2023 Edition Revisions to the SUDAS Standard Specifications

To updated your printed manual, print this packet. Then 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 or a change in the page number. **PLEASE READ CAREFULLY - PAY ATTENTION TO THE SECTION NUMBER!** Included shading to help distinguish between divisions. Questions can be directed to Beth Richards - brich@iastate.edu. The current edition of the manual, with the latest revisions incorporated, can be found at www.iowasudas.org.

Division	***Section***	***pg #***	***Summary of Revision(s)***
Manual introductory info			Updated the Contributors and Acknowledgments and the General Table of Contents pages. *Note - if you want to replace the small business card for the spine of your manual, you can print a copy from our website.*
1	1090, 1.04, C, 2	1-2	Number 2 was missing from the outline.
2	2010, 1.08, 2.04, & 3.01	1-12	Updated bid items to include various clarifications. Updated references in 2.04, C, 6 and 3.01, D.
3	3010, 1.08, B, 3	1-4	Added “includes” information to bid item; affected pages that followed.
4	Table of Contents	v-vi	Minor corrections
	4010, 3.12	13-14	Updated water and sewer separation language based on new Iowa DNR rules.
	4020, 2.06	5-6	Added “Grade 60” as an option.
	4020, 3.08	9-10	Updated water and sewer separation language based on new Iowa DNR rules.
	4030, 1.08, C & D	1-2	Updated bid items to include various clarifications.
	4040, 1.08, C & D	1-2	Separated subdrain and footing drain cleanouts, outlets, and connections to individual bid items.
	4050, 1.08, C, 1	5-6	Changed diameter to size.
	4050, 2.04 & 3.01	11-12	Fixed spelling and numbering errors.
	4060, 3.03, D	5-6	Added ASTM reference.
5	Table of Contents	i-ii	Updated Table of Contents based on changes made in Division 5.
	5010, 1.08, E	3-4	Added “includes” information.
	5010, 3.06	11-14	Updated water and sewer separation language based on new Iowa DNR rules; affected pages the followed.
	5020, 1.08, E & G	1-2	Added “includes” information.
6	Table of Contents	i-ii	Updated Table of Contents based on changes made in Division 6.
	6010	ALL	Replace ENTIRE SECTION with enclosed pages (excluding figures). Updated bid items to include various clarifications. Separated bid items. Updated references. Added composite casting as an alternate product.
	Figures 6010.301 to 305	ALL	Added note to allow for eccentric flat top.
	6020, 1.08, A & 2.02, B	1-4	Added “includes” information to bid item. Updated reference.
	6030, 3.04, C, 7	3-4	Updated reference.
7	Table of Contents	iii-vi	Updated Table of Contents based on changes made in Division 7.
	7010, 1.08 and 2.01	3-6	Changed terminology of HMA to asphalt. Added Type 1T cement as an option. Added reference for approved admixture sources.
	7010, 3.02, H	15-16	Changed terminology of HMA to asphalt.
	Figure 7010.903	1	Deleted the 1 inch fiber board and changed terminology from HMA to asphalt.
	Figure 7010.905	1-3	(Starts on the back of Figure 7010.904). Minor correction.

7 (con't)	7011	ALL	Replace ENTIRE SECTION with enclosed pages. Added bond breaker option. Changed terminology of HMA to asphalt.
	7020	ALL	Replace ENTIRE SECTION with enclosed pages (excluding figures). Updated bid items to include various clarifications. Added thickness check language for non-uniform pavement sections. Changed terminology of HMA to asphalt.
	Figure 7020.902	1	Deleted the 1 inch fiber board and changed terminology from HMA to asphalt.
	7021	ALL	Replace ENTIRE SECTION with enclosed pages. Changed terminology of HMA to asphalt.
	7030	ALL	Replace ENTIRE SECTION with enclosed pages (excluding figures). Updated bid items to include various clarifications. Changed terminology of HMA to asphalt. In 2.01, updated PCC mix options.
	Figure 7030.102	1	Minor spelling correction.
	7040	ALL	Replace ENTIRE SECTION with enclosed pages (excluding figures). Updated bid items to include various clarifications. Added glass fiber reinforced polymer bars for use in full depth PCC patches. Fixed various references to Section 7010.
	Figure 7040.106	1	Added a smaller dowel for pavement between 8 and 9.5 inches; added a table to address.
	7091, 1.08, E, 3	1-2	Added "includes" information to bid item.
	7092, 1.08, B	1-2	Added "type" and "size" to payment.
8	Table of Contents	iii-iv	Updated Table of Contents based on changes made in Division 8.
	8010, 1.08, A, 3	1-2	Added "includes" information to bid item.
	8010, 2.02, A, 1	5-6	Minor correction.
	8010, 2.05, C, 2	13-16	Clarified mast arm vibration mitigation; affected pages that followed.
	Figure 8010.105	1	Added new note 7 for mast arm vibration mitigation.
	8020, 2.01	5-6	Added another pavement marking product option.
	8020, 3.02	11	Modified resin designation for low temperature waterborne paint.
	8030, 1.07, C	1-2	Removed requirement to notify the National Federation of the Blind, per their request.
	8040 (NEW)	ALL	Added new section on traffic signs and posts.
9	Table of Contents	iii-vi	Updated Table of Contents based on changes made in Division 9.
	9010, 1.08, A	1-2	Added "includes" information to bid items.
	9010, 2.02, B	7-8	(Table 9010.07) updated to match Iowa DOT's recent changes due to limited supplies of certain seed.
	9010, 2.07, B	13-14	Updated to match Iowa DOT's recent changes due to limited supplies of certain seed.
	9040, 1.08 and 2.17, B	3-25	Updated bid items to include various clarifications; affected pages that followed. Deleted maximum slope requirements and added changes to allow synthetic components.
11	11,030, 1.08, A & B	1-2	Added "includes" information to bid items.
	11,040, 2.01	3-4	Deleted "Class V" from the first line.

Contributors and Acknowledgments

In 2022, SUDAS staff held many meetings to accomplish the various revisions reflected in the 2023 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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General Table of Contents

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.

C. The percentage markup to be allowed to the Contractor for extra work performed by a subcontractor shall be in accordance with the following:

1. 10% of the first $50,000 with a $100 minimum.

2. 5% of the portion over $50,000.

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.

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 within 30 calendar days, otherwise the retained and unpaid funds due the Contractor shall be released to the Contractor.

EARTHWORK, SUBGRADE, AND SUBBASE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Clearing and Grubbing

B. Earthwork, Excavation, and Embankment Construction

C. Subgrade Preparation

D. Subbase Construction

E. Topsoil

1.02 DESCRIPTION OF WORK

Excavate and construct embankments, subgrades, and subbases.

1.03 SUBMITTALS

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

Submit results of Standard Proctor and in-place density tests on compactions when required.

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

If impractical, or if scheduling does not allow the removal of utilities before excavation, work around the utilities.

1.08 MEASUREMENT AND PAYMENT

A. Clearing and Grubbing by Units: The quantity of clearing and grubbing will be the quantity, in units, shown in the contract documents.

1. Measurement:

a. Trees 6 inches in diameter or greater will be counted and the circumference will be measured at a height of 18 inches above the ground. The diameter will be calculated by measuring the circumference to the nearest inch and dividing by 3.14. See Table 2010.01 for identification of units per tree for clearing, grubbing, and clearing and grubbing.

b. Stumps 6 inches in diameter or greater will be counted and the diameter, in inches, calculated by determining the average diameter at cutoff. See Table 2010.01 for identification of units per stump for grubbing.

1.08 MEASUREMENT AND PAYMENT (Continued)

c. Logs and down timber 6 inches in diameter or greater will be measured at a point 18 inches from the end of the log with greatest diameter or 18 inches from the base of the tree for down timber for clearing.
d. Hedge rows will be measured in linear feet and converted to units using a rate of 30 units per 100 linear feet of hedge row.
e. Brush will be measured in square feet and converted to units by using a rate of 0.8 units per 100 square feet of brush.
f. Growing corn will be measured in square feet and converted to units by using a rate of 0.2 units per 100 square feet of growing corn.
g. Vegetation removal will not be measured for payment.
h. Field fence removal, included in clearing and grubbing, will be measured in stations and converted to units at a rate of 6.0 units per station of fence.

For each tree or stump counted as identified in Items a, b, and c, units will be determined as identified in the following table:

Table 2010.01: Tabulation of Units for Removal of Trees and Stumps

Size Diameter	Unit		
	Clearing	Grubbing	Clearing and Grubbing
Over 6 in. to 9 in. incl.	1.1	2.8	3.9
Over 9 in. to 12 in. incl.	1.9	4.8	6.7
Over 12 in. to 15 in. incl.	2.8	6.6	9.4
Over 15 in. to 18 in. incl.	4.7	8.8	13.5
Over 18 in. to 24 in. incl.	8.4	13.6	22.0
Over 24 in. to 30 in. incl.	11.4	17.6	29.0
Over 30 in. to 36 in. incl.	22.0	28.0	50.0
Over 36 in. to 42 in. incl.	30.0	50.0	80.0
Over 42 in. to 48 in. incl.	40.0	80.0	120.0
Over 48 in. to 60 in. incl.	60.0	100.0	160.0
Over 60 in. to 72 in. incl.	80.0	120.0	200.0
Over 72 in.	120.0	160.0	280.0

2. **Payment:** Payment will be at the unit price per unit.

3. **Includes:** Unit price includes, but is not limited to, placement of backfill in area where roots have been removed, and removal and disposal of all materials.

B. Clearing and Grubbing by Area:

1. **Measurement:** Measurement will be the plan quantities for the total area of clearing and grubbing. If the limits for this item are not shown in the contract documents, they will be calculated from a need line or right-of-way line as indicated in the project plans.

2. **Payment:** Payment will be at the unit price per acre.

3. **Includes:** Unit price includes, but is not limited to, removal and disposal of all materials and placement of backfill in area where roots have been removed.

C. Clearing and Grubbing by Lump Sum:

1. **Measurement:** Lump sum item; no measurement will be made.

2. **Payment:** Payment will be the contract lump sum price.

3. **Includes:** Lump sum price includes, but is not limited to, removing and disposing all materials and furnishing and placing backfill material in area where roots have been removed.

1.08 MEASUREMENT AND PAYMENT (Continued)

D. Topsoil:

1. On-site Topsoil:

a. Measurement: Measurement will be in cubic yards and will be computed on the basis of a uniform 8 inch finished thickness, or as specified.

b. Payment:

1) Payment will be at the unit price per cubic yard.
2) Topsoil salvaged from excavated areas and paid as topsoil will not be included in excavation quantities for which payment is made.
3) Overhaul will not be paid.

c. Includes: Unit price includes but is not limited to, stripping and stockpiling topsoil; preparing the topsoil placement area by tillage or ripping; re-spreading the topsoil; additional tillage to address compaction during placement; and removal of clods, roots, stones, and other undesirable materials.

2. Compost-amended Topsoil:

a. Measurement: Measurement will be the same as for on-site topsoil.

b. Payment: Payment will be the unit price per cubic yard. Overhaul will not be paid.

c. Includes: Unit price includes but is not limited to, preparing the placement area by tillage or ripping and furnishing, transporting, placing, and incorporating compost.

3. Off-site Topsoil:

a. Measurement: Measurement will be in cubic yards and will be computed on the basis of a uniform 8 inch thickness, or as specified.

b. Payment: Payment will be at the unit price per cubic yard. Overhaul will not be paid.

c. Includes: Unit price includes, but is not limited to, preparing the placement area by tillage or ripping; furnishing, transporting, and spreading the off-site topsoil; completing tillage to address compaction during placement; and removal of clods, roots, stones, and other undesirable materials.

E. Class 10, Class 12, or Class 13 Excavation:

1. Measurement:

a. Measurement for Class 10, Class 12, and Class 13 material excavated from the project site and borrow areas will be the plan quantity in cubic yards, without final field measurement. Adjustments may be made to the plan quantities if agreed to by both the Engineer and the Contractor.

b. If either the Contractor or the Engineer desires actual measurements rather than using contract document quantities, that party must provide written notice to the other party prior to starting work.

1) If actual measurements are used, use cross-section surveys by the Engineer before and after work for the basis of computing the cubic yards of excavation. The extra survey cost will be paid by the party requesting the survey.
2) When the Engineer determines it is impractical to make cross-section surveys, use the truck count method, with a shrinkage factor, resulting in volume per truck type and size determined by the Engineer. Unless otherwise specified, use a shrinkage factor of 1.35 for Class 10 and Class 13 excavation. No shrinkage factor will be used for Class 12.

2. Payment:

a. Payment will be at the unit price per cubic yard.

b. Payment will not be made for excavation work done prior to the staking and, if necessary, cross-sectioning.

1.08 MEASUREMENT AND PAYMENT (Continued)

3. **Includes, but is not limited to:**
   a. Site preparation for, and the construction of, embankment, fills, shoulder backfill, and backfill behind curbs.
   b. Overhaul.
   c. Finishing the soil surface, including roadways, shoulders, behind curbs, side ditches, slopes, and borrow pits.
   d. Repair or replacement of any fences that have been unnecessarily damaged or removed.

4. **Does not include:** Stripping, salvaging, and spreading 8 inches of topsoil, unless otherwise specified in the contract documents.

F. Below Grade Excavation (Core Out): If unsuitable or unstable soil is encountered below the 12 inches of subgrade, measurement and payment for removal and replacement of such materials is as follows:

1. **Measurement:** Will be measured and paid as extra work, unless otherwise specified in the contract documents.

2. **Payment:** To be considered for payment, the Engineer must order the removal and replacement of the material. Payment will be considered only in previously undisturbed areas and not in existing embankments or following proof rolling operations.

3. **Includes:** Payment includes, but is not limited to, equipment, tools, labor, disposal of unsuitable materials, dewatering, drying, furnishing, and placement of foundation materials as required by the Engineer, compaction and finishing of the excavated area, and all incidental work as may be required.

G. Subgrade Preparation:

1. **Measurement:** The area of the proposed pavement under which the subgrade preparation is performed, plus 2 feet on each side, will be measured in square yards.

2. **Payment:** Payment will be at the unit price per square yard.

3. **Includes:** Work includes, but is not limited to, excavating, manipulating, replacing, compacting, and trimming to the proper grade.

H. Granular Stabilization:

1. **Measurement:** Measurement will be in tons for the quantity of granular stabilization material required to replace unstable subgrade material removed. Measurement will be based on the scale tickets for the material delivered and incorporated into the project.

2. **Payment:** Payment will be at the unit price per ton for the quantity of granular stabilization material furnished and placed. Payment is in addition to subgrade preparation and use of other foundation options.

3. **Includes:** Unit price includes, but is not limited to, removal and disposal of unstable material and furnishing, hauling, placing, and compacting granular stabilization material.

1.08 MEASUREMENT AND PAYMENT (Continued)

I. Subgrade Treatment:

1. Measurement: The area of the proposed pavement under which each type of subgrade treatment is provided, plus 2 feet on each side, will be measured in square yards.

2. Payment:
a. Payment will be at the unit price per square yard for each type of subgrade treatment used.
b. Payment is in addition to subgrade preparation.

3. Includes: Work includes, but is not limited to, furnishing, placing, and incorporating the subgrade treatment material [cement, asphalt, fly ash, lime, geogrid (type), or geotextiles].

J. Subbase:

1. Measurement: The area of the proposed pavement under which each type and thickness of subbase is provided, plus 2 feet on each side, will be measured in square yards.

2. Payment: Payment will be at the unit price per square yard for each type and thickness of subbase.

3. Includes: Work includes, but is not limited to, furnishing, placing, compacting, and trimming to the proper grade.

K. Removals:

1. Structures:
a. Measurement: Each structure to be removed will be counted.
b. Payment: Payment will be at the unit price for each specified structure removed.
c. Includes: Unit price includes, but is not limited to, removal and disposal of structures.

2. Culverts:
a. Known Box Culverts:
1) Measurement: Each type and size of box culvert removed will be measured in linear feet from end to end along the centerline of the flowline.
2) Payment: Payment will be at the unit price per linear foot for each type and size of box culvert removed.
3) Includes: Unit price includes, but is not limited to, removal and disposal of box culverts.
b. Unknown Box Culverts: Removal of unknown box culverts will be measured and paid as extra work.
c. Known Pipe Culverts:
1) Measurement: Each type and size of pipe culvert removed will be measured in linear feet from end to end at the flowline.
2) Payment: Payment will be at the unit price per linear foot for each type and size of pipe culvert removed.
3) Includes: Unit price includes, but is not limited to, removal and disposal of pipe culverts.
d. Unknown Pipe Culverts: Removal of unknown pipe culverts will be measured and paid as extra work.

1.08 MEASUREMENT AND PAYMENT (Continued)

3. Pipes and Conduits:

a. Known Pipes and Conduits:

1) Measurement: Each type and size of pipe and conduit removed will be measured in linear feet from end to end.

2) Payment: Payment will be at the unit price per linear foot for each type and size of pipe and conduit removed.

3) Includes: Unit price includes, but is not limited to, removal, disposal, and plugging, if specified, of pipes and conduits.

4) Abandoned Private Utilities: Removal of all private utility lines is the responsibility of the respective utility agency, and will not be measured or paid.

b. Unknown Pipes and Conduits: Removal of unknown pipes and conduits will be measured and paid as extra work.

4. Pavement: Comply with Section 7040.

L. Filling and Plugging of Pipe Culverts, Pipes, and Conduits:

1. Known Pipe Culverts, Pipes, and Conduits:

a. Measurement: Each type and size of pipe culvert, pipe, and conduit filled and plugged will be measured in linear feet from end to end.

b. Payment: Payment will be at the unit price per linear foot for each type and size of pipe culvert, pipe, and conduit filled and plugged.

c. Includes: Unit price includes, but is not limited to, furnishing and installing the plug and the flowable mortar as designated by the Engineer.

d. Abandoned Private Utilities: Filling and plugging of all private utility lines is the responsibility of the respective utility agency, and will not be measured or paid.

2. Unknown pipe culverts, pipes, and conduits: Filling and plugging of unknown pipe culverts, pipes, and conduits will be measured and paid as extra work.

M. Compaction Testing:

1. The Contractor will not be responsible for compaction testing or payment unless otherwise specified in the contract documents.

2. If the contract documents specify that the Contractor is responsible for compaction 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 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 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:

1. 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.

2. 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.

2.04 FOUNDATION MATERIALS

A. Select Subgrade Materials:

1. All soils required for select subgrade materials must be approved by the Engineer. Approval of materials and their use will be based on AASHTO M 145.
   a. Cohesive soils must meet all of the following requirements:
      1) 45% or less silt size fraction.
      2) Density of 110 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).
      3) Plasticity index greater than 10.
      4) A-6 or A-7-6 soils of glacial origin.
   b. Granular soils must meet all of the following requirements:
      1) Density of 110 pcf or greater according to ASTM D 698 or AASHTO T 99 (Standard Proctor Density).
      2) 15% or less silt and clay.
      3) Plasticity index of 3 or less.
      4) A-1, A-2, or A-3 (0).

2. Crushed stone, crushed PCC, crushed composite pavement, or RAP; mixtures of gravel, sand, and soil; or uniformly-blended combinations of the above; as approved by the Engineer.

3. The Engineer may authorize a change in select subgrade materials subject to materials available locally at time of construction.

B. Granular Stabilization Materials:

1. Clean, crushed stone or crushed concrete, with the following gradation:

Sieve	Percent Passing
2 1/2”	100
2”	90 to 100
1 1/2”	35 to 70
1”	0 to 20
1/2”	0 to 5

2. The Engineer may authorize a change in gradation, subject to materials available locally at time of construction.

C. Subgrade Treatment:

1. Cement: Comply with Section 7010, 2.01, A.

2. Asphalt: Comply with AASHTO M 140.

3. Fly ash: Provide Class C meeting the requirements of ASTM C 618 with a minimum of 22% CaO; the Loss of Ignition requirements in Table 1 will not apply. Approval of source required.

4. Lime: Hydrated lime should meet requirements of ASTM C 207, Type N or AASHTO M 216, and others.

2.04 FOUNDATION MATERIALS (Continued)

5. Geogrid:

a. Rectangular or Square: Use an integrally-formed grid structure manufactured of a stress-resistant polypropylene material. Use Type 1 geogrid, unless Type 2 is specified. Meet the following minimum physical properties:

Table 2010.02: Geogrid (Rectangular or Square)

Property	Test Method	Units	Type 1[1]	Type 2
Aperture stability modulus at 20 kg-cm	Kinney[2] - 01	kg-cm/deg	3.2	6.5
Minimum true initial modulus in use				
Machine direction (MD)	ASTM D 6637	lb/ft	15,080	32,890
Cross Machine direction (CMD)			20,560	44,725
Tensile strength, 2% strain				
MD	ASTM D 6637	lb/ft	270	410
CMD			380	590
Junction efficiency	GRI-GG2-87	%	93	93
Flexural rigidity	ASTM D 1388	mg-cm	250,000	750,000
Aperture size				
Minimum	N/A	in.	0.5	0.5
Maximum			2.0	2.0

[1] Geogrids meeting the requirements of Iowa DOT Article 4196.01, B and Materials I.M. 496.01 will be acceptable.
[2] Dr. Thomas C. Kinney, P.E. and US Army Corps of Engineers.

b. Triangular: Use punched and drawn polypropylene that is oriented in three substantially equilateral directions. Meet the following minimum physical properties:

Table 2010.03: Geogrid (Triangular)

Property	Test Method	Units	Type 3	Type 4
Aperture stability modulus at 5 kg-cm	Kinney[1] - 01	kg-cm/deg	3.0	3.6
Resistance to loss of load capacity				
Chemical resistance	EPA 9090 Immersion	%	90-100	90-100
Ultra-violet light and weathering (500 hrs)	ASTM D 4355			
Junction efficiency	GRI-GG2-87 GRI-GG1-87	% of ultimate tensile strength	93	93
Radial stiffness	ASTM D 6637	lb/ft @ 0.5% strain	15,000	20,000
Rib Pitch				
Longitudinal	N/A	in.	1.5-1.75	1.5-1.75
Diagonal				
Mid-rib depth	N/A	in.	0.04-0.06	0.05-0.08
Mid-rib width	N/A	in.	0.035-0.05	0.035-0.055

[1] Dr. Thomas C. Kinney, P.E. and US Army Corps of Engineers.

6. Geotextiles: Use a woven or non-woven permeable fabric, manufactured of polymer fibers, meeting the requirements of Iowa DOT Article 4196.01, B, 5.

2.04 FOUNDATION MATERIALS (Continued)

D. Subbase:

1. Special Backfill:
   a. Comply with Iowa DOT Specifications Section 4132. The quality requirements of Iowa DOT Materials I.M. 210 for recycled pavements are waived.
   b. The Engineer may authorize a change in gradation subject to materials available locally at time of construction.

2. Granular Subbase:
   a. Comply with Iowa DOT Specifications Section 4121.
   b. The Engineer may authorize a change in gradation subject to materials available locally at time of construction.

3. Modified Subbase:
   a. Comply with Iowa DOT Specifications Section 4123.
   b. The Engineer may authorize a change in gradation, subject to materials available locally at time of construction.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

A. Notification: Notify the Engineer prior to start of clearing and grubbing activities.

B. Tree Cutting:

1. **October 1 through March 31:** No restrictions on tree cutting.

2. **April 1 through September 30:** Cut trees only after authorized by the Engineer and upon receiving a copy of the Determination of Effect indicating no affect to threatened or endangered species is expected within the work area.

C. Removal: Remove the following items:

1. Trees and stumps, including roots, to a depth of at least 12 inches. Place backfill to fill the hole.

2. Logs and downed timber.

3. Hedge rows, brush, field fence, and agricultural products.

4. Vegetation and rubbish.

5. Other objectionable materials.

D. Disposal: Dispose of material from clearing and grubbing according to Iowa Administrative Code 567-23.2 and must meet local ordinances. If burning is not allowed, proceed as follows:

1. Process by chipping logs, downed timber, or brush for mulching material; or salvage logs and downed timber for firewood.

2. Other vegetation, including corn stubble, may be disked into the existing soil if approved by the Engineer.

3. Haul vegetative materials from clearing and grubbing that are not handled on the project to a yard waste disposal site.

4. Remove field fence and other non-vegetative materials from the project.

3.02 TOPSOIL

Prior to placement of all types of topsoil, finish excavation and embankment work according to the specified grades and cross-sections considering topsoil requirements; grade and slope all surfaces to drain away from buildings and prevent ponding. Conform to the grading plan within ± 2 inches. Till or rip constructed surface to a minimum depth of 4 inches to reduce compaction prior to topsoil placement.

A. On-Site Topsoil:

1. **Stripping and Salvaging:**
   a. Mow all weeds, grass, and growing crops or other herbaceous vegetation close to the ground and remove from the site. Shred sod by shallow plowing or blading and thorough disking. Thoroughly shred to allow the soil to be easily spread in a thin layer over areas to be covered. If allowed by the Engineer, herbicides may be applied, and vegetation may be incorporated into the topsoil.

TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Trench Excavation for Pipe Systems

B. Trench Foundation Stabilization

C. Pipe Bedding and Backfill

1.02 DESCRIPTION OF WORK

A. Excavate trench for pipe installation.

B. Stabilize trench and install pipe bedding materials.

C. Place backfill material in trench.

1.03 SUBMITTALS

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

A. Gradation reports for bedding materials.

B. Results of required testing.

C. Dewatering plan.

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: The following items are incidental to the underground utility being installed and will not be paid for separately:

1. Standard trench excavation.

2. Removal and disposal of unsuitable backfill material encountered during standard trench excavation.

3. Removal of abandoned private utilities encountered during trench excavation.

4. Furnishing and placing granular bedding material.

5. Placing and compacting backfill material.

6. Dewatering including, but not limited to, all equipment such as generators, pumps, rock for sump pits, discharge piping, and any extra excavation needed to facilitate dewatering according to stormwater regulations, as applicable.

7. Sheeting, shoring, and bracing.

8. Adjusting the moisture content of excavated backfill material to the range specified for placement and compaction.

9. Temporary support for existing water, sewer, gas, telephone, electric, and other utilities or services that cross the trench.

B. Rock Excavation:

1. Measurement: Measurement will be by cubic yards of rock removed.

2. Payment: Payment will be at the unit price per cubic yard for the quantity of rock removed.

3. Includes: Unit price includes, but is not limited to, furnishing the equipment and labor to break up, remove, and properly dispose of rock encountered in the trench.

C. Trench Foundation:

1. Measurement: Measurement will be in tons for the quantity of stabilization material required to replace material removed by over-excavation. Measurement will be based on the scale tickets for the material delivered and incorporated into the project. Trench foundation required to correct unauthorized over-excavation will not be measured.

2. Payment: Payment will be at the unit price per ton for the quantity of stabilization material furnished and placed.

3. Includes: Unit price includes, but is not limited to, removal and disposal of over-excavated material required to stabilize trench foundation; and furnishing, hauling, and placing stabilization material.

1.08 MEASUREMENT AND PAYMENT (Continued)

D. Replacement of Unsuitable Backfill Material:

1. **Measurement:** Measurement will be in cubic yards for the quantity of backfill material required to replace unsuitable backfill material removed during standard trench excavation. Measurement will be based on compacted material in place.

2. **Payment:** Payment will be at the unit price per cubic yard for the quantity of backfill material furnished.

3. **Includes:** Unit price includes, but is not limited to, furnishing, hauling, and placing backfill material.

E. Special Pipe Embedment or Encasement:

1. **Measurement:** Measurement will be by the linear foot along the centerline of pipe for each type of special embedment or encasement.

2. **Payment:** Payment will be at the unit price per linear foot for each type of special pipe embedment or encasement.

3. **Includes:** Unit price includes, but is not limited to, furnishing and placing all required special pipe embedment or encasement materials.

F. Trench Compaction Testing: If the contract documents specify that the Contractor is responsible for trench compaction testing, measurement and payment will be as follows.

1. **Measurement:** Lump sum item; no measurement will be made.

2. **Payment:** Payment will be at the lump sum price for trench compaction testing.

3. **Includes:** Lump sum price includes, but is not limited to, all payments associated with retesting resulting from failure of initial tests.

PART 2 - PRODUCTS

2.01 MATERIALS EXCAVATED FROM A TRENCH

A. Standard Trench Excavation: All materials encountered during trench excavation, except rock and over-excavation.

1. **Suitable Backfill Material:** Class II, Class III, Class IVA, or Class IVB as defined in Section 3010, 2.02.

2. **Unsuitable Backfill Material:** Includes, but is not limited to, the following materials:
   a. Soils not classified as suitable backfill material, as defined in Section 3010, 2.02.
   b. Individual stones or concrete chunks larger than 6 inches and averaging more than one per each cubic foot of soil.
   c. Frozen materials.
   d. Stumps, logs, branches, and brush.
   e. Trash, metal, or construction waste.
   f. Soil in clumps or clods larger than 6 inches, and without sufficient fine materials to fill voids during placement.
   g. Environmentally contaminated soils.
   h. Materials removed as rock excavation or over-excavation.

3. **Topsoil:** Class V material. Comply with Section 3010, 2.03.

B. Rock Excavation: Boulders or sedimentary deposits that cannot be removed in trenches without continuous use of pneumatic tools or blasting.

C. Over-excavation: Excavation of unsuitable or unstable material in trenches below the pipe zone, comply with Figure 3010.101.

2.02 BEDDING MATERIAL

A. Class I Material:

1. Crushed stone complying with the following gradation:

Sieve	Percent Passing
1 1/2”	100
1”	95 to 100
1/2"	25 to 60
No. 4	0 to 10
No. 8	0 to 5

2. The Engineer may allow the use of gravel or authorize a change in gradation subject to materials available locally at the time of construction.

3. The Engineer may authorize the use of crushed PCC for pipe sizes up to 12 inches.

4. Use aggregates having a percentage of wear, Grading A or B, not exceeding 50%, determined according to AASHTO T 96.

Section 4040 - Subdrains and Footing Drain Collectors (Continued)

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, foamed cellular concrete, or CLSM (comply with Section 3010) by gravity flow or pumping.

3. Batching, mixing, and placing may be started when temperature is 34°F and rising. Cease mixing and placing when temperature is 38°F or less and falling.

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 Sanitary and Combined Sewers from Water Mains: Separate gravity sanitary and combined 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, provide a linear separation of at least 2 feet and one of the following:
   a. Construct sanitary and combined sewers of water main materials meeting the requirements of Section 5010, 2.01.
   b. Enclose the water main in a watertight casing pipe with an evenly spaced annular gap and watertight end seals.

B. Horizontal Separation of Water Mains from Sanitary and Combined Sewer Manholes: Ensure water pipes do not pass through or come in contact with any part of a sanitary or combined sewer manhole. Maintain a minimum horizontal separation of 3 feet.

C. Separation of Sanitary Sewer Force Mains from Water Mains: Separate sanitary 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.

D. Separation of Sanitary and Combined Sewers and Water Main Crossovers:

1. Vertically separate sanitary sewers crossing under any water main by 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, do not place the sewer 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 sanitary sewer crosses over or is less than 18 inches below a water main, utilize one of the following within 10 feet measured edge-to-edge horizontally, centered on the crossing:
   a. Construct sewer pipe of water main material.
   b. Enclose the water main in a watertight casing pipe with an evenly spaced annular gap and watertight end seals.

3.13 CLEANING, INSPECTION, AND TESTING

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

END OF SECTION

2.01 STORM SEWERS (Continued)

F. High Density Polyethylene Pipe (HDPE):

1. Use pipe complying with the following:
   a. AASHTO M 294, Type S corrugated exterior and smooth interior.
   b. Minimum pipe stiffness at 5% deflection according to ASTM D 2412.
   c. Integral bell and spigot joints with elastomeric seals complying with ASTM F 477.
   d. Maximum 5% deflection of the average inside diameter by testing after installation according to Section 4060, 3.05.

2. Use of this pipe material requires specific approval by the Engineer.

G. Corrugated Metal Pipe (CMP):

1. Use pipe complying with the following:
   a. AASHTO M 36, Type I.
   b. Zinc coating complying with AASHTO M 218.
   c. Corrugated steel circular section with annular or helical corrugations.
   d. Gage of pipe according to Iowa DOT Standard Road Plan DR-104 or as specified in the contract documents.
   e. Coupling bands with annular or helical corrugations to match pipe ends.

2. Use of this pipe material requires specific approval by the Engineer.

H. Spiral Rib Pipe:

1. Use pipe complying with the following:
   a. ASTM A 760 Type 1R.
   b. Corrugation profile of 3/4 inch by 3/4 inch by 7 1/2 inches.
   c. Type 2 aluminized steel complying with ASTM A 929.
   d. Minimum thickness of 0.064 inch. Use gage of pipe according to manufacturer's requirements.
   e. Coupling bands complying with manufacturer's recommendations.

2. Use of this pipe material requires specific approval by the Engineer.

I. Coated Corrugated Metal Pipe:

1. Use in corrosive soil or effluent conditions, or where specified in the contract documents or required by the Engineer.

2. Comply with AASHTO M 274. Use gage of pipe according to Iowa DOT Standard Road Plan DR-104 or as specified in the contract documents.

3. Use of this pipe material requires specific approval by the Engineer.

J. Corrugated Metal Arch Pipe (CMAP):

1. Use pipe complying with the following:
   a. AASHTO M 36, Type II.
   b. Zinc coating complying with AASHTO M 218.
   c. Corrugated steel Type I pipe reformed into a pipe-arch having an approximately flat bottom.
   d. Coupling bands with annular corrugations or helical corrugations to match pipe ends.
   e. Gage of pipe according to Iowa DOT Standard Road Plan DR-104.

2. Use of this pipe material requires specific approval by the Engineer.

2.01 STORM SEWERS (Continued)

K. Spiral Rib Arch Pipe:

1. Use pipe complying with the following:
   a. ASTM A 760 Type IIR.
   b. Corrugation profile of 3/4 inch by 3/4 inch by 7 1/2 inch.
   c. Type 2 aluminized steel complying with ASTM A 929.
   d. Minimum thickness of 0.064 inch. Use gage of pipe complying with manufacturer's requirements.
   e. Coupling bands complying with the manufacturer's recommendations.

2. Use of this pipe material requires specific approval by the Engineer.

L. Polypropylene Pipe:

1. Comply with the following for 12 inch to 30 inch pipe:
   a. Double walled pipe meeting ASTM F 2764.
   b. Minimum pipe stiffness per ASTM D 2412, 46 psi.
   c. Integral bell and spigot joint complying with ASTM D 3212 and ASTM F 477.

2. Comply with the following for 30 inch to 60 inch pipe:
   a. Triple walled pipe meeting ASTM F 2764.
   b. Minimum pipe stiffness per ASTM D 2412, 46 psi.
   c. Integral bell and spigot joint complying with ASTM D 3212 and ASTM F 477.

3. Use of this pipe material requires specific approval by the Engineer.

M. Bituminous Joint Primer: Material intended for use in priming concrete joints. Comply with the requirements of ASTM D 41.

N. Engineering Fabric: Comply with Iowa DOT Article 4196.01.

O. Non-Shrink Grout: Comply with Iowa DOT Materials I.M. 491.13.

2.02 LINEAR TRENCH DRAIN

Comply with approved manufacturer's requirements and Iowa DOT Materials I.M. 449 (MAPLE), as well as complying with Figure 6010.521. Provide certification indicating continuous trench drain meets AASHTO M 306 for 40,000 pound proof load.

2.03 CASING PIPE

Comply with Section 3020, 2.02 for casing pipe requirements.

2.04 PIPE APRONS

Comply with the requirements of Section 4020, 2.01 and Section 4030, 2.01 for the pipe material of which the apron is constructed. Supply concrete pipe aprons according to Figure 4030.222 and Figure 4030.223. Supply CMP pipe aprons according to Figure 4030.225.

2.05 APRON FOOTINGS

Comply with the requirements of Section 6010 for reinforcing steel and structural concrete used in apron footings.

2.06 APRON GUARD

Use smooth or deformed steel bars, ASTM A 615, Grade 40 or Grade 60, or merchant quality, in the construction of the apron guard. Hot dip galvanize the apron guard according to ASTM A 123.

3.06 APRONS (Continued)

C. Anchor the last three concrete pipe sections and the apron together with two pipe connections per joint. Comply with Iowa DOT Standard Road Plan DR-121.

D. Attach corrugated metal aprons to the pipe with a manufacturer's approved bolt, weld, or clamp to fasten directly to the pipe.

E. Install apron guard where specified in the contract documents. Construct according to Figure 4030.224 or 4030.225. Repair any damage to the galvanized coating that occurs due to storage, handling, or installation.

3.07 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.

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"

3.08 CONFLICTS

A. Horizontal Separation of Gravity Storm Sewers from Water Mains: Separate storm sewers and water mains by at least 10 feet measured edge to edge unless it is impossible to do so. When not possible to maintain a 10 feet horizontal separation, maintain a minimum separation of 3 feet and utilize one of the following within 10 feet measured edge to edge:

1. Construct the water main of ductile iron pipe with gaskets impermeable to hydrocarbons.

2. Enclose the water main in a watertight casing pipe with evenly spaced annular gap and watertight end seals.

3. Construct storm sewer pipe of water main materials.

4. Construct storm sewers of reinforced concrete pipe with gaskets manufactured according to ASTM C 443.

B. Separation of Storm Sewer Force Mains from Water Mains: Separate storm 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.

3.08 CONFLICTS (Continued)

C. Vertical Separation of Storm Sewers and Water Main Crossovers:

1. Vertically separate storm sewers from water mains by at least 18 inches measured between the outside edges of the water main and the storm sewer. Maintain the maximum feasible separation distance in all cases. Ensure the sewer and water pipes are adequately supported. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

2. When impossible to maintain an 18 inch vertical separation when the water main crosses over the storm sewer, maintain a minimum vertical separation of 6 inches and utilize one of the following within 10 feet measured edge-to-edge centered on the crossing:
   a. Construct the water main of ductile iron pipe with gaskets impermeable to hydrocarbons.
   b. Enclose the water main in a watertight casing pipe with evenly spaced annular gap and watertight end seals.
   c. Construct storm sewer pipe of water main materials.
   d. Construct storm sewers of reinforced concrete pipe with gaskets manufactured according to ASTM C 443.

3.09 STORM 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, foamed cellular concrete, or CLSM (comply with Section 3010) by gravity flow or pumping.

3. Batching, mixing, and placing may be started when temperature is 34°F and rising. Cease mixing and placing when temperature is 38°F or less and falling.

3.10 CONNECTION TO EXISTING MANHOLE OR INTAKE

Comply with Section 6010, 3.05.

3.11 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test according to Section 4060.

END OF SECTION

PIPE CULVERTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe Culverts

B. Pipe Aprons and Beveled Ends

C. Footings for Concrete Pipe Aprons

D. Pipe Apron Guards

1.02 DESCRIPTION OF WORK

Construct pipe culverts, beveled ends, pipe aprons, and associated appurtenances.

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. Pipe Culverts:

1. Trenched:

a. Measurement: Each type and size of pipe installed in a trench will be measured in linear feet from end of pipe to end of pipe along the centerline of pipe, exclusive of aprons. Lengths of elbows and tees will be included in length of pipe measured.

b. Payment: Payment will be made at the unit price of each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; testing; and inspection.

2. Trenchless:

a. Measurement: Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the casing pipe.

b. Payment: Payment will be made at the unit price for each type and size of pipe.

c. Includes: Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing and compacting backfill material; pipe connections; testing; and inspection.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Pipe Aprons:

1. **Measurement:** Each type and size of pipe apron will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron.

3. **Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; and other appurtenances.

C. Footings for Concrete Pipe Aprons:

1. **Measurement:** Each type and size of footing installed on a concrete pipe apron will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of footing.

3. **Includes:** Unit price includes, but is not limited to, excavation; dewatering; reinforcing steel; concrete; furnishing and installing apron; furnishing, placing and compacting bedding and backfill material.

D. Pipe Apron Guards:

1. **Measurement:** Each type and size of pipe apron guard will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron guard.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing the apron guard and repairing any damage to the apron from the installation process.

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. **Subdrain Cleanouts:**
   a. **Measurement:** Each type and size of subdrain cleanout will be counted.
   b. **Payment:** Payment for each cleanout will be made at the unit price for each type and size of subdrain cleanout.
   c. **Includes:** Unit price includes, but is not limited to, trench excavation; furnishing cleanout and lid; and furnishing, placing, and compacting bedding and backfill material.

2. **Footing Drain Cleanouts:**
   a. **Measurement:** Each type and size of footing drain cleanout will be counted.
   b. **Payment:** Payment for each cleanout will be made at the unit price for each type and size of footing drain cleanout.
   c. **Includes:** Unit price includes, but is not limited to, trench excavation; furnishing cleanout and lid; and furnishing, placing, and compacting bedding and backfill material.

D. Subdrain or Footing Drain Outlets and Connections:

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

2. **Footing Drain Outlets and Connections:**
   a. **Measurement:** Each type and size of outlet or connection to a structure will be counted.
   b. **Payment:** Payment for each outlet or connection to a structure will be made at the unit price for each type and size installed.
   c. **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.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Remove Protruding Service Connections:

1. **Measurement:** Each protruding service connection removed will be counted. Quantity will be based on number of protruding service connections identified in the pre-rehabilitation CCTV inspection and removed from the post-rehabilitation CCTV inspection.

2. **Payment:** Payment will be made at the unit price for each protruding service connection removed.

3. **Includes:** Unit price includes, but is not limited to, removal of protruding service connections and debris removal.

C. CIPP Lining:

1. **CIPP Main Lining:**
   a. **Measurement:** Each size of main pipe lining will be measured in linear feet along the centerline of the pipe lining from center of manhole to center of manhole.
   b. **Payment:** Payment will be made at the unit price per linear foot for each size of pipe lining.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and installing the liner and appurtenances, CCTV inspection immediately prior to lining, bypass pumping unless otherwise specified, sliding foil, post-lining CCTV inspection, and all costs associated with the public information and notification program.

2. **Building Sanitary Sewer Service Reinstatement:**
   a. **Measurement:** Each active sanitary sewer service reinstated, including those reinstated by excavation, will be counted.
   b. **Payment:** Payment will be made at the unit price for each active sewer service reinstated.
   c. **Includes:** Unit price includes, but is not limited to, reinstating sanitary sewer service connections, removal of debris, and coordination with service owners.

3. **CIPP End Seal:**
   a. **Measurement:** Each size of CIPP end seal installed will be counted.
   b. **Payment:** Payment will be made at the unit price for each CIPP end seal installed.
   c. **Includes:** Unit price includes, but is not limited to, end seal and installation.

D. CIPP Point Repair:

1. **Measurement:** Each diameter of CIPP point repair will be counted. Repairs in excess of 10 feet in length will be counted as multiple repairs.

2. **Payment:** Payment will be made at the unit price for each diameter of CIPP point repair.

3. **Includes:** Unit price includes, but is not limited to, furnishing and placing point repair liner, bypass pumping unless otherwise specified, sewer cleaning, removal of obstructions, debris removal, pipe preparation, and pre and post repair CCTV inspection.

1.08 MEASUREMENT AND PAYMENT (Continued)

E. CIPP Service Repair:

1. **CIPP Service Pipe, Connection:**
   a. **Measurement:** Each size combination of main and service connection diameters repaired will be counted.
   b. **Payment:** Payment will be made at the unit price for each size combination of CIPP service pipe, connection.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and placing service connection liner, bypass pumping unless otherwise specified, documentation, and all costs associated with the public information and notification program.

2. **CIPP Service Repair, Partial Pipe:**
   a. **Measurement:** Each size combination of main and service diameters and specified service length lined will be counted.
   b. **Payment:** Payment will be made at the unit price for each size combination of CIPP service repair, partial pipe.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and installing service repair liner, bypass pumping unless otherwise specified, documentation, and all costs associated with the public information and notification program.

F. Pressure Testing and Grouting of Sewer Joints and Service Connections:

1. **Pressure Testing of Mainline Sewer Joints:**
   a. **Measurement:** Each mainline sewer joint tested will be counted. Separate measurement will be made for each diameter of sewer main. Visually leaking joints, whether tested or not, will be counted if they are grouted.
   b. **Payment:** Payment will be made at the unit price for each sewer joint tested.
   c. **Includes:** Unit price includes, but is not limited to, bypass pumping unless otherwise specified, control testing, and documentation.

2. **Injection Grouting of Mainline Sewer Joints:**
   a. **Measurement:** Each mainline sewer joint grouted will be counted. Separate measurement will be made for each diameter of sewer main.
   b. **Payment:** Payment will be made at the unit price for each sewer joint grouted.
   c. **Includes:** Unit price includes, but is not limited to, bypass pumping unless otherwise specified, material testing, pressure testing after grouting, re-grouting of failed joints, and documentation. Unit price does not include the quantity of chemical grout used.

3. **Pressure Testing of Service Connections:**
   a. **Measurement:** Each sewer service connection tested will be counted. Separate measurement will be made for service connections on each diameter of sewer main.
   b. **Payment:** Payment will be made at the unit price for each service connection tested.
   c. **Includes:** Unit price includes, but is not limited to, bypass pumping unless otherwise specified, and documentation.

4. **Injection Grouting of Service Connections:**
   a. **Measurement:** Each service connection grouted will be counted. Separate measurement will be made for service connections on each diameter of sewer main.
   b. **Payment:** Payment will be made at the unit price for each service connection grouted.
   c. **Includes:** Unit price includes, but is not limited to, bypass pumping unless otherwise specified, material testing, pressure testing after grouting, and documentation. Unit price does not include the quantity of chemical grout used.

2.03 CIPP SERVICE REPAIR (Continued)

3. Comply with the following minimum structural properties:

Table 4050.03: Minimum Structural Properties for CIPP Service

Property	Test Method	Minimum Value
Flexural modulus of elasticity	ASTM D 790	250,000 psi
Flexural strength	ASTM D 790	4,500 psi

4. Do not consider the bond to the existing pipe in determining the structural performance of the lining system.

2.04 CHEMICAL GROUT

A. Grout: Provide a chemical grout (chemical sealing material) complying with ASTM F 2304 or ASTM F 2454.

B. Additives: Strengthening agents, shrinkage reducers, dyes, viscosity modifiers, gel time modifiers, and freeze/thaw inhibiters, are allowed at the Contractor's discretion. Provide additives compatible with the chemical grout and complying with chemical grout manufacturer's requirements.

