

Annual Revisions to the SUDAS Standard Specifications 2016 Edition

Please remove the old sheets and place the revised sheets in your manual. Some pages are completely new and do not replace an existing sheet. Also, some pages do not contain revisions, but are included due to changes on the other side of the sheet or a change in the page number. **PLEASE READ CAREFULLY - PAY ATTENTION TO THE SECTION NUMBER!** Questions can be directed to Beth Richards, SUDAS Program Coordinator, at 515-294-2869 or brich@iastate.edu.

Please replace the following: the small business card on the spine with the card titled "2016 Edition," the Contributors and Acknowledgments page, and the general Table of Contents. You might also find it helpful to keep this sheet behind the information contained within the Overview tab.

Division	Section	pg #	Summary of Revision(s)
1	1090, 1.05, D	1-3	Deleted the mobilization requirements from Division 1 because of the new section in Division 11.
2	2010, 2.03, B	7-8	Updated the reference.
3	Figure 3010.102	1-2	(Figure 3010.102 starts on the back of Figure 3010.101). Added bedding requirements to allow elliptical pipe as a standard storm sewer product.
	Figure 3010.103	1	Added depth of bury information for 12 to 36 inch polypropylene pipe.
4	Table of Contents	i-ii	Updated to reflect the changes made in Division 4.
	4010, 2.01; 2.02; 3.04	7-14	Added product information for polypropylene pipe. Expanded specifications to allow more sewage air release valves. Added execution language for polypropylene pipe.
	4020, 3.02, B	7-8	Added elliptical pipe as a standard storm sewer product.
	4040, 1.08, A, 3	1-2	Added "(when specified)" after engineering fabric.
	4060, 3.04	3-6	Provided additional guidance to eliminate confusion and made a minor correction.
5	5030, 3.02, B	3-4	Modified initial flushing requirements to match a recent AWWA C 651 change.
6	Table of Contents	i-ii	Updated to reflect the changes made in Division 6.
	6010, 2.03; 2.09; 2.11; 3.01	5-16	Updated DOT reference. Added product and execution information for expanded polypropylene adjustment rings for manholes or intakes. Added product and execution information for heat shrink sleeve infiltration barriers for sanitary sewers.
	6020, 2.01, C (new)	3-4	Added a reference for heat shrink sleeves.
	6030, 3.04, C, 5	3-4	Minor correction.
	Table of Contents	vii-viii	Updated to reflect the changes made in Division 7.
7	Figure 7010.101	1-8	Clarified existing and proposed pavements, as well as tooling and sawing transverse construction joints.
	Figure 7010.901	1	Wrong version was published with the complete reprint of the Specifications with the 2015 Edition.
	Figure 7010.902	1	Wrong version was published with the complete reprint of the Specifications with the 2015 Edition.

7 (con't)	Figure 7010.903	1	Corrected a reference in note 8.
	Figure 7020.902	1	Corrected a reference in note 6.
	7030, 1.07; 2.07	1-6	Simplified the notification information; clarified language in 2.07.
	Figures 7030.101 through 7030.205	ALL	Make all of the 7030 figures consistent with sidewalk slope language.
	7080 (new)	ALL	Added new section on permeable interlocking pavers.
	Figure 7080.101 (new)	1	Added new figure for permeable interlocking pavers.
8	Figure 7080.102 (new)	1	Added new figure for typical alley with permeable pavers.
	8010, 2.04, A, 2, c	9-10	Added "manual/stop time switch" to the police door cabinet requirements.
	9010, Table 9010.04	5-6	Minor formatting revision.
	9020, 2.01	3-4	Updated sod specifications.
9	Figure 9040.102	1	Minor correction.
	Figure 9072.221	1-2	Minor revisions.
	9080, 2.01, B	3-4	Updated Iowa DOT reference.
	Table of Contents	i-iv	Updated to reflect changes made in Division 11.
11	11,020 (new)	ALL	Added new section on mobilization.
	11,030 (new)	ALL	Added new section on pavement markings.
	11,040 (new)	ALL	Added new section on temporary services during construction.
	Figure 11040.101 (new)	1	Added new figure on temporary mailboxes.
	11,050 (new)	ALL	Added new section on temporary sidewalk access.
	Figure 11050.101 (new)	1	Added new figure on temporary granular sidewalk and temporary residential access.
	Figure 11050.102 (new)	1	Added new figure on temporary pedestrian channelizing device.
	11,060 (new)	ALL	Added new section on concrete washout.

Contributors and Acknowledgments

In 2015, SUDAS staff held many meetings to accomplish the various revisions reflected in the 2016 versions of the SUDAS manuals. These revisions would not have been possible without the efforts of the SUDAS technical committee members. The SUDAS program's success is also due to the dedication of the district committees and Board of Directors. Keeping the SUDAS manuals current is an ongoing, cooperative effort, involving hundreds of people who volunteer their time and expertise. It is not possible to acknowledge each of these volunteers individually, but we appreciate them all.

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Beth Richards	Program Coordinator

* Denotes an officer

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MEASUREMENT AND PAYMENT**1.01 MEASUREMENT**

The determination of quantities of work performed under the contract will be made by the Engineer, based upon the lines and grades as shown on the plans and as given during the progress of the work or as evidenced by approved tickets for weight or liquid measure or by measurements made by the Engineer. All items will be computed in the units shown in the contract.

1.02 SCOPE OF PAYMENT

- A. The Contractor shall receive and accept the compensation provided in the contract at unit prices, if it be a unit price contract; or at the lump sum price, if it be a lump sum price contract, except as may be modified by change orders. The compensation provided for in the contract shall constitute full payment for furnishing all labor, equipment, tools, and materials and for performing all work contemplated and embraced under the contract; for all loss or damage arising out of the nature of the work or from the action of the elements; for all expenses incurred by, or in consequence of, the suspension or discontinuance of the said prosecution of the work or from any unforeseen difficulties or obstructions that may arise or be encountered during the prosecution of the work; and for all risks of every description connected with the prosecution of the work until the final acceptance of the work by the Jurisdiction.
- B. Neither the payment of any progress payment nor of any retained percentage shall relieve the Contractor of any obligation to make good any defective work or material. Payment will be made only for materials actually incorporated in the work, except as provided in Section 1090, 1.05 - Progress Payments.
- C. The contract price for any item shall be full compensation for all labor, materials, supplies, equipment, tools, and all things of whatsoever nature required for the complete incorporation of the item into the work the same as though the item were to read "in place," unless the contract documents shall provide otherwise.

1.03 LUMP SUM BREAKDOWNS

- A. If the contract is based on a lump sum bid price, or contains one or more lump sum items for which progress payments are to be made, the Contractor shall prepare and submit a breakdown estimate covering each lump sum item to the Engineer for approval. The breakdown estimate shall show the estimated value of each kind or item of work. The sum of the lump sum items listed in the breakdown estimates shall equal the contract lump sum. Overhead and profit shall not be listed as separate items.
- B. The breakdown estimate shall be approved by the Engineer before any progress payments are prepared. An unbalanced breakdown estimate providing for overpayment to the Contractor for items of work to be performed first will not be approved but shall be revised by the Contractor and resubmitted until acceptable to the Engineer.

1.04 PAYMENT FOR CHANGE ORDERS

- A. The Contractor's claims for extra work will not be paid unless the extra work covered by such claims was authorized by a change order as specified in Section 1040, 1.07 - Change Orders.
- B. Payment for extra work shall be made in one or more of the following ways as determined by the agreement between the parties to the contract prior to the starting of the work.

1.04 PAYMENT FOR CHANGE ORDERS (Continued)

1. Unit Prices: By unit prices contained in the Contractor's original proposal and incorporated in the construction contract, so far as the same may apply.
2. Supplemental Schedule: By supplemental schedule of prices to include costs of all equipment, material, labor, supervision, management, insurance, overhead, and incidentals, said schedule to be submitted by the Contractor upon request of the Engineer and to be accepted by the Jurisdiction.
3. Lump Sum: By an acceptable lump sum proposal from the Contractor.

1.05 PROGRESS PAYMENTS

- A. Limits:** Progress payments made under the contract, unless provided otherwise by law, shall be made according to Iowa Code Chapter 573, and shall be made on the basis of monthly estimates of labor performed and material delivered and incorporated in to the work, as determined by the Engineer. Payment may be made for materials not incorporated into the project if they can be specifically identified and cost verified by invoice. Progress payment requests shall be accompanied by the documentation required in Section 1090, 1.07, B - Sales Tax and Use Tax.
- B. Retainage:** The Jurisdiction shall retain from each monthly progress payment 5% of the amount determined to be due according to the estimate of the Engineer. Early release of retained funds may be requested by the Contractor according to Iowa Code Section 26.13.
- C. Quantities:** Quantities used for progress payments shall be considered as only approximate and provisional and shall be subject to recalculation, adjustment, and correction by the Engineer in subsequent partial payments and in the final payment. Inclusion of any quantities in a progress payment, or failure to disapprove the work at the time of any progress payment, shall not be construed as acceptance of the corresponding work or materials.

1.06 PAYMENT OF RETAINAGE

- A.** Retained funds shall be retained by the Jurisdiction for a period of 30 calendar days after the completion and final acceptance of the improvement by the Jurisdiction. If at the end of the 30 calendar day period claims are on file as provided, the Jurisdiction shall continue to retain from the unpaid funds, a sum equal to double the total amount of all claims on file. The remaining balance of the unpaid fund, or if no claims are on file, the entire unpaid fund, shall be released and paid to the Contractor.
- B.** The Jurisdiction, the Contractor, any claimant for labor or material who has filed a claim, or the surety on any bond given for the performance of the contract, may, at any time after the expiration of 30 calendar days, and not later than 60 calendar days, following the completion and final acceptance of said improvement, bring action in equity in the county where the improvement is located to adjudicate all rights to said fund, or to enforce liability on said bond, pursuant to Iowa Code Chapter 573. Upon written demand of the Contractor, served in the manner prescribed for original notices, on the person filing a claim, requiring the claimant to commence action in court to enforce the claim, an action shall be commenced with 30 calendar days, otherwise the retained and unpaid funds due the Contractor shall be released to the Contractor.

1.07 SALES AND USE TAX STATEMENT

- A. At the completion of the contract and before final payment can be made thereon, the Contractor and all subcontractors shall file with the Engineer in triplicate, with original signatures on all three sets, a statement under oath on forms provided by the Iowa Department of Revenue and Finance showing the data with reference to sales, use, and service taxes required by Iowa Code Section 423.4, as amended. On projects with a total contract cost greater than \$1 million or with supplies and materials in excess of 50% of the contract price and when directed by the Engineer, the Contractor shall submit with each progress pay estimate completed sales and use tax forms from the Iowa Department of Revenue listing all supplies and materials purchased since the previous progress payment.
- B. If a Sales Tax Exemption Certificate(s) is issued by the Jurisdiction according to Section 1020, 1.08, no sales, use, or service statement is required.

1.08 ACCEPTANCE AND FINAL PAYMENT

- A. Final payment will be based on the actual final total amount of the work accomplished and finally accepted by the Jurisdiction under the contract. Under no circumstances or conditions will the Contractor be paid anything for anticipated profits for the work, nor will it be paid for any work not actually included in the improvement. The Jurisdiction will not give final acceptance of the work until the Contractor has submitted all documentation required by the contract documents.
- B. The Engineer shall, after determining the work has been finally and fully completed according to the contract documents, make a final estimate of the amount of work done and the value thereof.
- C. Final acceptance of construction shall be defined as final approval of the project only in the sense that it has been constructed, cleaned up, and completed in apparent substantial compliance with the contract documents. Said final acceptance is stipulated to mean a written acceptance by the Jurisdiction.
- D. It is mutually agreed between the parties to the contract that a certificate of completion of the project, submitted by the Engineer and approved by the Jurisdiction, shall constitute final acceptance of the work and materials included in the contract on the date of such approval, subject to the provision any such approval, acceptance, or payment as herein provided shall not constitute an acceptance of any unauthorized or defective work, or of any improper material.

END OF SECTION

PART 2 - PRODUCTS**2.01 TOPSOIL**

Use suitable topsoil of uniform quality, free from hard clods, roots, sod, stiff clay, hard pan, stones larger than 1 inch (1/2 inch for turfgrass seeding), lime cement, ash, slag, concrete, tar residue, tarred paper, boards, chips, sticks, or any undesirable material.

Use on-site topsoil, unless compost-amended or off-site topsoil is specified.

- A. On-site Topsoil:** On-site topsoil material is material excavated from the top 12 inches of the site. Use of on-site topsoil material is subject to the Engineer's approval.
- B. Compost-amended On-site Topsoil:** Amend low-quality on-site topsoil, not meeting the requirements specified for off-site topsoil, with a minimum of 1 inch of compost for every 3 inches of topsoil. Use compost meeting the requirements of mulch for pneumatic seeding in Section 9010, 2.07.
- C. Off-site Topsoil:** Contains at least 3% organic matter, according to ASTM D 2974, has a high degree of fertility, is free of herbicides that prohibit plant growth, has a pH level between 6.0 and 8.0, and meets the following mechanical analysis requirements:

Sieve	Percent Passing
1"	100
1/2"	95* to 97*
1/4"	40 to 60
No. 100	40 to 60
No. 200	10 to 30

* 100% for turfgrass

The Engineer will approve the source of off-site topsoil. Surface soils from ditch bottoms, drained ponds, and eroded areas, or soils that are supporting growth of noxious weeds or other undesirable vegetation, will not be accepted. The Engineer will determine if testing is necessary. The Contractor will be responsible for payment of the testing if the off-site topsoil does not meet the above requirements. If the testing verifies the off-site topsoil does meet the above requirements, payment for the testing will be the responsibility of the Jurisdiction.

2.02 EXCAVATION MATERIALS

All project site and borrow excavation will be classified as Class 10, Class 12, or Class 13 as defined below, and as indicated in the contract documents.

A. Class 10 Excavation:

- Class 10 excavation includes all normal soil such as loam, silt, gumbo, peat, clay, soft shale, sand, and gravel. It includes fragmentary rock handled in the manner normal to this class of excavation.
- Includes any combination of the above described materials and any other material not classified as Class 12 or Class 13.

2.02 EXCAVATION MATERIALS (Continued)**B. Class 12 Excavation:**

1. Material deposits so firmly cemented together that they cannot be removed without continuous use of pneumatic tools or blasting.
2. Class 12 excavation includes the actual measured volume of granite, trap, quartzite, chert, limestone, sandstone, hard shale, or slate in natural ledges or displaced masses.
3. Also includes the estimated or measured volume of rock fragments or boulders that occur on the surface or in subsurface deposits mixed with soil, sand, or gravel when their size, number, or location prevents them from being handled in a manner normal to Class 10 excavation.

C. Class 13 Excavation:

1. Class 13 excavation includes all materials listed under the definitions of Classes 10 and 12, and any other material encountered, regardless of its nature.
2. This classification covers work commonly referred to as "unclassified excavation."
3. The contract documents will specify the limits for Class 13 excavation. Excavation within these limits will not be classified as Class 10 or Class 12 excavation.

D. Unsuitable or Unstable Materials:

1. Material encountered during excavation above or below grade that does not meet the suitable soil requirements in Section 2010, 2.03.
2. Rubbish and debris, including trees, stumps, waste construction materials, scrap metals, and other materials that cannot be buried or used for backfill or topsoil.
3. Moisture content does not determine suitability of materials.

E. Borrow: Unless otherwise provided in the contract documents, when the quantity of fill material required is not available within the limits of the project cross-sections or specific borrow areas as indicated, the Contractor should make up the deficiency from borrow areas provided by the Engineer, or furnish equivalent material from other borrow areas.

2.03 SUITABLE EMBANKMENT MATERIALS

Meet the following requirements for all soils provided for the construction of embankments:

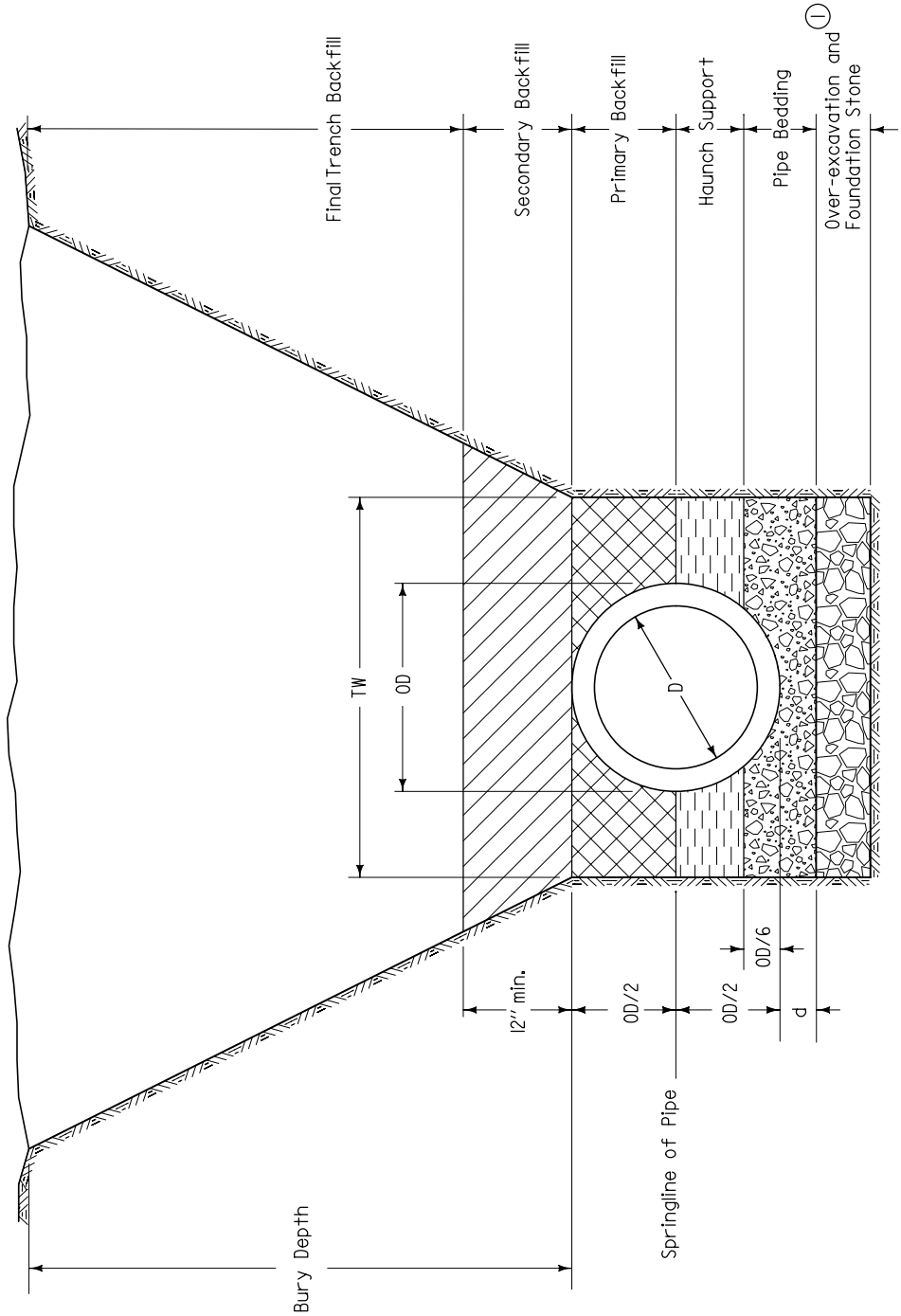
- A. Density of 95 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).
- B. AASHTO M 145 group index of less than 30.
- C. Liquid limit (LL) less than 50.
- D. Soils not meeting these requirements are considered unsuitable soils, regardless of classification.
- E. For soils to be placed below water, use clean granular material.

Refer to the contract documents for specific material and placement requirements.

① Required only when specified in the contract documents or when directed by the Engineer.

Key

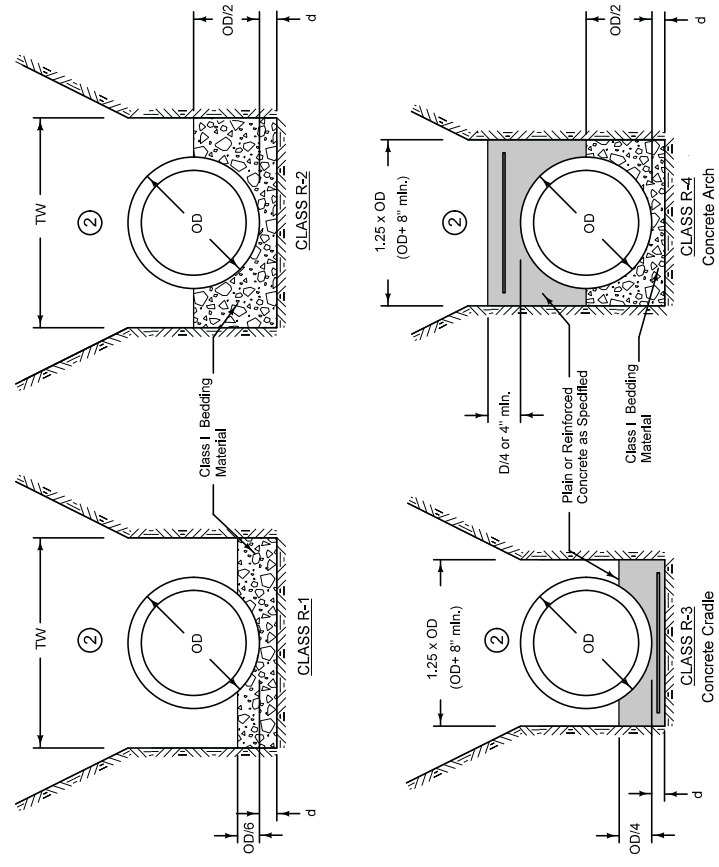
- OD = Outside diameter of pipe
- D = Inside diameter of pipe
- TW = Trench width at top of pipe
- d = Depth of bedding material below pipe



SUDAS	Iowa Department of Transportation	REVISION
		NEW 04-21-09
FIGURE 3010.101	STANDARD ROAD PLAN	SW-101
REVISIONS: New. Replaces SUDAS Figure 3010.1.		
SUDAS DIRECTOR <i>Deanna Mellich</i>		
DESIGN METHODS ENGINEER		

TRENCH BEDDING AND BACKFILL ZONES

RCP AND VCP PIPE BEDDING ①

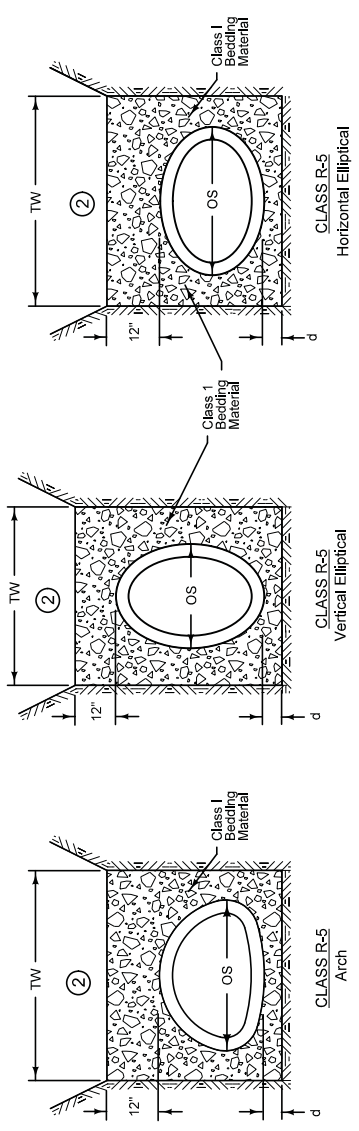


- Refer to sheet 2 for bury depth restrictions.
- ① Use Bedding Class R-1 or R-2 unless specified otherwise.
 - ② Place remainder of bedding and backfill materials as specified in the contract documents.

Key

- OD = Outside diameter of pipe
- OS = Outside span of pipe
- TW = Trench width at top of pipe:
- Min. = OD+18 inches
- Max. = 1.25xOD+12 inches OR 54 inches (whichever is greater)
- d = Depth of bedding material below pipe: OD/8 or OS/8, OR 4 inches (whichever is greater)

REINFORCED CONCRETE ARCH AND ELLIPTICAL PIPE BEDDING



	SUDAS	IOWA DOT	REVISION	
			1	10-20-15
FIGURE 3010.102		SW-102		
STANDARD ROAD PLAN		SHEET 1 of 2		
REVISIONS: Added horizontal elliptical and vertical elliptical abcs.				
Paul D. Weigand		Brian Smith		
SUDAS DIRECTOR		DESIGN METHOD ENGINEER		
RIGID GRAVITY PIPE				
TRENCH BEDDING				

ALLOWABLE BURY DEPTH

CLASS III RCP

Pipe Diameter (in)	Class R-1 Bedding	Class R-3 & R-4 Bedding		
		No Steel	As=0.4%	As=1.0%
12	7	15	19'	27'
15	8	10'	16'	19'
18	8	11'	20'	40'
21	8	11'	26'	40'
24	8	12'	36'	40'
27	10'	15'	40'	40'
30	11'	15'	29'	40'
33	11'	15'	28'	40'
36	11'	15'	27'	40'
42	11'	15'	26'	38'
48	11'	15'	26'	36'
54	11'	15'	25'	34'
60	11'	15'	25'	33'
66	11'	15'	24'	32'
72	11'	15'	24'	32'
As = Area of Steel Reinforcing				

CLASS IV RCP

Pipe Diameter (in)	Class R-1 Bedding	Class R-2 Bedding	Class R-3 & R-4 Bedding		
			No Steel	As=0.4%	As=1.0%
12	12'	15'	23'	28'	40'
15	12'	16'	23'	30'	40'
18	13'	16'	29'	40'	40'
21	13'	18'	40'	40'	40'
24	16'	23'	40'	40'	40'
27	19'	30'	40'	40'	40'
30	19'	29'	40'	40'	40'
33	19'	28'	40'	40'	40'
36	19'	28'	40'	40'	40'
42	18'	27'	40'	40'	40'
48	18'	26'	40'	40'	40'
54	18'	25'	40'	40'	40'
60	18'	25'	40'	40'	40'
66	18'	25'	40'	40'	40'
72	18'	24'	40'	40'	40'
As = Area of Steel Reinforcing					

CLASS V RCP

Pipe Diameter (in)	Class R-1 Bedding	Class R-2 Bedding	Class R-3 & R-4 Bedding		
			No Steel	As=0.4%	As=1.0%
12	18'	23'	35'	40'	40'
15	19'	24'	40'	40'	40'
18	19'	30'	40'	40'	40'
21	25'	40'	40'	40'	40'
24	34'	40'	40'	40'	40'
27	40'	40'	40'	40'	40'
30	40'	40'	40'	40'	40'
33	40'	40'	40'	40'	40'
36	40'	40'	40'	40'	40'
42	37'	40'	40'	40'	40'
48	35'	40'	40'	40'	40'
54	33'	40'	40'	40'	40'
60	32'	40'	40'	40'	40'
66	31'	40'	40'	40'	40'
72	31'	40'	40'	40'	40'
As = Area of Steel Reinforcing					

EXTRA STRENGTH VCP

Pipe Dia. (in)	Bedding Class			
	R-1	R-2	R-3 & R-4	
			No Steel	As=0.4%
6	25'	30'	30'	30'
8	20'	26'	30'	30'
10	18'	23'	30'	30'
12	16'	20'	30'	30'
15	15'	19'	28'	30'
18	14'	18'	30'	30'
21	15'	22'	30'	30'
24	18'	28'	30'	30'
27	20'	30'	30'	30'
30	19'	29'	30'	30'
33	20'	30'	30'	30'
36	20'	30'	30'	30'
39	19'	29'	30'	30'
42	18'	26'	30'	30'
As = Area of Steel Reinforcing				

CONCRETE ARCH PIPE

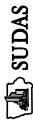
Pipe Size (inch by inch)	Equiv. Dia. (in)	Pipe Class	
		A-III	A-IV
18 x 11	15	6'	11'
22 x 13	18	6'	11'
26 x 15	21	6'	13'
29 x 18	24	7'	15'
36 x 22	30	8'	15'
44 x 27	36	8'	14'
51 x 31	42	8'	15'
58 x 36	48	8'	15'
65 x 40	54	8'	15'
73 x 45	60	8'	14'
88 x 54	72	9'	14'
Based on Class R-5 bedding			

HORIZONTAL ELLIPTICAL RCP

Pipe Size (in x in)	Equiv. Dia. (in)	Pipe Class	
		HE-III	HE-IV
14 x 23	18	12'	22'
19 x 30	24	15'	29'
22 x 34	27	15'	28'
24 x 38	30	15'	27'
27 x 42	33	15'	27'
29 x 45	36	15'	26'
32 x 49	39	15'	26'
34 x 54	42	15'	25'
38 x 60	48	15'	25'
43 x 68	54	15'	24'
48 x 76	60	15'	24'
53 x 83	66	15'	24'
58 x 91	72	15'	24'
63 x 98	78	15'	23'
68 x 106	84	15'	23'
Based on Class R-5 bedding			

VERTICAL ELLIPTICAL RCP

Pipe Size (in x in)	Equiv. Dia. (in)	Pipe Class			
		VE-III	VE-IV	VE-V	VE-VI
23 x 14	18	10'	15'	22'	33'
30 x 19	24	10'	16'	34'	40'
34 x 22	27	11'	20'	40'	40'
38 x 24	30	12'	23'	40'	40'
42 x 27	33	15'	30'	40'	40'
45 x 29	36	15'	29'	40'	40'
49 x 32	39	15'	29'	40'	40'
54 x 34	42	15'	28'	40'	40'
60 x 38	48	15'	27'	40'	40'
68 x 43	54	15'	27'	40'	40'
76 x 48	60	15'	26'	40'	40'
83 x 53	66	15'	25'	40'	40'
91 x 58	72	15'	25'	40'	40'
98 x 63	78	15'	25'	40'	40'
106 x 68	84	15'	24'	40'	40'
Based on Class R-5 bedding					




REVISION

1

10-20-15

FIGURE 3010.102

STANDARD ROAD PLAN

SW-102

SHEET 2 of 2

REVISIONS: Added horizontal elliptical and vertical elliptical abcs.

Paul D. Wiegand

SUDAS DIRECTOR

Brian Smith

DESIGN METHOD ENGINEER

RIGID GRAVITY PIPE

TRENCH BEDDING

① Place remainder of bedding and backfill materials as specified in the contract documents.



PIPE MATERIAL	STORM SEWER	SANITARY SEWER
Ductile Iron	F-1, F-2, F-3	F-1, F-2, F-3
HDPE	F-2, F-3	Not allowed
Polypropylene	Not allowed	F-3
PVC	F-2, F-3	F-3

Key

OD = Outside diameter of pipe

TW = Trench width at top of pipe:
Min. = OD+18 inches OR 1.25xOD+12 inches
(whichever is greater)

ALLOWABLE BURY DEPTH

PVC PIPE

Pipe Diameter (in)	ASTM D 3034						ASTM F 949	ASTM F 1803	ASTM D 2680
	Solid Wall			Solid Wall					
	SDR 23.5	SDR 26	SDR 35	SDR 35	SDR 35	SDR 35			
8	30'	28'	24'	24'	---	---	24'	---	32'
10	30'	28'	24'	24'	---	---	24'	---	32'
12	30'	28'	24'	24'	---	---	24'	---	32'
15	30'	28'	24'	24'	---	---	24'	---	32'
18	---	---	---	---	---	---	24'	---	---
21	---	---	---	---	---	---	24'	24'	---
24	---	---	---	---	---	---	24'	24'	---
27	---	---	---	---	---	---	24'	24'	---
30	---	---	---	---	---	---	24'	24'	---
33	---	---	---	---	---	---	24'	---	---
36	---	---	---	---	---	---	24'	24'	---
42	---	---	---	---	---	---	24'	24'	---
48	---	---	---	---	---	---	24'	24'	---
54	---	---	---	---	---	---	24'	24'	---
60	---	---	---	---	---	---	24'	24'	---

DUCTILE IRON, AWWA C151, CLASS 52

(Bedding Class F-1, F-2, or F-3)			
Pipe Diameter (in)	Class F-1 Bedding	Class F-2 Bedding	Class F-3 Bedding
4	40'	40'	40'
6	40'	40'	40'
8	40'	40'	40'
10	40'	40'	40'
12	37'	40'	40'
14	31'	40'	40'
16	28'	37'	40'
18	25'	34'	40'
20	23'	32'	40'
24	20'	29'	38'
30	18'	23'	31'
36	18'	22'	30'
42	17'	21'	29'
48	16'	19'	27'
54	16'	19'	27'

HDPE PIPE

(Bedding Class F-2 or F-3)	Pipe Diameter (in)	AASHTO M 294
	12	8'
	15	9'
	18	9'
	24	9'
	30	9'
	36	9'
	42	8'
	48	8'
	54	8'
	60	8'

POLYPROPYLENE PIPE

Pipe Diameter (in)	ASTM F 2736	ASTM F 2764
12	24'	---
15	25'	---
18	22'	---
24	20'	---
30	22'	22'
36	---	21'

	SUDAS		REVISION
			1 10-20-15
FIGURE 3010.103		SW-103	
STANDARD ROAD PLAN		SHEET 1 of 1	
REVISIONS: Added polypropylene filar.  Paul D. Wilgand SUDAS DIRECTOR  Bryan Smith DESIGN METEOROLOGICAL ENGINEER			

REVISIONS: Added polypropylene pipe.

Russ D. Wigand Brian Smith
SUDAS DIRECTOR DESIGN METHODS ENGINEER

FLEXIBLE GRAVITY PIPE TRENCH BEDDING

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2.01 SANITARY SEWER (Gravity Mains) (Continued)**6. Polyethylene Encasement:**

- a. Comply with AWWA C105.
- b. Minimum thickness of 8 mils.
- c. Use for all ductile iron pipe and fittings in buried service.

H. Vitrified Clay Pipe (VCP) 8 inch to 42 inch:

1. Pipe and fittings complying with ASTM C 700.
2. Compression joints complying with ASTM C 425 for plain end pipe or bell and spigot pipe.
3. Test according to ASTM C 301.

I. Double Walled Polypropylene Pipe 12 inch to 30 inch:

1. Comply with ASTM F 2736.
2. Minimum pipe stiffness per ASTM D 2412, 46 psi.
3. Integral bell and spigot joint complying with ASTM D 3212 and ASTM F 477.

J. Triple Walled Polypropylene Pipe 30 inch to 36 inch:

1. Comply with ASTM F 2764.
2. Minimum pipe stiffness per ASTM D 2412, 46 psi.
3. Integral bell and spigot joint complying with ASTM D 3212 and ASTM F477.

2.02 SANITARY SEWER FORCE MAINS

A. Ductile Iron Pipe (DIP) 4 inch to 54 inch: Comply with the DIP requirements in Section 4010, 2.01. If joint restraints are specified, comply with Section 5010, 2.03.

B. Polyvinyl Chloride Pipe (PVC): Comply with the requirements in Section 5010, 2.01 for PVC pipe. Provide restrained joints when specified.

C. Sewage Air Release Valve:

1. General: Consists of an elongated tapered or conical body and a float to operate (open and close) under pressure without spillage. Provide valves suitable for pressures up to 150 psi. Use a float with a linkage connection to the seal plug assembly to prevent irregular air release and protect the connecting rod. Ensure the bottom of the valve body is sloped or funnel-shaped to encourage the accumulated sewage and solids to drain from the valve. Preserve a volume of air at all times between the liquid sewage and the seal plug assembly. Provide a flushing port with attachments for backwashing.

2. Materials:**a. Body and Cover:**

- 1) Stainless Steel: ASTM A 351.
- 2) Cast Iron: ASTM A 126, Grade B.
- 3) Ductile Iron: ASTM A 536, Grade 65-45-12.
- 4) Other corrosion resistant materials.

b. Internal Metal Components: Stainless steel.

