

STATE	PROJECT NO.	PCN	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	23341	1	1

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

NH-9-999(477)

McKenzie, Mercer, Traill, Emmons, LaMoure, and Dickey Counties
Various Structures - Statewide

Box Culvert Joint Repairs, Spall Repairs, Wingwall Replacement, Scour Repair

GOVERNING SPECIFICATIONS	Date Published and Adopted by the North Dakota Department of Transportation
Standard Specifications	4/1/2023
Supplemental Specifications	NONE

PROJECT NUMBER \ DESCRIPTION	NET MILES	GROSS MILES
NH-9-999(477)	Varies	Varies

Structure #13-192.154
ND Hwy 13, RP 192.154
Section 1 & 12, T-132-N, R-78-W

Structure #23-033.279
ND Hwy 23, RP 33.279
Section 16 & 21, T-152-N, R-95-W

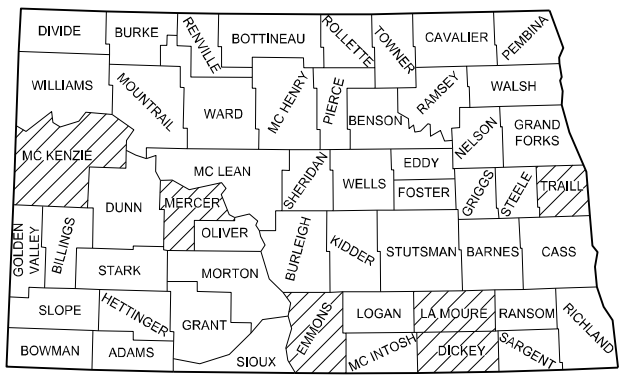
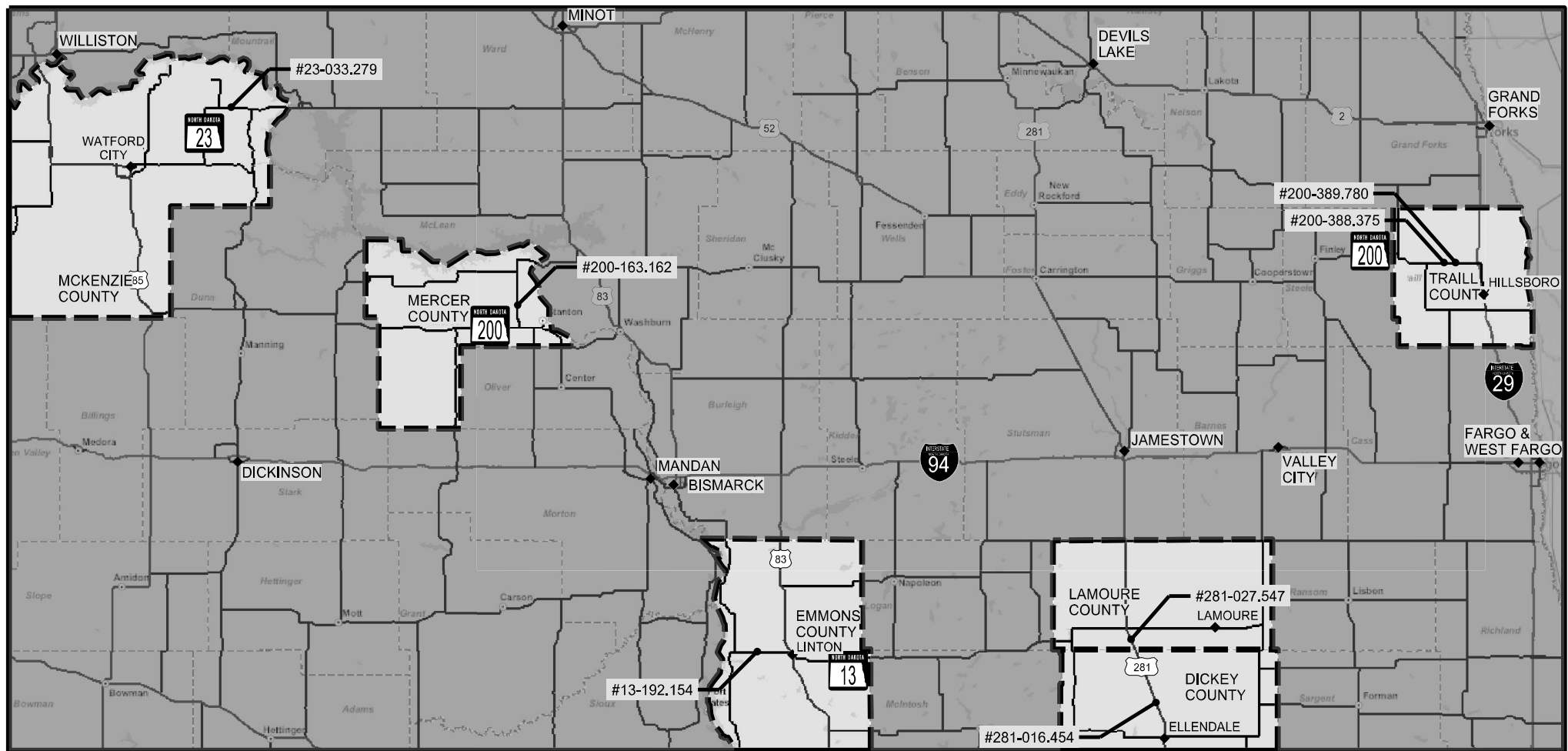
Structure #200-163.162
ND Hwy 200, RP 163.162
Section 15 & 16, T-145-N, R-85-W

Structure #200-388.375
ND Hwy 200, RP 388.375
Section 1, T-146-N, R-52-W
Section 36, T-147-N, R-52-W

Structure #200-389.780
ND Hwy 200, RP 389.780
Section 6, T-146-N, R-51-W
Section 31, T-147-N, R-51-W

Structure #281-016.454
ND Hwy 281, RP 16.454
Section 17, T-131-N, R-63-W

Structure #281-027.547
ND Hwy 281, RP 27.547
Section 24, T-133-N, R-64-W



STATE COUNTY MAP

DESIGNER Tatyana Fedorenko, PE Nikki Olson, PE
DESIGNER Charles Petersen, EIT Steven Hellman, Alex Rodriguez, EIT
DESIGNER Sawyer Kenney, EIT Sam Boulton, EIT

ND DEPARTMENT OF TRANSPORTATION
OFFICE OF PROJECT DEVELOPMENT

Thorenson, Jason R.
09/22/23

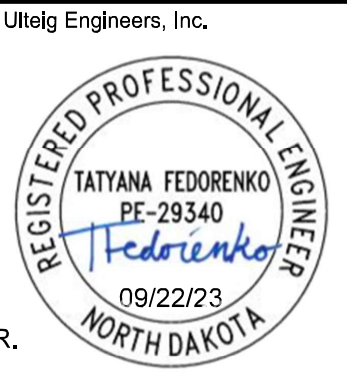


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8	1	Quantities
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170	1 - 22	Bridges and Box Culverts

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D-101-10	NDDOT Utility Company and Organization Abbreviations
D-101-20, 21	Line Styles
D-101-30, 31, 32	Symbols
D-704-1	Attenuation Device
D-704-7	Breakaway Systems For Construction Zone Signs - Perforated Tube
D-704-8	Breakaway Systems For Construction Zone Signs - U-Channel Post
D-704-9	Construction Sign Details - Terminal And Guide Signs
D-704-10	Construction Sign Details - Regulatory Signs
D-704-11, 11A	Construction Sign Details - Warning Signs
D-704-13	Barricade And Channelizing Device Details
D-704-14	Construction Sign Punching And Mounting Details
D-704-33	Two-Lane Roadway Portable Rumble Strips
D-704-50	Portable Sign Support Assembly
D-704-51	Portable Precast Concrete Median Barrier (Temporary Usage)

SPECIAL PROVISIONS

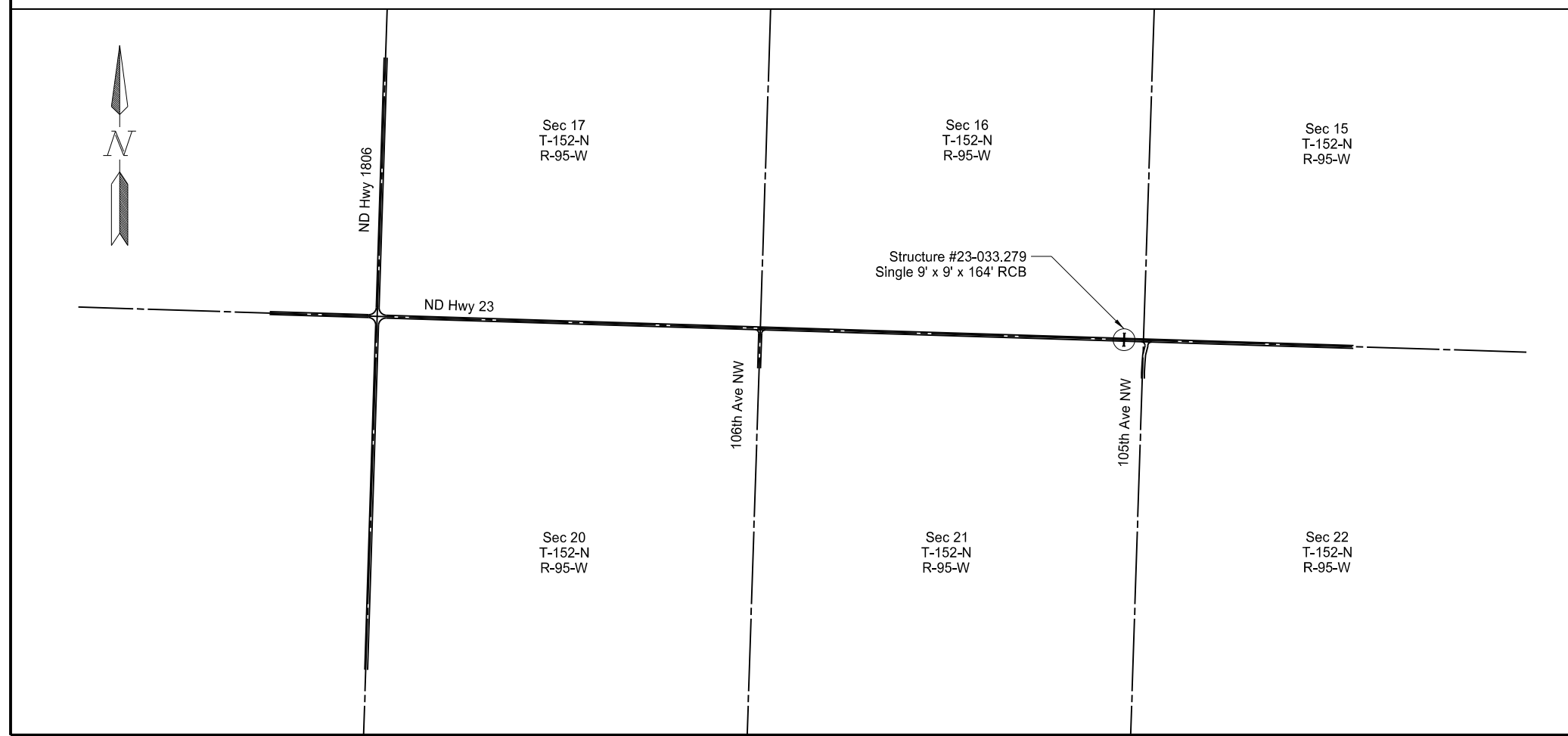
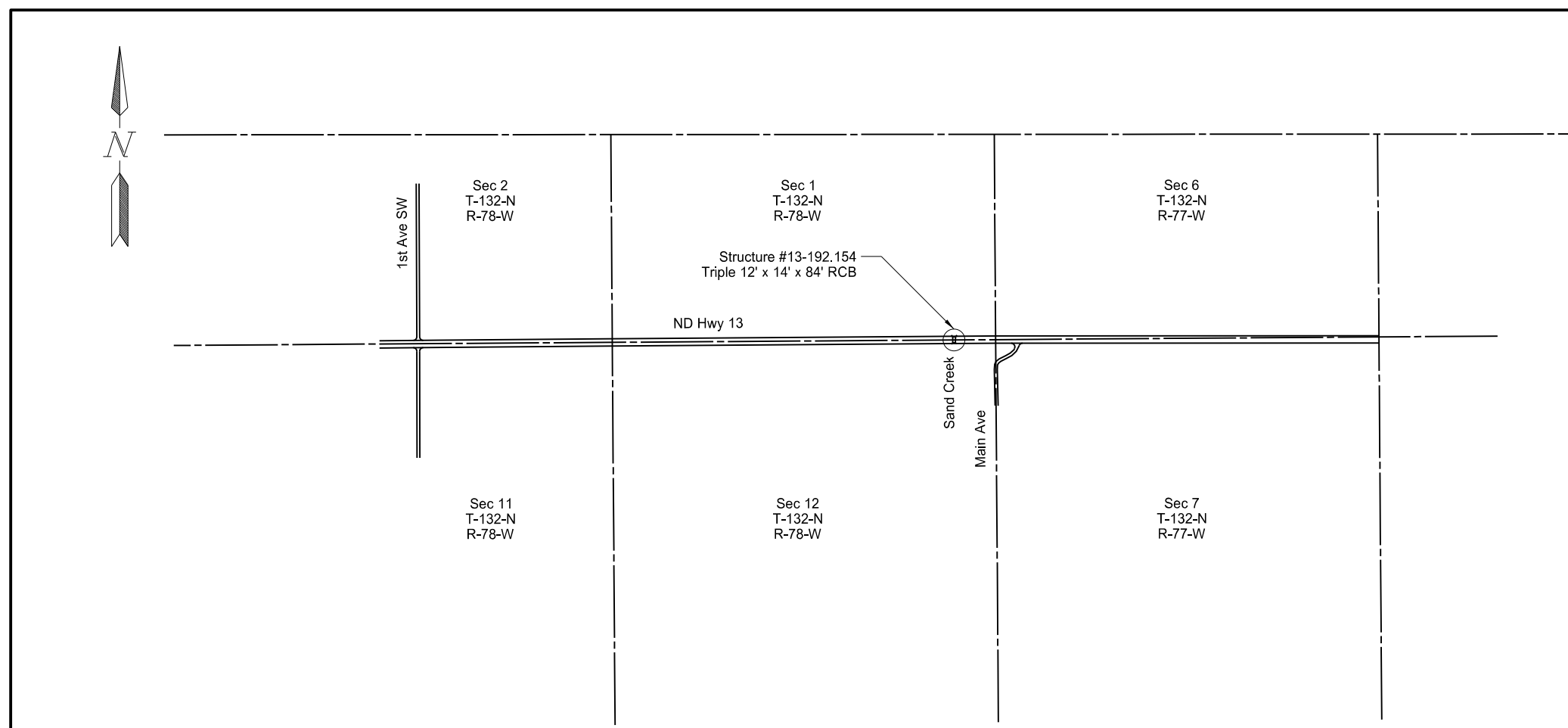
Number	Description
PSP 38(23)	Permits and Environmental Considerations
SSP 2	Federal Migratory Bird Treaty Act
SP 192(23)	Concrete Spall Repair by Shotcrete

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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REPAIR NOTES:

The general repairs of each structure are as follows:

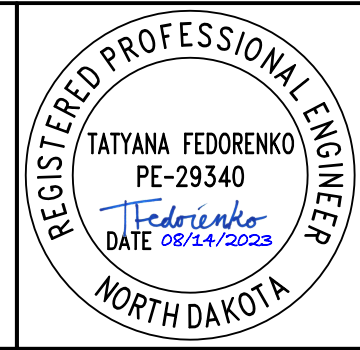
Structure #13-192.154: Spall Repair, Box Culvert Joint Repair, Wingwall Repair
 Structure #23-033.279: Spall Repair, Box Culvert Joint Repair, Joint Treatment

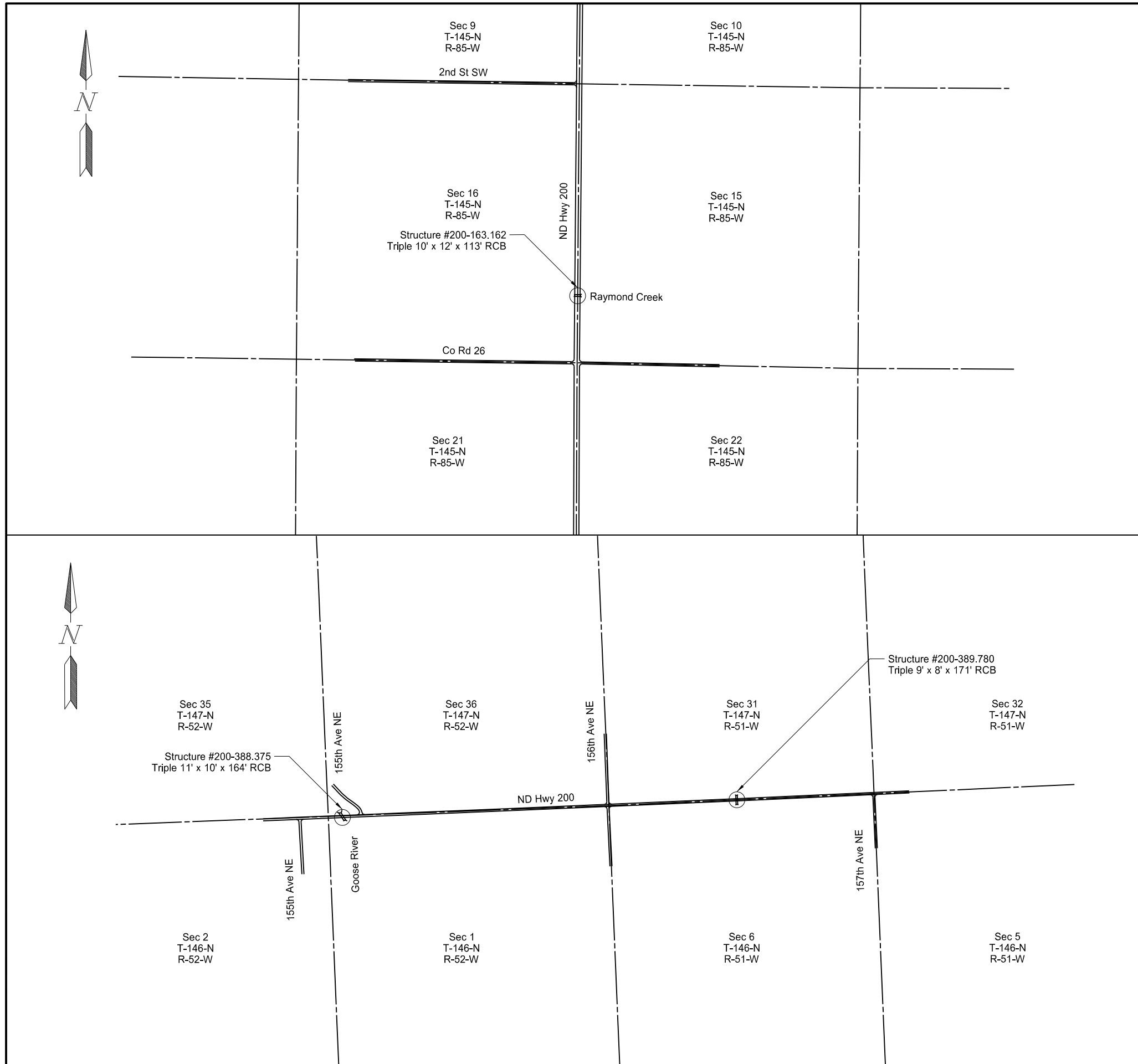


Scope of Work

Structure #13-192.154
 Structure #23-033.279

Structural Repair
 Various Structures - Statewide

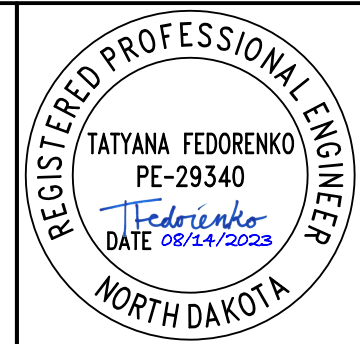




STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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REPAIR NOTES:
 The general repairs of each structure are as follows:
 Structure #200-163.162: Box Culvert Joint Repair, Joint Treatment
 Structure #200-388.375: Box Culvert Joint Repair, Scour Repair, Topsoil
 Structure #200-389.780: Spall Repair, Box Culvert Joint Repair, Scour Repair, Topsoil

Scope of Work
 Structure #200-163.162
 Structure #200-388.375
 Structure #200-389.780
 Structural Repair
 Various Structures - Statewide

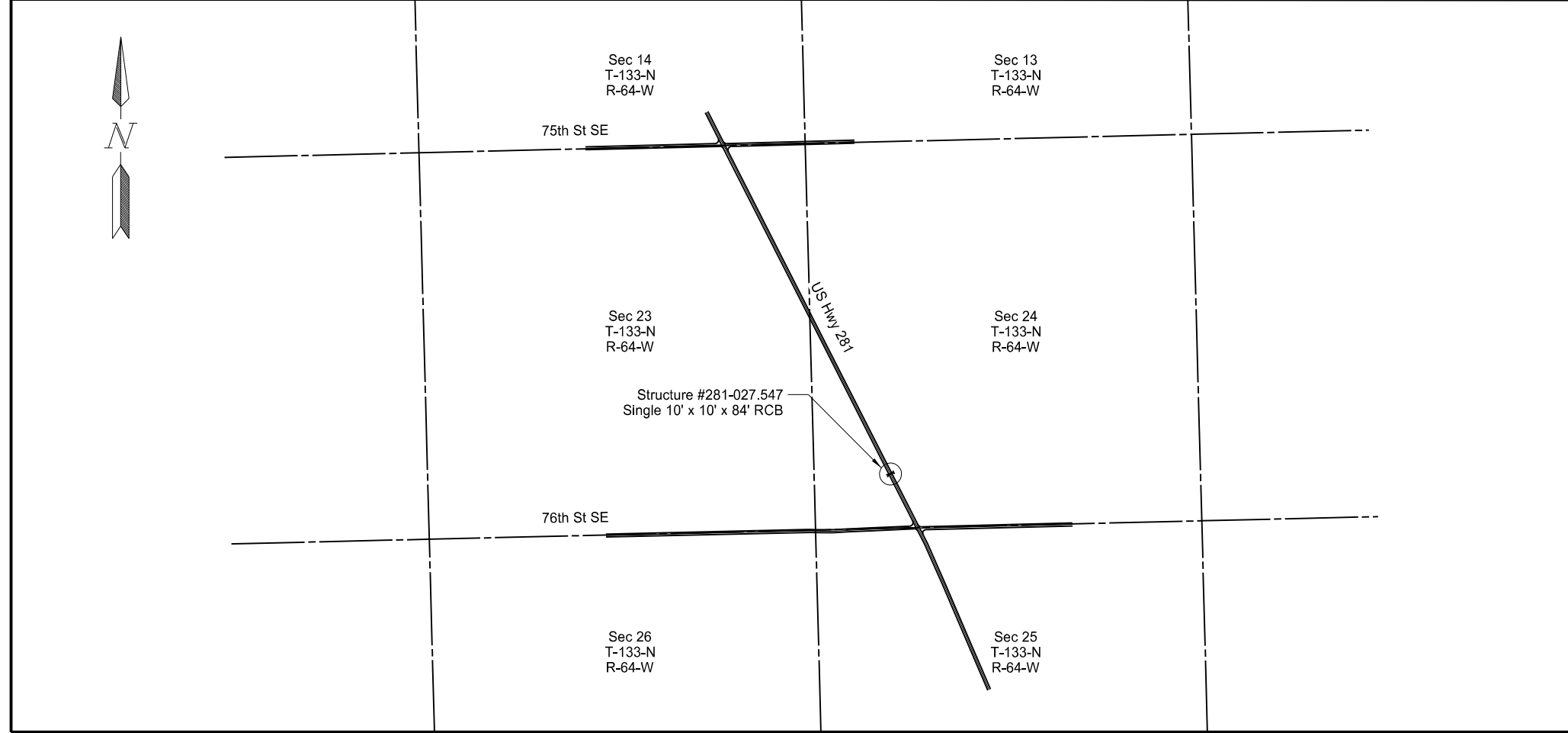
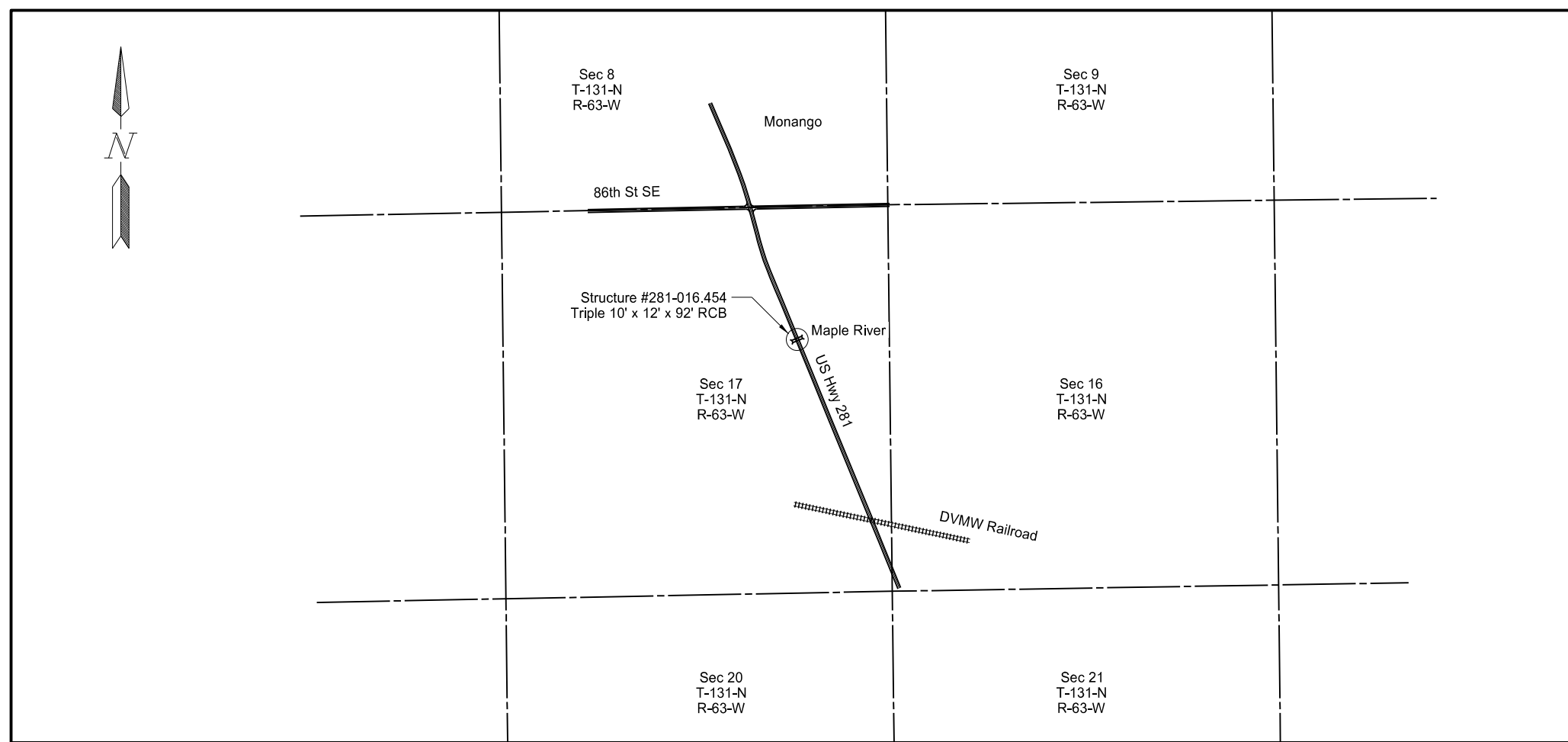


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REPAIR NOTES:

The general repairs of each structure are as follows:

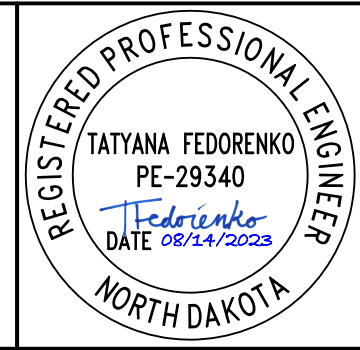
- Structure #281-016.454: Box Culvert Joint Repair, Wingwall Replacement, Scour Repair
- Structure #281.027.547: Box Culvert Joint Repair, Scour Repair, Topsoil



Scope of Work

Structure #281-016.454
Structure #281-027.547

Structural Repair
Various Structures - Statewide



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NOTES

100-P01 COORDINATION OF PROJECTS: Other projects in the vicinity of this project are under contract during the 2023-2026 construction season:

Upcoming project on US 281 at N TWP LINE N ELLENDALE TO EDGELEY
 Project 22614 is located on ND 200 at 2 NORTH OF ND 200A
 Project 20049 is located on ND 1806 at JCT 23 N TO CHARLSON
 Project 23583 is located on ND 18 at E JCT 200 W THRU PORTLAND

This list is not comprehensive and other projects may exist.

704-200 STATE FURNISHED MEDIAN BARRIERS: Obtain (96) 22.5" x 12.5' concrete barriers. They can be picked up and returned to the Sterling yard. Contact the Bismarck District office at 701-328-6950 to facilitate the exchanges.

Section 704.04 J "Precast Concrete Median Barrier (State Furnished)" applies to the contract item "State Furnished Median Barrier".

If returning barriers with connection components, coordinate the delivery location for the connecting components with the Engineer. Some 4 inch x 4 inch boards are available at the return location. Provide any additional 4 inch x 4 inch boards necessary to stack barriers. The boards will become property of the Department.

Payment for the State Furnished Median Barrier will follow Section 704.06 D "Precast Concrete Median Barrier (State Furnished)". Include all costs associated with median barriers in the contract unit price for "State Furnished Median Barrier".

704-500 PORTABLE RUMBLE STRIPS (PRS): Use PRS made of rubber or engineered polymers. Install PRS as part of the temporary traffic control when the following signs are also part of the required of the required traffic control set up:

"Be Prepared to Stop" (W3-4)
 "Flagger" symbol (W20-7)

Install PRS that meet the following criteria:

Have no adhesive or fasteners required for placement;
 Have a manufacturer's speed rating that meets or exceeds the posted speed limit;
 and each strip in the array must weigh a minimum of 100 pounds.

Use individual PRS constructed in one of the following manners:

A single piece;
 Interlocking segments; or
 Two pieces hinged at the midpoint.

An installed array of PRS consists of a minimum of 3 individual strips.

Move rumble strips with the flagging operation. Do not place rumble strips on horizontal curves.

The Engineer will count and measure each array as one unit. Include the cost of providing, installing, maintaining, and relocating PRS in the unit price bid for "Portable Rumble Strips".

704-P01 TRAFFIC CONTROL FOR BOX CULVERTS: Provide traffic control consisting of a single lane closure with flagging for two box culvert locations, and a double lane shift for five box culvert locations.

Traffic control device quantities are based on two simultaneous double lane shifts and one single lane closure, assuming a work space length of 100 feet. The Department will pay for additional devices if more locations are repaired concurrently.

See Single Lane Closure for:

Structure 13-192.154
 Structure 200-163.162

For Structure 13-192.154, Phase 1 is for active construction and Phase 2 is to be provided during curing and before backfill of wingwall when active construction and flagging operations are not underway.

See Double Lane Shift for:

Structure 23-033.279
 Structure 200-388.375
 Structure 200-389.780
 Structure 281-016.454
 Structure 281-027.547

Lane widths are to remain 12 feet minimum. Taper width "W" will be a minimum of 4 feet and field adjusted to provide a minimum work zone width of 12 feet.



ENVIRONMENTAL NOTES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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ENVIRONMENTAL NOTES (EN): The North Dakota Department of Transportation and the Federal Highway Administration have made environmental commitments to secure approval of this project. The following environmental notes are requirements to comply with these commitments:

EN-1 SPAWNING RESTRICTION: Do not work within the Sand Creek, Raymond Creek, Goose River, or Maple River from April 15 to June 1.

EN-2 AQUATIC NUISANCE SPECIES (ANS): Equipment that was last used outside of North Dakota or within a Class I infested waterbody (identified on the North Dakota Game and Fish Department (NDGFD) website) requires an inspection by NDGFD. Notify the NDGFD at least 10 business days prior to pumps, watercraft, or any equipment entering a public water to allow the NDGFD sufficient time to inspect any and all such equipment for ANS. Contact the NDGFD ANS Coordinator, Ben Holen by e-mail - bholen@nd.gov for equipment inspections. Supply one of the following to the engineer as proof of compliance prior to work taking place in the water: (1) the NDGFD inspection report, (2) documented NDGFD correspondence (email or signed letter).

EN-3 THREATENED AND ENDANGERED SPECIES: The project is located near/within suitable habitat for the species listed in the following table.

SPECIES	HABITAT	PRESENCE
Northern Long-Eared Bat	Forested/Wooded Areas/Bridges/Box Culverts/Caves/Mines	Active Season: April 1 - October 31* Inactive Season: November 1 - March 31*

*Time frames can differ slightly, depending on the year

If any of the above threatened and endangered species are identified within 1 mile of the project, the Contractor will notify the Engineer immediately and cease construction activities in the vicinity until an avoidance area is established. The Engineer will establish an avoidance area that is at least a 0.5 mile and immediately coordinate with the USFWS (701-355-8513), FHWA (701-221-9464), and NDDOT Environmental and Transportation Services (701-328-2592). The Contractor will not resume work within the avoidance area until the Engineer has confirmed with the agencies that work may proceed (either the species have left the area, or approved avoidance/minimization measures have been implemented).

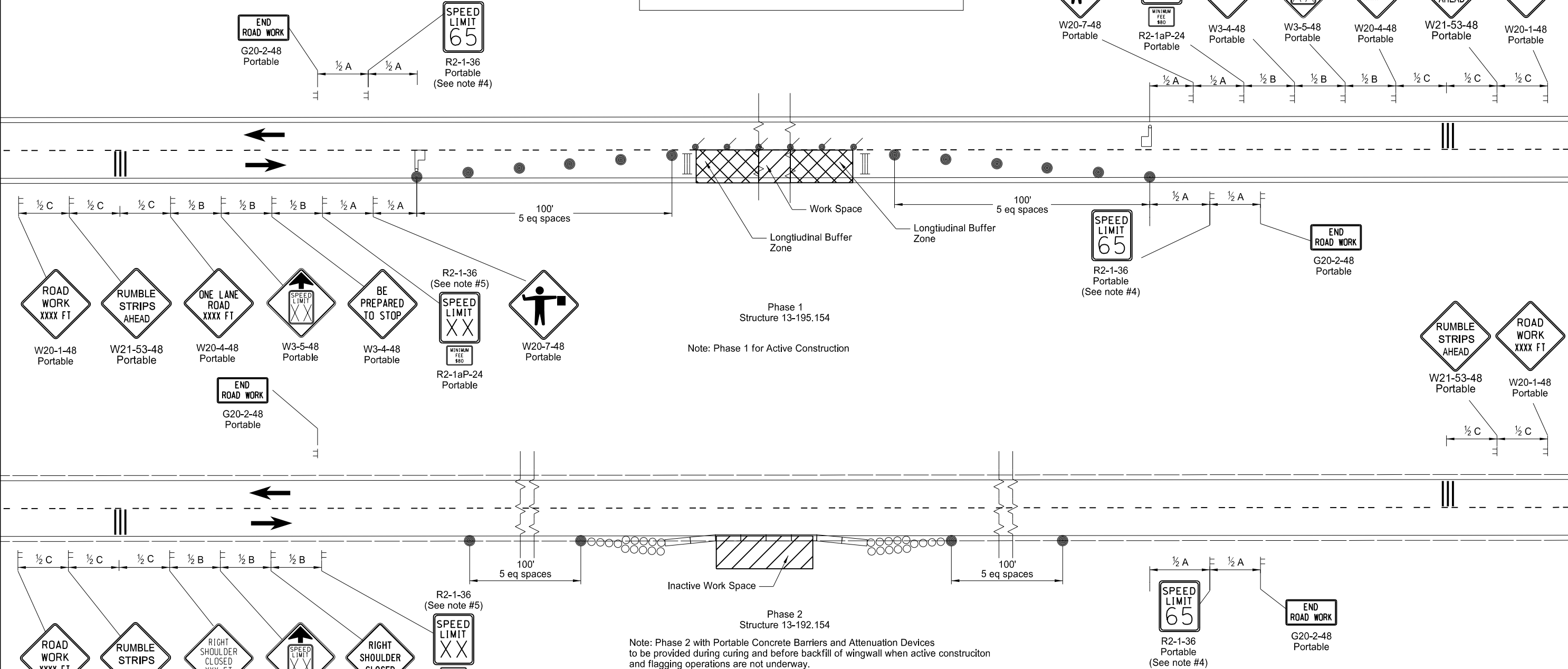
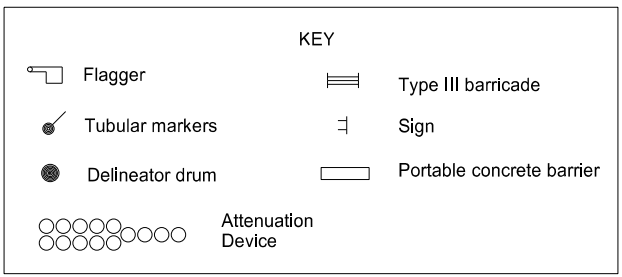


Estimated Quantities

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SPEC	CODE	ITEM DESCRIPTION	UNIT	Mainline:	TOTAL
103	0100	CONTRACT BOND	L SUM	0.48	0.48
202	0101	REMOVAL OF CONCRETE	EA	2	2
203	0109	TOPSOIL	CY	36.1	36.1
210	0210	FOUNDATION FILL	CY	91	91
256	0200	RIPRAP GRADE II	CY	340	340
602	1131	CLASS AE-3 CONCRETE-BOX CULVERT	CY	52.1	52.1
612	0114	REINFORCING STEEL-GRADE 60-BOX CULVERT	LBS	10262	10262
702	0100	MOBILIZATION	L SUM	0.61	0.61
704	0100	FLAGGING	MHR	90	90
704	1000	TRAFFIC CONTROL SIGNS	UNIT	1708	1708
704	1038	ATTENUATION DEVICE-TYPE B-40	EA	4	4
704	1048	PORTABLE RUMBLE STRIPS	EA	6	6
704	1052	TYPE III BARRICADE	EA	2	2
704	1060	DELINEATOR DRUMS	EA	100	100
704	1067	TUBULAR MARKERS	EA	54	54
704	3511	STATE FURNISHED MEDIAN BARRIER	LF	1200	1200
709	0155	GEOSYNTHETIC MATERIAL TYPE RR	SY	337	337
930	8230	SHORING	EA	2	2
930	9612	SPALL REPAIR	SF	125.5	125.5
930	9671	BOX CULVERT JOINT REPAIR	EA	89	89
950	9712	JOINT TREATMENT	LF	192	192

- Notes:
- Variables:
S=Numerical value of speed limit or 85th percentile
 - Place barricades on moveable assemblies and signs on portable assemblies when located in the roadway.
 - Space tubular markers for tangents at 2 times dimension "S".
 - Re-establish speed limit. Determine exact speed limit in the field, dependent on the location and conditions.
 - Determine the reduced speed limit dependent on the in-place speed limit before construction. When speed reductions exceed 30 mph, install second speed limit sign with the desired speed reduction (not to exceed 30 mph.) Place the second speed limit sign at 1/2 B.
 - Cover existing speed limit signs within a reduced speed zone.
 - Recommend using 40 mph speed limit in the vicinity of workers, unless location and conditions dictate otherwise.



ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min (ft)		
	A	B	C
Rural - High Speed (over 50 mph to 65 mph)	720	720	720

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

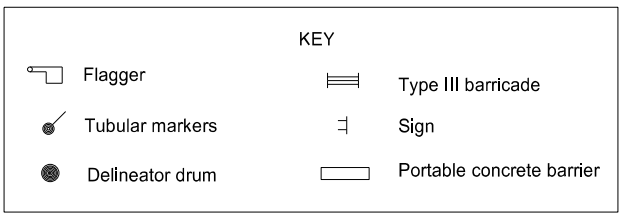
Work Zone Traffic Control

Single Lane Closure
Structure 13-192.154

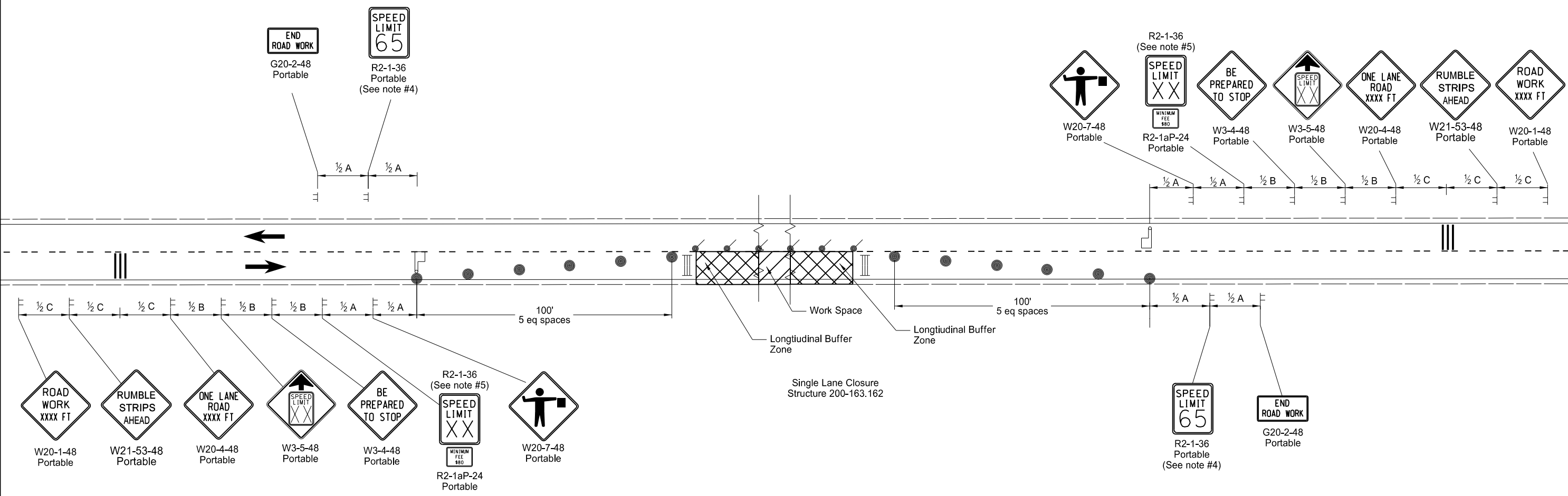
Structural Repair
Various Structures - Statewide



- Notes:
- Variables:
S=Numerical value of speed limit or 85th percentile
 - Place barricades on moveable assemblies and signs on portable assemblies when located in the roadway.
 - Space tubular markers for tangents at 2 times dimension "S".
 - Re-establish speed limit. Determine exact speed limit in the field, dependent on the location and conditions.
 - Determine the reduced speed limit dependent on the in-place speed limit before construction. When speed reductions exceed 30 mph, install second speed limit sign with the desired speed reduction (not to exceed 30 mph.) Place the second speed limit sign at 1/2B.
 - Cover existing speed limit signs within a reduced speed zone.
 - Recommend using 40 mph speed limit in the vicinity of workers, unless location and conditions dictate otherwise.



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ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min (ft)		
	A	B	C
Rural - High Speed (over 50 mph to 65 mph)	720	720	720

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

Work Zone Traffic Control

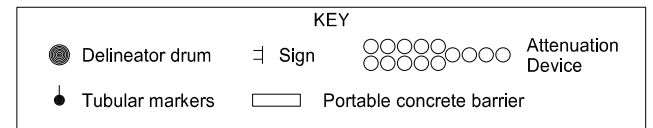
Single Lane Closure
Structure 200-163.162

Structural Repair
Various Structures - Statewide

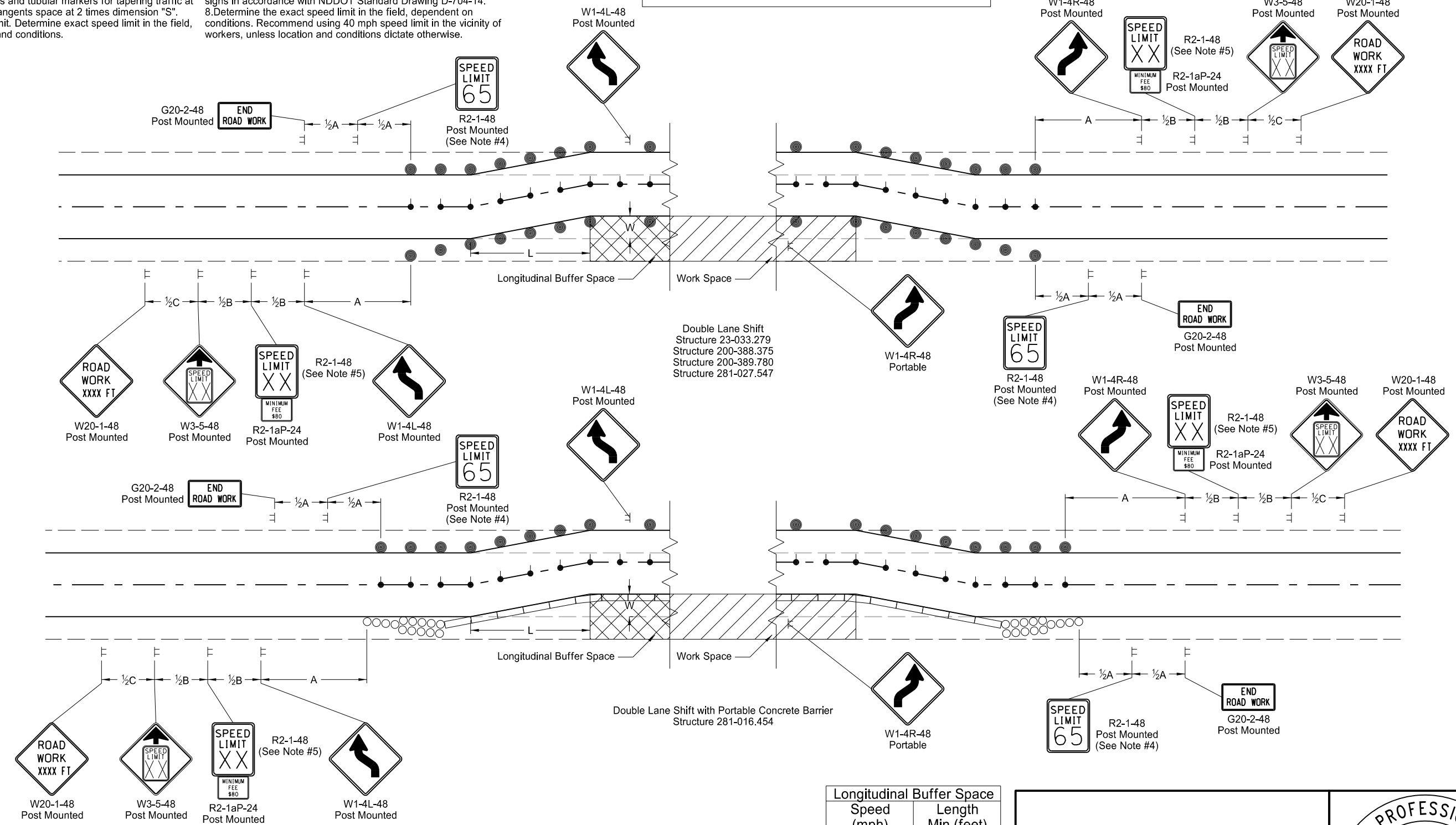


Notes:

- Variables
 - S = Numerical value of speed limit or 85th percentile.
 - W = The width of taper in feet.
 - L = Minimum length of taper, S x W.
- Place signs on portable assemblies when located on roadway.
- Place delineator drums and tubular markers for tapering traffic at dimension "S" and for tangents space at 2 times dimension "S".
- Re-establish speed limit. Determine exact speed limit in the field, dependent on location and conditions.
- Determine the reduced speed limit based on the in-place speed limit before construction. Where speed reductions exceed 30 mph, install a second speed limit sign with the desired speed reduction (not to exceed 30 mph.)
- Cover existing speed limit signs within reduced speed zones.
- As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
- Determine the exact speed limit in the field, dependent on conditions. Recommend using 40 mph speed limit in the vicinity of workers, unless location and conditions dictate otherwise.



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Road Type	Distance Between Signs Min (ft)		
	A	B	C
Rural - High Speed (over 50 mph to 65 mph)	720	720	720

Speed (mph)	Length Min (feet)
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645

Work Zone Traffic Control

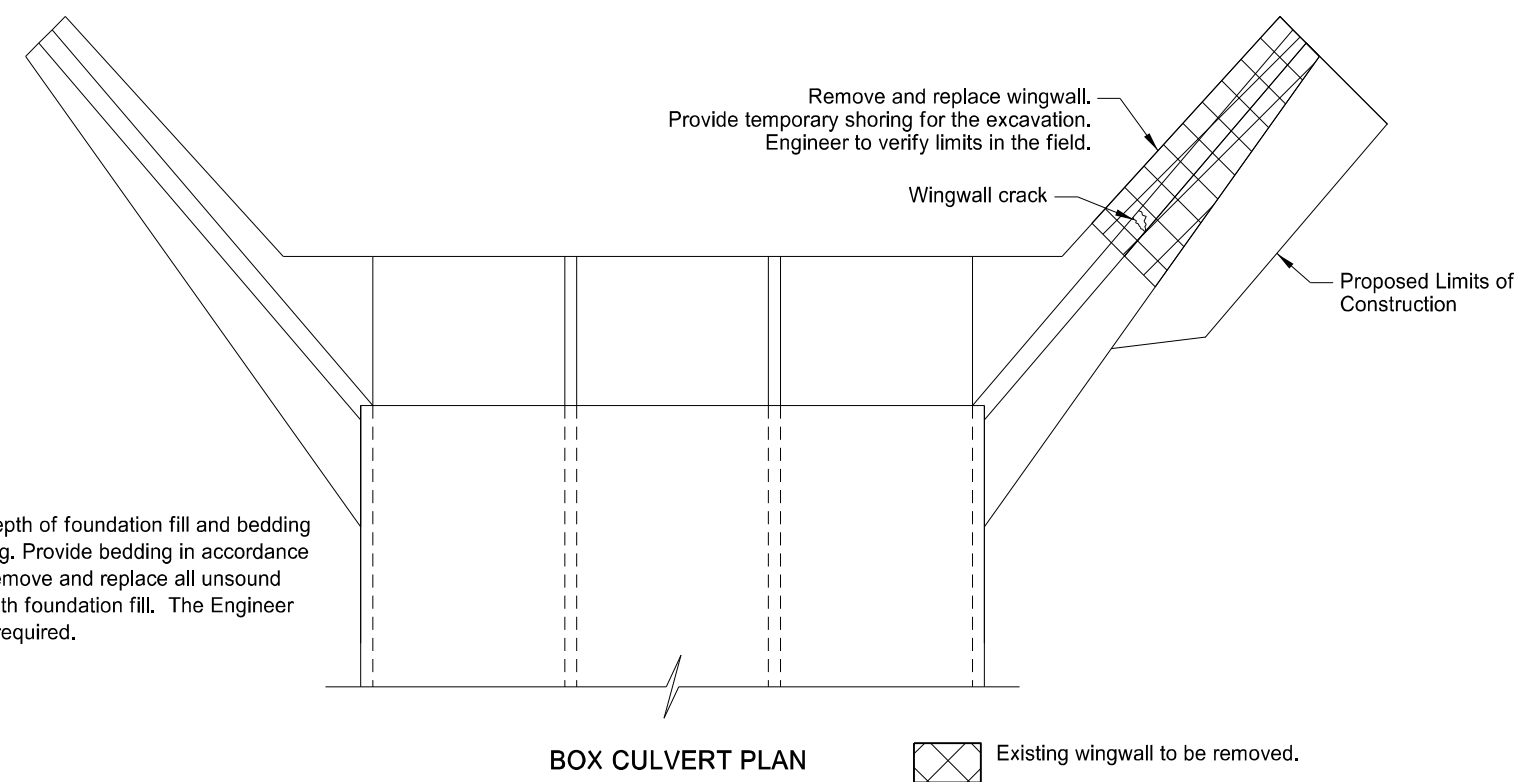
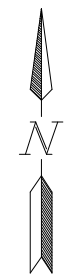
Double Lane Shift

Structural Repair
Various Structures - Statewide

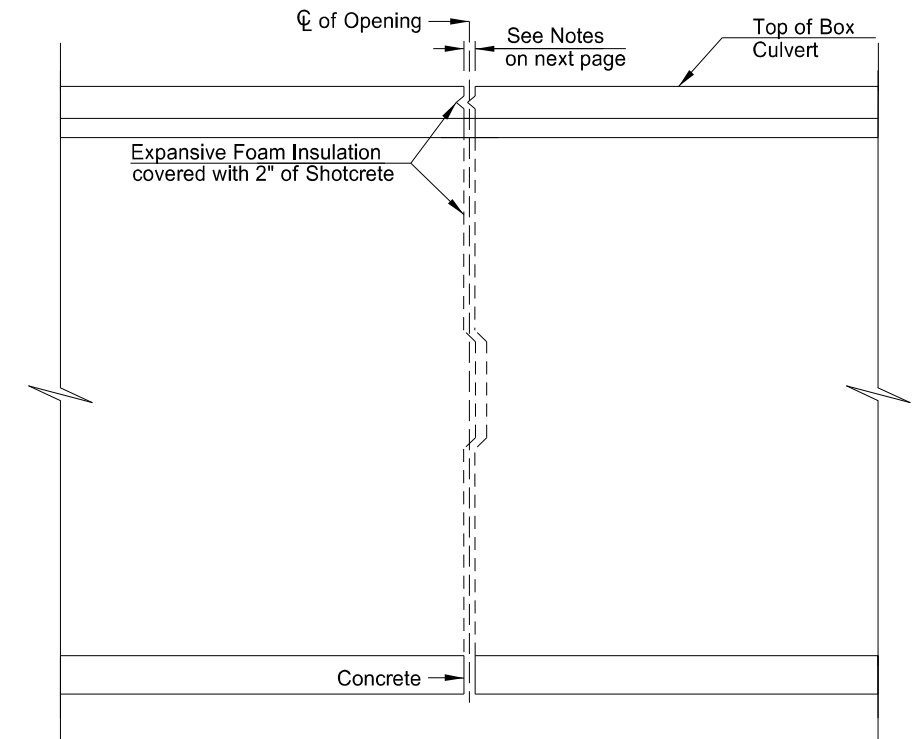


23 U.S.C. 407
NDDOT Reserves All Objections

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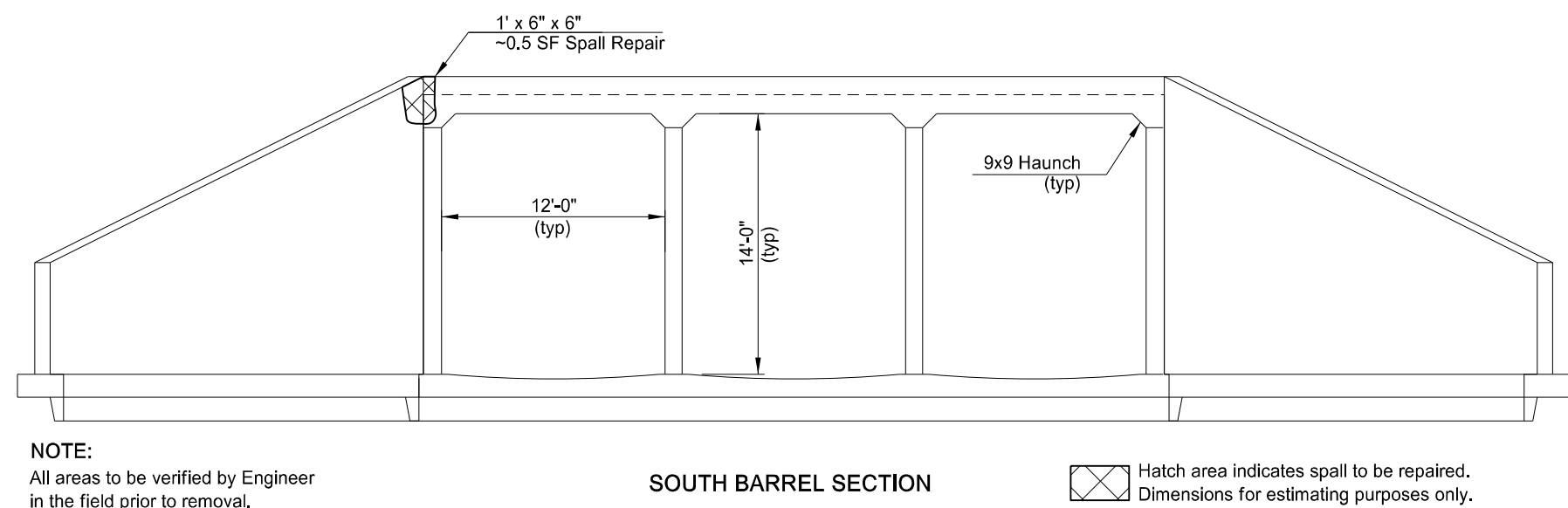
NOTE:
Place a 1'-0" minimum depth of foundation fill and bedding under the wingwall footing. Provide bedding in accordance with Section 606.E.1. Remove and replace all unsound material under the box with foundation fill. The Engineer will determine the depth required.



JOINT REPAIR DETAIL

BOX CULVERT BID ITEMS

SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
202	0101	REMOVAL OF CONCRETE	EA	1
210	0210	FOUNDATION FILL	CY	6
602	1131	CLASS AE-3 CONCRETE BOX CULVERT	CY	17.0
612	0114	REINFORCING STEEL-GRADE 60-BOX CULVERT	LBS	4035
930	8230	SHORING	EA	1
930	9612	SPALL REPAIR	SF	0.5
930	9671	BOX CULVERT JOINT REPAIR	EA	16



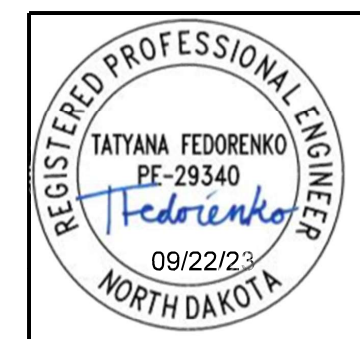
NOTE:
All areas to be verified by Engineer in the field prior to removal.

SOUTH BARREL SECTION

SPECIAL PROVISIONS	
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

SAND CREEK
ND 13, 7 MI WEST OF US 83

BOX CULVERT REPAIRS
13-192.154



ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Jason Thorenson Thorenson, Jason R.
09/22/23

NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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100 SCOPE OF WORK: Work at this site consists of repairing the spalled concrete on the southwest headwall, repairing joints at this triple 12 x 14 concrete box culvert, and replacing a section of the northeast wingwall.

100 GENERAL: Include the cost of furnishing and placing concrete inserts, rebar couplers, silicone sealant, and other miscellaneous items in the price bid for "Class AE-3 Concrete".

202 REMOVAL OF CONCRETE: Remove existing northeast wingwall 2 ft back from the crack. Cut wing footing to the limits shown. Use a 1" saw cut at 2 ft back from crack and jackhammer remaining concrete with a 15-pound hammer to prevent damage to existing reinforcement for rebar splicing and/or mechanical coupling in lieu of proposed dowels. Any additional cost for this option must be borne by the contractor. Include all materials, excavation, labor and equipment required for this work in the price bid for "Removal of Concrete".

602 CONCRETE: Cast the following elements of each section in one continuous run:

1. Wing footings
2. Wing complete to the top

If the existing wall thickness is different than the new thickness, set the inner surfaces flush and the exterior surfaces tapered in the first 1'-6" of the wing.

602 CURING CONCRETE: Wet cure all concrete surfaces not covered by forms. Cover the concrete with a double thickness of burlap. Maintain surface moisture between the final finish and placement of burlap by periodic applications of a light fog spray of water. Keep the burlap continuously moist until the end of the curing period.

602 POST INSTALLED ANCHORAGES: Concrete anchorages for the wingwall will require drilling and anchoring to existing concrete using a chemical adhesive. Provide an adhesive with a minimum characteristic bond strength in uncracked concrete of 1.5 ksi. Drill holes 1/8" larger in diameter than anchorage bar or per manufacturer's recommendations and to the depths shown in the details. The Contractor will verify that no reinforcement will be encountered while drilling and any modifications to anchorage spacing will be approved by the Engineer prior to drilling.

Submit to the Engineer one system, including installation instructions, for approval prior to beginning work. Install all anchors as specified by the Manufacturer's Printed Installation Instructions. Adhesive anchorage installers must hold current ACI-CRSI Adhesive Anchor Installer Certification credentials. Prior to installation of the anchorages on the project, meet with the Project Engineer, Inspectors, and Installers to review the installation process and requirements. At the Pre-installation meeting, submit a record of the contractor/installer ACI-CRSI certification card to the Project Engineer.

Meet the following conditions prior to installing:

- Ensure concrete surface is free of water prior to drilling
- Ensure the hole is dry
- Install anchorages per Manufacturer's Printed Installation Instructions

Include the price for installation and testing of anchorage of individual bars in the bid items "Reinforcing Steel-Grade 60". At the contractor's option, if rebar splicing and/or mechanical coupling per section 202, existing rebar in cutback from crack can be cleaned and spliced with required splice length or mechanically coupled in lieu of post-installed anchorage. Any additional cost for this option must be borne by the contractor.

612 REINFORCING STEEL: Dimensions of bent bars are given out to out.

930 SHORING: Temporary shoring is required for the excavation and replacement of the wingwall. The Contractor will design, construct, maintain, and remove the temporary shoring. All excavation, labor, equipment, and material needed for this work shall be included in the bid item, "Shoring".

930 SPALL REPAIR: The bid item "Spall Repair" is for the saw cutting, removal, and replacement of the unsound concrete on the southwest headwall of the original box culvert. Restore the spalled areas to their original cross section.

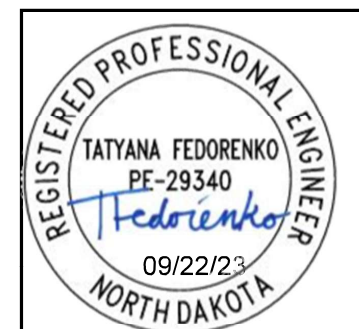
Use a 15-pound maximum size chipping hammer on any unsound concrete removal. Provide sharp, neat lines at least 1 inch deep at the edges of the repair areas. Within the removal area, remove concrete to provide a minimum 1" clearance around the periphery of the reinforcing steel. Produce these sharp, neat lines by saw cutting or other means approved by the Engineer. Take care in the removal process to ensure no damage is done to the reinforcing steel.

Sand blast clean the existing concrete and exposed reinforcing steel. Clean the existing concrete surface by high pressure water blasting. After the surface has dried and just before the patching material is placed, coat the surface with an epoxy bonding agent that includes a migratory corrosion inhibitor. The bonding agent and corrosion inhibitor may be Sika FerroGard 903 (Sika Corp.), Tamms Duralprep A.C., Pro-Poxy 204 (Unitex) or an approved equal.

Use a two component, polymer-modified, cementitious repair mortar material that is specifically intended for patching concrete and contains a corrosion inhibitor. This patching material may be SikaTop 123 Plus (Sika Corporation), Duraltop Gel (Euclid Chemical Company), MasterEmaco N 400 (BASF Corporation), or an approved equal repair mortar. Cure the material as recommended by the manufacturer.

At the contractor's option, and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform spall repairs using shotcrete in lieu of cementitious repair mortar. Any additional cost for this option must be borne by the contractor.

The actual limits of spall repair are to be determined by the Engineer in the field. Include the cost of all labor, equipment, and materials needed for spall repair in the price bid for "Spall Repair".



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ND	NH-9-999(477)	170	3

NOTES

930 BOX CULVERT JOINT REPAIR: The north construction joint has separated approximately 3" and the south construction joint has separated approximately 1".

If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the floor using shotcrete in lieu of concrete.

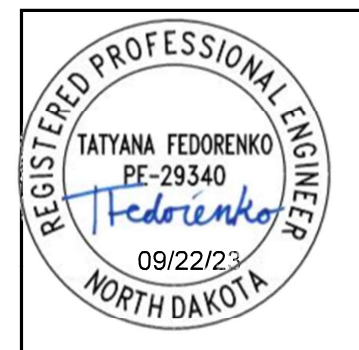
Fill the box culvert joints on the walls and the ceilings with expansive foam insulation. Cut expansive foam flush with the interior of the box culvert after it has dried. Install mechanical anchors in sound concrete to supply supplemental bond strength for shotcrete, then cover expansive foam and mechanical anchors with 2" layer of shotcrete. Refer to SP 192(23) for additional information.

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

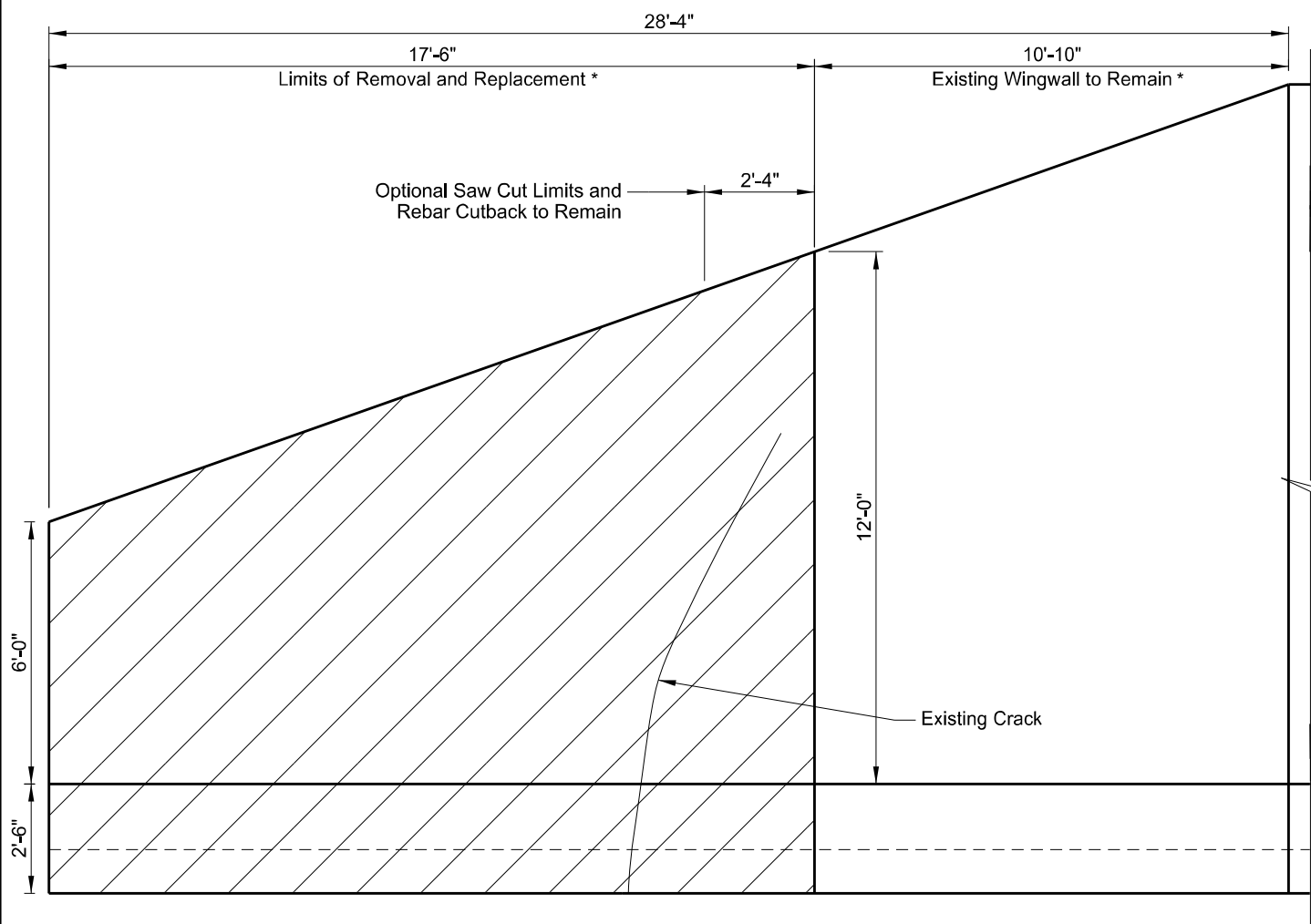
The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 16 joint segments will be paid for at the construction joint: 4 exterior walls, 6 floor segments, and 6 roof segments.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".

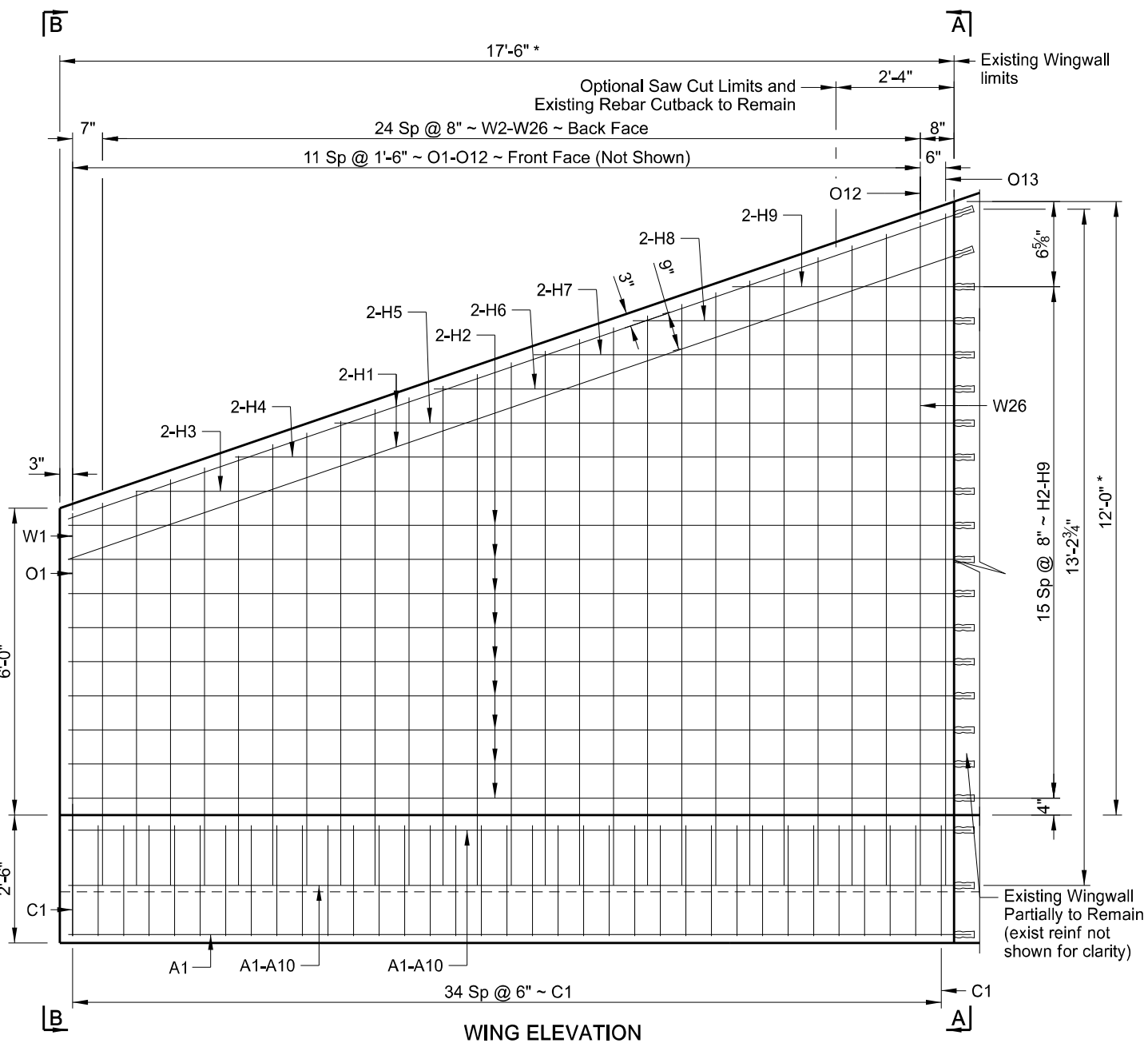


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NDDOT Reserves All Objections

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DEMOLITION ELEVATION



WING ELEVATION

***NOTE:**

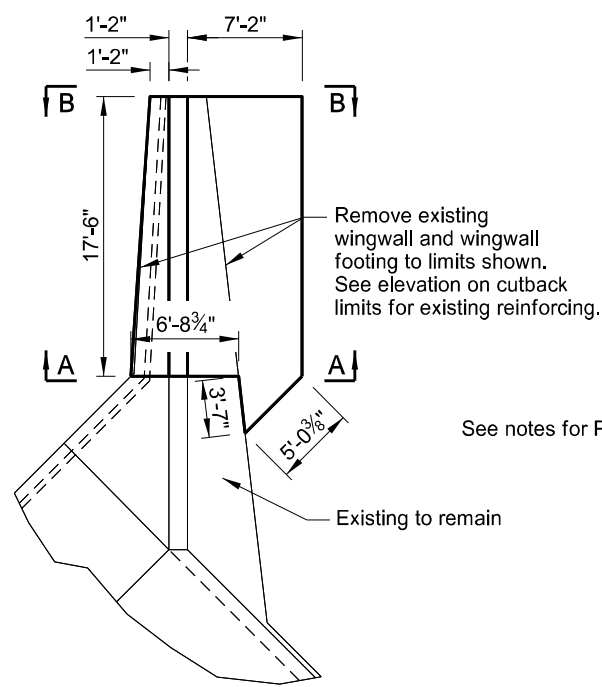
Engineer to verify limits of demolition in the field prior to removal and replacement.



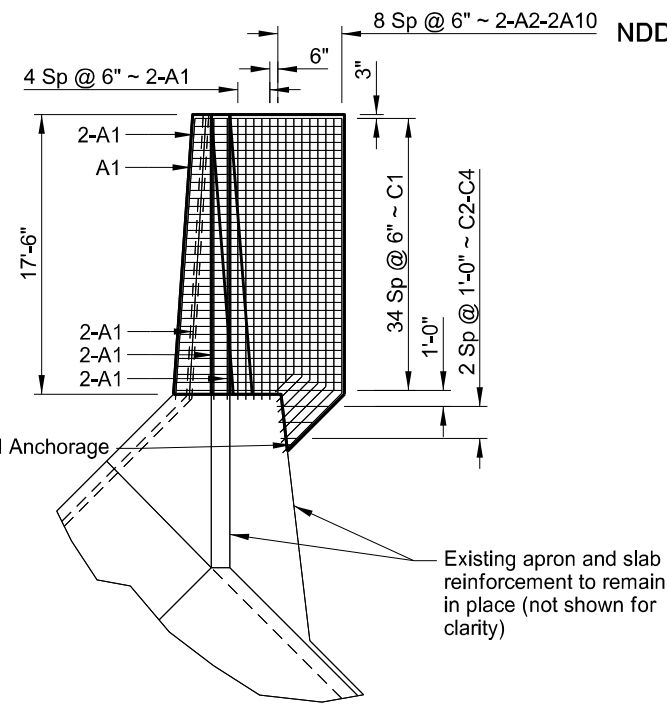
SAND
ND 13, 7 MI WEST OF US 83

BOX CULVERT REPAIRS
13-192.154

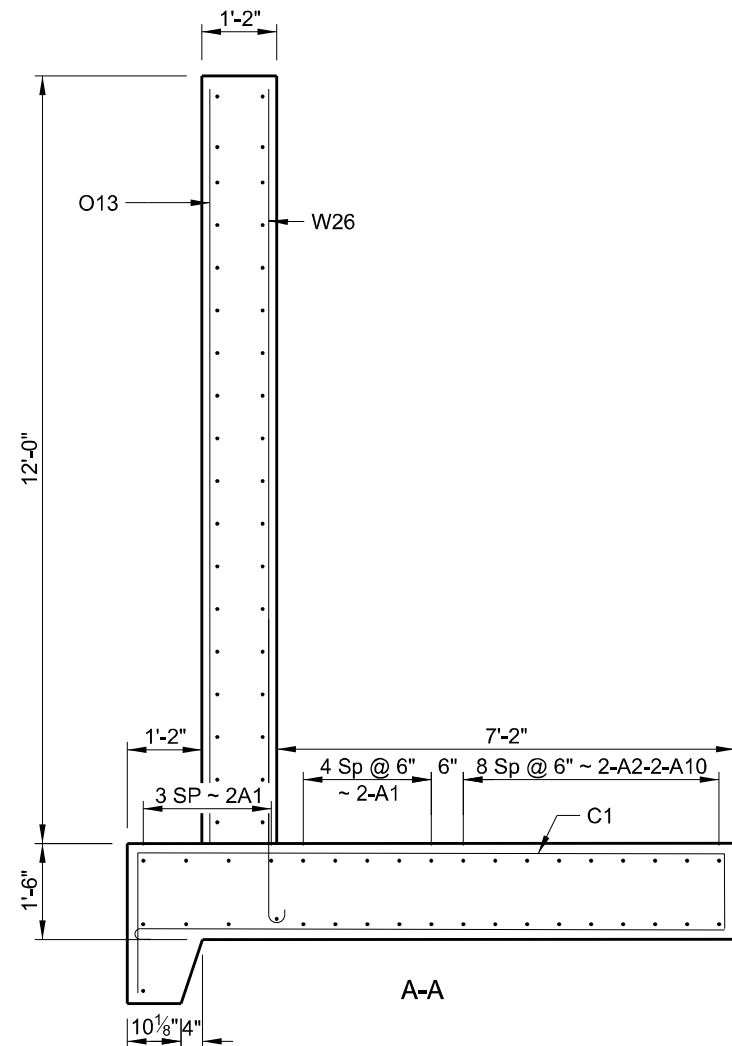
STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	5



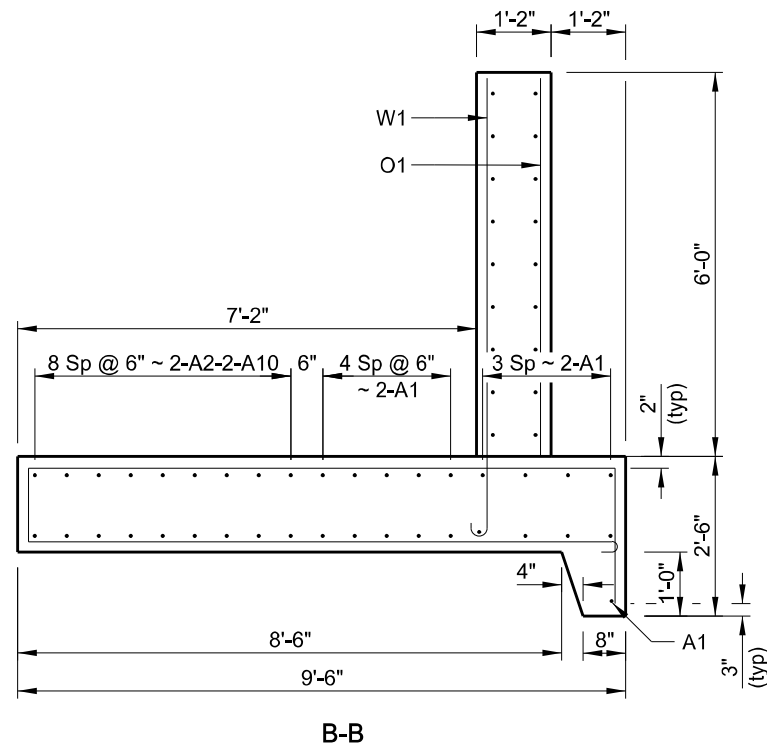
SHOWING DIMENSIONS ONLY



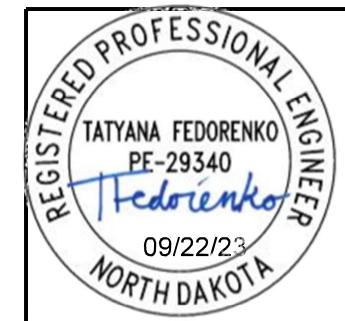
SHOWING PROPOSED FOOTING REINFORCEMENT ONLY
(Existing apron/floor reinforcing not show for clarity)



