

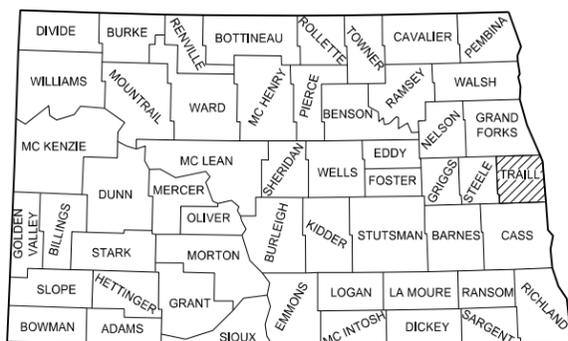
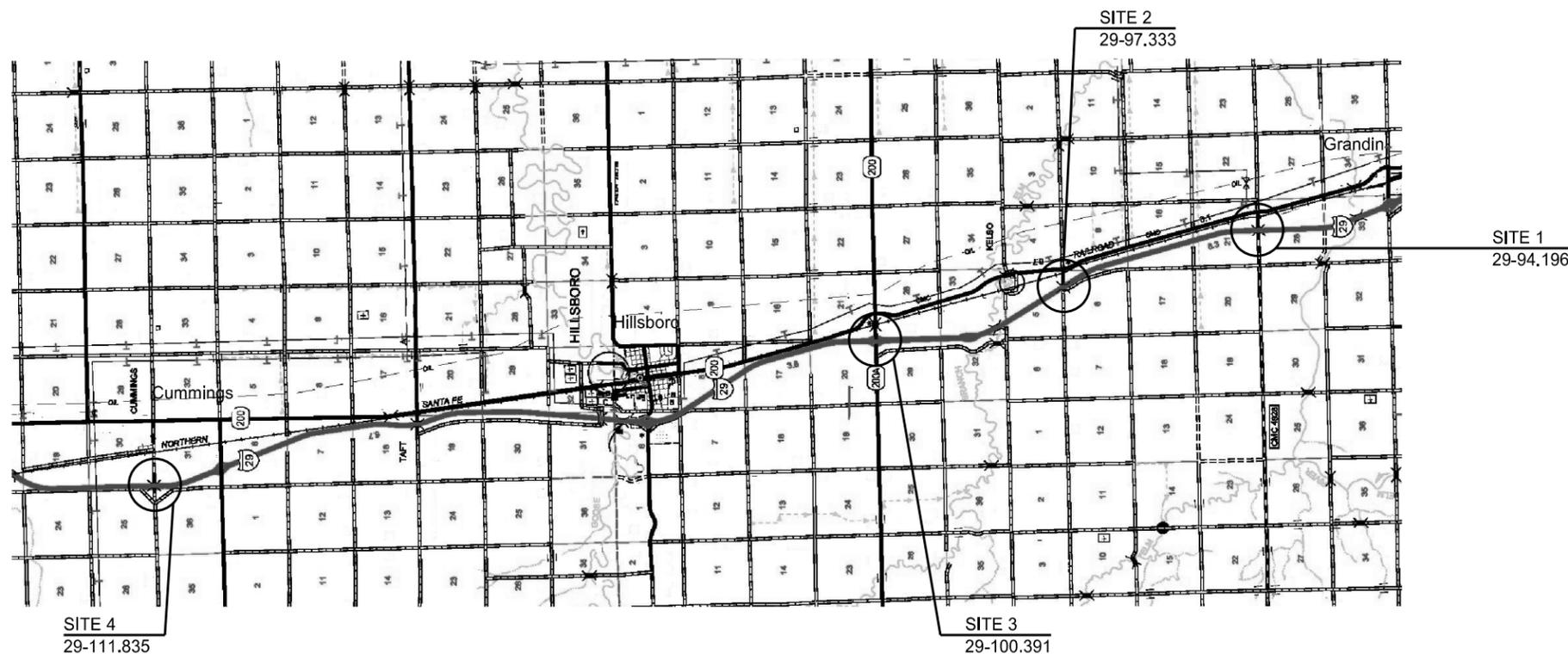
**JOB # 42**  
**NORTH DAKOTA**  
**DEPARTMENT OF TRANSPORTATION**

STATE	PROJECT NO.	PCN	SECTION NO.	SHEET NO.
ND	S-BRI-8-029(150)094	19710	1	1

S-BRI-8-029(150)094

**GOVERNING SPECIFICATIONS:**  
 Standard Specifications adopted by the North Dakota  
 Department of Transportation October 2014; Standard Drawings  
 currently in effect; and other Contract Provisions submitted herein.

Trail County  
 Galesburg Separation, Kelso Separation,  
 Blanchard Interchange, Cummings Separation  
 Structure Painting



STATE COUNTY MAP

I hereby certify that the attached plans were prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the state of ND.

APPROVED DATE 08/25/2014

Terrence R. Udland  
 BRIDGE DIVISION

This document was originally issued and sealed by  
 Terrence R. Udland  
 Registration Number  
 PE- 2674,  
 on 4/25/14 and the original document is stored at the  
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 of Transportation

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-BRI-8-029(150)094	2	1

TABLE OF CONTENTS

<u>Section No.</u>	<u>Sheet No.</u>	<u>Description</u>
1	1	Title Sheet
2	1	Table of Contents
6	1	Notes
8	1	Quantities
100	1	Work Zone Traffic Control
170	1	Bridges Notes
170	2-5	Structural Steel Painting Details

LIST OF STANDARD DRAWINGS

<u>Standard No.</u>	<u>Description</u>
D-704-01	Attenuation Device
D-704-07, 08	Breakaway Systems for Construction Zone Signs
D-704-09, 10, 11	Construction Sign Details
D-704-13	Barricade and Channelizing Device Details
D-704-14	Construction Sign Punching and Mounting Details
D-704-18	Sign Layout for Interstate System One Lane Closure
D-704-51	Portable Precast Concrete Median Barrier

LIST OF SPECIAL PROVISIONS (SP)

<u>SP #</u>	<u>Description</u>
SP 0004 (14)	Federal Migratory Bird Treaty Act
SP 0026 (14)	Lead Paint Removal, and Containment

## NOTES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-BRI-8-029(150)094	6	1

### GENERAL NOTES

704-200 PRECAST CONCRETE MEDIAN BARRIERS - STATE FURNISHED: The number of precast concrete median barriers required on the project shall be 168 – 10'x2.5' units. The contractor shall obtain all 168 barriers from the Casselton storage yard. Upon completion of the project, all barriers shall remain the property of the state and the contractor shall return them to the Casselton storage yard. Upon final storage, one barrier connecting bolt with two washers shall be placed through the barrier loops at one end of each segment, and the nut shall be installed sufficiently threaded to the bolt to retain this hardware during transportation. Any barrier segments that become damaged during handling, transportation, placing, or use, or any missing connecting bolts, nuts or washers, shall be replaced at the contractor's expense. The contractor shall contact the District Office a minimum of 7 days prior to and again 24 hours prior to picking up the barriers. The contractor shall contact the District Office a minimum of 24 hours prior to returning barriers.

The barriers shall be counted prior to removal from the storage area and after placement on the roadway and the number agreed to by the Engineer and the Contractor. Another count shall be made once the barriers have been returned to the storage area and agreed to by the Engineer and the Contractor. Both agreements shall be made in writing and signed by all parties.

Upon final storage, the state furnished barriers shall be stacked a maximum of two high and shall be placed on 4" x 4" boards separating the barrier from the ground and separating the barriers between stacked rows. Some 4" x 4" boards are available from the Casselton storage yard, but any additional 4" x 4" boards that are needed shall be supplied by the contractor, become property of the NDDOT, and shall be included in the price bid for "Precast Concrete Median Barrier - State Furnished."

All labor and equipment needed for obtaining, loading, transporting, installing, moving, removing, unloading, and maintaining the portable precast concrete median barriers shall be provided by the Contractor and included in the price bid for the item "Precast Concrete Median Barriers - State Furnished."

704-P01 TRAFFIC CONTROL FOR PAINTING: Traffic control for the painting of the structures will consist of a single lane closure in both the NB and SB lanes of I-29. Traffic Control Devices shall comply with the following Standard Drawings:

1. Standard Drawing D-704-18: Sign Layout for One Lane Closure – Interstate System.
2. Standard Drawings D-704-1, 7, 8, 9, 10, 11, 13, 14, and 51 are applicable.

704-P02 TRAFFIC CONTROL QUANTITIES: The quantities have been based on having 4 lane closures. There will be a minimum of 2 miles between the end of a lane closure and the advanced signing of the next lane closure. There will be no limit on the number of lane closures allowed but each lane closure will be no longer than 4 miles. If the contractor chooses to set up more than 4 lane closures, it will be at the contractor's expense. No additional compensation will be allowed for relocation of traffic control devices.

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Duane Carlstrom  
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PE-5832  
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# ESTIMATE OF QUANTITIES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
<b>ND</b>	S-BRI-8-029(150)094	<b>8</b>	1

SPEC CODE	ITEM DESCRIPTION	UNIT	MAINLINE	TOTAL
-----	-----	-----	-----	-----
103	0100 CONTRACT BOND	L SUM	1	1
630	0100 SAND BLASTING & PAINTING	L SUM	1	1
630	9000 CONTAINMENT SYSTEM	L SUM	1	1
702	0100 MOBILIZATION	L SUM	1	1
704	0100 FLAGGING	MHR	100	100
704	1000 TRAFFIC CONTROL SIGNS	UNIT	2,760	2,760
704	1045 ATTENUATION DEVICE-TYPE B-75	EA	4	4
704	1060 DELINEATOR DRUMS	EA	88	88
704	1087 SEQUENCING ARROW PANEL-TYPE C	EA	4	4
704	3510 PRECAST CONCRETE MED BARRIER-STATE FURNISHED	EA	168	168
762	0420 SHORT TERM 4IN LINE-TYPE R	LF	5,696	5,696



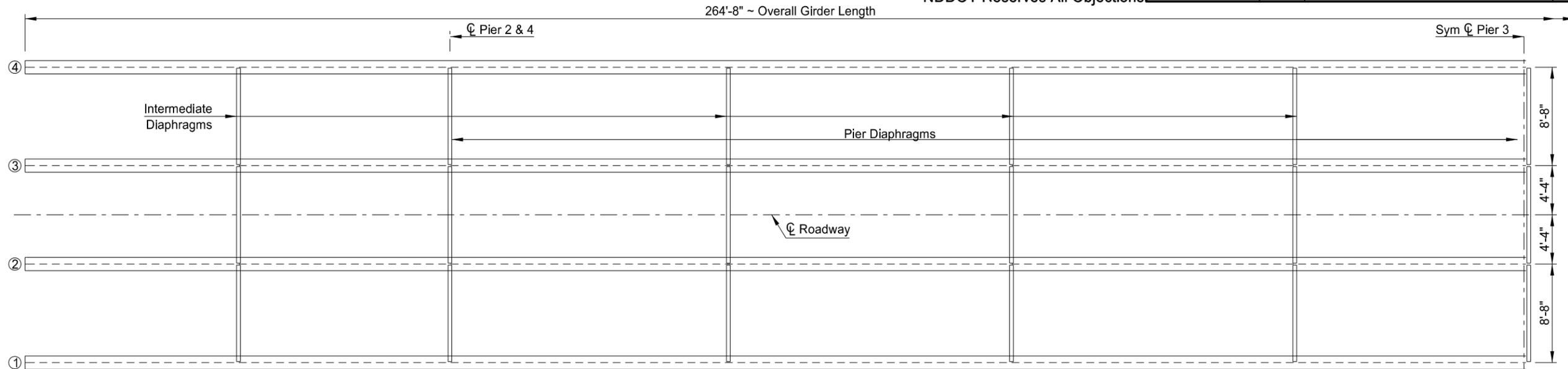
STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-BRI-8-029(150)094	170	1

**NOTES**

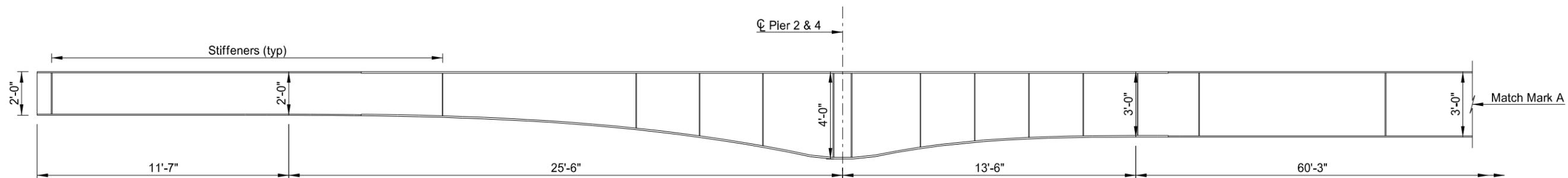
- 100 SCOPE OF WORK: This project consists of blast cleaning and painting all the exposed structural steel at four locations.
- 630 SANDBLASTING AND PAINTING: All structural steel surfaces that are to be painted shall be blast cleaned and painted according to Special Provision 0026(14). The finish coat shall be blue, color number 25240, and shall meet Federal Standard No. 595B. Lump Sum will be paid for the total area of 52,745 SF as noted in accordance with Special Provision 0026(14).
- 630 CONTAINMENT SYSTEM: The containment system shall be in accordance with Special Provision 0026(14). One-fourth of the total lump sum amount will be paid at each site.

