# DETAILED DRAWINGS

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**SUPPLEMENT TO THE SEPTEMBER 2014 EDITION**

**EFFECTIVE: APRIL 2019**

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**Abbreviations**

- **Dwgs. No.** 101-06
- **Standard Spec.** Section 101
- **Reference**
- **Effective:** September 2014
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FUNCTIONAL CLASS.

COUNTY AND MAIN ROADS USE ESTABLISHED STANDARDS FOR APPLICABLE CRITERIA SHOWN ARE FOR PRIVATE AND FARM FIELD APPROACHES. FOR RIGHT-OF-WAY.

SECURE WRITTEN PERMISSION FROM LANDOWNER FOR WORK BEYOND THE CONSTRUCT APPROACHES TO FIT LOCAL CONDITIONS.

TRAFFIC VOLUMES AND COST INDICATE SUCH TO BE JUSTIFIABLE.

APPROACH GRADE BEYOND LANDING IS NOT TO EXCEED 10% UNLESS OTHER UNITS ARE SHOWN.

NOTES:

1. APPROACH GRADE BEYOND LANDING IS NOT TO EXCEED 10% UNLESS TRAFFIC VOLUMES AND COST INDICATE SUCH TO BE JUSTIFIABLE.

2. CONSTRUCT APPROACHES TO FIT LOCAL CONDITIONS.

3. SECURE WRITTEN PERMISSION FROM LANDOWNER FOR WORK BEYOND THE RIGHT-OF-WAY.

** CRITERIA SHOWN ARE FOR PRIVATE AND FARM FIELD APPROACHES. FOR COUNTY AND MAIN ROADS USE ESTABLISHED STANDARDS FOR APPLICABLE FUNCTIONAL CLASS.

REMARKS:

TYPICAL SECTION WITHIN CLEAR ZONE

USE A PIPE AS NECESSARY FOR DRAINAGE. INSTALL CULVERTS OUTSIDE THE CLEAR ZONE OR PROVIDE END TREATMENT.

TYPICAL SECTION BEYOND CLEAR ZONE

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<td>9' - 10' [1.5 m - 3.0 m]</td>
<td>10' - 20' [3.0 m - 6.0 m]</td>
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<td>OVER 10' [3.0 m]</td>
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<td>1.5:1 MAX.</td>
<td>1.5:1 MAX.</td>
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* 25' [7.5 m] MIN. FOR PRIVATE OR FIELD APP.
75' [25.0 m] MIN. FOR COUNTY AND MAIN ROADS.

(LANDING GRADE -3% DESIRABLE, +3% ALLOWABLE).

NOTE: MAX. SKEW ANGLE IS 30°.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILS DRAWING

REFERENCE DWG. NO. STANDARD SPEC. SECTION 203

APPROACHES

EFFECTIVE: SEPTEMBER 2014

MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:

1. CONSTRUCT DITCH BLOCKS TO FIT LOCAL CONDITIONS. WHEN CONDITIONS DO NOT ALLOW 10:1 SLOPES, USE 6:1 SLOPES.

2. HEIGHTS SHOWN ARE MINIMUMS. SET HEIGHT OF DITCH BLOCKS BASED ON THE CURB VERT DIAMETER OR THE ELEVATION SHOWN IN THE PLANS.

UNITS SHOWN IN BRACKETS ( ) ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING
REFERENCE DWG. NO. STANDARD SPEC. 203-20
SECTION 203

DITCH BLOCKS

EFFECTIVE: SEPTEMBER 2014

MONTANA DEPARTMENT OF TRANSPORTATION
FINISHED GRADE

SUBGRADE

6:1 MAX. SLOPE

BRIDGE END BACKFILL

10' (3 m) MIN.

VARYING SLOPE

BERM (SEE BR. PLANS “GENERAL LAYOUT”)

SECTION A-A

SECTION B-B

SECTION C-C

NOTE: FILL MATERIAL MUST BE KEPT OFF THE TOP OF THE CONCRETE CAP

TOP OF BERM

USUALLY BOTTOM OF CAP

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.
STANDARD SPEC. SECTION 301.701
301-00
ROADWAY EMBANKMENT AT BRIDGE END
EFFECTIVE: SEPTEMBER 2014

MONTANA DEPARTMENT OF TRANSPORTATION
**Typical Shoulder Installation (Concrete Pavement)**

- **Direction of Travel**: LANE EDGE STRIPE
- **Edge of Travel Lane**: 6" [150 mm]
- **Travel Lane**: 6" [150 mm]
- **Continuous Shoulder (Intermittent Pattern)**
- **Intermittent Rumble Strip Spacing**: GREATER THAN 4' (1.2 m)
- **Direction of Travel**: LANE EDGE STRIPE

**Continuous Rumble Strips**

- **Edge of Shoulder (Concrete Pavement)**: 12" [300 mm]
- **Position**: 47'-0" [3.7 m] to 47'-8" [3.9 m] gap
- **Point**: 12'-4" [3.7 m] to 13'-0" [3.9 m] gap

**Intermittent Rumble Strips**

- **Spacing**: 13 TO 19
- **Radius (mm)**: 25
- **Depth (mm)**: 1" [25 mm]

**Typical Application**

- **Interstate Application**
- **Exit Ramp**: NO Rumble Strips
- **Entrance Ramp**: NO Rumble Strips
- **Mainline**: Rumble Strips

**Interstate Rumble Strips**

- **Spacing**: 250 TO 300
- **Depth**: 1" [25 mm]

**Note**: Do not install rumble strips on concrete bridge decks unless recessed installed, such as concrete barriers. Rail, prevent proper placement.

---

**Detailed Drawing Reference**: 411-02

**Diagram Series**: SHOULDER RUMBLE STRIPS

**Date of Issue**: January 2018

**Drawing Sheet**: MONTANA DEPARTMENT OF TRANSPORTATION

---
INTERMITTENT RUMBLE STRIP SPACING

GUARDRAIL IF THE SHOULDER IS LESS THAN 6' [1.8 m] IN WIDTH.

DISCONTINUE INTERMITTENT RUMBLE STRIPS IN FRONT OF GUARDRAIL IF THE SHOULDER IS LESS THAN 6' [1.8 m] IN WIDTH.

60' [18.3 m] CYCLE PATTERN

INTERMITTENT RUMBLE STRIP SPACING

DISCONTINUE INTERMITTENT RUMBLE STRIPS FOR PUBLIC APPROACHES, ETC.

RUMBLE STRIP DETAIL

NOTE:

1. DO NOT INSTALL RUMBLE STRIPS OVER CONCRETE (MID-SHORING) DECKS OR WHERE OBSTACLES SUCH AS CONCRETE RAIL, PAVEMENT, PINEY HEDGES, ETC. PREVENT PROPER PLACEMENT.

2. INSTALLATION ON SHOULDERS LESS THAN 4'7 (1.4 m) WILL NOT BE DECIDED ON A CASE-BY-CASE BASIS.

INSTALLATION ON SEGMENTS OF NATIONAL HIGHWAY OR PRIMARY ROUTES (INTERMITTENT PATTERN) AND ADJACENT TO MEDIANS OF ALL CONSTRUCTION, RECONSTRUCTION AND OVERLAY PROJECTS, UNLESS OTHERWISE SPECIFIED.

UNLESS OTHER UNITS ARE SHOWN.

METRIC AND ARE IN MILLIMETERS (mm)

UNITS SHOWN IN BRACKETS [ ] ARE

NOTE:

1. DO NOT INSTALL RUMBLE STRIPS OVER CONCRETE (MID-SHORING) DECKS OR WHERE OBSTACLES SUCH AS CONCRETE RAIL, PAVEMENT, PINEY HEDGES, ETC. PREVENT PROPER PLACEMENT.

2. INSTALLATION ON SHOULDERS LESS THAN 4'7 (1.4 m) WILL NOT BE DECIDED ON A CASE-BY-CASE BASIS.

INSTALLATION ON SEGMENTS OF NATIONAL HIGHWAY OR PRIMARY ROUTES (INTERMITTENT PATTERN) AND ADJACENT TO MEDIANS OF ALL CONSTRUCTION, RECONSTRUCTION AND OVERLAY PROJECTS, UNLESS OTHERWISE SPECIFIED.

UNLESS OTHER UNITS ARE SHOWN.

METRIC AND ARE IN MILLIMETERS (mm)

UNITS SHOWN IN BRACKETS [ ] ARE
RUMBLE STRIP DETAIL

SECTION A-A

SECTION B-B

PUBLIC APPROACH:

NOTES:

- Reserves within designated city or urban limits. Use engineering judgment on a case-by-case basis to determine if centerline rumble strip installation is appropriate.
- Renew centerline rumble strips for public approaches only.
- Consider removing existing centerline rumble strips prior to a second seal and cover application.
- Do not install centerline rumble strips on concrete橋德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德德
TYPICAL ISOLATION JOINT GUIDELINES

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>FEATURE</th>
<th>DISTANCE FROM NEAREST PAVEMENT JOINT</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>DROP ON CURB INLET</td>
<td>-----</td>
</tr>
<tr>
<td>B</td>
<td>DROP ON CURB INLET</td>
<td>-----</td>
</tr>
<tr>
<td>C</td>
<td>DROP ON CURB INLET</td>
<td>BACK OF ISOLATION JINT &gt; 4 FT [1220] FROM JOINT</td>
</tr>
<tr>
<td>D</td>
<td>DROP ON CURB INLET</td>
<td>EDGE OF INLET &lt; 2 FT [610] FROM JOINT</td>
</tr>
<tr>
<td>E</td>
<td>DROP ON CURB INLET</td>
<td>&gt; 4 FT [1220] FROM JOINT</td>
</tr>
<tr>
<td>F</td>
<td>MANHOLE</td>
<td>-----</td>
</tr>
<tr>
<td>G</td>
<td>MANHOLE</td>
<td>-----</td>
</tr>
<tr>
<td>H</td>
<td>MANHOLE</td>
<td>-----</td>
</tr>
<tr>
<td>I</td>
<td>MANHOLE</td>
<td>CENTER OF MANHOLE &lt; 3 FT [915] FROM JOINT</td>
</tr>
<tr>
<td>J</td>
<td>MANHOLE</td>
<td>CENTER OF MANHOLE = 3 FT [915] FROM JOINT</td>
</tr>
</tbody>
</table>

TYPICAL APPLICATIONS

- **CONDITION A**
  - PAVEMENT JOINT (TYP.)
  - FILL WITH JOINT SEALER

- **CONDITION B**
  - DROP OR CURB INLET
  - -----  

- **CONDITION C**
  - DROP OR CURB INLET
  - -----  

- **CONDITION D**
  - -----  

- **CONDITION E**
  - -----  

- **CONDITION F**
  - -----  

- **CONDITION G**
  - -----  

- **CONDITION H**
  - -----  

- **CONDITION I**
  - -----  

- **CONDITION J**
  - -----  

**REFERENCE**

D.O.T. ENGINEERING MANUAL

DEPARTMENT OF TRANSPORTATION

MONTANA DEPARTMENT OF TRANSPORTATION

DETAILED DRAWING

Dwg. No. 501-10

PCCP ISOLATION JOINTS

SEPTEMBER 2014

METRIC UNITS ARE IN MILLIMETERS ONLY UNLESS OTHER UNITS ARE SHOWN.

UNITS SHOWN IN BRACKETS [ ] ARE
**CHAIR DETAIL**

**SECTION E-E**

- Top of pavement after grinding
- Concrete pavement
- Top of existing cement

**Dowel Bar Placement Detail**

- Dowel bar expansion cap - both ends
- Dowel bar - prefabricated
- Dowel bar
- Saw blade diam. depending on radius varies
- Chair to rest parallel to surface
- Chair detail
- Use plastic chair or as approved by project manager

**LENGTH NEEDED FOR DOWEL BAR PLACEMENT**

- Top of pavement after grinding
- Concrete pavement
- Top of existing cement

**SAW BLADE DIAM.**

- Depth varies depending on saw blade diam.
- Chair to rest parallel to surface
- Chair detail
- Use plastic chair or as approved by project manager

**Dowel Bar Expansion Cap**

- Dowel bar - prefabricated
- Dowel bar
- Saw blade diam. depending on radius varies

**CHAIR DETAIL**

- Use plastic chair or as approved by project manager

**NOT INCLUDED IN BID ITEM**

- Top of pavement after grinding
- Concrete pavement
- Top of existing cement

**SAW BLADE DIAM.**

- Depth varies depending on saw blade diam.
- Chair to rest parallel to surface
- Chair detail
- Use plastic chair or as approved by project manager

**NOT INCLUDED IN BID ITEM**

- Top of pavement after grinding
- Concrete pavement
- Top of existing cement

**SAW BLADE DIAM.**

- Depth varies depending on saw blade diam.
- Chair to rest parallel to surface
- Chair detail
- Use plastic chair or as approved by project manager

**METRIC AND ARE IN MILLIMETERS (mm)**

UNLESS OTHER UNITS ARE SHOWN.
MULTIPLE ARCH CULVERTS  
(METAL CULVERTS SHOWN)

X: VARIABLE. FOR METAL CULV. SEE DTL. DWG. 603-37 (CIRCULAR) OR 603-34 (ARCH), AND FOR CONCRETE CULV. WITH FETS SEE DTL. DWG. 603-08 (ROUND) OR 603-12 (ARCH), AND FOR CONCRETE CULV. WITH SQUARE ENDS, THE "X" DIMENSIONS IS D/4 OR R/3

Y: FOR METAL CULV. AND CULV. WITHOUT FETS; Y = 4'-0" (1200) (OUTSIDE WALL TO OUTSIDE WALL)

FOR CONCRETE CULV. WITH FETS: USE Y AS REQUIRED FOR PARALLEL PIPE INSTALLATION, PER DTL. DWG. NO. 613-08

NOTE: Y MAY BE INCREASED ON LARGE DIAMETER PIPES (UP TO A MAX. OF 8'-0" [2400]) TO AID IN INSTALLATION AND BACKFILL. THE QUANTITIES SHOWN IN 552-04, 06 & 08 WERE FIGURED USING Y = 4'-0" (1200). ADJUST QUANTITIES AS NEEDED WHEN Y IS OTHER THAN 4'-0" (1200).

MULTIPLE ROUND CULVERTS  
(METAL CULVERTS SHOWN)

S: INSIDE PIPE SPAN

METAL CULVERTS SHOWN

SINGLE ROUND CULVERT  
(CONTRETE CULVERT SHOWN)

ANCHOR BOLT DETAILS

ANCHOR BOLT SPACING:
MIN. OF FIVE 3/4" DIA (M20) GALV. ANCHOR BOLTS IN WALL. USE MAX. SPACING OF 1.5' [455].

REINFORCING STEEL:
USE REBAR DOWELS MEETING THE REQUIREMENTS OF AASHTO M 31 GRADE 60 (GRADE 420).

EPOXY RESIN BONDING ADHESIVE:
MEET THE REQUIREMENTS OF AASHTO M 235 TYPE 4.
# CULVERT INSTALLATION QUANTITIES

## Cubic Yards of Class General Concrete (Each End)

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>Cut-off Wall (D/L, Sec. No. 552-200)</th>
<th>Concrete Edge Protection (D/L, Sec. No. 612-08)</th>
<th>Cubic Yards of Riprap (D/L, Sec. No. 612-12)</th>
<th>Polyethylene Bermed Material Per Foot (D/L, Sec. No. 612-16)</th>
<th>RCP (ft)</th>
<th>RCP (ft)</th>
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<td>1.4 2.3 1.7 2.3 2.0 2.4 2.7 4.0</td>
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<td>60</td>
<td>1.5 2.5 1.8 2.4 2.1 2.7 3.3 4.6</td>
<td>12.3 97.7 9.8 9.8 9.8 9.8 9.8 9.8</td>
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<td>13.3 97.3 9.7 9.7 9.7 9.7 9.7 9.7</td>
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</tbody>
</table>

## Cubic Yards of Riprap (Each End) UNLESS OTHER UNITS ARE SHOWN.

- METRIC AND ARE IN MILLIMETERS (mm)
- UNITS SHOWN IN BRACKETS [ ] ARE IN FEET (ft)

## Special Notes
- CULVERT RIPRAP IS USED ONLY IN SPECIAL CIRCUMSTANCE.
- TABLES SHOWED IN BRACKETS [ ] ARE BASED ON A THICKNESS OF 2 FT. [600 mm] AND ARE PROPORTIONED WHEN A DIFFERENT THICKNESS IS SPECIFIED.
- GRANULAR BEDDING QUANTITIES FOR CONCRETE PIPES ARE BASED ON SQUARE ENDS IS D/4 OR R/3.
- THE "X" DIMENSION FOR RCP AND RCPA WITH SQUARE ENDS IS D/4 OR R/3.

## References
- DWG. NO.
- SECTION 552-24
- CONCRETE, RIPRAMP AND GRANULAR BEDDING MATERIAL QUANTITIES FOR RCP AND RCPA WITH SQUARE ENDS IS D/4 OR R/3 UNLESS OTHER UNITS ARE SHOWN.
### Table: Culvert Bedding Quantities

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Bedding Material</th>
<th>Concrete Edge Protection</th>
<th>Inlet Protection</th>
<th>Outlet Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ft.</td>
<td>Riprap</td>
<td>Standard</td>
<td>Concrete</td>
<td>Metal</td>
</tr>
<tr>
<td>4 ft.</td>
<td></td>
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</tbody>
</table>

#### Notes:
- See DTL. DWG. NO. 603-19 for "X" dimensions of cutoff wall.
- Bedding quantities for metal pipes are based on bedding proportioned when a different thickness is specified.
- Concrete, riprap, and granular bedding quantities shown by cosine of skew angle.
- For pipes with skew bevel ends - divide the quantities of metal pipes.
- See DTL. DWG. NO. 603-32 and 603-34 for "X" dimensions of cutoff wall.
- Extend granular bedding to back depth.
- To compute the total bedding quantity multiply depth by (length of pipe minus 1.3 ft. [0.40 m]).
- Concrete, riprap, and granular bedding quantities shown by cosine of skew angle.
- Metal pipes are based on bedding proportioned when a different thickness is specified.
- Concrete edge protection is standard for metal culvert inlet and outlet protection. Riprap is only used in special circumstances.
CUBIC YARDS OF CURB GENERAL CONCRETE (EACH END)  
CUBIC METERS OF CURB GENERAL CONCRETE (EACH END)  
CUBIC METERS OF CURB REINFORCED CONCRETE (EACH END)  
CUBIC METERS OF CURB REINFORCED CONCRETE (EACH END)  

<table>
<thead>
<tr>
<th>DIAMETER OR SPAN (IN)</th>
<th>CURTUP WALL (EACH END)</th>
<th>CONCRETE EDGE PROTECTION (INT. W/ CHG.)</th>
<th>CURTUP WALL (EACH END)</th>
<th>CONCRETE EDGE PROTECTION (INT. W/ CHG.)</th>
<th>CURTUP WALL (EACH END)</th>
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<th>CURTUP WALL (EACH END)</th>
<th>CONCRETE EDGE PROTECTION (INT. W/ CHG.)</th>
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<td>2.1</td>
<td>2.3</td>
<td>2.6</td>
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</tbody>
</table>


d. Widths shown in tapers of 1/4".  
For Pipelines with Skew Bevel Ends - Divide the Quantities Shown by COSINE of SKEW ANGLE.  
Reverse Tapers Shown in tapers of 1/4".  

Notes:  
1. Concrete Edge Protection is STANDARD for Metal Culvert Trench and Metal Culvert Protection. Concrete Riprap is used in Special Circumstances.  
2. Quantities Shown in brackets [ ] are metal pipes.  
3. Quantities Shown in parentheses ( ) are brick, stone, or concrete tile.  
4. Quantities Shown in square brackets [ ] are rebar.  
5. Notes on Sheet No. 603-32 and 603-34 for "X" dimensions.  
6. Standard Concrete Bedding Quantities for Metal PIPES BASED on BEDDING PROPORTIONED WHEN A DIFFERENT THICKNESS IS SPECIFIED.  
7. Standard Concrete Bedding Quantities for Metal PIPES BASED on THICKNESS OF 2" [600] and ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE SHOWN BY COSINE OF SKEW ANGLE.  
8. For pipes with skew bevel ends - divide the Quantities Shown by Cosine of skew angle.  
9. SEE DTL. DWG. NO. 603-32 AND 603-34 FOR "X" DIMENSIONS TO BACK OF CUTOFF WALLS.  
10. Multiply by (LENGTH OF PIPE MINUS 1.3 FT. [0.40 m]) and A DEPTH EQUAL TO 1 FT. [300] + "X" + (CORRUGATION TO (DIAMETER OR SPAN) + 4 FT. [1200] + (2 TIMES CORRUGATION DETAILS SHOWN ON DTL. DWG. NO. 603-19 WITH A WIDTH EQUAL TO INLET AND OUTLET PROTECTION. CULVERT RIPRAP IS ONLY USED IN SPECIAL CIRCUMSTANCES.  
11. Concrete Bedding Quantities for Metal PIPES ARE BASED ON BEDDING PROPORTIONED WHEN A DIFFERENT THICKNESS IS SPECIFIED.  
12. Concrete Bedding Quantities for Metal PIPES ARE BASED ON A THICKNESS OF 2 FT. [600] AND ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE METAL PIPES AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.  
13. Standard Concrete Bedding Quantities for Metal PIPES BASED on BEDDING PROPORTIONED WHEN A DIFFERENT THICKNESS IS SPECIFIED.  
14. Standard Concrete Bedding Quantities for Metal PIPES BASED on THICKNESS OF 2 FT. [600] and ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE SHOWN BY COSINE OF SKEW ANGLE.  
15. Standard Concrete Bedding Quantities for Metal PIPES BASED on THICKNESS OF 2 FT. [600] and ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE SHOWN BY COSINE OF SKEW ANGLE.  
16. Standard Concrete Bedding Quantities for Metal PIPES BASED on THICKNESS OF 2 FT. [600] and ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE SHOWN BY COSINE OF SKEW ANGLE.  
17. Standard Concrete Bedding Quantities for Metal PIPES BASED on THICKNESS OF 2 FT. [600] and ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE SHOWN BY COSINE OF SKEW ANGLE.  
18. Standard Concrete Bedding Quantities for Metal PIPES BASED on THICKNESS OF 2 FT. [600] and ARE IN MILLIMETERS (mm). UNITS SHOWN IN BRACKETS [ ] ARE SHOWN BY COSINE OF SKEW ANGLE.
**Detailed Drawings**

**Reference**

**Dwg. No.**

603-08

**Standard Spec.**

635-70

**Prefabricated RCP Flanged End Terminal**

**Section (FETS) (Metric)**

**Slope Detail**

1. **PLAN**

2. **Slope Detail**

3. **Section X-X**

4. **Section Y-Y**

5. **End View**

6. **TIE BOLT DETAIL**

7. **TIE BOLT DETAIL (END SECTION)**

**Large Diameter Pipe**

**Tolerances in the Adjacent Tables May Not Correspond With Those Shown. Otherwise They Must Conform to AASHTO M 170. Vary More Than ±1.5% for the Dimensions Shown. Tolerances in the Adjacent Tables May Not Conform to AASHTO M 170.**

**Material: Use Two Ties per End Section.**

**Recommended Bolt Flow**

619 (Adj. ±38 Min.)

**Recommended Bolt**

**Type “A”**

**Large Diameter Culvert**

**SECTION X-X**

**END VIEW**

**Type “B”**

**TIE BOLT DETAIL**

**TIE BOLT DETAIL (END SECTION)**

**Construction:** Construct Per Section 70B.
**DIMENSION TABLE**

<table>
<thead>
<tr>
<th>EQUIV. SIZE</th>
<th>SPAN</th>
<th>RISE</th>
<th>T *</th>
<th>X</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>R</th>
<th>SLOPE</th>
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<tbody>
<tr>
<td>18&quot;</td>
<td>22&quot;</td>
<td>13 1/2</td>
<td>2 1/2&quot;</td>
<td>7&quot;</td>
<td>27&quot;</td>
<td>45°</td>
<td>72°</td>
<td>36°</td>
<td>3°</td>
<td>3:1</td>
</tr>
<tr>
<td>24&quot;</td>
<td>28 1/2&quot;</td>
<td>18&quot;</td>
<td>3 1/2&quot;</td>
<td>9&quot;</td>
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<td>60°</td>
<td>108&quot;</td>
<td>54°</td>
<td>3°</td>
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</tr>
<tr>
<td>30&quot;</td>
<td>36 1/4&quot;</td>
<td>22 1/2&quot;</td>
<td>4&quot;</td>
<td>9 1/2&quot;</td>
<td>40°</td>
<td>96°</td>
<td>192°</td>
<td>96°</td>
<td>3°</td>
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<td>43 3/4&quot;</td>
<td>26 3/8&quot;</td>
<td>11 1/8&quot;</td>
<td>60°</td>
<td>96°</td>
<td>192°</td>
<td>96°</td>
<td>6°</td>
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<td>42&quot;</td>
<td>51 1/8&quot;</td>
<td>31 5/16&quot;</td>
<td>15 1/16&quot;</td>
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<td>96°</td>
<td>192°</td>
<td>96°</td>
<td>6°</td>
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<td>5&quot;</td>
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<td>192°</td>
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<td>40&quot;</td>
<td>5 1/2&quot;</td>
<td>25 1/2&quot;</td>
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<td>96°</td>
<td>192°</td>
<td>6°</td>
<td>2:1</td>
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<td>62&quot;</td>
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<td>21 1/2&quot;</td>
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</table>

*A WALL "B" THICKNESS

**METRIC DIMENSION TABLE**

<table>
<thead>
<tr>
<th>EQUIV. SIZE</th>
<th>SPAN (mm)</th>
<th>RISE (mm)</th>
<th>T * (mm)</th>
<th>X (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>R (mm)</th>
<th>SLOPE</th>
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<tr>
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<td>560</td>
<td>345</td>
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<td>570</td>
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<td>1168.4</td>
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</table>

*A WALL "B" THICKNESS

---

**TIE BOLT DETAIL**

(TWO PER END SECTION)

**LONGITUDINAL SECTION**

**END VIEW**

**PLAN VIEW**

---

TIE BOLTS: USE TIE BOLTS ON ALL FLARED END SECTIONS, ONE ON EACH SIDE AT 60° TO THE VERTICAL. GALVANIZE ALL PARTS. UNLESS OTHER UNITS ARE SHOWN.

CONSTRUCTION: CONSTRUCT PER SECTION 708.

**DETAILED DRAWING**

REFERENCE: SECTION 603, 708, 711

PREFABRICATED RCP ARCH FLARED END TERMINAL SECTION (FTS)

EFFECTIVE: SEPTEMBER 2014

MONTANA DEPARTMENT OF TRANSPORTATION
**ROAD APPROACH CULVERT END TREATMENT**

**QUANTITIES (FOR ESTIMATING ONLY)**

<table>
<thead>
<tr>
<th>DIA. A RCP</th>
<th>H PIPE</th>
<th>LENGTH</th>
<th>F-64 1/2&quot; x 4 1/8&quot; FERRULE LOOP INSERT EACH</th>
<th>LENGTH 2 1/2&quot; DIA. SCHEDULE 40 GALV. PIPE</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>G</th>
<th>R</th>
<th>J</th>
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<tr>
<td>15&quot;</td>
<td>4.19</td>
<td>~</td>
<td>~</td>
<td>~</td>
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<td>0.75</td>
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<tr>
<td>24&quot;</td>
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<td>9.25</td>
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**METRIC QUANTITIES (FOR ESTIMATING ONLY)**

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<th>DIA. A RCP</th>
<th>H PIPE</th>
<th>LENGTH</th>
<th>M12 x 105 FERRULE LOOP INSERT, EACH</th>
<th>LENGTH 63 DIA. SCHEDULE 40 GALV. PIPE</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>G</th>
<th>R</th>
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<td>210</td>
<td>82</td>
<td>1219</td>
<td>76</td>
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<td>64</td>
<td>2819</td>
<td>76</td>
<td>229</td>
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</table>

**PLAN VIEW**

**SECTION A-A**

**END VIEW**

**VIEW OF INSERTS**

**NOTE:**

- Paint all non-galvanized parts per Section 710.
- Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.

**DETAILED DRAWING**

**REFERENCE DWG. NO.**

**STANDARD SPEC. SECTION 603,710,711**

**RCP ROAD APPROACH CULVERT END TREATMENT (RACET)**

**EFFECTIVE:** SEPTEMBER 2014

**MDT MONTANA DEPARTMENT OF TRANSPORTATION**
A. THE CULVERT IS FABRICATED WITH 12 GAUGE (0.109" [2.8] THICK) MATERIAL.

B. HALF-CIRCLE NOTCHES ARE CUT IN THE CULVERT FOR THE STEEL PIPE WITH CONTINUOUS WELD IN THE PERIPHERY IN CONTACT PROVIDED.

C. ALL WELDS AND OTHER NON-GALVANIZED PARTS ARE PAINTED PER STANDARD SPEC. OF TRANSPORTATION MONTANA DEPARTMENT.

NOTES:

1. PIPE TO HAVE ANNULAR CORRUGATION OR REROLLED ENDS. USE ONLY APPROVED COUPLING BAND PER SECTION 314 FOR CMP. FOR CMP END TREATMENT, SEE DTL. DWG. NO. 603-26 FOR CONNECTION.

2. THE TWO 3/4" [19] CHANNELS MAY BE ELIMINATED FROM THE CULVERT END TREATMENT IF:

   a. THE VALLEYS MAY BE WELDED.

   b. CRIMP AND SPOT WELD BOTH SIDES AT CREST OF EACH CORRUGATION. IF GAP FROM OUTER EDGE OF CMP TO CHANNEL IS LIMITED THE VALLEYS MAY BE WELDED.

3. CONNECTIONS MADE PER DTL. DWG. NO. 603-26 REQUIRE PIPE SENSITIVE H AND I TO BE INCREASED BY 9.146.

SCHEDULE 40 GALVANIZED STEEL PIPE (AS REQUIRED)

SCHEDULE 40 GALVANIZED STEEL PIPE (AS REQUIRED)

GALV. CHANNEL CRIMPED AND SPOT WELDED

GALV. CHANNEL CRIMPED AND SPOT WELDED

PLAN VIEW

END VIEW

SECTION A-A

Illustrated with DWG. 603-14

CMP ROAD APPROACH CULVERT END TREATMENT

DESCRIPTION: CRIMP AND SPOT WELD BOTH SIDES AT CREST OF EACH CORRUGATION. IF GAP FROM OUTER EDGE OF CMP TO CHANNEL IS LIMITED THE VALLEYS MAY BE WELDED.

QUANTITIES (FOR ESTIMATING ONLY)

<table>
<thead>
<tr>
<th>SECTION A-A</th>
<th>QTY</th>
<th>H PIPE LENGTH</th>
<th>3/4&quot; X 3/8&quot;</th>
<th>1/8&quot; TIMER</th>
<th>SCHEDULE 40</th>
<th>GALV. PIPE DIAMETER</th>
<th>LENGTH</th>
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</table>

DIMENSIONS (FT.)

SCHEDULE 40 GALVANIZED STEEL PIPE LENGTH 3" [75] DIA.


CMP DIAM. A LENGTH

NOTES:

UNIT SHEET PER DWG. NO. 603-26 UNLESS OTHER UNITS ARE SHOWN.

MTD. DWG. NO. 603-14

REFERENCE STANDARD SPEC. OF TRANSPORTATION MONTANA DEPARTMENT

SECTION 603-149/10

ADDITION REVISION 09/2014

ROAD APPROACH CULVERT END TREATMENT

<table>
<thead>
<tr>
<th>DIA.</th>
<th>A</th>
<th>C</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

ORDER: MUST BE SHOWN ON PLANS. UNIT SHEET PER DWG. NO. 603-26 UNLESS OTHER UNITS ARE SHOWN.
PER SECTION 711.

STRUCTURAL TUBING CROSS-PIPE

[64 x 64 x 6.4] GALV.

2 1/2" x 2 1/2" x 1/4"

CSPA

[530 x 380]

21" x 15"

[305]

1'-0"

[914] CONN.

3'-0"

CSP OR CSPA EXISTING OR NEW

PLAN VIEW

4 SPACES AT 1'-11" [584]

5 1/4" [133]

5 1/4" [133]

2-4 1/2" [123]

1'-6" [457]

GALV. BOLT (TYP.)

3/8" DIA. x 1" [M10 x 25]

METRIC AND ARE IN MILLIMETERS (mm)

UNITS SHOWN IN BRACKETS () ARE

NOTE:

PAINT ALL EXPOSED METAL PARTS WITH

ONE COAT OF ZINC RICH PAINT AND TWO

COATS OF ALUMINUM PAINT PER SECTION 710.

DETAIL A

10:1 SLOPE

1'-10 3/8" [350]

1'-5 3/8" [441]

METAL AND ARE IN MILLIMETERS (mm)

UNITS SHOWN IN BRACKETS () ARE

NOTE:

PAINT ALL EXPOSED METAL PARTS WITH

ONE COAT OF ZINC RICH PAINT AND TWO

COATS OF ALUMINUM PAINT PER SECTION 710.

DETAIL A

3/8" [M10]

LOOP FERRULE

INSERT (TYP.)

3/8" [M10]

LOOP FERRULE

INSERT (TYP.)

3/8" [M10]

LOOP FERRULE

INSERT (TYP.)

3/8" DIA. x 1" [M10 x 25]

GALV. BOLT (TYP.)

EXISTING OR NEW CSP OR CSPA

ELEVATION

NOTE:

PAINT ALL EXPOSED METAL PARTS WITH

ONE COAT OF ZINC RICH PAINT AND TWO

COATS OF ALUMINUM PAINT PER SECTION 710.
EXCAVATE AS NEEDED

BEDDING DEPTH

(SEE NOTE 3)

1'-0" [300] MIN.
THICKNESS OR AS DIRECTED BY THE
PROJECT MANAGER

FOUNDATION MATERIAL
WHEN SPECIFIED

SPECIAL BACKFILL (WHEN SPECIFIED)

2' (TYP.)

SPECIAL BACKFILL (WHEN SPECIFIED)

2" (600)

SIDE FILL

L O S T

EXISTING GROUND

GRANULAR BEDDING

STABILIZATION GEOTEXTILE

PER SECTION 716
WHEN SPECIFIED

E X I S T I N G  G R O U N D

F. L. C U L V E R T

GRANULAR BEDDING MATERIAL

SIDE FILL

1'-0" [305] MIN.

S I D E  F I L L

STABILIZATION GEOTEXTILE

PER SECTION 716
WHEN SPECIFIED

2'-0"

CONCRETE CUTOFF WALL

F O U N D A T I O N  M A T E R I A L
WHEN SPECIFIED

PIPE END DETAIL

(METAL CULVERTS SHOWN)

NOTES:

1) 3'-0" [900] MIN. OR 1'-0" [300] BELOW BOTTOM OF
FOUNDATION MATERIAL IF SPECIFIED

2) THE CONTRACTOR HAS THE OPTION OF USING A SAND CUSHION
AS APPROVED BY THE PROJECT MANAGER TO FACILITATE CULVERT INSTALLATION. IF A SAND CUSHION IS USED, THAT
MATERIAL WILL BE MEASURED AND PAID FOR AS GRANULAR
BEDDING.

3) COMPACT AND PLACE SIDE FILL PER SECTION 603 AND 203.

4) FURNISH GRANULAR BEDDING AND FOUNDATION MATERIAL PER
SECTION 701.

5) DIMENSIONS D, S, AND R ARE THE INSIDE PIPE DIAMETER,
SPAN, AND RISE. DIMENSION T IS THE CULVERT SHELL
THICKNESS FOR CONCRETE OR CORRUGATION DEPTH FOR METAL
PIPE.

6) THE BEDDING DEPTH FOR CONCRETE PIPE IS D/4 + T OR
R/3 + T. THE BEDDING DEPTH FOR METAL PIPE IS "X" + T.
SEE DTL. DWG. NO. 603-32 AND 603-34 FOR "X" DIMENSIONS
OF METAL PIPES. AFTER LAYING CULVERT, COMPACT GRANULAR BEDDING AT HAUNCHES AND SIDES.

7) EXCAVATE A SUFFICIENT AMOUNT TO PROVIDE A SAFE WORKING
ENVIRONMENT AND TO ALLOW ACHIEVEMENT OF ALL CULVERT
INSTALLATION AND COMPACTATION REQUIREMENTS. SLOPE, BENCH
OR PROVIDE SHORING FOR ALL EXCAVATIONS IN ACCORDANCE
WITH THE U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY
AND HEALTH ADMINISTRATION (OSHA) SAFETY AND HEALTH
REGULATIONS FOR CONSTRUCTION.

8) BUILD BERM WITH FILL MATERIAL AS NEEDED TO CONTAIN THE
GRANULAR BEDDING MATERIAL TO THE PROPER DEPTH.

9) COMPACT GRANULAR BEDDING BY PROOF ROLLING WITH A
VIBRATORY COMPACTOR IN 12 INCH LIFTS OR BY USING A
METHOD APPROVED BY THE PROJECT MANAGER.

D E T A I L E D  D R A W I N G

S T A N D A R D  S P E C .
S E C T I O N  2 0 3 , 2 0 7 , 6 0 3 , 7 0 1
G R A N U L A R  B E D D I N G  F O R
C U L V E R T S  5 4" [1350 mm]
E Q U I V A L E N T  &  L A R G E R

U N I T S  S H O W N  I N  B R A C K E T S  [ ] A R E
M E T R I C  A N D  A R E  I N  M I L L I M E T E R S  ( m m )

E F F E C T I V E :  S E P T E M B E R  2 0 1 4
---REV/SPD---

J A N U A R Y  2 0 1 8
M O N T A N A  D E P A R T M E N T
O F  T R A N S P O R T A T I O N

M D T A
M O N T A N A  D E P A R T M E N T
O F  T R A N S P O R T A T I O N
**NOTES**

1. **French Backfill:** Place per standard specification oréd 2 granular bedding placed substituted at no additional cost.

2. The bedding material directly underneath the pipe should be left uncompacted to facilitate the installation of the pipe. Compact granular bedding by proof rolling with vibratory compactor in 8-inch [200 mm] lifts or by using a method approved by the project manager.

3. Sand cushion use grade C material per Table 701-7 in standard specifications or D-22A.

4. The sand material would be left uncompacted to facilitate the installation of the pipe. Include the sand material in the cost of the granular bedding.

**QUANTITIES**

<table>
<thead>
<tr>
<th>DIAMETER (mm)</th>
<th>C.Y. PER FT.</th>
<th>DIAMETER (mm)</th>
<th>C.Y. PER FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
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<td>8&quot;</td>
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* BASED ON RCP B WALL PIPE.

