

SECTION B: GRADING PLANS

Plotting Date: 3/7/2024 Revised 3/8/24 JLB

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END P 1806(23)186
Station h 213+52

BEGIN P 1806(23)186
Station 1+68.9



SECTION B ESTIMATE OF QUANTITIES

BID ITEM NUMBER	ITEM	QUANTITY	UNIT
009E0010	Mobilization	Lump Sum	LS
110E0500	Remove Pipe Culvert	266	Ft
110E0510	Remove Pipe End Section	79	Each
110E0590	Remove Cattle Pass	16	Ft
110E0595	Remove Cattle Pass End Section	2	Each
110E0600	Remove Fence	476	Ft
110E0700	Remove 3 Cable Guardrail	640	Ft
110E0730	Remove Beam Guardrail	92.0	Ft
110E7500	Remove Pipe for Reset	176	Ft
110E7510	Remove Pipe End Section for Reset	12	Each
120E0010	Unclassified Excavation	38,283	CuYd
120E0600	Contractor Furnished Borrow Excavation	24,042	CuYd
120E2000	Undercutting	4,778	CuYd
120E4100	Reprofiling Ditch	22.9	Sta
120E6100	Water for Embankment	432.3	MGal
270E0112	Salvage Granular Material	991.5	Ton
430E0700	Precast Concrete Headwall for Drain	12	Each
450E0143	24" RCP Class 3, Furnish	184	Ft
450E0150	24" RCP, Install	184	Ft
450E2008	18" RCP Flared End, Furnish	29	Each
450E2009	18" RCP Flared End, Install	29	Each
450E2016	24" RCP Flared End, Furnish	14	Each
450E2017	24" RCP Flared End, Install	14	Each
450E2024	30" RCP Flared End, Furnish	2	Each
450E2025	30" RCP Flared End, Install	2	Each
450E4768	24" CMP 14 Gauge, Furnish	86	Ft
450E4770	24" CMP, Install	86	Ft
450E4778	30" CMP 14 Gauge, Furnish	50	Ft
450E4780	30" CMP, Install	50	Ft
450E5020	30" CMP Elbow, Furnish	2	Each
450E5021	30" CMP Elbow, Install	2	Each
450E5211	18" CMP Flared End, Furnish	8	Each
450E5212	18" CMP Flared End, Install	8	Each
450E5215	24" CMP Flared End, Furnish	12	Each
450E5216	24" CMP Flared End, Install	12	Each
450E5314	30" CMP Sloped End, Furnish	1	Each
450E5315	30" CMP Sloped End, Install	1	Each
450E5826	54" CMP Arch Flared End, Furnish	16	Each
450E5827	54" CMP Arch Flared End, Install	16	Each
* 450E8900	Cleanout Pipe Culvert	32	Each
450E8910	Cleanout for Culvert Treatment	10	Each
450E9000	Reset Pipe	176	Ft
450E9001	Reset Pipe End Section	12	Each

* - Denotes Non-Participating

BID ITEM NUMBER	ITEM	QUANTITY	UNIT
450E9518	18" Cured in Place Pipe	650	Ft
450E9524	24" Cured in Place Pipe	213	Ft
450E9528	36" Cured in Place Pipe	82	Ft
462E0250	Cellular Grout	20.6	CuYd
620E0020	Type 2 Right-of-Way Fence	80	Ft
620E0030	Type 3 Right-of-Way Fence	70	Ft
620E0520	Type 2 Temporary Fence	150	Ft
620E0530	Type 3 Temporary Fence	176	Ft
620E1030	3 Post Panel	4	Each
629E0110	High Tension 4 Cable Guardrail	566	Ft
629E0290	High Tension Cable Guardrail Anchor Assembly	4	Each
630E1010	Straight Class A W Beam Guardrail with Wood Posts	62.5	Ft
630E1025	Curved Class A W Beam Guardrail with CRT Posts	37.5	Ft
630E2035	W Beam Guardrail Special Anchor Assembly	1	Each
632E2510	Type 2 Object Marker Back to Back	158	Each
680E0204	4" Perforated PVC Drain Pipe with Sleeve	360	Ft
680E0224	4" PVC Outlet Pipe	160	Ft
680E2500	Porous Backfill	171.0	Ton
700E0210	Class B Riprap	99.8	Ton
720E1010	PVC Coated Bank and Channel Protection Gabion	10.5	CuYd
831E0110	Type B Drainage Fabric	160	SqYd
831E0400	Impermeable Plastic Membrane	68	SqYd
900E2030	Miscellaneous Work	11	Site

* - Denotes Non-Participating

GRADING OPERATIONS

Water for Embankment is estimated at the rate of 15 gallons of water per cubic yard of Embankment minus Waste. The estimated quantity of Water for Embankment is 432.3 MGal. All costs associated will be incidental to the contract unit price per MGal of "Water for Embankment".

The estimated cubic yards of excavation and/or embankment required to construct outlet ditches, ditch blocks, and approaches are included in the earthwork balance notes on the profile sheets.

TABLE OF EXCAVATION QUANTITIES BY BALANCES

Location		Excavation	* Undercut	* Contractor Furnished Borrow Exc.	Total Excavation
MRM to	MRM	(CuYd)	(CuYd)	(CuYd)	(CuYd)
Grading at Pipe Ends		-	-	80	-
192.00+0.256	192.00+0.284	889	739	1363	1628
193.00+0.326	193.00+0.414	2398	2323	3688	4721
193.00+0.523	193.00+0.588	1866	1716	2866	3582
Inslope Modification (Sections 6-9)		1416	-	16045	1416
Totals:		6569	4778	24042	11347

* The quantities for these items are in the Estimate of Quantities under their respective contract items.

Special ditch grades and other sections of the roadway different than the typical sections will be constructed to the limits shown on the cross sections. If significant changes to the cross sections are necessary during construction, the Engineer will contact the Designer for the proposed change.

Generally, all shallow inlet and outlet ditches as noted on the plan sheets will be cut with a 10-foot wide bottom with 5:1 backslopes. However, the Engineer may direct the Contractor to adjust the ditch width for proper alignment with the drainage structure.

UTILITIES

The Contractor will contact the involved utility companies through South Dakota One Call (1-800-781-7474) prior to starting work. It will be the responsibility of the Contractor to coordinate work with the utility owners to avoid damage to existing facilities.

Utilities are not planned to be affected on this project. If utilities are identified near the improvement area through the SD One Call Process as required by South Dakota Codified Law 49-7A and Administrative Rule Article 20:25, the Contractor will contact the Engineer to determine modifications that will be necessary to avoid utility impacts.

SALVAGE GRANULAR MATERIAL

In the heave repair areas, the Contractor will be required to salvage enough existing granular base material for a 4" lift of temporary surfacing, prior to asphalt concrete surfacing for the project. The 4" lifts are estimated to require 991.5 Tons of salvaged material. Cost associated with salvaging and stockpiling the material for use as temporary surfacing is incidental to the contract unit price per ton for "Salvage Granular Material".

SHRINKAGE FACTOR: Embankment +20%



TABLE OF UNCLASSIFIED EXCAVATION

	(CuYd)
Excavation	6569
Undercut	4778
Topsoil	26936
Total	38283

PROCEDURES FOR DETERMINING UNCLASSIFIED EXCAVATION QUANTITY

When plan quantities are used for payment, the Unclassified Excavation quantity will be used for final payment and the plans quantity of Topsoil and salvaged surfacing items listed in the Table of Unclassified Excavation will not be adjusted according to field measurements.

The Excavation quantities from individual balances and the table above have been reduced by the volume of in place concrete pavement and asphalt pavement that will be removed.

UNDERCUTTING

The undercut depth for the Fault-Heave Repair areas will be 3 feet.

The plan shown quantity will be the basis of payment. However, if there are additional areas of undercut other than what is shown in the plans, the Engineer will direct removal of these areas and the additional areas will be measured according to the Engineer.

TABLE OF UNDERCUTTING

MRM	to	MRM	Quantity
192.00+0.256		192.00+0.284	739
193.00+0.326		193.00+0.414	2323
193.00+0.523		193.00+0.588	1716
		Total	4778

CONTRACTOR FURNISHED BORROW EXCAVATION

The Contractor will provide a suitable site for Contractor furnished borrow excavation material. The Contractor is responsible for obtaining all required permits and clearances for the borrow site. The borrow material will be approved by the Engineer. The plans quantity for "Contractor Furnished Borrow Excavation" as shown in the Estimate of Quantities will be the basis of payment for this item.

Restoration of the Contractor furnished borrow excavation site will be the responsibility of the Contractor.

TABLE OF CONTRACTOR FURNISHED BORROW

Location	MRM	to	MRM	Quantity (CuYd)
Grading at Pipe Ends				80
192.00+0.256			192.00+0.284	1363
193.00+0.326			193.00+0.414	3688
193.00+0.523			193.00+0.588	2866
Inslope Modification (Sections 6-9)				16045
			Total:	24042

MISCELLANEOUS WORK

The Contractor will perform miscellaneous work, as detailed in the table below. Riprap will be removed to 12" below the ditch gradeline. Riprap removed from rock check dams will be hauled and stockpiled at the SDDOT Pierre Area Office, as directed by the Engineer. The resulting hole will be filled to within 4" of the gradeline with borrow material, with the top 4" being filled with Contractor supplied topsoil. Cost to remove the riprap, supply and place borrow material, supply and place Contractor supplied topsoil, and final grading, prior to placement of the erosion control appurtenances, is incidental to the contract unit price per Site for Miscellaneous Work.

The riprap at inlet of the box culvert at 24+80-L will be removed, and stockpiled. The inlet channel will then be re-shaped and the riprap replaced in the inlet channel at a depth of no less than 24". The reshaped channel will provide a consistent profile from the ditch-line to the RCBC. Prior to replacement of the riprap, Type B Drainage Fabric will be placed both under and on the vertical cut section where the riprap is replaced. Cost for removing, stockpiling, and placing riprap, supplying and placing Type B Drainage Fabric, and fine grading of the ditch to ensure drainage is maintained, is incidental to the contract unit price per Site for Miscellaneous Work.

Location	Work to be performed
1+86 L	Remove Rock Check Dam
4+00 L	Remove Rock Check Dam
6+41 L	Remove Rock Check Dam
8+90 L	Remove Rock Check Dam
12+00 L	Remove Rock Check Dam
14+71 L	Remove Rock Check Dam
17+89 L	Remove Rock Check Dam
20+84 L	Remove Rock Check Dam
22+57 L	Remove Rock Check Dam
23+82 L	Remove Rock Check Dam
24+75 L	Remove & Replace Riprap

REPROFILING DITCH (Station 1+86-L to 24+75-L)

The Contractor will reprofile the ditch as directed by the Engineer. The ditches will be excavated to obtain proper drainage. The excavated material may be used as fill material as approved by the Engineer.

All costs associated with clearing and reshaping of the existing ditch, labor, excavation, placing material, equipment, and incidentals will be paid for at the contract unit price per station for "Reprofiling Ditch". If embankment material is required, it will be paid for at the contract unit price cubic yard for Contractor Furnished Borrow.

FAULT-HEAVE REPAIR

The earthen subgrade will be undercut 3 feet below the earthen subgrade surface at the fault-heave areas specified in the table below. The undercut material or other suitable material, as directed by the Engineer, will then be replaced, and compacted to the density specified for the section being constructed. The undercut will utilize a 4:1 taper from the top of the subgrade to the bottom of the undercut.

MRM	to	MRM
192.256±		192.284±
193.326±		193.414±
193.523±		193.588±

Compaction of the earth embankment will be governed by the Specified Density Method.

For embankment soil with an optimum moisture of 20% or greater, the Density Specification (Percent of Maximum Dry Density) will be 92% to 98% and the Moisture Specification (Percent of Optimum Moisture) will be -2% to +3%.

In addition to undercutting the road, fault traces were noted in the ditches. Shape ditches to correct the distortions caused by the fault traces and reestablish proper drainage.

US CORPS OF ENGINEERS UTILITY LOCATION

The Contractor is required to contact and coordinate with the US Corps of Engineers USCOE) for locating existing phone line locations, a minimum of two weeks prior to any work starting for the undercutting of the fault-heave repairs. Fault-heave repair locations are located between MRM 192.00+0.256 to 193.00+0.588. Contact information for the USCOE is as follows:

Jason Taylor
Jason.r.taylor@usace.army.mil
 (Office) 605-945-3416
 (Cell) 605-280-1891

LeeJay Templeton
leejay.j.templeton@usace.army.mil
 (Office) 605-945-3411



GENERAL UNDERDRAIN NOTES

The SDDOT Geotechnical Engineering Activity will be contacted a minimum of one week prior to pavement removal for assistance in locating the fault trace underdrains and outlet locations.

The 4-inch Perforated PVC Drainpipe will be PS 46 Solvent Weld PVC pipe conforming to ASTM F758 or SDR 35 Solvent Weld PVC Pipe conforming to ASTM D3034 with perforations in accordance with ASTM F758. The 4-inch PVC Outlet Pipe will be Schedule 40 PVC Pipe conforming to ASTM D1785 designated as PVC 1120, PVC 1220, or PVC 2120. Pipe sections will be connected using a PVC Solvent Cement conforming to ASTM D2564. The Drain Sleeve will conform to ASTM D6707. All labor, tools, equipment, and incidentals necessary for the installation of the PVC Pipe will be incidental to the contract unit price per foot for each pipe type.

Care must be taken to ensure that the drainage tubing is not damaged during construction.

The drain location and depth given are based on the best information available to the Geotechnical Engineering Activity. The actual field conditions may require that adjustments be made by the Project Engineer to provide for sufficient drainage. The Geotechnical Engineering Activity will be available for onsite assistance if necessary.

Outlet headwalls will be cleared of topsoil, straw, or other debris after seeding operations have been completed. The as-built headwall locations will be recorded and submitted to the Engineer. Each headwall location will be identified by GPS coordinates and Station and Offset. The headwall locations will be cataloged in the Pierre Area office for future reference in post-construction maintenance.

FAULT TRACE UNDERDRAINS

After the surfacing section has been removed, reestablish the desired subgrade profile by removing excess heave material. Once the subgrade profile has been established, undercut 3 feet below the corrected subgrade surface. After excavating the subgrade material during undercut operations, an underdrain will be installed through the fault trace. It is anticipated that to provide positive drainage, the underdrain installation at MRM 192.27 may require adjusting the trench depth. Adjustment to the trench depth will be accomplished by backfilling the undercut area as needed prior to excavation of the underdrain trench and reducing the thickness of compacted soil backfill over 2 feet of porous backfill.

The underdrain will be installed in a trench 4 feet wide by 2 feet deep. The trench will be graded to maintain a minimum of .01ft/ft or 1% drop. The trench will be graded to drop from the east shoulder to the west ditch. Place 4-inch Perforated PVC Drainpipe with a filter fabric drain sleeve in the center of the trench bottom. Using SDR solvent weld PVC coupling, connect 4-inch PVC Outlet Pipe to the end of the Perforated PVC Drainpipe and place in the center of the trench. The outlet tubing will daylight at a headwall placed above the ditch bottom to provide positive drainage from the outlet and blend into the inslope. The depth of the trench may be adjusted to maintain the minimum grade needed to maintain positive drainage and proper placement of the headwalls. Backfill the trench containing the 4-inch Perforated PVC Drainpipe with Porous Backfill. The remainder of the trench from the edge of the subgrade top to the headwall will be backfilled with compacted soil.

Estimate of Quantities:

Item	Quantity	Unit
4-inch Perforated PVC Drainpipe with Filter Fabric Drain Sleeve	240	Ft
4-inch PVC Outlet Pipe	80	Ft
Porous Backfill	136	Ton
Headwalls (See Standard Plate No. 430.50)	4	Each

CUTOFF DRAIN

Cutoff drains will be installed in conjunction with fault heave repair and to prevent water from continuing to collect within a sag in the alignment. Cutoff drains at the fault-heave repairs will be installed after reconstruction of the subgrade and placement of the base course has been completed. Cutoff drains will be installed perpendicular to the centerline across both lanes at the following locations:

MRM 193.326, MRM 193.523, MRM 211.368, & MRM 211.487

The cutoff drain will be installed prior to placement of asphaltic surfacing. The cutoff drain will be installed in a trench 2 feet wide by 3 feet deep. The trench will be graded to maintain a minimum of 0.01ft/ft. or 1% drop from centerline to the ditches. Once the trench is excavated, place Impermeable Plastic Membrane on the trench bottom and against the downgrade side of the trench the entire width of the finished subgrade surface. The membrane will extend upward through the base course overlying the subgrade. The membrane will be folded, not cut, to fit against the bottom and the downgrade side of the trench. This may be done by rolling out the membrane perpendicular to centerline, folding the membrane into the trench, and cutting off the excess membrane from the top of the trench after backfilling. After the membrane is placed into the trench, place 4" Perforated PVC Drainpipe with a filter fabric drain sleeve on top of the membrane in the center of the trench bottom. Using a coupler, connect 4" PVC Outlet Pipe to both ends of the 4" Perforated PVC Drainpipe and place in the center of the unlined trench. The 4" PVC Outlet Pipe will daylight at a headwall placed above the ditch bottom to provide positive drainage from the outlet and blend into the inslope. The depth of the trench may be adjusted to maintain the minimum grade needed to maintain positive drainage and proper placement of the headwalls. Backfill the membrane lined trench containing the 4" Perforated PVC Drainpipe with porous backfill and 12" of Base Course. The remainder of the trench from the edge of the subgrade top to the headwall will be backfilled with compacted soil.

Estimate of Quantities:

Item	Quantity	Unit
Impermeable Plastic Membrane	68	SqYd
4-inch Perforated PVC Drainpipe with Filter Fabric Drain Sleeve	120	Ft
4-inch PVC Outlet Pipe	80	Ft
Porous Backfill	35	Ton
Headwalls (See Standard Plate No. 430.50)	8	Each

CORRUGATED METAL PIPE

Rev. 4-22-24 pak

Corrugated metal pipes will have 2 3/8-inch x 1/2-inch corrugations for 42-inch and smaller round pipe and 48-inch and smaller arch pipe unless otherwise stated in the plans. Corrugated metal pipes will have 3-inch x 1-inch or 5-inch x 1-inch corrugations for 48-inch and larger round pipe and 54-inch and larger arch pipe unless otherwise stated in the plans.

Areas within the project have soils that are highly corrosive to steel. Corrugated metal pipe in these areas will be polymer coated 14 gauge steel as specified in the Table of Pipe Quantities. Any required connection bands, elbows, tees, crosses, wyes, reducers, and transitions will also be polymer coated. The connection bands will be 24 inches wide. All polymer coated corrugated metal pipe and components will be in conformance with AASHTO M245. Riveted pipe will not be allowed.

All damage to the polymer coating will be repaired in accordance with the manufacturer's recommendations prior to installation of the pipe.

All costs associated with the polymer coating including repair of polymer coating will be incidental to the corresponding CMP contract items.

Metal pipe end sections connected to polymer coated CMP will be aluminum-coated (Type 2) in accordance with AASHTO M36 as specified in the Table of Pipe Quantities. All costs associated for gauge, coating, and connections will be incidental to the corresponding CMP End Section contract items

GASKETED REINFORCED CONCRETE PIPE

The 24" reinforced concrete pipe installed at MRMs 191.00+0.614 (Sta d 0+00) and 192.00+0.313 (Sta d 36+98) will require flexible watertight gaskets as per 450.2 E.

TEMPORARY FENCE

The Contractor will verify the location of the temporary fence with the landowner prior to installation of the fence.



MAINLINE CROSS PIPE REPLACEMENT

Pipe culverts at MRMs 191.614, 192.313, and 198.778 will be installed in accordance with the following notes and as shown on the Pipe Installation Detail.

This work will be completed prior to beginning cold milling on the project.

After the existing pipe has been removed, the new pipe culvert will be undercut to a minimum depth one 1 foot. The depth of undercut is an estimate and the actual depth necessary will be determined during construction. The Engineer will determine how much undercut will be done in accordance with Section 421 of the specifications but will not reduce the undercut to less than 1 foot in depth.

Select fill material for backfilling the undercut will conform to the gradation requirements of Base Course in Section 882. If groundwater is encountered during construction, the select fill material for backfilling the undercut area and Class B bedding will conform to the gradation requirements of Section 421.2 A. until backfill placement is above the groundwater level. The Engineer will process a CCO to provide for compensation to the Contractor for the added cost of the changed material. All other requirements of Section 421 will apply.

Pipe Culverts will be bedded in accordance with Section 450.3 F.2, Class B Bedding with the following exceptions. The excavated area will extend 2 feet from the outermost diameter on both sides of the pipe with the back of the excavated area being sloped 2:1 upward to the top of the roadway surface. Select fill material for Class B Bedding will conform to the gradation requirements of Base Course in section 882.

After the minimum testing requirements of M.S.T.R. Section 4.1F.3.a.1 (SDDOT Materials Manual) have been met, the minimum density testing requirements will be one test per zone. Each zone from the top of the pipe to the top of the subgrade will be 2 feet in depth. Moisture testing will remain as per M.S.T.R.

The remainder of the pipe culvert excavation will be backfilled with soils taken from the pipe removal excavation or other suitable material as approved by the Engineer. The Backfill will be benched into 2:1 excavation slope. Compaction of the backfill material will be governed by the Specified Density Method.

After the new pipe has been backfilled to the top of the subgrade, a 12" depth of Base Course and 5" (2-2.5" lifts) depth of asphalt concrete composite will be placed as a patch matching the existing asphalt concrete.

All costs to remove and dispose of asphalt concrete pavement, including full depth saw cutting of the asphalt concrete pavement, will be incidental to the contract until price per square yard to Remove Asphalt Concrete Pavement. All excavation necessary for Class B Bedding and the pipe installation will be incidental to the contract unit price per foot for the corresponding pipe installation contract items. The excavation of material for pipe culvert undercut will be paid for at the contract unit price per cubic yard for Pipe Culvert Undercut.

The select fill material used for backfilling the pipe culvert undercut and the Class B bedding will be paid for at the contract unit price per ton for Base Course. The 3" layer of bedding material to form the cradle in the pipe foundation will be incidental to the corresponding pipe installation contract items. The cost for asphalt concrete composite installed over the pipe replacement will be paid for at the contract unit price per ton for Asphalt Concrete Composite.

REINFORCED CONCRETE PIPE

High sulfate levels will be encountered on this project. The type of cement will be either a type V or a type II with 20% to 25% Class F Modified Fly Ash substituted for cement in accordance with section 605. The Water/Cementitious material ratio will not exceed 0.45 as defined in section 460.3 C. The mix will be as per fabricator's design; however, minimum compressive strength will not be less than 4500 psi at 28 days. The pipe must be marked in an acceptable way to designate meeting the requirements for sulfate resistance.

TEMPORARY EXCAVATION

Temporary 1.5:1 excavation slope will be required at Station f227+54 Rt. The temporary slope will become unstable over the long-term. However, the slope should remain globally stable over the short-term during construction if measures are taken to divert runoff away from the slope and construction activities are sequenced to minimize the amount of time the temporary slopes are left exposed and unsupported. Regular monitoring of the temporary slope is required during construction. If the temporary slope becomes unstable, excavation will cease, and the slope will be evaluated by the Engineer. Reconstructed embankment will be benched into the temporary excavation slope in accordance with Section 120.3.B.2 of the Specifications.

TABLE OF PVC COATED BANK AND CHANNEL PROTECTION GABIONS AND DRAINAGE FABRIC

MRM	L/R	PVC Coated Bank and Channel Protection Gabion (CuYd)	Type B Drainage Fabric (SqYd)
186.47+0.249	L	6.0	19
207.00+0.904	L	4.5	15
Totals:		10.5	34

TABLE OF RIPRAP AND DRAINAGE FABRIC

Station	L/R	Class B Riprap (Ton)	Type B Drainage Fabric (SqYd)
7+88	L	51.9	65
15+90	L	47.9	61
Section B Total		99.8	126
25+93 (See Section E)	R		

CELLULAR GROUT

The Contractor will submit a proposed grouting procedure to the Engineer at least two weeks prior to beginning this work.

Bulkheads will be constructed at each end of the pipe. Each bulkhead will be constructed to withstand the pressure of the grouting operation. The bulkhead will extend from the end of the existing pipe inward a minimum depth of 18 inches and will be free from leaks.

Pressure grouting will be done to ensure all the voids are filled including all breaks or holes in and around the existing pipe.

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B5	B54

Revised 4/26/24 EJW

The grout will be a cellular grout (grout with pre-generated foam) with a minimum 28-day compressive strength of 100 pounds per square inch. If water is not present within the pipe a low-density grout with a minimum of 30 pounds per cubic foot wet density may be used. When it is not possible to dewater the existing pipe, a high-density grout with a minimum of 70 pounds per cubic foot will be used which may include approved sand. The foaming agent used will meet the requirements of ASTM C869 when tested in accordance with ASTM C796.

Both of the cellular grout mix designs will be submitted to the SDDOT Concrete Engineer for approval prior to use. The mix design submittal will include the base cement slurry mix per cubic yard, expansion factor from the foaming agent, and the cellular grout wet density (pounds per cubic foot).

The Contractor will install a bypass valve adjacent to the location where the pressure grouting hose is attached for obtaining samples to be checked for wet density. The wet density of the cellular grout will be checked by the

Contractor to verify the proper minimum wet density before the cellular grout filling operations begin and at a minimum once every two hours during production. The SDDOT will document the results of the density checks.

Cellular grout will be wasted until the cellular grout meets the minimum wet density required; however, if 0.5 cubic yards or more of base cement slurry is wasted trying to meet density requirements, then that quantity will not be included for payment.

If grout holes are utilized, cylindrical wooden plugs or other approved plugs will be inserted to plug holes until the grout has set. After the plugs are removed the holes will be filled with concrete.

The quantity of cellular grout was estimated based on volume of the existing pipe and voids outside the existing pipe.

The quantity of base cement slurry ordered will be approved by the Engineer. The quantity of base cement slurry needed will be calculated to the nearest tenth of a cubic yard using the approved mix design, expansion factor of the foaming agent, and estimated amount of cellular grout. The quantity for payment to the nearest tenth of a cubic yard of "Cellular Grout" is a calculated quantity based on the amount of base cement slurry used on the project to the nearest tenth of a cubic yard, expansion factor of the foaming agent, and approved mix design.

All costs for furnishing and installing the cellular grout including bulkhead construction, inlet bevel construction, and incidentals necessary to satisfactorily complete the work will be included in the contract unit price per cubic yard for "Cellular Grout".

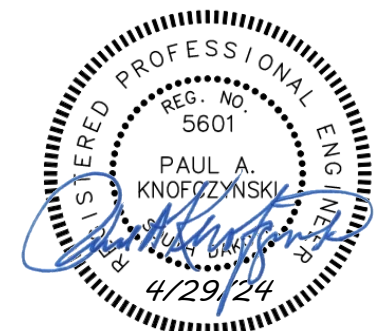


TABLE OF CELLULAR GROUT

Station	Quantity (CuYd)
77+08	20.6
Total:	20.6

The quantity at each location includes an additional 15% to account for void volume outside the existing pipe.

CLEANOUT PIPE CULVERT

Material in existing pipe culvert will be cleaned out by water flushing or other approved methods.

Material removed from the pipe culvert will become property of the Contractor for disposal.

The Contractor will implement appropriate sediment control measures prior to water flushing to prevent discharges from the project boundaries.

The pipe culvert will be cleaned to the satisfaction of the Engineer.

All costs to dewater, clean pipe, and dispose of removed materials will be incidental to the contract unit price per each for "Cleanout Pipe Culvert".

CLEANOUT FOR CULVERT TREATMENT

Cleanout of pipe culvert will be done in advance of the culvert lining.

Material in existing pipe culvert will be cleaned out by water flushing or other approved methods.

Material removed from the pipe culvert will become property of the Contractor for disposal.

The Contractor will implement appropriate sediment control measures prior to water flushing to prevent discharges from the project boundaries.

The pipe culvert will be cleaned to the satisfaction of the Engineer.

All costs to dewater, clean pipe, and dispose of removed materials will be incidental to the contract unit price per each for "Cleanout Pipe Culvert".

REMOVE & RESET PIPE

The Contractor will tie each section of pipe to the adjacent sections with tie bolts conforming to Standard Plate 450.18. All costs for drilling holes, furnishing, and installing the tie bolt assembly will be incidental to the corresponding pipe bid item.

Existing tie bolts, if any, may be salvaged and reused if condition is acceptable to the Engineer.

CULVERT LINING

Pipe culvert lengths shown in the Table of Mainline Culvert Work were obtained from the original grading plans and were not verified in the field.

The Contractor will submit to the Area Engineer a minimum of 2 week prior to the Preconstruction Meeting a detailed plan of how the pipe culvert cleaning and inspection will be staged. The plan will show how the Contractor is going to maintain traffic at each pipe culvert site, where equipment is going to be stored, the total length of the workspace if a lane of traffic needs to be closed to traffic, and the methods used to prevent material removed from the pipe culverts from entering the waterway. These plans will be approved by the Area Engineer prior to starting work on the pipe culvert cleaning and lining.

Sediment control may be required if water is flowing through the pipe culvert at the time of cleaning. Otherwise, sediment control is not anticipated.

The Contractor will implement appropriate sediment control measures prior to water flushing to prevent discharges beyond the project boundaries.

Wattles have been provided in the Estimate of Quantities and will be used to capture pipe cleanout material. Placement of the wattles will be as directed by the Engineer.

ENGINEER DRAWING AND DESIGN CALCULATION SUBMITTALS

The Contractor will submit the engineering drawing and design calculations for the culvert liners, as required by the various culvert lining Special Provision in Adobe PDF format.

Adobe PDF submittals will be sent to the following email addresses:
Paul.Knofczynski@kljeng.com

HIGH TENSION CABLE GUARDRAIL

The Contractor will furnish and install a high tension cable guardrail system that meets the Test Level 3 crash testing requirements of the Manual for Assessing Safety Hardware (MASH). The maximum dynamic deflection of the system will be less than 10'-0" and the maximum post spacing will be 10'-6" unless specified otherwise in the plans. High Tension 4 Cable Guardrail will be one of the following products:

- Valtir (Trinity) – CASS S3 M10
- Brifen – 4 Rope O-Post System

The high tension cable guardrail system will be in compliance with Specifications Section 6.9 Buy America.

The Contractor will install the system according to the manufacturer's installation recommendations except where stated otherwise in the plans. A copy of the detail drawings and installation instructions for the high tension cable guardrail and anchor assemblies will be given to the Engineer a minimum of 4 weeks prior to installation of the high tension cable guardrail system.

All posts will be galvanized and inserted into driven galvanized steel sleeves with soil plates. The driven sleeves must be designed for a minimum frost depth of 42" and to resist the additional lateral component of curved cable sections.

Delineation of the high tension cable guardrail will be in conformance with standard plate 632.40.

The cables provided will be pre-stretched in the factory.

The Contractor will check and adjust the tension of the cables a minimum of 3 weeks after installation and not longer than 6 weeks after installation. Cost for this work will be incidental to the contract unit price per foot for "High Tension 4 Cable Guardrail".

High tension cable guardrail will be installed on a 10:1 or flatter slope and the embankment limits will match the high tension cable guardrail limits. The embankment quantities may vary from plans quantity.

The lengths of high tension cable guardrail stated in the plans are based on a minimum effective length (length of need). The length and location of the high tension cable guardrail at each site will need to be adjusted during construction as necessary depending on the system provided and will be approved by the Design Engineer before installation. When the Valtir (Trinity) CASS S3 M10 system is installed adjacent to one-way traffic roadways, 26' of the anchor assembly on the approach end is considered non-effective, and 51' on the non-approach end is considered non-effective; however, when the same system is installed adjacent to two-way traffic roadways, 26' of the anchor assembly on both the approach and non-approach ends is considered non-effective. For Brifen 4 Rope O-Post System installations, the anchor assembly is non-effective.

The Contractor will provide a signed letter of compliance to the Engineer upon completion of the high tension cable guardrail installation(s) stating that the high tension cable barrier system has been installed in conformance to the manufacturer installation instructions and specifications, meets the Test Level 3 crash test requirements of MASH, and is terminated with an approved anchor assembly.

The high tension cable guardrail will be measured along the centerline of the cable guardrail from the beginning to the end of the minimum effective length.

All costs for furnishing and installing the high tension cable guardrail system including all labor, materials, and equipment will be incidental to the contract unit price per foot for "High Tension 4 Cable Guardrail".

Shop drawings of the individual components comprising the High Tension Cable Guardrail shall be provided to the Pierre Area Office.



Rev 9-26-23 PK

HIGH TENSION CABLE GUARDRAIL ANCHOR ASSEMBLY

The beginning and end of each "run" of high tension cable guardrail will terminate with an anchor assembly. The High Tension Cable Anchor Assemblies will be one of the following products:

Valtir (Trinity) – CASS Cable Terminal (CCT)
Brifen – MASH Gating Terminal (MGT)

The footing(s) for the anchor assembly will be designed to allow for 1 inch maximum of lateral deflection. The allowable design soil pressure will be 1000 psf. The top 2 feet of soil pressure will be neglected in the design of the footing(s). The footing(s) will be a minimum of 5' deep. The footing(s) design will be submitted through proper channels to the Office of Bridge Design for a one-time approval. Any changes to the anchor assembly that could affect footing size including configuration changes such as different number of cables and different number of footings will be resubmitted for approval. The approval will be obtained a minimum of 4 weeks prior to construction of the anchor footing(s).

Delineation of the high tension cable guardrail anchor assembly will be in conformance with standard plate 632.40.

All costs for furnishing and installing the High Tension Cable Guardrail Anchor Assembly including all labor, equipment, and materials which include the anchor footing(s), hardware, and all attachments to the anchor footing(s), will be incidental to the contract unit price per each for "High Tension Cable Guardrail Anchor Assembly".

Shop drawings of the individual components comprising the High Tension Cable Guardrail Anchor Assembly will be provided to the Pierre Area Office.