SITE	BRIDGE NO.	LOCATION	SPANS	GIRDER LENGTH	TOTAL AREA (SF)
1	29-094.196	Galesburg Separation	4	264'-8"	11,915
2	29-097.333	Kelso Separation	4	299'-6 <sup>1</sup> / <sub>8</sub> "	14,025
3	29-100.391	Blanchard Interchange	4	264'-8"	14,890
4	29-111.835	Cummings Separation	4	264'-8"	11,915
				<b>TOTAL</b>	<b>52,745</b>

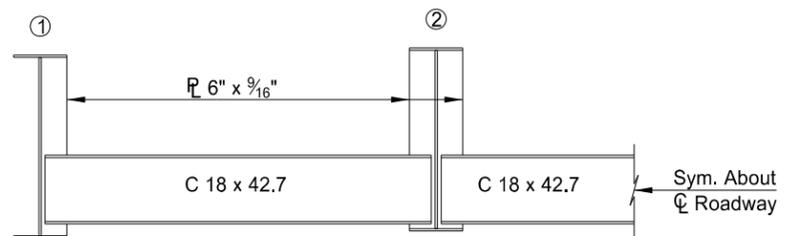
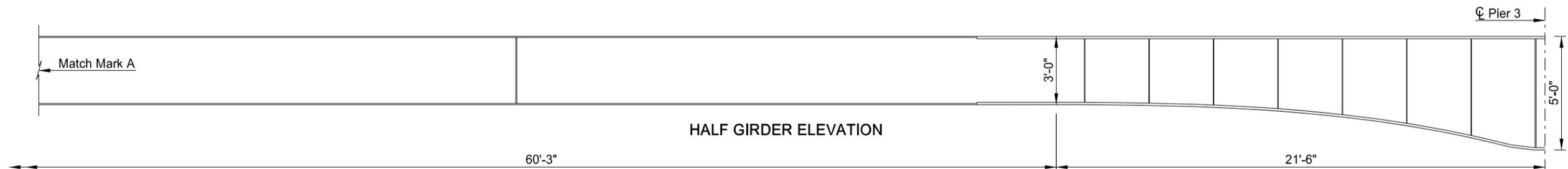
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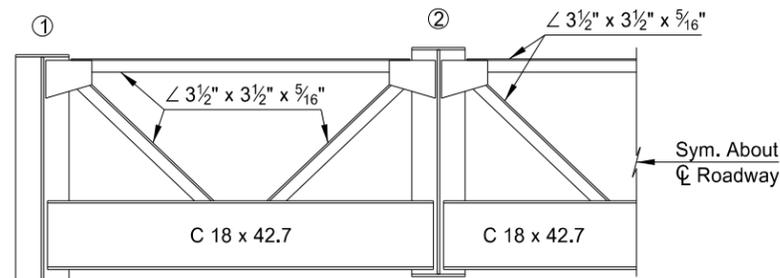
HALF GIRDER LAYOUT



HALF GIRDER ELEVATION



TYPICAL FOR DIAPHRAGMS @ PIERS 2 AND 4  
 AND ALL INTERMEDIATE DIAPHRAGMS



DIAPHRAGM @ PIER 3

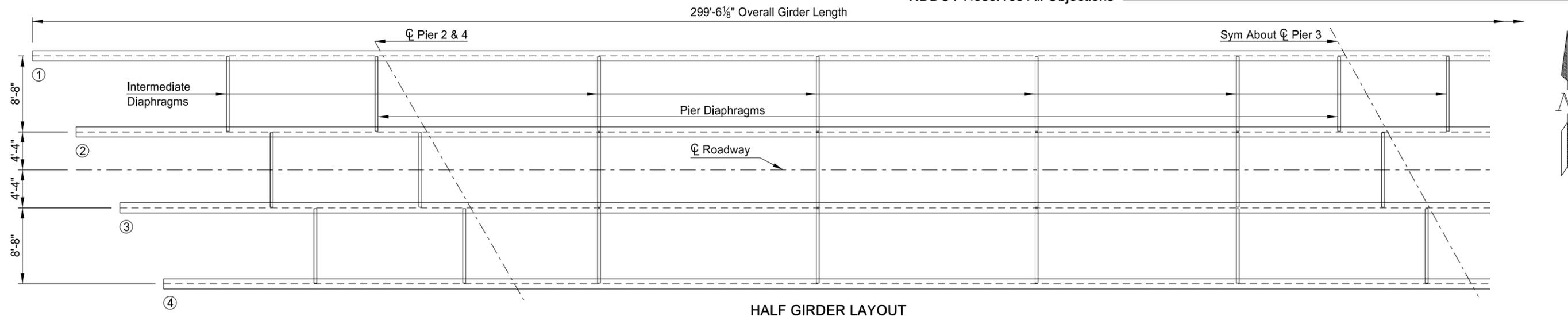
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SITE 1  
 GALESBURG SEPERATION CROSSROAD

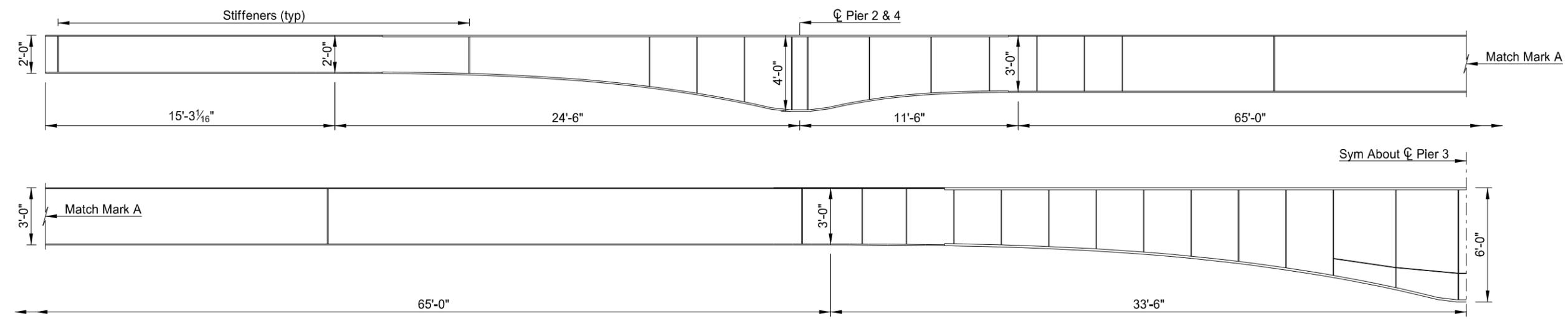
STRUCTURAL STEEL  
 PAINTING DETAILS

23 U.S.C. 409  
NDDOT Reserves All Objections

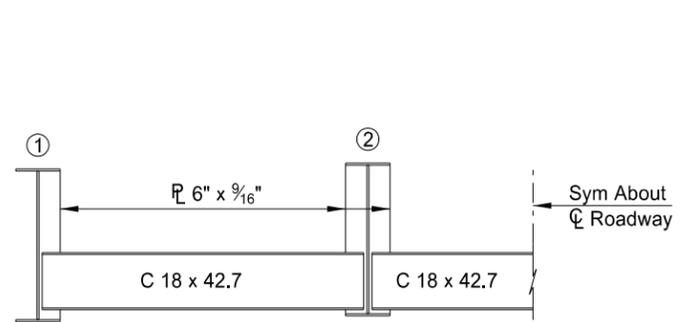
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ND	S-BRI-8-029(150)094	170	3



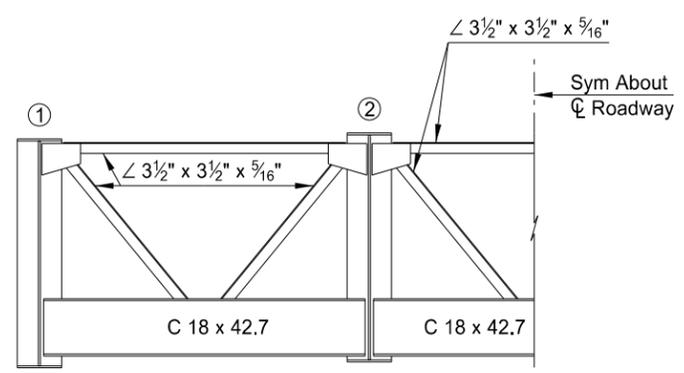
HALF GIRDER LAYOUT



HALF GIRDER ELEVATION



TYPICAL FOR DIAPHRAGMS @ PIERS 2 AND 4  
AND ALL INTERMEDIATE DIAPHRAGMS

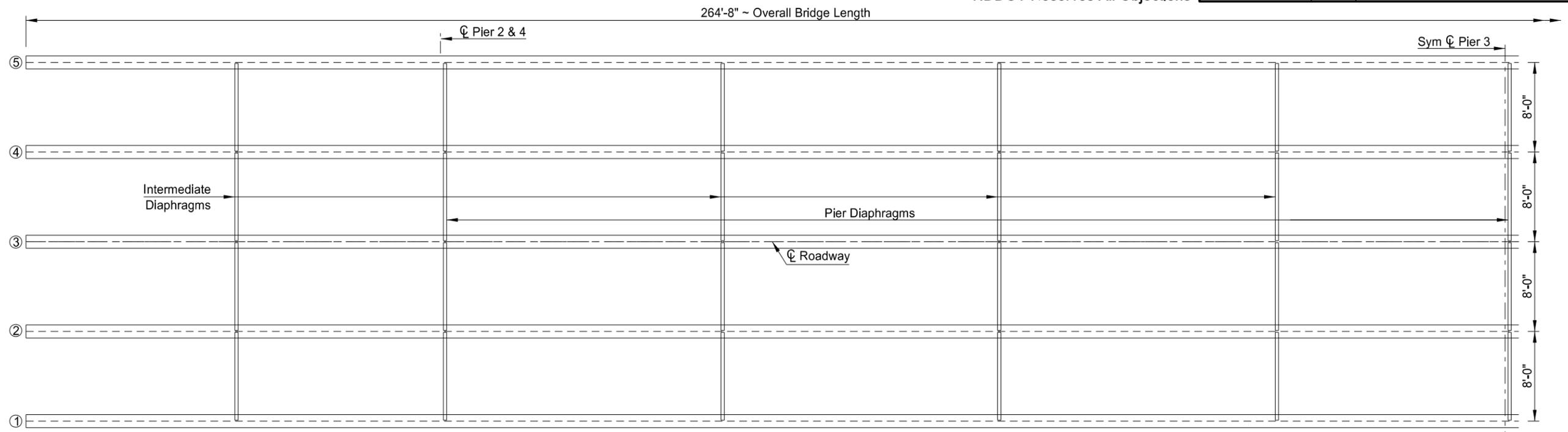


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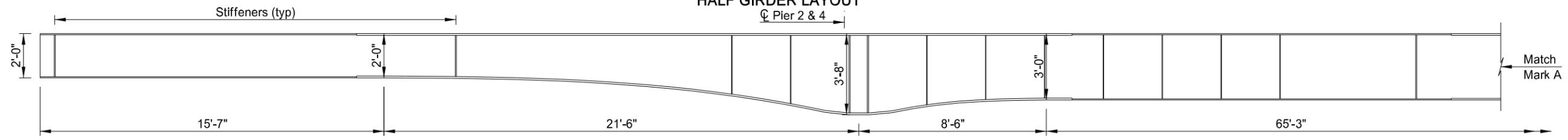
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SITE 2  
KELSO SEPERATION  
  
STRUCTURAL STEEL  
PAINTING DETAILS

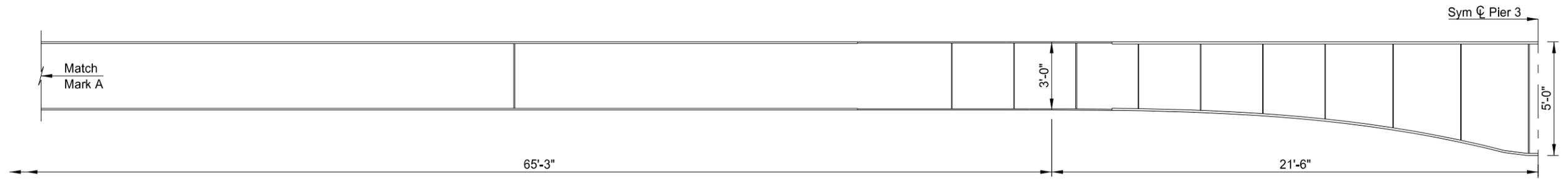
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ND	S-BRI-8-029(150)094	170	4



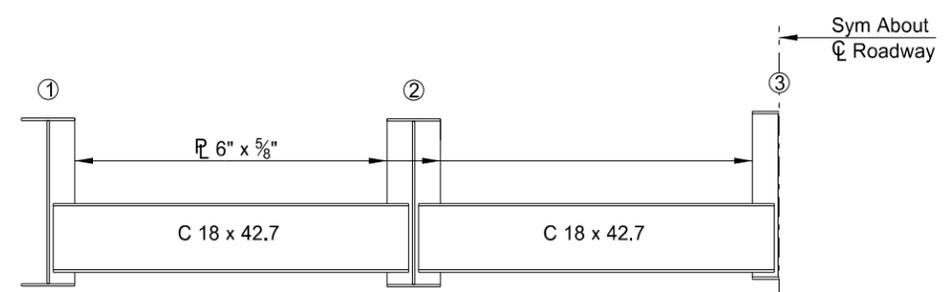
HALF GIRDER LAYOUT



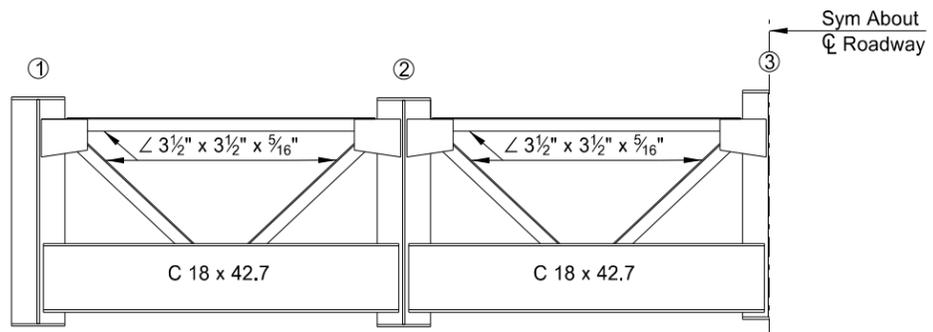
HALF GIRDER ELEVATION



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TYPICAL FOR DIAPHRAGMS @ PIERS 2 AND 4 AND ALL INTERMEDIATE DIAPHRAGMS

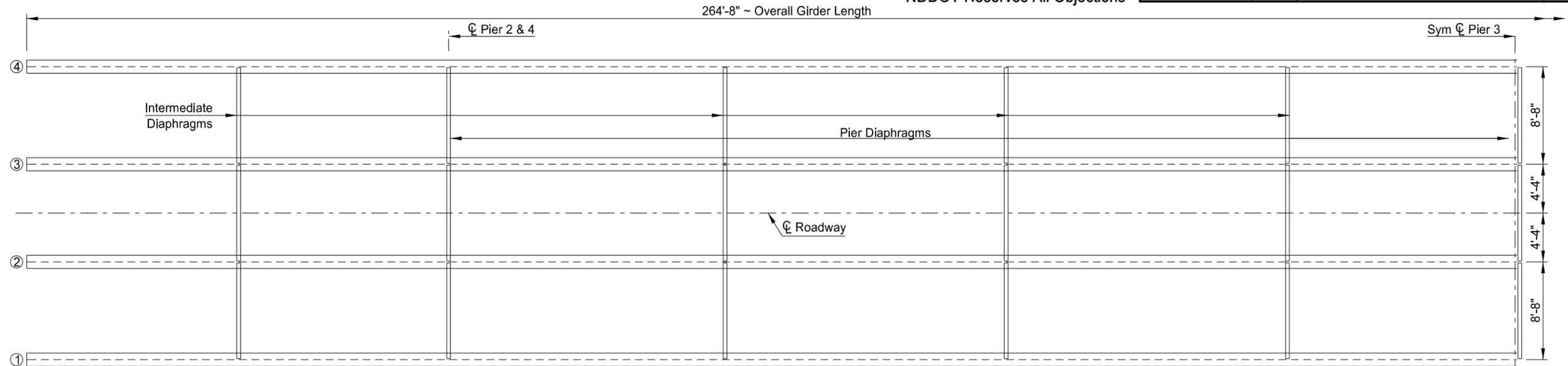


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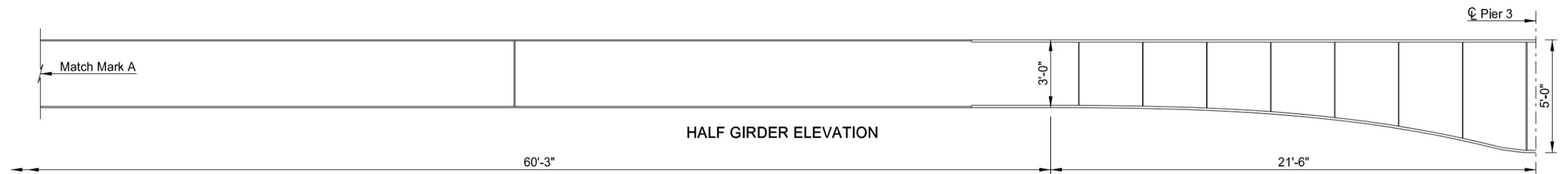
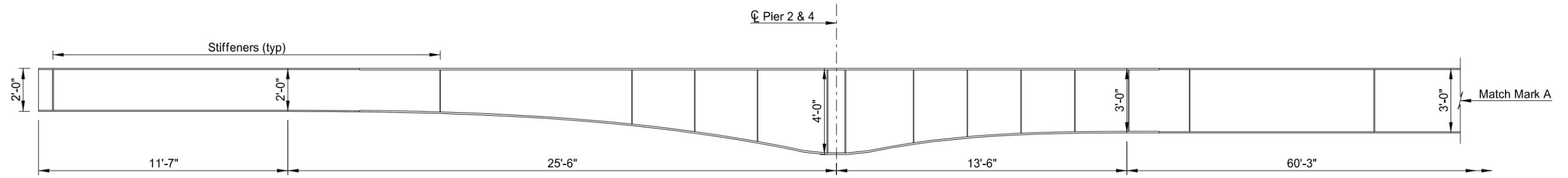
SITE 3  
 I29 BLANCHARD INTERCHANGE

