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CONSTRUCTION

CONSTRUCTION ROAD AND BRIDGE SPECIFICATIONS FOR THE STANDARD SUPPLEMENTAL TO DETAILED DRAWINGS MONTANA DEPARTMENT OF TRANSPORTATION EFFECTIVE: JANUARY 2020 – V1.0
# DETAILED DRAWINGS

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**Abbreviations**

- ABBREVIATIONS
- P.O.C. or POC: POINT ON CURVE
- P.C. or POC: POINT ON CURVE
- P.O. or POL: POINT ON LINE
- P.O.M. or POM: PRIMARY MERIDIAN OR PUNCH MARK
- P.M. or P.M.B.: PLANT MIX BASE
- P.M.P. or PMP: PERFORATED METAL PIPE
- P.M.S. or PMS: PLANT MIX SURFACING
- P.O.L. or POL: POINT ON LINE
- P.O.S. or POS: POINT ON SPIRAL
- P.O.S.T. or POST: POINT ON SEMI-TANGENT
- P.O.T. or POT: POINT ON TANGENT
- P.O.V. or PVO: POINT ON VERTICAL CURVE
- P.O.W. or POW: POWER POLE
- P.O.C. or POC: POINT ON CURVE
- P.O.L. or POL: POINT ON LINE
- P.O.S. or POS: POINT ON SPIRAL
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- P.O.T. or POT: POINT ON TANGENT
- P.O.V. or PVO: POINT ON VERTICAL CURVE
- P.O.W. or POW: POWER POLE

**Detailed Drawing Reference**

**Dwg. No:** 101-07

**Section:** 101

**Abbreviations**

- **Dwg. No.**
- **Standard Spec.**
- **Reference**
- **Section**
- **Abbreviations**

**Abbreviations Key**

- P.O.C. or POC: POINT ON CURVE
- P.O.L. or POL: POINT ON LINE
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- P.O.T. or POT: POINT ON TANGENT
- P.O.V. or PVO: POINT ON VERTICAL CURVE
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**Abbreviations List**

- ABBREVIATIONS
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- P.C. or POC: POINT ON CURVE
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**Abbreviations Usage**

- **Abbreviation:** P.O.C. or POC
  - **Definition:** POINT ON CURVE

- **Abbreviation:** P.M. or P.M.B.
  - **Definition:** PLANT MIX BASE

- **Abbreviation:** P.M.P.
  - **Definition:** PERFORATED METAL PIPE

- **Abbreviation:** P.M.S. or PMS
  - **Definition:** PLANT MIX SURFACING

- **Abbreviation:** P.O.L. or POL
  - **Definition:** POINT ON LINE

- **Abbreviation:** P.O.S. or POS
  - **Definition:** POINT ON SPIRAL

- **Abbreviation:** P.O.S.T. or POST
  - **Definition:** POINT ON SEMI-TANGENT

- **Abbreviation:** P.O.T. or POT
  - **Definition:** POINT ON TANGENT

- **Abbreviation:** P.O.V. or PVO
  - **Definition:** POINT ON VERTICAL CURVE

- **Abbreviation:** P.O.W. or POW
  - **Definition:** POWER POLE

**Abbreviations Example**

- **Abbreviation:** P.O.C.
  - **Definition:** POINT ON CURVE

**Abbreviations Purpose**

- **Purpose:** To provide a concise representation of specific terms in the context of surveying and civil engineering.

**Abbreviations Note**

- **Note:** The abbreviations are used to maintain uniformity and brevity in technical documentation.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.C. OR VC</td>
<td>VERTICAL CURVE</td>
</tr>
<tr>
<td>V.C. CORR.</td>
<td>VERTICAL CURVE OFFSET CORRECTION</td>
</tr>
<tr>
<td>V.C.M.</td>
<td>VERTICAL CONTROL MONUMENT</td>
</tr>
<tr>
<td>V.C.P.</td>
<td>VITRIFIED CLAY PIPE</td>
</tr>
<tr>
<td>VEH.</td>
<td>VEHICULAR</td>
</tr>
<tr>
<td>VENT. OR VT.</td>
<td>VERTICAL</td>
</tr>
<tr>
<td>VIT.</td>
<td>VITRIFIED</td>
</tr>
<tr>
<td>V.P.</td>
<td>VENT PIPE</td>
</tr>
<tr>
<td>V.P.C. OR VPC</td>
<td>VERTICAL POINT OF CURVE</td>
</tr>
<tr>
<td>V.P.I. OR VPI</td>
<td>VERTICAL POINT OF INTERSECTION</td>
</tr>
<tr>
<td>V.P.T. OR VPT</td>
<td>VERTICAL POINT OF TANGENCY</td>
</tr>
<tr>
<td>W</td>
<td>WEST OR WIDTH</td>
</tr>
<tr>
<td>W/</td>
<td>WITH</td>
</tr>
<tr>
<td>W.B. OR WB</td>
<td>WESTBOUND</td>
</tr>
<tr>
<td>W.C.</td>
<td>WITNESS CORNER</td>
</tr>
<tr>
<td>W.L.</td>
<td>WATER LINE</td>
</tr>
<tr>
<td>WLY.</td>
<td>WESTERLY</td>
</tr>
<tr>
<td>W/O</td>
<td>WITHOUT</td>
</tr>
<tr>
<td>W.P.</td>
<td>WING POINT</td>
</tr>
<tr>
<td>W.S.</td>
<td>WATER SERVICE OR WARPED OR VARIABLE SLOPE</td>
</tr>
<tr>
<td>WT.</td>
<td>WEIGHT</td>
</tr>
<tr>
<td>W.T.</td>
<td>WATER TABLE</td>
</tr>
<tr>
<td>W.V.</td>
<td>WATER VALVE</td>
</tr>
<tr>
<td>W.W.</td>
<td>WING WALL OR WOVEN WIRE</td>
</tr>
<tr>
<td>YD</td>
<td>YARD</td>
</tr>
<tr>
<td>YD²</td>
<td>SQUARE YARD</td>
</tr>
<tr>
<td>YD³</td>
<td>CUBIC YARD</td>
</tr>
<tr>
<td>XING.</td>
<td>CROSSING</td>
</tr>
<tr>
<td>XSEC.</td>
<td>CROSS SECTION</td>
</tr>
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</table>
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 NOTES: ZONE OR PROVIDE END TREATMENT.
INSTALL CULVERTS OUTSIDE THE CLEAR ZONE OR PROVIDE END TREATMENT.

TYPICAL SECTION WITHIN CLEAR ZONE

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

MAINLINE DITCH GRADE

TYPICAL SECTION BEYOND CLEAR ZONE

<table>
<thead>
<tr>
<th>BACK SLOPES **</th>
<th></th>
<th>FILL SLOPES **</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 9 [0.0 m - 1.5 m]</td>
<td>4:1</td>
<td>0 - 10 [0.0 m - 3.0 m]</td>
</tr>
<tr>
<td>9 - 10 [1.5 m - 3.0 m]</td>
<td>2:1</td>
<td>10 - 20 [3.0 m - 6.0 m]</td>
</tr>
<tr>
<td>OVER 10 [3.0 m]</td>
<td>1.5:1</td>
<td>OVER 20 [6.0 m]</td>
</tr>
</tbody>
</table>

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.

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

DETAILED DRAWING
REFERENCE DWG. NO. 203-05
STANDARD SPEC. SECTION 203

APPROACHES

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 CULVERT DIAMETER OR ON THE ELEVATION SHOWN IN THE PLANS.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
* Determining the method of installation for rumble strips on existing concrete shoulders on a case-by-case basis.

For rumble strips on existing concrete determine the method of installation.

**Typical Shoulder Installation (Concrete Pavement)**

- Continue rumble strips along the full length, excluding portions of medians, summary sections, turnouts, island medians, turnouts, farm field approaches, private approaches, etc.

**Typical Shoulder Installation (Asphalt Pavement)**

- Continue rumble strips along the full length, excluding portions of medians, summary sections, turnouts, island medians, turnouts, farm field approaches, private approaches, etc.

**Intermittent Rumble Strip Spacing**

- Intermittent rumble strips should be spaced approximately 4' (1.2 m) greater than 6' (1.8 m) to 15' (4.5 m) apart.

