

**REQUEST FOR QUOTATION
(THIS IS NOT AN ORDER)**



1. Request #: FY19-S-014 – DART CENTRAL STATION CASTING REPAIR	2. Date Issued April 11, 2019
3. Issued By: DART (Des Moines Area Regional Transit Authority)	4. Deliver to: Dan Clark dclark@ridedart.com 515-283-8116

<p>5. Please furnish quotations to the issuing office in block 4 on or before close of business day (Date):</p> <p style="text-align: center;">May 3, 2019</p> <p>PRE –BID CONFERENCE: A Pre-Bid Conference will be held in the Multimodal Room at DART Central Station, at 1:00 p.m. on Thursday, April 25, 2019. Attendance is not required to bid, but highly encouraged.</p>	<p>IMPORTANT: This request does not commit DART to pay any costs incurred in the preparation of the submission of this quotation or to contract for supplies or service. Any representations and/or certifications attached to this Request for Quotation must be completed by the quoter. Before making an award, DART reserves the right to request additional information and/or seek clarification from any bidder regarding any submitted statement/bid/offer that DART finds to be ambiguous.</p>
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6. SCOPE OF WORK

General:

This is a firm fixed-price contract for repairing two (2) broken castings and concrete boxouts for existing manholes to the rainwater cistern at DART Central Station (DCS), 620 Cherry Street, Des Moines, IA 50309. Proposed work includes removal and replacement of castings and concrete boxouts in NE bus drive at DCS.

SPECIAL PROVISION – SMALL BUSINESS SET-ASIDE:

As allowed in 48 CFR PART 19, subpart 19.5 – **Set Asides for Small Business** and 49 CFR PART 26, subpart 26.39 – **Fostering Small Business Participation**, this contract award will be granted to a contractor meeting Small Business Size per standards published by the U.S. Small business Administration in their *Table of Small Business Size Standards Matched to North American Industry Classification System (NAICS) - NAICS 2017*. Offers received from contractors that do not qualify as Small Business will be deemed nonresponsive and rejected. See attached clause.

Methods of Contractor Qualification – Small Business Set-Aside for DART project FY18-S-031 – Contractor must meet one (1) of the below:

1. Contractor holds current certification as a Disadvantaged Business Enterprise (in any state) and is able to provide verification of that certification upon DART request.
2. Contractor holds current certification as a Targeted Small Business with the State of Iowa.
3. Contractor holds current certification as a Small Business with the federal Small Business Administration
4. Contractor is able and willing to provide verification that it meets the size standard published in the SBA's Table of Small Business Size Standards Matched to North American Industry Classification System (NAICS 2017). **For this project, NAICS code 237310 has been identified with a qualifying size standard of \$36.5 million or below in average annual receipts as calculated per 13 CFR 121.104.**

DART will require the apparent low bidder to provide proof of qualifying as a Small Business after the bidding period has closed; failure to provide proof may cause DART to reject the submitted bid.

BASE BID AND ALTERNATIVES:

****Please attach this completed form to your bid submittal****

Base Bid: Remove and replace the broken casting and concrete boxout (west) and the broken casting and boxout (east) as shown on Exhibit 1.

Protect pavement and maintain existing PCC between and around the two boxouts to be removed. See Exhibit 2.

STATEMENT OF WORK:

- Coordinate all work with Pat Halsey, DCS Building Supervisor at 515-283-8122, contact at least forty-eight (48) hours prior to the scheduled start of work.
- Contact Project Engineer at 515-422-7016 forty-eight (48) hours prior to scheduled start of work.
- Work Schedule:
 - Close Bus Lane 8:00 a.m. Wednesday, May 22, 2019
 - Open Bus Lane by NLT 4:30 a.m. Tuesday, May 28, 2019
 - Contractor will be expected to work Memorial Day weekend to meet the schedule.
- All construction and repairs shall comply with the most current Iowa DOT specifications and SUDAS. Specific SUDAS applicable to this project include, but may not be limited to the following:
 - [SUDAS Section 3010 – Trench Excavation and Backfill](#)
 - [SUDAS Section 6010 - Structures for Sanitary and Storm Sewers](#)
 - [SUDAS Section 6020 – Rehabilitation of Existing Manholes](#)
 - [SUDAS Section 7010 – Portland Cement Concrete Pavement](#)
- Use Class 'M' PCC mix to match existing concrete pavement per Iowa DOT and SUDAS. Submit mix design to Project Engineer for approval prior to construction.
- Protect existing utilities, including rainwater cistern and manways, underground electric, geothermal wells and piping, storm sewer, and underground gas.
- Contractor is responsible for contacting Iowa One Call a minimum of two days before work is scheduled to begin. Iowa One Call may be contacted at 811, or 1-800-292-8989, or tickets may be submitted online at <http://www.iowaonecall.com>. Contractor will request Iowa One Call location provider notify the DCS Building Supervisor one (1) business day prior to their visit.
- Protect adjacent pavement.
- Remove existing concrete and dispose of offsite.
- Immediately after concrete has been removed, the geotechnical engineer (contracted separately by DART) will review and test existing subgrade to determine if subgrade is acceptable. Contractor shall include a line item cost in bid to remove 12" of existing subgrade and import, place, and compact special backfill. If geotechnical engineer determines that the existing subgrade is acceptable, the bid item for subgrade removal and import, place and compact of special backfill will be removed by a deductive change order.
- Compaction of subgrade (98% of maximum dry density) must be achieved prior to pouring concrete. The geotechnical engineer shall test and confirm compaction of subgrade.
- Contractor shall provide a barrier and traffic control plan to Pat Halsey, DCS Building Supervisor prior to beginning work. Work will not begin without the written approval of barrier and traffic control plan.
- Contractor shall install a manhole boxout in PCC Pavement per SUDAS 7010, Figure 7010.103. Install #5 bars and #4 hoop per detail and per SUDAS, placed mid-slab per SUDAS 7010, Figure 7010.103. Contractor shall use a BT-4 joint around the perimeter of the removal area per SUDAS 7010, Figure 7010.101
- Provide and install heavy duty rated Neenah Foundry Type R-6095 solid frame and lid, or approved equal.
- Install concrete per SUDAS 7010. Concrete shall be installed to match existing grade.
- Quality Control
 - Two weeks prior to beginning work, submit PCC pavement design to the Project Engineer for review and approval.
 - Comply with SUDAS 7010 Section 3.05 minimum age and tested strength of pavement before opening.
 - PCC test samples will be submitted to an independent test contractor specified by DART.

****Please attach this completed form to your bid submittal****

- Precedence: In the event of conflicts between language the order of precedence are (i) Iowa SUDAS, (ii) Project Engineer drawings, and (iii) this statement of work.

GENERAL CONTRACTOR RESPONSIBILITIES:

- Obtain, at their own expense, any and all permits and inspections necessary to complete all work contained in the attached specifications.
- All work will comply with Federal, State and local codes and regulations.
- Repair/Replace, at contractor's own expense, any damage to DART property by contractor's employees. Replacement or repair will be at *replacement cost value*.
- Remove, at contractor's own expense, all debris related to the project

SAFETY REQUIREMENTS:

- All costs for compliance with these safety provisions are the responsibility of the Contractor.
- Contractor shall ensure that all employees, independent contractors, and subcontractors on site are wearing all OSHA required Personal Protective Equipment (PPE) for their trade and the work being performed.
- All workers within DART property, must wear high visibility clothing. High visibility clothing or high visibility safety apparel is personal protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage. High Visibility safety apparel must meet the Performance Class 2 or 3 requirements of the American National Standards Institute/International Safety Equipment Association (ANSI/ISEA) 107-2004 for High-Visibility Safety Apparel and subsequent revisions thereof.
- Contractor and subcontractors shall comply with OSHA and reporting maintain an OSHA 300 log.
- Contractor shall have an English speaking supervisor on site at all times when work is being performed.
- Contractor shall have a site safety plan which includes, site safety orientation, tool box talks, material delivery schedule, and work attire review.
- Initial site safety orientation and tool box talk for each employee, independent contractor, or subcontractor will be documented.
- Contractor shall have a barricade and traffic control plan in order to protect DART vehicles, employees, and members of the public from harm.
- Accidents or incidents will be communicated to the DART Supervisor on site. The DART Supervisor will take charge of responding to or documenting accidents or incidents in accordance with DART policies and procedures.

BASIS OF AWARD:

DART will issue a single firm-fixed price contract to the lowest responsive, responsible proposer.

ADDITIONAL CONTRACT CLAUSES NOT INCLUDED IN DART'S FULL TERMS AND CONDITIONS FOR SMALL PURCHASES:

DART's standard Full Terms and Conditions for small purchases can be found at: <http://ridedart.com/business-center/contractual-terms-and-conditions>. Below are additional terms and conditions which are included for this project.

FORCE MAJEURE CLAUSE:

Neither party will be liable for its non-performance or delayed performance if caused by a Force Majeure Event (as defined herein). A "Force Majeure Event" shall be a condition beyond the performing party's control including, but not limited to acts of God, governmental restrictions (including the denial or cancellation of any export or other necessary license), wars, insurrections and/or any other cause beyond the reasonable control of the party whose performance is affected. A party that becomes aware of a Force Majeure Event that will significantly delay performance will notify the other party promptly in writing (but in no event later than ten (10) days) after it discovers the scope of the delay. If a Force Majeure Event occurs, the

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parties will execute a change order to extend the Performance Schedule for a time period that is reasonable under the circumstances. Contractor shall not be entitled to any claim for damages on account of hindrances or delays for any Force Majeure Event whatsoever. This includes, but is not limited to, any actions which result in delays of scheduling, changes in the scope of Services as set forth in the Statement of Work, or increases in the cost of performance of the Services.

SPECIAL EQUAL EMPLOYMENT OPPORTUNITY (EEO) PROVISION FOR CONSTRUCTION CONTRACTS CLAUSE:

During the performance of this Contract, Contractor agrees as follows:

(1) Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and Contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246

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of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(8) Contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, Contractor may request the United States to enter into such litigation to protect the interests of the United States.

PREVAILING WAGE AND ANTI-KICKBACK CLAUSE:

For all prime construction, alteration or repair contracts in excess of \$2,000 awarded by FTA, Contractor shall comply with the Davis-Bacon Act and the Copeland "Anti-Kickback" Act. Under 49 U.S.C. § 5333(a), prevailing wage protections apply to laborers and mechanics employed on FTA assisted construction, alteration, or repair projects. Contractor will comply with the Davis-Bacon Act, 40 U.S.C. §§ 3141-3144, and 3146-3148 as supplemented by DOL regulations at 29 C.F.R. part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction." In accordance with the statute, Contractor shall pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, Contractor agrees to pay wages not less than once a week. Contractor shall also comply with the Copeland "Anti-Kickback" Act (40 U.S.C. § 3145), as supplemented by DOL regulations at 29 C.F.R. part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in part by Loans or Grants from the United States." Contractor is prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled.

Performance Schedule Clause:

Existing site conditions present a safety hazard for DART; therefore, time is of the essence. Contractor will submit a project schedule to the DCS Building Supervisor which allows the completion of work in a reasonable amount of time. A reasonable time frame is further defined as the time allotted in the performance schedule plus any approved delays.

EXHIBITS:

- Exhibit A (Wage Determination)
- Exhibit B (Site Pictures)
- Exhibit 1 (Project Engineer Drawings)
- SUDAS Section 3010 – Trench Excavation and Backfill
- SUDAS Section 6010 - Structures for Sanitary and Storm Sewers
- SUDAS Section 6020 – Rehabilitation of Existing Manholes
- SUDAS Section 7010 – Portland Cement Concrete Pavement

NOTE: Additional Provisions and representations: Are X Are Not ___ attached.

7. Project Information (See appropriate clauses attached) – BIDDER REQUIRED TO COMPLETE NON-SHADED BOXES

Davis Bacon compliance required? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	If "yes", does vendor agree to submit to DART certified payrolls and comply with all other stipulations of the federal Davis Bacon Act? **If Contractor is Not Familiar with Davis Bacon, PLEASE BECOME SO BEFORE BIDDING**	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Authorized Vendor Representative Signature:
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Please attach this completed form to your bid submittal

<p>Will subs be used for this project? Yes <input type="checkbox"/> No <input type="checkbox"/></p>	<p>If "yes", please submit all subs potentially involved with this project, noting their willingness/ability to comply with Davis Bacon requirements (if applicable).</p>		<p>Contractor is solely responsible for ensuring that all Subcontractors comply with the terms and conditions of this Contract as applicable to the work to be performed by the Subcontractor. At a minimum, Contractor shall bind any and all Subcontractors to the confidentiality, indemnification, insurance, and dispute resolution provisions and third-party contracting requirements provided hereunder. (see relevant clauses below)</p>
<p>Is either the prime or sub(s) listed on this quote a certified Disadvantaged Business Entity (DBE)? Yes <input type="checkbox"/> No <input type="checkbox"/></p>	<p>If "yes", please note which vendor(s) hold current DBE certification.</p>		<p>*If applicable, provide attachment to bid form*</p>
<p>Other project information to note: Please review listed clauses relevant to this project. Full Terms and conditions can be found at: http://ridedart.com/business-center/contractual-terms-and-conditions</p>	<p>Relevant Clauses (third-party contracting requirements): No Federal Government obligations to third parties; False Statements or Claims of Civil and Criminal Fraud; Access to Third Party Contract Records; Changes to Federal Requirements; Termination; Civil Rights; EEO clause for Construction Projects (if over \$10,000); DBE (<u>including Prompt Payment Requirements for all subcontractors</u>); Incorporation of FTA Terms; Copeland Anti-Kickback Act; Energy Conservation; ADA</p>		
<p>Insurance Requirements for this Project: (per occurrence) Work Compensation: Statutory Gen. Comp. liability: \$2,000,000 Auto liability: \$1,000,000</p>	<p>The winning contractor shall be required to obtain and maintain during the term of this Contract, at Contractor's sole expense, insurance protection as noted. DART shall be listed as an additional insured under said insurance policies. Contractor shall furnish certificates of insurance to DART before services begin.</p>		

8. Bidder Information (Subcontractor will be required to complete this section as well)

<p>Name of Bidder or Subcontractor</p>	<p>Date of Quotation</p>		<p>Name of person Authorized to sign quotation (please type or print)</p>
<p>Street Address</p>	<p>Phone and email:</p>		<p>Signature</p>
<p>City</p>	<p>State</p>	<p>Zip</p>	<p>Title (type or print)</p>
<p>Annual Gross Receipts of Firm: Less Than \$1,000,000 _____ \$1,000,000 - \$5,000,000 _____ \$5,000,000 - \$8,000,000 _____ \$8,000,000 - \$15,000,000 _____ Over \$15,000,000 _____</p>	<p>Age of Firm:</p>		<p>All materials, equipment, goods and/or services offered meet or exceed the specifications and requirements and will be supplied in accordance with the entire contents of this solicitation including delivery schedules. No relationship exists or will exist during the contract period between the Contractor and DART that interferes with fair competition or constitutes a conflict of interest.</p>

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FY19-S-014

DART Central Station Casting Repairs

PRICING SHEET

BASE BID

Replace the West Broken Casting and Concrete Boxout

<i>PRICING SUBMITTAL</i>					
ITEM NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	EXTENDED PRICE
1	REMOVAL OF PCC PAVEMENT	SY	11	\$	\$
2	REMOVAL OF EXISTING SUBGRADE, 6"	SY	11	\$	\$
3	MODIFIED SUBBASE, 6"	SY	11	\$	\$
4	PCC PAVEMENT, 9"	SY	11	\$	\$
5	CASTING REPLACEMENT	EA	1	\$	\$
6	SUBTOTAL FOR WEST MANHOLE				\$

Replace the East Casting and Concrete Boxout

<i>PRICING SUBMITTAL</i>					
ITEM NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	EXTENDED PRICE
1	REMOVAL OF PCC PAVEMENT	SY	11	\$	\$
2	REMOVAL OF EXISTING SUBGRADE, 6"	SY	11	\$	\$
3	MODIFIED SUBBASE, 6"	SY	11	\$	\$
4	PCC PAVEMENT, 9"	SY	11	\$	\$
5	CASTING REPLACEMENT	EA	1	\$	\$
6	SUBTOTAL FOR EAST MANHOLE				\$

TOTAL BID: \$ _____

General Decision Number: IA190028 01/04/2019 IA28

Superseded General Decision Number: IA20180029

State: Iowa

Construction Types: Heavy and Highway

Counties: Adair, Adams, Allamakee, Appanoose, Audubon, Benton, Black Hawk, Boone, Bremer, Buchanan, Buena Vista, Butler, Calhoun, Carroll, Cass, Cedar, Cerro Gordo, Cherokee, Chickasaw, Clarke, Clay, Clayton, Clinton, Crawford, Dallas, Davis, Decatur, Delaware, Des Moines, Dickinson, Dubuque, Emmet, Fayette, Floyd, Franklin, Fremont, Greene, Grundy, Guthrie, Hamilton, Hancock, Hardin, Harrison, Henry, Howard, Humboldt, Ida, Iowa, Jackson, Jasper, Jefferson, Johnson, Jones, Keokuk, Kossuth, Lee, Linn, Louisa, Lucas, Lyon, Madison, Mahaska, Marion, Marshall, Mills, Mitchell, Monona, Monroe, Montgomery, Muscatine, O'Brien, Osceola, Page, Palo Alto, Plymouth, Pocahontas, Polk, Pottawattamie, Poweshiek, Ringgold, Sac, Shelby, Sioux, Story, Tama, Taylor, Union, Van Buren, Wapello, Warren, Washington, Wayne, Webster, Winnebago, Winneshiek, Woodbury, Worth and Wright Counties in Iowa.

EXCLUDES SCOTT COUNTY

HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number Publication Date
0 01/04/2019

* SUIA2018-001 10/18/2017

Rates Fringes

Carpenter & Piledrivermen

ZONE 1.....	\$ 27.47	12.58
ZONE 2.....	\$ 25.48	12.63
ZONE 3.....	\$ 25.48	12.63
ZONE 4.....	\$ 24.85	10.20
ZONE 5.....	\$ 23.85	8.70

CONCRETE FINISHER

ZONE 1.....	\$ 26.50	7.10
ZONE 2.....	\$ 26.50	7.10
ZONE 3.....	\$ 26.50	7.10
ZONE 4.....	\$ 23.55	6.10
ZONE 5.....	\$ 22.50	6.10

ELECTRICIAN (STREET AND
HIGHWAY LIGHTING AND TRAFFIC
SIGNALS)

ZONE 1, 2, AND 3.....	\$ 24.00	6.10
ZONE 4.....	\$ 22.70	6.10
ZONE 5.....	\$ 20.55	6.10

IRONWORKER (SETTING OF
STRUCTURAL STEEL)

ZONE 1.....	\$ 30.05	10.00
ZONE 2.....	\$ 27.96	10.00
ZONE 3.....	\$ 27.96	10.30
ZONE 4.....	\$ 25.80	9.00
ZONE 5.....	\$ 23.95	8.55

LABORER

ZONE 1, 2 AND 3

GROUP A.....	\$ 22.58	8.85
GROUP AA.....	\$ 24.96	8.85
GROUP B.....	\$ 20.73	8.85
GROUP C.....	\$ 17.65	8.85

ZONE 4

GROUP A.....	\$ 20.25	8.30
GROUP B.....	\$ 18.93	8.30
GROUP C.....	\$ 16.05	8.30

ZONE 5

GROUP A.....	\$ 20.75	6.85
GROUP B.....	\$ 18.25	6.85
GROUP C.....	\$ 17.40	6.85

POWER EQUIPMENT OPERATOR

ZONE 1

GROUP A.....	\$ 30.90	14.10
GROUP B.....	\$ 29.35	14.10
GROUP C.....	\$ 26.85	14.10
GROUP D.....	\$ 26.85	14.10

ZONE 2

GROUP A.....	\$ 30.20	14.10
GROUP B.....	\$ 28.60	14.10
GROUP C.....	\$ 26.05	14.10
GROUP D.....	\$ 26.05	14.10

ZONE 3

GROUP A.....	\$ 28.30	22.30
GROUP B.....	\$ 26.50	22.30
GROUP C.....	\$ 25.50	22.30
GROUP D.....	\$ 25.50	22.30

ZONE 4

GROUP A.....	\$ 29.80	10.85
GROUP B.....	\$ 28.66	10.85
GROUP C.....	\$ 26.58	10.85
GROUP D.....	\$ 26.58	10.85

ZONE 5

GROUP A.....	\$ 26.37	8.95
GROUP B.....	\$ 25.33	8.95
GROUP C.....	\$ 23.60	8.95
GROUP D.....	\$ 22.60	8.95

TRUCK DRIVER (AND PAVEMENT MARKING DRIVER/SWITCHPERSON)

ZONE 1.....	\$ 23.05	10.65
ZONE 2		
.....	\$ 23.05	10.65
ZONE 3.....	\$ 23.05	10.65
ZONE 4.....	\$ 23.05	6.45
ZONE 5		
.....	\$ 21.10	6.45

ZONE DEFINITIONS

- ZONE 1 The Counties of Polk, Warren, and Dallas for all Crafts, and Linn County Carpenters only.
- ZONE 2 The Counties of Dubuque for all Crafts and Linn County for all Crafts except Carpenters.
- ZONE 3 The Cities of Burlington, Clinton, Fort Madison, Keokuk, and Muscatine (and abutting municipalities of any such cities).
- ZONE 4 Story, Black Hawk, Cedar, Jasper, Jones, Jackson, Louisa, Madison, and Marion Counties; Clinton County (except the City of Clinton), Johnson County, Muscatine County (except the City of Muscatine), the City of Council Bluffs, Lee County and Des Moines County.
- ZONE 5 All areas of the state not listed above.

LABORER CLASSIFICATIONS - ALL ZONES

GROUP AA A- {Skilled pipelayer (sewer, water and conduits) and tunnel laborers; asbestos abatement worker (Zones 1, 2 and 3).

GROUP A - Carpenter tender on bridges and box culverts; curb machine (without a seat); deck hand; diamond & core drills; drill operator on air tracs, wagon drills and similar drills; form setter/stringman on paving work; gunnite nozzleleman; joint sealer kettleman; laser operator; powderman tender; powderman/blaster; saw operator; {pipelayer (sewer, water, and conduits); sign erector*; tunnel laborer; asbestos abatement worker (Zones 4 and 5), sign erector.

GROUP B - Air, gas, electric tool operator; barco hammer; carpenter tender; caulker; chain sawman; compressor (under 400 cfm); concrete finisher tender; concrete processing materials and monitors; cutting torch on demolition; drill tender; dumpmen; electric drills; fence erectors; form line expansion joint assembler; form tamper; general laborer; grade checker; handling and placing metal mesh, dowel bars, reinforcing bars and chairs; hot asphalt laborer; installing temporary traffic control devices; jackhammerman; mechanical grouter; painter (all except stripers); paving breaker; planting trees, shrubs and flowers; power broom (not self-propelled); power buggyman; rakers; rodman (tying reinforcing steel); sandblaster; seeding and mulching; sewer utility topman/bottom man; spaders; stressor or stretcherman on pre or post tensioned concrete; stringman on re/surfacing/no grade control; swinging stage, tagline, or block and tackle; tampers; timberman; tool room men and checkers; tree climber; tree groundman; underpinning and shoring caissons over twelve feet deep; vibrators; walk behind trencher; walk behind

paint stripers; walk behind vibrating compactor; water pumps (under three inch); work from bosun chair.

GROUP C - Scale weigh person; traffic control/flagger, surveillance or monitor; water carrier.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS - ALL ZONES

GROUP A - All terrain (off road) forklift; asphalt breakdown roller (vibratory); asphalt laydown machine; asphalt plant; asphalt screed; bulldozer (finish); central mix plant; concrete pump; crane; crawler tractor pulling scraper; directional drill (60,000 (lbs) pullback and above); dragline and power shovel; dredge engineer; excavator (over 1/2 cu. yd.); front end loader (4 cy and over); horizontal boring machine; master mechanic; milling machine (over 350 hp); motor grader (finish); push cat; rubber tired backhoe (over 1/2 cu. yd.); scraper (12 cu. yd. and over or finish); Self-propelled rotary mixer/road reclaimer; sidebroom tractor; slipform portland concrete paver; tow or push boat; trenching machine (Cleveland 80 or similar).

GROUP B - Articulated off road hauler, asphalt heater/planer; asphalt material transfer vehicle; asphalt roller; belt loader or similar loader; bulldozer (rough); churn or rotary drill; concrete curb machine; crawler tractor pulling ripper, disk or roller; deck hand/oiler; directional drill (less than 60,000 (lbs) pullback); distributor; excavator (1/2 cu. yd. and under); form riding concrete paver; front end loader (2 to less than 4 cu. yd.); group equipment greaser; mechanic; milling machine (350 hp. and less); paving breaker; portland concrete dry batch plant; rubber tired backhoe (1/2 cu. yd. and under); scraper (under 12 cu. yd.); screening, washing and crushing plant (mobile, portable or stationary); shoulder machine; skid loader (1 cu. yd. and over); subgrader or trimmer; trenching machine; water wagon on compaction.

GROUP C - Boom & winch truck; concrete spreader/belt placer; deep wells for dewatering; farm type tractor (over 75 hp.) pulling disc or roller; forklift; front end loader (under 2 cu. yd.); motor grader (rough); pile hammer power unit; pump (greater than three inch diameter); pumps on well points; safety boat; self-propelled roller (other than asphalt); self-propelled sand blaster or shot blaster, water blaster or striping grinder/remover; skid loader (under 1 cu. yd.); truck mounted post driver.

GROUP D - Boiler; compressor; cure and texture machine; dow box; farm type or utility tractor (under 75 hp.) pulling disk, roller or other attachments; group greaser tender; light plants; mechanic tender; mechanical broom; mechanical heaters; oiler; pumps (under three inch diameter); tree chipping machine; truck crane driver/oiler.

CARPENTERS AND PILEDRIVERMEN, or IRONWORKERS (ZONE 5)

Setting of structural steel; any welding incidental to bridge or culvert construction; setting concrete beams.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

=====
Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the E0, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the E0 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which

these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISION

**EXHIBIT B
SITE PICTURES**



1. Location of Castings and Boxouts at DART Central Station:



2. **West Casting and Boxout:** Broken casting and boxout to be removed and replaced



EXHIBIT B
SITE PICTURES

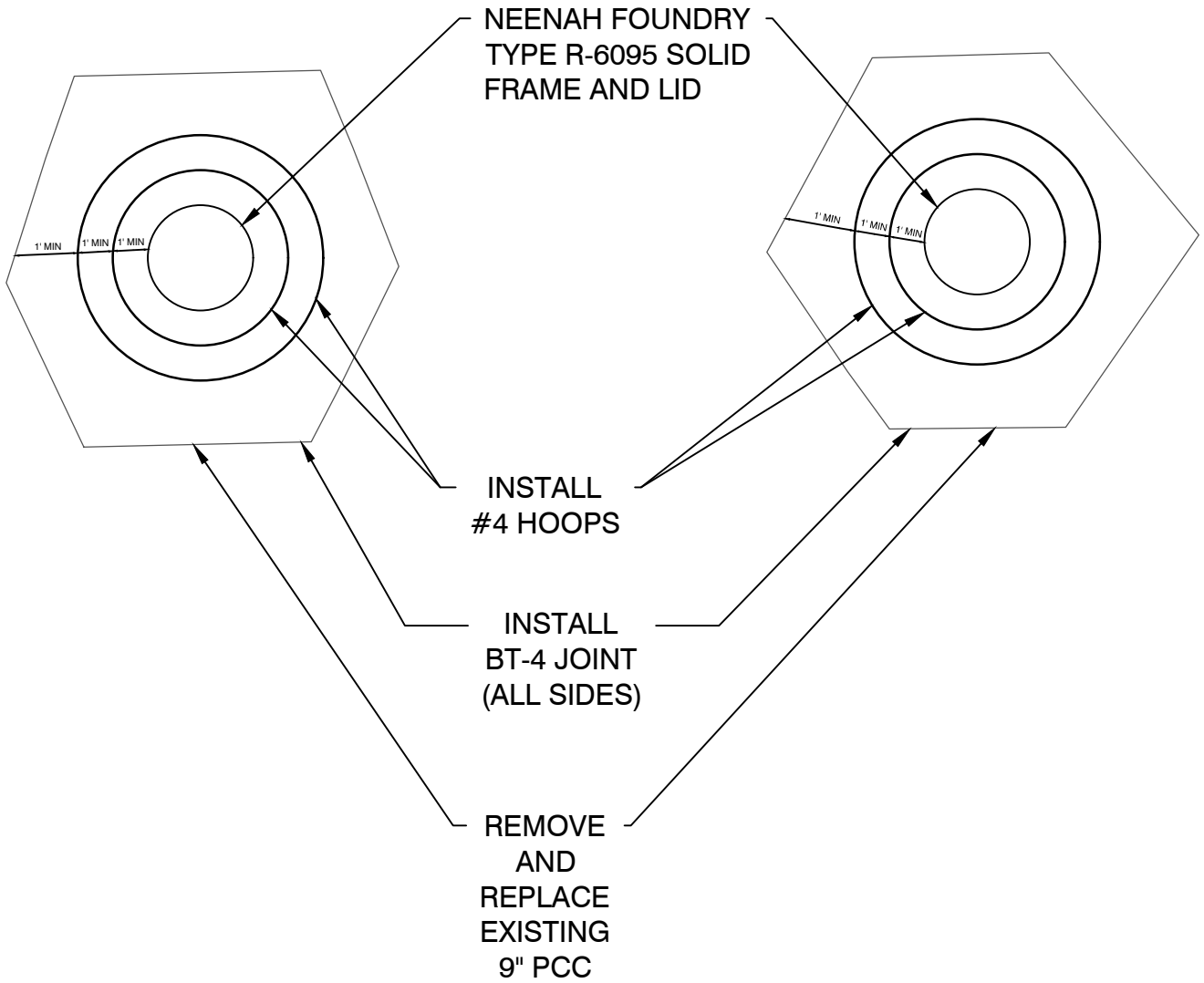


3. **East Boxout:** East casting and boxout to be removed and replaced:
Item #1:



WEST MANHOLE

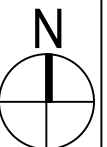
EAST MANHOLE



GRAPHIC SCALE



 IOWA
ONE CALL
CALL 811 / 1-800-292-8989
2 Working Days BEFORE YOU DIG
DigSafeWait48.com



CASTING REPAIR
DART CENTRAL STATION
DES MOINES, IOWA
EXHIBIT 1

 LT LEON
ASSOCIATES INC
500 EAST LOCUST STREET SUITE 400 office 515-422-7016
DES. MOINES, IOWA 50309 www.ltleon.com

PROJECT NO. 003.012

EXHIBIT 1

SHEET NO.

1 OF 2

HATCH LEGEND



PROPOSED 9" PCC, REINFORCED WITH #4 BARS SPACED @ 15" O.C.

NO.	REVISION	BY	DATE

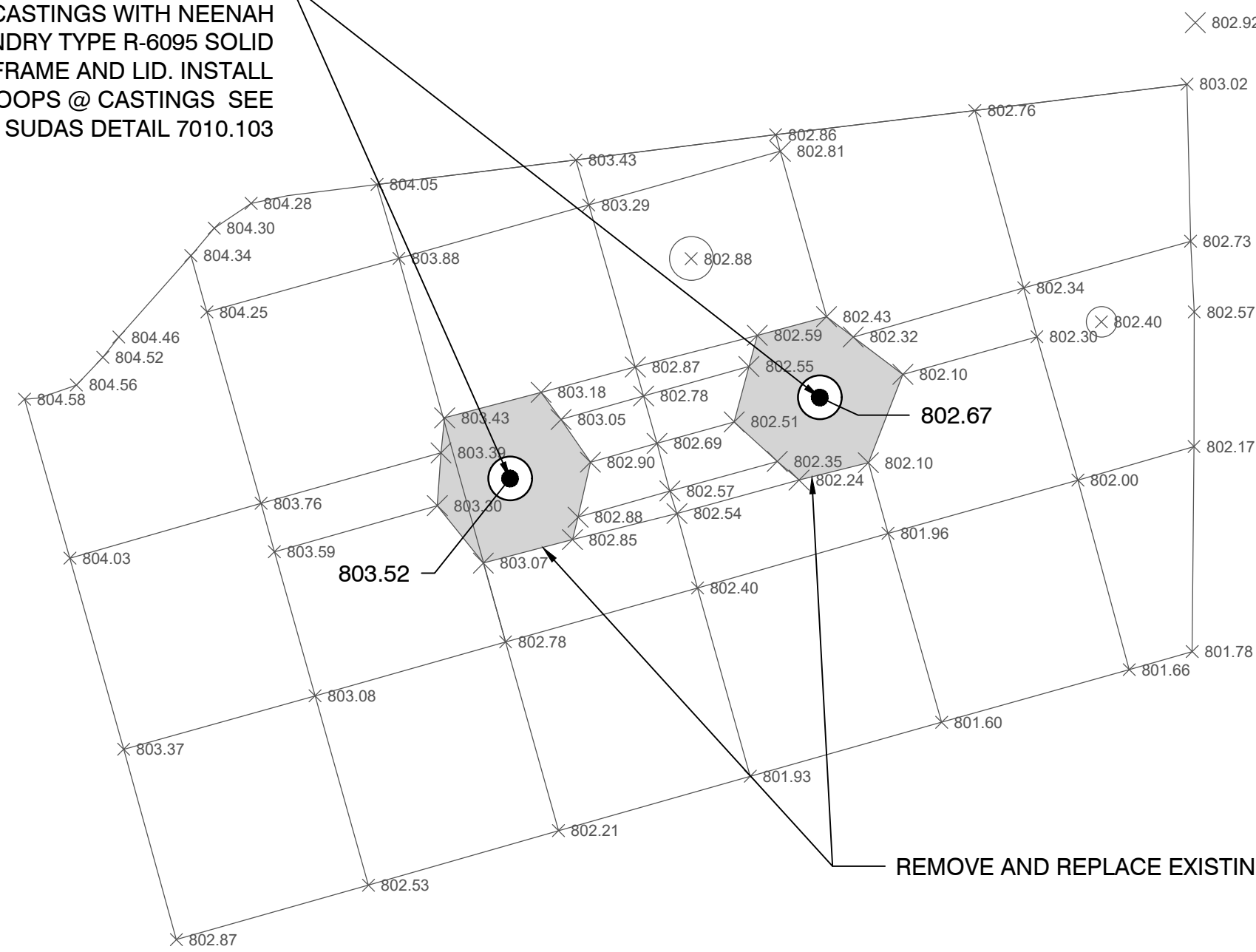
DESIGNED: ZCC
 DRAFTED: ZCC
 CHECKED: LTL
 SCALE: 1:10

PROJECT NO.: 003.012
 FILE NUMBER: 003.012
 SHEET NO.: 2 OF 2
 DATE: APRIL 11, 2019

LIT LEON
 ASSOCIATES INC.
 500 EAST LOCUST STREET SUITE 400
 DES MOINES, IOWA 50309
 office 515-427-7016
 www.ltleon.com

PROJECT NO. 003.012
 EXHIBIT 2
 SHEET NO.
 2 OF 2

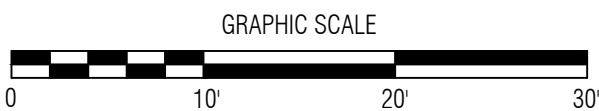
REPLACE EXISTING CASTINGS WITH NEENAH FOUNDRY TYPE R-6095 SOLID FRAME AND LID. INSTALL #4 HOOPS @ CASTINGS SEE SUDAS DETAIL 7010.103



JOINTING NOTE: BT-4 JOINT FOR ALL CONNECTIONS TO EXISTING PAVEMENT.

REMOVE AND REPLACE EXISTING 9" PCC

IOWA ONE CALL
 CALL 811 / 1-800-292-8989
 2 Working Days BEFORE YOU DIG
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PRELIMINARY
 NOT FOR CONSTRUCTION



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.
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.

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.

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.

1.08 MEASUREMENT AND PAYMENT (Continued)**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.

2.03 BACKFILL MATERIAL

- A. Class II Material:** Manufactured and non-manufactured open-graded (clean) or dense-graded (clean) processed aggregate, clean sand, or coarse-grained natural soils (clean) with little or no fines. Class II materials are further described in Table 3010.01.

Table 3010.01: Class II Materials

Type	Soil Group Symbol ASTM D 2487	Description	Percentage Passing Sieve Sizes		
			1 1/2 in.	No. 4	No. 200
Coarse-Grained Soils, clean	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.	100%	< 50% of "Coarse Fraction"	< 5%
	GP	Poorly-graded gravels and gravel-sand mixtures; little or no fines.			
	SW	Well-graded sands and gravelly sands; little or no fines.		> 50% of "Coarse Fraction"	
	SP	Poorly-graded sands and gravelly sands; little or no fines.			
Coarse-Grained Soils, borderline clean to with fines	e.g. GW-GC, SP-SM	Sands and gravels that are borderline between clean and with fines.	100%	Varies	5% to 12%

B. Class III Material:

1. Natural coarse-grained soils with fines. Class III materials are further described in Table 3010.02.
2. Do not use where water condition in trench may cause instability.

Table 3010.02: Class III Material

Table	Soil Group Symbol ASTM D 2487	Description
Coarse-Grained Soils, with fines	GM	Silty gravels, gravel-sand-silt mixtures.
	GC	Clayey gravels, gravel-sand-clay mixtures.
	SM	Silty sands, sand-silt mixtures.
	SC	Clayey sands, sand-clay mixtures.

C. Class IVA Material:

1. Natural fine-grained inorganic soils. Class IVA materials are further described in Table 3010.03.
2. The Engineer will determine if material is not suitable for use as backfill material under deep fills, surface applied wheel loads, heavy vibratory compactors, tampers, or other conditions.
3. Do not use where water conditions in trench may cause instability.
4. Material is suitable for use in dry trench conditions only.

2.03 BACKFILL MATERIAL (Continued)**Table 3010.03: Class IVA Material**

Type	Soil Group Symbol ASTM D 2487	Description
Fine-Grained Soils (inorganic)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clay, lean clay.

D. Class IVB Material:

1. Natural fine-grained inorganic (high elastic silts and plastic clays - fat clay) with a liquid limit greater than 50%. Class IVA materials are further described in Table 3010.04.
2. When approved by the Engineer, material may be used as final trench backfill in a dry trench.
3. Do not use in the pipe embedment zone.

Table 3010.04: Class IVB Material

Type	Soil Group Symbol ASTM D 2487	Description
Fine-Grained Soils (inorganic)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	CH	Inorganic clays of high plasticity, fat clays.

2.04 TOPSOIL**A. Class V Material:**

1. Organic soils. Class V materials are further described in Table 3010.05.
2. Use only as topsoil outside of the pavement, unless otherwise specified or allowed by the Engineer.
3. Do not use in the pipe embedment zone.

Table 3010.05: Class V Material

Type	Soil Group Symbol ASTM D 2487	Description
Organic Soils (unsuitable for backfill)	OL	Organic silts and organic silty clays of low plasticity.
	OH	Organic clays of medium to high plasticity, organic silts.
Highly Organic (unsuitable for backfill)	PT	Peat and other high organic soils.

2.05 STABILIZATION (FOUNDATION) MATERIALS

- A. Clean 2 1/2 inch crushed stone with the following gradation:

Table 3010.06: Stabilization Materials

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

- B. If specified, meet Iowa DOT Section 4128 for Gradation No. 13 screened over a 1 inch screen or the Engineer may authorize a change in gradation depending on materials available locally at time of construction.
- C. Crushed concrete may be used, if approved by the Engineer, if it is within \pm 5% of the gradation for each size of material.

2.06 SPECIAL PIPE EMBEDMENT AND ENCASEMENT MATERIAL

- A. Concrete Cradle, Arch, or Encasement:** Use Iowa DOT Class C concrete.
- B. Flowable Mortar:** Comply with Iowa DOT Article 2506.02.
- C. CLSM:**
1. Approximate quantities per cubic yard:
 - a. Cement: 50 pounds
 - b. Fly ash: 250 pounds
 - c. Fine aggregate: 2,910 pounds
 - d. Water: 60 gallons
 2. A compressive strength of at least 50 psi compressive strength at 28 calendar days can be expected.
 3. Comply with material requirements of Iowa DOT Article 2506.02.

PART 3 - EXECUTION**3.01 TRENCH EXCAVATION**

- A. Notify the Engineer prior to the start of excavation activities.
- B. Remove topsoil to a minimum depth of 12 inches and stockpile.
- C. Excavate trench to required elevations and dimensions. Comply with Figure 3010.101.
 - 1. Protect existing facilities, trees, and shrubs during trench excavation.
 - 2. Place excavated material away from trench.
 - 3. Grade spoil piles to drain. Do not allow spoil piles to obstruct drainage.
- D. Unsuitable Backfill Material:
 - 1. If unsuitable backfill material is encountered, notify the Engineer.
 - 2. Remove rock, rubbish, boulders, debris, and other unsuitable backfill materials at least 6 inches below and on each side of the pipe.
 - 3. Keep unsuitable backfill material separated from suitable backfill material and topsoil.
 - 4. Restore trench to design dimensions using bedding or stabilization material.

3.02 ROCK OR UNSTABLE SOILS IN TRENCH BOTTOM

- A. Notify the Engineer prior to over-excavation.
- B. The Engineer will determine the need for over-excavation and trench foundation stabilization prior to installation of pipes and structures.
- C. Comply with Figure 3010.101 for over-excavation of rock and wet or soft foundations.

3.03 TRENCH PROTECTION

- A. Install adequate trench protection (sheeting, shoring, and bracing) to prevent ground movement or damage to adjacent structures, pipelines, and utilities.
- B. Move trench boxes carefully to avoid disturbing pipe, bedding, or trench wall.

3.04 DEWATERING

- A. Maintain water levels below the bottom of trench excavation.
- B. Perform the dewatering operation according to the dewatering plan approved by the Engineer. The dewatering plan may be modified to meet actual field conditions, with approval of the Engineer.
- C. Ensure operation of the dewatering system does not damage adjoining structures and facilities. Cease dewatering operations and notify the Engineer if damage is observed.
- D. Discharged Water:
 - 1. Do not discharge water into sanitary sewers.
 - 2. Discharging water into storm sewers requires Engineer's approval.

3.04 DEWATERING (Continued)

3. Obtain permission of adjacent property owner prior to discharging water onto their property.
4. Maintain and control water discharge as necessary to prevent a safety hazard for vehicular and pedestrian traffic.
5. Direct water discharge away from electrical facilities or equipment.
6. Use dewatering equipment that will minimize disturbance from noise and fumes.
7. Protect discharge points from erosion. Provide sediment control for sediment contaminated water discharged directly from trench.

3.05 PIPE BEDDING AND BACKFILL

A. General: Comply with Figures 3010.101, 3010.102, 3010.103, 3010.104, and 3010.105, as appropriate.

1. Bedding and backfill used for pipe installation will depend on:
 - a. Type of installation (water main, sanitary sewer gravity main, sanitary sewer force main, or storm sewer).
 - b. Pipe material.
 - c. Depth of bury.
 - d. Pipe diameter.
2. After pipe installation, place remaining bedding material and immediately place backfill in trench.
3. Adjust the moisture content of excessively wet, but otherwise suitable, backfill material by spreading, turning, aerating, and otherwise working material as necessary to achieve required moisture range.
4. Adjust the moisture content of excessively dry, but otherwise suitable, backfill material by adding water, then turning, mixing, and otherwise blending the water uniformly throughout the material until the required moisture range is achieved.
5. Hydraulic compaction (flooding with water) is not allowed unless authorized by the Engineer.

B. Pipe Bedding:**1. Granular Material:**

- a. Class I granular bedding material is required for all gravity mains. Use when specified for pressure pipes.
- b. Comply with Figures 3010.101, 3010.102, 3010.103, 3010.104, and 3010.105.
- c. Place bedding material in the bottom of the trench in lifts no greater than 6 inches thick. Consolidate and moderately compact bedding material.
- d. Shape bedding material to evenly support pipe at the proper line and grade, with full contact under the bottom of the pipe. Excavate for pipe bells.
- e. Install pipe and system components.
- f. Place, consolidate, and moderately compact additional bedding material adjacent to the pipe to a depth equal to 1/6 the outside diameter of the pipe.

3.05 PIPE BEDDING AND BACKFILL (Continued)**2. Suitable Backfill Material:**

- a. Only use with pressure pipe. Comply with Figure 3010.104.
- b. Use suitable backfill material to shape trench bottom to evenly support pipe at the proper line and grade, with full contact under the bottom of the pipe. Excavate for pipe bells.

3. Special Pipe Embedment and Encasement Materials:**a. Concrete, Flowable Mortar, or CLSM:**

- 1) If specified in the contract documents, use concrete, flowable mortar, or CLSM in lieu of other bedding materials.
- 2) Secure pipe against displacement or flotation prior to placing concrete, flowable mortar, or CLSM.

b. Waterstop:

- 1) Place Class IVA clay backfill material, and compact to at least 90% of Standard Proctor Density. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
- 2) If trench stabilization material is required, extend waterstop through stabilization material to bottom of trench.

C. Haunch Support: Place from the top of the pipe bedding to the springline of the pipe.**1. Granular Material:**

- a. Place Class I material in lifts no greater than 6 inches thick.
- b. Consolidate and moderately compact by slicing with a shovel or using other approved techniques.

2. Suitable Backfill Material:

- a. Place in lifts no greater than 6 inches thick.
- b. For Class II backfill material, consolidate and moderately compact by slicing with a shovel or using other approved techniques.
- c. For Class III and Class IVA backfill materials, compact to at least 90% of Standard Proctor Density. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.

3. Special Pipe Embedment and Encasement Materials:**a. Concrete, Flowable Mortar, or CLSM:**

- 1) If specified in the contract documents, use concrete, flowable mortar, or CLSM in lieu of other bedding materials.
- 2) Secure pipe against displacement or flotation prior to placing concrete, flowable mortar, or CLSM.

b. Waterstop: Place and compact Class IVA clay backfill material according to the suitable backfill material requirement above.**D. Primary and Secondary Backfill:****1. General:**

- a. For primary backfill, place from the springline of the pipe to the top of the pipe.
- b. For secondary backfill, place from the top of the pipe to 1 foot above the top of the pipe.

2. Granular Material:

- a. Place in lifts no greater than 6 inches thick.
- b. Compact to at least 65% relative density.

3.05 PIPE BEDDING AND BACKFILL (Continued)**3. Suitable Backfill Material:**

- a. Place in lifts no greater than 6 inches thick.
- b. For Class II backfill material, compact to at least 65% relative density.
- c. For Class III and Class IVA backfill materials, compact to at least 95% of Standard Proctor Density. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.

4. Special Pipe Embedment and Encasement Materials:**a. Concrete, Flowable Mortar, or CLSM:**

- 1) If specified in the contract documents, use concrete, flowable mortar, or CLSM in lieu of other bedding materials.
- 2) Secure pipe against displacement or flotation prior to placing concrete, flowable mortar, or CLSM.

- b. Waterstop:** Place and compact Class IVA clay backfill material according to the suitable backfill material requirement above.

E. Final Trench Backfill:

1. Place suitable backfill material from 1 foot above the top of the pipe to the top of the trench.
 - a. Use no more than 8 inch thick lifts for backfill areas more than 3 feet below the bottom of pavement.
 - b. Use no more than 6 inch thick lifts for backfill areas less than or equal to 3 feet below the bottom of pavement.
2. Place backfill material after recording locations of connections and appurtenances or at the Engineer's direction.
3. Class I and Class II Backfill Material:
 - a. Compact to at least 65% relative density within right-of-way.
 - b. Compact to at least 50% relative density outside right-of-way.
4. Class III and Class IVA Backfill Material:
 - a. Compact to at least 95% of Standard Proctor Density within right-of-way.
 - b. Compact to at least 90% of Standard Proctor Density outside right-of-way.
 - c. Obtain required compaction within a soil moisture range of optimum moisture to 4% above optimum moisture content.
5. In areas to remain unpaved, terminate backfill material 8 inches below finished grade. Use topsoil for the final 8 inches above trench backfill material.
6. Terminate backfill material at subgrade elevation in areas to be paved.

3.06 TRENCH COMPACTION TESTING

A. General: When trench compaction testing is specified in the contract documents as the Contractor's responsibility, provide testing of trench backfill material using the services of an independent testing laboratory approved by the Engineer.

B. Soil Testing:**1. Cohesive Soils:**

- a. Determine moisture-density relationships by ASTM D 698 (Standard Proctor). Perform at least one test for each type of cohesive soil used.
- b. Determine in-place density and moisture content. Use ASTM D 1556 (sand-cone method) and ASTM D 2216 (laboratory moisture content), or use ASTM D 6938 (nuclear methods for density and moisture content).

3.06 TRENCH COMPACTION TESTING (Continued)**2. Cohesionless Soils:**

- a. Determine maximum and minimum index density and calculate relative density using ASTM D 4253 and ASTM D 4254.
- b. For Class I granular bedding material, determine gradation according to ASTM C 136.

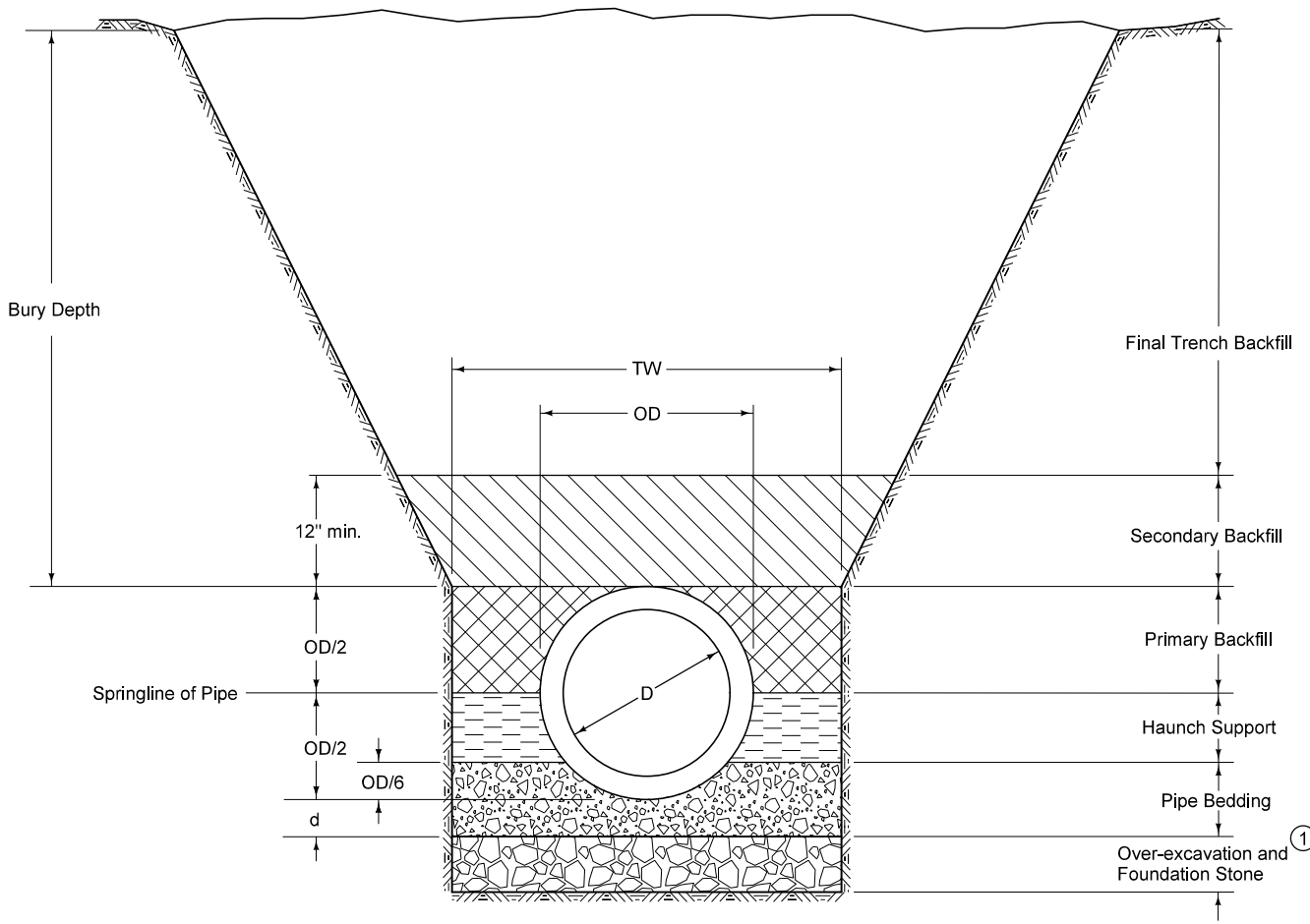
C. Field Testing:

- 1. Testing Frequency and Locations:** Perform testing of the final trench backfill, beginning at a depth of 2 feet above the top of the pipe, as follows:
 - a. Coordinate the timing of testing with the Engineer.
 - b. The Engineer will determine the location of testing.
 - c. For each 2 vertical feet of consolidated fill, provide tests at a maximum horizontal spacing of 200 feet and at all street crossings.
 - d. Additional testing may be required by the Engineer in the event of non-compliance or if conditions change.
 - e. If necessary, excavate to the depth and size as required by the Engineer to allow compaction tests. Place backfill material and recompact.
- 2. Test Failure and Retesting:** Rework, recompact, and retest as necessary until specified compaction and moisture content is achieved in all areas of the trench. In the event of failed tests, the Engineer may require retesting as deemed necessary.

END OF SECTION

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

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



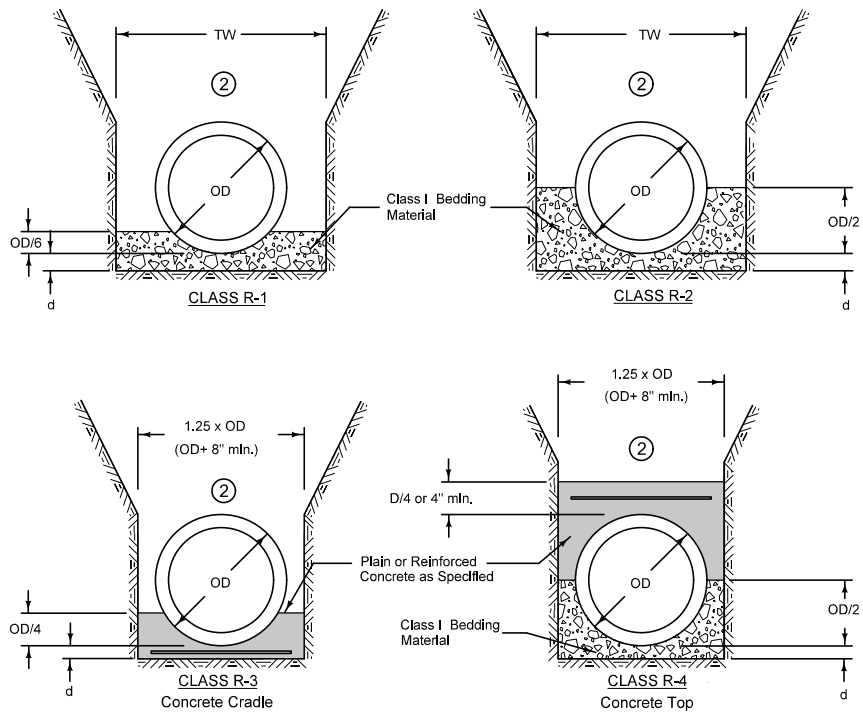
Key

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

FIGURE 3010.101 SHEET 1 OF 1

		REVISION
		1 04-17-18
FIGURE 3010.101	STANDARD ROAD PLAN	SW-101
		SHEET 1 of 1
<small>REVISIONS: Replaced Iowa DOT and SUDAS logos.</small>		
<i>Paul D. Wigand</i> <small>SUDAS DIRECTOR</small>		<i>Brian Smith</i> <small>DESIGN METHODS ENGINEER</small>
TRENCH BEDDING AND BACKFILL ZONES		

RCP AND VCP CIRCULAR PIPE BEDDING ①



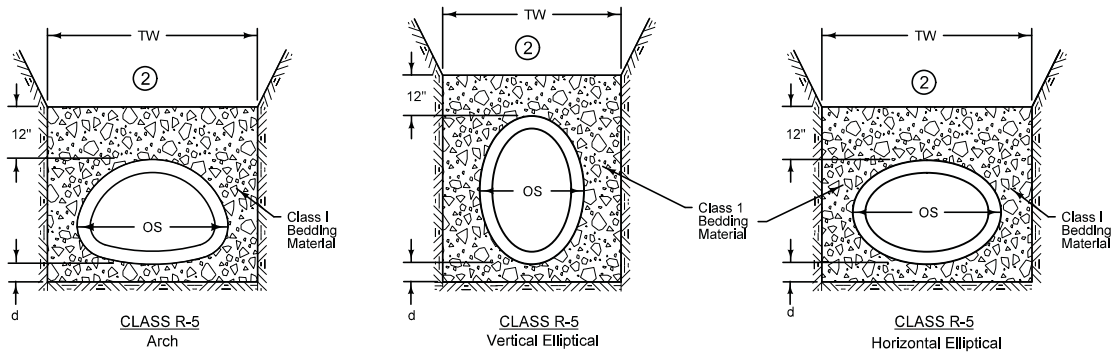
Refer to sheet 2 for bury depth restrictions.

- ① Use Bedding Class R-1 or R-2 unless specified otherwise.
- ② Place remainder of bedding and backfill materials as specified in the contract documents.