**METRIC QUANTITIES**

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<th>C.Y. PER M.</th>
<th>DIAMETER (mm)</th>
<th>C.Y. PER M.</th>
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* BASED ON 1" [25 mm] NOMINAL WALL THICKNESS.
# Dimension Table

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<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07 McL.</th>
<th>Li. Dia.</th>
<th>09</th>
<th>10</th>
<th>11</th>
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<th>X2</th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
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# Metric Dimension Table (mm)

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**NOTES:**
- Typical for storm drain and sewers on applications for heads up to 20 feet (6.1 m).
- Use number tables that meet the requirements of Section 707.
- Water tight joint for reinforced concrete pipe.
## DIMENSION TABLE

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<th>ASCE/ ACI WATER AREA (in²/pipe)</th>
<th>B7/ PER FLOUS UP Pipe</th>
<th>T + MIN. WALLS</th>
<th>( t ) / LENGTH OF JOINT</th>
<th>A (NORMAL = ( 0.030 ))</th>
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<th>D2</th>
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* WALL "B" THICKNESS

## METRIC DIMENSION TABLE

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* WALL "B" THICKNESS

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**NOTES:**

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
- WALL "B" THICKNESS:

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**TYPICAL LONGITUDINAL SECTION**

**XP (48") DIAMETER PIPE AND LARGER**

**SECTION A-A**

**SECTION B-B**

**TYPICAL JOINT DETAIL**

**REFINING AT ENDS OF PIPE**

**REINFORCED CONCRETE PIPE JOINT**

**NOTES:**

- PRODUCE TOLERANCES IN DIMENSIONS PER SECTION 700.
- TYPICAL FOR GRANITE APPLICATIONS.
SECTION A-A

CONNECTION DETAILS

**Typical Field Cast Concrete Bend**

- **#4 (#13) Bars at Approx. 9" (230) O.C.**
- **3" (75) or Equal Concrete General Class**
- **Approx. 9" (230) O.C., #4 (#13) Bars at 3" (75)**

**Details:**
- **1:1 Chamfer**
- **6" (150)**
- **Class General Concrete or Equal**
- **3" (75)**
- **Approx. 9" (230) O.C., #4 (#13) Bars at 3" (75)**

**Notes:**
- Units shown in brackets (mm) are in millimeters unless other units are shown.
- Effective: September 2014
PLAN VIEW OF INLET

OUTLET DETAIL

SECTION A-A

NOTES:

1. Corrugation may be either annular or helical. Bend on elbow (θ) is as shown unless otherwise specified in the plans or by the project manager.

2. The cost of SS-1 fog seal is included in the cost of plant mix surfacing.

* Included with roadway quantities.

UNITS SHOWN IN BRACKETS ( ) ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
TRANSVERSE CONTRACTION JOINT (15' [4.5 m] O.C.)

TRANSVERSE CONTRACTION JOINT (AS NEEDED)

SEALANT MATERIAL

SAWED JOINT FACE

BACKER ROD

DETAIL A

SAWED TRANSVERSE OR LONGITUDINAL JOINT WITH HOT POUR SEALANT

TYPICAL BOTH ENDS

REINFORCING STEEL FOR INLET

BACKFILL RETAINER & PCCP SLAB

11 - #4 [13] L BAR CONNECTORS
1' - 4" [400] x 1' - 4" [400]
@ APPROX. 1' - 4" [400] CENTERS

TYPICAL BOTH ENDS

REINFORCING STEEL FOR INLET

BACKFILL RETAINER & PCCP SLAB

11 - #4 [13] L BAR CONNECTORS
1' - 4" [400] x 1' - 4" [400]
@ APPROX. 1' - 4" [400] CENTERS
**Section 325-30: Circular Metal Culvert**

### Dimensions

<table>
<thead>
<tr>
<th>Dia (in)</th>
<th>X (in)</th>
<th>Y (in)</th>
<th>Area α (sq. in)</th>
<th>Area α &quot;D&quot; (sq. in)</th>
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**Notes:**
- MLS: LEVEL TO TOP OF CORNER PLATE.
- PIPE ENDS ARE SQUARE INDEPENDEINTLY TO CENTERLINE OF PIPE AND FULL SLIPS ARE SEPARATED TO CLEARLY ILLUST RATE THE END. END SLIPS ARE RECOMMENDED FOR USE IN BRANCHING LINES OR WHERE CORNER PLATES ARE USED.
- FAULTED VALVES ARE RECOMMENDED FOR USE IN BRANCHING LINES OR WHERE CORNER PLATES ARE USED.

**Area α is the area of the corregations.**

---

**Area α is the area of the culvert.**

**Anchor bolts:**

**Concrete cutoff wall:**

**CSP 3" x 1" OR 5" x 1" CORRUGATIONS (SEE NOTE 1)**

**Metric Dimensions:**

<table>
<thead>
<tr>
<th>Dia (mm)</th>
<th>X (mm)</th>
<th>Y (mm)</th>
<th>Area α (sq. cm)</th>
<th>Area α &quot;D&quot; (sq. cm)</th>
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<td>80.00</td>
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**Area α is the area of the corregations.**

**Anchor bolts:**

**Concrete cutoff wall:**

**CSP 75 x 25 OR 125 x 25 CORRUGATIONS (SEE NOTE 2)**

**Subgrade Width:**

**Bottom | Length**

2850 mm

2625 mm

2400 mm

2175 mm

1950 mm

1725 mm

1500 mm

1275 mm

1050 mm

825 mm

600 mm

**Area "A"**

<table>
<thead>
<tr>
<th>Section</th>
<th>Area &quot;A&quot;</th>
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<tbody>
<tr>
<td>Circular Metal Culvert</td>
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**Area "A" is the area of the corregations.**

---

**Reference:**

**Culvert Sizes:**

- **Section 325-30:**
- **METRIC AND ARE IN MILLIMETERS (mm):**
- **EQUALS assign measures inch (in) unless otherwise shown:**
- **UNLESS OTHER UNITS ARE SHOWN:**

**Detailed Drawing:**

**Step Relief for Circular Metal Culverts:**

**Units Shown in Brackets (100s) are** metric and are shown in millimeters (mm) unless otherwise shown.
SEE DTL. DWG. NO. 552-00, 603-30 AND 603-19.

FOR 96" [2400] DIAMETER CORRUGATED STEEL PIPE STOCKPASS IS 0.109" [2.77].

CORRUGATED STEEL PIPE STOCKPASS IS 0.079" [2.01]. THE MINIMUM THICKNESS

FOR 84" [2100] DIAMETER AND 90" [2250] DIAMETER

STEP BEVEL PIPE ENDS AT A 2:1 SLOPE.

COURSE ALONG ONE SIDE. (SEE DTL. DWG. NO. 613-14 AND 613-06.)

ASPHALT SURFACING; CROSS SLOPE ASPHALT SURFACING TO ALLOW DRAINAGE

AT THE INLET END AND OUTLET END, GRANULAR BEDDING AND

CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS, CONCRETE EDGE PROTECTION

WHEN COMBINATION STOCKPASSES AND DRAINS ARE SPECIFIED, INSTALL WITH

BACKFILL RETAINERS AT EACH END, GRAVEL FILL AND GRANULAR BEDDING.

UNLESS OTHERWISE SPECIFIED, INSTALL STOCKPASSES WITH CUTOFF WALLS AND

NOTES:

1. UNLESS OTHERWISE SPECIFIED, INSTALL STOCKPASSES WITH CUTOFF WALLS AND
BACKFILL RETAINERS AT EACH END, GRAVEL FILL AND GRANULAR BEDDING.

2. WHEN COMBINED STOCKPASSES AND DRAINS ARE SPECIFIED, INSTALL WITH
CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS, CONCRETE EDGE PROTECTION
AT THE INLET END AND OUTLET END, GRANULAR BEDDING AND

CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS AND CONCRETE EDGE PROTECTION

COURSE ALONG ONE SIDE. (SEE DTL. DWG. NO. 613-14 AND 613-06.)

3. STEP BEVEL PIPE ENDS AT A 2:1 SLOPE.

4. THE MINIMUM THICKNESS FOR 84" [2100] DIAMETER AND 90" [2250] DIAMETER
CORRUGATED STEEL PIPE STOCKPASS IS 0.109" [2.77]. THE MINIMUM THICKNESS
FOR 96" [2400] DIAMETER CORRUGATED STEEL PIPE STOCKPASS IS 0.079" [2.01].

(SEE FULL WEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.)

5. AS PDI. UNITS: UN. 0.109, 0.079 AND 0.058.

**SURFACE QUANTITIES PER LINEAR FOOT FOR DEPTH "D"**

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<tr>
<th>DIAMETER</th>
<th>X</th>
<th>X D</th>
<th>CLEAR</th>
<th>X H</th>
<th>W</th>
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<td>90&quot;</td>
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<td>6.75</td>
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<td>24&quot;</td>
<td>0.87</td>
<td>7.37</td>
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**METRIC DIMENSIONS**

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<th>DIAMETER</th>
<th>X (m)</th>
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<th>CLEAR</th>
<th>X H (m)</th>
<th>W (m)</th>
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<td>0.87</td>
<td>7.37</td>
<td>6.37</td>
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**METRIC SURFACING QUANTITIES PER METER FOR DEPTH "D"**

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<tr>
<th>DIAMETER</th>
<th>FULL DEPTH</th>
<th>24&quot; PMS AND REMAINING DEPTH GRAVEL</th>
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<td>(m³)</td>
<td>C.F. SURF.</td>
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<tr>
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<td>0.004</td>
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<td>0.005</td>
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<tr>
<td>96&quot;</td>
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<td>0.006</td>
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</table>

**CONCRETE CUTOFF WALL
INITIAL AND ERODT END**

(SEE DTL. DWG. NO. 322-00.)

**SECTION A-A**
GRATE

24" 30" 36"

SECTION A-A

1.0 1.0 1.0

SECTION A-A

DETAIL 1

MEDIAN SLOPE 6:1

TYPE 1

TYPE 3

D

DETAIL 2

COVER DETAIL

GRATE AND REINFORCING STEEL (LB.) *

GRATE AND REINFORCING STEEL (kg) *

CLASS GENERAL CONCRETE OR EQUAL (C.Y.) *

CLASS GENERAL CONCRETE OR EQUAL (CUBIC METERS) *

NOTE:

1. Paint all exposed metal parts with one coat of zinc rich paint and two coats of aluminum paint per Section 710.

2. When median inlet cover is installed over pipes larger than 36", without adequate cover to permit the use of type 1 installation, provide a detail of the installation in the plans.

3. When median inlet cover is installed over pipes larger than 609.6 mm, without adequate cover to permit the use of type 1 installation, provide a detail of the installation in the plans.

NOTE:

1. Paint all exposed metal parts with one coat of zinc rich paint and two coats of aluminum paint per Section 710.

2. When median inlet cover is installed over pipes larger than 36", without adequate cover to permit the use of type 1 installation, provide a detail of the installation in the plans.

* QUANTITIES ARE FOR ESTIMATING PURPOSES ONLY.

* TYPE 3 IS A SPECIAL CASE TO BE Figured FOR THE PARTICULAR INSTALLATION.

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* TYPE 3 IS A SPECIAL CASE TO BE Figured FOR THE PARTICULAR INSTALLATION.

NOTE:

1. Paint all exposed metal parts with one coat of zinc rich paint and two coats of aluminum paint per Section 710.

2. When median inlet cover is installed over pipes larger than 36", without adequate cover to permit the use of type 1 installation, provide a detail of the installation in the plans.

* QUANTITIES ARE FOR ESTIMATING PURPOSES ONLY.

* TYPE 3 IS A SPECIAL CASE TO BE Figured FOR THE PARTICULAR INSTALLATION.

* QUANTITIES ARE FOR ESTIMATING PURPOSES ONLY.

* TYPE 3 IS A SPECIAL CASE TO BE Figured FOR THE PARTICULAR INSTALLATION.
COMBINATION TYPE 3 MANHOLES. FOR TYPE I, II, IV AND V INLETS ON 48" CENTER THE OPENING OVER THE ROOF SLAB

TYPE 3 MANHOLE ROOF SLAB

**TYPE 1 SECTION A-A**
- 27" x 24" hole or shelf
- 3" shelf or channel
- 48" SHELF
- 5" SHELF
- 2 EXTRA BARS
- 1 EXTRA BAR

**TYPE 3 SECTION B-B**
- SLOPE 4%

**TYPE 1 SECTION B-B**
- STANDARD FRAME AND LID

**TYPE 3 MANHOLE COVER DIAMETER**
- 604,711 pounds
- MONTANA DEPARTMENT OF TRANSPORTATION

**NOTES:**
- Unit list in a cone to a pipe diameter from 48" to 60" (1219.2 to 1524)
- Top, bottom of lower section square to fit base. Offset joint between base and wall. A joint consisting of one easy foreland cement and two partsreinforced sand grout will be prescribed. Joint will be precast.

**CONCRETE**
- CONCRETE PLACED IN THE SUPER-FRAME. ADJAST IN THE SUPER-FRAME. PRECASTS ARE POURED IN FIELD. CONCRETE BASE TO BE POURED IN FIELD.

**MANHOLE STEPS**
- Furnish manhole with steps whenever the depth is more than 2 feet (610 mm). The minimum design live load for a single concentrated load is 3000 pounds (1350 kg).
- Use manhole steps that are metallic and coated with copolymer polypropylene, or an approved equal. The minimum design live load for a single concentrated load is 3000 pounds (1350 kg).

**FRAME AND LID**
- Standard frame and lid may be used if approved by the facility owner. Responsible for maintenance of the manhole.

**CONCRETE BASE:**
- Use prestressed concrete with a minimum compressive strength of 4000 psi (27.6 MPa). Concrete for all concrete, 4000 psi (27.6 MPa).
- Use Portland cement and two parts approved sand cement per cubic yard (335 kg/m³). Reinforcement shown is a 4-wire AASHTO M 32 (32M), (2) steel wire fabric - AASHTO M 55 (55M), or (2) steel bars - AASHTO M 47 (47M).

**SPECIAL DIMENSIONS:**
- All dimensions are in millimeters unless otherwise noted. The Eccentric cone transition will be permitted when its use will be as good or better than the ones shown, or if it is more adaptable to existing conditions.

**GROUT:**
- Use one part Portland cement and two parts approved sand to a concrete base. GROUT JOINT BETWEEN BASE AND WALL. A GROUT CONSISTING OF ONE PART PORTLAND CEMENT AND TWO PARTS APPROVED SAND.

**DETAILS:**
- Standard drawing reference: 604-02

**CONCRETE MANHOLE**
- Units shown in brackets if any metric and are in millimeters unless otherwise noted.

**DETAILED DRAWING**
- Reference: DETAIL NO. 604-02

**MATERIALS AND SPECIFICATIONS**
- Material and specifications as shown.

**CONCRETE MANHOLE ROOF SLAB**
- Concrete roof slab, 3" thick, 4mm - 6mm dia., 4" 10 bars, 5" 4 bars, 6" 2 bars, 7" 1 bar.

**CONCRETE MANHOLE ROOF SLAB (METRIC)**
- Concrete roof slab, 80mm thick, 16mm - 25mm dia., 100/5 bars, 120/4 bars, 150/3 bars, 180/2 bars, 210/1 bars.

**NOTES:**
- All dimensions are in millimeters unless otherwise noted.
FLOOR SLAB

STANDARD UNLESS OTHERWISE NOTED ON THE PLANS.

0.75% MIN. GRADE

ROOF SLAB

CENTER OF MANHOLE 8" [203.2]

MANHOLE DIAMETER AS REQUIRED

SLOPE TO DRAIN 3" [76.2]

SECTION A-A

BACK OF CURB TYPICAL

SECTION B-B

** STANDARD UNLESS OTHERWISE NOTED ON THE PLANS.

NOTES:

ALL CONCRETE IS CLASS GENERAL OR APPROVED EQUAL.

* SEE QUALIFIED PRODUCTS LIST FOR APPROVED GRATES.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

** MONTANA DEPARTMENT OF TRANSPORTATION
**PLAN**

- **Direction of Intake Flow**
- **Floor Slab**
- **Manhole Diameter**
- **Roof Slab**

**SECTI0N A-A**

- **Gutter Flow Line** (9 1/2" [242] from back of curb)

**SECTI0N B-B**

- **Back of Curb** (9 1/2" [240] from gutter flow line)
- **6" x 6" x 2.9 [152.4 x 152.4 x MW18.71] Wire Mesh**

**COMBINATION**

- **Type IV Drop Inlet Frame & Grate**

**NOTES:**

- All concrete is class general or approved equal.
- * See Qualified Products List for approved grates.
- Units shown in brackets () are metric and are in millimeters (mm) unless other units are shown.

**DIRECTIONS**

- Storm drain lateral
- 0.75% min. grade
- Slope to drain
- Wall "B" per section for
- **Single Drop Inlet**
  - **Type IV** *

**DETAILED DRAWING**

**REFERENCE**

- DWG. NO. 604-04
- STANDARD SPEC. 604-02
- SECTION 604, 708
- DROP INLET TYPE IV

**EFFECTIVE** September 2014

**MONTANA DEPARTMENT OF TRANSPORTATION**
GRATE SLOT DETAIL
CROSS BAR SPACER
TYPICAL GUTTER GRADE

GRATE SLOT WELDING DETAIL
CURB - MODIFIED
STANDARD CONCRETE

PLAN
TOP BACK OF CURB
D + 6" [152.4] (TYP.)
6" [152.4] (TYP.)
CONNECT ELBOW TO SLOTTED DRAIN WITH MODIFIED HUGGER BAND AND SEAM SOLVENT OR APPROVED EQUAL

ELEVATION
MINIMUM EXCAVATION LEAN CONCRETE
D + 3" [76.2]
6" [152.4] DEEP GRATE SLOT
3" [76.2] MIN.

SECTION A-A
9 1/2" [240]
1 1/2" [40]
#4 [13] REBAR AT 2'-0" [609.6] O.C.
#4 [13] REBAR, EXTEND REBAR TO INLET GRATE (TYP.)

SECTION B-B
GRATE SLOT DETAIL
NOTES:
1. PAINT ALL WELDS AND OTHER NON-GALVANIZED PARTS, EXCEPT REBAR, WITH ONE COAT OF ZINC RICH PAINT AND TWO COATS OF ALUMINUM PAINT PER SECTION 710.
2. USE A 15 OR 30 POUND [6.8 OR 13.6 KILOGRAM] ROOFING FELT MATERIAL OR OTHER PRODUCT AS APPROVED BY THE PROJECT MANAGER, FOR A BOND BREAKER.

SECTION C-C
GRATE SLOT WELDING DETAIL

SECTION D-D
CROSS BAR SPACER

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
**PLAN**

- **A**
  - **D + 6" [152.4] (TYP.)**
  - **6" [152.4] (TYP.)**

- **B**
  - **GUTTER SURFACE**
  - **D + 3" [76.2]**

- **C**
  - **STORM DRAIN LATERAL**
  - **30" [750] RCP CLASS 2 WALL 8" PER SECTION 708**

**ELEVATION**

- **A**
  - **D + 6" [152.4] (TYP.)**
  - **6" [152.4] (TYP.)**
  - **CONNECT ELBOW TO SLOTTED DRAIN WITH MODIFIED HUGGER BAND AND SEAM SOLVENT OR APPROVED EQUAL**

- **B**
  - **GUTTER FLOW LINE**
  - **9 1/2" [240]**
  - **1 1/2" [40]**

- **C**
  - **GUTTER SURFACE**
  - **#4 [#13] REBAR AT 2'-0" [609.6] O.C.**

**SECTION A-A**

- **D + 6" [152.4]**
  - **6" [152.4] O.C. (TYP.)**
  - **3/16" [6 mm]**

**SECTION B-B**

- **D + 6" [152.4]**
  - **5 3/16" [131.8]**

**SECTION C-C**

- **D + 6" [152.4]**
  - **1 1/2" [40]**

- **D + 3" [76.2]**

**SECTION D-D**

- **D + 6" [152.4]**
  - **6" [152.4] O.C. (TYP.)**
  - **3/16" [6 mm]**

**NOTES:**

- **PAINT ALL WELDS AND OTHER NON-GALVANIZED PARTS WITH ONE COAT OF ZINC RICH PAINT AND TWO COATS OF ALUMINUM PAINT PER SECTION 710.**

- **USE A 15 OR 30 POUND (6.8 OR 13.6 KILOGRAM) ROOFING FELT MATERIAL, OR OTHER PRODUCT AS APPROVED BY THE PROJECT MANAGER, FOR A BOND BREAKER.**

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**

**REFERENCE**

- **DETAILED DRAWING**
  - **DWG. NO.**
    - **604-08**

**EFFECTIVE:**

- **SEPTEMBER 2014**

**MONTANA DEPARTMENT OF TRANSPORTATION**
**Section A-A**

- **Curb to Grate**
- **Type I and V Drop Inlets**

**Notes:**
- All concrete is Class General or approved equal.
- See qualified products list for approved grates.
- Between each bar, provide safety lug on straight bar grate to match flow direction shown.
- Type I and Type V grates are interchangeable with the same frame and have the ability to be rotated 90 degrees in any direction. Install grate to match flow direction shown.
- Provide safety lug on straight bar grate between each bar.
- See plans for locations and quantities.
- All concrete adjustments are made as necessary to match roadway cross slope.
- Concrete matching comes with pipe spigot 25% (max) min. - 12" (304.8 mm) max.

**Units Shown in Brackets ( ) are metric and are in millimeters (mm) unless other units are shown.**

---

**Dimensions:**
- 60" (1524.0 mm)
- 30" (762.0 mm)
- 6" (152.4 mm)
- 48" (1219.2 mm)
- 33 3/4" (857.3 mm)

**Typical Opening in Roof Slab:**
- 32" (812.8 mm)

**Safety Lug:**
- For use with Type II and V grates.

**Wire Mesh:**
- 6" x 6" (152.4 x 152.4 mm) x 12 ga.
- 1 1/2" (38.1 mm) minimum.

---

**References:**
- Dwg. No.: 604-14
- Section: 604
- Montana Department of Transportation
- Montana Department of Transportation

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**Drop Inlets Type I and V**

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**Drop Inlets Type I and V**

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**Drop Inlets Type I and V**
**SECTION A-A**

**SECTION B-B**

**SECTION C-C**

**NOTE:** All concrete is Class General or Approved Equal.

See plans for locations and quantities.

1. Set all final inlet grate elevations to ensure that positive drainage is provided from the curb and gutter section into the inlet.
2. Slope station and offset is to the center of the structure.
3. **Standard unless otherwise noted on plans.**
4. **Type III and Type VI Grates are interchangeable with the same frame and have the ability to be rotated 90 degrees in any direction. Install grate to match flow direction shown.**
5. **Provide Safety Lug on Straight Bar Grate between each bar.**

See Qualified Products List for Approved Grates.

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**TYPE III DROP INLET**

**TYPE VI DROP INLET**

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**METRIC AND ARE IN MILLIMETERS (mm)**

UNLESS OTHER UNITS ARE SHOWN.

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**REFERENCES**

**Dwg. No.** 604-35

**Section 624**

**September 2014**
OPTIONAL LOOP DETAIL

1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO AASHTO M 31 (31M), GRADE 60 (420).
2. COLD BEND THE LOOPS BY USING A JIG THAT WILL PRODUCE AN ACCURATE RADIUS WITHOUT MARRING THE BAR. DO NOT HEAT THE BAR TO FACILITATE BENDING.
3. DO NOT INSTALL UNMACHINED CONCRETE BARRIER RAIL FOR OBSTACLES WITHIN 6 (152) mm OF THE BAR EDGE. SEE DETAIL DWG. NO. 605-00 FOR CONCRETE BARRIER RAIL ARCHAS.

ALTERNATE CONCRETE BARRIER RAIL DETAIL

1. USE THE ALTERNATE 8" (200 mm) DIA BAR IN THIS RAIL ON A COLUMNS LARGER THAN SPECIFIED IN THE PLANS.

OCCUPATIONAL END VIEW

A minimum reflective sheeting white or yellow per MUTCD is recommended on both sides. Use Class B reflectors on all roadway alignments, curves as well as on tangent. This is to be determined early in fabrication. Reflectorsize is acceptable. Rectangular cutouts are acceptable. Two-piece brackets with 1/2" (13 mm) chamfer entire opening (or sufficiently rounded so that a smooth radius can be maintained on all radius corners) for ease in fabrication. Connect each (120") section with connecting pins as installed in the fabricating grade or better. Connecting pins need not be painted.

NOTE:
- Use Class B deck concrete or equivalent.
- Preforming steel consists of deformed bars conforming to AASHTO M 31 (31M), grade 60 (420).
- Connect each (120") section with connecting pins as installed in the fabricating grade or better. Connecting pins need not be painted.
- The contractor is responsible for the proper fit-up of the precast concrete barriers rail assemblies and for sufficient number of precast sections in the fabricated plant to determine that pin size (1/8") can be maintained on all radius corners. Surfaces as well as on tangent. This is to be determined early in fabrication. Reflectorsize is acceptable. Rectangular cutouts are acceptable. Two-piece brackets with 1/2" (13 mm) chamfer entire opening (or sufficiently rounded so that a smooth radius can be maintained on all radius corners) for ease in fabrication. Connect each (120") section with connecting pins as installed in the fabricating grade or better. Connecting pins need not be painted.
- The optional tapered end shown is an acceptable alternative to the vertical end for all concrete barrier rail ends.
- Use the alternate 8" (200 mm) DIA BAR in this rail on a column basis as specified in the plans.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.
**Concrete Barrier Rail Anchors**

**Type 1 Anchor**

For temporary or permanent stability barrier rail installations on asphalt pavement.

- Plan View
  - Pinning hole (TYP.)
  - 2'-0" (600) x 2'-0" (600) x 13/16" (20.6) DIA. HOLE

- End View
  - Option 1
  - Option 2

**Type 2 Anchor**

For temporary or permanent stability barrier rail installations on concrete pavement.

- Plan View
  - Pinning hole (TYP.)
  - 2'-0" (600) x 2'-0" (600) x 13/16" (20.6) DIA. HOLE

- End View
  - Option 1
  - Option 2

**Type 3 Anchor**

For temporary or permanent stability barrier rail installations on concrete pavement.

- Plan View
  - Pinning hole (TYP.)
  - 2'-0" (600) x 2'-0" (600) x 13/16" (20.6) DIA. HOLE

- End View
  - Option 1
  - Option 2

**Notes**

1. Use these anchors with standard concrete barrier rail (C.B.R), as shown in DTL. DWG. NO. 605-00.
2. Cast the pinning holes into the C.B.R using 2" (50.8) I.D. steel pipe. Do not cast the pinning holes.
4. Use type 2 anchors when a deeper embedment (1 1/2" [38]) into the bridge deck or concrete pavement is permissible.
5. After removing type 2 or type 3 anchors, clean the holes in the concrete pavement and fill with an approved non-shrink or epoxy grout.
6. Remove type 3 anchors by first driving the steel pins down through the barrier to allow lifting of the barrier without interference. Then remove pins from the pavement and fill the pinning holes with an approved sealant.
7. Do not install anchored concrete barrier rail for distances within 3 (1.1) ft of the edge of the rail.
**Loop Detail**

1. Use continuous smooth round bars conforming to ASTM A 416, Grade 60 [420] for reinforcing steel being welded to loops.
2. Cold read the loops by using a Jig that will produce an accurate radius without marring the bar. Do not heat the bar to facilitate bending.
3. No additional welding is permitted on the smooth round bars or reinforcing steel.

**Elevation View**

- Use intermediate repair hot shown for clarity.
- Use additional welds on ends of each section shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
- Intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
- The contractor is responsible for the proper fit-up of the precast sections in the fabrication plant to determine that proper fit-up can be maintained on all roadway alignment.
- The contractor is responsible for the proper fit-up of all roadway alignment.
- Connect each 10' [3.05 m] section with connecting pins as specified for specific sites sensitive to straightness of rail.

**Rebar Detail**

- Minimum reflective sheeting must be yellow per note.
- The contractor is responsible for the proper fit-up of all roadway alignment.
- Use Class DECK CONCRETE or equivalent.
- Reinforcing steel consists of deformed bars conforming to ASTM A 416, Grade 60 [420].
- Galvanize or epoxy coat loops and reinforcing steel according to AASHTO M 270 [270M], Grade 36 [250].
- Use intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
- Galvanize or epoxy coat reinforcing steel and for specific sites sensitive to straightness of rail.
- Intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
- Intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
- Connect each 10' [3.05 m] section with connecting pins as specified for specific sites sensitive to straightness of rail.

**Notes:**

1. Use Class DECK CONCRETE or Equivalent.
2. Reinforcing Steel consists of deformed bars conforming to ASTM A416, Grade 60 [420].
3. Connect each 10' [3.05 m] section with connecting pins as detailed, and conforming to ASTM A 416, Grade 60 [420] or better. Connecting pins need not be painted.
4. Cutouts on ends of each section are shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
5. The contractor is responsible for the proper fit-up of all roadway alignment.
6. Use Intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
7. The contractor is responsible for the proper fit-up of all roadway alignment.
8. Use intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
9. The contractor is responsible for the proper fit-up of all roadway alignment.
10. Use Intermediate repair holes shown with slight taper to facilitate form removal. Rectangular cutouts are acceptable.
11. The contractor is responsible for the proper fit-up of all roadway alignment.
NOTES:

1. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.

2. USE WOOD BLOCKS OR OTHER “MASH” APPROVED BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY GALVANIZED NAILS OR 14 GAUGE WIRE WRAP.

3. INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE OF THE REFLECTOR FACING ADJACENT TRAFFIC. FABRICATE PER SECTION 704 OR PLASTIC REFLECTORS WITH A URETHANE HINGE. FASTEN REFLECTOR TO WOOD POST USING TWO 16 PENNY RING-SHANKED GALVANIZED NAILS.

4. IN EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 25'-0" [7.62 m].

5. MOUNTING DETAIL: STANDARD UNLESS SPECIFIED OTHERWISE IN PLANS.

6. UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm). UNITS SHOWN IN PARENTHESES ( ) UNLESS OTHERWISE IN PLANS.

7. BEAM SPLICE (SEE DETAIL)

8. POST HOLE DETAIL

9. TAMERAL FINISHED BANDS

10. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.

11. USE WOOD BLOCKS OR OTHER “MASH” APPROVED BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY GALVANIZED NAILS OR 14 GAUGE WIRE WRAP.

12. INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE OF THE REFLECTOR FACING ADJACENT TRAFFIC. FABRICATE PER SECTION 704 OR PLASTIC REFLECTORS WITH A URETHANE HINGE. FASTEN REFLECTOR TO WOOD POST USING TWO 16 PENNY RING-SHANKED GALVANIZED NAILS.

13. IN EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 25'-0" [7.62 m].

14. MOUNTING DETAIL: STANDARD UNLESS SPECIFIED OTHERWISE IN PLANS.

15. UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm). UNITS SHOWN IN PARENTHESES ( ) UNLESS OTHERWISE IN PLANS.

16. BEAM SPLICE (SEE DETAIL)

17. POST HOLE DETAIL

18. TAMERAL FINISHED BANDS

19. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.

20. USE WOOD BLOCKS OR OTHER “MASH” APPROVED BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY GALVANIZED NAILS OR 14 GAUGE WIRE WRAP.

21. INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE OF THE REFLECTOR FACING ADJACENT TRAFFIC. FABRICATE PER SECTION 704 OR PLASTIC REFLECTORS WITH A URETHANE HINGE. FASTEN REFLECTOR TO WOOD POST USING TWO 16 PENNY RING-SHANKED GALVANIZED NAILS.

22. IN EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 25'-0" [7.62 m].

23. MOUNTING DETAIL: STANDARD UNLESS SPECIFIED OTHERWISE IN PLANS.

24. UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm). UNITS SHOWN IN PARENTHESES ( ) UNLESS OTHERWISE IN PLANS.

25. BEAM SPLICE (SEE DETAIL)

26. POST HOLE DETAIL

27. TAMERAL FINISHED BANDS

28. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.

29. USE WOOD BLOCKS OR OTHER “MASH” APPROVED BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY GALVANIZED NAILS OR 14 GAUGE WIRE WRAP.

30. INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE OF THE REFLECTOR FACING ADJACENT TRAFFIC. FABRICATE PER SECTION 704 OR PLASTIC REFLECTORS WITH A URETHANE HINGE. FASTEN REFLECTOR TO WOOD POST USING TWO 16 PENNY RING-SHANKED GALVANIZED NAILS.

31. IN EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 25'-0" [7.62 m].

32. MOUNTING DETAIL: STANDARD UNLESS SPECIFIED OTHERWISE IN PLANS.
**NOTES:**

1. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
2. USE ROUTED WOOD BLOCKS OR OTHER "MASH" APPROVED BLOCKS.
3. ATTACH REFLECTORS TO POSTS EVERY 25 FEET (7.62 m), INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED SURFACE FACING ADJACENT TRAFFIC. FASTEN REFLECTOR TO STEEL POST USING AN APPROVED ADHESIVE. REFLECTORS MAY BE BOLTED TO POSTS PROVIDED HOLES IN POSTS ARE DRILLED BEFORE BEING GALVANIZED.
4. ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 27 3/4" (710 mm).
5. WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2'-0" (606.0 mm) FROM THE TRAFFIC LANE.
6. STEEL POSTS WITH OTHER POST HOLE CONFIGURATIONS MAY BE ACCEPTED, PROVIDED THEY HAVE AT LEAST THE HOLES DETAILED ON THIS DRAWING AND THEY MEET ASHTOS PUBLICATION, "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" AND "MASH" REQUIREMENTS.
7. DO NOT INSTALL W-BEAM GUARDRAIL FOR OBSTACLES WITHIN 5'-0" (152.4 mm) OF THE FACE OF THE RAIL.
8. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
9. USE 6" (150) POSTS FOR STANDARD INSTALLATIONS.

**REFERENCE**

--REVISED--

**EFFECTIVE: SEPTEMBER 2014**

**MDT** MONTANA DEPARTMENT OF TRANSPORTATION

**DETAILED DRAWING**

**REFERENCE**

DWG. NO. 606-05B

**STANDARD SPEC.**

SECTION 606

**METAL GUARDRAIL - STEEL POSTS (MGS)**

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**
STIFFENED GUARDRAIL SECTION PAY LIMITS

6" [150 mm] (Omit on divided roadways)

4 SPACES @ 3'-1 1/2" [955]

6" [150 mm]

4 SPACES @ 3'-1 1/2" [955]

1'-6 3/4" [475] POST SPACING

6 SPACES @ 1'-6 3/4" [475]

2 SPACES @ 6'-3" [1905]

12'-6" [3.81 m] (Typ)

DIRECTION OF TRAFFIC

NOTES:
2. Obstacles closer to the face of rail than the indicated limits require the use of a rigid barrier system with little to no dynamic deflection.
3. Gap all rail in the direction of adjacent traffic.
4. All posts and blocks are standard dimensions as per detailed drawing No. 606-05A and 606-05B.
5. Rail is RWMO-8.".
6. Pay limit defined by rails containing a section of reduced post spacing limits shown are for example only. Actual pay limits will differ depending upon splice locations.

* see dtl. dwg. No. 606-80 for schedule of guardrail hardware.

Units shown in brackets () are metric and are in millimeters (mm) unless otherwise stated.

DETAILED DRAWING

REFERENCE DWG. NO. STANDARD SPEC. SECTION 606

STIFFENED GUARDRAIL
SECTIONS (MGS)

606-07

MONTANA DEPARTMENT OF TRANSPORTATION

--REV/SED--

EFFECTIVE: SEPTEMBER 2014

JANUARY 2018

MDT®
LONG SPAN MGS GUARDRAIL PAY LIMITS 50'-0" (15.24m) OR 62'-6" (19.05m) SPAN

- 6 CRT POSTS AT 6'-3" (1.905 m) =12'-6" (3.81 m)
- 2 CRT POSTS AT 6'-3" (1.905 m) =52'-0" (15.75 m)
- 3 CRT POSTS AT 6'-3" (1.905 m) =10'-0" (3.05 m) (MAX.)

- 12' (3600)

- 2 POSTS OMITTED

- 2 POSTS OMITTED

- 1 POST OMITTED

NOTES:
1. SEE DET. DRG. AS 606-02A AND 606-02B FOR STANDARD MGS GUARDRAIL AND ASSOCIATED HARDWARE.
2. CURVE RAIL IN THE DIRECTION OF ADJACENT TRAFFIC.
3. TYPICAL SPACE LOCATIONS SHOWN MAY VARY BASED ON ALIGNMENT, SHAPED PLANE, VARIOUS OBSTRUCTIONS, SPACE LOCATION.
4. DO NOT INSTALL MGS LONG SPAN GUARDRAIL ON OBSTACLES WITHIN 8' (2.4m) OF THE FACE OF THE RAIL.
5. THE OBSTRUCTION DELIVERED OPENING OR EDGE OF BRIDGE DECK MUST BE LOCATED AT OR BEYOND THE BACK OF THE CRT POSTS.
6. SEE DET. DRG. AS 606-04 FOR SCHEDULE OF GUARDRAIL HARDWARE.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
**Wood Post and Mounting Detail**

**Notes:**

1. Install all rails with heads on traffic side of installation.
2. Use wood blocks or other "mash" approved blocks after blocks to posts with two 10 penny nails or 16 gauge wire wrap.
3. Attach reflectors to posts every 25' (7.62 m), including terminal sections, with the reflector-stamped surface facing adjacent traffic. Fabricate reflectors from .063" thick aluminum alloy per Section 704 or plastic. Reflectors are approved per MUTCD and the specified shape is a square with rounded corners.
4. On existing guardrail installations, the minimum rail height is 27 3/4" (705 mm).
5. Do not install posts in beam guardrail for distances within 6'-6" (1.98 m) of the face of the rail.
6. Use lower hole on new construction installations.
7. Attach reflectors to posts using two 10 penny nails in pre-drilled holes.
8. Notes shown in brackets (7 mm) unless other units are specified.