2.02 SANITARY SEWER FORCE MAINS (Continued)

- c. **Float:** Stainless steel, ASTM A 240, Type 304 or Type 316, or foamed polypropylene.
 - d. **Seal Plug Assembly:** Stainless steel, foamed polypropylene, EPDM rubber, Nitrile (Buna-N) rubber, and reinforced nylon.
- 3. **Tapping Saddle:** Stainless steel or nylon.
- 4. **Pit:** Construct according to Figure 4010.202.
- D. **Tracer Wire:** Comply with Section 5010, 2.05. Tracer wire will be required on all force mains.
- E. **Tracer Wire Station:**
 - 1. Two internal terminals with shunt.
 - 2. Five to six foot plastic post (color as specified by the Jurisdiction).
 - 3. Removable top cap with lock.
 - 4. Decals indicating "Sewer Force Main" or similar language.

2.03 CASING PIPE

Comply with Section 3020, 2.02 for casing pipe requirements.

2.04 SANITARY SEWER SERVICES**A. Connection to Main:**

- 1. **PVC Main:**
 - a. Preformed wye or tee service fitting with integral bell and spigot joints with elastomeric seals complying with ASTM D 3034 or ASTM F 949.
 - b. Preformed saddle wye or saddle tee for service tap complying with ASTM D 3034 or ASTM F 949.
 - c. PVC plastic meeting ASTM D 1784, Cell Classification 12454.
- 2. **PVC Composite Main:**
 - a. Preformed wye or tee service fitting with integral bell and spigot joints with elastomeric seals complying with ASTM D 3212.
 - b. Preformed saddle wye or saddle tee for service tap complying with ASTM D 2680.
- 3. **RCP Main:** Preformed saddle wye or saddle tee service tap designed for use with RCP.
- 4. **VCP Main:**
 - a. Precast VCP wye or tee service fitting complying with ASTM C 700 for pipe and ASTM C 425 for compression joints.
 - b. Preformed saddle wye or saddle tee service tap designed for use with VCP.
- 5. **DIP Main:**
 - a. Use DIP wye or tee fittings complying with AWWA C110 or AWWA C153.
 - b. Preformed saddle wye or tee services tap designed for use with DIP. Cut the hole for the tap with equipment designed for application.

2.04 SANITARY SEWER SERVICES (Continued)

- B. Wye and Tee Pipe Stop:** All saddle wye or saddle tee fittings must provide integrally molded pipe stop in the branch for positive protection against service pipe insertion beyond the inside of sewer main pipe wall.
- C. Service Pipe:** Use products as required by local plumbing code or regulations, if applicable. Otherwise, use the following:
- 1. PVC:**
 - a. Comply with ASTM D 3034, minimum thickness SDR 23.5 minimum pipe stiffness of 153 psi as per ASTM D 2412.
 - b. PVC plastic meeting ASTM D 1784, Cell Classification 12454.
 - c. Integral bell and spigot type rubber gasket joint complying with ASTM D 3212.
 - 2. DIP:** As specified for sanitary sewer force main, including polyethylene encasement.
- D. Connection to Existing Service:** Comply with Section 4050, 2.08.

2.05 SANITARY SEWER SERVICE RELOCATIONS

- A. Comply with Section 4010, 2.04 for all materials used for sanitary service relocation.
- B. Use the same nominal size as the existing service being relocated.

2.06 SANITARY SEWER CLEANOUT

Comply with Figure 4010.203.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify measurements at site. Make necessary field measurements to accurately determine pipe makeup lengths or closures.
- B. Examine site conditions to ensure construction operations do not pose hazards to adjacent structures or facilities.

3.02 GRAVITY SEWER INSTALLATION**A. General:**

- 1. Install watertight plug to prevent water from entering the existing sewer system.
- 2. Clean pipe interior and joints prior to installation. Keep pipe clean during construction.
- 3. Begin at the lowest point in the line. Lay groove or bell end pointing upstream unless otherwise specified.
- 4. Assemble joints according to Section 4010, 3.04.
- 5. Use a saw to cut ends of pipe flush with inside wall of manholes and structures. Do not use hammer or other means to break pipe.
- 6. Provide manholes as specified in the contract documents.
- 7. Install cap, plug, or bulkhead at exposed ends of pipe upon completion of construction or whenever pipe installation is not in progress.

B. Trenched:

- 1. Excavate trench and provide pipe bedding and backfill material as specified in Section 3010.
- 2. Prepare trench bottom to design line and grade so that only minor movement of the pipe is necessary after installation.
- 3. Lay pipe to design line and grade. Set field grades to invert of pipes.
- 4. Provide uniform bearing for full pipe barrel length. Excavate bell holes as necessary for uniform support of pipe barrel on bedding material.
- 5. Do not lay pipe in water or on saturated soil or bedding, or allow water to rise in trench around pipe prior to placing backfill material.
- 6. Do not disturb installed pipe and bedding when using movable trench boxes and shields. Block or anchor pipe as necessary to prevent joint displacement.
- 7. Install wye or tee service fitting at each location specified in the contract documents.

C. Trenchless: Comply with Section 3020.**3.03 SANITARY SEWER INSTALLED WITHIN A CASING PIPE**

Comply with Section 3020, 3.04 for installation of sanitary sewer within casing pipe.

3.04 GRAVITY MAIN PIPE JOINTING**A. General:**

1. Clean joint surfaces to remove soil or foreign material prior to jointing pipe.
2. Assemble joints according to pipe manufacturer's recommendations. Use equipment that does not apply damaging forces to pipe joints.

B. Polyvinyl Chloride Pipe (PVC) and Polyvinyl Chloride Composite Pipe (truss-type):

1. Coat rubber gasket and joint with soap-based lubricant immediately prior to closing joint.
2. Seal ends of PVC composite and closed profile pipe at manholes with the coating recommended by the manufacturer.

C. Reinforced Concrete Pipe (RCP): Coat rubber gasket and joint with soap-based lubricant immediately prior to closing joint.**D. Ductile Iron Pipe (DIP):**

1. Push-on Joint: Coat gasket and joint with soap-based lubricant immediately prior to closing joint.
2. Mechanical Joint: Wash plain end, bell socket, and gasket with soap solution. Press gasket into socket, set gland, and tighten bolts uniformly.

E. Polypropylene Pipe: Coat gasket and bell with lubricant immediately prior to closing joint.**F. Connections between Dissimilar Pipes:**

1. Use manufactured adapters or couplings approved by the Engineer.
2. Where adapters or couplings are not available, the Engineer may authorize use of a Type PC-2 concrete collar as shown on Figure 4020.211.

3.05 FORCE MAIN INSTALLATION**A. General:** Install according to Section 5010.**B. Tracer Wire:**

1. Required for all force main installations. Comply with Section 5010.
2. Install tracer wire station at each end of the force main and at additional locations specified in the contract documents.
3. Bury end of tracer wire station 2 feet and compact.

3.06 SANITARY SEWER SERVICE STUBS**A.** Provide sanitary sewer service stubs at locations specified in the contract documents.**B.** Install wye or tee for each service connection.

1. Connection of sanitary service to new sewer main, except RCP:
 - a. Use only factory wye or tees.
 - b. Install according to manufacturer's requirements and Section 4010, 2.04 and 3.04 for joints.

3.06 SANITARY SEWER SERVICE STUBS (Continued)

2. Connection to existing sewer main and new RCP:
 - a. Cut sewer main for service tap with hole saw or sewer tap drill.
 - b. Use preformed saddle wye or saddle tee for service tap. Use a gasketed saddle with rigid pipe mains and a solvent-cemented saddle with PVC mains.
 - c. Install according to the manufacturer's requirements, but always attach with at least two stainless steel band clamps.
- C. Install service stub from sewer main to a location 10 feet beyond the right-of-way line or as specified in the contract documents. Comply with Figure 4010.201.
 1. Install according to Section 4010, 3.02.
 2. Install service stub with a slope between 2% and 5% for 4 inch pipes, and between 1% and 5% for pipes 6 inches and greater.
 3. Terminate end of service stub 10 to 12 feet below finished ground elevation or as specified in the contract documents.
 4. If the depth of the sewer main causes the service to exceed a depth of 12 feet or a slope of 5%, install a service riser.
 5. For undeveloped properties, place watertight stopper, cap, or plug in end of sanitary sewer service. Mark the end of the service line as required by the Jurisdiction or as specified in the contract documents.
 6. For reconnection of new service pipe with existing service pipe, comply with the Jurisdiction's plumbing code.

3.07 SANITARY SEWER SERVICE RELOCATION

- A. Relocate existing sanitary sewer services that conflict with new storm or sanitary sewer installations. Existing services located within a conflict zone from 6 inches below the bottom of the proposed sewer pipe to 2 inches above the top of the proposed sewer pipe require relocation.
- B. When a conflicting service is encountered:
 1. Determine grades and elevations of the existing service and proposed main.
 2. Determine the extent of service replacement necessary to relocate the service outside of the conflict zone while maintaining a minimum 1% slope on the sewer service.
 3. If it is not feasible to maintain a minimum slope of 1% on the relocated service, a special design and additional work may be required. Stop work and contact the Engineer. Do not remove sewer service unless directed by the Engineer.
 4. If service relocation with a minimum slope of 1% is feasible, proceed with removal and replacement of the existing sanitary sewer service.
 - a. Length of replacement varies. Remove the existing service to the extent necessary to move the service out of the conflict zone.
 - b. Use all new materials complying with Section 4010, 2.04.
 - c. Re-install the service according to Section 4010, 3.02.
 - d. Maintain a minimum 1% grade on relocated service.

3.08 SANITARY SEWER ABANDONMENT**A. Plug:**

1. Prior to placing the sewer plug, the Engineer will verify the sewer line is not in use.
2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches, or one-half the pipe diameter, whichever is greater.

B. Fill:

1. Prior to filling the sewer, the Engineer will verify the sewer line is not in use.
2. If specified in the contract documents, fill the line to be abandoned with flowable mortar or CLSM (comply with Section 3010) by gravity flow or pumping.

3.09 CONNECTION TO EXISTING MANHOLE

Comply with Section 6010, 3.05.

3.10 SANITARY SEWER CLEANOUT

Provide cleanouts where specified in the contract documents. Comply with Figure 4010.203.

3.11 TOLERANCES

Apply the following tolerances to utilities installed by open trench construction. For trenchless construction, comply with Section 3020.

A. Gravity Main:

1. Do not allow horizontal and vertical alignment to vary from design line and grade at any structure by more than 1% of the inside diameter of the pipe or 1/4 inch, whichever is larger.
2. Do not allow the horizontal alignment of the pipe to vary from design line at any point along the pipe by more than 1% of the inside diameter of the pipe.
3. Low spots holding water exceeding the following depths for each pipe size will be considered unacceptable and must be removed and reinstalled to proper grade.

Pipe Diameter	Maximum Low Spot Depth
8"	1/2"
10"	1/2"
12"	3/4"
15"	3/4"
18" and Larger	5% of Pipe Diameter*

* Measured to the nearest 1/2"

- B. Force Main:** Do not allow horizontal and vertical alignment of trenched force mains to vary from design line and grade by more than 3 inches.

3.12 CONFLICTS

A. Horizontal Separation of Gravity Sewers from Water Mains: Separate gravity sewer mains from water mains by a horizontal distance of at least 10 feet unless:

1. The top of a sewer main is at least 18 inches below the bottom of the water main, and
2. The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.
3. When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of Section 5010, 2.01. However, provide a linear separation of at least 2 feet.

B. Separation of Sewer Force Mains from Water Mains: Separate sewer force mains and water mains by a horizontal distance of at least 10 feet unless:

1. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of Section 5010, 2.01 and
2. The sewer force main is laid at least 4 linear feet from the water main.

C. Separation of Sewer and Water Main Crossovers:

1. Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases.
2. Where the sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material so both joints are as far as possible from the water main. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

3.13 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test sanitary sewer per Section 4060.

END OF SECTION

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify measurements at site; make necessary field measurements to accurately determine pipe makeup lengths or closures.
- B. Examine site conditions to ensure construction operations do not pose hazards to adjacent structures or facilities.

3.02 PIPE INSTALLATION**A. General:**

- 1. Clean pipe interior and joints prior to lowering into trench. Keep pipe clean during construction.
- 2. Begin at the lowest point in the line. Lay groove or bell end pointing upstream unless otherwise specified.
- 3. Place pipe with lifting holes at the top of the pipe and fill lift hole with non-shrink grout or manufactured plugs.
- 4. Assemble joints as specified by the pipe manufacturer. When specified, wrap exterior of storm sewer pipe joints with engineering fabric.
- 5. Use a saw to cut ends of pipe flush with inside wall of manholes, intakes, and structures. Do not use hammer or other means to break pipe.
- 6. Provide manholes and intakes as specified in the contract documents.
- 7. Use watertight stopper, plug, or other approved means to protect the exposed upstream ends of the pipe and prevent soil sediment from entering the storm sewer system.

B. Trenched:

- 1. Excavate trench and provide pipe bedding and backfill material as specified in Section 3010.
- 2. Prepare trench bottom to design line and grade so that only minor movement of the pipe is necessary after installation.
- 3. Lay pipe to design line and grade. Set field grades to invert of pipe.
- 4. Provide uniform bearing for full pipe barrel length. Excavate bell holes as necessary for uniform support of pipe barrel on bedding material.
- 5. Do not lay pipe in water or on saturated soil or bedding, or allow water to rise in trench around pipe prior to placing backfill material.
- 6. Do not disturb installed pipe and bedding when using movable trench boxes and shields. Block or anchor pipe as necessary to prevent joint displacement.

C. Trenchless: Comply with Section 3020.**3.03 STORM SEWER INSTALLED WITHIN A CASING PIPE**

Comply with Section 3020, 3.04 for installation of storm sewer within casing pipe.

3.04 PIPE JOINTING**A. General:**

1. Clean joint surfaces to remove soil or foreign material prior to jointing pipe.
2. Assemble joints according to pipe manufacturer's recommendations. Use equipment that does not apply damaging forces to pipe joints.

B. Reinforced Concrete Pipe (RCP), Reinforced Concrete Arch Pipe (RCAP), and Reinforced Concrete Elliptical Pipe (RCEP):

1. Use cold applied bituminous or rubber rope gasket jointing materials unless otherwise specified.
 - a. Apply joint material to entire tongue, or to top half of tongue and bottom half of groove, in sufficient quantity to fill the joint. Close the joint between pipes.
 - b. Fill remaining voids in the joint, both inside and outside of pipe, with joint material. Smooth the joint material on the inside of pipes 24 inches and larger.
2. If a rubber O-ring or profile gasket is specified for RCP, coat the rubber gasket and joint with soap-based lubricant immediately prior to closing the joint.
3. If wrapped pipe joint is specified, comply with Figure 4020.211. Secure engineering fabric in place to prevent displacement while placing backfill material.
4. Place pipe such that joint openings on the outside or inside of the pipe do not exceed 1/8 inch at the bottom and 5/8 inch at the top.

C. Reinforced Concrete Low Head Pressure Pipe (RCPP); Polyvinyl Chloride Pipe (PVC) and Corrugated PVC Pipe; and High Density Polyethylene Pipe (HDPE): Coat gasket and joint with soap-based lubricant immediately prior to closing the joint.**D. Corrugated Metal Pipe (CMP) and Corrugated Metal Arch Pipe (CMAP):** Lap coupling bands to form a tightly closed joint upon installation.**E. Connections between Dissimilar Pipes:**

1. Use manufactured adapters or couplings approved by the Engineer.
2. Where adapters or couplings are not available, the Engineer may authorize use of a concrete collar as shown in Figure 4020.211.

3.05 TOLERANCES

The following tolerances apply to utilities installed by open trench construction. For trenchless construction, comply with Section 3020.

- A. Do not allow horizontal and vertical alignment to vary from design line and grade at any structure by more than 1% of the inside diameter of the pipe or 1/4 inch, whichever is larger.
- B. Do not allow the horizontal alignment of the pipe to vary from design line at any point along the pipe by more than 1% of the inside diameter of the pipe.
- C. Low spots holding water exceeding the following depths for each pipe size will be considered unacceptable and must be removed and reinstalled to proper grade.

SUBDRAINS AND FOOTING DRAIN COLLECTORS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Subdrains
- B. Subdrain Cleanouts and Outlets
- C. Footing Drain Collectors
- D. Storm Sewer Service and Connections

1.02 DESCRIPTION OF WORK

- A. Construct subdrains, subdrain cleanouts and outlets, and footing drain collectors.
- B. Construct storm sewer service and connections.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. Subdrains:**

1. **Measurement:** Each type and size of pipe installed will be measured in linear feet from end of pipe to end of pipe along the centerline of pipe, exclusive of outlets. Lengths of elbows and tees will be included in length of pipe measured.
2. **Payment:** Payment will be made at the unit price of each type and size of pipe.
3. **Includes:** Unit price includes, but is not limited to, trench excavation, furnishing and placing bedding and backfill material, engineering fabric (when specified), connectors, and elbows and tees.

1.08 MEASUREMENT AND PAYMENT (Continued)**B. Footing Drain Collectors:**

1. **Measurement:** Each type and size of pipe will be measured in linear feet along centerline of pipe from end of pipe to end of pipe.
2. **Payment:** Payment will be made at the unit price for each type and size of pipe.
3. **Includes:** Unit price includes, but is not limited to, trench excavation, pipe, wyes, tap, fittings, and furnishing and placing bedding and backfill material.

C. Subdrain or Footing Drain Cleanouts:

1. **Measurement:** Each type and size of subdrain or footing drain cleanout will be counted.
2. **Payment:** Payment for each cleanout will be made at the unit price for each type and size of subdrain or footing drain cleanout.

D. Subdrain or Footing Drain Outlets and Connections:

1. **Measurement:** Each type and size of outlet or connection to a structure will be counted.
2. **Payment:** Payment for each outlet or connection to a structure will be made at the unit price for each type and size installed.
3. **Includes:** Unit price includes, but is not limited to, pipe, non-shrink grout, coupling bands, and rodent guards for pipes 6 inches or smaller.

E. Storm Sewer Service Stub: The storm sewer service stub is the portion of the storm sewer service from the footing drain collector or storm sewer to a point 10 feet outside of the right-of-way or as specified in the contract documents.

1. **Measurement:** Each type and size of pipe will be measured in linear feet along centerline of pipe from the centerline of storm sewer or footing drain collector to 10 feet outside of the right-of-way.
2. **Payment:** Payment will be made at the unit price per linear foot for each type and size of storm sewer service stub.
3. **Includes:** Unit price includes, but is not limited to, trench excavation, furnishing bedding material, placing bedding and backfill material, tap, fittings, and plugs.

PART 3 - EXECUTION**3.01 CLEANING**

- A. Clean all sanitary sewers, storm sewers, and pipe culverts prior to testing by flushing with high pressure water and removing debris by vacuum extraction, and by removing sheeting, bracing, shoring, forms, soil sediment, concrete, or other debris.
- B. Do not discharge soil sediment or debris to drainage channels, existing storm sewers, or existing sanitary sewers.

3.02 VISUAL INSPECTION

- A. Check each section of sanitary sewer, storm sewer, or pipe culvert by lamping.
- B. Light should be visible through section of pipe lamped.
- C. Visually inspect each run of pipe.
- D. Repair or replace defective pipe or joints, or remove and relay pipe not meeting alignment tolerances, as directed by the Engineer.

3.03 VIDEO INSPECTION**A. General:**

- 1. Unless otherwise specified in the contract documents, conduct video inspection of all new and rehabilitated sanitary and storm sewers after all backfill and compaction operations are completed, but prior to paving.
- 2. Notify the Engineer the day prior to inspection so the Engineer may be present during the inspection.
- 3. Notify the Engineer of the extent of noncompliance with the low spot depth tolerances in Section 4010 for sanitary sewers and Section 4020 for storm sewers.
- 4. Re-inspect sewers after any corrective action has been completed.

B. Inspection Procedure:

- 1. Prior to video inspection, run sufficient water through the pipe to saturate potential low spots so they may be detected during inspection.
- 2. Inspect each pipe segment between manholes or access points in a single, continuous run. Progress through the entire project in a uniform direction.
- 3. Inspect all lateral connections and other observations at right angles utilizing the pan and tilt capabilities of the camera.
- 4. Center the video camera in the pipe during the inspection.
- 5. Do not exceed 30 feet of inspection per minute.

3.03 VIDEO INSPECTION (Continued)**C. Inspection Reporting:**

1. Provide a copy of the video inspection including on-screen continuous footage, pipe diameter, direction of viewing, and manhole and street location references in the recording. Affix labels to the recording media to include the name of the project, the date, and the location of the inspection.
2. Provide a written report of the inspection. In the report, include true-to-scale drawings of all sewer defects and observation locations. Reference the time stamp on each line item entry on the written report.

3.04 SANITARY SEWER LEAKAGE TESTING

Perform one or more of the following tests on new sanitary sewer gravity mains and sanitary sewer service stubs. Conduct tests only if service lines to any private properties are plugged and not active. Test sanitary sewer manholes separately as specified in Section 6030.

A. Sanitary Sewer Infiltration Testing:

1. Use only where ground water is more than 2 feet above top of pipe at highest point in section being tested.
2. Provide documented verification of ground water elevations for no less than 24 hours before measurement of infiltration.
3. Measure infiltration in sanitary sewer with a V-notch weir in a downstream manhole.
4. The maximum allowable infiltration for new sanitary sewers, including manholes, is 200 gallons per inch of diameter per mile of pipe per day.

B. Sanitary Sewer Exfiltration Testing:

1. **General:** Use an exfiltration test when ground water level is less than 2 feet above top of pipe at highest point in section being tested. Sectionalize the test section so the internal pressure in the pipe does not exceed 5 feet of water.
2. **Test Procedures:**
 - a. Install a watertight plug in the inlet of the upstream and downstream manhole of sewer section being tested.
 - b. Fill the sewer and upstream manhole with potable water until the water elevation in the upstream manhole is 2 feet higher than outside top of pipe in section being tested or 2 feet above existing ground water level, whichever is highest elevation.
 - c. Allow the water level to stabilize for 30 minutes, then refill the upstream manhole with water to the original level and begin the test.
 - d. Measure the amount of water lost in the upstream manhole in 1 hour. Use that amount to determine exfiltration in a 24 hour period.
3. **Exfiltration Rate:** The following table may be used to determine exfiltration in gallons per 24 hours by measuring the loss that occurs in 1 hour. The table is applicable only for 48 inch diameter manholes.

The maximum allowable exfiltration for new sanitary sewer, including manholes, is 200 gallons per inch of diameter per mile of pipe per day.

3.04 SANITARY SEWER LEAKAGE TESTING (Continued)**Table 4060.01: Loss in Gallons per 24 Hours for Drop in Water Level per Hour in 48 Inch Diameter Manhole (table may be interpolated to the nearest 1/4" drop)**

Drop	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"
	0	188	376	564	752	940	1128	1316	1504	1692

For manholes larger than 48 inch diameter use the following formula:

$$G = 0.0816(H)(D^2)$$

Where:

G = loss in gallons.

D = diameter of manhole in inches.

H = water level drop in manhole in inches.

C. Sanitary Sewer Low Pressure Air Testing:**1. General:**

- A low pressure air test may be used in lieu of an exfiltration test except as noted.
- Air test is not recommended when ground water elevation is 2 feet or greater above the top of the pipe, and cannot be used when ground water is greater than 6 feet above the top of the pipe.
- Use extreme care and follow safety precautions during testing operations. No one is allowed in manholes during testing.

2. Test Procedures:

- Clean entire line of all debris. Flush or wet line to produce consistent results.
- Plug all inlets and outlets to resist the test pressure. Special attention must be given to stoppers and laterals.
- Determine the test duration for the section being tested from the following table. This table ignores pipe length and uses the factor $0.472 \times d$, with "d" being in inches. Pressure holding time is based on average holding pressure of 3.0 psi or drop from 3.5 psi to 2.5 psi.

Table 4060.02: Test Duration

Size Pipe (inches)	Test Period Duration (minutes)
8	4.0
10	5.0
12	6.0
15	7.0
18	8.5
21	10.0
24	11.5
27	13.0
30	14.0
36	17.0
42	20.0
48	23.0
54	25.5
60	28.5

3.04 SANITARY SEWER LEAKAGE TESTING (Continued)

- d. Add air to the line segment being tested until the internal air pressure of the sewer line is raised to approximately 4.0 psi greater than the average back pressure of any ground water that may be over the top of the pipe. Pressure in the sewer should not exceed 5.0 psi. Allow at least 2 minutes for air pressure to stabilize.
- e. When pressure has stabilized and is at or above the starting test pressure of 3.5 psi, commence the test. Record the drop in pressure for the test period. The test may be discontinued when the prescribed test time has been completed, even though 1.0 psi drop has not occurred.
- f. If the ground water level at the time of testing is above the pipe invert, add 0.43 psi of air per foot of water above the invert to the test air pressure range of 2.5 psi to 3.5 psi stated above.
- g. If the pressure drop exceeds 1.0 psi during the test period, the test will be considered to have failed. Repair and retest the line.

D. Sanitary Sewer Vacuum Testing:**1. General:**

- a. Vacuum testing may be used in lieu of other specified test methods.
- b. Use extreme care and follow safety precautions during testing operations. Keep personnel out of and away from manholes during testing.
- c. Where practical, clean the pipe prior to testing and wet the pipe surface. Isolate the test segment as necessary, including closing service connections.

2. Test Procedures:

- a. Determine the test time for the size of pipe being tested using the following table.

Table 4060.03: Minimum Test Time

Nominal Pipe Size (inches)	Time (Minutes/100 feet of pipe)
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0

- b. Test time is the time required for vacuum to drop from 3.5 to 2.5 psi.
- c. Use a vacuum pump with the capacity to evacuate the sewer test section in time equal or less than that shown in Table 4060.03 for the size of pipe being tested.
- d. Evacuate air until the internal air pressure of the sewer line is lowered by approximately 4.0 psi. Allow the air pressure to stabilize.
- e. When the air pressure is stabilized near the starting test vacuum of 3.5 psi, commence the test by allowing gage pressure to drop to 3.5 psi, then commence time recording. Record the drop in vacuum for the test period.
- f. If the drop in vacuum is 1.0 psi or less during the test period, the test will be considered successfully passed.
- g. If the drop in vacuum is greater than 1.0 psi during the test period, inspect, evaluate, repair, and retest.

PART 3 - EXECUTION**3.01 SEQUENCE OF TESTING AND DISINFECTION**

Perform operations according to AWWA C651 in the sequence below. Successfully complete each operation before continuing to the next operation. The Jurisdiction will provide reasonable quantities of water for flushing and testing.

A. Continuous-Feed or Slug Method (After Water Main Installation): The sequence of testing and disinfection may be modified with approval of the Engineer.

1. Perform initial flush.
2. Perform disinfection.
3. Flush after disinfection.
4. Perform pressure and leak testing.

B. Tablet Method (Concurrent with Water Main Installation): Use this method only if approved by the Engineer. Modify the procedure for flushing, disinfection, and pressure and leak testing as needed if tablet method is used.

1. Perform disinfection.
2. Flush after disinfection.
3. Perform pressure and leak testing.

3.02 INITIAL FLUSHING

A. Flushing:

1. Coordinate flushing with the Jurisdiction.
2. Flush pipe prior to disinfection using potable water.
3. Measure flushing velocity.
4. Obtain a minimum flushing velocity of 3 feet per second in the pipe to be disinfected.

B. Minimum Flushing Rate: According to AWWA C651, Table 3, based on 40 psi residual pressure (see table below).

Table 5030.01: Minimum Flushing Rate

Pipe Diameter (inches)	Flow Rate for Flushing (gpm)	Number of Taps ²			Number of 2 1/2" Fire Hydrant Outlets ¹
		1"	1 1/2"	2"	
4	120	1	-	-	1
6	260	-	1	-	1
8	470	-	2	-	1
10	730	-	3	2	1
12	1,060	-	-	3	2
16	1,880	-	-	5	2

¹With a 40 psi pressure in the main with the fire hydrant flowing to atmosphere, a 2 1/2 inch fire hydrant outlet will discharge approximately 1,000 gpm; and a 4 1/2 inch fire hydrant outlet will discharge approximately 2,500 gpm.

²Number of taps on pipe based on discharge through 5 feet of galvanized iron pipe with one 90° elbow.

C. Property Protection: Protect public and private property from damage during flushing operations.

3.03 DISINFECTION**A. General:**

1. Disinfect according to AWWA C651. The tablet method contained in AWWA C651 is not to be used unless approved by the Engineer.
2. Keep piping to be chlorinated isolated from lines in service and from points of use.
3. Coordinate disinfection and testing with the Engineer.
4. Obtain and test water samples, unless otherwise provided by the Engineer.

B. Procedure:

1. Induce a flow of potable water through the pipe.
2. Introduce highly chlorinated water to the pipe at a point within 5 pipe diameters of the pipe's connection to an existing potable system, or within 5 pipe diameters of a closed end, if there is no connection to an existing system.
3. Introduce water containing a minimum of 25 mg/L free chlorine until the entire new pipe contains a minimum of 25 mg/L free chlorine.
4. Retain chlorinated water in the pipe for at least 24 hours and no more than 48 hours.

3.04 FINAL FLUSHING

- A. Flush pipe using potable water until chlorine residual equals that of the existing potable water system.
- B. Dispose of chlorinated water to prevent damage to the environment. Dechlorinate highly chlorinated water from testing before releasing into the ground or sewers. Obtain Jurisdiction approval prior to flushing activities.
 1. Check with the local sewer department for the conditions of disposal to the sanitary sewer.
 2. Chlorine residual of water being disposed will be neutralized by treating with one of the chemicals listed in the following table.

Table 5030.02: Amounts of Chemicals Required to Neutralize Various Residual Chlorine Concentrations in 100,000 Gallons of Water

Residual Chlorine Concentration mg/L	Sulfur Dioxide (SO ₂) lb	Sodium Bisulfite (NaHSO ₃) lb	Sodium Sulfite (Na ₂ SO ₃) lb	Sodium Thiosulfate (Na ₂ S ₂ O ₃ + 5H ₂ O) lb	Ascorbic Acid (C ₆ O ₈ H ₆) lb
1	0.8	1.2	1.4	1.2	2.1
2	1.7	2.5	2.9	2.4	4.2
10	8.3	12.5	14.6	12.0	20.9
50	41.7	62.6	73.0	60.0	104

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2.02 CONCRETE MATERIALS (Continued)**2. Iowa DOT Materials I.M.s:**

- a. 316 – Flexural Strength of Concrete
- b. 318 – Air Content of Freshly Mixed Concrete by Pressure
- c. 403 – Chemical Admixtures for Concrete
- d. 528 – Structural Concrete Plant Inspection
- e. 529 – Portland Cement Concrete Proportions
- f. 534 – Mobile Mixture Inspection

2.03 REINFORCEMENT

Comply with Iowa DOT Section 4151 for epoxy coated reinforcement.

2.04 NON-SHRINK GROUT

Comply with Iowa DOT Materials I.M. 491.13.

2.05 PRECAST RISER JOINTS**A. Joint Ends:**

1. Use tongue and groove ends.
2. If cast-in-place base is used, provide bottom riser with square bottom edge.

B. Joint Sealant:**1. Sanitary Sewers:**

- a. **Rubber O-ring or Profile Gasket:** Flexible joint, complying with ASTM C 443.
- b. **Bituminous Jointing Material:** Use a cold-applied mastic sewer joint sealing compound recommended by the manufacturer for the intended use and approved by the Engineer. Comply with ASTM C 990.
- c. **Butyl Sealant Wrap:** Comply with ASTM C 877.

2. Storm Sewers: All joint sealants used on sanitary sewers may also be used for storm sewers. The following may also be used.

- a. **Rubber Rope Gasket Jointing Material:** Comply with ASTM C 990.
- b. **Engineering Fabric Wrap:** If specified in the contract documents, supply engineering fabric wrap complying with Iowa DOT Article 4196.01, B.

2.06 MANHOLE OR INTAKE TOP

- A. Capable of supporting HS-20 loading.
- B. Use eccentric cone on sanitary sewer manholes unless otherwise specified or allowed.

2.07 BASE**A. Sanitary Sewer Manhole:**

1. **Circular Manhole:** Integral base and lower riser section according to ASTM C 478.
2. **All Other Manholes:** Use precast or cast-in-place concrete base.

B. Storm Sewer Manhole: Use precast or cast-in-place concrete base.

C. Intake: Use precast or cast-in-place concrete base.

2.08 PIPE CONNECTIONS

- A. Flexible, Watertight Gasket:** Comply with ASTM C 923.
- B. Non-Shrink Grout:** Comply with Section 6010, 2.04.
- C. Waterstop:** Provide elastomeric gasket that surrounds pipe and attaches with stainless steel bands and is designed to stop the movement of water along the interface between a pipe and a surrounding concrete collar.
- D. Concrete Collar:** Comply with Section 6010, 2.02 and 2.03.

2.09 MANHOLE OR INTAKE ADJUSTMENT RINGS (Grade Rings)

- A. Use one of the following materials for grade adjustments of manhole or intake frame and cover assemblies:
 - 1. Reinforced Concrete Adjustment Rings: Comply with ASTM C 478. Provide rings free from cracks, voids, and other defects.
 - 2. High Density Polyethylene Adjustment Rings: Comply with ASTM D 1248 for recycled plastic.
 - a. Test and certify material properties by the methods in the following table.

Table 6010.02: Test Methods

Property	Test Method	Acceptable Value
Melt Flow Index	ASTM D 1238	0.30 to 30 g/10 min.
Density	ASTM D 792	0.94 to 0.98 g/cm ³
Tensile Strength	ASTM D 638	2,000 to 5,000 lb/in ²

- b. Do not use polyethylene grade adjustment rings when they are exposed to HMA pavement or heat shrink infiltration barriers.
 - c. When used in a single configuration, provide tapered adjustment ring with thickness that varies from 1/2 inch to 3 inches.
 - d. Install adjustment rings on clean, flat surfaces according to the manufacturer's recommendations with the proper butyl rubber sealant/adhesive.
 - 3. Expanded Polypropylene Adjustment Rings: Comply with ASTM D 4819 for expanded polypropylene when tested according to ASTM D 2375.
 - a. Use adhesive meeting ASTM C 920, Type S, Grade N5, Class 25.
 - b. Provide finish rings with grooves on the lower surface and flat upper surface.
 - c. Do not use when heat shrinkable infiltration barrier is used.
- B. Ensure the inside diameter of the adjustment ring is not less than the inside diameter of the manhole frame or not less than the inside dimension of the intake grate opening.

2.10 CASTINGS (Ring, Cover, Grate, and Extensions)

- A. Gray Cast Iron:** AASHTO M 306.
- B. Load Capacity:** Standard duty unless otherwise shown on the casting figures.
 - 1. **Standard Duty:** Casting certified for 40,000 pound proof-load according to AASHTO M 306.
 - 2. **Light Duty:** Casting certified according to requirements of AASHTO M 306 for a 16,000 pound proof-load (HS-20). 40,000 pound proof-load is not required.

2.10 CASTINGS (Ring, Cover, Grate, and Extensions) (Continued)**C. Casting Types:**

1. **Manholes:** The following table lists the manhole casting types.

Table 6010.03: Manhole Casting Types

	Figure No.	Casting Type	Number of Pieces	Ring/Cover	Bolted Frame	Bolted Cover (Floodable)	Gasket
Sanitary Sewer	6010.601	SW-601, A	2	Fixed ²	Yes	No	Yes ¹
	6010.601	SW-601, B	3	Adjustable ³	No	No	Yes ¹
	6010.601	SW-601, C	2	Fixed ²	Yes	Yes	Yes ¹
	6010.601	SW-601, D	3	Adjustable ³	No	Yes	Yes ¹
Storm Sewer	6010.602	SW-602, E ⁴	2	Fixed ²	Yes	No	No
	6010.602	SW-602, F ⁴	3	Adjustable ³	No	No	No
	6010.602	SW-602, G ⁴	2	Fixed	No	No	No

¹ Machine bearing surfaces required.

