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

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

TYPICAL CROSS-SECTION: EXCAVATION OF PEAT, MUCK, OR OTHER MATERIAL NOT TO BE USED FOR THE CONSTRUCTION OF EMBANKMENTS

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

Use care in setting toe fills. Ensure proper drainage in side ditches is maintained.
Refer to the contract documents for specific material and placement requirements.

**Key:**
- **OD** = Outside diameter of pipe
- **TW** = Trench width at top of pipe
- **d** = Depth of bedding material below pipe

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

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD/2</td>
<td>Over-excavation and Foundation Stone</td>
</tr>
<tr>
<td>OD/6</td>
<td>Pipe Bedding</td>
</tr>
<tr>
<td>12''</td>
<td>Haunch Support</td>
</tr>
<tr>
<td>TW</td>
<td>Primary Backfill</td>
</tr>
<tr>
<td>12 mm</td>
<td>Secondary Backfill</td>
</tr>
<tr>
<td>12''</td>
<td>Final Trench Backfill</td>
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<tr>
<td>12''</td>
<td>Bury Depth</td>
</tr>
<tr>
<td></td>
<td>Springline of Pipe</td>
</tr>
</tbody>
</table>
Refer to sheet 2 for bury depth restrictions.

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

Key

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

#### Class RCP

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>No Steel</th>
<th>As=0.4%</th>
<th>As=1.0%</th>
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<tbody>
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<td>72</td>
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#### Class IV RCP

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#### Class V RCP

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### Extra Strength VCP

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<th>R-2</th>
<th>R-3 &amp; R-4</th>
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</tbody>
</table>

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### Rigid Gravity Pipe

- **Class III RCP**
- **Class IV RCP**
- **Class V RCP**

- Extra Steel: Area of Steel Reinforcing
- No Steel: Area of Steel Reinforcing

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### Concrete Arch Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>R-1</th>
<th>R-2</th>
<th>Bedding Class</th>
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<tbody>
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<tr>
<td>42</td>
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</table>

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### Horizontal Elliptical RCP

<table>
<thead>
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<th>Pipe Diameter (in)</th>
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<th>R-2</th>
<th>Bedding Class</th>
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<tbody>
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<td>24'</td>
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### Vertical Elliptical RCP

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<th>Bedding Class</th>
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### BEDDING CLASSES

<table>
<thead>
<tr>
<th>Class</th>
<th>OD (in) 4'' min.</th>
<th>Solid Wall SDR 35</th>
<th>Solid Wall SDR 36</th>
<th>Solid Wall SDR 26</th>
<th>Solid Wall SDR 23.5</th>
<th>PVC PIPE DUCTILE IRON, AWWA C151, CLASS 52</th>
<th>DUCTILE IRON, AWWA C151, CLASS 52</th>
<th>HDPE PIPE</th>
<th>HDPE PIPE</th>
<th>Polypropylene</th>
<th>Polypropylene</th>
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</tbody>
</table>

### Key
- **OD** = Outside diameter of pipe
- **TW** = Trench width at top of pipe
  - Min. = OD+18 inches OR 1.25xOD+12 inches (whichever is greater)

### Allowable Bury Depth

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

### Allowable Bedding Classes

<table>
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<tr>
<th>Pipe Material</th>
<th>Storm Sewer</th>
<th>Sanitary Sewer</th>
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<td>F-1, F-2, F-3</td>
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<tr>
<td>HDPE</td>
<td>F-2, F-3</td>
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<tr>
<td>PVC</td>
<td>F-2, F-3</td>
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</table>
**BEDDING CLASSES**

**CLASS P-1**
- Loose, Suitable Backfill Material or Undisturbed Material with Bell Shaping

**CLASS P-2**
- Class I Bedding Material

**CLASS P-3**
- Depth of bedding material below pipe:
  - Min. = OD + 18 inches OR 1.25xOD + 12 inches (whichever is greater)

**ALLOWABLE BURY DEPTH**

**DUCTILE IRON, AWWA C151, CLASS 52**

<table>
<thead>
<tr>
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<th>Class P-1 Bedding</th>
<th>Class P-2 Bedding</th>
<th>Class P-3 Bedding</th>
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**PVC, AWWA C900, DR18**

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<tr>
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<td>23'</td>
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1. Place remainder of bedding and backfill material as specified in the contract documents.

**Key**

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

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

2. Place encasement material in two lifts, or as required to prevent pipe flotation. Allow previous lift to reach initial set prior to placing subsequent lifts.

3. Restrain pipe as necessary to prevent flotation.

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

SDAS Standard Specifications

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

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

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

Comply with Figure 3010.101.

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 Trench Wall

Sanitary Sewer Main

Tee or Wye

Service Line

Slope

Cap or Plug

Class I Bedding Material

Fig. 4010.201

Sanitary Sewer Service Stub

22.5° to 45°
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%

3. 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 52). Use single length of pipe for riser, if possible.
Adjustment Rings
Arched Opening
Square Edge

TYPICAL SECTION

SECTION A-A

1. SW-601 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.
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

---

1. 6" PVC Riser
2. 45° Bend
3. Wye
4. Sewer Main
5. 20" min. Concrete Pad
6. #4 Bar (typ.)
7. Casting
8. Cap
9. Brass screw plug
12. Threaded PVC cap or iron body ferrule with brass screw plug

---

Sanitary Sewer Cleanout

Figure 4010.203

Cleanout

Sewer Main

6" PVC Riser

45° Bend

Wye

Concrete Pad

20" min.

#4 Bar (typ.)

Casting

Cap

Brass screw plug

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

6" PVC Service Pipe

Threaded PVC cap or iron body ferrule with brass screw plug

---

SUDAS Director

Design Methods Engineer
### Service Status

<table>
<thead>
<tr>
<th>Service Status</th>
<th>Contractor's Responsibility</th>
<th>Compensation</th>
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</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>
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<tr>
<td>3. Service located in zone of conflict, but elevations do not allow simple relocation as detailed above; special design required</td>
<td>Relocate service as directed by the Engineer</td>
<td>Change order</td>
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---

1. Zone of conflict is from 6 inches below the bottom of sewer pipe to 2 inches above the top of pipe.
Figure 4020.211

**Type PC-2 Concrete Collar Connection**

1. 6"x6" - w2xw2 (8ga.) Wire Mesh
2. 6" min.
3. Wall of Precast Manhole or Intake Structure
4. 4" min.
5. Lap ends of wire mesh a minimum of 6 inches.
6. Concrete collar is required when annular space between the outside of the pipe and the wall of the structure is 2 inches or greater.
7. Provide two #4 hoop bars in concrete collar. Lap bars a minimum of 6 inches.
8. Trowel concrete flush with inside wall of structure.

**Concrete Collar for Pipes 12" and Smaller**

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.

**Concrete Collar for Pipes Greater Than 12"**

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.

**Pipe to Pipe Connection**

1. Trim pipe and fill voids with mortar.
2. 6" min.
3. Wall of Precast Manhole or Intake Structure
4. 4" min.
5. 9" min.
6. Lap ends of wire mesh a minimum of 6 inches.
7. Concrete collar is required when annular space between the outside of the pipe and the wall of the structure is 2 inches or greater.
8. Provide two #4 hoop bars in concrete collar. Lap bars a minimum of 6 inches.
9. Trowel concrete flush with inside wall of structure.

**Pipe Joint Wrapping**

1. Pipe Joint
2. Overlap fabric 12" at top of pipe.
3. 12" min.
4. 12" min.
5. Engineering Fabric
6. Pipe to Pipe Connection
7. 6" min.
8. Wall of Precast Manhole or Intake Structure
9. 4" min.
10. 9" min.
11. Lap ends of wire mesh a minimum of 6 inches.
12. Concrete collar is required when annular space between the outside of the pipe and the wall of the structure is 2 inches or greater.
13. Provide two #4 hoop bars in concrete collar. Lap bars a minimum of 6 inches.
14. Trowel concrete flush with inside wall of structure.
### Typ 1 Aprons

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**Note**

Dimension "E" shown is the minimum and is considered the design length. Adjust for any differences 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.
### Approximate Dimensions

#### Slope

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### Alternate Design

**Plan**

**Section A-A**

**End (Arch)**

**End (Elliptical)**

**Design**

**Alternate**

---

**ARCH PIPE**

**ELLIPtical PIPE**

---

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.
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 APRON

METAL PIPE APRON

CORRUGATED METAL PIPE

PLAN VIEW

SIDE VIEW

END VIEW

METAL APRONS GUARD

DIMENSIONS

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<td>2.5</td>
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<td>64</td>
<td>39</td>
<td>39</td>
<td>0.25</td>
<td>2.5</td>
</tr>
</tbody>
</table>

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 gage 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 angle steel.
4. When specified, extend bottom cross bar through apron.
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.
Cleanout

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
#4 Hoop

See Detail A

Concrete Invert

Threaded PVC Cap or Iron Body Ferrule with Brass Screw Plug

6" Class I Bedding

Subdrain

Wye

45° Bend

Cleanout

Concrete

4" (min.)

1'-8"

V a r i e s

Type A-2 Cleanout

Type A-1 Cleanout

Type B Cleanout

Type A Cleanout Connections

45° Bend

Subdrain

Wye

END OF RUN

IN-LINE

DETAIL A

(Dimensions are nominal)
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 a minimum 1 foot radius for all bends or use two 45° fittings.
4. Provide a minimum trench width of 12 inches for a single outlet and 24 inches for a double outlet.
5. Provide a 6 inch minimum drop in elevation between longitudinal subdrain and outlet.
6. 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 bails.

<table>
<thead>
<tr>
<th>Diameter of Pipe, D (Inches)</th>
<th>Bends</th>
<th>Tees and Dead Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11°</td>
<td>22°</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
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<tr>
<td>6</td>
<td>1</td>
<td>2</td>
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<td>16</td>
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<td>14</td>
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<td>18</td>
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<td>17</td>
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<td>20</td>
<td>11</td>
<td>21</td>
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<td>24</td>
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<td>26</td>
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<td>47</td>
</tr>
<tr>
<td>36</td>
<td>34</td>
<td>67</td>
</tr>
</tbody>
</table>

Minimum surface area based on water pressure of 150 psi and allowable soil pressure of 1,000 psi.
**TYPICAL INSTALLATION**

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.

- **Fire Hydrant Barrel**
- **Fire Hydrant Valve**
- **Possible Splice**
- **New Water Main**
- **Clamp tracer wire to ground rod at system termination points.**
- **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.**
- **Do not run wire up valve box.**
- **Tape wire at midpoint of each pipe length.**
- **Ground Rod**
- **Existing Water Main**
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.
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.

See the contract documents for the location of each hydrant and the length of anchoring pipe.

1. Do not cover drain holes or tracer wire.
If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

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

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

3. When specified, provide an eccentric flat top in lieu of eccentric cone section.

---

**Joint Sealant (typ.)**

8'' min.

12'' min.

12'' min.

6'' min.

**Manhole Diameter**

**Depth**

**Location Station**

**PLAN**

**Maximum Pipe Diameter (inches) for 2 Pipes**

<table>
<thead>
<tr>
<th>Manhole Diameter (inches)</th>
<th>At 180° Separation</th>
<th>At 90° Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
<td>24</td>
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<td>72</td>
<td>42</td>
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<td>84</td>
<td>48</td>
<td>36</td>
</tr>
<tr>
<td>96</td>
<td>60</td>
<td>42</td>
</tr>
</tbody>
</table>

**Flowline**

**Lowest Flowline**

**Concrete Fillet**

**Flexible Pipe Connection (typ.)**

**Class I Bedding Material**

**TYPICAL SECTION**

---

**FIGURE 6010.301 STANDARD ROAD PLAN**

**SUDAS**

**KOWADOT**

**SW-301**

**CIRCULAR SANITARY SEWER MANHOLE**
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.

---

Flexible Pipe Connection (typ.)

Wall (typ.)

Joint Sealant (typ.)

Two #4 Hoop Bars

Concrete Fillet

Bedding Material

SW-601 Casting

Adjustment Rings

Top

Lowest Flowline

Wall Height

Short Wall Width

8'' min. Class I Bedding Material

4b1

4b2

4b3

4w2

4w3

12'' min.

6'' min.

8''

12''

12''

27'' dia.

10''

4''

4''

12'' min.

12'' min.

12'' min.

20 feet, install steps.

3b1

3b2

3b3

12 inch minimum wall height above all pipe openings.
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>
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<td>4</td>
<td>Base</td>
<td>36''</td>
<td>12''</td>
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</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td>Long Wall plus 18''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>4b3</td>
<td>4</td>
<td>Base</td>
<td>Short Wall plus 18''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>4t1</td>
<td>4</td>
<td>Top</td>
<td>36''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td>Long Wall plus 12''</td>
<td>6''</td>
<td></td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td>Short Wall plus 12''</td>
<td>6''</td>
<td></td>
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<td>4</td>
<td>Wall</td>
<td>Wall Height minus 4''</td>
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<td></td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Wall</td>
<td>Long Wall plus 12''</td>
<td>12''</td>
<td></td>
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</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.
5. When specified, provide an eccentric flat to in Lieu of eccentric cone section.