STRUCTURAL STEEL  
 PAINTING DETAILS

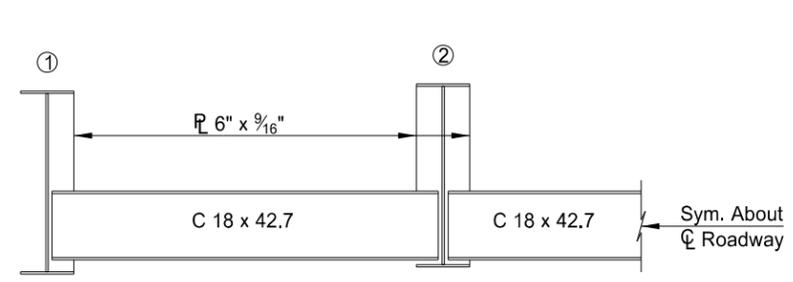
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ND	S-BRI-8-029(150)094	170	5



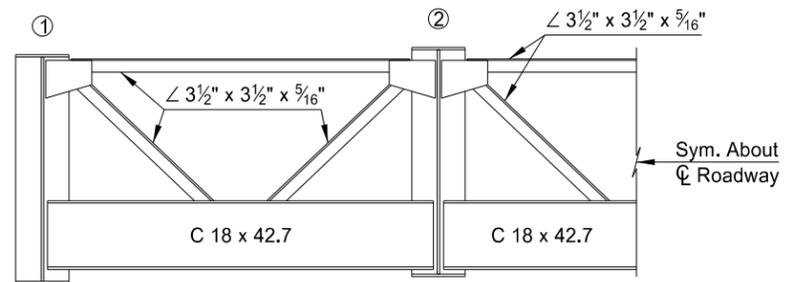
HALF GIRDER LAYOUT



HALF GIRDER ELEVATION



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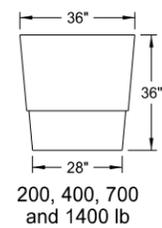
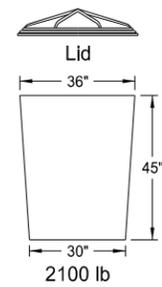
DIAPHRAGM @ PIER 3

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**SITE 4  
CUMMINGS SEPERATION**

**STRUCTURAL STEEL  
PAINTING DETAILS**

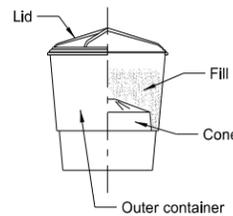
ATTENUATION DEVICE



Outer Containers

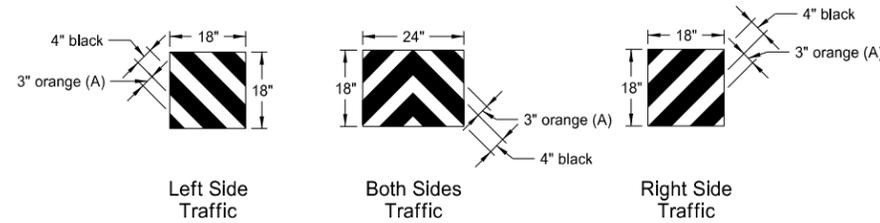


Cones



Typical Assembly

Typical Module Construction Detail

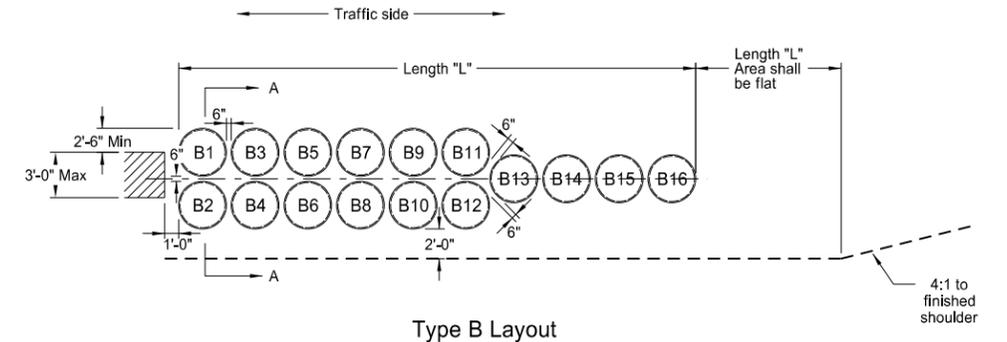


Reflective Sheet Detail

Note:  
The last attenuation device facing traffic shall have a reflective sheet, following the details above, directly applied to the outer container. The sheet may also be applied to a metallic sheet and attached to the container with approved fasteners. The reflective sheeting shall be Type III C as specified in NDDOT Standard Specifications.

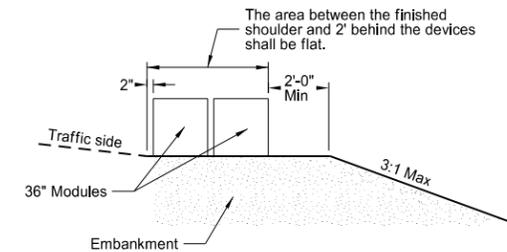
(A) 3" orange sheeting shall be used for temporary installations, and 3" yellow sheeting shall be used for permanent installations.

	Fill Chart				
	Module Weights (LBS)				
Distance from top edge	200	400	700	1400	2100
	8 1/2"	5"	4"	3"	0"



Type B Layout

Note:  
When attenuation devices are placed at piers offset from roadway, they shall be angled 10 degrees towards traffic.



Section A-A (Type B Layout)

Type B Attenuation Device											
Module Number	Dash Number										
	75	70	65	60	55	50	45	40	35	30	25
Module Weights (LBS)											
B1	2100										
B2	2100										
B3	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B4	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B5	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B6	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B7	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B8	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B9	700	700	700	700	700	700	700	700	700	700	700
B10	700	700	700	700	700	700	700	700	700	700	700
B11	700	700	700	700	700	700	700	700	700	700	700
B12	700	700	700	700	700	700	700	700	700	700	700
B13	700	700	700	700	700	700	700	700	700	700	700
B14	400	400	400	400	400	400	400	400	400	400	400
B15	400	400	400	400	400	400	400	400	400	400	400
B16	200	200	200	200	200	200	200	200	200	200	200
Length (L)	34.2'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	27.2'	27.2'
Module Weights (LBS)	Replacement Module										
	2100	1	1	1	1	1	1	1	1	1	
	1400	1	1	1	1	1	1	1	1	1	1
	700	2	2	2	2	2	2	2	2	2	2
	400	1	1	1	1	1	1	1	1	1	1
200	2	2	2	1	1	1	1	1	1	1	1

Notes:

- Materials
  - Modules shall be manufactured from a frangible polyethylene material which will shatter upon impact.
  - Modules shall be filled with class 43 aggregate meeting the requirements for aggregate according to NDDOT Standard Specifications. The fill unit weight shall be at least 100 pounds per cubic foot. Fill left over winter shall have a moisture content of 2% or less.
- Modules
 

The modules shall be provided in two sizes to contain volumes of either 2, 4, 7, 14, or 21 cubic feet as a minimum.

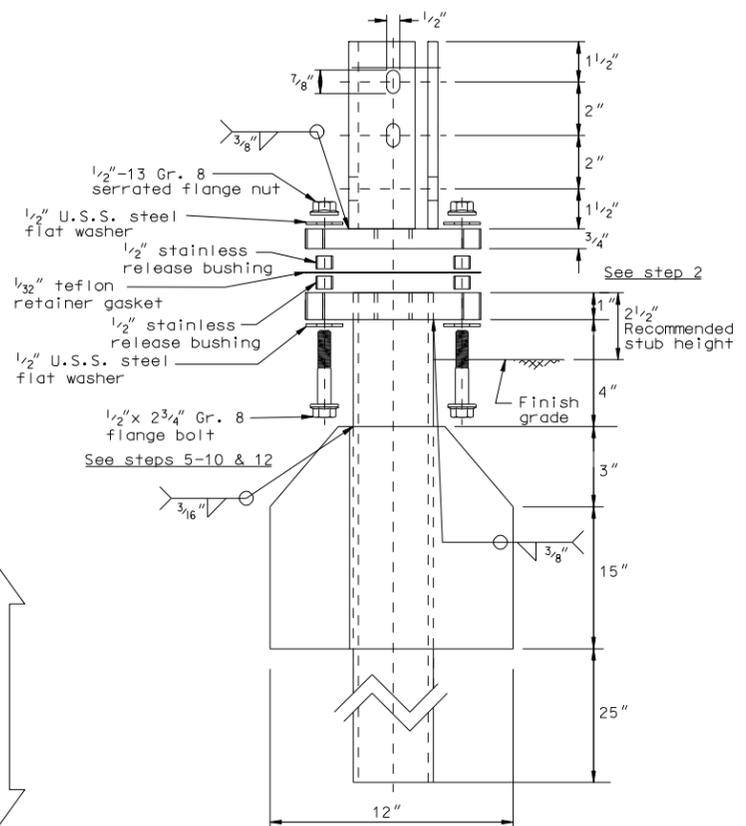
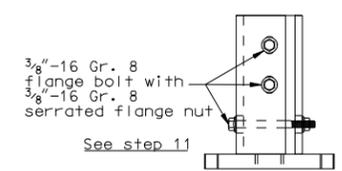
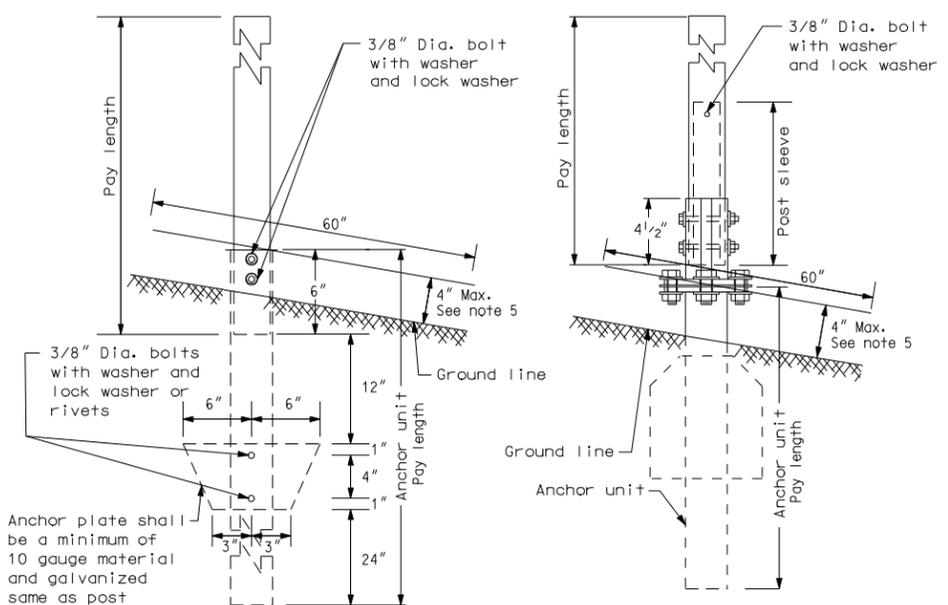
  - The module for the 2, 4 or 7 cubic foot container shall consist of three components:
    - A 14 C.F., yellow outer container.
    - A black lid which locks securely over the top lip of the container.
    - A cone-shaped supporting insert. The insert shall be varied to allow for the three sizes of modules and capable of supporting 200, 400, or 700 pounds of sand mass. The cone inserts shall be placed inside the 14 cubic foot container.
  - The module for the 21 cubic foot container shall consist of two components:
    - A 36" height X 36" width yellow outer container.
    - A black lid which locks securely over the top of the container.
- For temporary use: The modules shall be Energite or Fitch attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or an approved equal. The attenuation devices may be placed on pallets to facilitate maintenance. Pallets shall have a maximum thickness of 3 1/2".
- For permanent use: Barrel Attenuation Device installations, the outer sand container portion of the modules shall consist of a one-piece container with separate detachable lid. The modules which meet these requirements are Energite attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or an approved equal. Modules having outer sand containers assembled from multiple pieces shall not be accepted for permanent installations.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE

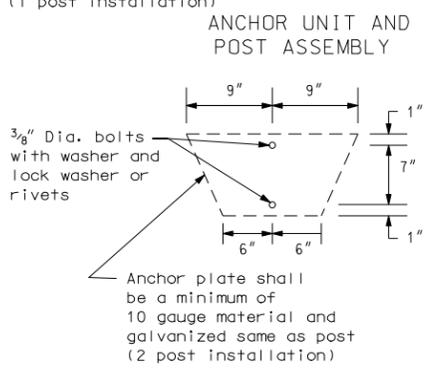
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 Roger Weigel,  
 Registration Number  
 PE-2930,  
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# BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

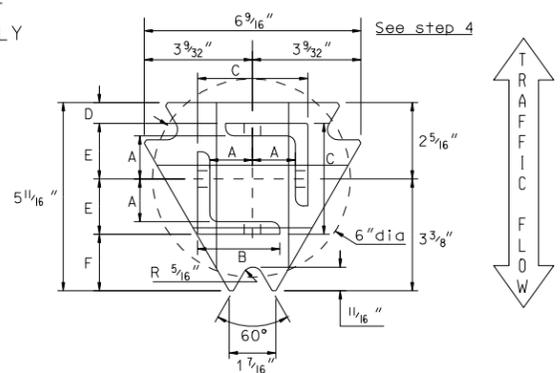
## PERFORATED TUBE



- Notes
1. Slip base bolts shall be torqued as specified by the manufacturer.
  2. The 2 3/16 inch size 10 gauge is shown as 2.19 inch size on the plans. The 2 1/2 inch size 10 gauge is shown as 2.51 inch size on the plans.
  3. Anchor for 2 inch, 2 1/4 inch, and 2 1/2 inch posts.
  4. Anchor material shall be 7 gauge H.R.P.O. Commercial quality ASTM A569 and 3 inch x 3 inch x 7 gauge ASTM A500 Grade B. Anchor shall have a yield strength of 43.9 KSI and tensile strength of 59.3 KSI. Anchor shall be hot dipped galvanized per ASTM A123/A153. All tolerances on anchor unit and slip base bottom assembly are ± 0.005 unless otherwise noted.
  5. 4 inch vertical clearance of anchor or breakaway base. The 4 inch x 60 inch measurement shall be made above and below post location and also back and ahead of post.
  6. When used in concrete sidewalk, anchor shall be the same except without the wings.
  7. Four post signs shall have over 8 feet between the first and fourth posts.



