POSSIBLE.

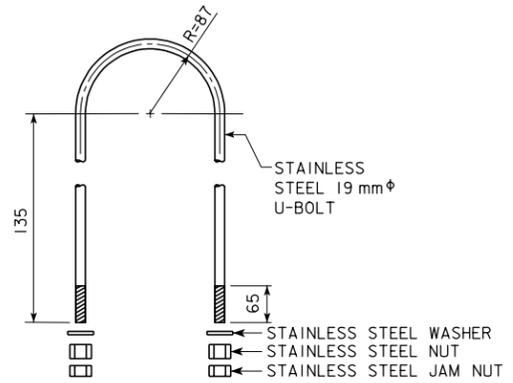


**PART PLAN**

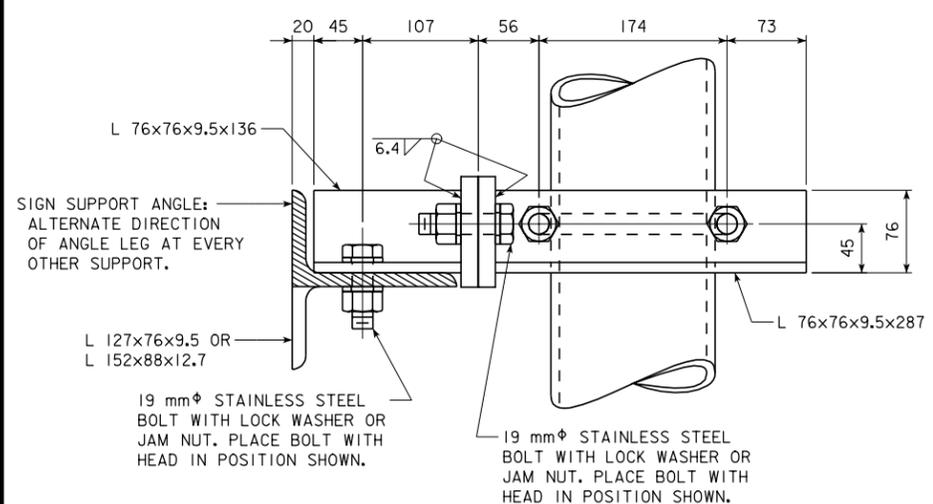
L 152x88x12.7 FOR SIGN DEPTH OVER 3300 TO 4425  
 L 127x76x9.5 FOR SIGN DEPTH 3300 OR LESS  
 SIGN DEPTH GREATER THAN 3600 REQUIRES APPROVAL.

Δ = IF SIGN DOES NOT EXTEND UP TO TOP CHORD, TRIM ANGLE TO 125 mm. TOPS OF ANGLES SHOULD FOLLOW PROFILE OF CURVED TOP CHORD.

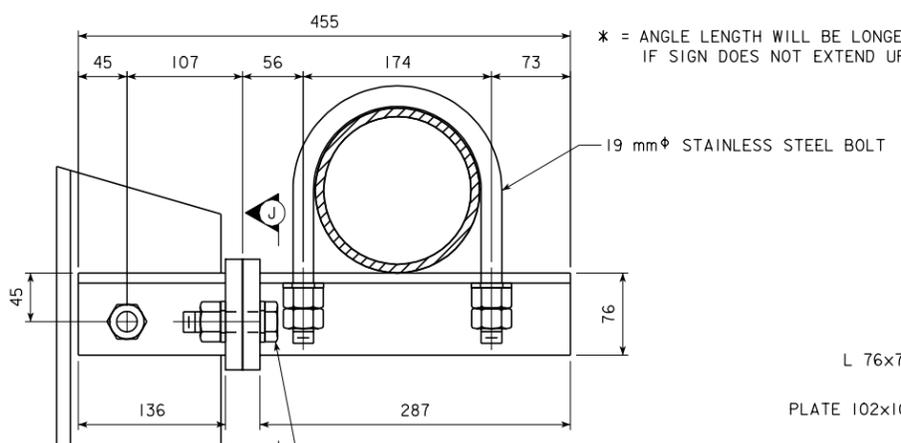
\* = ANGLE LENGTH WILL BE LONGER THAN DEPTH + 50 mm IF SIGN DOES NOT EXTEND UP TO TOP CHORD.