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**W-Beam - Long Posts - Wood (MGS)**

**Detailed Drawing Reference:**
- **Dwg. No.:** 606-11A
- **Section:** 606-70-4
- **Note:** SEE DETL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.
LONG POSTS - STEEL METAL GUARDRAIL - SECTION STANDARD SPEC. REFLECTOR (SEE NOTE 3) PROFILE

NOTES:
1. INSTALL ALL REFLECTORS WITH HEADS FACING ADJACENT TRAFFIC SIDE OF INSTALLATION.
2. USE ROUTED WOOD BLOCKS OR OTHER "MASH" APPROVED BLOCKS.
3. ATTACH REFLECTORS TO POSTS USING AN APPROVED ADHESIVE. REFLECTORS MAY BE BOLTED TO POSTS.
5. STEEL GUARDRAILS WITH OTHER POST HOLE CONFIGURATIONS MAY BE ACCEPTED PROVIDED THEY MEET AT LEAST THE HOLE DIMENSIONS IN DETAILED DWG. NO. 606-11B AND THEY MEET ALL OTHER SPECIFICATIONS.
6. STEEL POSTS WITH OTHER POST HOLE CONFIGURATIONS MAY BE ACCEPTED PROVIDED THEY MEET ALL OTHER SPECIFICATIONS.
7. USE ROUTED WOOD BLOCKS OR OTHER "MASH" REQUIREMENTS.
8. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
9. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
10. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
11. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
12. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
13. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
14. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
15. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE. 
16. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
17. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
18. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
19. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
20. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
21. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
22. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
23. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
24. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
25. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
26. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
27. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
28. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
29. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
30. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
31. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
32. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
33. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
34. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
35. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
36. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
37. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
38. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
39. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
40. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
41. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
42. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
43. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
44. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
45. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
46. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
47. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
48. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
49. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
50. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
51. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
52. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
53. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
54. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
55. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
56. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
57. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
58. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
59. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
60. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
61. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
62. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
63. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
64. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
65. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
66. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
67. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
68. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
69. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
70. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
71. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
72. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
73. DO NOT INSTALL LONG POST W-BEAM GUARDRAILS ON OBSTACLES WITHIN 4'-6" (1.36 m) OF THE FACE OF THE RAIL.
74. USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.
75. INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE.
76. FOR OBSTACLES WITHIN 5'-6" [1.65 m] OF THE FACE OF THE RAIL.
77. LOCATE POST 12" [305] (MAXIMUM) FROM INSLOPE BREAK.
78. DO NOT INSTA...
UNLESS OTHER UNITS ARE SHOWN. METRIC AND ARE IN MILLIMETERS (mm) UNITS SHOWN IN BRACKETS [ ] ARE

FLATTER 10:1 OR FLATTER 3:1 OR EDGE OF SHOULDER OR FACE OF GUARDRAIL

50

1

POST LOCATION

LOCATION

POST #1

SECTION FLARE RATE

OPTIONAL TERMINAL

A

TRINITY SOFTSTOP

OPTIONAL TERMINAL SECTION WIDENING TRANSITION

OPTIONAL TERMINAL SECTION WIDENING TRANSITION

203.

COMPACT SLOPES PER SECTION

COMPACT SLOPES PER SECTION

COMPACT SLOPES PER SECTION

COMACT SLOPES PER SECTION

15° MAX.

12'-6" [3.81 m]

3'-7" [1.09 m]

9'-4 1/2" [2.86 m]

12'-6" [3.81 m]

34'-4 1/2" [10.48 m]

11'-0" [3.35 m]

ROAD SYSTEMS MSKT W/ 9'-4 3/4" RAIL PANEL

STANDARD RIGIL

DISTANCE OF 5'-0" [1.52m] IS REQUIRED BEHIND POST LOCATION #1. LENGTH OF NEED POST LOCATION EQUALS STATION LIMITS THAT IS NOT WITHIN THE MANUFACTURER'S HEIGHT TOLERANCE. SEE DTL. DWG. NO. 606-05A AND 606-05B FOR MGS GUARDRAIL. MANUFACTURER'S DETAIL AND ASSEMBLY INSTRUCTIONS. OPTIONAL TERMINAL SECTION SYSTEMS VARY, REFER TO MANUFACTURER'S DETAIL AND ASSEMBLY INSTRUCTIONS. SEE DT. DWG. NO. 606-05A AND 606-05B FOR MGS GUARDRAIL. SEE DT. DWG. NO. 606-05A AND 606-05B FOR CONNECTING TO EXISTING RAIL THAT IS NOT WITHIN THE MANUFACTURER'S HEIGHT TOLERANCE. LENGTH OF NEED POST LOCATION EQUALS STATION LIMITS INDICATED IN THE PLANS. POST LOCATION #1.

OPTIONAL TERMINAL SECTION WIDENING TRANSITION

OPTIONAL TERMINAL SECTION WIDENING TRANSITION

OPTIONAL TERMINAL SECTION WIDENING TRANSITION

34'-4 1/2" [10.48 m]

12'-6" [3.81 m]

12'-6" [3.81 m]

12'-6" [3.81 m]

12'-6" [3.81 m]

12'-6" [3.81 m]

12'-6" [3.81 m]

12'-6" [3.81 m]

26'-4 1/2" [8.03 m]

12'-6" [3.81 m]

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12'-6" [3.81 m]

26'-4 1/2" [8.03 m]
GUARDRAIL TRANSITION
MGS TO METAL
606-20

EXISTING POST
MID SPAN SPLICE


THE MGS TO METAL GUARDRAIL TRANSITION IS PAID FOR AS LINEAR FEET OF MGS GUARDRAIL.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE TO BE MEASURED IN MILLIMETERS [mm] UNLESS OTHER DATA ARE SHOWN.

TRANSITION FROM 27 3/4" (705) (OR GREATER) TO 31" (775) GUARDRAIL MOUNTING HEIGHT

NOTES:
1. THE MGS TO METAL GUARDRAIL TRANSITION IS PAID FOR AS LINEAR FEET OF MGS GUARDRAIL.
2. SEE DET. Dwg. NO. 606-05A, 606-05B, 606-11A, AND 606-11B FOR MGS GUARDRAIL AND ASSOCIATED HARDWARE.
3. LAY ALL MGS RAIL IN THIS DIRECTION OF ADJACENT TRAFFIC.

REFERENCE: Dwg. No. 606-20
SECTION 606-20
MGS TO METAL GUARDRAIL TRANSITION
NOTES:
1. SEE DET. DWG. NO. 806-05 FOR STANDARD MGS GUARDRAIL AND ASSOCIATED HARDWARE.
2. SEE DET. DWG. NO. 806-05 FOR STANDARD MGS GUARDRAIL AND ASSOCIATED HARDWARE.
3. DO NOT FLARE BRIDGE APPROACH SECTIONS.
4. WHERE CURB EXTENDS UPSTREAM OF POST NO. 5, FURNISH 2 NESTED 12-GAUGE W-BEAM RAILS FOR THIS 12'-6" (3810) SECTION. SEE MGS SECTION (RWM04a*) FOR CONNECTOR DETAILS.
5. USE WOOD BLOCKS OR OTHER MGS APPROVED BLOCKS: 4'-0" BLOCS FOR POSTS WITH BRACKETS IN PERRY CURB BARS OR BRIDGE APPROACH SECTIONS. SEE MGS SECTION (RWM04a*) FOR CONNECTOR DETAILS.
6. SEE DET. DWG. NO. 806-05 FOR SCHEDULE OF GUARDRAIL HARDWARE.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

MONTANA DEPARTMENT OF TRANSPORTATION

606-23B

MGS THREE BEAM TERMINAL CONNECTOR

THTO15* (FOR OPPOSITE DIRECTION)

THREE-BEAM TERMINAL CONNECTOR

A3TO15*
**Metal Guardrail—Bridge Approach Section Type 1**

For skewed bridges using concrete barrier rail.

- **Guardsrail**: Standard W-beam.
- **Lap Guardrail in the direction of the adjacent traffic lane.**
- **Lap W-beam terminal connector (RWE02a-b) in the direction of the adjacent traffic lane.**
- **Use wood blocks or other NCHRP 350 approved blocks for blockouts.**
- **Do not flare bridge approach sections.**
- **See DTL. DWG. No. 606-24A for additional information.**
- **See DTL. DWG. No. 606-05A for metal guardrail (W-beam).**

**Notes:**

- **Tapered Concrete Curbs:**
  - Type 1, see DTL. DWG. No. 606-26
  - Type 3, see DTL. DWG. No. 606-27

**Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.**

---

**Detailed Drawing**

Reference: DWG. No. 606-25A

Standard Spec: Section 606

Skewed Bridge Approach Sections - Wood Posts

Effective: September 2014

Montana Department of Transportation
**METAL GUARDRAIL - BRIDGE APPROACH SECTION TYPE 1**

(For skewed bridges using concrete barrier rail)

- Use doubled guardrail beams

**METAL GUARDRAIL - BRIDGE APPROACH SECTION TYPE 3**

(For skewed bridges with existing concrete curbs)

- Use wood blocks or other NCHRP 350 approved blocks for blockouts.
- Do not flare bridge approach sections.
- See DTL. DWG. NO. 606-24A for additional information.
- See DTL. DWG. NO. 606-05B for metal guardrail (W-beam).
BILL OF REINFORCING STEEL (ONE SECTION ONLY)

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METRIC BILL OF REINFORCING STEEL (ONE SECTION ONLY)

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TOTAL REBAR WEIGHT PER 7' [2100 mm] TAPERED CURB EST. = 34 LB [15.1 kg].
TOTAL CONCRETE PER 7' [2100 mm] TAPERED CURB EST. = 0.2 C.Y. [0.17 m³].
ALL CONCRETE IS CLASS GENERAL.
FURNISH GRADE 60 [420] REINFORCING STEEL MEETING SECTION 711.
FURNISH WIRE ROPE MEETING SECTION 705.
TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION.

NOTES:

1. TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION.
2. FURNISH WIRE ROPE MEETING SECTION 705.
3. ALL CONCRETE IS CLASS GENERAL.
4. TOTAL CONCRETE PER 7' [2100 mm] TAPERED CURB EST. = 0.2 C.Y. [0.17 m³].
5. TOTAL REBAR WEIGHT PER 7' [2100 mm] TAPERED CURB EST. = 34 LB [15.1 kg].

IN UNITS SHOWN IN BRACKETS ( ) ARE METRIC UNITS IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

REFERENCES:
DETAILED DRAWING: DWG. NO. 606-26
TAPERED CONCRETE CURB DETAIL

METRIC BILL OF REINFORCING STEEL (ONE SECTION ONLY)

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TOTAL CONCRETE PER 7' [2100 mm] TAPERED CURB EST. = 0.2 C.Y. [0.17 m³].
ALL CONCRETE IS CLASS GENERAL.
FURNISH GRADE 60 [420] REINFORCING STEEL MEETING SECTION 711.
FURNISH WIRE ROPE MEETING SECTION 705.
TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION.
**Notes:**

1. Remove the existing surface under the new tapered concrete curb as approved by the project manager. Embed the tapered concrete curb a minimum of 4" (100) below the grade measured at the inside face of the existing curb.

2. Furnish grade 60 [420] reinforcing steel meeting Section 555 and 711.

3. Tapered concrete curb is used with bridge approach section type 3 (see DTL. DWG. No. 606-24A and 606-24B).

4. Adjust dimension to match existing curb.

5. All concrete is class general. Total concrete per 6' (1800) tapered curb est. = 0.5' x 12' x 6' x 1.5' x 40 = 360 lb (163 kg).

6. Tapered concrete curb is used with bridge approach section type 3 (see DTL. DWG. No. 606-24A and 606-24B).

7. Drill and grout 1'-0" [300] into the existing curb.

---

**Bill of Reinforcing Steel (One Section Only)**

**Metric Bill of Reinforcing Steel (One Section Only)**

---

**Unit Details:**

- Units shown in brackets [ ] are in millimeters (mm) unless other units are shown.

---

**Reference:**

- CURR. NO.: 606-27
- CURR. DETAIL: 606-24A
- CURR. SECTION: 606

---

**Drawing:**

- MDTX DEPARTMENT OF TRANSPORTATION
- REVISION: 07/2016
- EFFECTIVE: SEPT. 2014
ANCHOR UNIT & REBAR INSTALLATION DETAILS

NOTE:
Dimensions for left and right hand anchor units are the same, with the position of the anchor post and anchor bracket being the only difference.

ANCHOR POST DETAIL

ANCHOR POST ASSEMBLY (TWO PIECE INSTALLATION)

ANCHOR ASSEMBLY (ONE PIECE INSTALLATION)

NOTE:
Install the concrete anchor into the excavation, as detailed, so that the bottom of the anchor and a full and even bearing on the surface under it is shown. If using anchors of different metric and are in millimeters (mm) unless other units are shown.

CABLE END ASSEMBLY TO ANCHOR BRACKET DETAIL

CABLE END ASSEMBLY (ONE PIECE)

SLIP IMPACT BASE

KEEPER PLATE

SLIP IMPACT BASE

CABLE END ASSEMBLY (TWO PIECE INSTALLATION)

CABLE END ASSEMBLY (TWO PIECE INSTALLATION)

INSTALL ONE WASHER UNDER HEAD, ONE BETWEEN PLATES & ONE UNDER NUT. AN ADDITIONAL WASHER MIGHT BE PLACED BETWEEN PLATES TO SLOUGH THE ANCHOR POST.

METRIC TONS [3.6 TONS]

CONCRETE ANCHORS, ENSURE THAT THEY HAVE A SAFE WORKING LOAD OF 4 TONS [3.6 METRIC TONS] FOR THE ONE PIECE ANCHOR AND 2 TONS [1.8 METRIC TONS] EACH FOR THE TWO PIECE INSTALLATIONS. USE ALL THE SAME REBAR, AS SHOWN.

THE ADDITIONAL REBAR, AS SHOWN.

BACKFILL AROUND THE CONCRETE ANCHOR EVEN BEARING ON THE SURFACE UNDER IT. THE BOTTOM OF THE ANCHOR HAS A FULL AND COMPLETE BEARINGS.

EXCAVATION, AS DETAILED, SO THAT THE INSTALL THE CONCRETE ANCHOR INTO THE

NOTES:
1. INSTALL ONE WASHER UNDER HEAD, ONE BETWEEN PLATES & ONE UNDER NUT. AN ADDITIONAL WASHER MIGHT BE PLACED BETWEEN PLATES TO SLOUGH THE ANCHOR POST.
2. THE CONCRETE ANCHOR CAN BE PLACED AS ONE OR TWO PIECES. THIS DETAIL PRESENTLY SHOWS A TWO PIECE INSTALLATION. FOR A ONE PIECE INSTALLATION, USE ALL THE SAME DIMENSIONS, just the taper keyway and the additional rebar as shown.
3. IF LIFTING DEVICES ARE EMBEDDED INTO THE CONCRETE ANCHOR, ENSURE THAT THEY HAVE A SAFE WORKING LOAD OF 4 TONS [3.6 METRIC TONS] FOR THE ONE PIECE ANCHOR AND 2 TONS [1.8 METRIC TONS] EACH FOR THE TWO PIECE INSTALLATION.
4. USE CONCRETE ANCHORS OF THE SAME SIZE, WITH ALL METRIC AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.
**SECTION A-A**

**SHOULDER FINISHED NORMAL SLOPE VARIABLE**

- **2% SLOPE**
- **NORMAL FINISHED SHOULDER**
- **SOIL PLATE (PLS01*)**
- **VARIABLE SLOPE**
- **206 [671]**
- **6' [152]**
- **3 1/2' [89]**
- **6' [152]**
- **4 1/4' [108]**
- **6' [152]**

**EXPANSION JOINT**

- **TYPE A BOX BEAM POST (PSE08*)**
- **BOX BEAM SUPPORT BRACKET (FPP01*)**
- **1/2" DIA x 1 1/2" [M12 x 38]**
- **HEX BOLT (Fxb120*) & NUT (FXK10w*) WITH 2 FLAT WASHERS (FWC12w*)**

**ELEVATION**

- **NOTES:**
  1. USE BOX BEAM RAIL IN MINIMUM NOMINAL LENGTHS OF 18 FT. [5.49 m] UNLESS APPROVED BY THE PROJECT MANAGER.
  2. INSTALL EXPANSION JOINTS ON ALL BOX BEAM GUARDRAIL INSTALLATIONS GREATER THAN 300 FT. [90 m] IN LENGTH AT INTERVALS NOT TO EXCEED 500 FT. [150 m].
  3. ATTACH REFLECTIVE TABS TO EVERY FOURTH POST (24 FT. [7.32 m] TYP.) ANGLE TABS SLIGHTLY TOWARDS TRAFFIC. DO NOT USE REFLECTIVE TABS ON WY-BET TERMINALS. WY-BET TERMINALS RECEIVE REFLECTIVE CHANNELS.
  4. DO NOT INSTALL BOX BEAM GUARDRAIL FOR OBSTACLES WITHIN 3.8" [1.8 m] OF THE FACE OF THE RAIL.
  5. WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN 2'-0" [0.6 m] FROM THE TRAFFIC LANE.
  6. PROVIDE SHOP BENT BOX BEAM RAIL FOR ROADWAY CURVATURE WITH RADIUS OF LESS THAN 715 FEET [218 m].

- **REFERENCES:**
  - STANDARD SPEC. REFERENCE DWG. NO. 606-50
  - EFFECTIVE: SEPTEMBER 2014

**SPlice DETAIL**

- **REFLECTORIZED SMEETING, WHITE OR YELLOW PER MUTCD**
- **7/16" [11.1]**
- **DIA. HOLE**

**ReFLECTive TAb**

- **1 1/2" [38]**
- **5.5 [142]**
- **5 [127]**
- **2 1/2" [63.5]**

**Detailed Drawing**

- **REFERENCE DWG. NO.**
- **SECTION 606**
- **BOX BEAM GUARDRAIL**

**Effective:** SEPTEMBER 2014

---

**Units Shown in Brackets (1) Are Metric and Are in Millimeters (mm) Unless Other Units Are Shown.**

**Section A-A**
**Detail "A"**

**Plan**

- **Traffic Side**
  - **Standard Box Beam**
  - **Box Beam Terminal Rail (RB05*)**
  - **Traffic Side**
  - **Splice**
  - **Reflective Tab (Typ.)**

**Elevation**

- **Standard Box Beam Post, Hardware, and Widening**
- **Traffic**

**NOTES:**

1. **See DTL. DWG. NO. 606-50 for Standard Box Beam Guardrail and Associated Details.**
2. **See DTL. DWG. NO. 606-60 for Schedule of Guardrail Hardware.**

**Units Shown in Brackets [ ] Are Metric and Are in Millimeters (mm) Unless Other Units Are Shown.**

**Detailed Drawing**

**Reference**

- **DWG. NO.**
- **Standard Spec.**
- **Section 606**

**Box Beam One-Way Departure Terminal Section**

**Effective September 2014**

**Montana Department of Transportation**
Bridge rail connection included in approach section Pay Limits.

Upper rail - standard box beam rail splice (lower rail).  (See details)

T56 x 3 3/16 (TS152 x 51) rail connection (See details).

Box beam rail splice not included in cost of bridge Pay Limits.

Standard box beam rail splice may be included in cost of bridge Pay Limits.

Flanged washers (FWC10a*) (1 washer and nut (FNX10a*) with 2 3/8" dia. x 7 1/2" [M10 x 191] hex bolt (FBX10a*) (Typ.)

8 1/4" [210]

Flanged washers (FWC20b*) (Typ.)

Hardened flanged washers (FNX20b*) with two nuts (FBX20b*) and high strength hex bolt (FBX20b*) 3/4" dia. x 4" [M20 x 120] high strength hex bolt (FBX20b*) and nut (FNX20b*) with two hardened flat washers (FWC20b*) (Typ.)

Flanged washers (FWC10a*) (Typ.)**

Flanged washers (FWC20b*) (Typ.)**

3/8" dia. x 3 1/2" [M10 x 89] hex bolt (FBX10a*) and nut (FNX10a*) with 2 flat washers (FWC10a*) (Typ.)

3/8" dia. x 3 1/2" [M10 x 89] hex bolt (FBX10a*) and nut (FNX10a*) with 2 flat washers (FWC10a*) (Typ.)

Flanged washers (FWC20b*) (Typ.)

Hole for lower rail (PSE08*) (With extra type A box beam post (FPP01*) (Typ. P1 thru P9) type 2 box beam post (FPP01*) (Typ. P1 thru P9))

30' [9.14 m] standard box beam guardrail and associated details.

See Bridge Plans.

5" [127]

2'-8 3/4" [830]

8" [202]

3'-11 7/8" [1216]

2'-0 1/4" [616]

2 1/2" [64]

2 3/4" [70]

3 3/4" [95]

Variable slope

Normal formed shoulder

Edge of traffic lane

2% Slope

Guards widening detail (Typ. at Post P9, P8, P7)

Detailed drawing

Reference

Dwg. No.

Section 606-53

Box beam Bridge approach section - Types 1 & 2

Montana Department of Transportation

SEPTEMBER 2014

606-53

4 SPACES AT 6'-0" [1830] = 24'-0" [7320]

4 SPACES AT 4'-0" [1220] = 16'-0" [4880]
NOTES:
1. SEE DET. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.
2. USE ON EXIT END OF ONE-WAY TRAFFIC BRIDGES ONLY.
* SEE DET. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.
** SEE BRIDGE PLANS FOR MORE DETAILED INFORMATION ON BRIDGE RAIL AND CONNECTION DETAILS.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
FLATTER 10:1 OR FLATTER 3:1 OR TRAFFIC
GROUND LINE PLAN
ELEVATION
GUARDRAIL WIDENING

PLAN

ELEVATION

GUARDRAIL WIDENING

NOTES:
1. PLACE A SELF-ADHESIVE OBJECT MARKER ON THE FACE OF THE NOSE ASSEMBLY,-facing alternating astro-reflective black and yellow striped strips. Command at an angle of 45 degrees toward the side or which traffic is to pass.
2. FLARE THE END SECTION AWAY FROM TRAFFIC AT A RATE OF 10:1 FOR 50 FEET (15.24 m) /ILLUSTRATED FLARES OF 10:1 FOR 100 FEET (30.48 m). MAY ALSO BE USED FOR POST WIDENING.
3. PLACE A SELF-ADHESIVE OBJECT MARKER ON THE FACE OF THE NOSE ASSEMBLY, HAVING ALTERNATING RETRO-REFLECTIVE BLACK AND YELLOW STRIPES SLOPE DOWNWARD AT AN ANGLE OF 45 DEGREES TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS.
4. USE WOOD OR OTHER MASH APPROVED BLOCKS.

REFERENCE
DETAILED DRAWING
OPTIONAL BOX BEAM TERMINAL SECTION - WY-BET

UNIT SHOWN IN Eq. 6-2 (1.83 m)
UNLESS OTHER UNITS ARE SHOWN.
METRIC AND ARE IN MILLIMETERS (mm)
UNITS SHOWN IN BRACKETS [ ] ARE GREATER THAN 2 FEET (0.6 m) IN WIDTH.
MAY BE OMITTED ON ROADS WITH SHOULDERS Widths Greater Than 2 Feet (0.6 m) in Width.
MAY ALSO BE USED. THE FLARE (ILLUSTRATED). FLARES OF 50:1 FOR 100 FEET [15.24 m] FLARE THE END SECTION AWAY FROM TRAFFIC FROM TRAFFIC TO PASS.

RAIL AND POST WIDTH APPROX.
9" [230] APPROX.
**BILL OF MATERIAL**

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<thead>
<tr>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>METRIC DESCRIPTION</th>
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<tr>
<td>1</td>
<td>BOX BEAM POST, W6x15, 8'-0&quot; LG.</td>
<td>M24 ANCHOR CABLE HEX NUT</td>
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<tr>
<td>2</td>
<td>END TUBE RAIL, TS 152 x 152 x 3.2 x 3660</td>
<td>M8 x 191 HEX BOLT (GRADE 5)</td>
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<td>M16 HEX NUT</td>
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**NOTES:**

1. BEAT TERMINAL SECTION TO INCLUDE 36'-0" [10.98 m] OF BOX BEAM GUARDRAIL AS BEAT TERMINAL SECTION TO INCLUDE NOTES:

2. PLACE POST BREAKER ON TRAFFIC SIDE OF FIRST POST.
### Schedule of Guardrail Hardware

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<tr>
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<th>Metric Description</th>
<th>Colour Code</th>
<th>Schematic Code</th>
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<td>M8-8.0 x 0.8 Dia. Bolt</td>
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<td>05</td>
<td>670</td>
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**Notes:**
- 1. The ASSASSI-ADEMA Joint Committee Panel Team 10 report is based on the Standardized Highway Guardrail Hardware Publication for Additional, and Detailed Hardware Specifications.
- 2. Material Code Values:
  - W = Steel Metal Material
  - G = Galvanized Material
  - S = Box Beam Material
**GUARDRAIL HARDWARE**

### HEX BOLTS

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<th>Bolt Size</th>
<th>Designation</th>
<th>Transverse Diameter</th>
<th>L (MIN.)</th>
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**FLAT WASHERS**

- REGULAR FLAT WASHERS
- HARDENED FLAT WASHERS

### HEX NUTS

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### METRIC GUARDRAIL HARDWARE

### HEX BOLTS

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<td>M2.5</td>
<td>6.35</td>
<td>1 1/2&quot;</td>
</tr>
<tr>
<td>M3</td>
<td>M3</td>
<td>8.00</td>
<td>1&quot;</td>
</tr>
<tr>
<td>M4</td>
<td>M4</td>
<td>10.00</td>
<td>1&quot;</td>
</tr>
<tr>
<td>M5</td>
<td>M5</td>
<td>12.70</td>
<td>1&quot;</td>
</tr>
<tr>
<td>M6</td>
<td>M6</td>
<td>15.00</td>
<td>1 1/2&quot;</td>
</tr>
<tr>
<td>M8</td>
<td>M8</td>
<td>19.05</td>
<td>2&quot;</td>
</tr>
<tr>
<td>M10</td>
<td>M10</td>
<td>25.40</td>
<td>2&quot;</td>
</tr>
<tr>
<td>M12</td>
<td>M12</td>
<td>30.00</td>
<td>2 1/2&quot;</td>
</tr>
<tr>
<td>M16</td>
<td>M16</td>
<td>40.00</td>
<td>2 1/2&quot;</td>
</tr>
</tbody>
</table>

### FLAT WASHERS

- REGULAR HEX WASHERS
- HARDENED HEX WASHERS

**NOTES:**

- Furnish bolts and anchor rods meeting the requirements of Subsection 705.01.1.
- Furnish high strength bolts meeting the requirements of Subsection 711.06.
- Galvanize bolts, nuts and washers in accordance with Section 711.06.
- By thread angle for bolts furnb.-ot.
- See DTL. DWG. NO. 606-80 for schedule of guardrail hardware.

**DETAILS:**

- SECTION 606, 705, 711
- DWG. No. 606-82

**EFFECTIVE:**

- SEPTEMBER 2014
- JANUARY 2018
NOTES:

1. FOR RELATED FASTENER HARDWARE SEE FWC24a*, FNX24a* AND FPA01*.
2. MACHINE THE SWAGED FITTING FROM HOT-ROLLED CARBON STEEL CONFORMING TO THE REQUIREMENTS OF ASTM A576 (A576M), GRADE 1035, AND ANNEAL SUITABLE FOR COLD SWAGING. GALVANIZE THE SWAGED FITTING IN ACCORDANCE WITH SUBSECTION 711.08 BEFORE SWAGING. DRILL A LOCK PIN HOLE TO ACCOMMODATE A 1/8" [6.4 mm] PLATED SPRING STEEL PIN THROUGH THE HEAD OF THE SWAGED FITTING TO RETAIN THE STUD IN THE PROPER POSITION.
3. THE SWAGED FITTING, STUD AND NUT (FNX24a*) MUST DEVELOP THE BREAKING STRENGTH OF THE WIRE ROPE.

CABLE ASSEMBLY

ANCHOR BRACKET & END PLATE

POST SLEEVE

RECTANGULAR PLATE WASHER

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.
**W-BEAM END SECTION (FLARED)**

RWM22a-b*

**OR**

RWM22a-b* (12'-6" [3.81 m] LENGTH)

**W-BEAM TERMINAL CONNECTOR**

RWE02a-b*

**W-BEAM END SECTION (BUFFER)**

RWE06a-b*

**W-BEAM METAL GUARDRAIL HARDWARE**

<table>
<thead>
<tr>
<th>DESTINATION SUFFIX</th>
<th>METAL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>12 GAUGE [2.7 mm]</td>
</tr>
<tr>
<td>b</td>
<td>10 GAUGE [3.5 mm]</td>
</tr>
</tbody>
</table>

* SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
CABLE GUARDRAIL POST AND SOIL PLATE

PSG01* AND PSG01*

1/4" [6 mm]

2-1/2" [60]

5/3" [160]

2-11" [560]

3" [76]

3/4" [19]

1" [25]

3/8" [9.5]

5/16" DIA. [M8] ROUND HOOK BOLT

FBH03*

5/16" DIA. [M8] HEX BACKING NUT (FBX038*) OR APPROVED SHOULDER

ALTERNATE 5/16" DIA. [M8] HOOK BOLT

FBH02*

1/16" TO 1/8" [1.5 TO 3.0]

5/16" DIA. [M8] ALTERNATE TYPE ROUND BEND HOOK BOLT. NO BACKING NUT REQUIRED

5/16" DIA. [M8] HOOK BOLT

FBH01*

1/16" TO 1/8" [1.5 TO 3.0]

5/16" DIA. [M8] ROUND BEND HOOK BOLT

NOTE:


2. MANUFACTURE POSTS AND SOIL PLATES USING AASHTO M 270 (270M) (ASTM A 709 [A709]) GRADE 36 [250] STEEL. ALL WELDINGS IS TO CONFORM TO THE APPLICABLE AWS CODE.


4. GALVANIZE FABRICATED PARTS IN ACCORDANCE WITH SUBSECTION 711.08. GALVANIZE HOOK BOLTS AND NUTS IN ACCORDANCE WITH AASHTO M 232 [232M] (ASTM A 153 [A153M]). DO NOT PUNCH, DRILL, OR CUT AFTER GALVANIZING.

5. NUTS ARE OF THE HEAVY HEX TYPES. INSTALL BOLTS TO DEVELOP AN ULTIMATE PULL OPEN STRENGTH FROM 500 LB. TO 1000 LB. (2225 N TO 4450 N) APPLIED IN A DIRECTION NORMAL TO THE LONGITUDINAL AXIS OF THE POST.

6. SEE DTL. DWG. NO. 606-80 FOR SCHEDULE OF GUARDRAIL HARDWARE.

* SEE DTL. DWG. NO. 606-40 FOR DETAILS.)
**COMPENSATING CABLE END ASSEMBLY**

**RCE01***

**TURNBUCKLE CABLE END ASSEMBLY**

**RCE03***

**CABLE END ASSEMBLY**

**RCM01***

### NOTES:

1. Wire rope and connecting hardware are to conform to the requirements of AASHTO M30 (M30M) Type 1 Class A 3/4" [19.1] Rope. Connecting hardware must develop the full strength of a single cable (25,000 lb [111.2 kN]). Cast steel components are to conform to the requirements of AASHTO M103 [M103M] (ASTM A27 [A27M]). Malleable iron castings are to conform to the requirements of ASTM A47 [A47M].

2. At all locations where the cable is connected to a cable socket with a wedge type connection, crimp one wire of the cable over the base of the wedge to hold it firmly in place.

3. Compensating devices are to have spring constants of 450 pounds per inch (8.8 N/mm), plus or minus 50 pounds per inch (8.8 N/mm), and permit a travel of 6 inches (150) plus or minus 1 inch (25).

4. Design socket baskets for use with the wedge detailed in this drawing.

5. Alternate hardware designs will be considered for approval provided their connection details, for the purpose of maintenance substitutions, are compatible with the details of this drawing and their operating characteristics are similar to those of the hardware in this drawing.

* See DTL dwg. no. 606-80 for Schedule of Guadrail Hardware.
## WIRE SPACING TABLE

### COMBINATION WOVEN WIRE & BARBED WIRE FENCE

<table>
<thead>
<tr>
<th>48” [1200] FENCE HEIGHT</th>
<th>51” [1280] FENCE HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>32” [813] WW-2 BW *</td>
<td>32” [813] WW-3 BW *</td>
</tr>
<tr>
<td>TYPE F2-32WW [813WW]</td>
<td>TYPE F3-32WW [813WW]</td>
</tr>
<tr>
<td>6” [200]</td>
<td>6” [150]</td>
</tr>
<tr>
<td>4” [100]</td>
<td>4” [80]</td>
</tr>
<tr>
<td>3 1/2” [100]</td>
<td>3 1/2” [100]</td>
</tr>
<tr>
<td>5 1/2” [150]</td>
<td>5 1/2” [140]</td>
</tr>
<tr>
<td>5” [125]</td>
<td>5” [125]</td>
</tr>
<tr>
<td>4 1/2” [115]</td>
<td>4 1/2” [115]</td>
</tr>
<tr>
<td>4” [100]</td>
<td>4” [100]</td>
</tr>
<tr>
<td>3 1/2” [90]</td>
<td>3 1/2” [90]</td>
</tr>
<tr>
<td>2” [80]</td>
<td>2” [80]</td>
</tr>
</tbody>
</table>

### BARBED WIRE FENCE

<table>
<thead>
<tr>
<th>48” [1200] FENCE HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 RW</td>
</tr>
<tr>
<td>4 RW</td>
</tr>
<tr>
<td>5 RW</td>
</tr>
<tr>
<td>6 RW</td>
</tr>
<tr>
<td>TYPE F3</td>
</tr>
<tr>
<td>TYPE F4</td>
</tr>
<tr>
<td>TYPE F5</td>
</tr>
<tr>
<td>TYPE F6</td>
</tr>
<tr>
<td>6” [150]</td>
</tr>
<tr>
<td>5” [125]</td>
</tr>
<tr>
<td>4” [100]</td>
</tr>
<tr>
<td>3” [80]</td>
</tr>
</tbody>
</table>

### Approximate Weight of Woven Wire Fabric

- 32” [813] Woven Wire Fabric (832-6-12 1/2) per 20 rod (100 m) roll is 150 lb (68 kg) per linear foot (5 kg) (NOTE: 12 1/2 gauge)
- 39” [990] Woven Wire Fabric (939-6-12 1/2) per 20 rod (100 m) roll is 170 lb (77 kg) per linear foot (5 kg) (NOTE: 12 1/2 gauge)

### Notes:

1. Staple the bottom, top, center and alternate wires of woven wire to wood line posts.
2. Tie the bottom, top, center and alternate wires of woven wire to steel line posts.
3. Staple all wires of woven wire to wood corner posts or posts used to tie-off wire.
4. "M" denotes metal posts, i.e., Type F3M.
5. "W" denotes wood posts, i.e., Type FW.

### Stays

1. Use wire stays on all fences unless wood stays are specified.
2. Locate stays halfway between line posts.
3. Wire stays for barbed wire fencing are 2" (50) longer than the distance between the top and bottom wires.
4. For woven wire fencing with barbed wire on top, extend wire stays 6" [150] minimum below the top of the woven wire.
5. When wood stays are specified, use either 2" (50) round, a rough dimension 2" x 2" (50 x 50), or a 1 1/2" x 3 1/2" (37.5 x 87.5) (nominal 2" x 4" [50 x 100]). The stay must be of sufficient length to be placed on the ground with the top of the stay extending 2" (50) above the top wire. Attach each wire to the wood stays using 1 3/4" (44) x 9 gauge staples. Wood stays do not need to be treated.

### Units Shown in Brackets ( ) are Metric and are in Millimeters (mm) unless other units are shown.
WIRE SPACING TABLE

<table>
<thead>
<tr>
<th>WIRE SPACING</th>
<th>WIRE SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIRE SPACING</td>
<td>WIRE SPACING</td>
</tr>
<tr>
<td>WIRE SPACING</td>
<td>WIRE SPACING</td>
</tr>
</tbody>
</table>

*DEOTES STAPLE AND/OR TIE LOCATIONS*

BOTTOM WIRE HEIGHT

<table>
<thead>
<tr>
<th>WIRE SPACING</th>
<th>WIRE SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIRE SPACING</td>
<td>WIRE SPACING</td>
</tr>
<tr>
<td>WIRE SPACING</td>
<td>WIRE SPACING</td>
</tr>
</tbody>
</table>

NOTES:

1. "W" DENOTES METAL POSTS, IE. TYPE WF4M.
2. "W" DENOTES WOOD POSTS, IE. TYPE WF4W.
3. SEE DTL. DWG. NO. 607-05, 607-10, AND 607-15 FOR ADDITIONAL FENCING DETAILS.

UNITS SHOWN IN BRACKETS () ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING REFERENCE DWG. NO. STANDARD SPEC. SECTION 607

WILDLIFE FRIENDLY FENCE EFFECTIVE: SEPTEMBER 2014
WIRE FARM ENTRANCE GATE (TYPE G-2)

NOTE: USE SAME WIRE SCHEME ON GATE AS THAT USED ON FENCE, UNLESS STATED OTHERWISE IN R/W AGREEMENT.

METAL FARM ENTRANCE GATE (TYPE G-3)

NOTES:
1. ALL GATES ARE 16'-0" [4800] WIDE UNLESS R/W AGREEMENT STATES OTHERWISE.
2. ALL GATES WILL HAVE A SINGLE OR DOUBLE PANEL AT EACH END.
3. TYPE G-3 GATES ARE AVAILABLE IN WIDTHS FROM 4' [1.2 m] TO 20' [6.0 m] IN 2' [0.6 m] INCREMENTS.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
### FENCE DETAILS

**Notes:**

1. **Attach Barbed wires to posts by wrapping around the post at least two times, then wrapping around itself five times.**
2. **To attach woven wire to an end post, remove two or three vertical stay wires from the end of the fence. Place the first complete vertical stay wire against the post. Start at the middle of the horizontal line wires, wrapping around the end post at least two times and then wrapping around itself five times.**
3. **Place all fence wire on pasture side of post, except on curves. Then, place the wire on the outside of the curve.**
4. **In areas subject to high velocity winds and moving debris, wires may be placed on windward side of posts, except on curves.**
5. **Post spacing is generally measured parallel to ground.**
6. **Place wire stays per DTL. DWG. No. 607-00 halfway between posts. Do not place stays on panels.**
7. **Wood fence has one metal post in place of a wooden line post in each 500 [150 m] run for lightning protection.**

**Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.**

---

<table>
<thead>
<tr>
<th>FENCE TYPE</th>
<th>RUN = L</th>
<th>PANELS REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination Woven/Barbed</td>
<td>LESS THAN 100</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td>OVER 100 TO 200 MAX.</td>
<td>SINGLE</td>
</tr>
<tr>
<td>Barbed</td>
<td>LESS THAN 66'</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td>66'-660'</td>
<td>SINGLE</td>
</tr>
<tr>
<td></td>
<td>OVER 660 TO 990'</td>
<td>DOUBLE</td>
</tr>
</tbody>
</table>

### FENCE PANEL TYPES

- **Limit run lengths in poor soil conditions to reduce resulting tension at corner or angle break panels.**
- **Tie off on all cross hatched or shaded posts.**

---

**Detailed Drawing Reference DWG. No. 607-10**

**Section 607**

**Effective: September 2014**

---

**NOTE:**

- UNLESS OTHER UNITS ARE SHOWN.
- METRIC AND ARE IN MILLIMETERS (mm)
- UNITS SHOWN IN BRACKETS [ ] ARE
- UNIT S METER AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
FENCE LAYOUT ON STEEP SLOPES

Some must be steep enough to deter passage of trespassers.

FENCE CONNECTION TO CATTLE GUARD
1. Place single or double panels at each end of all cattle guards.
2. Securely fasten fence wire to the wings and arrange so that animals cannot pass.

FENCE LAYOUT AT CROSS-FENCE CONNECTION

1'-0" [300]

METAL POSTS DRIVER INTO GROUND AT LEAST THREE FEET [900]

THREE STRANDS OF 9 GAUGE WIRE TIED AROUND ALL WIRES AND AROUND THE METAL POSTS

ALTERNATE DEADMAN

When approved by the project manager the above deadman may be used.

A deadman may be a precast concrete block, a cast-in-place concrete block, a rock or other approved object weighing at least 150 lb. Secure the deadman in the ground by at least 2'-0" of cover. Attach the deadman to the fence by means of 9 gauge wire or a strand of 12 1/2 gauge wire. Attach with a metal posts.

