TYPICAL CROSS-SECTION: REBUILDING EMBANKMENT WHERE NATURAL GROUND IS GREATER THAN 5 FEET BELOW FINISHED GRADE LINE

Use only when new roadbed overlaps existing roadbed. Not for use on relocations or where new roadbed is to be built on natural ground.

TYPICAL CROSS-SECTION: REBUILDING EMBANKMENT WHERE NATURAL GROUND IS LESS THAN 5 FEET BELOW FINISHED GRADE LINE

TYPICAL TOE FILL CONSTRUCTION

Use care in setting toe fills. Ensure proper drainage in side ditches is maintained.

TYPICAL CROSS-SECTION: EXCAVATION OF PEAT, MUCK, OR OTHER MATERIAL NOT TO BE USED FOR THE CONSTRUCTION OF EMBANKMENTS
1. Embankment Construction: Compact with moisture and density control unless Type A Compaction is specified. Comply with Section 2010, 3.04.

2. Subgrade Preparation: Construct subgrade according to Section 2010, 3.06.

3. Subbase Construction: Construct subbase according to Section 2010, 3.08.

**Type of Work** | **Area** | **Payment Method**
--- | --- | ---
Excavation | A | Excavation
Fill | B | Included in Excavation or Borrow
Subgrade Preparation | C & D | Subgrade Preparation
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

**TRENCH BEDDING AND BACKFILL ZONES**

**STANDARD PLAN**

**FIGURE 3010.101**

**SUDAS DIRECTOR**

**DESIGN METHODS ENGINEER**

**requirements.**

**Refer to the contract documents for specific material and placement**

**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

Bury Depth

Final Trench Backfill

Secondary Backfill

Primary Backfill

Haunch Support

Pipe Bedding

Foundation Stone

Over-excavation and
Foundation Stone

Springline of Pipe

12" min.

OD/2

OD/2

OD/6

d
Use Bedding Class R-1 or R-2 unless specified otherwise.

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

Refer to sheet 2 for bury depth restrictions.

Key:

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

<table>
<thead>
<tr>
<th>Pipe Dia (in)</th>
<th>R1</th>
<th>R2</th>
<th>Class R-3 &amp; R-4 Bedding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>No Steel</td>
</tr>
<tr>
<td>6</td>
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<tr>
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</table>

As = Area of Steel Reinforcing

### Concrete Arch Pipe

<table>
<thead>
<tr>
<th>Pipe Size (in x in)</th>
<th>R3 &amp; R-4</th>
<th>R-3 &amp; R-4 Bedding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>A-III</td>
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<td>18 x 11</td>
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<td>22 x 13</td>
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<tr>
<td>26 x 15</td>
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<td>30 x 18</td>
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<td>7'</td>
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<td>35 x 22</td>
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<td>44 x 27</td>
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<td>51 x 31</td>
<td>42</td>
<td>8'</td>
</tr>
<tr>
<td>58 x 36</td>
<td>48</td>
<td>8'</td>
</tr>
<tr>
<td>65 x 40</td>
<td>54</td>
<td>8'</td>
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<tr>
<td>73 x 45</td>
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<td>8'</td>
</tr>
<tr>
<td>88 x 54</td>
<td>72</td>
<td>9'</td>
</tr>
</tbody>
</table>

Based on Class R-3 bedding

### Horizontal Elliptical RCP

<table>
<thead>
<tr>
<th>Pipe Size (in x in)</th>
<th>R-3 &amp; R-4 Bedding</th>
<th>R-3 &amp; R-4 Bedding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Steel</td>
<td>A=0.4%</td>
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<tr>
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<tr>
<td>72 x 15</td>
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</tbody>
</table>

Based on Class R-3 bedding

### Vertical Elliptical RCP

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<tr>
<th>Pipe Size (in x in)</th>
<th>R-3 &amp; R-4 Bedding</th>
<th>R-3 &amp; R-4 Bedding</th>
</tr>
</thead>
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<td></td>
<td>No Steel</td>
<td>A=0.4%</td>
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<tr>
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<td>15'</td>
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<tr>
<td>15 x 12</td>
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<tr>
<td>18 x 13</td>
<td>16'</td>
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<tr>
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<tr>
<td>24 x 16</td>
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<td>33 x 18</td>
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</tr>
<tr>
<td>72 x 15</td>
<td>25'</td>
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</table>

Based on Class R-3 bedding
DO NOT USE ON PRIMARY ROADWAYS

### Bedding Classes

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>SDR 23.5</th>
<th>SDR 26</th>
<th>SDR 35</th>
<th>SDR 35</th>
<th>Corrug Ext Circ</th>
<th>Composite (Truss Type)</th>
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<tr>
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<td>24'</td>
<td>32'</td>
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<td>24'</td>
<td>24'</td>
<td>24'</td>
<td>24'</td>
<td>32'</td>
</tr>
</tbody>
</table>

### PVC Pipe

**Class I Bedding Material**

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

### HDPE Pipe

**Class I Bedding Material**

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

### Polypropylene Pipe

**Class I Bedding Material**

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

### Key

- **OD** = Outside diameter of pipe
- **TW** = Trench width at top of pipe

- Minimum depth of bury 12 inches or as specified by the manufacturer.

**FOR SALE BY**

SUDAS

**SHEET 1 of 1**

**SW-103**

**REVISION** 04-20-21

**FIGURE 3010.103 STANDARD ROAD PLAN**

**REVISIONS:** Added note DO NOT USE ON PRIMARY ROADWAYS.
**DUCTILE IRON, AWWA C151, CLASS 52**

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>Class P-1 Bedding</th>
<th>Class P-2 Bedding</th>
<th>Class P-3 Bedding</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>40'</td>
<td>40'</td>
<td>40'</td>
</tr>
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<td>40'</td>
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</tr>
<tr>
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</table>

**PVC, AWWA C900, DR18**

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>Class P-1 Bedding</th>
<th>Class P-2 Bedding</th>
<th>Class P-3 Bedding</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
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<td>23'</td>
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</tr>
<tr>
<td>24</td>
<td>19'</td>
<td>23'</td>
<td>40'</td>
</tr>
</tbody>
</table>

**Class I Bedding Material**

- Loose, Suitable Backfill Material or Undisturbed Material with Bell Shaping

**Depth of Bedding Material below Pipe:**
Min. = OD/8 OR 4 inches

**Trench Width at Top of Pipe:**
\[ TW = \frac{OD}{4} \]

**Key**

- OD = Outside diameter of pipe
- TW = Trench width at top of pipe
- Min. = OD/8 or 4 inches (whichever is greater)
- d = Depth of bedding material below pipe
  - Min. = OD/8 or 4 inches (whichever is greater)

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

---

**Figure 3010.104**

**Standard Road Plan**

**SUDAS**

**SW-104**

**Revisions:**
- Added note: **DO NOT USE ON PRIMARY ROADWAYS**
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.

Install compacted clay waterstop between pipe joints.

When specified in the contract documents, install waterstops at a nominal spacing of 800 feet or at locations as specified by the Engineer.
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
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.

Comply with Figure 3010.101.
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

Comply with Figure 3010.101
1. Place bedding and backfill material as required for sewer main.

2. Service Line Slope:
   - 4 inch: 2% to 5%
   - 6 inch and greater: 1% to 5%

Sanitary Sewer Main

Sanitary Sewer Main Trench Wall

Tee or Wye

Location Post

ROW Line

Service Line

Cap or Plug

Class I Bedding Material

22.5° to 45°

Slope 2

10' to 12'

10'

SHEET 1 OF 2

SANITARY SEWER SERVICE STUB

SANITARY SEWER MAIN TRENCH WALL

Service Line Slope:
- 4 inch: 2% to 5%
- 6 inch and greater: 1% to 5%

Place bedding and backfill material as required for sewer main.

Revisions:
- Changed 1 to I on Bedding Material.
Place bedding and backfill material as required for sewer main.

Service Line Slope:
- 4 inch: 2% to 5%
- 6 inch and greater: 1% to 5%

If service riser slope is steeper than 1:1, construct riser of entire service line with schedule 40 PVC (ASTM D 1785) or ductile iron (AWWA C151, Class S2). Use single length of pipe for riser, if possible.
Adjustment Rings
Arched Opening
Square Edge
Arched Opening

1. SW-501 Type A or SW-602 Type G casting.
2. Place bedding material to springline of pipe.
3. Prevent riser from bearing on pipe by providing an arched opening with a diameter up to 6 inches larger than pipe diameter.

TYPICAL SECTION

SECTION A-A

12''

12''

Class I Bedding Material
SANITARY SEWER CLEANOUT

1. Standard duty casting complying with AASHTO M 306. Mark id with "Sanitary" or "Sanitary C.O."

2. Do not allow casting to bear on top of riser pipe.

3. 6 inch PVC Service Pipe

4. Threaded PVC cap or iron body ferrule with brass screw plug

Dimensions are nominal.

CLEANOUT

- 6" PVC Riser
- 45° Bend
- Wye
- Sewer Main
- Plug
- 20" min. Concrete Pad
- #4 Bar (typ.)
- Casting
- Cap
1. Zone of conflict is from 6 inches below the bottom of sewer pipe to 2 inches above the top of pipe.

### Service Status

<table>
<thead>
<tr>
<th>Service Status</th>
<th>Contractor's Responsibility</th>
<th>Compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Service located outside zone of conflict</td>
<td>Provide protection; if damaged, repair according to local government’s plumbing code</td>
<td>Incidental to other work</td>
</tr>
<tr>
<td>2. Service located in zone of conflict</td>
<td>Relocate service according to Section 4010, 3.07</td>
<td>Bid item; sanitary sewer service relocation</td>
</tr>
<tr>
<td>3. Service located in zone of conflict, but elevations do not allow simple</td>
<td>Relocate service as directed by the Engineer</td>
<td>Change order</td>
</tr>
<tr>
<td>relocation as detailed above; special design required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TYPE PC-1 CONCRETE COLLAR CONNECTION**

1. Lap ends of wire mesh a minimum of 6 inches.
2. Concrete collar is required when annular space between the outside of the pipe and the wall of the structure is 2 inches or greater.
3. Provide two #4 hoop bars in concrete collar. Lap bars a minimum of 6 inches.
4. Trowel concrete flush with inside wall of structure.

**TYPE PC-2 CONCRETE COLLAR CONNECTION**

1. Trim pipe and fill voids with mortar.
2. Wall of Precast Manhole or Intake Structure
3. Lap ends of wire mesh a minimum of 6 inches.
4. Concrete collar is required when annular space between the outside of the pipe and the wall of the structure is 2 inches or greater.
5. Provide two #4 hoop bars in concrete collar. Lap bars a minimum of 6 inches.
6. Trowel concrete flush with inside wall of structure.

**PIPE TO PIPE CONNECTION**

1. 6"x6" - w2xw2 (8ga.) Wire Mesh
2. 6" min.
3. 12" min.
4. Overlap fabric 12" at top of pipe.

**PIPE TO STRUCTURE CONNECTION**

1. Wall of Precast Manhole or Intake Structure
2. 6" min.
3. Lap bars a minimum of 6 inches.
4. Trowel concrete flush with inside wall of structure.

**CONCRETE COLLAR FOR PIPES 12" AND SMALLER**

1. 6" min.
2. 4" min.
3. Wall of Precast Manhole or Intake Structure
4. 4" min.
5. 9" min.
6. Lap bars a minimum of 6 inches.
7. Trowel concrete flush with inside wall of structure.

**CONCRETE COLLAR FOR PIPES GREATER THAN 12"**

1. 6" min.
2. 4" min.
3. Wall of Precast Manhole or Intake Structure
4. 4" min.
5. 9" min.
6. Lap bars a minimum of 6 inches.
7. Trowel concrete flush with inside wall of structure.
REINFORCING BAR LIST

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**Dimension E** shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

1. Tongue end used on inlet end section. Groove end used on outlet end section.

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**SUDAS Standard Specifications**

**CIRCULAR CONCRETE APRONS**
Dimension "E" shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

Tongue end used on inlet end section. Groove end used on outlet end section.
Provide guard dimensions to fit with type of apron provided. Ensure "V" Bar completely rests on apron.

All guards must include at least one intermediate cross bar. If pipe diameter, or equivalent diameter, is 60 inches or greater, use two intermediate cross bars equally spaced.
**FIGURE 4030.225**

**METAL PIPE APRONS AND APRON GUARDS**

1. On sizes 60 inches and larger, supplement the reinforced edge with a galvanized stiffener angle attached with bolts.

2. Install a galvanized toe plate (of the same gauge metal as apron) on all aprons 24 inch diameter and larger.

3. Hold inside bars up 3 inches off bottom of apron. Extend outside bars to bottom of apron and attach to 2 inch by 2 inch by 1/4 inch steel angle.

4. When specified, extend bottom cross bar through apron.

**DIMENSIONS**

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**SUDAS Standard Specifications**

**METAL PIPE APRON**

**METAL APRONS GUARD**

**PLAN VIEW**

**SIDE VIEW**

**END VIEW**

**SIDE VIEW**

**CORRUGATED METAL PIPE**

**METAL APRON GUARD**

**METAL APRON**

**DIMENSIONS**

- **Diameter**
- **Toe Plate**
- **Approx.**
- **Lap Joint (permissible)**
- **Corner Plate**
- **Reinforced Edge**
- **Bolt or weld plate to CMP pipe.**
- **3/4 inch rebar**
- **3/8 inch steel plate**
- **2" to 8"**
Type 1 installation is for longitudinal subdrain only. Type 2 installation is for combination subdrain/footing drain collectors.

1. Place perforations down for all installations.

2. When concrete pipe is specified, wrap pipe joints with engineering fabric. Do not apply joint sealant. Comply with Figure 4020.211.
Use in non-traffic areas.

1. Light duty casting. Label lid with "Storm" or "Storm C.O."
2. Do not allow casting to bear on top of riser pipe; provide 2 inch clearance, minimum.
3. A manufactured cleanout may be used in lieu of a Type B cleanout, if approved by the Engineer.
4. Design is intended for use in conjunction with 8 inch PVC riser pipe. Other sized caps may be used with smaller pipe, as approved by the Engineer.
5. Provide Type G casting, as required to fit pipe size.
6. PVC riser pipe; match diameter of subdrain (8 inches maximum).

Concrete Invert

6" Class I Bedding

Concrete

Subdrain

45° Bend

Wye

45° Bend

Casting, See Detail A

#4 Hoop

Threaded PVC Cap or Iron Body Ferrule with Brass Screw Plug


dimensions are nominal

FIGURE 4040.232
SHEET 1 OF 1

SUDAS Standard Specifications

SUBDRAIN CLEANOUTS
Subdrain outlets require only single outlets. Install double outlet pipes on all longitudinal subdrain systems, except at the beginning and end of the system. At these locations, install a single outlet pipe.

1. Fill annular space with non-shrink grout.
2. Outlets through intake walls to be CMP; corrugated, double-walled HDPE, or PVC.
3. Provide 6 inch minimum drop in elevation outlet.
4. Provide a minimum trench width of 12 inches for a single outlet and 24 inches for a double outlet.
5. If a CMP outlet is specified in the contract documents, construct the final 10 to 12 feet of the subdrain outlet to ditch with CMP 2 inches larger than the subdrain pipe. Connect pipes with a manufactured coupler or concrete collar.
6. Provide a minimum 1 foot radius for all bends or use two 45° fittings.
7. Provide a minimum trench width of 12 inches for a single outlet and 24 inches for a double outlet.
8. Provide a 6 inch minimum drop in elevation between longitudinal subdrain and outlet.
9. Use only fork type rodent guard for subdrain outlet to ditch.
Extend thrust blocks to undisturbed soil. Excavation into trench wall may be necessary.

Form vertical surfaces of poured concrete thrust blocks except on bearing surface.

Encase all fittings in polyethylene wrap. Do not allow concrete to directly contact joints or fitting bolts.

<table>
<thead>
<tr>
<th>Diameter of Pipe, D (inches)</th>
<th>11.5°</th>
<th>22.5°</th>
<th>45°</th>
<th>90°</th>
<th>115°</th>
<th>135°</th>
<th>145°</th>
<th>165°</th>
<th>180°</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
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<tr>
<td>6</td>
<td>1</td>
<td>2</td>
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<td>8</td>
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<td>14</td>
<td>5</td>
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<td>33</td>
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<td>7</td>
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<td>18</td>
<td>9</td>
<td>17</td>
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<td>65</td>
<td>45</td>
<td></td>
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<td></td>
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<tr>
<td>20</td>
<td>11</td>
<td>21</td>
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<td>24</td>
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<td>31</td>
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<td>111</td>
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<td>26</td>
<td>24</td>
<td>47</td>
<td>92</td>
<td>171</td>
<td>120</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>36</td>
<td>34</td>
<td>67</td>
<td>132</td>
<td>244</td>
<td>173</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Minimum bearing area based on water pressure of 150 psi and allowable soil pressure of 1,000 psi.
Revised Iowa DOT and SUDAS logos with new logos.

1. Extend tracer wire up fire hydrant barrel to internal terminals of tracer wire station and back down. Refer to WM-201 for details of fire hydrant assembly.

2. Clamp tracer wire to ground rod at system termination points.

- Anchor Tee
- Fire Hydrant
- New Water Main
- Fire Hydrant Valve
- Possible Splice
- Tape wire at midpoint of each pipe length
- Do not run wire up valve box
- Ground Rod
- Fire Hydrant Barrel
- Tape wire at midpoint of each pipe length
- Do not run wire up valve box
- Ground Rod
- Fire Hydrant Barrel
This figure details minimum required clearances between structure and water service lines. Adjust location of water services as directed by the Engineer to maintain the clearances shown.
Design Methods Engineer
Sudas Director

Location Station

Fire Hydrant (typ.)
Tracer Wire
Breakaway Flange
Finish Grade

Station Tracer Wire
Flange Breakaway
Finish Grade Wires
Tracer 12'' min.
Thrust Block
Concrete Solid Anchor Pipe

Valve Box 18'' min.
Nozzle Lowest
Valve Box 20'' to 23''

Min. depth as specified for water main
Shoe Valve

TYPICAL SECTION

Porous Backfill Pea Gravel or
Valve Gate
Fire Hydrant Assembly

1. Do not cover drain holes or tracer wire.

LOCATION STATION

18'' min.
Lowest Nozzle

2'' to 5''

12'' min.

Min. depth as specified for water main

Shoe Valve

1. Do not cover drain holes or tracer wire.

TYPICAL PLAN

18'' min.

ALTERNATE PLAN

18'' min.

Use ductile iron pipe with restrained mechanical joints for fire hydrant assembly and anchor tee.

All shaded items are included in the Fire Hydrant Assembly bid item.

1. Do not cover drain holes or tracer wire.
12 inch minimum riser height above all pipe openings.

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

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

1. For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.
2. 12 inch minimum riser height above all pipe openings.

<table>
<thead>
<tr>
<th>Manhole Diameter (inches)</th>
<th>Maximum Pipe Diameter (inches) for 2 Pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At 180° Separation</td>
</tr>
<tr>
<td>48</td>
<td>24</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
</tr>
<tr>
<td>72</td>
<td>42</td>
</tr>
<tr>
<td>84</td>
<td>48</td>
</tr>
<tr>
<td>95</td>
<td>60</td>
</tr>
</tbody>
</table>
Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

Install infiltration barrier.

