

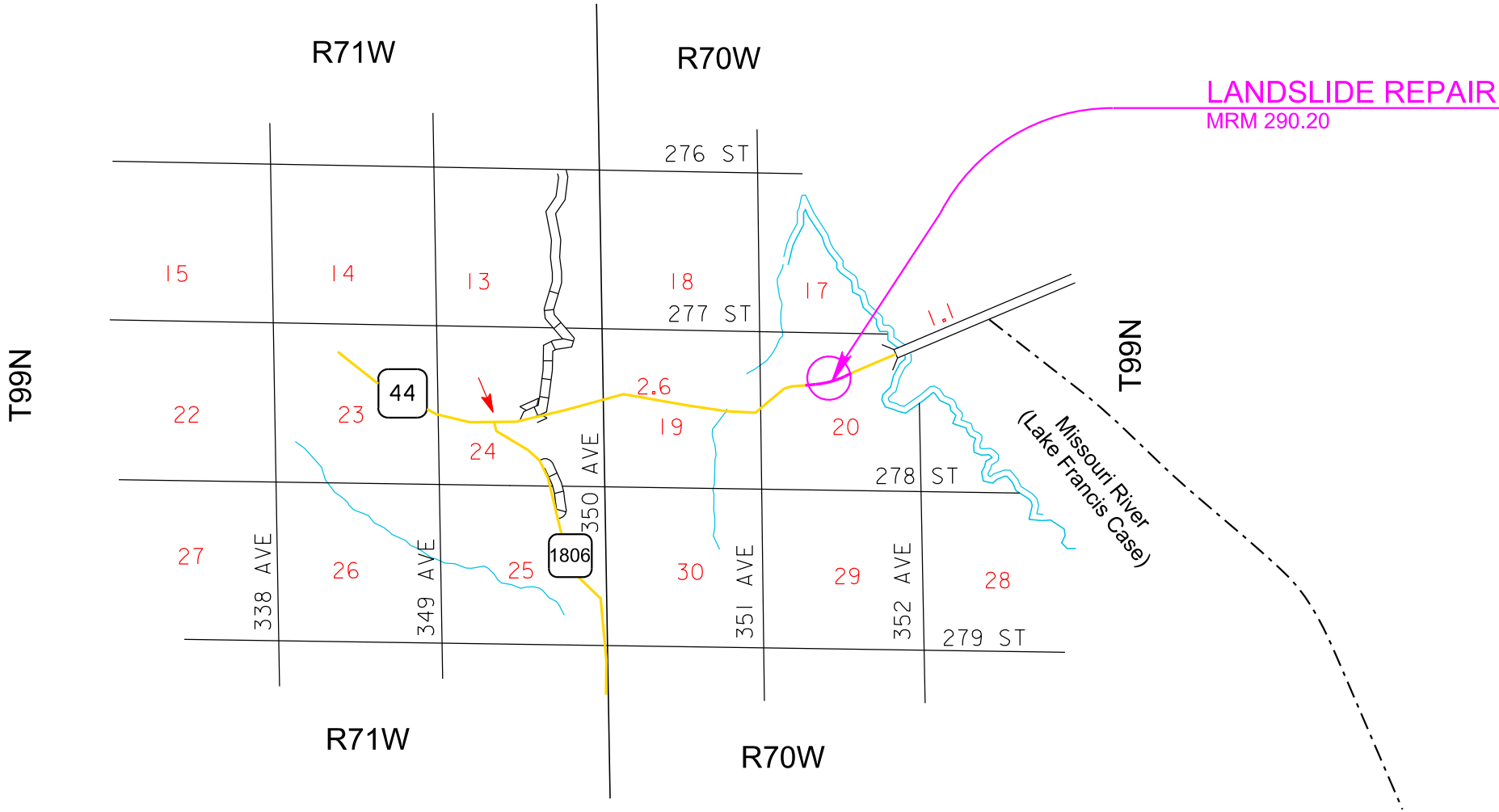
SECTION B: GRADING PLANS

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B1	B25

Plotting Date: 03/23/2021

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SECTION B ESTIMATE OF QUANTITIES

BID ITEM NUMBER	ITEM	QUANTITY	UNIT
009E0010	Mobilization	Lump Sum	LS
009E3220	Reestablish Right-of-Way and Property Corner	20	Each
009E3225	Reestablish Public Land Survey System Corner	1	Each
009E3230	Grade Staking	0.052	Mile
009E3245	Final Cross Section Survey	0.289	Mile
009E3250	Miscellaneous Staking	0.289	Mile
009E3280	Slope Staking	0.118	Mile
009E3301	Engineer Directed Surveying/Staking	20.0	Hour
100E0100	Clearing	Lump Sum	LS
110E0600	Remove Fence	1,682	Ft
110E1010	Remove Asphalt Concrete Pavement	821.0	SqYd
120E0010	Unclassified Excavation	118,853	CuYd
120E4100	Reprofiling Ditch	4.0	Sta
120E6100	Water for Embankment	1,782.8	MGal
250E0020	Incidental Work, Grading	Lump Sum	LS
450E0142	24" RCP Class 2, Furnish	128	Ft
450E0150	24" RCP, Install	128	Ft
450E2200	24" RCP Sloped End, Furnish	2	Each
450E2201	24" RCP Sloped End, Install	2	Each
450E4758	18" CMP 14 Gauge, Furnish	114	Ft
450E4760	18" CMP, Install	114	Ft
450E5010	18" CMP Elbow, Furnish	2	Each
450E5011	18" CMP Elbow, Install	2	Each
450E5211	18" CMP Flared End, Furnish	1	Each
450E5212	18" CMP Flared End, Install	1	Each
450E5314	30" CMP Sloped End, Furnish	2	Each
450E5315	30" CMP Sloped End, Install	2	Each
450E5406	18" CMP Safety End, Furnish	1	Each
450E5407	18" CMP Safety End, Install	1	Each
450E7630	30" Steel Pipe, Furnish	184	Ft
450E7631	30" Steel Pipe, Install	14	Ft
451E5130	Bore and Jack 30" Pipe	170	Ft
462E0250	Cellular Grout	96.3	CuYd
600E0200	Type II Field Laboratory	1	Each
620E0020	Type 2 Right-of-Way Fence	925	Ft
620E0030	Type 3 Right-of-Way Fence	1,140	Ft
620E0520	Type 2 Temporary Fence	1,440	Ft
620E1020	2 Post Panel	23	Each
620E1030	3 Post Panel	1	Each
680E0040	4" Underdrain Pipe	60	Ft
680E0440	4" Slotted Corrugated Polyethylene Drainage Tubing	712	Ft

BID ITEM NUMBER	ITEM	QUANTITY	UNIT
680E2000	Concrete Headwall for Underdrain	2	Each
680E2500	Porous Backfill	299.0	Ton
720E1010	PVC Coated Bank and Channel Protection Gabion	15.0	CuYd
831E0110	Type B Drainage Fabric	49	SqYd

GRADING OPERATIONS

Water for Embankment is estimated at the rate of 15 gallons of water per cubic yard of Embankment minus Waste.

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

Special ditch grades and other sections of the roadway different than the typical section(s) 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.

Temporary fence and/or permanent fence will be placed ahead of the grading operation unless otherwise directed by the Engineer.

TYPE II FIELD LABORATORY

The lab will be equipped with an internet connection such as DSL, cable modem, or other approved service. The internet connection will be provided with a multi-port wireless router. The internet connection will be a minimum speed of 5 Mbps unless limited by job location and approved by the DOT. Prior to installing the wireless router, the Contractor will submit the wireless router's technical data to the Area Office to check for compatibility with the state's computer equipment. The internet connection is intended for state personnel usage only. The Contractor's personnel are prohibited from using the internet connection unless pre-approved by the Project Engineer. These items will be incidental to the contract unit price per each for "Type II Field Laboratory".

UTILITIES

The Contractor will be aware that the existing utilities shown in the plans were surveyed prior to the design of this project and might have been relocated or replaced by a new utility facility prior to construction of this project, might be relocated or replaced by a new utility facility during the construction of this project, or might not require adjustment and may remain in its current location. The Contractor will contact each utility owner and confirm the status of all existing and new utility facilities. The utility contact information is provided elsewhere in the plans or bidding documents.

LANDSLIDE DEBRIS EXCAVATION

Landslide Debris Excavation will be required at each site as shown on the cross sections. It is anticipated that most of the excavated Landslide Debris can be used in the construction of embankment. The Landslide Debris Excavation limits will not exceed those shown on the cross sections unless directed by the Engineer. Temporary 3:1 backslopes are required to excavate the Landslide Debris and reconstruct the inslopes. The temporary slopes will be unstable over the long-term. However, the slopes should remain globally stable over the short-term during construction if measures are taken to divert runoff away from the slopes and construction activities are sequenced to minimize the amount of time the temporary backslopes are left exposed and unsupported. Regular monitoring of temporary slopes is required during construction. If temporary slopes become unstable, excavation will cease, and the slope will be evaluated by the Engineer. Landslide Debris Excavation will be paid for at the contract unit price per cubic yard for "Unclassified Excavation".

UNSTABLE MATERIAL EXCAVATION

Prior to embankment construction, Unstable Material Excavation will be required to excavate displaced or weak compressible soils and other organic materials. A nominal 5 ft. depth of compressible material is anticipated to be removed from the embankment footprint prior to construction of the embankment. The depth of unstable material excavation may be adjusted by the Engineer to ensure a solid foundation free of organic, soft, unstable material is prepared. Unstable and/or highly organic material will be stockpiled for use as topsoil or wasted at a site approved by the Engineer.

The areas of unstable material excavation are drawn on the cross sections. The estimated quantity of unstable material excavation will be paid for at the contract unit price per cubic yard for "Unclassified Excavation".

EMBANKMENT CONSTRUCTION

Embankment construction will not begin until all unstable compressible materials have been excavated from the embankment footprint to the satisfaction of the Engineer. A suitable embankment foundation consists of compacted soil which does not pump, rut, or otherwise displace when traveled over with construction equipment. Each embankment will be benched into the existing slopes in accordance with Section 120.3.B.2 of the Specifications.

EXCAVATION LEFT

The excavation from A 853+25 to A 855+64 – L will be excavated as shown on the cross sections or as directed by the Engineer. Excavation from station A 856+00 to A 862+00 will have a 5:1 slope with a variable height cut and a bench daylighting to the existing backslope. If the amount of exaction that is needed to complete the embankment changes the height of the cut will be adjusted in this area, but the 5:1 slope will stay the same.

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SHRINKAGE FACTOR: Embankment +25%

TABLE OF EXCAVATION QUANTITIES BY BALANCES

Station to	Station	Unstable Material Exc (CuYd)	Landslide Debris Exc. (CuYd)	Excavation (CuYd)	Total Excavation (CuYd)	* Haul (CuYdSta)	* Dead Haul (CuYdSta)
A853+00	A862+00 L	0	0	65,084	65,085		
856+26	862+50 R	14,180	30,753	0	44,933	219,000	501,900
Totals:		14,180	30,753	65,084	110,018	219,000	501,900

* The quantities for these items are for information only.

TABLE OF UNCLASSIFIED EXCAVATION

Excavation	(CuYd)
Topsoil	110,018
Embankment for Pipe Inlet	5,485
@ Sta 855+90-L	150
Excavation for Deep Pipe	3,200
Total	118,853

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 listed in the Table of Unclassified Excavation will not be adjusted according to field measurements.

The following paragraphs are general earthwork information and information in regard to computing the Unclassified Excavation quantity when final cross sections are taken in the field:

The Unstable Material Excavation and Landslide Debris Excavation quantities are included in the Excavation quantity listed in the Table of Unclassified Excavation. When finaling a project, the Unstable Material Excavation and Landslide Debris Excavation quantities will be added to the Excavation quantity to compute the Unclassified Excavation quantity.

Out-of-Balance Excavation is material obtained from waste generated from excavation on the left side of the highway. The quantity of Out-of-Balance Excavation is included in the Excavation quantity in the balance where it is excavated and is paid for once as Unclassified Excavation.

The Topsoil quantity in the Table of Unclassified Excavation is an estimate. When finaling a project, the total quantity of field measured Topsoil will be used in place of the estimated Topsoil quantity. The quantity of Topsoil from the cuts will be paid for twice as Unclassified Excavation, as it will be in both the Excavation and Topsoil quantities. This will be full compensation for Excavation, which includes necessary undercutting to provide space for placement of topsoil.

The Excavation quantities from individual balances and the Table of Unclassified Excavation have been reduced by the volume of in place surfacing that will be removed and/or salvaged.

HAUL

Included in the Table of Excavation Quantities by Balances are Dead Haul, and Haul. They are not pay items and are for informational purposes only. The mass haul diagram is available as part of the bid package for use in figuring this haul.

Dead Haul: Estimated quantity (CuYdSta) for moving material from the excavation on the left side of the road to the embankment on the right side of the road.

Haul: Estimated quantity (CuYdSta) for moving unclassified excavation material to the locations where it is needed throughout the earthwork balance. Estimated quantity was also included for temporarily moving the excavated material to the side before backfilling. A haul distance of 3 stations was assumed.

For Purpose of Extra Haul Computations:

Average Haul = (Haul + Dead Haul)/Unclassified Excavation = (219,000+501,900)/118,853 = 6.1 Sta.

REMOVE ASPHALT CONCRETE PAVEMENT

The Los Angeles Abrasion Loss on the aggregate used for the in-place asphalt concrete was 23. This value was obtained from testing during construction of the in-place asphalt concrete.

An estimated 230 Cubic Yards of the in-place asphalt concrete surfacing will be removed from the existing highway according to the in-place surfacing typical sections and wasted as directed by the Engineer.

The quantity of removed asphalt material is estimated from the in-place surfacing typical sections. This estimated quantity is not included in the unclassified excavation quantities.

