Standard Plans
For Road, Bridge, and Municipal Construction

M 21-01
English

Washington State Department of Transportation
American Public Works Association
Washington State Chapter
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This Standard Plans Manual contains engineering drawings that are used for road, bridge, and municipal construction. These drawings have been prepared under the direct supervision of a professional engineer, licensed in the state of Washington, who is knowledgeable in the specialized field of civil engineering depicted in that drawing. This manual standardizes fabrication, installation and construction methods for specific items of work and complements the contract documents and the English version of the Standard Specifications for Road, Bridge, and Municipal Construction.

Updating the manual is a continuous process and revisions are issued periodically. Questions, comments, and recommendations for changes are welcome. The Comment Request Form on the reverse side of this page is provided to encourage comments and assure their prompt delivery. Use copies of the form to send any attachments, such as marked copies of specific standard plans. Your comments should be sent to Design Standards, Transportation Building, Olympia, WA 98504-7329.

Bentley MicroStation DGN CAD files, Adobe PDF files and some AutoCAD DWG CAD files can be downloaded from the Design Standards website at:

http://www.wsdot.wa.gov/eesc/design/designstandards

Contact the Design Standards Office at (360) 705-7540 if you have questions about the technical content of this manual.

Additional copies of this manual can be ordered from the Engineering Publications Office (360) 705-7430.

Harold Peterfeso
State Design Engineer
**Comments**

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| To: Design Standards  
  Washington State Department of Transportation  
  Transportation Building  
  PO Box 47329  
  Olympia, WA 98504-7329 |
|-------------------------|

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<td>Chain Link Gates</td>
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<td></td>
</tr>
<tr>
<td>L-5</td>
<td>Glare Screen Type 1</td>
<td>7/31/98</td>
<td></td>
</tr>
<tr>
<td>L-5a</td>
<td>Glare Screen Type 2</td>
<td>7/31/98</td>
<td></td>
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<tr>
<td>L-6</td>
<td>Access Control Gate</td>
<td>7/25/97</td>
<td></td>
</tr>
</tbody>
</table>
CASE 3
ASPHALT CONCRETE PAVEMENT
(L-Type Abutment)

CASE 4
ASPHALT CONCRETE PAVEMENT

CASE 5
ASPHALT CONCRETE PAVEMENT
(ACP was on bridge and/or roadway
grade slopes up from bridge)

NOTES

1. Plane a taper into the existing pavement and shoulders (if paved). Depth shall taper from 0” at the beginning of pavement, to 1” at end of taper. Does not apply when existing pavement has been planed.

2. Before placing overlay, remove top 2” of existing joint filler, or 3” if existing joint is fiberboard, and block out the joint. After overlay, install new premolded joint filler. Top of joint filler shall be between 3/8” and 5/8” below overlay. When a compression seal is in place, see Bridge Plans.

3. Before placing overlay, block out the joint. After overlay, install premolded joint filler or rubberized asphalt filler. Top of joint filler shall be between 3/8” and 5/8” below overlay.

4. Full depth sawed grooves between 3/4” and 1/2” wide shall be placed directly over the existing sawed grooves in the cement concrete pavement and cement concrete shoulders.


LEGEND

Concrete Overlay
Asphalt Concrete Overlay
1. Curb shall be Extruded Curb Type 1, 2, 4, 4a, 5, or 5a, as specified in the contract.

2. Catch basin or grate inlet shall be located between guardrail posts.
NOTES

1. Install tie bars along longitudinal joint between full panel replacement and existing cement concrete pavement. Tie bars are not installed between cement concrete pavement and asphalt concrete shoulder.

2. Place polyethylene film (per AASHTO M-171-03) along the longitudinal joint between partial panel replacement and existing panel.

Cement Concrete Pavement Repair

STANDARD PLAN A-6

PLAN VIEW

COMPLETE PANEL REPLACEMENT
NOTES

1. As an acceptable alternate to rebar, wire mesh having a minimum area of 0.12 square inches per foot may be used. Wire mesh shall not be placed in knockouts.

2. The knockout diameter shall not be greater than 30°. Knockouts shall have a wall thickness of 2" minimum to 2.5" maximum. Provide a 1.5" minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar in accordance with standard specification 604.3.

3. The maximum depth from the finished grade to the pipe invert shall be 6".

4. Frame and grate may be installed with flange down or cast into adjustment section.

5. The precast base section may have a rounded floor and the walls may be sloped at a rate of 1:24 or steeper.

6. Opening shall be measured at the top of the precast base section.

---

PIPE ALLOWANCES

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Inside Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced or plain concrete</td>
<td>12&quot;</td>
</tr>
<tr>
<td>All metal pipe</td>
<td>15&quot;</td>
</tr>
<tr>
<td>Cast iron (Std. Spec. 6.06.30)</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Solid wall PVC (Std. Spec. 6.06.121)</td>
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</tr>
<tr>
<td>Profile wall PVC (Std. Spec. 6.06.122)</td>
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</table>

* Corrugated polyethylene storm sewer pipe

---

CATCH BASIN TYPE 1

STANDARD PLAN III-1

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION

Harold J. Peterson  07-31-03

Washington State Department of Transportation

EXPRESS JULY 1, 2005
PIPE ALLOWANCES

<table>
<thead>
<tr>
<th>PIPE MATERIAL</th>
<th>MAXIMUM ELBOW DIAMETER</th>
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</thead>
<tbody>
<tr>
<td>REINFORCED OR plain CONCRETE</td>
<td>18&quot;</td>
</tr>
<tr>
<td>ALL METAL PIPE</td>
<td>21&quot;</td>
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<tr>
<td>CFPIP in (Std. Pipe, 8-28.50)</td>
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<tr>
<td>SOLID WALL PIPE (Std. Pipe, 8-28.50)</td>
<td>21&quot;</td>
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<tr>
<td>PROFILE WALL Pipe (Std. Pipe, 8-28.50)</td>
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</table>

* Corrugated Polyethylene storm drain pipe

NOTES

1. As an acceptable alternate to rebar, wire mesh having a minimum area of 0.12 square inches per foot may be used. Wire mesh shall not be placed in knockout.

2. The knockout diameter shall not be greater than 36". Knockout shall have a wall thickness of 2" minimum to 2.5" maximum. Provide a 1.5" minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar in accordance with Std. Spec. 9-04.3.

3. The maximum depth from the finished grade to the pipe invert shall be 36".

4. Frame and grate may be installed with flange down or cast into adjustment section.

5. The present base section may have a rounded floor and the walls may be sloped at a rate of 1:25 or steeper.

6. Opening shall be measured at the top of the present base section.

CATCH BASIN TYPE 1L
STANDARD PLAN 5-1a
FRAME AND VANED GRATE

RECTANGULAR ADJUSTMENT SECTION

1. As an acceptable alternate to rebar, wire mesh having a minimum area of 0.12 square inches per foot may be used. Wire mesh shall not be placed in knockouts.

2. The knockout diameter shall not be greater than 16". Knockouts shall have a wall thickness of 2" minimum to 2 1/2" maximum.

3. The maximum depth from the finished grade to the pipe invert shall be 5'.

4. Frame and grate may be installed with flange down or cast into adjustment section.

5. The precast base section may have a rounded floor and the walls may be sloped at a rate of 1:24 or steeper.

6. Openings shall be measured at the top of the precast base section.

CATCH BASIN TYPE 1P
PARKING LOT C. B.
NOTES:

1. No steps are required when height is 4' or less.

2. The bottom of the precast catch basin may be sloped to facilitate cleaning.

3. Frame and grates may be installed with flange down or cast into adjustment section.

4. Knockouts shall have a wall thickness of 2" minimum in 2.5" minimum. Provide a 1.5" minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed fill the gap with joint mortar in accordance with 9sc. Spec. 0-04.3.

CATCH BASIN DIMENSIONS

<table>
<thead>
<tr>
<th>CATCH BASIN DIAMETER</th>
<th>WALL THICKNESS</th>
<th>BASE THICKNESS</th>
<th>MAXIMUM KNOCKOUT RADIUS</th>
<th>MINIMUM DISTANCE BETWEEN KNOCKOUTS</th>
<th>REINFORCED STEEL SQ.FT IN EACH DIRECTION</th>
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<tr>
<td>48&quot;</td>
<td>4&quot;</td>
<td>6&quot;</td>
<td>20&quot;</td>
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<td>0.29</td>
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PIPE ALLOWANCES

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<th>CATCH BASIN DIAMETER</th>
<th>PIPE MATERIAL WITH MAXIMUM INSIDE DIAMETER</th>
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<tr>
<td>60&quot;</td>
<td>36&quot; 40&quot; 44&quot; 48&quot; 52&quot; 56&quot; 60&quot;</td>
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<tr>
<td>72&quot;</td>
<td>48&quot; 52&quot; 56&quot; 60&quot; 64&quot; 68&quot; 72&quot; 76&quot;</td>
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<tr>
<td>86&quot;</td>
<td>60&quot; 64&quot; 68&quot; 72&quot; 76&quot; 80&quot; 84&quot; 88&quot;</td>
</tr>
</tbody>
</table>

1. CORRUGATED POLYTUBE USTANDARD STEAM PIPE (9sc Spec. 9-012)
2. (9sc Spec. 9-012.2.1)
3. (9sc Spec. 9-012.2.2)

CATCH BASIN TYPE 2

STANDARD PLAN B-1e

HEET 1 OF 1 SHEET

EXPRES JUL 1, 2005

APPROVED FOR PUBLICATION

HAROLD J. PETERSON 01-23-02

WASHINGTON DEPARTMENT OF TRANSPORTATION
1. As an acceptable alternate to rebar, wire mesh having a minimum area of 0.12 square inches per foot may be used for adjustment sections.

**Typical Orientation**

**For Access and Steps**

**Rectangular Adjustment Section**

**Miscellaneous Details for Manholes and Catch Basins**

**Circular Adjustment Section**

**Eccentric Cone Section**
1. When bolt down covers are specified in the Contract, provide two slots in the cover that are vertically aligned with the holes in the frame. Location of bolt down slots varies among different manufacturers.

2. Alternate reinforcing rib designs are acceptable.

3. Refer to Standard Specification B-08.15(2) for additional requirements.

4. For frame details, see Standard Plan B-2a.
NOTES:

1. This frame is designed to accommodate 20" x 24" grates or covers as shown on Standard Plans B-2, B-2b, B-2c and B-3c.

2. When bolt down grates or covers are specified in the Contract, provide two holes in the frame that are vertically aligned with the grate or cover edges. Tap each hole to accept a 5/8"-11 UNC x 2-1/2" allen head cap screw. Location of bolt down holes varies among different manufacturers.

3. Refer to Standard Specification 9-08.162(b) for additional requirements.

DETAIL "A"

REMOVABLE FRAME FOR CATCH BASIN OR CONCRETE INLET
STANDARD PLAN B-2a
NOTES

1. When bolt down grates are specified in the Contract, provide two slots in the grate that are vertically aligned with the holes in the frame. Location of bolt down slots varies among different manufacturers.

2. Refer to Standard Specification 06-162 for additional requirements.

3. For frame details, see Standard Plan B-2a.

PLAN VIEW

SECTION A

SLOT DETAIL

SECTION B

24"

7 OR 8 EQUAL SPACES

DIRECTION OF FLOW

1 1/8" MAX.
8 LEVELING PADS
2" x 1 1/8" x 1 1/8"

SECTION A

SEE SLOT DETAIL & NOTE 1

PLAN VIEW

SECTION B

1 3/4" MAX.

4 EQUAL SPACES

3/4"

SLOT DETAIL

NOTES

1. When bolt down grates are specified in the Contract, provide two slots in the grates that are vertically aligned with the holes in the frame. Location of bolt down slot varies among different manufacturers.

2. Refer to Standard Specification R-05.1462 for additional requirements.

3. For frame details, see Standard Plan B-2a.

BIDIRECTIONAL VANED GRATE FOR CATCH BASIN AND INLET
STANDARD PLAN B-2a

APPROVED FOR PUBLICATION
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

EXPRESS: JULY 1, 2003

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
1. When bolt down grates are specified in the Contract, provide two scots in the grate that are vertically aligned with the holes in the frame. Location of bolt down scots varies among different manufacturers.

2. Refer to Standard Specification 9-05.15(2) for additional requirements.

3. For frame details, see Standard Plan 9-2a.

4. The thickness of the grate shall not exceed 1 3/8".
CATCH BASIN TYPE 2
WITH FLOW RESTRICTOR
-OIL SEPARATOR
STANDARD PLAN B-3

NOTES:
1. The pipe supports and the weir/trash separator shall be constructed of the same material and be spaced at a maximum spacing of 36". Attach the pipe supports to the manhole with 3/8" stainless steel expansion bolts or embed the supports into the manhole well 3".

2. The vertical weir gate on the trash separator shall be the same diameter as the horizontal outlet pipe with a minimum diameter of 6".

3. The flow separator/strainer shall be furnished from one of the following materials:
   - CDS-L Corrugated Aluminum Alloy Drain Pipe
   - CDS-L Corrugated Galvanized Steel Drain Pipe with Treatment
   - CDS-L Corrugated Aluminized Steel Drain Pipe
   - 0.032 Aluminum Alloy flax sheet, in accordance with ASTM B 208M, A508 H52 or H56
   - High Density Polyethylene Steam Drainage Pipe

4. The frame and ladder or steps are to be affixed so that the sheave gate is visible from the top; the climb-down space is clear of the ladder and gate; the frame is clear of the curb.

5. The multi-office offices may be located as shown, or placed on one side of the door to assure ladder clearance. The sides of the offices and their placement shall be specified in the contract.

6. Receiver plate with doors as specified in the Contract. *With cover for oil pollution control only.

7. The operating handle is to be out round and smooth.

8. The operating handle shall be made of aluminum alloy in accordance with ASTM B 208M and ASTM B 275, designation 3003A or cast iron in accordance with ASTM A 49, Class 30E.

9. A hose connector is required between the fill and the gate. Install the gate so that the fill line and main is level when the gate is closed.

10. The operating surfaces of the lid and the body shall be machined for proper fit. All other gates bolts shall be stainless steel.

11. The operating mechanism for the gate shall be controlled by limited hinge movement, a stop, tell, or some other device.

12. Alternate opening designs are acceptable, if material specifications are met and hinge bolt pattern matches.
NOTES

1. See Contract for size and location of all pipes and orifices.
2. Baffle wall shall have #4 Bar at 12” spacing each way.
3. Precast baffle shall be keyed and grouted in place.
4. Bottom orifice plate shall be galvanized steel with a minimum thickness of 1/4”. Attach orifice with 1/2” stainless steel bolts. Orifice plate is not required when only oil separation is desired.
5. Upper flow orifice shall be aluminum, galvanized steel or galvanized steel. Galvanized steel shall have treatment 1.
1. Angles shall be set so that each bearing bar of prefabricated grate shall have full bearing on both ends. The finished top of concrete shall be even with the grate surface.

2. All exposed concrete shall be finished with a 1/2" radius edger tool.

3. The grade line at the top inside of any pipe shall enter no lower than the grade line of the top inside of the outlet pipe.

4. Culvert or sewer pipes may be set at any angle to the centerline of the highway and may enter the inlet on any side at any reasonable angle, provided the outside of the pipe can be contained between two opposite walls.

5. Grate B will be used only when specified in the Contract.
Angles shall be set so that each bearing bar or prefabricated grate shall have full bearing on both ends. The finished top of concrete shall be even with the grate surface.

Top of inlet grate shall be placed at ground level to present an unobstructed ditch or median section.

All exposed concrete edges shall be finished with a 1/2" radius edger tool.

Pipes may enter through the knockouts on any side at any reasonable angle, provided the outside of the pipe can be contained between two opposite walls. The flow line of the outlet pipe shall be 18" minimum above the inside bottom of the inlet structure.

The grade line of the top inside of any inlet pipe shall enter at a point no lower than the grade line of the top inside of the outlet pipe.

Unit H and optional extension units J and K shall be grouted in place to the satisfaction of the Engineer.

All pickup holes shall be grouted full after the basin has been placed.

---

B-4c
05-09-97
**NOTES:**

1. Angles shall be set so that each bearing bar on the grate shall have full seating on both ends. The finished top of concrete shall be even with the grate surface.

2. Top of inlet shall be placed at ground level to present an unobstructed ditch or median section.

3. Level or round exposed concrete edges \(\frac{1}{4}\)".

4. Pipes may enter through the knockouts at any reasonable angle provided the outside of the pipe can be contained within the knockout provided.

5. The grade line of the lowest inlet pipe shall enter the structure at an elevation equal to or higher than the grade line of the outlet pipe.

6. Precast inlet shall be marked with manufacturer's identification inside the structure in some readily accessible location.

7. Inside wall taper for form removal shall not result in any wall sections thinner than \(\frac{1}{8}\)" except in pipe knockout areas.

8. Amount, type and grade of reinforcing steel is the responsibility of the manufacturer. The manufacturer is responsible for the structure until final acceptance in place with all required knockouts removed.

---

**DIKE INSTALLATION FOR PREFERRED SLOPE**

*See Contract For Backslope Details*
1. Angles shall be set so that each bearing bar on the grate shall have full seating on both ends. The finished top of concrete shall be even with the grate surface.

2. Top of inlet shall be placed at ground level to present an unobstructed ditch or median section.

3. Bevel or round exposed concrete edges 1/8".

4. Pipes may enter through the knockouts at any reasonable angle provided the outside of the pipe can be contained within the knockout provided.

5. The grade line of the lowest inlet pipe shall enter the structure at an elevation equal to or higher than the grade line of the outlet pipe.

6. Precast inlet shall be marked with the manufacturer’s identification inside the structure in some readily accessible location.

7. Inside wall taper for form removal shall not result in any wall section thinner than 6" except in pipe knockout areas.

8. Amount, type and grade of reinforcing steel is the responsibility of the manufacturer. The manufacturer is responsible for the structure until final acceptance in place with all required knockouts removed.
1. The culvert ends shall be beveled to match the embankment or ditch slope and shall not be beveled flatter than 4:1. When slopes are between 4:1 and 5:1, place the slope in the vicinity of the culvert end to ensure that no part of the culvert passes more than 4" above the ground line.

2. Field cut culvert ends is permitted, when approved by the Engineer. All field cut culvert pipe shall be treated with treatment as shown in the Standard Specifications or General Special Provisions.
1. Span and rise dimensions are nominal and are measured to the inside crests of corrugations.

2. Allowable heights of cover shall be within the limits indicated in the table included herein. Minimums and maximums are shown.

3. Unless indicated otherwise a 10" depth (over the inside crests of corrugations) of earth shall be placed in the invert of the Structural Plate Underpass, Design 1, for its full width and length. The earth shall consist of natural occurring materials available in the vicinity of the structural plate underpass installation.

4. Designed for H-20 live load and maximum allowable soil pressure of 6 Kips per square foot.

<table>
<thead>
<tr>
<th>SPAN</th>
<th>RISE</th>
<th>CORRUGATED METAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'-8&quot;</td>
<td>1'-1&quot;</td>
<td>4'-26&quot;</td>
</tr>
<tr>
<td>6'-10&quot;</td>
<td>8'-2&quot;</td>
<td>5'-25&quot;</td>
</tr>
</tbody>
</table>
1. Span and rise dimensions are measured to the inside crests of corrugations and may vary slightly depending on manufacturer.
NOTES

1. The variable dimension indicated for the height of step for step mitered pipes shall conform to manufacturers’ recommendations unless specified differently on the plans or in the special provisions.

2. Reinforcing steel shall have 1½” clear cover to all concrete surfaces.

3. Headwalls for concrete culvert pipe may omit anchor bolt attachment.

4. When steel pipe safety bars are used, headwall thickness shall be increased to 8”.
**TOP VIEW**

Culvert is perpendicular to roadway
Headwall is placed parallel to roadway

**SECTION A-A**

8" x 24" x 3/8" Steel plate

1" x 4" Slot with 2" wide oval at bottom (TYP)
1/4" x 5/8" Bolt

**ELEVATION**

**DETAILED A**

8" x 24" x 3/8" Steel plate

1/4" Dia. threaded rod with nut

**NOTE**

1. Sockets shall be 3" extra strong steel pipe (3/8" OD). Sockets must be the proper angle to allow safety bar to be easily removed.
2. Safety Bar shall be 4" extra strong (1/4"") steel pipe.
3. Bevel culvert pipe to match side slope.

<table>
<thead>
<tr>
<th>Culvert Dia</th>
<th>Required number of pipes</th>
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</thead>
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<tr>
<td>Up to 26&quot;</td>
<td>None</td>
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<tr>
<td>26&quot; - 40&quot;</td>
<td>1</td>
</tr>
<tr>
<td>40&quot; - 90&quot;</td>
<td>2</td>
</tr>
<tr>
<td>90&quot; - 120&quot;</td>
<td>3</td>
</tr>
</tbody>
</table>

**TYPE 1 SAFETY BARS FOR STEPPED CULVERT PIPE OR PIPE ARCH**

Culvert is skewed to roadway
Headwall is placed parallel to roadway

Install adhesive anchorage system
NOTES
1. See Standard Specifications Section 7-06.3(3) for Pipe Zone Backfill.
2. See Standard Specifications Section 9-03.12(3) for Gravel Backfill for Pipe Zone Bedding
4. For sanitary sewer installation, concrete pipe shall be bedded to spring line.