### Table: Maximum Pipe Diameter (inches) for 2 Pipes

<table>
<thead>
<tr>
<th>Manhole Diameter (inches)</th>
<th>At 180° Separation</th>
<th>At 90° Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>24</td>
<td>18</td>
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<td>36</td>
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<tr>
<td>96</td>
<td>60</td>
<td>42</td>
</tr>
</tbody>
</table>
Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

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

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

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

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

- 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.
- 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.
- 12 inch minimum wall height above all pipe openings.
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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<td>48&quot;</td>
<td>12&quot;</td>
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<td>5t2</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5t3</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
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<td>5</td>
<td>Top</td>
<td>Short Wall plus 20&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
</tr>
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<td>5</td>
<td>Base</td>
<td>Long Wall plus 26&quot;</td>
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<td>12&quot;</td>
</tr>
<tr>
<td>5b2</td>
<td>5</td>
<td>Base</td>
<td>Short Wall plus 26&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
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<tr>
<td>5b3</td>
<td>5</td>
<td>Base</td>
<td>Short Wall plus 26&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
</tr>
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<td>5w1</td>
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<td>Top</td>
<td>Long Wall plus 68&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
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<td>5w4</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20&quot;</td>
<td>43&quot;</td>
<td>12&quot;</td>
</tr>
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</table>

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 opening (minimum) each side of pipe opening.
If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

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

2. When specified, provide an eccentric flat top In Lieu of eccentric cone section.
**COMPOSITE TEE DIMENSIONS**

<table>
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<th>Size</th>
<th>D1</th>
<th>H</th>
<th>T1</th>
<th>T2</th>
<th>C</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>48'' on 12''</td>
<td>12''</td>
<td>50''</td>
<td>8''</td>
<td>1/2''</td>
<td>26''</td>
<td>41/2''</td>
</tr>
<tr>
<td>48'' on 15''</td>
<td>15''</td>
<td>50''</td>
<td>7''</td>
<td>26''</td>
<td>43''</td>
<td>5400 lbs.</td>
</tr>
<tr>
<td>48'' on 18''</td>
<td>18''</td>
<td>50''</td>
<td>6''</td>
<td>26''</td>
<td>44''</td>
<td>5200 lbs.</td>
</tr>
<tr>
<td>48'' on 21''</td>
<td>21''</td>
<td>48''</td>
<td>6''</td>
<td>17/2''</td>
<td>36''</td>
<td>5800 lbs.</td>
</tr>
<tr>
<td>48'' on 24''</td>
<td>24''</td>
<td>48''</td>
<td>6''</td>
<td>16''</td>
<td>40''</td>
<td>5500 lbs.</td>
</tr>
<tr>
<td>48'' on 27''</td>
<td>27''</td>
<td>48''</td>
<td>9''</td>
<td>17/2''</td>
<td>38''</td>
<td>5900 lbs.</td>
</tr>
<tr>
<td>48'' on 30''</td>
<td>30''</td>
<td>48''</td>
<td>9''</td>
<td>10''</td>
<td>40''</td>
<td>5300 lbs.</td>
</tr>
<tr>
<td>48'' on 33''</td>
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<td>54''</td>
<td>9''</td>
<td>1''</td>
<td>40''</td>
<td>6600 lbs.</td>
</tr>
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<td>54''</td>
<td>8''</td>
<td>1''</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).

**Step 1:** Install infiltration barrier.

**Step 2:** Bedding Material 8" min. Class I

**Figure 6010.305 STANDARD ROAD PLAN**

**Section:**
- **A-A**
- **B-B**

**Table:** COMPOSITE TEE DIMENSIONS

**Diagram:**
- Location Station
- Joint Sealant (typ.)
- Precast Top
- Precast Riser Section
- Adjuster Rings
- SW-601 Casting
- Gasketed Pipe Joint (typ.)
- Composite Tee Section
- Bedding Material 8" min. Class I

**Drawing:**
- SUDAS DIRECTOR
- DESIGN METHODS ENGINEER

**Revision:**
- 10-18-22

**Notes:**
- Added circle note 2.

**Sheet:** Sheet 2 of 2

**Designation:**
- SANITARY SEWER MANHOLE
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.

Provide mechanical joints for all ductile iron pipe and fittings.

Possible Sleeve or Transition Coupling

Concrete Encasement

90° Elbow or Two 45° Bends

Class I Bedding Material
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.

### Typical Section

- **Manhole Diameter (inches):**
  - 27" dia

- **Manhole Diameter:**
  - 27" dia

- **Concrete Fillet:**
  - 6" min.

- **Location Station:**
  - Precast Riser Sections

- **Cast-in-place base:**
  - 8" min

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

<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>96</td>
<td>60</td>
</tr>
</tbody>
</table>

**Notes:**

- Bedding Material: 8" min. Class I
- Concrete Fillet: 6" min.
- #4 Bars @ 12" o.c. Each Way

**Diagram:**

- **Sw-602 Casting**
- **Precast Top**
- **Adjustment Rings**
- **Depth**
- **Manhole Diameter**
- **Location Station**
- **Concrete Fillet**
- **Square Edge**
- **Base**
- **Flowline**
- **Lowest Flowline**
- **Precast Riser Sections**

**Tables:**

- **Sheet 1 of 1**
- **Figure 6010.401**
- **SUDAS STANDARD ROAD PLAN**
- **CIRCULAR STORM SEWER MANHOLE**

**Revision:**

- 04-20-21

**Design Methods Engineer:**

- SUDAS
- IOWADOT
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.
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.

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>4</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>4</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>4</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>4</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>4</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>4</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>4</td>
</tr>
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</table>

Diameter of Largest Pipe, D

- Minimum Bar Size
  - 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.

TYPICAL SECTION

- SW-602 Casting
- Adjustment Rings
- Top
- Wall Width
- Wall Height
- Concrete Fillet
- Two #4 Hoop Bars (typ.)
- Base
- 8" min. Class I Bedding Material
- 8" Short Wall Width
- 8" Bedding Material
- 27" dia.
- 10"
- 12" min.
- Depth (12'-0" max.)
- Lowest Flowline
- Base
- SW-602 Casting

STORM SEWER MANHOLE
DEEP WELL RECTANGULAR

REVISIONS:
Added Class I Bedding Material.
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.

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.

**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>4t1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>36'</td>
<td>12'</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>Long Wall plus 12'</td>
<td>6'</td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>Short Wall plus 12'</td>
<td>6'</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>36'</td>
<td>12'</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>Long Wall plus 18'</td>
<td>12'</td>
</tr>
<tr>
<td>4b3</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>Short Wall plus 18'</td>
<td>12'</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
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<td></td>
<td>Short Wall plus 48'</td>
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<tr>
<td>4w2</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>Wall Height minus 4'</td>
<td>12'</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>Long Wall plus 12'</td>
<td>12'</td>
</tr>
</tbody>
</table>
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>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5t1</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>48&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5t2</td>
<td>5</td>
<td>Top</td>
<td>Long Wall plus 20&quot;</td>
<td>9&quot;</td>
<td></td>
</tr>
<tr>
<td>5t3</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20&quot;</td>
<td>9&quot;</td>
<td></td>
</tr>
<tr>
<td>5t4</td>
<td>5</td>
<td>Top</td>
<td>8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5b1</td>
<td>5</td>
<td>Base</td>
<td></td>
<td>43&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5b2</td>
<td>5</td>
<td>Base</td>
<td>Long Wall plus 26&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>5b3</td>
<td>5</td>
<td>Base</td>
<td>Short Wall plus 26&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>5w1</td>
<td>5</td>
<td>Wall</td>
<td>Short Wall plus 68&quot;</td>
<td>12&quot;</td>
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<tr>
<td>5w2</td>
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<td>Wall</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<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>
<td>Short Wall plus 20&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Plan Notes:**
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 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'' on 12''</td>
<td>12''</td>
<td>50''</td>
<td>8''</td>
<td>29''</td>
<td>41½''</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48'' on 15''</td>
<td>15''</td>
<td>50''</td>
<td>7''</td>
<td>26''</td>
<td>43''</td>
<td>5400 lbs.</td>
</tr>
<tr>
<td>48'' on 18''</td>
<td>18''</td>
<td>50''</td>
<td>5½''</td>
<td>25''</td>
<td>44½''</td>
<td>5200 lbs.</td>
</tr>
<tr>
<td>48'' on 21''</td>
<td>21''</td>
<td>48''</td>
<td>9½''</td>
<td>17½''</td>
<td>38½''</td>
<td>5800 lbs.</td>
</tr>
<tr>
<td>48'' on 24''</td>
<td>24''</td>
<td>48''</td>
<td>8''</td>
<td>16''</td>
<td>40''</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48'' on 27''</td>
<td>27''</td>
<td>48''</td>
<td>9½''</td>
<td>11½''</td>
<td>38½''</td>
<td>5900 lbs.</td>
</tr>
<tr>
<td>48'' on 30''</td>
<td>30''</td>
<td>48''</td>
<td>8''</td>
<td>10''</td>
<td>40''</td>
<td>5300 lbs.</td>
</tr>
<tr>
<td>48'' on 33''</td>
<td>33''</td>
<td>54''</td>
<td>9½''</td>
<td>11½''</td>
<td>44½''</td>
<td>6600 lbs.</td>
</tr>
<tr>
<td>48'' on 36''</td>
<td>36''</td>
<td>54''</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).
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.
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.

Place a minimum of one w1 bar above each 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>t1</td>
<td>See Table</td>
<td>Top</td>
<td>Long Wall plus 8”</td>
<td>6”</td>
<td></td>
</tr>
<tr>
<td>t2</td>
<td>See Table</td>
<td>Top</td>
<td>Short Wall plus 8”</td>
<td>6”</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>See Table</td>
<td>Base</td>
<td>Long Wall plus 14”</td>
<td>12”</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>See Table</td>
<td>Base</td>
<td>Short Wall plus 14”</td>
<td>12”</td>
<td></td>
</tr>
<tr>
<td>w1</td>
<td>See Table</td>
<td>Walls</td>
<td>Long Wall plus 8”</td>
<td>12”</td>
<td></td>
</tr>
<tr>
<td>w2</td>
<td>See Table</td>
<td>Walls</td>
<td>Short Wall plus 8”</td>
<td>12”</td>
<td></td>
</tr>
<tr>
<td>w3</td>
<td>See Table</td>
<td>Walls</td>
<td>Wall Height minus 4”</td>
<td>12”</td>
<td></td>
</tr>
</tbody>
</table>

*Diameter of Largest Pipe, D | Minimum Bar Size

- 4” or 5”
- 33” to 42”
- 30” or smaller

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

**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>
</tr>
</thead>
<tbody>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td>Wall Height minus 4&quot;</td>
<td>14</td>
<td>12&quot;</td>
<td></td>
</tr>
<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>

**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) for 2 Pipes at 180° Separation</th>
<th>at 90° Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
<td>24</td>
</tr>
<tr>
<td>72</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>84</td>
<td>48</td>
<td>36</td>
</tr>
<tr>
<td>96</td>
<td>60</td>
<td>42</td>
</tr>
</tbody>
</table>

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.

- **Adjustment Rings**
- **Top**
- **Back of Curb**
- **SW-602 Type E Casting**
- **SW-603 Type R Casting**
- **Form Grade**
- **Concrete Fillet**
- **Optional Construction Joint (typ.)**
- **Diagonal Bar (typ.)**
- **8" min. Class I Bedding Material**
- **Long Wall**
- **6'-0"**
- **7'-0"**
- **8" min. Class I Bedding Material**
- **Diagonal Bar**
- **Wall Height**
- **Wall**
- **Base**
- **4" dia**
- **Fillet**
- **Concrete**
- **Adjustment Rings**
- **12" min.**
- **24" dia**
- **4w3**
- **4w1**
- **4b1**
- **4b2**
- **4t1**
- **4t2**
- **411**
- **412**
- **Adjustment Rings**
### 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>4t1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>12</td>
<td>3'-0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>4'-0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>7</td>
<td>4'-0&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>5</td>
<td>7'-0&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Short Walls</td>
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<td>Varies</td>
<td>3'-0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w2</td>
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<td>Long Walls</td>
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<td>Varies</td>
<td>6'-0&quot;</td>
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<td>4</td>
<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.
REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
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<th>Location</th>
<th>Shape</th>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<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>
<td></td>
<td>8</td>
<td>4'-2&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>5</td>
<td>8'-2&quot;</td>
<td>10&quot;</td>
</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>4a2</td>
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<td>Adj. Ring</td>
<td></td>
<td>4</td>
<td>3'-2&quot;</td>
<td>See Adj. Ring Plan</td>
</tr>
</tbody>
</table>

| 4w1  | 4    | Walls   |       | 13    | Wall Height minus 4" | 12" |
| 4w2  | 4    | Walls   |       | 11    | Wall Height minus 16" | 12" |
| 4w3  | 4    | Long Walls | Varies | 7'-8" | 12" |
| 4w4  | 4    | Short Walls | Varies | 3'-8" | 12" |

MAXIMUM PIPE DIAMETERS

<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>
</tbody>
</table>

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

ADJUSTMENT RING

PLAN

SECTION B-B

Diagonal Bar (typ.)