TABLE OF FENCE QUANTITIES

Station to Station		Side (L/R)	Remove Fence Ft	Right-of-Way Fence		Fence Panel	Temporary Fence	
				Type 2 Ft	Type 3 Ft	3 Post Each	Type 2 Ft	Type 3 Ft
e 76+04	e 76+77	R	246		70	2		176
f 227+48	f 228+28	L	230	80		2	150	
TOTALS:			476	80	70	4	150	176

TABLE OF GUARDRAIL

Location	Remove 3 Cable Guardrail (Ft)	4 Cable High Tension Guardrail (Ft)	High Tension Cable Guardrail Anchor Assembly (Each)	Remove Beam Guardrail (Ft)	Straight Class A Beam Guardrail with Wood Posts (Ft)	Curved Class A Beam Guardrail with CRT Posts (Ft)	Guardrail Special Anchor Assembly (Each)
Spillway							
103+53 Lt.				92	62.5	37.5	1
Structure No. 59-234-176							
Structure Lt.	320	283	2				
Structure Rt.	320	283	2				
Totals:	640	566	4	92	62.5	37.5	1



TABLE OF PIPE QUANTITIES

Revised 4/26/24 EJW

Culvert #	MRM	Side	In Place Culvert Size and Type	End Type	Remove for Reset		Reset		Remove				RCP Flared End Section			CMP End Section				RCP				CMP				Cleanout Pipe Culvert	Cleanout for Culvert Treatment	CIPP Liner			Cellular Grout	PVC Coated Bank & Channel Protection Gabion	Type B Drainage Fabric	Contractor Furnished Borrow	Class B Riprap	Type 2 Object Marker Back to Back	Comments
					Pipe	End Section	Pipe	End Section	Cattle Pass End Section	Cattle Pass	Pipe	End Section	18"	24"	30"	18" Flared	24" Flared	30" Sloped	54" Arch Flared	24" CI 3	24" 14 Ga	30" 14 Ga	12.5° Elbow	18"	24"	36"	18"			24"	36"								
					Ft	Each	Ft	Each	Each	Ft	Ft	Each	Each	Each	Each	Each	Each	Each	Ft	Ft	Ft	Each	Each	Each	Ft	Ft	Ft			CuYd	CuYd	SqYd							
19	194.080	Lt	24" RCP	Flared	8		8					1	1																				2	Remove and Reset 16' of Culvert, Remove and Replace Ends					
		Rt		Flared	8		8						1	1																									
20	194.213	Lt	18" CMP	Flared								1																					2	Remove and Replace Ends, Install CIPP Liner, Cleanout, Regrade to Reestablish Ditch Drainage					
		Rt		Flared									1											1	121														
21	194.878	Lt	18" CMP	Flared								1																					2	Remove and Replace End, Cleanout Culvert					
		Rt		Flared									1											1															
22	195.036	Lt	24" CMP	Flared								1																						2	Remove and Replace Ends, Install CIPP Liner				
		Rt		Flared									1											1	87														
23	195.197	Lt	24" CMP	Flared								1																						2	Remove and Reset 8' of Culvert, Remove and Replace Ends				
		Rt		Flared	8		8						1																										
24	195.433	Lt	18" CMP	Flared								1																						2	Remove and Replace Ends				
		Rt		Flared									1																										
25	195.897	Lt	18" CMP	Flared								1																						2	Remove and Replace Ends				
		Rt		Flared									1																										
26	196.273	Lt	24" CMP	Flared	8		8					1																						2	Remove and Reset 8' of Culvert, Remove and Replace Ends				
		Rt		Flared									1																										
27	196.607	Lt	24" CMP	Flared																															2	Cleanout Culvert			
		Rt		Flared																				1															
28	196.732	Lt	18" RCP-CMP Downspout	Flared																														2	No Work Needed				
		Rt		Flared																																			
29	197.377	Lt	18" RCP	Flared	16		16					1	1																					2	Remove and Reset 32' of Culvert, Remove and Replace Ends				
		Rt		Flared	16		16						1	1																									
30	197.860	Lt	18" RCP	Flared								1	1																						2	Remove and Replace Ends			
		Rt		Flared									1	1																									
31	198.174	Lt	30" RCP	Flared								1																							2	Remove and Replace Ends			
		Rt		Flared									1											1															
32	198.522	Lt	18" RCP	Flared								1	1																						2	Remove and Replace Ends			
		Rt		Flared									1	1																									
33	198.778	Lt	18" CMP	Flared								1	1																						2	Remove and Replace Culvert			
		Rt		Flared						72			1	1						62																			
34	198.903	Lt	4'x6' RCP Cattle Pass	Flared								1	8																						2	See Layout for Installing Culvert in Existing RC Cattle Pass			
		Rt		Flared									1	8												20.6													
35	198.911	Lt	24" RCP	Flared	8	1	8	1																											2	Remove and reset 16' of Culvert, Remove and Replace Ends			
		Rt		Flared	8	1	8	1																1															
36	199.130	Lt	24" RCP	Flared																																2	No Work Needed		
		Rt		Flared																																			
Subtotal					80	2	80	2	2	16	72	26	6	4	2	8	8	0	0	62	86	0	0	5	2	121	87	0	20.6	0	0	80	0	36					

TABLE OF PIPE QUANTITIES

Revised 3/7/24 pak

Culvert #	MRM	Side	In Place Culvert Size and Type	End Type	Remove for Reset		Reset		Remove			RCP Flared End Section			CMP End Section				RCP				CMP				Cleanout Pipe Culvert	Cleanout for Culvert Treatment	CIPP Liner			Cellular Grout	PVC Coated Bank & Channel Protection Gabion	Type B Drainage Fabric	Contractor Furnished Borrow	Class B Riprap	Type 2 Object Marker Back to Back	Comments
					Pipe	End Section	Pipe	End Section	Cattle Pass End Section	Cattle Pass	Pipe	End Section	18"	24"	30"	18" Flared	24" Flared	30" Sloped	54" Arch Flared	24" CI 3	24" 14 Ga	30" 14 Ga	12.5° Elbow	18"	24"	36"												
					Ft	Each	Ft	Each	Each	Ft	Ft	Each	Each	Each	Each	Each	Each	Each	Ft	Ft	Ft	Each	Each	Each	Ft	Ft			Ft	CuYd	CuYd							
37	199.352	Lt Rt	24" RCP	Flared Flared																													2	No Work Needed				
38	199.768	Lt Rt	18" RCP	Flared Flared	1		1																1										2	Remove and Reset Ends, Cleanout				
39	199.937	Lt Rt	18" Slip Lined CMP	Flared Flared																														No Work Needed				
40	200.008	Lt Rt	18" RCP	Flared Flared							1	1																					2	Remove and Replace Ends				
41	200.841	Lt Rt	24" Slip Lined RCP	Flared Flared																														No Work Needed				
42	200.952	Lt Rt	18" RCP	Flared Flared							1	1											1		73								2	Remove and Replace End, Install CIPP Liner				
43	201.073	Lt Rt	24" Slip Lined CMP	Flared Flared																														No Work Needed				
44	201.420	Lt Rt	18" RCP	Flared Flared							1	1											1		80								2	Remove and Replace Ends, Install CIPP Liner				
45	201.585	Lt Rt	18" RCP	Flared Flared							1	1											1		75								2	Remove and Replace Ends, Install CIPP Liner				
46	201.782	Lt Rt	24" CMP	Flared Flared																													2	No Work Needed				
47	201.942	Lt Rt	18" RCP	Flared Flared							1	1											1										2	Remove and Replace Ends, Cleanout				
48	202.939	Lt Rt	24" RCP	Flared Flared																													2	No Work Needed				
49	203.484	Lt Rt	24" RCP	Flared Flared	8		8						1																				2	Remove and Reset 8' of Culvert, Install End Section				
50	203.726	Lt Rt	18" RCP	Flared Flared																														2	No Work Needed			
51	203.982	Lt Rt	18" RCP	Flared Flared							1	1											1											2	Remove and Replace Ends, Cleanout			
52	204.352	Lt Rt	18" RCP	Flared Flared							1	1											1											2	Remove and Replace Ends, Cleanout			
53	205.072	Lt Rt	24" RCP	Flared Flared																														2	Reprofile ditch to reestablish drainage			
54	205.393	Lt Rt	18" RCP	Flared Flared																														2	No Work Needed			
Subtotal					0	10	0	10	0	0	0	13	13	1	0	0	0	0	0	0	0	0	4	3	228	0	0	0	0	0	0	0	0	30				




TABLE OF PIPE QUANTITIES

Revised 4/26/24 EJW

Culvert #	MRM	Side	In Place Culvert Size and Type	End Type	Remove for Reset		Reset		Remove				RCP Flared End Section			CMP End Section				RCP				CMP				Cleanout Pipe Culvert	Cleanout for Culvert Treatment	CIPP Liner			Cellular Grout	PVC Coated Bank & Channel Protection Gabion	Type B Drainage Fabric	Contractor Furnished Borrow	Class B Riprap	Type 2 Object Marker Back to Back	Comments
					Pipe	End Section	Pipe	End Section	Cattle Pass End Section	Cattle Pass	Pipe	End Section	18"	24"	30"	18" Flared	24" Flared	30" Sloped	54" Arch Flared	24" CI 3	24" 14 Ga	30" 14 Ga	12.5° Elbow	18"	24"	36"	18"			24"	36"								
					Ft	Each	Ft	Each	Each	Ft	Ft	Each	Each	Each	Each	Each	Each	Each	Ft	Ft	Ft	Each	Each	Each	Ft	Ft	Ft			CuYd	CuYd	SqYd							
55	205.917	Lt	18" RCP	Flared	16		16					1	1																				2	Remove and Reset 32' of Culvert					
		Rt		Flared	16		16					1	1																			2	Cleanout culvert						
56	206.770	Lt	24" RCP	Flared																												2	Cleanout Culvert						
		Rt		Flared																												2	Remove and Replace Ends, Install CIPP Liner						
57	207.497	Lt	18" RCP	Flared								1	1																			2	Remove and Reset 32' of Culvert, Install CIPP Liner						
		Rt		Flared								1	1																			2	Remove and Replace Ends, Install CIPP Liner						
58	207.629	Lt	18" RCP	Flared	16		16					1		1																			2	Remove and Replace Ends, Install CIPP Liner					
		Rt		Flared	16		16					1		1																			2	Remove and Replace Ends, Install CIPP Liner					
59	207.904	Lt	24" RCP	Flared								1	1																				2	Remove and Replace Ends, Install CIPP Liner					
		Rt		Flared								1	1																				2	Remove and Replace Ends, Install CIPP Liner					
60	208.068	Lt	18" RCP	Flared								1	1																				2	No Work Needed					
		Rt		Flared								1	1																				2	No Work Needed					
61	208.213	Lt	30" RCP	Flared																													2	Remove and Replace End					
		Rt		Flared																													2	Remove and Replace Ends, Cleanout					
62	208.271	Lt	18" RCP	Flared								1																					2	Remove and Replace Ends					
		Rt		Flared								1																					2	Remove and Replace Ends, Install CIPP Liner					
63	209.369	Lt	24" RCP	Flared								1		1																			2	Remove and Reset 16' of Culvert, Remove and Replace Ends					
		Rt		Flared								1		1																			2	No Work Needed					
64	209.927	Lt	24" CMP	Flared								1																					2	No Work Needed					
		Rt		Flared								1																					2	No Work Needed					
65	211.351	Lt	24' CMP	Flared								1																					2	Remove and Replace Ends, Install CIPP Liner					
		Rt		Flared								1	1																				2	Remove and Replace Ends, Install CIPP Liner					
66	211.671	Lt	18" RCP	Flared	16		16					1		1																				2	Remove and Reset 16' of Culvert, Remove and Replace Ends				
		Rt		Flared	16		16					1		1																				2	No Work Needed				
67	211.820	Lt	24" RCP	Flared																														2	No Work Needed				
		Rt		Flared																														2	No Work Needed				
68	217.500	Lt	30" CMP	Flared																														2	No Work Needed				
		Rt		Flared																														2	No Work Needed				
69	217.950	Lt	24" CMP	Flared																														2	No Work Needed				
		Rt		Flared																														2	No Work Needed				
70	218.400	Lt	24" CMP	Flared																														2	No Work Needed				
		Rt		Flared																														2	No Work Needed				
71	218.450	Lt	24" CMP	Flared																														2	Install gabions				
		Rt		Flared																														2	No Work Needed				
72	218.900	Lt	30" CMP	Flared																															2	No Work Needed			
		Rt		Flared																															2	No Work Needed			
73	219.800	Lt	24" CMP	Flared																															2	No Work Needed			
		Rt		Flared																															2	No Work Needed			
74	220.600	Lt	24" CMP	Flared																															2	No Work Needed			
		Rt		Flared																															2	No Work Needed			
75	220.950	Lt	24" CMP	Flared																															2	No Work Needed			
		Rt		Flared																															2	No Work Needed			
Subtotal					96	0	96	0	0	0	0	19	10	5	0	0	0	0	0	0	0	0	2	3	217	126	0	0	10.5	34	0	0	4						
06QP Project Total					176	12	176	12	2	16	266	79	29	14	2	8	12	1	16	184	86	50	2	32	10	650	213	82	20.6	16.5	179	80	99.8	15					

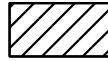



TYPICAL GRADING SECTION

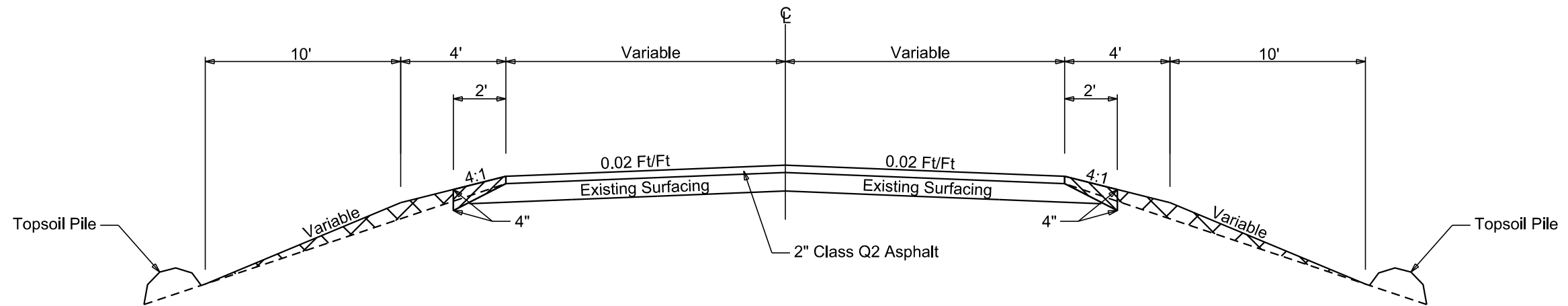
 STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B12	B56

Plotting Date: 3/7/2024

Station d -0+37.64 to Station h 213+52.00


 Gravel Cushion, Salvaged or
Gravel Cushion, Salvaged, State Furnished


 Contractor Furnished Borrow



SEQUENCE OF OPERATIONS

1. Blade back 3" of topsoil to allow placement of borrow and granular material.
2. Place and blade adequate borrow material along the shoulder to provide the necessary section, as shown.
3. Complete asphalt concrete resurfacing
4. Blade the shoulder to allow for the 2' of granular material, as per the section shown.
5. Fine grade the inslope to provide the slopes, as indicated in the grading section.
6. Replace the topsoil, mulch and seed the disturbed areas.




Plot Scale - 1:200

Plotted From - jenbrassfield


File - ...Section B\Grading Typical.dgn

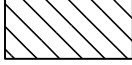
FAULT-HEAVE REPAIR

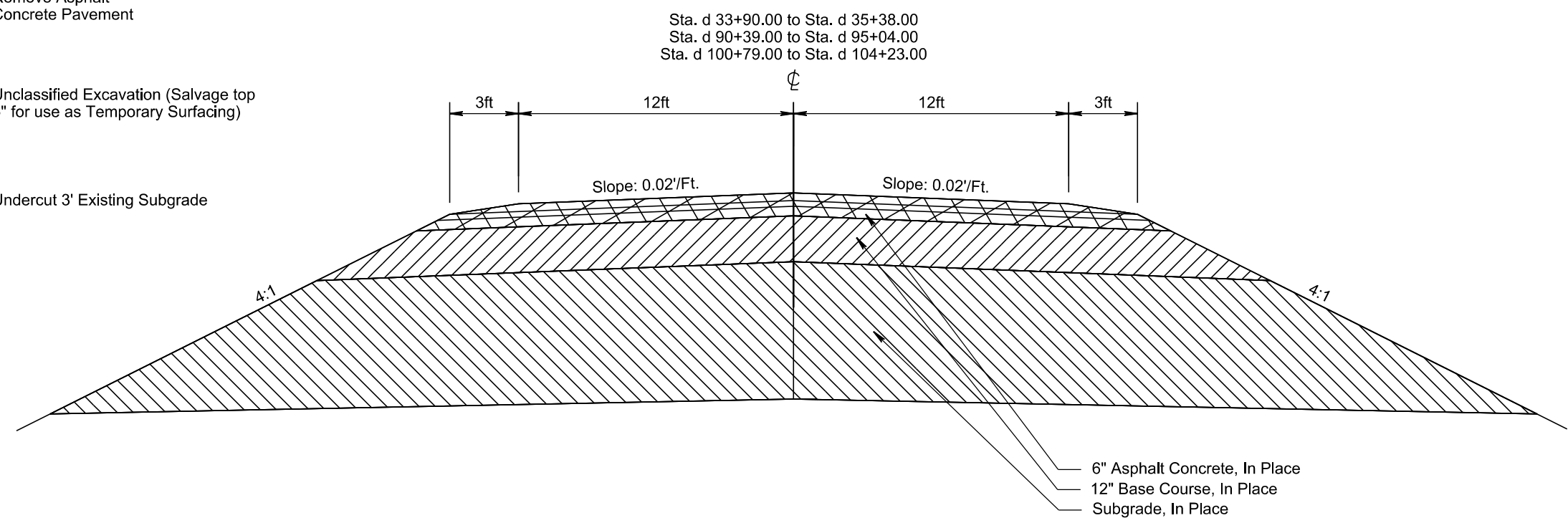
 STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B13	B56

Plotting Date: 3/7/2024


 Remove Asphalt Concrete Pavement


 Unclassified Excavation (Salvage top 5" for use as Temporary Surfacing)


 Undercut 3' Existing Subgrade



Plot Scale - 1:200

Plotted From - jbrassfield

File - ...Section B\Grading Typical.dgn



HORIZONTAL ALIGNMENT DATA

Rev 1-5-24 EJW

MAINLINE- US 14 to 204

Type	Station	Northing	Easting
POB	-0+75.00	743158.548	1952287.481
		TL= 15157.52	N 0°19'37" E
PC	150+82.52	758315.826	1952374.006
PI	158+66.82	R= 5728.65	Delta= 15°35'29" L
PT	166+41.42	759856.732	1952171.999
		TL= 3572.20	N 15°15'52" W
Equation: Sta. 201+13.85 Bk = Sta. a -11+34.45 Ah			
PC	a -10+34.68	763302.910	1951231.531
		R = 1145.08	Delta= 26°15'19" L
PI	a -7+67.63	763560.539	1951161.224
PT	a -5+09.96	763760.487	1950984.202
		TL= 1530.41	N 41°31'11" W
PC	a 10+20.46	764906.350	1949969.728
PI	a 14+02.16	R= 1145.08	Delta= 36°52'15" L
PT	a 17+57.33	765268.957	1949342.811
		TL= 1047.27	N 78°23'26" W
Equation: Sta. a 19+18.73 Bk = Sta. b 19+52.58 Ah			
PC	b 28+38.45	765268.957	1949342.811
PI	b 42+05.96	R= 1678.85	Delta= 78°19'45" R
PT	b 51+33.61	767122.416	1946975.969
		TL= 767.35	N 0°03'41" W
Equation: Sta. b 52+54.30 Bk = Sta. c 52+52.58 Ah			
POE	c 58+99.24	767122.416	1946975.969
Equation: Sta. c 58+99.24 Bk = Sta. d 0+00 Ah			

MAINLINE- 204 to SPILLWAY (Reverse Stationing)

Type	Station	Northing	Easting
POB	d 0+00.00	767897.912	1946929.456
		TL= 633.67	N 79°52'02" W
PC	d 6+33.67	768009.395	1946305.667
PI	d 8+09.03	R= 555.00	Delta= 35°04'04" R
PT	d 9+76.36	768164.672	1946009.492
		TL= 361.93	N 44°47'57" W
PC	d 13+35.29	768348.745	1945827.106
PI	d 14+86.06	R= 1275.00	Delta= 13°29'15" L
PT	d 16+35.43	768607.723	1945519.979
		TL= 498.05	N 58°18'12" W

PC	d 21+33.47	768869.407	1945096.221
PI	d 25+97.09	R= 1275.00	Delta = 39°57'53" R
PT	d 30+22.81	769553.042	1944555.842
		TL= 139.11	N 58°18'12" W
PC	d 31+61.92	247680.096	1850759.865
PI	d 42+15.73	R= 1145.00	Delta= 0°33'03" L
PT	d 49+82.93	770691.098	1943139.238
		TL= 1222.38	N 89°54'38" W
PC	d 62+05.31	770693.006	1941916.858
PI	d 66+03.96	R= 950.00	Delta = 45°31'45" L
PT	d 69+60.21	770409.584	1941238.489
		TL= 992.33	S 44°33'37" W
PC	d 79+52.54	769702.538	1940542.211
PI	d 85+63.87	R= 715.00	Delta= 81°03'42" R
PT	d 89+64.12	769623.018	1939616.324
		TL= 1057.49	N 54°22'41" W
PC	d 100+21.61	770238.940	1938756.712
PI	d 100+88.13	R= 1000.00	Delta= 7°36'40" R
PT	d 101+54.45	770323.244	1938654.179
		TL= 1057.49	N 54°22'41" W
PC	d 102+29.54	770374.680	1938599.469
PI	d 103+84.99	R= 375.00	Delta= 45°01'46" R
PT	d 105+24.26	770636.525	1938481.504
		TL= 3.08	N 1°44'15" W
PC	d 105+27.34	770639.609	1938481.411
PI	d 106+17.27	R= 51.00	N 120°53'02" L
PT	d 106+34.95	770681.017	1938402.941
		TL= 18.88	S 57°22'43" W
POE	d 106+53.82	770670.840	1938387.040
Equation: Sta. d 106+53.82 = Sta. e 354+27.30			

Mainline- SPILLWAY to END (Reverse Stationing)

Type	Station	Northing	Easting
POB	h 213+28.97	837494.207	1845034.369
		TL= 5131.46	S 20°40'01" E
PC	h 264+60.43	832692.967	1846845.437
PI	h 268+00.57	R = 3100.00	Delta = 12°31'23" L
PT	h 271+37.99	832090.071	1847151.680
		TL= 2954.23	S 30°11'24" E
PC	h 300+92.22	829617.793	1848768.876
PI	h 305+23.30	R = 1435.00	Delta = 33°26'26" R

The coordinates shown on this sheet are based on the South Dakota State Plane Coordinate System. South Zone NAD 83(2011); epoch 2011-NF; Geoid 18; SF = 1.000000000

HORIZONTAL ALIGNMENT DATA

Rev 1-5-24 EJW

PT	h 309+29.76		828825.977	1849002.968		PI	g 589+18.37	R = 2870.00	Delta = 26°30'43" L	808940.413	1864460.507
		TL= 5765.24	S 0°15'02" E			PT	g 595+70.26			808497.246	1864971.404
PC	h 366+94.99		823060.794	1848977.769				TL= 1567.63	S 49°04'54" E		
PI	h 370+30.80	R = 2842.00	Delta = 13°25'51" L		822724.989	1848976.301	PC	g 611+37.89		807470.473	1866155.972
PT	h 373+63.53		822398.027	1849052.871		PI	g 614+71.11	R = 2875.00	Delta = 13°13'20" R	807252.244	1866407.762
		TL= 2335.63	S 13°10'49" E			PT	g 618+01.36			806982.170	1866602.958
PC	h 396+99.16		820123.924	1849585.432				TL= 1393.74	S 35°51'34" E		
PI	h 402+62.01	R = 1430.00	Delta = 42°58'09" L		819575.904	1849713.770	PC	g 631+95.09		805852.607	1867419.405
PT	h 407+71.59		819262.382	1850181.210		PI	g 634+89.02	R = 2865.00	Delta = 11°42'54" R	805614.398	1867591.583
		TL= 163.47	S 57°02'54" E			PT	g 637+80.89			805346.190	1867711.808
PC	h 409+35.07		819173.465	1850318.384				TL= 2628.94	S 24°08'40" E		
PI	h 409+67.43	R = 1435.00	Delta = 2°35'04" L		819155.988	1850345.630	PC	g 664+09.83		802947.234	1868787.147
PT	h 409+99.78		819139.757	1850373.637		PI	g 667+79.58	R = 2865.00	Delta = 14°42'27" L	802609.833	1868938.387
		TL= 35.91	S 59°54'22" E			PT	g 671+45.26			802321.886	1869170.333
PC	h 410+35.71		819121.750	1850404.709				TL= 1840.17	S 38°51'07" E		
PI	h 411+73.33	R = 3200.00	Delta = 4°55'31" R		819052.742	1850523.782	Equation: Sta. g 679+92.90 = Sta. f 0+00.00				
PT	h 413+10.79		818973.767	1850636.491		PC	f 9+92.52			800888.821	1870324.687
		TL= 3984.91	S 54°58'51" E			PI	f 16+70.53	R = 5700.00	Delta = 13°34'00" R	800360.812	1870750.006
PC	h 452+95.70		816687.029	1850636.491		PT	f 23+42.19			799747.766	1871039.598
PI	h 455+93.33	R = 2840.00	Delta = 11°57'55" R		816516.236	1854143.726		TL= 4237.17	S 25°17'07" E		
PT	h 458+88.79		816298.622	1854346.767		PC	f 65+79.36			795916.552	1872849.397
		TL= 581.66	S 43°00'56" E			PI	f 75+65.63	R = 5830.00	Delta = 19°12'14" L	795916.552	1873270.659
PC	h 464+70.45		815873.331	1854743.574			f 85+33.40			794321.180	1873961.813
PI	h 470+43.96	R = 2860.00	Delta = 22°40'42" L		815453.994	1855134.826		TL= 2497.62	S 44°29'21" E		
PT	h 476+02.47		815217.929	1855657.506		PC	f 110+31.05			792539.422	1875712.075
		TL= 790.73	S 65°41'38" E			PI	f 117+12.29	R = 2950.00	Delta = 26°00'28" R	792053.411	1876189.495
PC	h 483+93.20		814892.456	1856378.145		PT	f 123+70.09			791407.271	1876405.455
PI	h 486+62.26	R = 2875	Delta = 10°41'35" R		814781.707	1856623.358		TL= 1434.64	S 18°28'52" E		
Equation: Sta. h 489+08.43 = Sta. g 488+68.07											
PT	g 488+89.40		814627.383	1856843.763		PC	f 138+04.70			790046.651	1876830.216
		TL= 3892.12	S 55°00'03" E			PI	f 144+93.42	R = 2836.00	Delta = 27°18'00" L	789393.449	1877078.536
PC	g 527+81.51		812395.003	1860032.031		PT	f 151+55.98			788913.135	1877572.129
PI	g 531+91.34	R = 1420.00	Delta = 31°11'50" L		812159.942	1860367.743		TL= 3359.73	S 45°46'52" E		
PT	g 535+79.48		812139.909	1860777.078		PC	f 185+17.71			786570.057	1879979.987
		TL= 874.00	S 87°11'53" E			PI	f 191+47.10	R = 3800.00	Delta = 18°52'03" L	786129.727	1880432.492
PC	g 544+53.48		812097.185	1861650.034		PT	f 197+67.05			785859.388	1881003.077
PI	g 548+82.94	R = 1420.00	Delta = 33°35'21" R		812076.234	1862078.098		TL= 5966.97	S 64°38'56" E		
PT	g 552+85.94		811821.963	1862423.097		PC	f 257+34.03			783304.532	1886395.429
		TL= 974.58	S 53°36'32" E			PI	f 267+74.04	R = 3843.00	Delta = 30°17'09" R	782859.233	1887335.288
PC	g 562+60.52		811243.750	1863207.621		PT	f 277+65.39			78200.725	1887922.304
PI	g 567+89.53	R = 1905.00	Delta = 31°02'21" R		810929.895	1863633.462		TL= 1048.20	S 34°21'46" E		
PT	g 572+92.53		810441.405	1863836.498		PC	f 288+13.60			781135.453	1888513.944
		TL= 949.73	S 22°34'11" E			PI	f 295+34.45	R = 2825.00	Delta = 28°37'46" L	780540.400	1888920.819
PC	g 582+42.26		809564.413	1864201.012		PT	f 302+25.19			780213.051	1889563.065
								TL= 1178.53	S 62°59'32" E		

CONTROL DATA

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B17	B56

HORIZONTAL AND VERTICAL CONTROL POINTS						
POINT	STATION	OFFSET	DESCRIPTION	NORTHING	EASTING	ELEVATION
CP	d 78+96.36	0.01' Lt		769742.559	1940581.637	1801.592
CP	d 79+28.93	0.28' Lt		769719.161	1940558.979	1800.340
CP	d 105+47.18	3.00' Lt		770660.041	1938479.762	1662.594
1806_CP100	d 90+12.26	606.15' Rt	Rebar	770143.780	1939930.234	1815.229
PBM-9	d 9+24.41	394.61' Rt		768433.137	1946299.895	1661.611
CP500	e 191+76.85	70.75' Rt		764812.213	1927371.748	1803.005
CP501	28+54.33	904.93' Lt	Nail	746092.999	1951399.287	1469.020
BUFFALO-1	g 529+34.62	58.16' Rt		812263.160	1860133.900	2149.236



The coordinates shown on this sheet are based on the South Dakota State Plane Coordinate System. South Zone NAD 83(2011); epoch 2010.00
 Geoid 18; SF = 1.000000000
 The elevations shown on this sheet are based on NAVD 88.

LEGEND

STATE OF SOUTH DAKOTA	PROJECT P 1806(23)186	SHEET B18	TOTAL SHEETS B56
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Plotting Date: 3/7/2024

Anchor		Mailbox		Subsurface Utility Exploration Test Hole		State and National Line	
Antenna		Manhole Electric		Telephone Fiber Optics		County Line	
Approach		Manhole Gas		Telephone Junction Box		Section Line	
Assumed Corner		Manhole Miscellaneous		Telephone Pole		Quarter Line	
Azimuth Marker		Manhole Sanitary Sewer		Television Cable Jct Box		Sixteenth Line	
BBQ Grill/ Fireplace		Manhole Storm Sewer		Television Tower		Property Line	
Bearing Tree		Manhole Telephone		Test Wells/Bore Holes		Construction Line	
Bench Mark		Manhole Water		Traffic Sign Double Face		ROW Line	
Box Culvert		Merry-Go-Round		Traffic Sign One Post		New ROW Line	
Bridge		Microwave Radio Tower		Traffic Sign Two Post		Cut and Fill Limits	
Brush/Hedge		Miscellaneous Line		Traffic Signal		Control of Access	
Buildings		Miscellaneous Property Corner		Trash Barrel		New Control of Access	
Bulk Tank		Miscellaneous Post		Tree Belt		Proposed ROW	
Cattle Guard		Overhang Or Encroachment		Tree Coniferous		(After Property Disposal)	
Cemetery		Overhead Utility Line		Tree Deciduous			
Centerline		Parking Meter		Tree Stumps			
Cistern		Pedestrian Push Button Pole		Triangulation Station		Drainage Arrow	
Clothes Line		Pipe With End Section		Underground Electric Line			
Concrete Symbol		Pipe With Headwall		Underground Gas Line		Remove Concrete Pavement	
Control Point		Pipe Without End Section		Underground High Pressure Gas Line		Remove Concrete Driveway Pavement	
Creek Edge		Playground Slide		Underground Sanitary Sewer		Remove Asphalt Concrete Pavement	
Curb/Gutter		Playground Swing		Underground Storm Sewer		Remove Concrete Sidewalk	
Curb		Power And Light Pole		Underground Tank		Remove Concrete Median Pavement	
Dam Grade/Dike/Levee		Power And Telephone Pole		Underground Telephone Line		Remove Concrete Curb and/or Gutter	
Deck Edge		Power Meter		Underground Television Cable			
Ditch Block		Power Pole		Underground Water Line			
Doorway Threshold		Power Pole And Transformer		Water Fountain			
Drainage Profile		Power Tower Structure		Water Hydrant			
Drop Inlet		Propane Tank		Water Meter			
Edge Of Asphalt		Property Pipe		Water Tower			
Edge Of Concrete		Property Pipe With Cap		Water Valve			
Edge Of Gravel		Property Stone		Water Well			
Edge Of Other		Public Telephone		Weir Rock			
Edge Of Shoulder		Railroad Crossing Signal		Windmill			
Electric Transformer/Power Junction Box		Railroad Milepost Marker		Wingwall			
Fence Barbwire		Railroad Profile		Witness Corner			
Fence Chainlink		Railroad ROW Marker					
Fence Electric		Railroad Signs					
Fence Miscellaneous		Railroad Switch					
Fence Rock		Railroad Track					
Fence Snow		Railroad Trestle					
Fence Wood		Rebar					
Fence Woven		Rebar With Cap					
Fire Hydrant		Reference Mark					
Flag Pole		Retaining Wall					
Flower Bed		Riprap					
Gas Valve Or Meter		River Edge					
Gas Pump Island		Rock And Wire Baskets					
Grain Bin		Rockpiles					
Guardrail		Satellite Dish					
Gutter		Septic Tank					
Guy Pole		Shrub Tree					
Haystack		Sidewalk					
Highway ROW Marker		Sign Face					
Interstate Close Gate		Sign Post					
Iron Pin		Slough Or Marsh					
Irrigation Ditch		Spring					
Lake Edge		Stream Gauge					
Lawn Sprinkler		Street Marker					
						Detectable Warning	
						Pedestrian Push Button Pole and 30" x 48" Clear Space with 1.5% slope	





STATE OF SOUTH DAKOTA

PROJECT

P 1806(23)186

SHEET

B19

TOTAL SHEETS

B56

Plotting Date:

5/10/2024

Revised 5/10/24 EJW

1+86 L
Remove Rock Check Dam
(Miscellaneous Work)

4+00 L
Remove Rock Check Dam
(Miscellaneous Work)

6+41 L
Remove Rock Check Dam
(Miscellaneous Work)

7+88 L
Install 51.9 tons of
Class B RipRap
& Type B Drainage
Fabric (65 SqYd)

8+90 L
Remove Rock Check Dam
(Miscellaneous Work)

12+00 L
Remove Rock Check Dam
(Miscellaneous Work)

13+26 L
Remove 30" - 50' CMP
Downspout & Flared End

13+26 - 71' to 135' L
(MRM 186.47+0.250)
Install 30" - 50' CMP
(16' & 34')
& 2 - 12.5° Elbows
& 1 CMP Sloped End

13+26 L
Install PVC Coated Bank and Channel
Protection Gabions (6.0 CuYd)
& Type B Drainage Fabric (19 SqYd)

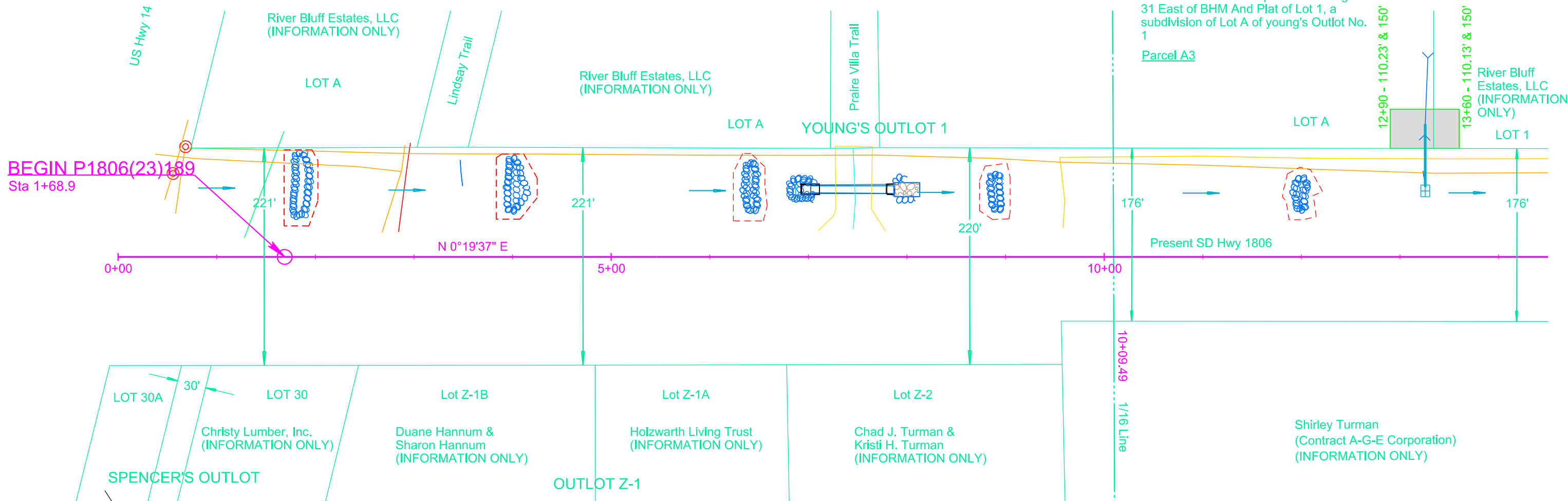
MRM 186.47+0.249
13+26



River Bluff Estates, LLC
Lot A of Young's Outlot 1, located in the
E1/2 of Section 20; and Lot A-1 of Lot A
of Young's Outlot 1, located in the SE1/4
of Section 20-Township 5 North-Range
31 East of BHM And Plat of Lot 1, a
subdivision of Lot A of young's Outlot No.
1

Parcel A3

River Bluff
Estates, LLC
(INFORMATION ONLY)



FORT PIERRE

Sec. 20 - T5N - R31E

Thomas L. Christensen
(INFORMATION ONLY)

Parcel A3
12+90 to 13+60 L
Temporary Easement containing
0.1 ac, more or less



Plot Scale - 1:100

Plotted From - evanwolf

File - ...Construction sheets\001.dgn



STATE OF SOUTH DAKOTA

PROJECT
P 1806(23)186

SHEET
B20

TOTAL SHEETS
B56

Plotting Date: 4/26/2024 Revised 4/26/24 EJW

14+71 L
Remove Rock Check Dam
(Miscellaneous Work)

15+90 L
Install Class B Riprap
(47.9 Ton)
& Type B Drainage Fabric
(61 SqYd)

17+89 L
Remove Rock Check Dam
(Miscellaneous Work)

20+84 L
Remove Rock Check Dam
(Miscellaneous Work)

22+57 L
Remove Rock Check Dam
(Miscellaneous Work)

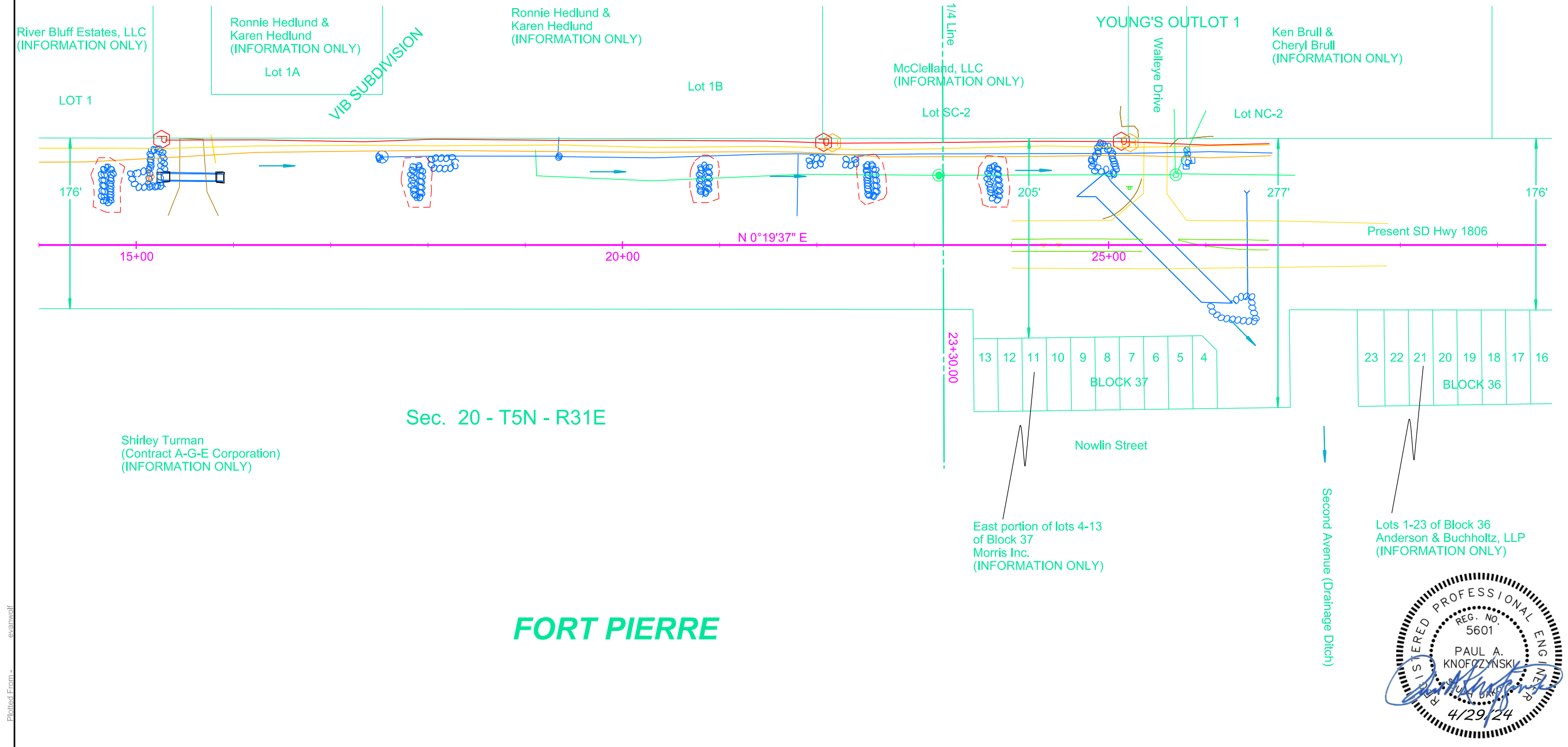
23+82 L
Remove Rock Check Dam
(Miscellaneous Work)

24+75 L
Remove and Replace Riprap
& Type B Drainage Fabric
(See Section E)

25+93 R
Install Class B Riprap
& Type B Drainage Fabric
(See Section E)



