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

1 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.
Type of Work | Area | Payment Method
--- | --- | ---
Excavation | A | Excavation
Fill | B | Included in Excavation or Borrow
Subgrade Preparation | C & D | Subgrade Preparation

1. Embankment Construction: Compact with moisture and density control unless Type A Compaction is specified. Comply with Section 2010, 3.04.
2. Subgrade Preparation: Construct subgrade according to Section 2010, 3.06.
3. Subbase Construction: Construct subbase according to Section 2010, 3.08.

Key
- Excavation
- Fill
- Subgrade preparation

FIGURE 2010.102
Refer to the contract documents for specific material and placement requirements.

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

**Key**

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

**Remarks:**

- **Bury Depth:** 12" min.
- **Springline of Pipe:**
- **Final Trench Backfill:**
- **Secondary Backfill:**
- **Primary Backfill:**
- **Haunch Support:**
- **Pipe Bedding:**
- **Foundation Stone:**
- **Over-excavation and Foundation Stone:**

---

**Figure 3010.101**

**SW-101 STANDARD ROAD PLAN**

**REVISIONS:** Replaced Iowa DOT and SUDAS logos

**TRENCH BEDDING AND BACKFILL ZONES**
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)

OD/2
OD/4
TW
CLASS R-1
OD
CLASS R-2
OD
Plain or Reinforced Concrete Bedding Material
CLASS R-3
Concrete Cradle
OD
Class I Bedding Material
1.25 x OD (OD+8" min.)
CLASS R-4
Concrete Top
OD
1.25 x OD (OD+8" min.)
CLASS R-5
Arch
OD
Class I Bedding Material
12"
CLASS R-5
Vertical Elliptical
OD
Class I Bedding Material
12"
CLASS R-5
Horizontal Elliptical
OD
Class I Bedding Material
12"

RCP AND VCP CIRCULAR PIPE BEDDING

REINFORCED CONCRETE ARCH AND ELLIPTICAL PIPE BEDDING

DO NOT USE ON PRIMARY ROADWAYS
### ALLOWABLE BURY DEPTH

#### CLASS RCP

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>Class R-1 Bedding</th>
<th>Class R-2 Bedding</th>
<th>Class R-3 &amp; R-4 Bedding</th>
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ASA = Area of Steel Reinforcing

#### CLASS IV RCP

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ASA = Area of Steel Reinforcing

#### CLASS V RCP

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ASA = Area of Steel Reinforcing

### EXTRA STRENGTH VCP

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ASA = Area of Steel Reinforcing

### CONCRETE ARCH PIPE

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<th>Pipe Size (in x in)</th>
<th>Equiv. Dia. (in)</th>
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ASA = Area of Steel Reinforcing

### HORIZONTAL ELLIPTICAL RCP

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ASA = Area of Steel Reinforcing

### VERTICAL ELLIPTICAL RCP

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ASA = Area of Steel Reinforcing
### Bedding Classes

**PVC Pipe**

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**Flexible Gravity Pipe**

- **Ductile Iron, AWWA C151, Class 52**
  - F 679
  - ASTM F 949
  - ASTM F 1803
  - M 294

- **HDPE**
  - ASTM F 2764
  - AASHTO M 294

**Polypropylene Pipe**

- F 2690
- ASTM F 2764

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

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<th>Sanitary Sewer</th>
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<td>F-2, F-3</td>
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*DO NOT USE ON PRIMARY ROADWAYS*

---

**Figure 3010.103**

**SUDA Director**

**DESIGN METHODS ENGINEER**

**Figure 3010.103 Standard Road Plan**

**SUDA**

**SW-103**

**FLEXIBLE GRAVITY PIPE**

**TRENCH BEDDING**

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

**DUCKLE IRON, AWWA C151, CLASS 52**

<table>
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**PVC, AWWA C900, DR18**

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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)

Do not use on primary roadways.
1. Place remainder of bedding and backfill material as specified in the contract documents.

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

3. Restrain pipe as necessary to prevent flotation.

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

- 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.
- Restrain pipe as necessary to prevent flotation.
- When specified in the contract documents, install waterstops at a nominal spacing of 800 feet or at locations as specified by the Engineer.
Install pipe support for all new sewers 12 inches in diameter or larger when clearance between bottom of new sewer and top of existing line is 12 inches or less.

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

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

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

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

Comply with Figure 3010.101.
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

FIGURE 3010.903
SHEET 1 OF 1
SUDAS Standard Specifications

FLOWABLE MORTAR FILL
UTILITY LINE SUPPORT

EXISTING UTILITY LINE

NEW SEWER

UNDISTURBED SOIL

BEDDING

PLACE FLOWABLE MORTAR TO SPRINGLINE OF EXISTING UTILITY.

COMPACTED BACKFILL

SECTION A-A

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

EXISTING UTILITY LINE

NEW SEWER

UNDISTURBED SOIL

BEDDING

PLACE FLOWABLE MORTAR TO SPRINGLINE OF EXISTING UTILITY.

COMPACTED BACKFILL

SECTION A-A
1. Place bedding and backfill material as required for sewer main.

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

Sanitary Sewer Main Trench Wall
Sanitary Sewer Main
Tee or Wye
Service Line
Slope
Cap or Plug
ROW Line
Location Post
Class I Bedding Material

Slope: 22.5° to 45°
10' to 12'
10'

SANITARY SEWER SERVICE STUB
Place bedding and backfill material as required for sewer main.

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

If service riser slope is steeper than 1:1, construct riser of entire service line with schedule 40 PVC (ASTM D 1785) or ductile iron (AWWA C151, Class 52). Use single length of pipe for riser, if possible.

Sanitary Sewer Service Stub with Riser
Adjustment Rings

Arched Opening

Square Edge

---

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

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**CLEANOUT**

- **Sewer Main**
- **6" PVC Riser**
- **45° Bend**
- **Wye**
- **Plug**

**CASTING**

- **20" min. Concrete Pad**
- **#4 Bar (typ.)**
- **Casting**
- **Cap**

(Dimensions are nominal)
1. Service located outside zone of conflict
   - Provide protection; if damaged, repair according to local government's plumbing code
   - Incidental to other work

2. Service located in zone of conflict
   - Relocate service according to Section 4010, 3.07
   - Bid item; sanitary sewer service relocation

3. Service located in zone of conflict, but elevations do not allow simple relocation as detailed above; special design required
   - Relocate service as directed by the Engineer
   - Change order

---

**Limits of Relocation of Sewer Service**

**Zone of Conflict**

- From 6 inches below the bottom of sewer pipe to 2 inches above the top of pipe.
Type PC-2 Concrete Collar Connection

- 6"x6" - w2xw2 (8ga.) Wire Mesh
- 3" min.
- 6" min.
- 12" min.
- Pipe Joint Wrapping

Type PC-1 Concrete Collar Connection

- 6"x6" - w2xw2 (8ga.) Wire Mesh
- 3" min.
- 6" min.
- Trim pipe and fill voids with mortar.

Concrete Collar for Pipes 12" and Smaller

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

Concrete Collar for Pipes Greater Than 12"

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

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**RCP Apron Section**

**RCP Apron Section Footing**

**TYPICAL SECTION**

**ELEVATION**
Tongue end used on inlet end section. Groove end used on outlet end section.

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.

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

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

### Approximate Dimensions

#### Arch Pipe

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**SUDAS Standard Specifications**

**ARCH AND ELLIPTICAL CONCRETE PIPE APRONS**
**Intermediate Cross Bar(s)**

**"V" Bar**

**Hinged Connections**

**PLAN**

**PROFILE**

---

**FIGURE 4030.224**

**SHEET 1 OF 1**

---

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.

---

### BAR SIZES

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<th>BOLT DIA.</th>
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<td>54&quot; to 60&quot;</td>
<td>4&quot;</td>
<td>3&quot;</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

**BOLT LENGTH = PIPE WALL THICKNESS + 2"**
On sizes 60 inches and larger, supplement the reinforced edge with a galvanized stiffener angle attached with bolts.

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

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

When specified, extend bottom cross bar through apron.

### Dimensions

<table>
<thead>
<tr>
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<td>96</td>
<td>25</td>
<td>35</td>
<td>12</td>
<td>87</td>
<td>150</td>
</tr>
</tbody>
</table>
Type 1 installation is for longitudinal subdrain only. Type 2 installation is for combination subdrain/footing drain collectors.

1. Place perforations down for all installations.

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

1. Light duty casting. Label lid with "Storm" or "Storm C.O."

2. Do not allow casting to bear on top of riser pipe; provide 2 inch clearance, minimum.

3. A manufactured cleanout may be used in lieu of a Type B cleanout, if approved by the Engineer.

4. Design is intended for use in conjunction with 8 inch PVC riser pipe. Other sized caps may be used with smaller pipe, as approved by the Engineer.

5. Provide Type G casting, as required to fit pipe size.

6. PVC riser pipe; match diameter of subdrain (8 inches maximum).
Transverse and backslope subdrains require only single outlets. Install double outlet pipes on all longitudinal subdrain systems, except at the beginning and end of the system. At these locations, install a single outlet pipe.

1. Fill annular space with non-shrink grout.
2. Outlets through intake walls to be CMP; corrugated, double-walled HDPE; or PVC.
3. Provide 6 inch minimum drop in elevation outlet between longitudinal subdrain and outlet.
4. Provide a minimum 1 foot radius for all bends or use two 45° fittings
5. Provide a minimum trench width of 12 inches for a single outlet and 24 inches for a double outlet.
6. Extend outlet pipe into structure as required to install removable rodent guard.
7. Provide a 6 inch minimum drop in elevation between longitudinal subdrain and outlet.
8. 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 belts.

---

**Typical Section**

**Tees**

**Bends**

**Crosses**

**Dead Ends**

---

**Minimum Bearing Surface (af)**

<table>
<thead>
<tr>
<th>Diameter of Pipe, D (inches)</th>
<th>Tees and Dead Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
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<tr>
<td>8</td>
<td>3</td>
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<td>10</td>
<td>4</td>
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<td>14</td>
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<tr>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>36</td>
<td>11</td>
</tr>
</tbody>
</table>

Minimum surface area based on water pressure of 150 psi and allowable soil pressure of 1,000 psi.
1. Extend tracer wire up fire hydrant barrel to internal terminals of tracer wire station and back down. Refer to WM-201 for details of fire hydrant assembly.
2. Clamp tracer wire to ground rod at system termination points.

- Anchor Tee
- Fire Hydrant
- New Water Main
- Fire Hydrant Valve
- Possible Splice
- Tap wire at midpoint of each pipe length
- Do not run wire up valve box
- Ground Rod
- Fire Hydrant Barrel
- Possible Splice
- Tap wire at midpoint of each pipe length
- Do not run wire up valve box
- Ground Rod

**TYPICAL INSTALLATION**
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.
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.

If manhole depth exceeds 20 feet, install steps.
Install infiltration barrier.

<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>30</td>
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<tr>
<td>72</td>
<td>42</td>
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<tr>
<td>84</td>
<td>48</td>
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<tr>
<td>96</td>
<td>60</td>
</tr>
</tbody>
</table>
Adjacent walls may have different widths based upon pipe configuration, but structure must be rectangular.

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

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.
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.
If manhole depth exceeds 20 feet, install steps. Install infiltration barrier.

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

<table>
<thead>
<tr>
<th>Manhole Diameter (inches) for 2 Pipes</th>
<th>Maximum Pipe Diameter (inches)</th>
<th>At 180° Separation</th>
<th>At 90° Separation</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td></td>
<td>24</td>
<td>18</td>
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<tr>
<td>60</td>
<td></td>
<td>36</td>
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</tr>
<tr>
<td>96</td>
<td></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.
### 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></td>
<td>Long Wall plus 20&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>5t3</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>Short Wall plus 20&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>5t4</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5b1</td>
<td>5</td>
<td>Base</td>
<td></td>
<td>43&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5b2</td>
<td>5</td>
<td>Base</td>
<td></td>
<td>Long Wall plus 26&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5b3</td>
<td>5</td>
<td>Base</td>
<td></td>
<td>Short Wall plus 26&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5w1</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>Short Wall plus 68&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5w2</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5w3</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>Long Wall plus 20&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5w4</td>
<td>5</td>
<td>Top</td>
<td></td>
<td>Short Wall plus 20&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

### BENT BARS

- Short Wall plus 20"
- Wall minus 4" to 12 feet maximum. Provide 12 inches of wall opening (minimum) each side of pipe opening.
- Wall widths vary with pipe diameter and range from 4 feet minimum to 12 feet maximum.
For sewer pipes less than 48 inches in diameter, install eccentric reducers/increasers with a standard tee or utilize a composite tee.

If manhole depth exceeds 20 feet, install steps.

Install infiltration barrier.