CLEARANCE BETWEEN PIPES FOR MULTIPLE INSTALLATIONS

<table>
<thead>
<tr>
<th>PIPE</th>
<th>SIZE</th>
<th>MINIMUM DISTANCE BETWEEN BARRIERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIRCULAR PIPE (DIAMETER)</td>
<td>12&quot; to 24&quot;</td>
<td>12&quot; DIA. / 48&quot;</td>
</tr>
<tr>
<td></td>
<td>30&quot; to 88&quot;</td>
<td>102&quot; to 192&quot;</td>
</tr>
<tr>
<td>PIPE ARCH METAL ONLY (SPAN)</td>
<td>18&quot; to 56&quot;</td>
<td>12&quot; SPAN / 48&quot;</td>
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<tr>
<td></td>
<td>48&quot; to 142&quot;</td>
<td>144&quot; to 300&quot;</td>
</tr>
</tbody>
</table>

PIPE ARCHES
NOTES:
1. Steel tie rods to be heavily coated with asphalt after installation.
2. Restrained joints may be substituted for tie rods.
3. Surface of ground within 36" of hydrant shall be smooth.

HYDRANT SETTING TYPES A AND B
**NOTE**

Steel tie rods to be heavily coated with asphalt after installation.

**DIMENSION TABLE**

<table>
<thead>
<tr>
<th>PIPE DIAM</th>
<th>TEST PRESSURE (PSI)</th>
<th>BEND ANGLE</th>
<th>CONCRETE VOLUME (Ft³)</th>
<th>CUBE SIZE (%)</th>
<th>TIE ROD DIAM</th>
<th>TIE ROD EMBREMENT</th>
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</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>280</td>
<td>11.25°</td>
<td>6</td>
<td>1.6</td>
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<td></td>
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<td>22.5°</td>
<td>12</td>
<td>2.3</td>
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<td>23</td>
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<tr>
<td>14&quot;</td>
<td>280</td>
<td>11.25°</td>
<td>79</td>
<td>4.2</td>
<td>5/8&quot;</td>
<td>17&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.5°</td>
<td>147</td>
<td>5.5</td>
<td>5/8&quot;</td>
<td>20&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45°</td>
<td>272</td>
<td>9.6</td>
<td>1&quot;</td>
<td>21&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>280</td>
<td>11.25°</td>
<td>98</td>
<td>4.6</td>
<td>5/8&quot;</td>
<td>17&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22.5°</td>
<td>192</td>
<td>5.5</td>
<td>7/8&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45°</td>
<td>355</td>
<td>7.1</td>
<td>1 1/8&quot;</td>
<td>30&quot;</td>
</tr>
</tbody>
</table>
1. Contractor to provide blocking adequate to withstand full test pressure.
2. Divide thrust by safe bearing load to determine required area (in square feet) of concrete to distribute load.
3. Areas to be adjusted for other pressure conditions.
4. Provide two (2) minimum diameter rods on valves up through 10" diameter. Valves larger than 10" require special tie rod design.

<table>
<thead>
<tr>
<th>Size</th>
<th>Test Pressure PS</th>
<th>Tee ends</th>
<th>45° Bend</th>
<th>90° Bend</th>
<th>22.5° Bend</th>
<th>11.25° Bend</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>250</td>
<td>3,140</td>
<td>4,440</td>
<td>2,405</td>
<td>1,225</td>
<td>615</td>
</tr>
<tr>
<td>6&quot;</td>
<td>250</td>
<td>7,070</td>
<td>9,595</td>
<td>5,410</td>
<td>2,760</td>
<td>1,385</td>
</tr>
<tr>
<td>8&quot;</td>
<td>250</td>
<td>12,565</td>
<td>17,770</td>
<td>9,620</td>
<td>4,905</td>
<td>2,465</td>
</tr>
<tr>
<td>10&quot;</td>
<td>250</td>
<td>19,635</td>
<td>27,770</td>
<td>15,030</td>
<td>7,660</td>
<td>3,850</td>
</tr>
<tr>
<td>12&quot;</td>
<td>250</td>
<td>28,275</td>
<td>39,385</td>
<td>21,640</td>
<td>11,030</td>
<td>5,545</td>
</tr>
<tr>
<td>14&quot;</td>
<td>250</td>
<td>38,485</td>
<td>54,425</td>
<td>29,455</td>
<td>15,015</td>
<td>7,545</td>
</tr>
<tr>
<td>16&quot;</td>
<td>250</td>
<td>50,265</td>
<td>71,085</td>
<td>38,470</td>
<td>19,615</td>
<td>9,855</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Safe Bearing Load (PSf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muck, peat, etc.</td>
<td>0</td>
</tr>
<tr>
<td>Soft clay</td>
<td>1,000</td>
</tr>
<tr>
<td>Sand</td>
<td>2,000</td>
</tr>
<tr>
<td>Sand and gravel</td>
<td>3,000</td>
</tr>
<tr>
<td>Sand and gravel cemented with clay</td>
<td>4,000</td>
</tr>
<tr>
<td>Hard shale</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**CONCRETE THRUST BLOCK**
Circular adjustment section

Eccentric cone section

12" (Typ)

Precast riser sections

Steps or ladder

24:1 Slope

Mortar Fillet

Channel and shelf

Reinforcing steel

12" MIN

6"

2/3" MAX

SEPARATE CAST IN PLACE BASE

PRECAST BASE WITH INTEGRAL RISER

Gravel backfill for pipe zone bedding

"O" Ring

SEPARATE PRECAST BASE

MANHOLE TYPE 1

MANHOLE DIMENSION TABLE

<table>
<thead>
<tr>
<th>Dia</th>
<th>Wall Thickness</th>
<th>Base Thickness</th>
<th>Maximum Knockout Size</th>
<th>Minimum Distance Between Knockouts</th>
<th>Base Reinforcing Steel 50 In/ft Each Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot;</td>
<td>4&quot;</td>
<td>6&quot;</td>
<td>36&quot;</td>
<td>6&quot;</td>
<td>0.15 0.25</td>
</tr>
<tr>
<td>54&quot;</td>
<td>4 1/2&quot;</td>
<td>8&quot;</td>
<td>42&quot;</td>
<td>6&quot;</td>
<td>0.19 0.19</td>
</tr>
<tr>
<td>60&quot;</td>
<td>5&quot;</td>
<td>8&quot;</td>
<td>48&quot;</td>
<td>6&quot;</td>
<td>0.25 0.25</td>
</tr>
</tbody>
</table>

NOTES:
1. Knockouts shall have a wall thickness of 2" minimum to 2 1/2" maximum.
**MANHOLE DIMENSION TABLE**

<table>
<thead>
<tr>
<th>DIA</th>
<th>WALL THICKNESS</th>
<th>BASE THICKNESS</th>
<th>MAXIMUM KNOCKOUT SIZE</th>
<th>MINIMUM DISTANCE BETWEEN KNOCKOUTS</th>
<th>BASE REINFORCING STEEL IN % IN EACH DIRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>72&quot;</td>
<td>8&quot;</td>
<td>8&quot;</td>
<td>60&quot;</td>
<td>12&quot;</td>
<td>0.24</td>
</tr>
<tr>
<td>96&quot;</td>
<td>8&quot;</td>
<td>12&quot;</td>
<td>84&quot;</td>
<td>12&quot;</td>
<td>0.29</td>
</tr>
</tbody>
</table>

**NOTES**

1. Knockouts shall have a wall thickness of 2" minimum to 2½" maximum.

**MANHOLE TYPE 2**

- Separate cast in place base
- Precast base with integral riser
- Gravel backfill for pipe zone bedding
- Reinforcing steel
- Mortar fillet
- Steps or ladder
- Channel and shelf
- Pre-Cast riser section
- Flat slab top
- Precast riser section
- Eccentric cone section
- Circular adjustment section
- Mortar fillet
MANHOLE TYPE 3

MANHOLE DIMENSION TABLE

<table>
<thead>
<tr>
<th>DIA</th>
<th>WALL THICKNESS</th>
<th>BASE THICKNESS</th>
<th>MAXIMUM KNOCKOUT SIZE</th>
<th>MINIMUM DISTANCE BETWEEN KNOCKOUTS</th>
<th>INTEGRAL BASE</th>
<th>SEPARATE BASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>48”</td>
<td>4”</td>
<td>6”</td>
<td>36”</td>
<td>8”</td>
<td>0.15</td>
<td>0.23</td>
</tr>
<tr>
<td>54”</td>
<td>4” 1/2”</td>
<td>6”</td>
<td>42”</td>
<td>8”</td>
<td>0.19</td>
<td>0.19</td>
</tr>
<tr>
<td>60”</td>
<td>5”</td>
<td>6”</td>
<td>48”</td>
<td>8”</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>72”</td>
<td>6”</td>
<td>8”</td>
<td>60”</td>
<td>12”</td>
<td>0.24</td>
<td>0.35</td>
</tr>
<tr>
<td>96”</td>
<td>8”</td>
<td>12”</td>
<td>84”</td>
<td>12”</td>
<td>0.29</td>
<td>0.39</td>
</tr>
</tbody>
</table>

NOTES:
1. Knockouts shall have a wall thickness of 2” minimum to 2 1/2” maximum.
1. Gasket and groove may be in the seat or underside of cover.

2. For bolt down manhole ring and covers that are not designated "watertight", the neoprene gasket, groove and washer are not required.

3. Washer shall be lead or neoprene.

4. In lieu of blind pick notch for storm sewer manhole covers, drill three 1" diameter holes at 120° spacing.

5. Proprietary manhole covers without bottom ribs are acceptable.

SECTION A-A

SECTION B-B
TYPE 1
STANDARD

SECTION B-B
TYPE 2
BOLT-DOWN/WATERTIGHT

SECTION B-B
TYPE 3
CAMLOCK

MANHOLE RING
AND COVER

COVER SKID DESIGN DETAIL
1. As an acceptable alternate to rebar, wire mesh having a minimum area of 0.12 square inches per foot may be used. Wire mesh shall not be placed in knockouts.

2. The knockout diameter shall not be greater than 18". Knockouts shall have a wall thickness of 1 1/8" minimum to 2" maximum.

3. Frame and grate may be installed with flange down or cast into adjustment section.

4. The precast base section may have a rounded floor and the walls may be sloped at a rate of 1:24 or steeper.

5. Opening shall be measured at the top of the precast base section.
NOTES:
1. Precast cone sections may be eccentric or concentric.
2. Seepage port orientation varies among manufacturers.
NOTES:

1. CONCRETE COLLAR WIDTH SHALL BE ONE-HALF OF THE OUTSIDE PIPE DIAMETER OF THE LARGEST PIPE. THE MINIMUM COLLAR WIDTH SHALL BE 12". CONCRETE COLLARS MAY BE USED WITH ALL PIPE MATERIALS AND DIAMETERS. THE CONCRETE COLLAR OPTION SHALL ONLY BE USED TO EXTEND EXISTING PIPES.

2. WHEN A COUPLING BAND CONNECTION IS REQUIRED ATTACHING A BELL END OF A CONCRETE PIPE THE BELL END OF THE PIPE SHALL BE REMOVED BEFORE THE CONNECTION IS INSTALLED.

3. INCREASE THE OUTSIDE DIAMETER OF THE METAL PIPE TO MATCH THE OUTSIDE DIAMETER OF THE CONCRETE PIPE WITH 12" WIDE RUBBER GASKETS. THICKNESS AS REQUIRED, RUBBER GASKETS SHALL BE IN ACCORDANCE WITH SECTION 9-04.4(3) OF THE STANDARD SPECIFICATIONS.

4. USE A FLAT TYPE K COUPLING BAND. TYPE K COUPLING BANDS WITH DIAMETERS ARE NOT ALLOWED FOR THE INSTALLATION DETAIL SHOWN. THE COUPLING BAND OPTION SHALL ONLY BE USED FOR EXTENDING EXISTING PIPES THAT HAVE AN INSIDE DIAMETER OF 36" OR LESS.

5. STEEL WELDED WIRE FABRIC SHALL BE IN ACCORDANCE WITH SECTION 9-07.7 OF THE STANDARD SPECIFICATIONS. INSTALL TWO WRAPS FOR SIZE 8 x 8 W1.4 x W1.4 (10 GAUGE) STEEL WELDED WIRE FABRIC OR ONE WRAP FOR ANY OF THE FOLLOWING SIZES:

- 6 x 6 W2.1 x W2.1 (8 GAUGE)
- 6 x 6 W2.9 x W2.9 (6 GAUGE)
- 4 x 4 W0.9 x W0.9 (6 GAUGE)
- 4 x 4 W4.0 x W4.0 (4 GAUGE)

CONNECTION DETAILS FOR DISSIMILAR CULVERT PIPE

STANDARD PLAN B-28

EXPDD JULY 2001

APPROVED FOR PUBLICATION
Clifford E. Mansfield 10-06-99

10-06-99

STANDARD PLAN B-28

10-06-99

APPROVED FOR PUBLICATION
Clifford E. Mansfield 10-06-99

STANDARD PLAN B-28

EXPDD JULY 2001

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STANDARD PLAN B-28

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EXPDD JULY 2001

APPROVED FOR PUBLICATION
Clifford E. Mansfield 10-06-99

STANDARD PLAN B-28

EXPDD JULY 2001

APPROVED FOR PUBLICATION
Clifford E. Mansfield 10-06-99
1. Install sewer saddle with gasket and stainless steel clamps for connection to existing sewers. Install wye or tee sewer fitting with gaskets for new sewer installations.

2. Mark location of sewer stub in accordance with Contracting Agency requirements.
STANDING SIDE SEWER CONNECTION
STANDARD PLAN B-30

45° bend

4" or 6" Sewer Pipe
(See Contract)

24" x 24" x 24" Concrete block
or Controlled Density Fill

Sewer main

Tee
TYPE 10

WOOD POST ASSEMBLY

13'-0"/

2'-0"

6'-3"

6'-3"

4'-0"

4'-0"

2'-0"

13'-0"

6'-3"

6'-3"

4'-0"

4'-0"

2'-0"

13'-0"

6'-3"

6'-3"

4'-0"

4'-0"

2'-0"

THREE BEAM RAIL ELEMENT

THREE BEAM EXPANSION SECTION

TYPE 11

WOOD POST ASSEMBLY

1/2" x 1/4" button head splice bolt with 1/2" oval grip and recessed hex nut (Twelve required per splice)

1/2" x 1/4" button head bolts with 1/2" oval grip and recessed hex nut (Twelve required per splice)

1 1/4" post bolt washer

1 1/4" post bolt washer

1/2" x 10" button head bolts with 1/2" oval grip and recessed hex nuts and cut washers

Wood block for steel post

See Note 1

See Note 1

NOTES

1. Type 10 posts shall be 6x6 timber or 6x6x9.
   Type 11 posts shall be 10x10 timbers or 8x8x15.
   For details, see "Standard Plan "Beam Guardrail Posts and Blocks."

2. Type 10 guardrail post spacing shall be 6'-3" on center.
   Type 11 shall be a maximum of 3'-3" on center.
NOTES
1. Wood posts for all guardrail placement plans shall be 6x8 except where noted otherwise.
2. Lower hole is for rub rail of Type 2 and Type 3 Beam Guardrail.
3. W6x9 steel posts and timber blocks are alternates for 6x8 timber posts and blocks. W6x15 steel posts and timber blocks are alternates for 10x10 timber posts and blocks.
4. Holes shall be located on approaching traffic side of web.
5. When contract requires "Beam Guardrail Type 1, 6 Foot Long Post," the steel post length shall be marked with numbers to ensure permanent identification of the location where the letter "H" is shown on the detail. The marking shall be 1/8" MIN height.
6. Soil plate may be welded to foundation tube. If so, holes in soil plate and foundation tube may be omitted.
V\(\frac{1}{4}\)" DIA x 1 1/2" hex head bolt with hex nut and 1 1/4" square x .135" washer. Guardrail rests on top of bolt.

DETAIL A

BEAM GUARDRAIL

Note 1:
- For post details see Standard Plan, "Beam Guardrail Posts and Blocks."
INTERMEDIATE GUARDRAIL POST CONNECTION DETAILS
(Type A shown)

THREE BEAM GUARDRAIL REDUCER SECTION
TYPE A
(Left section shown, right section reversed)

THREE BEAM GUARDRAIL REDUCER SECTION
TYPE B
NOTES

1. Type 4 anchor required. For details, see Standard Plan C-6c.

2. Post spacing is 6'-3" unless otherwise shown.

3. For Terminal type and details, see Contract Plans and applicable Standard Plan(s).

4. The slope from the edge of the shoulder into the face of the guardrail should not exceed 10:1 when the face of the guardrail is less than 12'-6" from the edge of the shoulder.

5. For one-way traffic, use Type 4 anchor. For two-way traffic, use Type 1 anchor. See applicable Standard Plan(s) for details.

6. When Beam Guardrail Flared Terminals are used on both ends a minimum of 25'-0" of Beam Guardrail shall be installed.

GUARDRAIL PLACEMENT

STANDARD PLAN C-2
NOTES
1. Fast spacing is 6'-3" except where noted.
2. For terminal type and details, see Contract and applicable Standard Plans.
3. The slope from the edge of the shoulder into the face of the guardrail should not be steeper than 10:1 when the guardrail is within 12'-0" from the edge of the shoulder.
4. See Contract for dimensions.
5. See Contract for Guardrail Transition Section and Guardrail Connection to Bridge Rail or Concrete Barrier.

FLARE RATE TABLE

<table>
<thead>
<tr>
<th>RATE</th>
<th>PISTED SPEED (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15x1</td>
<td>70</td>
</tr>
<tr>
<td>14x1</td>
<td>60</td>
</tr>
<tr>
<td>12x1</td>
<td>55</td>
</tr>
<tr>
<td>11x1</td>
<td>50</td>
</tr>
<tr>
<td>10x1</td>
<td>45</td>
</tr>
<tr>
<td>9x1</td>
<td>40 or less</td>
</tr>
</tbody>
</table>

Bridge rail

Transition pay limit

See Note 3

Curb face extension line

Case 4

One or Two Way Traffic

Beam Guardrail pay limit

X Spaces at 6'-3"

See Flare Rate Table

Terminal pay limit (SRT shown)

See Note 2

Note 2

Edge of shoulder

Note 3

Varies (see Note 4)

See Flare Rate Table

Notes

Case 5

One Way Traffic

Beam Guardrail pay limit

Flared terminal pay limit (SRT shown)

See Note 2

Median

10'-0" - 55 mph or less

13'-6" - 60 mph

20'-0" - 70 mph

See Note 3

Case 6

One Way Traffic

Bridge rail

Transition pay limit

See Note 5

36'-0" MIN
1. Attach standard wood or steel blocks to concrete structure with 1/4" expansion anchor or 1/4" threaded rod in a 1" x 8" hole grouted with epoxy.

2. For Type 3 Guardrail, terminate the end of the stud by lopping it behind the first 10 x 10 post of the Type 16 Transition Section, or as approved by the Engineer.

3. The Type 10 or Type 11 Guardrail shall extend 12'-6" MIN past the structure to allow installation of the Type 16 transition for the opposing traffic.

4. If the minimum number of 12'-6" thrie beam sections required to span the structure extends more than 6'-3" (but less than 12'-6") past the structure, then a 6'-3" section of nested thrie beam should be added. Otherwise, install an additional 12'-6" section.

5. Thrie Beam Guardrail Reducer Section Type B.

6. This Type 16 Transition shall end at a 10 x 10 post. Place nested thrie beam with 10 x 10 posts at 3'-1 1/2" WAX spacing between the end of the transition and the structure.

---

**FLARE RATE TABLE**

<table>
<thead>
<tr>
<th>Rate</th>
<th>Posted Speed (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15sl</td>
<td>70</td>
</tr>
<tr>
<td>14sl</td>
<td>60</td>
</tr>
<tr>
<td>12sl</td>
<td>55</td>
</tr>
<tr>
<td>11sl</td>
<td>50</td>
</tr>
<tr>
<td>10sl</td>
<td>45</td>
</tr>
<tr>
<td>9sl</td>
<td>40 or less</td>
</tr>
</tbody>
</table>
NOTES
1. This Beam Guardrail is used when the distance from the end of the Bullnose Terminal to the beginning of the transition of the Bridge Rail is less than 100 feet.
CASE 10A

CASE 10B

CASE 10C

NOTES
1. SR7 Terminal shown, for terminal type and details, see Contract or applicable State Plan.
2. Post spacing is 6'-3" except where noted.
3. Type 4 anchor required. See applicable State Plan.
4. The slope from the edge of the shoulder into the face of the guardrail should not exceed 10% when the guardrail is within 12'-0" from the edge of the shoulder.
NOTES

1. SKI Terminal shown. For terminal type and details see Contract and applicable Standard Plans.

2. Attach standard blocks to concrete structure with ½" DIA expansion anchor or ¾" DIA threaded rod in a 1" DIA x 8" hole grouted with epoxy.