Plot Scale - 1:100



Plotted From - evanwolf

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FORT PIERRE

d 0+00
Remove 70'-18" CMP

d 0+00
Install 72'-24" RCP
Skewed 8° RHF
(25' L & 47' R)
& 2 Flared Ends

MRM 191.00+0.614
d 0+00



Plot Scale - 1:100

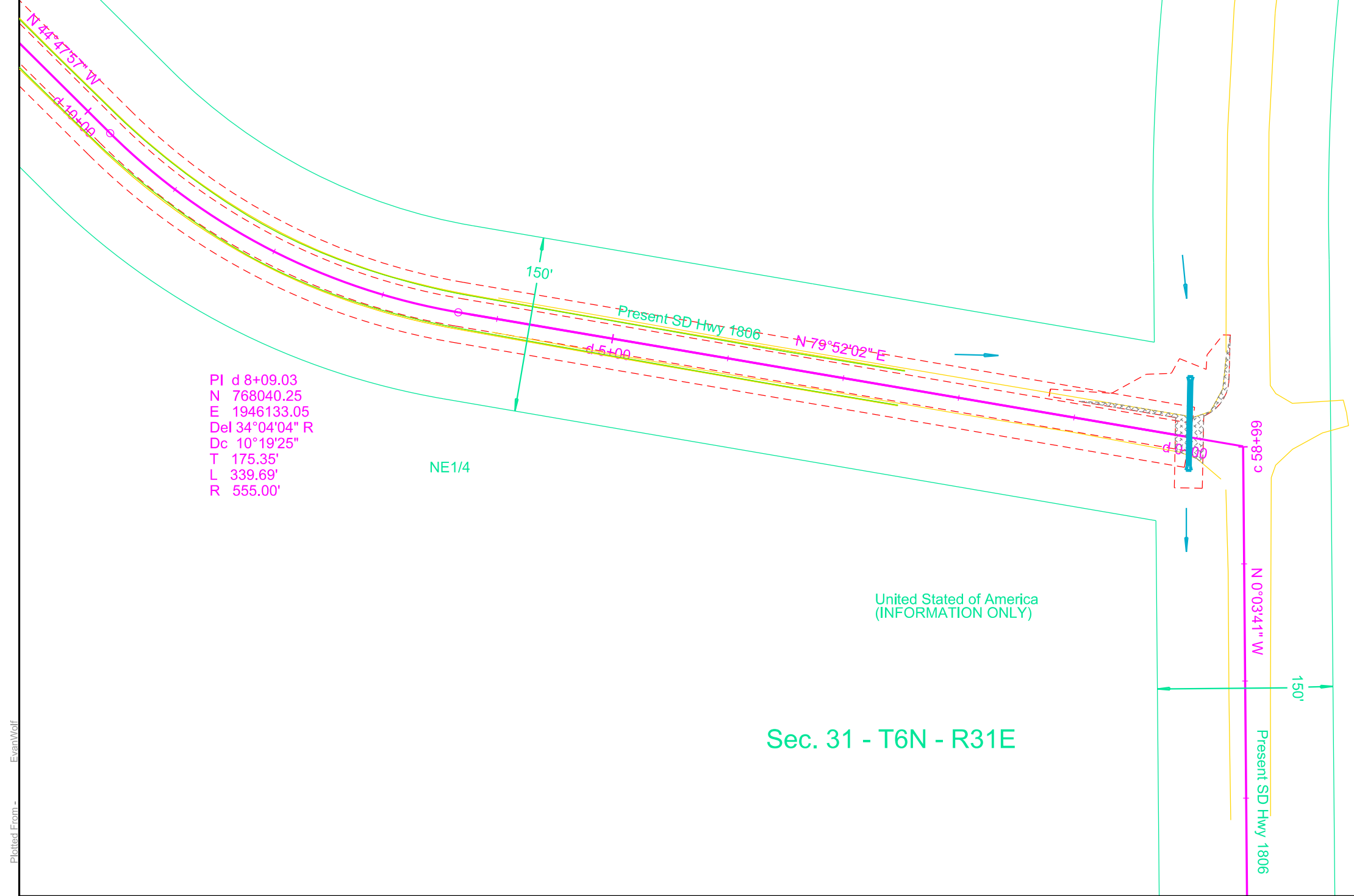
Plotted From - EvenWolf

PI d 8+09.03
N 768040.25
E 1946133.05
Del 34°04'04" R
Dc 10°19'25"
T 175.35'
L 339.69'
R 555.00'

NE1/4

United States of America
(INFORMATION ONLY)

Sec. 31 - T6N - R31E



d 47+55
Retain 18"-100' RCP
d 47+55
Cleanout Culvert

d 36+98
Remove 74'-18" RCP
d 36+98
Install 50'- 24" RCP
(18' L & 32' R)
& 2 Flared Ends

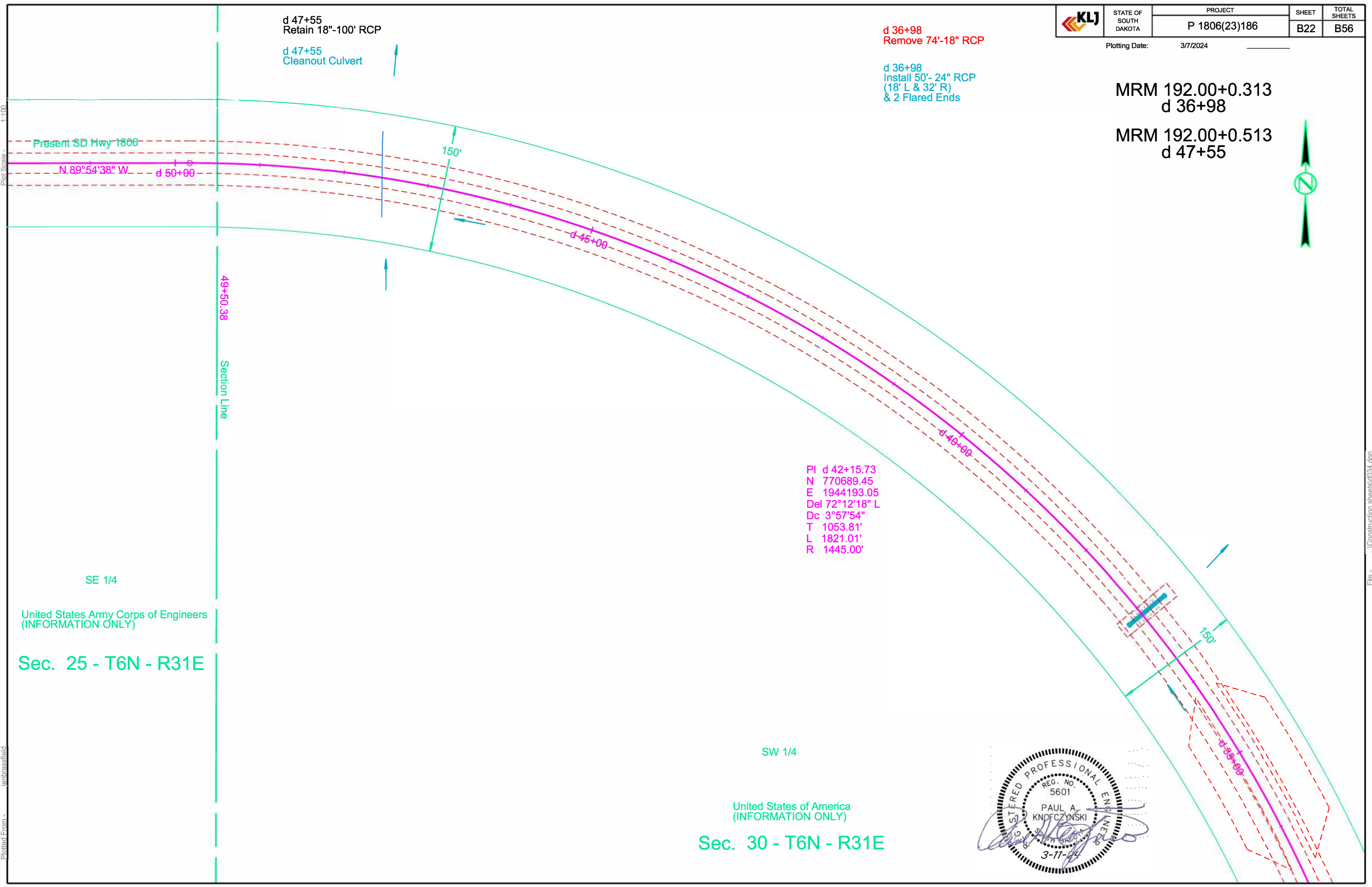
MRM 192.00+0.313
d 36+98
MRM 192.00+0.513
d 47+55



Plot Scale: 1:100

Plotted From: jenbrassfield

File: ...Construction sheets\d034.dgn



SE 1/4

United States Army Corps of Engineers
(INFORMATION ONLY)

Sec. 25 - T6N - R31E

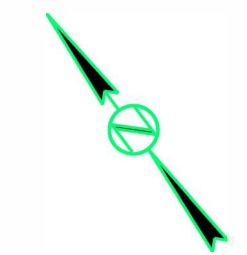
SW 1/4

United States of America
(INFORMATION ONLY)

Sec. 30 - T6N - R31E



MRM 193.00+0.311
Sta. d 89+92



Sec. 25 - T6N - R30E

SW1/4

United States Army Corps of Engineers
(INFORMATION ONLY)

PI d 85+64.12
N 769266.96
E 1940113.26
Del 81°03'42" R
Dc 8°00'48"
T 611.33'
L 1011.58'
R 715.00'

PI d 103.84.99
N 770481.15
E 1938486.22
Del 45°01'46" R
Dc 15°16'44"
T 155.44'
L 294.72'
R 375.00'

PI d 100+88.13
N 770277.68
E 1938702.64
Del 7°36'40" R
Dc 5°43'46"
T 66.50'
L 132.84'
R 1000.00'

d 103+53
Remove 92' Beam Guardrail

d 103+53
Install 50'-Straight Class A Beam
Guardrail with Wood Posts
& 37.5'-Curved Class A W Beam
Guardrail with Wood Posts
& 12.5' Guardrail Special Anchor
Assembly

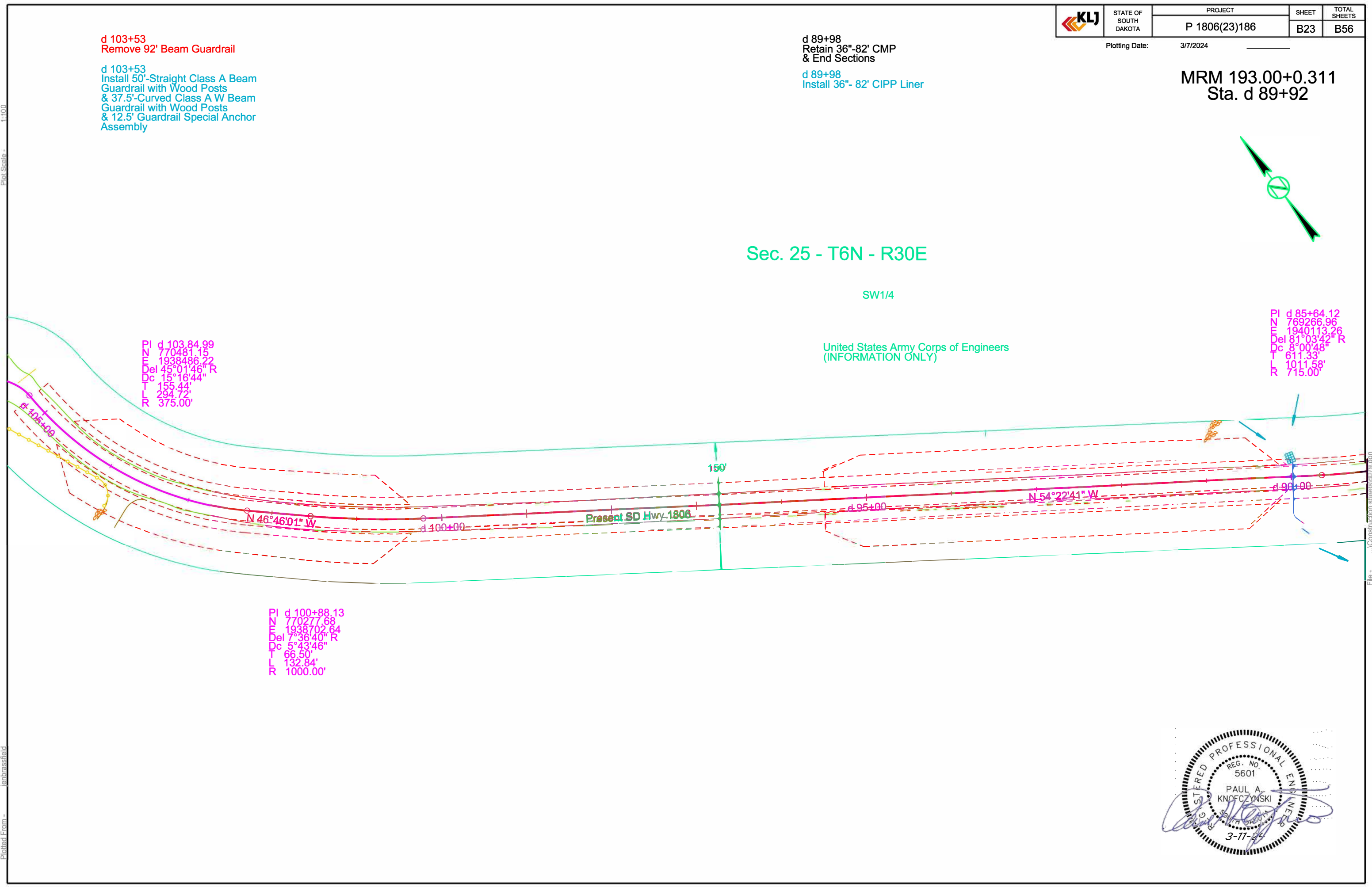
d 89+98
Retain 36"-82' CMP
& End Sections

d 89+98
Install 36"- 82' CIPP Liner

Plot Scale - 1:100

Plotted From - jenbrassfield

File - ...I:\construction\shenandoah\projgn



Plotting Date: 3/7/2024



MRM 198.00+0.778
e 83+85

MRM 198.00+0.903
e 77+08

MRM 198.00+0.911
e 76+32

Haskins Family LLC
(INFORMATION ONLY)

Buffalo Pasture Tract 1

- e 76+32 Retain 24"-136' RCP
- e 76+32 Remove 16'-24" RCP for Reset (8' R & 8' L)
- e 76+32 Remove 2 End Sections
- e 76+32 Reset 24"-16' RCP (8' R & 8' L)
- e 76+32 Install 2 RCP Flared Ends
- e 76+31 R Install PVC Coated Bank and Channel Protection Gabions (4.5 CuYd) & Type B Drainage Fabric (15 SqYd)
- e 77+08 Retain 4x6-32' Cattle
- e 77+08 Remove 16' Existing Cattle Pass (8' R & 8' L) & 2 End Sections
- e 77+08 Install 86'-24" CMP & 2-24" CMP Sloped Ends Fill Remaining Cattle Pass with Cellular Grout (20.6 CuYd)
- e 77+08 Place Contractor Finished Borrow Excavation Material to shape Inslope to Extend Pipe (74 CuYd)
- e 77+08 R Place Contractor Furnished Borrow Excavation Material to Fill Hole Under Pipe Outlet (6 CuYd)
- e 83+85 Remove 72'-18" CMP (37' R & 35' L) & 2 End Sections
- e 83+85 Install 62'-24" RCP (32' R & 30' L) & 2 Flared Ends

Harley J. Moser
(INFORMATION ONLY)

SE1/4

Sec. 5 - T5N - R30E

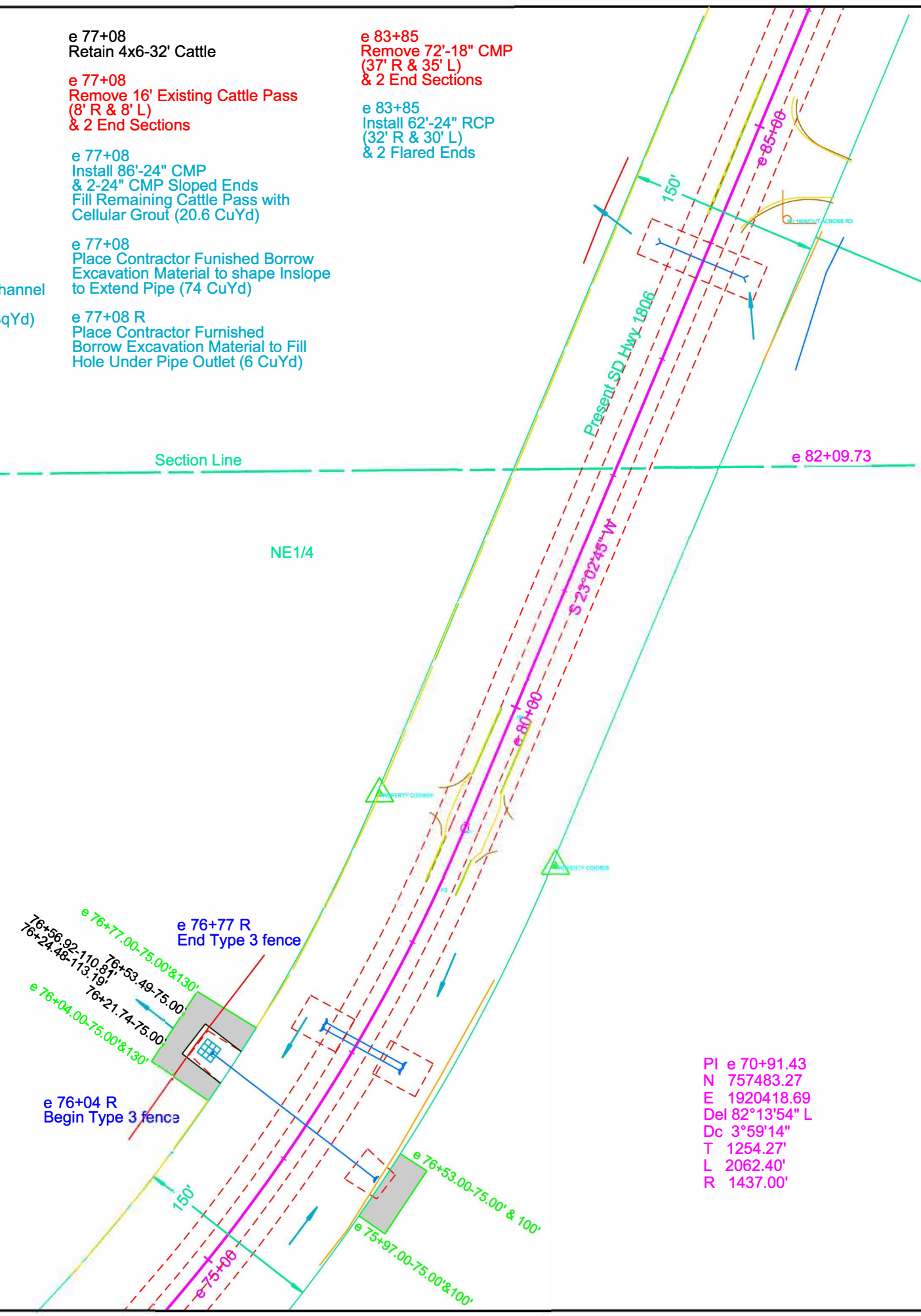
Harley J. Moser

The N1/2 North and East of County Road Highway in Section 8 - Township 5 North - Range 30 East

Parcel 1
0.03 ac, Permanent Easement (1113 sq ft), more or less

Parcel 1
e 76+04.00 to e 76+77.00 R
Temporary Easement containing 0.1 ac, more or less

Parcel A1
e 75+97.00 to e 76+53.00 L
Temporary Easement containing 0.1 ac, more or less



Haskins Family, LLC

Buffalo Pasture Tract 2
A subdivision of SE1/4 of Section 5 & The E1/2 of Section 8 - Township 5 North - Range 30 East of the BHM

Parcel A1

Sec. 8 - T5N - R30E

Plot Scale - 1:100

Plotted From - jenbrassfield

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f 227+54
Remove 24"-32' RCP for Reset
(16' R & 16' L)

f 227+54
Remove 2 Flared Ends

f 227+54
Reset 24"-32' RCP
Skewed 26° RHF
(16' R & 16' L)

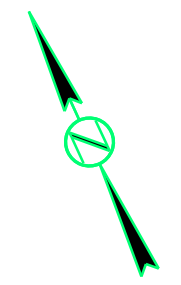
f 227+54
Retain 24"-94' CMP

f 227+54
Install 2 RCP Flared Ends

f 227+54
Cleanout for Culvert Treatment
Install 24"-126'
Cured in Place Pipe

f 227+32 L
Install PVC Coated Bank and Channel
Protection Gabions (4.5 CuYd)
& Type B Drainage Fabric (15 SqYd)

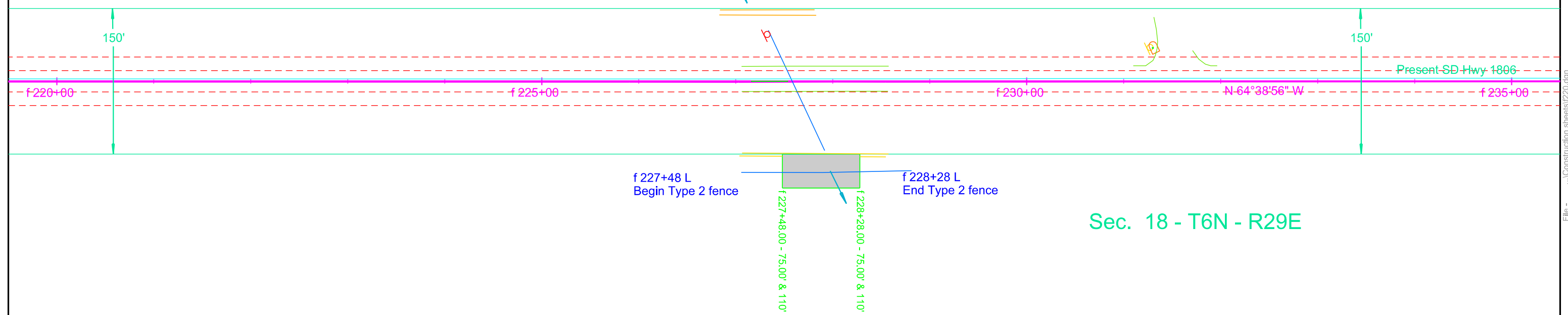
MRM 207.00+0.904
f 227+54



Larry G. McQuiston
(INFORMATION ONLY)

NE 1/4

Plot Scale - 1:100



Taylor L. Sonnenschein & Sarah D. Sonnenschein

The E1/2 lying South of Highway 1806 in
Section 18 - Township 6 North - Range
29 East of the B.H.M.

Parcel A2

Parcel A2
f 227+48.00 to f 228+28.00 L
Temporary Easement containing
0.1 ac, more or less




Plotted From - evanwolf

File - ...Construction sheets\220.dgn

Plot Scale - 1"=40'

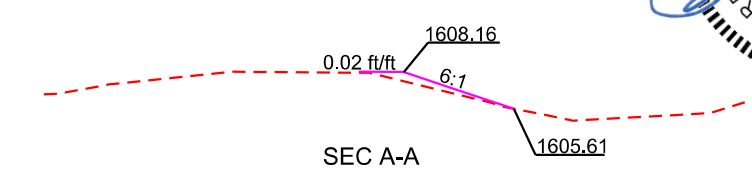
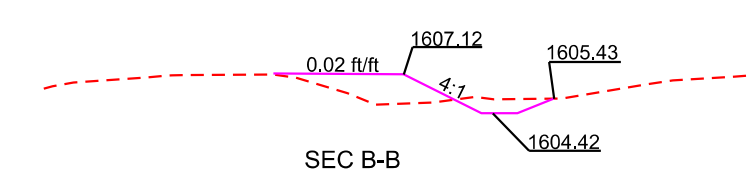
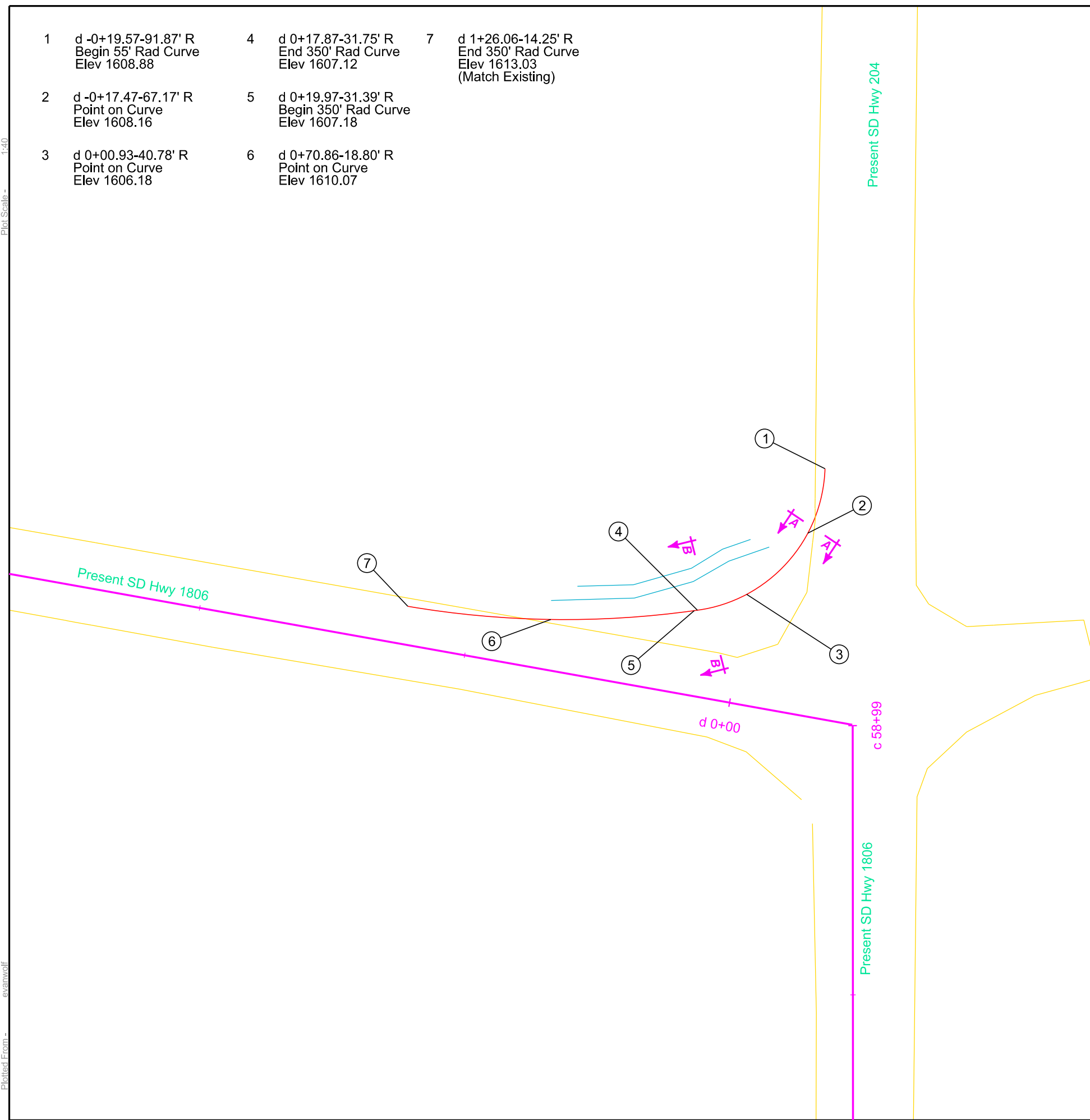
Plotted From - evanwolf

- | | | | | | |
|---|--|---|--|---|--|
| 1 | d -0+19.57-91.87' R
Begin 55' Rad Curve
Elev 1608.88 | 4 | d 0+17.87-31.75' R
End 350' Rad Curve
Elev 1607.12 | 7 | d 1+26.06-14.25' R
End 350' Rad Curve
Elev 1613.03
(Match Existing) |
| 2 | d -0+17.47-67.17' R
Point on Curve
Elev 1608.16 | 5 | d 0+19.97-31.39' R
Begin 350' Rad Curve
Elev 1607.18 | | |
| 3 | d 0+00.93-40.78' R
Point on Curve
Elev 1606.18 | 6 | d 0+70.86-18.80' R
Point on Curve
Elev 1610.07 | | |

 STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B26	B56

Plotting Date: 4/26/2024 Revised 4/26/24 EJW

MRM 191.00+0.614
d 0+00



File - ...Intersection_1806_204_Layout.dgn

GUARDRAIL LAYOUT

Spillway
SD Hwy 1806
MRM 193.624



STATE OF
SOUTH
DAKOTA

PROJECT

P 1806(23)186

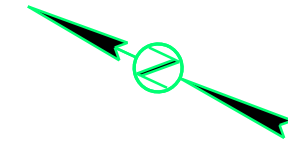
SHEET

B27

TOTAL
SHEETS

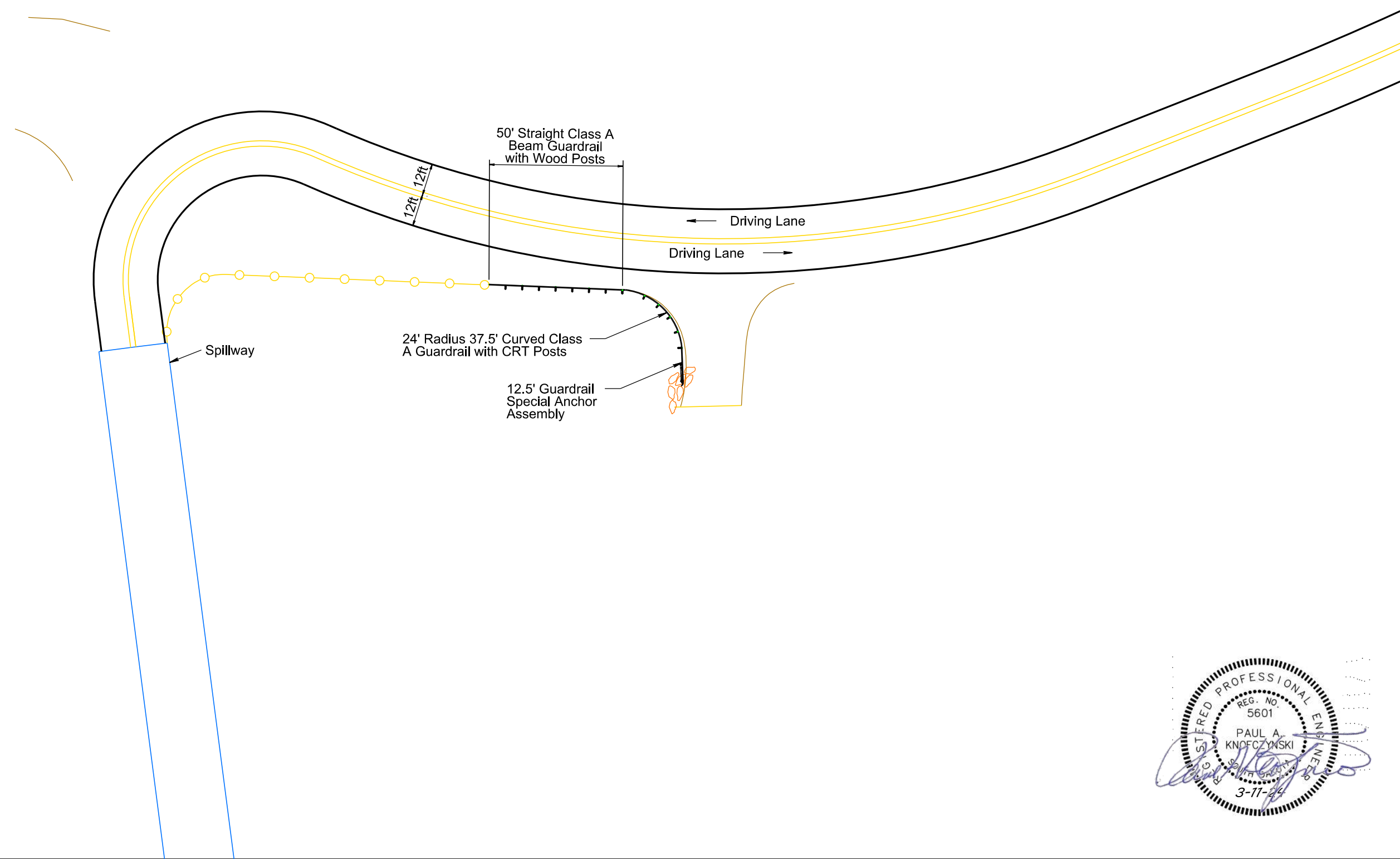
B56

Plotting Date: 3/7/2024



Plot Scale - 1:40

Plotted From - jenbrassfield



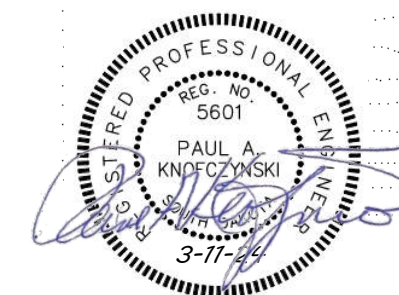
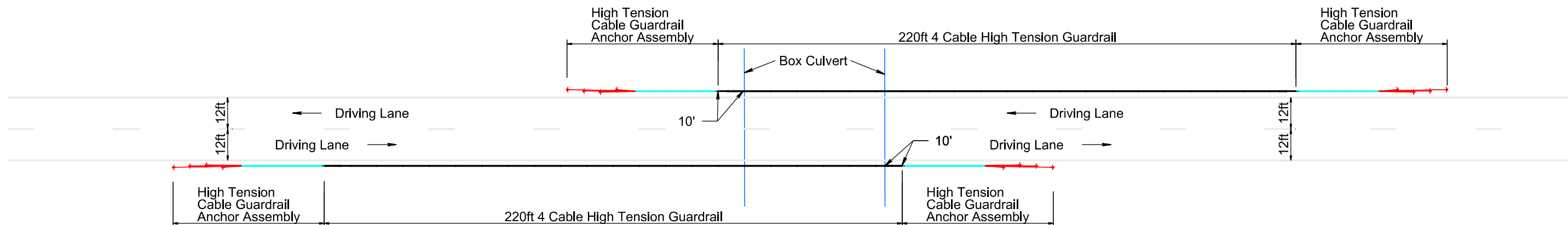
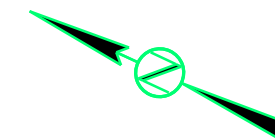
File - ...Section B\Guardrail02.dgn

GUARDRAIL LAYOUT

Structure No. 59-234-176
SD Hwy 1806
MRM 211.43

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B28	B56

Plotting Date: 3/7/2024



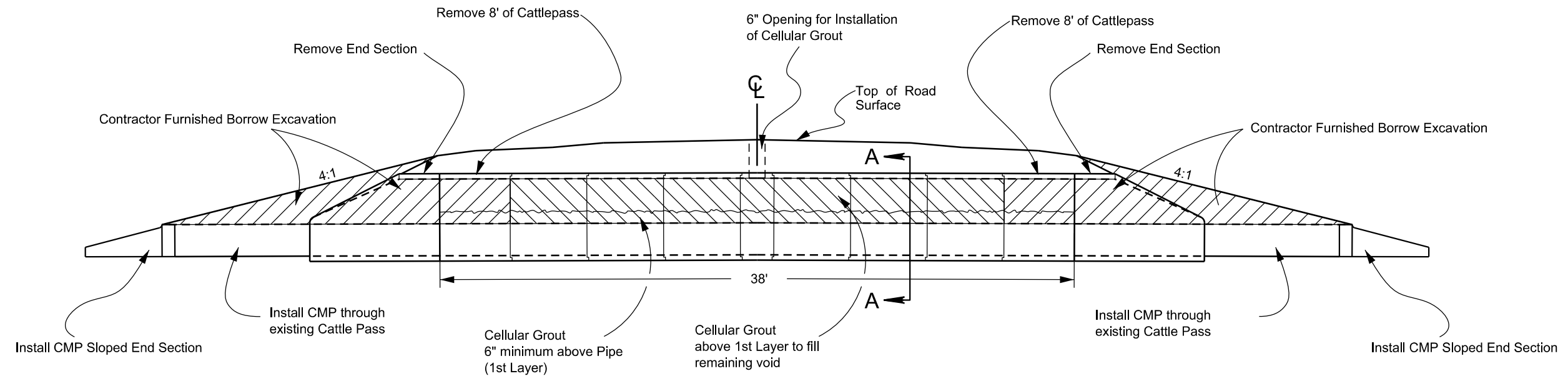
LAYOUT FOR INSTALLING CMP IN EXISTING RC CATTLE PASS

STATE OF SOUTH DAKOTA	PROJECT P 1806(23)186	SHEET B29	TOTAL SHEETS B56
-----------------------	--------------------------	--------------	---------------------

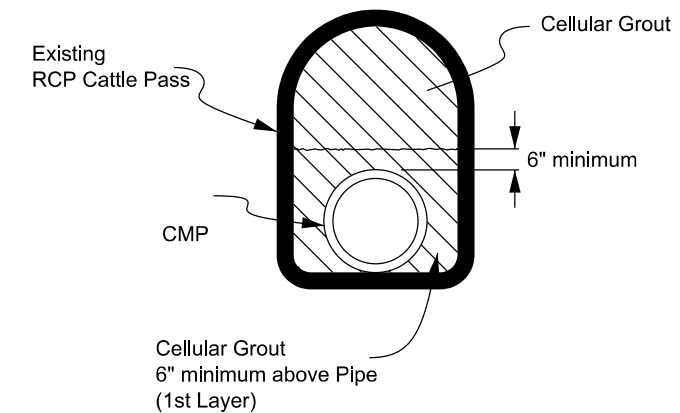
Plotting Date: 3/7/2024 Revised By:

MRM 198.00+0.911 e 77+08

 CELLULAR GROUT



SECTION A-A



NOTE:

- Contractor will match the existing roadway inslope to the satisfaction of the Engineer.
- Refer to plan notes for placing pipe and plugging the remaining void throughout the cattle pass.
- Refer to the plans for quantities.