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

<table>
<thead>
<tr>
<th>Size</th>
<th>D1</th>
<th>H</th>
<th>T1</th>
<th>T2</th>
<th>C</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; on 12&quot;</td>
<td>12&quot;</td>
<td>50&quot;</td>
<td>85</td>
<td>265</td>
<td>41(\frac{1}{2})</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 15&quot;</td>
<td>15&quot;</td>
<td>50&quot;</td>
<td>7</td>
<td>28</td>
<td>43</td>
<td>5400 lbs.</td>
</tr>
<tr>
<td>48&quot; on 18&quot;</td>
<td>18&quot;</td>
<td>50&quot;</td>
<td>5(\frac{1}{2})</td>
<td>265</td>
<td>44(\frac{1}{2})</td>
<td>5200 lbs.</td>
</tr>
<tr>
<td>48&quot; on 21&quot;</td>
<td>21&quot;</td>
<td>48&quot;</td>
<td>9(\frac{1}{2})</td>
<td>17(\frac{1}{2})</td>
<td>46</td>
<td>5800 lbs.</td>
</tr>
<tr>
<td>48&quot; on 24&quot;</td>
<td>24&quot;</td>
<td>48&quot;</td>
<td>8</td>
<td>16</td>
<td>40</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 27&quot;</td>
<td>27&quot;</td>
<td>48&quot;</td>
<td>9(\frac{1}{2})</td>
<td>11(\frac{1}{2})</td>
<td>38(\frac{1}{2})</td>
<td>5900 lbs.</td>
</tr>
<tr>
<td>48&quot; on 30&quot;</td>
<td>30&quot;</td>
<td>48&quot;</td>
<td>8</td>
<td>10</td>
<td>40</td>
<td>5300 lbs.</td>
</tr>
<tr>
<td>48&quot; on 33&quot;</td>
<td>33&quot;</td>
<td>54&quot;</td>
<td>9(\frac{1}{2})</td>
<td>11(\frac{1}{2})</td>
<td>44(\frac{1}{2})</td>
<td>6600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 36&quot;</td>
<td>36&quot;</td>
<td>54&quot;</td>
<td>8</td>
<td>10</td>
<td>46</td>
<td>6100 lbs.</td>
</tr>
</tbody>
</table>

**COMPOSITE TEE**

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

Install infiltration barrier.
Figure 6010.306

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

1. Place Class I bedding material, CLSM, flowable mortar, or concrete from top of elbow to bottom of sewer main.

2. Encase elbow in concrete. 12 inches minimum on all sides.
1. Core drill openings at least 12 inches from existing manhole joints.

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

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

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

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

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

3. 12 inch minimum riser height above all pipe openings.

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

**TYPICAL SECTION**

- **Base**: 8" min.
- **Concrete Fillet**: 8" min. Class I Bedding Material
- **Location Station**: 8" min.
- **Manhole Diameter**: 27" dia.
- **Depth**: 12" min.
- **2" Ring**: 6" min. o.c. Each Way
- **#4 Bars**: 12" o.c. Each Way
- **Square Edge**: 6" min.
- **Precast Riser Sections**: 8" min.
- **27" dia. Manhole Diameter**: 8" min.
- **Location Station**: 8" min.

**TABLE**

<table>
<thead>
<tr>
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<th>Maximum Pipe Diameter (inches) for 2 Pipes</th>
</tr>
</thead>
<tbody>
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<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>
Adjacency 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.

---

**Typical Section**

- **Base**: 8" min. Class I Bedding Material
- **Short Wall Width**: 6" min.
- **Concrete Fillet**: 6" min.
- **Wall Height**: 12" 8" min.
- **Hoop Bars**:
  - Two #4 (typ.)
  - Two #4 (top)

**Dimensions**

- **Diameter**: 27" dia.
- **Height**: 10" min.
- **Depth**: (8'-0 max.)
- **Lowest Flowline**

**Notes**

- **Bedding Material**: 8" min. Class I
- **Concrete**: 8" min. Class I
- **Adjacent Walls**: May have different widths based upon pipe configuration, but structure must be rectangular.

**Revision**

- **Date**: 04-21-20
- **Description**: Added Class I Bedding Material.
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></td>
</tr>
<tr>
<td>t2</td>
<td>See Table</td>
<td>Top</td>
<td>Short Wall plus 8&quot;</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>b1</td>
<td>See Table</td>
<td>Base</td>
<td>Long Wall plus 14&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>See Table</td>
<td>Base</td>
<td>Short Wall plus 14&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>w1</td>
<td>See Table</td>
<td>Walls</td>
<td>Long Wall plus 8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>w2</td>
<td>See Table</td>
<td>Walls</td>
<td>Short Wall plus 8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>w3</td>
<td>See Table</td>
<td>Walls</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter of Largest Pipe, D</th>
<th>Minimum Bar Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; or 54&quot;</td>
<td>6</td>
</tr>
<tr>
<td>33&quot; to 42&quot;</td>
<td>5</td>
</tr>
<tr>
<td>30&quot; or smaller</td>
<td>4</td>
</tr>
</tbody>
</table>

See Table
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**

- **Concrete Fillet**
- **Hoop Bars**
- **Adjustment Rings**
- **Wall**
- **Base**
- **Bedding Material**
- **8" min. Class I Bedding Material**
- **8" min. Class I Bedding Material**

---

**Note:** This diagram shows the typical section of a deep well rectangular storm sewer manhole. Dimensions and specifications are provided for construction purposes.
1. Provide two #4 hoop bars at top opening and at all pipe openings.

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

3. Wall widths vary with pipe diameter and range from 4 feet minimum to 9 feet maximum. Provide 12 inches of wall width (minimum) each side of pipe opening.

**REINFORCING BAR LIST**

<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>1</td>
<td>36&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>Long Wall plus 12&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4t3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>Short Wall plus 12&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>36&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>Long Wall plus 18&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b3</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>Short Wall plus 18&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>Short Wall plus 48&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>Long Wall plus 12&quot;</td>
<td>12&quot;</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>Long Wall plus 20''</td>
<td>48''</td>
<td>12''</td>
</tr>
<tr>
<td>5t2</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20''</td>
<td>9''</td>
<td></td>
</tr>
<tr>
<td>5t3</td>
<td>5</td>
<td>Top</td>
<td>Short Wall plus 20''</td>
<td>9''</td>
<td></td>
</tr>
<tr>
<td>5t4</td>
<td>5</td>
<td>Base</td>
<td>Base</td>
<td>8''</td>
<td>12''</td>
</tr>
<tr>
<td>5b1</td>
<td>5</td>
<td>Base</td>
<td>Base</td>
<td>43''</td>
<td>12''</td>
</tr>
<tr>
<td>5b2</td>
<td>5</td>
<td>Base</td>
<td>Long Wall plus 26''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>5b3</td>
<td>5</td>
<td>Base</td>
<td>Short Wall plus 26''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>5w1</td>
<td>5</td>
<td>Wall</td>
<td>Short Wall plus 68''</td>
<td>12''</td>
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</tr>
<tr>
<td>5w2</td>
<td>5</td>
<td>Wall</td>
<td>Wall Height minus 4''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>5w3</td>
<td>5</td>
<td>Wall</td>
<td>Long Wall plus 20''</td>
<td>12''</td>
<td></td>
</tr>
<tr>
<td>5w4</td>
<td>5</td>
<td>Wall</td>
<td>Short Wall plus 20''</td>
<td>12''</td>
<td></td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>Size</th>
<th>D1</th>
<th>H</th>
<th>T1</th>
<th>T2</th>
<th>C</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; on 12&quot;</td>
<td>12&quot;</td>
<td>50&quot;</td>
<td>8&quot;</td>
<td>29&quot;</td>
<td>41&quot;</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 15&quot;</td>
<td>15&quot;</td>
<td>50&quot;</td>
<td>7&quot;</td>
<td>26&quot;</td>
<td>43&quot;</td>
<td>5400 lbs.</td>
</tr>
<tr>
<td>48&quot; on 18&quot;</td>
<td>18&quot;</td>
<td>50&quot;</td>
<td>5&quot;</td>
<td>26&quot;</td>
<td>44&quot;</td>
<td>5200 lbs.</td>
</tr>
<tr>
<td>48&quot; on 21&quot;</td>
<td>21&quot;</td>
<td>48&quot;</td>
<td>9&quot;</td>
<td>17&quot;</td>
<td>38&quot;</td>
<td>5800 lbs.</td>
</tr>
<tr>
<td>48&quot; on 24&quot;</td>
<td>24&quot;</td>
<td>48&quot;</td>
<td>8&quot;</td>
<td>16&quot;</td>
<td>40&quot;</td>
<td>5600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 27&quot;</td>
<td>27&quot;</td>
<td>48&quot;</td>
<td>9&quot;</td>
<td>17&quot;</td>
<td>38&quot;</td>
<td>5900 lbs.</td>
</tr>
<tr>
<td>48&quot; on 30&quot;</td>
<td>30&quot;</td>
<td>48&quot;</td>
<td>8&quot;</td>
<td>10&quot;</td>
<td>40&quot;</td>
<td>5300 lbs.</td>
</tr>
<tr>
<td>48&quot; on 33&quot;</td>
<td>33&quot;</td>
<td>54&quot;</td>
<td>9&quot;</td>
<td>11&quot;</td>
<td>44&quot;</td>
<td>6600 lbs.</td>
</tr>
<tr>
<td>48&quot; on 36&quot;</td>
<td>36&quot;</td>
<td>54&quot;</td>
<td>8&quot;</td>
<td>10&quot;</td>
<td>46&quot;</td>
<td>6100 lbs.</td>
</tr>
</tbody>
</table>

COMPOSITE TEE
Alternate to standard tee with eccentric reducer (for pipes 36" and smaller).
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.
Refer to SW-514 for boxout details.

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

2. SW-603 Type R unless Type Q is specified in the contract documents.

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

4. 12 inch minimum wall height above all pipes.

<table>
<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>
</tr>
</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>

**REINFORCING BAR LIST**

- **Form Grade:** 6''
- **Wall Depth:** 12''
- **Diagonal Bar (typ.)**
- **Concrete Fillet**
- **Optional Construction Joint (typ.)**
- **Joint (typ.)**
- **Fillet**
- **Concrete**
- **8'' min. Class I Bedding Material**

**Section A-A**

**Plan**

**Lowest Flowline**

**Long Wall**

**Short Wall**

**Section Station (Back of Curb)**

**SECTION A-A**

**DIAGRAM**

**Bedding Material:** 8'' min. Class I
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>Maximum Pipe Diameter (inches) for 2 Pipes 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.

TYPICAL SECTION

- **Top**
- **Back of Curb**
- **Adjustment Rings**
- **Form Grade**
- **Concrete Fillet**
- **Diagonal Bar (typ.)**
- **Optional Construction Joint (typ.)**
- **Lowest Flowline**
- **Long Wall**
- **6''-0''**
- **7'-0''**
- **8'' min. Class I Bedding Material**
- **8'' min. Bedding Material**
- **24'' dia**
- **24''**
- **24''**
- **12'' min.**
- **12'' min.**
- **4''**
- **4''**
- **4''**
- **4''**
- **4w3**
- **4w1**
- **4w3**
- **4b1**
- **4b2**
- **4t1**
- **4t2**
- **411**
- **412**
- **Adjustment Rings**
- **Wall Height**
- **Wall**
- **Base**
- **Diagonal Bar**

---

**NOTES:**
- **Figure 6010.503**
- **SUDAS DIRECTOR**
- **DESIGN METHODS ENGINEER**
- **WITH MANHOLE**

---

**REVISIONS:**
- Added Class I Bedding Material.
REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
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<tbody>
<tr>
<td>4t1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>12</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4t2</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>4'-2&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>7</td>
<td>4'-2&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>5</td>
<td>7'-2&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Short Walls</td>
<td></td>
<td>Varies</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Long Walls</td>
<td></td>
<td>Varies</td>
<td>6'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<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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</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>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.

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

Plan

Reinforcing Bar List

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
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<tbody>
<tr>
<td>4t1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>1-1</td>
<td>3'-8&quot;</td>
<td>6&quot;</td>
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<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>
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<td>Base</td>
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<td>8'-2&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4a1</td>
<td>4</td>
<td>Adj. Ring</td>
<td></td>
<td>6</td>
<td>3'-8&quot;</td>
<td>See Adj. Ring Plan</td>
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<tr>
<td>4a2</td>
<td>4</td>
<td>Adj. Ring</td>
<td></td>
<td>4</td>
<td>3'-2&quot;</td>
<td>See Adj. Ring Plan</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>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>30&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

Diagonal Bar (typ.)

Location Station (Back of Curb)
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.
### 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>Beam</td>
<td>—</td>
<td>4</td>
<td>2'-8&quot;</td>
<td>4&quot;</td>
</tr>
<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>—</td>
<td>Varies</td>
<td>7'-4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td>—</td>
<td>Varies</td>
<td>2'-8&quot;</td>
<td>12&quot;</td>
</tr>
</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>60&quot;</td>
<td>66&quot;</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.

### MAXIMUM PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Wall</th>
<th>Max. Dia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30&quot; (2)</td>
</tr>
<tr>
<td>2</td>
<td>24&quot;</td>
</tr>
<tr>
<td>3</td>
<td>36&quot; (3)</td>
</tr>
<tr>
<td>4</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>

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.

Refer to SW-514 for boxout details.
**SECTION A-A**

**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>4</td>
<td>7'-8&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></td>
<td>Varies</td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Walls 1 and 3</td>
<td>Varies</td>
<td>6'-8&quot;</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4w4</td>
<td>4</td>
<td>Wall 4</td>
<td></td>
<td>Varies</td>
<td>7'-4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w5</td>
<td>4</td>
<td>Wall 5</td>
<td></td>
<td>Varies</td>
<td>2'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w6</td>
<td>4</td>
<td>Wall 6</td>
<td></td>
<td>Varies</td>
<td>3'-10&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

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

DOUBLE GRATE INTAKE WITH MANHOLE
1. Insert shaping may be modified for insert widths less than 36 inches. For an 18 inch insert, reduce dimensions indicated by 1 inch.