Key

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

REINFORCED CONCRETE ARCH AND ELLIPTICAL PIPE BEDDING



		REVISION
		2 04-18-17
FIGURE 3010.102	STANDARD ROAD PLAN	SW-102
SHEET 1 of 2		
<small>REVISIONS: Changed title to RCP AND VCP "CIRCULAR" BEDDING. Changed title on bedding Class R-4 from Concrete Arch to Concrete "Top".</small>		
<small>SUDAS DIRECTOR</small>		<small>DESIGN METHODS ENGINEER</small>
RIGID GRAVITY PIPE TRENCH BEDDING		

ALLOWABLE BURY DEPTH

CLASS III RCP

Pipe Diameter (in)	Class R-1 Bedding	Class R-2 Bedding	Class R-3 & R-4 Bedding		
			No Steel	As=0.4%	As=1.0%
12	7'	10'	15'	19'	27'
15	8'	10'	16'	19'	27'
18	8'	1 1'	16'	20'	40'
21	8'	1 1'	18'	26'	40'
24	8'	12'	23'	36'	40'
27	10'	15'	30'	40'	40'
30	1 1'	15'	29'	40'	40'
33	1 1'	15'	28'	40'	40'
36	1 1'	15'	27'	40'	40'
42	1 1'	15'	26'	38'	40'
48	1 1'	15'	26'	36'	40'
54	1 1'	15'	25'	34'	40'
60	1 1'	15'	25'	33'	40'
66	1 1'	15'	24'	32'	40'
72	1 1'	15'	24'	32'	40'

As = Area of Steel Reinforcing

CLASS IV RCP

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

As = Area of Steel Reinforcing

CLASS V RCP

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

As = Area of Steel Reinforcing

EXTRA STRENGTH VCP

Pipe Dia. (in)	Bedding Class				
	R-1	R-2	R-3 & R-4		
			No Steel	As=0.4%	As=1.0%
6	25'	30'	30'	30'	30'
8	20'	26'	30'	30'	30'
10	18'	23'	30'	30'	30'
12	16'	20'	30'	30'	30'
15	15'	19'	28'	30'	30'
18	14'	18'	30'	30'	30'
21	15'	22'	30'	30'	30'
24	18'	28'	30'	30'	30'
27	20'	30'	30'	30'	30'
30	19'	29'	30'	30'	30'
33	20'	30'	30'	30'	30'
36	20'	30'	30'	30'	30'
39	19'	29'	30'	30'	30'
42	18'	26'	30'	30'	30'

As = Area of Steel Reinforcing

CONCRETE ARCH PIPE

Pipe Size (inch by inch)	Equiv. Dia. (in)	Pipe Class	
		A-III	A-IV
18 x 1 1'	15	6'	1 1'
22 x 13	18	6'	1 1'
26 x 15	21	6'	13'
29 x 18	24	7'	15'
36 x 22	30	8'	15'
44 x 27	36	8'	14'
51 x 31	42	8'	15'
58 x 36	48	8'	15'
65 x 40	54	8'	15'
73 x 45	60	8'	14'
88 x 54	72	9'	14'

Based on Class R-5 bedding

HORIZONTAL ELLIPTICAL RCP

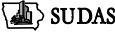



Pipe Size (in x in)	Equiv. Dia. (in)	Pipe Class	
		HE-III	HE-IV
14 x 23	18	12'	22'
19 x 30	24	15'	29'
22 x 34	27	15'	28'
24 x 38	30	15'	27'
27 x 42	33	15'	27'
29 x 45	36	15'	26'
32 x 49	39	15'	26'
34 x 54	42	15'	25'
38 x 60	48	15'	25'
43 x 68	54	15'	24'
48 x 76	60	15'	24'
53 x 83	66	15'	24'
58 x 91	72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

Based on Class R-5 bedding

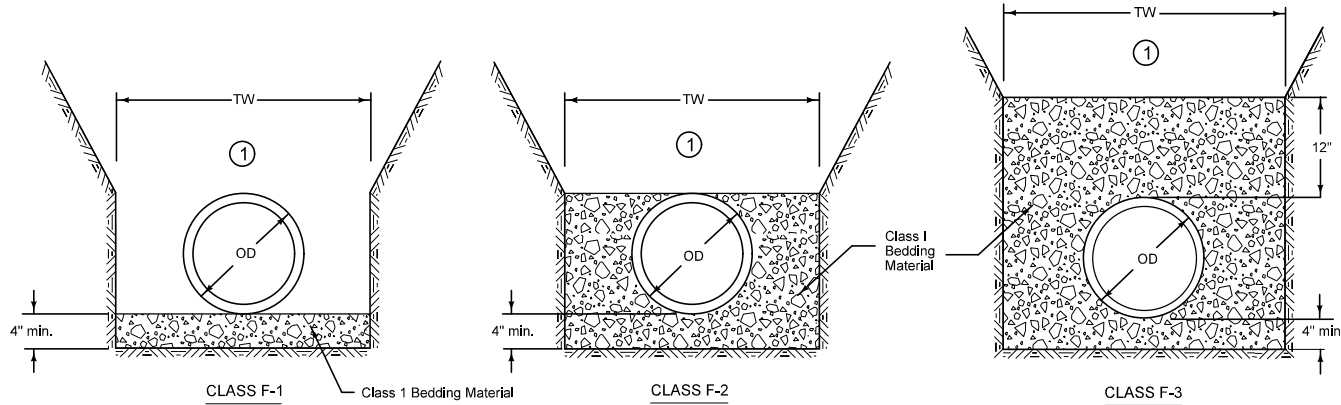
VERTICAL ELLIPTICAL RCP

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

Based on Class R-5 bedding

		REVISION
		2 04-18-17
FIGURE 3010.102	STANDARD ROAD PLAN	SW-102
SHEET 2 of 2		
REVISIONS: Changed title to RCP AND VCP "CIRCULAR" BEDDING. Changed title on bedding Class R-4 from Concrete Arch to Concrete "Top".		
		
SUDAS DIRECTOR		DESIGN METHODS ENGINEER
RIGID GRAVITY PIPE TRENCH BEDDING		

BEDDING CLASSES



- ① Place remainder of bedding and backfill materials as specified in the contract documents.
- ② Minimum depth of bury 12 inches or as specified by the manufacturer.

ALLOWABLE BEDDING CLASSES

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

Key

OD = Outside diameter of pipe

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

ALLOWABLE BURY DEPTH ②

PVC PIPE

Pipe Diameter (in)	ASTM D 3034			ASTM F 679	ASTM F 949	ASTM F 1803	ASTM D 2680
	Solid Wall			Solid Wall	Corrug. Exterior	Closed Profile	Composite (Truss Type)
	SDR 23.5	SDR 26	SDR 35	SDR 35			
8	30'	28'	24'	---	24'	---	32'
10	30'	28'	24'	---	24'	---	32'
12	30'	28'	24'	---	24'	---	32'
15	30'	28'	24'	---	24'	---	32'
18	---	---	---	24'	24'	---	---
21	---	---	---	24'	24'	24'	---
24	---	---	---	24'	24'	24'	---
27	---	---	---	24'	---	24'	---
30	---	---	---	24'	24'	24'	---
33	---	---	---	24'	---	---	---
36	---	---	---	24'	24'	24'	---
42	---	---	---	24'	---	24'	---
48	---	---	---	24'	---	24'	---
54	---	---	---	---	---	24'	---
60	---	---	---	---	---	24'	---

DUCTILE IRON, AWWA C151, CLASS 52

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

HDPE PIPE

Pipe Diameter (in)	AASHTO M 294
12	8'
15	9'
18	9'
24	9'
30	9'
36	9'
42	8'
48	8'
54	8'
60	8'

POLYPROPYLENE PIPE

Pipe Diameter (in)	ASTM F 2736	ASTM F 2764
12	24'	---
15	25'	---
18	22'	---
24	20'	---
30	22'	22'
36	---	21'
42*	---	22'
48*	---	23'
54*	---	21'
60*	---	21'

*Storm Sewer Only

SUDAS IOWADOT	REVISION 2 10-18-16
	FIGURE 3010.103 STANDARD ROAD PLAN SW-103 SHEET 1 of 1

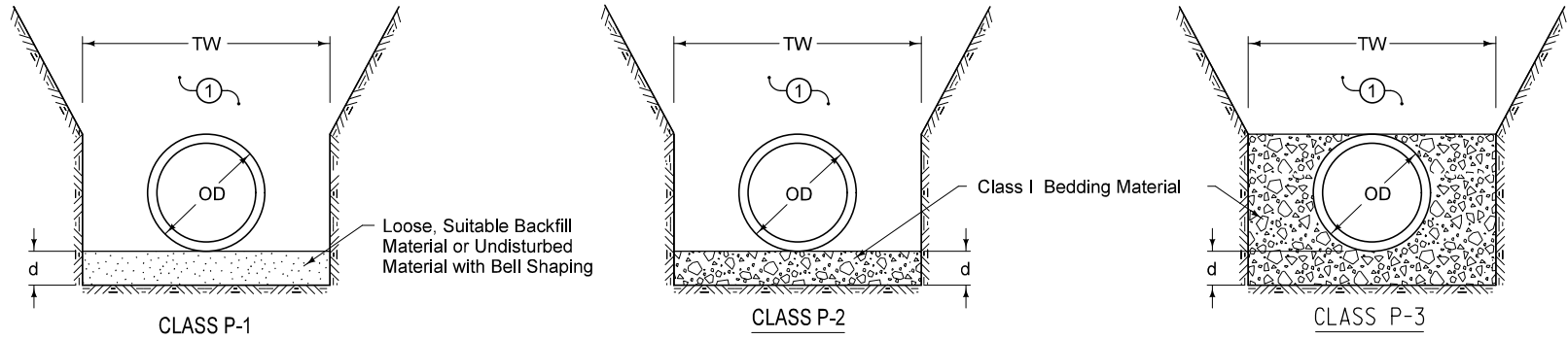
REVISIONS: Added polypropylene pipe for storm sewer applications.

Paul D. Wigand
 SUDAS DIRECTOR

Brian Smith
 DESIGN METHODS ENGINEER

FLEXIBLE GRAVITY PIPE
TRENCH BEDDING

BEDDING CLASSES



ALLOWABLE BURY DEPTH

DUCTILE IRON, AWWA C151, CLASS 52

Pipe Diameter (inches)	Class P-1 Bedding	Class P-2 Bedding	Class P-3 Bedding
4	40'	40'	40'
6	40'	40'	40'
8	40'	40'	40'
10	36'	40'	40'
12	31'	40'	40'
14	26'	40'	40'
16	23'	37'	40'
18	20'	34'	40'
20	18'	32'	40'
24	16'	29'	38'
30	13'	23'	31'
36	13'	22'	30'
42	13'	21'	29'
48	13'	19'	27'
54	13'	19'	27'

PVC, AWWA C900 & C905, DR18

Pipe Diameter (inches)	Class P-1 Bedding	Class P-2 Bedding	Class P-3 Bedding
4	19'	23'	40'
6	19'	23'	40'
8	19'	23'	40'
10	19'	23'	40'
12	19'	23'	40'
14	19'	23'	40'
16	19'	23'	40'
18	19'	23'	40'
20	19'	23'	40'
24	19'	23'	40'

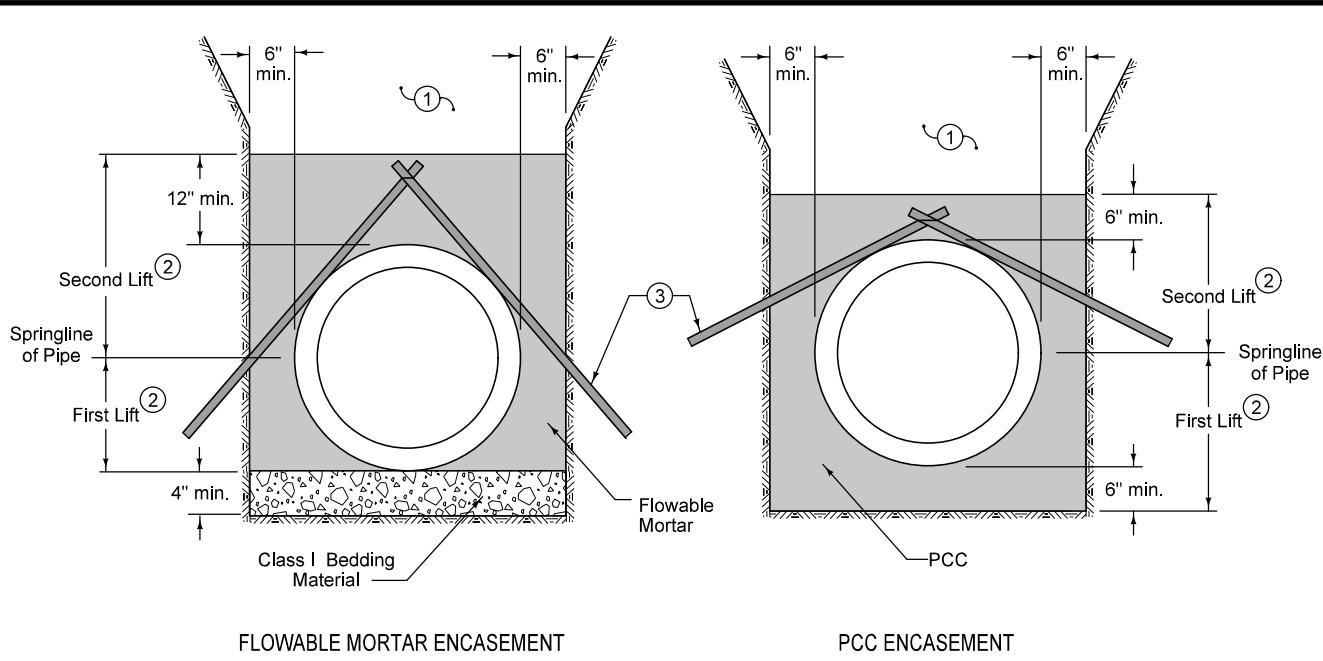
- ① Place remainder of bedding and backfill material as specified in the contract documents.

Key

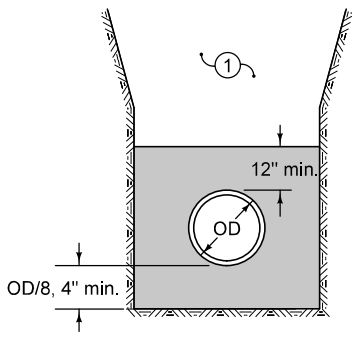
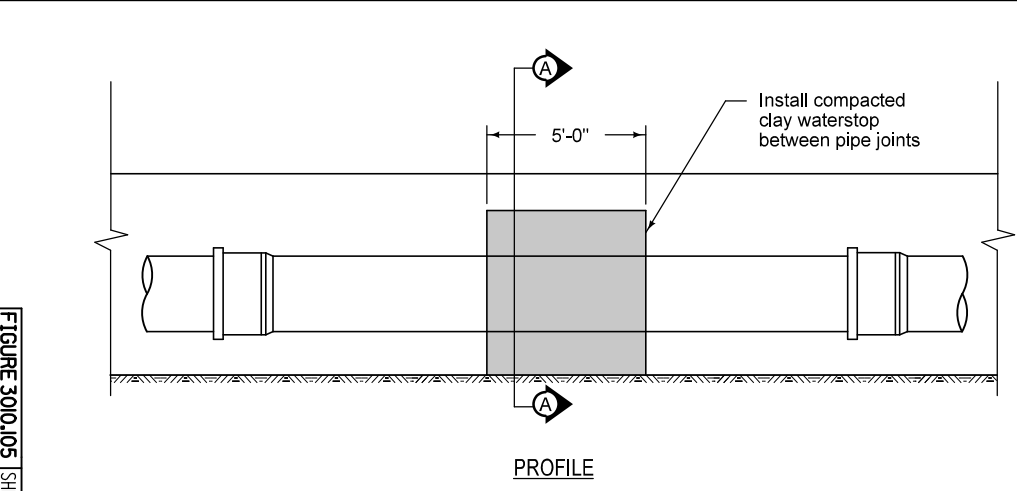
- OD = Outside diameter of pipe
 TW = Trench width at top of pipe:
 Min. = OD+18 inches OR 1.25xOD+12 inches (whichever is greater)
 d = Depth of bedding material below pipe:
 Min. = OD/8 OR 4 inches (whichever is greater)

FIGURE 3010.104 SHEET 1 OF 1

SUDAS	IOWADOT	REVISION
		1 04-17-18
FIGURE 3010.104	STANDARD ROAD PLAN	SW-104
		SHEET 1 of 1
REVISIONS: Replaced Iowa DOT and SUDAS logos.		
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER
PRESSURE PIPE TRENCH BEDDING		



- ① Place remainder of bedding and backfill material as specified in the contract documents.
- ② Place encasement material in two lifts, or as required to prevent pipe flotation. Allow previous lift to reach initial set prior to placing subsequent lifts.
- ③ Restrain pipe as necessary to prevent flotation.
- ④ When specified in the contract documents, install waterstops at a nominal spacing of 800 feet or at locations as specified by the Engineer.

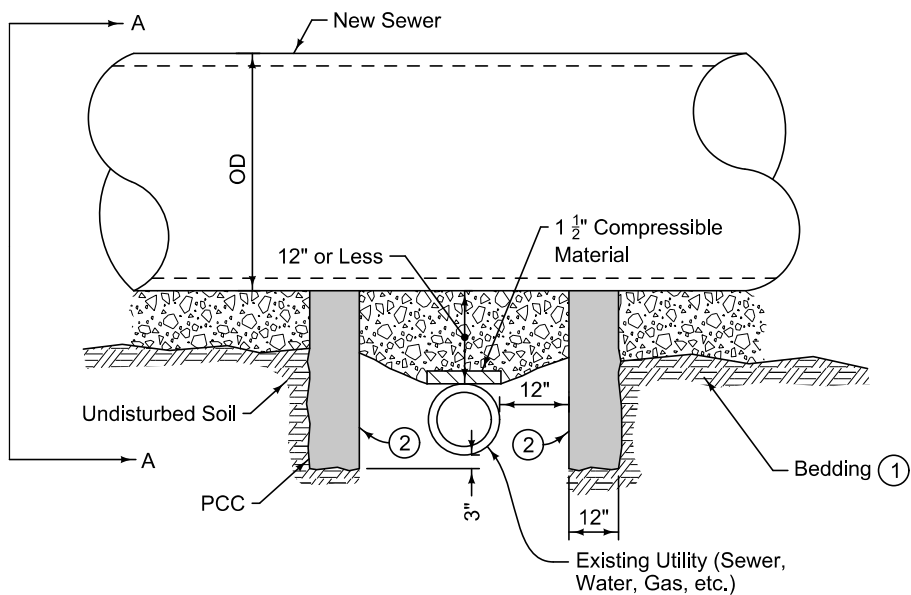


WATERSTOP FOR TRENCHES ④

SUDAS IOWADOT	REVISION 2 04-17-18
	SW-105 SHEET 1 of 1
REVISIONS: Replaced Iowa DOT and SUDAS logos.	
<i>Paul D. Wigand</i> SUDAS DIRECTOR	<i>Brian Smith</i> DESIGN METHODS ENGINEER

MISCELLANEOUS PIPE BEDDING

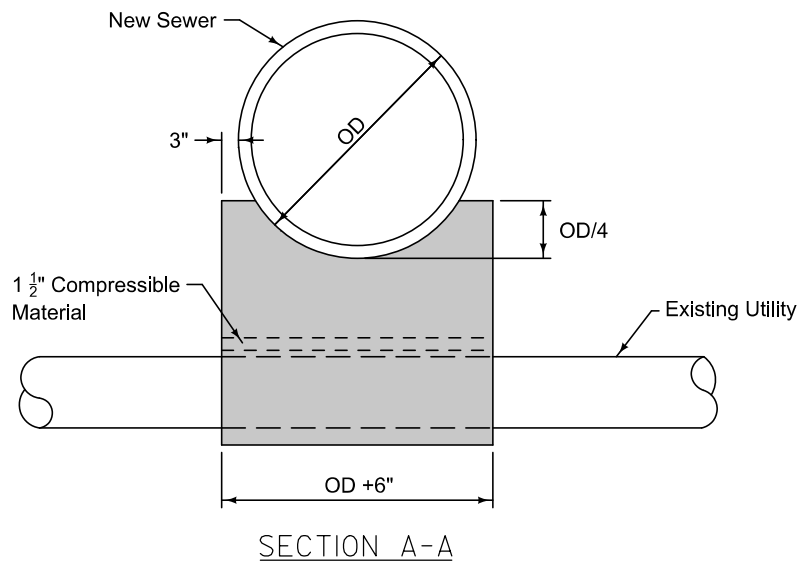
FIGURE 3010.105 SHEET 1 OF 1




Install pipe support for all new sewers 12 inches in diameter or larger when clearance between bottom of new sewer and top of existing line is 12 inches or less.

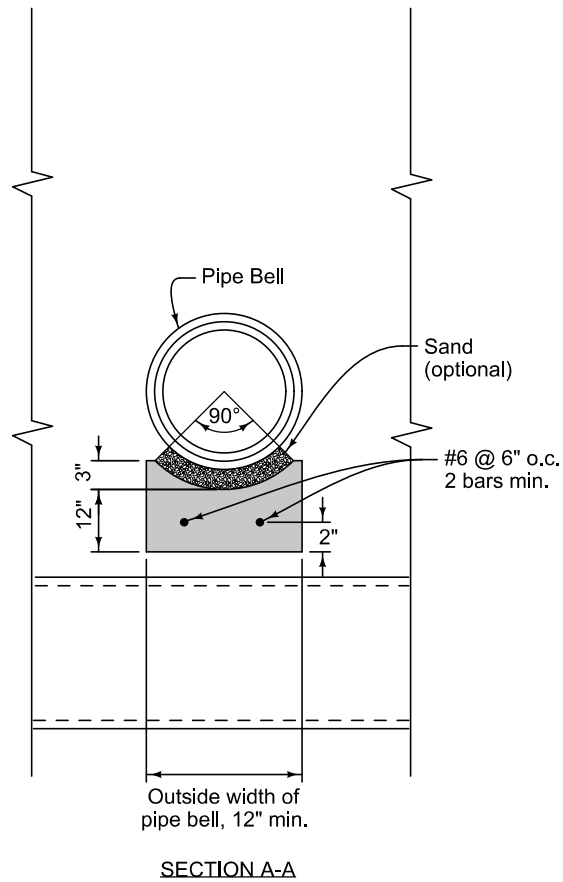
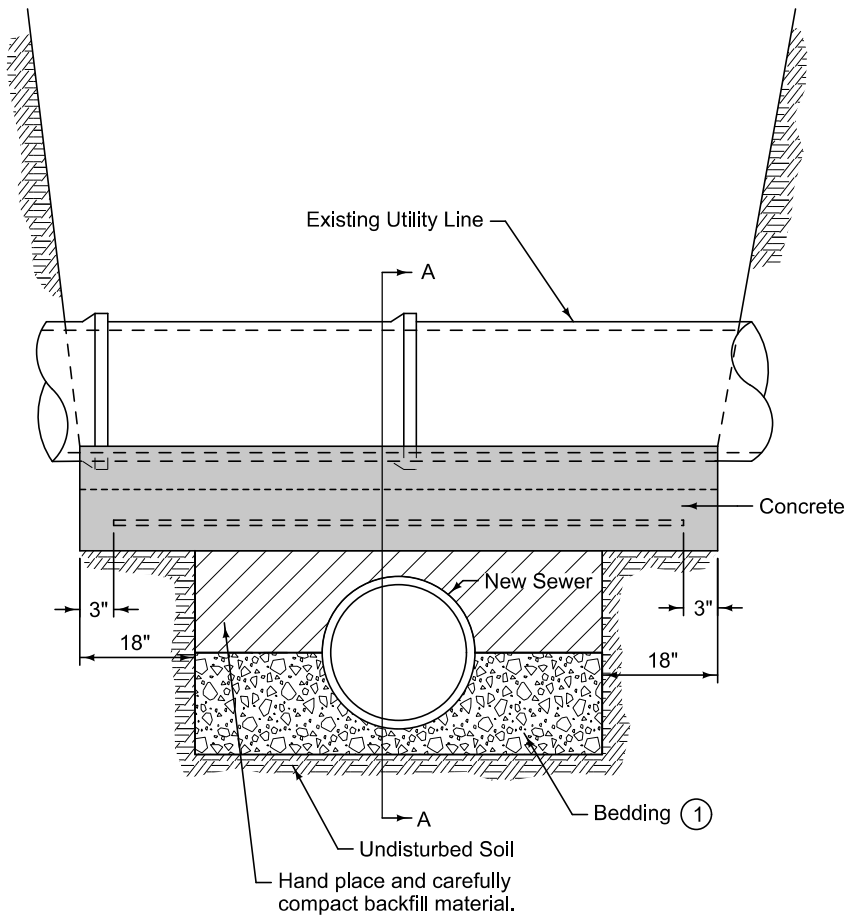
- ① Comply with Figure 3010.101.
- ② Form interior surface of footings. Keep the 12 inch utility clear zone free of concrete.

OD = Outside pipe diameter



SECTION A-A

	REVISION
	1 10-21-14
	3010.901
SHEET 1 of 1	
SUDAS Standard Specifications	
SEWER PIPE SUPPORT OVER EXISTING UTILITY LINE	




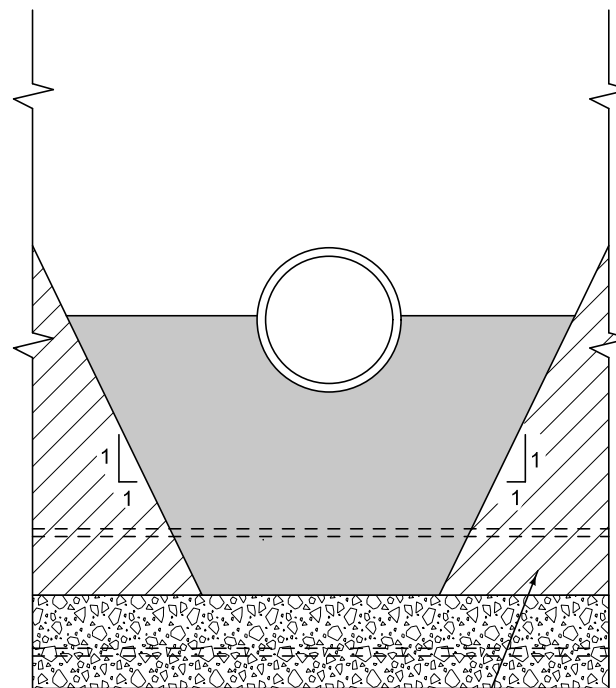
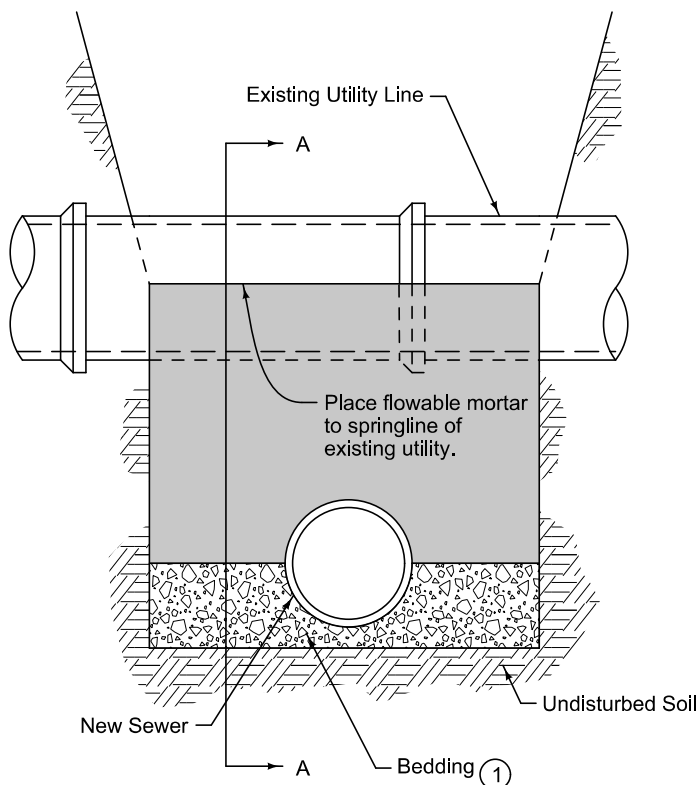
Use reinforced concrete beam utility line support when new sewer excavation is crossing under an existing utility line (sewer lines, water lines, gas lines, etc.) as directed by the Engineer.

Allow concrete to cure a minimum of 48 hours before placing backfill material.

Special design required for trench width greater than 7 feet or trench depth greater than 15 feet.

① Comply with Figure 3010.101.

	REVISION
	1 10-21-14
	3010.902
SHEET 1 of 1	
SUDAS Standard Specifications	
REINFORCED PCC BEAM UTILITY LINE SUPPORT	



Use flowable mortar utility line support when new utility excavation is crossing under an existing utility line (sewer lines, water lines, gas lines, etc.) as directed by the Engineer.

Allow flowable mortar fill to cure a minimum of 24 hours before placing backfill material.

Trim uncompacted backfill material away from slopes before pouring flowable mortar.

Side slopes of flowable mortar fill to be 1:1 or greater. See Section A-A

① Comply with Figure 3010.101


	REVISION 1 10-21-14
	SUDAS 3010.903
	SHEET 1 of 1
SUDAS Standard Specifications	
FLOWABLE MORTAR FILL UTILITY LINE SUPPORT	

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Boxouts for Grate Intakes	6010.514
Castings for Sanitary Sewer Manholes	6010.601
Castings for Storm Sewer Manholes	6010.602
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None.

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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 bedding material, placing bedding and backfill material, compaction, 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 bedding material, placing bedding and backfill material, compaction, base, structural concrete, reinforcing steel, precast units (if used), concrete fillets, pipe connections, castings, and adjustment rings.

C. Drop Connection:

- 1. **Measurement:** Each drop connection will be counted.
- 2. **Payment:** Payment will be at the unit price for each drop connection.
- 3. **Includes:** Unit price includes, but is not limited to, the connection to the manhole and all pipe, fittings, concrete encasement, and bedding and backfill material.

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.

1.08 MEASUREMENT AND PAYMENT (Continued)**E. Manhole or Intake Adjustment, Minor:**

1. **Measurement:** Each existing manhole or intake adjusted to finished grade by addition or removal of adjustment rings or adjustment of adjustable casting will be counted.
2. **Payment:** Payment will be made at the unit price for each minor manhole or intake adjustment.
3. **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).

F. Manhole or Intake Adjustment, Major:

1. **Measurement:** Each existing manhole or 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.
2. **Payment:** Payment will be at the unit price for each major adjustment.
3. **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.

G. Connection to Existing Manhole or Intake:

1. **Measurement:** Each connection made to an existing manhole or intake will be counted.
2. **Payment:** Payment will be made at the unit price for each sewer connection.
3. **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. **Measurement:** Each manhole or intake removed will be counted.
2. **Payment:** Payment will be made at the unit price for each manhole or intake.
3. **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

2.02 PRECAST

Comply with ASTM C 478.

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

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

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

- A. Gray Cast Iron:** AASHTO M 306.
- B. Ductile Iron:** ASTM A 536, Grade 80-55-06 or 70-50-05.
- C. Load Capacity:** Standard duty unless otherwise shown on the casting figures.
 1. **Standard Duty:** Casting certified for 40,000 pound proof-load according to AASHTO M 306.
 2. **Light Duty:** Casting certified according to requirements of AASHTO M 306 for a 16,000 pound proof-load (HS-20). 40,000 pound proof-load is not required.

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

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

Table 6010.03: Manhole Casting Types

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

¹ Machine bearing surfaces required.

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

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

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

2. Intakes:

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

3. Manhole Casting Extension Ring:

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

2.11 ADDITIONAL MATERIALS FOR SANITARY SEWER MANHOLES**A. Infiltration Barrier:****1. External Chimney Seal:****a. Rubber Sleeve and Extension:**

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

b. Compression Bands:

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

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

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

b. Expansion Bands:

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

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

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

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

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

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

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

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

2.14 PRECAST CONCRETE TEE

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

2.15 ANCHOR BOLTS 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 EXCAVATION AND BACKFILL MATERIAL

Comply with Section 3010 for bedding and backfill materials.

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

- A. Excavation:** Excavate according to Section 3010.
- B. Subgrade Preparation:**
- 1. Cut Sections (Undisturbed Soil):** Prepare subgrade to accurate elevation required to place structure base or subbase.
 - 2. Fill Sections:** Compact to 95% of maximum Standard Proctor Density and hand grade to accurate elevation required to place structure base or subbase, or install stabilization material as directed by the Engineer.
 - 3. Unstable Soil:** Install stabilization material as directed by the Engineer.
- C. Subbase:**
- 1. Cast-in-place Structures:** No subbase material is required.
 - 2. Precast Structures:** If precast structure is provided, install 8 inch thick pad of Class I bedding material a minimum of 12 inches outside footprint of the structure.
- D. Installation of Manhole or Intake Structure:** When necessary, adjust wall height and depth of base to provide a minimum of 48 inches between form grade elevation and top of base.
- 1. Cast-in-place:** Comply with Section 6010, 3.02.
 - 2. Precast:** Comply with Section 6010, 3.03.
- E. Pipes:** Install and bed pipes and connect to manhole or intake. Install pipe flush with inside wall of structure. Place bedding and pipe embedment material according to Section 3010.
- 1. Cast-in-place Structures:**
 - a. Storm:** Form structure walls around pipe.
 - b. Sanitary:** Form or core circular opening and install flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.
 - 2. Precast Storm Sewer Manholes or Intakes:** If annular space between pipe and structure is less than 2 inches, fill with non-shrink grout. If annular space is 2 inches or greater, construct a concrete collar around the pipe according to Section 6010, 3.05.
 - 3. Precast Sanitary Sewer Manholes:** Connect to structure with flexible, watertight gasket according to Section 6010, 2.08. Keep void between pipe and manhole section free of debris and concrete.
 - 4. Sanitary Sewer Manholes on Existing Pipe:** Install waterstop according to Section 6010, 2.08.
- F. Joint Sealant:**
- 1. Sanitary Sewer Manholes:**
 - a.** Install rubber O-ring or profile gasket (precast structures).
 - b.** Apply bituminous jointing material or butyl sealant wrap to exterior of all sanitary sewer manhole joints.

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

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

G. 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: Install the type of casting specified in the contract documents and adjust to proper grade. Where a manhole or intake is to be in a paved area, adjust the casting to match the slope of the finished surface. When specified in the contract documents, attach a casting frame to the structure with four anchor bolts.

K. Infiltration Barrier: Install on sanitary sewer manholes.

1. Internal or External Chimney Seal:

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

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

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

3. Heat Shrink Sleeve:

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

L. Backfill and Compaction:

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

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

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

B. Reinforcing Steel:

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

C. Concrete Mixing:

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

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

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

E. Stripping and Cleaning:

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

F. Curing:

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

G. Exterior Loading:

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

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

I. Concrete Testing: The Engineer will conduct testing.

3.03 ADDITIONAL REQUIREMENTS FOR PRECAST CONCRETE STRUCTURES

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

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

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

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

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

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

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

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

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

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

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

1. Remove casting.
2. Remove top.
3. Remove and replace or modify existing riser section and/or top section 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. 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.

3.05 CONNECTION TO EXISTING MANHOLE OR INTAKE (Continued)**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:

- b. Core new openings in existing manholes or intakes for all pipes less than 12 inches in diameter.
- c. 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 REMOVAL OF MANHOLE OR INTAKE**

A. Unless otherwise specified, remove the entire structure to a minimum of 10 feet below top of subgrade in paved areas or 10 feet below finished grade in other areas.

B. Pipes:

1. Contact the Engineer to verify the sewer line is not in use.
2. Construct sewer plug by completely filling the end of the pipe with concrete. Force concrete into the end of the pipe for a distance of 16 inches, or one-half the pipe diameter, whichever is greater.
3. If specified in the contract documents, fill the line to be abandoned with flowable mortar or CLSM (comply with Section 3010) by gravity flow or pumping.

C. Fill remaining structure using flowable mortar.

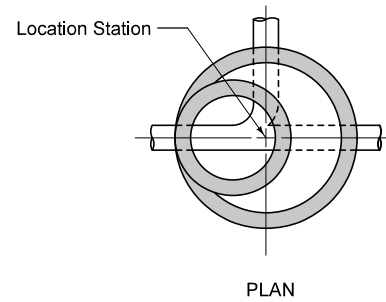
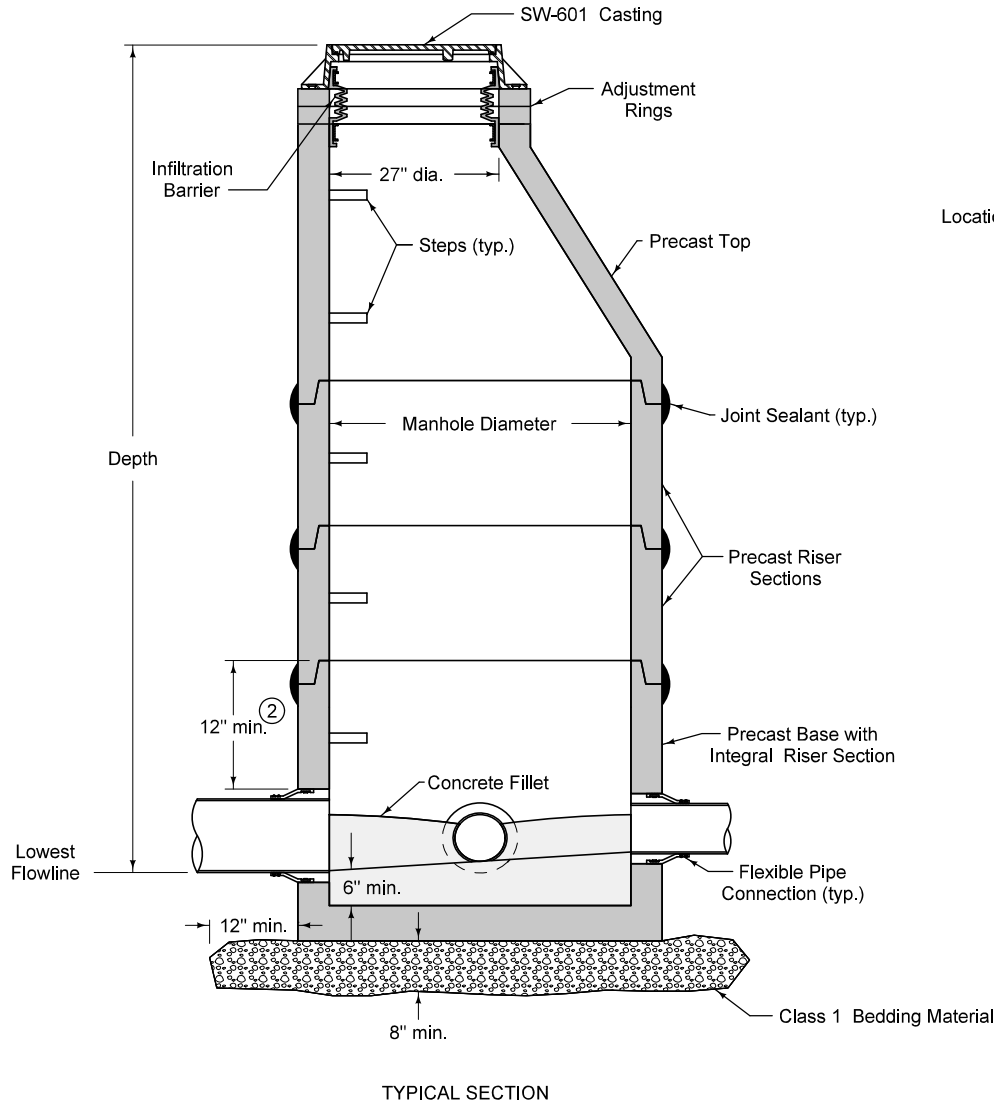
D. Place compacted backfill over remaining structure as required for embankment or compacted backfill.

3.07 CLEANING, INSPECTION, AND TESTING

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

END OF SECTION

- 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.



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

SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.301	STANDARD ROAD PLAN	SW-301
		SHEET 1 of 1

REVISIONS: Changed "Invert" to "Concrete Fillet".

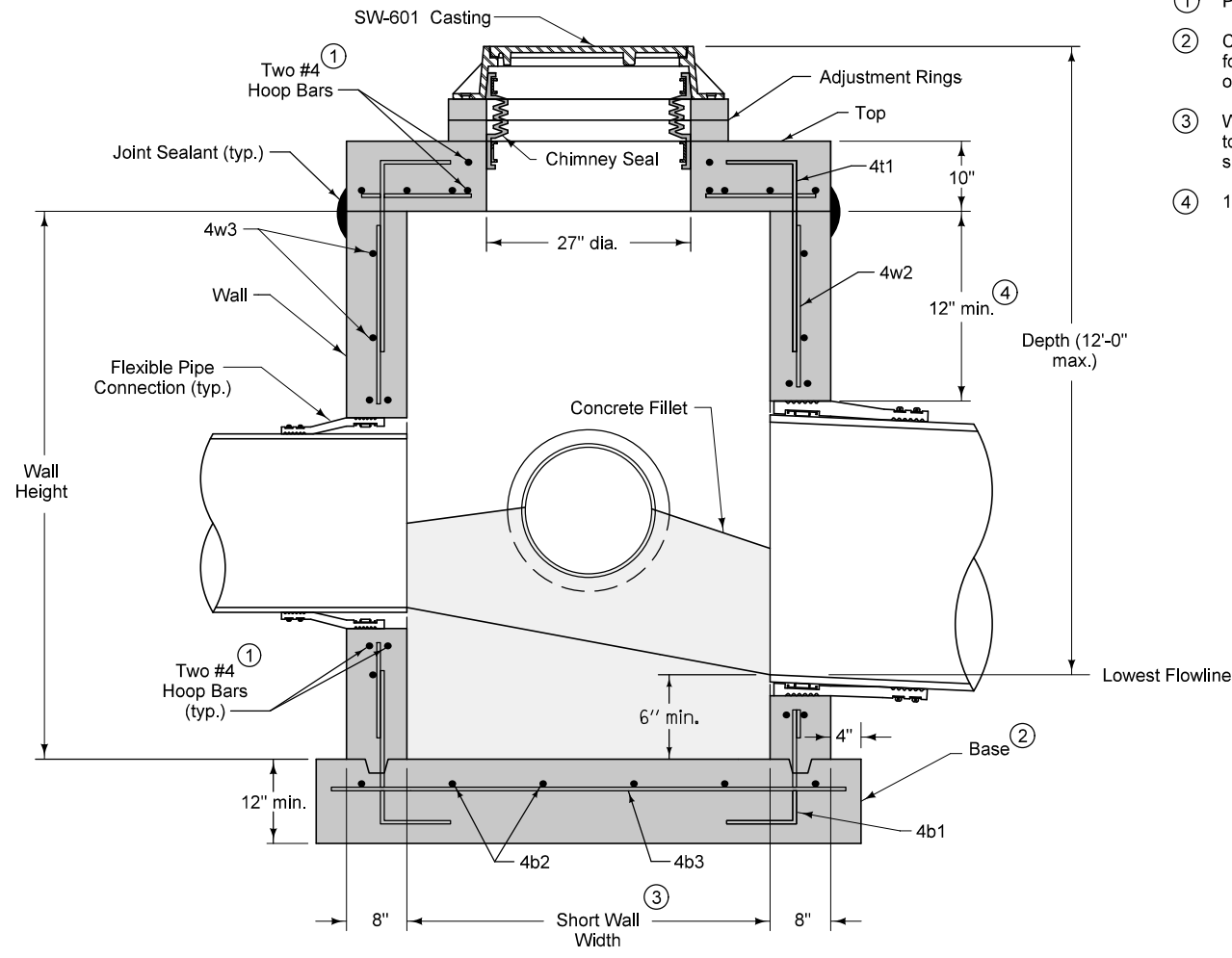
Paul D. Wigand
 SUDAS DIRECTOR

Brian Smith
 DESIGN METHODS ENGINEER

CIRCULAR SANITARY SEWER MANHOLE

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

- 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.

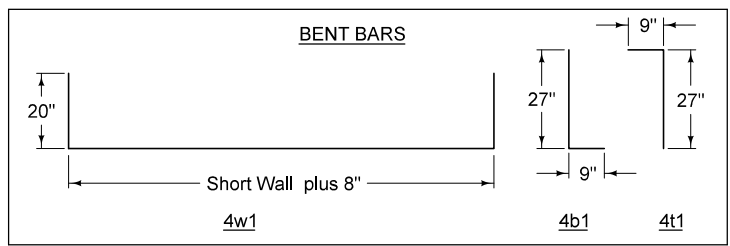
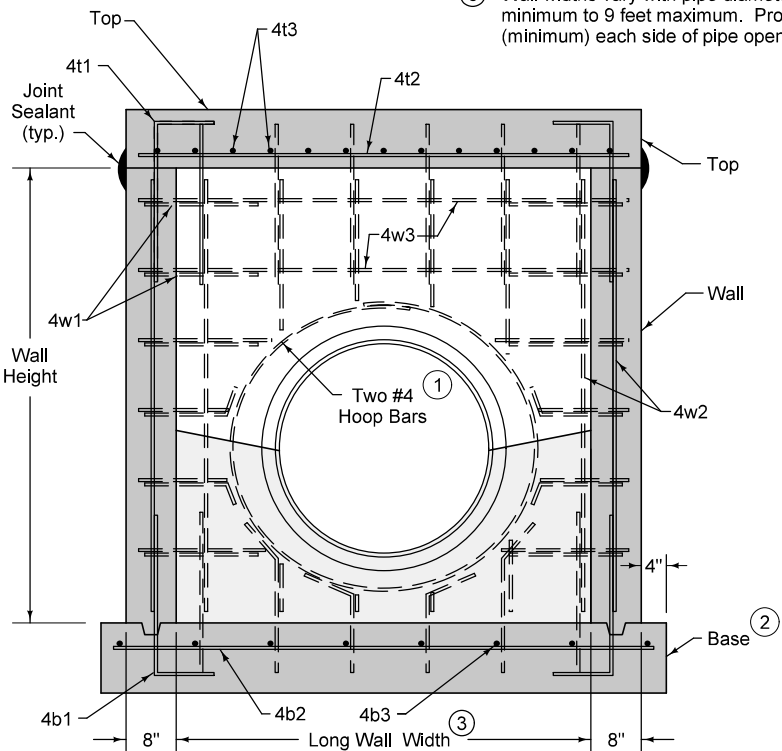
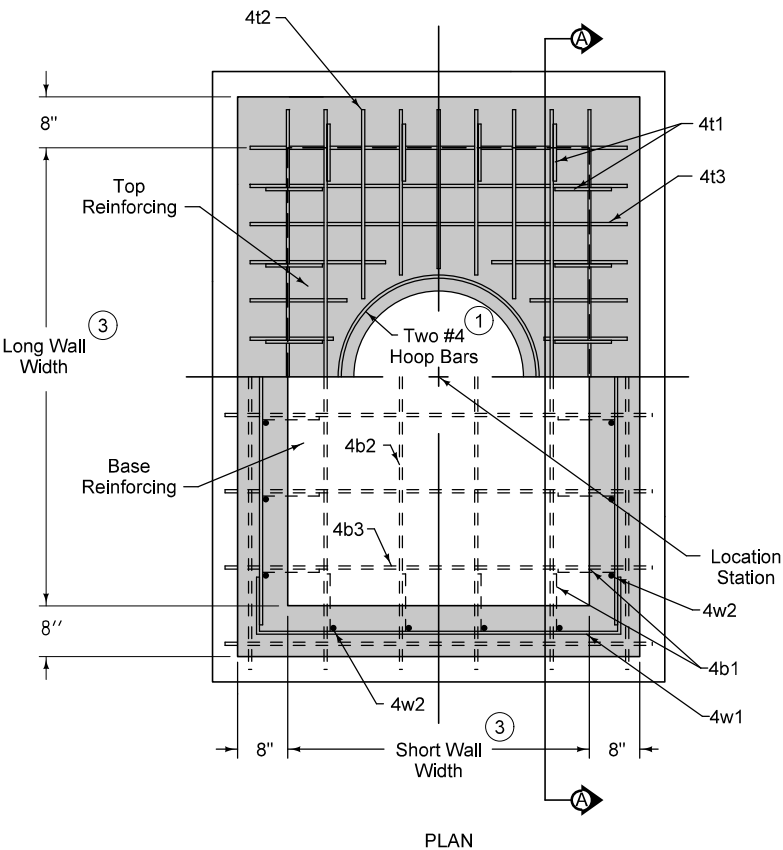


TYPICAL SECTION

FIGURE 6010.302 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION	
		1	04-17-18
FIGURE 6010.302	STANDARD ROAD PLAN	SW-302	
		SHEET 1 of 2	
<small>REVISIONS: Replaced Iowa DOT and SUDAS logos. Changed "Invert" to "Concrete Fillet".</small>			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
RECTANGULAR SANITARY SEWER MANHOLE			

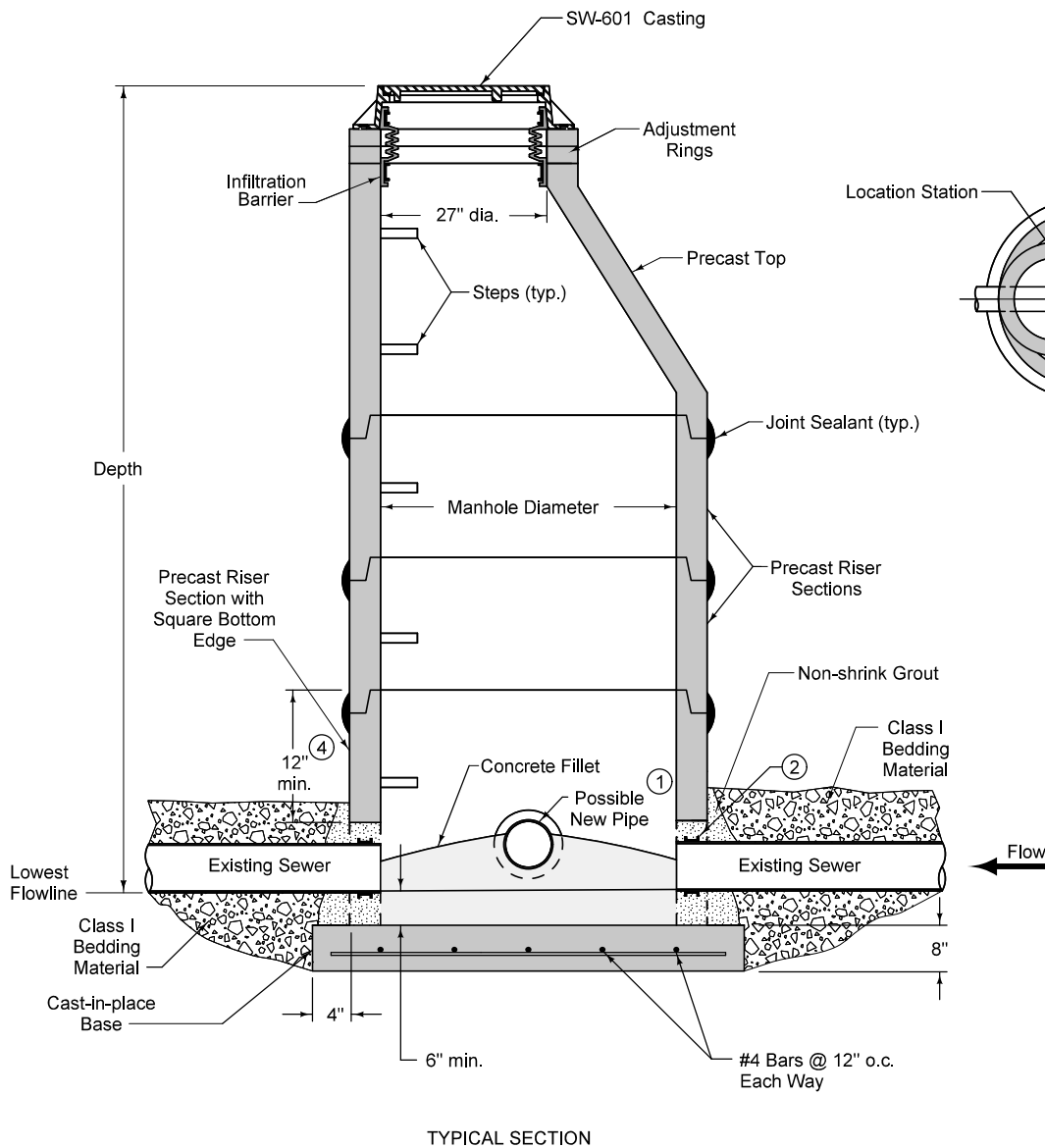
- ① Provide two #4 hoop bars at top opening and at all pipe openings.
- ② Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
- ③ Wall widths vary with pipe diameter and range from 4 feet minimum to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



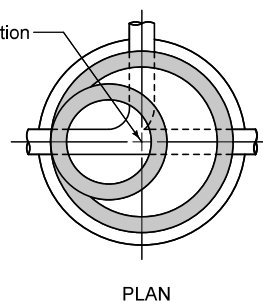
REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
4b1	4	Base	└	36"	12"
4b2	4	Base	—	Long Wall plus 18"	12"
4b3	4	Base	—	Short Wall plus 18"	12"
4t1	4	Top	┌	36"	12"
4t2	4	Top	—	Long Wall plus 12"	6"
4t3	4	Top	—	Short Wall plus 12"	6"
4w1	4	Wall	┌└	Short Wall plus 48"	12"
4w2	4	Wall	—	Wall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

FIGURE 6010.302 SHEET 2 OF 2

SUDAS IOWADOT	REVISION 1 04-17-18
	FIGURE 6010.302 STANDARD ROAD PLAN SW-302 SHEET 2 of 2
REVISIONS: Replaced Iowa DOT and SUDAS logos. Changed "Invert" to "Concrete Fillet".	
Paul D. Wigand SUDAS DIRECTOR	
Brian Smith DESIGN METHODS ENGINEER	
RECTANGULAR SANITARY SEWER MANHOLE	



- 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.



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

TYPICAL SECTION

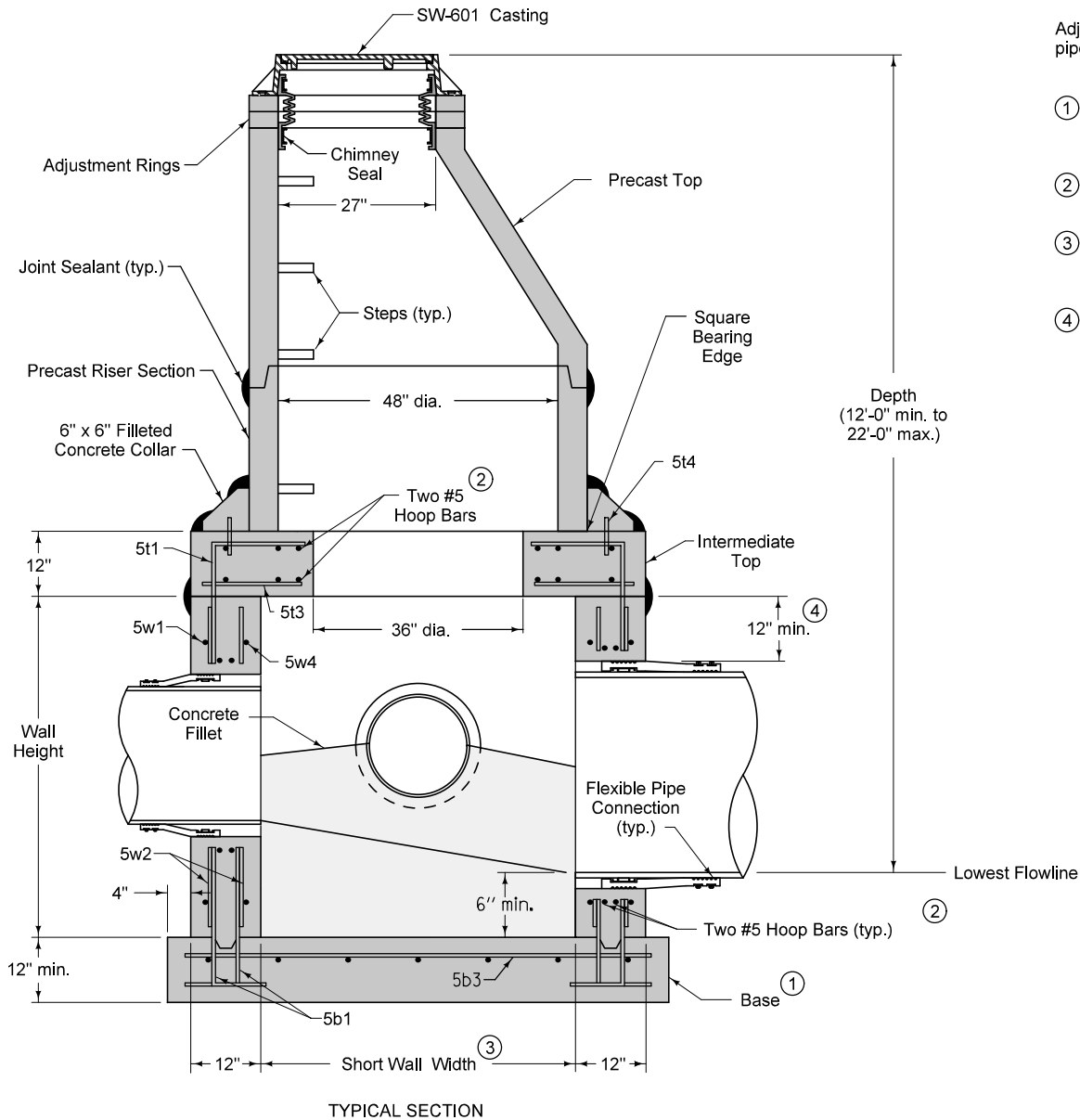
SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.303	STANDARD ROAD PLAN	SW-303
		SHEET 1 of 1

REVISIONS: Changed "Invert" to "Concrete Fillet".