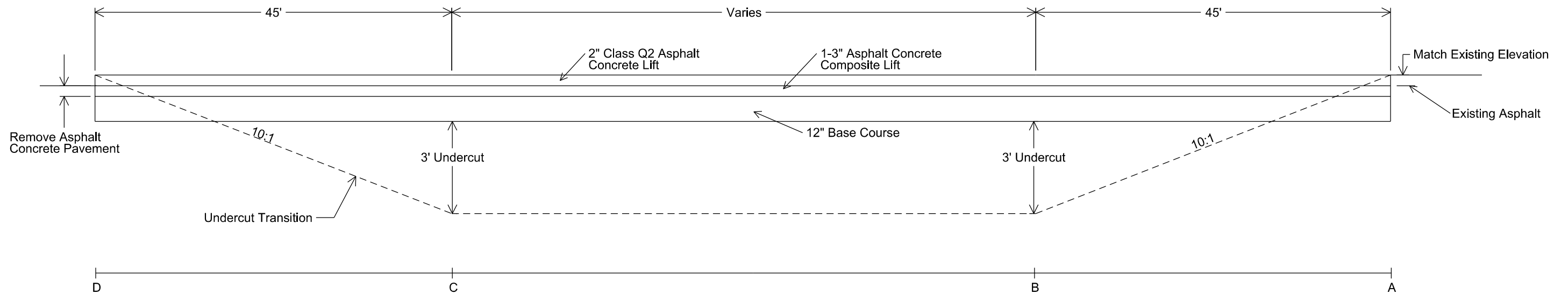
Plot Scale - 1:9.375

Plotted From - jbrbrassfield

File - ...Cattle Pass Details.dgn

FAULT-HEAVE REPAIR

STATE OF SOUTH DAKOTA	PROJECT P 1806(23)186	SHEET B30	TOTAL SHEETS B56
Plotting Date: 3/7/2024			



Heave Repair						
MRM		MRM	A	B	C	D
192.00+0.256	to	192.00+0.284	d 33+45	d 33+90	d 35+38	d 35+83
193.00+0.326	to	193.00+0.354	d 90+05	d 90+50	d 95+04	d 95+49
193.00+0.386	to	193.00+0.414	d 100+34	d 100+79	d 104+23	d 104+68



DRAWING NOT TO SCALE

Plot Scale - 1:28.9323

Plotted From - jenbrassfield

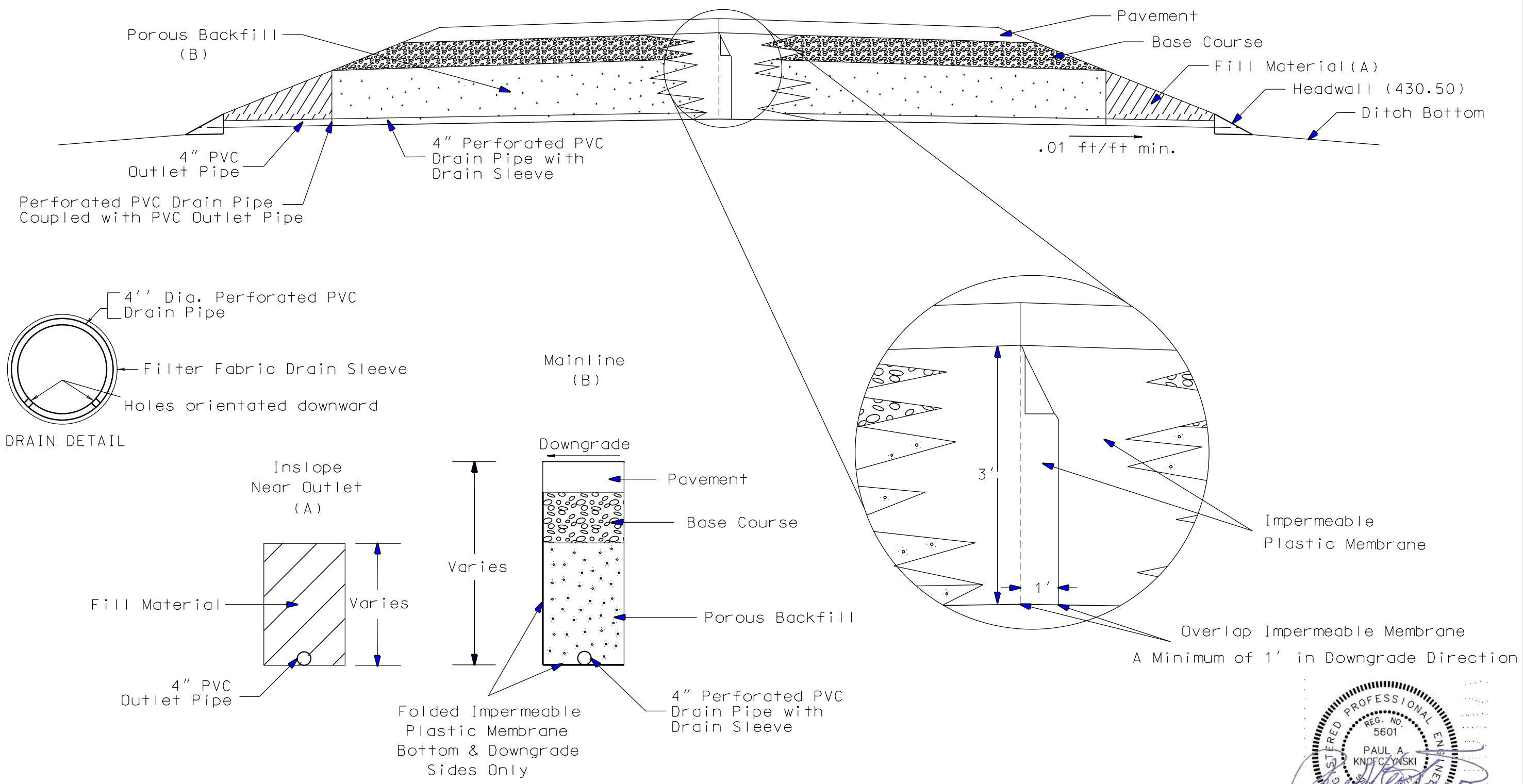
File - ...DetailsHeave Repair.dgn

Typical Cutoff Drain Installation

STATE OF SOUTH DAKOTA	PROJECT P 1806(23)186	SHEET B31	TOTAL SHEETS B56
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Plotting Date: 3/7/2024

Plot Scale - 1:25000



Plotted From - jbrassfield

File - ...Cutoff drain and underdrain=faul trace details.dgn



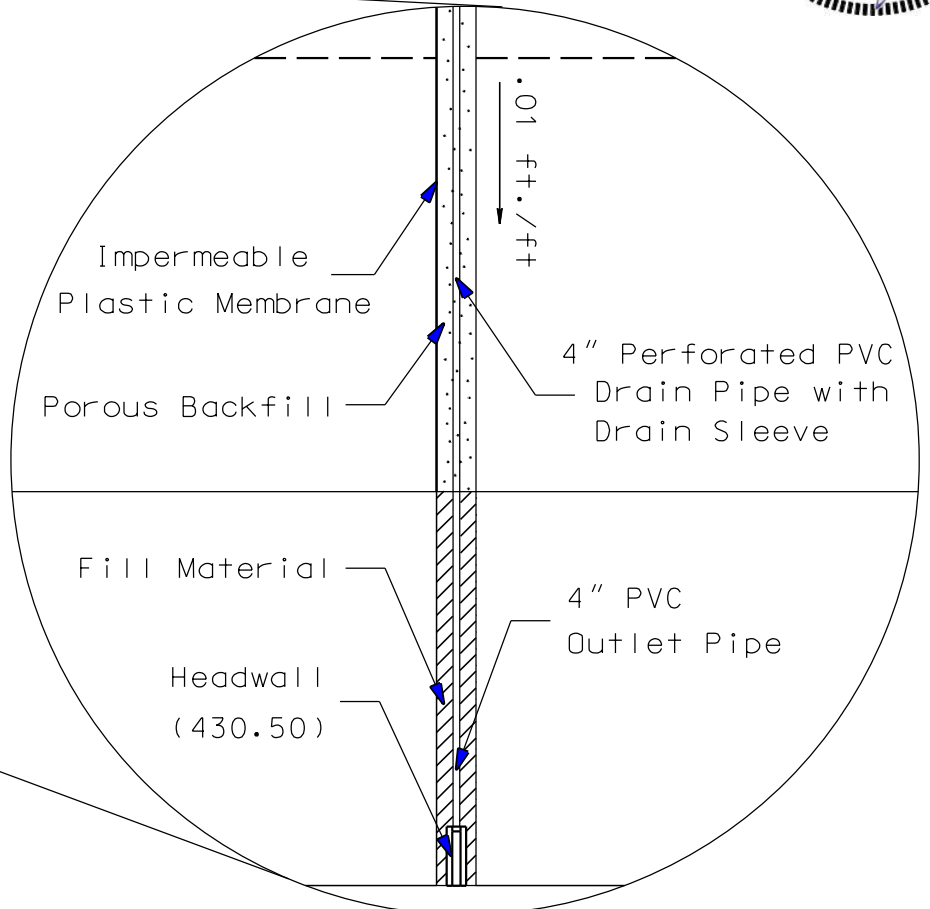
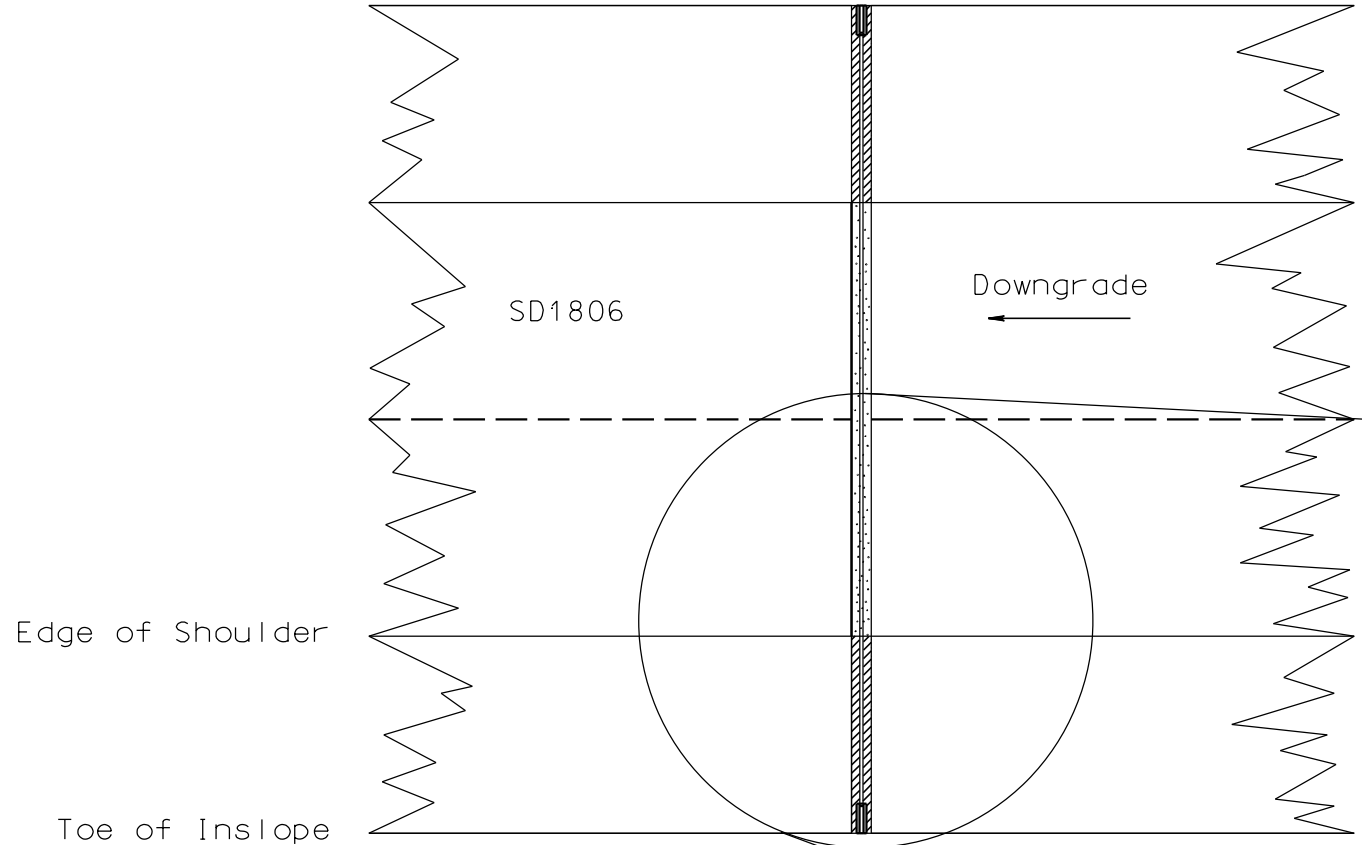
Typical Cutoff Drain Installation

STATE OF SOUTH DAKOTA	PROJECT P 1806(23)186	SHEET B32	TOTAL SHEETS B56
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Plotting Date: 3/7/2024

Plot Scale - 1:25000

Plotted From - jenbrassfield

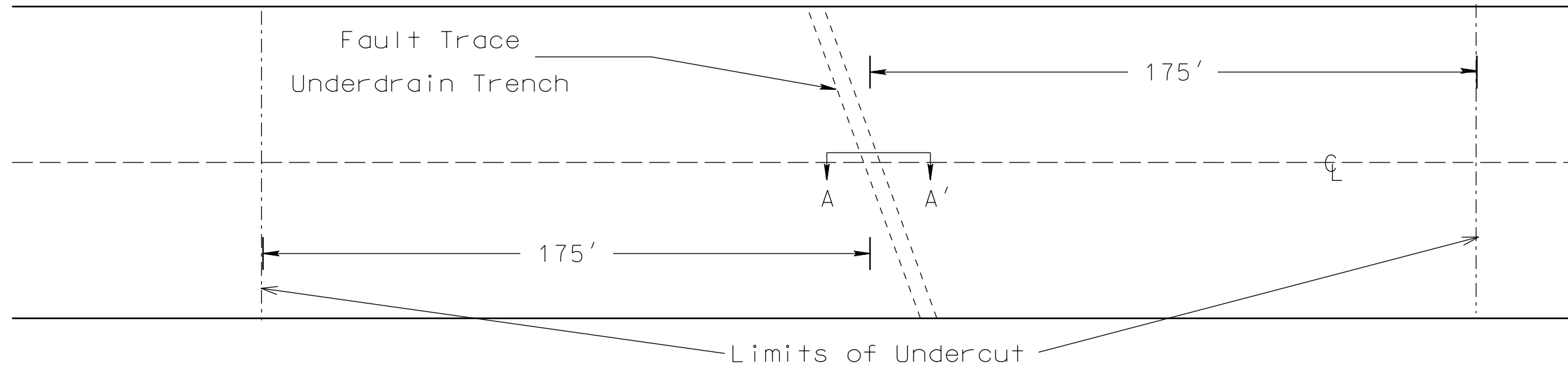


File - ...Cutoff drain and underdrain=fault trace details.dgn

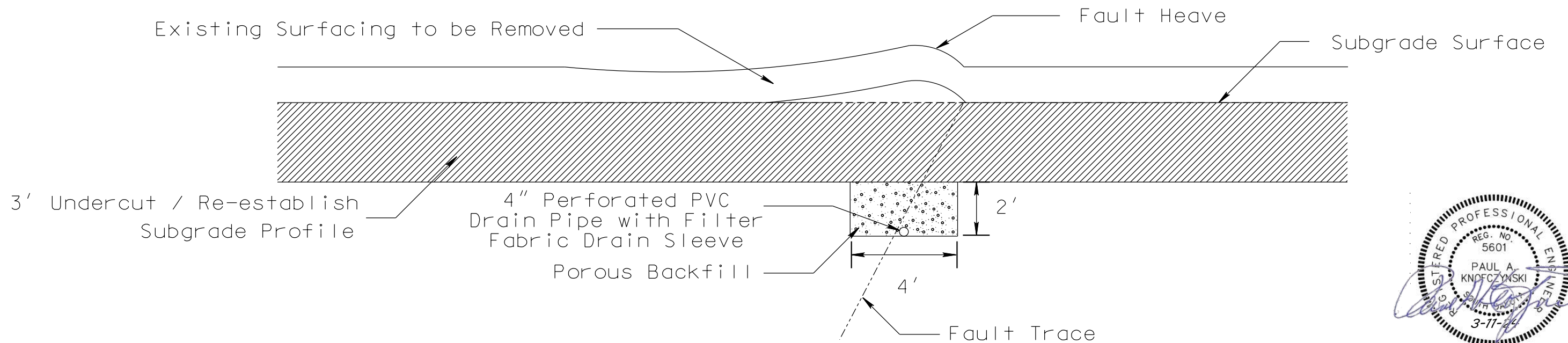
TYPICAL UNDERDRAIN SECTIONS

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B33	B56
Plotting Date: 3/7/2024			

FAULT TRACE UNDERDRAIN PLAN VIEW - MRM 193.56



TYPICAL FAULT TRACE UNDERDRAIN
SECTION A - A'



Plot Scale - 1:25000

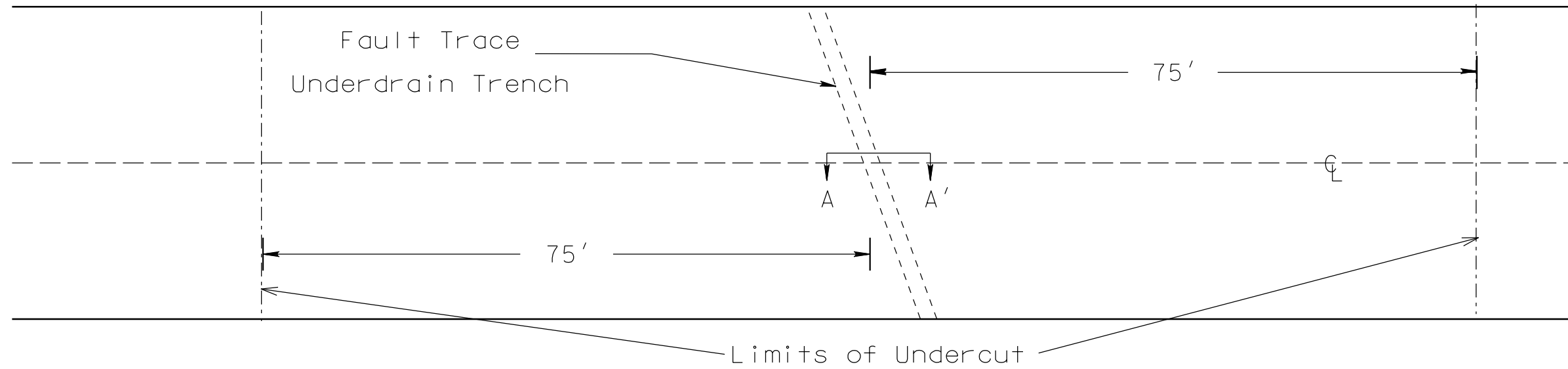
Plotted From - jbrassfield

File - ...:\Cutoff drain and underdrain=fault trace details.dgn

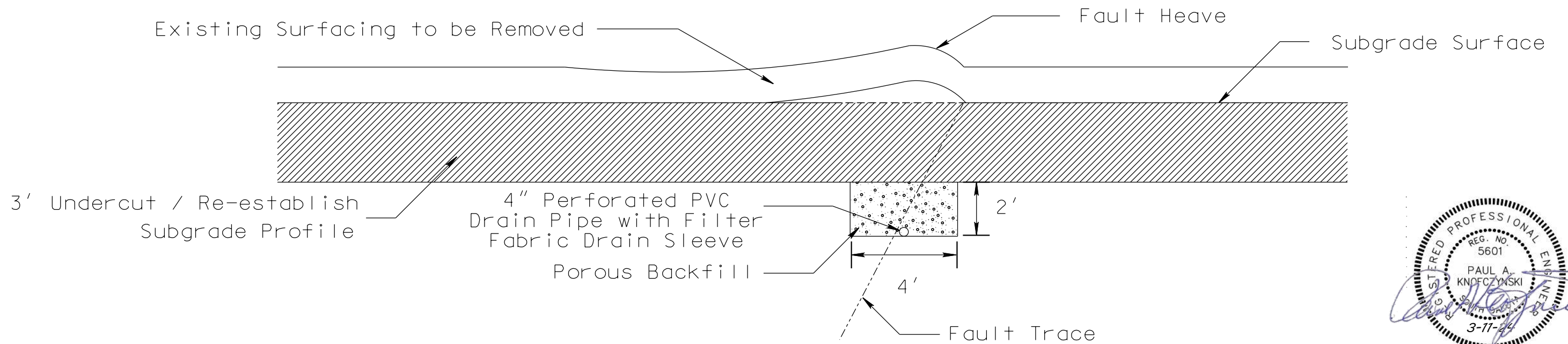
TYPICAL UNDERDRAIN SECTIONS

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B34	B56
Plotting Date: 3/7/2024			

FAULT TRACE UNDERDRAIN PLAN VIEW - MRM 192.27, 193.34 & 193.40



TYPICAL FAULT TRACE UNDERDRAIN
SECTION A - A'



Plot Scale - 1:25000

Plotted From - jbrassfield

File - ...I:Cutoff drain and underdrain=fault trace details.dgn

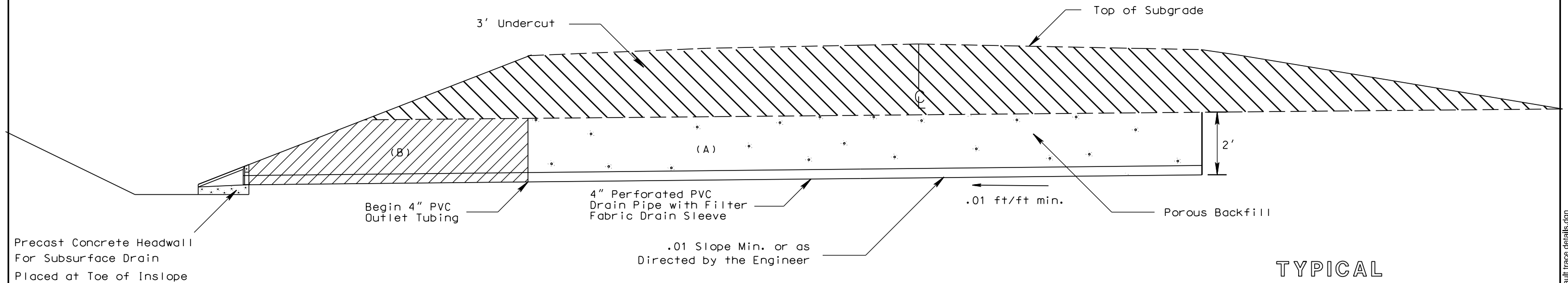
TYPICAL UNDERDRAIN SECTIONS

STATE OF SOUTH DAKOTA	PROJECT P 1806(23)186	SHEET B35	TOTAL SHEETS B56
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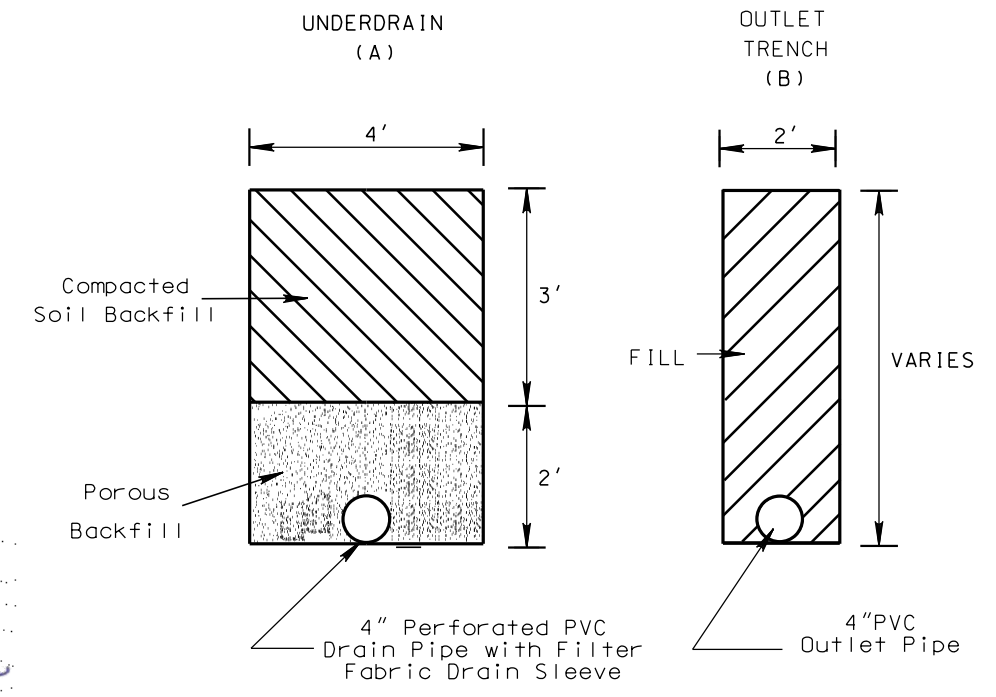
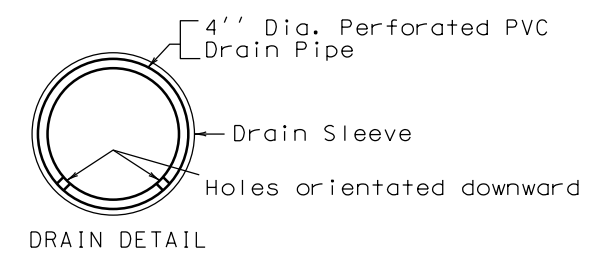
Plotting Date: 3/7/2024

TYPICAL FAULT TRACE UNDERDRAIN INSTALLATION - MRM 192.27, 193.34, 193.40 & 193.56

Plot Scale - 1:25000




TYPICAL UNDERDRAIN INSTALLATION

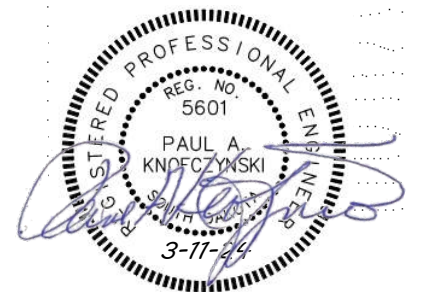
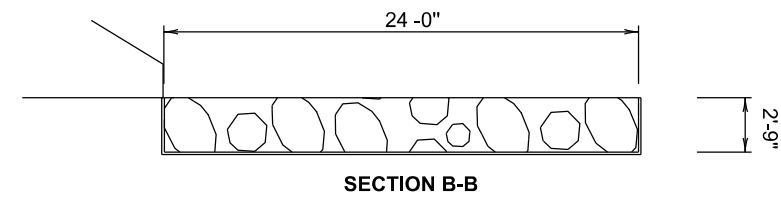
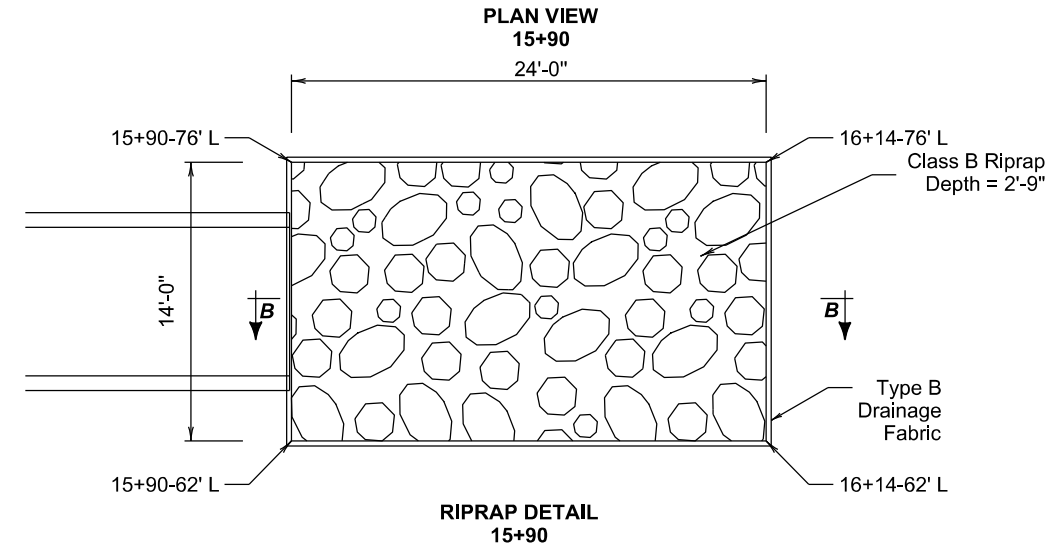
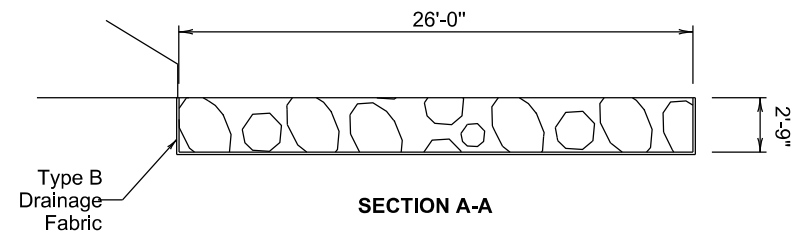
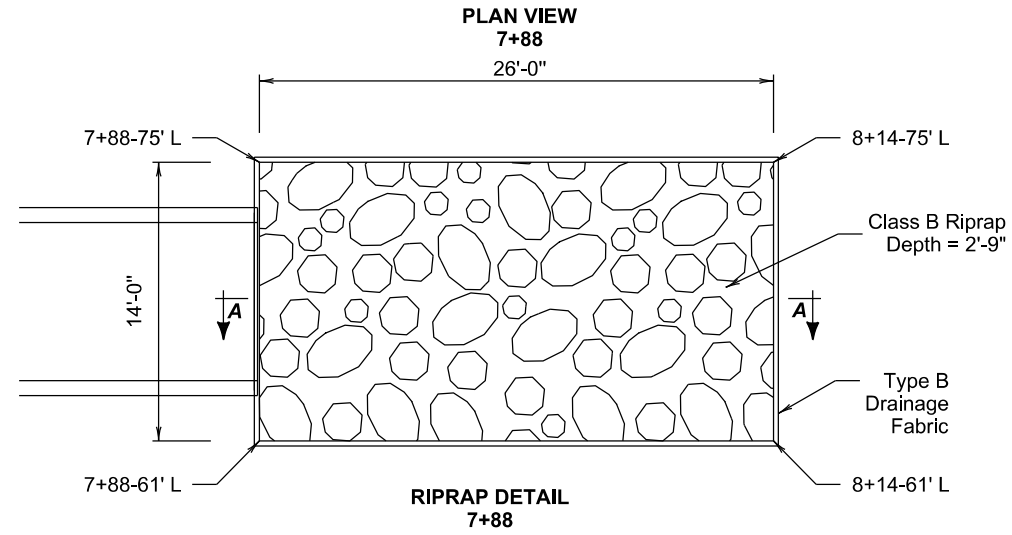


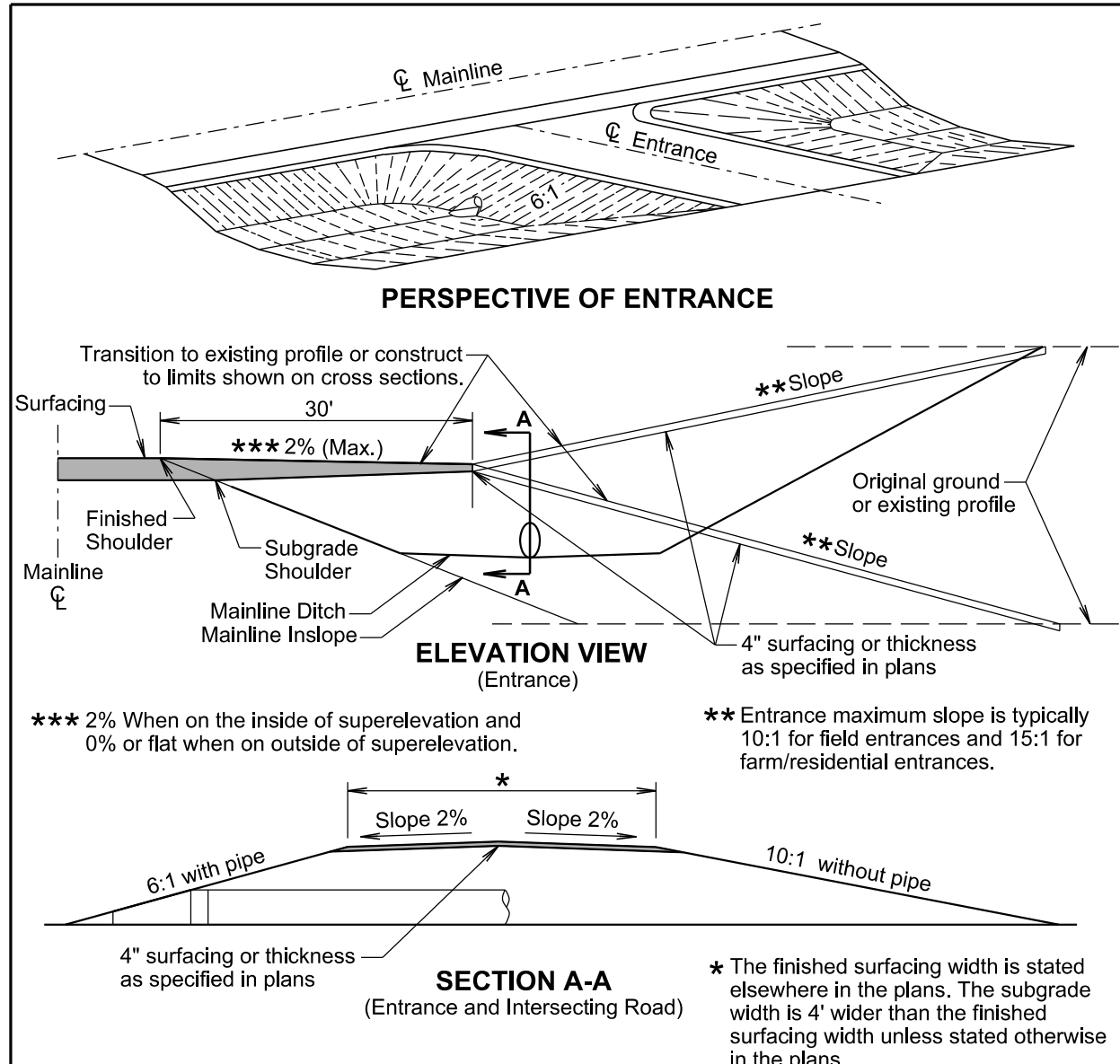
Plotted From - jbrassfield

File - ...Cutoff drain and underdrain=fault trace details.dgn

RIPRAP DETAILS

 STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 1806(23)186	B36	B56



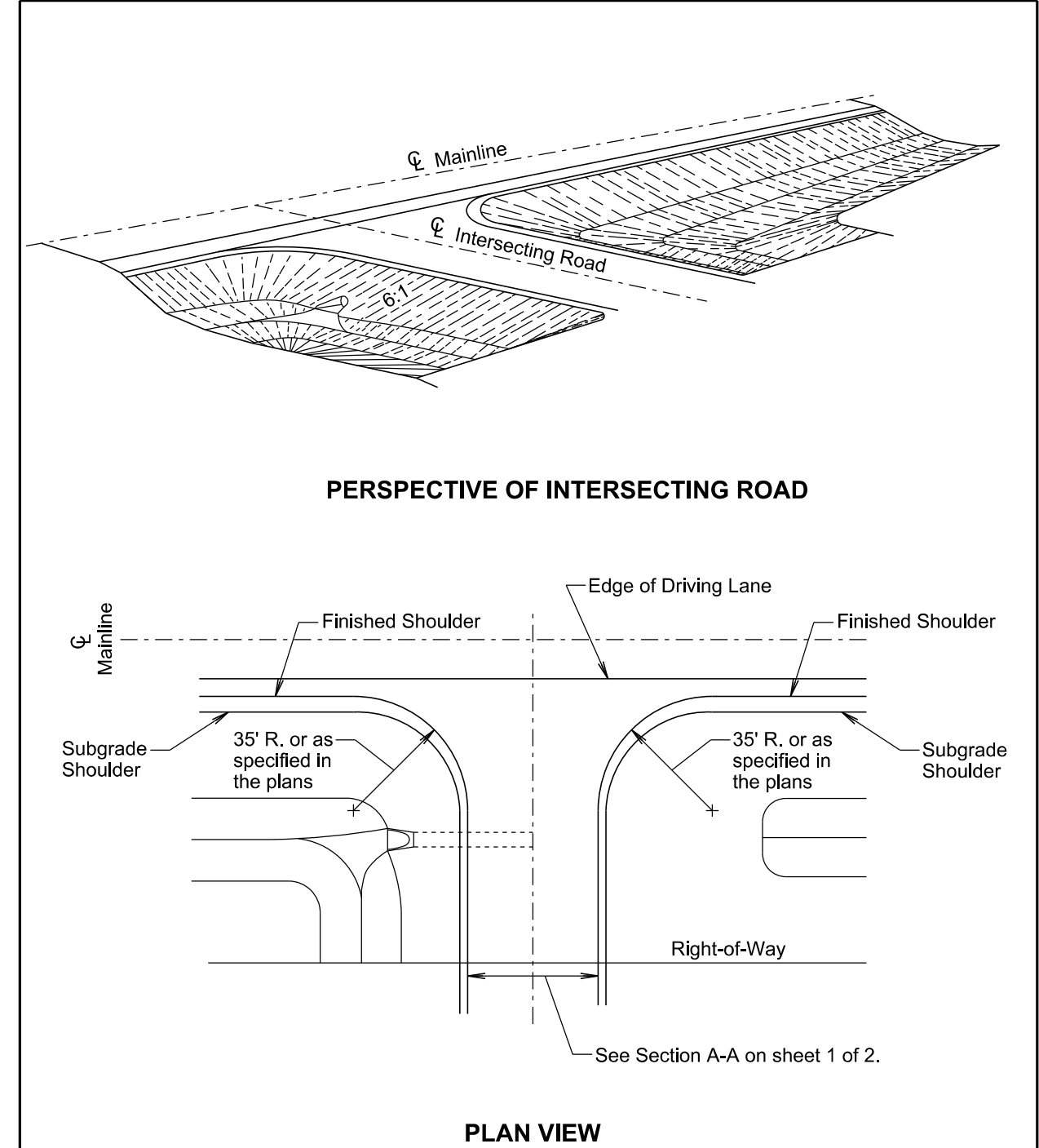


GENERAL NOTES:

- The ditch section shown above in the perspective view is only for illustrative purpose.
- The elevation view above is typical for either a ditch cut or fill section. Entrances that vary from above should be specified in the plans.
- Pipe length will be adjusted if necessary during construction to obtain the 6:1 slope. For grading projects, the pipe length is estimated typically using a 4" thickness of surfacing directly over the subgrade above the pipe.
- The transition area between the mainline inslope and the entrance or intersecting road inslope will be rounded to eliminate an abrupt transition.
- The turning radii will be 35' for intersecting roads and entrances unless stated otherwise in the plans.