C. Root Inhibitor: When specified in the contract documents, provide a root deterrent chemical to control root regrowth. Ensure root inhibitor is compatible with chemical grout and additives and complies with grout manufacturer's requirements.

2.05 SEWER DYE

Provide tracer dye complying with NSF/ANSI 60.

2.06 PIPE REPAIR COUPLINGS FOR SPOT REPAIRS BY PIPE REPLACEMENT

A. Style: Full circle, fully lined, bolted.

B. Length: As recommended by the manufacturer for pipe diameter; 12 inches, minimum.

C. Materials and Manufacturer:

1. Shells, armors, side bars, lugs, Turner lifting bars; complying with ASTM A 240, Type 304 stainless steel.

2. MIG welds, fully passivated.

3. Rubber gasket complying with ASTM D 2000, AA415 with full coverage and a grid pattern.

4. Stainless steel armor bonded to gasket to bridge lug area.

D. Nuts and Bolts: 1/2 inch or 5/8 inch diameter, complying with ASTM A 240, Type 304 stainless steel, and Teflon coated threads.

2.07 SEWER MAIN PIPE (FOR SPOT REPAIRS)

A. Comply with Section 4010.

B. Use materials for pipe replacement as specified in the contract documents or approved by the Engineer.

PART 3 - EXECUTION

3.01 SEWER CLEANING AND INSPECTION FOR REHABILITATION

A. General:

1. Provide equipment specifically designed and constructed for sewer cleaning and inspection.

2. Use sewer cleaning equipment manufacturer's recommended size tools for various pipe sizes.

3. Utilize equipment recommended by the manufacturer to protect the manhole and pipe during cleaning and inspection operations.

4. Perform all cleaning and removal operations under CCTV observation to monitor the progress of the work and to monitor the sewer line for damage. Continue until the condition of the host pipe meets the requirements of the liner manufacturer.

5. Flush all debris to downstream manhole. Screen, collect, and remove debris from sewer.

6. Dispose of all sanitary sewer debris and material at a location directed by the Owner. If specified in the contract documents, pay for all disposal fees.

B. Pre-Cleaning Inspection:

1. Complete CCTV inspection of sewer prior to initiating cleaning.

2. Inspect each pipe segment between manholes or access points in a single, continuous run where possible.

3. If line is impassable due to debris or obstructions, reverse setup and inspect from opposite manhole or access point.

C. Pre-Rehabilitation Sewer Pipe Cleaning:

1. Perform light cleaning with hydraulic flusher or high velocity cleaning equipment to remove loose debris.

2. Complete up to three passes in an attempt to remove all debris from line.

3. If the pre-rehabilitation light cleaning fails to leave the sewer line in a condition ready for lining, contact Engineer for authorization to proceed with additional sewer cleaning.

D. Additional Sewer Cleaning:

1. Notify Engineer prior to performing heavy cleaning as required to remove obstructions, grease, rock, sticks, deposits settled (DS), deposits attached grease (DAGS), deposits attached encrustation (DAE), and roots, so the sewer is ready for lining. This item does not include cutting/grinding protruding service lines.

2. Utilize rotating nozzles, saws or cutters, or high velocity hydro-cleaning equipment.

3. Notify Engineer prior to use of mechanical/hydraulic spinner nozzle, chain flail, or other devices that may damage pipe or service connections.

4. If deposits and obstructions cannot be removed by tools normally used in the sewer cleaning industry, notify Engineer immediately.

3.03 SANITARY SEWER LEAKAGE TESTING (Continued)

C. Sanitary Sewer Low Pressure Air Testing:

1. General:

a. A low pressure air test may be used in lieu of an exfiltration test except as noted.
b. 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.
c. Use extreme care and follow safety precautions during testing operations. No one is allowed in manholes during testing.

2. Test Procedures:

a. Clean entire line of all debris. Flush or wet line to produce consistent results.
b. Plug all inlets and outlets to resist the test pressure. Special attention must be given to stoppers and laterals.
c. Determine the test duration for the section being tested from the following table. This table ignores pipe length and uses the factor 0.472 x 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

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.

3.03 SANITARY SEWER LEAKAGE TESTING (Continued)

D. Sanitary Sewer Vacuum Testing: Comply with ASTM C 1244.

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.

3.04 DEFLECTION TESTING

A. Perform deflection tests on all flexible sanitary sewer mains, excluding ductile iron pipe. Also perform deflection tests on all flexible storm sewer or culvert pipe 12 inches in diameter or greater.

B. Perform deflection tests after backfill has been in place at least 30 calendar days and before paving activity takes place, or as per appropriate sections of these specifications.

C. Pull 9 arm deflection mandrel, complying with applicable ASTM Standards, through sewer by hand.

D. Ensure pipe deflection does not exceed 5% of average inside diameter as established by ASTM Standards.

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1.08 MEASUREMENT AND PAYMENT (Continued)

D. Water Service Stubs by Each:

1. **Measurement:** Each type and size of water service stub from the water main to the stop box will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of water service stub.

3. **Includes:** Unit price includes, but is not limited to, water service corporation; service pipe; curb stop; stop box; trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; and installation of tracer wire system for non-metallic service pipe.

E. Water Service Stubs by Length:

1. **Water Service Pipe:**
   a. **Measurement:** Each type and size of water service pipe will be measured in linear feet along the centerline of the pipe.
   b. **Payment:** Payment will be made at the unit price per linear foot of each type and size of water service pipe.
   c. **Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; and installation of tracer wire system for non-metallic service pipe.

2. **Water Service Corporation:**
   a. **Measurement:** Each type and size of water service corporation will be counted.
   b. **Payment:** Payment will be made at the unit price for each type and size of water service corporation.
   c. **Includes:** Unit price includes, but is not limited to, trench excavation (if necessary); furnishing and installing the water service corporation; and furnishing, placing, and compacting bedding and backfill material.

3. **Water Service Curb Stop and Box:**
   a. **Measurement:** Each type and size of water service curb stop and box will be counted.
   b. **Payment:** Payment will be made at the unit price for each type and size of water service curb stop and box.
   c. **Includes:** Unit price includes, but is not limited to trench excavation (if necessary); furnishing and installing the curb stop and box; and furnishing, placing, and compacting bedding and backfill material.

F. Water Main Abandonment, Cap:

1. **Measurement:** Each size and location of water main to be abandoned will be counted.

2. **Payment:** Payment will be made at the unit price for each size and location of water main abandoned.

3. **Includes:** Unit price includes, but is not limited to, trench excavation (if necessary); closing valves; removing valve boxes; installing thrust blocks; cutting pipe; installing MJ caps; and furnishing, placing, and compacting backfill material.

1.08 MEASUREMENT AND PAYMENT (Continued)

G. Water Main Abandonment, Fill and Plug:

1. **Measurement:** Each size and location of water main to be abandoned by filling and plugging will be measured in linear feet.

2. **Payment:** Payment will be made at the unit price per linear foot of water main filled and plugged.

3. **Includes:** Unit price includes, but is not limited to, trench excavation (if necessary); closing valves; removing valve boxes; installing thrust blocks; cutting and removing the specified section of pipe; furnishing and pumping flowable material to fill the pipe to be abandoned; installing MJ caps; and furnishing, placing, and compacting backfill material.

H. Water Main Removal:

1. **Measurement:** Each size and location of water main to be removed will be measured in linear feet from end to end.

2. **Payment:** Payment will be made at the unit price per linear foot for each pipe removed.

3. **Includes:** Unit price includes, but is not limited to, trench excavation (if necessary); closing valves; installing thrust blocks; cutting pipe; installing MJ caps; removal and disposal of all valves and pipe specified for removal; furnishing, placing, and compacting backfill material.

3.06 CONFLICTS

A. Horizontal Separation of Gravity Sewers from Water Mains:

1. Sanitary and Combined Sewers:

a. Separate gravity sanitary and combined 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.

b. Maintain the maximum feasible separation distance in all cases. 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, provide a linear separation of at least 2 feet and one of the following:
   1) Construct sanitary and combined sewers of water main materials meeting the requirements of Section 5010, 2.01.
   2) Enclose the water main in a watertight casing pipe with an evenly spaced annular gap and watertight end seals.

2. Storm Sewers: Separate storm sewers and water mains by at least 10 feet measured edge-to-edge unless it is impossible to do so. When impossible to maintain a 10 feet horizontal separation, maintain a minimum separation of 3 feet and utilize one of the following within 10 feet measured edge-to-edge:

a. Construct the water main of ductile iron pipe with gaskets impermeable to hydrocarbons.
b. Enclose the water main in a watertight casing pipe with evenly spaced annular gap and watertight end seals.
c. Construct storm sewer pipe of water main materials.
d. Construct storm sewers of reinforced concrete pipe with gaskets manufactured according to ASTM C 443.

B. Horizontal Separation of Water Mains from Sanitary and Combined Sewer Manholes: Ensure water pipes do not pass through or come in contact with any part of a sanitary or combined sewer manhole. Maintain a minimum horizontal separation of 3 feet.

C. Horizontal 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.

D. Vertical Separation of Sewers and Water Main Crossovers:

1. Sanitary and Combined Sewers:

a. Vertically separate sanitary and combined sewers crossing under water mains by 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, do not place the sewer closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases. Ensure the sewer and water pipes are adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

3.06 CONFLICTS (Continued)

b. Where the sanitary sewer crosses over or less than 18 inches below a water main, utilize one of the following within 10 feet measured edge-to-edge horizontally, centered on the crossing:
   1) Construct sanitary and combined sewers of water main material meeting the requirements of Section 5010, 2.01.
   2) Enclose the water main in a watertight casing pipe with an evenly spaced annular gap and watertight end seals.

2. Storm Sewers:

a. Vertically separate storm sewers from water mains by at least 18 inches measured between the outside edges of the water main and the storm sewer. Maintain the maximum feasible separation distance in all cases. Ensure the sewer and water pipes are adequately supported. Use a low permeability soil for backfill material within 10 feet of the point of crossing.
b. When impossible to maintain an 18 inch vertical separation when the water main crosses over the storm sewer, maintain a minimum vertical separation of 6 inches and utilize one of the following within 10 feet measured edge-to-edge centered on the crossing:
   1) Construct the water main of ductile iron pipe with gaskets impermeable to hydrocarbons.
   2) Enclose the water main in a watertight casing pipe with evenly spaced annular gap and watertight end seals.
   3) Construct storm sewer pipe of water main materials.
   4) Construct storm sewers of reinforced concrete pipe with gaskets manufactured according to ASTM C 443.

3.07 TRANSITIONS IN PIPING SYSTEMS

Where the specified material of a piping system entering or exiting a structure changes, make the change at the outside of the structure wall, beyond any wall pipe or wall fitting required, unless otherwise specified.

3.08 STRUCTURE PENETRATIONS

A. Wall Pipes:

1. Install where pipes penetrate and terminate at a wall or floor surface of a concrete structure, or where the pipe protrudes through the concrete wall or floor and the protrusion is otherwise unsupported.

2. Provide a waterstop flange near the center of the embedment length. The waterstop is to be cast integrally with the wall pipe, or fully welded to it around the pipe circumference.

B. Wall Sleeves:

1. Install where a pipe passes through a structure wall.

2. Sleeves in concrete walls are to be supplied with a waterstop collar, fully welded, and cast-in-place in the concrete.

3.09 WATER SERVICE STUB

A. Install water service pipe, corporations, stops, and stop boxes according to local Jurisdiction requirements.

B. Install 1 inch and smaller corporation valves tapped at 45 degrees above horizontal at a minimum distance of 18 inches from pipe bell or other corporation. Install 1 1/2 inch and 2 inch corporation valves tapped horizontal a minimum distance of 24 inches from pipe bell or other corporation.

C. Construct trench and place backfill material according to Section 3010.

3.10 WATER MAIN ABANDONMENT

Verify with the Engineer that all services are no longer using the main to be abandoned.

A. For Each Pipe to be Abandoned by Capping:

1. Close valves and remove valve boxes as specified in the contract documents.
2. Construct thrust blocks on each end of the active pipes according to Figure 5010.101.
3. Cut pipe to be abandoned a minimum of 5 feet from the closed valve on each end of the active pipes, leaving a minimum of 12 inches of pipe exposed beyond the thrust block.
4. Remove a minimum of 3 feet of the pipe to be abandoned.
5. Install a MJ cap using a retaining gland according to Figure 5010.101 on the end of each pipe to be abandoned and each active pipe.

B. For Each Pipe to be Abandoned by Filling:

1. Close valves and remove valve boxes as specified in the contract documents.
2. Construct thrust blocks on each end of the active pipes according to Figure 5010.101.
3. Cut pipe to be abandoned a minimum of 5 feet from the closed valve on each end of the active pipes, leaving a minimum of 12 inches of pipe exposed beyond the thrust block.
4. Remove a minimum of 3 feet of the pipe to be abandoned.
5. Install a MJ cap using a retaining gland according to Figure 5010.101 on each pipe to be abandoned and each active pipe.
6. Fill the pipe to be abandoned by pumping with flowable mortar, foamed cellular concrete, or CLSM complying with Section 3010.

3.11 WATER MAIN REMOVAL

Verify with the Engineer that all services are no longer using the main and have been disconnected from the main to be removed.

A. Close valves as specified in the contract documents.

B. Construct thrust block on each end of the active pipes according to Figure 5010.101.

C. Cut pipe to be removed a minimum of 5 feet from the closed valve on each end of the active pipes leaving a minimum of 12 inches of pipe exposed beyond the thrust block.

3.11 WATER MAIN REMOVAL (Continued)

D. Install a MJ cap using a retaining gland according to Figure 5010.101 at the end of each active pipe.

E. Remove and dispose of water main pipe. Furnish, place, and compact backfill material.

3.12 TESTING AND DISINFECTION

Test and disinfect according to Section 5030.

END OF SECTION

VALVES, FIRE HYDRANTS, AND APPURTENANCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Butterfly Valves

B. Gate Valves

C. Tapping Valve Assemblies

D. Fire Hydrant Assemblies

E. Flushing Devices (Blowoffs)

F. Valve Boxes

1.02 DESCRIPTION OF WORK

Install valves, fire hydrants, and appurtenances for water mains.

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, as well as the following:

Remove valves, fire hydrants, and appurtenances contaminated with mud and surface water from the site. Do not use in construction unless thoroughly cleaned, inspected, and approved by the owner.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Valve (Butterfly or Gate):

1. **Measurement:** Each type and size of valve will be counted.

2. **Payment:** Payment will be at the unit price for each type and size of valve.

3. **Includes:** Unit price includes, but is not limited to, all components attached to the valve or required for its complete installation, including underground or above ground operator, square valve operating nut, valve box and cover, valve box extension, and valve stem extension.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Tapping Valve Assembly:

1. **Measurement:** Each size of tapping valve assembly will be counted.

2. **Payment:** Payment will be at the unit price for each tapping valve assembly.

3. **Includes:** Unit price includes, but is not limited to, tapping sleeve, tapping valve, the tap, valve box and cover, valve box extension, and valve stem extension.

C. Fire Hydrant Assembly:

1. **Measurement:** Each fire hydrant assembly will be counted.

2. **Payment:** Payment will be at the unit price for each fire hydrant assembly.

3. **Includes:** Unit price includes, but is not limited to, the fire hydrant, barrel extensions sufficient to achieve proper bury depth of anchoring pipe and height of fire hydrant above finished grade, and components to connect the fire hydrant to the water main, including anchoring pipe, fittings, thrust blocks, pea gravel or porous backfill material, and fire hydrant gate valve and appurtenances, except tapping valve assembly if used.

D. Alternate Fire Hydrant Assembly:

1. **Measurement:** Each alternate fire hydrant assembly will be counted.

2. **Payment:** Payment will be at the unit price for each alternate fire hydrant assembly.

3. **Includes:** Unit price includes, but is not limited to, the fire hydrant, barrel extensions sufficient to achieve proper bury depth of anchoring pipe and height of fire hydrant above finished grade, and components to connect the fire hydrant to the water main, including anchoring pipes, 90 degree bend; fittings, thrust blocks, pea gravel or porous backfill material, and fire hydrant gate valve and appurtenances, except tapping valve assembly if used.

E. Flushing Device (Blowoff):

1. **Measurement:** Each size of flushing device will be counted.

2. **Payment:** Payment will be at the unit price for each flushing device

3. **Includes:** Unit price includes, but is not limited to, trench excavation; furnishing, installing, and removing the flushing device (if designated by the Engineer); and furnishing, placing, and compacting bedding and backfill material.

F. Valve Box Adjustment, Minor: Measurement and payment for minor adjustment of an existing valve box by raising or lowering the adjustable valve box is incidental.

G. Valve Box Extension:

1. **Measurement:** Each existing valve box adjusted to finished grade by adding a valve box extension will be counted.

2. **Payment:** Payment will be at the unit price for each valve box extension.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing the valve box extension and replacing the valve box lid.

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STRUCTURES FOR SANITARY AND STORM SEWERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manholes and Intakes for Storm Sewers

B. Manholes for Sanitary Sewers

C. Adjustment of Existing Manholes and Intakes

D. Connection to Existing Manholes and Intakes

E. Removal of Manholes and Intakes

F. Special Structures for Storm Sewers

G. Excavation and Backfill of Structures

1.02 DESCRIPTION OF WORK

A. Construct sanitary and storm sewer manholes to provide access to sewer systems for maintenance and cleaning purposes.

B. Construct storm sewer intakes for collection of surface water and conveyance to the storm sewer system.

C. Modify existing manholes and intakes as necessitated by other improvements adjacent to the manholes or intakes.

1.03 SUBMITTALS

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

A. Shop drawings of steel reinforcement, showing sizes, lengths, bends, and counts, if required.

B. Concrete mix design, if required by Engineer.

C. Shop drawing schedule of new manholes and/or intakes showing total depth, relative elevations of all connecting sanitary or storm sewer lines, all drops, and orientation of connecting lines.

D. Results of required testing.

E. Catalog cuts of iron castings and sewer line connection gaskets.

F. Gradation and soil classification reports for structure bedding and backfill materials.

G. Dewatering plan.

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. Store reinforcing steel only on pallets or lagging.

B. Follow the aggregate storage and concrete transport requirements in Iowa DOT Article 2301.02, C.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

A. Do not place concrete when stormy or inclement weather will prevent good quality work.

B. Cold weather placement is restricted per Iowa DOT Article 2403.03, F.

1.08 MEASUREMENT AND PAYMENT

A. Manhole:

1. **Measurement:** Each type and size of manhole will be counted.

2. **Payment:** Payment will be at the unit price for each type and size of manhole.

3. **Includes:** Unit price includes, but is not limited to, excavation; furnishing and installing pipe; lining (if specified); furnishing, placing, and compacting bedding and backfill material; base; structural concrete; reinforcing steel; precast units (if used); concrete fillets; pipe connections; infiltration barriers (sanitary sewer manholes only); castings; and adjustment rings.

B. Intake:

1. **Measurement:** Each type and size of intake will be counted.

2. **Payment:** Payment will be at the unit price for each type and size of intake.

3. **Includes:** Unit price includes, but is not limited to, excavation; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; base; structural concrete; reinforcing steel; precast units (if used); concrete fillets; pipe connections; castings; and adjustment rings.

C. Drop Connection:

1. **Internal Drop Connection:**
   a. **Measurement:** Each size of internal drop connection will be counted.
   b. **Payment:** Payment will be at the unit price for each size of internal drop connection.
   c. **Includes:** Unit price includes, but is not limited to, cutting the hole and installing a flexible watertight connector, providing and installing the receiving bowl, flexible coupler between the bowl and the drop pipe, the PVC drop pipe, pipe brackets and bolts, the bottom elbow, repair of fillet if required, and a splash guard if required.

2. **External Drop Connection:**
   a. **Measurement:** Each size of external drop connection will be counted.
   b. **Payment:** Payment will be at the unit price for each size of external drop connection.
   c. **Includes:** Unit price includes, but is not limited to, the connection to the manhole and all pipe; fittings; concrete encasement; and furnishing, placing, and compacting bedding and backfill material.

1.08 MEASUREMENT AND PAYMENT (Continued)

D. Casting Extension Rings:

1. **Measurement:** Each casting extension ring will be counted.

2. **Payment:** Payment will be at the unit price for each casting extension ring.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing each casting extension ring and reinstalling the casting lid.

E. Manhole or Intake Adjustment, Minor:

1. **Manhole Adjustment, Minor:**
   a. **Measurement:** Each existing manhole adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
   b. **Payment:** Payment will be made at the unit price for each minor manhole adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removing existing casting and existing adjustment rings, furnishing and installing adjustment rings, furnishing and installing new casting, and installing new infiltration barrier (sanitary sewer manholes only).

2. **Intake Adjustment, Minor:**
   a. **Measurement:** Each existing intake adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
   b. **Payment:** Payment will be made at the unit price for each minor intake adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removing existing casting and existing adjustment rings, furnishing and installing adjustment rings, and furnishing and installing new casting.

F. Manhole or Intake Adjustment, Major:

1. **Manhole Adjustment, Major:**
   a. **Measurement:** Each existing manhole adjusted to grade by addition or removal of riser, cone or flat top sections, or the exchange of existing riser sections with sections having different vertical dimensions will be counted.
   b. **Payment:** Payment will be at the unit price for each major adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removal of existing casting, adjustment rings, top sections, and risers; excavation; concrete and reinforcing steel or precast sections; furnishing and installing new casting; installing new infiltration barrier (sanitary sewer manholes only); placing backfill material; and compaction.

2. **Intake Adjustment, Major:**
   a. **Measurement:** Each existing intake adjusted to grade by addition or removal of riser, cone or flat top sections, or the exchange of existing riser sections with sections having different vertical dimensions will be counted.
   b. **Payment:** Payment will be at the unit price for each major adjustment.
   c. **Includes:** Unit price includes, but is not limited to, removal of existing casting, adjustment rings, top sections, and risers; excavation; concrete and reinforcing steel or precast sections; furnishing and installing new casting; placing backfill material; and compaction.

1.08 MEASUREMENT AND PAYMENT (Continued)

G. Connection to Existing Manhole or Intake:

1. Connection to Existing Manhole:
- **a. Measurement:** Each connection made to an existing manhole will be counted.
- **b. Payment:** Payment will be made at the unit price for each sewer connection.
- **c. Includes:** Unit price includes, but is not limited to, coring or cutting into the existing manhole or intake, pipe connections, grout, and waterstop (when required).

2. Connection to Existing Intake:
- **a. Measurement:** Each connection made to an existing intake will be counted.
- **b. Payment:** Payment will be made at the unit price for each sewer connection.
- **c. Includes:** Unit price includes, but is not limited to, coring or cutting into the existing manhole or intake, pipe connections, grout, and waterstop (when required).

H. Remove Manhole or Intake:

1. Remove Manhole:
- **a. Measurement:** Each manhole removed will be counted.
- **b. Payment:** Payment will be made at the unit price for each manhole.
- **c. Includes:** Unit price includes, but is not limited to, removal of casting, concrete, and reinforcement; plugging pipes; filling remaining structure with flowable mortar; and placing compacted fill over structure to finished grade.

2. Remove Intake:
- **a. Measurement:** Each intake removed will be counted.
- **b. Payment:** Payment will be made at the unit price for each intake.
- **c. Includes:** Unit price includes, but is not limited to, removal of casting, concrete, and reinforcement; plugging pipes; filling remaining structure with flowable mortar; and placing compacted fill over structure to finished grade.

PART 2 - PRODUCTS

2.01 MANHOLE AND INTAKE TYPES

Table 6010.01: Manhole and Intake Types

	Figure No.	Type	Description
Sanitary Sewer Manholes	6010.301	SW-301	Circular Sanitary Sewer Manhole
	6010.302	SW-302	Rectangular Sanitary Sewer Manhole
	6010.303	SW-303	Sanitary Sewer Manhole Over Existing Sewer
	6010.304	SW-304	Rectangular Base/Circular Top Sanitary Sewer Manhole
	6010.305	SW-305	Tee-section Sanitary Sewer Manhole
Storm Sewer Manholes	6010.401	SW-401	Circular Storm Sewer Manhole
	6010.402	SW-402	Rectangular Storm Sewer Manhole
	6010.403	SW-403	Deep Well Rectangular Storm Sewer Manhole
	6010.404	SW-404	Rectangular Base/Circular Top Storm Sewer Manhole
	6010.405	SW-405	Tee-section Storm Sewer Manhole
	6010.406	SW-406	Shallow Rectangular Storm Sewer Manhole
Intakes	6010.501	SW-501	Single Grate Intake
	6010.502	SW-502	Circular Single Grate Intake
	6010.503	SW-503	Single Grate Intake with Manhole
	6010.504	SW-504	Single Grate Intake with Flush-top Manhole
	6010.505	SW-505	Double Grate Intake
	6010.506	SW-506	Double Grate Intake with Manhole
	6010.507	SW-507	Single Open-throat Intake, Small Box
	6010.508	SW-508	Single Open-throat Intake, Large Box
	6010.509	SW-509	Double Open-throat Intake, Small Box
	6010.510	SW-510	Double Open-throat Intake, Large Box
	6010.511	SW-511	Rectangular Area Intake
	6010.512	SW-512	Circular Area Intake
	6010.513	SW-513	Open-sided Area Intake
	6010.515	SW-515	Triple Rectangular Area Intake
	6010.541	SW-541	Open-Throat Curb Intake Under Pavement
	6010.542	SW-542	Extension Unit for Open-Throat Curb Intake Under Pavement
	6010.545	SW-545	Single Open-Throat Curb Intake with Extended Opening

2.02 PRECAST

Comply with ASTM C 478 (circular) and ASTM C 913 (rectangular).

2.03 CAST-IN-PLACE

A. Concrete: Use Class C concrete. Comply with the following Iowa DOT Specifications and Materials I.M.s.

1. Iowa DOT Specifications Sections:

a. 2403 – Structural Concrete
b. 4101 – Portland Cement
c. 4102 – Water for Concrete and Mortar
d. 4103 – Liquid Admixtures for Portland Cement Concrete
e. 4104 – Burlap for Curing Concrete
f. 4106 – Plastic Film and Insulating Covers for Curing Concrete
g. 4108 – Supplementary Cementitious Materials
h. 4109 – Aggregate Gradations
i. 4110 – Fine Aggregate for Portland Cement Concrete
j. 4115 – Coarse Aggregate for Portland Cement Concrete

2.03 CAST-IN-PLACE (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

B. 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 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. Comply with ASTM D 36 with minimum 350°F softening point for butyl rubber sealant.

3. Expanded Polypropylene Adjustment Rings: Comply with ASTM D 4819 for expanded polypropylene when tested according to ASTM D 3575.
   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. Ductile Iron: ASTM A 536, Grade 80-55-06 or 70-50-05.

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

C. Composite: AASHTO M 306.

1. Hardware: Attach lid to frame with 316 stainless steel hardware.

2. Slip Resistance: Greater than 0.6 when tested according to ASTM C 1028.

3. Ultraviolet Resistance: Meet ASTM G 154 Cycle 1 for a minimum of 1,000 hours.

4. Detection: Must be detectable using standard detection equipment.

D. 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.

E. 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	Yes	No	Yes[1]
	6010.601	SW-601, B	3	Adjustable	No	No	Yes[1]
	6010.601	SW-601, C	2	Fixed	Yes	Yes	Yes[1]
	6010.601	SW-601, D	3	Adjustable	No	Yes	Yes[1]
Storm Sewer	6010.602	SW-602, E[2]	2	Fixed	Yes	No	No
	6010.602	SW-602, F[2]	3	Adjustable	No	No	No
	6010.602	SW-602, G[2]	2	Fixed	No	No	No

[1] Machine bearing surfaces required.

[2] 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. 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.

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES (Continued)

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 CONCRETE FILLET

A. Cast-in-place Base: Provide a cast-in-place concrete fillet with concrete complying with the requirements of Section 6010, 2.03.

B. Precast Base Section:

1. For sanitary sewers, provide a precast concrete fillet, unless otherwise allowed by the Engineer. Comply with Section 6010, 3.01.

2. For storm sewers, provide a cast-in-place concrete fillet with concrete complying with the requirements of Section 6010, 2.03.

2.13 STEPS

A. Depths:

1. For manholes and intakes less than 20 feet deep, do not install steps unless otherwise specified in the contract documents.

2. For manholes and intakes deeper than 20 feet, install steps to meet OSHA regulations.

B. Requirements:

1. ASTM C 478.

2. Manufacture using polypropylene encased steel.

3. Uniformly space steps at 12 to 16 inches.

4. Align with vertical side of eccentric top section.

5. 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 CASTING ANCHOR BOLTS AND WASHERS

A. Material: Stainless steel or hot-dipped galvanized.

B. Diameter: Provide bolts and washers 1/8 inch smaller than hole or slot in the casting frame, but no less than 1/2 inch diameter.

C. Bolt Length: As required to pass through adjustment rings and into manhole or intake structure to embedment depth recommended by anchor manufacturer.

2.16 DROP CONNECTION

A. Internal:

1. Receiving Bowl: Marine grade fiberglass meeting ASTM D 790, ASTM D 638, and ASTM D 2583 with non-magnetic stainless steel anchor bolts meeting the manufacturer's recommendation.

2. Flexible Coupler: Provide flexible couple matching the size of the receiving bowl and the drop pipe.

3. Drop Pipe and Bottom Elbow: Provide drop pipe an equivalent diameter of the influent pipe. Limit pipe size to maintain space available for maintenance activities. Provide solid wall SDR 35 PVC pipe and elbow complying with Section 4020, 2.01, A or Schedule 40 PVC pipe and elbow complying with ASTM D 1785.

4. Pipe Brackets: ASTM A 240, Type 304 or Type 316 stainless steel with stainless steel nuts and bolts.

B. External:

1. Pipe and Fittings: Comply with Section 5010, 2.01, B for ductile iron pipe and Section 5010, 2.03 for fittings.

2. Concrete Encasement: Comply with Section 7010, 2.02.

3. Embedment Material: Comply with Section 3010, 2.02, A or 2.06 for backfill material from the top of the elbow to the bottom of the sewer main.

2.17 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 subbase.

2. **Fill Sections:** Compact to 95% of maximum Standard Proctor Density and hand grade to accurate elevation required to place subbase, or install stabilization material as directed by the Engineer.

3. **Unstable Soil:** Install stabilization material as directed by the Engineer.

C. Subbase: 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. Form walls and construction joints for cast-in-place intakes or install precast intake boxes to ensure intake lids are set to match the longitudinal slope of the adjacent street unless otherwise specified in the contract documents.

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. Fillet:

1. Construct manhole or intake fillet up to one-half of pipe diameter to produce a smooth half-pipe shape between pipe inverts.

2. Slope fillet top toward pipe 1/2 inch per foot perpendicular to flow line.

3. For sanitary sewer, keep void between pipe and structure wall free of debris and concrete.

4. For precast fillets, 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:

1. Install the type of casting specified in the contract documents and adjust to proper grade.

2. Where a manhole or intake is to be in a paved area, adjust the casting to match the slope of the finished surface.

3. Three-piece Castings:
a. Attach the frame to the structure with four anchor bolts.
b. Set initial position of movable portion of the casting in the center of the adjustment range.
c. Remove height-adjustment bolts or mechanism after the paving is completed.

3.01 GENERAL REQUIREMENTS FOR INSTALLATION OF MANHOLES AND INTAKES (Continued)

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.

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.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES (Continued)

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.

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.

3.02 ADDITIONAL REQUIREMENTS FOR CAST-IN-PLACE CONCRETE STRUCTURES (Continued)

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.

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.

3.04 ADJUSTMENT OF EXISTING MANHOLE OR INTAKE (Continued)

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 according to the method approved by the Engineer.

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 fillet 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.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE (Continued)

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 and Chipped Opening:
a. Use for pipe sizes 12 inches in diameter or larger.
b. Saw opening to approximate dimensions with a masonry saw. Saw to depth sufficient to sever reinforcing steel.
c. Remove concrete and expand opening to a diameter at no more than 4 inches larger than the outside diameter of the new pipe.
d. Leave a minimum of 6 inches of manhole or intake wall above and on the sides of the pipe.
e. Cut off all reinforcing steel protruding from the structure wall.

2. Cored Opening:
a. Core new openings in existing manholes or intakes for all pipes less than 12 inches in diameter.
b. Opening to be no greater than 2 inches larger than the outside diameter of the pipe.
c. Leave a minimum of 6 inches of manhole or intake wall above and on the sides of the pipe.

3. Fill Opening: 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 DROP CONNECTION TO SANITARY SEWER MANHOLE

A. Internal:

1. Core opening in existing manhole wall and install flexible watertight connector.

2. Cut incoming pipe so a maximum of 2 inches extends into the manhole.

3. Allow 1 inch clearance between bottom of incoming pipe and top of the receiving bowl. Connect receiving bowl to manhole with stainless steel anchor bolts as recommended by the manufacturer.

4. Install flexible coupler connecting the receiving bowl and the drop pipe.

5. Mount drop pipe on the side of the manhole with stainless steel brackets spaced a maximum of 4 feet apart. Provide a minimum of two brackets per pipe segment.

6. Remove existing concrete fillet as required to accommodate bottom elbow.

3.06 DROP CONNECTION TO SANITARY SEWER MANHOLE (Continued)

7. Install elbow at bottom of drop pipe to match concrete fillet and create a smooth flow transition. Align elbow so discharge is directed at outlet pipe or at 45 degrees to manhole flow.

8. Repair fillet according to Section 6010, 3.01, G.

9. Comply with Figure 6010.308.

B. External:

1. Core opening in existing manhole wall and install flexible watertight connector, if required.

2. Install ductile iron pipe and fittings according to Section 5010, 3.01 and 3.02.

3. Place concrete from the base of the manhole to the top of the elbow.

4. Comply with Section 3010, 3.05 for bedding and backfill of the external drop piping.

5. Comply with Figure 6010.307.

3.07 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.

3.08 CLEANING, INSPECTION, AND TESTING

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

END OF SECTION

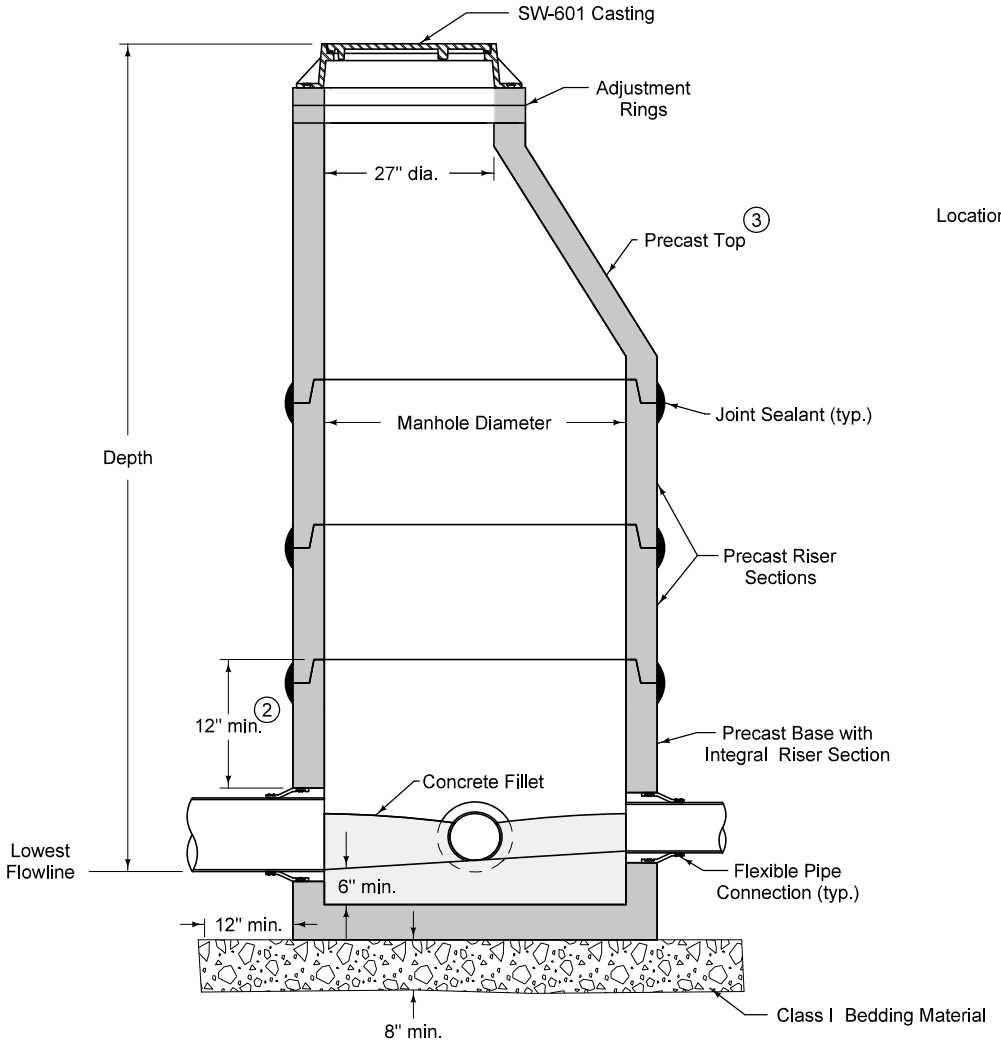
If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

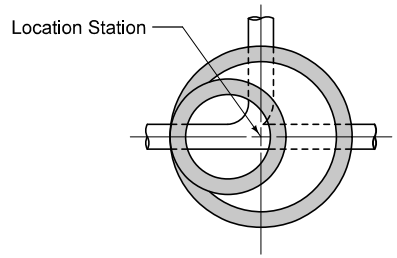
(1) For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.

(2) 12 inch minimum riser height above all pipe openings.

(3) When specified, provide an eccentric flat top In Lieu of eccentric cone section.



TYPICAL SECTION



PLAN

Manhole Diameter (inches)	Maximum Pipe Diameter (inches) for 2 Pipes (1)	
	At 180° Separation	At 90° Separation
48	24	18
60	36	24
72	42	30
84	48	36
96	60	42

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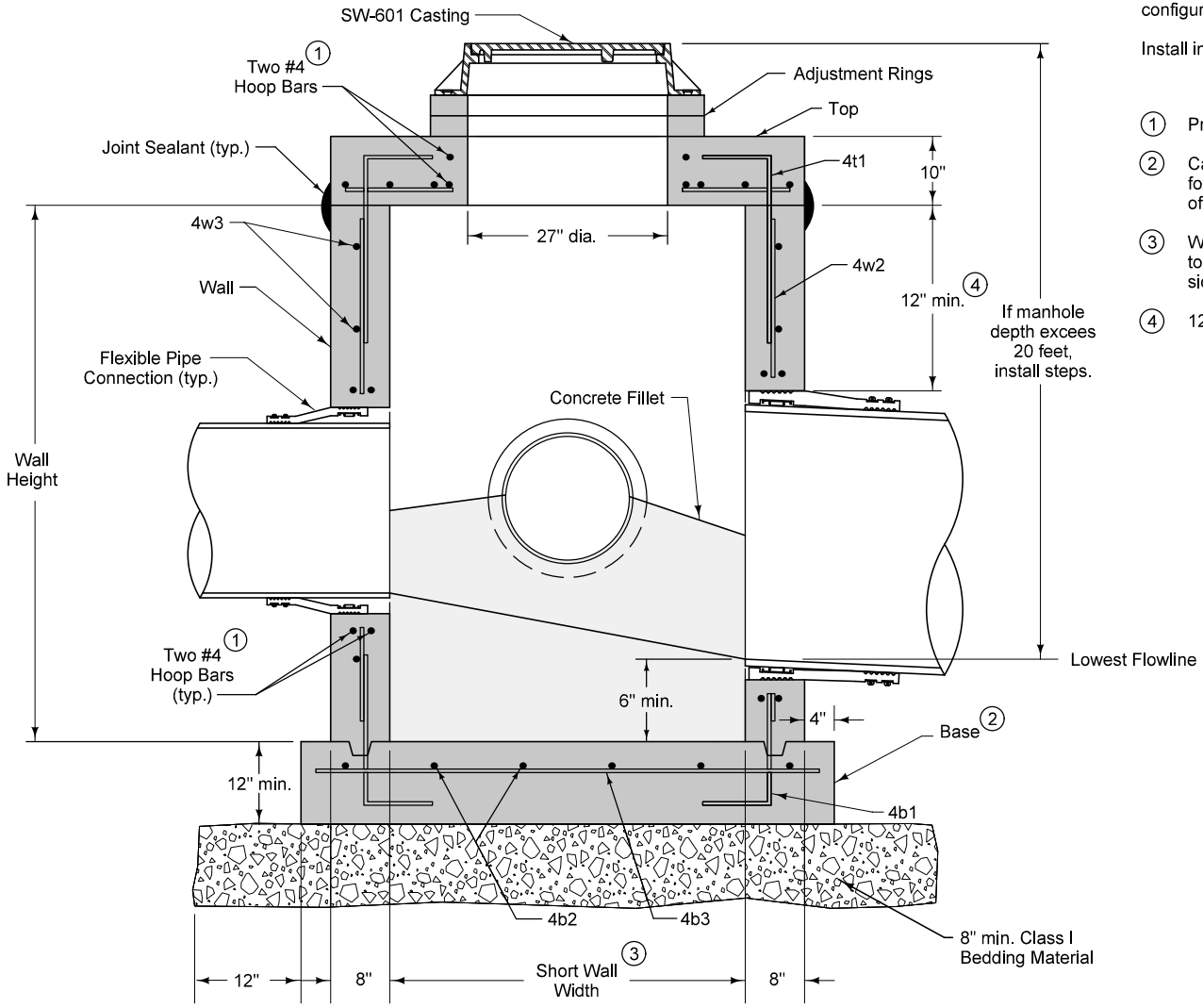
FIGURE 6010.301 | STANDARD ROAD PLAN | SW-301 SHEET 1 of 1

REVISIONS: Added circle note 3.

Paul D. Wigand, SUDAS DIRECTOR | Stuart Nicholson, DESIGN METHODS ENGINEER

CIRCULAR SANITARY SEWER MANHOLE

FIGURE 6010.301 SHEET 1 OF 1



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

Install infiltration barrier.

1. Provide two #4 hoop bars at top opening and at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.
4. 12 inch minimum wall height above all pipe openings.

FIGURE 6010.302 | SHEET 1 OF 2

SUDAS	IOWADOT	REVISION 3	04-20-21
FIGURE 6010.302	STANDARD ROAD PLAN	SW-302	SHEET 1 of 2

REVISIONS: Added infiltration barrier note.