FENCE DETAILS

EXECUTED: SEPTEMBER 2014

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

REFERENCE

DETAILED DRAWING

MTX
MONTANA DEPARTMENT OF TRANSPORTATION

ENVerNo.

SECTION 627

407-15
UPSTAIR FENCE LAYOUT AT CORRUGATED STEEL PIPE (CSP) STOCKPASS

- 1'-0" [300] * ONE FOOT OFFSET APPLIES TO INTERSTATE FENCING ONLY.
- 4" [102] DIAM POSTS
- 6" [150] DIA POSTS
- 6" [150] MAX OVERLAP
- 6" [150] MIN OVERLAP
- 4'-6" [1370] MAX SPACING
- 4'-0" [1220] Approach Spacing
- 6" [150] MIN OVERLAP
- 2'-6" [760] MAX SPACING
- 7'-0" [2130] R/W Line
- 10'-6" [3200] MAX RAIL LENGTH
- 2'-0" [610] X-SEC VIEW
- 4" [102] DIAMETER POLE
- 6" [150] RINGED NAIL
- 4" [102] DIAMETER POLE
- 6" [150] RINGED NAIL

FENCE DETAILS

- NOTE: ALL POLES, POSTS, RAILS, OR WOOD ITEMS WILL BE TREATED WITH ONE 6" [150] RINGED NAIL.
- NOTE: ALL POLES, POSTS, RAILS, OR WOOD ITEMS WILL BE TREATED WITH ONE 6" [150] RINGED NAIL.

UNITS SHOWN IN BRACKETS ( ) ARE INTEG. AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

MTD MONTANA DEPARTMENT OF TRANSPORTATION

FENCE LAYOUT FOR REINFORCED CONCRETE BOX (RCB) STOCKPASS

- 1'-0" [300] * ONE FOOT OFFSET APPLIES TO INTERSTATE FENCING ONLY.
- 4" [102] DIAM POSTS
- 6" [150] DIA POSTS
- 6" [150] MAX OVERLAP
- 6" [150] MIN OVERLAP
- 4'-6" [1370] MAX SPACING
- 4'-0" [1220] Approach Spacing
- 6" [150] MIN OVERLAP
- 2'-6" [760] MAX SPACING
- 7'-0" [2130] R/W Line
- 10'-6" [3200] MAX RAIL LENGTH
- 2'-0" [610] X-SEC VIEW
- 4" [102] DIAMETER POLE
- 6" [150] RINGED NAIL
- 4" [102] DIAMETER POLE
- 6" [150] RINGED NAIL

NOTE: ALL POLES, POSTS, RAILS, OR WOOD ITEMS WILL BE TREATED WITH ONE 6" [150] RINGED NAIL.
NOTE: ALL POLES, POSTS, RAILS, OR WOOD ITEMS WILL BE TREATED WITH ONE 6" [150] RINGED NAIL.

UNITS SHOWN IN BRACKETS ( ) ARE INTEG. AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

MTD MONTANA DEPARTMENT OF TRANSPORTATION

FENCE LAYOUT AT CORRUGATED STEEL PIPE (CSP) STOCKPASS

- 1'-0" [300] * ONE FOOT OFFSET APPLIES TO INTERSTATE FENCING ONLY.
- 4" [102] DIAM POSTS
- 6" [150] DIA POSTS
- 6" [150] MAX OVERLAP
- 6" [150] MIN OVERLAP
- 4'-6" [1370] MAX SPACING
- 4'-0" [1220] Approach Spacing
- 6" [150] MIN OVERLAP
- 2'-6" [760] MAX SPACING
- 7'-0" [2130] R/W Line
- 10'-6" [3200] MAX RAIL LENGTH
- 2'-0" [610] X-SEC VIEW
- 4" [102] DIAMETER POLE
- 6" [150] RINGED NAIL
- 4" [102] DIAMETER POLE
- 6" [150] RINGED NAIL

NOTE: ALL POLES, POSTS, RAILS, OR WOOD ITEMS WILL BE TREATED WITH ONE 6" [150] RINGED NAIL.
NOTE: ALL POLES, POSTS, RAILS, OR WOOD ITEMS WILL BE TREATED WITH ONE 6" [150] RINGED NAIL.

UNITS SHOWN IN BRACKETS ( ) ARE INTEG. AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

MTD MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:
1. INSTALL PANELS ACCORDING TO DETAIL DRAWING 607-05.
2. INSTALL NON-INTERSTATE FENCE ON THE RIGHT-OF-WAY LINE AS SHOWN.
3. OFFSET PANEL POSTS 18" (450mm) FROM STAKED R/W BREAKS AND R/W MONUMENTS AS SHOWN IN DETAIL.
4. DO NOT DISTURB SURVEY MONUMENTS.
5. INCLUDE COST OF 2 x 6 [50 x 150] CROSS RAILS IN THE COST OF ADJACENT PANELS.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING
REFERENCE: DWG. NO.
STANDARD SPEC.
SECTION 607
FENCING AT RIGHT OF WAY BREAKS

--REVISED-- EFFECTIVE: SEPTEMBER 2014
MDT 2016
D TURNBUCKLE

26" [650]

SEPTEMBER 2014

D

INTO THE CONCRETE BLOCK AT LEAST SIX INCHES [150]. INSTALLATIONS. THE DROP BAR MUST BE ABLE TO BE INSERTED A DROP BAR LOCKING DEVICE IS REQUIRED FOR ALL DOUBLE GATE SAME AS CORNER BRACING.

PULL POST BRACING ON 6' [1.8 m] AND 8' [2.4 m] FENCE IS THE CURVE ENDS.

FOR EACH 10° OF DEFLECTION, EVENLY SPACED, BETWEEN CURVES WITH RADII SHARPER THAN 1150' [350 m], INSTALL A DOUBLE TANGENTS OR MORE THAN 250' [75 m] APART ON ANY CURVE. FOR DO NOT INSTALL DOUBLE PANELS MORE THAN 300' [90 m] APART ON

NOTES:

TENSION WIRE

SECTION

ROUND

10" [250]

12" [300] ROUND

3' [915]

4' [1220]

5' [1525]

6' [1830]

8' [2440]

3000 [10'-0"

TURNBUCKLE

FABRIC BAND

10'-0"

TURNBUCKLES

CABLE

END POST

H

LINE POST

D

FABRIC SELVAGE

GENERAL NOTES

Fence height 6' [1.8 m] and over: TOP AND BOTTOM KNUCKLED SELVAGE. PROVIDE CHAIN LINK FENCE MATERIALS PER SECTION 712. FENCE HEIGHT UNDER 6' [1.8 m]: TOP AND BOTTOM KNUCKLED SELVAGE. PROVIDE ROUNDED TOPS FOR ALL OTHER ROUND BRACE BANDS:

PROVIDE EYE-TOP CAPS FOR ALL POSTS SEE SECTION 712.01.5.

PROVIDE REGULAR BRACE BANDS FOR TOP CABLE. TOP CABLE ALONG ALL FENCE. TERMINATE TOP CABLE WITH GALVANIZED CABLE TURNBUCKLES FASTENED WITH THE FABRIC SELVAGE AT THE POST.

FACE SELVAGE:

PROVIDE CHAIN LINK FENCE MATERIALS PER SECTION 712.

PROVIDE REGULAR BRACE BANDS FOR ALL POSTS ON TOP CABLE. PROVIDE BRIGHT TOPS FOR ALL OTHER ROUND POSTS. FABRIC SELVAGE: PROVIDE ROUNDED TOPS FOR ALL OTHER ROUND.

ALSO PROVIDE EYE-TOP CAPS FOR ALL POSTS

See Section 712.01.4.

SCIETY DETAILS

GENERAL NOTES

FABRIC SELVAGE:

PROVIDE CHAIN LINK FENCE MATERIALS PER SECTION 712.

PROVIDE EYE-TOP CAPS FOR ALL POSTS SEE SECTION 712.01.5.

PROVIDE REGULAR BRACE BANDS FOR TOP CABLE. TOP CABLE ALONG ALL FENCE. TERMINATE TOP CABLE WITH GALVANIZED CABLE TURNBUCKLES FASTENED WITH THE FABRIC SELVAGE AT THE POST.

FACE SELVAGE:

PROVIDE CHAIN LINK FENCE MATERIALS PER SECTION 712.

PROVIDE REGULAR BRACE BANDS FOR ALL POSTS ON TOP CABLE. PROVIDE BRIGHT TOPS FOR ALL OTHER ROUND POSTS. FABRIC SELVAGE: PROVIDE ROUNDED TOPS FOR ALL OTHER ROUND.
FASTEN SLOPE BRACES WITH 3 ~ 16d COMMON BARBED SHANK NAILS AT EACH LOCATION.

SLOPE BRACE FASTENING

USE 12 GAUGE OR HEAVIER GALVANIZED WIRE TO FORM THE WIRE TIES.

WIRE TIE DIAMETER OF 6" [152.4]. BUTT TREAT 3' [914.4] MINIMUM.

ARE 6'-6" [1981.2] LONG WITH A MINIMUM DIAMETER OF 3" [76.2] AND A MAXIMUM DIAMETER OF 6" [152.4].

PLACE LINE POSTS AT EACH END OF EACH LINE OF SNOW FENCE AS SHOWN. POSTS ARE 6'-6" [1981.2] LONG WITH A MINIMUM DIAMETER OF 3" [76.2] AND A MAXIMUM DIAMETER OF 6" [152.4]. BUTT TREAT 3' [914.4] MINIMUM.

LINE POSTS

FASTEN SLATS TO THE FRAME WITH 3 ~ 12d COMMON BARBED SHANK NAILS AT EACH LOCATION.

SLAT FASTENING

FASTEN THE SILL AND FRAME MEMBERS TO THE FRAME AT EACH LOCATION WITH 2 ~ 8d COMMON NAILS AT EACH LOCATION.

FRAME TO SILL AND FRAME TO FRAME FASTENING

FASTEN BRACES TO THE FRAME WITH 4 ~ 8d COMMON NAILS AT EACH LOCATION.

BRACE FASTENING

5/8" DIA. x 5" [M16 x 127] STANDARD MACHINE BOLTS, EACH WITH HEX NUT AND TWO FLAT WASHERS.

SEE NOTE X AT RIGHT.

NOTE: USE ONLY WHEN SLOPE IS 5:1 OR STEEPER.

GENERAL NOTES

ANCHOR SYSTEM DETAIL

USE ANCHOR SYSTEM #1 UNLESS SOIL AND MOISTURE CONDITIONS NECESSITATE THE USE OF AN ALTERNATE SYSTEM OR AS DIRECTED IN THE PROJECT MANUAL. CONSULT DETACHED DRAWING NUMBERS DTM-40 AND DTM-45 FOR ANCHOR SYSTEMS #3 (ROCKY CONDITIONS) OR AS DIRECTED BY THE PROJECT MANAGER. CONSULT DETAILED DRAWING NUMBERS 607-40 AND 607-45 FOR ANCHOR SYSTEM #3 (ROCKY CONDITIONS) OR AS DIRECTED BY THE PROJECT MANAGER.

BILL OF MATERIALS FOR ONE PANEL

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</tr>
<tr>
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<td>3</td>
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NOTE: PRESSURE TREAT ALL 2" x 6" [50 x 150] MEMBERS (COMPLETE PANEL).

NOTE: USE ONLY WHEN SLOPE IS 5:1 OR STEEPER.

BILL OF MATERIALS FOR ONE PANEL

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NOTE: USE ONLY WHEN SLOPE IS 5:1 OR STEEPER.

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NOTE: USE ONLY WHEN SLOPE IS 5:1 OR STEEPER.

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NOTE: PRESSURE TREAT ALL 2" x 6" [50 x 150] MEMBERS (COMPLETE PANEL).

NOTE: USE ONLY WHEN SLOPE IS 5:1 OR STEEPER.
GENERAL NOTES

1. ANCHOR SYSTEM DETAIL
   USE ANCHOR SYSTEM #1 UNLESS SOIL AND MOISTURE CONDITIONS REQUIRE THE USE
   OF AN ALTERNATE SYSTEM, OR AS DIRECTED IN THE PROJECT MANAGER'S CONSULT
   DETAINED SHAPING NUMBERS 607-35 AND 607-45 FOR ANCHOR SYSTEMS #3 (ROCKY
   CONDITIONS) AND #2 (WIND CONDITIONS).

2. SLAT FASTENING
   FASTEN SLATS TO THE FRAME WITH 3 ~ 12d COMMON BARBED SHANK NAILS AT EACH
   LOCATION.

3. SLAT BRACE FASTENING
   FASTEN SLAT BRACE TO THE FRAME WITH 4 ~ 8d COMMON NAILS AT EACH LOCATION
   AND TO FRAME MEMBERS.

4. PANEL LENGTH = 16'-0" (4876.8 mm)
   DRAWING NUMBERS 607-40 AND 607-45 FOR ANCHOR SYSTEMS #3 (ROCKY CONDITIONS)
   OF AN ALTERNATE SYSTEM, OR AS DIRECTED BY THE PROJECT MANAGER.  CONSULT DETAILED
   DETAILS, DWG. NO. 607-35.

5. ** NOTE: PRESSURE TREAT ALL 2" x 6" (50 x 150 mm) MEMBERS (ENTIRE FRAME)
   LUMBER - 12' (3.6 m) SNOW FENCE W/ ANCHOR SYSTEM #1

6. ** NOTE: USE ONLY WHEN SLOPE IS 5:1 OR STEEPER
   BILL OF MATERIALS FOR ONE PANEL

- ** FRAMES
  - FRAME
  - FRAME
  - FRAME

- ** SLAT BRACE
  - SLAT
  - SLAT
  - SLAT

- ** BACK BRACE
  - BACK BRACE
  - BACK BRACE

- ** LINE POSTS
  - LINE POSTS
  - LINE POSTS

- ** HOLE DIAMETER
  - 3/4" (19.05 mm)
  - 3/4" (19.05 mm)
  - 1 1/2" (38.1 mm)

- ** ASSEMBLY NOTE
  - ALL NAILS MAY BE EITHER HAND DRIVEN OR DRIVEN WITH A PNEUMATIC NAILER.

HARDWARE - 12' (3.6 m) SNOW FENCE W/ ANCHOR SYSTEM #1

BILL OF MATERIALS FOR ONE PANEL

<table>
<thead>
<tr>
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<th>NO.</th>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2&quot; x 13'-0&quot; (6015.2 mm)</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>2&quot; x 8'-0&quot; (2438.4 mm)</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1&quot; x 6'-0&quot; (1828.8 mm)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2&quot; x 6'-0&quot; (1828.8 mm)</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>2&quot; x 6'-0&quot; (1828.8 mm)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3/4&quot; x 1 1/2&quot; (19.05 x 38.1 mm)</td>
</tr>
<tr>
<td>1</td>
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NOTE:
- USE 1-1/2" DIA. X 1 1/4" DEEP,ZINC-PLATED,3/8" HARDWARE BOLT ON FRAME AND SIll
- USE LINE POSTS TO FRAME AT FRAME, SIll, AND FRAME MEMBERS A, B, C & D IS CRITICAL.
- PLC FLUSH TIGHT AGAINST SNOW FENCE
- DIG OUT AS REQUIRED FOR ENDS OF MEMBERS B, C & D AND TIGHT AGAINST TERRAIN.
- PLACE REBAR ANCHORS 6'-6" (1981.2 mm) LONG WITH A MINIMUM DIAMETER OF 3" (76.2 mm) AND A MAXIMUM DIAMETER OF 6" (152.4 mm).
- USE ANCHOR SYSTEM #1 UNLESS SOIL AND MOISTURE CONDITIONS NECESSITATE THE USE
  OF AN ALTERNATE SYSTEM, OR AS DIRECTED BY THE PROJECT MANAGER.
- CONSULT DETAILED DRAWING NUMBERS 607-40 AND 607-45 FOR ANCHOR SYSTEMS #3 (ROCKY CONDITIONS)

DETAILED DRAWING

REFERENCE
- STANDARD SPEC.
- DWG. NO.
- SECTION
- MONTANA DEPARTMENT OF TRANSPORTATION
- MONTANA DEPARTMENT OF TRANSPORTATION
- 607-35
## ANCHOR SYSTEM #3
### FOR ROCKY CONDITIONS

**LEFT END VIEW**

- **NOTE:**
  - USE TWO #6 [#19] REINFORCING BARS FOR EACH END OF EACH SILL MEMBER. DRIVE THE BARS UP TIGHT TO THE FRAME WHEN STARTING THE TIE.
  - EQUAL LENGTHS OF WIRE ON EITHER SIDE OF THE REBAR.
  - WRAP FIRST 5 LAPS OF WIRE AROUND REBAR.
  - WRAP SECOND 5 LAPS OF WIRE AROUND FIRST 5 LAPS.
- **STEP 1**
  - WRAP FIRST 5 LAPS OF WIRE AROUND REBAR.
- **STEP 2**
  - WRAP SECOND 5 LAPS OF WIRE AROUND FIRST 5 LAPS.
- **STEP 3**
  - TWIST TIE AND FOLD UNDER WRAPS.
- **WIRE TIE DETAIL**
  - USE FLAT WASHERS FOR 5/8" [M16] DIA. BOLT UNLESS OTHER UNITS ARE SHOWN.
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT (FOR ROCKY CONDITIONS). SEE DETAIL N.
  - USE ON FRONT AND BACK OF CENTER SUPPORT.
  - 5/8" DIA. x 5' [M16 X 1219.2] BAR W/ 4 HEX NUTS.
- **SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1**
  - NAILS REQUIRED ARE SAME AS SHOWN ON HARDWARE SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1.
  - UNLESS OTHER UNITS ARE SHOWN.

**RIGHT END VIEW**

- **NOTE:**
  - USE TWO #6 [#19] REINFORCING BARS FOR EACH END OF EACH SILL MEMBER. DRIVE THE BARS UP TIGHT TO THE FRAME WHEN STARTING THE TIE.
  - EQUAL LENGTHS OF WIRE ON EITHER SIDE OF THE REBAR.
  - WRAP FIRST 5 LAPS OF WIRE AROUND REBAR.

**TOP**

- **NOTE:**
  - USE FLAT WASHERS FOR 5/8" [M16] DIA. BOLT UNLESS OTHER UNITS ARE SHOWN.
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT (FOR ROCKY CONDITIONS). SEE DETAIL N.
  - USE ON FRONT AND BACK OF CENTER SUPPORT.
  - 5/8" DIA. x 5' [M16 X 1219.2] BAR W/ 4 HEX NUTS.
- **SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1**
  - NAILS REQUIRED ARE SAME AS SHOWN ON HARDWARE SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1.
  - UNLESS OTHER UNITS ARE SHOWN.

**SIDE**

- **NOTE:**
  - USE FLAT WASHERS FOR 5/8" [M16] DIA. BOLT UNLESS OTHER UNITS ARE SHOWN.
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT (FOR ROCKY CONDITIONS). SEE DETAIL N.
  - USE ON FRONT AND BACK OF CENTER SUPPORT.
  - 5/8" DIA. x 5' [M16 X 1219.2] BAR W/ 4 HEX NUTS.
- **SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1**
  - NAILS REQUIRED ARE SAME AS SHOWN ON HARDWARE SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1.
  - UNLESS OTHER UNITS ARE SHOWN.

**FRONT VIEW**

- **NOTE:**
  - USE FLAT WASHERS FOR 5/8" [M16] DIA. BOLT UNLESS OTHER UNITS ARE SHOWN.
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT (FOR ROCKY CONDITIONS). SEE DETAIL N.
  - USE ON FRONT AND BACK OF CENTER SUPPORT.
  - 5/8" DIA. x 5' [M16 X 1219.2] BAR W/ 4 HEX NUTS.
- **SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1**
  - NAILS REQUIRED ARE SAME AS SHOWN ON HARDWARE SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1.
  - UNLESS OTHER UNITS ARE SHOWN.

---

**LUMBER - SNOW FENCE W/ ANCHOR SYSTEM #3**

**BILL OF MATERIALS FOR ONE PANEL**

**HARDWARE - SNOW FENCE W/ ANCHOR SYSTEM #3**

**BILL OF MATERIALS FOR ONE PANEL**

---

**REFERENCE**

- **DWG. NO.:** 607-40
- **SECTION:** 607-00

- **MT: 10° 30'**
- **MT: 52° 30'**
- **MT: 52° 30'**
- **MT: 52° 30'**

- **CLASS GENERAL CONCRETE ANCHOR**
  - 8" [203.2] DIA. x 3'-0" [914.4] (POURED IN PLACE)
  - 9" [228.6] ± [0.122 m]
  - 5/8" DIA. x 4'-0" [M16 X 1219.2] BAR W/ 3 HEX NUTS
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT

---

**STANDARD ANCHOR DETAIL**

- **DESCRIPTION**
  - **QUANTITY**
    - 4 5/8" DIA. x 4' (M16 X 1219.2) BAR W/ 3 HEX NUTS
    - 4 FLAT WASHERS FOR 5/8" [M16] DIA. BOLT

---

**DETAILED DRAWING**

**NOTE:**

- AFTER SUB [M16] DIA. BOLTS HAVE BEEN TIGHTENED, BURR THE THREAD DIRECTLY BEHIND THE NUT TO PREVENT EVENTUAL LOOSENING OF THE NUTS.

---

**SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1**

- CLASS GENERAL CONCRETE ANCHOR:
  - 8" [203.2] DIA. x 3'-0" [914.4] (POURED IN PLACE)
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT

---

**LUMBER - SNOW FENCE W/ ANCHOR SYSTEM #3**

**BILL OF MATERIALS FOR ONE PANEL**

**HARDWARE - SNOW FENCE W/ ANCHOR SYSTEM #3**

**BILL OF MATERIALS FOR ONE PANEL**

---

**REFERENCE**

- **DWG. NO.:** 607-40
- **SECTION:** 607-00

---

**WOOD SNOW FENCE**

**ANCHOR SYSTEM #3**

**AND #1 DETAILS**

---

**DETAILED DRAWING**

**NOTE:**

- AFTER SUB [M16] DIA. BOLTS HAVE BEEN TIGHTENED, BURR THE THREAD DIRECTLY BEHIND THE NUT TO PREVENT EVENTUAL LOOSENING OF THE NUTS.

---

**SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1**

- CLASS GENERAL CONCRETE ANCHOR:
  - 8" [203.2] DIA. x 3'-0" [914.4] (POURED IN PLACE)
  - FLAT WASHERS FOR 5/8" [M16] DIA. BOLT

---

**LUMBER - SNOW FENCE W/ ANCHOR SYSTEM #3**

**BILL OF MATERIALS FOR ONE PANEL**

**HARDWARE - SNOW FENCE W/ ANCHOR SYSTEM #3**

**BILL OF MATERIALS FOR ONE PANEL**

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**REFERENCE**

- **DWG. NO.:** 607-40
- **SECTION:** 607-00

---

**WOOD SNOW FENCE**

**ANCHOR SYSTEM #3**

**AND #1 DETAILS**

---

**DETAILED DRAWING**

**NOTE:**

- AFTER SUB [M16] DIA. BOLTS HAVE BEEN TIGHTENED, BURR THE THREAD DIRECTLY BEHIND THE NUT TO PREVENT EVENTUAL LOOSENING OF THE NUTS.
### Lumbar - Snow Fence w/ Anchor System #2

**Bill of Materials for One Panel**

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<tbody>
<tr>
<td>4</td>
<td>9&quot; x 3&quot; x 3/8&quot; x 90° (117 x 76.2 x 9.525 x 127 L)</td>
</tr>
<tr>
<td>3</td>
<td>3/8&quot; (9.525) x 3000 (M16) Screws</td>
</tr>
<tr>
<td>4</td>
<td>Flat Washers for 3/8&quot; (M16) Screws</td>
</tr>
<tr>
<td>4</td>
<td>#6 (19mm) Rebar x 30&quot; (762) (3/4&quot; (19.05) Dia.)</td>
</tr>
<tr>
<td>6</td>
<td>1 1/2&quot; (38.1) x 30&quot; (762) Mild Steel Building Post</td>
</tr>
<tr>
<td>2</td>
<td>3/8&quot; (9.525) x 3000 (M16) Screws</td>
</tr>
<tr>
<td>1</td>
<td>3/8&quot; (9.525) x 3000 (M16) Washers</td>
</tr>
</tbody>
</table>

**Summary for Snow Fence w/ Anchor System #1**

Note: Nails required are same as shown or hardware summary for snow fence w/ anchor system #1.

---

### Hardware - Snow Fence w/ Anchor System #2

**Bill of Materials for One Panel**

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</tbody>
</table>

**Notes:**

- After supporting deadmen bolts have been tightened, allow thread directly behind the nut to prevent eventual loosening of the nuts.
- Placement of the wire as possible when excavating to displace as little material as possible.
- Use on front and back of center support.
- Note: for placement of the wire as possible when excavating.
- Placement of the wire as possible when excavating.

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### Diagrams

- **Detail E**: Snow Fence w/ Anchor System #2 Details
- **Detail H**: Snow Fence w/ Anchor System #2 Details
- **Detail I**: Snow Fence w/ Anchor System #2 Details

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**Reference**

[MTX] 607-45 WOOD SILENT FENCE ANCHOR SYSTEM #2 DETAILS

[MDX] WOOD DECKING PARTICULARS

[MDT] WOOD SILENT FENCE ANCHOR SYSTEM #2 DETAILS

**Effective:** September 2014
WILDLIFE FENCE W/ DIG BARRIER

FENCE PANEL TYPES
- SINGLE PANEL
- DOUBLE PANEL

CONCRETE DIG BARRIER APRON
- SINGLE OR DOUBLE PANEL

METAL MAINTENANCE ACCESS GATE
- CENTER CONCRETE DIG BARRIER APRON
- EXTEND CONCRETE TO BACK OF FENCE POST

NOTE:
- TIE OFF ALL CROSS HATCHED OR SHAPED POSTS.

FENCE PANEL TYPES
- PANELS SHOWN: 3'-0" (3600) 6'-0" (7200) 12'-0" (14400)
- SHADED POSTS:
  - 6" (150) DIA. TREATED BRACE RAIL
  - 5" (125) DIA. TREATED WOOD POST
  - 23" (580) HORIZONTAL TUBES AT MID HEIGHT
  - 25" (635) VERTICAL TUBES

NOTE:
- TIE OFF ALL CROSS HATCHED OR SHAPED POSTS.

TIE BAR MOUNTING DETAIL
- FOR GATE CLOSERS

SECTION A-A
- CENTER CONCRETE DIG BARRIER APRON UNDER CLOSED GATE

LEVERS & LOCK WASHERS
- FOR GATE CLOSERS
- FASTEN WITH 6 ~ 1/4" GALV. STEEL PLATE.
- [3 x 150 x 550]

METAL EQUINE GATE
- WOOD LINE POSTS
- 5" (125) DIA. TREATED WOOD POSTS
- 16" (400) WALL TO MOUNT BRACKET HINGE

WILDLIFE FENCE W/ DIG BARRIER
- PANELS NOT SHOWN

CONCRETE DIG BARRIER APRON
- SINGLE OR DOUBLE PANEL

WILDLIFE FENCE
- SINGLE PANEL
- DOUBLE PANEL
JACK AND WIRE ASSEMBLY

JACK LEG NOTCHING

LINE JACK SPACING

MUD SILL

SET POST BRACE

BRACE POLE NOTCHING

BASE: JACK LEG (USA TO A DEPTH OF APPROXIMATELY ONE-INCH THE DIA. OF THE DIA. PROVIDE W - 150 mm)
MAX. DIA. 1 1/2 FOR JACK LEG.

SKEW EACH JACK LEG AND ENSURE WIDTH IS APPROX. EQUAL TO DIA. SILL (ASSEMBLED AS SHOWN).

DRILL ONE W [75 mm] HORIZONTAL HOLE INTO EACH SIDE OF THE JACK THRU ALL JOINT. CLINCH PROTRUDING NAIL ENDS AS NEEDED.

6" [150 mm]  MIN.

5'-3" [1600 mm]  ON TOP AND BOTTOM OF POLES.

DIA. SMALL END) POLES. STRIP OF BARK 18' [5.5 m]  UNIFORM LENGTH (3" [75 mm]) SWAMPY GROUND ONLY.

WOOD ITEMS WILL BE TREATED.

NOTE: ALL POLES, POSTS, RAILS, OR UNITS SHOWN IN BRACKETS ( ) AND METRIC UNITS ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

MDT Montana Department of Transportation

DETAILED DRAWING

REFERENCE

SECTION 827

JACK LEG WIRE FENCE

NOTE: ALL POLES, POSTS, RAILS, OR UNITS SHOWN IN BRACKETS ( ) AND METRIC UNITS ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

NOTE: ALL POLES, POSTS, RAILS, OR UNITS SHOWN IN BRACKETS ( ) AND METRIC UNITS ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
Jack and Pole Assembly

Jack Leg Notching

Mud Sill

Detail "A"

Reporting: September 2014

Jack and Pole Assembly

Jack Leg Notching

Mud Sill

Detail "A"
CURB RAMP TYPES

PERPENDICULAR CURB RAMP (SEE DETAILED DRAWING NUMBER 608-25 FOR ADDITIONAL DETAILS)

PARALLEL CURB RAMP (SEE DETAILED DRAWING NUMBER 608-30 FOR ADDITIONAL DETAILS)

GENERAL NOTES:
① USE CURB RAMPS IN THE FOLLOWING ORDER OF PREFERENCE:
A. PERPENDICULAR CURB RAMP
B. COMBINED (PARALLEL/PERPENDICULAR) CURB RAMP
C. PARALLEL CURB RAMP

② USE THE FLATTEST SLOPES POSSIBLE (5% MIN.) FOR ALL CURB RAMPS. MAXIMUM CONSTRUCTED RAMP SLOPES OF 8.3% ARE SHOWN FOR GUIDANCE AT DIFFICULT SITES.

③ FINAL FIELD LOCATION OF THE CURB RAMPS WILL BE DETERMINED BY THE PROJECT MANAGER.

④ PEDESTRIAN ACCESS POINTS AT CROSSWALKS ARE TO BE WHOLLY CONTAINED WITHIN THE CROSSWALK LINES.

⑤ FOR ADDITIONAL INFORMATION CONSULT DRAFT PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG)

CONSTRUCTION REQUIREMENTS:
① OBTAIN A SURFACE TEXTURE ON THE RAMP BY COARSE BROOMING, TRANSVERSE TO THE RAMP SLOPE.

② TAKE CARE DURING CONSTRUCTION TO ASSURE UNIFORM RAMP GRADES, FREE OF SAGS AND SHARP GRADE CHANGES.
CONSTRUCTION REQUIREMENTS:

1. THE DESIRABLE WIDTH OF THE CURB RAMP (DIMENSION "W" ABOVE) IS 5 FEET [1524] OR WIDER. THE MINIMUM WIDTH ("W") IS 4 FEET [1219].


3. THE DESIRABLE RUNNING SLOPE FOR THE CURB RAMP IS BETWEEN 5% (1:20) AND 7.1% (1:14). THE MAXIMUM CONSTRUCTED CURB RAMP SLOPE IS 8.3% (1:12).

4. THE DESIRABLE SLOPE FOR THE FLARED SIDE OF THE CURB RAMP IS 8.3% (1:12) OR FLATTER. THE MAXIMUM CONSTRUCTED FLARED SIDE SLOPE IS 10% (1:10).

5. THE DESIRABLE CROSS SLOPE OF THE SIDEWALK, RAMP, OR LANDING IS 1.5% (1:66.7) OR LESS. THE MAXIMUM CONSTRUCTED CROSS SLOPE OF THE SIDEWALK, RAMP, OR LANDING IS 2% (1:50).

6. THE RUNNING SLOPE OF THE SIDEWALK IS EQUAL TO THE STREET GRADE OR FLATTER.

7. PROVIDE DETECTABLE WARNING DEVICES ON THE BOTTOM 2 FEET [610] OF EACH RAMP AS SHOWN ABOVE. SEE DETAILED DRAWING NUMBER 608-40 FOR DETECTABLE WARNING DEVICES DETAILS.

8. WHERE EXISTING SITE DEVELOPMENT CONDITIONS PROHIBIT THE STRICT AND FULL COMPLIANCE OF ALL ADA CRITERIA, PROVIDE ACCESSIBILITY TO THE MAXIMUM EXTENT FEASIBLE. DOCUMENT WITH AN ADA STATEMENT OF TECHNICAL INFEASIBILITY FORM WHEN ADA STANDARDS CAN'T BE ACHIEVED.

GENERAL NOTES:

1. WHERE THE RIGHT-OF-WAY WILL NOT ACCOMMODATE A PERPENDICULAR CURB RAMP AND LANDING, CONSIDER USING A COMBINED (PARALLEL/PERPENDICULAR) CURB RAMP. COMBINED (PARALLEL/PERPENDICULAR) CURB RAMPS ARE TO MEET THE CRITERIA FOR BOTH THE PARALLEL AND PERPENDICULAR CURB RAMPS. (SEE DETAILED DRAWING NUMBER 608-30 AND THIS DRAWING.)

2. THERE IS NO TOLERANCE FOR EXCEEDING MAXIMUM STANDARDS.

3. THE COST OF RETAINING WALLS IS INCLUDED IN THE UNIT PRICE BID FOR CONCRETE SIDEWALK.

4. 4" [102] RETAINING WALL

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE
STANDARD SPEC.
SECTION 608

PERPENDICULAR CURB RAMPS

---REVISED---
EFFECTIVE: SEPTEMBER 2014
APRIL 2019

MONTANA DEPARTMENT OF TRANSPORTATION
CONSTRUCTION REQUIREMENTS

NOTE: WHEREVER POSSIBLE, ALTER EXISTING FACILITIES TO COMPLY WITH THE NEW CONSTRUCTION REQUIREMENTS.

1. THE DESIRABLE LENGTH OF THE LANDING (DIMENSION "L" ABOVE) IS 5 FEET [1524]. THE MINIMUM LANDING LENGTH IS 4 FEET [1219].


3. THE DESIRABLE SLOPE FOR THE CURB RAMPS IS 5% (1:20) TO 7.1% (1:14). THE MAXIMUM CONSTRUCTED CURB RAMP SLOPE IS 8.3% (1:12).

4. THE DESIRABLE CROSS SLOPE OF THE SIDEWALK, RAMP, OR LANDING IS 3.5% (1:28.6) OR LESS. THE MAXIMUM CONSTRUCTED CROSS SLOPE OF THE SIDEWALK, RAMP, OR LANDING IS 2% (1:50).

5. PROVIDE DETECTABLE WARNING DEVICES AT THE BACK OF CURB ON EACH LANDING AS SHOWN ABOVE. SEE DETAILED DRAWING NUMBER 608-40 FOR DETECTABLE WARNING DEVICES DETAILS.

6. WHERE EXISTING SITE DEVELOPMENT CONDITIONS PROHIBIT THE STRICT AND FULL COMPLIANCE OF ALL ADA CRITERIA, PROVIDE ACCESSIBILITY TO THE MAXIMUM EXTENT FEASIBLE AND DOCUMENT WITH AN ADA STATEMENT OF TECHNICAL INFEASIBILITY FORM WHEN ADA STANDARDS CAN'T BE ACHIEVED.

GENERAL NOTES:

1. THE COST OF RETAINING WALLS IS INCLUDED IN THE UNIT PRICE BID FOR CONCRETE SIDEWALK.

2. THERE IS NO TOLERANCE FOR EXCEEDING MAXIMUM STANDARDS.
Curb Ramp Design Options for Private Approach or Side Streets with Curb Returns but Without Sidewalk

PERPENDICULAR CURB RAMP

COMBINED (PARALLEL / PERPENDICULAR) CURB RAMP

Curb Ramp Options for Private Approach or Side Streets with Curb Returns but Without Sidewalk

Requirements for New Construction and Alterations to Existing Facilities:

1. The desirable width of the curb ramp (dimension W above) is 5 feet (1524 mm) or wider.
2. The minimum width of a curb is 4 feet (1219 mm). The landing width is equal to the ramp width.
3. The desirable length of the landing at the top of the curb ramp (dimension V above) is at least 5 feet (1524 mm) when the landing is perpendicular to the back of the sidewalk. The maximum landing length is 10 feet (3048 mm).
4. The desirable slope for the flared side of the curb ramp is 8.3% (1:12) or flatter. The maximum constructed curb ramp slope is 8.3% (1:12).
5. The desirable cross slope of the sidewalk, ramp, or landing is 1.5% (1:66.7) or less. The maximum constructed cross slope of the sidewalk, ramp, or landing is 2% (1:50).
6. Provide detectable warning devices on the bottom 2 feet (610 mm) of each ramp run at the back of curb or curb side landing as shown. See detailed drawing numbers 608-40 for detectable warning devices details.

General Notes:

1. Where the sight of way will not accommodate a perpendicular curb ramp and landing meeting these requirements, consider using a combined (parallel / perpendicular) curb ramp design.
2. Term project detectable warning devices panels to fit on private approach sidewalk curb ramps as shown above.
3. The cost of retaining walls is included in the unit price bid for concrete sidewalk.
4. There is no tolerance for exceeding maximum standards.

Units shown in brackets ( ) and inches and feet (if applicable) (in) unless other units are shown.
CONSTRUCTION REQUIREMENTS:

1. Install detectable warning devices that extend the full width of the ramp, 2 feet (610) in depth.
2. Install the detectable warning devices adjacent to the back of curb unless otherwise shown in the plans.
3. Embed the detectable warning devices directly into the concrete, so the top of the base plate is flush with the concrete and the domes protrude above the adjacent concrete surface.
4. Use cast iron detectable warning devices that visually contrast with adjacent walkway surfaces.
5. Use detectable warning devices that visually contrast with adjacent walkway surfaces.
6. Ensure a uniform grade on the detectable warning devices free of sags and irregular edges.
7. Ensure the alignment and pattern of the domes is continued across any joints between detectable warning devices base plate.
8. Ensure the alignment and pattern of the domes is continued across any joints between detectable warning devices base plate.
9. Install detectable warning devices adjacent to the ADA laydown curb unless otherwise shown in the plans.
10. Embed the detectable warning devices directly into the concrete, so the top of the base plate is flush with the concrete and the domes protrude above the adjacent concrete surface.

DETAILED DRAWING

REFERENCE Dwg. No. 608-40

MONTANA DEPARTMENT OF TRANSPORTATION

DETECTABLE WARNING DEVICES

--REVISED--
EFFECTIVE: SEPTEMBER 2014
APRIL 2019
CURB RETURN FILLET REQUIRED FOR NEW CURB & GUTTER INSTALLATIONS (TYPICAL)

NOTE: INCLUDE COST OF CONCRETE FILLET IN VALLEY GUTTER.