November 19, 2021

Published Date: 2024	S D D O T	INTERSECTING ROADS AND ENTRANCES	PLATE NUMBER
			120.01
			Sheet 1 of 2

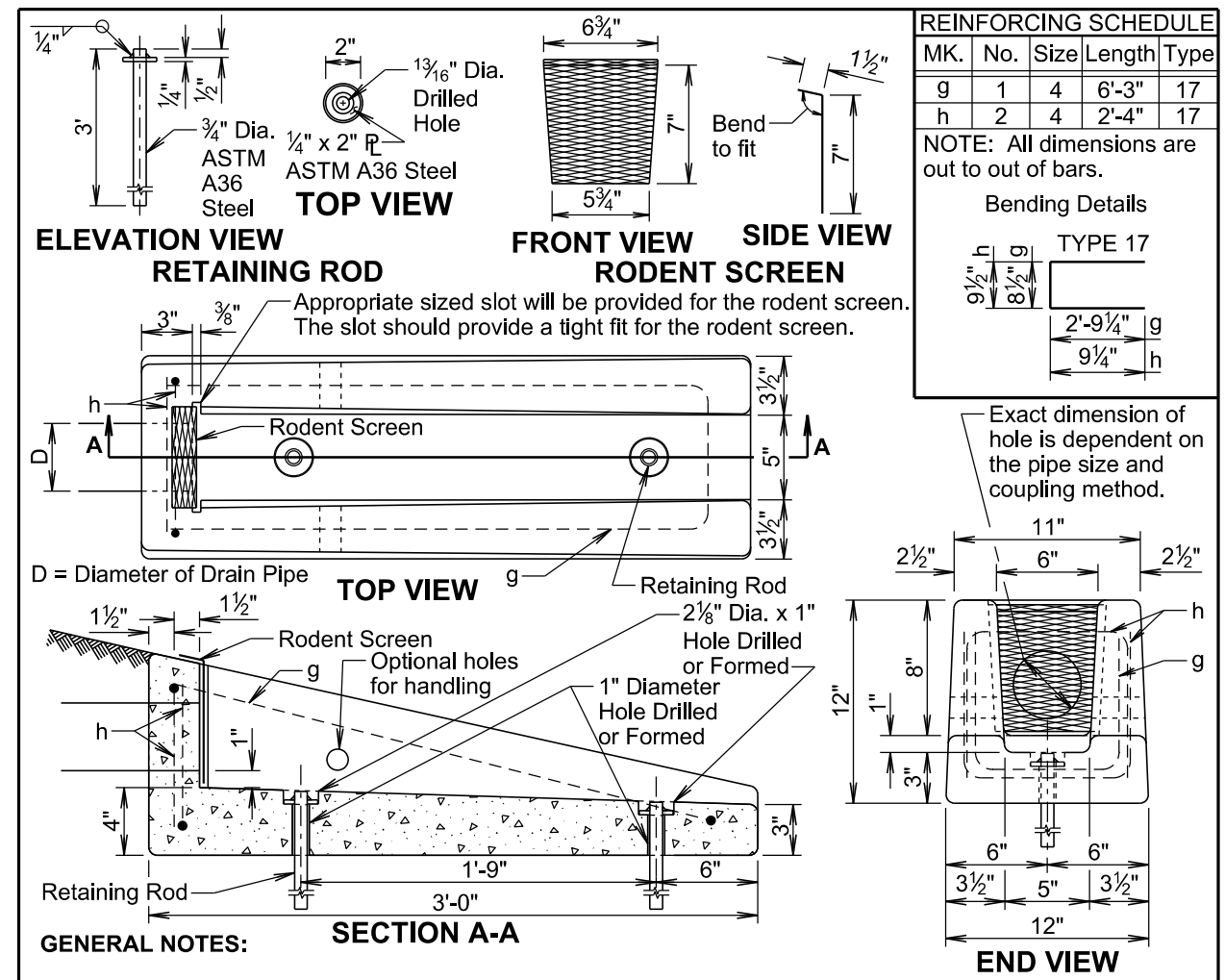


GENERAL NOTES:

- The 6:1 or 10:1 intersecting road inslope will transition to the existing intersecting road inslope near the right-of-way or at a location as determined by the Engineer.

November 19, 2021

Published Date: 2024	S D D O T	INTERSECTING ROADS AND ENTRANCES	PLATE NUMBER
			120.01
			Sheet 2 of 2



GENERAL NOTES:

The concrete will be Class M6. The concrete will conform to the requirements of Section 462 of the Specifications. It is estimated that each unit weighs approximately 210 pounds.

All reinforcing steel will conform to ASTM A615, Grade 60 and will be epoxy coated. The reinforcing steel will be securely retained to prevent displacement during placement of concrete. It is estimated that 7.3 pounds of reinforcing steel is required for each unit.

The pipe will be placed in the concrete headwall with the pipe end flush with the concrete surface adjacent to the rodent screen.

The rodent screen will be galvanized 13 Ga. steel with a diamond shaped flattened mesh pattern. The size will be 1/2". The size refers to the measurement across the smallest diamond shaped opening measured from the centers of the wires.

The retaining rod will be galvanized in accordance with ASTM A123 after all shop welding has been completed.

The drawing indicates using 1/2" fillets; however, 3/4" chamfers may be substituted for the 1/2" fillets.

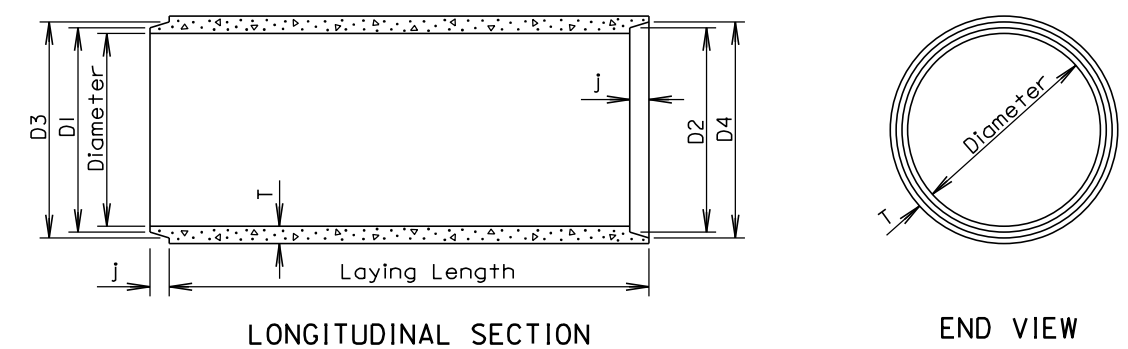
All costs for furnishing and installing the concrete headwall including equipment, labor, and materials including concrete, reinforcing steel, retaining rods, and rodent screen will be incidental to the contract unit price per each for "Precast Concrete Headwall for Drain".

November 19, 2021

Published Date: 2024	SD DOT	PRECAST CONCRETE HEADWALL FOR DRAIN	PLATE NUMBER 430.50
			Sheet 1 of 1

TOLERANCES IN DIMENSIONS

Diameter: ±1.5% for 24" Dia. or less and ±1% or 3/8" whichever is more for 27" Dia. or greater.
 Diameters at joints: ± 3/16" for 30" Dia. or less and ± 1/4" for 36" or greater.
 Length of joint (j): ± 1/4".
 Wall thickness (T): not less than design T by more than 5% or 3/16", whichever is greater.
 Laying length: shall not underrun by more than 1/2".



GENERAL NOTES:

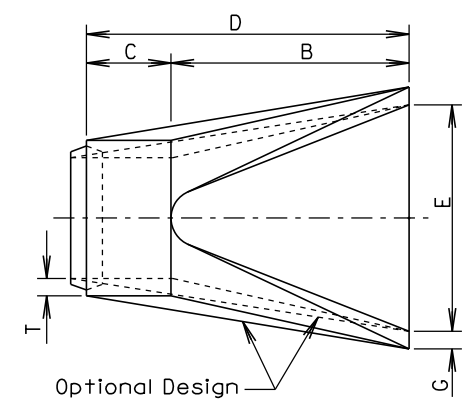
Construction of R.C.P. shall conform to the requirements of Section 990 of the Specifications.

Not more than 2 four-foot sections shall be permitted near the ends of any culvert. Four-foot lengths shall be used only to secure the required length of culvert.

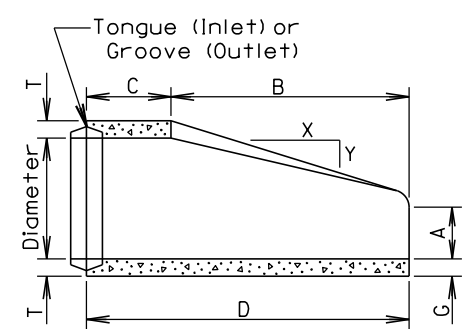
Diam. (in.)	Approx. Wt. /Ft. (lb.)	T (in.)	J (in.)	D1 (in.)	D2 (in.)	D3 (in.)	D4 (in.)
12	92	2	1 3/4	13 1/4	13 5/8	13 7/8	14 1/4
15	127	2 1/4	2	16 1/2	16 7/8	17 1/4	17 5/8
18	168	2 1/2	2 1/4	19 5/8	20	20 3/8	20 3/4
21	214	2 3/4	2 1/2	22 7/8	23 1/4	23 3/4	24 1/8
24	265	3	2 3/4	26	26 3/8	27	27 3/8
27	322	3 1/4	3	29 1/4	29 5/8	30 1/4	30 5/8
30	384	3 1/2	3 1/4	32 3/8	32 3/4	33 1/2	33 7/8
36	524	4	3 3/4	38 3/4	39 1/4	40	40 1/2
42	685	4 1/2	4	45 1/8	45 5/8	46 1/2	47
48	867	5	4 1/2	51 1/2	52	53	53 1/2
54	1070	5 1/2	4 1/2	57 7/8	58 3/8	59 3/8	59 7/8
60	1296	6	5	64 1/4	64 3/4	66	66 1/2
66	1542	6 1/2	5 1/2	70 5/8	71 1/8	72 1/2	73
72	1810	7	6	77	77 1/2	79	79 1/2
78	2098	7 1/2	6 1/2	83 3/8	83 7/8	85 5/8	86 1/8
84	2410	8	7	89 3/4	90 1/4	92 1/8	92 5/8
90	2740	8 1/2	7	95 3/4	96 1/4	98 1/8	98 5/8
96	2950	9	7	102 1/8	102 5/8	104 1/2	105
102	3075	9 1/2	7 1/2	109	109 1/2	111 1/2	112
108	3870	10	7 1/2	115 1/2	116	118	118 1/2

June 26, 2015

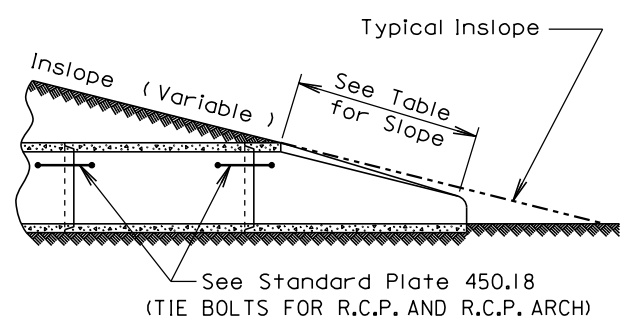
Published Date: 2024	SD DOT	REINFORCED CONCRETE PIPE	PLATE NUMBER 450.01
			Sheet 1 of 1



TOP VIEW



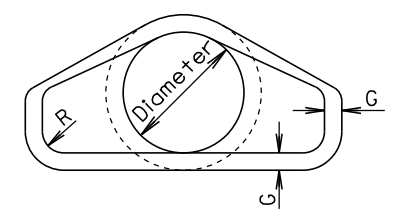
LONGITUDINAL SECTION



SLOPE DETAIL

GENERAL NOTES:

Lengths of concrete pipe shown on plan sheets are between flared ends only.
Construction of R.C.P. Flared End shall conform to the requirements of Section 990 of the Specifications.



END VIEW

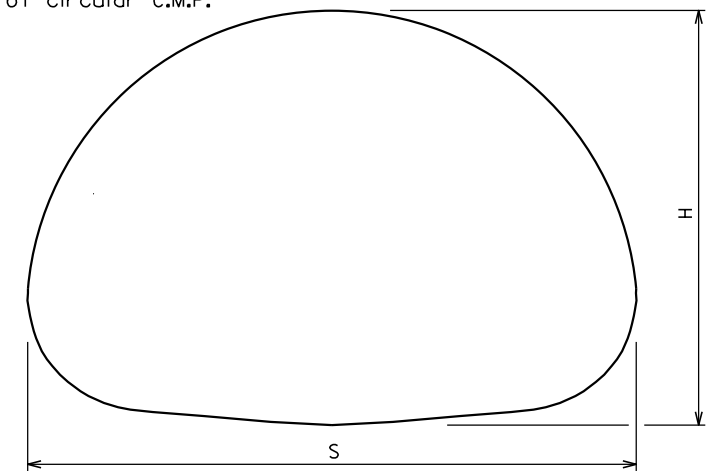
Dia. (in.)	Approx. Wt. of Section (lbs.)	Approx. Slope (X to Y)	T (in.)	A (in.)	B (in.)	C (in.)	D (in.)	E (in.)	G (in.)	R (in.)
12	530	2.4:1	2	4	24	48 ⁷ / ₈	72 ⁷ / ₈	24	2	1 ¹ / ₂
15	740	2.4:1	2 ¹ / ₄	6	27	46	73	30	2 ¹ / ₄	1 ¹ / ₂
18	990	2.3:1	2 ¹ / ₂	9	27	46	73	36	2 ¹ / ₂	1 ¹ / ₂
21	1280	2.4:1	2 ³ / ₄	9	36	37 ¹ / ₂	73 ¹ / ₂	42	2 ³ / ₄	1 ¹ / ₂
24	1520	2.5:1	3	9 ¹ / ₂	43 ¹ / ₂	30	73 ¹ / ₂	48	3	1 ¹ / ₂
27	1930	2.5:1	3 ¹ / ₄	10 ¹ / ₂	49 ¹ / ₂	24	73 ¹ / ₂	54	3 ¹ / ₄	1 ¹ / ₂
30	2190	2.5:1	3 ¹ / ₂	12	54	19 ³ / ₄	73 ³ / ₄	60	3 ¹ / ₂	1 ¹ / ₂
36	4100	2.5:1	4	15	63	34 ³ / ₄	97 ³ / ₄	72	4	1 ¹ / ₂
42	5380	2.5:1	4 ¹ / ₂	21	63	35	98	78	4 ¹ / ₂	1 ¹ / ₂
48	6550	2.5:1	5	24	72	26	98	84	5	1 ¹ / ₂
54	8240	2:1	5 ¹ / ₂	27	65	33 ¹ / ₄	98 ¹ / ₄	90	5 ¹ / ₂	1 ¹ / ₂
60	8730	1.9:1	6	35	60	39	99	96	5	1 ¹ / ₂
66	10710	1.7:1	6 ¹ / ₂	30	72	27	99	102	5 ¹ / ₂	1 ¹ / ₂
72	12520	1.8:1	7	36	78	21	99	108	6	1 ¹ / ₂
78	14770	1.8:1	7 ¹ / ₂	36	90	21	111	114	6 ¹ / ₂	1 ¹ / ₂
84	18160	1.6:1	8	36	90 ¹ / ₂	21	111 ¹ / ₂	120	6 ¹ / ₂	1 ¹ / ₂
90	20900	1.5:1	8 ¹ / ₂	41	87 ¹ / ₂	24	111 ¹ / ₂	132	6 ¹ / ₂	6

June 26, 2015

S D D O T	R. C. P. FLARED ENDS	PLATE NUMBER 450.10
	Published Date: 2024	Sheet 1 of 1

* Dia. (in.)	2 ² / ₃ " x 1 ¹ / ₂ " CORRUGATIONS			3" X 1" CORRUGATIONS		
	S Span (in.)	H Rise (in.)	Area (Sq. Ft.)	S Span (in.)	H Rise (in.)	Area (Sq. Ft.)
15	17	13	1.1			
18	21	15	1.6			
21	24	18	2.2			
24	28	20	2.8			
30	35	24	4.4			
36	42	29	6.4	40	31	7.0
42	49	33	8.7	46	36	9.4
48	57	38	11.4	53	41	12.3
54	64	43	14.3	60	46	15.6
60	71	47	17.6	66	51	19.3
66	77	52	21.3	73	55	23.2
72	83	57	25.3	81	59	27.4
78				87	63	32.1
84				95	67	37.0
90				103	71	42.4
96				112	75	48.0
102				117	79	54.2
108				128	83	60.8
114				137	87	67.4
120				142	91	74.5

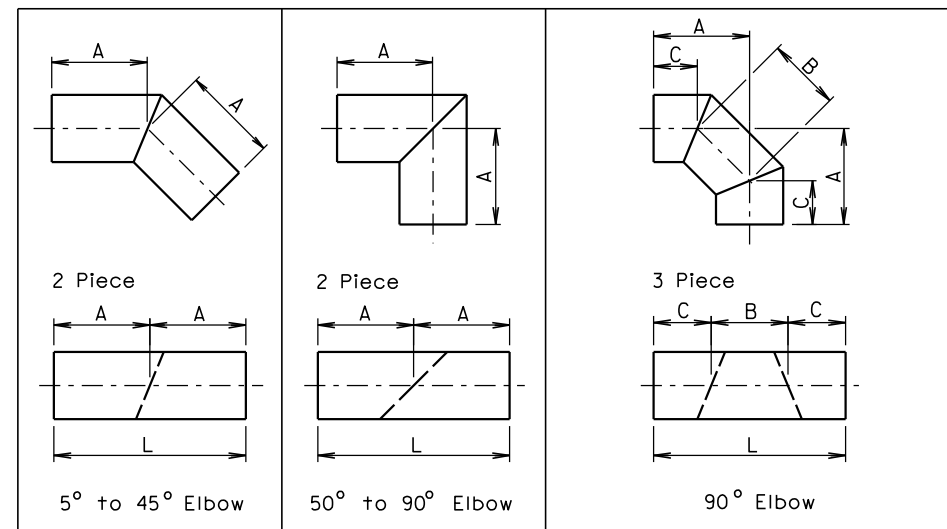
* Equivalent diameter of circular C.M.P.



GENERAL NOTE:
All dimensions measured from inside crest.

March 31, 2000

S D D O T	CORRUGATED METAL PIPE ARCH CULVERT	PLATE NUMBER 450.30
	Published Date: 2024	Sheet 1 of 1



Diameter	A	L	Diameter	A	L	Diameter	A	B	C	L
Inches	Feet	Feet	Inches	Feet	Feet	Inches	Inches			Feet
12	1	2	12	2	4	12	25 1/2	11	18 1/2	4
15	1	2	15	2	4	15	26 1/2	12	18	4
18	1	2	18	2	4	18	27	14	17	4
21	2	4	21	2	4	21	27	15	16 1/2	4
24	2	4	24	2	4	24	27 1/2	16	16	4
27	2	4	27	2	4	27	27 1/2	17	15 1/2	4
30	2	4	30	3	6	30	40	19	26 1/2	6
33	2	4	33	3	6	33	40	20	26	6
36	2	4	36	3	6	36	40 1/2	21	25 1/2	6
42	2	4	42	3	6	42	41	23	24 1/2	6
48	2	4	48	4	8	48	53 1/2	26	35	8
54	3	6	54	4	8	54	54	28	34	8
60	3	6	60	4	8	60	54 1/2	31	32 1/2	8
66	3	6	66	4	8	66	54	33	31 1/2	8
72	3	6	72	5	10	72	67 1/2	36	42	10
78	3	6	78	5	10	78	68	39	40 1/2	10
84	3	6	84	5	10	84	68 1/2	41	39 1/2	10
90	3	6	90	6	12	90	70	46	37	10
96	3	6	96	6	12	96	82	46	49	12

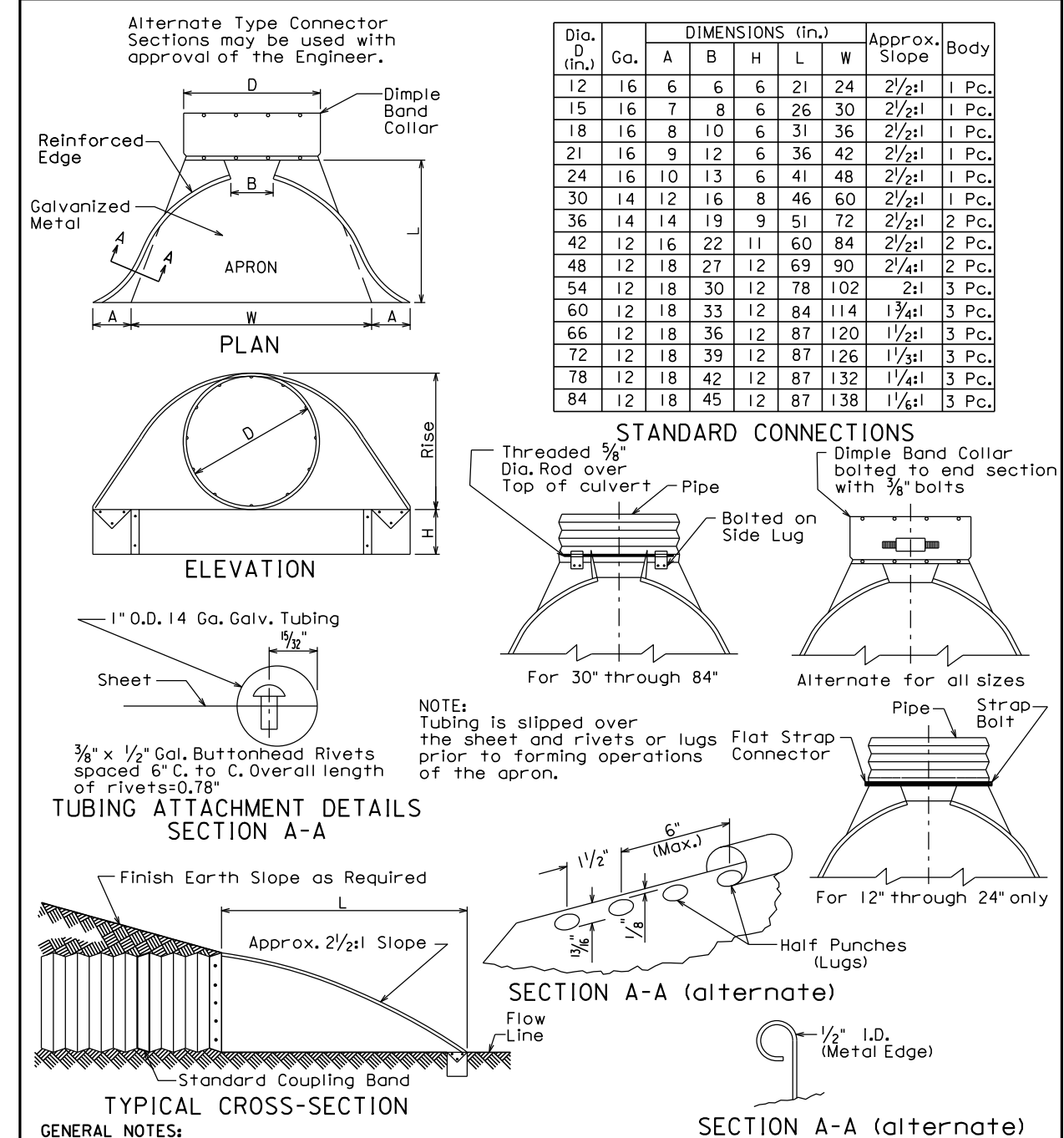
FABRICATED ELBOW LENGTHS FOR ALL CORRUGATIONS

GENERAL NOTES:
 All dimensions shown are nominal.
 L = Linear Feet of C.M.P. required to fabricate fitting.

June 26, 2001

S D D O T	C.M.P. FABRICATED LENGTHS FOR ELBOWS	PLATE NUMBER 450.32
		Sheet 1 of 1

Published Date: 2024



Dia. D (in.)	Ga.	DIMENSIONS (in.)					Approx. Slope	Body
		A	B	H	L	W		
12	16	6	6	6	21	24	2 1/2:1	1 Pc.
15	16	7	8	6	26	30	2 1/2:1	1 Pc.
18	16	8	10	6	31	36	2 1/2:1	1 Pc.
21	16	9	12	6	36	42	2 1/2:1	1 Pc.
24	16	10	13	6	41	48	2 1/2:1	1 Pc.
30	14	12	16	8	46	60	2 1/2:1	1 Pc.
36	14	14	19	9	51	72	2 1/2:1	2 Pc.
42	12	16	22	11	60	84	2 1/2:1	2 Pc.
48	12	18	27	12	69	90	2 1/4:1	2 Pc.
54	12	18	30	12	78	102	2:1	3 Pc.
60	12	18	33	12	84	114	1 3/4:1	3 Pc.
66	12	18	36	12	87	120	1 1/2:1	3 Pc.
72	12	18	39	12	87	126	1 1/3:1	3 Pc.
78	12	18	42	12	87	132	1 1/4:1	3 Pc.
84	12	18	45	12	87	138	1 1/6:1	3 Pc.

NOTE:
 Tubing is slipped over the sheet and rivets or lugs prior to forming operations of the apron.

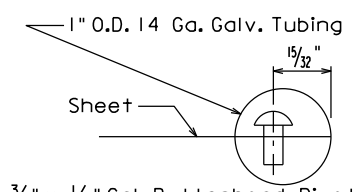
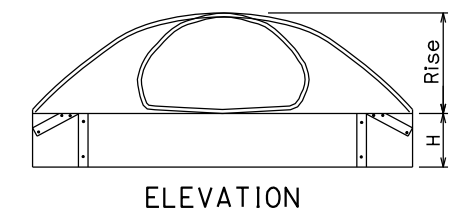
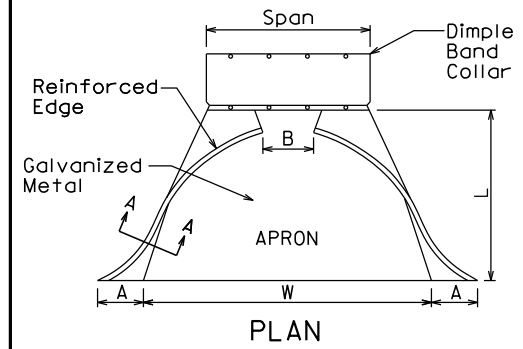
GENERAL NOTES:
 All 3 pc. bodies shall have 12 Ga. sides and 10 Ga. center panels. Width of center panels shall be greater than 20% of the pipe periphery. Multiple panel bodies to have lap seams tightly joined by 3/8" Dia. galvanized rivets or bolts.
 For 60" through 84" sizes, reinforced edges shall be supplemented with galvanized stiffener angles. The angles will be 2" x 2" x 1/4" for 60" through 72" diameters and 2 1/2" x 2 1/2" x 1/4" for 78" and 84" diameters. The angles shall be attached by 3/8" diameter galvanized nuts and bolts.
 Rivets and Bolts shall be 3/8" Dia. Min. for 10 Ga. and 12 Ga. sheet, and 5/16" Dia. Min. for 14 Ga. and 16 Ga. sheets. Tighten nuts with torque wrench to 25 lbs. torque.

March 31, 2000

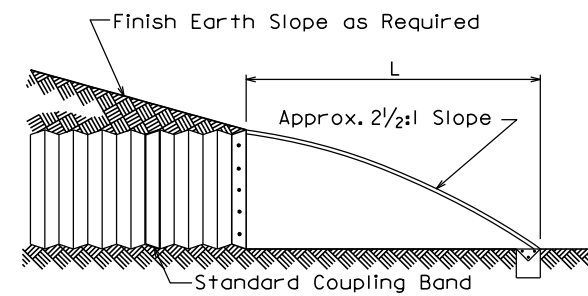
S D D O T	C.M.P. FLARED ENDS	PLATE NUMBER 450.35
		Sheet 1 of 1

Published Date: 2024

Alternate Type Connector Sections may be used with approval of the Engineer.



3/8" x 1/2" Gal. Buttonhead Rivets spaced 6" C. to C. Overall length of rivets=0.78"
TUBING ATTACHMENT DETAILS SECTION A-A



GENERAL NOTES:

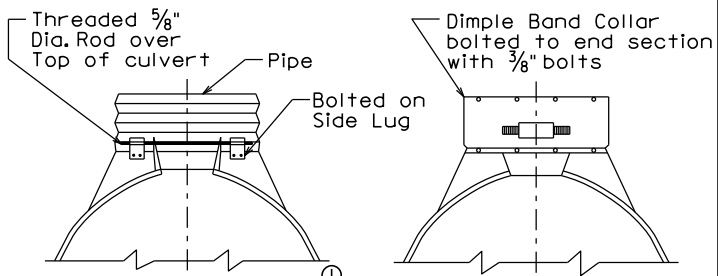
All 3 pc. bodies shall have 12 Ga. sides and 10 Ga. center panels. Width of center panels shall be greater than 20% of the pipe periphery. Multiple panel bodies shall have lap seams tightly joined by 3/8" Dia. galvanized rivets or bolts.

For 77" x 52" and 83" x 57" sizes, reinforced edges shall be supplemented with galvanized stiffener angles. The angles will be 2" x 2" x 1/4" for both the 77" x 52" size and the 83" x 57" size. The angles shall be attached by 3/8" Dia. galvanized nuts and bolts.

Rivets and Bolts shall be 3/8" Dia. Min. for 10 Ga. and 12 Ga. sheet, and 5/16" Dia. Min. for 14 Ga. and 16 Ga. sheets. Tighten nuts with torque wrench to 25 lbs. torque.

Span x Rise (in.)x(in.)	Equiv. Dia. (in.)	Ga.	APPROX. DIMENSIONS (in.)					Approx. Slope	Body
			A	B	H	L	W		
17x13	15	16	7	9	6	19	30	2 1/2:1	1 Pc.
21x15	18	16	7	10	6	23	36	2 1/2:1	1 Pc.
24x18	21	16	8	12	6	28	42	2 1/2:1	1 Pc.
28x20	24	16	9	14	6	32	48	2 1/2:1	1 Pc.
35x24	30	14	10	16	6	39	60	2 1/2:1	1 Pc.
42x29	36	14	12	18	8	46	75	2 1/2:1	1 Pc.
49x33	42	12	13	21	9	53	85	2 1/2:1	2 Pc.
57x38	48	12	16	26	12	63	90	2 1/2:1	2 Pc.
64x43	54	12	18	30	12	70	102	2 1/4:1	2 Pc.
71x47	60	12	18	33	12	77	114	2 1/4:1	3 Pc.
77x52	66	12	18	36	12	77	126	2:1	3 Pc.
83x57	72	12	18	39	12	77	133	2:1	3 Pc.

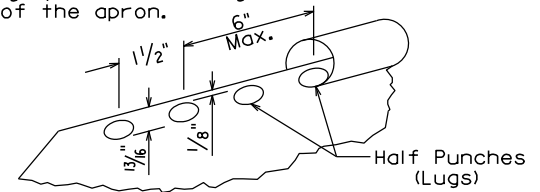
STANDARD CONNECTIONS



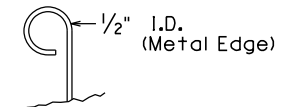
For 17"x13" through 83"x57" Alternate for all sizes

① For 17" through 28" span pipe-arches a flat strap connector may be used in place of the rod connection. Strap connector shall be 1" wide, 12 ga. strap with standard 6" long x 1/2" dia. bond bolt and nut.

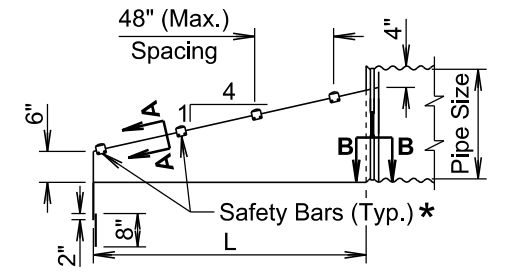
NOTE: Tubing is slipped over the sheet and rivets or lugs prior to forming operations of the apron.



SECTION A-A (alternate)

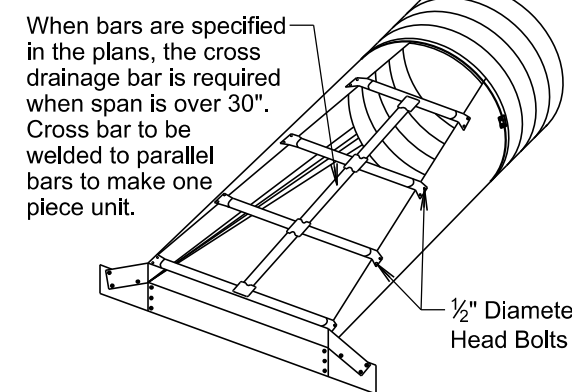


SECTION A-A (alternate)

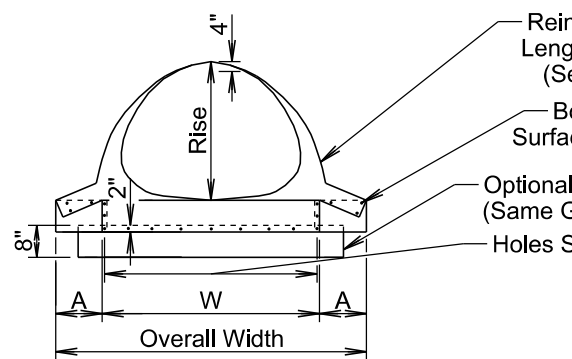


* Number of bars required will vary depending on the length of the end section.

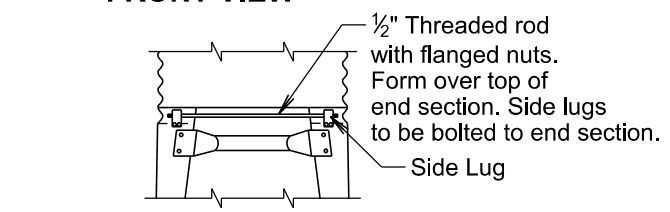
ELEVATION VIEW



ISOMETRIC VIEW

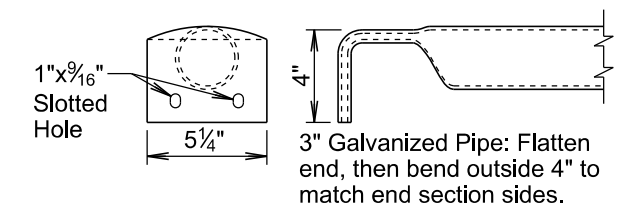


FRONT VIEW

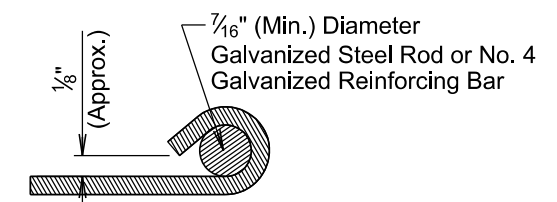


TYPE #2 CONNECTOR DETAIL

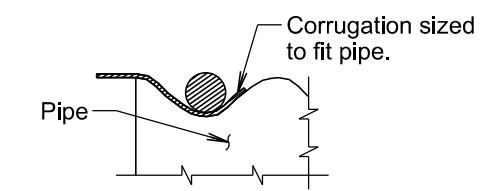
(For 30" and Larger)
(For 21"x15" and Larger)



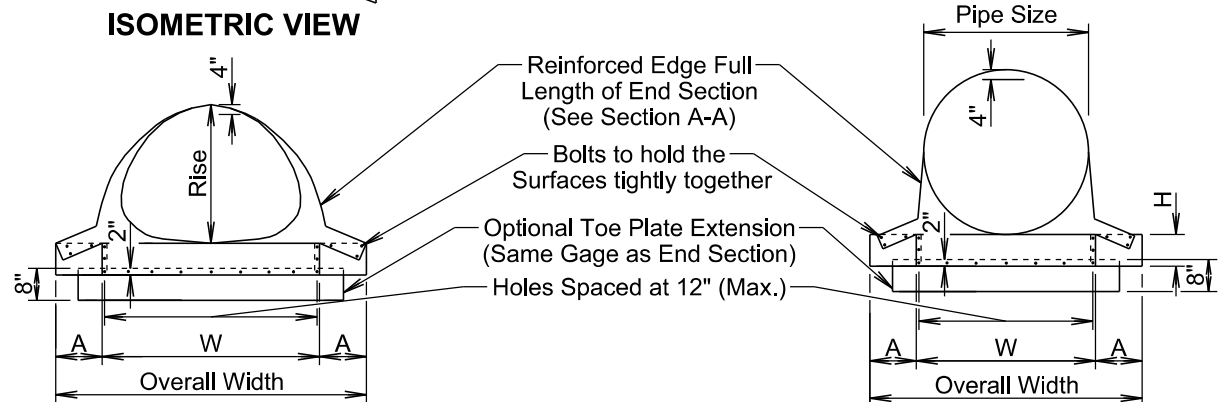
DETAIL OF SAFETY BARS



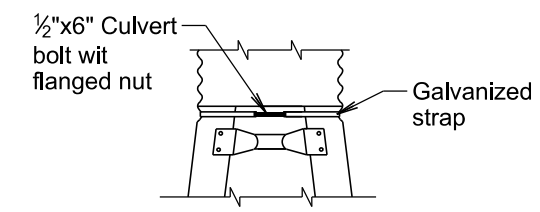
SECTION A-A



SECTION B-B



FRONT VIEW



TYPE #1 CONNECTOR DETAIL

(For 15" Through 24")

March 31, 2000

August 31, 2022

Published Date: 2024

S
D
D
O
T

C.M.P. ARCH FLARED ENDS

PLATE NUMBER
450.36

Sheet 1 of 1

Published Date: 2024

S
D
D
O
T

C.M.P. SLOPED ENDS

PLATE NUMBER
450.37

Sheet 1 of 2

ARCH C.M.P. SLOPED ENDS										
Equiv. Dia. (Inch)	(Inches)		(Min.) Thick.	Dimensions (Inches)				L Dimensions		
	Span	Rise		Inch	Gage	A	H	W	Overall Width	Slope
18	21	15	.064	16	8	6	27	43	4:1	20
21	24	18	.064	16	8	6	30	46	4:1	32
24	28	20	.064	16	8	6	34	50	4:1	40
30	35	24	.079	14	12	9	41	65	4:1	56
36	42	29	.109	12	12	9	48	72	4:1	76
42	49	33	.109	12	16	12	55	87	4:1	92
48	57	38	.109	12	16	12	63	95	4:1	112
54	64	43	.109	12	16	12	70	102	4:1	132
60	71	47	.109	12	16	12	77	109	4:1	148
72	83	57	.109	12	16	12	89	121	4:1	188

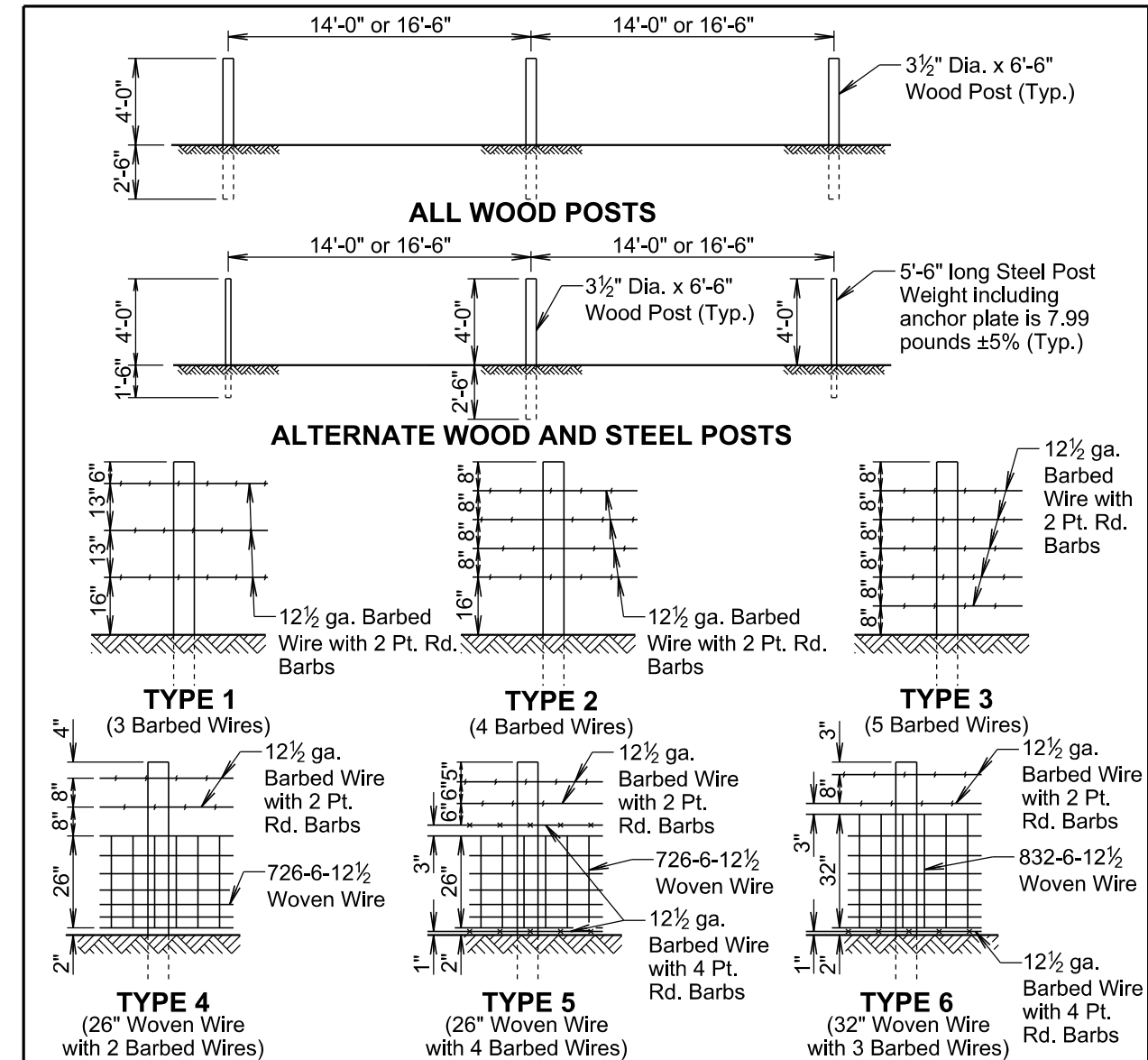
CIRCULAR C.M.P. SLOPED ENDS								
Pipe Dia. (Inch)	(Min.) Thick.		Dimensions (Inches)			L Dimensions		
	Inch	Gage	A	H	W	Overall Width	Slope	Length (Inch)
15	.064	16	8	6	21	37	4:1	20
18	.064	16	8	6	24	40	4:1	32
21	.064	16	8	6	27	43	4:1	44
24	.064	16	8	6	30	46	4:1	56
30	.109	12	12	9	36	60	4:1	80
36	.109	12	12	9	42	66	4:1	104
42	.109	12	16	12	48	80	4:1	128
48	.109	12	16	12	54	86	4:1	152
54	.109	12	16	12	60	92	4:1	176
60	.109	12	16	12	66	98	4:1	200

GENERAL NOTES:

- Safety bars will be provided when specified in the plans.
- Sloped ends will be fabricated from galvanized steel and will conform to the requirements of the Specifications.
- Safety bars will be fabricated from steel schedule 40 pipe in conformance with ASTM A53, grade B or HSS 3.5x.216 in conformance with ASTM A500, grade B.
- Slotted holes for safety bar attachment will be provided for all end sections.
- Attachment to circular pipes 15" through 24" diameter will be made with Type #1 straps. All other sizes will be attached with Type #2 rods and lugs.
- When stated in the plans, optional toe plate extension will be punched and bolted to end section apron lip with 3/8" diameter galvanized bolts. Steel for toe plate extension will be same gauge as end section. Dimensions will be overall width less 6" by 8" high.
- Installation will be performed in accordance with the Specifications.
- Cost of all work and materials required for fabrication and installation of sloped ends will be incidental to the bid items for the various sizes of sloped ends.