² Typically used with non-paved or flexible surfaces, including HMA, seal coat, gravel, and brick.

³ Typically used with PCC surfaces, including castings in concrete boxouts.

⁴ Storm sewer casting may include environmental symbols and/or messages such as "DUMP NO WASTE, DRAINS TO RIVER."

2. **Intakes:**

- a. Comply with Figures 6010.602, 6010.603, 6010.604, and the contract documents.
- b. Castings may include environmental symbols and/or messages such as "DUMP NO WASTE, DRAINS TO RIVER."

3. **Manhole Casting Extension Ring:**

- a. Match the dimensions of the existing ring and cover with an allowable diameter tolerance of -1/4 inch for the frame ridge and +1/4 inch for the cover recess.
- b. Provide extension ring with height as required to raise the top of the casting to make it level or no more than 1/4 inch below the finished pavement surface. Maximum ring height is 3 inches.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES**A. Infiltration Barrier:**

1. **External Chimney Seal:**

- a. **Rubber Sleeve and Extension:**

- 1) Corrugated; minimum thickness of 3/16 inches, according to ASTM C 923.
- 2) Minimum allowable vertical expansion of at least 2 inches.

- b. **Compression Bands:**

- 1) One-piece band assembly to compress sleeve or extension against manhole and casting surfaces.
- 2) 16 gauge ASTM C 923, Type 304 stainless steel, minimum 1 inch width, minimum adjustment range of 4 inches more than the manhole outside diameter.
- 3) For standard two-piece castings, shape top band to lock sleeve to manhole frame's base flange. For three-piece adjustable castings, shape top band to lock sleeve to upper piece of adjustable frame.
- 4) Stainless steel fasteners complying with ASTM F 593 and 594, Type 304.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES (Continued)**2. Internal Chimney Seal:****a. Rubber Sleeve and Extension:**

- 1) Double pleated, minimum thickness 1/8 inch thick, according to ASTM C 923.
- 2) Minimum allowable vertical expansion of at least 2 inches.
- 3) Integrally formed expansion band recess top and bottom with multiple sealing fins.

b. Expansion Bands:

- 1) One-piece band assembly to compress sleeve or extension against manhole and casting surfaces to make a watertight seal.
- 2) 16 gauge ASTM C 923, Type 304 stainless steel, minimum 1 inch width, minimum adjustment range of 2 inches more than the manhole inside diameter.
- 3) Positive stainless steel locking mechanism permanently securing the band in its expanded position after tightening.

3. Molded Shield:**a. Barrier Shield:**

- 1) Medium density polyethylene, according to ASTM D 1248.
- 2) Certified for 40,000 pound proof-load according to AASHTO M 306.
- 3) Diameter to match cone section and internal dimension of casting.

b. Sealant: Butyl material meeting ASTM C 990.**4. Heat Shrink Sleeve:** Heat-shrinkable wrap around sleeve designed for protection of buried and exposed sanitary sewer manholes. Do not use with polypropylene or polyethylene adjustment rings.**a. Primer:** Compatible with concrete, ductile and cast iron, and sleeve material.**b. Sleeve and Backing:**

Property	Standard	Value
Water Absorption	ASTM D 570	0.05% maximum
Low Temperature Flexibility	ASTM D 2671	-40° F
Tensile Strength	ASTM D 638	2,900 psi minimum
Elongation	ASTM D 638	600% minimum
Hardness	ASTM D 2240	Shore D: 46
Shrink Factor	---	40% minimum
Thickness	---	0.1 inch minimum

c. Adhesive: Softening point of 212° F maximum meeting ASTM E 28.**B. Riser Section Coating:**

1. **Exterior:** When exterior waterproof coating is specified, provide bituminous or coal tar coating.
2. **Interior:** When interior manhole lining is specified, provide lining according to Section 4010, 2.01 (lined, reinforced concrete pipe).

2.12 INVERT**A. Cast-in-place Base:** Provide a cast-in-place invert with concrete complying with the requirements of Section 6010, 2.02.**B. Precast Base Section:**

1. For sanitary sewers, provide a precast invert, unless otherwise allowed by the Engineer. Comply with Section 6010, 3.01.
2. For storm sewers, provide a cast-in-place invert with concrete complying with the requirements of Section 6010, 2.02.

2.13 STEPS

- A. Provide steps in all circular, precast manholes unless otherwise specified in the contract documents.
- B. Comply with ASTM C 478.
- C. Manufacture using polypropylene encased steel.
- D. Uniformly space steps at 12 to 16 inches.
- E. Align with vertical side of eccentric top section.
- F. Place first step no more than 36 inches from top of casting.

2.14 PRECAST CONCRETE TEE

- A. **Tee and Eccentric Reducers:** ASTM C 478.
- B. **Composite Tee:** Comply with Figure 6010.305. May be substituted for pipe diameters less than 48 inches.

2.15 ANCHOR BOLTS

- A. **Material:** Stainless steel or hot-dipped galvanized.
- B. **Diameter:** Minimum 1/2 inch diameter.
- C. **Length:** As required to pass through adjustment rings and into manhole or intake structure to embedment depth recommended by anchor manufacturer.

2.16 EXCAVATION AND BACKFILL MATERIAL

Comply with Section 3010 for bedding and backfill materials.

PART 3 - EXECUTION**3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES**

A. Excavation: Excavate according to Section 3010.

B. Subgrade Preparation:

1. **Cut Sections (Undisturbed Soil):** Prepare subgrade to accurate elevation required to place structure base or subbase.
2. **Fill Sections:** Compact to 95% of maximum Standard Proctor Density and hand grade to accurate elevation required to place structure base or subbase, or install stabilization material as directed by the Engineer.
3. **Unstable Soil:** Install stabilization material as directed by the Engineer.

C. Subbase:

1. **Cast-in-place Structures:** No subbase material is required.
2. **Precast Structures:** If precast structure is provided, install 8 inch thick pad of Class I bedding material a minimum of 12 inches outside footprint of the structure.

D. Installation of Manhole or Intake Structure: When necessary, adjust wall height and depth of base to provide a minimum of 48 inches between form grade elevation and top of base.

1. **Cast-in-place:** Comply with Section 6010, 3.02.
2. **Precast:** Comply with Section 6010, 3.03.

E. Pipes: Install and bed pipes and connect to manhole or intake. Install pipe flush with inside wall of structure. Place bedding and pipe embedment material according to Section 3010.

1. Cast-in-place Structures:

- a. **Storm:** Form structure walls around pipe.
- b. **Sanitary:** Form or core circular opening and install flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.

2. Precast Storm Sewer Manholes or Intakes: If annular space between pipe and structure is less than 2 inches, fill with non-shrink grout. If annular space is 2 inches or greater, construct a concrete collar around the pipe according to Section 6010, 3.05.

3. Precast Sanitary Sewer Manholes: Connect to structure with flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.

4. Sanitary Sewer Manholes on Existing Pipe: Install waterstop according to Section 6010, 2.08.

F. Joint Sealant:

1. Sanitary Sewer Manholes:

- a. Install rubber O-ring or profile gasket (precast structures).
- b. Apply bituminous jointing material or butyl sealant wrap to exterior of all sanitary sewer manhole joints.

**3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES
(Continued)****2. Storm Sewer Manhole and Intakes:**

- a. Apply bituminous jointing material or install rubber rope gasket.
- b. If indicated in the contract documents, apply engineering fabric wrap to joints.

G. Invert:

1. Construct manhole or intake invert up to one-half of pipe diameter to produce a smooth half-pipe shape between pipe inverts.
2. Shape invert to provide a smooth transition between pipe inverts.
3. Slope invert top toward pipe 1/2 inch per foot perpendicular to flow line.
4. For sanitary sewer, keep void between pipe and structure wall free of debris and concrete.
5. For precast inverts, remove any projections and repair any voids to provide a hydraulically smooth channel between ends of pipes.

H. Top Sections: Install manhole eccentric cone or flat top section or install intake top.**I. Adjustment Ring(s):**

1. Bed each concrete ring with bituminous jointing material in trowelable or rope form.
2. Bed each polyethylene or expanded polypropylene ring with manufacturer's approved product and according to manufacturer's recommended installation procedure.
3. Construct manholes and intakes with the following adjustment ring stack heights:
 - a. Minimum: 4 inches for new manholes and intakes. No minimum for rehabilitation projects.
 - b. Maximum: 12 inches for new manholes and intakes; 16 inches for existing manholes and intakes.
4. For greater adjustment, modify lower riser section(s).

J. Casting: Install the type of casting specified in the contract documents and adjust to proper grade. Where a manhole or intake is to be in a paved area, adjust the casting to match the slope of the finished surface. When specified in the contract documents, attach a casting frame to the structure with four anchor bolts.**K. Infiltration Barrier:** Install on sanitary sewer manholes.**1. Internal or External Chimney Seal:**

- a. Do not use external chimney seal if seal will be permanently exposed to sunlight.
- b. Extend seal 3 inches below the lowest adjustment ring.
- c. Extend seal to 2 inches above the flange of the casting for a standard two-piece casting, or 2 inches above the top of the base section of the casting for an adjustable three-piece casting.
- d. Use multiple seals, if necessary.
- e. Install compression bands (external chimney seal) or expansion bands (internal chimney seal) to lock the rubber sleeve or extension into place and to provide a positive watertight seal. Once tightened, lock the bands into place. Use only manufacturer recommended installation tools and sealants.

**3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES
(Continued)****2. Molded Shield:**

- a. Clean surface of structure cone section.
- b. Apply sealant to the top surface of the cone section. Use sufficient sealant to accommodate flaws in the surface of the cone section.
- c. Cut molded shield to height by adding the dimensions of the adjustment rings and casting height. Be sure not to interfere with seating of the lid into the casting frame.
- d. Seat the molded shield against the sealant on the cone section.
- e. Add adjustment rings and casting to meet final grade.

3. Heat Shrink Sleeve:

- a. Ensure all surfaces are clean, dry, and free of foreign objects and sharp edges.
- b. Warm the surface to drive off any moisture.
- c. Cut sleeve to required length per manufacturer's requirements.
- d. Apply primer to manhole and casting surface.
- e. Place sleeve according to manufacturer's requirements.
- f. Apply heat to the sleeve, smooth out wrinkles, and remove trapped air.
- g. Cut the sleeve at the casting gussets. Reheat to place the sleeve onto the casting.
- h. Trim off any excess material.

L. Backfill and Compaction:

1. Place suitable backfill material after concrete in structure has reached at least 3,000 psi compressive strength or 550 psi flexural strength. If concrete strength is not determined, place backfill at least 14 calendar days after initial concrete placement.
2. Place backfill material simultaneously on all sides of walls and structures so the fill is kept at approximately the same elevation at all times.
3. Compact the 3 feet closest to all walls using pneumatic or hand tampers only. Ensure proper and uniform compaction of backfill around structure.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES**A. Forms:**

1. Comply with Iowa DOT Article 2403.03, B.
2. Form all cast-in-place manholes and intakes on both the inside and the outside face above the base. Do not form against excavated earthen surface.

B. Reinforcing Steel:

1. Comply with Iowa DOT Section 2404.
2. Lap bars a minimum of 36 diameters, unless otherwise specified in the contract documents.
3. Provide a minimum of 3 inches of clearance for structure bases and 2 inches of clearance for walls and tops.

C. Concrete Mixing:

1. Comply with Iowa DOT Article 2403.02, D.
2. When using ready-mixed concrete, comply with ASTM C 94.

**3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES
(Continued)****D. Concrete Placing:**

1. Comply with Iowa DOT Article 2403.03, C.
2. Do not place concrete when the air temperature is less than 40°F without the approval of the Engineer. When placement of concrete below 40°F is allowed, comply with Iowa DOT Article 2403.03, F.
3. Place concrete continuously in each section until complete. Do not allow more than 30 minutes to elapse between depositing adjacent layers of concrete within each section.
4. Comply with Iowa DOT Article 2403.03, D for concrete vibration.
5. Form 1 1/2 inch by 3 inch keyed construction joints at locations shown in the contract documents.
6. Provide a broom finish on portions of structure that are to become part of exposed pavement.

E. Stripping and Cleaning:

1. Remove forms for manhole and intake walls and tops according to Iowa DOT Article 2403.03, M. References to culverts include all sanitary and storm structures. When allowed by the Engineer, compressive strengths at six times the stated flexural strengths may be used in determining concrete strength of structure tops.
2. Finish surfaces according to Iowa DOT Article 2403.03, P. Give exposed surfaces a Class 2 finish.

F. Curing:

1. Comply with Iowa DOT Article 2403.03, E.
2. For surfaces visible to the public, use only curing compounds complying with ASTM C 309, Type 1-D or Type 2.

G. Exterior Loading:

1. Restrict exterior loads on concrete according to Iowa DOT Article 2403.03, N.
2. When allowed by the Engineer, compressive strengths at six times the stated flexural strengths may be used.

H. Repairs: After visual inspection of the completed manhole or intake, repair honeycomb areas, visible leaks, tie holes, or other damaged areas. Remove concrete webs or protrusions.

I. Concrete Testing: The Engineer will conduct testing.

3.03 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE STRUCTURES

A. Substitutions: If approved by the Engineer, precast structures may be substituted for designated cast-in-place structures. Comply with the requirements of Section 6010, 3.02 or Iowa DOT Materials I.M. 445.

3.03 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE STRUCTURES (Continued)**B. Cast-in-place Base:**

1. Comply with Section 6010, 3.02 for placement of concrete.
2. Ensure proper vertical and horizontal alignment of base riser section.

C. Precast Base or Base with Integral Riser Section: Place base or base with integral riser section and ensure proper vertical and horizontal alignment.

D. Additional Riser Sections: Install additional riser sections as required.

E. Lift Holes: Install rubber plug in lift holes. Cover plug and hole with non-shrink grout.

3.04 ADJUSTMENT OF EXISTING MANHOLE OR INTAKE**A. Casting Extension Rings:**

1. Install casting extension rings only when specified in the contract documents, and only in conjunction with pavement overlays.
2. Install according to the manufacturer's recommendation and adjust for proper alignment.

B. Minor Adjustment (Adding or Removing Adjustment Rings):

1. Remove casting.
2. Modify adjustment ring stack height by one of the following methods:
 - a. Add adjustment rings as necessary to adjust existing manhole or intake to finished pavement grade or finished topsoil grade, to a maximum ring stack height of 16 inches. Bed each concrete ring with bituminous jointing material. Bed each polyethylene ring with manufacturer's approved product.
 - b. Remove one or more adjustment rings, as appropriate, to reduce casting elevation.
3. Install new casting on modified adjustment ring stack. Existing casting may be reinstalled when specified in the contract documents.
4. Replace infiltration barrier for sanitary sewer manhole using only new materials.

C. Major Adjustment (Adding, Removing, or Modifying Riser or Cone Section): When adjustment is greater than can be accomplished through adding or removing adjustment rings, a major adjustment will be required.

1. Remove casting.
2. Remove top.
3. Remove and replace or modify existing riser section and/or top section, as appropriate.
4. Install new frame and cover or grate. Existing casting may be reinstalled when specified in the contract documents.
5. Replace infiltration barrier for sanitary sewer manhole using only new materials.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE**A. General:**

1. Remove existing invert as necessary to install pipe at required elevation and develop hydraulic channel.
2. Insert pipe into structure and trim end flush with inside wall of structure.
3. Place backfill material according to Section 3010.

B. Concrete Collar:

1. For new pipes 12 inches or smaller, install two number 4 steel reinforcing hoops in collar around pipe. Pour concrete collar around pipe/structure junction to a minimum thickness and width of 6 inches, providing a minimum of 4 inches of concrete extending beyond the pipe opening.
2. For new pipes larger than 12 inches, install two number 4 steel reinforcing hoops in collar around pipe. Pour concrete collar around pipe/structure junction to minimum thickness and width of 9 inches, providing a minimum of 4 inches of concrete extending beyond the pipe opening.

C. Sanitary Sewer:**1. General:**

- a. Core new openings in existing manholes unless otherwise specified in the contract documents.
- b. Divert flow as necessary. Obtain approval of the diversion plan from the Engineer. Maintain sanitary sewer service at all times unless otherwise specified in the contract documents.

2. Cored Opening:

- a. Insert flexible watertight connector into new opening.
- b. Install and tighten internal expansion sleeve to hold flexible connector in place.
- c. Insert pipe through flexible connector and tighten external compression ring.
- d. Do not install grout or concrete collar for cored opening with flexible connector.

3. Cut and Chipped Opening (Knock-out): Use only when specified or allowed.

- a. Saw opening to approximate dimensions with a masonry saw. Saw to depth sufficient to sever reinforcing steel.
- b. Remove concrete and expand opening to a diameter at least 6 inches larger than the outside diameter of the new pipe.
- c. Cut off all reinforcing steel protruding from the structure wall.
- d. Install waterstop around new pipe centered within structure wall.
- e. Fill opening between structure and pipe with non-shrink grout.
- f. Construct concrete collar around pipe and exterior manhole opening.
- g. Provide pipe joint, non-shear coupling, or other approved flexible coupling within 2 feet of structure wall to allow for differential settlement between the new sewer and the structure.

D. Storm Sewer:

1. Cut opening to manhole or intake to 3 to 6 inches beyond the outside of the pipe.
2. Fill opening between manhole or intake wall and outside of pipe with non-shrink grout or construct a concrete collar around the pipe according to Section 6010, 3.05, B.

3.06 REMOVAL OF MANHOLE OR INTAKE

- A. Unless otherwise specified, remove the entire structure to a minimum of 10 feet below top of subgrade in paved areas or 10 feet below finished grade in other areas.
- B. Pipes:
 - 1. Contact the Engineer to verify the sewer line is not in use.
 - 2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches, or one-half the pipe diameter, whichever is greater.
 - 3. If specified in the contract documents, fill the line to be abandoned with flowable mortar or CLSM (comply with Section 3010) by gravity flow or pumping.
- C. Fill remaining structure using flowable mortar.
- D. Place compacted backfill over remaining structure as required for embankment or compacted backfill.

3.07 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test structures according to Section 6030.

END OF SECTION

PART 2 - PRODUCTS**2.01 INFILTRATION BARRIER**

- A. Rubber Chimney Seal:** Comply with Section 6010, 2.11 for external and internal rubber chimney seals.
- B. Molded Shield:** Comply with Section 6010, 2.11 for molded shields.
- C. Heat Shrink Sleeve:** Comply with Section 6010, 2.11 for heat shrink sleeves.
- D. Urethane Chimney Seal:** Comply with the following table for the physical properties.

Table 6020.01: Physical Properties

Property	ASTM Test Method	Acceptable Value
Elongation	D 412	800%, minimum
Tensile Strength	D 412	1150 psi, minimum
Adhesive Strength	D 903	175 lb/in, minimum
Pressure Resistance	C 1244	2 minutes

2.02 IN-SITU MANHOLE REPLACEMENT, CAST-IN-PLACE CONCRETE

- A. Forming System:** Provide an internal forming system capable of forming a new and structurally independent manhole wall within the existing manhole, with the specified thickness and conforming to the general shape of the existing manhole.
- B. Concrete:** Type I/II portland cement with 5/8 inch minus coarse aggregate with fiber reinforcement and water reducer, 4,000 psi minimum 28 day compressive strength or as approved by the Engineer.
- C. Plastic Liner:** When specified, provide a PVC or PE plastic liner resistant to degradation by sulfuric acid. Use a liner capable of being attached to the exterior of the forming system during erection of the forms. Use a plastic liner with a ribbed or studded exterior surface suitable for anchoring to the newly formed interior wall.
- D. Casting:** Provide new casting. Comply with Section 6010, 2.10.

2.03 CENTRIFUGALLY CAST CEMENTITIOUS MORTAR LINER WITH EPOXY SEAL**A. Cementitious Lining:**

1. Use a high-strength, high-build, corrosion-resistant mortar, based on Portland cement fortified with micro silica. Mixed mortar is to have a paste-like consistency that may be sprayed, cast, pumped, or gravity-flowed into any area 1/2 inch and larger.

2.03 CENTRIFUGALLY CAST CEMENTITIOUS MORTAR LINER WITH EPOXY SEAL (Continued)

2. Comply with the following table for physical properties.

Table 6020.02: Physical Properties

Property	Value
Unit Weight	125 pcf
Set Time at 70° F ASTM C 403 Initial Set / Final Set	240 minutes / 440 minutes
Modulus of Elasticity ASTM C 469 24 hours / 28 days	180,000 psi / 1,150,000 psi
Flexural Strength ASTM C 293 24 hours / 28 days	650 psi / 800 psi
Compressive Strength ASTM C 109 24 hours / 28 days	3,000 psi / 10,000 psi
Tensile Strength ASTM C 307	600 psi
Shear Bond ASTM C 882	>1,000 psi
Shrinkage ASTM C 157	None
Chloride Permeability ASTM C 1202	<550 Coulombs

3. Use a lining containing a liquid admixture for the prevention of micro-biologically induced corrosion.

B. Corrosion-Resistant Epoxy Lining:

1. Use a two-component 100% solids epoxy formulated for use in sewer systems.
2. Comply with the following table for physical properties.

Table 6020.03: Physical Properties

Property	Value
Dry Time	4-6 hours at 75° F
Compressive Strength ASTM D 695	16,800 psi
Flexural Strength ASTM D 790	13,900 psi
Tensile Strength ASTM D 638	12,400 psi
Hardness ASTM D 2240	68-72 Shore D
Heat Distortion ASTM D 648	220°F
Ultimate Elongation ASTM D 638	4.5 %
Adhesive Shear ASTM C 882	1,000 psi

- C. Casting:** Provide new casting. Comply with Section 6010, 2.10.

3.04 SANITARY SEWER MANHOLE TESTING (Continued)

6. Install the vacuum tester head assembly on the manhole top access, and inflate the seal.
7. Evacuate the manhole to 5 psi or 10 inches mercury (Hg). Close the isolation valve and start the test. Record the starting time.
8. Maintain a vacuum in the manhole for the time indicated in the following table for the diameter and depth of manhole being tested.
9. Test failure is indicated by vacuum loss greater than 0.5 psi or 1 inch mercury (Hg) within the minimum test time indicated in the table below for the depth and diameter of the manhole being tested.

Table 6030.01: Minimum Vacuum Test Times for Various Manhole Diameters

Depth (feet)	Diameter (inches)				
	48	54	60	66	72
	Time (seconds)				
8	20	23	26	29	33
10	25	29	33	36	41
12	30	35	39	43	49
14	35	41	46	51	57
16	40	46	52	58	67
18	45	52	59	65	73
20	50	53	65	72	81
22	55	64	72	79	89
24	59	64	78	87	97
26	64	75	85	94	105
28	69	81	91	101	113
30	74	87	98	108	121

C. Exfiltration Test:

1. Applicable to new manholes (when specified in the contract documents) or rehabilitated manholes.
2. Testing may be performed in conjunction with sanitary sewer line testing. Comply with Section 4060.
3. Do not test by this method if water may potentially freeze during the test.
4. Plug the manhole inlet and outlet.
5. Fill the manhole with water to 2 feet above the outside top of the connecting pipe. If ground water is present, fill the manhole to no less than 2 feet nor more than 5 feet above the ground water level. Do not fill above the top of the standard barrel sections.
6. Mark the water level.
7. Allow water to stand in the manhole for 1 hour, then refill to the original water level and begin the test.
8. Determine the allowable drop in water level by using the equation given in Section 4060, 3.04. After 1 hour, measure the drop in water level.
9. Test failure is indicated by water loss greater than the maximum allowable calculated exfiltration.

3.05 TEST FAILURE

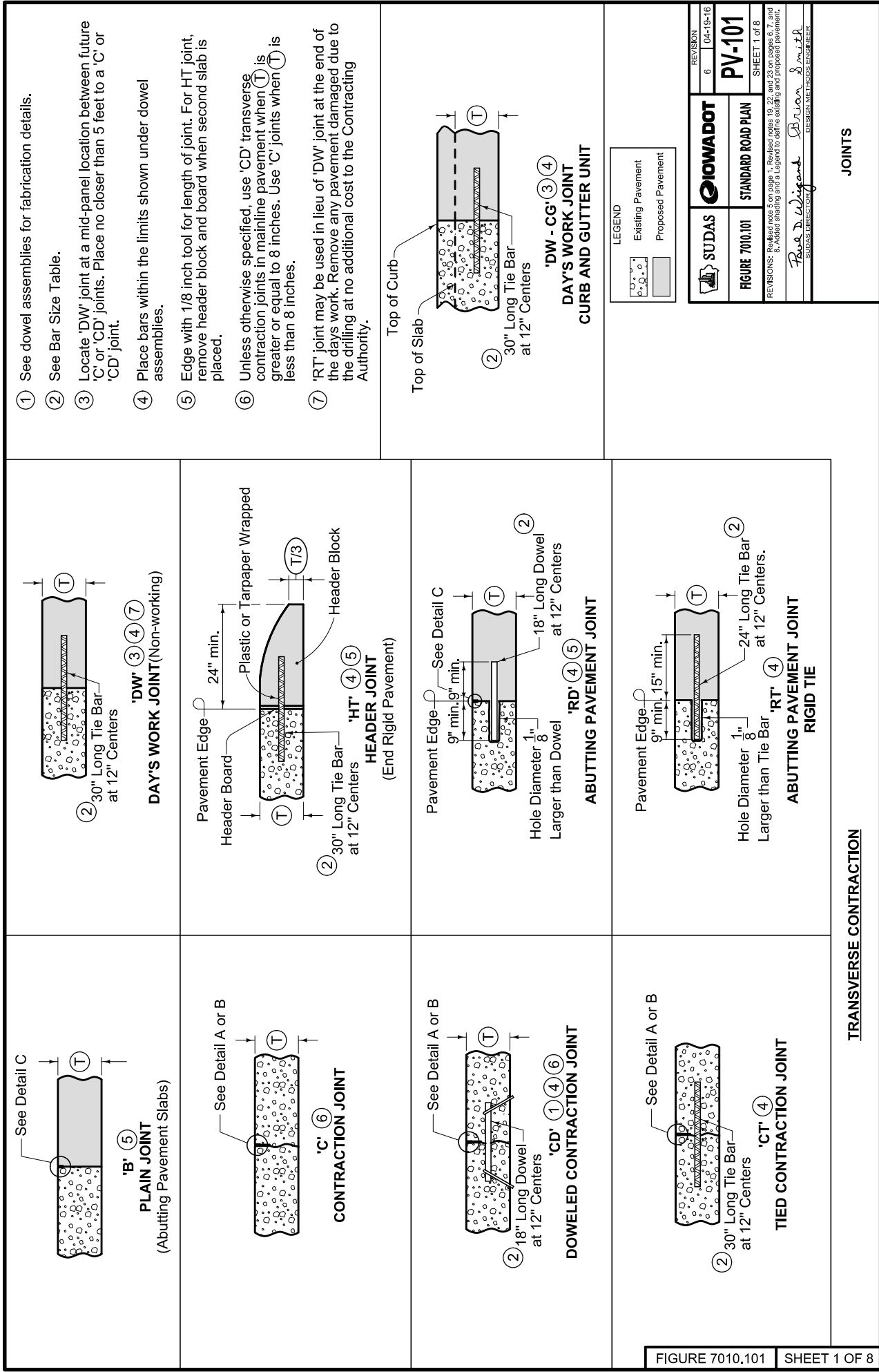
If testing fails, reseal the openings, repair the manhole, and retest. An alternate test method complying with these specifications may be used for a retest if desired.

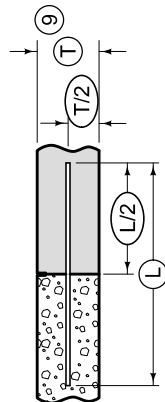
END OF SECTION

Section 7060 - Bituminous Seal Coat (Continued)	Page No.
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1.03 Submittals	1
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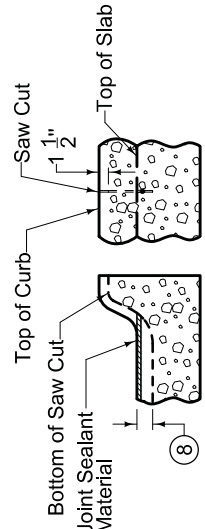
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Figures		Figure No.
Permeable Interlocking Pavers		7080.101
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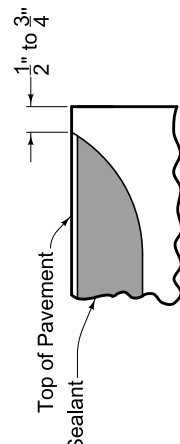




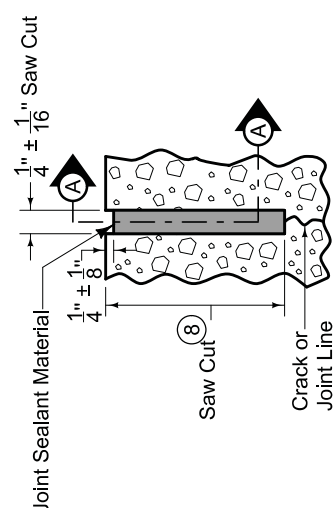
BAR PLACEMENT
(Applies to all joints unless otherwise detailed.)



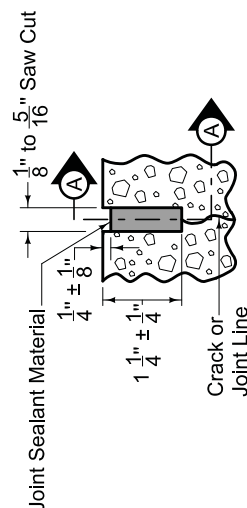
'C' JOINT IN CURB
(Match 'CT', 'CD', or 'C' joint in pavement.)



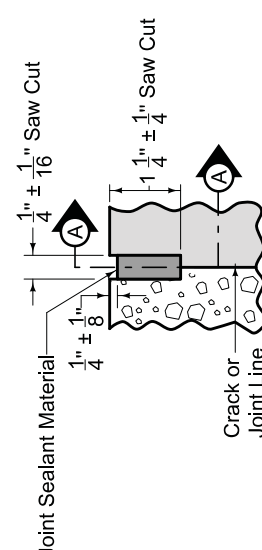
SECTION A-A
(Detail at Edge of Pavement)



DETAIL A
(Saw cut formed by conventional concrete sawing equipment.)



DETAIL B
(Saw cut formed by approved early concrete sawing equipment.)



DETAIL C

- ⑧ Saw 'CD' joint to a depth of $T/3 \pm 1/4"$; saw 'C' joint to a depth of $T/4 \pm 1/4"$.
- ⑨ When tying into old pavement, $\textcircled{T}$ represents the depth of sound PCC.

BAR SIZE TABLE		
$\textcircled{T}$	Dowel Diameter	Tie Bar Size
$< 8"$	$\frac{3}{4}"$	#6
$\geq 8"$ but $< 10"$	$1\frac{1}{4}"$	#10
$\geq 10"$	$1\frac{1}{2}"$	#11

LEGEND

Existing Pavement

Proposed Pavement

SUDAS

IOWA DOT

REVISION
6 04-19-16

FIGURE 7010.101

STANDARD ROAD PLAN

PV-101

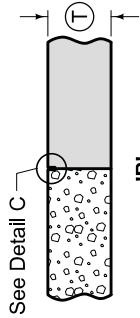
SHEET 2 of 8

REVISIONS: Revised note 5 on page 1; Revised notes 19, 22, and 23 on pages 6, 7, and 8; Added shading and a legend to define existing and proposed pavement.

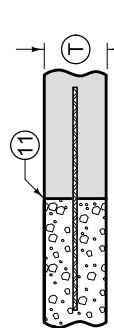
Paul D. Wiegand SUDAS DIRECTOR

Brian Smith DESIGN METHOD ENGINEER

JOINTS

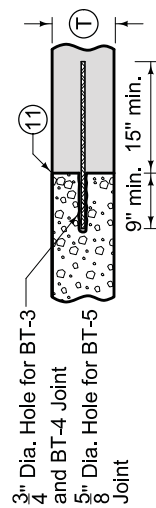


'B'
PLAIN JOINT
(Abutting Pavement Slabs)



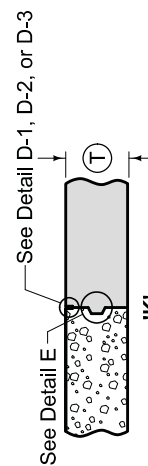
'BT'
ABUTTING PAVEMENT JOINT - RIGID TIE

(T)	Joint	Bars	Bar Length and Spacing
< 8"	'BT-1'	#4	36" Long at 30" Centers
≥ 8"	'BT-2'	#5	36" Long at 30" Centers

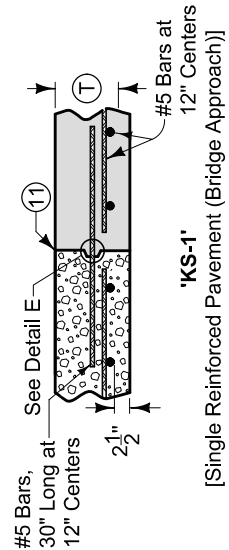


'BT'
ABUTTING PAVEMENT JOINT - RIGID TIE (Drilled)

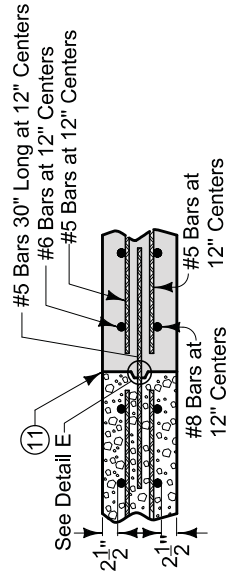
(T)	Joint	Bars	Bar Length and Spacing
< 8"	'BT-5'	#4	24" Long at 30" Centers
≥ 8"	'BT-3'	#5	24" Long at 30" Centers
	'BT-4'		24" Long at 15" Centers



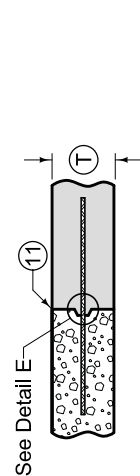
'K'
KEYED JOINT FOR ADJACENT SLABS
(Where T is 8" or more)



'KS-1'
[Single Reinforced Pavement (Bridge Approach)]



'KS-2'
[Double Reinforced Pavement (Bridge Approach)]



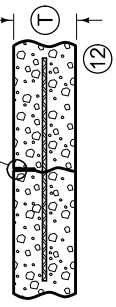
'KT'
ABUTTING PAVEMENT JOINT - KEYWAY TIE

(T)	Joint	Bars	Bar Length and Spacing
< 8"	'KT-1'	#4	30" Long at 30" Centers
≥ 8"	'KT-2'	#5	30" Long at 30" Centers
	'KT-3'		30" Long at 15" Centers

LONGITUDINAL CONTRACTION

- ⑩ Bar supports may be necessary for fixed form paving to ensure the bar remains in a horizontal position in the plastic concrete.
- ⑪ Sawing or sealing of joint not required.
- ⑫ The following joints are interchangeable, subject to the pouring sequence: 'BT-1', 'L-1', and 'KT-1'; 'KT-2' and 'L-2'; 'KT-3' and 'L-3'

See Detail D-1, D-2, or D-3



'L'
CONTRACTION JOINT

(T)	Joint	Bars	Bar Length and Spacing
< 8"	'L-1'	#4	36" Long at 30" Centers
≥ 8"	'L-2'	#5	36" Long at 30" Centers
	'L-3'		36" Long at 15" Centers

LEGEND

Existing Pavement

Proposed Pavement

SUDAS **IOWA DOT**

FIGURE 7010.101 **STANDARD ROAD PLAN**

REVISIONS: Revised note 5 on page 1, Revised notes 19, 22, and 23 on pages 6, 7, and 8, Added shading and a Legend to define existing and proposed pavement.