A-A



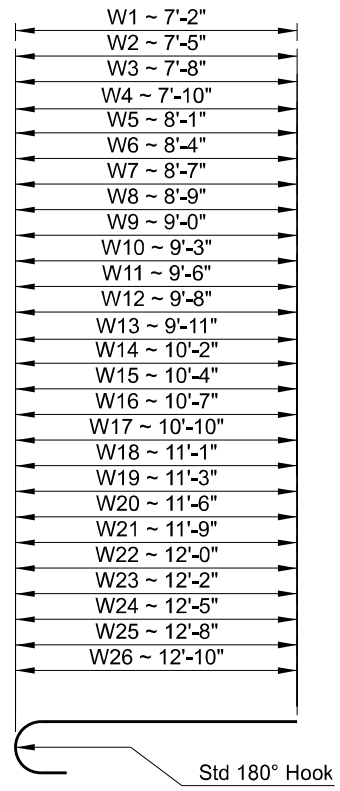
B-B



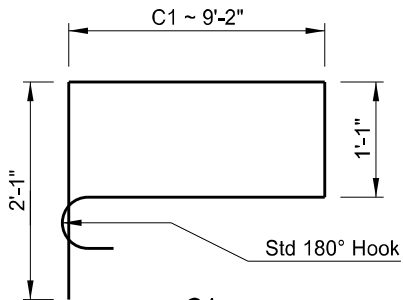
SAND CREEK
ND 13, 7 MI WEST OF US 83

BOX CULVERT REPAIRS
13-192.154

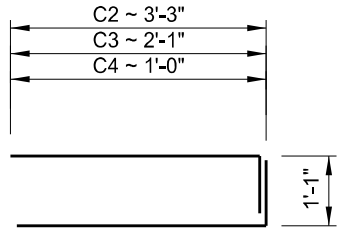
BAR LIST (CONSTANT)				
MARK	SIZE	NO.	LENGTH	SHAPE
W1	5	1	7'-9"	BENT
W2	5	1	8'-0"	BENT
W3	5	1	8'-3"	BENT
W4	5	1	8'-5"	BENT
W5	5	1	8'-8"	BENT
W6	5	1	8'-11"	BENT
W7	5	1	9'-2"	BENT
W8	5	1	9'-4"	BENT
W9	5	1	9'-7"	BENT
W10	5	1	9'-10"	BENT
W11	5	1	10'-1"	BENT
W12	5	1	10'-3"	BENT
W13	5	1	10'-6"	BENT
W14	5	1	10'-9"	BENT
W15	5	1	10'-11"	BENT
W16	5	1	11'-2"	BENT
W17	5	1	11'-5"	BENT
W18	5	1	11'-8"	BENT
W19	5	1	11'-10"	BENT
W20	5	1	12'-1"	BENT
W21	5	1	12'-4"	BENT
W22	5	1	12'-7"	BENT
W23	5	1	12'-9"	BENT
W24	5	1	13'-0"	BENT
W25	5	1	13'-3"	BENT
W26	5	1	13'-5"	BENT
C1	7	35	22'-4"	BENT
C2	5	2	4'-4"	BENT
C3	5	2	3'-2"	BENT
C4	5	2	2'-1"	BENT
H1	7	4	18'-7"	STR
H2	5	18	17'-7"	STR
H3	5	2	16'-3"	STR
H4	5	2	14'-4"	STR
H5	5	2	12'-5"	STR
H6	5	2	10'-6"	STR
H7	5	2	8'-7"	STR
H8	5	2	6'-8"	STR
H9	5	2	4'-9"	STR
A1	7	19	17'-7"	STR
A2	7	2	17'-6"	STR
A3	7	2	17'-11"	STR
A4	7	2	18'-7"	STR
A5	7	2	19'-3"	STR
A6	7	2	19'-11"	STR
A7	7	2	20'-7"	STR
A8	7	2	21'-3"	STR
A9	7	2	21'-11"	STR
A10	7	2	22'-7"	STR
O1-O12	4	1 SET	103'-9"	STR
O13	4	1	11'-8"	STR



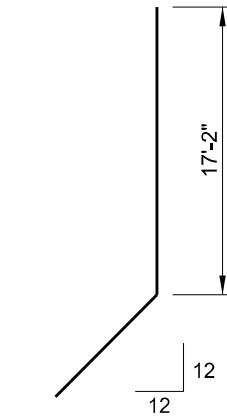
W1 - W26



C1



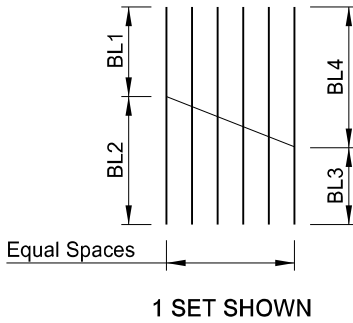
C2 - C4



A2-A10

23 U.S.C. 407
NDDOT Reserves All Objections

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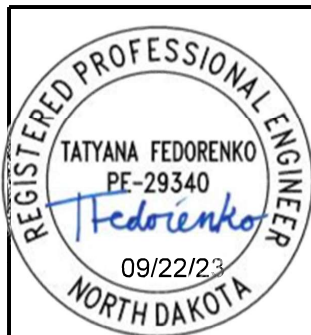
1 SET SHOWN

MARK	LENGTH 1 SET	BL1	BL2	BL3	BL4	SPACES
O1-O12	103'-9"	5'-10"	11'-5½"	8'-11"	8'-4½"	5

BAR CUTTING DETAILS

CONCRETE QUANTITIES	
FLOOR	9.8 CY
WINGWALL	6.8 CY
TOTAL	17.0 CY

QUANTITIES	
CLASS AE-3 CONCRETE	17.0 CY
REINFORCING STEEL	4035 LBS



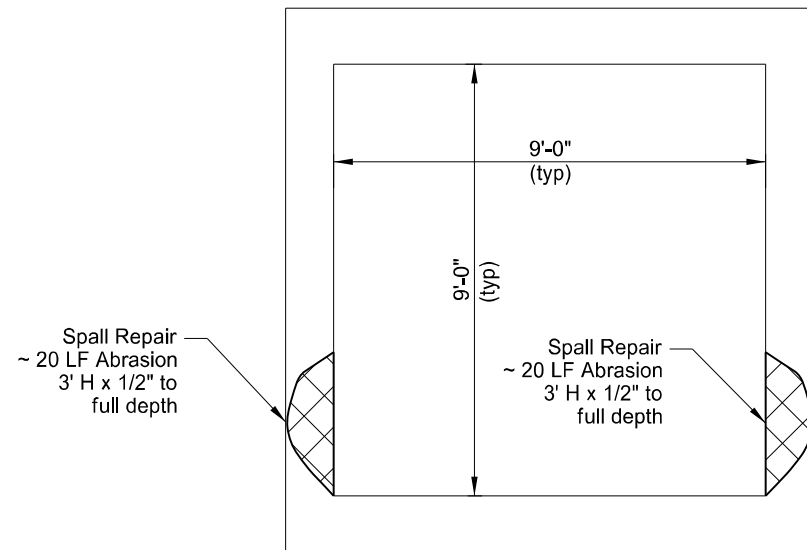
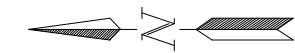
SAND CREEK
ND 13, 7 MI WEST OF US 83

BOX CULVERT REPAIRS
13-192.154

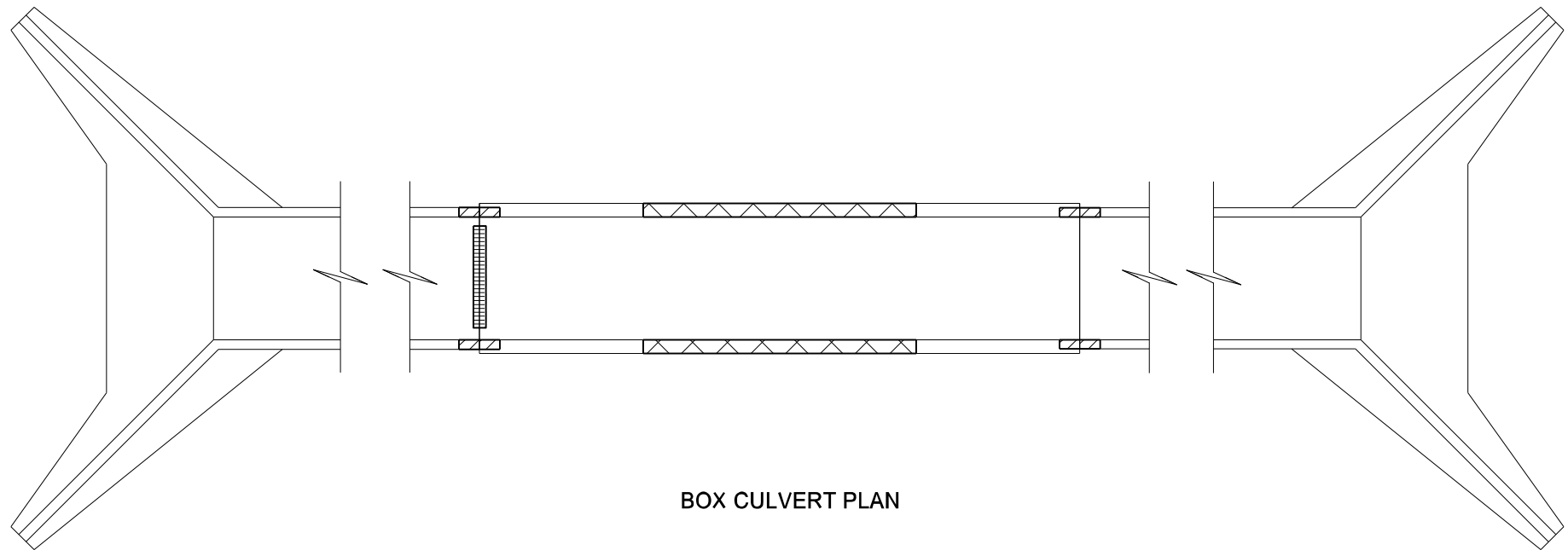
23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	7

NOTE:
All areas to be verified by Engineer in the field prior to removal.

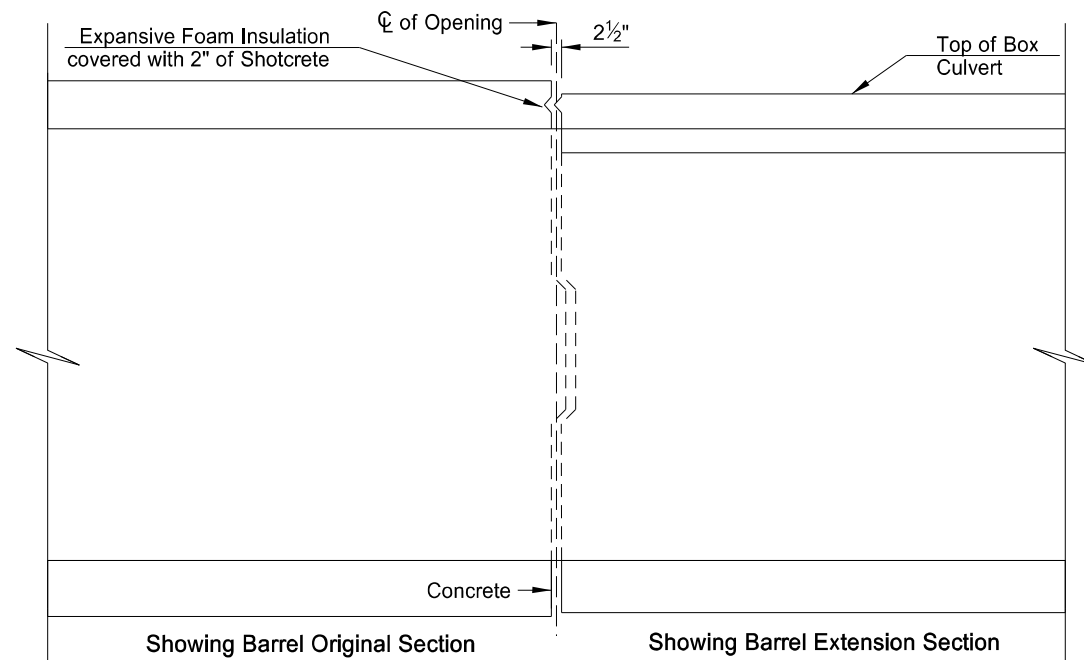


BARREL ORIGINAL SECTION
(BARREL EXTENSION SECTION NOT SHOWN)



BOX CULVERT PLAN

- Indicates joint repair with 2.5 ft void in ceiling to be filled with expansive foam insulation.
- Indicates spall repair area. Dimensions for estimating purpose only.
- Hatched area indicates joint treatment. Dimensions for estimating purposes only.



JOINT REPAIR DETAIL

BOX CULVERT BID ITEMS

SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
930	9612	SPALL REPAIR	SF	120
930	9671	BOX CULVERT JOINT REPAIR	EA	2
950	9712	JOINT TREATMENT	LF	36

SPECIAL PROVISIONS

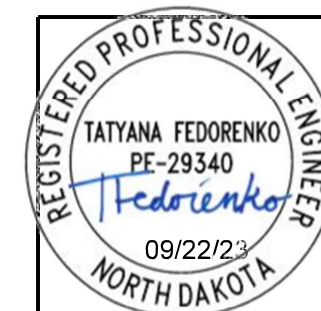
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

CREEK
ND 23, 5 MI WEST OF ND 22

BOX CULVERT REPAIRS
23-033.279

ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Jason Thorenson Thorenson, Jason R.
09/22/23



NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	8

100 SCOPE OF WORK: Work at this site consists of repairing the abrasions on the lower 3 feet of the barrel walls and repairing the joints at this single 9 x 9 concrete box culvert.

930 SPALL REPAIR: The bid item "Spall Repair" is for the saw cutting, removal, and replacement of the unsound concrete on a section of the lower walls of the barrel of the original box culvert. Restore the spalled areas to their original cross section.

Use a 15-pound maximum size chipping hammer on any unsound concrete removal. Provide sharp, neat lines at least 1 inch deep at the edges of the repair areas. Within the removal area, remove concrete to provide a minimum 1" clearance around the periphery of the reinforcing steel. Produce these sharp, neat lines by saw cutting or other means approved by the Engineer. Take care in the removal process to ensure no damage is done to the reinforcing steel.

Sand blast clean the existing concrete and exposed reinforcing steel. Clean the existing concrete surface by high pressure water blasting. After the surface has dried and just before the patching material is placed, coat the surface with an epoxy bonding agent that includes a migratory corrosion inhibitor. The bonding agent and corrosion inhibitor may be Sika FerroGard 903 (Sika Corp.), Tamms Duralprep A.C., Pro-Poxy 204 (Unitex) or an approved equal.

Use a two component, polymer-modified, cementitious repair mortar material that is specifically intended for patching concrete and contains a corrosion inhibitor. This patching material may be SikaTop 123 Plus (Sika Corporation), Duraltop Gel (Euclid Chemical Company), MasterEmaco N 400 (BASF Corporation), or an approved equal repair mortar. Cure the material as recommended by the manufacturer.

At the contractor's option, and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform spall repairs using shotcrete in lieu of cementitious repair mortar. Any additional cost for this option must be borne by the contractor.

The actual limits of spall repair are to be determined by the Engineer in the field. Include the cost of all labor, equipment, and materials needed for spall repair and removing and reinstalling brace in the price bid for "Spall Repair".

930 BOX CULVERT JOINT REPAIR: The north construction joint has separated approximately 2.5". Voids measured from the inside of the box culvert measured up to 2.5' deep above the ceiling.

If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the

floor using shotcrete in lieu of concrete.

Fill voids above the roof with expansive foam insulation. Cut expansive foam flush with the interior of the box culvert after it has dried. Install mechanical anchors in sound concrete to supply supplemental bond strength for shotcrete, then cover expansive foam and mechanical anchors with 2" layer of shotcrete. Refer to SP 192(23) for additional information.

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 2 joint segments will be paid for at the construction joint: 1 floor segment and 1 roof segment.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".



NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

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ND	NH-9-999(477)	170	9

950 JOINT TREATMENT: The reinforced concrete box culvert has severe splits at both extension joints. The Engineer will sound and mark out areas of unsound concrete prior to removal.

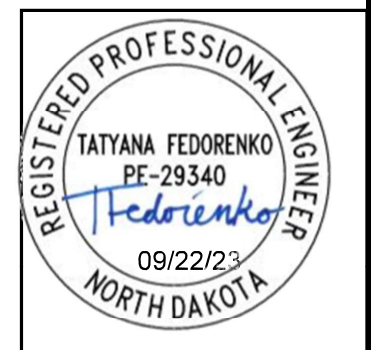
Remove all unsound concrete and replace it with new concrete material. Use a 15-pound maximum size chipping hammer on any unsound concrete. Provide sharp, neat lines at least 1 inch deep at the edges of the repair areas. Produce these sharp, neat lines by saw cutting or other means approved by the Engineer. Remove concrete to a depth that provides a minimum clearance of 1" around the periphery of the rebar. Take care not to damage existing reinforcement.

Sand blast clean any rust scale found on the exposed reinforcing steel. Clean the existing concrete surface by light sand blasting. After the surface has dried just before the patching material is placed, coat the surface with an epoxy bonding agent.

Use shotcrete in accordance with SP 192(23) Concrete Spall Repair by Shotcrete. Apply and cure the material as recommended by the manufacturer.

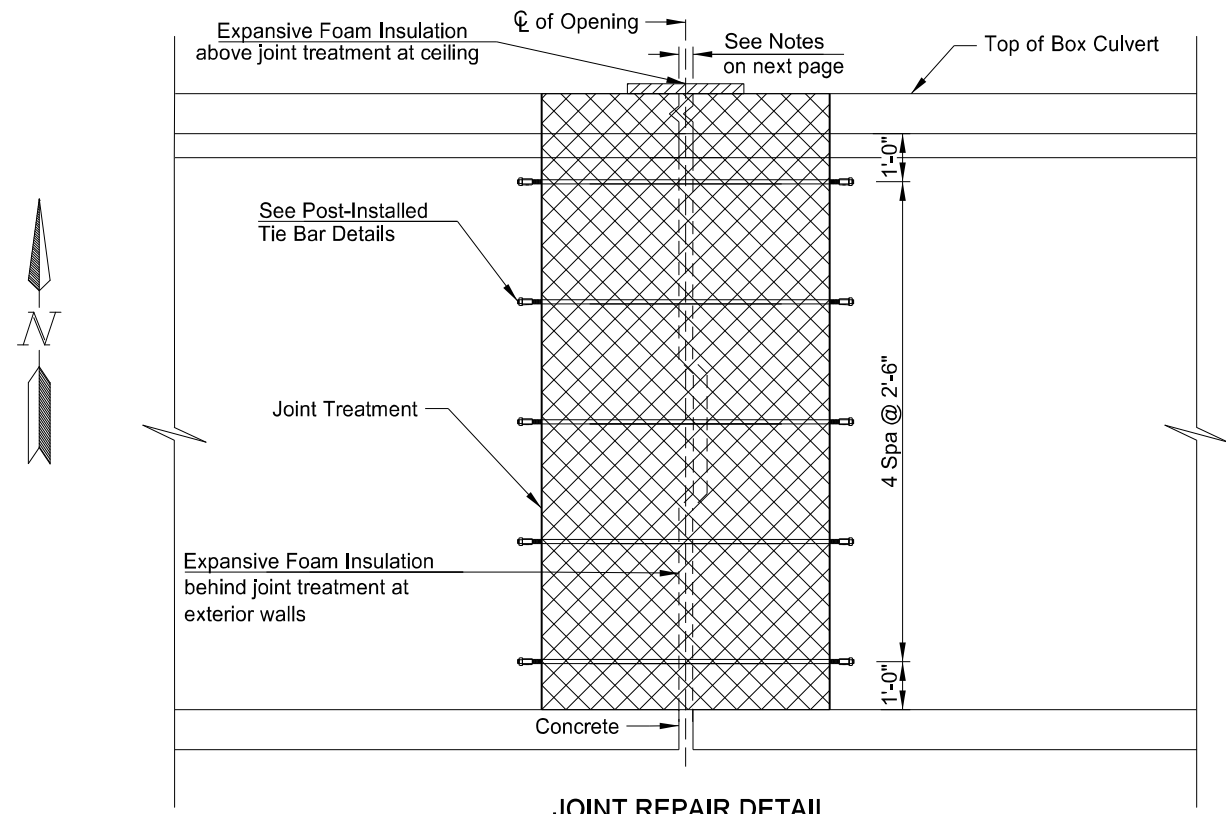
The plan quantity is based on the assumption that the areas to be repaired are to the dimensions shown in plan view. The actual limits of the repair are to be determined by the Engineer in the field.

Include all labor, equipment, and materials needed to repair the spall areas in the bid item "Joint Treatment".

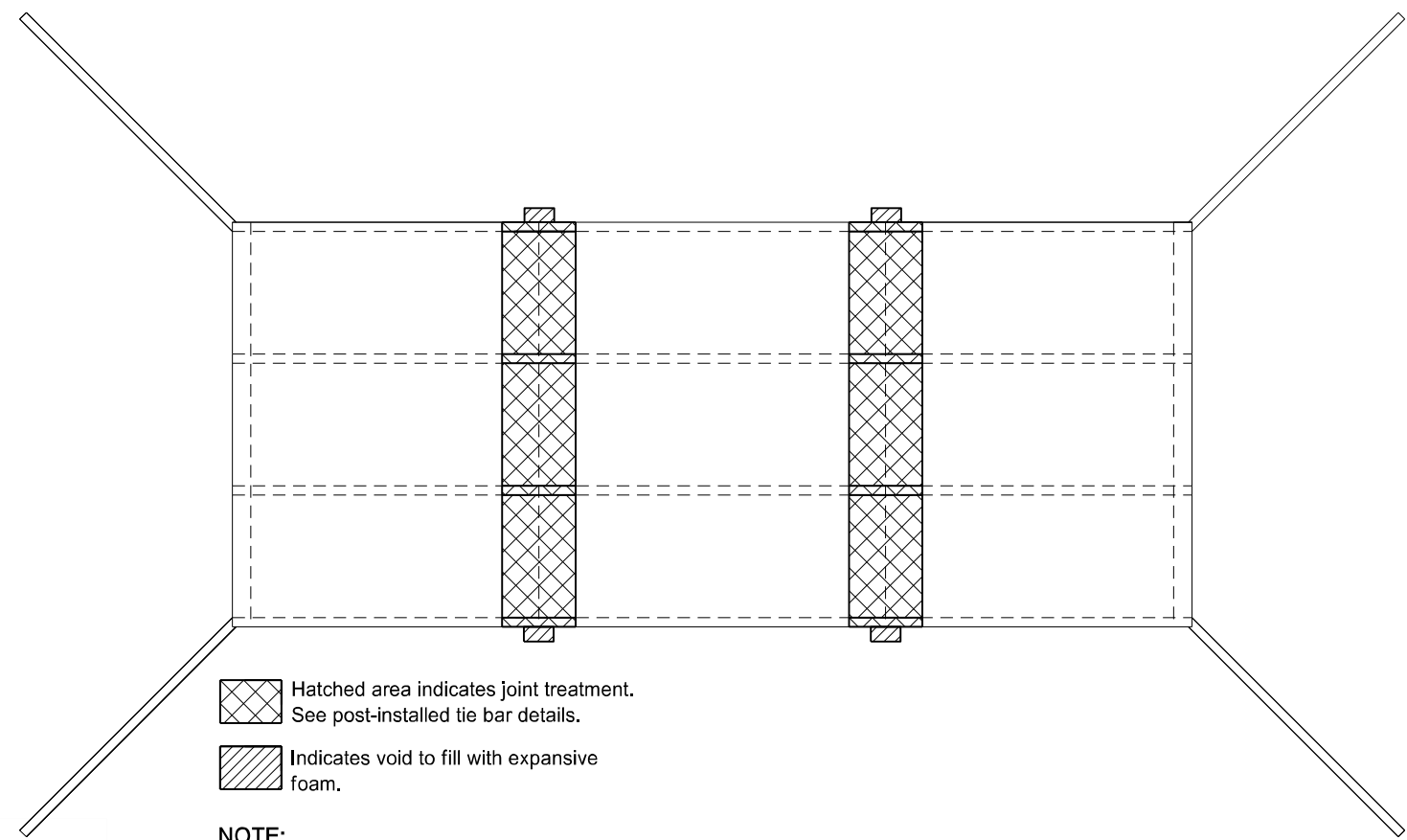


23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	10



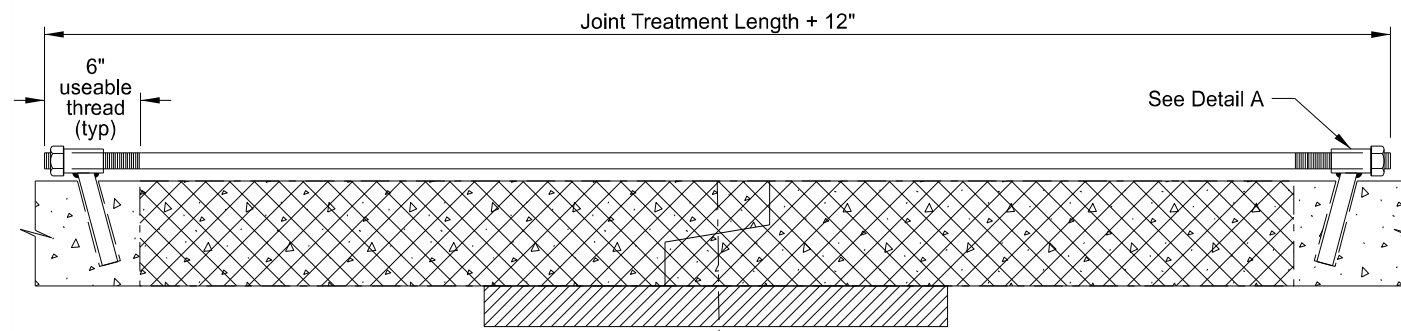
JOINT REPAIR DETAIL



Hatched area indicates joint treatment.
See post-installed tie bar details.
Indicates void to fill with expansive foam.

NOTE:
All areas to be verified by Engineer
in the field prior to removal.

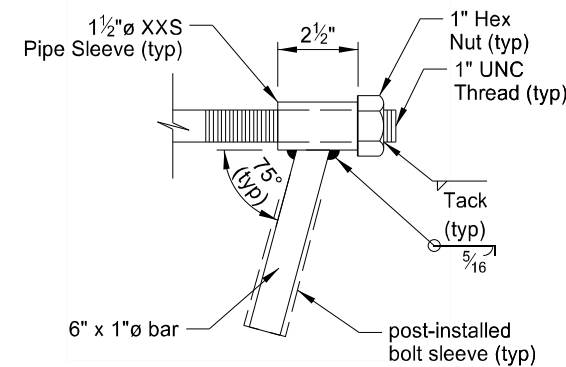
BOX CULVERT PLAN



POST-INSTALLED TIE BAR DETAILS

NOTE:
Post-installed bolt sleeves to be drilled and epoxied into box culvert with Hilti HIT-HY 200 adhesive (or approved equal) @ 2'-6" OC max, 4" minimum effective embedment. Do not use ties to pull the RCB sections tight. The ties are only for holding sections together.

Hatched area indicates joint treatment.
Indicates void to fill with expansive foam.



DETAIL A

BOX CULVERT BID ITEMS

SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
930	9671	BOX CULVERT JOINT REPAIR	EA	16
950	9712	JOINT TREATMENT	LF	156

SPECIAL PROVISIONS

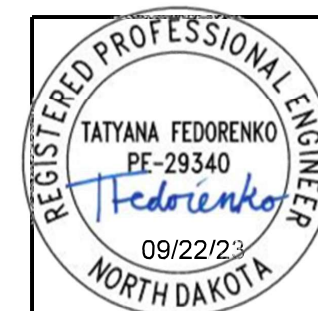
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

BRANCH OF RAYMOND CREEK
ND 200, 6 MI NORTH OF 200A

BOX CULVERT REPAIRS
200-163.162

ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Thorenson, Jason R.
09/22/23



NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	11

100 SCOPE OF WORK: Work at this site consists of repairing the joints at this triple 10 x 12 concrete box culvert.

930 BOX CULVERT JOINT REPAIR: The east construction joint near mid length has separated approximately 1.5" and the west construction joint near mid length has separated approximately 2.0". There is a loss of fill behind the east and west joints.

If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the floor using shotcrete in lieu of concrete.

Fill void behind the wall with expansive foam insulation. Cut expansive foam flush with the exterior of the box culvert after it has dried to allow space for the joint treatment. After joint treatment, use tie rods anchored to the wall at each exterior wall joint to tie joints in the box culvert as shown in the detail past the limits of the Joint Treatment repair. Post-install the bolt sleeves using Hilti HIT-HY adhesive or approved equivalent according to manufacturer's instructions.

Fill the voids on the ceilings with expansive foam insulation. Cut expansive foam flush with the exterior of the box culvert after it has dried.

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 16 joint segments will be paid for at the construction joint: 4 exterior walls, 6 roof segments, and 6 floor segments.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".

950 JOINT TREATMENT: The reinforced concrete box culvert has severe splits and porous deteriorated concrete at all expansion joints. The Engineer will sound and mark out areas of unsound concrete prior to removal.

Remove unsound concrete and replace it with new concrete material. If unsound

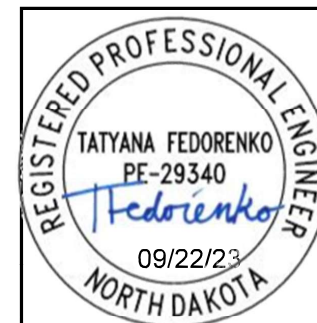
concrete extends past 1" periphery around rebar, notify the Engineer before further removal. Use a 15-pound maximum size chipping hammer on any unsound concrete. Expose existing reinforcement, without damage, and lap with proposed identical reinforcement. New reinforcement should be matched to existing and be verified by the Engineer in the field. Provide sharp, neat lines. Remove concrete to a depth that provides a minimum clearance of 1" around the periphery of the rebar. Take care not to damage existing reinforcement.

Sand blast clean any rust scale found on the exposed reinforcing steel. Clean the existing concrete surface by light sand blasting. After the surface has dried just before the patching material is placed, coat the surface with an epoxy bonding agent.

Use shotcrete in accordance with SP 192(23) Concrete Spall Repair by Shotcrete. Apply and cure the material as recommended by the manufacturer.

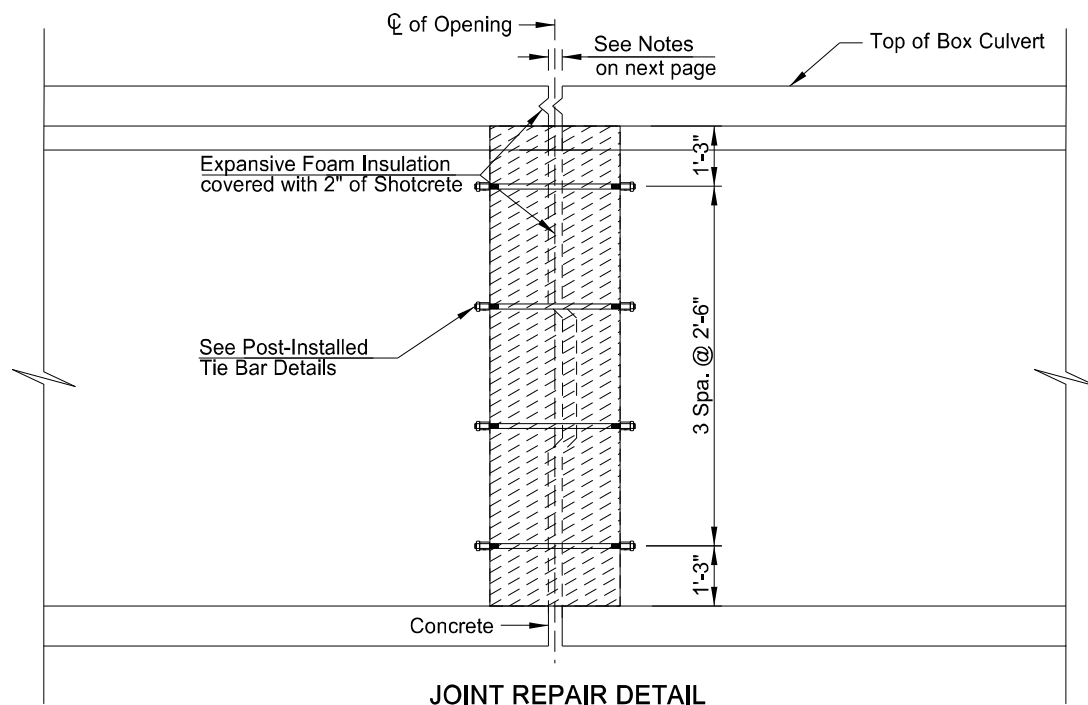
The plan quantity is based on the assumption that the lengths to be repaired are to the dimensions shown in plan view and joint treatment width is estimated as 6 ft. The actual limits of the repair are to be determined by the Engineer in the field.

Include all labor, equipment, and materials needed to repair the spall areas in the bid item "Joint Treatment".

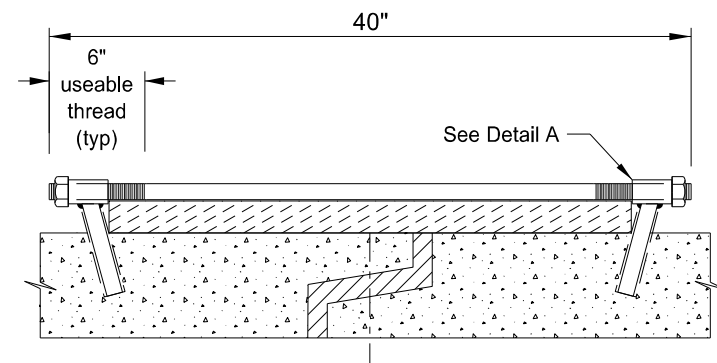


23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	12



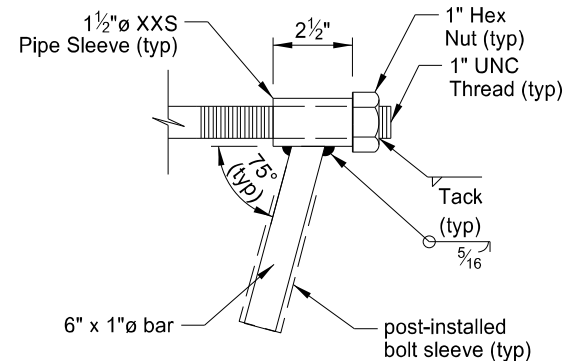
JOINT REPAIR DETAIL



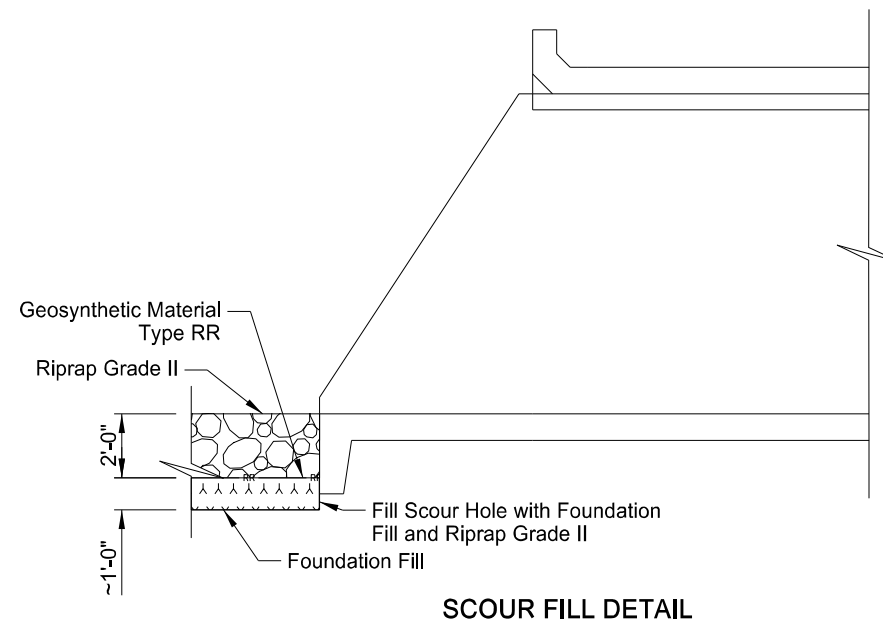
POST-INSTALLED TIE BAR DETAILS

- Indicates expansive foam insulation joint filler.
- Indicates 2" Shotcrete layer over foam.

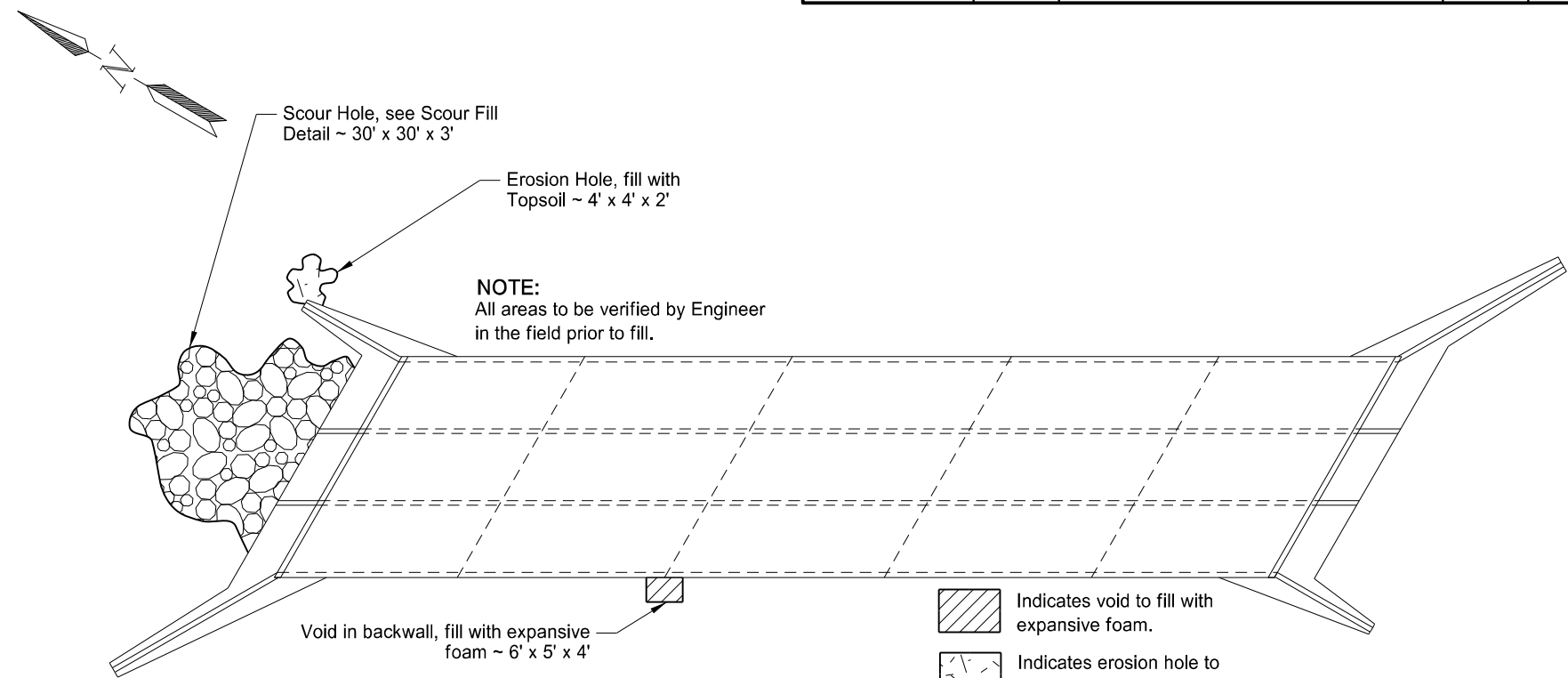
NOTE:
Anchors to be drilled and epoxied into box culvert with Hilti HIT-HY 200 adhesive (or approved equal) @ 2'-6" OC max, 4" minimum effective embedment. Do not use ties to pull the RCB sections tight. The ties are only for holding sections together.



DETAIL A



SCOUR FILL DETAIL



BOX CULVERT PLAN

- Indicates void to fill with expansive foam.
- Indicates erosion hole to fill with topsoil.
- Indicates scour hole area to fill with foundation fill and cover with riprap.

