

**JOB # 20
NORTH DAKOTA**

DEPARTMENT OF TRANSPORTATION

SS-9-999(340)
ITS-9-999(350)

Billings, Burleigh, Morton, Stutsman, Williams

2016 ATR, WIM, & ESS Improvement
Statewide

STATE	PROJECT NO.	PCN	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	20899	1	1
	ITS-9-999(350)	21118		

GOVERNING SPECIFICATIONS:

2014 Standard Specifications adopted by the North Dakota Department of Transportation and the Supplemental Specifications effective on the date the project is advertised.

PROJECT NUMBER \ DESCRIPTION NET MILES GROSS MILES



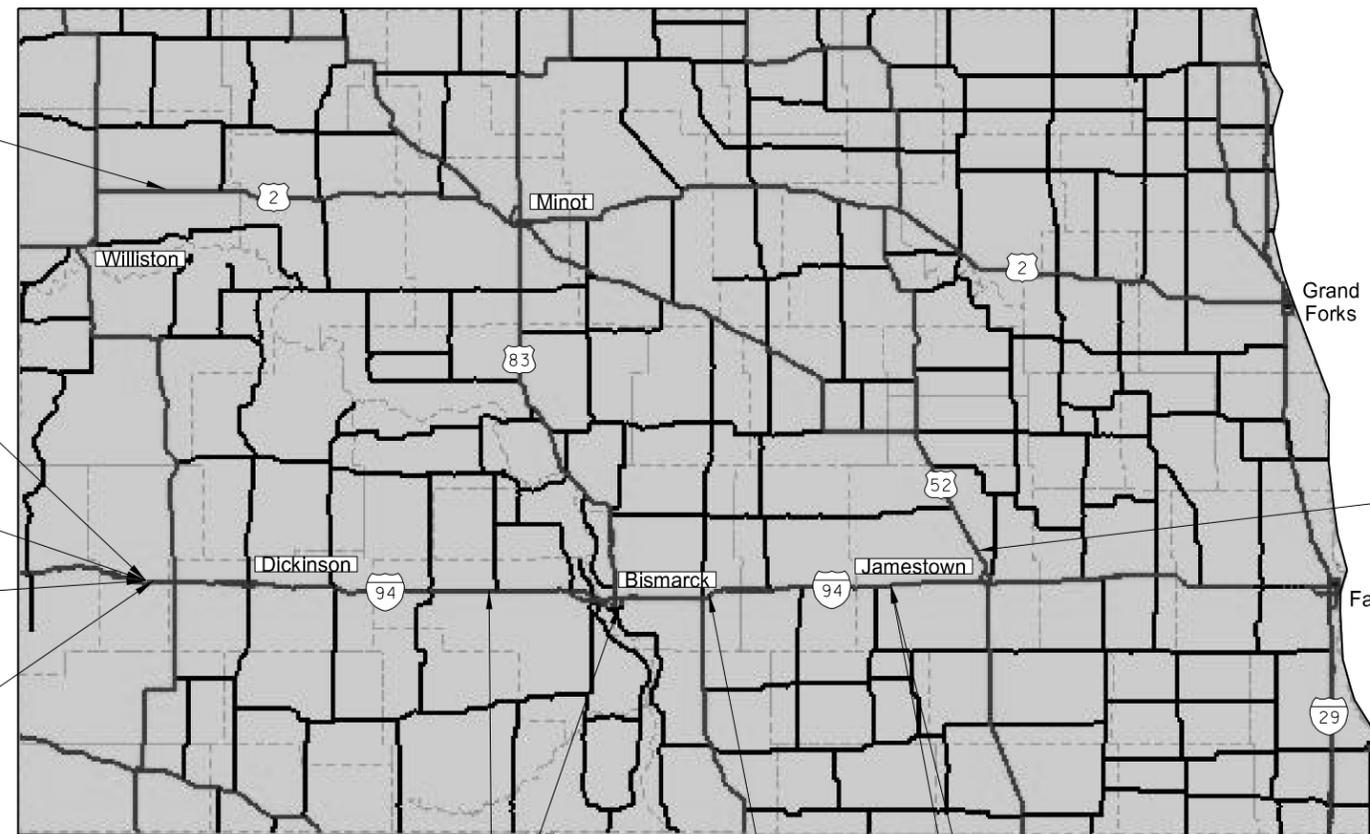
Ray ATR
US 2, RP 51.30
Site 201

Belfield ATR
RP 34.66
Site 279

Belfield ESS
I-94, RP 34.68

Belfield WIM
I-94, RP 34.69
Site 1

Fryburg ESS
Removal



Jamestown ATR
US 52, RP 259.55
Site 215

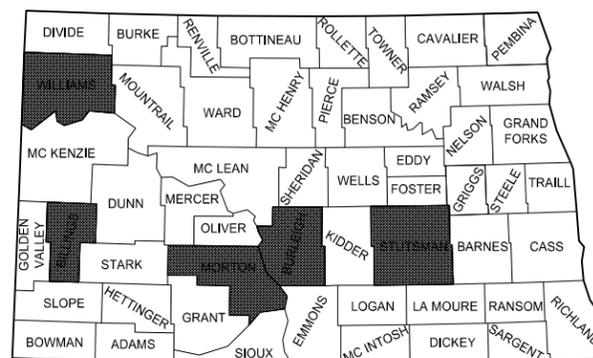
Bismarck ATR
ND 810, RP 5.58
Site 503

New Salem ESS
I-94, RP 126.88

Sterling ESS
I-94, RP 184.62

Medina ATR
I-94, RP 231.29
Site 207

Medina ESS
I-94, RP 231.29



STATE COUNTY MAP

DESIGNERS

Spencer Ulvestad

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

APPROVED DATE 12/1/15

James Douglas Rath

DESIGN DIVISION

APPROVED DATE 12/1/15

for Roger Weigel

OFFICE OF PROJECT DEVELOPMENT
ND DEPARTMENT OF TRANSPORTATION

This document was originally issued and sealed by James Douglas Rath Registration Number PE- 4288 , on 12/1/15 and the original document is stored at the North Dakota Department of Transportation

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LIST OF STANDARD DRAWINGS

ITS-9-999(350)

Number	Description
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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	Construction Sign Details - Warning Signs
D-704-13	Barricade and Channelizing Device Details
D-704-14	Construction Sign Punching and Mounting Details
D-704-23	Short Term Urban Detour and Lane Closure on a Divided Highway Layouts
D-704-50	Portable Sign Support Assembly
D-770-1	Concrete Foundations (Traffic Signals & Highway Lighting)

SPECIAL PROVISIONS

Number	Description
SP 240(14)	Automatic Traffic Recorder System
SP 241(14)	Virtual Weigh In Motion System
SP 242(14)	Environmental Sensor Station

NOTES

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GENERAL

100-P01 COORDINATION OF PROJECTS: Automatic Traffic Recorder (ATR) Site 207 is located with the Medina ESS site. These sites are located on I-94 at RP 231.29. Project SIM-2-094(102)227 is a CPR project planned for the westbound lanes of I-94, project IM-2-094(144)148 is a CPR project planned for the eastbound lanes of I-94. These projects are planned for the 2016 construction season. The ATR work shall be completed after the paving work on each roadway.

The Contractor shall coordinate work with these projects to ensure that paving work is completed before the loops are installed in the roadway.

704-P01 TRAFFIC CONTROL DEVICES: The Traffic Control Devices List has been developed using the following Standard Drawing layouts for traffic control:

D-704-23 Type P – Four Lane Divided Roadway – One Lane Closure

The pavement marking shall not be changed for a lane closure. Traffic control quantities are provided for one location.

SECTION 110

772-P01 EXISTING EQUIPMENT: The electrical equipment in ATR sites 207, 215, 279, and Weigh in Motion (WIM) site 1 will be removed by the NDDOT prior to any work on each site. This equipment includes solar panels, regulators, controllers, modems, and other items inside each cabinet. All other items to be removed shall become property of the Contractor.

The Environmental Sensor Station (ESS) equipment from the New Salem, Sterling, and Medina sites shall be removed by the Contractor and delivered to the Bismarck District office. This includes cabinets, sensors, towers, and electronics. All other items shall become property of the Contractor.

Robert Steckler
NDDOT Bismarck District Office
218 Airport Rd.
Bismarck, ND 58504
(701) 328-6935
rsteckler@nd.gov

The ESS equipment from the Fryburg ESS site shall be delivered to the Dickinson District Office. This includes cabinets, sensors, tower, and electronics. All other items shall become property of the Contractor.

Aaron Auer
NDDOT Dickinson District Office
1700 3rd Ave. W.
Dickinson, ND 58601
(701) 227-6504
aaauer@nd.gov

All costs associated with this work shall be included in the price bid for "Automatic Traffic Recorder System", "Virtual Weigh In Motion System", and "Install ESS Station/RWIS".

772-P02 FEED POINTS: The following changes will be made to feed points as part of this project.

Site 201, Ray- Two meters are currently on the north side of the road mounted to a nearby utility pole. One meter will be removed as part of this project. For more information contact:

Bruce Balerud
Mountrail-Williams Electric Coop.
218 58th St. W.
Williston, ND 58802
(701) 577-3765
bruce@mwec.com

Site 207, Medina- The switch box will be removed from the utility pole. New switch boxes will be installed on the ESS and ATR cabinets. The meter will remain on the utility pole. For more information contact:

Rich Short
Northern Plains Electric Coop.
1515 W. Main
Carrington, ND 58421
(701) 652-3156
richs@nplains.com

Site 215, Jamestown- A new meter will be installed on the existing wood utility pole. For more information contact:

Rich Short
Northern Plains Electric Coop.
1515 W. Main
Carrington, ND 58421
(701) 652-3156
richs@nplains.com

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NOTES

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772-P03 REVISE ATR: SP 240(14) "Automatic Traffic Recorder System" contains information for a new ATR site. ATR Sites 201 and 503 have minor work such as new loops and sensors. The Contractor shall refer only to the Special Provision details relating to the work outlined in the plans.

772-P04 REVISE ESS: SP 242(14) "Environmental Sensor Station" contains information for a new ESS site. The Sterling ESS Site will use the existing tower. The Contractor shall refer only to the Special Provision details relating to the work outlined in the plans.

772-P05 CONCRETE JOINTS: This note applies to ATR sites 201 and 207.

A non-metallic conduit shall be placed over the loop wire at each longitudinal concrete joint. The PEEK certified technician should be on site to provide guidance if needed. The Contractor shall insure that the conduit material will not interfere with the properties of the concrete or degrade the electrical signal output from the loop wire.

All costs associated with this work shall be included in the price bid for "Automatic Traffic Recorder System" and "Revise Automatic Traffic Recorder System".

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ENVIRONMENTAL COMMITMENTS

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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ENVIRONMENTAL COMMITMENTS (EC): The North Dakota Department of Transportation and the Federal Highway Administration has made environmental commitments to secure approval of this project. The environmental commitments are as follows:

EC-1: Unavoidable impacts to wetlands will be mitigated onsite.

ACTION REQUIRED/TAKEN: 1.24 acres of wetlands are jurisdictional and 2.29 acres of wetlands are non-jurisdictional. .001 acres of temporary wetland impacts to wetland number 5 will result from construction activities. Temporary impact areas will be graded to preconstruction contours.

Wetland Impact Table																			
Wetland Number	Location	Cowardin Class.	Wetland Type	Wetland Size (acres)	Wetland Feature	USACE Jurisdictional Wetlands ¹	Wetland Impacts (acres)		USFWS Easement Impacts (acres)		Wetland Mitigation								
							Temp.	Perm.	Temp.	Perm.	Mitigation Required			Bank		Onsite			
											EO 11990	USACE	USFWS	Location	acres	Mitigation Location; Ratio	acres	Constructed Site #	Constructed size (acres)
1***	Sec. 35, T141N, R64W	PEMA	Basin	1.71	Natural	No													
2a**	Sec. 3, T160N, R51W	PEMCx	Ditch	0.97	Artificial	Yes													
2b**	Sec. 2/3, T160N, R51W	PEMCx	Ditch	0.1	Artificial	Yes													
3**	Sec. 2/3, T160N, R51W	PEMC	Basin	0.14	Natural	Yes													
4**	Sec. 2/3, T160N, R51W	PEMA	Basin	0.03	Natural	Yes													
5***	Sec. 2, T138N, R80W	PEMAx	Ditch	0.25	Artificial	No	0.001												
6***	Sec. 17, T139N, R85W	PEMAx	Ditch	0.33	Artificial	No													
Totals				3.53			0.001	0	0	0				0			0		0

** Wetland Jurisdictional Determination was issued by the USACE: (previous project) NWO-2015-0216-BIS

*** Wetland Jurisdictional Determination was issued by the USACE: 10/16/2015 NWO-2015-1721-BIS.

ESTIMATE OF QUANTITIES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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SPEC CODE	ITEM DESCRIPTION	UNIT	SS-9-999(340)	ITS-9-999(350)	TOTAL
-----	-----	-----	-----	-----	-----
103	0100 CONTRACT BOND	L SUM	0.55	0.45	1
702	0100 MOBILIZATION	L SUM	0.55	0.45	1
704	0100 FLAGGING	MHR	240	160	400
704	1000 TRAFFIC CONTROL SIGNS	UNIT	561	459	1,020
704	1060 DELINEATOR DRUMS	EA	16	14	30
704	1065 TRAFFIC CONES	EA	11	9	20
704	1067 TUBULAR MARKERS	EA	27	23	50
704	1087 SEQUENCING ARROW PANEL-TYPE C	EA	0.55	0.45	1
772	9010 AUTOMATIC TRAFFIC RECORDER SYSTEM	EA	3		3
772	9012 REVISE AUTOMATIC TRAFFIC RECORDER SYSTEM	EA	2		2
772	9110 VIRTUAL WEIGH IN MOTION SYSTEM	EA	1		1
772	9151 INSTALL ESS STATION/RWIS	EA		4	4

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810

Right of way line

11'
4'

Approximate area of temporary impacts (.001 acres)

Wetland 5

☉ of roadway

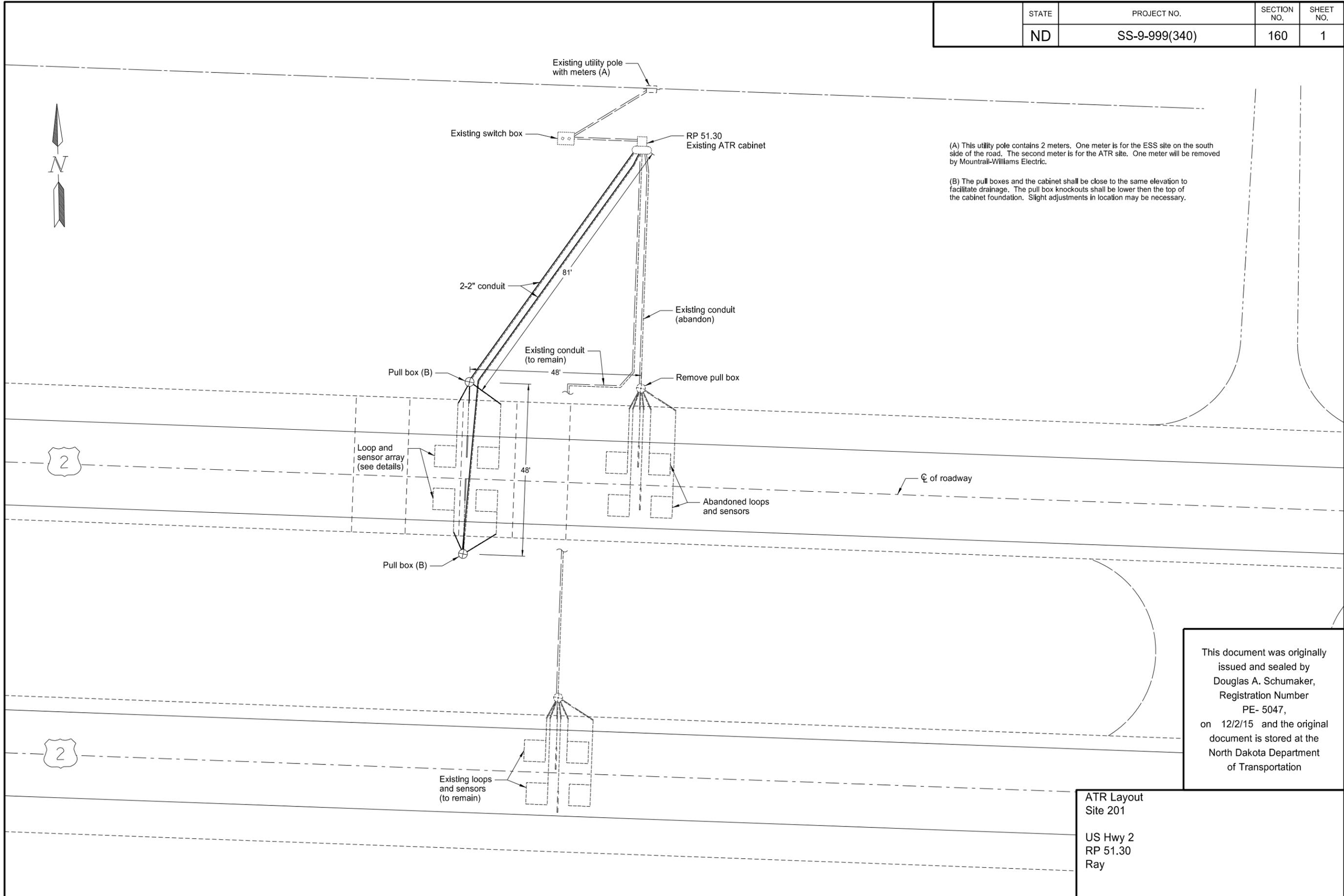
☉ of roadway

Right of way line

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Wetland Layout Site 503
ND Hwy 810
RP 5.58
Bismarck Expressway

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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(A) This utility pole contains 2 meters. One meter is for the ESS site on the south side of the road. The second meter is for the ATR site. One meter will be removed by Mountrail-Williams Electric.

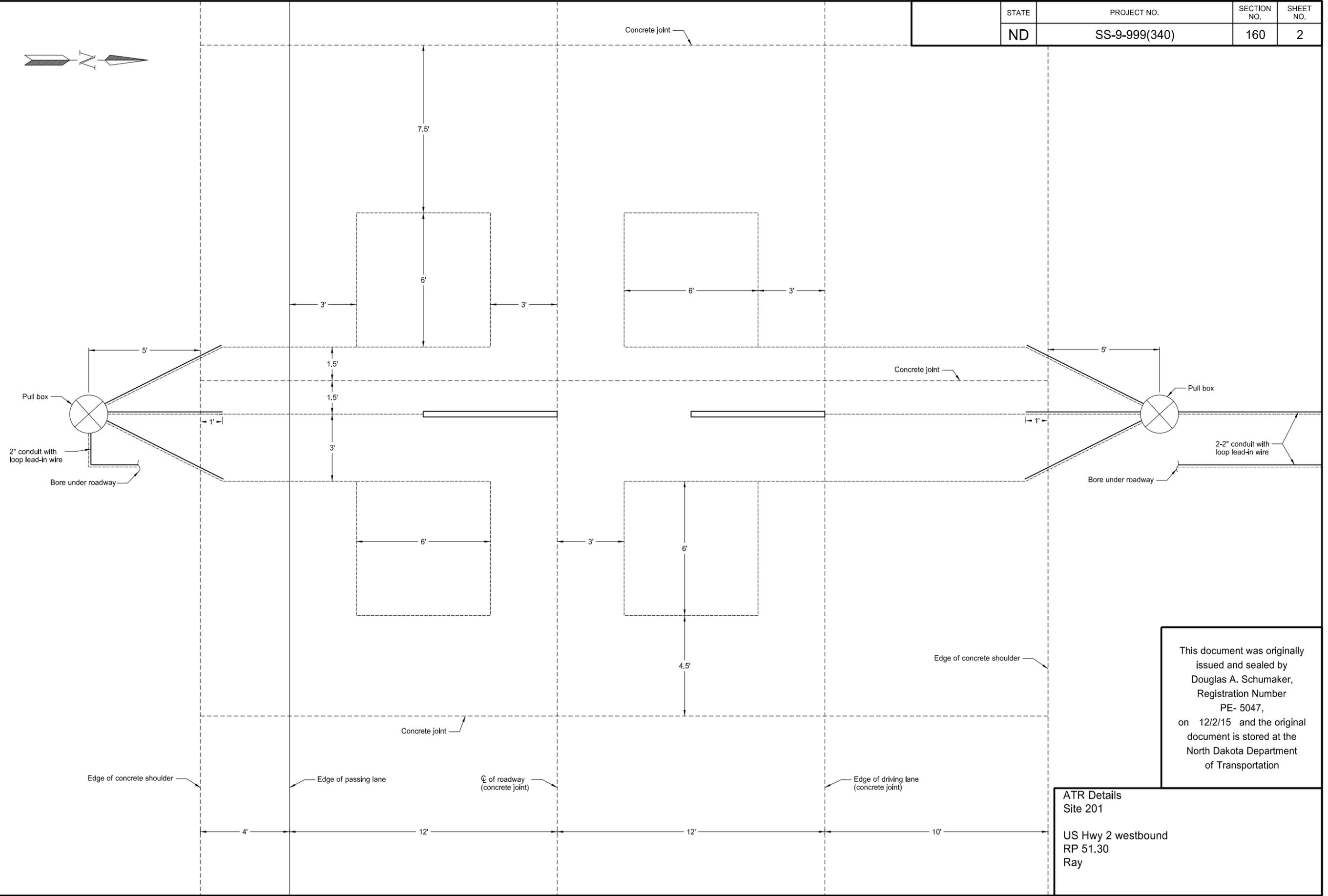
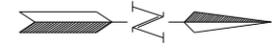
(B) The pull boxes and the cabinet shall be close to the same elevation to facilitate drainage. The pull box knockouts shall be lower than the top of the cabinet foundation. Slight adjustments in location may be necessary.

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ATR Layout
Site 201

US Hwy 2
RP 51.30
Ray

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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ATR Details
 Site 201
 US Hwy 2 westbound
 RP 51.30
 Ray

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	3

Quantities (A)		
PVC Pull Box	EA	2
Shielded Twisted Pair Loop Lead-In Wire 14 AWG XHHW	LF	960
Conductor Loop Wire 14 AWG XHHW (B)	LF	272
Saw Slot and Sealant for Loops	LF	144
3/4 Inch Diameter Rigid HDPE Conduit	LF	42
2 Inch Diameter Rigid HDPE Conduit	LF	234
AXOR K 6 Foot Class II Piezo Electric Sensor including cable, epoxy, and mounting accessories	EA	2
4G Cellular Modem with all necessary cabling including ethernet and power cables	EA	1
Ethernet Lightning Suppressor	EA	1
PEEK Representative Oversight	EA	1
Vehicle Classification and Testing	EA	1
30 Day Monitoring Period	EA	1
Excavation	CY	0.70
Fill required	CY	0.22
Seeding Class II	SF	650

Revise Automatic Traffic Recorder System	EA	1
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(A) These quantities shall be included in the price bid for the item "Revise Automatic Traffic Recorder System".
(B) The Entrance and Exit Loops shall be 6'x6' with 4 turns of conductor per loop.

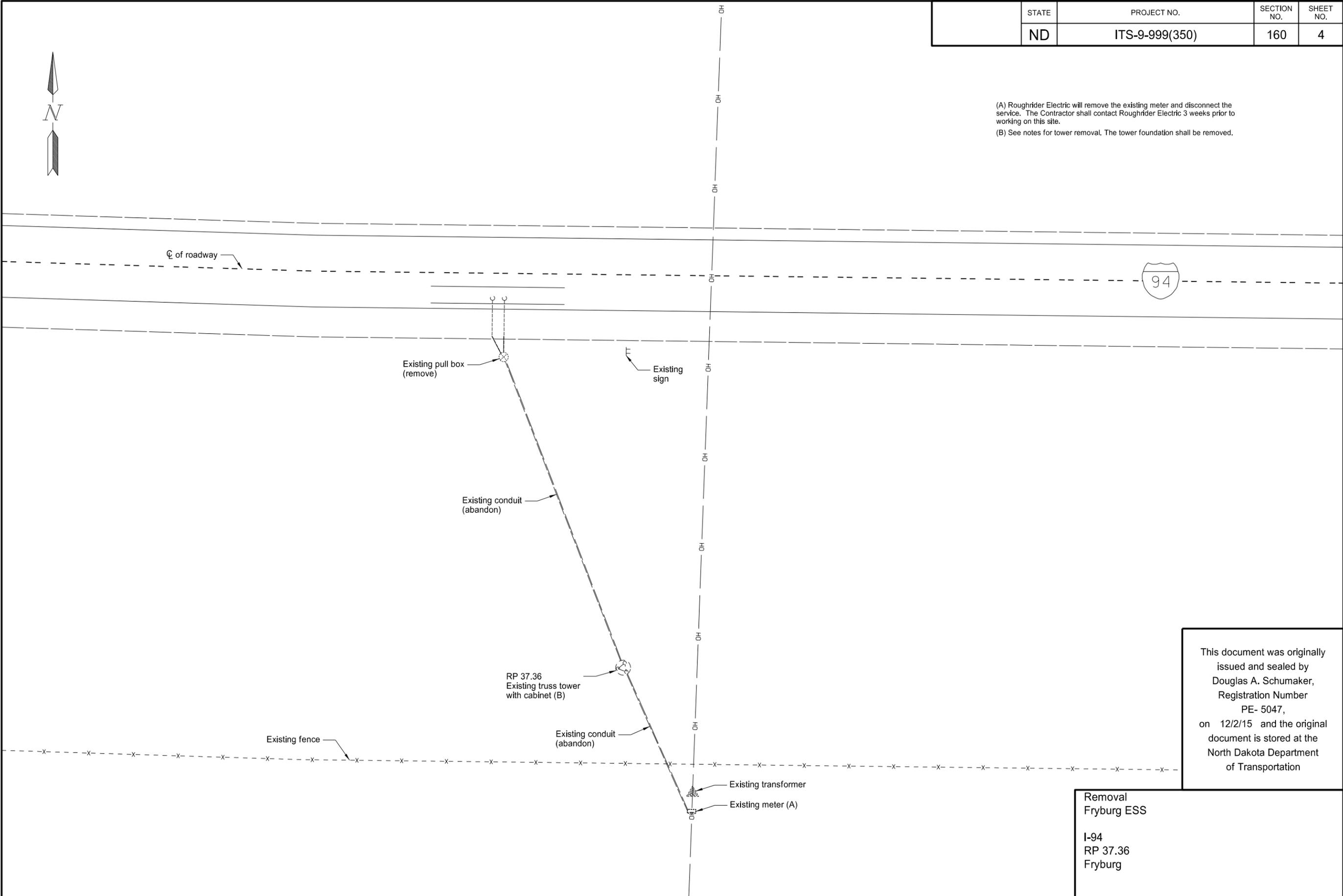
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ATR Quantities
Site 201
US Hwy 2
RP 51.30
Ray

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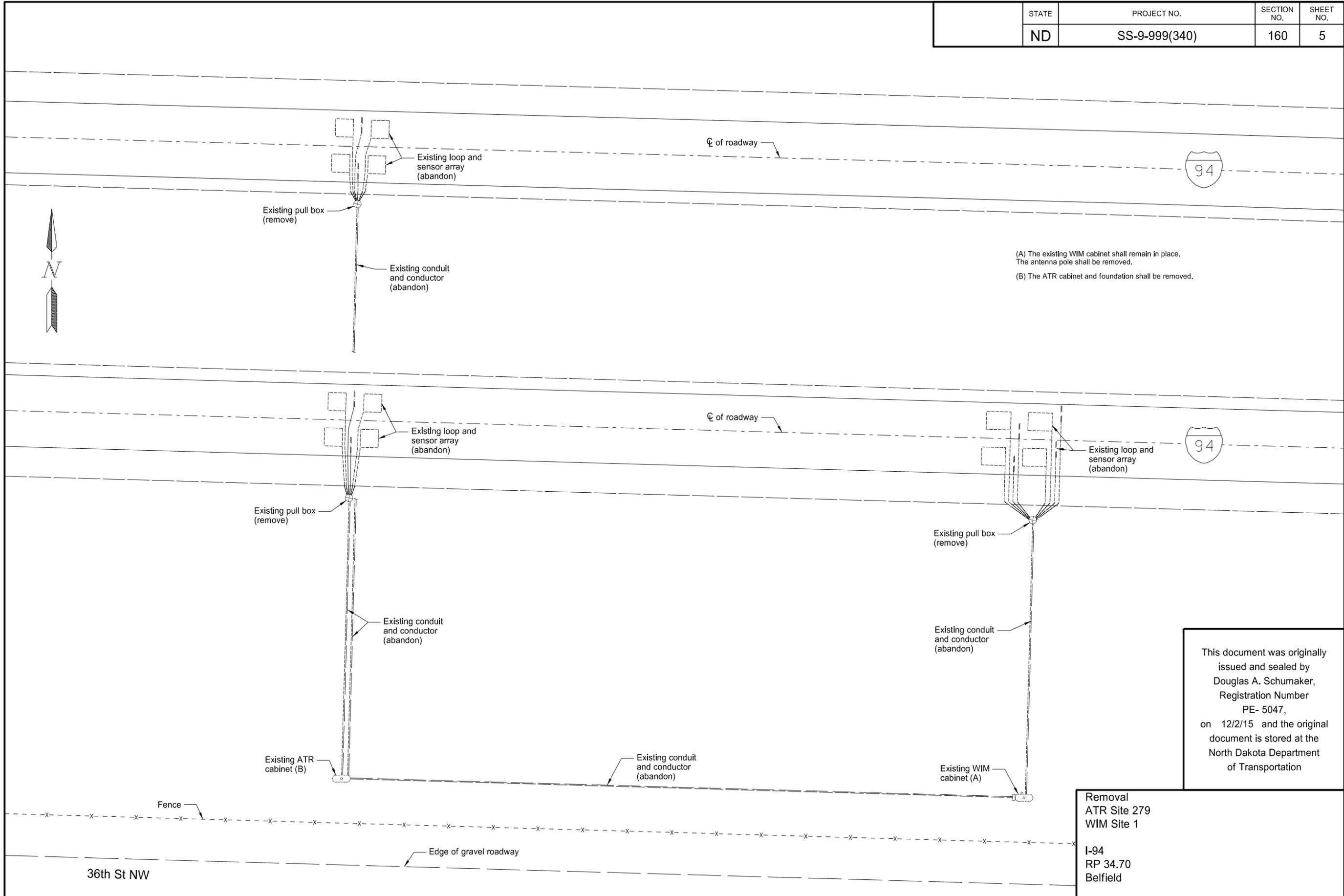
(A) Roughrider Electric will remove the existing meter and disconnect the service. The Contractor shall contact Roughrider Electric 3 weeks prior to working on this site.
 (B) See notes for tower removal. The tower foundation shall be removed.