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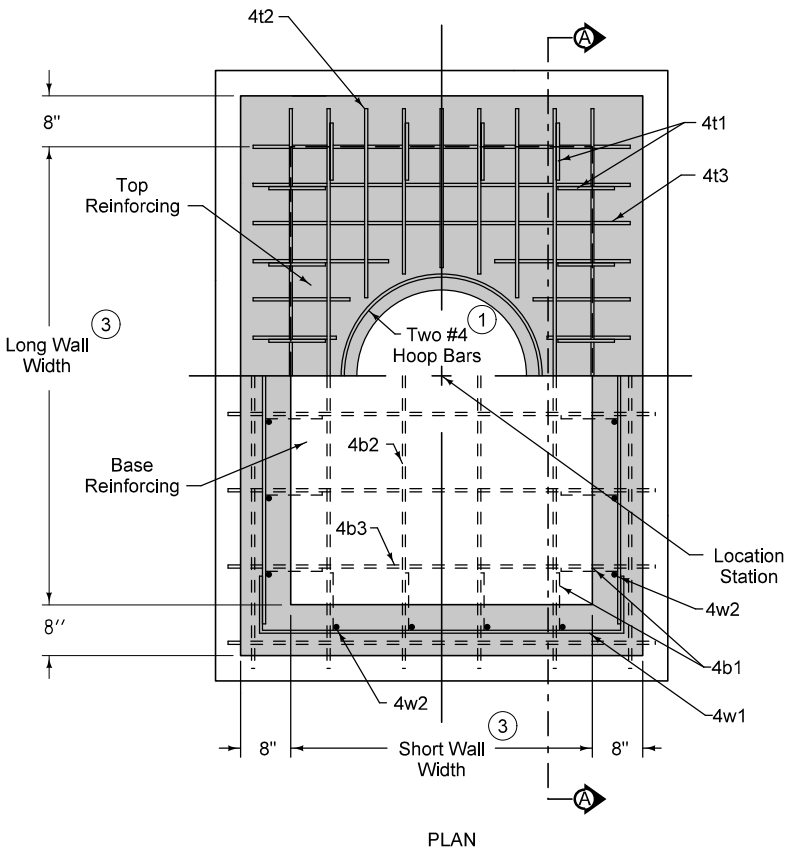
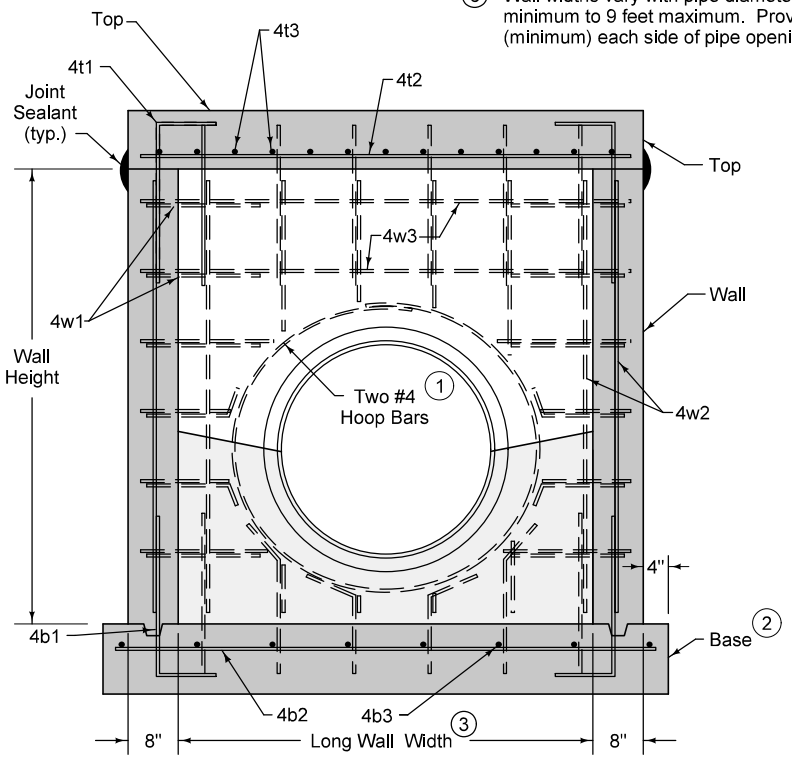
SUDAS DIRECTOR

Stuart Nicholson
DESIGN METHODS ENGINEER

RECTANGULAR SANITARY SEWER MANHOLE



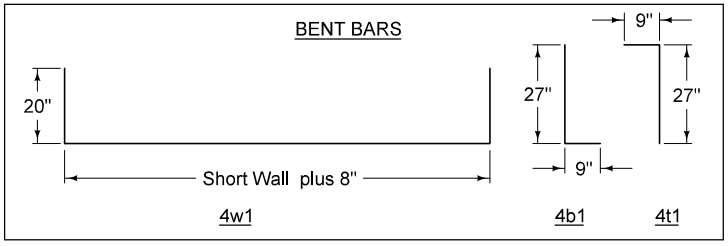
PLAN



SECTION A-A

1. Provide two #4 hoop bars at top opening and at all pipe openings.
2. Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
3. Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
4b1	4	Base	⌟	36"	12"
4b2	4	Base	—	Long Wall plus 18"	12"
4b3	4	Base	—	Short Wall plus 18"	12"
4t1	4	Top	⌝	36"	12"
4t2	4	Top	—	Long Wall plus 12"	6"
4t3	4	Top	—	Short Wall plus 12"	6"
4w1	4	Wall	⌐¬	Short Wall plus 48"	12"
4w2	4	Wall	—	Wall Height minus 4"	12"
4w3	4	Wall	—	Long Wall plus 12"	12"



SUDAS | IOWADOT | REVISION 3 04-20-21

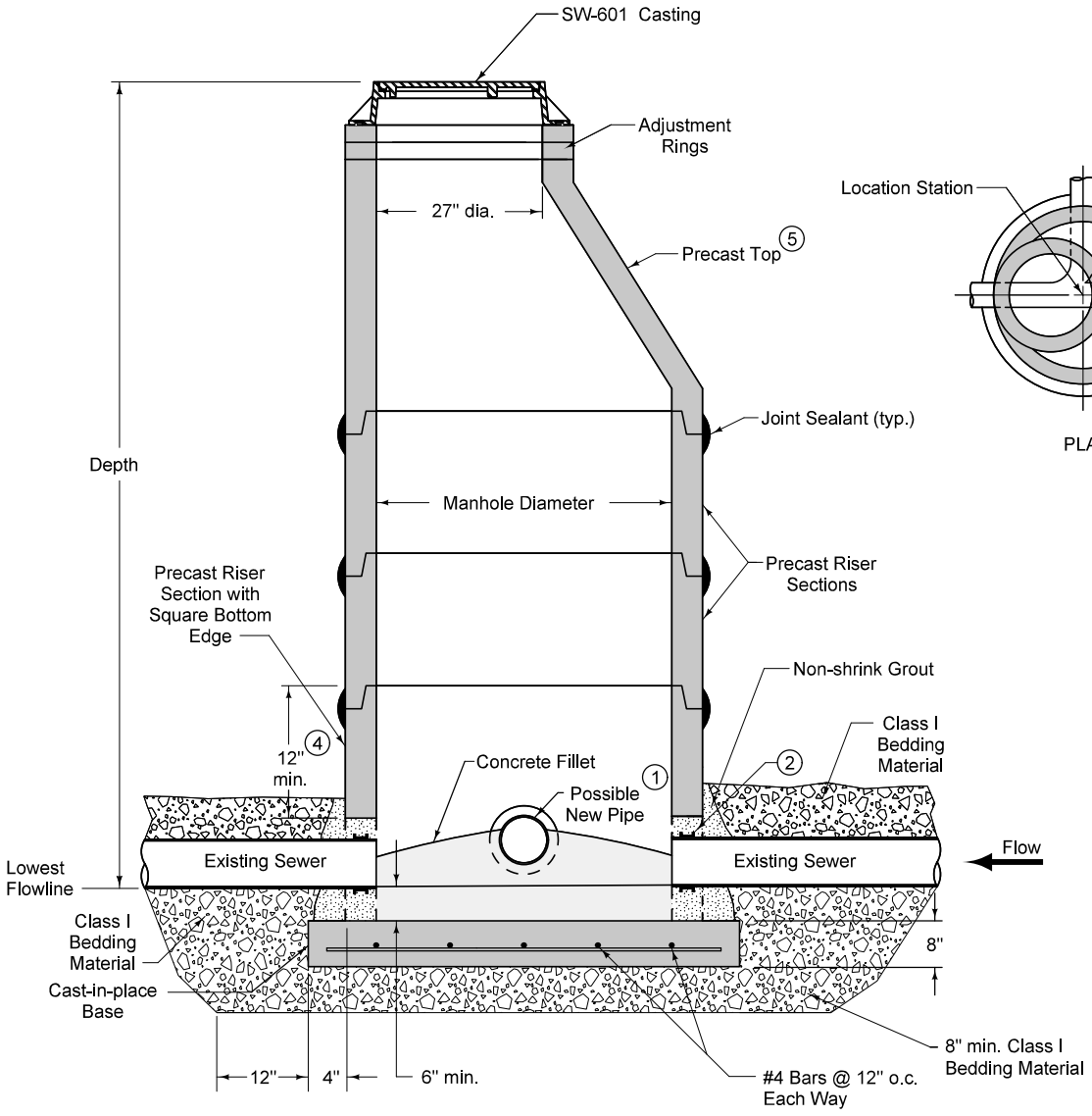
FIGURE 6010.302 | STANDARD ROAD PLAN | SW-302 | SHEET 2 of 2

REVISIONS: Added Infiltration barrier note.

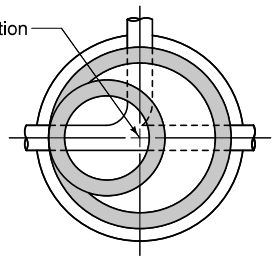
Paul D. Wigand, SUDAS DIRECTOR | DESIGN METHODS ENGINEER

RECTANGULAR SANITARY SEWER MANHOLE

FIGURE 6010.302 SHEET 2 OF 2



TYPICAL SECTION



PLAN

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

(1) For new pipe connections, provide cored opening with flexible pipe connector.

(2) For existing pipe connections, provide an arched opening with a diameter up to 6 inches larger than outside diameter of pipe. Install waterstop around existing pipe. Fill void between pipe and opening with non-shrink grout.

(3) For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.

(4) 12 inch minimum riser height above all pipe openings.

(5) When specified, provide an eccentric flat to In Lieu of eccentric cone section.

Manhole Diameter (inches)	Maximum Pipe Diameter (inches) for 2 Pipes (3)	
	At 180° Separation	At 90° Separation
48	24	18
60	36	24
72	42	30
84	48	36
96	60	42

FIGURE 6010.303 SHEET 1 OF 1

SUDAS | IOWA DOT

REVISION 5 10-18-22

FIGURE 6010.303 | STANDARD ROAD PLAN | SW-303

SHEET 1 of 1

REVISIONS: Added circle note 5.

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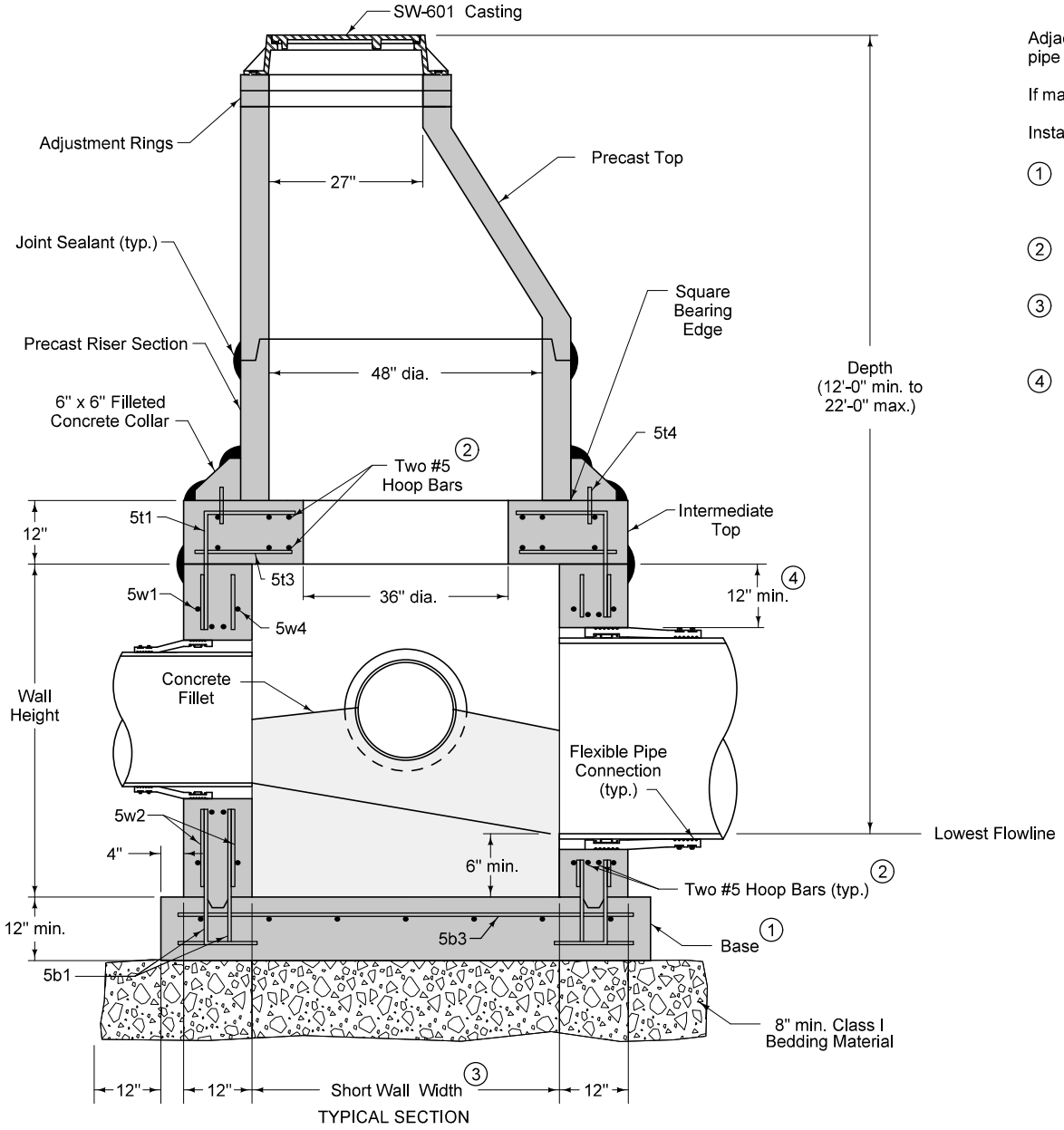
SUDAS DIRECTOR

Steven Nichols
DESIGN METHODS ENGINEER

SANITARY SEWER MANHOLE OVER EXISTING SEWER



TYPICAL SECTION

Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

(1) Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.

(2) Provide two #5 hoop bars at intermediate top opening and at all pipe openings.

(3) Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

(4) 12 inch minimum wall height above all pipe openings.

FIGURE 6010.304 SHEET 1 OF 2

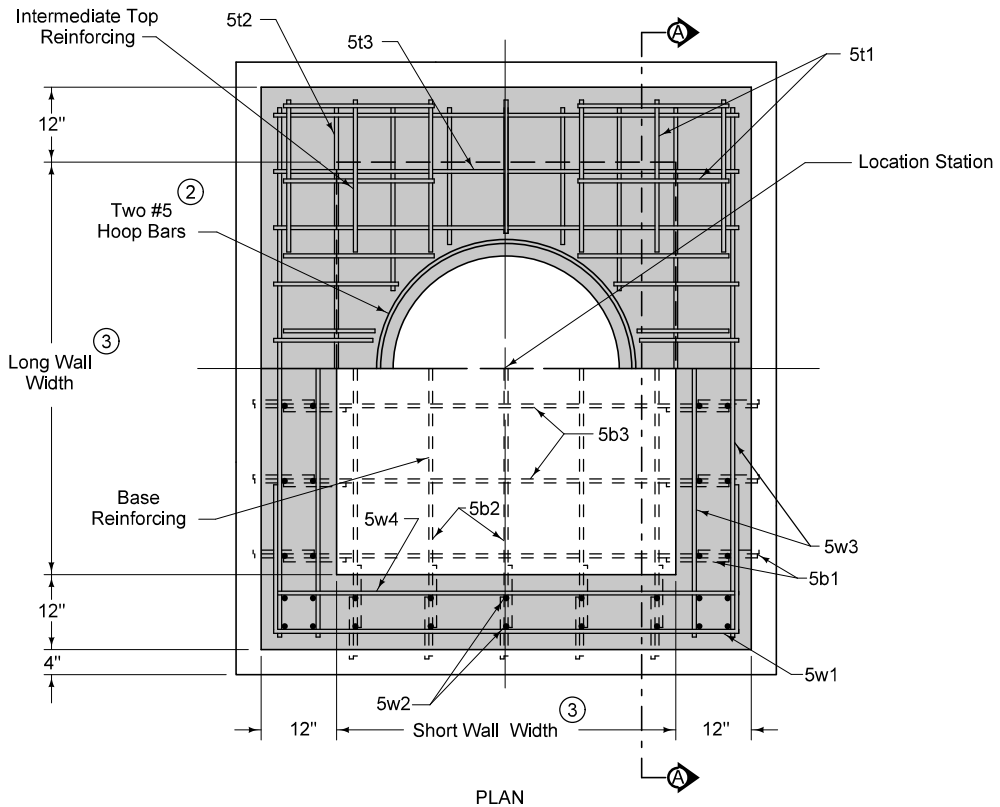
SUDAS	IOWADOT	REVISION 4 04-20-21
FIGURE 6010.304	STANDARD ROAD PLAN	SW-304 SHEET 1 of 2

REVISIONS: Added manhole depth note and infiltration barrier note.

Paul D. Wigand — SUDAS DIRECTOR

Stuart Nicholson — DESIGN METHODS ENGINEER

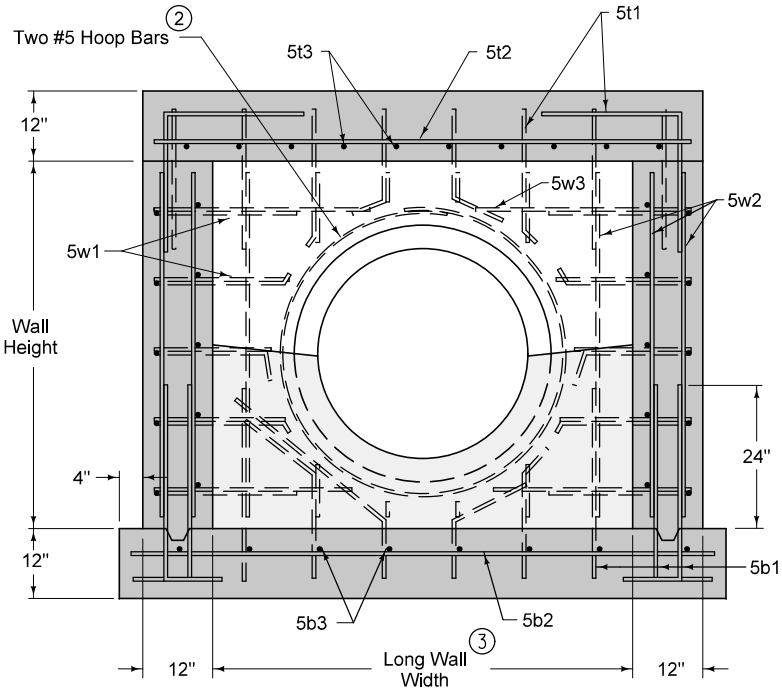
RECTANGULAR BASE/ CIRCULAR TOP SANITARY SEWER MANHOLE



PLAN

2 Provide two #5 hoop bars at intermediate top opening and at all pipe openings.

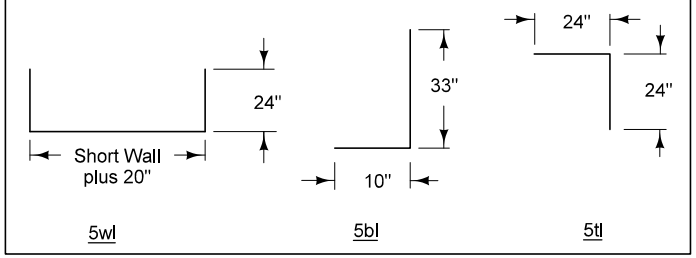
3 Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall opening (minimum) each side of pipe opening.



SECTION A-A

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
5t1	5	Top	L	48"	12"
5t2	5	Top	—	Long Wall plus 20"	9"
5t3	5	Top	—	Short Wall plus 20"	9"
5t4	5	Top	—	8"	12"
5b1	5	Base	L	43"	12"
5b2	5	Base	—	Long Wall plus 26"	12"
5b3	5	Base	—	Short Wall plus 26"	12"
5w1	5	Top	⌐	Short Wall plus 68"	12"
5w2	5	Top	—	Wall Height minus 4"	12"
5w3	5	Top	—	Long Wall plus 20"	12"
5w4	5	Top	—	Short Wall plus 20"	12"

BENT BARS



SUDAS | IOWADOT | REVISION 4 04-20-21

FIGURE 6010.304 | STANDARD ROAD PLAN | SW-304 | SHEET 2 of 2

REVISIONS: Added manhole depth note and Infiltration barrier note.

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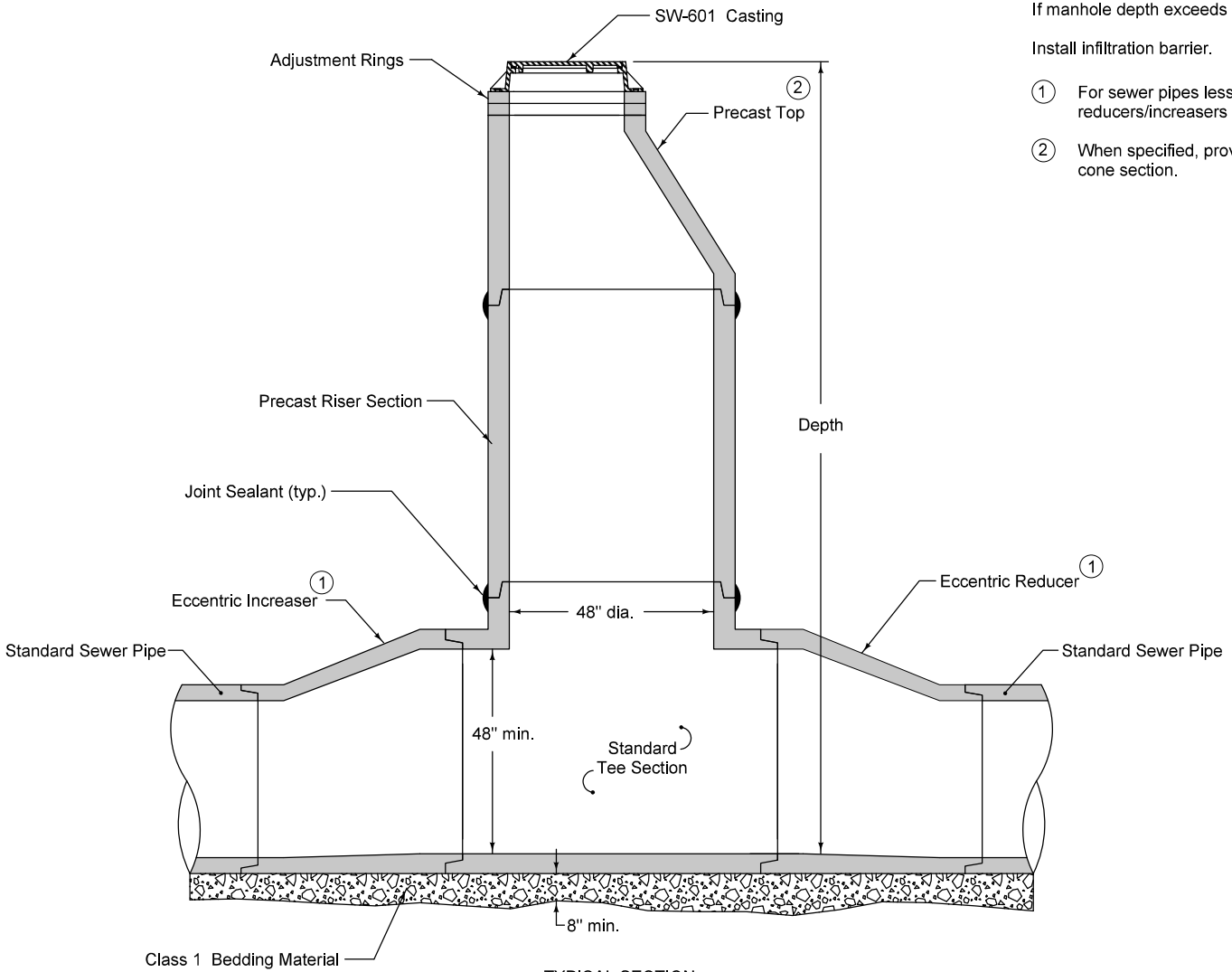
RECTANGULAR BASE/ CIRCULAR TOP SANITARY SEWER MANHOLE

FIGURE 6010.304 SHEET 2 OF 2



TYPICAL SECTION

1

STANDARD TEE

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

1. For sewer pipes less than 48 inches in diameter, install eccentric reducers/increasers with a standard tee or utilize a composite tee.

2. When specified, provide an eccentric flat top In Lieu of eccentric cone section.

SUDAS	IOWA DOT	REVISION 4 10-18-22
FIGURE 6010.305	STANDARD ROAD PLAN	SW-305
		SHEET 1 of 2

REVISIONS: Added circle note 2.

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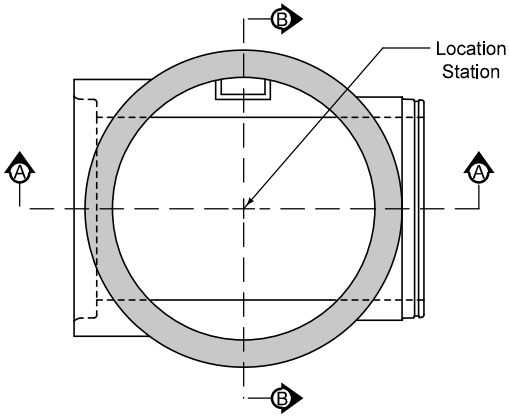
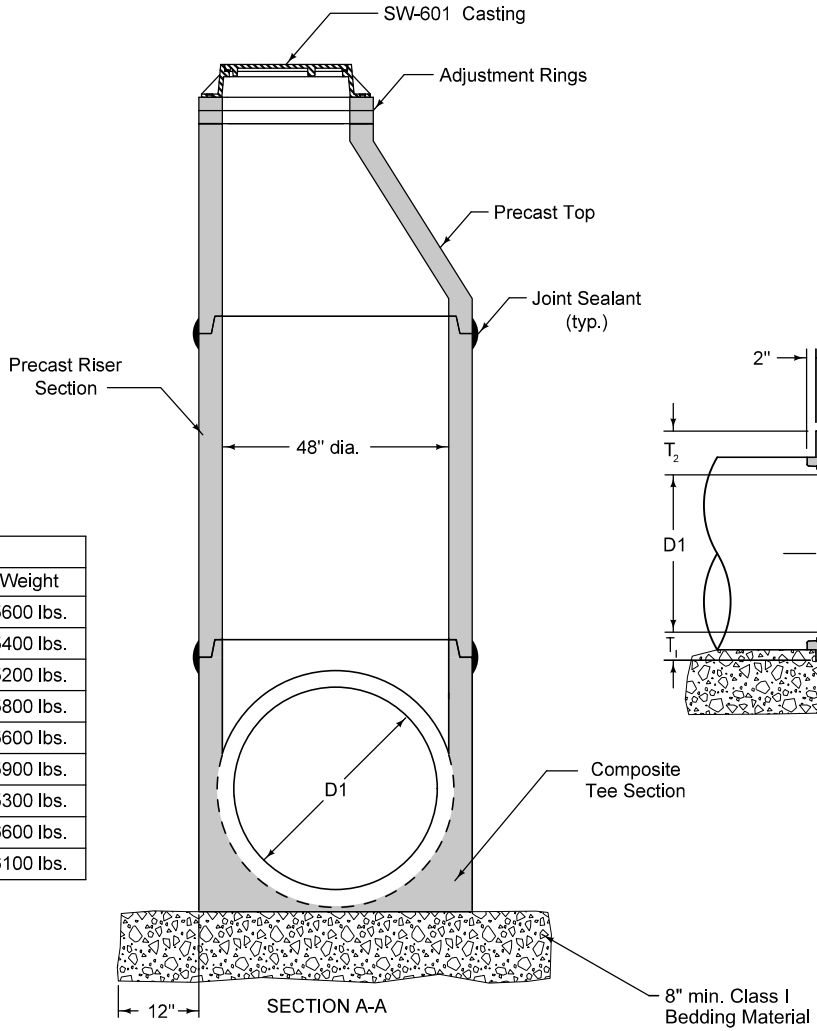
TEE-SECTION
SANITARY SEWER MANHOLE

FIGURE 6010.305 SHEET 1 OF 2

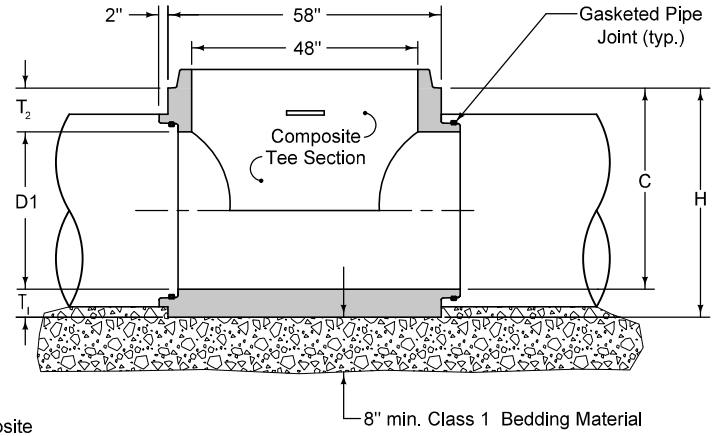


PLAN



SECTION A-A

Install infiltration barrier.



SECTION B-B

COMPOSITE TEE DIMENSIONS						
Size	D1	H	T_1	T_2	C	Weight
48" on 12"	12"	50"	$8\frac{1}{2}$"	$29\frac{1}{2}$"	$41\frac{1}{2}$"	5600 lbs.
48" on 15"	15"	50"	7"	28"	43"	5400 lbs.
48" on 18"	18"	50"	$5\frac{1}{2}$"	$26\frac{1}{2}$"	$44\frac{1}{2}$"	5200 lbs.
48" on 21"	21"	48"	$9\frac{1}{2}$"	$17\frac{1}{2}$"	$38\frac{1}{2}$"	5800 lbs.
48" on 24"	24"	48"	8"	16"	40"	5600 lbs.
48" on 27"	27"	48"	$9\frac{1}{2}$"	$11\frac{1}{2}$"	$38\frac{1}{2}$"	5900 lbs.
48" on 30"	30"	48"	8"	10"	40"	5300 lbs.
48" on 33"	33"	54"	$9\frac{1}{2}$"	$11\frac{1}{2}$"	$44\frac{1}{2}$"	6600 lbs.
48" on 36"	36"	54"	8"	10"	46"	6100 lbs.

COMPOSITE TEE

Alternate to standard tee with eccentric reducer (for pipes 36" and smaller).

FIGURE 6010.305 SHEET 2 OF 2

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FIGURE 6010.305 | STANDARD ROAD PLAN | SW-305 | SHEET 2 of 2

REVISIONS: Added circle note 2.

Paul D. Wigand, SUDAS DIRECTOR | Stuart Nicholson, DESIGN METHODS ENGINEER

TEE-SECTION
SANITARY SEWER MANHOLE

REHABILITATION OF EXISTING MANHOLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Rehabilitation of existing manholes.

1.02 DESCRIPTION OF WORK

Rehabilitate existing manholes to waterproof and to prevent inflow and infiltration, to prevent corrosion, or to reestablish the structural integrity of the manhole. Includes construction of structural liners, protective liners, and infiltration barriers.

1.03 SUBMITTALS

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

A. Concrete mix design, if required by the Engineer.

B. Catalog cuts of all mortar mixes, sealants, and liners.

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. Infiltration Barriers:

1. **Rubber Chimney Seal:**
   - **a. Measurement:** Each rubber chimney seal installed on an existing manhole will be counted.
   - **b. Payment:** Payment will be made at the unit price for each chimney seal.
   - **c. Includes:** Unit price includes, but is not limited to, all necessary compression or expansion bands and extension sleeves as necessary to complete chimney seal.

2. **Molded Shield:**
   - **a. Measurement:** Each molded shield installed on an existing manhole will be counted.
   - **b. Payment:** Payment will be made at the unit price for each molded shield.
   - **c. Includes:** Unit price includes, but is not limited to, sealant.

1.08 MEASUREMENT AND PAYMENT (Continued)

3. **Urethane Chimney Seal:**
   a. **Measurement:** Each urethane chimney seal installed on an existing manhole will be counted.
   b. **Payment:** Payment will be at the unit price for each urethane chimney seal.
   c. **Includes:** Unit price includes, but is not limited to, preparing the surface of the manhole and furnishing and applying primer and urethane chimney seal according to the manufacturer's requirements.

B. In-Situ Manhole Replacement, Cast-in-place Concrete:

1. **Measurement:** The vertical dimension of in-situ manhole replacement will be measured in feet from the lowest flowline to the top of the rim.

2. **Payment:** Payment will be at the unit price per vertical foot.

3. **Includes:** Unit price includes, but is not limited to, handling of sewer flows as required to properly complete the installation, invert overlay as recommended by the manufacturer, replacement of existing casting with a new casting, and testing the manhole upon completion.

C. In-Situ Manhole Replacement, Cast-in-place Concrete with Plastic Liner:

1. **Measurement:** The vertical dimension of in-situ manhole replacement with plastic liner will be measured in feet from the lowest flowline to the top of the rim.

2. **Payment:** Payment will be at the unit price per vertical foot.

3. **Includes:** Unit price includes, but is not limited to, handling of sewer flows as required to properly complete the installation, invert overlay as recommended by the manufacturer, replacement of existing casting with a new casting, sealing at the frame and cover, sealing pipe penetrations as recommended by the manufacturer, and testing the manhole upon completion.

D. Manhole Lining with Centrifugally Cast Cementitious Mortar Liner with Epoxy Seal:

1. **Measurement:** The vertical dimension of manhole lining will be measured for depth in feet from the bottom of the lining to the top of the lining for each liner thickness specified.

2. **Payment:** Payment will be at the unit price per vertical foot for each liner thickness.

3. **Includes:** Unit price includes, but is not limited to, the handling of sewer flows during lining operations as required to properly complete the installation, and replacement of the existing casting with a new casting.

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: Comply with Section 7010, 2.01, A.

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	102 to 130 pcf
Set Time at 70° F ASTM C 403 Initial Set / Final Set	240 minutes / 480 minutes
Modulus of Elasticity ASTM C 469 24 hours / 28 days	180,000 psi min. / 1,150,000 psi min.
Flexural Strength ASTM C 293 24 hours / 28 days	650 psi min. / 800 psi min.
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; 50% Relative Humidity
Compressive Strength ASTM D 695	15,000 psi min.
Flexural Strength ASTM D 790	11,000 psi min.
Tensile Strength ASTM D 638	4,500 psi min.
Hardness ASTM D 2240	68 to 90 Shore D
Ultimate Elongation ASTM D 638	3.5 to 5.5 %
Adhesion ASTM D 7234	Substrate Failure

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. Testing may be performed in conjunction with sanitary sewer line testing. Comply with Section 4060.

2. Do not test by this method if water may potentially freeze during the test.

3. Plug the manhole inlet and outlet.

4. 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.

5. Mark the water level.

6. Allow water to stand in the manhole for 1 hour, then refill to the original water level and begin the test.

7. Determine the allowable drop in water level by using the equation given in Section 4060, 3.03. After 1 hour, measure the drop in water level.

8. 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 7020 - Asphalt Pavement **Page No.**

Section 7021 - Asphalt Overlays **Page No.**

Figures **Figure No.**

Section 7030 - Sidewalks, Shared Use Paths, and Driveways **Page No.**

1.08 MEASUREMENT AND PAYMENT (Continued)

G. Concrete Median:

1. **Measurement:** Measurement will be in square yards of concrete median. When the curb is integral with the pavement, the width will be measured from back of curb to back of curb.

2. **Payment:** Payment will be at the unit price per square yard of concrete median.

3. **Includes:** Unit price includes, but is not limited to, final subgrade/subbase preparation, bars and reinforcement, joints and sealing, surface curing and pavement protection, and boxouts for fixtures.

H. PCC Railroad Crossing Approach:

1. **Measurement:** Measurement will be in square yards of railroad crossing approach.

2. **Payment:** Payment will be at the unit price per square yard of railroad crossing approach.

3. **Includes:** Unit price includes, but is not limited to, excavation for modified subbase and subdrain, furnishing and installing subdrain, furnishing and installing subdrain outlet or connection to storm sewer, furnishing and installing porous backfill material, furnishing and placing modified subbase material, furnishing and installing reinforcing steel and tie bars, furnishing and placing concrete, furnishing, placing, and compacting asphalt.

I. PCC Pavement Samples and Testing:

1. **Measurement:** Lump sum item; no measurement will be made.

2. **Payment:** Payment will be at the lump sum price for PCC pavement samples and testing.

3. **Includes:** Lump sum price includes, but is not limited to, certified plant inspection, pavement thickness cores, profilograph pavement smoothness measurement (when required by the contract documents), and maturity testing.

J. Granular Surfacing: Comply with Section 7030 for granular surfacing material placed at intersecting roads, driveways, and turnouts.

K. PCC Pavement Widening:

1. **Measurement:** Measurement will be in square yards for each different thickness of PCC pavement widening. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured pavement widening area.

2. **Payment:** Payment will be at the unit price per square yard for each thickness of PCC pavement widening.

3. **Includes:** Unit price includes, but is not limited to, final subgrade/subbase preparation, integral curb, bars and reinforcement, joints and sealing, surface curing and pavement protection, safety fencing, concrete for rigid headers, boxouts for fixtures, and pavement smoothness.

L. Pavement Removal: Comply with Section 7040.

M. Fixture Adjustment: Comply with Section 6010 for adjustment of manholes and intakes and Section 5020 for adjustment of water valves and fire hydrants.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: Meet the requirements of Iowa DOT Section 4101 and Materials I.M. 401, including Type I and Type II cements and blended hydraulic cements Type 1P, Type 1S, Type 1T, and Type 1L.

B. Supplementary Cementitious Materials (SCM):

1. Fly Ash: Comply with Iowa DOT Section 4108.

2. Ground Granulated Blast Furnace Slag (GGBFS): Comply with Iowa DOT Section 4108.

3. Limestone: Comply with Iowa DOT Materials I.M. 401.

C. Fine Aggregate for Concrete:

1. Meet the requirements of Iowa DOT Section 4110 and Materials I.M. 409, Source Approvals for Aggregates.

2. Comply with the following gradation:

Sieve Size	Percent Passing
3/8”	100
No. 4	90 to 100
No. 8	70 to 100
No. 30	10 to 60
No. 200	0 to 1.5
Iowa DOT Article 4109.02, Gradation No. 1 in the Aggregate Gradation Table.	

3. The Engineer may authorize a change in gradation, subject to materials available locally at the time of construction.

D. Coarse Aggregate for Concrete:

1. Crushed stone particles with Class 2 durability complying with Iowa DOT Section 4115 and Materials I.M. 409, Source Approvals for Aggregates.

2. Comply with one of the following gradations:

Sieve Size	Gradation No. 3 Percent Passing	Gradation No. 4 Percent Passing	Gradation No. 5 Percent Passing
1 1/2”	100	100	-----
1”	95 to 100	50 to 100	100
3/4”	-----	30 to 100	90 to 100
1/2”	25 to 60	20 to 75	-----
3/8”	-----	5 to 55	20 to 55
No. 4	0 to 10	0 to 10	0 to 10
No. 8	0 to 5	0 to 5	0 to 5
No. 200	0 to 1.5	0 to 1.5	0 to 1.5
Iowa DOT Article 4109.02, Gradation No. 3, 4, and 5 in the Aggregate Gradation Table.			

3. The Engineer may authorize a change in gradation, subject to materials available locally at the time of construction.

2.01 MATERIALS (Continued)

E. Intermediate Aggregate for Concrete: Use if specified in contract documents.

1. Meet the requirements of Iowa DOT Section 4112 and Materials I.M. 409, Source Approvals for Aggregates.

2. For crushed limestone or dolomite, meet the durability class required for the coarse aggregate. When gravel durability is lower than the coarse aggregate durability requirements, pea gravel is not to exceed 15% of the total aggregate mix.

3. Comply with the following aggregate gradation:

Sieve Size	Percent Passing
1/2”	95 to 100
3/8”	-----
No. 4	-----
No. 8	0 to 10
Iowa DOT Article 4109.02, Gradation No. 2 in the Aggregate Gradation Table	

4. The Engineer may authorize a change in gradation subject to materials locally available at the time of construction.

F. Water Requirements: Comply with Iowa DOT Section 4102. Potable water obtained from a municipal supply, suitable for drinking, may be accepted without testing.

G. Admixtures: Meet Iowa DOT Materials I.M. 403 and the requirements for the liquid admixtures shown below. Other admixtures may be used subject to the approval of the Engineer.

1. Air Entrainment Admixture: Comply with Iowa DOT Section 4103.

2. Retarding and Water Reducing Admixtures: Comply with Iowa DOT Section 4103.

3. Accelerating admixtures (calcium chloride): Comply with Iowa DOT Article 2529.02.

H. Bars: Comply with Iowa DOT Section 4151 for metallic tie bars and dowel bars or Iowa DOT Section 4156 for glass fiber reinforced polymer dowel bars. Meet the tie bar requirements for bar mats. All metallic bars must be epoxy coated.

I. Expansion Tubes: Comply with Iowa DOT Section 4191.

J. Metal Keyways: Comply with Iowa DOT Section 4191.

K. Supports for Bars: Comply with Iowa DOT Materials I.M. 451.01.

L. Joint Fillers and Sealers:

1. Joint Sealers: Comply with Iowa DOT Article 4136.02.

2. Preformed Expansion Joint Fillers and Sealers: Use the following types of preformed materials for filling expansion joints that comply with Iowa DOT Article 4136.03. When the type is not specified, use a resilient filler.

- Resilient filler
- Flexible foam expansion joint filler
- Tire buffings expansion joint filler
- Elastomeric joint seals

2.01 MATERIALS (Continued)

M. Liquid Curing Compound: Comply with Iowa DOT Section 4105.

N. Covering:

1. Burlap: Comply with Iowa DOT Section 4104.

2. Plastic Film: Comply with Iowa DOT Section 4106.

3. Insulating Cover: Comply with Iowa DOT Section 4106.

O. Grout Systems: Use polymer grouts that comply with Iowa DOT Materials I.M. 491.11.

2.02 CONCRETE MIXES

A. Mix Design:

1. Comply with Iowa DOT Class C or Class M mix meeting the requirements of Materials I.M. 529. If higher durability mixes are specified, use C-SUD or CV-SUD mixes.

2. Ensure compatibility of all material combinations. If the concrete materials are not producing a workable concrete mixture, a change in the material may be required. Changes will be at no additional cost to the Contracting Authority.

B. Consistency and Workability:

1. Slump:
   a. Use an amount of mixing water that will produce workable concrete of uniform consistency. Unless specifically modified by the Engineer, ensure slump, measured according to Iowa DOT Materials I.M. 317, is no less than 1/2 inch or no more than 2 1/2 inches for machine finish and no less than 1/2 inch and no more than 4 inches for hand finish.
   b. If it is not possible to produce concrete having the required consistency without exceeding the maximum allowable water to cement ratio specified, the cement content may be increased or water reducing admixture may be added. Obtain the Engineer's approval. Do not exceed the maximum water to cement ratio. Additional cement or water reducer will be added with no additional cost to the Contracting Authority.
   c. The basic absolute volume of water per unit volume of concrete is based on average conditions. If material characteristics require that the total quantity of water used to secure the required consistency reduces the batch yield (computed on the basis of absolute volumes of the batch quantities used) by more than 2.0%, the Engineer may adjust the proportions to correct the yield. This adjustment will not be a basis for adjustment of the contract unit price.

2. Air Content: Use an approved air entraining agent.
   a. For machine-placed pavement, use a target air content of 8% with a tolerance of plus or minus 2% when measured on the grade just prior to consolidation, as determined by Iowa DOT Materials I.M. 318. The target air content may be adjusted by the Engineer based on random tests of the consolidated concrete behind the paving machine. These additional tests will be used to consider the need for a target value change and will not be used in the acceptance decision.
   b. For hand-placed pavement, use a target content for hand finish of 7% with a tolerance of plus or minus 1.5% when measured on the grade and just prior to consolidation, as determined by Iowa DOT Materials I.M. 318.

3.02 PAVEMENT CONSTRUCTION (Continued)

b. Use freshly mixed concrete; do not store concrete in receptacles at side of pavement for use in curb at a later time; do not use concrete requiring retempering.
c. Consolidate curb concrete to obtain adequate bond with the pavement slab and to eliminate honeycomb in the curb. Avoid disturbing the alignment of forms or the gutter flow line.

H. PCC Railroad Crossing Approach: Construct according to Section 7010 and Figure 7010.903. Construct asphalt section according to the full depth patch requirements of Section 7040.

I. Finishing:

1. Grade and Crown: Promptly after concrete has been placed and vibrated, strike off the surface to the true section by the screed. Finish the surface true to crown and grade.

2. Watering the Surface: The practice of lubricating the pavement surface by sprinkling water by spray, brush, or other methods to afford greater ease in finishing operation is not allowed.

3. Floats: Finish surface with wood or magnesium floats; finish from both sides simultaneously if pavement is placed to full width with one pass of paving machine.

4. Straightedging:
a. After the longitudinal floating has been completed and the excess water has been removed, and while the concrete is still plastic, test the pavement surface for trueness.
b. Immediately fill any depressions found with freshly mixed concrete, struck off, consolidated, and refinished.
c. Check surface longitudinally while concrete is still plastic; correct any surface deviations greater than 1/8 inch in 10 feet.

5. Surface Treatment:
a. Drag Surface Treatment: Unless otherwise specified, texture the finished surface with an artificial turf or burlap drag treatment.
1) Pull the artificial turf or burlap drag longitudinally over the finished surface to produce a tight, uniform, textured surface, and round the edges in a workmanlike manner.
2) Remove the artificial turf or burlap drag from the pavement surface at regular intervals and clean with water to remove accumulated concrete from the fabric in order to maintain a consistent finished texture.
3) When the desired texture is not attained, the Engineer may require the final finish be a broom finish.

b. Surface Tining: When surface tining is specified, use a longitudinal tining. Under special circumstances, when specified in the contract documents, transverse tining may be required.
1) Longitudinal:
a) Complete longitudinal surface tining using a machine with a wire broom or comb. For small or irregular areas, or during equipment breakdown, hand methods may be used. Use a broom or comb with a single row of tines 1/8 inch (+/- 1/64 inch) in width and uniformly spaced at 3/4 inch intervals. The depth of the grooves must be a minimum of 1/8 inch to a maximum of 3/16 inch in the plastic concrete.
b) Use equipment with horizontal and vertical string line controls to ensure straight grooves.
c) Conduct this operation at such time and in such manner that the desired surface texture will be achieved while minimizing displacement of the larger aggregate particles and before the surface permanently sets.
d) At longitudinal joints, leave a 2 to 3 inch wide strip of pavement surface (centered along the joint) that is not grooved for the length of the joint.

3.02 PAVEMENT CONSTRUCTION (Continued)

2) Transverse:

a) If transverse surface tining is required or allowed, use a machine with a wire broom or comb. For small or irregular areas, or during equipment breakdown, hand methods may be used. Use a broom or comb with a single row of tines 1/8 inch (+/- 1/64 inch) in width and randomly spaced from 3/8 inch to 1 5/8 inch with no more than 50% of the spacing exceeding 1 inch. The depth of the grooves must be a minimum of 1/8 inch to a maximum of approximately 3/16 inch in the plastic concrete.

b) Conduct this operation at such time and in such manner that the desired surface texture will be achieved while minimizing displacement of the larger aggregate particles and before the surface permanently sets.

c) Where abutting pavement is to be placed, the tining should extend as close to the edge as possible without damaging the edge.

d) If abutting pavement is not to be placed, do not tine the 6 inch area nearest the edge or 1 foot from the face of the curb.

6. Edge Finish: Before the concrete has taken its initial set, finish all edges of the pavement with an 1/8 inch radius edging tool.

7. Honeycomb Repair: When paving without forms, fill any honeycombed area immediately with freshly mixed concrete and work into the slab prior to initial set and the application of curing. Failure to do so may prompt the Engineer to declare the work defective and cause it to be removed and replaced at no additional cost to the Contracting Authority.

J. Surface Curing:

1. Apply liquid curing compound in a fine spray to form a continuous, uniform film on the horizontal surface and vertical edges of pavement, curbs, and back of curbs immediately after surface moisture has disappeared, but no later than 30 minutes after finishing. With approval of the Engineer, the timing of cure application may be adjusted due to varying weather conditions and concrete mix properties to ensure acceptable macrotexture is achieved.
   a. Use a white pigment liquid curing compound for concrete not receiving an asphalt overlay. When specified in the contract documents, use a linseed oil solution.
   b. Use a dark-colored curing compound for concrete receiving an asphalt overlay.