Paul D. Wigand
 SUDAS DIRECTOR

Brian Smith
 DESIGN METHODS ENGINEER

**SANITARY SEWER MANHOLE
OVER EXISTING SEWER**

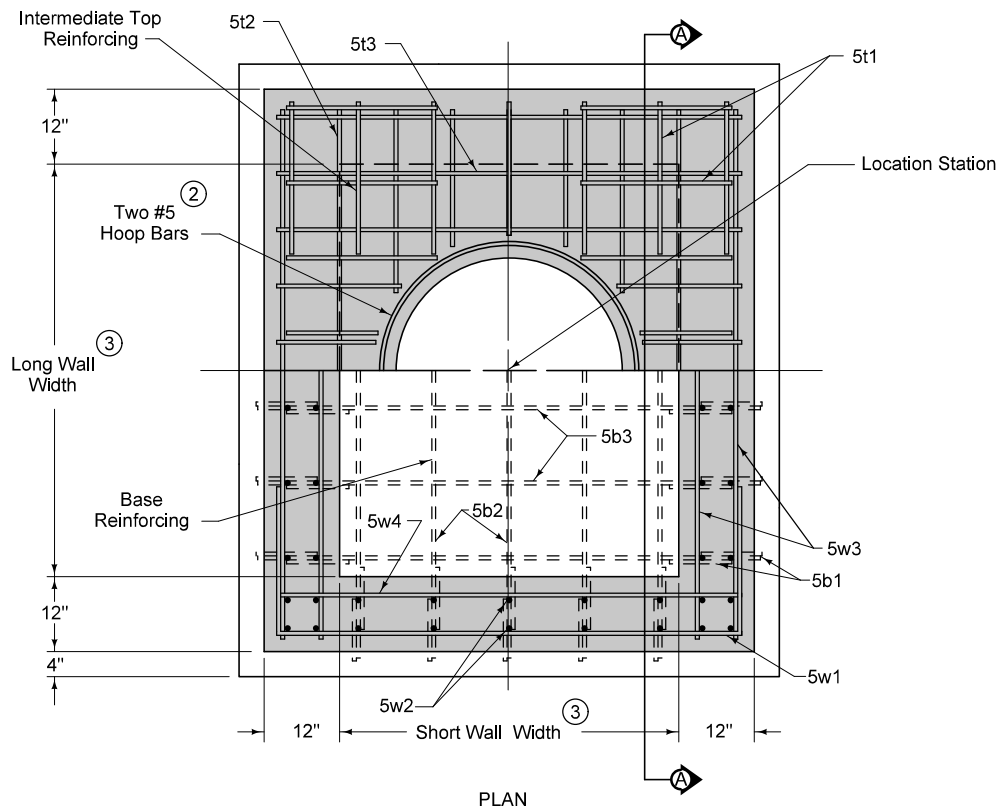


Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

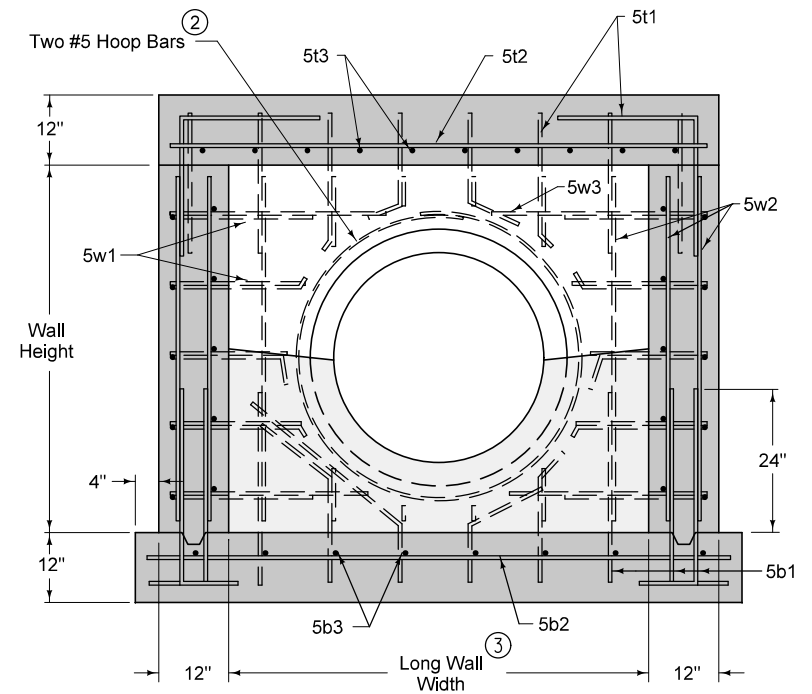
- ① Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
- ② Provide two #5 hoop bars at intermediate top opening and at all pipe openings.
- ③ Wall widths vary with pipe diameter and range from 4 feet 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

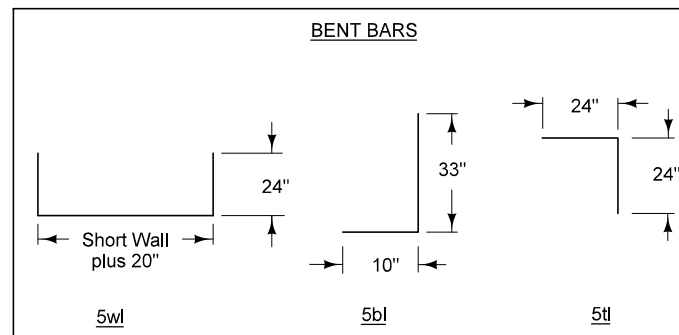
SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.304	STANDARD ROAD PLAN	SW-304
		SHEET 1 of 2
<small>REVISIONS: Replaced Iowa DOT and SUDAS logos. Changed "Invert" to "Concrete Fillet".</small>		
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER
RECTANGULAR BASE/ CIRCULAR TOP SANITARY SEWER MANHOLE		



- 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.

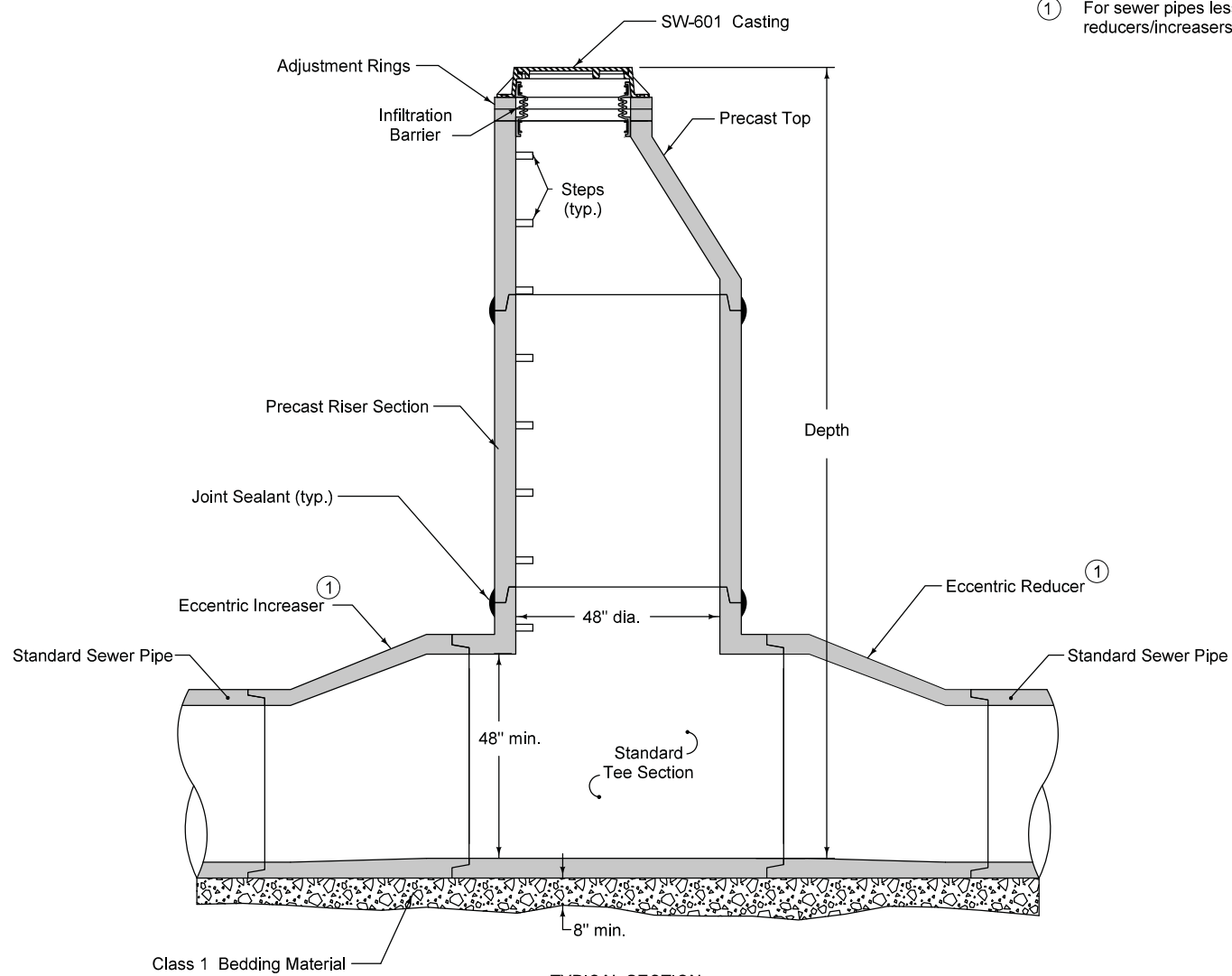


REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
5t1	5	Top		48"	12"
5t2	5	Top		Long Wall plus 20"	9"
5t3	5	Top		Short Wall plus 20"	9"
5t4	5	Top		8"	12"
5b1	5	Base		43"	12"
5b2	5	Base		Long Wall plus 26"	12"
5b3	5	Base		Short Wall plus 26"	12"
5w1	5	Top		Short Wall plus 68"	12"
5w2	5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



SUDAS IOWADOT	REVISION 2 04-17-18
	SW-304 SHEET 2 of 2
REVISIONS: Replaced Iowa DOT and SUDAS logos. Changed "Invert" to "Concrete Fflet".	
<i>Paul D. Wigand</i> SUDAS DIRECTOR	
<i>Brian Smith</i> DESIGN METHODS ENGINEER	
RECTANGULAR BASE/ CIRCULAR TOP SANITARY SEWER MANHOLE	

FIGURE 6010.304 SHEET 2 OF 2

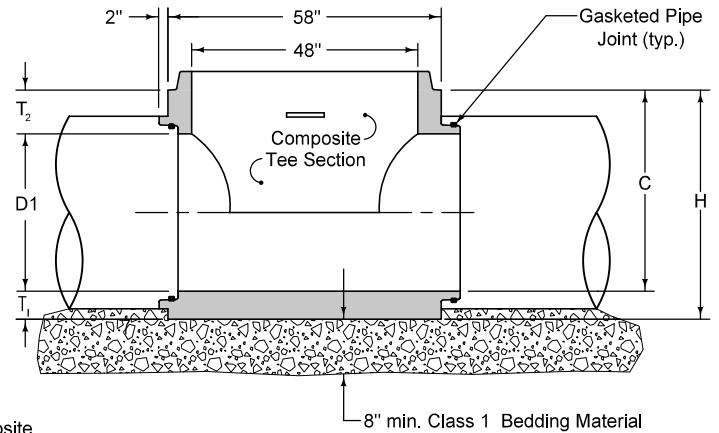
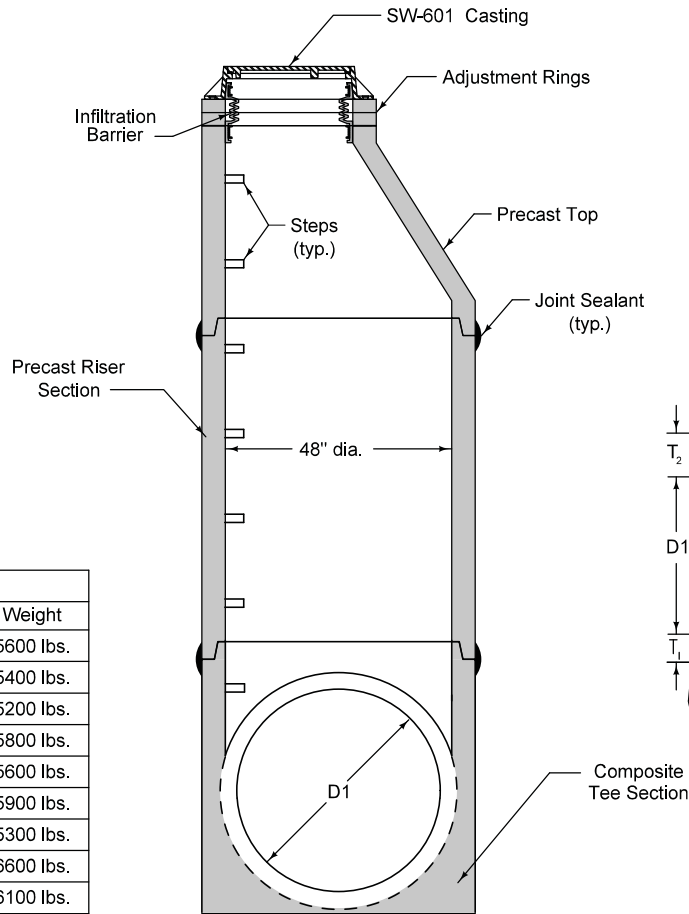
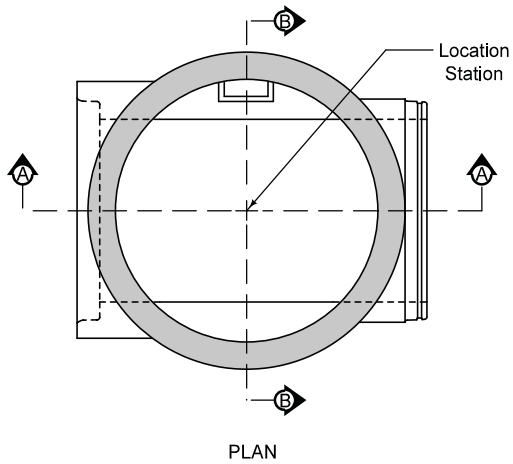


① For sewer pipes less than 48 inches in diameter, install eccentric reducers/increasers with a standard tee or utilize a composite tee.

TYPICAL SECTION
STANDARD TEE ①

FIGURE 6010.305 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION
		1 10-21-14
FIGURE 6010.305	STANDARD ROAD PLAN	SW-305
		SHEET 1 of 2
REVISIONS: Replaced "Chimney Seal" with "Infiltration Barrier". Removed flow arrow.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
TEE-SECTION SANITARY SEWER MANHOLE		



COMPOSITE TEE DIMENSIONS						
Size	D1	H	T ₁	T ₂	C	Weight
48" on 12"	12"	50"	8½"	29½"	41½"	5600 lbs.
48" on 15"	15"	50"	7"	28"	43"	5400 lbs.
48" on 18"	18"	50"	5½"	26½"	44½"	5200 lbs.
48" on 21"	21"	48"	9½"	17½"	38½"	5800 lbs.
48" on 24"	24"	48"	8"	16"	40"	5600 lbs.
48" on 27"	27"	48"	9½"	11½"	38½"	5900 lbs.
48" on 30"	30"	48"	8"	10"	40"	5300 lbs.
48" on 33"	33"	54"	9½"	11½"	44½"	6600 lbs.
48" on 36"	36"	54"	8"	10"	46"	6100 lbs.

SECTION A-A

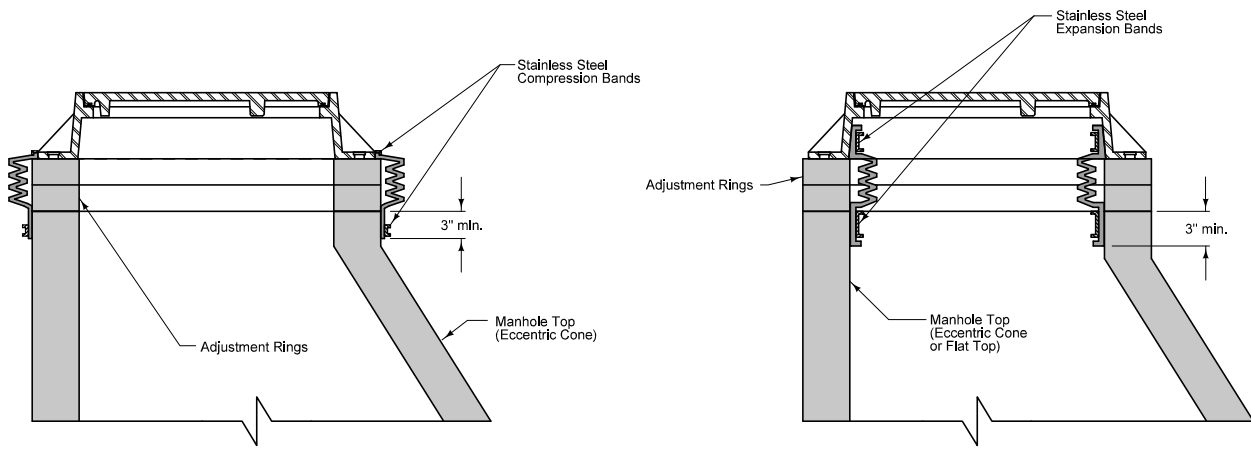
SECTION B-B

COMPOSITE TEE

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

SUDAS IOWADOT	REVISION	1	10-21-14
	FIGURE 6010.305	STANDARD ROAD PLAN	SW-305
REVISIONS: Replaced "Chimney Seal" with "Infiltration Barrier". Removed flow arrow.			SHEET 2 of 2
Paul D. Wigand <small>SUDAS DIRECTOR</small>		Brian Smith <small>DESIGN METHODS ENGINEER</small>	
TEE-SECTION SANITARY SEWER MANHOLE			

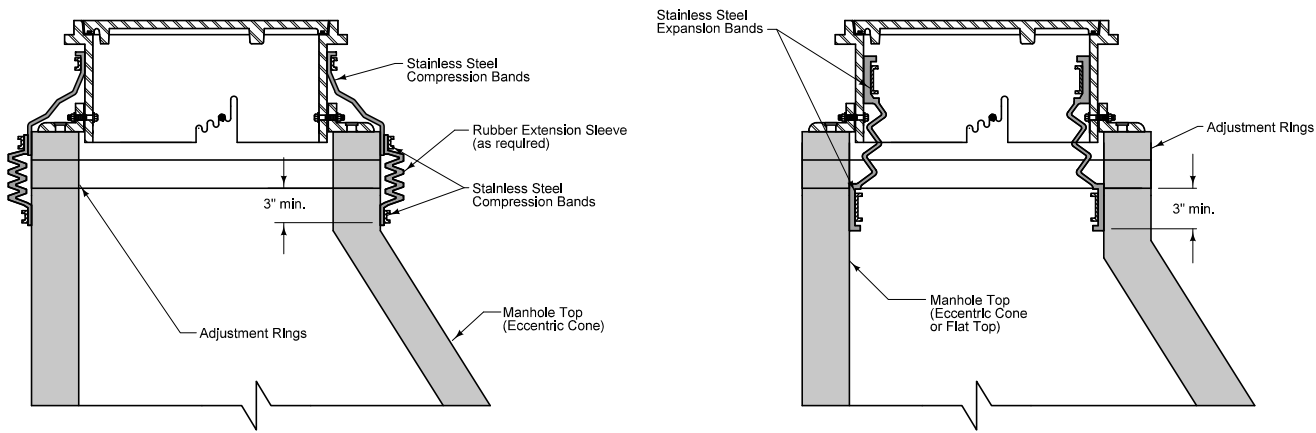
CHIMNEY SEALS FOR 2-PIECE CASTINGS



EXTERNAL SEAL

INTERNAL SEAL

CHIMNEY SEALS FOR 3-PIECE CASTINGS

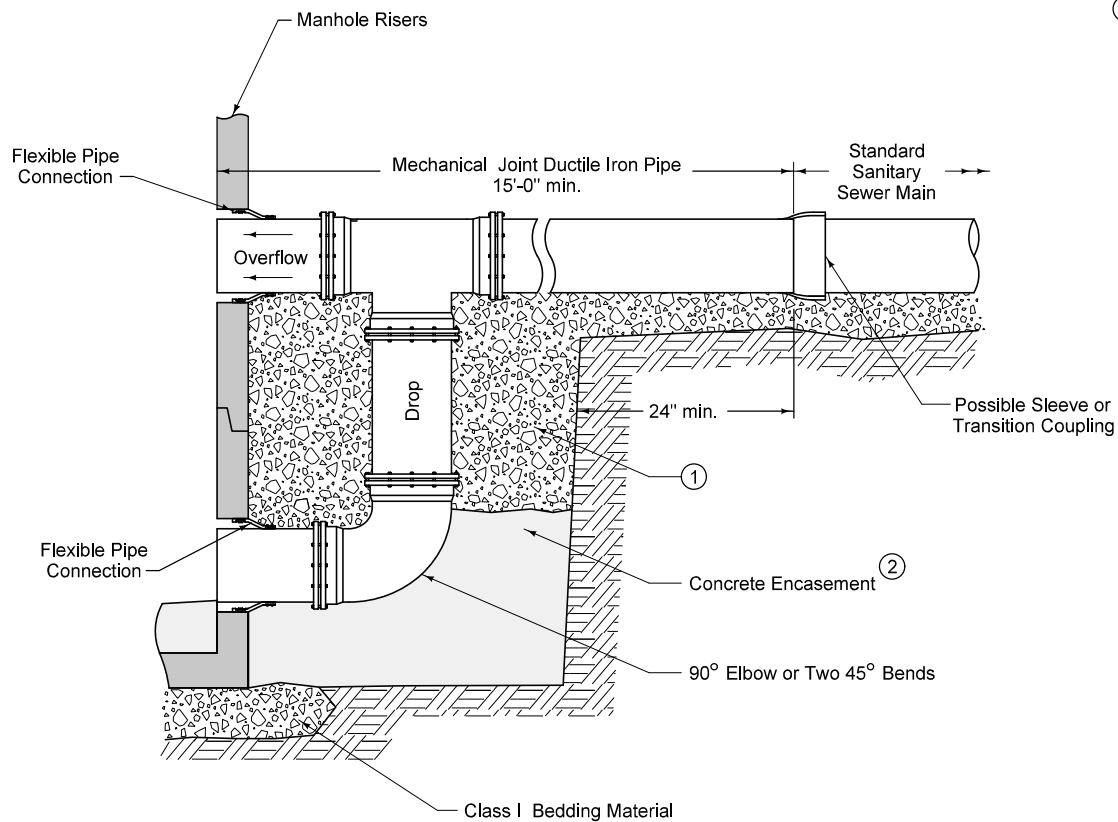


EXTERNAL SEAL

INTERNAL SEAL

FIGURE 6010.306 SHEET 1 OF 1

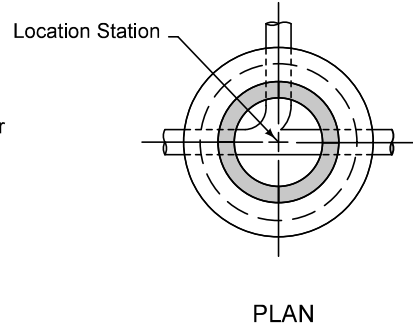
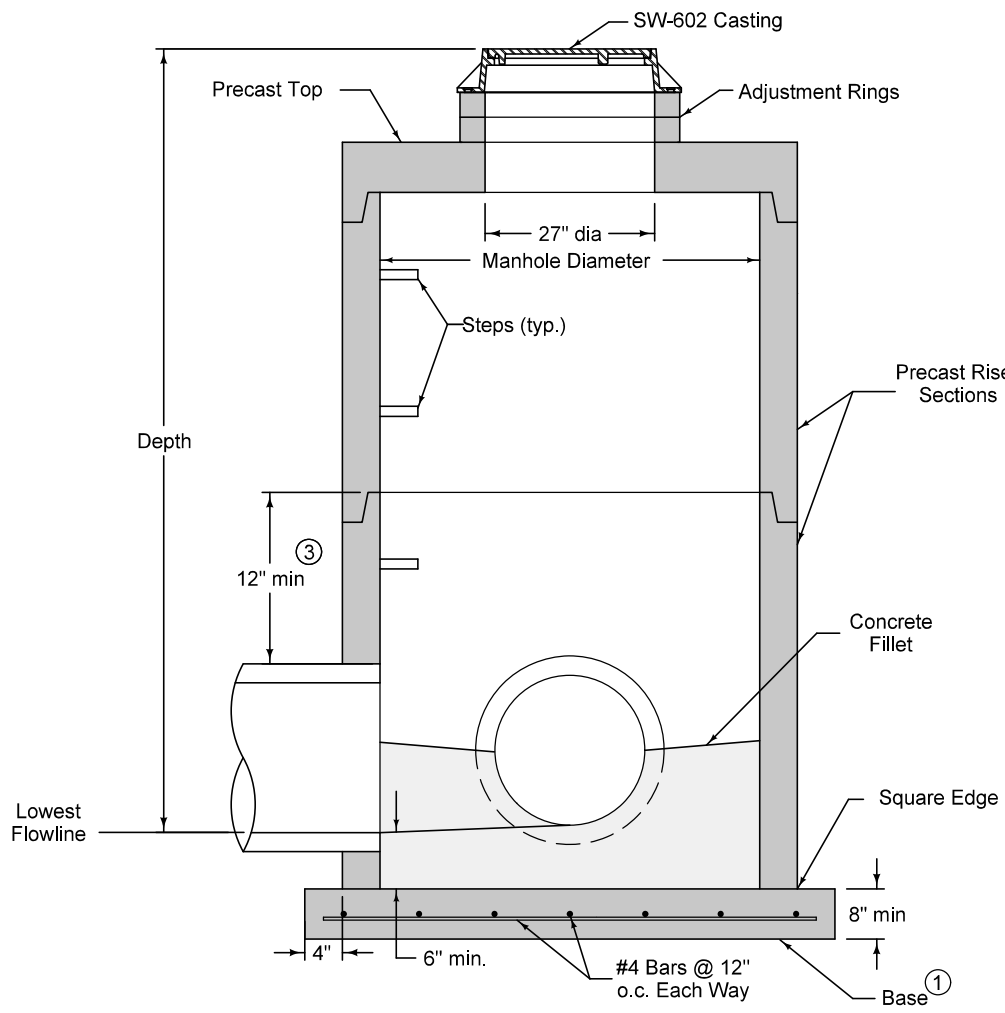
		REVISION
		1 04-21-15
FIGURE 6010.306	STANDARD ROAD PLAN	SW-306
		SHEET 1 of 1
REVISIONS: Revised 3-piece casting configuration.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
CHIMNEY SEALS FOR SANITARY SEWER MANHOLES		



Construct drop and overflow from ductile iron pipe of same diameter specified for sewer main. Provide mechanical joints for all ductile iron pipe and fittings.

- ① Place Class 1 bedding material, CLSM, flowable mortar, or concrete from top of elbow to bottom of sewer main.
- ② Encase elbow in concrete. 12 inches minimum on all sides.

SUDAS	IOWADOT	REVISION
		1 04-17-18
FIGURE 6010.307	STANDARD ROAD PLAN	SW-307
		SHEET 1 of 1
<small>REVISIONS: Replaced Iowa DOT and SUDAS logos.</small>		
<i>Paul D. Wigand</i> <small>SUDAS DIRECTOR</small>		<i>Brian Smith</i> <small>DESIGN METHODS ENGINEER</small>
DROP CONNECTION FOR SANITARY SEWER MANHOLE		



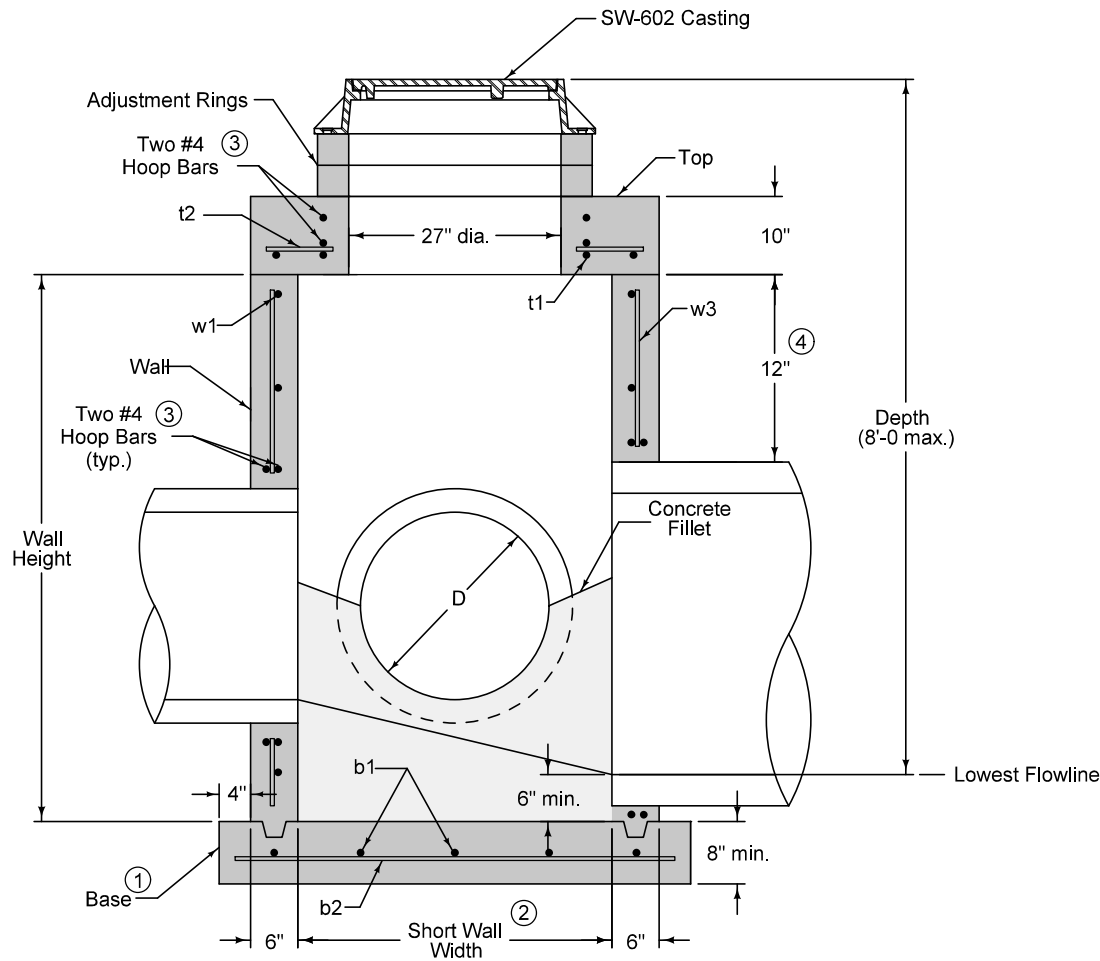
- ① Cast-in-place base shown. If base is precast integral with bottom riser, the footprint of the base is not required to extend beyond the outer edge of the riser.
- ② For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.
- ③ 12 inch minimum riser height above all pipe openings.

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

TYPICAL SECTION

FIGURE 6010.401 SHEET 1 OF 1

SUDAS	IOWADOT	REVISION
		1 04-17-18
FIGURE 6010.401	STANDARD ROAD PLAN	SW-401
		SHEET 1 of 1
<small>REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated Invert and Sudas and DOT logo.</small>		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
CIRCULAR STORM SEWER MANHOLE		



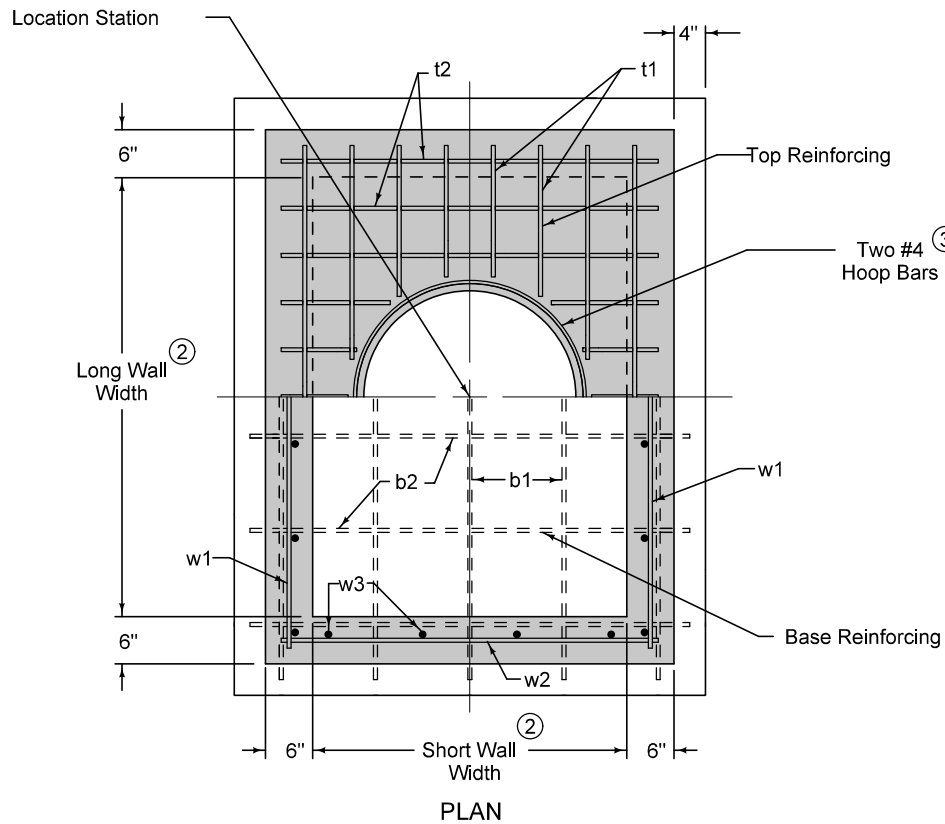
TYPICAL SECTION

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

- 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 Wall widths vary with pipe diameter and range from 40 inches minimum to 77 inches maximum. Provide 6 inches of wall width (minimum) each side of pipe opening.
- ③ Provide two #4 hoop bars at top opening and at all pipe openings.
- ④ 12 inch minimum wall height above all pipes.

FIGURE 6010.402 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION	
		1	04-17-18
FIGURE 6010.402	STANDARD ROAD PLAN	SW-402	
		SHEET 1 of 2	
<small>REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated line work and Dot and Sudas Logo.</small>			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
RECTANGULAR STORM SEWER MANHOLE			



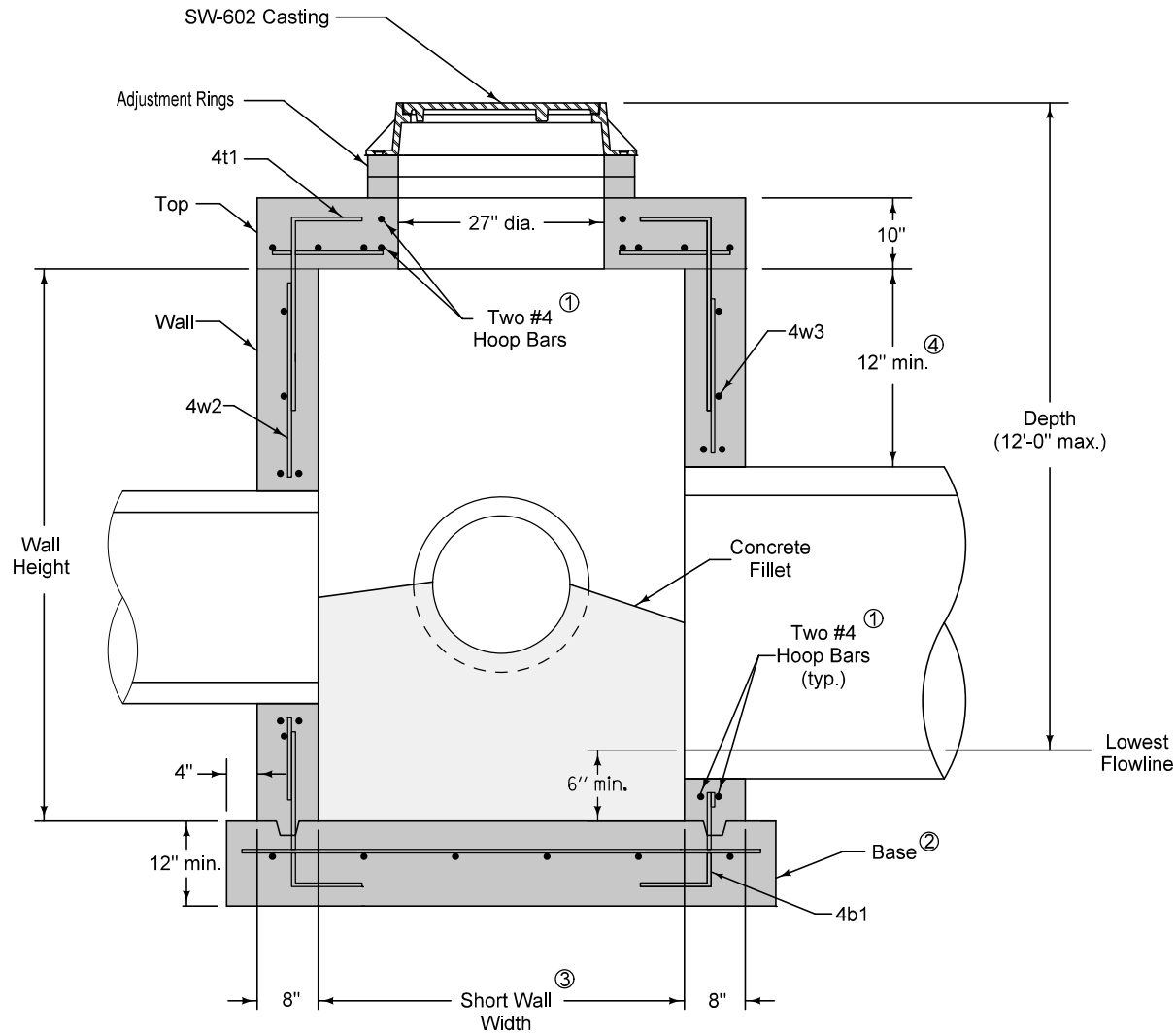
- ② Wall widths vary with pipe diameter and range from 40" minimum to 77" maximum. Provide 6" of wall width (minimum) each side of pipe opening.
- ③ Provide two #4 hoop bars at top opening and at all pipe openings.

REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
t1	See Table	Top	—	Long Wall plus 8"	6"
t2	See Table	Top	—	Short Wall plus 8"	6"
b1	See Table	Base	—	Long Wall plus 14"	12"
b2	See Table	Base	—	Short Wall plus 14"	12"
w1	See Table	Walls	—	Long Wall plus 8"	12"
w2	See Table	Walls	—	Short Wall plus 8"	12"
w3	See Table	Walls	—	Wall Height minus 4"	12"

Diameter of Largest Pipe, D	Minimum Bar Size
48" or 54"	6
33" to 42"	5
30" or smaller	4

FIGURE 6010.402 SHEET 2 OF 2

		REVISION
		1 04-17-18
FIGURE 6010.402	STANDARD ROAD PLAN	SW-402
SHEET 2 of 2		
<small>REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated the work and Dot and Sudas Logo.</small>		
<small>SUDAS DIRECTOR</small>		<small>DESIGN METHODS ENGINEER</small>
RECTANGULAR STORM SEWER MANHOLE		



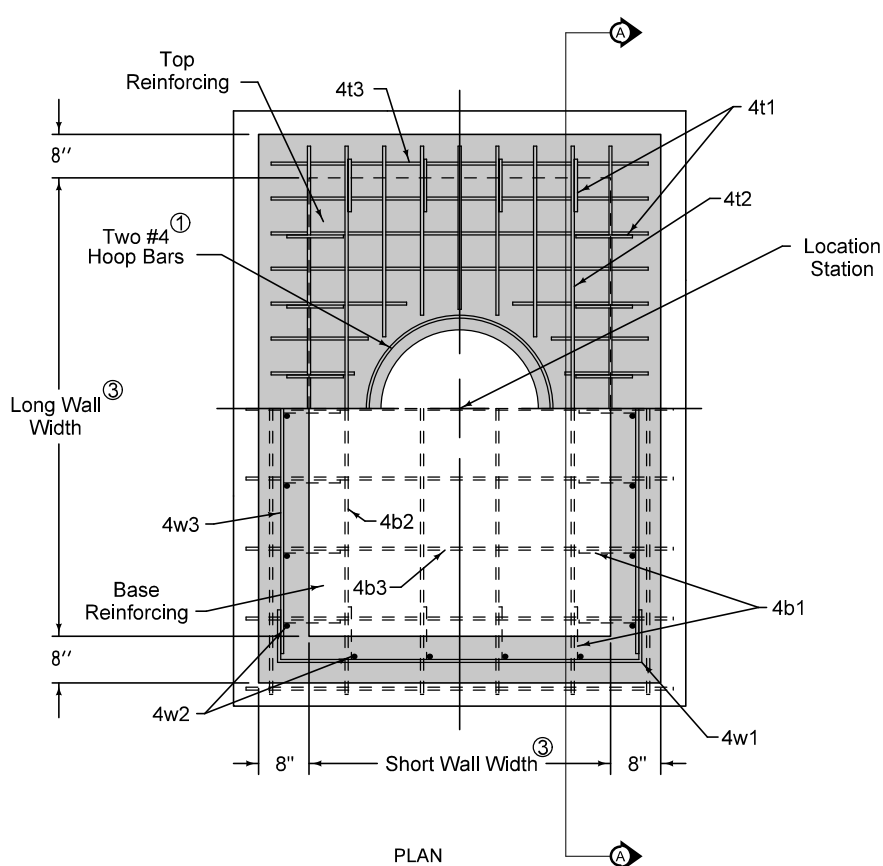
Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

- 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 pipes.

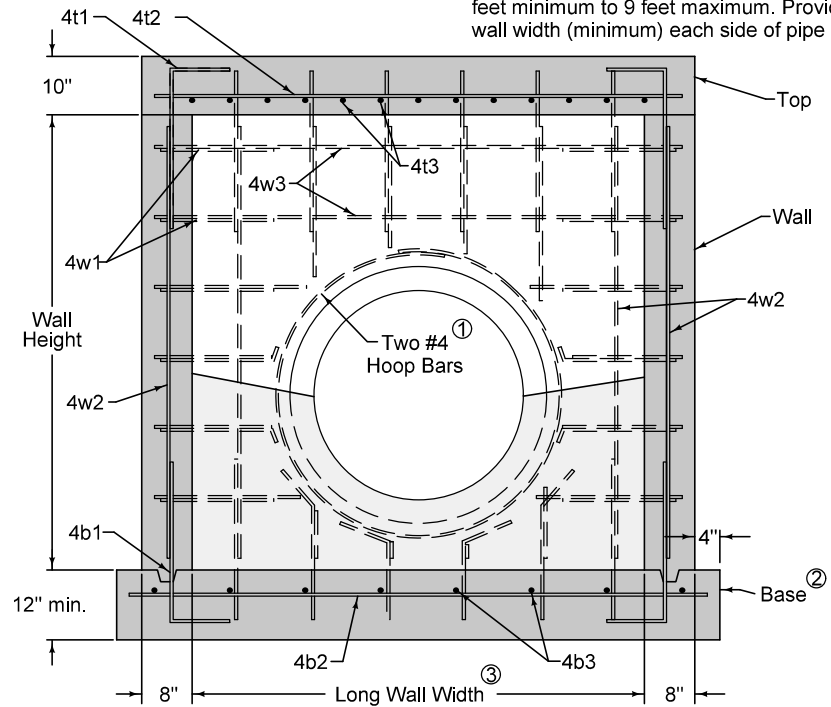
TYPICAL SECTION

FIGURE 6010.403 SHEET 1 OF 2

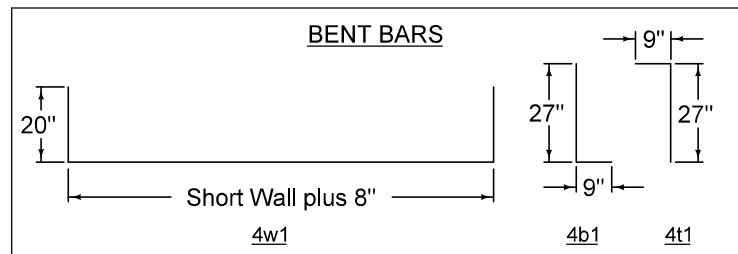
SUDAS	IOWADOT	REVISION	
		1	04-17-18
FIGURE 6010.403	STANDARD ROAD PLAN	SW-403	
		SHEET 1 of 2	
<small>REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated line work and DOT and SUDAS logos.</small>			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
DEEP WELL RECTANGULAR STORM SEWER MANHOLE			



- 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 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.



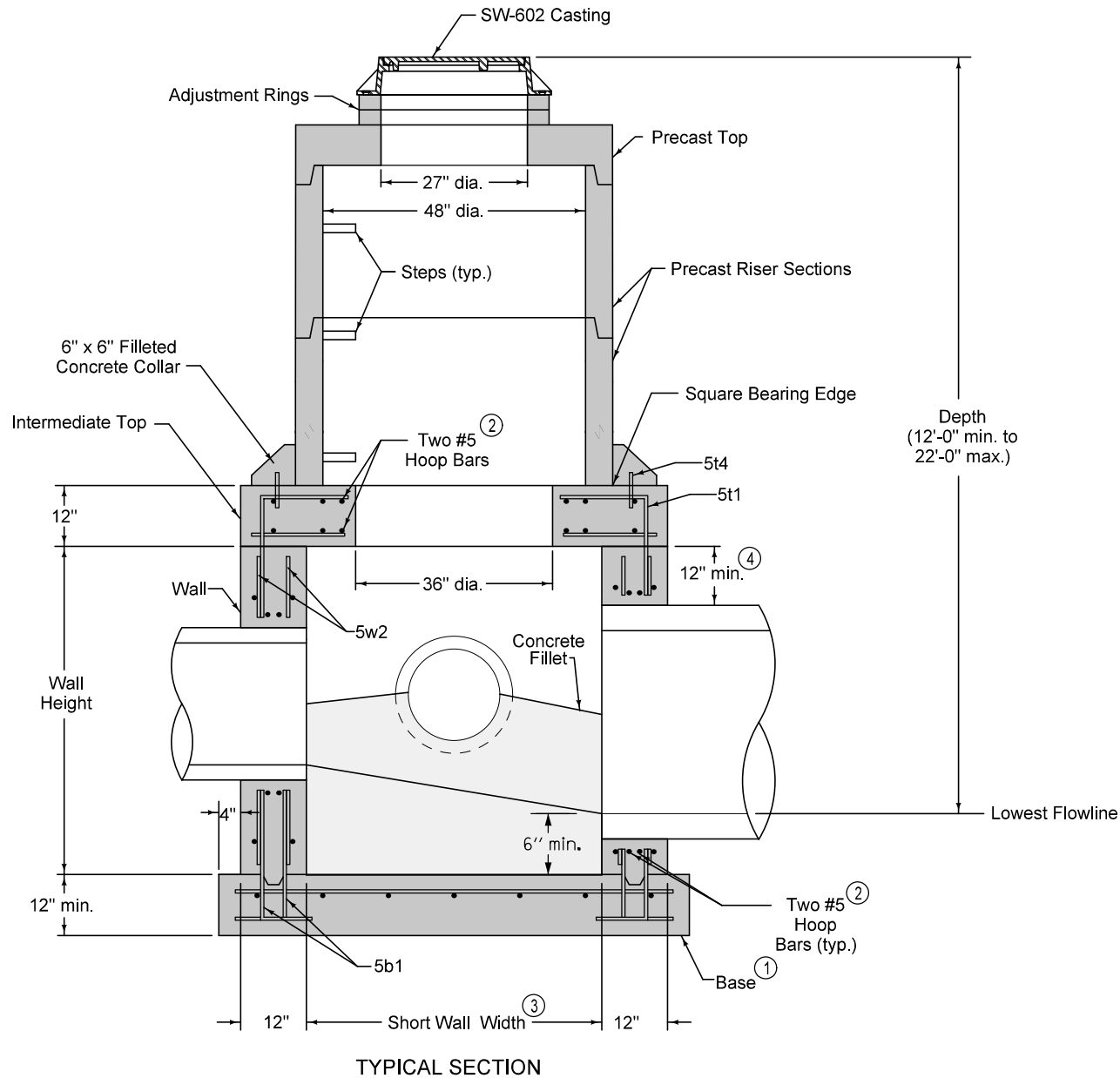
REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
4t1	4	Top	└	36"	12"
4t2	4	Top	—	Long Wall plus 12"	6"
4t3	4	Top	—	Short Wall plus 12"	6"
4b1	4	Base	└	36"	12"
4b2	4	Base	—	Long Wall plus 18"	12"
4b3	4	Base	—	Short Wall plus 18"	12"
4w1	4	Walls	└	Short Wall plus 48"	12"
4w2	4	Walls	—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



SECTION A-A

FIGURE 6010.403 SHEET 2 OF 2

SUDAS IOWADOT	REVISION	1	04-17-18
	FIGURE 6010.403	STANDARD ROAD PLAN	SW-403
REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated the work and DOT and SUDAS logos.			SHEET 2 of 2
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
DEEP WELL RECTANGULAR STORM SEWER MANHOLE			

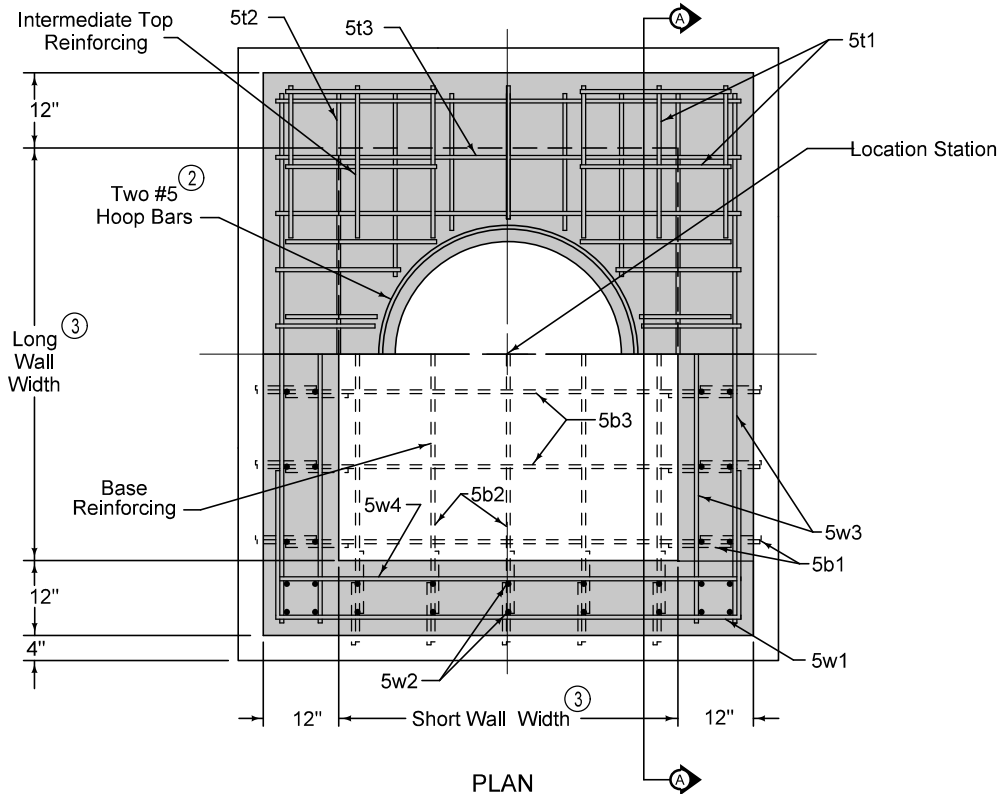


Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

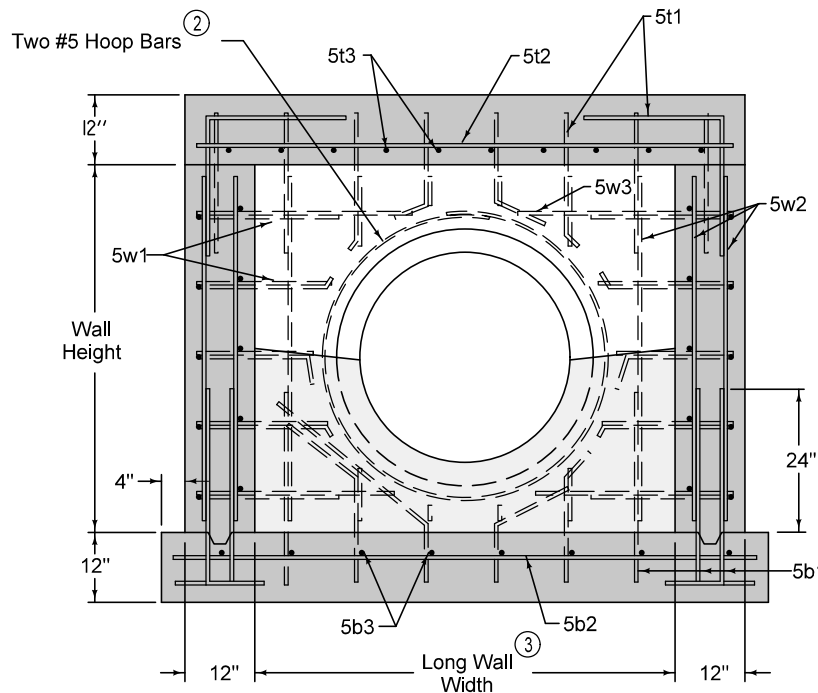
- ① Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
- ② Provide two #5 hoop bars at intermediate top opening and at all pipe openings.
- ③ Wall widths vary with pipe diameter and range from 4 feet 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 pipes.

FIGURE 6010.404 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.404	STANDARD ROAD PLAN	SW-404
		SHEET 1 of 2
<small>REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated line work and DOT and SUDAS logos.</small>		
<i>Paul D. Wigand</i> Brian Smith <small>SUDAS DIRECTOR DESIGN METHODS ENGINEER</small>		
RECTANGULAR BASE/ CIRCULAR TOP STORM SEWER MANHOLE		

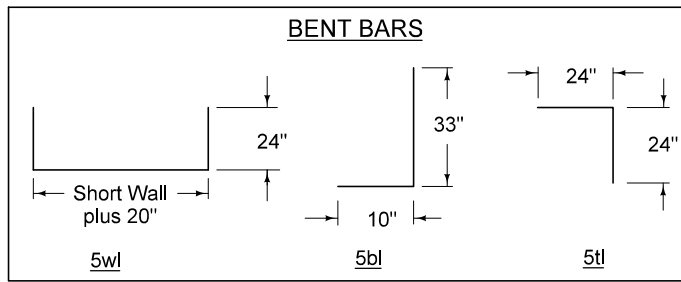


- ② Provide two #5 hoop bars at intermediate top opening and at all pipe openings.
- ③ Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.