**Continuous Rumble Strips**

- Continuous rumble strips should be spaced approximately 4' (1.2 m) greater than 12' (3.6 m) to 15' (4.5 m) apart.

**TYPICAL APPLICATION**

- No rumble strips.

**Interstate Application**

- No rumble strips.

**Rumble Strip Detail**

- Do not install rumble strips over concrete bridge decks or where installed, such as concrete barrier rail, prevent proper placement.

**Table**

<table>
<thead>
<tr>
<th>Material</th>
<th>Depth (mm)</th>
<th>Width (mm)</th>
<th>Span (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>12.7 to 32</td>
<td>12 max</td>
<td>32 max</td>
</tr>
<tr>
<td>Asphalt</td>
<td>25 (ASPH)</td>
<td>25 (ASPH)</td>
<td>30 (ASPH)</td>
</tr>
</tbody>
</table>

**Reference**

- MONTANA DEPARTMENT OF TRANSPORTATION
- DWG. NO: 41102
- SECTION 471
**Intermittent Rumble Strip Spacing**

**Guardrail if the Shoulder is less than 6' [1.8 m] in width.**

**Discontinue Intermittent Rumble Strips in front of structures if the shoulder is less than 6' [1.8 m] in width.**

**60' [18.3 m] Cycle Pattern**

- **47'-0" to 47'-8"**
- **[3.7 m to 3.9 m] gap**
- **12'-4" to 13'-0"**

**Direction of Travel**

**Asphalt Pavement**

**Typical Shoulder Installation**

- **Lane edge stripe**
- **Cold milled rumble strip**
- **Edge of travel lane**

**TYPICAL APPLICATION**

**Rumble Strip Detail**

1. Do not install rumble strips over concrete parking decks or where obstacles such as concrete barrier rails prevent proper placement.
2. Installation on shoulders less than 4.7 (1.4 m) will be decided on a case-by-case basis.

**Units Shown in Inches (1) and Metric and are in Millimeters (2) unless other units are shown.**

**DEPARTMENT OF TRANSPORTATION**

**MDTX**

**Detailed Drawing**

**Reference**

**Dwg. No.**

**Section 411-03**

**Modified Shoulder Rumble Strips**
NOTE:

1. AVOID INSTALLING CENTERLINE RUMBLE STRIPS ON CONCRETE PAVEMENT PRIOR TO A SECOND SEAL AND COVER APPLICATION.
2. CONSIDER REMILLING EXISTING CENTERLINE RUMBLE STRIPS IN APPROACHES ONLY.
3. BREAK CENTERLINE RUMBLE STRIPS FOR PUBLIC INSTALLATION IS APPROPRIATE.
4. BASED ON ENGINEERING JUDGMENT ON A CASE-BY-CASE BASIS TO DETERMINE IF CENTERLINE RUMBLE STRIP USE IS APPROPRIATE.

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

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

UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS ONLY UNLESS OTHER UNITS ARE SHOWN.

REFERENCE

REFERENCE

REFERENCE

REFERENCE

REFERENCE
**CHAIR DETAIL**

**SECTION E-E**

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

- **2 1/2"**
- Surface parallel to chair to rest
- Dowel bar placement detail

- **NOT INCLUDED IN BID ITEM**

- **TOP OF PAVEMENT AFTER GRINDING**
- **CONCRETE PAVEMENT**
- **TOP OF EXISTING CEMENT**

- **SAW CENTER OF E**
- **PREFABRICATED CHAIR (TYP.)**
- **LENGTH NEEDED FOR DOWEL BAR PLACEMENT**

- **DOWEL BAR EXPANSION CAP - BOTH ENDS**
- **SAW BLADE DIAM. DEPENDING ON RADIUS VARIES**

- **CHAIR TO REST TO PARALLELS TO SURFACE**
- **CHAIR DETAIL**
  - USE PLASTIC CHAIR OR AS APPROVED BY PROJECT MANAGER

- **TOP OF PAVEMENT AFTER GRINDING (NOT INCLUDED IN BID ITEM)**
- **CENTER OF CHAIR**

- **HAZUS VARIES DEPENDING ON SAW BLADE DIAM.**
- **TOP OF PAVEMENT TO PARALLELS TO SURFACE**

- **DOWEL BAR EXPANSION CAP - BOTH ENDS**
- **SAW CUT DEPTH 1 1/2" [40] 6" [150] MIN.**
- **MAX. SAW CUT AFTER CONCRETE PATCH MATERIAL HAS SET**
- **MIN. 3/16" [5] TO 5/16" [8]**
- **MIN. SAW CUT DEPTH 1 1/2" [40]**
- **MAX. SAW CUT DEPTH 1 1/2" [40]**

- **FOR DOWEL BAR DRILL 1 1/2" [40] DIAM. HOLE FOR DOWEL BAR**
- **TRANSVERSE CONTRACTION JOINT**
- **EXISTING CEMENT CONCRETE PAVEMENT**
- **PAVEMENT SURFACE IS PARALLEL TO BOTTOM OF SLOT TRANSVERSE CONTRACTION JOINT**

- **DOWEL BAR DIMENSION TABLE**

- **PCP THICKNESS**
  - **DIAMETER**
    - **[6]** 1/8" [3]
    - **[10]** 1/4" [6]

- **DOWEL BAR DIMENSIONS**
  - **DIAMETER**
    - **[6]** 1/8" [3]
    - **[10]** 1/4" [6]

- **REFERENCE DWG. NO.**
  - **REFERENCE SECTION**
  - **STANDARD SPEC.**
  - **DETAILED DRAWING**

- **FOR PcP**

- **MAVING DEPARTMENT OF TRANSPORTATION**

- **UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS 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 603-10 (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 6'-0" [1800]) 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).

H: 7'-0" (2100) MIN. OR 1'-0" (300) BELOW BOTTOM OF FOUNDATION MATERIAL IF SPECIFIED.

T: CULVERT WALL THICKNESS FOR CONCRETE OR CORRUGATION DEPTH FOR METAL.

S: INSIDE PIPE SPAN

MULTIPLE ROUND CULVERTS
(METAL CULVERTS SHOWN)

4'-0" (1200)

SINGLE ROUND CULVERT
(CONCRETE CULVERT SHOWN)

6" [152] LONG FOR METAL PIPE
9" [229] LONG FOR CONCRETE PIPE

ANCHOR BOLT DETAILS
ANCHOR BOLT SPACING:
MIN. OF FIVE 3/4" DIA. [M20] GALV. ANCHOR BOLTS IN WALL. USE MAX. SPACING OF 15" [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.

3/4" [M20] LOOP FERRULE INSERT

6" x 6" x W2.9
[152.4 x 152.4 x MW18.71]
WIRE MESH (TYP. FOR CMP AND RCP)

3" [75] MIN. CLEARANCE

NOTES:
1. USE CLASS GENERAL CONCRETE OR EQUAL.
2. SEE DTL. DWG. NO. 603-18 AND 603-19 FOR BEDDING UNDER CULVERTS.

CONCRETE CUTOFF WALLS
FOR CULVERTS

REFERENCE
DWG. NO.
552-00

STANDARD SPEC.
SECTION 552,603,613

MTDA
MONTANA DEPARTMENT OF TRANSPORTATION
### Cubix Yards of Class General Concrete (Each End)

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>Cubix Yards of RipRap (Each End)</th>
<th>Concrete Edge Protection (In. One)</th>
<th>Material Per Foot (In. One)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>56</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>72</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
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<tr>
<td>80</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>96</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
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</table>

### RCP (SG. End)

<table>
<thead>
<tr>
<th>Diameter (In)</th>
<th>Cubix Yards of Class General Concrete (Each End)</th>
<th>Concrete Edge Protection (In. One)</th>
<th>Material Per Foot (In. One)</th>
</tr>
</thead>
<tbody>
<tr>
<td>63&quot;</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>66&quot;</td>
<td>2.5</td>
<td>2.7</td>
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<td>78&quot;</td>
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<td>80&quot;</td>
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</tr>
<tr>
<td>96&quot;</td>
<td>2.5</td>
<td>2.7</td>
<td>2.7</td>
</tr>
</tbody>
</table>

### Notes:

1. Cubix RipRap is used only in special circumstance. Quantities are based on a thickness of 2 ft. (600 mm) and are proportioned When a different thickness is specified.
2. Granular Bedding quantities for concrete pipes are based on bedding details shown on DTL. DWG. NO. 603-08 with a width equal to (diameter + 4 ft) (1200 mm + 1200 mm) and average depth equal to 1 ft. (300 mm). Concrete shell thicknesses and a specific depth equal to 1 ft. (300 mm). This table sets the total bedding quantity without any allowance of pipe moves 2 ft. (600 mm) x 4 ft. (1200 mm) Granular Bedding Bedding to each of Cutoff Wall.
3. RCP, concrete RipRap and RipRap slope units shown in brackets [ ] are additional to those shown in rows 1 & 2. Unless other units are shown.