Location Station (Back of Curb)
Precast Beam
4"
8" min.
6"
6"
3'-0"
7'-8"
4b2
1
2
3
4w2
4w1
Adjustment Rings
Form Grade
Back of Curb
SW-603 Type R Casting
Diagonal Bar (typ.)
Concrete Fillet
8"
6" min.
4" min.
8" min.
4b1
4b2
12"
6" min.
6"
6"
2'-0"
3'-0"
8" min. Class I Bedding Material
8" min. Class I Bedding Material
Location Station
(Back of Curb)
Short Wall
2'-0"
3'-0"
12 inch minimum wall height above all pipes.
Long Wall
6'-8"
7'-8"
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.
DOUBLE GRATE INTAKE
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'</td>
<td>18'</td>
</tr>
<tr>
<td>Long Wall</td>
<td>60'</td>
<td>66'</td>
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</table>

REINFORCING BAR LIST

<table>
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<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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<tr>
<td>4t1</td>
<td>4</td>
<td>Beam</td>
<td></td>
<td>4</td>
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<td>4&quot;</td>
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<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>4</td>
<td>7'-10&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>8</td>
<td>3'-2&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>Long Walls</td>
<td>Varies</td>
<td>7'-4&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td>Varies</td>
<td>2'-8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</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.
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>Maximum Pipe Diameters</th>
<th>Wall</th>
<th>Max. Dia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>30&quot;</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>24&quot;</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>36&quot;</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>42&quot;</td>
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Refer to SW-514 for boxout details.
### REINFORCING BAR LIST

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<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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</thead>
<tbody>
<tr>
<td>4t1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>4</td>
<td>7'-4&quot;</td>
<td>See Detail</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>4</td>
<td>6'-8&quot;</td>
<td>See Detail</td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>4</td>
<td>2'-8&quot;</td>
<td>See Detail</td>
</tr>
<tr>
<td>4t4</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4t5</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>6</td>
<td>4'-2&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>4</td>
<td>7'-10&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>4</td>
<td>3'-2&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b3</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>5</td>
<td>7'-2&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b4</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>4</td>
<td>4'-2&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>29</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Wall 2</td>
<td>Varies</td>
<td></td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
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<tr>
<td>4w3</td>
<td>4</td>
<td>Walls 1 and 3</td>
<td>Varies</td>
<td></td>
<td>6'-8&quot;</td>
<td>12&quot;</td>
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<td>4w4</td>
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<td>Wall 4</td>
<td>Varies</td>
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<td>7'-4&quot;</td>
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<tr>
<td>4w5</td>
<td>4</td>
<td>Wall 5</td>
<td>Varies</td>
<td></td>
<td>2'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w6</td>
<td>4</td>
<td>Wall 6</td>
<td>Varies</td>
<td></td>
<td>3'-10&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

### Notes

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

2. Back of Curb

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

4. Edge of Gutter (if applicable)

5. 12''

6. 6''

7. 6''

8. 6''

9. Normal Pavement Slope

10. Slope

11. Pavement Normal

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

13. Face of 6'' Standard Curb

14. 4''

15. 8''

16. 4''

17. 6''

18. 6''

19. 6''

20. Form Grade

21. Trowel smooth and place bond breaker

22. (6 Inch Standard Curb)

23. Back of Curb

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

25. Edge of Gutter (if applicable)

26. 12''

27. 6''

28. 6''

29. Normal Pavement Slope

30. Slope

31. Pavement Normal

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

33. Face of 4'' Sloped Curb

34. 4''

35. 4''

36. 6''

37. 6''

38. Form Grade

39. Trowel smooth and place bond breaker

40. (4 Inch Sloped Curb)

41. INSERT

42. (6 Inch Standard Curb)

43. INSERT

44. (4 Inch Sloped Curb)
**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''</td>
<td>30''</td>
</tr>
<tr>
<td>Long Wall</td>
<td>30''</td>
<td>36''</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>4t1</td>
<td>4</td>
<td>Top</td>
<td>-</td>
<td>6</td>
<td>4'-8''</td>
<td>See Insert</td>
</tr>
<tr>
<td>4t2</td>
<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>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td>-</td>
<td>6</td>
<td>3'-6''</td>
<td>11''</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td>-</td>
<td>5</td>
<td>4'-8''</td>
<td>10''</td>
</tr>
<tr>
<td>4l1</td>
<td>4</td>
<td>Insert</td>
<td>-</td>
<td>4</td>
<td>Boxout Length minus 8''</td>
<td>See Plan</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td>-</td>
<td>14</td>
<td>Wall Height minus 4''</td>
<td>14''</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Long Walls</td>
<td>-</td>
<td>Varies</td>
<td>4'-8''</td>
<td>12''</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td>-</td>
<td>Varies</td>
<td>3'-8''</td>
<td>12''</td>
</tr>
</tbody>
</table>

- **Form Grade**: 10''
- **Boxout Length**: 6'' min. 12'' max.
- **Long Wall**: 4'-0''
- **Short Wall**: 3'-0''
- **MAXIMUM PIPE DIAMETERS**
  - 5'-0''
  - 4'-0''
  - 6'' min. 12'' typ.
  - 18'' min. 36''

---

**Additional Notes**

- 12 inch minimum wall height above all pipes.
- Slope of 1.5% or as specified in the contract documents.
- 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.
Trowel smooth and place bond breaker.

Edge of Gutter (if applicable)

12"
6"
6"
6"
12"

Normal Pavement Slope

Back of Curb

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

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

Face of 6"
Standard Curb

Trowel smooth and place bond breaker

INSERT
(6 Inch Standard Curb)

Sloped Curb

Form Grade

Trowel smooth and place bond breaker

INSERT
(4 Inch Sloped Curb)
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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</thead>
<tbody>
<tr>
<td>4t1</td>
<td>4</td>
<td>Top</td>
<td>———</td>
<td>7</td>
<td>4'-8''</td>
<td>See Insert</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td>———</td>
<td>4</td>
<td>4'-6''</td>
<td>12''</td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td>———</td>
<td>10</td>
<td>1'-10''</td>
<td>6''</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td>———</td>
<td>6</td>
<td>4'-6''</td>
<td>11''</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td>———</td>
<td>6</td>
<td>4'-6''</td>
<td>11''</td>
</tr>
<tr>
<td>4t1</td>
<td>4</td>
<td>Insert</td>
<td>———</td>
<td>4</td>
<td>Boxout Length minus 8''</td>
<td>See Plan</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td>———</td>
<td>16</td>
<td>Wall Height minus 4''</td>
<td>14''</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Walls</td>
<td>———</td>
<td>Varies</td>
<td>4'-8''</td>
<td>12''</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Walls</td>
<td>———</td>
<td>Varies</td>
<td>4'-8''</td>
<td>12''</td>
</tr>
</tbody>
</table>

12 inch minimum wall height above all pipes.

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

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.
(6 Inch Standard Curb Insert)

(4 Inch Sloped Curb Insert)

SECTION A-A

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

Edge of Gutter
(if applicable)

Normal Pavement Slope

Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by \( \frac{1}{8} \) 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

<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>4b1</td>
<td>4</td>
<td>Base</td>
<td>4</td>
<td>9</td>
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<td>12&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td>4</td>
<td>5</td>
<td>8'-6&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4t1</td>
<td>4</td>
<td>Insert</td>
<td>4</td>
<td>4</td>
<td>Boxout Length minus 8&quot;</td>
<td>See Insert</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>6</td>
<td>8'-6&quot;</td>
<td>See Plan</td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>8</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td>4</td>
<td>18</td>
<td>10&quot;</td>
<td>6&quot;</td>
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<tr>
<td>4w2</td>
<td>4</td>
<td>Long Walls</td>
<td>4</td>
<td>22</td>
<td>Wall Height minus 4&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td>4</td>
<td>Varies</td>
<td>4'-8&quot;</td>
<td>12&quot;</td>
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<tr>
<td>5w1</td>
<td>5</td>
<td>Beam</td>
<td>5</td>
<td>2</td>
<td>7'-3&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

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.

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>60&quot;</td>
<td>66&quot;</td>
</tr>
</tbody>
</table>

SECTION B-B

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

SECTION C-C

(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 \( \frac{1}{2} \) 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>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
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</thead>
<tbody>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>9</td>
<td>4'-6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>6</td>
<td>8'-6&quot;</td>
<td>11&quot;</td>
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<td>4</td>
<td>Insert</td>
<td></td>
<td>4</td>
<td>Boxout Length minus 8&quot;</td>
<td>See Insert</td>
</tr>
<tr>
<td>4i1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>7</td>
<td>8'-6&quot;</td>
<td>See Plan</td>
</tr>
<tr>
<td>4i2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>4'-4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4i3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>18</td>
<td>1'-10&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
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<td>Walls</td>
<td></td>
<td>24</td>
<td>Wall Height minus 4&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
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<td>Long Walls</td>
<td></td>
<td>Varies</td>
<td>4'-8&quot;</td>
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</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td></td>
<td>Varies</td>
<td>8'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5w1</td>
<td>5</td>
<td>Beam</td>
<td></td>
<td>2</td>
<td>8'-3&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>
**Section C-C**

- **Beam with Spacer** for alignment of Top Walls (Refer to Section B-B)
- **Spacer Center Wall**
- **Spacer End Wall**

**Section B-B**

- **Beam**
- **Concrete Fillet**
- **Wall Height**
- **Lowest Flowline**
- **Walls**
- **Spacer**
- **Top**
- **Beam**
- **Walls**

**Isometric View**

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

**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>30''</td>
<td>36''</td>
</tr>
<tr>
<td>Long Wall</td>
<td>60''</td>
<td>96''</td>
</tr>
</tbody>
</table>

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

- **Note 6:** Added Class I Bedding Material and changed maximum box out length to 17'.

---

**Contract Documents:**

- **Flowline:** Lowest 8'' min.
- **Intake, Large Box**
- **Double Open-Throat Curb**
- **Standard Road Plan**
- **Sudas Director**
- **Design Methods Engineer**

**Revision:**

- **04-21-20**
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.

<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>

**MAXIMUM PIPE DIAMETERS**
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.

1. 12 inch minimum riser height above all pipes.

**TYPICAL SECTION**

CASE 1

**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&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>15&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>21&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>27&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>
Minimum riser diameter is 18 inches.
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.

1. Center bars vertically within slab.
BOXOUT IN PCC CURB AND GUTTER

Back of Curb

Intake Grate (typ.)

#4 Bars @ 12" o.c.

'ED' Joint

'D' Joint

#4 Bars

Boxout Length 15'-0" Typical

2" Clear (typ.)

Center bars vertically within slab.

SECTION A-A
ALTERNATE BOXOUT IN PCC CURB AND GUTTER

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

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

1. Center bars vertically within slab.
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.
MAXIMUM PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Pipe Location</th>
<th>Precast Size</th>
<th>Cast-in-place Size</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>Variies</td>
<td></td>
<td>3'-0&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Long Wall</td>
<td>Variies</td>
<td></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

Provide two #4 hoop 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.

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

Minimum 6 inches. Width as determined by manufacturer.
Slope same as adjacent pavement. For joint details, see PV-101.
Linear Trench Drain.
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.
For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

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③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

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④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.

① Additional keyed construction joint when attaching the SW-542 extension unit.

② Top of well flush with pavement.

③ 5'-0'' to 17'-0'' (max.)

④ 4'-0'' min. at Low Point

For joint details, refer to PV-101.
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>b2</td>
<td>4</td>
<td>Intake Wall</td>
<td></td>
<td>3</td>
<td>2'-6&quot;</td>
<td>9.0</td>
<td>9&quot;</td>
</tr>
<tr>
<td>f1</td>
<td>4</td>
<td>Bottom</td>
<td></td>
<td>3</td>
<td>4'-9&quot;</td>
<td>9.5</td>
<td>9&quot;</td>
</tr>
<tr>
<td>t2</td>
<td>4</td>
<td>Bottom</td>
<td></td>
<td>4</td>
<td>1'-7&quot;</td>
<td>4.2</td>
<td>18&quot;</td>
</tr>
<tr>
<td>g2</td>
<td>4</td>
<td>Wall</td>
<td></td>
<td>3</td>
<td>Various* Various** 12&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>4</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></td>
<td>4</td>
<td>Various* Various** 18&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Place 6" standard curb: g3 for 6 inch standard curb; g5 for 4 inch sloped curb.
2. Place 4" standard curb: 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.

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.

- Place one of each length.

Match Existing Pavement Joints

(SW-542 EXTENSION AND SW-541 INTAKE)
Figure 6010.542

Section A-A

Section B-B

Section C-C

6 Inch Standard Curb

2:1 Slope (Horizontal:Vertical)

See SW-541 for reinforcing.
FIGURE 6010.542
SECTION D-D
SECTION E-E

Keyed Construction Joint

Bottom Edge of Intake Top

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. See SW-541 for reinforcing.