3. Type 4 anchor or Type 4 anchor (thrie beam) required.

4. The slope from the edge of the shoulder into the face of the guardrail should not be steeper than 10:1 when the guardrail is within 12'-0" from the edge of the shoulder.

5. If the distance from end of Type 11 guardrail to column/structure exceeds 6'-3" using 12'-6" thrie beam sections, add a 6'-3" nested section of thrie beam with 10 x 10 posts, spaced at 3'-1½" (MAX), and begin transition.

6. Thrie Beam Guardrail Reducer Section Type B.

7. Guardrail post spacing for Type 11 guardrail past the End Bridge Pier shall be at 6'-3" spacing, maximum, with 6 x 8 post and standard block.

---

**GUARDRAIL PLACEMENT**

One Way Traffic

CASE 11C
CASE 12 .D
(see Note 7)

Beam Guardrail
Anchor Type 7

Rail not bolted
to CRT post

5/8" Bolt
1/2" Washer

X Spacing at 6'- 3"
1 (space MIN)

CREA AREA

Point B

9'- 6" MAX radius

PC

Length = 25'

X Spacing at 6'- 3"
1 (space MIN)

CASE 12 .C
(see Note 7)

Beam Guardrail
Anchor Type 7

Point A

X Spacing at 6'- 3"
1 (space MIN)

CASE 12.A
(see Note 8)

Beam Guardrail
Anchor Type 5

Splicer
Bolt slot

Rail
Element

Identification plate

Identification post

CASE 12 B.
(see Note 7)

Identification Plate
Mounting Detail
(see Note 5)

IDENTIFICATION PLATE
WEAK POST INTERSECTION
DESIGN (8'- 6" MAX RADIUS)

GUARDRAIL PLACEMENT

NOTES
1. See Contract for guardrail connection to bridge rail and
   concrete barrier.
2. The slope from the edge of the shoulder into the face of
   the guardrail shall not be steeper than 10:1.
3. Attach to rail with 1/2" x 9" long bolt, nut and
   1/2" washer on back of post.
4. For terminal type and details, see Contract and
   applicable Standard Plan(s).
5. Radius dimensions shall be etched into plate replacing
   the letters "MIN" shown on the Identification Plate.
   Digits shall be 1/8" MIN height and 1/2" MAX width.
   The plate shall be galvanized after etching.
6. The guardrail radius identification Plate shall be mounted
   on the back side of the Rail Element using the lowest
   splice bolt at the P.C. of the guardrail radius.
7. First letter of case designation placement indicates end
   treatment on side road. Second letter indicates end
   treatment on main road. For instance, a Type 5 Anchor
   on the side road and a bridge connection on the main road
   would be Case 12 AC.
8. For the 8'- 6" radius, 5' long CRT posts are required
   when using the CRT post at point B.
9. For CRT post details, see Standard Plan "Beam Guardrail Posts
   and Blocks".
1. For Service Level I, Weak Post Bridge Roll System, see Contract.

2. See Terminal shown. For Terminal type and details, see Contract and Applicable Standard Plans.

3. The slope from the edge of the shoulder into the face of the guardrail should not be steeper than 10:1.


---

Type 1 Beam Guardrail
Type 1 Beam Guardrail
Type 6 Transition
pay limit
pay limit
pay limit

Type 20 Beam Guardrail
pay limit
See Note 1.

0 Spaces
MIN
0 Spaces
MIN

C-2 Post (TYP)
(see Note 2)

See Note 3

---

Edge of bridge

Three Beam Guardrail
Reducer Section Type B

---

Direction of Traffic

---

CASE 14

GUARDRAIL PLACEMENT
**GUARDRAIL PLACEMENT**

**STANDARD PLAN C-21**

**FLARE RATE TABLE**

<table>
<thead>
<tr>
<th>Rate (1000)</th>
<th>Posted Speed (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:1</td>
<td>70</td>
</tr>
<tr>
<td>14:1</td>
<td>60</td>
</tr>
<tr>
<td>12:1</td>
<td>55</td>
</tr>
<tr>
<td>11:1</td>
<td>50</td>
</tr>
<tr>
<td>10:1</td>
<td>45</td>
</tr>
<tr>
<td>9:1</td>
<td>40 or less</td>
</tr>
</tbody>
</table>

**NOTES**

1. Type 4 anchor required. For details, see applicable Standard Plan 31.
2. For terminal type and details, see contract and applicable Standard Plan 31.
3. Post spacing is 6'-3" except where noted.
4. For guardrail to bridge roll connection see applicable Standard Plan 31 or Contract.
5. The slope from the edge of the shoulder into the face of the guardrail should not be steeper than 10:1 when the guardrail is within 12'-0" from the edge of the shoulder. Beyond 12'-0", the slope shall not be steeper than 6:1.

**CASE 16**

**CASE 17**

**CASE 18**
CASE 21

NOTE:
1. See Standard Plan C-1b for additional details.
2. One-way traffic layouts are identical to the two-way layout with the exception that only the posts installed the span need to be CRT's with double blocks.
NOTE
1. Install Type 2 Asphaltec Extended Curb at face of Guardrail. See Standard Plan F-20.
NOTES

1. If the distance from the end of the bridge to the end of the three beam bridge rail section exceeds 8' 3" using "12'-0" three beam sections, build a 4'-3" section of three beam bridge rail to reduce the length to less than 6'-3".

2. When three beam is installed at the face of the bridge curb, install a Type 2 Asphalt Extruded Curb at face of Guardrail. See Standard Plan C-2b. Match the height of existing bridge curb with a 30:1 transition.

3. When three beam is installed at the face of rigid bridge rail, an ACP ramp is required from the roadway surface to the top of the bridge curb or sidewall. The slope of the ramp shall be 20:1 or shallier.
### Flare Rate Table

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<th>Rate</th>
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<td>70</td>
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<tr>
<td>1:2</td>
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<td>65</td>
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<tr>
<td>1:3</td>
<td>10</td>
<td>60</td>
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<tr>
<td>1:4</td>
<td>10</td>
<td>50</td>
</tr>
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</table>
| 0:1   | 10   | 40 or less       

**Beam Guardrail, Buried Terminal Type 1**

**Standard Plan C-4**

---

**Section A**

**Beam Guardrail Anchor Type 2**

**Top of Cut**

**Plan**

**Edge of Shoulder**

**Beam Guardrail Anchor Type 2**

**Buried Point**

---

**Beam Guardrail**

**Buried Terminal Type 1**

**Elevation**

---

**Effective:** January 8, 2004 to August 1, 2004

---

**Effective:** January 5, 2004 to August 1, 2004

---

**Effective:** January 5, 2004 to August 1, 2004
NOTES

1. Unless otherwise indicated in the contract, the SRT-350 (12.5, 8 Post) as manufactured by Trinity Industries, Inc., or a PLET 350 as manufactured by Road Systems Inc., shall be installed per manufacturer's recommendations. If specified in the contract, the PLET TL2 as manufactured by Road Systems, Inc., shall be installed per manufacturer's recommendations.

2. Where terminal is placed on a curve, and post offsets would result in the rail intruding onto the shoulder (e.g., the inside of a curve), the posts shall be installed so that the face of the rail is at the edge of the shoulder.

3. When snow load post washers and snow load rail washers are called for in the contract, the snow load rail washers must be omitted within the terminal limits.

4. Offset distances:
   - PLET 350 = 4'-0"
   - PLET TL2 = 1'-8" (MIN)
1. An ET-PLUS (TL3) as manufactured by Trinity Industries, Inc. or an SKT-380 as manufactured by Road Systems, Inc. shall be installed according to manufacturer's recommendations. When a TL2 terminal is specified in the contract an ET-PLUS (TL2) as manufactured by Trinity Industries, Inc. or an SKT-TL2 as manufactured by Road Systems, Inc. shall be installed according to manufacturer's recommendations.

2. A reflectorized object marker shall be installed according to manufacturer's recommendations.

3. When snow load post washers and snow load rail washers are required by the contract, the snow load rail washers must not be installed within the terminal limits.

4. Terminal shall be installed at a taper, ensuring that end piece is entirely off shoulder.

5. Length for ET-PLUS (TL3) and SKT-380 is 80'. Length for ET-PLUS (TL2) and SKT-TL2 is 20'.

---

**EFFECTIVE:** JANUARY 5, 2004 TO AUGUST 1, 2004
1. Anchor plate may be constructed from 1/4" plates welded to equal strength and dimensions as shown.
2. For end section details see Standard Plan "Beam Guardrail End Sections".
3. For post details, see Standard Plan "Beam Guardrail Posts and Blocks".
4. Eight 3/4" x 1/2" machine bolts with hex nut and washer. Place washer on face side of rail.
5. Outside nut shall be torqued against inside nut a minimum of 100 ft-lbs.
6. Torque all bearing plate with 10d nail at corners to prevent turning.
7. Anchor pay limit does not apply when anchor is included in a Beam Guardrail Terminal.
1. Roll section and W8 x 17 post shall be fabricated to receive 3/8" hex head bolts as shown.

2. All bolts shall be high strength 3/8" hex head bolts with anchor roll washers.
NOTES
1. For details, see Standard Plan C-6.
2. For end section details see Standard Plan C-7 or C-7a.
3. For details, see Standard Plan C-4b.
4. Outside nut shall be torqued against inside nut a minimum of 100 ft-lbs.
5. Post and block shall match beam guardrail posts.

BEAM GUARDRAIL
PAY LIMIT

6'-3"
12" 16" 18"

ANCHOR PAY LIMIT

ANCHOR PLATE
TYP (SEE NOTE 1)

TWo 1" NUTS
AND WASHERS
TYP (SEE NOTE 4)

THREE BEAM GUARDRAIL
PAY LIMIT

6'-3"
12" 16" 18"

ANCHOR PAY LIMIT

ANCHOR RAIL WASHER
(SEE NOTE 1)

END SECTION DESIGN C
THREE BEAM (SEE NOTE 2)

WOOD BREAKAWAY POST
(SEE NOTE 5)

ANCHOR POST ASSEMBLY
(SEE NOTE 3)

THREE BEAM INSTALLATION

SEa NOTE 5

ANCHOR RAIL WASHER
(SEE NOTE 1)

END SECTION DESIGN C
TYP (SEE NOTE 1)

STANDARD 2" ID PIPE
SLEEVE (2 3/8" OD)

BEARING PLATE
(SEE NOTE 1)

TWo 1" NUTS AND
WASHERS (SEE NOTE 4)

ANCHOR POST ASSEMBLY
(SEE NOTE 3)

THREE BEAM INSTALLATION

SEa NOTE 5

STANDARD PLAN C-6c

NOTE: THIS PLAN IS A SPECIFICATIONS DOCUMENT BUT AN ELECTRONIC VERSION OF THE ORIGINAL "WORKeria OR THE ENGINEERING AND APPROVED FOR PLAN REVIEW. SUBJECT TO REVIEW BY THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY BE ORDERED FOR 10 CENTS. Approved for publication: 01-06-99

Clifford E. Mansfield
1. Attach W-beam to steel pipe with 5/8" x 1/2" button head bolt with no washer. No connection to the post is required.

2. For end section details see Standard Plan, "Beam Guardrail End Sections".

3. For details see Standard Plan, "Beam Guardrail Anchor Type 1".

4. For details see Standard Plan, "Beam Guardrail Posts".

5. Outside nut shall be torqued against inside nut a minimum of 100 ft/lbs.
1. For details, see Standard Plan, “Beam Guardrail Anchor Type 1”.

2. The rail element is to be included in the “Beam Guardrail” pay item. The “Anchor” pay item includes the anchor post, anchor plate, anchor cable, bearing plate, nuts and washers.

3. For details, see Standard Plan, “Beam Guardrail Posts and Blocks”.

4. Post shall match beam guardrail posts.

BEAM GUARDRAIL ANCHOR
TYPE 7 ANCHOR

Beam guardrail pay limit (see Note 2)
NOTES
1. End Section Design G shall be used except where noted on the plans or contract.
2. Attach guardrail to bridge rail or concrete barrier with 7/8" diameter high-strength bolts (Standard Specifications 406(1)) with self-drill inserts or resin bonded anchors. See the Contract Plans.
3. A single plate having similar dimensional shape to Design G and mating with the W-beam guardrail is an alternate.
4. In cases where Design "F" end section is placed on the outside of the guardrail, a galvanized 1/2" ID, 3/8" OD, 0.145" thick, Type A Plain Washer or anchor rail washer shall be placed under the splice bolt head.
**NOTES**

1. Attach guardrail to bridge rail or concrete barrier with 7/8" diameter high strength bolts (Standard Specification 0-55-04) with bolts slotted female inserts or resin bonded anchors. See the Contract Plans.

2. In cases where Design F End Section is lapped on the outside of the guardrail, a galvanized 1" ID, 2" OD, 0.134" thick, narrow Type A Plain Washer or an anchor nut washer will be placed under the split lock nuts.
DELETED
DELETED
SPECIAL BASE PLATE

Four 32 mm O.D. holes

ANKOR BOLT DETAIL

BAR LIST
All dimensions are cut to cut

<table>
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<tr>
<th>MARK</th>
<th>LOCATION</th>
<th>QTY.</th>
<th>SIZE</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>LENGTH</th>
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<tbody>
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<td>Footing-Dowel</td>
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<td>4</td>
<td>1-9&quot;</td>
<td>2-1/2&quot;</td>
<td>4&quot;</td>
<td>4'-3&quot;</td>
</tr>
<tr>
<td>M2</td>
<td>Footing</td>
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<td>Footing</td>
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<td>4</td>
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<td>2'-5-1/2&quot;</td>
<td>5'-3&quot;</td>
<td>7'-9-1/2&quot;</td>
</tr>
</tbody>
</table>

BENDING DIAGRAM

NOTE:

1. This plan shall be used for 42" and 50" light standards with 32" and 42" lengths double post drums.
2. For details on wire rope and connecting pin, see Standard Plan "Concrete Barrier Type 2."

Anchor bolts

2" Conduit

Anchor bolts

2-1/2"

Headed bolt

Threaded bolt

Base plate

1" bolt with heavy hex nuts and washers

Lock weld three spots

1" weld on top of barrier

Back-up strip no thinner than pole wall; tack weld to plate
1. For details on loops, connecting pin, reinforcing steel, and terminal units see Standard Plan Concrete Barrier Type 2.

2. See plans for surface treatment on back face of barrier.

3. At the juncture between the Concrete Barrier Type 5 and the Bridge Barrier, cover the exposed foot of the Type 5 Barrier with an earth berm.

Point of cover extend fill about half way down first precast unit. See Note 3.
BOX CULVERT GUARDRAIL STEEL POST TYPE 1

10” to 36” ground cover

CENTER LINE OF M6x35

3/4” Grout pad

See Base Plate Detail

See Cover Plate Detail

See Bearing Plate Detail

Wood block for steel posts
See Standard Plan C-10

See Post Attachment Detail

See Post Base Plate Detail

See Post Cover Plate Detail

1” Top and Bottom (TIP)

DATE

POST ATTACHMENT DETAIL

POST BASE ATTACHMENT DETAIL

BOX CULVERT GUARDRAIL STEEL POST TYPE 2

10” to 6” ground cover

CENTER LINE OF M6x8

3/4” Grout pad

See Base Plate Detail

See Cover Plate Detail

See Bearing Plate Detail

Wood block for steel posts
See Standard Plan C-10

See Post Attachment Detail

See Post Base Plate Detail

See Post Cover Plate Detail

1” Top and Bottom (TIP)
1. Length of W8x35 and W6x9 shall be determined based on distance from top of ground to top of grout pad. This distance shall be verified by the contractor.

2. Attach guardrail post to box culvert with 3/4" high strength bolts with resin bonded anchors.

3. Drill 1/2" diameter hole in concrete slab for 3/4" high strength bolts. Length of bolts is determined by top slab of box culvert thickness which shall be verified by the contractor.

4. For details of post attachment to double box culvert see Standard Plan "Guardrail Placement," Case 1B.

POST ANCHOR ATTACHMENT DETAIL

ANCHOR ATTACHMENT DETAIL

POST BASE PLATE DETAIL

BASE PLATE DETAIL

COVER PLATE DETAIL

BEARING PLATE DETAIL

NOTE: THE PLANS AND SPECIFICATIONS DOCUMENT ARE SUBJECT TO CHANGE. CONTACT THE ENGINEER OR THEIR REPRESENTATIVE TO VERIFY THE CURRENT INFORMATION. THIS PLAN IS A DRAFT.
1. When installed in front of slopes steeper than 6:1 distance between posts and slope break point shall be 12" Min.

2. Where barrier is parallel to the edge of the traveled way, every sixth post shall have a reflector. Reflectors shall be white when installed on the right side of traffic, and yellow when installed on the left side of traffic.

<table>
<thead>
<tr>
<th>Curve Radius</th>
<th>Post Spacing</th>
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<tbody>
<tr>
<td>700' or more</td>
<td>16'</td>
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<tr>
<td>600' to 220'</td>
<td>12'</td>
</tr>
<tr>
<td>219' to 110'</td>
<td>6'</td>
</tr>
<tr>
<td>Less than 110'</td>
<td>Use Not Recommended</td>
</tr>
</tbody>
</table>
1. Stagger Spring Cable End assemblies for clearance between units. Installation of cable end assemblies shall be as follows:

**LENGTH OF CABLE RUNS**

- Up to 500’ - Use the Spring Cable End Assembly on one end, and turnbuckle only on the other end of each cable.
- Over 500’ to 2000’ - Use the Spring Cable End Assembly on each end of each cable.


3. Distance from tangent of barrier run to notch for top cable on breakaway anchor angle shall be 4’.

4. The distance from the top of the footing to top of the highest cable is:
   - 31” for TYPE 1 Cable Barrier,
   - 30” for TYPE 2 and TYPE 3 Cable Barrier.

5. Where the cable is connected to a cable socket with a wedge type connector, one wire of the wire rope shall be cramped over the base of the wedge to hold it firmly in place.
NOTE

The Barrier Terminal is only used on the trailing end of a barrier separating two roadways with
the same direction of travel.
NOTES:
1. All concrete shall be Class 4000 except as noted.
2. For backfill requirements, see Standard Plan "D-4c".
3. When Wall Type 3-5w (saltwater) is specified, the concrete cover over steel in the front face and the total wall thickness shall be increased by 1'.
4. When Wall Type 3-5w (saltwater) is specified, concrete in the table column "Material Quantity" shall be increased by 0.003 \times N \times DVLF.
5. Concrete in the 24" wall sections shall be placed separately between expansion joints with a minimum 24-hour period between concrete placement.

SECTION - VERTICAL FACE

WALL TOP DETAIL

GUTTER DETAIL

KEY DETAIL

ELEVATION

WALL DESIGN WITH VERTICAL FRONT FACE AND 2:1 BACKSLOPE

REINFORCED CONCRETE RETAINING WALL TYPE 3 AND 3W STANDARD PLAN D-1c SHEET 1 OF 2 SHEETS

APPROVED FOR PUBLICATION
Clifford E. Mansfield 10/9/99
<table>
<thead>
<tr>
<th>BAR</th>
<th>MATERIAL QUANTITY</th>
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<td>BAR E (SIZE = #)</td>
<td>STEM REINFORCEMENT</td>
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<tr>
<td>H (in)</td>
<td>B/L (lbs/lin ft)</td>
</tr>
<tr>
<td>P</td>
<td>C</td>
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**WALL DESIGN WITH VERTICAL FRONT FACE AND 2:1 BACKSLOPE**

**REINFORCED CONCRETE RETAINING WALL TYPE 3 AND 3 SW STANDARD PLAN D-1c**

**APPROVED FOR PUBLICATION**

Clifford E. Mansfield

10/06/99

WASHINGON STATE DEPARTMENT OF TRANSPORTATION

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- Sheet 2 of 2 Sheets
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<th>DIMENSIONS</th>
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<th>STEM REINFORCEMENT</th>
<th>MATERIAL QUANTITY</th>
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WALL DESIGN WITH SLOPING FRONTPANE AND 2:1 BACKSLOPE

REINFORCED CONCRETE RETAINING WALL
TYPE 4 AND 4 SW
STANDARD PLAN D-1d
SHEET 2 OF 2 SHEETS

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UPON REQUEST.