2. Apply compound with power sprayer; rate of application not less than 15 square yards per gallon (0.067 gallon per square yard); do not dilute compound. For concrete receiving an asphalt overlay, use a minimum rate for dark-colored cure of 12.5 square yards per gallon (0.08 gallon per square yards).

3. Ensure liquid curing materials are well agitated in the supply drum or tank immediately before transfer to the sprayer. Keep curing materials well agitated during application.

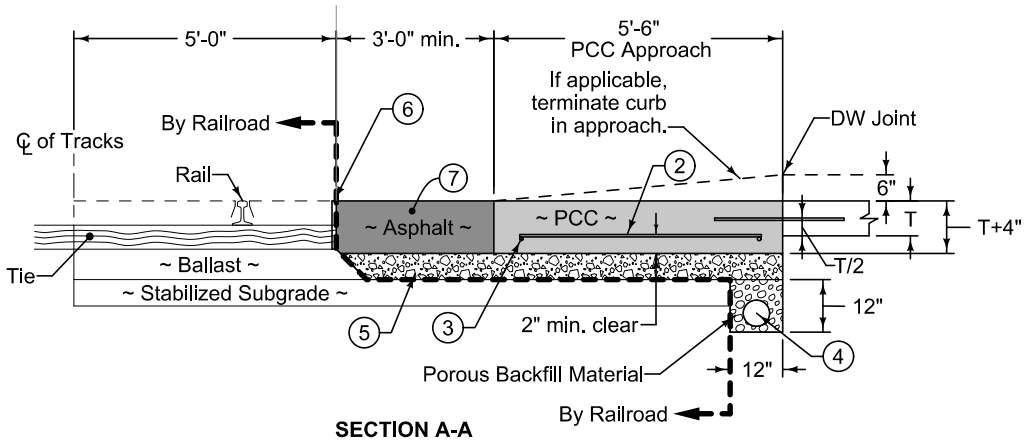
4. Hand operated sprayers may be used for small and irregular areas.

5. If forms are used, apply to pavement edges and back of curbs within 30 minutes after forms are removed.

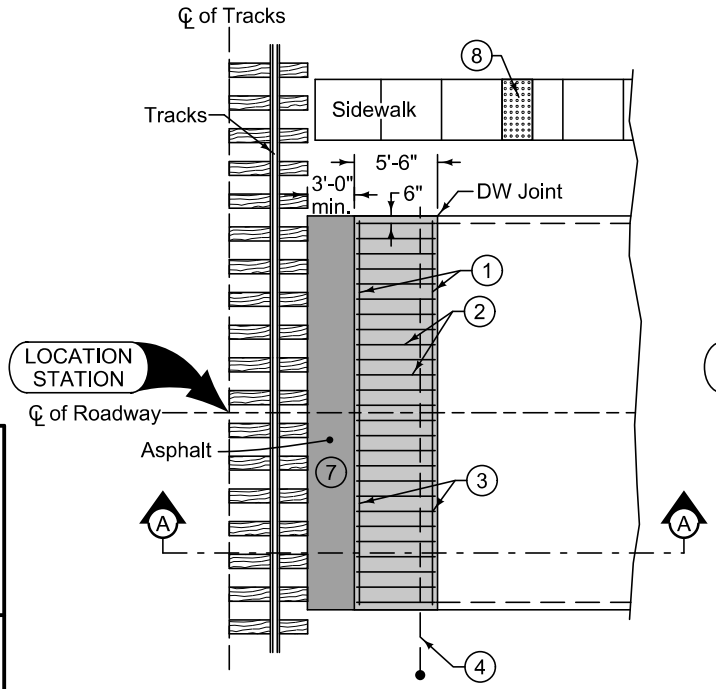
6. If, due to other operations, the coating is damaged within 72 hours after being applied, immediately re-coat the affected areas. Coating of the sawed surface with curing compound will not be allowed on joints that are to be sealed. When pavement is opened to traffic prior to 72 hours after application of the curing coating, a re-coating will not be required.

K. Construction of Joints:

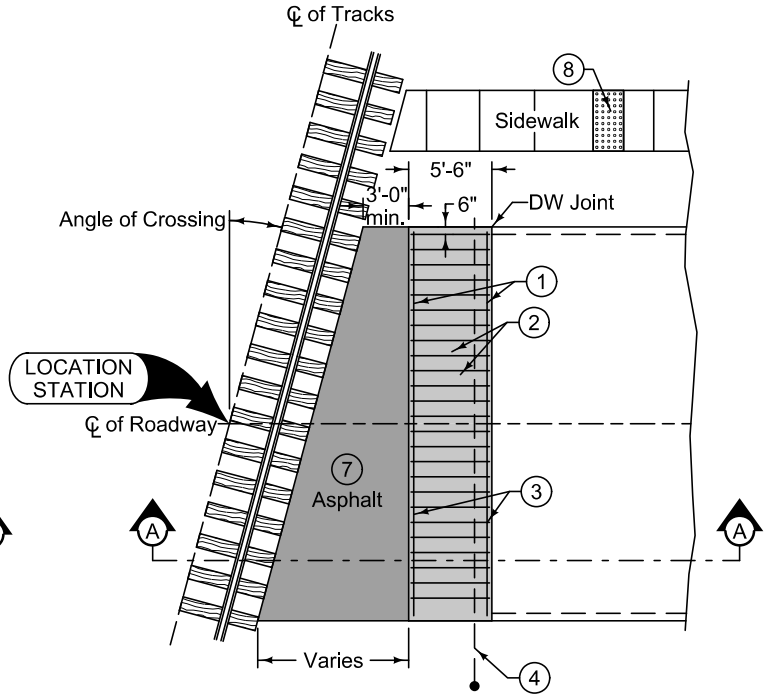
1. General:
   a. Construct joints of the type, dimensions, and at the locations specified in the contract documents. See the 7010 figures.
   b. Place longitudinal joints coincident with or parallel to the pavement centerline.



SECTION A-A



PLAN VIEW - STRAIGHT CROSSING



PLAN VIEW - SKEWED CROSSING

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. Full depth asphalt patch per Section 7040.
8. Refer to Figure 7030.205 for detectable warning location.

FIGURE 7010.903

SHEET 1 OF 1

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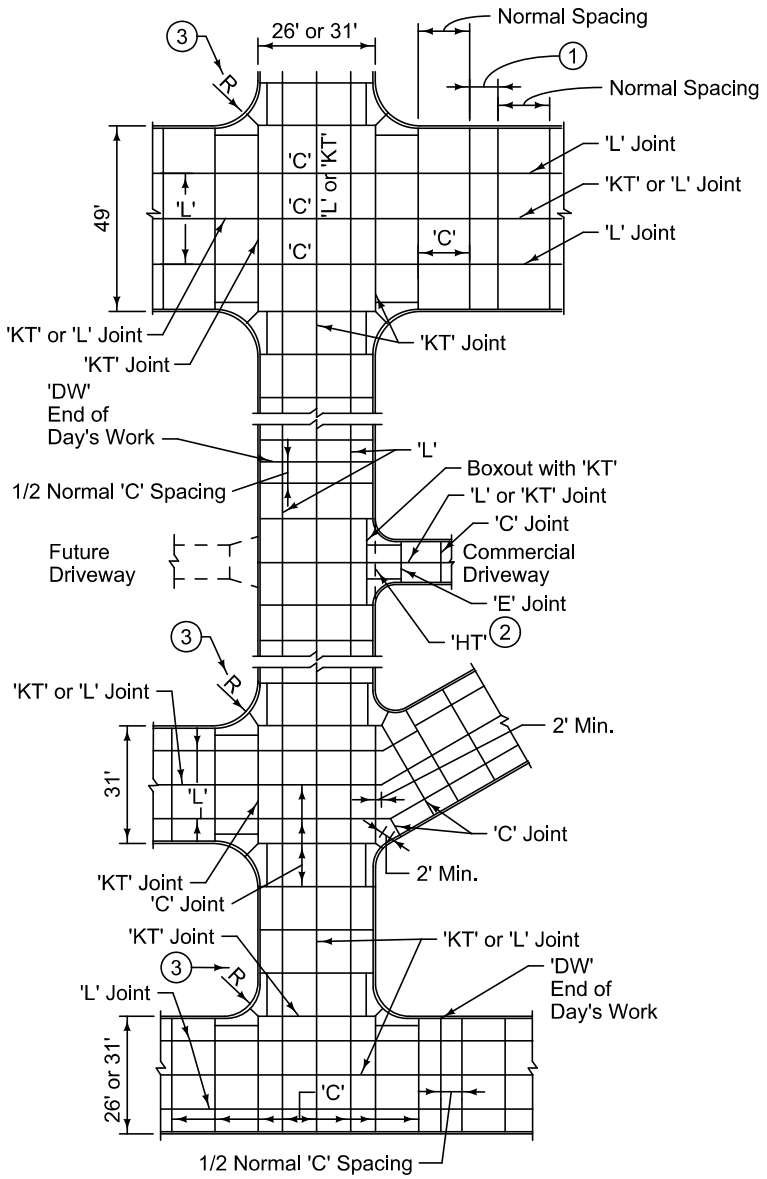
SUDAS Standard Specifications

PCC RAILROAD CROSSING APPROACH



PLAN VIEW

Refer to Figure 7010.901 for maximum transverse joint spacing.

Where new and existing pavements meet, and no existing dowels, tie bars, or keyed joints are present, provide a 'BT', 'RT', or 'RD' joint.

1. Shorten jointing pattern on either side of openings to allow joints to intersect round castings and fall at the edges of intake boxouts.
2. Where pavement abuts an unimproved street, terminate with a type 'HT' joint.
3. When radius exceed 20 feet, add one additional 'C' joint at radius intersections.

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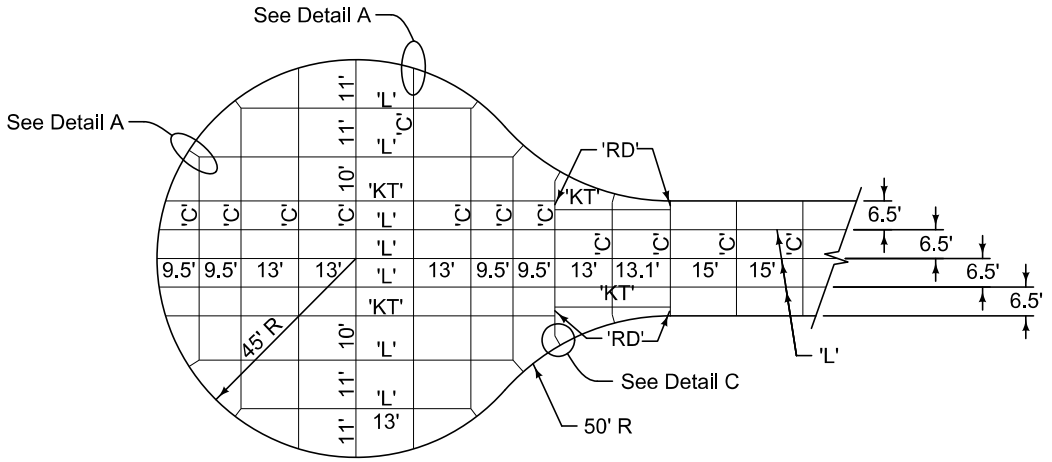
7010.904

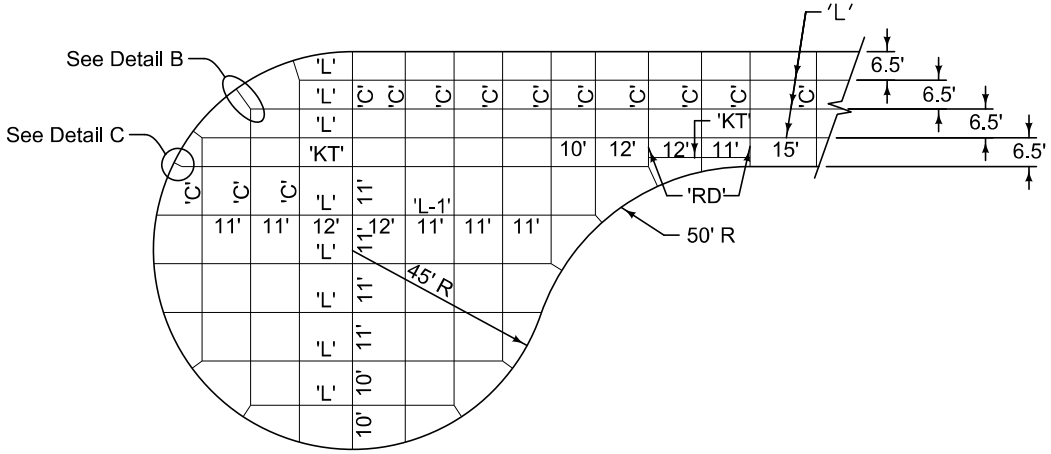
SHEET 1 of 1

SUDAS Standard Specifications

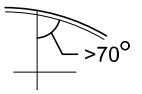
TYPICAL JOINTING LAYOUT

FIGURE 7010.904 | SHEET 1 OF 1

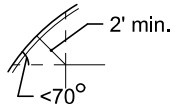




QUARTER POINT JOINTING



DETAIL A



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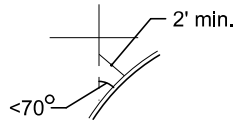

DETAIL C

FIGURE 7010.905 SHEET 1 OF 3

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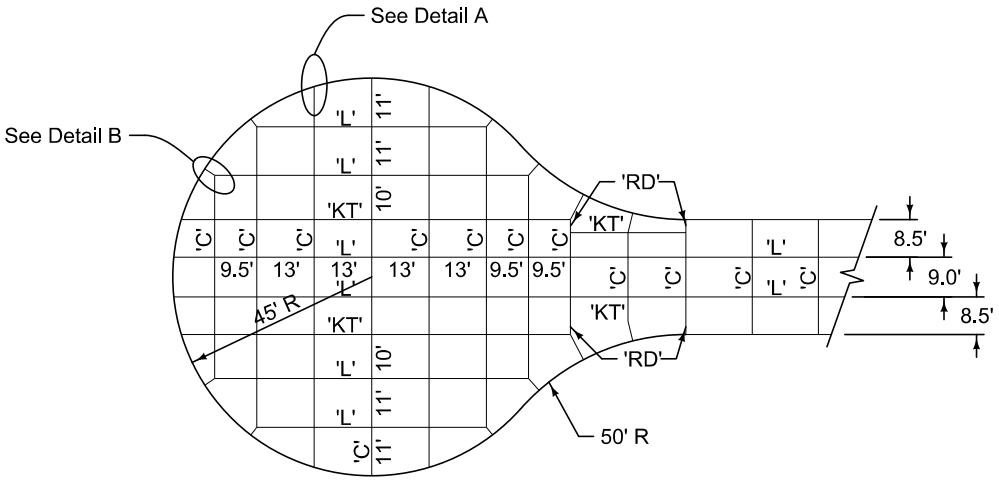
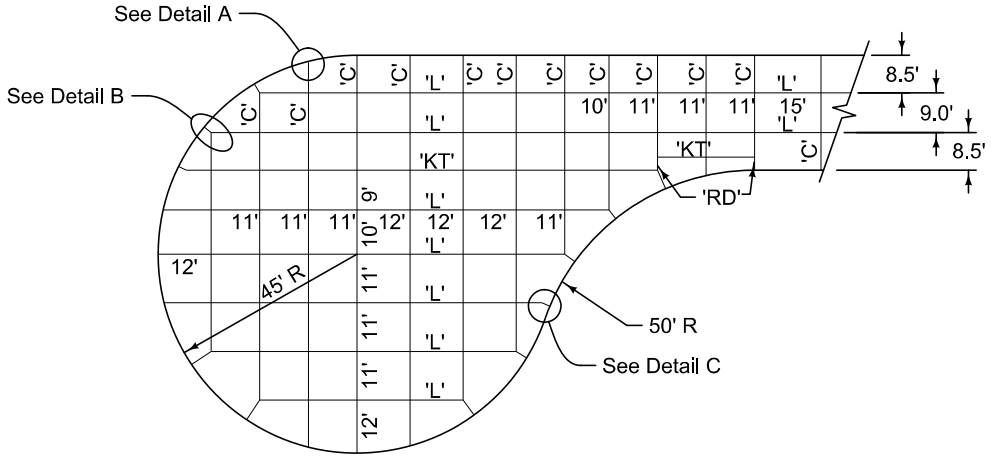
SHEET 1 of 3

SUDAS Standard Specifications

PCC CUL-DE-SAC JOINT LOCATIONS





THIRD POINT JOINTING

FIGURE 7010.905 | SHEET 2 OF 3

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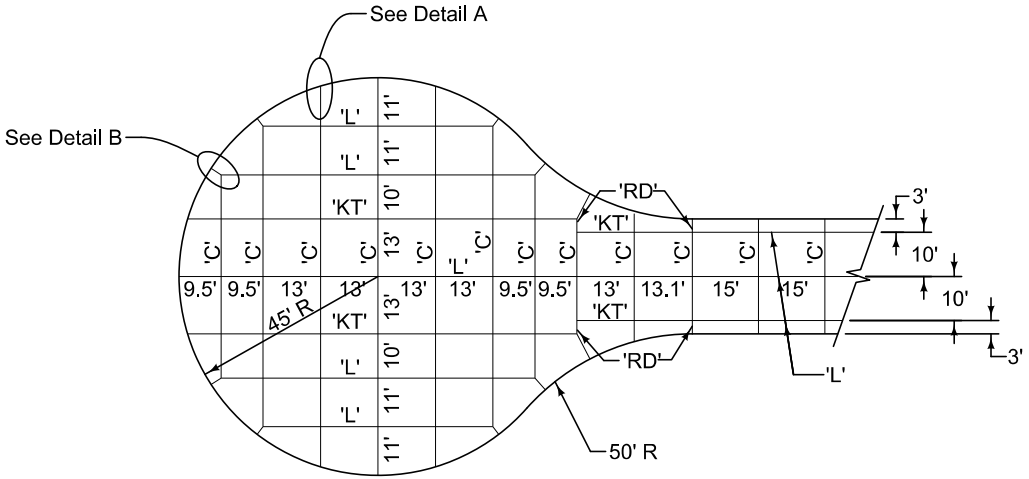
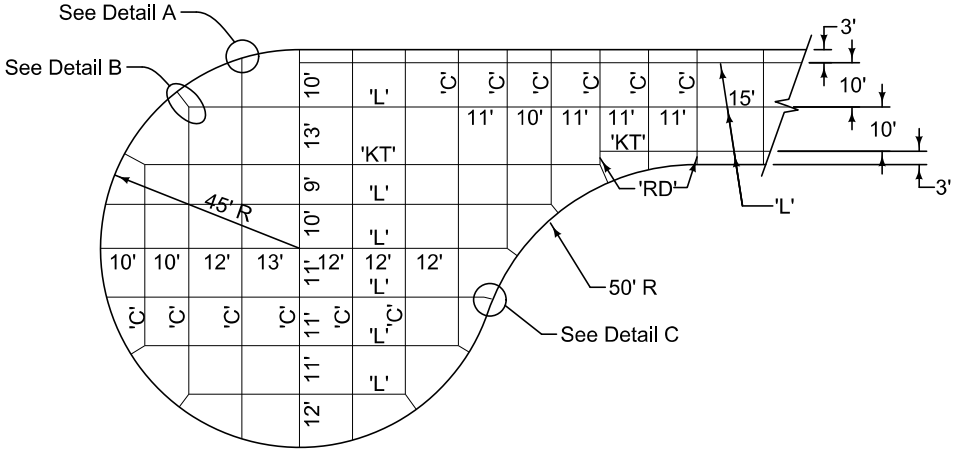
SHEET 2 of 3

SUDAS Standard Specifications

PCC CUL-DE-SAC JOINT LOCATIONS





GUTTERLINE JOINTING

FIGURE 7010.905 SHEET 3 OF 3

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SHEET 3 of 3

SUDAS Standard Specifications

PCC CUL-DE-SAC JOINT LOCATIONS

PORTLAND CEMENT CONCRETE OVERLAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Bonded Concrete Overlays Over Concrete

B. Bonded Concrete Overlays Over Asphalt

C. Unbonded Concrete Overlays Over Concrete (with separation layer)

D. Unbonded Concrete Overlays Over Asphalt

1.02 DESCRIPTION OF WORK

Includes the requirements for the construction of PCC overlays.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants and Section 7010, 1.03.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

Comply with Division 1 - General Provisions and Covenants and Section 7010, 1.05.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants and Section 7010, 1.06.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. PCC Overlays:

1. **PCC Overlay, Furnish Only:**
   - **a. Measurement:** Measurement will be in cubic yards of PCC furnished and incorporated into the PCC overlay, including widening sections, partial depth patches (as part of pre-overlay repairs), and irregular sections.
   - **b. Payment:** Payment will be at the unit price per cubic yard of PCC furnished and incorporated into the PCC overlay.
   - **c. Includes:** Unit price includes, but is not limited to, furnishing the concrete mixture and delivery to the project site.

2. **PCC Overlay, Place Only:**
   - **a. Measurement:** Measurement will be in square yards of PCC overlay placed, including widening sections, partial depth patches, and irregular sections. The area of manholes, intakes, or other fixtures in the overlay will not be deducted from the measured overlay area. Area is based on the longitudinal surface and nominal width of existing pavement.
   - **b. Payment:** Payment will be at the unit price per square yard of PCC overlay placed.
   - **c. Includes:** Unit price includes, but is not limited to, integral curb, bars and reinforcement, joints and sealing, finishing and texturing, surface curing and pavement protection, safety fencing, concrete for rigid headers, boxouts for fixtures, and pavement smoothness testing.

1.08 MEASUREMENT AND PAYMENT (Continued)

3. **Surface Preparation for Bonded PCC Overlay:**
   a. **Measurement:** Measurement will be in square yards of pavement surface prepared for bonded PCC overlay based on the area shown in the contract documents. Area is based on the longitudinal surface and nominal width of existing pavement.
   b. **Payment:** Payment will be at the unit price per square yard of pavement surface prepared for bonded PCC overlay.
   c. **Includes:** Unit price includes, but is not limited to, sandblasting, shot blasting, scarification, and surface cleaning.

4. **Surface Preparation for Unbonded PCC Overlay:**
   a. **Measurement:** Measurement will be in square yards of pavement scarified for unbonded PCC overlay based on the area shown in the contract documents. Area is based on the longitudinal surface and nominal width of existing pavement.
   b. **Payment:** Payment will be at the unit price per square yard of pavement scarified for unbonded PCC overlay.
   c. **Includes:** Unit price includes, but is not limited to, surface preparation required by the contract documents, including scarification and surface cleaning.

5. **Asphalt Separation Layer for Unbonded PCC Overlay:**
   a. **Measurement:** Measurement will be in square yards of asphalt separation layer for unbonded PCC overlay. Area is based on the longitudinal surface and nominal width of existing pavement.
   b. **Payment:** Payment will be at the unit price per square yard of asphalt separation layer for unbonded PCC overlay.
   c. **Includes:** Unit price includes, but is not limited to, cleaning surface and furnishing and placing asphalt mix, including asphalt binder.

6. **Geotextile Fabric Separation Layer for Unbonded PCC Overlay:**
   a. **Measurement:** Measurement will be in square yards of geotextile fabric separation layer for unbonded PCC overlay. Area is based on the longitudinal surface and nominal width of existing pavement.
   b. **Payment:** Payment will be at the unit price per square yard of geotextile fabric separation layer for unbonded PCC overlay.
   c. **Includes:** Unit price includes, but is not limited to, cleaning surface and furnishing, placing, and securing the geotextile fabric separation layer.

7. **Liquid Curing Compound Separation Layer on PCC Surface Patches for Unbonded PCC Overlay:**
   a. **Measurement:** Measurement will be in square yards of liquid curing compound for a separation layer.
   b. **Payment:** Payment will be the unit price per square yard of liquid curing compound separation layer.
   c. **Includes:** Unit price includes but is not limited to, cleaning PCC surface patches and furnishing and placing the liquid curing compound.

B. Pavement Removal: Comply with Section 7040, 1.08, H.

C. Air Content Deficiency: Comply with Section 7010, 1.08, B.

D. Pavement Smoothness Deficiency: Comply with Section 7010, 1.08, C.

E. PCC Pavement Thickness Deficiency: Comply with Section 7010, 1.08, D.

F. Curb and Gutter: Comply with Section 7010, 1.08, E.

G. Fixture Adjustment: Comply with Section 6010 for adjustment of manholes and intakes and Section 5020 for adjustment of water valves and fire hydrants.

H. PCC Pavement Samples and Testing: Comply with Section 7010.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: Comply with Section 7010, 2.01, A.

B. Supplementary Cementitious Materials (SCM): Comply with Section 7010, 2.01, B.

C. Fine Aggregate for Concrete: Comply with Section 7010, 2.01, C.

D. Coarse Aggregate for Concrete:

1. Crushed stone particles with Class 2 durability complying with Iowa DOT Section 4115 and Materials I.M. 409.

2. Comply with Iowa DOT Section 4115 and Article 4109.02, Gradation No. 3 and 5 in the Aggregate Gradation Table.

3. Bonded PCC Overlays:
   a. Use the maximum nominal coarse aggregate size that is no greater than one-third of the overlay thickness.
   b. Provide aggregates that will produce a concrete mixture having a coefficient of thermal expansion (CTE) equal to or less than the CTE of the existing concrete pavement.

4. The Engineer may authorize a change in gradation, subject to materials available locally at the time of construction.

E. Fiber Reinforcement:

1. Provide macro-synthetic fibers complying with ASTM C 1116, Type III Section 4.1.3

2. Incorporate at a dosage rate according to the manufacturer's recommendations (typically 3 pounds per cubic yard to 7.5 pounds per cubic yard).

F. Water Requirements: Comply with Section 7010, 2.01, E.

G. Admixtures: Comply with Section 7010, 2.01, F.

H. Tie Bars, Dowel Bars, and Expansion Tubes: Comply with Section 7010, 2.01, G and H.

I. Joint Fillers and Sealers: Comply with Section 7010, 2.01, L.

J. Liquid Curing Compound:

1. White Pigmented Compounds. Comply with Iowa DOT Section 4105.

2. Poly Alpha-methylstyrene: Comply with ASTM C 309, Type 2, Class B with 100% of the resin consisting of poly alpha-methylstyrene (PAMS) meeting the requirements of Table 7011.01.

Table 7011.01: PAMS Curing Compound

Properties	Range
Total solids, % by weight of compound	$\geq$ 42
% reflectance in 72 hr (ASTM E 1347)	$\geq$ 65
Loss of water, kg/m^2 in 24 hr (ASTM C 156)	$\leq$ 0.15
Loss of water, kg/m^2 in 72 hr (ASTM C 156)	$\leq$ 0.40
V.O.C. Content, g/L	$\leq$ 350

2.01 MATERIALS (Continued)

K. Asphalt Separation Layer for Unbonded Overlay over Concrete:

1. **Asphalt Binder:** PG 58-28S.

2. **Mixture:** Standard Traffic (ST) 3/8 inch asphalt mix.
   a. Target air voids is 3%.
   b. No maximum film thickness restriction.
   c. No minimum filler/bitumen ratio restriction.

3. **Aggregate:**
   a. Type B.
   b. No percent crushed particle requirement.
   c. Gradation cannot fall below the restricted zone.

L. Geotextile Fabric Separation Layer for Unbonded Overlay over Concrete:

1. **Material Properties:** Based on the contract document's specified mass per unit area, provide a geotextile fabric meeting the requirements of Table 7011.02.

2. **Fabric Weight and Thickness:**
   a. For unbonded overlays less than or equal to 4 inches thick, provide a geotextile separation layer with a weight of 13.3 oz/yd^2 and a thickness of 130 mils.
   b. For unbonded overlays greater than or equal to 4.5 inches thick, provide a geotextile separation layer with a weight of 14.7 oz/yd^2 and a thickness of 170 mils.

Table 7011.02: Geotextile Separation Layer

Property	Requirements	Test Procedures
Geotextile Type	Nonwoven, needle-punched, no thermal treatment to include calendaring*	EN 13249, Annex F (Certification)
Color	Uniform/nominally same color fibers	(Visual Inspection)
Weight (mass per unit area)[13]	≥ 13.3 oz/yd^2 ≥ 14.7 oz/yd^2 ≤ 16.2 oz/yd^2	ISO 9864 (ASTM D 5261)
Thickness under load (pressure)	[a] 0.29 psi: ≥ 0.12 in. [b] 2.9 psi: ≥ 0.10 in. [c] 29 psi: ≥ 0.04 in.	ISO 9863-1 (ASTM D 5199)
Wide-width tensile strength	≥ 685 lb/ft.	ISO 10319 (ASTM D 4595)
Wide-width maximum elongation	≤ 130 percent	ISO 10319 (ASTM D 4595)
Water permeability in normal direction under load (pressure)	≥ 3.3 x 10^{-4} ft/s at 2.9 psi	DIN 60500-4 (modified ASTM D5493)
In-lane water permeability (transmissivity) under load (pressure)	[a] ≥ 1.6 x 10^{-3} ft/s at 2.9 psi [b] ≥ 6.6 x 10^{-3} ft/s at 2.9 psi	ISO 12958 (ASTM D 6574) or ISO 12958 (modified ASTM D 4716)
Weather resistance	Retained strength ≥ 60 percent (70% average)	EN 12224 (ASTM D 4355 @ 500 hr exposure for grey, white, or black material only)
Alkali resistance	≥ 96 percent polypropylene/polyethylene	EN 13249, Annex B (Certification)

* Calendering is a process that passes the geotextile through one or more heated rollers during the manufacturing process. The surface of the geotextile is modified during this process. Calendering may reduce the absorption properties of the geotextile on the calendered side.

2.01 MATERIALS (Continued)

M. Liquid Curing Compound Separation Layer on PCC Surface Patches for Unbonded Overlay over Concrete: Comply with Iowa DOT Section 4105.

N. Covering:

1. Burlap: Comply with Iowa DOT Section 4104.

2. Plastic Film: Comply with Iowa DOT Section 4106.

3. Insulating Cover: Comply with Iowa DOT Section 4106.

2.02 CONCRETE MIXES

A. Mix Design: Comply with Section 7010, 2.01 and 2.02, except as modified below:

1. Provide C-3WR or C-4WR for bonded overlays.

2. Comply with Iowa DOT Class C mix meeting the requirements of Iowa DOT Materials I.M. 529.

2. Ensure compatibility of all material combinations. If the concrete materials are not producing a workable concrete mixture, a change in the material may be required. Changes will be at no additional cost to the Contracting Authority.

B. Consistency and Workability: Comply with Section 7010, 2.02, B.

C. Fly Ash and Ground Granulated Blast Furnace Slag (GGBFS) as Supplementary Cementitious Materials: Comply with Section 7010, 2.02, C.

PART 3 - EXECUTION

3.01 EQUIPMENT

Comply with Section 7010, 3.01.

3.02 CONSTRUCTION

Construct overlays in the same manner as PCC pavement (Section 7010, 3.02), except as modified herein.

A. Pre and Post Construction: Comply with the contract documents.

B. Overlay Transition Areas: Refer to the contract documents for details of overlay transitions at project limits, bridges, intersections, and other locations.

C. Temperature Limitations:

1. **Air Temperature:** Do not place overlay concrete when air or existing pavement surface is below 40°F.

2. **Surface Temperature:** Do not place overlay on pavement when the surface temperature exceeds 120°F. If the surface is above 110°F:
   a. Apply water to the pavement surface ahead of the paving operation. Ensure no standing water remains on the pavement at the time the overlay is placed.
   b. If a fabric separation layer is used, wet the fabric but do not saturate.
   c. Do not apply water to the surface if the temperature is below 100°F.

D. Bonded Overlay Surface Preparation:

1. **Over PCC:**
   a. Remove all dirt, oil, and other foreign materials, as well as any laitance or loose material from the surface against which new concrete is to be placed, including all pavement markings and raised pavement markings.
   b. If the existing pavement is milled, shotblast or waterblast the milled surface.
   c. Complete patching with concrete patches after milling, as shown in the contract documents.
   d. Sweep the prepared surface and blow clean with dry, oil free compressed air directly ahead of the paving operation to remove loose dirt or debris. Keep air blasting operations as close to overlay operations as possible to prevent any resettlement of debris onto the previously cleaned area. If material is subsequently tracked onto the surface, the surface must be re-cleaned.

2. **Over Asphalt:**
   a. If required, mill the existing surface to the depth and cross-slope shown in the contract documents. If stripped or loose asphalt is encountered, remove to provide sound structural layer for bonding. Minimum thickness of sound asphalt required for bonding is 3 inches.
   b. Complete patching with concrete patching after milling, as shown in the contract documents. Adjust panel location as necessary so no single overlay panel is located over both asphalt pavement and a concrete patch.
   c. Sweep the prepared surface and blow clean with dry, oil free compressed air directly ahead of the paving operation to remove loose dirt or debris. Keep air blasting operations as close to overlay operations as possible to prevent any resettlement of debris onto the previously cleaned area. If material is subsequently tracked onto the surface, the surface must be re-cleaned.

3.02 CONSTRUCTION (Continued)

E. Unbonded Overlay Surface Preparation: Clean the existing pavement surface immediately prior to paving to remove dirt or debris.

1. Over PCC with Asphalt Separation Layer:
a. Do not scarify the existing PCC surface if an asphalt separation layer will be constructed.
b. Use Class II compaction except use only static steel wheeled rollers complying with Iowa DOT Articles 2303.03 and 2303.04.

2. Over PCC with Geotextile Fabric Separation Layer:
a. Limit ridges on milled surfaces to 1/4 inch maximum height.
b. Roll fabric onto pavement and pull fabric tight without wrinkles.
c. Do not place more fabric than can be paved over within one day.
d. Overlap adjacent rolls by 8 inches ± 2 inches. No more than three layers should overlap.
e. Fasten fabric to existing pavement with pneumatic driven nails every 6 feet or less or secure the geotextile with 3M HoldFast 70 Cylinder Spray Adhesive or approved equal. Apply adhesive to all edges of the fabric and as needed to prevent shifting or folding of the fabric during concrete placement.

3. Over PCC with Liquid Curing Compound
a. Place liquid curing compound meeting Iowa DOT Section 4105 on all PCC patched surfaces prior to placement of the PCC overlay.
b. Apply a minimum of two coats evenly on the full patch area with each coat at a rate of 1 gallon per 200 square feet.
c. If dry to the touch within 10 minutes or rapid absorption is noted, apply a third coat at a rate of 1 gallon per 200 square feet.
d. Prohibit traffic on patches with curing compound applied, and ensure the curing compound is surface dry prior to placement of the overlay.

4. Over Asphalt:
a. Mill high spots in the existing asphalt surface as specified in the contract documents.
b. Remove all loose asphalt material after milling.

F. Existing Pavement Loading:

1. Do not allow concrete delivery trucks to travel over existing pavement unless approved by the Engineer. If approved, limit cleaning and water misting of the existing pavement to just ahead of the paving machine.

2. Do not allow loads in excess of the legal axle load on the existing pavement.

3. Partially loaded trucks may be required to prevent damage to the existing pavement. If asphalt thickness after milling is 3 inches or less, reduce loaded truck hauling over the existing pavement.

G. Paving Suspended:

1. Suspend the paving operation where stability of the underlying pavement section has been lost.

2. Do not place concrete on an underlying pavement that has become unstable.

3.02 CONSTRUCTION (Continued)

H. Bar and Reinforcement Placement:

1. Tie Bars: When the contract documents require tie bars for widening units greater in thickness than the overlay:
   a. Provide No. 4 tie bars.
   b. For overlay thickness 4.5 inches or less, secure tie bars to surface of existing pavement.
   c. For overlay thickness 5 inches or greater, place tie bars at mid-point of overlay thickness.

2. Dowel Bars:
   a. At least 7 days prior to the beginning of concrete paving, submit a written Quality Control Plan that provides a method for keeping the dowel basket assemblies anchored to the subgrade, the existing pavement, or bond breaker layer and into the underlying pavement. Ensure the Quality Control Plan includes the following:
      1) Proposed type and number of fasteners
      2) Proposed installation equipment
      3) Dowel basket assembly anchoring plan (i.e. anchor all basket assemblies prior to concrete placement, one lane at a time, anchor all basket assemblies during the concrete placement operation, etc.)
      4) Action plan if misaligned baskets are identified during concrete pavement placement
   b. Paving operations may be suspended by the Engineer if basket anchoring fails to comply with the Quality Control Plan.

I. Surface Curing:

1. For bonded concrete overlays, apply curing compound at twice the standard rate recommended by the manufacturer.

2. For unbonded concrete overlays 6 inches or thinner, apply curing compound at twice the standard rate recommended by the manufacturer.

3. If PAMS curing compound is specified per Section 7011, 2.01, J, apply at the rate recommended by the manufacturer.

J. Saw Joints:

1. General: Submit a plan for the Engineer's approval, which includes the following items.
   a. Method(s) for assuring adequate sawcut depth in areas of variable concrete overlay thickness.
   b. Anticipated production rate of concrete overlay placement.
   c. Estimated number of saws necessary to prevent random cracking.
   d. Appropriate corrective actions should random cracking occur.
   e. Seal all joints unless directed otherwise.

2. Bonded Overlay Over Existing Concrete Pavement: Submit a plan for the Engineer's approval, which includes the following items.
   a. Marking of all existing joint locations to ensure that joints in the overlay will be placed directly over all existing joints in the underlying concrete pavement.
   b. Transverse Joints:
      1) Saw transverse contraction joints directly over the existing concrete joint the full depth of the overlay plus 1/2 inch (including accommodating variable thickness of the bonded concrete overlay).
      2) Ensure that the width of the sawed transverse joints in the bonded concrete overlay exceeds the width of the crack opening in the underlying joints.

3.02 CONSTRUCTION (Continued)

c. Longitudinal Joints: Saw directly over existing joints full depth.

3. Bonded Overlay Over Existing Asphalt or Composite Pavement:

a. Transverse Joint: Saw to a depth of 1/3 of the overlay thickness or no less than 1.25 inches with an early entry saw.
b. Longitudinal Joints: Saw to a depth of 1/3 of the overlay thickness.
c. Expansion Joints: Match expansion joints in the bonded overlay to those in the existing concrete pavement.

4. Unbonded Overlays Over Concrete, Composite, or Asphalt Pavement:

a. Transverse Joints: Saw to a depth of 1/3 of the overlay thickness or no less than 1.25 inches with an early entry saw.
b. Longitudinal Joints: Saw to a depth of 1/3 of the overlay thickness.
c. Expansion Joints: Match expansion joints in the bonded overlay to those in the existing concrete pavement.

3.03 CURB AND GUTTER CONSTRUCTION

Comply with Section 7010, 3.03.

3.04 PAVEMENT PROTECTION

Comply with Section 7010, 3.04.

3.05 USE OF PAVEMENT

Comply with Section 7010, 3.05.

3.06 TRANSPORTATION RESTRICTIONS

Comply with Section 7010, 3.06.

3.07 QUALITY CONTROL

Comply with Section 7010, 3.07.

END OF SECTION

ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Asphalt Pavement

B. Base Widening

1.02 DESCRIPTION OF WORK

A. Includes the requirements for the construction of asphalt surface, intermediate, and base courses placed upon a prepared subgrade, subbase, base, or pavement and asphalt base widening.

B. Comply with Iowa DOT Section 2303 for construction of asphalt pavement and base widening, except as modified herein.

1. Provide Quality Management - Asphalt (QM-A) for bid items with asphalt quantities exceeding 1,000 tons. Provide quality control for bid items with asphalt quantities of 1,000 tons or less according to Section 7020, 3.06.

2. Refer to Table 7020.01 for gyratory mixture design criteria. Note - this table was copied from the SUDAS Design Manual, Section 5D-1.

1.03 SUBMITTALS

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

A. Prepare and submit the job mix formula to the Engineer for approval prior to asphalt production.

B. Provide quality control test results.

C. Submit all pavement smoothness testing and certifications according to Section 7020, 3.05.

D. Upon request, provide material certifications to the Engineer.

E. Submit asphalt certifications for all bid items with asphalt quantities of 1,000 tons or less, according to Section 7020, 3.06.

F. Weight receipts should include mix size and type and/or correlate to the bid item.

1.04 SUBSTITUTIONS

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

Table 7020.01: Mixture Design Criteria
(derived from Iowa DOT Materials I.M. 510)

Mix	Layer Designation	Gyratory Density		Film Thickness	Aggregate[2]			
		N_{des}	Design % G_{mm} (target)		Quality Type	Crush (min)	FAA (min)	Sand Equivalent (min)
LT	0.3 M S	50	96.0	8.0 - 15.0	A[1]	60[1]	---	40
	0.3 M I							
	0.3 M B		97.0		A[1]	45		
ST	1M S	50	96.0	8.0 - 15.0	A	75[1]	40	40
	1M I				A[1]	60[1]		
	1M B		97.0				---	
HT	10M S	75	96.0	8.0 - 15.0	A	75	43	45
	10M I							
	10M B		96.5		A[1]	60		
For mix design levels exceeding 10M ESALs, see Iowa DOT Materials I.M. 510.								

[1] Requirements differing from Iowa DOT Materials I.M. 510; for base mixes, aggregate quality improved from B to A and percent crushed aggregate increased by 15%.

[2] Flat & Elongated 10% maximum at a 5:1 ratio

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

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

A. Aggregate Storage: Prevent contamination and intermingling per Iowa DOT Section 2303.

B. Salvaged or Reclaimed Materials: Classification of RAP will be as determined by the Iowa DOT. If RAP stockpile classification has not been determined by the Iowa DOT, the Contractor is responsible for obtaining the classification from an outside testing firm using the same tests as the Iowa DOT.

C. Disposal: Dispose of excess asphalt according to applicable local, state, and federal regulations in a manner that does not cause damage or harm to adjacent properties or public facilities.

1.06 SCHEDULING AND CONFLICTS

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

Complete elements of the work that can affect line and grade in advance of other open cut construction unless noted on plans.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Asphalt Pavement by Ton:

1. **Measurement:** Measurement will be in tons for each different layer (surface, intermediate, base), aggregate size, and binder grade of asphalt pavement.

2. **Payment:** Payment will be at the unit price per ton for each different layer (surface, intermediate, base), aggregate size, and binder grade of asphalt pavement.

3. **Includes:** Unit price includes, but is not limited to, asphalt mix with asphalt binder, tack coats between layers, construction zone protection, and quality control.

B. Asphalt Pavement by Square Yards:

1. **Measurement:** Measurement will be in square yards for each different thickness and binder grade of asphalt pavement. 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 different thickness and binder grade of asphalt pavement.

3. **Includes:** Unit price includes, but is not limited to, asphalt mix with asphalt binder, tack coats between layers, construction zone protection, and quality control.

C. Asphalt Base Widening by Ton:

1. **Measurement:** Measurement will be in tons for each different layer (surface, intermediate, base), aggregate size, and binder grade of asphalt base widening.

2. **Payment:** Payment will be at the unit price per ton for each different layer (surface, intermediate, base), aggregate size, and binder grade of asphalt base widening.

3. **Includes:** Unit price includes, but is not limited to, asphalt mix with asphalt binder, tack coat between layers, construction zone protection, and quality control.

D. Asphalt Base Widening by Square Yard:

1. **Measurement:** Measurement will be in square yards for each different thickness and binder grade of asphalt base widening. The area of manholes, intakes, or other fixtures in the pavement will not be deducted from the measured base widening area.

2. **Payment:** Payment will be at the unit price per square yard for each different thickness and binder grade of asphalt base widening.

3. **Includes:** Unit price includes, but is not limited to, asphalt mix with asphalt binder, tack coat between layers, construction zone protection, and quality control.

1.08 MEASUREMENT AND PAYMENT (Continued)

E. Asphalt Railroad Crossing Approach:

1. **Measurement:** Measurement will be in square yards of railroad crossing approach.

2. **Payment:** Payment will be at the unit price per square yard of railroad crossing approach.

3. **Includes:** Unit price includes but is not limited to excavation for modified subbase and subdrain, furnishing and installing subdrain, furnishing and installing subdrain outlet, furnishing and installing porous backfill material, furnishing and placing modified subbase material, furnishing and applying tack coat, furnishing, placing, and compacting asphalt.

F. Density Deficiency:

1. **Measurement:** Measurement will be in square yards for each different density of asphalt pavement subject to a unit price reduction for density deficiency according to Section 7020, 3.04.

2. **Payment:** Payment will be at the reduced unit price according to Table 7020.02 for each density of asphalt pavement. If there is a density deficiency on a privately contracted roadway project, the Jurisdiction ultimately accepting ownership of the roadway will receive the penalty payment prior to acceptance of the work.

G. Asphalt Pavement Thickness Deficiency:

1. **Measurement:** Measurement will be in square yards for each different thickness of asphalt pavement that has deficient pavement thickness as determined in Section 7020, 3.04.

2. **Payment:** Payment will be at the percentage of the unit price indicated in Table 7020.03 for each different thickness of asphalt pavement. If there is a pavement thickness deficiency on a privately contracted roadway project, the Jurisdiction ultimately accepting ownership of the roadway will receive the penalty payment prior to acceptance of the work.

H. Asphalt Pavement Smoothness Deficiency:

1. **Measurement:** Measurement will be in square yards for each different segment of asphalt pavement subject to a unit price reduction for pavement smoothness according to Section 7020, 3.05.

2. **Payment:** Payment will be at the reduced unit price according to Table 7020.04 for each segment of asphalt pavement. If there is a pavement smoothness deficiency on a privately contracted roadway project, the Jurisdiction ultimately accepting ownership of the roadway will receive the penalty payment prior to acceptance of the work.

I. Asphalt Pavement Samples and Testing:

1. **Measurement:** Lump sum item; no measurement will be made.

2. **Payment:** Payment will be at the lump sum price for asphalt pavement samples and testing.