---

### Concrete Bedding Material Quantities for Single (length of pipe minus 1.3 ft. [0.40 m]). Extend granular Bedding to Compute the total bedding quantity multiply by (D/4 or R/3) + (Concrete Shell Thickness) and a depth equal to 1 ft. (300 mm).**

---

### Concrete Bedding Material Quantities for Single (length of pipe minus 1.3 ft. [0.40 m]). Extend granular Bedding to Compute the total bedding quantity multiply by (D/4 or R/3) + (Concrete Shell Thickness) and a depth equal to 1 ft. (300 mm).**
UNLESS OTHER UNITS ARE SHOWN. METRIC AND ARE IN MILLIMETERS (mm)

NOTES:

1. CONCRETE EDGE PROTECTION IS STANDARD FOR METAL CULVERT INSTALLATION.
2. RIPRAP PROTECTION IS RECOMMENDED FOR METAL PIPE INSTALLATION.
3. QUANTITIES ARE BASED ON A THICKNESS OF 2 FT. [600] AND ARE IN SPECIAL CIRCUMSTANCES.
4. CULVERT RIPRAP IS ONLY USED INLET AND OUTLET PROTECTION. CULVERT RIPRAP IS ONLY USED FOR METAL CULVERTS.
5. CONCRETE EDGE PROTECTION IS STANDARD FOR METAL CULVERT INSTALLATION.
6. QUANTITIES ARE BASED ON A THICKNESS OF 2 FT. [600] AND ARE IN SPECIAL CIRCUMSTANCES.

UNITS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
### Cubic Yards of Class General Concrete (Each End)

<table>
<thead>
<tr>
<th>DIAMETER (IN.)</th>
<th>CUBIC YARDS OF RIPRAP (IN. DIA. 603-19)</th>
<th>CUBIC YARDS OF RIPRAP (IN. DIA. 603-19)</th>
<th>CUBIC YARDS OF RIPRAP (IN. DIA. 603-19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot;</td>
<td>0.4 - 0.2</td>
<td>0.4 - 0.2</td>
<td>0.4 - 0.2</td>
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<tr>
<td>6&quot;</td>
<td>0.8 - 0.4</td>
<td>0.8 - 0.4</td>
<td>0.8 - 0.4</td>
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<tr>
<td>7&quot;</td>
<td>1.2 - 0.8</td>
<td>1.2 - 0.8</td>
<td>1.2 - 0.8</td>
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<tr>
<td>8&quot;</td>
<td>1.6 - 1.2</td>
<td>1.6 - 1.2</td>
<td>1.6 - 1.2</td>
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<tr>
<td>9&quot;</td>
<td>2.0 - 1.6</td>
<td>2.0 - 1.6</td>
<td>2.0 - 1.6</td>
</tr>
<tr>
<td>10&quot;</td>
<td>2.4 - 2.0</td>
<td>2.4 - 2.0</td>
<td>2.4 - 2.0</td>
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<tr>
<td>11&quot;</td>
<td>2.8 - 2.4</td>
<td>2.8 - 2.4</td>
<td>2.8 - 2.4</td>
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<td>12&quot;</td>
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<td>3.2 - 2.8</td>
<td>3.2 - 2.8</td>
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<td>13&quot;</td>
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<td>3.6 - 3.2</td>
<td>3.6 - 3.2</td>
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<td>14&quot;</td>
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### Cubic Yards of Class General Concrete (Each End)

<table>
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<tr>
<th>DIAMETER (IN.)</th>
<th>CUBIC METERS OF CLASS GENERAL CONCRETE (Each End)</th>
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<tbody>
<tr>
<td>5&quot;</td>
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<tr>
<td>6&quot;</td>
<td>0.8 - 0.4</td>
</tr>
<tr>
<td>7&quot;</td>
<td>1.2 - 0.8</td>
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<tr>
<td>8&quot;</td>
<td>1.6 - 1.2</td>
</tr>
<tr>
<td>9&quot;</td>
<td>2.0 - 1.6</td>
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<tr>
<td>10&quot;</td>
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<td>11&quot;</td>
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<td>3.6 - 3.2</td>
</tr>
<tr>
<td>14&quot;</td>
<td>4.0 - 3.6</td>
</tr>
</tbody>
</table>

### Metric and are in millimeters (mm)

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

UNITS SHOWN IN BRACKETS [ ] ARE 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 AND DBL. CULVERT INSTALLATION BEDDING MATERIAL QUANTITIES FOR SING. CONCRETE, RIPRAP AND GRANULAR BEDDING QUANTITIES FOR METAL PIPES ARE BASED ON BEDDING PROPORTIONED WHEN A DIFFERENT THICKNESS IS SPECIFIED.

QUANTITIES ARE BASED ON A THICKNESS OF 2 FT. [600] AND ARE IN SPECIAL CIRCUMSTANCES.

INLET AND OUTLET PROTECTION. CULVERT RIPRAP IS ONLY USED CONCRETE EDGE PROTECTION IS STANDARD FOR METAL CULVERT NOT SHOWN.

MULTIPLY BY (LENGTH OF PIPE MINUS 1.3 FT. [0.40 m]). EXTEND BEDDING DEPTH). TO COMPUTE THE TOTAL BEDDING QUANTITY DEPTH) 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 GRADE PIPE LAYERS ARE BASED ON BEDDING DEPTH OF 12" [300] AND A WIDTH OF 18" [450] EXEMPLARY CIRCUMSTANCES.

### Notes:

1. CONCRETE EDGE PROTECTION IS STANDARD FOR METAL, CULVERT, AND CULVERT RIPRAP INSTALLATION. CONCRETE RIPRAP IS ONLY USED IN SPECIAL CIRCUMSTANCES.

2. QUANTITIES ARE BASED ON A THICKNESS OF 2 FT. [600] AND ARE PROPORTIONED WHEN A DIFFERENT THICKNESS IS SPECIFIED.

3. CULVERT RIPRAP QUANTITIES FOR METAL, PIPES ARE BASED ON BEDDING DETAILS SHOWN IN DTL. DWG. NO. 603-19 WITH A WIDTH EQUAL TO (DIAMETER OR SPAN) + 4 FT. [1200] + (2 TIMES CORRUGATION DETAIL, SEE DTL. DWG. NO. 603-19 WITH A WIDTH EQUAL TO (DIAMETER OR SPAN) + 5 FT. [1500].

4. FOR PIPES WITH SKEW BEVEL ENDS - DIVIDE THE QUANTITIES SHOWN BY COSINE OF SKEW ANGLE.

5. UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
### Type "A"

- **End View**: Tongue end on inlet end sections, groove end on outlet end sections.
- **Normal Shoulder Slope**: See Type Section.
- **Shoulder Slope**: See Type Section.
- **Road Surface**: See Type Section.
- **Slope**: SLOPE 1:1
- **Slope Detail**: DIA.
- **Reinforcement**: Bar and Steel Mesh
- **Section X-X**: Type "A" end view.
- **Wall "B" Thickness**: 12" 2'-0" 2'-0" 15" 2'-6" 18" 2'-3" 3'-0" 24" 4'-0" 30" 1'-0" 4'-6" 6'-0" 36" 5'-3" 2'-11" 8'-2" 6'-6" 42" 1'-9" 5'-3" 48" 2'-0" 6'-0" 2'-2" 8'-2" 54" 2'-3" 5'-5" 7'-6"
- **Pipes**: Large Diameter Pipe