**STAINLESS STEEL U-BOLT**

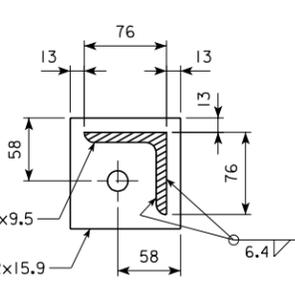


**SECTION F-F**

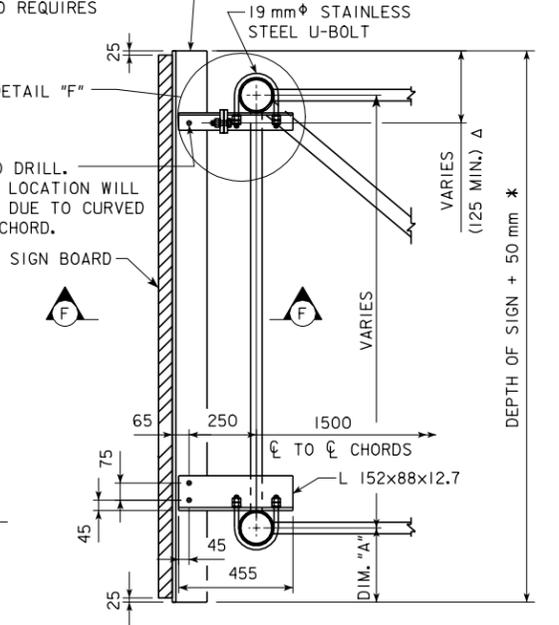


**DETAIL "F"**

ASSEMBLY NOTE: INSERT THIS BOLT FIRST. PLACE BOLT WITH HEAD IN POSITION SHOWN. ADJUST ANGLE PARTS FOR TOP CHORD SLOPE. TIGHTEN ADJACENT U-BOLT NUTS WITH OPEN ENDED WRENCH.



**SECTION J-J**



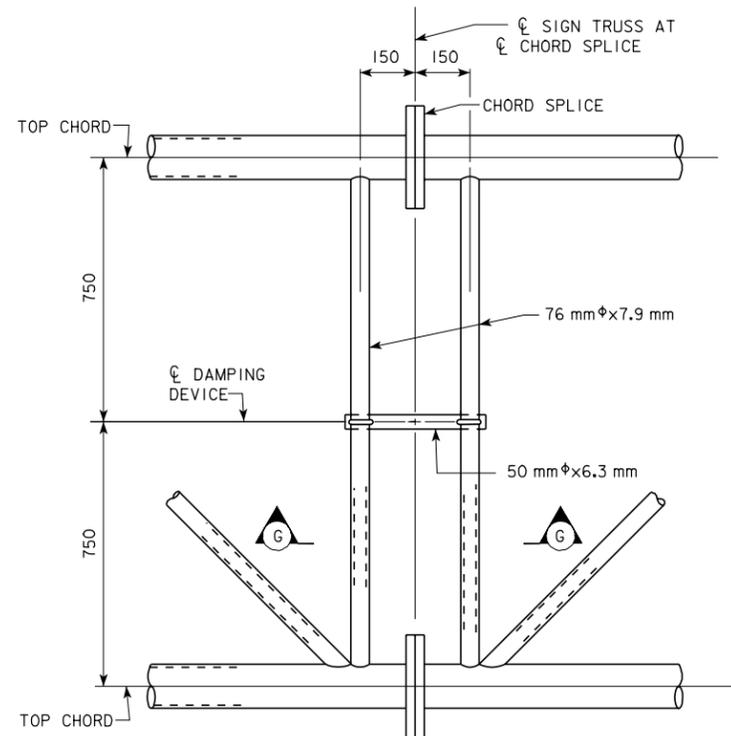
**TYPICAL SIGN PANEL SECTION**

DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE CL TO CL POSTS	DIM. "A"
3306	579+55	1235 EB	27.0 m	480
3406	579+90	1235 WB	22.5 m	480
3706	592+15	1235 EB	22.5 m	480
3806	595+15	1235 WB	21.0 m	480
4006	600+70	1235 EB	24.0 m	1080
4206	609+20	1235 EB	21.0 m	480
4306	612+45	1235 EB	21.0 m	480
4406	612+55	1235 WB	21.0 m	480
4506	615+55	1235 WB	21.0 m	480