ANCHOR UNIT AND POST ASSEMBLY

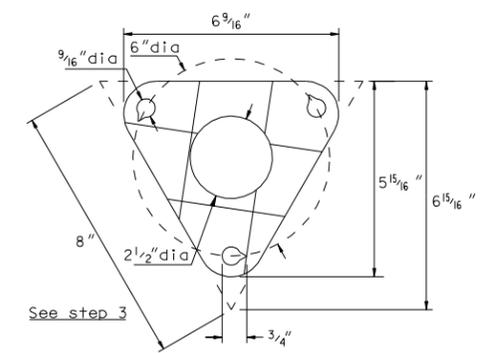


TOP POST RECEIVER

Materials: Plate - ASTM A572 grade 50  
Angle receiver - 2 1/2 inch x 2 1/2 inch x 3/8 inch ASTM A36 structural angle

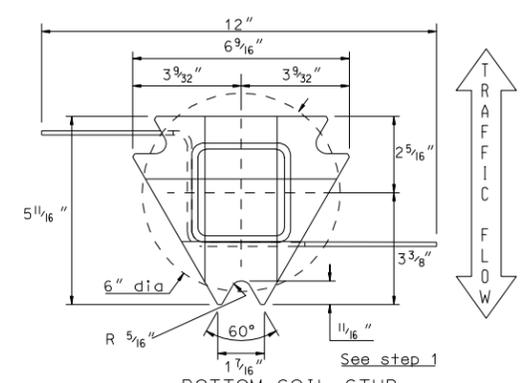
Square Post Sizes	A	B	C	D	E	F
2 3/16 inch x 10 Ga. Square Post	1 3/64 inch	2 1/2 inch	3 1/32 inch	2 5/32 inch	1 3/64 inch	1 7/8 inch
2 1/2 inch x 10 Ga. Square Post	1 3/32 inch	2 1/2 inch	3 5/16 inch	5/8 inch	1 2/32 inch	1 3/4 inch

2 3/16 inch x 10 gauge may be inserted into 2 1/2 inch x 10 gauge for additional wind load.



BOLT RETAINER FOR BASE CONNECTION  
Materials: 1/32 inch reprocessed Teflon

MULTI-DIRECTIONAL SLIP BASE ASSEMBLY	
STEP	INSTALLATION PROCEDURE
1.	Install bottom soil anchor stub plumb and squared up with road, with point of plate facing oncoming traffic.
2.	Depth of imbedment to leave 2 1/2 inch from grade to top of anchor plate.
3.	Place teflon bolt retainer gasket on top of bottom plate (make sure that notches in holes are pointing counter clockwise).
4.	Place top post receiver on to retainer gasket, properly indexed so that angle receivers are squared up with road.
5.	Slide 1 each 1/2 inch flat washer on to 1 each inverted 1/2 inch - 13 gr. 8 flange bolt, followed by 1 each stainless steel release bushing.
6.	Insert above bolt with washer and bushing up through notched points of top and bottom plates, passing through hole in gasket.
7.	Slide second bushing down on to above bolt until it rests on top of gasket followed by second washer.
8.	Complete by threading 1/2 inch - 13 gr. 8 serrated flange nut snugly down against top of washer.
9.	Repeat steps 5,6,7 & 8 at the two remaining notched triangle points.
10.	Insert sign post into angle receivers on top half until post(s) bottom out. *NOTE: Where higher wind load is desired, insert the next size smaller square post inside bottom of main upright post (Minimum of 48 inch, not to exceed beyond bottom edge of sign).
11.	Secure posts into receivers using 3 each 3/8 inch - 16 gr. 8 flange bolts and 3 each 3/8 inch - 16 serrated flange nuts in receiver slots (top 2 bolts should be parallel to highway) do not tighten nuts until all bolts are in place.
12.	After all sub-assembly hardware is tightened, then torque the three 1/2 inch - 13 nuts to 42 ft-lbs, in a circular pattern until all bolt assemblies reach the required torque. *NOTE: On multi-leg installations, be sure that all anchors are squared and lined up with each other.



BOTTOM SOIL STUB  
Materials: Tube - 3 inch x 3 inch x 7 gauge ASTM A500 Gr B tube  
Stabilizing Wing - 7 gauge H.R.P.O. ASTM A 569  
Plate - ASTM A572 grade 50

Number of Posts	Telescoping Perforated Tube					
	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size Without Slip Base In.
1	2	12			No	2 1/4
1	2 1/4	12			No	2 1/2
1	2 1/2	12			B	3
1	2 1/2	10			Yes	
1	2 1/4	12	2	12	Yes	
1	2 1/2	12	2 1/4	12	Yes	
2	2	12			No	2 1/4
2	2 1/4	12			No	2 1/2
2	2 1/2	12			Yes	
2	2 1/2	10			Yes	
2	2 1/4	12	2	12	Yes	
2	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/2	12			Yes	
3 & 4	2 1/2	10			Yes	
3 & 4	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/4	12	2	12	Yes	
3 & 4	2 1/2	10	2 3/16	10	Yes	

B - The 2 1/2 inch, 12 gauge posts do not need breakaway bases when placed in standard soils, but require a shim as specified by the manufacturer. The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak. Weak soils are classified as boggy, wet, or loose soil areas.

Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In. 4	Cross Sect. Area In. 2	Section Modulus In. 3
1 1/2 x 1 1/2	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.416	0.372	0.590	0.372
2 1/4 x 2 1/4	0.105	12	2.773	0.561	0.695	0.499
2 3/16 x 2 3/16	0.135	10	3.432	0.605	0.841	0.590
2 1/2 x 2 1/2	0.105	12	3.141	0.804	0.803	0.643
2 1/2 x 2 1/2	0.135	10	4.006	0.979	1.010	0.785
4 x 4	0.250	1/4	6.600	3.040	1.940	1.050

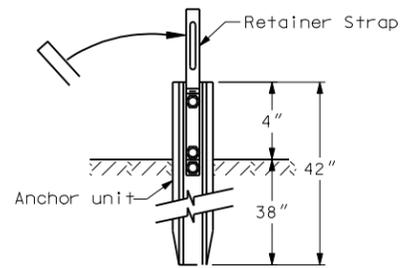
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-21-02	
REVISIONS	
DATE	CHANGE
12-01-04	PE stamp added

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# BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-8

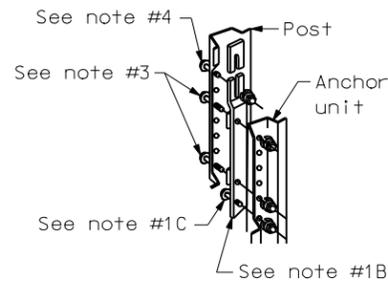
## FLANGED CHANNEL



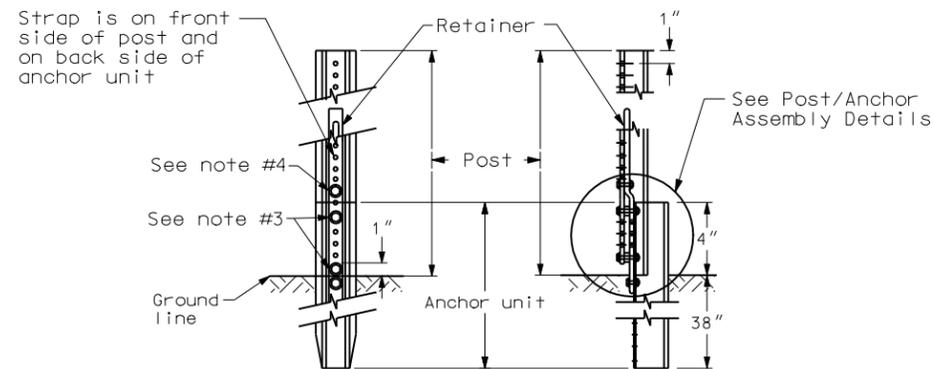
Anchor Unit & Strap Assembly Detail

### STEPS OF INSTALLATION

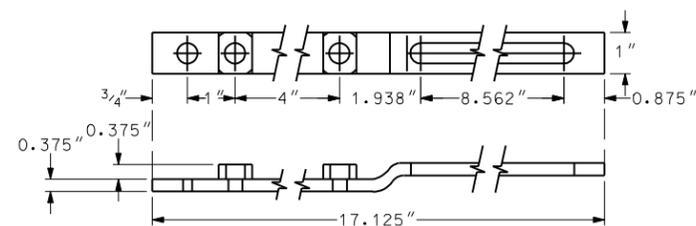
1. A) Drive anchor unit to within 12" of ground level.  
B) Proper assembly established by lining up the top 3/4" slot of retainer spacer strap with top hole of anchor unit.  
C) Assemble strap to back of anchor unit using 3/8"-16 UNC x 2.0" long bolt, lock washer and nut.  
D) Rotate strap 90° to left.
2. A) Drive anchor unit to 4" dimension.  
B) Rotate strap to vertical position.
3. A) Place 3/8"-16 UNC x 2" bolt, lock washer & nut in bottom of sign post to facilitate alignment of sign post with proper hole in anchor unit (this coincides with the bottom 3/4" slot in the strap).  
B) Alternately tighten two connector bolts.
4. A) Complete assembly by tightening 3/8"-16 UNC x 2" long retainer bolt (this fastens sign post to retainer spacer strap).
5. The base post, strap & sign post shall be properly nested. Proper nesting occurs when all flat surfaces of the base post, strap and sign post at the bolts have full contact across the entire width.



Post/Anchor Assembly Details



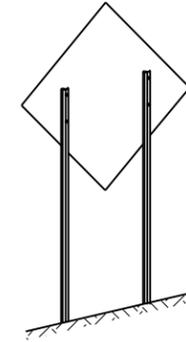
Front View Side View Sign Post Assembly Detail



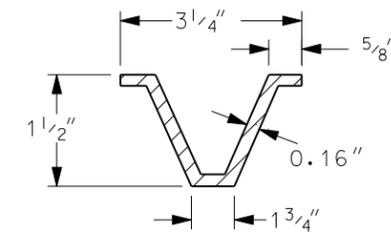
Retainer/Spacer Strap Detail

CHANNEL SIZE IN.	WALL THICKNESS IN.	WEIGHT PER FOOT LBS.	MOMENT OF INERTIA IN. 4	CROSS SECT. AREA IN. SQ.	SECTION MODULUS IN. 3
1.516 x 3.125"	.116	2.00	.179	.590	.225
1.532 x 3.125"	.124	2.25	.201	.648	.254
1.562 x 3.125"	.132	2.50	.233	.748	.289
1.578 x 3.125"	.140	2.75	.271	.819	.329
1.750 x 3.500"	.150	3.00	.372	.918	.403
1.750 x 3.500"	.175	4.00	.500	1.190	.560

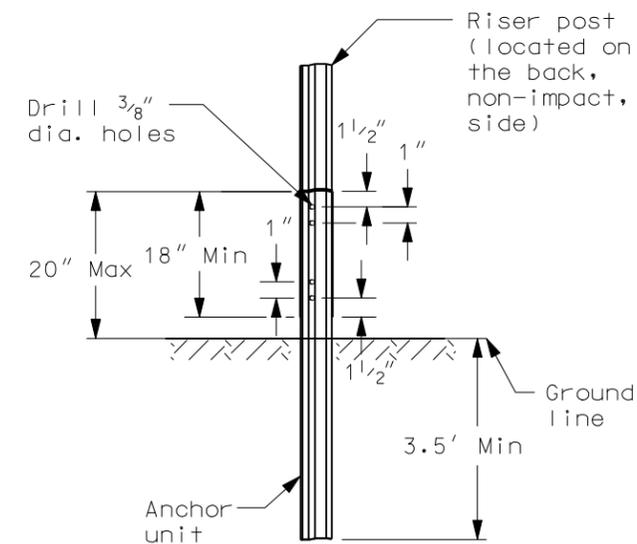
## 3 LB/FT U POSTS



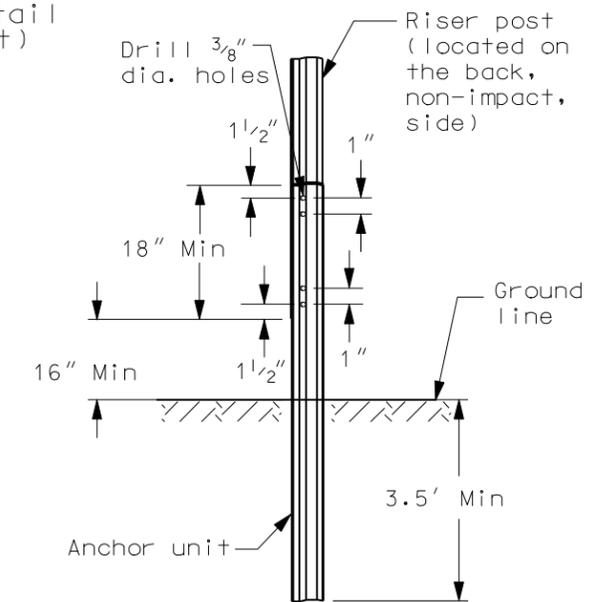
Typical Installation



U-Post Detail (3 lb/ft)