August 31, 2022

S D D O T	C.M.P. SLOPED ENDS	PLATE NUMBER 450.37
	<i>Published Date: 2024</i>	Sheet 2 of 2



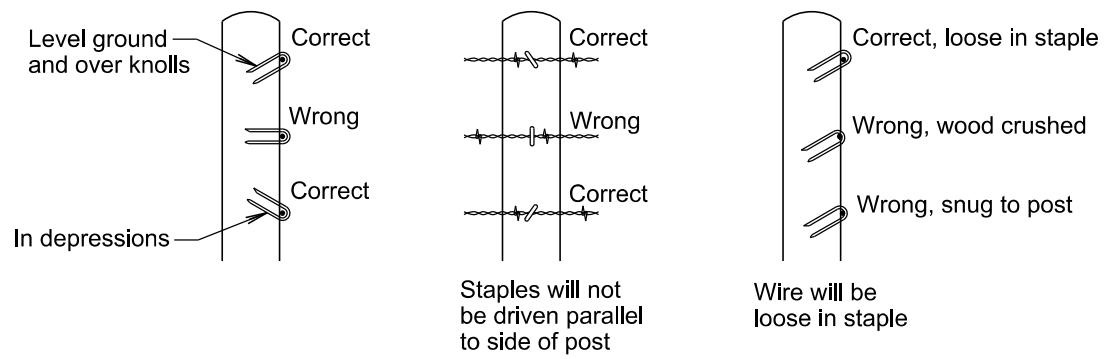
TYPE	DESCRIPTION	LINE POST SPACING	WIRE GAGE	BARBED WIRE	WOVEN WIRE
				NUMBER AND SHAPE OF BARBS	STYLE OR DESIGN NO.
1	3 Barbed Wires	16'-6"	12 1/2	2 Point Round	—
2	4 Barbed Wires	16'-6"	12 1/2	2 Point Round	—
3	5 Barbed Wires	16'-6"	12 1/2	2 Point Round	—
4	26" Woven Wire with 2 Barbed Wires	14'-0"	12 1/2	2 Point Round	726-6-12 1/2
5	26" Woven Wire with 4 Barbed Wires	14'-0"	12 1/2	2 wires with 2 Pt. Rd. 2 wires with 4 Pt. Rd.	726-6-12 1/2
6	32" Woven Wire with 3 Barbed Wires	14'-0"	12 1/2	2 wires with 2 Pt. Rd. 1 wire with 4 Pt. Rd.	832-6-12 1/2

GENERAL NOTES:

- Fence types designated on the plans that are followed by the letter S will have smooth (barbless) wires.
- When type 5S or 6S is designated the bottom wire may be barbed, smooth, or left off.
- All degrees of curvature stated for fence are at centerline of roadway.

June 26, 2019

S D D O T	RIGHT-OF-WAY FENCE	PLATE NUMBER 620.01
	<i>Published Date: 2024</i>	Sheet 1 of 1



STAPLE INSTALLATION

GENERAL NOTES:

The Right-of-Way fence will consist of barbed wire or a combination of woven wire and barbed wire. The barbed wire and/or woven wire will be fastened to all wood posts or fastened to alternating wood and steel posts. Only wood posts will be used for brace panels. Gates will be of the type designated in the plans or as otherwise directed by the Engineer. Fence will be constructed conforming to the details on the standard plates and in the plans unless otherwise directed by the Engineer.

Right-of-Way fence on Interstate Projects will be constructed one foot within the Interstate Right-of-Way lines except at bridge openings, cattle passes, and as otherwise directed by the Engineer.

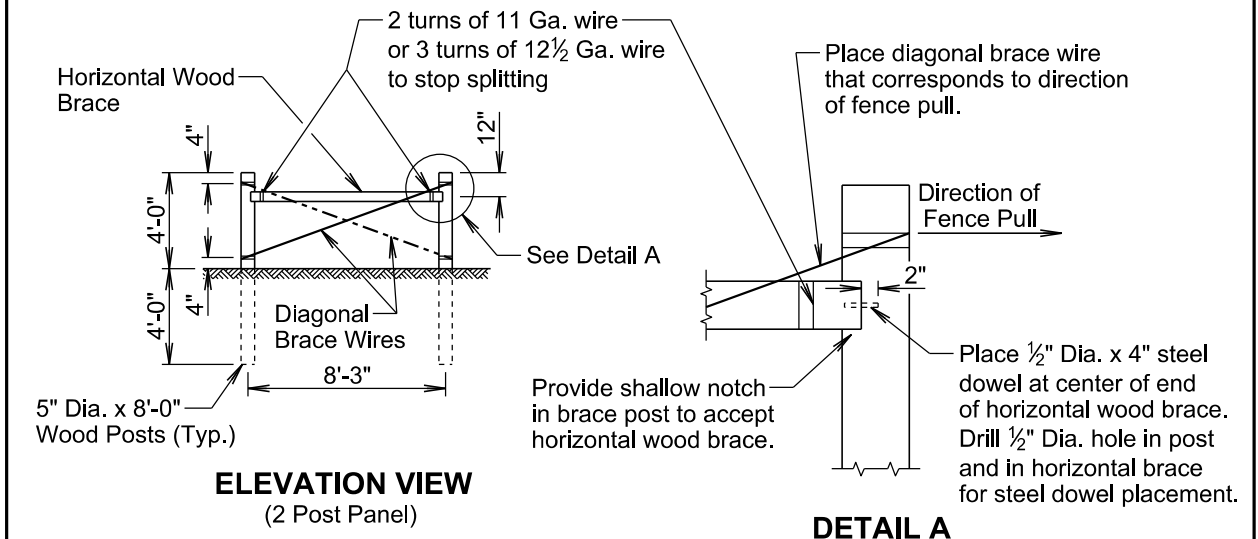
Right-of-Way fence other than on Interstate Projects will be constructed within one foot of the Right-of-Way on the Landowner's side except at bridge openings, cattle passes, and as otherwise directed by the Engineer.

Barbs will be fabricated from zinc coated 14 ga. wire. Two point barbs will be wrapped twice around one main strand at four-inch spacings and the four point barbs will be interlocked and wrapped around both main strands at five-inch spacings.

The gages of wire and wood post lengths and sizes are the minimum acceptable unless otherwise specified in the plans. The tolerances for steel posts will be as stated in AASHTO M281. Woven wire will conform to design and specifications of ASTM A116 and barbed wire will conform to ASTM A121.

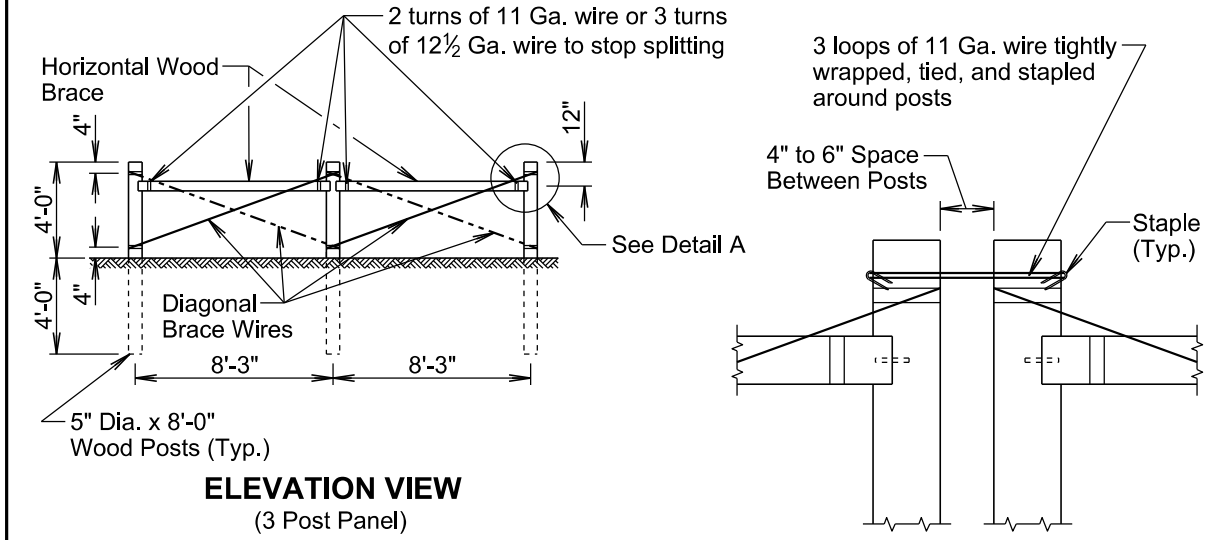
June 26, 2019

<i>Published Date: 2024</i>	S D D O T	STAPLE INSTALLATION AND GENERAL RIGHT-OF-WAY FENCE NOTES	PLATE NUMBER 620.02
			Sheet 1 of 1



ELEVATION VIEW
(2 Post Panel)

DETAIL A



ELEVATION VIEW
(3 Post Panel)

DETAIL B

GENERAL NOTES:

Two Post Panels will be installed at least every 1320' between corners.

Two Post Panels will be installed at any sharp vertical angle crest points and as directed by the Engineer.

Horizontal wood braces will consist of 4" dia. x 8' wood posts or rough 4" x 4" x 8' timbers.

Diagonal brace wires will be fabricated with 4 strands of 9 Ga. galvanized wire twisted tight. The diagonal brace wires will be installed in accordance with the direction of the fence pull. Two diagonal brace wires are required if fence pull is in both directions.

January 22, 2023

<i>Published Date: 2024</i>	S D D O T	BRACE PANELS AND APPLICATIONS OF BRACE PANELS	PLATE NUMBER 620.03
			Sheet 1 of 3

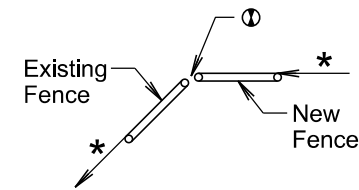
RADIUS OF CURVE	SPACING OF 2 POST PANEL
Greater than 1800 Ft.	** 1320'
Less than 1800 Ft.	** At P.C., P.T., and at every 1320' between P.C. and P.T.

GENERAL NOTE:

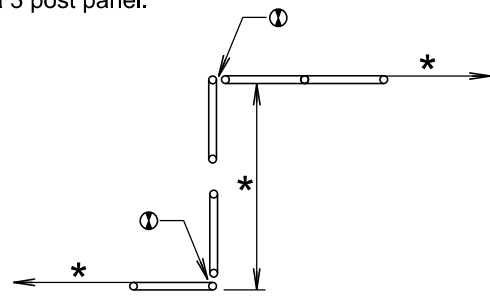
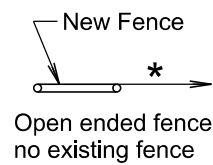
All degrees of curvature stated for fence are at centerline of roadway.
 * If fence length is less than 600' to next corner use a 2 post panel.
 * If fence length is greater than 600' to next corner use a 3 post panel.

** Fence lengths greater than 1320' and less than 2640' place 2 Post Panel approximately at midpoint.

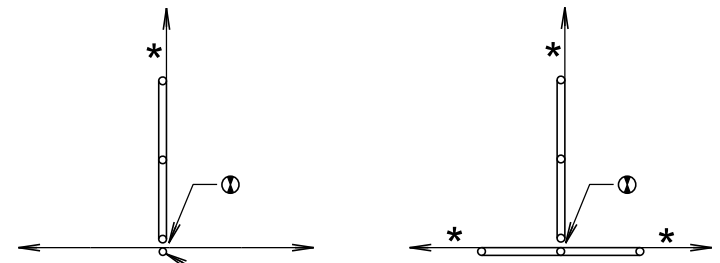
① See Detail B on Sheet 1 of 3.



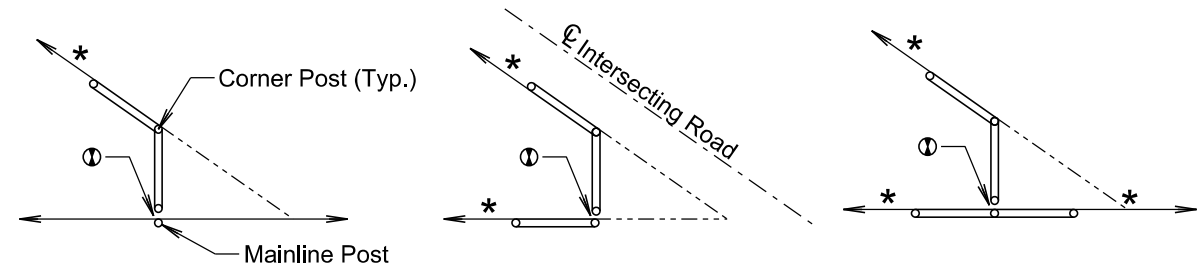
BEGIN OR END FENCE
(Where new fence ties into existing fence)



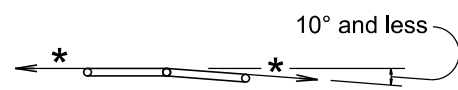
SHORT JOGS IN FENCE



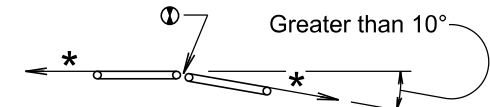
CROSS FENCE



SHARP ANGLES IN CROSS FENCE



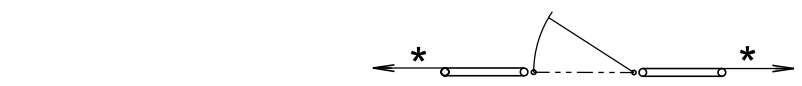
Additional fence panel is NOT required when an angle in the mainline fence is 10° and less.



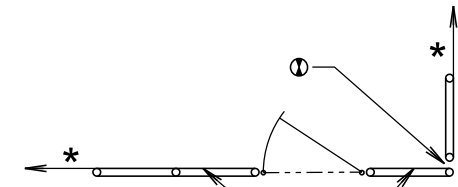
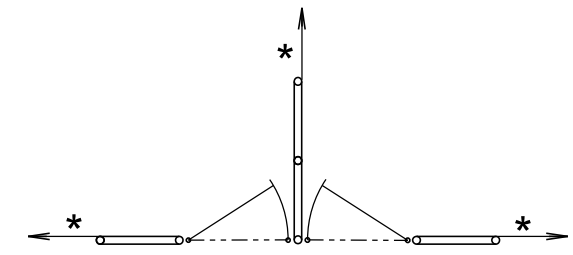
Additional fence panel is required when an angle in the mainline fence is greater than 10°.

ANGLES IN MAINLINE FENCE

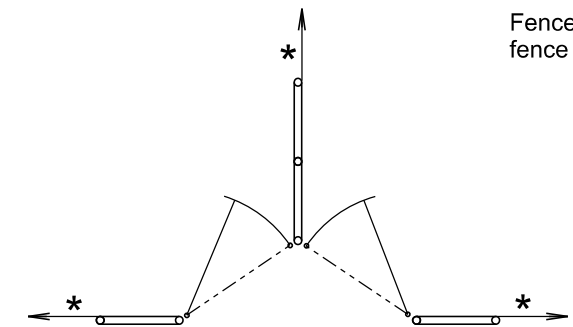
January 22, 2023



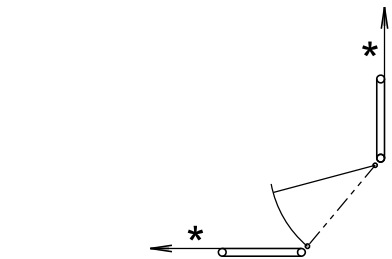
ENTRANCE
(Not on corner)



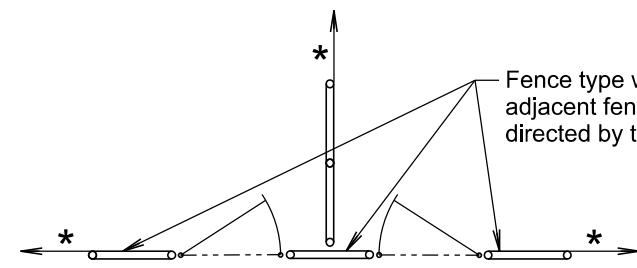
Fence type will be same as adjacent fence type or as directed by the Engineer.



DOUBLE ENTRANCES



ENTRANCES AT CORNERS



Fence type will be same as adjacent fence type or as directed by the Engineer.

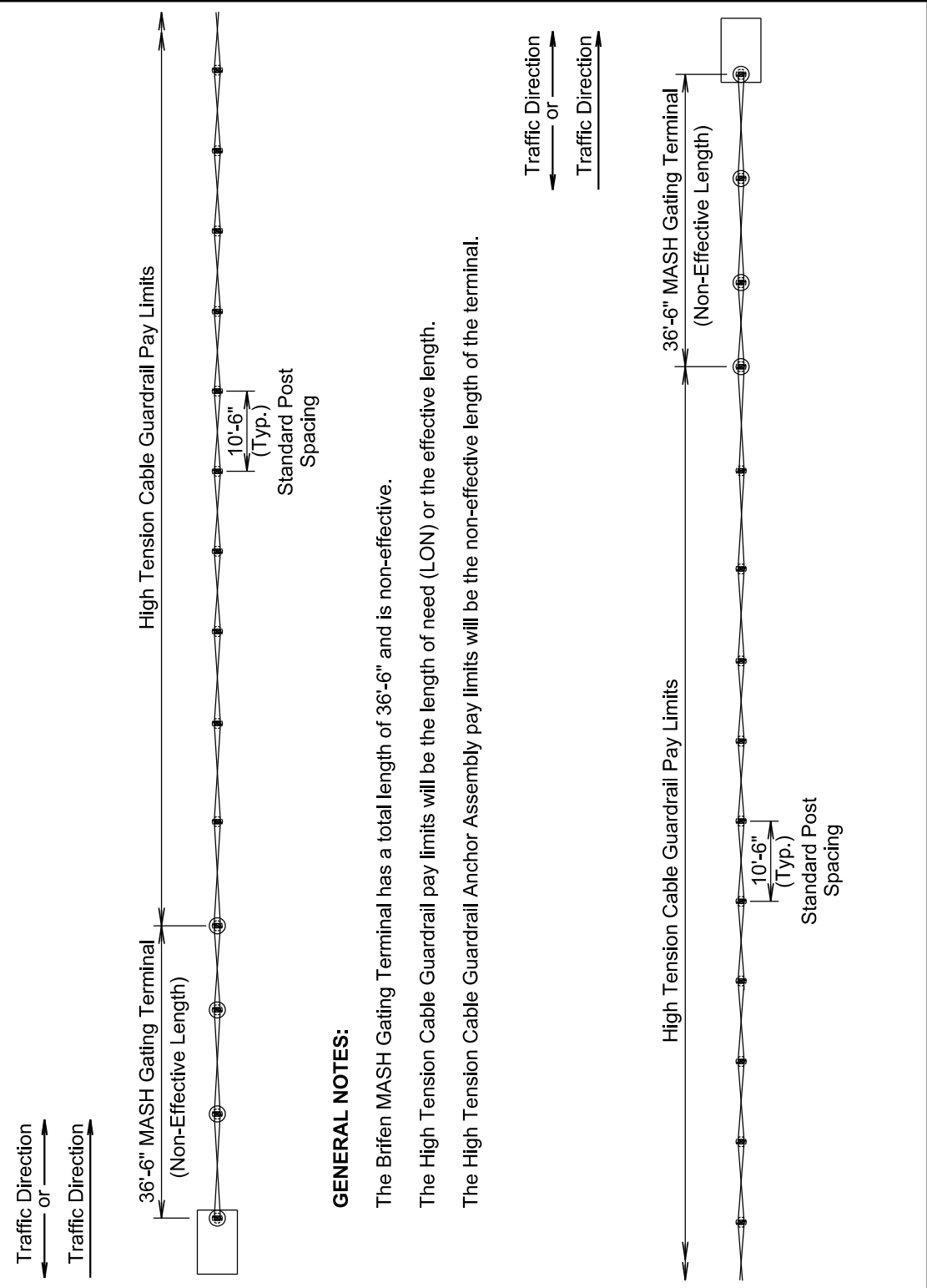
GATES

* If fence length is less than 600' to next corner use a 2 post panel.
 * If fence length is greater than 600' to next corner use a 3 post panel.

① See Detail B on Sheet 1 of 3.

January 22, 2023

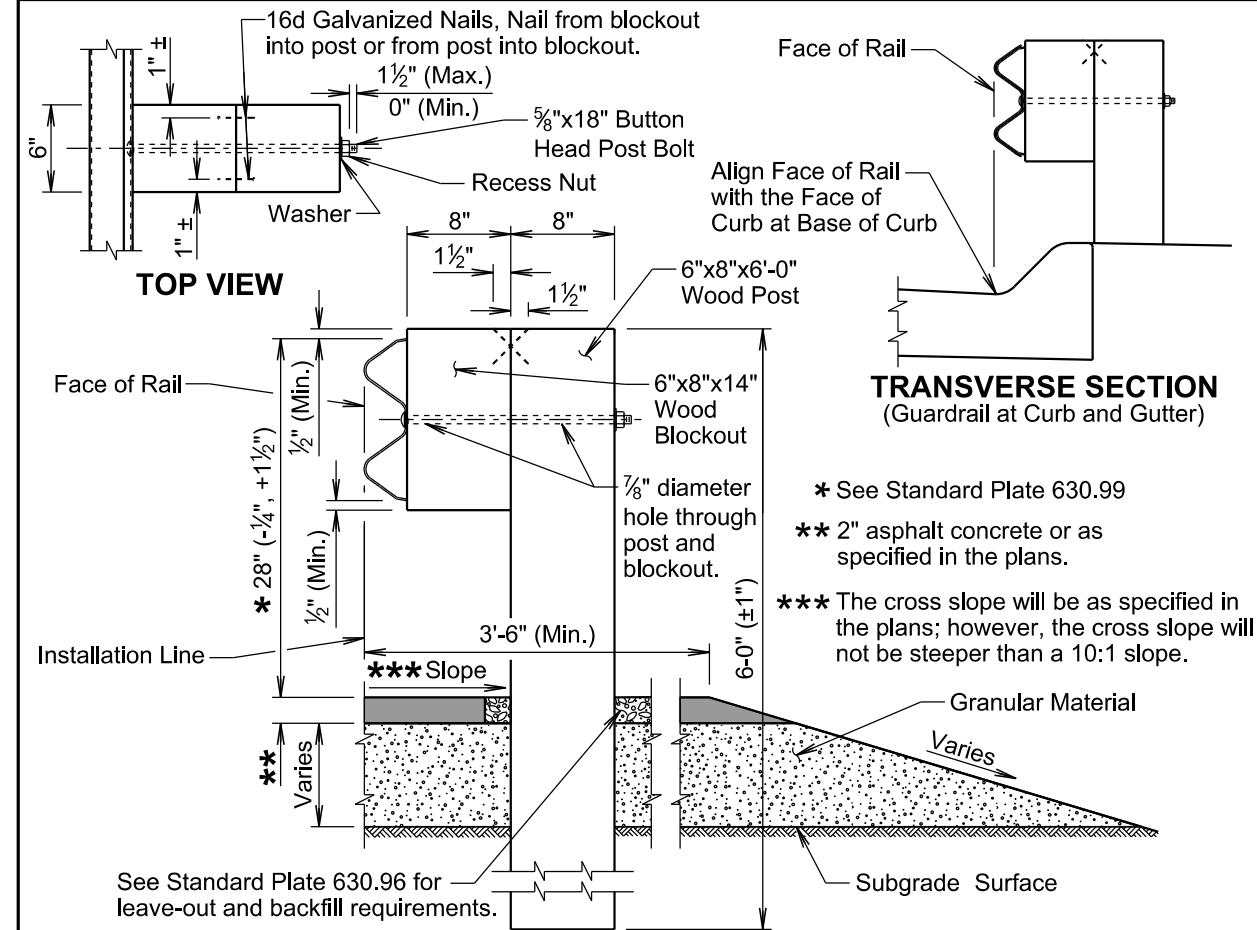
Pay Limits for One-Way and Two-Way Traffic Roadway
Brifen System



GENERAL NOTES:
 The Brifen MASH Gating Terminal has a total length of 36'-6" and is non-effective.
 The High Tension Cable Guardrail pay limits will be the length of need (LON) or the effective length.
 The High Tension Cable Guardrail Anchor Assembly pay limits will be the non-effective length of the terminal.

January 22, 2023

Published Date: 2024	S D D O T	HIGH TENSION CABLE GUARDRAIL	PLATE NUMBER 629.50
			Sheet 3 of 3



GENERAL NOTES:

Asphalt concrete will be the same type used elsewhere on the project or will be as specified in the plans. If asphalt concrete is not specified in the plans, the asphalt concrete will conform to the Specifications for "Asphalt Concrete Composite".

Granular material will be the same type used elsewhere on the project or will be as specified in the plans. If granular material type is not specified in the plans, the material will conform to the Specifications for "Base Course". The granular material will be placed the same thickness as the mainline surfacing or as specified in the plans.

Topsoil is not shown in the transverse section drawing.

All W beam rail will be Type 1 and Class A (12 Ga.) unless specified otherwise in the plans.

W beam rail section lengths may be 12'-6" and/or 25'-0". The combination of section lengths used will be compatible with the total length of rail per site as shown in the plans.

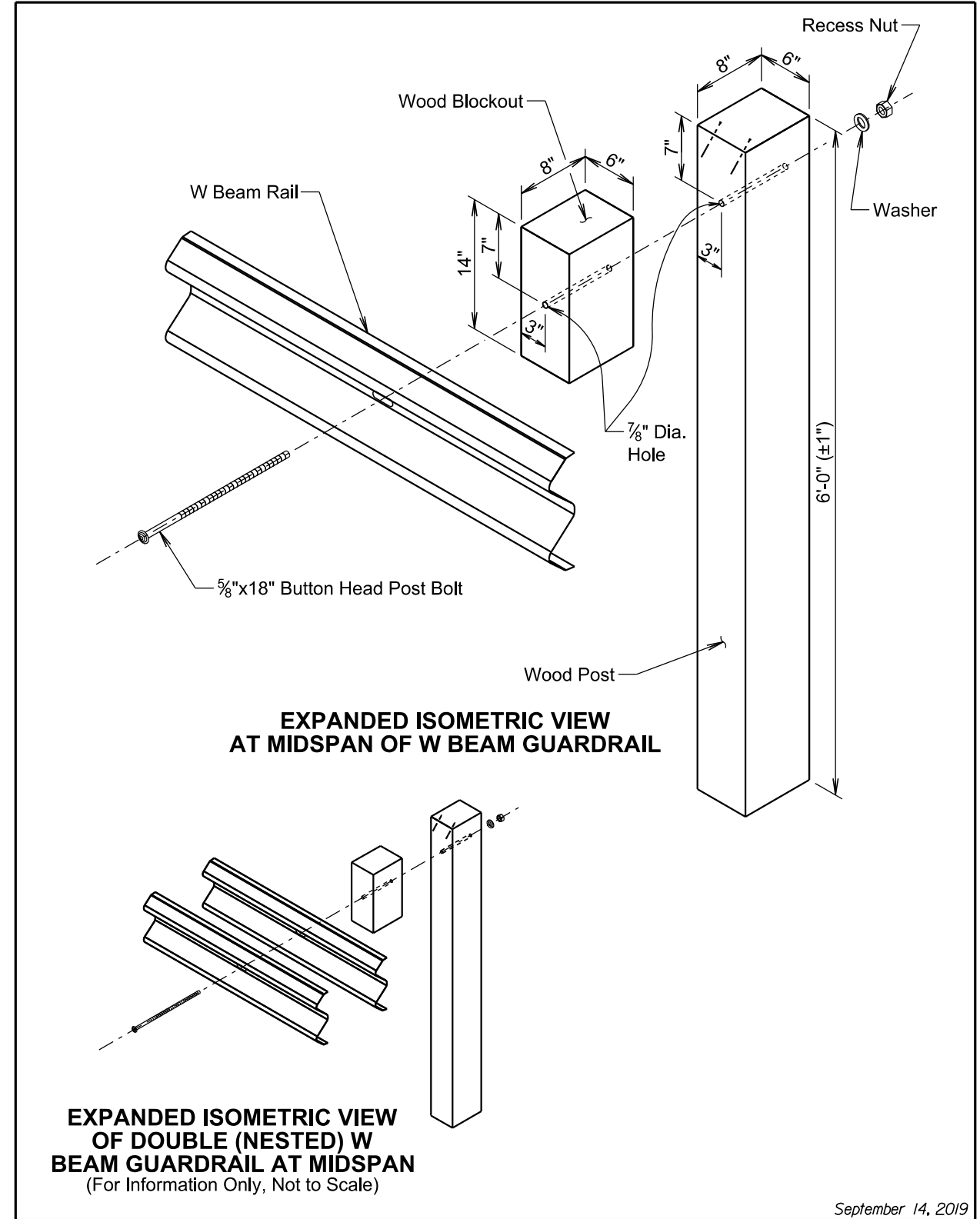
Slots in the rails will be provided as specified in the plans and by the manufacturer. A drilled hole through the rail is not allowed as a replacement for a slot. If the Contractor must create a slot, a cutting torch or plasma cutter is not allowed. The slot edges will be smooth and free of burrs or notches.

The top of post and top of block will have a true square cut. The top of block will be a maximum of ± 1/2 inch from the top of the post.

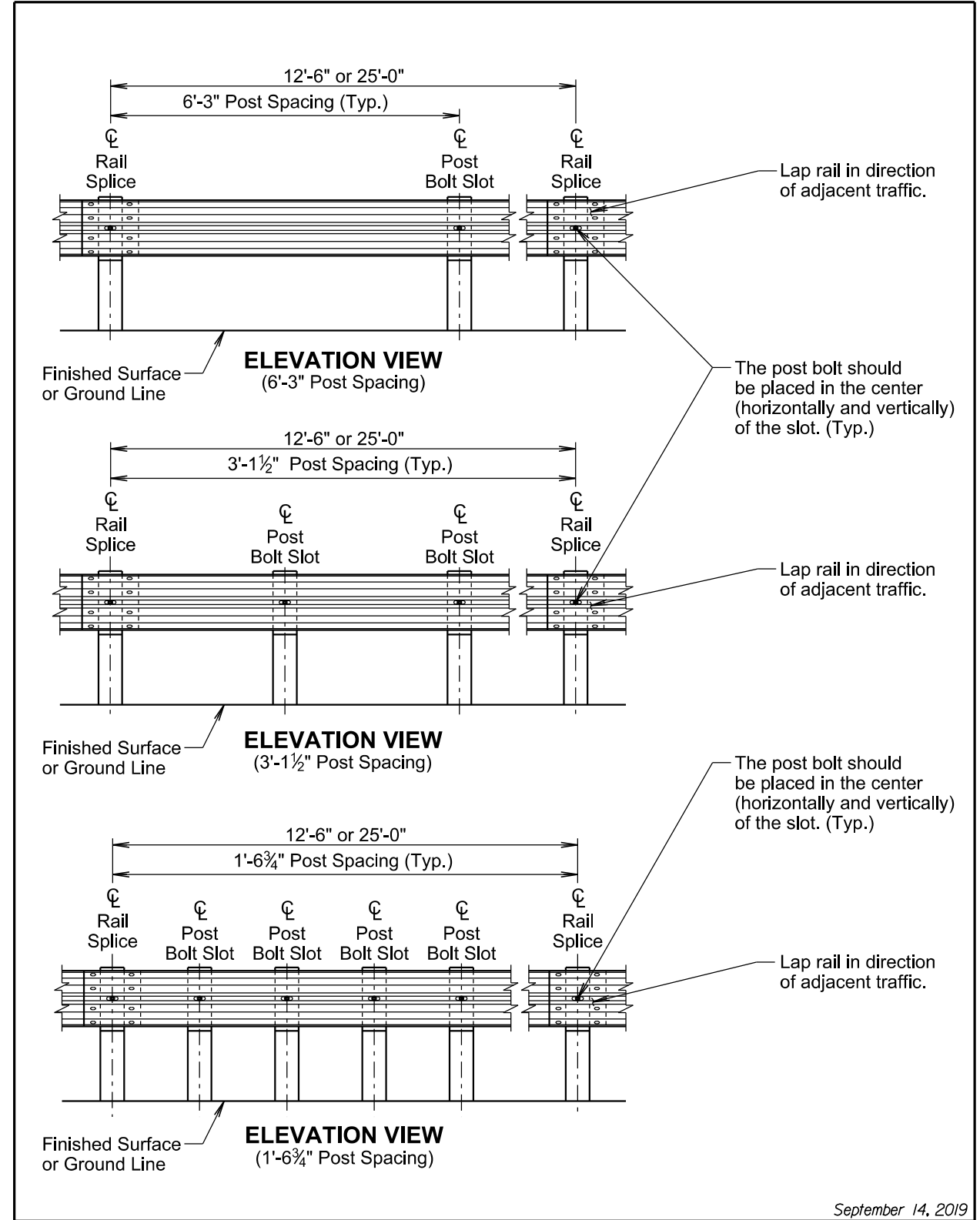
- * See Standard Plate 630.99
- ** 2" asphalt concrete or as specified in the plans.
- *** The cross slope will be as specified in the plans; however, the cross slope will not be steeper than a 10:1 slope.