### Type "B"

- **End View**: Tongue end on inlet end sections, groove end on outlet end sections.
- **Normal Shoulder Slope**: See Type Section.
- **Shoulder Slope**: See Type Section.
- **Road Surface**: See Type Section.
- **Slope**: SLOPE 2.4:1 2.4:1 2.3:1 2.5:1 2.5:1 2.5:1 2.5:1 2.5:1 2.0:1
- **Slope Detail**: DIA.
- **Reinforcement**: Steel Mesh Bar and Steel Mesh
- **Section X-X**: Type "B" end view.
- **Wall "B" Thickness**: 6" 5'-0" 8'-0" 1'-9" 10'-0" 1.5:1 6" 3'-0" 6'-6" 1'-9" 8'-3" 9'-0" 6" 3'-0" 7'-6" 1'-9" 9'-3" 9'-6" 6" 3'-0" 7'-6 1/2" 7'-3 1/2" 9'-3 1/2" 9'-3 1/2" 5" 6 1/2" 7 1/2" 8 1/2" 9 1/2" 2'-0" 11'-0" 2 1/4" 2 1/2" 3 1/2" 4 1/2" 5 1/2"
- **Pipes**: Large Diameter Pipe

### Tie Bolt Connection

- **2 Tie Bolts Each At End To The Vertical, 4" Dia.**
- **Tie Bolt Details**: (Two Per End Section)
- **Details**: Use Two Tie Bolts On All adjoining Sections One In Each Flange End Sections. One On Each Tie Bolt. See Bolt Detail.

### References

- **Reference**: Mont. Transp. Dept. Section 603-08
- **MDTX**: Montana Department of Transportation
- **FLARED END TERMINAL**: Prefabricated RCP Of Transportation. Otherwise They Must Conform To AASHTO M 170.
- **Tolerances**: In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.
- **Tolerances In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.**
- **Tolerances In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.**
- **Tolerances In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.**
- **Tolerances In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.**
- **Tolerances In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.**
- **Tolerances In The Adjacent Tables May Not Vary More Than ±±1.5% For The Dimensions Shown. Otherwise They Must Conform To AASHTO M 170.**
ROAD APPROACH CULVERT END TREATMENT

QUANTITIES (FOR ESTIMATING ONLY)

<table>
<thead>
<tr>
<th>DIA. A RCP</th>
<th>H PIPE 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>DIMENSIONS (FT.)</th>
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<tr>
<td>375</td>
<td>1448</td>
<td></td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>450</td>
<td>1981</td>
<td></td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>600</td>
<td>3048</td>
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<td>C</td>
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METRIC QUANTITIES (FOR ESTIMATING ONLY)

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<th>DIA. A RCP</th>
<th>H PIPE LENGTH</th>
<th>M12 x 105 FERRULE LOOP INSERT EACH</th>
<th>LENGTH 63 DIA. SCHEDULE 40 GALV. PIPE</th>
<th>DIMENSIONS (mm)</th>
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<td></td>
<td>B</td>
<td>C</td>
</tr>
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<tr>
<td>600</td>
<td>3048</td>
<td></td>
<td>B</td>
<td>C</td>
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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.

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

**SECTION A-A**
- Illustrated with 3D model.
- CMP (3") CIP (1") CIP (1") for four 1/4" CMP (1/4"

**SECTION B-B**
- Illustrated with 3D model.
- CMP (3") CIP (1") CIP (1") for four 1/4" CMP (1/4"

**NOTES:**
- **A.** The culvert is fabricated with 3/4" O.D. (19") thick material.
- **B.** Half circle notches are cut in the culvert for the steel pipe with continuous welds in the perimeter in contact provided.
- **C.** All welds and other non-galvanized parts are painted per Section 710.
- **D.** Connections made per DTL. Dwg. No. 603-26 for CMP and J to be increased by 3" unless other units are shown.

**ROAD APPROACH CULVERT END TREATMENT QUA N T I T I E S (FOR ESTIMATING ONLY)**

<table>
<thead>
<tr>
<th>DIA A</th>
<th>H PIPE LENGTH</th>
<th>H1/2 X 3/16 X 1/8</th>
<th>LENGTH OF GALV. CHANNEL</th>
<th>SCHEDULE 40 GALV. PIPE</th>
<th>DIMENSIONS (FT.)</th>
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<tr>
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<tr>
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<td>0.90</td>
<td>1.95</td>
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<tr>
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<td>16</td>
<td>0.25</td>
<td>1.25</td>
<td>1.95</td>
</tr>
</tbody>
</table>

**CULVERT END TREATMENT IF: **
- The two 3/4" [19] CHANNELS MAY BE ELIMINATED FROM THE CULVERT END TREATMENT.
- The outer edge of CSP to CHANNEL is limited to one quarter the width of the corrugations.
- If space from each end of the channel is limited to one quarter the width of the corrugations.
- The valleys may be crimped and spot welded.

**REFERENCES:**
- Dwg. No. 603-14
- Section 603,709,710
- Standard Spec.
- Montana Department of Transportation

**UNITS SHOWN IN BRACKETS [ ] ARE METRIC (MM) ILLUSTRATED WITH 24" [600]
- 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

21" x 15" [530 x 380]

CSPA

[530 x 380]

1'-0"

[914]

CONN.

3'-0"

EXISTING OR NEW CSP OR CSPA

PLAN VIEW

4 SPACES AT 1'-11" [584]

[593]

1'-0" [305]

CONNECTION

[914]

1'-0"

[305]

EXISTING OR NEW CSP OR CSPA

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

[64 x 64 x 6.4] GALV.

STRUCTURAL TUBING CROSS-PIPE

PER SECTION 711.

PLAN VIEW

1'-5 3/8"

[568]

1'-10 3/8"

603-17

SECTION

STANDARD SPEC.

DWG. NO.

603-17

REFERENCE

MDT× MONTANA DEPARTMENT OF TRANSPORTATION

PRECAST MEDIAN U-TURN CROSS DRAIN AND CONC. BEVELED END

DETAIL A

ELEVATION

DETAIL A

NOTE:
PAINT ALL EXPOSED METAL PARTS WITH
ONE COAT OF ZINC RICH PAINT AND TWO
COATS OF ALUMINUM PAINT PER SECTION 710.

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

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.

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 DETL 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 compaction 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.

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

**Trench/Bedding Detail**

For 12" (300) to 54" (1350) Dia.

**Quantities* Metric Quantities**

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Granular Bedding (C.Y. per ft)</th>
<th>Granular Bedding (m³ per m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10&quot;</td>
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* * BASED ON 1" [25 mm] NOMINAL WALL THICKNESS.

**Flexible Pipe**

**Trench/Bedding Detail**

For 12" (300) to 48" (1200) Dia.

**Quantities* Metric Quantities**

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Granular Bedding (C.Y. per ft)</th>
<th>Granular Bedding (m³ per m)</th>
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<tr>
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<td>1.85</td>
<td>0.31</td>
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</table>

* * BASED ON 1" [25 mm] NOMINAL WALL THICKNESS.

**Notes**

1. Trench Backfill: Place per standard specification. Rigid pipe shall be supported by granular bedding and compacted 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. The sand material should be left uncompacted to facilitate the installation of the pipe. Include the sand material in the cost of the granular bedding.
3. Sand cushion use Grade 5 material per Table 701-7 in Standard Specifications 701-10.
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.

**Detailed Drawing**

Reference: Section 603.701

**Storm Drain**

Trench Bedding Detail

Units shown in brackets (mm) are in millimeters unless otherwise noted.
### Dimension Table

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<tr>
<td>10&quot;</td>
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### Metric Dimension Table

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<tr>
<td>80</td>
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<tr>
<td>100</td>
</tr>
</tbody>
</table>

### Typical Longitudinal Section

- **Welding**
- **Reinforcing at Ends of Pipe**

### TYPICAL LONGITUDINAL SECTION

#### TYPICAL HORIZONTAL SECTION

- **Pipe Joint**

### Notes:

- All dimensions are in millimeters unless otherwise noted.