U-Channel Splice Option 1



U-Channel Splice Option 2

### Notes

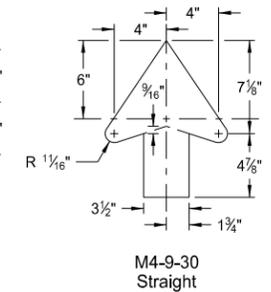
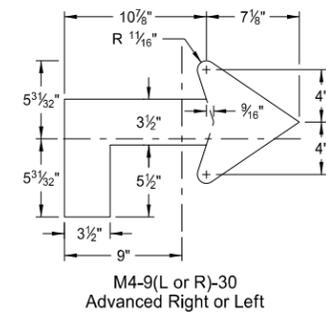
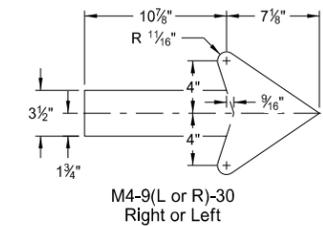
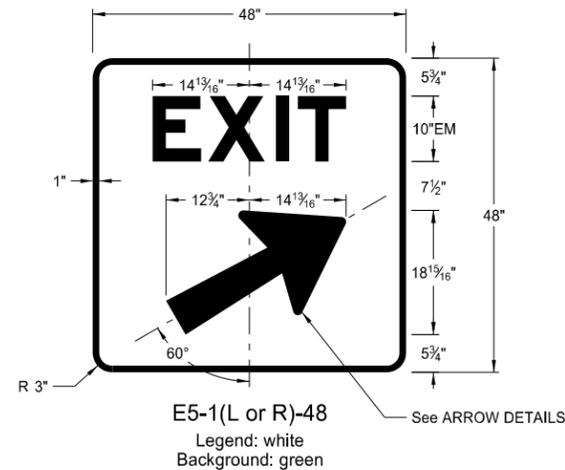
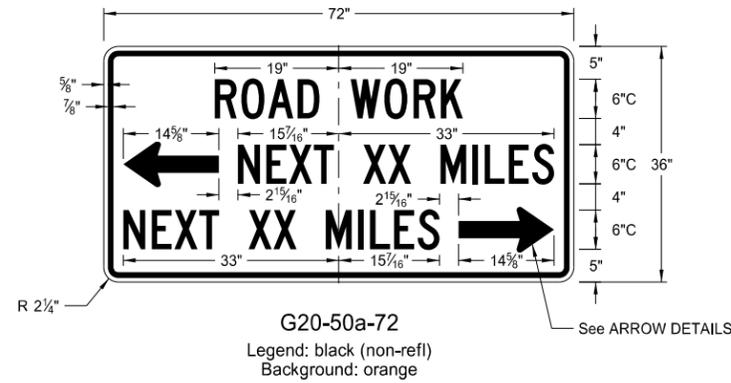
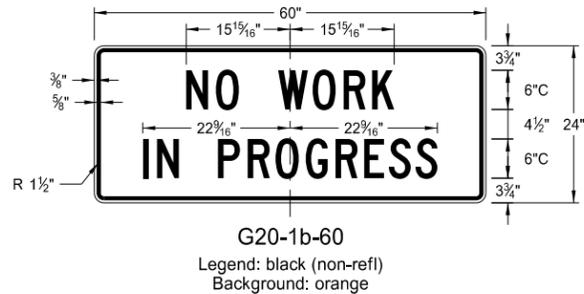
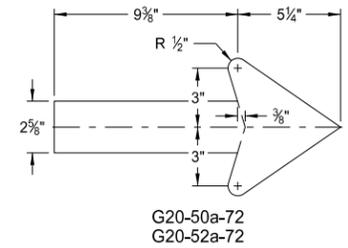
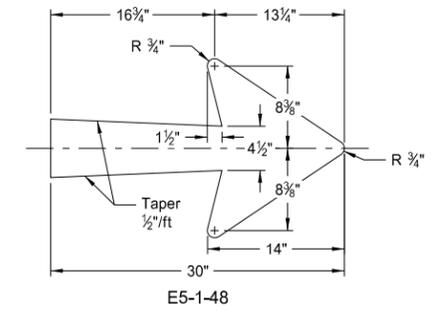
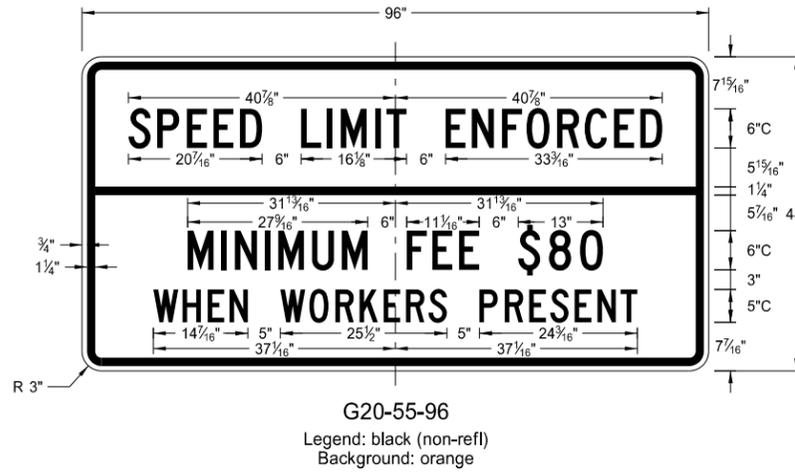
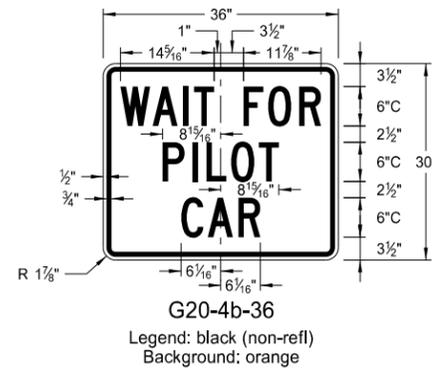
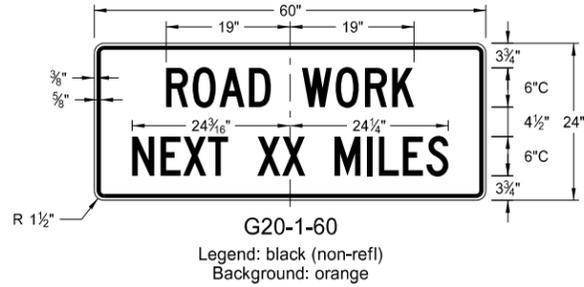
1. Use 3 lb/ft riser anchor units and risers
2. Driven riser posts shall be at least 7' long and embedded at least 3.5'.
3. A splice shall overlap a minimum of 18".
4. Use 4 bolts 5/16" diameter with washers and nuts. Two at top and two at bottom of splice.
5. Anchor unit for guy wires shall be no more than 4" above ground and embedded at least 3.5'.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-28-93	
REVISIONS	
DATE	CHANGE
03-07-01	Revised U-post details
11-21-02	Deleted perforated tube
05-08-03	Revised U-Channel splice
12-01-04	PE stamp added
06-29-05	Revised flanged channel note

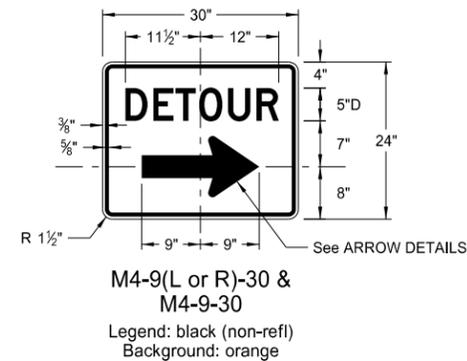
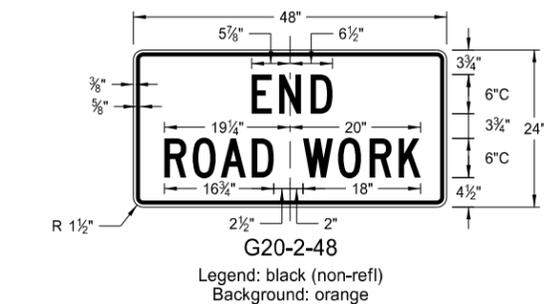
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CONSTRUCTION SIGN DETAILS  
 TERMINAL AND GUIDE SIGNS

D-704-9



ARROW DETAILS



NOTES:

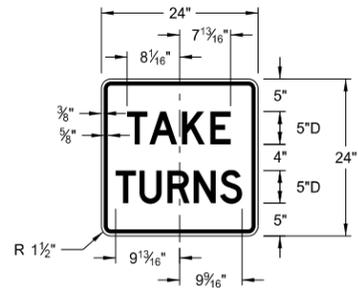
(A) Arrow may be right or left of the legend to indicate construction to the right or left.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE

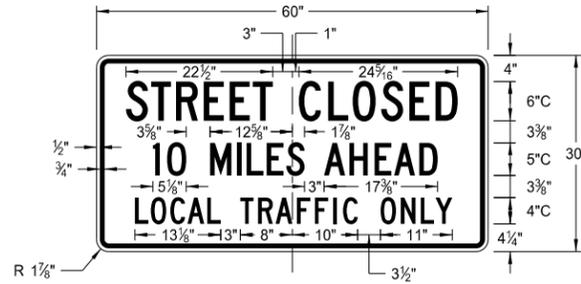
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 Roger Weigel,  
 Registration Number  
 PE-2930,  
 on 8/13/13 and the original document is stored at the  
 North Dakota Department  
 of Transportation

CONSTRUCTION SIGN DETAILS  
REGULATORY SIGNS

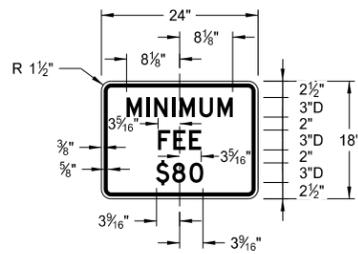
D-704-10



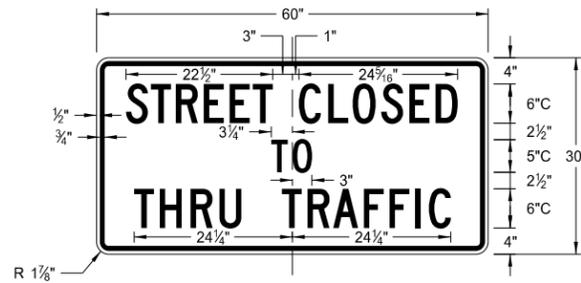
R1-50-24  
Legend: black (non-refl)  
Background: white



R11-3c-60  
Legend: black (non-refl)  
Background: white



R2-1a-24  
Legend: black (non-refl)  
Background: white



R11-4a-60  
Legend: black (non-refl)  
Background: white



R11-2a-48  
Legend: black (non-refl)  
Background: white

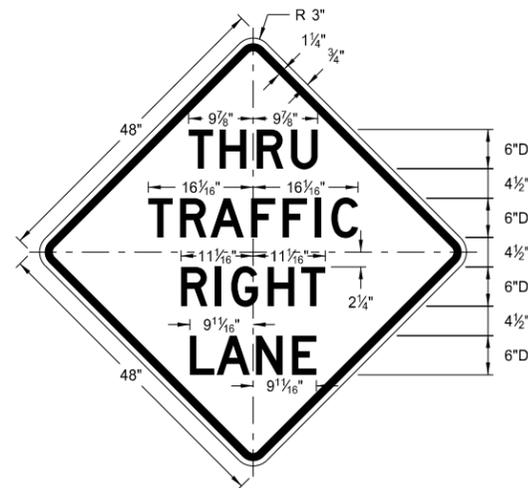
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE

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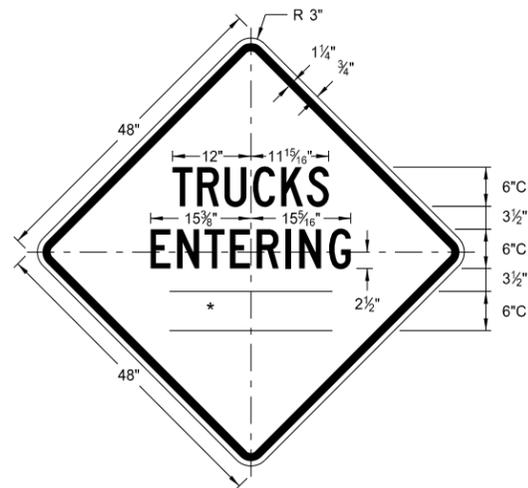
CONSTRUCTION SIGN DETAILS  
WARNING SIGNS

WORD	LETTER SPACING
AHEAD	Standard
200 FT	Standard
350 FT	Standard
500 FT	Standard
1000 FT	Reduce 40%
1500 FT	Reduce 40%
½ MILE	Reduce 50%
1 MILE	Standard

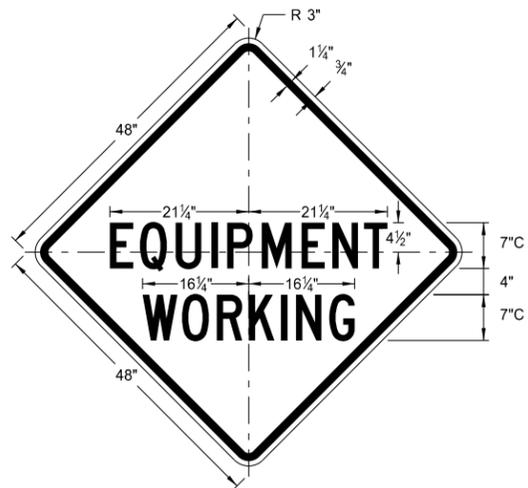
\* DISTANCE MESSAGES



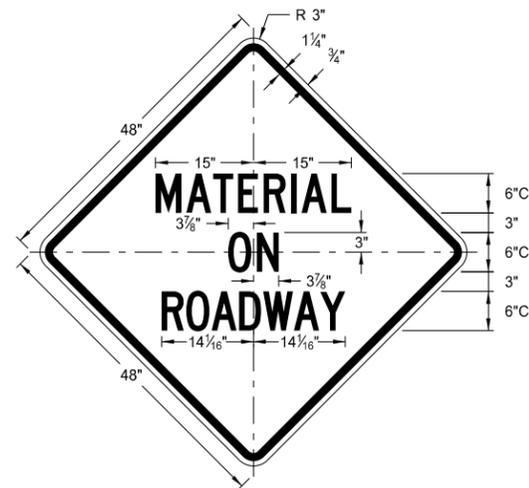
W5-8-48  
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Background: orange



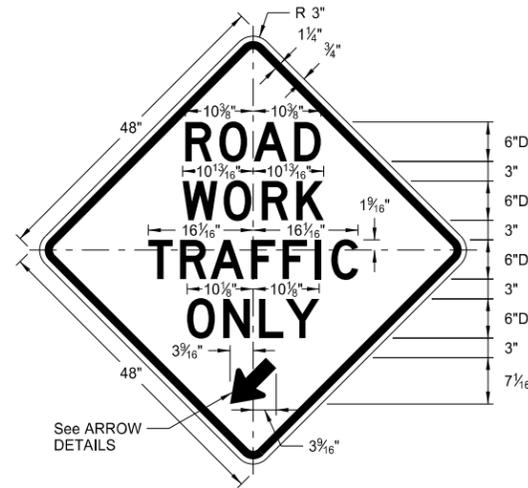
W8-54-48  
Legend: black (non-refl)  
Background: orange



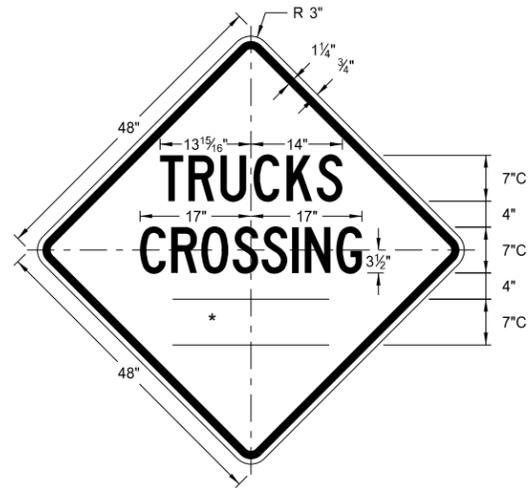
W20-51-48  
Legend: black (non-refl)  
Background: orange



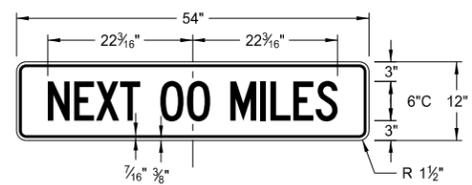
W21-51-48  
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Background: orange