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Removal
 Fryburg ESS
 I-94
 RP 37.36
 Fryburg

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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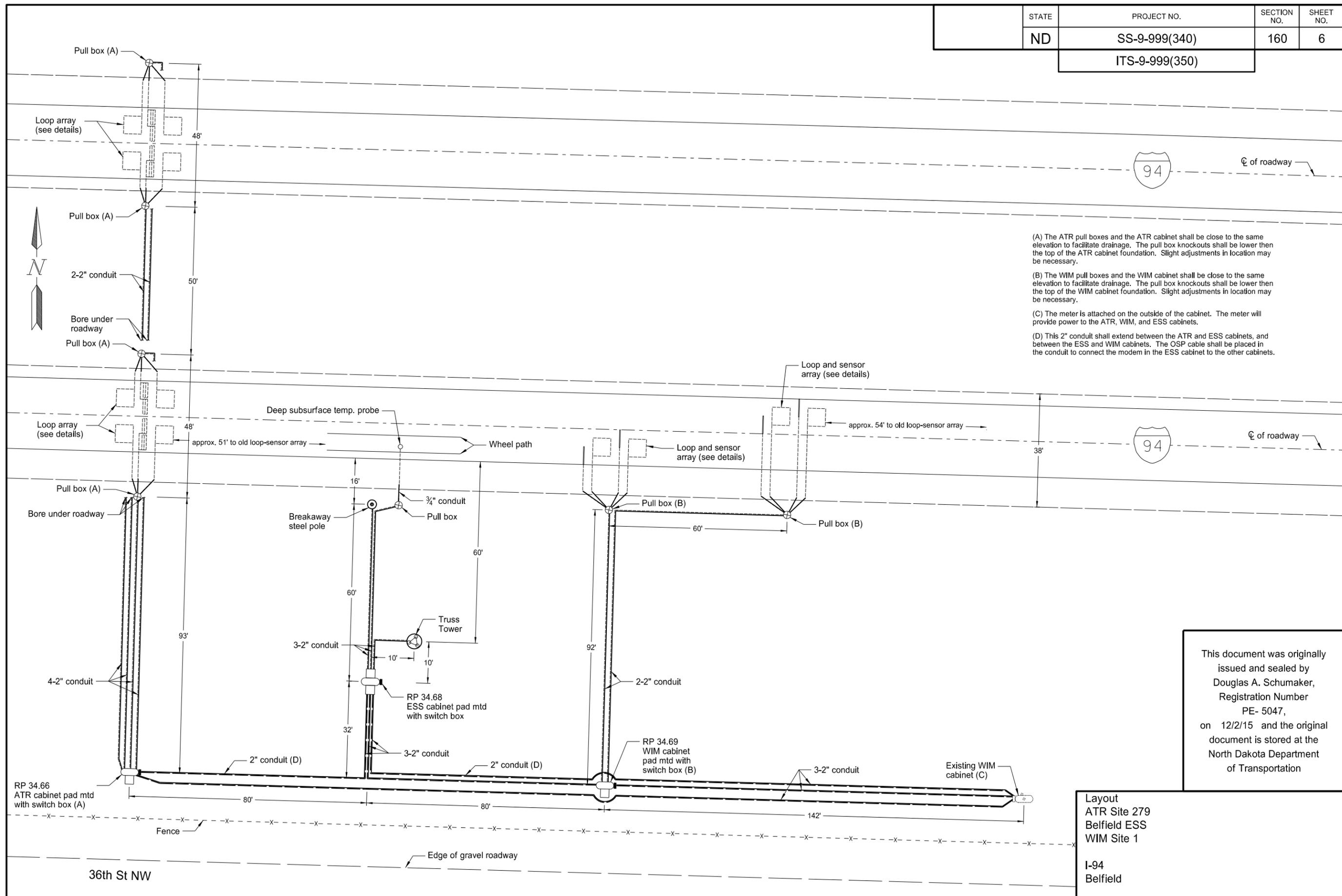


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Removal
ATR Site 279
WIM Site 1

I-94
RP 34.70
Belfield

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
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		ITS-9-999(350)		

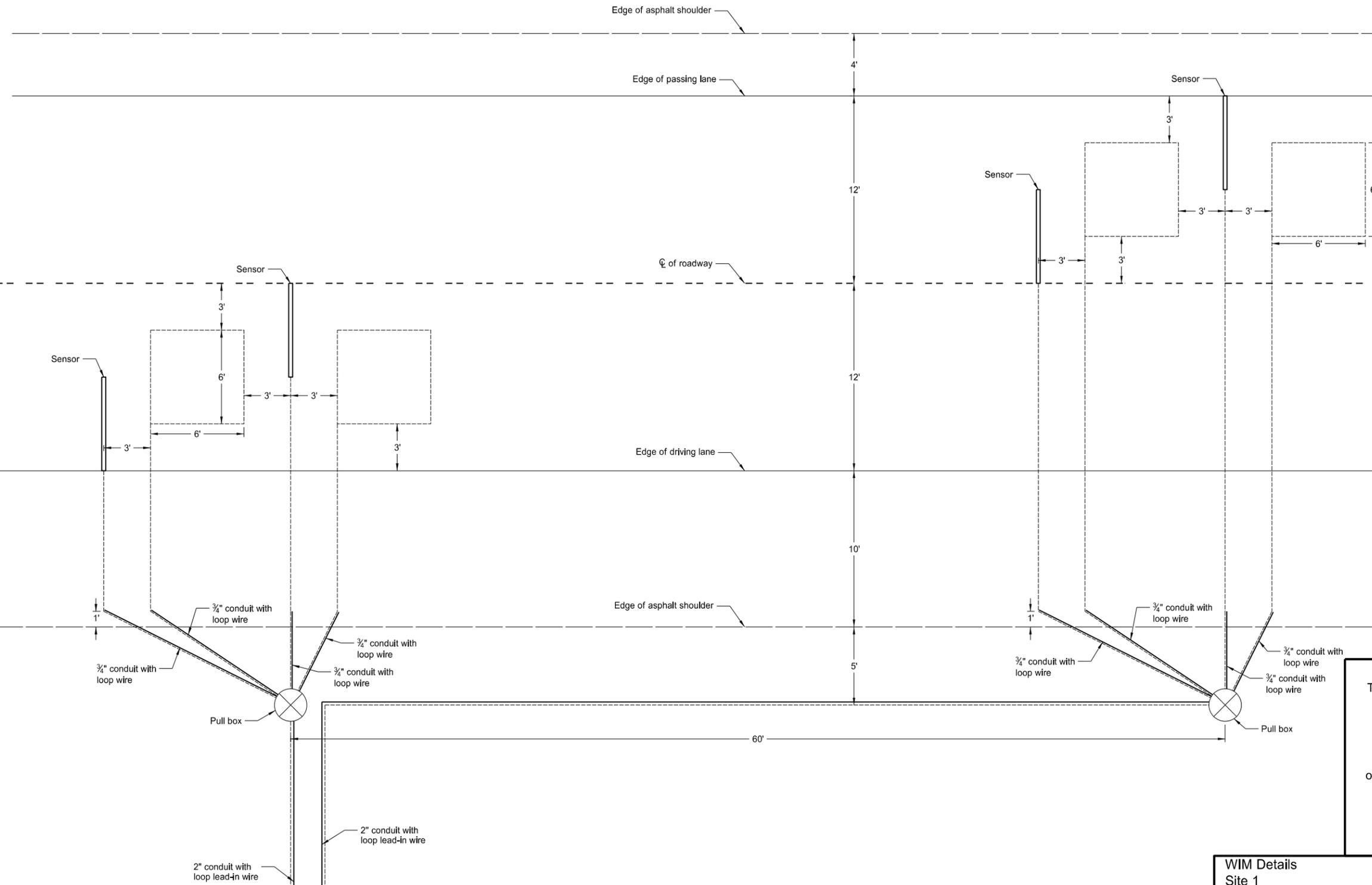


- (A) The ATR pull boxes and the ATR cabinet shall be close to the same elevation to facilitate drainage. The pull box knockouts shall be lower than the top of the ATR cabinet foundation. Slight adjustments in location may be necessary.
- (B) The WIM pull boxes and the WIM cabinet shall be close to the same elevation to facilitate drainage. The pull box knockouts shall be lower than the top of the WIM cabinet foundation. Slight adjustments in location may be necessary.
- (C) The meter is attached on the outside of the cabinet. The meter will provide power to the ATR, WIM, and ESS cabinets.
- (D) This 2" conduit shall extend between the ATR and ESS cabinets, and between the ESS and WIM cabinets. The OSP cable shall be placed in the conduit to connect the modem in the ESS cabinet to the other cabinets.

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Layout
 ATR Site 279
 Belfield ESS
 WIM Site 1
 I-94
 Belfield

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	7

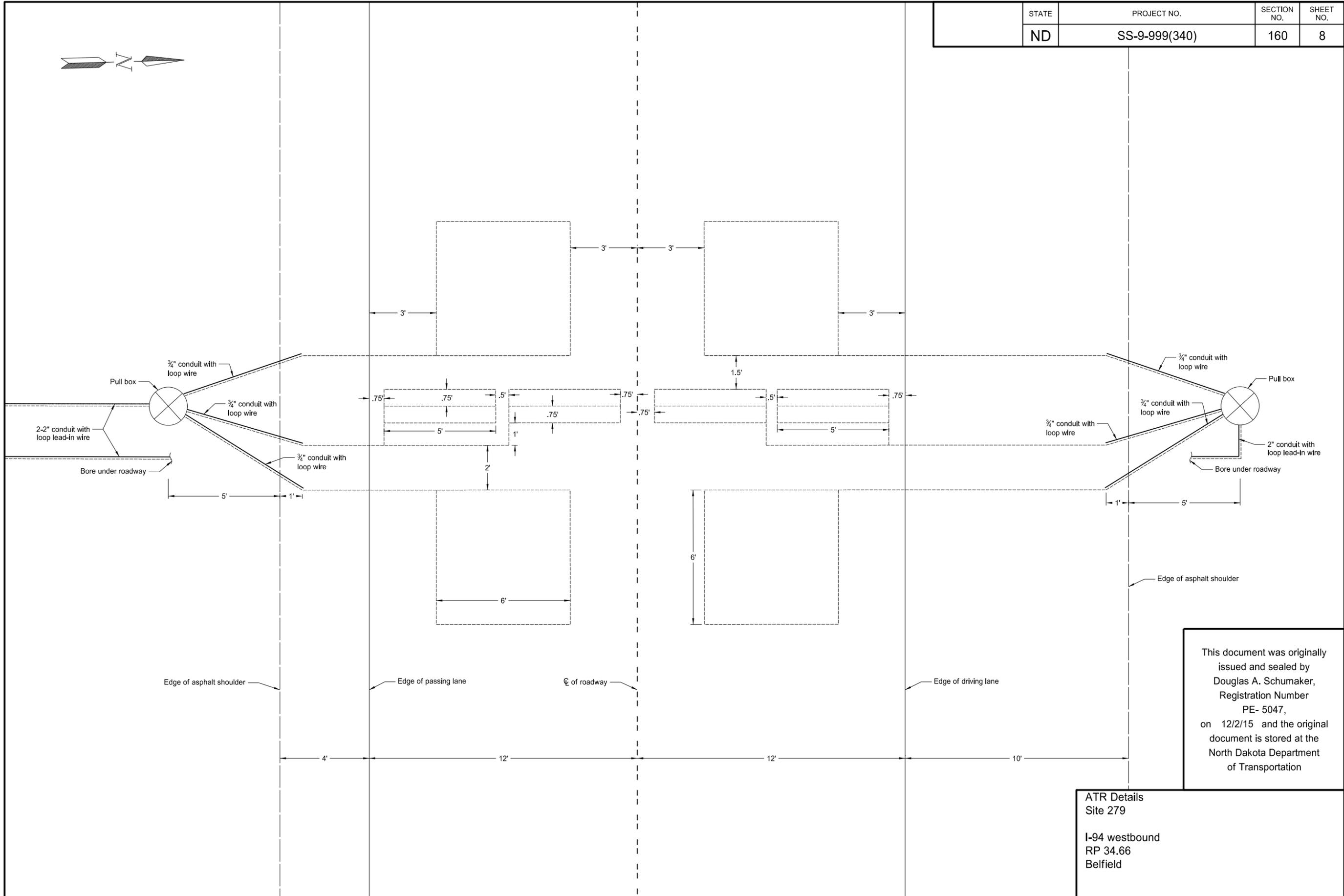
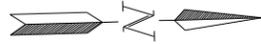


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WIM Details
Site 1

I-94 eastbound
RP 34.69
Belfield

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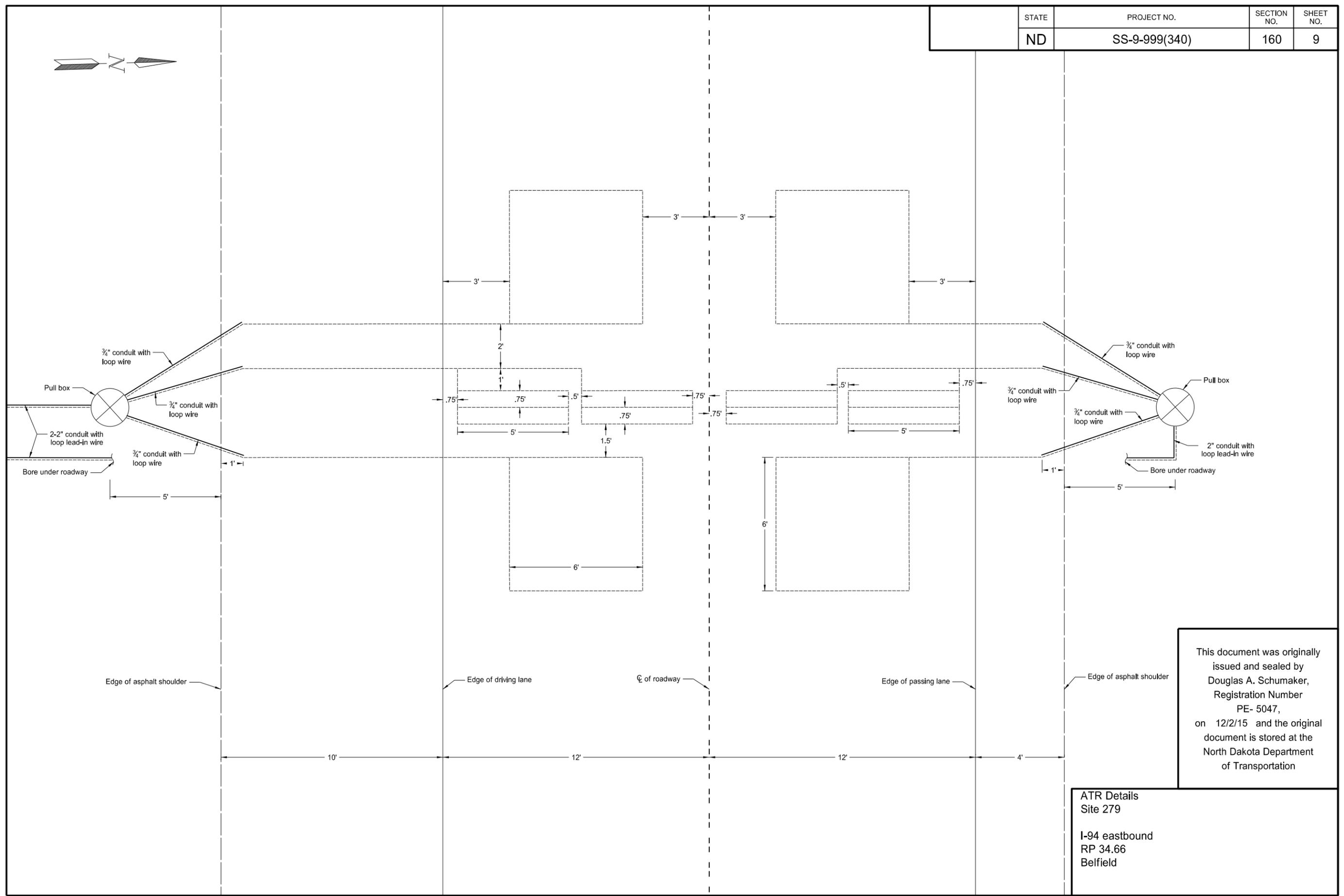
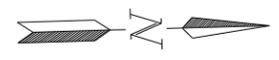


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ATR Details
Site 279

I-94 westbound
RP 34.66
Belfield

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ATR Details
 Site 279
 I-94 eastbound
 RP 34.66
 Belfield

Quantities (A)		
PVC Pull Box	EA	4
Underground Conductor No 4 Type RHW (B)	LF	644
Underground Conductor No 6 Type THW (B)	LF	322
Shielded Twisted Pair Loop Lead-In Wire 14 AWG XHHW	LF	2896
Conductor Loop Wire 14 AWG XHHW (C)	LF	2080
Saw Slot and Sealant for Loops	LF	465
3/4 Inch Diameter Rigid HDPE Conduit	LF	96
2 Inch Diameter Rigid HDPE Conduit (D)	LF	1054
NEMA Type 3R Ground Mounted Cabinet with AC Power Panel and Sensor Surge Boards with Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
PEEK ADR 6000 Traffic Counter/Classifier with all necessary cabling plus IDRIS License	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
GFCI/Duplex Receptacles (3), Thermostatically Controlled Fan	EA	1
Telephone with Surge Protection	EA	1
OSP Cat 6 Cable (E)	LF	132
PEEK Representative Oversight	EA	1
Video Verification and Validation	EA	1
30 Day Monitoring Period	EA	1
Excavation	CY	1.93
Fill required	CY	0.76
Seeding Class II	SF	2300
Remove ATR cabinet, foundation, and pull boxes (F)	EA	1

Automatic Traffic Recorder System	EA	1
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- (A) These quantities shall be included in the price bid for the item "Automatic Traffic Recorder System".
- (B) 1 No 6 and 2 No 4 conductors are provided to extend from the ATR cabinet to the meter. Northern Plains Electric will provide the service connection to the existing meter.
- (C) The Entrance and Exit Loops shall be 6'x6' with 4 turns of conductor per loop. The Inner Axle Loops shall be 1.5'x5' Quadrapol with 3 turns of conductor.
- (D) This quantity includes an extra 20' conduit stub out for future use. Both ends shall be capped.
- (E) This cable will extend from the ATR cabinet to the ESS cabinet.
- (F) Refer to the notes for more details.

Quantities (F)		
PVC Pull Box	EA	2
Underground Conductor No 4 Type RHW (G)	LF	324
Underground Conductor No 6 Type THW (G)	LF	162
Shielded Twisted Pair Loop Lead-In Wire 14 AWG XHHW	LF	1096
Conductor Loop Wire 14 AWG XHHW (H)	LF	648
Saw Slot and Sealant for Loops	LF	264
3/4 Inch Diameter Rigid HDPE Conduit	LF	72
2 Inch Diameter Rigid HDPE Conduit (I)	LF	582
Kistler Lineas Quartz Sensor including cable, epoxy, and mounting accessories	EA	4
NEMA Type 3R Ground Mounted Cabinet with AC Power Panel, 6 unit Power Strip, Surge Protector, & Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
IRD brand iSINC Lite Electronics data collection equipment	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
Detector Amplifier Input Unit	EA	1
OSP Cat 6 Cable (J)	LF	132
IRD Technician Oversight	EA	1
Calibration and Testing	EA	1
30 Day Monitoring Period	EA	1
Excavation	CY	1.23
Fill required	CY	0.22
Seeding Class II	SF	960
Remove pull box and antenna (K)	EA	1

Virtual Weigh in Motion System	EA	1
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- (F) These quantities shall be included in the price bid for the item "Virtual Weigh in Motion System".
- (G) 1 No 6 and 2 No 4 conductors are provided to extend from the ATR cabinet to the meter. Northern Plains Electric provides the service to the existing meter.
- (H) The Entrance and Exit Loops shall be 6'x6' with 4 turns of conductor per loop.
- (I) This quantity includes an extra 20' conduit stub out for future use. Both ends shall be capped.
- (J) This cable will extend from the WIM cabinet to the ESS cabinet.
- (K) Refer to the notes for more details.

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ATR & WIM Quantities
I-94
Belfield

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	ITS-9-999(350)	160	11

Quantities (A)		
PVC Pull Box	EA	1
Underground Conductor No 4 Type RHW (B)	LF	548
Underground Conductor No 6 Type THW (B)	LF	274
Saw Slot and Sealant	LF	24
3/4 Inch Diameter Rigid HDPE Conduit	LF	10
2 Inch Diameter Rigid HDPE Conduit	LF	493
Ground-Mounted ESS Cabinet with Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
30 Foot Hinged Truss Tower and Concrete Foundation	EA	1
30 Foot Steel Breakaway Pole and Concrete Foundation	EA	1
Remote Processing Unit	EA	1
4G Cellular Modem with all necessary cabling including ethernet and power cables	EA	1
Ethernet Switch	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
Non-Intrusive Pavement Temperature Sensor	EA	1
Non-Intrusive Pavement Condition Sensor	EA	1
Barometric Pressure Sensor (C)	EA	1
Deep Subsurface Temperature Probe	EA	1
Temperature/Relative Humidity Sensor	EA	1
Precipitation Occurrence Sensor	EA	1
Wind Speed/Direction Sensor	EA	1
Radiation Sensor	EA	1
Microwave Vehicle Detection System	EA	1
PTZ Camera with Memory Card	EA	1
OSP Cat 6 Cable (D)	LF	65
Infrared Illuminator	EA	1
No 12 AWG 2, 600V Cable (E)	LF	70
Qualified Technician	EA	1
Excavation	CY	2.98
Fill required	CY	1.32
Seeding Class II	SF	670
Remove ESS tower and foundation, sensors, and electronic equipment (F)	EA	1

Install ESS Station/RWIS	EA	1
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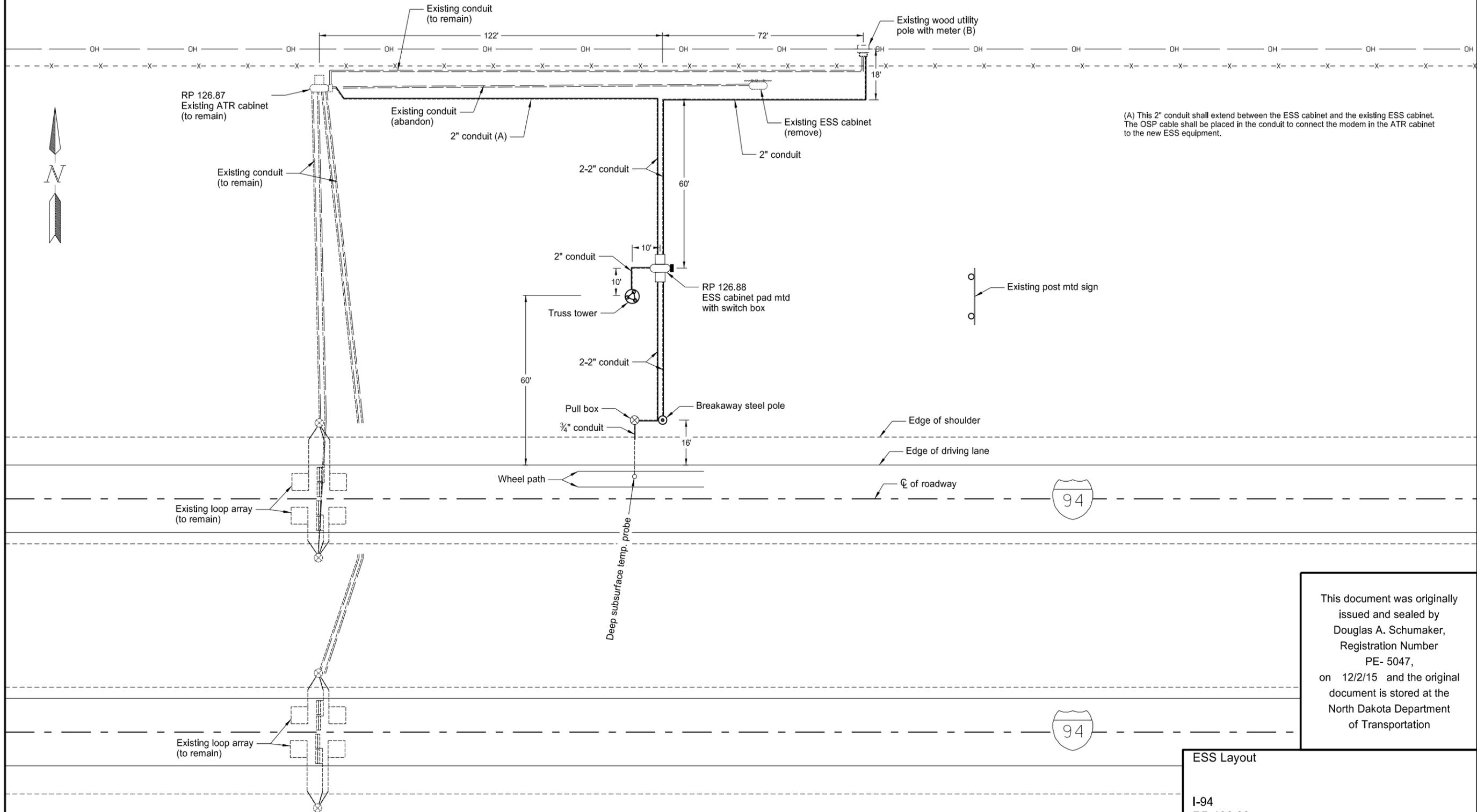
- (A) These quantities shall be included in the price bid for the item "Install ESS Station/RWIS".
(B) 1 No 6 and 2 No 4 conductors are provided to extend from the ESS cabinet to the feed point.
(C) The Barometric Pressure Sensor shall be mounted inside the ESS cabinet.
(D) This cable will extend from the ESS cabinet to the PTZ camera.
(E) This cable will extend from the ESS cabinet to the Infrared Illuminator.
(F) Refer to the notes for more details.

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ESS Quantities
I-94
Belfield

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	ITS-9-999(350)	160	12

Frontage Road



(A) This 2" conduit shall extend between the ESS cabinet and the existing ESS cabinet. The OSP cable shall be placed in the conduit to connect the modem in the ATR cabinet to the new ESS equipment.

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ESS Layout

I-94
RP 126.88
New Salem

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	ITS-9-999(350)	160	13

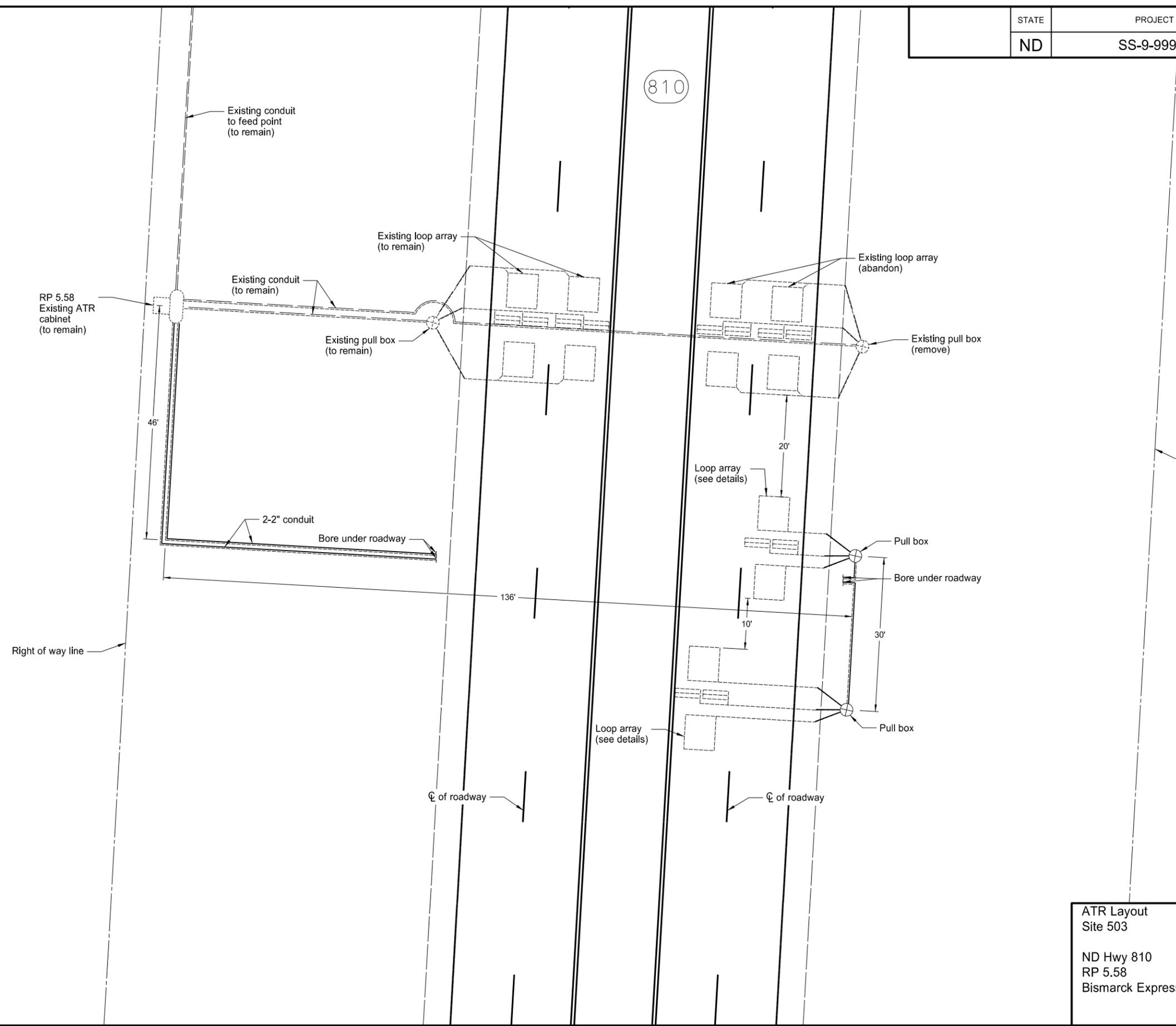
Quantities (A)		
PVC Pull Box	EA	1
Underground Conductor No 4 Type RHW (B)	LF	380
Underground Conductor No 6 Type THW (B)	LF	190
Saw Slot and Sealant	LF	24
3/4 Inch Diameter Rigid HDPE Conduit	LF	10
2 Inch Diameter Rigid HDPE Conduit	LF	597
Ground-Mounted ESS Cabinet with Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
30 Foot Hinged Truss Tower and Concrete Foundation	EA	1
30 Foot Steel Breakaway Pole and Concrete Foundation	EA	1
Remote Processing Unit	EA	1
Ethernet Switch (C)	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
Non-Intrusive Pavement Temperature Sensor	EA	1
Non-Intrusive Pavement Condition Sensor	EA	1
Barometric Pressure Sensor (D)	EA	1
Deep Subsurface Temperature Probe	EA	1
Temperature/Relative Humidity Sensor	EA	1
Precipitation Occurrence Sensor	EA	1
Wind Speed/Direction Sensor	EA	1
Radiation Sensor	EA	1
Microwave Vehicle Detection System	EA	1
PTZ Camera with Memory Card	EA	1
OSP Cat 6 Cable (E)	LF	65
Infrared Illuminator	EA	1
No 12 AWG 2, 600V Conductor Cable (F)	LF	70
Qualified Technician	EA	1
Excavation	CY	2.98
Seeding Class II	SF	1300
Remove ESS cabinet and foundation, electronic equipment, and perforated tube supports (G)	EA	1
Install ESS Station/RWIS	EA	1

- (A) These quantities shall be included in the price bid for the item "Install ESS Station/RWIS".
- (B) 1 No 6 and 2 No 4 conductors are provided to extend from the ESS cabinet to the meter.
- (C) The Ethernet Switch shall be installed in the ATR cabinet.
- (D) The Barometric Pressure Sensor shall be mounted inside the ESS cabinet.
- (E) This cable will extend from the ESS cabinet to the PTZ camera.
- (F) This cable will extend from the ESS cabinet to the Infrared Illuminator.
- (G) Refer to the notes for more details.