BOX CULVERT BID ITEMS

SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
203	0109	TOPSOIL	CY	2.5
210	0210	FOUNDATION FILL	CY	33
256	0200	RIP RAP GRADE II	CY	67
700	0709	GEOSYNTHETIC MATERIAL TYPE RR	SY	100
930	9671	BOX CULVERT JOINT REPAIR	EA	24

SPECIAL PROVISIONS

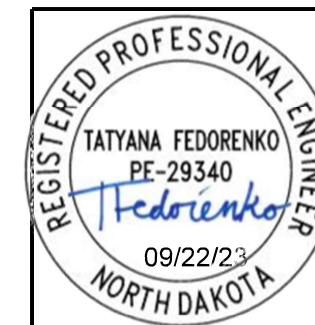
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

GOOSE RIVER
ND 200, 4 MI EAST OF MAYVILLE

BOX CULVERT REPAIRS
200-388.375

ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Jason Thorenson Thorenson, Jason R.
09/22/23



NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	13

- 100 SCOPE OF WORK: Work at this site consists of repairing various construction joints, filling topsoil erosion holes and addressing scour on the north end of this triple 11 x 10 concrete box culvert.
- 203 TOPSOIL: Fill erosion hole at the east of structure along the north bank with topsoil, seed with wetland seed mix meeting 251.03.F, and cover with Erosion Control Blanket meeting 255.03. Include all materials, labor and equipment required for this work in the price bid for "Topsoil".
- 210 FOUNDATION FILL: Engineer will verify dimensions of scour hole prior to commencement of work. Use clay fill to fill the bottom of the scour hole as shown in Scour Repair Detail. Use clay fill that meets AASHTO Silt-Clay Materials Classification. See Riprap Grade II for filling the top of the scour hole. Include all materials, excavation, labor, and equipment for this work in the price bid for "Foundation Fill".
- 256 RIPRAP GRADE II: Fill the top 2' of the scour hole with Riprap Grade II. Before placing the riprap and after placing the foundation fill, place Geosynthetic Material Type RR. Include all materials, excavation, labor, and equipment required for this work in the price bid for "Riprap Grade II".
- 930 BOX CULVERT JOINT REPAIR: In the west culvert barrel, the north center joint has separated approximately 1.25" and the north joint has separated approximately 5". Voids in the west culvert barrel at the north joint measured up to 4' deep with misalignment up to 3/4". In the center culvert barrel, the south joint has separated between 7/8" and 1.5", the north center joint has separated 1.25", and the north joint has separated between 2.5" and 4" with misalignment up to 7/8". In the east culvert barrel the north joint has separated approximately 1.25", the north center joint has separated approximately 1.25", and the south joint has separated approximately 1.75" with misalignment up to 3/4".

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 24 joint segments will be paid for at the construction joint: 6 exterior walls, 9 floor segments, and 9 roof segments.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".

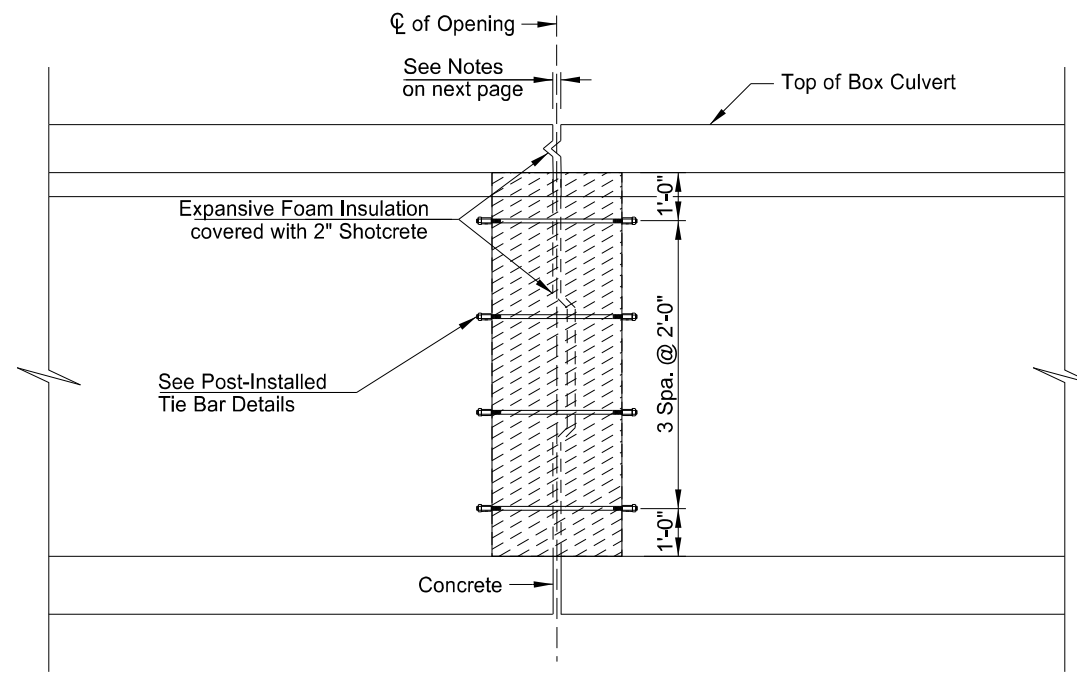
If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the floor using shotcrete in lieu of concrete.

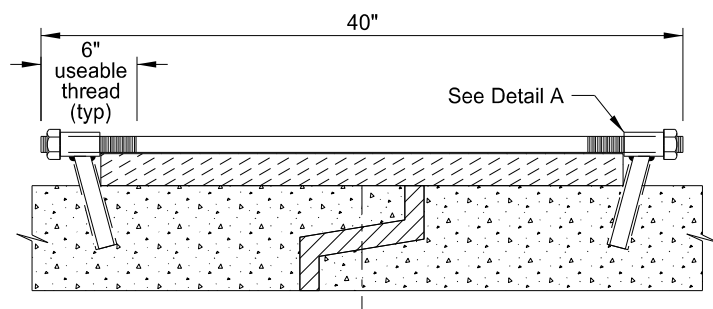
Fill the voids along the walls and the ceilings with expansive foam insulation. Cut expansive foam flush with the interior of the box culvert after it has dried. Install mechanical anchors in sound concrete to supply supplemental bond strength for shotcrete, then cover expansive foam and mechanical anchors with 2" layer of shotcrete. Refer to SP 192(23) for additional information. Use tie rods anchored to the wall at each exterior wall joint to tie joints in the box culvert as shown in the detail. Post-install the bolt sleeves using Hilti HIT-HY adhesive or approved equivalent according to manufacturer's instructions.



STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	14



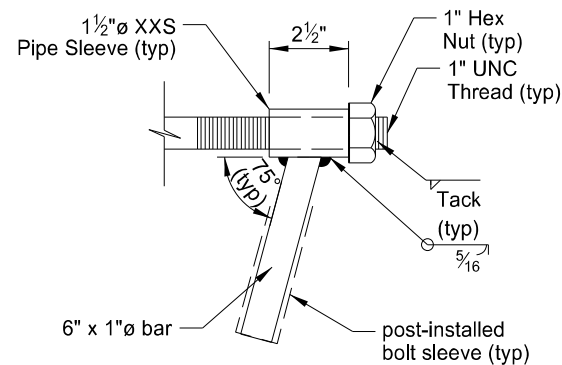
JOINT REPAIR DETAIL



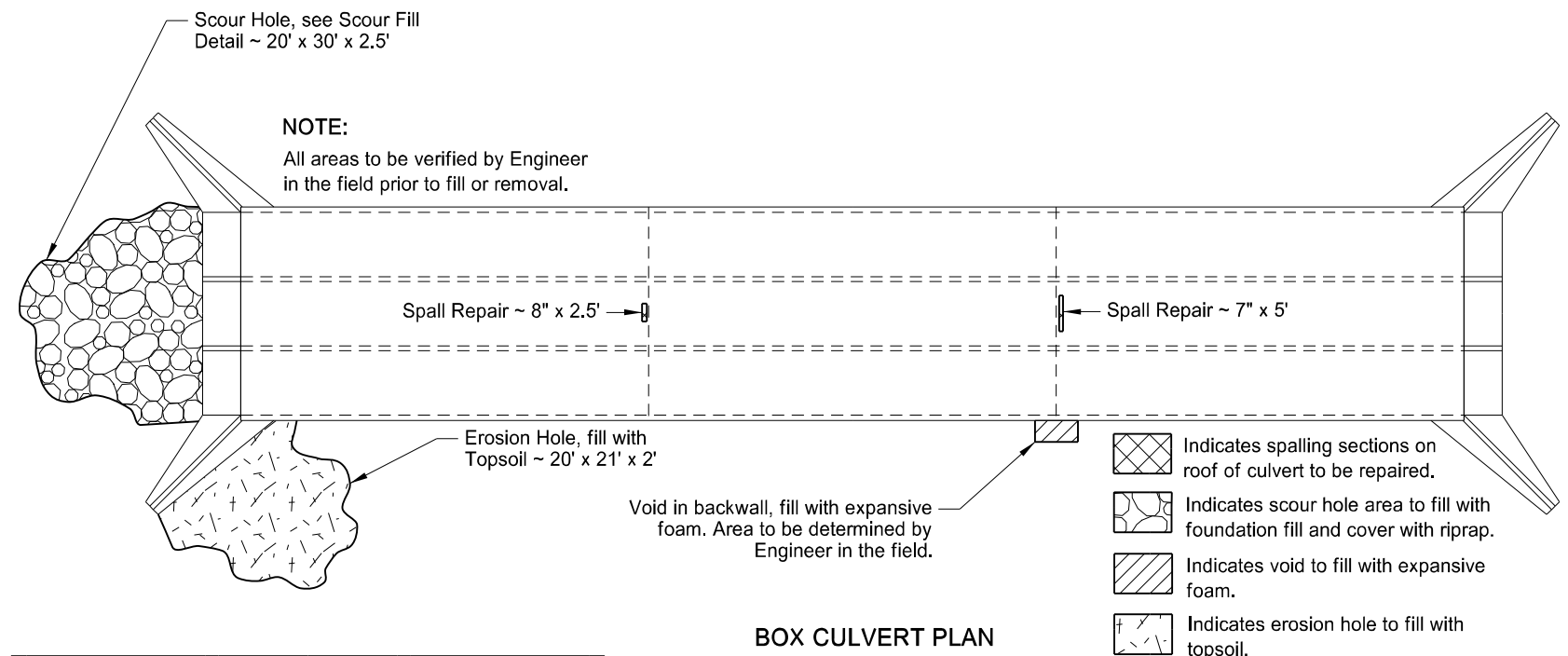
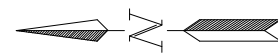
POST-INSTALLED TIE BAR DETAILS

- Indicates expansive foam insulation joint filler.
- Indicates 2" Shotcrete layer.

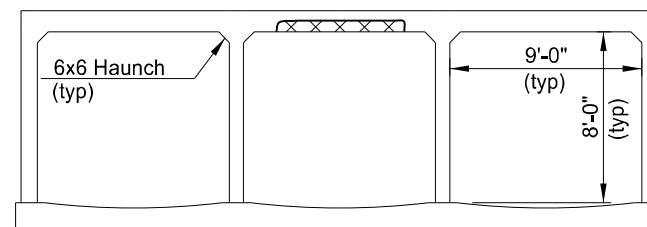
NOTE:
Post-installed bolt sleeves to be drilled and epoxied into box culvert with Hilti HIT-HY 200 adhesive (or approved equal) @ 2'-6" OC max, 4" minimum effective embedment. Do not use ties to pull the RCB sections tight. The ties are only for holding sections together.



DETAIL A



BOX CULVERT PLAN

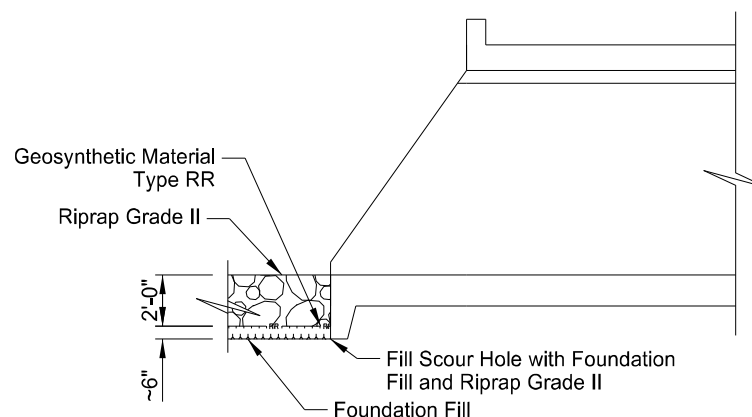


BARREL SECTION

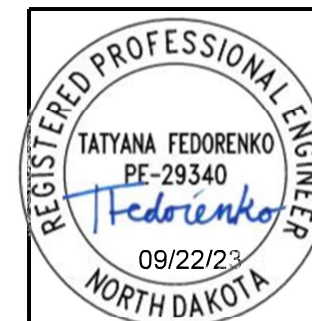
- Indicates spall areas on roof. Area specified on plan view.

SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
203	0109	TOPSOIL	CY	31
210	0210	FOUNDATION FILL	CY	11
256	0200	RIP RAP GRADE II	CY	44
700	0709	GEOSYNTHETIC MATERIAL TYPE RR	SY	67
930	9612	SPALL REPAIR	SF	5
930	9671	BOX CULVERT JOINT REPAIR	EA	20

BOX CULVERT BID ITEMS



SCOUR FILL DETAIL



SPECIAL PROVISIONS	
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

INTERMITTENT STREAM
ND 200, 5 MI EAST OF MAYVILLE

BOX CULVERT REPAIRS
200-389.780

ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Jason Thorenson Thorenson, Jason R.
09/22/23

NOTES

23 U.S.C. 407
 NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	15

- 100 SCOPE OF WORK: Work at this site consists of repairing the north and south joints, the spall, and scour at this triple 9 x 8 concrete box culvert.
- 203 TOPSOIL: Fill erosion hole at the west of structure along the north bank with topsoil, seed with Class II seed mix meeting 251.03.D, and cover with Erosion Control Blanket meeting 255.03. Include all materials, labor and equipment required for this work in the price bid for "Topsoil".
- 210 FOUNDATION FILL: Engineer will verify dimensions of scour hole prior to commencement of work. Use clay fill to fill the bottom of the scour hole as shown in Scour Repair Detail. Use clay fill that meets AASHTO Silt-Clay Materials Classification. See Riprap Grade II for filling the top of the scour hole. Include all materials, excavation, labor, and equipment for this work in the price bid for "Foundation Fill".
- 256 RIPRAP GRADE II: Fill the top 2' of the scour hole with Riprap Grade II. Before placing the riprap and after placing the foundation fill, place Geosynthetic Material Type RR. Include all materials, excavation, labor, and equipment required for this work in the price bid for "Riprap Grade II".
- 930 SPALL REPAIR: The bid item "Spall Repair" is for the saw cutting, removal, and replacement of the unsound concrete on the ceiling. Restore the spalled areas to their original cross section.

Use a 15-pound maximum size chipping hammer on any unsound concrete removal. Provide sharp, neat lines at least 1 inch deep at the edges of the repair areas. Within the removal area, remove concrete to provide a minimum 1" clearance around the periphery of the reinforcing steel. Produce these sharp, neat lines by saw cutting or other means approved by the Engineer. Take care in the removal process to ensure no damage is done to the reinforcing steel.

Sand blast clean the existing concrete and exposed reinforcing steel. Clean the existing concrete surface by high pressure water blasting. After the surface has dried and just before the patching material is placed, coat the surface with an epoxy bonding agent that includes a migratory corrosion inhibitor. The bonding agent and corrosion inhibitor may be Sika FerroGard 903 (Sika Corp.), Tamms Duralprep A.C., Pro-Poxy 204 (Unitex) or an approved equal.

Use a two component, polymer-modified, cementitious repair mortar material that is specifically intended for patching concrete and contains a corrosion inhibitor. This patching material may be SikaTop 123 Plus (Sika Corporation), Duraltop Gel (Euclid Chemical Company), MasterEmaco N 400 (BASF Corporation), or an approved equal repair mortar. Cure the material as recommended by the manufacturer.

At the contractor's option, and in accordance with North Dakota Department of Transportation SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform spall repairs using shotcrete in lieu of cementitious repair mortar. Any additional cost for this option must be borne by the contractor.

The actual limits of spall repair are to be determined by the Engineer in the field. Include the cost of all labor, equipment, and materials needed for spall repair in the price bid for "Spall Repair".

- 930 BOX CULVERT JOINT REPAIR: In the west culvert barrel, the south joint has separated between 6" and 4.75" approximately and the north joint has separated between 4.5" and 3.75" approximately. In the east culvert barrel the south joint has separated between 5" and 4" approximately and the north joint has separated between 4.75" and 4" approximately.

If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the floor using shotcrete in lieu of concrete.

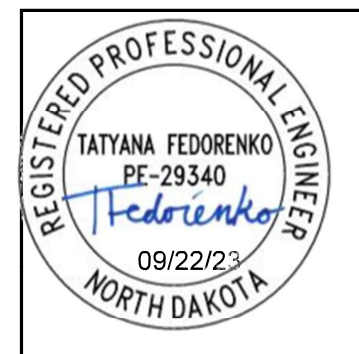
Fill voids along the walls and the ceilings with expansive foam insulation. Cut expansive foam flush with the interior of the box culvert after it has dried. Install mechanical anchors in sound concrete to supply supplemental bond strength for shotcrete, then cover expansive foam and mechanical anchors with 2" layer of shotcrete. Refer to SP 192(23) for additional information. Use tie rods anchored to the wall at each exterior wall joint to tie joints in the box culvert as shown in the detail. Post-install the bolt sleeves using Hilti HIT-HY adhesive or approved equivalent according to manufacturer's instructions.

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

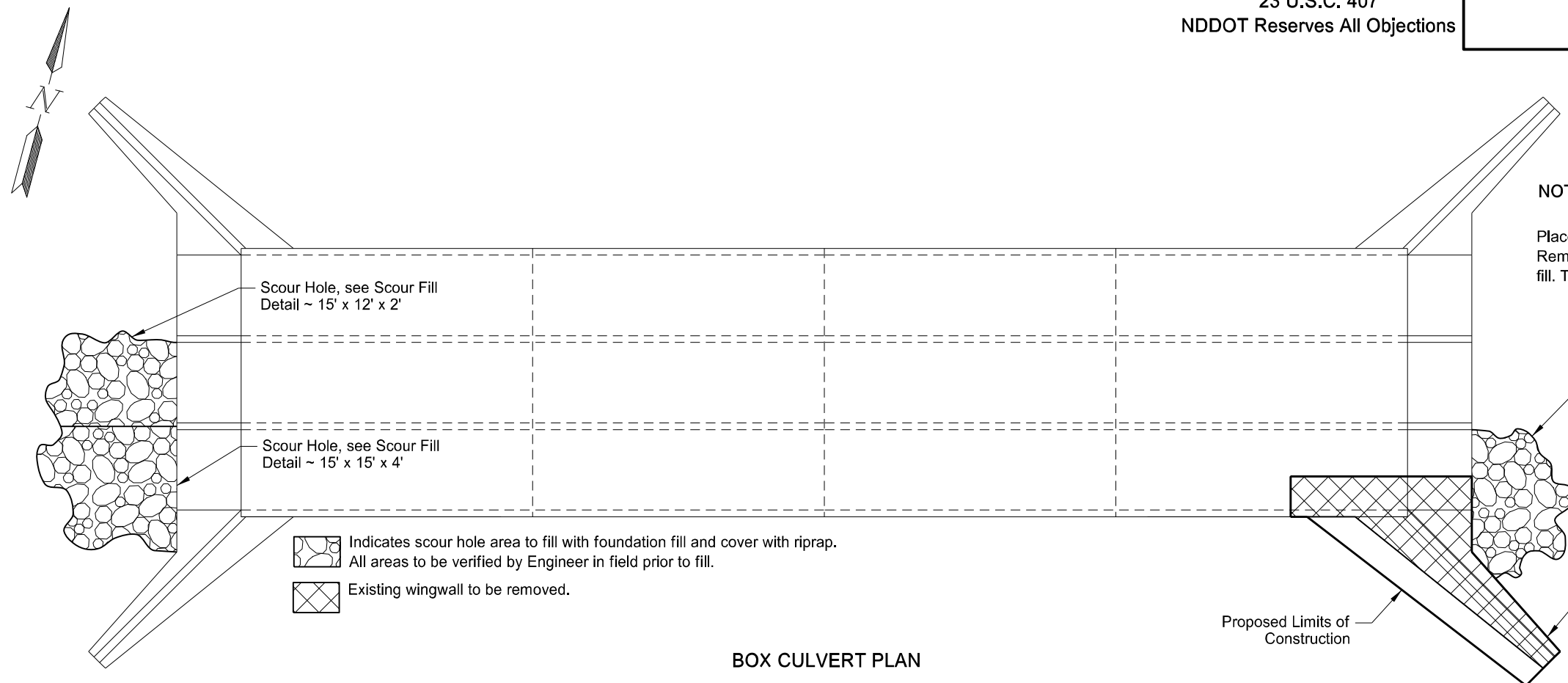
The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 20 joint segments will be paid for at the construction joint: 4 exterior walls, 4 interior walls, 6 floor segments, and 6 roof segments.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".



23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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NOTE:
Place a 1'-0" minimum depth of foundation fill under the wingwall footing. Remove and replace all unsound material under the box with foundation fill. The Engineer will determine the depth required.

Scour Hole, see Scour Fill Detail ~ 15' x 12' x 2'

Scour Hole, see Scour Fill Detail ~ 15' x 15' x 4'

Scour Hole, see Scour Fill Detail ~ 15' x 15' x 2.5'

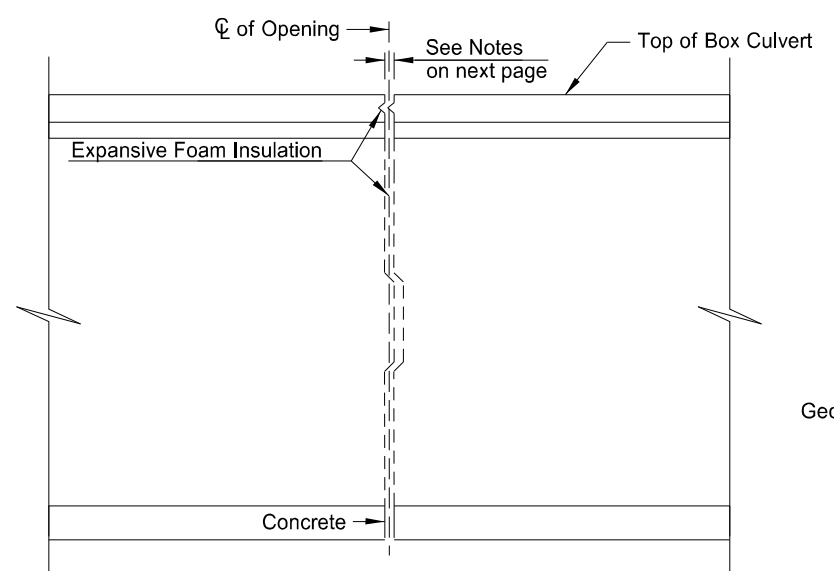
- Indicates scour hole area to fill with foundation fill and cover with riprap. All areas to be verified by Engineer in field prior to fill.
- Existing wingwall to be removed.

Remove and Replace Wingwall. Provide temporary shoring for the excavation. Engineer to verify limits in the field.

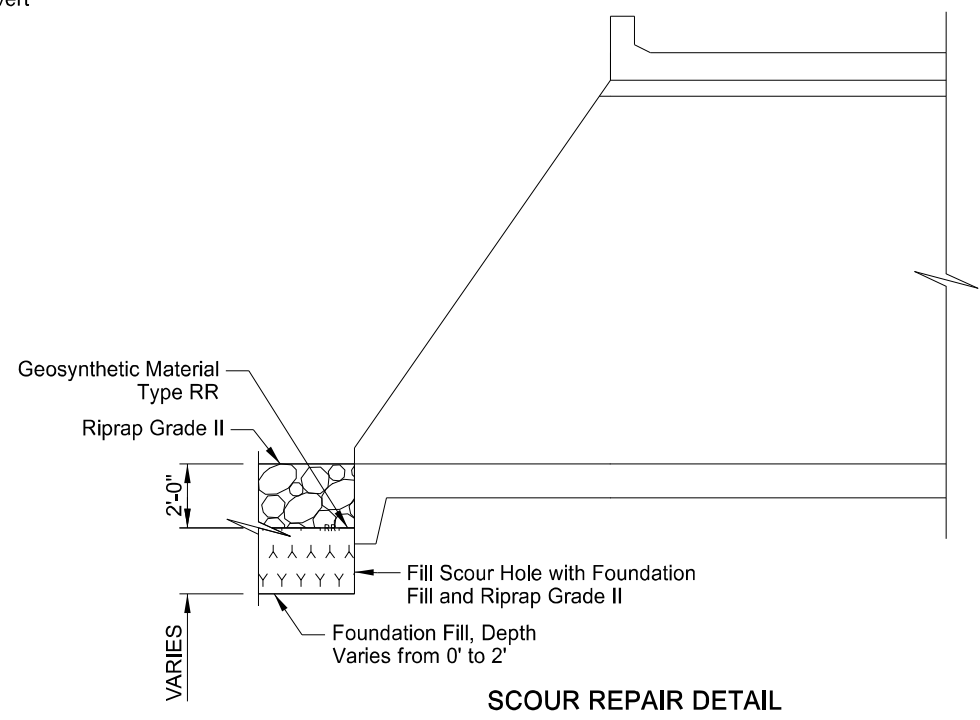
BOX CULVERT PLAN

BOX CULVERT BID ITEMS

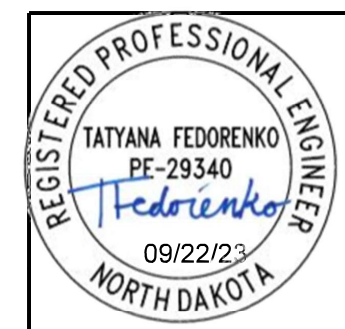
SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
202	0101	REMOVAL OF CONCRETE	EA	1
210	0210	FOUNDATION FILL	CY	35
256	0200	RIP RAP GRADE II	CY	47
602	1131	CLASS AE-3 CONCRETE BOX CULVERT	CY	35.1
612	0114	REINFORCING STEEL-GRADE 60-BOX CULVERT	LBS	6,227
700	0709	GEOSYNTHETIC MATERIAL TYPE RR	SY	70
930	8230	SHORING	EA	1
930	9671	BOX CULVERT JOINT REPAIR	EA	3



JOINT REPAIR DETAIL



SCOUR REPAIR DETAIL



SPECIAL PROVISIONS	
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

SOUTH FORK-MAPLE RIVER
US 281, 1 MI SOUTH OF MONANGO

BOX CULVERT REPAIRS
281-016.454

ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Jason Thorenson Thorenson, Jason R.
09/22/23

NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	17

100 SCOPE OF WORK: Work at this site consists of repairing joints, removing and replacing the southeast wingwall and repairing scour at this triple 10 x 12 concrete box culvert.

202 REMOVAL OF CONCRETE: Remove existing southeast wingwall in its entirety. Cut wing footing, apron, culvert floor and wall to the limits shown, leaving the existing culvert and apron reinforcing. Leave the barrel roof in place. Shore the existing culvert during the partial remove and replacement. Include all materials, excavation, labor and equipment required for this work in the price bid for "Removal of Concrete".

210 FOUNDATION FILL: Engineer will verify dimensions of scour hole prior to commencement of work. Use clay fill to fill the bottom of the scour hole as shown in Scour Repair Detail. Use clay fill that meets AASHTO Silt-Clay Materials Classification. See Riprap Grade II for filling the top of the scour hole. Provide foundation fill below wingwall in accordance with Section 210.B.3. Include all materials, excavation, labor, and equipment for this work in the price bid for "Foundation Fill".

256 RIPRAP GRADE II: Fill the top 2' of the scour hole with Riprap Grade II. Before placing the riprap and after placing the foundation fill, place Geosynthetic Material Type RR. Include all materials, excavation, labor, and equipment required for this work in the price bid for "Riprap Grade II".

602 CONCRETE: Cast the following elements of each section in one continuous run:
 1. Wing footings, culvert floor, and apron.
 2. Wing complete to the top and culvert wall.

If the existing wall thickness is different than the new thickness, set the inner surfaces flush and the exterior surfaces tapered in the first 1'-6" of the wing.

602 CURING CONCRETE: Wet cure all concrete surfaces not covered by forms. Cover the concrete with a double thickness of burlap. Maintain surface moisture between the final finish and placement of burlap by periodic applications of a light fog spray of water. Keep the burlap continuously moist until the end of the curing period.

612 REINFORCING STEEL: Dimensions of bent bars are given out to out.

930 SHORING: Temporary shoring is required for the excavation and replacement of the wingwall. The Contractor will design, construct, maintain, and remove the temporary shoring. All excavation, labor, equipment, and material needed for this work shall be included in the bid item, "Shoring".

930 BOX CULVERT JOINT REPAIR: In the south culvert barrel the center joint has separated 1".

If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a

minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the floor using shotcrete in lieu of concrete.

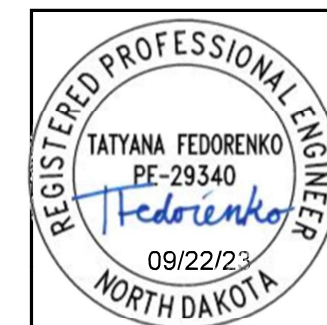
Fill the box culvert joints on the walls and the ceilings with expansive foam insulation. Cut expansive foam flush with the interior of the box culvert after it has dried.

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

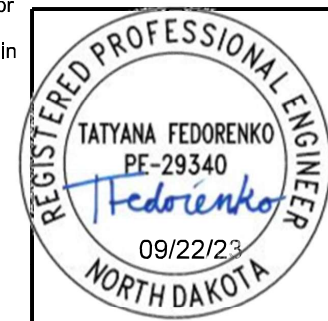
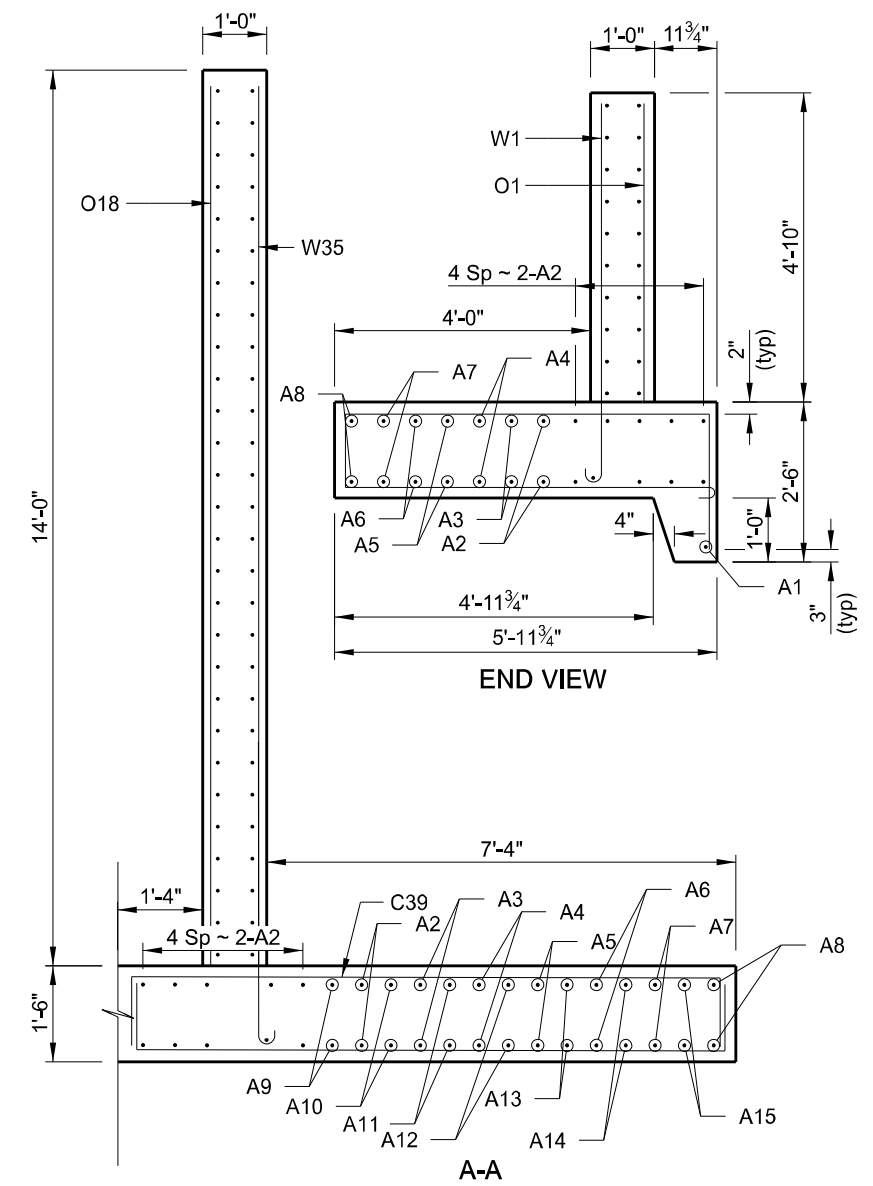
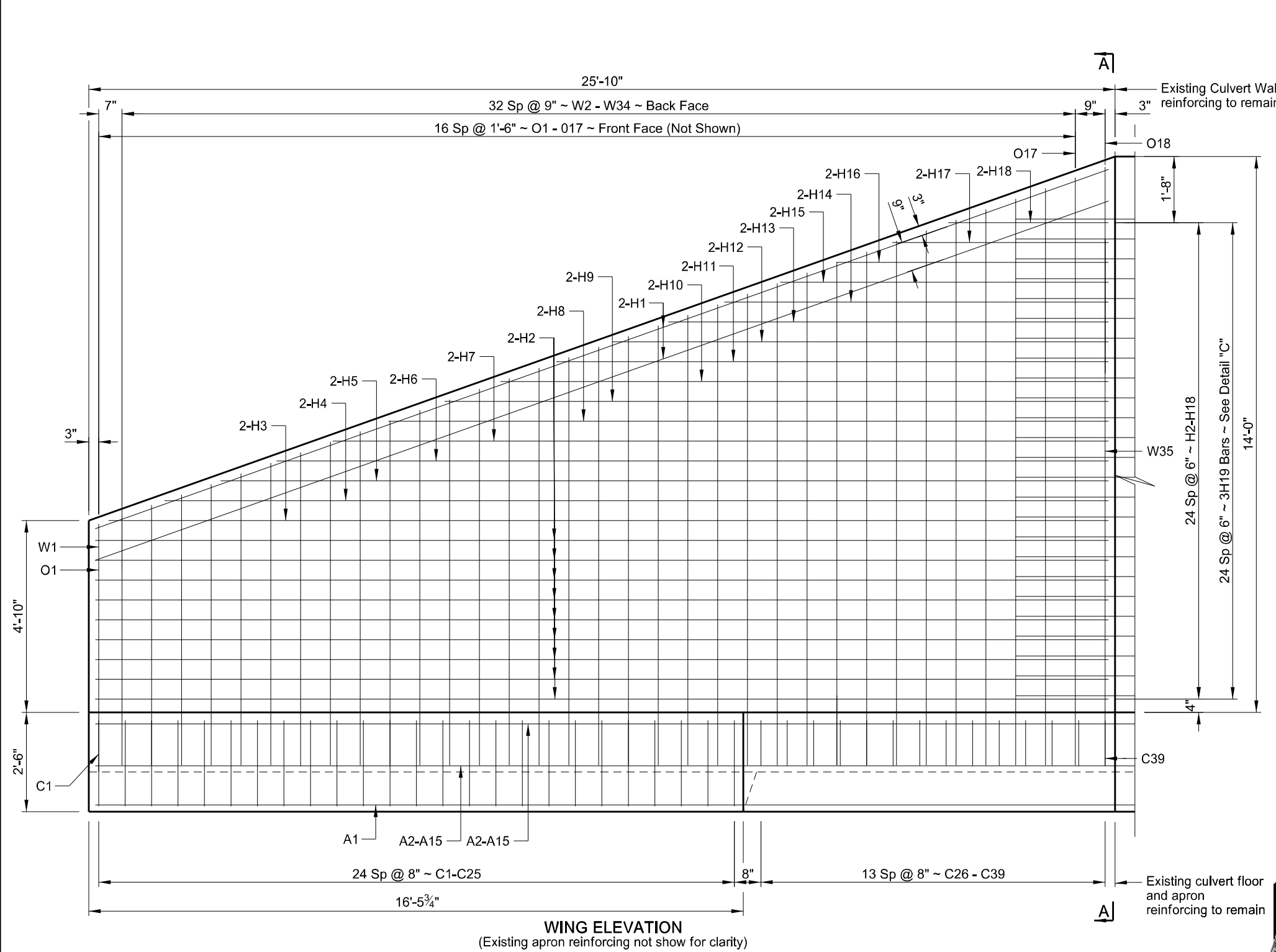
The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 3 joint segments will be paid for at the construction joint: 1 exterior wall, 1 floor segment, and 1 roof segments.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".