### Water Area (Square Feet)

<table>
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<th>Water Area</th>
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### Joint Detail

- **Alternate Bell Type End**
- **Joint**

### Reference

- **Reference**
- **Dimensions**
- **Section B-B**

### Typical for Drainage Applications

- **Typical Longitudinal Section**

### Reinforced Concrete Pipe Joint

- **Reinforcement**
- **Single Line Reinforcement**

---

**NOTE:** All dimensions are in millimeters unless otherwise noted.

* Wall "B" thickness

**REFERENCE:**

- **MDTX:**
- **DEPARTMENT:**
- **MONTEJO DEPARTMENT:**
- **DWG. NO.: 603-24**

---

**METRIC AND AREAS SHOWN IN BRACKETS [ ] ARE UNLESS OTHER UNITS ARE SHOWN.
SECTION A-A

CONNECTION DETAILS

TYPICAL FIELD CAST CONCRETE BEND
RAIL FACE
FINISHED SHOULDER
TO FIT CURB
WARP SHOULDER
FINISHED

10% PAVEMENT AT 10%

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.

DETAIL DRAWING
REFERENCE
DWG. NO.
STANDARD SPEC.
SECTION 603

EMBANKMENT PROTECTOR

MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:

- Designate these structures, in plans and proposal, as "vehicular underpass." Use the term "vehicular underpass" regardless of the purpose of the structure.
- Provide end treatment for all vehicular underpasses including cutoff walls, backfill retaining walls and concrete slope collars.
- Provide surfacing for the interior of the structure, cross-sloped to allow a draining course down the centerline.
- For grade thickness see road design manual fill resistant tables.
- Use class general concrete or equal.
- Use the term "backfill retaining" when specified.
- See DTL. DWG. NO. 552-00 for alternate "C" pccp transfer joint and backfill retaining details.

SURFACING QUANTITIES PER LINEAR FOOT FOR DEPTH "D:" *

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>ALTERNATE &quot;A&quot;</th>
<th>ALTERNATE &quot;B&quot;</th>
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(PLANT 0.0012)

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<th>D</th>
<th>ALTERNATE &quot;A&quot;</th>
<th>ALTERNATE &quot;B&quot;</th>
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<td>0.0007</td>
</tr>
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(PLANT 0.0012)

BACKFILL RETAINER & CUTOFF WALL DETAIL

- Extended #4 bars 3'-0" into cutoff wall.

SECTION B-B
- 4'-0" angle-iron bolts at 1'-0" centers for length of concrete slope collar (typical).
- P. slab cover (typical).

SECTION C-C
- 1'-6" into cutoff wall (collar (typical)).
- Extends #4 bars for length of slope.
- 4'-0" #4 stirrups at 18" o.c.
- 3/4" dia. x 6" anchor bolts at 1'-6" o.c.
- 3/4" dia. x 6" galv. anchor bolts.

DATE: 7-1-91

MDTX MONTANA DEPARTMENT OF TRANSPORTATION
TRANSVERSE CONTRACTION JOINT (15' [4.5 m] O.C.)

TRANSVERSE CONTRACTION JOINT (AS NEEDED)

TYPICAL BOTH ENDS
REINFORCING STEEL FOR INLET
BACKFILL RETAINER & PCCP SLAB

SEALANT MATERIAL
SAWED JOINT FACE
BACKER ROD

DETAIL A
SAWED TRANSVERSE OR LONGITUDINAL JOINT WITH HOT POURED SEALANT

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
SEE DETL. DWG. NO. 552-00, 603-30 AND 603-19.

SEE FILL HEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.

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 DETL. 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 NOT CUTOFF WALLS AND BACKFILL RETAINERS.

NOTES:

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

2. WHEN COMBINATION STOCKPASSES AND GRADES ARE SPECIFIED, INSTALL WITH CUTOFF WALLS, BACKFILL RETAINERS AT BOTH ENDS, CONCRETE EDGE PROTECTION AT THE INLET END AND OUTLET END, GRANULAR BEDDING AND DRAINAGE COVERAGE ALONG ONE SIDE. (SEE DETL. DWG. NO. 613-14 AND 613-06.)

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

4. THE MINIMUM HOLLOWNESS FOR 84" [2100] DIAMETER AND 90" [2250] DIAMETER CORRUGATED STEEL PIPE STOCKPASSES IS 0.054" [1.38]. THE MINIMUM HOLLOWNESS FOR 96" [2400] DIAMETER CORRUGATED STEEL PIPE STOCKPASSES IS 0.068" [1.73]. SEE FILL HEIGHT TABLES FOR OTHER THAN THE MINIMUM REQUIREMENTS.

5. SEE DETL. DWG. NO. 552-00, 603-30 AND 603-19.
** STANDARD UNLESS OTHERWISE NOTED ON THE PLANS.

** ** STANDARD UNLESS OTHERWISE NOTED ON THE PLANS.

NOTES: ALL CONCRETE IS CLASS GENERAL OR APPROVED EQUAL.

* SEE QUALIFIED PRODUCTS LIST FOR APPROVED GRATES.

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

SEE DETAILED DRAWING NO. 604-02 FOR DIAMETER, SLAB THICKNESS AND REINFORCING REQUIREMENTS FOR COMBINATION TYPE 3 MANHOLE, DO NOT USE TYPE II COMBINATION INLETS FOR MANHOLE DEPTHS GREATER THAN 4 FEET (1.2 m).
DIRECTION OF INTAKE FLOW

FLOOR SLAB

MANHOLE DIAMETER

ROOF SLAB (ALL SIDES)

IN BOTTOM

1 EXTRA BAR (TYPICAL)

BACK OF CURB

4" [102.4] 91.44
STD. DEPTH

STORM DRAIN LATERAL

30" [762.0] RCP CLASS 2
WALL "B" PER SECTION 708.

0.75% MIN. GRADE

TYPE IV DROP INLET
FRAME & GRATE *

SLOPE TO DRAIN

3" [76.2]

6" [152.4]

FLOOR SLAB

6" x 6" x W2.9
[152.4 x 152.4 x W08.71]
WIRE MESH

OPTIONAL SUMP
AS SPECIFIED IN PLANS

SINGLE DROP INLET

TYPE IV *

SECTION A-A

SECTION B-B

NOTE:
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.
**DRAIN**
SLOPE TO CURB TO GRATE

**SLOPE** OR ROADWAY CROSS MATCH INLET APRON AS SPECIFIED IN PLANS

**NOTES:**
- **TYPE III** and **TYPE VI** GRATES ARE INTERCHANGEABLE STRUCTURES.
- PLAN STATION AND OFFSET IS TO THE CENTER OF THE INLET.
- **FLOWLINE** OF THE CURB AND GUTTER SECTION INTO THE INLET.
- SET ALL FINAL INLET GRATE ELEVATIONS TO ENSURE THAT POSITIVE DRAINAGE IS PROVIDED FROM THE CURB AND GUTTER SECTION INTO THE INLET.
- **ALL CONCRETE IS CLASS GENERAL OR APPROVED EQUAL.**
- SEE PLANS FOR LOCATIONS AND QUANTITIES.
- PROVIDE SAFETY LUG ON STRAIGHT BAR GRATE BETWEEN EACH BAR.
- PROVIDE SAFETY LUG ON STRAIGHT BAR GRATE.
- **TYPE III** and **TYPE VI** GRATES ARE INTERCHANGEABLE WITH THE SAME FRAME AND HAVE THE ABILITY TO BE INSTALLED GRATE TO MATCH FLOW DIRECTION SHOWN.
- **OUTFLOW DIRECTION OF PIPE VARIES.**
- **OUTLET** OF DRAIN AT **8 1/8"**:
  - **G.C.** MAXIMUM SPACES EQUALLY
  - **OPTIONAL SUMP AS SPECIFIED IN PLANS**

**SECTION A-A**

**SECTION B-B**

**SECTION C-C**

**STRAIGHT BAR GRATE**

**VANE STYLE GRATE**

**PLAN FRAME**

**TOP VIEW**

**SECTION VIEW**

**FLOW**
**NOTE:**

1. Use continuous smooth round bars conforming to ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) to fabricate the optional connecting pin. Do not heat the bar to facilitate bending. Rectangular cutouts are acceptable. Cutouts on ends of each section are shown with slight taper. This is to be determined early in fabrication.

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. A cold chamfer to loops meeting Section 624 requirements using 1/2" (13 mm) of 1/8" (3 mm) R CLEARANCE MANNER. Rectangle cutouts are acceptable. (See Alternate Concrete Barrier Rail Detail)

3. No welding is permitted on the smooth round bars or reinforcing steel. Welding of reinforcing steels is not required as long as the reinforcing steel conforming to ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) is used. Do not heat the bar to facilitate bending. Rectangular cutouts are acceptable. Cutouts on ends of each section are shown with slight taper. This is to be determined early in fabrication.