Paul D. Wiegand *Brian Smith*

SUDAS DIRECTOR SUDAS METHOD ENGINEER

JOINTS

REVISION 6 04-19-16

PV-101

SHEET 3 of 8



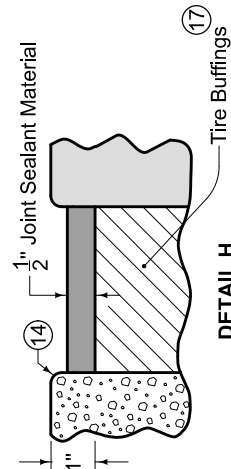
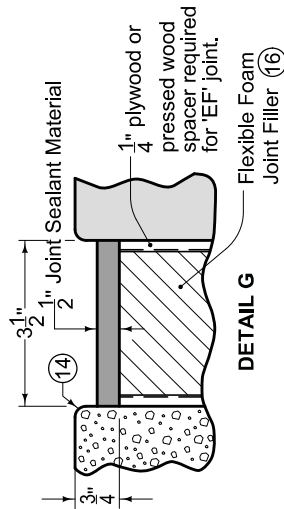
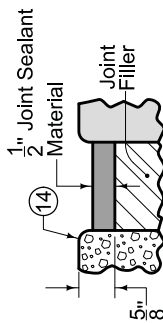
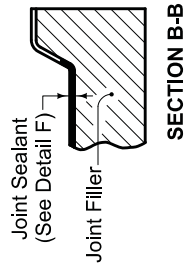
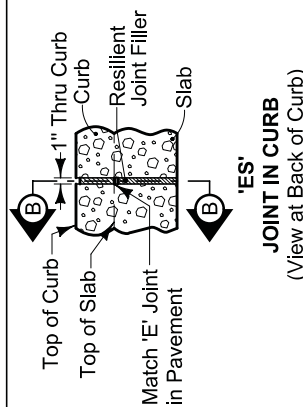
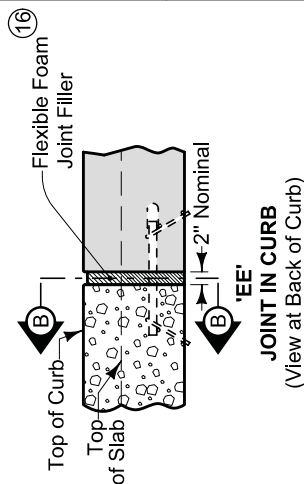
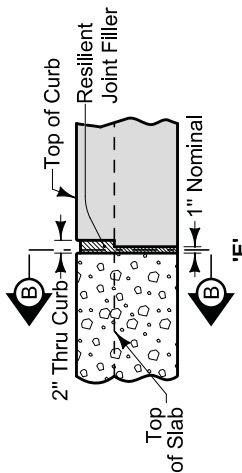
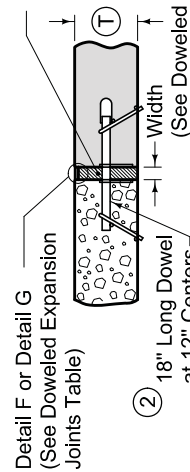
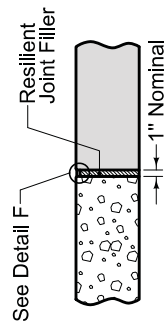
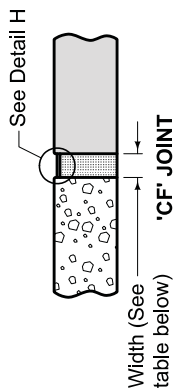
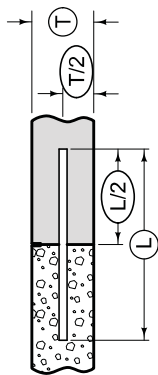
LEGEND

	Existing Pavement
	Proposed Pavement

 SUTDAS	 IOWADOT	REVISION 6 04-19-16
		PV-101 STANDARD ROAD PLAN FIGURE 700.101
REVISIONS: Paved and Gravel 1' Radius Cuts 10' 20' and 30' 40' and 50' 60' and 70' 80' and 90' 100' and 110' 120' and 130' 140' and 150' 160' and 170' 180' and 190' 200' and 210' 220' and 230' 240' and 250' 260' and 270' 280' and 290' 300' and 310' 320' and 330' 340' and 350' 360' and 370' 380' and 390' 400' and 410' 420' and 430' 440' and 450' 460' and 470' 480' and 490' 500' and 510' 520' and 530' 540' and 550' 560' and 570' 580' and 590' 600' and 610' 620' and 630' 640' and 650' 660' and 670' 680' and 690' 700' and 710' 720' and 730' 740' and 750' 760' and 770' 780' and 790' 800' and 810' 820' and 830' 840' and 850' 860' and 870' 880' and 890' 900' and 910' 920' and 930' 940' and 950' 960' and 970' 980' and 990' 1000' and 1010' 1020' 1030' 1040' 1050' 1060' 1070' 1080' 1090' 1100' 1110' 1120' 1130' 1140' 1150' 1160' 1170' 1180' 1190' 1200' 1210' 1220' 1230' 1240' 1250' 1260' 1270' 1280' 1290' 1300' 1310' 1320' 1330' 1340' 1350' 1360' 1370' 1380' 1390' 1400' 1410' 1420' 1430' 1440' 1450' 1460' 1470' 1480' 1490' 1500' 1510' 1520' 1530' 1540' 1550' 1560' 1570' 1580' 1590' 1600' 1610' 1620' 1630' 1640' 1650' 1660' 1670' 1680' 1690' 1700' 1710' 1720' 1730' 1740' 1750' 1760' 1770' 1780' 1790' 1800' 1810' 1820' 1830' 1840' 1850' 1860' 1870' 1880' 1890' 1900' 1910' 1920' 1930' 1940' 1950' 1960' 1970' 1980' 1990' 2000' 2010' 2020' 2030' 2040' 2050' 2060' 2070' 2080' 2090' 2100' 2110' 2120' 2130' 2140' 2150' 2160' 2170' 2180' 2190' 2200' 2210' 2220' 2230' 2240' 2250' 2260' 2270' 2280' 2290' 2300' 2310' 2320' 2330' 2340' 2350' 2360' 2370' 2380' 2390' 2400' 2410' 2420' 2430' 2440' 2450' 2460' 2470' 2480' 2490' 2500' 2510' 2520' 2530' 2540' 2550' 2560' 2570' 2580' 2590' 2600' 2610' 2620' 2630' 2640' 2650' 2660' 2670' 2680' 2690' 2700' 2710' 2720' 2730' 2740' 2750' 2760' 2770' 2780' 2790' 2800' 2810' 2820' 2830' 2840' 2850' 2860' 2870' 2880' 2890' 2900' 2910' 2920' 2930' 2940' 2950' 2960' 2970' 2980' 2990' 3000' 3010' 3020' 3030' 3040' 3050' 3060' 3070' 3080' 3090' 3100' 3110' 3120' 3130' 3140' 3150' 3160' 3170' 3180' 3190' 3200' 3210' 3220' 3230' 3240' 3250' 3260' 3270' 3280' 3290' 3300' 3310' 3320' 3330' 3340' 3350' 3360' 3370' 3380' 3390' 3400' 3410' 3420' 3430' 3440' 3450' 3460' 3470' 3480' 3490' 3500' 3510' 3520' 3530' 3540' 3550' 3560' 3570' 3580' 3590' 3600' 3610' 3620' 3630' 3640' 3650' 3660' 3670' 3680' 3690' 3700' 3710' 3720' 3730' 3740' 3750' 3760' 3770' 3780' 3790' 3800' 3810' 3820' 3830' 3840' 3850' 3860' 3870' 3880' 3890' 3900' 3910' 3920' 3930' 3940' 3950' 3960' 3970' 3980' 3990' 4000' 4010' 4020' 4030' 4040' 4050' 4060' 4070' 4080' 4090' 4100' 4110' 4120' 4130' 4140' 4150' 4160' 4170' 4180' 4190' 4200' 4210' 4220' 4230' 4240' 4250' 4260' 4270' 4280' 4290' 4300' 4310' 4320' 4330' 4340' 4350' 4360' 4370' 4380' 4390' 4400' 4410' 4420' 4430' 4440' 4450' 4460' 4470' 4480' 4490' 4500' 4510' 4520' 4530' 4540' 4550' 4560' 4570' 4580' 4590' 4600' 4610' 4620' 4630' 4640' 4650' 4660' 4670' 4680' 4690' 4700' 4710' 4720' 4730' 4740' 4750' 4760' 4770' 4780' 4790' 4800' 4810' 4820' 4830' 4840' 4850' 4860' 4870' 4880' 4890' 4900' 4910' 4920' 4930' 4940' 4950' 4960' 4970' 4980' 4990' 5000' 5010' 5020' 5030' 5040' 5050' 5060' 5070' 5080' 5090' 5100' 5110' 5120' 5130' 5140' 5150' 5160' 5170' 5180' 5190' 5200' 5210' 5220' 5230' 5240' 5250' 5260' 5270' 5280' 5290' 5300' 5310' 5320' 5330' 5340' 5350' 5360' 5370' 5380' 5390' 5400' 5410' 5420' 5430' 5440' 5450' 5460' 5470' 5480' 5490' 5500' 5510' 5520' 5530' 5540' 5550' 5560' 5570' 5580' 5590' 5600' 5610' 5620' 5630' 5640' 5650' 5660' 5670' 5680' 5690' 5700' 5710' 5720' 5730' 5740' 5750' 5760' 5770' 5780' 5790' 5800' 5810' 5820' 5830' 5840' 5850' 5860' 5870' 5880' 5890' 5900' 5910' 5920' 5930' 5940' 5950' 5960' 5970' 5980' 5990' 6000' 6010' 6020' 6030' 6040' 6050' 6060' 6070' 6080' 6090' 6100' 6110' 6120' 6130' 6140' 6150' 6160' 6170' 6180' 6190' 6200' 6210' 6220' 6230' 6240' 6250' 6260' 6270' 6280' 6290' 6300' 6310' 6320' 6330' 6340' 6350' 6360' 6370' 6380' 6390' 6400' 6410' 6420' 6430' 6440' 6450' 6460' 6470' 6480' 6490' 6500' 6510' 6520' 6530' 6540' 6550' 6560' 657		

LONGITUDINAL CONTRACTION

JOINTS



- ② See Bar Size Table.
- ⑭ Edge with 1/4 inch foot for length of joint indicated if formed; edging not required when cut with diamond blade saw.
- ⑮ See Dowel Assemblies for fabrication details and placement limits. Coat the free end of dowel bar to prevent bond with pavement. At intake locations, dowel bars may be cast-in-place.
- ⑯ Predrill or preform holes in joint material for appropriate dowel size.
- ⑰ Compact tire buffings by spading with a square-nose shovel.

DOWELED EXPANSION JOINTS	
TYPE	WIDTH
ED	1"
EE	2"
EF	3 1/2"

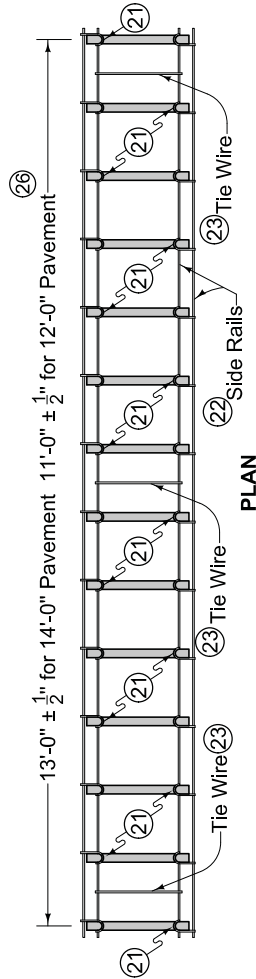
BAR SIZE TABLE			
(T)	< 8"	≥ 8" but < 10"	≥ 10"
Dowel Diameter	3" 4	1" 4	1" 2

LEGEND

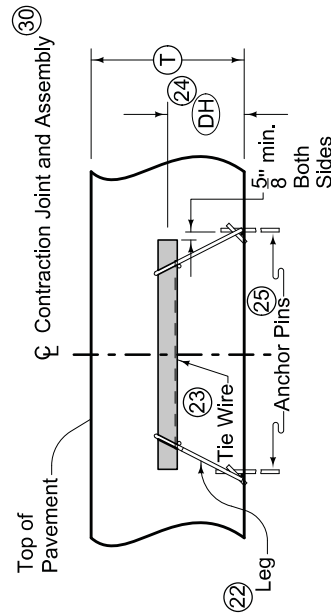
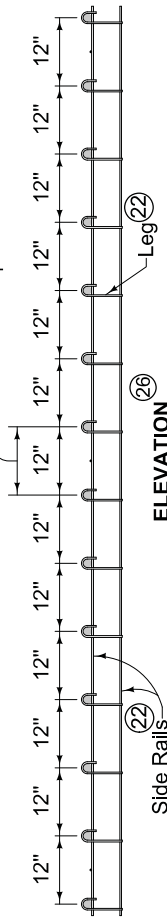
	Existing Pavement
	Proposed Pavement

	SUDAS		REVISION
			6 04-18-18
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101	SHEET 5 of 8
REVISIONS: Replaced final design 1. Studied notes 10, 20, and 30. Added notes 6, 7, and 8. Added shading and a Legend to define existing and proposed pavement.			
<i>Rae D. Wiegand</i> SUDAS DIRECTOR		<i>Bryan Smith</i> DESIGN METHODS ENGINEER	
JOINTS			

CONTRACTION JOINTS



Spaces between dowel bars are nominal dimensions with a $\frac{1}{4}$ inch allowable tolerance.



DOWEL ASSEMBLIES

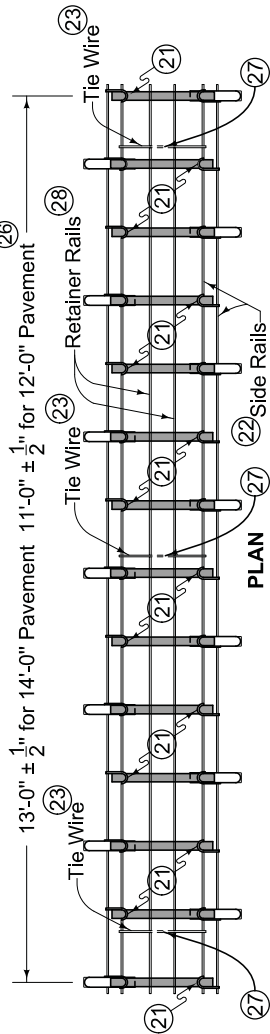
(18) (19) (20)

DOWEL HEIGHT AND DIAMETER		
(T)	(DH) (24)	Diameter
7" to 7 1/2"	3 1/2"	3/4"
8" to 9 1/2"	4 1/4"	1 1/4"
10" to 11 1/2"	5 1/4"	1 1/2"
12" to 13"	6 1/4"	1 3/4"

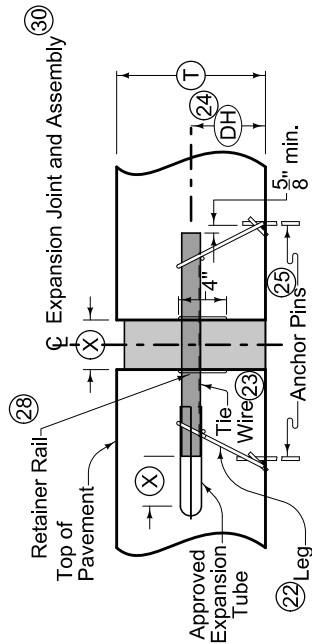
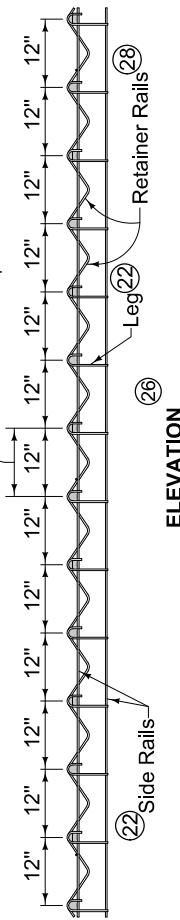
- (18) Use 18 inch long dowel bars with a tolerance of $\pm 1/8$ inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within $\pm 1/8$ inch.
- (19) Use wires with a minimum tensile strength of 50 ksi.
- (20) Details apply to both transverse contraction and expansion joints.
- (21) Weld alternately throughout.
- (22) #10 gauge (0.306 inch diameter) wire. Wire sizes shown are the minimum required.
- (23) #10 gauge (0.177 inch diameter) wire, welded or friction fit to upper side rail, both sides.
- (24) Measured from the centerline of dowel bar to bottom of lower side rail + $1/4$ inch.
- (25) Per lane width, install a minimum of 8 anchor pins evenly spaced (4 per side), to prevent movement of assembly during construction. Anchor assemblies placed on pavement or PCC base with devices approved by the Engineer.
- (26) If dowel basket assemblies are required for curbed pavements, the assembly length is based on the jointing layout. See PV-101, sheet 8.
- (30) Ensure dowel basket assembly centerline is within 2 inches of the intended joint location longitudinally and has no more than $1/4$ inch horizontal skew from end of basket to end of basket.

		REVISION 6 04-19-16
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101 SHEET 6 of 8
REVISIONS: Revised note 5 on page 1. Revised notes 19, 22, and 23 on pages 6, 7, and 8. Added shading and a legend to define existing and proposed pavement. Paul D. Wiegand, SUDAS DIRECTOR Brian Smith, DESIGN METHOD ENGINEER		
JOINTS		

EXPANSION JOINTS



Spaces between dowel bars are nominal dimensions with a $\frac{1}{4}$ allowable tolerance.

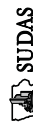


SECTION THRU EXPANSION JOINT

JOINT OPENING AND EXPANSION TUBE EXTENSION		
Joint Type	(X)	Minimum Tube Length
"ED"	1"	6"
"EE"	2"	7"
"EF"	3 1/2"	9"

DOWEL HEIGHT AND DIAMETER	
(T)	(DH)(24) Diameter
7" to 7 1/2"	3 1/2" 3 3/4"
8" to 9 1/2"	4 1/4" 1 1/4"
10" to 11 1/2"	5 1/4" 1 1/2"
12" to 13"	6 1/4" 1 1/2"

- (18) Use 18 inch long dowel bars with a tolerance of $\pm 1/8$ inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within $\pm 1/8$ inch.
- (19) Use wires with a minimum tensile strength of 50 ksi.
- (20) Details apply to both transverse contraction and expansion joints.
- (21) Weld alternately throughout.
- (22) #1/0 gauge (0.306 inch diameter) wire. Wire sizes shown are the minimum required.
- (23) #10 gauge (0.177 inch diameter) wire, welded or friction fit to upper side rail, both sides.
- (24) Measured from the centerline of dowel bar to bottom of lower side rail + $1/4$ inch.
- (25) Per lane width, install a minimum of 8 anchor pins evenly spaced (4 per side), to prevent movement of assembly during construction. Anchor assemblies placed on pavement or PCC base with devices approved by the Engineer.
- (26) If dowel basket assemblies are required for curbed pavements, the assembly length is based on the jointing layout. See PV-101, sheet 8.
- (27) Clip and remove center portion of tie during field assembly.
- (28) 1/4 inch diameter wire.
- (30) Ensure dowel basket assembly centerline is within 2 inches of the intended joint location longitudinally and has no more than $1/4$ inch horizontal skew from end of basket to end of basket.



REVISION

604-19-16



FIGURE 7010.101

STANDARD ROAD PLAN

PV-101

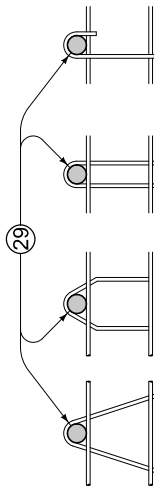
SHEET 7 of 8

REVISIONS: Revised note 5 on page 1, Revised notes 19, 22, and 23 on pages 6, 7, and 8. Added shading and a Legend to define existing and proposed pavement.

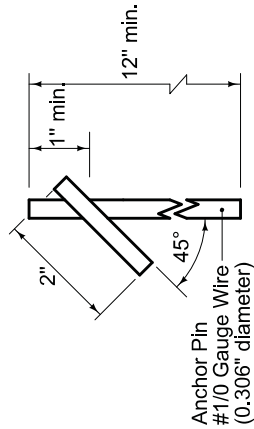
Paul D. Wiegand
SUDAS DIRECTOR

Brian Smith
DESIGN METHOD ENGINEER

JOINTS

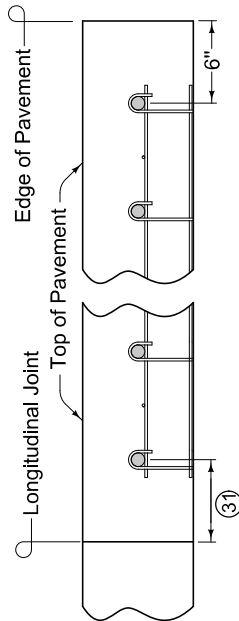


OPTIONAL LEG SHAPES

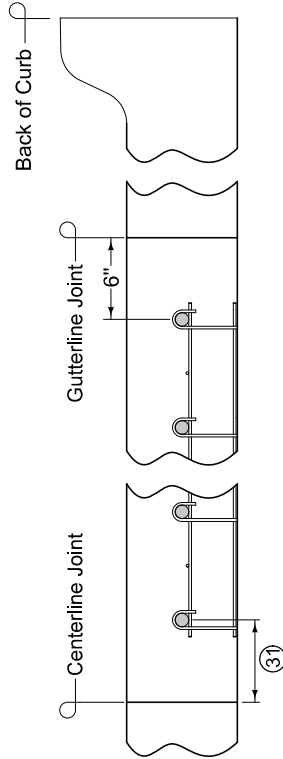


ANCHOR PIN

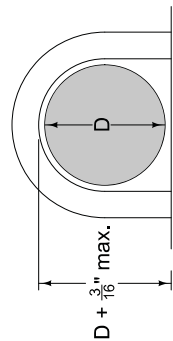
- ⑮ Use 18 inch long dowel bars with a tolerance of $\pm 1/8$ inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within $\pm 1/8$ inch.
- ⑲ Use wires with a minimum tensile strength of 50 ksi.
- ⑳ Details apply to both transverse contraction and expansion joints.
- ㉑ Diameter of bend around dowel is dowel diameter + $1/8$ to $3/16$ inches.
- ㉓ For uniform lane widths: 3" - 6". For taper and variable width pavements: 3" - 12".



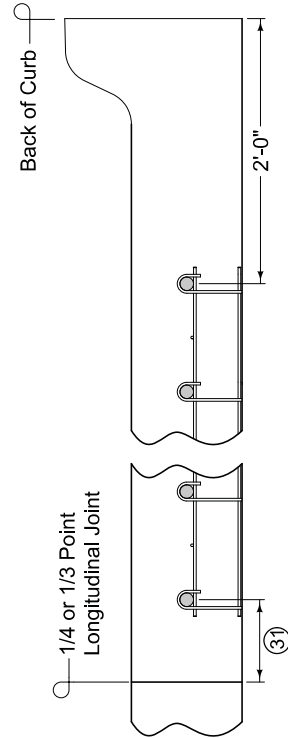
PLACEMENT LIMITS
(Rural Section)



PLACEMENT LIMITS
(Curb and Gutter - Gutterline Jointing)



BEND AROUND DOWEL



PLACEMENT LIMITS
(Curb and Gutter - 1/4 or 1/3 Point Jointing)

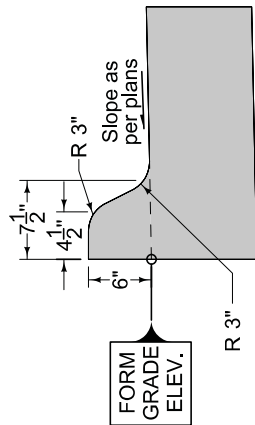
DOWEL ASSEMBLIES
⑮⑲⑳㉑

JOINTS

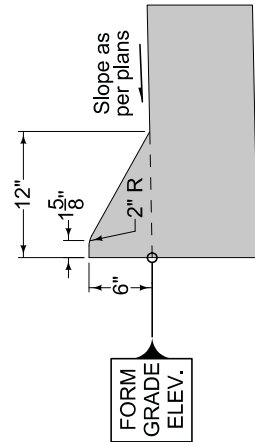
		REVISION 6 04-19-16
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
SHEET 8 of 8		
REVISIONS: Revised note 5 on page 1. Revised notes 19, 22, and 23 on pages 6, 7, and 8. Added shading and a legend to define existing and proposed pavement.		
<i>Paul D. Wigand</i> <i>Brian Smith</i>		
SUDAS DIRECTOR DESIGN METHOD ENGINEER		

For joint details, see PV-101.

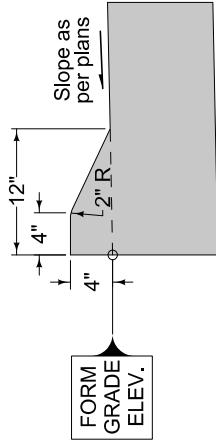
- ① 6" Standard Curb, 6" Sloped Curb, or 4" Sloped Curb as specified.
- ② $\frac{1}{8}$ " if Proposed Pavement is HMA. No elevation difference if Proposed Pavement is PCC.
- ③ 'BT', 'KT', or 'L' joint if Proposed Pavement is PCC. 'B' joint if Proposed Pavement is HMA.



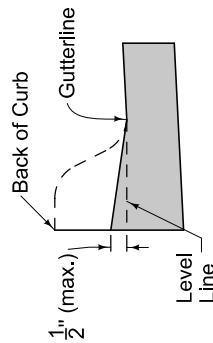
6" STANDARD CURB



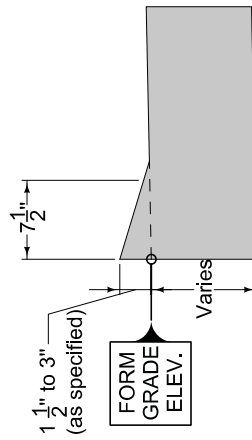
6" SLOPED CURB



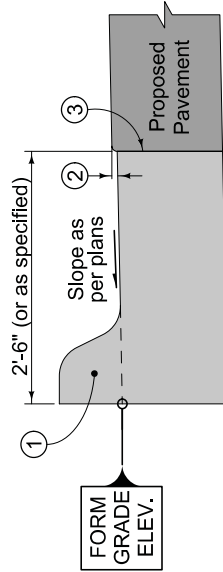
4" SLOPED CURB



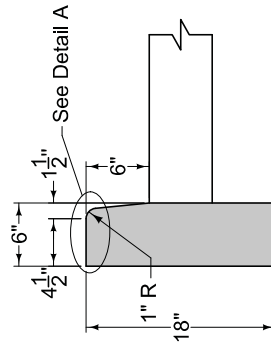
DROP CURB
AT SIDEWALK



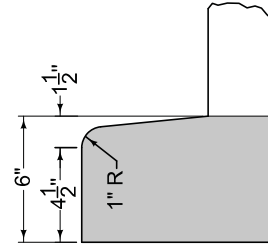
DRIVEWAY DROP CURB



CURB AND GUTTER UNIT

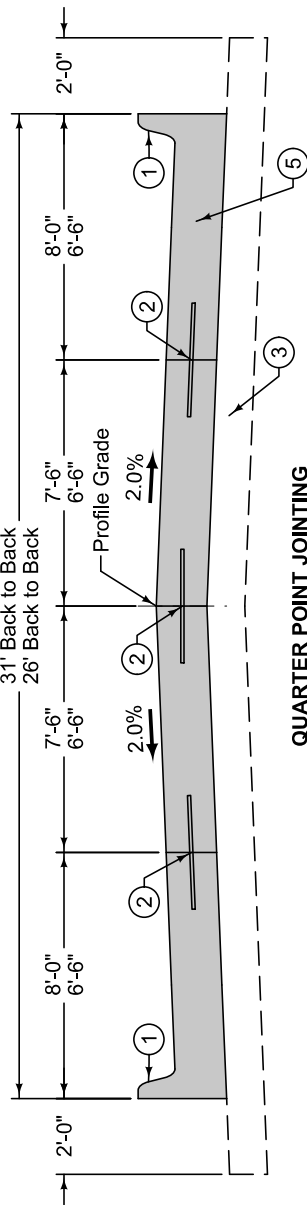


BEAM CURB*
*For short replacement sections,
match existing curb profile

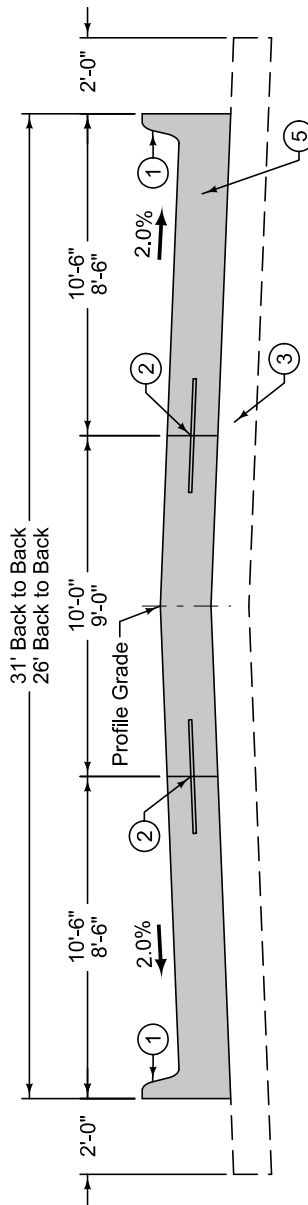


DETAIL A

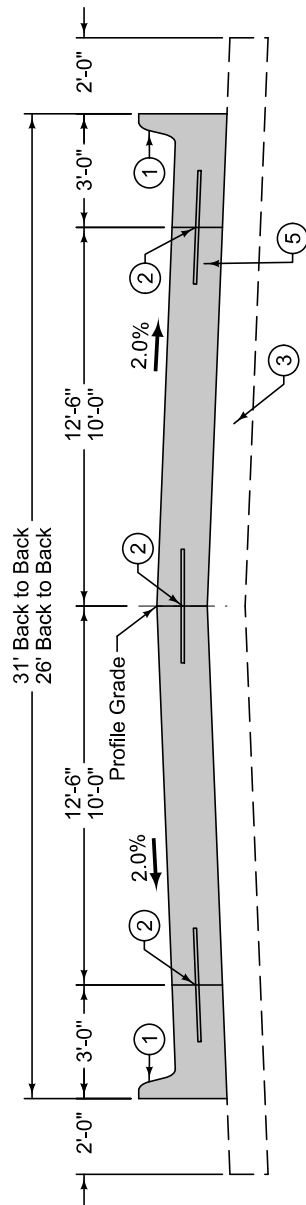
SUDAS	Iowa Department of Transportation	REVISION 3 04-15-14
		PV-102
FIGURE 7010.102	STANDARD ROAD PLAN	SHEET 1 of 2
REVISIONS: Added the Jointing Diagram for Curb and Gutter and page 2.		
Paul D. Wiegand, Brian Smith SUDAS DIRECTOR DESIGN METHOD ENGINEER		
PCC CURB DETAILS		



QUARTER POINT JOINTING



THIRD POINT JOINTING



GUTTERLINE JOINTING

- ① 6 inch standard curb.
- ② BT, KT, or L joint depending on pavement thickness and construction staging.
- ③ Subbase or subgrade as specified.
- ④ Unless otherwise specified in the contract documents.
- ⑤ No dowels within 24" of the back of curb. With gutterline joint, place first dowel 6 inches from the joint. See Figure 7010.101, Sheet 8.

TRANSVERSE JOINT REQUIREMENTS ④			
Pavement Thickness	Transverse Joint Type	Transverse Joint Spacing	
6"	C		12'
7"	C		15'
8"	CD ⑤		15'
9"	CD ⑤		15'
≥10"	CD ⑤		20'

REVISION
1 10-16-12

7010.901

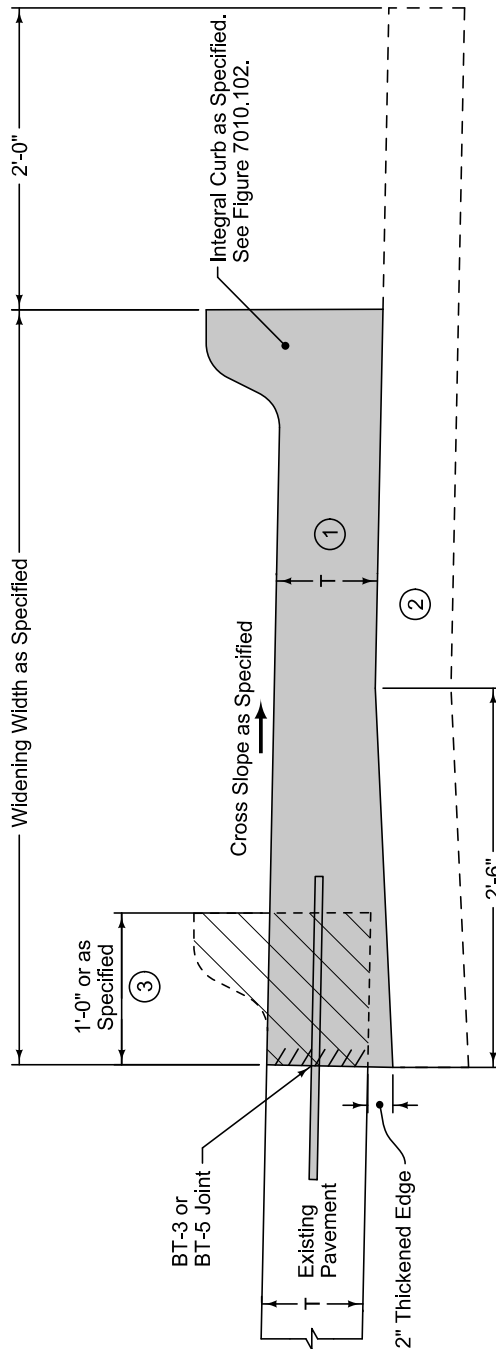
SHEET 1 of 1

SUDAS Standard Specifications

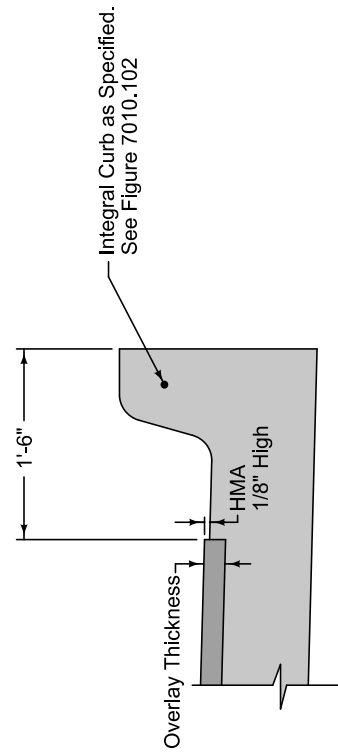
PCC PAVEMENT JOINTING

See Figure 7010.121 for typical joint layout.

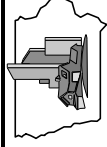
- ① Match existing pavement thickness or as specified in the contract documents.
- ② Subgrade or subbase material as specified.
- ③ Remove existing curb using full depth saw cut.