23 U.S.C. 407
 NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	18

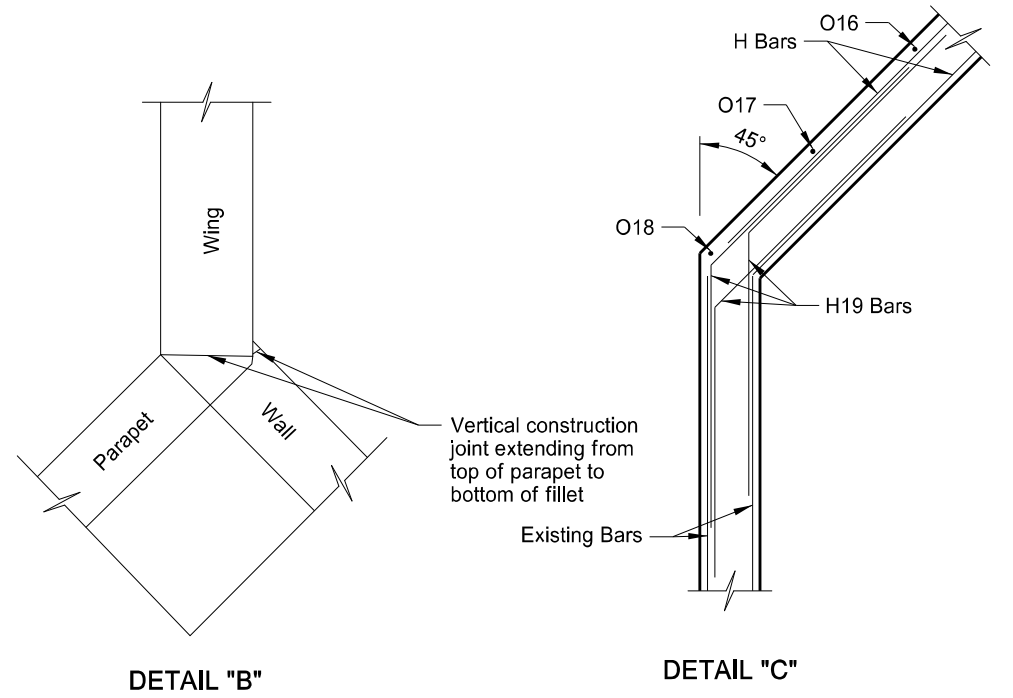
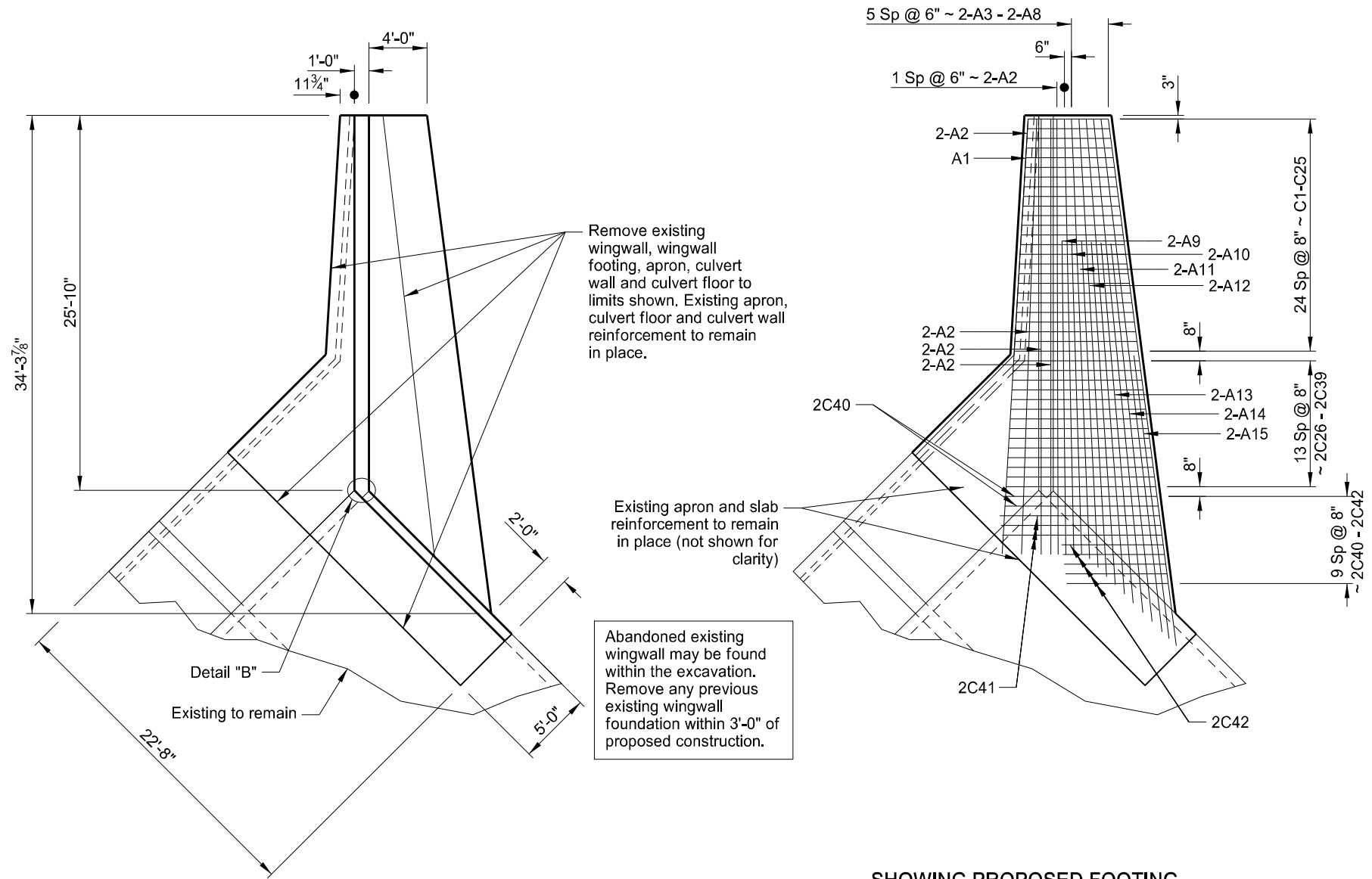


SOUTH FORK-MAPLE RIVER
 US 281, 1 MI SOUTH OF MONANGO

BOX CULVERT REPAIRS
 281-016.454

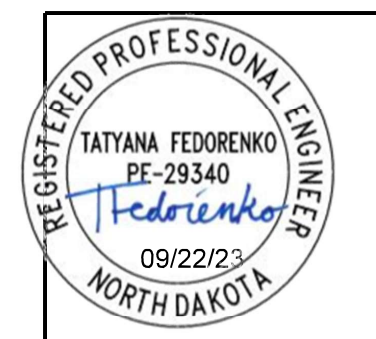
23 U.S.C. 407
 NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	19



SHOWING DIMENSIONS ONLY

SHOWING PROPOSED FOOTING REINFORCEMENT ONLY
 (Existing apron/floor reinforcing not show for clarity)

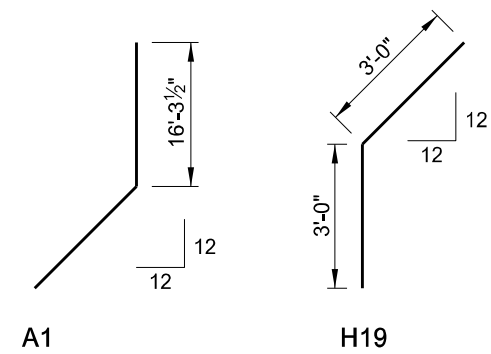


SOUTH FORK-MAPLE RIVER
 US 281, 1 MI SOUTH OF MONANGO

BOX CULVERT REPAIRS
 281-016.454

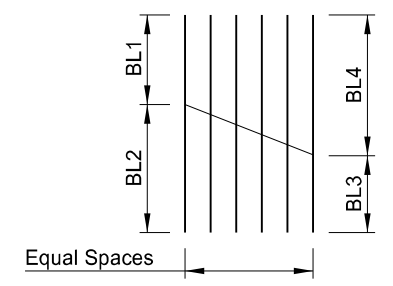
BAR LIST (CONSTANT)				
MARK	SIZE	NO.	LENGTH	SHAPE
W1	6	1	6'-8"	BENT
W2	6	1	6'-11"	BENT
W3	6	1	7'-3"	BENT
W4	6	1	7'-6"	BENT
W5	6	1	7'-9"	BENT
W6	6	1	8'-0"	BENT
W7	6	1	8'-3"	BENT
W8	6	1	8'-7"	BENT
W9	6	1	8'-10"	BENT
W10	6	1	9'-1"	BENT
W11	6	1	9'-4"	BENT
W12	6	1	9'-7"	BENT
W13	6	1	9'-11"	BENT
W14	6	1	10'-2"	BENT
W15	6	1	10'-5"	BENT
W16	6	1	10'-8"	BENT
W17	6	1	10'-11"	BENT
W18	6	1	11'-3"	BENT
W19	6	1	11'-6"	BENT
W20	6	1	11'-9"	BENT
W21	6	1	12'-0"	BENT
W22	6	1	12'-3"	BENT
W23	6	1	12'-7"	BENT
W24	6	1	12'-10"	BENT
W25	6	1	13'-1"	BENT
W26	6	1	13'-4"	BENT
W27	6	1	13'-7"	BENT
W28	6	1	13'-10"	BENT
W29	6	1	14'-2"	BENT
W30	6	1	14'-5"	BENT
W31	6	1	14'-8"	BENT
W32	6	1	14'-11"	BENT
W33	6	1	15'-2"	BENT
W34	6	1	15'-6"	BENT
W35	6	1	15'-9"	BENT
C1	7	1	15'-0"	BENT
C2	7	1	15'-4"	BENT
C3	7	1	15'-6"	BENT
C4	7	1	15'-8"	BENT
C5	7	1	16'-0"	BENT
C6	7	1	16'-4"	BENT
C7	7	1	16'-6"	BENT
C8	7	1	16'-10"	BENT
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C18	7	1	19'-4"	BENT
C19	7	1	19'-8"	BENT
C20	7	1	19'-10"	BENT
C21	7	1	20'-2"	BENT
C22	7	1	20'-4"	BENT
C23	7	1	20'-8"	BENT
C24	7	1	20'-10"	BENT
C25	7	1	21'-2"	BENT
C26	7	2	10'-10"	BENT
C27	7	2	11'-0"	BENT
C28	7	2	11'-1"	BENT
C29	7	2	11'-3"	BENT
C30	7	2	11'-4"	BENT
C31	7	2	11'-6"	BENT
C32	7	2	11'-7"	BENT
C33	7	2	11'-9"	BENT
C34	7	2	11'-10"	BENT
C35	7	2	12'-0"	BENT
C36	7	2	12'-1"	BENT

BAR LIST (CONSTANT)				
MARK	SIZE	NO.	LENGTH	SHAPE
C37	7	2	12'-2"	BENT
C38	7	2	12'-4"	BENT
C39	7	2	12'-6"	BENT
C40	7	4	10'-7"	STR
C41	7	6	11'-0"	STR
C42	7	10	7'-0"	STR
H1	7	4	26'-11"	STR
H2	5	18	25'-6"	STR
H3	5	2	25'-3"	STR
H4	5	2	24'-10"	STR
H5	5	2	24'-5"	STR
H6	5	2	24'-0"	STR
H7	5	2	23'-7"	STR
H8	5	2	23'-2"	STR
H9	5	2	22'-9"	STR
H10	5	2	22'-4"	STR
H11	5	2	21'-11"	STR
H12	5	2	21'-6"	STR
H13	5	2	21'-1"	STR
H14	5	2	20'-8"	STR
H15	5	2	20'-3"	STR
H16	5	2	19'-10"	STR
H17	5	2	19'-5"	STR
H18	5	2	19'-0"	STR
H19	5	75	6'-0"	STR
A1	6	1	26'-6"	STR
A2	6	12	30'-0"	STR
A3	6	2	30'-4"	STR
A4	6	2	31'-7"	STR
A5	6	2	32'-10"	STR
A6	6	2	34'-2"	STR
A7	6	2	35'-7"	STR
A8	6	2	36'-7"	STR
A9	6	2	21'-7"	STR
A10	6	2	21'-7"	STR
A11	6	2	22'-6"	STR
A12	6	2	23'-8"	STR
A13	6	2	24'-11"	STR
A14	6	2	26'-2"	STR
A15	6	2	19'-8"	STR
O1-O18	4	1 SET	165'-0"	STR



23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	20

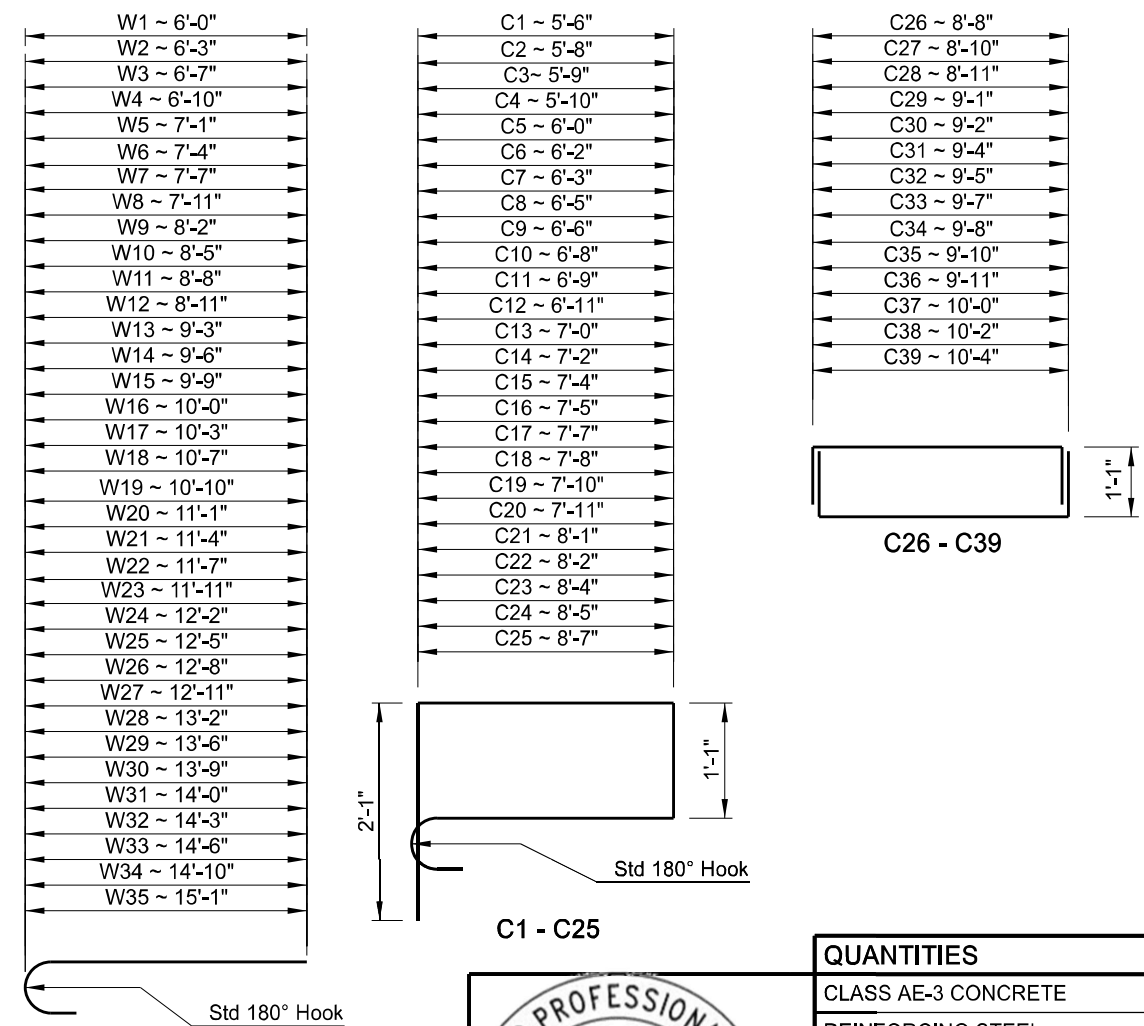


CONCRETE QUANTITIES (0° SKEW)	
FLOOR	21.9 CY
WINGWALL + WALL	13.2 CY
TOTAL	35.1 CY

1 SET SHOWN

MARK	LENGTH 1 SET	BL1	BL2	BL3	BL4	SPACES
O1-O18	165'-0"	4'-8"	13'-8"	9'-4 1/2"	8'-10 1/2"	8

BAR CUTTING DETAILS



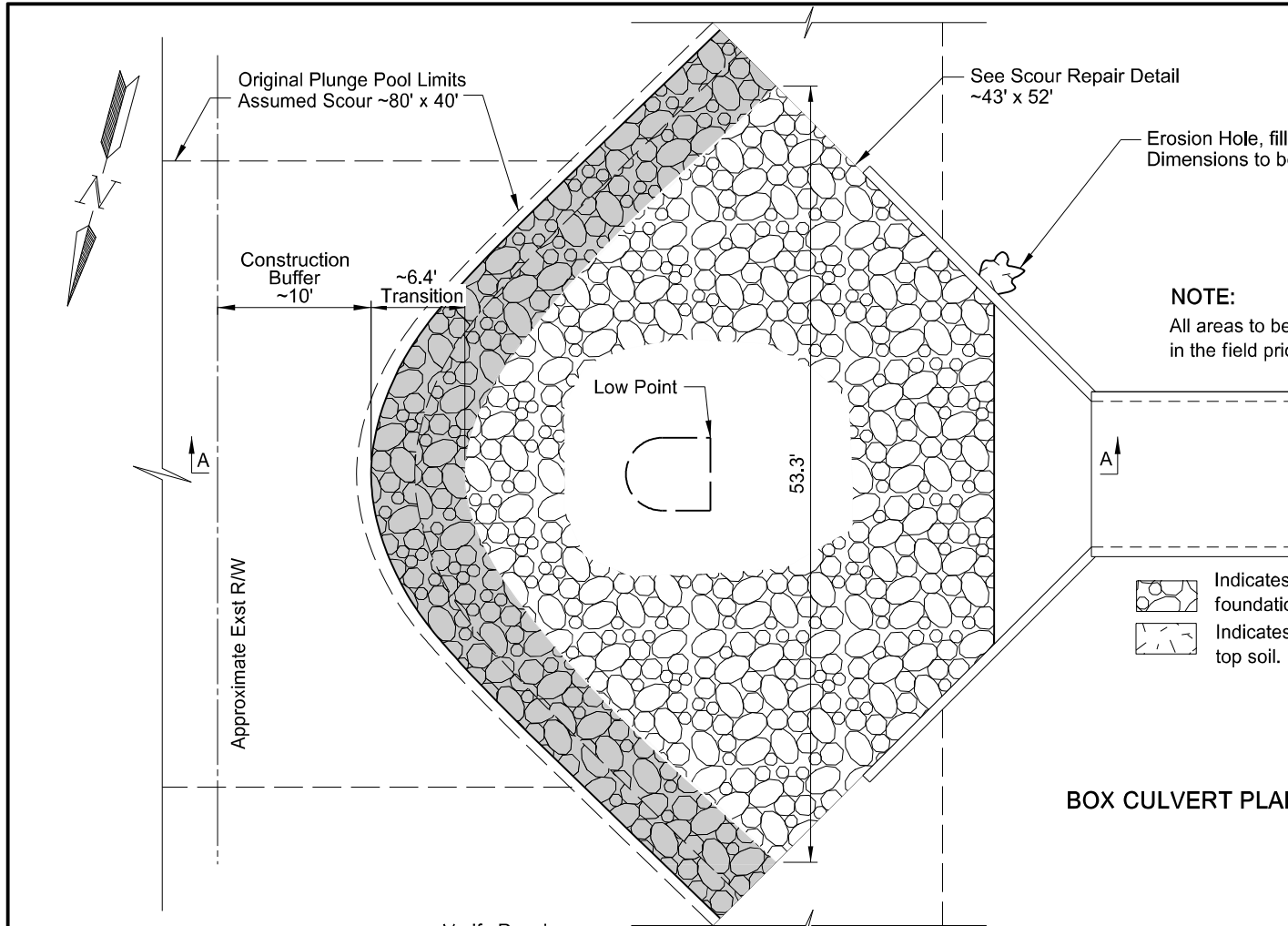
QUANTITIES	
CLASS AE-3 CONCRETE	35.1 CY
REINFORCING STEEL	6227 LBS

SOUTH FORK-MAPLE RIVER
US 281, 1 MI SOUTH OF MONANGO

BOX CULVERT REPAIRS
281-016.454

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	21



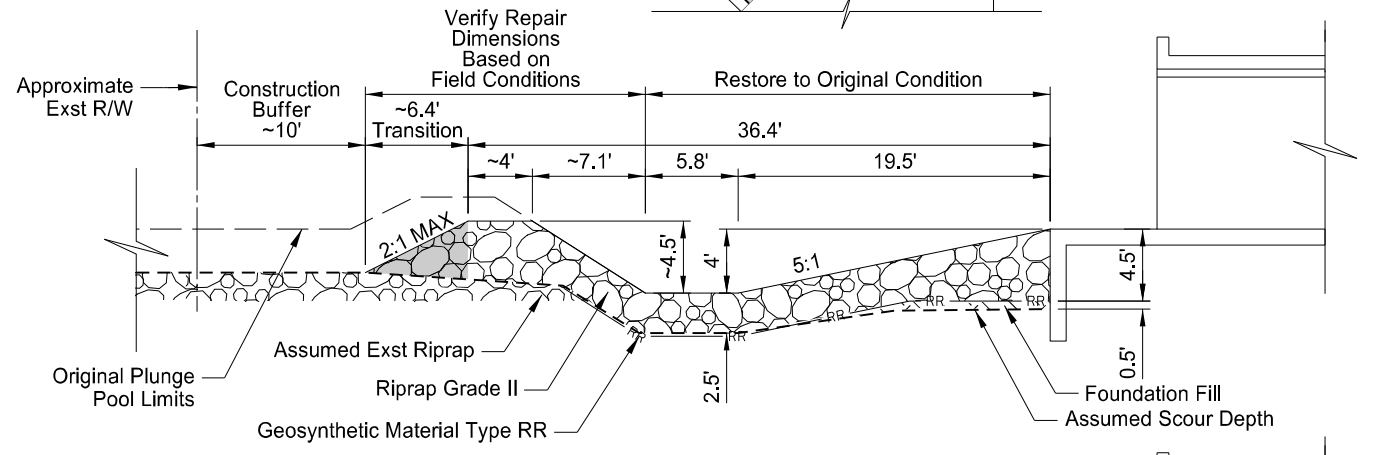
NOTE:
All areas to be verified by Engineer in the field prior to fill.

- Indicates scour hole area to fill with foundation fill and cover with rip rap.
- Indicates erosion hole area to fill with top soil.

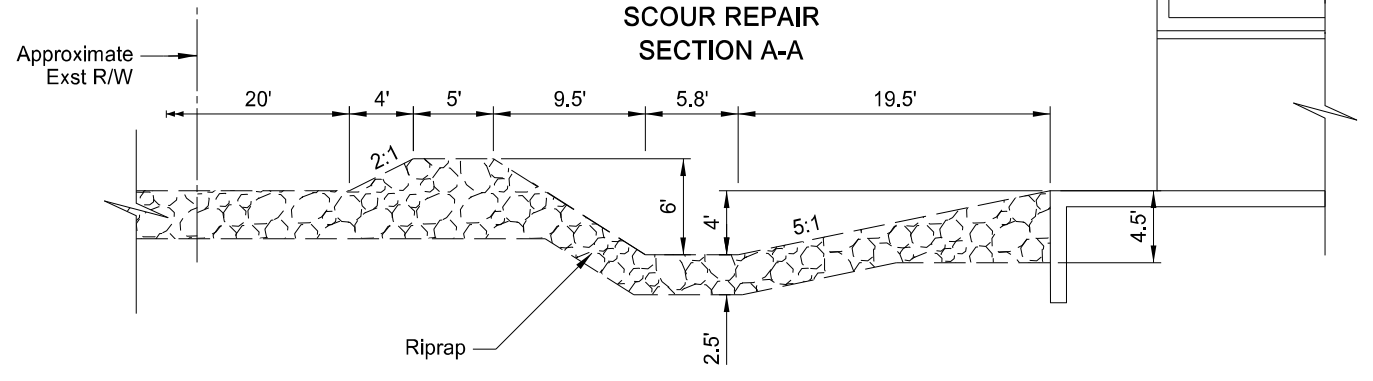
BOX CULVERT PLAN

BOX CULVERT BID ITEMS

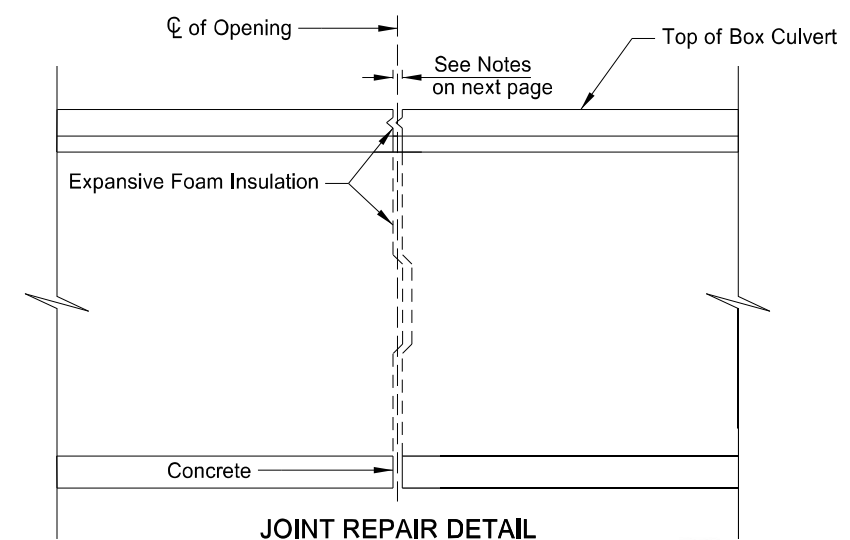
SPEC	CODE	ITEM DESCRIPTION	UNIT	QUANTITY
203	0109	TOPSOIL	CY	2.6
210	0210	FOUNDATION FILL	CY	6
256	0200	RIP RAP GRADE II	CY	182
700	0709	GEOSYNTHETIC MATERIAL TYPE RR	SY	100
930	9671	BOX CULVERT JOINT REPAIR	EA	8



SCOUR REPAIR SECTION A-A



ORIGINAL PLUNGE POOL SECTION A-A



JOINT REPAIR DETAIL

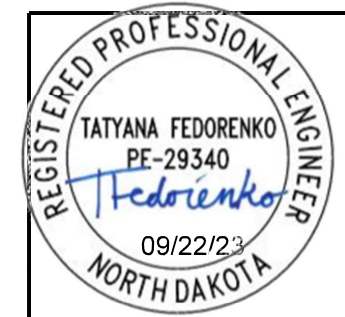
SPECIAL PROVISIONS	
SSP 2	MIGRATORY BIRD TREATY ACT
SP 192(23)	CONCRETE SPALL REPAIR BY SHOTCRETE

CREEK
US 281, 3 MI SOUTH OF ND 13

BOX CULVERT REPAIRS
281-027.547

ND DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

Jason Thomson Thorenson, Jason R.
09/22/23



NOTES

23 U.S.C. 407
NDDOT Reserves All Objections

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	NH-9-999(477)	170	22

- 100 SCOPE OF WORK: Work at this site consists of repairing the east and west joints, scour, and addressing the topsoil at this single 10 x 10 concrete box culvert.
- 203 TOPSOIL: Fill erosion hole behind the southeast wing with topsoil, seed with wetland seed mix meeting 251.03.F, and cover with Erosion Control Blanket meeting 255.03 include all materials, labor and equipment required for this work in the price bid for "Topsoil".
- 210 FOUNDATION FILL: Place foundation fill for conditions described in "Riprap Grade II" note. Quantities are based on section A-A which shows a potential restoration layout for assumed conditions called out in the detail. Use clay fill that meets AASHTO Silt-Clay Materials Classification. Include all materials, labor, and equipment for the placement of foundation fill in the price bid for "Foundation Fill".

- 256 RIPRAP GRADE II: The Engineer will verify the existing field conditions and dimensions of the scour hole and the original plunge pool prior to the commencement of work.

If the scour hole needs to be dewatered, include the price in the amount bid for "Riprap Grade II".

Restore the plunge pool within the R/W to the original condition shown in Original Plunge Pool Section A-A. In areas where no riprap exists, install foundation fill below the proposed riprap line and place Geosynthetic Material Type RR prior to the placement of proposed riprap. In areas where riprap exists, install proposed riprap directly on top of existing to meet proposed conditions.

Restore the 25' adjacent to the existing box culvert to the original condition. The Engineer will adjust the remaining dimensions as necessary to tie into existing conditions. Maintain a 10' buffer from existing R/W. Quantities are based on Scour Repair Section A-A which shows a potential restoration layout for assumed conditions called out in the detail.

Foundation Fill shall be paid for under price bid for "Foundation Fill". Include all other materials, excavation, labor, and equipment required for this work in the price bid for "Riprap Grade II".

- 930 BOX CULVERT JOINT REPAIR: The west joint has separated approximately 1 1/2" and the east joint has separated approximately 1 1/8".

If the box culvert needs to be dewatered, include the price in the amount bid for "Box Culvert Joint Repair".

Fill the voids along the box culvert floor with concrete. Provide AE-3 Concrete in accordance with Section 602 or a commercially packaged mix meeting ASTM C387. Mix concrete according to manufacturer's instructions. Wet cure concrete a minimum of 5 days. At the contractor's option and in accordance with SP 192(23) Concrete Spall Repair by Shotcrete, the contractor may perform joint repair along the floor using shotcrete in lieu of concrete.

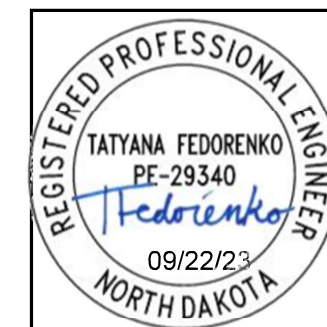
Fill the box culvert joints on the walls and the ceilings with expansive foam insulation. Cut expansive foam flush with the interior of the box culvert after it has dried.

Expansive foam insulation must consist of a high expansion hydrophobic polyurethane foam that is nontoxic, nonflammable, and meets the following requirements:

Test	Requirement	Method
Tensile Strength	50 psi	ASTM D 638
Compressive Strength	90 psi	ASTM D 1621
Shear Strength	25 psi	ASTM D 732
Water Absorption	< 2% by volume	ASTM D 2842

The bid item "Box Culvert Joint Repair" applies to all different types of joint segments in a box culvert. At this site, a total of 8 joint segments will be paid for at the construction joint: 4 exterior walls, 2 floor segments, and 2 roof segments.

Include the cost of all equipment, labor, and materials required for the joint repair work at each segment in the price bid for "Box Culvert Joint Repair".



NDDOT ABBREVIATIONS

D-101-1

? This is a special text character used in the labeling of existing features. It indicates a feature that has an unknown characteristic, potentially based on: lack of description, location accuracy or purpose.

Abn abandoned
 Abut abutment
 Adj adjusted
 Aggr aggregate
 Ahd ahead
 ARV air release valve
 Align alignment
 Al alley
 Alt alternate
 Alum aluminum
 ADA Americans with Disabilities Act
 & and
 Appr approach
 Approx approximate
 ACP asbestos cement pipe
 Asph asphalt
 AC asphalt cement
 Assmd assumed
 @ at
 Atten attenuation
 ATR automatic traffic recorder
 Ave Avenue
 Avg average
 ADT average daily traffic

Bk back
 BF back face
 Balc balcony
 B Wire barbed wire
 Barr barricade
 Btry battery
 BI beehive inlet
 Beg begin
 BG below grade
 BM bench mark
 Bkwy bikeway
 Bit bituminous
 Blk block
 BH bore hole
 Bot bottom
 Blvd Boulevard
 Bndry boundary
 Brkwy breakaway
 Br bridge
 Bldg building
 Bus. business
 BV butterfly valve
 Byp bypass

C Gdrl cable guardrail
 Calc calculate
 CIP cast iron pipe
 CB catch basin
 CRS cationic rapid setting
 C Gd cattle guard
 C To C center to center
 CL or C centerline
 Ch chain
 Chnlk chain-link
 Ch Blk channel block
 Ch Ch channel change
 Chk check
 Chsld chiseled
 Cir circle
 Cl class
 Clnt clean-out
 Clr clear
 Cl&gr clearing & grubbing
 Comb. combination
 Coml commercial
 Compr compression
 CADD computer aided drafting & design
 Conc concrete
 CECB concrete erosion control blanket
 Cond conductor
 Const construction
 Cont continuous
 CSB continuous split barrel sample
 Contr contraction
 Contr contractor
 CP control point
 Coord coordinate
 Cor corner
 Corr corrected
 CAES corrugated aluminum end section
 CAP corrugated aluminum pipe
 CMES corrugated metal end section
 CMP corrugated metal pipe
 CPVCP corrugated poly-vinyl chloride pipe
 CSES corrugated steel end section
 CSFES corrugated steel flared end section
 CSP corrugated steel pipe
 CSTES corrugated steel traversable end section
 Co County
 Crse course
 Ct Court
 Xarm cross arm
 Xbuck cross buck
 Xsec cross sections
 Xing crossing
 Xrd crossroad
 Crn crown

Culv culvert
 C&G curb & gutter
 CI curb inlet
 CR curb ramp
 C cut
 Dd Ld dead load
 Defl deflection
 Defm deformed
 DInt delineate
 DIntr delineator
 Depr depression
 Desc description
 Det detail
 DWP detectable warning panel
 Dtr detour
 Dia or \emptyset diameter
 Dir direction
 Dist distance
 DM disturbed material
 DB ditch block
 DG ditch grade
 Dbl double
 Dn down
 Dwg drawing
 Dr drive
 Drwy driveway
 DI drop inlet
 D dry density

Ea each
 Esmt easement
 E East
 EB Eastbound
 Elast elastomeric
 EL electric locker
 E Mtr electric meter
 Elec electric/al
 EDM electronic distance meter
 Elev or El elevation
 Ellipt elliptical
 Emb embankment
 Emuls emulsion/emulsified
 ES end section
 Engr engineer
 ESS environmental sensor station
 Eq equal
 Evgr evergreen
 Exc excavation
 Exst existing
 Exp expansion
 Expy Expressway
 E external of curve
 Extru extruded

FOS factor of safety
 Fed Federal
 FP feed point
 Fn fence
 Fn P fence post
 FO fiber optic
 FD field drive
 F fill
 FAA fine aggregate angularity
 FH fire hydrant
 Fl flange
 Flrd flared
 FES flared end section
 F Bcn flashing beacon
 FA flight auger sample
 FL flow line
 Ftg footing
 FM force main
 Fnd found
 Fdn foundation
 Frac fractional
 Frwy freeway
 Frt front
 FF front face
 F Disp fuel dispenser
 FFP fuel filler pipes
 FLS fuel leak sensor
 Furn furnish/ed

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05-20-18	General Revisions
12-10-20	General Revisions
08-16-22	General Revisions



NDDOT ABBREVIATIONS

Galv	galvanized	Ln	lane	Obsc	obscure(d)	Qty	quantity
Gar	garage	Lg	large	Ocpd	occupied	Qtr	quarter
Gs L	gas line	Lat	latitude	Ocpy	occupy		
G Reg	gas line regulator	Lt	left	O/s	offset		
GMV	gas main valve	Lens	lenses	OC	on center	Rad or R	radius
G Mtr	gas meter	Lvl	level	C	one dimensional consolidation	RR	railroad
GSV	gas service valve	Lvng	leveling	OC	organic content	Rlwy	railway
GVP	gas vent pipe	Lht	light	Orig	original	Rsd	raised
GV	gate valve	LP	light pole	O To O	out to out	RC	rapid curing
Ga	gauge	Ltg	lighting	OD	outside diameter	Rec	record
Gov	government	Liq	liquid	OH	overhead	Recy	recycle
Grd	graded/grade	LL	liquid limit			RAP	recycled asphalt pavement
Grnd	ground	Loc	location			RPCC	recycled portland cement concrete
GWM	ground water monitor	Long.	longitude	PMT	pad mounted transformer	Ref	reference
Gdrl	guardrail	Lp	loop	Pg	pages	R Mkr	reference marker
Gtr	gutter	LD	loop detector	Pntd	painted	RM	reference monument
		Lum	luminaire	Pr	pair	RP	reference point
				Pnl	panel	Refl	reflectorized
H Plg	H piling			Pk	park	RCB	reinforced concrete box
Hdwl	headwall	Mb	mailbox	PSD	passing sight distance	RCES	reinforced concrete end section
Ht	height	ML	main line	Pvmt	pavement	RCFES	reinforced concrete flared end section
Hel	helical	MH	manhole	Ped	pedestal	RCP	reinforced concrete pipe
HDPE	high density polyethylene	Mkd	marked	Ped	pedestrian	RCPS	reinforced concrete pipe sewer
HM	high mast	Mkr	marker	PPP	pedestrian pushbutton post	RCTES	reinforced concrete traversable end section
HP	high pressure	Mkg	marking	Pen.	penetration	Reinf	reinforcement
HPS	high pressure sodium	MA	mast arm	Perf	perforated	Res	reservation
HTCG	high tension cable guardrail	Matl	material	Per.	perimeter	Res	residence
Hwy	highway	Max	maximum	Perm	permanent	Ret	retaining
Hor	horizontal	MC	meander corner	PL	pipeline	Rev	reverse
HBP	hot bituminous pavement	Meas	measure	PI	place	Rt	right
HMA	hot mix asphalt	Mdn	median	P&P	plan & profile	R/W	right of way
Hyd	hydrant	MD	median drain	PL	plastic limit	Riv	river
Ph	hydrogen ion content	MC	medium curing	Pl or \bar{P}	plate	Rd	road
		MGS	Midwest Guardrail System	Pt	point	Rdbd	road bed
		MM	mile marker	PE	polyethylene	Rdwy	roadway
Id	identification	MP	mile post	PVC	polyvinyl chloride	RWIS	roadway weather information system
Incl	inclinometer tube	Min	minimum	PCC	Portland Cement concrete	Rk	rock
IMH	inlet manhole	Misc	miscellaneous	PP	power pole	Rt	route
ID	inside diameter	Mon	monument	Preempt	preemption		
Inst	instrument	Mnd	mound	Prefab	prefabricated		
Intchg	interchange	Mtbl	mountable	Prfmd or Pref	performed		
Intmdt	intermediate	Mtd	mounted	Prep	preparation		
Intscn	intersection	Mtg	mounting	Press.	pressure		
Inv	invert	Mk	muck	PRV	pressure relief valve		
IP	iron pipe			Prestr	prestressed		
				Pvt	private		
				PD	private drive		
Jt	joint	Neop	neoprene	Prod.	production/produce		
Jct	junction	Ntwk	network	Prog	programmed		
		N	North	Prop.	property		
		NE	North East	Prop Ln	property line		
		NW	North West	Ppsd	proposed		
		NB	Northbound	PB	pull box		
		No. or #	number				

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08/16/22

NDDOT ABBREVIATIONS

D-101-3

Salv	salvage(d)	Tel	telephone
San	sanitary sewer line	Tel B	Telephone Booth
Sec	section	Tel P	telephone pole
SL	section line	Tv	television
Sep	separation	Temp	temperature
Seq	sequence	Temp	temporary
Serv	service	TBM	temporary bench mark
Sht	sheet	T	thinwall tube sample
Shtng	sheeting	Ts	topsoil
Shldr	shoulder	Traf	traffic
Sw or Sdwk	sidewalk	TSCB	traffic signal control box
SD	sight distance	Tr	trail
SN	sign number	Transf	transformer
Sig	signal	Trans	transition
Sgl	single	TT	transmission tower
SRCP	slotted reinforced concrete pipe	TES	traversable end section
SC	slow curing	Trans	transverse
SS	slow setting	Trtd	treated
Sm	small	Trmt	treatment
S	South	Qc	triaxial compression
SE	South East	TERO	tribal employment rights ordinance
SW	South West	Tpl	triple
SB	Southbound	Typ	typical
Sp	spaces		
Spcl	special	Qu	unconfined compressive strength
SA	special assembly	Ugrnd	underground
SP	special provisions	Util	utility
G	specific gravity		
Spk	spike	VG	valley gutter
SB	split barrel sample	Vap	vapor
SH	sprinkler head	Vert	vertical
SV	sprinkler valve	VCP	vitrified clay pipe
Sq	square	Vol	volume
Stk	stake	VSFS	vehicle speed feedback sign
Std	standard		
N	standard penetration test	Wkwy	walkway
Std Specs	standard specifications	W	water content
Stm L	steam line	WGV	water gate valve
SEC	steel encased concrete	WL	water line
SMA	stone matrix asphalt	WM	water main
SSD	stopping sight distance	WMV	water main valve
SD	storm drain	W Mtr	water meter
St	street	WSV	water service valve
SPP	structural plate pipe	WW	water well
SPPA	structural plate pipe arch	Wrng	wearing
Str	structure	WIM	weigh in motion
Subd	subdivision	W	west
Sub	subgrade	WB	westbound
Sub Prep	subgrade preparation	Wrng	wiring
Ss	subsoil	W/	with
SS	supplement specification	W/o	without
Supp	supplemental	WC	witness corner
Surf	surfacing		
Surv	survey		
Sym	symmetrical		

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MEASUREMENTS

ac acres
 A ampere
 Bd Ft board feet
 Cd candela
 cm centimeter
 C coulomb
 CF cubic feet
 m3 cubic meter
 m3/s cubic meters per second
 CY cubic yard
 CY/mi cubic yards per mile
 D or Deg degree
 F Fahrenheit
 F farad
 ft feet/foot
 Gal gallon
 G giga
 Ha hectare
 H henry
 Hz hertz
 hr hour(s)
 in inch
 J joule
 K kelvin
 kN kilo newton
 kPa kilo pascal
 kg kilogram
 kg/m3 kilogram per cubic meter
 km kilometer
 K Kip(s)
 LF linear foot
 L litre
 Lm lumen
 L sum lump sum
 Lx lux
 M Hr man hour
 M mega
 m meter
 m/s meters per second
 mi mile
 mL milliliter
 mm millimeter
 mm/hr millimeters per hour
 n nano
 N newton
 Pa pascal
 lb pounds
 sec seconds
 S siemens
 SF square feet
 km2 square kilometer
 m2 square meter
 SY square yard
 Sta Yd station yards
 SI Systems International

T tesla
 T/mi tons per mile
 V volt
 W watt
 Wb weber

SURVEY DESCRIPTIONS

Az azimuth
 Bs backsight
 Brg bearing
 BP Cap blue plastic cap
 BS both sides
 BC brass cap
 CS curve to spiral
 Eq equation
 E external of curve
 FS far side
 FB field book
 Fs foresight
 Geod geodetic
 GIS Geographical Information System
 GPS Global Positioning System
 HI height of instrument
 IM iron monument
 I Pn iron pin
 LS Land Surveyor (licensed)
 LSIT Land Surveyor In Training
 L length of curve
 LC long chord
 LB level book
 Mer meridian
 M mid ordinate of curve
 NGS National Geodetic Survey
 NS near side
 Obsn observation
 Off Loc office location
 OP Cap orange plastic cap
 PK Parker-Kalon nail
 P Cap plastic cap
 PP Cap pink plastic cap
 PCC point of compound curve
 PC point of curve
 PI point of intersection
 PRC point of reverse curvature
 PT point of tangent
 POC point on curve
 POT point on tangent
 RTP random traverse point
 Rge range
 RP Cap red plastic cap
 SC spiral to curve
 ST spiral to tangent
 Sta station
 SE superelevation
 Tan tangent
 T tangent (semi)
 TS tangent to spiral
 Twp township
 TB transit book
 TP traverse point
 TP turning point
 USC&G US Coast & Geodetic Survey
 USGS US Geologic Survey
 VC vertical curve
 WGS World Geodetic System
 YP Cap yellow plastic cap
 Z zenith