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	Wall	U	Short Wall plus 68"	12"
5w2	5	Wall	—	Wall Height minus 4"	12"
5w3	5	Wall	—	Long Wall plus 20"	12"
5w4	5	Wall	—	Short Wall plus 20"	12"



SUDAS IOWADOT	REVISION 2 04-17-18
	FIGURE 6010.404 STANDARD ROAD PLAN SW-404 SHEET 2 of 2
REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'. Updated the work and DOT and SUDAS logos.	
<i>Paul D. Wigand</i> SUDAS DIRECTOR	
<i>Brian Smith</i> DESIGN METHODS ENGINEER	
RECTANGULAR BASE/ CIRCULAR TOP STORM SEWER MANHOLE	

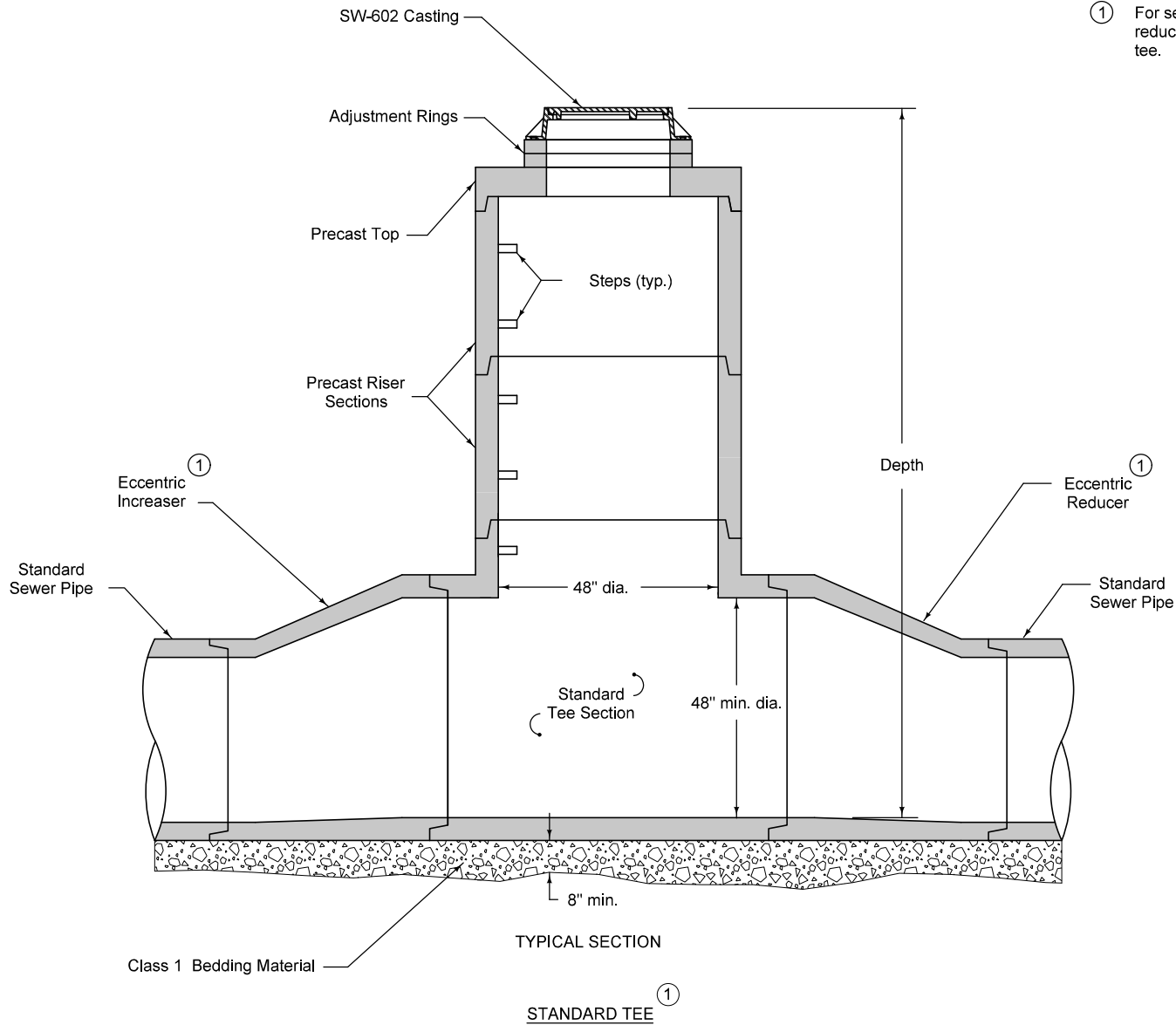
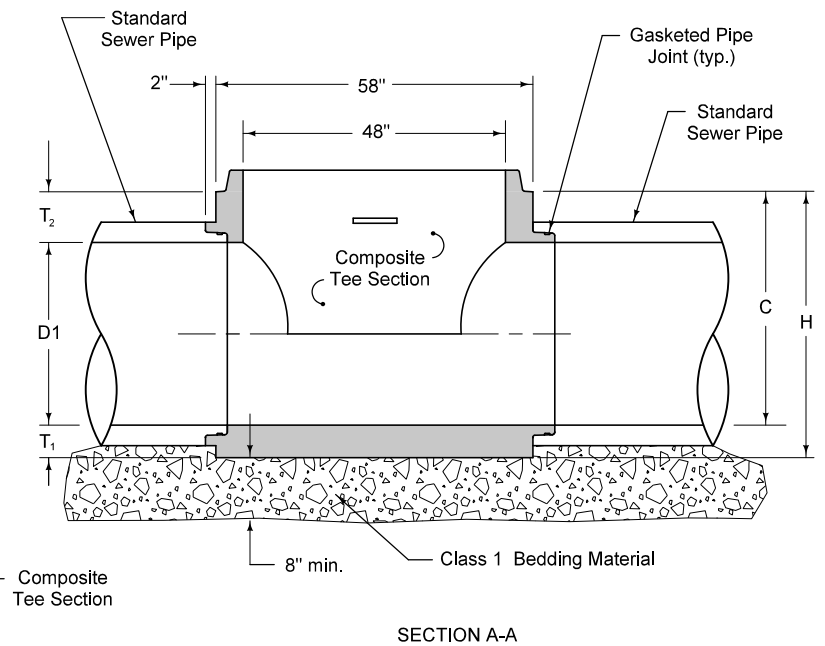
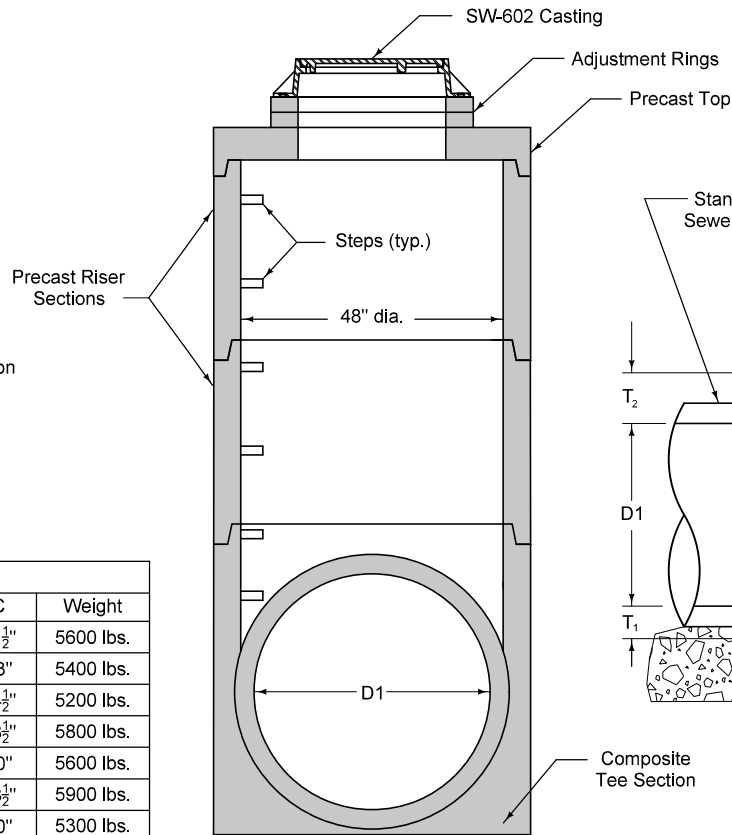
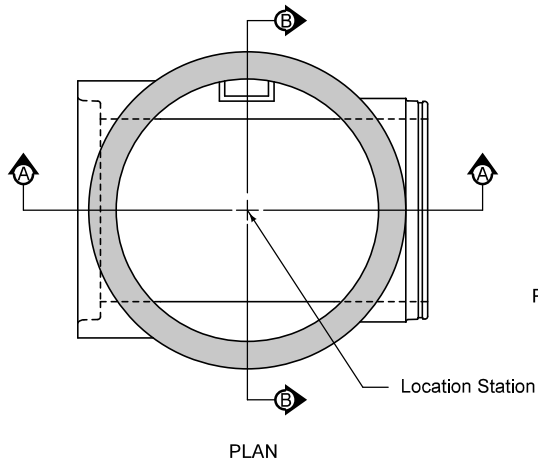


FIGURE 6010.405 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION
		2 10-17-17
FIGURE 6010.405	STANDARD ROAD PLAN	SW-405
		SHEET 1 of 2
REVISIONS: Changed title from TEE-SECTION STORM SECTION MANHOLE to TEE-SECTION STORM SEWER MANHOLE.		
<i>Bruce D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
TEE-SECTION STORM SEWER MANHOLE		



COMPOSITE TEE DIMENSIONS						
Size	D1	H	T ₁	T ₂	C	Weight
48" on 12"	12"	50"	8½"	29½"	41½"	5600 lbs.
48" on 15"	15"	50"	7"	28"	43"	5400 lbs.
48" on 18"	18"	50"	5½"	26½"	44½"	5200 lbs.
48" on 21"	21"	48"	9½"	17½"	38½"	5800 lbs.
48" on 24"	24"	48"	8"	16"	40"	5600 lbs.
48" on 27"	27"	48"	9½"	11½"	38½"	5900 lbs.
48" on 30"	30"	48"	8"	10"	40"	5300 lbs.
48" on 33"	33"	54"	9½"	11½"	44½"	6600 lbs.
48" on 36"	36"	54"	8"	10"	46"	6100 lbs.

SECTION B-B

SECTION A-A

COMPOSITE TEE

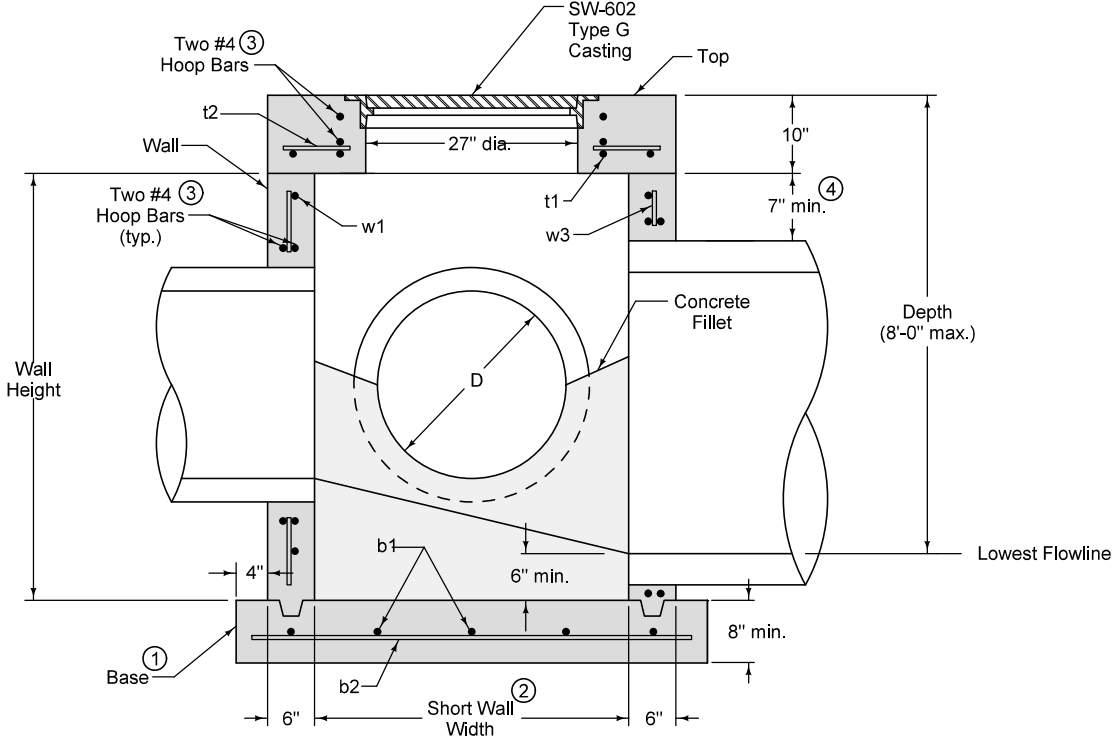
Alternate to standard tee with eccentric reducer (for pipes 36" and smaller).

FIGURE 6010.405 SHEET 2 OF 2

		REVISION
		2 10-17-17
FIGURE 6010.405	STANDARD ROAD PLAN	SW-405
		SHEET 2 of 2
<small>REVISIONS: Changed title from TEE-SECTION STORM SECTION MANHOLE to TEE-SECTION STORM SEWER MANHOLE.</small>		
<i>Paul D. Wigand</i> <small>SUDAS DIRECTOR</small>		<i>Brian Smith</i> <small>DESIGN METHODS ENGINEER</small>
TEE-SECTION STORM SEWER MANHOLE		

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

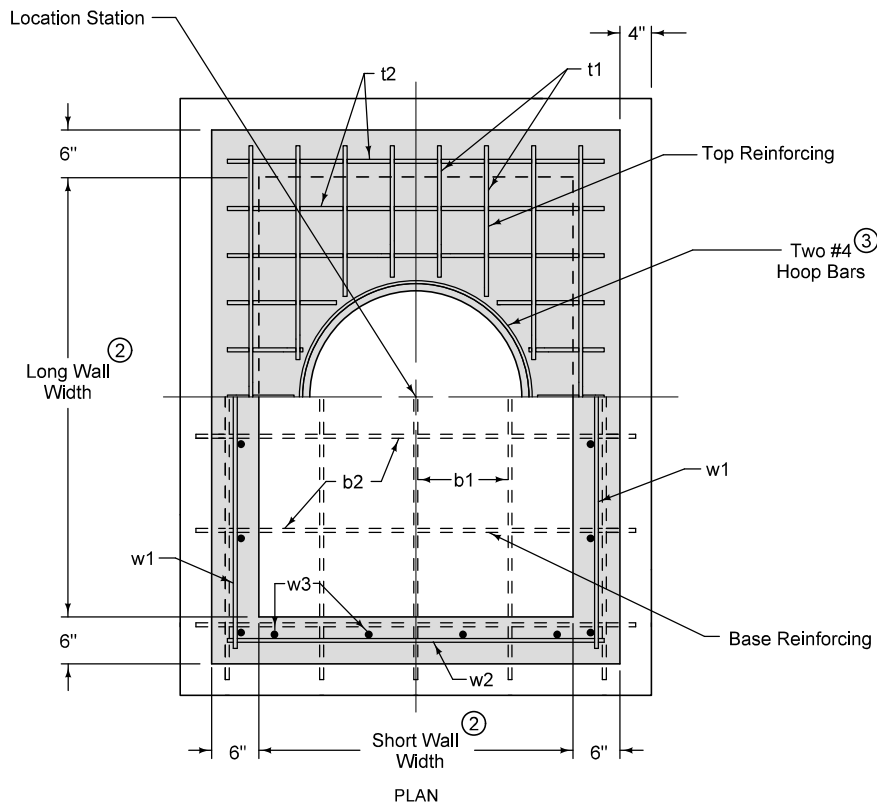
- ① Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
- ② Wall widths vary with pipe diameter and range from 40 inches minimum to 77 inches maximum. Provide 6 inches of wall width (minimum) each side of pipe opening.
- ③ Provide two #4 hoop bars at top opening and at all pipe openings.
- ④ 7 inch minimum wall height above all pipes.



TYPICAL SECTION

FIGURE 6010.406 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION	
		1	04-17-18
FIGURE 6010.406	STANDARD ROAD PLAN	SW-406	
		SHEET 1 of 2	
REVISIONS: Changed 'invert' callout to 'Concrete Fillet'.			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
SHALLOW RECTANGULAR STORM SEWER MANHOLE			



- ② Wall widths vary with pipe diameter and range from 40 inches minimum to 77 inches maximum. Provide 6 inches of wall width (minimum) each side of pipe opening.
- ③ Provide two #4 hoop bars at top opening and at all pipe openings.

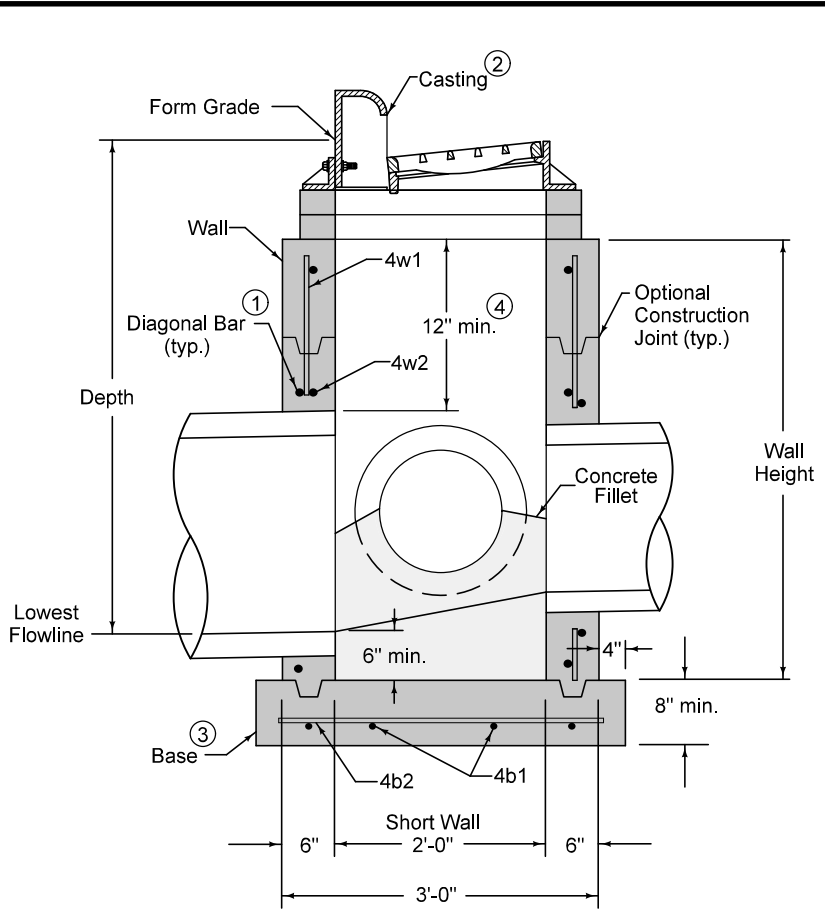
REINFORCING BAR LIST					
Mark	Size	Location	Shape	Length	Spacing
t1	See Table	Top	—	Long Wall plus 8"	6"
t2	See Table	Top	—	Short Wall plus 8"	6"
b1	See Table	Base	—	Long Wall plus 14"	12"
b2	See Table	Base	—	Short Wall plus 14"	12"
w1	See Table	Walls	—	Long Wall plus 8"	12" ^f
w2	See Table	Walls	—	Short Wall plus 8"	12"
w3	See Table	Walls	—	Wall Height minus 4"	12"

^fPlace a minimum of one w1 bar above each pipe opening

Diameter of Largest Pipe, D	Minimum Bar Size
48" or 54"	6
33" to 42"	5
30" or smaller	4

FIGURE 6010.406 SHEET 2 OF 2

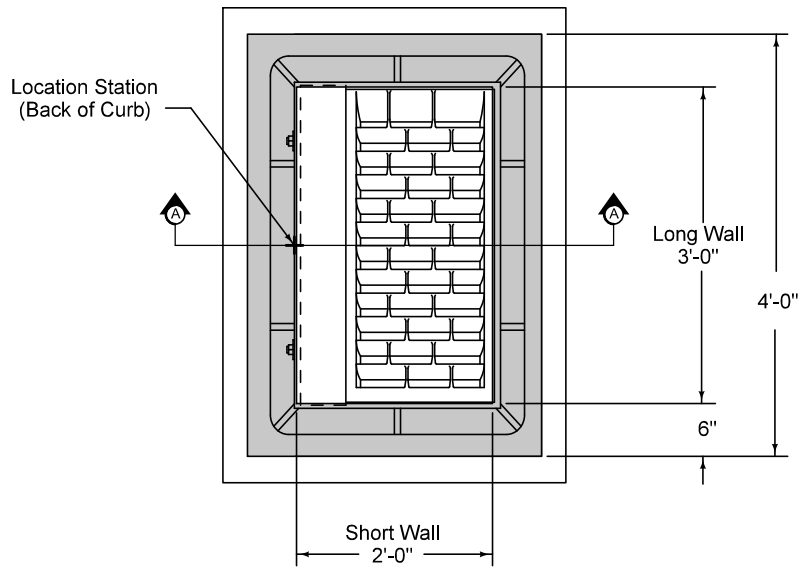
SUDAS IOWADOT	REVISION	1	04-17-18
	FIGURE 6010.406	STANDARD ROAD PLAN	SW-406
REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'.			SHEET 2 of 2
Paul D. Wigand <small>SUDAS DIRECTOR</small>		Brian Smith <small>DESIGN METHODS ENGINEER</small>	
SHALLOW RECTANGULAR STORM SEWER MANHOLE			



SECTION A-A

Refer to SW-514 for boxout details.

- ① Install four #4 diagonal bars at all pipe openings.
- ② SW-603 Type R unless Type Q is specified in the contract documents.
- ③ 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.
- ④ 12 inch minimum wall height above all pipes.



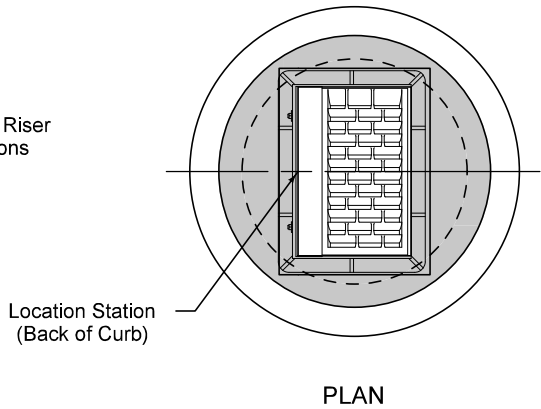
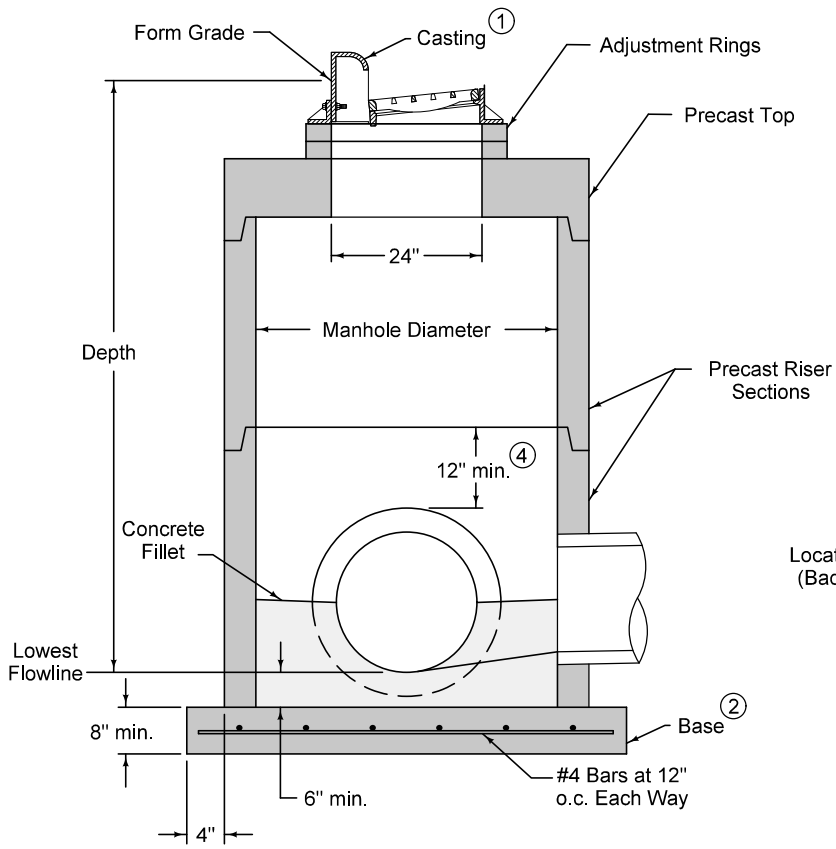
PLAN

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Length	Count	Spacing
4w1	4	Walls	—	Wall Height minus 4"	14	12"
4w2	4	Long Walls	—	3'-8"	Varies	12"
4w3	4	Short Walls	—	2'-8"	Varies	12"
4b1	4	Base	—	4'-2"	4	10"
4b2	4	Base	—	3'-2"	5	10"

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	15"	18"
Long Wall	24"	30"

SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.501	STANDARD ROAD PLAN	SW-501
SHEET 1 of 1		
REVISIONS: Changed "invert" callout to "Concrete Fillet". Updated DOT and SUDAS logos.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
SINGLE GRATE INTAKE		

FIGURE 6010.501 SHEET 1 OF 1



TYPICAL SECTION

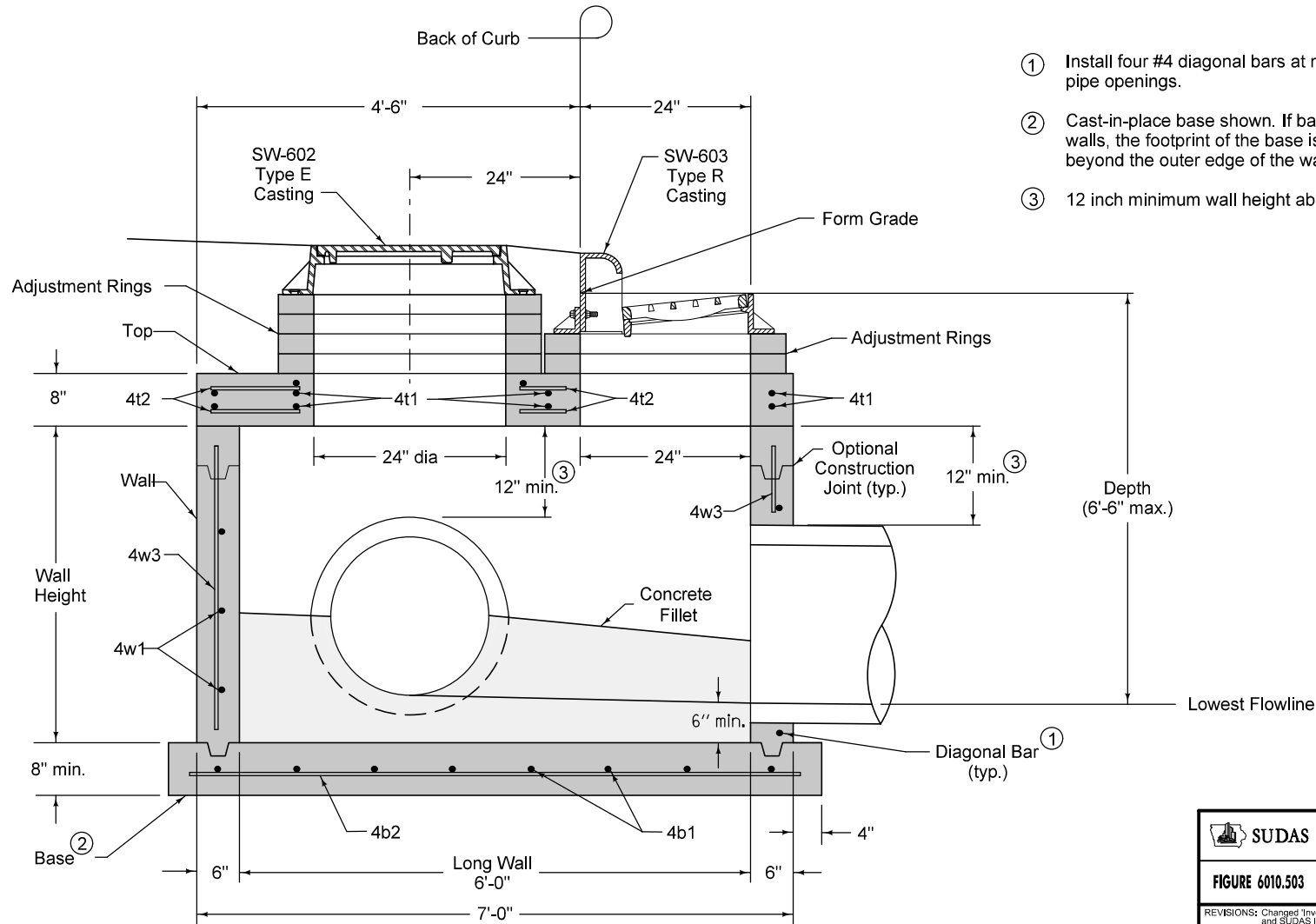
- Refer to SW-514 for boxout details.
- ① SW-603 Type R unless Type Q is specified in the contract documents.
 - ② Cast-in-place base shown. Base may be square. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
 - ③ For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.
 - ④ 12 inch minimum riser height above all pipes.

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 6010.502 SHEET 1 OF 1

SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.502	STANDARD ROAD PLAN	SW-502
		SHEET 1 of 1
<small>REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'. Updated Inwork and Iowa DOT and SUDAS logo.</small>		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
CIRCULAR SINGLE GRATE INTAKE		

Refer to SW-514 for boxout details.



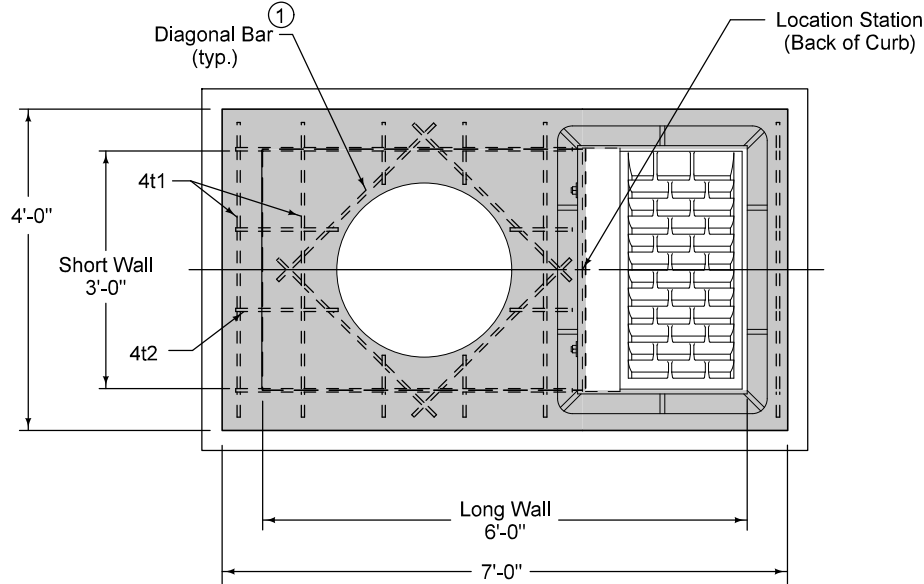
- ① Install four #4 diagonal bars at manhole opening and at all pipe openings.
- ② Cast-in-place base shown. If base is precast integral with walls, the footprint of the base is not required to extend beyond the outer edge of the walls.
- ③ 12 inch minimum wall height above all pipes.

TYPICAL SECTION

FIGURE 6010.503 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION	
		2	04-17-18
FIGURE 6010.503	STANDARD ROAD PLAN	SW-503	
		SHEET 1 of 2	
<small>REVISIONS: Changed 'invert' callout to 'Concrete Fillet'. Updated linework and Iowa DOT and SUDAS logo.</small>			
<i>Paul D. Wigand</i> <small>SUDAS DIRECTOR</small>		<i>Brian Smith</i> <small>DESIGN METHODS ENGINEER</small>	
SINGLE GRATE INTAKE WITH MANHOLE			

① Install four #4 diagonal bars at manhole opening and at all pipe openings.



PLAN

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	—	12	3'-8"	12"
4t2	4	Top	—	8	4'-2"	12"
4b1	4	Base	—	7	4'-2"	13"
4b2	4	Base	—	5	7'-2"	10"
4w1	4	Short Walls	—	Varies	3'-8"	12"
4w2	4	Long Walls	—	Varies	6'-8"	12"
4w3	4	Walls	—	18	Wall Height minus 4"	13"

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	24"	30"
Long Wall	30"	36"

SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.503	STANDARD ROAD PLAN	SW-503
SHEET 2 of 2		
<small>REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'. Updated Ithework and Iowa DOT and SUDAS logo.</small>		
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER
SINGLE GRATE INTAKE WITH MANHOLE		

Refer to SW-514 for boxout details.

- ① Install four #4 diagonal bars at manhole 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 12 inch minimum wall height above all pipes.
- ④ Slope of 1.5% or as specified in the contract documents.

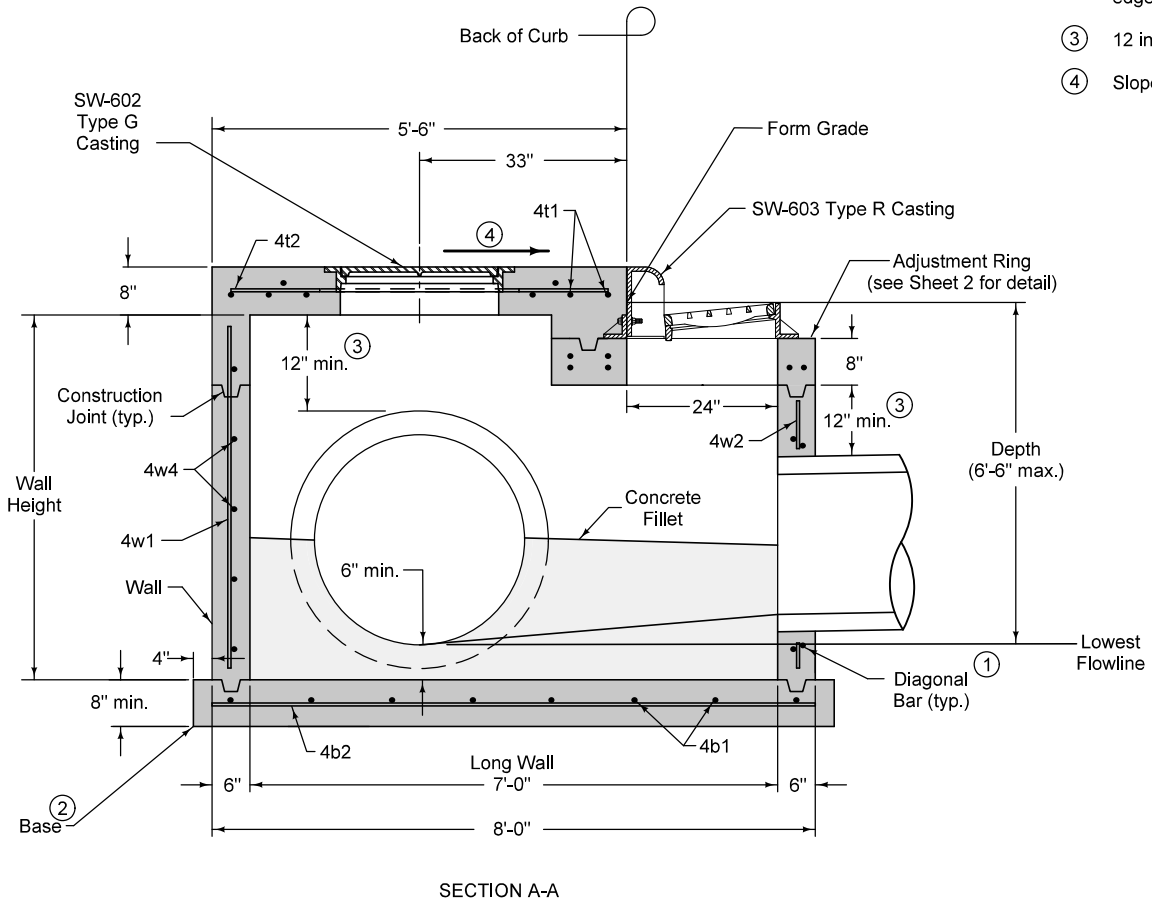
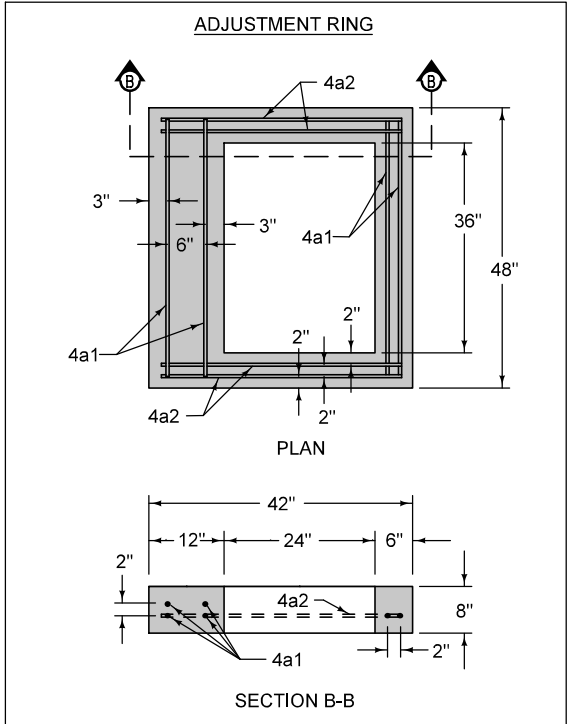
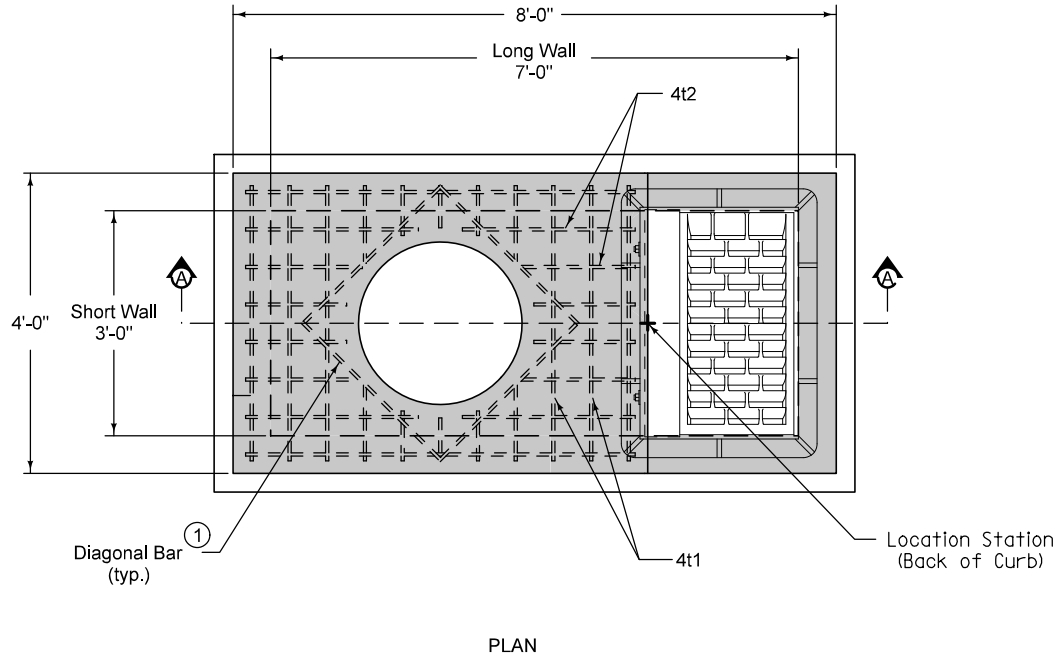


FIGURE 6010.504 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION	
		3	04-17-18
FIGURE 6010.504	STANDARD ROAD PLAN	SW-504	
		SHEET 1 of 2	
REVISIONS: Changed 'invert' callout to 'Concrete Fillet'.			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
SINGLE GRATE INTAKE WITH FLUSH-TOP MANHOLE			

- ① Install four #4 diagonal bars at manhole opening and at all pipe openings.



REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	—	11	3'-8"	6"
4t2	4	Top	—	8	5'-2"	6"
4b1	4	Base	—	8	4'-2"	13"
4b2	4	Base	—	5	8'-2"	10"
4a1	4	Adj. Ring	—	6	3'-8"	See Adj. Ring Plan
4a2	4	Adj. Ring	—	4	3'-2"	See Adj. Ring Plan
4w1	4	Walls	—	13	Wall Height minus 4"	12"
4w2	4	Walls	—	11	Wall Height minus 16"	12"
4w3	4	Long Walls	—	Varies	7'-8"	12"
4w4	4	Short Walls	—	Varies	3'-8"	12"

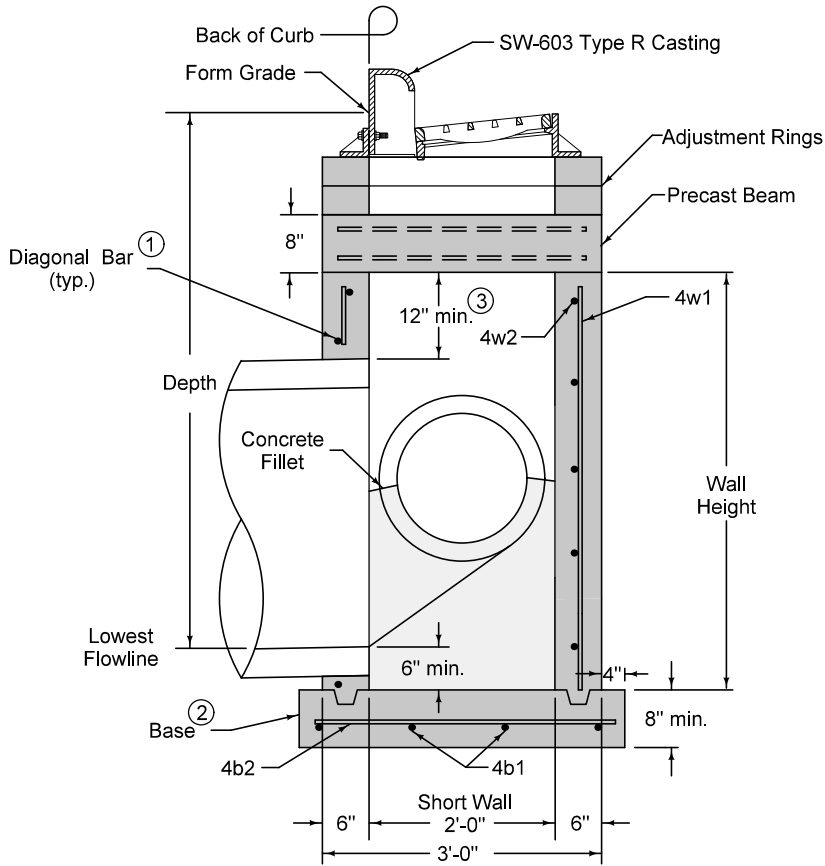
MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	18"	24"
Long Wall	30"	36"

SUDAS IOWADOT	REVISION 3 04-17-18
	FIGURE 6010.504 STANDARD ROAD PLAN SW-504 SHEET 2 of 2
REVISIONS: Changed 'invert' callout to 'Concrete Fillet'.	
Paul D. Wigand SUDAS DIRECTOR	
Brian Smith DESIGN METHODS ENGINEER	
SINGLE GRATE INTAKE WITH FLUSH-TOP MANHOLE	

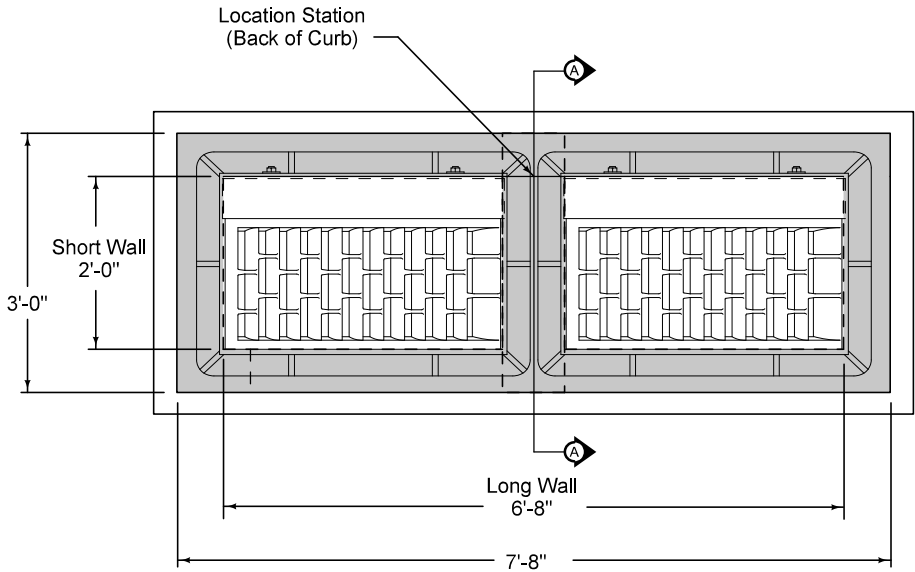
FIGURE 6010.504 SHEET 2 OF 2

Refer to SW-514 for boxout details.

- ① Install four #4 diagonal bars 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 12 inch minimum wall height above all pipes.



SECTION A-A



PLAN

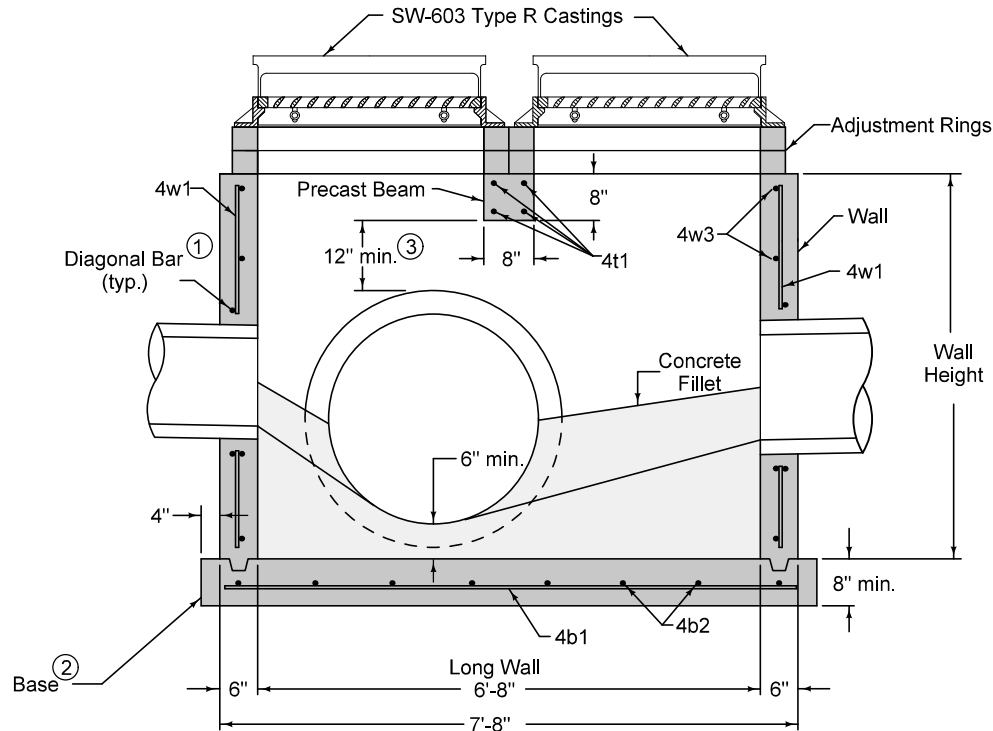
SUDAS	IOWADOT	REVISION	
		2	04-17-18
FIGURE 6010.505	STANDARD ROAD PLAN	SW-505	
		SHEET 1 of 2	

REVISIONS: Changed 'invert' callout to 'Concrete fillet'. Updated linework and Iowa DOT and SUDAS logo.

Paul D. Wigand SUDAS DIRECTOR *Brian Smith* DESIGN METHODS ENGINEER

DOUBLE GRATE INTAKE

FIGURE 6010.505 SHEET 1 OF 2



TYPICAL SECTION

- ① Install four #4 diagonal bars 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 12 inch minimum wall height above all pipes.

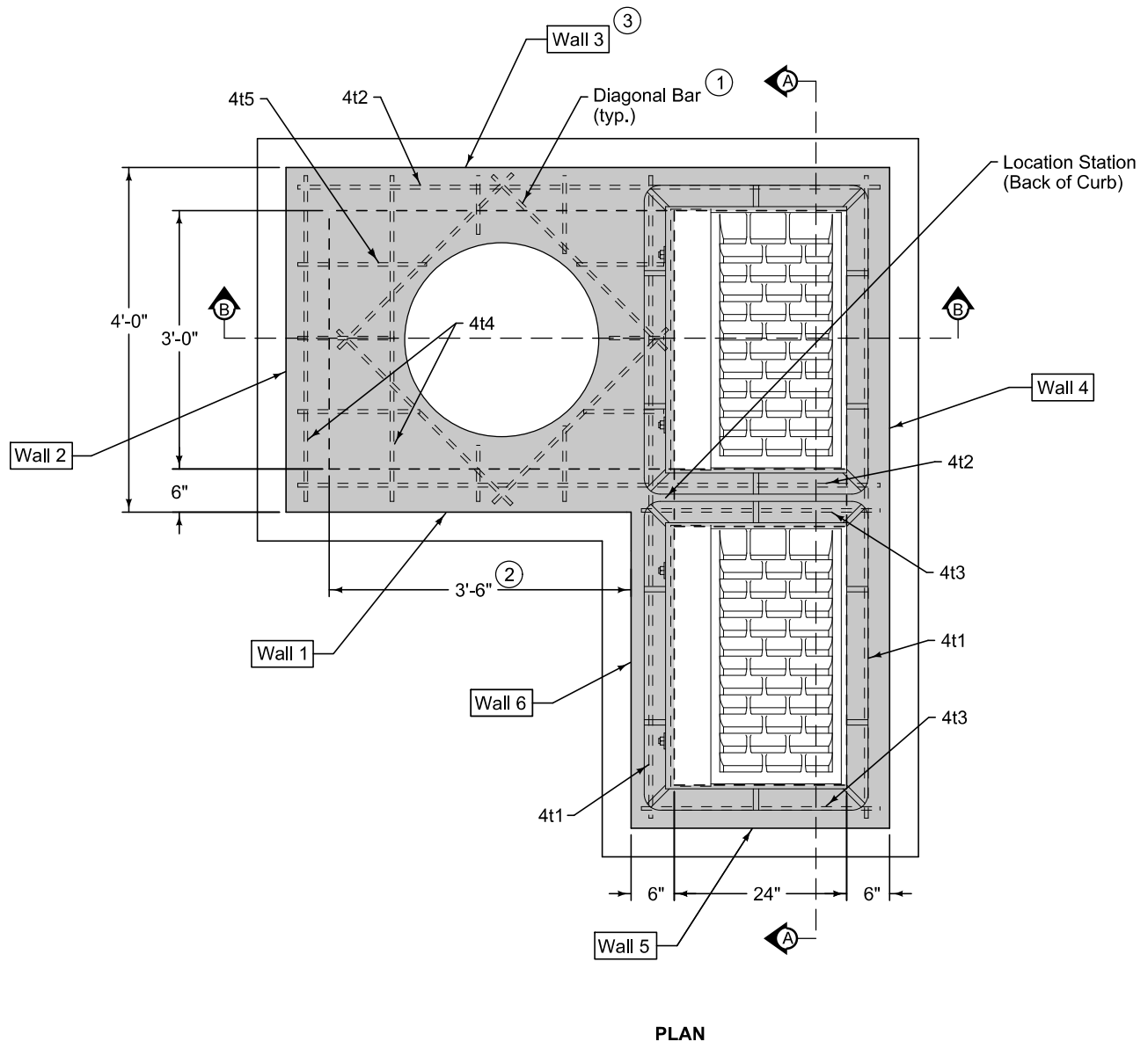
REINFORCING BAR LIST

Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Beam	—	4	2'-8"	4"
4b1	4	Base	—	4	7'-10"	10"
4b2	4	Base	—	8	3'-2"	12"
4w1	4	Walls	—	20	Wall Height minus 4"	12"
4w2	4	Long Walls	—	Varies	7'-4"	12"
4w3	4	Short Walls	—	Varies	2'-8"	12"

MAXIMUM PIPE DIAMETERS

Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	15"	18"
Long Wall	60"	66"

		REVISION
		2 04-17-18
FIGURE 6010.505	STANDARD ROAD PLAN	SW-505
SHEET 2 of 2		
<small>REVISIONS: Changed 'invert' callout to 'Concrete fillet'. Updated linework and Iowa DOT and SUDAS logo.</small>		
 <small>SUDAS DIRECTOR</small>		 <small>DESIGN METHODS ENGINEER</small>
DOUBLE GRATE INTAKE		



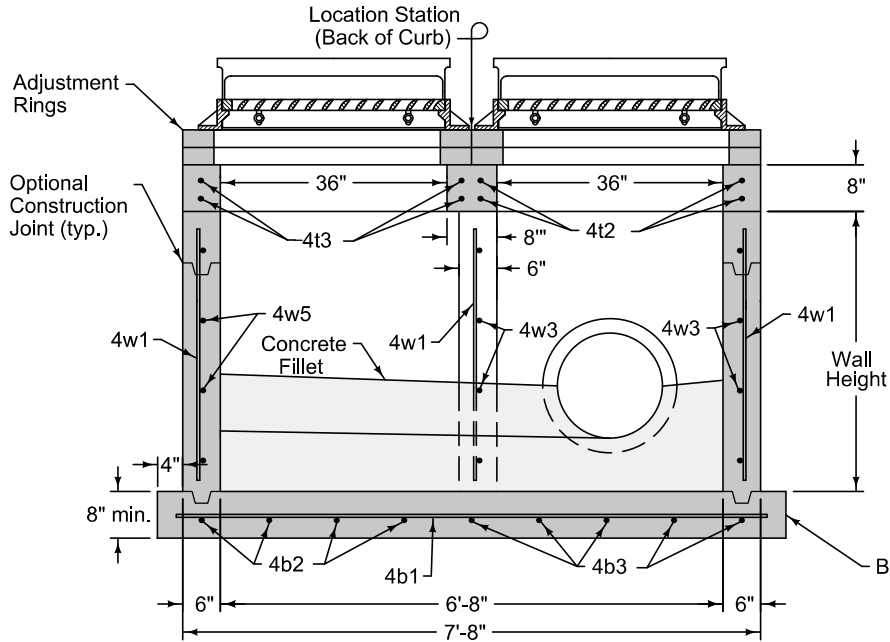
Maximum pipe diameters are set based on maximum structure depth of 6 feet-6 inches and the objective of placement of the centerline of the pipe on the centerline of the manhole opening for maintenance purposes.

Refer to SW-514 for boxout details.

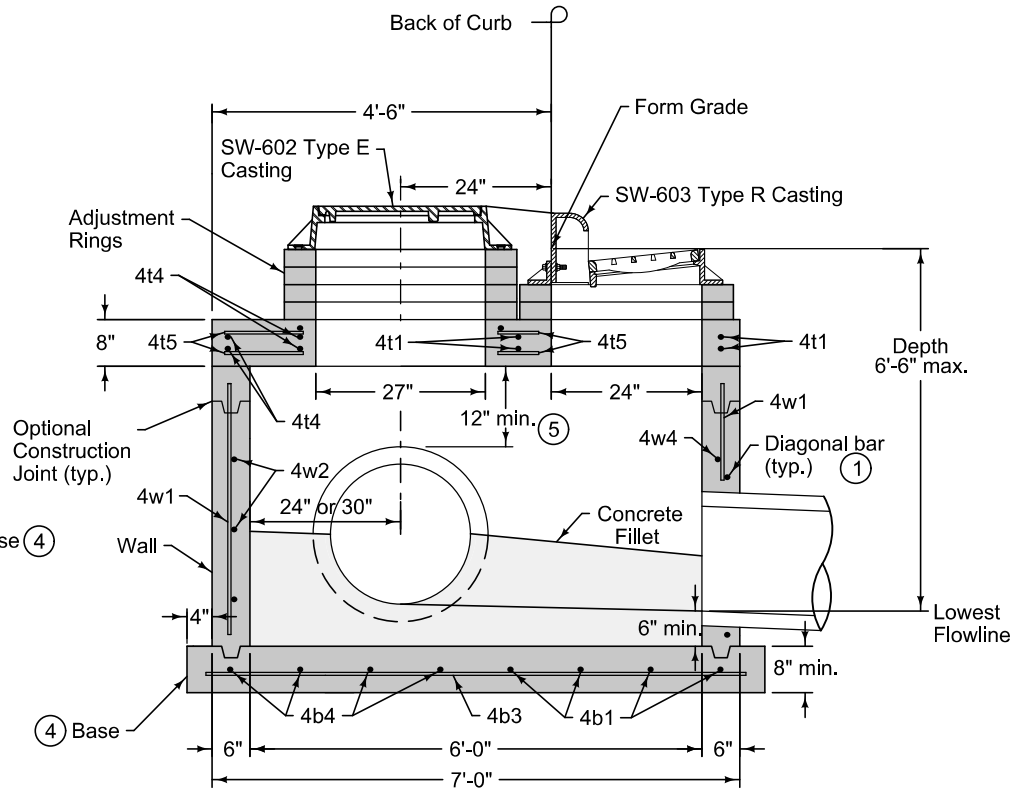
- ① Install four #4 diagonal bars at manhole opening and at all pipe openings.
- ② If Wall 1 is widened to 4 feet, the maximum pipe diameter can be increased to 36 inches.
- ③ If Wall 1 is widened to 4 feet, the maximum pipe diameter in Wall 3 can be increased to 42 inches.