APPROVED FOR PUBLICATION
Clifford E. Mansfield
10/09/99

DEPARTMENT OF TRANSPORTATION
Maryland State

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004

| Column A | Column B | Column C | Column D | Column E | Column F | Column G | Column H | Column I | Column J | Column K | Column L | Column M | Column N | Column O | Column P | Column Q | Column R | Column S | Column T | Column U | Column V | Column W | Column X | Column Y | Column Z |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Value 1 | Value 2 | Value 3 | Value 4 | Value 5 | Value 6 | Value 7 | Value 8 | Value 9 | Value 10 | Value 11 | Value 12 | Value 13 | Value 14 | Value 15 | Value 16 | Value 17 | Value 18 | Value 19 | Value 20 | Value 21 | Value 22 | Value 23 | Value 24 | Value 25 | Value 26 | Value 27 |

**Notes:**
- Column A contains the header for the first data column.
- Column B contains the header for the second data column.
- The table continues with similar headers for subsequent columns.
- Additional notes or instructions are present below the table.
### Wall to be designed Noise Barrier Type 1A, 1B, 1C or 1D. The Contract specifies actual wall designations.

### For intermediate wall heights, use the next higher H.

### Panels shall have at least 3 feet of level ground on each side.

### Construction joints in the footing shall be spaced at 120 feet maximum.

### The Contract specifies actual foundation requirements D1 or D2.

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<tr>
<th>WALL HT</th>
<th>TYPE 1A</th>
<th>TYPE 1B</th>
<th>TYPE 1C</th>
<th>TYPE 1D</th>
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<td>6&quot; x 3'-9&quot;</td>
<td>5&quot; x 3'-9&quot;</td>
</tr>
</tbody>
</table>

#### Typical Section

- Vertical reinforcing steel Bar D centered on wall
- Final ground line
- Construction joint with roughened surface
- Cast against undisturbed earth

#### Elevation

- 6" MIN 2'-0" MAX
- 6" MIN 3'-0" MAX
- 3" Clearance 12'-0" MIN

#### Notes

- **D-2a**
- 03-14-97
FOOTING WIDTH TRANSITION DETAIL

(NOTE: Transverse bars not shown)

Joint and Corner Detail

NOISE BARRIER - TYPE 2
CAST-IN-PLACE CONCRETE WALL
ON SPREAD FOOTING

D-2b
03-14-97
FOOTING WIDTH TRANSITION DETAIL
(For locations without footing step)

NOTE: Transverse bars not shown

NOISE BARRIER - TYPE 3
CAST-IN-PLACE CONCRETE WALL
ON SPREAD FOOTING
(OFFSET FOOTING)
NOTES

1. Wall to be designated Noise Wall Type 8A, BB, BC or BD. The Contract specifies actual wall designations.
2. For intermediate wall heights, use the next higher H.
3. Panels shall have at least 3'-0" of level ground on each side.
4. Construction joints in the footing shall be spaced at 120 feet maximum.
5. All joints shall be in full contact and sealed.
6. The Contract specifies actual foundation requirements D1 or D2.

NOISE BARRIER - TYPE 8
PRECAST CONCRETE WALL ON TRENCH FOOTING
## NOISE BARRIER - TYPE 9

**PRECAST CONCRETE WALL WITH SPREADING FOOTING**

### NOTES

1. Wall to be designated Noise Barrier Type 9A, 9B, 9C or 9D. The Contract specifies actual wall designation.
2. For intermediate wall heights, use the next higher height.
3. Panels shall have at least 3'-0" of level ground on each side.
4. Construction joints in the footing shall be spaced at 120 feet maximum.
5. All joints shall be in full contact and sealed.

### Typical Section

**2'-0" MIN**

- 2'-0" MIN
- 3'-0" at 18" (Typ)
- Bar A with 2'-0" MIN
- Construction Joint (Typ)
- Splice extending thru construction joint (Typ)
- Bar H alternate placement of hooks
- 3" Clearance

**2'-0" MIN**

- #4 at 18" (Typ)
- Bar A with 2'-0" MIN
- Construction Joint (Typ)
- Bar H alternate placement of hooks

### Elevation

- Panel width 15'-0" MAX
- See Joint Detail
- Level (Typ)
- 6" MIN
- 2'-0" MAX
- Sept - 1/2" (Typ)
- Grout pad, set panel immediately after placing grout
- Final ground line
- Grout hole without ducts. Ducts w/ opposite side from traffic
- Bar D (Typ)

### Effective:

- January 5, 2004 to August 1, 2004

---

**Sheet 1 of 2 Sheets**

---

**D-2i**

03-14-97
FOOTING WIDTH TRANSITION DETAIL
(for locations without footing step)

NOTE: Transverse bars not shown

JOINT AND CORNER DETAIL

NOISE BARRIER - TYPE 9
PRECAST CONCRETE WALL WITH SPREAD FOOTING
NOISE BARRIER - TYPE 10
PRECAST CONCRETE WALL WITH OFFSET SPREAD FOOTING

NOTES:
1. Wall to be designated Noise Barrier Type 10A, 10B, 10C or 10D. The contract specifies actual wall designation.
2. If intermediate wall heights, use the next higher height.
3. Panels shall have at least 3'-0" of level ground on each side.
4. Construction joints in the footing shall be spaced at 120 feet maximum.
5. All joints shall be in full contact and sealed.

TYPICAL SECTION
*Required for wall height 24'-0" - Type 10C,
  walls 22'-0" - 24'-0" - Type 10B and
  20'-0" - 22'-0" - Type 10A

D-2j
03-14-97
DETAIL B

FOOTING WIDTH TRANSITION DETAIL
(for locations without footing step)
NOTE: Transverse bars not shown

JOINT AND CORNER DETAIL

NOISE BARRIER - TYPE 10
PRECAST CONCRETE WALL WITH OFFSET SPREAD FOOTING
### Detail D

- **Block-out 10” long, Grout after bolting.**
- **Set elevation of leveling nut before setting panel.**
- **Anchor bolts AASHTO M183.**
- **Nuts with hardened washers or plate washer 3/8” x 2 3/8” x 2 3/8” AASHTO M183.**

### Base Plate Detail
- **Slot C for anchor bolt (TPB).**
- **Hole for B Bar (TPB).**

### End Panel
- **Panel length - 12’-0” MAX.**

### Shear-Key
- **Deflected reinforcement bar.**
- **Standard rivet head based on nominal size bar.**
- **Button head shall be firm and uniform against base plate.**
- **Bar B shall be held secure during concrete placement to prevent gaps between button head and base plate.**

### Step Detail
- **Top of pilaster (Typ).**
- **Alternate center tie locations.**
- **3 Ties at 12” OC MAX.**

### Wall Reinforcement
- **Outside of pilaster to outside of pilaster minus 4 1/2”**

---

**NOISE BARRIER - TYPE 11 PRECAST CONCRETE WALL ON SHAFT FOUNDATION**

---

**Sheet 2 of 3 Sheets**
**NOISE BARRIER - TYPE 12**

**PRECAST CONCRETE WALL WITH TRAFFIC BARRIER ON TRENCH FOOTING**

**TRENCH FOOTING**

See Note 3
### Column 1:

**Wall Height (H):**
- 6'-0" - 8'-0" - 10'-0" - 12'-0" - 14'-0" - 16'-0" - 18'-0"

**Bar A:**
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"

### Column 2:

**Wall Height (H):**
- 6'-0" - 8'-0" - 10'-0" - 12'-0" - 14'-0" - 16'-0" - 18'-0"

**Bar A:**
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"
- 8 at 15" / 4 at 15" / 3 at 15" / 5 at 15"

### Notes:
1. Wall to be designated Noise Wall Type 114, 115, 130, or 130. The Contract specifies actual wall designations.
2. For intermediate wall heights, use the next higher H.
3. Panels shall have at least 3 feet of level ground on each side.
4. Construction joints in the footing shall be spaced at 120 feet maximum.
5. All joints shall be in full contact and sealed.
6. The Contract specifies actual foundation requirements 51 or 52.

---

**Noise Barrier - Type 13**

**Precast Concrete Wall**

**With Traffic Barrier on Spread Footing**

**Reinforcement Section**

**Typical Section**

**Elevation**

---

**Sheet 1 of 2 Sheets**
NOTES:
1. Wall to be designated Noise Barrier Type 14A, 14B, 14C or 14D. The Contract specifies actual wall dimensions.
2. For intermediate wall heights, use the next higher height.
3. Construction joints in the footing wall shall be spaced at 120 feet maximum.
4. Panels shall have at least 3 feet level ground on each side.
5. All joints shall be in full contact and sealed.

RIGHT-OF-WAY TRAFFIC SIDE

Bar A centered on wall
see chart for gap size and spacing (TYP)

1/2" Seal full height (TYP)

Surface treatment as required

Construction joint with reinforced surface

2'0" MIN splice

Top of roadway

Encase base plate and block-out with grout after final alignment at wall panel.

TYPICAL SECTION

*Height may vary if required to provide a smooth profile consistent with the roadway profile

SECTION AT SHAFT SUPPORT

ANCHOR SPIRAL WITH TWO TURNS TOP AND BOTTOM

ANCHOR BOLTS WITH NUTS TOP AND BOTTOM

PLATE 1/2" x 4" x 0'-11" with holes. See Section C-C for bolt hole locations.

ALTERNATE ANCHOR DETAIL

PLATE 1" x 4" x 0'-11" with holes. See Section C-C for bolt hole locations.

ANCHOR BOLTS

ANCHOR BOLT (TYP 4 places)

#8 Spiral at 4" pitch

#4 at end of barrier

#4 at end of barrier

2'-6"

2'-4/"
1. Wall to be designated Noise Barrier Type 15A, 15B, 15C or 15D. The contract specifies actual wall designations.

2. For intermediate wall heights not listed use the next higher type.

3. Panels shall have at least 3 feet of level ground on each side.

4. Plywood and Glulam panels and all timber to be pressure preservative treated.

5. The contract shall specify actual foundation requirements D1 or D2.
### Notes
1. Wall to be designated Noise Barrier Type 16A, 16B, 16C, or 16D. The Contract specifies actual wall designations.
2. For intermediate wall heights, use the next higher H.
3. All masonry shall be a low unit and installed as running bond.
4. All masonry is to be specially inspected.
5. All Concrete Masonry Unit (CMU) cells that have vertical steel reinforcing bars or bond beam units shall be filled with grout.
6. Panels shall have at least 3 feet of level ground on each side.
7. Construction joints in the footing shall be spaced at 120 feet maximum.
8. See "Masonry wall Finishes and Details" sheet for masonry block finishes, special shapes, sizes, and layouts.

### Diagram
- **Elevation**
- **Noise Barrier - Type 16**
- **Masonry Wall on Trench footing**

### Tables
- **Wall Type 16A**
- **Wall Type 16B**
- **Wall Type 16C**
- **Wall Type 16D**

### Additional Details
- **Two blocks MIN, Three blocks MAX**
- **Expansion joints at 40'-0" MAX centers. See other sheets for details.**
- **For reinforcement details, see wall schedule.**
- **Construction joints (see Note 17). Separate from wall joint.**
- **Solid grout cap Bond beam at top 2" (Typ)"**
- **Reinforcement steel Bar D (centered)"**
- **CMU (see Note 5)"**
- **#5 at 4'-0" MAX (Typ)"**
- **3'-0" MIN""**
- **6'-0" MAX 1""**
- **#4 at about 18" with 2'-0" MIN splice continuous thru expansion joint"**
- **1'-0" 10' CMU"**
- **3" Clearance"**
- **Final ground line"**
- **Top of footing 2'-0" MIN splice continuous thru expansion joint"**
- **WALL DIM X DEPTH D1 DEPTH D2 BAR C BAR D**
- **WALL HT H CMU DIM X DEPTH D1 DEPTH D2 BAR C BAR D**

### Effective Dates
- **Effective: January 5, 2004 to August 1, 2004**

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**Sheet 1 of 2 Sheets**
TYPICAL EXPANSION JOINT

*5 (TYP)
See Detail A

At expansion joints: continuous expansion joint filler placed in stone block recesses. Size as required.

Polyurethane sealant
Backer rod

V/2 Joint

DETAIL A
Typical both sides of wall

BOND BEAM DETAIL

Bond beam unit
Bond beam limit

NOISE BARRIER - TYPE 16
MASONRY WALL ON TRENCH FOOTING
### Noise Barrier - Type 17

**Masonry Wall on Spread footing**

#### Typical Section

**Details:**
- **1.** Wall to be designated Noise Barrier Type 17A, 17B, 17C, or 17D. The Contract specifies actual wall designations.
- **2.** For intermediate wall heights, use the next higher m.
- **3.** All masonry shall be hollow unit and installed as running bond.
- **4.** All masonry is to be specially inspected.
- **5.** All Concrete Masonry Unit (CMU) cells that have vertical steel reinforcing bars or bond beam units shall be filled with grout.
- **6.** Pipe ascends have of least 3 feet of level ground on each side.
- **7.** Construction joints in the footing shall be spaced at 120 feet maximum.
- **8.** See "Masonry Wall Finishes and Details" sheets for masonry block finishes, special shapes, sizes, and layout.

![Diagram](image-url)

#### Tables

**Table 17A**

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**Notes:**
- See Note 7 on expanding joint material and placement.
### BAR SIZE | SPLICE LENGTH
---|---
*6| 2'-8"
*7| 3'-8"
*8| 4'-10"

**Bond Beam Detail**

- Cells with vertical reinforcing and bond beams to be filled with grout.
- Expansion joint filler placed in sand block recesses.
- Traffic side

**Typical Expansion Joint**

- Bond beam units
- Bond beam limit
- Polyurethane sealant
- Backer rod
- 1/4" Joint

**Footing Width Transition Detail**

- For locations without footing step.
- NOTE: Transverse bars not shown.

**Noise Barrier - Type 17**

- Masonry wall on spread footing.
NOISE BARRIER - TYPE 1B

MASONRY WALL ON OFFSET SPREAD FOOTING

1. Wall to be designated Noise Barrier Type 18A, 18B, 18C or 18D. The Contract specifies actual wall designations.
2. For intermediate wall heights, use the next higher H.
3. All masonry shall be hollow unit and installed as running bond.
4. All masonry is to be specially inspected.
5. All Concrete Masonry Unit (CMU) cells that have vertical steel reinforcing bars or bond beam units shall be filled with grout.
6. Panels shall have at least 3 feet of level ground on each side.
7. Construction joints in the footing shall be spaced at 120 feet maximum.
8. See "Masonry Wall Finishes and Details" sheets for masonry block finishes, special shapes, sizes, and layout.

D-2r
03-14-97
**DETAIL A**

- Hooks parallel to wall layout line
- No. 4 Stirrup spacing of 12"
- Three - No. 4 Stirrup spacing of 6"
- Concrete shaft
- No. 3.5 spiral at 6 pitch

**TYPICAL EXPANSION JOINT**

- Expansion joint
- Concrete block recesses
- Size as required

- Polyurethane sealant
- 1/4" Joint
- Backer rod

**DETAIL B**

Typical both sides of wall

**BOND BEAM DETAIL**

- Bond beam units
- Bond beam limit

**STEP DETAIL**

- No. 4 at 1.0
- Even multiples of 6.0

**NOISE BARRIER - TYPE 19**

Masonry wall on shaft with grade beam foundation
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**Notes:**
- Use standard reinforcement for panels 1-3.
- Use synthetic reinforcement for panels 4-6.
- Panels 7-9 require custom reinforcement per engineer's approval.
1. Get form on completed lift.

2. Unroll geosynthetic and position it so that a 4 to 6 inch lap over the weld of a geosynthetic is used for the geosynthetic reinforcement. Tuck geotextile to prevent muck from falling through geotextile openings.

3. Place the backfill until the backfill is up to half of the welded vertical geosynthetic layer spacings.

4. Place a narrow groove greater than full lift height against the form.

5. Place the geosynthetic back over the narrow and lock into place with backfill.

6. Complete backfill units. The completed backfill layer thickness is equal to the required vertical geosynthetic layer spacings.

7. Repeat the form and repeat the sequence.

**GEOSYNTHETIC WALL CONSTRUCTION SEQUENCE**

---

**NOTES**

1. Pouring two layers at a time will keep muck from falling into the wall face cavity.
2. Construction joints in the cohesive rocks shall be aligned at 200 feet max.
3. For details of expansion joints in cohesive rocks, see standard plan D-14, sheet 1, elevation.

---

**ELEVATION**

- Place struts at 4 to 6 inches along wall face.
- Temporary form system detail (optional).

---

**PLAN**

- 3-4 inch spreader plate.
- 2-3 inch steel strap.
- 1 1/4 inch pipe on backwall.
- 1 1/4 inch steel pin (secured to steel strap).
- 2-3 VMP.

---

**WOOD INNOCK TO SUPPORT AND CLEAR SPACE**

---

**GEOSYNTHETIC WALL TYPES 1-6**

**STANDARD PLAN D-3**

Sheet 4 of 4 sheets

APPROVED FOR PUBLICATION

[Signature]

[Date]
TYPICAL GABION

Unit A - 2 cell gabion = 6'
Unit B - 3 cell gabion = 9'
Unit C - 4 cell gabion = 12'

CROSS-CONNECTING WIRE
PLACEMENT, END CELLS

FASTENING ADJACENT BASKETS

LACING DETAIL

TWISTED FABRIC

WELDED FABRIC

CROSS CONNECTING WIRE
PLACEMENT, INTERIOR CELLS
OF FRONT GABIONS
ASSEMBLY DETAILS

- Anchor wire rope
- Horizontal wire rope: 5/8" steel u-bolt
- U-BOLT: Use to clump intermediate horizontal wire ropes to vertical wire ropes

Wire rope connection

HOG RING
Use for top connections of netting

9 gauge Steel wire

1. The Contractor may provide two twin-base wire rope clips at 5' O.C. in lieu of three single-base wire rope clips as shown.

NOTES:

- Top wire rope
- 4" 014 x 1/8" Steel ring (TP)
- Hog rings at 2" intervals (TP)
- Anchor wire rope
- Top anchor
- Intermediate horizontal wire rope
- 3/8" U-bolt
- Intermediate vertical wire rope
- Bottom wire rope
- Maximum length of horizontal wire rope < 150'
- Weight is less than 50

9/16" - 1" x 3" Steel plate
- Steel ring, anchor rod or bottom horizontal wire rope
- Wire rope clips (see note 1)

WIRE ROPE CONNECTION

STANDARD PLAN D-7

SLOPE PROTECTION
TYPE 1 ANCHOR
(FOR USE IN EARTH)

TYPE 2 ANCHOR
(FOR USE IN COMBINED EARTH AND ROCK)

TYPE 3 ANCHOR
(FOR USE IN SOLID ROCK)

TYPE 4 ANCHOR
(FOR USE IN SOLID ROCK)
ELEVATION

CONCRETE SLOPE PROTECTION
(Pneumatically placed or poured in place cement concrete shown)

Concrete
Slope protection

Embankment slope

SECTION

TYPE 1 SLOPE PROTECTION FILL SECTION DETAIL
(Semi-open concrete masonry units shown)

SIDESLOPE

10 Gage 6" x 6" wire
mesh reinforcement
 Ø center
(See Std Spec.9-07.7)

TYPE 2 SLOPE PROTECTION CUT SECTION DETAIL
(Pneumatically placed or poured in place cement concrete shown)

Top of slope protection
See Type 1 Slope Protection Fill Section Detail

Slope protection

Calculated toe of fill slope

SIDE ELEVATION
(For fill section on lower roadway)

Fill slope shall be rounded to allow placement of concrete slope protection.

Slope protection
Bottom edge of slope protection follows bottom of ditch.

SIDE ELEVATION
(For cut section on lower roadway)

See Type 2 Slope Protection Cut Section Detail

Slope protection

Bottom edge of slope protection follows bottom of ditch.

Shoulder

Edge of lane
1. The design and shape of the semi-open concrete masonry unit shown is only one example of the products that may be used.

2. The Type 3 Slope Protection Curb Detail shall be used only when the lower roadway cross section requires a curb.
1. Dimensions and notations for superstructure are typical for both single lane and two lane bridges.
2. All timber and lumber shall be fir or better and untreated Douglas fir-larch.
3. All planking shall be untreated Douglas fir and shall be driven to develop a minimum load bearing capacity of 15 tons.
4. Blocking for frame bents shall be proportioned to carry a minimum load of 15 tons per post.
5. All hardware shall be black, unpainted.
6. Each deck plate shall be spiked to each stringer with two 2" spikes, number 3 or larger.
7. On 17' spans, stringers shall be 8x16 S.I.E. On 15' spans, stringers shall be 6x16 S.I.E.
   Two-lane bridges shall use thirteen times of stringers, three-lane bridges shall use seven times of stringers.
8. Overlay thickness must be sufficient to cover bolts.

SECTION A-A

DISTRIBUTION PLATE DETAIL

BASE PLATE DETAIL

BACKING PLATE DETAIL

PILE OR FRAME DETOUR BRIDGE WITH ASPHALT OVERLAY

USE ONLY FOR TEMPORARY BRIDGES

STANDARD PLAN E-2

SHEET 2 OF 2 SHEETS

APPROVED FOR PUBLICATION

5/29/98

STATE DESIGN ENGINEER

STATE DEPARTMENT OF TRANSPORTATION

M. MINT LEIN

REGISTERED PROFESSIONAL ENGINEER

EXPRESS JANUARY 17, 1999
NOTES
2. Type 4a and Type 5a curbs do not require steel tie bars or adhesive for anchoring.