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

Install infiltration barrier.

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

Provide two #4 hoop bars at top opening and at all pipe openings.

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.

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.

12 inch minimum wall height above all pipe openings.
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**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td>36&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td>Long Wall plus 18&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4b3</td>
<td>4</td>
<td>Base</td>
<td>Short Wall plus 18&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4t1</td>
<td>4</td>
<td>Top</td>
<td>36&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td>Long Wall plus 12&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td>Short Wall plus 12&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Wall</td>
<td>Short Wall plus 48&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Wall</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Wall</td>
<td>Long Wall plus 12&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>
If manhole depth exceeds 20 feet, install steps.
Install infiltration barrier.

1. For new pipe connections, provide cored opening with flexible pipe connector.
2. For existing pipe connections, provide an arched opening with a diameter up to 6 inches larger than outside diameter of pipe. Install waterstop around existing pipe. Fill void between pipe and opening with non-shrink grout.
3. For additional configurations, maintain a minimum of 12 inches of concrete between vertical edges of pipe openings.
4. 12 inch minimum riser height above all pipe openings.

<table>
<thead>
<tr>
<th>Manhole Diameter (inches)</th>
<th>Maximum Pipe Diameter (inches) for 2 Pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 180° Separation</td>
<td>At 90° Separation</td>
</tr>
<tr>
<td>48</td>
<td>24</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
</tr>
<tr>
<td>72</td>
<td>42</td>
</tr>
<tr>
<td>84</td>
<td>48</td>
</tr>
<tr>
<td>96</td>
<td>60</td>
</tr>
</tbody>
</table>

Casting:
- SW-601

Locations Station 1, 2, 3, 4

Other notes:
- Cast in-place concrete fillet
- Minimum 12 inches of concrete riser height above all pipe openings
- Infiltration barrier
- Steps if manhole depth exceeds 20 feet

 SANITARY SEWER MANHOLE
 OVER EXISTING SEWER
Joint Sealant (typ.)

Base 6'' min.

36'' dia.

Precast Riser Section

Precast Top

27''

Adjustment Rings

Precast Top

Concrete Fillet

6'' x 6'' Filleted Concrete Collar

Square Bearing Edge

Two #5 Hoop Bars

Intermediate Top

Hoop Bars (typ.)

Base

Concrete Collar 6'' x 6'' Filleted

Edge Bearing

5t1 5w1

5t3 5w4

5t3

5w2

5w4

22'-0'' max.)

(12'-0'' min. to 12 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

12 inch minimum wall height above all pipe openings.

Install infiltration barrier.

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

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

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

4. If manhole depth exceeds 20 feet, install steps.

Provide two #5 hoop bars at intermediate top opening.

Provide 12 inches of wall width (minimum) each side of pipe opening.

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

Install infiltration barrier.

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

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

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

4. If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

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

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

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

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Install infiltration barrier.

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

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

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

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Install infiltration barrier.

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

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

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

4. If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

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

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

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

4. If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.
### REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
</tr>
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<tbody>
<tr>
<td>5t1</td>
<td>5</td>
<td>Top</td>
<td>Long Wall plus 20''</td>
<td>48''</td>
<td>12''</td>
</tr>
<tr>
<td>5t2</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20''</td>
<td>8''</td>
<td>12''</td>
</tr>
<tr>
<td>5t3</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20''</td>
<td>43''</td>
<td>12''</td>
</tr>
<tr>
<td>5t4</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 26''</td>
<td>12''</td>
<td></td>
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<tr>
<td>5b1</td>
<td>5</td>
<td>Base</td>
<td>Short Wall plus 68''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>5b2</td>
<td>5</td>
<td>Base</td>
<td>Long Wall plus 26''</td>
<td>9''</td>
<td></td>
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<tr>
<td>5b3</td>
<td>5</td>
<td>Base</td>
<td>Short Wall plus 26''</td>
<td>9''</td>
<td></td>
</tr>
<tr>
<td>5w1</td>
<td>5</td>
<td>Top</td>
<td>Wall Height minus 4''</td>
<td>12''</td>
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<tr>
<td>5w2</td>
<td>5</td>
<td>Top</td>
<td>Wall Height minus 8''</td>
<td>12''</td>
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<td>5w4</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20''</td>
<td>12''</td>
<td></td>
</tr>
</tbody>
</table>

### BENT BARS

- Short Wall plus 20''
- Wall Height minus 4''
- Wall Height minus 8''
- Long Wall plus 20''
- Short Wall plus 20''

### Instructions

1. Provide two #5 hoop bars at intermediate top opening and at all pipe openings.
2. 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.
For sewer pipes less than 48 inches in diameter, install eccentric reducers/increasers with a standard tee or utilize a composite tee.

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.
**COMPOSITE TEE DIMENSIONS**

<table>
<thead>
<tr>
<th>Size</th>
<th>D1</th>
<th>H</th>
<th>T1</th>
<th>T2</th>
<th>C</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; on 12&quot;</td>
<td>12&quot;</td>
<td>50&quot;</td>
<td>8½</td>
<td>29½</td>
<td>43½</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 15&quot;</td>
<td>15&quot;</td>
<td>50&quot;</td>
<td>7</td>
<td>28</td>
<td>43</td>
<td>5400 lbs.</td>
</tr>
<tr>
<td>48&quot; on 18&quot;</td>
<td>18&quot;</td>
<td>50&quot;</td>
<td>5½</td>
<td>26½</td>
<td>44½</td>
<td>5200 lbs.</td>
</tr>
<tr>
<td>48&quot; on 21&quot;</td>
<td>21&quot;</td>
<td>48&quot;</td>
<td>9½</td>
<td>17½</td>
<td>38½</td>
<td>5800 lbs.</td>
</tr>
<tr>
<td>48&quot; on 24&quot;</td>
<td>24&quot;</td>
<td>48&quot;</td>
<td>8</td>
<td>16</td>
<td>40</td>
<td>5500 lbs.</td>
</tr>
<tr>
<td>48&quot; on 27&quot;</td>
<td>27&quot;</td>
<td>48&quot;</td>
<td>9½</td>
<td>11½</td>
<td>38½</td>
<td>5900 lbs.</td>
</tr>
<tr>
<td>48&quot; on 30&quot;</td>
<td>30&quot;</td>
<td>48&quot;</td>
<td>8</td>
<td>10</td>
<td>40</td>
<td>5300 lbs.</td>
</tr>
<tr>
<td>48&quot; on 33&quot;</td>
<td>33&quot;</td>
<td>54&quot;</td>
<td>9½</td>
<td>11½</td>
<td>44½</td>
<td>6600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 36&quot;</td>
<td>36&quot;</td>
<td>54&quot;</td>
<td>8</td>
<td>10</td>
<td>46</td>
<td>6100 lbs.</td>
</tr>
</tbody>
</table>

**COMPOSITE TEE**

Alternate to standard tee with eccentric reducer (for pipes 36" and smaller).
Figure 6010.306

RESERVED FOR FUTURE USE
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 I 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.
1. Core drill openings at least 12 inches from existing manhole joints.

2. Install flexible pipe coupler or pipe joint on new sanitary sewer 18 to 24 inches from outside of manhole wall.

3. Align elbow so discharge is directed at outlet pipe or at 45 degrees to manhole flow.

4. Reshape fillet to provide a smooth transition and to direct flow to outlet.
If manhole depth exceeds 20 feet, install steps.

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 (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

#4 Bars @ 12" o.c. Each Way

8" min. Bedding Material

6" min. Class I Bedding Material

Location Station

Concrete Fillet

Precast Riser Sections

Manhole Diameter

Depth

27" dia

Manhole Diameter

Precast Top

SW-602 Casting

Adjustment Rings

Square Edge

Precast Top

Precast Riser

Bedding Material

8" min. Class I Bedding Material

8" min. 8" min. 12" min

6" min. 6" min. 4" min.

12" min

12" min

4" min.
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.
**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>t1</td>
<td>See Table</td>
<td>Top</td>
<td>Long Wall plus 8&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>t2</td>
<td>See Table</td>
<td>Top</td>
<td>Short Wall plus 8&quot;</td>
<td>6&quot;</td>
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</tr>
<tr>
<td>b1</td>
<td>See Table</td>
<td>Base</td>
<td>Long Wall plus 14&quot;</td>
<td>12&quot;</td>
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</tr>
<tr>
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<td>Base</td>
<td>Short Wall plus 14&quot;</td>
<td>12&quot;</td>
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</tr>
<tr>
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<td>See Table</td>
<td>Walls</td>
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<tr>
<td>w2</td>
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<td>Walls</td>
<td>Short Wall plus 8&quot;</td>
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</tr>
<tr>
<td>w3</td>
<td>See Table</td>
<td>Walls</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- 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.
- Provide two #4 hoop bars at top opening and at all pipe openings.

**Diameter of Largest Pipe, D:**
- 48" or 54": 6
- 33" to 42": 5
- 30" or smaller: 4
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.
### Plan

<table>
<thead>
<tr>
<th>Mark</th>
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<th>Location</th>
<th>Shape</th>
<th>Length</th>
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<td>Top</td>
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<td>Long Wall plus 12&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4t3</td>
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<td>Top</td>
<td></td>
<td>Short Wall plus 12&quot;</td>
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<tr>
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<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
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<tr>
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<td>4</td>
<td>Walls</td>
<td></td>
<td>Long Wall plus 12&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

### Section A-A

- Provide two #4 hoop bars at top opening and at all pipe openings.
- 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.
- 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.

### Notes

- Provide two #4 hoop bars at top opening and at all pipe openings.
- 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.
- 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.
Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

If manhole depth exceeds 20 feet, install steps.

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.
### REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
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<th>Location</th>
<th>Shape</th>
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<td>9&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
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<td>5</td>
<td>Top</td>
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<td>9&quot;</td>
<td>12&quot;</td>
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<tr>
<td>5t4</td>
<td>5</td>
<td>Top</td>
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<td>8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5b1</td>
<td>5</td>
<td>Base</td>
<td></td>
<td>43&quot;</td>
<td>12&quot;</td>
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<tr>
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<td>Base</td>
<td>Long Wall plus 26&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
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<td>Base</td>
<td>Short Wall plus 26&quot;</td>
<td>12&quot;</td>
<td></td>
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<td>Wall</td>
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<td>Wall</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
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<td>5w3</td>
<td>5</td>
<td>Wall</td>
<td>Long Wall plus 20&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>5w4</td>
<td>5</td>
<td>Wall</td>
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<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

---

**Intermediate Top Reinforcing**

**Base Reinforcing**

**Long Wall Width**

**Two #5 Hoop Bars**

**Location Station**

**Short Wall Width**

**BENT BARS**

**5t2**

**5t3**

**5t1**

**5w1**

**5w2**

**5w3**

**5w4**

**5b1**

**5b2**

**5b3**

**5bl**

**5t1**

**5t2**

**5t3**

**5t4**

---

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

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

If manhole depth exceeds 20 feet, install steps.
### COMPOSITE TEE DIMENSIONS

<table>
<thead>
<tr>
<th>Size</th>
<th>D1</th>
<th>H</th>
<th>T1</th>
<th>T2</th>
<th>C</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; on 12&quot;</td>
<td>12&quot;</td>
<td>50&quot;</td>
<td>8&quot;</td>
<td>24&quot;</td>
<td>28&quot;</td>
<td>41½&quot;</td>
</tr>
<tr>
<td>48&quot; on 15&quot;</td>
<td>15&quot;</td>
<td>50&quot;</td>
<td>7&quot;</td>
<td>26&quot;</td>
<td>28&quot;</td>
<td>43&quot;</td>
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<tr>
<td>48&quot; on 18&quot;</td>
<td>18&quot;</td>
<td>50&quot;</td>
<td>5½&quot;</td>
<td>26&quot;</td>
<td>28&quot;</td>
<td>44½&quot;</td>
</tr>
<tr>
<td>48&quot; on 21&quot;</td>
<td>21&quot;</td>
<td>48&quot;</td>
<td>9½&quot;</td>
<td>17½&quot;</td>
<td>38½&quot;</td>
<td>5800 lbs.</td>
</tr>
<tr>
<td>48&quot; on 24&quot;</td>
<td>24&quot;</td>
<td>48&quot;</td>
<td>8&quot;</td>
<td>16&quot;</td>
<td>40&quot;</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 27&quot;</td>
<td>27&quot;</td>
<td>48&quot;</td>
<td>9½&quot;</td>
<td>11½&quot;</td>
<td>38½&quot;</td>
<td>5900 lbs.</td>
</tr>
<tr>
<td>48&quot; on 30&quot;</td>
<td>30&quot;</td>
<td>48&quot;</td>
<td>8&quot;</td>
<td>10&quot;</td>
<td>40&quot;</td>
<td>5300 lbs.</td>
</tr>
<tr>
<td>48&quot; on 33&quot;</td>
<td>33&quot;</td>
<td>54&quot;</td>
<td>9½&quot;</td>
<td>11½&quot;</td>
<td>44½&quot;</td>
<td>6600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 36&quot;</td>
<td>36&quot;</td>
<td>54&quot;</td>
<td>8&quot;</td>
<td>10&quot;</td>
<td>46&quot;</td>
<td>6100 lbs.</td>
</tr>
</tbody>
</table>

---

**COMPOSITE TEE**

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

---

**LOCATION STATION**

**PLAN**

**SECTION A-A**

**SECTION B-B**

**GASKETED PIPE JOINT (TYP.)**

**STANDARD SEWER PIPE**

**COMPOSITE TEE SECTION**

**ADJUSTMENT RINGS**

**PRECAST TOP**

**SW-602 CASTING**

**PRECAST RISER SECTIONS**

---

**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.
**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
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</thead>
<tbody>
<tr>
<td>t1</td>
<td>See Table</td>
<td>Top</td>
<td>Long Wall plus 8&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>t2</td>
<td>See Table</td>
<td>Top</td>
<td>Short Wall plus 8&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>See Table</td>
<td>Base</td>
<td>Long Wall plus 14&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>See Table</td>
<td>Base</td>
<td>Short Wall plus 14&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>w1</td>
<td>See Table</td>
<td>Walls</td>
<td>Long Wall plus 8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>w2</td>
<td>See Table</td>
<td>Walls</td>
<td>Short Wall plus 8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>w3</td>
<td>See Table</td>
<td>Walls</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

- **Place a minimum of one w1 bar above each pipe opening.**

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.

Provide two #4 hoop bars at top opening and at all pipe openings.
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.

Table: REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Count</th>
<th>Spacing</th>
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</thead>
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<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td>Wall Height minus 4&quot;</td>
<td>14</td>
<td>12&quot;</td>
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<tr>
<td>4w2</td>
<td>4</td>
<td>Long Walls</td>
<td>3'-8&quot;</td>
<td>Varies</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td>2'-8&quot;</td>
<td>Varies</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td>4'-2&quot;</td>
<td>4</td>
<td>10&quot;</td>
<td></td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td>3'-2&quot;</td>
<td>5</td>
<td>10&quot;</td>
<td></td>
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</tbody>
</table>

Table: MAXIMUM PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>15&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>24&quot;</td>
<td>30&quot;</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Manhole Diameter (inches)</th>
<th>Maximum Pipe Diameter (inches) at 180° Separation</th>
<th>at 90° Separation</th>
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<tr>
<td>48</td>
<td>24</td>
<td>18</td>
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<td>60</td>
<td>36</td>
<td>24</td>
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<td>72</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>84</td>
<td>48</td>
<td>36</td>
</tr>
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<td>96</td>
<td>60</td>
<td>42</td>
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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.
## REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
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<tbody>
<tr>
<td>4t1</td>
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<td></td>
<td>12</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>4'-2&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>7</td>
<td>4'-2&quot;</td>
<td>13&quot;</td>
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<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
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<td>5</td>
<td>7'-2&quot;</td>
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<td>Short Walls</td>
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<td>Varies</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
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<td>Long Walls</td>
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<td>Varies</td>
<td>6'-8&quot;</td>
<td>12&quot;</td>
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<td>4w3</td>
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<td>Walls</td>
<td></td>
<td>18</td>
<td>Wall Height minus 4&quot;</td>
<td>13&quot;</td>
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### MAXIMUM PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>24&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>30&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>30&quot;</td>
<td>36&quot;</td>
</tr>
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### Reinforcing Bar List

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<th>Length</th>
<th>Spacing</th>
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</thead>
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<td>4t1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>11</td>
<td>3'-8&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>5'-2&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
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<td>8</td>
<td>4'-2&quot;</td>
<td>13&quot;</td>
</tr>
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<td>4</td>
<td>Base</td>
<td></td>
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<td>8'-2&quot;</td>
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</tr>
<tr>
<td>4a1</td>
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<td>Adj. Ring</td>
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<td>3'-8&quot;</td>
<td>See Adj. Ring Plan</td>
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<td>Adj. Ring</td>
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<td></td>
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<td>Short Walls</td>
<td>Varies</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

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

2. Diagonal Bars (typ.)

The figure shows a plan view of a structure with various measurements and annotations, including:

- **Long Wall**: 7'-0"
- **Short Wall**: 3'-0"
- **Diagonal Bar**: 3'-8"
- **Location Station**: (Back of Curb)

The diagram also includes a section view labeled **Section B-B** with dimensions and notes on reinforcement and pipe diameters.
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.

Add 8" min. Class I Bedding Material.

Location Station
(Back of Curb)
**REINFORCING BAR LIST**

<table>
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<td></td>
<td>Varies</td>
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**MAXIMUM PIPE DIAMETERS**

<table>
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<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
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<tbody>
<tr>
<td>Short Wall</td>
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</tr>
<tr>
<td>Long Wall</td>
<td>60&quot;</td>
<td>66&quot;</td>
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</table>

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.

Double Grate Intake
**Double Grate Intake with Manhole**

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.

<table>
<thead>
<tr>
<th>Wall</th>
<th>Max. Dia</th>
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<tr>
<td>1</td>
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<td>3</td>
<td>36&quot;</td>
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<tr>
<td>4</td>
<td>42&quot;</td>
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**Diagonal Bars**

- Location Station (Back of Curb)
- Wall 1
- Wall 2
- Wall 3
- Wall 4
- Wall 5
- Wall 6

**Referenced Walls**

- Wall 3
- Wall 4
- Wall 5
- Wall 6

**Diagonal Bar Locations**

- 4" diagonal bars at Location Station (Back of Curb)
- 4" diagonal bars at Wall 3
- 4" diagonal bars at Wall 4
- 4" diagonal bars at Wall 5

**Boxout Details**

Refer to SW-514 for boxout details.
**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Mark</th>
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<th>Spacing</th>
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<td>Top</td>
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<td>2'-8&quot;</td>
<td>See Detail</td>
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<tr>
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<tr>
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<td>Wall 6</td>
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<td>3'-10&quot;</td>
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</table>

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 base is not required to extend beyond the outer edge of the walls.
3. 12 inch minimum wall height above all pipes.
Trowel smooth and place bond breaker

INSERT (6 Inch Standard Curb)

Face of 6" Standard Curb

Width of Insert (36" typ., 18" min.)

Edge of Gutter (if applicable)

Normal Pavement Slope

Face of 4" Sloped Curb

Width of Insert (36" typ., 18" min.)