SW-507

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

Figure 6010.507

Standard Road Plan

SUDAS

IOWADOT

SHEET 1 of 2

SINGLE OPEN-THROAT CURB

INTAKE, SMALL BOX
**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>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>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>

**Plan and Details**

- **2'-0'' min. on Grade**
- **3'-6'' at Low Point**

**Notes:**

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

- **Concrete Fillet**
- **8'' min. Class I Bedding Material**

**Typical Section:**

- **Location Station (Back of Curb)**
- **2'-0'' min. on Grade**
- **4'-0'' min. at Low Point**

**Pocket**

- **Depth 10'-0'' max.**
- **Wall Height 10'-0'' max.**

**Location Station**

- **4'-0'' min. at Low Point**
- **2'-0'' min. on Grade**

**Boxout Length**

- **4'-0'' min.**
- **Back of Curb**
- **Flow**

**Bedding Material**

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

**Factors Considered:**

- **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.

**Insert (6 Inch Standard Curb)**

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

Face of 6" Standard Curb

Edge of Gutter (if applicable)

Form Grade

Normal Pavement Slope

Back of Curb

**Insert (4 Inch Sloped Curb)**

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

Face of 4" Sloped Curb

Edge of Gutter (if applicable)

Form Grade

Normal Pavement Slope

Back of Curb

Trowel smooth and place bond breaker.

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

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 \( \frac{1}{3} \) inch.

SECTION A-A
(6 Inch Standard Curb Insert)

SECTION A-A
(4 Inch Sloped Curb Insert)
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.

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>
</tr>
</thead>
<tbody>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>9</td>
<td>3'-6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>5</td>
<td>8'-6&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4/1</td>
<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>4/1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>6</td>
<td>8'-6&quot;</td>
<td>See Plan</td>
</tr>
<tr>
<td>4/1</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>8</td>
<td>3'-6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4/3</td>
<td>4</td>
<td>Top</td>
<td></td>
<td>18</td>
<td>10&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>22</td>
<td>Wall Height minus 4&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Long Walls</td>
<td></td>
<td></td>
<td>4'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w3</td>
<td>4</td>
<td>Short Walls</td>
<td></td>
<td></td>
<td>3'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5w1</td>
<td>5</td>
<td>Beam</td>
<td></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.

<table>
<thead>
<tr>
<th>MAXIMUM PIPE DIAMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Location</td>
</tr>
<tr>
<td>Short Wall</td>
</tr>
<tr>
<td>Long Wall</td>
</tr>
</tbody>
</table>

SECTION C-C

PLAN (SPACER)

ISOMETRIC (Refer to SECTION B-B for alignment of Top with Spacer)
Trowel smooth and place bond breaker.

End Wall Spacer

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

Edge of Gutter (if applicable)

Normal Pavement Slope

Face of 6" Standard Curb

5" min. 3'

Face of 4" Sloped Curb

Form Grade

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

Edge of Gutter (if applicable)

Normal Pavement Slope

Face of 4" Sloped Curb

Form Grade

Trowel smooth and place bond breaker.

SECTION A-A
(6 Inch Standard Curb Insert)

SECTION A-A
(4 Inch Sloped Curb Insert)

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.
**FIGURE 6010.510**

**DOUBLE OPEN-THROAT CURB**

**INTAKE, LARGE BOX**

**SUDAS**

**DESIGN METHODS ENGINEER**

**SW-510 STANDARD ROAD PLAN**

**SHEET 3 of 3**

---

**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>66''</td>
</tr>
</tbody>
</table>

---

**SECTION B-B**

- **Beam:**
  - 6''
  - 3'-8''
  - 4'-6''
  - 5'-0''
  - 6''

- **Walls:**
  - 8''

- **Spacer Material:**
  - 6''

**Location:**

- **Concrete:**
  - 8'' min. Class I

**Flowline:**

- 8'' min. Bedding Material

**ISOMETRIC**

- **Beam:**
  - 6''

- **Walls:**
  - 8''

**SECTION C-C**

- **Beam:**
  - 6''

- **Walls:**
  - 8''

**Flowline:**

- 8'' min. Bedding Material

**Contract Documents:**

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

---

**REVISIONS:**

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

---

**REV/2020-04-21**
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**

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

---

**SECTION A-A**

**PLAN**

- SW-604 Type 6 Casting
- Form Grade
- Adjustment Rings
- #4 Bars at 15" o.c. Each Way
- Concrete Fillet
- Diagonal Bar (typ.)
- Base
- #4 Bars at 12" o.c. Each Way
- 8" min. Class I Bedding Material

**REVISIONS:**
- Added Class I Bedding Material.
1. Precast (shown) or cast-in-place base:
   - Precast: 6 inch thick concrete with #6 welded wire mesh on 4 inch centers (WWF 4" x 4"). Center mesh vertically within base.
   - Cast-in-place: 8 inch thick non-reinforced concrete.

2. 12 inch minimum riser height above all pipes.

<table>
<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.

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

**Class 1 Bedding Material**

**TYPICAL SECTION**

**CASE 2**
Structure may be built with openings on any or all sides. Provide openings and orientation as specified in the contract documents.

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

1. Construct inlet openings with 15 inch #4 epoxy coated bars at 8 inches on center. Embed bars a minimum of 3 inches into walls and top at all openings.

2. Grade to inlet elevation on open sides. Grade to top elevation on closed sides.

3. Corner pier required between openings of two adjacent walls. Extend wall reinforcing vertically through pier. Install one additional 15 inch #4 bar in pier.

4. Center pier required at center of any inlet opening with length of 5 feet or greater. Extend wall reinforcing vertically through pier. Install one additional 15 inch #4 bar in pier.

5. Wall widths vary with pipe diameter. Provide 6 inches of wall width (minimum) each side of pipe opening. Minimum wall width is 36 inches. Maximum wall width is 72 inches.

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

7. Install four #4 diagonal bars at all pipe openings.

8. 12 inch minimum wall height above all pipes.
BOXOUT IN PCC PAVEMENT AND PCC BASE WITH HMA OVERLAY

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

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

Center bars vertically within slab.

#4 Bars

Normal Crown of Street

PCC Pavement or PCC Base with HMA Overlay

SECTION A-A
BOXOUT IN PCC CURB AND GUTTER

1 Center bars vertically within slab.

SECTION A-A

Dowel Bar (typ.)

'ED' Joint

Back of Curb

Intake Grade (typ.)

#4 Bars @ 12" o.c.

Flow

Boxout Length 15'-0" Typical

'ED' Joint

'ED' Joint

30"

12" (typ.)

30"

12" (typ.)

2"

2" Clear (typ.)

Back of Curb

Normal Crown of Street

Form Grade

Pavement

#4 Bars

30"

6"

Pavement

#4 Bars

Normal Crown of Street

Form Grade

Pavement

30"

6"

Pavement

#4 Bars

6010.514

SHEET 2 OF 3

SUDAS DIRECTOR
DESIGN METHODS ENGINEER

REV 04-17-18

REVISIONS:

SUDAS logo.

Added dimension to back of grate. Updated line work and Iowa DOT and SUDAS logos.

GRATE INTAKES

BOXOUT FOR

FIGURE 6010.514

STANDARD ROAD PLAN

SW-514

SHEET 2 of 3
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.

Bedding Material

8" min. Class I
(8'-0" Max.)

8" min. Class I Bedding Material

Type 7 Grate

Optional Construction Joint (typ.)

Depth (5'-6" Max.)

12" min.

Concrete Fillet

Wall Height

4w3

4w1

4b1

4b2

Location Station (Center of Structure)

Long Wall

4'-6"

5'-6"

3'-4"

Short Wall

2'-4"

Base

A

A

A

2

3

B

B

B

5'-6"

4b1

4b2

8" min. Class I

4w1

4w3

2'-4"

3'-4"

6"

6"

6"

6"
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>
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<th>Cast-in-place Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Wall</td>
<td>18&quot;</td>
<td>21&quot;</td>
</tr>
<tr>
<td>Long Wall</td>
<td>36&quot;</td>
<td>42&quot;</td>
</tr>
</tbody>
</table>

REINFORCING BAR LIST

<table>
<thead>
<tr>
<th>Mark</th>
<th>Size</th>
<th>Location</th>
<th>Shape</th>
<th>Count</th>
<th>Length</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>6</td>
<td>3'-6&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Base</td>
<td></td>
<td>4</td>
<td>5'-8&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td></td>
<td>20</td>
<td>Wall Height minus 4&quot;</td>
<td>12&quot;</td>
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<tr>
<td>4w2</td>
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<td>Short Wall</td>
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<td>3'-0&quot;</td>
<td>12&quot;</td>
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<tr>
<td>4w3</td>
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<td>5'-2&quot;</td>
<td>12&quot;</td>
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</tbody>
</table>
For joint details, see PV-101.

Slope same as adjacent pavement.

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

**FIGURE 6010.541**

**STANDARD ROAD PLAN**

**SUDAS**

**INTAKE UNDER PAVEMENT**

**OPENCROSS CURB**

**INSERT**
(6 Inch Standard Curb)

**INSERT**
(4 Inch Sloped Curb)
For joint details, refer to PV-101.

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

Top of well flush with pavement.

For joint details, refer to PV-101.

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

Top of well flush with pavement.

### Bent Bars

- **Base**: 4''
- **Form Grade**: 6''
- **Back of Curb**: 6''
- **Wall Height**: 12'' min.
- **Depth**: 10'-0'' max.
- **Bedding Material**: 8'' min. Class I

### 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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<tbody>
<tr>
<td>b1</td>
<td>4</td>
<td>Base</td>
<td>------</td>
<td>4'-6''</td>
<td>11''</td>
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<tr>
<td>b2</td>
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<td>Wall</td>
<td>Wall Height minus 4''</td>
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<td>12''</td>
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<tr>
<td>w2</td>
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<td>Wall</td>
<td>Wall Height minus 4''</td>
<td>4'-8''</td>
<td>12''</td>
</tr>
<tr>
<td>c1</td>
<td>4</td>
<td>Top</td>
<td>------</td>
<td>2'-7''</td>
<td>14''</td>
</tr>
<tr>
<td>c2</td>
<td>4</td>
<td>Top</td>
<td>------</td>
<td>2'-6''</td>
<td>14''</td>
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<tr>
<td>c3</td>
<td>4</td>
<td>Top</td>
<td>------</td>
<td>4'-8''</td>
<td>See Detail</td>
</tr>
<tr>
<td>c4</td>
<td>4</td>
<td>Top</td>
<td>------</td>
<td>4'-8''</td>
<td>See Detail</td>
</tr>
<tr>
<td>c5</td>
<td>4</td>
<td>Top</td>
<td>------</td>
<td>3'-2''</td>
<td>See Detail</td>
</tr>
</tbody>
</table>

### MAXIMUM PIPE DIAMETER

- **Precast**: 30''
- **Cast-in-Place**: 36''

### SW-602 Type G Casting

- **Form Grade**: 6''
- **Back of Curb**: 6''
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>
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<th>WEIGHT</th>
<th>SPACING</th>
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<td>3</td>
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<td>6.0</td>
<td>9&quot;</td>
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<tr>
<td>f1</td>
<td>4</td>
<td>Bottom</td>
<td>3</td>
<td>4-9&quot;</td>
<td>6.5</td>
<td>9&quot;</td>
<td></td>
</tr>
<tr>
<td>f2</td>
<td>4</td>
<td>Bottom</td>
<td>4</td>
<td>1-7&quot;</td>
<td>4.2</td>
<td>18&quot;</td>
<td></td>
</tr>
<tr>
<td>g1</td>
<td>4</td>
<td>Wall</td>
<td>3</td>
<td>Varies*</td>
<td>Varies**</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>g2</td>
<td>4</td>
<td>Wall</td>
<td>4</td>
<td>4-9&quot;</td>
<td>3.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g3</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>Varies**</td>
<td>Varies**</td>
<td>18&quot;</td>
<td></td>
</tr>
<tr>
<td>g4</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>6-4&quot;</td>
<td>12.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g5</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>Varies**</td>
<td>Varies**</td>
<td>18&quot;</td>
<td></td>
</tr>
</tbody>
</table>

b2 15" D=4" x 15"  

g2 11" D=4" x 11"  

g3 11" D=4" x 11"  

g4 11" D=4" x 11"

Provide one of each length

Extension unit may be used on either or both sides of SW-541 intakes. Details are similar when extension unit is on the opposite side.

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

Casting Type G

Curb Line Back of radius 4"

Match Existing Pavement Joints

15'-10" (min.) to 20'-0" (max.)

Extension unit is on the opposite side. Extension unit may be used on either or both sides of SW-541 intakes. Details are similar when extension unit is on the opposite side.

1. g3 for 6 inch standard curb; g5 for 4 inch sloped curb.
2. c1 for 6 inch standard curb; c2 for 4 inch sloped curb. See SW-541 for reinforcing.
3. The location station is where the centerline of intake meets the back of the curb line.
FIGURE 6010.542
SHEET 2 of 4
SW-542
EXTENSION UNIT FOR
OPEN-THROAT CURB
INTAKE UNDER PAVEMENT

SECTION A-A

SECTION B-B

SECTION C-C

6 INCH STANDARD CURB

Back of Curb

Keyed Construction Joint

11" 18"
30" 10"
21"

11" 18" 33"
10" 21"
3-3" 21"
2" Clear

Face of 6" Standard Curb

Form Grade Elevation

Back of Curb

Pavement Slab

2:1 Slope (Horizontal:Vertical)

See SW-541 for reinforcing.

See SW-542

REVISIONS:

Removed Interim from standard.

Removing Interim from standard.