4. Use Class DECK concrete or equivalent.

5. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

6. The optional tapered end shown is an acceptable alternate to the vertical end for all Concrete Barrier Rail ends.

7. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

8. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER.

9. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

10. The optional tapered end shown is an acceptable alternate to the vertical ends for all Concrete Barrier Rail Ends.

11. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

12. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

13. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

14. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

15. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

16. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

17. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

18. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

19. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

20. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

21. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

22. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

23. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.

24. Use ASTM A 311 (Grade 60) or ASTM A 311M (Grade 60M) for reinforcing steel. Use Class DECK concrete or equivalent. Use the Alternate B (and W) end in this rail on a 1/8" (3 mm) CLEARANCE MANNER. Do not install unanchored Concrete Barrier Rail for obstacles within 8'-0" (2.4 m) of the base chord of the rail. See DETAIL 605-00 for Concrete Barrier Rail Anchors.
**ANCHORS**

**CONCRETE BARRIER RAIL INSTALLATIONS ON ASPHALT PAVEMENT**

- **Attachment A** DETAIL
- **Attachment B** DETAIL

**PLAN VIEW**

- **Type 1 Anchor**
  - (For temporary or permanent concrete barrier rail installations or asphalt pavement)
  - 55°

**END VIEW**

- **Option 1**
  - Traffic on both sides of C.B.R.
- **Option 2**
  - Traffic on one side of C.B.R.

**NOTE:**

- Use these anchors with standard concrete barrier rail (C.B.R.), as shown in DTL. DWG. NO. 554-605.
- Cast the pinning holes into the C.B.R. using 2 1/2" (50.8 mm) I.D. steel pipe. Do not drill the pinning holes.
- Use Type 2 anchors when a deeper embedment (5 1/2" [140 mm] into the bridge deck or concrete pavement is permissible.
- Adjust the location of the Type 2 or Type 3 anchors to avoid the main reinforcing when placed in the bridge deck.

**Type 1 Anchor**

**PLAN VIEW**

- 5" [127]
- 1 3/4" [44] DIA. EXPANSION BOLT
- 1 1/8" [28.6] DIA. HOLE
- 1 3/4" [44] DIA. EXPANSION BOLT
- 1 1/2" [38] DIA. HOLE

**END VIEW**

- 3" [76] MIN. EMBEDMENT
- 1 1/2" [38] EXPANSION BOLT WITH 1" [25.4] DIA. HOLE

**Type 2 Anchor**

**PLAN VIEW**

- 1 1/8" [27.0] DIA. HOLE
- 1 1/4" [38] DIA. HOLE
- 1 3/4" [44] DIA. HOLE
- 1 1/2" [38] DIA. EXPANSION BOLT WITH 1" [25.4] DIA. HOLE

**END VIEW**

- 3" [76] MIN. EMBEDMENT
- 1 1/2" [38] EXPANSION BOLT WITH 1" [25.4] DIA. HOLE

**Type 3 Anchor**

**PLAN VIEW**

- 1 1/4" [38] DIA. HOLE
- 1 3/4" [44] DIA. HOLE
- 1 1/4" [38] DIA. HOLE
- 1 1/2" [38] DIA. HOLE

**END VIEW**

- 3" [76] MIN. EMBEDMENT
- 1 1/2" [38] EXPANSION BOLT WITH 1" [25.4] DIA. HOLE

**NOTES:**

- Use approved non-shrink or epoxy grout. Use Type 2 anchors when a deeper embedment (5 1/2" [140 mm]) into the bridge deck or concrete pavement is permissible.
- 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.
- Ensure Type 3 anchors are first driven through the barrier to allow lifting of the barrier without interferences. Then remove the barrier and fill the pinning holes with an approved sealant.
- Do not install anchored concrete barrier rail for distances within 3 1/2 ft. of the base (traffic side) of the rail.
NOTES:
1. USE CLASS DECK CONCRETE OR EQUIVALENT.
2. REINFORCING STEEL CONSISTS OF DEFORMED BARS CONFORMING TO ASTM A 615 (250), GRADE 60 (420).
3. CONNECT EACH 10' (3.05 m) SECTION WITH CONNECTING PINS AS DETAILED AND
   CONFORMING TO ASTM A 27 (270), GRADE 36 (250) OR BETTER. CONNECTING
   PINS NEED NOT BE PAINTED.
4. 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.
5. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR
   REINFORCING STEEL.

REINFORCING STEEL CONSISTS OF DEFORMED BARS CONFORMING TO
ASTM A 615 (250), GRADE 60 (420). CONNECTING PINS MEETING SECTION 556
FABRICATION REQUIREMENTS USING 1/8" (3 mm) DIA. E8018 GRADE 36
(250) ROD. DO NOT TACK WELD THE PIECES TOGETHER PRIOR TO WELDING.
USE 1/8" (3) DIA. E8018 GRADE 36 (250) FOR REBAR TO FACILITATE FORM REMOVAL. RECTANGULAR CUTOUTS ARE ACCEPTABLE.
BENDING. EPOXY COAT IN ACCORDANCE WITH SUBSECTION 711.02. GALVANIZE OR EPOXY COAT LOOPS AND CONNECTING PINS AFTER FABRICATION/DETAIL MAY ALSO BE USED HERE.
PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER
CONCRETE BARRIER RAIL. ASSEMBLE AND PIN SUFFICIENT NUMBER OF
CONNECTING PINS TO FACILITATE REMOVAL. RECTANGULAR CUTOUTS ARE ACCEPTABLE.
REINFORCEMENT USING 1/8" (3 mm) DIA. E8018 GRADE 36 (250) TO FABRICATE THE OPTIONAL
TAPERED END DETAIL MAY ALSO BE USED HERE.
SMOOTH ROUND BARS OR REINFORCING STEEL.
USE CONNECTION DETAILS SHOWN FOR EXERCISE PURPOSES, NOT FOR JANt.
GALVANIZING STANDARDS.
BENDING. EPOXY COAT IN ACCORDANCE WITH SUBSECTION 711.02. GALVANIZE OR EPOXY COAT LOOPS AND CONNECTING PINS AFTER FABRICATION/DETAIL MAY ALSO BE USED HERE.
PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER
REINFORCEMENT USING 1/8" (3 mm) DIA. E8018 GRADE 36 (250) TO FABRICATE THE OPTIONAL
TAPERED END DETAIL MAY ALSO BE USED HERE.
GALVANIZING STANDARDS.

1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO ASTM A 27 (270), GRADE 36 (250) TO FABRICATE THE OPTIONAL
TAPERED END DETAIL MAY ALSO BE USED HERE.
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. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm)
ASTM GALVANIZING STANDARDS.
BENDING. EPOXY COAT IN ACCORDANCE WITH SUBSECTION 711.02. GALVANIZE OR EPOXY COAT LOOPS AND CONNECTING PINS AFTER FABRICATION/DETAIL MAY ALSO BE USED HERE.
PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER
REINFORCEMENT USING 1/8" (3 mm) DIA. E8018 GRADE 36 (250) TO FABRICATE THE OPTIONAL
TAPERED END DETAIL MAY ALSO BE USED HERE.
GALVANIZING STANDARDS.

1. USE CONTINUOUS SMOOTH ROUND BARS CONFORMING TO ASTM A 27 (270), GRADE 36 (250) TO FABRICATE THE OPTIONAL
TAPERED END DETAIL MAY ALSO BE USED HERE.
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. NO ADDITIONAL WELDING IS PERMITTED ON THE SMOOTH ROUND BARS OR REINFORCING STEEL.

UNITS SHOWN IN BRACKETS [] ARE METRIC AND ARE IN MILLIMETERS (mm)
ASTM GALVANIZING STANDARDS.
BENDING. EPOXY COAT IN ACCORDANCE WITH SUBSECTION 711.02. GALVANIZE OR EPOXY COAT LOOPS AND CONNECTING PINS AFTER FABRICATION/DETAIL MAY ALSO BE USED HERE.
PRECAST SECTIONS IN THE FABRICATIONS PLANT TO DETERMINE THAT PROPER
REINFORCEMENT USING 1/8" (3 mm) DIA. E8018 GRADE 36 (250) TO FABRICATE THE OPTIONAL
TAPERED END DETAIL MAY ALSO BE USED HERE.
GALVANIZING STANDARDS.
WIDENING IS REQUIRED IF FINISHED SHOULDER IS LESS THAN

DO NOT INSTALL W-BEAM GUARDRAIL FOR OBSTACLES WITHIN

USE LOWER HOLE ON NEW CONSTRUCTION INSTALLATIONS.