Edge of Gutter (if applicable)

Normal Pavement Slope

Trowel smooth and place bond breaker

INSERT (4 Inch Sloped Curb)
**Form Grade**

- 10''
- 4'-0'' min.
- 12'' min.

**Boxout Length**

- Short Wall: 3'-0''
- Long Wall: 5'-0''

**MAXIMUM PIPE DIAMETERS**

- 5'-0''
- 4'-0''
- 6''
- 36'' typ.

**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Mark</th>
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<th>Length</th>
<th>Spacing</th>
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<tr>
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<td>4</td>
<td>Top</td>
<td></td>
<td>4</td>
<td>3'-6''</td>
<td>12''</td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>10</td>
<td>10''</td>
<td>6''</td>
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<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>6</td>
<td>3'-6''</td>
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<td>4b2</td>
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<td>10''</td>
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<td>Insert</td>
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<td>Varies</td>
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<td>12''</td>
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<tr>
<td>4w3</td>
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<td>Short Walls</td>
<td></td>
<td>Varies</td>
<td>3'-8''</td>
<td>12''</td>
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</tbody>
</table>

**Notes:**

1. 12 inch minimum wall height above all pipes.
2. Slope of 1.5% or as specified in the contract documents.
3. Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.
4. 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.
Back of Curb

Width of Insert (36" typ., 18" min.)

Edge of Gutter (if applicable)

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

Face of 6" Standard Curb

Normal Pavement Slope

Form Grade

Trowel smooth and place bond breaker

Normal Pavement Slope

Trowel smooth and place bond breaker

INSERT (6 Inch Standard Curb)

INSERT (4 Inch Sloped Curb)

Face of 4" Sloped Curb

Edge of Gutter (if applicable)

FIGURE 6010.508

Width of Insert (36" typ., 18" min.)

Edge of Gutter (if applicable)

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

Face of 4" Sloped Curb

Normal Pavement Slope

Trowel smooth and place bond breaker

Normal Pavement Slope

Trowel smooth and place bond breaker

INSERT (4 Inch Sloped Curb)

FIGURE 6010.508

Width of Insert (36" typ., 18" min.)

Edge of Gutter (if applicable)

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

Face of 4" Sloped Curb

Normal Pavement Slope

Trowel smooth and place bond breaker

Normal Pavement Slope

Trowel smooth and place bond breaker

INSERT (4 Inch Sloped Curb)
REINFORCING BAR LIST

<table>
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<tr>
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<th>Size</th>
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<th>Count</th>
<th>Length</th>
<th>Spacing</th>
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<tbody>
<tr>
<td>4i1</td>
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<td>Top</td>
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<td>7</td>
<td>4'-8''</td>
<td>See Insert</td>
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<tr>
<td>4i2</td>
<td>4</td>
<td>Top</td>
<td>—</td>
<td>4</td>
<td>4'-6''</td>
<td>12''</td>
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<td>4i3</td>
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<td>10</td>
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<tr>
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<td>12''</td>
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<td>—</td>
<td>Varies</td>
<td>4'-8''</td>
<td>12''</td>
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</table>

1. 12 inch minimum wall height above all pipes.
2. Slope of 1.5% or as specified in the contract documents.
3. Transverse joint spacing on new concrete pavement is controlled by the intake boxout. Adjust adjacent joint spacing as required to accommodate boxouts.
4. 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.
Trowel smooth and place bond breaker

Width of Insert (36'' typ., 18'' min.)

Face of 6'' Standard Curb

Face of 4'' Sloped Curb

Form Grade

Trowel smooth and place bond breaker

Back of Curb

Edge of Gutter (if applicable)

Normal Pavement Slope

SECTION A-A

(6 Inch Standard Curb Insert)

SECTION A-A

(4 Inch Sloped Curb Insert)

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.
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

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<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
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<th>Length</th>
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**BENT BARS**

3'-3"  
24"  
5w1
12 inch minimum wall height above all pipes.

Slope of 1.5% or as specified in the contract documents.

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
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</thead>
<tbody>
<tr>
<td>Short Wall</td>
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<td>Long Wall</td>
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MAXIMUM PIPE DIAMETERS

SECTION B-B

ISOMETRIC

(Refer to SECTION B-B for alignment of Top with Spacer)
Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by ½ inch.
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.

Rounded shaping at inlet.

**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
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<th>Length</th>
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<td>Top</td>
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<td>12&quot;</td>
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<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td></td>
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<td>1'-10&quot;</td>
<td>6&quot;</td>
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<td>Beam</td>
<td></td>
<td>2</td>
<td>8'-3&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

**BENT BARS**

4'-3"
Do not extend keyed joint into front wall of box.

12 inch minimum wall height above all pipes.

Slope of 1.5% or as specified in the contract documents.

### MAXIMUM PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>30&quot;</td>
<td>36&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>60&quot;</td>
<td>66&quot;</td>
</tr>
</tbody>
</table>

**SECTION C-C**

- **Wall of Box into Front Keyed Joint**: Extend...
- **Spacer Beam (with Spacer)** for alignment of Top (Refer to Section B-B)

**ISOMETRIC**

- **Top**
- **Spacer**
- **Beam**
- **Walls**

**PLAN (SPACER)**

- **Depth 10'-0" max.**
- **Concrete Fillet**
- **Wall Height**
- **Form Grade**

**FILLET**

- **Concrete**
- **Bedding Material**

**LOCATION**

- **Pipe Structure**
- **Precast Structure**
- **Cast-in-place Structure**

**BEDDING MATERIAL**

- **8" min. Class I**

**SPACING**

- **8" min. Class I Bedding Material**

**SECTION B-B**

- **Wall Height**
- **8" min.**
- **12" min.**
- **Depth 10'-0" max.**
- **Back of Curb**
- **Form Grade**
- **Concrete Fillet**
- **Wall Height**
- **Depth 10'-0" max.**
- **Concrete Fillet**
- **Bedding Material**

**DOUBLE OPEN-THROAT CURB**

INTAKE, LARGE BOX
Install four #4 diagonal bars at all pipe openings.

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.

12 inch minimum wall height above all pipes.

**MAXIMUM PIPE DIAMETERS**

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>15&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>24&quot;</td>
<td>30&quot;</td>
</tr>
</tbody>
</table>

**SECTION A-A**

- SW-604 Type 6 Casting
- Form Grade
- Slope 1/4 per foot
- #4 bars
- Adjustment Rings
- Concrete Fillet
- Diagonal Bar (typ.)
- Base
- #4 Bars at 12" o.c. Each Way
- 8" min. Bedding Material
- Short Wall 2'-0" 6" 6" 3'-0"
- Long Wall 3'-0" 4'-0"
- Location Station

**PLAN**

- SW-604 Type 6 Casting
- Short Wall 2'-0" 3'-0"
- Long Wall 3'-0" 4'-0"
- 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.

**REVISIONS:**
- Added Class I Bedding Material.
**SW-604 Type 3, 4, or 5 Casting**

**Inlet Elevation**

**Class 3 RCP Risers**

**Square Edge Base**

**4'' 4'' 6'' min. 6'' min.**

**Location Station**

**Depth**

**Diameter, D1**

**Diameter, D2**

**Riser (varies)**

**Concrete Fillet**

**Fillet 6'' min. 6'' min. 4'' 4''**

**Base**

**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.**

---

**TABLE: INTAKE SIZE - CASE 1**

<table>
<thead>
<tr>
<th>Outlet Pipe Diameter, D1</th>
<th>Minimum Riser Diameter, D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>12''</td>
<td>18''</td>
</tr>
<tr>
<td>15''</td>
<td>24''</td>
</tr>
<tr>
<td>18''</td>
<td>24''</td>
</tr>
<tr>
<td>21''</td>
<td>30''</td>
</tr>
<tr>
<td>24''</td>
<td>30''</td>
</tr>
<tr>
<td>27''</td>
<td>36''</td>
</tr>
</tbody>
</table>

---

**Figure 6010.512**

**SUDAS DIRECTOR**

**DESIGN METHODS ENGINEER**

---

**REVISIONS:** Changed 1 to I on Bedding Material.

---

**SHEET 1 of 2**

**CIRCULAR AREA INTAKE**
Minimum riser diameter is 18 inches.

CASE 2

### INTAKE SIZE - CASE 2

<table>
<thead>
<tr>
<th>Through Pipe Diameter, D1</th>
<th>Maximum Riser Diameter, D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>21&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>27&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>36&quot; or more</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

**TYPICAL SECTION**

- **Location Station**
- **Inlet Elevation**
- **Riser Diameter, D2** (varies)
- **Class 3 RCP Riser**
- **Standard Tee Section**
- **Through Pipe Diameter, D1** (varies)
- **Class I Bedding Material**
- **8" min.**

**CASE 2**
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 inch minimum wall height above all pipes.
BOXOUT IN PCC PAVEMENT AND PCC BASE WITH HMA OVERLAY

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.

---

**Section A-A**

- **Back of Curb**
- **Intake Grate (typ.)**
- **#4 Bars @ 12” o.c.**
- **Flow**
- **'ED' Joint**
- **'B' Joint**
- **#4 Bars**
- **Boxout Length 15'-0” Typical**
- **2” Clear (typ.)**
- **3”**
- **36”**
- **12”**
- **12” (typ.)**
- **Dowel Bar (typ.)**
- **Center bars vertically within slab.**

---

**REVISIONS:**
- Added dimension to back of grate.
- Updated line work and Iowa DOT and SUDAS logo.

**SHEET 1 of 3**
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.
1. Provide two #4 hoop 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.

4. If required by casting manufacturer, provide support beam under all frame joints. Modify structure walls as required to provide pocket for beam.

Location Station (Center of Structure)

PLAN

SECTION A-A

Bedding Material

8" min. Class I

Type 7 Grate

Optional Construction Joint (typ.)

Concrete Fillet

Wall Height

4"

4w3

8" min.

4w1

12" min.

Depth
(8'-0" Max.)

2'-4"

Short Wall

5'-6"

Long Wall

4'-6"

Base

3'-4"

4'-6"

2'-4"

8" min. Class I Bedding Material

4b1

4b2

3'-4"

6" Short Wall

6"
Maximum Pipe Diameters

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Structure</th>
<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>18&quot;</td>
<td>21&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>36&quot;</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>

Reinforcing Bar List

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>6</td>
<td>3'-6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>4</td>
<td>5'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>20</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Short Wall</td>
<td></td>
<td>Varies</td>
<td>3'-0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Long Wall</td>
<td></td>
<td>Varies</td>
<td>5'-2&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

1. Provide two #4 hoop 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.
4. If required by casting manufacturer, provide support beam under all frame joints. Modify structure walls as required to provide pocket for beam.

**SECTION B-B**

Concrete Fillet

Base

Optional Construction Joint (typ.)

Wall Height

8" min. Class I Bedding Material

Depth (8'-0" max.)

8" min. Class I Bedding Material

FIGURE 6010.515

Sheet 2 of 2

REVISION 04-21-20

TRIPLE RECTANGULAR AREA INTAKE
1. 6 inches or same as thickness of adjacent pavement, whichever is greater.
2. Linear Trench Drain.
3. For joint details, see PV-101.
4. Slope same as adjacent pavement.
5. Width as determined by manufacturer. Minimum 6 inches.
1. 6 inches or same as thickness of adjacent pavement, whichever is greater.
2. Linear Trench Drain.
3. For joint details, see PV-101.
4. Slope same as adjacent pavement.
5. Width as determined by manufacturer. Minimum 6 inches.
6. Standard or sloped curb. For curb details, see PV-102.
7. Minimum thickness same as thickness of adjacent pavement or curb width, whichever is greater.
1. 39 inches when attaching the SW-542 extension unit.
2. 37 inches when attaching the SW-542 extension unit.
3. Additional keyed construction joint when attaching the SW-542 extension unit.

OPEN-THROAT CURB
INTAKE UNDER PAVEMENT
For joint details, refer to PV-101.

Additional keyed construction joint when attaching the SW-542 extension unit.

Top of well flush with pavement.

### TYPICAL SECTION

- **Back of Curb**: 6'' (min.) to 11'-0'' (max.)
- **Flow**
- **B’ Joint**
- **ED’ Joint**
- **Wall Height**
- **Base**
- **8'' min. Class I Bedding Material**
- **Depth 10'-0'' max**.
- **Wall Height**
- **Base**
- **8'' min.**

### PLAN

- **MAXIMUM PIPE DIAMETER**
  - Precast: 30''
  - Cast-in-Place: 36''

### REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>b1</td>
<td>4</td>
<td>Base</td>
<td>---------</td>
<td>4'-6''</td>
<td>11''</td>
</tr>
<tr>
<td>b2</td>
<td>4</td>
<td>Base</td>
<td>---------</td>
<td>4'-6''</td>
<td>11''</td>
</tr>
<tr>
<td>w1</td>
<td>4</td>
<td>Wall</td>
<td>Wall Height minus 4''</td>
<td>2'-7''</td>
<td>14''</td>
</tr>
<tr>
<td>w2</td>
<td>4</td>
<td>Wall</td>
<td>Wall Height minus 4''</td>
<td>2'-5''</td>
<td>14''</td>
</tr>
<tr>
<td>c1</td>
<td>4</td>
<td>Top</td>
<td>---------</td>
<td>4'-8''</td>
<td>See Detail</td>
</tr>
<tr>
<td>c2</td>
<td>4</td>
<td>Top</td>
<td>---------</td>
<td>4'-8''</td>
<td>See Detail</td>
</tr>
<tr>
<td>c3</td>
<td>4</td>
<td>Top</td>
<td>---------</td>
<td>3'-2''</td>
<td>See Detail</td>
</tr>
<tr>
<td>c4</td>
<td>4</td>
<td>Top</td>
<td>---------</td>
<td>4'-8''</td>
<td>See Detail</td>
</tr>
<tr>
<td>c5</td>
<td>4</td>
<td>Top</td>
<td>---------</td>
<td>3'-2''</td>
<td>See Detail</td>
</tr>
</tbody>
</table>

**BENT BARS**

- **D=4''**
- **c1**
- **c2**
- **20''**
- **18''**
- **2-3''**
- **c5**
Extension unit may be used on either or both sides of SW-541 intakes. Details are similar when extension unit is on the opposite side.

1. g3 for 6 inch standard curb; g5 for 4 inch sloped curb.
2. c1 for 6 inch standard curb; c2 for 4 inch sloped curb. See SW-541 for reinforcing.
3. The location station is where the centerline of intake meets the back of the curb line.

Placing sequence: 1. Base; 2. Walls and Extension; 3. Top; 4. Insert

### REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>BAR</th>
<th>SIZE</th>
<th>LOCATION</th>
<th>SHAPE</th>
<th>NO.</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>s2</td>
<td>4</td>
<td>Intake Wall</td>
<td>2.6&quot;</td>
<td>1</td>
<td>2.5&quot;</td>
<td>6.0</td>
<td>9&quot;</td>
</tr>
<tr>
<td>f1</td>
<td>4</td>
<td>Bottom</td>
<td>3</td>
<td>3</td>
<td>4.9&quot;</td>
<td>9.5</td>
<td>9&quot;</td>
</tr>
<tr>
<td>g2</td>
<td>4</td>
<td>Bottom</td>
<td>4</td>
<td>4</td>
<td>1.7&quot;</td>
<td>4.2</td>
<td>18&quot;</td>
</tr>
<tr>
<td>g1</td>
<td>4</td>
<td>Wall</td>
<td>5</td>
<td>5</td>
<td>4.2&quot;</td>
<td>6.5</td>
<td>12&quot;</td>
</tr>
<tr>
<td>g4</td>
<td>4</td>
<td>Top</td>
<td>6</td>
<td>6</td>
<td>6.4&quot;</td>
<td>12.7</td>
<td>18&quot;</td>
</tr>
<tr>
<td>g5</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>4</td>
<td>6.4&quot;</td>
<td>12.7</td>
<td>18&quot;</td>
</tr>
</tbody>
</table>

Provide one of each length

---

FIGURE 6010.542

SHEET 1 of 4

EXTENSION UNIT FOR
OPEN-THROAT CURB
INTAKE UNDER PAVEMENT
SECTION A-A

SECTION B-B

SECTION C-C

6 INCH STANDARD CURB

2:1 Slope (Horizontal:Vertical)

See SW-541 for reinforcing.
See SW-541 for reinforcing.

g3 for 6 inch standard curb; g5 for 4 inch sloped curb.

c1 for 6 inch standard curb; c2 for 4 inch sloped curb. See SW-541 for reinforcing.

§ See SW-541 for reinforcing.
Extension unit may be used on either or both sides of intake. Details are similar when extension unit is on the opposite side. For joint details, refer to PV-101.

1. Match gutter slope. Drain to well.
2. Other lengths of opening may be constructed by varying the length of the extension and the rebar.
3. Includes 2 inches for 'ED' Joints.
4. 12 inch minimum wall height above all pipes.

**TABLE OF DIMENSIONS**

<table>
<thead>
<tr>
<th>LO</th>
<th>Length of Curb Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;-0&quot;</td>
<td>14&quot;-0&quot;</td>
</tr>
<tr>
<td>LE</td>
<td>Extension Length</td>
</tr>
<tr>
<td>4'-0&quot;-10&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>MB</td>
<td>Minimum Boxout Length</td>
</tr>
<tr>
<td>16&quot;-0&quot;</td>
<td>18&quot;-0&quot;</td>
</tr>
</tbody>
</table>

**MAXIMUM PIPE DIAMETERS**

<table>
<thead>
<tr>
<th>Structure</th>
<th>30&quot;</th>
<th>36&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cast-in-place</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**6 Inch Standard Curb**

**INSERT DETAIL (6 Inch Standard Curb)**

**REINFORCING BAR LIST $L = 12' - 0"$**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LOCATION</th>
<th>NO.</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>4e1</td>
<td>4</td>
<td>Top/Base</td>
<td>9</td>
<td>9'-5&quot;</td>
<td>68.5</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>6.7</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>17.0</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>17.0</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>8'-2&quot;</td>
<td>10.9</td>
<td>22&quot;</td>
</tr>
<tr>
<td>4I*</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>10.6</td>
<td>22&quot;</td>
</tr>
</tbody>
</table>

*With 15'-6" Boxout. Total: 119.1 lbs.

**REINFORCING BAR LIST $L = 14' - 0"$**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LOCATION</th>
<th>NO.</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>4e1</td>
<td>4</td>
<td>Top/Base</td>
<td>11</td>
<td>9'-5&quot;</td>
<td>68.5</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>6.7</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>17.0</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>17.0</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>8'-2&quot;</td>
<td>10.9</td>
<td>22&quot;</td>
</tr>
<tr>
<td>4I*</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>11.9</td>
<td>22&quot;</td>
</tr>
</tbody>
</table>

*With 15'-6" Boxout. Total: 142.4 lbs.

**REINFORCING BAR LIST $L = 16' - 0"$**

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LOCATION</th>
<th>NO.</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>4e1</td>
<td>4</td>
<td>Top/Base</td>
<td>13</td>
<td>9'-5&quot;</td>
<td>68.5</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>6.7</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>22.4</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>22.4</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>12'-2&quot;</td>
<td>18.2</td>
<td>22&quot;</td>
</tr>
<tr>
<td>4I*</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>13.2</td>
<td>22&quot;</td>
</tr>
</tbody>
</table>

*With 20'-6" Boxout. Total: 165.6 lbs.