INSERTIONS:

21-03-20

21-03-20
4 INCH SLOPED CURB

Back of Curb

SECTION A-A

Back of Curb

SECTION B-B

SECTION C-C

2.1 Slope (Horizontal: Vertical)

See SW-541 for reinforcing.
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

SECTION D-D

SECTION E-E

Bottom edge of intake top at face of intake

2" Clear

18"

18"

18"

6" 18" lap

2" Clear

Varies

Varies

Varies

Varies

2" Clear

10"

12" 8"

12" 6" 5'-0"

2" Clear

4"

3'-3"

2" Clear

Varies

Varies

Varies

Varies

12" 12" 12" 12"

2" Clear

2" Clear

12"

12"

12"

12"

12"

12"
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>Dimension</th>
<th>Length of Curb Opening</th>
<th>Extension Length</th>
<th>Minimum Boxout Length</th>
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<tbody>
<tr>
<td></td>
<td>Length of Curb Opening</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12'-0''</td>
<td>7'-10''</td>
<td>16'-0''</td>
</tr>
<tr>
<td></td>
<td>14'-0''</td>
<td>8'-10''</td>
<td>18'-0''</td>
</tr>
<tr>
<td></td>
<td>16'-0''</td>
<td>10'-10''</td>
<td>20'-0''</td>
</tr>
<tr>
<td></td>
<td>18'-0''</td>
<td>12'-10''</td>
<td>22'-0''</td>
</tr>
</tbody>
</table>

KEYED CONSTRUCTION JOINT

- Bedding Material: 8" min. Class I
- Concrete Fillet: 6" min.
- Keyed Construction Joint: 8" min.
- Keyed Joint: (should not extend onto front wall of box)

MAXIMUM PIPE DIAMETERS

<table>
<thead>
<tr>
<th>Structure Type</th>
<th>Maximum Pipe Diameters</th>
</tr>
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<tbody>
<tr>
<td>Cast-in-place</td>
<td>36''</td>
</tr>
<tr>
<td>Structure</td>
<td>30''</td>
</tr>
</tbody>
</table>

FIGURE 6010.545

SHEET 1 OF 4

SUDAS DIRECTOR
DESIGN METHODS ENGINEER

REVISIONS:
- Clarified labeling of rebar.

REV. 04-19-22

SHEET 1 of 4

SINGLE OPEN-THROAT CURB INTAKE WITH EXTENDED OPENING

Extension of box (should not extend onto front wall of box)
**REINFORCING BAR LIST**

<table>
<thead>
<tr>
<th>MARK</th>
<th>DIA</th>
<th>LOC</th>
<th>NO.</th>
<th>LENGTH</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>4b1</td>
<td>4</td>
<td>Base</td>
<td>6</td>
<td>4'-6''</td>
<td>11''</td>
</tr>
<tr>
<td>4b2</td>
<td>4</td>
<td>Top</td>
<td>4</td>
<td>4'-3''</td>
<td>11''</td>
</tr>
<tr>
<td>4w1</td>
<td>4</td>
<td>Walls</td>
<td>15</td>
<td>Wall Height minus 4''</td>
<td>14''</td>
</tr>
<tr>
<td>4w2</td>
<td>4</td>
<td>Walls</td>
<td>15</td>
<td>Wall Height minus 4''</td>
<td>12''</td>
</tr>
</tbody>
</table>

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 4e1 or 4e4. See Sheets 3 and 4.

⑥ Slope of 1.5% or as specified in the contract documents.
**6 INCH STANDARD CURB**

**REINFORCING BAR LIST (C = 12'-0")**

<table>
<thead>
<tr>
<th>MARK</th>
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<th>NO.</th>
<th>LENGTH</th>
<th>WEIGHT</th>
<th>SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>4e1</td>
<td>Top</td>
<td>1</td>
<td>12'-0&quot;</td>
<td>58.6</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4e2</td>
<td>Top</td>
<td>2</td>
<td>12'-0&quot;</td>
<td>17.0</td>
<td>15&quot;</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>Top</td>
<td>2</td>
<td>12'-0&quot;</td>
<td>22.4</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4e4</td>
<td>Base</td>
<td>2</td>
<td>8'-0&quot;</td>
<td>18.2</td>
<td>22&quot;</td>
<td></td>
</tr>
<tr>
<td>4e5</td>
<td>Insert</td>
<td>1</td>
<td>18'-0&quot;</td>
<td>13.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* With 16'-0" Boxout. Total: 119.1 lbs.

**REINFORCING BAR LIST (C = 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>Top</td>
<td>1</td>
<td>14'-0&quot;</td>
<td>69.5</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4e2</td>
<td>Top</td>
<td>1</td>
<td>12'-0&quot;</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>Top</td>
<td>2</td>
<td>14'-0&quot;</td>
<td>18.7</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4e4</td>
<td>Base</td>
<td>2</td>
<td>18'-0&quot;</td>
<td>19.0</td>
<td>22&quot;</td>
<td></td>
</tr>
<tr>
<td>4e5</td>
<td>Insert</td>
<td>1</td>
<td>17'-0&quot;</td>
<td>11.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* With 16'-0" Boxout. Total: 142.4 lbs.

**REINFORCING BAR LIST (C = 16'-0")**

<table>
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<th>MARK</th>
<th>SIZE</th>
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<th>NO.</th>
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<th>WEIGHT</th>
<th>SPACING</th>
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</thead>
<tbody>
<tr>
<td>4e1</td>
<td>Top</td>
<td>1</td>
<td>16'-0&quot;</td>
<td>9.3</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4e2</td>
<td>Top</td>
<td>2</td>
<td>16'-0&quot;</td>
<td>22.4</td>
<td>15&quot;</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>Top</td>
<td>2</td>
<td>16'-0&quot;</td>
<td>22.4</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>4e4</td>
<td>Base</td>
<td>2</td>
<td>12'-0&quot;</td>
<td>18.2</td>
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<td></td>
</tr>
<tr>
<td>4e5</td>
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<td>1</td>
<td>18'-0&quot;</td>
<td>13.2</td>
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</table>

* With 20'-0" Boxout. Total: 165.6 lbs.

**REINFORCING BAR LIST (C = 18'-0")**

<table>
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<th>MARK</th>
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<th>LENGTH</th>
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<th>SPACING</th>
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</thead>
<tbody>
<tr>
<td>4e1</td>
<td>Top</td>
<td>1</td>
<td>18'-0&quot;</td>
<td>10.7</td>
<td>12&quot;</td>
<td></td>
</tr>
<tr>
<td>4e2</td>
<td>Top</td>
<td>2</td>
<td>18'-0&quot;</td>
<td>25.0</td>
<td>22&quot;</td>
<td></td>
</tr>
<tr>
<td>4e3</td>
<td>Top</td>
<td>2</td>
<td>18'-0&quot;</td>
<td>25.0</td>
<td>22&quot;</td>
<td></td>
</tr>
<tr>
<td>4e4</td>
<td>Base</td>
<td>2</td>
<td>14'-0&quot;</td>
<td>19.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4e5</td>
<td>Insert</td>
<td>1</td>
<td>21'-10&quot;</td>
<td>14.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* With 22'-0" Boxout. Total: 186.0 lbs.

---

**BENT BAR DETAILS**

**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.**

---

**SINGLE OPEN-THROAT CURB INTAKE WITH EXTENDED OPENING**

---

**SUDAS**

**KOWADOT**

**FIGURE 6010.545 STANDARD ROAD PLAN**

**REVISIONS:** Clarified labeling of rebar.

---

**SW-545**

---

**SUDAS**

**KOWADOT**

**FIGURE 6010.545 STANDARD ROAD PLAN**

**REVISIONS:** Clarified labeling of rebar.

---

**SUDAS**

**KOWADOT**

**FIGURE 6010.545 STANDARD ROAD PLAN**

**REVISIONS:** Clarified labeling of rebar.
Section C-C (4 Inch Sloped Curb)

**NOTE:** ALL DIMENSIONS ARE OUT TO OUT

D = PIN DIAMETER

---

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

<table>
<thead>
<tr>
<th>MARK</th>
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<th>LOCATION</th>
<th>NO.</th>
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<th>SPACING</th>
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</thead>
<tbody>
<tr>
<td>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-6&quot;</td>
<td>6.7</td>
<td>0.7</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-6&quot;</td>
<td>17.0</td>
<td>1.5</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>12'-6&quot;</td>
<td>17.0</td>
<td>6&quot;</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>4e6</td>
<td>4</td>
<td>Top/Base</td>
<td>9</td>
<td>9'-30&quot;</td>
<td>58.9</td>
<td>12&quot;</td>
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<tr>
<td>4I</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>15'-0&quot;</td>
<td>10.6</td>
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</table>

* With 18'-6" Boxout. Total 119.0 lbs.

---

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

<table>
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<th>MARK</th>
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<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-6&quot;</td>
<td>6.7</td>
<td>0.7</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>14'-6&quot;</td>
<td>19.7</td>
<td>1.5</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>14'-6&quot;</td>
<td>19.7</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>18'-2&quot;</td>
<td>13.6</td>
<td>22</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top/Base</td>
<td>11</td>
<td>9'-30&quot;</td>
<td>69.5</td>
<td>12&quot;</td>
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<tr>
<td>4I</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 18'-6" Boxout. Total 142.3 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>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-6&quot;</td>
<td>6.7</td>
<td>0.7</td>
</tr>
<tr>
<td>4e3</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-6&quot;</td>
<td>22.4</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4e4</td>
<td>4</td>
<td>Top</td>
<td>2</td>
<td>16'-6&quot;</td>
<td>22.4</td>
<td>6&quot;</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>18'-2&quot;</td>
<td>13.6</td>
<td>22</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top/Base</td>
<td>13</td>
<td>9'-30&quot;</td>
<td>82.1</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4I</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>18'-10&quot;</td>
<td>13.2</td>
<td></td>
</tr>
</tbody>
</table>

* With 20'-0" Boxout. Total 165.5 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>4e2</td>
<td>4</td>
<td>Top</td>
<td>1</td>
<td>12'-6&quot;</td>
<td>6.7</td>
<td>0.7</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>1&quot;&quot;</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>9&quot;</td>
</tr>
<tr>
<td>4e5</td>
<td>4</td>
<td>Base</td>
<td>2</td>
<td>14'-2&quot;</td>
<td>18.8</td>
<td>22&quot;</td>
</tr>
<tr>
<td>4e6</td>
<td>4</td>
<td>Top/Base</td>
<td>15</td>
<td>9'-30&quot;</td>
<td>94.8</td>
<td>12&quot;</td>
</tr>
<tr>
<td>4I</td>
<td>4</td>
<td>Insert</td>
<td>1</td>
<td>21'-10&quot;</td>
<td>14.6</td>
<td></td>
</tr>
</tbody>
</table>

* With 22'-6" Boxout. Total 188.9 lbs.

---

**BENT BAR DETAILS**

**NOTE:** ALL DIMENSIONS ARE OUT TO OUT

D = PIN DIAMETER
**SANITARY SEWER MANHOLES**

**CASTINGS FOR**

**SANITARY SEWER MANHOLES**

---

**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.


---

**Bolt-Down Cover (Type C)**

---

**Anchor Bolt Hole**

---

**Flange (typ.)**

---

**Gasket Seal**

---

**SANITARY SEWER**

---

**SEWER**

---

**PLAN**

---

**TYPICAL SECTION**

---

**TYPICAL SECTION**

---

**Anchor Bolt**

---

**Gasket to seal out debris**

---

**24" min. clear opening**
SANITARY SEWER MANHOLE

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

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

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

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

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

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


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

5. Height adjustment method may vary; two options are shown.
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 Hole
Flange (typ.)

Gasket to seal out debris

24" min. clear opening

26" min.

33" min.

24" min.

35 1/2 min.

26" min.

1 1/2"

7" min.

7" min.

1 1/2"

24" min.

35 1/2 min.

1 Anchor Bolt

Roughness pattern and text style may vary. Minimum one pickhole.

SUDAS

CASTINGS FOR
STORM SEWER MANHOLES

STORM

SEWER

SEWER

STORM

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

Gasket to seal out debris

24" min. clear opening

26" min.

33" min.

24" min.

35 1/2 min.

1 1/2"

7" min.

7" min.

1 1/2"

24" min.

35 1/2 min.

1 Anchor Bolt

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

Gasket to seal out debris

24" min. clear opening

26" min.

33" min.

24" min.

35 1/2 min.

1 1/2"

7" min.

7" min.

1 1/2"

24" min.

35 1/2 min.

1 Anchor Bolt

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

Gasket to seal out debris

24" min. clear opening

26" min.

33" min.

24" min.

35 1/2 min.

1 1/2"

7" min.

7" min.

1 1/2"

24" min.

35 1/2 min.
TYPE F: PCC
Three-piece floating casting for use in PCC paving and PCC boxouts

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

Typical Section Notes:
- 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.

- Gasket to seal out debris
- Steel Sleeve
- Height Adjustment Mechanism
- Lug
- Anchor Bolt

24" min. clear opening
26" min.
33 1/2" min.
TYPE G
Two piece fixed casting

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

PLAN

TYPICAL SECTION

STORM

SEWER

MINIMUM ONE PICKHOLE.

31" min.

25 3/4" min.

1 1/2"

4"

1"

24" min.

25 3/4" min.

26 1/2" min.

MINIMUM ONE PICKHOLE.
**TYPE Q**

Driveway Grate  
(Minimum open area 370 in²)

**TYPE R**

Curb Inlet Grate  
(Minimum open area 180 in²)

---

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

---

For details of boxout pavement, refer to SW-514.
Provide bicycle-safe vane-style grate. At low points, grates with vanes facing both directions of flow are allowed. The Contractor has the choice of which Type S Grate to use.

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

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

**Plan**

- *Flow*
- **Type S**
  - Barrier/Intake Grate
  - (Minimum open area 300 in²)

- **Plan**
  - Bolt frame to grate with six ½ X 3¾ flat head cap screws.