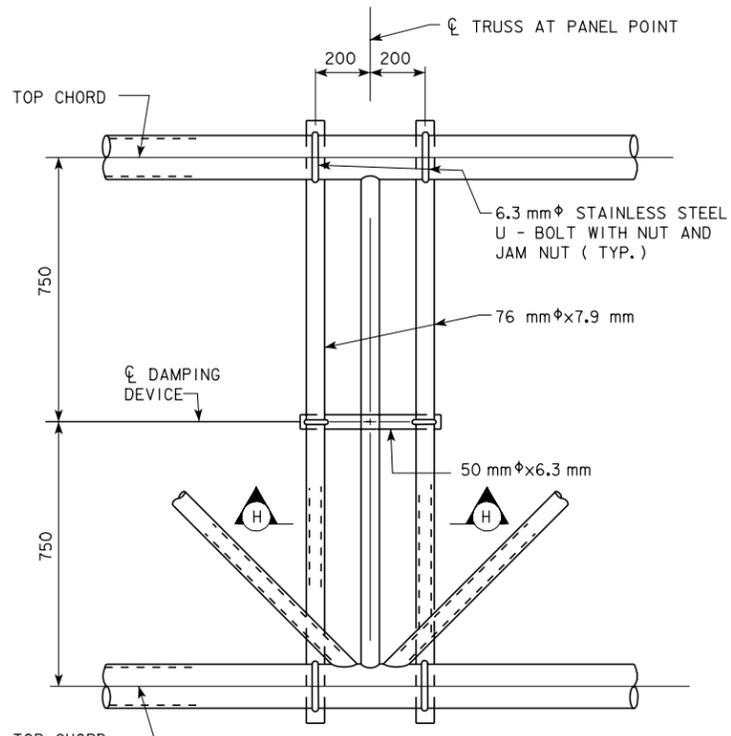
DESIGN FOR  
**ALUMINUM CANTILEVER TRUSS AND STEEL POST**

POLK COUNTY  
 IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 6 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

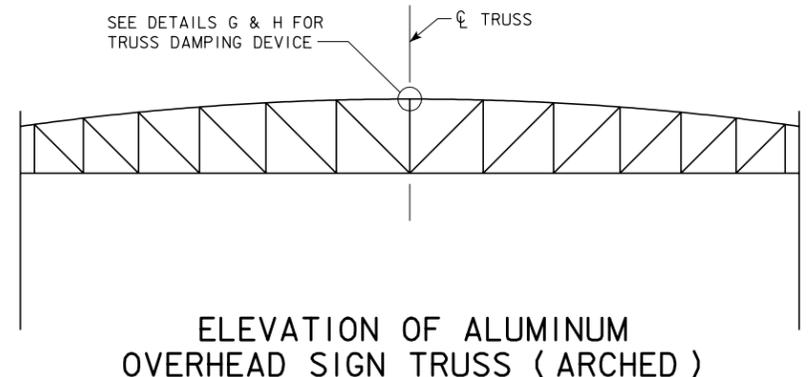
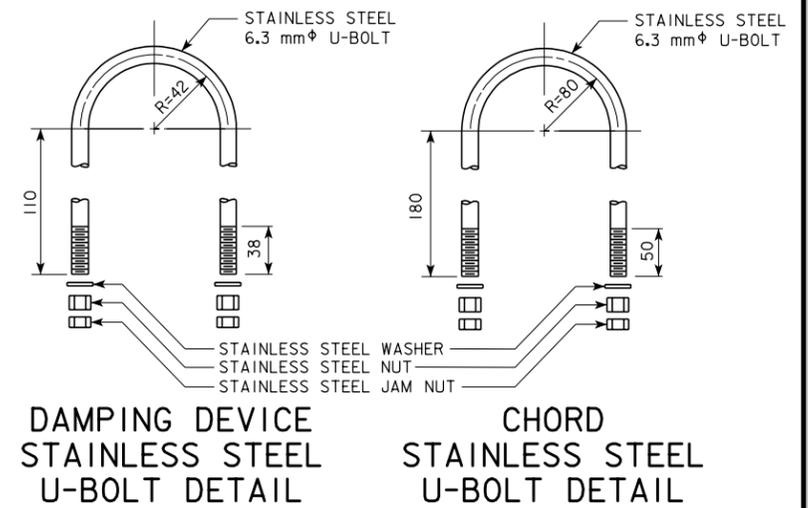
OCTOBER, 2005



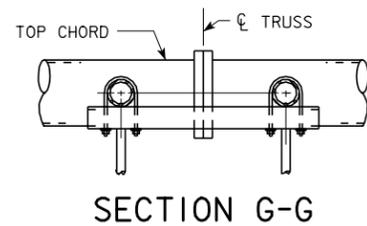
DETAIL "G" DAMPING DEVICE ATTACHMENT FOR  $\phi$  TRUSS LOCATED AT  $\phi$  OF CHORD SPLICES