**REINFORCING BAR LIST $L = 18' - 0"$**

<table>
<thead>
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<th>NO.</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
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</thead>
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<tr>
<td>4e1</td>
<td>4</td>
<td>Top/Base</td>
<td>15</td>
<td>9'-5&quot;</td>
<td>68.5</td>
<td>12&quot;</td>
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<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>6.7</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>22.4</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>2'-9&quot;</td>
<td>22.4</td>
<td>15&quot;</td>
</tr>
<tr>
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<td>4</td>
<td>Base</td>
<td>2</td>
<td>14'-2&quot;</td>
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<tr>
<td>4I*</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>1'-0&quot;</td>
<td>14.8</td>
<td>22&quot;</td>
</tr>
</tbody>
</table>

*With 22'-6" Boxout. Total: 186.0 lbs.

**NOTE:** All dimensions are out to out. $D =$ Pin Diameter

Other lengths of opening may be constructed by varying the length of the extension and the rebar.
INSERT DETAIL

4 INCH SLOPED CURB

REINFORCING BAR LIST $O = 12' - 0''$

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LOCATION</th>
<th>NO</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
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</thead>
<tbody>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>10'-0''</td>
<td>8.7</td>
<td>94.8</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-8''</td>
<td>17.0</td>
<td>10.6</td>
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<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-8''</td>
<td>17.0</td>
<td>6'</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>8'-2''</td>
<td>19.9</td>
<td>22'</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top/Base</td>
<td>9</td>
<td>9'-30''</td>
<td>58.9</td>
<td>12'</td>
</tr>
<tr>
<td>4f</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>15'-10''</td>
<td>10.6</td>
<td></td>
</tr>
</tbody>
</table>

* With 16'-0'' Boxout. Total 119.0 lbs.

REINFORCING BAR LIST $O = 14' - 0''$

<table>
<thead>
<tr>
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<th>WEIGHT</th>
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<tr>
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<td>Top</td>
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<td>12'-0''</td>
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<td>94.8</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>14'-6''</td>
<td>19.7</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>14'-6''</td>
<td>19.7</td>
<td>6'</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>18'-2''</td>
<td>13.6</td>
<td>22'</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top/Base</td>
<td>11</td>
<td>9'-30''</td>
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<td>4f</td>
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<td>17'-10''</td>
<td>11.9</td>
<td></td>
</tr>
</tbody>
</table>

* With 16'-0'' Boxout. Total 142.5 lbs.

REINFORCING BAR LIST $O = 16' - 0''$

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
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<th>NO</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
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</thead>
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<tr>
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<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-0''</td>
<td>8.3</td>
<td>94.8</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-6''</td>
<td>22.4</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-6''</td>
<td>22.4</td>
<td>6'</td>
</tr>
<tr>
<td>4e5</td>
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<td>Base</td>
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<td>18'-2''</td>
<td>18.2</td>
<td>22'</td>
</tr>
<tr>
<td>4e6</td>
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<td>Top/Base</td>
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<td>9'-30''</td>
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<td>19'-10''</td>
<td>13.2</td>
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</tr>
</tbody>
</table>

* With 20'-0'' Boxout. Total 165.5 lbs.

REINFORCING BAR LIST $O = 18' - 0''$

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
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<th>NO</th>
<th>LENGTH</th>
<th>WEIGHT</th>
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</thead>
<tbody>
<tr>
<td>4e2</td>
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<td>Top</td>
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<td>10'-0''</td>
<td>9.7</td>
<td>94.8</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-9''</td>
<td>25</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
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<td>Top</td>
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</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>14'-12''</td>
<td>18.8</td>
<td>22'</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top</td>
<td>15</td>
<td>9'-3-12''</td>
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<tr>
<td>4f</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>21'-10''</td>
<td>14.6</td>
<td></td>
</tr>
</tbody>
</table>

* With 22'-9'' Boxout. Total 188.9 lbs.

NOTE: ALL DIMENSIONS ARE OUT TO OUT

D = PIN DIAMETER

4'e6

BENT BAR DETAILS

NOTE: OTHER LENGTHS OF OPENING MAY BE CONSTRUCTED BY VARYING THE LENGTH OF THE EXTENSION AND THE REBAR.

SECTION C-C

REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>MARK</th>
<th>SIZE</th>
<th>LOCATION</th>
<th>NO</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
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</thead>
<tbody>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>10'-0''</td>
<td>9.7</td>
<td>94.8</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-9''</td>
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<td>15'</td>
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<tr>
<td>4e4</td>
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<td>14'-12''</td>
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<td>22'</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top</td>
<td>15</td>
<td>9'-3-12''</td>
<td>94.8</td>
<td>12'</td>
</tr>
<tr>
<td>4f</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>21'-10''</td>
<td>14.6</td>
<td></td>
</tr>
</tbody>
</table>

* With 22'-9'' Boxout. Total 188.9 lbs.
SANITARY SEWER MANHOLES

**TYPE A**
Two-piece fixed casting

**TYPE C**
Two-piece fixed casting with bolt-down cover

**FRAME NOTES**
Size, spacing, and number of lugs and flanges may vary.

**COVER NOTES**
Roughness pattern and text style may vary. Minimum one concealed pickhole.

1. Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.

2. If specified, furnish bolt down frame and cover with four 1/2 inch minimum diameter stainless steel, hex nut, recessed cap screws. Secure cover with screws, washers, and rubber gasket seals.


**TYPICAL SECTION**

- **Flange (typ.)**
- **Anchor Bolt Hole**
- **Bolt-Down Cover (Type C)**
- **Gasket Seal**
- **Sanitary Sewer**
- **Anchor Bolt**
- **Bolt-Down Cover (Type D)**
- **Gasket to seal out debris**
- **24" min. clear opening**
- **35\(\frac{5}{8}\)" min.**
- **24" min.**
- **26" min.**
- **33" min.**
- **26" min.**

**PLAN**

- **SANITARY**
- **SEWER**
- **Anchor Bolt**
- **Bolt-Down Cover**
- **Gasket to seal out debris**
- **SANITARY**
- **SEWER**
- **35" min.**
- **24" min. clear opening**
- **24" min.**
- **35\(\frac{5}{8}\)" min.**
- **26" min.**
SANITARY SEWER MANHOLES

CASTINGS FOR
STANDARD PLAN

FIGURE 6010.601

TYPE B: PCC
Three-piece floating casting for use in PCC paving and PCC boxouts

TYPE D: PCC
Three-piece floating casting with bolt-down cover for use in PCC paving and PCC boxouts

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

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

1. Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.

2. If specified, furnish bolt down frame and cover with four 1/2 inch minimum diameter stainless steel, hex nut, recessed cap screws. Secure cover with screws, washers, and rubber gasket seals.


4. Set casting at proper grade using the adjustment slots or adjustment mechanism. Remove bolts or mechanism upon completion of paving.

5. Height adjustment method may vary; two options are shown.

### Typical Section

- **Bolt-Down Cover (Type D)**
- **Anchor Bolt**
- **Gasket Seal**
- **Lug**
- **Steel Sleeve**
- **Gasket to seal out debris**
- **Height Adjustment Mechanism**
- **Height Adjustment Bolts and Slots**

24" min. clear opening

33 1/2" min.

26" min.

24" min. clear opening

33 1/2" min.

26" min.
TYPE E
Two-piece fixed casting

TYPE F: HMA
Three-piece floating casting for use in HMA paving

---

Anchor Bolt Hole
Flange (typ.)

---

Anchor Bolt ①

---

Flange (typ.)
Anchor Bolt Hole

---

33" min.
26" min.

---

STORM
SEWER

---

STORM
SEWER

---

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

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

1. Anchor the lower frame of all three-piece castings to the manhole structure. When specified in the contract documents, anchor the frame of two-piece castings to the manhole structure. If casting frame does not include anchor holes or slots, drill four 7/8 inch diameter holes, equally spaced around the frame.

2. Casting height varies. Minimum adjustment range of 4 inches.

---

STORM SEWER MANHOLES

---

Figure 6010.602
Sheet 1 of 3

CASTINGS FOR
STORM SEWER MANHOLES
TYPE F: PCC
Three-piece floating casting for use
in PCC paving and PCC boxouts

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

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

1. Anchor the lower frame of all
three-piece castings to the manhole
structure. When specified in the
contract documents, anchor the frame of
two-piece castings to the manhole
structure. If casting frame does not
include anchor holes or slots, drill
four 7/8 inch diameter holes, equally
spaced around the frame.

2. Casting height varies. Minimum
adjustment range of 4 inches.

3. Set casting at proper grade using the
adjustment slots or adjustment
mechanism. Remove bolts or mechanism
upon completion of paving.

4. Height adjustment method may vary; two
options are shown.

FIGURE 6010.602
SHEET 2 OF 3

Anchor Bolt 1

Lug

Gasket to seal
out debris

Steel Sleeve

26" min.

24" min. clear opening

24" min. clear opening

26" min.

33 1/2" min.

2

2

33 1/2" min.

Height Adjustment
Bolts and Slots 3

Height Adjustment
Mechanism 3

TYPICAL SECTION 4

STORM SEWER MANHOLES

SUDAS
IOWADOT

REVISIONS: Add option for 3 piece HMA casting

REV: SW-602
FIGURE 6010.602
STANDARD ROAD PLAN
SHEET 2 of 3

SUDAS DIRECTOR
DESIGN METHODS ENGINEER

PLAN

CASTINGS FOR
STORM SEWER MANHOLES

4-21-20

REVISION

Sudie S. Wignall

Chief CADC

3-21-20

Sudie S. Wignall

Chief CADC
TYPE G
Two piece fixed casting

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

PLAN

TYPICAL SECTION

STORM
SEWER

Minimum one pickhole.

25 3/4" min.
24" min.
25 3/4" min.
26 3/4" min.

31" min.
1 1/2"
1"
1 1/2"
4"
**Type Q**
Driveway Grate
(Minimum open area 370 in²)

**Type R**
Curb Inlet Grate
(Minimum open area 180 in²)

---

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.
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.

Use ductile iron frame castings meeting the requirements of ASTM A 536.

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

Grate minimum weight = 340 lbs.

Type S
Barrier Intake Grate
(Minimum open area 300 in²)

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.

Use ductile iron frame castings meeting the requirements of ASTM A 536.

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

Grate minimum weight = 340 lbs.
**Figure 6010.604 (Sheet 2 of 2)**

**CASTINGS FOR AREA INTAKES**

**TYPE 6**

- Minimum Weight = 75 lbs. (Light Duty)

**TYPE 7**

- Minimum Weight = 75 lbs.

- Frame provided in three segments (two ends and one center). Bolt segments together as specified by the casting manufacturer.

- Provide bicycle safe, vane style grates with a minimum open area of 4 square feet. At low points, grates with vanes facing both directions will be allowed.

- If required by casting manufacturer, provide support beam under all frame joints. Modify structure walls as required to provide pocket for beam.

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

**TYPE 9**

- Minimum Weight = 85 lbs.

- (Light Duty)

---

**A**

**SECTION A-A**

**SECTION B-B**

---

**Notes:**

- Added Type 7 casting. Modified circle notes.

---

**Revisions:**

- 04-21-20

---

**Comments:**

- Used in an inverted position.

---
FIGURE 7010.101

**PLAIN JOINT**
(Abbuting Pavement Slabs)

- See Detail C

**CONTRACTION JOINT**

- See Detail A or B

**DOWELED CONTRACTION JOINT**

- See Detail A or B

**TIED CONTRACTION JOINT**

- See Detail A or B

**DAY'S WORK JOINT**
(Non-working)

- 30" Long Tie Bar
  at 12" Centers

**HEADER JOINT**
(End Rigid Pavement)

- Pavement Edge
- 24" min.
- Plastic or Tarpaper Wrapped

**ABUTTING PAVEMENT JOINT**

- 30" Long Tie Bar
  at 12" Centers

**RIGID TIE**

- Hole Diameter
  Larger than Tie Bar

**CURB AND GUTTER UNIT**

- 30" Long Tie Bar
  at 12" Centers

**JOINTS**

- See dowel assemblies for fabrication details.
- 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.
- Place bars within the limits shown under dowel assemblies.
- Edge with 1/8 inch tool for length of joint. For HT joint, remove header block and board when second slab is placed.
- Unless specified otherwise, use "CD" transverse contraction joints in mainline pavement where "C" is greater or equal to 8 inches. Use "C" joints when "C" is less than 8 inches.
- "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.

Legend:
- Existing Pavement
- Proposed Pavement
BAR PLACEMENT
(Appplies to all joints unless otherwise detailed.)

Saw 'CD' joint to a depth of T/3 ± 1/4''; saw 'C' joint to a depth of T/4 ± 1/4''.

When tying into old pavement, represents the depth of sound PCC.

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

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

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

BAR SIZE TABLE FOR CONTRACTION JOINTS

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Solid Dowel Diameter</th>
<th>Tubular Dowel Diameter</th>
<th>Tie Bar Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8&quot;</td>
<td>3/4</td>
<td>7/8</td>
<td>#6</td>
</tr>
<tr>
<td>≥ 8&quot; but &lt; 10&quot;</td>
<td>1 1/4</td>
<td>1 3/8</td>
<td>#10</td>
</tr>
<tr>
<td>≥ 10&quot;</td>
<td>1 1/2</td>
<td>1 5/8</td>
<td>#11</td>
</tr>
</tbody>
</table>

Tubular Dowel Bars will not be allowed for RD joints.

SECTION A-A
(Detail at Edge of Pavement)

TRANSVERSE CONTRACTION

LEGEND

PV-101

SUDAS DIRECTOR
DESIGN METHODS ENGINEER
When tying into old pavement, \( T \) represents the depth of sound PCC.

Sealant or cleaning not required.

### Keyway Dimensions

<table>
<thead>
<tr>
<th>Keyway Type</th>
<th>Pavement Thickness</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>8&quot; or greater</td>
<td>( \frac{3}{4} &quot; )</td>
<td>( \frac{5}{8} &quot; )</td>
</tr>
<tr>
<td>Narrow</td>
<td>Less than 8&quot;</td>
<td>1&quot;</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>

### TIE BAR PLACEMENT

(Appplies to all joints unless otherwise detailed.)

### DETAIL D-1

(Required when specified in the contract documents.)

### 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)

### DETAIL E

LEGEND

- Existing Pavement
- Proposed Pavement

**SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION**

**SUDAS**

**PV-101**

**FIGURE 7010.101**

**STANDARD ROAD PLAN**

**SHEET 4 of 8**

**REVISIONS:** Modified Joint Assemblies on Sheets 6 and 7 to eliminate reference to Joint SPEC.

**DATE UPDATED:** 04-21-20
FIGURE 7010.101

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

See Detail H

Width (See table below)

'CF' JOINT

Type | Width
---|---
CF-1 | 2"
CF-2 | 2 1/2"
CF-3 | 3"
CF-4 | 3 1/2"

See Detail F

Resilient Joint Filler

1" Nominal

See Detail F or Detail G
(See Bar Size Table for Doweled Expansion Joints)

Joint Filler Material
(See Bar Size Table for Doweled Expansion Joints)

18" Long Dowel at 12" Centers

'D', 'EE', 'EF' (18)

DOWELED EXPANSION JOINT

See Bar Size Table for Doweled Expansion Joints.

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Width</th>
<th>Filler Material</th>
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<tbody>
<tr>
<td>ED</td>
<td>1&quot;</td>
<td>Resilient (Detail F)</td>
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<tr>
<td>EE</td>
<td>2&quot;</td>
<td>Flexible Foam (Detail F)</td>
</tr>
<tr>
<td>EF</td>
<td>3 1/2&quot;</td>
<td>Flexible Foam (Detail G)</td>
</tr>
</tbody>
</table>

BAR SIZE TABLE FOR DOWELED EXPANSION JOINTS

<table>
<thead>
<tr>
<th>Diameter</th>
<th>&lt; 8&quot;</th>
<th>≥ 8&quot; but &lt; 10&quot;</th>
<th>≥ 10&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dowel</td>
<td>3/4&quot;</td>
<td>1 1/4&quot;</td>
<td>1 3/2&quot;</td>
</tr>
</tbody>
</table>

Tubular Dowel Bars will not be allowed for expansion joints.

LEGEND
Existing Pavement
Proposed Pavement

DETAIL F

Joint Sealant Material

1 1/2 Joint Sealant Material

1 1/2 plywood or pressed wood spacer required for 'EF' joint.

DETAIL G

Flexible Foam Joint Filler

DETAIL H

Tire Buffings

T = 1/4 inch tool for length of joint indicated if formed; edging not required when cut with diamond blade saw.

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.

Predrill or preform holes in joint material for appropriate dowel size.

Compact tire buffings by spading with a square-nose shovel.

DETAIL F

Joint Sealant Material

1 1/2 Joint Sealant Material

1 1/2 plywood or pressed wood spacer required for 'EF' joint.

DETAIL G

Flexible Foam Joint Filler

DETAIL H

Tire Buffings

T = 1/4 inch tool for length of joint indicated if formed; edging not required when cut with diamond blade saw.

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.

Predrill or preform holes in joint material for appropriate dowel size.

Compact tire buffings by spading with a square-nose shovel.
CONTRACTION JOINTS

Spaces between dowel bars are nominal dimensions with a 1/8" allowable tolerance.

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.

If dowel basket assemblies are required for curbed pavements, the assembly length is based on the jointing layout. See PV-101, sheet 8.

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.

Dowel Assemblies

Dowel Height and Diameter for Doweled Contraction Joints

<table>
<thead>
<tr>
<th>Diameter (Solid)</th>
<th>Diameter (Tubular)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7&quot; to 7 1/2&quot;</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>8&quot; to 9 1/2&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>10&quot; to 11 3/4&quot;</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>12&quot; to 13&quot;</td>
<td>6 1/4&quot;</td>
</tr>
</tbody>
</table>

Tubular Dowel Bars will not be allowed for RD joints.
19. 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.

20. Use wires with a minimum tensile strength of 50 ksi.

21. Details apply to both transverse contraction and expansion joints.

22. Weld alternately throughout.

23. 0.306 inch diameter wire. Wire sizes shown are the minimum required.

24. Maximum 0.177 inch diameter wire, welded or friction fit to upper side rail, both sides.

25. Measured from the centerline of dowel bar to bottom of lower side rail + 1/4 inch.

26. Per lane width, install a minimum of 8 anchor pins evenly spaced (4 per side), to prevent movement of jointing layout. See PV-101, sheet 8.

27. If dowel basket assemblies are required for curbed pavements, the assembly length is based on the jointing layout. See PV-101, sheet 8.

28. 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.

29. Clip and remove center portion of tie during field assembly.

30. 1/4 inch diameter wire.
FIGURE 7010.101
OPTIONAL LEG SHAPES

ANCHOR PIN

ANCHOR PIN

PLACEMENT LIMITS
(Rural Section)

PLACEMENT LIMITS
(Curb and Gutter - Gutterline Jointing)

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

BEND AROUND DOWEL

Dowel Assemblies

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.

Use wires with a minimum tensile strength of 50 ksi.

Details apply to both transverse contraction and expansion joints.