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

NOTES:

INSTALL ALL BOLTS WITH HEADS ON TRAFFIC SIDE

USE WOOD BLOCKS OR OTHER "MASH" APPROVED
BLOCKS. AFFIX BLOCKS TO POSTS WITH TWO 16 PENNY
GALV. NAILS OR 14 GAUGE WIRE WRAP.

INCLUDING TERMINAL SECTIONS, WITH THE REFLECTORIZED
SURFACE 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
ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL
ATTACH REFLECTORS TO POSTS EVERY 25 FEET [7.62 m],
REFLECTORS FROM 0.063" [1.6] THICK ALUMINUM ALLOY
AND TWO 3/16" [4.8] DIA. WASHERS IN PRE-DRILLED HOLES.

HEIGHT IS 27 3/4" [705.]
2'-0" [0.6 m] FROM THE TRAFFIC LANE.
5.3' [1.6 m] OF THE FACE OF THE RAIL.

USE 6' [1830] POSTS FOR STANDARD INSTALLATIONS.

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

DETAILED DRAWING
REFERENCE
606-05A
SECTION
STANDARD SPEC.
MTD-
WOOD POSTS (MGS)
METAL GUARDRAIL -
OF TRANSPORTATION
MONTANA DEPARTMENT
YELLOW PER MUTCD
SHEETING WHITE OR
INTENSITY)
TYPE III (HIGH
REFLECTORIZED
[100 TO 130]
4" TO 5"
3/16" [5]
3/4" [20]
[35]
1 1/2"
3 " [7.5]
REFLECTOR
POST
WOOD
TOP OF
RAIL
8" [205]
3/4" [19]
7"
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3/4" [19]
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3/4" [19]
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7"
3/4" [19]
7"
3/4" [19]
7"
**STIFFENED GUARDRAIL SECTION PAY LIMITS**

<table>
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<td>6'-3&quot; (1905)</td>
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<tr>
<td>2 SPACES @ 3'-1 1/2&quot; (955)</td>
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<tr>
<td>6 SPACES @ 1'-6 3/4&quot;</td>
</tr>
<tr>
<td>15'-7 1/2&quot; (476m) TRANSITION (OMIT ON DIVIDED ROADWAYS)</td>
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<tr>
<td><strong>STIFFENED GUARDRAIL SECTION</strong></td>
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<tr>
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<td>2 SPACES @ 3'-1 1/2&quot; (955)</td>
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<td>6 SPACES @ 1'-6 3/4&quot;</td>
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<tr>
<td>15'-7 1/2&quot; (476m) TRANSITION (OMIT ON DIVIDED ROADWAYS)</td>
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**HALF POST SPACING**

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<tr>
<td>6'-3&quot; (1905)</td>
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<tr>
<td>4 SPACES @ 3'-1 1/2&quot; (955)</td>
</tr>
<tr>
<td><strong>HALF POST SPACING 3'-1 1/2&quot; (955)</strong></td>
</tr>
</tbody>
</table>

**NOTES:**

1. SEE DTL. DWG. NO. 606-05A AND 606-05B FOR STANDARD MGS GUARDRAIL AND ASSOCIATED HARDWARE.
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 RWMB-B5.
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 SPICE LOCATIONS.

* 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.**
LONG POSTS - WOOD
METAL GUARDRAIL - UNLESS OTHER UNITS ARE SHOWN.
METRIC AND ARE IN MILLIMETERS (mm)
UNITS SHOWN IN BRACKETS [ ] ARE

2 :1 MAX (SEE NOTE 7)

SLOPE VARIES APPROX.

REFLECTOR (SEE NOTE 3)

DIA. (TYP.)

3/16" [5]

3/4" [20]

1 1/2" [35]

[100 TO 130]

4" TO 5"

[635]

2'-1"

[490]

1'-7"

SHOULDER FINISHED
NORMAL
POST WOOD TOP OF PROFILE

NOTE:
YELLOW PER MUTCD SHEETING WHITE OR INTENSITY)
TYPE III (HIGH REFLECTORIZED

NOTE:
ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 27 3/4" (705).

BOLT SLOT PATTERN
3/4"x2 1/2" [19.1 X 63.5]

RAIL SPLICE
POST
POST
POST
POST
POST
POST

POST BOLT SLOT

6'-3" [1.905 m]
6'-3" [1.905 m]

RAIL ELEMENT LENGTH = 13'-6 1/2" (4.13 m)

RAIL ELEMENTS SPACED AT 12'-6" INTERVALS (3.8 m)

DIRECTION OF ADJACENT TRAFFIC

ELEVATION

NOTES:
1. INSTALL ALL NAILS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
2. USE WOOD BLOCKS OR OTHER "MASH" APPROVED BLOCKS AFTER BLOCKS TO POSTS WITH TWO (2) 10 PENNY GALVANIZED NAILS OR 16 PENNY WIRE WRAP.
3. ATTACH REFLECTORS TO POSTS AWAY FROM TRAFFIC FACING NAILS AND TOOP RAIL ELEMENT (TYP.)
4. ATTACH REFLECTORS TO WOOD POST USING TWO 10 PENNY GALVANIZED NAILS AND TWO (2) 3/16" (4.8) WASHERS IN PRE-DRILLED HOLES.
5. ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 27 3/4" (705).

4 1/4" [108]

POST BOLT SLOT

6'-3" [1.905 m]
6'-3" [1.905 m]

RAIL ELEMENT LENGTH = 13'-6 1/2" (4.13 m)

RAIL ELEMENTS SPACED AT 12'-6" INTERVALS (3.8 m)

DIRECTION OF ADJACENT TRAFFIC

ELEVATION

NOTES:
1. INSTALL ALL NAILS WITH HEADS ON TRAFFIC SIDE OF INSTALLATION.
2. USE WOOD BLOCKS OR OTHER "MASH" APPROVED BLOCKS AFTER BLOCKS TO POSTS WITH TWO (2) 10 PENNY GALVANIZED NAILS OR 16 PENNY WIRE WRAP.
3. ATTACH REFLECTORS TO POSTS AWAY FROM TRAFFIC FACING NAILS AND TOOP RAIL ELEMENT (TYP.)
4. ATTACH REFLECTORS TO WOOD POST USING TWO 10 PENNY GALVANIZED NAILS AND TWO (2) 3/16" (4.8) WASHERS IN PRE-DRILLED HOLES.
5. ON EXISTING GUARDRAIL INSTALLATIONS, THE MINIMUM RAIL HEIGHT IS 27 3/4" (705).
UNLESS OTHER UNITS ARE SHOWN. METRIC AND ARE IN MILLIMETERS (mm) UNITS SHOWN IN BRACKETS [ ] ARE
10:1 OR FLATTER
3:1 OR FLATTER
EDGE OF SHOULDER OR FACE OF GUARDRAIL

TRINITY SOFTSTOP

OPTIONAL TERMINAL SECTION SYSTEMS VARY, REFER TO MANUFACTURER'S DETAIL AND ASSEMBLY INSTRUCTIONS.
SEE DTG. NO. 606-203 FOR MGS GUARDRAIL. SEE DTG. NO. 606-204 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.
P-5'-8" (1.68 m) MINIMUM DIMENSION ALLOWS FOR OPTIONAL TERMINAL SECTION FLARE AND SYSTEM WIDTH. A MINIMUM WIDENING
DISTANCE OF 5'-0" (1.52 m) IS REQUIRED BEHIND POST LOCATION #1.

ROAD SYSTEMS MSK2 WITH 9'-4 1/2" RAIL PANEL

UNITS SHOWN IN INCHES () AND MILLIMETERS [ ] UNLESS OTHER UNITS ARE SHOWN.
GUARDRAIL TRANSITION
MGS TO METAL

EXISTING METAL GUARDRAIL MOUNTING HEIGHT

GUARDRAIL MOUNTING HEIGHT TRANSITION

EXISTING POST

MID SPAN SPLICE

MGS GUARDRAIL MOUNTING HEIGHT

6'-3" (1.905 m)

3'-1 1/2" (950)

15'-7 1/2" (4.763 m)

28'-1 1/2" (8.573 m)

12'-4" (3.73 m)

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 LINEAL FEET OF MGS GUARDRAIL.