MAXIMUM PIPE DIAMETERS	
Wall	Max. Dia.
1	30" ②
2	24"
3	36" ③
4	42"

SUDAS IOWADOT	REVISION
	3 04-17-18
FIGURE 6010.506	STANDARD ROAD PLAN
Paul D. Wigand SUDAS DIRECTOR	
Brian Smith DESIGN METHODS ENGINEER	
DOUBLE GRATE INTAKE WITH MANHOLE	



SECTION A-A



SECTION B-B

REINFORCING BAR LIST

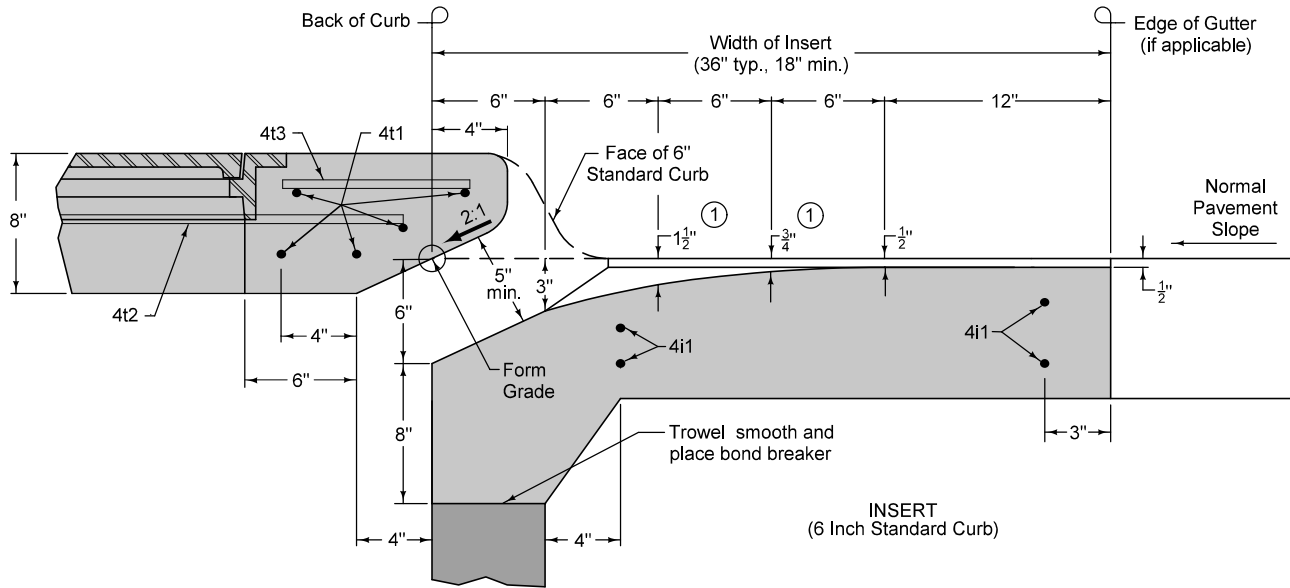
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	—	4	7'-4"	See Detail
4t2	4	Top	—	4	6'-8"	See Detail
4t3	4	Top	—	4	2'-8"	See Detail
4t4	4	Top	—	8	3'-8"	12"
4t5	4	Top	—	6	4'-2"	12"
4b1	4	Base	—	4	7'-10"	12"
4b2	4	Base	—	4	3'-2"	12"
4b3	4	Base	—	5	7'-2"	12"
4b4	4	Base	—	4	4'-2"	12"
4w1	4	Walls	—	29	Wall Height minus 4"	12"
4w2	4	Wall 2	—	Varies	3'-8"	12"
4w3	4	Walls 1 and 3	—	Varies	6'-8"	12"
4w4	4	Wall 4	—	Varies	7'-4"	12"
4w5	4	Wall 5	—	Varies	2'-8"	12"
4w6	4	Wall 6	—	Varies	3'-10"	12"

- ① Install four #4 diagonal bars at manhole opening and at all pipe openings.
- ④ Cast-in-place base shown. If base is precast integral with walls, the footprint of base is not required to extend beyond the outer edge of the walls.
- ⑤ 12 inch minimum wall height above all pipes.

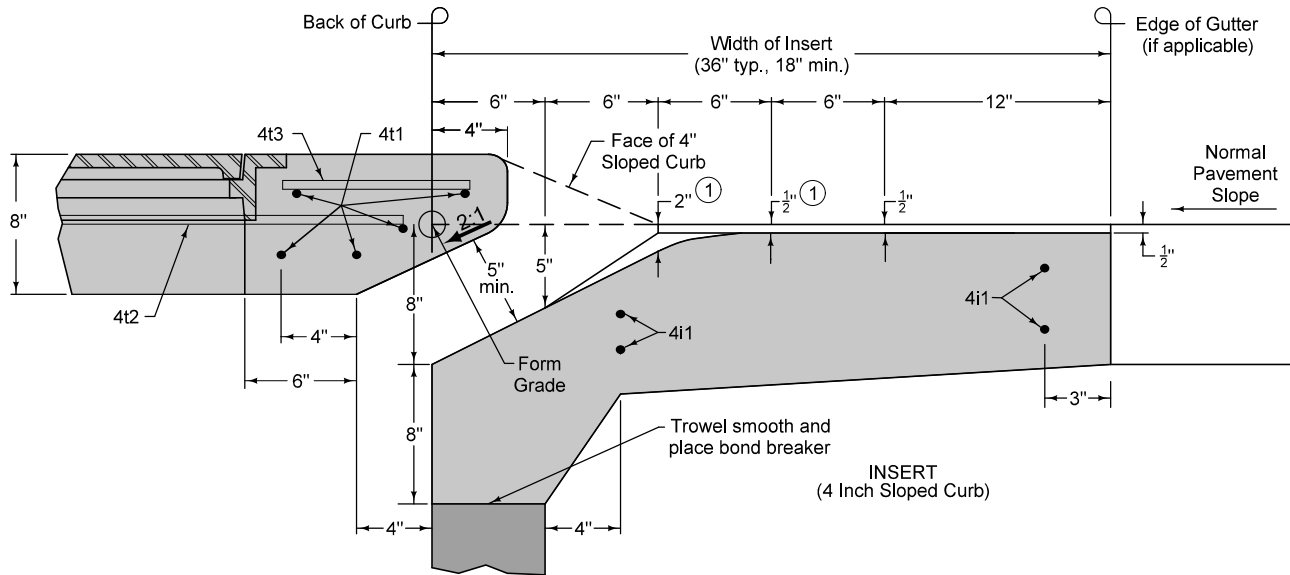
FIGURE 6010.506

SHEET 2 OF 2

		REVISION
		3 04-17-18
FIGURE 6010.506	STANDARD ROAD PLAN	SW-506
REVISIONS: Changed 'invert' callout to 'Concrete Fillet.'		SHEET 2 of 2
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
DOUBLE GRATE INTAKE WITH MANHOLE		



① Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by $\frac{1}{2}$ inch.

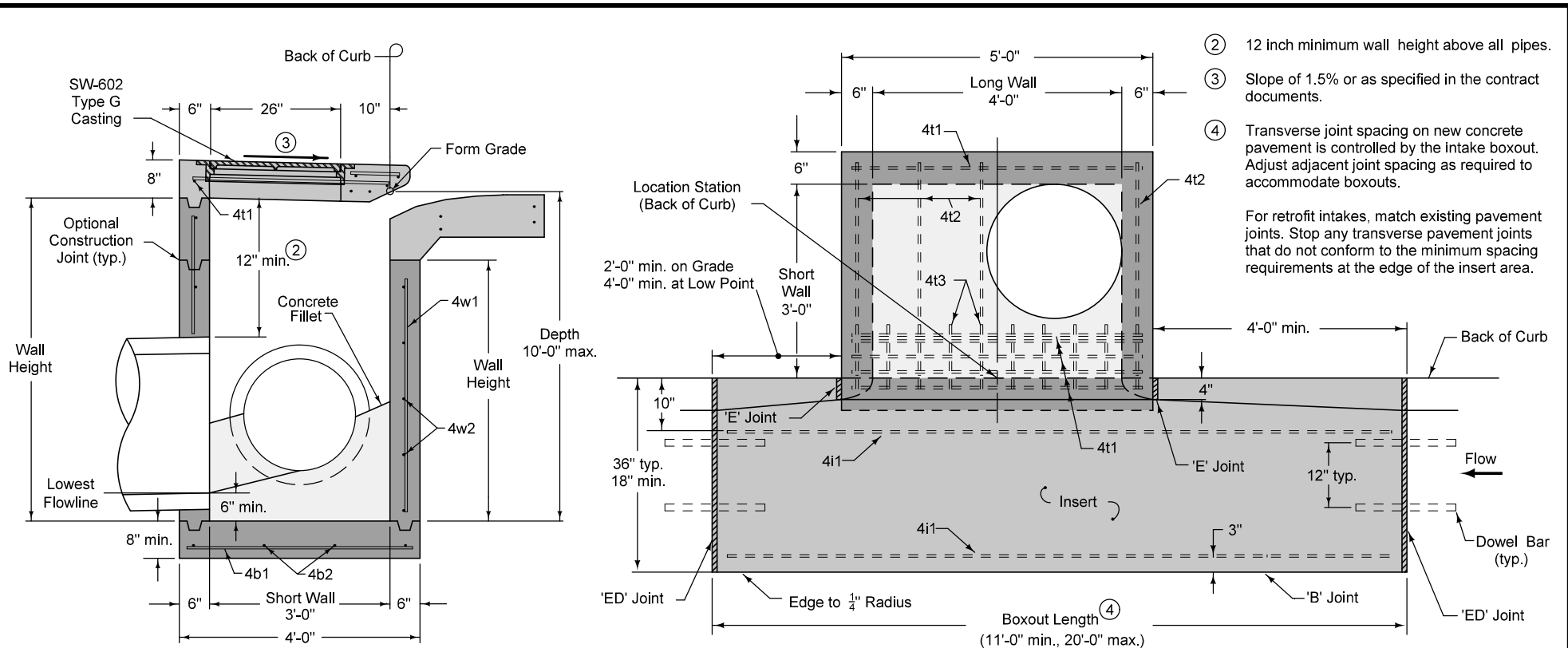


SUDAS	IOWADOT	REVISION
		3 04-17-18
FIGURE 6010.507	STANDARD ROAD PLAN	SW-507
		SHEET 1 of 2

REVISIONS: Added second insert drawing to include 4" curb. Changed 'Insert' callout to 'Concrete Fillet'. Modified circle notes.

Paul D. Wigand SUDAS DIRECTOR
Brian Smith DESIGN METHODS ENGINEER

**SINGLE OPEN-THROAT CURB
 INTAKE, SMALL BOX**



TYPICAL SECTION

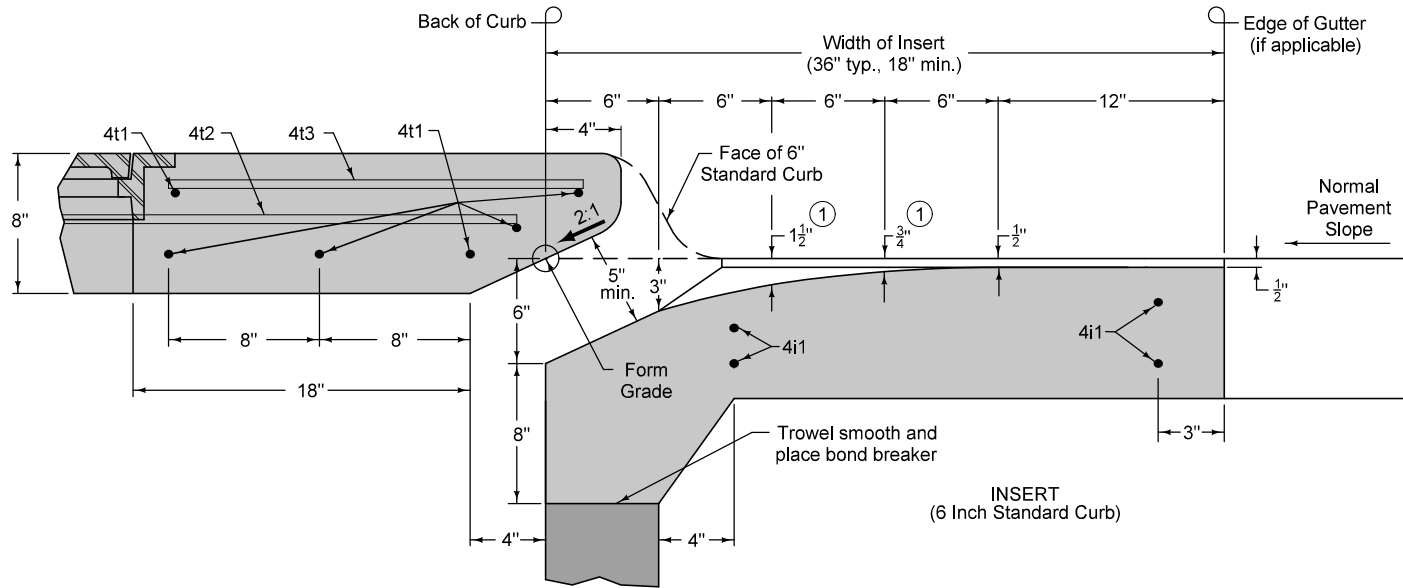
PLAN

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	—	6	4'-8"	See Insert
4t2	4	Top	—	4	3'-6"	12"
4t3	4	Top	—	10	10"	6"
4b1	4	Base	—	6	3'-6"	1 1"
4b2	4	Base	—	5	4'-6"	10"
4i1	4	Insert	—	4	Boxout Length minus 8"	See Plan
4w1	4	Walls	—	14	Wall Height minus 4"	14"
4w2	4	Long Walls	—	Varies	4'-8"	12"
4w3	4	Short Walls	—	Varies	3'-8"	12"

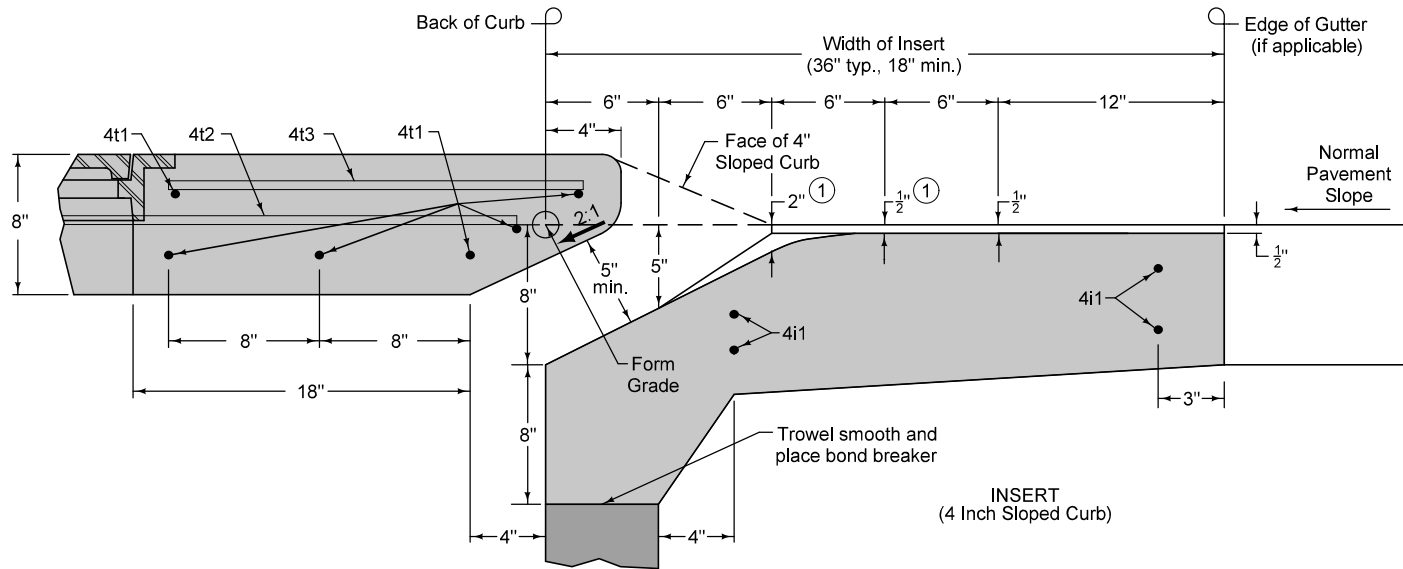
MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	24"	30"
Long Wall	30"	36"

SUDAS IOWADOT	REVISION 3 04-17-18
	SW-507 SHEET 2 of 2
FIGURE 6010.507 STANDARD ROAD PLAN	REVISIONS: Added second Insert drawing to include 4" curb. Changed "Insert" callout to "Concrete Fillet". Modified circle notes.
<i>Paul D. Wigand</i> SUDAS DIRECTOR	<i>Brian Smith</i> DESIGN METHODS ENGINEER
SINGLE OPEN-THROAT CURB INTAKE, SMALL BOX	

FIGURE 6010.507 SHEET 2 OF 2

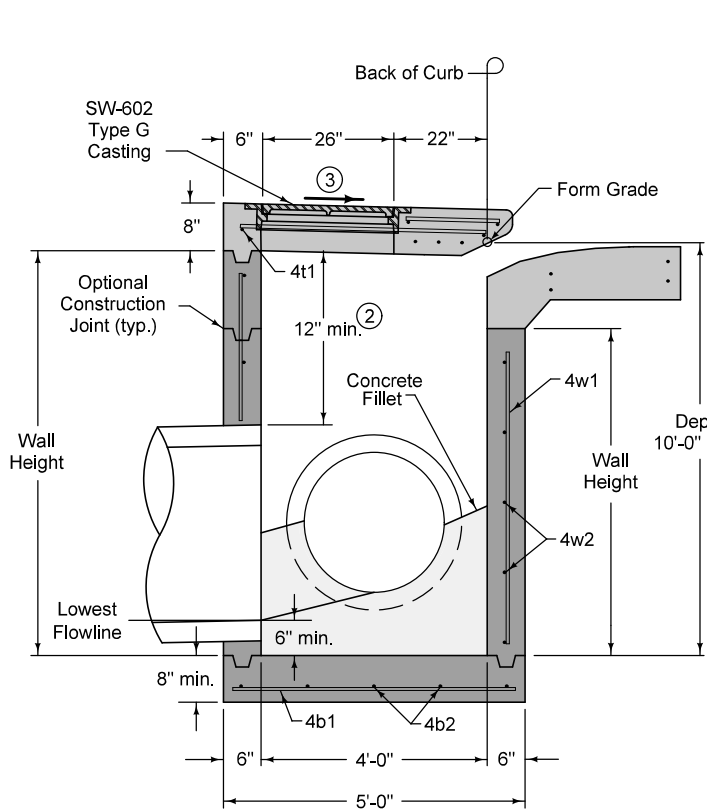


① Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by $\frac{1}{2}$ inch.

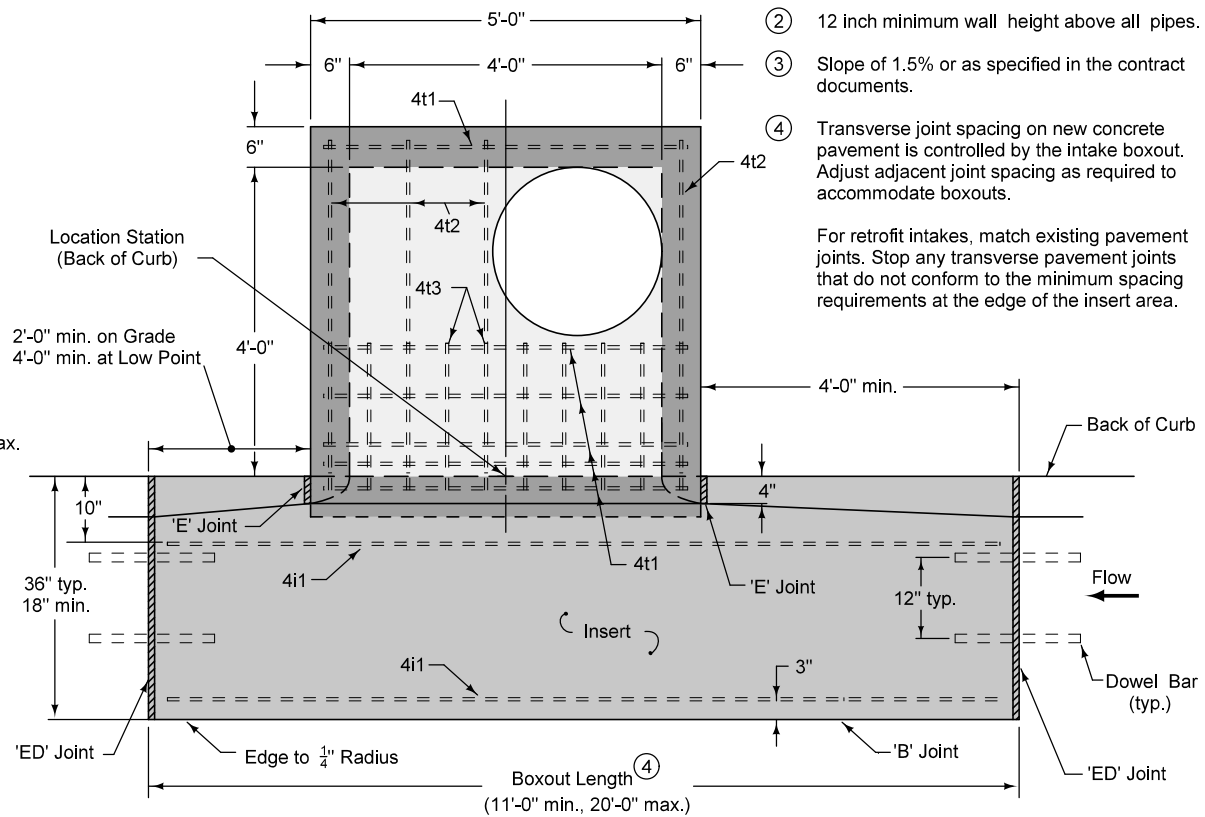


SUDAS	IOWADOT	REVISION
		3 04-17-18
FIGURE 6010.508	STANDARD ROAD PLAN	SW-508
		SHEET 1 of 2
REVISIONS: Added second insert drawing to include 4" curb, changed 'Invert' callout to 'Concrete Fillet', and modified circle notes.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER

**SINGLE OPEN-THROAT CURB
INTAKE, LARGE BOX**



TYPICAL SECTION



PLAN

- ② 12 inch minimum wall height above all pipes.
 - ③ Slope of 1.5% or as specified in the contract documents.
 - ④ Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.
- For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.

REINFORCING BAR LIST

Mark	Size	Location	Shape	Count	Length	Spacing
4t1	4	Top	—	7	4'-8"	See Insert
4t2	4	Top	—	4	4'-6"	12"
4t3	4	Top	—	10	1'-10"	6"
4b1	4	Base	—	6	4'-6"	11"
4b2	4	Base	—	6	4'-6"	11"
4i1	4	Insert	—	4	Boxout Length minus 8"	See Plan
4w1	4	Walls	—	16	Wall Height minus 4"	14"
4w2	4	Walls	—	Varies	4'-8"	12"
4w3	4	Walls	—	Varies	4'-8"	12"

MAXIMUM PIPE DIAMETERS	
Precast Structure	Cast-in-place Structure
30"	36"

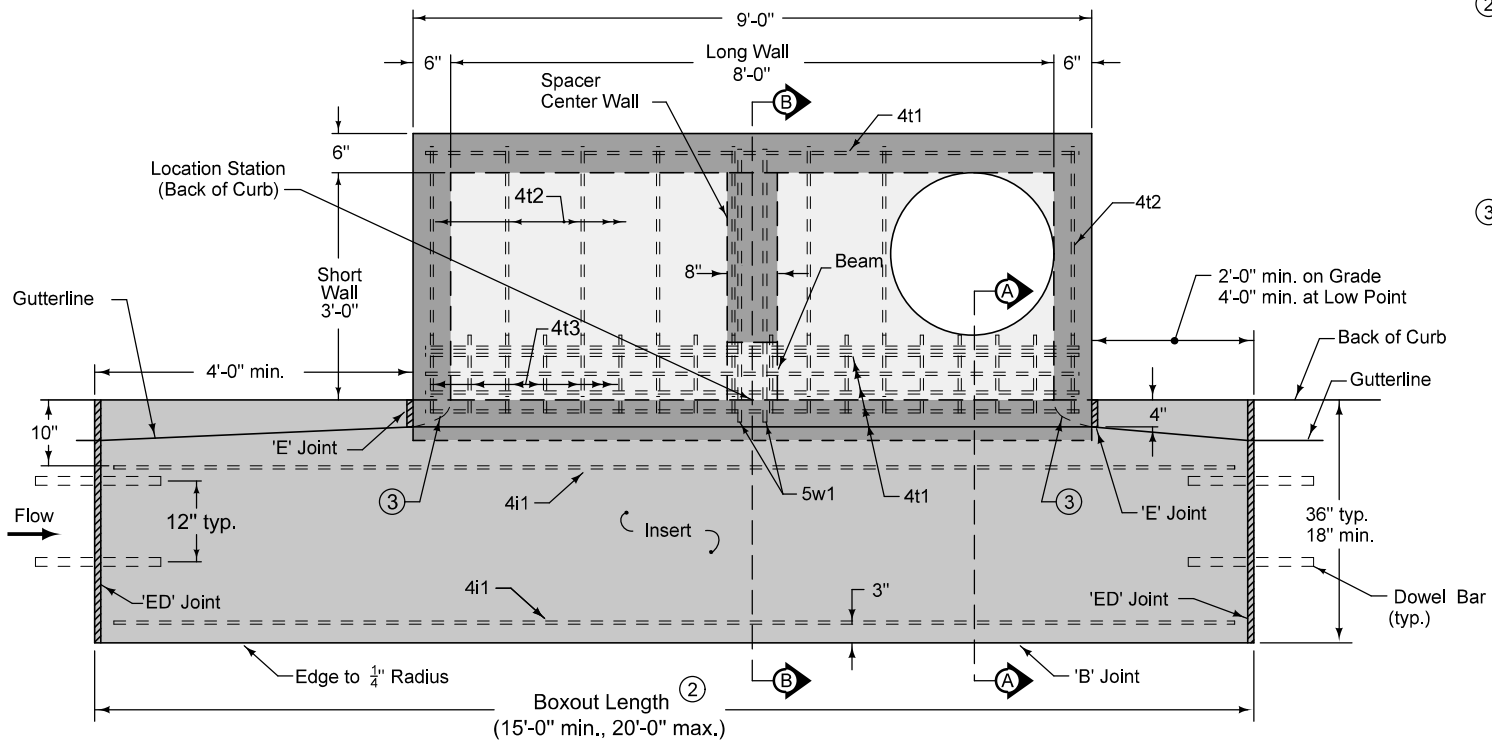
SUDAS IOWADOT	REVISION 3 04-17-18
	SW-508 SHEET 2 of 2

REVISIONS: Added second Insert drawing to include 4" curb, changed 'Insert' callout to 'Concrete Fillet', and modified circle notes.

Paul D. Wigand
 SUDAS DIRECTOR

Brian Smith
 DESIGN METHODS ENGINEER

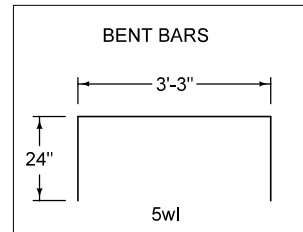
**SINGLE OPEN-THROAT CURB
INTAKE, LARGE BOX**



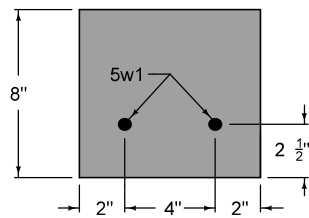
PLAN

- ② Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.
- For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.
- ③ Rounded shaping at inlet.

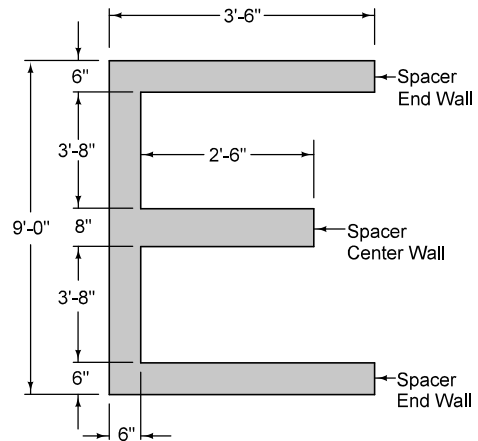
REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4b1	4	Base	—	9	3'-6"	12"
4b2	4	Base	—	5	8'-6"	10"
4i1	4	Insert	—	4	Boxout Length minus 8"	See Insert
4t1	4	Top	—	6	8'-6"	See Plan
4t2	4	Top	—	8	3'-6"	12"
4t3	4	Top	—	18	10"	6"
4w1	4	Walls	—	22	Wall Height minus 4"	13"
4w2	4	Long Walls	—	Varies	4'-8"	12"
4w3	4	Short Walls	—	Varies	3'-8"	12"
5w1	5	Beam	⌈	2	7'-3"	4"



SUDAS	IOWADOT	REVISION	
		5	04-17-18
FIGURE 6010.509	STANDARD ROAD PLAN	SW-509 SHEET 2 of 3	
REVISIONS: Added second insert drawing to include 4" curb. Changed 'Insert' callout to 'Concrete Fillet'. Modified circle notes.			
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER	
DOUBLE OPEN-THROAT CURB INTAKE, SMALL BOX			



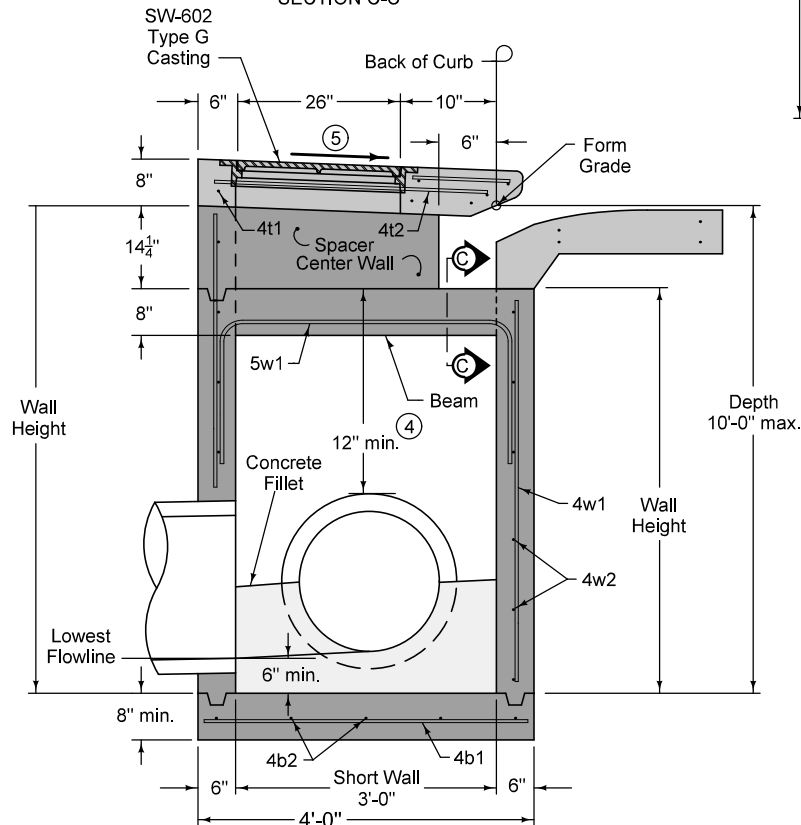
SECTION C-C



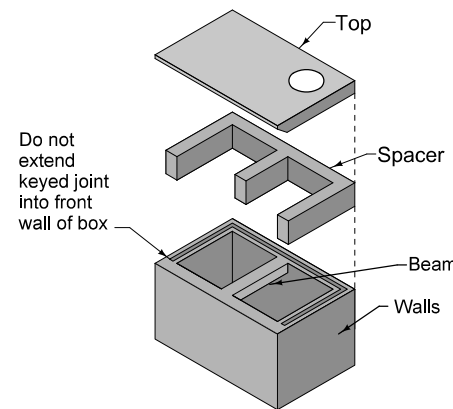
PLAN (SPACER)

- ④ 12 inch minimum wall height above all pipes.
- ⑤ Slope of 1.5% or as specified in the contract documents.

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	24"	30"
Long Wall	60"	66"



SECTION B-B



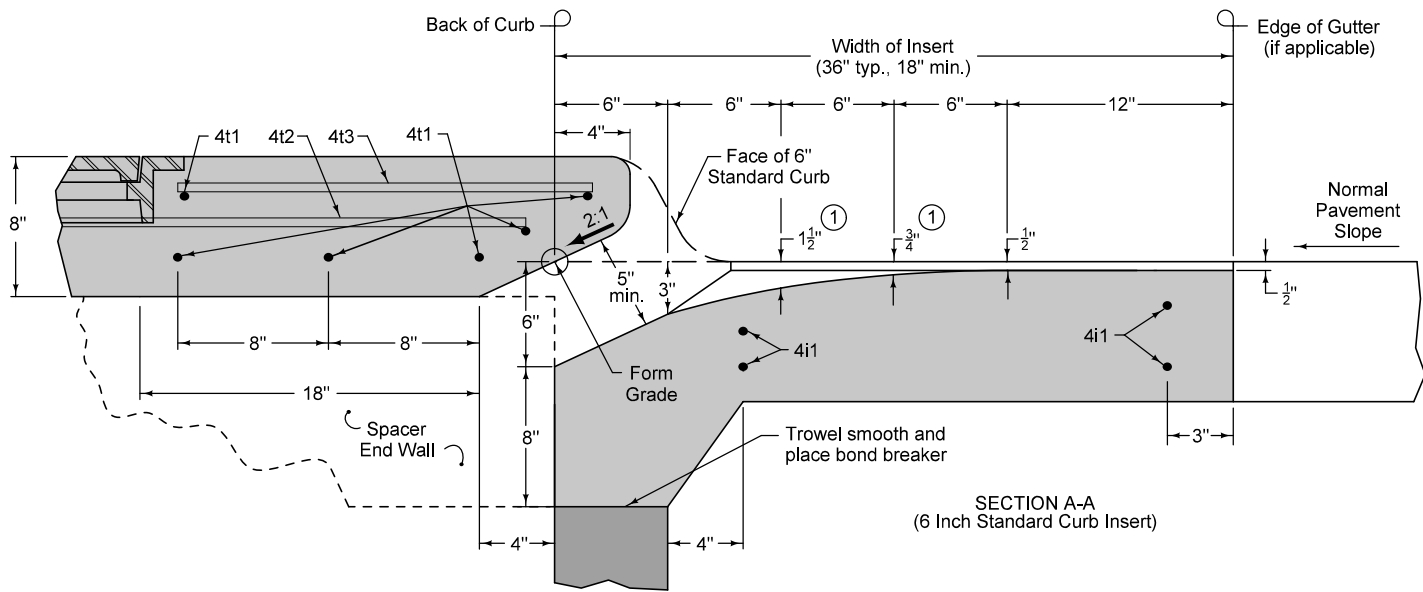
ISOMETRIC
(Refer to SECTION B-B for alignment of Top with Spacer)

SUDAS	IOWADOT	REVISION
		5 04-17-18
FIGURE 6010.509	STANDARD ROAD PLAN	SW-509
		SHEET 3 of 3

REVISIONS: Added second Insert drawing to include 4" curb. Changed "invert" callout to "Concrete Fillet". Modified circle notes.

Paul D. Wigand SUDAS DIRECTOR
Brian Smith DESIGN METHODS ENGINEER

DOUBLE OPEN-THROAT CURB INTAKE, SMALL BOX



① Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by $\frac{1}{4}$ inch.

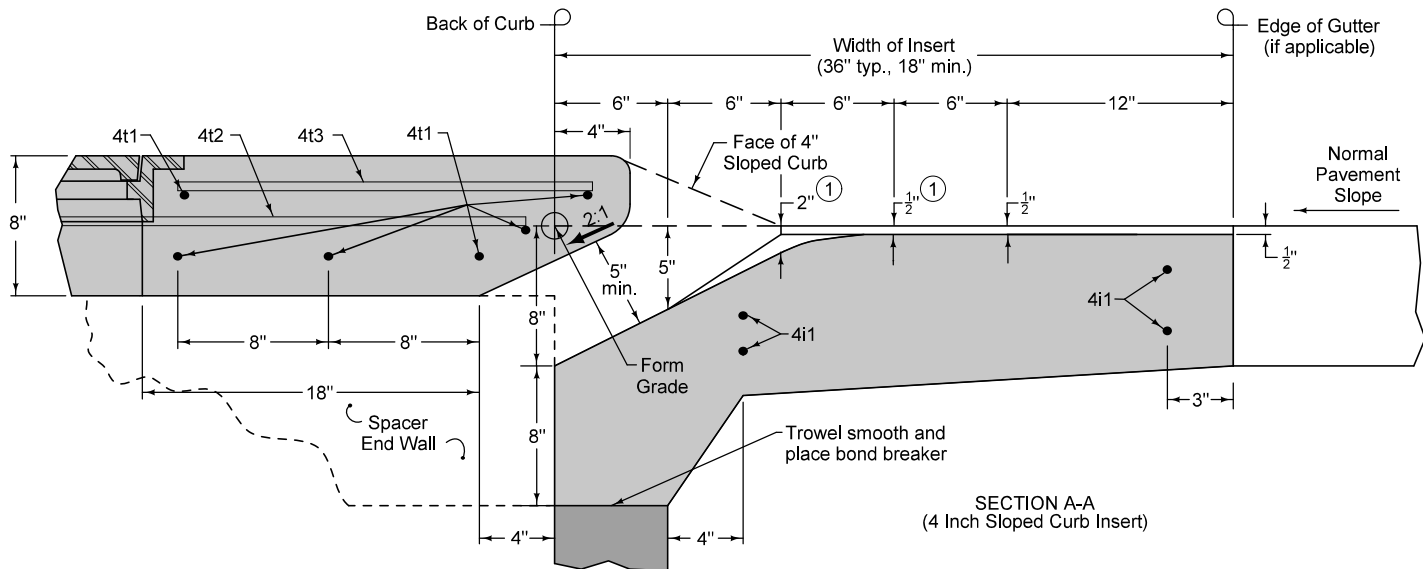
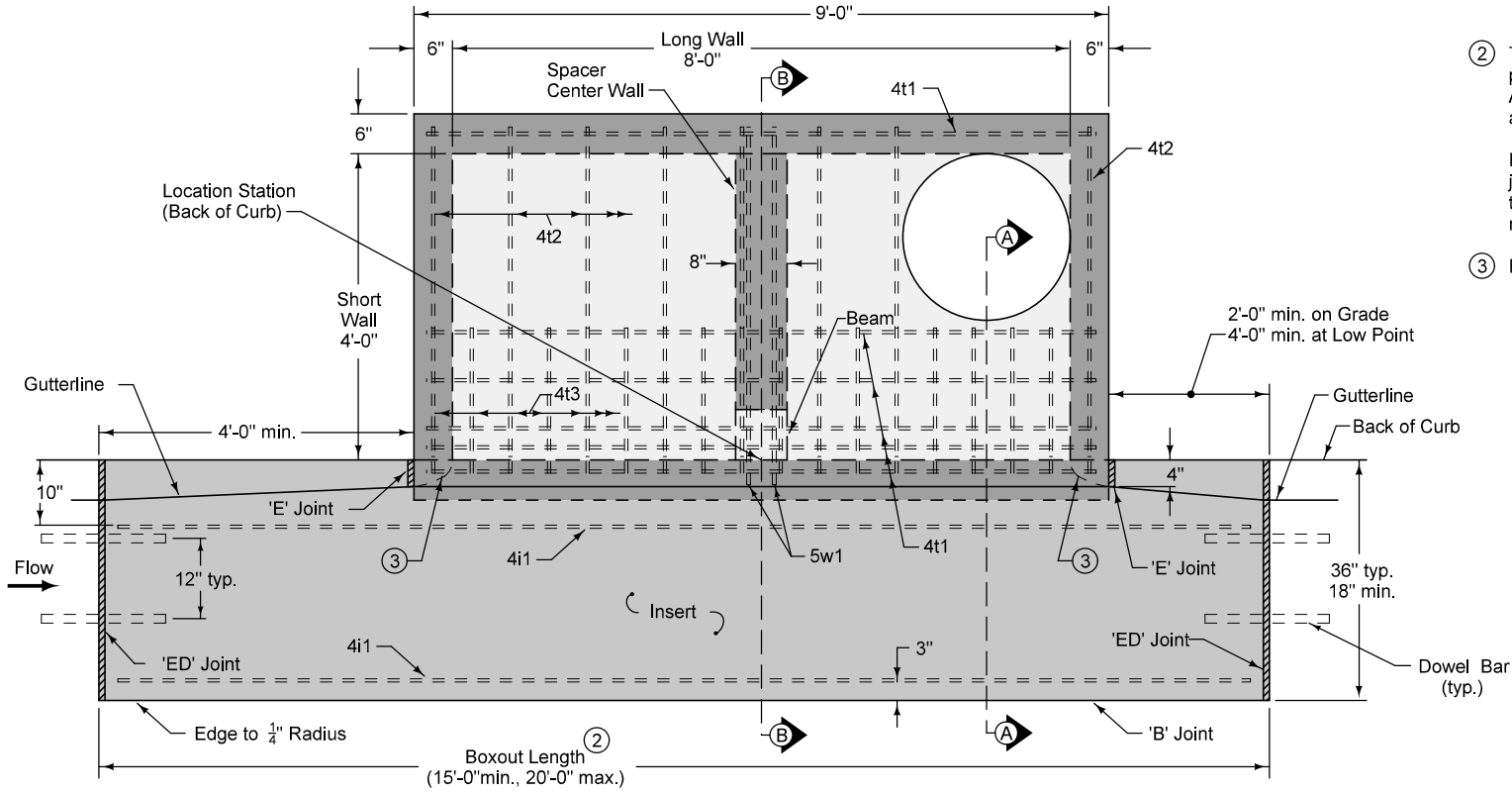


FIGURE 6010.510 SHEET 1 OF 3

SUDAS	IOWADOT	REVISION
		5 04-17-18
FIGURE 6010.510	STANDARD ROAD PLAN	SW-510
		SHEET 1 of 3
<small>REVISIONS: Added second Insert drawing to include 4" curb. Changed "Invert" callout to "Concrete Fillet". Modified circle notes.</small>		
<i>Paul D. Wigand</i> <small>SUDAS DIRECTOR</small>		<i>Brian Smith</i> <small>DESIGN METHODS ENGINEER</small>
DOUBLE OPEN-THROAT CURB INTAKE, LARGE BOX		



- ② Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.
- For retrofit intakes, match existing pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the insert area.
- ③ Rounded shaping at inlet.

PLAN

REINFORCING BAR LIST						
Mark	Size	Location	Shape	Count	Length	Spacing
4b1	4	Base	—	9	4'-6"	12"
4b2	4	Base	—	6	8'-6"	11"
4i1	4	Insert	—	4	Boxout Length minus 8"	See Insert
4t1	4	Top	—	7	8'-6"	See Plan
4t2	4	Top	—	8	4'-4"	12"
4t3	4	Top	—	18	1'-10"	6"
4w1	4	Walls	—	24	Wall Height minus 4"	13"
4w2	4	Long Walls	—	Varies	4'-8"	12"
4w3	4	Short Walls	—	Varies	8'-8"	12"
5w1	5	Beam	┌┐	2	8'-3"	4"

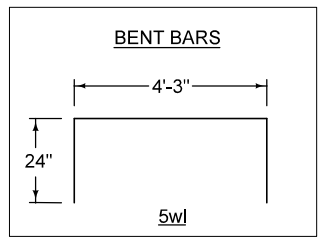
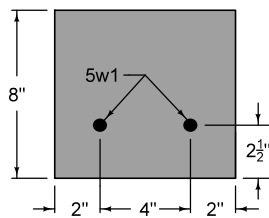
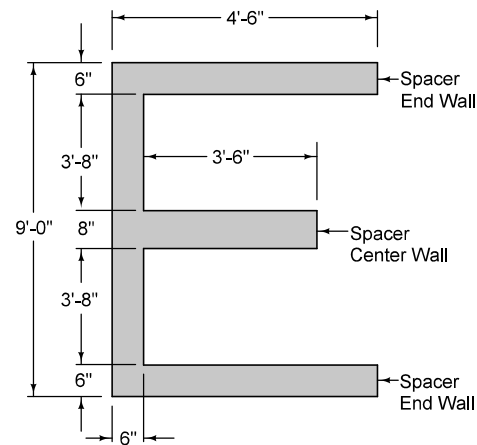


FIGURE 6010.510 SHEET 2 OF 3

SUDAS IOWADOT	REVISION	5	04-17-18
	FIGURE 6010.510	STANDARD ROAD PLAN	SW-510
SHEET 2 of 3			
REVISIONS: Added second insert drawing to include 4" curb. Changed 'Insert' callout to 'Concrete Filet'. Modified circle notes. <i>Paul D. Wigand</i> SUDAS DIRECTOR <i>Brian Smith</i> DESIGN METHODS ENGINEER			
DOUBLE OPEN-THROAT CURB INTAKE, LARGE BOX			



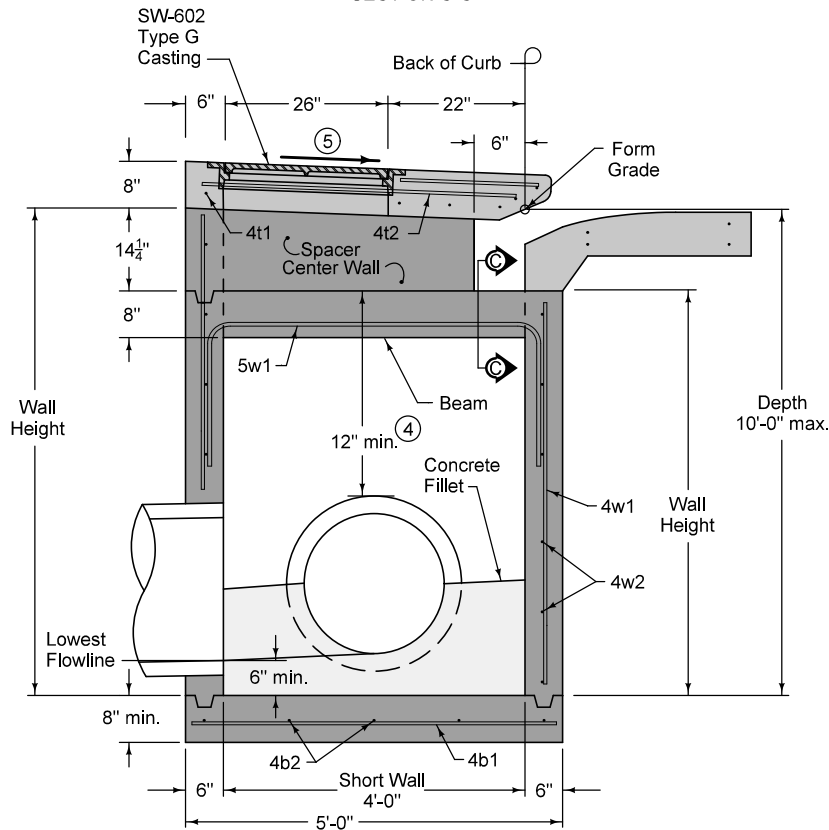
SECTION C-C



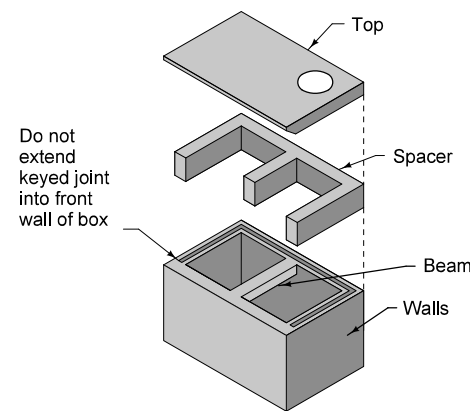
PLAN (SPACER)

- ④ 12 inch minimum wall height above all pipes.
- ⑤ Slope of 1.5% or as specified in the contract documents.

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	30"	36"
Long Wall	60"	66"



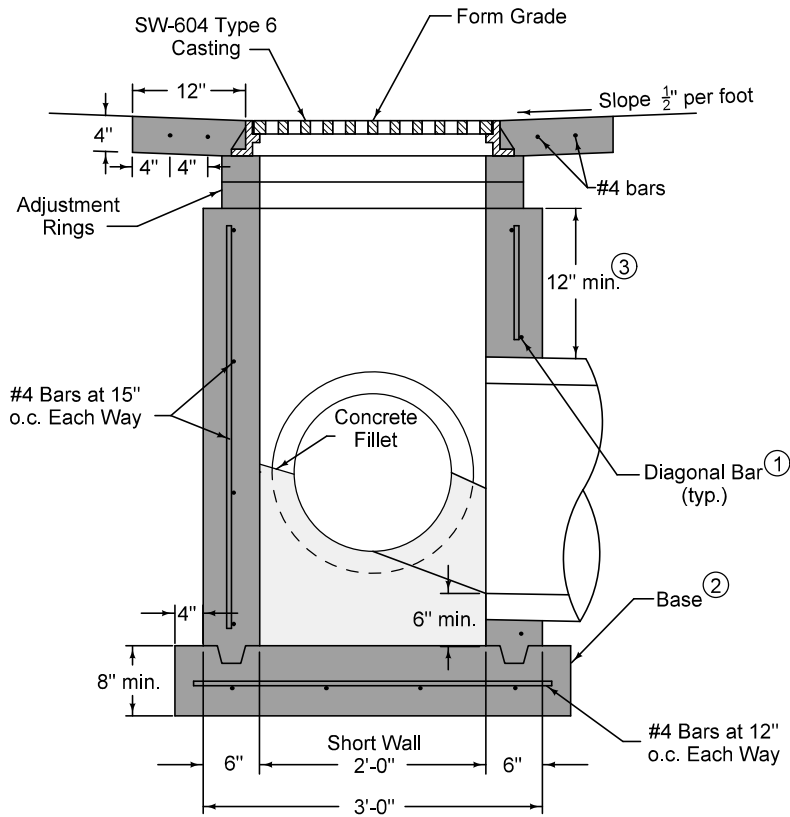
SECTION B-B



ISOMETRIC
(Refer to Section B-B for alignment of Top with Spacer)

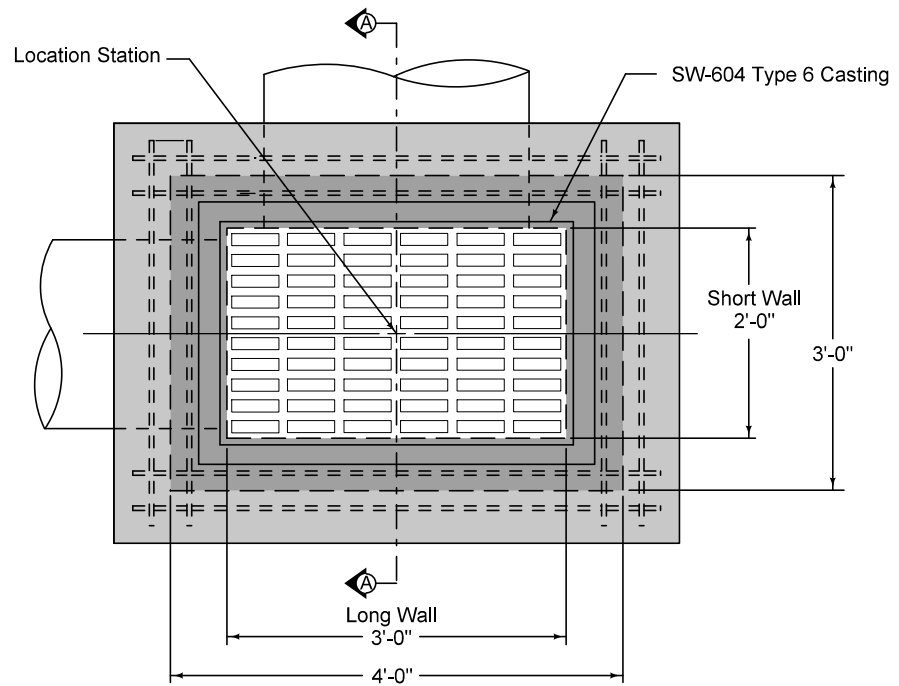
FIGURE 6010.510 SHEET 3 OF 3

SUDAS	IOWADOT	REVISION
		5 04-17-18
FIGURE 6010.510	STANDARD ROAD PLAN	SW-510
SHEET 3 of 3		
REVISIONS: Added second Insert drawing to include 4" curb. Changed "invert" callout to "Concrete Fillet". Modified circle notes.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		
<i>Brian Smith</i> DESIGN METHODS ENGINEER		
DOUBLE OPEN-THROAT CURB INTAKE, LARGE BOX		



SECTION A-A

- ① Install four #4 diagonal bars 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 12 inch minimum wall height above all pipes.

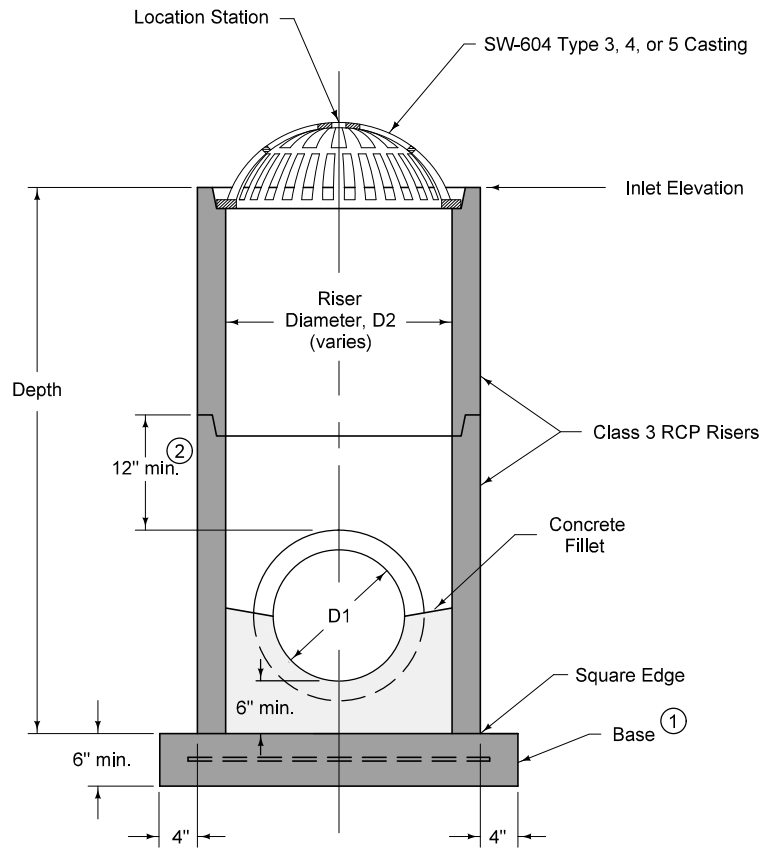


PLAN

MAXIMUM PIPE DIAMETERS		
Pipe Location	Precast Structure	Cast-in-place Structure
Short Wall	15"	18"
Long Wall	24"	30"

FIGURE 6010.511 SHEET 10F-1

		REVISION
		1 04-17-18
FIGURE 6010.511	STANDARD ROAD PLAN	SW-511
SHEET 1 of 1		
<small>REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'. Updated the work and Iowa DOT and SUDAS logo.</small>		
 SUDAS DIRECTOR		 DESIGN METHODS ENGINEER
RECTANGULAR AREA INTAKE		



TYPICAL SECTION

CASE 1

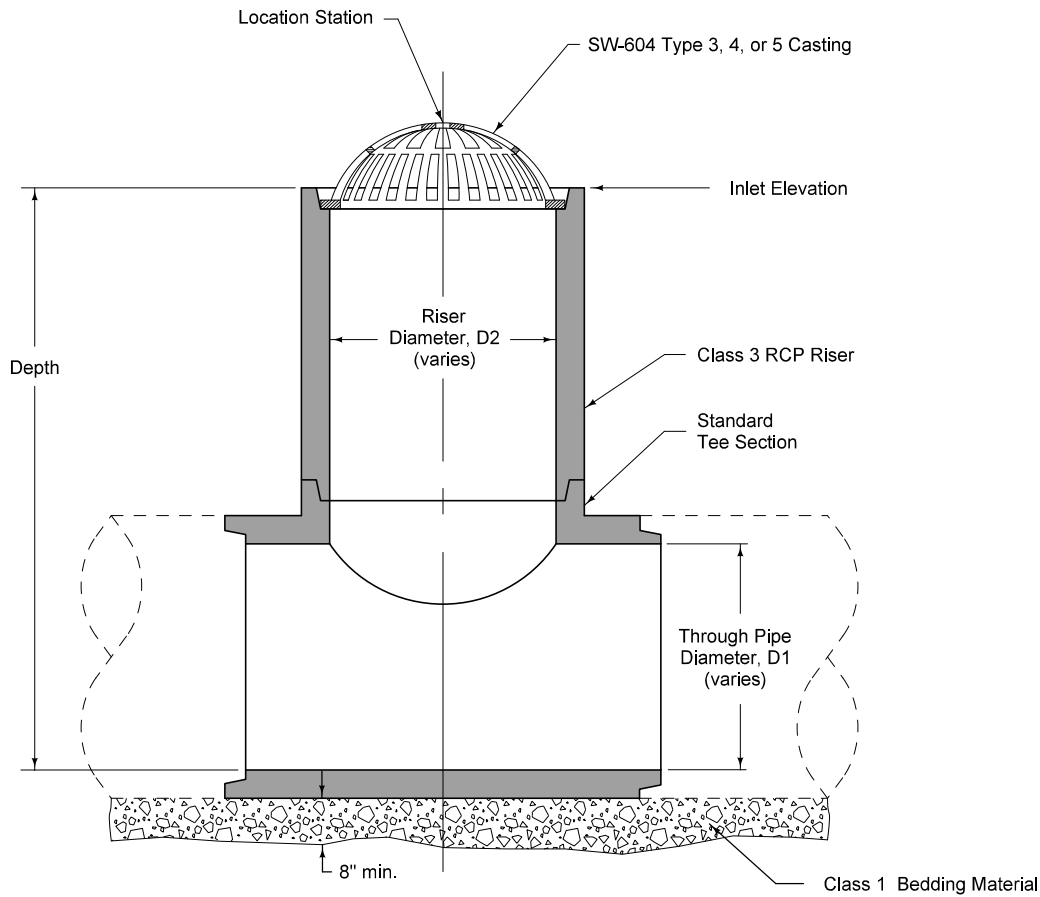
- ① Precast (shown) or cast-in-place base:
 - Precast: 6 inch thick concrete with #6 welded wire mesh on 4 inch centers (WWF 4" x 4"). Center mesh vertically within base.
 - Cast-in-place: 8 inch thick non-reinforced concrete.
- ② 12 inch minimum riser height above all pipes.