Diameter of bend around dowel is dowel diameter + 1/8 to 3/16 inches.

For uniform lane widths: 3" - 6". For taper and variable width pavements: 3" - 12".

Back of Curb

Top of Pavement

Longitudinal Joint

Edge of Pavement

Centerline Joint

Gutterline Joint

6''

2'-0"

3/16" max.

D + 3/16" max.

1/4 or 1/3 Point
Longitudinal Joint

Back of Curb

12'' min.

1'' min.

45°

(0.306" diameter)

#1/0 Gauge Wire

Anchor Pin

PV-101

STANDARD ROAD PLAN

REVISIONS:

Modified Dowel Assemblies on Sheets 6 and 7 to eliminate reference to STP-2001.

D "width pavements: 3" - 12".

18 inch - 6". For taper and variable width pavements: 3" - 12".

For uniform lane widths: 3" - 6". For taper and variable width pavements: 3" - 12".

Details apply to both transverse contraction and expansion joints.

Diameter of bend around dowel is dowel diameter + 1/8 to 3/16 inches.
**Beam Curb**

*For short replacement sections, match existing curb profile*

**Drop Curb at Sidewalk**

1/2" (max.)

**Driveway Drop Curb**

(Iowa Department of Transportation is not the Contracting Authority)

1 1/2" to 3" (as specified)

**Driveway Drop Curb**

(Iowa Department of Transportation is the Contracting Authority)

1 1/2" to 3" (as specified)

**For joint details, see PV-101.**

1. 6 inch Standard Curb, 6 inch Sloped Curb, or 4 inch Sloped Curb as specified.
2. 1/2 inch 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.
4. 0 to 2 inches for residential entrances. 1 1/2 to 3 inches for industrial or commercial entrances.
图7010.102

对于所有路缘：
- 15英尺正常
- 5'-0"过渡
- 无路缘

曲线路缘过渡：
- 6"标准至6"斜面
- 6"斜面至6"标准

曲缘过渡：
- 6"斜面至4"斜面
- 6"标准至4"斜面

注：如果拟建路面为PCC，与拟建路面相匹配的膨胀接缝间距。
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.
Match adjacent pavement jointing.

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 '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''

SECTION A-A
12'' Hole for Sign Post (if required){par}See Detail 'A'

6'' STANDARD PLAN

'RED' Joint

6'' SLOPED PLAN

'RED' Joint

Match adjacent pavement jointing.

MATCH ADJACENT PAVEMENT JOINTING.
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.

Possible Curb

Existing Expansion Joint (PCC)

Cracks

Existing ‘C’ or ‘CD’ Joint (PCC)

Existing Pavement

PCC Widening

PCC Widening

15' Typical

Min. 5'

Maximum 20'

Possible Curb

Cut joints opposite existing joints first, then make intermediate cuts.

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.
QUARTER POINT JOINTING

THIRD POINT JOINTING

GUTTERLINE JOINTING

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

### TRANSVERSE JOINT REQUIREMENTS

<table>
<thead>
<tr>
<th>Pavement Thickness</th>
<th>Transverse Joint Type</th>
<th>Transverse Joint Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>C</td>
<td>12'</td>
</tr>
<tr>
<td>7&quot;</td>
<td>C</td>
<td>15'</td>
</tr>
<tr>
<td>8&quot;</td>
<td>CD (5)</td>
<td>15'</td>
</tr>
<tr>
<td>9&quot;</td>
<td>CD (5)</td>
<td>15'</td>
</tr>
<tr>
<td>≥10&quot;</td>
<td>CD (5)</td>
<td>20'</td>
</tr>
</tbody>
</table>
Widening Width as Specified

1'-0" or as Specified

Cross Slope as Specified

Integral Curb as Specified. See Figure 7010.102.

2'-0"

2'-6"

2" Thickened Edge

Existing Pavement

BT-3 or BT-5 Joint

Match existing pavement thickness or as specified in the contract documents.

Subgrade or subbase material as specified.

Remove existing curb using full depth saw cut.

CURB FOR WIDENING WITH HMA OVERLAY

Overlay Thickness

Integral Curb as Specified. See Figure 7010.102

HMA 1/8" High

See Figure 7010.121 for typical joint layout.
If applicable, terminate curb in approach.

By Railroad

C of Tracks

Rail

Tie

If applicable, terminate curb in approach.

C of Track

1" Fiber Board

Porous Backfill Material

By Railroad

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.
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.
Seal all joints.

Install expansion joints as directed by the Engineer. Construct expansion joints with 1 inch expansion material. Seal all joints.

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.

Median height as specified in the contract documents.

Dowel bars at 24" C-C longitudinal spacing. Drill holes in existing slab for dowel bars and install with polymer grout.

Width of island as specified in the contract documents.

Grass or Landscaping (as specified) 4% Cross Slope (or as specified)

LANDSCAPE MEDIAN

DOWEL BAR DETAIL

DOWELED MEDIAN

SUHAS Standard Specifications
Construct boxout with Class C concrete. Minimum 2 inches clear on reinforcement. Center casting within boxout area.

1. 4 foot 8 inch (typ.) #4 bar. Place at mid-slab.
2. If boxout is constructed prior to placement of HMA overlay or final lift of HMA pavement, boxout may be constructed low, with a 'B' joint in place of the 'E' joint, and then final lift or overlay placed.
3. Apply tack coat.
4. #4 hoops (variable length). Place at mid-slab.
Compacted Subgrade or Subbase

Width - Back of Curb to Back of Curb

Do not disturb parking.

Existing Curb and Gutter

Compacted Subgrade or Subbase

Width - Edge of Gutter to Edge of Gutter

HMA PAVEMENT SECTION
(With Existing Curb and Gutter)

Grade parking as specified in the contract documents.

Standard PCC Curb and Gutter Section. See Figure 7010.102 (PV-102).

HMA Surface Course
HMA Intermediate Course
HMA Base Course

Compacted Subgrade or Subbase

Width - Back of Curb to Back of Curb

HMA PAVEMENT SECTION
(With New Curb and Gutter)
1. 6 inch standard curb and gutter.
2. Subbase or subgrade as specified.

HMA Pavement

Standard PCC Curb and Gutter

'C' Joints

15' nominal  15' nominal  15' nominal

31' Back to Back
26' Back to Back

13'-0"  10'-6"

13'-0"  10'-6"

2'-6"

2.0%  2.0%

TYPICAL CROSS-SECTION
By Railroad

SECTION A-A

If applicable, terminate curb prior to approach.

1. HMA or composite mainline paving.
2. Install 6 inch perforated CMP subdrain, if specified. Include rodent guard per Iowa DOT Materials I.M. 443.01.
3. Granular subbase, modified subbase, or ballast meeting railroad specifications.
4. For new crossings, construct pavement 1/2 inch to 1 inch below top of rail. For existing crossings, construct pavement level to 1/2 inch below top of rail.
5. Construct HMA approach according to full depth HMA patch requirements, or requirements for mainline paving if constructed with HMA mainline.
6. Refer to Figure 7030.205 for detectable warning location.
For temporary runouts and wedges, place subgrade paper, burlap, or similar material over adjacent surfaces to facilitate removal. Construct temporary runout at a length of 10 feet for each 1 inch of resurfacing thickness.

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

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

**MINIMUM FILLET WIDTH**

<table>
<thead>
<tr>
<th>TYPE OF ACCESS</th>
<th>PRIMARY ROADS</th>
<th>SECONDARY AND LOCAL ROADS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F (ft.)</td>
<td>F (ft.)</td>
</tr>
<tr>
<td>Residential Entrance</td>
<td>40</td>
<td>12</td>
</tr>
<tr>
<td>Farm Entrance</td>
<td>60</td>
<td>18</td>
</tr>
<tr>
<td>Commercial Entrance</td>
<td>80</td>
<td>24</td>
</tr>
<tr>
<td>Non-paved Road</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>Paved Road</td>
<td>Variable</td>
<td>Variable</td>
</tr>
</tbody>
</table>
TYPICAL LEVELING COURSE

TYPICAL STRENGTHENING COURSE

MILLED SURFACE NOTCH RUNOUT

GUTTERLINE EDGE - MATCH

WEDGE SHAPED RUNOUT
(When Milling is not Specified)

GUTTERLINE EDGE - NOTCH

DOUBLE COURSE RESURFACING

~ Existing Pavement ~

Intermediate Material

Begin Station

Length of Leveling Course

End Station

Runout Back

Length of Leveling Course

Runout Ahead

Location Station

Runout Length

Surface Course

Intermediate Course

Width

(as specified)

Surface Course

Intermediate Course

Location Station

Runout Length

Surface Course

Intermediate Course

Location Station

Runout Length

Surface Course

Intermediate Course

Width

(as specified)

Surface Course Thickness

Mill edge. Match surface course thickness.

Surface Course Thickness

Mill

SUDAS Standard Specifications

DETAILS FOR
ASPHALT RESURFACING
CONCRETE DRIVEWAY, TYPE A

TYPE A WITH FLARES

1. Driveway radius (R).
   Residential: 10 foot minimum, 15 foot maximum.
   Commercial and industrial: As specified in the contract documents.

2. Transition the curb height to 0 inches at end of taper/radius or at the front edge of sidewalk. Do not extend raised curb across sidewalk.

3. Pavement thickness.
   Residential: 6 inches minimum.
   Commercial and industrial: 7 inches minimum.

4. Sidewalk thickness through driveway to match thickness of driveway.

5. Center reinforcing bar vertically in the pavement.

6. Match thickness of adjacent roadway, 8 inches minimum.

7. Provide ‘E’ joint at back of curb unless ‘B’ joint is specified.

8. For alleys, invert the pavement crown 2% toward center of alley.

9. Target cross slope of 1.5% with a maximum cross slope of 2.0%. If specified in the contract documents, construct the sidewalk through the driveway 5 feet wide to serve as a passing space.

10. If cross slope of adjacent sidewalk panel exceeds 2.0%, remove and replace to transition from existing sidewalk to sidewalk through driveway. If elevation change requires a curb ramp, comply with Figure 7030.205; verify need for detectable warning panel with Engineer.

SUDAS Standard Specifications

CONCRETE DRIVEWAY, TYPE A

2. Transition the curb height to 0 inches at end of ramp/radius or at the front edge of sidewalk. Do not extend raised curb cross sidewalk.


4. Sidewalk thickness through driveway to match thickness of driveway.

5. If longitudinal joint is located 48 inches or less from the back of curb, extend boxout to joint line. Full depth saw cut is still required.

6. For alleys, invert the pavement crown 2% toward the center of the alley.

7. Target cross slope of 1.5% with a maximum cross slope of 2.0%. If specified in the contract documents, construct the sidewalk through the driveway 5 feet wide to serve as a passing space.

8. If cross slope of adjacent sidewalk panel exceeds 2.0%, remove and replace to transition from existing sidewalk to sidewalk through driveway. If the elevation change requires a curb ramp, comply with Figure 7030.205, verify need for detectable warning panel with Engineer.
1. 10 foot vertical curve required for 5% or greater change in grade.
2. Slope varies. See contract documents.
3. Target cross slope of 1.5% with a maximum cross slope of 2.0%.

TYPICAL CUT SECTION

TYPICAL FILL SECTION
TYPICAL CUT SECTION

- Existing Ground Line
- Round slope at toe.
- Round slope at top.
- Parking Slope:
  - If parking width is less than 10 feet wide, slope at 1/4 inch per foot.
  - If parking width is 10 feet wide and greater, slope at 1/2 inch per foot.
- Varies
- Line, Ground, Existing

TYPICAL FILL SECTION

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

\[ W = \text{Sidewalk width as specified in the contract documents.} \]
See Figure 7010.101, Detail C

See Figure 7010.101, Detail E

Roadway Pavement

Sidewalk

4" min.

12" 18"

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

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

1/2" Expansion Joint

Roadway Pavement

Sidewalk

5" 3"

1" Radius

Adjacent Pavement

Sealed 'E' Joint

4" min.

12" 18"
1. Install 2 inch diameter, 12 inch long, PVC pipe even with the top of the asphalt setting bed at locations specified. Fill pipe with 3/4 inch clean rock.

2. Fill reservoir with 3/4 inch clean rock. Extend reservoir to subdrain if present.

Install brick/paver sidewalk with pattern specified in the contract documents.

Refer to Detail A

Pavement Base

Construct joint for concrete base as specified for concrete sidewalk.

Weep Hole

Cover weep hole with engineering fabric.

Finish Grade

1/2" max Radius

1/2" min.

1/4" max. Chamfer

1/16" to 3/16" Joint Opening

Detail A

SUDAS Standard Specifications

BRICK/PAVER SIDEWALK WITH PAVEMENT BASE

BRICK/PAVER SIDEWALK

SUDAS
Curb ramp requirements:
1. Maximum curb ramp slope of 8.3%, or
2. Minimum length of 15'-0" at any constant slope.
3. Target cross slope of 1.5% with a maximum cross slope of 2.0%.

Key
- Curb Ramp
- Turning Space
- Detectable Warning
- Grass

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

Perpendicular Curb Ramp (length varies)
Turning Space (4'-0"x4'-0" min.)
Parallel Curb Ramp (if required)
Standard Sidewalk

See Detail A
5% max. Cross Slope

Pavement

Key
- Curb Ramp
- Turning Space
- Detectable warning

SKewed CROSSING
PERPENDICULAR CROSSING

Detectable Warning (location varies)
Possible Crossing Arm
Edge of Pavement

24" Wide (min.)

Locate front edge of detectable warning panel 12 to 15 feet from centerline of nearest rail. Orient truncated domes parallel to the direction of pedestrian travel.

1. Provide a minimum 2 foot width of detectable warning surfaces in the direction of pedestrian travel across the full width of the curb ramp or turning space, exclusive of curbs or flares.
2. Provide a minimum of 6 inches of concrete below the detectable warning panel.
3. Minimum 4 feet by 4 feet. Target cross slope of 1.5% with a maximum cross slope of 2.0%.
4. If normal sidewalk elevation cannot be achieved with the perpendicular ramp between the street and landing due to limited ramp length, provide a parallel ramp to make up the elevation difference between the landing and the standard sidewalk. The length of the parallel ramp is not required to exceed 15 feet, regardless of the resulting slope. Do not exceed 8.3% slope for parallel ramps shorter than 15 feet.
5. If crossing gate conflicts with location of detectable warning or if pedestrian crossing gate is provided, place detectable warning panel in advance of the crossing gate.
6. Provide a minimum 2 foot width of detectable warning surfaces in the direction of pedestrian travel across the full width of the curb ramp or turning space, exclusive of curbs or flares.

GENERAL SIDEWALK AND CURB RAMP DETAILS
1. **Perpendicular Curb Ramp**: Target running slope of 6.25% with maximum running slope of 8.3%. Match pedestrian street crossing cross slope at back of curb. At mid-block crossings, cross slope may exceed 2.0% to match roadway grade.

2. **Parallel Curb Ramp**: Target cross slope of 1.5% with a maximum cross slope of 2.0%. The length of the parallel ramp is not required to exceed 15 feet, regardless of resulting slope. Do not exceed 8.3% slope for parallel ramps shorter than 15 feet.

3. **Turning Space**: Target slope of 1.5%, with a maximum slope perpendicular to the travel directions of 2.0%. At mid-block crossings, cross slope of landing may exceed 2.0% to match roadway grade. Minimum 4 feet by 4 feet.

4. **Flare (10:1 max.)**: Required if ramp is contiguous with sidewalk.
1. Parallel Curb Ramp: If normal sidewalk elevation cannot be achieved with the perpendicular ramp between the street and landing due to limited ramp length, provide a parallel ramp to make up the elevation difference between the landing and the standard sidewalk.

The length of the parallel ramp is not required to exceed 15 feet, regardless of the resulting slope. Do not exceed 8.3% slope for parallel ramps shorter than 15 feet.

2. Turning Space: Target slope of 1.5% with maximum slope perpendicular to the travel directions of 2.0%. Minimum 4 feet by 4 feet.

3. Perpendicular Curb Ramp: Target running slope of 6.25% with maximum running slope of 8.3%.

4. Target cross slope of 1.5% with a maximum cross slope of 2.0%.

5. Match pedestrian street crossing cross slope or flatter.

Key:
- Curb Ramp
- Turning Space
- Detectable warning
- Grass

SUDAS Standard Specifications

CURB RAMP FOR CLASS B OR C SIDEWALK
1. Parallel Curb Ramp: If normal sidewalk elevation cannot be achieved with the perpendicular ramp between the street and landing due to limited ramp length, provide a parallel ramp to make up the elevation difference between the landing and the standard sidewalk.

The length of the parallel ramp is not required to exceed 15 feet, regardless of the resulting slope. Do not exceed 8.3% slope for parallel ramps shorter than 15 feet.

2. Turning Space: Target slope of 1.5% with maximum slope perpendicular to the direction of travel of 2.0%. Minimum 4 feet by 4 feet.

3. Target cross slope of 1.5% with a maximum cross slope of 2.0%.

Key:
- Dark Gray: Curb Ramp
- Light Gray: Turning Space
- Black Dots: Detectable warning
- Green: Grass

Cut panels as required to provide continuous detectable warning surface around radius.
Figure 7030.209

Class A Sidewalk Curb Ramp

Key:
- Curb Ramp
- Turning Space
- Detectable Warning

1. Turning Space: Target slope of 1.5% with maximum slope perpendicular to the travel direction of 2.0%. Minimum 4 feet by 4 feet (turning spaces may overlap).

2. Perpendicular Curb Ramp: Target running slope of 6.25% with maximum running slope of 8.3%.

3. Parallel Curb Ramp: Target running slope of 6.25% with maximum running slope of 8.3%. The length of the parallel ramp is not required to exceed 15 feet, regardless of the resulting slope. Do not exceed 8.3% for parallel ramps shorter than 15 feet.
Provide a minimum 2 foot width of detectable warning surfaces in the direction of pedestrian travel across the full width of the curb ramp or turning space, exclusive of curbs or flares.

1. When detectable warning is located on curb ramp surface, orient domes in the direction of pedestrian travel.

2. When the distance between the grade break and the back of curb is less than 5 feet, place detectable warning surface at the bottom of the curb ramp.

Where one corner of the curb ramp is more than 5 feet from the back of curb, construct curb ramp as a parallel curb ramp. Move grade break back as required to place detectable warning on turning space at the back of curb.
THIRD POINT JOINTING

GUTTERLINE JOINTING

ONE PANEL WIDTH PATCH WITH OPPOSING JOINT

OUTSIDE PANEL PATCH WITH OPPOSING JOINT

CENTER PANEL PATCH WITH OPPOSING JOINT

NO OPPOSING JOINT

ONE PANEL WIDTH PATCH

CENTER PANEL PATCH

OUTSIDE PANEL PATCH

FULL ROADWAY

WIDTH PATCH

ADJACENT PANELS

PATCH

Patches on roadways with quarter point jointing will be similar to third point jointing details.

Minimum distance between existing joint and patch is 6 feet. If distance is less than 6 feet, extend patch to existing joint.

If subgrade or subbase material is required below patch, bring material to a level 2 inches below bottom of existing pavement.

BT, KT, or L joint depending on pavement thickness and pouring sequence.