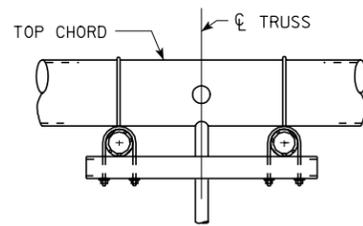
DETAIL "H" DAMPING DEVICE ATTACHMENT FOR  $\phi$  TRUSS LOCATED AT PANEL POINTS



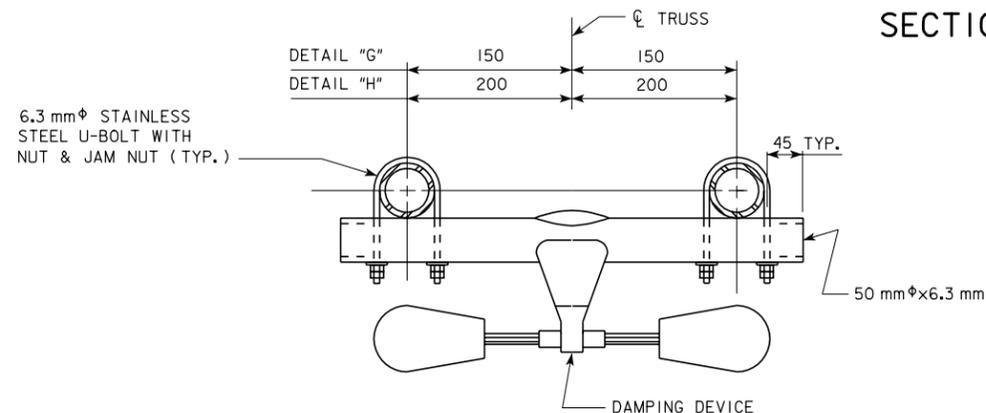
NOTE:  
 ONE TRUSS DAMPER LOCATED AT  $\phi$  OF TRUSS IS REQUIRED PER TRUSS. ALCOA ALUMINUM TRUSS DAMPER 1708-17.1 (14 kg STOCKBRIDGE TYPE) OR APPROVED EQUAL SHALL BE USED.  
 THE COST OF DAMPING DEVICE IS TO BE INCLUDED IN THE PRICE BID FOR SIGN TRUSS. IN DETAILS "G" AND "H", THE DAMPING DEVICE IS NOT SHOWN.



SECTION G-G



SECTION H-H



TRUSS DAMPING DEVICE DETAIL

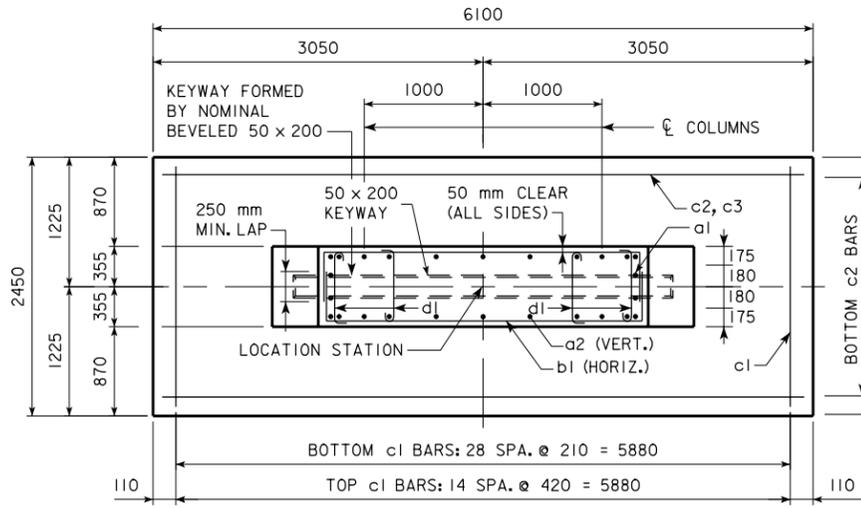
DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE $\phi$ TO $\phi$ POSTS
3306	579+55	I235 EB	27.0 m
3406	579+90	I235 WB	22.5 m
3706	592+15	I235 EB	22.5 m
3806	595+15	I235 WB	21.0 m
4006	600+70	I235 EB	24.0 m
4206	609+20	I235 EB	21.0 m
4306	612+45	I235 EB	21.0 m
4406	612+55	I235 WB	21.0 m
4506	615+55	I235 WB	21.0 m

DESIGN FOR  
**ALUMINUM CANTILEVER TRUSS  
 AND STEEL POST**

OCTOBER, 2005

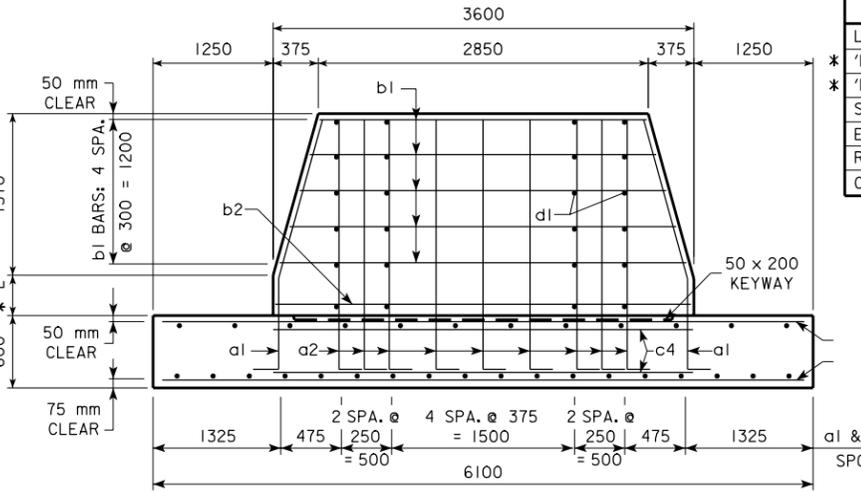
**POLK COUNTY**  
 IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 7 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS



**PLAN**

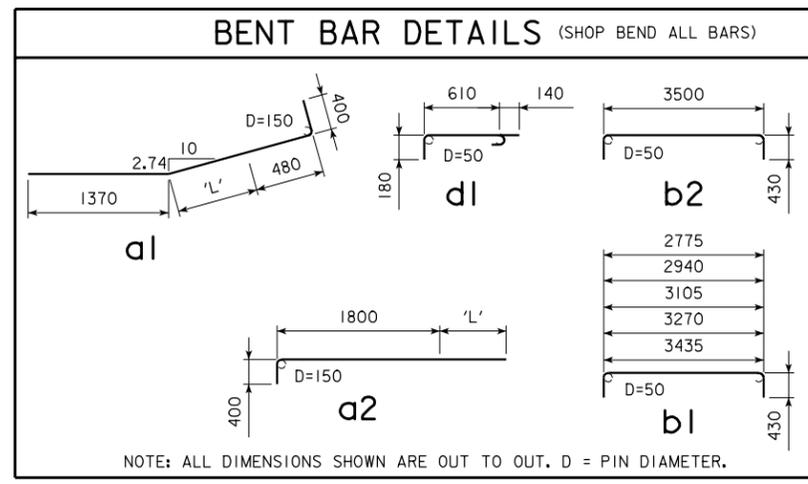
(ANCHOR BOLT ASSEMBLIES AND WIRE DUCTS NOT SHOWN.)



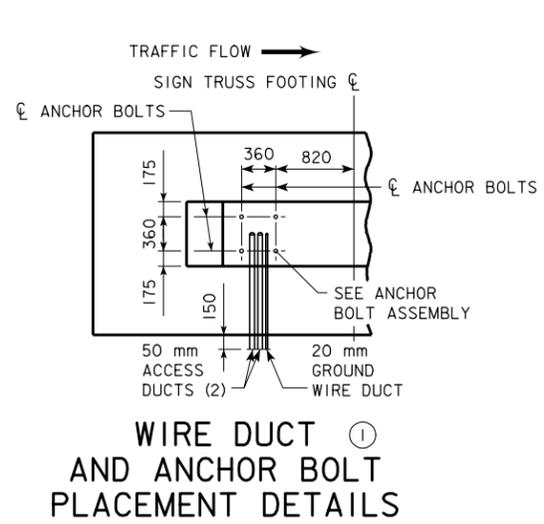
**SIDE ELEVATION**

(ANCHOR BOLT ASSEMBLIES AND WIRE DUCTS NOT SHOWN.)

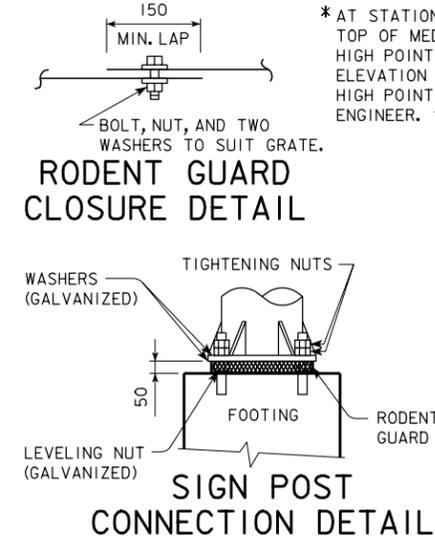
\* 'L' SHALL NOT EXCEED 1800 mm



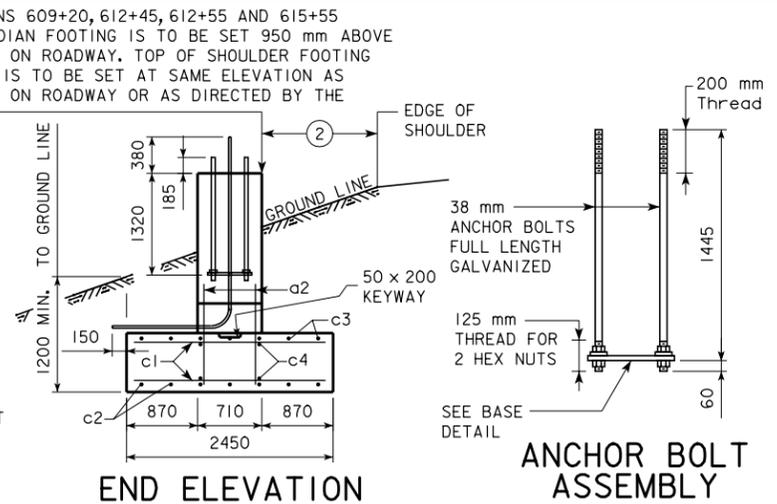
NOTE: ALL DIMENSIONS SHOWN ARE OUT TO OUT. D = PIN DIAMETER.