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ESS Quantities
I-94
RP 126.88
New Salem

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	14

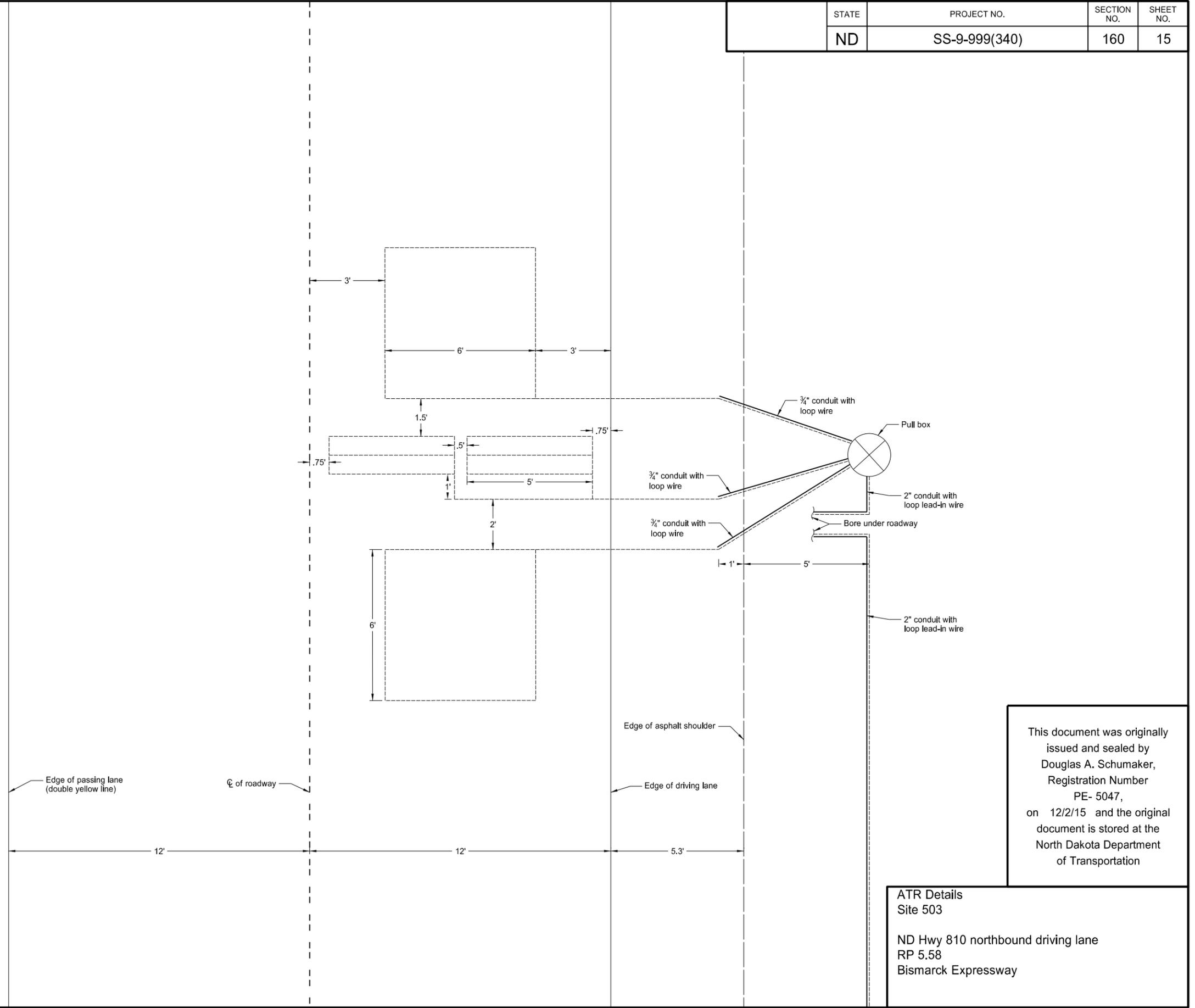


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ATR Layout
Site 503

ND Hwy 810
RP 5.58
Bismarck Expressway

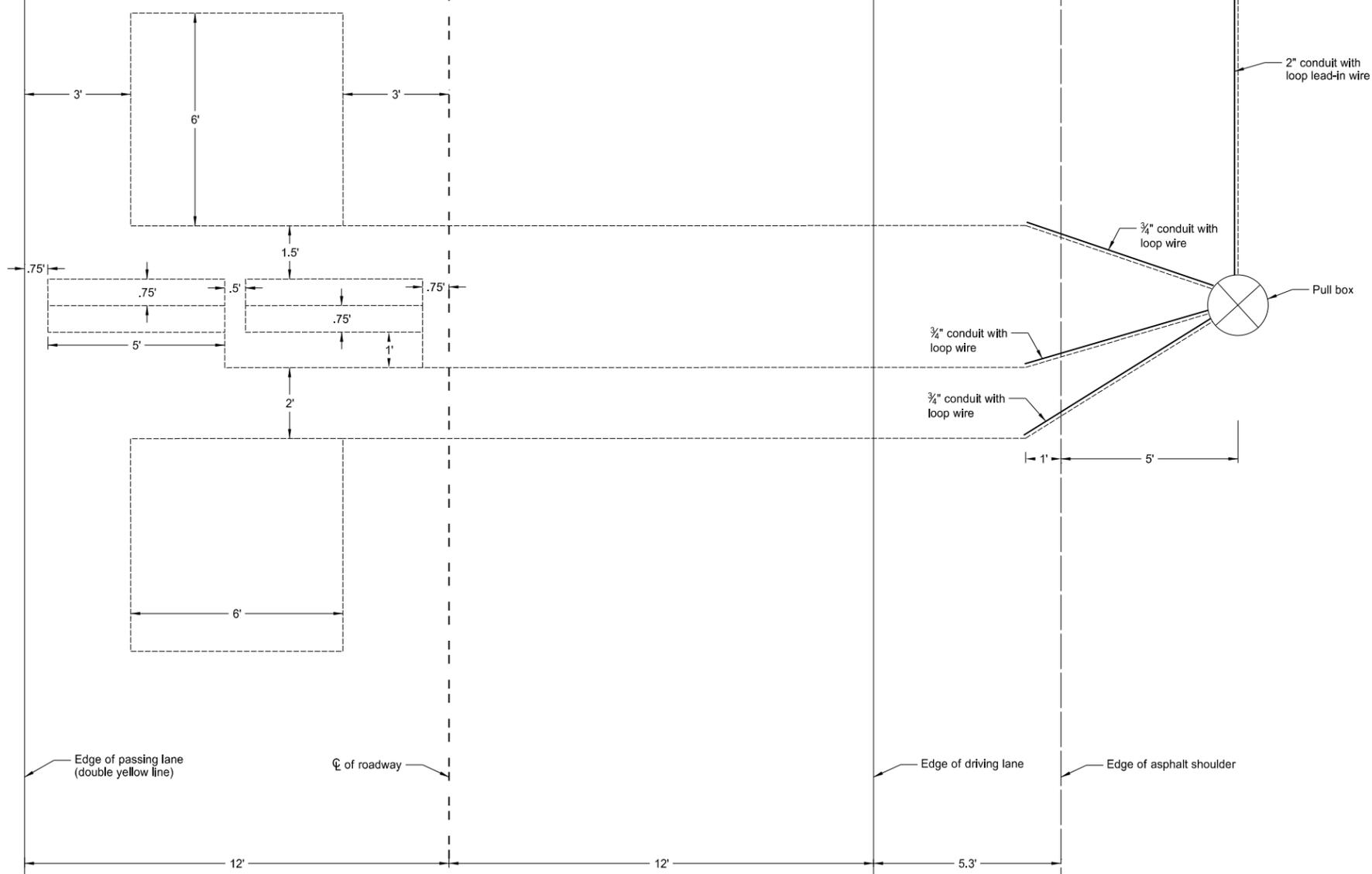
STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	15



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ATR Details
 Site 503
 ND Hwy 810 northbound driving lane
 RP 5.58
 Bismarck Expressway

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	16



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ATR Details
 Site 503
 ND Hwy 810 northbound passing lane
 RP 5.58
 Bismarck Expressway

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	17

Quantities (A)		
PVC Pull Box	EA	2
Shielded Twisted Pair Loop Lead-In Wire 14 AWG XHHW	LF	1696
Conductor Loop Wire 14 AWG XHHW (B)	LF	805
Saw Slot and Sealant for Loops	LF	280
3/4 Inch Diameter Rigid HDPE Conduit	LF	42
2 Inch Diameter Rigid HDPE Conduit	LF	418
4G Cellular Modem with all necessary cabling including ethernet and power cables	EA	1
Ethernet Lightning Suppressor	EA	1
PEEK Representative Oversight	EA	1
Vehicle Classification and Testing	EA	1
30 Day Monitoring Period	EA	1
Excavation	CY	0.70
Fill required	CY	0.22
Seeding Class II	SF	620

Revise Automatic Traffic Recorder System	EA	1
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(A) These quantities shall be included in the price bid for the item "Revise Automatic Traffic Recorder System".

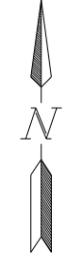
(B) The Entrance and Exit Loops shall be 6'x6' with 4 turns of conductor per loop.
The Inner Axle Loops shall be 1.5'x5' Quadrapol with 3 turns of conductor.

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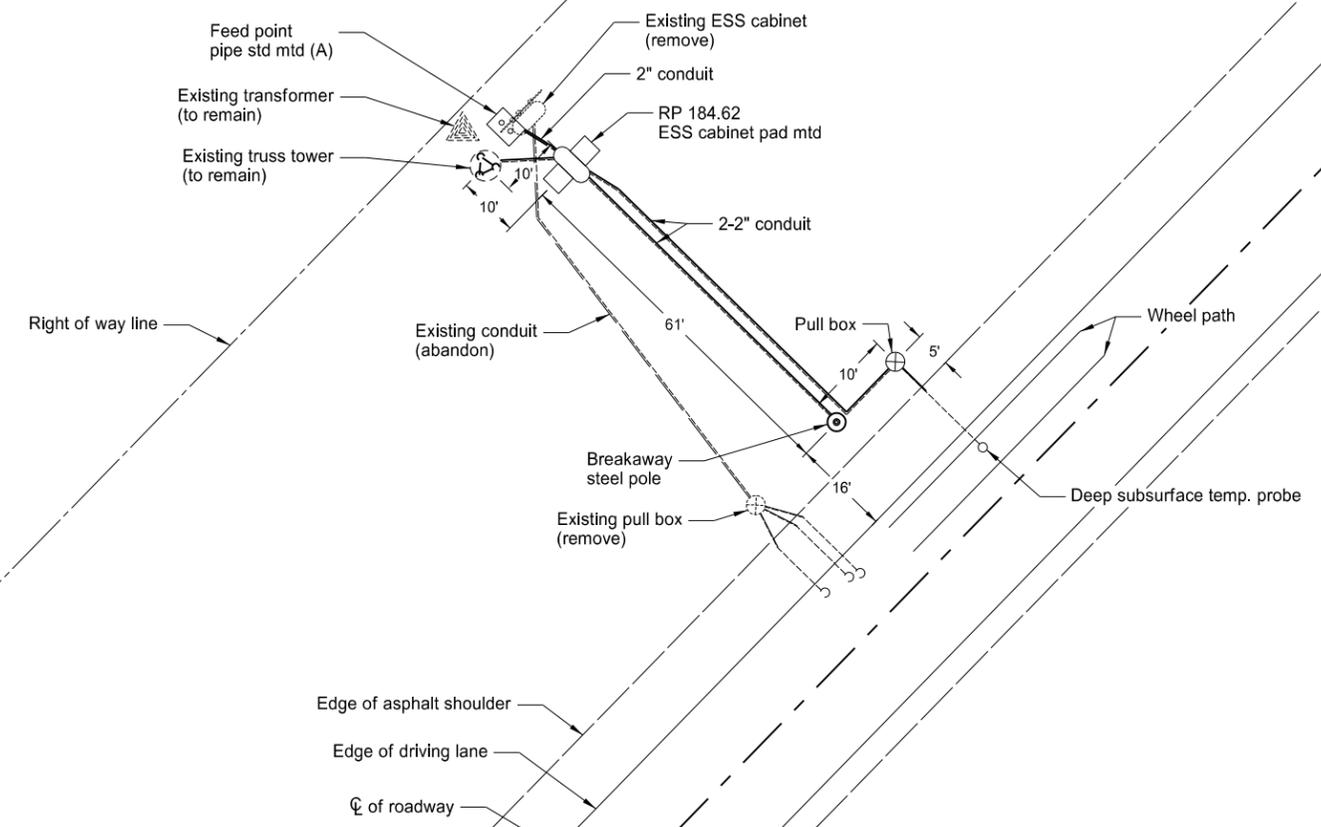
ATR Quantities
Site 503

ND Hwy 810
RP 5.58
Bismarck Expressway

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	ITS-9-999(350)	160	18



(A) A new pipe stand feed point shall be built in the location shown. The existing switch box and meter shall be moved to the new pipe stand feed point.



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ESS Layout
I-94
RP 184.62
Sterling

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	ITS-9-999(350)	160	19

Quantities (A)		
PVC Pull Box	EA	1
Underground Conductor No 4 Type RHW (B)	LF	80
Underground Conductor No 6 Type THW (B)	LF	40
Saw Slot and Sealant	LF	24
3/4 Inch Diameter Rigid HDPE Conduit	LF	10
2 Inch Diameter Rigid HDPE Conduit	LF	251
Ground-Mounted ESS Cabinet with Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
30 Foot Steel Breakaway Pole and Concrete Foundation	EA	1
Remote Processing Unit	EA	1
4G Cellular Modem with all necessary cabling including ethernet and power cables	EA	1
Ethernet Switch	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
Non-Intrusive Pavement Temperature Sensor	EA	1
Non-Intrusive Pavement Condition Sensor	EA	1
Barometric Pressure Sensor (C)	EA	1
Deep Subsurface Temperature Probe	EA	1
Temperature/Relative Humidity Sensor	EA	1
Precipitation Occurrence Sensor	EA	1
Wind Speed/Direction Sensor	EA	1
Radiation Sensor	EA	1
Microwave Vehicle Detection System	EA	1
PTZ Camera with Memory Card	EA	1
OSP Cat 6 Cable (D)	LF	65
Infrared Illuminator	EA	1
No 12 AWG 2, 600V Conductor Cable (E)	LF	70
Qualified Technician	EA	1
Excavation	CY	2.08
Fill required	CY	0.22
Seeding Class II	SF	700
Remove ESS cabinet, supports, sensors, and electronic equipment (F)	EA	1

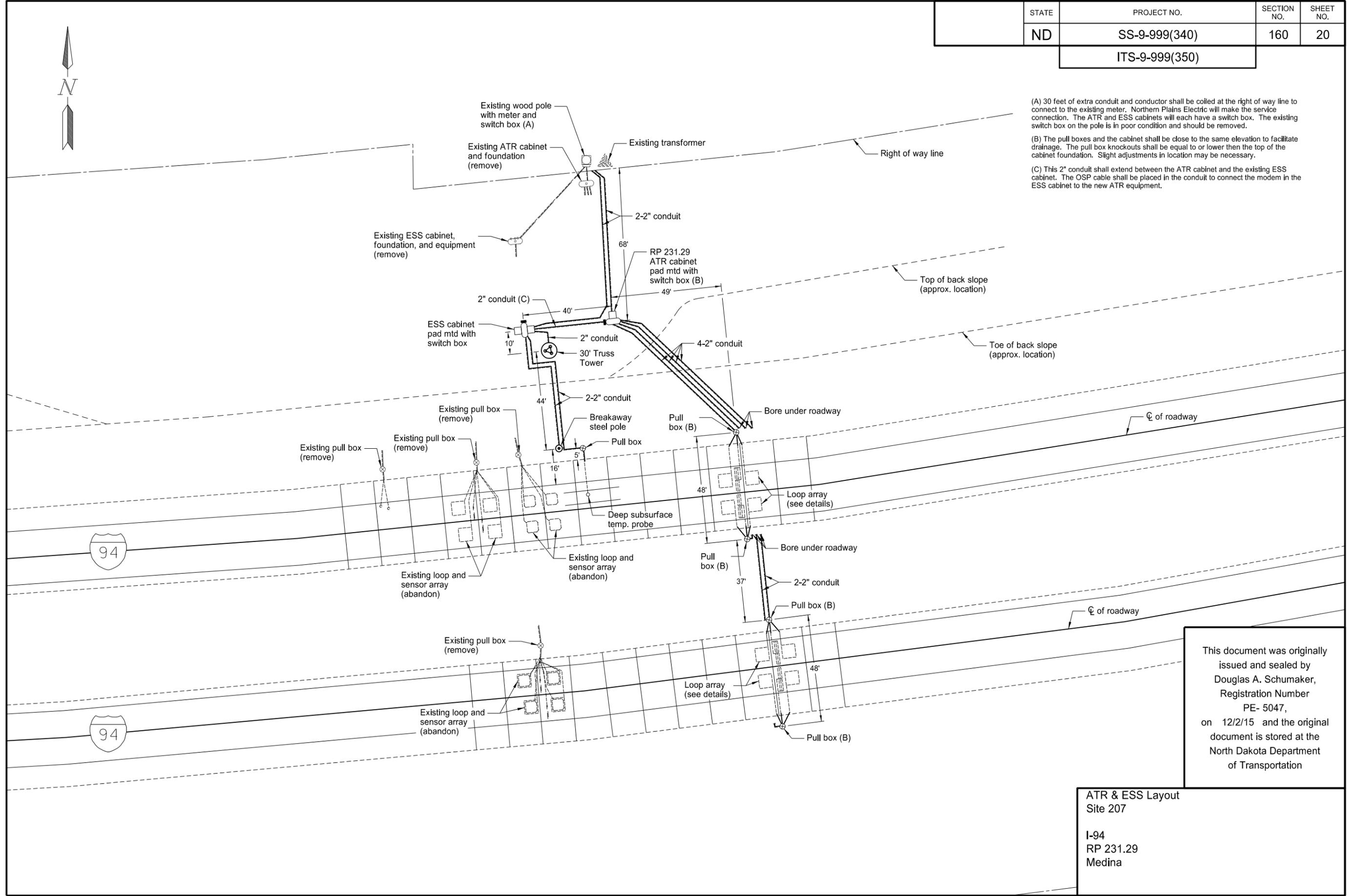
Install ESS Station/RWIS	EA	1
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- (A) These quantities shall be included in the price bid for the item "Install ESS Station/RWIS".
- (B) 1 No 6 and 2 No 4 conductors are provided to extend from the ESS cabinet to the feed point.
- (C) The Barometric Pressure Sensor shall be mounted inside the ESS cabinet.
- (D) This cable will extend from the ESS cabinet to the PTZ camera.
- (E) This cable will extend from the ESS cabinet to the Infrared Illuminator.
- (F) Refer to the notes for more details.

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ESS Quantities
I-94
RP 184.62
Sterling

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	20
ITS-9-999(350)			



(A) 30 feet of extra conduit and conductor shall be coiled at the right of way line to connect to the existing meter. Northern Plains Electric will make the service connection. The ATR and ESS cabinets will each have a switch box. The existing switch box on the pole is in poor condition and should be removed.

(B) The pull boxes and the cabinet shall be close to the same elevation to facilitate drainage. The pull box knockouts shall be equal to or lower than the top of the cabinet foundation. Slight adjustments in location may be necessary.

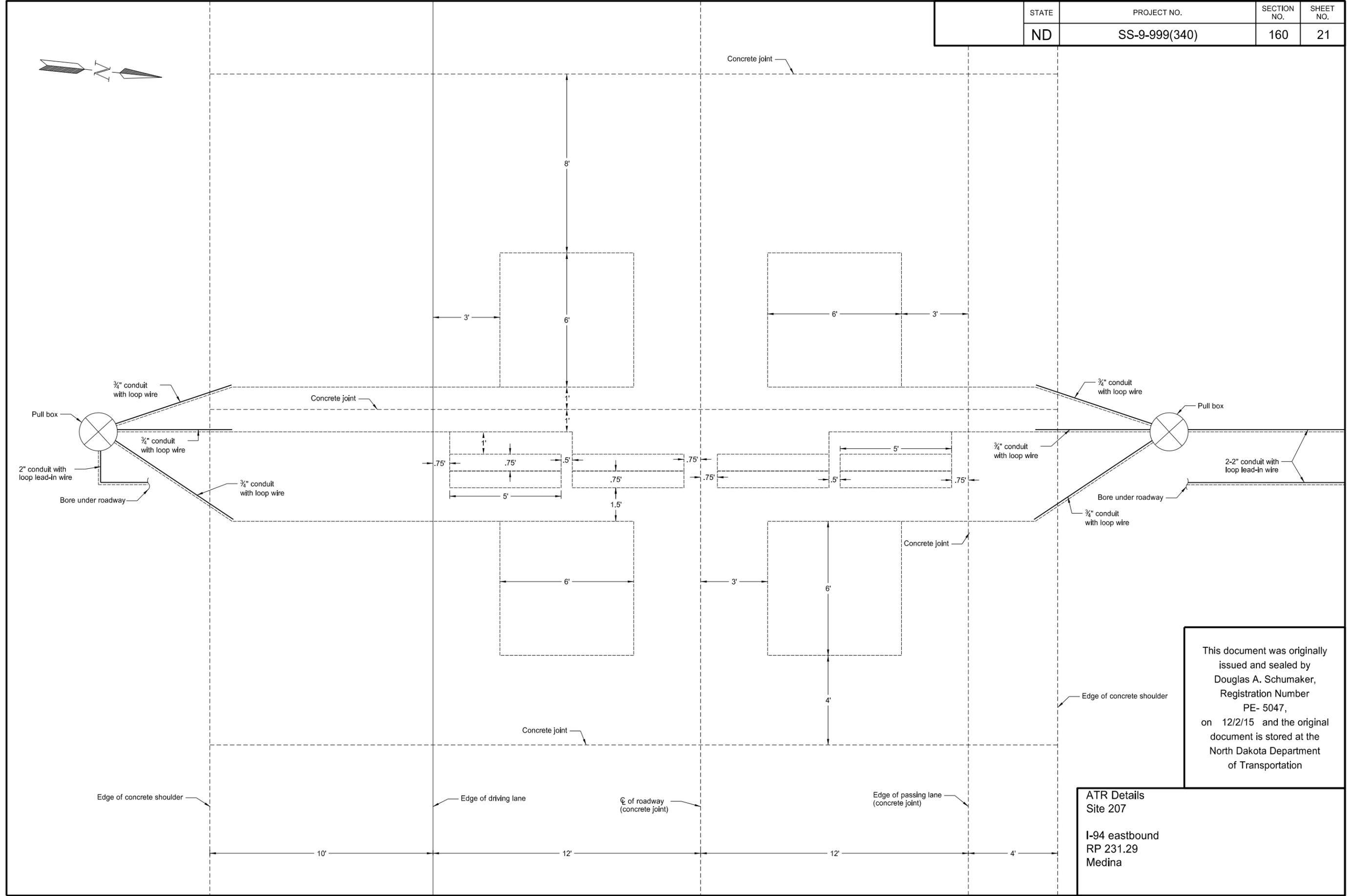
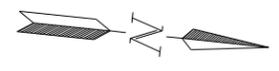
(C) This 2" conduit shall extend between the ATR cabinet and the existing ESS cabinet. The OSP cable shall be placed in the conduit to connect the modem in the ESS cabinet to the new ATR equipment.

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ATR & ESS Layout
Site 207

I-94
RP 231.29
Medina

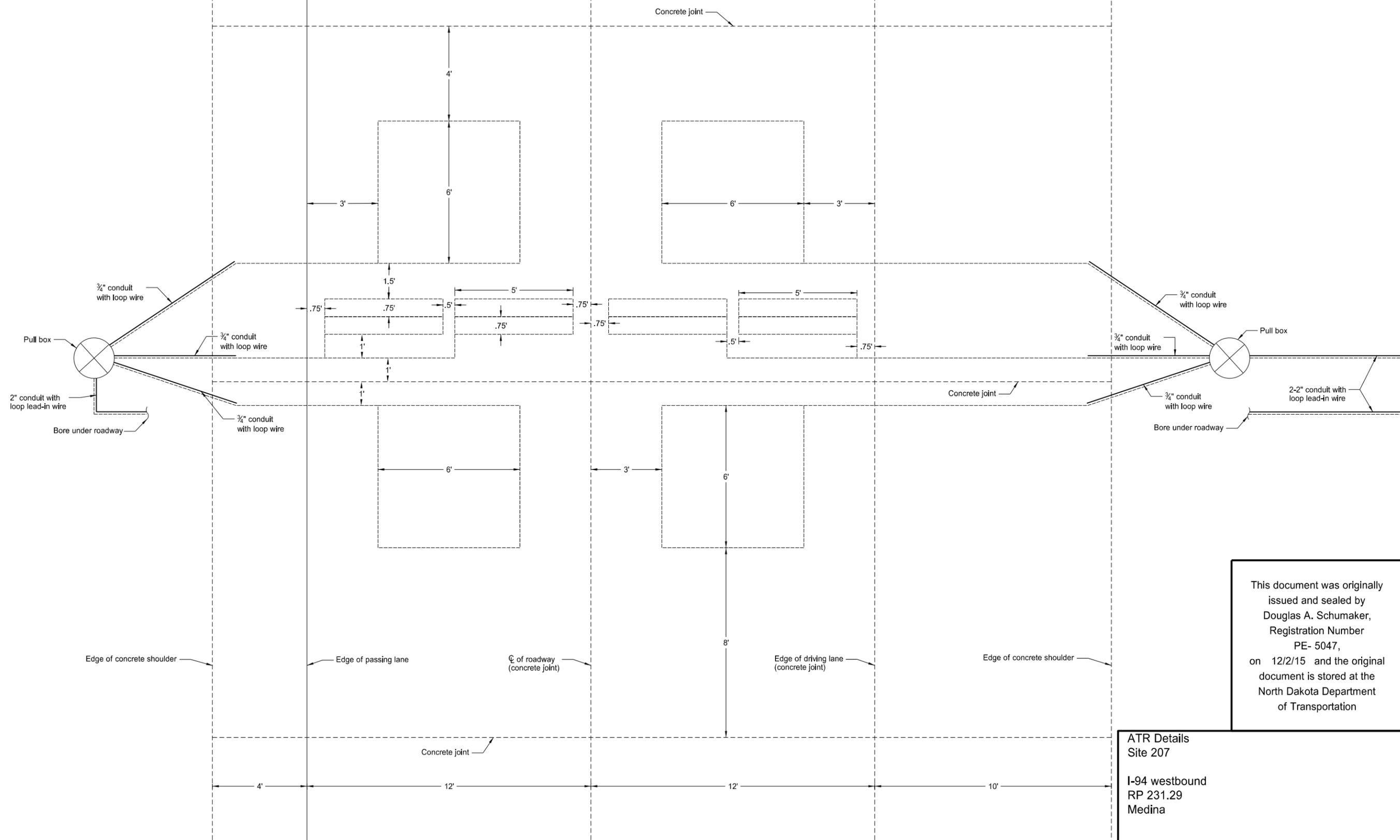
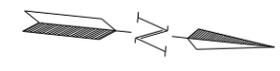
STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	21



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ATR Details
 Site 207
 I-94 eastbound
 RP 231.29
 Medina

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	22



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ATR Details
 Site 207
 I-94 westbound
 RP 231.29
 Medina

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	23
		ITS-9-999(350)		

Quantities (A)		
PVC Pull Box	EA	1
Underground Conductor No 4 Type RHW (B)	LF	296
Underground Conductor No 6 Type THW (B)	LF	148
Saw Slot and Sealant	LF	24
3/4 Inch Diameter Rigid HDPE Conduit	LF	10
2 Inch Diameter Rigid HDPE Conduit	LF	365
Ground-Mounted ESS Cabinet with Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
30 Foot Hinged Truss Tower and Concrete Foundation	EA	1
30 Foot Steel Breakaway Pole and Concrete Foundation	EA	1
Remote Processing Unit	EA	1
4G Cellular Modem with all necessary cabling including ethernet and power cables	EA	1
Ethernet Switch	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
Non-Intrusive Pavement Temperature Sensor	EA	1
Non-Intrusive Pavement Condition Sensor	EA	1
Barometric Pressure Sensor (C)	EA	1
Deep Subsurface Temperature Probe	EA	1
Temperature/Relative Humidity Sensor	EA	1
Precipitation Occurrence Sensor	EA	1
Wind Speed/Direction Sensor	EA	1
Radiation Sensor	EA	1
Microwave Vehicle Detection System	EA	1
PTZ Camera with Memory Card	EA	1
OSP Cat 6 Cable (D)	LF	65
Infrared Illuminator	EA	1
No 12 AWG 2, 600V Conductor Cable (E)	LF	70
Qualified Technician	EA	1
Excavation	CY	2.98
Fill required	CY	0.32
Seeding Class II	SF	870
Remove ESS cabinet, supports, sensors, and electronic equipment (F)	EA	1

Install ESS Station/RWIS	EA	1
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Quantities (G)		
PVC Pull Box	EA	4
Underground Conductor No 4 Type RHW (H)	LF	216
Underground Conductor No 6 Type THW (H)	LF	108
Shielded Twisted Pair Loop Lead-In Wire 14 AWG XHHW	LF	2504
Conductor Loop Wire 14 AWG XHHW (I)	LF	2048
Saw Slot and Sealant for Loops	LF	465
3/4 Inch Diameter Rigid HDPE Conduit	LF	84
2 Inch Diameter Rigid HDPE Conduit (J)	LF	802
NEMA Type 3R Ground Mounted Cabinet with AC Power Panel and Sensor Surge Boards and Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
PEEK ADR 6000 Traffic Counter/Classifier with all necessary cabling plus IDRIS License	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
GFCI/Duplex Receptacles (3), Thermostatically Controlled Fan	EA	1
Telephone with Surge Protection	EA	1
OSP Cat 6 Cable (K)	LF	60
PEEK Representative Oversight	EA	1
Video Verification and Validation	EA	1
30 Day Monitoring Period	EA	1
Excavation	CY	1.93
Fill required	CY	1.20
Seeding Class II	SF	1100
Remove existing ATR cabinet and foundation, and 3 pull boxes (L)	EA	1

Automatic Traffic Recorder System	EA	1
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- (A) These quantities shall be included in the price bid for the item "Install ESS Station/RWIS".
- (B) 1 No 6 and 2 No 4 conductors are provided to extend from the ESS cabinet to the meter. Northern Plains Electric will provide the service connection to the existing meter.
- (C) The Barometric Pressure Sensor shall be mounted inside the ESS cabinet.
- (D) This cable will extend from the ESS cabinet to the PTZ camera.
- (E) This cable will extend from the ESS cabinet to the Infrared Illuminator.
- (F) Refer to the notes for more details.
- (G) These quantities shall be included in the price bid for the item "Automatic Traffic Recorder System".
- (H) 1 No 6 and 2 No 4 conductors are provided to extend from the ATR cabinet to the meter. Northern Plains Electric will provide the service connection to the existing meter.
- (I) The Entrance and Exit Loops shall be 6'x6' with 4 turns of conductor per loop. The Inner Axle Loops shall be 1.5'x5' Quadrapol with 3 turns of conductor.
- (J) This quantity includes an extra 20' conduit stub out for future use. Both ends shall be capped.
- (K) This cable will extend from the ESS cabinet to the ATR cabinet.
- (L) Refer to the notes for more details.