INTAKE SIZE - CASE 1	
Outlet Pipe Diameter, D1	Minimum Riser Diameter, D2
12"	18"
15"	24"
18"	24"
21"	30"
24"	30"
27"	36"

FIGURE 6010.512 SHEET 1 OF 2

SUDAS	IOWADOT	REVISION	
		3	04-17-18
FIGURE 6010.512	STANDARD ROAD PLAN	SW-512	
		SHEET 1 of 2	
REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'.			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
CIRCULAR AREA INTAKE			

③ Minimum riser diameter is 18 inches.



TYPICAL SECTION

CASE 2

INTAKE SIZE - CASE 2	
Through Pipe Diameter, D1	Maximum Riser Diameter, D2 ③
18"	18"
21"	18"
24"	24"
27"	24"
30"	30"
36" or more	36"

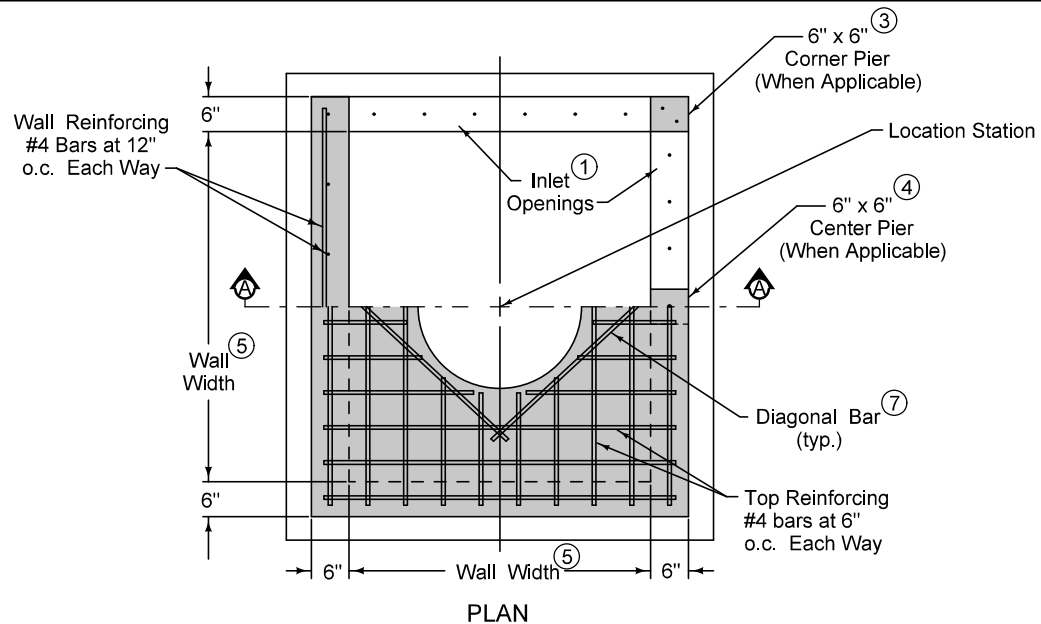
SUDAS	IOWADOT	REVISION
		3 04-17-18
FIGURE 6010.512	STANDARD ROAD PLAN	SW-512
		SHEET 2 of 2

REVISIONS: Changed 'invert' callout to 'Concrete Fillet'.

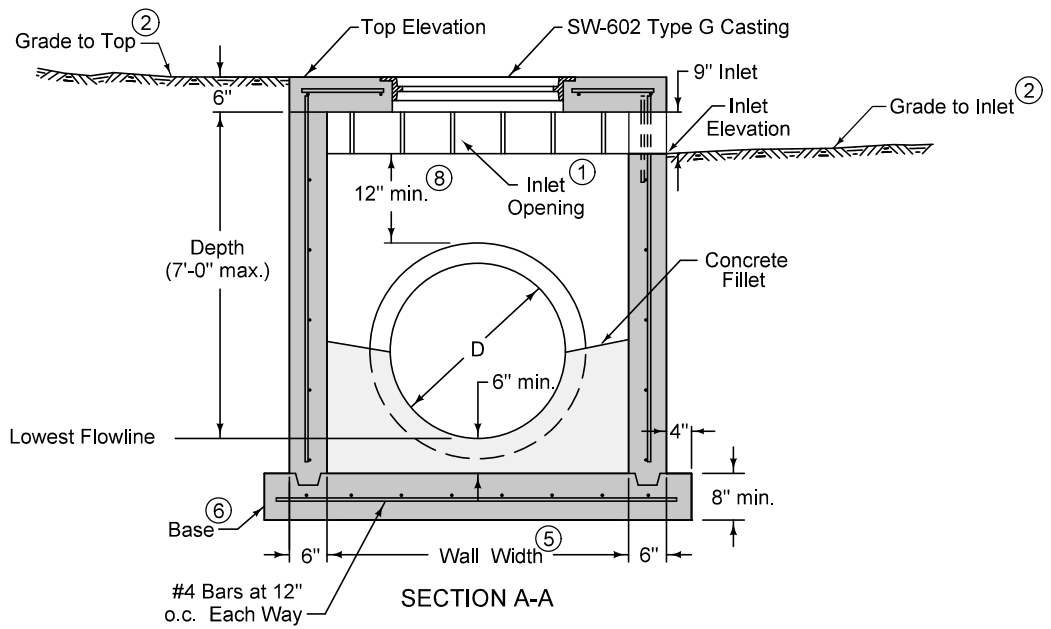
Paul D. Wigand
 SUDAS DIRECTOR

Brian Smith
 DESIGN METHODS ENGINEER

CIRCULAR AREA INTAKE



PLAN



SECTION A-A

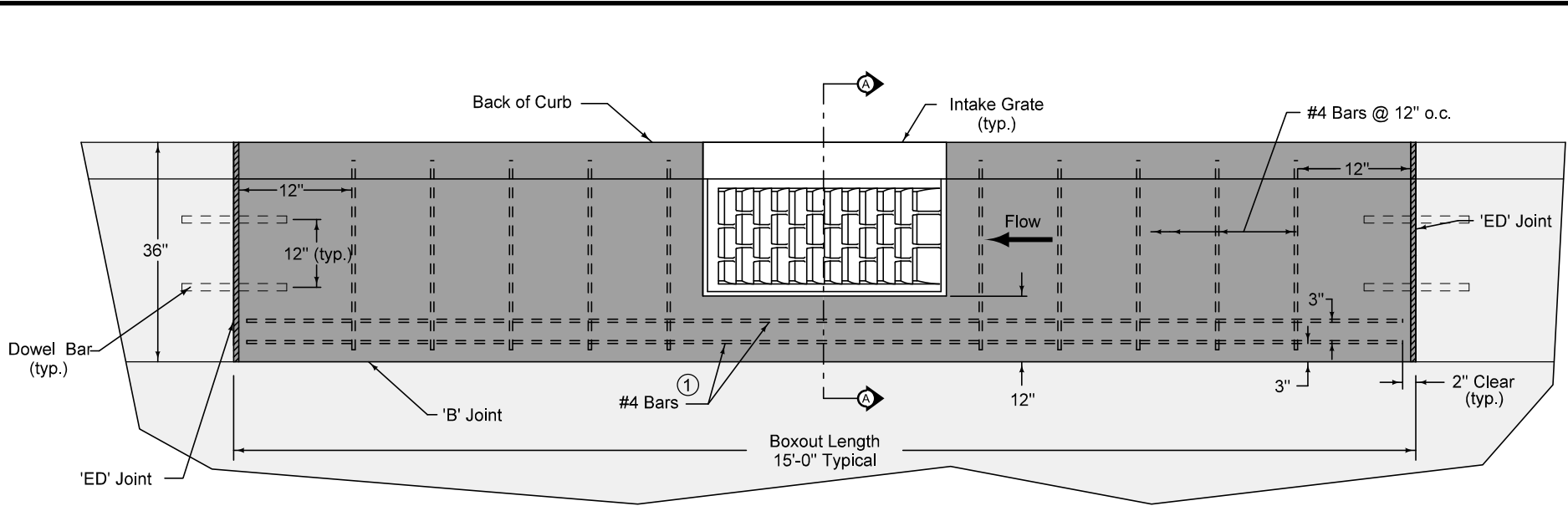
Structure may be built with openings on any or all sides. Provide openings and orientation as specified in the contract documents.

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

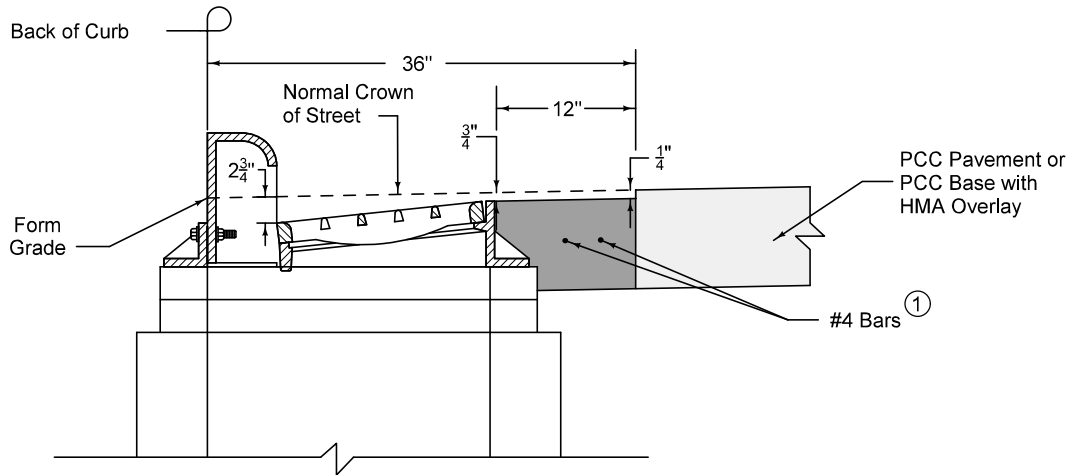
- ① Construct inlet openings with 15-inch #4 epoxy-coated bars at 8 inches on center. Embed bars a minimum of 3 inches into walls and top at all openings.
- ② Grade to inlet elevation on open sides. Grade to top elevation on closed sides.
- ③ Corner pier required between openings of two adjacent walls. Extend wall reinforcing vertically through pier. Install one additional 15-inch #4 bar in pier.
- ④ Center pier required at center of any inlet opening with length of 5 feet or greater. Extend wall reinforcing vertically through pier. Install one additional 15-inch #4 bar in pier.
- ⑤ Wall widths vary with pipe diameter. Provide 6 inches of wall width (minimum) each side of pipe opening. Minimum wall width is 36 inches. Maximum wall width is 72 inches.
- ⑥ Cast-in-place base shown. If base is precast integral with walls, the footprint of base is not required to extend beyond the outer edge of the walls.
- ⑦ Install four #4 diagonal bars at all pipe openings.
- ⑧ 12" minimum wall height above all pipes.

FIGURE 6010.513 SHEET 1 OF 1

SUDAS	IOWADOT	REVISION
		1 04-17-18
FIGURE 6010.513	STANDARD ROAD PLAN	SW-513
		SHEET 1 of 1
<small>REVISIONS: Changed 'Invert' callout to 'Concrete Fillet'. Updated the work and Iowa DOT and SUDAS logo.</small>		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
OPEN-SIDED AREA INTAKE		



BOXOUT IN PCC PAVEMENT AND PCC BASE WITH HMA OVERLAY



SECTION A-A

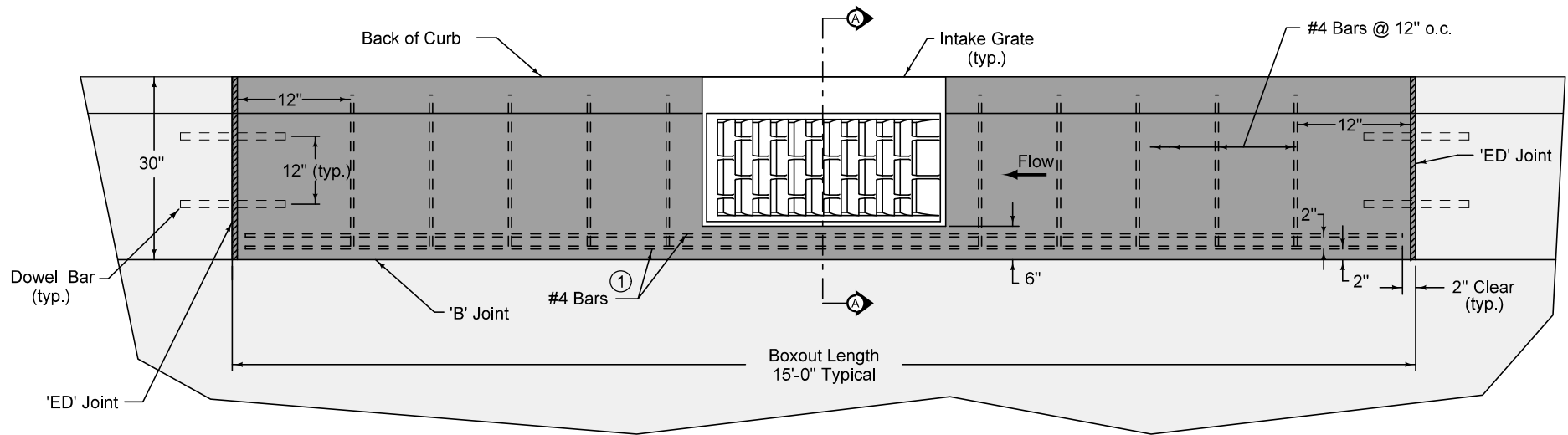
Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.

For retrofit intakes, match existing concrete pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the boxout.

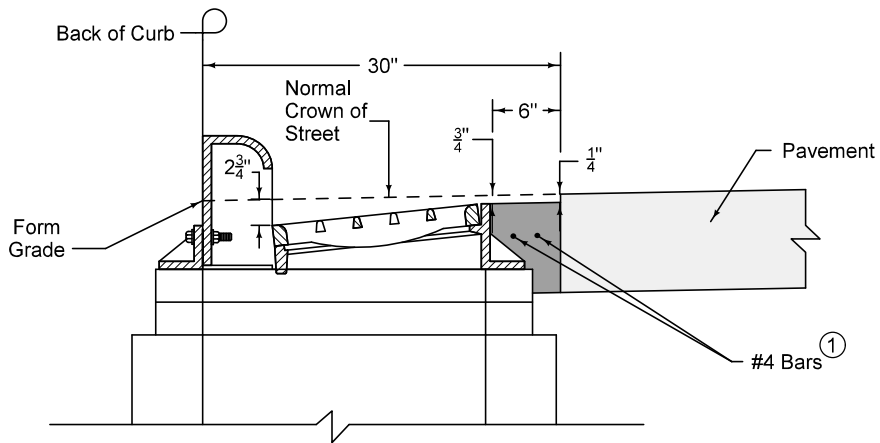
① Center bars vertically within slab.

FIGURE 6010.514 SHEET 1 OF 3

SUDAS	IOWADOT	REVISION
		1 04-17-18
FIGURE 6010.514	STANDARD ROAD PLAN	SW-514
		SHEET 1 of 3
<small>REVISIONS: Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logos.</small>		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
BOXOUT FOR GRATE INTAKES		



BOXOUT IN PCC CURB AND GUTTER

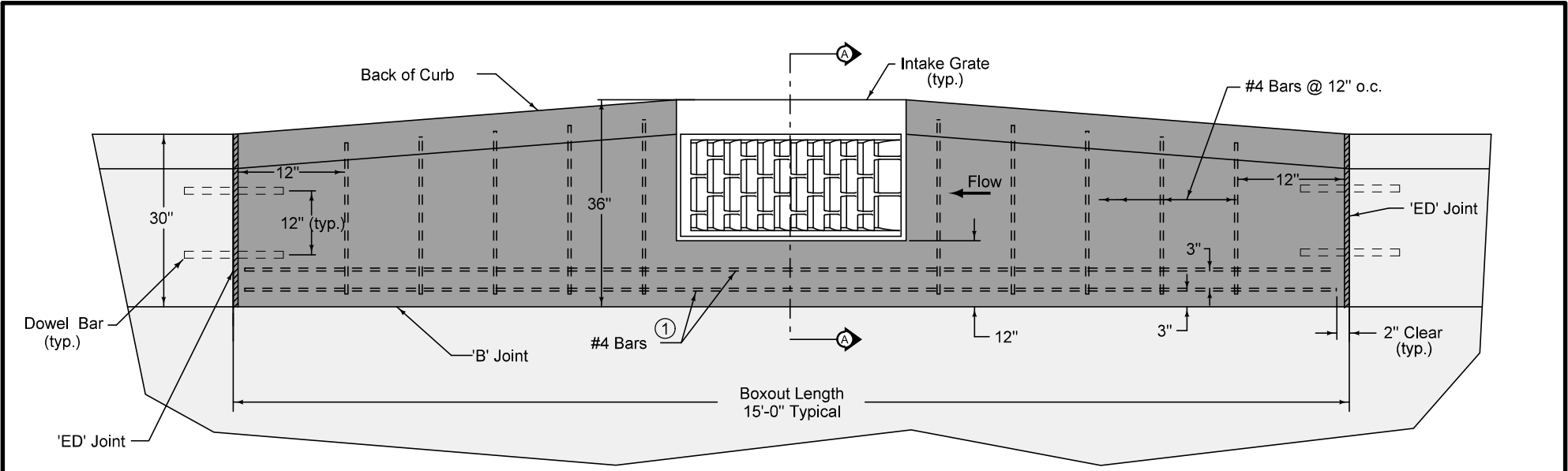


SECTION A-A

① Center bars vertically within slab.

FIGURE 6010.514 SHEET 2 OF 3

SUDAS	IOWADOT	REVISION	
		1	04-17-18
FIGURE 6010.514	STANDARD ROAD PLAN	SW-514	
REVISIONS: Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logos.		SHEET 2 of 3	
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
BOXOUT FOR GRATE INTAKES			

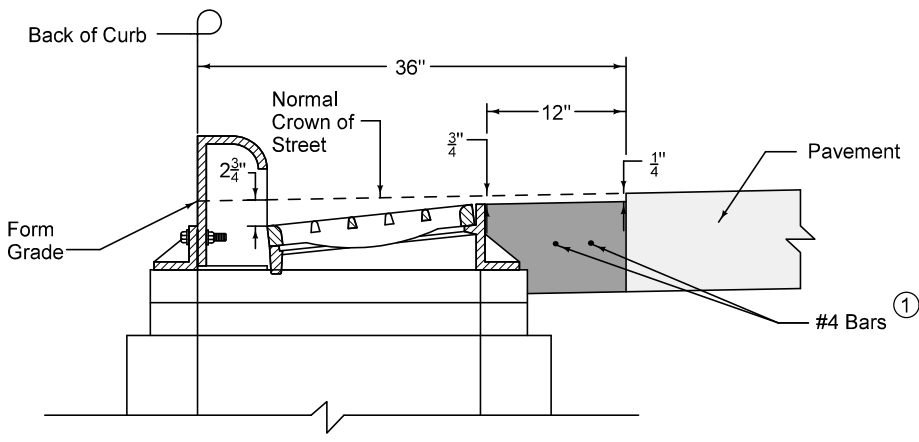


ALTERNATE BOXOUT IN PCC CURB AND GUTTER

Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjacent joint spacing may need to be field adjusted to fit boxouts.

For retrofit intakes, match existing concrete pavement joints. Stop any transverse pavement joints that do not conform to the minimum spacing requirements at the edge of the boxout.

- ① Center bars vertically within slab.



SECTION A-A

FIGURE 6010.514 SHEET 3 OF 3

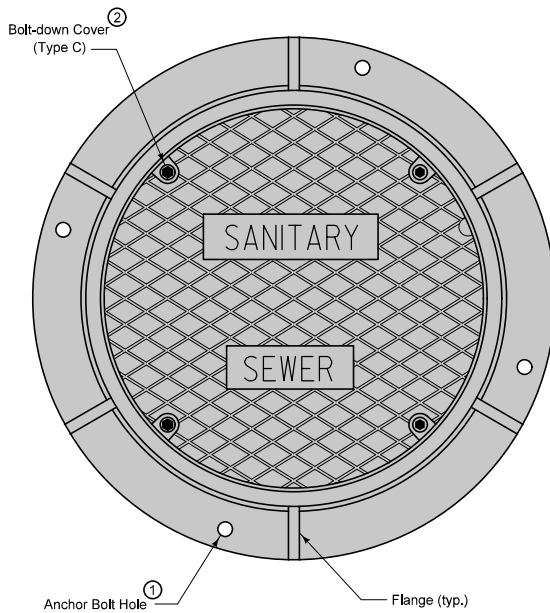
		REVISION
		1 04-17-18
FIGURE 6010.514	STANDARD ROAD PLAN	SW-514
		SHEET 3 of 3
<small>REVISIONS: Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logos.</small>		
<i>Paul D. Wigand</i> <small>SUDAS DIRECTOR</small>		<i>Brian Smith</i> <small>DESIGN METHODS ENGINEER</small>
BOXOUT FOR GRATE INTAKES		

TYPE A

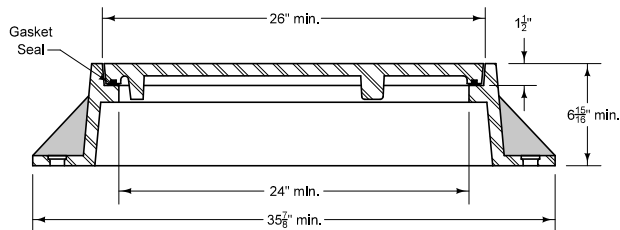
Two-piece fixed casting

TYPE C

Two-piece fixed casting with bolt-down cover^②



PLAN



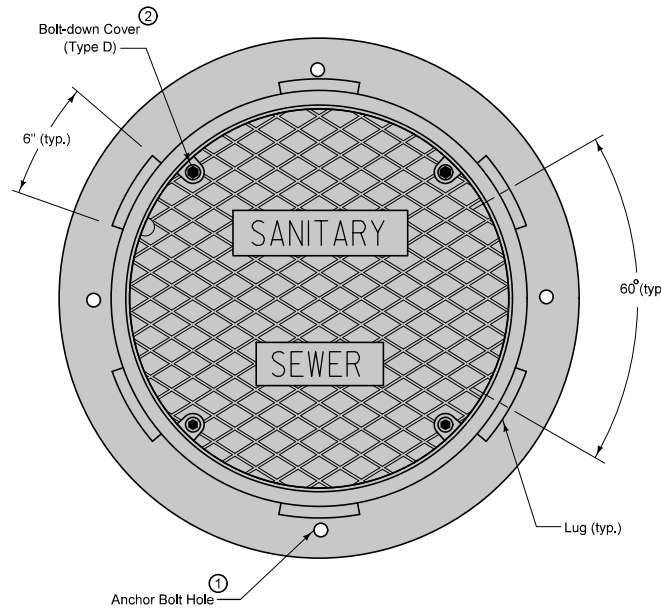
TYPICAL SECTION

TYPE B

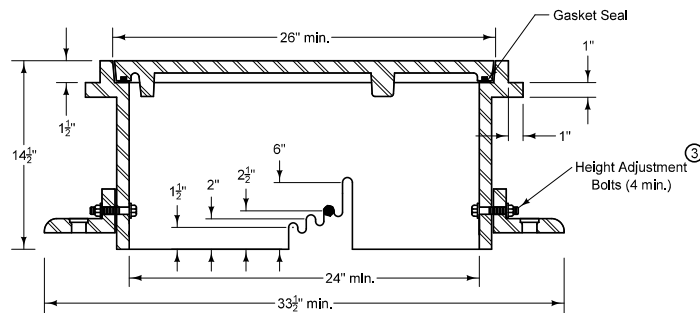
Three-piece floating casting

TYPE D

Three-piece floating casting with bolt-down cover^②



PLAN



TYPICAL SECTION

Frame Notes:
Size and spacing of lugs and flanges may vary.

Cover Notes:
Roughness pattern and text style may vary.
Minimum one concealed pickhole.

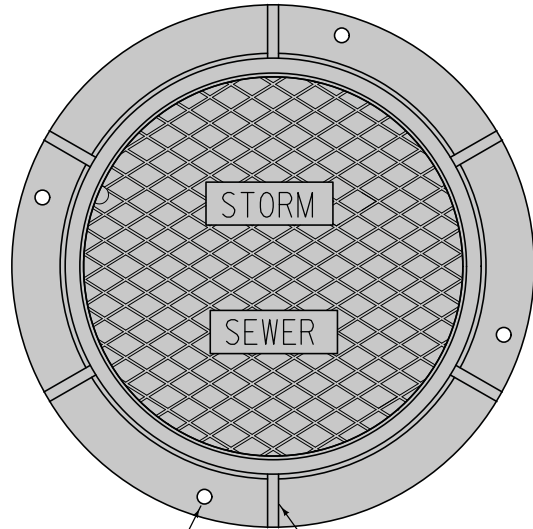
- ① When the contract documents require the frame to be attached to the structure, drill four $\frac{7}{8}$ " diameter holes or slots, equally spaced around frame.
- ② If specified, furnish bolt down frame and cover with four $\frac{1}{2}$ " x $2\frac{1}{2}$ " stainless steel, hex head, recessed cap screws. Secure cover with screws, washers, and rubber gasket seals.
- ③ Set casting at proper grade using one of the adjustment slots. Remove bolts upon completion of paving.

FIGURE 6010.601 SHEET 1 OF 1

		REVISION
		3 04-21-15
FIGURE 6010.601	STANDARD ROAD PLAN	SW-601
		SHEET 1 of 1
<small>REVISIONS: Minor revision to depict adjustability of TYPE B and TYPE D casting. Modified circle note 3.</small>		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
CASTINGS FOR SANITARY SEWER MANHOLES		

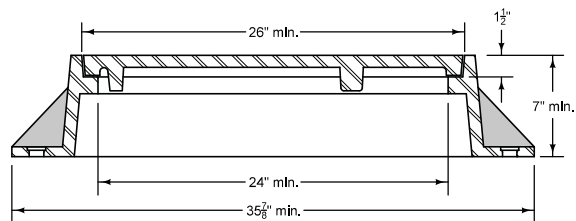
TYPE E

Two-piece fixed casting



Anchor Bolt Hole ① Flange (typ.)

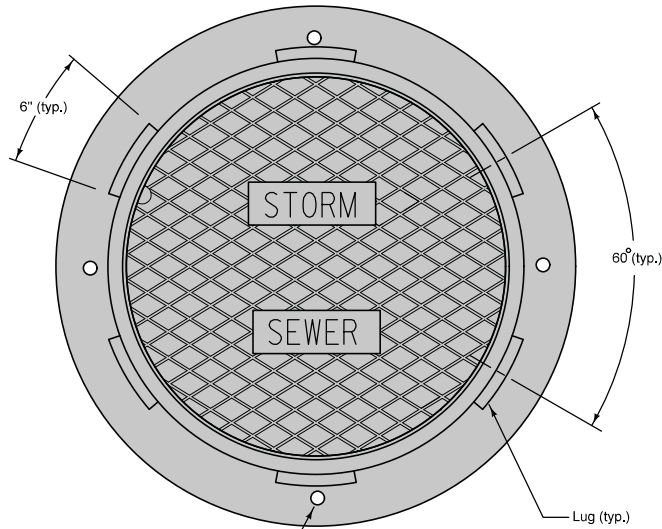
PLAN



TYPICAL SECTION

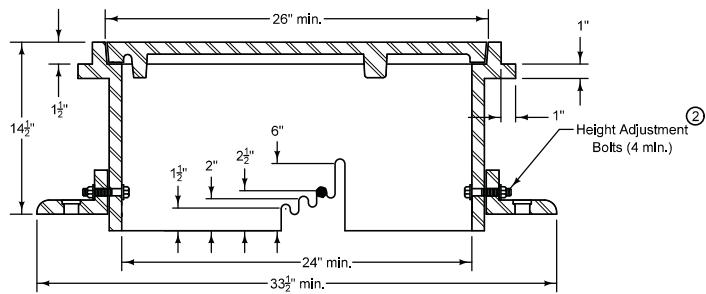
TYPE F

Three-piece floating casting



Anchor Bolt Hole ① Lug (typ.)

PLAN



TYPICAL SECTION

Frame Notes:
Size and spacing of lugs and flanges may vary.

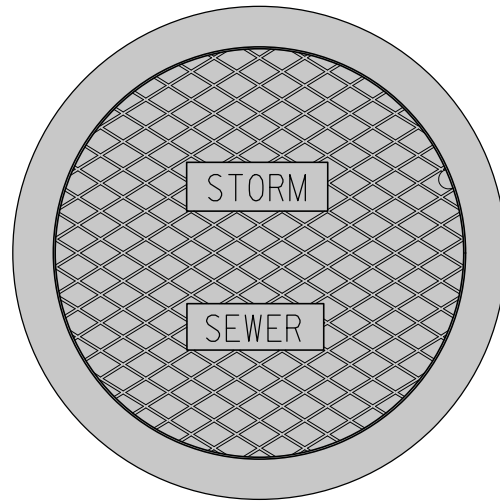
Cover Notes:
Roughness pattern and text styles may vary.
Minimum one concealed pickhole.

- ① When the contract documents require the frame to be attached to the structure, drill four $\frac{7}{8}$ " diameter holes or slots, equally spaced around frame.
- ② Set casting at proper grade using one of the adjustment slots. Remove bolts upon completion of paving.

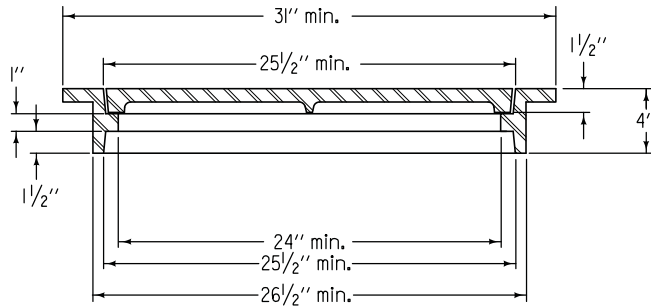
FIGURE 6010.602 SHEET 1 OF 2

		REVISION
		3 04-21-15
FIGURE 6010.602	STANDARD ROAD PLAN	SW-602
		SHEET 1 of 2
REVISIONS: Revised three-piece casting configuration. Modified circle note 2.		
SUDAS DIRECTOR		DESIGN METHODS ENGINEER
CASTINGS FOR STORM SEWER MANHOLES		

TYPE G
Two-piece fixed casting



PLAN

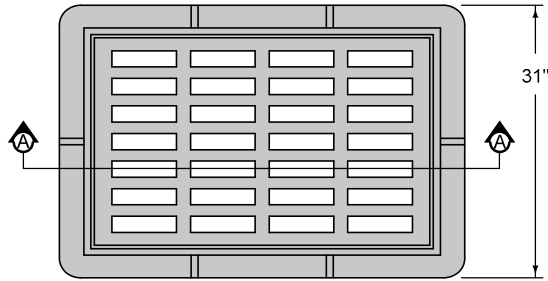


TYPICAL SECTION

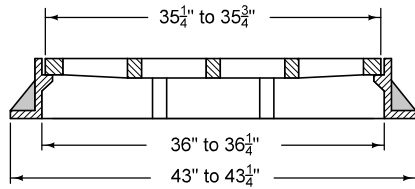
FIGURE 6010.602 SHEET 2 OF 2

SUDAS	IOWADOT	REVISION
		3 04-21-15
FIGURE 6010.602	STANDARD ROAD PLAN	SW-602
		SHEET 2 of 2
REVISIONS: Revised three-piece casting configuration. Modified circle note 2.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
CASTINGS FOR STORM SEWER MANHOLES		

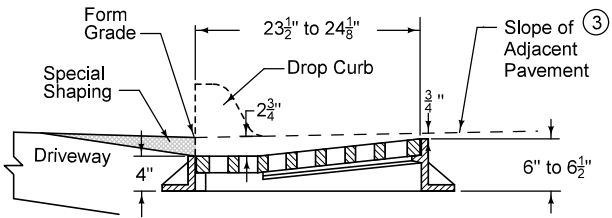
TYPE Q ^①
 Driveway Gate
 (Minimum open area 370 in²)



PLAN

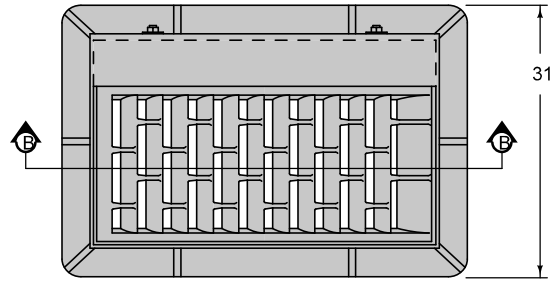


SECTION A-A

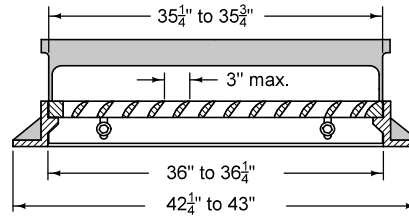


TYPICAL SECTION

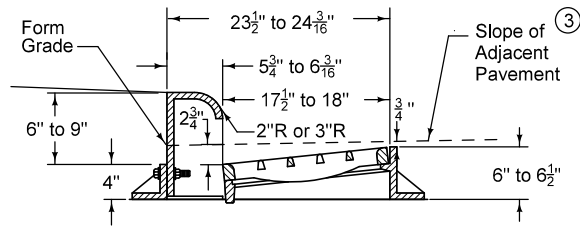
TYPE R ^②
 Curb Inlet Gate
 (Minimum open area 180 in²)



PLAN



SECTION B-B



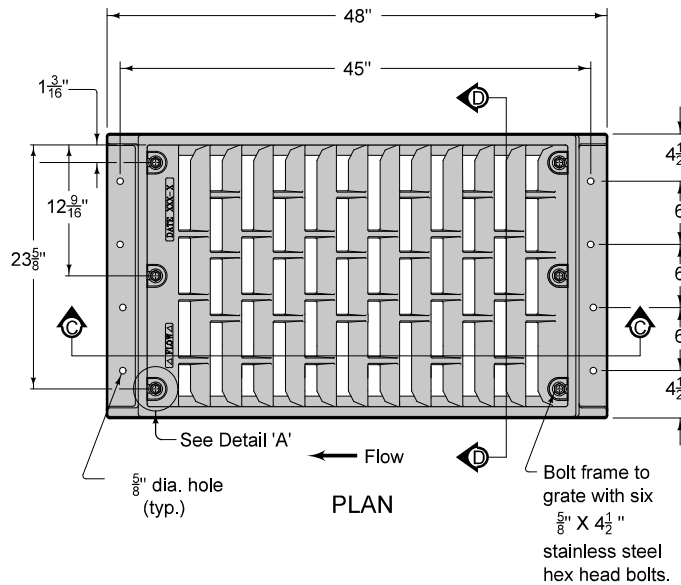
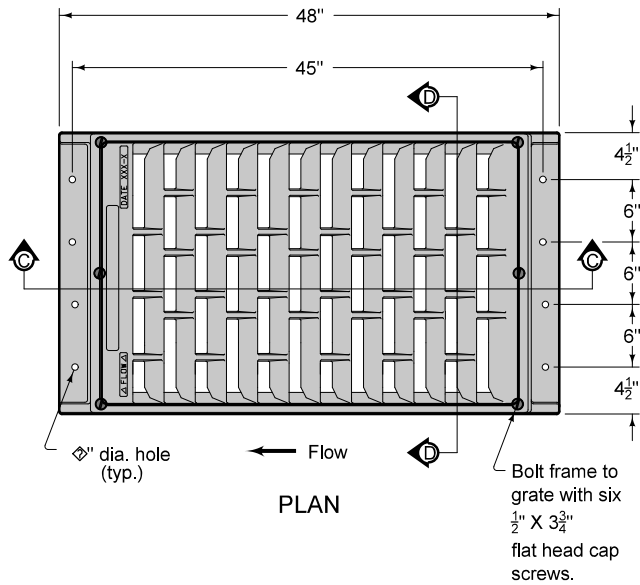
TYPICAL SECTION

- ① For use at curb drops for driveways. Use only when specified in the contract documents.
- ② Provide bicycle-safe vane-style grate. At low points, grates with vanes facing both directions of flow are allowed.
- ③ For details of boxout pavement, refer to SW-514.

FIGURE 6010.603 SHEET 1 OF 2

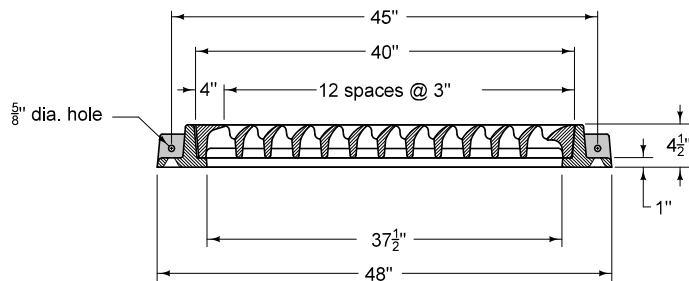
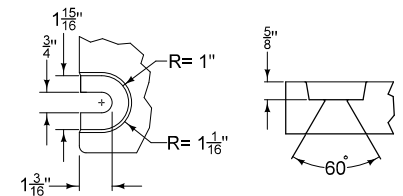
SUDAS	IOWADOT	REVISION
		5 04-17-18
FIGURE 6010.603	STANDARD ROAD PLAN	SW-603
		SHEET 1 of 2
REVISIONS: Added dimension on back of grate on page 1. Replace Iowa DOT and SUDAS logos.		
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER
CASTINGS FOR GRATE INTAKES		

TYPE S ②④
 Barrier Intake Gate
 (Minimum open area 300 in²)

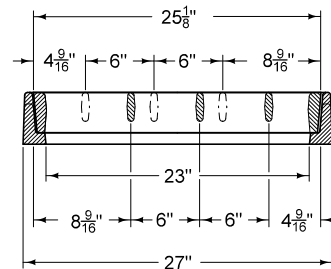


- ② Provide bicycle-safe vane-style grate. At low points, grates with vanes facing both directions of flow are allowed. The Contractor has the choice of which Type S Grate to use.
- ④ Use ductile iron frame castings meeting the requirements of ASTM A 536.

Frame minimum weight = 220 lbs.
 Grate minimum weight = 340 lbs.



SECTION C-C

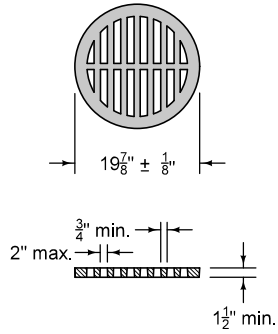


SECTION D-D

FIGURE 6010.603 SHEET 2 OF 2

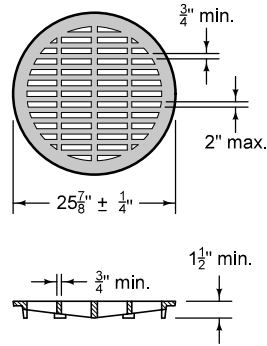
SUDAS IOWADOT	REVISION	5	04-17-18
	FIGURE 6010.603	STANDARD ROAD PLAN	SW-603
REVISIONS: Added dimension on back of grate on page 1. Replace Iowa DOT and SUDAS logos.			SHEET 2 of 2
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER	
CASTINGS FOR GRATE INTAKES			

TYPE 4



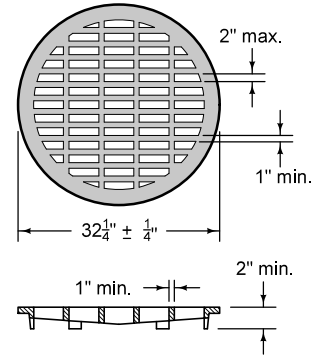
TYPE 4A

For Placement on 18" RCP



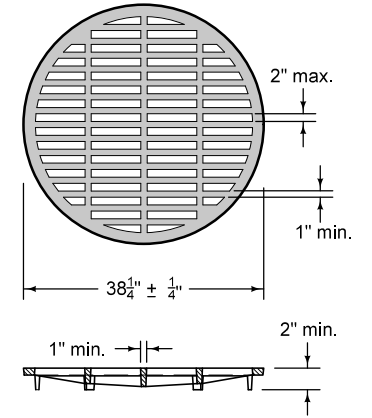
TYPE 4B

For Placement on 24" RCP



TYPE 4C

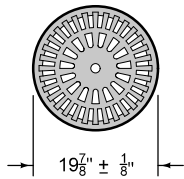
For Placement on 30" RCP



TYPE 4D

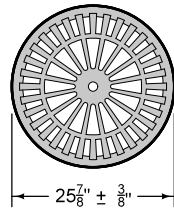
For Placement on 36" RCP

TYPE 3
(Light Duty)



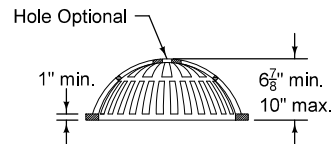
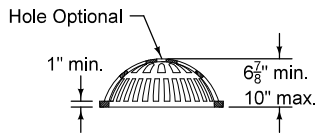
TYPE 3A

For Placement on 18" RCP



TYPE 3B

For Placement on 24" RCP



TYPE 5
(Light Duty)
For Placement on 24" to 30" RCP

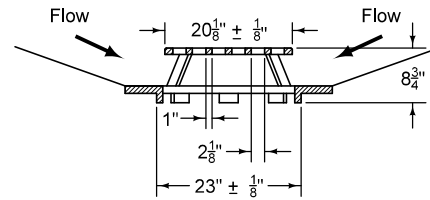
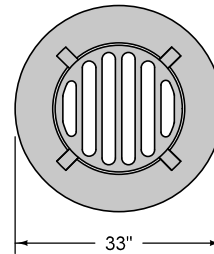


FIGURE 6010.604 | SHEET 1 OF 2

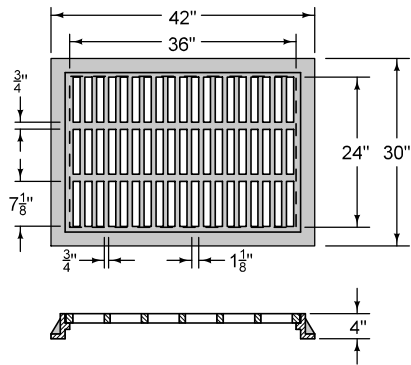
SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.604	STANDARD ROAD PLAN	SW-604
		SHEET 1 of 2

REVISIONS: Replaced Iowa DOT and SUDAS logos.

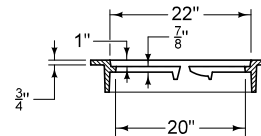
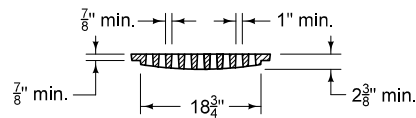
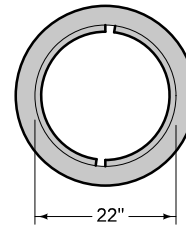
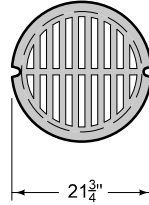
Bruce D. Wigand SUDAS DIRECTOR *Brian Smith* DESIGN METHODS ENGINEER

CASTINGS FOR AREA INTAKES

TYPE 6



TYPE 9
(Light Duty)



GRATE ①

Minimum Weight = 85 lbs.

FRAME

Minimum Weight = 75 lbs.

- ① Cast grate without locking lugs so it may be used in an inverted position.

SUDAS	IOWADOT	REVISION
		2 04-17-18
FIGURE 6010.604	STANDARD ROAD PLAN	SW-604
		SHEET 2 of 2

REVISIONS: Replaced Iowa DOT and SUDAS logos.

Paul D. Wigand
SUDAS DIRECTOR

Brian Smith
DESIGN METHODS ENGINEER

CASTINGS FOR AREA INTAKES

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.

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

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

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

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

2. Comply with the following table for physical properties.

Table 6020.02: Physical Properties

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

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

B. Corrosion-Resistant Epoxy Lining:

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

Table 6020.03: Physical Properties

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

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

PART 3 - EXECUTION**3.01 INFILTRATION BARRIER**

- A. Rubber Chimney Seal:** Comply with Section 6010, 3.01.
- B. Molded Shield:** Comply with Section 6010, 3.01.
- C. Urethane Chimney Seal:** Use only when specified in the contract documents.
 - 1. Prepare the surface according to the manufacturer's recommendations, including sandblasting, pressure washing, sealing leaks or gaps, and drying the surface.
 - 2. Apply primer, prepare product, and brush-apply the seal to a minimum thickness of 175 mils, covering 2 inches above the bottom of the frame and the entire adjustment ring area to 3 inches below the bottom adjustment ring.

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

- A. Preparation:** Prepare according to the forming system manufacturer's recommendations, including the following:
 - 1. Clean the existing surface to remove loose material and debris.
 - 2. Remove existing steps that might interfere with the erection of the forms.
 - 3. Control infiltration that may affect placement of concrete.
- B. Installation:** Install and test according to the forming system manufacturer's recommendations, including the following:
 - 1. Place pipe extensions through the structure to maintain flow during installation.
 - 2. Erect forms inside the manhole. Secure the assembled internal forms to prevent shifting and to provide sufficient stiffness and strength to prevent collapse.
 - 3. Install a plastic liner when specified.
 - 4. Seal the forms at the bottom of the manhole to ensure the concrete does not enter the sewer.
 - 5. Carefully place concrete between the forms and the existing manhole walls. Place concrete from the bottom up to prevent segregation of concrete.
 - 6. Consolidate concrete as required to fill all pockets, seams, and cracks within the existing manhole wall.
 - 7. Remove the forms when the concrete has cured sufficiently.
 - 8. Weld and test joints if a plastic liner is installed.
 - 9. Apply a sealing strip around the circumference of the invert top where it meets the vertical wall and around all pipe penetrations to form a waterstop.
 - 10. Overlay the invert top with concrete or high-strength mortar. Vary thickness from 3 inches at the wall to 1/2 inch at the edge of the channel.

3.02 IN-SITU MANHOLE REPLACEMENT, CAST-IN-PLACE CONCRETE (Continued)

11. Apply an epoxy lining to the invert top. Apply clean sand to the epoxy to create a non-slip surface.
12. Seal the plastic liner to the manhole casting and existing pipe stubs as recommended by the manufacturer.
13. Install new casting.

3.03 CENTRIFUGALLY CAST CEMENTITIOUS MORTAR LINER WITH EPOXY SEAL

A. Surface Preparation: Prepare according to the manufacturer's recommendations, including the following:

1. Wash the interior with a high-pressure washer.
2. Plug active leaks with the appropriate sealing material.

B. Mortar Application: Apply according to the manufacturer's recommendations, including the following:

1. Apply with a rotating centrifugal casting applicator, beginning at the bottom of the manhole.
2. Retrieve the applicator head at the manufacturer's recommended speed to achieve the desired thickness.
3. Apply to the full required thickness utilizing multiple passes as necessary. Minimize the time between passes so subsequent passes are cast against fresh mortar.
4. Verify thickness with a wet gauge at several locations to ensure proper depth.
5. Hand-apply high-strength mortar to the invert surface. Vary thickness from 3 inches at the wall to 1/2 inch at the edge of the channel.

C. Epoxy Seal Application: Seal according to the manufacturer's recommendations, including the following:

1. Apply with a rotating centrifugal casting applicator or airless sprayer onto the fresh mortar liner.
2. If the epoxy seal is applied more than 24 hours after application of the mortar liner, or if the mortar liner is contaminated, clean the liner and then apply the epoxy.

D. Finishing: Install a new casting.

3.04 CLEANING, INSPECTION, AND TESTING

Comply with Section 6030 for in-situ manhole replacement and centrifugally cast mortar lined rehabilitation.

END OF SECTION

CLEANING, INSPECTION, AND TESTING OF STRUCTURES**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Cleaning, inspecting, and testing sanitary sewer manholes.
- B. Cleaning and inspecting storm sewer manholes, intakes, and other utility structures.

1.02 DESCRIPTION OF WORK

- A. Clean, inspect, and test sanitary sewer manholes.
- B. Clean and inspect storm sewer manholes, intakes, and other utility structures.

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, as well as the following:

- A. Notify the Engineer at least 24 hours prior to performing testing.
- B. The Engineer must be present to review testing procedures and record results.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT

Cleaning, inspection, and testing of structures are incidental to construction of structures and will not be paid for separately.

PART 2 - PRODUCTS

None.

PART 3 - EXECUTION**3.01 CLEANING**

- A. Clean all manholes, intakes, and structures by removing sheeting, bracing, shoring, forms, soil sediment, concrete waste, and other debris.
- B. Do not discharge soil sediment or debris to drainage channels or existing storm sewer or sanitary sewer system.

3.02 VISUAL INSPECTION

- A. Examine structure for:
 - 1. Damage.
 - 2. Slipped forms.
 - 3. Indication of displacement of reinforcement.
 - 4. Porous areas or voids.
 - 5. Proper placement of seals, gaskets, and embedments.
- B. Verify that the structure is set to true line, grade, and plumb.
- C. Verify structure dimensions and thicknesses.

3.03 REPAIR

Comply with Section 6010 for repairs.

3.04 SANITARY SEWER MANHOLE TESTING**A. General:**

- 1. Use vacuum testing for sanitary sewer manholes, unless exfiltration testing is specified in the contract documents.
- 2. Conduct the final test after manhole construction is complete, all repairs and connections have been made, and the invert has been installed.

B. Vacuum Test:

- 1. Applicable only for new manholes isolated from connecting sewer lines.
- 2. Use manufactured vacuum test equipment meeting the Engineer's approval. Follow the equipment manufacturer's recommended procedures throughout, unless directed otherwise by the Engineer or these specifications.
- 3. Use extreme care and follow safety precautions during testing operations. Keep personnel clear of manholes during testing.
- 4. Seal all openings except manhole top access using pneumatic plugs rated for test pressures. Install plugs according to the test equipment manufacturer's recommendations.
- 5. Brace pipe inverts if backfill material has not been placed around connecting pipes.

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, 3.04. 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

PORTLAND CEMENT CONCRETE PAVEMENT**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Pavement
- B. Curb and Gutter

1.02 DESCRIPTION OF WORK

Includes the requirements for the construction of full depth PCC pavement and curb and gutter.

1.03 SUBMITTALS

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

- A. Two weeks prior to commencing any PCC pavement placement, submit a paving mix design for each different source of aggregate to be used for review and approval by the Engineer. Submit mixes or mix designs approved by the Iowa Department of Transportation or an independent testing laboratory.
- B. Maturity curves for paving mixes and maturity reading results.
- C. Submit all testing and certifications according to Section 7010, 3.07.

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. Aggregate Storage:** Comply with Iowa DOT Article 2301.02, C.
- B. Cement and Fly Ash:** Comply with Iowa DOT Article 2301.02, C.
- C. Admixtures:** Store in suitable weather tight enclosures which will preserve quality.
- D. Reinforcing Steel:** Store off ground on timbers or other supports.

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. PCC Pavement:**

1. **Measurement:** Measurement will be in square yards for each different thickness of PCC 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 thickness of PCC pavement.
3. **Includes:** Unit price includes, but is not limited to, final trimming of subgrade or subbase, integral curb, bars and reinforcement, joints and sealing, surface curing and pavement protection, safety fencing, concrete for rigid headers, boxouts for fixtures, pavement smoothness testing, and quality control for stringless paving.

B. Air Content Deficiency:

1. **Measurement:** Measurement will be in square yards for each different thickness of PCC pavement subject to a unit price reduction for air content deficiency according to Section 7010, 3.07.
2. **Payment:** Payment will be at the reduced unit price according to Table 7010.03 for each thickness of PCC pavement. If there is an air content 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.

C. Pavement Smoothness Deficiency:

1. **Measurement:** Measurement will be in square yards for each different thickness of PCC pavement subject to a unit price reduction for pavement smoothness according to Section 7010, 3.07.
2. **Payment:** Payment will be at the reduced unit price according to Table 7010.04 for each thickness of PCC 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.

D. PCC Pavement Thickness Deficiency:

1. **Measurement:** Measurement will be in square yards for each different thickness of PCC pavement that has deficient pavement thickness as determined in Table 7010.05.
2. **Payment:** Payment will be at the percentage of the unit price indicated in Table 7010.05 for each different thickness of PCC 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.

E. Curb and Gutter:

1. **Measurement:** Measurement will be in linear feet measured along the face of the curb for each different width and thickness of curb and gutter.
2. **Payment:** Payment will be at the unit price per linear feet of curb and gutter.
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.

1.08 MEASUREMENT AND PAYMENT (Continued)**F. Beam Curb:**

1. **Measurement:** Measurement will be in linear feet measured along the face of the curb.
2. **Payment:** Payment will be at the unit price per linear feet of beam curb.
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.

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

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.

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, 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 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 tie bars and dowel bars. Meet the tie bar requirements for bar mats. All 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
3. **Backer Rod:** Comply with Iowa DOT Section 4136.

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.

2.02 CONCRETE MIXES (Continued)**C. Use of Fly Ash and Ground Granulated Blast Furnace Slag (GGBFS) as Supplementary Cementitious Materials:**

1. Mix proportions for the various mixes using fly ash and GGBFS are included in Iowa DOT Materials I.M. 529. The maximum allowable fly ash substitution rate is 20%. Do not use a GGBFS substitution rate of more than 35% by weight (mass). The total supplementary cementitious material substitution rate is not to exceed 40%.
2. If C-SUD or CV-SUD mixes are specified, the maximum allowable Class F fly ash substitution rate is 25% and the maximum Class C fly ash substitution rate is 35%. The maximum combination rate is 20% Class C fly ash and 20% GGBFS.
3. When Type IP or IS cement is used in the concrete mixture, only fly ash substitution will be allowed. Between October 16 and March 15, supplementary cementitious materials will be allowed only when maturity method is used to determine time of opening. Transport, store, haul, and batch fly ash and GGBFS in such a manner to keep it dry.

PART 3 - EXECUTION**3.01 EQUIPMENT****A. Batching and Mixing Equipment:****1. General:**

- a. Weighing and Proportioning Equipment:** Comply with Iowa DOT Article 2001.20.
- b. Mixing Equipment:** Comply with Iowa DOT Article 2001.21.
- c. Material Bins:** Involves any structure in which materials are stored. Each part of any bin, including foundations and supports, must be adequate to withstand any stress to which it might be subjected to while in use.

2. Batching:

- a. Ensure the batching plant is Iowa DOT calibrated and approved. Provide copy of current calibrations and approvals.
- b. Coordinate the batch plant operation and batch trucks with the paving operation in order to ensure a steady supply of materials.
- c. Operate the batch plant and trucks to minimize dust, noise, or truck nuisances.

3. Mixing:**a. Construction or Stationary Mixer:**

- 1) Ensure the concrete is uniform in composition and consistency. If this condition is not produced because of the size of the batch, the size of the batch may be reduced or the mixing time increased, or both, until this result is obtained. If non-uniform, corrective action must be taken.
- 2) Ensure the methods of delivering and handling the concrete are such that objectionable segregation or damage to the concrete will not occur, and they will facilitate placing with a minimum of handling.

b. Ready Mixed Concrete:

- 1) Ensure the concrete is uniform in composition and consistency. If non-uniform, concrete producers must take corrective action.
- 2) Ready mixed concrete is defined as concrete proportioned in a central plant and mixed in a stationary mixer for transportation in trucks without agitation, proportioned at a central plant, and only partially mixed in a stationary mixer for transportation and finish mixing in a transit mixer, or proportioned at a central plant, and then mixed in a transit mixer prior to or during transit.
- 3) When necessary to add additional mixing water at the site of placement, mix the batch at least an additional 30 revolutions of the drum at mixing speed.
- 4) Ensure each vehicle in which concrete will be delivered is capable of discharging concrete having a slump not over 2 inches at an overall rate for its entire load of not less than 1.25 cubic yards per minute. Ensure the concrete is delivered at a rate sufficient to maintain a sustained rate of progress of not less than 100 feet per hour for the width and depth of pavement to be placed.

- c. All Methods:** Identify each truck load by a plant charge ticket showing plant name, contractor, project data, quantity, class, time batched, and water added at site.

B. Concrete Delivery Equipment:**1. General:**

- a. In handling concrete from the mixer to the place of deposit, take care to avoid segregation.
- b. When concrete is deposited through a chute, slope the chute to allow concrete to flow slowly without segregation. Place the delivery point of the chute as close as possible to the point of deposit. Keep chutes and spouts clean. Thoroughly flush them with water before and after each run. Discharge the water outside the paving area in an approved concrete washout area.

3.01 EQUIPMENT (Continued)

- c. Provide alternate plan for concrete delivery in event of equipment failure.
- d. Take concrete samples from material placed on the subgrade or subbase.

2. Concrete Transfer Equipment:

- a. Utilize placers, conveyors, buckets, or buggies designed specifically for transporting concrete.
- b. Do not allow concrete to free fall into or out of transfer equipment.
- c. Meet the requirements of Section 7010, 2.02, B, 2 for air entrainment of the concrete mix and testing for compliance.