**WIRE DUCT AND ANCHOR BOLT PLACEMENT DETAILS**



**SIGN POST CONNECTION DETAIL**

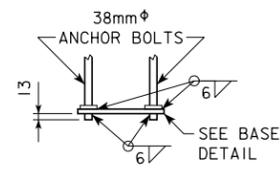


**END ELEVATION**

**ANCHOR BOLT ASSEMBLY**

ESTIMATED QUANTITIES (TWO FOOTINGS)										
DESIGN NUMBER	3306	3406	3706	3806	4006	4206	4306	4406	4506	
LOCAL STATION	579+55	579+90	592+15	595+15	600+70	609+20	612+45	612+55	615+55	
'L' MEDIAN	600	900	900	600	1800	900	600	600	600	
'L' SHOULDER	900	0	300	300	600	300	300	300	300	
STRUCTURAL CONCRETE	28.1	26.5	27.3	26.5	30.4	27.3	26.5	26.5	26.5	
EPOXY COATED REINFORCING STEEL	744	664	704	664	864	704	664	664	664	
REINFORCING STEEL	862	862	862	862	862	862	862	862	862	
CLASS 20 EXCAVATION	90.9	82.4	83.8	75.1	69.7	76.0	75.7	75.7	75.7	

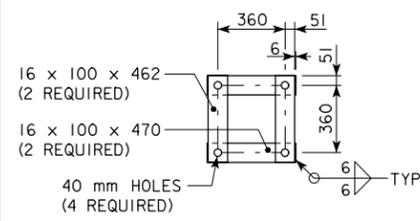
CONCRETE PLACEMENT QUANTITIES (ONE FOOTING)		
ITEM	'L' = 0	EACH 300 mm OF 'L'
WALL	3.14	0.77
FOOTING	8.97	
TOTAL (m <sup>3</sup> )	12.11	0.77



**ALTERNATE ANCHOR BOLT ASSEMBLY**

REINFORCING BAR LIST - EPOXY COATED (ONE FOOTING)											
SIZE	SHAPE	'L' = 0			EACH 300 mm OF 'L'			NO.	LENGTH	MASS	
		NO.	LENGTH	MASS	NO.	LENGTH	MASS				
a1	25	8	2250	71	SEE DETAIL	8	300 (A)	9			
a2	25	18	2200	155	SEE DETAIL	18	300 (A)	21			
b1	10	10	Varies	31	300						
b2	10					2 (B)	4360	7			
d1	10	20	930	15	SEE DETAIL	4 (C)	930	3			
TOTAL 272 kg					TOTAL 40 kg						

(A) ADDITIONAL LENGTH TO BAR a1 FOR 'L' = 0 (B) TWO IN EACH 300 mm OF 'L'. (C) FOUR IN EACH 300 mm OF 'L'.



**BASE DETAIL**

REINF. BAR LIST - NON-EPOXY (ONE FOOTING)							
SIZE	SHAPE	'L' = 0			NO.	LENGTH	MASS
		NO.	LENGTH	MASS			
c1	15	44	2300	159	SEE DETAIL		
c2	25	7	5950	163	360		
c3	20	7	5950	98	360		
c4	10	4	3600	11	SEE DETAIL		
TOTAL 431 kg							

DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE TO POSTS
3306	579+55	1235 EB	27.0 m
3406	579+90	1235 WB	22.5 m
3706	592+15	1235 EB	22.5 m
3806	595+15	1235 WB	21.0 m
4006	600+70	1235 EB	24.0 m
4206	609+20	1235 EB	21.0 m
4306	612+45	1235 EB	21.0 m
4406	612+55	1235 WB	21.0 m
4506	615+55	1235 WB	21.0 m

- ① FOR FOOTINGS SUPPORTING SIGN TRUSSES WITH DYNAMIC MESSAGE SIGNS, PLACE 20 mm GROUND WIRE DUCT AND TWO 50 mm ACCESS DUCTS WITHIN THE ANCHOR BOLT CIRCLE CLOSEST TO THE DIRECTION OF THE APPROACHING TRAFFIC. CAP ENDS TO EXCLUDE MOISTURE UNLESS SIGN LIGHTING IS PART OF THE CONTRACT. EXTEND CONDUIT ENDS 150 mm PAST EDGE OF FOOTING ON SIDE AWAY FROM ROADWAY. LOCATION SHALL BE ON DETAIL PROJECT PLANS. ALL DUCTS SHALL MEET REQUIREMENTS FOR PLASTIC CONDUIT.
- ② SEE FOOTING TABULATION.