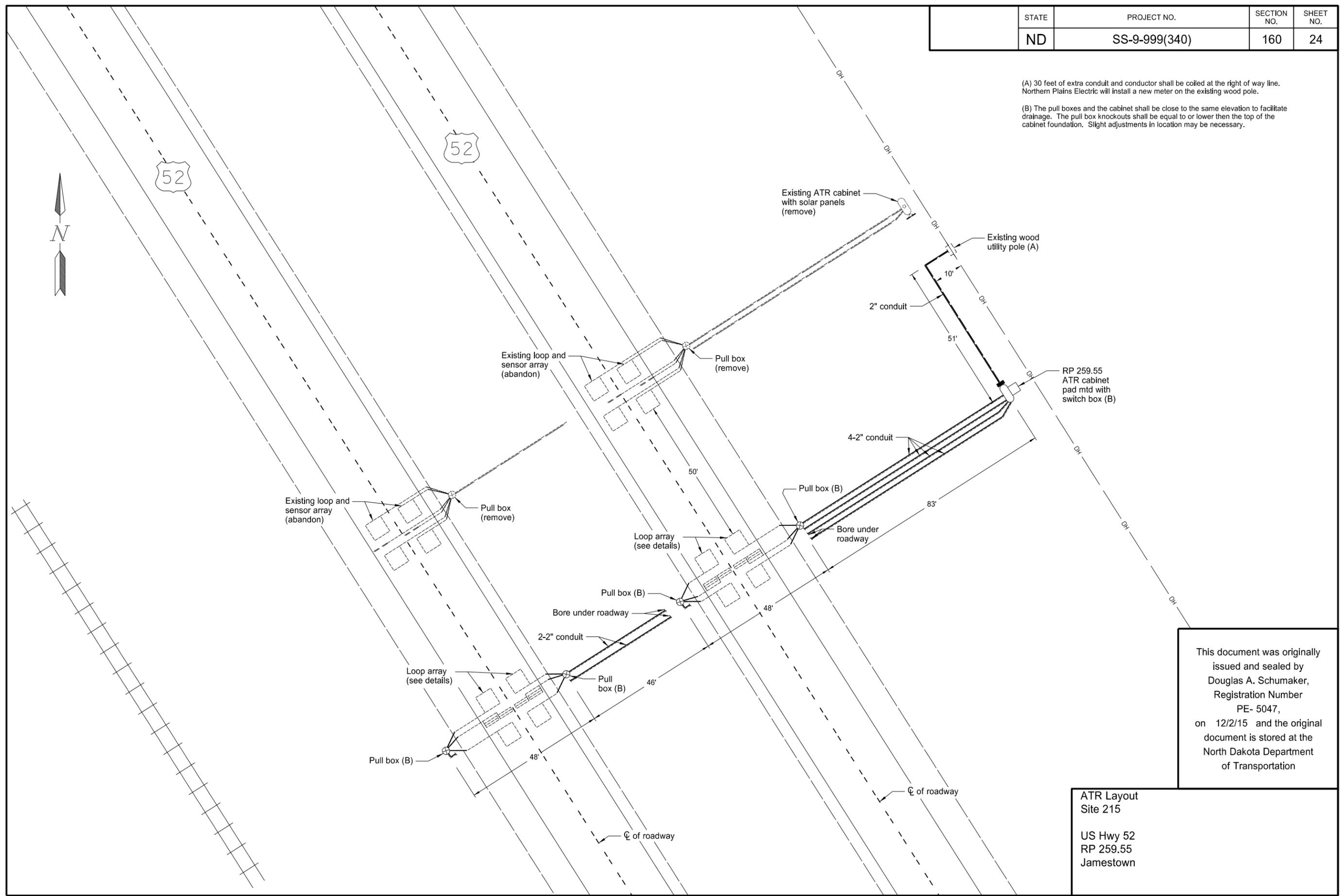
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ATR & ESS Quantities
Site 207
I-94
RP 231.29
Medina

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	24

(A) 30 feet of extra conduit and conductor shall be coiled at the right of way line. Northern Plains Electric will install a new meter on the existing wood pole.

(B) The pull boxes and the cabinet shall be close to the same elevation to facilitate drainage. The pull box knockouts shall be equal to or lower than the top of the cabinet foundation. Slight adjustments in location may be necessary.

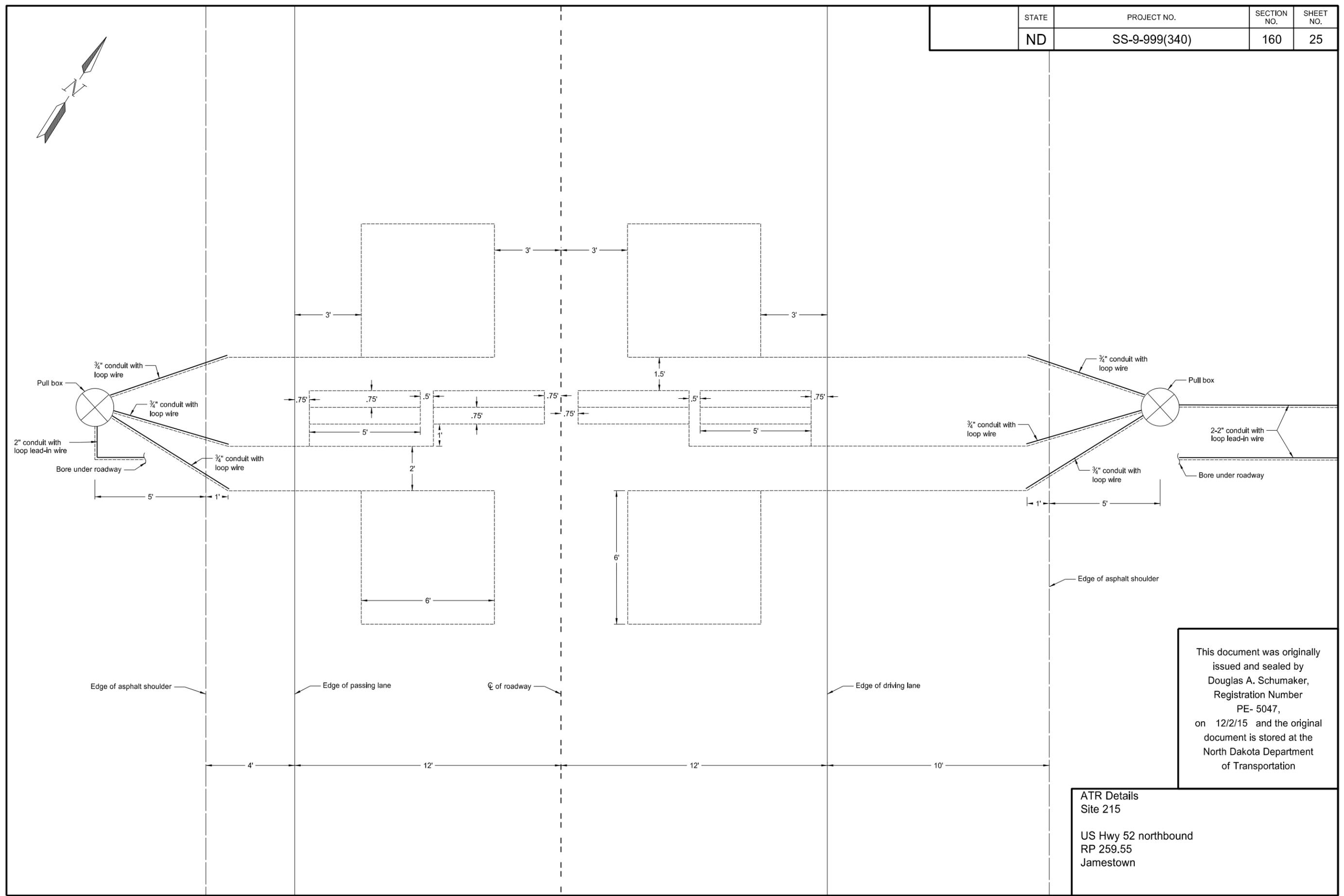
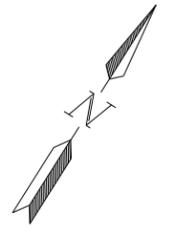


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ATR Layout
Site 215

US Hwy 52
RP 259.55
Jamestown

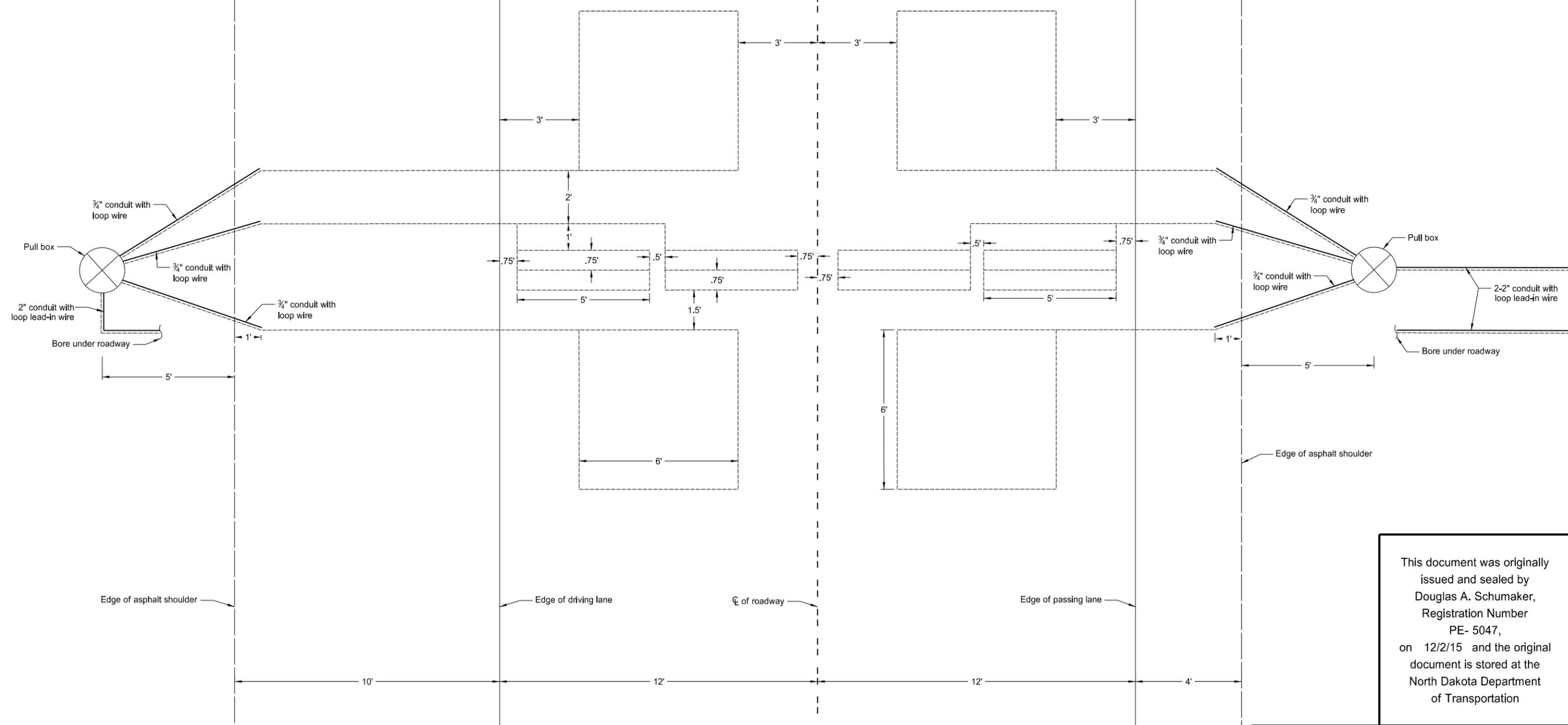
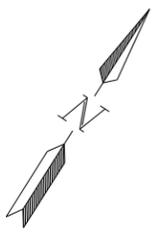
STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	25



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ATR Details
 Site 215
 US Hwy 52 northbound
 RP 259.55
 Jamestown

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SS-9-999(340)	160	26



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ATR Details
 Site 215
 US Hwy 52 southbound
 RP 259.55
 Jamestown

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	27

Quantities (A)		
PVC Pull Box	EA	4
Underground Conductor No 4 Type RHW (B)	LF	240
Underground Conductor No 6 Type THW (B)	LF	120
Shielded Twisted Pair Loop Lead-In Wire 14 AWG XHHW	LF	2704
Conductor Loop Wire 14 AWG XHHW (C)	LF	2048
Saw Slot and Sealant for Loops	LF	465
3/4 Inch Diameter Rigid HDPE Conduit	LF	84
2 Inch Diameter Rigid HDPE Conduit (D)	LF	805
NEMA Type 3R Ground Mounted Cabinet with AC Power Panel and Sensor Surge Boards with Switch Box	EA	1
Concrete Cabinet Foundation with working slab and grounding system	EA	1
PEEK ADR 6000 Traffic Counter/Classifier with all necessary cabling plus IDRIS License	EA	1
Ethernet Lightning Suppressor	EA	1
Remote Power Control Rack Mounted Outlet Strip	EA	1
GFCI/Duplex Receptacles (3), Thermostatically Controlled Fan	EA	1
Telephone with Surge Protection	EA	1
4G Cellular Modem with all necessary cabling including ethernet and power cables	EA	1
PEEK Representative Oversight	EA	1
Video Verification and Validation	EA	1
30 Day Monitoring Period	EA	1
Excavation	CY	1.93
Fill required	CY	0.76
Seeding Class II	SF	1600
Remove existing ATR cabinet and foundation, and 2 pull boxes (E)	EA	1

Automatic Traffic Recorder System	EA	1
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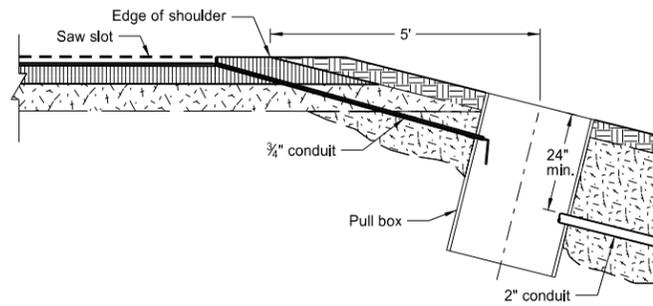
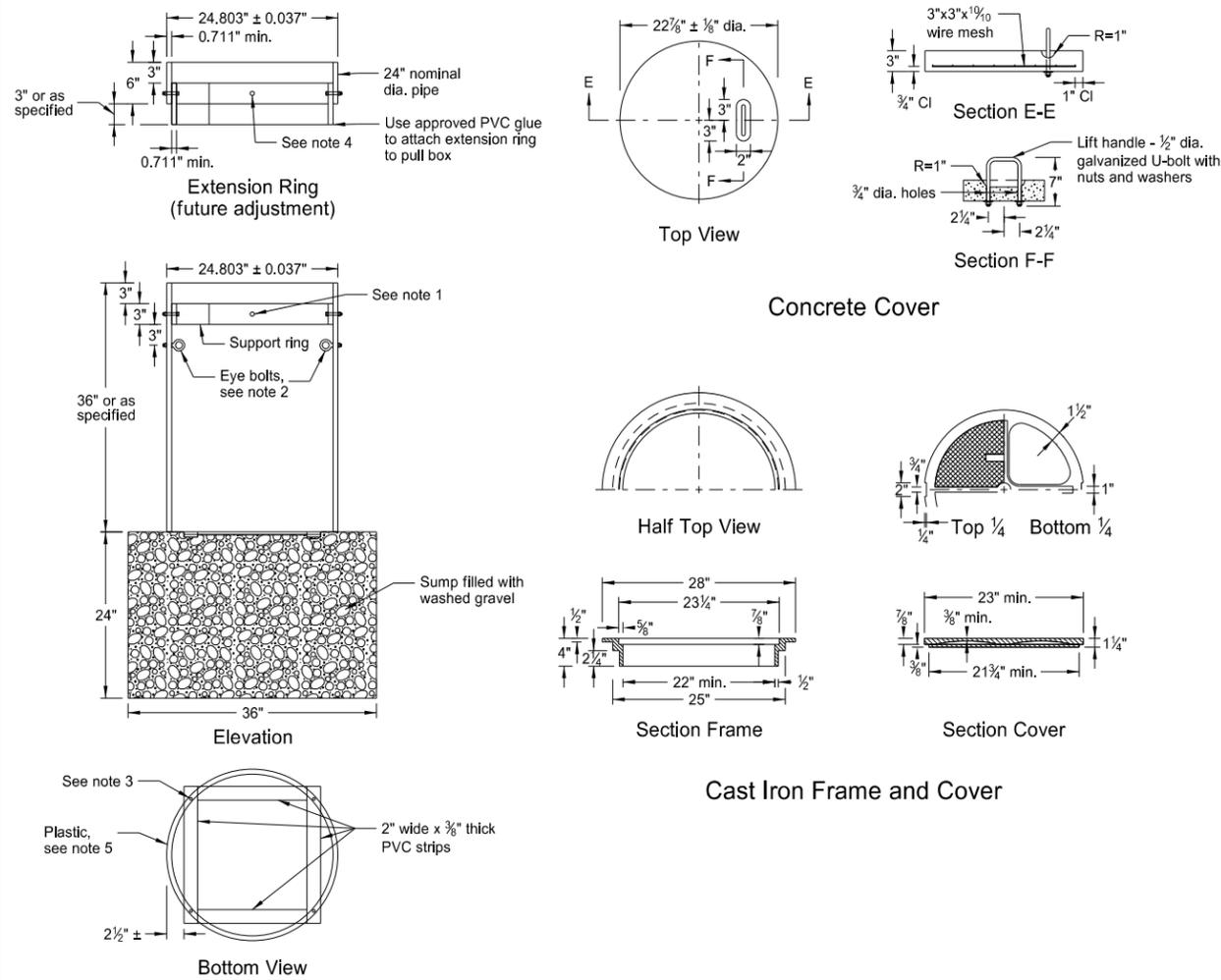
- (A) These quantities shall be included in the price bid for the item "Automatic Traffic Recorder System".
- (B) 1 No 6 and 2 No 4 conductors are provided to extend from the ATR cabinet to the meter. Northern Plains Electric will provide the service connection to the new meter.
- (C) The Entrance and Exit Loops shall be 6'x6' with 4 turns of conductor per loop. The Inner Axle Loops shall be 1.5'x5' Quadrapol with 3 turns of conductor.
- (D) This quantity includes an extra 20' conduit stub out for future use. Both ends shall be capped.
- (E) Refer to the notes for more details.

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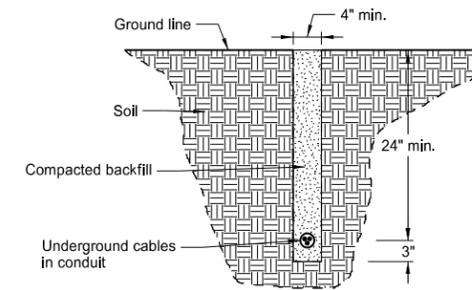
ATR Quantities
Site 215

US Hwy 52
RP 259.55
Jamestown

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	28
		ITS-9-999(350)		



Saw Slot to Pull Box Details



Cable Trench Type II

PVC Pull Box Notes:

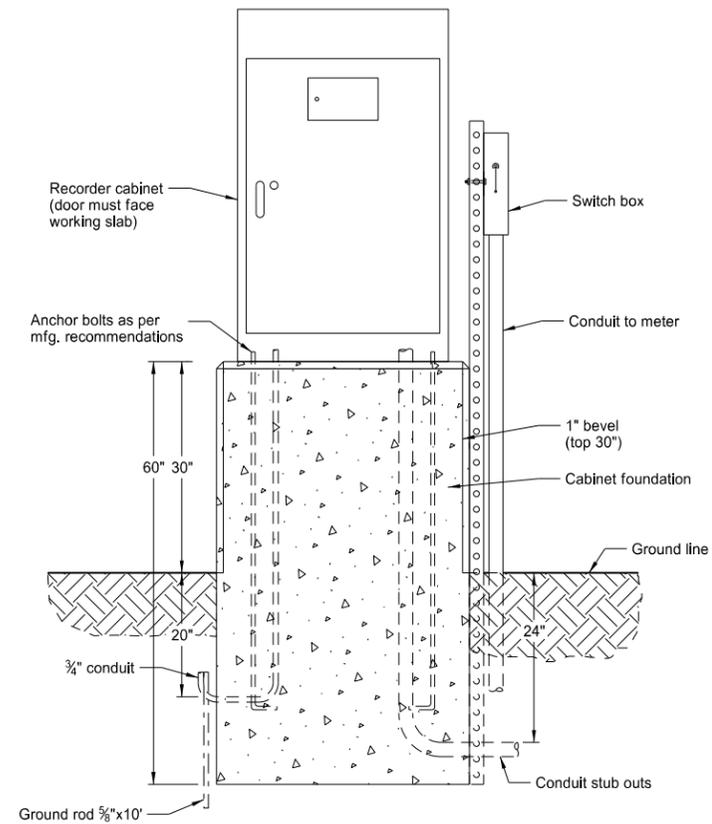
1. Attach split 24" nominal diameter PVC cover support ring with four 3/8" dia. x 2" long stainless steel hex head bolts with nuts at 90 degrees apart.
2. Two type 2 shoulder eye bolts, 3/8" dia. x 1 1/4" shank length with hex nuts 180 degrees apart (for lifting pull box and supporting electric cable).
3. Four 1/4" x 1 1/4" long galvanized lag screws. Screw assembly together.
4. Attach split 24" nominal diameter PVC cover support extension ring with four 3/8" dia. x 2" long stainless steel hex head bolts with nuts at 90 degrees apart.
5. Bolt assembly together.
6. Conduit holes located in barrel section shall be sized no more than 1" larger than size of conduit being used.
7. After pull box and conduit installation all inside walls and cover shall be made water tight to the satisfaction of the Engineer.
8. PVC pipe to meet requirements of ASTM F679T-1 or equal.
9. Hex head bolts and nuts shall be austenitic stainless steel. Other fasteners to be galvanized as per AASHTO M-232.
10. Concrete cover shall be coated on top and sides with an approved epoxy coating. The epoxy protective coating shall be light gray, clear, or neutral in color and shall be applied as recommended by the manufacturer. The surfaces of the concrete to which the epoxy protective coating is applied, shall be cleaned by wire brush and shall be dry before application.
11. Cast Iron cover castings shall be gray iron as per AASHTO M 105, Class 35B.