3. **Includes:** Lump sum price includes, but is not limited to, certified plant inspection, pavement thickness cores, density analysis, profilograph pavement smoothness measurement (when required by the contract documents), and air void testing.

1.08 MEASUREMENT AND PAYMENT (Continued)

J. Fixture Adjustment: Comply with Section 6010 for adjustment of manholes and intakes and Section 5020 for adjustment of water valves and fire hydrants.

K. Pavement Removal: Comply with Section 7040.

L. Subgrade and Subbase: For excavation and construction of subgrade and subbase, comply with Section 2010.

PART 2 - PRODUCTS

2.01 ASPHALT MATERIALS

Comply with Iowa DOT Section 2303, with the following exception:

Follow the procedure outlined in Iowa DOT Materials I.M. 510 for asphalt mixture designs, except replace Table 1 in Appendix A, Asphalt Mixture Design Criteria with the SUDAS Asphalt Mixture Design Criteria (Table 7020.01) (Tables 2 through 4 in Appendix A still apply).

2.02 WARM MIX ASPHALT MATERIALS

If use of warm mix asphalt (WMA) is approved by the Jurisdiction, comply with Iowa DOT Section 2303.

2.03 RECYCLED ASPHALT MATERIALS

A. Recycled Asphalt Pavement: If use of recycled asphalt pavement (RAP) is approved by the Jurisdiction, comply with Iowa DOT Section 2303.

B. Recycled Asphalt Shingles: If use of recycled asphalt shingles (RAS) is approved by the Jurisdiction, comply with Iowa DOT Section 2303.

2.04 SUBGRADE AND SUBBASE

Comply with Section 2010.

PART 3 - EXECUTION

3.01 ASPHALT PAVEMENT

Construct according to Iowa DOT Section 2303 and the following:

A. Preparation of Pavement Foundation: Construct subgrade and subbase according to Section 2010.

B. Compaction: Compact to a minimum of 94% of laboratory density. Do not exceed 8% average air void level for roadway density specimens.

C. Tack Coats: Apply tack coats according to Iowa DOT Section 2303. In addition, if the emulsion is diluted, the dilution must be done by the manufacturer and certified. Provide the Engineer with the new application rate required to achieve the specified undiluted application rate.

D. Fillets and Runouts: Rake out coarse aggregate prior to shaping and compaction of fillets and runouts.

E. Asphalt Railroad Crossing Approach: Construct according to Section 7020 and Figure 7020.902.

F. Fixtures in the Pavement Surface:

1. Adjust manhole frames and other fixtures within area to be paved to conform to finished surface. Comply with Section 6010, 3.04 for manhole adjustments and Section 5020, 3.04 for water fixture adjustments.

2. Clean outside of fixture to depth of pavement before asphalt placement.

3. Construct boxouts where allowed for later adjustment of fixtures. See Figure 7020.201 for the size and shape of the boxout.

G. Samples and Testing: Take samples from the compacted material and test according to Section 7020, 3.04. Randomly locate samples in the pavement area Notify the Jurisdiction the day prior to coring and testing to give the Jurisdiction the opportunity to witness coring and testing.

3.02 BASE WIDENING

A. Equipment: Use equipment complying with Iowa DOT Section 2213.

B. Conditions:

1. Resurfacing over Concrete Base Widening: When the existing pavement is asphalt material over concrete pavement, saw or mill the old asphalt to the full depth of the proposed resurfacing or to depth of sound material producing a reasonable vertical line at the edge of the underlying concrete.

2. Asphalt Base Widening: Apply a tack coat to the vertical edge of the old pavement at a rate of 0.10 to 0.15 gallon per square yard according to Section 7020, 3.01. No waiting period will be required before placing the widening.

3.02 BASE WIDENING (Continued)

C. Preparation of Subgrade:

1. Cut the width of the trench for the widening at least 6 inches greater than the base width of the widening according to the contract documents. If widening roadways with open ditches, provide ditches or drains from the widening trench at frequent intervals to allow subgrade drainage to side ditches.

2. Construct subgrade and subbase according to Section 2010.

3. Bring the subgrade to an elevation and cross-section such that, after being compacted to a minimum of 95% of maximum Standard Proctor Density, the surface will be at the required elevation.

4. Remove material, other than sand, that will not readily compact. Replace with material that will readily compact and roll that portion of the subgrade again. Use an appropriate roller complying with Iowa DOT Article 2001.05.

5. While constructing the subgrade, maintain the soil in a condition sufficiently moist to facilitate compaction.

6. Check the finished subgrade with a template supported on the surface of the adjacent pavement. Clean the edge of the old pavement.

D. Construction:

1. Place the asphalt mixture in the number of lifts required to produce the required thickness. Do not allow the compacted thickness of the top lift to exceed 2 1/2 inches.

2. The maximum compacted thickness of lower lifts may exceed 3 inches if the thicker lifts demonstrate satisfactory compaction. Maximum lift thickness shall be 4 1/2 inches.

3. Do not place asphalt on the surface of the existing pavement, and immediately remove any spilled base material.

4. Ensure that, after compaction, the constructed width conforms to the required width.

5. Promptly and thoroughly compact each lift. Comply with Section 7020, 3.01.

6. Place succeeding lifts of asphalt material as soon as the previous lift has been compacted.

7. Obtain the lab density for that day's asphalt paving from an Iowa DOT-approved testing lab and based on the job mix formula design criteria.

8. Take density samples from the compacted material and test according to Section 7020, 3.04. Randomly locate samples in the area 6 inches from the base being widened to 6 inches from the outside edge of a given pass of the placing equipment. Notify the Jurisdiction the day prior to coring and testing to give the Jurisdiction the opportunity to witness coring and testing.

9. When the contract for base widening does not include resurfacing, construct the final surface of widening flush with, or no more than 1/8 inch below, the surface of the old pavement.

10. Do not open the widening to traffic until it has cooled sufficiently to support the traffic without displacement or movement.

3.03 PROTECTION FROM TRAFFIC

A. General:

1. Protect the new pavement and its appurtenances damages caused by traffic, both public and that of the Contractor's own employees and agents, at no additional cost to the Contracting Authority. This includes the erection and maintenance of warning signs, lights, fence, and barricades; flaggers to direct traffic; and pavement bridges or crossovers as appropriate.

2. Do not operate equipment with metal tracks, metal bucket blades, or metal motor patrol blades directly on new paving. Do not unload soil or granular materials, including base rock for storage and future reloading directly onto new paving.

B. End of Day's Run:

1. At the end of each day's run and at all side streets, erect and maintain safety barriers and fencing as necessary to protect the pavement from damage.

2. Install construction zone protection upon completion of paving operations. Leave protection in place and maintained until the pavement has cooled sufficiently to withstand traffic without damage.

3. Intermediate construction zone protection may be required for the purpose of opening the pavement for access to a side road, side street, or entrances.

C. Repair of Damages: At the discretion of the Engineer, and at no additional cost to the Contracting Authority, repair or replace any part of the pavement damaged by traffic or other causes occurring prior to final acceptance of the pavement.

3.04 DEFECTS OR DEFICIENCIES

A. Repairs Required:

1. Remove and replace or repair pavement containing excessive cracks, deformities, deficiencies, or other defects at no additional cost to the Contracting Authority. The method of replacement or repair will be determined by the Engineer. Extended warranty may be approved by the Engineer.

2. Areas to be replaced will be determined by the Engineer. Complete all repairs according to Section 7040.

B. Density Deficiencies:

1. The Engineer will obtain and test 7 samples for each lot according to Iowa DOT Materials I.M. 204 Appendix F. The quality index for density of each lot will be determined by the following formula:

$$\text{Density (Q.I.)} = \frac{(\text{Average } G_{mb})_{\text{Field Lot}} - ((\%\ \text{Density})_{\text{Specified}} \times (\text{Average } G_{mb})_{\text{Lab Lot}})}{(\text{Standard Deviation } G_{mb})_{\text{Field Lot}}}$$

where G_{mb} = bulk Specific Gravity of the mixture

3.04 DEFECTS OR DEFICIENCIES (Continued)

2. Payment will be adjusted according to the density requirements of Table 7020.02 for the quality index for density determined for the lot:

Table 7020.02: Pay Factor for Asphalt Pavement Density

Density Index 7 Samples[1]	Percent Payment
greater than 0.72	100
0.40 to 0.72	95
0.00 to 0.39	85
less than 0.00	75 Maximum

[1]Or 6 samples and 1 outlier. Only one outlier will be allowed.

No incentive payment for pavement density will be made.

C. Thickness Deficiencies:

1. The Engineer will measure the cores according to Iowa DOT Materials I.M. 337. All areas of uniform and similar thickness and width for the project will be divided into lots.
2. The thickness of the completed course will be measured to the nearest 1/8 inch, exclusive of seal coat. All areas of uniform and similar thickness and width for the project will be divided into lots. The frequency specified for taking density samples from the surface lift will be used when measuring for completed thickness. However, samples that may not be tested for density because they are less than 70% of the intended thickness will be used for thickness, and in these particular instances, the additional samples of sufficient thickness that are used for density tests will not be measured for thickness. Thickness samples will be taken full depth of the completed course and after measurement; remove the density samples for the top layer from the core. If any of the measurements for a lot is less than the designated thickness, the quality index for thickness of that lot will be determined by the following formula:

$$\text{Thickness (Q.I.)} = \frac{\text{Avg. Thickness - (Design Thickness - 0.50)}}{\text{Max Thickness - Minimum Thickness}}$$

3. Payment will be further adjusted by the appropriate percentage according to the quality index for thickness determined for that lot and the following table:

Table 7020.03: Pay Factor for Asphalt Pavement Thickness

Thickness Index 7 Samples	Percent Payment (Previously Adjusted for Density)
greater than 0.34	100
0.14 to 0.34	95
0.00 to 0.13	85
less than 0.00	75 Maximum

No incentive payment for pavement thickness will be made.

4. Do not apply the thickness quality index adjustment to a layer with a designated thickness of “variable” or “nominal”, or to a layer designated as a scratch course or leveling course. Do not apply the quality index adjustment to pavement layers designated in the contract documents as grade correction or cross slope correction.

3.05 PAVEMENT SMOOTHNESS

A. Straightedge: The Engineer will check asphalt pavement surfaces with a 10 foot straightedge placed parallel to the centerline. Areas showing high spots of more than 1/4 of an inch in 10 feet will be marked. Complete surface corrections according to the procedures in Iowa DOT Section 2316 to an elevation where the area or spot will not show surface deviations in excess of 1/8 inch when tested with a 10 foot straightedge. Surface corrections will be completed at the direction of the Engineer with no additional cost to the Contracting Authority.

B. Profilograph:

1. If specified in the contract documents, comply with Iowa DOT Section 2316 to measure pavement smoothness with a profilograph. Ensure the evaluation is certified according to Iowa DOT Materials I.M. 341. Position the center wheel of the profilometer 6 feet from the centerline or the lane line.

2. Evaluate according to the smoothness requirements of Table 7020.04 and make surface corrections and/or price reductions. Surface corrections will be completed with no additional cost to the Contracting Authority. No incentive for pavement smoothness will be made.

Table 7020.04: Price Reduction for Pavement Smoothness

Initial Profile Index (inch/mile/segment)	New Pavements ($/segment)	Resurfaced Pavements ($/segment)
12.1 - 22.0	Unit price	Unit price
22.1 - 30.0	$500	$250
30.1 and over[1]	Grind only	Grind only

[1] For segments with an initial index of 30.1 and over, grind the surface to a finish index of 22.0 or better. In lieu of accepting a price reduction and grinding the surface to a final index of 22.0 or better, the Contractor may elect to replace part or the entire segment.

3.06 QUALITY CONTROL

A. Provide Quality Management - Asphalt (QM-A) for bid items with asphalt quantities exceeding 1,000 tons. On locally let projects, all testing normally conducted by the Iowa DOT may be performed by the Jurisdiction or an independent testing laboratory hired by the Jurisdiction.

1. General: Follow the procedures and meet the criteria established in Iowa DOT Article 2303.03, B; Section 2521; and Materials I.M. 510 and 511. Percent within Limits (PWL) stipulations in these documents is not required.

2. Mix Design - Job Mix Formula (JMF):
   a. The Contractor is responsible for the JMF for each mixture.
   b. Submit a completed JMF for approval to the materials lab designated by the Contracting Authority. Submit supporting documentation demonstrating the design process was followed and how the recommended JMF was determined. Include an economic evaluation when required according to Iowa DOT Section 2303. Include trial and final proposed aggregate proportions and corresponding gyratory data. In addition, submit sufficient loose mixture and individual material samples for approval of the design if requested by the Engineer.
   c. The person preparing the JMF must be Iowa DOT certified in bituminous mix design.
   d. If the JMF is not satisfactory, submit another JMF for review. An approved JMF will be required prior to beginning plant production.

3.06 QUALITY CONTROL (Continued)

3. Plant Production:
   a. General:
      1) Perform sampling and testing to provide the quality control of the mixture during plant production. Certified Plant Inspection according to Iowa DOT Section 2521 is required.
      2) Ensure personnel performing production quality control testing is Iowa DOT certified for the duties performed.
      3) Provide easy and safe access to the location in the plant where samples are taken.
      4) A "significant mix change" is defined as a single occurrence of an aggregate interchange of greater than 5%, a single occurrence of an asphalt content change greater than 0.2%, or any deletion or introduction of a new material into the mix.
   b. Sampling and Testing:
      1) Sample and test asphalt binder to verify the quality of the binder grade. Take asphalt binder samples at random times as directed and witnessed by the Engineer according to Iowa DOT Materials I.M. 204.
      2) Use cold feed or ignition oven gradation for aggregate gradation control to assure materials are being proportioned according to the specifications. Take aggregate samples at random times as directed and witnessed by the Engineer according to Iowa DOT Materials I.M. 204. The Engineer will secure the samples according to Iowa DOT Materials I.M. 205, Appendix A.
      3) Sample the hot asphalt mixture at random locations as directed and witnessed by the Engineer according to Iowa DOT Materials I.M. 322. Secure the samples according to Iowa DOT Materials I.M. 205, Appendix A.
      4) Assist the Engineer with material sampling for verification testing. When the Engineer provides notification that a sample is to be taken, obtain sample within 15 minutes.
      5) Each day's production of a mix design will be considered a lot.
         a) When the anticipated quantity for the day is 2,000 tons or more, divide that day's production into four sublots, with the first sublot being the first 500 tons produced. The Engineer will divide the remaining anticipated quantity for the day into three equally sized sublots.
         b) When the anticipated quantity for the day is less than 2,000 tons, use the first 500 tons produced for the first daily sublot. The Engineer will establish 750 ton daily sublots for mix production exceeding the first 500 tons.
      6) No more than four paired hot asphalt mixture samples will be required for acceptance of a lot.
      7) Do not take paired samples from the first 100 tons of mix produced each day or the first 100 tons of mix following a significant mix change. When paving operations are staged so each day of placement is less than 100 tons for the entire production of a bid item, establish a sampling plan with the Engineer that includes a minimum of one sample per 2,500 tons.
      8) Test the quality control sample of each production paired sample as follows:
         a) Prepare and compact two gyratory specimens according to Iowa DOT Materials I.M. 325G.
         b) Determine the density for each specimen according to Iowa DOT Materials I.M. 321. Average the results to determine sample density.
         c) Use the field quality control laboratory compaction for field density control. The laboratory density for field control will be the bulk specific gravity of compacted mixture (Gmb) at Ndesign. Bulk specific gravity at Ndesign will be determined by compacting specimens to Nmax and back calculating the bulk specific gravity at Ndesign.
         d) Determine the Theoretical Maximum Specific Gravity of the uncompacted mixture according to Iowa DOT Materials I.M. 350 or other test methods recognized by AASHTO or ASTM.

3.06 QUALITY CONTROL (Continued)

e) Determine laboratory air voids for each sample according to Iowa DOT Materials I.M. 501.

9) When liquid anti-strip additives are used, satisfy one of the following methods to regulate the quantity of additive:
   a) Present certification that the equipment used to measure and blend the liquid anti-strip additive:
      - Meets the anti-strip supplier's recommended practice,
      - Is directly tied to the asphalt binder supply system, and
      - Has been calibrated to the equipment manufacturer's guidelines.
   b) Test the binder to measure the quantity of liquid anti-strip additive in the binder for every 5,000 tons of asphalt production. Obtain the Engineer's approval for the supplier's test method prior to use of the test.
   c) Run the test method in Iowa DOT Materials I.M. 319 during production. If unable to certify or test for the presence and quality, run the test method in Iowa DOT Materials I.M. 319 each 10,000 tons of production to measure the effectiveness of the additive. Ensure test results satisfy the minimum requirements of Iowa DOT Article 2303.02, E.

c. Production Control:
   1) After the JMF is established, the combined aggregate furnished for the project, the quantity of asphalt binder, and the laboratory air voids should consistently comply with the JMF, as target values. Control them within the production tolerance given in Table 7020.05.

Table 7020.05 Production Tolerances

Measured Characteristic	Target Value (%)	Specifications Tolerance (%)[1]
Cold feed gradation No. 4 (4.75 mm) and larger sieves	by JMF	± 7.0
Cold feed gradation No. 8 (2.36 mm)	by JMF	± 5.0
Cold feed gradation No. 30 (600 µm)	by JMF	± 4.0
Cold feed gradation No. 200 (75 µm)	by JMF	± 2.0[2]
Daily asphalt binder content	by JMF	± 0.3
Field laboratory air voids - absolute deviation from target	0.0[3]	<1.0[4]

[1] Based on single test unless otherwise specified.
[2] Maintain the filler/bitumen ratio of the plant produced mixture between 0.6 and 1.4.
[3] Unless otherwise specified.
[4] Based on the moving average of four test values.

2) Control plant production so that the plant produced asphalt mixture will meet mixture design criteria (within the test tolerances given in Table 7020.05) for Air Voids at Ndesign gyrations of the gyratory compactor. Monitor the slope of the gyratory compaction curve of plant produced material. Slope variations in excess of ±0.40 of the mixture design gyratory compaction curve slope may indicate potential problems with uniformity of the mixture.
3) The gyratory mix design gradation control points for the size mixture designated in the project plans will not apply to plant production control.
4) Strive for the target value of the percent air void and asphalt binder by adjusting gradation and asphalt binder content.
5) Produce a uniform composition mixture complying with the JMF.
6) Adjustments to the JMF target gradation and asphalt binder content values may be made.
   a) Determine from quality control testing that adjustments are necessary to achieve the specified properties.
   b) Consult with the Engineer regarding adjustments to the JMF.
   c) The Contractor's adjustment recommendations prevail, provided all specifications and established mix criteria are being met for plant production.

3.06 QUALITY CONTROL (Continued)

7) Measure estimated film thickness and voids in the mineral aggregate (VMA) for specifications compliance every day of asphalt production.
8) Prepare quality control charts according to Iowa DOT Materials I.M. 511. Keep the charts current and available showing both individual sample results and moving average values. Base moving average values on four consecutive sample results. Moving averages may restart only in the event of a mandatory plant shutdown for failure to maintain the average within the production tolerance. Include the target value and specifications tolerances on control charts.
9) Calculate laboratory voids for individual samples according to Iowa DOT Materials I.M. 501. Use the individual density and individual maximum specific gravity determined for each sample. To determine the moving average of laboratory voids, use the average of the last four individual sample laboratory voids.
10) Monitor the test results and make mix adjustments, when appropriate, to keep the mixture near the target values. Notify the Engineer whenever the process approaches a specification tolerance limit. Cease operations when the moving average point for laboratory air voids is outside the specification tolerance limit. Assume responsibility to cease operations, including not incorporating material which has not been placed. Do not start the process again until notifying the Engineer of the corrective action proposed.

B. Provide quality control for bid items with asphalt quantities of 1,000 tons or less as follows:

1. Mix Design: Prepare the job mix formula. Prior to asphalt production, obtain the Engineer's approval for the job mix formula. Comply with Iowa DOT Article 2303.02 and Iowa DOT Materials I.M. 510. Submit for approval.

2. Plant Production: Use a current calibration of the asphalt production plant for the job mix formula no more than 12 months old. Maintain an asphalt binder log to track when the binder was delivered. Identify the job mix formula on the asphalt delivery ticket. Use certified asphalt binder and approved aggregate sources meeting the job mix formula. Monitor the quality control test results and make adjustments to keep the mixture near the target job mix formula values.

3. Construction: Take density measurements of the compacted mixture. Use the field quality control laboratory compaction for field density control as specified in Section 7020, 3.04. The Engineer may accept the density of the compacted layer based on cores or density gauge. The Engineer may waive density measurement provided the compaction has been thorough and effective. Take density measurements of the compacted mixture no later than the next working day following placement and compaction. For small quantities, a lot is the entire quantity of each asphalt mixture bid item. The quality index for density will not apply to small quantities.

3.06 QUALITY CONTROL (Continued)

4. Sampling and Testing: Material sampling and testing is for production quality control only. Acceptance of mixture is based on Contractor certification. Perform a minimum of one aggregate cold-feed and one loose asphalt test per lot. Sampling and testing of loose asphalt is only required for mechanically placed mixture. All sampling and testing procedures will follow the Iowa DOT Specifications and Materials I.M.s using certified technicians and qualified testing equipment. The Engineer may approve alternative sampling procedures, or may approve sampling of uncompacted mix and gradation if Contractor can provide plant reports for other recent projects(s) demonstrating the job mix formula has been produced according to the specifications. Take the sample between the first 100 to 200 tons of production. No split samples for agency correlation testing are required. Asphalt binder will be accepted based on the asphalt supplier's shipment certification. No binder sampling or testing is required. No material sampling or testing is required for daily asphalt production of less than 100 tons on any project.

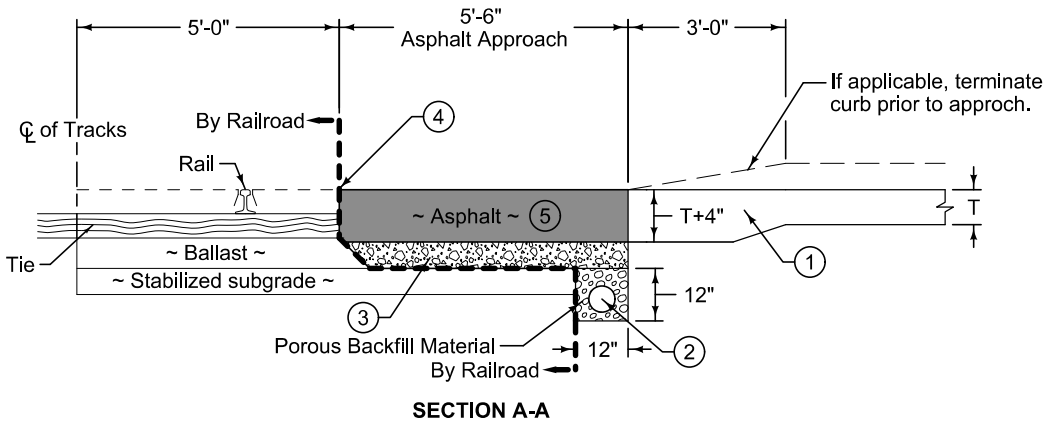
5. Certification: Provide a certification for the production of any mixture in which the requirements in this section for small quantities are applied. Place the test results and certification statement on the Iowa DOT Daily Plant Report. The Daily Plant Report for certified asphalt may be submitted at the end of the project for all certified asphalt quantities, or submitted at intervals for portions of the certified quantity. Use the following certification statement:

   "The certified asphalt was produced in compliance with the provisions of Section 7020, of the SUDAS Standard Specifications. The certified asphalt was produced with certified asphalt binder and approved aggregates as specified in the approved mix design."

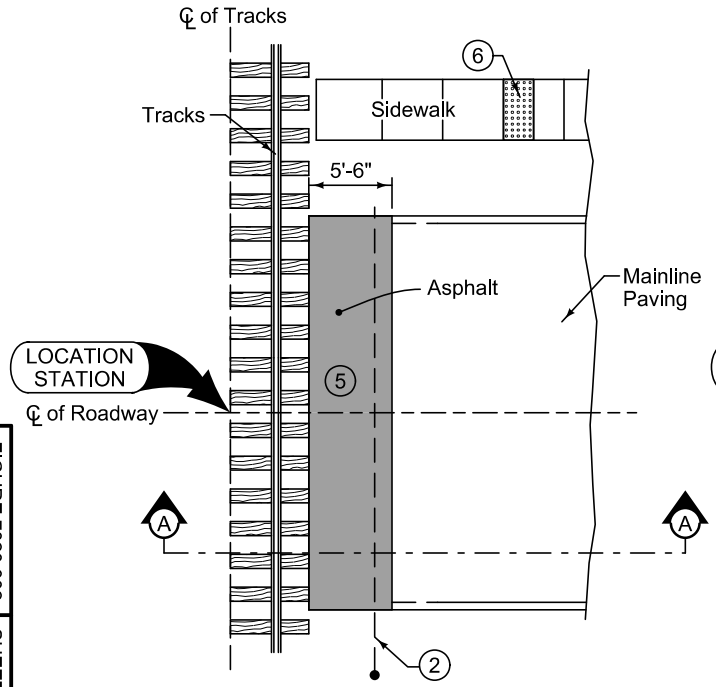
3.07 REMOVAL OF PAVEMENT

Comply with Section 7040.

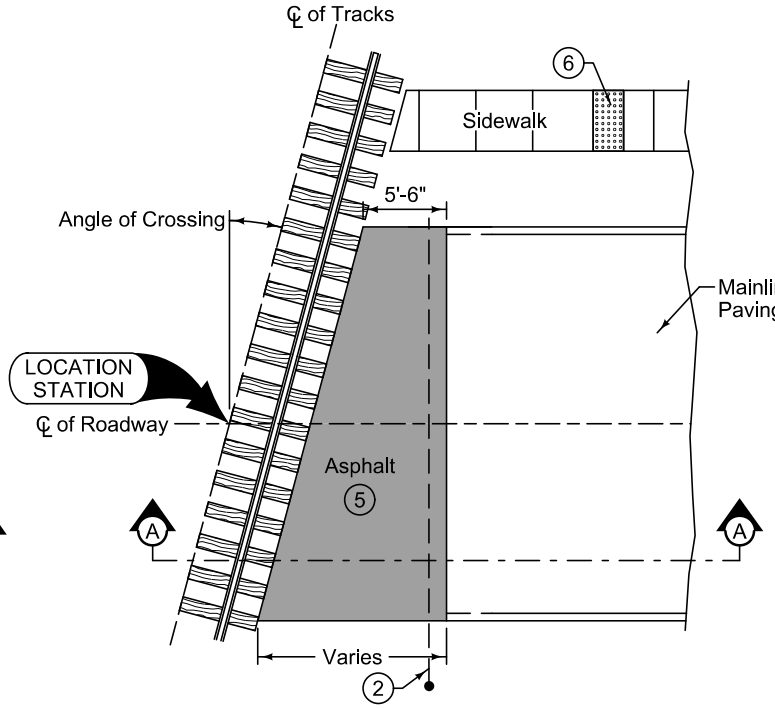
END OF SECTION



SECTION A-A



PLAN VIEW - STRAIGHT CROSSING



PLAN VIEW - SKEWED CROSSING

1. Asphalt 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 asphalt approach according to the requirements for full depth asphalt patching or the requirements for asphalt paving if constructed in conjunction with mainline asphalt.
6. Refer to Figure 7030.205 for detectable warning location.

FIGURE 7020.902

SHEET 1 OF 1

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SHEET 1 of 1

SUDAS Standard Specifications

ASPHALT RAILROAD CROSSING APPROACH

ASPHALT OVERLAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Asphalt Overlays

1.02 DESCRIPTION OF WORK

Includes the requirements for the construction of asphalt overlay surface course placed upon an existing pavement.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants and Section 7020, 1.03.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

Comply with Division 1 - General Provisions and Covenants and Section 7020, 1.05.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants, as well as Section 7020, 1.06.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

Comply with Section 7020, 1.08, except as modified herein:

A. Asphalt Overlay by Ton:

1. **Measurement:** Measurement will be in tons of asphalt overlay.

2. **Payment:** Payment will be at the unit price per ton of asphalt overlay.

3. **Includes:** Unit price includes, but is not limited to, asphalt mix with asphalt binder, tack coats between layers, construction zone protection, and quality control.

B. Asphalt Overlay by Square Yards:

1. **Measurement:** Measurement will be in square yards for each different thickness of asphalt overlay. 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 asphalt overlay.

3. **Includes:** Unit price includes, but is not limited to, asphalt mix with asphalt binder, tack coat, construction zone protection, and quality control.

PART 2 - PRODUCTS

2.01 ASPHALT OVERLAY MATERIALS

Comply with Iowa DOT Section 2303, with the following exception:

Follow the procedure outlined in Iowa DOT Materials I.M. 510 for asphalt mixture designs, except replace Table 1 in Appendix A, Asphalt Mixture Design Criteria with the SUDAS Asphalt Mixture Design Criteria (Table 7020.01) (Tables 2 through 4 in Appendix A still apply).

2.02 WARM MIX ASPHALT MATERIALS

If use of warm mix asphalt (WMA) is approved by the Jurisdiction, comply with Iowa DOT Section 2303.

2.03 RECYCLED ASPHALT MATERIALS

When recycled asphalt materials (RAM) are used and they exceed 20% replacement of the total binder, the binder grades may need to be modified. Comply with Iowa DOT Materials I.M. 510.

A. Recycled Asphalt Pavement: If use of recycled asphalt pavement (RAP) is approved by the Jurisdiction, comply with Iowa DOT Section 2303.

B. Recycled Asphalt Shingles: If use of recycled asphalt shingles (RAS) is approved by the jurisdiction, comply with Iowa DOT Section 2303.

2.04 BINDER GRADES

A. Conventional Overlays: Use the specified binder grade.

B. Asphalt Interlayer: Use PG 58-34E meeting AASHTO T 321 with minimum 100,000 cycles to failure. Comply with Iowa DOT Materials I.M. 510A. Do not use RAP.

C. High Performance Thin Lift: Use PG 64-34E+ complying with requirements of PG 64-34E except that a minimum percent recovery of 90% when tested at 64°C per AASHTO T 350 at 3.2kPa is required. Comply with Iowa DOT I.M. 510A. Do not use RAS.

2.05 HIGH PERFORMANCE THIN LIFT

A. Mix Design:

Design Gyrations	50
Design Voids Target (based on %Gmm)	≤ 2.0
Film Thickness	8.0 to 15.0
Aggregate Quality	A
Minimum crushed content	50%
FAA minimum	40
Minimum sand equivalency	50
Friction Aggregate	Minimum 50% Type 4 or better

B. Replacement: Do not use more than 15% binder replacement. Do not use RAS.

2.05 HIGH PERFORMANCE THIN LIFT (CONTINUED)

C. Gradation:

Sieve Size	Minimum Percent Passing	Maximum Percent Passing
1 1/2”		
1”		
3/8”	91	100
No. 4		90
No. 8	27	63
No. 16		
No. 30		
No. 50		
No. 100		
No. 200	2	10

2.06 NOMINAL AGGREGATE SIZE FOR ASPHALT OVERLAYS

Nominal aggregate size dictates lift thickness. Minimum lift thickness should be at least 3 times the nominal maximum aggregate size to ensure aggregate can be aligned during compaction to achieve required density. Therefore, desired lift thickness can direct the decision on nominal aggregate size to use.

PART 3 - EXECUTION

3.01 ASPHALT OVERLAY

Comply with Section 7020, Iowa DOT Section 2303, Section 7040, and the following:

A. Preparation of Existing Pavement:

1. Remove pavement by milling as required by the contract documents. Mill to the depth, cross-section, or profile specified.

2. Sweep existing pavement with approved broom. Provide dust control during brooming.

3. If milling is not required, correct irregularities in existing pavement cross slope with partial patching, full-depth patching, and leveling base coat prior to placing the overlay. Use base or intermediate course mixes to correct irregularities. Surface course thickness per plan.

B. Special Requirements for Thin Lift Overlays and Asphalt Interlayer:

1. Apply tack coat prior to placement of thin lift overlay and asphalt interlayer. Comply with Section 7020.

2. Compact with static steel wheel roller.

3.02 PROTECTION FROM TRAFFIC

Comply with Section 7020, 3.03.

3.03 DEFECTS OR DEFICIENCIES

Comply with Section 7020, 3.04.

3.04 PAVEMENT SMOOTHNESS

Comply with Section 7020, 3.05.

3.05 QUALITY CONTROL

A. General: Comply with Section 7020, 3.06.

B. Special Requirements for Thin Lift Overlays and Asphalt Interlayer:

1. Complete field voids for Class II compaction as defined in Iowa DOT Section 2303.

2. Sample and test from windrow or hopper. Apply Iowa DOT Article 2303.05, A, 3 for AAD acceptance. Air void target is based on approved JMF.

3. Take at least one cold feed each day for gradation control.

3.06 REMOVAL OF PAVEMENT

Comply with Section 7040.

END OF SECTION

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. Asphalt 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. Asphalt: See Section 7020.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Removal of Sidewalk, Shared Use Path, or Driveway:

1. **Removal of Sidewalk:**
   a. **Measurement:** Measurement will be in square yards for the area of sidewalk removed.
   b. **Payment:** Payment will be at the unit price per square yard for the area of sidewalk removal.
   c. **Includes:** Unit price includes, but is not limited to, sawing, hauling, and disposal of materials removed.

2. **Removal of Shared Use Path:**
   a. **Measurement:** Measurement will be in square yards for the area of shared use path removed.
   b. **Payment:** Payment will be at the unit price per square yard for the area of shared use path removal.
   c. **Includes:** Unit price includes, but is not limited to, sawing, hauling, and disposal of materials removed.

3. **Removal of Driveway:**
   a. **Measurement:** Measurement will be in square yards for the area of driveway removed.
   b. **Payment:** Payment will be at the unit price per square yard for the area of driveway removal.
   c. **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, slope and 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, slope and smoothness testing and correction, and testing.

F. Brick/Paver Sidewalk with Pavement Base:

1. **Measurement:** Measurement will be in square yards for the area of brick/paver sidewalk placed on a pavement base. The area of pavement base will not be measured separately.

2. **Payment:** Payment will be at the unit price per square yard for the area of brick/paver sidewalk.

3. **Includes:** Unit price includes, but is not limited to, subgrade preparation, pavement base, setting bed, neoprene asphalt adhesive for asphalt setting bed, setting the bricks/pavers, installing weep holes and associated materials, 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.

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 by Square Yards:**
   a. **Measurement:** Measurement will be in square yards for the thickness of granular surfacing placed.
   b. **Payment:** Payment will be at the unit price per square yard for each thickness of granular surfacing placed.
   c. **Includes:** Unit price includes, but is not limited to, excavation and preparation of subgrade.

1.08 MEASUREMENT AND PAYMENT (Continued)

3. Granular Surfacing for Driveways by Tons:

a. Measurement: Measurement will be in tons for the thickness of granular surfacing placed.

b. Payment: Payment will be at the unit price per ton for each thickness of granular surfacing placed.

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. Sidewalk Assurance Testing:

a. The Contractor will not be responsible for concrete compression or asphalt density testing unless otherwise specified in the contract documents.

b. If the contract documents specify that the Contractor is responsible for concrete compression and asphalt density testing, performed by an independent testing laboratory hired by the Contractor, measurement and payment will be as follows:

1) Measurement: Lump sum item; no measurement will be made.

2) Payment: Payment will be at the contract lump sum price.

c. The Contractor will be responsible for payments associated with all retesting resulting from failure of initial tests.

2. Shared Use Path Assurance Testing:

a. The Contractor will not be responsible for concrete compression or asphalt density testing unless otherwise specified in the contract documents.

b. If the contract documents specify that the Contractor is responsible for concrete compression and asphalt density testing, performed by an independent testing laboratory hired by the Contractor, measurement and payment will be as follows:

1) Measurement: Lump sum item; no measurement will be made.

2) Payment: Payment will be at the contract lump sum price.

c. The Contractor will be responsible for payments associated with all retesting resulting from failure of initial tests.

3. Driveway Assurance Testing:

a. The Contractor will not be responsible for concrete compression or asphalt density testing unless otherwise specified in the contract documents.

b. If the contract documents specify that the Contractor is responsible for concrete compression and asphalt density testing, performed by an independent testing laboratory hired by the Contractor, measurement and payment will be as follows:

1) Measurement: Lump sum item; no measurement will be made.

2) Payment: Payment will be at the contract lump sum price.

c. 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. Use Class A or C concrete for sidewalks and driveways and Class C for shared use paths 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 A or C	Class A 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 ASPHALT

Comply with Section 7020 for mix design.

A. Use Low Traffic (LT), 1/2 inch or 3/8 inch mix.

B. For shared use paths adjacent to pavement that also functions as the pavement shoulder, use Low Traffic (LT), 1/2 inch mix.

C. Use asphalt binder complying with Section 7020 with a performance grade of PG 58-28S or 58-34S.

2.03 BRICKS/PAVERS

A. Clay Bricks: Use 8 inch by 4 inch by 2 1/4 inch thick clay paving bricks with straight edges or a maximum chamfer of 1/8 inch manufactured to comply with ASTM C 902, Class SX, Type I. Color selection and surface texture as approved by the Engineer.

B. Concrete Pavers: Supply as specified in the contract documents. Use pavers with straight edges or a maximum chamfer of 1/8 inch.

2.04 SETTING BED FOR BRICKS/PAVERS

A. Asphalt:

1. 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.

2. Asphalt Binder: Use asphalt binder complying with Section 7020 with a performance grade of PG 58-28 or 64-22.

3. 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.

2.04 SETTING BED FOR BRICKS/PAVERS (CONTINUED)

B. Pre-mixed High Performance Cold Mix: If allowed, substitute a pre-mixed high performance cold mix product for the asphalt setting bed generally meeting the asphalt mixture requirements noted above.

C. Sand: Use clean, hand sand free from deleterious materials. Use sand meeting ASTM C 33 that is uniformly graded with all passing the No. 4 sieve and 3% or less passing the No. 200 sieve.

2.05 NEOPRENE MODIFIED ASPHALT ADHESIVE FOR BRICKS/PAVERS

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/PAVER 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 as specified in the contract documents.

2.07 DETECTABLE WARNINGS

Use manufactured detectable warning panels 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%.

PART 3 - EXECUTION

3.01 REMOVALS

A. Remove sidewalks, shared use paths, driveways, bricks, and curbs to the removal limits specified in the contract documents.

B. Saw pavement full depth in straight lines to the specified removal limits.

C. Remove to the specified removal limits without damage to adjacent property, trees, utilities, or pavement that are to remain in place.

D. Salvage and stockpile all bricks removed.

E. Grind or saw existing curbs at locations specified in the contract documents to install sidewalks, shared use paths, and driveways.

F. Dispose of rubble and debris resulting from removal operations.

3.02 SUBGRADE PREPARATION

A. Shared Use Paths:

1. Subgrade Preparation: Comply with Iowa DOT Section 2109.

2. Special Subgrade Preparation:
   a. Construct subgrade to final elevation.
   b. Scarify and mix the top 6 inches of subgrade material to a width equal to that of the proposed pavement, plus 2 feet on each side.
   c. Compact loose subgrade material with Type A compaction complying with Section 2010.
   d. Proof roll compacted subgrade according to Section 2010.

B. Sidewalks and Driveways:

1. Remove all vegetation and roots from ground surface.

2. Construct grade to final subgrade elevation.
   a. Cut area: Remove all material that will be displaced by the sidewalk.
   b. Fill area: Scarify the surface to be covered with embankment to a depth of at least 6 inches and compact. Construct embankment in lifts of 6 inches or less and compact each lift. Tamp surface with a mechanical tamper until firm and unyielding.

3. Remove all soft, spongy, or yielding spots and fill the void with suitable backfill material.

3.03 ADJUSTMENT OF FIXTURES

A. Adjust fixtures to conform to the finished pavement surface. Cooperate and coordinate with the utility agency to ensure proper fixture adjustment.

B. Comply with Sections 5020, 6010, or 8010 as appropriate.

3.04 PCC SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS

Construct sidewalks and shared use paths to the line and running slope specified in the contract documents. Unless otherwise specified in the contract documents, the maximum cross slope is 2.0%, target cross slope is 1.5%, and minimum cross slope is 1.0%.

A. Form Setting: Comply with Section 7010 with the following additional requirements and exceptions.

1. Slip form paving equipment may be allowed in lieu of setting forms, if approved by the Engineer.

2. Wood forms are allowed.

3. Use of an automated subgrade trimmer is not required.

4. Set forms true to line and grade and hold them rigidly in place by stakes placed outside the forms and flush with or below the top edge of the forms.

5. Measure or stake as required to construct project elements. If either of the following is met and construction survey is not a bid item, the Contracting Authority will verify that form work complies with the design requirements:
   a. The tolerance between the design running slope and the maximum allowable running slope is less than 1.0%.
   b. The tolerance between the design cross slope of the sidewalk, turning space, or shared use path and the maximum allowable cross slope is less than 0.5%.

   If adequate tolerances are contained in the design, the Contracting Authority will not verify the form work for the construction of sidewalks or shared use paths. If field adjustments cause changes that will bring the facility into the range of tolerances shown above, notify the Engineer prior to construction.

B. Concrete Pavement Placement:

1. Shared Use Paths: Comply with Section 7010.

2. Sidewalk:
   a. Maintain moist subgrade in front of paving operation
   b. Deposit concrete on the subgrade as required to minimize rehandling to prevent segregation.
   c. Hand spread with shovels, not rakes.
   d. Place concrete as required to slightly overfill the space between the forms.
   e. For thicknesses less than 5 inches, consolidate by knifing with hand tools. When thickness is 5 inches or greater, consolidate with hand or mechanical vibrators meeting Section 7010, 3.01, C, 3. Smooth by use of a straightedge.
   f. Do not contaminate freshly mixed concrete with earth or other foreign materials.

3. Driveways: Comply with Figures 7030.101 and 7030.102 and Section 7010. The use of a paving machine is not required.

C. Finishing:

1. Shared Use Paths and Driveways:
   a. Comply with Section 7010.
   b. Provide a burlap drag or broom finish.

3.04 PCC SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS (Continued)

2. Sidewalks:
a. Use a wood float to depress the large aggregate and create a dense surface.
b. Allow concrete to set until all shine has disappeared from the surface.
c. Smooth with a metal trowel until surface is free from defects and blemishes.
d. Construct joints by sawing or by using a jointer or groover tool.
e. Finish edges of sidewalk or driveway with an edging tool having a radius of approximately 1/2 inch. Ensure tool marks do not appear on the finished surface.
f. Brush with a soft broom at right angles to the side forms to provide a non-skid surface.

D. Curing: Cure according to Section 7010.

E. Form Removal: Comply with Section 7010.

F. Jointing:

1. Construction Joints:
a. Locate construction joints to provide uniform joint spacing.
b. Place a construction joint at the close of each day's work or when depositing of concrete is stopped for 45 minutes or more.
c. Form construction joint by using a header board. Set perpendicular to the surface and at right angles to the centerline.

2. Transverse Contraction Joints:
a. Shared Use Paths:
1) Space transverse joints equal to the width of the shared use path, or as specified in the contract documents.
2) Saw contraction joints according to Section 7010.
b. Sidewalks and Driveways:
1) Space sidewalk contraction joints equal to the width of the sidewalk.
2) Space driveway contraction joints so panel length does not exceed 12 feet.
3) Form transverse contraction joints to a depth of 1 1/4 inches with a pointed trowel or jointing tool. In lieu of forming, joints may be sawed within 12 hours of placement with a 1/8 inch blade saw to a depth of 1/3 the pavement thickness. Use a straightedge if joints are sawed with a hand-held saw.

3. Longitudinal Contraction Joints:
a. Shared Use Paths and Sidewalks: Saw joint to 1/8 inch wide and to a depth of 1/3 the pavement thickness.
b. Driveways:
1) Space longitudinal contraction joints so panel width does not exceed 12 feet.
2) Form longitudinal contraction joints to a depth of 1 1/4 inches with a pointed trowel or jointing tool. In lieu of forming, joints may be sawed with a 1/8 inch blade saw to a depth of 1/3 the pavement thickness. Use a straightedge if joints are sawed with a hand-held saw.

4. Isolation Joints:
a. Install isolation joints where sidewalks, shared use paths, or driveways abut roadway pavement, parking lots, buildings, and structures.
b. For a sidewalk constructed with a driveway, install an isolation joint on the property side of the sidewalk and a 'C' or 'E' joint on the street side of the sidewalk.
c. Install a 1/2 inch or 3/4 inch thick strip of preformed resilient joint material, according to Section 7010, to the full depth of concrete. Trim any isolation joint material protruding above the finished work to the level of the abutting concrete.
d. If the isolation joint is to be sealed, place the preformed material 1/2 inch below the level of the abutting concrete.

3.04 PCC SIDEWALKS, SHARED USE PATHS, AND DRIVEWAYS (Continued)

5. Joint Sealing:

a. Do not seal construction or contraction joints in sidewalks, shared use paths, or driveways.

b. If sealing of expansion or isolation joints is specified in the contract documents, trim preformed joint material to a depth of 1/2 inch below the concrete surface. Ensure the joint is clean and dry. Install joint sealant per manufacturer's recommendations.

3.05 ASPHALT SHARED USE PATHS AND DRIVEWAYS

Construct sidewalks and shared use paths to the line and running slope specified in the contract documents. Unless otherwise specified in the contract documents, the maximum cross slope is 2.0%, target cross slope is 1.5%, and minimum cross slope is 1.0%. Comply with Section 7020.

3.06 BRICK/PAVER SIDEWALKS WITH A PAVEMENT BASE

A. General:

1. Comply with Figure 7030.203.

2. Use a cross-section and patterns as specified in the contract documents or approved by the Engineer.

3. Do not use broken bricks or materials with stained faces in the paving areas.

4. Construct the concrete base to comply with PCC sidewalk construction specifications.

B. Setting Bed:

1. Place 3/4 inch depth control bars on the base to serve as guides for the striking board. Shim depth control bars as necessary to adjust bedding thickness and to ensure the top surface of pavers will be at the required finished grade.