SPACING OF ANCHOR BARS

EXTRUDED CURB
1. Avoid placing drainage structures, junction boxes or other obstructions in front of ramp access areas.
2. Detectable warning patterns may be etched by any method that will achieve the truncated dome dimensions and spacing shown.
3. Curb and gutter shown, see the Contract Plans for the curb design specified. See Std. Plan P-1 for curb details.
4. The plan view for SIDEWALK RAMP TYPES 1B, 1C & 1D are provided to define each ramp type. See the RAMP DETAIL on this sheet. See Std. Plan P-3 for sidewalk joint placement and details.
5. Ramp slope shall not be steeper than 1:12H:V.

NOTES:

CERTIFICATE:

[Signature]

[Position]

[Date]

[Company]

[Address]
NOTES:

1. Avoid placing drainage structures, street box, or other obstructions in front of ramp access areas.

2. Detectable warning patterns may be created by any method that will achieve the intended color dimensions and spacing shown. The detectable warning pattern area shall be yellow, in compliance with Std. Spec. 6-14-303.

3. Curb and gutter shown, see the Contract Plans for the curb design specified. See Std. Plan F-1 for curb details.

4. See Std. Plan F-3 for sidewalk joint placement and details.

5. Ramp slope shall not be steeper than 1:20:1.

SIDWALK RAMP TYPES 3A, 3B, 3C & 3D
STANDARD PLAN F-3b

Sheet of 3 sheets
APPROVED FOR PUBLICATION

Harold J. Petersen
01-13-03
Washington State Department of Transportation

EXPIRES MAY 10, 2003
Base plate hole + pole outside dia plus $\frac{3}{4}''$
1-8'' Bolt circle

0.75'' Dia Hole for anchor bolt (TOP)

Hand hole frame
Round and smooth inside edges

1-8'' Steel bolt, 1-8'' long, with washer and nut for ground.

Removable drain tight hand hole cover with gasket.
Fasten with 2 stainless steel (ASTM F-1931) screws

CONDUIT PLACEMENT

To sign luminare isolation switch enclosure

END POST BASE WITH HANDELHOLE LOCATION

PEND thickness less $\frac{3}{4}''$

HANDHOLE DETAIL

$\frac{3}{4}$'' Allen hollow set screw with dog point (corrosion resistant metal or coating) at 90° intervals

Hemispherical post finial $\frac{3}{8}$'' M6
thickens, install after galvanizing

Drill and tap for set screw
Bend brace for snug fit

FINIAL DETAIL

NOTES
1. Horizontal and vertical clearance requirements shall be as shown in Contract Plans.
2. Assemble with $\frac{3}{4}$'' Diameter bolts. Install bolts with head upward. Exclude bolt threading from grip.
3. Details not shown are same as Chord to End Post Connection Type A, defining the $\frac{3}{4}$'' plate stiffener on the top member.
4. Ends of diagonals shall be cut to fit neatly against chord or post. Filllet weld size to be diagonal tube or pipe thickness plus $\frac{3}{4}$''.
5. Horizontal diagonals must join chords where vertical diagonals connect (panel points).
6. Interior diagonals shall be placed at panel points, 40'' maximum spacing. Locate symmetrical about centerline of span if possible. An interior diagonal is not required at span ends.
7. BOLT gussets or shims where interior diagonals are not required at chord field splice.
8. Dimension shall equal chord thickness or $\frac{3}{4}$'', whichever is less.
9. No post splice permitted in lower third of height, nor closer than $3''-0''$ to bottom of chord. No chord shop splice permitted in middle third of span, maximum of one splice in each end post.
10. Drill hole in chord at each diagonal and strut. Diameter shall be $\frac{3}{8}$'' for spans over 60'. For spans 60' or less, diameter shall be $\frac{3}{4}$''.

GONN BRIDGE
STANDARD PLAN G-3
SHEETS OF 8 SHEETS

APPROVED FOR PUBLICATION

Washington State Department of Transportation

EXPRESS: JANUARY 5, 2004 TO AUGUST 1, 2004

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
**Laminated Post Embedment Depth (D) in Feet**

<table>
<thead>
<tr>
<th>Height Z (FT)</th>
<th>Total Sign Area (Square Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 to 12</td>
<td>6 6 7 8 9 10</td>
</tr>
<tr>
<td>13 to 15</td>
<td>6 6 7.5 9 10</td>
</tr>
<tr>
<td>16 to 18</td>
<td>7 7.5 9 10</td>
</tr>
<tr>
<td>19 to 22</td>
<td>7 8 10</td>
</tr>
<tr>
<td>23 to 26</td>
<td>7.5 8.5</td>
</tr>
</tbody>
</table>

- **9 to 12 ft:**
  - 6 ft (50)
  - 6 ft (100)
  - 7 sq ft (150)
  - 8 sq ft (200)
  - 9 sq ft (250)
  - 10 sq ft (290)

- **13 to 15 ft:**
  - 6 ft (50)
  - 6 ft (100)
  - 7.5 sq ft (150)
  - 9 sq ft (200)
  - 10 sq ft (250)

- **16 to 18 ft:**
  - 7 sq ft (150)
  - 8 sq ft (200)
  - 9 sq ft (250)

- **19 to 22 ft:**
  - 7 sq ft (150)
  - 8 sq ft (200)
  - 10 sq ft (250)

- **23 to 26 ft:**
  - 7.5 sq ft (150)
  - 8.5 sq ft (200)

**GALVANIZED METAL CAP**

**See “Sign Specifications” sheet of Contract Plans for H, V, W, X, and Y values.**

**G-4b 1 of 1**

---

**End Notes:**

- Post will be Micro-Lam® Laminated veneer Type L or Type M post manufactured by Trus Joist or an equivalent that has been crash tested and approved by the FHWA.
- $H_1$, $H_2$, $H_3$, $H_4$ = Length of post.
- $V$ = Elevation difference from edge of lane to bottom of sign.
- $W$ = Distance from edge of lane to center of nearest post.
- $X$ = Horizontal measurement of sign.
- $Y$ = Vertical measurement of sign (or signs).
- $Z$ = Height from ground to mid-height of sign (or signs) of longest post.
- $D$ = Post embedment.

---

**ROADSIDE SIGNS ON LAMINATED WOOD BOX POSTS**

**Type L Post**

**Type M Post**

**SECTION A-A**

**Traffic Direction**

**DETAIL C**

- Galvanized nails
- 20 Gauge galvanized metal cap

**DETAIL B**

- 1" DIA holes connected by sawcut (both sides TYP)
- Finished ground line

**TYPE L POST**

**TYPE M POST**

---

**Traffic Direction**

**DETAIL C**

- Galvanized nails
- 20 Gauge galvanized metal cap

**DETAIL B**

- 1" DIA holes connected by sawcut (both sides TYP)
- Finished ground line

**TYPE L POST**

**TYPE M POST**

---
MATERIAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>PIPE</th>
<th>ASTM A 36 OR ASTM A 36 GRADE E OR B</th>
<th>OR ASTM A 36 GRADE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLATING AND SHAPED</td>
<td>ASTM A 36</td>
<td></td>
</tr>
<tr>
<td>STRUCTURAL TUBING</td>
<td>ASTM A 36 GRADE B</td>
<td></td>
</tr>
<tr>
<td>GALVANIZED FOR PIPE PLATES AND SHAPES</td>
<td>ASABTO U 111</td>
<td></td>
</tr>
</tbody>
</table>
| HIGH STRENGTH BOLTS | STD SPEC. 86-A (2)
| ALL OTHER BOLTS | STD SPEC. 86-A (2) |
| FASTENER GALVANIZED | ASABTO N 202 |
| STEEL SADDLE | ASTM A 36 |

NOTES

1. NOT INTENDED FOR USE IN FRONT OF STATIC ENTRANCE.
2. FOR MOUNTING THE MAINTENANCE WALKWAY TO A MONUMENT OVERHEAD SIGN STRUCTURE, SEE STANDARD PLAN 5-5.
3. FOR MOUNTING THE MAINTENANCE WALKWAY TO A TRUSS-TYPE OVERHEAD SIGN STRUCTURE, SEE STANDARD PLAN 5-5.
4. LOCATION OF NAILING SPACES TO BE DETERMINED BY FABRICATOR.

MAINTENANCE WALKWAY

ELEVATION

MAINTENANCE WALKWAY

PLAN

MAINTENANCE WALKWAY

END VIEW A

END VIEW B

MAINTENANCE WALKWAY DATA

INSTALL 3 HAMERS 1/4" x 3/4" BOLTS

2" NUT PIPE HEADER AND POST (TYPE)

2" STK. PIPE HEADER AND POST (TYPE)

3" STK. PIPE HEADER AND POST (TYPE)

STEEL GRATING DRAWING DETAIL (TYPE)

STEEL GRATING DRAWING DETAIL (TYPE)

STEEL GRATING DRAWING DETAIL (TYPE)

TOP OF TOE PLATE

TOP OF GRATING

Provide a size 3" drain hole in pipe, at pipe crossover, for walkway.
1. Mileposts of the type specified shall be placed as shown hereon. If conditions preclude placement at the correct location, the mileposts may be moved as much as 5% in either directions mileposts that cannot be placed within this degree of accuracy shall be omitted entirely.

2. Mileage for mileposts shall commence at the south or west terminus of the highway route and progress in a north or east direction.

3. All Spur and Equation signs shall have “S” and “E” plaques.

4. Mileposts in cut sections shall be placed at back of ditch. Milepost markers may be placed up to 30' from the edge of the traveled way.

5. See “Washington State Sign Fabrication Manual” for the dimensions and colors of the Milepost/Plaque.
**Type 2A Base Connection Detail**

Use only when sign area is less than 35 square feet per post.

**Boss & Offset Table**

<table>
<thead>
<tr>
<th>When Z &gt; R</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 ≤ 10</td>
<td>0.0875&quot;</td>
</tr>
<tr>
<td>10 ≤ 12</td>
<td>0.0675&quot;</td>
</tr>
<tr>
<td>14 ≤ 15</td>
<td>0.0375&quot;</td>
</tr>
</tbody>
</table>

**Shims**

Shims shall be 14 gauge or 18 gauge.

**Shim Detail - Type 2A**

Use no more than two shims per anchor coupling.

**Bracket Detail - Type 2A**

**Anchor Coupling Detail - Type 2A**

**Coupling Bolt Detail - Type 2A**

**Foundation Detail - Type 2A**

**Anchor Ferrule Detail - Type 2A**

---

**Roadside Sign Structures**

**Steel Post Signs**

**Standard Plan G-8a**

**Sheet 2 of 3 Sheets**

**Approved for Publication**

Clifford E. Mansfield

10/09/04
## Dimension Table for Type 2B Bases

<table>
<thead>
<tr>
<th>Post Size</th>
<th>Anchor Ferrule Spacing</th>
<th>Keyway Offset 1</th>
<th>K Distances are</th>
<th>Bracket Width Bw</th>
<th>Hole Dia D</th>
<th>Spacing S</th>
<th>Fasteners</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3x9</td>
<td>13%&quot;</td>
<td>3&quot;</td>
<td>0.200&quot;</td>
<td>0.150&quot;</td>
<td>0.100&quot;</td>
<td>5&quot;/1&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>W5x12</td>
<td>14%&quot;</td>
<td>When Z &gt; 7&quot;</td>
<td>9&quot; &lt; 12&quot;</td>
<td>12&quot; &lt; 25&quot;</td>
<td>1½&quot;</td>
<td>1&quot;/1½&quot;</td>
<td>Top bolt M14 2¾&quot;</td>
</tr>
<tr>
<td>W6x16</td>
<td>14%&quot;</td>
<td>When Z &gt; 8&quot;</td>
<td>10&quot; &lt; 14&quot;</td>
<td>14&quot; &lt; 25&quot;</td>
<td>1½&quot;</td>
<td>1½&quot;/1½&quot;</td>
<td>Middle bolt 2¾&quot;</td>
</tr>
<tr>
<td>W8x18</td>
<td>16%&quot;</td>
<td>When Z &gt; 9&quot;</td>
<td>11&quot; &lt; 16&quot;</td>
<td>16&quot; &lt; 25&quot;</td>
<td>1½&quot;</td>
<td>3&quot;</td>
<td>Bottom bolt 3&quot;</td>
</tr>
<tr>
<td>W8x21</td>
<td>16%&quot;</td>
<td>When Z &gt; 9½&quot;</td>
<td>11½&quot; &lt; 16½&quot;</td>
<td>16½&quot; &lt; 25½&quot;</td>
<td>1½&quot;</td>
<td>1½&quot;</td>
<td>Cap screw 1½&quot;</td>
</tr>
<tr>
<td>W10x22</td>
<td>18%&quot;</td>
<td>When Z &gt; 10&quot;</td>
<td>12&quot; &lt; 17&quot;</td>
<td>17&quot; &lt; 25&quot;</td>
<td>2&quot;</td>
<td>1½&quot;</td>
<td>5/8&quot; bolt, lockwasher, and nut</td>
</tr>
<tr>
<td>W10x26</td>
<td>18%&quot;</td>
<td>When Z &gt; 10½&quot;</td>
<td>12½&quot; &lt; 17½&quot;</td>
<td>17½&quot; &lt; 25½&quot;</td>
<td>1½&quot;</td>
<td>2&quot;</td>
<td>3/4&quot; bolt, lockwasher, and nut</td>
</tr>
</tbody>
</table>

- **Shims shall be 14 gauge or 19 gauge.**

**Shim Detail - Type 2B**

Use no more than two shims per anchor coupling.

Use no more than three shims for any two anchor couplings.

**Bracelet Detail - Type 2B**

Stainless steel bosses to be press fit into bracket.

**Anchor Coupling Detail - Type 2B**

**Type 2B Foundation Detail**

- Eight x 7 Bars
- W8-18H x 2042
- Ground line at L Post
- Anchor ferrules
- Concrete foundation
- Grilled shank permitted
- 2½" Clearance to 8" 3/4" bolts

**Type 2B Foundation Detail**

- Anchor ferrule spacing (See Dimension Table)

**Roadside Sign Structures for Multiple Steel Post Signs**

**Standard Plan G-8a**

**Sheet 3 of 3 Sheets**

**Approval for Publication**

- Clifford E. Mansfield

**Effective:** January 5, 2004 to August 1, 2004

**Effective:** January 8, 2004 to August 1, 2004
### Guide Post Reflective Sheeting Applications

<table>
<thead>
<tr>
<th>Type</th>
<th>Type WW</th>
<th>Type W</th>
<th>Type Y</th>
<th>Type YY</th>
<th>Type G1</th>
<th>Type G2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**NOTES**

1. When guardrail runs co-nominal, the contractor shall either:
   A. Drive the flexible guide post in line with the guardrail posts, or
   B. Mount the shorter flexible guide post onto the guardrail post.

2. Guide posts shall be fastened to the guardrail posts using two 2'' x 36'' lag screws with washers, along perimeter of post. Also acceptable is any approved method submitted by the guardrail post manufacturer.

3. When concrete barrier runs co-nominal, the contractor shall mount barrier delineators where guideposts are required.

---

**FLEXIBLE GUIDE POST**

**GUIDE POSTS**

**STANDARD PLAN H-1**

*Sheet 1 of 1 Sheet*

---

**APPROVED FOR PUBLICATION**

Harold J. Petersen 11/10/04

Washington State Department of Transportation
THREE EQUAL SPACES WHEN R<15
FOUR EQUAL SPACES WHEN R>25 (TYP)

100' DECELERATION TAPER

40' 60'

500'

200'

100' (TYP)

DIVIDED HIGHWAY

GUIDE POST PLACEMENT
GRADE INTERSECTION
STANDARD PLAN H-1a

LEGEND

TYPE W
TYPE Y
TYPE WW

SEE TABLE IN STANDARD PLAN H-1 FOR DEFINITION OF GUIDE POST TYPES

EXPDES OCTOBER 26, 2000

GUIDE POST PLACEMENT
GRADE INTERSECTION
STANDARD PLAN H-1a

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC VERSION OF THE ABOVE RELIABLE INTERPRETATION FOR THE USE OF THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY NOT BE REPRODUCED WITHOUT AUTHORIZATION.

APPROVED FOR PUBLICATION

Clifford E. Mansfield 4/14/00

Washington State Department of Transportation

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
GUIDE POST SPACING (FEET)

<table>
<thead>
<tr>
<th>RADIUS</th>
<th>N</th>
<th>RADIUS</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>90</td>
<td>3,000</td>
<td>90</td>
</tr>
<tr>
<td>100</td>
<td>95</td>
<td>3,060</td>
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<tr>
<td>150</td>
<td>90</td>
<td>4,060</td>
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<tr>
<td>200</td>
<td>85</td>
<td>4,860</td>
<td>90</td>
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<tr>
<td>250</td>
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<td>5,000</td>
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<td>35</td>
<td>12,000</td>
<td>90</td>
</tr>
<tr>
<td>650</td>
<td>30</td>
<td>13,000</td>
<td>90</td>
</tr>
</tbody>
</table>

INTERPOLATE FROM THIS TABLE FOR RADIUS NOT SHOWN

TWO-WAY UNDIVIDED HIGHWAYS
GUIDE POSTS ON OUTSIDE OF CURVE IN DIRECTION OF TRAVEL

NOTES
1. The limit guide post is positioned 3/4" distance from the beginning of curvature.
2. If the last guide post beyond the curve is 1/2 "S" or more, no additional posts are required.
3. If the last guide post beyond the curve is less than 1/2 "S", one additional post is required.
4. For definitions of guide post types, see Standard Plan H-1.

GUIDE POST PLACEMENT FOR HORIZONTAL CURVES

STANDARD PLAN H-1c

LEGEND
- TYPE W
- TYPE XA
- TYPE Y

NOTE 1

MULTIPLE DIVIDED HIGHWAYS
GUIDE POSTS ON INSIDE AND OUTSIDE OF CURVE FOR EACH DIRECTION OF TRAVEL
WARNING LIGHT ATTACHMENT DETAIL

ATTACHMENT DETAIL "A"

ATTACHMENT DETAIL "B"

NOTE:

1. All fixtures may be either painted, galvanized, or stainless steel. All steel angle and tubing shall be hot-rolled, high carbon steel, painted or galvanized.

2. Install one lightweight Type A low-intensity flashing warning light on the traffic side of the barricade. Install two Type A low-intensity flashing warning lights per barricade when the barricades are used to close a roadway. Attach the light to the barricade according to the manufacturer's recommendations or use the clips shown on the plan.

3. Strips on barricade rails shall be alternating orange and white reflective stripes (selecting outward at an angle of 45 degrees in the direction traffic is to pass).

4. The Type 3 barricade design shown on this plan meets the current test requirements of MCHP 580. Alternate designs may be approved if they conform to the MCHP 580 crash test criteria.

5. When a sign is mounted on the barricade, it shall be securely bolted to at least two plywood panels. The top of the sign shall not be higher than the top panel of the barricade.

6. When sandbags are used in freezing weather, ensure blanket shall be placed with the sand in a quantity to prevent the sand from freezing.
STRIPE ON THE BARRICADES SHALL SLOPE DOWNWARD IN THE DIRECTION TRAFFIC IS TO PASS

ROAD CLOSURE AT INTERSECTION

STRIPE ON THE BARRICADES SHALL SLOPE DOWNWARD IN THE DIRECTION TRAFFIC IS TO PASS

ROAD CLOSURE AT OTHER LOCATIONS

TYPE 3 BARRICADE

STANDARD PLAN H-2

SHEET 2 OF 3 SHEETS

APPROVED FOR PUBLICATION

Scott Zabel
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

EXPIRED: MAY 5, 2003

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
NOTES:

1. Recessed pavement markers, when specified, shall be installed at the locations shown for Type 2W RPM's on multilane one way roadways, and Type 2YY RPM's on two lane two way roadways.

MULTILANE ONE WAY TRAFFIC

M-1. For lane lines, Type 2W RPM's shall be spaced at 80' intervals on tangents and horizontal curves with a radius of 5000' or more, and 40' intervals on horizontal curves having radius of less than 5000'.

M-2. When specified, Type 2Y RPM's shall be placed outside the left edge line. Placement is shown on "Left Edge of Lane Placement".

TWO LANE TWO WAY TRAFFIC

T-1. For center lines, Type 2YY RPM's shall be spaced at 80' intervals on tangents and horizontal curves with a radius of 5000' or more, and 40' intervals on horizontal curves having radius less than 5000'. Type 2YY RPM's are to be centered between skip lines.
**LEFT TURN LANE**

- **Taper length** = $T_1 \times \text{taper rate}$
- **Approach**
- **Departure**
- **Double yellow center line**, see Detail B
- **Type 2L traffic arrows**, see Note 1

**TWO-WAY LEFT TURN LANE**

- **Taper length** = $T_2 \times \text{taper rate}$
- **Two-way left turn line**, see Detail C
- **Type 2L traffic arrows**, see Detail E

**NOTES:**
1. First Type 2L arrow is installed 50' back of stop bar or crosswalk. Second arrow is located 100' back, or at left turn pocket.
2. "S" = 140' for posted speed < 50 MPH, "S" = 170' for posted speed ≥ 50 MPH.
3. Stopping point shall be marked with stop bar only when mainline movement is controlled by a stop sign or traffic signal.
4. Raised pavement markers shall be installed only when specified in the Contract Plans.
6. No Pass Line on approach side with split center line on departure side unless Double Yellow Center Line is required in the contract.