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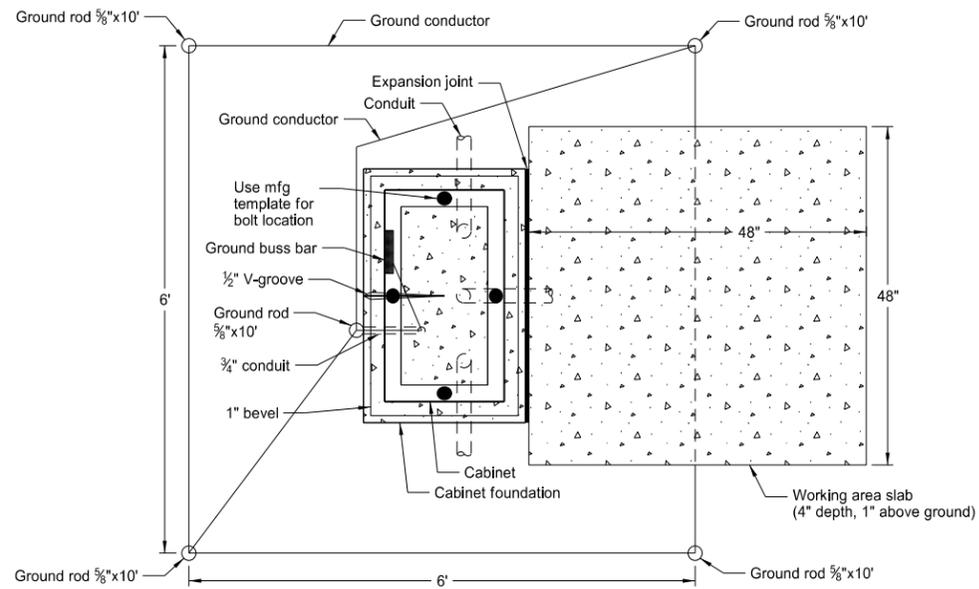
ATR, ESS, and WIM Details

All Sites

	STATE	PROJECT NO.	SECTION NO.	SHEET NO.
	ND	SS-9-999(340)	160	29



**ATR/WIM Recorder Cabinet
with Concrete Foundation
and Switch Box
Sites 1, 207, 215, 279**

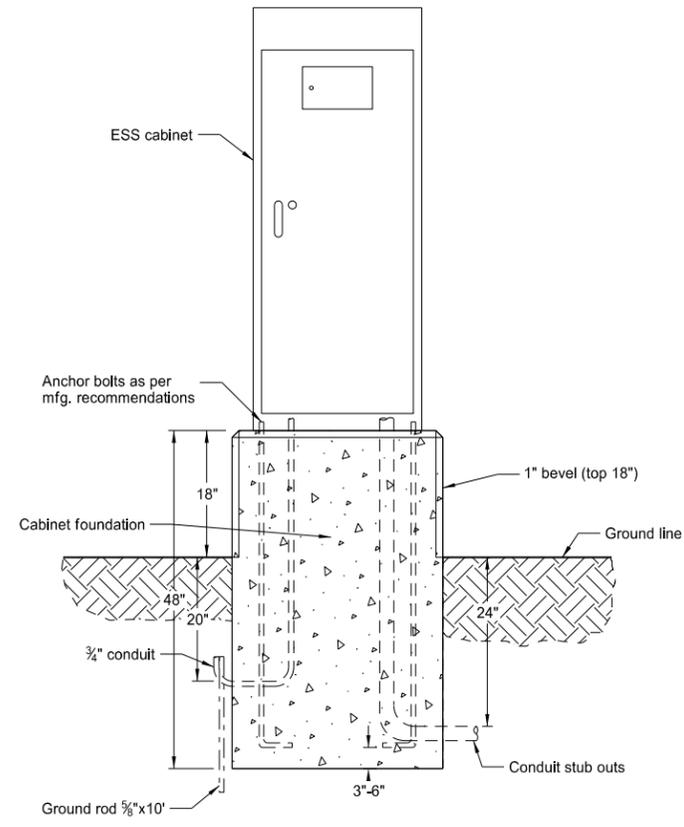


**ATR/WIM Cabinet Foundation
and Working Slab
Sites 1, 207, 215, 279**

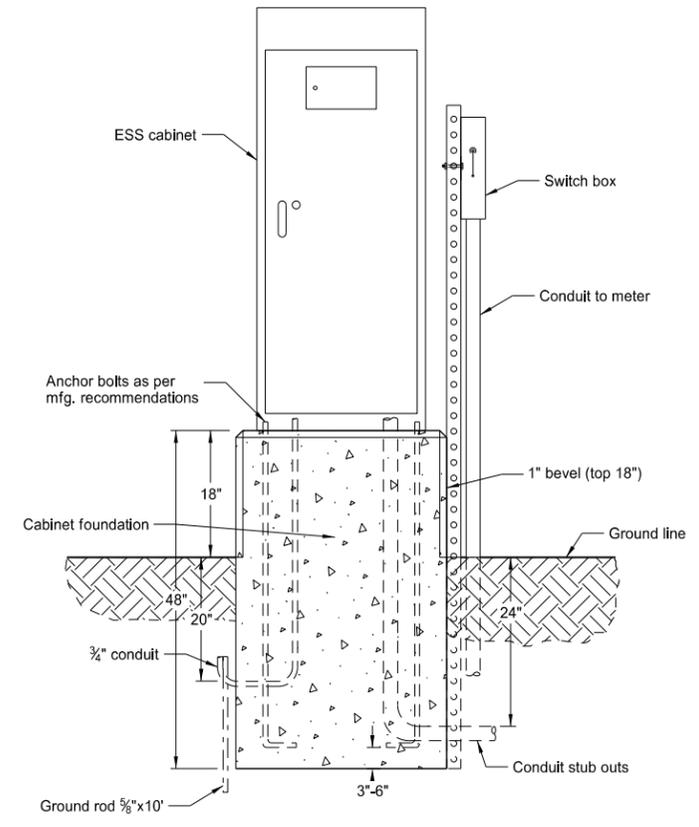
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ATR and WIM Details
Various Sites

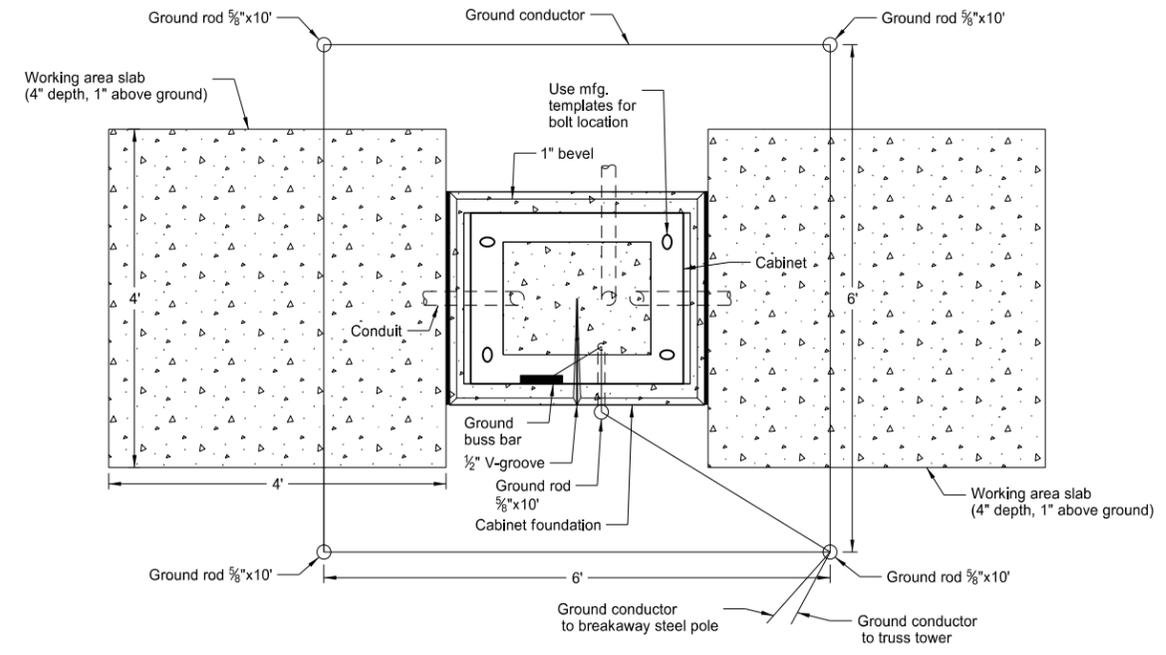
STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	ITS-9-999(350)	160	30



ESS Cabinet
with Concrete Foundation
Sterling



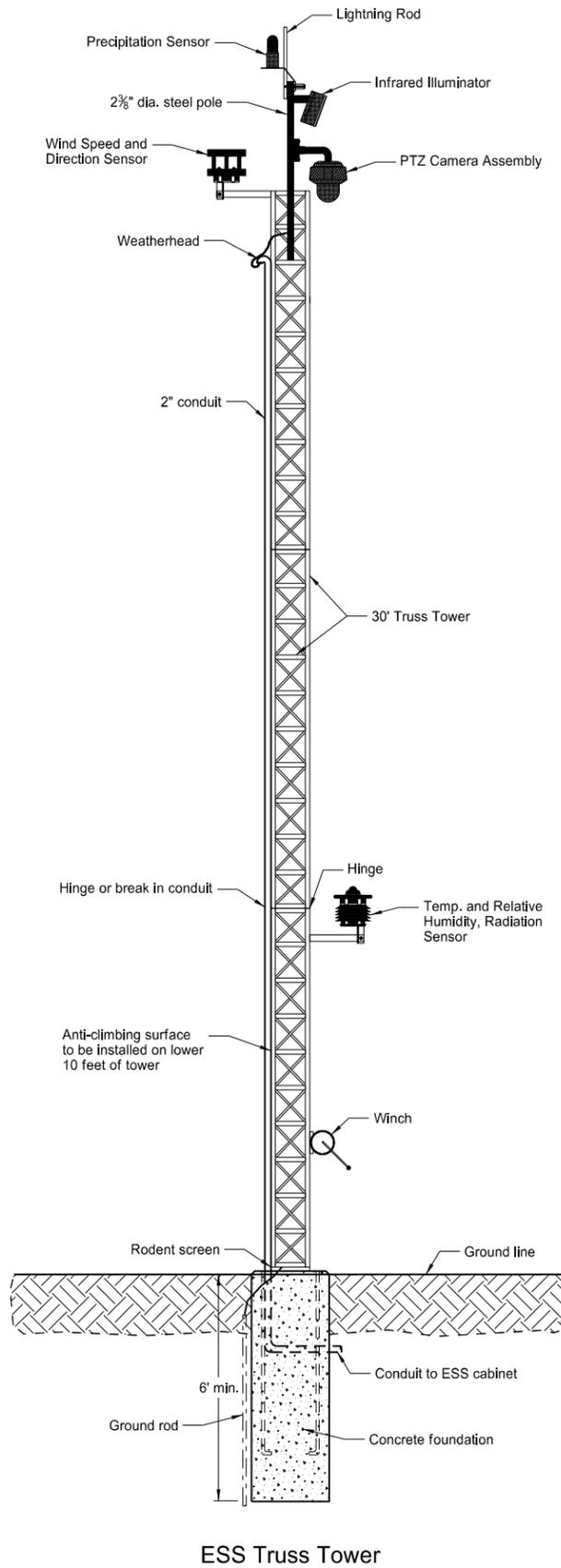
ESS Cabinet with Concrete Foundation
and Switch Box
Belfield, New Salem, Medina



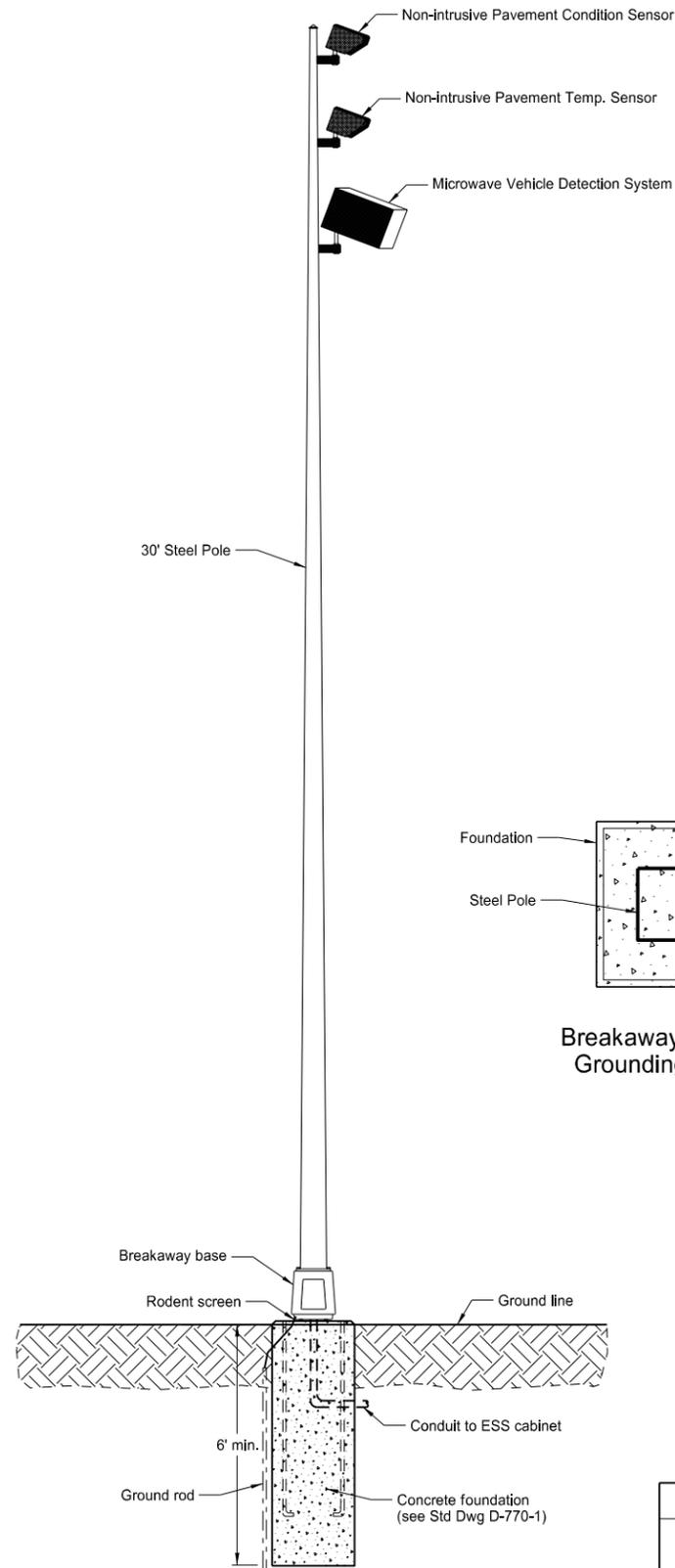
Cabinet Foundation
and Working Slabs
Belfield, New Salem, Sterling, Medina

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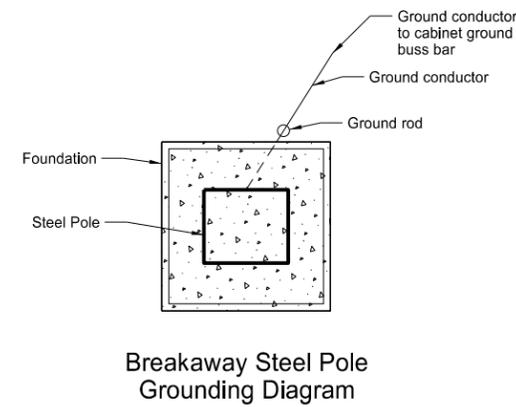
ESS Details
All Sites



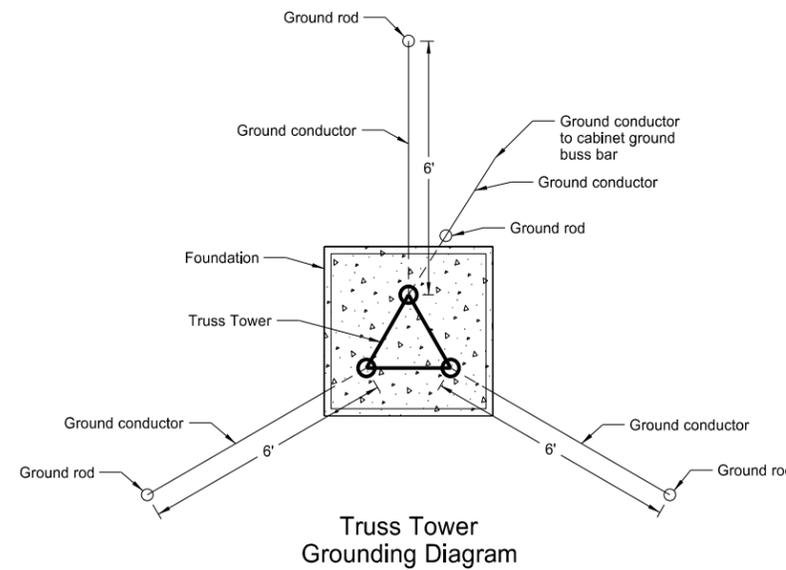
ESS Truss Tower



Breakaway Steel Pole

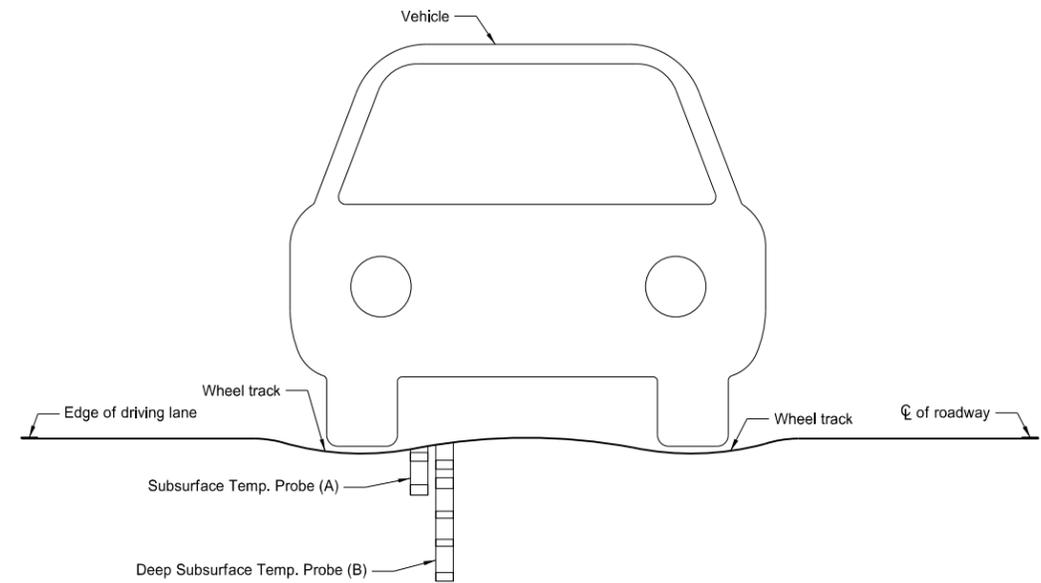


Breakaway Steel Pole Grounding Diagram



Truss Tower Grounding Diagram

Breakaway Steel Pole Foundation Table		
Description	Footing Depth "D"	Footing Depth "D"
	24" and 30" Dia.	36" and 42" Dia.
30' Pole	6'	5'



ESS Sensor Placement in a Lane (approx. location shown)

- (A) The Subsurface Temp. Probe shall be located at 17" measured from the top of the pavement.
- (B) The Deep Subsurface Temp. Probe shall be located 0"-72" measured from the bottom of the pavement.

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ESS Details
All Sites

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
 Ac acres
 Adj adjusted
 Aggr aggregate
 Ahd ahead
 ARV air release valve
 Align alignment
 Al alley
 Alt alternate
 Alum aluminum
 ADA Americans with Disabilities Act
 A ampere
 & 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
 Az azimuth
 Bk back
 BF back face
 Bs backsight
 Balc balcony
 B Wire barbed wire
 Barr barricade
 Btry battery
 Brg bearing
 BI beehive inlet
 Beg begin
 BM bench mark
 Bkwy bikeway
 Bit bituminous
 Blk block
 Bd Ft board feet
 BH bore hole
 BS both sides
 Bot bottom
 Blvd Boulevard
 Bndry boundary
 BC brass cap
 Brkwy breakaway
 Br bridge
 Bldg building

BV butterfly valve
 Byp bypass
 C Gdrl cable guardrail
 Calc calculate
 Cd candela
 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
 Cm centimeter
 Ch chain
 Chnlk chain-link
 Ch Blk channel block
 Ch Ch channel change
 Chk check
 Chsld chiseled
 Cir circle
 Cl class
 Cl clay
 Cl F clay fill
 Cl Hvy clay heavy
 Cl Lm clay loam
 Clnt clean-out
 Clr clear
 Cl&gr clearing & grubbing
 Co S coal slack
 Comb. combination
 Coml commercial
 Compr compression
 CADD computer aided drafting & design
 Conc concrete
 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
 CSP corrugated steel pipe
 C coulomb
 Co County
 Crse course
 C Gr course gravel
 CS course sand

Ct Court
 Xarm cross arm
 Xbuck cross buck
 Xsec cross sections
 Xing crossing
 Xrd Crossroad
 Crn crown
 CF cubic feet
 M3 cubic meter
 M3/s cubic meters per second
 CY cubic yard
 Cy/mi cubic yards per mile
 Culv culvert
 C&G curb & gutter
 CI curb inlet
 CR curb ramp
 CS curve to spiral
 C cut
 Dd Ld dead load
 Defl deflection
 Defm deformed
 Deg or D degree
 DInt delineate
 DIntr delineator
 Depr depression
 Desc description
 Det detail
 DWP detectable warning panel
 Dtr detour
 Dia 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
 Eq equation
 Evgr evergreen
 Exc excavation
 Exst existing
 Exp expansion
 Expy Expressway
 E external of curve
 Extru extruded
 FOS factor of safety
 F Fahrenheit
 FS far side
 F farad
 Fed Federal
 FP feed point
 Ft feet/foot
 Fn fence
 Fn P fence post
 FO fiber optic
 FB field book
 FD field drive
 F fill
 FAA fine aggregate angularity
 FS fine sand
 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
 Fs foresight
 Fnd found
 Fdn foundation
 Frac fractional
 Frwy freeway
 Frt front
 FF front face
 F Disp fuel dispenser

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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NDDOT ABBREVIATIONS

D-101-2

FFP	fuel filler pipes	IPn	Iron Pin	MC	medium curing	Ped	pedestal
FLS	fuel leak sensor	IP	iron Pipe	M	mega	Ped	pedestrian
Furn	furnish/ed	Jt	joint	Mer	meridian	PPP	pedestrian pushbutton post
Gal	gallon	J	joule	M	meter	Pen.	penetration
Galv	galvanized	Jct	junction	M/s	meters per second	Perf	perforated
Gar	garage	K	kelvin	M	mid ordinate of curve	Per.	perimeter
Gs L	gas line	Kn	kilo newton	Mi	mile	PL	pipeline
G Reg	gas line regulator	Kpa	kilo pascal	MM	mile marker	PI	place
GMV	gas main valve	Kg	kilogram	MP	mile post	P&P	plan & profile
G Mtr	gas meter	Kg/m3	kilogram per cubic meter	MI	milliliter	PL	plastic limit
GSV	gas service valve	Km	kilometer	Mm	millimeter	PI	plate
GVP	gas vent pipe	K	Kip(s)	Mm/hr	millimeters per hour	Pt	point
GV	gate valve	LS	Land Surveyor (licensed)	Min	minimum	PCC	point of compound curve
Ga	gauge	LSIT	Land Surveyor In Training	Misc	miscellaneous	PC	point of curve
Geod	geodetic	Ln	lane	Mon	monument	PI	point of intersection
GIS	Geographical Information System	Lg	large	Mnd	mound	PRC	point of reverse curvature
G	giga	Lat	latitude	Mtbl	mountable	PT	point of tangent
GPS	Global Positioning System	Lt	left	Mtd	mounted	POC	point on curve
Gov	government	L	length of curve	Mtg	mounting	POT	point on tangent
Grd	graded/grade	Lens	lenses	Mk	muck	PE	polyethylene
Gr	gravel	Lvl	level	Mun	municipal	PVC	polyvinyl chloride
Grnd	ground	LB	level book	N	nano	PCC	Portland Cement concrete
GWM	ground water monitor	Lvng	leveling	NGS	National Geodetic Survey	Lb or #	pounds
Gdrl	guardrail	Lht	light	NS	near side	PP	power pole
Gtr	gutter	LP	light pole	Neop	neoprene	Preempt	preemption
H Plg	H piling	Ltg	lighting	Ntwk	network	Prefab	prefabricated
Hdwl	headwall	Lig Co	lignite coal	N	newton	Prfmd	performed
Ha	hectare	Lig Sl	lignite slack	N	North	Prep	preparation
Ht	height	LF	linear foot	NE	North East	Press.	pressure
HI	height of instrument	Liq	liquid	NW	North West	PRV	pressure relief valve
Hel	helical	LL	liquid limit	NB	Northbound	Prestr	prestressed
H	henry	L	litre	No. or #	number	Pvt	private
HZ	hertz	Lm	loam	Obsc	obscure(d)	PD	private drive
HDPE	high density polyethylene	Loc	location	Obsn	observation	Prod.	production/produce
HM	high mast	LC	long chord	Ocpd	occupied	Prog	programmed
HP	high pressure	Long.	longitude	Ocpy	occupy	Prop.	property
HPS	high pressure sodium	Lp	loop	Off Loc	office location	Prop Ln	property line
Hwy	highway	LD	loop detector	O/s	offset	Ppsd	proposed
Hor	horizontal	Lm	lumen	OC	on center	PB	pull box
HBP	hot bituminous pavement	Lum	luminaire	C	one dimensional consolidation		
HMA	hot mix asphalt	L Sum	lump sum	OC	organic content		
Hr	hour(s)	Lx	lux	Orig	original		
Hyd	hydrant	ML	main line	O To O	out to out		
Ph	hydrogen ion content	M Hr	man hour	OD	outside diameter		
Id	identification	MH	manhole	OH	overhead		
In or "	inch	Mkd	marked	PMT	pad mounted transformer		
Incl	inclinometer tube	Mkr	marker	Pg	pages		
IMH	inlet manhole	Mkg	marking	Pntd	painted		
ID	inside diameter	MA	mast arm	Pr	pair		
Inst	instrument	Matl	material	Pnl	panel		
Intchg	interchange	Max	maximum	Pk	park		
Intmdt	intermediate	MC	meander corner	PK	Parker-Kalon nail		
Intscn	intersection	Meas	measure	Pa	pascal		
Inv	invert	Mdn	median	PSD	passing sight distance		
IM	iron monument	MD	median drain	Pvmt	pavement		

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NDDOT ABBREVIATIONS

D-101-3

Qty	quantity	SN	sign number	Tan	tangent	Wb	weber
Qtr	quarter	Sig	signal	T	tangent (semi)	WIM	weigh in motion
Rad or R	radius	Si Cl	silt clay	TS	tangent to spiral	W	west
RR	railroad	Si Cl Lm	silty clay loam	Tel	telephone	WB	westbound
Rlwy	railway	Si Lm	silty loam	Tel B	Telephone Booth	Wrng	wiring
Rsd	raised	Sgl	single	Tel P	telephone pole	W/	with
RTP	random traverse point	SC	slow curing	Tv	television	W/o	without
Rge or R	range	SS	slow setting	Temp	temperature	WC	witness corner
RC	rapid curing	Sm	small	Temp	temporary	WGS	world geodetic system
Rec	record	S	South	TBM	temporary bench mark	Z	zenith
Rcy	recycle	SE	South East	T	tesla		
RAP	recycled asphalt pavement	SW	South West	T	thinwall tube sample		
RPCC	recycled portland cement concrete	SB	Southbound	T/mi	tons per mile		
Ref	reference	Sp	spaces	Ts	topsoil		
R Mkr	reference marker	Spcl	special	Twp or T	township		
RM	reference monument	SA	special assembly	Traf	traffic		
Refl	reflectorized	SP	special provisions	TSCB	traffic signal control box		
RCB	reinforced concrete box	G	specific gravity	Tr	trail		
RCES	reinforced concrete end section	Spk	spike	Transf	transformer		
RCP	reinforced concrete pipe	SC	spiral to curve	TB	transit book		
RCPS	reinforced concrete pipe sewer	ST	spiral to tangent	Trans	transition		
Reinf	reinforcement	SB	split barrel sample	TT	transmission tower		
Res	reservation	SH	sprinkler head	Trans	transverse		
Ret	retaining	SV	sprinkler valve	Trav	traverse		
Rev	reverse	Sq	square	TP	traverse point		
Rt	right	SF	square feet	Trtd	treated		
R/W	right of way	Km2	square kilometer	Trmt	treatment		
Riv	river	M2	square meter	Qc	triaxial compression		
Rd	road	SY	square yard	TERO	tribal employment rights ordinance		
Rdbd	road bed	Stk	stake	Tpl	triple		
Rdwy	roadway	Std	standard	TP	turning point		
RWIS	roadway weather information system	N	standard penetration test	Typ	typical		
Rk	rock	Std Specs	standard specifications	Qu	unconfined compressive strength		
Rt	route	Sta	station	Ugrnd	underground		
Salv	salvage(d)	Sta Yd	station yards	USC&G	US Coast & Geodetic Survey		
Sd	sand	Stm L	steam line	USGS	US Geologic Survey		
Sdy Cl	sandy clay	SEC	steel encased concrete	Util	utility		
Sdy Cl Lm	sandy clay loam	SMA	stone matrix asphalt	VG	valley gutter		
Sdy Fl	sandy fill	SSD	stopping sight distance	Vap	vapor		
Sdy Lm	sandy loam	SD	storm drain	Vert	vertical		
San	sanitary sewer line	St	street	VC	vertical curve		
Sc	scoria	SPP	structural plate pipe	VCP	vitrified clay pipe		
Sec	seconds	SPPA	structural plate pipe arch	V	volt		
Sec	section	Str	structure	Vol	volume		
SL	section line	Subd	subdivision	Wkwy	walkway		
Sep	separation	Sub	subgrade	W	water content		
Seq	sequence	Sub Prep	subgrade preperation	WGV	water gate valve		
Serv	service	Ss	subsoil	WL	water line		
Sh	shale	SE	superelevation	WM	water main		
Sht	sheet	SS	supplement specification	WMV	water main valve		
Shtng	sheeting	Supp	supplemental	W Mtr	water meter		
Shldr	shoulder	Surf	surfacing	WSV	water service valve		
Sw	sidewalk	Surv	survey	WW	water well		
S	siemens	Sym	symmetrical	W	watt		
SD	sight distance	SI	systems international	Wrng	wearing		

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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 TEL	Red River Rural Telephone
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 Coop
All PI	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	RSR ELEC	R.S.R. Electric Cooperative
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	MID-CONT CABLE	Mid-Continent Cable	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 W W S	Missouri West Water System	TRI-CNTY WU	Tri-County Water Users Incorporated
CAP ELEC	Capital Electric Cooperative Incorporat	MNKOTA PWR	Minnkota Power	TRL CO RWU	Traill County Rural Water Users
CASS CO ELEC	Cass County Electric Cooperative	MOR-GRAN-SOU ELEC	Mor-gran-sou Electric Cooperative	UNTD TEL	United Telephone
CASS RWU	Cass Rural Water Users Incorporated	MOUNT-WILLI ELEC	Mountrail-williams Electric Cooperative	UPPR SOUR WUA	Upper Souris Water Users Association
CAV ELEC	Cavalier Rural Electric Cooperative	MRE LBTY TEL	Moore & Liberty Telephone	US SPRINT	U.S. Sprint
CBLCOM	Cablecom Of Fargo	MUNICIPAL	City Water And Sewer	USAF MSL CABLE	U.S.A.F. Missile Cable
CENEX PL	Cenex Pipeline	MUNICIPAL	City Of '.....'	USFWS	US Fish and Wildlife Service
CENT PL WATER DIST	Central Pipe Line Water District	N CENT ELEC	North Central Electric Cooperative	USW COMM	U.S. West Communications
CENT PWR ELEC	Central Power Electric Cooperative	N VALL W DIST	North Valley Water District	VRNDRY ELEC	Verendrye Electric Cooperative
COE	Corps of Engineers	ND PKS & REC	North Dakota Parks And Recreation	W RIV TEL	West River Telephone Incorporated
CONS TEL	Consolidated Telephone	ND TEL	North Dakota Telephone Company	WEB	W. E. B. Water Development Association
CONT RES	Continental Resource Inc	NDDOT	North Dakota Department of Transportation	WILLI RWA	Williams Rural Water Association
CPR	Canadian Pacific Railway	NDSU SOIL SCI DEPT	NDSU Soil Science Department	WILSTN BAS PL	Williston Basin Interstate Pipeline Company
D O E	Department Of Energy	NEMONT TEL	Nemont Telephone	WLSH RWD	Walsh Water Rural Water District
DAK CARR	Dakota Carrier Network	NODAK R ELEC	Nodak Rural Electric Cooperative	WOLVRTN TEL	Wolverton Telephone
DAK CENT TEL	Dakota Central Telephone	NOON FRMS TEL	Noonan Farmers Telephone Company	XLENER	Xcel Energy
DAK RWD	Dakota Rural Water District	NPR	Northern Plains Railroad	YSVR	Yellowstone Valley Railroad
DGC	Dakota Gasification Company	NSP	Northern States Power		
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		
DOPE PL	Dome Pipeline Company	NW COMM	Northwest Communication Cooperation		
DVELEC	Dakota Valley Electric Cooperative	ONEOK	Oneok gas		
DVMW	Dakota, Missouri Valley & Western	OSHA	Occupational Safety and Health Administration		
ENBRDG	Enbridge Pipelines Incorporated	OTTR TL PWR	Otter Tail Power Company		
ENVENTIS	Enventis Telephone	P L E M	Prairielands Energy Marketing		
FALK MNG	Falkirk Mining Company	POLAR COM	Polar Communications		
FHWA	Federal Highway Administration	PVT ELEC	Private Electric		
G FKS-TRL WD	Grand Forks-traill Water District	QWEST	Qwest Communications		
GETTY TRD & TRAN	Getty Trading & Transportation	R&T W SUPPLY	R & T Water Supply Association		
GLDN W ELEC	Golden West Electric Cooperative	RAMSEY R SEW	Ramsey Rural Sewer Association		
GRGS CO TEL	Griggs County Telephone	RAMSEY RW	Ramsey Rural Water Association		
		RAMSEY UTIL	Ramsey County Rural Utilities		