2. Place bedding material between the parallel depth control bars. Pull striking board over bars several times. After each pass, spread fresh bedding material over low or porous spots to produce a smooth and even setting bed. After placing and smoothing each section, advance depth control bars to next section. After removal of depth control bars and shims, carefully fill any depressions that remain.

3. While still hot, roll the asphalt setting bed with a power roller to a nominal depth of 3/4 inch.

4. Ensure the joints in the concrete base do not project through the asphalt setting bed.

5. Apply neoprene modified asphalt adhesive over the top surface of the cooled asphalt setting bed with notched trowel with serration not exceeding 1/16 inch. Allow adhesive to dry to the touch before placing pavers.

C. Weep Holes:

1. Install 2 inch diameter, 12 inch long, PVC pipe even with the top of the asphalt setting bed at the locations identified on the plans.

2. Fill pipe with 3/4 inch clean rock and cover weep hole with engineering fabric.

3. Install minimum of 12 inch deep and 12 inch wide reservoir of clean 3/4 inch rock around the pipe below the PCC sidewalk base or extend the rock reservoir to the pavement subdrain.

3.06 BRICK/PAVER SIDEWALKS WITH A PAVEMENT BASE (Continued)

D. Bricks/Pavers:

1. Place the bricks/pavers by hand in straight courses with hand tight joints and uniform top surface.

2. Sweep dry joint filler into joints until the joints are completely filled.

3. Fog surface lightly with water to cure cement.

4. Clean any cement stains from bricks/pavers surface. Remove stains from other concrete surfaces.

E. Protection: Protect newly laid bricks/pavers at all times using panels of plywood. Panels can be advanced as work progresses; however, keep the plywood protection in areas that will be subjected to movement of materials, workers, and equipment. Take precautions in order to avoid depressions and protect brick/paver alignment until cured and ready for pedestrian or vehicle traffic.

3.07 DETECTABLE WARNING INSTALLATION

Set detectable warning panels in fresh concrete according to the manufacturer's recommendations and Figure 7030.210.

3.08 SLOPE AND SMOOTHNESS TESTING

A. Slope for Sidewalks, Curb Ramps, Turning Spaces, and Shared Use Paths:

1. Complete slope measurements and documentation according to Iowa DOT Materials I.M. 363.

2. At no additional cost to the Contracting Authority, remove and replace all sections not meeting PROWAG requirements as detailed in SUDAS Design Manual Section 12A-2.

B. Smoothness for Shared Use Paths and Driveways:

1. Check finished surface with a 10 foot straightedge placed parallel to the centerline. Mark areas showing high spots of more than 1/4 of an inch in 10 feet.

2. If directed by the Engineer, correct marked areas by grinding down with an approved grinding tool to an elevation where the area will not show deviations in excess of 1/8 inch.

3.09 GRANULAR DRIVEWAY SURFACING

Comply with Iowa DOT Section 2315.

3.10 CLEANING

A. Remove all litter and construction materials or tools immediately after the end of the curing period.

B. Remove excess dirt from the site.

C. Broom clean completed sidewalks, shared use paths, and driveways.

3.11 MATERIAL TESTING

A. General: When testing is specified in the contract documents as the Contractor's responsibility, provide testing using the services of an independent testing laboratory approved by the Engineer.

B. Concrete Compression Tests: When the concrete volume placed on a single day exceeds 20 cubic yards, comply with the following test requirements. When deficiencies are encountered, comply with Section 7010, 3.07, E.

1. Prepare at least two test cylinders per day.

2. If the concrete volume placed on a single day exceeds 200 cubic yards, prepare two test cylinders for each 200 cubic yards placed.

3. Provide 7 and 28 calendar day tests according to ASTM C 39. Minimum compressive strength is 2,000 psi at 7 days and 4,000 psi at 28 days.

C. Asphalt Density and Thickness Tests: When the area of asphalt placed on a single day exceeds 100 square yards, comply with the following test requirement. When deficiencies are encountered, comply with Section 7020, 3.04, A.

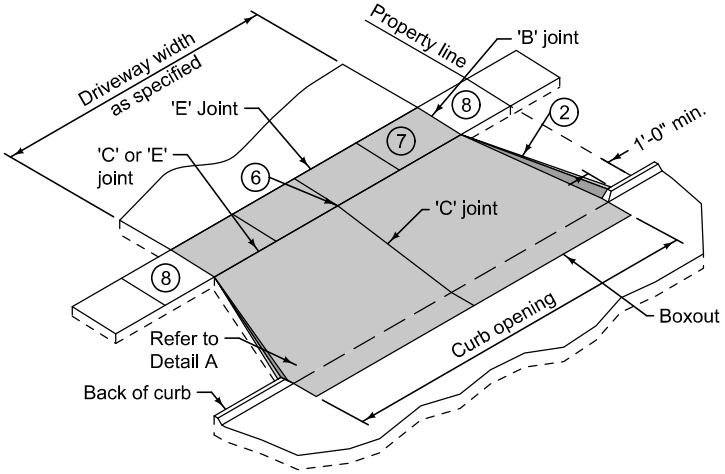
1. Prepare at least two cores per day.

2. If the area of asphalt placed on a single day exceeds 2,000 square yards, prepare two cores for each 2,000 square yards placed.

3.12 SIDEWALK AND CURB RAMP COMPLIANCE

Compliance with cross slopes and grades, as well as all other elements, for sidewalks and curb ramps is crucial. If the construction cannot be completed as specified in the contract documents, it may be necessary to adjust slopes within the accepted legal limitations. Contact the Engineer prior to placement of the concrete if changes from the values specified in the contract documents are being made.

END OF SECTION



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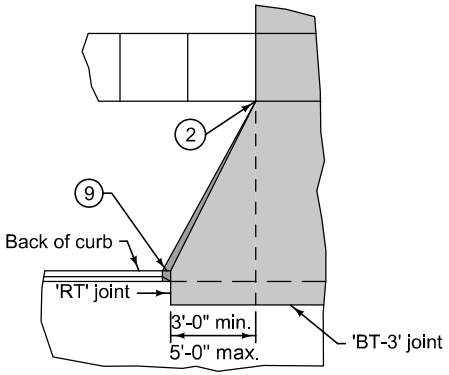
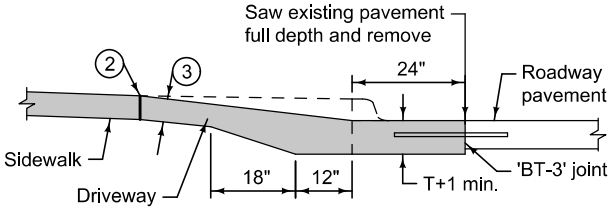
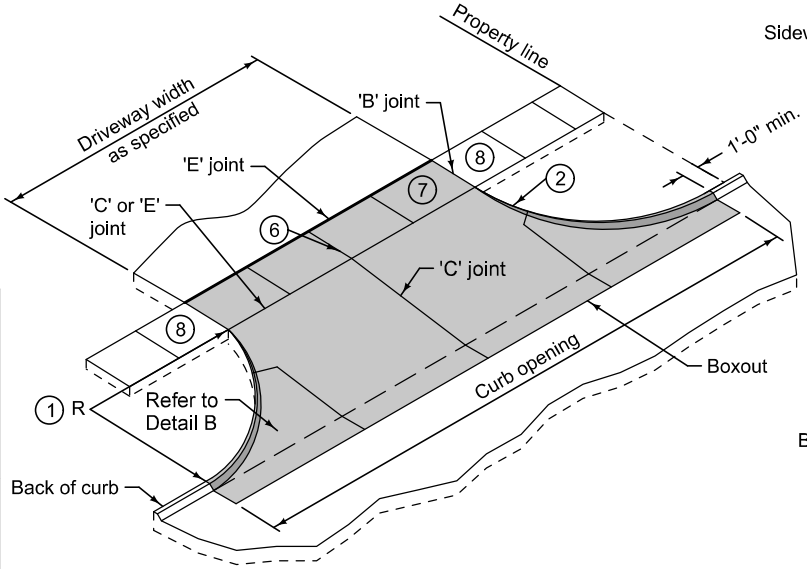


DETAIL A

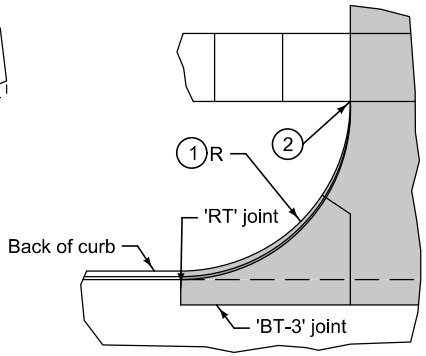
(Residential/Agricultural Only)



SECTION A-A



TYPE B WITH RADII



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.
9. Transition street curb at minimum 1:1 slope to meet driveway curb.

FIGURE 7030.102 | SHEET 1 OF 1

SUDAS

REVISION: 5 | 2023 Edition

7030.102

SHEET 1 of 1

SUDAS Standard Specifications

CONCRETE DRIVEWAY, TYPE B

PAVEMENT REHABILITATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Full and Partial Depth PCC Patches

B. Full and Partial Depth Asphalt Patches

C. Full Depth Composite Patches

D. Diamond Grinding

E. Milling

F. Cleaning and Filling Joints and Cracks

G. Curb and Gutter Replacement

H. Dowel Bar Retrofit

I. Core Hole Cutting and Replacement

1.02 DESCRIPTION OF WORK

A. Construct full depth PCC, asphalt, and composite patches.

B. Construct partial depth PCC and asphalt patches.

C. Grind existing PCC pavement surface for profile improvement using a diamond grinder.

D. Mill the surface of asphalt or PCC pavement to improve the surface profile and cross-section in preparation for resurfacing.

E. Clean and fill longitudinal and transverse joints and random cracks in PCC and asphalt pavement.

F. Remove existing pavement and curb and gutter.

G. Install epoxy coated dowel bars on transverse joints and cracks.

H. Cutting and replacement of pavement cores.

1.03 SUBMITTALS

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

A. PCC mix design.

B. Asphalt mix design.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

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

A. PCC: See Section 7010.

B. Asphalt: See Section 7020

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Full Depth Patches:

1. **Measurement:** Measurement will be in square yards for each type and thickness of full depth patch. Patches less than 2 square yards in area will be considered 2 square yards.

2. **Payment:** Payment will be made at the unit price per square yard for each type and thickness of full depth patch.

3. **Includes:** Unit price includes, but is not limited to, sawing, removing, and disposing of existing pavement and reinforcing; restoring the subgrade; furnishing and installing tie bars and dowel bars; furnishing and placing the patch material, including the asphalt binder and tack coat; forming and constructing integral curb; surface curing and pavement protection; joint sawing and filling; and placing backfill and restoring disturbed surfaces.

B. Subbase Over-excavation:

1. **Measurement:** Measurement will be in tons of subbase material placed for authorized over-excavation.

2. **Payment:** Payment will be made at the unit price per ton of subbase material.

3. **Includes:** Unit price includes, but is not limited to, removal of existing subbase or subgrade, disposal of materials removed, furnishing and placing subbase material, and any additional excavation required for subbase placement.

C. Partial Depth Patches:

1. **Measurement:** Measurement will be in square feet for each type of partial depth patch. Patches less than 1 square foot in area will be considered 1 square foot.

2. **Payment:** Payment will be made at the unit price per square foot for each type of partial depth patch.

3. **Includes:** Unit price includes, but is not limited to, sawing, removing, and disposing of existing pavement; furnishing tack coat or bonding agent; furnishing and placing the patch material; curing; joint filling (PCC patches only); placing backfill; and restoring disturbed surfaces.

1.08 MEASUREMENT AND PAYMENT (Continued)

4. **Extra Payment:** When partial depth patches are constructed to full depth at the direction of the Engineer, payment will be at 2 times the unit price per square foot for each type of partial depth patch.

D. Crack and Joint Cleaning and Filling, Hot Pour:

1. **Measurement:** Measurement will be in linear feet measured along the cracks or joints.

2. **Payment:** Payment will be made at the unit price per linear foot of crack and joint cleaning and filling.

3. **Includes:** Unit price includes, but is not limited to, furnishing crack and joint filler material and routing, sawing, cleaning, and filling joints or cracks.

E. Crack Cleaning and Filling, Emulsion:

1. **Crack Cleaning and Filling, Emulsion:**
   a. **Measurement:** Measurement will be in linear feet measured along the cracks. Map cracked areas will not be measured.
   b. **Payment:** Payment will be made at the unit price per linear foot of crack cleaning and filling.
   c. **Includes:** Unit price includes, but is not limited to, furnishing emulsified crack filler material, cleaning cracks, placing soil sterilant, and filling cracks.

2. **Asphalt for Crack Filling:**
   a. **Measurement:** Measurement will be in tons of asphalt used for filling cracks greater than 1 inch. Quantity will be based upon scale tickets. Mixture not used in the work will be deducted based upon scaled weights.
   b. **Payment:** Payment will be made at the unit price per ton for asphalt used in filling cracks over 1 inch.
   c. **Includes:** Unit price includes, but is not limited to, cleaning, applying tack coat, and furnishing and placing asphalt for crack filling.

F. Diamond Grinding:

1. **Measurement:** Measurement will be in square yards for the area of diamond grinding.

2. **Payment:** Payment will be made at the unit price per square yard of diamond grinding.

3. **Includes:** Unit price includes, but is not limited to, diamond grinding pavement, testing for smoothness according to the contract documents, and removal of slurry and residue from the project site.

G. Milling:

1. **Measurement:** Measurement will be in square yards for the area of milling.

2. **Payment:** Payment will be made at the unit price per square yard of milling.

3. **Includes:** Unit price includes, but is not limited to, milling pavement; furnishing water; and salvaging, stockpiling, and removing cuttings and debris.

1.08 MEASUREMENT AND PAYMENT (Continued)

H. Pavement Removal:

1. **Measurement:** Measurement will be in square yards. No deduction in area will be made for manholes, storm sewer intakes, valve boxes, or other structures less than 2 square yards in area. Pavement removal for patching is included as part of the patching item and will not be measured separately.

2. **Payment:** Payment will be made at the unit price per square yard.

3. **Includes:** Unit price includes, but is not limited to, sawing, breaking, removing, and disposing of existing pavement and reinforcing steel.

I. Curb and Gutter Removal:

1. **Measurement:** Measurement will be in linear feet measured along the back of curb.

2. **Payment:** Payment will be made at the unit price per linear foot of curb and gutter removed.

3. **Includes:** Unit price includes, but is not limited to, sawing, breaking, removing, and disposing of existing curb and gutter.

J. Dowel Bar Retrofit:

1. **Measurement:** Each size of dowel bars satisfactorily placed will be counted.

2. **Payment:** Payment will be made at the contract unit price for each size of dowel bar.

3. **Includes:** Unit price includes, but is not limited to, cutting the slots, preparing the slots, placing and grouting the bars, and curing the surface.

K. Core Hole Cutting and Replacement:

1. **Measurement:** Measurement will be by count of the number of core holes replaced.

2. **Payment:** Payment will be made at the contract unit price per core hole replaced.

3. **Includes:** Unit price includes but is not limited to, cutting the core hole, vacuum excavation, furnishing and placing backfill material and pavement, or replacing the pavement core using waterproof bonding material, if specified.

L. Sampling and Testing: Required sampling and testing for pavement repair and rehabilitation work is incidental to other project costs and will not be paid for separately.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PCC:

1. **Standard Patching:** Use Class C mix complying with Section 7010. Comply with Iowa DOT Materials I.M. 401. Construct all patches as standard patches unless otherwise specified in the contract documents.

2. **High Early Strength Patching:** Use Class M mix complying with Section 7010. Do not use calcium chloride unless otherwise specified in the contract documents.

3. **Partial Depth Patching:** Use a coarse aggregate in concrete mix complying with Iowa DOT Article 4109.02, Gradation No. 5 in the Aggregate Gradation Table.

B. Asphalt: Provide a minimum Low Traffic (LT) mixture complying with Section 7020, unless otherwise specified in the contract documents. Provide mixture with an asphalt binder meeting or exceeding PG 58-28S.

C. Crack and Joint Filler Material:

1. **Hot Pour Crack and Joint Filler:** Comply with Iowa DOT Section 4136.

2. **Emulsified Asphalt Crack Filler:** Provide CRS-2 or CRS-2P emulsions complying with Iowa DOT Section 4140.

3. **Asphalt for Filling Cracks:**
   a. Provide a 3/4 inch, 1/2 inch, or 3/8 inch asphalt mixture complying with Section 7020, or a similar mixture from a commercial source subject to approval from the Engineer.
   b. Upon approval of the Engineer, a high performance bituminous cold premix may be used, depending on the availability of the specified asphalt.

4. **Blotting Material:** Provide sand complying with Iowa DOT Sections 4124 or 4125, or similar sand approved by the Engineer.

5. **Soil Sterilant:** Provide soil sterilant as specified in the contract documents.

D. Primer or Tack Coat Bitumen: Comply with Iowa DOT Article 2303.02.

E. Epoxy for Bonding Dowel and Tie Bars: Comply with Iowa DOT Materials I.M. 491.11.

F. Tie Bars and Dowel Bars: Provide epoxy coated bars complying with Iowa DOT Section 4151 or glass fiber reinforced polymer bars complying with Iowa DOT Section 4156.

G. Subbase Material: Unless otherwise specified in the contract documents, use modified subbase complying with Section 2010.

H. Liquid Curing Compound: Comply with Iowa DOT Section 4105.

I. Sand-cement Grout: Provide a sand-cement grout mixture with a ratio of one part water to one part sand and two parts cement.

J. Preformed Compression Relief Material: Provide 1/4 inch polystyrene, 1/4 inch polyethylene, 1/4 inch Styrofoam, or 3/16 inch waxed coated cardboard.

2.01 MATERIALS (Continued)

K. Epoxy Coated Dowel Bars: Comply with Figure 7010.101 and Iowa DOT Section 4151 for the length and diameter specified. Uniformly coat dowel bars with approved bond breaker according to Iowa DOT Article 4151.02, B. Include tight fitting nonmetallic end caps that allow a minimum of 1/4 inch movement at each end.

L. Dowel Chairs: Prevent movement of the dowel bar during grout placement with epoxy coated or nonmetallic dowel chair devices which provide a minimum clearance of 1/2 inch between the bottom of the bar and the surface upon which the bar is placed and also between the bar and the end walls of the slot.

M. Caulking Filler: Any commercial caulk designed as a concrete sealant that is compatible with the grout material being used.

N. Foam Core Inserts: Provide 3/8 inch ± 1/8 inch thick closed cell foam core board filler faced with film, foil, or poster board material on both sides.

O. Rapid Set Patch Material:

1. Provide a shrinkage compensated rapid set patch material meeting Iowa DOT Materials I.M. 491.20 and the following strength requirements:
   - 3 hour minimum compressive strength of 3,000 psi according to ASTM C 39.
   - 24 hour minimum compressive strength of 5,000 psi according to ASTM C 39.

2. Use grout material from packaged bags or proportioned on site from bulk cementitious materials.
   a. Extend packaged bags with pea gravel, proportioned and mixed according to the manufacturer's recommendations. Fine aggregate additions and water in excess of the manufacturer's recommendations are not allowed.
   b. Use bulk cementitious materials equivalent in composition to the cementitious materials used in packaged bags and proportioned with fine aggregate and water and extended with pea gravel to produce a mixture equivalent to the packaged bag mix meeting the manufacturer's recommendations. Water in excess of the manufacturer's recommendations is not allowed.
   c. Supply fine aggregates meeting Iowa DOT Section 4110.

3. Provide pea gravel with a minimum Class 2 durability meeting the requirements of Iowa DOT Article 4112.03, B and Article 4109.02, Gradation No. 9 in the Aggregate Gradation Table.

4. Use water meeting the requirements of Iowa DOT Section 4102. Potable water obtained from a municipal supply, suitable for drinking, may be accepted without testing.

P. Backfill Material:

1. CLSM or foamed cellular concrete, per Section 3010, 2.06, if required by the Jurisdiction.

2. Class I granular material meeting Section 3010, 2.02, A or pea gravel complying with Iowa DOT Article 4109.02, Gradation No. 21.

Q. Waterproof Bonding Material: Meet ASTM C 928 with a minimum bond strength of 1,500 psi at one day and 2,000 psi at 7 days. Carry an AASHTO H-25 truck load within 1 hour when temperature is 50° F.

PART 3 - EXECUTION

3.01 GENERAL

A. Conduct all operations to minimize inconvenience to traffic. Confine operations to one traffic lane, unless the road is to be closed to traffic. Minor encroachment into the adjacent lane, such as for sawing and installing forms, will be acceptable with the use of a flagger according to MUTCD.

B. Do not remove pavement for either full depth or partial depth patching unless the patch can be completed before the end of the working day.

C. Construct full depth and partial depth patches to the dimensions specified in the contract documents or as marked by the Engineer in the field. Construct all full depth patches to full panel width.

D. Make saw cuts parallel or perpendicular to the centerline.

E. Remove and dispose of materials not designated for salvage.

F. Restore the area outside the pavement by placing and compacting backfill material, placing topsoil, and sodding or seeding as specified in the contract documents.

G. For pavement patches in areas removed to determine utility locations, replace pavement according to Figures 7040.101, 7040.102, 7040.103, and 7040.107 as directed by the Jurisdiction.

3.02 FULL DEPTH PATCHING

A. Pavement Removal:

1. Saw pavement to full depth at the edges of the patch. A second saw cut, 2 inches inside the initial saw cut, may be required to prevent damage to adjacent pavement.

2. Do not damage pavement that is to remain. Do not use heavy equipment adjacent to new concrete until the opening strength is achieved.

B. Restoring Subgrade or Subbase:

1. Excavate 2 inches below the bottom of the existing pavement. If more than 2 inches is excavated, place and compact new subbase material as required to bring the subbase to a level 2 inches below the bottom of the existing pavement. Correct unauthorized over-excavation at no additional cost to the Contracting Authority.

2. Compact the exposed subgrade or subbase by a minimum of four complete passes with a plate-type vibratory compactor with a minimum force rating of 3,500 pounds.

3. When unstable material or excessive moisture is encountered, the Engineer may order removal and replacement of the unstable material.
   a. Remove existing unstable subgrade or subbase, or both, to the depth directed by the Engineer.
   b. Place and compact new subbase material as required to bring the subbase to a level 2 inches below the bottom of the existing pavement.

C. Placing PCC Patches:

1. Equipment: Comply with Iowa DOT Article 2301.03, A, specifications on equipment for standard concrete pavement.

3.02 FULL DEPTH PATCHING (Continued)

2. **Tie Bars and Dowel Bars:** Comply with Section 7010 and the figures in Sections 7010 and 7040.
   a. When there is a common line between two adjacent patches, a bent bar may be placed in a keyway and later straightened.
   b. Coat dowel bars extending into the patch area with a bond breaker. Do not coat tie bars.

3. **Forms:** Comply with Section 7010, 3.02, D, as well as the following.
   a. Use forms on all exposed edges and along the centerline for patches that extend into an adjacent lane, unless full pavement width patches are constructed.
   b. Rigid wood forms may be used in lieu of steel.

4. **Placing, Consolidation, and Finishing the Concrete:**
   a. Moisten the subbase or subgrade.
   b. Except for preplanned joints, place the patch continuously until the patch is completed.
   c. When a delay of 45 minutes cannot be avoided, construct a day's work ('DW') joint.
   d. Carefully place concrete into the patch area to avoid segregation; spread into place and consolidate with a mechanical vibrator. Place full lane width patches over 25 feet in length with a suitable finishing machine that has at least one vibrating screed. Avoid excessive vibrating.
   e. Finish patches per Section 7010, 3.02, I.
   f. For joints with tie bars, tool the edge. For joints with dowel bars, saw to a depth of approximately 1 1/8 inch, leaving an opening of at least 3/8 inch in width to provide a reservoir for joint filler.
   g. Texture the patch to match the adjacent surface.

5. **Curing:** Comply with Section 7010, 3.02, J. Cure the concrete, including exposed vertical edges, immediately after the concrete has been finished and the surface water has evaporated.

6. **Joints:** Construct and fill joints according to Section 7010, 3.02. Place joints at locations specified in the contract documents.

7. **Pavement Protection:** Comply with Section 7010, 3.04.

8. **Use of Pavement:** Comply with opening strength requirements of Section 7010, 3.05. Maturity testing is not required.

D. Placing Asphalt Patches:

1. Use equipment complying with Iowa DOT Article 2303.03. Use of a paving machine is not required.

2. Apply tack coat to the vertical edges of the remaining pavement at a rate of 0.10 to 0.15 gallons per square yard.

3. Place asphalt patch mixture in lifts that will not exceed 3 inches in thickness after compaction, with the top lift not exceeding 2 inches in thickness when compacted.

4. Compact each lift while hot by rolling or compacting with a vibratory compactor. Subsequent lifts may be placed as soon as the preceding lift has been properly compacted.

3.02 FULL DEPTH PATCHING (Continued)

5. Smooth the final lift with a steel-tired finish roller. Ensure the final compacted surface is level with, or no more than 1/8 inch above, the adjacent pavement and has a smooth riding surface. If the patch becomes distorted for any reason, smooth the surface by blading, scraping, grinding, filling, or other approved means.

6. Do not extend patch material beyond the edge of the existing pavement; remove patch material that extends outside the patch limits.

7. Do not open to traffic until the mixture has cooled sufficiently to provide stability.

3.03 PARTIAL DEPTH PATCHING

A. Pavement Removal:

1. Ensure all patches are square or rectangular in shape.

2. For removal by the saw and chip method, cut at the designated removal limits to a minimum depth of 2 inches and a maximum depth of T/2 or the top of the dowels in PCC pavement. For PCC patches, taper the sides of the removal area 30 to 60 degrees from vertical using a pneumatic hammer to eliminate the polished face.

3. Using a 15 pound maximum size pneumatic hammer, remove the deteriorated pavement down to sound pavement. A 30 pound pneumatic hammer may be used if it does not result in damage to the patch area and edges.

4. In lieu of sawing and removal with a pneumatic hammer, the designated patch area may be milled to the prescribed depth. Milling equipment must provide tapered edges 30 to 60 degrees from vertical for PCC patches. Chip out secondary spalling resulting from milling at no additional cost to the Contracting Authority.

5. Remove pavement to the appropriate depth. Do not damage steel reinforcement during the removal process on PCC pavements. Damaged steel will be the responsibility of the contractor. If the end of a dowel bar is exposed, cut and remove the bar. Place duct tape, form oil, grease or use other method approved by the Engineer as a bond breaker on dowels not removed. If the required depth to sound pavement exceeds the maximum T/2 removal depth, construct a full depth patch.

B. PCC Patch Placement:

1. Clean removal area by sandblasting or water blasting, followed by airblasting, until the area is clean and dry. Ensure the compressed air used for cleaning is oil and moisture free. Place concrete the same day as cleaning.

2. Install preformed compression relief material in joints or cracks or tool the joint in the plastic concrete. Use material equal in width to the adjacent joint or crack at the patch boundary. For wide openings, use multiple thicknesses. Compression relief material is to extend at a minimum of 1/4 inch below the bottom of the patch so as to completely separate all patching material on both sides and 3 inches beyond the patch boundaries. If tooling of the joint is specified, complete a relief saw cut to the full depth of the patch plus 1/4 inch as soon as the concrete has reached proper set.

3. Thoroughly coat the bottom and sides of the patch area with a cement grout immediately prior to placement of concrete. Do not allow grout to set prior to placement of concrete. Remove grout set by sandblasting and reapply.

3.03 PARTIAL DEPTH PATCHING (Continued)

4. Deposit concrete in the patch; finish patch from the center outward. Ensure concrete does not infiltrate into existing cracks or joints.

5. Apply joint filler material to expansion joints. At the interface between the patch and the slab, apply sand-cement grout to fill and seal the edge. Position the grout so 1 inch is over the surrounding pavement and 3 inches are over the patch.

6. Texture the patch similar to the adjacent surface.

7. Cure patch according to Section 7040, 3.02.

8. Fill joints according to Section 7040, 3.06. Complete filling within 5 calendar days after patch is placed.

C. Asphalt Patch Placement:

1. Clean removal area by airblasting until the area is clean and dry. Ensure the compressed air used for cleaning is moisture free.

2. Cover the entire removal area with tack coat at a rate of 0.10 to 0.15 gallons per square yard.

3. Place asphalt patch mixture in lifts that will not exceed 3 inches in thickness after compaction, with the top lift not exceeding 2 inches in thickness when compacted.

4. Compact each lift while hot by rolling with an adequately weighted pneumatic tire roller or by tamping with a mechanical tamper. Succeeding lifts may be placed as soon as the preceding lift has been properly compacted.

5. Smooth the final lift with a steel-tired finish roller. Ensure the final compacted surface is level with, or no more than 1/8 inch above, the adjacent pavement and has a smooth riding surface. If the patch becomes distorted for any reason, smooth the surface by blading, scraping, grinding, filling, or other approved means.

6. Do not open to traffic until the mixture has cooled sufficiently to provide stability.

3.04 DIAMOND GRINDING

A. Use equipment complying with Iowa DOT Article 2532.03, A.

B. Grind and texture the entire surface of the pavement parallel to the centerline until the pavement surface on both sides of transverse joints and all cracks are in the same plane with no greater than 1/16 inch difference between adjacent sides of joints and cracks and the pavement surface meets the required smoothness. Feather grind into existing structures such as manholes and water valves in a manner that eliminates abrupt edges or drops and provides a uniform texture.

C. Ensure the ground surface is of uniform texture. In each lane, ensure at least 95% of the area in each 100 foot section has a newly textured surface. Depressed pavement areas due to subsidence or other localized causes and areas containing feathering due to pavement structures will be exempted from texturing requirements.

D. Except at joints and cracks, ensure grinding depth does not exceed 1/2 inch. At joints and cracks, ensure grinding depth does not exceed 3/4 inch.

3.04 DIAMOND GRINDING (Continued)

E. For multiple passes, ensure overlaps do not exceed 1 inch. Begin at the crown of the roadway, proceeding toward the pavement edge with each subsequent pass. Ensure each subsequent pass is at least as deep as the previous pass in order to provide transverse drainage. All passes are to begin and end at the same station location. Ensure no unground areas are left between passes. For grinding adjacent to an unground turn lane or other pavement surface, feather smoothly from the edge of the ground surface to the unground surface leaving no more than a 1/8 inch ridge. If street surface to be ground includes a curb and gutter section, extend grinding to within 4 inches of the curb face and feather to provide proper drainage.

F. Assemble and adjust the grinding head as necessary during the project to produce the following tolerances on pavements with the indicated coarse aggregates. Both the distance between grooves and the texture depth must be within the specified range to be in compliance. Assemble the grinding head to produce the tolerances indicated below for the type of coarse aggregate in the pavement.

	Crushed Stone	Gravel/Quartzite
Width of Land Area Between Grooves*	0.090” to 0.110”	0.080” to 0.095”
Texture Depth**	Target of 1/8” with average between 1/16” and 3/16”	

*Based on an average of a minimum of ten measurements across the ground width for one pass.
**Based on an average of a minimum of six measurements across the ground width for one pass.

G. Prior to enforcement of the tolerances listed above, a test area 300 feet long and the width of the grinding head will be allowed for a new head that has been restacked, provided a surface texture in reasonable conformance with the specifications, as determined by the Engineer, is being produced.

H. Ensure the transverse slope of the ground pavement is uniform to a degree that there are no depressions or misalignment of slope greater than 1/4 inch in 12 feet when tested by string line or straightedge placed perpendicular to the centerline.

I. Continuously remove all slurry or residue resulting from the grinding operations with a well-maintained vacuum system and remove from the project limits. Ensure residue from grinding operations does not flow across lanes occupied by public traffic or into gutters, storm sewers, ditches, or other drainage facilities.

J. Measure smoothness with a 10-foot straightedge. Regrind high spots to ensure no surface deviations greater than 1/8 inch remain. When profilograph testing is specified in the contract documents, comply with Iowa DOT Materials I.M. 341 and the following requirements:

1. Prior to performing any grinding work, provide a control profilogram for each lane and/or segment over 50 feet in length that is to be ground. Ensure pavement is relatively clean and free of debris prior to establishing the control profilogram.

2. Ensure each segment of the finished ground surface has a final profile index less than or equal to 35% of the control profilogram trace or 22 inches per mile, whichever is greater, and does not include any bumps exeeding 1/2 inch in 25 feet.

3. Depressed pavement areas due to subsidence or other localized causes and areas where the maximum cut restricts further grinding will be excluded from testing with the profilograph when approved by the Engineer.

K. Recheck smoothness following any regrinding activities to ensure compliance with the above requirements.

3.05 MILLING

A. Use equipment complying with Iowa DOT Article 2531.03, A.

B. Mill the entire pavement area designated to the depth specified in the contract documents. Mill in straight lines. Make sufficient passes, or cuts, such that all irregularities or high spots are eliminated.

C. Control milling operations to provide a surface that is true within a nominal tolerance of 1/4 inch and 1/4 inch at longitudinal joints where adjacent passes meet. The profile may be inspected by checking with a 10 foot surface checker placed parallel to the centerline. Correct variations greater than 1/4 inch.

D. Load cuttings directly into dump trucks and remove the remaining small cuttings and debris from the street. Sweep the scarified surface with a rotary broom before opening to traffic. Unless otherwise specified in the contract documents, all materials removed are property of the Contractor.

E. Do not operate metal tracked equipment on streets, other than those being milled.

F. Ensure excessive dust does not become airborne during construction. Additional water may be required at any time for dust control.

G. Mill around manholes and utility valves. Correct any damage to manholes or valves by the milling operation at no additional cost to the Contracting Authority.

H. Do not leave a vertical drop of more than 2 inches at the centerline or lane line overnight. Taper the ends of milled sections subject to traffic to provide a uniform and gradual transition.

3.06 CRACK AND JOINT CLEANING AND FILLING, HOT POUR

A. General:

1. Use equipment complying with Iowa DOT Articles 2541.03 (asphalt) and 2542.03 (PCC).

2. Rout or saw joints and cracks with an average opening of 3/8 inch or less to provide a minimum sealant reservoir of 3/8 inch wide by a nominal 1/2 inch deep.

B. Crack and Joint Cleaning:

1. Clean cracks or joints of existing joint filler material, backer rod, vegetation, dirt, and other foreign material.

2. Clean joints or cracks by air blasting or by other methods as necessary to remove debris.

3. If specified in the contract documents, clean wet sawn joints with high pressure water immediately after sawing to remove residue produced by the sawing operation.

4. When cleaned joints or cracks are contaminated before being filled, clean them again before filling.

C. Crack and Joint Filling:

1. Ensure cracks and joints are dry prior to placement of filler material.

3.06 CRACK AND JOINT CLEANING AND FILLING, HOT POUR (Continued)

2. Heat, handle, and apply joint filler material to the proper level as specified in the contract documents and as recommended by the manufacturer.
   a. PCC Pavement: Do not overfill joint or crack with filler material. Immediately remove filler material placed on the pavement surface.
   b. Asphalt Pavement: Slightly overfill the entire crack reservoir with filler material. Smooth with a narrow V-shaped squeegee immediately after placement of the filler material to within 1/2 inch on each side of the crack edge.

4. Place joint filler material when the pavement and ambient air temperatures are 40°F or higher. When near this minimum, additional air blasting or drying time, or both, may be necessary to ensure a satisfactory bond to the joint surfaces.

5. Lanes may be opened to traffic only after the filler material has set sufficiently so it will not pick up under traffic. Blotting material may be applied to the filler material, but only after the surface has set to avoid penetration of the blotting material into the filler material.

3.07 CRACK CLEANING AND FILLING, EMULSION

Use emulsified asphalt for filling cracks in asphalt surfaces only. Do not use on PCC pavements.

A. General:

1. Clean cracks with either high pressure air or water equipment. Do not use water when freezing temperatures exist or are forecasted.

2. Ensure vegetation is removed from cracks. Alternative cleaning methods may be necessary to remove vegetation.

3. When specified in the contract documents, apply a soil sterilant in crack prior to placing the filler material.

4. For filling cracks, use a hand operated wand or pouring pot, capable of placing the filler material into the crack and filling to the adjacent surface. Use a spout or nozzle small enough to place the filler material into the crack without soiling the adjacent surface.

5. Immediately after placement of the filler material, tightly spread the emulsion using a 2 inch, or less, V-shaped rubber-edged squeegee. Take proper measures to hold the filler in place and prevent runout at edge of pavement or at low areas.

B. Cracks Wider Than 1 inch:

1. Clean the cracks of loose and spalled material, sand, and other foreign debris to a depth of 3 inches using high pressure water.

2. When specified in the contract documents, utilize additional methods to clean cracks of old crack filler.

3. Blow the cleaned cracks free of water with high pressure air.

4. Lightly apply a tack coat to the crack surfaces.

3.07 CRACK CLEANING AND FILLING, EMULSION (Continued)

5. Fill the cracks with asphalt.
   a. Ensure mix is warm and pliable when placed.
   b. Rod and tamp the mix into place level with the adjacent surface.
   c. Place mixture prior to filling cracks with emulsion.

6. Place a thin application of emulsion over the asphalt and tightly spread with a squeegee.

C. Cracks 1/4 inch to 1 inch in Width:

1. Clean the cracks of loose and spalled material, sand, and other foreign debris with high pressure air or high pressure water. Clean crack down to sound material, but a depth greater than 3 inches will not be required.

2. When specified in the contract documents, utilize additional methods to clean cracks of old crack filler.

3. Fill cracks with emulsion filler material.

D. Cracks Less Than 1/4 inch in Width:

1. Clean sufficiently to remove sand and other foreign debris.

2. Fill cracks with emulsion filler material.

E. Map-cracked (Alligator) Areas:

1. Cover area with emulsion filler material.

2. Spread emulsion over area with squeegee, working emulsion into cracks. Provide a thin, smooth application.

3. Promptly cover the filler material with a light application of blotter material.

3.08 PAVEMENT REMOVAL

A. Saw full depth at pavement removal limits.

B. Extend pavement removal limits to existing joint lines as directed by the Engineer.

C. Protect existing pavement, beyond removal limits, from damage. Remove to a new saw line and replace, at no additional cost to the Contracting Authority, all concrete broken or damaged beyond the removal limits designated by the Engineer.

3.09 CURB AND GUTTER REMOVAL

A. Saw longitudinally along the existing gutter joint or at a location directed by Engineer. Saw transversely at the curb and gutter removal limits.

B. Remove existing curb and gutter without damaging the existing pavement to remain.

3.10 DOWEL BAR RETROFIT

A. Cutting and Preparing Slots:

1. Cut slots to the required width and depth with gang saw capable of cutting a minimum of three slots in each wheel path simultaneously. Multiple cuts in each slot may be required.

2. Use 30 pound maximum pneumatic hammers operated at a 45 degree angle or less to remove concrete from the slots. Prevent damage to surrounding concrete. Smooth and level the bottom of the slots with a lightweight bush hammer.

3. Sandblast or waterblast to clean exposed surfaces of slot and fill transverse contraction joint on the bottom and sides of the slot with caulking filler.

B. Placing Dowel Bars:

1. Set dowel bars at the depth shown on the plans with chair devices.

2. Ensure dowel bars are parallel to the centerline of the pavements and to the pavement surface.

3. Place dowel bars within 1/4 inch of required alignment.

4. Center dowel bars over transverse joints or cracks so a minimum of 6 inches extends into adjacent panel.

5. Cut foam core material and place at center of dowel bar so the material is flush with the pavement surface or slightly recessed and in line with the joint or crack. Maintain foam core material in vertical position, tight to the slot edges during grout placement.

C. Grouting:

1. Thoroughly moisten all surfaces of the slot immediately prior to filling with grout. Remove any excess water with compressed air.

2. Produce grout with a portable mixer and place immediately after mixing and before grout has attained initial set. Do not retemper grout with water.

3. Place grout according to manufacturer's recommendations. Consolidate with hand held vibrator. If pavement is to be diamond ground place grout 1/8 inch higher than surrounding pavement. Place grout flush if the pavement is not to be ground.

4. Thoroughly coat grout with white pigment curing compound immediately after placement.

D. Re-establish Joints or Cracks: After grout has attained sufficient strength, re-establish joint or crack above the foam core insert within 8 hours of grout placement by means of sawing. If foam board is visible, sawing is not required.

3.11 CORE HOLE CUTTING AND REPLACEMENT

A. Cutting Core:

1. Place a temporary mark on the pavement core and adjacent pavement if the core is to be reinstalled. Maximum diameter is 12 inches.

2. Utilize a diamond bit with the vertical alignment of core hole saw perpendicular to the horizon. Include a center core hole or another mechanism to extract the core without damage.

3. Cut the full depth of the existing pavement. Protect core from damage if it is expected to be re-used.

4. Vacuum or hydro excavate to expose the buried infrastructure. Maintain vertical sides.

B. Backfill: Place backfill using suitable native soil compacted to 95% Standard Proctor Density according to Section 3010, granular material compacted to 65% Relative Density, CLSM, or foamed cellular concrete to the elevation required in Figure 7040.107.

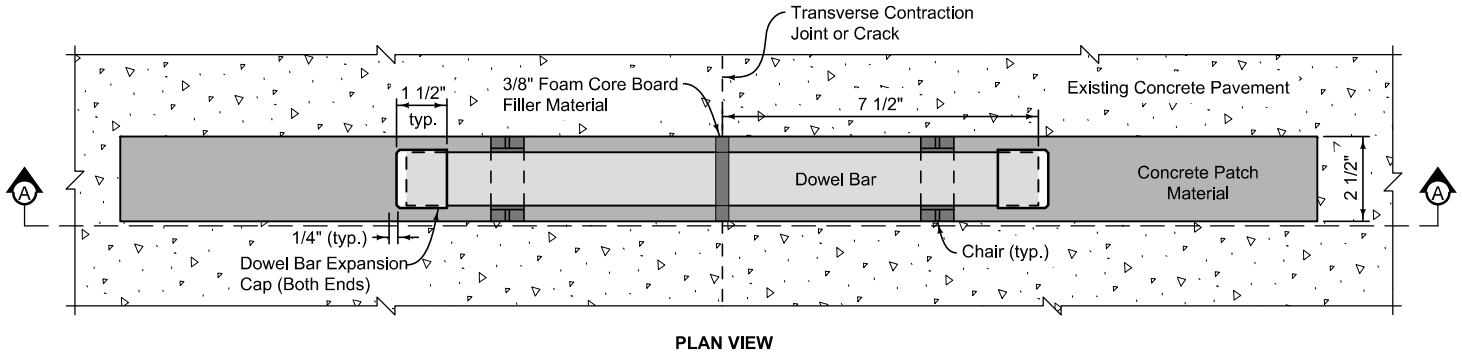
C. Pavement Core Replacement: Comply with Figure 7040.107 and the following.

1. If allowed by the Jurisdiction, replace pavement core utilizing waterproof bonding material. Mix and place bonding material according to the manufacturer's recommendations to fill the annular space around the core and the original slab. Ensure reinstalled core is in its original orientation and is flush and level with the adjacent pavement. Remove excess bonding material.

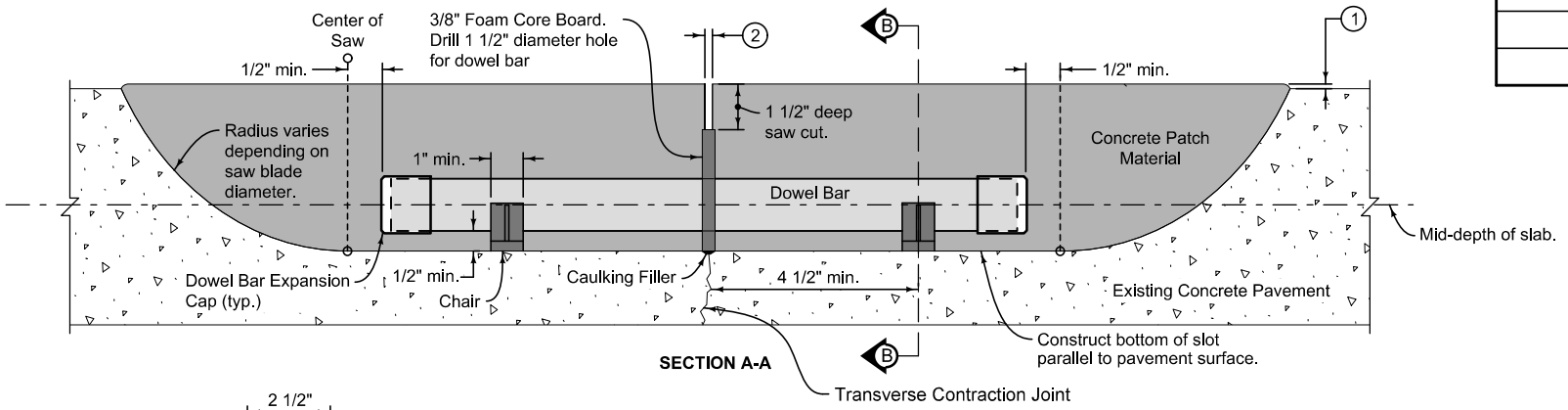
2. For PCC pavement install rebar pins and place low slump concrete to match elevation of existing pavement.

3. For asphalt pavements, use standard traffic surface, 1/2 inch mix, and PG 58-28S binder. Maximum lift thickness is 2 inches. If allowed by the Engineer, replace core with low slump concrete or pre-mixed high performance cold mix generally meeting the asphalt mixture noted above. Match elevation of existing pavement.

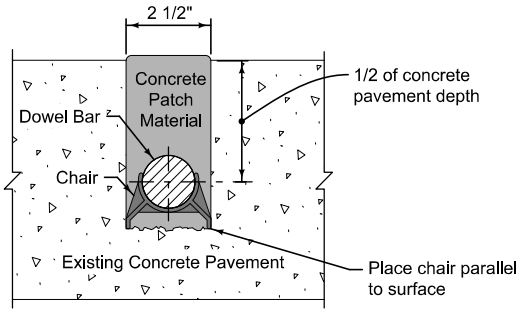
END OF SECTION



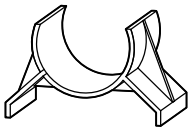
PLAN VIEW



SECTION A-A



SECTION B-B



CHAIR DETAIL

1. Extend concrete patch material 1/8" above existing concrete surface for projects to be diamond ground; construct flush if diamond grinding is not required.
2. Sawcut joint width 3/16" min to 5/16" max. Saw after concrete patch material has set.