THRU PCC PATCH

LONGITUDINAL SECTION

THRU PCC PATCH
**GREATER THAN 15' LONG FULL DEPTH PATCHES**

**GUTTERLINE JOINTING**

- **ONE PANEL WIDTH PATCH**
  - (Diagram)

- **FULL ROADWAY WIDTH PATCH**
  - (Diagram)

**THIRD POINT JOINTING**

- **OUTSIDE PANEL PATCH**
  - (Diagram)

- **CENTER PANEL PATCH**
  - (Diagram)

- **FULL ROADWAY WIDTH PATCH**
  - (Diagram)

1. Patches on roadways with quarter point jointing will be similar to third point jointing details.
2. Minimum distance between existing joint and patch is 8 feet. If distance is less than 6 feet, extend patch to existing joint.
3. Match existing joint type and locations.
4. "C" joint unless "CD" joint is specified.
5. If existing joint spacing is greater than 20 feet, add a "CT" joint at mid-panel.
6. If subgrade or subbase material is required below patch, bring material to a level 2 inches below bottom of existing pavement.
7. BT, KT, or L joint depending on pavement thickness and pouring sequence.

**LONGITUDINAL SECTION**

- **THRU PCC PATCH**
  - (Diagram)

**SUDAS Standard Specifications**

**FIGURE 7040.102**

- **SUDAS Standard Specifications**
  - (Text)

**7040.102**

**REV 4 2021 Edition**

**SHEET 1 OF 1**

**FULL DEPTH PATCHES GREATER THAN 15' LONG**
1. If subgrade or subbase material is required below patch, bring material to a level 2 inches below bottom of existing pavement.

2. When removing pavement, saw to full depth or 10 inches, whichever is less.
PARTIAL DEPTH PATCHES

1 Vertical saw cut (typical). Apply tack coat to sides and bottom.
2 Taper the sides of the removal area 30 to 60 degrees from vertical. Apply cement grout to sides and bottom.
3 Saw and seal existing joint.
4 Extend patch limits at least 3 inches beyond distressed area.
5 When milled removal is allowed, sawed vertical edges are not required. Apply cement grout to milled area.

SECTION A-A
(Option 1: Sawed Edges)

SECTION A-A
(Option 2: Milled Edges)

SECTION B-B

PCC PATCH ACROSS JOINT

PCC PATCH ABUTTING JOINT

HMA PATCH

Initial Saw Cut

Existing Joint or Crack

T/2 max.

2" min.

Existing Joint or Crack

T/2 max.

2" min.

Existing Joint or Crack

T/2 max.

2" min.

Existing Joint or Crack

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Existing Joint or Crack

T/2 max.

2" min.

Existing Joint or Crack

T/2 max.
**PLAN VIEW**
(Flowable mortar cutoffwall and cross run location.)

**SECTION A-A**
(Flowable mortar cutoffwall and storm sewer)

**FLOWABLE MORTAR CUTOFFWALL**
(Without Sewer)

**FLOWABLE MORTAR CUTOFFWALL**
(With Subdrain)

**DISTANCE FROM \( \zeta \) INTAKE TO \( \zeta \) CROSSRUN**

<table>
<thead>
<tr>
<th>Size</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot; RCP</td>
<td>0.7'</td>
</tr>
<tr>
<td>15&quot; CMP</td>
<td>0.8'</td>
</tr>
<tr>
<td>18&quot; RCP</td>
<td>0.5'</td>
</tr>
<tr>
<td>18&quot; CMP</td>
<td>0.7'</td>
</tr>
</tbody>
</table>
Extend concrete patch material 1/8" above existing concrete surface for projects to be diamond ground; construct flush if diamond grinding is not required.

Sawcut joint width 3/16" min to 5/16" max. Saw after concrete patch material has set.
For pedestrian ramps damaged by subsurface utility exploration (SUE) core holes, replace the entire ramp according to Section 7030. For pavements damaged by SUE core holes, provide patches according to Figures 7040.101 or 7040.103. If allowed by the Engineer, repair core holes as shown.

1. Fill vacuum excavated SUE hole with CLSM to an elevation within 2 inches of the bottom of the pavement.

2. When allowed by the Engineer, fill utility verification hole with Class I bedding stone, pea gravel, or suitable native materials. Place backfill materials in 4 inch maximum lifts and compact each lift.

3. For PCC core hole repairs, drill four, 5 inch long, 5/8 inch diameter holes into the sides of the core hole at a 30 to 45 degree angle. Grout four 8 inch long #4 reinforcing bars into holes. Fill core holes with low slump concrete, tamp to remove air voids, screed level with existing pavement and texture to match existing pavement.

4. For asphalt core hole repairs, place asphalt mixture in 2 inch lifts and compact. If allowed by the Engineer, replace core with low slump concrete as noted above or pre-mixed high performance cold mix generally meeting the asphalt mixture specified. Match elevation of existing pavement.

5. When allowed by the Engineer, the removed core may be replaced back in the core hole. If the removed core is intact, stable, and free of fractures, replace core back in hole and fill annular space with approved bonding material.

For pedestrian ramps damaged by subsurface utility exploration (SUE) core holes, replace the entire ramp according to Section 7030. For pavements damaged by SUE core holes, provide patches according to Figures 7040.101 or 7040.103. If allowed by the Engineer, repair core holes as shown.

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Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.

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

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.

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

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.

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

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.

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

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.

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

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.

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

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

4. When underdrain collectors and/or laterals are specified, install to the line and grade specified in the contract documents. Place permeable pavement filter aggregate to springline of pipe.

5. Place 4 inches of filter aggregate under curb and gutter section. Extend to 12 inches beyond the back of curb. Extend engineering fabric under aggregate.

6. Install paver edge restraint system along unrestrained edges.
Refer to the contract documents for dimensions, grades, and additional requirements for permeable interlocking pavers and associated improvements.

1. Permeable interlocking pavers as specified in the contract documents.

2. 2 inch minimum permeable pavement bedding aggregate to accommodate imperfections in the permeable pavement filter aggregate layer.

3. Permeable pavement storage aggregate thickness as specified in the contract documents.

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

Alley Width (as specified)

2'-0" 0% Slope

Slope subgrade at 1%.

1. Permeable Pavers

2. Bedding Aggregate

3. Storage Aggregate

4. 6" PCC Edge Restraint

4" Layer of Filter Aggregate

Place filter aggregate around underdrain.

Place engineering fabric over subgrade and up sides of excavation.

Install 6" perforated underdrain collector.
NEMA CONTROLLER CABINET FOOTING

1. Shape top 11 inches with forms.
2. Bolt spacing and conduit locations as specified by the manufacturer.

- Anchor Bolts
- Conduit
- Riser
- Ground Rod Clamp
- 1" Ground Wire Duct
- Cabinet Width +6"
- Cabinet Depth +6"
- Cabinet
- 4" Apron
- Expansion Material
- Ground Rod
- Conduit
- Riser
The Type A Foundation is the normally required foundation construction. Where rock is encountered, the Engineer may approve the use of the Type B or C Foundation. Prior to installing a foundation in rock, obtain a subsurface investigation certified by a geotechnical engineer licensed in the State of Iowa.

1. Shape top 11 inches with forms. See Detail 'A'.
2. Install rodent guard or non-shrink grout with weep hole.
3. Furnish nut, nut and plate, or nut and anchor bolt assembly ring plate on embedded end.

### TABLE

<table>
<thead>
<tr>
<th>Max. Mast Arm Length</th>
<th>Foundation</th>
<th>&quot;V&quot; Bars</th>
<th>Tie Bars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W</td>
<td>L</td>
<td>Size</td>
</tr>
<tr>
<td>35'-0&quot;</td>
<td>3'-0&quot;</td>
<td>12'-0&quot;</td>
<td>#8</td>
</tr>
<tr>
<td>45'-0&quot;</td>
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<td>14'-0&quot;</td>
<td>#8</td>
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<tr>
<td>55'-0&quot;</td>
<td>3'-0&quot;</td>
<td>16'-0&quot;</td>
<td>#8</td>
</tr>
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<td>60'-0&quot;</td>
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<td>#10</td>
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<td>80'-0&quot;</td>
<td>3'-6&quot;</td>
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<td>#10</td>
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<tr>
<td>90'-0&quot;</td>
<td>4'-0&quot;</td>
<td>22'-0&quot;</td>
<td>#10</td>
</tr>
<tr>
<td>100'-0&quot;</td>
<td>4'-0&quot;</td>
<td>24'-0&quot;</td>
<td>#10</td>
</tr>
</tbody>
</table>

### BENT BAR DETAIL

Note: All dimensions are out to out.
Type B Foundation is applicable for traffic signal poles with mast arm lengths up to 60 feet.

If the excavation for a Type B Foundation is left open for more than 1 calendar day, install temporary barrier rail if any part of the excavation is located within the clear zone. Temporary barrier rail layout requires the Engineer's approval.

Competent rock has an average unconfined compressive strength (q_u) of at least 2.0 ksi and rock quality designation of at least 90%. Conditions not meeting minimum requirements will require either:
- A site specific design, or
- Using the parameters for Mast Arm Pole Foundation in Soil.

1. Install rodent guard or non-shrink grout with weep hole.
2. Furnish nut, nut and plate, or nut and anchor bolt assembly ring plate on embedded end.
3. Place 13 equally spaced #6 vertical bars.
4. Cast foundation concrete against competent rock. If foundation is formed, place backfill with concrete cast against rock.
5. When in contact with rock, place ground rods as specified in National Electrical Code, current edition.
6. #6 bars spaced at 8 inch maximum. Ties may be welded to vertical bars.
### MAST ARM POLE FOUNDATION IN ROCK

**TYPE C FOUNDATION**

- **Ground Rod Clamp**
- **6 Spaces at 4" O.C.**
- **Finished Pavement Grade**
- **3" Clearance**
- **Drilled Shaft Tie Bars**
- **Rock Socket Tie Bars**

### BENT BAR DETAIL

- **Detail 'A'**
- **6" Clear Cover Drilled Shaft**
- **3" Clear Cover Rock Socket**

### "V" Bars

- **Ground Rod**
- **Note:** All dimensions are out to outer.

### "V" Bars (See Table for Count)

- **Stagger hooks to engage different "V" bars each row**

### Pole Base

- **Shape with Forms**

---

### Traffic Signal Pole Foundation

- **BENT BAR DETAIL**
  - **Pole Base**
  - **Shape with Forms**

---

### Table: VARS L = (L - L_{L})

<table>
<thead>
<tr>
<th>Max. Mast Arm Length</th>
<th>Foundation Broken Rock*</th>
<th>Foundation Competent Rock**</th>
<th>&quot;V&quot; Bars</th>
<th>Tie Bars</th>
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<tbody>
<tr>
<td>35'-0&quot;</td>
<td>3'-0&quot;</td>
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<td>4'-6&quot;</td>
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<td>55'-0&quot;</td>
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<td>24'-0&quot;</td>
<td>6'-0&quot;</td>
</tr>
</tbody>
</table>

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*Broken rock has an average unconfined compressive strength \((q)\) of at least 1.0 ksi and rock quality designation of at least 20%.

**Competent rock** has an average unconfined compressive strength \((q)\) of at least 2.0 ksi and rock quality designation of at least 90%.

**Total foundation length** \(L\) must be sufficient to provide a 3 inch clearance between the bottom of the traffic signal pole anchor bolts and the bottom of the rock socket.

**The Rock Socket Length** \(L_{S}\) can be decreased if the total length of the shaft is \(L\) long as shown in the table.

**Conditions not meeting minimum requirements** will require site specific designs or shall use the Type A Foundation Soil parameters.
① Shape top 11 inches with forms. See Detail 'A'.
② Install rodent guard or non-shrink grout with weep hole.
③ Furnish nut, nut and plate, or nut and anchor bolt assembly ring plate on embedded end.

PEDESTAL POLE FOUNDATION IN SOIL OR ROCK

1. Shape top 11 inches with forms. See Detail 'A'.
2. Install rodent guard or non-shrink grout with weep hole.
3. Furnish nut, nut and plate, or nut and anchor bolt assembly ring plate on embedded end.

---

**SUDAS**

**KOWADOT**

**TS-102**

**FIGURE 8010.102**

**STANDARD ROAD PLAN**

**REVISIONS**

Modified conduit details in MAST ARM POLE FOUNDATION drawings on Sheets 1, 2, and 3.

**TRAFFIC SIGNAL POLE FOUNDATION**
CONDUIT AND PRECAST HANDHOLES

- **Precautions**: Ensure all connections and components are properly secured and aligned.

- **Dimensions**:
  - HDPE Handhole (Type V):
    - **Finished Pavement Grade**: 2'-0" min.
    - **2'-0" min. diameter**
    - **2'-0" min. thickness**
    - **Composite Lid**
  - Precast Concrete Handhole (Type I):
    - **2'-0" min. diameter**
    - **2'-0" min. thickness**
    - **Cable Hooks (4) Required**
    - **1" dia. walls of handhole**
    - **Extend 8" granular base 6" beyond walls of handhole.**

- **Materials**:
  - HDPE Frame
  - Composite Lid

- **Installation**:
  - Align all components to ensure proper function and longevity.

- **Inspection**:
  - Regular checks are recommended for maintenance and safety purposes.

**Referenced Standards and Codes**

**Revisions**: Added the HDPE handhole to the precast concrete and composite ones.
**CONDUIT AND PRECAST HANDBOLES**

**HANDHOLE DIMENSIONS TABLE**

<table>
<thead>
<tr>
<th>TYPE</th>
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<tr>
<td>IV</td>
<td>48&quot;</td>
<td>30&quot;</td>
<td>36&quot;</td>
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</table>

**PRECAST CONCRETE COMPOSITE HANDBOLE**

- Stainless Steel Bolt
- One Piece Lid  —  (Type II or III)  
- Pull Slot
- Skid Resistant Surface

- Two Piece Lid  —  (Type IV)  
- Pull Slot
- Skid Resistant Surface

- Cable Hooks  —  (4) Required

- Extend granular base 8" beyond walls of handhole.

- Ensure backfill material is free of cinders, concrete, or other rubble.

- Compact Backfill Material

- 4" min. Trench

**CONDUIT IN TRENCH**

- Conduit Depth

- 24" min. to 48" max.
MODIFIED DIAMOND DETECTOR LOOP

SECTION A-A

RECTANGULAR DETECTOR LOOP

SUDAS Standard Specifications

INDUCTIVE LOOP VEHICLE DETECTORS
STEEL MAST ARM POLE

Number of signals, signs, and spacing as specified in the contract documents.

Typical placement of traffic control and street name signs.

1. Ensure the top of the signal housing is no more than 25.6 feet above the pavement. Ensure the bottom of the signal housing and related attachments are at least 15 feet above the pavement.

2. Ensure the bottom of the signal housing (including brackets) that is not located over a roadway is a minimum of 8 feet and a maximum of 19 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

3. Mount pedestrian signal heads with the bottom of the signal housing (including brackets) no less than 7 feet or more than 10 feet above the sidewalk level. Position and adjust heads to provide maximum visibility at the beginning of the controlled crosswalk.

Handhole

Luminaire Arm Length

Mast Arm Length

Fixed or Universally Adjustable Mounting Brackets

Pedestrian Push Button and Sign

3'-6" Above Sidewalk

Minimum 4"X6" Handhole

Backplates

Luminaire

Mounting Height

SUDAS Standard Specifications

MAST ARM POLE DETAILS

10-15-13

POLE DETAILS

MAST ARM

MOUNTING HEIGHT

NUMBER OF SIGNALS, SIGNS, AND SPACING AS SPECIFIED IN THE CONTRACT DOCUMENTS.

TYPICAL PLACEMENT OF TRAFFIC CONTROL AND STREET NAME SIGNS.

1. Ensure the top of the signal housing is no more than 25.6 feet above the pavement. Ensure the bottom of the signal housing and related attachments are at least 15 feet above the pavement.

2. Ensure the bottom of the signal housing (including brackets) that is not located over a roadway is a minimum of 8 feet and a maximum of 19 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

3. Mount pedestrian signal heads with the bottom of the signal housing (including brackets) no less than 7 feet or more than 10 feet above the sidewalk level. Position and adjust heads to provide maximum visibility at the beginning of the controlled crosswalk.
1. Shape top 11 inches with forms.
2. Install rodent guard or non-shrink grout with weep hole.
3. Provide 1/2 inch diameter hex nut with 1 1/2 inch flat washer. Protect anchor bolt with nut cover.
4. Deform threads to prevent nut from backing off.

Fixed or Universally Adjustable Mounting Brackets

Pedestrian Traffic Signal Head Assembly

Pedestrian Push Button Sign

Pedestrian Push Button

PEDESTAL POLE

PEDESTRIAN PUSH BUTTON POST AND FOUNDATION

Expansion Material

Finished Pavement Grade

1/2" x 24" Anchor Bolts, Threaded Rod with Nut

Concrete Foundation

12" dia.

1" Conduit

5/8" dia. Hole

2 1/4" dia. Hole

4 1/2" dia. Bolt Circle

1/2" Steel Plate

BASE PLATE DETAIL

PEDESTRIAN POST DETAILS
TEMPORARY TRAFFIC CONTROL

Flagger (facing left) tells traffic what to expect ahead.

Advance Warning Area moves traffic out of its normal path.

Transition Area provides protection for traffic and workers.

Buffer Space (longitudinal) tells traffic what to expect ahead.

Traffic Space allows traffic to pass through the activity area.

Activity Area is where work takes place.

Work Space (longitudinal) provides protection for traffic and workers.

Buffer Space (lateral) provides protection for traffic and workers.

Downstream Taper

Termination Area lets traffic resume normal operations.

Shoulder Taper

FIGURE 8030.101

Distance Between Signs

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-25</td>
<td>100</td>
<td>50</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>30-40</td>
<td>250</td>
<td>100</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>45-50</td>
<td>350</td>
<td>150</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>55</td>
<td>500</td>
<td>200</td>
<td>150</td>
<td>70</td>
</tr>
</tbody>
</table>

Channelizing Device Spacing

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>Taper (ft)</th>
<th>Buffer (ft)</th>
<th>Work Space (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>35</td>
<td>35</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>45</td>
<td>45</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>110</td>
<td>110</td>
</tr>
</tbody>
</table>

Merging Taper Lengths for Lane Closure*

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>Taper Length (ft)</th>
<th>Number of Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>80</td>
<td>6</td>
</tr>
<tr>
<td>25</td>
<td>125</td>
<td>6</td>
</tr>
<tr>
<td>30</td>
<td>180</td>
<td>7</td>
</tr>
<tr>
<td>40</td>
<td>245</td>
<td>8</td>
</tr>
<tr>
<td>45</td>
<td>320</td>
<td>9</td>
</tr>
<tr>
<td>50</td>
<td>540</td>
<td>13</td>
</tr>
<tr>
<td>55</td>
<td>600</td>
<td>13</td>
</tr>
</tbody>
</table>

*Values shown are for a 12 foot shift. Table does not apply to one-lane, two-way (flagger) tapers.

It may be necessary to combine two or more examples to adequately address the traffic control needed.

Utilize vehicle warning lights (amber, high-intensity rotating, flashing, oscillating, or strobe light) on all shadow and work vehicles.

Vehicle hazard lights may be used to supplement warning lights. Do not use hazard lights alone.