FIGURE 6010.542
SHEET 4 of 4

EXTENSION UNIT FOR OPEN-THROAT CURB
INTAKE UNDER PAVEMENT

REVISIONS:
Removed Interim from standard
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>Keyed Construction Joint</th>
<th>Cast-in-place Structure</th>
<th>Precast Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>8'' min. Class I Bedding Material</td>
<td>36''</td>
<td>36''</td>
</tr>
<tr>
<td>Concrete Fillet</td>
<td>12''</td>
<td>12''</td>
</tr>
<tr>
<td>Keyed Construction Joint</td>
<td>6'' min.</td>
<td>6'' min.</td>
</tr>
<tr>
<td>Gutter Grade</td>
<td>6''</td>
<td>8'' min.</td>
</tr>
<tr>
<td>Flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top of Curb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition 18'' Curb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18'' Curb Transition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boxout Length - 23'-0'' max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E' Joint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>'ED' Joint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top of Curb</td>
<td>32''</td>
<td>12'-0''</td>
</tr>
<tr>
<td>Location Station</td>
<td>30''</td>
<td>16'-0''</td>
</tr>
<tr>
<td>'B' Joint</td>
<td>6''</td>
<td>6''</td>
</tr>
<tr>
<td>Length of Curb Opening</td>
<td>6'' dia. Concrete Post</td>
<td>6''</td>
</tr>
<tr>
<td>Gutter Grade</td>
<td>12''</td>
<td>12''</td>
</tr>
<tr>
<td>Flow</td>
<td>6''</td>
<td>6''</td>
</tr>
</tbody>
</table>

**MAXIMUM PIPE DIAMETERS**

<table>
<thead>
<tr>
<th>MAXIMUM PIPE DIAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
</tr>
<tr>
<td>36''</td>
</tr>
</tbody>
</table>

**REVISE**

04-19-22

**SHEET 1 OF 4**

**FIGURE 6010.545**

**SUDAS STANDARD ROAD PLAN**

**SW-545**

**SUDAS IOWADOT**

**REVISED**

Clarified labeling of rebar.

**REVISED**

Extended openings.

**SUDAS**

**DESIGN METHODS ENGINEER**

**REVISIONS**

04-19-22
**REINFORCING BAR LIST (6 Inch Standard Curb)**

**MARK SIZE LOCATION NO. LENGTH WEIGHT SPACING**

<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>6e1</td>
<td>4</td>
<td>Top/Base</td>
<td>11</td>
<td>9'-9&quot;</td>
<td>69.5</td>
<td>12'</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-0&quot;</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-9&quot;</td>
<td>17.0</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-9&quot;</td>
<td>17.0</td>
<td>15'</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>8'-2&quot;</td>
<td>19.9</td>
<td>22'</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>18'-0&quot;</td>
<td>10.6</td>
<td></td>
</tr>
</tbody>
</table>

* With 16'-6" Boxout: Total 119.1 lbs.

**REINFORCING BAR LIST (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'-9&quot;</td>
<td>69.5</td>
<td>12'</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-0&quot;</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-9&quot;</td>
<td>17.0</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-9&quot;</td>
<td>17.0</td>
<td>15'</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>8'-2&quot;</td>
<td>19.9</td>
<td>22'</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>17'-10&quot;</td>
<td>11.9</td>
<td></td>
</tr>
</tbody>
</table>

* With 16'-6" Boxout: Total 142.4 lbs.

**REINFORCING BAR LIST (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'-9&quot;</td>
<td>69.1</td>
<td>12'</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-0&quot;</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-8&quot;</td>
<td>22.4</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-8&quot;</td>
<td>22.4</td>
<td>15'</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>8'-2&quot;</td>
<td>18.2</td>
<td>22'</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>18'-0&quot;</td>
<td>13.2</td>
<td></td>
</tr>
</tbody>
</table>

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

**REINFORCING BAR LIST (18'-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>15</td>
<td>9'-9&quot;</td>
<td>69.8</td>
<td>12'</td>
</tr>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>16'-0&quot;</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>18'-9&quot;</td>
<td>25.0</td>
<td>15'</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>18'-9&quot;</td>
<td>25.0</td>
<td>15'</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>14'-2&quot;</td>
<td>18.9</td>
<td>22'</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>21'-10&quot;</td>
<td>14.8</td>
<td></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.
REINFORCING BAR LIST  \( (4" \text{ Sloped Curb}) \)

### Extension Length

- **Mark:** 4
- **Size:** 4e4
- **Location:** Top/Base
- **Location:** Top
- **Location:** Base
- **Length:** 4e6
- **Weight:** 4e2
- **Spacing:** 4e3

### Top of Extension Reinforcing Placement

1. **Mark:** 4e2
2. **Location:** Top
   - **No.:** 1
   - **Length:** 10'-0"
   - **Weight:** 9.3
3. **Location:** Base
   - **No.:** 1
   - **Length:** 18'-0"
   - **Weight:** 14.6

### Bottom of Extension Reinforcing Placement

1. **Mark:** 4e2
2. **Location:** Top/Base
   - **No.:** 1
   - **Length:** 10'-0"
   - **Weight:** 9.3
3. **Location:** Top
   - **No.:** 1
   - **Length:** 18'-0"
   - **Weight:** 14.6

### Reinforcing Bar List  \( (4" \text{ Sloped Curb}) \)

- **Mark:** 4e2
- **Location:** Top
  - **No.:** 1
  - **Length:** 10'-0"
  - **Weight:** 9.3
- **Location:** Base
  - **No.:** 1
  - **Length:** 18'-0"
  - **Weight:** 14.6

### Reinforcing Bar List  \( (4" \text{ Sloped Curb}) \)

- **Mark:** 4e3
- **Location:** Top
  - **No.:** 2
  - **Length:** 12'-0"
  - **Weight:** 17.0
- **Location:** Base
  - **No.:** 2
  - **Length:** 12'-0"
  - **Weight:** 17.0

### Reinforcing Bar List  \( (4" \text{ Sloped Curb}) \)

- **Mark:** 4e4
- **Location:** Top
  - **No.:** 2
  - **Length:** 12'-0"
  - **Weight:** 17.0
- **Location:** Base
  - **No.:** 2
  - **Length:** 12'-0"
  - **Weight:** 17.0

### Reinforcing Bar List  \( (4" \text{ Sloped Curb}) \)

- **Mark:** 4e5
- **Location:** Top/Base
  - **No.:** 9
  - **Length:** 8'-0"
  - **Weight:** 58.9
  - **Spacing:** 4e3
- **Location:** Top
  - **No.:** 1
  - **Length:** 15'-0"
  - **Weight:** 13.6

### Reinforcing Bar List  \( (4" \text{ Sloped Curb}) \)

- **Mark:** 4e6
- **Location:** Top/Base
  - **No.:** 11
  - **Length:** 10'-0"
  - **Weight:** 69.5
  - **Spacing:** 4e3
- **Location:** Top
  - **No.:** 1
  - **Length:** 17'-0"
  - **Weight:** 11.9

### Reinforcing Bar List  \( (4" \text{ Sloped Curb}) \)

- **Mark:** 4e4
- **Location:** Top
  - **No.:** 1
  - **Length:** 12'-0"
  - **Weight:** 12.3

### Weight

- **Mark:** 4e1
- **Location:** Top/Base
  - **No.:** 1
  - **Length:** 8''
  - **Weight:** 6.7

### Keyed Construction Joint

- **Mark:** 4e2
- **Location:** Line at Back of Curb

### Normal Slope

- **Mark:** 4e1
- **Location:** Form Grade Line
  - **No.:** 1
  - **Length:** 12'-0"
  - **Weight:** 10.6

### Insert Detail

1. **Mark:** 4e5
2. **Location:** Top/Base
   - **No.:** 4
   - **Length:** 22''
3. **Location:** Top
   - **No.:** 1
   - **Length:** 15'-10"
4. **Location:** Base
   - **No.:** 1
   - **Length:** 8'-2"

### Bent Bar Details

1. **Mark:** 4e6
2. **Location:** Line at Back of Curb
   - **No.:** 1
   - **Length:** 10''
   - **Weight:** 188.9 lbs.

### Insert Detail

1. **Mark:** 4e6
2. **Location:** Line at Back of Curb
   - **No.:** 1
   - **Length:** 10''
   - **Weight:** 188.9 lbs.

### Use when adjacent pavement is HMA or composite.

### Clarified labeling of rebar.

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

### 4 Inch Sloped Curb

1. **Mark:** 4e1
2. **Location:** Top/Base
   - **No.:** 1
   - **Length:** 10'-0"
   - **Weight:** 10.7
3. **Location:** Top
   - **No.:** 2
   - **Length:** 12'-0"
   - **Weight:** 15.6

### Revisions

- **Revision:** 04-19-22

### Single Open-Throat Curb Intake with Extended Opening

### Bending Moment Diagram

- **Mark:** 4e6
- **Location:** Line at Back of Curb
  - **No.:** 1
  - **Length:** 10''
  - **Weight:** 188.9 lbs.
**SANITARY SEWER MANHOLES**

**FIGURE 6010.601**

**SANITARY SEWER CASTINGS**

**SANITARY SEWER PLAN**

**SANITARY SEWER STANDARD ROAD PLAN**

**SANITARY SEWER ENGINEER**

**SANITARY SEWER DESIGN METHODS ENGINEER**

**SANITARY SEWER SUDAS DIRECTOR**

---

**TYPE A**
Two-piece fixed casting

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

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

**TYPE D: HMA**
Three-piece floating casting with bolt-down cover for use in HMA paving

---

**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.

Sanitary Sewer Manholes

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

**TYPES 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**

- **Anchor Bolt (Type D):**
  - Bolt-Down Cover
  - Lug
  - Gasket Seal
  - Height Adjustment Bolts and Slots

- **Steel Sleeve**
  - Gasket to seal out debris

- **Bolt-Down Cover (Type D):**
  - Height Adjustment Mechanism

---

**Cover Notes:**
Roughness pattern and text style may vary. Minimum one concealed pickhole.
TYPE E
Two-piece fixed casting

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

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.

Anchor Bolt

Flange (typ.)

Gasket to seal out debris

Anchor Bolt Hole

STORM

SEWER

STORM

SEWER

26" min. clear opening

24" min.

33" min.

26" min.

35 7/8" min.

7" min.

24" min.

26" min.

1 7/8"
FIGURE 6010.602
SHEET 2 OF 3

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

Anchor Bolt
Lug
Steel Sleeve
Gasket to seal out debris

28" min.
24" min. clear opening

26" min.
24" min. clear opening

33 1/2 min.

Height Adjustment
Bolts and Slots

TYPICAL SECTION

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.

STORM SEWER MANHOLES
CASTINGS FOR
STANDARD ROAD PLAN

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.
TYPE G
Two piece fixed casting

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

PLAN

TYPICAL SECTION

Minimum one pickhole.

25 3/4 min.
26 3/4 min.
1 1/2" min.

Minimum 1".
**TYPE Q**
Driveway Grate
(Minimum open area 370 in$^2$)

**TYPE R**
Curb Inlet Grate
(Minimum open area 180 in$^2$)

---

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.

---

**PLAN**

**SECTION A-A**

**SECTION B-B**

**TYPICAL SECTION**

**TYPICAL SECTION**
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.

**PLAN**

- Bolt frame to grate with six $\frac{3}{8} \times 3\frac{3}{4}''$ flat head cap screws.
- Bolt frame to grate with six $\frac{3}{8} \times 4\frac{1}{2}''$ stainless steel hex head bolts.

**SECTION C-C**

- $\frac{3}{8}''$ dia. hole (typ.)
- 12 spaces @ 3''
- 45''
- 40''
- 37.5''
- 48''

**SECTION D-D**

- 48''
- 45''
- 45''
- 48''

**DETAIL 'A'**

Bolt Slot Detail

**CASTINGS FOR GRATE INTAKES**
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 structure walls as required to provide pocket support beam under all frame joints. Modify directions will be allowed.

Cast grate without locking lugs so it may be used in an inverted position.
### Contraction Joints

**PLAIN JOINT**
- Abutting Pavement Slabs
- **B**
- See Detail C

**CONTRACTION JOINT**
- **C**
- See Detail A or B

**DOWELED CONTRACTION JOINT**
- **CD**
- 18" Long Dowel at 12" Centers
- See Detail A or B

**TIED CONTRACTION JOINT**
- **CT**
- 30" Long Tie Bar at 12" Centers
- See Detail A or B

**DOWEL ASSEMBLIES**
- See dowel assemblies for fabrication details.

**DAY'S WORK JOINT (Non-working)**
- **DW**
- 30" Long Tie Bar at 12" Centers

**HEADER JOINT**
- **HT**
- Header Block
- Plastic or Tarpaper Wrapped

**AButting Pavement JOINT**
- **RD**
- 18" Long Dowel Larger than Dowel
- Top of Curb

**TIED CONTRACTION JOINT**
- **RT**
- 24" Long Tie Bar at 12" Centers

**ABUTTING PAVEMENT JOINT**
- **CT**
- Hole Diameter 1\(\frac{1}{8}\)" Larger than Tie Bar
- Top of Slab

**DAY'S WORK JOINT**
- **DW**
- 30" Long Tie Bar at 12" Centers

**CURB AND GUTTER UNIT**
- **DV**
- 30" Long Tie Bar at 12" Centers

---

**LEGEND**
- Existing Pavement
- Proposed Pavement

**REVISIONS:**
- SUDAS DIRECTOR
- DESIGN METHODS ENGINEER
- PV-101

---

**NOTES:**
- 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 when the hole diameter is greater or equal to 8 inches. Use "C" joints when the hole diameter 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.
**BAR PLACEMENT**
(Appplies to all joints unless otherwise detailed.)

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

- **Top of Pavement**
- **Joint Sealant Material**
- **Saw Cut**
- **Crack or Joint Line**

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

- **Top of Curb**
- **Bottom of Saw Cut**
- **Knife Cut**
- **Top of Slab**

**DETAIL C**

- **Top of Pavement**
- **Sealant**
- **Joint Sealant Material**
- **Saw Cut**
- **Crack or Joint Line**

**SECTION A-A**
(Detail at Edge of Pavement)

**TRANSVERSE CONTRACTION**

- **‘C’ JOINT IN CURB**
  (Match ‘CT’, ‘CD’, or ‘C’ joint in pavement.)