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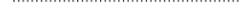
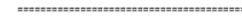
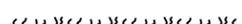
Line Styles

.....	Limits of Const Transition Line	—— s —— s ——	Floating Silt Curtain	—— ——— ———	Existing Aggregate (Cross Section View)	- - - - -	Existing Centerline
.....	Bale Check	—— ——— T ——	Existing Telephone Line	—— ——— ———	Existing Curb and Gutter (Cross Section View)	- - - - -	Supplemental Contour
.....	Rock Check	—— ——— TV ——	Existing TV Line	—— ——— ———	Existing Riprap	—— - - - - -	Right of Way
.....	Sight Distance Triangle Line	Void — void — void — v	Existing Assumed Ground (Not Surveyed)	—— ——— ———	Existing Underground Vault or Lift Station	—— - - - - -	Existing Right of Way
- - - - -	Small Hidden Object	Void — void — void — v	Tentative Ground Line	—— ——— ———	Tangent Line	—— - - - - -	Existing Right of Way Railroad
- - - - -	Dimension Leader	—— ——— w ——	Existing Water or Steam Line	- - - - -	Hidden Object	- - - - -	Failure Line
- - - - -	Existing Ground	=====	Existing Under Drain	—— ——— ———	Existing Dirt Surface	- - - - -	Existing Conditions
- - - - -	Existing Topsoil (Cross Section View)	=====	Under Drain	—— ——— ———	Existing Conduit	- - - - -	Existing Ground (Details)
—— ——— ———	Large Hidden Object	=====	Wall	—— ——— ———	Topsoil Profile	—— - - - - -	Existing Sixteenth Section Line
—— ——— ———	Edge Drain	=====	Existing Slotted Drain	- - - - -	Existing Conductor	- - - - -	Existing Right of Way Not State Owned
—— D —— D ——	Geotextile Fabric Type D	—— + —— + ——	Existing Cemetary Boundary	- - - - -	Conductor	- - - - -	Phantom Object
—— ——— E ——	Existing Electrical	—— ——— ———	Centerline Pavement Marking	- - - - -	Fiber Optic	- - - - -	Centerline Main
—— ——— FO ——	Existing Fiber Optic Line	=====	Barrier with Centerline Pavement Marking	- - - - -	Existing Loop Detector	-	Existing Guardrail Cable
—— ——— FO ——	Existing TV Fiber Optic	=====	Barrier Pavement Marking	- - - - -	Subgrade, Subcut or Ditch Grade	— . — . — . — .	Existing Guardrail Metal
—— ——— G ——	Existing Gas Pipe	- - - - -	Stripe 4 IN Dotted Extension White	—— ——— ———	Existing Asphalt Surface	—— . ——— . ——— .	Existing Edge of Water
—— Geo —— Geo ——	Geogrid	- - - - -	Stripe 8 IN Dotted Extension White	—— ——— ———	Existing Asphalt (Cross Section View)	- - - - -	Excavation Limits
—— ——— OH ——	Existing Overhead Utility Line	- - - - -	Stripe 8 IN Lane Drop	—— ——— ———	Existing Reinforcement Rebar	—— ———	Existing Government Lot Line
—— ——— P ——	Existing Power	—— ——— ———	Wetland Mitigation	—— ——— ———	Existing Tie Point Line	.....	Existing Adjacent Block Lines
—— ——— PL ——	Existing Fuel Pipeline	- - - - -	Existing Box Culvert Bridge	—— ——— ———	Existing State or International Line	.....	Existing Adjacent Lot Lines
—— ——— PL ——	Existing Undefined Above Ground Pipe Line	- - - - -	Existing Concrete Surface	—— ——— ———	Existing Quarter Section Line	.....	Existing Adjacent Property Line
—— ——— R —— R ——	Geotextile Fabric Type R	- - - - -	Existing Drainage Structure	—— ——— ———	Existing County	.....	Existing Adjacent Subdivision Lines
—— ——— R —— R ——	Geotextile Fabric Type R1	- - - - -	Easement	—— ——— ———	Existing Section Line	.....
—— REMOVE —— REMOVE ——	Remove Line	- - - - -	Existing Concrete	—— ——— ———	Existing Township	.....
—— RR —— RR ——	Geotextile Fabric Type RR	- - - - -	Existing Easement	—— ——— ———	Existing Railroad Centerline	
—— ——— S —— S ——	Geotextile Fabric Type S	—— ——— ———	Existing Gravel Surface	—— ——— ———	Centerline	

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Line Styles

	Subgrade Reinforcement		Existing Railroad Switch		Sheet Piling
	Existing Down Guy Wire Down Guy		Overhead Sign Structure Cantilever		W-Beam w Posts
	Existing Fence		24 Inch Pipe		Existing W-Beam Guardrail with Posts
	Existing Railroad		Reinforced Concrete Pipe		Exst Wet Area-Vegetation Break
	Existing Sanitary Sewer		Signal Head with Mast Arm		Existing Wetland Delineated
	Existing Sanitary Force Main		Existing Signal Head with Mast Arm		
	Existing Storm Drain		Tie Bar at Random Spacing		
	Existing Storm Drain Force Main		3-Cable w Posts		
	Fence		Existing 3-Cable w Posts		
	Silt Fence		Site Boundary		
	Existing Field Line		Fiber Rolls		
	Exst Flow		Doweled Joint		
	Flow		Tie Bar 30 Inch 4 Foot Center to Center		
	Existing Culvert		Tie Bar 18 Inch 3 Foot Center to Center		
	Existing Curb		Existing Berm, Dike, Pit, or Earth Dam		
	Existing Valley Gutter		Existing Ditch Block		
	Existing Driveway Gutter		Depression Contours		
	Existing Curb and Gutter		Existing City Corporate Limits or Reservation Boundary		
	Existing Mountable Curb and Gutter		Gravel Pit - Borrow Area		
	Existing Double Micro Loop Detector		Existing Tree Boundary		
	Micro Loop Detector Double		Tree Row		
	Existing Overhead Sign Structure		Existing Brush or Shrub Boundary		
	Existing Micro Loop Detector		Existing Retaining Wall		
	Micro Loop Detector		Existing Planter or Wall		
	Existing Overhead Sign Structure Cantilever		Retaining Wall (Plan View)		

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Symbols

	North Arrow (Half Scale)		Attenuation Device		Existing Railroad Battery Box		Existing Delineator Type E
	Truck Mounted Attenuator		Diamond Grade Delineator Type A		Existing Bush or Shrub		Existing EFB Misc
	Type I Barricade		Diamond Grade Delineator Type B		Existing Gas Cap or Stub		Existing Flashing Beacon
	Type II Barricade		Diamond Grade Delineator Type C		Existing Sanitary Cap or Stub		Existing Pipe Mounted Flasher
	Type III Barricade		Diamond Grade Delineator Type D		Existing Storm Drain Cap or Stub		Existing Pad Mounted Feed Point
	Catch Basin		Diamond Grade Delineator Type E		Existing Water Cap or Stub		Existing Pipe Mounted Feed Point with Pad
	Cairn or Stone Circle		Flexible Delineator		Existing Sanitary Cleanout		Existing Pole Mounted Feed Point
	Video Detection Camera		Flexible Delineator Type A		Existing Concrete Foundation		Existing Railroad Frog
	Storm Drain Cap or Stub		Flexible Delineator Type B		Existing Traffic Signal Controller		Existing Snow Gate 18
	Corrugated Metal End Section 18 Inch		Flexible Delineator Type C		Existing Pad Mounted Signal Controller		Existing Snow Gate 28
	Corrugated Metal End Section 24 Inch		Flexible Delineator Type D		Existing Sixteenth Section Corner		Existing Snow Gate 40
	Corrugated Metal End Section 30 Inch		Flexible Delineator Type E		Existing Quarter Section Corner		Existing Headwall
	Corrugated Metal End Section 36 Inch		Delineator Type A		Existing Section Corner		Existing Pedestrian Head with Number
	Corrugated Metal End Section 42 Inch		Delineator Type A Reset		Existing Railroad Crossbuck		Existing Signal Head
	Corrugated Metal End Section 48 Inch		Delineator Type B		Existing Satellite Dish		Existing Sprinkler Head
	Concrete Foundation		Delineator Type B Reset		Existing Fuel Dispensers		Existing Fire Hydrant
	Ground Connection Conductor		Delineator Type C		Existing Flexible Delineator Type A		Existing Catch Basin Drop Inlet
	Neutral Connection Conductor		Delineator Type D		Existing Flexible Delineator Type B		Existing Curb Inlet
	Phase 1 Connection Conductor		Delineator Type E		Existing Flexible Delineator Type C		Existing Manhole Inlet
	Phase 2 Connection Conductor		Delineator Drums		Existing Flexible Delineator Type D		Existing Junction Box
	Traffic Cone		Spot Elevation		Existing Flexible Delineator Type E		
	Signal Controller		Existing Access Control Arrow		Existing Delineator Type A		
	Pad Mounted Signal Controller		Existing Artifact		Existing Delineator Type B		
	Alignment Data Point		Existing Flashing Beacon		Existing Delineator Type C		
	Emergency Vehicle Detector		Existing Benchmark		Existing Delineator Type D		

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Symbols

	Existing Light Standard		Existing Manhole with Valve Water		Existing Telephone Pole		Existing Undefined Manhole
	Existing High Mast Light Standard 10 Luminaire		Existing Water Manhole		Existing Wood Pole		Existing Undefined Pull Box
	Existing High Mast Light Standard 3 Luminaire		Existing Mile Post Type A		Existing Post		Existing Undefined Pedestal
	Existing High Mast Light Standard 4 Luminaire		Existing Mile Post Type B		Existing Pedestrian Push Button Post		Existing Undefined Valve
	Existing High Mast Light Standard 5 Luminaire		Existing Mile Post Type C		Existing Control Point CP		Existing Undefined Pipe Vent
	Existing High Mast Light Standard 6 Luminaire		Existing Reference Marker		Existing Control Point GPS-RTK		Existing Gas Valve
	Existing High Mast Light Standard 7 Luminaire		Existing RW Marker		Existing Control Point TRI		Existing Water Valve
	Existing High Mast Light Standard 8 Luminaire		Existing Utility Marker		Existing Reference Marker Point NGS		Existing Fuel Pipe Vent
	Existing High Mast Light Standard 9 Luminaire		Iron Monument Found		Existing Pull Box		Existing Gas Pipe Vent
	Existing Overhead Sign Structure Load Center		Iron Pin R/W Monument		Existing Intelligent Transportation Pull Box		Existing Sanitary Pipe Vent
	Existing Luminaire		Existing Object Marker Type I		Existing Water Pump		Existing Storm Drain Pipe Vent
	Existing Light Standard Luminaire		Existing Object Marker Type II		Existing Slotted Reinforced Concrete Pipe		Existing Water Pipe Vent
	Existing Federal Mailbox		Existing Object Marker Type III		Existing RR Profile Spot		Existing Weather Station
	Existing Private Mailbox		Existing Electrical Pedestal		Existing Fuel Leak Sensors		Existing Ground Water Well Bore Hole
	Existing Meander Section Corner		Existing Telephone Pedestal		Existing Highway Sign		Existing Windmill or Tower
	Existing Meter		Existing Fiber Optic Telephone Pedestal		Existing Miscellaneous Spot		Existing Witness Corner
	Existing Electrical Manhole		Existing TV Pedestal		Existing Lighting Standard Pole		Flashing Beacon
	Existing Gas Manhole		Existing Fiber Optic TV Pedestal		Existing Traffic Signal Standard		Flagger
	Existing Sanitary Manhole		Existing Fuel Filler Pipes		Existing Transformer		Pipe Mounted Flasher
	Existing Sanitary Force Main Manhole		Existing Traverse PI Aerial Panel		Existing Large Evergreen Tree		Sanitary Force Main with Valve
	Existing Sanitary Manhole with Valve		Existing Pole		Existing Small Evergreen Tree		
	Existing Storm Drain Manhole		Existing Power Pole		Existing Large Tree		
	Existing Force Main Storm Drain Manhole		Existing Power Pole with Transformer		Existing Small Tree		
	Existing Force Main Storm Drain Manhole with Valve				Existing Tree Trunk		
	Existing Telephone Manhole				Existing Pad Mounted Traffic Signal Control Box		

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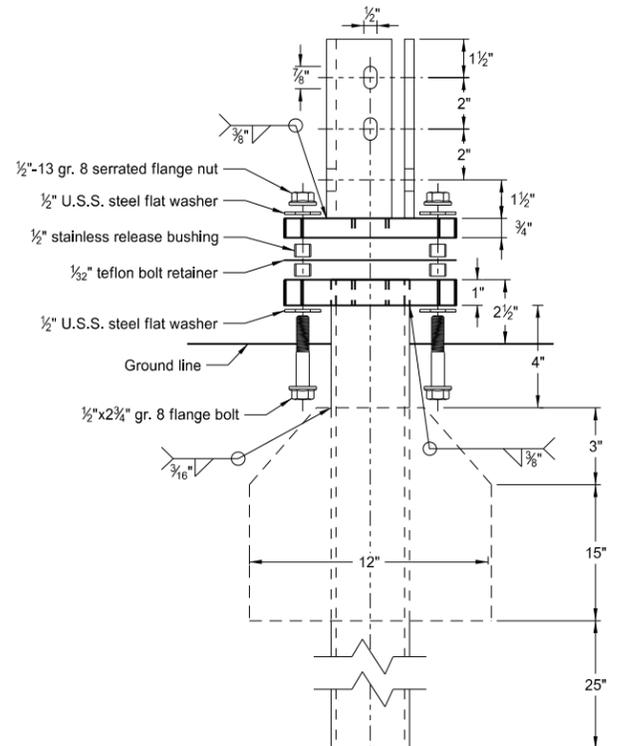
Symbols

D-101-32

 Pad Mounted Feed Point  Pipe Mounted Feed Point with Pad  Pole Mounted Feed Point  Headwall  Double Headwall with Vegetation Barrier  Single Headwall with Vegetation Barrier  Pole Mounted Head  Sprinkler Head  Fire Hydrant  Inlet Type 1  Inlet Type 2  Double Inlet Type 2  Inlet Gate Type 2  Junction Box  High Mast Light Standard 10 Luminaire  High Mast Light Standard 3 Luminaire  High Mast Light Standard 4 Luminaire  High Mast Light Standard 5 Luminaire  High Mast Light Standard 6 Luminaire  High Mast Light Standard 7 Luminaire  High Mast Light Standard 8 Luminaire  High Mast Light Standard 9 Luminaire  Relocate Light Standard  Overhead Sign Structure Load Center  Light Standard 100 Watt High Pressure Sodium Vapor Luminaire	 Light Standard 1000 Watt High Pressure Sodium Vapor Luminaire  Light Standard 150 Watt High Pressure Sodium Vapor Luminaire  Light Standard 175 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 35 Watt High Pressure Sodium Vapor Luminaire  Light Standard 400 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 700 Watt High Pressure Sodium Vapor Luminaire  Manhole  Manhole 48 Inch  Sanitary Force Main Manhole  Sanitary Sewer Manhole  Storm Drain Manhole  Storm Drain Manhole with Inlet  Reset Mile Post  Mile Post Type A  Mile Post Type B  Mile Post Type C  Right of Way Marker  Tubular Marker  Alignment Monument  Iron Pin Reference Monument	 Object Marker Type I  Object Marker Type II  Object Marker Type III  Caution Mode Arrow Panel  Back to Back Vertical Panel Sign  Double Direction Arrow Panel  Left Directional Arrow Panel  Right Directional Arrow Panel  Sequencing Arrow Panel  Truck Mounted Arrow Panel  Power Pole  Wood Pole  Pedestrian Push Button Post  Property Corner  Pull Box  Intelligent Transportation Pull Box  Sanitary Pump  Storm Drain Pump  Reinforced Pavement  Reinforced Concrete End Section 15 Inch  Reinforced Concrete End Section 18 Inch  Reinforced Concrete End Section 24 Inch  Reinforced Concrete End Section 30 Inch  Reinforced Concrete End Section 36 Inch  Reinforced Concrete End Section 42 Inch	 Reinforced Concrete End Section 48 Inch  Reinforced Concrete End Section 54 Inch  Reset Right of Way Marker  Reset USGS Marker  Right of Way Markers  Riser 30 Inch  Continuous Split Barrel Sample  Flight Auger Sample  Split Barrel Sample  Thinwall Tube Sample  Highway Sign  SNOW GATE 18 FT  SNOW GATE 28 FT  SNOW GATE 40 FT  Standard Penetration Test  Transformer  Inclinometer Tube  Underdrain Cleanout  Excavation Unit  Water Valve
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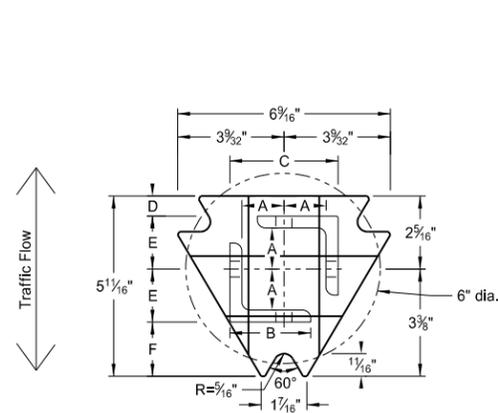
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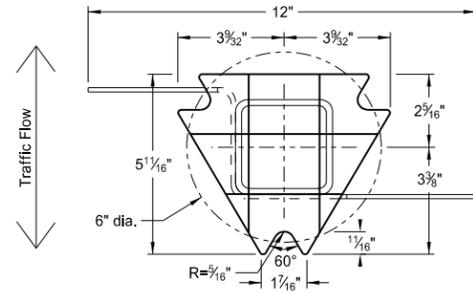


Multi-Directional Slip Base Assembly

Perforated Tube



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



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

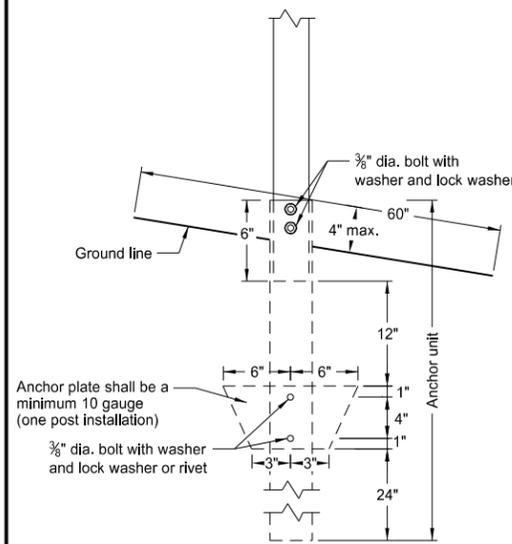
Notes:

1. Slip base bolts shall be torqued as specified by the manufacturer.
2. Anchor shall have a yield strength of 43.9 KSI and tensile strength of 59.3 KSI.
3. The 4" vertical clearance is required for the anchor or breakaway base. The 4"x60" measurement shall be made above and below post location and also back and ahead of the post.
4. When used in concrete sidewalk, anchor shall be same except without the wings.
5. Four post signs shall have over 7' between the first and the fourth posts.

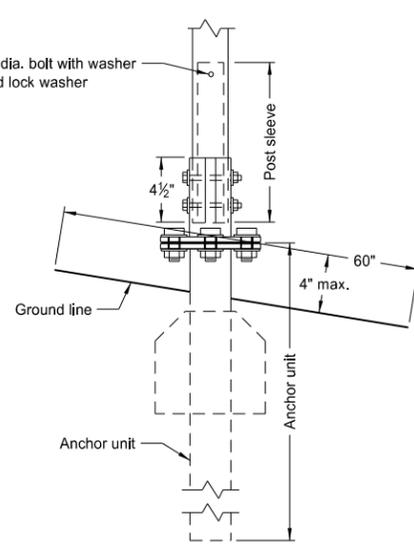
Number of Posts	Post Size in.	Wall Thickness Gauge	Sleeve Size in.	Wall Thickness Gauge	Slip Base	Anchor Size without Slip Base in.
1	2	12			No	2 1/4
1	2 1/4	12			No	2 1/2
1	2 1/2	12			(A)	3
1	2 1/2	10			Yes	
1	2 1/4	12	2	12	Yes	
1	2 1/2	12	2 1/4	12	Yes	
2	2	12			No	2 1/4
2	2 1/4	12			No	2 1/2
2	2 1/2	12			Yes	
2	2 1/2	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	

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

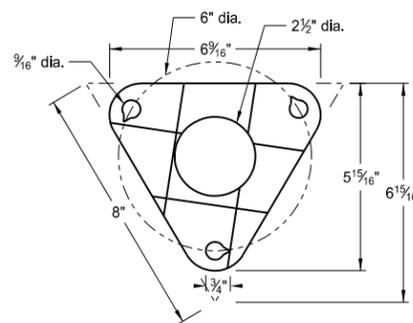
Square Post Sizes (B)	A	B	C	D	E	F
2 3/16" x 10 ga.	1 9/64"	2 1/2"	3 1/32"	2 5/32"	1 33/64"	1 1/8"
2 1/2" x 10 ga.	1 9/32"	2 1/2"	3 5/16"	5/8"	1 21/32"	1 3/4"



Anchor Unit and Post Assembly

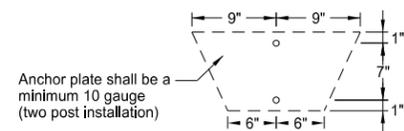


Multi-Directional Slip Base Anchor Unit and Post Sleeve Assembly



Bolt Retainer for Base Connection
Bolt Retainer - 1/32" Reprocessed Teflon

- (A) The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak.
(B) The 2 3/16" x 10 ga. may be inserted into 2 1/2" x 10 ga. for additional wind load.

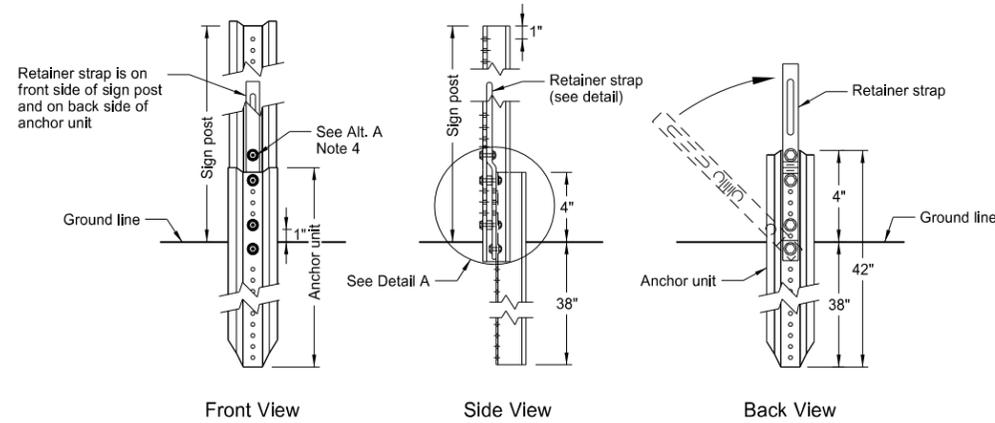
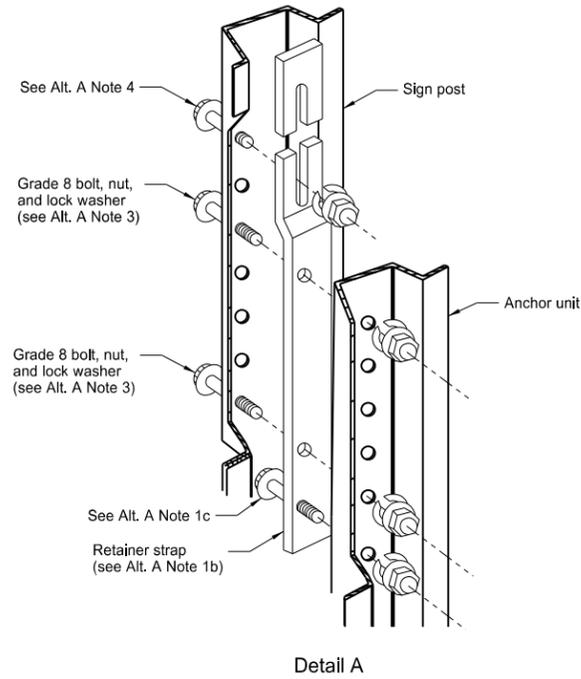


Anchor plate shall be a minimum 10 gauge (two post installation)

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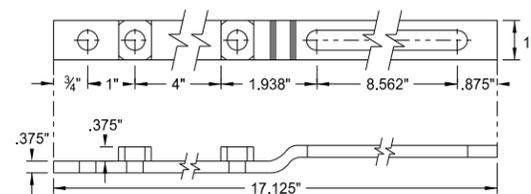
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U-Channel Post

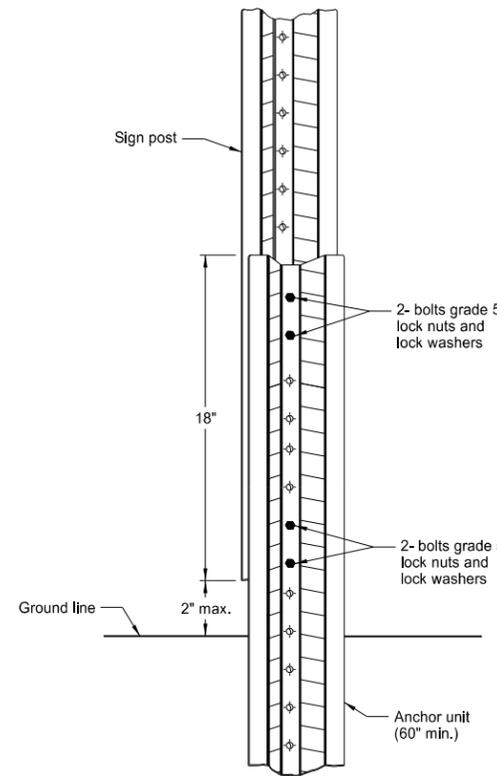


Breakaway U-Channel Detail Alternate A

A maximum of 2 posts shall be installed within 7'.

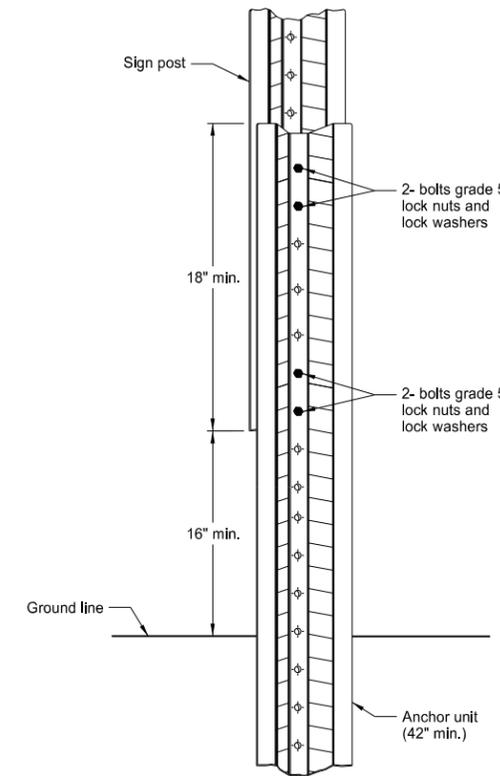


Retainer Strap Detail



Breakaway U-Channel Splice Detail Alternate B (2.5 and 3 lb/ft)

A maximum of 3 posts shall be installed within 7'.



Breakaway U-Channel Splice Detail Alternate C (2.5 and 3 lb/ft)

A maximum of 3 posts shall be installed within 7'.