**TABLE 1**

<table>
<thead>
<tr>
<th>Posted Speed</th>
<th>Taper Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 mph</td>
<td>60 mph</td>
</tr>
<tr>
<td>55 mph</td>
<td>55 mph</td>
</tr>
<tr>
<td>50 mph</td>
<td>50 mph</td>
</tr>
<tr>
<td>45 mph</td>
<td>45 mph</td>
</tr>
<tr>
<td>40 mph</td>
<td>45 mph</td>
</tr>
<tr>
<td>35 mph</td>
<td>40 mph</td>
</tr>
<tr>
<td>30 mph</td>
<td>35 mph</td>
</tr>
<tr>
<td>25 mph</td>
<td>30 mph</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>Posted</th>
<th>Decel. Taper</th>
<th>Taper Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 mph</td>
<td>180'</td>
<td>60 mph</td>
</tr>
<tr>
<td>55 mph</td>
<td>165'</td>
<td>55 mph</td>
</tr>
<tr>
<td>50 mph</td>
<td>150'</td>
<td>50 mph</td>
</tr>
<tr>
<td>45 mph</td>
<td>135'</td>
<td>45 mph</td>
</tr>
<tr>
<td>40 mph</td>
<td>120'</td>
<td>40 mph</td>
</tr>
<tr>
<td>35 mph</td>
<td>105'</td>
<td>35 mph</td>
</tr>
<tr>
<td>30 mph</td>
<td>90'</td>
<td>30 mph</td>
</tr>
<tr>
<td>25 mph</td>
<td>75'</td>
<td>25 mph</td>
</tr>
</tbody>
</table>

**TABLE 3**

<table>
<thead>
<tr>
<th>Posted Speed</th>
<th>No pass length (Minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 mph</td>
<td>790'</td>
</tr>
<tr>
<td>55 mph</td>
<td>725'</td>
</tr>
<tr>
<td>50 mph</td>
<td>660'</td>
</tr>
<tr>
<td>45 mph</td>
<td>590'</td>
</tr>
<tr>
<td>40 mph</td>
<td>520'</td>
</tr>
<tr>
<td>35 mph</td>
<td>260'</td>
</tr>
<tr>
<td>30 mph</td>
<td>200'</td>
</tr>
<tr>
<td>25 mph</td>
<td>150'</td>
</tr>
</tbody>
</table>

**END TWO-WAY LEFT TURN LANE**

- $W_1$ = Approaching through lane
- $W_2$ = Departing lane
- $T_1$ = Width of left turn lane on approach side of $Q$
- $T_2$ = Width of left turn lane on departure side of $Q$
- $W_r$ = Total width of channelization ($W_1 + W_2 + T_1 + T_2$)
Pavement markings may be curved here as shown to allow continuous painting by the striping machine.

When RPM's required by contract, use Type 2Y, see Note 5

40' RPM spacing

20' RPM spacing for decel, taper

Type YY RPMs 10' O.C.

Inside edge of lane

Type 2Y RPM see Note 5

5' to 10'

Type 2L Traffic Arrows

1/2 Width

1/2 Width

VENT LINE DETAIL

ALT LINE DETAIL

Lane width measurement point

Type 2Y RPM see Note 5

4"
SHOULDER RUMBLE STRIP
TYPE 1
FOR DIVIDED HIGHWAYS

$\text{STANDARD PLAN H-4}$

\text{MULTIPLE DIVIDED HIGHWAY}
SINGLE LANE ON CONNECTION

MEDIAN Crossover

SHOULDER RUMBLE STRIP
ON OUTSIDE SHOULDER

SHOULDER RUMBLE STRIP
ON OUTSIDE SHOULDER

SHOULDER RUMBLE STRIP
ON RIGHT SHOULDER AT END OF ACCELERATION TAPER

SHOULDER RUMBLE STRIP
ON LEFT SHOULDER

SHOULDER RUMBLE STRIP
ON RIGHT SHOULDER ADJACENT TO BEGINNING OF ON RAMP VINE LINE

SHOULDER RUMBLE STRIP
ON MEDIAN SHOULDERS

SHOULDER RUMBLE STRIPS
ON SHOULDER

STRUCTURE OR OTHER FEATURE NECESSITATING A REDUCTION IN SHOULDER WIDTH

SHOULDER TAPER DETAIL

OUTSIDE SHOULDER

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

HERALD J. PETERSON, PE
REGISTERED ENGINEER

APPROVED FOR PUBLICATION
HERALD J. PETERSON   10-9-03

SHOULDER RUMBLE STRIP TYPE 1
FOR DIVIDED HIGHWAYS

STANDARD PLAN H-4

SHEET 3 OF 3 SHEETS

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004

EXPRES MAY 6, 2005

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
NOTE
Rumble strips are not installed in certain reduced-width shoulder locations.
See the SHOULDER TAPER DETAIL on Standard Plan H-4.
SINGLE LANE ON CONNECTION

NOTE:
Where shown on the plans or specified in special provisions, raised pavement markers shall be used to supplement or substitute for the painted pavement markings shown herein.

SINGLE LANE OFF CONNECTION

PAVEMENT MARKING DETAILS
STANDARD PLAN H-5

EXPRESS OCTOBER 26, 2000

ROBERT D. RICHMAN
STATE HIGHWAY ENGINEER

Clifford E. Mansfield  2/18/00

APPRAISED FOR PUBLICATION

DATE: 2/18/00

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
NOTES:
Where indicated on the plans or special provisions, raised pavement markers shall be used to supplement or substitute for painted pavement markings.

TWO LANE ON CONNECTION

TWO LANE OFF CONNECTION

DETAIL A

DETAIL B

PAVEMENT MARKING DETAILS
STANDARD PLAN H-5a

APPROVED FOR PUBLICATION
Clifford E. Mansfield 2/18/00

DATE: JANUARY 5, 2004 TO AUGUST 1, 2004
COLLECTOR ROAD ON CONNECTION

COLLECTOR ROAD OFF CONNECTION
NOTES:

1. Slope treatment shall be constructed simultaneously with the roadway excavation. Ordinarily hand trimming will not be required if satisfactory results are obtained with mechanical equipment.

2. It is essential that the construction of cut and fill slopes and the application of slope treatment fit as naturally as possible into the existing landscape to provide an aesthetically and geometrically satisfactory completed roadway.

3. When the distance $K$ is greater than the distance from the top of cut to the bottom of ditch, slope treatment shall begin at bottom of ditch.

LEGEND:

J Distance from slope stoke to slope treatment stoke, measured on natural ground slope.

K Distance from slope stoke to lower limit of slope treatment, measured down face of cut slope.

H Difference in elevation between finished shoulder grade and slope stoke.

D Difference in elevation between slope stoke and slope treatment stoke.

Z Depth of slope treatment or slope stoke as determined by a straight line between the midpoints of $J$ and $K$.

S Horizontal distance per foot cut for the slope under consideration.

(For a 3:1 slope, $S=3$)

<table>
<thead>
<tr>
<th>CUT SLOPE</th>
<th>Class A</th>
<th>Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:1</td>
<td>7'</td>
<td>5'</td>
</tr>
<tr>
<td>3:1</td>
<td>7'</td>
<td>5'</td>
</tr>
<tr>
<td>2:1</td>
<td>7'</td>
<td>9'</td>
</tr>
<tr>
<td>1.75:1</td>
<td>7'</td>
<td>12'</td>
</tr>
</tbody>
</table>

VALUES OF Z (feet)

For Class A Slope Treatment

\[
Z = \frac{K}{2} - \frac{\sqrt{J^2 + \left(\frac{D}{2}\right)^2 + \left(\frac{0.5K}{4}\right)^2}}{k}
\]

In this equation the term $10K/4$ is positive when the slope treatment stoke is lower than the stoke stoke (descending ground) and negative when the slope treatment stoke is higher than the stoke stoke (ascending ground).
1. Manufacturer shall submit shop drawings of pipe railing for review.
   Design shall be in accordance with AASHO specifications.
2. Aluminum pipe railing shall have no external surface welds.
MAILBOX INSTALLATION

TYPE 1 & TYPE 2
STANDARD PLAN H-12

MAILBOX SPACING DETAIL

MAILBOX SIZE 1, 1A, OR 2 (TYP.) (2 CLAMPS PER BOX)

INSTALL MOUNTING BRACKET AND DRIVE IN SCREWS

MAILBOX SIZE 1, 1A, OR 2 (TYP.) (2 CLAMPS PER BOX)

NOTE:
1. An adjustable platform may be used in lieu of the platform design shown on this plan. Adjustable platforms must fit the tendon design shown on this plan. Brackets are required for all single post installations. Field drilling may be required.

2. A Type 2 support is required when 2 or more mailboxes are to be installed on one support. A maximum of 8 mailboxes may be installed on a Type 2 support. See 6th Ed. Spec. 9-38.7.

3. Attach a newspaper box to a steel post with two 1 7/8" Kliffer Clamps spaced 4" apart. Field drill 7/8" holes in the newspaper box to 1-1/4" deep to allow newspaper box to be fastened. Newspaper box must not extend beyond the front of the mailbox when the mailbox door is closed.

4. Spacing of mailbox mounting holes varies among manufacturers. Attachment of the mailbox to the platform may require drilling additional holes through the mailbox to fit the platform.

5. Center the mailbox on the platform to ensure space for the mailbox door to open and to allow space for installing the fasteners.

6. A socket and washer anchoring system may be substituted in lieu of the self-tapping plate assembly for single wood posts shown on this plan. The socket and washer anchoring system shall meet B9ESP-560 green wood criteria. Anti-twist plates are not included for wood post installations.

MAILBOX PLACEMENT SECTIONS

1. AT EDGE OF SHOULDER
2. BEHIND CURB
3. BEHIND SIDEWALK

NOTE:
3.2 A maximum of 8 mailboxes may be installed on a Type 2 support. See 6th Ed. Spec. 9-38.7.

4. Spacing of mailbox mounting holes varies among manufacturers. Attachment of the mailbox to the platform may require drilling additional holes through the mailbox to fit the platform.

5. Center the mailbox on the platform to ensure space for the mailbox door to open and to allow space for installing the fasteners.

6. A socket and washer anchoring system may be substituted in lieu of the self-tapping plate assembly for single wood posts shown on this plan. The socket and washer anchoring system shall meet B9ESP-560 green wood criteria. Anti-twist plates are not included for wood post installations.
TYPE 1 BOLLARD

Cover plate

Base plate

Pipe sleeve

Top plate

Concrete footing round or square

3" ID steel pipe

1½" Grade 3 Chain 6" long

2½" Chain

A

A

Direction of Pedestrian/Bicycle Traffic

8 ½"

1½" x 8 ½" Square plate

3½" Hole

4" ID Steel pipe

1½" x 6 ½" Square plate

½" Chamfer (TYP)

½" Drain hole

½" x ½" Full surface heavy welding hinge

1½" x 2" Reflective Tape

½" Reflective Tape

1½" x 1½" Square plate welded to underside of cap and hinge.

Base plate

Cover plate

Top plate

Pipe sleeve

Top view

Side view

SECTION A - A

Chain

Granular free draining material

Concrete footing

Pipe drain, ½" ID pipe 3" long

Base assembly

Finish grade

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004

H-13 1 of 1

07-25-97
SECTION A-A

POST

SIDE VIEW

FRONT VIEW

TYPE 2 BOLLARD

PLAN

Concrete footing round or square

Steel pipe

1/2" Reflective tape

1/4" Drilled hole

Steel cap plate

Concrete footing round or square

1'-2/5"

1'-2/5"

3'-4"

10'-0"

6'-0"

6" x 1/4" DIA bar

6" x 1/4" DIA bar

1'-6"

2'-6"

8'-0"

1'-0"

Concrete footing round or square

Finish grade

6" x 1/4" DIA Steel bar

Concrete footing round or square
ALIGNMENT STAKE
Stake every 100 feet on tangents, every 25 feet on curves.

CLEARING/GRUBBING LATH
Stake at each full station, 100 feet on tangents, every 25 feet on curves. No hub necessary.

SLOPE STAKE
Offset from slope stake, catch (10 feet).
Fill at RP stake (11.23 feet).
Cut at Catch Point (Back of Ditch).
Distance from Q to Catch Point.
Side Slope Ratio (4:1).
Back of Ditch.

SLOPE LATH REFERENCES

Offset from slope stake, catch (7 feet).
Cut at ST Stake (2.88 feet).
Distance from Q to Catch (back of ditch) (23.5 feet).
Side Slope Ratio (3:1).
Back of Ditch.

SLOPE TREATMENT (ST) STAKES
FOR CUT SECTIONS

Offset from slope stake, catch (2.47 feet).
Cut at Catch Point (2.17 feet).
Distance from Q to Catch (back of ditch) (25.68 feet).
Side Slope Ratio (4:1).
Back of Ditch.

DAYLIGHT STAKE
Offset from slope stake, catch (6.0 feet).
Fill (0.07 feet).
Side slope to a 2% roadway slope (50:1).
Distance from Q (16.24 feet).

STANDARD PLAN H-14
Sheet 1 of 2 sheets

EFFECTIVE: JANUARY 5, 2004 TO AUGUST 1, 2004
CREST GAGE

1/4" DIA HOLE (1) FOR AIR EXCHANGE
1/2" I.D. PVC OR STEEL PIPE

1/4" DIA x 6" LONG FIBERGLASS ROD

BRACKET (2 PER UNIT), SEE DETAIL

1 5/8" LONG x 5/16" DIA LAG BOLT
(4 TOTAL)

3 1/2" LONG x 5/16" DIA BOLT
PATH LOCK NUT (2 TOTAL)

2x6" PRESSURE TREATED HOOD

PVC OR PRIMED STEEL T-ADAPTER
FOR 1" I.D. PIPE

1" I.D. x 6" LONG PVC PIPE,
SCORE 1/4" DEEP EVERY 1/2
ALTERNATING CUTS ON TOP
AND BOTTOM FOR DRAINAGE,
PLACE AT LOWEST WATER LEVEL

ANGLE IRON (SEE DETAIL) NOTE:
EXTENSION CAN BE USED AS
SHOWN IN DETAIL. IF NEEDED
ATTACH ANGLE IRON TO FULL
LENGTH OF SUPPORTING BOARD
WITH 1 1/2" HOOD SCREWS

WATER INTAKE & CLEAN-OUT ASSEMBLY

1/4" DIA FIBERGLASS ROD

1" I.D. PVC OR STEEL PIPE

3/16" DIA HOLE (2 TOTAL)

3 1/2" LONG x 5/16" DIA BOLT
PATH LOCK NUT

2" ANGLE IRON 3/16" THICK
GALVANIZED AND PRIMER PAINTED

3/8" DIA HOLES (4 TOTAL)

1 1/2" STEEL STRAPS, 1/4" THICK,
GALVANIZED AND PRIMER PAINTED

3/16" DIA HOLE (2 TOTAL)

1" LONG x 1/4" DIA BOLT WITH
LOCK NUT

2" ANGLE IRON 3/16" THICK
GALVANIZED AND PRIMER PAINTED

3/8" DIA HOLES (4 TOTAL)

NOTE: FOUR IN APPROXIMATELY 1 TABLESPOON OF COIR
DUST AT INSTALLATION AND AFTER EACH READING

NOTE: GAGE ASSEMBLY BACKING BOARD, PIPE, ROD, AND
ANGLE IRON CAN BE EXTENDED AS NEEDED TO FIT SITE
REQUIREMENTS.

CREST GAGE

STANDARD PLAN L-2

MARK W. MAURER
CERTIFICATE NO. 005008

STATE OF WASHINGTON
LICENSEE/LANDSCAPE ARCHITECT

APPROVED FOR PUBLICATION
Clifford E. Mansfield 04-23-99

NOTE: THIS IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN EXPLANATORY DOCUMENT
APPROVAL OF THIS DOCUMENT BY THE WASHINGTON DEPARTMENT OF TRANSPORTATION
DOES NOT CONSTITUTE APPROVAL OF THE DESIGN OR SPECIFICATIONS OF THE PROJECT.

0301270003
AUTOMATED GROUND WATER MONITORING WELL

NOT TO SCALE
NOTES

1. MAXIMIZE DETENTION OF STORMWATER BY PLACING FENCE AS FAR AWAY FROM THE TOP OF SLOPE AS POSSIBLE WITHOUT ENTRAPING ON SENSITIVE AREAS OR OUTSIDE OF THE CLEARING BOUNDARIES.

2. INSTALL SILT FENCING ALONG CONTOURS WHENEVER POSSIBLE.

3. INSTALL THE ENDS OF THE SILT FENCE TO POINT SLIGHTLY UP-SLOPE TO PREVENT SEDIMENT FROM FLOWING AROUND THE EDGES OF THE FENCE.

4. PERFORM MAINTENANCE IN ACCORDANCE WITH STANDARD SPECIFICATIONS 8-01.59[A] AND 8-01.59[C].

SILT FENCE

STANDARD PLAN 1-4

Sheet 1 of 1 Sheet

APPROVED FOR PUBLICATION

Mark W. Maurer
Certificate No. 09898

State of Washington
Department of Transportation

Effective: January 5, 2004 to August 1, 2004
**Silt Fence Design**

- **Edges of Geotextile**
  - Place geotextile for temporary silt fence (see Sec. 8-29.2, Table 9).
  - Post (see Sec. 8-01.3.4(a))
  - Embed posts into bands as required around culvert to provide support for silt fence.

- **Flow**
  - Originating from disturbed area.

- **Protected Area**
  - Culvert, box culvert, or pipe arch (End treatment varies).

- **Disturbed Area**
  - Compost berm design.

**NOTE**

Perform maintenance in accordance with Standard Specifications 8-01.2.4(a) and 8-01.2.16.

**State of Washington Department of Transportation**

**Mark W. Muehlen**
Certificate No. 03535

**Erosion Control at Culvert Ends**

- **Standard Plan 1-4**
- **Compost Berm Design**

**EFFECTIVE:** JANUARY 5, 2004 TO AUGUST 1, 2004

**EFFECTIVE:** JANUARY 5, 2004 TO AUGUST 1, 2004
NOTES
1. PREFABRICATED UNITS MAY BE USED IN LIEU OF THE DESIGN SHOWN ON THIS PLAN
   UPON APPROVAL OF THE ENGINEER.
2. STRUCTURE SHALL BE CONSTRUCTED SUCH THAT GEOFABRIC MATERIAL SHALL BE
   FASTENED TO POSTS CREATED A SEAMLESS JOINT
3. ENSURE THAT PONDING HEIGHT OF WATER DOES NOT CAUSE FLOODING ON
   ADJACENT ROADWAYS OR PRIVATE PROPERTY.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH STANDARD SPECIFICATIONS 0-01.2(13).
NOTES
1. Perform maintenance in accordance with standard specification 8-01.010.
2. Size the below grate inlet device (BGID) for the storm water structure it will service.
3. The BGID shall have a built-in high-flow relief system (overflow bypass).
4. The retrieval system must allow removal of the BGID without spilling the collected material.

PREFABRICATED BELOW GRATE INLET DEVICE DETAILS

STORM DRAIN INLET PROTECTION
STANDARD PLAN I-7
SHEET 1 OF 1 SHEET
APPROVED FOR PUBICATION
Mark W. Mauker
Certificate No. 00008

STATE OF WASHINGTON RECOMMEND LANDSCAPE ARCHITECT
Washington State Department of Transportation
NOTES

1. INSTALL WATTLES ALONG CONTOURS (SEE STANDARD SPECIFICATION 8-01.5(10)).

2. WATTLES SHALL BE INSPECTED REGULARLY, AND IMMEDIATELY AFTER A RUNOFF PRODUCING RAINFALL, TO ENSURE THEY REMAIN THOROUGHLY ENTRANCED AND IN CONTACT WITH THE SOIL.

3. LIVE STAKES MAY BE USED FOR PERMANENT INSTALLATIONS.

4. PERFORM MAINTENANCE IN ACCORDANCE WITH STANDARD SPECIFICATION 8-01.5(10).

5. INSTALL WATTLES SUCCINCTLY INTO THE TRENCH. ABUT ADJACENT WATTLES TIGHTLY, END TO END, WITHOUT OVERLAPPING THE ENDS.

6. PILOT HOLES MAY BE DRIVEN THROUGH THE WATTLE AND INTO THE SOIL, WHEN SOIL CONDITIONS REQUIRE.

WATTLE SPACING TABLE

<table>
<thead>
<tr>
<th>SLOPE</th>
<th>MAXIMUM SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:1</td>
<td>10 FEET</td>
</tr>
<tr>
<td>2:1</td>
<td>20 FEET</td>
</tr>
<tr>
<td>3:1</td>
<td>30 FEET</td>
</tr>
<tr>
<td>4:1</td>
<td>40 FEET</td>
</tr>
</tbody>
</table>
1. Geotextile encased check dam shall meet the requirements of standard specifications 6-01.3(50A) and 6-14.2(4).