TABLE OF ASPHALT CONCRETE PAVEMENT REMOVAL

Station to	Station	L/R	Quantity (SqYd)
858+50	861+25	R	555.0
861+42	Pipe Removal		266.0
Total:			821.0

REPROFILE DITCH

The Contractor will reprofile the ditches to match flowline into the new pipe inlets. All costs associated with clearing and reshaping of the ditch including labor, excavation, equipment, and incidentals will be paid for at the at the contract unit price per station for "Reprofiling Ditch". It's estimated that 300 cubic yards of fill material will be needed to grade the ditches. See cross sections for elevations of reprofiled ditches. The estimated cubic yards of embankment required to reprofile the ditches are included in the earthwork balance notes on the profile sheets.

TABLE OF REPROFILE DITCH

Station to	L/R	Quantity (Sta)
853+80	855+25	R
855+25	856+25	L
860+50	861+50	L
862+25	862+75	R
Total:		4.0

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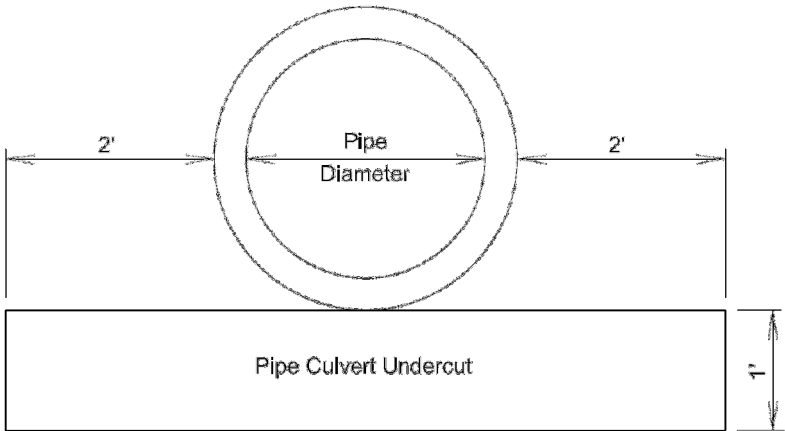
PIPE CULVERT UNDERCUT

Pipe culvert undercut may be required for this project. The Engineer will determine which pipe will be undercut in accordance with Section 421 of the Specifications.

If pipe culvert undercut is required, the table below contains the rate for one-foot depth of pipe culvert undercut per foot of pipe length. When calculating pipe culvert undercut, the length of pipe ends should be included in the overall pipe length.

Storm sewer and approach pipes do not require undercutting unless specified otherwise in these plans.

Pipe Diameter (In)	Round Pipe Undercut Rate for 1' Depth (CuYd/Ft)	Arch Pipe Undercut Rate for 1' Depth (CuYd/Ft)
24	0.2407	0.2577
30	0.2623	0.2847
36	0.2840	0.3110
42	0.3056	0.3337
48	0.3272	0.3596
54	0.3488	0.3827
60	0.3704	0.4105
66	0.3920	---
72	0.4136	0.4630
78	0.4352	---



INCIDENTAL WORK, GRADING

Station	L/R	Remarks
853+80	R	Exhume & Reset Underdrain Headwall
855+79	R	Take Out 18"-115' CMP
860+50-500'R	to	Shape Outlet Ditch
860+75-520'R		
861+42		Take Out 24"-190' CMP
861+77-53'R	to	Shape Outlet Ditch
862+70-265'R		

TABLE OF PIPE INSTALLATIONS

Location	Pipe Installation
855+25-55' R to 856+29-110' R	18"- 114' CMP, 2-15° Elbows & 1 Safety End & 1 Flared End
856+20	Bore & Jack 30"- 170' Steel Pipe and Install 30"-14' Steel Pipe & 2 CMP Sloped Ends
861+50	24"- 128' RCP & 2 Sloped Ends

UNDERDRAIN

Several underdrain systems will be required to capture water from local seeps and improve subgrade and embankment foundation conditions. Underdrains will be installed as per the following:

Station 853+80±, 50' Rt. Ditch Drain

The existing underdrain outlet and ditch bottom is blocked by vegetation and sediment. Exhume the outlet and clear the mainline ditch of vegetation. Reset the underdrain outlet headwall and shape ditch to establish positive drainage away from the outlet. Mark outlet with an approved object marker.

Station 857+25± to Station 859+00±, Rt. – Tributary Drain

An underdrain will be installed at the toe of the berm slope from Station 857+25±, 230' Rt. to Station 859+00±, 386' Rt. Excavate all landslide debris and unstable material and construct the embankment to elevation 1426 prior to underdrain installation. The underdrain will consist of 4-inch Slotted Corrugated Polyethylene Tubing placed in a 2-foot-wide by 3-foot-deep trench backfilled with 3 feet of Porous Backfill. The underdrain will outlet through 40 feet of 4-inch PVC Outlet Pipe placed in a 2-foot-wide trench of variable depth backfilled with soil. The underdrain outlet pipe will daylight at an Outlet Headwall at approximately Station 859+00±, 386' Rt. as directed by the Engineer.

The estimated quantities for the underdrain system are as follows:

4" Schedule 40 PVC Pipe	40	Ft
4" Slotted Corrugated Polyethylene Tubing	210	Ft
Porous Backfill	89	Ton
Concrete Headwall for Underdrain (See Standard Plate 680.01)	1	Each
Excavation	48	CuYd

Station 859+00± to Station 861+00±, Rt. – Longitudinal Drain

An underdrain will be installed at the toe of the temporary excavation slope from Station 859+00±, 123.5' Rt. to Station 861+00±, 165' Rt. Excavate all landslide debris and unstable material prior to underdrain installation.

The underdrain will consist of 4-inch Slotted Corrugated Polyethylene Tubing placed in a 2-foot-wide by 3-foot-deep trench backfilled with 3 feet of Porous Backfill. The underdrain will tee into the Lateral Outlet Drain at Station 860+50±, 233' Rt.

The estimated quantities for the underdrain system are as follows:

4" Slotted Corrugated Polyethylene Tubing	292	Ft
4" Polyethylene Tee Connector	1	Each
Porous Backfill	122	Ton
Excavation	65	CuYd

Station 860+50±, 233' Rt. to Station 860+50±, 495' Rt. – Lateral Outlet Drain

A lateral underdrain will tee into the longitudinal drain at Station 860+50±, 233' Rt. and extend to daylight at the toe of the proposed berm slope at Station 860+50±, 495' Rt. Excavate all landslide debris and unstable material and construct the embankment to elevation 1402 prior to underdrain installation.

The underdrain will consist of 4-inch Slotted Corrugated Polyethylene Tubing placed in a 2-foot-wide by 3-foot-deep trench backfilled with 3 feet of Porous Backfill. The underdrain will outlet through 20 feet of 4-inch PVC Pipe placed in a 2-foot-wide trench of variable depth backfilled with soil. The underdrain outlet pipe will daylight at an Outlet Headwall at approximately Station 860+50±, 495' Rt. as directed by the Engineer.

The estimated quantities for the underdrain system are as follows:

4" Schedule 40 PVC Pipe	20	Ft
4" Slotted Corrugated Polyethylene Tubing	210	Ft
Porous Backfill	88	Ton
Concrete Headwall for Underdrain (See Standard Plate 680.01)	1	Each
Excavation	47	CuYd

UNDERDRAIN CONSTRUCTION

Each underdrain trench will be graded to maintain a minimum of .01ft/ft. or 1% drop from beginning to outlet. Each Outlet Headwall will be placed to blend in with the surrounding topography with the outlet pipe placed above the bottom of the drainage to permit proper flow from the outlet.

The 4" Dia. 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 2564. All labor, tools, equipment, and incidentals necessary for the installation of the of the PVC Outlet Pipe will be incidental to the contract unit price per foot for 4" Underdrain Pipe.

The Contractor will ensure all segments of drainage tubing and outlet pipe are positively connected utilizing couplers, tees, gaskets, fittings or other approved methods. The contractor will take precautions to assure each connection remains soil tight during installation of the underdrain system.

Care must be taken to ensure that the underdrain and outlet pipe is not damaged during construction. Sufficient cover material is to be placed over the underdrains before compaction equipment is allowed to work over the underdrains. Damaged pipe will be replaced by the Contractor at no additional cost to the Department.

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UNDERDRAIN CONSTRUCTION (CONTINUED)

The underdrain locations and elevations given are based on the best information available to the Geotechnical Engineering Activity. Actual field conditions may require that adjustments be made by the Project Engineer during construction to provide for sufficient drainage. The Geotechnical Engineering Activity will be available for onsite assistance if necessary.

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 Mitchell Area office for reference in post construction maintenance.

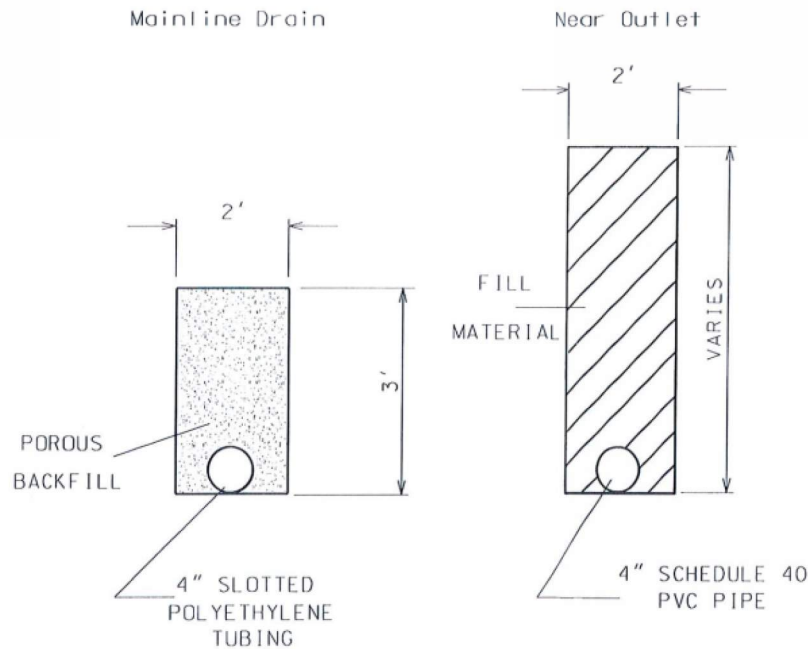
The 160 cubic yards of excavation and the 4-inch polyethylene tee connector will be incidental to the contract unit price per foot for the corresponding "Polyethylene Tubing" contract items.

The total project estimated quantities for the underdrain system are as follows:

Total Underdrain Estimate of Quantities:

4" Schedule 40 PVC Pipe	60	Ft
4" Slotted Corrugated Polyethylene Tubing	712	Ft
4" Polyethylene Tee Connector	1	Each
Porous Backfill	299	Ton
Concrete Headwall for Underdrain (See Standard Plate 680.01)	2	Each
Excavation	160	CuYd

Typical Underdrain Installation



Underdrains will be constructed in accordance with Section 680, Standard Specifications for Roads and Bridges 2015 Edition.

CORRUGATED METAL PIPE

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

PIPE FOR DOWNSPOUT AT 855+25 TO 856+29-R

High density polyethylene or polypropylene pipe may be substituted for the CMP downspout at 855+25 to 856+29-R at no additional cost to the State. All necessary connections, transitions, and anchoring methods will be in accordance with the manufacturer's recommendations and be approved by the Engineer. Bedding and backfill material and installation procedures will conform to the manufacturer's design requirements.

If high density polyethylene pipe or polypropylene pipe (will be in conformance with AASHTO M330) are provided, then the end sections will be metal, be compatible, and conform to the type of end section as shown in the plans.

EXCAVATION FOR DEEP PIPE REMOVAL

Included in the quantity of "Unclassified Excavation" are 3200 cubic yards of excavation for removal of a deep pipe at 861+42. Deep pipe are existing pipe at depths of 10 feet or greater (measured from the flow line to the lowest elevation of either the existing ground line, undercut line, or bottom of removed or salvaged surfacing).

All work necessary to excavate and backfill the deep pipe including labor, equipment, and incidentals will be incidental to the contract unit price per cubic yard for "Unclassified Excavation". Payment for deep pipe excavation will be based only on plans quantity and measurement of these excavation quantities during construction will not be performed.

The excavation quantities for deep pipe are not included with the earthwork balance quantities on the plans profile sheets. The quantities computed for excavation of the deep pipe are based on the limits shown in the drawing below. The drawing shows a box culvert for illustration purposes only; the limits are similar for a pipe.

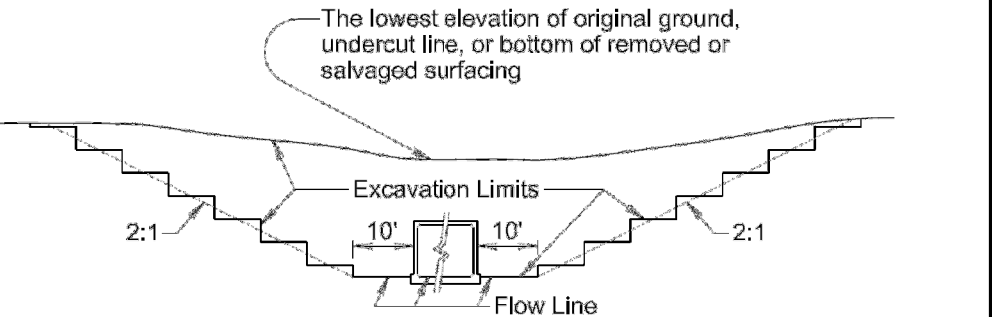


TABLE OF PVC COATED BANK AND CHANNEL PROTECTION GABIONS AND DRAINAGE FABRIC

Station	L/R	PVC Coated Bank and Channel Protection Gabion (CuYd)	Type B Drainage Fabric (SqYd)
856+29	R	4.5	15
856+51	R	6.0	19
861+77	R	4.5	15
Totals:		15.0	49

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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.

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)
856+07	96.3
Total:	96.3

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

BORE AND JACK STEEL PIPE

The Contractor will install steel pipe at station 856+20 by boring and jacking the pipe through the existing highway embankment. The pipe will be installed by boring and jacking methods as specified herein unless an alternate plan is submitted in writing and approved by the Engineer.

As shown on the appropriate pipe cross section, some excavation of the existing roadway embankment is anticipated in order to reduce the length of the bore and jack pipe installation.