Alternate A Steps of Installation:

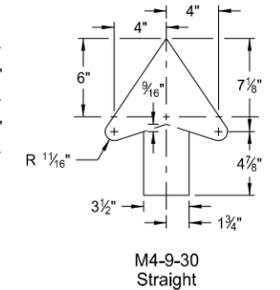
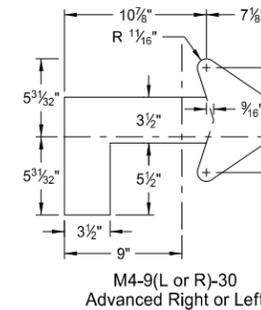
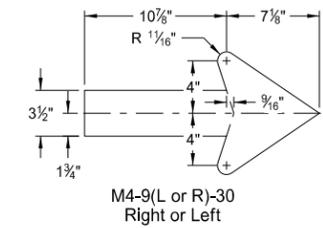
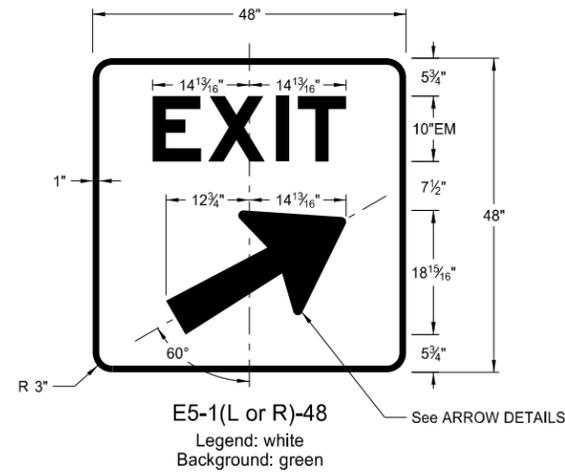
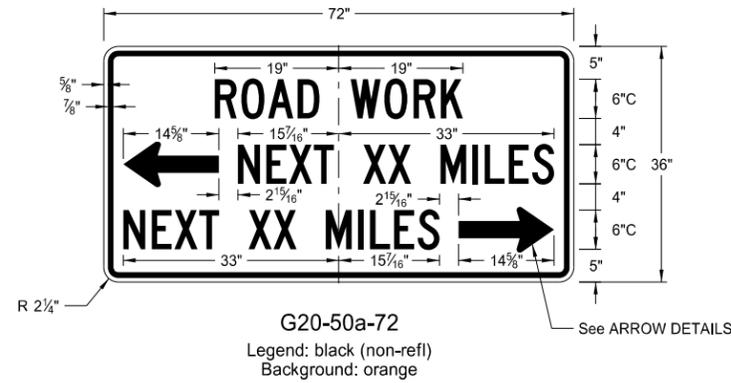
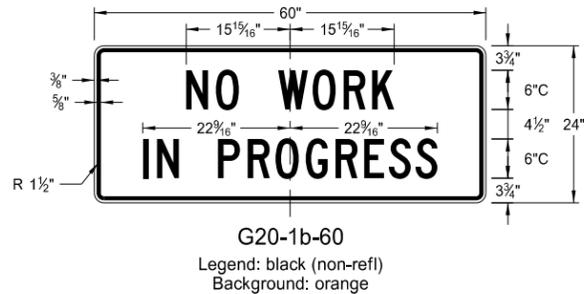
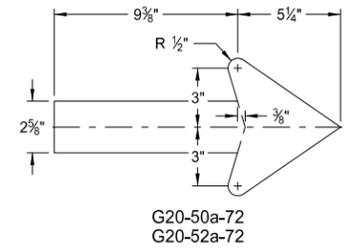
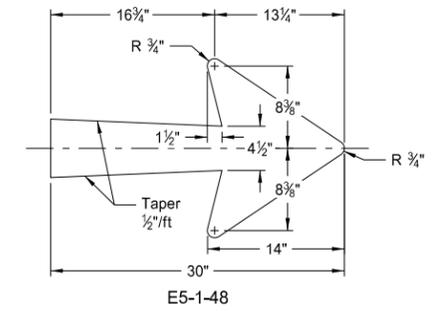
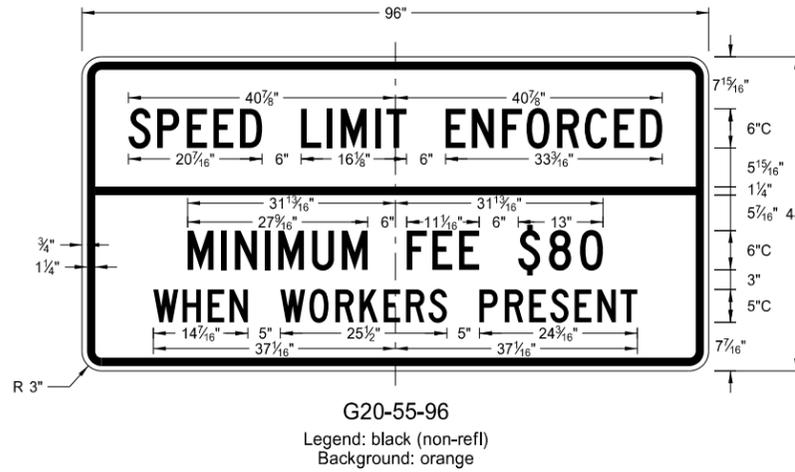
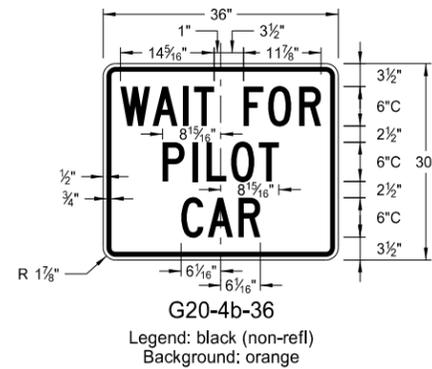
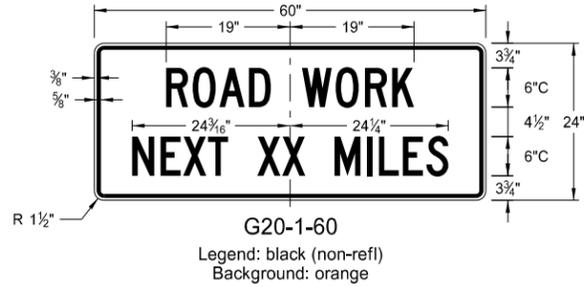
1. a) Drive anchor unit to within 12" of ground level.
b) Proper assembly established by lining up the bottom hole of retainer strap with the 6th hole from the top of the anchor unit.
c) Assemble strap to back of anchor unit using 5/16"x2" bolt, lock washer and nut.
d) Rotate strap 90° to left.
2. a) 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. The base post, strap and sign post shall be properly nested. Proper nesting occurs when all flat surfaces of the base post, strap, and sign post at the bolts have full contact across the entire width.

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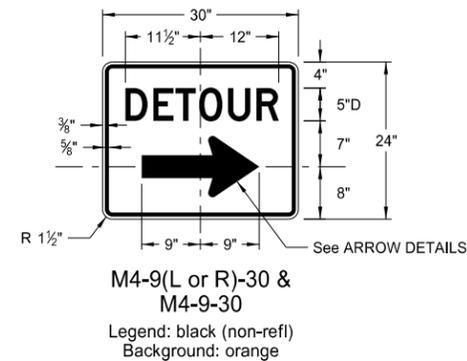
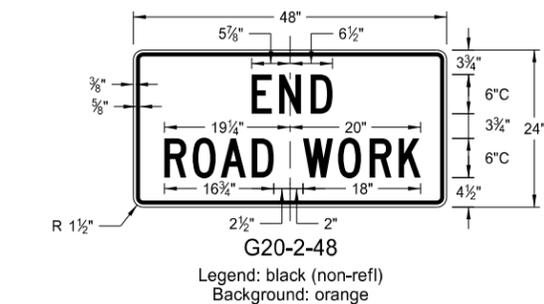
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CONSTRUCTION SIGN DETAILS
 TERMINAL AND GUIDE SIGNS

D-704-9



ARROW DETAILS



NOTES:

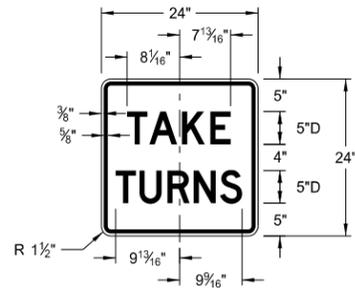
(A) Arrow may be right or left of the legend to indicate construction to the right or left.

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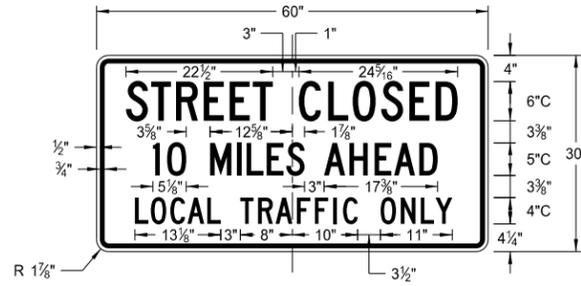
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CONSTRUCTION SIGN DETAILS
REGULATORY SIGNS

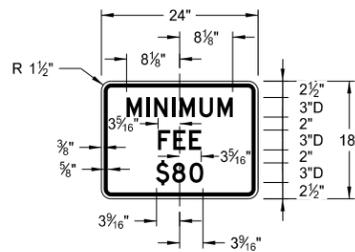
D-704-10



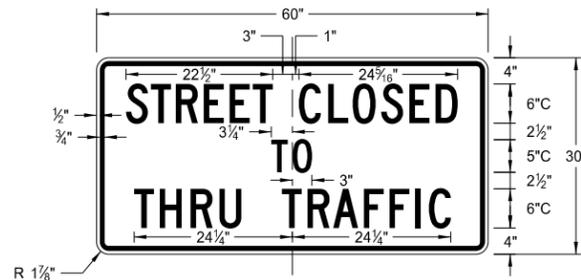
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Background: white



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



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



R11-4a-60
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Background: white



R11-2a-48
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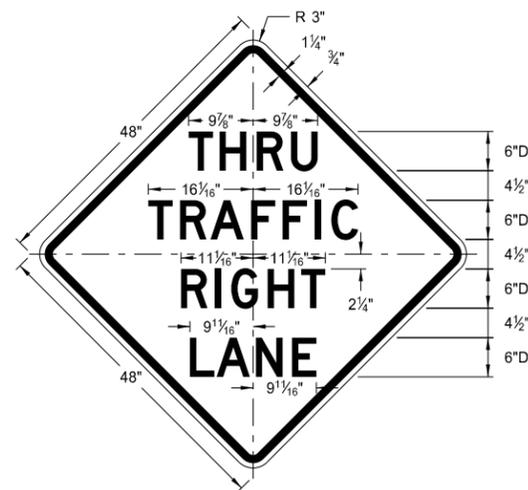
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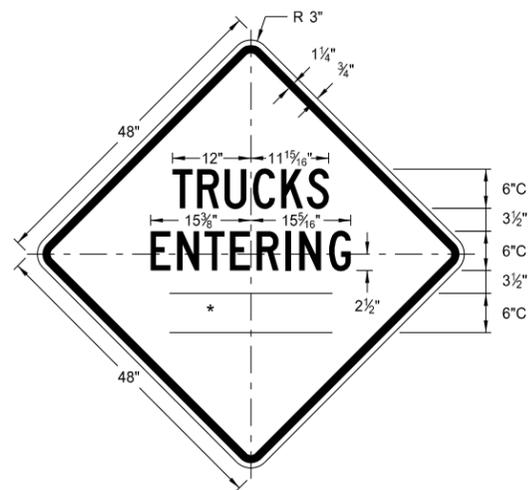
CONSTRUCTION SIGN DETAILS
WARNING SIGNS

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

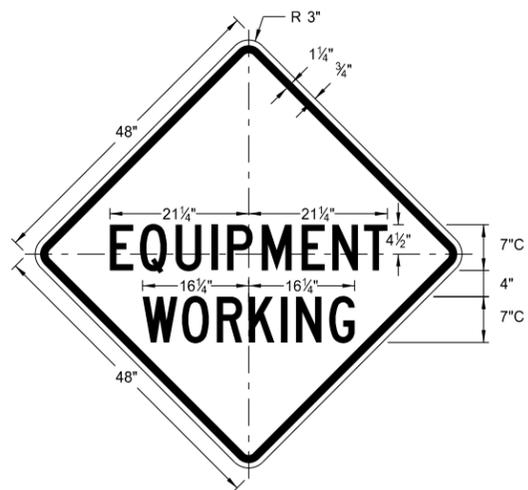
* DISTANCE MESSAGES



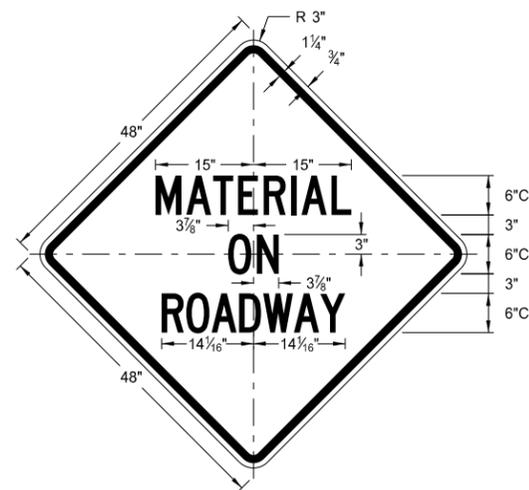
W5-8-48
Legend: black (non-refl)
Background: orange



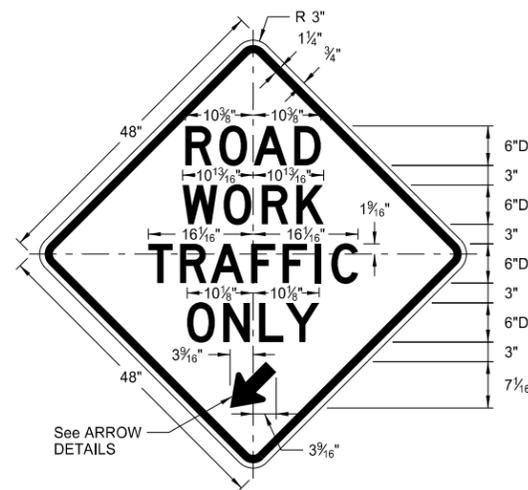
W8-54-48
Legend: black (non-refl)
Background: orange



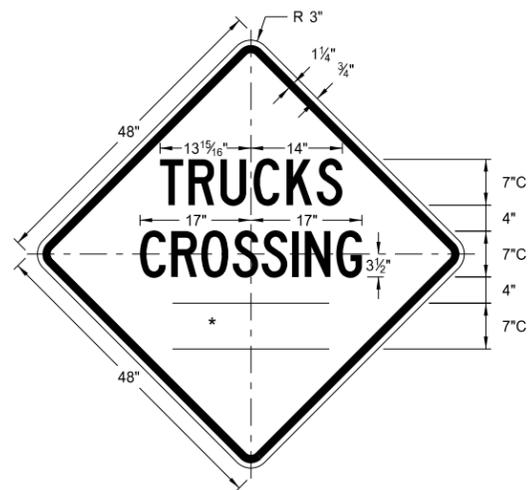
W20-51-48
Legend: black (non-refl)
Background: orange



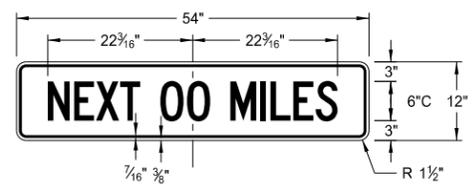
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Background: orange



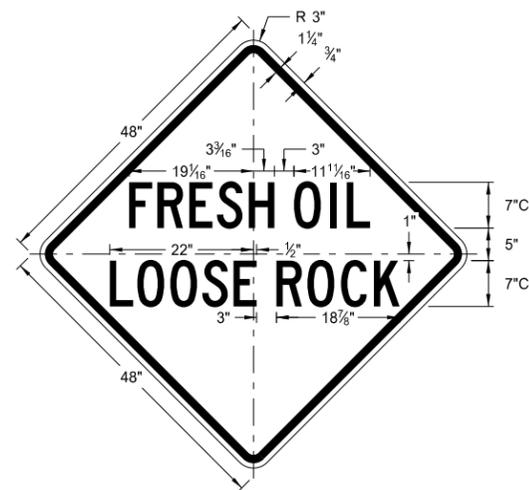
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Background: orange



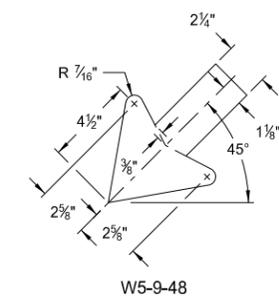
W8-55-48
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Background: orange



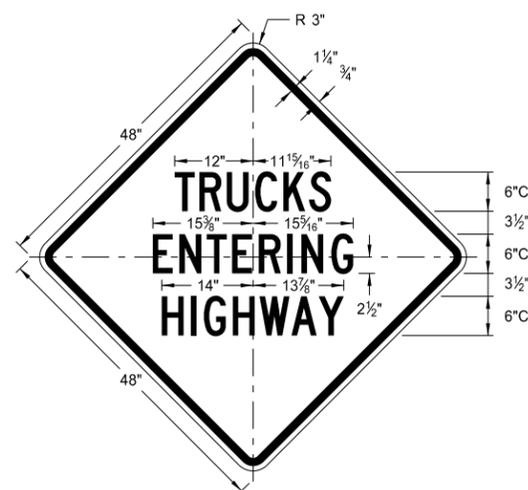
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Legend: black (non-refl)
Background: orange



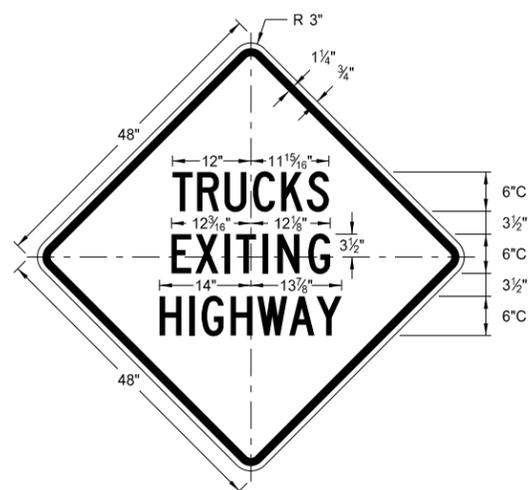
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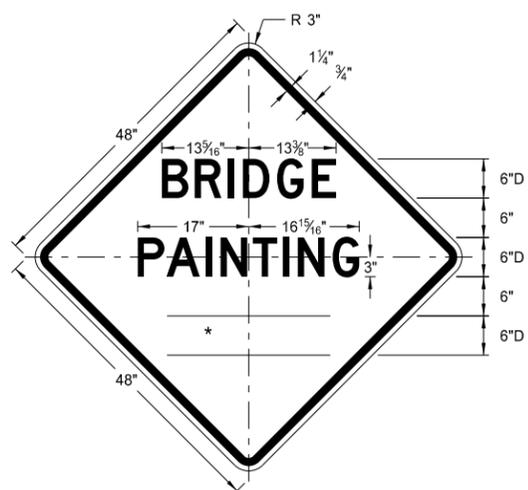
W5-9-48
ARROW DETAILS



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



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

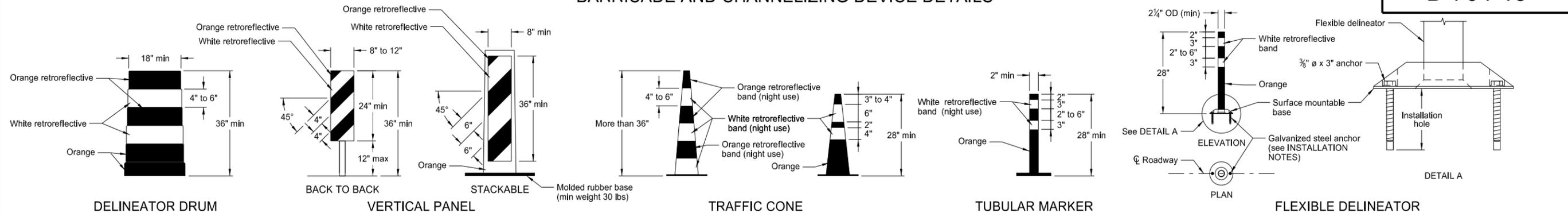


W21-50-48
Legend: black (non-refl)
Background: orange

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
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BARRICADE AND CHANNELIZING DEVICE DETAILS



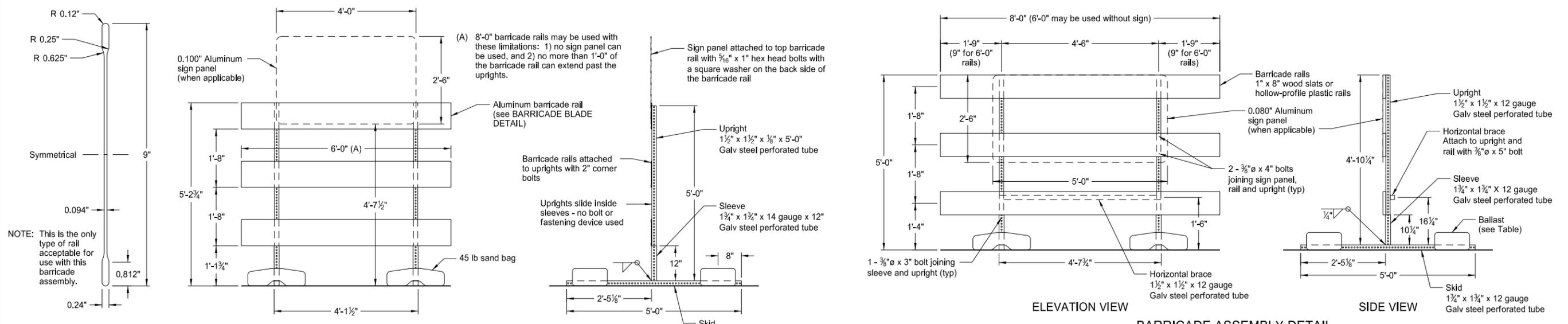
- INSTALLATION NOTES:**
1. Drill installation holes to diameter and depth as required by manufacturer's specifications.
 2. For removal, remove anchors and fill installation hole with an epoxy designed to bond to pavement surface.
 3. In lieu of bolted down base, the contractor may use an 8" x 8" butyl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

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

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

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

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

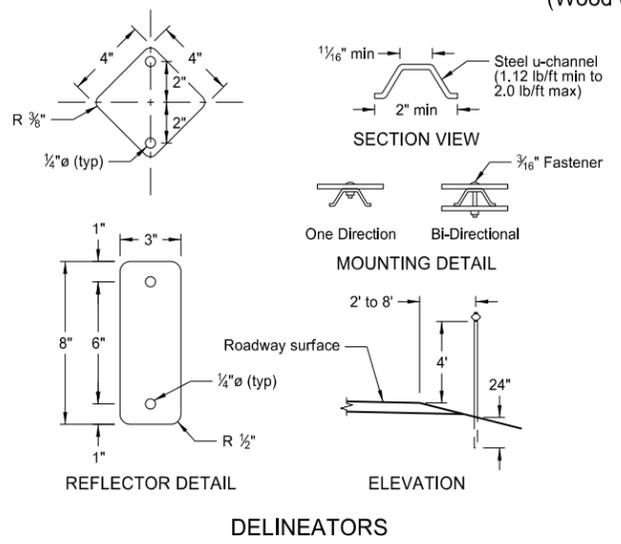
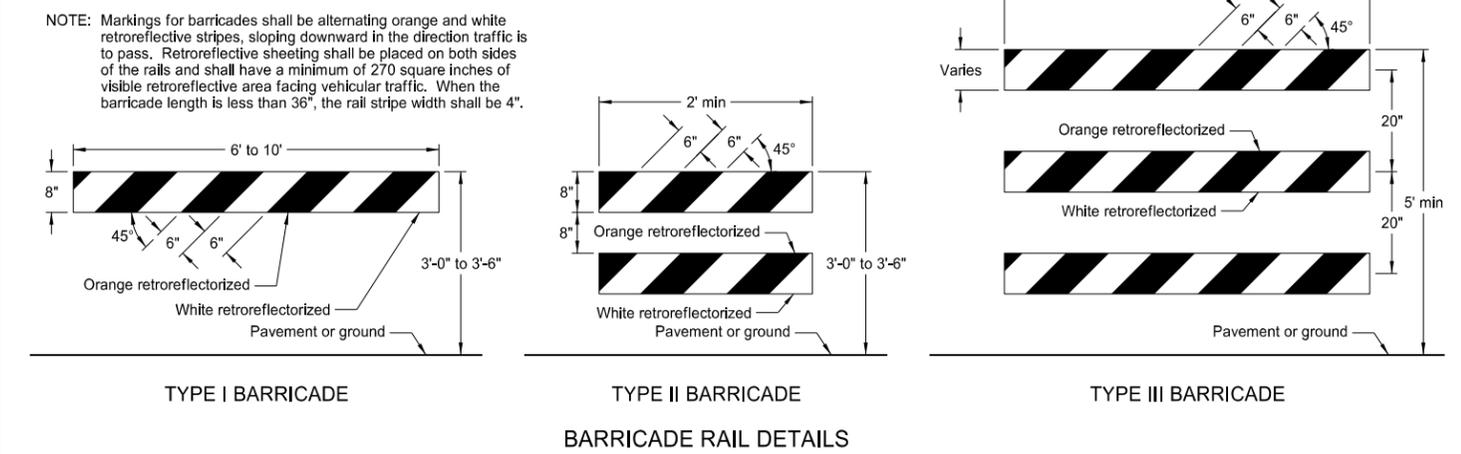


NOTE: Markings for barricades shall be alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Retroreflective sheeting shall be placed on both sides of the rails and shall have a minimum of 270 square inches of visible retroreflective area facing vehicular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

MINIMUM BALLAST
 (For each side of barricade support)

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

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

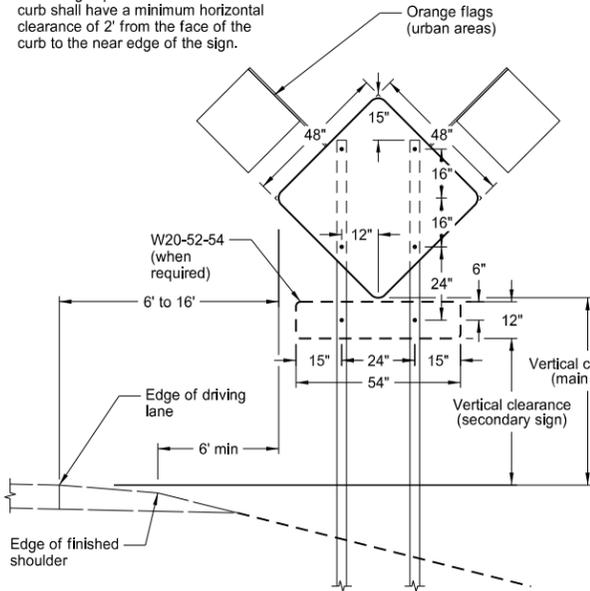


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE

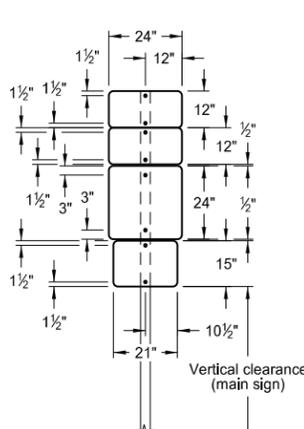
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CONSTRUCTION SIGN PUNCHING AND MOUNTING DETAILS

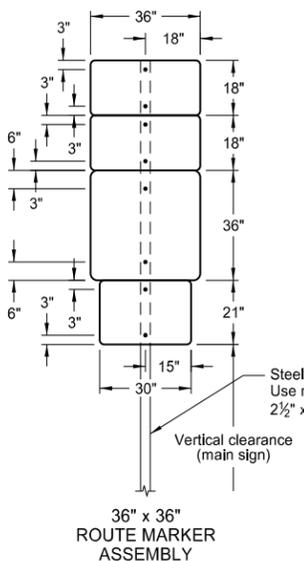
Note: Signs placed in sections with curb shall have a minimum horizontal clearance of 2' from the face of the curb to the near edge of the sign.