VARIABLE RADIUS

BACK OF CURB

CONCRETE CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

FRONT OF GUTTER

CURB TO CURB WIDTH VARY

CONTRACTION JOINTS ARE REQUIRED APPROX. EVERY 10 FEET [3000]

PLAN

CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

EXISTING CURB & GUTTER INSTALLATION WITHOUT CURB RETURN FILLET

VARIABLE RADIUS

BACK OF CURB

1. CURB RETURN EXISTS, GRIND GUTTER TO FORM OUTLET CHANNEL. WHEN THIS IS THE HIGH SIDE

NOTES:

1. INDIVIDUAL LOCATIONS MAY REQUIRE MORE DETAILS FOR ELEVATIONS AND DIMENSIONS.
2. INSTALL REINFORCEMENT AT ALL CONSTRUCTION JOINTS.
3. CONTRACTION JOINTS ARE 1/8" [3 mm] MIN. AND 3/8" [10 mm] MAX. IN WIDTH. FORM JOINTS BY SAWING OR SCORING TO A MINIMUM DEPTH OF 1" [25 mm]. FORM SCORED JOINTS BY A TOOL WHICH WILL LEAVE ROUNDED CORNERS AND DESTROY AGGREGATE INTERLOCK TO A MINIMUM DEPTH OF 1" [25 mm].
4. TO BE USED ON PLANT MIX SURFACING PROJECTS ONLY. PROVIDE PROJECT SPECIFIC DETAILS FOR PCCP PROJECTS.

STREET SURFACE


SECTION A-A

4% SLOPE

7" [180]

3'-0" [900] MINIMUM

VARIABLE

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.
STANDARD SPEC. 609-00
SECTION 609

MONTANA DEPARTMENT OF TRANSPORTATION

EFFECTIVE: SEPTEMBER 2014
JULY 2016

CURB RETURN FILLET REQUIRED FOR NEW CURB & GUTTER INSTALLATIONS (TYPICAL)

NOTE: INCLUDE COST OF CONCRETE FILLET IN VALLEY GUTTER.

VARIABLE RADIUS

BACK OF CURB

CONCRETE CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

FRONT OF GUTTER

CURB TO CURB WIDTH VARY

CONTRACTION JOINTS ARE REQUIRED APPROX. EVERY 10 FEET [3000]

PLAN

CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

EXISTING CURB & GUTTER INSTALLATION WITHOUT CURB RETURN FILLET

VARIABLE RADIUS

BACK OF CURB

1. CURB RETURN EXISTS, GRIND GUTTER TO FORM OUTLET CHANNEL. WHEN THIS IS THE HIGH SIDE

NOTES:

1. INDIVIDUAL LOCATIONS MAY REQUIRE MORE DETAILS FOR ELEVATIONS AND DIMENSIONS.
2. INSTALL REINFORCEMENT AT ALL CONSTRUCTION JOINTS.
3. CONTRACTION JOINTS ARE 1/8" [3 mm] MIN. AND 3/8" [10 mm] MAX. IN WIDTH. FORM JOINTS BY SAWING OR SCORING TO A MINIMUM DEPTH OF 1" [25 mm]. FORM SCORED JOINTS BY A TOOL WHICH WILL LEAVE ROUNDED CORNERS AND DESTROY AGGREGATE INTERLOCK TO A MINIMUM DEPTH OF 1" [25 mm].
4. TO BE USED ON PLANT MIX SURFACING PROJECTS ONLY. PROVIDE PROJECT SPECIFIC DETAILS FOR PCCP PROJECTS.

STREET SURFACE


SECTION A-A

4% SLOPE

7" [180]

3'-0" [900] MINIMUM

VARIABLE

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.
STANDARD SPEC. 609-00
SECTION 609

MONTANA DEPARTMENT OF TRANSPORTATION

EFFECTIVE: SEPTEMBER 2014
JULY 2016

CURB RETURN FILLET REQUIRED FOR NEW CURB & GUTTER INSTALLATIONS (TYPICAL)

NOTE: INCLUDE COST OF CONCRETE FILLET IN VALLEY GUTTER.

VARIABLE RADIUS

BACK OF CURB

CONCRETE CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

FRONT OF GUTTER

CURB TO CURB WIDTH VARY

CONTRACTION JOINTS ARE REQUIRED APPROX. EVERY 10 FEET [3000]

PLAN

CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

EXISTING CURB & GUTTER INSTALLATION WITHOUT CURB RETURN FILLET

VARIABLE RADIUS

BACK OF CURB

1. CURB RETURN EXISTS, GRIND GUTTER TO FORM OUTLET CHANNEL. WHEN THIS IS THE HIGH SIDE

NOTES:

1. INDIVIDUAL LOCATIONS MAY REQUIRE MORE DETAILS FOR ELEVATIONS AND DIMENSIONS.
2. INSTALL REINFORCEMENT AT ALL CONSTRUCTION JOINTS.
3. CONTRACTION JOINTS ARE 1/8" [3 mm] MIN. AND 3/8" [10 mm] MAX. IN WIDTH. FORM JOINTS BY SAWING OR SCORING TO A MINIMUM DEPTH OF 1" [25 mm]. FORM SCORED JOINTS BY A TOOL WHICH WILL LEAVE ROUNDED CORNERS AND DESTROY AGGREGATE INTERLOCK TO A MINIMUM DEPTH OF 1" [25 mm].
4. TO BE USED ON PLANT MIX SURFACING PROJECTS ONLY. PROVIDE PROJECT SPECIFIC DETAILS FOR PCCP PROJECTS.

STREET SURFACE


SECTION A-A

4% SLOPE

7" [180]

3'-0" [900] MINIMUM

VARIABLE

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.
STANDARD SPEC. 609-00
SECTION 609

MONTANA DEPARTMENT OF TRANSPORTATION

EFFECTIVE: SEPTEMBER 2014
JULY 2016

CURB RETURN FILLET REQUIRED FOR NEW CURB & GUTTER INSTALLATIONS (TYPICAL)

NOTE: INCLUDE COST OF CONCRETE FILLET IN VALLEY GUTTER.

VARIABLE RADIUS

BACK OF CURB

CONCRETE CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

FRONT OF GUTTER

CURB TO CURB WIDTH VARY

CONTRACTION JOINTS ARE REQUIRED APPROX. EVERY 10 FEET [3000]

PLAN

CURB RETURN FILLET

REINFORCE WITH 3 – #4 x 36" (#13 x 900) EPOXY COATED DEFORMED REBARS EVENLY SPACED ON 6" [150] CENTERS WITH 3 1/2" [90] COVER

EXISTING CURB & GUTTER INSTALLATION WITHOUT CURB RETURN FILLET

VARIABLE RADIUS

BACK OF CURB

1. CURB RETURN EXISTS, GRIND GUTTER TO FORM OUTLET CHANNEL. WHEN THIS IS THE HIGH SIDE

NOTES:

1. INDIVIDUAL LOCATIONS MAY REQUIRE MORE DETAILS FOR ELEVATIONS AND DIMENSIONS.
2. INSTALL REINFORCEMENT AT ALL CONSTRUCTION JOINTS.
3. CONTRACTION JOINTS ARE 1/8" [3 mm] MIN. AND 3/8" [10 mm] MAX. IN WIDTH. FORM JOINTS BY SAWING OR SCORING TO A MINIMUM DEPTH OF 1" [25 mm]. FORM SCORED JOINTS BY A TOOL WHICH WILL LEAVE ROUNDED CORNERS AND DESTROY AGGREGATE INTERLOCK TO A MINIMUM DEPTH OF 1" [25 mm].
4. TO BE USED ON PLANT MIX SURFACING PROJECTS ONLY. PROVIDE PROJECT SPECIFIC DETAILS FOR PCCP PROJECTS.

STREET SURFACE


SECTION A-A

4% SLOPE

7" [180]

3'-0" [900] MINIMUM

VARIABLE

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.
STANDARD SPEC. 609-00
SECTION 609

MONTANA DEPARTMENT OF TRANSPORTATION

EFFECTIVE: SEPTEMBER 2014
JULY 2016
CONCRETE CURBS

**2% SLOPE**

2% SLOPE

CONCRETE CURBS

9 1/2" +

12" [305]

LAPDOWN CURB (STRAIGHT LINE, TRANSITION FROM FLOWLINE TO TOP BACK OF CURB)

**2% SLOPE**

24"

**2% SLOPE**

2% SLOPE

CONCRETE ADA LAYDOWN CURBS

24" TO TOP BACK OF CURB

TRANSITION FROM FLOWLINE LAYDOWN CURB (STRAIGHT LINE 9 1/2"

24" [610]

8" [152] OR OTHERWISE AS REQUIRED

P = AREA TO BE PAINTED, WHEN PAINTED CURB IS REQUIRED (102 SQ. FT. [9.48 SQ. METERS] PER 100 FT. [30.48 M] OF CURB)

7.5% GRADE

6 3/4" [171]

**2% SLOPE**

24"

6" [152] OR AS REQUIRED

**2% SLOPE**

24"

CONCRETE ADA LAYDOWN CURBS

VARIES (9 1/2" MIN.)

VARIES (6 1/8" [156] MIN.)

**2% SLOPE**

24"

EXPANSION JOINT FILLER MATERIAL:

USE PREFORMED EXPANSION JOINT FILLER MEETING THE REQUIREMENTS OF SECTION 707.

BOND BREAKER MATERIAL:

USE A 15 OR 30 POUND [6.8 OR 13.6 KILOGRAM] ROOFING FELT MATERIAL, OR OTHER PRODUCT AS APPROVED BY THE PROJECT MANAGER. DO NOT USE EXPANSION JOINT MATERIAL.

RADIUS:

MINIMUM CURB RETURN RADIUS = 10' [3.05 m]. 15' [4.57 m] RADIUS ARE DESIRABLE FOR STREETS.

CONCRETE:

UNLESS OTHERWISE SPECIFIED, CONSTRUCT CONCRETE CURBS AND CONCRETE INTEGRAL CURB AND GUTTER WITH CLASS GENERAL CONCRETE OR APPROVED EQUAL.

* QUANTITIES FOR ESTIMATING PURPOSES ONLY.


CONCRETE CURBS

Curb Section

1 CUBIC FOOT (0.305 cu m) OF CONCRETE WILL MAKE ABOUT 8 LINEAR FEET (2.44 in m) OF CURB.

NOTES:

1) WHEN CURB IS USED IN CONJUNCTION WITH GUARDRAIL, USE THE 4" [102] HIGH TYPE. OTHERWISE, THE CONTRACTOR MAY USE EITHER SECTION.

2) CONFORM ALL MATERIALS AND CONSTRUCTION PER SECTION 609.

3) PROVIDE CONTRACTION JOINTS IN CONCRETE CURBS AS DESCRIBED IN NOTE (B) ABOVE.

UNIT'S SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm). UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE

DWG. NO.

STANDARD SPEC.

SECTION 609, 707

MISCELLANEOUS CURBS

---REVISED---

EFFECTIVE: SEPTEMBER 2014

APRIL 2019

MONTANA DEPARTMENT OF TRANSPORTATION

---REVISED---

EFFECTIVE: SEPTEMBER 2014

APRIL 2019

MONTANA DEPARTMENT OF TRANSPORTATION
DROP INLET

INCLUDED IN THE UNIT PRICE BID FOR THE COST OF THE DROP INLET APRON IS ELEVATION.

IS 1" LOWER THAN THE CURB FLOWLINE.

THE REFERENCED GRATE ELEVATION BETWEEN GRATE AND ADJUSTING RING SHOWN IN THE TABLES. FILL SPACE TBC PROFILE AND GRATE APRON SLOPE SHIM DROP INLET FRAME TO MATCH OR APPROVED EQUAL.

ALL CONCRETE IS CLASS GENERAL
NOTES:
UNLESS OTHER UNITS ARE SHOWN.
METRIC AND ARE IN MILLIMETERS (mm)
UNITS SHOWN IN BRACKETS [

REFERENCE
SECTION
STANDARD SPEC.
609
609-07

DROP INLET APRONS

SECTION A-A

SECTION B-B

- SEE CROSS SECTIONS FOR CROSS SLOPES IN STREET.

DROP INLET TYPE I, III, V, VI

ROADWAY % 
CROSS SLOPE*
APRON ELEVATION
TOP BACK OF CURB
APRON & APRON SLAVE %

0.00
5.00
10.0
15.0
20.0
25.0
30.0
35.0
40.0

0.45
0.40
0.36
0.32
0.28
0.25
0.25
0.35
0.45

0.137
0.134
0.131
0.128
0.125
0.122
0.119
0.116
0.113

0.44
0.43
0.42
0.41
0.40
0.39
0.38
0.37
0.36

0.137
0.134
0.131
0.128
0.125
0.122
0.119
0.116
0.113

0.44
0.43
0.42
0.41
0.40
0.39
0.38
0.37
0.36

* SEE CROSS SECTIONS FOR CROSS SLOPES IN STREET.

DROP INLET TYPE IV

ROADWAY % 
CROSS SLOPE*
APRON ELEVATION
TOP BACK OF CURB
APRON & APRON SLAVE %

0.00
5.00
10.0
15.0
20.0
25.0
30.0
35.0
40.0

0.45
0.40
0.36
0.32
0.28
0.25
0.25
0.35
0.45

0.137
0.134
0.131
0.128
0.125
0.122
0.119
0.116
0.113

0.44
0.43
0.42
0.41
0.40
0.39
0.38
0.37
0.36

0.137
0.134
0.131
0.128
0.125
0.122
0.119
0.116
0.113

0.44
0.43
0.42
0.41
0.40
0.39
0.38
0.37
0.36

* SEE CROSS SECTIONS FOR CROSS SLOPES IN STREET.

NOTES:
ALL CONCRETE IS CLASS GENERAL

ON APPROVED EPOXY

SHOW DROP INLET FRAME TO MATCH THE PROFILE AND SLAVE APRON SLOPE.

SHOW SLOPE BETWEEN GRATE AND ADJUSTING RING WITH CLASS GENERAL CONCRETE.

THE REFERENCED GRATE ELEVATION IS 1" LOWER THAN THE CURB FLOWLINE.

THE COST OF THE DROP INLET APRON IS INCLUDED IN THE UNIT PRICE BID FOR THE DROP INLET.
CONSTRUCTION:

1. CURBS MAY BE CONSTRUCTED USING ANY OF THE FOLLOWING THREE METHODS:
   (1) PRECAST
   (2) CAST IN PLACE
   (3) CONSTRUCTED BY THE USE OF AN APPROVED CURB FORMING OR SLIP FORM MACHINE.

2. WHEN USING EITHER METHOD (2) OR (3), REINFORCING STEEL IS NOT REQUIRED, WITH THE EXCEPTION OF THE PINS, SCORE OR SAW CUT CURBS TO A DEPTH OF 1" [25] TO FORM CONTRACTION JOINTS AT INTERVALS OF 10 FT. [3000] OR LESS. EXTEND 1/2" [13] MIN. WIDTH EXPANSION JOINTS COMPLETELY THROUGH CURB EVERY 100 FT. (± 30 FT.) [30 m (± 10 m)], AT INTERVALS EQUAL TO THE NEAREST MULTIPLE OF THE CONTRACTION JOINT INTERVAL AND FILL WITH PREFORMED EXPANSION JOINT FILLER MEETING SECTION 707.

3. FORM PRECAST CURBS IN THEIR INVERTED POSITION, IN LENGTHS NOT LESS THAN 4 FT. [1200], OR MORE THAN 10 FT. [3050].

MATERIAL:

1. CONSTRUCT CURBS WITH CLASS GENERAL CONCRETE OR AN APPROVED EQUIVALENT MIX.

2. EPOXY BINDER FOR GROUTING MUST MEET THE REQUIREMENTS OF (AASHTO M 235 [235 M]) (ASTM C 881 [881 M]).
NOTES:
1/2" [13] EXPANSION JOINTS ARE SHOWN AS DARK SOLID LINES FOR VISUAL PURPOSES.
BOND BREAKER IS SHOWN AS DARK DASHED LINE FOR VISUAL PURPOSES.

SECTION A-A

NOTES:
1. INSTALL PREFORMED EXPANSION JOINT FILLER, PER SECTION 707, AT ALL EXPANSION JOINTS, FOR THE FULL THICKNESS OF THE CONCRETE MEDIAN CAP.
3. ALL JOINTS MUST BE STRAIGHT AND PERPENDICULAR TO THE CENTERLINE AND THE SURFACE OF THE MEDIAN CAP. WHERE PRACTICAL ALIGN ALL JOINTS WITH LIKE JOINTS IN ADJOINING WORK. USE JOINTS TO OUTLINE ALL PANELS IN THE MEDIAN CAP. USE SQUARE PANELS WHEN PRACTICAL. ON NARROW MEDIAN CAPS RECTANGULAR SHAPED PANELS ARE ACCEPTABLE.
5. LOCATE EXPANSION JOINTS AT ALL JOINTS BETWEEN THE MEDIAN CAP AND STRUCTURES IN PLACE AND EVERY 100 FT. (±30 m) AT INTERVALS EQUAL TO THE NEAREST MULTIPLE OF THE CONTRACTION JOINT INTERVAL. USE A LONGITUDINAL EXPANSION JOINT IN THE CENTERLINE OF ALL MEDIAN CAPS WIDER THAN 12 FT. (3660).
6. USE LONGITUDINAL CONTRACTION JOINTS IN MEDIAN CAPS WIDER THAN 6 FT. (1830), WITH SPACING NOT TO EXCEED 6 FT. (1830). SPACE TRANSVERSE CONTRACTION JOINTS EQUAL TO THE LONGITUDINAL SPACING ON MEDIAN CAPS WIDER THAN 6 FT. (1830), FOR MEDIAN CAPS NARROWER THAN 6 FT. (1830), SPACE TRANSVERSE CONTRACTION JOINTS 10 FT. (3000) OR LESS.
7. CONSTRUCT CONCRETE MEDIAN CURB AND CAP WITH CLASS GENERAL CONCRETE OR APPROVED EQUAL.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILLED DRAWING
REFERENCE Dwg. NO. 609-12
STANDARD SPEC. 609-12
SECTION 609, 707
CONCRETE MEDIAN CAPS
EFFECTIVE: SEPTEMBER 2014

MONTANA DEPARTMENT OF TRANSPORTATION
SEEDING

<table>
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<tr>
<th>AREA NO.</th>
<th>DEFINITION</th>
<th>TREATMENT</th>
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<tr>
<td>1</td>
<td>3:1 OR FLATTER SLOPES</td>
<td>CONDITION SEEDBED, SEED &amp; FERTILIZE</td>
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<tr>
<td>2</td>
<td>STEEPER THAN 3:1 SLOPES</td>
<td>SEED, FERTILIZE &amp; MULCH</td>
</tr>
<tr>
<td>3</td>
<td>15' (4.5 m) OR TO THE EDGE OF THE SURFACING INSLOPE, WHICHEVER IS GREATER</td>
<td>CONDITION SEEDBED &amp; SEED</td>
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</table>

NOTES:

1. PLACE TOPSOIL ON THE SURFACING INSLOPE TO A DEPTH OF 4" (100) ± NOT LESS THAN 2'0" (0.6 m) FROM THE EDGE OF PAVEMENT. FEATHER TOPSOIL TO THE EDGE OF PAVEMENT.

2. SEED AREAS BEYOND THE CONSTRUCTION LIMITS WITHIN THE RIGHT-OF-WAY OR PERMIT BOUNDARIES THAT HAVE BEEN DISTURBED (i.e. STAGING AREAS, TOPSOIL PILES, EQUIPMENT TRAILS, etc.).

3. SALVAGE SUFFICIENT AMOUNTS OF TOPSOIL TO ASSURE QUANTITIES ARE AVAILABLE TO COVER ALL CLEARED AND GRUBBED AREAS WITH 4" (100) OF TOPSOIL. IF QUANTITIES ARE NOT AVAILABLE, RE-Spread TOPSOIL TO AN EVEN DEPTH ACROSS ALL DISTURBED GROUND.

UNITS SHOWN IN BRACKETS () ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILS DRAWING

REFERENCE SPEC.
SECTION 610
 TOPSOIL AND SEEDING

MONTANA DEPARTMENT OF TRANSPORTATION

EFFECTIVE: SEPTEMBER 2014
INITIAL ANCHOR TRENCH

LONGITUDINAL TRENCH

TURF REINFORCEMENT MAT OR EROSION CONTROL BLANKET

WOOD STAKES AT 2'-0" [600] O.C.

EXISTING GROUND

BACKFILL AND COMPACT TRENCH

SLOPE INSTALLATION

* UNLESS OTHERWISE NOTED IN PLANS

DITCH INSTALLATION

* UNLESS OTHERWISE NOTED IN PLANS

NOTES:

1. PROVIDE A SOIL SURFACE STABLE, FREE OF ROCKS, AND TO PLAN SPECIFICATIONS

2. SEED, FERTILIZER AND/OR APPLY OTHER SPECIFIED (IF APPROPRIATE) SOIL AMENDMENTS PRIOR TO INSTALLATION. RAKE ALL SEED INTO THE UPPER 0.5" [13] OF SOIL PRIOR TO TRM OR ECB PLACEMENT.

3. USE WOODEN STAKES THAT ARE OF THE SIZE AND DIMENSION SHOWN. METAL STAPLES ARE NOT ALLOWED.

4. SEED, FERTILIZER AND/OR APPLY OTHER SPECIFIED (IF APPROPRIATE) SOIL AMENDMENTS PRIOR TO INSTALLATION. RAKE ALL SEED INTO THE UPPER 0.5" [13] OF SOIL PRIOR TO TRM OR ECB PLACEMENT.

5. Provide an Initial Anchor Trench at the beginning of the slope or ditch installation for the plan width of the TRM or ECB.

6. Provide a Terminal Trench adjacent to the edge of the slope or ditch installation for the plan width of the TRM or ECB.

7. Check Slot/Consecutive Roll Joint Trench: Provide a Check Slot a Minimum of Every 25'-0" [7.6 m] Do not locate a Check Slot at a Ditch Flowline or Where a Constructed Slope and In-Place Slope Meet.

8. UNLESS OTHERWISE SHOWN, METRIC AND ARE IN MILLIMETERS (mm)

9. UNLESS OTHER UNITS ARE SHOWN.
BILL OF REINFORCING STEEL

**16 FT. C.G.**

<table>
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<tr>
<th>NAME</th>
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<th>WTM.</th>
<th>WT/FT.</th>
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<td>12</td>
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<tr>
<td>B2</td>
<td>#13</td>
<td>12</td>
<td>STG</td>
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**20 FT. C.G.**

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<tr>
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**24 FT. C.G.**

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<th>WTM.</th>
<th>WT/FT.</th>
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<tbody>
<tr>
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<td>7.20</td>
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<td>949.4kg</td>
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<tr>
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**28 FT. C.G.**

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<td>STG</td>
<td>7.20</td>
<td>7180</td>
<td>919.0kg</td>
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<td>B3</td>
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<td>STG</td>
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<td>7180</td>
<td>919.0kg</td>
<td>4 1/2&quot;</td>
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<tr>
<td>B4</td>
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**32 FT. C.G.**

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<tbody>
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<td>STG</td>
<td>7.20</td>
<td>6800</td>
<td>888.2kg</td>
<td>4 1/2&quot;</td>
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<tr>
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<td>4 1/2&quot;</td>
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METRIC BILL OF REINFORCING STEEL

**4.8 M.C.G.**

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<th>WTM.</th>
<th>WT/FT.</th>
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<tbody>
<tr>
<td>B1</td>
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<td>7.20</td>
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**6.0 M.C.G.**

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<tbody>
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<td>12780</td>
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<td>STG</td>
<td>7.20</td>
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<tr>
<td>B3</td>
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**7.2 M.C.G.**

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**9.0 M.C.G.**

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<td>7.20</td>
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<td>4 1/2&quot;</td>
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<td>B4</td>
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<td>STG</td>
<td>7.20</td>
<td>15180</td>
<td>1359kg</td>
<td>4 1/2&quot;</td>
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</table>
FIELD PLACED 100 G.C. HOLES PER CF DIRECTED BY THE PROJECT MANAGER

40 CL. FRAMES IN PANELS FOR 25 #13 STR. BARS
8 HOOPS AT APPROX. 280 O.C.

2-5/8 Dia. Bar

2-5/8 Dia. Bar

150 INTERRUPTED SUPPORT PANEL A
2590 PANEL B
2590 PANEL C
3200 PANEL D
3200 PANEL E
1300 PANEL F
1300 PANEL G
1300 PANEL B
1300 PANEL H

TYPICAL PLAN VIEW

INTERMEDIATE SUPPORT PANEL B ELEVATION

PANEL B ELEVATION

PANEL D ELEVATION

PANEL C ELEVATION

PANEL E ELEVATION

PANEL F ELEVATION

PANEL G ELEVATION

PANEL H ELEVATION

PANEL A ELEVATION

VIEW C-C

All dimensions are inches unless otherwise noted.

3810 SECTION - PANEL G
3810 SECTION - PANEL H
2440 SECTION - PANEL B
2250 SECTION - PANEL A
2250 SECTION - PANEL B
2250 SECTION - PANEL C
2250 SECTION - PANEL D
2250 SECTION - PANEL E
2250 SECTION - PANEL F
2250 SECTION - PANEL G
2250 SECTION - PANEL H

ESTIMATED WT. = 25.2 kg
ESTIMATED WT. = 21.6 kg
ESTIMATED WT. = 18 kg
ESTIMATED WT. = 16.8 kg

STANDARD SPEC. NO. 611-10

L/DIA. HOLES CAST IN PANELS

(2) 25 Dia. Bar

(3) LAPPED PANEL JOINTS

1300 PANEL B
1300 PANEL H
1300 PANEL G

NOTE:
1. Use only in field or private approaches.
2. Provide cast-in anchor bolts as shown in DTL. DWG. No. 611-10 or at the approximate locations cast-in cast-iron plates. Similar to those shown in DTL. DWG. Nos. 617-15, may also be used.
3. All reinforcing steel is of the deformed type, meeting the requirements of AISC No. 601 (ASTM A615, Grade 60).
4. For details of steel shapes and steel bars see DTL. DWG. No. 617-40.

LIGHT DUTY CATTLE GUARD - PRECAST (METRIC)

LENTHENED DRAWING

REMARKS (METRIC)

REFERENCE NUMBERS
DWG. NO. 611-50
SECTION 417

MTTX MONTANA DEPARTMENT OF TRANSPORTATION
CONCRETE CUTOFF WALL (SEE DTL Dwg. NO. 552-00)

RIPRAP AS SPECIFIED

CONCRETE CUTOFF WALL (SEE DTL Dwg. NO. 603-32)

1'-0" [300]

VARIATES - SEE DTL Dwg. NO. 603-34

2'-0" [600]

6" [150]

6" x 6" x W2.9
[152.4 x 152.4 x AW18.71]
WIRE MESH

#4 BARS (#13 BARS)

SECTION A-A

ARCH PIPE

1'-0" [300]

VARIATES - SEE DTL Dwg. NO. 603-34

2'-0" [600]

6" [150]

6" x 6" x W2.9
[152.4 x 152.4 x MW18.71]
WIRE MESH

#4 BARS (#13 BARS)

SECTION B-B

NOTE:
ALL CONCRETE IS CLASS GENERAL OR EQUAL.

UNITS SHOWN IN BRACKETS () ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
**CONCRETE EDGE PROTECTION FOR CONCRETE CULVERTS**

**SECTION A-A**

- **CONCRETE CUTOFF WALL INLET AND OUTLET END**
- **WIRE MESH REINFORCING THROUGHOUT ENTIRE STRUCTURE**

**NOTES:**
1. ALL CONCRETE IS CLASS GENERAL CONCRETE OR EQUAL
2. SEE DTL. DWG. NO. 603-00 AND 603-10 FOR RCP AND RCPA CULVERTS WITH FETS.
3. FOR RCP AND RCPA CULVERTS WITH SQUARE ENDS, THE "A" DIMENSION IS 0/4 OR R/3.

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**

---

**CONCRETE CUTOFF WALL INLET AND OUTLET END**

- **WIRE MESH REINFORCING THROUGHOUT ENTIRE STRUCTURE**

**NOTES:**
1. ALL CONCRETE IS CLASS GENERAL CONCRETE OR EQUAL
2. SEE DTL. DWG. NO. 603-00 AND 603-10 FOR RCP AND RCPA CULVERTS WITH FETS.
3. FOR RCP AND RCPA CULVERTS WITH SQUARE ENDS, THE "A" DIMENSION IS 0/4 OR R/3.

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**

---

**CONCRETE CUTOFF WALL INLET AND OUTLET END**

- **WIRE MESH REINFORCING THROUGHOUT ENTIRE STRUCTURE**

**NOTES:**
1. ALL CONCRETE IS CLASS GENERAL CONCRETE OR EQUAL
2. SEE DTL. DWG. NO. 603-00 AND 603-10 FOR RCP AND RCPA CULVERTS WITH FETS.
3. FOR RCP AND RCPA CULVERTS WITH SQUARE ENDS, THE "A" DIMENSION IS 0/4 OR R/3.

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**
### INLET AND OUTLET HEADWALLS FOR RCP

**SECTION A-A**

**PLAN**

2 - #4 (#13) BARS AT APPROX. 12" O.C. THROUGHOUT SIDE WALL

**ELEVATION**

<table>
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<tr>
<th>DIA. D</th>
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* FOR INFORMATION PURPOSES ONLY INCLUDE IN THE COST OF CL 3D CONCRETE

**METRIC INLET AND OUTLET HEADWALLS FOR RCP**

**SECTION B-B**

**PLAN**

2 - #4 (#13) BARS AT APPROX. 12" O.C. THROUGHOUT SIDE WALL

**ELEVATION**

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<tr>
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* FOR INFORMATION PURPOSES ONLY INCLUDE IN THE COST OF CL 3D CONCRETE

### METRIC INLET AND OUTLET HEADWALLS FOR RCP

**SECTION 4.3**

**DIMENSION TABLE**

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* FOR INFORMATION PURPOSES ONLY INCLUDE IN THE COST OF CL 3D CONCRETE

**SPELIVE INLET AND OUTLET HEADWALLS FOR RCP**

**SECTION 4.3**

**DIMENSION TABLE**

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* FOR INFORMATION PURPOSES ONLY INCLUDE IN THE COST OF CL 3D CONCRETE

### METRIC INLET AND OUTLET HEADWALLS FOR RCP

**SECTION 4.3**

**DIMENSION TABLE**

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* FOR INFORMATION PURPOSES ONLY INCLUDE IN THE COST OF CL 3D CONCRETE

**UNIT SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN

**REFERENCE**

CHG NO: 613-12

**DETAILED DRAWING**

**INLET AND OUTLET HEADWALLS FOR RCP AND CMP PIPES**

**REMARKS**

- Dimension and are in millimeters (mm) unless otherwise indicated.
CULVERT RIPRAP

2'-0" [600]

CLASS 1 RIPRAP UNLESS OTHERWISE SPECIFIED

4'-0"

CUTOFF WALL

UNLESS OTHER UNITS ARE SHOWN.

METRIC AND ARE IN MILLIMETERS (mm)

NOTES:

1. CULVERT RIPRAP IS ONLY USED IN SPECIAL CIRCUMSTANCES.

2. KEY ENDS OF RIPRAP WALLS INTO THE EMBANKMENT SLOPES A MINIMUM OF 2 FEET (600 mm) FROM OUTER FACE OF THE RIPRAP FOR THE FULL HEIGHT OF THE RIPRAP WALL.

UNITS SHOWN IN BRACKETS [] ARE METER AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
EMBANKMENT PROTECTION

MINIMUM T FOR:
CLASS I RIPRAP = 1.0 [300]
CLASS II RIPRAP = 2.5 [750]
CLASS III RIPRAP = 3.0 [900]

PER SECTION 716
CONTROL GEOTEXTILE
OF PERMANENT EROSION
RIPRAP PLACED ON TOP
1' [300] MIN. DEPTH
TOP OF STREAM BANK

1' [300] MIN. OVERLAP
1.5:1 MAX.

PLACE RIPRAP UP SLOPE

T

PERMANENT EROSION
CONTROL GEOTEXTILE
PER SECTION 716

ENSURE INTIMATE CONTACT OF
PERMANENT EROSION CONTROL
GEOTEXTILE TO SUBGRADE SOIL

T + 0.5' [150]
(2.0 [600] MIN.)

T + 1.0' [300]

18' [450] LAP

GEOTEXTILE PLACEMENT DETAIL
METHOD FOR PLACING PERMANENT
EROSION CONTROL GEOTEXTILE FOR
PROTECTION OF STREAM BANKS

NOTES:
1. INSTALL PERMANENT EROSION CONTROL
GEOTEXTILE PER SECTION 627.

GEOTEXTILE PLACEMENT DETAIL
METHOD FOR PLACING PERMANENT
EROSION CONTROL GEOTEXTILE FOR
PROTECTION OF CUT AND FILL SLOPES

5 [1.5 m] MIN. OFFSET BETWEEN
ADJACENT ROLL ENDS

MACHINE DIRECTION
OF GEOTEXTILE

CROSS MACHINE
DIRECTION
OF GEOTEXTILE

SECTIONS A-A

REFERENCES
STANDARD SPEC.
SECTION 613, 622

RIPRAP SLOPE PROTECTION

UNITS SHOWN IN BRACKETS [ ] ARE
METRIC, AND ARE IN MILLIMETERS (mm)
UNLESS OTHER UNITS ARE SHOWN.
**Inlet and Outlet Concrete Transitions for CSP**

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<thead>
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**Inlet and Outlet Concrete Transitions for RCP**

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**ISOMETRIC VIEW OF TRANSITION**

Place rebar in center of walls, slab, etc. unless otherwise specified.

**SECTION A-B**

LAP REINFORCING BAR 450.

**SECTION A-A**

LAP REBAR IN CENTER OF WALLS, SLAB, ETC. UNLESS OTHERWISE SPECIFIED.

**Notes:**

- Install structures outside the clear zone.
- Provide transducers when required. See DTL.
- Dimensions are millimeters.
TYPE 2 OBJECT MARKER

**TYPE 2 OBJECT MARKER NOTES:**
1. Use Type 2 Object Markers to delineate roadside constructions of the clear zone (i.e., drop-offs, obstacles, abrupt changes in roadway alignment, etc.).
2. Do not use Type 2 Object Markers as channelizing devices.
3. Attach panels to posts at both top and bottom hole locations.
4. Reduce or eliminate the 2'-0" (0.6 m) distance when obstacle or hazard is less than 2'-0" (0.6 m) from the edge of the driving lane.

PORTABLE VERTICAL PANEL

**PORTABLE VERTICAL PANEL NOTES:**
1. Use portable vertical panels as channelizing devices only. Do not use portable vertical panels to delineate roadside constructions of the clear zone.
2. Vertical panels designated "R" are placed to the right side of approaching traffic. Those designated "L" are placed to the left side.
3. Use retro-reflective sheeting as per the contract.

FLEXIBLE GUIDE POST (TUBULAR MARKER)

**FLEXIBLE GUIDE POST AND PLASTIC DRUM NOTES:**
1. Use flexible guide posts and plastic drums as channelizing devices.
2. Use ASTM Type 3 retro-reflective sheeting on all plastic drums and flexible guide posts.
3. Use one size guide post for continuous runs.

PLASTIC DRUM

**GENERAL NOTES:**
1. See the Manual on Uniform Traffic Control Devices for Dots, Part 6, for additional information.
SUPPORT ASSEMBLY
PORTABLE SIGN

4 PLACES ON COUPLER
1/4" [6]

2" x 2" x 3/16" x 36" 
[51 x 51 x 4.8 x 900] L

2" x 2" x 3/16" x 16 1/2" 
[51 x 51 x 4.8 x 412.5] L

3" x 1/8" x 12" 
[76 x 3.2 x 305] PL.

1 1/2" x 1/4" x 12" 
[40 x 6.4 x 305] PL.

1/4" [6] DIA., x 3" [75] PIPE AT 10° OFFSET

2" x 2" x 1/8" x 9" 
[51 x 51 x 3.2 x 229] L

3/4" [19.1] DIA.

1/4" [6]

3" x 1/8" x 71" 
[76 x 3.2 x 1805] SQUARE TUBE

13 1/2" [345]

3" x 1/8" x 12" 
[76 x 3.2 x 305] SQUARE TUBE

1/4" [6]

CHANNEL, ONE SIDE
1/4" [6]

3/4" [19.1] DIA.

1/4" [6]

OUTSIDE EDGES OF ANGLES (TYP.)

1/4" [6]

NOTES:
1. THE MAXIMUM WEIGHT OF THIS ASSEMBLY IS 250 POUNDS [115 kg].
2. USE A 14" [355] WHEEL AND TIRE.
3. AUTOMOTIVE AND EQUIPMENT AXLE ASSEMBLIES MAY NOT BE USED FOR TRAILER-MOUNTED SIGN SUPPORTS.
4. OTHER NCHRP 350 OR MASH CRASH TESTED ASSEMBLIES ARE ACCEPTABLE.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING
REFERENCE DWG. NO. STANDARD SPEC. SECTION 618-02
MONTANA DEPARTMENT OF TRANSPORTATION
EFFECTIVE: SEPTEMBER 2014
PORTABLE SIGN SUPPORT ASSEMBLY
### PORTABLE BARRICADES

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<td><img src="diagram2.png" alt="Diagram" /></td>
<td><img src="diagram3.png" alt="Diagram" /></td>
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**Portable Barricades Notes:**

1. **Rail Stripes and 4" (100 mm) in Width for Barricades 3' (0.9 m) or Greater in Length:** For barricades less than 3' (0.9 m) in length, 3" (76 mm) stripes may be used.
2. **The Predominant Color for Other Barricade Components Is White:** But unpainted/uncoated metal or aluminum components may be used.
3. **Where Road Barricades Are to Face Traffic From Two Directions:** Stripping on both the front and rear sides is optional.
4. **Use Materials for Barricade Framework, Assembly, Attached Signs, and Means of Sign Attachment That Meet NCHRP 350 AND/OR MASH Requirements for Work Zone Devices Options:** For sign attachment:
   - Signs up to 10 sq ft (0.9 sq m) must be bolted to the top rail.
   - Signs over 10 sq ft (0.9 sq m) must be bolted to the rails and both upright supports.
   - Signs may be mounted behind the barricade or on a separate support.
   - Use retro-reflective sheeting as per the contract.

### RAIL STRIPES

![Diagram](rail-stripes.png)

**Where Barricades Extend Entirely Across the Roadway:** Position barricades so that the stripes slope downward in the direction toward which the road users must turn.

**Barricades with Left and Right Turns Are Permitted:** Position barricades so that the stripes slope downward in both directions toward the center of the barricade or barricades.
NOTES:

1. THIS SIGN LAYOUT IS INTENDED TO BE A PERMANENT INSTALLATION FOR THE DURATION OF THE CONSTRUCTION PROJECT, AS APPROVED BY THE PROJECT MANAGER. COVER OR REMOVE ANY SIGNS WHEN NOT IN USE, INCLUDING SPEED LIMIT SIGNS NOT WARRANTED. REMOVE ANY SIGN SUPPORTS IF THEY WILL NOT BE NEEDED WITHIN 90 DAYS.

2. POST THE END OF WORK ZONE SPEED LIMIT CONSISTING OF ONE SIGN WHEN THE NORMAL POSTED SPEED LIMIT FOR ALL VEHICLES IS THE SAME. USE TWO SIGNS WHEN CAR, TRUCK, AND NIGHTTIME SPEED LIMITS ARE DIFFERENT.