Steel pipe for boring and jacking will meet or exceed the requirements of ASTM A53 Grade B, ASTM A139 Grade B or ASTM A252 Grade 2. Hydrostatic testing will not be required for this application. The pipe will be required to have the minimum wall thickness as shown in the following table:

Pipe Diameter	Wall Thickness
48" & below	1/2"
54"	5/8"
60"	5/8"
66"	3/4"
72"	3/4"

The exterior of the steel pipe will be coated with a fusion bonded epoxy coating and an abrasion resistant overcoat or a two-component coal tar epoxy. The coal tar will meet the requirements of Sherwin-Williams Targuard, Tnemec Hi-Build Tneme-Tar, or an approved equal. Applications of the coatings will be in conformance with the manufacturer's recommendations.

The pipe joints will be welded by a certified welder in accordance with Section 410.3 D of the Specifications. After the welding has been completed, the exposed area will be coated with 3M Scotchkote Liquid Epoxy 328 or a two-component coal tar epoxy meeting the requirements of Sherwin-Williams Targuard, Tnemec Hi-Build Tneme-Tar, or an approved equal.

The jacking pit will be constructed of sufficient size to accommodate equipment and workmen. The pit walls will be sloped or shored to comply with all applicable State and Federal regulations. The Contractor will be responsible for the design of the pit floor and jacking thrust restraint wall to carry the cyclic loads and thrust applied by the Contractor's operation. Water will not be allowed to accumulate in the jacking pit. All components of the jacking pit will be removed after installation of the pipe unless otherwise allowed by the Engineer.

The pipe will be pushed into position from a jacking pit with hydraulic jacks while simultaneously excavating at the forward end of the pipe. Each pipe section will be jacked from the jacking pit as the excavation at the boring head progresses so that the excavation is supported by the boring head or the pipe at all points.

Jacking thrust will be applied to the pipe by means of a yoke or frame designed to distribute the thrust uniformly around the pipe joint. The thrust will be applied to the pipe joint only in the location and only to the maximum force recommended by the pipe manufacturer. The pipe will be jacked into place without visible damage to the pipe or joint.

The boring head excavation will be circular with a maximum diameter equal to the outside diameter of the jacking pipe plus 1 inch. The Contractor will take whatever corrective action is necessary to prevent running, flowing, or squeezing ground conditions at the cutting face from causing large voids or significant loss of soil that may cause surface settlement.

The Contractor will control the alignment and grade of the pipe installation to meet the following tolerances:

- Maximum horizontal deviation from plan shown alignment will be less than 0.15% of pipe length from the downstream end of pipe to the point of measurement.
- Maximum vertical deviation from plan shown alignment will be less than 0.075% of pipe length from the downstream end of pipe to the point of measurement.

All material excavated by the boring head for the pipe installation will be disposed of by the Contractor. The excavated material from the boring pit will be used as backfill for the pit and compacted into place to the satisfaction of the Engineer.

Steel casing will be installed horizontally through 170' +/- of embankment. The pipe will be placed through an approximate 25' vertical depth of silt clay material. The parent formation from which the embankment material was excavated consists of shale and may contain minor sandstone and concretions. Large boulders are not anticipated to be encountered within the bore and jack envelope.

Installation of CMP ends on the steel pipe will require the placement of a minimum of 2 welded stops at each pipe end to prevent the end from slipping off the steel pipe. The location and size will be determined in the field by the Engineer and installed by a certified welder. Stops will be coated with a coal tar epoxy. All costs, including labor and materials for the installation of the stops will be incidental to the contract unit price per foot for the corresponding steel pipe furnish contract item. Alternative methods of attachment may be allowed with the approval of the Engineer.

Payment for furnishing the pipe will be incidental to the contract unit price per foot for the corresponding steel pipe furnish contract item.

All costs involved with boring and jacking the pipe including labor, equipment, welding, materials, disposal of waste material, constructing and backfilling the jacking pit, and excavating and backfilling the roadway embankment will be incidental to the contract unit price per foot for the corresponding bore and jack pipe contract item.

1:200
Plot Scale -

Plotted From -
TRPR17192

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B7	B25

Plotting Date: 03/29/2021

STEEL PIPE

Steel pipe will meet the same requirements, including pipe specifications, welding and coal tar epoxy coating as the steel pipe used in the bore and jack installation.

TEMPORARY FENCE

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

BRACE PANELS FOR ROW FENCE

The E-Z Brace or an approved equal may be utilized as an alternate horizontal brace in the brace panels if approved by the Engineer. The E-Z Brace will be attached to each wood post utilizing two 5/16" x 3" lag screws. Holes of appropriate diameter, based on wood post condition, will be drilled before placement of lag screws. The following are contacts regarding the E-Z Brace:

Roger Papka
E-Z Brace
1160 Karen St.
Watertown, SD 57201
605-881-6142

Dennis Mack
E-Z Brace
108 18th St. NE
Watertown, SD 57201
605-881-4990

TABLE OF SUPERELEVATION

Station	to	Station	
858+25		858+25	- 0.0374 Existing Cross Slope
858+25		858+75	Superelevation Transition
858+75		861+19	- 2910' Radius Curve Left
			0.0540'/' Superelevation Rate
			Point of Rotation at Centerline
861+19		861+50	- Superelevation Transition
861+50		861+50	- 0.0437 Existing Cross Slope

TABLE OF CONSTRUCTION STAKING

(See Special Provision for Contractor Staking)

Roadway and Description	Begin Station	End Station	Number of Lanes	Length (Ft)	Grade Staking				Miscellaneous Staking Quantity (Mile)	Slope Staking Quantity (Mile)	Final Cross Section Survey Quantity (Mile)
					Length (Mile)	Lane Factor	*Sets of Stakes	**Grade Staking Quantity (Mile)			
SD44 Landslide Repair Right Side – Berm	856+00	858+50	0	250	0.047	0	0	0	0.047	0.047	0.047
SD44 Landslide Repair Right Side – Lane and Shoulder	858+50	861+25	1	275	0.052	1	1	0.052	0.052	0.052	0.052
SD44 Landslide Repair Right Side – Berm	861+25	862+25	0	100	0.019	0	0	0	0.019	0.019	0.019
SD44 Landslide Repair Left Side Excavation	853+00	862+00	0	900	0.171	0	0	0	0.171	0	0.171
Totals:								0.052	0.289	0.118	0.289

- * 1 = Blue Top Stakes Only (Asphalt Concrete Pavement)
** Grade Staking Quantity = (Length) x (Lane Factor) x (Sets of Stakes)

TABLE OF FENCE

		ROW Fence		Fence Panels		Temporary Fence		Remove Fence		
Station	to	Station	Side	Type 2 (Ft)	Type 3 (Ft)	2 Post (Each)	3 Post (Each)	Type 2 (Ft)	(Ft)	
852+65		862+55	L	925		13	1	1440	950	Note: Right-of-way fence will be constructed using alternate wood and steel posts except as noted.
855+86		862+72	R	0	1140	10	0		732	
			Totals =	925	1140	23	1	1440	1682	

PUBLIC LANDS SURVEY SYSTEM, RIGHT OF WAY, AND PROPERTY CORNERS

The Contractor will have a Land Surveyor, licensed in the State of South Dakota, to set, reestablish or verify public land survey system (PLSS) corners, right of way (ROW) corners, and property corners as directed by the appropriate SDDOT Region Land Surveyor. It is estimated that 1 PLSS corners and 20 ROW and property corners will be set, reestablished, or verified for this

project. The Contractor's Land Surveyor, under the direction of the Region Land Surveyor, will set, reestablish, or verify all corner monuments after surfacing and fencing operations are completed in accordance with the PUBLIC LANDS SURVEY SYSTEM CORNERS section and the RIGHT OF WAY AND PROPERTY CORNERS section in Chapter 8 of the SDDOT Survey Manual.

< <https://dot.sd.gov/doing-business/engineering/design-services/surveyors> >

All costs associated with furnishing and installing PLSS caps, rebar, and all other materials associated with setting, reestablishing, or verifying PLSS, ROW corners, and property corners in accordance with the SDDOT Survey Manual will be incidental to the contract unit price per each for "Reestablish Public Land Survey System Corner" and/or "Reestablish Right-of-Way and Property Corner".

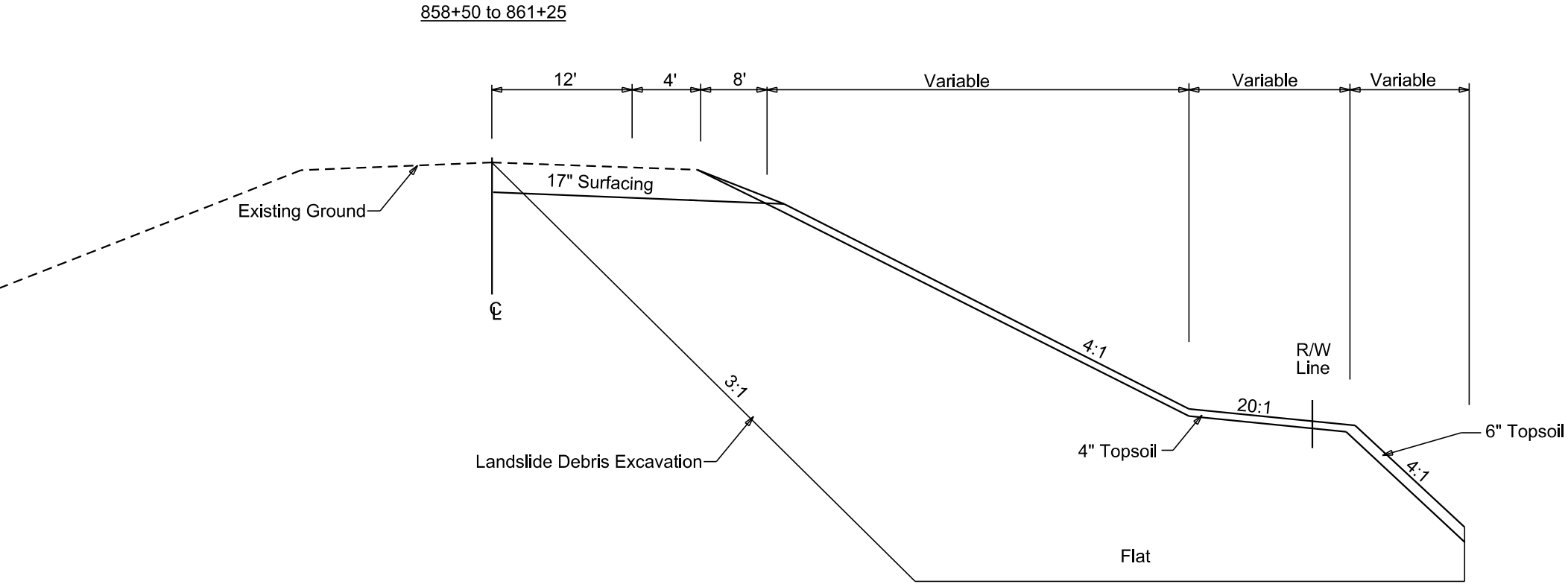
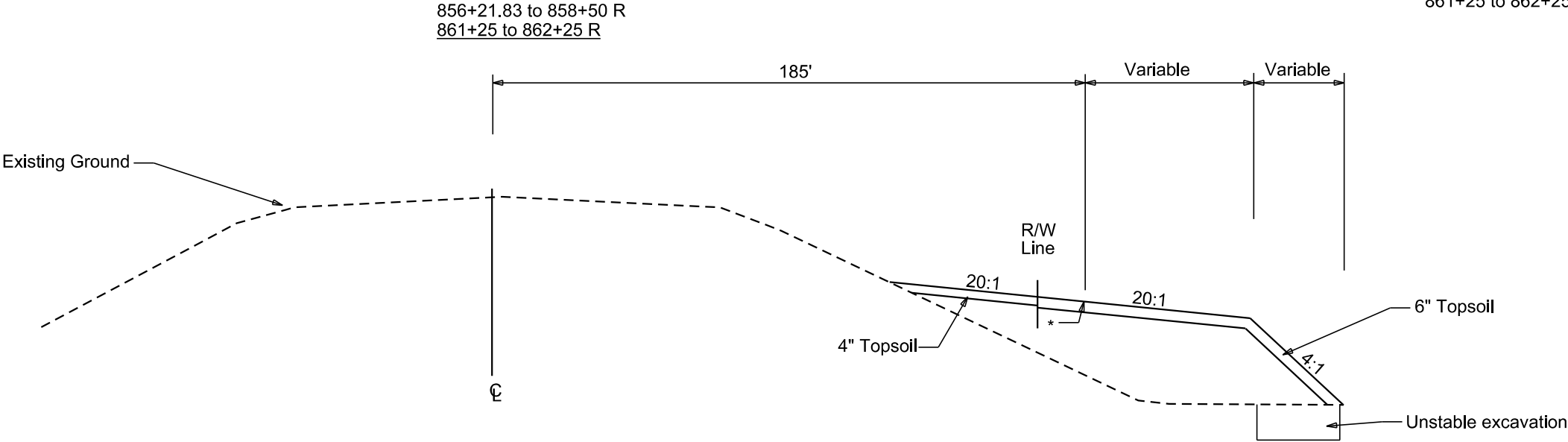
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TYPICAL GRADING SECTIONS