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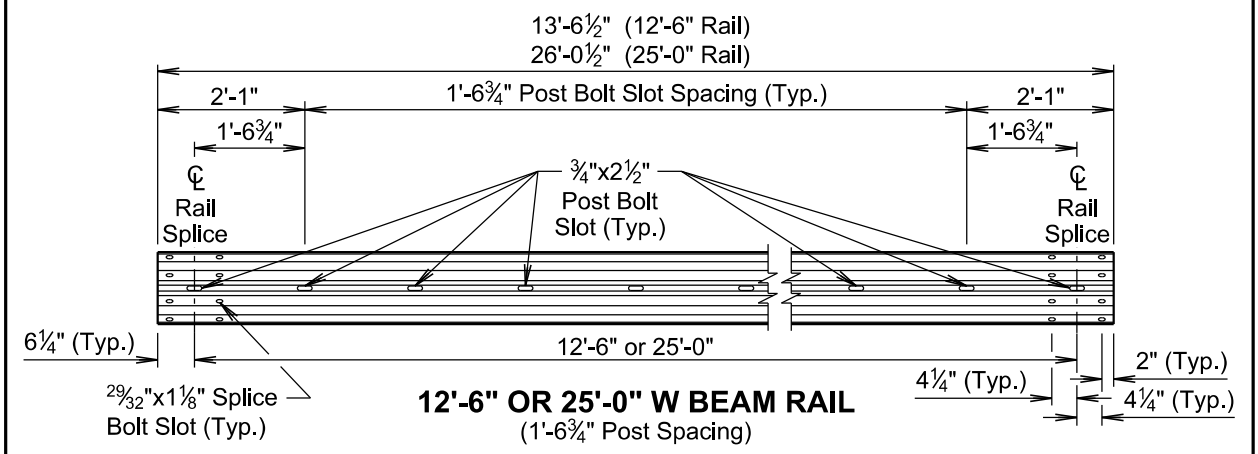
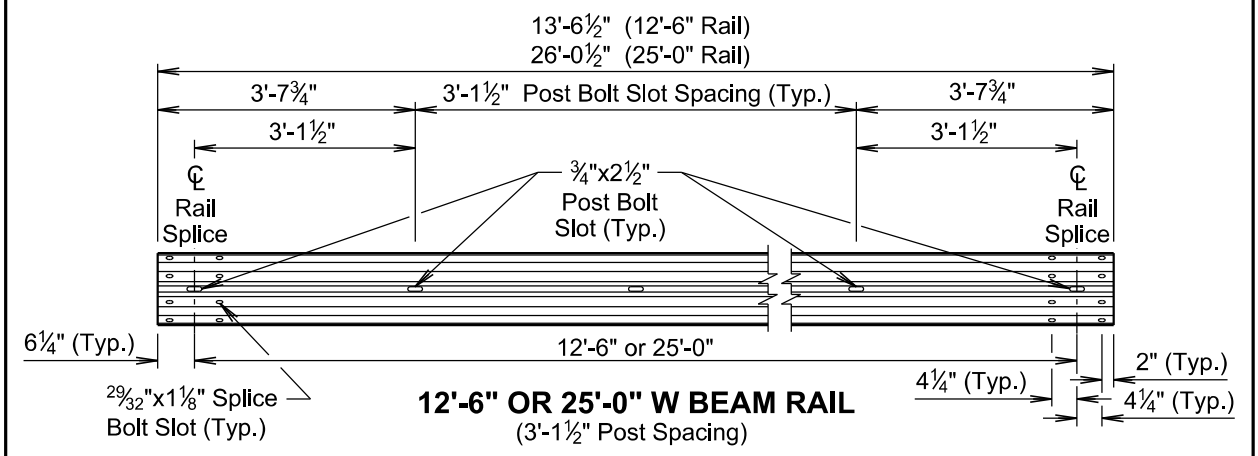
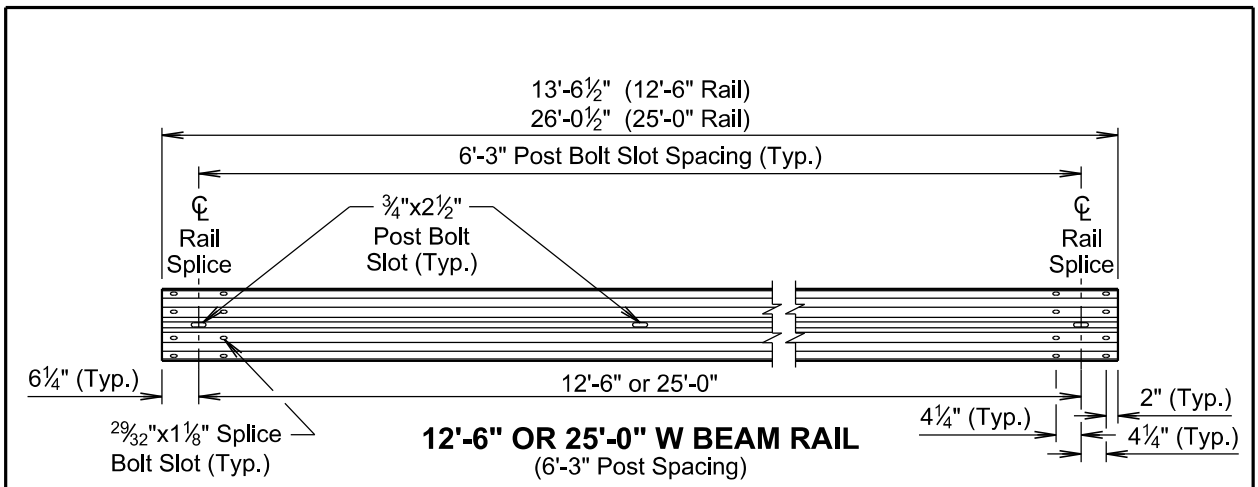
Published Date: 2024	S D D O T	W BEAM GUARDRAIL	PLATE NUMBER 630.10
			Sheet 1 of 5



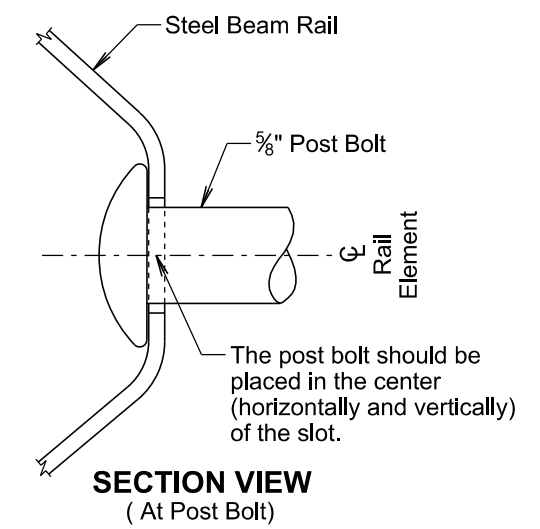
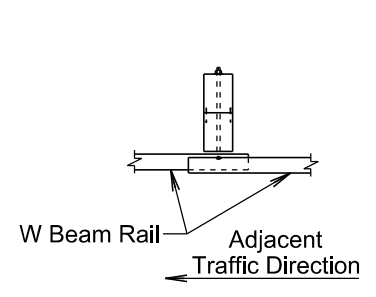
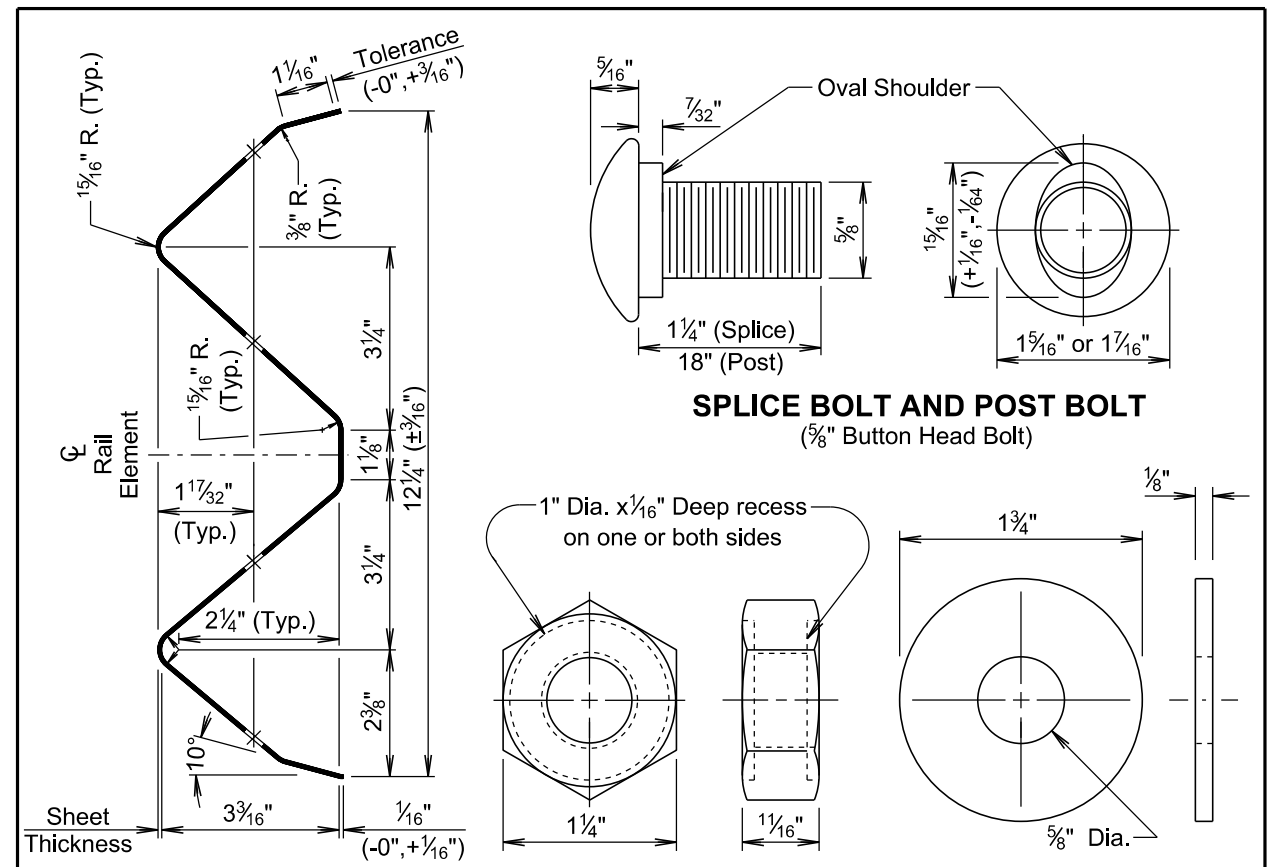
Published Date: 2024	S D D O T	W BEAM GUARDRAIL	September 14, 2019
			PLATE NUMBER 630.10
			Sheet 2 of 5



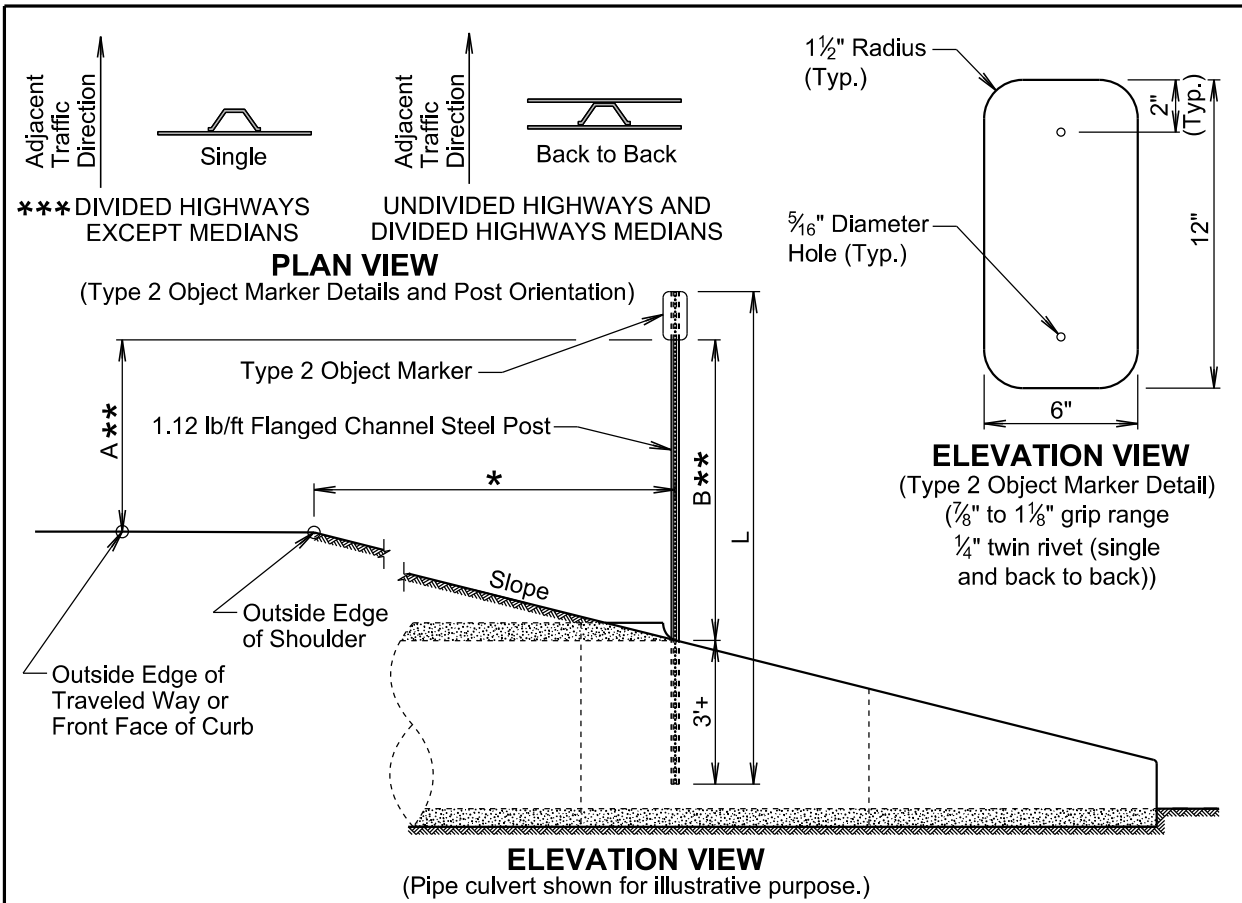
Published Date: 2024	S D D O T	W BEAM GUARDRAIL	September 14, 2019
			PLATE NUMBER 630.10
			Sheet 3 of 5



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ELEVATION VIEW
(Type 2 Object Marker Detail)
(7/8" to 1 1/8" grip range
1/4" twin rivet (single and back to back))

TYPE 2 OBJECT MARKER POST LENGTHS										
OFFSET (*)	1'	2'	3'	4'	5'	6'	7'	8'	Greater Than 8'	
POST LENGTH (L)										
SLOPE	3:1	8'-6"	8'-9"	9'-3"	9'-6"	9'-9"	10'-3"	10'-6"	10'-9"	8'-0"
	4:1	8'-6"	8'-9"	9'-0"	9'-3"	9'-9"	9'-9"	10'-0"	10'-3"	8'-0"
	5:1	8'-3"	8'-6"	8'-9"	9'-0"	9'-3"	9'-3"	9'-6"	9'-9"	8'-0"
	6:1	8'-3"	8'-6"	8'-9"	8'-9"	9'-0"	9'-3"	9'-3"	9'-6"	8'-0"

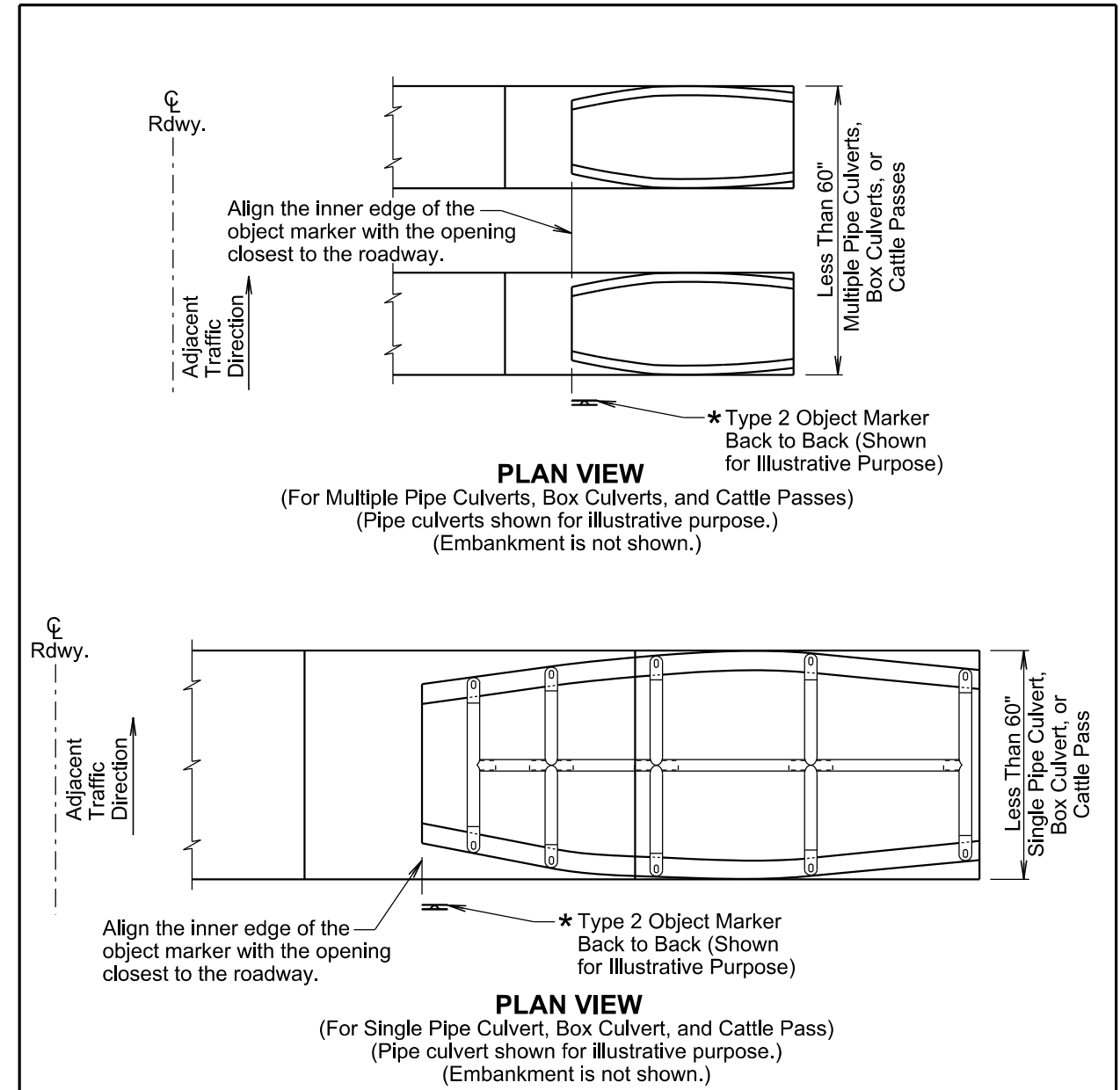
GENERAL NOTES:

- *** The type 2 object marker may be installed back to back when specified in the plans.
- Post Length L was calculated based on a shoulder width of 6 feet at a crossslope of 4 percent and L was rounded up to the nearest 3 inches.
- ** Dimension A is 4 feet when the Offset * is 8 feet and less. Dimension B is 4 feet when Offset * is greater than 8 feet.
- The type 2 object marker and the 1.12 lb/ft flanged channel steel post will be in conformance with Specifications Section 982.2 J.
- Payment for the type 2 object marker will be in conformance with Specification Section 632.5 B.

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S D D O T	TYPE 2 OBJECT MARKER (DIRECT DRIVE)	PLATE NUMBER 632.01
		Sheet 1 of 1

Published Date: 2024



PLAN VIEW
(For Multiple Pipe Culverts, Box Culverts, and Cattle Passes)
(Pipe culverts shown for illustrative purpose.)
(Embankment is not shown.)

PLAN VIEW
(For Single Pipe Culvert, Box Culvert, and Cattle Pass)
(Pipe culvert shown for illustrative purpose.)
(Embankment is not shown.)

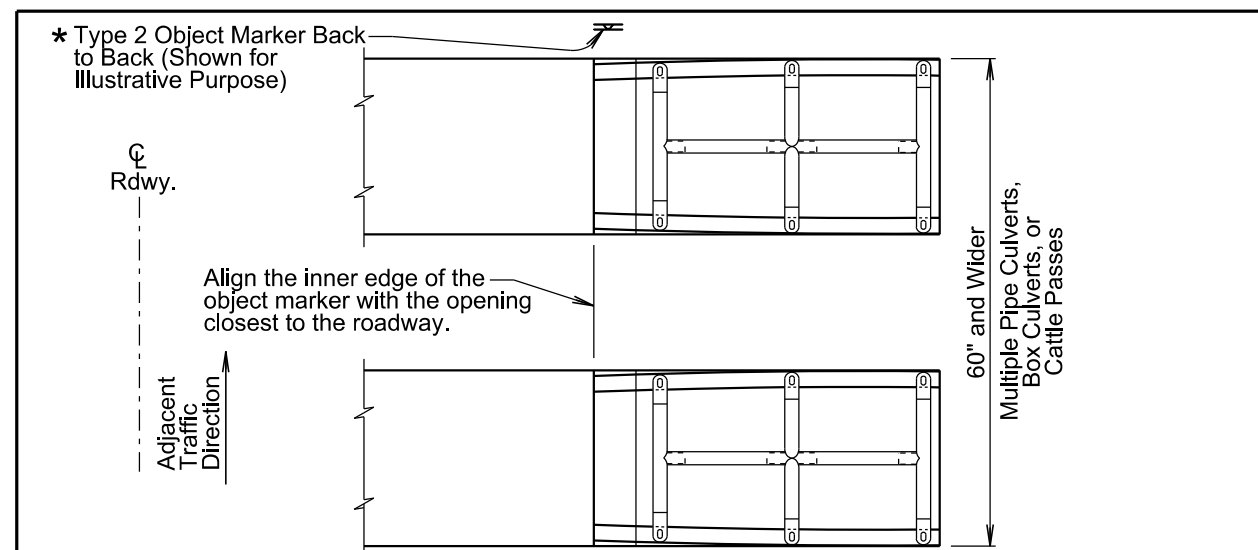
GENERAL NOTES:

- This standard plate will be used in conjunction with standard plate 632.01.
- * The type 2 object markers will be installed at the locations shown above. The type 2 object markers, single faced or back to back, will be as specified in the plans.

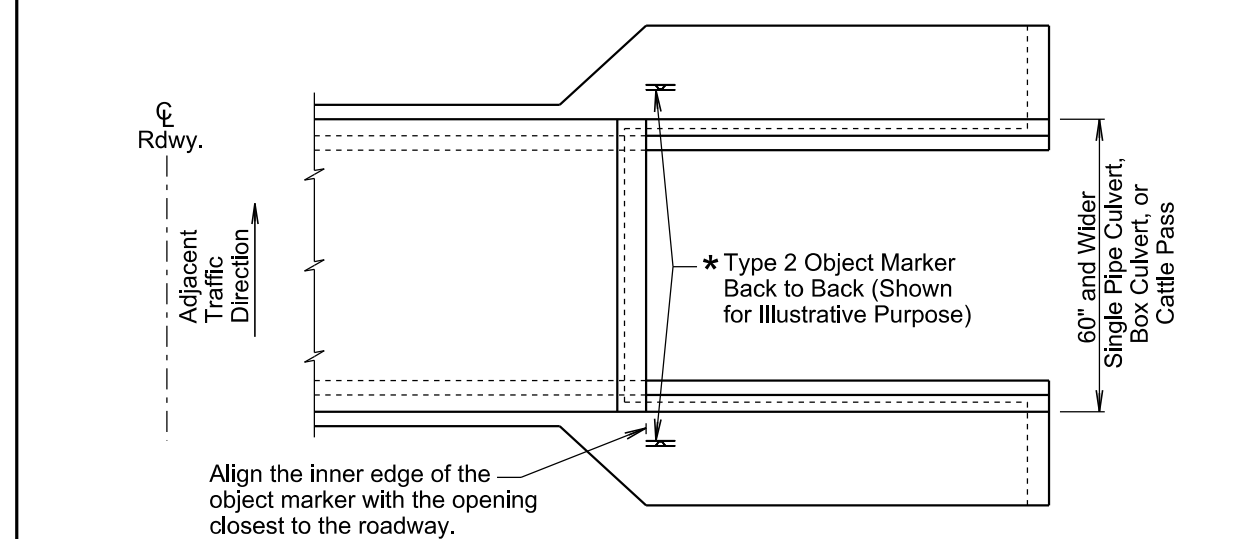
December 23, 2019

S D D O T	TYPE 2 OBJECT MARKER AT PIPE CULVERTS, BOX CULVERTS, AND CATTLE PASSES (Less than 60" Overall Width)	PLATE NUMBER 632.03
		Sheet 1 of 1

Published Date: 2024



PLAN VIEW
(For Multiple Pipe Culverts, Box Culverts, and Cattle Passes)
(Pipe culverts shown for illustrative purpose.)
(Embankment is not shown.)



PLAN VIEW
(For Single Pipe Culvert, Box Culvert, and Cattle Pass)
(Box culvert shown for illustrative purpose.)
(Embankment is not shown.)

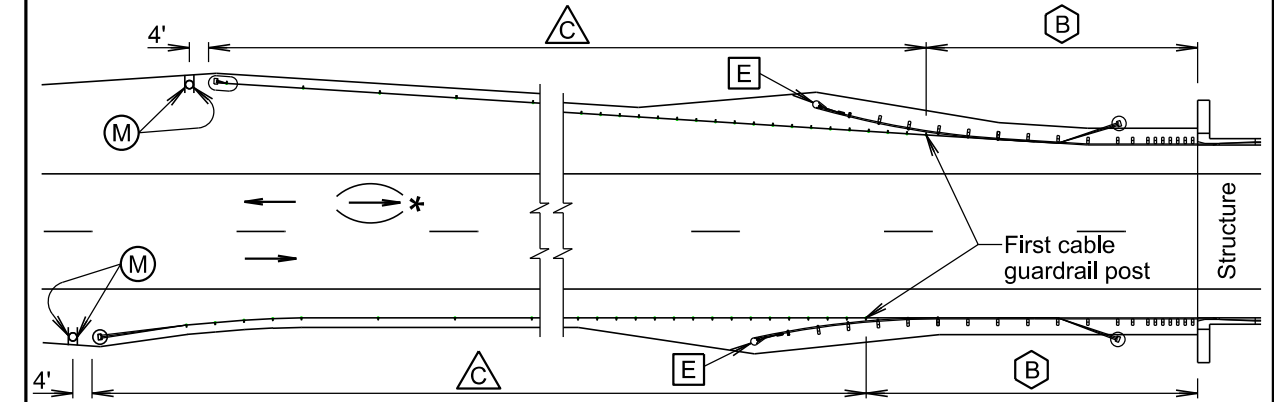
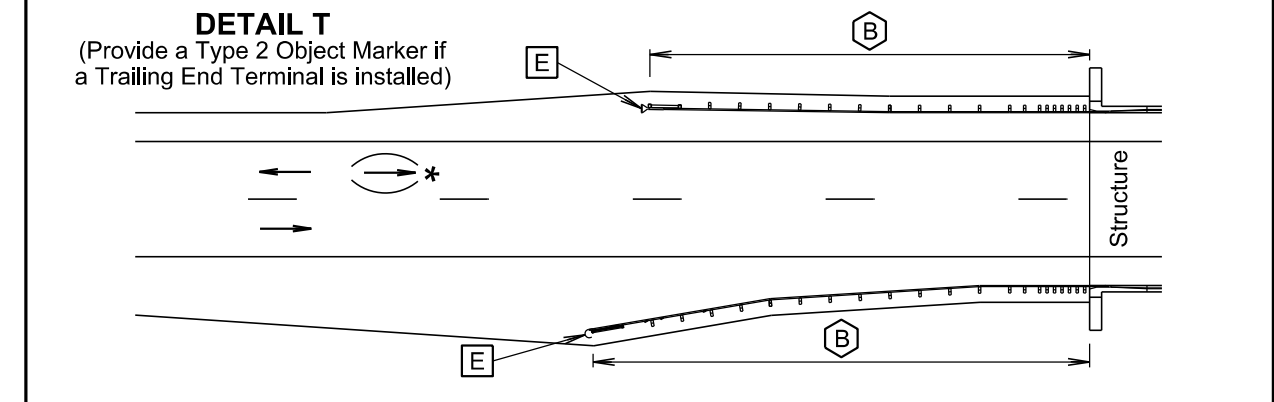
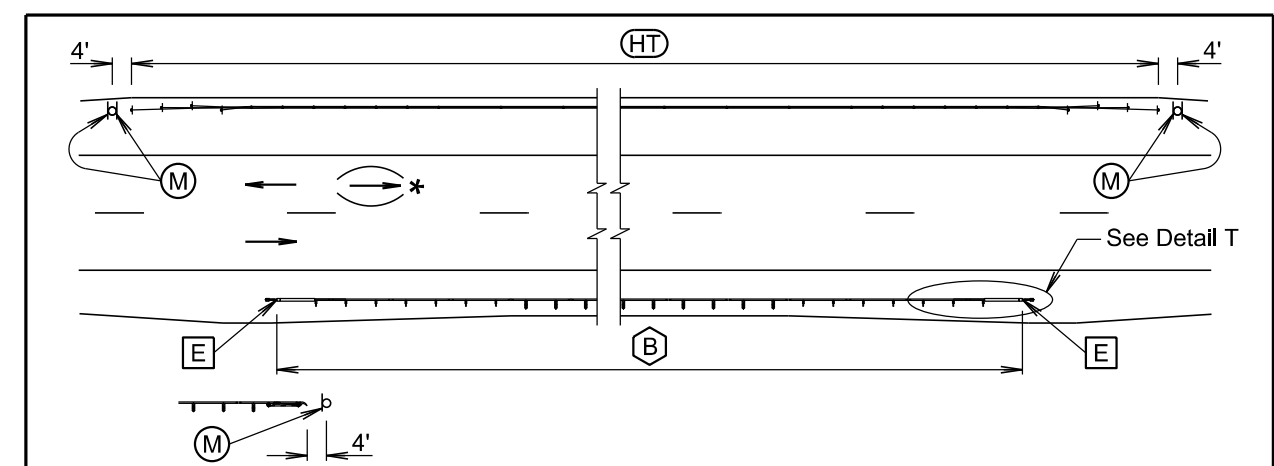
GENERAL NOTES:

This standard plate will be used in conjunction with standard plate 632.01.

* The type 2 object markers will be installed at the locations shown above. The type 2 object markers, single faced or back to back, will be as specified in the plans.

Published Date: 2024	S D D O T	TYPE 2 OBJECT MARKER AT PIPE CULVERTS, BOX CULVERTS, AND CATTLE PASSES (60" and Greater Overall Width)	PLATE NUMBER 632.04
			Sheet 1 of 1

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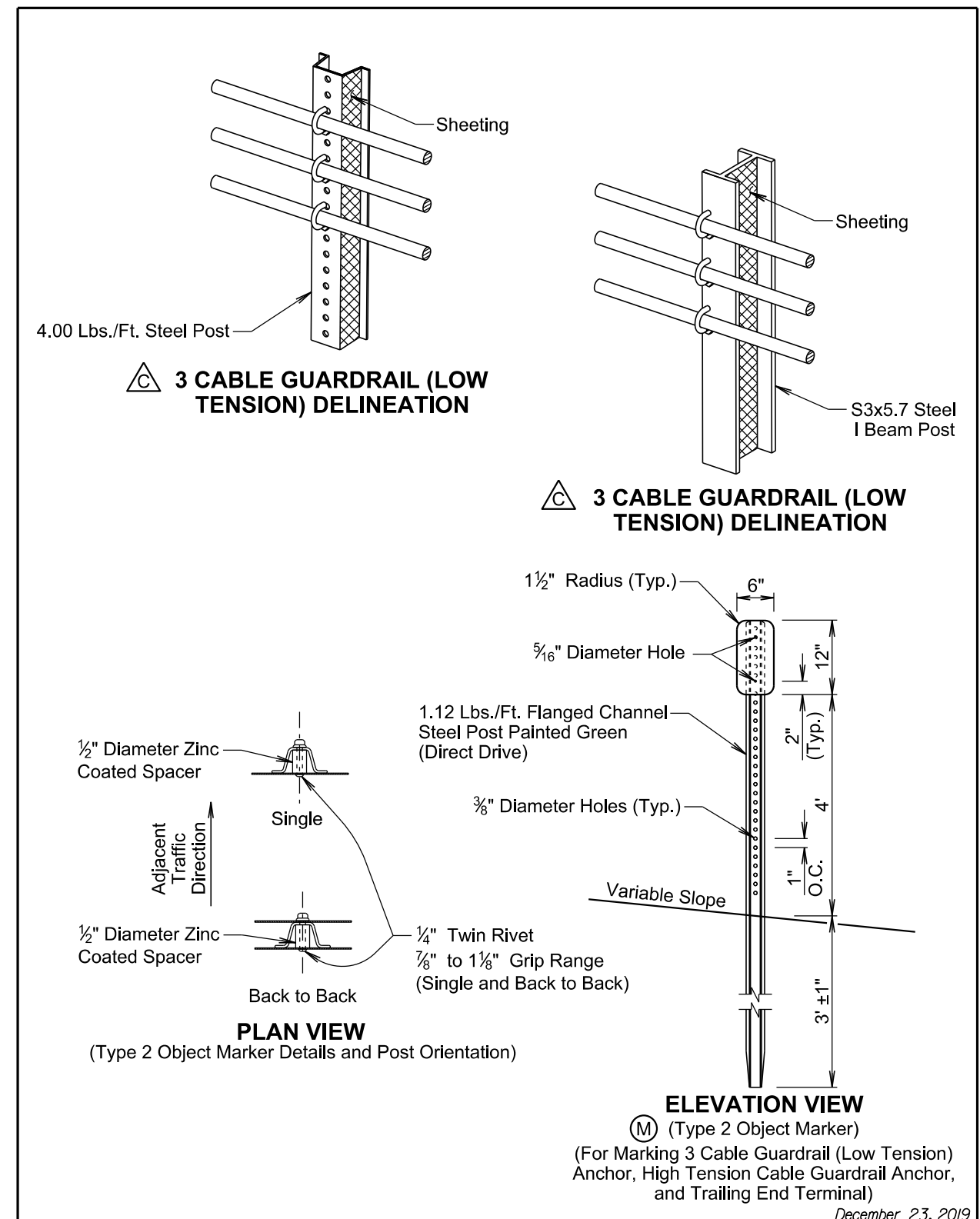
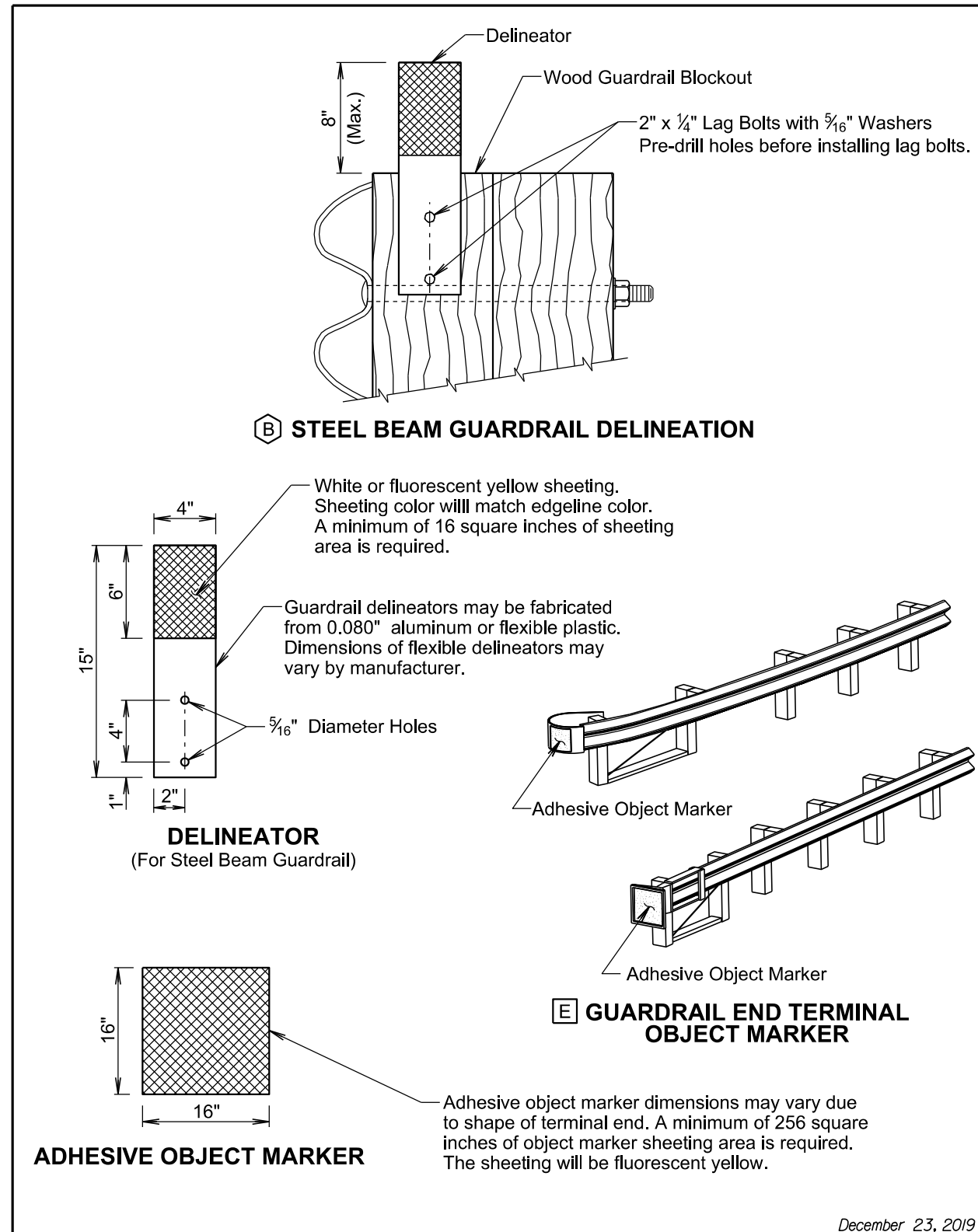
PLAN VIEW
(Typical Guardrail Layouts)

- (B) Steel Beam Guardrail Delineation
- (E) Guardrail End Terminal Object Marker
- (C) 3 Cable Guardrail (Low Tension) Delineation
- (HT) High Tension Cable Guardrail Delineation
- (M) Type 2 Object Marker

* For two-way traffic, install delineation at the opposite end of structure the same as shown. Back-to-back delineation is required for two-way traffic, single-sided delineation for one-way traffic.