3. Concrete Pumps:

- a. Do not pump concrete through aluminum conduit or tubing.
- b. Use the concrete pump to deliver the material as close to horizontal as possible, keep restrictions and drops to a minimum, and avoid free fall.
- c. Meet the requirements of Section 7010, 2.02, B, 2 for air entrainment of the concrete mix and testing for compliance.
- d. Sample the first load after pumping a minimum of 3 cubic yards. Sample after each significant change in boom angle.
- e. Sample before and after the pump to determine if any changes in the slump and other significant mixture characteristics occur.
- f. When sampling at the end of the placement line, take care to ensure that the sample is representative of the concrete being placed from the pipeline. Note: Changes to the placement rate or boom configuration can result in changes in the concrete properties. Typically, the vertical position of the boom results in the greatest potential for air loss while the horizontal position of the boom has the least potential. Location of pumping equipment should be determined so that it is possible to maintain a consistent, low boom angle as much as possible during placement.
- g. If air test shows that air entrainment is outside of the allowed range, follow procedure as outlined in Section 7010, 3.07, B.
- h. Leaks in the line or pump hydraulics, which would allow air to be added to the concrete, are prohibited.

C. Concrete Placement Equipment:**1. Consolidating and Finishing Equipment:**

- a. Use a paving machine that meets all of the following:
 - 1) Is designed for the specific purpose of placing, consolidating, and finishing concrete pavement.
 - 2) Develops vertical edges on the pavement.
 - 3) Is self propelled and equipped with a means for spreading the concrete to a uniform depth before it enters the throat.
 - 4) Vibrates the concrete to the full width and depth being placed in a single passage. Use vibrating tubes or arms working in the concrete or a vibrating pan operating on the surface of the concrete.
 - 5) Produces a surface reasonably free of voids and tears.
 - 6) When the paver is operated on previously placed concrete, prevent damage to the pavement surface.
 - 7) For slip form pavers, use a paver equipped with automatic horizontal and vertical grade controls.
- b. Hand methods utilizing air screeds and vibrating screeds may be used for short pavement runs, cul-de-sacs, driveways, and some intersections.
- c. When allowed by the Engineer, use stringless paving equipment capable of providing the same accuracy necessary to comply with the requirements of Section 7010.

3.01 EQUIPMENT (Continued)

- d. Use a laser guided screed that meets all of the following:
 - 1) Designed for the specific purpose of placing and finishing of concrete pavement using a 3-dimensional surface model.
 - 2) All equipment for laser guided screed, including the guidance system, will meet the project design model tolerances.
 - 3) Will provide consolidation to full width and full depth of concrete placement. Provide intermediate consolidation by using external hand held vibrators.
 - 4) Produces a surface reasonably free of voids and tears.
 - 5) Provide boom-style screed (drive-in screeds are not allowed) with an auger boom, placement head (water spray mechanism not allowed), guidance equipment, and software to produce 3-dimensional surface.
 - 6) Produces pavement smoothness as specified in Section 7010, 3.07, C.

2. Vibrators for Machine Paving:

- a. Consolidate, with a single pass of an approved internal or surface vibrator, the full width and depth of concrete requiring a finishing machine. Operate internal vibrators within a frequency range of 4,000 to 8,000 vibrations per minute. The Engineer may authorize the minimum vibration frequency to be lowered to 3,500 vibrations per minute for particular sections of paving, such as superelevations. Operate surface vibrators within a frequency range of 3,500 to 6,000 vibrations per minute.
- b. Avoid operating vibrators in a manner to cause a separation of the mix ingredients, either a downward displacement of large aggregate particles or an accumulation of laitance on the surface of the concrete. When forward motion of the paver is reduced, vibrator frequency may need to be reduced to avoid separation of the mix.
- c. If a vibrator fails to operate within the specifications, repair or change the vibrator before the paving begins:
 - The following day, or
 - The same day if the continuous paving that day is stopped at a header or at the end of a session.
- d. If two adjacent vibrators fail to operate within the specifications, stop the paving operation and repair or replace the vibrators.
- e. Stop vibrators whenever forward motion of the paver is stopped.
- f. Set the internal vibrator penetration depth into the concrete pavement to mid slab or as deep as possible while passing above reinforcing steel. Provide an operating position locking device so that no part of the vibrating unit can be lowered to the extent that it will come in contact with reinforcing steel or tie bars while paving.
- g. Do not exceed the manufacturer's recommendations for vibrator horizontal spacing. Do not exceed 16 inches from center to center.
- h. Mount the longitudinal axis of the vibrator body approximately parallel to the direction of paving. Tilt the trailing end of each vibrator downward to an approximate slope of 15 degrees below horizontal.
- i. Use vibrators that meet or exceed the following specifications at the manufacturer's design frequency of 10,000 vpm:
 - 1) Amplitude (peak to peak) 0.070 inches.
 - 2) Centrifugal force 1,200 pounds.

- 3. Vibrators for Hand Methods:** Use a vibration rate between 3,500 to 6,000 vibrations per minute, and use an amplitude sufficient to be perceptible on the surface of the concrete more than 12 inches from the vibrating unit.

- 4. Hand Finishing Equipment:** Provide all finishing tools necessary for proper finishing of the concrete including straightedges for checking and correcting finished concrete surfaces.

3.01 EQUIPMENT (Continued)**5. Forms:**

- a. Rigid Forms:** Steel, minimum thickness of 5 gage, height at least equal to design thickness of pavement with base width at least 6 inches.
- 1) Minimum section length of 10 feet, joint connections designed to allow horizontal and vertical adjustment with locking device to hold abutting sections firmly in alignment.
 - 2) Bracing, support, and staking must prevent deflection or movement of forms.
- b. Flexible Forms:** Use steel or wood flexible forms for curves with a radius less than 100 feet.
- 1) Bracing, support, and staking must prevent deflection or movement of forms.
 - 2) Ensure that forms used to shape back of curbs at returns have height at least equal to design thickness of pavement and curb height.
 - 3) Forms must be free from scale and surface irregularities.

- 6. Curing Equipment:** Use pressure sprayer capable of applying a continuous uniform film of curing compound. Use equipment with a shield if wind conditions do not allow proper coverage

- 7. Concrete Saws:** Use power operated concrete saws capable of cutting hardened concrete neatly.

- 8. Joint Sealing Equipment:** Use equipment capable of cleaning the joint and heating and installing sealant in joints according to manufacturer's recommendations.

3.02 PAVEMENT CONSTRUCTION

- A. Removal of Pavement:** Comply with Section 7040, 3.02.

B. Final Subgrade/Subbase Preparation:**1. General:**

- a. Meet the requirements of Section 2010 for subgrade construction, subgrade treatment, and subbase construction.
- b. Trim the subgrade or subbase to the final grade for placement of concrete.
- c. Unless otherwise ordered by the Engineer, the subgrade or subbase, at time of placing concrete for concrete pavement, must be in a uniformly moist but not muddy condition to a depth of not less than 1 inch.

2. Subgrade and Subbase Loading:

- a. Travel of concrete delivery trucks on a subgrade or subbase must be approved by the Engineer. In such cases, watering of the subgrade or subbase must be limited to just ahead of the paving machine.
- b. Enter and exit from side streets to minimize repetitive loading on the subgrade or subbase by concrete trucks.
- c. Do not allow loads in excess of the legal axle load on the completed subgrade or subbase.
- d. Partially loaded trucks may be required.
- e. If subgrade or subbase failure occurs, coordinate the repair with the Engineer.

3. Paving Suspended:

- a. Suspend the paving operation where subgrade or subbase stability has been lost.
- b. Do not place concrete on a subgrade or subbase that has become unstable, bears ruts or tire marks of equipment, or that is excessively softened by rain until such subgrade or subbase has been reconsolidated and reshaped to correct the objectionable condition.

3.02 PAVEMENT CONSTRUCTION (Continued)

- c. If necessary, scarify to a minimum depth of 6 inches, aerating, and recompact at no additional cost to the Contracting Authority. Meet the compaction requirements of Section 2010, 3.06.

4. **Maintenance of Subgrade or Subbase:** Maintain the completed subgrade or subbase during subsequent construction activities.

C. Surface Fixture Adjustment:

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 concrete placement.
3. Construct boxouts where allowed for later adjustment of fixtures. See Figure 7010.103 for the size and shape of the boxout.

D. Setting of Forms: When forms are used, meet the following requirements.

1. Ensure forms have sufficient strength to support paving operations being used.
2. Set base of forms at or below subgrade elevation with top of forms at pavement surface elevation. With Engineer approval, extra height forms may be used to shape the back of integral curb and edge of pavement; set base at or below subgrade elevation with top of form at top of curb elevation.
3. Place and secure forms to required grade and alignment. Do not vary the top face of the form from a true plane by more than 1/8 inch in 10 feet, and do not vary the vertical face from a true plane by more than 1/4 inch in 10 feet.
4. If the soil supporting the forms is softened by rain or standing water so that the forms are inadequately supported, or if voids occur under the forms, remove forms. Rework subgrade to proper elevation and density, and reinstall forms.
5. Ensure forms are free of latent concrete and coated with release agent before concrete is placed.

E. Bar and Reinforcement Placement: Ensure bars are clean, straight, free from distortion and rust, and are firmly secured in position as specified in the contract documents. Place all bars in approved storage to prevent damage; do not distribute along the work site except as needed to avoid delay in paving.**1. Tie Bars:**

- a. Place bars prior to vibration. For slip form paving, tie bars may be installed after vibration, provided the concrete is consolidated around the bars. Bars may be supported by approved chairs or may be placed in position by a machine or method approved by the Engineer.
- b. Use approved continuous bolsters with runners to support reinforcement for bridge approach sections. Place the supports transversely across the approach and space them longitudinally no greater than 4 feet. For double reinforced approach sections the top layer of reinforcing may be chaired off the bottom layer of reinforcing using approved continuous high chairs with runners, provided they are positioned directly above the continuous bolsters with runners supporting the bottom layer of reinforcing. Hold epoxy coated reinforcing steel in place with epoxy or plastic coated bar supports and epoxy or plastic coated tie wires.

3.02 PAVEMENT CONSTRUCTION (Continued)**2. Dowel Bar Assemblies:**

- a. When dowel bar assemblies are required in the contract documents, accurately place these assemblies as shown. To prevent their movement during subsequent concrete paving operations, securely stake or fasten to the base to line and grade.
- b. Do not use assemblies that are damaged prior to placement. If assemblies are damaged after placement, replace prior to paving. Ensure horizontal and vertical alignment of the load transfer bars does not exceed 1/4 inch from parallel to line and grade. Place each assembly so the bars are in a horizontal plane at $T/2 \pm 1/2$ inch.
- c. Check the placement of each assembly and the position of the bars within the assembly using a suitable template or other device approved by the Engineer. If the assembly is found to be placed outside of the above tolerances, correct the placement.
- d. Cutting the tie wires of the load transfer assemblies is optional.

3. Bar Mats for Reinforced Pavement:

- a. When reinforced pavement is specified, assemble bar mats accordingly and firmly fastened together at all bar intersections.
- b. Place, secure, latch, and tie bar mats for a continuous mat as specified in the contract documents. Displacement during concrete placement operations is not allowed.
- c. Use chairs to ensure proper placement of bar mats.

4. Tie Bars and Dowel Bars in Existing Pavement:

- a. When anchoring in existing concrete, use a grout system according to the manufacturer's instructions. Obtain the Engineer's approval for the grout system.
- b. For horizontal installations, use either a pressure injection system with mechanical proportioning and mixing, or use encapsulated chemical anchors. Install as follows:
 - 1) Ensure drilled holes to receive the grout match the dimensions and spacing specified in the contract documents. When not specified in the contract documents, the maximum nominal diameter of the hole must be 1/8 inch larger than the outside diameter of the dowel or bar, or as recommended by the manufacturer. Drill holes for tie bars and dowel bars into the face of the existing pavement at midpoint. To ensure proper horizontal alignment, do not allow any hole misalignments to exceed 1/4 inch in the vertical or horizontal plane. Clean the hole with compressed air immediately prior to placing the grout.
 - 2) Use a polymer grout to secure the dowels in the existing pavement. Inject the grout into the rear of the hole with pressure. Use sufficient grout so that when the bar to be grouted is placed in position, excess grout will be forced out the front of the hole. Rotate the bar during the insertion process to ensure complete coating with the grouting material. Hand proportioning and mixing is not allowed.
 - 3) If using grout with approved encapsulated anchors, install according to the manufacturer's recommendations.
 - 4) Use horizontal installation procedures for vertical or angled installations; however, pourable grouts may be used. Pourable grouts must be mechanically mixed.

F. Concrete Pavement Placement:

1. Use paving machine for all uniform width pavements 8 1/2 feet or more in width and 250 feet or more in length, unless alternate methods are approved by the Engineer. Screeds and laser guided screeds may be used on short pavement runs up to 250 feet.
2. Place, consolidate, and finish the concrete to the full depth and width conforming to the specified crown and cross-section in a single operation.

3.02 PAVEMENT CONSTRUCTION (Continued)

3. Keep a uniform pile of concrete in front of the paving machine, up to a maximum of 6 to 8 inches above the design surface elevation. Distribute and spread the concrete as soon as placed. A mechanical concrete spreader may be used.
 4. Deposit the concrete upon the in-place bars keeping segregation to a minimum.
 5. Use shovels, not rakes, to do necessary hand spreading and spading.
 6. Do not allow the edges of pavement, including all longitudinal construction joints, to deviate from the line shown on the plans by more than 1/2 inch at any point.
 7. If the paving machine operates on adjacent pavement, protect pavement from damage.
 8. When placing by hand methods, consolidate the concrete by using vibrating units. Use a definite system or pattern in the operation of the vibrator so the full width of concrete in each linear foot of lane will receive adequate and uniform consolidation. The system and methods of vibrating is subject to approval of the Engineer. Do not use vibrating equipment as a tool for moving concrete laterally.
 9. Stringless Paving:
 - a. Provide an electronic file identifying x, y, and z coordinates for curbs and pavement edges, as well as pavement centerline based on project alignments and elevations.
 - b. Location and elevation of the finished slab should be verified against grade check hubs at 25 foot intervals for the first 100 feet of each days run and at critical locations, such as intakes and through intersections where grades may be flat. The Engineer may waive these requirements if experience has shown compliance with the design elevations.
 - c. Record each verification check and submit to the Engineer.
 - d. At the beginning of paving operations on the project or after each modification to the paving machine, verify the paving equipment is calibrated per the manufacturer's recommendations.
- G. Integral Curbs:** Integral curbs are placed with the pavement in a single paving machine operation; however, hand methods may be allowed for radius, returns, and sections of curb and gutter 100 feet or less in length or in other special sections where mechanical equipment cannot be used.
1. Pave, edge, protect, saw, and cure curb in same manner as pavement.
 2. Finish curb as rapidly as finishing operations on pavement permit. Maximum distance behind paving machine is 100 feet.
 3. Complete final finish on curbs by hand methods, including the use of a 6 foot straightedge.
 4. Check surfaces of curb and gutter with 10 foot straightedge; correct variations greater than 1/8 inch.
 5. For drop curb at driveways and where sidewalks intersect streets, use forms to shape the backs of such curbs.
 6. When using hand methods for building curb, the following additional requirements will apply:
 - a. Remove free water, latency, dust, leaves, or other foreign matter from the slab prior to placing concrete for curb.

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. 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.

I. 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.

J. 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.

3.02 PAVEMENT CONSTRUCTION (Continued)

- c. Place all transverse joints at right angles to the centerline and extend the full width of the pavement.
 - d. Place all joints perpendicular to the finished grade of the pavement and do not allow the alignment across the joint to vary from a straight line by more than 1 inch.
 - e. Exercise care in placing, consolidating, and finishing the concrete at all joints.
- 2. Saw Joints:**
- a. Mark joint locations with a string line before sawing.
 - b. Begin transverse joint sawing as soon as the concrete has hardened sufficiently to allow sawing without raveling or moving of aggregate. Saw joints before uncontrolled cracking takes place.
 - c. Saw all joints in a single cutting operation for a specific joint. Make saw cuts true to line and to the dimensions specified in the contract documents.
 - d. Discontinue sawing a joint if a crack develops ahead of the saw.
 - e. Saw longitudinal joints within 24 hours of the concrete being placed.
 - f. If necessary, continue the sawing operations both day and night.
 - g. The concrete must be capable of supporting the sawing operations to allow the use of an early green concrete saw.
 - h. Repair or replace pavement with uncontrolled or random cracking at no additional cost to the Contracting Authority. Use repair methods approved by the Engineer. Repair or replace at the direction of the Engineer.
 - i. Use wet sawing for dust control when specified in the contract documents.
 - j. Where boxouts occur in pavement, construct joints as shown on Figures 7010.103 and 7010.904.
- 3. Construction Joints:**
- a. Place longitudinal and transverse construction joints where specified in the contract documents, at boxouts, and at headers.
 - b. Locate and place forms for boxouts on grade prior to paving as shown on Figures 7010.103 and 7010.904.
 - c. Construct a Days Work (DW) or a Rigid Tie (RT) transverse construction joint no closer than 5 feet of an existing or planned transverse contraction joint. Construct the DW or RT transverse construction joint if concrete placement is delayed for more than 30 minutes, at planned pavement gaps, or at the end of each day.
 - d. Finish the edges of the pavement at construction joints with a 1/8 inch radius edging tool.
- 4. Expansion Joints:**
- a. Install expansion joints as specified in the contract documents.
 - b. Prevent movement of or damage to joint assembly when placing concrete; set joint material low enough to clear the finish machine.
 - c. Construct double width expansion joint in curb over expansion joint in pavement. The backside of the joint must be clear of concrete.
 - d. Align the expansion joint straight and true. After the mechanical finishing equipment has passed over the joint, check the joint for movement. If movement in excess of 1/2 inch has occurred, immediately correct the installation to its intended position.
 - e. If joint fillers are assembled in sections, or if joints as a whole are constructed in sections, do not allow offsets between adjacent fillers.
 - f. Where more than one section is used in a joint, securely lace or clip the sections together.
 - g. Supplemental vibration equipment is required for proper consolidation of the concrete.
 - h. After the surface finishing has been completed, finish the edge of the joint with a 1/8 inch edging tool.

3.02 PAVEMENT CONSTRUCTION (Continued)**K. Joint Sealing:****1. Timing:**

- a. Unless otherwise allowed or approved by the Engineer, before any portion of the pavement is opened to the Contractor's equipment or to general traffic, clean and seal joints that require sealing.
- b. The Engineer may limit the wheel loads and axle loads of equipment operating on the pavement during this operation, if prior to the age and strength specified in Section 7010, 3.05. Additional tests to determine the pavement strength may be required.

2. Cleaning:

- a. For those joints that are not to be sealed, cleaning is not required.
- b. Within 3 hours after a joint has been wet sawed to the finished dimension, flush the wet sawing residue away from the sawed faces using a high pressure water blast operating with a minimum pressure of 1,000 pounds per square inch. Within 3 hours after a joint has been dry sawed to the finished dimension, blow the dry sawing residue from the joint using air compressors that provide moisture and oil free compressed air.
- c. Immediately prior to installation of sealant, clean joints with an air blast. Do not perform sealing until visual examination verifies the joint surfaces appear dry, in addition to being clear of dust and contamination.

3. Sealing:

- a. Prepare and install joint sealer in the joint and to the proper level specified in the contract documents and as recommended by the manufacturer.
- b. Heat hot-poured sealers in a thermostatically controlled heating kettle; heat the material to the temperature required for use, but not above that recommended by the manufacturer. After sealing, remove excess sealer from the pavement surface.
- c. Seal joints the same day they are cleaned. Apply sealant only when the joint surfaces appear dry by visual examination.
- d. Place joint sealer only when the pavement and ambient air temperatures are 40°F or above. When near this minimum, additional air blasting or drying time, or both, may be necessary to ensure a satisfactory bond to the joint faces. When this sealer cannot be properly placed due to late fall work, submit a joint construction plan and sealing details to the Engineer for approval before commencing paving. Delay the cleaning, sealing, and, if required, resawing of joints until the following spring. This delay requires the Engineer's approval.
- e. When surface correction is required, repair seals damaged from the corrective work. Joint preparation, cleaning, and sealing may be delayed until after corrective work, provided the pavement is not opened to traffic before corrective work is performed.

- L. Pavement Backfill:** Following slipform paving operations, place backfill material along the pavement within 48 hours of pavement attaining opening strength or as directed by the Engineer to prevent flow of water and any subsequent damage caused by undermining of the pavement. Prior to placement of full backfill material, construct check dams or other protection as appropriate to ensure no damage to the subgrade and/or subbase occurs.

M. Form Removal:**1. Timing:**

- a. Remove forms after the initial set of the concrete has taken place.
- b. Remove stakes and forms with care to prevent cracking, spalling, or over stressing concrete. If damage does occur, repairs will be made as required by the Engineer.

2. Honeycomb Repair:

- a. When the forms are removed, fill honeycombs with mortar composed of 1 part cement and 2 parts fine aggregate by weight.

3.02 PAVEMENT CONSTRUCTION (Continued)

- b. If the honeycombing is to the degree and nature that it is considered by the Engineer as defective work, remove and replace at no additional cost to the Contracting Authority.
- 3. **Paving Protection:** In the area adjacent to the curbs and pavement edge, immediately place backfill after the forms are removed. Construct dams or other protection to ensure that no saturation or erosion of the subgrade under or near the pavement occurs. This may include check dams, pumping, etc.

3.03 CURB AND GUTTER CONSTRUCTION (See Figure 7010.102)

- A. Complete the construction of curb and gutter separate from pavement in the same manner as for pavement in Section 7010, 3.02.
- B. Use a paving machine for curb and gutter. For curb and gutter sections less than 250 feet, hand finish methods may be used.

3.04 PAVEMENT PROTECTION

A. Weather Conditions: Do not place concrete when stormy or inclement weather or temperature prevents good workmanship. Temperature restrictions and protection requirements may be modified by the Engineer under unusual conditions.

1. Cold Weather:

- a. **Paving:** Do not place aggregates containing frozen lumps, and do not place concrete on a frozen subgrade or subbase. Take all necessary actions to prevent the pavement from freezing.
 - 1) Concrete mixing and placement may be started, if weather conditions are favorable, when the air temperature is at least 34°F and rising. At the time of placement, concrete must have a temperature of at least 40°F.
 - 2) Stop mixing and placing when the air temperature is 38°F or less and falling or if the temperature stops rising and does not reach 38°F.
- b. **Protection:** Prior to applying protection, cure all concrete pavement and curb/gutters, including exposed edges of the pavement and curb. In addition, protect concrete less than 36 hours old as follows:

Night Temperature Forecast	Type of Protection ¹
35°F to 32°F	One layer of burlap for concrete.
31°F to 25°F	Two layers of burlap or one layer of plastic on one layer of burlap.
Below 25°F	Four layers of burlap between layers of 4 mil plastic or equivalent commercial insulating material approved by the Engineer.

¹ Keep protection in place until one of the following conditions is met:

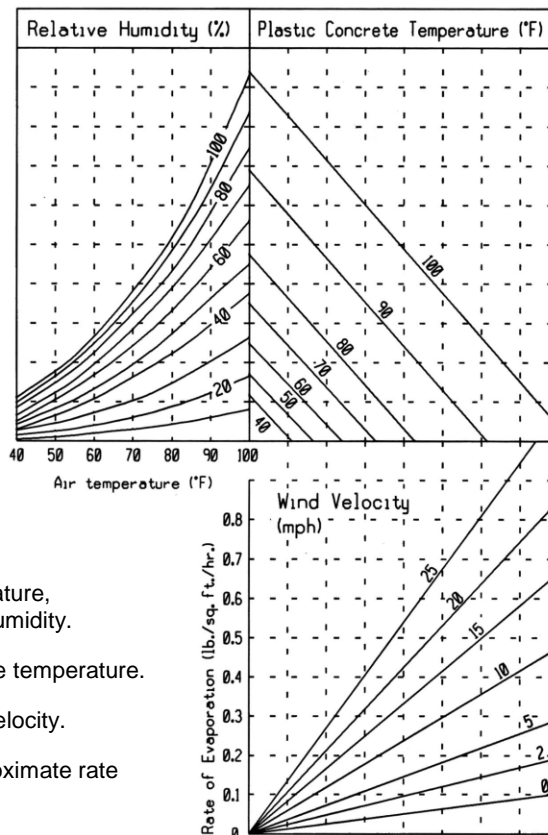
- a. The pavement is 5 calendar days old.
- b. Opening strength is attained.
- c. Forecasted low temperatures exceed 35°F for the next 48 hours.
- d. Forecasted high temperatures exceed 55°F for the next 24 hours and subgrade temperatures are above 40°F.

- 1) Shut down paving operations in time to comply with protection requirements outlined above. During cold weather, allow more time for finishing and protection. Perform all finishing and covering operations prior to darkness. Temperature restrictions and protection requirements may be modified by the Engineer.

3.04 PAVEMENT PROTECTION (Continued)

- 2) Equivalent commercial insulating material approved by the Engineer may be used. This material must be waterproof and have a minimum R value of 1.0. If initial set has not yet occurred, place a layer of burlap on top of concrete prior to placing insulating blankets.
 - 3) Use a method of protection and materials that will maintain the concrete temperature above 40°F.
- 2. Hot Weather:** Hot weather condition is defined as any combination of the following conditions that tend to impair the quality of plastic concrete by accelerating the rate of moisture loss and rate of cement hydration causing thermal shrinkage and resulting in plastic shrinkage cracking:
- High Ambient Temperature
 - High Concrete Temperature
 - Low Relative Humidity
 - High Wind Velocity
 - Solar Radiation
- a. General:
 - 1) During hot weather conditions, the Engineer may restrict concrete placement to early morning or evening hours.
 - 2) During hot weather conditions, advise the Engineer of the results of the theoretical evaporation rate throughout paving operations.
 - b. Determine the Theoretical Rate of Evaporation: Use the following chart and the National Weather Service’s predicted maximum air temperature, relative humidity, and maximum steady wind velocity without gusts, for the date and the location of the paving pour.

Theoretical Rate of Evaporation Chart



To Use this Chart:

1. Enter with air temperature, move up to relative humidity.
2. Move right to concrete temperature.
3. Move down to wind velocity.
4. Move left, read approximate rate of evaporation

3.04 PAVEMENT PROTECTION (Continued)

- c. If the evaporation rate exceeds 0.1 pounds per square foot per hour but is less than 0.3 pounds per square foot per hour, provide the following concrete evaporation protection.
 - 1) Immediately apply an approved evaporation retarder to the concrete pavement and curbs or increase the surface cure application to 1.5 times the standard specified rate.
 - 2) Take special precautions to ensure that the forms and subgrade are sufficiently moist or protected to avoid lowering the water content at the pavement/subgrade interface. In hot weather conditions, moisten the subgrade the evening before operations.
 - 3) Ensure that the time between placing and curing is minimized and eliminate delays.
 - 4) Moisten concrete aggregates that are dry and absorptive.
 - 5) Use a fog spray to raise the relative humidity of the ambient air if there is a delay in immediately applying the curing compound.
 - 6) Minimize solar heat by shading, wetting, or covering concrete chutes or other equipment that comes in contact with plastic concrete.
- d. If the evaporation rate is 0.3 pounds per square foot per hour or greater, discontinue placement of concrete.

3. Rain Protection:

- a. Have materials available, near the work site, for proper protection of the edges and surface of concrete. Protective material may consist of sheets of burlap or plastic film. Also have planks or other material with suitable stakes that can be used as temporary forms available.
- b. If initial set has not occurred, take every precaution necessary to protect the surface texture of the concrete.
- c. If so determined by the Engineer, failure to properly protect concrete will constitute cause for removal and replacement of defective pavement.

B. Night Conditions: Perform all finishing and covering operations prior to darkness (half an hour after sunset). Do not commence construction until half an hour before sunrise. Do not place or finish concrete under artificial light, unless approved by the Engineer.

C. Protection from Traffic:**1. General:**

- a. Protect the new pavement and its appurtenances from traffic, both public and that caused by 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, barricades, watchmen to direct traffic, and pavement bridges or crossovers.
- b. 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.

2. End of Day's Run:

- a. 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.
- b. Install safety fences within 1 hour of the completion of finishing and curing operations. Leave fences in place and maintained until the concrete has attained the minimum strength or age.
- c. Intermediate safety fences may be required for the purpose of opening the pavement for access to a side road, side street, or entrance.

3.04 PAVEMENT PROTECTION (Continued)

3. **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.

3.05 USE OF PAVEMENT

Time for opening pavement for use is determined by maturity method complying with Iowa DOT Materials I.M. 383 or age and test results. The minimum age and test results needed for opening are shown in Table 7010.01.

Table 7010.01: Minimum Age and Tested Strength of Pavement Before Opening

Class of Mix	Type of Cement	Minimum Age For Opening ¹	Minimum Compressive Strength (psi)	Minimum Flexural Strength Center Point (psi)
C	Type I	7 Days ²	3,000	500
M	Type I	48 Hours	3,000	500

¹ Opening without testing only allowed upon approval of Engineer

² Five calendar days for concrete 9 inches thick or more.

3.06 TRANSPORTATION RESTRICTIONS

- A. Do not use concrete transported with continuous agitation when the cement has been in contact with the aggregate more than 90 minutes before it is placed. With the approval of the Engineer, an approved retarding admixture may be used at the rates required in Iowa DOT Materials I.M. 403.
- B. Do not use concrete transported without continuous agitation if the period elapsed between the time the concrete is mixed and the time it is placed is greater than 30 minutes. With the approval of the Engineer, an approved retarding admixture may be used at the rates required in Iowa DOT Materials I.M. 403 and the mixed-to-placed time may be extended.
- C. Ensure the methods of delivering and handling the concrete are such that objectionable segregation or damage to the concrete will not occur, and concrete placing will occur with a minimum of rehandling.
- D. Thoroughly clean the truck compartment in which concrete is transported and flush with water to ensure that hardened concrete will not accumulate. Discharge the flushing water from the truck compartment to the designated discharge point before it is charged with the next batch.

3.07 QUALITY CONTROL

- A. Testing:** Provide the following material certifications and testing required to be performed by Supplier or Contractor.

Table 7010.02: Material Certifications and Testing

Material or Construction Item	Tests	Applicable Standard ¹	Methods of Acceptance of Sampling and Testing	Field Sampling and Testing	
				Frequency (minimum)	Responsible Party
Fine Aggregates	Gradation	I.M. 302, 306, 336	Cert. Plant Insp. ²	1/250 CY or min 1/day	Supplier/ Contractor
	Moisture	I.M. 308, 527	Cert. Plant Insp. ²	1 per 1/2 day	
	Specific Gravity	I.M. 307	Cert. Plant Insp. ²	1/250 CY or min 1/day	
	Quality	I.M. 209	Approved Source	Prior to use	
Coarse Aggregates	Gradation	I.M. 302, 306, 336	Cert. Plant Insp. ²	1/250 CY or min 1/day	
	Moisture	I.M. 308, 527	Cert. Plant Insp. ²	1 per 1/2 day	
	Specific Gravity	I.M. 307	Cert. Plant Insp. ²	1/250 CY or min 1/day	
	Quality	I.M. 209	Approved Source	Prior to use	
Portland Cement	Quality	I.M. 401	Approved Source	Prior to use	
Fly Ash	Quality	I.M. 491.17	Approved Source	Prior to use	
GGBFS	Quality	I.M. 491.14	Approved Source	Prior to use	
Curing Compound	Quality	Iowa DOT Section 4105	Approved Source	Prior to use	
Joint Sealer	Quality	I.M. 436.01	Approved Source	Prior to use	
Epoxy Dowel Bars and Assemblies	Quality	I.M. 451.03B	Approved Source	Prior to use	
Tie Bars	Quality	I.M. 451	Approved Source	Prior to use	
Plastic Concrete	Air Content	I.M. 318, 327	Field Test	1/200 CY or min. 1/day	Engineer
	Slump	I.M. 317	Field Test	1/200 CY or min. 1/day	
	Cylinders 6"	I.M. 315	Field Test	Set of 3/500 CY or two sets/day	
	Beams	I.M. 316, 327, 328	Field Test	Set of 3/500 CY or two sets/day	
	Thickness	-----	Field Test	1/200 CY	
Hardened Concrete	Smoothness	SUDAS 7010, 3.08	Field Test - Straightedge	Project length	Contractor
	Smoothness	SUDAS 7010, 3.08	Field Test - Profilograph	Project length	
	Thickness	SUDAS 7010, 3.08	Field Test	1 core/1000 SY or 3 cores/project	
	Strength	I.M. 383	Maturity Tests ³	Prior to placement	

¹ Refers to the Iowa DOT Materials I.M.s, Iowa DOT Standard Specifications, or SUDAS Standard Specifications.

² Certified plant inspection per Iowa DOT Materials I.M. 527.

³ The Contractor is responsible for developing the maturity curve for the specified mix, taking maturity readings, and delivering a copy of the results to the Engineer.

3.07 QUALITY CONTROL (Continued)**B. Air Content:**

1. Air content of the concrete will be evaluated according to Iowa DOT Materials I.M. 318 and 327.
2. When a test result is outside the tolerance for the target air content, the contractor will be notified immediately. An air test will then be immediately run behind the paver to aid in identifying the limits of the non-complying air. A test result between 5% and 8% behind the paver will be considered complying. This test will represent all concrete from the back of the paver back to the last documented complying test. Make immediate adjustments to the mix production and placement process to bring the air content back within tolerance. Do not use succeeding loads below the lower target air content tolerance by more than 0.5%. Each subsequent load will be tested until air content is within tolerance for two consecutive loads. For all incorporated, non-complying concrete that is out of tolerance, the Engineer will determine if removal and replacement is required or if a price adjustment, according to Table 7010.03, will be applied.

Table 7010.03: Concrete Air Content Price Adjustments

Air Content Range			% Payment of Unit Price
Minimum		Maximum	
1.1*	and	below	0%
0.6	to	1.0*	50%
0.1	to	0.5*	75%
	Low air tolerance limit		100%
	Target		100%
	High air tolerance limit		100%
0.1	to	0.5**	95%
0.6	to	1.0**	85%
1.1	to	1.5**	75%
1.6	to	2.0**	60%
2.1**	and	above	0%

*Air content deviation below the acceptable limits

** Air content deviation above the acceptable limits

C. Pavement Smoothness: Evaluate pavement smoothness for all PCC pavement and overlay surfaces.

1. **Straightedge:** The Engineer will check PCC 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.
2. **Profilograph:**
 - a. If specified in the contract documents, comply with Iowa DOT Section 2316 to measure pavement smoothness with a profilograph.
 - b. Evaluate according to the smoothness requirements of Table 7010.04 and make surface corrections and price reductions. Surface corrections will be completed with no additional cost to the Contracting Authority. No incentive for pavement smoothness will be made.

3.07 QUALITY CONTROL (Continued)**Table 7010.04: Pay Factor if Profilograph Used**

Segment Index (inch/mile)	Pay Factor
0 - 22.0	100%
22.1 - 30.0	97%
30.1 and over	Grind as directed by Engineer

- c. Smoothness measurements will be suspended for structures and through intersections.

D. Pavement Thickness:

1. At locations determined by the Engineer, cut samples from the pavement by drilling with a core bit that will provide samples with a 4 inch outside diameter. Restore the surface by tamping low slump concrete into the hole, finishing, and texturing. The Engineer will witness the core drilling, identify, and take possession of the cores. The Engineer will determine the core locations, measure the cores, and determine the thickness index according to Iowa DOT Materials I.M. 346 and 347, except as modified as follows:
 - a. For regular or irregular shaped areas, use a lot size of 1,000 square yards. Include remnants less than 500 square yards in the last lot and remnants greater than 500 square yards in a separate lot. Take a minimum of three cores per project.
 - b. For any core with a deficiency greater than 0.15 inch, take two additional cores in that pavement lot and use the average of the three cores.
2. Coring of pavement or other work for thickness determination may be waived by mutual agreement for sections of the same design thickness less than 2,500 square yards.
3. Based on the thickness index determined by the Engineer, the pavement payment will be as shown in Tables 7010.05 and 7010.06.
4. If the thickness index deficiency is greater than 0.51 for pavements thinner than 9 inches or 0.91 for pavements 9 inches or thicker, the Engineer will study the extent and severity of the deficiency of the pavement areas. The Engineer will require one of the following based on a review on the level of deficiency, the amount of the payment penalty, and the estimated reduction in the design life of the deficient pavement:
 - a. Removal and replacement of the deficient areas with pavement complying with the contract documents at no additional cost to the Contracting Authority.
 - b. Completion of an agreement that provides a combination of an extended guarantee period and payment penalty and allows the deficient pavement to be left in place.

Table 7010.05: Pay Factor for PCC Pavement for Design Thickness less than 9"

Thickness Index Range	Percent Payment
More than 0 to -0.15	100
-0.16 to -0.25	95
-0.26 to -0.50	85
-0.51 or less	As determined by the Engineer

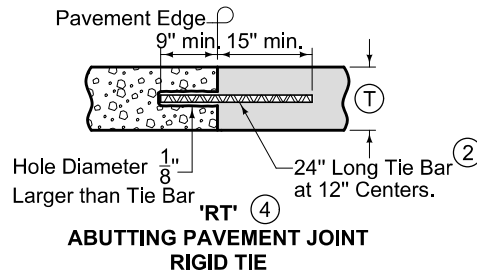
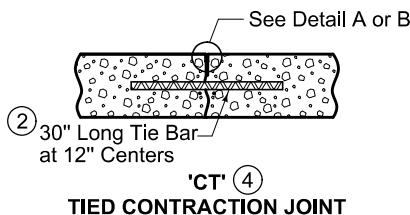
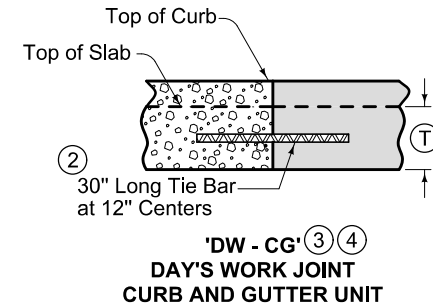
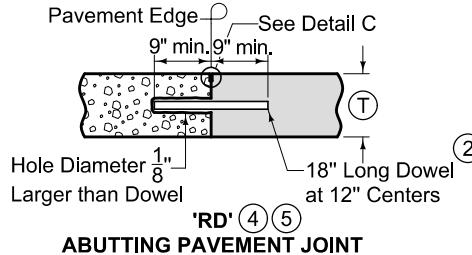
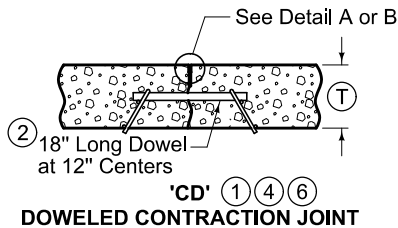
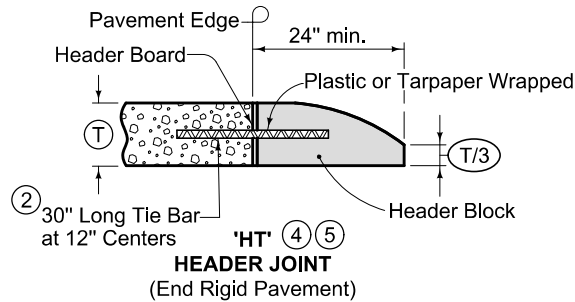
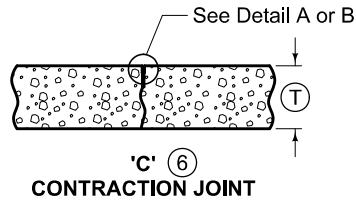
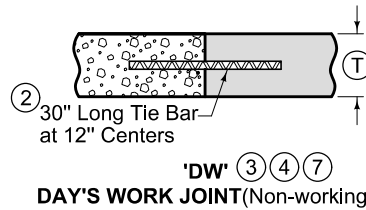
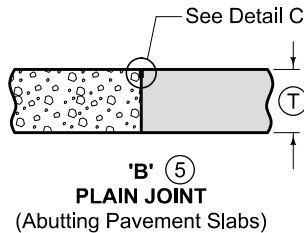
3.07 QUALITY CONTROL (Continued)**Table 7010.06: Pay Factor for PCC Pavement for Design Thickness 9" or Greater**

Thickness Index Range	Percent Payment
More than 0.00 to -0.15	100
-0.16 to -0.20	99
-0.21 to -0.25	98
-0.26 to -0.30	97
-0.31 to -0.35	96
-0.36 to -0.40	95
-0.41 to -0.45	94
-0.46 to -0.50	93
-0.51 to -0.55	92
-0.56 to -0.60	91
-0.61 to -0.65	90
-0.66 to -0.70	89
-0.71 to -0.75	88
-0.76 to -0.80	87
-0.81 to -0.85	86
-0.86 to -0.90	85
-0.91 or less	As determined by the Engineer

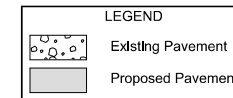
- E. Defects or Deficiencies:** Remove and replace or repair pavement containing excessive cracks, fractures, spalls, or other defects at no additional cost to the Contracting Authority. The method of replacement or repair will be determined by the Engineer.

END OF SECTION

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- ① See dowel assemblies for fabrication details.
- ② See Bar Size Table.
- ③ Locate 'DW' joint at a mid-panel location between future 'C' or 'CD' joints. Place no closer than 5 feet to a 'C' or 'CD' joint.
- ④ Place bars within the limits shown under dowel assemblies.
- ⑤ Edge with 1/8 inch tool for length of joint. For HT joint, remove header block and board when second slab is placed.
- ⑥ Unless otherwise specified, use 'CD' transverse contraction joints in mainline pavement when (T) is greater or equal to 8 inches. Use 'C' joints when (T) is less than 8 inches.
- ⑦ 'RT' joint may be used in lieu of 'DW' joint at the end of the days work. Remove any pavement damaged due to the drilling at no additional cost to the Contracting Authority.



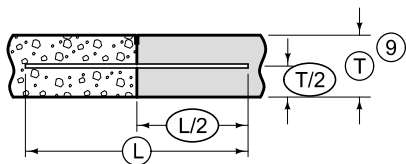
		REVISION
		7 10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
		SHEET 1 of 8

REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.

Bruce D. Wigand SUDAS DIRECTOR *Brian Smith* DESIGN METHODS ENGINEER

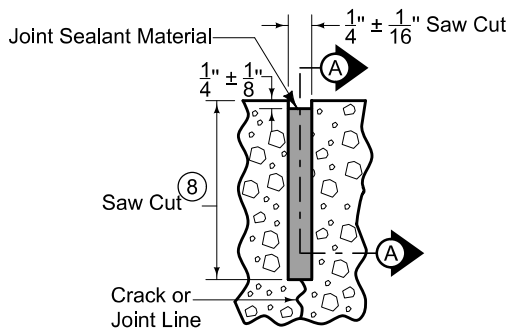
JOINTS

TRANSVERSE CONTRACTION



BAR PLACEMENT

(Applies to all joints unless otherwise detailed.)

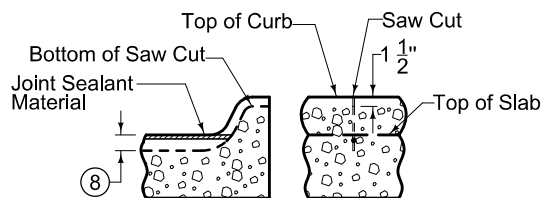


DETAIL A

(Saw cut formed by conventional concrete sawing equipment.)

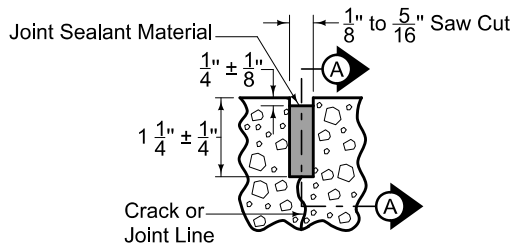
- ⑧ Saw 'CD' joint to a depth of $T/3 \pm 1/4"$; saw 'C' joint to a depth of $T/4 \pm 1/4"$.
- ⑨ When tying into old pavement, \textcircled{T} represents the depth of sound PCC.

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



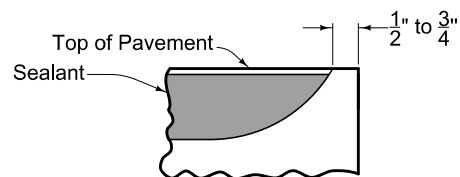
'C' JOINT IN CURB

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



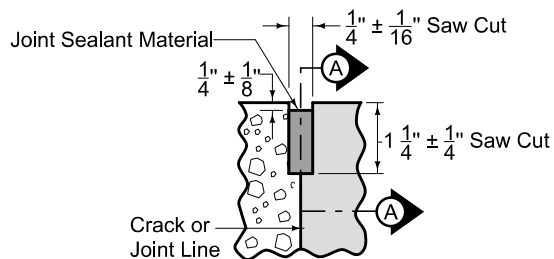
DETAIL B

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



SECTION A-A

(Detail at Edge of Pavement)



DETAIL C

LEGEND	
	Existing Pavement
	Proposed Pavement

		REVISION
		7 10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
		SHEET 2 of 8

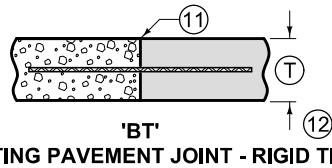
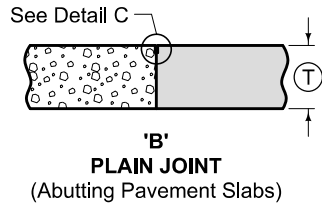
REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.

Paul D. Wigand
SUDAS DIRECTOR

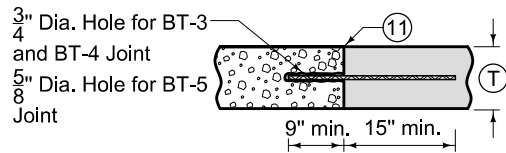
Brian Smith
DESIGN METHODS ENGINEER

JOINTS

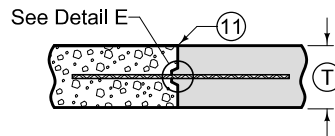
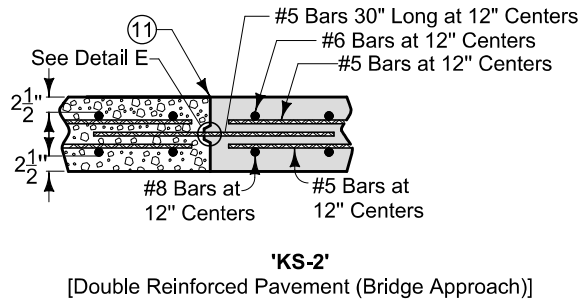
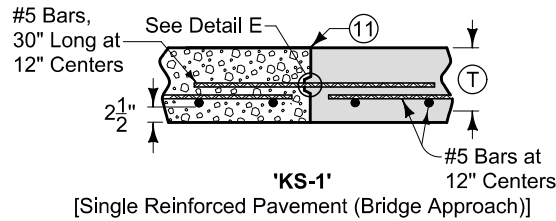
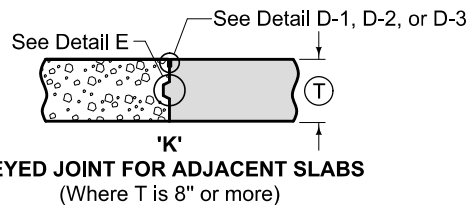
TRANSVERSE CONTRACTION



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



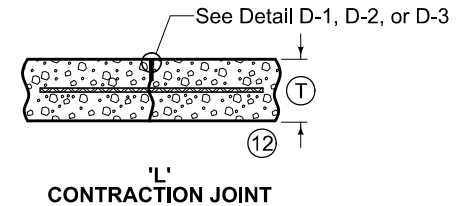
Ⓣ	Joint	Bars	Bar Length and Spacing
< 8"	'BT-5'	#4	24" Long at 30" Centers
≥ 8"	'BT-3'	#5	24" Long at 30" Centers
	'BT-4'		24" Long at 15" Centers



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

LONGITUDINAL CONTRACTION

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



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

LEGEND

Existing Pavement

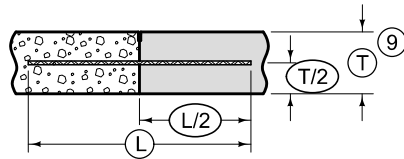
Proposed Pavement

SUDAS	IOWADOT	REVISION
		7 10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
		SHEET 3 of 8

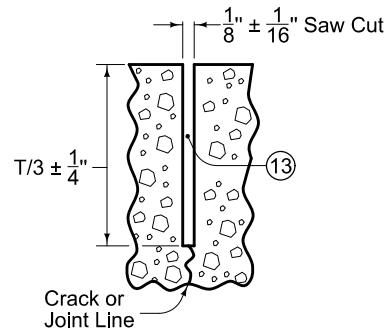
REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.

Paul D. Wigand SUDAS DIRECTOR
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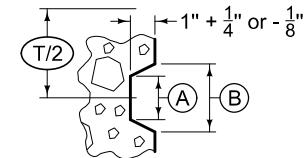
JOINTS



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

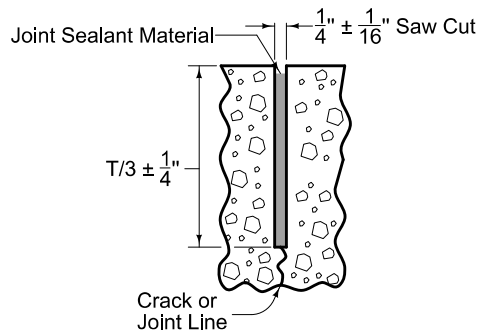


DETAIL D-1
(Required when specified in the contract documents.)

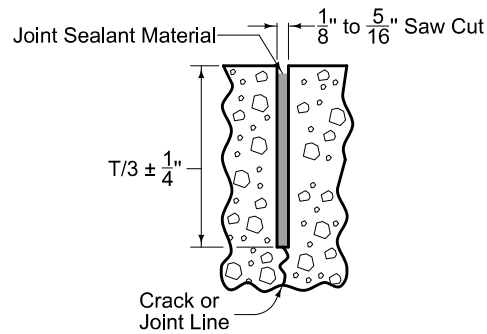


DETAIL E

- ⑨ When tying into old pavement, (T) represents the depth of sound PCC.
- ⑬ Sealant or cleaning not required.

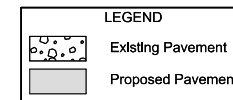


DETAIL D-2
(Required when the Department of Transportation is not the Contracting Authority, or when specified in the contract documents)



DETAIL D-3
(Required when the Department of Transportation is the Contracting Authority, or when specified in the contract documents)

KEYWAY DIMENSIONS			
Keyway Type	Pavement Thickness (T)	(A)	(B)
Standard	8" or greater	1 3/4"	2 3/4"
Narrow	Less than 8"	1"	2"



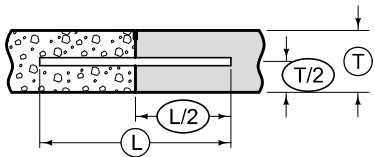
SUDAS	IOWADOT	REVISION
		7 10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
		SHEET 4 of 8

REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.

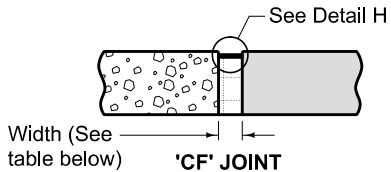
Paul D. Wigand
SUDAS DIRECTOR
 Brian Smith
DESIGN METHODS ENGINEER

JOINTS

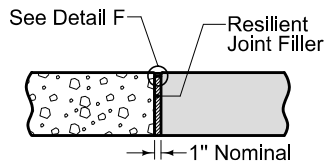
LONGITUDINAL CONTRACTION



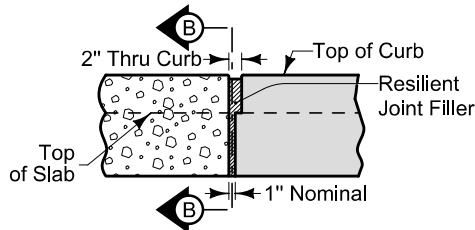
DOWEL PLACEMENT
(Applies to all joints unless otherwise detailed.)



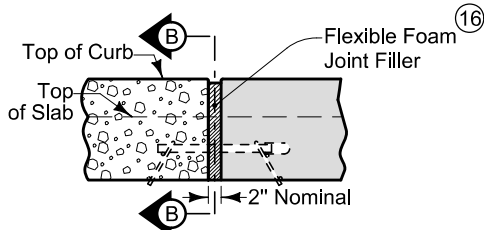
TYPE	WIDTH
CF-1	2"
CF-2	2 1/2"
CF-3	3"
CF-4	3 1/2"



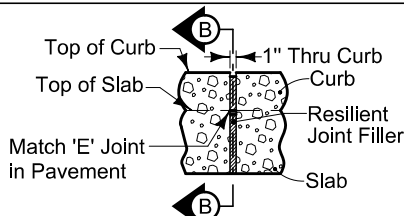
'E' 1" EXPANSION JOINT



'E' JOINT IN CURB
(View at Back of Curb)



'EE' JOINT IN CURB
(View at Back of Curb)

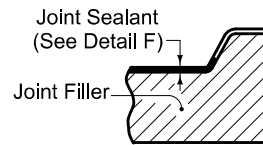


'ES' JOINT IN CURB
(View at Back of Curb)

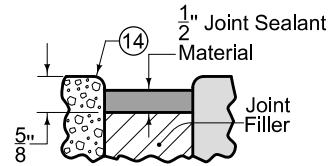


② 18" Long Dowel at 12" Centers (See Doweled Expansion Joints Table)

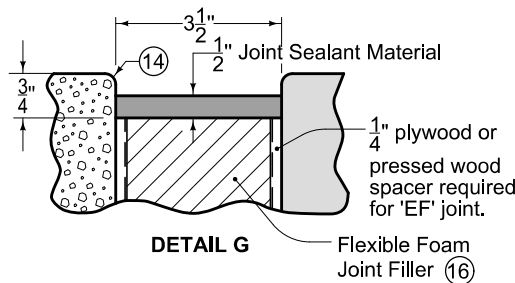
'ED', 'EE', 'EF' (15) DOWELED EXPANSION JOINT



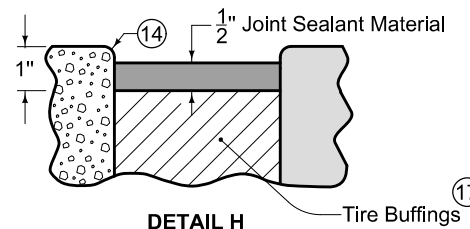
SECTION B-B



DETAIL F



DETAIL G



DETAIL H

EXPANSION

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

DOWELED EXPANSION JOINTS		
TYPE	WIDTH	FILLER MATERIAL (16)
ED	1"	Resilient (Detail F)
EE	2"	Flexible Foam (Detail F)
EF	3 1/2"	Flexible Foam (Detail G)

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

LEGEND	
	Existing Pavement
	Proposed Pavement

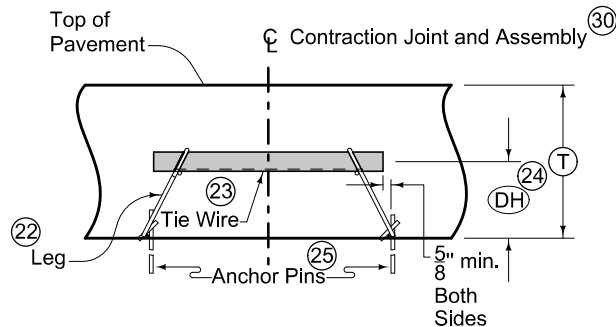
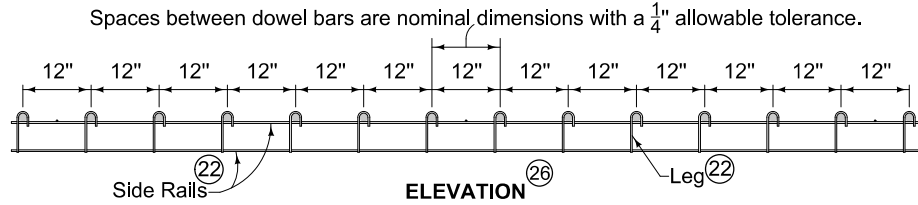
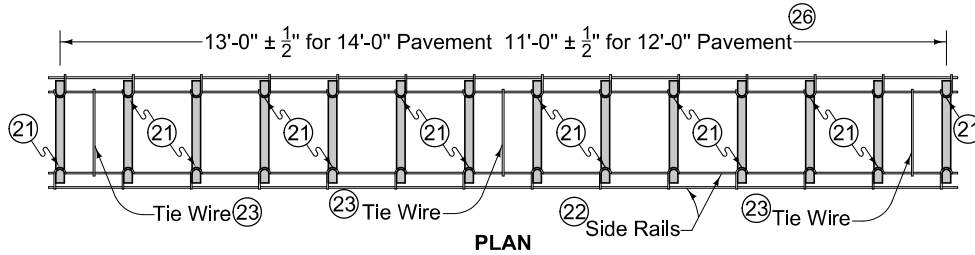
SUDAS	IOWADOT	REVISION
		7 10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
		SHEET 5 of 8

REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.