TYPICAL SECTION



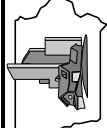
CURB FOR WIDENING WITH HMA OVERLAY

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	1	
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SUDAS Standard Specifications

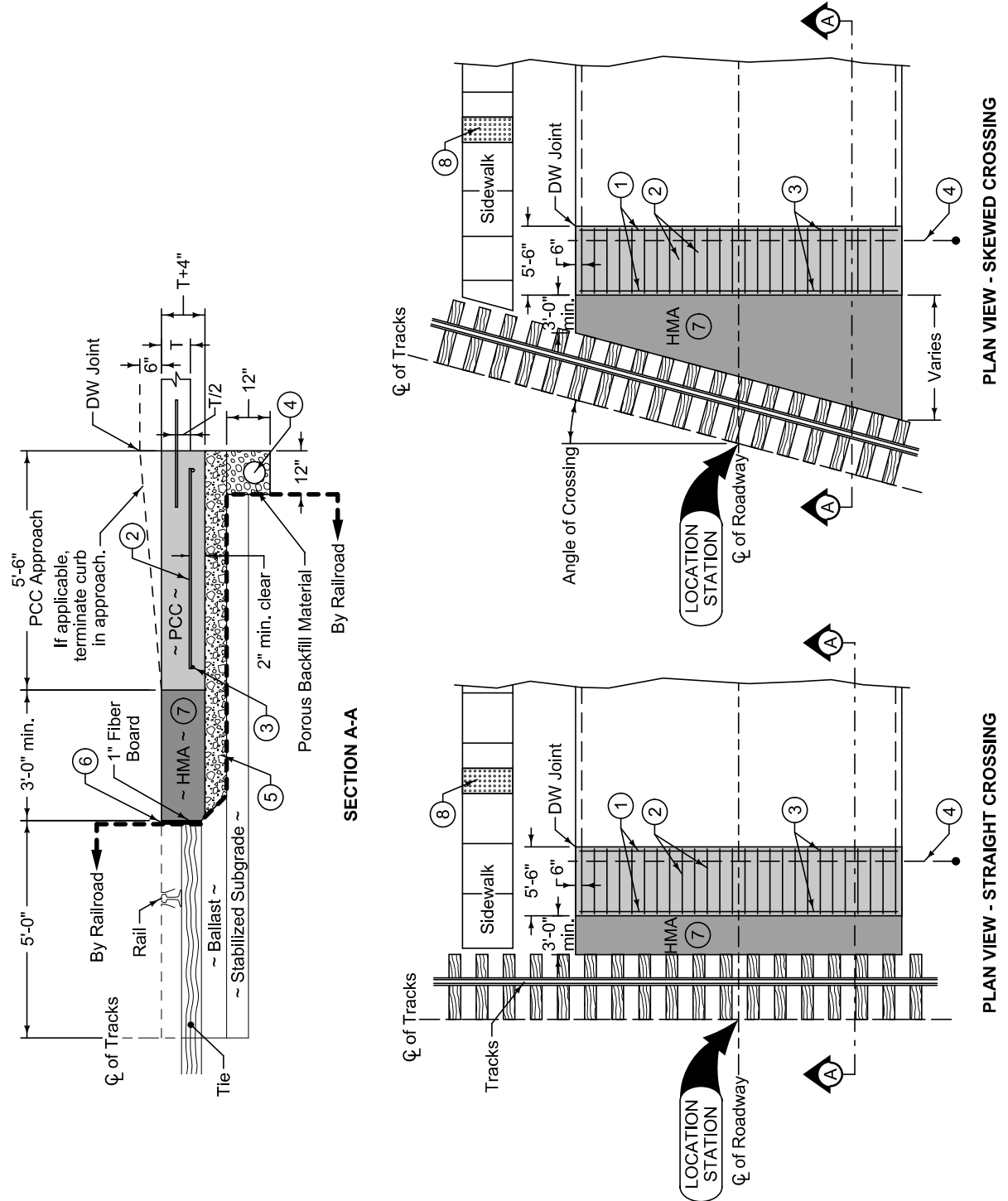
PCC PAVEMENT WIDENING

- ① Tie reinforcing bars with wire at all intersections with other bars. Lap reinforcing bars a minimum of 12 inches when necessary and tie securely.
- ② 5 foot 2 inch (typ.) #5 bar or pavement length minus 4 inches, at 12 inches on center.
- ③ #5 bars X (approach width minus 4 inches).
- ④ Install 6 inch perforated CMP subdrain, if specified. Include rodent guard per Iowa DOT Materials I.M. 443.01.
- ⑤ Granular subbase, modified subbase, or ballast meeting railroad specifications.
- ⑥ For new crossings, construct pavement 1/2 inch to 1 inch below top of rail. For existing crossings, construct pavement level to 1/2 inch below top of rail.
- ⑦ HMA full depth patch per Section 7040.
- ⑧ Refer to Figure 7030.205 for detectable warning location.

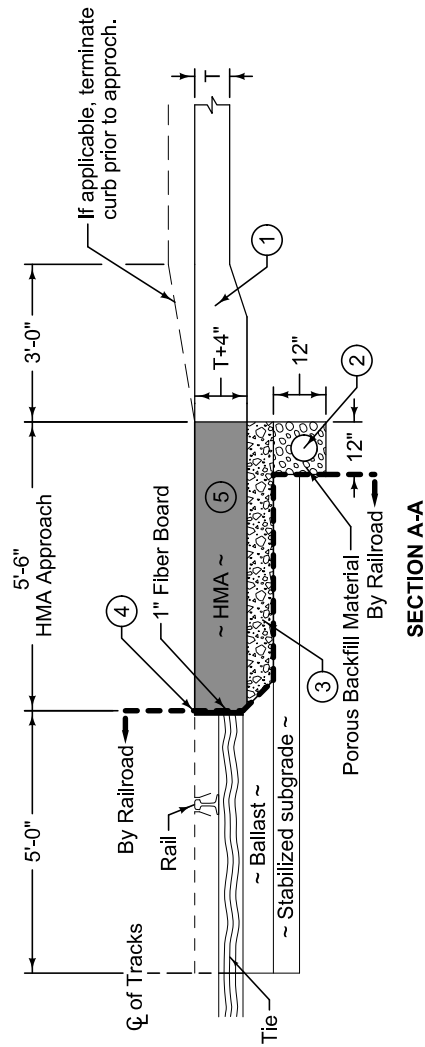
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SUDAS Standard Specifications

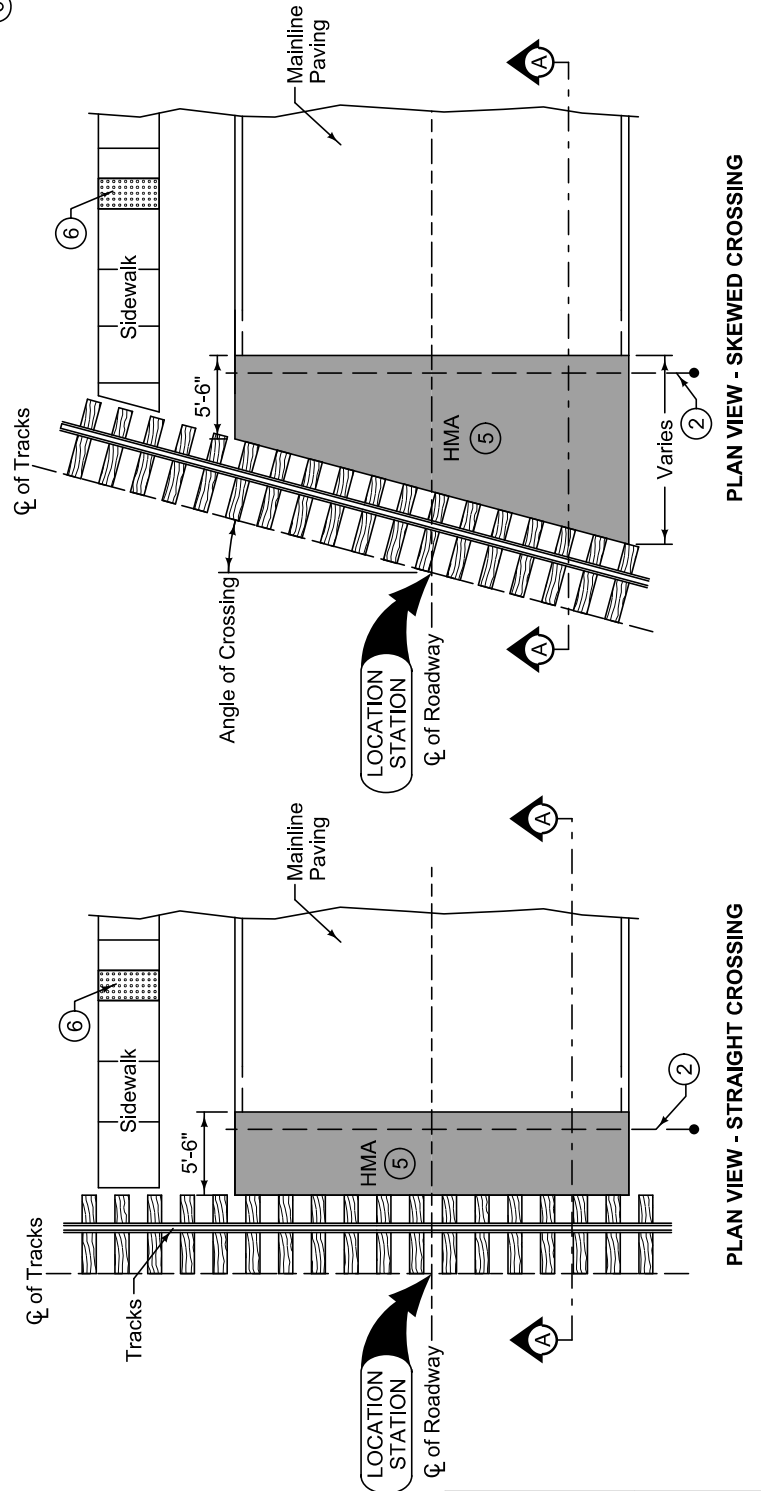
PCC RAILROAD
CROSSING APPROACH

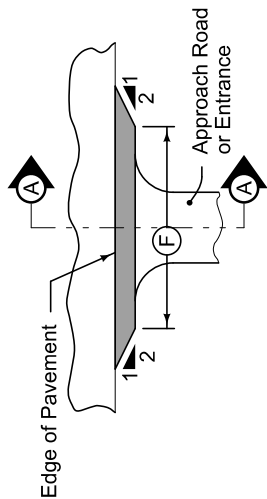


- ① HMA or composite mainline paving.
- ② Install 6 inch perforated CMP subdrain, if specified. Include rodent guard per Iowa DOT Materials I.M. 443.01.
- ③ Granular subbase, modified subbase, or ballast meeting railroad specifications.
- ④ For new crossings, construct pavement 1/2 inch to 1 inch below top of rail. For existing crossings, construct pavement level to 1/2 inch below top of rail.
- ⑤ Construct HMA approach according to full depth HMA patch requirements, or requirements for mainline paving if constructed with HMA mainline.
- ⑥ Refer to Figure 7030.205 for detectable warning location.

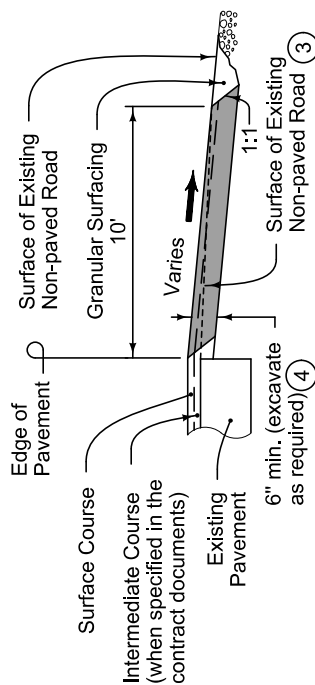


SECTION A-A



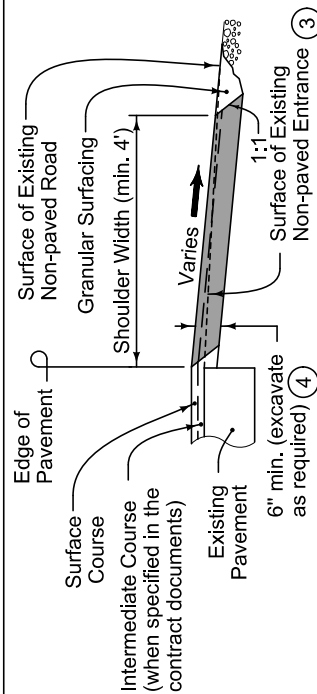


TYPICAL PLAN FOR FILLET AT
ENTRANCE OR INTERSECTING ROAD



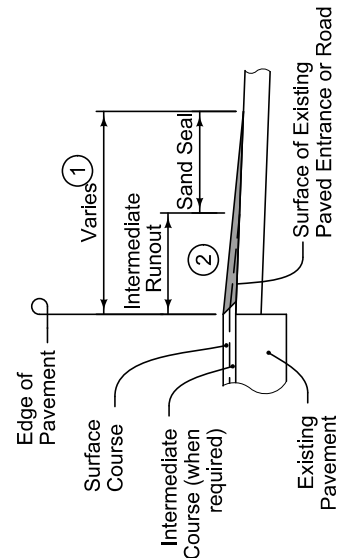
SECTION A-A

(Full Thickness Fillet - Non-paved Road)



SECTION A-A

(Full Thickness Fillet - Non-paved Entrance)



SECTION A-A

(Wedge Shaped Fillet - Paved Entrance or Road)

TYPE OF ACCESS	MINIMUM FILLET WIDTH	
	PRIMARY ROADS (F)	SECONDARY AND LOCAL ROADS (F)
Residential Entrance	40	12
Farm Entrance	60	18
Commercial Entrance	80	24
Non-paved Road	100	30
Paved Road	Variable (5)	Variable (5)

GENERAL DETAILS

For temporary runouts and wedges, place subgrade paper, burlap, or similar material over adjacent surfaces to facilitate removal. Construct temporary runout at a length of 10 feet for each 1 inch of resurfacing thickness.

Construct wedge shaped asphalt fillets at all paved entrances and paved roads. Construct full thickness fillets at all non-paved entrances and non-paved roads.

- ① Width of fillet is 4 feet for each inch of overlay thickness.
- ② The runout length of the intermediate course is equal to the total runout length, multiplied by the intermediate course thickness, divided by the total resurfacing thickness.
- ③ Excavate and shape road or entrance as required to accommodate proposed fillet.
- ④ For existing fillets at non-paved roads and entrances, construct a wedge shaped fillet matching the thickness of the resurfacing.
- ⑤ Match width and shape of existing pavement.

RUNOUT LENGTH	
POSTED SPEED LIMIT (mph)	RUNOUT RATIO (ft. per inch)
45 or More	50
20 to 45	25

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DETAILS FOR
ASPHALT RESURFACING

SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Removal of Sidewalks, Shared Use Paths, and Driveways
- B. Installation of Sidewalks, Shared Use Paths, and Driveways

1.02 DESCRIPTION OF WORK

- A. Remove existing sidewalks, shared use paths, and driveways.
- B. Install shared use paths.
- C. Install sidewalk.
- D. Install driveway.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. PCC mix design.
- B. HMA mix design.
- C. Brick source, absorption, compressive strength; samples of brick showing texture and color.
- D. Submit type and color of detectable warnings.
- E. Results of required testing.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. Portland Cement Concrete:** See Section 7010.
- B. Hot Mix Asphalt:** See Section 7020.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

Provide 10 calendar days advance notification of a pedestrian path closure to the Engineer and the National Federation of the Blind of Iowa (www.nfbi.org).

1.08 MEASUREMENT AND PAYMENT**A. Removal of Sidewalk, Shared Use Path, or Driveway:**

1. **Measurement:** Measurement will be in square yards for the area of sidewalks, shared use paths, or driveways removed.
2. **Payment:** Payment will be at the unit price per square yard for the area of sidewalk, shared use path, or driveway removal.
3. **Includes:** Unit price includes, but is not limited to, sawing, hauling, and disposal of materials removed.

B. Removal of Curb:

1. **Measurement:** Measurement will be in linear feet for removal of curb by grinding or sawing, measured along the back of curb.
2. **Payment:** Payment will be at the unit price per linear foot for the removal of curb.
3. **Includes:** Unit price includes, but is not limited to, hauling and disposal of materials removed.

C. Shared Use Paths:

1. **Measurement:** Each type and thickness of shared use paths will be measured in square yards. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement area.
2. **Payment:** Payment will be at the unit price per square yard for each type and thickness of shared use path.
3. **Includes:** Unit price includes, but is not limited to, subgrade preparation, jointing, sampling, smoothness testing and correction, and testing.

D. Special Subgrade Preparation for Shared Use Paths:

1. **Measurement:** Measurement will be in square yards for special subgrade preparation. Measured area will include 2 feet outside of the pavement on either side of the path.
2. **Payment:** Payment will be at the unit price per square yard for the area of special subgrade preparation.
3. **Includes:** Unit price includes, but is not limited to, water required to bring subgrade moisture content to within the required limits.

1.08 MEASUREMENT AND PAYMENT (Continued)**E. PCC Sidewalk:**

1. **Measurement:** Each thickness of PCC sidewalk will be measured in square yards. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement area.
2. **Payment:** Payment will be at the unit price per square yard for each thickness of PCC sidewalk.
3. **Includes:** Unit price includes, but is not limited to, minor grade adjustments at driveways and other intersections, subgrade preparation, formwork, additional thickness at thickened edges, jointing, sampling, smoothness testing and correction, and testing.

F. Brick Sidewalk:

1. **Brick Sidewalk with Sand Base:**
 - a. **Measurement:** Measurement will be in square yards for the area of brick sidewalk placed on a sand base.
 - b. **Payment:** Payment will be at the unit price per square yard for the area of sidewalk.
 - c. **Includes:** Unit price includes, but is not limited to, subgrade preparation, brick edge restraints, furnishing and placing compacted sand base, and sand/cement joint filler.
2. **Brick Sidewalk with Concrete Base:**
 - a. **Measurement:** Measurement will be in square yards for the area of brick sidewalk placed on a concrete base. The area of concrete base will not be measured separately.
 - b. **Payment:** Payment will be at the unit price per square yard for the area of sidewalk.
 - c. **Includes:** Unit price includes, but is not limited to, subgrade preparation, concrete base, HMA setting bed, neoprene asphalt adhesive for asphalt setting bed, and sand/cement joint filler.

G. Detectable Warnings:

1. **Measurement:** Measurement will be in square feet for the area of detectable warnings installed. Paved area beneath detectable warnings will be measured with sidewalk or shared use path item.
2. **Payment:** Payment will be at the unit price per square foot for the area of detectable warnings installed.
3. **Includes:** Unit price includes, but is not limited to, steel bar supports and manufactured detectable warning panels.

1.08 MEASUREMENT AND PAYMENT (Continued)**H. Driveways:****1. Paved Driveways:**

- a. Measurement:** Each type and thickness will be measured in square yards. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement area.
- b. Payment:** Payment will be at the unit price for each type and thickness of driveway.
- c. Includes:** Unit price includes, but is not limited to, excavation, subgrade preparation, jointing, sampling, and testing.

2. Granular Surfacing for Driveways:

- a. Measurement:** Measurement will be in square yards or tons, as specified in the contract documents, for the quantity of granular surfacing placed.
- b. Payment:** Payment will be at the unit price per square yard or ton, as specified.
- c. Includes:** Unit price includes, but is not limited to, excavation and preparation of subgrade.

I. Sidewalk, Shared Use Path, and Driveway Assurance Testing:

- 1. The Contractor will not be responsible for concrete compression or HMA density testing unless otherwise specified in the contract documents.
- 2. If the contract documents specify that the Contractor is responsible for concrete compression and HMA density testing, performed by an independent testing laboratory hired by the Contractor, measurement and payment will be as follows:
 - a. Measurement: Lump sum item; no measurement will be made.
 - b. Payment: Payment will be at the contract lump sum price.
- 3. The Contractor will be responsible for payments associated with all retesting resulting from failure of initial tests.

PART 2 - PRODUCTS**2.01 PORTLAND CEMENT CONCRETE**

- A. Class B or C concrete with materials complying with Section 7010. Use coarse aggregate of Class 2 durability or better.
- B. Comply with the following for PCC mixes for sidewalks, shared use paths, and driveways unless otherwise approved by the Engineer.

Table 7030.01: PCC Mixes

	Machine Finish	Hand Finish
Type of Concrete	Class B or C	Class B or C
Slump Minimum	1/2 in.	1/2 in.
Slump Maximum	2 1/2 in.	4 in.
Percent Air Content		
• Target	7%	7%
• Minimum	6%	6%
• Maximum	8 1/2%	8 1/2%

2.02 HOT MIX ASPHALT

Comply with Section 7020 for mix design.

- A. Use 100,000 ESAL, 1/2 inch or 3/8 inch mix.
- B. For shared use paths adjacent to pavement that also functions as the pavement shoulder, use 300,000 ESAL, 1/2 inch mix.
- C. Use asphalt binder complying with Section 7020 with a performance grade of PG 58-28 or 64-22.

2.03 BRICK PAVERS

- A. **Clay:** Use 8 inch by 4 inch by 2 1/4 inch thick clay paving bricks manufactured to comply with ASTM C 902, Class SX, Type I. Color selection and surface texture as approved by the Engineer.
- B. **Concrete:** Supply as specified in the contract documents.

2.04 HMA SETTING BED FOR BRICK

- A. **Mixture:** Proportion mix using 7% asphalt binder and 93% fine aggregate. Apportion each ton in the approximate ratio of 145 pounds asphalt binder to 1,855 pounds sand. Maintain mix temperature at approximately 250°F during placement.
- B. **Asphalt Binder:** Use asphalt binder complying with Section 7020 with a performance grade of PG 58-28 or 64-22.
- C. **Fine Aggregate:** Use clean, hard sand with durable particles free from adherent coating, lumps of clay, alkali salts, and organic matter. Use sand that is uniformly graded from coarse to fine with all passing the No. 4 sieve and meeting AASHTO T 27.

2.05 NEOPRENE MODIFIED ASPHALT ADHESIVE FOR BRICK**A. Mastic (Asphalt Adhesive):**

Solids (Base):	74% to 76%
Pounds per Gallon:	8 to 8 1/2 pounds
Solvent:	Mineral spirits with a flash point above 100° F

B. Base (2% Neoprene, 10% Asbestos-free Fiber, 88% Asphalt):

Melting Point:	200° F minimum according to ASTM D 36
Penetration:	23 to 27 according to ASTM D 5
Ductility:	1250 mm minimum according to ASTM D 113 @ 25° C, and a rate of 50 mm/minute

2.06 BRICK JOINT FILLER

Dry sand-cement mixture consisting of one part masonry cement complying with ASTM C 91 and three parts sand complying with ASTM C 144 and passing the No. 16 sieve. Provide colored cement to match bricks.

2.07 DETECTABLE WARNINGS

Use manufactured detectable warning panels or brick pavers with a non-slip surface and raised truncated domes. Comply with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (also known as PROWAG) for contrast and dimension requirements. Also comply with Iowa DOT Materials I.M. 411.

2.08 GRANULAR DRIVEWAY SURFACING

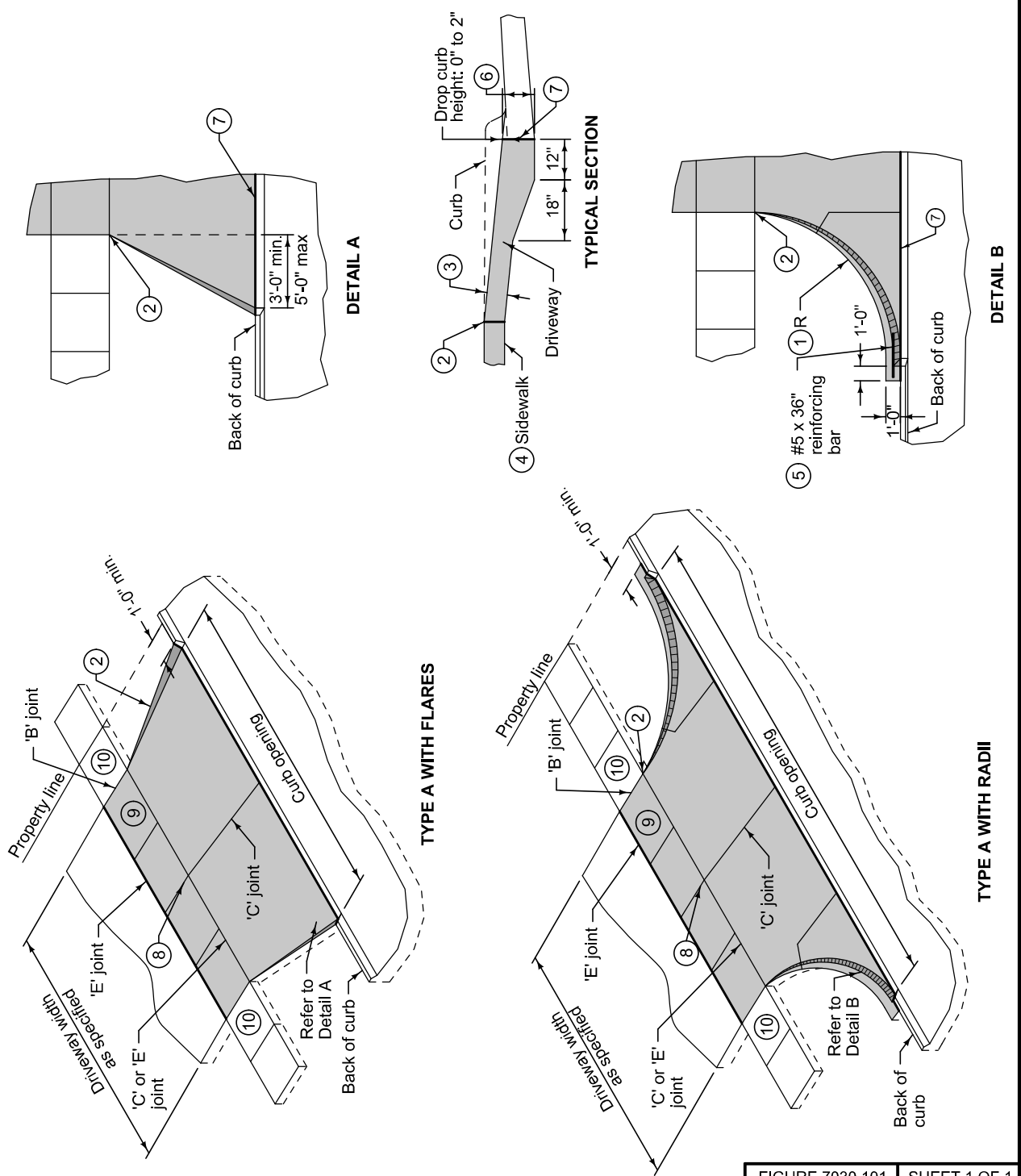
Class A crushed stone or Class C gravel complying with Iowa DOT Section 2315.

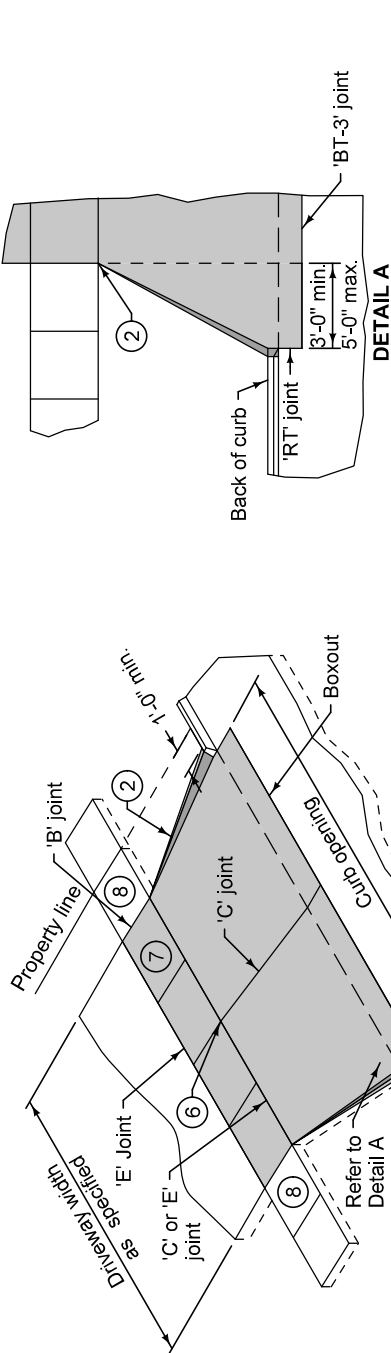
2.09 ISOLATION AND EXPANSION JOINT SEALANT

Use a polyurethane, self-leveling sealant complying with ASTM C 920. Application temperature range of 40 to 120°F. Minimum elongation 700%.

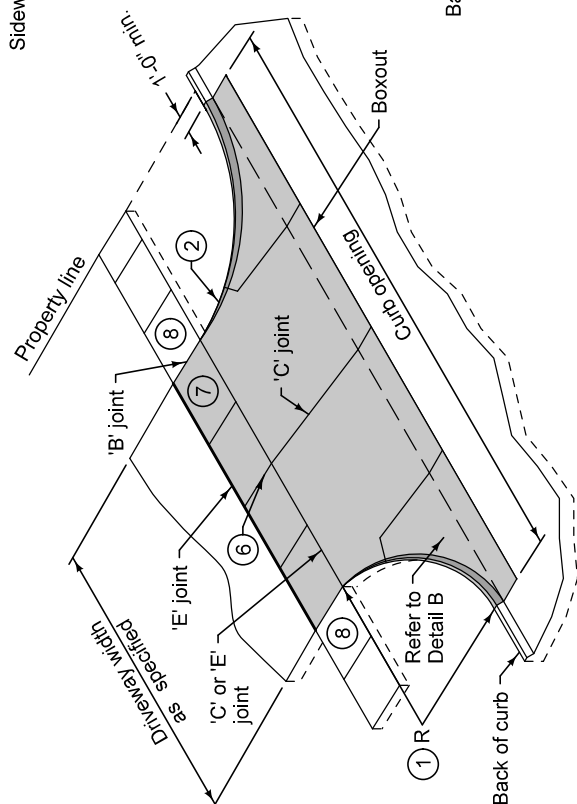
- ① Driveway radius (R). Residential: 10 foot minimum, 15 foot maximum. Commercial and industrial: As specified in the contract documents.
- ② Transition the curb height to 0 inches at end of taper/radius or at the front edge of sidewalk. Do not extend raised curb across sidewalk.
- ③ Pavement thickness. Residential: 6 inches minimum. Commercial and industrial: 7 inches minimum.
- ④ Sidewalk thickness through driveway to match thickness of driveway.
- ⑤ Center reinforcing bar vertically in the pavement.
- ⑥ Match thickness of adjacent roadway, 8 inches minimum.
- ⑦ Provide 'E' joint at back of curb unless 'B' joint is specified.
- ⑧ For alleys, invert the pavement crown 2% toward center of alley.
- ⑨ Target cross slope of 1.5% with a maximum cross slope of 2.0%. If specified in the contract documents, construct the sidewalk through the driveway 5 feet wide to serve as a passing space.
- ⑩ If cross slope of adjacent sidewalk panel exceeds 2.0%, remove and replace to transition from existing sidewalk to sidewalk through driveway. If elevation change requires a curb ramp, comply with Figure 7030.205; verify need for detectable warning panel with Engineer.

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CONCRETE DRIVEWAY, TYPE A			

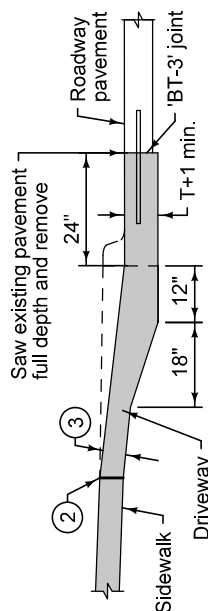




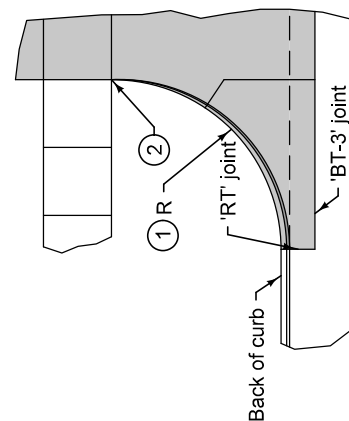
TYPE B WITH FLARES



TYPE B WITH RADII

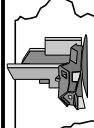


SECTION A-A



DETAIL B

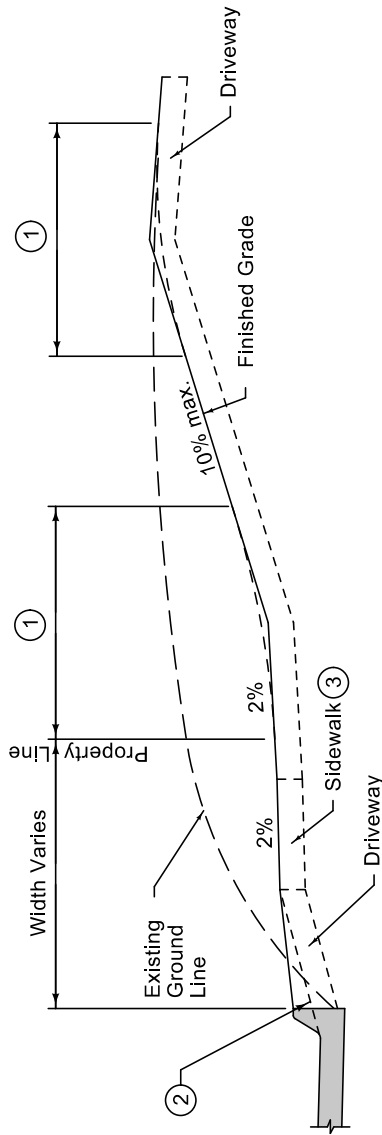
- ① Driveway radius (R).
Residential: 10 foot minimum, 15 foot maximum.
Commercial and industrial: As specified in the contract documents.
- ② Transition the curb height to 0 inches at end of taper/radius or at the front edge of sidewalk. Do not extend raised curb cross sidewalk.
- ③ Pavement thickness.
Residential: 6 inches minimum.
Commercial and industrial: 7 inches minimum.
- ④ Sidewalk thickness through driveway to match thickness of driveway.
- ⑤ If longitudinal joint is located 48 inches or less from the back of curb, extend boxout to joint line. Full depth saw cut is still required.
- ⑥ For alleys, invert the pavement crown 2% toward the center of the alley.
- ⑦ Target cross slope of 1.5% with a maximum cross slope of 2.0%. If specified in the contract documents, construct the sidewalk through the driveway 5 feet wide to serve as a passing space.
- ⑧ If cross slope of adjacent sidewalk panel exceeds 2.0%, remove and replace to transition from existing sidewalk to sidewalk through driveway. If the elevation change requires a curb ramp, comply with Figure 7030.205; verify need for detectable warning panel with Engineer.

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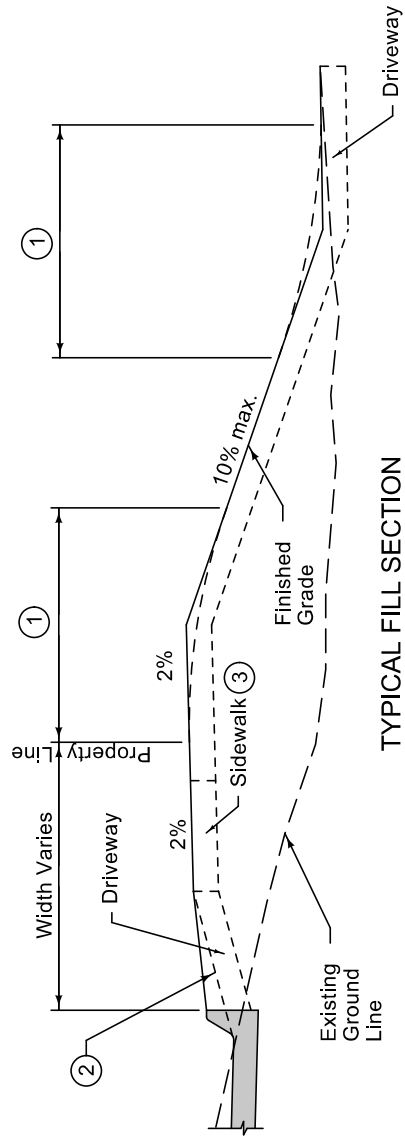
SUDAS Standard Specifications

CONCRETE DRIVEWAY, TYPE B

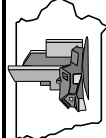
- ① 10 foot vertical curve required for 5% or greater change in grade.
- ② Slope varies. See contract documents.
- ③ Target cross slope of 1.5% with a maximum cross slope of 2.0%.