- **‘C’ JOINT IN CURB**
  (Match ‘CT’, ‘CD’, or ‘C’ joint in pavement.)

**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”</td>
<td>3/4</td>
<td>7/8</td>
<td>#6</td>
</tr>
<tr>
<td>≥ 8” but &lt; 10”</td>
<td>1 1/2”</td>
<td>1 3/8”</td>
<td>#10</td>
</tr>
<tr>
<td>≥ 10”</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.

- **8** Saw ‘CD’ joint to a depth of T/3 ± 1/4”;
  saw ‘C’ joint to a depth of T/4 ± 1/4”.
- **9** When tying into old pavement, **1** represents the depth of sound PCC.

**LEGEND**

- **PCC**
- **Existing Pavement**
- **Proposed Pavement**
TIE BAR PLACEMENT
(Appplies to all joints unless otherwise detailed.)

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

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

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

KEYWAY DIMENSIONS

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

LEGEND

- Existing Pavement
- Proposed Pavement

LONGITUDINAL CONTRACTION

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

Sealant or cleaning not required.
CONTRACTION JOINTS

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

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>2 1/4&quot;</td>
</tr>
<tr>
<td>8&quot; to 9 1/4&quot;</td>
<td>2 1/2&quot;</td>
</tr>
<tr>
<td>10&quot; to 11 1/2&quot;</td>
<td>2 1/2&quot;</td>
</tr>
<tr>
<td>12&quot; to 13&quot;</td>
<td>2 1/2&quot;</td>
</tr>
</tbody>
</table>

Tubular Dowel Bars will not be allowed for RD joints.

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.

Weld alternately throughout.

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

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

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

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

CONTRACTION JOINTS

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

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Weld alternately throughout.

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Use wires with a minimum tensile strength of 50 ksi.

Details apply to both transverse contraction and expansion joints.

Weld alternately throughout.

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

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

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

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.

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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 dowel 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.

Weld alternately throughout.

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


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.

Clip and remove center portion of tie during field assembly.

1/4 inch diameter wire.

Use 18 inch long dowel bars with a tolerance of ± 1/8 inch. Ensure the centerlines of individual dowels are parallel to the other dowel 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.

Weld alternately throughout.

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


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

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Clip and remove center portion of tie during field assembly.

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

- 3/16" diameter

#1/0 Gauge Wire

ANCHOR PIN

- 1" min.
- 12" min.
- 2"
- 45°

Anchor Pin

#1/0 Gauge Wire

(0.306" diameter)

PLACEMENT LIMITS

- Longitudinal Joint
- Edge of Pavement
- Top of Pavement
- Centerline Joint
- Gutterline Joint
- Back of Curb

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

D + 3/16" max.

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 to 6 inches. For taper and variable width pavements: 3 to 12 inches.

Details apply to both transverse contraction and expansion joints.

Use wires with a minimum tensile strength of 50 ksi.

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

For uniform lane widths: 3 to 6 inches. For taper and variable width pavements: 3 to 12 inches.
**FIGURE 7010.102**

**BEAM CURB**

*For short replacement sections, match existing curb profile*

**DROP CURB AT SIDEWALK**

1. **6” STANDARD CURB**
2. **6” SLOPED CURB**
3. **4” SLOPED CURB**

**DRIVEWAY DROP CURB**

1. **6 inch Standard Curb, 6 inch Sloped Curb, or 4 inch Sloped Curb as specified.**
2. \( \frac{1}{2} \) 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\( \frac{1}{2} \) to 3 inches for industrial or commercial entrances.

**CURB AND GUTTER UNIT**

For joint details, see **PV-101**.
FOR ALL CURBS
CURB RUNOUT
FROM 6" SLOPED TO 4" SLOPED
CURB TRANSITION
FROM 6" STANDARD TO 6" SLOPED
CURB TRANSITION
FROM 6" STANDARD TO 4" SLOPED

If proposed pavement is PCC, match joint spacing for proposed pavement. Place "E" joints in curb and gutter section where expansion joints are to be placed in proposed pavement.
MANHOLE BOXOUTS IN PCC PAVEMENT

**PV-103**

**REVISION 04-19-22**

**SHEET 1 of 1**

**REVISIONS:**

PCC PAVEMENT MANHOLE BOXOUTS IN STANDARD PLAN

---

**Figure 7010.103**

**SUDAS DIRECTOR DESIGN METHODS ENGINEER**

---

**Added note 5.**

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.

5. If a circular boxout is cut and extracted after PCC construction, a 'B' joint may be substituted for the 'E' joint if approved by the Engineer.

---

**Section A-A**

(For three-piece floating casting)

Construct boxout with Class C concrete or match pavement class. Minimum 2 inches clear on reinforcement. Minimum 12 inches of concrete between outside of casting and nearest joint. Center casting within boxout area if possible.

---

**Section A-A**

(For two-piece fixed casting)

---

**At Joint Intersection**

---

**Offset At Joint Intersection**

---

**Circular**

---

**At a Single Joint**

---
When X or Y is 4 feet or greater the expansion joints will be at the beginning of the rounded median. For details of paved median, see contract documents.

When X or Y is 4 feet or greater the expansion joints will be at the beginning of the rounded median. For details of paved median, see contract documents.

Formulas:

- W = Width from back of curb to back of curb
- X = W/2 + 7.5"
- Y = W/2 + 12"

12" Hole for Sign Post (if required)

Match adjacent pavement jointing.

\[ \text{Boxout Limits (varies)} \]

\[ \text{Median Width 8'-0" or Less} \]

\[ \text{Top of Median} \]

\[ \text{12" Hole for Sign Post (if required)} \]

\[ \text{Roadway Surface} \]
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

Min. 5'

Maximum 20'

Possible Curb

15' Typical

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

Existing Expansion Joint (PCC)

Cracks

Existing 'C' or 'CD' Joint (PCC)

Existing Pavement

PCC Widening

PCC Widening

Less than 5'

No Joint

15' Typical

FIGURE 7010.121

JOINTING PCC PAVEMENT WIDENING
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.

<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>17'</td>
</tr>
</tbody>
</table>
Widening Width as Specified

1'-0" or as Specified

2'-0"

2'-6"

Cross Slope as Specified

Integral Curb as Specified. See Figure 7010.102.

CURB FOR WIDENING WITH HMA OVERLAY

See Figure 7010.121 for typical joint layout.

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

2. Subgrade or subbase material as specified.

3. Remove existing curb using full depth saw cut.

Overlay Thickness

HMA

1/8" High
SECTION A-A

PLAN VIEW - STRAIGHT CROSSING

- Ballast
- ~ Stabilized Subgrade ~
- ~ Stabilized Subgrade ~
- PCC Approach
- DW Joint
- Porous Backfill Material
- By Railroad

PLAN VIEW - SKEWED CROSSING

- Ballast
- ~ Stabilized Subgrade ~
- ~ Stabilized Subgrade ~
- PCC Approach
- DW Joint
- Porous Backfill Material
- By Railroad

Note:
1. Tie reinforcing bars with wire at all intersections with other bars. Lap reinforcing bars a minimum of 12 inches when necessary and tie securely.
2. 5 foot 2 inch (typ.) #5 bar or pavement length minus 4 inches, at 12 inches on center.
3. #5 bars X (approach width minus 4 inches).
4. Install 6 inch perforated CMP subdrain, if specified. Include rodent guard per Iowa DOT Materials I.M. 443.01.
5. Granular subbase, modified subbase, or ballast meeting railroad specifications.
6. For new crossings, construct pavement 1/2 inch to 1 inch below top of rail. For existing crossings, construct pavement level to 1/2 inch below top of rail.
7. Full depth asphalt patch per Section 7040.
8. Refer to Figure 7030.205 for detectable warning location.
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.
1. Median height as specified in the contract documents.
2. Construct 'C' joints at a maximum spacing of 15'. Match the joint pattern of the existing pavement. Install expansion joints as directed by the Engineer. Construct expansion joints with 1 inch expansion material. Seal all joints.

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

DOWELED MEDIAN

LANDSCAPE MEDIAN

Possible Overlay
Existing Pavement
Surface

Concrete

Mill existing pavement 1/2".

8" typ.

5"

Cross slope as specified.

1 1/2" typ.

Width of island as specified in the contract documents.

4"

10"

#4 Deformed Bar

DOWEL BAR DETAIL

Grass or Landscaping (as specified)

3% Cross Slope (or as specified)

4% Cross Slope (or as specified)

New Pavement

Existing Pavement

Removal Line

Typical Half Section with Existing Pavement

Typical Half Section with New Pavement

Install BT-3, BT-4, or BT-5 Joint

SUDAS Standard Specifications

MEDIANS
Construct boxout with Class C concrete or match pavement class. Minimum 2 inches clear on reinforcement. Minimum 12 inches of concrete between outside of casting and nearest joint.
Center casting within boxout area if possible.

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 - 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)

Do not disturb parking.

Existing Curb and Gutter

Pav't.

HMA

Sect.

Gutter

HMA_SURFACE

HMA_INTERMEDIATE

HMA_BASE

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

TYPICAL CROSS-SECTION

1. 2'-6''
2. 10'-6''
3. 13'-0''

15' nominal 15' nominal 15' nominal

31' Back to Back
26' Back to Back

2.0% 2.0%
By Railroad

C of Tracks

Rail

Ballast

Stabilized subgrade

~ Asphalt ~

Porous Backfill Material

By Railroad

12"

5'-6"

Asphalt Approach

If applicable, terminate curb prior to approach.

5'-0"

3'-0"

T+4"

LOCATEON STATION

C of Roadway

Asphalt

Mainline Paving

LOCATEON STATION

C of Roadway

Asphalt

Mainline Paving

PLAN VIEW - STRAIGHT CROSSING

PLAN VIEW - SKEWED CROSSING

SECTION A-A

1. Asphalt mainline paving.

2. Install 6 inch perforated CMP subdrain, if specified. Include rodent guard per Iowa DOT Materials I.M. 443.01.

3. Granular subbase, modified subbase, or ballast meeting railroad specifications.

4. For new crossings, construct pavement 1/2 inch to 1 inch below top of rail. For existing crossings, construct pavement level to 1/2 inch below top of rail.

5. Construct asphalt approach according to the requirements for full depth asphalt patching or the requirements for asphalt paving if constructed in conjunction with mainline asphalt.

6. Refer to Figure 7030.205 for detectable warning location.

STATION LOCATION

STATION LOCATION

5'-6"

Varies

7020.902

SUDAS Standard Specifications

ASPHALT RAILROAD CROSSING APPROACH
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.

### Table: 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>

### Diagrams

**SECTION A-A (Full Thickness Fillet - Non-paved Road)**

- Edge of Pavement
- Surface of Existing Non-Paved Road
- Granular Surfacing
- Intermediate Course (when specified in the contract documents)
- Existing Pavement
- 6" min. (excavate as required)

**SECTION A-A (Wedge Shaped Fillet - Paved Entrance or Road)**

- Edge of Pavement
- Surface of Existing Paved Entrance or Road
- Intermediate Runout
- Sand Seal

**SECTION A-A (Full Thickness Fillet - Non-paved Entrance)**

- Edge of Pavement
- Surface of Existing Non-Paved Road
- Intermediate Course (when specified in the contract documents)
- Existing Pavement
- 6" min. (excavate as required)
**TYPICAL LEVELING COURSE**

- **Begin Station**
- **Length of Leveling Course**
- **End Station**
- **Surface Material**
- **Station Progress**
- **Runout**
- **Proposed Overlay**
- **~ Existing Pavement ~**

**GUTTERLINE EDGE - MATCH**

- **Location Station**
- **Surface Course**
- **Runout Length**
- **25'-0' Sand Seal**
- **~ Existing Pavement ~**

**TYPICAL STRENGTHENING COURSE**

- **Begin Station**
- **Length of Leveling Course**
- **End Station**
- **Proposed Overlay**
- **~ Existing Pavement ~**
- **Surface Course**
- **Strengthening Thickness**
- **Surface Material**

**WEDGE SHAPED RUNOUT**
(When Milling is not Specified)

- **Location Station**
- **Runout Length**
- **~ Existing Pavement ~**
- **Surface Course**
- **Resurfacing Thickness**
- **Mill runout. Match surface course thickness.**

**MILLED SURFACE NOTCH FOR RUNOUT**

- **Location Station**
- **Surface Course**
- **Runout Length**
- **~ Existing Pavement ~**
- **Resurfacing Thickness**
- **Mill edge. Match surface course thickness.**

**GUTTERLINE EDGE - NOTCH**

- **Surface Course**
- **Width**
- **~ Existing Pavement ~**
- **Mill edge. Match surface course thickness.**

**SINGLE COURSE RESURFACING**

- **SUDAS Standard Specifications**
- **Details for Asphalt Resurfacing**

**RUNOUT LENGTH**

<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(mph)</strong></td>
</tr>
<tr>
<td>45 or More</td>
</tr>
<tr>
<td>20 to 45</td>
</tr>
</tbody>
</table>

**RATIO**

- **(ft. per inch)**
- **50**
- **25**
### Typical Leveling Course

- **Begin Station**
- **End Station**
- **Intermediate Material**
- **Existing Pavement**

### Typical Strengthening Course

- **Begin Station**
- **End Station**
- **Runout Back**
- **Runout Ahead**
- **Strengthening Thickness**  
  (Intermediate Material)
- **Existing Pavement**

### Milled Surface Notch Runout

- **Location Station**
- **Runout Length**
- **Mill**
- **Surface Course Thickness**
- **Existing Pavement**

### Gutterline Edge - Match

- **Width** (as specified)
- **Intermediate Course**
- **Surface Course**
- **Existing Pavement**

### Gutterline Edge - Notch

- **Width** (as specified)
- **Intermediate Course**
- **Surface Course**
- **Existing Pavement**

### Double Course Resurfacing

- **Surface Course**
- **Intermediate Course**
- **Mill**
- **6" min.**
- **Existing Pavement**

### Runout Length

<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT (mph)</th>
<th>RUNOUT RATIO (ft. per inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 or More</td>
<td>50</td>
</tr>
<tr>
<td>20 to 45</td>
<td>25</td>
</tr>
</tbody>
</table>

### Details for Asphalts Resurfacing

- **7021.101**
- **SUDAS Standard Specifications**
- **New 2022 Edition**

---

**FIGURE 7021.101  SHEET 2 OF 2**

---

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

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.