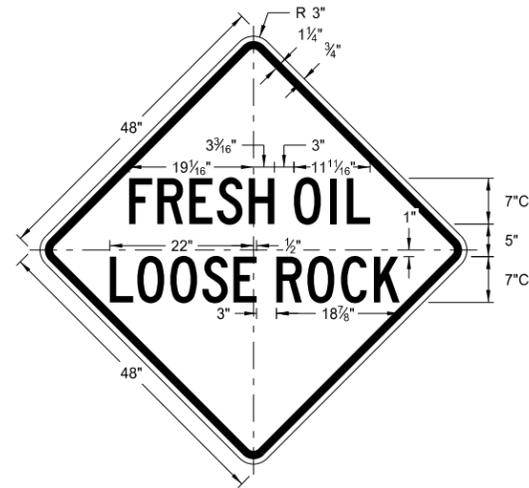
W5-9-48  
Legend: black (non-refl)  
Background: orange



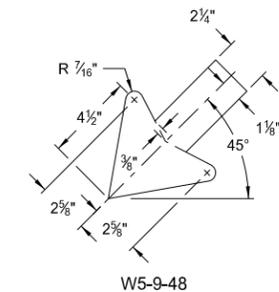
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Background: orange



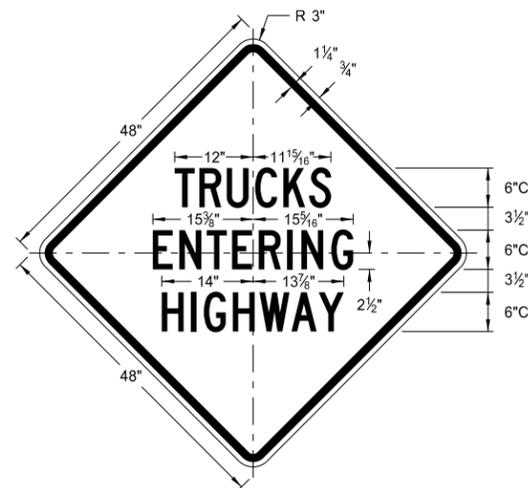
W20-52-54  
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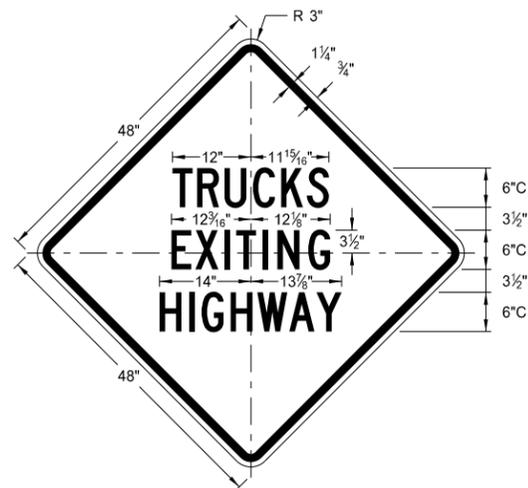
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Background: orange



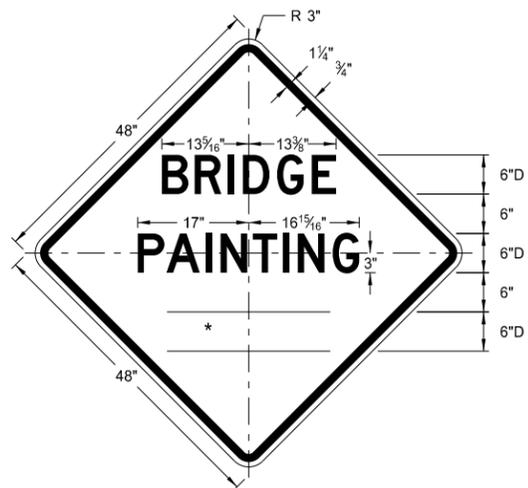
W5-9-48  
ARROW DETAILS



W8-53-48  
Legend: black (non-refl)  
Background: orange



W8-56-48  
Legend: black (non-refl)  
Background: orange

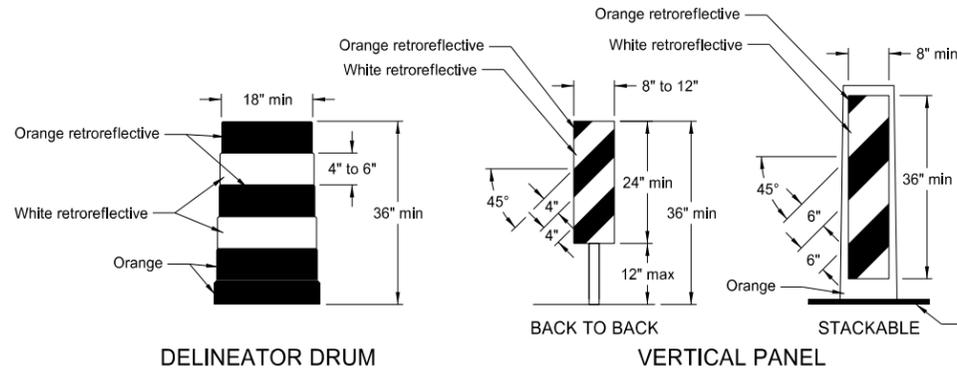


W21-50-48  
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Background: orange

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE

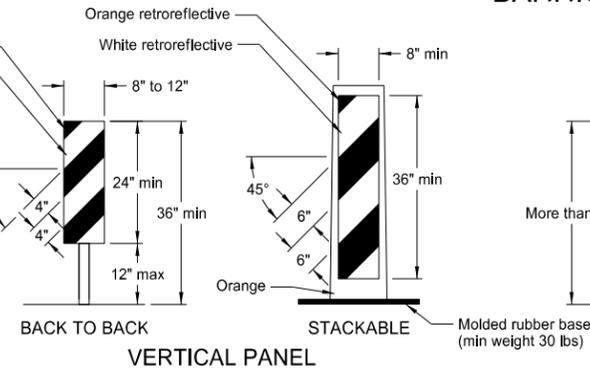
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BARRICADE AND CHANNELIZING DEVICE DETAILS



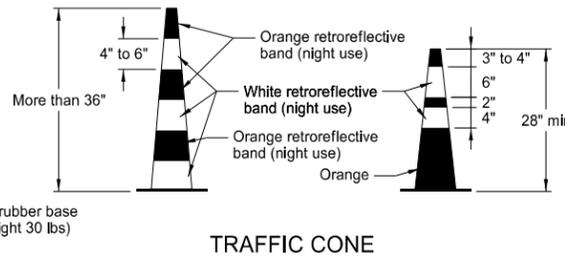
DELINEATOR DRUM

The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4" to 6" wide. Each drum shall have a minimum of two orange and two white stripes with the top stripe being orange. Any nonretroreflectORIZED spaces between the horizontal orange and white stripes shall not exceed 3" wide. Stripes shall not be placed on ribs or indentations in the drum. Drums shall have closed tops that will not allow collection of construction debris or other debris. Ballast shall not be placed on the top of a drum.



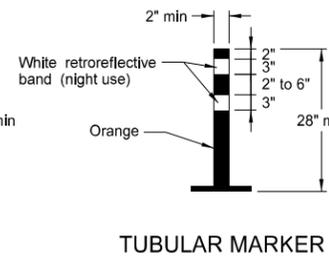
VERTICAL PANEL

Markings for vertical panels shall be alternating orange and white retroreflective stripes, sloping downward in the direction vehicular traffic is to pass. Retroreflective sheeting shall be placed on both sides of panel and shall have a minimum of 270 square inches of retroreflective area facing vehicular traffic. Where the height of the retroreflective material on the vertical panel is 36 inches or more, a stripe width of 6 inches shall be used.



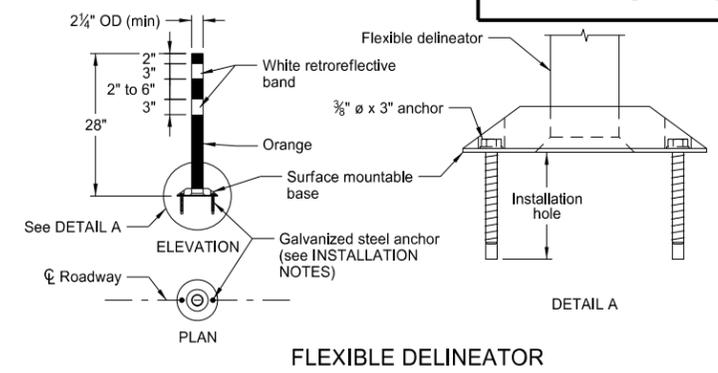
TRAFFIC CONE

RetroreflectORIZATION of cones more than 36" in height shall be provided by alternating orange and white retroreflective stripes. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any nonretroreflectORIZED space between the orange and white stripes shall not exceed 3" wide.



TUBULAR MARKER

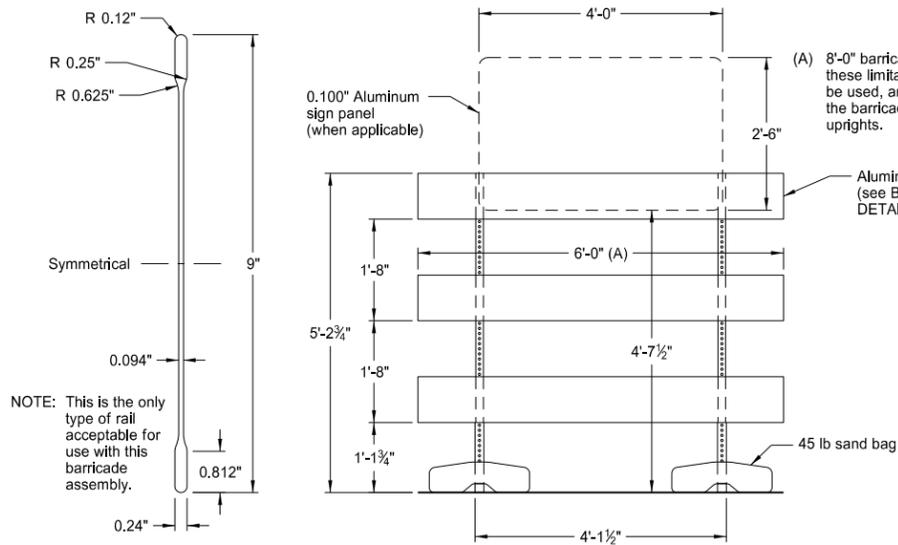
RetroreflectORIZATION of tubular markers more than 42" in height shall be provided by alternating four 4" to 6" wide orange and white stripes with the top stripe being orange.



FLEXIBLE DELINEATOR

INSTALLATION NOTES:

1. Drill installation holes to diameter and depth as required by manufacturer's specifications.
2. For removal, remove anchors and fill installation hole with an epoxy designed to bond to pavement surface.
3. In lieu of bolted down base, the contractor may use an 8" x 8" butyl pad or hot melt butyl. Butyl shall be removed as close as possible to pavement surface.

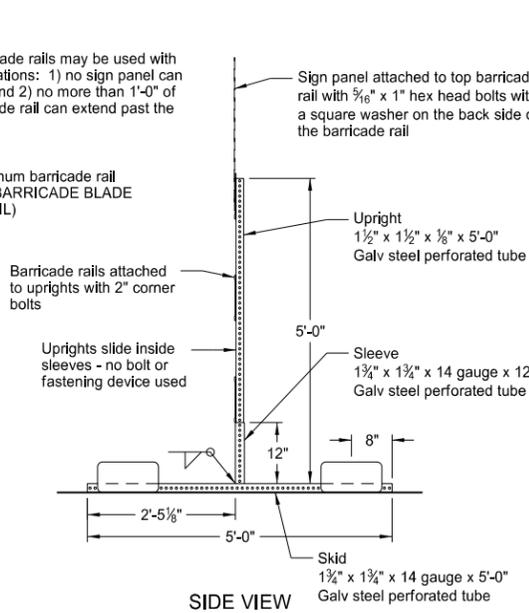


BARRICADE BLADE DETAIL

ELEVATION VIEW

BARRICADE ASSEMBLY DETAIL (Aluminum Barricade Rails)

NOTE: This is the only type of rail acceptable for use with this barricade assembly.

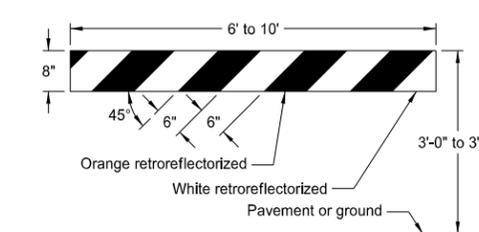


ELEVATION VIEW

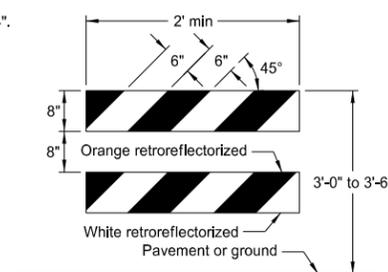
BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

SIDE VIEW

NOTE: Markings for barricades shall be alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Retroreflective sheeting shall be placed on both sides of the rails and shall have a minimum of 270 square inches of visible retroreflective area facing vehicular traffic. When the barricade length is less than 36", the rail stripe width shall be 4".