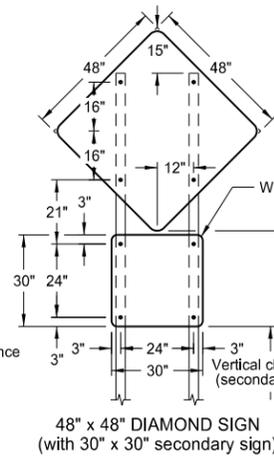
TYPICAL SECTION (48" x 48" diamond warning sign shown)



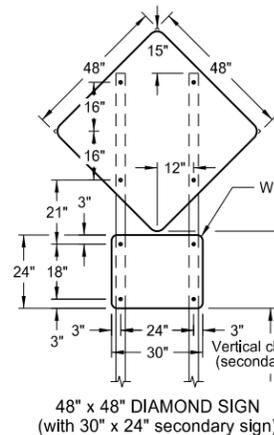
24" x 24" ROUTE MARKER ASSEMBLY



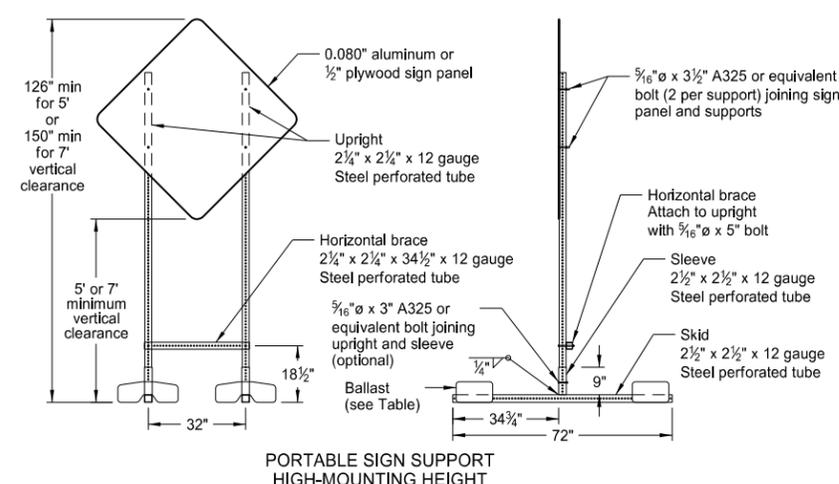
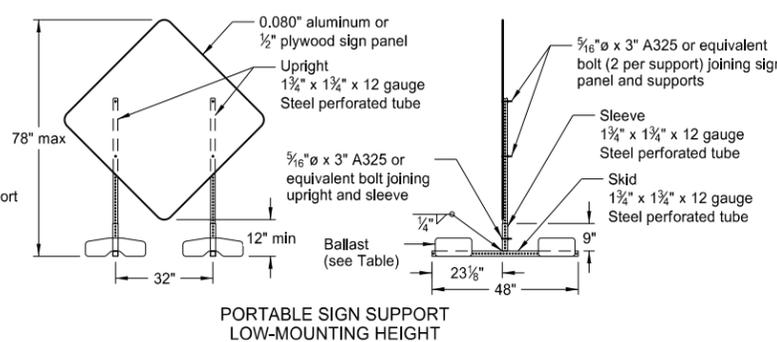
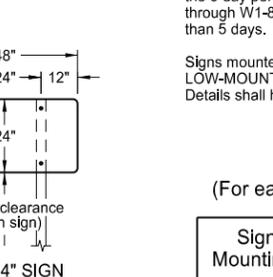
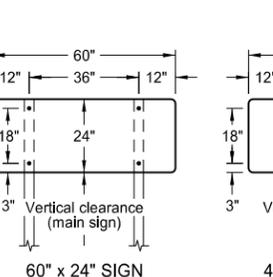
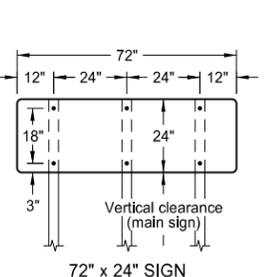
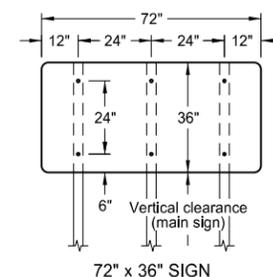
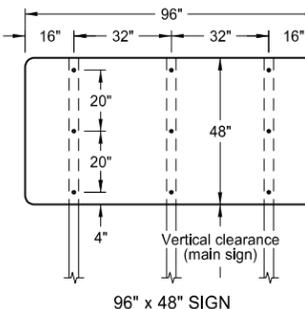
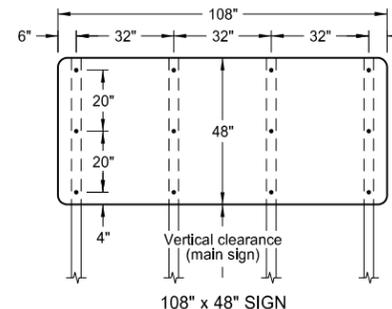
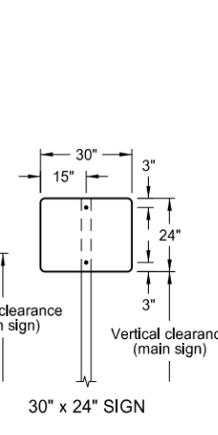
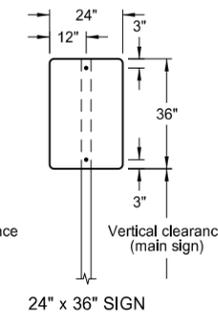
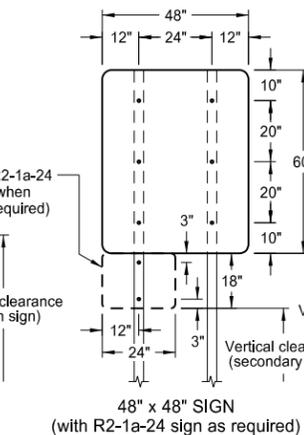
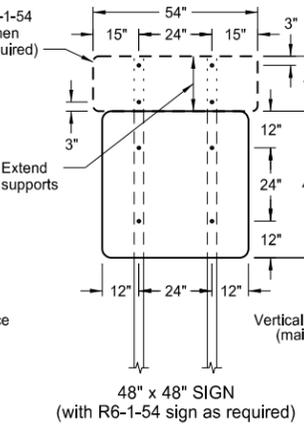
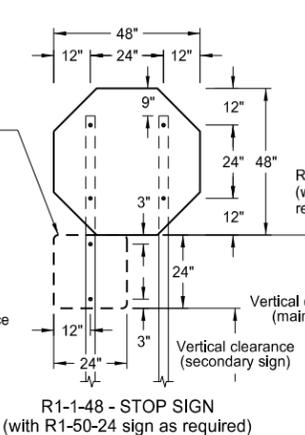
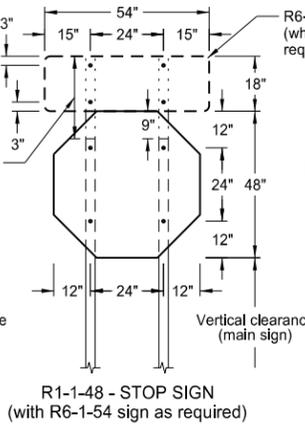
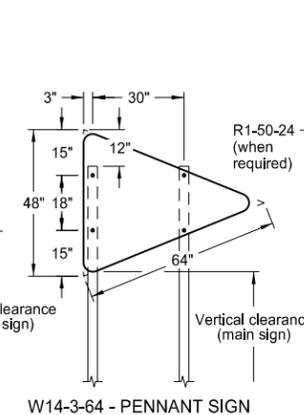
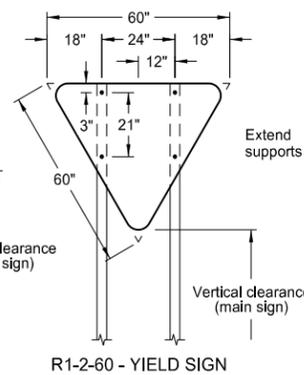
36" x 36" ROUTE MARKER ASSEMBLY



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



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



- NOTES:
- Sign Supports: Supports shall be galvanized or painted. Minimum post sizes are 2.5 lb/ft u-channel or 2" x 2" x 12 gauge steel perforated tube, except where noted. When installing signs on u-channel, the minimum post size for assemblies containing a secondary sign is 3.0 lb/ft. Post sizes are based on a wind speed of 55 MPH.
Signs over 50 square feet should be installed on 2 1/2" x 2 1/2" perforated tube supports as a minimum.
Guy wires shall not be attached to sign supports. Wind beams may be attached to u-posts behind the sign panels.
 - Sign Panels: Provide sign panels made of 0.100" aluminum, 1/2" plywood, or other approved material, except where noted. All holes to be punched round for 3/8" bolts.
 - Alternate Messages: The signs that have alternate messages may have these alternate messages placed on a reflectorized plate (without a border) and installed and removed as required. (i.e. "Left" and "Right" message on a lane closure sign)
 - 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 as stated above.
Large signs having an area exceeding 50 square feet shall have a minimum clearance of 7'-0" from the ground at the post.
 - Portable Signs: Provide portable signs that meet the vertical clearance as stated above. Use portable signs when it is necessary to place signs within the pavement surface.
When portable signs are used for 5 days or less, low-mounting height (minimum 12" vertical clearance) sign supports may be used as long as the view of the sign is not obstructed. Time delays caused by unforeseen circumstances, such as equipment breakdown, rain, subgrade failures, etc., will not accrue towards the 5 day period. The R9-8 through R9-11a series, W1-5 through W1-8 series, M4-10, and E5-1 may be used for longer than 5 days.
Signs mounted to the portable sign supports shown in the LOW-MOUNTING HEIGHT and HIGH-MOUNTING HEIGHT Details shall have a maximum surface area of 16 square feet.

MINIMUM BALLAST (For each side of sign support base)

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

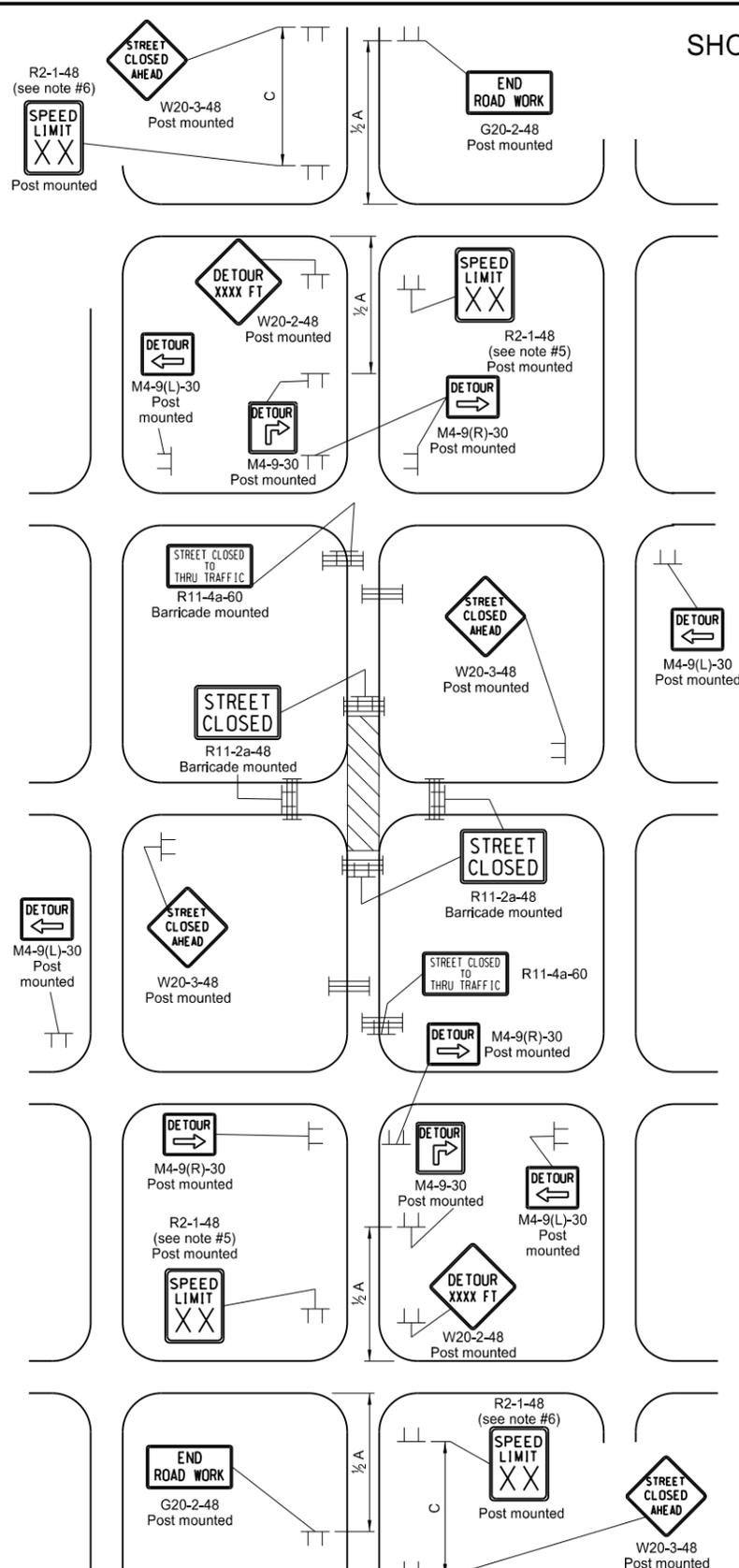
Note: The number of sandbags are based on a wind speed of 55 MPH. The sandbags are assumed to be placed at or near the ends of the skids.

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

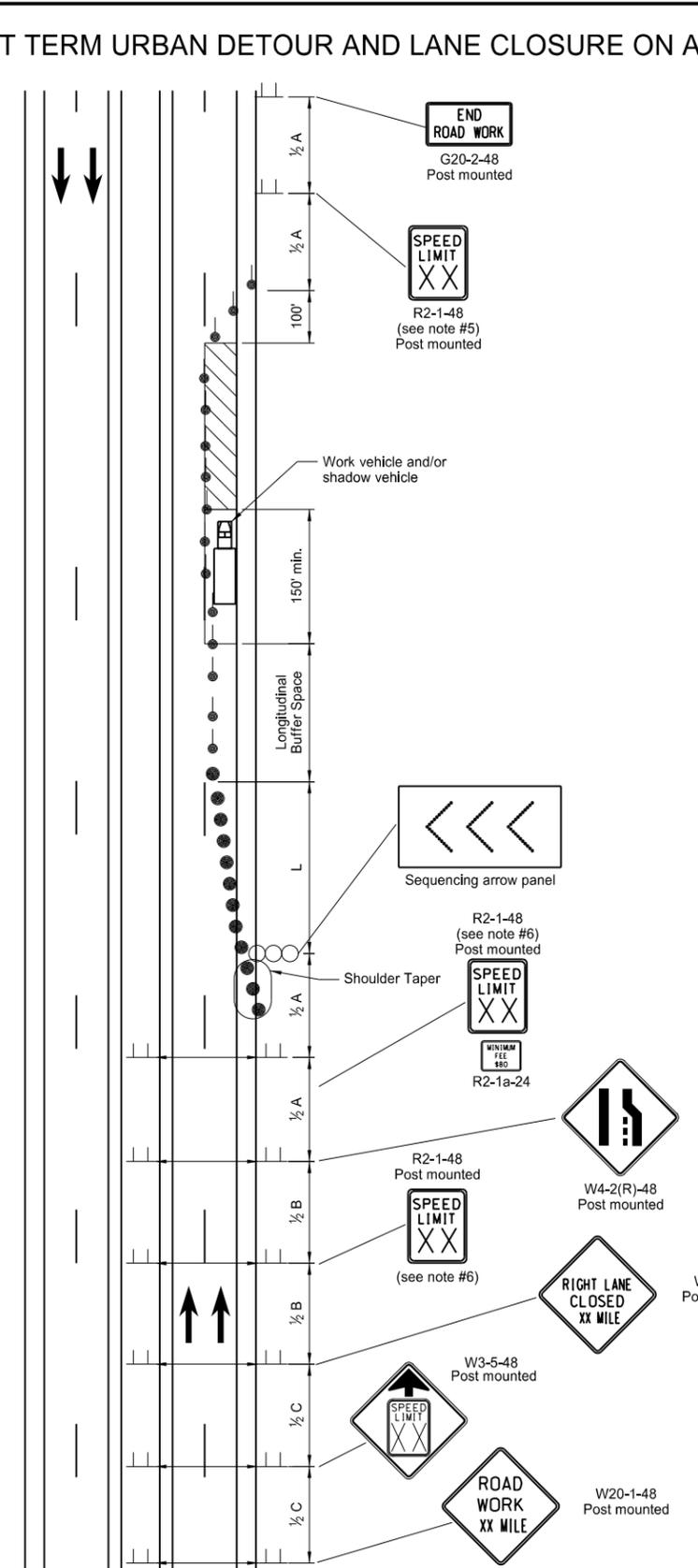
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SHORT TERM URBAN DETOUR AND LANE CLOSURE ON A DIVIDED HIGHWAY LAYOUTS

D-704-23



TYPE Q
DETOUR FOR A CLOSED STREET
 Where city streets are used for detouring traffic.
 Urban projects do not require the G20-55-96 and R2-1a-24 signs.



TYPE P
STATIONARY LANE CLOSURE ON A DIVIDED HIGHWAY
 4 lane divided roadway where 1/2 of roadway is closed.
 Short-term (more than 1 hour within a single daylight period.)

- Notes
- Variables
 - S = Numerical value of speed limit or 85th percentile.
 - W = The width of taper
 - L = Minimum length of taper, or $S \times W$ for freeways, expressways, and all other roads with speeds of 45 mph or greater, or $W \times S^2 / 60$ for urban, residential, and other streets with speeds of 40 mph or less.
 - Barricades placed on roadway shall be on a moveable assembly. Signs placed on the roadway shall be placed on skid mounted assemblies.
 - Delinicator drums used for tapering traffic shall be spaced at dimension "S". Delinicator drums or tubular markers used for tangents shall be spaced at 2 times "S".
 - Sequencing Arrow Panels
 - Panels should normally be placed at the beginning of the taper. Where shoulder width does not provide sufficient room the panel should be moved closer to the work area so that it can be placed on the roadway surface.
 - Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).
 - Type B shall be used on roadways with moderate traffic speeds and volumes (40 mph or less and 5000 ADT or less).
 - Type C shall be used on roadways with high traffic speeds and volumes (over 40 mph or over 5000 ADT).
 - The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
 - The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at 1/2 B.
 - When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
 - Existing speed limit signs within a reduced speed zone shall be covered.
 - Obliterated or covered pavement marking shall be paid for as Obliteration of Pavement Marking. The covering shall be approved by the engineer.
 - Intersection control for Type Q may have to be changed on detour. The Engineer in the field shall determine what control is necessary.
 - Where necessary, safe speed to be determined by the Engineer. When parking is present, signs shall be placed so they are entirely visible above parked vehicles or placed at the edge of the parking area so they are visible to oncoming traffic. These signs may be skid mounted when placed on the roadway surface.
 - The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.

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

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

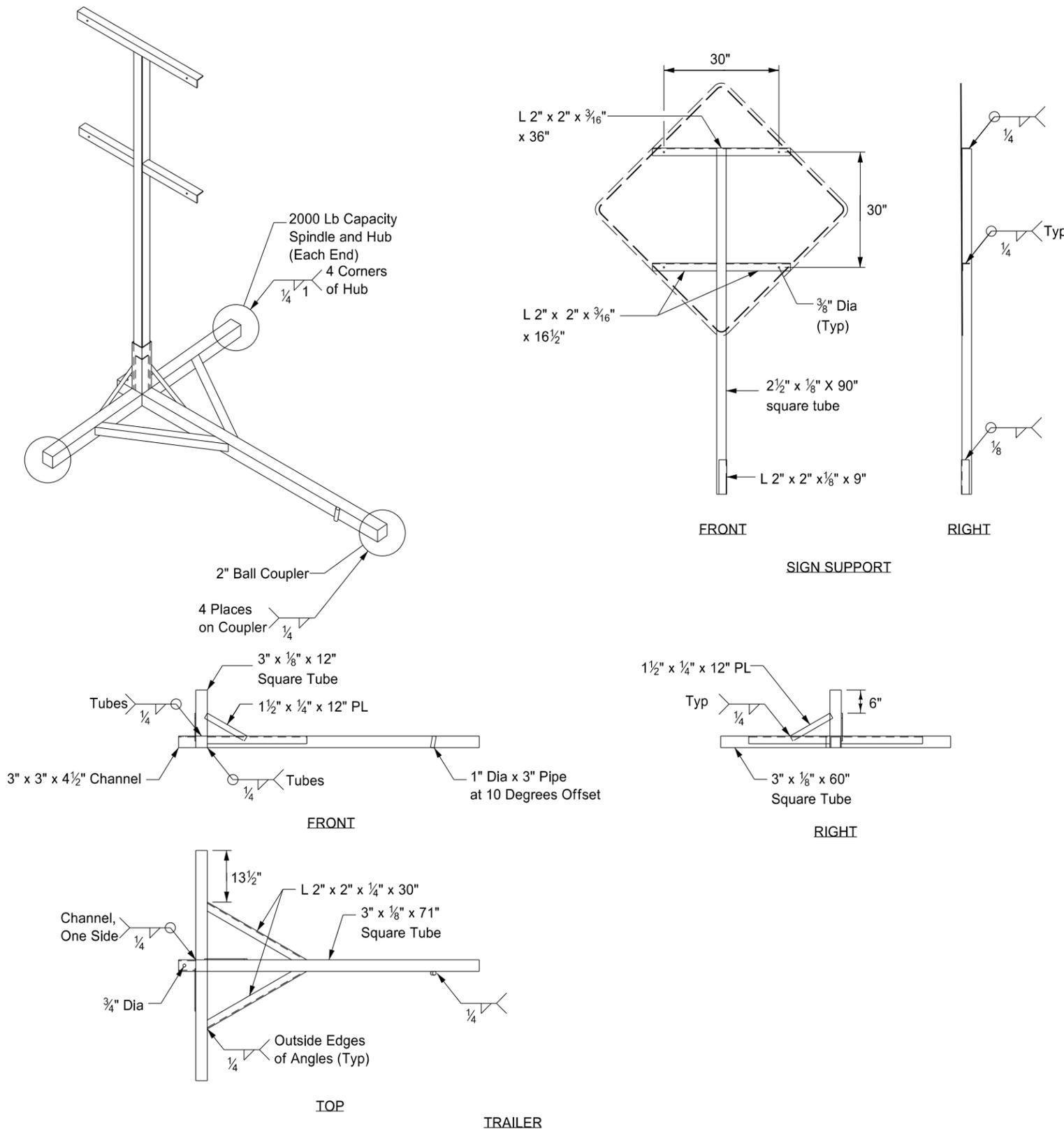
KEY	
	Type III barricade
	Sign
	Delineator Drum
	Work area
	Sequencing arrow panel
	Tubular Markers

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PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



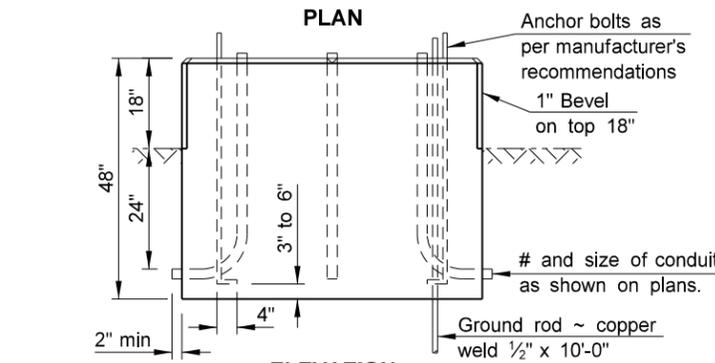
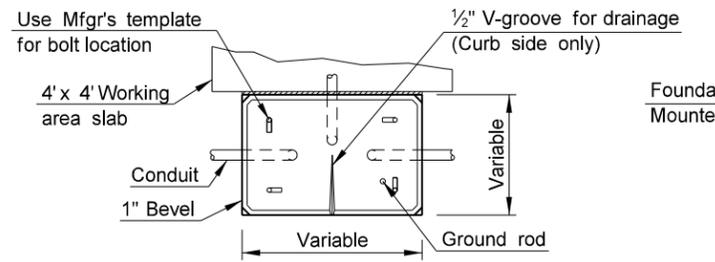
Notes:

- ① The maximum weight of the assembly is 250 pounds.
- ② Use a 14" wheel and tire.
- ③ Automotive and equipment axle assemblies may not be used for trailer-mounted sign supports.
- ④ Other NCHRP 350 crash tested assemblies are acceptable.

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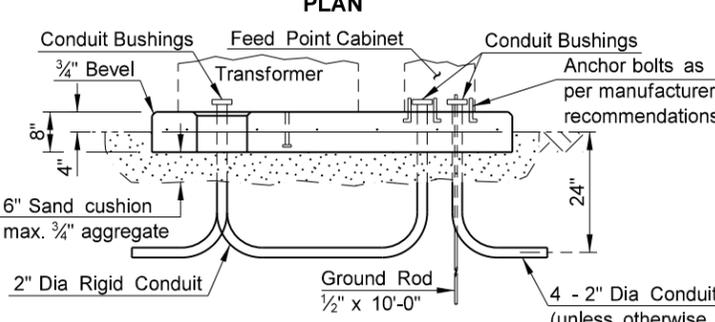
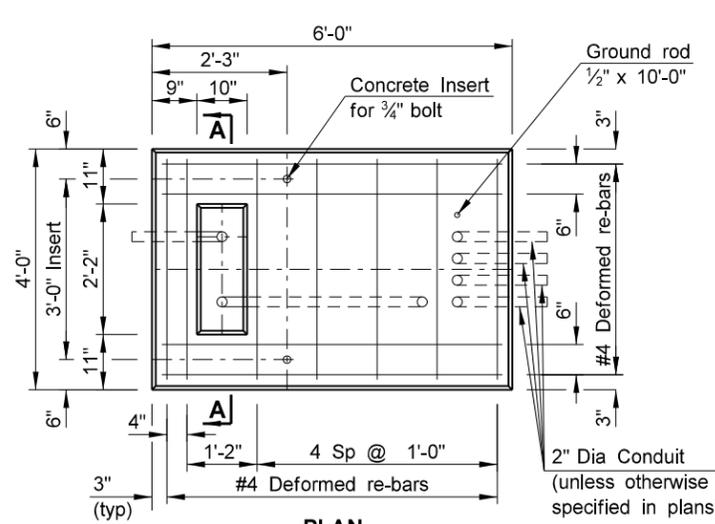
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 Roger Weigel
 Registration Number PE-2930,
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**CONCRETE FOUNDATIONS
(TRAFFIC SIGNALS & HIGHWAY LIGHTING)**



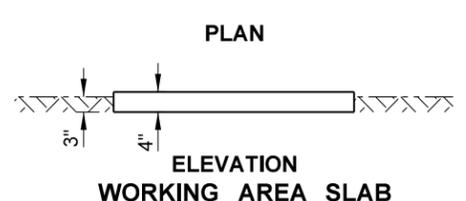
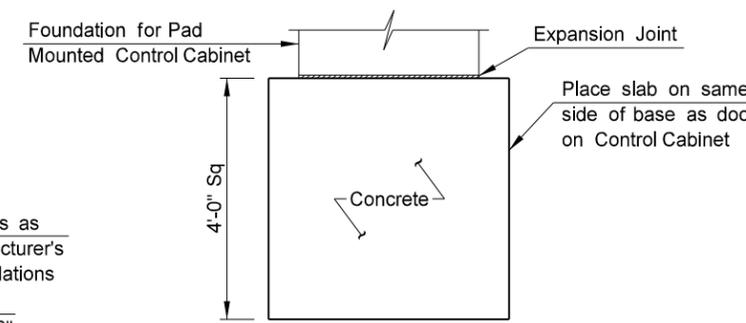
CONTROLLER CABINET FOUNDATION PAD MOUNT

The Controller Cabinet Foundation shall be bid as Concrete Foundation - Traffic Signals.

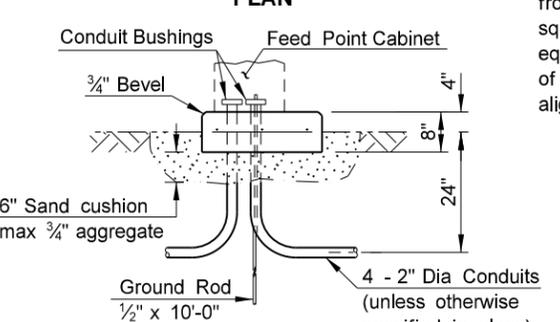
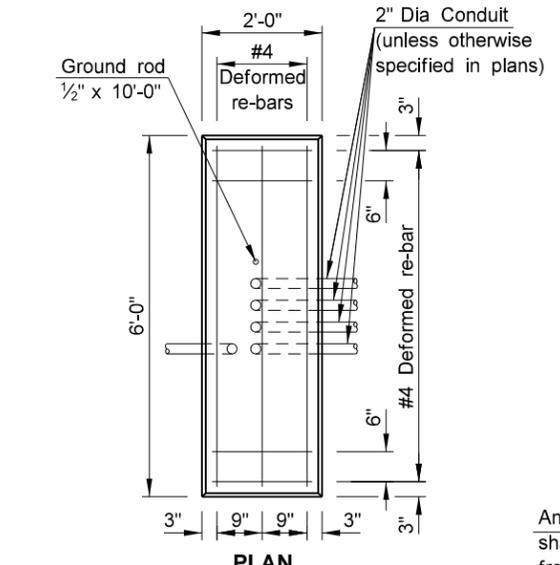


TRANSFORMER & FEED POINT CABINET FOUNDATION PAD MOUNT

The Transformer & Feed Point Cabinet Foundation Pad Mount shall be bid as Concrete Foundation ~ Feed Point ~ Type A.

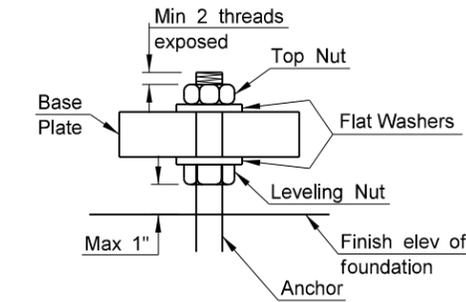


The Working Area Slab shall be installed where shown on the plans and shall not be bid separately but shall be included in the price bid for Concrete Foundation - Traffic Signals.

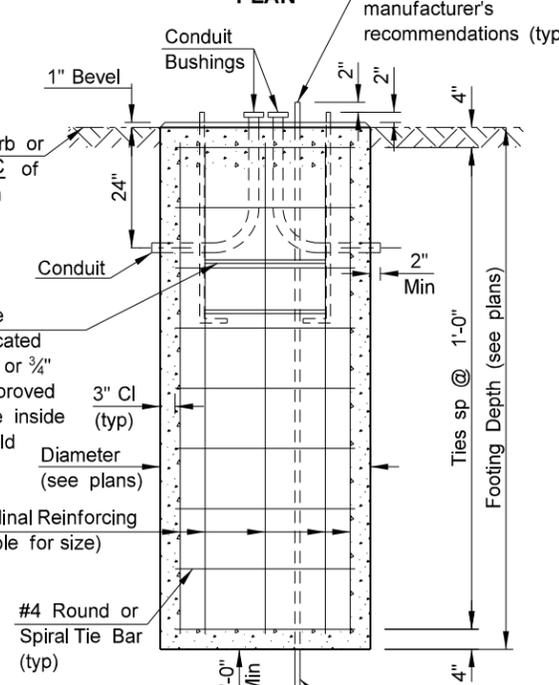
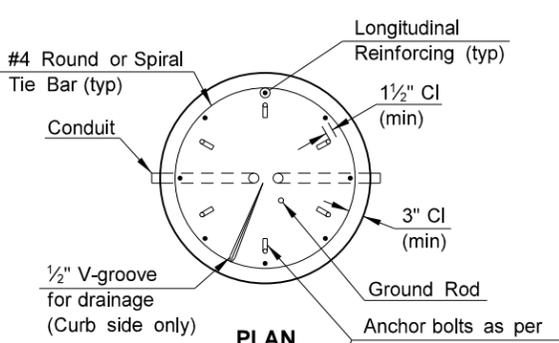


FEED POINT CABINET FOUNDATION PAD MOUNT

The Feed Point Cabinet Foundation Pad Mount shall be bid as Concrete Foundation ~ Feed Point ~ Type B.



ANCHOR BOLT DETAIL



LIGHT & SIGNAL STANDARD FOUNDATION

An anchor bolt cage shall be shop fabricated from #6 bar circle or 3/4 inch square stock or approved equal welded to the inside of anchor bolt to hold alignment.

NOTES:

LIGHT & SIGNAL STANDARD FOUNDATIONS:
See plans for conduit size, number of bends and correct position for each foundation. When conduit does not continue beyond the foundation, conduit with a 105° bend and bushings on both ends may be substituted for the 90° bends shown. See plans for correct size & location of foundations. The grade and exact location shall be established by the Engineer in the field. All reinforcing shall be Grade 60. Tie bars shall have a minimum of a 12" lap. Reinforcing may be omitted for Type I, II, V, VI & VII signal standard foundations if the anchor bolts extend to within 3" to 6" above the bottom of the foundation. A minimum of 6 anchor bolts shall be used for cantilevered structures.

CONTROLLER CABINET FOUNDATION PAD MOUNT FOUNDATION: See plans for the number of 90° bends per foundation and correct positioning. The foundation for Pad Mounted Controller Cabinet shall be of sufficient size so that there is a minimum of 3" of clearance from the outside edge of cabinet to the outside edge of the foundation on any side. The contractor shall ensure a water-tight seal between the controller cabinet and the foundation by caulking, except for V-groove.

WORKING AREA SLAB: The materials and preparation of this slab shall be as approved by the Engineer in the field.

TRANSFORMER & FEED POINT CABINET FOUNDATION PAD MOUNTED: The foundation shall have a wood float finish. All conduits shown shall be installed. Conduit that is not used at this time shall be plugged with an expandable plug.

FEED POINT CABINET FOUNDATION PAD MOUNTED: The foundation shall have a wood float finish. All conduits shown shall be installed. Conduit that is not used at this time shall be plugged with an expandable plug.

LIGHT & SIGNAL FOUNDATION TABLE	
FOOTING DEPTH (ft)	LONGITUDINAL REINFORCING
≤ 12	8 - #5
13 - 14	8 - #6
15 - 16	8 - #7
17 - 19	8 - #8

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6-15-10	
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