2. Install the sloped ends of the check dam a minimum of 3" higher than the top of the check dam in the channel to ensure that water flows over the dam and not around it.

3. Flat bottom ditch design shown, check dam installation details are similar for 3/4" bottom ditches.

4. Perform maintenance in accordance with standard specification 6-01.3(18).
NOTES

1. MORE THAN THE MINIMUM OF ONE FASTENER PER SQUARE YARD MAY BE REQUIRED DUE TO CONDITIONS SUCH AS
   BLANKET COMPOSITION, SOIL TYPE, SURFACE UNIFORMITY, AND SLOPE STEEPNESS.

2. SEE STANDARD SPECIFICATION A-01.303.
Erosion Control Blanket Placement in Channel

NOTES
1. MORE THAN THE MINIMUM OF ONE FASTENER PER SQUARE YARD MAY BE REQUIRED DUE TO CONDITIONS SUCH AS BLANKET COMPOSITION, SOIL TYPE, SURFACE UNIFORMITY, AND FLOW VELOCITY.
2. ROLL ENDS MAY BE SPliced IN A CHECK SLOT.
3. SEE STANDARD SPECIFICATION 6-01-49.

Perspective View

Flow

Anchoring Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

NOTE: DRAWN TO SCALE

Flow

6" x 6" Trench

6" x 6" Overlap

6" Max. Ctrl.

Tamped Native Soil

B. C. Arrow

NOTE: DRAWN TO SCALE

6" Max. Ctrl.

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

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B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

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NOTE: DRAWN TO SCALE

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B. C. Arrow

Anchor Section

Initial Anchor Section

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NOTE: DRAWN TO SCALE

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6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

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6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

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6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

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Anchor Section

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6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

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6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

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B. C. Arrow

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Initial Anchor Section

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6" Max. Ctrl.

NOTE: DRAWN TO SCALE

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B. C. Arrow

Anchor Section

Initial Anchor Section

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Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.

NOTE: DRAWN TO SCALE

Flow

B. C. Arrow

6" x 6" Overlap

B. C. Arrow

Anchor Section

Initial Anchor Section

Check Slot Section

Tamped Native Soil

6" x 6" Overlap

6" Max. Ctrl.
1. See Standard Plan C-6b for base plate and foundation requirements when light standards are mounted on concrete barriers.

2. Round and smooth all edges along wireway to protect conductors. See Standard Plan J-16 for wiring details.

3. The top of the anchor rod shall be both threaded and galvanized a minimum of 1%o. The bottom of the anchor rod shall be threaded a minimum of 1%. Galvanizing shall be in accordance with AASHTO M 273 and steel shall be either 1¼" AASHTO M 273 or 1½" AASHTO M 283.

4. Strap templates shall be held in place by nuts 6" from the top of the foundation, and at bottom of anchor bolts resting on 4" x 4" square washers.

5. Pole base plate for a slip base design shall be 1¼" AASHTO M 273 Gr. 345. Pole base plate for a fixed base design may be either 1¼" AASHTO M 273 Gr. 345 or 1½" AASHTO M 283.

6. Installation of a 50' pole with double mast arms on a slip base is not allowed.
ASSEMBLY DETAILS

After bolting bottom slip plate assembly to foundation, fill slotted bolt holes with grout.

Grade around foundation to ensure stub height does not exceed 4".  Removal of the frangible base from the existing base plate is required.

Misaligned anchor bolts must be removed and replaced.

NOTE:
Plate shall conform to AASHTO M183 M (ASTM A36) except as noted.
Flat washer shall conform to AASHTO M164 M (ASTM A325).
Install sized reducing washer and connector to secure conductors at end of mast arm.

For Double Mast Arm, install additional cable and quick disconnects.

Mast Arm Wiring Detail

24" slack required to allow quick disconnects to be pulled outside handhole 6" MIN.

See Detail A

Junction box

Wiring Detail Light Standard Slip Base

*Application for fixed base similar except no cable tie is required at junction box.

Typical Junction Box Location

Alternate locations allowed provided junction box to base distance does not exceed 10'.

Detail A

Light Standards Wiring Details

Conductor attachment bracket

Strip outer cable sheath below bracket

Eliminate all slack

Quick disconnects

Insulated grounding bushing

Galvanized steel conduit

Conductor

Pole and bracket cable to lamp

Handhole

Bend

120 Pound tensile strength black cable tie

Remove all slack before installing cable tie

Conductors

Insulating grounding bushing

Bend

Junction box

08-01-97
1. Metering arrangements may vary with different serving utilities. The contractor shall verify the requirements of the utility prior to installing the service equipment.

2. All service pole conduit shall be secured to the pole with conduit strap at 5' centers.

3. All risers and service equipment shall be installed on side of pole that is away from traffic.

4. Where required by the serving utility, service breakers shall be installed above the meter socket in a separate rain-tight enclosure.

5. Bend and attach to pole within 1' of enclosure. See Standard Plan "Typical Grounding Details."

6. For Type B service wiring diagram, use Standard Plan "Modified Type B Service."

7. For Type C service wiring diagram, use Standard Plan "Type C Service."

8. See breaker schedule in contract for breaker and contactor sizes.

Type A Wiring Diagram 120 Volt

Type A, B and C Service Lighting Details
NOTES

1. Where pad or pedestal mounts are located in a sidewalk, construct mount top flush with sidewalk grade, omitting chamfer where top and sidewalk abut.

2. Pad mount design is typical.

3. Place a silicone seal between the cabinet foundation and the cabinet for the pad mount design.
NOTES:
1. SEE CONTRACT FOR HEAD TYPE, MOUNTING HEIGHT AND ORIENTATION.
2. ALL NIPPLES, FITTINGS AND CENTER PIPES SHALL BE 1 1/2" DIAMETRAL TRADE SIZE (NPT).
3. INSTALL NEOPRENE GASKET OUTSIDE HEAD WHEN FLANGED ELBOWS ARE SUPPLIED.

KEY:
① CENTER PIPE ② LOCK NIPPLE ③ NIPPLE ④ SERRATED ELBOW ⑤ SERRATED OR FLANGED ELBOW ⑥ REMED TEE WITH SET SCREW ⑦ REMED ELBOW WITH SET SCREW ⑧ BRONZE TERMINAL COMPARTMENT WITH:
- GASKETED COVER
- FASTENERS
- WIRE LEADS
- MOUNTING SADDLE FOR SIDE MOUNTS
- 1/2" DIA. HOLE
- 12" POSITION TERMINAL STRIP
- WIREWAY FOR SIDE MOUNTS
① BRONZE COLLAR, 4/4" I.D. WITH SET SCREWS ② CHIMNEY CAP ③ GASKET AND WASHER ④ CONDUIT LOCKNUT ⑤ TYPE E HINGE MOUNTING ⑥ FASTENER WITH SPACER
- 5/8" LAG SCREWS ON WOOD POLE
- 5/8" BOLTS TAPPED TO METAL POLE ⑦ FLATHEAD SOCKET BOLT ⑧ 1/2" INSERT HOLE FOR EXTERNAL WIRE ENTRANCE REQUIRED ON TIMBER POLE MOUNTINGS ONLY.
**NOTES:**

1. Type M mounting shall have a 2” ring groove and seal top and bottom at signal attachment.
2. Type M mounting for conventional heads shall have a 2" diameter opening at the signal attachment.
3. Type M mounting for optically programmed heads shall have a 2 1/2" diameter opening at the signal attachment.
4. Type N mounting with optically programmed heads shall be installed with 14” nominal arms.
5. See Standard Plan J-6g for tether wire, and backplate requirements.
TYPICAL CONDUIT PLACEMENT FOR LOOP LEAD-IN WIRES

<table>
<thead>
<tr>
<th>Loop lead pairs</th>
<th>1-2</th>
<th>3</th>
<th>4-5</th>
<th>6-8</th>
<th>9-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduit size (MIN)</td>
<td>1&quot;</td>
<td>1¼&quot;</td>
<td>1½&quot;</td>
<td>2&quot;</td>
<td>3&quot;</td>
</tr>
</tbody>
</table>

**TABLE A**

**INDUCTION LOOP DETAILS**

- VGA shield
- Drain wire
- Two layers vinyl electric tape
- Plastic nailing
- Seal both ends with electric putty and tape

**SPLICE DETAIL**

- Foil shield
- Detector lead-in cable (2CV)
- 1" 1"
- Soldered compression connection
- Ground drain wire at amplifier only
**LOOP INSTALLATION NOTES**

1. Install junction box and lead-in conduit.
2. Saw loop slots and lead-in slots.
3. Lay out loop wire beginning at junction box, allowing 6’ minimum slack.
4. Install wire in loop slot. See Loop Winding Details.
5. Return to junction box and identify leads with plan detector number and “S” for start and “F” for finish.
6. Twist each pair of lead-in wires two turns per foot from loop to junction box and install in lead-in slot and conduit. Reverse direction of twist for each successive pair installed.
7. Construct supplemental splice containing any series or parallel loop connections required in plans. Supplemental splices are subject to the same requirements shown for the loop lead and shielded cable splice.
8. Splice lead-in wires for supplemental splice to shielded cable as noted.
9. Complete installation and test loop circuits or combination loop circuits.
10. Front of loop should be measured from back of stop bar, or back of crosswalk where no stop bar is installed.
11. Seal ends of conduit.

---

**INDUCTION LOOP DETAILS**

- Sealant
- Twisted polypropylene rope (SIzed for snug fit)
- Loop wire - number varies (See Loop Winding Details)
- Lead-in wires: One pair for each loop served, three pairs maximum per sawcut (See Installation Notes)
- Extend sawcut sufficient length to provide full sawcut depth around corners
1. If parallel circuits of different sizes are contained in one conduit, the size of the grounding conductor shall be determined on the basis of the largest conductor. Only one grounding conductor is required for each conduit regardless of the number of circuits contained.

2. Service ground per serving utility requirement. If the utility uses aluminum service conductors, an approved Al-Si pressure type ground connector shall be used to secure the service neutral to the copper neutral bar in the service enclosure. Except for the above, all grounding conductors shall be copper.

3. Equipment grounding conductors and grounding electrode conductors shall be sized in accordance with the National Electric Code (No. 6 minimum).

Required to supplement equipment grounding for luminaire standards with direct burial, aerial feeds, or where required in plans.

GROUND ROD DETAILS

Required at all services and separately derived systems.
### Junction Box Dimension Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. OUTSIDE LENGTH OF JUNCTION BOX</td>
<td>28&quot;</td>
<td>28&quot;</td>
<td>28&quot;</td>
</tr>
<tr>
<td>B. OUTSIDE WIDTH OF JUNCTION BOX</td>
<td>21 7/8&quot;</td>
<td>21 7/8&quot;</td>
<td>21 7/8&quot;</td>
</tr>
<tr>
<td>C. INSIDE WIDTH OF JUNCTION BOX</td>
<td>10 3/4&quot;</td>
<td>10 3/4&quot;</td>
<td>10 3/4&quot;</td>
</tr>
<tr>
<td>D. INSIDE LENGTH OF JUNCTION BOX</td>
<td>15 1/2&quot;</td>
<td>15 1/2&quot;</td>
<td>15 1/2&quot;</td>
</tr>
<tr>
<td>E. LID LENGTH</td>
<td>20&quot;</td>
<td>20&quot;</td>
<td>20&quot;</td>
</tr>
<tr>
<td>F. LID WIDTH</td>
<td>14 7/8&quot;</td>
<td>14 7/8&quot;</td>
<td>14 7/8&quot;</td>
</tr>
<tr>
<td>G. DEPTH OF JUNCTION BOX</td>
<td>12&quot;</td>
<td>12&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>H. LID AND FRAME DEPTH</td>
<td>15 1/2&quot;</td>
<td>15 1/2&quot;</td>
<td>15 1/2&quot;</td>
</tr>
<tr>
<td>J. MINIMUM WALL THICKNESS</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>K. HOLLOW WALL TROUGH - SIDE DIMENSION (NOTE G)</td>
<td>4 3/8&quot;</td>
<td>4 3/8&quot;</td>
<td>4 3/8&quot;</td>
</tr>
<tr>
<td>L. MOUNTING HOLE PATTERN - SIDE DIMENSION (NOTE G)</td>
<td>4 3/8&quot;</td>
<td>4 3/8&quot;</td>
<td>4 3/8&quot;</td>
</tr>
</tbody>
</table>

### Notes:
1. All box dimensions are nominal. Exact configurations vary among different manufacturers.
2. The noted lid thicknesses are nominal minimums. The diamond pattern for Type 1 or 3 boxes shall be 25% minimum of overall thickness. The diamond pattern for Type 2 boxes shall have a minimum thickness of 3/32".
3. Lid support members shall be 3/16" minimum. Black steel, I, L, or T shape welded to the frame.
4. When specified in the Contract, Type 2 and Type 3 boxes shall be provided with 12" deep extension access.
5. A 1/2" MC x 3/4" Schedule 40 Conduit Bury with 6" Nut shall be welded to the bottom of the foundation.
6. See the Standard Specifications for alternate use of reinforcement.

### Legend
- **LT**: Lighting System
- **COMM**: Communication System
- **TS**: Traffic Signal System
- **TEL**: Telephone System
- **ITS**: Intelligent Transportation System

### Foundation for Type 3 Junction Box

- **Foundation Area**: 8" gravel pad

### Standard Plan J-11a

- **Incidental Vehicle Traffic Paved Area**: 8" gravel pad

### Standard Junction Box

- **Type 1 or 3 Junction Box Installation Detail**: 8" gravel pad

### Handle Detail

- **Mark (K)**: Handle detail
- **Nut or Welded Washer**: Handle stop
- **1 1/2" high bead at hook**: Frame top
- **1/4" nominal**: Lid
- **1/2" nominal**: Lid hood mark
- **1/4" nominal**: Frame top
- **1/2" nominal**: Hook or bolt

### LID HOOK MARK

- **Mark (K)**: LID hook mark
- **4" nominal**: LID hook mark
- **4" nominal**: LID hook mark

### Incidental Vehicle Traffic Paved Area

- **8" gravel pad**: Type 3 junction box installation detail

### Standard Plan J-11a

- **Approved for Publication**: Harold J. Peterson 08-02-01

**State of Washington**

**Washington State Department of Transportation**

**Effective**: January 5, 2004 to August 1, 2004

**Effective**: January 5, 2004 to August 1, 2004

**Effective**: January 5, 2004 to August 1, 2004

**Effective**: January 5, 2004 to August 1, 2004
1. SIGN SEQUENCE IS THE SAME FOR BOTH DIRECTIONS OF TRAVEL, ADJUSTED FOR THE DIRECTION OF ROADWAY CURVES.

2. FLASHING WARNING LIGHTS (TYPE B, MUTCD) AND/OR FLAGS SHALL BE USED TO CALL ATTENTION TO THE ADVANCE WARNING SIGNS.

3. EXISTING CONFLICTING PAVEMENT MARKINGS AND SIGNS NO LONGER APPLICABLE SHALL BE REMOVED. TEMPORARY PAVEMENT MARKINGS SHALL BE USED TO DELINEATE BYPASS DETOUR.

4. RAISED PAVEMENT MARKERS AND/OR TEMPORARY GUIDEPOSTS MAY BE USED ON BYPASS AS DIRECTED BY THE ENGINEER.

5. STEADY BURNING WARNING LIGHTS (TYPE C, MUTCD) SHALL BE USED TO MARK TRAFFIC CONTROL DEVICES AT NIGHT.

6. WHERE ADVISORY SPEEDS ARE 30 MPH OR LESS, REVERSE TURN SIGNS SHOULD BE USED. OTHER CURVE OR TURN WARNING SIGNS MAY BE SUBSTITUTED TO DEPICT ROADWAY ALIGNMENT AS APPROPRIATE.

7. ROADSIDE BARRIERS AND END TREATMENTS SHALL BE CRASHWORTHY.

**SIGN SPACING = X (FEET)**

| Rural Roads | 45/55 MPH | 500**--** |
| Urban Arterials & Rur of Rdrds | 35/40 MPH | 350**--** |

**CHANNELIZING DEVICE SPACING (FEET)**

<table>
<thead>
<tr>
<th>MPH</th>
<th>TAPER</th>
<th>TANGENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/70</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>35/45</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>25/30</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
NOTES
1. MODIFY REGULATORY TRAFFIC CONTROL DEVICES FOR THE DURATION OF THE DETOUR.
2. TWO FLASHING WARNING LIGHTS (TYPE A, MUTCD) SHALL BE USED TO MARK EACH BARRICADE AT NIGHT.
3. DETOUR TRAILBLAZERS SHALL BE INSTALLED THROUGHOUT THE DETOUR.
4. SIGNING SHOWN FOR ONE DIRECTION ONLY.
5. COORDINATE WITH EMERGENCY SERVICES.

SIGN SPACING = X (FEET)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Rural Roads</th>
<th>Urban Arterials &amp; Rural Roads</th>
<th>Urban Streets Residential Areas &amp; Business Districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>45/55 MPH</td>
<td>35/40 MPH</td>
<td>25/30 MPH</td>
</tr>
<tr>
<td>Sign Spacing</td>
<td>500+</td>
<td>350+</td>
<td>200+</td>
</tr>
</tbody>
</table>

All signs are black on orange unless otherwise designated.

LEGEND
• TYPE 3L BARRICADE
• TYPE 3R BARRICADE
• SIGN LOCATION - POST MOUNT
NOTES
1. EXTEND TAPER ACROSS SHOULDER.
2. THE MAXIMUM LENGTH OF WORK AREA CONTROLLED BY ONE-WAY TRAFFIC SIGNAL IS 400 FT. SIGNAL TIMING SHALL BE ESTABLISHED BY QUALIFIED PERSONNEL.
3. SIGNS SHALL BE POST MOUNTED IF SIGNAL REMAINS IN PLACE MORE THAN 3 DAYS.
SIGHT DISTANCE DATA
MIN. STOPPING SIGHT DIST. = S

<table>
<thead>
<tr>
<th>SPEED LIMIT MPH</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTANCE FEET</td>
<td>75'</td>
<td>100'</td>
<td>150'</td>
<td>225'</td>
<td>300'</td>
<td>375'</td>
<td>450'</td>
</tr>
</tbody>
</table>

Distances shown are minimums, use additional distance when possible.

NOTES
1. Daylight hours only.
2. Radio contact between work crew and shadow vehicle recommended.

LEGEND
WORK VEHICLE WITH FLASHING AMBER WARNING BEACON
SHADOW VEHICLE WITH FLASHING AMBER WARNING BEACON
(WITH TRUCK MOUNTED ATTENUATOR WHEN SPECIFIED IN CONTRACT)
NOTES

1. EXISTING CONFLICTING PAVEMENT MARKINGS NO LONGER APPLICABLE SHALL BE REMOVED OR OBLETTERATED.

2. TEMPORARY MARKINGS SHALL BE USED AS NECESSARY.

3. EXPOSED ENDS OF CONCRETE BARRIERS SHALL BE MAINTAINED OUTSIDE THE CLEAR ZONE AND ADEQUATELY FLARED OR FITTED WITH IMPACT ATTENUATORS.

4. STEADY BURNING WARNING LIGHTS (TYPE C, MUTCD) SHALL BE USED TO MARK CHANNELIZING DEVICES AT NIGHT AS NEEDED.

5. ROADSIDE BARRIERS AND END TREATMENT SHALL BE CRUSHWORTHY.

6. INSTALL PORTABLE CHANGEABLE MESSAGE SIGN (WHEN SPECIFIED) APPROXIMATELY 1 MILE IN ADVANCE OF LANE CLOSURE.

BUFFER SPACE = B

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (feet)</td>
<td>55</td>
<td>65</td>
<td>80</td>
<td>100</td>
<td>120</td>
<td>160</td>
<td>200</td>
<td>250</td>
<td>300</td>
</tr>
</tbody>
</table>

MINIMUM TAPER LENGTH = L (FEET)

<table>
<thead>
<tr>
<th>LANE WIDTH (feet)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taper (feet)</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
</tr>
</tbody>
</table>

CHANNELIZING DEVICE SPACING (Feet)

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>50/65</th>
<th>35/45</th>
<th>25/30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taper (feet)</td>
<td>40</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Taper (feet)</td>
<td>80</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

SIGN SPACING = X (Feet)

- **Rural Roads**: 45/65 MPH - 500**--
- **Urban Arterials & Rural Roads**: 35/40 MPH - 350**--
- **Residential & Business Districts**: 25/30 MPH - 200**--

All signs are black on orange unless otherwise designated.
NOTES

1. OTHER WARNING SIGNS, SUCH AS LOOSE GRAVEL, TRUCK CROSSING, BUMP, ABRUPT LANE EDGE, ETC. SHALL BE USED AS NECESSARY ALONG WITH ADVISORY SPEED SIGNS.