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B8	B25

Plotting Date: 03/23/2021

* 856+21.83 to 858+50 Elev 1470
861+25 to 862+25 Elev 1460



Plot Scale - 1:200

Plotted From - TRPR17192

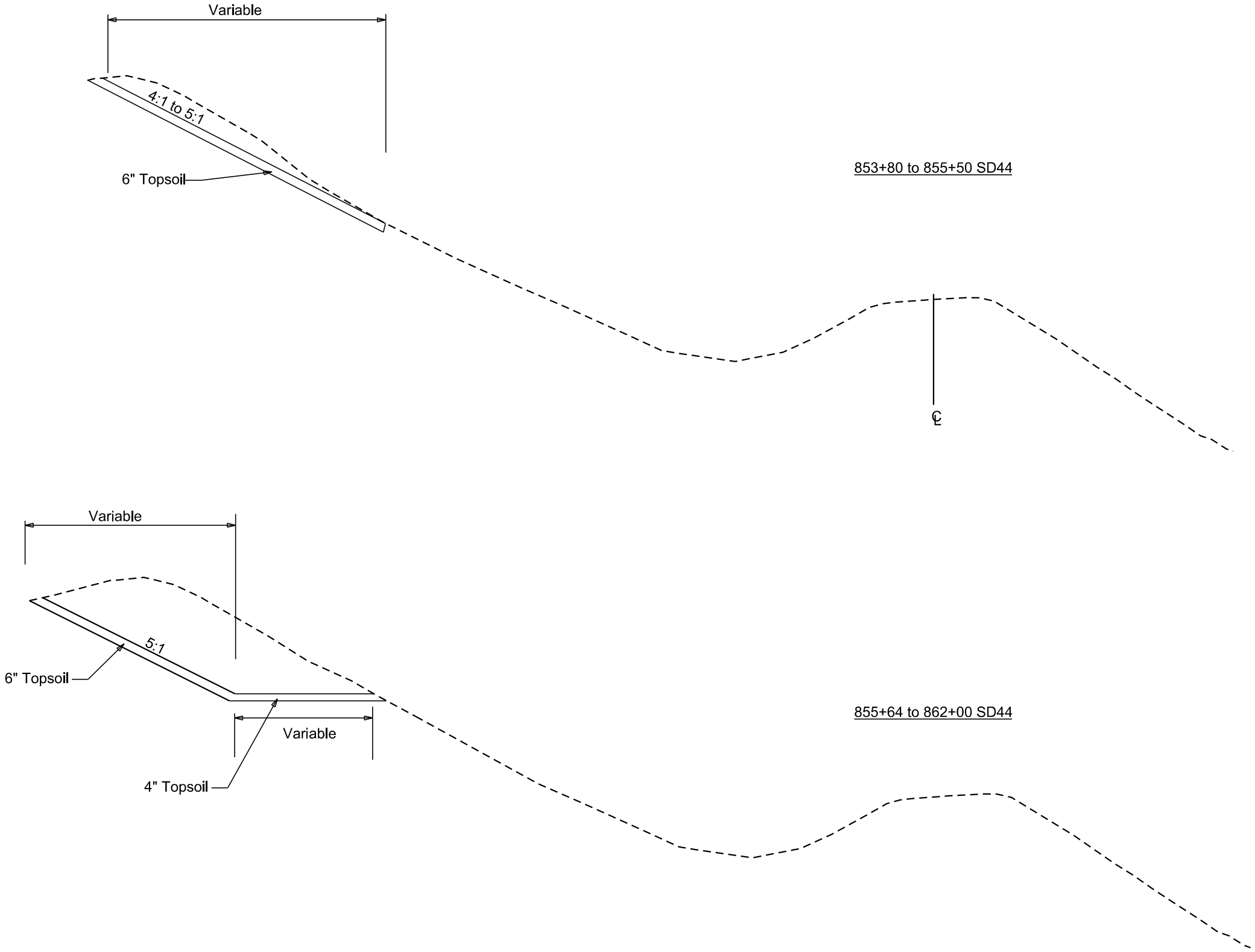
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Plot Scale - 1:200

Plotted From - TRPR17192

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B9	B25

Plotting Date: 03/23/2021



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Plot Scale -
Plotted From -
TRPR17192

HORIZONTAL ALIGNMENT DATA

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B10	B25

Plotting Date: 03/23/2021

MAINLINE

Type	Station			Northing	Easting
POB	850+00.00			384160.267	2282688.945
		TL= 522.91	N 84°16'45" E		
PC	855+22.91			384212.392	2283209.248
PI	860+19.27	R = 2910.00	Delta = 19°21'35" L	384261.871	2283703.136
PT	865+06.16			384472.275	2284152.695
		TL= 499.96	N 64°55'10" E		
POE	870+06.13			384684.206	2284605.519

SD44 (Future SD44)

Type	Station			Northing	Easting
POB	822+13.08			383308.436	2280950.866
		TL= 417.71	N 45°50'06" E		
PC	826+30.79			383599.463	2281250.501
PI	832+95.85	R = 1909.86	Delta = 38°23'56" R	384062.829	2281727.574
PT	839+10.75			384129.647	2282389.270
		TL= 65.95	N 84°14'02" E		
PI	839+76.70			384136.274	2282454.890
EQNBK	839+76.70			384136.274	2282454.890
EQNAHD	A 847+60.60			384136.274	2282454.890
		TL= 564.83	N 84°14'02" E		
PC	A 853+25.43			384193.022	2283016.865
PI	A 858+63.33	R = 2910.00	Delta = 20°56'43" L	384247.064	2283552.040
PT	A 863+89.22			384488.847	2284032.533
		TL= 7182.03	N 63°17'19" E		
PC	A 935+71.25			387717.143	2290448.111
PI	A 939+67.98	R = 5210.00	Delta = 8°42'33" R	387895.473	2290802.504
PT	A 943+63.18			388018.084	2291179.814
		TL= 2088.97	N 71°59'52" E		
PC	A 964+52.16			388663.690	2293166.520
PI	A 965+71.63	R = 3274.05	Delta = 4°10'47" R	388700.615	2293280.146
PCC	B 100+50.00			388729.159	2293396.162
PI	B 105+30.10	R = 3274.05	Delta = 16°41'04" R	388843.862	2293862.356
EQNBK	A 966+91.00			388729.159	2293396.162
EQNAHD	B 100+50.00			388729.159	2293396.162
PT	B 110+03.40			388819.890	2294341.856
		TL= 906.96	S 87°08'17" E		
POE	B 119+10.36			388774.604	2295247.687

The coordinates shown on this sheet are based on the South Dakota State Plane Coordinate System. North Zone (NAD 83/11); epoch 2010.00; Geoid 12A; SF = 0.9998442579

Plotted From -

TRPR17192

Plot Scale -

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CONTROL DATA

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B11	B25

Plotting Date: 03/23/2021

HORIZONTAL AND VERTICAL CONTROL POINTS						
POINT	STATION	OFFSET	DESCRIPTION	NORTHING	EASTING	ELEVATION
CP21	A947+93(F. SD44)	385' R	5/8" REBAR	387784.819	2291707.302	1412.604
CP22	A933+55(F. SD44)	348' R	5/8" REBAR	387316.428	2290424.967	1398.650
CP23	A872+05(F. SD44)	212' R	5/8" REBAR	384666.297	2284856.433	1415.228
CP24	857+18(SD 44)	25' R	5/8" REBAR	384213.951	2283406.928	1499.668
CP25	832+87(F. SD44)	25' L	5/8" REBAR	383990.279	2281779.621	1553.805

The coordinates shown on this sheet are based on the South Dakota State Plane Coordinate System. North Zone (NAD 83/11); epoch 2010.00
Geoid 12A; SF = 0.9998442579
The elevations shown on this sheet are based on NAVD 88.

1:200
Plot Scale -
TRPR17192
Plotted From -

LEGEND

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B12	B25

Plotting Date: 03/23/2021

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			
Control Point		Pipe Without End Section		Underground High Pressure Gas Line		Remove Concrete Pavement	
Creek Edge		Playground Slide		Underground Sanitary Sewer		Remove Concrete Driveway Pavement	
Curb/Gutter		Playground Swing		Underground Storm Sewer		Remove Asphalt Concrete Pavement	
Curb		Power And Light Pole		Underground Tank		Remove Concrete Sidewalk	
Dam Grade/Dike/Levee		Power And Telephone Pole		Underground Telephone Line		Remove Concrete Median Pavement	
Deck Edge		Power Meter		Underground Television Cable		Remove Concrete Curb and/or Gutter	
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					

Plot Scale - 1:200

Plotted From - TRPR17192

853+80-50'+- R
Exhume & Reset Underdrain Headwall
(Incidental Work, Grading)

856+20 (9 ac)
(Skew 18° RHF)
Bore & Jack 30" - 170' Steel Pipe
Install 30"-14' Steel Pipe
& 2 CMP Sloped Ends

855+79-83' R
Take Out 18" - 115' CMP
(Incidental Work, Grading)

856+51-98' R
Install Bank and Channel
Protection Gabions (6 CY)
and Type B Drainage Fabric
(19 SqYd)

856+07 Fill 24"-188' CMP
with Cellular Grout

855+25-55' R to 856+29-110' R (4 ac)
Install 18" - 114' CMP (14', 90 & 10')
& 1 CMP Safety End
& 1 CMP Flared End

861+42
Take Out 24"-190' CMP
(Incidental Work, Grading)

861+50- (5 ac)
Install 24" - 128' RCP
Skewed 27.5° RHF
& 2 Sloped Ends

861+77-53' R
Install Bank and Channel
Protection Gabions (4.5 CY)
and Type B Drainage Fabric
(15 SqYd)

856+29-110'R
Install Bank and Channel
Protection Gabions (4.5 CY)
and Type B Drainage Fabric
(15 SqYd)

State of South Dakota
(Department of Game, Fish & Parks)

The W1/2 NE1/4 of Section 20 -
Township 99 North - Range 70 West of the 5th P.M.

Parcel 1
3.51 ac, Permanent Easement
(152874 sq ft) more or less

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B13	B25

Plotting Date: 04/23/2021 Rev 04/23/2021(BT)

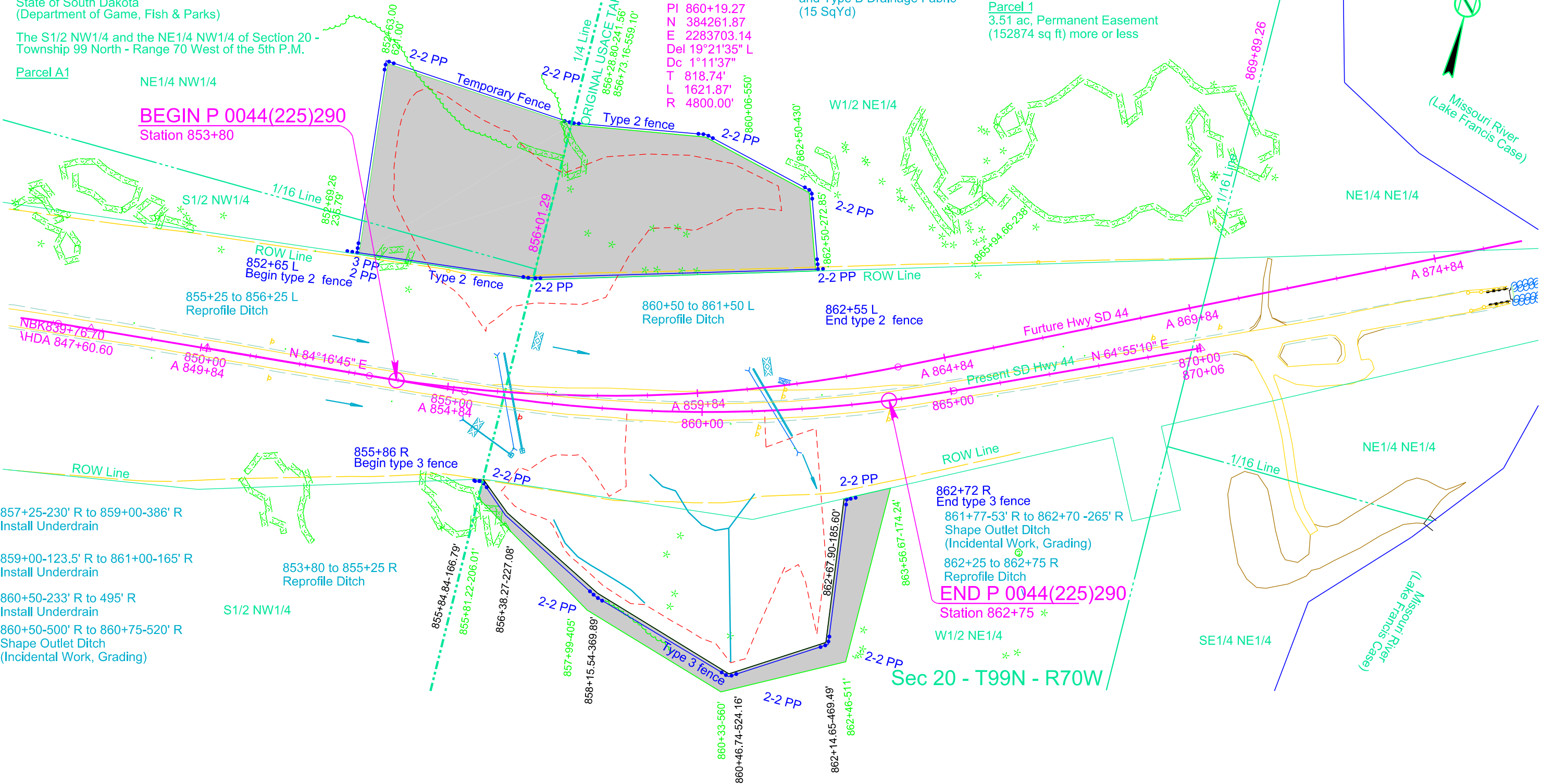
State of South Dakota
(Department of Game, Fish & Parks)

The S1/2 NW1/4 and the NE1/4 NW1/4 of Section 20 -
Township 99 North - Range 70 West of the 5th P.M.