SOIL TYPES

Cl clay
 Cl F clay fill
 Cl Hvy clay heavy
 Cl Lm clay loam
 Co S coal slack
 C Gr coarse gravel
 CS coarse sand
 FS fine sand
 Gr gravel
 Lig Co lignite coal
 Lig Sl lignite slack
 Lm loam
 Rk rock
 Sd sand
 Sdy Cl sandy clay
 Sdy Cl Lm sandy clay loam
 Sdy Fl sandy fill
 Sdy Lm sandy loam
 Sc scoria
 Sh shale
 Si Cl silt clay
 Si Cl Lm silty clay loam
 Si Lm silty loam

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NDDOT UTILITY COMPANY AND ORGANIZATION ABBREVIATIONS

D-101-10

702COM	702 Communications	GT PLNS NAT GAS	Great Plains Natural Gas Company	RED RIV COMM	Red River Rural Communications
ACCENT	Accent Communications	HALS TEL	Halstad Telephone Company	RESVTN TEL	Reservation Telephone
AGASSIZ WU	Agassiz Water Users Incorporated	IDEA1	Idea1	ROBRTS TEL	Roberts Company Telephone
AGC	Associated General Contractors of America	INT-COMM TEL	Inter-Community Telephone Company	R-RIDER ELEC	Roughrider Electric Cooperative
ALL PL	Alliance Pipeline	KANEB PL	Kaneb Pipeline Company	RRVW	Red River Valley & Western Railroad
ALL SEAS WU	All Seasons Water Users Association	KEM ELEC	Kem Electric Cooperative Incorporated	S CENT REG WD	South Central Regional Water District
AMOCO PI	Amoco Pipeline Company	KOCH GATH SYS	Koch Gathering Systems Incorporated	S E W U	South East Water Users Incorporated
AMRDA HESS	Amerada Hess Corporation	LKHD PL	Lakehead Pipeline Company	SCOTT CABLE	Scott Cable Television Dickinson
AT&T	AT&T Corporation	LNGDN RWU	Langdon Rural Water Users Incorporated	SHERDN ELEC	Sheridan Electric Cooperative
B PAW	Bear Paw Energy Incorporated	LWR YELL R ELEC	Lower Yellowstone Rural Electric	SHEYN VLY ELEC	Sheyenne Valley Electric Cooperative
BAKER ELEC	Baker Electric	MCKNZ CON	McKenzie Consolidated Telcom	SKYTECH	Skyland Technologies Incorporated
BASIN ELEC	Basin Electric Cooperative Incorporated	MCKNZ ELEC	McKenzie Electric Cooperative	SLOPE ELEC	Slope Electric Cooperative Incorporated
BEK TEL	Bek Communications Cooperative	MCKNZ WRD	McKenzie County Water Resource District	SOURIS RIV TELCOM	Souris River Telecommunications
BELLE PL	Belle Fourche Pipeline Company	MCLEOD	McLeod USA	ST WAT COMM	State Water Commission
BLM	Bureau of Land Management	MCLN ELEC	McLean Electric Cooperative	STATE LN WATER	State Line Water Cooperative
BNSF	Burlington Northern Santa Fe Railway	MCLN-SHRDN R WAT	McLean-Sheridan Rural Water	STER ENG	Sterling Energy
BOEING	Boeing	MDU	Montana-dakota Utilities	STUT RWU	Stutsman Rural Water Users
BRNS RWD	Barnes Rural Water District	MIDCO	MidContinent Communications	SW PL PRJ	Southwest Pipeline Project
BURK-DIV ELEC	Burke-Divide Electric Cooperative	MIDSTATE TEL	Midstate Telephone Company	T M C	Turtle Mountain Communications
BURL WU	Burleigh Water Users	MINOT CABLE	Minot Cable Television	TCI	TCI of North Dakota
CABLE ONE	Cable One	MINOT TEL	Minot Telephone Company	TESORO GHG PLNS PL	Tesoro High Plains Pipeline
CABLE SERV	Cable Services	MISS VALL COMM	Missouri Valley Communications	TRI-CNTY WU	Tri-County Water Users Incorporated
CAP ELEC	Capital Electric Cooperative Incorporat	MISS W W S	Missouri West Water System	TRL CO RWU	Traill County Rural Water Users
CASS CO ELEC	Cass County Electric Cooperative	MNKOTA PWR	Minnkota Power	UNTD TEL	United Telephone
CASS RWU	Cass Rural Water Users Incorporated	MOR-GRAN-SOU ELEC	Mor-gran-sou Electric Cooperative	UPPR SOUR WUA	Upper Souris Water Users Association
CAV ELEC	Cavalier Rural Electric Cooperative	MOUNT-WILLI ELEC	Mountrail-williams Electric Cooperative	US SPRINT	U.S. Sprint
CBLCOM	Cablecom Of Fargo	MRE LBTY TEL	Moore & Liberty Telephone	USAF MSL CABLE	U.S.A.F. Missile Cable
CENEX PL	Cenex Pipeline	MUNICIPAL	City Water And Sewer	USFWS	US Fish and Wildlife Service
CENT PL WATER DIST	Central Pipe Line Water District	MUNICIPAL	City Of '.....'	USW COMM	U.S. West Communications
CENT PWR ELEC	Central Power Electric Cooperative	N CENT ELEC	North Central Electric Cooperative	VRNDRY ELEC	Verendrye Electric Cooperative
CENTURYLINK	CenturyLink	N VALL W DIST	North Valley Water District	W RIV TEL	West River Telephone Incorporated
COE	Corps of Engineers	ND PKS & REC	North Dakota Parks And Recreation	WAPA	Western Area Power Administration
CONS TEL	Consolidated Telephone	ND TEL	North Dakota Telephone Company	WAWSA	Western Area Water Supply Authority
CONT RES	Continental Resource Inc	NDDOT	North Dakota Department of Transportation	WEB	W. E. B. Water Development Association
CPR	Canadian Pacific Railway	NDSU SOIL SCI DEPT	NDSU Soil Science Department	WILLI RWA	Williams Rural Water Association
D O E	Department Of Energy	NEMONT TEL	Nemont Telephone	WILSTN BAS PL	Williston Basin Interstate Pipeline Company
DAK CARR	Dakota Carrier Network	NODAK R ELEC	Nodak Rural Electric Cooperative	WLSH RWD	Walsh Water Rural Water District
DAK CENT TEL	Dakota Central Telephone	NOON FRMS TEL	Noonan Farmers Telephone Company	WOLVRTN TEL	Wolverton Telephone
DAK RWD	Dakota Rural Water District	NPR	Northern Plains Railroad	XLENER	Xcel Energy
DGC	Dakota Gasification Company	NSP	Northern States Power	YSVR	Yellowstone Valley Railroad
DICKEY R NET	Dickey Rural Networks	NTH PRAIR RW	Northern Prairie Rural Water Association		
DICKEY RWU	Dickey Rural Water Users Association	NTHN BRDR PL	Northern Border Pipeline		
DICKEY TEL	Dickey Telephone	NTHN PLNS ELEC	Northern Plains Electric Cooperative Incorporated		
DNRR	Dakota Northern Railroad	NTHWSTRN REF	Northwestern Refinery Company		
DOME PL	Dome Pipeline Company	NW COMM	Northwest Communication Cooperation		
DVELEC	Dakota Valley Electric Cooperative	NWRWD	Northwest Rural Water District		
DVMW	Dakota, Missouri Valley & Western	ONEOK	Oneok gas		
ENBRDG	Enbridge Pipelines Incorporated	OSHA	Occupational Safety and Health Administration		
ENVENTIS	Enventis Telephone	OTTR TL PWR	Otter Tail Power Company		
EQUINOR	Equinor Pipeline	PAAP	Plains All American Pipeline		
FALK MNG	Falkirk Mining Company	P L E M	Prairielands Energy Marketing		
FHWA	Federal Highway Administration	POLAR COM	Polar Communications		
G FKS-TRL WD	Grand Forks-traill Water District	PVT ELEC	Private Electric		
GETTY TRD & TRAN	Getty Trading & Transportation	QWEST	Qwest Communications		
GLDN W ELEC	Golden West Electric Cooperative	R&T W SUPPLY	R & T Water Supply Association		
GRGS CO TEL	Griggs County Telephone				
GTR RAMSEY WD	Greater Ramsey Water District				

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
04-23-18	General Revisions
05-20-18	General Revisions
12-18-20	General Revisions
08-16-22	General Revisions



LINE STYLES

D-101-20

Existing Topography

- Existing Ground Void
- Existing Cemetery Boundary
- Existing Box Culvert Bridge
- Existing Concrete Surface
- Existing Drainage Structure
- Existing Gravel Surface
- Existing Riprap
- Existing Dirt Surface
- Existing Asphalt Surface
- Existing Tie Point Line
- Existing Railroad Centerline
- Existing Guardrail Cable
- Existing Guardrail Metal
- Existing Edge of Water
- Existing Fence
- Existing Railroad
- Existing Field Line
- Exst Flow
- Existing Curb
- Existing Valley Gutter
- Existing Driveway Gutter
- Existing Curb and Gutter
- Existing Mountable Curb and Gutter

Proposed Topography

- Existing 3-Cable w Posts
- Site Boundary
- Existing Berm, Dike, Pit, or Earth Dam
- Existing Ditch Block
- Existing Tree Boundary
- Existing Brush or Shrub Boundary
- Existing Retaining Wall
- Existing Planter or Wall
- Existing W-Beam Guardrail with Posts
- Existing Railroad Switch
- Gravel Pit - Borrow Area
- Existing Wet Area-Vegetation Break
- Existing High Tension Cable Guardrail
- Existing High Tension Cable Guardrail with Posts
- 3-Cable w Posts
- Flow
- Fence
- Remove Line
- Wall
- Retaining Wall (Plan View)
- W-Beam w Posts
- High Tension Cable Guardrail with Posts

Existing Utilities

- Existing Electrical
- Existing Fiber Optic Line
- Existing TV Fiber Optic
- Existing Gas Pipe
- Existing Overhead Utility Line
- Existing Power
- Existing Fuel Pipeline
- Existing Undefined Above Ground Pipe Line
- Existing Sanitary Sewer
- Existing Sanitary Force Main
- Existing Storm Drain
- Existing Storm Drain Force Main
- Existing Culvert
- Existing Telephone Line
- Existing TV Line
- Existing Water or Steam Line
- Existing Under Drain
- Existing Slotted Drain
- Existing Conduit
- Existing Conductor
- Existing Down Guy Wire Down Guy
- Existing Underground Vault or Lift Station

Proposed Utilities

- 24 Inch Pipe
- Reinforced Concrete Pipe
- Under Drain
- Edge Drain

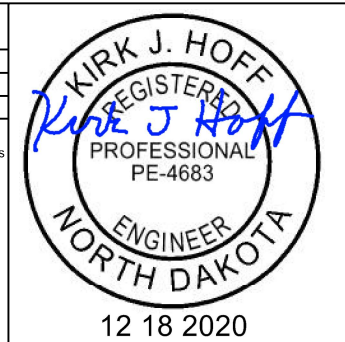
Traffic Utilities

- Conductor
- Fiber Optic
- Existing Loop Detector
- Existing Double Micro Loop Detector
- Micro Loop Detector Double
- Existing Micro Loop Detector
- Micro Loop Detector
- Signal Head with Mast Arm
- Existing Signal Head with Mast Arm

Sign Structures

- Existing Overhead Sign Structure
- Existing Overhead Sign Structure Cantilever
- Overhead Sign Structure Cantilever

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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DATE	CHANGE
09-23-16	Added and Revised Items, Organized by Functional Groups General Revisions
12-18-20	



LINE STYLES

D-101-21

Right Of Way

- Easement
- Existing Easement
- Right of Way
- Existing Right of Way
- Existing Right of Way Railroad
- Existing Right of Way Not State Owned
- Existing Government Lot Line
- Existing Adjacent Block Lines
- Existing Adjacent Lot Lines
- Existing Adjacent Property Line
- Existing Adjacent Subdivision Lines
- Sight Distance Triangle Line
- Dimension Leader

Boundary Control

- ////// Existing City Corporate Limits or Reservation Boundary
- Existing State or International Line
- Existing Township
- Existing County
- Existing Section Line
- Existing Quarter Section Line
- Existing Sixteenth Section Line
- Existing Centerline
- Tangent Line

Cross Sections and Typical

- Existing Ground
- Existing Topsoil (Cross Section View)
- void - void - void - v Existing Ground Void (Not Surveyed)
- Existing Concrete
- Existing Aggregate (Cross Section View)
- Existing Curb and Gutter (Cross Section View)
- Existing Asphalt (Cross Section View)
- Existing Reinforcement Rebar

Geotechnical

- D ----- D ----- Geotextile Fabric Type D
- **Geo** ----- **Geo** ----- Geogrid
- R ----- R ----- Geotextile Fabric Type R
- R ----- R ----- Geotextile Fabric Type R1
- RR ----- RR ----- Geotextile Fabric Type RR
- S ----- S ----- Geotextile Fabric Type S

Countours

- Depression Contours
- Supplemental Contour

Profile

- Subgrade, Subcut or Ditch Grade
- Topsoil Profile

Striping

- Centerline Pavement Marking
- ===== Barrier with Centerline Pavement Marking
- ===== Barrier Pavement Marking
- - - - - Stripe 4 IN Dotted Extension White
- - - - - Stripe 8 IN Dotted Extension White
- - - - - Stripe 8 IN Lane Drop

Pavement Joints

- ===== Doweled Joint
- +++++ Tie Bar 30 Inch 4 Foot Center to Center
- +++++ Tie Bar 18 Inch 3 Foot Center to Center
- +++++ Tie Bar at Random Spacing

Bridge Details

- Small Hidden Object
- Large Hidden Object
- Phantom Object
- Existing Conditions Object
- Centerline Main
- Centerline Secondary
- Excavation Limits
- Proposed Ground
- Sheet Piling

Erosion Control

- Limits of Const Transition Line
- Bale Check
- Rock Check
- s ----- s ----- Floating Silt Curtain
- SF ----- SF ----- Silt Fence
- Excavation Limits
- Fiber Rolls

Environmental

- Wetland Mitigation
- Existing Wetland Easement USFWS
- Existing Wetland Jurisdictional
- Existing Wetland
- Tree Row

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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09-23-16	Added and Revised Items, Organized by Functional Groups General Revisions
12-18-20	



SYMBOLS



North Arrow (Half Scale)



Alignment Data Point



Alignment Monument



Spot Elevation



Existing Miscellaneous Spot



Existing Access Control Arrow



Existing Benchmark



Reset USGS Marker



Iron Monument Found



Iron Pin R/W Monument



Property Corner



Iron Pin Reference Monument



Right of Way Marker (Exst, Ppsd, Reset)



Existing Federal Reference Corner



Existing Section Corner (Full, Quarter, Sixteenth, Meander)



Existing Witness Corner



Existing Control Point (CP, GPS-RTK, TRI)



Existing Traverse PI Aerial Panel



Existing Reference Marker Point NGS



Existing EFB Misc



Existing Bush or Shrub



Existing Large Evergreen Tree



Existing Small Evergreen Tree



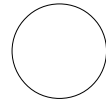
Existing Large Tree



Existing Small Tree



Existing Tree Trunk



Cairn or Stone Circle



Existing Artifact



Existing Satellite Dish



Existing Weather Station



Existing Windmill or Tower



Reinforced Pavement



Continuous Split Barrel Sample



Flight Auger Sample



Split Barrel Sample



Thinwall Tube Sample



Standard Penetration Test



Inclinometer Tube



Excavation Unit



















































































Existing Ground Water Well Bore Hole

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions

SYMBOLS

D-101-32

 Existing Luminaire  Luminaire LED  Existing Light Standard Luminaire  Relocate Light Standard  Light Standard Light LED Luminaire  Light Standard 35 Watt High Pressure Sodium Vapor Luminaire  Light Standard 50 Watt High Pressure Sodium Vapor Luminaire  Light Standard 70 Watt High Pressure Sodium Vapor Luminaire  Light Standard 100 Watt High Pressure Sodium Vapor Luminaire  Light Standard 150 Watt High Pressure Sodium Vapor Luminaire  Light Standard 200 Watt High Pressure Sodium Vapor Luminaire  Light Standard 250 Watt High Pressure Sodium Vapor Luminaire  Light Standard 310 Watt High Pressure Sodium Vapor Luminaire  Light Standard 400 Watt High Pressure Sodium Vapor Luminaire  Light Standard 700 Watt High Pressure Sodium Vapor Luminaire  Light Standard 1000 Watt High Pressure Sodium Vapor Luminaire  Emergency Vehicle Detector  Video Detection Camera	  High Mast Light Standard 3 Luminaire (Exst, Ppsd)   High Mast Light Standard 4 Luminaire (Exst, Ppsd)   High Mast Light Standard 5 Luminaire (Exst, Ppsd)   High Mast Light Standard 6 Luminaire (Exst, Ppsd)   High Mast Light Standard 7 Luminaire (Exst, Ppsd)   High Mast Light Standard 8 Luminaire (Exst, Ppsd)   High Mast Light Standard 9 Luminaire (Exst, Ppsd)   High Mast Light Standard 10 Luminaire (Exst, Ppsd)   Overhead Sign Structure Load Center (Exst, Ppsd)   Traffic Signal Controller (Exst, Ppsd)   Pad Mounted Traffic Signal Controller (Exst, Ppsd)   Flashing Beacon (Exst, Ppsd)   Concrete Foundation (Exst, Ppsd)   Pipe Mounted Flasher (Exst, Ppsd)   Pad Mounted Feed Point (Exst, Ppsd)   Pipe Mounted Feed Point with Pad (Exst, Ppsd)   Pole Mounted Feed Point (Exst, Ppsd)   Junction Box (Exst, Ppsd)  Existing Pedestrian Head with Number  Existing Signal Head  Pole Mounted Head  Existing Lighting Standard Pole	 Existing Traffic Signal Standard    Pull Box (Exst-Ppsd-Undefined)   Intelligent Transportation Pull Box (Exst, Ppsd)   Transformer (Exst, Ppsd)    Power Pole (Exst-Ppsd-with Transformer)   Wood Pole (Exst, Ppsd)   Pedestrian Push Button Post (Exst, Ppsd)  Existing Pole  Existing Telephone Pole  Existing Post     Connection Conductor (Ground, Neutral, Phase 1, Phase 2)
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NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions



KIRK J. HOFF

REGISTERED

PROFESSIONAL

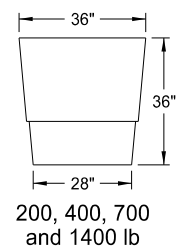
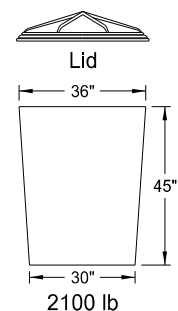
PE-4683

ENGINEER

NORTH DAKOTA

12 18 2020

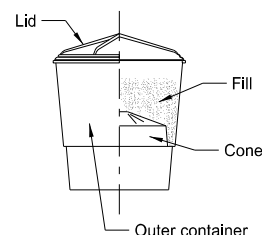
ATTENUATION DEVICE



Outer Containers

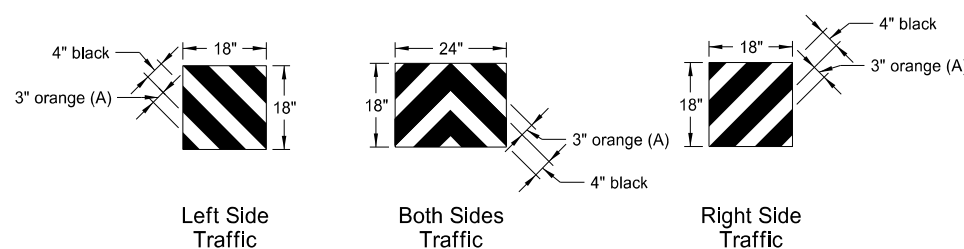


Cones



Typical Assembly

Typical Module Construction Detail

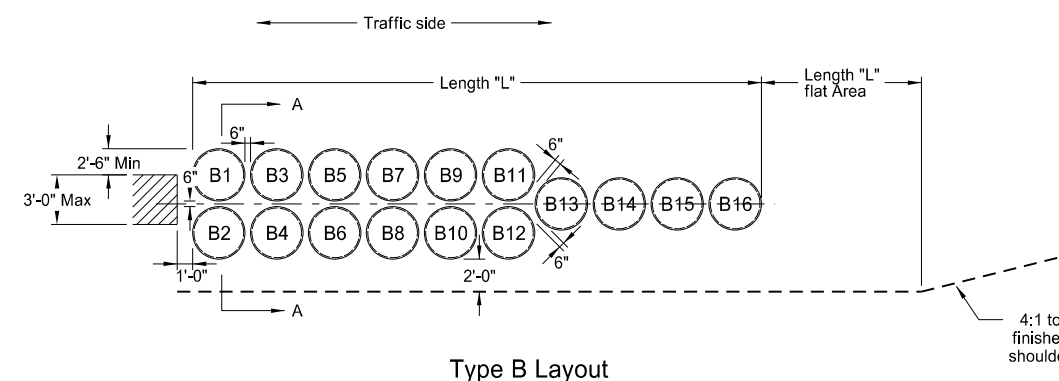


Reflective Sheet Detail

Note:
Apply Type IV reflective sheeting (as specified in the NDDOT Standard Specifications) directly to the outer container of the last attenuation device facing traffic, following the details above. Or apply the sheet to a metallic sheet and attach it to the container with approved fasteners.

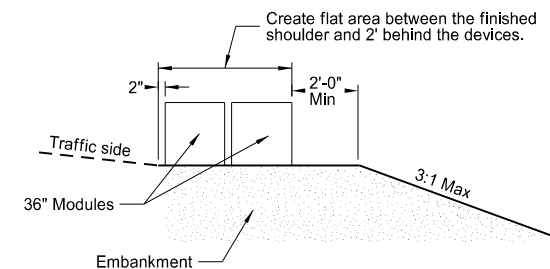
(A) Use 3" orange sheeting for temporary installations, and 3" yellow sheeting for permanent installations.

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



Type B Layout

Note:
Angle attenuation devices 10 degrees towards traffic when placed at piers offset from roadway.



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	1	1	
1400	1	1	1	1	1	1	1	1	1	1	1	
700	2	2	2	2	2	2	2	2	2	2	2	
400	1	1	1	1	1	1	1	1	1	1	1	
200	2	2	2	1	1	1	1	1	1	1	1	

Notes:

- Materials
 - Use modules manufactured from frangible polyethylene material which shatters upon impact.
 - Fill modules with class 43 aggregate meeting NDDOT Standard Specifications aggregate requirements. Use fill with a unit weight of at least 100 pounds per cubic foot. Use fill with a moisture content of 2% or less when left over winter.
- Modules

Provide modules in two sizes containing volumes of either 2, 4, 7, 14, or 21 cubic feet minimum.

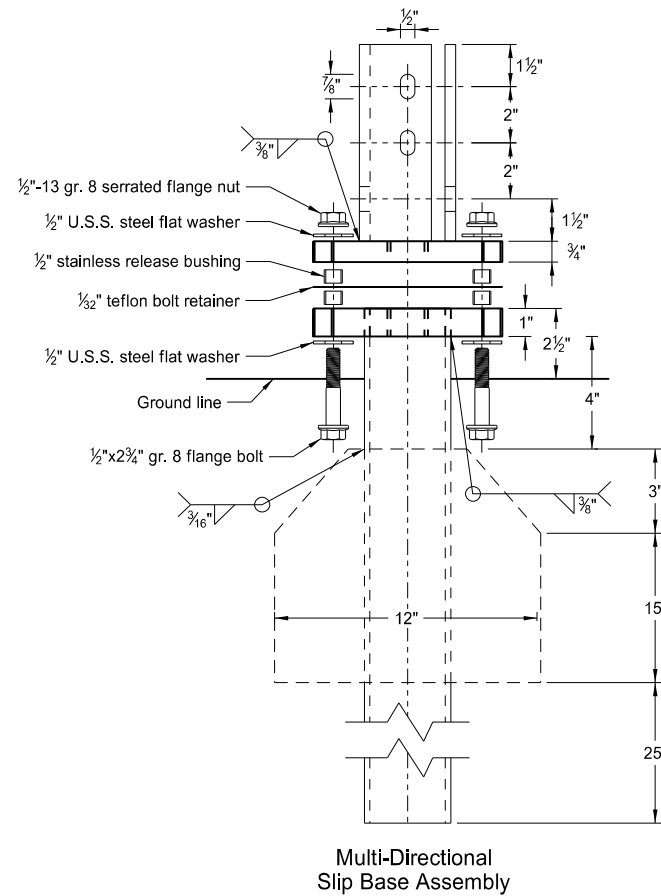
 - Provide three components for 2, 4, or 7 cubic foot module containers:
 - A 14 C.F., yellow outer container.
 - A black lid securely locking over the top lip of the container.
 - A variable cone-shaped supporting insert capable of supporting 200, 400, or 700 pounds of sand mass to allow for three sizes of modules. Place cone inserts inside the 14 cubic foot container.
 - Provide two components for the 14 cubic foot module container:
 - A 14 C.F., yellow outer container.
 - A black lid securely locking over the top lip of the container.
 - Provide two components for the 21 cubic foot module container:
 - A 36" height X 36" width yellow outer container.
 - A black lid which locks securely over the top of the container.
- For temporary installations use 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 approved equal modules. As an option, place attenuation devices on 3 1/2" maximum thickness pallets to facilitate maintenance.
- For permanent installations use Barrel Attenuation Device consisting of one-piece outer sand container modules with separate detachable lid. Energite attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or approved equal meet these requirements.
- The Typical Module Construction Detail and Type B Layout are based on the Energite Crash Cushion manufactured by Energy Absorption. Provide any required layouts and details from other sand filled attenuation module manufacturers which differ from those shown here.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
7-18-14	Revised sheeting in reflective sheet detail
9-27-17	Update to active voice
10-03-19	New Design Engr PE Stamp

This document was originally issued and sealed by
Kirk J Hoff,
Registration Number
PE- 4683,
on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

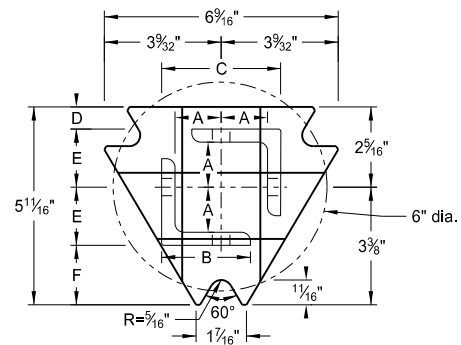
BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

Perforated Tube



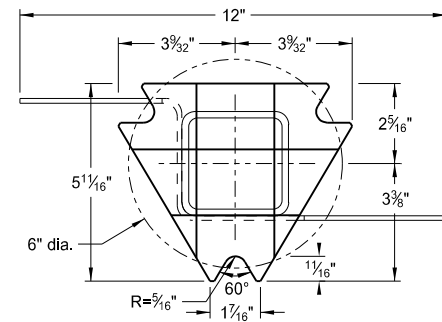
Multi-Directional Slip Base Assembly

Traffic Flow

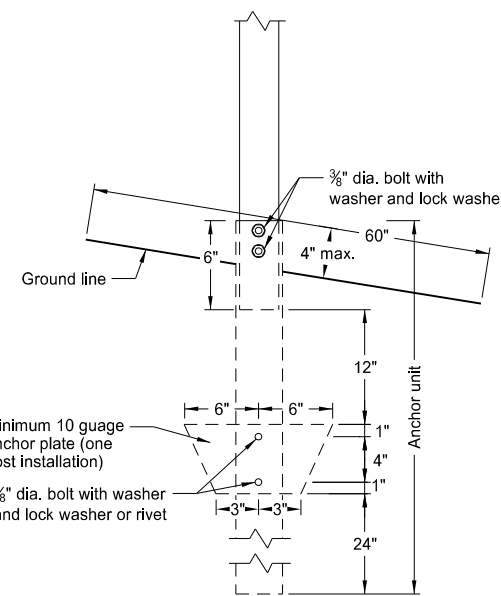


Top Post Receiver
Plate - ASTM A572 grade 50
Angle Receiver - 2 1/2" x 2 1/2" x 3/8" ASTM A36 structural angle

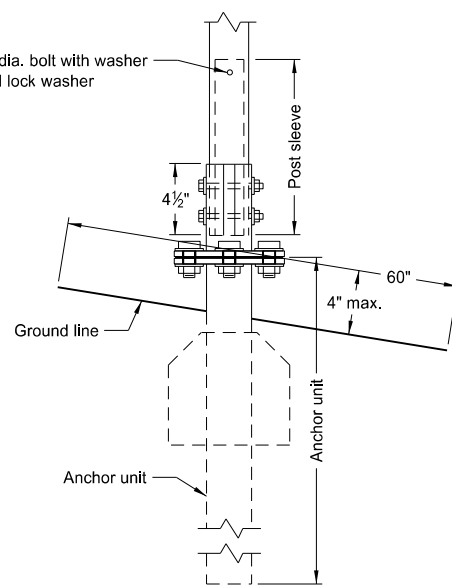
Traffic Flow



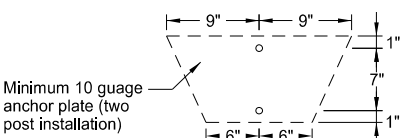
Bottom Soil Stub
Tube - 3"x3"x7 gauge ASTM A500 grade B tube
Stabilizing Wing - 7 gauge H.R.P.O. ASTM A1011
Plate - ASTM A572 grade 50



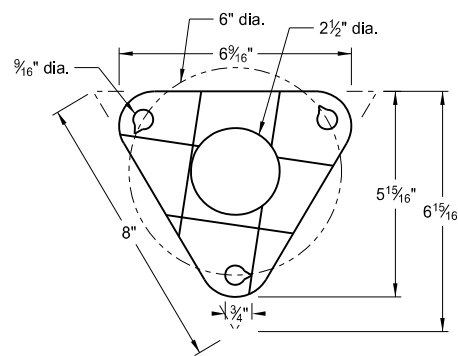
Anchor Unit and Post Assembly



Multi-Directional Slip Base Anchor Unit and Post Sleeve Assembly



Minimum 10 gauge anchor plate (two post installation)



Bolt Retainer for Base Connection
Bolt Retainer- 1/2" Reprocessed Teflon

Notes:

1. Torque slip base bolts as specified by manufacturer.
2. Use anchor with 43.9 KSI yield strength and 59.3 KSI tensile strength.
3. Provide 4" vertical clearance for anchor or breakaway base. Measure the 4"x60" measurement above and below post location and back and ahead of post.
4. In concrete sidewalk, use same anchor without wings.
5. Provide more than 7' between the first and fourth posts of a four post sign.

Telescoping Perforated Tube

Number of Posts	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			(A)	3
1	2 1/2	10			Yes	
1	2 1/2	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	12			Yes	
2	2 1/4	10	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	

Properties of Telescoping Perforated Tube

Tube Size in.	Wall Thickness in.	U.S. Standard Gauge	Weight per Foot lbs.	Moment of Inertia in. ⁴	Cross Sec. 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

Top Post Receiver Data Table

Square Post Sizes (B)	A	B	C	D	E	F
2 3/16" x 10 ga.	1 5/16"	2 1/2"	3 1/2"	2 5/32"	1 3 3/64"	1 7/8"
2 1/2" x 10 ga.	1 3/32"	2 1/2"	3 5/16"	5/8"	1 2 1/32"	1 3/4"

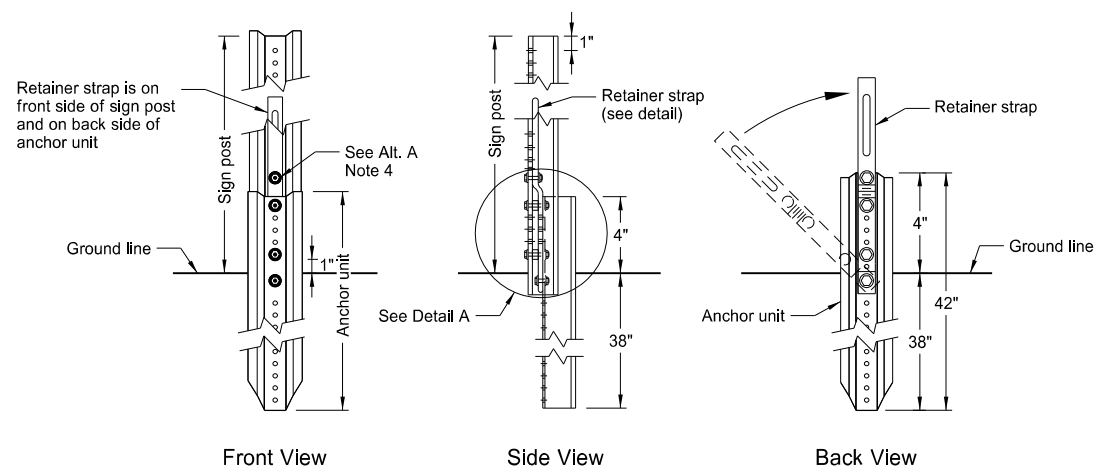
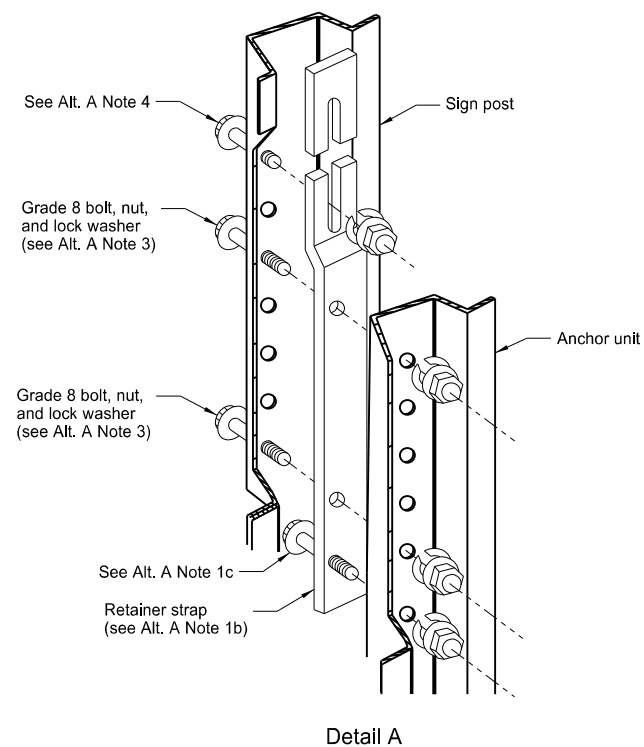
(A) Use breakaway base when support is placed in weak soils. Engineer determines if soils are weak.

(B) For additional wind load, insert the 2 3/16" x 10 ga. into 2 1/2" x 10 ga.

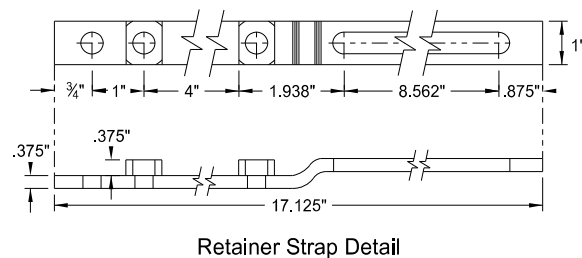
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
10-03-19	New Design Engr PE Stamp

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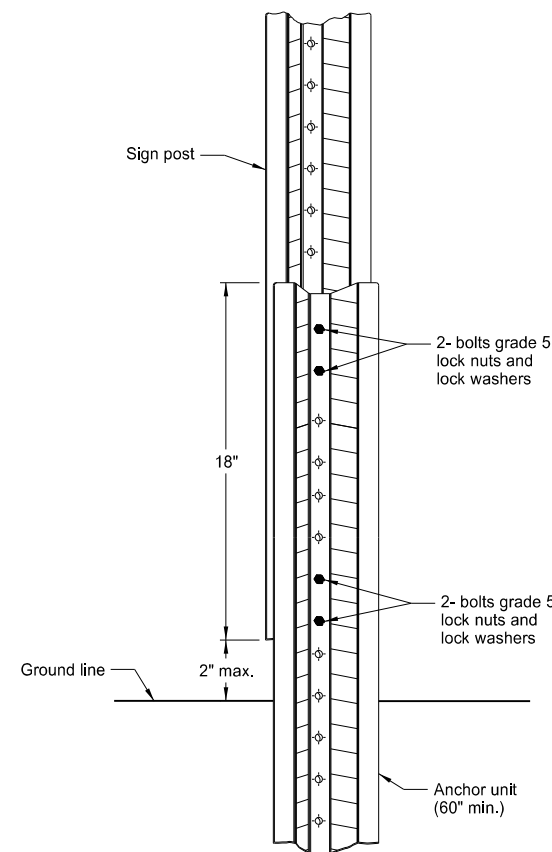
U-Channel Post



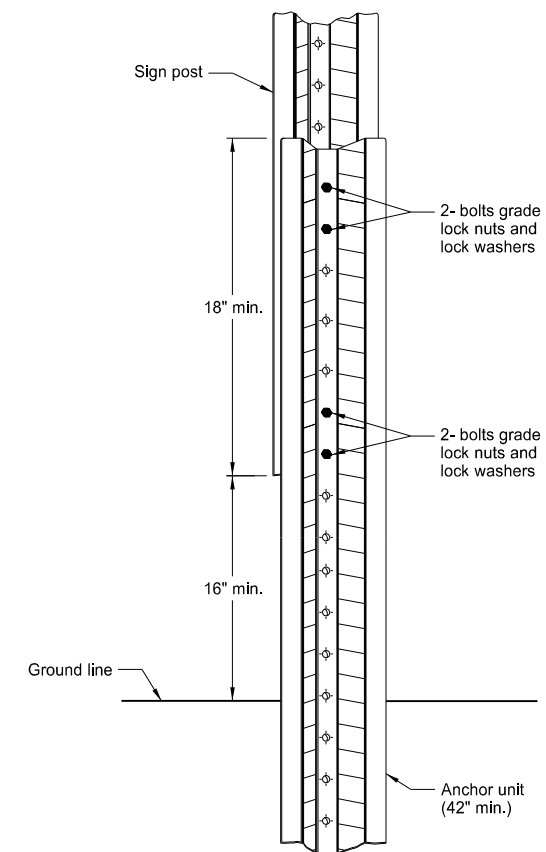
Breakaway U-Channel Detail Alternate A
Install a maximum of 2 posts within 7'.



Retainer Strap Detail



Breakaway U-Channel Splice Detail Alternate B
(2.5 and 3 lb/ft)
Install a maximum of 3 posts within 7'.



Breakaway U-Channel Splice Detail Alternate C
(2.5 and 3 lb/ft)
Install a maximum of 3 posts within 7'.