DOWEL BAR DIAMETER	
Pavement Thickness (inches)	Diameter (inches)
8 to 9½	1¼
>10	1½

FIGURE 7040.106 | SHEET 1 OF 1

SUDAS

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7040.106

SHEET 1 of 1

SUDAS Standard Specifications

DOWEL BAR RETROFIT

FULL DEPTH RECLAMATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

Full depth reclamation of asphalt roadways

1.02 DESCRIPTION OF WORK

Includes pulverizing and mixing of existing asphalt and underlying materials; addition of stabilizing agents and additives if required; compaction of the reclaimed materials and curing of the compacted street.

1.03 SUBMITTALS

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

A. Prepare and submit the job mix formula to the Engineer for approval prior to initiating full reclaiming operations.

B. Provide quality control test results.

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. Full Depth Reclamation:

1. Measurement: Measurement will be in square yards for the area of roadway reclaimed.

2. Payment: Payment will be at the unit price per square yard of roadway reclaimed.

3. Includes: Unit price includes, but is not limited to, pulverizing and sizing of existing asphalt layers; incorporating and mixing of existing underlying materials; protecting street fixtures; development of a job mix formula; adding and mixing stabilizing agents and additives, if required; compacting the reclaimed mix; shaping of the mix; removing any loose or excess material; curing; and final clean up.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Mechanical Stabilization Agents:

1. **Measurement:** Measurement will be in tons of aggregate.

2. **Payment:** Payment will be at the unit price per ton of aggregate.

3. **Includes:** Unit price includes, but is not limited to, furnishing and placing of aggregate and blending of the aggregates.

C. Bituminous Stabilization Agents:

1. **Measurement:** Measurement will be in gallons of asphalt emulsion or foamed asphalt furnished and incorporated.

2. **Payment:** Payment will be at the unit price per gallon of asphalt emulsion or foamed asphalt furnished and incorporated.

3. **Includes:** Unit price includes, but is not limited to, furnishing and placing of materials and mixing the agent into the reclaimed mix.

D. Chemical Stabilization Agents:

1. **Measurement:** Measurement will be in tons of chemical stabilization agents.

2. **Payment:** Payment will be at the unit price per ton of chemical stabilization agents.

3. **Includes:** Unit price includes, but is not limited to, furnishing and placing of materials and mixing the agent into the reclaimed mix.

E. Microcracking

1. **Measurement:** Measurement will be in square yards for the area of roadway microcracked.

2. **Payment:** Payment will be at the unit price per square yard of roadway microcracked.

3. **Includes:** Unit price includes, but is not limited to, furnishing equipment, protecting street fixtures, completing microcracking, and curing.

F. Interlayer for Cement Stabilized Base

1. **Measurement:** Measurement will be in square yards for each type and thickness of interlayer.

2. **Payment:** Payment will be at the unit price per square yard for each type and thickness of interlayer.

3. **Includes:** Unit price includes, but is not limited to, surface cleaning, furnishing, and placing of the interlayer (if specified).

G. Fixture Adjustment: Comply with Section 6010 for adjustment of manholes and intakes and Section 5020 for adjustment of water valves and fire hydrants.

CRACK AND SEAT EXISTING PCC PAVEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

Crack and seat of existing PCC pavement prior to overlay.

1.02 DESCRIPTION OF WORK

Full-depth saw cut along curbs and in the area of fixtures; cracking of existing PCC pavement; seating of the cracked pavement. Associated work could include subdrain installation; removal and replacement of curb and gutter; removal of existing asphalt overlay or large partial depth patches; vibration monitoring; installing crack control fabric between the leveling course and surface lifts over all full-depth saw cuts; milling of notches along the curb and at the ends of the project.

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

Notify all nearby affected parties 24 hours in advance that vibration generating activities will begin when the pavement cracking operation is ongoing. Report any specific concerns raised by adjacent parties to the Engineer.

1.08 MEASUREMENT AND PAYMENT

A. Crack and Seat of PCC Pavement:

1. **Measurement:** Measurement will be in square yards for the area cracked and seated.

2. **Payment:** Payment will be at the unit price per square yard of roadway cracked and seated.

3. **Includes:** Unit price includes, but is not limited to, notifying adjacent properties, providing traffic control and no parking signs; vibration monitoring if specified; cracking and seating of the designated PCC pavement to the specified pattern; watering to verify crack pattern; protecting existing fixtures; cleaning of slab prior to overlay; and final project site cleanup.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Remove and Replace Curb and Gutter:

1. **Measurement:** Measurement will be in linear feet along the face of the curb for each type and size of curb and gutter removed and replaced.

2. **Payment:** Payment will be at the unit price per linear foot for each type and size of curb and gutter removed and replaced.

3. **Includes:** Unit price include, but is not limited to, full depth sawing; removing and disposing removed materials; furnishing and compacting subgrade material to bring to the proper elevation; all form work required; concrete; placing new curb and gutter; and final cleanup and backfill placement behind the new curb.

C. Full Depth Saw Cut:

1. **Measurement:** Measurement will be in linear feet for the length of full depth saw cut.

2. **Payment:** Payment will be made at the unit price per linear foot of full depth saw cut.

3. **Includes:** Unit price includes, but is not limited to, providing a concrete saw or other cutting device that will result in a full depth vertical edge and severing all tie or reinforcing steel.

D. Milling: Comply with Section 7040.

E. Subdrains: Comply with Section 4040.

F. Fixture Adjustment: Comply with Section 6010 for adjustment of manholes (major and minor) and intakes (minor) and Section 5020 for adjustment of water valves.

G. Intake Adjustment, Major:

1. **Measurement:** Each existing intake adjusted to grade by removal of the boxout including any grate assembly and re-setting the grate or adjusting the open throat elevation of the intake will be counted.

2. **Payment:** Payment will be made at the unit price for each major intake adjustment.

3. **Includes:** Unit price includes, but is not limited to, sawing all three sides of the boxout; removing and replacing the boxout; furnishing and installing a new grate assembly or, if specified, removing and re-setting the existing grate assembly; removing existing open-throat intake grate; adjusting intake walls; furnishing and installing new intake grate or, if specified, re-setting existing intake grate; and furnishing, placing, and compacting backfill.

H. Joint Control Fabric:

1. **Measurement**: Measurement will be in linear feet of 12 inch wide joint control fabric placed.

2. **Payment:** Payment will be made at the unit price per linear foot of joint control fabric placed.

3. **Includes:** Unit price includes, but is not limited to, cleaning and preparing the surface, furnishing, placing, and adhering joint control fabric prior to placing surface lift.

Section 8030 - Temporary Traffic Control **Page No.**

TRAFFIC SIGNALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Underground

B. Detection

C. Communications

D. Cabinet and Controller

E. Poles, Heads, and Signs

1.02 DESCRIPTION OF WORK

This part of the specifications includes the furnishing of all material and equipment necessary to complete, in place and operational, traffic control signal(s) as described in the project plans.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as the additional requirements listed below. All of the following must be submitted within 30 days after awarding of the contract for the project. Verify the method of submittal with the Jurisdiction.

A. Schedule of Unit Prices: Submit a completed schedule of unit prices. Estimates of the work performed on the project will be made by the Jurisdiction and the unit costs will be used to prepare progress payments to the Contractor.

B. Material and Equipment List: Submit a completed list of materials and equipment to the Jurisdiction for written approval before any equipment or materials are ordered.

C. Contractor Certification: Submit the name(s) and contact information of the International Municipal Signal Association (IMSA) Level II Certified Traffic Signal Technician(s) working on the project and a copy of their IMSA certificate.

D. Shop Drawings/Catalog Cuts: Submit PDF shop drawings file for traffic signal poles and structures to be furnished on the project. Submit single PDF of catalog cuts files and list manufacturer's specifications for all items in the project documents.

E. Fiber Optic Cable: Submit a splicing schematic.

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. Comply with the current edition of the MUTCD as adopted by the Iowa DOT.

B. Electrical equipment complying with current NEMA requirements.

C. Ensure materials and work conform to current NEC and IMSA requirements.

1.08 MEASUREMENT AND PAYMENT

A. Traffic Signal:

1. Measurement: Lump sum item; no measurement will be made.

2. Payment: Payment will be at the lump sum price for traffic signal installation. Partial payment will be made according to the approved schedule of unit prices for those materials installed.

3. Includes: Lump sum price includes, but is not limited to, furnishing and installing all pole foundations, poles, wiring, conduit, heads, signs, detection equipment, traffic signal control equipment (including pedestrian equipment), traffic signal controller and cabinet, and associated appurtenances for a complete, fully operation installation.

B. Temporary Traffic Signal:

1. Measurement: Lump sum item; no measurement will be made.

2. Payment: Payment will be at the lump sum price for temporary traffic signal. 80% of the lump sum bid amount will be paid upon completion of the installation and successful initial operation of the signal; the final 20% will be paid upon removal of the temporary traffic signal and cleanup of the site.

3. Includes: Lump sum price includes, but is not limited to, furnishing, installing, maintaining, and removing poles; wiring; traffic signal control equipment including pedestrian equipment if specified; implement all modifications of signal timing, signal placement and display due to Contractor initiated changes in the construction staging plan established by the Contracting Authority; relocation of trailer mounted temporary traffic signal systems; placement in another physical location to address changes in construction staging; and all appurtenances.

C. Traffic Signal Removal:

1. Measurement: Lump sum item; no measurement will be made.

2. Payment: Payment will be at the lump sum price for traffic signal removal.

3. Includes: Lump sum price includes, but is not limited to, removal of poles, concrete pads, foundations, wiring, traffic signal cabinet and equipment, pedestrian signal equipment, and handholes; delivery of removed materials to the location specified in the contract documents; furnishing, placing, and compacting backfill in all excavations; and restoring disturbed surfaces.

2.01 UNDERGROUND (Continued)

d. Single-Mode Fiber: Meet attributes of ITU-T G.652.D Table 2 and/or ITU-T G.657.A1 for low loss bend as specified in the contract documents.
e. Glass reinforced plastic rod central member designed to prevent the buckling of the cable. Cable core interstices filled with water blocking tape to prevent water infiltration. Dielectric fillers may be included in the cable core where needed to lend symmetry to the cable cross-section.
f. Buffer tubes of dual layer construction with a polycarbonate inner layer and polyester outer layer. Each buffer tube filled with a water-swellable yarn or tape. Buffer tubes stranded around the central member using reverse oscillation or “SZ” stranding process. Gel-free cable and buffer tubes.
g. Buffer tubes and fibers meeting TIA/EIA-598A, “Color coding of fiber optic cables,” with 12 fibers per buffer tube.
h. Cable tensile strength provided by a high tensile strength aramid yarn and/or fiber glass.
i. Dielectric cables, without armoring, or armored cables with corrugated steel tape armor as specified in the contract documents. Outer jacket of medium density polyethylene applied directly over the tensile strength members and flooding compound. Jacket or sheath marked in a contrasting color with the manufacturer's name and the words “Optical Cable,” the year of manufacture, and sequential meter or feet marks. Additionally, provide a durable weather proof label on the cable jacket showing the actual attenuation of each fiber expressed in dB/km.
j. Cable fabricated to withstand a maximum pulling tension of 600 pounds during installation (short term) and 135 pounds upon installation (long term).
k. Shipping, storing, and operating temperature range of the cable: -40° C to + 70° C. Installation temperature range of cable: -30° C to + 70° C.
l. Each fiber of all fiber optic cable tested by manufacturer at the 100% level for the following tests:
    - Proof tested at a minimum load of 50 kpsi (350 Mpa)
    - Attenuation
m. Meet the appropriate standard Fiber Optic Test Procedure for the following measurements:
    - Fluid Penetration
    - Compound Drip
    - Compressive Loading Resistance
    - Cyclic Flexing
    - Cyclic Impact
    - Tensile Loading and Bending
n. Make cable ends available for testing. Seal cable ends to prevent moisture impregnation.
o. Fiber Distribution Panel: Provide a fiber distribution panel capable of terminating the number of fibers as specified in the contract documents.
p. Fiber Optic Connectors:
    1) ST type connectors of ceramic ferrule and physical contact end finish to terminate multi-mode fibers to equipment.
    2) SC type connectors of ceramic ferrule and physical contact end finish to terminate single-mode fibers to equipment.
    3) ST or mechanical connectors not allowed for cable splices.
    4) Maximum attenuation per connector: 0.75 dB.
q. Fiber Optic Jumpers/Patch Cords: For connections in the cabinet, provide factory-assembled duplex pigtail jumpers with dielectric strength member, durable outer jacket and ST or SC compatible connectors. Provide adequate length for connections and 2 feet minimum slack.
r. Fiber Optic Breakout Kits: Provide breakout kits for separation and protection of individual fibers, with buffering tube and jacketing materials suitable for termination of the fiber and fiber optic connector.

2.01 UNDERGROUND (Continued)

s. Splices/ Splice Enclosures: Fusion splice continuous fiber runs or branch circuit connections in splice enclosures as allowed or specified in the contract documents. Provide environmentally protected outside plant splice enclosures with adequate number of trays to splice all fibers. Do not splice continuous fibers unless physical restraints require all fibers to be cut, unless approved by the Jurisdiction. Maximum attenuation per splice: 0.3 dB.

D. Footings and Foundations:

1. Use Class C structural concrete complying with Iowa DOT Section 2403.

2. Use uncoated reinforcing steel complying with Iowa DOT Section 4151.

E. Bonding and Grounding:

1. Ground Rods: Provide 5/8 inch by 8 foot copper clad, steel ground rod.

2. Bonding Jumper or Connecting Wire: Provide #6 AWG bare conductor, copper wire.

2.02 DETECTION

A. Inductive Loop Vehicle Detector: A detector consists of a conductor loop or series of loops installed in the roadway, lead-in (feeder) cable, and a sensor (amplifier) unit with power supply installed in a traffic signal controller cabinet.

1. Cables:
a. Tube Loop Detector Cable: Comply with IMSA Specifications 51-5.
b. Preformed Loop Detector Cable: As approved by the Engineer.
c. Loop Detector Lead-in Cable: Comply with IMSA Specifications 50-2.

2. Detector Loop Sealant:
a. Use a rapid cure, high viscosity, liquid epoxy sealant formulated for use in sealing inductive wire loops and leads embedded in pavement. Ensure the cured sealer is unaffected by oils, gasoline, grease, acids, and most alkalis.
b. Use a sealant complying with Iowa DOT Materials I.M. 491.18.

3. Sensor (Amplifier) Unit:
a. Use a sensor unit that is solid state, digital, providing detection channel(s) with an inductance range of 0 to 2,000 micro-henries. Output circuits of the sensor unit will be provided by relays. Vehicle presence will result in a continuous call indication.
b. Provide a sensor unit with the following qualities:
1) Sensitivity adjustment to allow as a minimum the selection of high, medium, or low sensitivity.
2) Be capable of providing reliable detection of all licensed motor vehicles.
3) Provide an indicator light for visual indication of each vehicle detection.
4) Will not require external equipment for tuning or adjustment.
5) Provide operation in the pulse mode or presence mode. Ensure mode switch is readily accessible.
6) Provide a self tuning system that is activated automatically with each application of power. Provide automatic and continuous fine tuning to correct for environmental drift of loop impedance.
7) Provide for fail-safe operation (continuous call) in the event of detector loop failure.
8) Ensure each detector channel will respond to a frequency shift in an increasing or decreasing value as occurs with temperature shifts in the pavement without requiring a locked call.

2.05 POLES, HEADS, AND SIGNS (Continued)

3. LED Module:

a. Provide a LED unit(s) for the filled upraised hand symbol, walking person symbol, and countdown timer.
b. Ensure immediate blank out of the countdown timer display upon recognizing a shortened “Walk” or a shortened "Flashing Don't Walk" interval.
c. Comply with current ITE standards and consistent with cabinet voltage requirements.

C. Traffic Signal Poles and Mast Arms:

1. General:

a. Use mast arm length and vertical pole height as specified in the contract documents.
b. Ensure the mast arms, poles, and supporting bases are galvanized on both interior and exterior surfaces according to ASTM A 123.
c. Use continuously tapered, round, steel poles of the transformer base type for poles with mast arms 60 feet or less. Fabricate poles from low carbon (maximum carbon 0.30%) steel of U.S. standard gauge.
d. For poles with mast arms greater than 60 feet or when a transformer base is not specified, provide a 6 inch by 16 inch handhole in the pole shaft for cable access. Provide a cover for the handhole. Secure the cover to the base with simple tools. Use corrosion resistant hardware.
e. Ensure minimum yield strength of 48,000 psi after manufacture. Supply base and flange plates of structural steel complying with ASTM A 36 and cast steel complying with ASTM A 27, Grade 65-35 or better.
f. Where a combination street lighting/signal pole is specified in the contract documents, ensure the luminaire arm is mounted in the same vertical plane as the signal arm unless otherwise specified. Use a luminaire arm of the single member tapered type. Fabricate the pole with a minimum 4 inch by 6 inch handhole and cover located opposite the signal mast arm.
g. If allowed by the Engineer, poles and mast arms may be fabricated by shop welding two sections together, resulting in a smooth joint as follows:
    1) Ensure a minimum of 60% penetration for longitudinal butt welds in plates 3/8 inch and less in thickness, except within 1 foot of a transverse butt-welded joint. Ensure a minimum of 80% penetration for longitudinal butt welds in plates over 3/8 inch in thickness.
    2) Ensure 100% penetration for longitudinal butt welds in poles and arms within 1 foot of a transverse butt-welded joint.
    3) Ensure 100% penetration for transverse butt welds by using a back-up ring or bar to connect the sections.
    4) Examine the full length of all transverse butt welds and 100% penetration longitudinal butt welds by ultrasonic inspection according to the requirements of ANSI/AWS D1.1.
    5) Comply with ANSI/AWS D1.1 except as modified by Iowa DOT Article 2408.03, B.
h. For mast arms over 50 feet length, two-piece mast arms with a slip-fit and bolt connection are allowed.
i. Provide non-shrink grout (complying with Iowa DOT Materials I.M. 491.13) or a rodent guard (complying with Iowa DOT Materials I.M. 443.01) for placement between the pole base and the foundation per the manufacturer’s requirements.

2.05 POLES, HEADS, AND SIGNS (Continued)

2. **Pole Design:** Comply with AASHTO 2013 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. Use a 90 mph basic wind speed with a 50 year mean recurrence interval for strength design. Use Category II for fatigue design. Apply only natural wind gust loads (i.e. do not apply galloping loads, vortex shedding loads, or truck-induced gust loads) for fatigue design. Install vibration mitigation devices that mechanically or statically minimize vibration on the mast arm caused by wind on all traffic signal pole mast arms over 60 feet in length as shown on Figure 8010.105.

3. **Hardware:**
   a. **General:**
      1) Equip poles and mast arms with all necessary hardware and anchor bolts to provide for a complete installation without additional parts.
      2) Furnish each anchor bolt with one leveling nut, one anchoring nut, and one jam nut (if required) on the exposed end and one of the following on the embedded end: nut, nut and plate, or nut and anchor bolt assembly ring plate. Use anchor bolts, nuts, and washers that comply with Iowa DOT Materials I.M. 453.08.
   b. **Anchor Bolts:**
      1) Use straight full-length galvanized bolts.
      2) Comply with ASTM F 1554, Grade 105, S4 (-20°F).
      3) Threads are to comply with ANSI/ASME B1.1 for UNC thread series, Class 2A tolerance.
      4) The end of each anchor bolt intended to project from the concrete is to be color coded to identify the grade.
      5) Do not bend or weld anchor bolts.
   c. **Nuts:**
      1) Comply with ASTM A 563, Grade DH or ASTM A 194, Grade 2H.
      2) Use heavy hex.
      3) Use ANSI/ASME B1.1 for UNC thread series, Class 2B tolerance.
      4) Nuts may be over-tapped according to the allowance requirements of ASTM A 563.
      5) Refer to Section 8010, 3.05, B, 2 for tightening procedure and requirements.
   d. **Washers:** Comply with ASTM F 436 Type 1.
   e. **Galvanizing:** Galvanize entire anchor bolt assembly consisting of anchor bolts, nuts, and washers (and plates or anchor bolt assembly ring plate, if used) according to the requirements of ASTM B 695, Class 55 Type 1 or ASTM F 2329 with zinc bath temperature limited to 850°F. Galvanize entire assembly by the same zinc-coating process, with no mixed processes in a lot of fastener assemblies.

D. Traffic Signal Pedestal Poles:

1. **Materials:**
   a. **Pedestal:** The height from the bottom of the base to the top of the shaft as specified in the contract documents.
   b. **Pedestal Shaft:** Schedule 80 with satin brush or spun finish aluminum tubing. Top of the shaft outer diameter to be 4 1/2 inches and provided with a pole cap. Supply base collar for poles with shaft lengths greater than 10 feet. Provide brackets to mount pedestrian signal on side of pole.
   c. **Pedestal Base:** Cast aluminum, square in shape, with a handhole.
      1) Handhole: Minimum of 3 1/2 inches by 5 1/2 inches and equipped with a cast aluminum cover that can be securely fastened to the base with the use of simple tools.
      2) Base: A breakaway base with a four bolt pattern uniformly spaced on a minimum of 6 inch diameter bolt circle. Meet or exceed AASHTO breakaway requirements.

2.05 POLES, HEADS, AND SIGNS (Continued)

2. Anchor Bolts: Four 5/8 inch by 7 1/2 inch steel (minimum), hot dip galvanized anchor bolts complying with ASTM F 1554, Grade 36, meeting pole manufacturer requirements for installation, complete with all hardware required for installation. For pedestal pole sidewalk mounting, provide anchor bolts and hardware per pole manufacturer requirements.

E. Traffic Signs:

1. Sheet aluminum and retroreflective sheeting complying with Iowa DOT Section 4186.

2. Use a universally adjustable mast arm mounted sign bracket.

3. Comply with MUTCD and the contract documents for the street name sign dimensions, letter height, and font.

PART 3 - EXECUTION

3.01 UNDERGROUND

A. Handhole:

1. Locations:
a. Do not construct in ditch bottoms, low areas where ponding of water may occur, or where they will be subject to normal vehicular traffic.
b. With Engineer approval, additional handholes may be placed, at no additional cost to the Contracting Authority, to facilitate the work.

2. Excavation: Excavate as necessary to accommodate the handhole and granular base.

3. Granular Base: Install 8 inch thick granular base extending a minimum of 6 inches beyond the outside walls of the handhole.

4. Placement:
a. In paved areas, install the handhole at an elevation so the casting is level and flush with the pavement. In unpaved areas, install the handhole approximately 1 inch above the final grade.
b. Verify ring placement. Invert rings when installed in paved areas.

5. Conduit:
a. Remove knockouts as necessary to facilitate conduit entrance.
b. Extend conduit into the handhole, through a knockout, approximately 2 inches beyond the inside wall. Conduit to slope down and away from the handhole.
c. Place non-shrink grout (complying with Iowa DOT Materials I.M. 491.13) in the opening of the knockout area after placement of conduit.

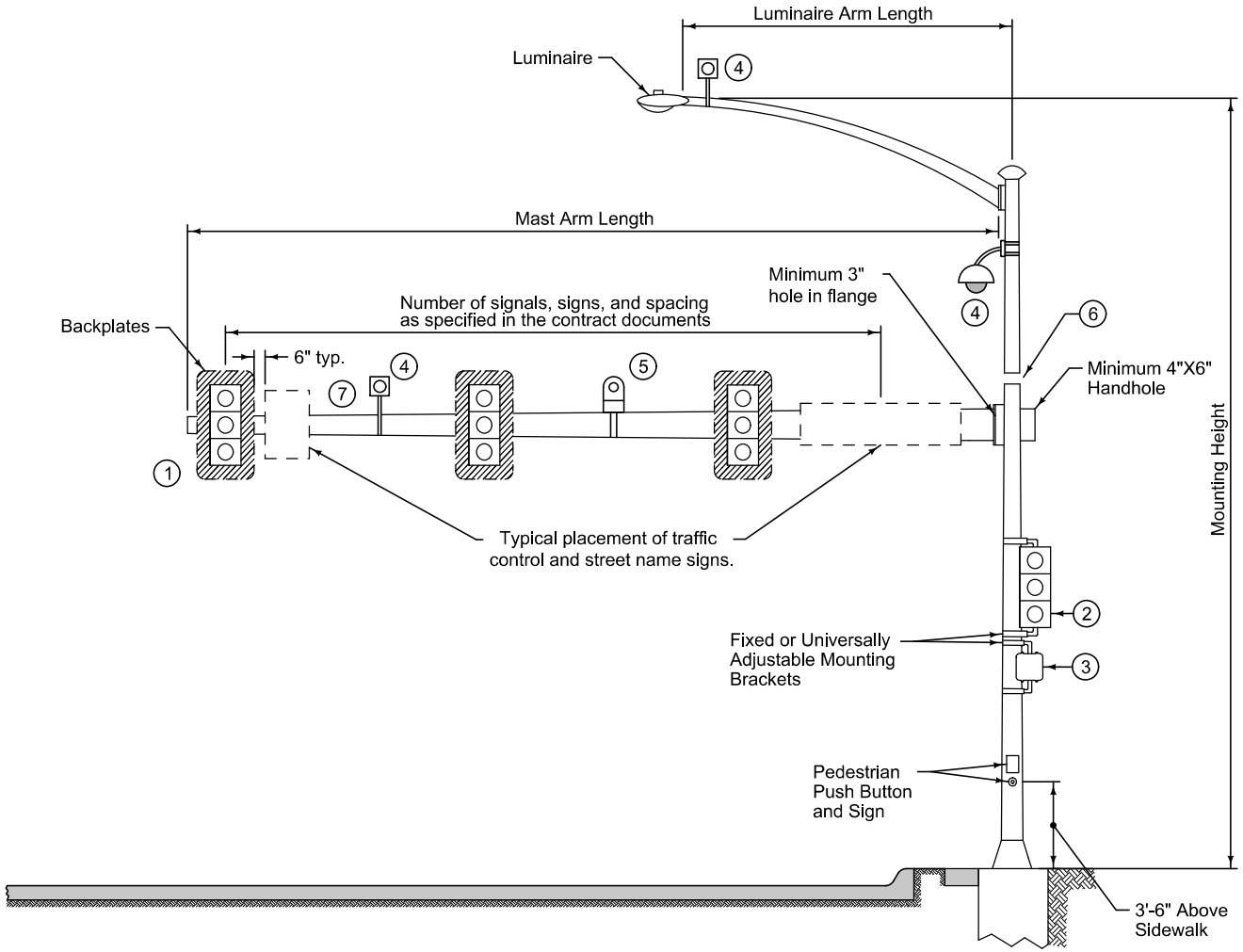
6. Cable Hooks:
a. Install cable hooks centered between the knockouts and the top of the handhole anchored within the handhole wall.
b. Place non-shrink grout (complying with Iowa DOT Materials I.M. 491.13) in the opening around the hook after placement of the hook.

7. Backfill: Place suitable backfill material according to Section 3010.

8. Casting: Place the casting on the handhole. Ensure the final elevation meets the handhole placement requirements.

B. Conduit:

1. General:
a. Place conduit to a minimum depth of 30 inches and a maximum depth of 60 inches below the gutterline, unless utility conflicts require deeper placement. When conduit is placed behind the curb, place to a minimum depth of 24 inches and a maximum depth of 48 inches below top of curb.
b. Change direction at handholes or by bending, such that the conduit will not be damaged or its internal diameter changed. Ensure bends are uniform in curvature and the inside radius of curvature of any bend is no less than six times the internal diameter of the conduit.
c. On the exposed ends of conduit, place bell-end fittings on PVC or HDPE conduit and bushings on steel conduit prior to installing cable. Extend all conduits a minimum of 2 inches and a maximum of 4 inches above the finished surface of any foundation, footing, or structural base.



STEEL MAST ARM POLE

1. Ensure the top of the signal housing is no more than 25.6 feet above the pavement. Ensure the bottom of the signal housing and related attachments are at least 15 feet above the pavement.
2. Ensure the bottom of the signal housing (including brackets) that is not located over a roadway is a minimum of 10 feet and a maximum of 19 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.
3. Mount pedestrian signal heads with the bottom of the signal housing (including brackets) no less than 7 feet or more than 10 feet above the sidewalk level. Position and adjust heads to provide maximum visibility at the beginning of the controlled crosswalk.
4. Possible video camera location.
5. Possible EVP detector.
6. Pole cap if no luminaire extension.
7. Install wind vibration dampening device on mast arms greater than 60 feet in length. Locaton and mounting method as specified by manufacturer.

FIGURE 8010.105

SHEET 1 OF 1

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SHEET 1 of 1

SUDAS Standard Specifications

MAST ARM POLE DETAILS

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide pavement marking materials complying with Iowa DOT Sections 2527 and 4183.

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
   d. Methyl methacrylate (MMA), two component paint

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 each 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)

2. Temperature Restrictions:

a. Waterborne and Solvent Based Paint Pavement Markings: Comply with Table 8020.05.

Table 8020.05: 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 per Iowa DOT Materials I.M. 483.03	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 TRAFFIC CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary Traffic Control Devices

B. Installation

C. Maintenance

D. Quality Control

1.02 DESCRIPTION OF WORK

This part of the specifications includes materials, equipment, and procedures for traffic control during construction. Furnish, erect, operate, maintain, move, and remove all traffic control devices required. Comply with the current edition of the MUTCD as adopted by the Iowa DOT.

1.03 SUBMITTALS

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

A. Submit a traffic control plan for review and approval prior to installation.

B. Submit proposed modifications to the traffic control plan for review and approval prior to making changes.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

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 Temporary Traffic Control 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 temporary traffic control, all costs incurred by the contractor for temporary traffic control are incidental to other work and will not be paid for separately.

1.08 MEASUREMENT AND PAYMENT

A. Temporary Traffic Control:

1. **Measurement:** Lump sum item; no measurement will be made.

2. **Payment:** Payment will be at the lump sum price for temporary traffic control. Proportional payments will be made equal to the percentage of the dollar amount paid on the original contract amount.

3. **Includes:** Lump sum price includes, but is not limited to, installation, maintenance, and removal of temporary traffic control; total roadway closures with installation and removal of detour signing as shown in the contract documents; removal and reinstallation or covering of permanent traffic control devices that conflict with the temporary traffic control plan; monitoring and documenting traffic control conditions; and flaggers. When required in the contract documents, the following are also included in traffic control unless a separate bid item is provided: portable dynamic message signs, temporary barrier rail, temporary flood lighting, and pilot cars.

TRAFFIC SIGNS AND POSTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Traffic Signs

B. Traffic Posts

C. Removal of Signs and Posts

1.02 DESCRIPTION OF WORK

This part of the specifications includes materials, equipment, and procedures for furnishing, erecting, and removing traffic signs. Comply with the current edition of the MUTCD as adopted by the Iowa DOT.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants, as well as submitting shop drawings showing the dimensions of each sign and type of post provided for in the contract documents for review prior to installation.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, HANDLING, AND SALVAGING

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 bid items for traffic signs and posts are included on the proposal form, comply with this section for measurement and payment, materials, and execution.

B. When the proposal form does not include a bid item for traffic signs and posts, the Contracting Authority will be responsible for furnishing and installing traffic signs and posts.

1.08 MEASUREMENT AND PAYMENT

A. Traffic Signs by Each:

1. **Measurement:** Each type and size of sign as designated in the contract documents will be counted.

2. **Payment:** Payment will be at the unit price for each type and size of sign.

3. **Includes:** Unit price includes, but is not limited to, the sign blank, application of reflective sheeting, application of screened message, all mounting hardware, and erecting the sign according to the traffic control technician's direction.

B. Traffic Signs by Area:

1. **Measurement:** Measurement will be in square feet of sign area, which will be determined based on the nominal dimensions of each sign. Cutouts for rounded corners will not be deducted.

2. **Payment:** Payment will be at the unit price per square foot of sign.

3. **Includes:** Unit price includes, but is not limited to, the sign blank, application of reflective sheeting, application of screened message, all mounting hardware, and erecting the sign according to the traffic control technician's direction.

C. Wood Posts:

1. **Measurement:** Measurement will be in linear feet for each 4 inch by 4 inch post measured to the nearest foot.

2. **Payment:** Payment will be made at the unit price per linear foot of wood post.

3. **Includes:** Unit price includes, but is not limited to, furnishing and erecting the post, including treatment and other details necessary to provide a complete installation.

D. Perforated Square Steel Tube Posts:

1. **Measurement:** Measurement will be in linear feet for each perforated square steel tube post measured to the nearest foot.

2. **Payment:** Payment will be made at the unit price per linear foot of perforated square steel tube post.

3. **Includes:** Unit price includes, but is not limited to, fabricating, furnishing, and erecting the post and other details required to provide a complete installation.

E. U-Shaped Rail Steel Posts:

1. **Measurement:** Measurement will be in linear feet for each U-shaped rail steel post measured to the nearest foot.

2. **Payment:** Payment will be made at the unit price per linear foot of U-shaped rail steel post.

3. **Includes:** Unit price includes, but is not limited to, fabricating, furnishing, and erecting the post and other details required to provide a complete installation.

1.08 MEASUREMENT AND PAYMENT (Continued)

F. Round Steel Posts:

1. **Measurement:** Measurement will be in linear feet for each round steel post measured to the nearest foot.

2. **Payment:** Payment will be made at the unit price per linear foot of round steel post.

3. **Includes:** Unit price includes, but is not limited to, fabricating, furnishing, and erecting the post and other details required to provide a complete installation.

G. Perforated Square Steel Tube Post Anchors:

1. **Measurement:** Each type and size of anchor will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of anchor.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing the anchor, coring pavement and filling with concrete, if required, slip base hardware, and other details necessary to provide a complete installation.

H. Round Steel Post Anchors:

1. **Measurement:** Each type and size of anchor will be counted.

2. **Payment:** Payment will be made at the unit price for each type and size of anchor.

3. **Includes:** Unit price includes, but is not limited to, furnishing and installing the anchor, coring pavement and filling with concrete, if required, slip base hardware, and other details necessary to provide a complete installation.

I. Remove and Reinstall Traffic Signs:

1. **Measurement:** Each sign removed and reinstalled will be counted.

2. **Payment:** Payment will be at the unit price for each sign removed and reinstalled.

3. **Includes:** Unit price includes, but is not limited to, removing the sign and post, filling the post hole, storing and maintaining the sign and post in good condition, and reinstalling the sign and post. Replacing signs and posts designated for reinstallation that have been damaged is the Contractor's responsibility.

J. Remove and Salvage Traffic Sign Assembly:

1. **Measurement:** Count each sign assembly removed and salvaged.

2. **Payment:** Payment will be at the unit price for each sign assembly removed and salvaged.

3. **Includes:** Unit price includes, but is not limited to, removing the sign assembly, removing the post and anchor hardware, filling the post hole, and delivering the traffic sign and post to the site designated by the Contracting Authority. Replacing signs and posts designated for salvage that have been damaged is the Contractor's responsibility.

PART 2 - PRODUCTS

2.01 GENERAL

Use products and materials complying with the MUTCD and the current edition and approved supplements of the Standard Highway Signs manual as developed by the FHWA.

2.02 SIGNS

A. Blank Material: Sheet aluminum or galvanized steel complying with Iowa DOT Article 4186.02.

B. Size and Type:

1. **Regulatory Signs:** As indicated in the contract documents or complying with Chapter 2B and Table 2B-1 of the MUTCD.

2. **Warning Signs:** Comply with Table 8040.01. For object markers, see Figure 5C-1 of the MUTCD.

Table 8040.01: Warning Signs

Speed Limit (mph)	Minimum Sign Size	Minimum Uppercase Letter Size	Minimum Plaque Size
< 25	30” x 30”	4”	18” x 18”
25 - 35	36” x 36”	5”	18” x 24”
>35	48” x 48”	7”	24” x 30”

3. **Guide Signs:** As indicated in the contract documents or complying with Chapter 2D and Table 2D-1 of the MUTCD.

4. **Bicycle Signs:** As indicated in the contract documents or complying with Chapter 9B and Table 9B-1 of the MUTCD.

C. Retroreflective Sheeting: Comply with Iowa DOT Article 4186.03. Supply Type XI - diamond grade, unless Type IV - high intensity is specified in the contract documents.

D. Fabrication: Comply with Iowa DOT Article 4186.06.

2.03 POSTS

A. Wood Posts: Comply with Iowa DOT Section 4164.04 for treated 4 inch by 4 inch posts.

B. U-Shaped Rail Steel Posts: 3.0 pounds per foot, conforming with ASTM A 499, Grade 60. Punch or drill 3/8 inch diameter holes on the centerline, spaced 1 inch on center, starting 1 inch from the top and extending to the bottom of the post.

C. Perforated Square Steel Tube Posts and Anchors: Minimum 2 inch square perforated steel tubing complying with Iowa DOT Article 4186.10.

D. Round Steel Posts and Anchors: Minimum 2 3/8 inch diameter round 16 gauge galvanized steel with 0.06 inch minimum wall thickness. Furnish anchors 2 3/8 inch diameter 12 gauge galvanized steel with 0.10 wall thickness.

2.04 FASTENING ACCESSORIES

Comply with Iowa DOT Article 4186.09.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Accurately install all signs to comply with the dimensions and location details included in the contract documents.

B. Sign Posts: Comply with Iowa DOT Article 2524.03, B.

3.02 QUALITY CONTROL

A. Traffic Control Technician: Maintain a traffic control technician on staff who has attended and passed the exam in one of the following classes:

1. ATSSA Traffic Control Technician
2. IMSA Work Zone Traffic Control
3. Minnesota DOT Traffic Control Supervisor
4. Texas Engineering Extension Service Work Zone Traffic Control

B. Staking: Traffic Control Technician is to stake each sign location to ensure installation complies with MUTCD and the contract documents.

END OF SECTION

Section 9030 - Plant Material and Planting (Continued) **Page No.**

Section 9030 - Plant Material and Planting (Continued)

Section 9040 - Erosion and Sediment Control (Continued) **Page No.**

SEEDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Certification of Products

B. Acceptance and Warranty

C. Seed Types and Mixes

D. Equipment

E. Application of Seed

1.02 DESCRIPTION OF WORK

Includes the requirements for seedbed preparation; furnishing, applying, and covering the seed; and compaction of the seedbed.

1.03 SUBMITTALS

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

A. Submit certification of products to the Engineer prior to seed placement:

1. Seed: Submit a laboratory analysis for all seeds, specifying the purity and germination. Provide a lot number on all submittals and labeling. Ensure lot number is the same on all records pertaining to a particular seed. Provide 48 hours notice prior to mixing the seed and give the Engineer an opportunity to witness the seed mixing. Submit a mechanically printed seed tag from an Iowa Crop Improvement Association-approved seed conditioner or grower.

2. Fertilizer: Submit certification of the fertilizer analysis with scale weight and statement of guaranteed analysis. Submit from a certified fertilizer dealer, a mechanically printed commercial fertilizer label, or bill of lading. Comply with the inspection and acceptance requirements of Iowa DOT Materials I.M. 469.03.

3. Wood Cellulose Fiber Mulch: Submit certification of the degradable wood cellulose fiber mulch ingredients with applicable use and rate, and the water retention capacity by manufacturer or supplier.

4. Wood Excelsior Mulch: Bale wood excelsior and determine the mass (weight). Use the mass of the material, furnished by the manufacturer, to determine the rate of application.

5. Straw Mulch: Certify weight. Furnish a list of the number of bales and a corresponding ticket from an approved scale for the mulch material to be used on the project.

6. Compost: Submit certification of composted organics analysis with U.S. Compost Council's Seal of Testing Assurance (STA), recommended rates of application, and manufacturer's estimated cubic yards per ton.

7. Inoculant: Furnish information from inoculant packaging.

8. Tackifier: Submit certification of the tackifier ingredients, recommended rates of application, and expiration date.

B. Submit written instructions recommending procedures for maintenance of seeded areas.

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. Deliver packaged materials in original, unopened, and undamaged containers. Do not mix or blend materials except in the presence of the Engineer.

B. Deliver, handle, and store all materials according to product recommendations, and protect from loss, damage, and deterioration.

C. Materials not meeting these requirements will be rejected.

1.06 SCHEDULING AND CONFLICTS

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

A. Coordinate the seeding schedule with all other work on the project. Notify the Engineer at least three calendar days prior to the start of seeding operations.

B. After all land-disturbing activities are complete and the seedbed has been approved by the Engineer, perform seeding operations.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

A. Conventional Seeding:

1. Seeding:
- **a. Measurement:** Measurement will be in acres for each type of seed.
- **b. Payment:** Payment will be in unit price per acre for each type of seed.
- **c. Includes:** Unit price includes, but is not limited to, removal of rock and other debris from the area; repairing rills and washes; preparing the seedbed; furnishing and placing seed, including any treatment required; furnishing and placing fertilizer and mulch; and furnishing water and other care during the care period, unless these items are bid separately.

2. Fertilizing:
- **a. Measurement:** Measurement will be in acres of fertilizer.
- **b. Payment:** Payment will be at unit price per acre of fertilizer.
- **c. Includes:** Unit price includes, but is not limited to, furnishing, applying, and incorporating fertilizer to the area to be seeded.

3. Mulching:
- **a. Measurement:** Measurement will be in acres of mulch.
- **b. Payment:** Payment will be in unit price per acre of mulch.
- **c. Includes:** Unit price includes, but is not limited to, furnishing, applying, and incorporating mulch to the area to be seeded.

2.01 SEED (Continued)

Table 9010.05: Forbs

Common Name	Scientific Name
Black-eyed Susan	Rudbeckia hirta
Blue-flag iris	Iris virginica-shrevii
Boneset	Eupatorium perfoliatum
Canadian anemone	Anemone canadensis
Common mountainmint	Pycnanthemum virginianum
Common rush	Juncus effusus
Fowl manna grass	Glyceria striata
Golden Alexanders	Zizia aurea
Great blue lobelia	Lobelia siphilitica
Grey-headed coneflower	Ratibida pinnata
Heath aster	Symphyotrichum ericoides
Ironweed	Veronia faxciculate
Joe-pye weed	Eupatorium maculatum
Meadow blazingstar	Liatris ligulistylis
Milkweed, butterfly	Asclepias tuberosa
Milkweed, swamp	Asclepias incarnata
New England aster	Symphyotrichum novae-angliae
Ohio spiderwort	Tradescantia ohiensis
Oxeye sunflower	Heliopsis helianthoides
Pale purple coneflower	Echinacea pallida
Partridge pea	Chamaecrista fasciculate
Prairie blazing star	Liatris pycnostachya
Purple prairie clover	Dalea purpurea
Rattlesnake master	Eryngium yuccifolium
Reed manna grass	Glyceria grandis
Rice cutgrass	Leersia oryzoides
Showy goldenrod	Solidago speciosa
Showy tic-trefoil	Desmodium canadense
Stiff goldenrod	Solidago rigida
Swamp aster	Aster puniceus
White wild indigo	Baptisia alba
Wild bergamot	Monarda fistulosa

2.02 SEED MIXTURES AND SEEDING DATES

See the contract documents for the specified seed mixture. If a mixture is not specified, use the following. The Contractor may submit a modification of the mixture for the Engineer's consideration.

A. Type 1 (Permanent Lawn Mixture): Used for residential and commercial turf site, fertilized, and typically mowed. Use between March 1 and May 31 and between August 10 and September 30.

Table 9010.06: Type 1 Seed Mixture[1]

Common Name	Application Rate lb/acre
Creeping red fescue	25
Turf-type perennial ryegrass[2]	20
Turf-type perennial ryegrass[2]	20
Kentucky bluegrass cultivar[3]	65
Kentucky bluegrass cultivar[3]	65
Kentucky bluegrass cultivar[3]	65

[1] A commercial mixture may be used if it contains a high percentage of similar bluegrasses; it may or may not contain creeping red fescue.
[2] Choose two different cultivars of turf-type perennial ryegrass, at 20 lbs/acre each.
[3] Choose three different cultivars of Kentucky bluegrass, at 65 lbs/acre each.

B. Type 2 (Permanent Cool Season Mixture for Slopes and Ditches): Not typically mowed. Reaches a maximum height of 2 to 3 feet, low fertility requirements, grows in the spring and fall, and can go dormant in the summer. Use between March 1 and May 31 and between August 10 and September 30.

Table 9010.07: Type 2 Seed Mixture

Common Name	Application Rate lb/acre
Tall fescue[1]	100
Kentucky bluegrass	20
Ryegrass, perennial[2]	75

[1] Use endophyte free cultivars including Fawn, K-31, or a combination.
[2] Use cultivars including Linn, Amazon, Noriea, or Nui, or a combination.

C. Type 3 (Permanent Warm-Season Slope and Ditch Mixture): Not typically mowed. Reaches a height of 5 to 6 feet, stays green throughout summer, and responds well to being burned in spring; no fertilizer. Use between March 1 and June 30.

Table 9010.08: Type 3 Seed Mixture

Common Name	Application Rate lb/acre
Big bluestem*	3 PLS
Grain rye	40
Indiangrass*	4 PLS
Little bluestem*	3 PLS
Oats	16
Sideoats grama*	5 PLS
Switchgrass*	1 PLS

* Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-Iowa.

2.07 MULCH

A. For Conventional Seeding:

1. Material used as mulch may consist of the following:
   a. Dry cereal straw (oats, wheat, barley, or rye)
   b. Prairie hay
   c. Wood excelsior composed of wood fibers, at least 8 inches long, based on an average of 100 fibers, and approximately 0.024 inch thick and 0.031 inch wide. The fibers must be cut from green wood and be reasonably free of seeds or other viable plant material.

2. Do not use other hay (bromegrass, timothy, orchard grass, alfalfa, or clover).

3. All material used as mulch must be free from all noxious weed, seed-bearing stalks, or roots and will be inspected and approved by the Engineer prior to its use.