TYPICAL CUT SECTION



TYPICAL FILL SECTION

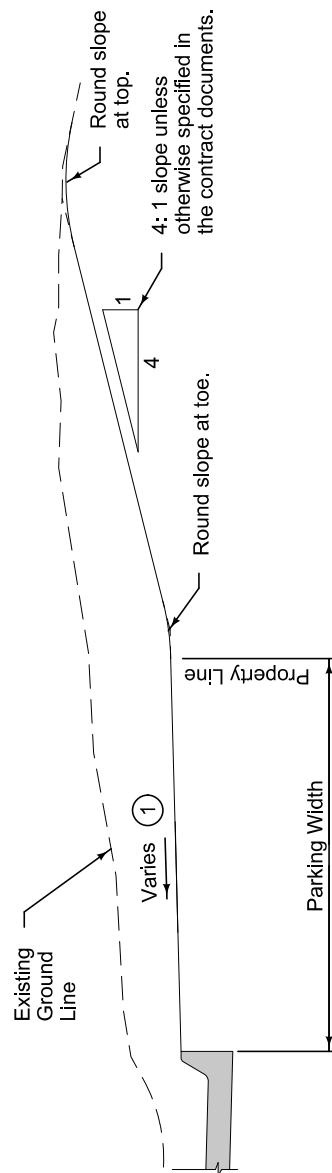
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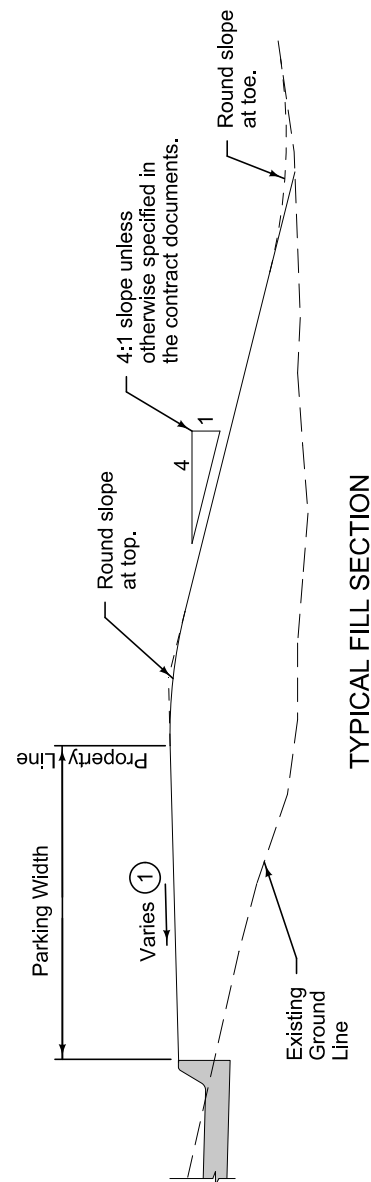
DRIVEWAY GRADING

- ① Parking Slope:
If parking width is less than 10 feet
wide, slope at 1/4 inch per foot.

If parking width is 10 feet wide and
greater, slope at 1/2 inch per foot.



TYPICAL CUT SECTION



TYPICAL FILL SECTION

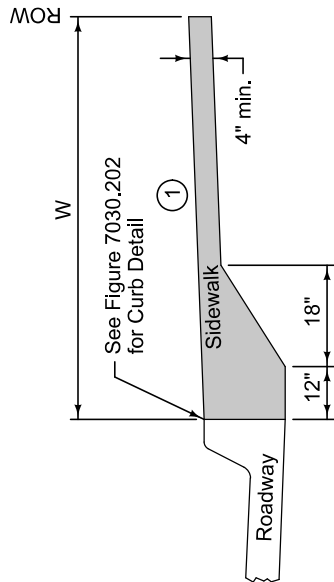
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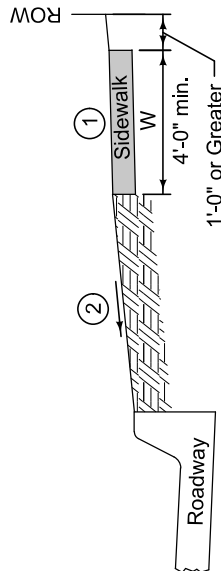
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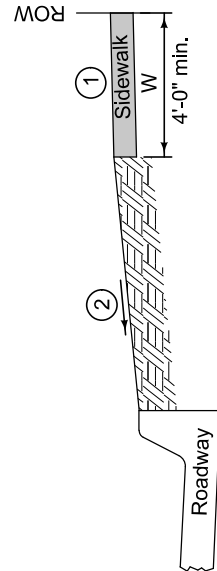
RIGHT-OF-WAY GRADING



CLASS A SIDEWALK
(Sidewalk extends from
back of curb to ROW)



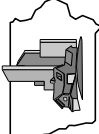
CLASS B SIDEWALK



CLASS C SIDEWALK

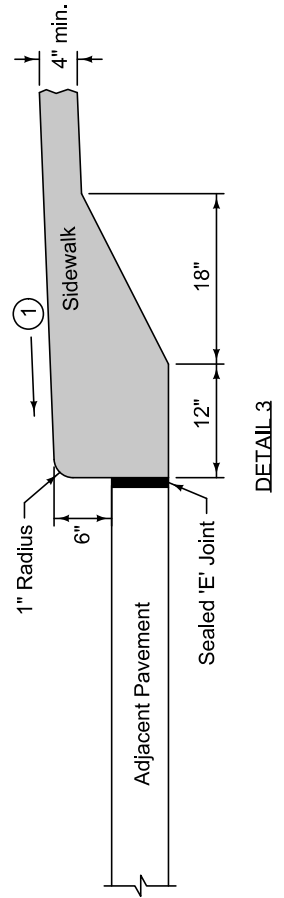
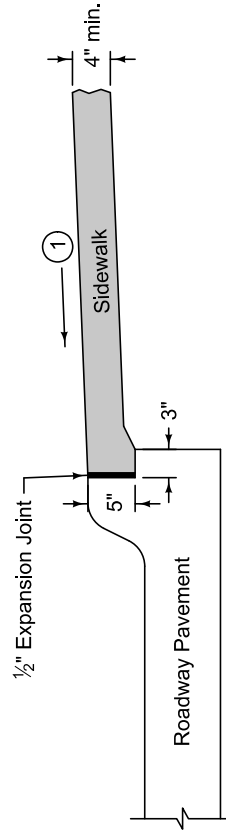
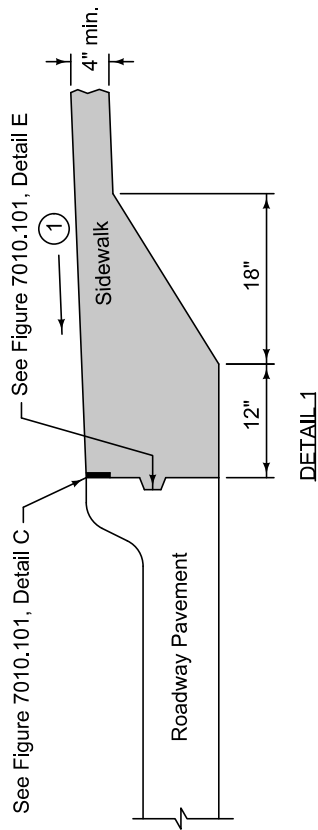
- ① Target cross slope of 1.5% with a maximum cross slope of 2.0% (including sidewalk through driveway).
 - ② Parking Slopes:
If parking width is less than 10 feet wide, slope at $\frac{1}{4}$ inch per foot.
If parking width is 10 feet wide and greater, slope at $\frac{1}{2}$ inch per foot.
- Special grade may be specified in the contract documents.

W = Sidewalk width as specified in the contract documents.

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CLASSES OF SIDEWALKS		

For new sidewalk with new curb and gutter, comply with Detail 1 or Detail 2. Comply with Detail 3 for new sidewalk adjacent to existing pavement or when specified in the contract documents.

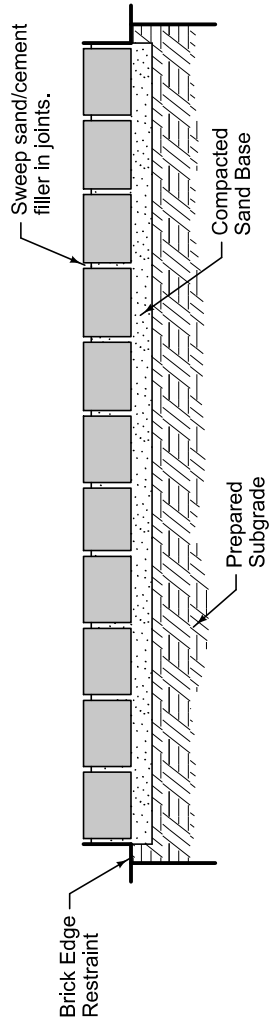
- ① Target cross slope of 1.5% with a maximum cross slope of 2.0%.



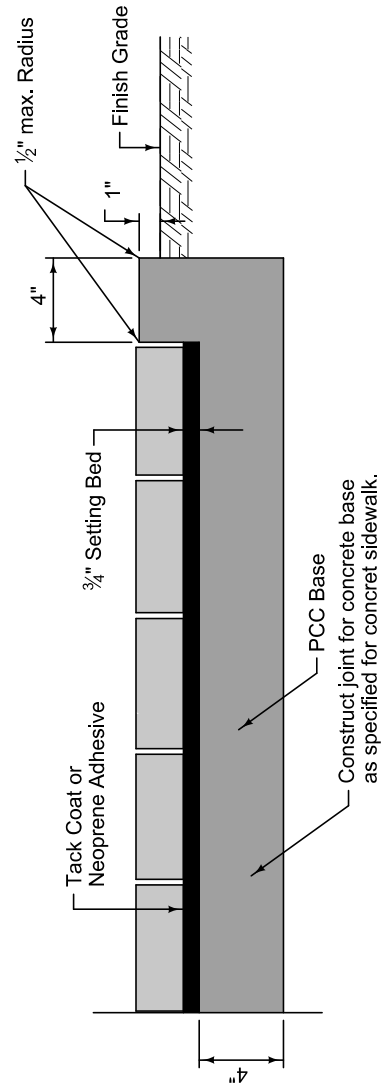
SUDAS Standard Specifications

CURB DETAILS FOR
CLASS A SIDEWALK

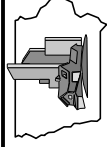
Install brick sidewalk with pattern specified in the contract documents.



BRICK SIDEWALK WITH SAND BASE

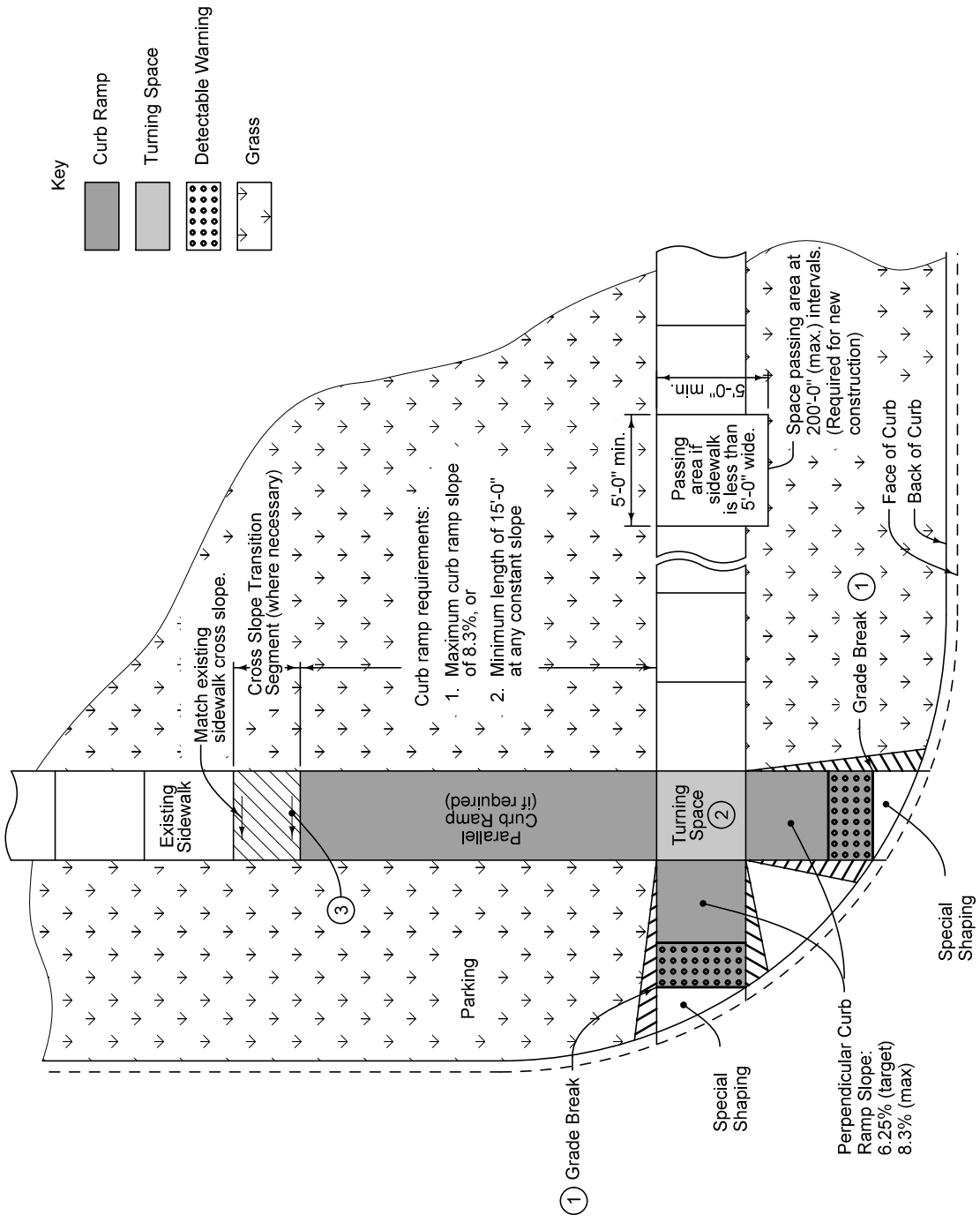


BRICK SIDEWALK WITH CONCRETE BASE

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SUDAS Standard Specifications

BRICK SIDEWALK



- ① Match pedestrian street crossing slope, or flatter.
- ② Minimum 4 feet by 4 feet. Target cross slope of 1.5% with a maximum cross slope of 2.0%.
- ③ Target cross slope of 1.5% with a maximum cross slope of 2.0%.



REVISION

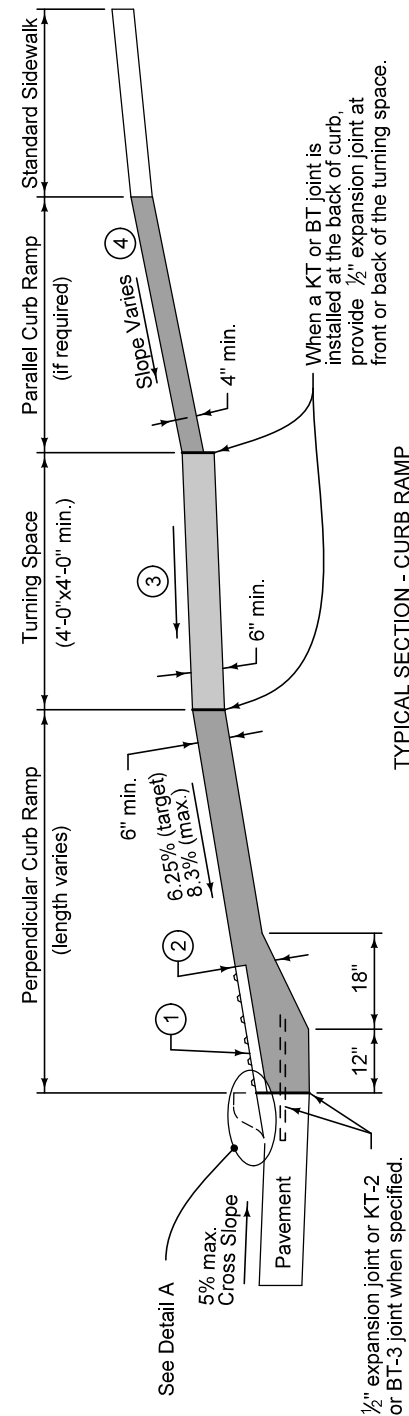
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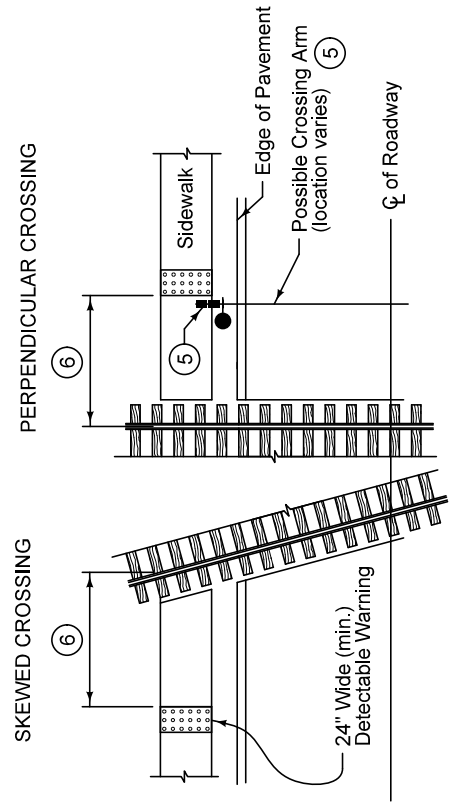
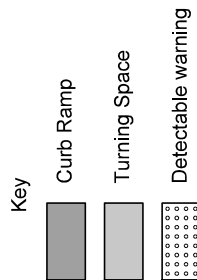
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SUDAS Standard Specifications

GENERAL FEATURES OF AN ACCESSIBLE SIDEWALK



TYPICAL SECTION - CURB RAMP



DETECTABLE WARNING LOCATION AT RAILROAD CROSSING

- Provide a minimum 2 foot width of detectable warning surfaces in the direction of pedestrian travel across the full width of the curb ramp or turning space, exclusive of curbs or flares.
- Provide a minimum of 6 inches of concrete below the detectable warning panel.
- Minimum 4 feet by 4 feet. Target cross slope of 1.5% with a maximum cross slope of 2.0%.
- If normal sidewalk elevation cannot be achieved with the perpendicular ramp between the street and landing due to limited ramp length, provide a parallel ramp to make up the elevation difference between the landing and the standard sidewalk.

The length of the parallel ramp is not required to exceed 15 feet, regardless of the resulting slope. Do not exceed 8.3% slope for parallel ramps shorter than 15 feet.
- If crossing gate conflicts with location of detectable warning or if pedestrian crossing gate is provided, place detectable warning panel in advance of the crossing gate.
- Locate front edge of detectable warning panel 12 to 15 feet from centerline of nearest rail. Orient truncated domes parallel to the direction of pedestrian travel.

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SUDAS Standard Specifications

GENERAL SIDEWALK AND CURB RAMP DETAILS

PERMEABLE INTERLOCKING PAVERS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Subgrade Preparation
- B. Placement of Storage Aggregate
- C. Placement of Filter Aggregate
- D. Placement of Bedding Course
- E. Placement of Permeable Interlocking Pavers
- F. Quality Control
- G. Protection of the Pavement

1.02 DESCRIPTION OF WORK

Construct permeable interlocking pavement for mitigation of stormwater runoff.

1.03 SUBMITTALS

- A. Sample Pavers:** Representative of the type and color proposed for the project.
- B. Installation Instructions:** Manufacturer's published installation instructions.
- C. Material Certification:** Submit certification letter from paver manufacturer indicating compliance with the ASTM specifications and the contract documents.
- D. Bedding, Filter, and Storage Aggregates:** Submit 5 pound samples of each aggregate type. Include aggregate type, source, gradation, and compacted void content.
- E. Project Details:** Include schedule, construction procedures, and quality control plan that describes material staging; paving direction; details of placement and compaction of the storage, filter, and bedding aggregate; and the paver installation procedures.
- F. Involved Parties:** Submit a list of all subcontractors, material suppliers, and testing laboratories.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS**A. Qualifications of Paver Installer:**

1. **Experience:** Successful completion of paver installations similar in design, material, and extent. Provide project location, owner name, and email contact information.
2. **Certification:** Successful completion of a permeable paver installation certification course developed by the Interlocking Concrete Paver Institute or the School for Advanced Segmental Paving.

- B. Test Section:** Install a 5 foot by 5 foot mock-up paver area on the prepared substrate to determine joint sizes, lines, laying patterns, paver edge treatments, colors, and texture of the project. If approved by the Engineer, it may be incorporated into the project.

1.08 MEASUREMENT AND PAYMENT

- A. Class 10, Class 12, or Class 13 Excavation:** Comply with Section 2010, 1.08, E.

B. Engineering Fabric:

1. **Measurement:** Measurement will be in square yards for the surface area covered with engineering fabric. Both horizontal and vertical areas covered with engineering fabric will be measured.
2. **Payment:** Payment will be made at the unit price per square yard of engineering fabric.
3. **Includes:** Unit price includes, but is not limited to, placing and securing filter fabric and any overlapped areas.

C. Underdrain:

1. **Measurement:** Each type and size of pipe installed will be measured in linear feet from end of pipe to end of pipe along the centerline of pipe, exclusive of outlets. The vertical height of cleanouts; the vertical height of observation wells; and lengths of elbows, tees, wyes, and other fittings will be included in the length of pipe measured.
2. **Payment:** Payment will be made at the unit price of each type and size of pipe.
3. **Includes:** Unit price includes, but is not limited to, furnishing and placing pipe, cleanouts, observation wells, and pipe fittings.

D. Storage Aggregate:

1. **Measurement:** Measurement will be in tons based upon scale tickets for the material delivered and incorporated into the project.
2. **Payment:** Payment will be made at the unit price per ton of storage aggregate.
3. **Includes:** Unit price includes, but is not limited to, furnishing, hauling, placing, and compacting storage aggregate.

1.08 MEASUREMENT AND PAYMENT (Continued)**E. Filter Aggregate:**

1. **Measurement:** Measurement will be in tons based upon scale tickets for the material delivered and incorporated into the project.
2. **Payment:** Payment will be made at the unit price per ton of filter aggregate.
3. **Includes:** Unit price includes, but is not limited to, furnishing, hauling, placing filter, and compacting aggregate.

F. Permeable Interlocking Pavers:

1. **Measurement:** Measurement will be in square yards for the area of each type of permeable interlocking pavers installed. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement area.
2. **Payment:** Payment will be made at the unit price per square yard of each type of permeable interlocking pavers.
3. **Includes:** Unit price includes, but is not limited to, testing, placement of bedding course, installing permeable interlocking pavers, placing joint/opening fill material, refilling joint after 6 months, and pavement protection.

G. PCC Edge Restraint:

1. **Measurement:** Measurement will be in linear feet for each type and size of PCC edge restraint. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement area.
2. **Payment:** Payment will be at the unit price per linear feet for each type and size of PCC edge restraint.
3. **Includes:** Unit price includes, but is not limited to, final trimming of subgrade or subbase, bars and reinforcement, joints and sealing, surface curing and pavement protection, safety fencing, and boxouts for fixtures.

PART 2 - PRODUCTS**2.01 ENGINEERING FABRIC**

Comply with Iowa DOT Section 4196, requirements for subsurface drainage.

2.02 UNDERDRAIN

- A. Provide slotted or perforated pipe(s) complying with the requirements for Type 1 Subdrain in Section 4040.
- B. Provide 6 inch diameter collector pipes unless otherwise specified in the contract documents.
- C. Provide 4 inch diameter lateral pipes unless otherwise specified in the contract documents.

2.03 AGGREGATE

Provide crushed stone with 90% fractured faces. Wash all stone materials to ensure less than 2% passing the No. 200 sieve.

- A. **Storage Aggregate:** Aggregate complying with Iowa DOT Section 4122, Gradation No. 13, Class 2 durability (AASHTO M 43/ASTM D 448, Size 2).
- B. **Filter Aggregate:** Aggregate complying with Iowa DOT Section 4115, Gradation No. 3, Class 2 durability (AASHTO M 43/ASTM D 448, Size 57).
- C. **Bedding/Joint/Void Filler Aggregate:** Crushed stone complying with Iowa DOT Section 4125, Gradation No. 29 (AASHTO M 43/ASTM D 448, Size 8).

2.04 PERMEABLE INTERLOCKING PAVERS

- A. **Interlocking Concrete Pavers:** Comply with ASTM C 936 for minimum 3 1/8 inch thick pavers.
- B. **Clay Brick Pavers:** Comply with ASTM C 1272 for minimum 2 3/4 inch thick, Type F brick for PX applications.

2.05 PCC EDGE RESTRAINT

Provide PCC edge restraint complying with Section 7010. A PCC edge restraint may be standard curb and gutter section, a vertical curb section, or a narrow concrete slab.

PART 3 - EXECUTION**3.01 PRE-INSTALLATION PROTECTION**

- A. Complete grading, utility installation, and other earth disturbing operations prior to excavating for the permeable paver system.
- B. Prior to placing permeable interlocking pavers, install sediment control practices upstream to protect the area from sediment in stormwater runoff from disturbed soil.

3.02 SUBGRADE PREPARATION FOR PERMEABLE INTERLOCKING PAVERS

- A. Excavate area to the elevations and grades specified in the contract documents.
- B. When underdrain is specified, excavate a minimum 12 inch wide by 8 inch deep trench at locations specified in the contract documents.
- C. Where fill materials are required, compact materials to 95% of maximum Modified Proctor Density. Do not over compact.
- D. Fill and lightly re-grade any areas damaged by erosion, ponding, or traffic compaction prior to placing the engineering fabric.

3.03 ENGINEERING FABRIC

- A. Install engineering fabric over completed subgrade, including trench for underdrain when specified.
- B. Overlap adjacent strips of fabric a minimum of 12 inches.
- C. Extend fabric up the sides of the subbase trench to the bottom of the proposed pavement.

3.04 UNDERDRAIN**A. Underdrain Collector Pipes:**

- 1. Place 2 inches of filter aggregate in the bottom of the underdrain trench over engineering fabric.
- 2. Begin underdrain collector installation at the outlet and continue upgrade.
- 3. Lay underdrain collector pipe to the proper line and grade. Place pipe with perforations down.
- 4. Place filter aggregate over installed pipe in layers no more than 6 inches thick. Thoroughly tamp each layer with mechanical tampers.
- 5. Provide cleanouts where specified in the contract documents. Comply with Figure 4040.232.
- 6. Connect underdrain collector to outlet. Comply with Figure 4040.233. Install rodent guard on all underdrain pipe 6 inches or smaller.
- 7. Install underdrain cleanout pipes and observation wells as specified in the contract documents.

3.04 UNDERDRAIN (Continued)**B. Underdrain Lateral Pipes:**

1. Place 2 inches of filter aggregate over the bottom of the prepared subgrade at lateral pipe locations specified in the contract documents.
2. Lay underdrain lateral over filter aggregate to the proper line and grade. Place pipe with perforations down.
3. Connect underdrain laterals to underdrain collector with wye or tee fitting.
4. Install plug or cap on upstream end of lateral pipe.
5. Place additional filter aggregate along each side of the lateral pipe to the springline of the pipe.

3.05 STORAGE AGGREGATE

- A. Place storage aggregate in 6 inch maximum lifts to the thickness specified in the contract documents. If underdrain system is specified, take care not to damage or displace pipe during placement of storage aggregate.
- B. Compact each lift with a vibratory drum roller until no visible movement can be seen in the aggregate layer. Do not crush aggregate. Do not operate compaction equipment directly over underdrain, until a minimum of 12 inches of storage aggregate is placed over the underdrain.
- C. Install storage aggregate to the elevation specified in the contract documents.

3.06 FILTER AGGREGATE

- A. Place filter aggregate directly over storage aggregate.
- B. Install aggregate in a single lift with a thickness of 4 inches.
- C. Lightly compact filter aggregate with one or two passes from a vibratory plate compactor or vibratory roller. If a vibratory roller is utilized, perform the final pass without vibration. Do not crush aggregate.

3.07 BEDDING AGGREGATE

- A. Place bedding aggregate directly over filter aggregate.
- B. Install aggregate in a single lift with a thickness of 2 inches.
- C. Use laser guided spreader or place screed rails on the completed filter aggregate layer. Use screed width no less than the full width of each cross-section component of the roadway and no less than 16 feet for parking areas. Surface variations must be within 3/8 inch when tested with a 10 foot straightedge prior to compaction.
- D. Lightly compact bedding aggregate with one or two passes from a vibratory plate compactor or vibratory roller. Recheck tolerance following compaction and make necessary corrections. Ensure surface is even, smooth with no roller ridges, and at the proper elevation to accommodate the pavers.
- E. Restrict pedestrians and equipment from screeded bedding prior to placement of pavers.

3.08 INSTALLING PCC EDGE RESTRAINT

Place PCC edge restraint according to Section 7010.

3.09 INSTALLING INTERLOCKING PERMEABLE PAVER SYSTEM

Place and install pavers according to the pattern specified, the paver manufacturer's published installation specifications, and the following:

- A. Where pavers are placed against a curb and gutter or other pavement, installation of an edge course or soldier course is required if the pavement edge is not straight. Trim pavers as required to compensate for deviations in the adjacent pavement edge. Do not cut pavers to less than 1/3 their original size.
- B. Install PCC edge restraint.
- C. Place chalk lines on the bedding course to maintain straight joint lines.
- D. After pavers have been installed on the bedding course, and all cut pavers have been inserted to provide a full and complete surface, inspect pavers for damaged units and irregular joint lines. Remove and replace pavers as required.
- E. After inspection and replacement of damaged pavers, fill joint openings with bedding stone. Sweep the surface clean.
- F. Compact pavement surface with two passes of a vibratory plate compactor capable of at least 5,000 pounds centrifugal compaction force. Do not operate plate compactor within 6 feet of an unrestrained pavement edge.
- G. Re-inspect pavers, and remove and replace all damaged units. Refill joint openings completely. Sweep pavers clean. Complete compaction with two passes of the plate compactor.
- H. Refill all paver joint openings with bedding aggregate 6 months after installation.

3.10 QUALITY CONTROL

- A. Ensure horizontal alignment of the PCC edge restraint is within 1/2 inch of design alignment.
- B. Ensure final surface is within 3/8 inch when tested with a 10 foot straightedge.
- C. Ensure no greater than 1/8 inch difference in height between adjacent pavers.
- D. Maintain surface elevation within 1/4 inch above adjacent drainage inlets, gutters, and other appurtenances.

3.11 PROTECTION OF PAVEMENT

- A. Protect pavement from heavy construction traffic, including trucks, skid steers, loaders, and all tracked vehicles.
- B. Provide barriers and protection as necessary.

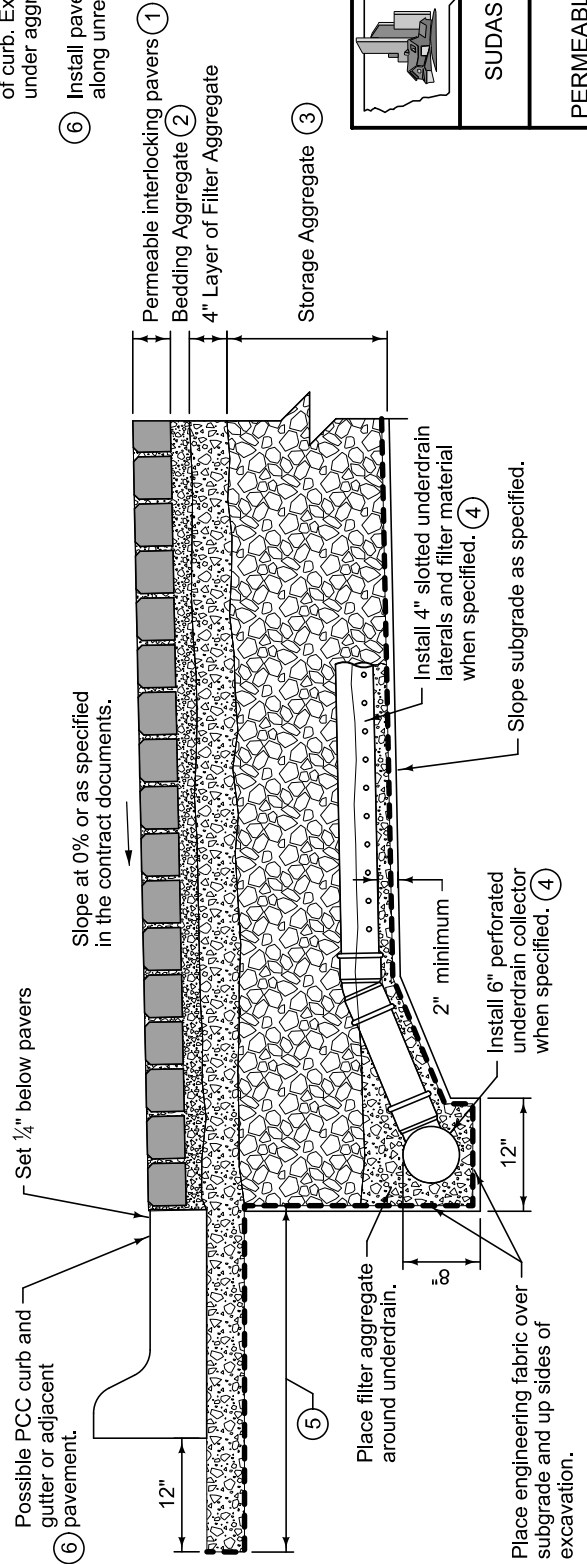
3.11 PROTECTION OF PAVEMENT (Continued)

- C. Do not place soil, mulch, sand, aggregate, or stockpile other materials on the pavement surface that may contaminate the pavement and plug the porous surface.
- D. Remove by vacuuming any base and bedding materials contaminated with sediment and replace with clean materials at no cost to the contracting authority.

END OF SECTION

Refer to the contract documents for dimensions, grades, and additional requirements for permeable interlocking pavers and associated improvements.

- ① Permeable interlocking pavers as specified in the contract documents.
- ② 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.
- ③ Permeable pavement storage aggregate thickness as specified in the contract documents.
- ④ When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.
- ⑤ Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.
- ⑥ Install paver edge restraint system along unrestrained edges.



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SUDAS Standard Specifications
PERMEABLE INTERLOCKING PAVERS

④ Set PCC edge restraint 1/4 inch below pavers.



SUDAS Standard Specifications

TYPICAL ALLEY WITH PERMEABLE PAVERS

2.03 COMMUNICATIONS (Continued)

1. Pan/tilt/zoom (PTZ) color camera with automatic conversion to monochrome during low light levels, auto focus, auto-iris control, electronic image stabilization, privacy masking and high resolution 1/4 inch CCD imager. Minimum optical zoom: 25X. Minimum digital zoom: 12X.
2. Camera system provided in a NEMA 4X or IP66 certified rugged weather-resistant package.
3. Provide all required lightning protection for electronics control, power, and coax video outputs.
4. Operating temperature range: -40°C to +50°C.
5. Maximum cable length as specified by camera manufacturer.
6. Provide full 360 degree endless pan and 220 degree tilt under PTZ control.
7. Dome electronics capable of programming a minimum of 64 preset views and nine preprogrammed pattern sequences of preset views. All views selectable by the central office computer or a remote control device.
8. Provide encoder and decoder devices as needed to transmit video over existing or proposed communication systems at 30 frames per second.
9. Provide all necessary rack support devices for video viewing and PTZ control.
10. Provide ability to control PTZ and view video remotely.