2. ADVISORY SPEED SIGNS ARE DETERMINED BY THE ENGINEER.

3. FLOODLIGHTS SHALL BE PROVIDED TO MARK FLAGGER STATIONS AT NIGHT.

SIGN SPACING = X (FEET)

- Rural Roads: 45/65 MPH 500' +
- Urban Arterials & Rural Roads: 35/40 MPH 350' +

All signs are black on orange unless otherwise designated.

LEGEND
★ SIGN LOCATION-POST MOUNTED
1. NO ENCROachment ON TRAVELLED LANE IF ENCROachment IS NECESSARY, LANE SHALL BE CLOSED.

2. FOR OPERATIONS OF 15 MINUTES OR LESS, ALL SIGNS AND CHANNELIZATION DEVICES MAY BE ELIMINATED.
NOTES

1. THE SIGN SHOWN IS NOT REQUIRED IF THE WORK SPACE IS BEHIND A BARRIER, MORE THAN 2' BEHIND THE CURB, OR 15' OR MORE FROM THE EDGE OF ANY ROADWAY.

W20-1

ROAD WORK AHEAD

SIGN SPACING = X (feet)
- Rural Roads 45/55 MPH 500'-
- Urban Arterials 35/40 MPH 350'-
- Urban Streets 25/30 MPH 200'-
- Business Districts

All signs are black on orange unless otherwise designated.

WORK BEYOND THE SHOULD

1. SHOULDER EXCAVATION SHALL BE LIMITED TO ONE SIDE AT A TIME.

W21-801

ABRUPT LANE EDGE

LOCATE AS NEEDED FOR SITE CONDITIONS TO SUPPLEMENT WARNING SIGNS.

WB-1801

NO SHOULDER

2'' MIN EXISTING LANE

EXISTING LANE EXISTING SHOULDER

TEMPORARY TRAFFIC CONTROL DEVICE

SHOULDER WORK AREA

SHOULDER WORK AREA PROTECTION NON-WORKING HOURS

4:1 WEDGE OF COMPACTED STABLE MATERIAL
NOTES

1. WORK VEHICLE AND SHADOW/PROTECTIVE VEHICLE SHALL USE WARNING BEACONS.

2. SHADOW/PROTECTIVE VEHICLE RECOMMENDED - SHALL MAINTAIN 500'-1000' OF SIGHT DISTANCE TO APPROACHING TRAFFIC.

3. THIS PLAN MAY BE IMPLEMENTED ON MULTI-LANE HIGHWAYS WITH LESS THAN 10,000 ADT.

4. IN THOSE SITUATIONS WHERE MULTIPLE WORK LOCATIONS WITHIN A LIMITED DISTANCE MAKE IT PRACTICAL TO PLACE STATIONARY SIGNS, THE DISTANCE BETWEEN THE ADVANCE WARNING SIGN AND THE WORK SHOULD NOT EXCEED 2 MILES.

5. IN THOSE SITUATIONS WHERE THE DISTANCE BETWEEN THE ADVANCE WARNING SIGNS AND THE WORK IS 1 TO 2 MILES, A SUPPLEMENTAL DISTANCE PLAQUE SHALL BE USED WITH THE ROAD WORK AHEAD SIGN.

LEGEND

-SEQUENTIAL ARROW PANEL - TYPE "B" (CAUTION MODE)

-TMA TRUCK MOUNTED ATTENUATOR

-WARNING BEACON

(Roll Ahead Stopping Distance Assumes Dry Pavement)
NOTES
1. CONTROLS SHOWN ARE FOR PEDESTRIAN TRAFFIC ONLY.
2. USE WARNING LIGHTS ON BARRICADES.
3. TEMPORARY PEDESTRIAN ROUTES SHALL BE COMPLIANT
   WITH ADA REQUIREMENTS.
4. CURB PARKING SHALL BE PROHIBITED FOR AT LEAST 50'
   IN ADVANCE OF A MID-BLOCK CROSSWALK.
**BUFFER DATA**

**BUFFER SPACE** = B

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (feet)</td>
<td>55</td>
<td>85</td>
<td>120</td>
<td>170</td>
<td>220</td>
<td>280</td>
<td>335</td>
</tr>
</tbody>
</table>

**PROTECTIVE VEHICLE ROLL AHEAD DISTANCE** = R

<table>
<thead>
<tr>
<th>TYPICAL LOADED VEHICLE</th>
<th>TYPICAL VEHICLE LOADED WEIGHT (LRV)</th>
<th>POSTED SPEED (mph)</th>
<th>STATIONARY OPERATION (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 YARD DUMP TRUCK</td>
<td>24,000</td>
<td>60-65</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55-55</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>2 TON CARGO TRUCK</td>
<td>10,000</td>
<td>60-65</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50-55</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>1 TON CARGO TRUCK</td>
<td>10,000</td>
<td>60-65</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50-55</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>100</td>
</tr>
</tbody>
</table>

**ROLL AHEAD STOPPING DISTANCE** ASSUMES DRY PAVEMENT

**MINIMUM TAPER LENGTH = L (FEET)**

<table>
<thead>
<tr>
<th>LANE WIDTH (feet)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
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</thead>
<tbody>
<tr>
<td>Posted Speed (mph)</td>
<td>10</td>
<td>115</td>
<td>150</td>
<td>205</td>
<td>270</td>
<td>450</td>
<td>500</td>
</tr>
<tr>
<td>Rural Roads</td>
<td>45/55 MPH</td>
<td>550**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Arteriary</td>
<td>35/40 MPH</td>
<td>350**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Areas</td>
<td>25/30 MPH</td>
<td>250**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business District</td>
<td>21/30 MPH</td>
<td>210**</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Aligns are black on orange unless otherwise designated.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**SIGN SPACING = X (FEET)**

<table>
<thead>
<tr>
<th>CHANNELLING DEVICE SPACING (feet)</th>
<th>50/35</th>
<th>45</th>
<th>60</th>
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</thead>
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<tr>
<td></td>
<td>RH</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

1. EXTEND TAPER ACROSS SHOULDER.
2. IF EXISTING SIGNAL IS PRESENT, SIGNAL SHALL BE SET TO ALL "RED FLASH MODE" OR DE-ENERGIZED DURING FLAGGING OPERATIONS.
3. IF THE LANE SHIFT IS SHORT AND HAS SHARP CURVES (30 MPH OR LESS) USE SIGN W1-3 IN LIEU OF SIGN W1-4.
### BUFFER DATA

**BUFFER SPACE = B**

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>25</th>
<th>30</th>
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<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
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<tbody>
<tr>
<td>LENGTH (feet)</td>
<td>55</td>
<td>85</td>
<td>120</td>
<td>170</td>
<td>220</td>
<td>280</td>
<td>335</td>
</tr>
</tbody>
</table>

**PROTECTIVE VEHICLE ROLL AHEAD DISTANCE = R**

<table>
<thead>
<tr>
<th>VEHICLE TYPE</th>
<th>TYPICAL VEHICLE</th>
<th>LOADED WEIGHT (LBS)</th>
<th>POSTED SPEED (MPH)</th>
<th>STATIONARY OPERATION (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 YARD DUMP TRUCK</td>
<td>24,000</td>
<td>50-55</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>2 TON CARGO TRUCK</td>
<td>15,000</td>
<td>50-55</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>1 TON CARGO TRUCK</td>
<td>10,000</td>
<td>50-55</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

**CHANNELIZING DEVICE SPACING (FEET)**

<table>
<thead>
<tr>
<th>MPH/TAPER</th>
<th>TANGENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/55</td>
<td>40/80</td>
</tr>
<tr>
<td>35/45</td>
<td>30/60</td>
</tr>
<tr>
<td>25/50</td>
<td>20/40</td>
</tr>
</tbody>
</table>

**NOTES**

1. Maintain a minimum of one access point for each business within work area limits.

Field locate 1 mile -- in advance of lane closure.
NOTES
1. NO LEFT TURN SIGNS ARE TO BE USED IF TRAFFIC VOLUMES ARE TOO HIGH OR THERE IS A SIGNAL OPERATING. CLOSE LEFT TURN POCKET IF THERE IS ONE ON THE SIDE STREET.
2. FLASHING WARNING LIGHTS (TYPE A, MUTCD) SHOULD BE USED TO MARK BARRICADES AT NIGHT.
3. STEADY BURNING WARNING LIGHTS (TYPE C, MUTCD) SHALL BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.
4. FOR LONG-TERM PROJECTS, CONFLICTING PAVEMENT MARKINGS NO LONGER APPLICABLE SHALL BE REMOVED OR OBLITERATED. TEMPORARY MARKINGS SHALL BE USED.

MINIMUM TAPER LENGTH = L (feet)

<table>
<thead>
<tr>
<th>LANE WIDTH (feet)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>105</td>
<td>150</td>
<td>205</td>
<td>270</td>
<td>345</td>
<td>500</td>
<td>550</td>
</tr>
<tr>
<td>11</td>
<td>115</td>
<td>165</td>
<td>225</td>
<td>295</td>
<td>370</td>
<td>520</td>
<td>570</td>
</tr>
<tr>
<td>12</td>
<td>125</td>
<td>180</td>
<td>245</td>
<td>320</td>
<td>400</td>
<td>560</td>
<td>610</td>
</tr>
</tbody>
</table>

SIGN SPACING = X (feet)

<table>
<thead>
<tr>
<th>Type</th>
<th>Speed</th>
<th>Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Roads</td>
<td>45/55 MPH</td>
<td>500**</td>
</tr>
<tr>
<td>Urban Arterials</td>
<td>35/40 MPH</td>
<td>350**</td>
</tr>
<tr>
<td>Urban Streets</td>
<td>25/33 MPH</td>
<td>200**</td>
</tr>
</tbody>
</table>

All signs are block on orange unless otherwise designated.

CHANNELIZING DEVICE SPACING (feet)

<table>
<thead>
<tr>
<th>MPH</th>
<th>50/70</th>
<th>40/70</th>
<th>35/45</th>
<th>30/45</th>
<th>25/30</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAPER</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>TANGENT</td>
<td>80</td>
<td>80</td>
<td>60</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

EXPRES NOVEMBER 25, 2003
NOTES:

1. PROHIBIT TURNS AS NECESSARY FOR TRAFFIC CONDITIONS. CLOSE LEFT TURN POCKET IF THERE IS ONE ON SIDE STREET.

2. FLASHING WARNING LIGHTS (TYPE A, MUTCD) SHOULD BE USED TO MARK BARRICADES AT NIGHT.

3. STEADY WARNING WARNING LIGHTS (TYPE C, MUTCD) SHALL BE USED TO MARK CHANNELIZING DEVICES AT NIGHT.

4. FOR LONG-TERM PROJECTS, CONFLICTING PAVEMENT Markings no longer applicable shall be removed or obliterated. TEMPORARY Markings shall be used.

---

**MINIMUM TAPER LENGTH + L (feet)**

<table>
<thead>
<tr>
<th>Lane Width (feet)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>105</td>
<td>150</td>
<td>205</td>
<td>270</td>
<td>450</td>
<td>500</td>
<td>550</td>
</tr>
<tr>
<td>11</td>
<td>115</td>
<td>165</td>
<td>225</td>
<td>295</td>
<td>495</td>
<td>550</td>
<td>605</td>
</tr>
<tr>
<td>12</td>
<td>125</td>
<td>180</td>
<td>245</td>
<td>320</td>
<td>540</td>
<td>600</td>
<td>660</td>
</tr>
</tbody>
</table>

---

**SIGN SPACING + X (feet)**

- Rural Roads: 45/55 MPH; 500'-
- Urban Arterials: 35/45 MPH; 350'-
- Urban Streets: 25/30 MPH; 200'-
- Residential Areas & Business Districts: All signs are back on orange unless otherwise designated.

---

**CHANNELIZING DEVICE SPACING (feet)**

<table>
<thead>
<tr>
<th>MPH</th>
<th>TAPER</th>
<th>TANGENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/70</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>35/45</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>25/30</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>
NOTES

1. EXTEND DEVICES TAPER ACROSS SHOULDER.

2. SIGN SEQUENCE IS THE SAME FOR BOTH DIRECTIONS OF TRAVEL ON THE HIGHWAY.

3. STEADY BURNING WARNING LIGHTS (TYPE C, MUTCD) SHALL BE USED TO MARK TRAFFIC CONTROL DEVICES AT NIGHT.

4. FOR USE WHEN TRAFFIC VOLUMES ARE SUCH THAT SUFFICIENT GAPS EXIST FOR MOTOR VEHICLES THAT MUST YIELD.

5. DRIVERS MUST HAVE ADEQUATE SIGHT DISTANCE TO SEE OPPOSING TRAFFIC AS THEY APPROACH, OTHERWISE FLAGGERS AND/OR TEMPORARY SIGNAL IS REQUIRED.

BUFFER DATA

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (feet)</td>
<td>55</td>
<td>65</td>
<td>70</td>
<td>80</td>
<td>90</td>
</tr>
</tbody>
</table>

LEGEND

☆ SIGN LOCATION - TRIPOD MOUNT
□ □ TEMPORARY TRAFFIC CONTROL DEVICES
△ FLASHING WARNING LIGHT
### TYPE 3L BARRICADE
1. FOR USE WITH SPEEDS OF 45 MPH AND UNDER.

2. 3 ADVANCED WARNING SIGNS ARE REQUIRED FOR FLAGGING OPERATIONS. (L&I REQUIREMENTS)

LEGEND

SIGN LOCATION - TRIPOD MOUNT

TEMPORARY TRAFFIC CONTROL DEVICES

FLAGGING STATION

SURVEYOR

SIGN SPACING = X (FEET)

Rural Roads 45 MPH 500' +
Urban Arterials 25/40 MPH 500'
Urban Streets Residential Areas & Business Districts 25/30 MPH 200'

ROAD WORK

NOTE

CHANNELIZING DEVICE SPACING (FEET)

MPH TAPER TANGENT
35/45 30 60
25/30 20 40
NOTES

1. PROHIBIT TURNS AS NECESSARY FOR TRAFFIC CONDITIONS. CLOSE LEFT TURN POCKET IF THERE IS ONE ON SIDE STREET.

2. FLASHING WARNING LIGHTS (TYPE A, MUTCD) SHOULD BE USED TO MARK BARRICADES AT NIGHT, AS NEEDED.

3. STEADY BURNING WARNING LIGHTS (TYPE C, MUTCD) SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT AS NEEDED.

4. FOR LONG-TERM PROJECTS, CONFLICTING PAVEMENT MARKINGS NO LONGER APPLICABLE SHALL BE REMOVED OR OBLITERATED AS SOON AS PRACTICABLE. TEMPORARY MARKINGS SHALL BE USED AS NECESSARY.

LEGEND

- **SIGN LOCATION-PORTABLE MOUNT**
- **SIGN MOUNT - TRIPOD MOUNT**
- **TEMPORARY TRAFFIC CONTROL DEVICES**
- **SEQUENTIAL ARROW SIGN**
- **PAINTED TRAFFIC ARROW (OPTIONAL)**

<table>
<thead>
<tr>
<th>MINIMUM TAPER LENGTH (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LANE WIDTH (feet)</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
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<tr>
<td>10</td>
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<td>150</td>
<td>205</td>
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<td>650</td>
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<td>11</td>
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<td>165</td>
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<td>245</td>
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<td>540</td>
<td>600</td>
<td>660</td>
</tr>
</tbody>
</table>

| SIGN SPACING = X (feet) |

- Rural Roads: 45/55 MPH 500’
- Urban Arterials: 35/40 MPH 350’
- Urban Streets, Residential Areas & Business Districts 25/30 MPH 200’

Aligns are block on orange unless otherwise designated.

<table>
<thead>
<tr>
<th>CHANNELIZING DEVICE SPACING (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>50/70</td>
</tr>
<tr>
<td>35/45</td>
</tr>
<tr>
<td>25/30</td>
</tr>
</tbody>
</table>
NOTES
1. PROHIBIT TURNS AS NECESSARY FOR TRAFFIC CONDITIONS. CLOSE LEFT TURN POCKET IF THERE IS ONE ON SIDE STREET.
2. FLASHING WARNING LIGHTS (TYPE A, MUTCD) SHOULD BE USED TO MARK BARRICADES AT NIGHT, AS NEEDED.
3. STEADY BURNING WARNING LIGHTS (TYPE C, MUTCD) SHOULD BE USED TO MARK CHANNELIZING DEVICES AT NIGHT AS NEEDED.
4. FOR LONG-TERM PROJECTS, CONFLICTING PAVEMENT MARKINGS NO LONGER APPLICABLE SHALL BE REMOVED OR OBLITERATED AS SOON AS PRACTICABLE. TEMPORARY MARKINGS SHALL BE USED AS NECESSARY.

SIGN SPACING - X (feet)

<table>
<thead>
<tr>
<th>Rural Roads</th>
<th>45/55 MPH</th>
<th>500+</th>
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<tbody>
<tr>
<td>Urban Arterials</td>
<td>35/40 MPH</td>
<td>350+</td>
</tr>
<tr>
<td>Urban Streets Residential Areas &amp; Business Districts</td>
<td>25/30 MPH</td>
<td>200+</td>
</tr>
</tbody>
</table>

Aligns are block on orange unless otherwise designated.

CHANNELIZING DEVICE SPACING (feet)

<table>
<thead>
<tr>
<th>MPH</th>
<th>TAPER</th>
<th>TANGENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>45/65</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>35/45</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>25/30</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>
WIRE FENCE - TYPE 1

- Wire clamp
- Gate or end post
- Vertical clinch stay
- Line post
- Concrete (Class 3000)
- 12" Round section
- 14' MAX

LINE BRACE
(Maximum spacing 1000 feet)

- 18" Square section
- 12" Round section
- Concrete (Class 3000)

- Pull post

WIRE FENCE - TYPE 2

- Gate or end post
- Wire clamp
- Vertical clinch stay

CORNER BRACE
(Angles 30° and over)

- Concrete (Class 3000)

INTERSECTING FENCE BRACE

- Brace
- End post

TREATMENT OF SAGS

- Stone or concrete block
  (MIN weight 100 pounds)
  or drilled and grouted
  hole in solid rock

14' MAX

STEEL POST DETAILS

Details for Type 2 Fence identical
as shown for Type 1 Fence
**NOTES:**

- All concrete post bases shall be 10" minimum diameter.
- All posts shall be spaced at 10' maximum intervals unless otherwise directed by the Engineer.
- Top or bottom tension wires shall be placed within the limits of the first full fabric weave.
- Details are illustrative and shall not limit hardware design or post selection of any particular fence type.

### ROLL FORMED SECTIONS

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>BRACE RAIL &amp; TOP RAIL</th>
<th>LINE &amp; BRACE POST</th>
<th>END, CORNER, &amp; PULL POST</th>
<th>GATE POST</th>
<th>ALL POSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>ROUND</td>
<td>H-COLUMN</td>
<td>ROLL FORMED</td>
<td>ROUND</td>
<td>H-COLUMN</td>
</tr>
<tr>
<td>1.14</td>
<td>2.27</td>
<td>11/2 x 13/4</td>
<td>1.35</td>
<td>17/8 x 13/4</td>
<td>1.35</td>
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<tr>
<td>1.14</td>
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<td>11/2 x 13/4</td>
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<td>17/8 x 13/4</td>
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<tr>
<td>1.14</td>
<td>2.27</td>
<td>11/2 x 13/4</td>
<td>1.35</td>
<td>17/8 x 13/4</td>
<td>1.35</td>
</tr>
<tr>
<td>1.14</td>
<td>2.27</td>
<td>11/2 x 13/4</td>
<td>1.35</td>
<td>17/8 x 13/4</td>
<td>1.35</td>
</tr>
</tbody>
</table>

**CHAIN LINK FENCE**

**L-2**

07-18-97
1. Fence fabric shall be secured to gate frames with knuckled selvage along top edge for Types 4 & 6 chain link fence installations.

2. Minimum post lengths:
   - Types 1 & 3: 8’ - 8’
   - Types 4 & 6: 5’ - 6’
NOTES

1. Posts shall be 6 x 8 wood or W6 x 9 steel. See Standard Plan "Beam Guardian Posts and Blocks".

2. Padlocked end shall be determined by the Project Engineer. Lock shall not be provided.

PLAN

\[
\frac{3}{16}'' \text{ MIN galvanizedHWRC wires used rope may be approved by the Engineer}
\]

Galvanized eye bolt, \(\frac{3}{16}''\) shank, eye to be large enough to allow chain to pass through

\[
\frac{3}{16}'' \text{ Galvanized chain approximately } 2' \text{ long, to connect padlocked end. (See Note 2)}
\]

Loop and clamp end

\[
\frac{3}{8}'' \text{ Galvanized eye bolt}
\]

Galvanized nut and washer

ELEVATION

6'' MIN

Lock 11'' MIN

Ground line

Posts (See Note 1)

Galvanized nut and washer

Burr or swell end of bolt to prevent removal of nut