Paul D. Wigand SUDAS DIRECTOR *Brian Smith* DESIGN METHODS ENGINEER

JOINTS

CONTRACTION JOINTS



LONGITUDINAL SECTION

DOWEL ASSEMBLIES

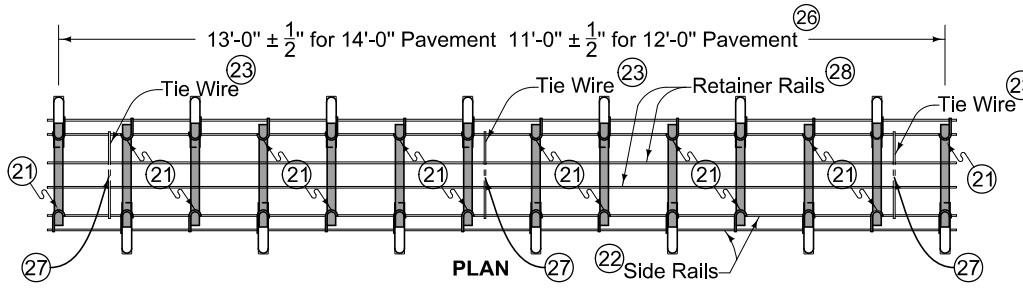
(18)(19)(20)

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

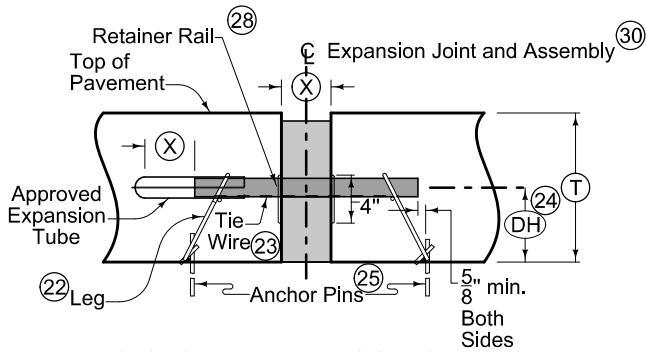
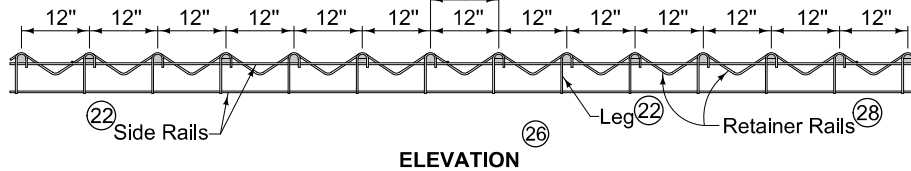
- (18) Use 18 inch long dowel bars with a tolerance of $\pm 1/8$ inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within $\pm 1/8$ inch.
- (19) Use wires with a minimum tensile strength of 50 ksi.
- (20) Details apply to both transverse contraction and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

		REVISION	
		7	10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN		
SHEET 6 of 8			
<small>REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.</small>			
 SUDAS DIRECTOR		 DESIGN METHODS ENGINEER	
JOINTS			

EXPANSION JOINTS



Spaces between dowel bars are nominal dimensions with a 1/4" allowable tolerance.



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

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

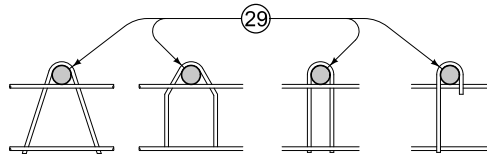
DOWEL ASSEMBLIES

(18)(19)(20)

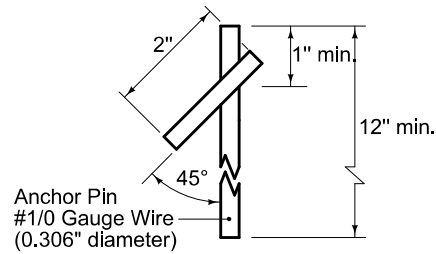
- (18) Use 18 inch long dowel bars with a tolerance of ± 1/8 inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within ± 1/8 inch.
- (19) Use wires with a minimum tensile strength of 50 ksi.
- (20) Details apply to both transverse contraction and expansion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

FIGURE 7010.101 SHEET 7 OF 8

SUDAS IOWADOT	REVISION	
	7	10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101
REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.		SHEET 7 of 8
Fred D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER
JOINTS		

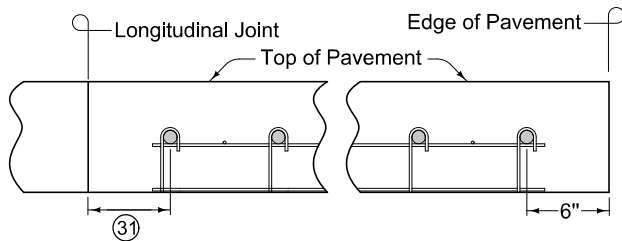


OPTIONAL LEG SHAPES

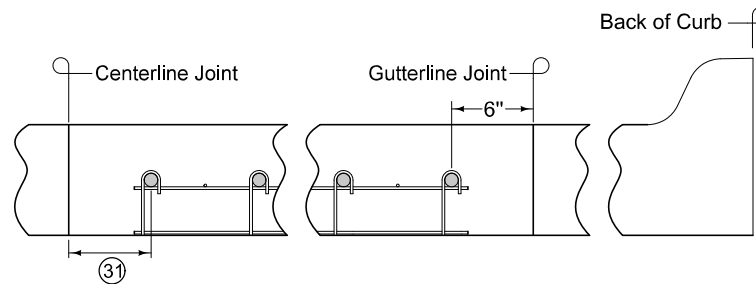


ANCHOR PIN

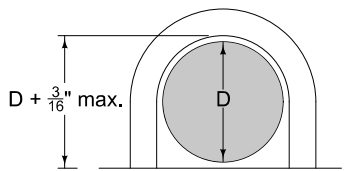
- ⑱ Use 18 inch long dowel bars with a tolerance of $\pm 1/8$ inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within $\pm 1/8$ inch.
- ⑲ Use wires with a minimum tensile strength of 50 ksi.
- ⑳ Details apply to both transverse contraction and expansion joints.
- ㉑ Diameter of bend around dowel is dowel diameter + $1/8$ to $3/16$ inches.
- ㉒ For uniform lane widths: 3" - 6". For taper and variable width pavements: 3" - 12".



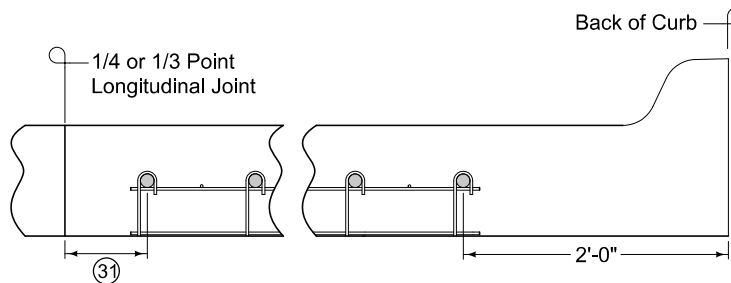
PLACEMENT LIMITS
(Rural Section)



PLACEMENT LIMITS
(Curb and Gutter - Gutterline Jointing)



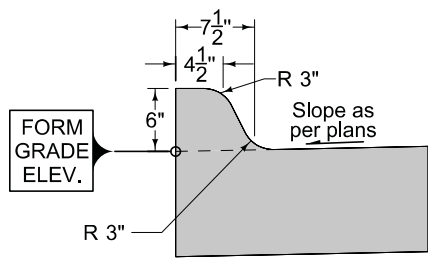
BEND AROUND DOWEL ㉑



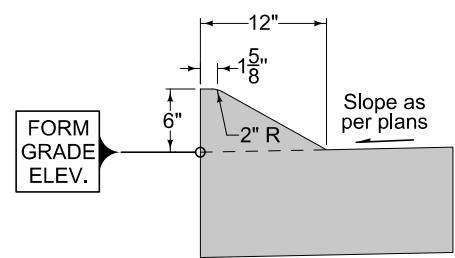
PLACEMENT LIMITS
(Curb and Gutter - 1/4 or 1/3 Point Jointing)

DOWEL ASSEMBLIES ⑱⑲⑳

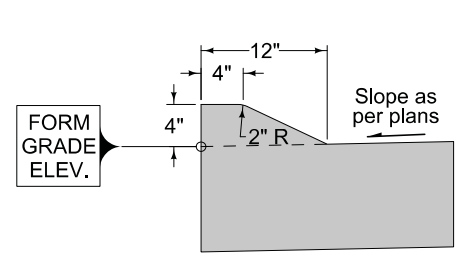
		REVISION	
		7	10-17-17
FIGURE 7010.101	STANDARD ROAD PLAN	PV-101	
		SHEET 8 of 8	
<small>REVISIONS: Revised notes 22 and 23 on pages 6 and 7 to align with current industry standards.</small>			
<i>Paul D. Wigand</i> SUDAS DIRECTOR		<i>Brian Smith</i> DESIGN METHODS ENGINEER	
JOINTS			



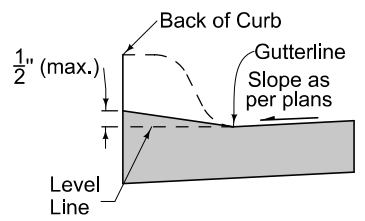
6" STANDARD CURB



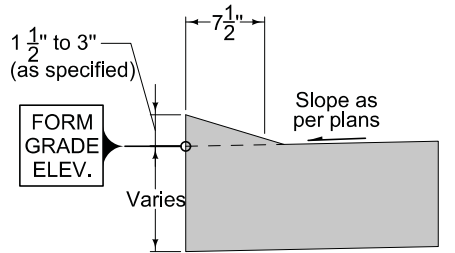
6" SLOPED CURB



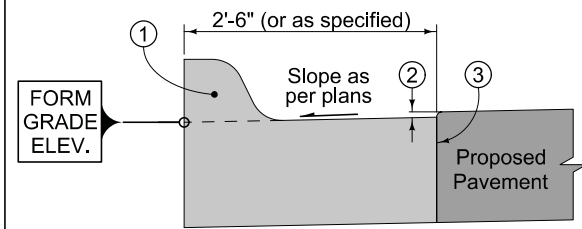
4" SLOPED CURB



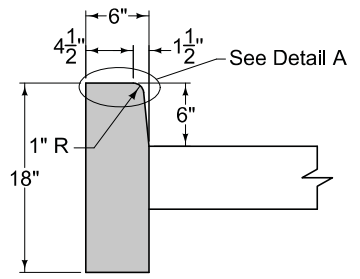
DROP CURB AT SIDEWALK



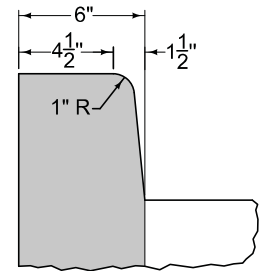
DRIVEWAY DROP CURB



CURB AND GUTTER UNIT



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



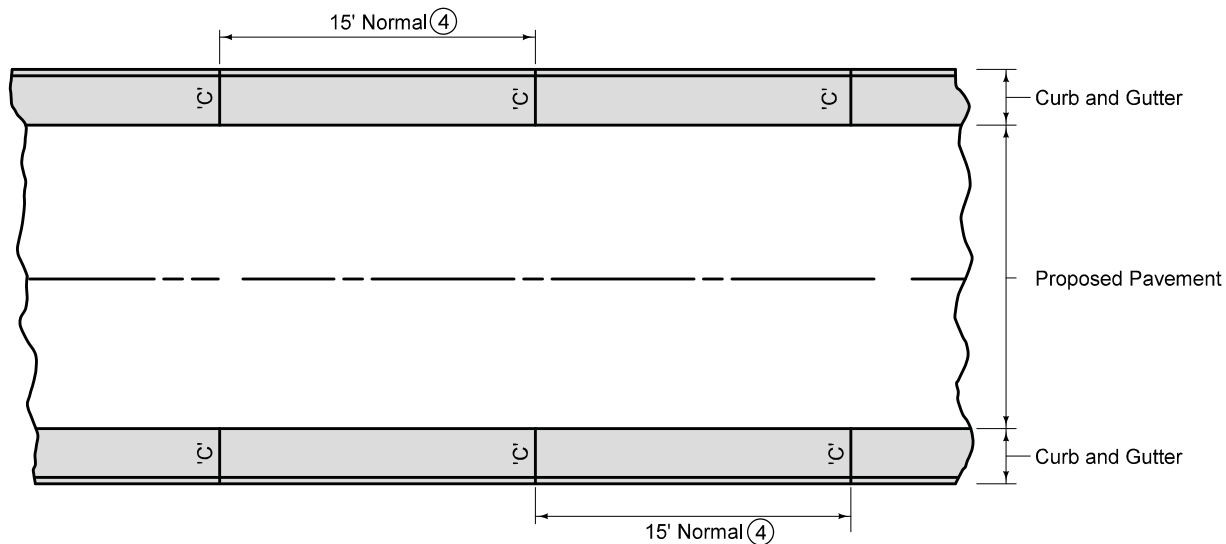
DETAIL A

For joint details, see PV-101.

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

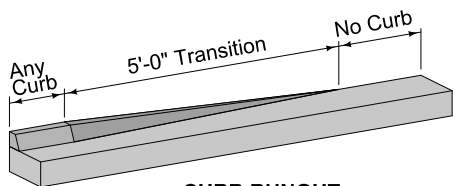
FIGURE 7010.102 SHEET 1 OF 2

SUDAS IOWADOT	REVISION 4 10-18-16
	PV-102 SHEET 1 of 2
FIGURE 7010.102 STANDARD ROAD PLAN	REVISIONS: Added note, 'Slope as per plans' on Drop Curb views on page 1, Updated DOT logo to new version.
Paul D. Wigand SUDAS DIRECTOR	Brian Smith DESIGN METHODS ENGINEER
PCC CURB DETAILS	

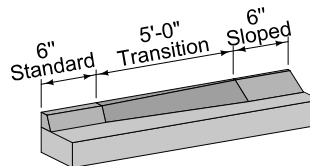


JOINTING DIAGRAM FOR CURB AND GUTTER UNIT

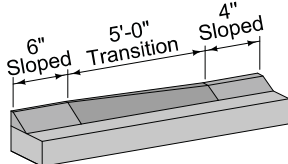
(4) If proposed pavement is PCC, match joint spacing for proposed pavement. Place 'E' joints in curb and gutter section where expansion joints are to be placed in proposed pavement.



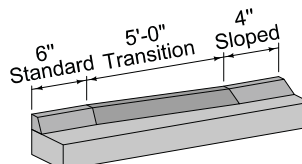
CURB RUNOUT FOR ALL CURBS



CURB TRANSITION FROM 6" STANDARD TO 6" SLOPED



CURB TRANSITION FROM 6" SLOPED TO 4" SLOPED

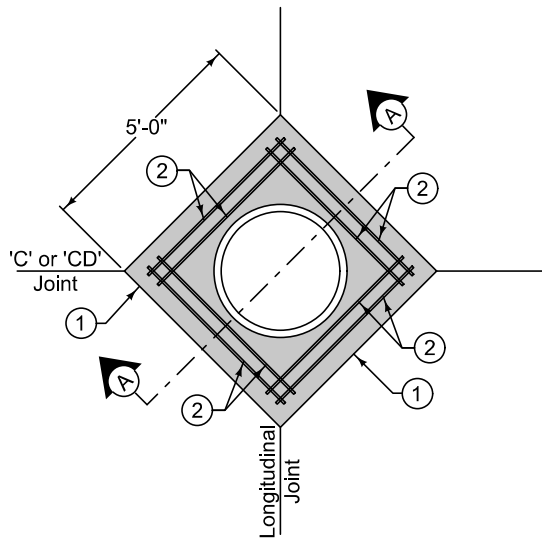


CURB TRANSITION FROM 6" STANDARD TO 4" SLOPED

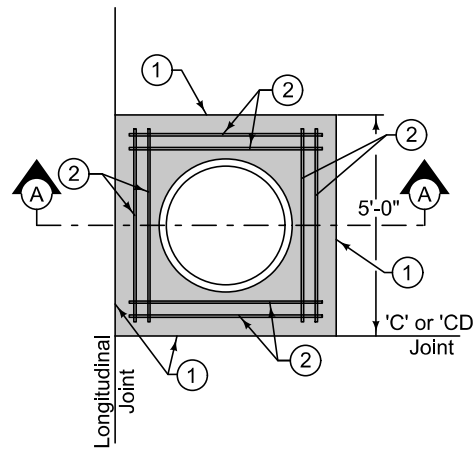
FIGURE 7010.102

SHEET 2 OF 2

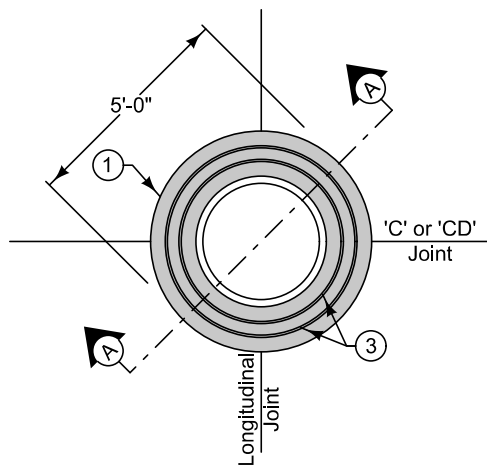
SUDAS	IOWADOT	REVISION
		4 10-18-16
FIGURE 7010.102	STANDARD ROAD PLAN	PV-102
		SHEET 2 of 2
REVISIONS: Added note, 'Slope as per plans' on Drop Curb views on page 1. Updated DOT logo to new version.		
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER
PCC CURB DETAILS		



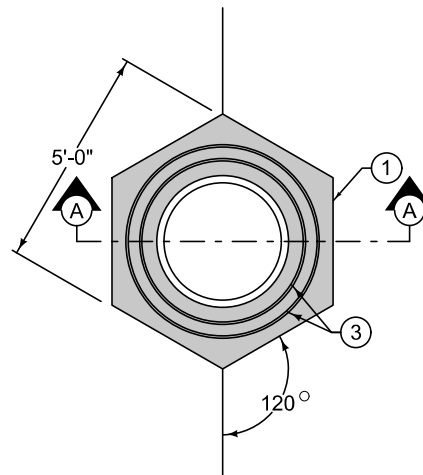
AT JOINT INTERSECTION



OFFSET AT JOINT INTERSECTION



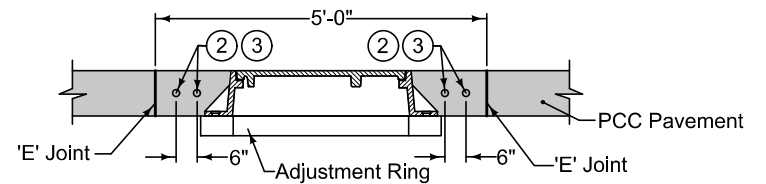
CIRCULAR



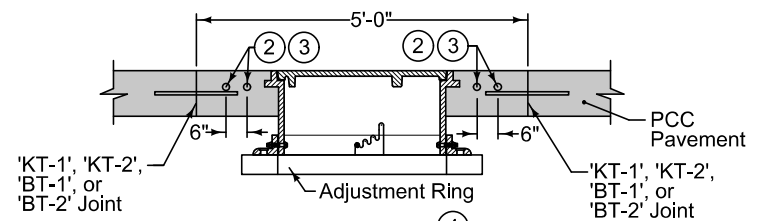
AT A SINGLE JOINT

Construct boxout with Class C concrete or match pavement class. Minimum 2 inches clear on reinforcement. Center casting within boxout area.

- ① 'KT-1', 'KT-2', 'BT-1', or 'BT-2' joint if three-piece floating casting (SW 601 Type B and D or SW-602 Type F) is used. 'E' joint if two-piece fixed casting (SW 601 Type A and C or SW-602 Type E) is used.
- ② 4 foot 8 inch (typ.) #4 bar. Place at mid-slab.
- ③ #4 hoops (variable length). Place at mid-slab.
- ④ No boxout is required for three-piece floating castings (SW 601 Type B and D or SW-602 Type F). If a boxout is used with a three-piece casting, construct as detailed in Section A-A for three-piece floating casting.



SECTION A-A
(For two-piece fixed casting)

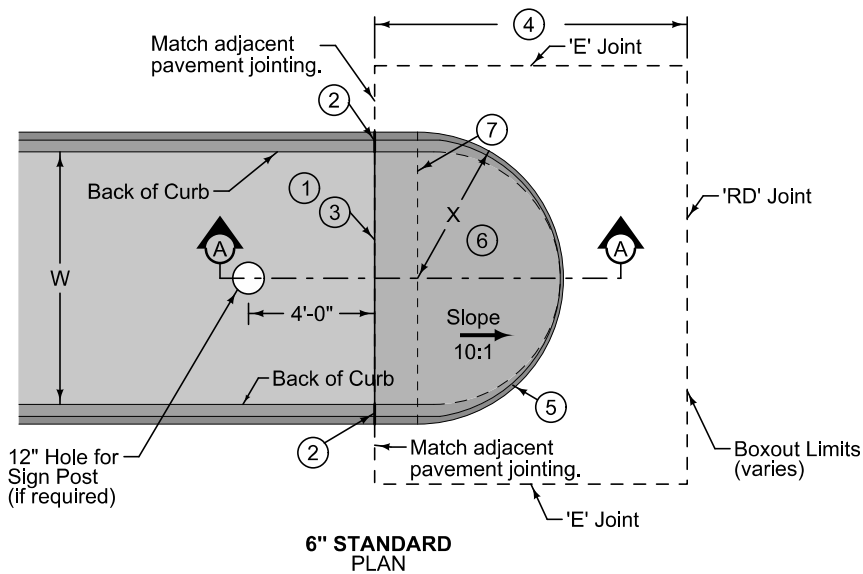


SECTION A-A ④
(For three-piece floating casting)

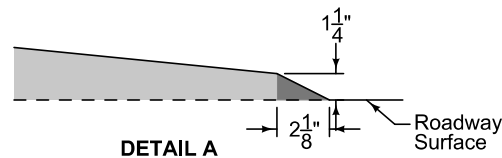
SUDAS Iowa Department of Transportation	REVISION
	New 04-19-11
FIGURE 7010.103	STANDARD ROAD PLAN
Paul D. Weigand SUDAS DIRECTOR	
Deanna Markfeld DESIGN METHODS ENGINEER	

REVISIONS: New. Joint Standard with SUDAS.

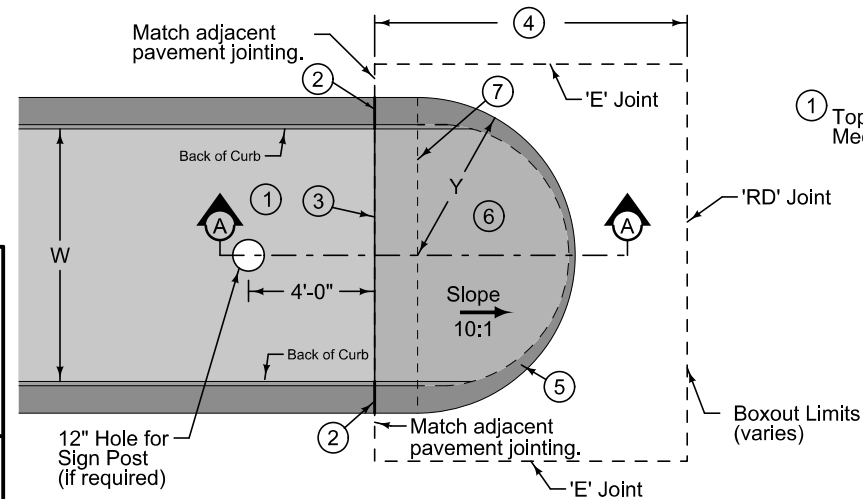
MANHOLE BOXOUTS IN
PCC PAVEMENT



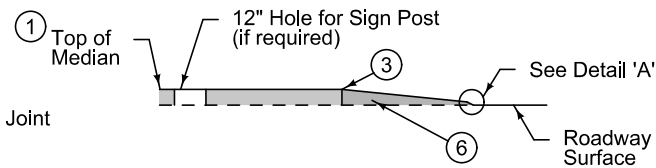
6" STANDARD PLAN



DETAIL A



6" SLOPED PLAN



SECTION A-A

RAMPED MEDIAN NOSE
(Median Width 8'-0" or Less)

- ① For details of paved median, see contract documents.
- ② 'EE' Joint. Expansion joints located at the end of normal curb.
- ③ 'E' Joint. If median is paved, place expansion joints at the end of normal curb.
- ④ If boxout length is less than or equal to 12 feet, provide 'C' Joint. If boxout length is greater than 12 feet, provide 'RD' joint.
- ⑤ Special shaping of curb.
- ⑥ Quantities for ramped median nose area is included in roadway pavement quantities.
- ⑦ When X or Y is 4 feet or greater the expansion joints will be at the beginning of the rounded median.
W = Width from back of curb to back of curb
X = $W/2 + 7.5'$
Y = $W/2 + 12'$

SUDAS Iowa Department of Transportation	REVISION
	New 04-19-11
FIGURE 7010.104	STANDARD ROAD PLAN
PV-104	
SHEET 1 of 1	

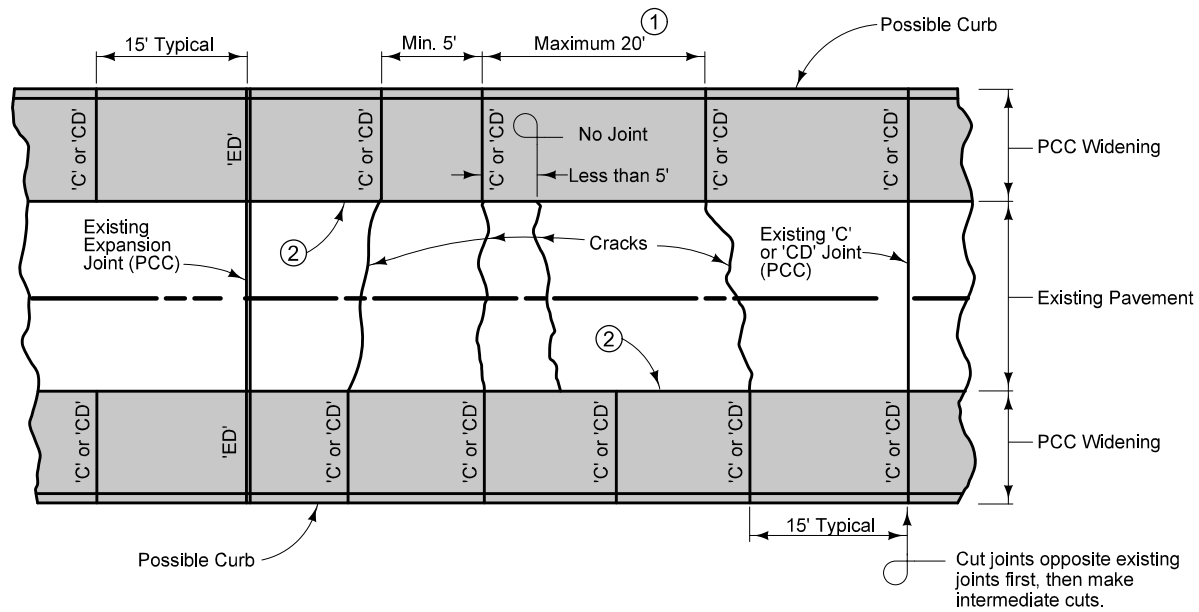
REVISIONS: New. Previously page 2 of PV-2.

Paul D. Wiegand SUDAS DIRECTOR
Deanna Marfield DESIGN METHODS ENGINEER

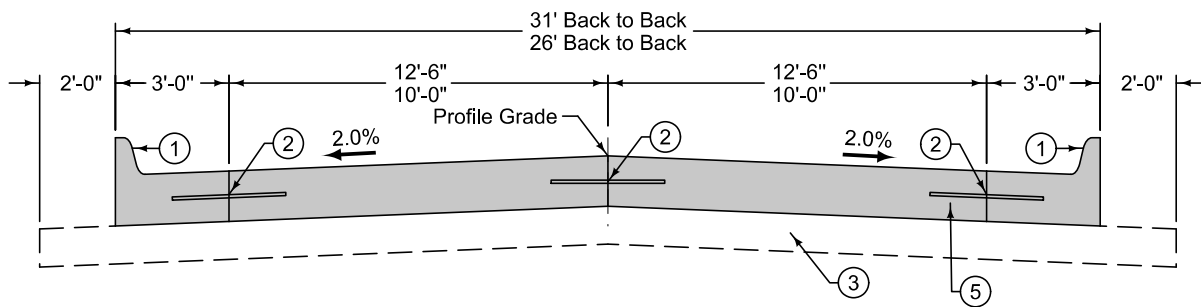
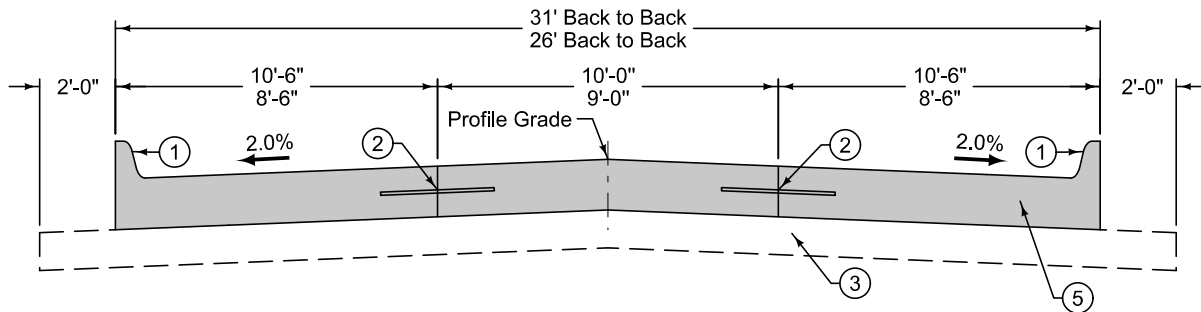
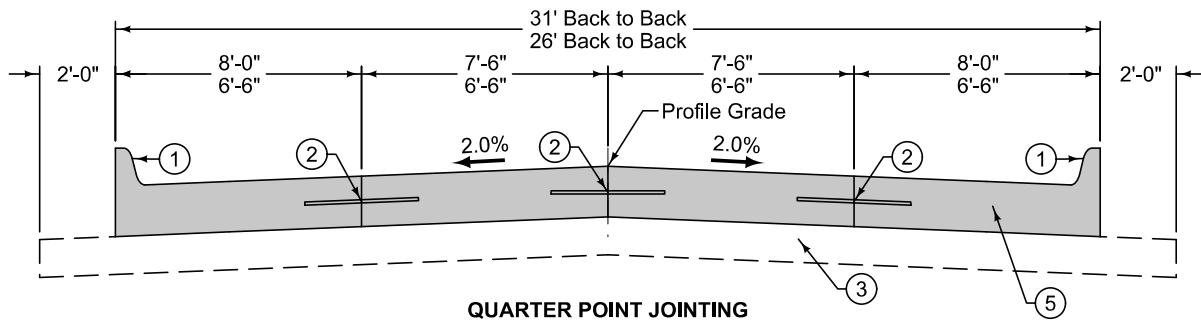
RAMPED MEDIAN NOSE

For joint details, see PV-101.
 For curb details, see PV-102.

- ① If more than 20 feet, add extra joint at midpoint.
- ② 'BT' Joint.



SUDAS IOWADOT	REVISION	1	04-21-15
	FIGURE 7010.121	STANDARD ROAD PLAN	PV-121
			SHEET 1 of 1
REVISIONS: Added circle note 2 and replaced the DOT logo in the title block with the new version.			
Paul D. Wigand SUDAS DIRECTOR		Brian Smith DESIGN METHODS ENGINEER	
JOINTING PCC PAVEMENT WIDENING			



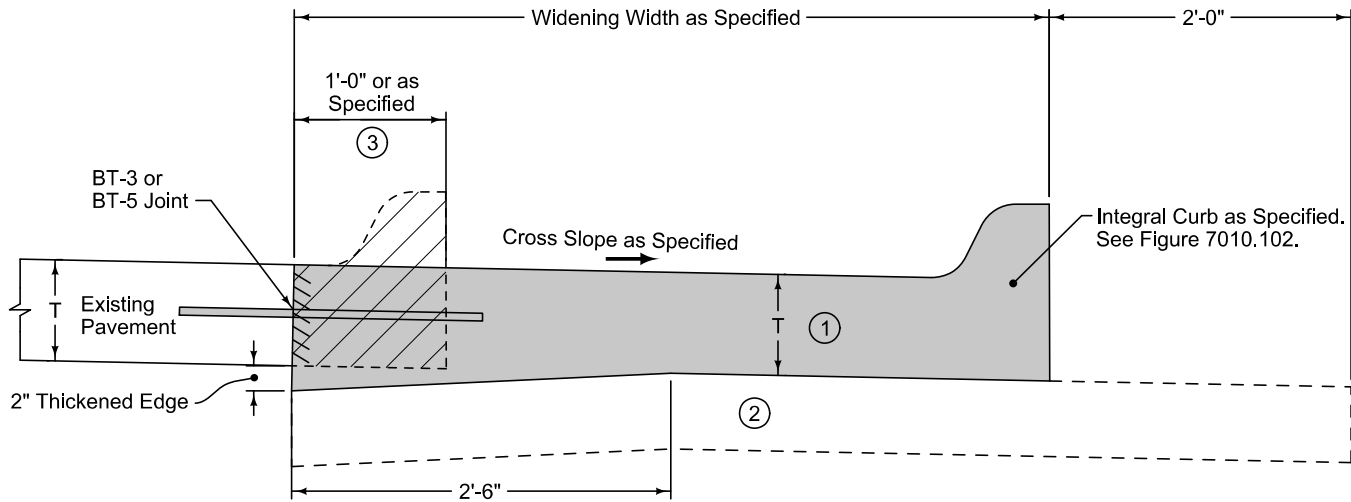
- ① 6 inch standard curb.
- ② BT, KT, or L joint depending on pavement thickness and construction staging.
- ③ Subbase or subgrade as specified.
- ④ Unless otherwise specified in the contract documents.
- ⑤ No dowels within 24" of the back of curb. With gutterline joint, place first dowel 6 inches from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

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

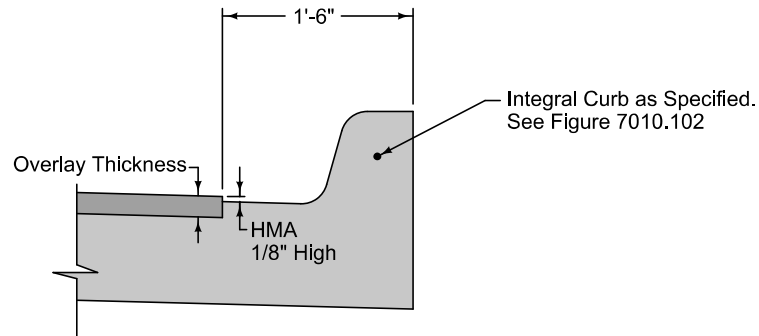
	<small>REVISION</small> 1 10-16-12
	SUDAS 7010.901
	<small>SHEET 1 of 1</small>

SUDAS Standard Specifications

PCC PAVEMENT JOINTING



TYPICAL SECTION



CURB FOR WIDENING WITH HMA OVERLAY

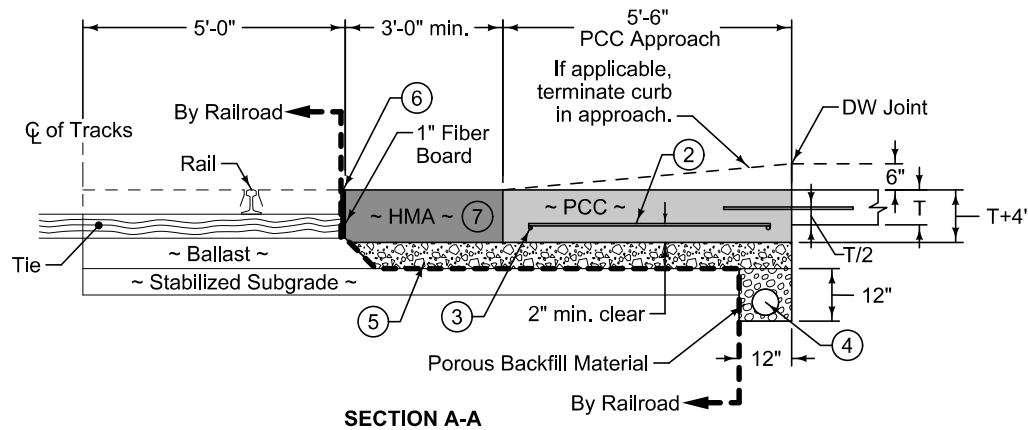
See Figure 7010.121 for typical joint layout.

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

	REVISION
	1 10-15-13
	SUDAS 7010.902
SHEET 1 of 1	

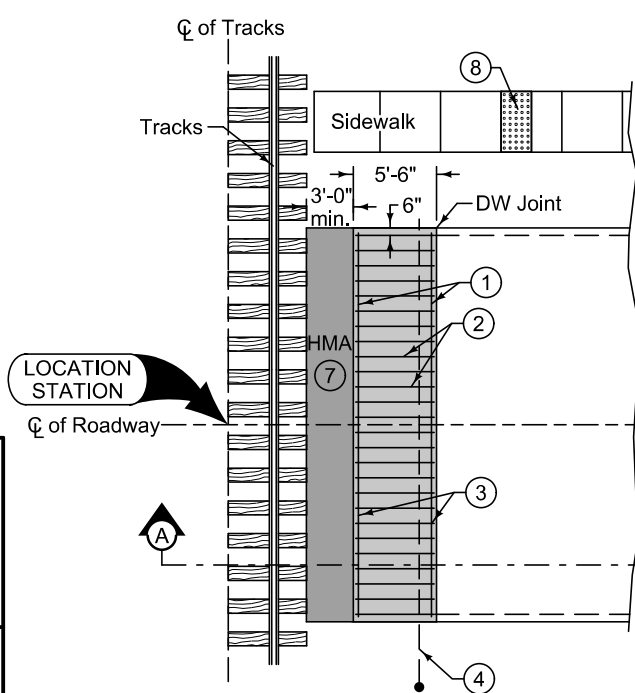
SUDAS Standard Specifications

PCC PAVEMENT WIDENING

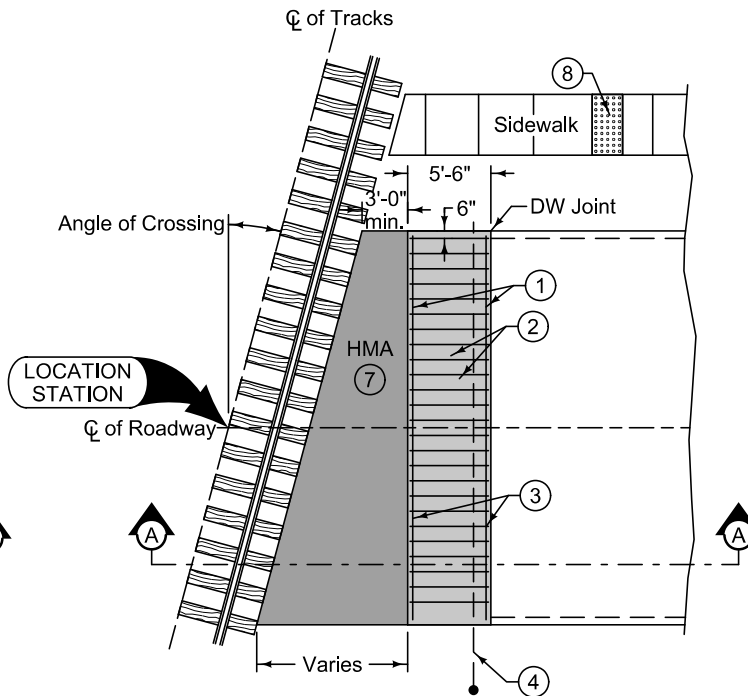


SECTION A-A


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

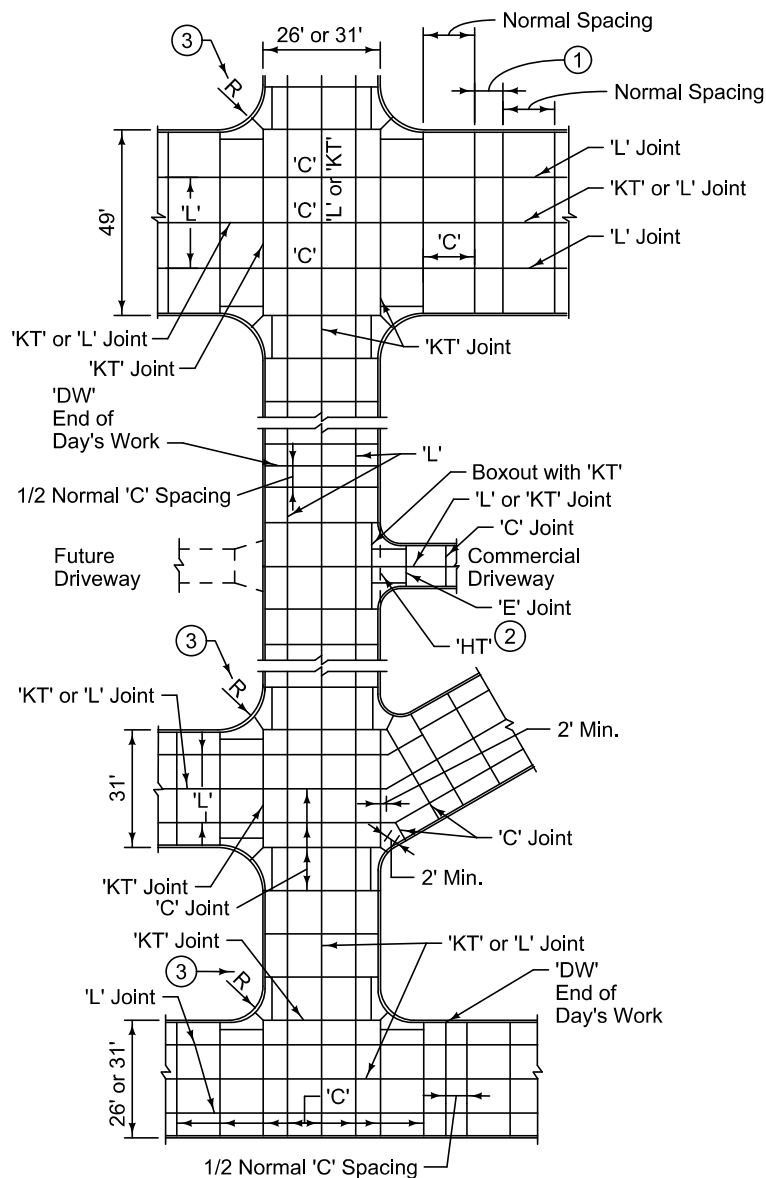


PLAN VIEW - STRAIGHT CROSSING



PLAN VIEW - SKEWED CROSSING

	REVISION 2 10-20-15
	SUDAS 7010.903
	SHEET 1 of 1
SUDAS Standard Specifications	
PCC RAILROAD CROSSING APPROACH	



PLAN VIEW

Refer to Figure 7010.901 for maximum transverse joint spacing.

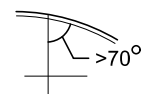
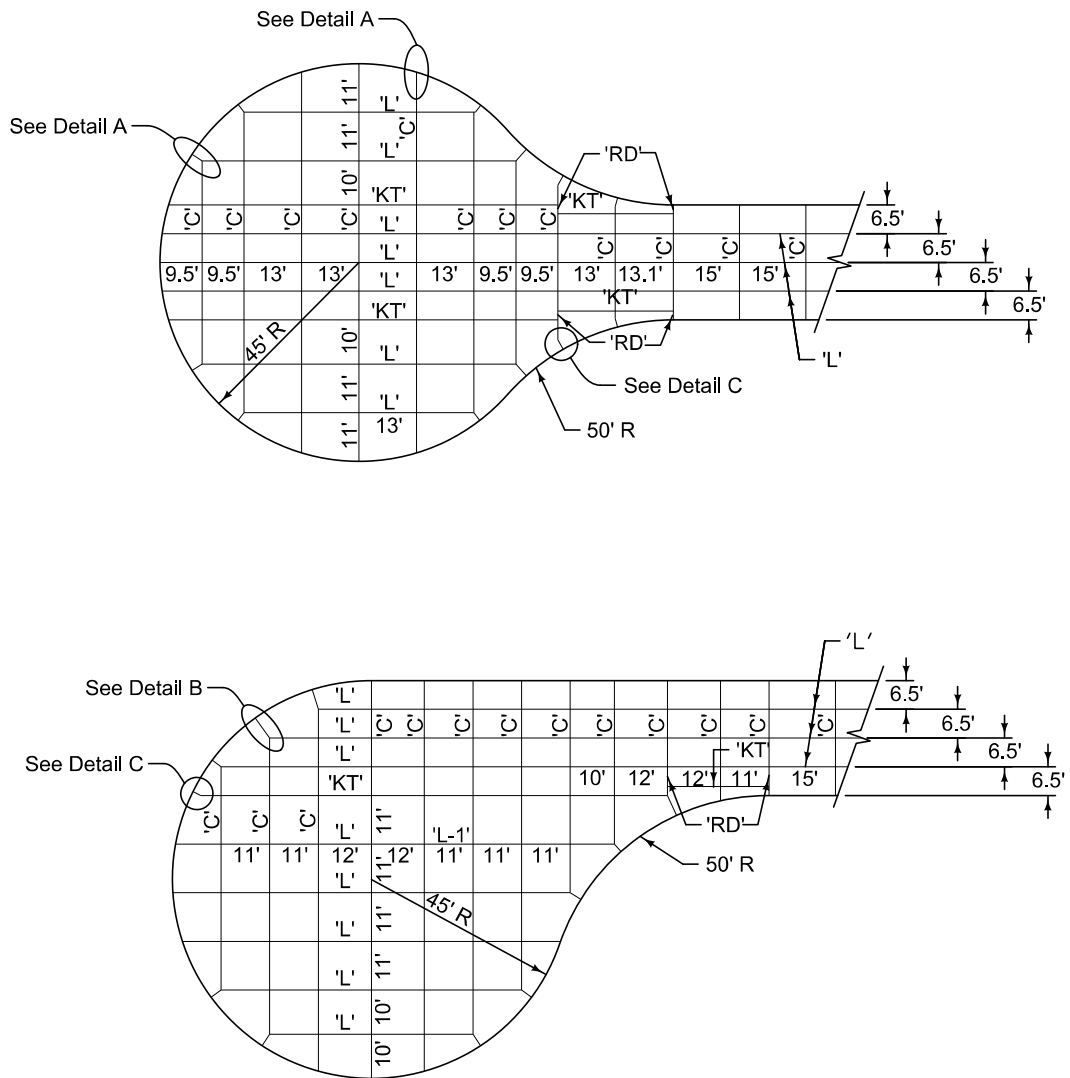
Where new and existing pavements meet, and no existing dowels, tie bars, or keyed joints are present, provide a 'BT', 'RT', or 'RD' joint.

- 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.

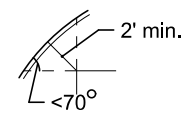
	<small>REVISION</small> New 10-19-10
	SUDAS 7010.904
	<small>SHEET 1 of 1</small>

SUDAS Standard Specifications

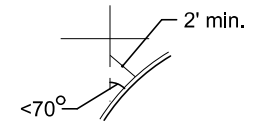
TYPICAL JOINTING LAYOUT



DETAIL A



DETAIL B

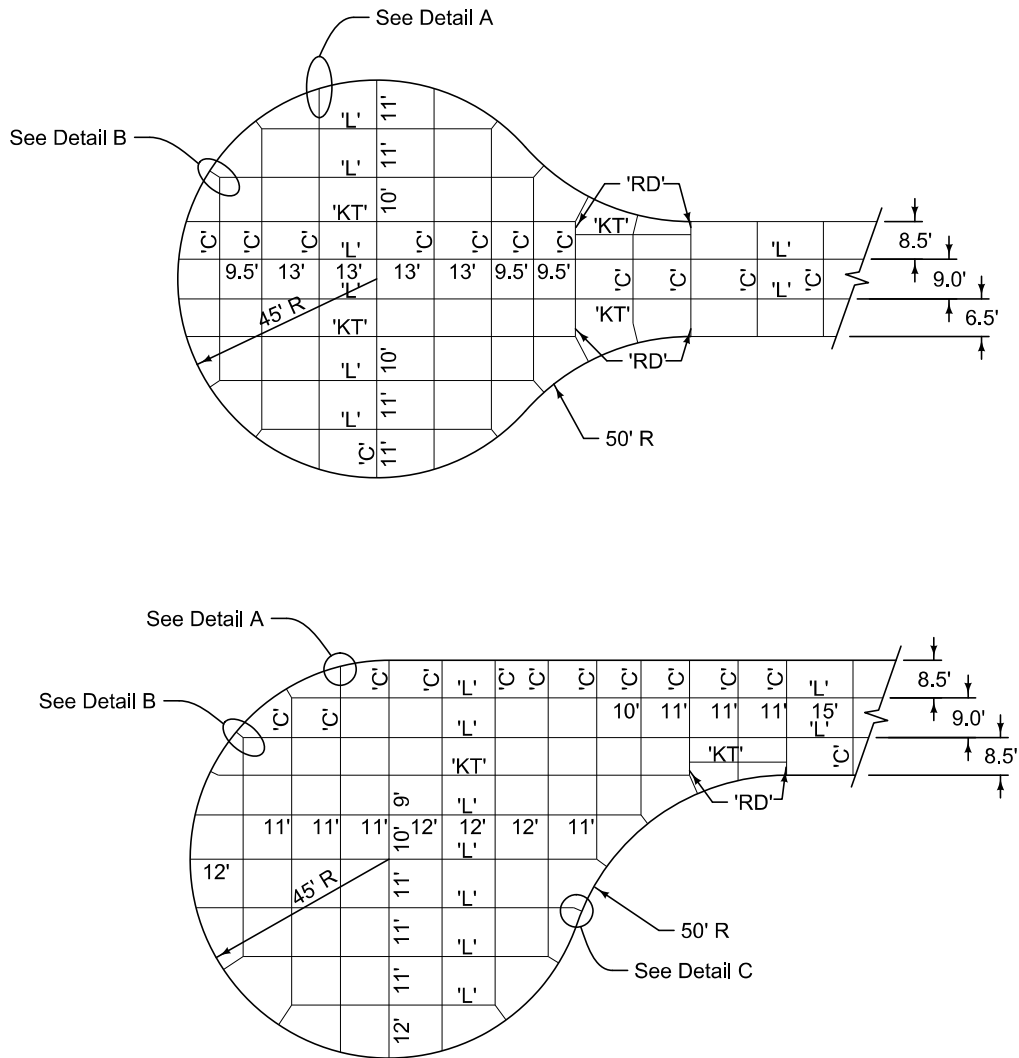


DETAIL C

QUARTER POINT JOINTING

FIGURE 7010.905 SHEET 1 OF 3

	REVISION	
	New	10-19-10
	7010.905	
SUDAS Standard Specifications		
PCC CUL-DE-SAC JOINT LOCATIONS		

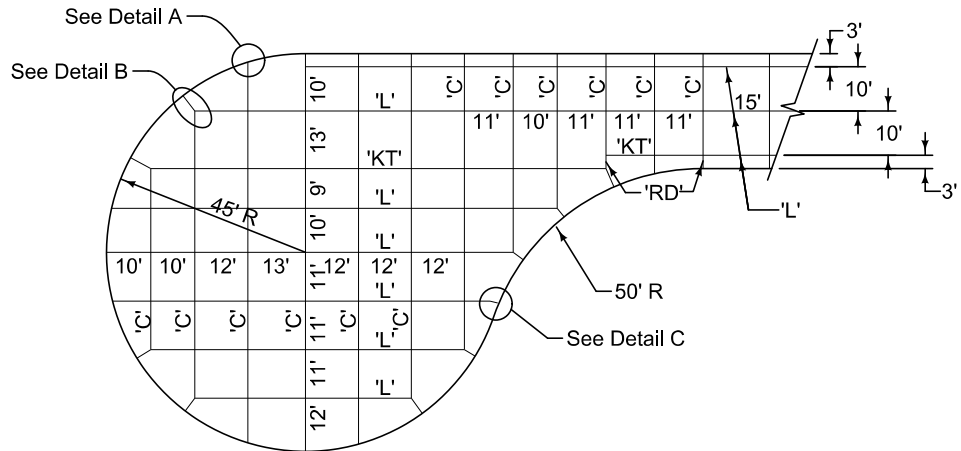
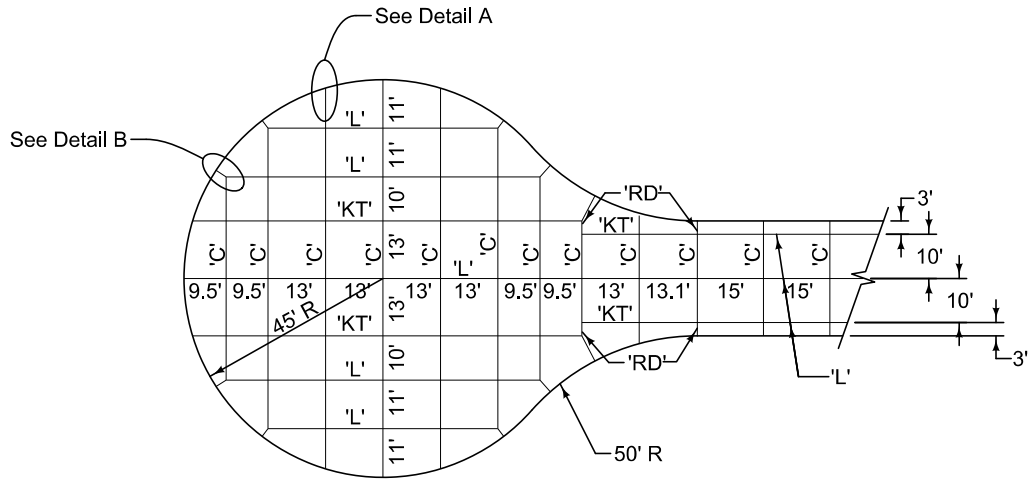


THIRD POINT JOINTING

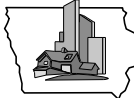
	REVISION
	New 10-19-10
	7010.905
SHEET 2 of 3	

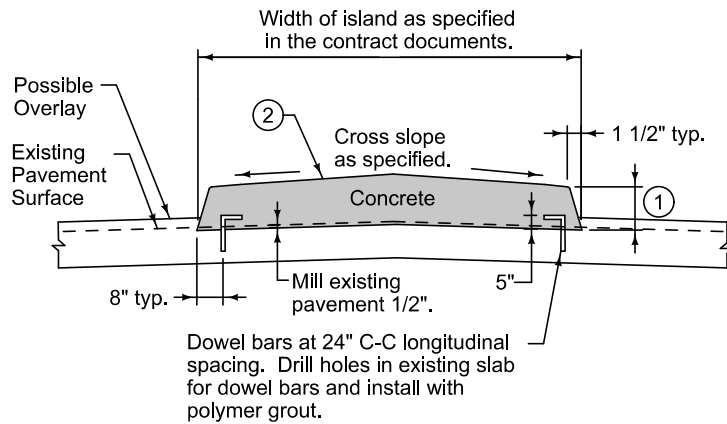
SUDAS Standard Specifications

PCC CUL-DE-SAC JOINT LOCATIONS

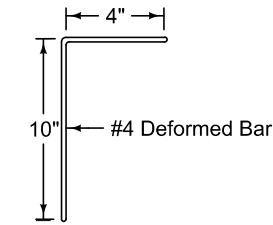


GUTTERLINE JOINTING

	REVISION	
	New	10-19-10
	SUDAS 7010.905	
SUDAS Standard Specifications		
PCC CUL-DE-SAC JOINT LOCATIONS		
SHEET 3 of 3		

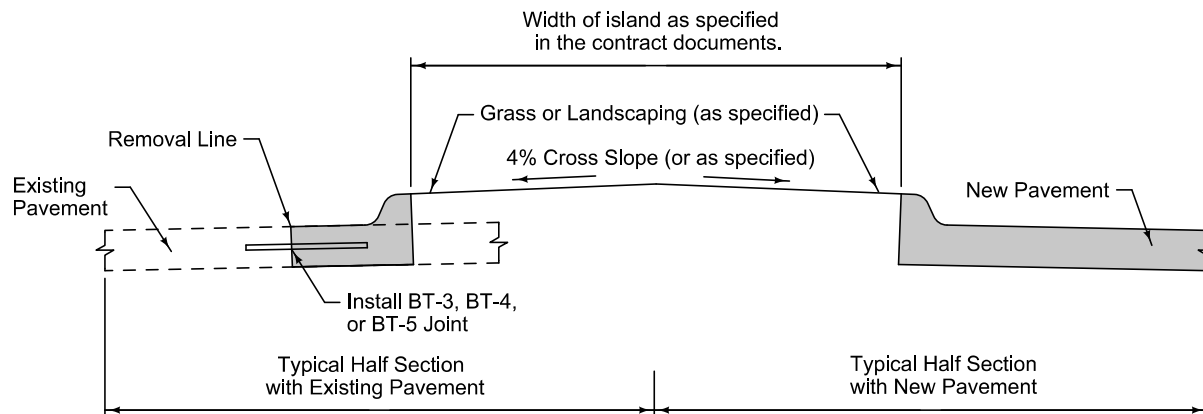


DOWELED MEDIAN



DOWEL BAR DETAIL

- ① Median height as specified in the contract documents.
- ② Construct 'C' joints at a maximum spacing of 15'. Match the joint pattern of the existing pavement. Install expansion joints as directed by the Engineer. Construct expansion joints with 1 inch expansion material. Seal all joints.



LANDSCAPE MEDIAN

	REVISION
	New 10-19-10
	7010.906
SHEET 1 of 1	

SUDAS Standard Specifications

MEDIANS