B. Fiber Optic Hub Cabinet: As specified in the contract documents.

C. Wireless Interconnect Network: Provides two-way data communication between the on-street master controller and local traffic signal controllers.

1. Data Transceiver:

- a. Utilize a license-free spread spectrum radio frequency (902-928 MHz) with frequency hopping technology.
- b. Completely programmable by software. Furnish software to the Jurisdiction.
- c. Built-in diagnostics capabilities.
- d. Configurable as master, slave, or repeater with store and forward capability.
- e. Maintains user selectable power output levels between 0.1 and 1 watt.
- f. Operates with input voltages between 6 VDC and 30 VDC.
- g. RS-232 interface with 115.2 kbps capability.
- h. Operating temperature of -40°C to +75°C.
- i. Receiver sensitivity of -108 to -110 dBm at 10⁻⁶ BER.
- j. Protected from power surges.
- k. Rack or shelf mounted in controller cabinet and connections for antenna, power, and controller.

2. Antenna:

- a. Capable of transmitting and receiving data between intersections.
- b. Mount near the top of the signal pole nearest the controller cabinet or as specified in the contract documents. Provide engineer-approved mounting hardware.
- c. Connect to transceiver via appropriate cable from pole to signal cabinet in same conduit as traffic signal cable. Conceal cable within a watertight connection at antenna.

2.04 CABINET AND CONTROLLER

A. NEMA Controller, Cabinet, and Auxiliary Equipment: Comply with the latest edition of NEMA TS1 or TS2 standards.

1. Controller:

- a. Solid state modular design with digital timing and capable of accommodating at least eight phases.
- b. Fully prompted, front panel keyboard with menu driven programmability.
- c. Local time base scheduler including automatic accommodation for daylight savings time.
- d. Local coordination control.
- e. Local preemption control with at least four programmable internal preemption sequences.
- f. Current software and documentation.
- g. Data retained in a memory medium that does not require battery backup.

2. Cabinet:

- a. Unpainted aluminum cabinet according to NEMA standards.
- b. Aluminum cabinet riser with same dimensions as cabinet and 12 to 18 inch height, as specified in the contract documents.
- c. Police door with auto/flash switch, manual/stop time switch, and on/off power switch for signal heads only. Controller to remain in full operation regardless of switch positions.
- d. Maintenance panel on inside of the main door containing the following test switches.
 - 1) Controller power switch.
 - 2) Detector test switches.
 - 3) Stop time switch.
 - 4) Signal flash switch.
- e. Heavy-duty clear plastic envelope attached to inside wall of cabinet or cabinet door, for cabinet wiring diagrams, 12 inches by 18 inches minimum.
- f. GFI electrical outlet and lamp in accessible location near the front of the cabinet. GFI outlet fused separately from main AC circuit breaker. Fluorescent or LED cabinet lamp connected and fused with GFI outlet.
- g. Back panel positions to accommodate phasing and expansibility specified in the contract documents.
- h. Power protection devices including AC power circuit breakers, radio interference suppressors, and lightning and surge protectors.
 - 1) AC field service single pole, nonadjustable, magnetic breaker rated for 117 VAC operation, NEC approved.
 - 2) Radio interference suppressors (RIS) as required to minimize interference in all broadcast transmission and aircraft frequency bands.
 - 3) Lightning arrestor/surge protector capable of withstanding repeated (minimum of 25) 30,000 ampere surges.
- i. Neatly train wiring throughout the cabinet and riser. Bundle and attach wiring to interior panels using nonconductive clamps or tie-wraps.

3. Auxiliary Equipment: Conflict monitor/malfunction management unit, flasher, load switches, terminals and facilities, and miscellaneous equipment and materials according to NEMA standards.

B. Uninterruptible Power Supply Battery Backup System: Monitors 120VAC input from the electric utility source and automatically switches to/from a system consisting of batteries and electronics.

- 1. Include a maintenance bypass switch to allow operation of the traffic signal system while repairs are made to the battery backup system.
- 2. Designed to provide a minimum of 4 hours of normal operation.

2.01 SEED (Continued)**Table 9010.01: Domestic Grasses**

Common Name	Scientific Name	Purity (%)	Germination (%)
Bluegrass, Kentucky	<i>Poa pratensis</i>	85	80
Brome, smooth-LINCOLN	<i>Bromus inermis</i>	90	85
Fescue, creeping, red	<i>Festuca rubra</i>	98	85
Fescue, tall, FAWN	<i>Festuca arundinacea</i> -FAWN	98	85
Orchardgrass	<i>Dactylis glomerata</i>	90	90
Red top	<i>Agrostis alba</i>	92	85
Ryegrass, perennial	<i>Lolium perenne</i>	95	90
Wildrye, Canada	<i>Elymus Canadensis</i>	95	85
Wildrye, Russian	<i>Psathyrostachys junceus</i>	95	85

Table 9010.02: Legumes

Common Name	Scientific Name	Purity (%)	Germination (%)
Alfalfa, RANGER/VERNAL	<i>Medicago sativa</i>	99	90*
Alfalfa, travois	<i>Medicago</i> spp.	99	90*
Clover, Alsike	<i>Trifolium hybridum</i>	99	90*
Clover, red, medium	<i>Trifolium pratense</i>	99	90*
Clover, white	<i>Trifolium repens</i>	98	90*
Hairy vetch	<i>Vicia villosa</i>	96	85*
Lespedeza, Korean	<i>Lespedeza stipulacea</i>	98	80*

* Includes hard seed.

Table 9010.03: Stabilizing Crop

Common Name	Scientific Name	Purity (%)	Germination (%)
Oats	<i>Avena sativa</i>	97	90
Rye	<i>Secale cereale</i>	97	90
Sudangrass, PIPER	<i>Sorghum vulgare</i> var. sudanese	98	85

2.01 SEED (Continued)**Table 9010.04: Native Grasses**

Common Name	Scientific Name
Big bluestem*	<i>Andropogon gerardii</i>
Blue grama	<i>Bouteloua gracilis</i>
Blue-joint grass	<i>Calamagrostis Canadensis</i>
Bottlebrush sedge	<i>Carex hystericina</i>
Buffalograss*	<i>Buchloe dactyloides</i>
Common rush	<i>Juncus effusus</i>
Fowl bluegrass	<i>Poa palustris</i>
Fowl manna grass	<i>Glyceria striata</i>
Fox sedge	<i>Carex vulpinoidea</i>
Green bulrush	<i>Scirpus atrovirens</i>
Hairy wood chess	<i>Bromus purgans</i>
Indiangrass*	<i>Sorghastrum nutans</i>
Intermediate wheatgrass	<i>Agropyron intermedium</i>
Little bluestem*	<i>Andropogon scoparius</i>
Prairie dropseed	<i>Sporobolus heterolepis</i>
Reed manna grass	<i>Glyceria grandis</i>
Rice cutgrass	<i>Leersia oryzoides</i>
Rye grass, annual	<i>Lolium italicum</i>
Sand bluestem*	<i>Andropogon gerardii</i> , var. <i>paucipilus</i>
Sand dropseed	<i>Sporobolus cryptandrus</i>
Sand lovegrass	<i>Eragrostis trichodes</i>
Sideoats grama*	<i>Bouteloua curtipendula</i>
Slender wheatgrass	<i>Agropyron trachycaulum</i> , var. <i>unilaterale</i>
Spike rush	<i>Eleocharis palustris</i>
Softstem bulrush	<i>Schoenoplectus tabernaemontani</i>
Switchgrass*	<i>Panicum virgatum</i>
Tussock sedge	<i>Carex stricta</i>
Virginia wild-rye	<i>Elymus virginicus</i>
Weeping lovegrass	<i>Eragrostis curvula</i>
Western wheatgrass*	<i>Agropyron smithii</i>
Wool grass	<i>Scirpus cyperinus</i>

PART 2 - PRODUCTS**2.01 SOD**

- A. Provide a well-established (no less than 18 months old), well rooted, healthy, nursery-grown sod blend of improved Kentucky Bluegrass with a uniform color, leaf texture, density, and varieties consisting of a minimum of three cultivars selected from the following list:

Allowed Kentucky Bluegrass Cultivars:

4-Seasons	Liberator
Arrowhead	Midnight
Award	NuBlue
Beyond	NuDestiny
Blue Chip Plus	NuGlade
Concerto	Rubicon
Everest	Rugby II
Everglade	Rush

- B. Sod grown in peat bedded soil will not be accepted.
- C. Ensure sod is free from objectionable grasses and broadleaf weeds, roots of trees or shrubs, stones, thatch, and other objectionable materials, nematodes and soil-born insects, and free from disease. Sod will be considered free of weeds if less than two such plants are found per 100 square feet of area.
- D. Mow at a height of 2 inches prior to cutting.
- E. Cut sod with a sod machine in strips of uniform width and length, with square ends. Cut to a uniform soil thickness of approximately 1 inch; thickness measurement excludes top growth.
- F. Ensure sod is moist when placed.

2.02 FERTILIZER

Comply with Iowa DOT Article 4169.03.

2.03 STAKES

- A. Softwood Stakes:** 3/4 inch diameter and 8 inches long.
- B. Steel Pins:** Tee shaped with a 4 inch head and 8 inch leg.

2.04 WATER

Unless otherwise specified in the contract documents, provide water and watering equipment such as hoses and sprinklers. Provide water free of substances harmful to plant growth.

PART 3 - EXECUTION**3.01 PREPARATION OF SODBED**

- A. Limit preparation to areas that will be immediately sodded.
- B. Where weed growth has developed, remove all weeds and weed debris.
- C. Shape and fine grade sodbed to remove washes or gullies, water pockets, and irregularities. Provide an even surface, true to grade and cross-section.
- D. Rototill and cultivate sodbed to a fine and mellow condition to a minimum depth of 3 inches. Clear the top 3 inches of soil lumps, stones over 3/4 inch, and foreign material using hand labor as required.

3.02 FERTILIZING - FIRST APPLICATION

- A. Provide a guaranteed analysis of 20-26-6 commercial fertilizer or the equivalent units of nitrogen (N), phosphate (P), and potash (K) by weight at the rate of 200 pounds per acre.
- B. Incorporate fertilizer into soil to a depth of 1 1/2 inches prior to placing sod.

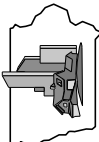
3.03 SOD INSTALLATION

- A. Do not install sod between the dates of June 15 and August 15, unless authorized by the Engineer.
- B. Do not lay frozen sod; do not lay sod on frozen soil or when freezing conditions are forecasted within 24 hours.
- C. Dampen dry soil prior to placing sod.
- D. Firm or heal in soil along the edges of the sodded areas.
- E. Carefully place sod in rows or strips evenly, with the longest edge parallel to the finished contours, and at right angles to the centerline of ditches and channels. On slopes, begin placing sod at the bottom and progress upward.
- F. Minimize traffic on newly laid sod during installation. Provide plank or wood sheets to protect sod already laid from equipment and vehicles.
- G. Tightly fit each strip against each other without voids. Do not overlap edges. Stagger joints at the ends of sod strips with adjacent strips of sod.
- H. Finish sod edges at walks, curbs, planting, mulch edges, and other vertical surface by cutting and fitting tightly to edge.
- I. Place sod mat approximately 1 inch below finished surface of walks, pavement, curbs, or other permanent features. Remove any sod not conforming to this requirement, adjust the subgrade, and re-lay the sod.
- J. Where new sod joins existing lawns, cut straight and neatly into existing lawn and level subgrade to match height.
- K. Stake sod on grades exceeding 4:1 and in drainage channels. Stake each roll at 2 foot intervals or as required to prevent movement during rainfall and stormwater runoff events.
- L. Roll lightly-watered sod with a small mechanical or hand sod roller to sufficiently set or heal sod into soil and remove lumps. Roll as required to firm and level the sodded areas.

Berm shown is typical for slopes flatter than 3:1. For steeper slopes, increase berm size as directed by the Engineer.

Place berm in uncompacted windrow perpendicular to the slope at locations specified in the contract documents.

Filter sock diameter as specified in the contract documents.



REVISION

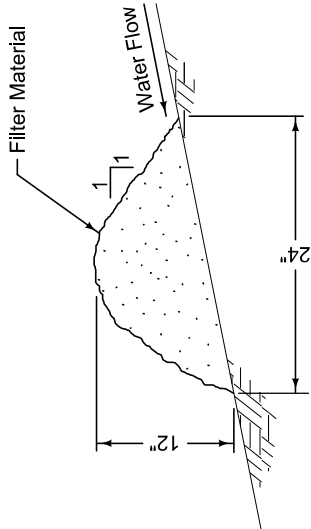
3 10-18-16

9040.102

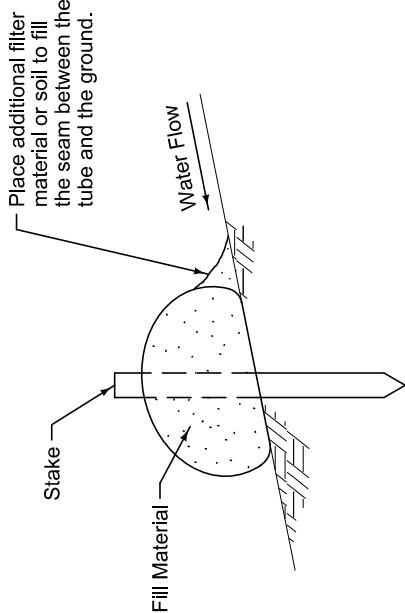
SHEET 1 of 1

SUDAS Standard Specifications

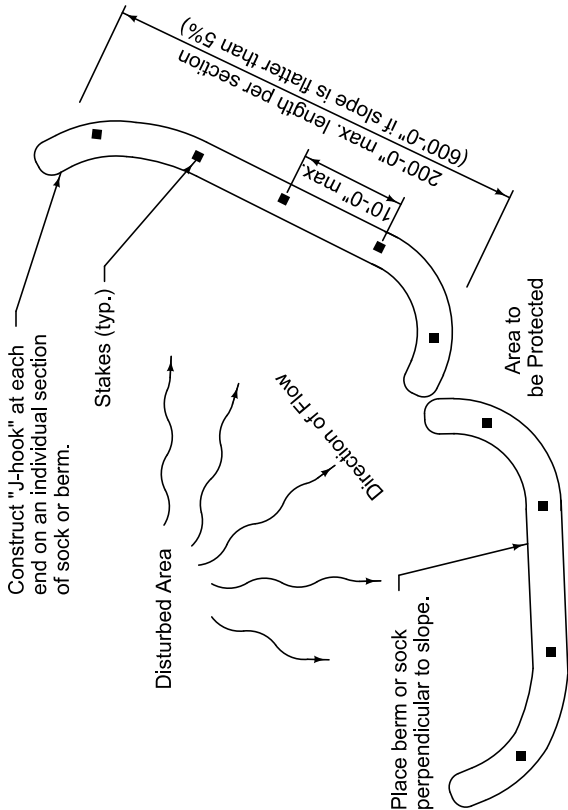
FILTER BERM AND FILTER SOCK



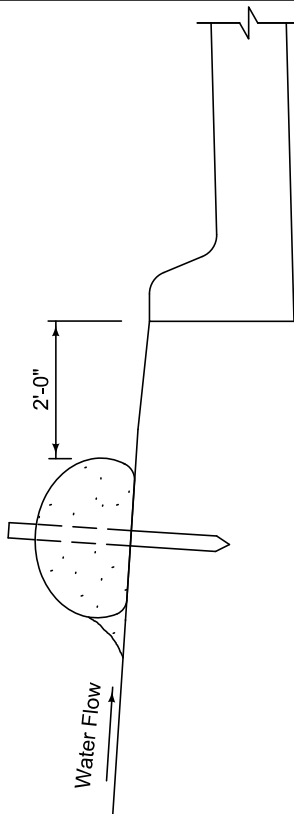
FILTER BERM



FILTER SOCK



PLAN VIEW OF SLOPE
(for sediment and slope control)



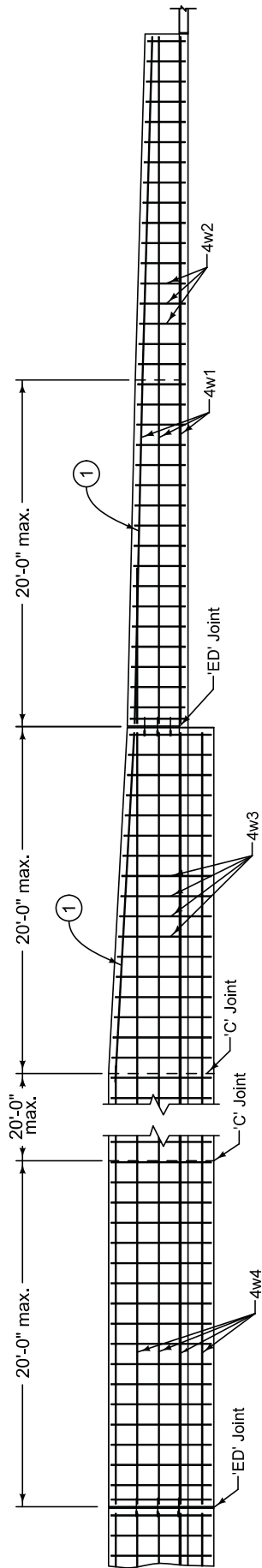
SECTION VIEW AT STREET
(for perimeter control along street)

TYPICAL PLACEMENT OF BERM OR SOCK

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Provide a minimum concrete cover to near reinforcement of 1 1/2 inches. Provide 3 inches minimum cover at the ends of bars.

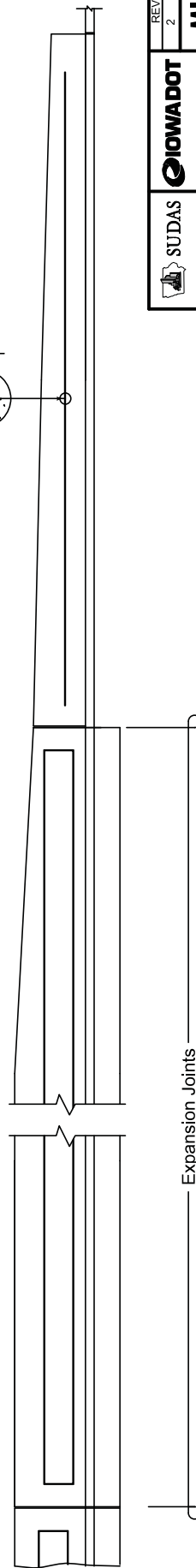
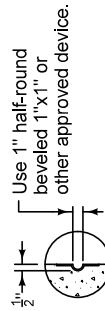
- ① Top bar parallel to top of wall. Lap 6 inch minimum as necessary. Tie securely.



TYPE A WALL

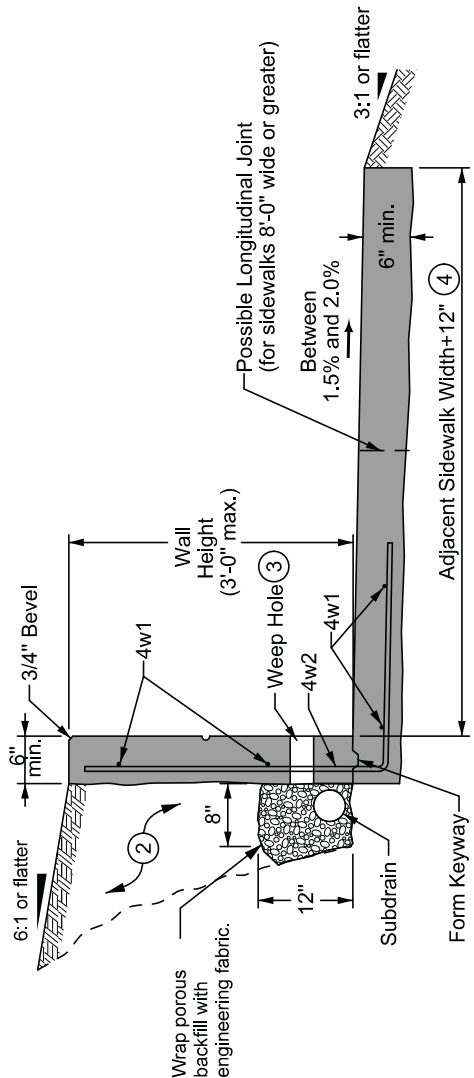
TYPE B WALL

TYPICAL LONGITUDINAL SECTION OF RETAINING WALL

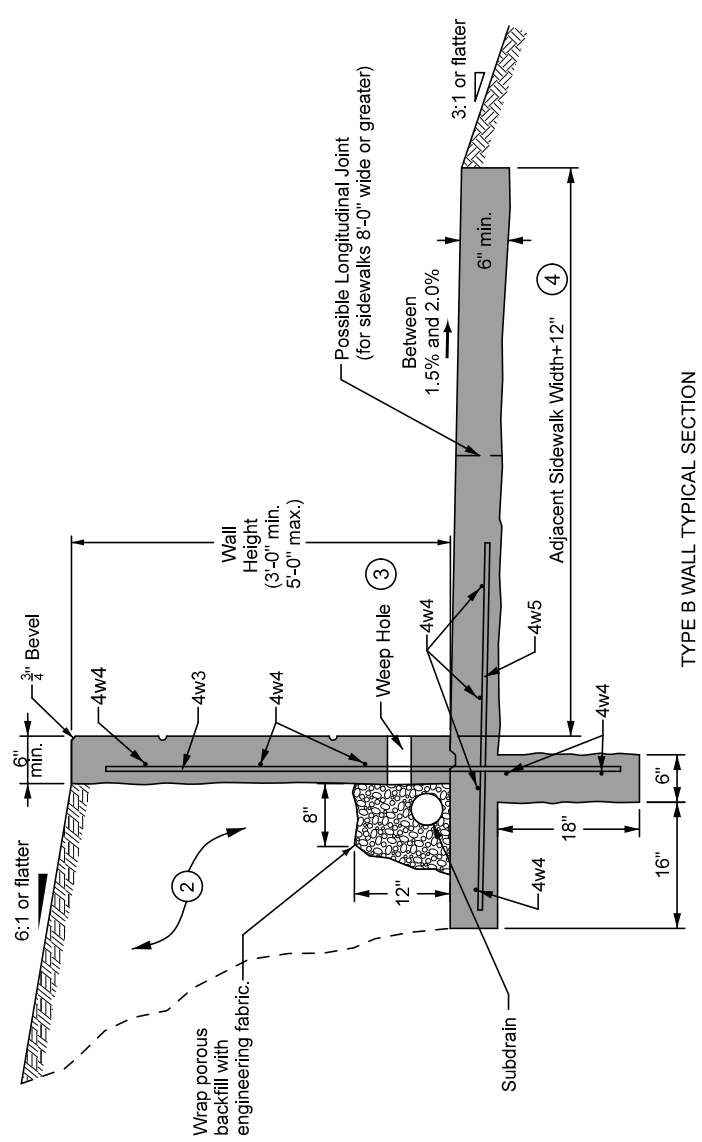


TYPICAL RUSTICATION DETAIL

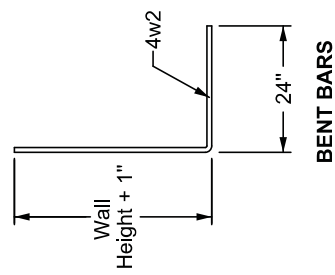
		REVISION 2 10-20-15
FIGURE 9072.221	STANDARD ROAD PLAN	MI-221
REVISIONS: Replaced DOT and SUDAS logos with new versions.		
Paul D. Wigand SUDAS DIRECTOR		
Brian Smith DESIGN METHODS ENGINEER		
COMBINED RETAINING WALL - SIDEWALK		



TYPE A WALL TYPICAL SECTION



TYPE B WALL TYPICAL SECTION



BENT BARS

REINFORCING BAR LIST				
Wall Type	Mark	Size	Shape	Length
Type A	4w1	4	—	Variable
	4w2	4	L	Variable
Type B	4w3	4	—	Wall Height + 18"
	4w4	4	—	Variable
	4w5	4	—	3'-10"

- Provide a minimum concrete cover to near reinforcement of 1 1/2 inches. Provide 3 inches minimum cover at the ends of bars.
- Excavate and place backfill material as necessary.
- Provide 3 inch diameter weep holes at 8 foot intervals. Install rodent guards in weep holes. Align bottom of weep hole with top of subdrain.
- Additional 12 inch width is adjacent to wall.

		REVISION 2 10-20-15
		MI-221 SHEET 2 OF 2
FIGURE 9072.221 REVISIONS: Replaced DOT and SUDAS logos with new versions.	STANDARD ROAD PLAN	SHEET 2 OF 2
Paul D. Wiegand Brian Smith SUDAS DIRECTOR DESIGN METHODS ENGINEER		
COMBINED RETAINING WALL - SIDEWALK		

PART 2 - PRODUCTS**2.01 STEPS**

- A. Concrete:** Class C concrete complying with Section 6010, 2.02.
- B. Reinforcing Steel:** Comply with Iowa DOT Section 4151 for epoxy coated reinforcement.
- C. Expansion Joint:** Comply with Iowa DOT Section 4136.03, A.
- D. Forms:** Comply with Iowa DOT Section 2403.

2.02 HANDRAIL

1 1/4 to 2 inches in diameter; ensure post diameter matches handrail diameter.

- A. Steel:** Welded or seamless black steel pipe and posts complying with ASTM A 53, Grade A or B.
- B. Aluminum:** Aluminum-alloy extruded structural pipe complying with ASTM B 429, alloy 6061-T6 or 6063-T6, schedule 40 (if specified; for use with grouted connection only).
- C. Bends:** Provide manufactured pipe bends and connections for handrail. Do not field bend pipe.

2.03 SAFETY RAIL

- A. Rails and Posts:** Provide 2 1/2 inch by 2 1/2 inch tubular high strength steel with 1/4 inch minimum wall thickness. Comply with ASTM A 500, Grade B.
- B. Pickets:** Provide 1 inch by 1 inch tubular high strength steel with 1/8 inch minimum wall thickness. Comply with ASTM A 500, Grade B.

2.04 FINISH

- A. Painted:** Provide factory-mixed paint / primer.
 - 1. Primer:** Provide single component, water-based rust and corrosion resistant primer specifically designed for use on steel surfaces.
 - 2. Paint:** Provide water-based, abrasion-resistant paint specifically designed for use on steel surfaces.
- B. Galvanized:** When specified in the contract documents, galvanize handrail and safety rail.
 - 1. Provide zinc coating complying with ASTM A 123.
 - 2. Hot-dip galvanize components after fabrication.
 - 3. For hot-dip galvanized components that will be powder coated, utilize the dry-kettle (pre-fluxing) process. Air cool galvanized components. Do not quench in water or chromate.
- C. Powder Coated:** Apply powder coat to steel, galvanized steel, or aluminum handrail and safety rail when specified in the contract documents. Comply with the manufacturer's recommendations for surface preparation, application of primer, and application of the powder coating, in addition to the following minimum requirements.

2.04 FINISH (Continued)**1. Surface Preparation:****a. Steel Substrate:**

- 1) Remove oils and surface contamination by solvent cleaning. Comply with the requirements of SSPC-SP 1. Rinse thoroughly with hot water or water pressure and dry completely.
- 2) Remove loose rust, loose mill scale, and other foreign substances by hand or power tool cleaning. Comply with SSPC-SP 2 or 3.
- 3) Remove all dirt, grease, rust scale, mill scale, paint, slag, and other foreign substances by blast cleaning. Comply with SSPC-SP 6.
- 4) Remove all blast cleaning products by means of vacuuming or compressed air.
- 5) Chemically clean surface to remove residual contamination, apply conversion coating, and apply sealing agent to prepare the surface for powder coating.
- 6) Begin powder coating as soon as possible after surface preparation to prevent the development of iron oxide on the surface of the steel.

b. Galvanized Steel Substrate:

- 1) Remove all tears, spikes, high spots, or other surface defects caused by the galvanizing process using hand or power tools.
- 2) Apply an alkaline solution, with a pH between 11 and 12, to remove traces of oil, grease, and dirt.
- 3) Remove residual zinc oxide by spraying surface with a mild acidic solution (pH of 3.5 to 4.5).
- 4) Apply conversion coating to the surface and apply sealing agent to prepare the surface for powder coating.

c. Aluminum Substrate:

- 1) Clean surface by power washing to remove contaminants.
- 2) Clean surface with an aqueous alkaline solution by immersion or scrubbing with a soft brush. Do not scrub with a steel bristle brush. Dry completely after cleaning.
- 3) Remove oils and surface contamination by solvent cleaning. Comply with the requirements of SSPC-SP 1.
- 4) Remove light deposits of aluminum reaction by-products by hand or power tool cleaning. Comply with SSPC-SP 2 or 3.
- 5) Remove aluminum oxide by sweep blasting or chemical treatment:
 - a) Sweep Blasting:
 - i) Utilize oil-free compressed air to prevent contamination of cleaned surface.
 - ii) Utilize blast media with a MOH hardness of 5 or less, or utilize organic media such as corn cobs or walnut shells. Do not roughen surface.
 - iii) Powder coat surface within 60 minutes of sweep blasting to prevent re-formation of aluminum oxide.
 - b) Chemical Treatment: Comply with ASTM D 1730 for Type B treatment.
- 6) Chemically clean surface to remove residual contamination, apply conversion coating, and apply sealing agent to prepare the surface for powder coating.

2. Priming: Apply as recommended by coating manufacturer for specific substrate to all surfaces, unless specifically not required by coating manufacturer.**3. Coating:****a. General:**

- 1) Provide complete multi-coat systems formulated and recommended by the manufacturer for the application indicated.
- 2) Provide urethane, TGIC polyester, polyester wrinkle, or non-TGIC polyester based powder coatings as recommended by the powder coating manufacturer to provide long term exterior durability.

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MOBILIZATION**PART 1 - GENERAL****1.01 SECTION INCLUDES**

Project Mobilization

1.02 DESCRIPTION OF WORK

Mobilization includes preparatory work, operations performed, or costs incurred prior to beginning work on the various items on the project site.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

- A. When a bid item for mobilization is included on the proposal form, comply with this section for measurement and payment.
- B. When the proposal form does not include a bid item for mobilization, all costs incurred by the contractor for mobilization are incidental to other work and no separate payment will be made.

1.08 MEASUREMENT AND PAYMENT**A. Mobilization:**

- 1. Measurement:** Lump sum item; no measurement will be made.
- 2. Payment:**
 - a. When 5% of the original contract amount has been completed, 25% of the contract price for mobilization will be paid.
 - b. When 10% of the original contract amount has been completed, 50% of the contract price for mobilization will be paid.
 - c. When 50% of the original contract amount has been completed, 100% of the contract price for mobilization will be paid.
- 3. Includes:** The unit price for mobilization may include the following.
 - a. The movement of personnel, equipment, and supplies to the project site.
 - b. The establishment of offices, buildings, and other facilities necessary for the project.
 - c. Bonding, permits, or other expenses incurred prior to construction.

PART 2 - PRODUCTS

None.

PART 3 - EXECUTION

None.

END OF SECTION

PAVEMENT MARKINGS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Permanent Pavement Markings, Symbols, and Legends
- B. Removable Pavement Markings, Symbols, and Legends
- C. Temporary Delineators
- D. Raised Pavement Markers
- E. Removal of Pavement Markings, Symbols, and Legends
- F. Grooves Cut for Pavement Markings, Symbols, and Legends

1.02 DESCRIPTION OF WORK

- A. Furnish, install, maintain, and remove permanent or temporary pavement markings, temporary delineators, and raised pavement markers, such as for:
 - 1. Diversions and on-site detours where the need for this work is anticipated as part of the traffic control plan to accommodate traffic during construction.
 - 2. Replacing markings obliterated during construction activities on roads open to public traffic.
 - 3. Changing markings on roads open to public traffic where the necessary changes result from staged construction.
 - 4. Replacing markings that are obsolete.
 - 5. Marking newly completed pavement surfaces.
 - 6. Replacing existing markings that have faded or worn away on roads open to public traffic.
- B. Permanent pavement markings are intended to remain in place after the project is completed. Temporary markings are designated for removal, will be obliterated during construction, or require changes during construction.
- C. Diversions are installations or modifications for the transfer of traffic on four lane or wider roadways to lanes that would normally carry traffic in the opposite direction. Diversions provide for continuous but restricted traffic flow from both directions for divided highways. Diversions usually include crossovers.
- D. On site detours are temporary roadways specifically constructed to accommodate traffic during construction.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants as well as the following:

- A. Submit a list of pavement marking materials proposed for use on the project.
- B. Provide the Engineer with a copy of the manufacturer's recommendations for applying the pavement marking.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. General:**

1. Painted, taped, or removed lines will be measured in stations based upon a single 4 inch width.
2. The length of each type of marking will be as specified in the contract documents and will consider measured field adjustments.
3. The measurement for dashed and dotted lines will be adjusted to exclude the skips.
4. Measured lengths of lines wider than 4 inches will be multiplied by a width factor as follows:
$$\text{Width Factor} = \text{Actual Width} / 4 \text{ inches}$$

B. Painted Pavement Markings, Solvent/Waterborne:

1. **Measurement:** Each type of painted pavement marking will be measured in stations.
2. **Payment:** Payment will be made at the unit price for each type of painted pavement marking.
3. **Includes:** Unit price includes, but is not limited to, reflectorizing spheres, layout, surface preparation, and application of marking paint.

C. Painted Pavement Markings, Durable:

1. **Measurement:** Each type of painted pavement markings will be measured in stations.
2. **Payment:** Payment will be made at the unit price for each type of painted pavement marking.
3. **Includes:** Unit price includes, but is not limited to, layout, surface preparation, and application of marking paint.

1.08 MEASUREMENT AND PAYMENT (Continued)**D. Painted Pavement Markings, High-Build:**

1. **Measurement:** Each type of painted pavement markings will be measured in stations.
2. **Payment:** Payment will be made at the unit price for each type of painted pavement marking.
3. **Includes:** Unit price includes, but is not limited to, layout, surface preparation, and application of marking paint.

E. Permanent Tape Markings:

1. **Measurement:** Each type of marking tape will be measured in stations.
2. **Payment:** Payment will be made at the unit price for each type of tape marking.
3. **Includes:** Unit price includes, but is not limited to, layout, surface preparation, and application of marking tape.

F. Wet, Retroreflective Removable Tape Markings:

1. **Measurement:** Wet, retroreflective removable tape markings will be measured in stations.
2. **Payment:** Payment will be made at the unit price per station for wet, retroreflective removable tape markings.
3. **Includes:** Unit price includes, but is not limited to layout, surface preparation, application, and removal.

G. Painted Symbols and Legends:

1. **Measurement:** Each type of painted symbol and legend will be counted.
2. **Payment:** Payment will be made at the unit price for each painted symbol and legend.
3. **Includes:** Unit price includes, but is not limited to, layout, surface preparation, and application of each symbol and legend.

H. Precut Symbols and Legends:

1. **Measurement:** Each type of precut symbol and legend will be counted.
2. **Payment:** Payment will be made at the unit price for each precut symbol and legend.
3. **Includes:** Unit price includes, but is not limited to, layout, surface preparation, and application of each symbol and legend.

I. Temporary Delineators:

1. **Measurement:** Each temporary delineator installed and removed will be counted.
2. **Payment:** Payment will be made at the unit price for each delineator.
3. **Includes:** Unit price includes, but is not limited to, installation and removal of delineators.

1.08 MEASUREMENT AND PAYMENT (Continued)**J. Raised Pavement Markers:**

1. **Measurement:** Each raised pavement marker installed and removed will be counted.
2. **Payment:** Payment will be made at the unit price for each marker.
3. **Includes:** Unit price includes, but is not limited to, installation and removal of pavement markers.