3. INCLUDE REGULATORY SIGNING ONLY IF A WORK ZONE OR ROADWAY HAS CONDITIONS THAT WARRANT SPEED RESTRICTIONS. MODIFY REGULATORY SIGNS TO MATCH ADJACENT REGULATIONS.

4. IN ADDITION TO THE SIGNS SHOWN, INCLUDE THE APPROPRIATE TWO-LANE WORK AREA SIGNS (DTL. DWG. 618-08) WHEN A WORK AREA IS LOCATED AT THE BEGINNING OR END OF THE WORK ZONE.

5. SET UP THIS SIGN LAYOUT IN EACH TRAFFIC DIRECTION.

6. POST THE SPEED LIMIT APPROPRIATE FOR ALL VEHICLES FOR THE REMAINDER OF THE WORK ZONE BEFORE RESUMING TO NORMAL POSTED SPEED LIMITS AT THE END OF THE WORK ZONE.

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DATE: SEPTEMBER 2014

TWO-LANE WORK ZONE

REFERENCE DWG. NO. STANDARD SPEC. SECTION 618

618-04 618

REVISED EFFECTIVE: SEPTEMBER 2014

MDT* MONTANA DEPARTMENT OF TRANSPORTATION
WORK AREA WITH NO FLAGGER

WORK AREA WITH FLAGGER

NOTES:

1. THESE SIGN LAYOUTS ALSO USED IN CONJUNCTION WITH THE PERMANENT LAYOUT ILLUSTRATED ON DTL. DWG. 618-04 FOR WORK AREAS LOCATED AT THE BEGIN AND END OF THE WORK ZONES.

2. XX = SPEED DETERMINED BY THE PROJECT MANAGER.

3. INCLUDE REGULATORY SIGNING ONLY IF THERE IS REASON TO RESTRICT SPEED WITHIN THE WORK ZONE. REMOVE OR COVER EXISTING REGULATORY SIGNS TO MATCH ADJACENT REGULATIONS.

4. SET UP THIS SIGN LAYOUT IN EACH TRAFFIC DIRECTION. COMBINE SUCCESSIVE WORK AREAS WHEN LESS THAN 1.0 MILE (1.6 km) APART.

5. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.

6. PROVIDE A SECOND FLAGGER WHEN REQUIRED PER SECTION 618.

7. POST THE SPEED LIMIT APPROPRIATE FOR ALL VEHICLES FOR THE REMAINDER OF THE WORK ZONE BEFORE RESUMING TO NORMAL POSTED SPEED LIMITS AT THE END OF THE WORK ZONE.

8. ENSURE THE AMBER LED FLASHERS MEET REQUIREMENTS OF STANDARD SPECIFICATION 715 AND DTL. DWG. 618-01.

9. INCLUDE THESE SIGNS WITH ALL FLAGGERS. INCLUDE THESE SIGNS WITHIN WORK ZONES WHEN STEP DOWN IS 30 M.P.H. OR GREATER.

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DetaileD DrawiNG

REFERENCE DWG. NO. 618-08
STANDARD SPEC. 715
SECTION 618.715

TWO-LANE WORK AREAS

---REVISED--- EFFECTIVE: SEPTEMBER 2014

OCTOBER 2017 MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:

1. MODIFY REGULATORY SIGNS TO MATCH ADJACENT REGULATIONS.
2. SET UP THIS SIGN LAYOUT IN EACH TRAFFIC DIRECTION.
3. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
4. PROVIDE A SECOND FLAGGER WHEN REQUIRED BY SECTION 618.03.14.
5. XX = SPEED DETERMINED BY THE PROJECT MANAGER.
6. POST THE SPEED LIMIT APPROPRIATE FOR ALL VEHICLES FOR THE REMAINDER OF THE WORK ZONE BEFORE RESUMING TO NORMAL POSTED SPEED LIMITS AT THE END OF THE WORK ZONE.
7. ENSURE THE AMBER LED FLASHERS MEET REQUIREMENTS OF STANDARD SPECIFICATION 715 AND DTL. DWG. 618-01.
8. INCLUDE THESE SIGNS WITH ALL FLAGGERS. INCLUDE THESE SIGNS WITHIN WORK ZONES WHEN STEP DOWN IS 20 M.P.H. OR GREATER.
* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

NOTE: XX = SPEED DETERMINED BY THE PROJECT MANAGER.

REFERENCES:
- DWG. NO. 618-12
- STANDARD SPEC. 618.715
- SECTION 618.03.14

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAIL DRAWING

REFERENCE

DWG. NO.

618-12

STANDARD SPEC.

618.715

SECTION

618.03.14

TWO-LANE WORK AREA LANE CLOSURE - FLAGGER CONTROLLED

REVISED EFFECTIVE: SEPTEMBER 2014

OCTOBER 2017

MONTANA DEPARTMENT OF TRANSPORTATION
LIMIT SPEED XX
AHEAD ONE LANE ROAD
SPEED LIMIT XX
500 FEET
STOP HERE ON RED

DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

STANDARD SPECIFICATION 715 AND DTL. DWG. 618-01.

INSURE THE AMBER LED FLASHERS MEET REQUIREMENTS OF IS 20 M.P.H. OR GREATER.

THESE SIGNS WITHIN WORK ZONES WHEN STEP DOWN INCLUDE THESE SIGNS WITH ALL FLAGGERS. INCLUDE TEMPORARY TRAFFIC CONTROL SIGNS, DEVICES, ETC.

SIGNAL CONTROLLED OPERATION VIA THE USE OF WITHIN THE WORK AREA BOUNDARIES INTO THE MAINLINE INCORPORATE ANY SIDE APPROACH TRAFFIC THAT OCCURS SIGNAL INDICATIONS AT EACH END OF THE WORK ZONE.

SAFEGUARDS TO AVOID THE POSSIBILITY OF CONFLICTING INTERVALS ARE ADEQUATE TO CLEAR THE ONE-LANE ENSURE THAT THE DURATIONS OF RED CLEARANCE BY CONSULTING WITH AN AUTHORIZED TRAFFIC ENGINEER.

ESTABLISH TEMPORARY TRAFFIC CONTROL SIGNAL TIMING PERMANENT TRAFFIC CONTROL SIGNALS.

TEMPORARY TRAFFIC CONTROL SIGNALS ARE TO MEET THE PHYSICAL DISPLAY AND OPERATIONAL REQUIREMENTS OF PERMANENT TRAFFIC CONTROL SIGNALS.

ESTABLISH ANY SIDE APPROACH TRAFFIC THAT OCCURS WITHIN THE WORK AREA BOUNDARIES INTO THE MAINLINE SIGNAL CONTROLLED OPERATION VIA THE USE OF TEMPORARY TRAFFIC CONTROL SIGNS, DEVICES, ETC.

INCLUDE THESE SIGNS WITH ALL FLAGGERS. INCLUDE THESE SIGNS WITHIN WORK ZONES WHEN STEP DOWN IS 20 M.P.H. OR GREATER.

ENSURE THE AMBER LED FLASHERS MEET REQUIREMENTS OF STANDARD SPECIFICATION 715 AND DTL. DWG. 618-01.

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

WORK ZONE SIGNING
(SEE DTL. DWG. 618-04)
NOTES:

1. USE THIS SIGN LAYOUT WHEN APPROPRIATE. OTHERWISE REFER TO DTL Dwg. 618-16 WHEN A FLAGGER IS NEEDED.

2. SET UP THIS SIGN LAYOUT IN EACH TRAFFIC DIRECTION, AS NEEDED.

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE Dwg. No.
STANDARD SPEC. 618-14
SECTION 618

TWO-LANE EQUIPMENT ENTRANCES

REVISED EFFECTIVE: SEPTEMBER 2014
OCTOBER 2017

MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:

1. SET UP THIS SIGN LAYOUT IN EACH TRAFFIC DIRECTION, AS NEEDED.
2. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
3. XX = SPEED DETERMINED BY THE PROJECT MANAGER.
4. WHEN THIS OCCURS OUTSIDE OF A CONSTRUCTION PROJECT INCLUDE THE W20-1 AND R2-15* SIGNS.
5. POST THE SPEED LIMIT APPROPRIATE FOR ALL VEHICLES FOR THE REMAINDER OF THE WORK ZONE BEFORE RESUMING TO NORMAL POSTED SPEED LIMITS AT THE END OF THE WORK ZONE.
6. WHEN OUTSIDE OF A CONSTRUCTION PROJECT, POST THE SPEED LIMIT CONSISTING OF ONE SIGN WHEN THE NORMAL POSTED SPEED LIMIT FOR ALL VEHICLES IS THE SAME; USE TWO SIGNS WHEN CAR, TRUCK, AND NIGHTTIME SPEED LIMITS ARE DIFFERENT.
7. ENSURE THE AMBER LED FLASHERS MEET REQUIREMENTS OF SECTION 715 AND DTL. DWG. 618-01.
8. INCLUDE THESE SIGNS WITH ALL FLAGGERS. INCLUDE THESE SIGNS WITHIN WORK ZONES WHEN STEP DOWN IS 20 M.P.H. OR GREATER.
9. * DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
NOTES:

1. This sign layout is intended to be a permanent installation for the duration of the construction project, as approved by the project manager. Cover or remove signs when not in use, including speed limit signs not warranted. Remove any sign supports if they will not be needed within 90 days.

2. Post the end of work zone speed limit consisting of one limit when the normal posted speed limit for all vehicles is the same. When car and truck speed limits differ, post both limits on a single sign.

3. Include regulatory signing only if a work zone or roadway has conditions that warrant speed restrictions. Modify regulatory signs to match adjacent regulations.

4. Set up this sign layout in each traffic direction.

5. In addition to the signs shown, include the appropriate four-lane work zone signs (Dtl. Dwg. 618-24) when a work area falls at the begin or end of the work zone.

6. Divided four-lane is shown. For un-divided four-lane, place signs on right side only.

* Denotes signs that are unique to Montana.

Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.

Detailed Drawing

Divided Four-Lane Work Zone

Revised: Effective: September 2014

October 2017

Montana Department of Transportation
MATCH LINE FROM DTL DWG. 618-30

LEGEND

- OBLITERATE CONFLICTING PAVEMENT MARKINGS AND FILL ANY EXISTING RUMBLE STRIPS WITH PMS
- PLASTIC DRUMS (SEE NOTES FOR SPACING)
- RAISED RIGID PAVEMENT MARKERS TYPE I (WHITE) OR TYPE II (YELLOW) AT 5' [1.5 m] SPACING
- DOUBLE YELLOW PAINT OR DOUBLE PLASTIC PAVEMENT MARKING TABS AT 5' [1.5 m] SPACING
- FLEXIBLE GLUE-DOWN GUIDE POSTS ON TWO-LANE (SEE NOTES FOR SPACING EXCEPT AS SHOWN)

NOTES:
1. SPACE CHANNELIZING DEVICES ON TANGENTS AT INTERVALS IN FEET [METERS] OF NO MORE THAN 2 [0.6] TIMES THE SPEED LIMIT IN M.P.H. AND ON ALL TAPER SECTIONS AT INTERVALS IN FEET [METERS] OF NO MORE THAN 1 [0.3] TIMES THE SPEED LIMIT IN M.P.H. FOR SPEED LIMITS LESS THAN 35 M.P.H. SPACE CHANNELIZING DEVICES AS DIRECTED BY THE PROJECT MANAGER.
2. OBLITERATE ALL PAVEMENT MARKINGS THAT CONFLICT AT ANY TIME DURING OR AFTER MEDIAN CROSSOVER USE.
3. INDICATED SPACINGS ARE INTENDED TO BE A MAXIMUM AND MAY BE REDUCED IF CONDITIONS WARRANT.
4. SEE DET. DWG. 618-03.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
EXIT 1/2 MILE

NOTE:
1. SPACE CHANNELIZING DEVICES ON TANGENTS AT INTERVALS IN FEET (METERS) OF NO MORE THAN 2 [0.6] TIMES THE SPEED LIMIT IN M.P.H. AND ON ALL TAPER SECTIONS AT INTERVALS IN FEET (METERS) OF NO MORE THAN 2 [0.6] TIMES THE SPEED LIMIT IN M.P.H. FOR SPEED LIMITS LESS THAN 35 M.P.H. SPACE CHANNELIZING DEVICES AS DIRECTED BY THE PROJECT MANAGER.
2. OBLECTRATE ALL PAVEMENT MARKINGS THAT CONFLICT AT ANY TIME DURING OR AFTER MEDIAN CROSSOVER USE.
3. INDICATED SPACINGS ARE INTENDED TO BE A MAXIMUM AND MAY BE REDUCED IF CONDITIONS WARRANT.
4. PROVIDE ADDITIONAL SIGNING FOR EXIT DESTINATION WHEN EXIT DELINEATION IS NOT VISIBLE.
5. SEE DET. DWG. 618-03.
This document contains a series of diagrams and text related to traffic signs and equipment placement for construction zones. The diagrams illustrate various scenarios for setting up and managing traffic during construction projects, including the use of warning signs, speed limits, and traffic control devices. The text provides instructions and guidelines for proper signage and equipment installation, ensuring safety and compliance with traffic regulations. The document is intended for use by construction project managers and traffic control professionals to guide the setup of traffic control at construction sites.
This page contains a series of diagrams illustrating the positioning and placement of various traffic control devices and signs. The details include:

- **Median Crossings**:
  - With or without a flagger
  - Signs and equipment vary based on whether the crossing is with or without a flagger.

- **Speed Limit Signs**:
  - Normal and posted speed limits are shown.

- **Plastic Drums**:
  - Used to control traffic flow in work zones.

- **Flexible Guide Posts**:
  - Used to delineate work zones and ensure safety.

- **Equipment Road Signs**:
  - Denote areas where equipment is stored.

- **Other Signs**:
  - Reflecting the use of standard regulatory signs.

**Notes**:
- Include speed limit signing in work zones.
- Space devices appropriately.
- Use standard signs.
- Ensure safety and compliance with regulations.
- Ensure visibility and legibility.

**Units**:
- Present units are in feet (meters), unless otherwise specified.

**References**:
- Standard drawings for various sections of the Montana Department of Transportation.

**Details**:
- Ensure proper spacing and alignment of signs and devices.
- Maintain clear communication with project managers.
- Ensure signage is appropriate for the situation.

**Project Manager**
- Advised for changes or updates.
- Ensure all regulations are followed.
NOTE:
1. Include regulatory signing only as required. Remove or cover regulatory signs to match adjacent regulations.
2. Indicated spacings are intended to be a maximum and may be reduced if conditions warrant.
3. SS speed determined by the median crossover design speed or reduced if conditions warrant.
4. Use channelizing devices in tangent sections at intervals in feet (meters) of no more than one and one-half times the speed limit in M.P.H. for speed limits less than 30 M.P.H. Soft-channelling devices are not directed by this section.
5. Substitute all pavement markings that conflict at any time during or after median crossover use
6. See DTL. DWG. 618-05.

SEE DTL. DWG. 618-03.

TYPICAL CROSSOVER SECTION (PLANT MIX SURFACING)

OBLITERATE CONFLICTING PAVEMENT MARKINGS AND EMBLEMS AT MEDIAN CROSSOVER USE.

OBLITERATE ALL PAVEMENT MARKINGS THAT CONFLICT AT ANY TIME DURING PROJECT MANAGER.

THAN 35 M.P.H., SPACE CHANNELIZING DEVICES AS DIRECTED BY THE PROJECT MANAGER.

THAN ONE [0.3] TIMES THE SPEED LIMIT IN M.P.H. FOR SPEED LIMITS LESS THAN 30 M.P.H. SPACE CHANNELIZING DEVICES ON TANGENTS AT INTERVALS IN FEET [METERS] OF NO MORE THAN TWO [0.6] TIMES THE SPEED LIMIT IN M.P.H.

XX = SPEED DETERMINED BY THE MEDIAN CROSSOVER DESIGN SPEED OR REDUCED IF CONDITIONS WARRANT.

INCLUDE REGULATORY SIGNING ONLY AS REQUIRED. REMOVE OR COVER REGULATORY SIGNS TO MATCH ADJACENT REGULATIONS.

NOTES:
1. Include regulatory signing only as required. Remove or cover regulatory signs to match adjacent regulations.
2. Indicated spacings are intended to be a maximum and may be reduced if conditions warrant.
3. SS speed determined by the median crossover design speed on the project manager.
4. Use channelizing devices in tangent sections at intervals in feet (meters) of no more than two (2) times the speed limit in M.P.H. and all in tangent sections at intervals in feet (meters) of no more than one and one-half times the speed limit in M.P.H. for speed limits less than 30 M.P.H. Soft-channelling devices are not directed by this section.
5. Substitute all pavement markings that conflict at any time during or after median crossover use.
6. See DTL. DWG. 618-05.

SEE DTL. DWG. 618-03.

TYPICAL CROSSOVER SECTION (PLANT MIX SURFACING)
WORK AREA

LEGEND

- OBLITERATE CONFLICTING PAVEMENT MARKINGS
- PLASTIC DRUMS (SEE NOTES FOR SPACING)
- FLEXIBLE GLUE-DOWN GUIDE POSTS (SEE NOTES FOR SPACING)
- FLEXIBLE GUIDE POSTS

NOTES:
1. THESE SIGN LAYOUTS USED IN CONJUNCTION WITH THE LAYOUT ILLUSTRATED ON DTL. DWG. 618-28.
2. INCLUDE REGULATORY SIGNING ONLY AS REQUIRED. REMOVE OR COVER REGULATORY SIGNS TO MATCH ADJACENT REGULATIONS.
3. XX = SPEED DETERMINED BY THE PROJECT MANAGER.
4. SPACE CHANNELIZING DEVICES ON TANGENTS AT INTERVALS IN FEET [METERS] OF NO MORE THAN TWO [0.6] TIMES THE SPEED LIMIT IN M.P.H. AND ON ALL TAPER SECTIONS AT INTERVALS IN FEET [METERS] OF NO MORE THAN ONE [0.3] TIMES THE SPEED LIMIT IN M.P.H. FOR SPEED LIMITS LESS THAN 35 M.P.H., SPACE CHANNELIZING DEVICES AS DIRECTED BY THE PROJECT MANAGER.
5. SPACE FLEXIBLE GLUE-DOWN GUIDE POSTS USED FOR LANE SHIFT TAPER AT INTERVALS IN FEET [METERS] OF M.P.H.
6. THE LANE SHIFT TAPER LENGTH ASSUMES AN 8' [2400] LANE SHIFT OFFSET AND AN 80 M.P.H. APPROACH SPEED. CONTACT THE PROJECT MANAGER IF CONDITIONS VARY.
7. TEMPORARY POSITIVE PROTECTION BARRIER CAN TERMINATE AT THE CENTER OF THE CLOSED LANE FOR ACCESS PURPOSES IF AN APPROVED TEMPORARY IMPACT ATTENUATOR IS USED.
8. PLACE REFLECTIVE MARKERS ALONG THE TOP OF TEMPORARY BARRIER AND ENSURE REFLECTORS ON EXISTING BARRIER ARE INTACT.
9. POST THE SPEED LIMIT APPROPRIATE FOR ALL VEHICLES FOR THE REMAINDER OF THE WORK ZONE BEFORE RESUMING TO NORMAL POSTED SPEED LIMITS AT THE END OF THE WORK ZONE.
10. OBLITERATE CONFLICTING PAVEMENT MARKINGS BEGINNING AT THE SHIFTING TAPER AND CONTINUING THROUGH THE WORK AREA.

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNITS SHOWN IN BRACKETS (I) ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DTALED DRAWING
REFERENCE DWG. NO. 618-33
SECTION 618
DIVIDED FOUR-LANE SINGLE LANE CLOSURE LANE SHIFT

--REVISED-- EFFECTIVE: 2017-2018
OCTOBER 2017
MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:

1. SHORT DURATION ACTIVITIES ARE DEFINED AS THOSE LASTING UP TO ONE HOUR.

2. SHORT-TERM STATIONARY ACTIVITIES ARE DEFINED AS THOSE LASTING GREATER THAN ONE HOUR, UP TO A FULL SHIFT.

3. THE REGULATORY SPEED SIGNS MUST MOVE AS NEEDED TO REMAIN WITHIN 500 FEET (150 m) OF THE WORK AREA.

4. SIGN BOTH TRAVEL DIRECTIONS ON TWO-LANE, TWO-WAY ROADWAYS OR BOTH SHOULDERS ON TWO-LANE, ONE-WAY ROADWAYS.

5. PROVIDE AT LEAST THE DISTANCE SHOWN FOR DELINEATOR MOUNTED SIGNS.

6. USE REFLECTIVE DEVICES.

7. XX = NORMAL POSTED SPEED LIMIT(S).

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO. STANDARD SPEC. SECTION 618 618-34

SHORT DURATION OR SHORT-TERM STATIONARY CREW SIGNING

OCTOBER 2017 --REVISED-- EFFECTIVE SEPTEMBER 2014

MDT MONTANA DEPARTMENT OF TRANSPORTATION

APRIL 2019

W3-5
48" x 48" [1200 x 1200]

W21-1
48" x 48" [1200 x 1200]

W21-6
48" x 48" [1200 x 1200] OR WORKERS

R2-15*
36" x 48" [900 x 1200]

R2-1
36" x 48" [900 x 1200]

R2-40*
36" x 48" [900 x 1200] OR SPEED LIMIT

XX TRUCKS PRESENT

BEGIN WORK AREA

END WORK AREA
TO STOP
PREPARED BE LIMIT
SPEED 35
AHEAD WORK ROAD SPEED LIMIT 35
XX XX TRUCKS ROAD WORK END

PRESENT WORKERS WHEN DOUBLE FINES
CRACK SEALING WORK ZONE FOR SHORT-TERM TWO-LANE MAINTENANCE GUIDELINE

--REVISED-- EFFECTIVE: SEPTEMBER 2014

DWG. NO. REFERENCE SECTION STANDARD SPEC. 618-M1

DETAILED DRAWING

FOR SHORT-TERM TWO-LANE CRACK SEALING WORK ZONE

NOTES:

1. MINIMUM REGULATORY SIGN SIZE IS 24" X 30" (600 x 750) ON TWO-LANE ROADS.
2. ON ROADWAYS WITH HIGH TRAFFIC VOLUMES OR VISIBILITY RESTRICTIONS, A 500' (150 m) SPACING FOR ALL SIGNS IS RECOMMENDED.
3. SPACE CHANNELIZING DEVICES AT INTERVALS IN FEET (METERS) EQUAL TO TWICE (0.6 TIMES) THE SPEED LIMIT IN M.P.H. THROUGH THE BUFFER AND WORK AREA.
4. IF A NEED ARISES TO INCREASE VEHICLE STORAGE, ADD AN ADDITIONAL W20-7a "FLAGGER AHEAD" SIGN BETWEEN THE R2-1 AND W3-4 SIGNS AND/OR CONSIDER AN ADDITIONAL ADVANCE FLAGGER.
5. A MIRROR IMAGE OF THIS SIGN SEQUENCE IS REQUIRED FOR THE TRAFFIC FROM THE OPPOSITE DIRECTION.
6. FOR MORE INFORMATION OR CLARIFICATION CONTACT THE DISTRICT TRAFFIC ENGINEER. FOR EXAMPLE, IF WORK ZONE IS CLOSE TO A HORIZONTAL CURVE, A VERTICAL CURVE, A BRIDGE, INTERCHANGE, POOR SIGHT DISTANCE, OR OTHER SPECIAL CONDITION.
7. COVER ANY CONFLICTING SIGNS IN THE WORK ZONE.
8. SHORT-TERM WORK ZONE SIGNING IS NOT REQUIRED TO BE POST MOUNTED.
9. THE BUFFER SPACE CAN BE LATERAL AND LONGITUDINAL AND MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
10. TYPICALLY 2 MILES (3.2 km) IS THE MAX WORK AREA. HOWEVER, WHEN SIGHT DISTANCE, BUFFER ZONES OR ACCOMPLISHMENT RATES FOR EQUIPMENT ARE CONSIDERED, SOME MINOR ADJUSTMENTS TO THIS MAX. MAY BE CONSIDERED.
11. XX = NORMAL POSTED SPEED LIMIT(S).

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.

UNIT SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

NOTES:

- MINIMUM REGULATORY SIGN SIZE IS 24" X 30" (600 x 750) ON TWO-LANE ROADS.
- ON ROADWAYS WITH HIGH TRAFFIC VOLUMES OR VISIBILITY RESTRICTIONS, A 500' (150 m) SPACING FOR ALL SIGNS IS RECOMMENDED.
- SPACE CHANNELIZING DEVICES AT INTERVALS IN FEET (METERS) EQUAL TO TWICE (0.6 TIMES) THE SPEED LIMIT IN M.P.H. THROUGH THE BUFFER AND WORK AREA.
- IF A NEED ARISES TO INCREASE VEHICLE STORAGE, ADD AN ADDITIONAL W20-7a "FLAGGER AHEAD" SIGN BETWEEN THE R2-1 AND W3-4 SIGNS AND/OR CONSIDER AN ADDITIONAL ADVANCE FLAGGER.
- A MIRROR IMAGE OF THIS SIGN SEQUENCE IS REQUIRED FOR THE TRAFFIC FROM THE OPPOSITE DIRECTION.
- FOR MORE INFORMATION OR CLARIFICATION CONTACT THE DISTRICT TRAFFIC ENGINEER. FOR EXAMPLE, IF WORK ZONE IS CLOSE TO A HORIZONTAL CURVE, A VERTICAL CURVE, A BRIDGE, INTERCHANGE, POOR SIGHT DISTANCE, OR OTHER SPECIAL CONDITION.
- COVER ANY CONFLICTING SIGNS IN THE WORK ZONE.
- SHORT-TERM WORK ZONE SIGNING IS NOT REQUIRED TO BE POST MOUNTED.
- THE BUFFER SPACE CAN BE LATERAL AND LONGITUDINAL AND MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
- TYPICALLY 2 MILES (3.2 km) IS THE MAX WORK AREA. HOWEVER, WHEN SIGHT DISTANCE, BUFFER ZONES OR ACCOMPLISHMENT RATES FOR EQUIPMENT ARE CONSIDERED, SOME MINOR ADJUSTMENTS TO THIS MAX. MAY BE CONSIDERED.
- XX = NORMAL POSTED SPEED LIMIT(S).

* DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.
NOTES:
1. Use a minimum 320 [100 m] shoulder taper.
2. Use thirteen approved channelizing devices for a 12 [3.6 m] lane closure taper [80 m.p.h. spaced at 80 (22 m)]. Assume that the taper is a minimum length of 960 [300 m].
3. Space channelizing devices at intervals in feet (meters) equal to twice (0.6 times) the speed limit in m.p.h. through the buffer and work area.
4. Place the arrow board on the shoulder at the start of the travel lane closure taper.
5. The buffer space can be lateral and longitudinal. Keep the buffer space clear of equipment and personnel.
6. For more information or clarification contact the district traffic engineer. For example, if work area is close to a horizontal curve, a vertical curve, a bridge, interchange, poor sight distance or other special condition.
7. Cover any conflicting signs in the work area.
8. Short-term work zone signing is not required to be post mounted.
9. When the work area changes within the work zone, these signs should be moved to reflect the actual work area.
10. Typically 2 miles [3.2 km] is the max. work area. However, when sight distance, buffer zones or accomplishment rates for equipment are considered, some minor adjustments to this max. may be considered.
11. XX = normal posted speed limit(s).
* Denotes signs that are unique to Montana.

UNITs SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
MOBILE OPERATIONS ON MULTILANE ROAD

WORK VEHICLE

TRUCK-MOUNTED ATTENUATOR (OPTIONAL)

SHADOW VEHICLE 1

TRUCK-MOUNTED ATTENUATOR (REQUIRED)

SHADOW VEHICLE 2

TRUCK-MOUNTED ATTENUATOR (OPTIONAL)

MOBILE OPERATIONS ON TWO-LANE ROAD

WORK VEHICLE

TRUCK-MOUNTED ATTENUATOR (OPTIONAL)

SHADOW VEHICLE

TRUCK-MOUNTED ATTENUATOR (REQUIRED)

NOTES:

1. PLACE APPROPRIATE LANE CLOSURE SIGN ON SHADOW VEHICLE 2 SO AS NOT TO OBSCURE THE ARROW BOARD.

2. FOLLOW THE WORK OPERATION WITH SHADOW VEHICLE 2 SO AS TO PROVIDE ADEQUATE SIGHT DISTANCE FOR VEHICULAR TRAFFIC APPROACHING FROM THE REAR.

3. COVER OR TURN THE SIGN LEGENDS ON VEHICLE-MOUNTED SIGNS FROM VIEW WHEN WORK IS NOT IN PROGRESS.

4. WHEN THE WORK VEHICLE OCCUPIES AN INTERIOR LANE OF A DIRECTIONAL ROADWAY MACH A RIGHT SHOULDER TO PROVIDE 
   A DEVELOPMENT SUPPORT TO SHADOW VEHICLE 2 ALONG THE RIGHT-HAND SHOULDER WITH A SIGN INDICATING WORK IS TAKING PLACE IN THE INTERIOR LANE.

5. ON HIGH-SPEED ROADWAYS, A THIRD SHADOW VEHICLE MAY BE USED WITH SHADOW VEHICLE 1 IN THE CLOSED 
   LANE. SHADOW VEHICLE 2 STRADDLING THE EDGE LINE, AND SHADOW VEHICLE 3 ON THE SHOULDER. WHERE 
   ADEQUATE SHOULDER WIDTH IS NOT AVAILABLE, SHADOW VEHICLE 2 MAY ALSO STRADDLE THE EDGE LINE.

6. THE MINIMUM ARROW BOARD SIZE IS TYPE B, 60 INCHES X 30 INCHES [1500 X 750].

7. VARY THE DISTANCE BETWEEN THE WORK LOCATION AND SHADOW VEHICLE 2 TO PROVIDE ADEQUATE SIGHT DISTANCE 
   FOR VEHICULAR TRAFFIC APPROACHING FROM THE REAR.

8. MAINTAIN A MINIMUM SPACING BETWEEN THE WORK VEHICLE AND SHADOW VEHICLES, AND BETWEEN EACH SHADOW 
   VEHICLE TO DETER ROAD USERS FROM DRIVING IN BETWEEN.

MOBILE OPERATIONS ON TWO-LANE ROAD

WORK VEHICLE

TRUCK-MOUNTED ATTENUATOR (OPTIONAL)

SHADOW VEHICLE

TRUCK-MOUNTED ATTENUATOR (REQUIRED)

NOTES:

1. TRUCK-MOUNTED ATTENUATOR IS REQUIRED FOR SHADOW VEHICLE.

2. EQUIP SHADOW VEHICLE WITH VEHICLE-MOUNTED SIGN. USE SIGN SHAPE AND LEGEND APPROPRIATE TO THE TYPE 
   OF WORK.

3. PLACE SHADOW VEHICLE 1 IN THE CLOSED LANE. PLACE APPROPRIATE LANE CLOSURE SIGN ON SHADOW VEHICLE 2 SO AS NOT TO OBSCURE THE ARROW BOARD.

4. FOLLOW THE WORK OPERATION WITH SHADOW VEHICLE 2 SO AS TO PROVIDE ADEQUATE SIGHT DISTANCE FOR VEHICULAR TRAFFIC APPROACHING FROM THE REAR.

5. COVER OR TURN THE SIGN LEGENDS ON VEHICLE-MOUNTED SIGNS FROM VIEW WHEN WORK IS NOT IN PROGRESS.

6. WHENEVER APPROPRIATE, STRADDLE THE EDGE LINE OR MOUNT VEHICLE-MOUNTED SIGN IN A MANNER SO EQUIPMENT OR SUPPLIES DO NOT OBSCURE THE SIGN.

7. PLACE A CAUTION ATTENUATOR TRUCK-MOUNTED FLASHING CAUTION OR ALTERNATING DIAMOND CAUTION TO THE TYPE OF WORK.

UNIT SHOWN IN BRACKETS [ ] ARE 
METERS AND ARE IN MILLIMETERS (mm) 
LESS THAN ONE METER AND SHOWN.

DETAILED DRAWING

REFERENCE

MDOT NO: 618-M4

SECTION 6-18

MOBILE OPERATIONS

MONTANA DEPARTMENT OF TRANSPORTATION
**SPACE ALL CHANNELIZING DEVICES AT "G" UNLESS OTHERWISE NOTED.**

**NOTES:**

1. USE THIS SIGN LAYOUT IN URBAN APPLICATIONS ONLY. USE THE RURAL, OPEN ROADWAY SIGNING DETAILS WHEN HIGHER SPEED LIMITS ARE USED.

2. INCLUDE SPEED LIMIT SIGNS ONLY IF THERE IS A REASON TO RESTRICT SPEED, COVER CONFLICTING SPEED LIMIT SIGNS.

3. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.

4. LARGER SIGN SIZES MAY BE APPROVED BY THE PROJECT MANAGER.

5. PLACE END ROADWORK SIGN AT END OF PROJECT LIMITS.

6. POST EXISTING SPEED LIMIT IF CHANGED BY WORK ZONE LIMITS.

7. ENSURE THE AMBER LED FLASHERS MEET REQUIREMENTS OF SECTION 715 AND DTL. DWG. 618-U01.

---

**LEGEND**

- **FLEXIBLE GUIDE POSTS**
- **PLASTIC DRUMS**
- **DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.**

**XX** - SPEED DETERMINED BY THE PROJECT MANAGER. (25 M.P.H. OR 35 M.P.H.)

---

**TABLE**

<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT FOR WORK ZONE</th>
<th>SIGN SPACING (A)</th>
<th>SPACING OF CHANNELIZING DEVICES (MAX.) (G)**</th>
<th>BUFFER SPACE (B)</th>
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<td>(M.P.H.)</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
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<tr>
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<td>100 (30)</td>
<td>25 (8)</td>
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<td>100 (30)</td>
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**REFERENCES**

- DWG. NO.
- STANDARD SPEC.
- SECTION

**LATE CLOSURE-FLAGGER CONTROLLED (URBAN TWO LANE, TWO WAY ROAD)**

---

**DETAILED DRAWING**

**EFFECTIVE:** SEPTEMBER 2014

**OCTOBER 2017**
**SPEED LIMIT XXX AHEAD**

**ROAD WORK END**

**SPEED LIMIT XXX**

**PRESENT WORKERS WHEN DOUBLE FINES**

---

**NOTES:**

1. USE THIS SIGN LAYOUT IN URBAN APPLICATIONS ONLY. USE THE RURAL, OPEN ROADWAY SIGNING DETAILS WHEN HIGHER SPEED LIMITS ARE USED.

2. INCLUDE SPEED LIMIT SIGNS ONLY IF THERE IS A REASON TO Restrict SPEED. COVER CONFLICTING EXISTING SPEED LIMIT SIGNS.

3. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.

4. THIS LAYOUT SHOULD ONLY BE USED WHEN THERE IS AT LEAST 10' [3 m] IN WIDTH BETWEEN THE CHANNELIZING DEVICES AND THE EDGE OF PAVEMENT. PROVIDE NO PARKING SIGNS WHEN APPROPRIATE.

5. LARGER SIGNS MAY BE APPROVED BY THE PROJECT MANAGER.

6. PLACE END ROAD WORK SIGNS AT END OF PROJECT LIMITS.

7. POST EXISTING SPEED LIMIT IF CHANGED BY WORK ZONE.

8. SEE DTL. DWG. 608-03.

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**LEGEND**

- **-** FLEXIBLE GUIDE POSTS
- - PLASTIC DRUMS
- **-** DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.
- **XX** - SPEED DETERMINED BY THE PROJECT MANAGER (25 M.P.H. OR 35 M.P.H.)

---

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**

---

**DETAILED DRAWING**

**REFERENCE**

**DWG. NO.**

**STANDARD SPEC.**

**SECTION 618**

**618-U03**

**WORK ZONE IN CENTER OF ROAD (URBAN TWO-LANE, TWO-WAY ROAD)**

---

**REVISED**

**EFFECTIVE: SEPTEMBER 2014**

**OCTOBER 2017**

**MONTANA DEPARTMENT OF TRANSPORTATION**
NOTES:

1. MINIMAL TRAFFIC CONTROL DEVICES CONTROLLING PEDESTRIAN FLOWS ARE SHOWN. OTHER DEVICES MAY BE NEEDED TO CONTROL TRAFFIC ON THE STREETS. USE THE APPROPRIATE PARKING LANE CLOSURE WHEN NEEDED.

2. DO NOT DIRECT PEDESTRIANS INTO A LANE OF MOVING TRAFFIC.

3. WHERE SPEEDS EXCEED 25 M.P.H., PHYSICAL BARRIERS SHOULD BE USED TO SEPARATE THE TEMPORARY WALKWAY FROM VEHICULAR TRAFFIC. FLEXIBLE GUIDE POSTS WITH DETECTABLE EDGING IS THE MINIMUM REQUIREMENT FOR SEPARATION. PROVIDE LARGER PHYSICAL BARRIERS, AS DETERMINED BY THE PROJECT MANAGER, ON A CASE BY CASE BASIS.

4. SEE DTL. DWG. 618-03.

5. PROVIDE A PHYSICAL BARRIER, WITH A MINIMUM 6 INCH [150 mm] HEIGHT DETECTABLE EDGING, BETWEEN THE PEDESTRIAN DETOUR WALKWAY AND THE WORK AREA. PROVIDE LARGER PHYSICAL BARRIERS TO PROTECT PEDESTRIANS FROM HAZARDS IN THE WORK AREA, AS DETERMINED BY THE PROJECT MANAGER.

6. ENSURE THAT ENTIRE WALKWAY MEETS ADA REQUIREMENTS. PROVIDE A MINIMUM WALKWAY WIDTH OF 5 FEET [1525 mm] AND A FIRM, STABLE, SLIP RESISTANT WALKING SURFACE ALONG ENTIRE WALKWAY.

7. PROVIDE TEMPORARY RAMPS AND DETECTABLE EDGING (MINIMUM 6 INCH HEIGHT [150 mm] ON BOTH SIDES OF WALKWAY) ALONG TEMPORARY PEDESTRIAN DETOUR ROUTE. SEE MUTCD FOR ADDITIONAL GUIDANCE.

8. PLACE R9-11 ON SIGN POSTS (AS SHOWN BELOW) IF BUSINESS ACCESS IS NOT REQUIRED. PLACE TYPE I BARRICADE ON SIDEWALK WITH R9-11 SIGN IF BUSINESS ACCESS IS NOT REQUIRED.

9. PLACE TYPE I BARRICADE ON SIDEWALK WITH R9-9 SIGN.

PEDESTRIAN DETOUR

BYPASS WALKWAY PROVIDED THROUGH WORK ZONE

Legend

- = Flexible guide posts

Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.