Published Date: 2024	S D D O T	DELINEATION OF GUARDRAIL	PLATE NUMBER 632.40
			Sheet 1 of 4

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GENERAL NOTES:

The delineation of high tension cable guardrail will be reflective sheeting placed back to back on every other post cap or cable spacer. The sheeting will be type XI in conformance with ASTM D4956. The color of the reflective sheeting shall be the same as the nearest pavement marking.

The delineators for steel beam guardrail and sheeting on 3 cable guardrail (low tension) posts will be covered with a minimum of 16 square inches of reflective sheeting. The reflective sheeting will be type XI in conformance with ASTM D4956. Along two-way roadways the sheeting will be on both sides of the delineators and guardrail posts and will be white in color. For one-way roadways the sheeting will only be required on the side facing traffic and the color will be the same as the nearest pavement marking, yellow on the left side of the roadway and white on the right side.

When steel beam guardrail is attached to a bridge the first delineator will be attached to the post nearest the bridge.

At bridges with guardrail less than 200 feet in length, a minimum of 4 delineators will be placed in addition to the end terminal yellow object marker. The spacing between the delineators will be approximately one third of the length of the guardrail.

At bridges with guardrail 200 feet and greater in length, including bridges that have steel beam guardrail transitioning to 3 cable guardrail (low tension), the delineators will be placed at a spacing of approximately 50 feet. Delineation will extend throughout the length of the guardrail system.

Steel beam guardrail that is not attached to a bridge and is less than 200 feet in length, a minimum of 4 delineators will be placed in addition to the end terminal yellow object markers. The spacing between the delineators will be approximately one third of the length of the guardrail.

Steel beam guardrail that is not attached to a bridge and is 200 feet and greater in length, including steel beam guardrail transitioning to 3 cable guardrail (low tension), the delineators will be placed at a spacing of approximately 50 feet. Delineation will extend throughout the length of the guardrail system.

All costs for furnishing and installing single or back to back guardrail delineation on 3 cable guardrail and steel beam guardrail will be included in the contract unit price per each for "Guardrail Delineator".

All costs for furnishing and installing the reflective sheeting on the cable spacers or post caps for the high tension cable guardrail will be incidental to the respective high tension cable guardrail contract item.

An adhesive object marker will be placed on the end of the W beam guardrail or MGS end terminal. The adhesive object marker dimensions may vary due to the shape of the terminal end. A minimum of 256 square inches of object marker reflective sheeting area is required. The reflective sheeting will be fluorescent yellow type XI sheeting in conformance with ASTM D4956. All costs for furnishing and installing the adhesive object marker will be incidental to various contract items.

A type 2 object marker will be placed adjacent to the 3 cable guardrail (low tension) anchor, high tension cable guardrail anchor, and trailing end terminal at the location noted on sheet 1 of this standard plate. The type 2 object marker (6" x 12") will have fluorescent yellow type XI sheeting in conformance with ASTM D4956. All costs for furnishing and installing the type 2 object marker including the steel post, 6" x 12" reflective panel, and hardware will be included in the contract unit price per each for "Type 2 Object Marker" for single-sided and "Type 2 Object Marker Back to Back" for back to back type 2 object markers.

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S D D O T	DELINEATION OF GUARDRAIL	PLATE NUMBER 632.40
		Sheet 4 of 4
		Published Date: 2024

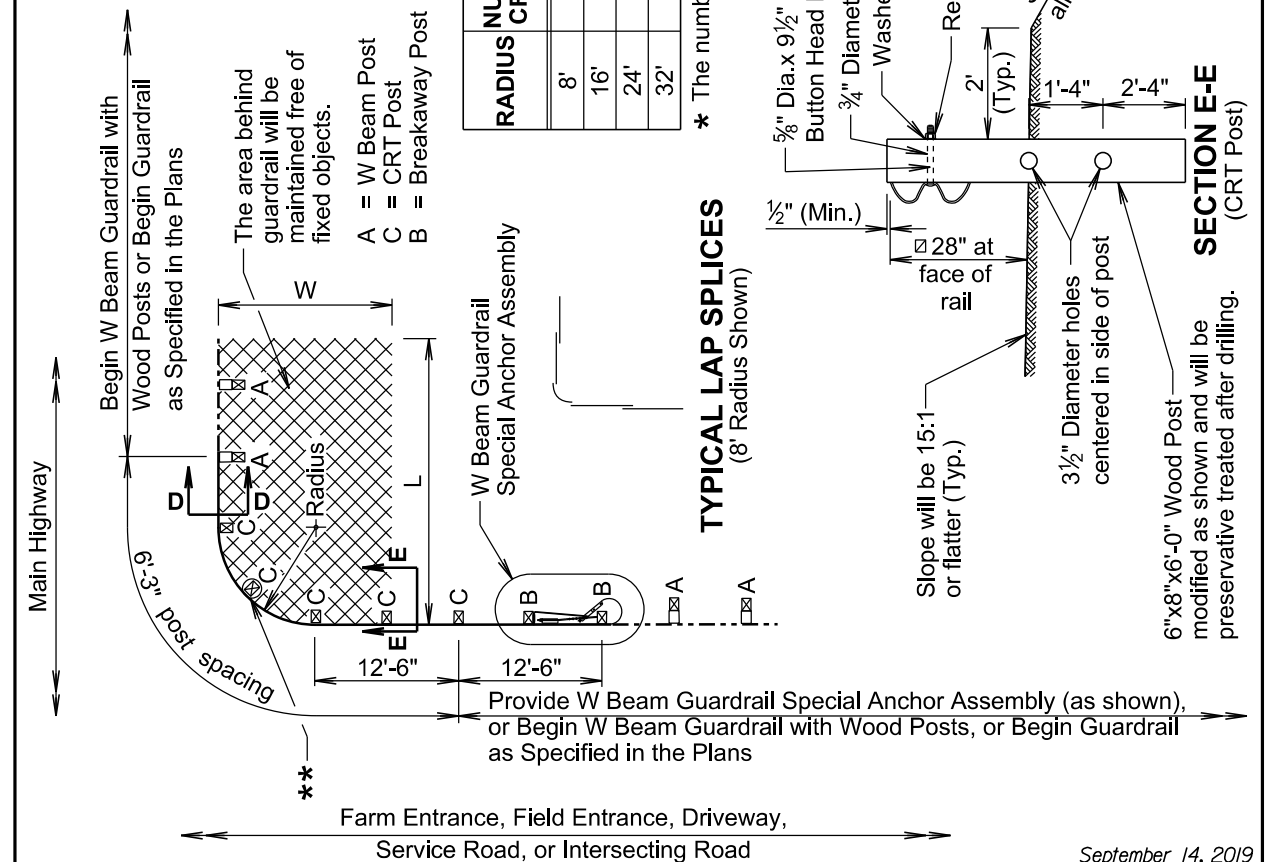
GENERAL NOTES:

Washers will NOT be used on the face of the rail under the 5/8" button head bolts connecting the rail to the Controlled Releasing Terminal (CRT) posts.

** The rail will NOT be bolted to the CRT post at the center of the 8' radius nose only.

The curved guardrail sections will be shop bent.

The W Beam Guardrail Special Anchor has NOT been tested as a crashworthy end treatment for approaching traffic on the intersecting roadway. Therefore, its use will be limited to farm and field entrances, driveways, or service roads.



S D D O T	SHORT RADIUS W BEAM GUARDRAIL AND SPECIAL ANCHOR ASSEMBLY	PLATE NUMBER 630.84
		Sheet 1 of 4
		Published Date: 2024

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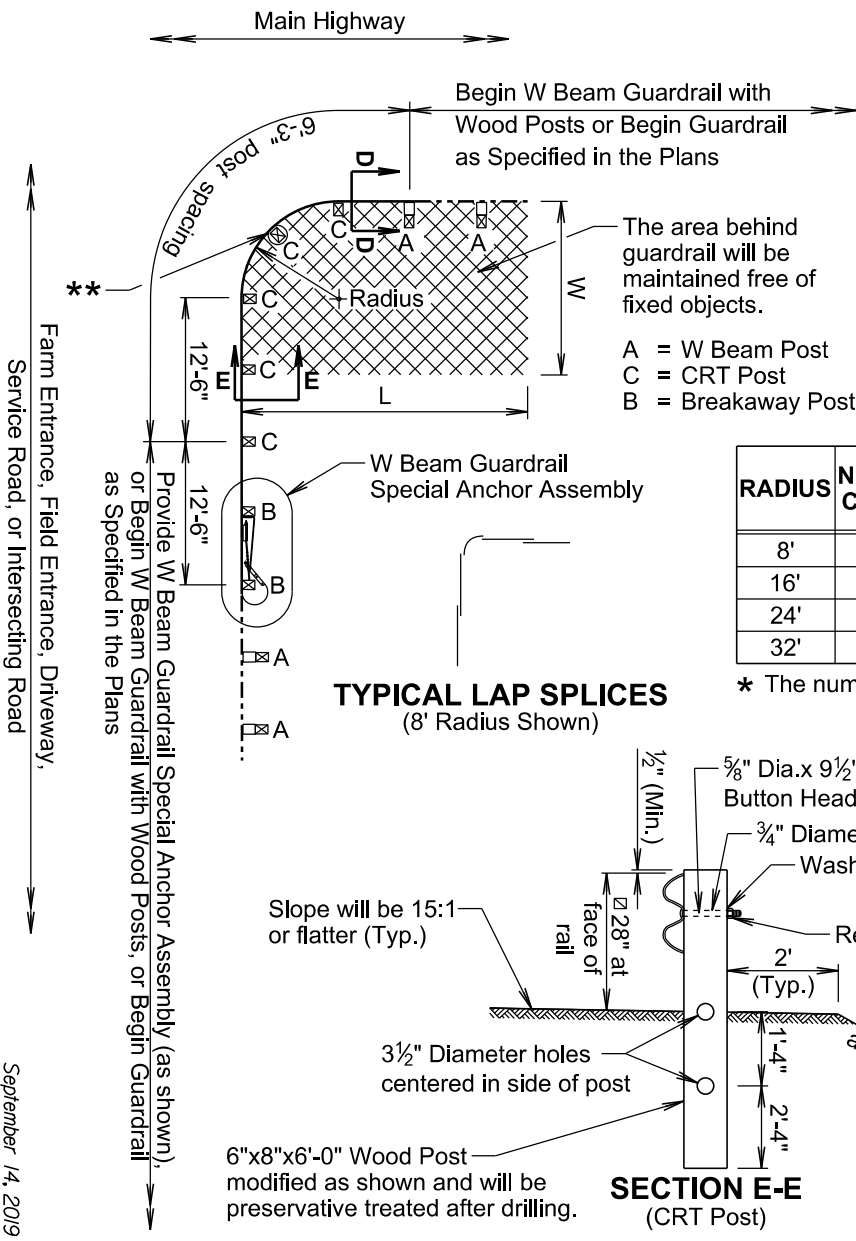
SD DOT

SHORT RADIUS W BEAM GUARDRAIL AND SPECIAL ANCHOR ASSEMBLY

PLATE NUMBER 630.84

Sheet 1 of 4

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GENERAL NOTES:

Washers will NOT be used on the face of the rail under the 5/8" button head bolts connecting the rail to the Controlled Releasing Terminal (CRT) posts.

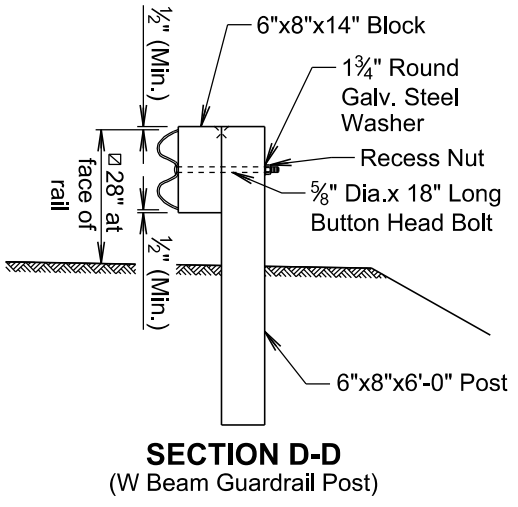
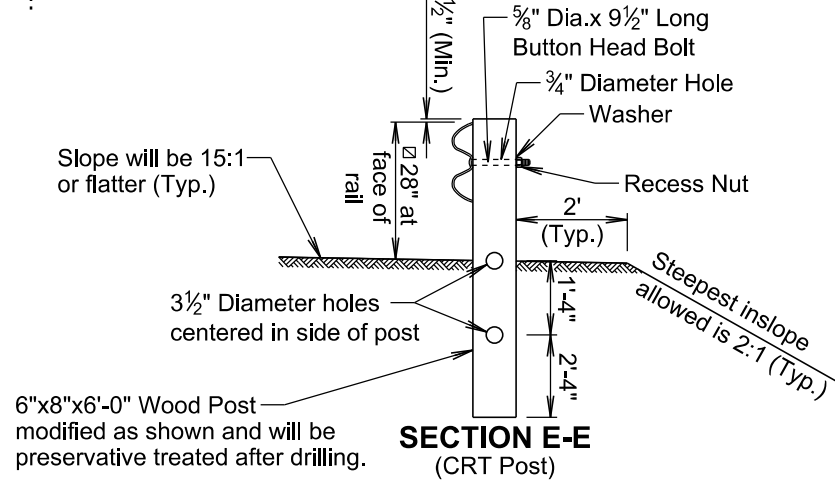
** The rail will NOT be bolted to the CRT post at the center of the 8' radius nose only.

The curved guardrail sections will be shop bent.

The W Beam Guardrail Special Anchor has NOT been tested as a crashworthy end treatment for approaching traffic on the intersecting roadway. Therefore, its use will be limited to farm and field entrances, driveways, or service roads.

RADIUS	NUMBER OF CRT POSTS	*NUMBER AND LENGTH OF CURVED RAILS	REQUIRED AREA FREE OF FIXED OBJECTS (L x W)
8'	5	1 @ 12.5'	25' x 15'
16'	7	1 @ 25'	30' x 15'
24'	9	1 @ 25' and 1 @ 12.5'	40' x 20'
32'	11	2 @ 25'	50' x 20'

TYPICAL LAP SPLICES (8' Radius Shown)



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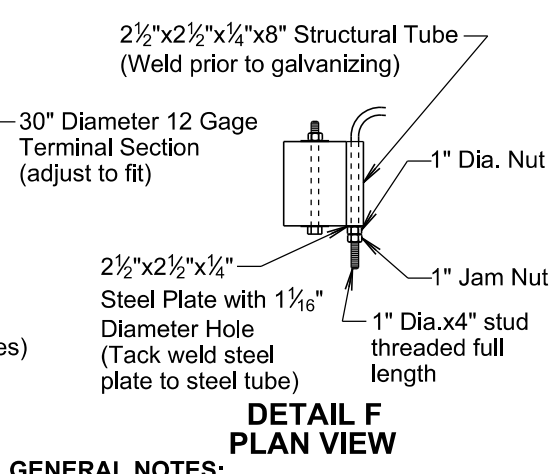
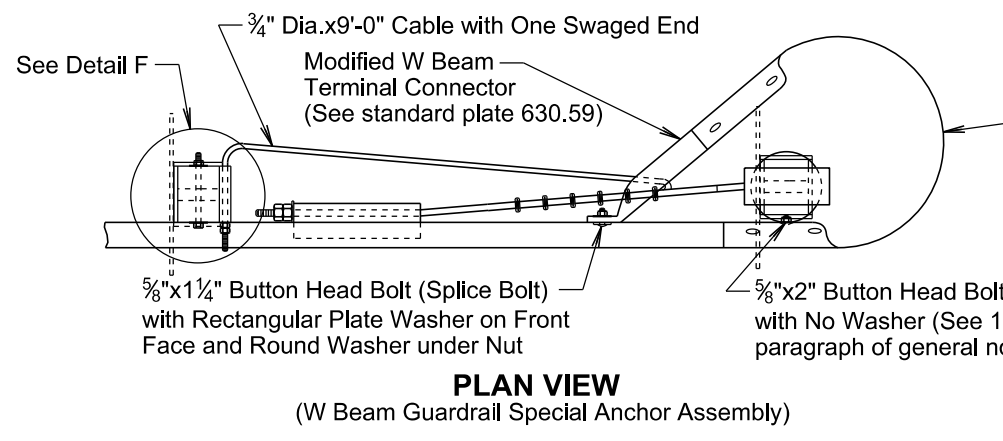
SD DOT

SHORT RADIUS W BEAM GUARDRAIL AND SPECIAL ANCHOR ASSEMBLY

PLATE NUMBER 630.84

Sheet 2 of 4

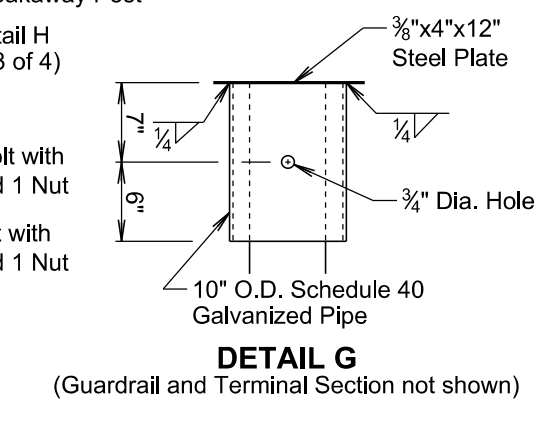
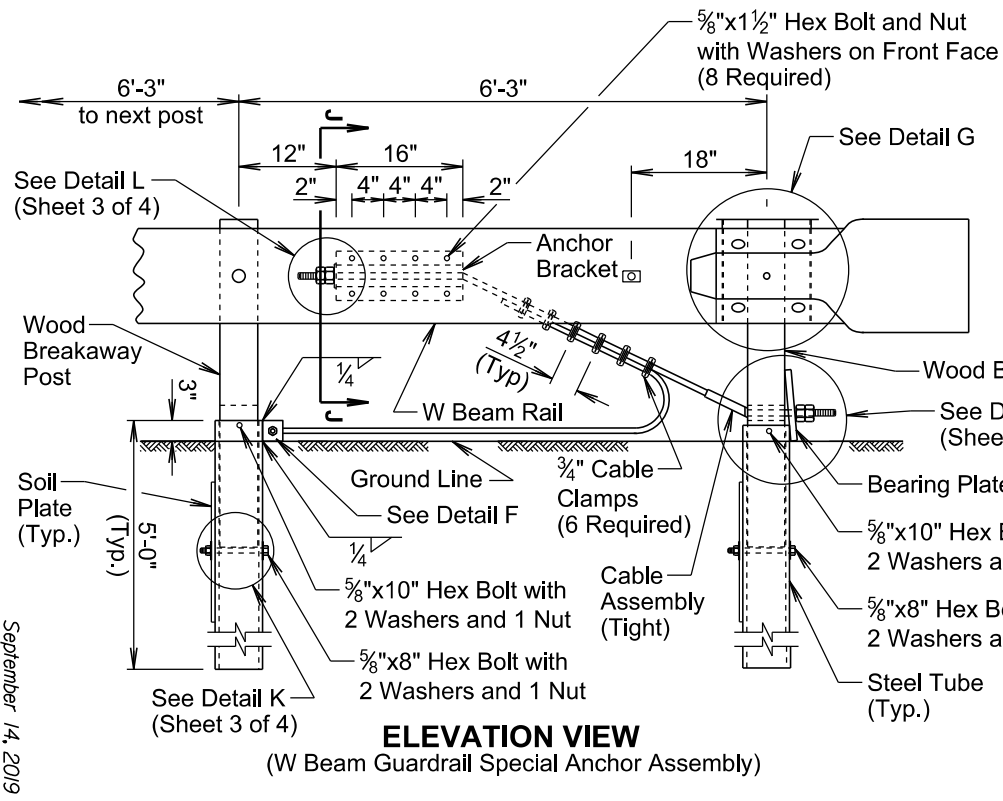
September 14, 2019

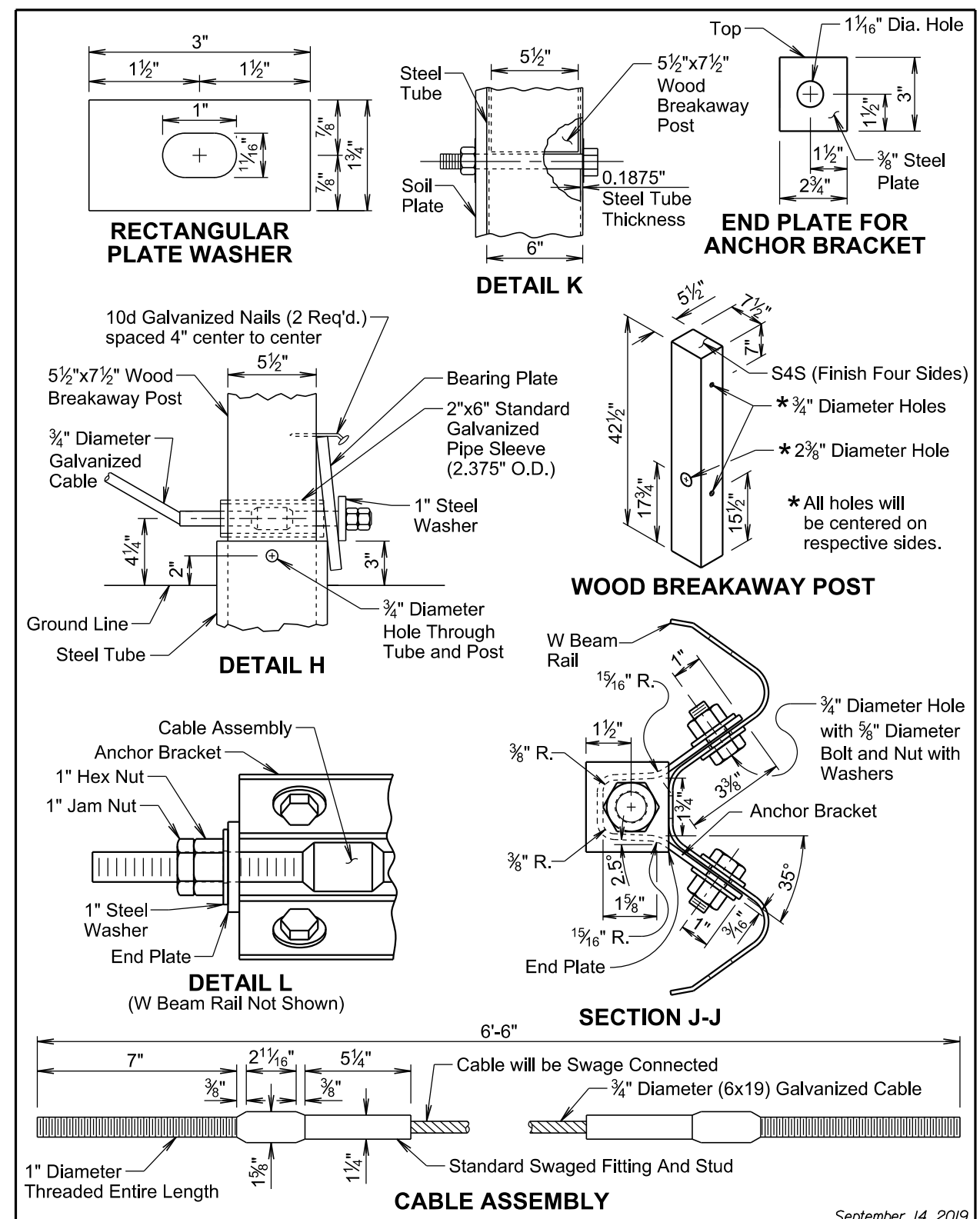


GENERAL NOTES:

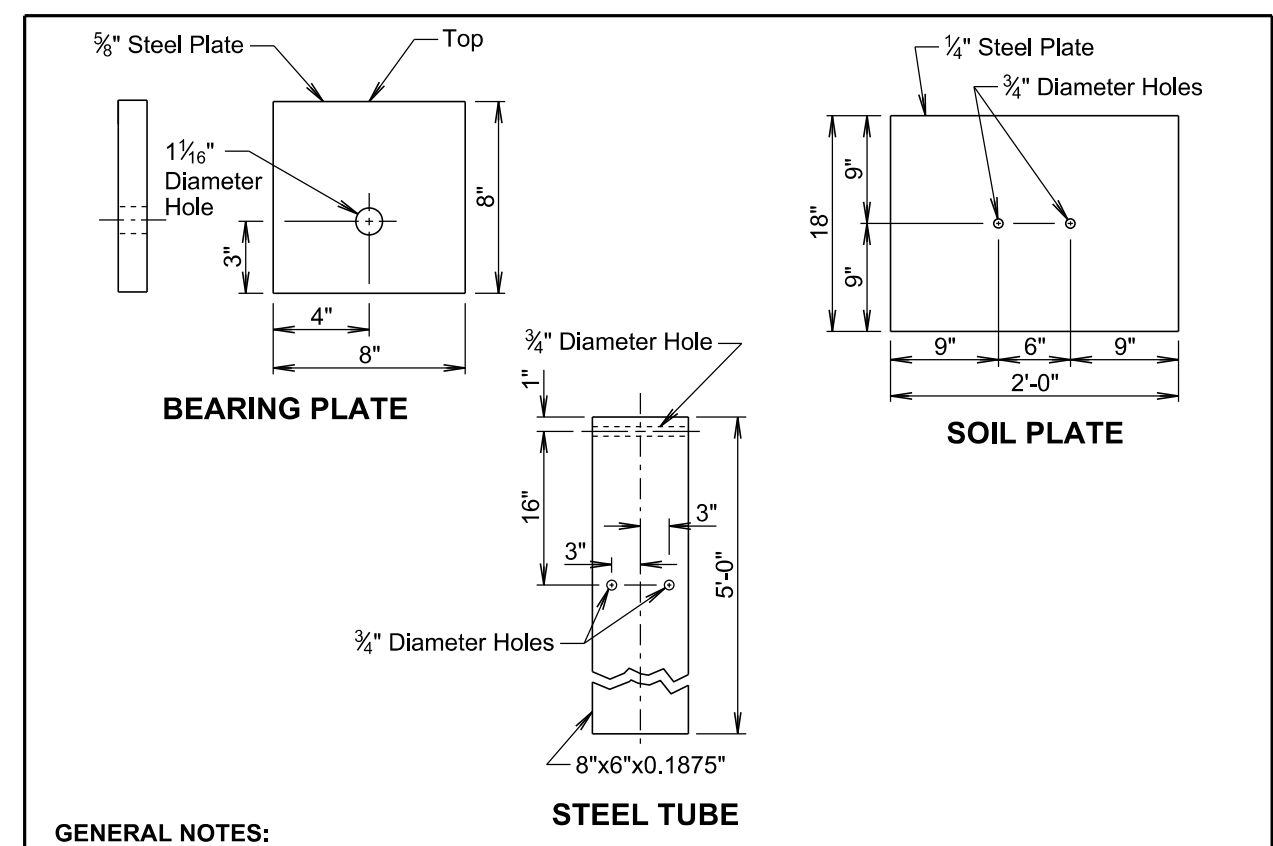
Attach W beam rail to the steel pipe with a 5/8"x2" button head bolt with no washer. Connection to the post is NOT required.

Wire rope will conform to the requirements of AASHTO M 30, will be 3/4 inch (6x19) preformed wire strand core or independent wire rope core, and will be galvanized. The wire rope will be manufactured of improved plow steel with a minimum breaking strength of 42,800 pounds.





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GENERAL NOTES:

The wood breakaway post will be in conformance with Section 630.2 A of the Specifications.

The bolts will be in conformance with ASTM A307 and the nuts will be in conformance with ASTM A563, Grade A or better. The bolts and nuts will be galvanized in accordance with ASTM A153.

All angles, channels, and plates will conform to the requirements of ASTM A36 and the structural tubing will conform to ASTM A500. Welding will meet the current requirements of the Structural Welding Code AWS D1.1. All structural steel will be galvanized in accordance with ASTM A123. Punching, drilling, cutting, or welding will NOT be permitted after galvanizing.

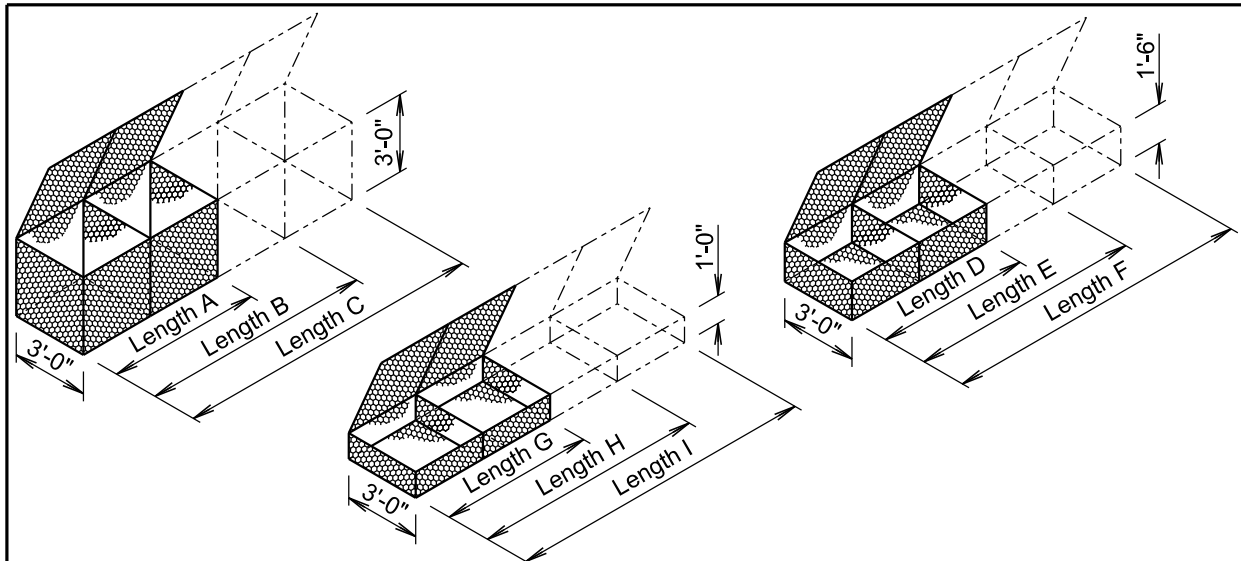
Slots in the rails will be provided as specified in the plans and by the manufacturer. A drilled hole through the rail is not allowed as a replacement for a slot. If the Contractor must create a slot, a cutting torch or plasma cutter is not allowed. The slot edges will be smooth and free of burrs or notches.

All costs for constructing the straight W beam guardrail with CRT posts including labor, equipment, and materials including all posts, blocks, steel beam rail, and hardware will be incidental to the contract unit price per foot for "Straight Class A W Beam Guardrail with CRT Posts".

All costs for constructing the curved W beam guardrail with CRT posts including labor, equipment, and materials including all CRT posts, steel beam rail, and hardware will be incidental to the contract unit price per foot for "Curved Class A W Beam Guardrail with CRT Posts".

All costs for constructing the W beam guardrail special anchor assembly including labor, equipment, hardware, and all components of the W beam guardrail special anchor assembly except the W beam rail will be incidental to the contract unit price per each for "W Beam Guardrail Special Anchor Assembly". The 12'-6" length of W beam rail located within the W beam guardrail special anchor assembly will be paid for per foot with the contract item "Straight Class A W Beam Guardrail with Wood Posts".

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GABION DETAILS

STANDARD SIZES					
SIZE	LENGTH	WIDTH	HEIGHT	NUMBER OF CELLS	CAPACITY (Cu. Yd.)
A	6'-0"	3'-0"	3'-0"	2	2.0
B	9'-0"	3'-0"	3'-0"	3	3.0
C	12'-0"	3'-0"	3'-0"	4	4.0
D	6'-0"	3'-0"	1'-6"	2	1.0
E	9'-0"	3'-0"	1'-6"	3	1.5
F	12'-0"	3'-0"	1'-6"	4	2.0
G	6'-0"	3'-0"	1'-0"	2	0.7
H	9'-0"	3'-0"	1'-0"	3	1.0
I	12'-0"	3'-0"	1'-0"	4	1.3

GENERAL NOTES:

Above dimensions subject to mill tolerances.

Lacing and internal connecting wire will be 0.0866 inch diameter steel wire ASTM A641, Class 3 soft temper measured after galvanizing and for PVC coated gabions will be 0.0866 inch diameter steel wire measured after galvanizing but before PVC coating.

The lacing procedure is as follows:

1. Cut a length of lacing wire approximately 1½ times the distance to be laced but not exceeding 5 feet.
2. Secure the wire terminal at the corner by looping and twisting.
3. Proceed lacing with alternating single and double loops at a spacing not to exceed 6 inches.
4. Securely fasten the other lacing wire terminal.

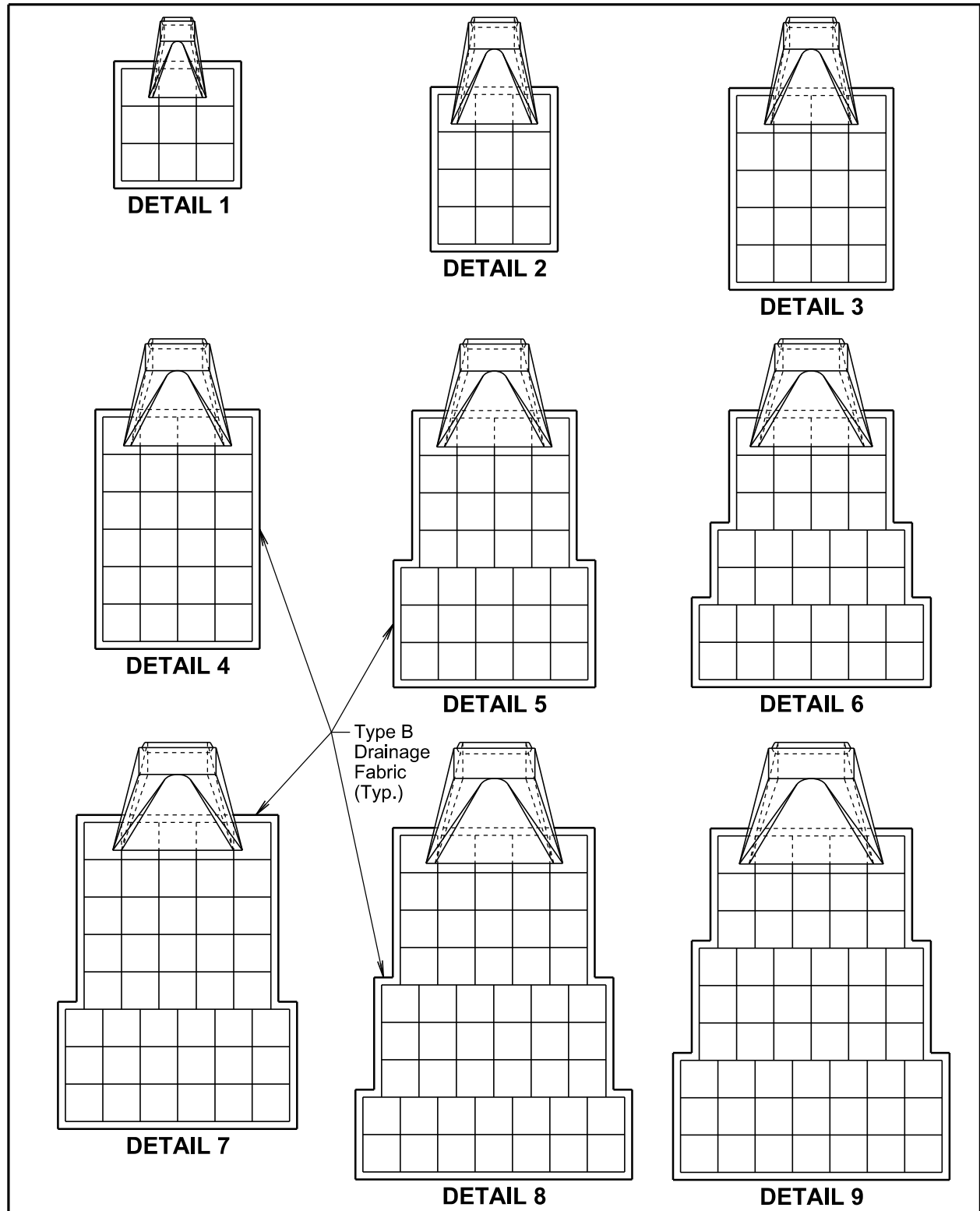
Wire lacing or interlocking type fasteners will be used for gabion assembly and final construction of gabion structures. Interlocking fasteners for galvanized gabions will be high tensile 0.120 inch diameter galvanized steel wire measured after galvanizing. The galvanizing will conform to ASTM A641-92, Class 3 coating. Fasteners will also be in accordance with ASTM A764, Class II, Type III.

Interlocking fasteners for PVC coated gabions will be high tensile 0.120 inch diameter stainless steel wire conforming to ASTM A313, Type 302, Class 1. The spacing of the interlocking fasteners during all phases of assembly and construction will not exceed 6 inches.

All fasteners will be placed where the mesh weaves around the selvage wire at the vertical and horizontal joints.

February 14, 2020

S D D O T	BANK AND CHANNEL PROTECTION GABIONS	PLATE NUMBER 720.01
		Sheet 1 of 1
Published Date: 2024		



February 14, 2020

S D D O T	BANK AND CHANNEL PROTECTION GABION PLACEMENT UNDER PIPE END SECTIONS	PLATE NUMBER 720.03
		Sheet 1 of 2
Published Date: 2024		

* ESTIMATED QUANTITIES				
Detail	Pipe Diameter (Inches)	Gabion (Cu. Yd.)	Type B Drainage Fabric (Sq. Yd.)	
RCP, RCP Arch, CMP, and CMP Arch	1	12, 18, and 24	4.5	15
	2	30 and 36	6.0	19
	3	42	10.0	29
	4	48 and 54	12.0	34
	5	60	15.5	43
	6	66	17.0	47
	7	72	21.5	57
	8	78	26.0	68
	9	84	27.0	70

GENERAL NOTES:

Gabions at outlets of CMP and RCP will be placed under the end section a distance of 2 feet from the outlet end. For CMP end section installations, the upper fabric of the gabions will be modified to accommodate the metal end section as approved by the Engineer.

- * Gabion and type B drainage fabric quantities on this standard plate are based on standard gabion sizes D, E, and F as depicted on standard plate 720.01.

Type B drainage fabric will be placed under the gabions and around the exterior sides (perimeter) of the gabions as approved by the Engineer. The type B drainage fabric will be in conformance with Section 831 of the Specifications. Measurement and payment of the type B drainage fabric will be in conformance with Section 720 of the Specifications.

February 14, 2020