Alternate A Steps of Installation:

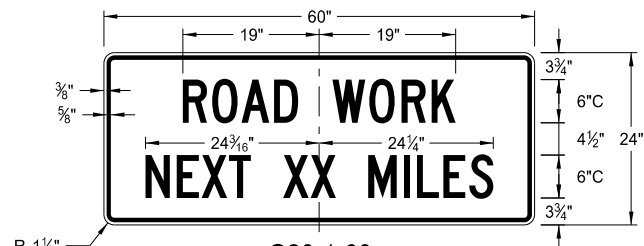
1. a) Drive anchor unit to within 12" of ground level.
b) Establish proper assembly by lining up bottom hole of retainer strap with 6th hole from the top of the anchor unit.
c) Assemble strap to back of anchor unit using 5/16"x2" bolt, lock washer and nut.
d) Rotate strap 90° to left.
2. a) Drive anchor unit to 4" above ground.
b) Rotate strap to vertical position.
3. a) Place 5/16"x2" bolt, lock washer and nut in bottom of sign post to facilitate alignment of sign post with proper hole in anchor unit.
b) Alternately tighten two connector bolts.
4. Complete assembly by tightening 5/16"x2" bolt (this fastens sign post to retainer strap).
5. Properly nest base post, strap, and sign post. 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.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
9-27-17 10-03-19	Updated to active voice New Design Engr PE Stamp

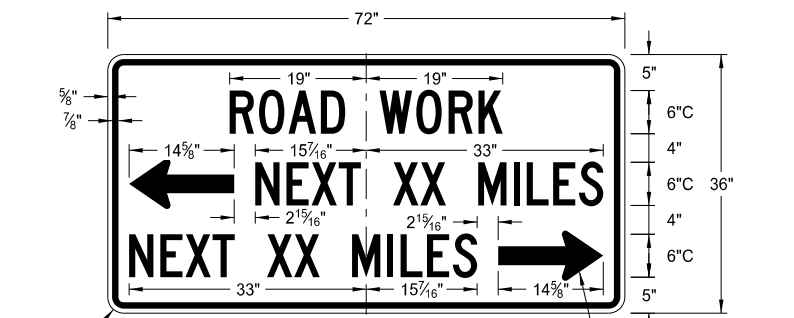
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CONSTRUCTION SIGN DETAILS
 TERMINAL AND GUIDE SIGNS

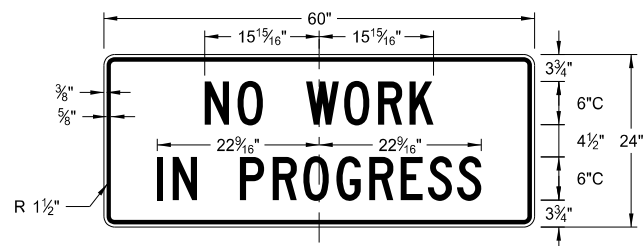
D-704-9



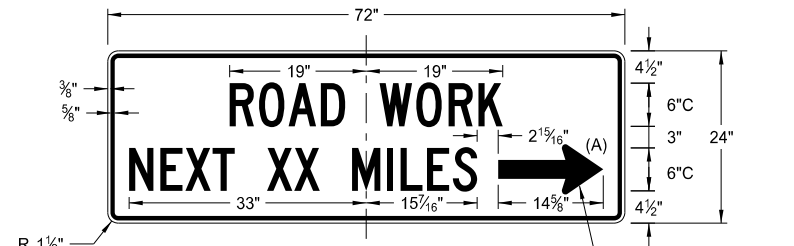
G20-1-60
 Legend: black (non-refl)
 Background: orange



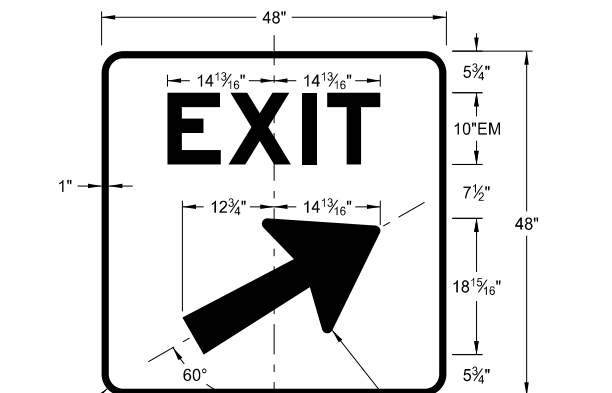
G20-50a-72
 Legend: black (non-refl)
 Background: orange



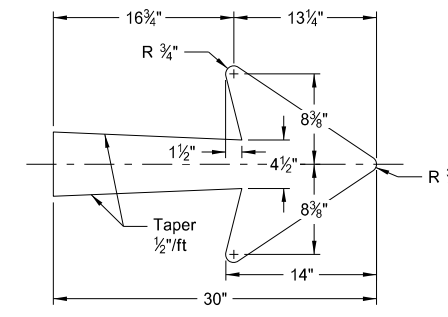
G20-1b-60
 Legend: black (non-refl)
 Background: orange



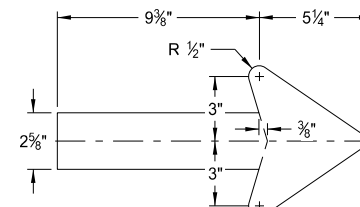
G20-52a-72
 Legend: black (non-refl)
 Background: orange



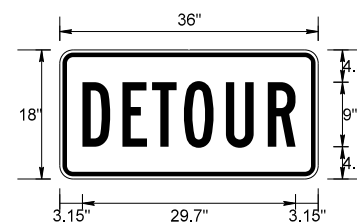
E5-1(L or R)-48
 Legend: white
 Background: green (orange optional)



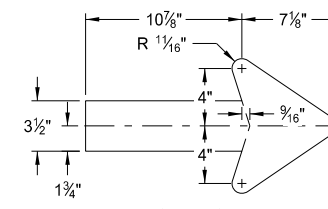
E5-1-48



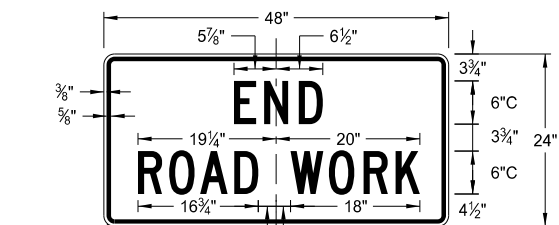
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 G20-52a-72



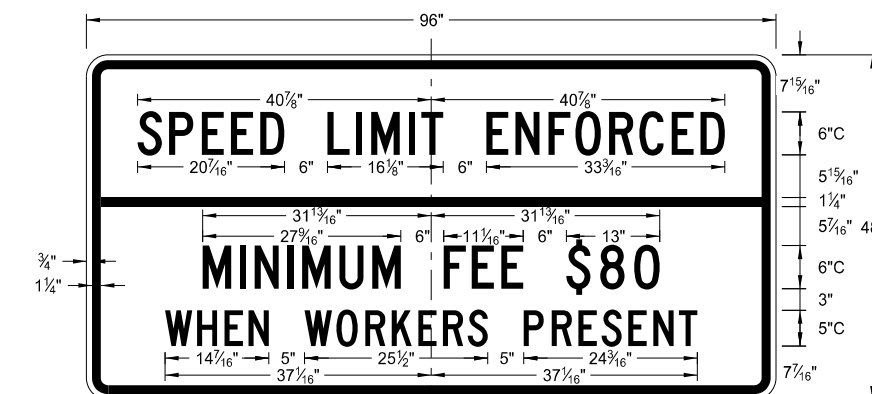
M4-8-36
 Legend: black (non-refl)
 Background: orange



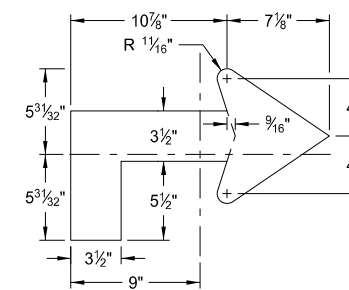
M4-9(L or R)-30
 Right or Left



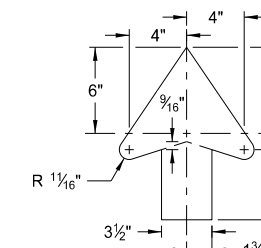
G20-2-48
 Legend: black (non-refl)
 Background: orange



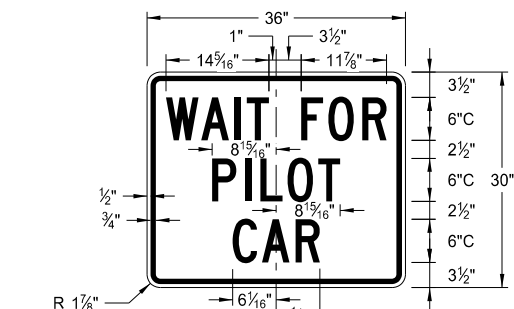
G20-55-96
 Legend: black (non-refl)
 Background: orange



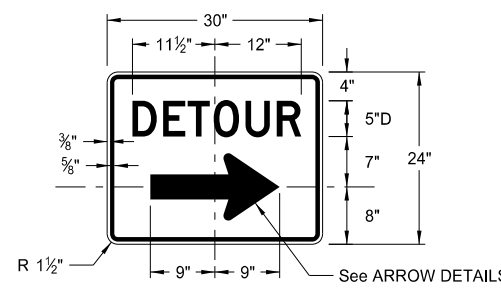
M4-9(L or R)-30
 Advanced Right or Left



M4-9-30
 Straight



G20-4b-36
 Legend: black (non-refl)
 Background: orange



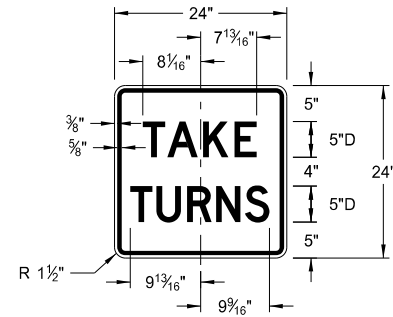
M4-9(L or R)-30 &
 M4-9-30
 Legend: black (non-refl)
 Background: orange

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

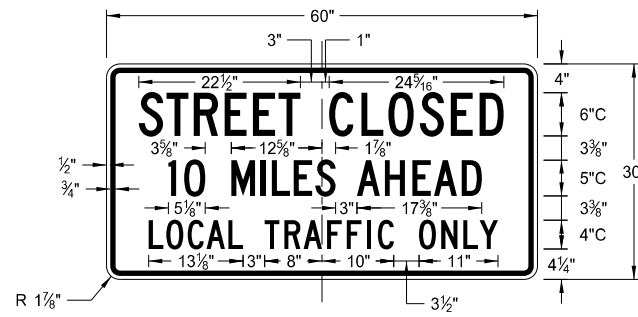
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17 10-03-19	Added sign & background color New Design Engineer PE Stamp

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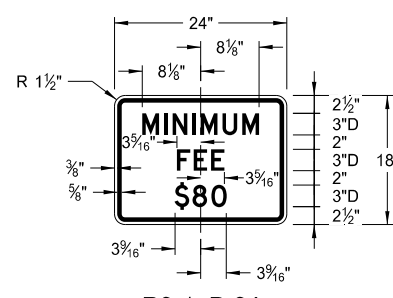
CONSTRUCTION SIGN DETAILS
REGULATORY SIGNS



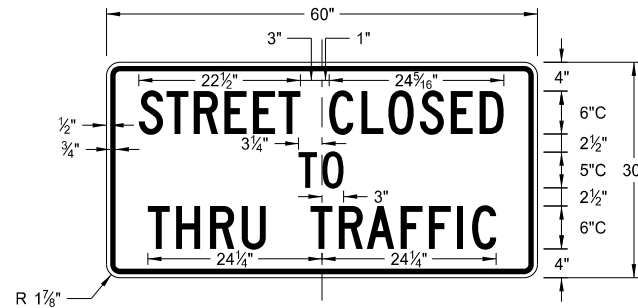
R1-50P-24
Legend: black (non-refl)
Background: white



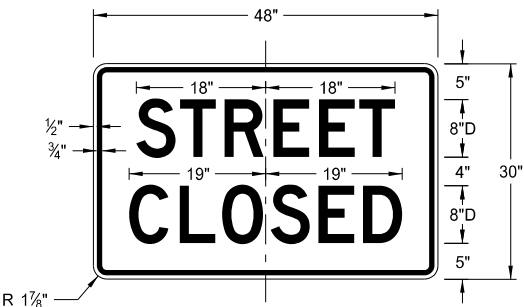
R11-3c-60
Legend: black (non-refl)
Background: white



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



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

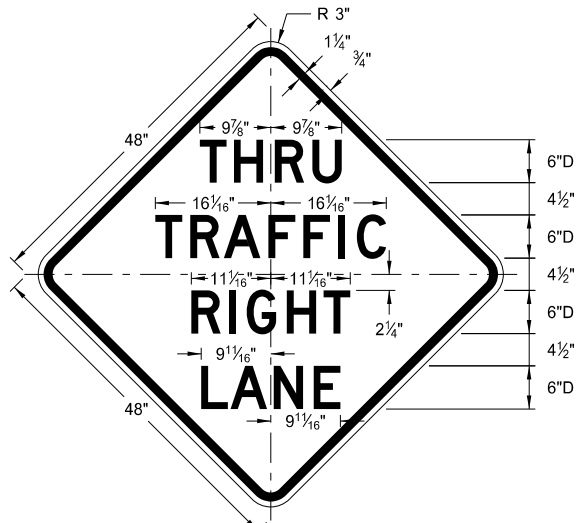


R11-2a-48
Legend: black (non-refl)
Background: white

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17	Revised sign number
10-03-19	New Design Engineer PE Stamp

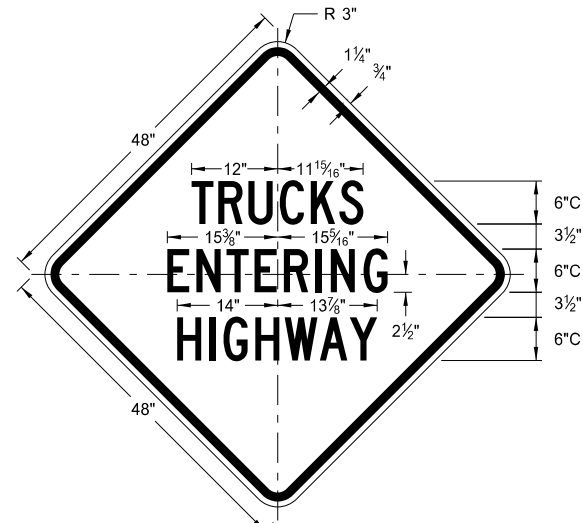
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CONSTRUCTION SIGN DETAILS
WARNING SIGNS



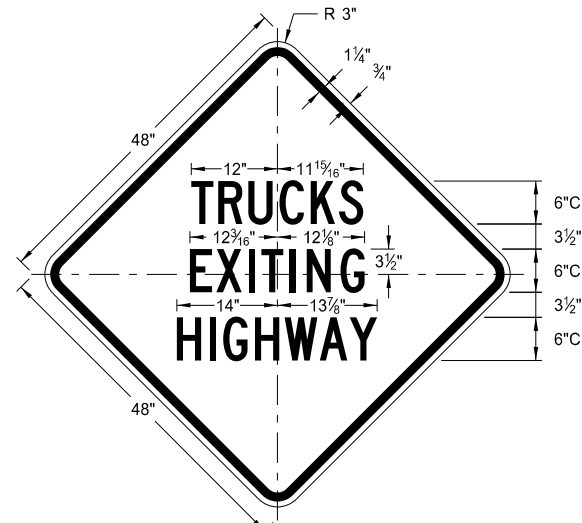
W5-8-48

Legend: black (non-refl)
Background: orange



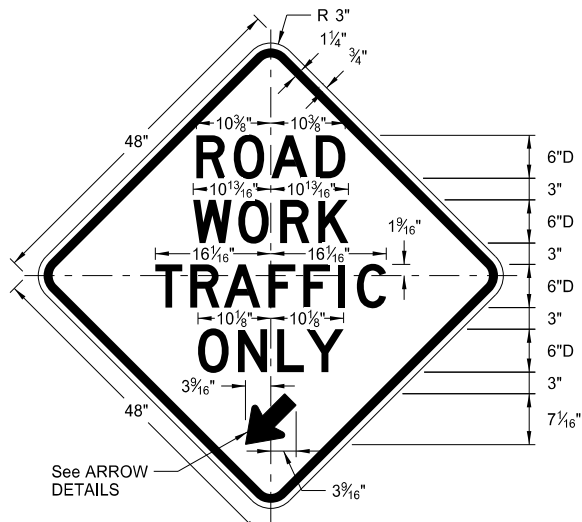
W8-53-48

Legend: black (non-refl)
Background: orange



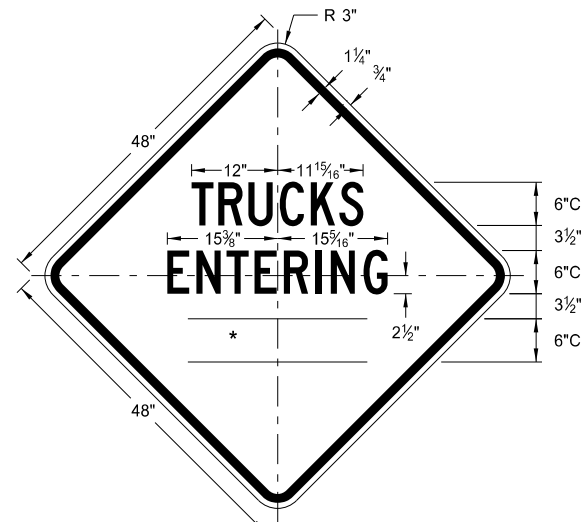
W8-56-48

Legend: black (non-refl)
Background: orange



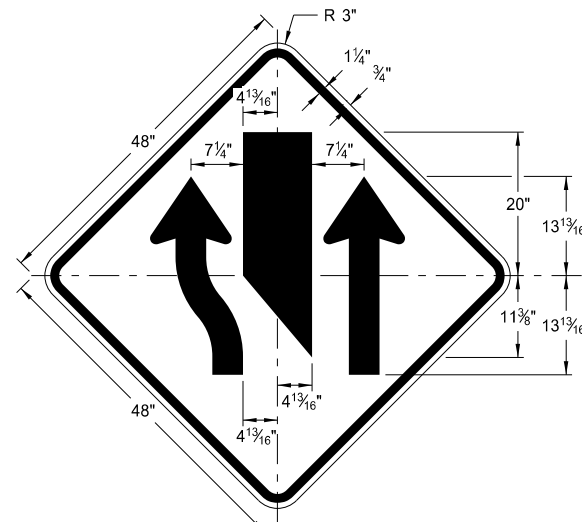
W5-9-48

Legend: black (non-refl)
Background: orange



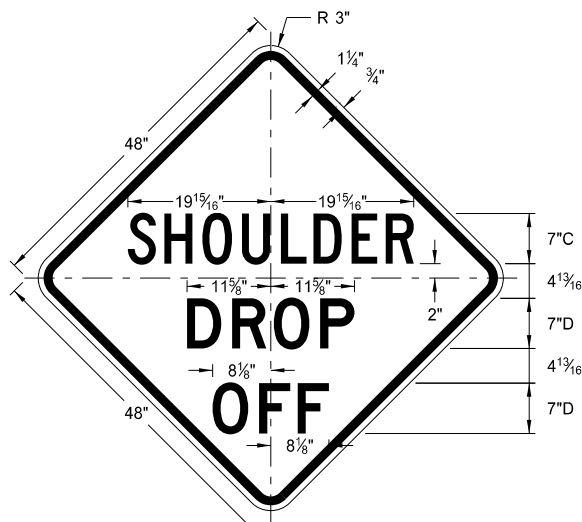
W8-54-48

Legend: black (non-refl)
Background: orange



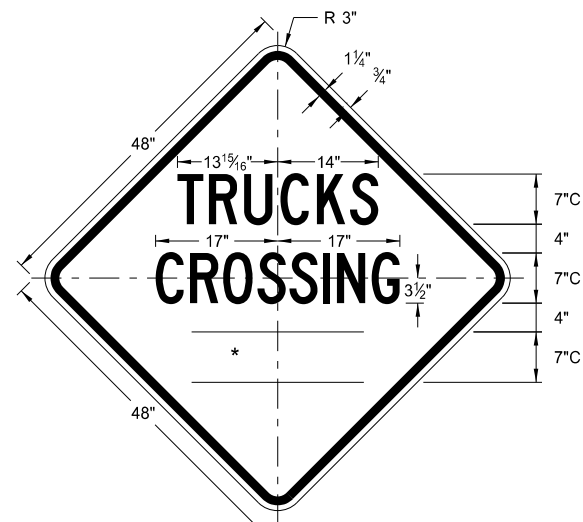
W9-3a-48

Legend: black (non-refl)
Background: orange



W8-9a-48

Legend: black (non-refl)
Background: orange

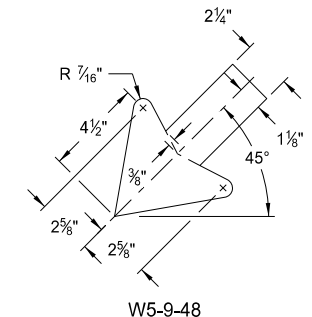


W8-55-48

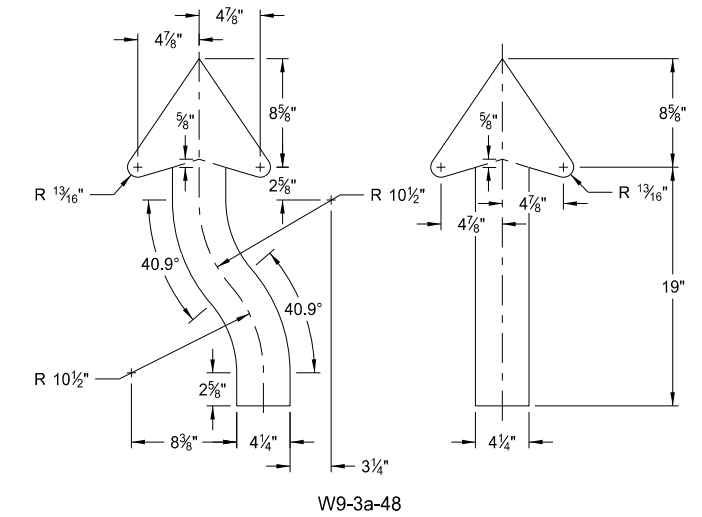
Legend: black (non-refl)
Background: orange

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



W5-9-48



W9-3a-48

ARROW DETAILS

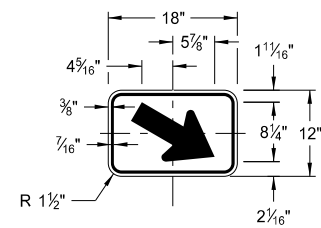
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17	Updated sign number
5-31-18	Revised sign and arrow details
10-03-19	New Design Engineer PE Stamp

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CONSTRUCTION SIGN DETAILS
WARNING SIGNS

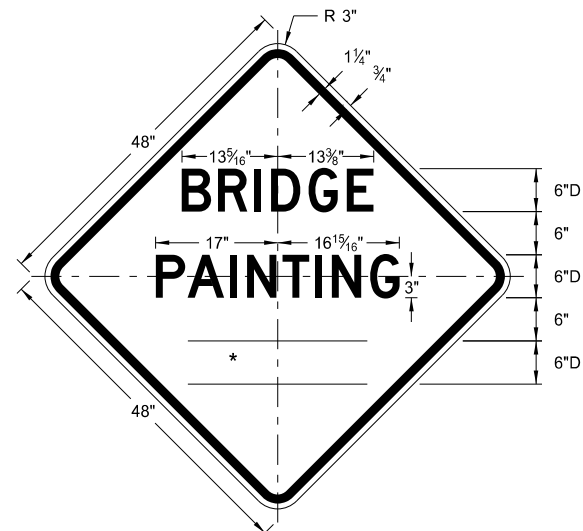
WORD	LETTER SPACING
AHEAD	Standard
200 FT	Standard
350 FT	Standard
500 FT	Standard
1000 FT	Reduce 40%
1500 FT	Reduce 40%
½ MILE	Reduce 50%
1 MILE	Standard

* DISTANCE MESSAGES



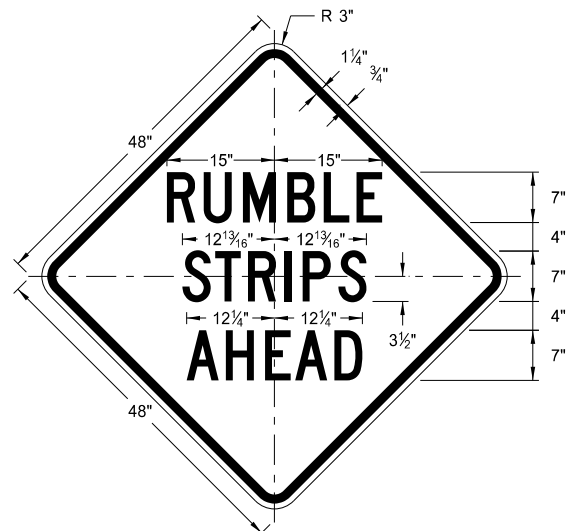
W16-7aP-18

Legend: black (non-refl)
Background: orange



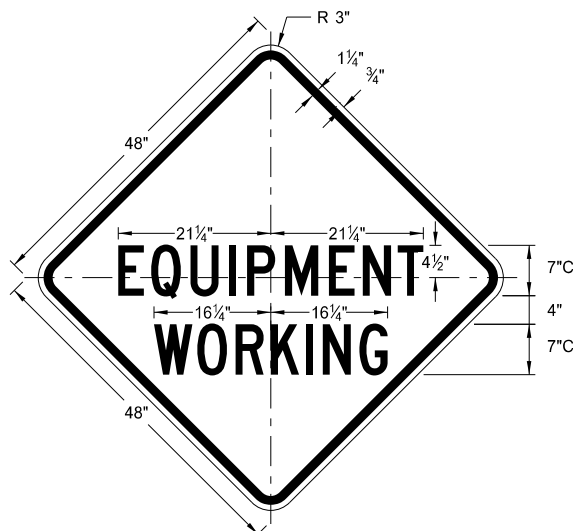
W21-50-48

Legend: black (non-refl)
Background: orange



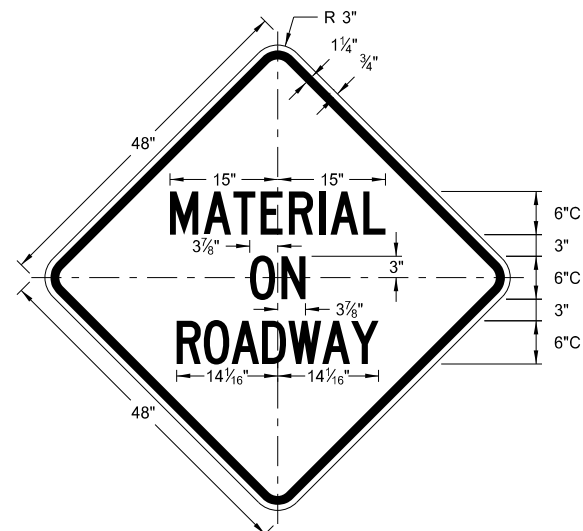
W21-53-48

Legend: black (non-refl)
Background: orange



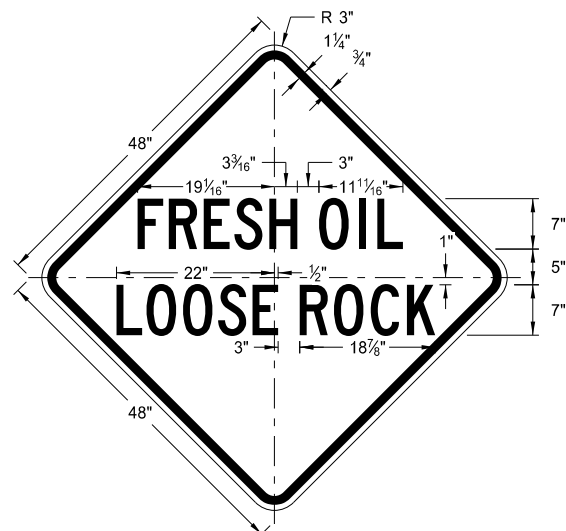
W20-51-48

Legend: black (non-refl)
Background: orange



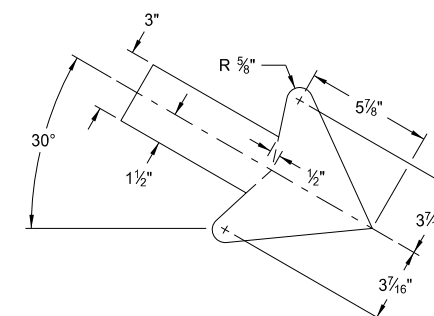
W21-51-48

Legend: black (non-refl)
Background: orange

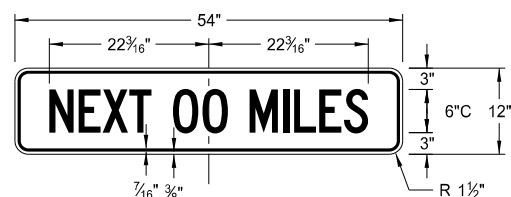


W22-8-48

Legend: black (non-refl)
Background: orange

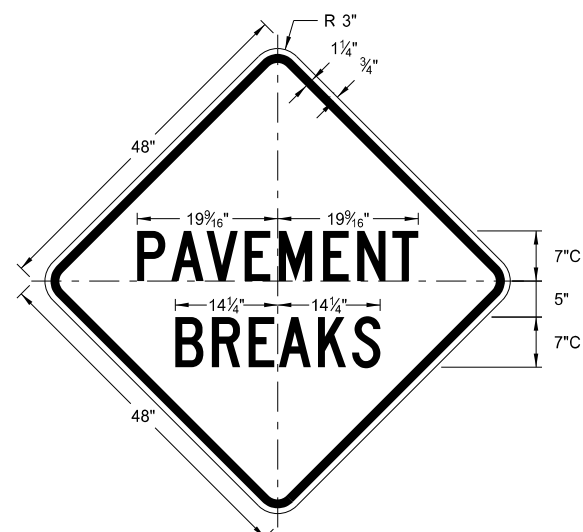


W16-7aP-18



W20-52P-54

Legend: black (non-refl)
Background: orange



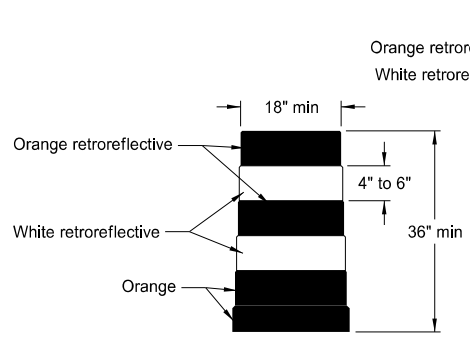
W21-52-48

Legend: black (non-refl)
Background: orange

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
5-31-18	
REVISIONS	
DATE	CHANGE
11-01-19	Added details for sign W16-7aP-18.

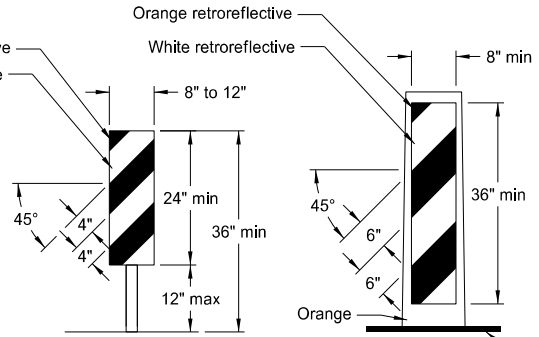
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BARRICADE AND CHANNELIZING DEVICE DETAILS



DELINEATOR DRUM

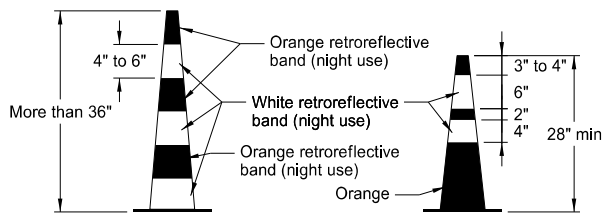
Provide horizontal, circumferential, alternating orange and white retroreflective stripes 4" to 6" wide for drum markings. Use a minimum of two orange and two white stripes with the top stripe being orange for each drum. Do not exceed 3" nonretroreflectORIZED spaces between the horizontal orange and white stripes. Avoid placement of stripes on drum ribs or indentations. Use closed top drums that will not allow collection of debris. Do not place ballast on the top of drum.



BACK TO BACK VERTICAL PANEL STACKABLE

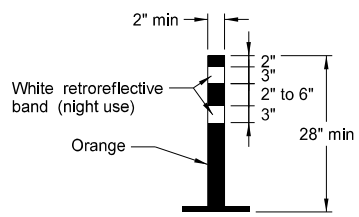
Provide alternating orange and white retroreflective stripes, sloping downward in direction vehicular traffic is to pass. Place retroreflective sheeting on both sides of panel with a minimum of 270 square inches of retroreflective area facing vehicular traffic. Where the height of the retroreflective material on the vertical panel is 36 inches or more, use a stripe width of 6 inches.

Molded rubber base (min weight 30 lbs)



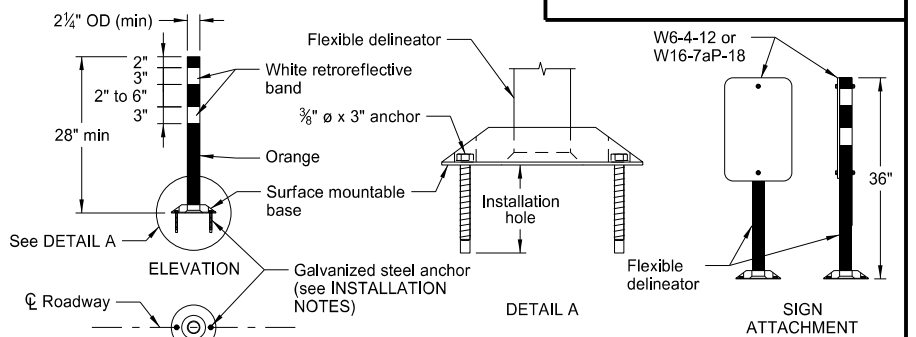
TRAFFIC CONE

Provide retroreflectORIZATION of cones more than 36" in height by alternating orange and white retroreflective stripes. Use a minimum of two orange and two white stripes for each cone with the top stripe being orange. Use maximum 3" nonretroreflectORIZED space between the orange and white stripes.



TUBULAR MARKER

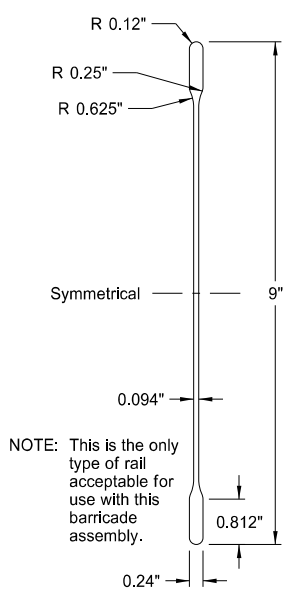
Provide retroreflectORIZATION of tubular markers more than 42" in height by alternating four 4" to 6" wide orange and white stripes with the top stripe being orange.



FLEXIBLE DELINEATOR

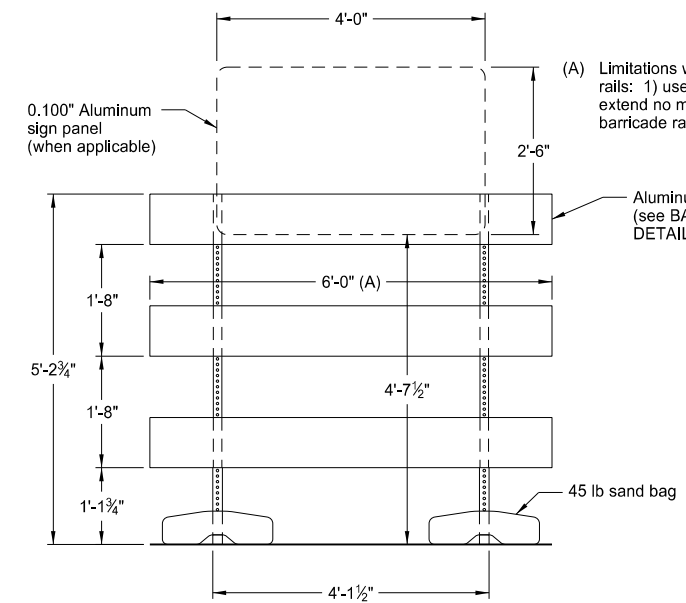
INSTALLATION NOTES:

1. Drill installation holes to diameter and depth 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, use an 8" x 8" butyl pad or hot melt butyl. Remove butyl as close as possible to pavement surface.

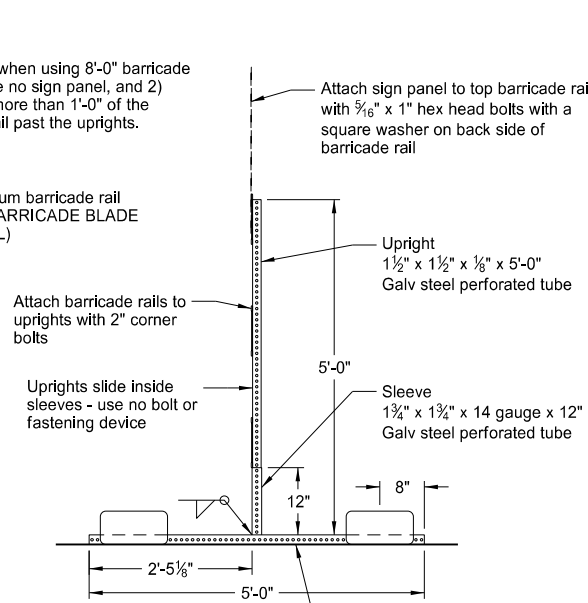


BARRICADE BLADE DETAIL

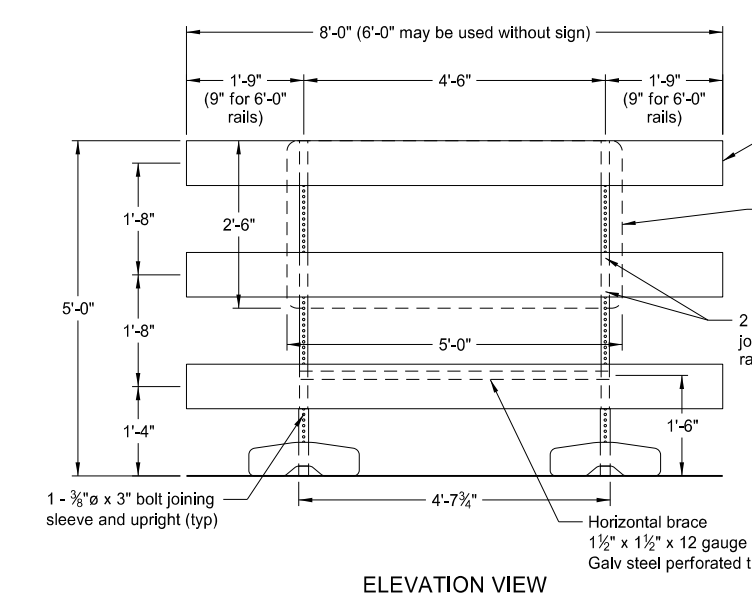
NOTE: This is the only type of rail acceptable for use with this barricade assembly.



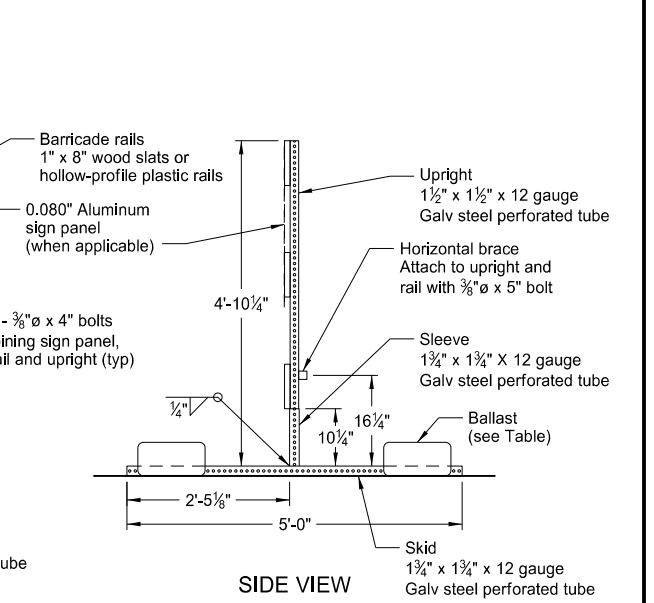
ELEVATION VIEW BARRICADE ASSEMBLY DETAIL (Aluminum Barricade Rails)



SIDE VIEW BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

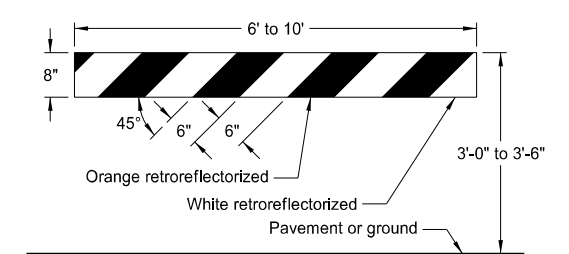


ELEVATION VIEW BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

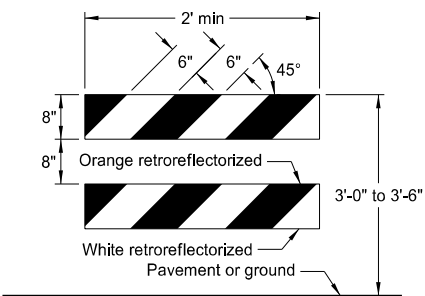


SIDE VIEW BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

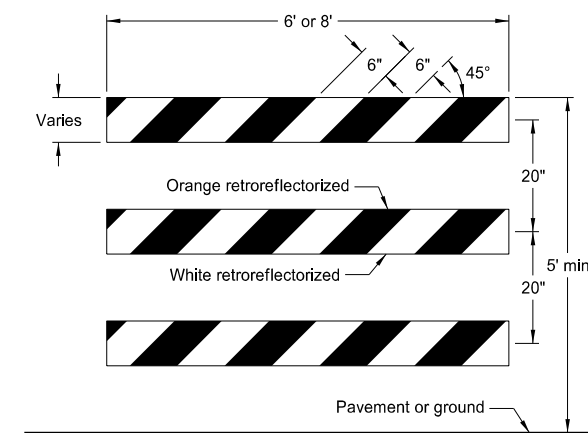
NOTE: For barricade markings use alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Place retroreflective sheeting on both sides of the rails with a minimum of 270 square inches of visible retroreflective area facing vehicular traffic. When the barricade length is less than 36", use a rail stripe width of 4".