Parcel A1

NE1/4 NW1/4

BEGIN P 0044(225)290
Station 853+80

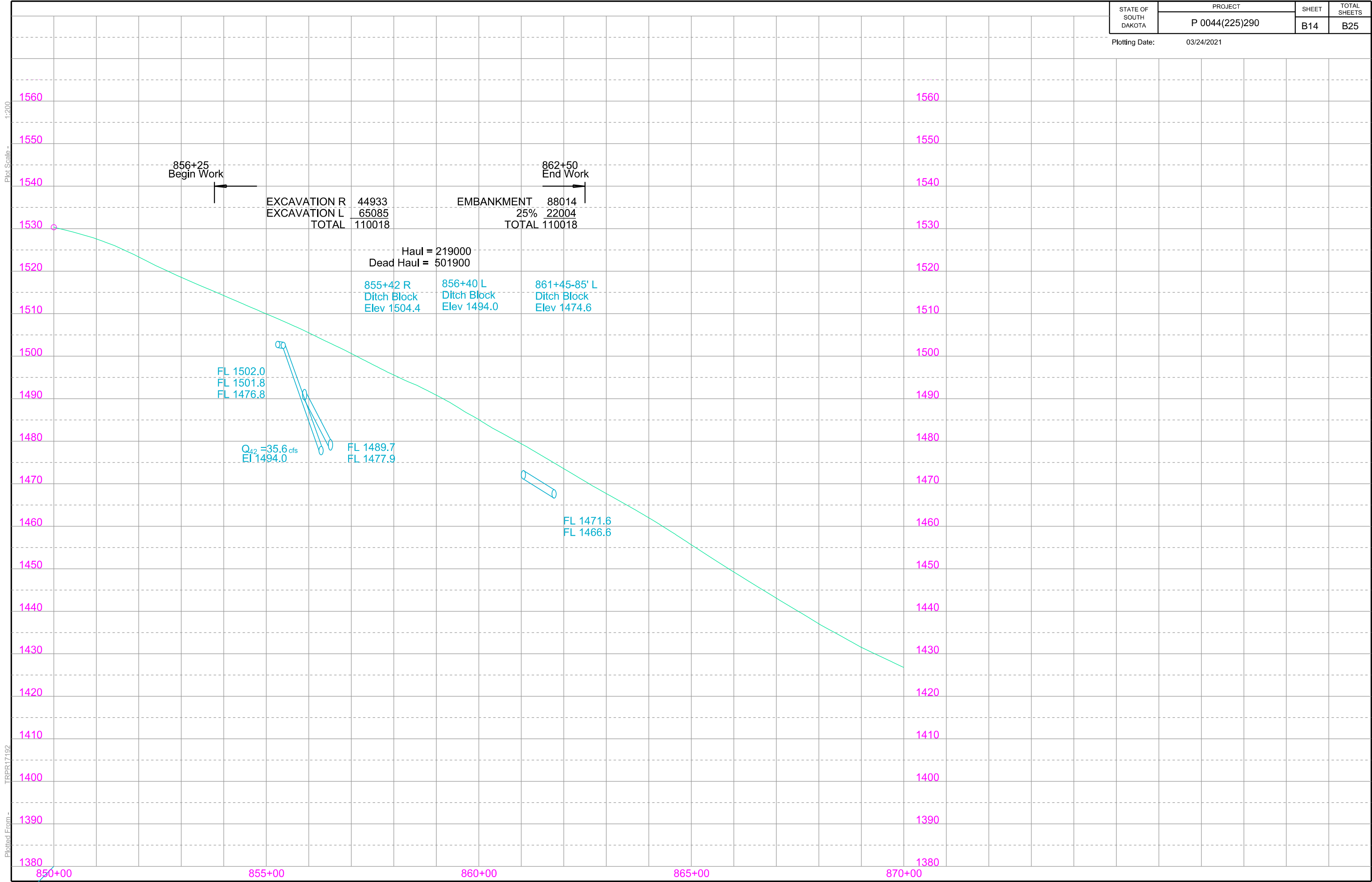


Parcel A1
852+63 to 856+73.16 L
Temporary Easement containing
3.0 ac, more or less

Parcel 1
855+81.22 to 863+56.67 R
Temporary Easement containing
1.2 ac, more or less

Parcel 1
856+28.80 to 862+50 L
Temporary Easement containing
3.1 ac, more or less

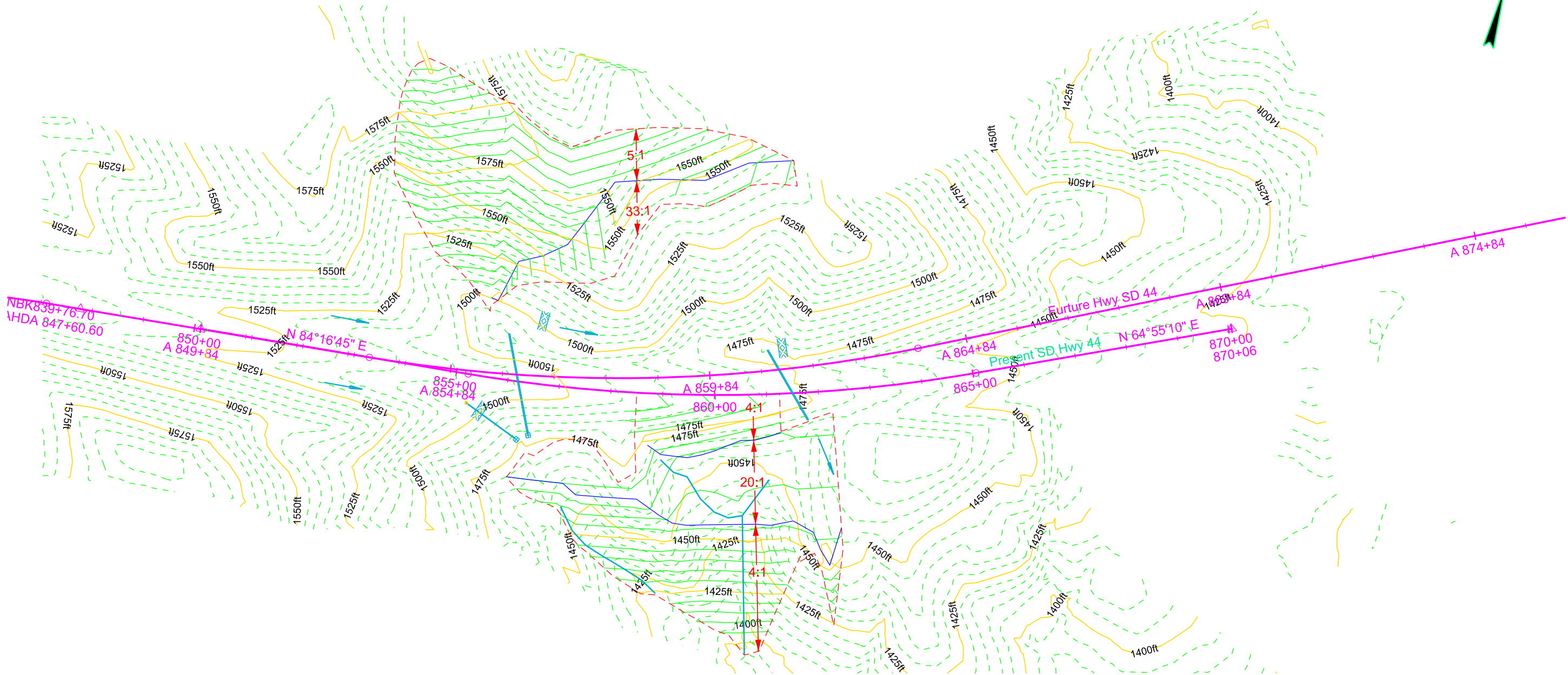
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CONTOURS

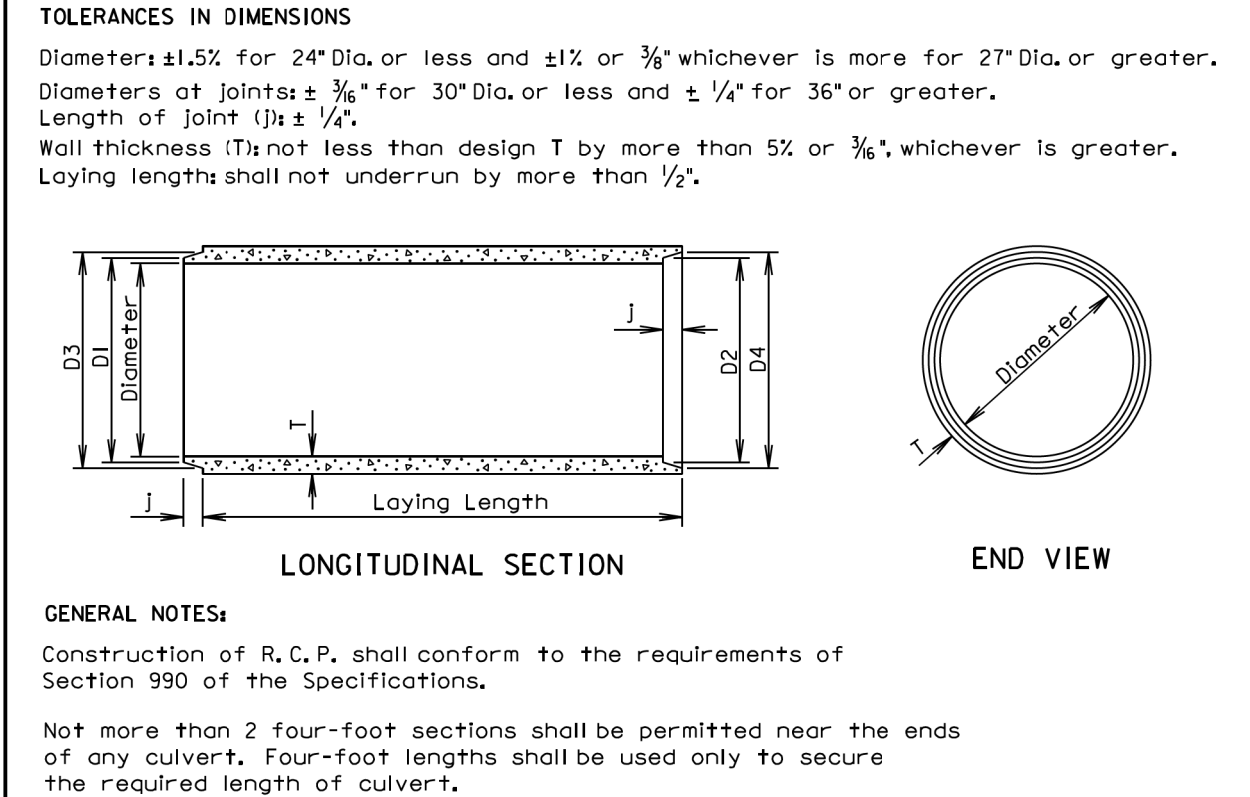
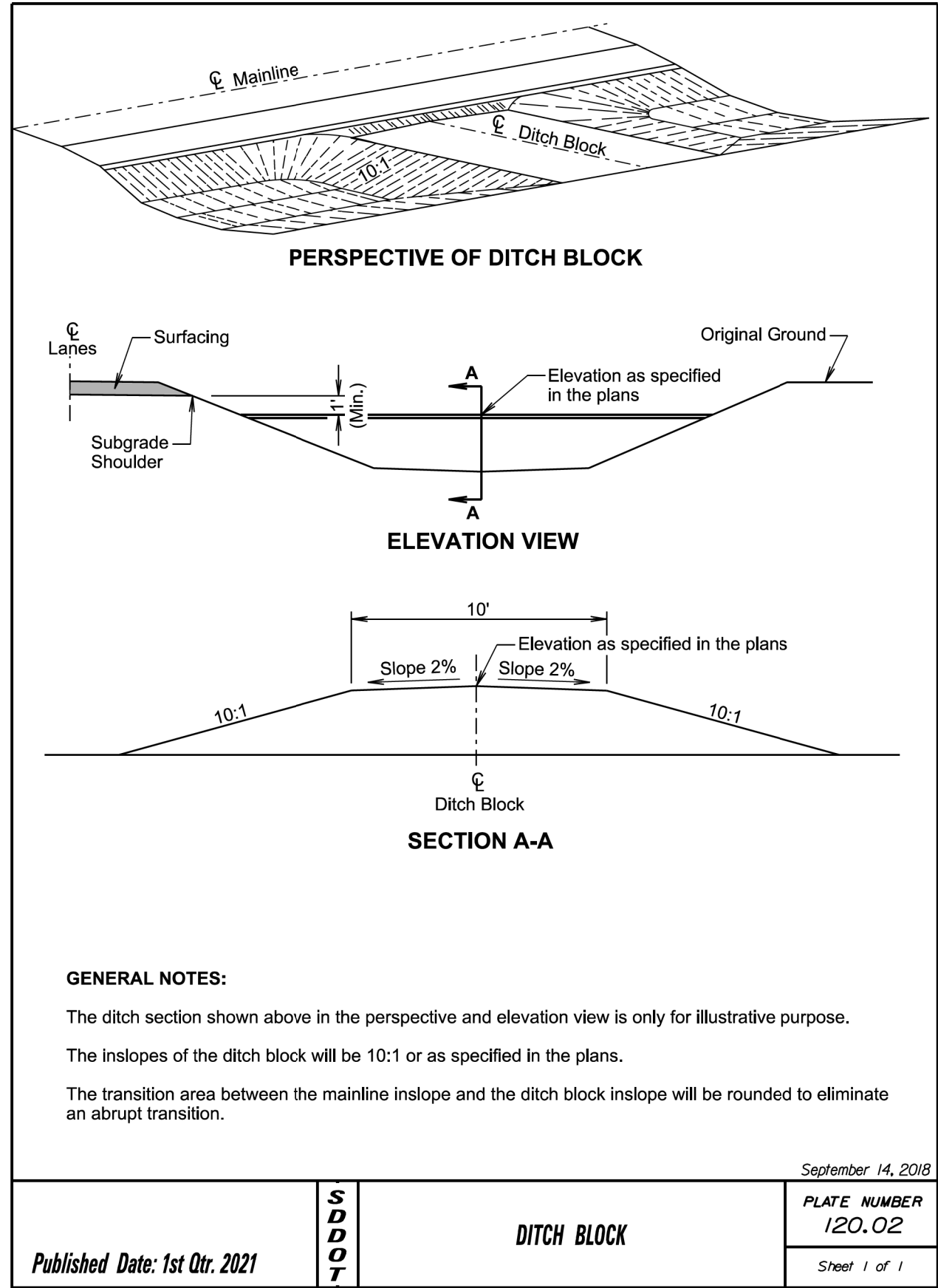
STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	P 0044(225)290	B15	B25