Sidewalk thickness through driveway to match thickness of driveway.

Center reinforcing bar vertically in the pavement.

Match thickness of adjacent roadway, 8 inches minimum.

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

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

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.

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.

Transition street curb at minimum 1:1 slope to meet driveway curb.

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


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

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

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

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

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

9. Transition street curb at minimum 1:1 slope to meet driveway curb.
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**

- Existing Ground Line
- Driveway
- Sidewalk
- Finished Grade
- Property Line

**TYPICAL FILL SECTION**

- Existing Ground Line
- Driveway
- Sidewalk
- Finished Grade
- Property Line
TYPICAL CUT SECTION

Existing Ground Line

Parking Width

Property Line

Variety

Round slope at toe.

4:1 slope unless otherwise specified in the contract documents.

TYPICAL FILL SECTION

Existing Ground Line

Parking Width

Property Line

Variety

Round slope at top.

4:1 slope unless otherwise specified in the contract documents.

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.
1 Target cross slope of 1.5% with a maximum cross slope of 2.0% (including sidewalk through driveway).
2 Ensure top of curb slopes to street for drainage.
3 Parking Slopes:
   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.
Special grade may be specified in the contract documents.

W = Sidewalk width as specified in the contract documents.

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

CLASS B SIDEWALK

CLASS C SIDEWALK
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%.

2. Ensure top of curb slopes to street for drainage.

See Figure 7010.101, Detail C
See Figure 7010.101, Detail E

[Diagram of Detail 1]

Roadway Pavement
Sidewalk
4" min.
12" 18"

[Diagram of Detail 2]

Roadway Pavement
Sidewalk
4" min.
5" 3"

[Diagram of Detail 3]

Adjacent Pavement
Sealed 'E' Joint
4" min.
12" 18"
FIGURE 7030.203

BRICK/PAVER SIDEWALK WITH PAVEMENT BASE

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

3/4" Setting Bed

Cover weep hole with engineering fabric.

Pavement Base

Construct joint for concrete base as specified for concrete sidewalk.

Weep Hole

1/2" max. Chamfer

1/8" to 1/4" Joint Opening

Detail A

1/2" max Radius

1" Finish Grade

4" min.

12" min.

12" min.

3/4" min.

Reservoir

BRICK/PAVER SIDEWALK WITH PAVEMENT BASE

SUDAS Standard Specifications
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%.
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 edges.

2. Provide a minimum of 8 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 another curb ramp is provided, place detectable warning panel in advance of the crossing gate.

6. 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.

Pavement

5.5% max. Cross Slope

5/8" expansion joint or KT-2 or BT-3 joint when specified.

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

12" 18"

When a KT or BT joint is installed at the back of curb, provide 5/8" expansion joint at front or back of the turning space.

Key

- Curb Ramp
- Turning Space
- Detectable warning

SKewed CROSSING

PERPENDICULAR CROSSING

3/4" (max.)

Gutterline

Level Line

DETAIL A

24" Wide (min.)

Detectable Warning

 Sidewalk

Possible Crossing Arm (location varies)

Edge of Pavement

C of Roadway

DetECTABLE WARNING LOCATION AT RAILROAD CROSSING
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.

Key:
- Curb Ramp
- Turning Space
- Detectable Warning

**Perpendicular Curb Ramp**
(For Class A Sidewalk)

**Parallel Curb Ramp**
(For Class A Sidewalk)

**Perpendicular and Parallel 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 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

FIGURE 7030.207
SHEET 1 OF 1
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%.

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

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

SUDAS Standard Specifications

ALTERNATIVE CURB RAMP FOR CLASS B OR C SIDEWALK
FIGURE 7030.209

CLASS A SIDEWALK CURB RAMP

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.

Key:
- Curb Ramp
- Turning Space
- Detectable Warning

SUDAS Standard Specifications
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.

Key

- Curb Ramp
- Turning Space
- Detectable Warning
THIRD POINT JOINTING

- 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.

GUTTERLINE JOINTING

- ONE PANEL WIDTH PATCH WITH OPPOSING JOINT
  - 'B' Joint
  - 'RD' Joint
  - Existing Joint

- ONE PANEL WIDTH PATCH NO OPPOSING JOINT
  - 'B' Joint
  - 'RD' Joint
  - Existing Joint

- FULL ROADWAY WIDTH PATCH
  - 'B' Joint
  - 'RD' Joint
  - Existing Joint

THIRD POINT JOINTING

- OUTSIDE PANEL PATCH WITH OPPOSING JOINT
  - Existing Joint
  - 'B' Joint
  - 'RD' Joint

- CENTER PANEL PATCH WITH OPPOSING JOINTS
  - Existing Joint
  - 'B' Joint
  - 'RD' Joint
  - 'RT' Joint

LONGITUDINAL SECTION

- THRU PCC PATCH
  - Existing Joint
  - Dowel or Tie Bars
  - Curb
  - Existing Curb

FIGURE 7040.101
SHEET 1 OF 1

SUDAS Standard Specifications

FULL DEPTH PCC PATCHES
LESS THAN OR EQUAL TO 15' LONG
GREATER THAN 15' LONG

FULL DEPTH PATCHES

GUTTERLINE JOINTING

THIRD POINT JOINTING

ONE PANEL WIDTH PATCH

OUTSIDE PANEL PATCH

CENTER PANEL PATCH

FULL ROADWAY WIDTH PATCH

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 6 feet. If distance is less than 6 feet, extend patch to existing joint.
3. Match existing joint type and locations. If specified, replace existing 'C' joints with 'CD' joints.
4. If existing joint spacing is greater than 20 feet, add a 'CT' joint at mid-panel.
5. If subgrade or subbase material is required below patch, bring material to a level 2 inches below bottom of existing pavement.
6. BT, KT, or L joint depending on pavement thickness and pouring sequence.
FIGURE 7040.103

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.

HMA PATCHES

LONGITUDINAL SECTION THRU HMA PATCH

1 1/2" to 2" Surface Course

T+2" (typ.)

Existing Pavement
**SECTION A-A**  
(Option 1: Sawed Edges)

**SECTION B-B**

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 2: Milled Edges)

**HMA PATCH**

SUDAS Standard Specifications

PARTIAL DEPTH PATCHES
**Flowable Mortar Cutoff Wall**

- **Subbase** (as specified)
- **Pavement**
- **Pea Gravel**
- **Filter Fabric** (when specified)
- **Perforated Storm Sewer** (perforations up)
- **Impervious Bedding** Compacted in Place
- **Soil** Undisturbed
- **1,500 PSI Flowable Mortar**

**SECTION A-A**

- **Flowable mortar cutoff wall and storm sewer**

**FLOWABLE MORTAR CUTOFF WALL**

- **Subbase** (as specified)
- **Pavement**
- **Pea Gravel**
- **Filter Fabric** (when specified)
- **Undisturbed Soil**
- **1,500 PSI Flowable Mortar**
- **Flowable Subdrain** (perforations down)

**FLOWABLE MORTAR CUTOFF WALL**

- **Subbase** (as specified)
- **Pavement**
- **Pea Gravel**
- **Filter Fabric** (when specified)
- **Undisturbed Soil**
- **1,500 PSI Flowable Mortar**
- **Flowable Subdrain** (perforations down)

**DISTANCE FROM C INTAKE TO C CROSSRUN**

<table>
<thead>
<tr>
<th>Size</th>
<th>D</th>
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<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>

**PLAN VIEW**

(Flowable mortar cutoff wall and cross run location.)

**FLOWABLE MORTAR CUTOFF WALL**

(Without Sewer)

Length of cutoff wall to be back of curb to back of curb.
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.

### Table: Dowel Bar Diameter

<table>
<thead>
<tr>
<th>Pavement Thickness (inches)</th>
<th>Diameter (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 to 9(\frac{1}{2})</td>
<td>1(\frac{1}{2})</td>
</tr>
<tr>
<td>&gt;10</td>
<td>1(\frac{1}{2})</td>
</tr>
</tbody>
</table>

**Plan View**

- **Center of Saw:** 1/2" min.
- **3/8" Foam Core Board for dowel bar:** Drill 1 1/2" diameter hole.
- **1 1/2" deep saw cut:**
- **1/2" min. Chair:**
- **Caulking Filler:** Construct bottom of slot parallel to pavement surface.
- **Mid-depth of slab:**
- **Transverse Contraction Joint or Crack:**

**Section A-A**

- **Radius varies depending on saw blade diameter:**
- **Dowel Bar Expansion Cap (typ.):**
- **Existing Concrete Pavement:**
- **Concrete Patch Material:**

**Section B-B**

- **1/2 of concrete pavement depth:**
- **Concrete Patch Material:**
- **Chair:**
- **Existing Concrete Pavement:**

**Chair Detail**

- **Center of Saw:** 1/2" min.
- **3/8" Foam Core Board:**
- **Dowel Bar Expansion Cap (typ.):**
- **Existing Concrete Pavement:**
- **Concrete Patch Material:**
- **Chair:**
- **Existing Concrete Pavement:**
- **Place chair parallel to surface:**

**Transverse Contraction Joint**

**SUDAS Standard Specifications**

**Dowel Bar Retrofit**
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 premixed 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.
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.

---

Place filter aggregate around underdrain. Place engineering fabric over subgrade and up sides of excavation.

Slope subgrade as specified.

Install 6" perforated underdrain collector when specified.

Install 4" slotted underdrain laterals and filter material when specified.

Set ¼" below pavers.

Slope at 0% or as specified in the contract documents.

Possible PCC curb and gutter or adjacent pavement.

Permeable interlocking pavers

Bedding Aggregate

4" Layer of Filter Aggregate

Storage Aggregate
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.

Place filter aggregate around underdrain.

Place engineering fabric over subgrade and up sides of excavation.

Install 6" perforated underdrain collector.

Slope subgrade at 1%.

Permeable Pavers

Bedding Aggregate

4" Layer of Filter Aggregate

Storage Aggregate

6" PCC Edge Restraint

TYPICAL ALLEY WITH PERMEABLE PAVERS
OVERLAY DETAIL

- Full Depth Sawcut Before Crack and Seat
- Joint Crack Control (if specified)
- Asphalt Overlay
- Joint Crack Control (if specified)
- Existing Driveway
- Use a leveling course to fill in settled areas.
- Remove overlays and large patches before cracking PCC pavement.

REMOVAL OF EXISTING ASPHALT

- Remove partial depth patches exceeding 4 feet longitudinally, unsound patches, or as marked.
1. Shape top 11 inches with forms.
2. Bolt spacing and conduit locations as specified by the manufacturer.
3. Provide apron on three sides of cabinet if cabinet has front and back doors.
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.
4. Provide conduits as per plans.
5. Install ground rod adjacent to foundation or in adjacent handhole.

<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>Count</td>
</tr>
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<td>35'-0&quot;</td>
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<td>16'-0&quot;</td>
<td>12</td>
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<td>80'-0&quot;</td>
<td>3'-6&quot;</td>
<td>21'-0&quot;</td>
<td>14</td>
</tr>
<tr>
<td>90'-0&quot;</td>
<td>4'-0&quot;</td>
<td>22'-0&quot;</td>
<td>16</td>
</tr>
<tr>
<td>100'-0&quot;</td>
<td>4'-0&quot;</td>
<td>24'-0&quot;</td>
<td>18</td>
</tr>
</tbody>
</table>
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. Provide conduits as per plans.
4. When in contact with rock, place ground rods as specified in National Electrical Code, current edition, adjacent to foundation or in adjacent handhole.
5. Cast foundation concrete against competent rock. If foundation is formed, place backfill with concrete cast against rock.
6. Place 13 equally spaced #8 vertical bars.
7. #6 bars spaced at 8 inch maximum. Ties may be welded to vertical bars.
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.
4. Provide conduits as per plans.
5. When in contact with rock, place ground rods as specified in National Electrical Code, current edition, adjacent to foundation or in adjacent handhole.