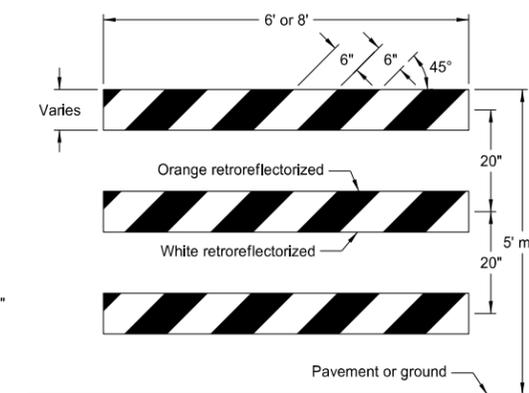


TYPE I BARRICADE

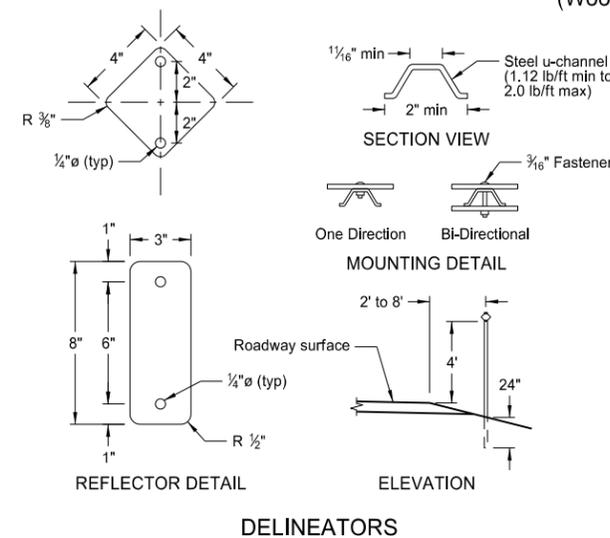


TYPE II BARRICADE

BARRICADE RAIL DETAILS

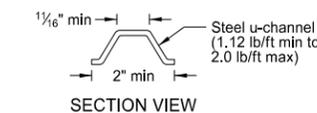


TYPE III BARRICADE



REFLECTOR DETAIL

DELINEATORS



SECTION VIEW



MOUNTING DETAIL

One Direction Bi-Directional

ROADWAY SURFACE

ELEVATION

MINIMUM BALLAST (For each side of barricade support)

Without Sign	4 - 25 lb sandbags
With Sign	6 - 25 lb sandbags

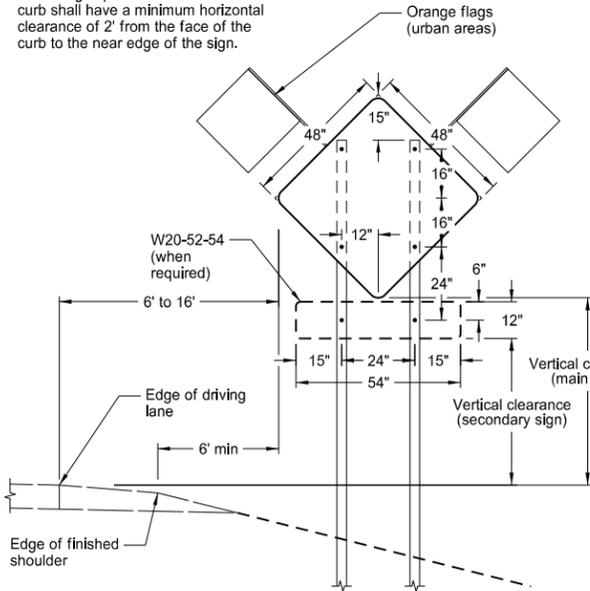
Note: The number of sandbags are based on a wind speed of 55 MPH. The sandbags are assumed to be placed at or near the ends of the skids.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE

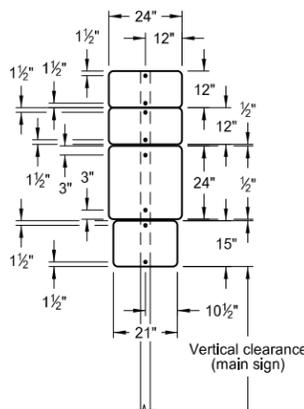
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CONSTRUCTION SIGN PUNCHING AND MOUNTING DETAILS

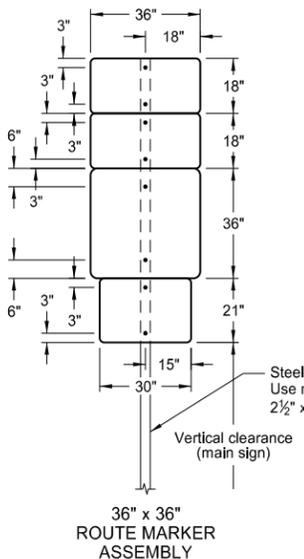
Note: Signs placed in sections with curb shall have a minimum horizontal clearance of 2' from the face of the curb to the near edge of the sign.



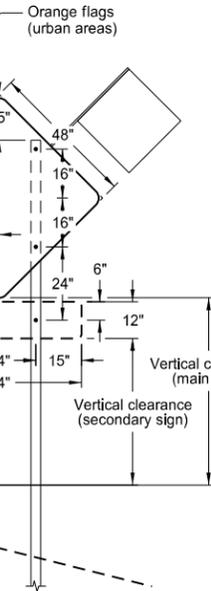
TYPICAL SECTION  
(48" x 48" diamond warning sign shown)



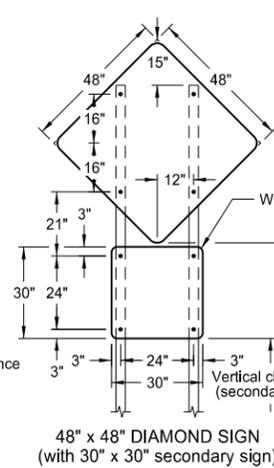
24" x 24" ROUTE MARKER ASSEMBLY



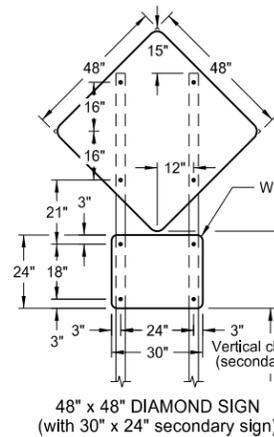
36" x 36" ROUTE MARKER ASSEMBLY



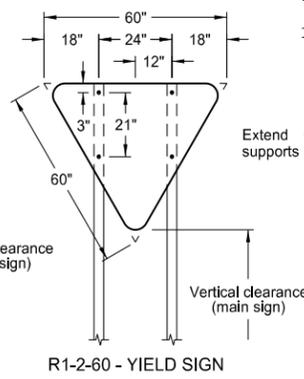
18" x 18" DIAMOND SIGN



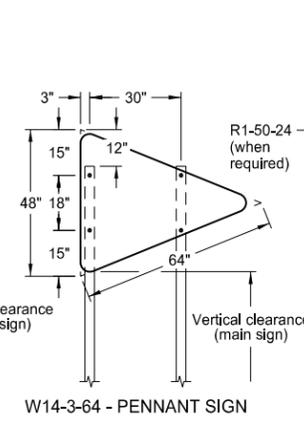
48" x 48" DIAMOND SIGN  
(with 30" x 30" secondary sign)



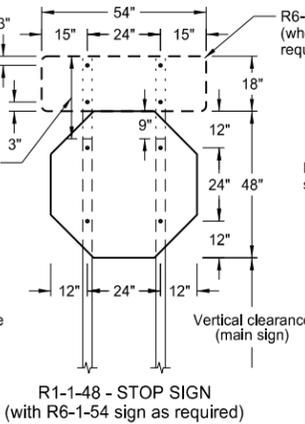
48" x 48" DIAMOND SIGN  
(with 30" x 24" secondary sign)



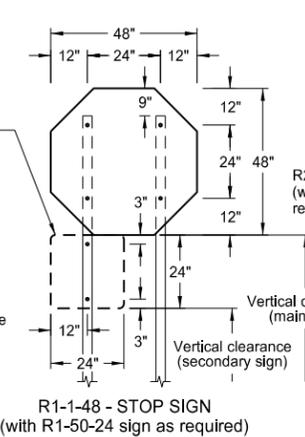
R1-2-60 - YIELD SIGN



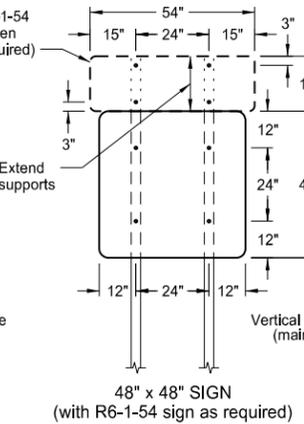
W14-3-64 - PENNANT SIGN



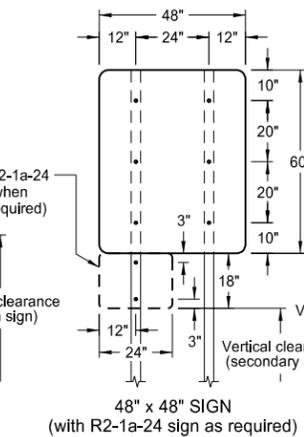
R1-1-48 - STOP SIGN  
(with R6-1-54 sign as required)



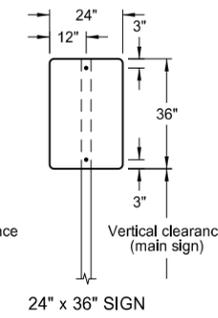
R1-1-48 - STOP SIGN  
(with R1-50-24 sign as required)



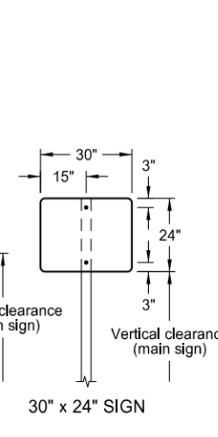
48" x 48" SIGN  
(with R6-1-54 sign as required)



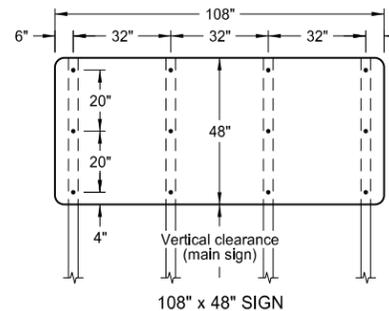
48" x 48" SIGN  
(with R2-1a-24 sign as required)



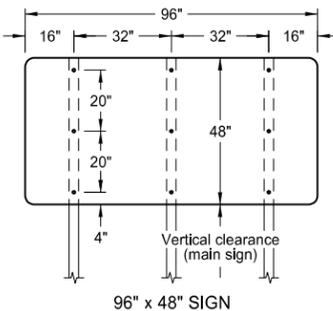
24" x 36" SIGN



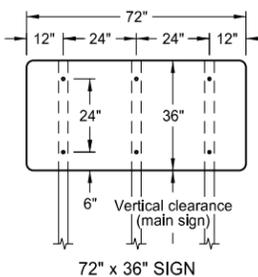
30" x 24" SIGN



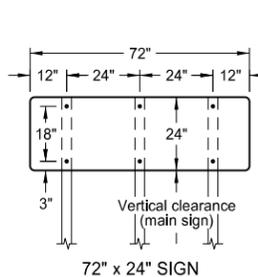
108" x 48" SIGN



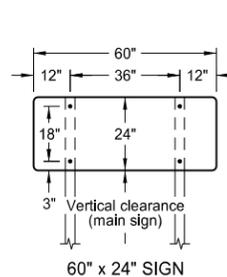
96" x 48" SIGN



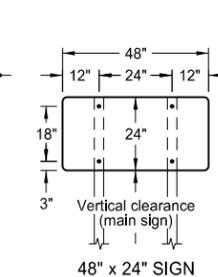
72" x 36" SIGN



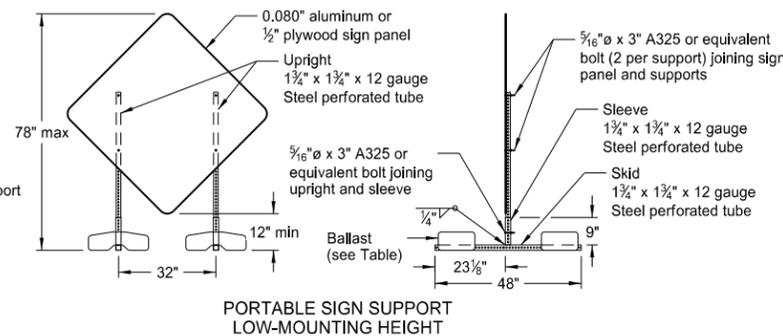
72" x 24" SIGN



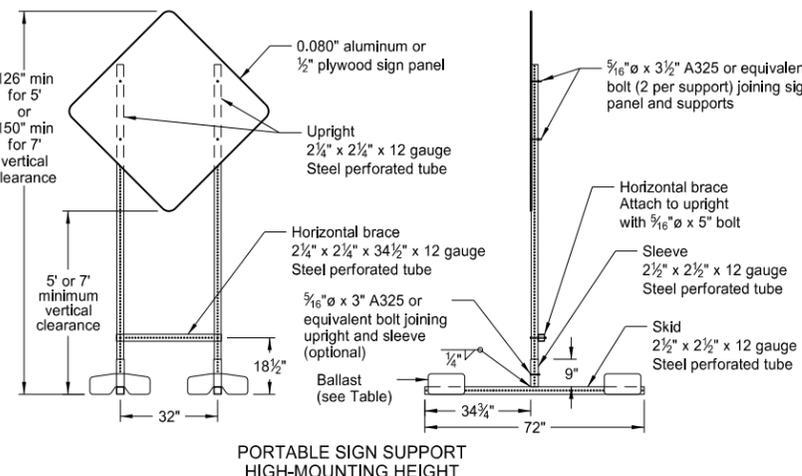
60" x 24" SIGN



48" x 24" SIGN



PORTABLE SIGN SUPPORT  
LOW-MOUNTING HEIGHT



PORTABLE SIGN SUPPORT  
HIGH-MOUNTING HEIGHT

NOTES:

1. Sign Supports: Supports shall be galvanized or painted. Minimum post sizes are 2.5 lb/ft u-channel or 2" x 2" x 12 gauge steel perforated tube, except where noted. When installing signs on u-channel, the minimum post size for assemblies containing a secondary sign is 3.0 lb/ft. Post sizes are based on a wind speed of 55 MPH.

Signs over 50 square feet should be installed on 2 1/2" x 2 1/2" perforated tube supports as a minimum.

Guy wires shall not be attached to sign supports. Wind beams may be attached to u-posts behind the sign panels.

2. Sign Panels: Provide sign panels made of 0.100" aluminum, 1/2" plywood, or other approved material, except where noted. All holes to be punched round for 3/8" bolts.

3. Alternate Messages: The signs that have alternate messages may have these alternate messages placed on a reflectorized plate (without a border) and installed and removed as required. (i.e. "Left" and "Right" message on a lane closure sign)

4. Route Marker Auxiliary Signs: Provide route marker auxiliary signs, such as the cardinal direction and directional arrows, with a background and legend that match the route marker they are used with:

Interstate - white legend on blue background  
Interstate Business Loop - white legend on green background  
US and State - black legend on white background  
County - yellow legend on blue background

5. Vertical Clearance: Install signs with a vertical clearance of 5'-0" (see TYPICAL SECTION.) In areas where parking or pedestrian movements are likely or the view of the sign may be obstructed, install signs with a vertical clearance of 7'-0" from the top of the curb or from the near edge of the driving lane in absence of a curb.

The vertical clearance to secondary signs is 1'-0" less than the vertical clearance as stated above.

Large signs having an area exceeding 50 square feet shall have a minimum clearance of 7'-0" from the ground at the post.

6. Portable Signs: Provide portable signs that meet the vertical clearance as stated above. Use portable signs when it is necessary to place signs within the pavement surface.

When portable signs are used for 5 days or less, low-mounting height (minimum 12" vertical clearance) sign supports may be used as long as the view of the sign is not obstructed. Time delays caused by unforeseen circumstances, such as equipment breakdown, rain, subgrade failures, etc., will not accrue towards the 5 day period. The R9-8 through R9-11a series, W1-5 through W1-8 series, M4-10, and E5-1 may be used for longer than 5 days.

Signs mounted to the portable sign supports shown in the LOW-MOUNTING HEIGHT and HIGH-MOUNTING HEIGHT Details shall have a maximum surface area of 16 square feet.