Flags may be used to call attention to the advanced warning signs.

If a closure extends overnight, utilize channelizing devices with retroreflective sheeting.

Speed limit refers to the legally established and signed speed limit.

If an arrow board is used on 2-lane roads, operate only in the caution mode.

Adjust the position of warning signs and channelizing devices for available sight distance.

Do not install temporary traffic control devices until work is ready to begin, and remove or cover all signs and devices promptly when they are not needed.

The END WORK (G20-2) signs shown on all figures are optional.
Use only on minor, low speed (≤40 mph) streets. Provide a lane closure for higher speed traffic conditions.

Maintain a minimum lane width of 10 feet as measured to the rear face of channelizing devices. For short-term use on low speed, low volume roads without wider heavy commercial vehicles, a minimum lane width of 9 feet may be used.

Where the opposite shoulder is suitable for carrying vehicular traffic, lanes may be shifted by using closely spaced channelizing devices provided the resulting lane widths are at least 10 feet wide.

Additional advanced warning may be appropriate, such as a ROAD NARROWS sign.

For short-term work, the taper and channelizing devices may be omitted if a shadow vehicle with activated vehicle warning lights is used.

Refer to Figure 8030.101 for symbol key and sign spacing.

Provide a lane closure for higher speed traffic conditions.

Maintain a minimum lane width of 10 feet as measured to the rear face of channelizing devices. For short-term use on low speed, low volume roads without wider heavy commercial vehicles, a minimum lane width of 9 feet may be used.

Where the opposite shoulder is suitable for carrying vehicular traffic, lanes may be shifted by using closely spaced channelizing devices provided the resulting lane widths are at least 10 feet wide.

Additional advanced warning may be appropriate, such as a ROAD NARROWS sign.

For short-term work, the taper and channelizing devices may be omitted if a shadow vehicle with activated vehicle warning lights is used.

Refer to Figure 8030.101 for symbol key and sign spacing.
Maintain a minimum lane width on either side of the center work space of 10 feet as measured from the near edge of channelizing devices to the edge of pavement, paved shoulder, or face of curb.

A lane width of 9 feet may be used for short-term stationary work on low speed (< 40 mph), low volume roads when motor vehicle traffic does not include longer and wider heavy commercial vehicles.

A work vehicle displaying vehicle warning lights may be used instead of the channelizing devices forming the tapers.

Refer to Figure 8030.101 for symbol key and sign spacing.
Traffic may be self-regulating when the work space is short and drivers can see the roadway beyond.

Use one or two flaggers when motor vehicle traffic cannot effectively self-regulate.

Refer to Figure 8030.101 for symbol key and sign spacing.

Alternate 1

Use of Alternate 1 is restricted to low-speed roadways with good sight distance (paved or unpaved) during daylight hours.

Traffic may be self-regulating when the work space is short and drivers can see the roadway beyond.

Use one or two flaggers when motor vehicle traffic cannot effectively self-regulate.

Alternate 2

Use of Alternate 2 is restricted to roadways where average daily traffic is fewer than 400 vehicles and good sight distance exists.

Do not use within 2,500 feet of a similar work site.

May be used for overnight closures. During non-working hours remove materials, equipment, or stockpiled waste and fill or cover excavations.
A second flagger may be required when the flagger’s view of approaching traffic in the open lane is less than 1/4 mile or the work site is in an area of restricted sight distance (such as a No Passing Zone); and excessive traffic delays and conflicts are encountered.

If second flagger is required, refer to Figure 8030.106.

Flagger Notes:
Allow traffic in the open lane to flow freely.

Stop the first vehicle in the closed lane from the centerline to stop other vehicles.

A work vehicle displaying vehicle warning lights may be substituted for the Type III barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.

Do not park vehicles or equipment on opposite side of work area.

A work vehicle displaying vehicle warning lights may be substituted for the Type III barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.

Use is restricted to roadways where average daily traffic is fewer than 2,000 vehicles per day and good sight distance exists. Use during daylight hours only.

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Use is restricted to roadways where average daily traffic is fewer than 2,000 vehicles per day and good sight distance exists. Use during daylight hours only.

Do not park vehicles or equipment on opposite side of work area.

A work vehicle displaying vehicle warning lights may be substituted for the Type III barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.

Flagger Notes:
Allow traffic in the open lane to flow freely.

Stop the first vehicle in the closed lane from the centerline to stop other vehicles.

A work vehicle displaying vehicle warning lights may be substituted for the Type III barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.

Do not park vehicles or equipment on opposite side of work area.

A work vehicle displaying vehicle warning lights may be substituted for the Type III barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.

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Do not park vehicles or equipment on opposite side of work area.

A work vehicle displaying vehicle warning lights may be substituted for the Type III barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.
An optional BE PREPARED TO STOP sign may be added between the flagger sign and the ONE LANE ROAD AHEAD sign.

Extend the buffer space as required so the two-way traffic taper is placed before a horizontal curve (or crest vertical curve) to provide adequate sight distance for the flagger and a queue of stopped vehicles.

Refer to Figure 8030.105 for work in vicinity of a street-rail crossing.

Flagger Notes:
Stop the first vehicle in the closed lane from the flagger position shown, then move toward the centerline to stop other vehicles.

Provide lighting to mark flagger stations at night.

A single flagger may be used for low volume situations with short work zones on straight roadways where the flagger is visible to road users approaching from both directions. Refer to Figure 8030.105.

Refer to Figure 8030.107 for work in vicinity of a street-rail crossing.
Coordinate with railroad company early, before work starts.

When roadway work activities come within or near railroad grade crossing, take extra care to eliminate the possibility of lane restrictions, flagging, or other operations where vehicles might be stopped within the grade crossing, which is defined as 15 feet from the closest rail.

Extend the buffer space of the activity area upstream of the grade crossing (as depicted in the figure) so a vehicle backup by the flagging operation will not extend across the grade crossing.

Refer to Figure 8030.101 for symbol key and sign spacing.

Flagger Notes:

The railroad company may require railroad-supplied flaggers.
May be used for short-term daylight operations in urban areas on 3-lane street. Nighttime operations require additional traffic control and retroreflective sheeting.

Cones may be used as channelizing devices during daylight hours.

Flaggers and additional traffic control devices may be required for higher traffic volumes or commercial areas.

Refer to Figure 8030.101 for symbol key and sign spacing.
May be used for short-term daylight operations in urban areas on 3-lane or 5-lane streets. Nighttime operations require additional traffic control and retroreflective sheeting.

Cones may be used as channelizing devices during daylight hours.

Flaggers and additional traffic control devices may be required for higher traffic volumes or commercial areas.

Refer to Figure 8030.101 for symbol key and sign spacing.
For low speed, low volume, urban streets the LEFT/RIGHT LANE CLOSED AHEAD sign may be omitted.

Refer to Figure 8030.101 for symbol key and sign spacing.
Place arrow board within the closed lane behind the channelizing devices and as close to the beginning of the taper as practical, while keeping it on the paved surface.

If the work area extends across the crosswalk, the crosswalk should be closed using appropriate information and devices.

For traffic signal maintenance, consider using law enforcement and/or a shadow vehicle.

For intersection approaches reduced to a single lane, left-turning movements may be prohibited to maintain capacity for through motor vehicle traffic.

Right lane closure shown; for left lane closure, modify sign messages and arrow board.

Refer to Figure 8030.101 for symbol key and sign spacing.
If the work area extends across the crosswalk, the crosswalk should be closed using appropriate information and devices.

For traffic signal maintenance, consider using law enforcement and/or a shadow vehicle.

Right lane closure shown; for left lane closure, modify sign messages and arrow board.

Refer to Figure 8030.101 for symbol key and sign spacing.
Left lane closure shown; for right lane closure, modify sign messages and channelizing devices.

For intersection approaches reduced to a single lane, left turn movements may be prohibited to maintain capacity for through motor vehicle traffic.

Prohibit left turn movements if sight distance from the through lane is restricted for left turning vehicles.

If work area extends across the crosswalk, the crosswalk should be closed using appropriate information and devices.

Refer to Figure 8030.101 for symbol key and sign spacing.

Optional channelizing devices for use with painted median.

Prohibit left turn movements if sight distance from the through lane is restricted for left turning vehicles.

If work area extends across the crosswalk, the crosswalk should be closed using appropriate information and devices.

Refer to Figure 8030.101 for symbol key and sign spacing.
Maintain a minimum lane width of 10 feet as measured to the near face of channelizing devices. For short-term use on low speed, low volume roads without wider heavy-commercial vehicles, a minimum lane width of 9 feet may be used.

Left turns may be prohibited as required by geometric and traffic conditions.

For short-duration work, the channelizing devices may be eliminated if a vehicle displaying vehicle warning lights is positioned in the work space. Arrow signs (W1-6) may be used to replace the KEEP RIGHT signs.

Refer to Figure 8030.101 for symbol key and sign spacing.
Use sign shape and legend appropriate to the type of work. Examples include:

- CRACK SEALING
- FRESH OIL
- WET PAINT

If an arrow board is used, operate in the caution mode.

Use for pavement marking and surface maintenance operations in daylight hours only.

Place vehicle-mounted signs at an elevation so they are not obscured by equipment or materials and are fully visible to approaching traffic.

Cover or turn sign legends from view when work is not in progress.

Refer to Figure 8030.101 for symbol key and sign spacing.
When distance "A" is less than 500 feet, place the barricade with the ROAD CLOSED TO THRU TRAFFIC sign in the middle of the traffic lane approaching the work area. The barricade may be omitted if the distance to the work area is less than 250 feet.

Maintain safety fence closures to prevent unauthorized vehicles from passing through.

Place staggered Type III barricades in the roadway after the last public road intersection prior to the closure.

If local traffic is allowed to pass a Type III barricade, retroreflective sheeting is required on both sides of the barricade.

Refer to Figure 8030.101 for symbol key and sign spacing.
Use when crosswalks, sidewalks, or other pedestrian facilities are closed or relocated. Ensure temporary facilities are detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

Signs such as KEEP RIGHT (LEFT) may be placed to guide or direct pedestrians.

Provide continuous barriers or fencing complying with the requirements of PROWAG to secure work areas from pedestrians.

When required in the contract documents, provide auxiliary lighting or audible information devices to assist pedestrians with visual disabilities.

Only the temporary traffic control devices related to pedestrians are shown. Other devices related to control of vehicular traffic may be necessary.

Refer to Figure 8030.101 for symbol key and sign spacing.
Use when crosswalks, sidewalks, or other pedestrian facilities are closed or relocated. Ensure temporary facilities are detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

Provide continuous barriers or fencing complying with the requirements of PROWAG to secure work areas from pedestrians.

Where pedestrians are diverted onto high-speed roadways, provide a temporary traffic barrier and, if specified in the contract documents, a crash cushion, to separate the temporary sidewalk from vehicular traffic.

When required in the contract documents, provide auxiliary lighting or audible information devices to assist pedestrians with visual disabilities.

Only the temporary traffic control devices related to pedestrians are shown. Other devices related to control of vehicular traffic may be necessary.

Refer to Figure 8030.101 for symbol key and sign spacing.
Use when work activities close crosswalk or reduce width to less than 4 feet. Ensure temporary facilities are detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

When required in the contract documents, provide auxiliary lighting or audible information devices to assist pedestrians with visual disabilities.

Refer to Figure 8030.101 for symbol key and sign spacing.
FIGURE 9030.101

PLANTING PIT
(Bare Root Plants)

1. Spread root system in natural position with soil excavated from pit.
2. Over-excavate 6 inches. Place 6 inches of loose soil in pit prior to planting.
3. Install with root collar at or slightly above grade. Do not place mulch within 2 inches of trunk.
4. Begin transition at edge of root ball.
5. Cut and completely remove all twine, burlap, and wire baskets from root ball prior to placing backfill material.

PLANTING PIT
(On Slopes)

1. Scarify sides of pit.
2. Form 3” deep saucer.
3. Place root ball on undisturbed soil.
4. Over-excavate 6 inches. Place 6 inches of loose soil in pit prior to planting.
5. Install with root collar at or slightly above grade. Do not place mulch within 2 inches of trunk.

PLANTING PIT
(Balled and Burlapped Plants)

1. Scarify sides of pit.
2. Form 3” deep saucer.
3. Place root ball on undisturbed soil.
Wrap trunk from ground line to first branch when specified in the contract documents.

1/4 to 1/3 Tree Height (2'-0" min.)

Steel Post

Flagging Material

Flagging Material

Garden Hose

1/2 to 2/3 Tree Height (4'-0" min.)

Planting Pit per Figure 9030.101

2'-0" min.

STAKING PLAN
(Trees 2 1/2 inch diameter or smaller)

Place one stake to southwest.

STAKING PLAN
(Trees larger than 2 1/2 inch diameter)

Place one stake to southwest.

FIGURE 9030.102
SHEET 1 OF 2
Wrap trunk from ground line to first branch when specified in the contract documents.

Wrap trunk from ground line to first branch when specified in the contract documents.

Wrap trunk from ground line to first branch when specified in the contract documents.

Wrap trunk from ground line to first branch when specified in the contract documents.

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Wrap trunk from ground line to first branch when specified in the contract documents.
SUDAS Standard Specifications

TREE DRAINAGE WELL

FIGURE 9030.103

Planting Pit per Figure 9030.101

Porous Backfill Material

Impervious Soil

Pervious Soil (if present)

Engineering Fabric

Finished Grade

8" to 12" Diameter

10'-0" 1

12"

1 If pervious soil is encountered at a depth less than 10 feet, the drainage well may be terminated when the well extends a minimum of 12 inches into the pervious soil layer.
Compost blanket may be vegetated or unvegetated as specified in the contract documents.

Lap blanket 5'-0" to 10'-0" over top of slope.

Loosen ground surface to a minimum depth of 1".

Filter Berm or Filter Sock (when specified)

**TABLE 9040.101**

<table>
<thead>
<tr>
<th>SLOPE</th>
<th>BLANKET THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:1</td>
<td>3&quot;</td>
</tr>
<tr>
<td>≤ 4:1</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>
Construct "J-hook" at each end on an individual section of sock or berm.

Stakes (typ.)

Disturbed Area

Direction of Flow

90'-0" max. length per section

200'-0" if slope is flatter than 5%

3 min. overlap

Area to be Protected

Place berm or sock perpendicular to slope.

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

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

Filter sock diameter as specified in the contract documents.

Filter sock shown is typical for slopes flatter than 5%

Stake

Fill Material

Stake

Fill Material

Water Flow

2'-0"

Water Flow

2'-0"
Secure blanket to ground according to manufacturer's recommended anchoring pattern and minimum shown in Table 1.

TABLE 1

<table>
<thead>
<tr>
<th>Max. slope</th>
<th>Min. anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 3:1</td>
<td>1.5/yd²</td>
</tr>
<tr>
<td>2:1</td>
<td>2/yd²</td>
</tr>
<tr>
<td>1:1</td>
<td>2.5/yd²</td>
</tr>
</tbody>
</table>
Flow

8" max.

STAPLE CHECK

Install 2 rows of anchors, 12" on-center. Stagger rows 6".

8" max.

END LAP

Flow

12" min.

Compacted Soil Backfill

Flow

6" min.

ANCHOR SLOT
(1'-0" max. anchor spacing)

Longitudinal Slot

Anchor Slot

Edge Lap

End Lap

Longitudinal Slot

(4'-0" max. anchor spacing)

LONGITUDINAL SLOT
(3'-0" max. anchor spacing)

EDGE LAP

Install 2 rows of anchors, 12" on-center. Stagger rows 6".

8" max.

STAPLE CHECK

SUDAS Standard Specifications

ROLLED EROSION CONTROL
PRODUCT (RECP)
INSTALLATION IN CHANNEL
Disturbed Area

Protected Area to be as specified in the contract documents.

Wattle Direction of Flow

Area to be Protected

2-4' Trench

4'-0" max.

3'-0"

Joint Wrap

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.
FIGURE 9040.106

Crest

Ditch Slope, s, ft./ft.

Top of Fence

Steel Post

Silt Fence

h/s

(24" typ.)

SILF FENCE CHECK DAM (DITCH CHECK)
(See Figure 9040.119 for installation of Silt Fence Ditch Checks.)

ROCK CHECK DAM
(See Figure 9040.107 for installation of Rock Check Dams.)

Crest

Ditch Slope, s, ft./ft.

h/s

MANUFACTURED CHECK DAM
(Synthetic Permeable and Triangular Foam Check Dam)

Crest

Ditch Slope, s, ft./ft.

h/s

CHECK DAM SPACING
DITCH CROSS-SECTION

SECTION A-A

Top of Bank

6" min.

Crest

6" min.

6" min.

Engineering Fabric

Engineering Fabric

as specified

9040.107

FIGURE 9040.107

SHEET 1 OF 1

ROCK CHECK DAM

SUDAS Standard Specifications
Diversion Types 1, 2, and 3 may be used interchangeably unless otherwise specified in the contract documents.

Alternate configurations may be used upon approval from the Engineer.

Total height of diversion (swale and berm): 18 inch minimum or as specified.
Flow

Depth as specified, 6" min.

Excavate depression to slope or flatter.

Last 20'-0" of diversion at 1% slope or flatter.

Excavated Depression - Grade = 0%

Possible Diversion

Stable Outlet

PERSPECTIVE VIEW

Elevate top of spreader 1" above ground.

Level top of spreader.

Anchor 2" X 8" with 18" rebar spaced at 4'-0".

Excavate depression to depth as specified, 6" min.

6'-0" min.

CROSS-SECTION

LEVEL SPREADER

SUDAS Standard Specifications
FIGURE 9040.110

SHEET 1 OF 1

Section A-A

To the end of slope

Length, L

Width, W

3D

Pipe Diameter, D

Slope = 0%

Engineering Fabric

Stable Ground

Thickness, T

Footing for Apron

Construct notch at end of apron. Depth = 2T

Depth = 2T at end of apron.

PLAN

PROFILE

Section A-A

SUDAS Standard Specifications

RIP RAP FOR PIPE OUTLET ONTO FLAT GROUND
Top of Bank

Width, W

Edge of Channel

PLAN

A

Slope = 0%

Depth = 2T.

Construct notch at end of apron. Depth = 2T.

Engineering Fabric

Stable Channel

Top of Bank

Profile

Section A-A

Footing for Apron

Thickness, T

T min.

CROSS-SECTION

RIP RAP APRON FOR PIPE
OUTLET INTO CHANNEL
SLOPE DRAIN ANCHORING OPTIONS
(Options A, B, and C are interchangeable unless otherwise specified in the contract documents)

- **OPTION A**: Place and compact fill along sides of pipe.
- **OPTION B**: Install steel fence post on both sides of pipe at 10'-0" max. spacing.
- **OPTION C**: Bury pipe to springline. (May also be combined with options A or B)

- **12" min. cover.**
- **2'-0" min.**
- **2:1 typ.**
- **Carefully compact diversion structure around pipe.**

- **Pipe Apron**
- **Secure pipe with method shown below.**
1. Barrel length and diameter as specified in the contract documents.
2. Riser pipe and base/dewatering device: See Figure 9040.115.
3. Anti-vortex device: See Figure 9040.116.