- **Plan**
  - Bolt frame to grate with six ½ X 4½ stainless steel hex head bolts.

**Details**

- **Detail 'A'**
  - Bolt Slot Detail

**Section C-C**

- **Section D-D**
  - 12 spaces @ 3''

**Notes**

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

**Figure 6010.603**

**Standard Road Plan**

**SUDAS**

**REVISIONS:**
- Corrected typo on page two that said SHEET 1 of 2.
CASTINGS FOR AREA INTAKES

TYPE 3
(Light Duty)

TYPE 4

For Placement on 18" RCP

TYPE 4A
19½" ± ½"
2" max.
2" min.
1½" min.

TYPE 4B
25½" ± ½"
2" max.
2" min.
1½" min.

TYPE 4C
32½" ± ½"
2" max.
1" min.
2" min.

TYPE 4D
36½" ± ½"
1" min.
2" min.

For Placement on 24" RCP

For Placement on 30" RCP

For Placement on 36" RCP

TYPE 3A
For Placement on 18" RCP

Hole Optional

1" min.
10" max.
6½" min.

TYPE 3B
For Placement on 24" RCP

Hole Optional

1" min.
10" max.
6½" min.

For Placement on 24" to 30" RCP

TYPE 5
(Light Duty)

Flow

20½" ± ½"
8½" ± ½"

Flow

23" ± ½"
11" ± ¼"

For Placement on 24" RCP

For Placement on 36" RCP
CASTINGS FOR AREA INTAKES

FRAME
Minimum Weight = 85 lbs.

FIGURE 6010.604
STANDARD ROAD PLAN
SHEET 2 of 2

SW-604

SUDAS
KOWADOT

REVISION
3 05-21-20

REVISED: Added Type 7 casting. Modified circle notes.

CASTINGS FOR AREA INTAKES

FRAME
Minimum Weight = 75 lbs.

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

2. 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.

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

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

TYPE 6

TYPE 7

SECTION A-A

SECTION B-B

TYPE 9
(Light Duty)
See Bar Size Table for Contraction Joints on Sheet 2.

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 clearance is greater or equal to 8 inches. Use 'C' joints when clearance 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.

See dowel assemblies for fabrication details.

See dowel assemblies for fabrication details.

Remove header block and board when second slab is placed.

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.

See dowel assemblies for fabrication details.

See dowel assemblies for fabrication details.
FIGURE 7010.101

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

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

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

**DETAIL C**

**BAR PLACEMENT**
(Appplies to all joints unless otherwise detailed.)

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

**SHEET 2 OF 8**

**BAR SIZE TABLE FOR CONTRACTION JOINTS**

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

Tubular Dowel Bars will not be allowed for RD joints.

---

When tying into old pavement, \( L/2 \) represents the depth of sound PCC.

Saw 'CD' joint to a depth of \( T/3 \pm 1/4'' \); saw 'C' joint to a depth of \( T/4 \pm 1/4'' \).

### TRANSVERSE CONTRACTION

**CONTRACTION JOINTS**

- **LEGEND**
  - Existing Pavement
  - Proposed Pavement

**REVISIONS:**

- Modified circle note 32.
FIGURE 7010.101

PLAIN JOINT
(Abutting Pavement Slabs)

'BT' ABUTTING PAVEMENT JOINT - RIGID TIE

<table>
<thead>
<tr>
<th>T</th>
<th>Joint</th>
<th>Bars</th>
<th>Bar Length and Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8&quot;</td>
<td>'BT-1'</td>
<td>#4</td>
<td>30&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td>≥ 8&quot;</td>
<td>'BT-2'</td>
<td>#5</td>
<td>30&quot; Long at 30&quot; Centers</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>T</th>
<th>Joint</th>
<th>Bars</th>
<th>Bar Length and Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8&quot;</td>
<td>'BT-5'</td>
<td>#4</td>
<td>24&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td>≥ 8&quot;</td>
<td>'BT-3'</td>
<td>#5</td>
<td>24&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td></td>
<td>'BT-4'</td>
<td></td>
<td>24&quot; Long at 15&quot; Centers</td>
</tr>
</tbody>
</table>

KEYED JOINT FOR ADJACENT SLABS
(Where T is 8" or more)

'K' ABUTTING PAVEMENT JOINT - KEYWAY TIE

<table>
<thead>
<tr>
<th>T</th>
<th>Joint</th>
<th>Bars</th>
<th>Bar Length and Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8&quot;</td>
<td>'K-T-1'</td>
<td>#4</td>
<td>30&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td>≥ 8&quot;</td>
<td>'K-T-2'</td>
<td>#5</td>
<td>30&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td></td>
<td>'K-T-3'</td>
<td></td>
<td>30&quot; Long at 15&quot; Centers</td>
</tr>
</tbody>
</table>

LONGITUDINAL CONTRACTION

JOINTS

10 Bar supports may be necessary for fixed form paving to ensure the bar remains in a horizontal position in the plastic concrete.

11 Sawing or sealing of joint not required.

12 The following joints are interchangeable, subject to the pouring sequence:
   'BT-1', 'L-1', and 'KT-1'
   'KT-2' and 'L-2'
   'KT-3' and 'L-3'

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

CONTRACTION JOINT

<table>
<thead>
<tr>
<th>T</th>
<th>Joint</th>
<th>Bars</th>
<th>Bar Length and Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 8&quot;</td>
<td>'L-1'</td>
<td>#4</td>
<td>36&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td>≥ 8&quot;</td>
<td>'L-2'</td>
<td>#5</td>
<td>36&quot; Long at 30&quot; Centers</td>
</tr>
<tr>
<td></td>
<td>'L-3'</td>
<td></td>
<td>36&quot; Long at 15&quot; Centers</td>
</tr>
</tbody>
</table>

LEGEND

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

DETAIL D-1
(Required 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&quot; or greater</td>
<td>1(\frac{3}{4})&quot;</td>
<td>2(\frac{3}{4})&quot;</td>
<td></td>
</tr>
<tr>
<td>Narrow</td>
<td>Less than 8&quot;</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td></td>
</tr>
</tbody>
</table>

LONGITUDINAL CONTRACTION

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

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

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

Sealant or cleaning not required.

DETAIL E

LEGEND

Existing Pavement

Proposed Pavement
FIGURE 7010.101

Dowel Placement
(Appplies to all joints unless otherwise detailed.)

See Detail H

Width (See table below)

‘CF’ JOINT

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

‘EE’ JOINT

1” Expansion Joint

Joint in Curb (View at Back of Curb)

Top of Curb
Top of Slab
Joint Filler

‘ES’ JOINT

Joint in Curb (View at Back of Curb)

Top of Curb
Top of Slab
Joint Filler

‘E’ JOINT

Joint in Curb (View at Back of Curb)

Top of Curb
Top of Slab
Joint Filler

See Detail F

RESILIENT JOINT FILLER

DETAIL F

1/2” Joint Sealant Material
Joint Filler

DETAIL G

1/2” Joint Sealant Material
Joint Filler

Tire Buffings

DETAIL H

1/2” Joint Sealant Material
Joint Filler

Tire Buffings

See Bar Size Table for Doweled Expansion Joints.

Bar Size Table for Doweled Expansion Joints

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

Tubular Dowel Bars will not be allowed for expansion joints.

Legend

Existing Pavement
Proposed Pavement

SUDAS | OWADOT

PV-101

Figure 7010.101
Standard Road Plan

Sheet 5 of 8

Revisions:
Modified circle note 32.

Date: 04-19-22

Sheet 5 of 8

Revised: 11
CONTRACTION JOINTS

Spaces between dowel bars are nominal dimensions with a $\frac{3}{8}$ allowable tolerance.

Dowel Height and Diameter for Doweled Contraction Joints

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

- 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.

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.
19. Use 18 inch long dowel bars with a tolerance of ± 1/8 inch. Ensure the centerlines of individual dowels are parallel to the other dowels in the assembly within ± 1/8 inch.
20. Use wires with a minimum tensile strength of 50 ksi.
21. Details apply to both transverse contraction and expansion joints.
22. Weld alternately throughout.
23. 0.306 inch diameter wire. Wire sizes shown are the minimum required.
24. Maximum 0.177 inch diameter wire, welded or friction fit to upper side rail, both sides.
25. Measured from the centerline of dowel bar to bottom of lower side rail + 1/4 inch.
26. Per lane width, install a minimum of 8 anchor pins evenly spaced (4 per side), to prevent movement of assembly during construction. Anchor assemblies placed on pavement or PCC base with devices approved by the Engineer.
27. If dowel basket assemblies are required for curbed pavements, the assembly length is based on the jointing layout. See PV-101, sheet 8.
28. Ensure dowel basket assembly centerline is within 2 inches of the intended joint location longitudinally and has no more than 1/4 inch horizontal skew from end of basket to end of basket.
29. Clip and remove center portion of tie during field assembly.
30. 1/4 inch diameter wire.
FIGURE 7010.101

OPTIONAL LEG SHAPES

ANCHOR PIN

Anchor Pin #1/0 Gauge Wire (0.306" diameter)

2"

1" min.

12" min.

45°

PLACEMENT LIMITS

(Rural Section)

LONGITUDINAL JOINT

EDGE OF PAVEMENT

TOP OF PAVEMENT

PLACEMENT LIMITS

(Curb and Gutter - Gutterline Jointing)

Centerline Joint

Gutterline Joint

6"

PLACEMENT LIMITS

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

1/4 or 1/3 Point Longitudinal Joint

1/4 or 1/3 Point Anchoring Joint

Back of Curb

BEND AROUND DOWEL

D + 1/8" max.

DOWEL ASSEMBLIES

1. 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.

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

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

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

5. For uniform lane widths: 3 to 6 inches. For taper and variable width pavements: 3 to 12 inches.
**FIGURE 10.02**

**BEAM CURB**

- For short replacement sections, match existing curb profile.

**DROP CURB AT SIDEWALK**

- $1\frac{1}{2}$" (max.)
- Back of Curb
- Gutterline
- Level Line
- Slope as per plans

**DRIVEWAY DROP CURB**

- (Iowa Department of Transportation is not the Contracting Authority)

- $\frac{1}{2}$" to 3" (as specified)
- Slope as per plans
- Varies

**CURB AND GUTTER UNIT**

- 2'-6" (or as specified)
- Slope as per plans

**FOR JOINT DETAILS, SEE PV-101.**

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.

**SHEET 1 OF 2**

**REVISIONS:** Split DRIVEWAY DROP CURB detail into two details. Added new circle note 4 on Sheet 1. Renumbered circle note on Sheet 5.
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.

JOINTING DIAGRAM FOR CURB AND GUTTER UNIT

15' Normal

Curb and Gutter
Proposed Pavement
Curb and Gutter

CURB RUNOUT FOR ALL CURBS

Any Curb 5'-0" Transition No Curb

CURB TRANSITION FROM 6" STANDARD TO 6" SLOPED

6" Standard 5'-0" Transition 6" SLOPED

CURB TRANSITION FROM 6" SLOPED TO 4" SLOPED

6" 5'-0" Transition 4" Sloped

CURB TRANSITION FROM 6" STANDARD TO 4" SLOPED

6" Standard 5'-0" Transition 4" Sloped
**MANHOLE BOXOUTS IN PCC PAVEMENT**

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). 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.

6. 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.

**AT JOINT INTERSECTION**

**OFFSET AT JOINT INTERSECTION**

**CIRCULAR**

**AT A SINGLE JOINT**
1. For details of paved median, see contract documents.

2. 'EE' Joint. Expansion joints located at the end of normal curb.

3. 'E' Joint. If median is paved, place expansion joints at the end of normal curb.

4. If boxout length is less than or equal to 12 feet, provide 'RD' joint.

5. Special shaping of curb.

6. Quantities for ramped median nose area is included in roadway pavement quantities.

7. When X or Y is 4 feet or greater the expansion joints will be at the beginning of the rounded median.

\[ W = \text{Width from back of curb to back of curb} \]

\[ X = \frac{W}{2} + 7.5'' \]

\[ Y = \frac{W}{2} + 12'' \]

DETAIL A

SECTION A-A

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

(PCC) or 'CD' Joint

Existing 'C'

Existing Expansion
Joint (PCC)

Cracks

No Joint

Less than 5'

Minimum 5'

Maximum 20'

Possible Curb

PCC Widening

Existing Pavement

Possible Curb

Cut joints opposite existing joints first, then make intermediate cuts.
TRANSVERSE JOINT REQUIREMENTS

<table>
<thead>
<tr>
<th>Pavement Thickness</th>
<th>Transverse Joint Type</th>
<th>Transverse Joint Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>C</td>
<td>12'</td>
</tr>
<tr>
<td>7&quot;</td>
<td>C</td>
<td>15'</td>
</tr>
<tr>
<td>8&quot;</td>
<td>CD</td>
<td>15'</td>
</tr>
<tr>
<td>9&quot;</td>
<td>CD</td>
<td>15'</td>
</tr>
<tr>
<td>≥10&quot;</td>
<td>CD</td>
<td>17'</td>
</tr>
</tbody>
</table>

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.
Widening Width as Specified

1'-0" or as Specified

Cross Slope as Specified

Integral Curb as Specified. See Figure 7010.102.

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.
If applicable, terminate curb in approach.

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

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.

HMA full depth patch per Section 7040.

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.
THIRD POINT JOINTING

See Detail A

See Detail B

See Detail C
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.