Details:

W20-1 36" x 36" (900 x 900) (optional)

R9-9 24" x 12" (600 x 300)

R9-11 24" x 12" (600 x 300)

Type II or III Barricades (see note 4 above)

Sidewalk Closed Ahead

See Notes 6 and 7 above

Bypass walkway provided through work zone

Sidewalk closures and bypass walkway

--Revised-- Effective September 2014

Montana Department of Transportation

Reference: DWG. NO. 618-U05

Standard Spec. Section 618

Detailed Drawing

Legend

- = Flexible guide posts

Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.
SIDEWALK CLOSED
PEDESTRIAN CROSSWALK

NOTES:
1. COVER PEDESTRIAN TRAFFIC SIGNAL DISPLAYS CONTROLLING CLOSED CROSSWALKS.
2. ONLY TRAFFIC CONTROL DEVICES CONTROLLING PEDESTRIAN FLOWS ARE SHOWN. OTHER DEVICES MAY BE NEEDED TO CONTROL TRAFFIC ON THE STREETS.
3. SEE DTL. DWG. 618-U3.
4. WHEN POSSIBLE, USE THE EXISTING INTERSECTION CROSSWALKS FOR PEDESTRIAN DETOURS. AS A LAST OPTION, USE THE MID-BLOCK TEMPORARY PEDESTRIAN CROSSING SHOWN BELOW. FOR LONG-TERM STATIONARY WORK, THE DOUBLE YELLOW CENTERLINE AND/OR LANE LINES ARE REMOVED BETWEEN CROSSWALK LINES. PROVIDE A MINIMUM WALKWAY WIDTH OF 5 FEET (1525 mm) AND A FIRM, STABLE, SLIP RESISTANT WALKING SURFACE ACROSS BOULEVARDS AND OTHER AREAS ALONG THE TEMPORARY PEDESTRIAN WALKWAY. PROVIDE YIELD PAVEMENT MARKINGS AS SHOWN BELOW.

5. PLACE R9-9 AND R9-10 SIGNS ON TYPE I BARRICADES ON SIDEWALK.
6. PROVIDE TEMPORARY RAMPS FOR PEDESTRIAN CROSSWALK WHEN REQUIRED.
7. PLACE R9-11 AND R9-11a ON SIGN POSTS (AS SHOWN BELOW) IF BUSINESS ACCESS IS REQUIRED. PLACE TYPE I BARRICADE ON SIDEWALK WITH R9-11 ON R9-11a SIGN IF BUSINESS ACCESS IS NOT REQUIRED.

UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
AHEAD WORK ROAD SPEED LIMIT XX SPEED LIMIT XX AHEAD WORK ROAD PRESENT WORKERS WHEN DOUBLE FINES SEE DTL. DWG. 618-U05.

PLACE END ROAD WORK SIGNS AT END OF PROJECT. LARGER SIGN SIZES MAY BE APPROVED BY THE PROJECT MANAGER.

IF PEDESTRIAN TRAFFIC IS IMPACTED SEE DTL. DWG. 618-U05.

LARGER SIGN SIZES MAY BE APPROVED BY THE PROJECT MANAGER.

PLACE END ROAD WORK SIGNS AT END OF PROJECT LIMITS.

POST EXISTING ROAD SIGNS AT END OF PROJECT LIMITS.

SEE DTL. DWG. 618-03.

LEGEND

- FLEXIBLE GUIDE POSTS
- PLASTIC DRUMS
- DENOTES SIGNS THAT ARE UNIQUE TO MONTANA.
- SPEED DETERMINED BY THE PROJECT MANAGER (25 M.P.H. OR 35 M.P.H.)
- DENOTES SIGNS THAT ARE DENOTES SIGNS THAT ARE DISTINCT FROM OTHER APPLICATIONS WITHIN MONTANA.
- BUFFER SPACE

NOTES:

1. USE THIS SIGN LAYOUT IN URBAN APPLICATIONS ONLY. USE THE RURAL, OPEN ROADWAY SIGNING DETAILS WHEN HIGHER SPEED LIMITS ARE USED.
2. INCLUDE SPEED LIMIT SIGNS ONLY IF THERE IS A REASON TO RESTRICT SPEED. COVER OR REMOVE EXISTING CONFLICTING SIGNS.
3. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
4. THE SHOULDER TAPER MAY BE OMITTED WHEN THE PAVED SHOULDER IS LESS THAN 8' [2.4 m] IN WIDTH.
5. IF PEDESTRIAN TRAFFIC IS IMPACTED SEE NOTE
6. IF PEDESTRIAN TRAFFIC IS IMPACTED, SEE NOTE
7. EXPERIENCE DETERMINED BY THE PROJECT MANAGER.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE ShOWN.
NOTES:
① USE THIS SIGN LAYOUT IN URBAN APPLICATIONS ONLY. USE THE RURAL, OPEN ROADWAY SIGNING DETAILS WHEN HIGHER SPEED LIMITS ARE USED.
② INCLUDE SPEED LIMIT SIGNS ONLY IF THERE IS A REASON TO RESTRICT SPEED. COVER OR REMOVE CONFLICTING EXISTING SPEED LIMIT SIGNS.
③ THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
④ LARGER SIGN SIZES MAY BE APPROVED BY THE PROJECT MANAGER.
⑤ PLACE END ROAD WORK SIGNS AT END OF PROJECT LIMITS.
⑥ POST EXISTING SPEED LIMIT IF CHANGED BY WORK ZONE.
⑦ SEE DTL. DWG. 618-03.
## POSTED SPEED LIMIT FOR WORK ZONE

<table>
<thead>
<tr>
<th>M.P.H.</th>
<th>FEET [m]</th>
<th>FEET [m]</th>
<th>FEET [m]</th>
</tr>
</thead>
</table>

** Space all channelizing devices at "G" unless otherwise noted.

### NOTES:

1. Use this sign layout in urban applications only. Use the rural, open roadway signing details when higher speed limits are used.
2. Include speed limit signs only if there is a reason to restrict speed, cover or remove conflicting existing speed limit signs.
3. The buffer space may be increased for downgrades and other conditions that affect stopping distance.
4. The shoulder taper may be omitted when paved shoulder is less than 2.4 m in width.
5. Larger sign sizes may be approved by the Project Manager.
6. Place end road work signs at end of project limits.
7. Post existing speed limit if changed by work zone.
8. See DTL. DWG. 618-U05.

### LEGEND

- Flexible guide posts
- Plastic drums
- Denotes signs that are unique to Montana.

### SPEED LIMIT

** - Speed determined by the Project Manager (25 M.P.H. or 35 M.P.H.)

### UNITS

Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.

### DETAILED DRAWING

**_REFERENCE DWG. NO._**

**STANDARD SPEC.**

**SECTION 618**

**RIGHT LANE CLOSURE (URBAN MULTI-LANE, UNDIVIDED ROAD)**

**REVISED EFFECTIVE SEPTEMBER 2014**

**OCTOBER 2017**

**MONTANA DEPARTMENT OF TRANSPORTATION**

---
<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT FOR WORK ZONE</th>
<th>SIGN SPACING (A)</th>
<th>TAPER LENGTH (L)</th>
<th>SPACING OF CHANNELIZING DEVICES (MAX.) (G)</th>
<th>BUFFER SPACE (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(M.P.H.)</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
</tr>
</tbody>
</table>

** SPACE ALL CHANNELIZING DEVICES AT "G" UNLESS OTHERWISE NOTED.

** NOTES:
1. USE THIS SIGN LAYOUT IN URBAN APPLICATIONS ONLY. USE THE RURAL, OPEN ROADWAY SIGNING DETAILS WHEN HIGHER SPEED LIMITS ARE USED.
2. INCLUDE SPEED LIMIT SIGNS ONLY IF THERE IS A REASON TO RESTRICT SPEED, COVER OR REMOVE CONFLICTING EXISTING SPEED LIMIT SIGNS.
3. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
4. LARGER SIGN SIZES MAY BE APPROVED BY THE PROJECT MANAGER.
5. PLACE END ROAD WORK SIGN AT END OF PROJECT LIMITS.
6. POST EXISTING SPEED LIMIT IF CHANGED BY WORK ZONE.

---

** LEGEND
- ** FLEXIBLE GUIDE POSTS
- • PLASTIC DRUMS
- - DENOTES SIGNS THAT ARE UNIQUE TO MONTANA
- XX SPEED DETERMINED BY THE PROJECT MANAGER (25 M.P.H. OR 35 M.P.H.)

---

** DETAIL DRAWING

** REFERENCES
- DWG. NO. 618-U25
- STANDARD SPEC. 618
- SECTION 618

** LEFT LANE CLOSURE
- (LOW SPEED URBAN MULTI-LANE, UNDIVIDED ROAD)

---

** EFFECTIVE: SEPTEMBER 2014
- OCTOBER 2017
- MONTANA DEPARTMENT OF TRANSPORTATION
**NOTES:**

1. Use this sign layout in urban applications. Only use the rural, open roadway signing details when higher speed limits are used.

2. Include speed limit signs only if there is a reason to restrict speed. Cover or remove conflicting existing speed limit signs.

3. The buffer space may be increased for downgrades and other conditions that affect stopping distance.

4. Larger sign sizes may be approved by the project manager.

5. Place end road work signs at end of project limits.

6. Post existing speed limit if changed by work zone.

7. See DTL. DWG. 610-03.

**LEGEND**

- Flexible guide posts
- Plastic drums
- Denotes signs that are unique to Montana.

XX = Speed determined by the project manager (25 M.P.H. or 35 M.P.H.)

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**
**SPACE ALL CHANNELIZING DEVICES AT "0" UNLESS OTHERWISE NOTED.**

<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT FOR WORK ZONE</th>
<th>SIGN SPACING (A)</th>
<th>TAPE LENGTH (L)</th>
<th>SPEACING OF CHANNELIZING DEVICES (MAX.) (G)</th>
<th>BUFFER SPACE (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(M.P.H.)</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
</tr>
</tbody>
</table>

**NOTES:**

1. USE THIS SIGN LAYOUT IN URBAN APPLICATIONS ONLY. USE THE RURAL, OPEN ROADWAY SIGNING DETAILS WHEN HIGHER SPEED LIMITS ARE USED.
2. INCLUDE SPEED LIMIT SIGNS ONLY IF THERE IS A REASON TO RESTRICT SPEED. COVER OR REMOVE CONFLICTING EXISTING SPEED LIMIT SIGNS.
3. THE BUFFER SPACE MAY BE INCREASED FOR DOWNGRADES AND OTHER CONDITIONS THAT AFFECT STOPPING DISTANCE.
4. THE SHOULDER TAPER MAY BE OMITTED WHEN THE PAVED SHOULDER IS LESS THAN 8' [2.4 m] IN WIDTH.
5. LARGER SIGN SIZES MAY BE APPROVED BY THE PROJECT MANAGER.
6. PLACE END ROAD WORK SIGNS AT END OF PROJECT LIMITS.
7. POST EXISTING SPEED LIMIT IF CHANGED BY WORK ZONE.
8. SEE DTL. DWG. 618-03.

---

**LEGEND**

- "**" FLEXIBLE GUIDE POSTS
- • PLASTIC DRUMS
- •• DENOTES SIGNS THAT ARE UNIQUE TO MONTANA
- XX SPEED DETERMINED BY THE PROJECT MANAGER. (25 M.P.H. OR 35 M.P.H.)
- # ORBITERATE CONFLICTING PAVEMENT MARKINGS WHEN WORK OPERATION IS LONGER THAN 3 DAYS. (DO NOT REMOVE THERMOPLASTIC)

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
NOTES:

1. 6' [1.8 m] minimum; 50' [15.2 m] maximum.

2. Place R1-1 sign at the beginning of curb radius or shoulder radius, or 4 feet (1.2 m) in advance of the marked or unmarked crosswalk.

3. See plans for final signing and pavement marking locations.

4. Use hardware meeting the requirements of Section 704.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
CONFORM ALL ALUMINUM SIGNS TO SECTIONS 619, AND 704.

FOR SIGNS 4'-0" (1200) HIGH BY 6'-0" (1800) LONG OR LESS USE A SINGLE SHEET OF ALUMINUM.

DO NOT USE HORIZONTAL JOINTS IN SIGNS 8'-0" (2400) IN WIDTH OR SMALLER. THE MINIMUM SHEET WIDTH IS 2'-0" (600).

SIGNS OVER 6'-0" (1800) HIGH MAY HAVE HORIZONTAL AND VERTICAL JOINTS. THE MINIMUM SHEET SIZE IS 1'-6" (450) WIDE BY 1'-6" (450) HIGH.

CLEAN AND DRY POST CLIP NUTS, THEN TORQUE TO 225 INCH-POUNDS (25.4 Nm).

LOCATE ALL HORIZONTAL JOINTS AT A "T"-SECTION.

USE SCREWS, BOLTS AND LOCKWASHERS MEETING THE REQUIREMENTS OF SECTION 704.

USE ONLY ALUMINUM RIVETS.

THE MAXIMUM GAP BETWEEN INDIVIDUAL SIGN PANELS AT JOINTS IS 1/16" (1.6) AT ANY POINT.

THE PROJECT MANAGER MAY APPROVE ADDITIONAL METHODS TO PREVENT LIGHT LEAKAGE THROUGH SIGN PANEL SEAMS.

MAXIMUM WIDTH "B" (mm)

<table>
<thead>
<tr>
<th>POST</th>
<th>2 POST</th>
<th>3 POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'-0&quot;</td>
<td>18'-0&quot;</td>
<td>22'-0&quot;</td>
</tr>
<tr>
<td>2'-0&quot;</td>
<td>17'-0&quot;</td>
<td>21'-0&quot;</td>
</tr>
<tr>
<td>1'-0&quot;</td>
<td>12'-0&quot;</td>
<td>15'-0&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>14&quot;</td>
<td>18&quot;</td>
</tr>
</tbody>
</table>

FOR ALUMINUM PLATE THICKNESS INFORMATION SEE SECTION 704.

METRIC BACKBRACING TABLE - ALUMINUM SIGNS

<table>
<thead>
<tr>
<th>SPACING &quot;A&quot; (mm)</th>
<th>500</th>
<th>550</th>
<th>600</th>
<th>750</th>
<th>900</th>
<th>1050</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'-0&quot;</td>
<td>5400</td>
<td>5100</td>
<td>4950</td>
<td>4425</td>
<td>4050</td>
<td>3750</td>
</tr>
<tr>
<td>2'-0&quot;</td>
<td>8100</td>
<td>7700</td>
<td>7400</td>
<td>6600</td>
<td>6000</td>
<td>5550</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPACING &quot;A&quot; (mm)</th>
<th>12'-0&quot;</th>
<th>13'-0&quot;</th>
<th>14'-0&quot;</th>
<th>16'-0&quot;</th>
<th>18'-0&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'-0&quot;</td>
<td>1050</td>
<td>1050</td>
<td>1050</td>
<td>1050</td>
<td>1050</td>
</tr>
</tbody>
</table>

NOTES:

1. DO NOT USE HORIZONTAL JOINTS IN SIGNS 8'-0" (2400) IN WIDTH OR SMALLER. THE MINIMUM SHEET WIDTH IS 2'-0" (600).

2. SIGNS OVER 6'-0" (1800) HIGH MAY HAVE HORIZONTAL AND VERTICAL JOINTS. THE MINIMUM SHEET SIZE IS 1'-6" (450) WIDE BY 1'-6" (450) HIGH.

3. CLEAN AND DRY POST CLIP NUTS, THEN TORQUE TO 225 INCH-POUNDS (25.4 Nm).

4. LOCATE ALL HORIZONTAL JOINTS AT A "T"-SECTION.

5. USE SCREWS, BOLTS AND LOCKWASHERS MEETING THE REQUIREMENTS OF SECTION 704.

6. USE ONLY ALUMINUM RIVETS.

7. THE MAXIMUM GAP BETWEEN INDIVIDUAL SIGN PANELS AT JOINTS IS 1/16" (1.6) AT ANY POINT.

8. THE PROJECT MANAGER MAY APPROVE ADDITIONAL METHODS TO PREVENT LIGHT LEAKAGE THROUGH SIGN PANEL SEAMS.
USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704. THE PLANS SPECIFY OTHERWISE FOR SPECIAL DESIGN SIGNS.

CONSTRUCT PLYWOOD SIGNS OF ONE PIECE OF PLYWOOD UNLESS HIGH.

THE MINIMUM SIZE PANEL IS 1'-6" [450] WIDE BY 4'-0" [1200] JOINT IN LIEU OF USING STANDARD LENGTH PANEL AS SHOWN.

MAY BE OBTAINED WITH PANELS HAVING A FACTORY SCARFED JOINT FOR SIGNS OVER 10'-0" [3000] IN HEIGHT, THE FULL HEIGHT [1200], PLACE THE ODD LENGTH PANEL ON THE INSIDE EDGE.

FOR SIGNS WITH WIDTHS THAT ARE NOT IN MULTIPLES OF 4'-0"

DO NOT USE HORIZONTAL JOINTS ON SIGNS LESS THAN 4'-0" PANELS LESS THAN 4'-0" IN HEIGHT.

ON SIGNS 4'-0" [1200] HIGH AND GREATER, DO NOT USE ANY BACKBRACING.

CONFORM ALL PLYWOOD SIGNS TO SECTIONS 619 AND 704.

NOTE:

1. Conform all plywood signs to Sections 619 and 704.
2. On signs 4'-0" [1200] high and greater, do not use any panels less than 4'-0" (1200) in height.
3. Do not use horizontal joints on signs less than 4'-0" (1200) in height.
4. For signs with widths that are not in multiples of 4'-0" (1200), place the odd length panels on the inside edges.
5. For signs over 15'-0" [4500] in height, the full height may be obtained with panels having a Factory Scarf Joint in lieu of using standard (center panel) as shown.
6. The minimum size panel is 5'-0" (1500) wide by 4'-0" (1200) high.
7. Construct plywood signs of one piece of plywood unless the plans specify otherwise for special design signs.
8. Use hardware meeting the requirements of Section 704.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

REFERENCE NO. 619-06
SECTION 619-20

PLYWOOD SHEET INCREMENT GUIDE SIGN
CONSTRUCTION DETAILS

DETAILED DRAWING

MT DNR 2014-10-19-06
MONTANA DEPARTMENT OF TRANSPORTATION

DETAIL A VERTICAL JOINT
DETAIL B HORIZONTAL JOINT

BACKBRACING TABLE - PLYWOOD SIGNS

<table>
<thead>
<tr>
<th>MAXIMUM BACKBRACE SPACING</th>
<th>PLYWOOD SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 POST</td>
<td>3 POST</td>
</tr>
<tr>
<td>1'-0&quot;</td>
<td>1'-0&quot;</td>
</tr>
<tr>
<td>1'-2&quot;</td>
<td>1'-2&quot;</td>
</tr>
<tr>
<td>1'-4&quot;</td>
<td>1'-4&quot;</td>
</tr>
<tr>
<td>1'-6&quot;</td>
<td>1'-6&quot;</td>
</tr>
</tbody>
</table>

DIMENSIONS

| MAXIMUM WIDTH OF | maximum width
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 POST (in.)</td>
<td>3 POST (in.)</td>
</tr>
<tr>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>600</td>
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<td>850</td>
<td>850</td>
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<tr>
<td>900</td>
<td>900</td>
</tr>
</tbody>
</table>

METRIC DIMENSIONS

<table>
<thead>
<tr>
<th>MAXIMUM BACKBRACE SPACING</th>
<th>PLYWOOD SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 POST [mm]</td>
<td>3 POST [mm]</td>
</tr>
<tr>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>600</td>
<td>600</td>
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<tr>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>850</td>
<td>850</td>
</tr>
</tbody>
</table>

NOTES:

1. Use hardware meeting the requirements of Section 704.
NOTES:

1. MOUNTING SYSTEMS SHOWN ARE TYPICAL. OTHER SYSTEMS MAY BE APPROVED BY THE PROJECT MANAGER.
2. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
3. SEE THE SIGNING PLANS FOR THE TYPES OF POSTS AND FOUNDATIONS.
4. MOUNT THE TOP OF WOOD SIGNS DIRECTLY TO WOOD POLES OR POSTS, WHEN SPECIFIED IN THE PLANS, BY BOLTING THROUGH THE SIGN PLATE AND THE POLE AS REQUIRED BY THE DETAILED DRAWINGS, SPECIFICATIONS AND DESIGN.
5. USE "T"-SECTION WOOD BEAMS WHEN SPECIFIED BY DTL. DWG. NO. 619-20.
6. USING LARGE SUPPLEMENTAL SIGNS ADDED AFTER INITIAL SIGN INSTALLATION, FROM MAJOR SIGN PANELS OR BACKBRACING, ATTACHMENT TO MULTIPLE POSTS/POLES IS NOT ALLOWED.
7. USE POST SPACING, POST SIZE AND BREAKAWAY DEVICES SPECIFIED IN THE PLANS AND IN THE SPECIFICATIONS. FOR INFORMATION REGARDING APPROPRIATE BREAKAWAY DEVICES FOR NEW INSTALLATIONS NOT SUPPORTED BY THE PLANS, CONTACT THE TRAFFIC UNIT.
8. IN INSTALLING SIGNS, AVOID PLACING POSTS IN DITCH MOUTIONS WHERE THEY WOULD IMPede DRAINAGE.
9. DIMENSIONS ARE SPECIFIED IN THE SIGNING PLANS.

CENTER POST IS DESIGNATED WHERE 3 POSTS ARE REQUIRED, = 0.35 x B FOR 3 POSTS
= 0.60 x B FOR 2 POSTS

POST SPACING WIDTH:
= 0.8 x B FOR 2 POSTS
= 0.35 x B FOR 3 POSTS
WHERE 3 POSTS ARE USED, THE CENTER POST IS DESIGNATED 2 POST.

GUIDE SIGN CLEARANCE OR MOUNTING DETAILS

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DIMENSIONS ARE SPECIFIED IN THE SIGNING PLANS.

IMPEDE DRAINAGE.

IN LOCATING SIGNS, AVOID PLACING POSTS IN DITCH MOUTIONS WHERE THEY WOULD IMPede DRAINAGE.

MOUNTING SYSTEMS SHOWN ARE TYPICAL. OTHER SYSTEMS MAY BE APPROVED BY THE PROJECT MANAGER.

USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

SEE THE SIGNING PLANS FOR THE TYPES OF POSTS AND FOUNDATIONS.

MOUNT THE TOP OF WOOD SIGNS DIRECTLY TO WOOD POLES OR POSTS, WHEN SPECIFIED IN THE PLANS, BY BOLTING THROUGH THE SIGN PLATE AND THE POLE AS REQUIRED BY THE DETAILED DRAWINGS, SPECIFICATIONS AND DESIGN.

USE "T"-SECTION WOOD BEAMS WHEN SPECIFIED BY DTL. DWG. NO. 619-20.

USING LARGE SUPPLEMENTAL SIGNS ADDED AFTER INITIAL SIGN INSTALLATION, FROM MAJOR SIGN PANELS OR BACKBRACING, ATTACHMENT TO MULTIPLE POSTS/POLES IS NOT ALLOWED.

USE POST SPACING, POST SIZE AND BREAKAWAY DEVICES SPECIFIED IN THE PLANS AND IN THE SPECIFICATIONS. FOR INFORMATION REGARDING APPROPRIATE BREAKAWAY DEVICES FOR NEW INSTALLATIONS NOT SUPPORTED BY THE PLANS, CONTACT THE TRAFFIC UNIT.

IN INSTALLING SIGNS, AVOID PLACING POSTS IN DITCH MOUTIONS WHERE THEY WOULD IMPede DRAINAGE.

DIMENSIONS ARE SPECIFIED IN THE SIGNING PLANS.
EXISTING SIGN FACE
SHEET ALUMINUM OVERLAY
EXISTING ALUMINUM SIGNS
EXISTING PLYWOOD SIGNS

FASTENER PATTERN

NOTES:

① REMOVE ALL RAISED LETTERS, NUMERALS, SYMBOLS, BORDERS AND
PREVIOUS SIGN OVERLAYS TO BE REPLACED, AND CLEAN SIGN FACE
TO A SMOOTH SURFACE BEFORE OVERLAYING.

② ALL LETTERS, NUMERALS, SYMBOLS AND BORDERS ARE TYPE "C"
CUTOUT UNLESS OTHERWISE SPECIFIED, AND APPLIED TO THE BACK-
GROUND SHEETING PRIOR TO FIELD APPLICATION OF THE SIGN.

③ THE SIZE OF ALL GUIDE SIGN OVERLAYS AND LEGENDS MUST BE
VERIFIED BY THE PROJECT MANAGER PRIOR TO FABRICATION.

④ AN ADHESIVE-BACKED SHEETING MAY BE USED AS AN ALTERNATIVE
ON SIGN WIDTHS OF 6'-0" [1800] OR LESS IF IT IS PREFABRICATED TO
A MINIMUM THICKNESS OF 0.005" [.13] AND CONSTRUCTED OF
PREAPPLIED REFLECTIVE SHEETING ON ADHESIVE-BACKED ALUMINUM.
APPLY ADHESIVE-BACKED OVERLAY SHEETING WHEN AIR AND SURFACE
TEMPERATURES ARE ABOVE 50°F (10°C). DO NOT USE THIS TYPE
OF OVERLAY MATERIAL ON OVERHEAD SIGNS.

⑤ PROVIDE A MINIMUM REFLECTIVE SHEETING INTENSITY OF TYPE 4,
MEETING THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS,
UNLESS SPECIFIED OTHERWISE.

⑥ APPLY ALL MATERIALS IN ACCORDANCE WITH THE MANUFACTURER’S
SPECIFICATIONS AND RECOMMENDATIONS.

⑦ USE ALUMINUM ALLOY TYPE 6061-T6 OR AA5052-H38. CONVERSION
COAT ALL ALUMINUM WITH A PROCESS SUCH AS ALODINE 1200 (OR
EQUAL), AND RINSE AND DRY THOROUGHLY. PROTECT IT FROM SOIL
BY ACCEPTABLE METHODS.

⑧ SIGN OVERLAYS MAY REQUIRE REMOVAL OF THE SIGN FROM THE POSTS
TO AVOID PROJECTING BOLT HEADS. DO NOT LEAVE WARNING AND
REGULATORY SIGNS TO BE OVERLayed UNDISPLAYED FOR MORE THAN
ONE (1) HOUR DURING DAYLIGHT. DO NOT LEAVE GUIDE SIGNS
UNDISPLAYED FOR MORE THAN TEN (10) HOURS DURING DAYLIGHT.
INSURE SIGNS TO BE OVERLAYED ARE OPERATIONAL PRIOR TO
DARKNESS.

⑨ OVERLAY SIGNS SMALLER THAN 4'-0" x 6'-0" [1200 x 1800] WITH
ONE PANEL OF MATERIAL. FOR SEAMS IN LARGE OVERLAYS, USE
RIVETS OR BOLTS SPACED AS SHOWN ON THIS DRAWING AND
PLACE PARALLEL TO AND NO MORE THAN 3" [75] LATERALLY
FROM THE SEAM.

⑩ USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
### Base Connection Data

<table>
<thead>
<tr>
<th>Post Size</th>
<th>Bolt Size</th>
<th>Bolt Torque</th>
<th>Dimensions (in)</th>
<th>Base Plate Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>W4 x 12</td>
<td>3/8-16 x 3</td>
<td>40 ft-lb</td>
<td>6-1/2&quot; x 3-1/4&quot;</td>
<td>3/16&quot;</td>
</tr>
<tr>
<td>W6 x 16</td>
<td>5/16-18 x 3</td>
<td>40 ft-lb</td>
<td>12-1/2&quot; x 3-1/4&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>W8 x 24</td>
<td>3/4-10 x 3</td>
<td>60 ft-lb</td>
<td>12&quot; x 3-1/4&quot;</td>
<td>5/16&quot;</td>
</tr>
<tr>
<td>3/4 x 72</td>
<td>3/4-10 x 4</td>
<td>60 ft-lb</td>
<td>12-1/2&quot; x 3-1/4&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>3-1/2 x 103</td>
<td>3/4-10 x 4</td>
<td>60 ft-lb</td>
<td>19-1/2&quot; x 3-1/4&quot;</td>
<td>5/16&quot;</td>
</tr>
</tbody>
</table>

### Fuse Plate Data

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Plate Thickness</th>
<th>Plate Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/16&quot;</td>
<td>0.012&quot; ±</td>
<td>t</td>
</tr>
<tr>
<td>1-1/8&quot;</td>
<td>0.012&quot; ±</td>
<td>t</td>
</tr>
<tr>
<td>1&quot;</td>
<td>0.012&quot; ±</td>
<td>t</td>
</tr>
</tbody>
</table>

### Foundation Data

<table>
<thead>
<tr>
<th>Post Size</th>
<th>Bolt Size</th>
<th>Bolt Torque</th>
<th>Dimensions (in)</th>
<th>Base Plate Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>W4 x 12</td>
<td>3/8-16 x 3</td>
<td>40 ft-lb</td>
<td>6-1/2&quot; x 3-1/4&quot;</td>
<td>3/16&quot;</td>
</tr>
<tr>
<td>W6 x 16</td>
<td>5/16-18 x 3</td>
<td>40 ft-lb</td>
<td>12-1/2&quot; x 3-1/4&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>W8 x 24</td>
<td>3/4-10 x 3</td>
<td>60 ft-lb</td>
<td>12&quot; x 3-1/4&quot;</td>
<td>5/16&quot;</td>
</tr>
<tr>
<td>3/4 x 72</td>
<td>3/4-10 x 4</td>
<td>60 ft-lb</td>
<td>12-1/2&quot; x 3-1/4&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>3-1/2 x 103</td>
<td>3/4-10 x 4</td>
<td>60 ft-lb</td>
<td>19-1/2&quot; x 3-1/4&quot;</td>
<td>5/16&quot;</td>
</tr>
</tbody>
</table>

### Notes

1. Assemble post to stub with bolts and one fuse washer between plates.
2. Tighten bolts in a systematic order to the prescribed torque (see tables).
3. Use hardware meeting the requirements of Section 704.

### Procedure for Foundation Assembly

1. Assemble post to stub with bolts and one fuse washer between plates.
2. Show as required to plumb post.
3. Tighten nuts at bottom. Use center punch to prevent nuts from turning.

### Notes on Sign Post Details

- DO NOT USE ON SINGLE POST SIGNS.
- USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
- USE CLASS GENERAL CONCRETE WITH A SMOOTH FINISH.
- USE ONLY WITH SINGLE POST SIGNS.

### Notes on Fuse Plate Details

- SHIMS FABRICATED FROM BRASS SHIM STOCK.
- FLAT HARD FUSE PLATE ASSEMBLY WITH SLOTS TOWARDS BASE.
- TOP PLATE THICKNESS = t.
**TELESCOPED SQUARE TUBES SIGN POST INSTALLATION ON SLIP BASE**

- As noted by the triangle symbol in the location and specification sheets.

**SINGLE SQUARE TUBE SIGN TO POST INSTALLATION ON SLIP BASE**

- As noted by the circle symbol in the location and specification sheets.

---

**NOTES:**

- Breakaway devices must be listed on the Department's Qualified Products list.
- Use class general concrete with 80 psi minimum compressive strength.
- Use one coat of aluminum paint. See specification sheets.
- Check the sign framing for any special requirements.
- Use hardware meeting the requirements of Section 2.4a.
- Paint pipe with one shop coat of 2.25" or 2.5" square tubing.
- Use post to manufacturer recommendations for installation and use.
AS SPECIFIED PIPE POST

2" x 2" x 32" x 1/4" L

CLIP PLATE

WASHER AND NUT
HEAD BOLT, PLATE WASHER,
5/16" DIA. [M8] HEX HEAD

FOR STANDARD HOLE SPACING IN SIGNS.

ASSEMBLY SHOWN ARE TYPICAL AND HOLE SPACING OF EACH SIGN. THE LENGTH OF EACH ANGLE BRACKET DEPENDS ON THE MOUNTING ASSEMBLY.

REFER TO FHWA'S "STANDARD HIGHWAY SIGNS" IN A LIKE MANNER.

FOR STANDARD HOLE SPACING IN SIGNS.

SEE SIGNING PLANS FOR ROUTE MARKER ASSEMBLIES. ERECT SIMILAR ASSEMBLIES ASSEMBLIES SHOWN ARE TYPICAL AND HOLE SPACING OF EACH SIGN. THE LENGTH OF EACH ANGLE BRACKET DEPENDS ON THE MOUNTING ASSEMBLY.

NOTE: THE COST FOR MOUNTING D-3 SIGNS IS ABSORBED IN OTHER BID ITEMS OF THE CONTRACT.

REFER TO FRAME'S "STANDARD HIGHWAY SIGN" STYLE FOR 2-S STREET NAME SIGN TYPICAL LAYOUT.

THE CONTRACT.

THE COST FOR MOUNTING D-3 SIGNS IS ABSORBED IN OTHER BID ITEMS OF THE CONTRACT.

NOTE: THE COST FOR MOUNTING D-3 SIGNS IS ABSORBED IN OTHER BID ITEMS OF THE CONTRACT.

NOTE: THE COST FOR MOUNTING D-3 SIGNS IS ABSORBED IN OTHER BID ITEMS OF THE CONTRACT.
NOTES:

1. REFER TO FHWA MANUAL "STANDARD HIGHWAY SIGNS" FOR STANDARD HOLE SPACING IN SIGNS.
2. USE POST CLIPS AS SHOWN IN SIGNING DETAILED DRAWINGS. ALTERNATE A WHEN CANTILEVER MOUNTING IS NEEDED.
3. USE POSTS ONE SIZE LARGER THAN THOSE REQUIRED FOR STANDARD MOUNTINGS.
4. DIMENSIONS FOR POST CLIP SPACING ARE SHOWN TO THE TOP OF EACH CLIP.
5. ALTERNATE MOUNTING MUST BE APPROVED BY THE PROJECT MANAGER.
6. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
7. USE POST CLIPS AS SHOWN IN SIGNING DETAILED DRAWINGS. ALTERNATE A WHEN CANTILEVER MOUNTING IS NEEDED.
8. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
9. DRAWING NO. 619-12 WHEN CANTILEVER MOUNTING IS NEEDED.
RIVET SPACING

SEE RIVET SPACING DTL. RIGHT

SIGN FACE 36" x 48" [900 x 1200]

STRUCTURAL STEEL POST

RIVET SPACING

2 3/4" x 2 3/8" x 28" [69.9 x 60.4 x 700] EXTRUDED "T"-SECTION BACKBRACE (SEE DTL. DWG. NO. 619-04)

SIGN FACE 48" x 60" [1200 x 1500]

STRUCTURAL STEEL POST

RIVET SPACING

2 3/4" x 2 3/8" x 34" [69.9 x 60.4 x 850] EXTRUDED "T"-SECTION BACKBRACE (SEE DTL. DWG. NO. 619-04)

NOTE:

1. SEE THE PLANS FOR BACKBRACING REQUIREMENTS.
2. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

WS 2 3/4" x 2 3/8" x 28" [69.9 x 60.4 x 700] EXTRUDED "T"-SECTION BACKBRACE (SEE DTL. DWG. NO. 619-04)

WS 2 3/4" x 2 3/8" x 34" [69.9 x 60.4 x 850] EXTRUDED "T"-SECTION BACKBRACE (SEE DTL. DWG. NO. 619-04)

DWG. NO. 619-04) BACKBRACE (SEE DTL. EXTRUDED "T"-SECTION [69.9 x 60.4 x 650] 2 3/4" x 2 3/8" x 28"

SIGN FACE 36" x 48" [900 x 1200]

SIGN FACE 48" x 60" [1200 x 1500]

STEEL POST STRUCTURAL

DWG. NO. 619-04) BACKBRACE (SEE DTL. EXTRUDED "T"-SECTION [69.9 x 60.4 x 700] 2 3/4" x 2 3/8" x 28"
NOTE:
1. SIGNS OF THESE SIZES AND LARGER REQUIRE WOOD BACKBRACING.
2. SMALLER SIGNS MAY REQUIRE BACKBRACING IF THE CONDITIONS WARRANT (SEE SIGNING PLANS).
   IN THIS CASE, THE CONTRACTOR HAS THE OPTION OF USING WOOD OR STEEL BACKBRACING (SEE DTL. DWG. NO. 619-22).

WOOD BACKBRACE INSTALLATIONS

SIGN MOUNTING DETAIL

NOTE:
1. CONFORM ALL WOOD POLES TO THE REQUIREMENTS OF SECTION 704.
2. GAIN ALL POLES ON THE SIGN SIDE THE MINIMUM WIDTH SHOWN IN THE TABLE ON DTL. DWG. NO. 619-20, FOR HALF THE LENGTH OF EACH POLE.
3. USE TREATED 2" x 4" [50 x 100] S4S LUMBER FOR ALL WOOD BACKBRACING, CONFORMING TO THE REQUIREMENTS OF SECTION 704.
4. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
5. SEE DTL. DWG. NO. 619-20 FOR BREAKAWAY AND SUPPORT DETAILS.

GAIN DETAIL

TOP END TREATMENT
WARNING SIGNS

NO PASSING PENNANTS

REGULATORY SIGNS

STEEL BACKBRACE INSTALLATIONS

<table>
<thead>
<tr>
<th>POLE DIAMETER (IN)</th>
<th>BACKBRACE DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3' (91.44)</td>
<td>A</td>
</tr>
<tr>
<td>2' 1/8&quot; (54.00)</td>
<td>B</td>
</tr>
<tr>
<td>2' 1/8&quot; (54.00)</td>
<td>C</td>
</tr>
<tr>
<td>3' 3/4&quot; (95.30)</td>
<td>5/16&quot; DIA. [M8] PLATE WASHER</td>
</tr>
<tr>
<td></td>
<td>5/16&quot; DIA. [M8] HEX HEAD BOLT, PLATE WASHER, LOCK WASHER AND NUT</td>
</tr>
</tbody>
</table>

STEEL BACKBRACE DETAILS

NOTES:

1. USE COMMERCIAL QUALITY, MILD STEEL THAT IS HOT-DIPPED AFTER FABRICATION. GALVANIZE IN ACCORDANCE WITH SUBSECTION 711.08.
2. SEE DTL. DWG. NO. 619-20 FOR ADDITIONAL SIGN MOUNTING REQUIREMENTS. MOUNT SIGN FACE TO POLE BEFORE INSTALLING BACKBRACING.
3. SEE DTL. DWG. NO. 619-20 FOR BREAKAWAY AND SUPPORT DETAILS.
4. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.
STANDARD SPEC.
SECTION 619, 704, 711

TREATED WOOD POLE OPTIONAL BACKBRACE

EFFECTIVE: SEPTEMBER 2014

MTA MONTANA DEPARTMENT OF TRANSPORTATION
DETAILED DRAWING

EFFECTIVE: SEPTEMBER 2014

METRIC DIMENSIONS (mm)

<table>
<thead>
<tr>
<th>SIGN SIZE (mm)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>450 x 600</td>
<td>6 x 50 x 580</td>
<td>380</td>
<td>225</td>
<td>450</td>
<td>450</td>
</tr>
<tr>
<td>600 x 750</td>
<td>6 x 50 x 655</td>
<td>455</td>
<td>300</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>750 x 900</td>
<td>6 x 50 x 735</td>
<td>535</td>
<td>375</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>900 x 1200</td>
<td>6 x 50 x 810</td>
<td>610</td>
<td>450</td>
<td>900</td>
<td>900</td>
</tr>
</tbody>
</table>

NOTES:

1. INSTALL CHEVRONS WITH A MINIMUM 10'-0" (3.0 m) HORIZONTAL CLEARANCE AND A 5'-0" (1.5 m) VERTICAL MOUNTING HEIGHT.
2. SPACING FOR DESIGN PURPOSES IS DOUBLE THE SPACING SHOWN IN THE TABLE ON DTL DWG. NO. 619-26, UP TO A MAXIMUM CHEVRON SPACING OF 200’ (60 m). A MINIMUM OF 3 VISIBLE CHEVRONS ARE REQUIRED THROUGH A CURVE.
3. FIELD INSPECT THE CHEVRONS AT NIGHT AND ADJUST THEIR LOCATIONS TO ACHIEVE 500’ [150 m] OF VISIBILITY.
4. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
MAJOR SIGN PANEL
CLOSED
OPEN

2'-8" [304.8]
1'-0" [304.8]
HASP KEEPER (TYP.)