FIGURE 9040.113

SEDIMENT BASIN WITHOUT EMERGENCY SPILLWAY

**Barrel**

"Dry" Storage: 1,800 CF/Acre

"Wet" Storage: 1,800 CF/Acre

Dewatering Orifice

Principal Spillway

Anti-seep collars (required only when specified in the contract documents)

Top of Embankment

Bottom of Basin

Elevation

Design High Water Level

Freeboard: 2'-0" min.

Riser pipe and base/dewatering device: See Figure 9040.115.

SUDAS Standard Specifications
Barrel length and diameter as specified in the contract documents.

2. Riser pipe and base/dewatering device: See Figure 9040.115.

3. Anti-vortex device: See Figure 9040.116.

---

**Anti-seep collars (required only when specified in the contract documents)**

- **Dry** Storage: 1,800 CF/Acre
- **Wet** Storage: 1,800 CF/Acre

---

**Design High Water**

**Overflow Elevation**

**Principal Spillway**

**Top of Embankment**

**Emergency Spillway**

---

**Barrel**

**Bottom of Basin**

**Dewatering Orifice**

**SUDAS Standard Specifications**

**SEDIMENT BASIN WITH EMERGENCY SPILLWAY**
Elevations and dimensions not given are as specified in the contract documents.

1. Drill four, 5/8 inch diameter holes, 3 inches from bottom of riser pipe and insert two, #4 bars in an "X" configuration. Length of bars = D+16 inches.

2. Provide perforation configuration as specified in the contract documents.

---

Figure 9040.115

**SHEET 1 OF 1**

**SEDIMENT BASIN**

**DEWATERING DEVICE**

**(PERFORATED RISER)**
Support Bars

Tack weld top to cylinder.

Leave top of riser open.

12" Spacer Bar (#6 bar min.)

Leave bottom of cylinder open.

Riser Diameter (as specified)

Pressure Relief Holes 1/2" Dia.

Orient top stiffener (if required) perpendicular to corrugations and weld to top.

Support Bar (#6 bar min.)

Cylinder

Welded

Plan View

Isometric

Ante-vortex Device

Alternate anti-vortex device configurations may be utilized upon approval of the Engineer.

1. See sheet 2 for dimensions of cylinder support bars, top plate, and top stiffener.

2. Firmly attach the anti-vortex cylinder to the top of the riser by welding or other means.

3. Corrugated metal or 1/8 inch steel plate cylinder and top.

4. Pressure relief holes may be omitted if ends of corrugations are left fully open when the top is attached.
<table>
<thead>
<tr>
<th>RISER</th>
<th>CYLINDER</th>
<th>MINIMUM TOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (in.)</td>
<td>Diameter (in.)</td>
<td>Thickness (gage)</td>
</tr>
<tr>
<td>12</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>21</td>
<td>16</td>
</tr>
<tr>
<td>18</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>24</td>
<td>36</td>
<td>16</td>
</tr>
<tr>
<td>27</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>36</td>
<td>54</td>
<td>16</td>
</tr>
<tr>
<td>42</td>
<td>60</td>
<td>16</td>
</tr>
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<td>48</td>
<td>72</td>
<td>16</td>
</tr>
<tr>
<td>54</td>
<td>78</td>
<td>16</td>
</tr>
<tr>
<td>60</td>
<td>90</td>
<td>14</td>
</tr>
<tr>
<td>66</td>
<td>96</td>
<td>14</td>
</tr>
<tr>
<td>72</td>
<td>102</td>
<td>14</td>
</tr>
<tr>
<td>78</td>
<td>114</td>
<td>14</td>
</tr>
<tr>
<td>84</td>
<td>120</td>
<td>12</td>
</tr>
</tbody>
</table>

Notes:
1. The criterion for sizing the cylinder is that the area between the inside of the cylinder and the outside of the riser is equal to or greater than the area inside the riser. Therefore, the above table is invalid for use with concrete pipe risers.
2. C - Corrugated  F - Flat.
Collar Width = barrel dia. + 4'-0"

Barrel

Collar Width = barrel dia. + 4'-0"

Slotted holes for 3/8" dia. bolts.

1/2" X 2" slotted holes for 3/8" dia. bolts.

#4's @ 12" o.c. each direction.

Anti-seep collars are not required unless specified in the contract documents.

Continuous weld between band and collar.

Slotted holes @ 8" o.c.

Continuous weld between band and collar.

Corrugated metal sheet welded to center of band.

CONCRETE COLLAR

SECTION A-A

SECTION B-B

CMP COLLAR

SUDAS Standard Specifications
Remove accumulated sediment when level reaches one-half the height of the wet storage.

**Spillway Length**

<table>
<thead>
<tr>
<th>H (ft.)</th>
<th>L (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>3.0</td>
<td>2.5</td>
</tr>
<tr>
<td>3.5</td>
<td>3.0</td>
</tr>
<tr>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>5.0</td>
<td>4.5</td>
</tr>
</tbody>
</table>

**Height, H**

(5'-0" max.)

**Spillway Length (L)**

(see table)

**Width (W)** as specified

**Overflow Elevation**

**Impervious Earth Fill**

(as required)

**Erosion Stone**

**Engineering Fabric**

**Top of bank or ditch.**

**Bottom of channel or ditch.**

**Overflow Elevation**

**1,800 CF/Acre**

*"Dry" Storage*

**1,800 CF/Acre**

*"Wet" Storage*

**Spillway Length (L)**

(see table)

**Height, H**

(5'-0" max.)

**Width (W)** as specified

**Overflow Elevation**

**Impervious Earth Fill**

(as required)

**Engineering Fabric**

**1,800 CF/Acre**

*"Dry" Storage*

**1,800 CF/Acre**

*"Wet" Storage*

**Spillway Length (L)**

(see table)

**Height, H**

(5'-0" max.)

**Width (W)** as specified

**Overflow Elevation**

**Impervious Earth Fill**

(as required)

**Engineering Fabric**

**1,800 CF/Acre**

*"Dry" Storage*

**1,800 CF/Acre**

*"Wet" Storage*
Foreslope

Backslope

Variable (20'-0" max. for a normal 10'-0" wide ditch.)

Post Spacing
(5'-0" max.)

Post Spacing
(5'-0" max.)

2"

20" min.

1

TYPICAL SILT FENCE DITCH CHECK

ATTACHMENT TO POST

Wire or Cable Ties

Fabric

Post

1 Insert 12 inches of fabric a minimum of 6 inches deep (fabric may be folded below the ground line).
TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Plan View)

Install parallel to ground contour.
Install "J-hook" at each end of an individual section of silt fence.

200'-0" max. length per section
(600'-0" if slope is flatter than 5%)

TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Profile View)

See plans for spacing.

Ground line

T" Steel Fence Post
4'-0" min.

Ground Contours

FLOW

DETAILS OF SILT FENCE ON LONGITUDINAL SLOPES

1. Insert 12 inches of fabric a minimum of 6 inches deep (fabric may be folded below the ground line).
2. Reduce post spacing to 5'-0" at water concentration areas, or as required to adequately support fence.
Entrance length: 50 foot minimum (30 foot for single family residential), or as specified in the contract documents. Length of entrance may be increased if sediment track-out occurs.

Thickness as specified (6" min.).
1. Connect edges of basket with lacing wire or fasteners.
2. Install connecting wires on exposed gabion faces.
3. Twist wire a minimum of four turns.

CONNECTING WIRE LOCATION

EDGE CONNECTIONS

Lacing Wire  Manufactured Fasteners

DETAIL A
POST INSTALLATION

PULL POST INSTALLATION

ANGLE OR CORNER POST INSTALLATION

PLAN OF FENCE

FENCE POST FOOTING DEPTH AND DIAMETER

<table>
<thead>
<tr>
<th>USE IN FENCE</th>
<th>FENCE HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4'-0&quot; and less</td>
</tr>
<tr>
<td>Line and Brace Posts</td>
<td>X</td>
</tr>
<tr>
<td>Terminal Post*</td>
<td>0'-0&quot;</td>
</tr>
</tbody>
</table>

*Includes corner, angle, end, and pull posts.

Place fence fabric on roadway side of post. For certain curves, stream crossings, or other locations, the Contractor has the option to place fabric on the side of the post away from the roadway.

1. Fabric width as specified in the contract documents.
2. For fence heights greater than 8 feet, the depth of the fence post footing is 3 feet plus 3 inches for each 1 foot in height over 8 feet.
3. Install the fence on the roadway side of the right-of-way when specified in the contract documents.
Frame patterns for various gate openings

Comply with Figure 9060.101.

Gate post footing depth and diameter

<table>
<thead>
<tr>
<th>Gate Height</th>
<th>Gate Leaf Width</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-0&quot; or less</td>
<td>4'-0&quot; or less</td>
<td>0'-10&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>6'-0&quot; or less</td>
<td>over 4'-0&quot; to 10'-0&quot;</td>
<td>0'-12&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>6'-0&quot; or less</td>
<td>over 10'-0&quot; to 18'-0&quot;</td>
<td>1'-2&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>over 6'-0&quot;</td>
<td>6'-0&quot; or less</td>
<td>0'-10&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>over 6'-0&quot;</td>
<td>over 6'-0&quot; to 12'-0&quot;</td>
<td>1'-0&quot;</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>over 6'-0&quot;</td>
<td>over 12'-0&quot; to 18'-0&quot;</td>
<td>1'-4&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td>over 6'-0&quot;</td>
<td>over 18'-0&quot; to 24'-0&quot;</td>
<td>1'-6&quot;</td>
<td>4'-0&quot;</td>
</tr>
</tbody>
</table>

Double swing gate is required only for widths greater than 16 feet. Exact details of gate design are subject to approval of the Engineer. Furnish gate with approved stop, latch, and means for locking. Install as recommended by the manufacturer.

End post used to terminate run of fence if no gate is proposed.

Horizontal members are required only if the fabric height is 8 feet or greater.

Approved center gate stop, installed according to fabricator's instructions.
For modular block retaining walls, install column tube or PVC pipe as backfill material is placed. When fence is installed after backfill material is placed, utilize hand excavation of post hole footings to avoid damaging engineering fabric tiebacks. For landscape timber walls, locate fence posts to avoid timber tiebacks.

2. Cut or displace engineering fabric tiebacks (if present) around column tube or PVC pipe.

3. Column tubes or PVC pipes may be installed behind PCC retaining walls during placement of backfill material or post holes may be excavated upon completion of backfill material placement.

4. Comply with Chain Link Fence or Safety Rail figures for post footing dimensions.

5. Construct a PCC cap between the back of the wall and the fence or rail.
1. Construct entire first course of timbers beneath finished grade.

2. No tie backs in upper two courses or lower three courses of timbers. Stagger tie back location.

3. Secure each course with spikes.

4. Excavate and place backfill material. Use suitable soil or granular material.

---

**SECTION A-A**

- **Finished Grade**
- **Compacted Backfill Material**
- **Tie Back**
- **Wall Height** (4'-0" max.)
- **Subdrain**
- **Compacted Foundation**
- **1/2" Setback Each Course**
- **Length of tieback equal to wall height.**
- **8" min.**
- **Wrap porous backfill material with engineering fabric.**
- **Construct a 6" thick X 18" wide (min.) leveling pad.**

---

**ELEVATION**

- **Finished Grade**
- **6" Leveling Pad**
- **6"**
- **4'-0" max.**
- **2'-0"**
- **2'-0"**

---

**SUDAS Standard Specifications**

SUDAS Standard Specifications
Exact dimensions, wall batter, backfill limits, reinforcement, and leveling pad materials and dimensions will be specified by the wall manufacturer.

For walls higher than 4 feet, use segmental block retaining wall.

TYPICAL SECTION

- Cap Stone
- Granular Backfill Material
- Finished Grade (slope varies)
- Topsoil or Suitable Backfill Material
- Geogrid (if required)
- Excavation Line
- Subdrain
- Compacted Foundation
- Wall Unit (typ.)
- Pins or Lip to Ensure Proper Block Setback
- 6" min.
- 8" min.
- 4'-0" max.
- Construct a 6" thick X 18" wide (min.) leveling pad.
- Wrap porous backfill material with engineering fabric.
LIMESTONE RETAINING WALL

TYPICAL SECTION

1. Compact backfill material as wall construction progresses.
2. Construct entire first course of limestone below finished grade.

Batter wall 3 inches per foot

Finished Grade

12" Compacted Foundation

Wrap porous backfill material with engineering fabric.

Subdrain

Wall Height (4'-0" max.)

8" min.

12" Compacted Backfill Material

Compact backfill material as construction progresses.

8" min.

8" min.

Construct a 6" thick X 18" wide (min.) leveling pad.
Provide a minimum concrete cover to near reinforcement of 1 1/2 inches. Provide 3 inches minimum cover at the ends of bars.

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

TYPICAL LONGITUDINAL SECTION OF RETAINING WALL

Expansion Joints

TYPICAL RUSTICATION DETAIL

Use 1" half-round beveled 1"x1" or other approved device.
Provide a minimum concrete cover to near reinforcement of 1 1/2 inches. Provide 3 inches minimum cover at the ends of bars.

2. Excavate and place backfill material as necessary.

3. Provide 3 inch diameter weep holes at 8 foot intervals. Install rodent guards in weep holes. Align bottom of weep hole with top of subdrain.

4. Additional 12 inch width is adjacent to wall.

---

**Possible Longitudinal Joint (for sidewalks 8'-0" wide or greater) Between 1.5% and 2.0%**

---

### REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Wall Type</th>
<th>Mark</th>
<th>Size</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>4w1</td>
<td>4</td>
<td></td>
<td>Variable</td>
<td>15&quot;</td>
</tr>
<tr>
<td></td>
<td>4w2</td>
<td>4</td>
<td></td>
<td>Variable</td>
<td>14&quot;</td>
</tr>
<tr>
<td>Type B</td>
<td>4w3</td>
<td>4</td>
<td></td>
<td>Wall Height + 18&quot;</td>
<td>14&quot;</td>
</tr>
<tr>
<td></td>
<td>4w4</td>
<td>4</td>
<td></td>
<td>Variable</td>
<td>15&quot;</td>
</tr>
<tr>
<td></td>
<td>4w5</td>
<td>4</td>
<td></td>
<td>3'-10&quot;</td>
<td>14&quot;</td>
</tr>
</tbody>
</table>

---

**TYPE A WALL TYPICAL SECTION**

**TYPE B WALL TYPICAL SECTION**

---

**BEND BARS**

---

**FIGURE 9072.221 STANDARD ROAD PLAN**

---

**COMBINED RETAINING WALL - SIDEWALK**
Provide a minimum of 2 inches of cover for all reinforcing.

Ensure all risers are an equal height and all treads are an equal depth within a flight of stairs.

1. Minimum riser height is 4 inches. Maximum riser height is 7 inches.
2. Minimum tread depth is 11 inches.
3. Match existing sidewalk width.
4. Construct cross slope of landing to match adjacent sidewalk.
5. Slope tread 1% minimum to 2% maximum in any direction.
6. Weld post to anchor plate with 1/4 inch weld. Grind weld to provide smooth surface, free of burrs.

**SUDAS Standard Specifications**

**TYPE A CONCRETE STEPS WITH HANDRAIL**

**Rise** | **Tread**
---|---
1 | 12" |
2 | 6" |
3 | 5" |
4 | 4" |

8" min. 12" 6" 3 1/4" 1 1/2" to 2" Diameter Post

6" x 6" x 1/4" Anchor Plate

1" Preformed Expansion Joint

#4 @ 18" C-C

1" Anchor Plate

#4 @ 12" C-C

**SECTION A-A**

Possible Sidewalk

Width (varies)

Rise

Tread

**PLAN**

**ISOMETRIC**
FIGURE 9080.102

WITH HANDRAIL

TYPE B CONCRETE STEPS
WITH HANDRAIL

Provide a minimum of 2 inches of cover for all reinforcing.

Ensure all risers are an equal height and all treads are an equal depth within a flight of stairs.

1. Minimum riser height is 4 inches. Maximum riser height is 7 inches.

2. Minimum tread depth is 11 inches.

3. Match existing sidewalk width.

4. Construct cross slope of landing to match adjacent sidewalk.

5. Slope tread 1% minimum to 2% maximum in any direction.

6. Weld post to anchor plate with 1/4 inch weld. Grind weld to provide smooth surface, free of burns.

SUDAS Standard Specifications
Provide expansion joint at 48'-0" max. spacing (top and bottom rail. See expansion sleeve detail.

Attach railing to concrete pavement or concrete retaining wall with base plate and anchor rods. See anchor plate detail.

For railing set in ground, set post in hole and encase in concrete.

Weld all components with 1/4 inch fillet welds. Grind welds and connections as required to provide a smooth surface, free of burrs.

Field paint safety rail after installation as specified in the contract documents.

Detail shown is for top rail. Expansion joint for bottom rail is similar.

Attach railing to concrete pavement or concrete retaining wall with base plate and anchor rods. See anchor plate detail.

For railing set in ground, set post in hole and encase in concrete.

Weld all components with 1/4 inch fillet welds. Grind welds and connections as required to provide a smooth surface, free of burrs.

Field paint safety rail after installation as specified in the contract documents.

Detail shown is for top rail. Expansion joint for bottom rail is similar.
CLASS 1 WELL

1. Remove the top 4 feet of the existing casing pipe.

2. Place sealing material to a minimum thickness of 20 feet (10 feet minimum above and below bottom of casing or top of the aquifer).

CLASS 2 BEDROCK WELL IN SINGLE CONFINED AQUIFER (Artesian Well)

1. Fill or Sealing Material

2. Neat Cement, Grout, or Concrete

CLASS 2 BEDROCK WELL IN SINGLE UNCONFINED AQUIFER

CLASS 2 BEDROCK WELL IN MULTIPLE AQUIFERS

FIGURE 10010.101

SUDAS Standard Specifications

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

TEMPORARY RESIDENTIAL ACCESS

1. If sidewalk width is less than 5 feet, provide 5 foot long by 5 foot wide passing spaces at 200 foot intervals.

2. Target cross slope of 1.5% with a maximum cross slope of 2%.

4'-0" min.

3" Compacted Granular Surfacing

2" x 4" Edging

Compacted Granular Surfacing

4" Nominal

SUDAS Standard Specifications

TEMPORARY GRANULAR SIDEWALK AND TEMPORARY RESIDENTIAL ACCESS
1. If sidewalk width is less than 5 feet, provide 5 foot long by 5 foot wide passing spaces at 200 foot intervals.

2. Provide non-reflective orange and white sheeting on top and bottom rails.

3. Attach 12 inch long splice boards on the back side of rails at joints between sections.

4. When specified in the contract documents, install orange construction safety fence between the top of the bottom rail and the bottom of the top rail.

**Front View**

- **1" x 6" Top Rail**
- **1" x 6" Middle Rail**
- **1" x 8" Bottom Rail**

**End View**

- **Construction Area**
- **Sandbag**
- **2" x 6" Base Plate**

**Section Length Varies (10'-0" max.)**

- **1/4" max. gap**
- **1" x 4" Splice**
- **1" x 6" Splice**
- **1" x 8" Splice**

**Temporary Sidewalk Surface**

**Building, Obstruction, or Edge of Sidewalk**

- **2" x 4"**
- **8" min.**
- **2" max.**

**Temporary Pedestrian Channelizing Device**

**Sandbag**

**END VIEW**