DOWEL BAR DETAIL

LANDSCAPE MEDIAN

Possible Overlay

Existing Pavement

Surface

Removal Line

Existing Pavement

New Pavement

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

Typical Half Section with Existing Pavement

Typical Half Section with New Pavement

Grass or Landscaping (as specified)

4% Cross Slope (or as specified)

Width of island as specified in the contract documents.

Doweling MEDIAN

Width of island as specified in the contract documents.

Concrete

Mill existing pavement 1/2".

Cross slope as specified.

1 1/2" typ.

10"

4" #4 Deformed Bar

#4 Deformed Bar

Seal all joints.

joints with 1 inch expansion material.

the Engineer. Construct expansion

pattern of the existing pavement.

Spacing of 15'. Match the joint

Document.

Document.

surface

Document.

Document.

Document.
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 - Back of Curb to Back of Curb

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 PAVEMENT SECTION
(With New Curb and Gutter)

Do not disturb parking.

Existing Curb and Gutter

HMA Surface Course
HMA Intermediate Course
HMA Base Course

HMA Surface Course
HMA Intermediate Course
HMA Base Course

Compacted Subgrade or Subbase

Width - Back of Curb to Back of Curb

HMA PAVEMENT (With Existing Curb and Gutter)

HMA PAVEMENT SECTION

Existing Curb and Gutter

Do not disturb parking.

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

**TYPICAL CROSS-SECTION**

- 15' nominal width for the base layers.
- 10' nominal width for the 'C' joints.
- 31' Back to Back for the curb and gutter.
- 26' Back to Back for the curb and gutter.

**HMA Pavement**

- "C" Joints

**Standard PCC Curb and Gutter**

**FIGURE 7020.901**

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

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

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

### MINIMUM FILLET WIDTH

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

- Begin Station
- Length of Leveling Course
- Station Progress
- End Station
- Proposed Overlay
- Surface Material
- Runout Ahead
- Runout Back
- "Existing Pavement"

**TYPICAL STRENGTHENING COURSE**

- Begin Station
- End Station
- Runout Back
- Length of Leveling Course
- Runout Ahead
- Proposed Overlay
- Strengthening Thickness
- (Surface Material)
- "Existing Pavement"

**WEDGE SHAPED RUNOUT**

(When Milling is not Specified)

- Location Station
- Surface Course
- Runout Length
- Width
- Mill runout. Match surface course thickness.
- Mill edge. Match surface course thickness.
- "Existing Pavement"

**MILLED SURFACE NOTCH FOR RUNOUT**

- Location Station
- Surface Course
- Runout Length
- Resurfacing Thickness
- "Existing Pavement"

**GUTTERLINE EDGE - MATCH**

- Surface Course
- Sand Seal
- "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>

**SINGLE COURSE RESURFACING**

- Width
- "Existing Pavement"

**GUTTERLINE EDGE - NOTCH**

- Surface Course
- Width (as specified)
- Mill edge. Match surface course thickness.
- "Existing Pavement"
1. Driveway radius (R).
   Residential: 10 foot minimum, 15 foot maximum.
   Commercial and industrial: As specified in the contract documents.

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

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

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

5. Center reinforcing bar vertically in the pavement.

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

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

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

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

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

11. 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 8 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 roadway. 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.
Width Varies

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

1. Parking Slope:
   - If parking width is less than 10 feet wide, slope at 1/4 inch per foot.
   - If parking width is 10 feet wide and greater, slope at 1/2 inch per foot.

TYPICAL FILL SECTION

1. Parking Slope:
   - If parking width is less than 10 feet wide, slope at 1/4 inch per foot.
   - If parking width is 10 feet wide and greater, slope at 1/2 inch per foot.
CLASS A SIDEWALK
(Sidewalk extends from back of curb to ROW)

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 ¼ inch per foot.
   - If parking width is 10 feet wide and greater, slope at ½ inch per foot.
   - Special grade may be specified in the contract documents.

W = Sidewalk width as specified in the contract documents.

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.
Finish Grade

as specified for concrete sidewalk.

Construct joint for concrete base

" max Radius

Refer to Detail A

Weep Hole

Pavement Base

Cover weep hole with engineering fabric.

Weep Hole

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.

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

BRICK/PAVER SIDEWALK WITH PAVEMENT BASE

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

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.

BRICK/PAVER SIDEWALK WITH PAVEMENT BASE

BRICK/PAVER SIDEWALK
Curb ramp requirements:
1. Maximum curb ramp slope of 8.3%, or
2. Minimum length of 15'-0" at any constant slope

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

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

Match pedestrian street crossing slope, or flatter.

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

Target cross slope of 1.5% with a maximum cross slope of 2.0%.
**TYPICAL SECTION - CURB RAMP**

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

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

**Detectable Warning**
- 24" Wide (min.)
- Location varies

**Possible Crossing Arm**
- Location varies

**Level Line**
- Gutterline

**Back of Curb**

**GENERAL SIDEWALK AND CURB RAMP DETAILS**

1. Provide a minimum 2 foot width of detectable warning surfaces in the direction of pedestrian travel across the full width of the curb ramp or turning space, exclusive of curbs or flares.

2. Provide a minimum of 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.

5. If crossing gate conflicts with location of detectable warning or if pedestrian crossing gate is provided, place detectable warning panel in advance of the crossing gate.

6. Locate front edge of detectable warning panel 12 to 15 feet from centerline of nearest rail. Orient truncated domes parallel to the direction of pedestrian travel.
1. **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.
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.

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

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

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

Match pedestrian street crossing cross slope or flatter.

Key

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

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

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

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

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

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

**Key**

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

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. If subgrade or subbase material is required below patch, bring material to a level 2 inches below bottom of existing pavement.
4. BT, KT, or L joint depending on pavement thickness and pouring sequence.

**GUTTERLINE JOINTING**

- **One Panel Width Patch with Opposing Joint**
  - 15'-0" max.
  - 6'-0" min.
  - 'B' Joint
  - 'RD' Joint

- **One Panel Width Patch No Opposing Joint**
  - 15'-0" max.
  - 6'-0" min.
  - 'B' Joint
  - 'RD' Joint

- **Full Roadway Width Patch**
  - 15'-0" max.
  - 6'-0" min.
  - 'B' Joint
  - 'RD' Joint

**THIRD POINT JOINTING**

- **Outside Panel Patch with Opposing Joint**
  - 15'-0" max.
  - 6'-0" min.
  - 'B' Joint
  - 'RD' Joint

- **Center Panel Patch with Opposing Joints**
  - 15'-0" max.
  - 6'-0" min.
  - 'B' Joint
  - 'RD' Joint

**LONGITUDINAL SECTION**

- **THRU PCC PATCH**
  - Dowel or Tie Bars
  - Curb
  - T/2
  - T+2" (typ.)

**FIGURE 7040.101**

SUDAS Standard Specifications

FULL DEPTH PCC PATCHES
LESS THAN OR EQUAL TO 15' LONG
### Gutterline Jointing

Existing Pavement

- **BT** Joint
- **RT** Joint

**ONE PANEL WIDTH PATCH**

- **RD** Joint
- **RD** Joint

**FULL ROADWAY WIDTH PATCH**

- **RD** Joint
- **RD** Joint

### Third Point Jointing

Existing Pavement

- **BT** Joint
- **RT** Joint

**OUTSIDE PANEL PATCH**

- **RD** Joint
- **RD** Joint

**CENTER PANEL PATCH**

- **RD** Joint
- **RD** Joint

**FULL ROADWAY WIDTH PATCH**

- **RD** Joint
- **RD** Joint

### Longitudinal Section

**THRU PCC PATCH**

- **RD** Joint
- **RD** Joint

- **CT** Joint

**Existing Pavement**

- **Dowel or Tie Bars**

- **Existing Curb**

- **T + 2" (typ.)**

**SUDAS Standard Specifications**

**FIGURE 7040.102**

---

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 'CO' 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.

---

**GREATER THAN 15' LONG**

**SUDAS 7040.102**

**SHEET 1 OF 1**
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.

FIGURE 7040.103

HMA PATCHES

- Existing HMA Pavement
- Possible PCC Curb and Gutter
- All patches are full lane width.
- 10'-0" min. Between Patches

LONGITUDINAL SECTION THRU HMA PATCH

- 1 1/2" to 2" Surface Course
- T+2" (typ.) Existing Pavement

- T
- T

+2" (typ.)

- 2

SUDAS Standard Specifications

FULL DEPTH HMA PATCHES
PARTIAL DEPTH PATCHES

PCC PATCH ACROSS JOINT

SECTION A-A
(Order 1: Sawed Edges)

Existing Joint or Crack

Initial Saw Cut

Existing PCC Pavement

PCC PATCH ABUTTING JOINT

SECTION B-B

Existing Joint or Crack

Initial Saw Cut

Existing PCC Pavement

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.

SUDAS Standard Specifications
PLAN VIEW
(Flowable mortar cutoff wall and cross run location.)

FLOWABLE MORTAR CUTOFF WALL
(Without Sewer)

SECTION A-A
(Flowable mortar cutoff wall and storm sewer)

DISTANCE FROM C
INTAKE TO C CROSSRUN

<table>
<thead>
<tr>
<th>Size</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot; RCP</td>
<td>0.7&quot;</td>
</tr>
<tr>
<td>15&quot; CMP</td>
<td>0.8&quot;</td>
</tr>
<tr>
<td>18&quot; RCP</td>
<td>0.5&quot;</td>
</tr>
<tr>
<td>18&quot; CMP</td>
<td>0.7&quot;</td>
</tr>
</tbody>
</table>

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.

1/2 of concrete pavement depth

Place chair parallel to surface

Transverse Contraction Joint or Crack

1/2" min. saw cut. 1 1/2" deep saw cut.
For pedestrian ramps damaged by subsurface utility exploration (SUE) core holes, replace the entire ramp according to Section 7030. For pavements damaged by SUE core holes, provide patches according to Figures 7040.101 or 7040.103. If allowed by the Engineer, repair core holes as shown.

1. Fill vacuum excavated SUE hole with CLSM to an elevation within 2 inches of the bottom of the pavement.
2. When allowed by the Engineer, fill utility verification hole with Class I bedding stone, pea gravel, or suitable native materials. Place backfill materials in 4 inch maximum lifts and compact each lift.
3. For PCC core hole repairs, drill four, 5 inch long, 5/8 inch diameter holes into the sides of the core hole at a 30 to 45 degree angle. Grout four 8 inch long #4 reinforcing bars into holes. Fill core holes with low slump concrete, tamp to remove air voids, screed level with existing pavement and texture to match existing pavement.
4. For asphalt core hole repairs, place asphalt mixture in 2 inch lifts and compact. If allowed by the Engineer, replace core with low slump concrete as noted above or pre-mixed high performance cold mix generally meeting the asphalt mixture specified. Match elevation of existing pavement.
5. When allowed by the Engineer, the removed core may be replaced back in the core hole. If the removed core is intact, stable, and free of fractures, replace core back in hole and fill annular space with approved bonding material.
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.

- Slope subgrade as specified.
- Install 6" perforated underdrain laterals and filter material when specified.
- Place engineering fabric over subgrade and up sides of excavation.
- Place filter aggregate around underdrain.
- Set 1/4" below pavers.
- Possible PCC curb and gutter or adjacent pavement.
Refer to the contract documents for dimensions, grades, and additional requirements for permeable interlocking pavers and associated improvements.

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

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

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

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

Alley Width (as specified)

2'-0" 0% Slope

Permeable Pavers

Bedding Aggregate 2

Permeable Pavers 1

2'-0" 2% Slope

6" PCC Edge Restraint

4" Layer of Filter Aggregate

Storage Aggregate 3

Slope subgrade at 1%.

Install 6" perforated underdrain collector.

Place filter aggregate around underdrain.

Place engineering fabric over subgrade and up sides of excavation.

Permeable Pavers

6" PCC Edge Restraint

4" Layer of Filter Aggregate

Storage Aggregate 3
FIGURE 7092.101

OVERLAY DETAIL

- Joint Crack Control (if specified)
- Crack and Seat Between Full Depth Sawcuts
- Asphalt Overlay
- Joint Crack Control (if specified)
- Full Depth Sawcut Before Crack and Seat
- Use a leveling course to fill in settled areas.

OVERLAY WITH CRACK AND SEAT

REMOVAL OF EXISTING ASPHALT

- Remove overlays and large patches before cracking PCC pavement.
- Remove partial depth patches exceeding 4 feet longitudinally, unsound patches, or as marked.

Existing Driveway

Joint Crack Control

Full Depth Sawcut

Before Crack and Seat

PCC pavement.
FIGURE 8010.101

CABINET FOOTING

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.