Plotting Date: 03/23/2021



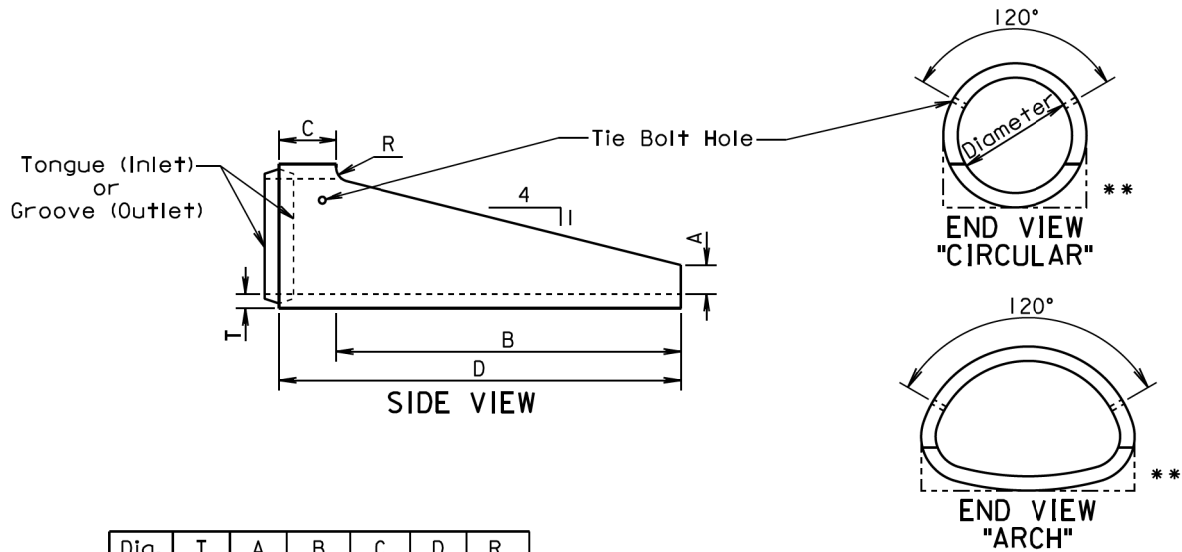
Plot Scale - 1:200

Plotted From - TRPR17192



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 3/8	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 3/4	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

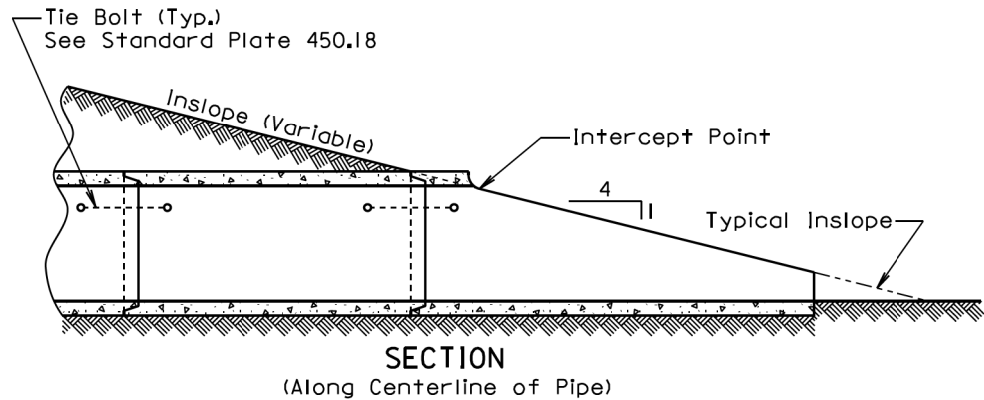
S D D O T	REINFORCED CONCRETE PIPE	PLATE NUMBER 450.01
		Sheet 1 of 1
		Published Date: 1st Qtr. 2021



Dia. (in.)	T (in.)	A (in.)	B (in.)	C (in.)	D (in.)	R (in.)
FOR CIRCULAR PIPE						
24	3	6	72	12	84	3
30	3½	7½	90	12	102	3½
FOR ARCH PIPE						
* 24	3	6	48	12	60	3
* 30	3½	7½	60	12	72	3½
* 36	4½	8⅝	66	30	96	0
* 42	4½	10	77¼	18¾	96	0

* Equivalent Diameter of Circular R.C.P.
** Acceptable Flat Bottom Alternate.

Dia. (in.)	T (in.)	A (in.)	B (in.)	C (in.)	D (in.)	R (in.)
FOR CIRCULAR PIPE						
24	3	9	72	12	84	0
30	3½	11	90	12	102	0
FOR ARCH PIPE						
* 24	3	9	48	12	60	0
* 30	3½	11	60	12	72	0



GENERAL NOTE:
The length of concrete pipe shown in the construction plans is between sloped ends.

September 22, 2006

<i>Published Date: 1st Qtr. 2021</i>	S D D O T	R. C. P. SLOPED ENDS	PLATE NUMBER 450.13
			Sheet 1 of 1

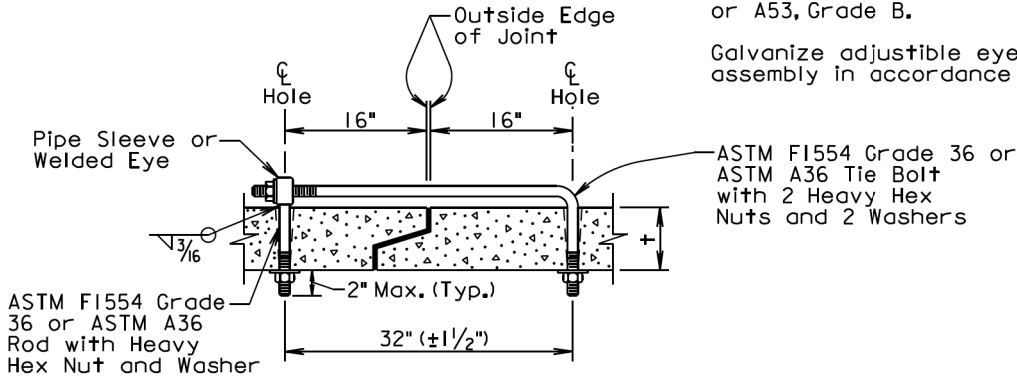
Wall "t" (in.)	Rod Dia. (in.)	Pipe Sleeve Dia. (nominal)
≤ 3¼	5⁄8	¾
3½-6½	¾	1
≥ 7	1	1¼

GENERAL NOTES:

Tie bolts shall conform to ASTM F1554 Grade 36 or ASTM A36. Nuts shall be heavy hex conforming to ASTM A563. Washers shall conform to ASTM F436.

Pipe Sleeve shall conform to ASTM A500 or A53, Grade B.

Galvanize adjustable eye bolt tie assembly in accordance with ASTM A153.



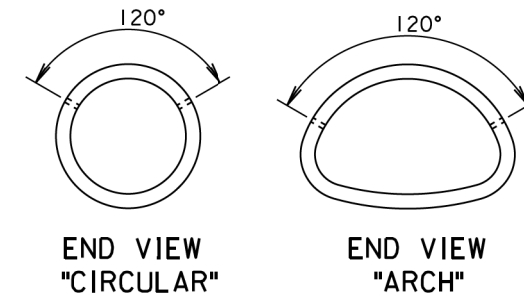
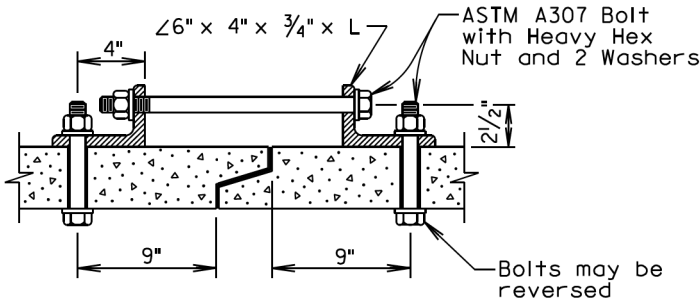
Pipe Dia. (in.)	"L" (in.)	Bolt Dia. (in.)
≤ 48	4	¾
> 48	6	1

GENERAL NOTES:

Angles shall conform to ASTM A36.

Bolts shall conform to ASTM A307. Nuts shall be heavy hex conforming to ASTM A563. Washers shall conform to ASTM F436.

Galvanize angles, bolts, nuts, and washers in accordance with ASTM A153.



GENERAL NOTES:

In lieu of the tie bolts detailed above other types of tie bolt connections may be installed as approved by the Office of Bridge Design.

All pipe sections of R.C.P. and R.C.P. Arch shall be tied with tie bolts except for pipe located between drop inlets, manholes, and junction boxes. All pipe sections of pipes that only enter or exit drop inlets, manhole, and junction boxes shall be tied with tie bolts.

There will be no separate measurement or payment for the tie bolts. The cost for furnishing and installing the tie bolts shall be incidental to the contract unit price per foot for the corresponding bid item for R.C.P. or R.C.P. Arch.

February 28, 2013

<i>Published Date: 1st Qtr. 2021</i>	S D D O T	TIE BOLTS FOR R.C.P. AND R.C.P. ARCH	PLATE NUMBER 450.18
			Sheet 1 of 1

2 Piece			2 Piece			3 Piece				
5° to 45° Elbow			50° to 90° Elbow			90° Elbow				
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	25½	11	18½	4
15	1	2	15	2	4	15	26½	12	18	4
18	1	2	18	2	4	18	27	14	17	4
21	2	4	21	2	4	21	27	15	16½	4
24	2	4	24	2	4	24	27½	16	16	4
27	2	4	27	2	4	27	27½	17	15½	4
30	2	4	30	3	6	30	40	19	26½	6
33	2	4	33	3	6	33	40	20	26	6
36	2	4	36	3	6	36	40½	21	25½	6
42	2	4	42	3	6	42	41	23	24½	6
48	2	4	48	4	8	48	53½	26	35	8
54	3	6	54	4	8	54	54	28	34	8
60	3	6	60	4	8	60	54½	31	32½	8
66	3	6	66	4	8	66	54	33	31½	8
72	3	6	72	5	10	72	67½	36	42	10
78	3	6	78	5	10	78	68	39	40½	10
84	3	6	84	5	10	84	68½	41	39½	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

<i>Published Date: 1st Qtr. 2021</i>	S D D O T	C.M.P. FABRICATED LENGTHS FOR ELBOWS	PLATE NUMBER
			450.32
			Sheet 1 of 1

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

PLAN

ELEVATION

TUBING ATTACHMENT DETAILS SECTION A-A

TYPICAL CROSS-SECTION

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

Dia. D (in.)	Ga.	DIMENSIONS (in.)					Approx. Slope	Body
		A	B	H	L	W		
12	16	6	6	6	21	24	2½:1	1 Pc.
15	16	7	8	6	26	30	2½:1	1 Pc.
18	16	8	10	6	31	36	2½:1	1 Pc.
21	16	9	12	6	36	42	2½:1	1 Pc.
24	16	10	13	6	41	48	2½:1	1 Pc.
30	14	12	16	8	46	60	2½:1	1 Pc.
36	14	14	19	9	51	72	2½:1	2 Pc.
42	12	16	22	11	60	84	2½:1	2 Pc.
48	12	18	27	12	69	90	2¼:1	2 Pc.
54	12	18	30	12	78	102	2:1	3 Pc.
60	12	18	33	12	84	114	1¾:1	3 Pc.
66	12	18	36	12	87	120	1½:1	3 Pc.
72	12	18	39	12	87	126	1½:1	3 Pc.
78	12	18	42	12	87	132	1¼:1	3 Pc.
84	12	18	45	12	87	138	1⅙:1	3 Pc.

STANDARD CONNECTIONS

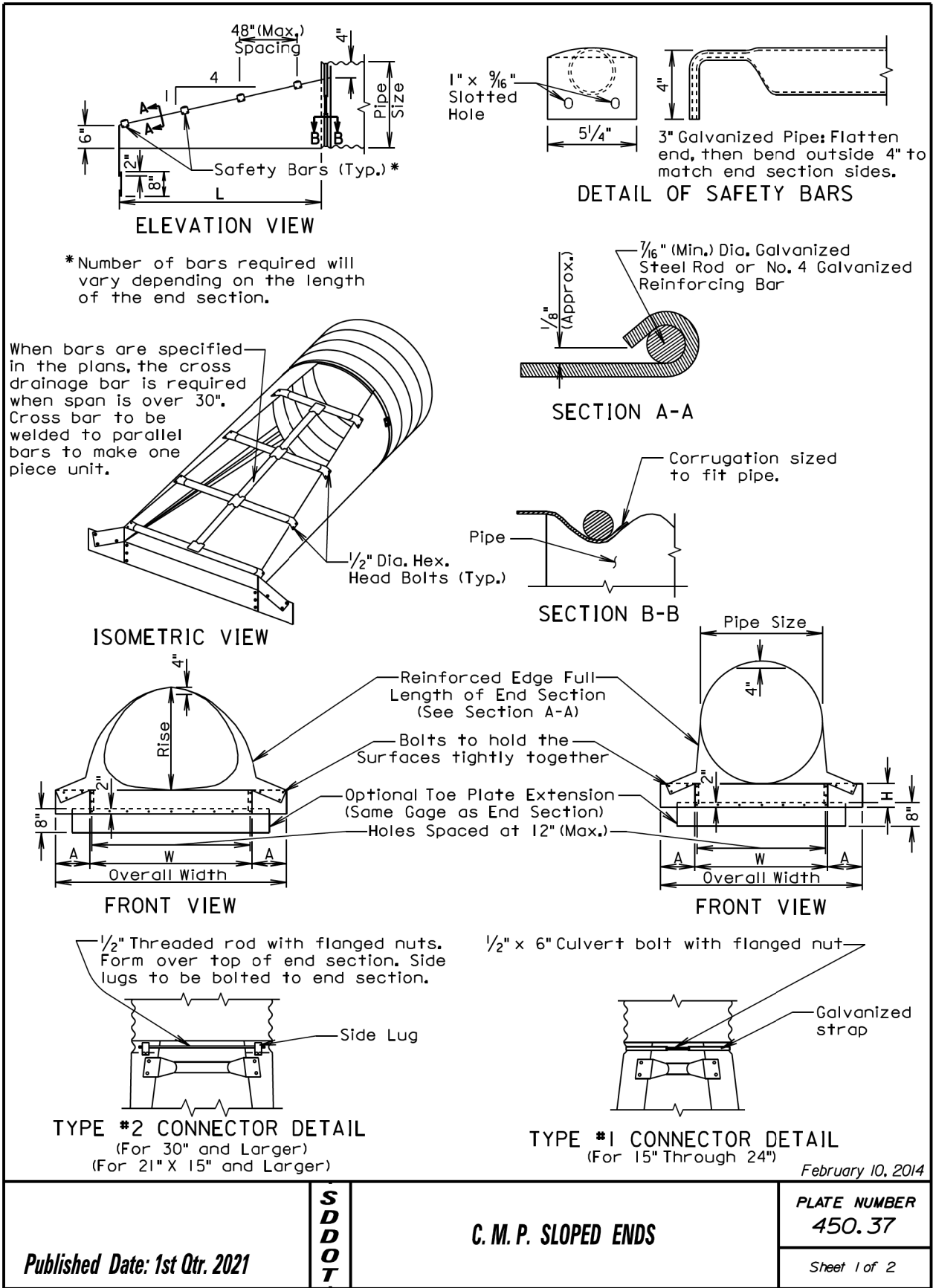
For 30" through 84"

Alternate for all sizes

For 12" through 24" only

SECTION A-A (alternate)

<i>Published Date: 1st Qtr. 2021</i>	S D D O T	C.M.P. FLARED ENDS	PLATE NUMBER
			450.35
			Sheet 1 of 1



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	Length (Inch)
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 shall be attached to sloped ends over 30" in diameter only when specified in the plans.