<table>
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<td>35'-0&quot;</td>
<td>3'-0&quot;</td>
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<td>100'-0&quot;</td>
<td>4'-0&quot;</td>
<td>3'-6&quot;</td>
<td>24'-0&quot;</td>
</tr>
</tbody>
</table>

*Broken rock has an average unconfined compressive strength (q_u) of at least 1.0 ksi and rock quality designation of at least 20%.
**Competent rock has an average unconfined compressive strength (q_u) 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_v 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. When in contact with rock, place ground rods as specified in National Electrical Code, current edition, adjacent to foundation or in adjacent handhole.
4. Install four anchor bolts, washers, and nuts in new or existing concrete sidewalk by drilling and anchoring with epoxy adhesive. Provide bolts according to manufacturer’s recommendations.
5. Provide 4 foot accessible path adjacent to push button pole.
6. 12 to 24 inch diameter as shown in contract documents.
7. Install four anchor bolts, washers, and nuts in new or existing concrete sidewalk by drilling and anchoring with epoxy adhesive. Provide bolts according to manufacturer’s recommendations.
Added option for conduit to enter through the bottom of handhole.

Potential conduit entry through bottom of handhole.
### HANDHOLE DIMENSIONS TABLE (NOMINAL)

<table>
<thead>
<tr>
<th>TYPE</th>
<th>L</th>
<th>W</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>30&quot;</td>
<td>17&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>III</td>
<td>36&quot;</td>
<td>24&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>IV</td>
<td>48&quot;</td>
<td>30&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

---

**PRECAST CONCRETE COMPOSITE HANDHOLE**

- One Piece Lid (Type II or III)
- Two Piece Lid (Type IV)
- Stainless Steel Bolt
- Pull Slot
- Skid Resistant Surface
- Cable Hooks (4) Required
- Extend granular base 8" beyond walls of handhole.
- Conduit Entry Through Side of Handhole

---

**CONDUIT IN TRENCH**

- 4" min. Trench
- Compact Backfill Material
- Ensure backfill material is free of cinders, concrete, or other rubble.

---

1. Potential conduit entry through bottom of handhole.
2. For conduit behind curb, place 24 to 48 inches below top of curb. For conduit under roadway, place 30 to 60 inches below the gutterline.
RECTANGULAR DETECTOR LOOP

Length (L) as specified in the contract documents.

To Handhole

Handhole

Continuous loop leads to handhole.

CURB

1" to 3"

NO CURB

DETECTOR CONDUIT ENTRY

1" to 3"

Typ.

Flow

Traffic

SECTION A-A

3/8" Sealant

Loop Saw Cut

Conduit

Pavement

12" Shoulder

Handhole

Conduit

Parking Area

9"

Pavement

9"

Parking Area

Handhole

Conduit

1" to 3"

Loop Saw Cut

Continuous loop leads to handhole.

1'-0" Typ.

6'-0"

To Handhole

1'-0"

F lo w

T ra ffic

VEHICLE DETECTORS

SUDAS Standard Specifications

SUDAS 8010.104

2022 Edition

1  Sheet 1 of 2

INDUCTIVE LOOP

SHEET 1 OF 2

FIGURE 8010.104
BICYCLE QUADRUPOLE LOOP DETECTOR

WINDING PATTERN
(Number of turns is 3-6-3)

Drill separate hole for each loop.

Edge of Pavement or Back of Curb

MODIFIED DIAMOND DETECTOR LOOP

Drill separate hole for each loop.

Edge of Pavement or Back of Curb

SECTION A-A

3/8" Sealant

2" Loop Wire

2' 0" 4' 0" 4' 0" 2' 0" 2' 0" 2' 0"
STEEL MAST ARM POLE

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

2. Ensure the bottom of the signal housing (including brackets) that is not located over a roadway is a minimum of 10 feet and a maximum of 19 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

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

4. Possible video camera location.

5. Possible EVP detector.

6. Pole cap if no luminaire extension.

7. Install wind vibration dampening device on mast arms greater than 60 feet in length. Location and mounting method as specified by manufacturer.

Typical placement of traffic control and street name signs.

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

Minimum 3" hole in flange

Minimum 4"x6" Handhole

Luminaire Arm Length

Mast Arm Length

Luminaire

Backplates

6" typ.

Fixed or Universally Adjustable Mounting Brackets

Pedestrian Push Button and Sign

3'-6" Above Sidewalk

Mounting Height

SUDAS Standard Specifications

SUDAS

8010.105

MAST ARM POLE DETAILS
PEDESTAL POLE DETAILS

- Fixed or Universally Adjustable Mounting Brackets
- Pedestrian Traffic Signal Head Assembly
- Pedestrian Push Button Sign
- Pedestrian Push Button
- Base Collar (if required)

1. For signal head visibility and possible pedestrian head installation.

PEDESTAL POLE

3'-6" Above Sidewalk
7'-0" min.
10'-0" max.

10'-0" min.
19'-0" max.

SUDAS Standard Specifications

PEDESTAL POLE DETAILS
5% of Span Sag Distance: Sidewalk Roadway Wire Clamp Cable as Required Multi-Conductor Tether Bottom Signal and Backplates Signal Heads and Backplates Class 4 Wood Pole Conduit Entry Cap Eye Angle Bolt Galvanized Thimble Eye Nut Messenger Wire; 7 Strand (Utilities Grade) Controller Cabinet Pole or Pad Mounted Controller Cabinet Pole Guard Anchor Wire Ground Rod

Possible video camera location.

Possible EVP detector location.
TEMPORARY TRAFFIC CONTROL

Flagger (facing left)

Sign (shown oscillating, or strobe rotating, flashing)

Advance Warning Area tells traffic what to expect ahead

Shoulder Taper

Transition Area moves traffic out of its normal path

Buffer Space (lateral) provides protection for traffic and workers

Traffic Space allows traffic to pass through the activity area

Activity Area is where work takes place

Buffer Space (longitudinal) provides protection for traffic and workers

Work Space is set aside for workers, equipment, and material storage

Buffer Space (longitudinal) downstream taper

Downstream Taper

Termination Area lets traffic resume normal operations

Distance Between Signs

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-25</td>
<td>100</td>
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<tr>
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<td>45-50</td>
<td>350</td>
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<tr>
<td>55</td>
<td>500</td>
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</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>
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<tbody>
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<td>20</td>
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</table>

Merging Taper Lengths for Lane Closure*

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>Taper Length (L) (ft)</th>
<th>Number of Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
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<td>80</td>
<td>11</td>
</tr>
<tr>
<td>55</td>
<td>80</td>
<td>12</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.

*Applies to all Section 8030 figures

Key*

- Arrow Board
- Arrow Board Support or Trailer
- Shadow Vehicle
- Channelizing Device
- Sign (shown facing left)
- Direction of Traffic
- Work Space
- Type III Barricade
- Drum
- Work Vehicle
- Pedestrian Channelizing Device
- Vehicle Warning Light (amber, high-intensity rotating, flashing, oscillating, or strobe light)

*SUDAS Standard Specifications

TEMPORARY TRAFFIC CONTROL
GENERAL INFORMATION
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.

FIGURE 8030.102
SHEET 1 OF 1

WORK OFF OF PAVEMENT WITH MINOR ENCROACHMENT ONTO TRAVELED WAY
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.
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.
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 flagger position shown, then move toward the centerline to stop other vehicles.

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:

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.

Refer to Figure 8030.107 for work in vicinity of a road ahead.

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.

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.
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.
Outside Lane Closure

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.

"LANE CLOSURE AT AN INTERSECTION"
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.
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 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.

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

Use sign shape and legend appropriate to the type of work. Examples include:

- CRACK SEALING
- FRESH OIL
- WET PAINT
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 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.

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
SHEET 1 OF 2

PLANTING PIT
(Bare Root Plants)

1. Spread root system in natural position with soil excavated from pit.
2. Build a firm cone-shaped mound of soil in the middle of the planting pit.
3. Install with root flare at or slightly above grade. Do not place mulch within 6 inches of trunk.
4. Install root flare 2 to 3 inches above grade. Do not place mulch within 6 inches of trunk.

PLANTING PIT
(Bare Root Plants on Poorly Drained Soils)

1. Form 3" deep saucer.
2. Build a firm cone-shaped mound of soil in the middle of the planting pit.
3. 3" deep Mulch
4. Mound finished grade to cover portion of rootball above grade.

Depth as Required

3 Times Root System

Finished Grade

3 Times Root System

Scarify sides of pit.

Existing Grade

3" Deep Mulch

Mound finished grade to cover portion of rootball above grade.
PLANTING PIT
(Balled and Burlapped Plants)

1. Form 3" deep saucer.
2. Place rootball on undisturbed soil.
3. Scarify sides of pit.
4. 3 Times Root Ball Diameter
5. Depth of Root Ball or Container Root System
6. Placed rootball above grade.

PLANTING PIT
(On Slopes)

1. Form 3" deep saucer.
2. Place rootball on undisturbed soil.
3. Scarify sides of pit.
4. 3 Times Root Ball Diameter
5. Depth of Root Ball or Container Root System
6. Placed rootball above grade.

- Place rootball on undisturbed soil.
- Scarify sides of pit.
- Form 3" deep saucer.
- 3 Times Root Ball Diameter
- Depth of Root Ball or Container Root System
- Placed rootball above grade.

3. Install with root flare at or slightly above grade. Do not place mulch within 6 inches of trunk.
4. Install root flare 2 to 3 inches above grade. Do not place mulch within 6 inches of trunk.
5. Begin transition at edge of root ball.
6. Cut and completely remove top 1/2 of twine, burlap, and wire baskets from root ball prior to placing backfill material.

Existing Grade
Mound finished grade to cover portion of rootball above grade.

3" Deep Mulch
Grade
Original
of pit.

3" Deep Mulch
Grade
Finished

3" Deep Mulch
Grade

3" Deep Mulch
Grade

SUDAS Standard Specifications

PLANTING PIT
(Balled and Burlapped Plants on Poorly Drained Soils)
STAKING PLAN
(Trees larger than 2 1/2 inch diameter)

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

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

Place one stake to southwest.

Place one stake to southwest.

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

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

Planting Pit
per Figure 9030.101

Steel Post

Trunk Support Strapping

Flagging Material

Flagging Material
GUYING PLAN

1. Place one anchor to the southwest.

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

Trunk Support Strapping

Cable or Manufactured Restraint System

Flogging Material

1/3 to 1/2 Tree Height

Earth Anchor

Planting Pit per Figure 9030.101

1/3 Tree Height

1/3 Tree Height
If pervious soil is encountered at a depth less than 6 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.

Filter Berm or Filter Sock (when specified)

Loosen ground surface to a minimum depth of 1".

**COMPOST BLANKET DETAIL**

<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>
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.

Construct "J-hook" at each end on an individual section of sock or berm.

Place berm or sock perpendicular to slope.

Filter sock shown is typical for slopes flatter than 5%.

Berm length per section: 20' or max. (60' if slope is flatter than 5%)

3' min. overlap.

Area to be protected.

Stakes (typ.)

Direction of Flow

Disturbed Area

PLAN VIEW OF SLOPE
(for sediment and slope control)

SECTION VIEW AT STREET
(for perimeter control along street)

TYPICAL PLACEMENT OF BERM OR SOCK
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>

FIGURE 9040.103

1. Anchor Trench
2. Edge Lap
3. End Splice

6" min.

Compacted Soil Backfill

ANCHOR TRENCH (12" min. anchor spacing)

EDGE LAP (4'-0" min. anchor spacing)

END SPLICE (18" min. anchor spacing)
Flow

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

END LAP
8" max.

Compacted Soil Backfill

Flow

STAPLE CHECK
8" max.

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

Longitudinal Slot

Anchor Slot

Edge Lap

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

(1'-0" max. anchor spacing)

LONGITUDE SLOT
(4'-0" max. anchor spacing)

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

Backfill

End Lap

Flow

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

Fig. 9040.104
Flow

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

Space as specified in the contract documents.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

4'-0" max.

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

2-4" Trench

4'-0" max.

3'-0"

Joint Wrap

Turn uphill.
Crest

Ditch Slope, s, ft./ft.

Crest

Ditch Slope, s, ft./ft.

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

h/s

h

h/s

h

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

h/s

Steel Post

Top of Fence

h

(24" typ.)

Ditch Slope, s, ft./ft.

h/s

Silt Fence

Ditch Slope, s, ft./ft.

SILT FENCE CHECK DAM (DITCH CHECK)
(See Figure 9040.119 for installation of Silt Fence Ditch Checks.)
DITCH CROSS-SECTION

SECTION A-A

6" min.

Top of Bank

Crest

6" min. or as specified

Engineering Fabric

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.
Excavate depression to depth as specified, 6" min.

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

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

Elevate top of spreader 1" above ground.

Level top of spreader.

Excavated Depression - Grade = 0%

Possible Diversion

Stable Outlet

Flow
**Figure 9040.110**

**Section A-A**

- **Pipe Diameter, D**
- **Tee of Slope**
- **Length, L**
- **Width, W**

**Toe of Slope**

**Engineering Fabric**

**Stable Ground**

**Thickness, T**

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

**Profile Section A-A**

**Footing for Apron**

**Slope = 0%**

**Depth = 2T**

**RIP RAP FOR PIPE OUTLET ONTO FLAT GROUND**

**SUDAS Standard Specifications**
Top of Bank

Stable Channel

Edge of Channel

Width, \( W \)

Slope = 0%

Depth = 2\( T \)
at end of apron.