NOTES:
1. SEE SIGNS AND SIGNING MATERIALS CATALOG FOR COMPLETE LISTING OF SIGNS AND SIGN SIZES. DETAILS ARE AVAILABLE FROM THE TRAFFIC ENGINEERING DIVISION FOR SIGN UNITS UNIQUE TO MONTANA.
3. PAINT ALL HARDWARE VISIBLE ON THE SIGN FACE OR COVER WITH RETRO-REFLECTIVE SHEETING, THE SAME COLOR AS THE SIGN.
4. SUBMIT SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION.
5. SUPPLEMENTAL SIGN PANEL BELOW MAJOR SIGN PANEL MUST HAVE RETRO-REFLECTORIZED LEGEND AND BACKGROUND COLORS OF MAJOR PANEL.
6. THE MINIMUM MOUNTING HEIGHT TO THE BOTTOM OF THE SECONDARY PANEL IS 2'-0" [609.6].
7. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

NOTE: UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS [mm] UNLESS OTHER UNITS ARE SHOWN.

UNLESS OTHER UNITS ARE SHOWN.
DESIGN A USAGE:
Use for continuous delineation and at
intersections of all
interstates and highways.

DESIGN B USAGE:
Use on left shoulder
of interstate routes.

DESIGN C USAGE:
Gore LT & RT for wrong way travelers.
Interchange off ramps from mid-point to
use for truck escape ramps and
crossroads.

DESIGN D USAGE:
Use at approaches with
radius greater than 677
(200 m) to 765
(230 m). Radius,
intersection, or
crossroad.

DESIGN E USAGE:
Use for truck escape ramps and
interchange off ramps from midpoint to
use for two-way traffic.

DESIGN F USAGE:
Use for crossROADS
outside and inside of curves.

DESIGN G USAGE:
Use on left shoulder
of interstate routes.

DESIGN H USAGE:
Use on left shoulder
of interstate routes.

DESIGN J USAGE:
Use for truck escape ramps and
interchange off ramps from midpoint to
use for two-way traffic.

NOTES:
1. Some typical users are shown
for each design. Refer to the
notes for proper usage.
2. Use hardware meeting the
requirements of Section 204.

SNOWPOLE DELINERATOR DETAILS:
- 1/4" x 1" (6 x 25) bolt
- 1/4" x 3" (6 x 75) bolt
- 1/2" (8) flat washer
- 1/8" (4) hex nut
- 5/8" (16) drill
- Aluminum strap (shop bend)

FRONTAGE DETAILS:
HORIZONTAL CURVE SPACING TABLE

<table>
<thead>
<tr>
<th>RADIUS (m)</th>
<th>SPACING ON CURVE (m)</th>
<th>SPACING ON BOTH APPROACH TANGENTS (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5730 &amp; up</td>
<td>A 300</td>
<td>B 400</td>
</tr>
<tr>
<td>2862 - 5729</td>
<td>A 225</td>
<td>B 300</td>
</tr>
<tr>
<td>1910 - 2864</td>
<td>A 160</td>
<td>B 220</td>
</tr>
<tr>
<td>1433 - 1909</td>
<td>A 130</td>
<td>B 260</td>
</tr>
<tr>
<td>955 - 1432</td>
<td>A 110</td>
<td>B 220</td>
</tr>
<tr>
<td>716 - 954</td>
<td>A 100</td>
<td>B 185</td>
</tr>
<tr>
<td>478 - 715</td>
<td>A 75</td>
<td>B 150</td>
</tr>
<tr>
<td>287 - 477</td>
<td>A 65</td>
<td>B 125</td>
</tr>
<tr>
<td>0 - 286</td>
<td>A 45</td>
<td>B 90</td>
</tr>
</tbody>
</table>

METRIC HORIZONTAL CURVE SPACING TABLE

<table>
<thead>
<tr>
<th>RADIUS (m)</th>
<th>SPACING ON CURVE (m)</th>
<th>SPACING ON BOTH APPROACH TANGENTS (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1750 &amp; up</td>
<td>A 90</td>
<td>B 120</td>
</tr>
<tr>
<td>900 - 1749</td>
<td>A 65</td>
<td>B 120</td>
</tr>
<tr>
<td>600 - 999</td>
<td>A 50</td>
<td>B 95</td>
</tr>
<tr>
<td>450 - 599</td>
<td>A 40</td>
<td>B 75</td>
</tr>
<tr>
<td>300 - 449</td>
<td>A 35</td>
<td>B 65</td>
</tr>
<tr>
<td>200 - 299</td>
<td>A 25</td>
<td>B 55</td>
</tr>
<tr>
<td>150 - 199</td>
<td>A 20</td>
<td>B 45</td>
</tr>
<tr>
<td>100 - 149</td>
<td>A 20</td>
<td>B 35</td>
</tr>
<tr>
<td>0 - 99</td>
<td>A 15</td>
<td>B 25</td>
</tr>
</tbody>
</table>

NOTES:

1. FURNISH RETRO-REFLECTIVE SHEETING ACCORDING TO THE STANDARD SPECIFICATIONS FOR RETRO-REFLECTIVE SHEETING B (HIGH INTENSITY). POSITION DELINEATOR FACES PERPENDICULAR TO THE TANGENT TO CURVE CENTERLINE AS SHOWN IN FIGURE B.


3. PLACE DELINEATORS AT A CONSTANT CLEARANCE DISTANCE FROM THE EDGE OF THE PAVEMENT EXCEPT WHERE GUARDRAIL OR OTHER OBSTRUCTIONS INTERFERE. ALIGN THE DELINEATORS WITH THE INSIDE EDGE OF THE OBSTRUCTION CLEARANCE FOR DELINEATORS IS 6'-0" (1.8 m) ON INTERSTATE HIGHWAYS, 2'-0" TO 6'-0" (0.6 m TO 1.8 m) ON PRIMARY AND SECONDARY HIGHWAYS OR AS DETERMINED BY THE PROJECT MANAGER. THE STANDARD MOUNTING HEIGHT IS 4'-0" (1.2 m) TO THE TOP OF THE POST. SUPPLY POST LENGTHS TO MAINTAIN THE PROPER MOUNTING HEIGHT AND A MINIMUM OF 18" (0.45 m) EMBEDMENT.

4. SPACE DELINEATORS ACCORDING TO THE DISTANCES FOUND IN THE TABLE ABOVE OR AS SPECIFIED IN THE PLANS. IN FIGURE A, IF "F" IS GREATER THAN 20' (6 m) ADD ONE REGULAR DELINEATOR IN AT "A" SPACING. UNDER NORMAL SPACING, SHOULDER DELINEATOR FALL WITHIN A CROSSROAD OR APPROACH, IT MAY BE MOVED IN EITHER DIRECTION A DISTANCE NOT TO EXCEED ONE QUARTER OF THE NORMAL SPACING. ELIMINATE DELINEATORS STILL FALLING IN SUCH AREAS.

5. ALL DELINEATOR REFLECTORS HAVE 3/4" (18.75) CORNER RADII EXCEPT DESIGN "C".


7. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

<table>
<thead>
<tr>
<th>PC OR TS</th>
<th>PT OR ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 - 899</td>
<td>450 - 599</td>
</tr>
<tr>
<td>300 - 449</td>
<td>200 - 299</td>
</tr>
<tr>
<td>150 - 199</td>
<td>100 - 149</td>
</tr>
<tr>
<td>0 - 99</td>
<td>0 - 99</td>
</tr>
</tbody>
</table>

UNITOS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm). UNLESS OTHER UNITS ARE SHOWN.
**Type 1 (X3-2)**

- Yellow reflectors on a yellow or black background
- Alternate design for Type 2
- Object markers is a yellow retro-reflectORIZED panel of the same size.
- Two X3-3 panels mounted back to back on steel U-post.

**Type 2 (X3-3)**

- Yellow reflectors on a yellow or black background
- Yellow retro-reflectORIZED panel of the same size.
- Steel U-post, 7' [2.1 m] min. in length (1.12 lb./ft. [1.7 kg/m], min. of 16 [19 mm] max. [25 mm] max) with a minimum of forty-two 3/8" [9.5 mm] max. dia. holes drilled or punched on 1" [25 mm] centers from the top of the post prior to galvanizing.

**Type 3 (OM-3 shown)**

- Steel U-post, 10' [3.1 m] in length (max. of 10 lb./ft. [16 kg/m] max. h/r wires drilled or punched on 1" [25 mm] centers from the top of the post prior to galvanizing.

**Typical Use and Placement**

- X3-2 is used only as optional to enhance target value when needed.
- Place post and panels so that panel(s) are directly adjacent to inner-most edge of object nearest traveled way.
- General Notes:
  - Use hardware meeting the requirements of Section 704.
  - Object marker design and placement details for obstructions adjacent to or within highways.

**Materials and Dimensions**

- Units shown in brackets (imperial) are in millimeters (metric) unless other units are shown.
TYPICAL USE AND PLACEMENT

DETAILS ARE REPRESENTATIVE ONLY. ACTUAL DESIGN USED/SPECIFIED MAY VARY (SEE PLANS).

FLEXIBLE SURFACE-MOUNTED DELINEATORS

NOTES:
1) MOUNT OR DRIVE FLEXIBLE DELINEATORS TO THE MANUFACTURER’S SPECIFICATIONS.
2) THE EXACT LOCATION AND PLACEMENT OF THE FLEXIBLE DELINEATORS ARE SHOWN IN THE SIGNING PLANS.
3) USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

FLEXIBLE DRIVABLE DELINEATORS

DETAILS ARE REPRESENTATIVE ONLY. ACTUAL DESIGN USED/SPECIFIED MAY VARY (SEE PLANS).

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
SIGN MOUNTING DETAILS

BARRICADE DETAILS

NOTE:
1. Use hardware meeting the requirements of Section 704.
2. Furnish treated, round wood posts in accordance with 3/8", 5/8", and 7/8" x 6' for detail drawing 619-20 and for a length to provide seat all panels of the barricade.
3. Size of RETRO-REFLECTIVE BRACKETS, BOLTS, AND NUTS MOUNTING DETAILS 1” X 2” X 6’ FOR ALL CONNECTIONS.
4. All barricades have alternating RETRO-REFLECTIVE RED AND WHITE STRIPES. 
5. BI BARRICADE B(1) L SHOWN.
6. BI BARRICADE B(1) L SHOWN.
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3. BI BARRICADE B(1) L SHOWN.
UP TO $250 FINE AND /OR 60 DAYS IMPRISONMENT FOR INJURY TO OR POSSESSION OF THIS SIGN
INSTALLED 2010
SIGN FABRICATOR'S NAME HERE

PLACEMENT DETAILS

DATE TAG DETAIL

DATE TAG COLOR SEQUENCE
DATE TAG COLOR CORRESPONDS TO THE LAST DIGIT OF THE INSTALLATION YEAR AS FOLLOWS:

0 - YELLOW   5 - RED
1 - WHITE     6 - PURPLE
2 - LIGHT BLUE 7 - ORANGE
3 - BLUE      8 - BLUE
4 - LIGHT GREEN 9 - GREEN

NOTES:
1. FURNISH AND PLACE INSTALLATION DATE TAGS ON ALL SIGNS PRIOR TO FINAL ACCEPTANCE OF THE PROJECT.
2. THE TAGS DISPLAY THE YEARS IN WHICH THE SIGNS WERE INSTALLED. SEE THE COLOR SEQUENCE TABLE SHOWN ON THIS DRAWING FOR THE APPROPRIATE COLORS. DATE TAGS ARE TO BE RETRO-REFLECTIVE.
3. PLACE A TAG ON THE BACK OF EACH SIGN, LOCATED NEAR THE LOWER CORNER OF THE SIGN NEAREST THE EDGE OF ROADWAY, TO BE VISIBLE FROM THE ROADWAY AS SHOWN IN THE EXAMPLES ABOVE.
4. PLACE TAGS ON ANY NEW SIGN INSTALLED IN THE FIELD AS ROUTINE MAINTENANCE BY MDT FORCES. MAINTENANCE DESIGN DATE TAGS CAN BE ORDERED FROM THE SIGN SHOP IN HELENA.
5. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.

UNITS SHOWN IN BRACKETS ( ) ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
A 22 MIL \[0.559 \text{ mm} \] THICKNESS.

PAINT VOLUMES ASSUME A 17 MIL \[0.432 \text{ mm} \] THICKNESS. EPOXY VOLUMES ASSUME ESTIMATING PURPOSES ONLY.

QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN AND ARE FOR SUGGESTED, BUT TO THE RELATIVE SCALE.

ON NARROW, LOW-SPEED BICYCLE PATHS, SIZES OF LETTERS MAY BE SMALLER THAN TEN TIMES THE HEIGHT OF THE CHARACTERS UNDER ANY CONDITION.

TIMES THE HEIGHT OF CHARACTERS FOR LOW-SPEED ROADS, BUT NOT MORE THAN WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM AT LEAST FOUR LOCATION.

DIRECTION OF TRAVEL. DO NOT EXCEED THREE LINES OF INFORMATION AT ANY FOR MULTIPLE LINES OF INFORMATION, PLACE THE INFORMATION SO IT READS IN THE MORE INFORMATION.

EXCEPT IN THE CASE OF THE WORD "SCHOOL." SEE DTL. DWG. NO. 620-10 FOR DO NOT EXCEED MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT MARKINGS ABOVE AVERAGE SPEEDS AND OTHER CRITICAL LOCATIONS.

HEIGHT OF ANY LETTER IS 6.0 FEET \[1.8 \text{ m} \]. LARGER SIZES MAY BE USED FOR APPROXIMATELY ONE-THIRD FOR LOW-SPEED, URBAN CONDITIONS. THE MINIMUM NEEDED. THE SIZE OF LETTERS MAY BE SCALED PROPORTIONATELY DOWN BY USE THE SIZES OF LETTERS SHOWN UNLESS SMALLER OR LARGER SIZES ARE

NOTES:

1. EACH SQUARE EQUALS 4 INCHES \[100 \text{ mm} \].

2. ALL PAINT MARKINGS ARE TO CONFORM TO THE REQUIREMENTS OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY SIGNS" PUBLICATIONS FROM THE FEDERAL HIGHWAY ADMINISTRATION.

3. ALL LETTERS ARE TO BE WHITE.

4. USE THE SIZES OF LETTERS SHOWN UNLESS SMALLER OR LARGER SIZES ARE NEEDED. THE SIZE OF LETTERS MAY BE SCALE PROPORTIONATELY DOWN BY THE HEIGHT OF ANY LETTER TO 60 FEET \[18 \text{ m} \]. LARGER SIZES MAY BE USED FOR AROUND INTERSECTION SPACES AND OTHER CRITICAL LOCATIONS.

5. DO NOT EXCEED MORE THAN ONE LINE IN WIDTH FOR ANY PAINT MARKINGS EXCEPT IN THE CASE OF THE WORD "SCHOOL." SEE DTL. DWG. NO. 620-10 FOR MORE INFORMATION.

6. FOR MULTIPLE LINES OF INFORMATION, PLACE THE INFORMATION SO IT READS IN THE DIRECTION OF TRAFFIC. DO NOT EXCEED THREE LINES OF INFORMATION AT ANY CONDITION.

7. WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR LOW-SPEED ROADS, BUT NOT MORE THAN TEN TIMES THE HEIGHT OF THE CHARACTERS UNDER ANY CONDITION.

8. IN WALKING, LOW-SPEED BICYCLE PATHS, SIZES OF LETTERS MAY BE SMALLER THAN INDICATED, BUT TO THE NECESSARY SCALE.

9. QUANTITIES ARE BASED ON THE SIZES OF PAINT MARKINGS SHOWN AND ARE FOR ESTIMATING PURPOSES ONLY.

10. PAINT VOLUMES ASSUME A 17 MIL \[0.432 \text{ mm} \] THICKNESS. EPOXY VOLUMES ASSUME A 22 MIL \[0.559 \text{ mm} \] THICKNESS.
EPOXY VOLUMES ASSUME A 22 MIL [0.559] THICKNESS.
PAINT VOLUMES ASSUME A 17 MIL [0.432] THICKNESS.
AND ARE FOR ESTIMATING PURPOSES ONLY.
QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN SMALLER THAN SUGGESTED, BUT TO THE RELATIVE SCALE.
ON NARROW, LOW-SPEED BICYCLE PATHS, SIZES OF NUMBERS MAY BE
CHARACTERS UNDER ANY CONDITION.
WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM
AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR LOW-SPEED ROADS, BUT NOT MORE THAN TEN TIMES THE HEIGHT OF THE CHARACTERS UNDER ANY CONDITION.

NOTES:
1. EACH SQUARE EQUALS 4 INCHES [100].
2. ALL PAVEMENT MARKINGS ARE TO CONFORM TO THE REQUIREMENTS OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY SIGNS" PUBLICATIONS, FROM THE FEDERAL HIGHWAY ADMINISTRATION.
3. ALL NUMBERS ARE TO BE WHITE.
4. USE THE SIZES OF NUMBERS SHOWN UNLESS SMALLER OR LARGER SIZES ARE NEEDED. THE SIZE OF NUMBERS MAY BE SCALLED PROPORTIONALLY DOWN BY APPROXIMATELY ONE-THIRD FOR LOW-SPEED, URBAN CONDITIONS.
5. THE MINIMUM HEIGHT OF ANY NUMBER IS 6 FEET [1.8 m]. LARGER SIZES MAY BE USED FOR ABOVE AVERAGE SPEEDS AND OTHER CRITICAL LOCATIONS.
6. DO NOT EXCEED MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT MARKINGS EXCEPT IN THE CASE OF THE WORD "SCHOOL". SEE DTL.
7. DWG. NO. 620-10 FOR MORE INFORMATION.
8. FOR MULTIPLE LINES OF INFORMATION, PLACE THE INFORMATION SO IT READS IN THE DIRECTION OF TRAVEL. DO NOT EXCEED THREE LINES OF INFORMATION AT ANY LOCATION.
9. WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR LOW-SPEED ROADS, BUT NOT MORE THAN TEN TIMES THE HEIGHT OF THE CHARACTERS UNDER ANY CONDITION.
10. ON NARROW, LOW-SPEED BICYCLE PATHS, SIZES OF NUMBERS MAY BE SMALLER THAN SUGGESTED, BUT TO THE RELATIVE SCALE.
11. QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN AND ARE FOR ESTIMATING PURPOSES ONLY.
12. PAINT VOLUMES ASSUME A 17 MIL [0.432] THICKNESS.
EPOXY VOLUMES ASSUME A 22 MIL [0.559] THICKNESS.

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<tr>
<th>QUANTITIES</th>
<th>METRIC QUANTITIES</th>
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<tr>
<td>#</td>
<td>AREA (FT²)</td>
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<tr>
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<td>5.54</td>
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<td>5</td>
<td>6.89</td>
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<td>6.94</td>
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<td>8</td>
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<td>9</td>
<td>6.94</td>
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<tr>
<td>0</td>
<td>7.11</td>
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NOTES:
1. EACH SQUARE EQUALS 4 INCHES [100].
2. ALL PAVEMENT MARKINGS ARE TO CONFORM TO THE REQUIREMENTS OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY SIGNS" PUBLICATIONS, FROM THE FEDERAL HIGHWAY ADMINISTRATION.
3. ALL NUMBERS ARE TO BE WHITE.
4. USE THE SIZES OF NUMBERS SHOWN UNLESS SMALLER OR LARGER SIZES ARE NEEDED. THE SIZE OF NUMBERS MAY BE SCALLED PROPORTIONALLY DOWN BY APPROXIMATELY ONE-THIRD FOR LOW-SPEED, URBAN CONDITIONS.
5. THE MINIMUM HEIGHT OF ANY NUMBER IS 6 FEET [1.8 m]. LARGER SIZES MAY BE USED FOR ABOVE AVERAGE SPEEDS AND OTHER CRITICAL LOCATIONS.
6. DO NOT EXCEED MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT MARKINGS EXCEPT IN THE CASE OF THE WORD "SCHOOL". SEE DTL.
7. DWG. NO. 620-10 FOR MORE INFORMATION.
8. FOR MULTIPLE LINES OF INFORMATION, PLACE THE INFORMATION SO IT READS IN THE DIRECTION OF TRAVEL. DO NOT EXCEED THREE LINES OF INFORMATION AT ANY LOCATION.
9. WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR LOW-SPEED ROADS, BUT NOT MORE THAN TEN TIMES THE HEIGHT OF THE CHARACTERS UNDER ANY CONDITION.
10. ON NARROW, LOW-SPEED BICYCLE PATHS, SIZES OF NUMBERS MAY BE SMALLER THAN SUGGESTED, BUT TO THE RELATIVE SCALE.
11. QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN AND ARE FOR ESTIMATING PURPOSES ONLY.
12. PAINT VOLUMES ASSUME A 17 MIL [0.432] THICKNESS.
EPOXY VOLUMES ASSUME A 22 MIL [0.559] THICKNESS.
NOTES:

1. UNLESS OTHERWISE NOTED EACH SQUARE EQUALS 4 [100] INCHES.

2. ALL PAVEMENT MARKINGS ARE TO CONFORM TO THE REQUIREMENTS OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY SIGNS" PUBLICATIONS, FROM THE FEDERAL HIGHWAY ADMINISTRATION.

3. ALL WORDS ARE TO BE WHITE.

4. USE THE SIZES OF WORDS SHOWN UNLESS SMALLER OR LARGER SIZES ARE NEEDED. THE SIZE OF WORDS MAY BE SCALDED PROPORTIONATELY DOWN BY APPROXIMATELY ONE-THIRD FOR LOW-SPEED, URBAN CONDITIONS. THE MINIMUM HEIGHT OF ANY WORD IS 6 FEET [1.8 m]. LARGER SIZES MAY BE USED FOR ABOVE AVERAGE SPEEDS AND OTHER CRITICAL LOCATIONS.

5. DO NOT EXCEED MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT MARKINGS, EXCEPT IN THE CASE OF THE WORD "SCHOOL", WHEN "SCHOOL" IS EXTENDED TO THE WIDTH OF TWO LANES, SCALE THE WORD UP PROPORTIONATELY TO FIT THE APPLICATION WIDTH.

6. FOR MULTIPLE LINES OF INFORMATION, PLACE THE INFORMATION SO IT READS IN THE DIRECTION OF TRAVEL. DO NOT EXCEED THREE LINES OF INFORMATION AT ANY LOCATION.

7. WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR LOW-SPEED ROADS, BUT NOT MORE THAN TEN TIMES THE HEIGHT OF THE CHARACTERS UNDER ANY CONDITION.

8. ON NARROW, LOW-SPEED BICYCLE PATHS, SIZES OF LETTERS MAY BE SMALLER THAN SUGGESTED, BUT TO THE RELATIVE SCALE.

9. QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN AND ARE FOR ESTIMATING PURPOSES ONLY.

10. PAINT VOLUMES ASSUME A 17 MIL [0.432] THICKNESS. EPOXY VOLUMES ASSUME A 22 MIL [0.559] THICKNESS.

QUANTITIES

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<tr>
<th>WORD</th>
<th>AREA (FT²)</th>
<th>PAINT (GAL.)</th>
<th>EPOXY (GAL.)</th>
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</tr>
<tr>
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METRIC QUANTITIES

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<td>SCHOOL</td>
<td>4.54</td>
<td>1.56</td>
<td>2.54</td>
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UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO. 620-10

PAVEMENT MARKINGS (WORDS)

EFFECTIVE: SEPTEMBER 2014
NO. 420-25

NOTES:

1. ALL PAVEMENT MARKINGS ARE TO CONFORM TO THE REQUIREMENTS OF THE
   "HIGHWAY ON-RAMP TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY
   SIGNS" PUBLICATIONS, FROM THE FEDERAL HIGHWAY ADMINISTRATION.

2. DO NOT EXCEED MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT
   MARKINGS EXCEPT IN THE CASE OF THE WORD "SCHOOL". SEE DTL.

3. WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACING SHOULD
   BE AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR LEGIBLE
   READABILITY, BUT NOT MORE THAN EIGHT TIMES THE HEIGHT OF THE
   CHARACTERS UNDER ANY CONDITION.

4. QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN
   HERE AND ARE FOR ESTIMATING PURPOSES ONLY.

5. EP. = PAINT VOLUMES ASSUME A 0.75 MIL [19.05] THICKNESS.
   (6) = EP VOLUMES ASSUME A 0.50 MIL [12.7] THICKNESS.

6. UNITS SHOWN IN PARENTHESES () ARE
   DEVIATIONS AND ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO.

620-25

SECTION 620

SEPT. 2014
NOTES:

① ADJUST MANHOLES UPWARD WITH ADJUSTING RINGS UNDER FRAME.
② ADJUST MANHOLES DOWNWARD BY REMOVING CONE AND BARREL SECTIONS AS NECESSARY AND REPLACING WITH SECTIONS OF LENGTH REQUIRED TO MATCH GRADE.
③ SLOPE MANHOLE FRAME AS REQUIRED TO MATCH SLOPE OF STREET.
④ MAKE FINAL MANHOLE ADJUSTMENTS BEFORE PAVING.

MANHOLE ADJUSTMENT DETAIL

NOTES:

① ADJUST WATER VALVES UPWARD OR DOWNWARD AS REQUIRED.
② MAKE FINAL ADJUSTMENT BEFORE PAVING.

VALVE BOX ADJUSTMENT DETAIL
Notes:
1. Adjust manholes upward with adjusting rings under frame.
2. Adjust manholes downward by removing cone and barrel sections as necessary and replacing with sections of length required to match grade.
3. Slope manhole frame as required to match slope of street.
4. Construct concrete apron of class general concrete or approved equal.

Manhole Adjustment Detail

Valve Box Adjustment Detail

Concrete Apron Detail

- **Type**: Manhole, Valve
- **Dimensions**: 0.5 C.Y. [0.4m³], 0.1 C.Y. [0.0m³]
- **Concrete Apron Quantities**: A - Class General Concrete

Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.
**NOTES:**

1. **The minimum distance from the edge of driving lane to the first mailbox should be the clear zone distance plus 6'-0" (1.8 m).**

2. **The width of the approach and mailbox turnout combined should not exceed 40'-0" (12.0 m). If more than 40'-0" (12.0 m), the mailbox turnout widening is not required.**

3. The minimum spacing between mailboxes is equal to three-fourths of their height above the ground. See DTL. DWG. NO. 623-20 and 623-25 for mailbox details.

**Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.**

**Detailed Drawing**

**Reference DWG. No.**

**Standard Spec.**

**Section 623**

**Approach Mailbox Turnout**

**Effective: September 2014**
TURNOUT WITHOUT APPROACH

TURNOUT WITH APPROACH

MAILBOX LOCATION DETAIL

NOTE:
THE MINIMUM SPACING BETWEEN MAILBOXES IS EQUAL
TO THREE-FOURTHS OF THEIR HEIGHT ABOVE THE
GROUND. SEE DTL Dwg. No. 623-20 AND 623-25
FOR MAILBOX DETAILS.

UNITS SHOWN IN BRACKETS [] ARE
METRIC AND ARE IN MILLIMETERS (mm)
UNLESS OTHER UNITS ARE SHOWN.
SINGLE MAILBOX ASSEMBLY

NOTES:

1. GALVANIZE ALL MATERIALS MEETING SECTION 711.
2. STAKE MAILBOX LOCATIONS BEFORE INSTALLATION FOR PROPER HEIGHT AND DISTANCE FROM THE ROADWAY. ONLY STAKE WITH THE PROJECT MANAGER AND THE POST OFFICE. THE PROJECT MANAGER AND POSTMASTER/MAILCARRIER ARE ALLOWED 48 HOURS TO REVIEW AND MODIFY THE STAKED LOCATIONS PRIOR TO FINAL INSTALLATION.
3. OTHER WOCP OR MASH CRASH TESTED MAILBOX SUPPORTS AND ASSEMBLIES MAY ALSO BE USED.
4. LOCATE THE MAILBOX 8" TO 12" OUTSIDE THE EDGE OF THE SHOULDER OR 6" TO 12" FROM THE FACE OF CURB.
5. FOR MULTIPLE MAILBOX INSTALLATIONS, SPACE THE MAILBOX SUPPORTS A MINIMUM DISTANCE OF 42" (1.05 m) APART.
6. FOR URBAN LOCATIONS USE 40" TO 48" (1020 TO 1220) MOUNTING HEIGHT. FOR RURAL LOCATIONS USE 38" TO 42" (965 TO 1065) MOUNTING HEIGHT.
7. SEE "GUIDE TO MAILBOX SAFETY IN MONTANA" FOR ADDITIONAL INFORMATION.

Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.

Mailbox Detail

Effective: SEPTEMBER 2014

MTDX MONTANA DEPARTMENT OF TRANSPORTATION

Mailbox Detail

Reference: MONTANA DOT

Section 623-6.71

Mailbox Detail

Detailed Drawing

DWG. NO. 623-20
PIPE/POST CONNECTION
ROADWAY VIEW

36" TO 42" (965 TO 1065) RURAL
45" TO 48" (1145 TO 1220) URBAN

3 45° ELBOWS FOR 1 1/4" [31] DIA. NOMINAL PIPE

1 1/4" [31] DIA. NOMINAL PIPE x 30 1/2" [775]

1 1/4" [31] DIA. NOMINAL PIPE x 5" [130], CUT AS NECESSARY TO ADJUST HEIGHT

1" [25] DIA. x 9" [230] PIPE

1 1/4" [31] DIA. NOMINAL PIPE x 2 3/4" [70], CUT AS NECESSARY TO ADJUST HEIGHT

30" [915]

VARIABLE DITCH SLOPE

1" [25] DIA. x 9" [230] PIPE

OUTSIDE EDGE OF SHOULDER

OUTSIDE EDGE OF SHOULDER

BOLT WOOD FILLER TO PIPE BEFORE ATTACHING MAILBOX

1 1/2" [38.1] TAIL PIPE CLAMP (AVAILABLE WHERE AUTOMOBILE TAIL PIPE FITTINGS ARE SOLD)

6 FT. [1830] MIN. FLANGED CHANNEL SIGN POST (1 LB./FT. [4.5 kg/m] ) PER SECTION 704.

1 1/4" [31] DIA. NOMINAL PIPE, CUT TO FIT

1" [25] DIA. x 9" [230] PIPE

1 1/4" [31] DIA. NOMINAL PIPE x 2 3/4" [70], CUT AS NECESSARY TO ADJUST HEIGHT

SECTION A-A

STEEL PIPE WITH FITTINGS AND STEEL FENCE POST

MAILBOX SUPPORT

NOTES:

1. GALVANIZE ALL MATERIALS MEETING SECTION 711.
2. STAKE MAILBOX LOCATIONS BEFORE INSTALLATION FOR PROPER HEIGHT AND DISTANCE FROM THE ROADWAY. ONCE STAKED, NOTIFY THE PROJECT MANAGER AND THE POST OFFICE. THE PROJECT MANAGER AND POSTMASTER/MAIL CARRIER ARE ALLOWED 48 HOURS TO REVIEW AND MODIFY THE STAKED LOCATIONS PRIOR TO FINAL INSTALLATION.
3. OTHER NCHRP 350 OR MASH CRASH TESTED MAILBOX SUPPORTS AND ASSEMBLIES MAY ALSO BE USED.
4. LOCATE THE MAILBOX 8" TO 12" (0.2 TO 0.3 METERS) OUTSIDE THE EDGE OF THE SHOULDER OR 6" TO 12" (0.15 TO 0.3 METERS) FROM THE FACE OF CURB.
5. SEE "A GUIDE TO MAILBOX SAFETY IN MONTANA" FOR ADDITIONAL INFORMATION.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

REFERENCE

Dwg. No. 623-25
Standard Spec. 623.704 AND 711
Optional Mailbox Detail
Effective: September 2014

Montana Department of Transportation
Mail U.S.

NOTES:

1. WASHER AND NUT ARE FINISHED WITH ALL BOLT CONNECTIONS MOUNTING BRACKET.

2. BOLT PLACEMENT IS SYMMETRICAL THROUGHOUT MOUNTING BRACKET.

3. ALL BOLT CONNECTIONS ARE FINISHED WITH A WASHER AND NUT.

4. FOR THE POST USE EITHER DOUGLAS FIR OR HEM FIR, WHICH IS SURFACED FOUR SIDES (245) AND FREE OF HEART CENTER (FOHC).

5. UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

6. EFFECTIVE: SEPTEMBER 2014

ELEVATION VIEW

FRONT VIEW

PLAN VIEW

2 - 3/8" DIA. [M10] BOLTS

1 - 4" x 6" x 3/8 [100 x 100 x 90]

2 - 3/8" x 3" [10 x 75]
LAG SCREWS

1 - 2" x 4" x 39° [50 x 100 x 90] AT 45° ANGLE

1 - 2" x 4" x 6" [50 x 100 x 150]

2 - 3/8" x 3" [10 x 75]
LAG SCREWS

4 - 3/8" x 4" [10 x 100]
LAG SCREWS

1 - 3/8" DIA. [M10] BOLT

1 - 3/8" DIA. [M10] BOLT

2 - 3/8" DIA. [M10] BOLTS

1 - 3/8" DIA. [M10] BOLT

SANDBAGS (25 lb. [11 kg] MAX/SACK) (AS NEEDED)

4 - 3/8" x 4" [10 x 100]
LAG SCREWS

2 - 3/8" DIA. [M10] BOLTS

1 - 3/8" DIA. [M10] BOLT

1 - 3/8" DIA. [M10] BOLT

2 - 3/8" DIA. [M10] BOLTS

1 - 3/8" DIA. [M10] BOLT

1 - 2' x 4" [50 x 100]

60° [1524]

40° [1016]
NOTES:

1. THIS MOUNTING DEVICE IS INTENDED FOR USE IN CONSTRUCTION ZONES.

2. BOLT PLACEMENT IS SYMMETRICAL THROUGHOUT MOUNTING BRACKET.

3. ALL BOLT CONNECTIONS ARE FINISHED WITH A WASHER AND NUT.

ATTACHMENT DETAILS

ATTACH TO ELBOW BRACKETS WITH 3/8" DIA. [M10] BOLTS

ATTACH TO MAILBOX WITH 5/16" DIA. [M8] BOLTS ON EACH SIDE

ATTACH TO POST WITH 3/8" DIA. [M10] BOLTS GOING THROUGH THE WOODEN MEMBER

ATTACH TO BRACKET PLATE WITH 3/8" DIA. [M10] BOLTS

UNITs SHOWN IN BRACKETS - ( ) ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

DETAILED DRAWING

REFERENCE DWG. NO. 623-35

STANDARD SPEC. SECTION 623

TEMPORARY MAILBOX SUPPORT BRACKET DETAILS

EFFECTIVE: SEPTEMBER 2014

MONTANA DEPARTMENT OF TRANSPORTATION
STANDARD U-TURN FOR NARROW MEDIANS

PROFILE

PLAN

(INTERSTATE LAYOUT SHOWN)

PROFILE

WIDTH

Q TO Q

RADIUS = WIDTH - 32 [9.6 m] / 2

10:1 SLOPE MIN.
20:1 DESIRABLE

SAG

PROFILE GRADE

3%

SURFACING

3%

PROFILE GRADE

MEDIAN WIDTHS 36' [10.8 m] TO 76' [22.8 m]
LOCATE AND CONSTRUCT TURNOUTS ABOVE IN CONJUNCTION WITH DITCH BLOCKS IF AT ALL POSSIBLE. PROVIDE DRAINAGE WHEN NECESSARY.

STANDARD U-TURN FOR NARROW MEDIANS

NOTES:

1. NARROW MEDIANS, MEDIAN WIDTHS GREATER THAN 76' [22.8 m] AND INDEPENDENT ROADWAYS REQUIRE SPECIAL DESIGN.
2. GRADES: UNIFORM BETWEEN INSIDE SHOULDERS OF MAIN TRAVELED WAY EXCEPT FOR SPECIAL DESIGN.
3. SURFACING: SEE PLANS FOR QUANTITIES.
4. DRAINAGE: USE 18' [450] OR 24' [600] CULVERTS IF REQUIRED.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

U-TURN MEDIAN OPENINGS
ON CONTROLLED ACCESS HIGHWAYS
EFFECTIVE: SEPTEMBER 2014

REFERENCE

DWG. NO.

STANDARD SPEC.

SECTION

900-00

DETAILED DRAWING

MONTANA DEPARTMENT OF TRANSPORTATION
Plan A-A

Section B-B

Concrete Base

Monument Box (Heavy Duty) or Approved Equal

Neenah Foundry R-1968 Type 36-B Adjustable

Subgrade

Concrete Mound

Finish Grade

Depress 1/4" below Finish Grade

Brass or Bronze Monument

Asphalt or Concrete to Drain

Notes:

1. Install the 4" (102) dia. pipe, concrete base and adjustable monument box as detailed. Place concrete in the pipe below the top of the pipe. Do not fill completely.

2. Position the center of the pipe to within 1/2" (13) horizontally of the desired coordinates and center the monument box over the pipe.

3. Depending on contract requirements, attach box to pipe under the direct supervision of a Montana licensed professional land surveyor or contractor following the direct supervision of District Survey Manager. Do not exceed the distance of 1" (25) below the top of the pipe with concrete. Set and mark the box or bracket monument within the box after construction. The Montana licensed professional land surveyor is required to prepare and file corner records in accordance with state statutes, administrative rules and Montana and approved equal. The box after construction, provide copies of filed corner records to the Montana licensed professional land surveyor or contractor for forces under the direct supervision of a Montana licensed professional land surveyor or contractor for forces under the direct supervision of a Montana licensed professional land surveyor. Provide copies of filed corner records to the project manager, who will forward them to the district survey manager.

4. An acceptable bronze monument is the "BERNTSEN C25DB" or approved equal. An acceptable brass monument is the "SURV-KAP M/M-BCS-2 1/2 D" or approved equal.

5. Use class general concrete or approved equal.


Details:

References:

Units shown in brackets ( ) are in millimeters (mm) unless other units are shown.

Montana Department of Transportation

ADJUSTABLE MONUMENT BOX

DETERMINED DRAWING

REVIEWED: [Date]

UNITS SHOWN IN BRACKETS ( ) ARE IN MILLIMETERS (MM) UNLESS OTHER UNITS ARE SHOWN.

DECEMBER 2014