SUDAS Standard Specifications
FIGURE 8010.102

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>
<tr>
<td>35'-0&quot;</td>
<td>3'-0&quot;</td>
<td>12'-0&quot;</td>
<td>12</td>
</tr>
<tr>
<td>45'-0&quot;</td>
<td>3'-0&quot;</td>
<td>14'-0&quot;</td>
<td>12</td>
</tr>
<tr>
<td>55'-0&quot;</td>
<td>3'-0&quot;</td>
<td>16'-0&quot;</td>
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<td>90'-0&quot;</td>
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<td>22'-0&quot;</td>
<td>16</td>
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<tr>
<td>100'-0&quot;</td>
<td>4'-0&quot;</td>
<td>24'-0&quot;</td>
<td>18</td>
</tr>
</tbody>
</table>

SHEET 1 OF 4

TRAFFIC SIGNAL POLE FOUNDATION

SUDAS
KOWADOT

FIGURE 8010.102

STANDARD ROAD PLAN

TRAFFIC SIGNAL POLE FOUNDATION
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.
8. #6 Ties
9. #8 Vertical Bars
10. Conduits
11. #8 Ties
12. Anchor Bolts
13. Ground Rod Clamp
14. 2'-0" Min.
15. 3'-0" Min.
16. 1'-0" Min.
17. 12" Centers
18. #6 Bars at 12" Centers
19. #6 Ties
20. Ground Wire Duct
21. 1" Dia.
22. Pedestal
23. 3" Clear
24. 4" (typ.)
25. 2" Typ.
26. 2'-0" Min.
27. 9'-0" x 9'-0" Base
28. #4 Bars at Equal Spaces (typ. all sides)
29. Rock
30. #8 Vertical Bars
31. 3'-0" Min.
32. 3" Clear Cover (Typ.)
33. 1'-10" min
34. 1" Chamfer 4" (typ.)
35. Finished Ground Line
36. 6'' Min.
37. 3''
38. 1'' Chamfer
39. Rock
40. 2'-0" Min.
41. 3'-0" Max.
42. Ground Wire Duct
43. 2'-0" Min.
44. 1'-0" Min.
45. 12" Centers
46. #6 Bars at 12" Centers (both ways)
47. Ground Rod Clamp
48. 1" Dia.
49. #6 Ties
50. Anchor Bolts
51. Conduits
52. 2'-0" Min.
53. 3'-0" Max.
54. 2" Typ.
55. Pedestal
56. 6"
FIGURE 8010.102
SHEET 3 OF 4

**TRAFFIC SIGNAL POLE FOUNDATION**

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.

**DETAIL 'A'**

- Shape top 11 inches with forms. See Detail 'A'.
- Install rodent guard or non-shrink grout with weep hole.
- Furnish nut, nut and plate, or nut and anchor bolt assembly ring plate on embedded end.
- Provide conduits as per plans.
- When in contact with rock, place ground rods as specified in National Electrical Code, current edition, adjacent to foundation or in adjacent handhole.

### MAST ARM POLE FOUNDATION IN ROCK

**TYPE C FOUNDATION**

- Use the Type A Foundation Soil parameters.

Conditions not meeting minimum requirements will require site specific designs or shall use the Type A Foundation Soil parameters.

**Foundations**

- **V** Bars
- Tie Bars

<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>35'-0&quot;</td>
<td>3'-0&quot;</td>
<td>12'-0&quot;</td>
<td>4'-6&quot;</td>
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<tr>
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<td>3'-0&quot;</td>
<td>14'-0&quot;</td>
<td>4'-6&quot;</td>
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<td>6'-0&quot;</td>
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<tr>
<td>100'-0&quot;</td>
<td>3'-0&quot;</td>
<td>24'-0&quot;</td>
<td>6'-0&quot;</td>
</tr>
</tbody>
</table>

**NOTES**

- *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 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 field specific designs or shall use the Type A Foundation Soil parameters.*
PEDESTAL POLE FOUNDATION IN SOIL OR ROCK

1. Shape top 11 inches with forms. See Detail 'A'.
2. Install rodent guard or non-shrink grout with weep hole.
3. 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. 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.

ALTERNATE PUSH BUTTON POLE SIDEWALK MOUNTING

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. 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.

Finishing Pavement Grade

2'-0" min. diameter

1" to 3"

2'-0" dia.

Finished Pavement Grade

Cable Hooks (4) Required

1"

Extend 8" granular base 6" beyond walls of handhole.

2'-0" min.

2'-0" min. diameter

HDPE Frame

Composite Lid

Potential conduit entry through bottom of handhole.
PRECAST CONCRETE COMPOSITE 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>
</tbody>
</table>
| IV   | 48"| 30"| 36"

CONDUIT IN TRENCH

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.
3. Compact Backfill Material
4. Ensure backfill material is free of cinders, concrete, or other rubble.
5. Conduit Depth
6. 4" min. Trench

Conduit Entry Through Side of Handhole

Cable Hooks (4) Required

Extend granular base 8" beyond walls of handhole.

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.

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

Steel Bolt
Stainless
Surface
Pull Slot
Two Piece Lid (Type IV)

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REVISION
04-19-22
SHEET 2 of 2

CONDUIT AND PRECAST HANDHOLES

Added option for conduit to enter through the bottom of handhole.

Extend granular base 8" beyond walls of handhole.

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.

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

Steel Bolt
Stainless
Surface
Pull Slot
Two Piece Lid (Type IV)

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SHEET 2 of 2

CONDUIT AND PRECAST HANDHOLES

Added option for conduit to enter through the bottom of handhole.

Extend granular base 8" beyond walls of handhole.

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.
Length (L) as specified in the contract documents.

Continuous loop leads to handhole.

SECTION A-A

RECTANGULAR DETECTOR LOOP

Pavement

Handhole

Conduit

Loop Saw Cut

Loop Wire

Sealant

3/8" 2"

Traffic Flow

To Handhole

6'-0"

Typ.

1'-0"

CURB

Pavement

12"

Shoulder

1" to 3"

Handhole

Conduit

Loop Saw Cut

Continuous loop leads to handhole.

NO CURB

Pavement

Handhole

Conduit

Loop Saw Cut

Continuous loop leads to handhole.

1" to 3"
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

- Sealant
- Loop Wire

2"  2'-0"  2'-0"  2'-0"  4'-0"  4'-0"
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>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.</td>
</tr>
<tr>
<td>4</td>
<td>Possible video camera location.</td>
</tr>
<tr>
<td>5</td>
<td>Possible EVP detector.</td>
</tr>
<tr>
<td>6</td>
<td>Pole cap if no luminaire extension.</td>
</tr>
</tbody>
</table>

**STEEL MAST ARM POLE**

- **Mast Arm Length**
- **Luminaire Arm Length**
- **Mounting Height**
- **Backplates**
- **Handhole**
- **Minimum 4"X6"**
- **Luminaire**
- **Fixed or Universally Adjustable Mounting Brackets**
- **Pedestrian Push Button and Sign**
- **3'-6" Above Sidewalk**

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.
PEDESTAL POLE DETAILS

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

For signal head visibility and possible pedestrian head installation.

SUDAS Standard Specifications
5% of Span
Sag Distance:
Sidewalk
Roadway
Wire Clamp
Cable as Required
Multi-Conductor
Tether
Bottom Signal
and Backplates
Signal Heads
Conduit Entry Cap
Eye Angle Bolt
Galvanized
Thimble
Eye Nut
Galvanized Thimble
Eye Angle Bolt
Messenger Wire; 7 Strand
(Utilities Grade)
Pole or Pad Mounted
Controller Cabinet
Guy Guard
Anchor
Ground Wire
Ground Rod
1 5'-0" min.
M U T C D
1 6' min.
5'-0" to 3'-0"

Possible video camera location.
Possible EVP detector location.

Galvanized
Guy Connector
End Fitting
Galvanized
Post Plate

2.5" Galvanized
Steel Pipe

Cable Straps

Multi-Conductor
Cable as Required

W O O D P O L E

Class 4 Wood Pole
### General Information

**Temporary Traffic Control**

- **Flagger** (facing left)
- **Sign**
- **Drum**
- **Advance Warning Area**
  - Tells traffic what to expect ahead
  - Moves traffic out of its normal path
- **Transition Area**
  - Provides protection for traffic and workers
- **Activity Area**
  - Where work takes place
  - For workers, equipment, and material storage
- **Work Space**
  - Longitudinal
  - Buffer space
- **Shoulder Taper**
- **Buffer Space** (lateral)
  - Provides protection for traffic and workers
- **Buffer Space** (longitudinal)
  - Allows traffic to pass through the activity area
- **Termination Area**
  - lets traffic resume normal operations
- **Downstream Taper**

#### Figures

- **FIGURE 8030.101**
  - Distance Between Signs
    - **Speed Limit (mph)**: A
      - 20-25: 100
      - 30-40: 250
      - 45-50: 350
      - 55: 500
  - **Distance Between Signs**
    - **Channelizing Device Spacing**
      - **Direction of Traffic**
        - **Shadow Vehicle**
        - **Sign (shown facing left)**
        - **Channelizing Device**
      - **Taper**
        - Downstream
  - **Merging Taper Lengths for Lane Closure**
    - **Speed Limit (mph)**: 30
      - 20: 80
      - 25: 125
      - 30: 180
      - 35: 245
      - 40: 320
      - 45: 640
      - 50: 600
      - 55: 660
    - **Number of Devices**:
      - 6: 7
      - 13

#### Key

- **Arrow Board**
- **Safety Fence**
- **Shadow Vehicle**
- **Sign (shown facing left)**
- **Channelizing Device**
- **Type III Barricade**
- **Work Space**
- **Work Vehicle**
- **Pedestrian Channelizing Device**
- **Vehicle Warning Light** (amber, high-intensity rotating, flashing, oscillating, or strobe light)

*Applies to all Section 8030 figures*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

May be used for overnight closures. During non-working hours remove materials, equipment, or stockpiled waste and fill or cover excavations.
A second flagger may be required when the flagger’s view of approaching traffic in the open lane is less than \( \frac{1}{4} \) 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:

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.

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 8030.101 for symbol key and sign spacing.

FIGURE 8030.106

SUDAS Standard Specifications

LANE CLOSURE ON TWO-LANE ROAD USING TWO FLAGGERS
Flagger Notes:

The railroad company may require railroad-supplied flaggers.

Coordinate with railroad company early, before work starts.

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

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

Refer to Figure 8030.101 for symbol key and sign spacing.

Flagger Notes:

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

Cones may be used as channelizing devices during daylight hours.

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

Refer to Figure 8030.101 for symbol key and sign spacing.
FIGURE 8030.109

SUDAS Standard Specifications

TRAFFIC CONTROL FOR CLOSURE
OF CONTINUOUS LEFT TURN LANE

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

- CRACK SEALING
- FRESH OIL
- WET PAINT

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Refer to Figure 8030.101 for symbol key and sign spacing.

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. Install root flare at or slightly above grade. Do not place mulch within 6 inches of trunk.
4. Do not place mulch within 6 inches of trunk.
PLANTING PIT
(Balled and Burlapped Plants)

3 Times Root Ball Diameter

Place rootball on undisturbed soil.

3" Deep Mulch

Form 3" deep saucer.

Scarify sides of pit.

Finished Grade

Depth of Root Ball or Container Root System

Existing Grade

Mound finished grade to cover portion of rootball above grade.

3 Times Root Ball Diameter

Place rootball on undisturbed soil.

PLANTING PIT
(Balled and Burlapped Plants on Poorly Drained Soils)

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.

3" Deep Mulch

Form 3" deep saucer.

Scarify sides of pit.

Finished Grade

Depth of Root Ball or Container Root System

3 Times Root Ball Diameter

Place rootball on undisturbed soil.
FIGURE 9030.102  SHEET 1 OF 2

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

Planting Pit per Figure 9030.101

Steel Post

Flagging Material

Trunk Support Strapping

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

STAKING

Place one stake to southwest.

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

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

(1) Protect trunk from ground line to first branch when specified in the contract documents.
GUYING PLAN

1. **Trunk Support Strapping**
   - Material: Flagging
   - Location: 1/3 to 1/2 Tree Height

2. **Restraint System**
   - Material: Cable or Manufactured
   - Location: Planting Pit

3. **Earth Anchor**
   - Location: 1/3 Tree Height

4. **Planting Pit**
   - Material: per Figure 9030.101

5. **GUYING PLAN**
   - Place one anchor to the southwest.

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

**MINIMUM COMPOST BLANKET THICKNESS**

<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.

*Figures 9040.102 (for perimeter control along street)*

Water Flow

(600'-0" if slope is flatter than 5%)

20'-0" max. length per section

3'-0" min. overlap

Stakes (typ.)

Area to be Protected

Direction of Flow

Disturbed Area

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

Place berm or sock perpendicular to slope.

**PLAN VIEW OF SLOPE**
(for sediment and slope control)

**SECTION VIEW AT STREET**
(for perimeter control along street)

**FILTER BERM**

**FILTER 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 9040.104

Anchor Slot

Longitudinal Slot

Edge Lap

Staple Check

End Lap

Flow

8" max.

STAPLE CHECK

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

Flow

8" max.

END LAP

Compacted Soil Backfill

Flow

12" min.

6" min.

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

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

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

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

Flow
Disturbed Area

Protected Area to be as specified in the contract documents.

Wattle

Direction of Flow

2-4" Trench

Compact trench spoil against uphill side of wattle.

9" (nominal) dia. or as specified.

4'-0" max.

WATTLE

Area to be Protected

Joint Wrap

Space as specified in the contract documents.

Turn uphill.

Stakes

Compact trench spoil against uphill side of wattle.

2-4" Trench

3'-0"

4'-0" max.

SUDAS Standard Specifications
FIGURE 9040.106
SHEET 1 OF 1

Crest

Ditch Slope, s, ft./ft.

h/s

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

Crest

Ditch Slope, s, ft./ft.

h/s

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

Top of Fence

Steel Post

h

(24" typ.)

Silt Fence

Ditch Slope, s, ft./ft.

SILT FENCE CHECK DAM (DITCH CHECK)
(See Figure 9040.119 for installation of Silt Fence Ditch Checks.)
FIGURE 9040.107

SUDAS Standard Specifications

ROCK CHECK DAM

Top of Bank

Crest

6" min.

A

6" min.

A

A

A

6" min.

Engineering Fabric

Engineering Fabric

DITCH CROSS-SECTION

SECTION A-A
Diversion Types 1, 2, and 3 may be used interchangeably unless otherwise specified in the contract documents.

Alternate configurations may be used upon approval from the Engineer.