MINIMUM BALLAST  
(For each side of sign support base)

Sign Panel Mounting Height (ft)	Number of 25 lb sandbags for 4' x 4' sign panel
1'	6
5'	8
7'	10

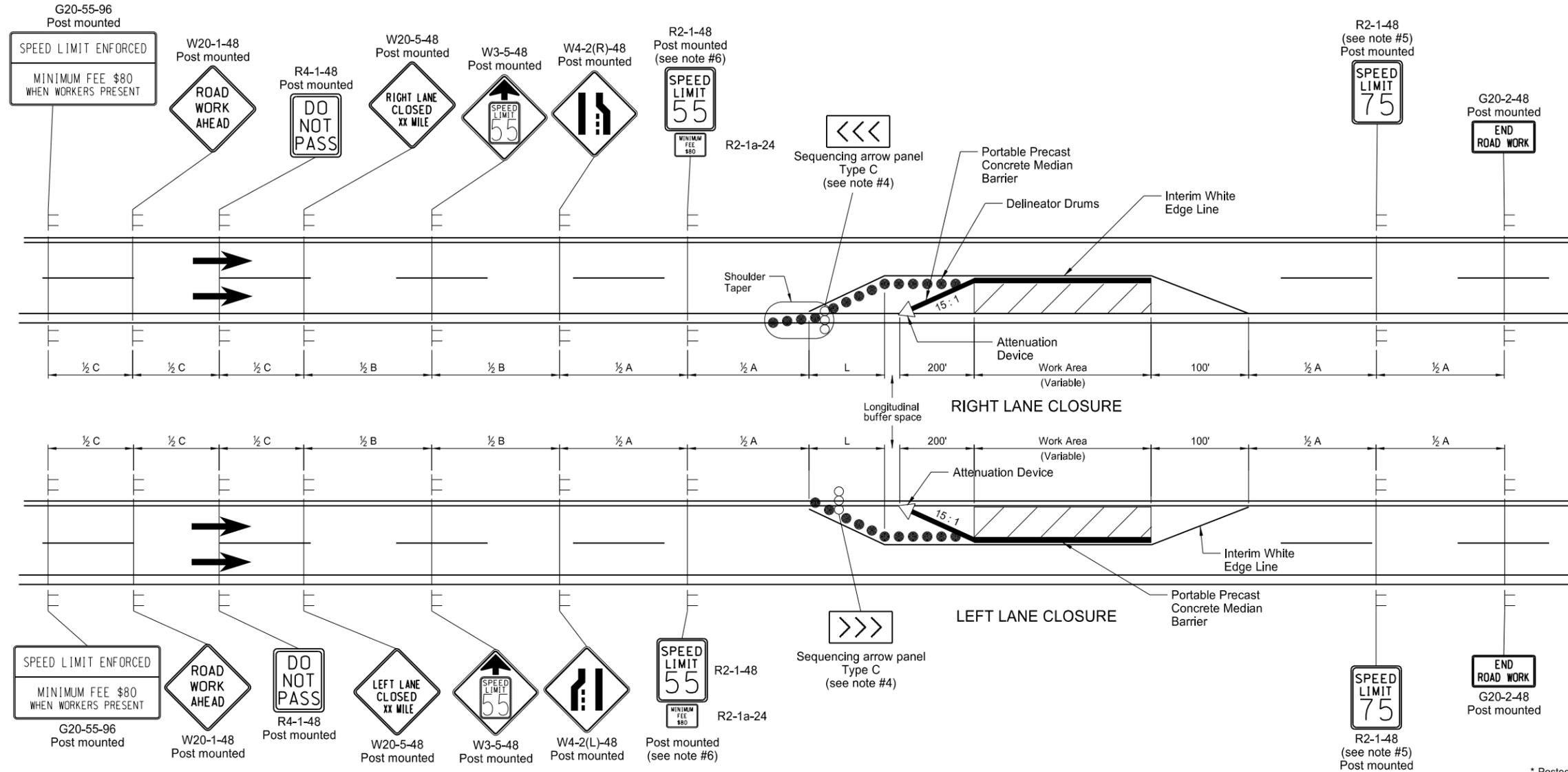
Note: The number of sandbags are based on a wind speed of 55 MPH. The sandbags are assumed to be placed at or near the ends of the skids.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-4-13	
REVISIONS	
DATE	CHANGE
11-14-13	Revised Note 6.

This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 11/14/13 and the original document is stored at the North Dakota Department of Transportation

# SIGN LAYOUT FOR INTERSTATE SYSTEM ONE LANE CLOSURE

D-704-18



**KEY**

- Delineator Drum
- ⊢ Sign
- △ Attenuation Device
- Sequencing Arrow Panel
- ▨ Work Area

Longitudinal Buffer Space	
*Speed (mph)	Length Min (feet)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820

- Notes**
- Variables
    - S = Numerical value of speed limit or 85th percentile.
    - W = The width of the taper.
    - L = Minimum length of taper, or  $S \times W$  for freeways, expressways, and all other roads with speeds of 45 mph or greater, or  $W \times S^2 / 60$  for urban, residential, and other streets with speeds of 40 mph or less.
  - Barricades placed on roadway shall be on a moveable assembly. Signs placed on the roadway shall be placed on skid mounted assemblies.
  - Delineator drums used for tapering traffic and on the tangent shall be spaced at the dimension "S".
  - Sequencing Arrow Panels
    - Panels should normally be placed at the beginning of the taper. Where shoulder width does not provide sufficient room, the panel should be moved closer to the work area so that it can be placed on the roadway surface. See Shoulder Closure Standard Drawing.
    - Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).
    - Type B shall be used on roadways with moderate traffic speeds and volumes (40 mph or less and less than 5000 ADT).
    - Type C shall be used on roadways with high traffic speeds and volumes (over 40 mph or 5000 ADT or greater).
  - The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
  - The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at 1/2 B.

- When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
- Existing speed limit signs within a reduced speed zone shall be covered.
- The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications. G20-55-96 sign is not required if this standard is part of other traffic control layouts, or the work is less than 15 days.

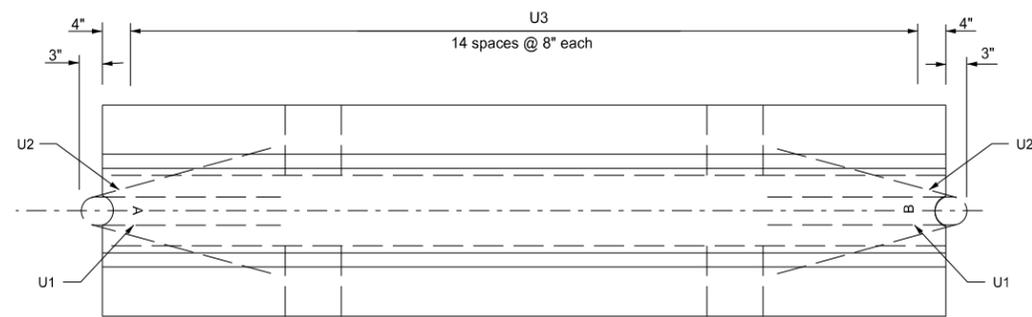
\* Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

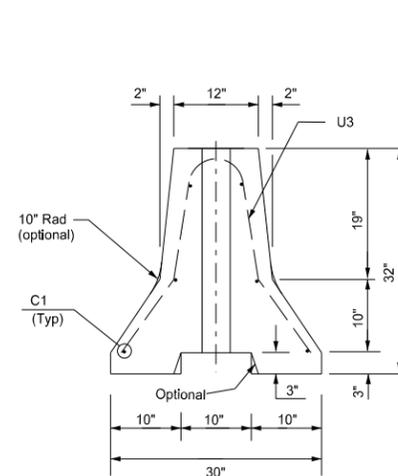
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9-27-13	
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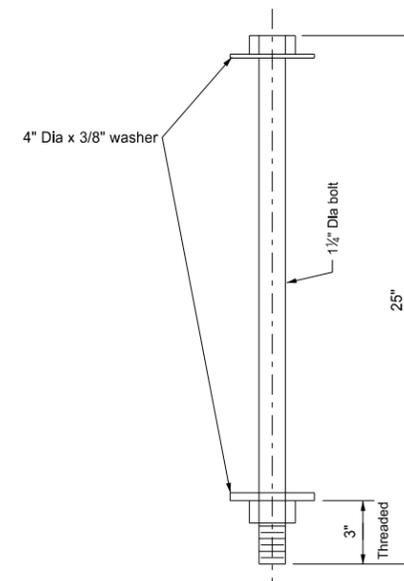
PORTABLE PRECAST CONCRETE MEDIAN BARRIER  
(TEMPORARY USAGE)



Plan View



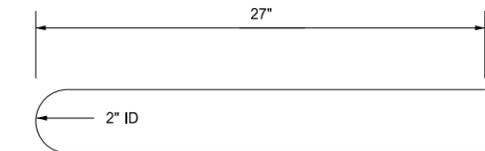
End View



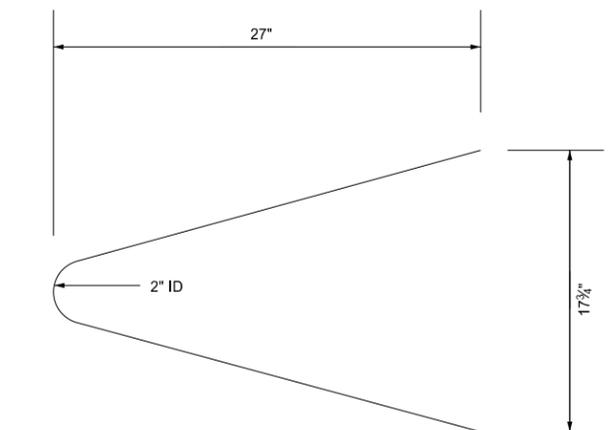
Connecting Bolt Detail  
(One per 10 Ft section)

Notes:

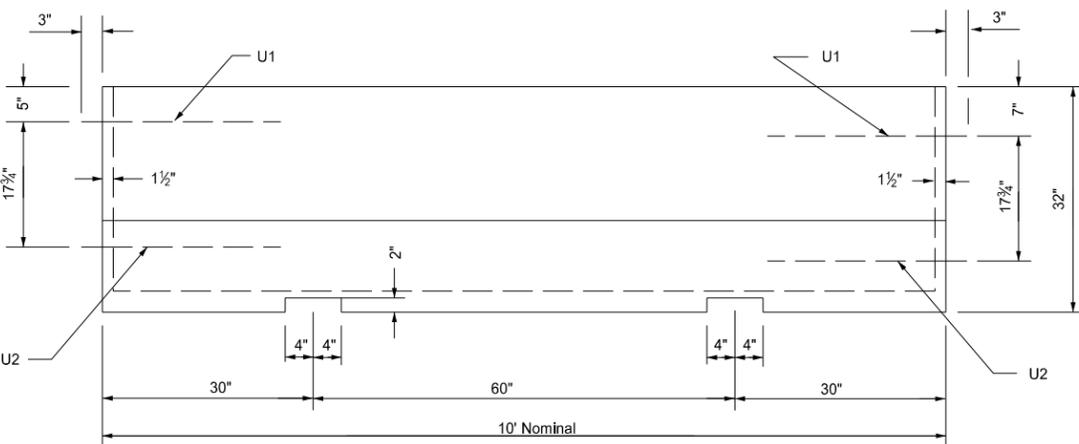
- All exposed hardware shall be galvanized as per ASTM A153, except for the loop inserts.
- Concrete shall be Class AAE-3.
- All steel shall conform to Section 612 of the NDDOT Standard Specifications.
- Barrier ends shall be imprinted A and B as shown with 4 inch letters. Field placement shall match the A end with the B end.
- Barrier markers shall be placed at the center of the barrier at 20' centers.
- Barrier sections shall be connected together with the 1 1/4" Dia A-307 double hex connecting bolt. The bottom nut and washer connection shall be maintained by the contractor for the duration of the barrier installation.
- Barrier shall be placed such that openings between individual sections shall be kept to a minimum.



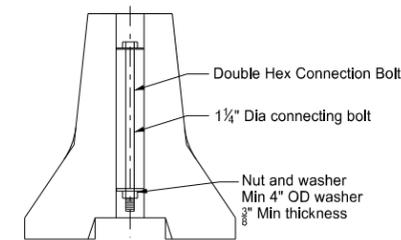
U1 Bar Detail



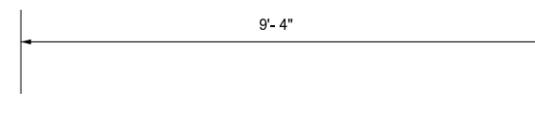
U2 Bar Detail



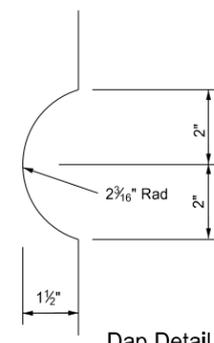
Side View



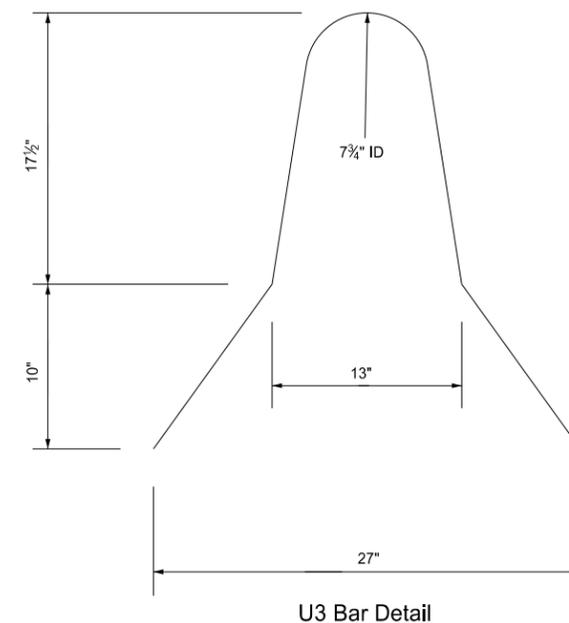
Bolt Connection Detail



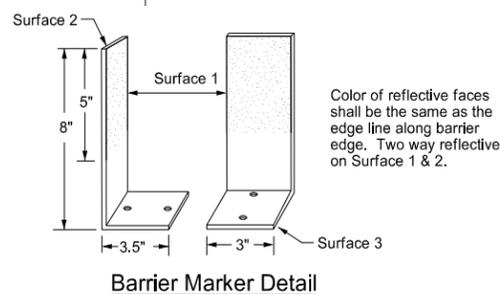
C1 Bar Detail



Dap Detail



U3 Bar Detail



Barrier Marker Detail

Color of reflective faces shall be the same as the edge line along barrier edge. Two way reflective on Surface 1 & 2.

Reflective Tape

The reflector shall be a retroreflective, acrylic microprism material with acrylic backing, 3" wide, providing the following minimum optical performance with an observation angle of 0.1° measured in candlepower:

Entrance Angle	Specific Intensity
Yellow - 4"	136
White - 4"	200

Adhesive

Markers shall be temporarily mounted to the portable concrete barrier with factory applied solid butyl rubber 1/8" thick, 2" wide on 2 1/4" wide release paper on surface 3.

Bar List				
Mark	Size	No.	Length	Shape
C1	4	6	9'- 4"	Straight
U1	4	2	4'- 8"	Bent
U2	4	2	4'- 10 1/4"	Bent
U3	4	15	5'- 4"	Bent

Marker Body

The marker shall be made of a high impact, weatherable engineering thermo-plastic material which conforms to the following:

Property	Result	ASTM Test Method
Thickness (min)	.090"	—
Tensile strength (min psi) @ yield	5,500	D638
Impact strength @ -20°F (ft-lbs/in of notch)	3.2	D256 Method A
Impact strength @ 73°F (ft-lbs/in of notch)	14.0	D256 Method A
Flexural strength, PSI 1/4" @ 73°F	8,000	D790
Flexural modulus, PSI 1/4" @ 73°F	300,000	D790
Elongation @ yield	30%	D638

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-20-12	
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Registration Number PE- 2930,  
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