ALL DIMENSIONS GIVEN IN MILLIMETERS UNLESS NOTED.

DESIGN FOR

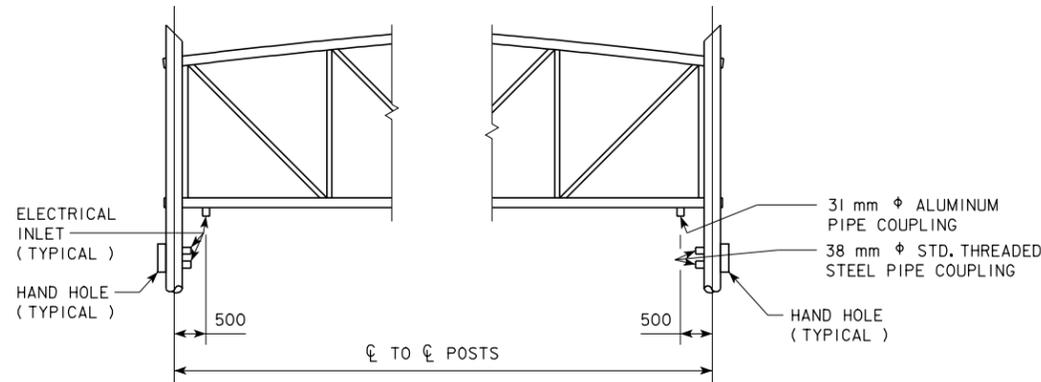
## ALUMINUM CANTILEVER TRUSS AND STEEL POST

POLK COUNTY

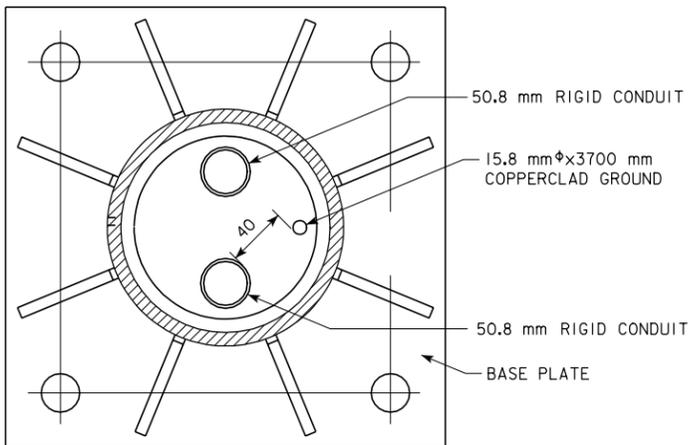
OCTOBER, 2005

IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION

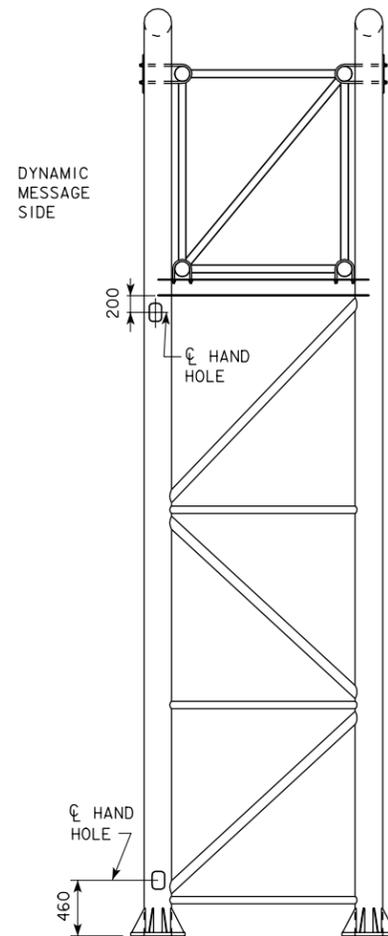
DESIGN SHEET NO. 8 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE



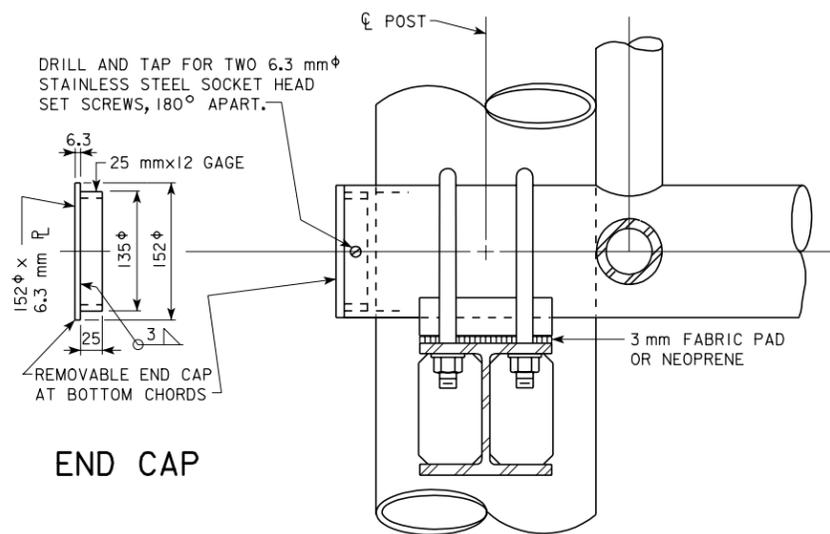
PART ELEVATION



BASE PLATE PLAN

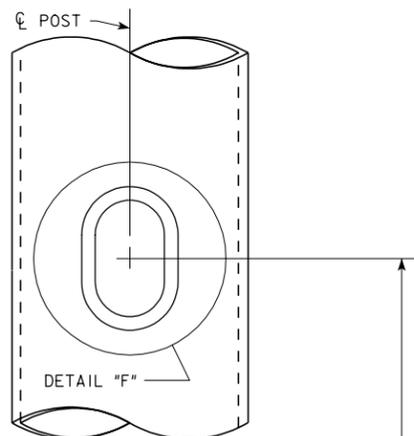


END VIEW OF TRUSS SUPPORT



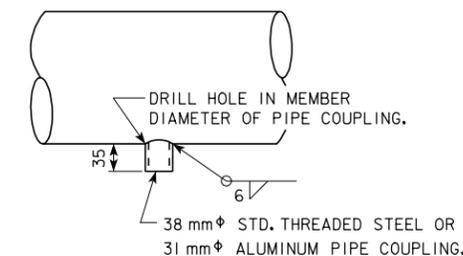
END CAP

BOTTOM CHORD



BASE AND HAND HOLE DETAIL

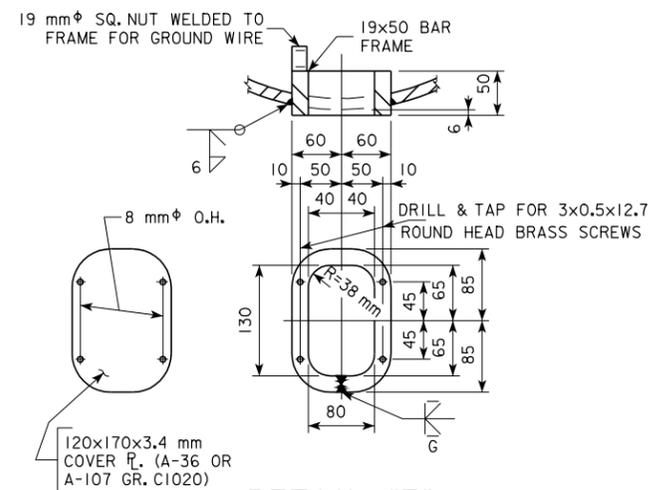
THIS SHEET APPLIES ONLY TO DESIGN NUMBERS 4206 AT STATION 609+20 & 4506 AT STATION 615+55.



ELECTRICAL INLET

NOTE: INLET COUPLING IS TO BE STEEL OR ALUMINUM FOR FASTENING TO STEEL OR ALUMINUM MEMBERS RESPECTIVELY AND SHALL BE FITTED WITH STANDARD PLUGS UNTIL CONDUIT IS INSTALLED.

NOTE: HAND HOLES AND ELECTRICAL INLET HOLES SHALL BE IN BOTH END TRUSSES AND ON DYNAMIC MESSAGE SIDE ONLY.



DETAIL "F"

DESIGN NO.	STATION	LOCATION	OVERHEAD SIGN TRUSS SIZE &Circ; TO &Circ; POSTS
4206	609+20	I-235 E.B.	21.0 m
4506	615+55	I-235 W.B.	21.0 m

DESIGN FOR  
**ALUMINUM CANTILEVER TRUSS AND STEEL POST**  
**ELECTRICAL ACCESS DETAILS**  
 OCTOBER, 2005  
**POLK COUNTY**  
 IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 9 OF 15 FILE NO. 29555 DESIGN NO. SEE TABLE

FOR INFORMATION ONLY - THIS SHEET INCLUDED FROM ORIGINAL DESIGN PLANS