Total height of diversion (swale and berm): 18 inch minimum or as specified.
Flow depth as specified, 6" min. Excavate depression to slope or flatter. Last 20'-0" of diversion at 1% slope or flatter.

Excavated Depression - Grade = 0%

Possible Diversion

Stable Outlet

Elevate top of spreader 1" above ground.

Level top of spreader.

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

6'-0" min.

Excavate depression to depth as specified, 6" min.

LEVEL SPREADER

PERSPECTIVE VIEW

CROSS-SECTION
**FIGURE 9040.110**

**SHEET 1 OF 1**

**Section A-A**

- **Pipe Diameter, D**
- **3D**
- **Tie of Slope**
- **Length, L**
- **Width, W**
- **Stable Ground**
- **Footing for Apron**
- **Thicknss, T**
- **Slope = 0%**
- **Construct notch at end of apron. Depth = 2T**
- **Engineering Fabric**

**PLAN**

**PROFILE**
Section A-A
SLOPE DRAIN ANCHORING OPTIONS
(Options A, B, and C are interchangeable unless otherwise specified in the contract documents)

OPTION A
Pipe Apron

12" min. cover.

2'-0" min.

Carefully compact diversion structure around pipe.

2:1 typ.

Secure pipe with method shown below.

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

OPTION C
Bury pipe to springline.

(May also be combined with options A or B)

Place and compact fill along sides of pipe.

D
1
1

Varies

Pipe Apron
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.
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.

1,800 CF/Acre
"Dry" Storage

1,800 CF/Acre
"Wet" Storage

Design High Water

Overflow Elevation

Principal Spillway

Top of Embankment

Emergency Spillway

Barrel

Dewatering Orifice

Bottom of Basin

Anti-seep collars (required only when specified in the contract documents)
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.
Orient top stiffener (if required) perpendicular to corrugations and weld to top.

Pressure Relief Holes 1/2" Dia.

Support Bars

Tack weld top to cylinder.

Leave top of riser open.

12" Spacer Bar (#6 bar min.)

Leave bottom of cylinder open.

Riser Diameter (as specified)

Support Bar (#6 bar min.)

Cylinder

Welded

Top

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.
### MINIMUM TOP

<table>
<thead>
<tr>
<th>RISER Diameter (in.)</th>
<th>CYLINDER Diameter (in.)</th>
<th>Thickness (gage)</th>
<th>Height (H) (in.)</th>
<th>Minimum Size Support Bar</th>
<th>Thickness</th>
<th>Stiffener</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>18</td>
<td>16</td>
<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>
</tr>
<tr>
<td>15</td>
<td>21</td>
<td>16</td>
<td>7</td>
<td>#6 rebar or 1 1/2&quot; X 3/16&quot; angle</td>
<td>16 ga F &amp; C</td>
<td>---</td>
</tr>
<tr>
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<td>27</td>
<td>16</td>
<td>8</td>
<td>#6 rebar or 1 1/2&quot; X 3/16&quot; angle</td>
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<td>16 ga (C), 14 ga (F)</td>
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<tr>
<td>24</td>
<td>36</td>
<td>16</td>
<td>13</td>
<td>#6 rebar or 1 1/2&quot; X 3/16&quot; angle</td>
<td>16 ga (C), 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), 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), 12 ga (F)</td>
<td>---</td>
</tr>
<tr>
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<td>16</td>
<td>19</td>
<td>#8 rebar</td>
<td>14 ga (C), 12 ga (F)</td>
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<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), 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), 10 ga (F)</td>
<td>---</td>
</tr>
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<td>60</td>
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<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), 8 ga (F)</td>
<td>---</td>
</tr>
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<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), 8 ga (F)</td>
<td>2&quot; X 2&quot; X 1/4&quot; angle</td>
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<td>102</td>
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<td>36</td>
<td>2&quot; pipe or 2&quot; X 2&quot; X 1/4&quot; angle</td>
<td>12 ga (C), 8 ga (F)</td>
<td>2 1/2&quot; X 2 1/2&quot; X 1/4&quot; angle</td>
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<td>2 1/2&quot; pipe or 2&quot; X 2&quot; X 1/4&quot; angle</td>
<td>12 ga (C), 8 ga (F)</td>
<td>2 1/2&quot; X 2 1/2&quot; X 1/4&quot; angle</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), 8 ga (F)</td>
<td>2 1/2&quot; X 2 1/2&quot; X 5/16&quot; angle</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.
Anti-seep collars are not required unless specified in the contract documents.

**CONCRETE COLLAR**

- Use side wall and bottom of trench as form.
- Collar Width = barrel dia. + 4'-0".
- Continuous weld between band and collar.
- 1/2" X 2" slotted holes for 3/8" dia. bolts.
- Slotted holes @ 8" o. c.

**CMP COLLAR**

- Collar Width = barrel dia. + 4'-0"
- Top of Band
- Bottom of Band
- Bottom of Collar
- Continuous weld between band and collar.
- Corrugated metal sheet welded to center of band.
- #4's @ 12" o. c. each direction.

**SECTION A-A**

- Use side wall and bottom of trench as form.
- Collar Width = barrel dia. + 4'-0"
- Continuous weld between band and collar.
- 1/2" X 2" slotted holes for 3/8" dia. bolts.
- Slotted holes @ 8" o. c.

**SECTION B-B**

- Continuous weld between band and collar.
- 12" min.
- Corrugated metal sheet welded to center of band.
Width (W) as specified

Spillway Length (L)
(see table)

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

Erosion Stone

Engineering Fabric

Impervious Earth Fill
(as required)

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

### Table: 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>
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<tr>
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<td>2.5</td>
</tr>
<tr>
<td>3.0</td>
<td>2.5</td>
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<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>5.0</td>
<td>4.5</td>
</tr>
</tbody>
</table>
1. Insert 12 inches of fabric a minimum of 6 inches deep (fabric may be folded below the ground line).

TYPICAL SILT FENCE DITCH CHECK

ATTACHMENT TO POST

Fabric

Wire or Cable Ties

Post

Foreslope

Backslope

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

Post Spacing (5'-0" max.)

2" min.

20" min.

Post Spacing (5'-0" max.)
FIGURE 9040.119
SHEET 2 OF 2

TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Plan View)

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

Install parallel to ground contour.

Install "J-hook" at each end of an individual section of silt fence.

Ground Contours

See plans for spacing.

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

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.

DETAILS OF SILT FENCE ON LONGITUDINAL SLOPES

Gound Line

Fabric

Flow

TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Profile View)

TYPICAL SILT FENCE INSTALLATION ON LONGITUDINAL SLOPES
(Plan View)
Entrance length: 50 foot minimum (30 foot for single family residential), or as specified in the contract documents. Length of entrance may be increased if sediment track-out occurs.

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

CONNECTING WIRE LOCATION

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.

---

**FENCE POST FOOTING DEPTH AND DIAMETER**

<table>
<thead>
<tr>
<th>FENCE HEIGHT</th>
<th>USE IN FENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4'-0&quot; and less</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Line and Brace Posts</td>
<td>0'-8&quot;</td>
</tr>
<tr>
<td>Terminal Post*</td>
<td>0'-10&quot;</td>
</tr>
</tbody>
</table>

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

---

**PLAN OF FENCE**

- Property Side
- R.O.W. Line
- Footing
- Fencing
- Posts
- Roadway Side
- Approx. 12"
**Ground Rod Installation**

- Wire tie or clamp spaced at 12" max. centers.
- Provide knuckled selvedge at top and bottom of fence fabric.

**Brace Post Assembly**

- Clamps to top rail.
- Connect twice to fence fabric.
- Clamp to ground wire to ground rod.

**Rail Sleeve**

- For every third sleeve, provide spring-loaded expansion type.

**Brace Rail**

- Brace rail clamp.
- Ground wire.
- Clamps to bottom tension wire.

**Top Rail**

- Tightening device: Turnbuckle or Truss Rod Clamp.
- Attach at approximately 12" intervals.

**Ground Line**

- Approximately 1".
- Encasement: Concrete or End Post Angle, Corner, or End Post.
- For every third sleeve, provide knuckled selvedge (see detail).

**BRACE POST ASSEMBLY**

- Provide knuckled selvedge at top and bottom of fence fabric.
- Wire tie or clamp spaced at 12" max. centers.

**Ground Rod**

- For every third sleeve, provide spring-loaded expansion type.

**Rail Sleeve**

- Top rail clamp.
- Lock nut.
- Turnbuckle or Truss Rod tightening device.

**Angle, Corner, or End Post**

- Approx. 1" max.
- 15" max.
- Stretcher bar.

**Ornamental Post Top**

- Attach at approximately 12" intervals.

**Top Rail**

- Top rail clamp.
- Ground line.

**Top Rail Post Cap**

- Brace rail clamp.
- Ground line.

**Concrete Encasement**

- Anchor or end post angle, corner, or end post.
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.

Chain Link Fence
Comply with Figure 9060.101.

GATE POST FOOTING DEPTH AND DIAMETER

<table>
<thead>
<tr>
<th>GATE HEIGHT</th>
<th>GATE LEAF WIDTH</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
</table>
| 6'-0" or less | 4'-0" or less | 0'-10" | 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'-6"
| over 6'-0" | over 18'-0" to 24'-0" | 1'-6" | 4'-0"
For modular block retaining walls, install column tube or PVC pipe as backfill material is placed. When fence is installed after backfill material is placed, utilize hand excavation of post hole footings to avoid damaging engineering fabric tiebacks.

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

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

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

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

5. Construct a PCC cap between the back of the wall and the fence or rail.
1. Construct entire first course of timbers beneath finished grade.
2. No tie backs in upper two courses or lower three courses of timbers. Stagger tie back location.
3. Secure each course with spikes.
4. Excavate and place backfill material. Use suitable soil or granular material.

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

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

1. Prepare the site by removing vegetation, topsoil, and grading to the required slope.
2. Excavate to the proper depth and width for the wall.
3. Install geogrid if required for reinforcement.
4. Install subdrain systems as required to prevent water from accumulating behind the wall.
5. Construct a 6" thick X 18" wide (min.) leveling pad.
7. Place granular backfill material.
8. Placement and compaction of topsoil or suitable backfill material.
9. Install wall units with proper block setback and pins or lip to ensure proper block setback.
10. Install finished grade (slope varies) and cap stone.
FIGURE 9070.103

LIMESTONE RETAINING WALL

TYPICAL SECTION

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

Batter wall 3 inches per foot

Finished Grade

12" Compacted Foundation

Wrap porous backfill material with engineering fabric.

Subdrain

Construct a 6" thick X 18" wide (min.) leveling pad.

8" min.

Wall Height (4'-0" max.)

8" min.

Foundation
12" Compacted Backfill Material

Compacted Backfill Material
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>
<td>4w1</td>
<td>4</td>
<td>—</td>
<td>Variable</td>
<td>15&quot;</td>
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<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'</td>
<td>14&quot;</td>
</tr>
<tr>
<td></td>
<td>4w4</td>
<td>4</td>
<td>—</td>
<td>Variable</td>
<td>15&quot;</td>
</tr>
<tr>
<td></td>
<td>4w5</td>
<td>4</td>
<td>—</td>
<td>3'-10&quot;</td>
<td>14&quot;</td>
</tr>
</tbody>
</table>
Minimum riser height is 4 inches. Maximum riser height is 7 inches.

Minimum tread depth is 11 inches.

Match existing sidewalk width.

Construct cross slope of landing to match adjacent sidewalk.

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

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

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 tread depth is 11 inches.

Match existing sidewalk width.

Construct cross slope of landing to match adjacent sidewalk.

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

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

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.

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Construct cross slope of landing to match adjacent sidewalk.

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

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

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

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

7 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.

8 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.

Anchor Plate

BENT BAR

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

ALTERNATE SECTION B-B
(Side Rails and Stairs Formed and Constructed Separately)
Field paint safety rail after installation as specified in the contract documents.

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

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

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

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

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

Expand sleeve detail.

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

EXPANSION SLEEVE DETAIL

ANCHOR PLATE DETAIL

SAFETY RAIL
**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 Confining Aquifer**

- Artesian Well

1. 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 Unconfining Aquifer**

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

2. 1'-0" Cap, Sealing Material

**Class 2 Bedrock Well in Multiple Aquifers**

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

2. 1'-0" Cap, Sealing Material
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.

FRONT VIEW

SIDE VIEW

TEMPORARY CLUSTER BOX UNIT

TEMPORARY GROUP MAILBOX

1. 2
2. 3
3. 4
4. 5

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

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

FIGURE 11040.101

SHEET 1 OF 1

TEMPORARY RESIDENTIAL ACCESS

TEMPORARY GRANULAR SIDEWALK
FIGURE 11040.102
SHEET 1 OF 1

TEMPORARY PEDESTRIAN CHANNELIZING DEVICE

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

Temporary Sidewalk Surface

1" x 6" Splice
1" x 6" Splice
1" x 8" Splice

1/4" max. gap

SUDAS Standard Specifications

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.

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

1'-4" nominal

4' -0" max.

4'-0" min.

Building, Obstruction, or Edge of Sidewalk

Construction Area

Sandbag

2" x 6" Base Plate

2" x 6" (nominal)

2x4

2'-10" to 3'-2"

2" max

8" min.

2"

2' -0" to 3'-2"

2'-9" (nominal)

1'-4" nominal

Sandbag

2" x 6" (nominal)

END VIEW

Area Construction Splice Splice Splice

4'-0" max.

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

Sandbag

2" x 6" (nominal)

2'-10" to 3'-2"

SUDAS Standard Specifications

11040.102
SHEET 1 OF 1

REVISION 10-18-16
SHEET 1 OF 1