4. The Contractor may use other materials, subject to the approval of the Engineer.

B. For Hydraulic Seeding:

1. Wood Cellulose:
   a. Use material that is a natural or cooked cellulose fiber processed from whole wood chips, or a combination of up to 50% of cellulose fiber produced from whole wood chips, recycled fiber from sawdust, or recycled paper (by volume).
   b. Product contains a colloidal polysaccharide tackifier adhered to the fiber to prevent separation during shipment and avoid chemical co-agglomeration during mixing.
   c. Form a homogeneous slurry of material, tackifier, and water.
   d. Use a slurry that can be applied with standard hydraulic mulching equipment.
   e. Dye the slurry green to facilitate visual metering during application.
   f. Do not use materials that have growth or germination-inhibiting factors or any toxic effect on plant or animal life when combined with seed or fertilizer.

2. Bonded Fiber Matrix (BFM):
   a. Manufactured to be applied hydraulically.
   b. Dyed to facilitate visual metering.
   c. All components pre-packaged by manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.
   d. Meet the following requirements:
      1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM D 7101 and EPA 2021.0-1.
      2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.
      3) Hydraulic mulch that is completely photo-degradable or biodegradable.
      4) Have a rainfall event (R-factor) of 140 < R according to ASTM D 6459.
      5) Have a cover factor of C ≤ 0.03 according to ASTM D 6459.
      6) Vegetation Establishment of 400% minimum according to ASTM D 7322.
      7) Water Holding Capacity 600% minimum according to ASTM D 7367.

3. Mechanically-Bonded Fiber Matrix (MBFM):
   a. Manufactured to be applied hydraulically.
   b. Dyed to facilitate visual metering.
   c. All components pre-packaged by manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.

2.07 MULCH (Continued)

d. Meet the following requirements:
   1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM D 7101 and EPA 2021.0-1.
   2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.
   3) Hydraulic mulch that is completely photo-degradable or biodegradable.
   4) Have a rainfall event (R-factor) of 162 < R according to ASTM D 6459.
   5) Have a cover factor of C ≤ 0.01 according to ASTM D 6459.
   6) Vegetation establishment of 500% minimum according to ASTM D 7322.
   7) Water holding capacity of 700% minimum according to ASTM D 7367.

C. For Pneumatic Seeding: Use compost meeting the following requirements.

1. Derived from a well-decomposed source of organic matter.

2. Produced using an aerobic composting process, meeting Code of Federal Regulations (CFR) 503 for time, temperature, and heavy metal concentrations.

3. No visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.

4. Certified by the U.S. Composting Council's Seal of Testing Assurance (STA) program.

5. Conforms to chemical, physical, and biological parameters of AASHTO R 52, with the following additional requirements:
   a. Follow U.S. Composting Council's TMECC guidelines for all testing.
   b. Organic Matter Content: 30% minimum.
   c. pH: between 6.0 and 8.0.
   d. Maturity (growth screening): Minimum 90% emergence for all compost to be vegetated.
   e. Particle Size:

Sieve Size	Percent Passing*
2"	100
1"	90-100
3/4"	65-100
3/8"	0-75

*6 inch maximum particle length.

1.08 MEASUREMENT AND PAYMENT (Continued)

B. Compost Blankets:

1. **Measurement:** Measurement will be in square feet for each thickness of compost blanket.

2. **Payment:** Payment will be at the unit price per square foot for each thickness of compost blanket.

3. **Includes:** Unit price includes, but is not limited to, furnishing and spreading compost over the designated area.

C. Filter Berms:

1. **Measurement:** Measurement will be in linear feet for each size of filter berm, measured longitudinally along the top of the berm.

2. **Payment:** Payment will be at the unit price per linear foot for each size of berm.

3. **Includes:** Unit price include, but is not limited to, furnishing material and constructing the filter berm, including vegetation if specified.

D. Filter Socks:

1. **Installation:**
   a. **Measurement:** Measurement will be in linear feet for each size of filter sock.
   b. **Payment:** Payment will be at the unit price per linear foot for each size of filter sock.
   c. **Includes:** Unit price includes, but is not limited to, anchoring stakes.

2. **Removal:**
   a. **Measurement:** Measurement will be in linear feet of filter sock removed.
   b. **Payment:** Payment will be at the unit price per linear foot of filter sock removed.
   c. **Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of filter socks and accumulated sediment.

E. Temporary Rolled Erosion Control Products (RECP):

1. **Measurement:** Measurement will be in square yards, based on the width specified in the contract documents and actual measured length, for each type of temporary RECP.

2. **Payment:** Payment will be at the unit price per square yard for each type of temporary RECP.

3. **Includes:** Unit price includes, but is not limited to, excavation, staples, anchoring devices, and material for anchoring slots.

F. Wattles:

1. **Installation:**
   a. **Measurement:** Measurement will be in linear feet for each type and size of wattle.
   b. **Payment:** Payment will be at the unit price per linear foot for each type and size of wattle.
   c. **Includes:** Unit price includes, but is not limited to, anchoring stakes.

1.08 MEASUREMENT AND PAYMENT (Continued)

2. Removal:
- **a. Measurement:** Measurement will be in linear feet of wattle removed.
- **b. Payment:** Payment will be at the unit price per linear foot of wattle removed.
- **c. Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of wattle and accumulated sediment.

G. Check Dams:

1. Rock Check Dams:
- **a. Measurement:** Measurement will be in ton of stone installed.
- **b. Payment:** Payment will be at the unit price per ton of stone installed.
- **c. Includes:** Unit price includes, but is not limited to, engineering fabric.

2. Manufactured Check Dams:
- **a. Installation:**
  - **1) Measurement:** Measurement will be in linear feet for each type and size of manufactured check dam.
  - **2) Payment:** Payment will be at the unit price per linear foot for each type and size of manufactured check dam.
  - **3) Includes:** Unit price includes, but is not limited to, anchoring stakes.
- **b. Removal:**
  - **1) Measurement:** Measurement will be in linear feet for each type of manufactured check dam removed.
  - **2) Payment:** Payment will be at the unit price per linear foot for each type of manufactured check dam removed.
  - **3) Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of manufactured check dam and accumulated sediment.

H. Temporary Earth Diversion Structures:

1. Measurement: Measurement will be in linear feet for each type and size of temporary earth diversion structure.

2. Payment: Payment will be at the unit price per linear foot of temporary earth diversion structure.

3. Includes: Unit price includes, but is not limited to, removal of the structure upon completion of the project.

I. Level Spreaders:

1. Measurement: Measurement will be in linear feet of level spreaders.

2. Payment: Payment will be at the unit price per linear foot of level spreader.

3. Includes: Unit price includes, but is not limited to, maintaining the spreader during the period of construction and removal upon completion of the project, unless otherwise specified in the contract documents.

1.08 MEASUREMENT AND PAYMENT (Continued)

J. Rip Rap:

1. **Measurement:** Measurement will be in tons for each type of rip rap.

2. **Payment:** Payment will be at the unit price per ton of rip rap.

3. **Includes:** Unit price includes, but is not limited to, engineering fabric.

K. Temporary Pipe Slope Drains:

1. **Measurement:** Measurement will be in linear feet for each type and size of temporary pipe slope drain, measured from end of apron to end of apron.

2. **Payment:** Payment will be at the unit price per linear foot for each type and size of pipe.

3. **Includes:** Unit price includes, but is not limited to, excavation, furnishing and installing pipe and pipe aprons, grading, and removal of the slope drain upon completion of the project.

L. Sediment Basin:

1. **Outlet Structure:**
   a. **Measurement:** Each size of sediment basin outlet structure will be counted.
   b. **Payment:** Payment will be at the unit price for each sediment basin outlet structure.
   c. **Includes:** Unit price includes, but is not limited to, concrete base, dewatering device, anti-vortex device, outlet pipe, and anti-seep collars (if specified).
   d. **Does Not Include:** Unit price does not include earthwork required for construction of the sediment basin.

2. **Removal of Sediment:**
   a. **Measurement:** Each occurrence of sediment removal will be counted.
   b. **Payment:** Payment will be at the unit price for each occurrence of sediment removal.
   c. **Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

3. **Removal of Outlet Structure:**
   a. **Measurement:** Each sediment basin outlet structure removed will be counted.
   b. **Payment:** Payment will be at the unit price for each sediment basin outlet structure removed.
   c. **Includes:** Unit price includes, but is not limited to, dewatering and off-site disposal of the outlet structure, concrete base, emergency spillway, and accumulated sediment.
   d. **Does Not Include:** Unit price does not include earthwork required to remove the sediment basin and restoration of the area to finished grade.

M. Sediment Trap Outlet:

1. **Installation:**
   a. **Measurement:** Measurement will be in tons of crushed stone placed.
   b. **Payment:** Payment will be at the unit price per ton of crushed stone.
   c. **Includes:** Unit price includes, but is not limited to, engineering fabric.
   d. **Does Not Include:** Unit price does not include earthwork required for construction of the sediment trap.

1.08 MEASUREMENT AND PAYMENT (Continued)

2. Removal of Sediment:
- **a. Measurement:** Each occurrence of sediment removal will be counted.
- **b. Payment:** Payment will be at the unit price for each occurrence of sediment removal.
- **c. Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

3. Removal of Device:
- **a. Measurement:** Each sediment trap outlet removed will be counted.
- **b. Payment:** Payment will be at the unit price for each sediment trap outlet removed.
- **c. Includes:** Unit price includes, but is not limited to, dewatering and off-site disposal of sediment trap outlet and accumulated sediment.
- **d. Does Not Include:** Unit price does not include earthwork required to remove the sediment trap outlet and restoration of the area to finished grade.

N. Silt Fence or Silt Fence Ditch Check:

1. Installation:
- **a. Measurement:** Measurement will be in linear feet of silt fence or silt fence ditch check.
- **b. Payment:** Payment will be at the unit price per linear foot of silt fence or silt fence ditch check.
- **c. Includes:** Unit price includes, but is not limited to, anchoring posts.

2. Removal of Sediment:
- **a. Measurement:** Each occurrence of sediment removal will be counted.
- **b. Payment:** Payment will be at the unit price for each occurrence of sediment removal.
- **c. Includes:** Unit price includes, but is not limited to, dewatering and removal and off-site disposal of accumulated sediment.

3. Removal of Device:
- **a. Measurement:** Measurement will be in linear feet of silt fence removed.
- **b. Payment:** Payment will be at the unit price per linear foot of silt fence removed.
- **c. Includes:** Unit price includes, but is not limited to, restoration of the area to finished grade and off-site disposal of fence, posts, and accumulated sediment.

O. Stabilized Construction Entrance:

1. Stabilized Construction Entrance by Square Yard:
- **a. Measurement:** Measurement will be in square yards of material placed.
- **b. Payment:** Payment will be at the unit price per square yard of material placed.
- **c. Includes:** Unit price includes, but is not limited to, subgrade stabilization fabric.

2. Stabilized Construction Entrance by Ton:
- **a. Measurement:** Measurement will be in tons of material placed.
- **b. Payment:** Payment will be at the unit price per ton of material placed.
- **c. Includes:** Unit price includes, but is not limited to, subgrade stabilization fabric.

1.08 MEASUREMENT AND PAYMENT (Continued)

P. Dust Control:

1. **Water for Dust Control:**
   a. **Measurement:** Measurement will be by metering of water applied to haul roads and other areas to control dust. If metering is not available, measurement will be by counting the loads from a transporting tank of known volume and gauging the contents of the transporting truck for partial loads.
   b. **Payment:** Payment will be at the unit price per 1,000 gallons of water used.
   c. **Includes:** Unit price includes, but is not limited to, furnishing, transporting, and distributing water to the haul road.

2. **Dust Control Product:**
   a. **Measurement:** Measurement will be in square yards of the treated area.
   b. **Payment:** Payment will be at the unit price per square yard of product applied.
   c. **Includes:** Unit price include, but is not limited to, furnishing and incorporating the dust control product to the haul road.

Q. Erosion Control Mulching:

1. **Conventional Mulching:**
   a. **Measurement:** Measurement will be in acres of conventional mulch.
   b. **Payment:** Payment will be at the unit price per acre of conventional mulch.
   c. **Includes:** Unit price includes, but is not limited to, furnishing and incorporating mulch in the area designated in the contract documents.

2. **Hydromulching:**
   a. **Measurement:** Measurement will be in acres for each type of hydromulch.
   b. **Payment:** Payment will be at the unit price per acre for each type of hydromulch.
   c. **Includes:** Unit price includes, but is not limited to, furnishing mulch and tackifier (if applicable), providing equipment specific to hydromulching, and applying the mulch to the specified area.

R. Turf Reinforcement Mats (TRM):

1. **Measurement:** Measurement will be in squares for each type of turf reinforcement mat, each square containing 100 square feet.

2. **Payment:** Payment will be at the unit price per square for each type of turf reinforcement mat.

3. **Includes:** Unit price includes, but is not limited to, excavation, staples, anchoring devices, and material for anchoring slots.

S. Surface Roughening:

1. **Measurement:** Measurement will be in square feet of surface roughening, including directional tracking or grooving/furrowing.

2. **Payment:** Payment will be at the unit price per square foot of surface roughening.

3. **Includes:** Unit price includes, but is not limited to, providing equipment to complete directional tracking or grooving/furrowing and completing surface roughening of slopes specified in the contract documents.

1.08 MEASUREMENT AND PAYMENT (Continued)

T. Inlet Protection Device:

1. **Installation:**
   a. **Measurement:** Each type of inlet protection device will be counted.
   b. **Payment:** Payment will be at the unit price for each inlet protection device.
   c. **Includes:** Unit price includes, but is not limited to, removal of the device upon completion of the project.

2. **Maintenance:**
   a. **Measurement:** Each inlet protection device maintenance occurrence will be counted.
   b. **Payment:** Payment will be at the unit price for each inlet protection device maintenance occurrence.
   c. **Includes:** Unit price includes, but is not limited to, removal and off-site disposal of accumulated sediment.

U. Flow Transition Mat:

1. **Measurement:** Measurement will be in square feet of flow transition mat.

2. **Payment:** Payment will be at the unit price per square foot of flow transition mat.

3. **Includes:** Unit price includes, but is not limited to, anchoring devices.

V. End of Season Temporary Erosion Control:

1. **Measurement:** Measurement will be in acres of end of season temporary erosion control applied.

2. **Payment:** Payment will be at the unit price per acre for end of season temporary erosion control.

3. **Includes:** Unit price includes, but is not limited to, furnishing, placing, and maintaining the end of season temporary erosion control throughout the winter season.

PART 2 - PRODUCTS

2.01 COMPOST BLANKETS

Comply with Section 9010, 2.07, C for compost material requirements for compost blankets.

2.02 COMPOST BLANKET AND FILTER BERM TACKIFIER

A. Use a biodegradable, organic binding agent or polyacrylamide that can be mixed with, or injected into, compost or filter material as it is placed, which is not detrimental to the establishment of vegetation.

B. Use in filter berms or compost blankets when specified in the contract documents.

C. Apply at the rate recommended by the manufacturer.

2.03 FILTER MATERIAL

Material for use in filter socks, filter berms, and other areas, as specified in the contract documents.

A. Use material derived from wood, bark, or other, non-toxic vegetative feedstocks.

B. Use material with no visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.

C. Use material meeting the following particle sizes:

Sieve Size	Percent Passing[1]
2”	100
1”	90-100
3/8”	0-30

[1]The target flow rate of in-place material is 10 gal/min/lf. The Engineer may approve use of alternate materials meeting the target flow rate.

2.04 FILTER SOCK

A. For slope and sediment control applications, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 5 mil thickness, photodegradable HDPE.

B. For inlet protection, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 500 denier polypropylene.

C. Use 1 inch by 2 inch (minimum) hardwood stakes or stakes of equivalent strength.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP)

Use temporary rolled erosion control products that are classified and have material properties according to the Erosion Control Technology Council’s (ECTC) guidelines as follows:

A. Material Classification:

1. **RECP Type 1 (Ultra Short-term):** Functional longevity of 3 months or less and classified as follows:
   a. **RECP Type 1.A:** Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
   b. **RECP Type 1.B:** Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

c. **RECP Type 1.C:** Single-net erosion control blankets and open weave textiles, consisting of processed degradable natural and/or polymer fibers, mechanically bound together by a single rapidly-degrading, synthetic or natural fiber netting, or an open weave textile of processed rapidly-degrading natural or polymer yarns or twines woven into a continuous matrix.
d. **RECP Type 1.D:** Double-net erosion control blankets, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two rapidly-degrading, synthetic or natural fiber nettings.

2. **RECP Type 2 (Short-term):** Functional longevity between 3 and 12 months and classified as follows:
   a. **RECP Type 2.A:** Mulch control net, consisting of a photodegradable synthetic mesh or woven biodegradable natural fiber netting.
   b. **RECP Type 2.B:** Netless rolled erosion control blankets, consisting of natural and/or polymer fibers, mechanically interlocked and/or chemically adhered together to form a RECP.
   c. **RECP Type 2.C:** Single-net erosion control blankets and open weave textiles, consisting of an erosion control blanket composed of processed degradable natural or polymer fibers, mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix, or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.
   d. **RECP Type 2.D:** Double-net erosion control blanket, consisting of processed degradable natural and/or polymer fibers, mechanically bound together between two degradable synthetic or natural fiber nettings.

3. **RECP Type 3 (Extended Term):** Functional longevity between 12 and 24 months and classified as follows:
   a. **RECP Type 3.A:** Mulch control nets, consisting of a slow-degrading synthetic mesh or woven natural fiber netting.
   b. **RECP Type 3.B:** Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow-degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

4. **RECP Type 4 (Long Term):** Functional longevity of 36 months and classified as follows: Erosion control blankets and open weave textiles, consisting of processed slow-degrading natural or polymer fibers, mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix, or an open weave textile composed of processed slow-degrading natural or polymer yarns or twines woven into a continuous matrix.

B. Properties and Performance:

1. Testing performed according to the ECTC's Testing Procedures for Rolled Erosion Control Products. Verify manufacturer's test results by independent testing.

2.05 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

2. Material properties meeting the Erosion Control Technology Council's (ECTC) Standard Specifications for Rolled Erosion Control Products as follows:

Classification	Slope Application Max. Grade*	Channel Application Permissible Shear Stress	Min. Tensile Strength
RECP Type 1.A	5:1 (H:V)	0.25 lb/ft^2	5 lb/ft
RECP Type 1.B	4:1 (H:V)	0.50 lb/ft^2	5 lb/ft
RECP Type 1.C	3:1 (H:V)	1.50 lb/ft^2	50 lb/ft
RECP Type 1.D	2:1 (H:V)	1.75 lb/ft^2	75 lb/ft
RECP Type 2.A	5:1 (H:V)	0.25 lb/ft^2	5 lb/ft
RECP Type 2.B	4:1 (H:V)	0.50 lb/ft^2	5 lb/ft
RECP Type 2.C	3:1 (H:V)	1.50 lb/ft^2	50 lb/ft
RECP Type 2.D	2:1 (H:V)	1.75 lb/ft^2	75 lb/ft
RECP Type 3.A	5:1 (H:V)	0.25 lb/ft^2	25 lb/ft
RECP Type 3.B	1.5:1 (H:V)	2.00 lb/ft^2	100 lb/ft
RECP Type 4	1:1 (H:V)	2.25 lb/ft^2	125 lb/ft

*Product tested according to ECTC Test Method No. 2 and meeting the ECTC Standard Specifications for "C" factor.

C. RECP Anchors: Stakes or staples as recommended by manufacturer, with a minimum length of 6 inches.

2.06 WATTLES

A. Netting: Open weave, degradable netting. Nominal diameter of 9 inches, or as specified.

B. Fill Material: Straw, wood excelsior, coir, or other natural materials approved by the Engineer.

C. Stakes: 1 inch by 1 inch (minimum) wooden stakes, or stakes of equivalent strength.

2.07 CHECK DAMS

A. Synthetic Permeable Check Dam (HDPE):

1. Ditch Berm:
a. Installed height of 9 to10 inches.
b. Manufactured check dam constructed from sheets of perforated, UV-stabilized High Density Polyethylene (HDPE).
c. Perforations of 30 to 40% open area.

2. RECP for Permeable Check Dam (when specified): RECP Type 4, 4 feet wide.

3. Anchors: As recommended by the manufacturer.

B. Triangular Foam Check Dam: Triangular-shaped device with a height of 8 to 10 inches and a base of 16 to 20 inches.

1. Inner Support Material: Urethane foam.

2. Outer Cover: Woven geotextile material shaped to fit around the inner support material, extending 2 to 3 feet beyond the bottom edge of the triangular-shaped inner support.

3. Length: 7 feet.

2.07 CHECK DAMS (Continued)

C. Rock Check Dam:

1. Aggregate: Erosion stone complying with Iowa DOT Article 4130.04.

2. Engineering Fabric: Comply with Section 9040, 2.20.

2.08 LEVEL SPREADERS

A. Provide 2 inch by 8 inch (minimum) pressure-treated timber of the length specified.

B. Use timbers that are relatively straight and have a minimum length of 5 feet each.

2.09 RIP RAP

A. Class A Revetment: Comply with Iowa DOT Section 4130.

B. Class B Revetment: Comply with Iowa DOT Section 4130.

C. Class D and E Revetment: Comply with Iowa DOT Section 4130.

D. Erosion Stone: Comply with Iowa DOT Section 4130.

2.10 TEMPORARY PIPE SLOPE DRAINS

A. PVC, HDPE, and metal pipes as specified in Section 4020, 2.01.

B. HDPE, Type C (corrugated interior).

C. All pipes listed are allowed for use within the right-of-way.

2.11 SEDIMENT BASIN OUTLET STRUCTURES

A. Base: Class C concrete unless otherwise specified in the contract documents.

B. Riser: CMP complying with Section 4020; diameter as specified in the contract documents.

C. Dewatering Device:

1. Drill holes in the riser of the number, diameter, and at the elevation specified in the contract documents.

2. 1/4 inch by 1/4 inch or 1/2 inch by 1/2 inch wire mesh for hardware cloth.

D. Barrel: CMP complying with Section 4020; diameter as specified in the contract documents.

E. Anti-Vortex Device: CMP complying with Section 4020; diameter according to Figure 9040.116 and riser diameter as specified in the contract documents.

F. Anti-Seep Collar:

1. Corrugated metal sheet of same material and gage as barrel section.

2. Size according to Figure 9040.117.

2.12 SEDIMENT TRAPS

A. Erosion Stone: Comply with Section 9040, 2.09.

B. Engineering Fabric: Comply with Section 9040, 2.20.

2.13 SILT FENCE

A. Fabric: Comply with Iowa DOT Article 4196.01.

B. Posts: 4 foot minimum steel (T-section) weighing at least 1.25 pounds per foot, exclusive of anchor plate. Painted posts are not required.

C. Fastener: Wire or plastic ties with a minimum tensile strength of 50 pounds.

2.14 STABILIZED CONSTRUCTION ENTRANCE

A. Entrance Stone: Comply with Iowa DOT Section 4122, Gradation 13, Macadam crushed stone.

B. Subgrade Stabilization Material: Use woven, UV-stabilized geotextile with a minimum tensile strength of 135 lb/ft.

2.15 DUST CONTROL

A. Water: Use potable water or water from a source approved by the engineer.

B. Calcium Chloride: Comply with Iowa DOT Article 4194.01.

C. Lignosulfonate (Tree Sap): Use a commercially-available product with known lignin content.

D. Soapstock (Soybean Oil):

1. Use a commercially-available, undiluted, soybean oil soapstock emulsion.

2. Comply with manufacturer's recommendations for storage, transportation, temperature, and application equipment requirements.

2.16 EROSION CONTROL MULCH

A. Conventional Mulch:

1. Use dry cereal straw (oats, wheat, barley, or rye) or native grass straw.

2. Use material that is free of noxious weeds, seed-bearing stalks, or roots, and will be inspected and approved by the Engineer prior to use.

3. Other materials, subject to the approval of the Engineer, may be used.

B. Hydromulch:

1. Wood Cellulose Mulch: Comply with Section 9010, 2.07.

2. Bonded Fiber Matrix (BFM): Comply with Section 9010, 2.07.

3. Mechanically Bonded Fiber Matrix (MBFM): See Section 9010, 2.07.

2.17 TURF REINFORCEMENT MATS (TRM)

A. Material Classification:

1. **TRM Type 1:** Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion, or the placement of synthetic fibers between two high-strength, biaxially-oriented nets, mechanically bound by parallel stitching with polyolefin thread. Products may contain a degradable component.

2. **TRM Type 2 and 3:** Use a TRM that is constructed of a web of mechanically or melt-bonded polymer netting, monofilaments, or fibers that are entangled or woven to form a strong and dimensionally stable mat. Non-woven bonding methods include polymer welding, thermal or polymer fusion, or the placement of fibers between two high-strength, biaxially oriented nets, mechanically bound by parallel stitching with polyolefin thread. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation.

3. **TRM Type 4:** Use a high performance/survivability TRM that is composed of monofilament yarns woven into a resilient uniform configuration. Use a mat that has a matrix that exhibits very high interlock and reinforcement capacities with both soil and root systems and demonstrate a high tensile modulus. TRMs manufactured from discontinuous or loosely held together by stitched or glued, netting, or composites are not allowed in this category. Use only components that are 100% synthetic and resistant to biological, chemical, and ultraviolet degradation. Use this category when field conditions exist with high loading and/or high survivability requirements.

B. Properties and Performance:

Meet the minimum material and performance requirements contained in the following table:

	Property[1]	Test Method	Type 1	Type 2	Type 3	Type 4
Material	Thickness	ASTM D 6525	0.25 in	0.25 in[5]	0.25 in[5]	0.25 in[5]
Material	Tensile Strength[2]	ASTM D 6818	125 lb/ft	240 lb/ft	750 lb/ft	3,000 lb/ft
Material	UV Resistance[3]	ASTM D 4355	80% @ 500 hrs	80% @ 1,000 hrs	80% @ 1,000 hrs	90% @ 3,000 hrs
Performance	Maximum Shear Stress[4] (Channel Applications)	ASTM D 6460	7 lb/ft^2	10 lb/ft^2	12 lb/ft^2	15 lb/ft^2

1 For TRMs containing degradable components, all values must be obtained on the non-degradable portion of the matting.
2 Minimum Average Roll Values, machine direction only.
3 Tensile strength of structural components retained after UV exposure.
4 Minimum shear stress that fully-vegetated TRM can sustain without physical damage or excess erosion (0.5 in soil loss) during a 30 minute flow event in large scale testing. Acceptable large scale testing protocol includes ASTM D 6460 or independent testing conducted by the Texas Transportation Institute, Colorado State University, Utah State University, or other approved testing facility. Bench scale testing is not acceptable.
5 Type 2, 3, and 4 TRM may include additional degradable components as long as material and performance requirements are met by the 100% synthetic components.

2.18 INLET PROTECTION

A. Drop-in Intake Protection:

1. Use a manufactured device that is inserted into the intake and is capable of trapping or filtering sediment from runoff prior to entering the storm sewer.

2. All components must be contained entirely below the surface of the intake grate.

3. Incorporate means of emergency outflow to prevent flooding if plugged with sediment.

B. Surface-applied Intake Protection:

1. Use devices or filter socks, placed around or over the intake, that are capable of trapping or filtering sediment from runoff prior to entering the storm sewer.

2. Do not allow the device to completely block or plug the intake, preventing inflow.

2.19 FLOW TRANSITION MATS

Comply with the following and Iowa DOT Materials I.M. 469.10.

A. Mat:

1. Constructed of 85% minimum UV resistant material with a maximum ground cover of 80%.

2. Meet the requirements of the following table:

Property	Test Method	Value
Mass/Unit Area (max.)	ASTM D 6566	3 lbs/SF
Minimum Thickness	ASTM D 6525	0.4 inch
Maximum Thickness	ASTM D 6525	1.1 inch
Tensile Strength	ASTM D 6818	550 lbs/ft
Minimum Percent Open Area	ASTM D 6567	20%
UV Stability	ASTM D 4355	85%

B. Anchoring Devices:

1. Furnish bullet tip style anchors made of a metal alloy attached to a wire rope.

2. Anchors capable of withstanding a minimum 300 pounds (136 kg) of pull out resistance in cohesive soils.

3. Wire rope a minimum of 30 inches (762 mm) in length with a minimum breaking strength of at least 300 pounds (136 kg).

4. The top washer a minimum of 3 inches (76 mm) in diameter and constructed of a UV resistant plastic.

5. Each anchor equipped to allow the retightening of the anchor when deemed necessary by the Engineer.

2.20 ENGINEERING FABRIC

Comply with Iowa DOT Article 4196.01, B, 3.

PART 3 - EXECUTION

3.01 SWPPP PREPARATION

A. Prepare a SWPPP according to the requirements of the Iowa DNR NPDES General Permit No. 2.

B. Ensure that controls utilized in the SWPPP conform to the type and quantity of erosion and sediment controls specified in the contract documents.

C. Submit the completed SWPPP to the Engineer for review and approval prior to filing the Notice of Intent.

D. Upon approval of the Engineer, file public notices, as required by the NPDES General Permit No. 2.

E. File the Notice of Intent and fee, as required by the NPDES General Permit No. 2.

3.02 SWPPP MANAGEMENT

Coordinate and carry out all requirements of Iowa DNR NPDES General Permit No. 2 and any local ordinance requirements, including:

A. Update the SWPPP according to the requirements of the NPDES General Permit No. 2.

B. Revise the SWPPP and implement changes, as necessary, to prevent sediment or hazardous materials from being transported off the site.

C. Submit all SWPPP revisions to the Engineer for review and approval.

D. Perform and maintain records of weekly erosion and sediment control site inspections, unless otherwise specified in the contract documents.

E. Maintain records of transfer of responsibility under the NPDES General Permit No. 2.

F. Retain all records on-site, or as required by the NPDES General Permit No. 2.

G. After final stabilization, file a Notice of Discontinuation, according to the NPDES General Permit No. 2.

H. Provide all records and documentation to the Engineer upon completion of the project. Retain a copy of all records for the period required under the Permit.

I. Continue to perform the work required under this item throughout the duration of the project, and until final stabilization is achieved and a Notice of Discontinuation is filed.

3.03 EROSION AND SEDIMENT CONTROL INSPECTION

A. Perform inspections according to and at frequency required by the Iowa DNR NPDES General Permit No. 2.

B. Schedule necessary maintenance or improvements for items that are included in the contract documents.

C. Notify the Engineer immediately of situations requiring attention beyond that provided for in the contract documents.

3.03 EROSION AND SEDIMENT CONTROL INSPECTION (Continued)

D. Provide copies of the inspection reports to the Engineer.

3.04 EQUIPMENT

Comply with Iowa DOT Article 2601.03.

3.05 COMPOST BLANKETS (Figure 9040.101)

A. Loosen the ground surface to a minimum depth of 1 inch.

B. Evenly spread compost, as specified in the contract documents, or as directed by the Engineer.

C. Divert concentrated flows away from the slope.

D. Do not operate heavy equipment over the compost blanket after placement, or throughout the required period of protection.

E. Inspect the ground under the blanket at regular intervals for signs of erosion.

3.06 FILTER BERMS (Figure 9040.102)

A. Install filter berm along the contour as specified in the contract documents, or as directed by the Engineer.

B. Turn the ends of the filter berm uphill to prevent runoff from flowing around the end of the berm.

C. When a vegetated berm is specified, apply seed to the surface of the berm.

D. Replace the berm when sediment accumulation reaches one-half of the height of the berm.

3.07 FILTER SOCKS (Figure 9040.102)

A. Installation:

1. Fill mesh filter sock with filler material to the size and length specified in the contract documents.

2. Place the filter sock along the contour as specified in the contract documents, or as directed by the Engineer.

3. Construct a “J-hook” at each end of a continuous run of filter sock, by turning the end of the sock uphill, as necessary to prevent runoff from flowing around the ends when water behind the sock ponds up to a level even with the top of the sock.

4. Drive stakes into the ground at a maximum spacing of 10 feet, and as required to secure the sock and prevent movement.

5. Repair or replace non-functioning filter socks that allow water to flow under the sock, are torn, or are otherwise damaged, due to inadequate installation.

6. Remove filter material from damaged socks that are located along streambanks, around intakes, in ditches, or in other locations where the material may be carried to surface waters.

3.07 FILTER SOCKS (Continued)

B. Removal: When specified in the contract documents, or as directed by the Engineer; remove the filter sock upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Upon completion of the project, completely remove socks and filter material that are located along streambanks, around intakes, in ditches, or in other locations where the filter material may be carried to surface waters if the sock degrades and/or tears.

2. Slice the sock longitudinally. Remove and dispose of the filter sock material and stakes.

3. Spread the filter material and accumulated sediment to match finished grade and to ensure proper drainage.

4. If the site has been brought to finished grade and prepared for permanent seeding, spread and incorporate the filter material into the surface by tilling, or as required to break up any large particles and provide a finished surface suitable for permanent seeding.

C. Replacement:

1. When accumulated sediment reaches a level one-half the height of the sock, or when the sock becomes clogged with sediment and no longer allows runoff to flow through, remove the sock as described above, and replace according to the installation instructions above.

2. At the Engineer's option, the existing filter sock and accumulated sediment may be left in place, and a new filter sock installed up-slope from the existing filter sock.

3.08 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Figures 9040.103 and 9040.104)

Install temporary RECPs according to the manufacturer's published installation recommendations, subject to the following minimum requirements:

A. Slope Application:

1. Grade and smooth surface. Remove all rocks, clods, vegetation, or other obstructions that will prevent direct contact between the RECP and the soil surface.

2. When specified, prepare seedbed and place seed and fertilizer according to Section 9010 prior to placing RECP.

3. Install anchor trench at top of slope. Seed and fertilize trench after backfill and compaction, if seeding is specified.

4. Unroll the RECP down or horizontally across the slope.

5. Place consecutive blankets down the slope end-over-end, shingle style.

6. Overlap ends of consecutive rolls a minimum of 3 inches, and install anchors at a maximum spacing of 18 inches along all overlaps.

7. Overlap edges of adjacent rolls a minimum of 2 inches.

8. Install anchors at edge seams between rows.

3.08 TEMPORARY ROLLED EROSION CONTROL PRODUCTS (RECP) (Continued)

B. Channel/Ditch Application:

1. When specified, prepare seedbed and place seed and fertilizer according to Section 9010, prior to placing RECP.

2. Place end of first roll in the anchor slot at the center of the upstream channel and secure with anchors.

3. Position adjacent rolls in the anchor slot, overlapping adjacent rolls a minimum of 3 inches.

4. Place backfill material in anchor slot and compact. Unroll RECP over compacted slot and secure with anchors.

5. Unroll RECP downstream. Maintain a minimum 3 inch overlap between adjacent rolls. Secure edge lap with anchors.

6. Install intermittent staple check slots every 30 feet.

7. Construct end lap at end of roll and beginning of new roll. Overlap roll ends with upstream RECP on top.

8. Excavate longitudinal trench along both sides of the channel at the outside edges of installation. Place outer edges of RECP into longitudinal slot. Install anchors, place backfill material, and compact.

9. Terminate installation at downstream end with staple check.

10. Install anchors in a regular pattern over entire area covered according to manufacturer's published recommendations (minimum three anchors per square yard).

3.09 WATTLES (Figure 9040.105)

A. Installation:

1. Construct a shallow trench, 2 to 4 inches deep, matching the width and contour of the wattle.

2. Install wattle along contour of slope.

3. Turn ends of wattle uphill to prevent water from flowing around ends.

4. Place and compact excavated soil against the wattle, on the uphill side.

5. Drive stakes through the center of the wattle, into the ground at a maximum spacing of 4 feet along the length of the wattle, and as needed to secure the wattle and prevent movement.

6. Abut ends of adjacent wattles tightly. Wrap joint with a 36 inch wide section of silt fence and secure with stakes.

B. Removal: When specified in the contract documents, or as directed by the Engineer, remove the wattle upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

3.09 WATTLES (Continued)

1. Completely remove the wattle netting, filler material, and stakes.

2. Spread the accumulated sediment to match finished grade and to ensure proper drainage.

3. When allowed by the Engineer, the wattle netting may be sliced open and the filler material spread out over the ground. Removal of netting and stakes and spreading of sediment is still required.

C. Replacement:

1. When accumulated sediment reaches a level one-half the height of the wattle, or when the wattle becomes clogged with sediment and no longer allows runoff to flow through, remove the wattle as described above, and replace according to the installation instructions above.

2. At the Engineer's option, the existing wattle and accumulated sediment may be left in place, and a new wattle installed up-slope from the existing wattle.

3.10 CHECK DAMS (Figure 9040.106)

A. Synthetic Permeable Check Dam (HDPE):

1. Install according to the manufacturer's recommendations.

2. When specified, provide an RECP under the check dam, installed according to the manufacturer's recommendations.

B. Triangular Foam Check Dam: Install according to the manufacturer's recommendations.

C. Rock Check Dam: Construct according to Figure 9040.107.

D. Removal: When specified in the contract documents, or as directed by the Engineer, remove check dams upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.

1. Remove the check dam and dispose of materials, or salvage to the contractor.

2. Remove the accumulated sediment or spread to match finished grade; ensure proper drainage.

3. Stabilize the area disturbed by removal operations.

3.11 TEMPORARY EARTH DIVERSION STRUCTURES (Figure 9040.108)

A. Ensure positive drainage along the diversion toward the outlet area.

B. Adequately compact fill to prevent failures or seepage.

C. Outlet the diversion to undisturbed and/or stabilized areas only.

D. Stabilize the surface of the earth diversion with temporary erosion control seeding, as specified in Section 9010.

3.12 LEVEL SPREADERS (Figure 9040.109)

A. Butt multiple timbers together, as necessary to provide the required length.

B. Ensure the spreader is installed level in all directions. Adjust as necessary during construction to maintain spreader in a level condition.

C. Excavate a depression behind the spreader to the depth specified in the contract documents. The depression may be over-excavated up to 1 foot to provide an area for sediment accumulation.

D. Grade as required to prevent flow around the ends of spreader.

E. Remove the accumulated sediment from the depression when the depth is reduced below that specified in the contract documents.

3.13 RIP RAP (Figures 9040.110 and 9040.111)

Install rip rap (revetment stone or erosion stone) as shown on Figures 9040.110 and 9040.111.

3.14 TEMPORARY PIPE SLOPE DRAINS (Figure 9040.112)

A. Place slope drain on undisturbed soil or well compacted fill.

B. Carefully compact cohesive soils around inlet ends of the drain in 6 inch lifts.

C. Discharge slope drain to a stable outlet or to a sediment retention device.

3.15 SEDIMENT BASIN OUTLET STRUCTURES (Figures 9040.113 and 9040.114)

A. Concrete Base: Construct the concrete base and anchor riser section, as shown on Figure 9040.115.

B. Dewatering Device:

1. Drill holes in the riser section. The number, diameter, and configuration will be specified in the contract documents.

2. Wrap the perforated section of the riser pipe with metal hardware cloth.

C. Anti-vortex Device: If required by the contract documents, firmly attach the cylinder to the top of the riser by welding or other means. Comply with Figure 9040.116.

3.16 ANTI-SEEP COLLAR (Figure 9040.117)

A. General: Place backfill material and compact over-excavation areas to a minimum of 95% Standard Proctor Density per Section 3010.

B. Concrete Collar:

1. Place collars a minimum of 2 feet from pipe joints.

2. Provide Class C concrete per Section 6010.

3.16 ANTI-SEEP COLLAR (Continued)

C. CMP Collar:

1. Provide collar of same gage as the pipe barrel on which it is used.
2. Paint or tag unassembled collars to identify matching pairs.
3. Furnish each collar with two 1/2 inch diameter rods with tank lugs for connecting collars to pipe.
4. Install collar with corrugations vertical.
5. Seal the tap between the two half sections and between the pipe and connecting band with a bituminous jointing compound at the time of installation.

3.17 SEDIMENT TRAPS (Figure 9040.118)

Construct the storage area to the size and elevations specified in the contract documents.

3.18 SILT FENCES (Figure 9040.119)

A. Installation:

1. Install material along the contour of the ground, as specified in the contract documents, or as directed by the Engineer.
2. Install silt fence with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used when situations will not allow soil slicing, as determined by the Engineer.
3. Construct a “J-hook” at each end of a continuous run of silt fence, by turning the end of the silt fence uphill, as necessary to prevent runoff from flowing around ends when water behind the fence ponds to a level even with the top of the fence.
4. Insert 12 inches of fabric to a minimum depth of 6 inches (fabric may be folded below the ground line).
5. Compact installation by driving along each side of the silt fence, or by other means, as necessary to adequately secure the fabric in the ground, to prevent pullout and water flow under the fence.
6. Drive steel posts into the ground alongside the silt fence, to a minimum depth of 20 inches, unless otherwise specified by the Engineer. Space posts as shown on Figure 9040.119 or as required to adequately support silt fence.

B. Maintenance: Repair or replace non-functioning silt fence that allows water to flow under the fence, is torn, or is otherwise damaged, due to inadequate installation, at no additional cost to the Contracting Authority.

C. Removal:

1. Remove the silt fence upon final stabilization of the project area, or according to the staging indicated in the SWPPP.
2. Remove and dispose of silt fence and posts.
3. Remove sediment or spread to match finished grade; ensure proper drainage.
4. Stabilize the area disturbed by removal operations.

3.18 SILT FENCES (Continued)

D. Replacement:

1. When accumulated sediment reaches a level one-half the height of the fence, remove the silt fence as described above, and replace according to the installation instructions above.

2. At the Engineer's option, the existing silt fence and accumulated sediment may be left in place, and a new silt fence installed up-slope from the existing silt fence.

3. When allowed by the Engineer, the existing silt fence may be left in place and the accumulated sediment removed to the original ground line and within 6 inches of the silt fence. Carefully inspect the existing silt fence for structural integrity and signs of undermining. Make any necessary repairs.

3.19 STABILIZED CONSTRUCTION ENTRANCE (Figure 9040.120)

A. Install a stabilized construction entrance at all locations where construction traffic leaving the site presents the potential for sediment track-out.

B. Remove vegetation and excavate soft soils from entrance area. Thoroughly compact subgrade prior to placing stone.

C. Install culvert under entrance if necessary to maintain drainage.

D. Grade entrance to prevent runoff from flowing onto street. Direct all runoff from entrance to a sediment retention device.

E. When specified, install subgrade stabilization fabric prior to placing crushed stone.

F. Install layer of crushed stone to the thickness (6 inches minimum) and dimensions specified in the contract documents.

G. Remove the accumulated sediment and install new stone, as required to prevent track-out.

3.20 DUST CONTROL

A. Water: Apply frequent light watering to ground surface, as required to control dust.

B. Calcium Chloride: Apply according to Iowa DOT Section 2314.

C. Lignosulfonate (Tree Sap):

1. Loosen the top 1 to 2 inches of the roadway surface.

2. Apply solution with a 50% residual concentration, at a rate of 0.50 gal/yd^2, to deliver a 25% residual. For diluted solutions, increase the application rate, as required, to deliver an equivalent 25% residual.

3. Allow product to penetrate through the loosened material.

4. Tight-blade road surface.

D. Soapstock (Soybean Oil):

1. Loosen the top 1 to 2 inches of the roadway surface.

2. Apply undiluted soapstock at a rate of 0.70 gal/yd^2.

3.20 DUST CONTROL (Continued)

3. Allow product to penetrate through the loosened material.

4. Tight-blade road surface.

3.21 EROSION CONTROL MULCHING

A. Conventional Mulching:

1. Use conventional mulching when the surface cannot be stabilized by seeding, due to season or ground conditions.

2. Uniformly distribute mulch over the required areas, at a rate of 2 tons/acre for dry cereal straw, or 2.5 tons/acre for prairie hay.

3. Work the mulch into the soil with a mulch tucker, designed to anchor the mulch into the soil, by means of dull blades or disks.

B. Hydromulching:

1. Place mulch and tackifier (if applicable) in equipment specifically manufactured for hydraulic mulching.

2. Mix materials with fresh, potable water using a combination of re-circulation through the equipment's pump and mechanical agitation to form a homogeneous slurry.

3. If necessary, dampen any dry, dusty soil as required to prevent balling of the material during application.

4. Apply hydromulch in multiple layers from opposing directions, where possible.

5. Apply the slurry evenly over all specified areas, at the minimum component material rates specified:
   a. Wood Cellulose Mulch:
      1) Mulch: Minimum 3,000 lb/acre dry weight.
      2) Tackifier: Minimum 50 lb/acre.
   b. Bonded Fiber Matrix: Minimum 3,000 lb/acre dry weight.
   c. Mechanically Bonded Fiber Matrix: Minimum 3,000 lb/acre dry weight.

6. Retain and count empty bags of mulch to ensure final application rate.

3.22 TURF REINFORCEMENT MATS

Install according to the manufacturer's published installation literature for the product specified and application (slope or channel).

3.23 SURFACE ROUGHENING

A. Directional Tracking:

1. Do not use on slopes steeper than 3:1.

2. Operate tracked equipment up and down exposed slope to create ridges perpendicular to the slope.

3. Continue operation until the entire surface has been tracked.

3.23 SURFACE ROUGHENING (Continued)

B. Grooving/Furrowing:

1. May be used on all slopes.

2. Use rippers, disks, harrows, chisel plows, or other equipment capable of operating on the slope and creating grooves a maximum of 15 inches apart and 3 inches deep.

3. Operate equipment along the contour of the slope to create grooves that are perpendicular to the slope.

4. Perform over all exposed slopes as specified.

3.24 INLET PROTECTION

A. Install inlet protection devices according to the manufacturer's recommendations.

B. Remove the accumulated sediment, as required to maintain the inlet protection device in working order. Remove any accumulated sediment from streets open to traffic if it encroaches into the traveled roadway.

3.25 FLOW TRANSITION MATS

Install according to the manufacturer's published recommendations.

3.26 TEMPORARY EROSION CONTROL SEEDING

Comply with Section 9010.

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.

3. **Includes:** Lump sum price includes, but is not limited to, coordinating with USPS and erecting and maintaining temporary mailboxes.

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.

3. **Includes:** Lump sum price includes, but is not limited to, coordinating and maintaining solid waste collection services including establishing alternate collection sites if required.

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 2 - PRODUCTS

2.01 GRANULAR SURFACING

Provide 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 11040.102.

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 11040.102, 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