TYPE I BARRICADE

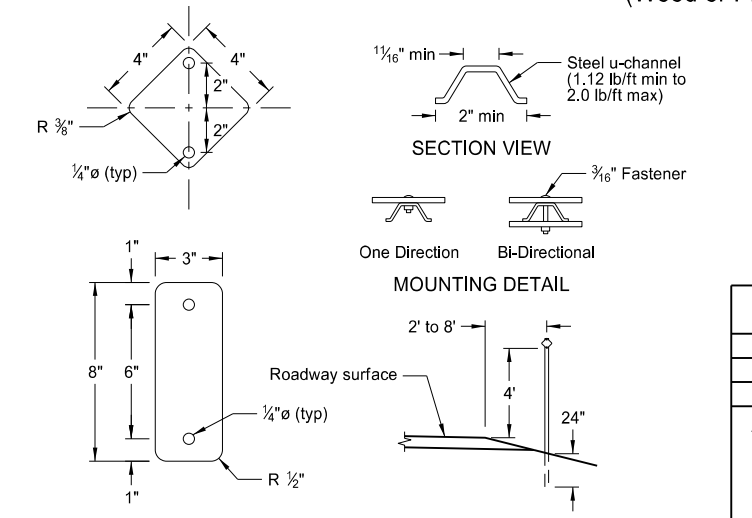


TYPE II BARRICADE



TYPE III BARRICADE

BARRICADE RAIL DETAILS



REFLECTOR DETAIL DELINEATORS

MINIMUM BALLAST (For each side of barricade support)

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

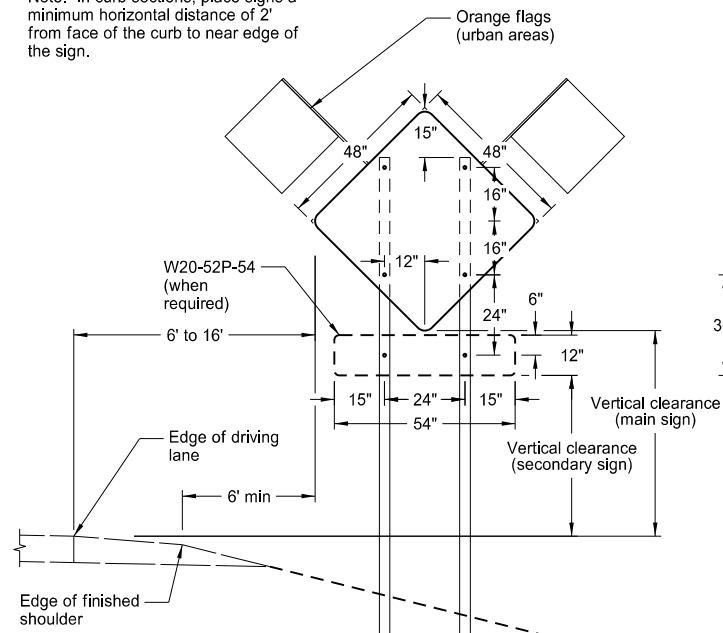
Note: Number of sandbags based on a wind speed of 55 MPH. Sandbags assumed to be placed at or near the ends of the skids.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
11-01-19	Revised details for Flexible Delineator

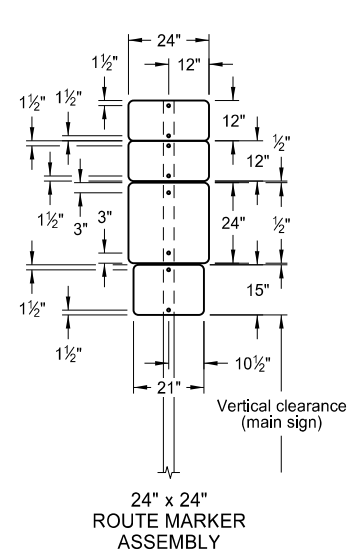
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

CONSTRUCTION SIGN PUNCHING AND MOUNTING DETAILS

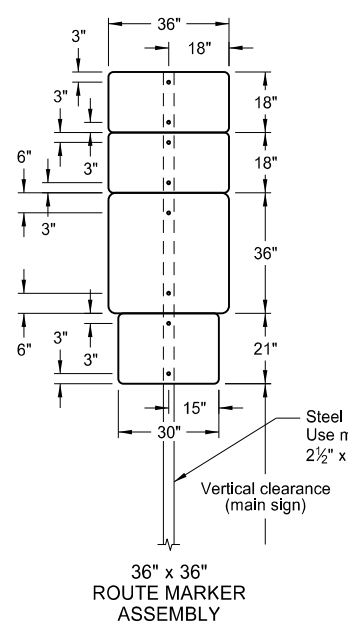
Note: In curb sections, place signs a minimum horizontal distance of 2' from face of the curb to near edge of the sign.



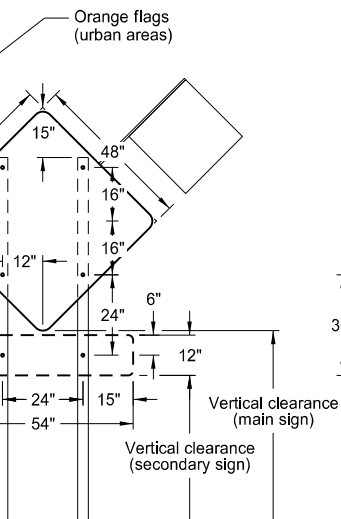
TYPICAL SECTION
(48" x 48" diamond warning sign shown)



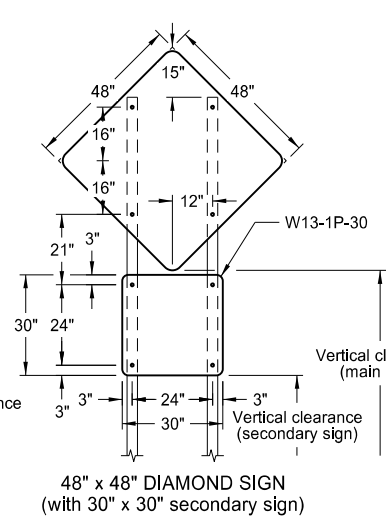
24" x 24" ROUTE MARKER ASSEMBLY



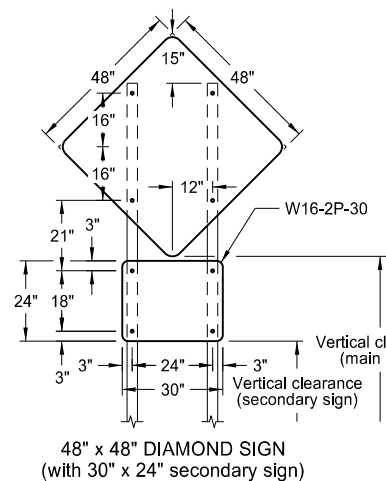
36" x 36" ROUTE MARKER ASSEMBLY



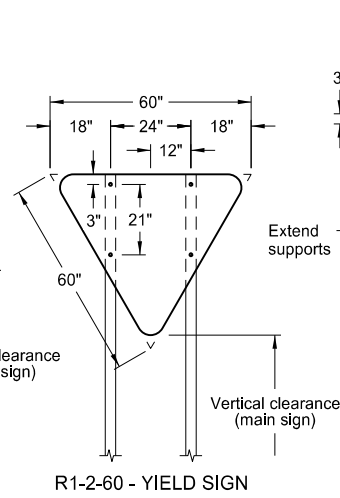
18" x 18" DIAMOND SIGN



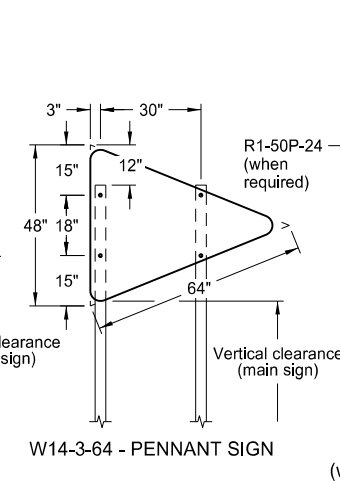
48" x 48" DIAMOND SIGN
(with 30" x 30" secondary sign)



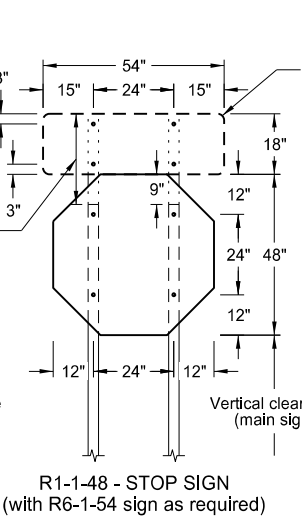
48" x 48" DIAMOND SIGN
(with 30" x 24" secondary sign)



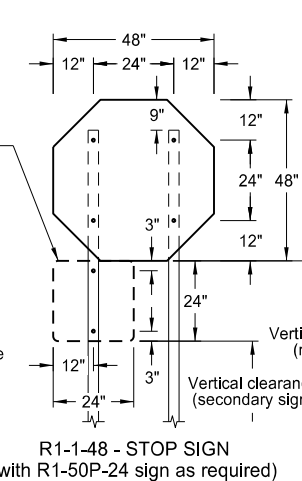
R1-2-60 - YIELD SIGN



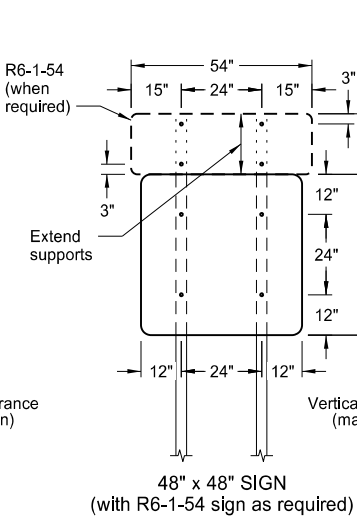
W14-3-64 - PENNANT SIGN



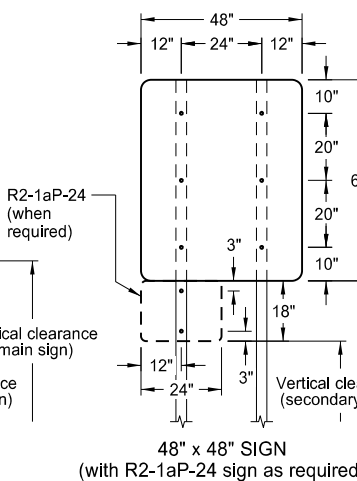
R1-1-48 - STOP SIGN
(with R6-1-54 sign as required)



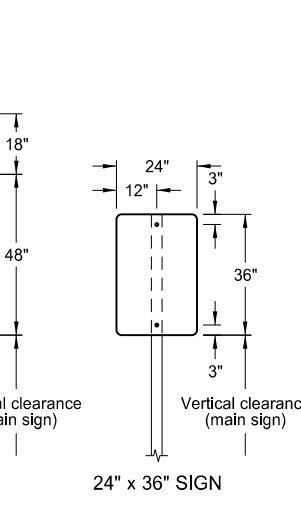
R1-1-48 - STOP SIGN
(with R1-50P-24 sign as required)



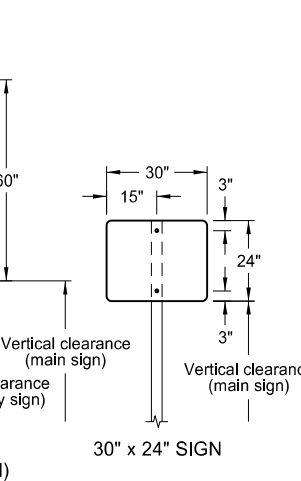
48" x 48" SIGN
(with R6-1-54 sign as required)



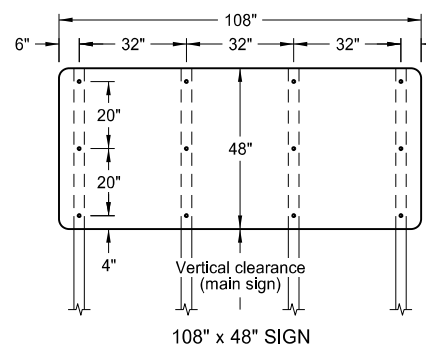
48" x 48" SIGN
(with R2-1aP-24 sign as required)



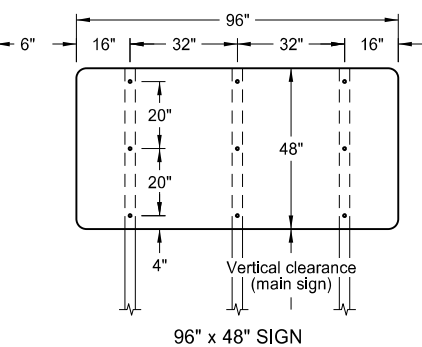
24" x 36" SIGN



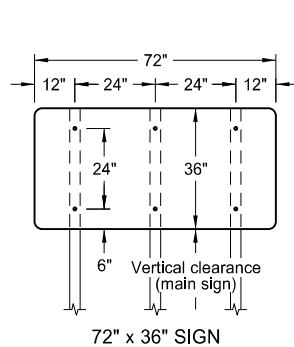
30" x 24" SIGN



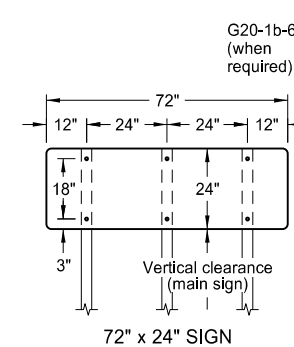
108" x 48" SIGN



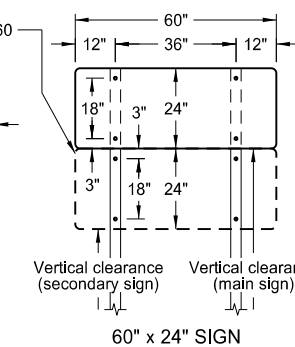
96" x 48" SIGN



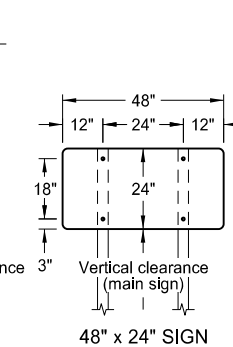
72" x 36" SIGN



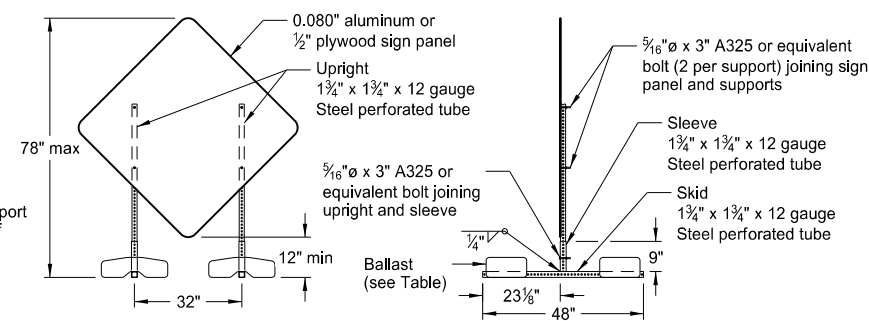
72" x 24" SIGN



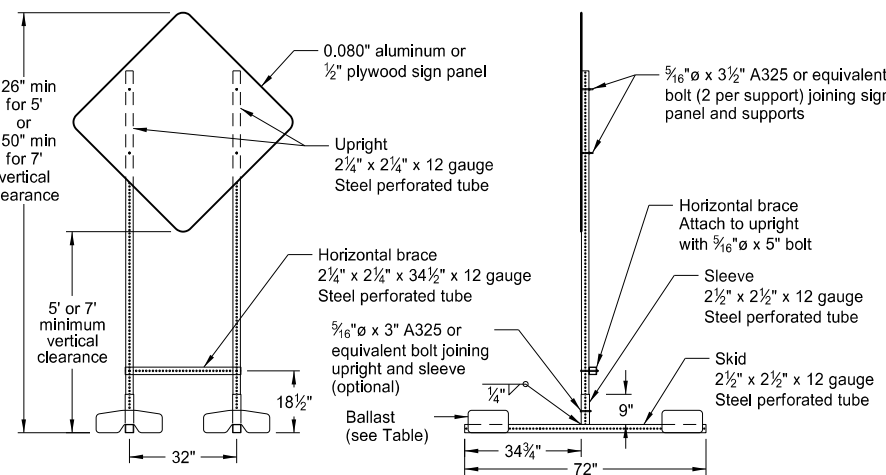
60" x 24" SIGN



48" x 24" SIGN



PORTABLE SIGN SUPPORT
LOW-MOUNTING HEIGHT



PORTABLE SIGN SUPPORT
HIGH-MOUNTING HEIGHT

NOTES:

- Sign Supports: Galvanize or paint supports. 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, minimum post size for assemblies containing a secondary sign is 3.0 lb/ft. Post sizes based on a wind speed of 55 MPH.

Place signs over 50 square feet on 2 1/2" x 2 1/2" perforated tube supports as a minimum.

Do not attach guy wires to sign supports. Attach wind beams behind sign panels when used with u-posts.
- Sign Panels: Provide sign panels made of 0.100" aluminum, 1/2" plywood, or other approved material, except where noted. Punch all holes round for 5/16" bolts.
- Alternate Messages: Install and remove alternate message signs on reflectorized plate (without borders) as required. (i.e. "Left" and "Right" message on lane closure sign)
- 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

- 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 stated above.

Provide a minimum clearance of 7'-0" from the ground at the post for signs with an area exceeding 50 square feet.

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

Use of low-mounting height (minimum 12" vertical clearance) portable signs for 5 days or less, is allowed as long as the view of the sign is not obstructed. Time delays caused by unforeseen circumstances, such as equipment breakdowns, rain, subgrade failures, etc., will not accrue towards the 5 day period. Use of R9-8 through R9-11a series, W1-6 through W1-8 series, M4-10, and E5-1 is allowed for longer than 5 days.

Restrict signs mounted on portable sign supports shown in the LOW-MOUNTING HEIGHT and HIGH-MOUNTING HEIGHT details to 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. Place sandbags at or near the ends of skids.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-4-13	
REVISIONS	
DATE	CHANGE
11-14-13	Revised Note 6
9-27-17	Updated to active voice
11-01-19	Revised 60"x24" sign detail

This document was originally issued and sealed by
Kirk J Hoff,
Registration Number
PE-4683,
on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

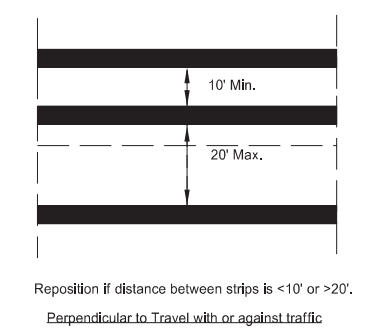
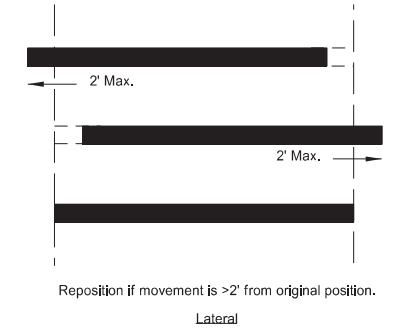
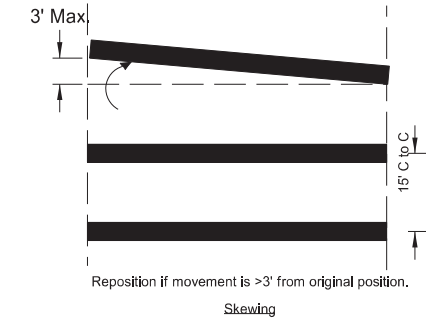
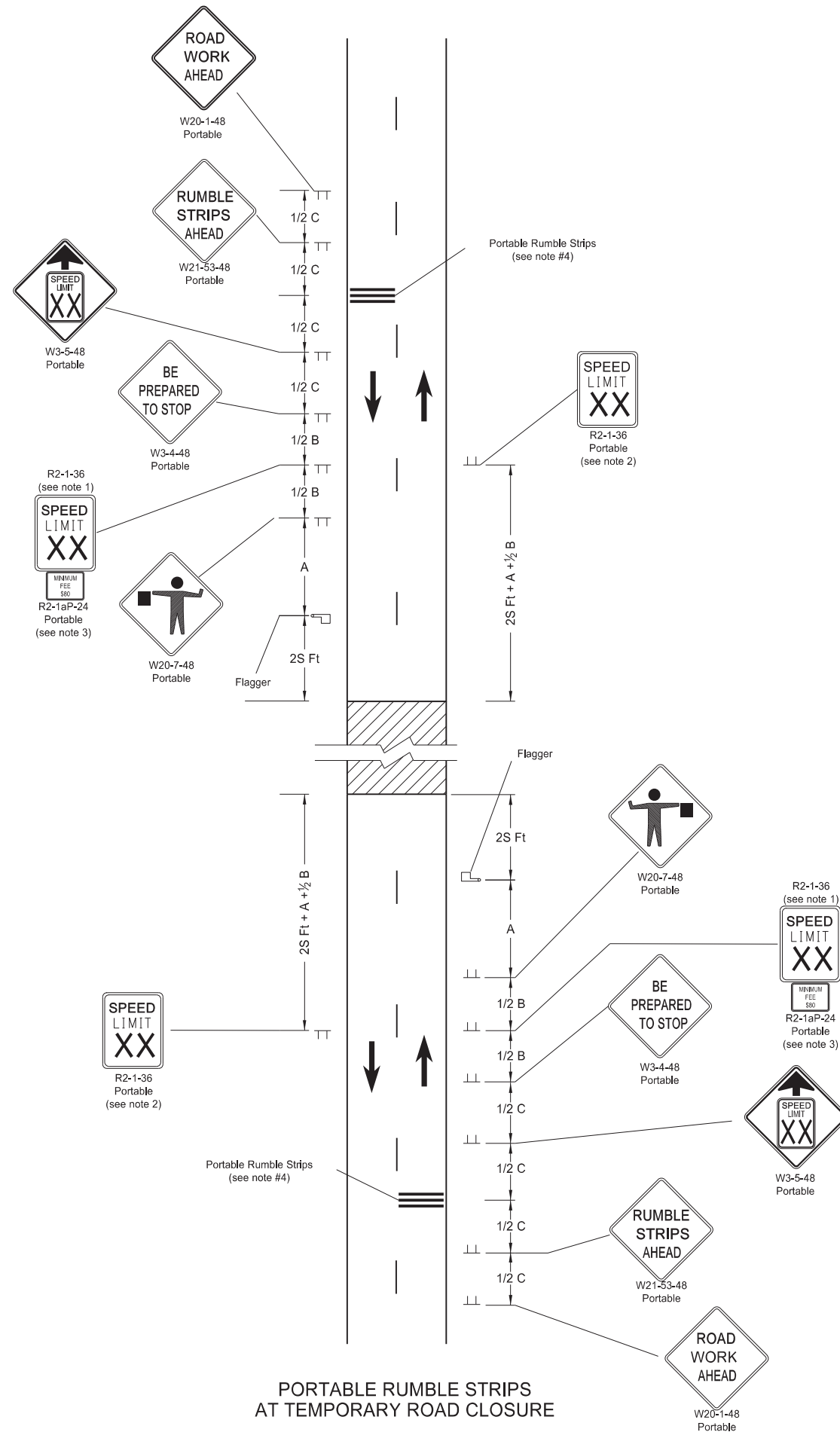
Two-Lane Roadway Portable Rumble Strips

KEY

- Work area
- Flagger
- Sign

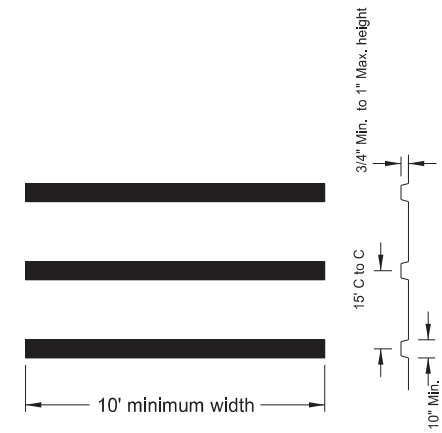
S = Numerical value of speed limit or 85th percentile.

Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - High Speed (over 45 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720



PORTABLE RUMBLE STRIPS ARRAY TYPES OF MOVEMENT AND MAXIMUM ALLOWANCES

- Notes:
- Determine speed in the field based on location and conditions.
 - Re-establish the speed limit. Determine the exact speed limit in the field, dependent on location and conditions.
 - Sign R2-1aP-24 is not required when pilot car operation is used.
 - Do not use rumble strips on a non paved surface or in a pre-construction speed zone of 45 mph or less.



PORTABLE RUMBLE STRIPS ARRAY DETAIL

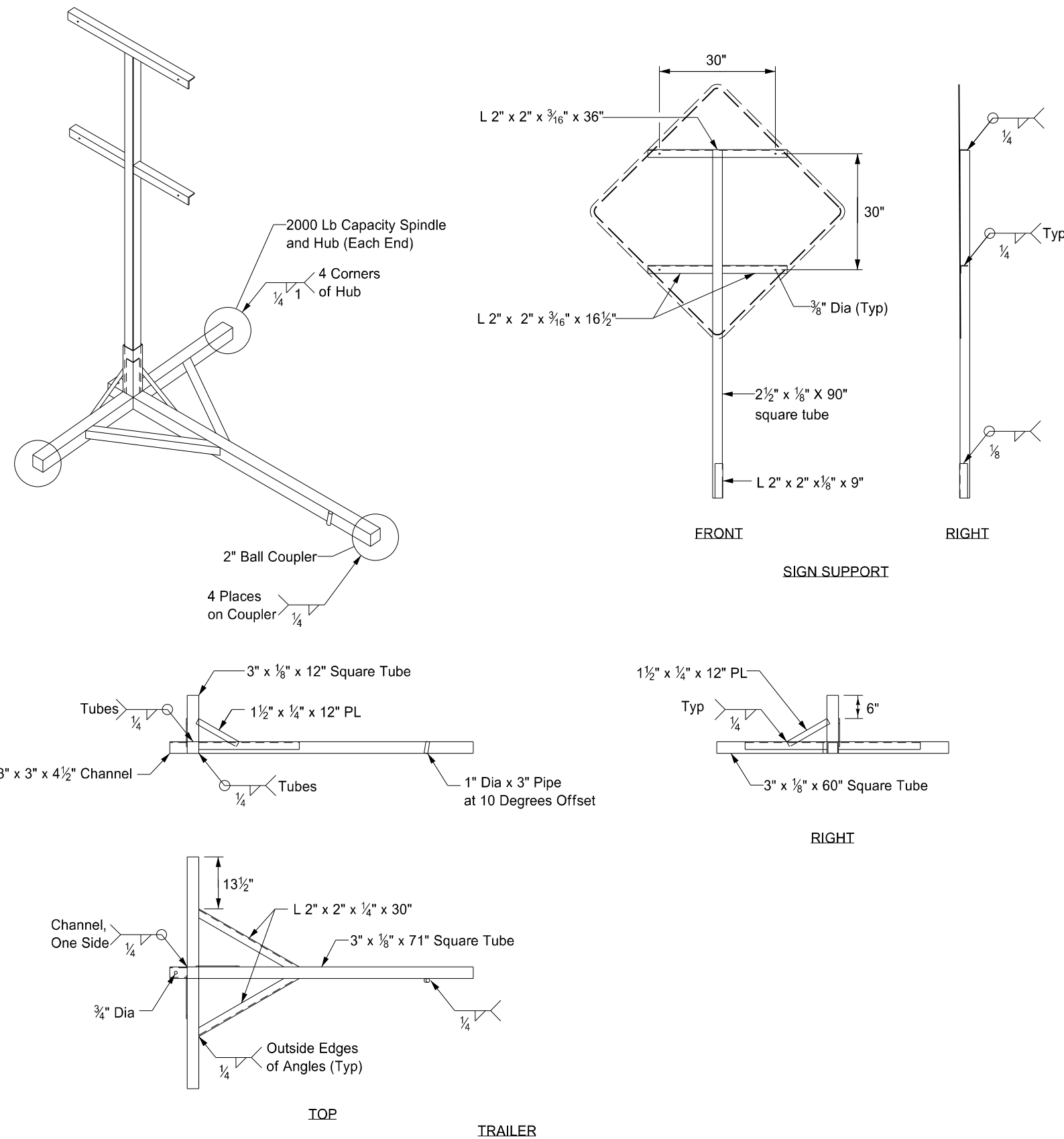
PORTABLE RUMBLE STRIPS AT TEMPORARY ROAD CLOSURE

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION		
02-22-22 REVISIONS		
DATE	CHANGE	<p>03/07/23 Use changed to min 45 mph.</p>
03/07/23		

03/07/23

PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



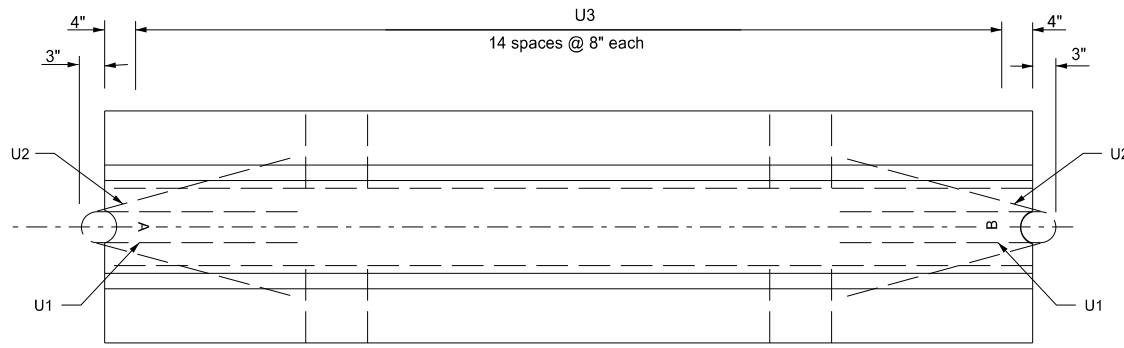
Notes:

- ① Maximum 250 pound weight of assembly.
- ② Use a 14" wheel and tire.
- ③ Use no automotive and equipment axle assemblies for trailer-mounted sign supports.
- ④ Other NCHRP 350 or MASH crash tested assemblies are acceptable.

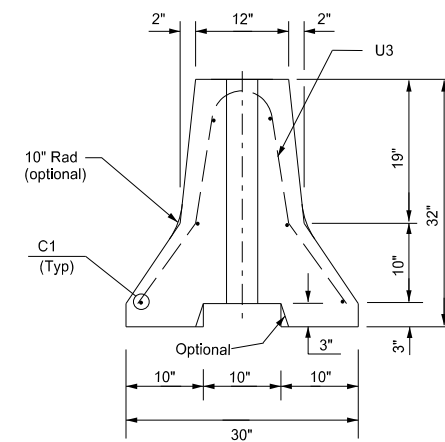
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-23-10	
REVISIONS	
DATE	CHANGE
12/02/2020	Updated Note to active voice.

KIRK J. HOFF
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PE-4683
ENGINEER
NORTH DAKOTA
12 02 2020

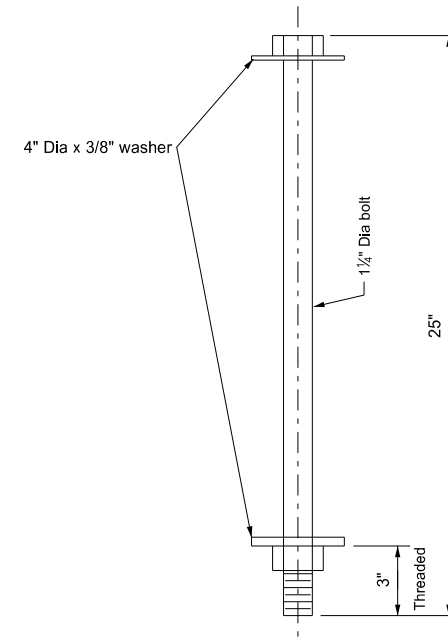
PORTABLE PRECAST CONCRETE MEDIAN BARRIER
(TEMPORARY USAGE)



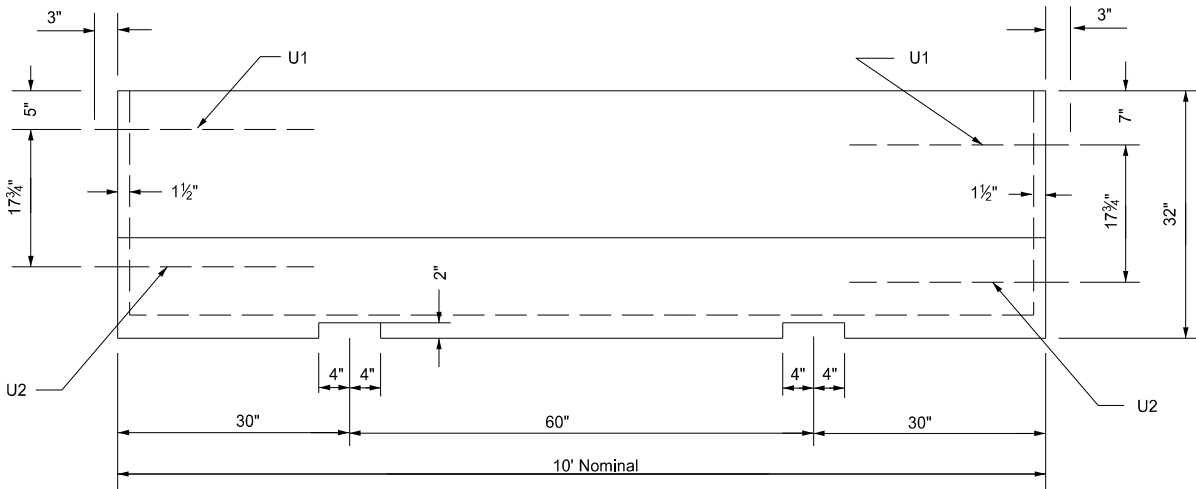
Plan View



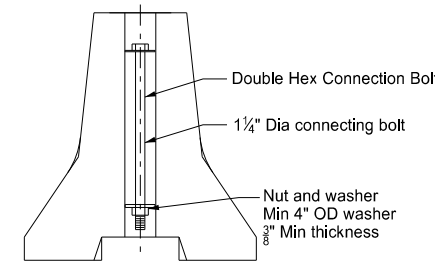
End View



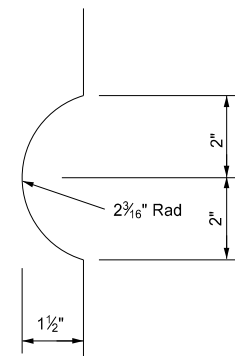
Connecting Bolt Detail
(One per 10 Ft section)



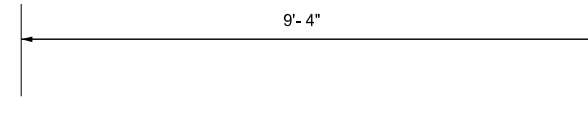
Side View



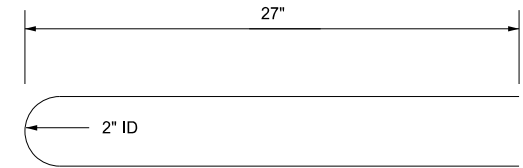
Bolt Connection Detail



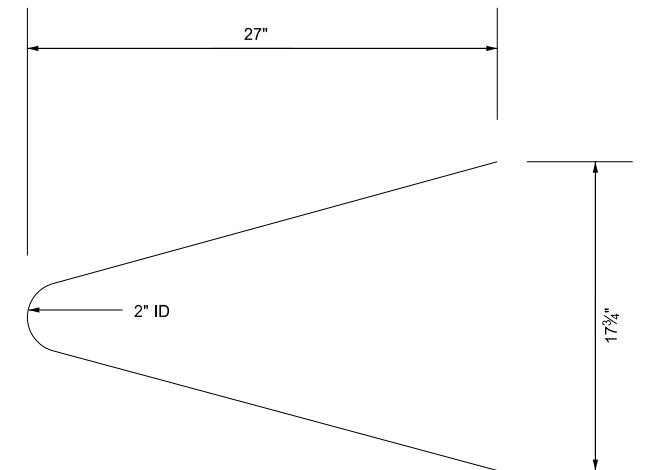
Dap Detail



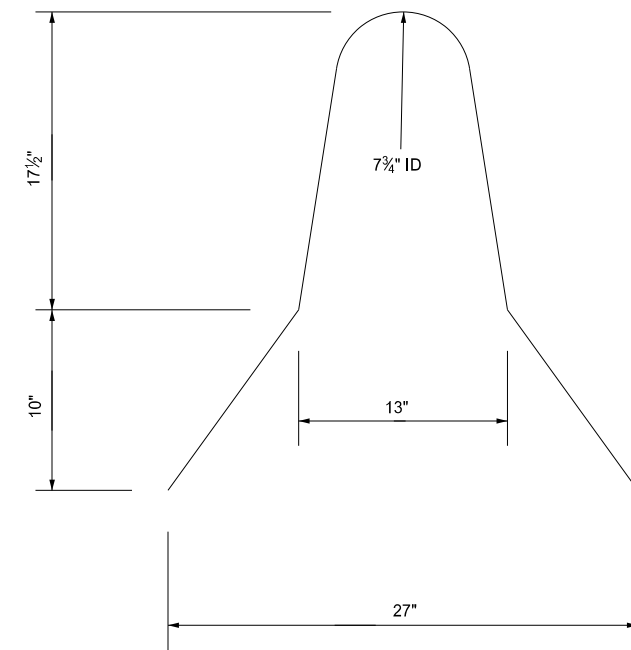
C1 Bar Detail



U1 Bar Detail



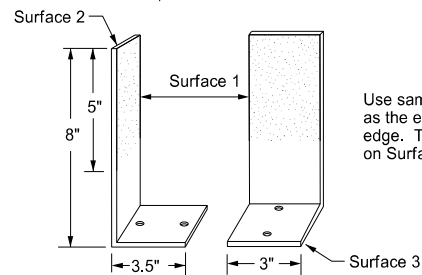
U2 Bar Detail



U3 Bar Detail

Notes:

- Galvanize all exposed hardware as per ASTM A153, except for the loop inserts.
- Use AAE-3 Concrete.
- Provide steel in accordance with Section 612 of NDDOT Standard Specifications.
- Imprint barrier ends A and B as shown with 4 inch letters. Field match A end with B end.
- Place barrier markers at the center of the barrier at 20' centers.
- Connect barrier sections with 1 1/4" Dia A-307 double hex connecting bolt. Maintain bottom nut and washer connection for duration of barrier installation.
- Place barrier to minimize openings between individual sections.



Barrier Marker Detail

Use same color reflective faces as the edge line along barrier edge. Two way reflective on Surface 1 & 2.

Reflective Tape
Use 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 for the reflector:

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

Adhesive
Use factory applied solid butyl rubber 1/8" thick, 2" wide on 2 1/4" wide release paper on surface 3 to temporarily mount markers to portable concrete barrier.

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
Use high impact, weatherable engineering thermo-plastic material conforming 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	
REVISIONS	
DATE	CHANGE
9-27-17 11-01-19	Updated to active voice New Design Engr PE Stamp

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Registration Number
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