Construct notch at end of apron.
Depth = 2\( T \).

Top of Bank

Footing for Apron

Thicknss, \( T \)

Stable Channel

Engineering Fabric

Profile
Section A-A

CROSS-SECTION

OUTLET INTO CHANNEL

SUDAS Standard Specifications

RIP RAP APRON FOR PIPE
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.
- 12" min. cover.
- Pipe Apron

OPTION B
- Install steel fence post on both sides of pipe at 10'-0" max. spacing.
- 2'-0" min.
- 2:1 typ.

OPTION C
- Bury pipe to springline.
- Carefully compact diversion structure around pipe.
- Secure pipe with method shown below.

(May also be combined with options A or B)
Barrel length and diameter as specified in the contract documents.

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

Anti-vortex device: See Figure 9040.116.
Anti-seep collars (required only when specified in the contract documents).

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.
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.

- **Principal Spillway**
- **Dry storage depth varies.**
- **Dewatering Orifice**
- **Wet storage depth varies.**
- **Bottom of Basin**
- **18" min., or as specified.**
- **Discharge pipe barrel, diameter as specified.**
- **Embed riser 12"**
- **Concrete Base**
- **Diameter, D as specified**
- **Leave top of riser open.**
- **Corrugated Metal Riser**

**SEDIMENT BASIN**

**DEWATERING DEVICE**

**(PERFORATED RISER)**
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.

Tack weld top to cylinder.

Riser Diameter (as specified)

Support Bars

Pressure Relief Holes 1/2" Dia.

Leave top of riser open.

12" Spacer Bar (#6 bar min.)

Leave bottom of cylinder open.

12" Spacer Bar (#6 bar min.)

Support Bar (#6 bar min.)

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

Cylinder

Support Bar

Top

Welded
<table>
<thead>
<tr>
<th>RISER Diameter (in.)</th>
<th>CYLINDER Diameter (in.)</th>
<th>CYLINDER Thickness (gage)</th>
<th>CYLINDER Height (H) (in.)</th>
<th>CYLINDER Minimum Size Support Bar</th>
<th>MINIMUM TOP Thickness</th>
<th>MINIMUM TOP Stiffener</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
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<td>6</td>
<td>#6 rebar or 1 1/2&quot; X 3/16&quot; angle</td>
<td>16 ga F &amp; C</td>
<td>---</td>
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<td>16 ga F &amp; C</td>
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<td>#6 rebar or 1 1/2&quot; X 3/16&quot; angle</td>
<td>16 ga (C),</td>
<td>---</td>
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<tr>
<td></td>
<td></td>
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<td></td>
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<td>14 ga (F)</td>
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<td>16 ga (C),</td>
<td>---</td>
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<td>14 ga (F)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>42</td>
<td>16</td>
<td>15</td>
<td>#6 rebar or 1 1/2&quot; X 3/16&quot; angle</td>
<td>16 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14 ga (F)</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>54</td>
<td>16</td>
<td>17</td>
<td>#8 rebar</td>
<td>14 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12 ga (F)</td>
<td></td>
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<tr>
<td>42</td>
<td>60</td>
<td>16</td>
<td>19</td>
<td>#8 rebar</td>
<td>14 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>12 ga (F)</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>72</td>
<td>16</td>
<td>21</td>
<td>1 1/4&quot; pipe or 1 1/4&quot; X 1 1/4&quot; X 1/4&quot; angle</td>
<td>14 ga (C),</td>
<td>---</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>10 ga (F)</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>78</td>
<td>16</td>
<td>25</td>
<td>1 1/4&quot; pipe or 1 1/4&quot; X 1 1/4&quot; X 1/4&quot; angle</td>
<td>14 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10 ga (F)</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>90</td>
<td>14</td>
<td>29</td>
<td>1 1/2&quot; pipe or 1 1/2&quot; X 1 1/2&quot; X 1/4&quot; angle</td>
<td>12 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8 ga (F)</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>96</td>
<td>14</td>
<td>33</td>
<td>2&quot; pipe or 2&quot; X 2&quot; X 1/4&quot; angle</td>
<td>12 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>8 ga (F)</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>102</td>
<td>14</td>
<td>36</td>
<td>2&quot; pipe or 2&quot; X 2&quot; X 1/4&quot; angle</td>
<td>12 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>8 ga (F)</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>114</td>
<td>14</td>
<td>39</td>
<td>2 1/2&quot; pipe or 2&quot; X 2&quot; X 1/4&quot; angle</td>
<td>12 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
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<td>8 ga (F)</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>120</td>
<td>12</td>
<td>42</td>
<td>2 1/2&quot; pipe or 2&quot; X 2&quot; X 1/4&quot; angle</td>
<td>12 ga (C),</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8 ga (F)</td>
<td></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"

Use side wall and bottom of trench as form.

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

Anti-seep collars are not required unless specified in the contract documents.
Width (W) as specified

Overflow Elevation

1,800 CF/Acre "Dry" Storage

1,800 CF/Acre "Wet" Storage

Erosion Stone

Engineering Fabric

Impervious Earth Fill (as required)

Top of bank or ditch.

Bottom of channel or ditch.

Overflow Elevation

Spillway Length (L) (see table)

Height, H (5'-0" max.)

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>
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<tr>
<td>2.5</td>
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<tr>
<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>5.0</td>
<td>4.5</td>
</tr>
</tbody>
</table>

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

"Dry" Storage 1,800 CF/Acre

"Wet" Storage 1,800 CF/Acre

Profile

Section A-A

SUDAS Standard Specifications

Sediment Trap
TYPICAL SILT FENCE DITCH CHECK

ATTACHMENT TO POST

1. Insert 12 inches of fabric a minimum of 6 inches deep (fabric may be folded below the ground line).
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
(Plan View)

See plans for spacing.

TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Profile View)

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.

Length as specified (6" min.).

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.

**GABION ASSEMBLY**

**CONNECTING WIRE LOCATION**

- **DETAIL A**

- **EDGE CONNECTIONS**

- **Manufactured Fasteners**

- **Lacing Wire**

- **12"**

- **See Detail A**
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.

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

*Includes corner, angle, end, and pull posts.
6'-0" or less 4'-0" or less 0'-0" 3'-0"
6'-0" or less over 4'-0" to 10'-0" 0'-12" 3'-0"
6'-0" or less over 10'-0" to 18'-0" 1'-2" 3'-0"
over 6'-0" 6'-0" or less 0'-10" 3'-0"
over 6'-0" over 6'-0" to 12'-0" 1'-0" 3'-0"
over 6'-0" over 12'-0" to 18'-0" 1'-4" 3'-0"
over 6'-0" over 18'-0" to 24'-0" 1'-6" 4'-0"

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.
1. 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.

2. For landscape timber walls, locate fence posts to avoid timber tiebacks.

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

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.

Use suitable soil or granular material. Excavate and place backfill material. Secure each course with spikes. Lower three courses of timbers. No tie backs in upper two courses or timbers beneath finished grade. Construct entire first course of timbers beneath finished grade. 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
- Finished Grade 1
- 1/2" Setback Each Course
- Length of tieback equal to wall height.
- Compacted Foundation
- Wrapped porous backfill material with engineering fabric.
- 8" min.
- 8" min.
- Construct a 6" thick X 18" wide (min.) leveling pad.

ELEVATION

- 6" Leveling Pad
- 6" Finished Grade
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)**
- **Excavation Line**
- **Geogrid (if required)**
- **Topsoil or Suitable Backfill Material**
- **Subdrain**
- **Compacted Foundation**
- **Wall Unit (typ.)**
- **Pins or Lip to Ensure Proper Block Setback**
- **6" min.**
- **8" min.**
- **Proper Block Setback**
- **Pins or Lip to Ensure**
- **Wrap porous backfill material**
- **with engineering fabric.**
- **Construct a 6" thick X 18" wide (min.) leveling pad.**
**FIGURE 9070.103**

**TYPICAL SECTION**

1. Compact backfill material as wall construction progresses.

2. Construct entire first course of limestone below finished grade.

---

**LIMESTONE RETAINING WALL**

- **Foundation**
  - 12" Compacted Backfill Material
  - 8" min.

- **Wall Height**
  - 4'-0" max.

- **Subdrain**
  - Wrap porous backfill material with engineering fabric.

- **Finished Grade**
  - Batter wall 3 inches per foot

- **Construction**
  - 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

Use 1" half-round beveled 1"x1" or other approved device.

TYPICAL RUSTICATION DETAIL

Expansion Joints
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.

---

### 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>
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<td></td>
<td>Variable</td>
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</tr>
<tr>
<td></td>
<td>4w2</td>
<td>4</td>
<td>L</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>
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<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**

- 6:1 or flatter
- 3/4" Bevel
- Wall Height (3'-0" max.)
- Possible Longitudinal Joint (for sidewalks 8'-0" wide or greater)
- Between 1.5% and 2.0%
- Weep Hole
- Wall Height + 12"
- Adjacent Sidewalk Width + 12"

**Type B Wall Typical Section**

- 6:1 or flatter
- 3/4" Bevel
- Wall Height (3'-0" min. 5'-0" max.)
- Possible Longitudinal Joint (for sidewalks 8'-0" wide or greater)
- Between 1.5% and 2.0%
- Weep Hole
- Wall Height + 12"
- Adjacent Sidewalk Width + 12"
**FIGURE 9080.101**

**SECTION A-A**

<table>
<thead>
<tr>
<th>Rise</th>
<th>Tread</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>3</td>
<td>5&quot;</td>
<td>15&quot;</td>
</tr>
<tr>
<td>4</td>
<td>4&quot;</td>
<td>16&quot;</td>
</tr>
</tbody>
</table>

**PLAN**

- **Possible Sidewalk**
- **Handrail Posts**
- **#4 @ 12" C-C**
- **#4 @ 18" C-C**

**Possible Sidewalk**

**Rise**

**Tread**

**ANKOR PLATE DETAIL**

<table>
<thead>
<tr>
<th>Diameter Post</th>
<th>1 1/2&quot; to 2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor Plate</td>
<td>6&quot; x 6&quot; x 1/4&quot;</td>
</tr>
</tbody>
</table>

**ISOMETRIC**

- **Expansion Joint 1" Preformed**
- **Width (varies)**
- **Length**
- **#4 @ 12" C-C**
- **#4 @ 18" C-C**
- **1" Preformed Expansion Joint**
- **1" Diameter Post**
- **8" min.**
- **2'-0"**
- **Possible Sidewalk**
- **Sidewalk**
- **1'-7"**
- **1'-5" to 12"**
- **3'-2" to 2'-10"**
- **4" x 16"**
- **5'-0" max. spacing**

**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.**

**TYPE A CONCRETE STEPS WITH HANDRAIL**

**SUDAS Standard Specifications**

**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. Construct cross slope of landing to match adjacent sidewalk.
4. Slope tread 1% minimum to 2% maximum in any direction.
5. Match existing sidewalk width.

**Rise/Tread Table**

<table>
<thead>
<tr>
<th>Rise</th>
<th>Tread</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>2</td>
<td>6&quot;</td>
</tr>
<tr>
<td>3</td>
<td>5&quot;</td>
</tr>
<tr>
<td>4</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

Maximum in any direction.

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

Minimum tread depth is 11 inches.

Contractor:

Riser height and batter of retaining wall.

Handrail:

Edge of landing.

**Notes:**

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

2. Upon approval of Engineer, side rails may be formed and constructed separately from the stairs. Seal the cold joint between the side rail and stairs according to Section 7010.

3. If side rails and stairs are constructed separately, dowel bar substitutes may be used for the bent bars connections between the side rails and the stairs.

5. 7 6 5 4 3 2 1

FIGURE 9080.102
SHEET 2 OF 2

SUDAS Standard Specifications

TYPE B CONCRETE STEPS
WITH HANDRAIL

ANCHOR PLATE DETAIL

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

6" 3 1/4"
Diameter Post

1 1/2" to 2"

1 3/4" C-C
Bent Bar

6" x 6" x 1/4"

Section B-B
(Side Rails and Stairs Formed and Constructed Monolithically)

Alternate Section B-B
(Side Rails and Stairs Formed and Constructed Separately)
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.
### 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. 6'-0" of Neat Cement, Grout, or Concrete

2. Bridge Plug or Packer

### CLASS 2 BEDROCK WELL IN SINGLE UNCONFINED AQUIFER

1. 6'-0" of Neat Cement, Grout, or Concrete

### CLASS 2 BEDROCK WELL IN MULTIPLE AQUIFERS

1. 6'-0" of Neat Cement, Grout, or Concrete

2. Static Water Level
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 MAILBOXES

FRONT VIEW

TEMPORARY CLUSTER BOX UNIT

SIDE VIEW

FRONT VIEW

TEMPORARY GROUP MAILBOX

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

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

FIGURE 11040.101  
TEMPORARY GRANULAR SIDEWALK AND TEMPORARY RESIDENTIAL ACCESS
FIGURE 11040.102
SHEET 1 OF 1

CHANNELIZING DEVICE
TEMPORARY PEDESTRIAN

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

END VIEW

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

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

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

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

FRONT VIEW

Temporary Sidewalk Surface

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

1/4" max. gap

1" x 4" Splice 3
1" x 6" Splice 3
1" x 8" Splice 3