K. Pavement Markings Removed:

1. **Measurement:** Pavement markings removed will be measured in stations. Removable marking tape or markings obliterated during construction will not be measured.
2. **Payment:** Payment will be made at the unit price for pavement markings removed.
3. **Includes:** Unit price includes, but is not limited to, pavement marking removal and waste material collection, removal, and disposal.

L. Symbols and Legends Removed:

1. **Measurement:** Each symbols or legends removed will be counted.
2. **Payment:** Payment will be made at the unit price for each symbol or legend removed.
3. **Includes:** Unit price includes, but is not limited to symbol and legend marking removal and waste material collection, removal, and disposal.

M. Grooves Cut for Pavement Markings:

1. **Measurement:** Measurement will be in stations and will be equivalent to the quantity of pavement markings associated with the grooving.
2. **Payment:** Payment will be made at the unit price per station.
3. **Includes:** Unit price includes, but is not limited to, layout, cutting grooves, collection and disposal of removed material, and additional groove width and transition length beyond the pavement marking dimensions.

N. Grooves Cut for Symbols and Legends:

1. **Measurement:** Each symbol or legend groove will be counted.
2. **Payment:** Payment will be made at the unit price for each symbol or legend groove.
3. **Includes:** Unit price includes, but is not limited to, layout, cutting grooves, and collection and disposal of removed material.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Provide pavement marking materials that comply with Iowa DOT Section 2527.
- B. Pavement marking materials include:
 - 1. Wet, retroreflective removable tape markings
 - 2. Painted Pavement Markings:
 - a. Waterborne and solvent based paint pavement markings
 - b. Durable paint pavement markings
 - c. High-build waterborne paint pavement markings
 - 3. Regular marking tape
 - 4. Temporary delineators
 - 5. Raised pavement markers
 - 6. Channelizer markers
 - 7. Preformed polymer tape
 - 8. Removable, nonreflective preformed tape
 - 9. Profiled pavement marking tape
 - 10. Intersection marking tape

PART 3 - EXECUTION**3.01 EQUIPMENT**

A. General: Utilize equipment complying with Iowa DOT Section 2527.

B. Pavement Marking Equipment:

1. Capable of placing two lines simultaneously with either line in a solid or intermittent pattern in yellow or white.
2. Capable of applying reflectorizing spheres at the required rate with a pressurized system.
3. All guns in full view of the operator at all times.
4. Equipped with a metering device to register the accumulated length of reach gun, each day.
5. Designed so the pressure gages of each proportioning pump are visible to the operator at all times during operation to monitor fluctuations in pressure.
6. Capable of applying paint without dilution.

C. Pavement Marking Removal:

1. Operates without the release of dust.
2. Recovers all removed material.
3. Includes a waste collection and transfer system and for dry wastes, ensure the system incorporates high-efficiency particulate absorption (HEPA) methods and equipment.

D. Pavement Grooving:

1. Utilize grooving equipment with stacked diamond cutting heads mounted on a floating head with controls capable of providing uniform depth and alignment.
2. If pavement is grooved by dry cutting, provide equipment that is self vacuuming.
3. When requested, make available to the Engineer a caliper, depth gage, or depth plate, for use in measuring groove depth.

3.02 CONSTRUCTION

A. General:

1. Comply with the requirements of the MUTCD for traffic control during all pavement marking operations.
2. Install all pavement markings according to the product manufacturer's published recommendations.

3.02 CONSTRUCTION (Continued)

3. Ensure the following for all painted and taped pavement markings:
 - a. Uniform thickness
 - b. Uniform distribution of reflectorizing spheres throughout the line width
 - c. Line widths as specified, with a tolerance of $\pm 1/4$ inch for 4 inch lines and $\pm 1/2$ inch for wider lines
 - d. Symbols and Legends are visually proportional to contract documents with an out-to-out tolerance of ± 6 inches
 - e. Markings have sharp edges and cutoffs at the ends
 4. For all painted markings:
 - a. Apply the paint without dilution
 - b. Apply reflectorizing spheres immediately to the wet-paint with a pressurized system
 5. For all tape products, follow the manufacturer's recommendations for surface dryness, primers, adhesives, and other surface preparation requirements. Unless otherwise specified by the tape manufacturer, meet the following test for determining surface dryness before applying the tape:
 - a. In an area of direct sunlight where the tape will be applied, place an 18 inch by 18 inch piece of polyethylene (a green or black garbage bag may be used). There should not be any holes or tears in the polyethylene.
 - b. Tape down all the edges of the polyethylene sheet to seal all the edges and not allow any air movement to get under the polyethylene.
 - c. Firmly tamp the tape using the tamper cart or by foot tamping.
 - d. Allow 20 to 25 minutes for the polyethylene to be exposed to the direct sunlight.
 - e. Remove the polyethylene from the road surface. If no moisture is present on the underside of the polyethylene or on the road surface, the tape can be applied.
 - f. If any moisture is present, allow another hour to pass and repeat the test until no moisture is found.
- B. Surface Preparation:** For all pavement markings, ensure the pavement surface is dry and free from dirt, dust, oil, curing compound, and other contaminants that may interfere with markings properly bonding to the surface.
1. Clean surface to at least 1 inch wider than the anticipated marking.
 2. Unless otherwise specified, sweep the pavement surface with a rotary broom or street sweeper.
 3. Shoot an air blast on the pavement surface immediately prior to placing the new marking. The air blast is not intended to remove large amounts of dust, but only the residue that might be left from the removal and cleaning operation.
 4. When pavement markings are placed on newly constructed PCC pavements, remove the existing curing compound film from horizontal surfaces in these locations. Curing compound film need not be removed from curbs or other vertical surfaces. Remove the curing compound in a manner that does not damage the underlying pavement.

3.02 CONSTRUCTION (Continued)**C. Painted Pavement Markings:**

1. **Waterborne and Solvent Based Paint:** Apply paint and reflectorizing spheres at the nominal rates shown in the following tables.

Table 11,030.01: Waterborne Paint Application Rates

Line Width	Wet-Film Thickness	Paint	Reflectorizing Spheres
4"	14 mils	343 ft of solid line per gallon of paint	9.0 lb/gal

Table 11,030.02: Solvent-based Paint Application Rates

Line Width	Wet-Film Thickness	Paint	Reflectorizing Spheres
4"	16 mils	300 ft of solid line per gallon of paint	9.0 lb/gal

2. **Durable Paint Pavement Markings:**
 - a. Use the same binder thickness as applied on the National Transportation Product Evaluation Program (NTPEP) deck with a tolerance of 10%.
 - b. Bead application rate is at the discretion of the Contractor.
 - c. Construct durable pavement markings to comply with the following retroreflectivity requirements when tested according to Iowa DOT Materials I.M. 483.04.

Table 11,030.03: Minimum Coefficient of Retroreflected Luminance

White line, symbols, and legends	300 mcd/ft ² /ft-cdl.
Yellow line	200 mcd/ft ² /ft-cdl.

3. **High-Build Waterborne Paint Pavement Markings:**
 - a. Provide binder thickness of 0.022 inches $\pm$ 0.0025 inches.
 - b. Bead application rate is at the discretion of the Contractor.
 - c. Construct high-build waterborne paint pavement markings to comply with the following retroreflectivity requirements when tested according to Iowa DOT Materials I.M. 483.04.

Table 11,030.04: Minimum Coefficient of Retroreflected Luminance

White line, symbols, and legends	300 mcd/ft ² /ft-cdl.
Yellow line	225 mcd/ft ² /ft-cdl.

- D. **Marking Tape:** If grooving is specified, do not inlay the tape into hot HMA.

1. **Inlaid:** When the installation of preformed polymer pavement marking material or profiled pavement marking tape is in conjunction with placement of HMA, inlay the tape by positioning it on the HMA prior to the final rolling. Perform the installation of the tape according to the manufacturer's recommendations.
2. **Grooved:** When grooving is specified, install marking tape in recessed groove according to the manufacturer's recommendations.

- E. **Temporary Delineators:** Mount temporary delineators 4 feet above the pavement on delineator posts. Install posts 2 feet from the outside edge of the shoulder at locations specified in the contract documents.

3.02 CONSTRUCTION (Continued)

- F. Raised Pavement Markers:** Ensure markers continually exposed to traffic do not extend more than 3/4 inch above the pavement surface.

G. Pavement Marking Layout and Location:

- 1. Permanent Markings:** Place all lines within 2 inches of reference location. The location of edge lines may be referenced to the pavement edge. The locations of other longitudinal lines may be referenced to accurately locate longitudinal joints. Where reference locations do not exist or are not reliable, locate the lines as follows:
 - a. For straight or nearly straight lines, reference the locations to a string line set between marking line points.
 - b. For curves, reference the locations to closely spaced marking line points. For sharp curves, a spacing of 10 feet may be required.
 - c. Other equally effective systems the Engineer approves.
- 2. Temporary Markings:** The location of temporary pavement marking will be specified in the contract documents or as directed by the Engineer to maximize the effectiveness of the traffic control plan.

H. Removal of Pavement Markings:

- 1. Staging:**
 - a. At the start of construction and at each change in staging, remove all existing pavement markings that conflict with the pavement marking plan.
 - b. Prior to final pavement marking, remove all temporary pavement markings.
 - c. The Engineer may designate other pavement markings for removal to maximize the effectiveness of the traffic control plan.
- 2. Process:**
 - a. Remove existing painted pavement markings so that 90% or more of the pavement is visible. Tightly adhering markings may remain in the bottom of the tining and other depressions on the pavement surface, but ensure they are not visible to the motorist during daytime or nighttime. Remove tape markings according to the manufacturer's recommendations. Ensure removal processes do not cause functional damage to the transverse or longitudinal joint sealant materials.
 - b. Conduct pavement marking removal operations in a manner so that the finished pavement surface is not damaged or left in a pattern that may mislead or misdirect the motorist. When the operations are completed, power broom the pavement surface. Remove all marking removal debris from the pavement surface before the pavement is open to public traffic.
 - c. Perform pavement marking removal to a width no less than the width of the existing or new pavement markings plus 1 inch. Remove the entire area of the existing symbol or legend in a rectangular shape so no directionality may be observed from the removed symbol or legend.
 - d. Removal of pavement markings may be performed by vacuum blasting, vacuum dry grinding, wet grinding, shot blasting, or high pressure water blasting. Open abrasive blasting or dry grinding without containment is not allowed.

I. Markings Obliterated During Construction:

1. On sections of pavement open to traffic, place pavement markings where construction or traffic operations have obliterated existing markings.

3.02 CONSTRUCTION (Continued)

2. Replace markings obliterated during construction within 3 calendar days after the operation that obliterated the markings has been completed. At intersections with Iowa DOT highways, replace all obliterated edge lines, lane lines, no passing zones, and centerlines prior to opening to traffic.
 3. Place symbols and legends within 3 calendar days from the day the road is open to traffic.
- J. Grooving for Pavement Markings:** When specified in the contract documents, place pavement markings in a groove cut into the pavement surface. Dry or wet cut the groove in a single pass.
1. **Groove Depth:** Construct groove according to pavement marking material manufacturer's recommendations with the following minimums.
 - a. **Paint:** Minimum groove depth of 60 mils.
 - b. **Tape:** Minimum groove depth of 100 mils.
 2. **Groove Width:** Marking width plus 1 inch with a tolerance of minus 0.0 inches and plus 0.2 inches.
 3. **Groove Length:** Full length of tape plus 3 inches minimum grooving transition on either end. Do not use a continuous groove for dash markings. When replacing existing dash markings, start cycle so most of the existing marking is removed with the groove. No additional removal of existing markings is required.
 4. **Groove Position:** Locate grooves a minimum of 2 inches from edge of longitudinal joints.
 5. **Finished Surface:** Ensure the bottom of the groove has a fine corduroy-like texture. The maximum allowable rise between the high and low points across the width of the groove is 10 mils.
 6. **Groove Cleaning:** Ensure the surface to receive the marking is free from dust, dirt, or other contaminants that may interfere with the marking properly bonding.
 - a. **Dry Cutting:** Vacuum and broom grooves using a high pressure air blast for the final cleaning.
 - b. **Wet Cutting:**
 - 1) Immediately flush the groove with high pressure water and recover the removed material.
 - 2) Allow the surface to dry a minimum of 24 hours to a visibly dry condition.
- K. Limitations:**
1. **General:**
 - a. Coordinate pavement marking application with other construction work and associated traffic control changes.
 - b. Complete the placement of pavement markings before the lane, road, on-site detour, or diversion is open to traffic.
 - c. If unavoidable circumstances result in not being able to complete the pavement marking placement or removal specified for that day, provide traffic control until the pavement marking placement or removal work is completed.
 - d. Follow the manufacturer's written recommendations for all details of application.

3.02 CONSTRUCTION (Continued)**2. Temperature Restrictions:**

- a. Waterborne and Solvent Based Paint Pavement Markings:** Comply with Table 11,030.05.

Table 11,030.05: Pavement Marking Temperature Restrictions

Type of Marking	Oct. 23 to April 7	April 8 to April 22	April 23 to Oct. 7	Oct. 8 to Oct. 22
Waterborne Paint	not allowed	45° F	45° F	45° F
Low Temperature Waterborne Paint with Rohm & Haas XSR Resin	35° F	35° F	35° F	35° F
Solvent Based Paint	No restrictions	No restrictions	(a)	No restrictions

(a) Only use solvent-based paint if temperature requirements for waterborne paint cannot be met.

b. Durable Paint Pavement Markings:

- 1) Air and pavement surface temperature are 40°F and rising.
- 2) The Engineer may allow placement of durable paint at temperatures below these values based on the durable paint manufacturer's written recommendations.

c. High-Build Waterborne Paint Pavement Markings:

- 1) Air and pavement surface temperature are 50°F and rising.
- 2) When temperatures are below 50°F, the Engineer may approve the use of marking products denoted by the manufacturer as "low-temperature." When approved, low-temperature paints may be applied when temperatures are between 32°F and 50°F.

d. Marking Tape Pavement Markings:

- 1) Air and pavement surface temperature are 50°F and rising.
- 2) Minimum overnight temperature of 40°F the night before application
- 3) The Engineer may allow placement of marking tape at temperatures below these values based on the marking manufacturer's written recommendations.

END OF SECTION

TEMPORARY SERVICES DURING CONSTRUCTION**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Maintenance of Postal Service
- B. Coordination of Solid Waste Collection

1.02 DESCRIPTION OF WORK

- A. Maintain postal service to all properties within the project area.
- B. Maintain solid waste collection to all properties within the project area. Solid waste includes garbage, recycling, and yard waste.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. Maintenance of Postal Service:**

1. **Measurement:** Lump sum item; no measurement will be made.
2. **Payment:** Payment will be at the lump sum price for maintenance of postal service.

B. Maintenance of Solid Waste Collection:

1. **Measurement:** Lump sum item; no measurement will be made.
2. **Payment:** Payment will be at the lump sum price for maintenance of solid waste collection.

PART 2 - PRODUCTS**2.01 MAILBOXES**

- A. Curbside Mailboxes:** Provide standard curbside mailboxes complying with US Postal Service (USPS) STD-7B.
- B. Cluster Mailboxes:** Provide cluster box units complying with USPS-B-1118.

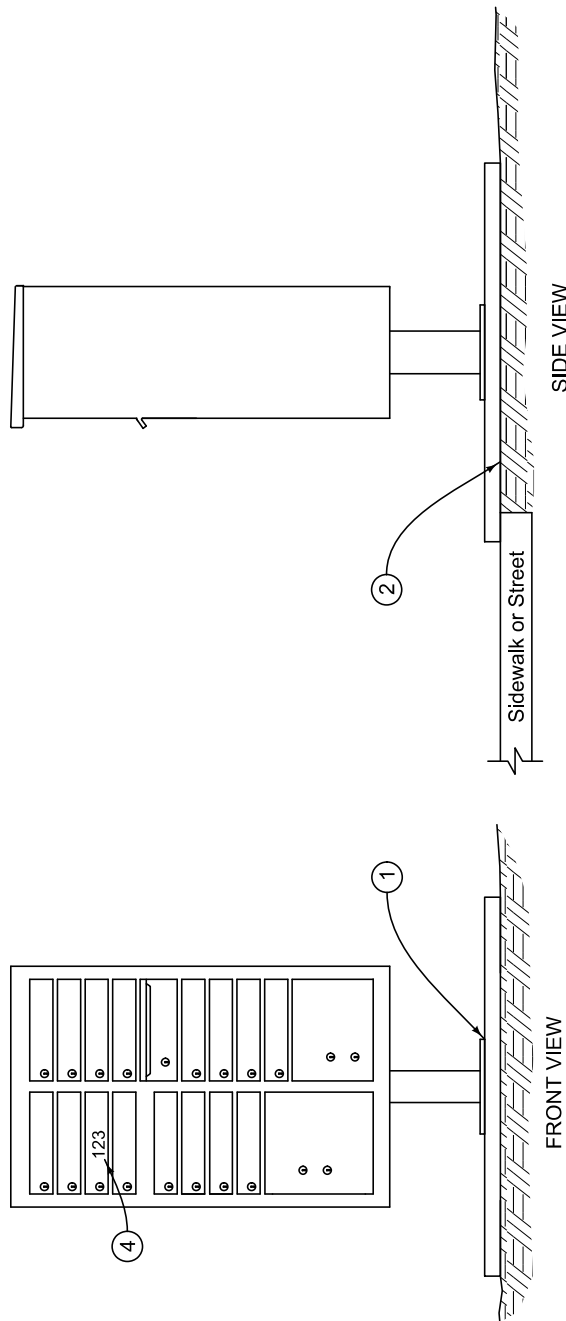
PART 3 - EXECUTION**3.01 POSTAL SERVICE**

- A. Coordinate delivery of mail with the USPS.
- B. Maintain postal service to all properties within the project area. Meet the needs of physically challenged individuals within the project area.
- C. When construction staging prohibits access to normal mailbox locations by the USPS, establish temporary mail service as follows:
 - 1. Coordinate with the USPS to establish an acceptable location for a temporary group mailbox.
 - 2. Verify proposed location with the Engineer prior to installation.
 - 3. Erect and maintain a temporary group mailbox or provide a temporary USPS approved cluster box unit complying with Figure 11,040.101.

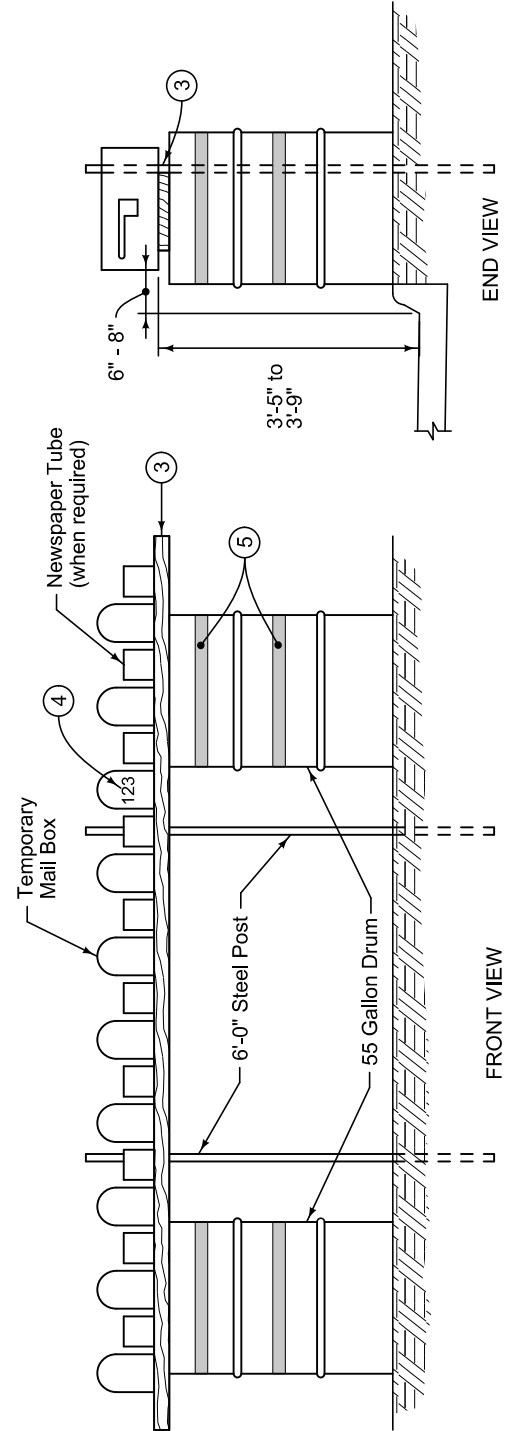
3.02 SOLID WASTE COLLECTION

- A. Coordinate collection of solid waste with property owners and the solid waste collection agencies operating in the project area.
- B. Maintain access for solid waste collection vehicles during construction.
- C. When construction staging prohibits access to normal collection locations by solid waste collection vehicles, comply with the following:
 - 1. Coordinate with solid waste collection agencies to establish a common location for collection outside the inaccessible area.
 - 2. Coordinate with residents/businesses within the project area for the alternate solid waste collection procedures.
 - 3. Affix a temporary label to solid waste containers identifying the property owner's or renter's name or address.
 - 4. Prior to the normal collection time, gather containers from properties within the inaccessible area, and transport to the common location accessible by solid waste collection vehicles.
 - 5. Return solid waste containers to each property within 24 hours after collection.

END OF SECTION

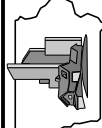


TEMPORARY CLUSTER BOX UNIT



TEMPORARY GROUP MAILBOX

- ① Attach cluster box unit to a stable skid or anchor plate.
- ② Set cluster box on firm and level ground adjacent to sidewalk or street paving. Provide anchorage as needed to prevent overturning.
- ③ Provide a 2 inch x 12 inch plank with length as required. Firmly attach mailboxes and newspaper tubes to plank. Secure plank to steel posts for lateral support.
- ④ Label each mailbox with property address.
- ⑤ Attach two bands of 2 inch wide reflectorized tape to each barrel.

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TEMPORARY MAILBOXES

TEMPORARY SIDEWALK ACCESS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Temporary Residential Access
- B. Temporary Granular Sidewalk
- C. Temporary Longitudinal Channelizing Device

1.02 DESCRIPTION OF WORK

- A. Construct a temporary access to residential properties impacted by construction.
- B. Construct a granular surfaced, temporary, public sidewalk.
- C. Construct temporary longitudinal channelizing device along a public sidewalk to delineate the pedestrian access route.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. Temporary Pedestrian Residential Access:**

1. **Measurement:** Granular surfacing for temporary pedestrian residential access will be measured in square yards.
2. **Payment:** Payment for temporary pedestrian residential access will be made at the unit price per square yard.
3. **Includes:** The unit price for temporary pedestrian residential access includes, but is not limited to, supplying and placing granular material, continuous maintenance of granular surface, removal of temporary granular sidewalk, and restoring disturbed surfaces to a condition equal to that which existed prior to construction.

1.08 MEASUREMENT AND PAYMENT (Continued)**B. Temporary Granular Sidewalk:**

- 1. Measurement:** Temporary granular sidewalk will be measured in square yards.
- 2. Payment:** Payment for temporary granular sidewalk will be made at the unit price per square yard.
- 3. Includes:** The unit price for temporary granular sidewalk includes, but is not limited to, excavation, grading, timber edging, supplying and placing granular material, continuous maintenance of granular surface, removal of temporary granular sidewalk, and restoring disturbed surfaces to a condition equal to that which existed prior to construction.

C. Temporary Longitudinal Channelizing Device:

- 1. Measurement:** Temporary longitudinal channelizing device will be measured in linear feet along the top rail support.
- 2. Payment:** Payment for longitudinal channelizing device will be made at the unit price per linear foot.
- 3. Includes:** The unit price for temporary longitudinal channelizing device includes, but is not limited to construction, placement, maintenance, and removal of the device.

PART 2 - PRODUCTS**2.01 GRANULAR SURFACING**

Provide Class V fine limestone complying with Iowa DOT Article 4109.02, Gradation No. 8 in the Aggregate Gradation Table and the quality requirements of Iowa DOT Article 4117.03 for temporary residential access or a temporary granular sidewalk.

2.02 TEMPORARY LONGITUDINAL CHANNELIZING DEVICE

- A. Construct channelizing device from common dimensional lumber and construction fasteners. Comply with Figure 11050.102.
- B. Provide a manufactured pedestrian guidance system complying with the requirements of the *American's with Disabilities Act Accessibility Guidelines for Buildings and Facilities* (ADAAG) and the MUTCD.
- C. Other alternatives that comply with the ADAAG and MUTCD requirements may be allowed upon approval of the Engineer.

PART 3 - EXECUTION**3.01 TEMPORARY PEDESTRIAN RESIDENTIAL ACCESS**

This item is for the construction of a temporary granular path through the project area for pedestrian access to residential properties when street and sidewalk access area is impacted by construction. This access is not intended to provide access to the general public.

- A. Construct a 4 foot wide granular path through the project area as required to maintain access to residential properties.
- B. Place granular material directly on the existing surface to a nominal depth of 3 inches.
- C. Grade the granular surface smooth and compact.
- D. Maintain the surface of the path in a firm, stable, and slip resistant condition.
- E. Relocate or replace path as required by construction staging.
- F. Place additional granular material as directed by the Engineer.

3.02 TEMPORARY GRANULAR SIDEWALK

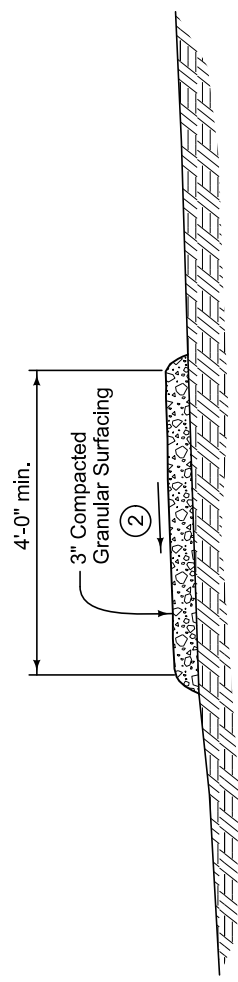
- A. Construct temporary granular sidewalk at locations specified in the contract documents.
- B. Excavate existing ground surface to a nominal depth of 4 inches. Install 2 by 4 edging along both sides of the excavation.
- C. Place granular surfacing between edging and compact.
- D. Maintain the surface of the granular sidewalk in a firm, stable, and slip resistant condition.
- E. Place additional granular material as directed by the Engineer.

3.03 TEMPORARY LONGITUDINAL CHANNELIZING DEVICE

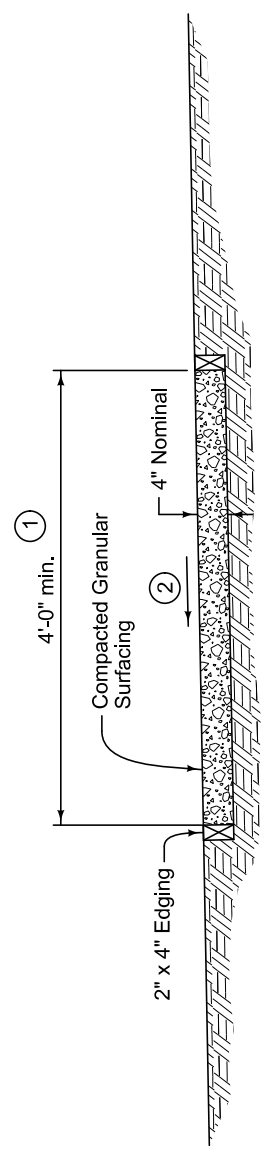
- A. Construct temporary longitudinal channelizing device according to Figure 11050.102, or erect manufactured or other approved pedestrian railing system.
- B. Locate device as specified in the contract documents.
- C. Add additional posts, braces, base plates, screws, nails, sandbags, or other appurtenances as required to maintain device in a stable condition at no additional cost to the Contracting Authority.

END OF SECTION

- ① If sidewalk width is less than 5 feet, provide 5 foot long by 5 foot wide passing spaces at 200 foot intervals.
- ② Target cross slope of 1.5% with a maximum cross slope of 2%.

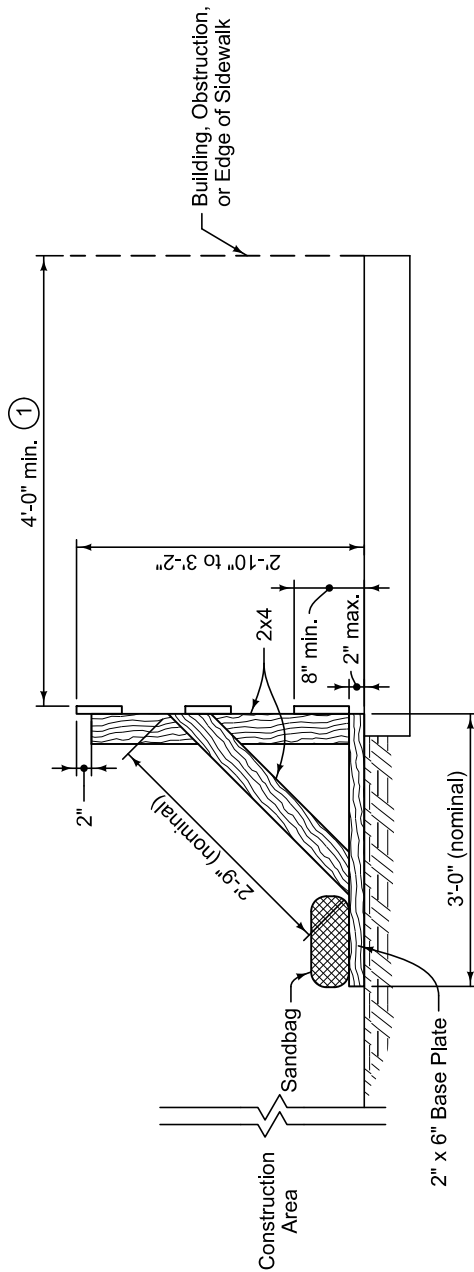


TEMPORARY RESIDENTIAL ACCESS

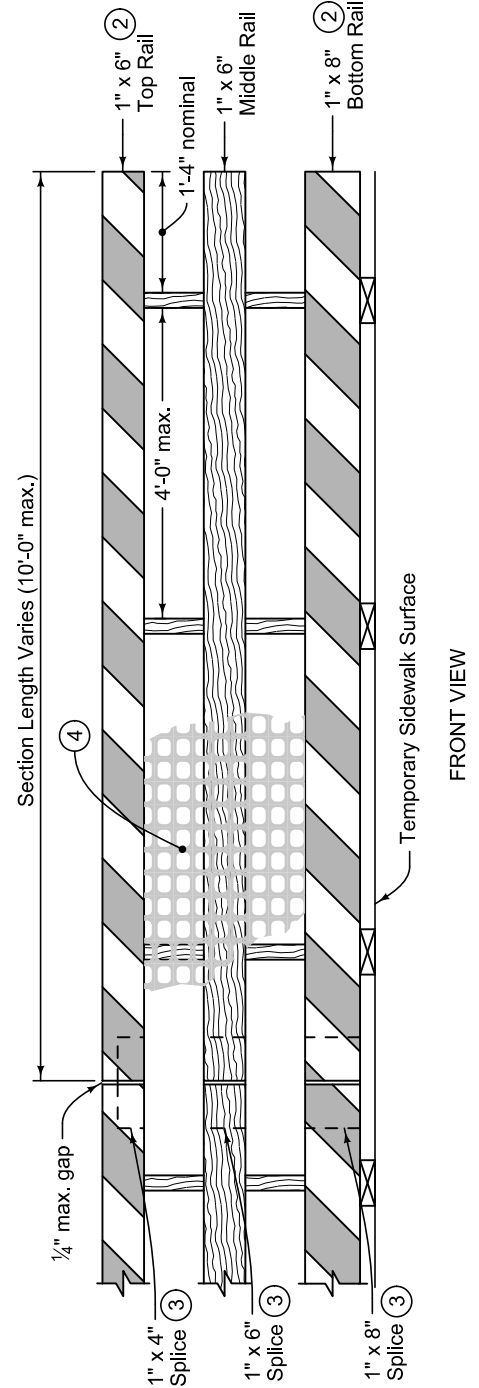


TEMPORARY GRANULAR SIDEWALK

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TEMPORARY GRANULAR SIDEWALK AND TEMPORARY RESIDENTIAL ACCESS		



END VIEW



- ① If sidewalk width is less than 5 feet, provide 5 foot long by 5 foot wide passing spaces at 200 foot intervals.
- ② Provide non-reflective orange and white sheeting on top and bottom rails.
- ③ Attach 12 inch long splice boards on the back side of rails at joints between sections.
- ④ When specified in the contract documents, install orange construction safety fence between the top of the bottom rail and the bottom of the top rail.

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TEMPORARY PEDESTRIAN
CHANNELIZING DEVICE

CONCRETE WASHOUT**PART 1 - GENERAL****1.01 SECTION INCLUDES**

Concrete Washout

1.02 DESCRIPTION OF WORK

Provide and maintain concrete washout system.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. Concrete Washout:**

- 1. Measurement:** Lump sum item; no measurement will be made.
- 2. Payment:** Payment will be at the lump sum price for concrete washout.
- 3. Includes:** Lump sum price includes, but is not limited to, providing concrete washwater containment, collection, and disposal.

PART 2 - PRODUCTS**2.01 CONCRETE WASHOUT**

Provide a concrete washout system that retains all concrete washwater and complies with one of the following:

A. Manufactured Washout Containment:

- 1. Concrete Washout Containers:** Provide roll-off type metal container that is leak-proof and designed specifically for collection of concrete and concrete washwater. When concrete pumper trucks are utilized, provide a ramp or other means to allow access for pumper trucks.
- 2. Concrete Washout Collection Bags:** Provide leak-proof collection bags designed specifically for collection of concrete and concrete washwater.
- 3. Chute Washout Box:** Provide ready mixed trucks with on-vehicle chute washout system to collect concrete washwater for return to the ready mixed plant.

B. Non-Manufactured Containment:

- 1. Below-grade System:** For excavated pits, provide an impermeable plastic liner with a minimum thickness of 10 mils.
- 2. Above-grade Containment:** For containment areas constructed from earthen berms, provide a double thickness of impermeable plastic liner with a minimum thickness of 10 mil per sheet.

- C. Prohibited Products:** Silt fence, unlined hay bales, unlined earthen embankments, and other practices that may allow concrete washwater to leak out of the containment area or to come in direct contact with the ground are not allowed.

PART 3 - EXECUTION**3.01 CONCRETE WASHOUT**

- A. Provide concrete washwater containment on all projects where concrete washwater will be generated. Clearly mark the location of the washout area and provide directions to truck drivers.
- B. Locate concrete washout containment systems a minimum of 50 feet from proposed or existing storm sewer intakes, open ditches, or waterbodies.
- C. Collect all concrete washwater from ready mixed trucks, pumper trucks, and cleaning of tools and other equipment.
- D. Retain concrete washwater within the containment system until the water evaporates or is collected and disposed.
- E. Prior to rain events, lower the liquid level or cover the concrete washout containment area to prevent overflow.
- F. Clean out the concrete washwater containment area when it reaches 75% of the total capacity.
- G. Hardened solids may be removed from the containment area and disposed of as other non-hazardous wastes or may be broken up and used on the site for other appropriate uses.

3.02 CLEANUP AND REMOVAL

- A. Remove all manufactured washout containment facilities from the project area.
- B. For excavated pits, pump out and properly dispose of all remaining water, remove any hardened solids, and remove all plastic liner materials and fill pit area flush with surrounding ground.
- C. For above-grade containment facilities, pump out and properly dispose of all remaining water, remove any hardened solids, and remove all plastic liner materials and spread out earthen berms.

END OF SECTION