Sloped ends shall be fabricated from galvanized steel and shall conform to the requirements of the Specifications.

Safety bars shall 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 shall be provided for all end sections.

Attachment to circular pipes 15" through 24" diameter shall be made with Type #1 straps. All other sizes shall be attached with Type #2 rods and lugs.

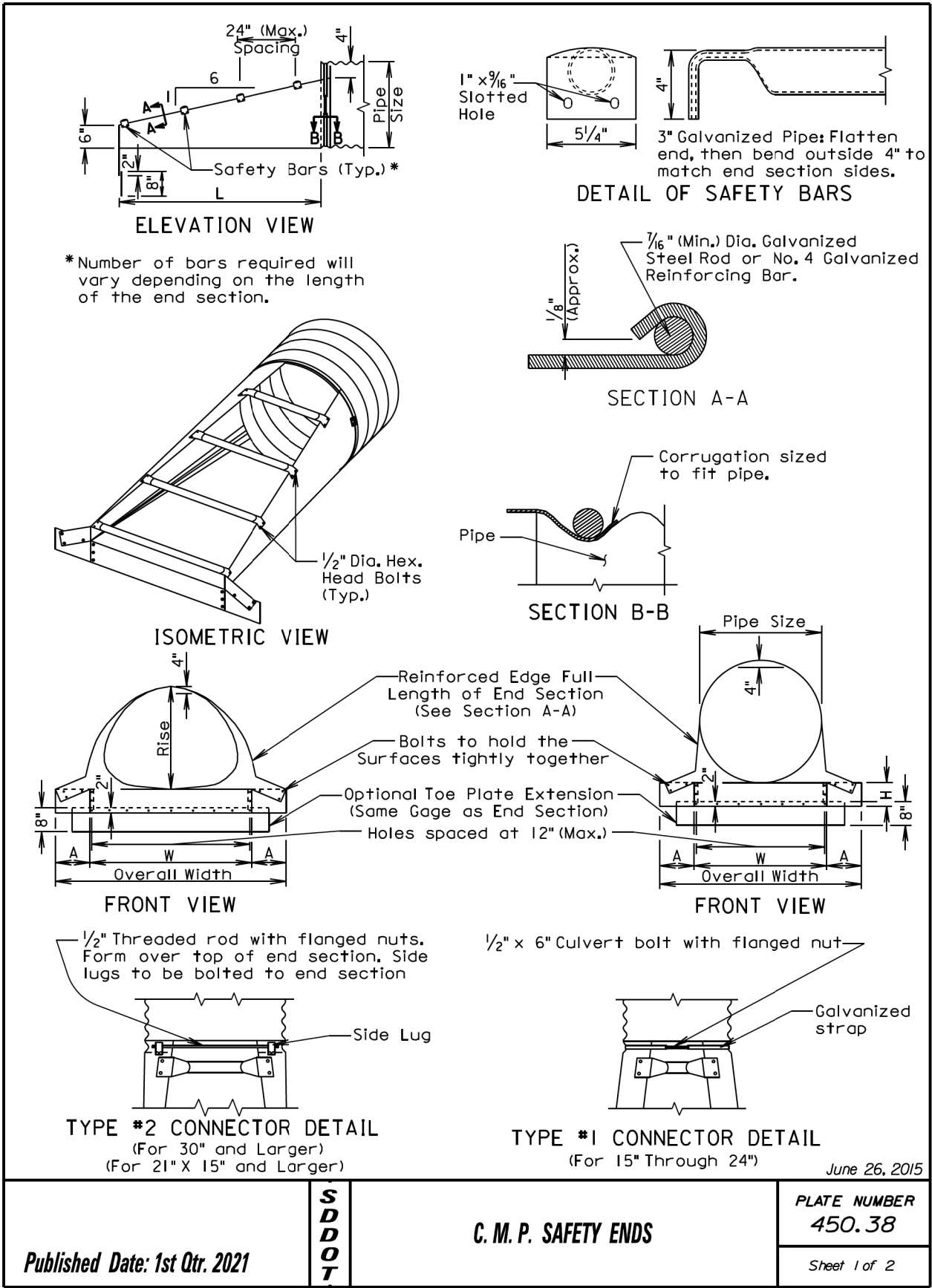
When stated in the plans, optional toe plate extension shall be punched and bolted to end section apron lip with 3/8" diameter galvanized bolts. Steel for toe plate extension shall be same gauge as end section. Dimensions shall be overall width less 6" by 8" high.

Installation shall be performed in accordance with the Specifications.

Cost of all work and materials required for fabrication and installation of sloped ends shall be incidental to the bid items for the various sizes of sloped ends.

February 10, 2014

Published Date: 1st Qtr. 2021	S D D O T	C. M. P. SLOPED ENDS	PLATE NUMBER 450.37
			Sheet 2 of 2



ARCH C.M.P. SAFETY ENDS										
Equiv. Dia. (Inch)	(Inches)		Min. Thick.		Dimensions (Inches)			L Dimensions		
	Span	Rise	Inch	Gage	A	H	W	Overall Width	Slope	Length (Inch)
18	21	15	.064	16	8	6	27	43	6:1	30
21	24	18	.064	16	8	6	30	46	6:1	48
24	28	20	.064	16	8	6	34	50	6:1	60
30	35	24	.079	14	12	9	41	65	6:1	84
36	42	29	.109	12	12	9	48	72	6:1	114
42	49	33	.109	12	16	12	55	87	6:1	138
48	57	38	.109	12	16	12	63	95	6:1	168
54	64	43	.109	12	16	12	70	102	6:1	198
60	71	47	.109	12	16	12	77	109	6:1	222
72	83	57	.109	12	16	12	89	121	6:1	282

CIRCULAR C.M.P. SAFETY 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	6:1	30
18	.064	16	8	6	24	40	6:1	48
21	.064	16	8	6	27	43	6:1	66
24	.064	16	8	6	30	46	6:1	84
30	.109	12	12	9	36	60	6:1	120
36	.109	12	12	9	42	66	6:1	156
42	.109	12	16	12	48	80	6:1	192
48	.109	12	16	12	54	86	6:1	228
54	.109	12	16	12	60	92	6:1	264
60	.109	12	16	12	66	98	6:1	300

GENERAL NOTES:

Safety ends shall be fabricated from galvanized steel conforming to the requirements of the Specifications.

Safety bars shall 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 shall be provided for all end sections.

Attachment to circular pipes 15" through 24" diameter shall be made with Type #1 straps. All other sizes shall be attached with Type #2 rods and lugs.

When stated in the plans, optional toe plate extension shall be punched and bolted to end section apron lip with 3/8" diameter galvanized bolts. Steel for toe plate extension shall be same gauge as end section. Dimensions shall be overall width less 6" by 8" high.

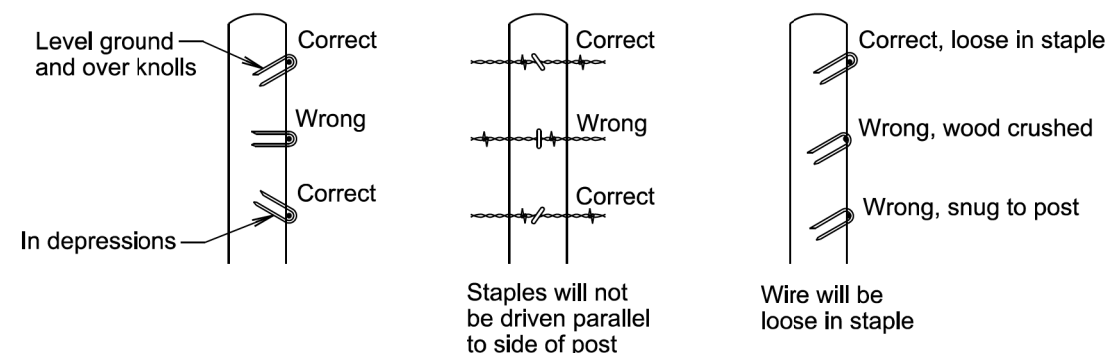
Installation shall be performed in accordance with the Specifications.

Cost of all work and materials required for fabrication and installation of safety ends shall be incidental to the bid items for the various sizes of safety ends.

June 26, 2015

Published Date: 1st Qtr. 2021	S D D O T	C. M. P. SAFETY ENDS	PLATE NUMBER 450.38
			Sheet 1 of 2

Published Date: 1st Qtr. 2021	S D D O T	C. M. P. SAFETY ENDS	PLATE NUMBER 450.38
			Sheet 2 of 2



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.

GENERAL NOTES:

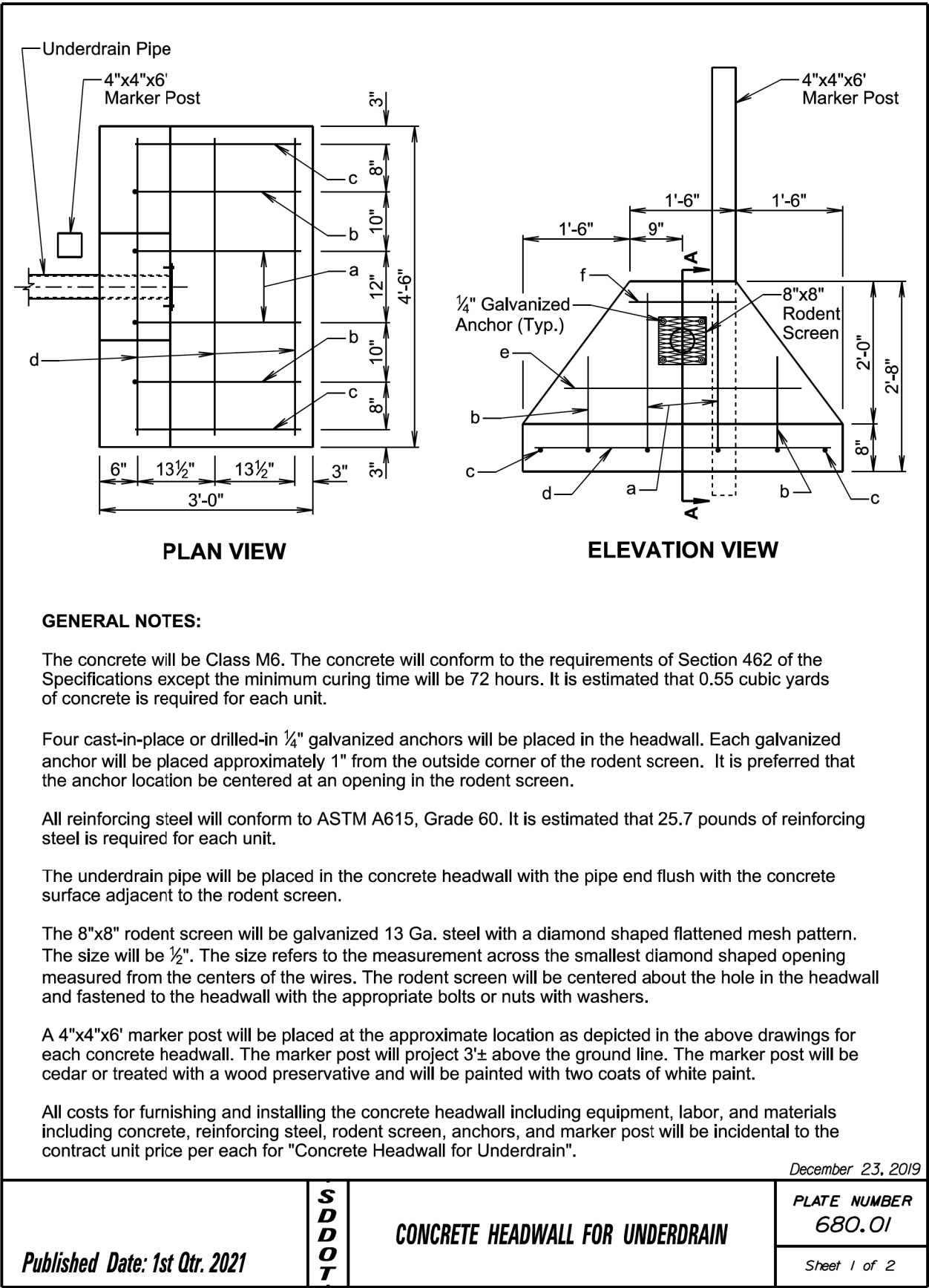
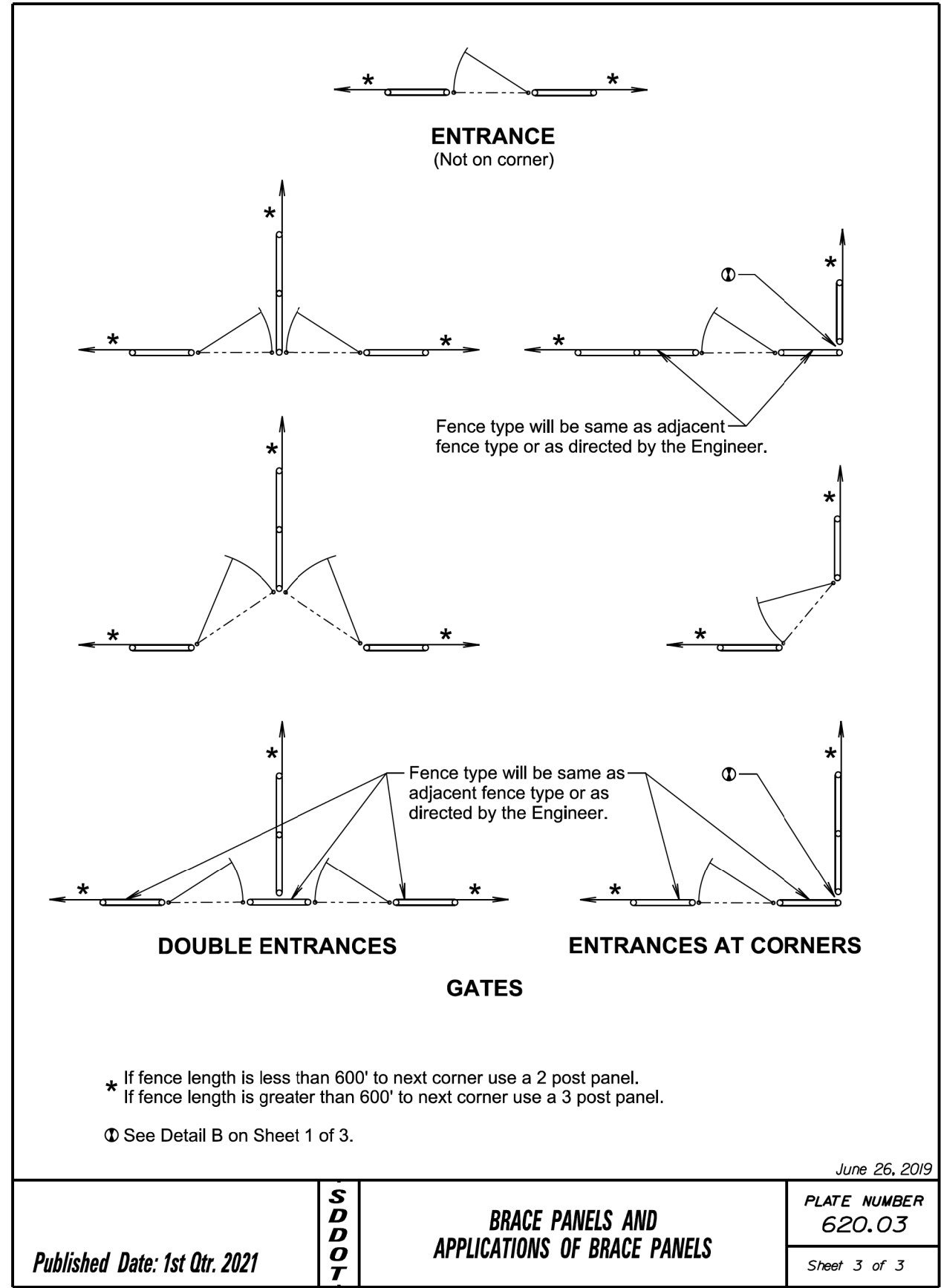
Fence types designated on the plans that are followed by the letter S will have smooth (barbless) wires.

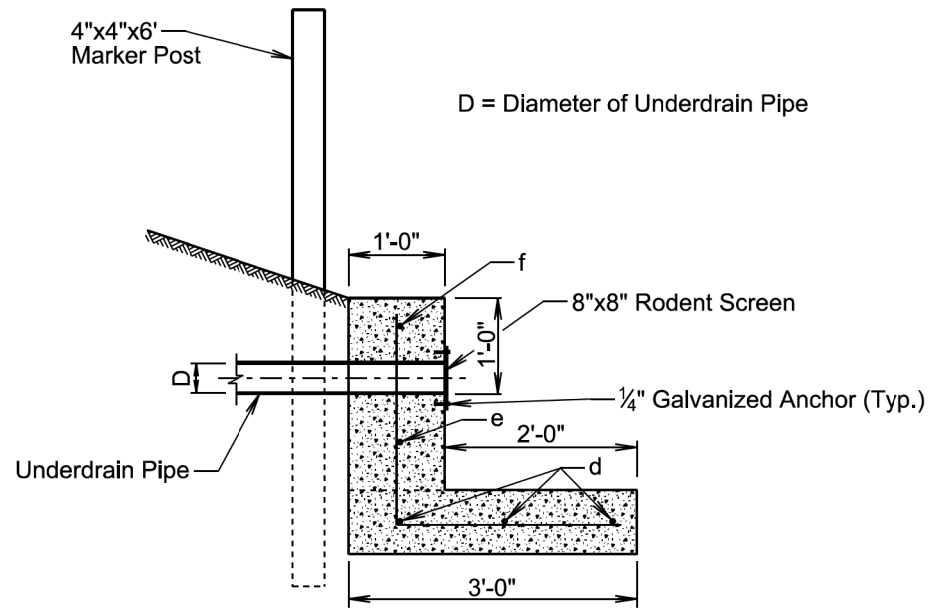
When type 5S or 6S is designated the bottom wire may be barbed, smooth, or left off.

All degrees of curvature stated for fence are at centerline of roadway.

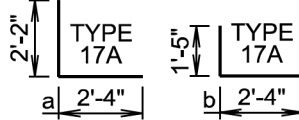
June 26, 2019

Published Date: 1st Qtr. 2021	S D D O T	STAPLE INSTALLATION AND GENERAL RIGHT-OF-WAY FENCE NOTES	PLATE NUMBER 620.02
			Sheet 1 of 1



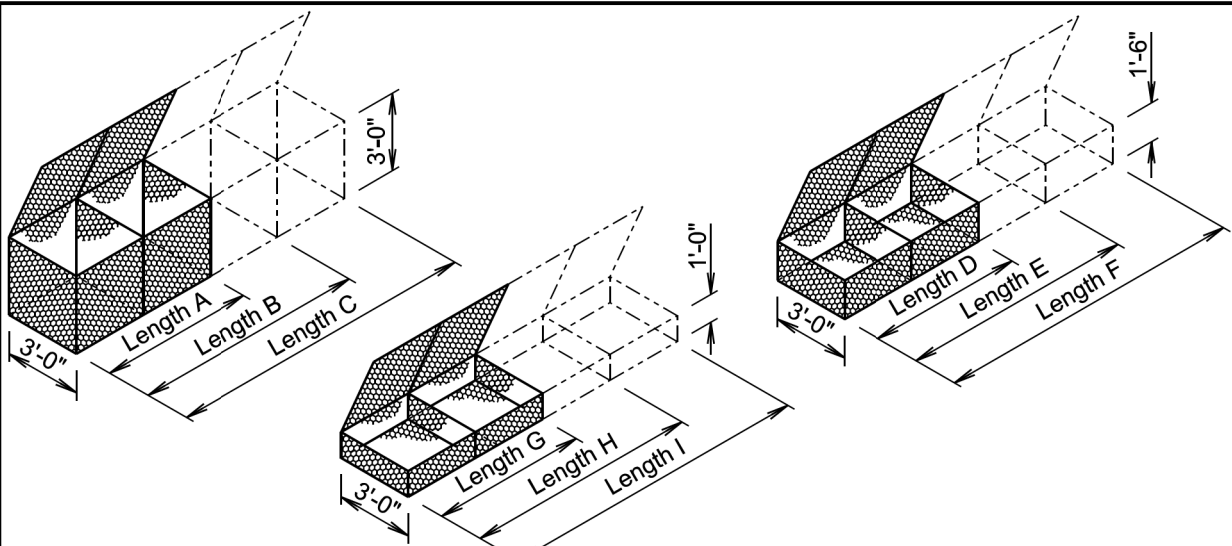


SECTION A-A

REINFORCING SCHEDULE					
MK.	No.	Size	Length	Type	Bending Details
a	2	4	4'-6"	17A	
b	2	4	3'-9"	17A	
c	2	4	2'-4"	Str.	
d	3	4	4'-2"	Str.	
e	1	4	3'-4"	Str.	
f	1	4	1'-6"	Str.	
NOTE: All dimensions are out to out of bars.					

December 23, 2019

Published Date: 1st Qtr. 2021	S D D O T	CONCRETE HEADWALL FOR UNDERDRAIN	PLATE NUMBER 680.01
			Sheet 2 of 2



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.

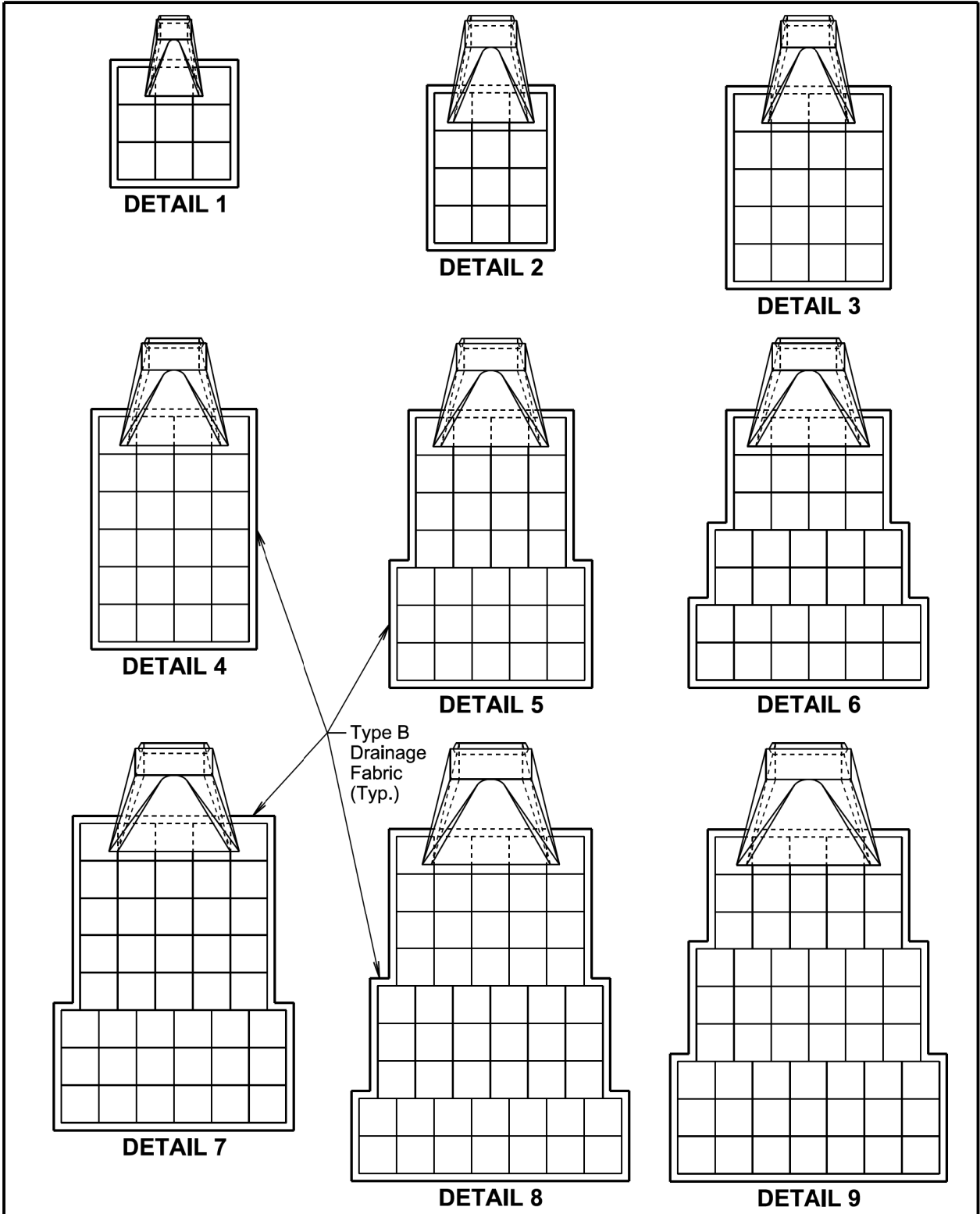
Wire lacing or interlocking type fasteners will be used for gabion assembly and final construction of gabion structures. Interlocking fasteners for galvanized gabions will be high tensile 0.120 inch diameter galvanized steel wire measured after galvanizing. The galvanizing will conform to ASTM A641-92, 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

Published Date: 1st Qtr. 2021	S D D O T	BANK AND CHANNEL PROTECTION GABIONS	PLATE NUMBER 720.01
			Sheet 1 of 1



February 14, 2020

<i>Published Date: 1st Qtr. 2021</i>	S D D O T	BANK AND CHANNEL PROTECTION GABION PLACEMENT UNDER PIPE END SECTIONS	PLATE NUMBER
			720.03
			Sheet 1 of 2

★ ESTIMATED QUANTITIES				
RCP, RCP Arch, CMP, and CMP Arch	Detail	Pipe Diameter (Inches)	Gabion (Cu. Yd.)	Type B Drainage Fabric (Sq. Yd.)
	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

<i>Published Date: 1st Qtr. 2021</i>	S D D O T	BANK AND CHANNEL PROTECTION GABION PLACEMENT UNDER PIPE END SECTIONS	PLATE NUMBER
			720.03
			Sheet 2 of 2