2. SEE DETS. AS AN 600-20A, 600-20F, ANK-17A, AND 600-35A FOR MGS GUARDRAIL AND ASSOCIATED HARDWARE.

3. LAP ALL @-WAY RAIL IN THIS DIRECTION OF ADJACENT TRAFFIC.

UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE TO BE CONVERTED TO MILLIMETERS (MM) UNLESS OTHER DATES AND UNITS SHOWN.
USE DOUBLED GUARDRAIL BEAMS

END OF CONCRETE BARRIER

BRIDGE WING WALL

FOR TAPERED CONCRETE CURB DETAILS, SEE DTL. DWG. NO. 606-27

BRIDGE RAIL (SEE BRIDGE PLANS)

PAY LIMITS

<table>
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<td>SEE DTL. DWG. NO. 606-05A FOR METAL GUARDRAIL (W-BEAM).</td>
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NOTES:

1. TAPERED CONCRETE CURBS:
   - TYPE 1, SEE DTL. DWG. NO. 606-26
   - TYPE 3, SEE DTL. DWG. NO. 606-27

2. TAPERED CONCRETE CURBS ARE ALSO REQUIRED ON CONCRETE APPROACH SLABS.

3. LAP GUARDRAIL IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE.
   (SEE DTL. DWG. NO. 606-05A).

4. LAP W-BEAM TERMINAL CONNECTOR (RWE02a-b) IN THE DIRECTION OF THE ADJACENT TRAFFIC LANE.

5. USE WOOD BLOCKS OR OTHER NCHRP 350 APPROVED BLOCKS FOR BLOCKOUTS.

6. DO NOT FLARE BRIDGE APPROACH SECTIONS.

7. SEE DTL. DWG. NO. 606-05A FOR METAL GUARDRAIL (W-BEAM).
BENT BARS

METRIC BILL OF REINFORCING STEEL (ONE SECTION ONLY)

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<td>#8</td>
<td>3</td>
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<td>10&quot;</td>
<td>7&quot;</td>
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<td>1-7/8</td>
<td>3-1/2</td>
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<tr>
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<td>#10</td>
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<td>4-1/2</td>
<td>10&quot;</td>
<td>7&quot;</td>
<td>1-1/2</td>
<td>1-7/8</td>
<td>4-1/2</td>
</tr>
<tr>
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<td>#8</td>
<td>#12</td>
<td>6</td>
<td>4-1/2</td>
<td>10&quot;</td>
<td>7&quot;</td>
<td>1-1/2</td>
<td>1-7/8</td>
<td>5-1/2</td>
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<tr>
<td>C4</td>
<td>#10</td>
<td>#14</td>
<td>9</td>
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<td>1-7/8</td>
<td>6-1/2</td>
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<tr>
<td>C6</td>
<td>#12</td>
<td>#16</td>
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</table>

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

NOTE: UNLESS OTHER UNITS ARE SHOWN.

TOTAL SECTIONS 606-26

REINFORCING STEEL METETING SECTION 711.

FURNISH CONCRETE CURB DETAIL

TAPERED CONCRETE CURB IS USED IN BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION

NOTES:

1. ALL CONCRETE IS CLASS GENERAL.

TOTAL SECTIONS 606-26

REINFORCING STEEL METETING SECTION 711.

FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED IN BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.

TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION


FURNISH WIRE ROPE MEETING SECTION 705.
Tapered Concrete Curb Detail

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

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

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<tr>
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Notes:
2. FURNISH GRADE 60 [420] REINFORCING STEEL MEETNG SECTION 555 AND 711.
3. ALL CONCRETE IS CLASS GENERAL.
4. TAPERED CONCRETE CURB EST. = 0.2 C.Y. [0.16 m³] TOTAL WEIGHT PER 6' [1800] TAPERED CURB EST. = 27 LB. [11.7 kg] TOTAL REBAR WEIGHT PER 6' [1800] TAPERED CURB EST. = 27 LBS.
5. TAPERED CONCRETE CURB IS USED WITH BRIDGE APPROACH SECTION TYPE 3.
6. MINIMUM OF 4" [100] BELOW THE GRADE MEASURED AT THE INSIDE FACE OF THE CURB IS EMBEDDED.
7. REMOVE THE EXISTING SURFACE UNDER THE NEW TAPERED CONCRETE CURB AS APPROVED BY THE PROJECT MANAGER.
8. ADJUST DIMENSION TO MATCH EXISTING CURB.

Details shown in brackets [ ] are metric only and are in millimeters only unless otherwise shown.
**Section A-A**

**Shoulder Finished Normal Slope Variable**

2% Slope

Reflective Tab

Expansion Joint

Splice Detail

Notes:

1. Use box beam rail in minimum nominal length 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).
4. Do not install box beam guardrail for obstacles within 3 ft. (1.8 m) of the face of the rail.
5. Widening is required if finished shoulder is less than 2'-0" (6.1 m) from the traffic lane.
6. Provide shop bent box beam rail for roadway curvature with radii of less than 715 feet (218 m).

* 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.**
NOTE:

1. SEE DETAIL DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.

2. SEE DETAIL 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.
NOTES:

1. SEE DTL. DWG. NO. 606-50 FOR STANDARD BOX BEAM GUARDRAIL AND ASSOCIATED DETAILS.

2. USE ON EXIT END OF ONE-WAY TRAFFIC BRIDGES ONLY.

* SEE DTL. 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

3'-0" (914) E-0' (0)
4'-0" (1219)
5'-0" (1524)
6'-0" (1829) 7'-0" (2134)
8'-0" (2438) 9'-0" (2743) 10'-0" (3048)
11'-0" (3353) 12'-0" (3658) 13'-0" (4063)
14'-0" (4368) 15'-0" (4673) 16'-0" (4978)
17'-0" (5283) 18'-0" (5588) 19'-0" (5893)
20'-0" (6198) 21'-0" (6503) 22'-0" (6808)
23'-0" (7113) 24'-0" (7418) 25'-0" (7723)
26'-0" (8028) 27'-0" (8333) 28'-0" (8638)
29'-0" (8943) 30'-0" (9248) 31'-0" (9553)
32'-0" (9858) 33'-0" (10163) 34'-0" (10468)
35'-0" (10773) 36'-0" (11078) 37'-0" (11383)
38'-0" (11688) 39'-0" (11993) 40'-0" (12298)

NOTES:
1. PLACE A SELF-ADHESIVE OBJECT MARKER ON THE FACE OF THE NOSE ASSEMBLY. PAINT THE ALTERNATING ASTRO REFLECTIVE BLACK AND YELLOW STRIPED SLIDED COMMAND AT AN ANGLE OF 45° TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS. FLARE THE END SECTION AWAY FROM TRAFFIC UNLESS OTHER UNITS ARE SHOWN.
2. USE WOOD OR OTHER NCHRP 350/MASH APPROVED BLOCKS.
3. PLACE A SELF-ADHESIVE OBJECT MARKER ON THE FACE OF THE NOSE ASSEMBLY. PAINT THE ALTERNATING ASTRO REFLECTIVE BLACK AND YELLOW STRIPED SLIDED COMMAND AT AN ANGLE OF 45° TOWARDS THE SIDE ON WHICH TRAFFIC IS TO PASS. FLARE THE END SECTION AWAY FROM TRAFFIC UNLESS OTHER UNITS ARE SHOWN.
4. USE WOOD OR OTHER NCHRP 350/MASH APPROVED BLOCKS.

ATTACHMENT DETAILS.
SEE DTL. DWG. NO. 606-56A END ANCHORAGE ASSEMBLY.

UNIT SHOWN (WEIGHT: 1.14 TONS)
APPLY A กร๊อง (นิค) (solution 1/4)
UNLESS OTHER UNITS ARE SHOWN.

PLATE 103 B References 5-55A OPTIONS SHOWN ON THIS DETAIL.

REFERENCE Dwg. No.
OPTIONAL BOX BEAM TERMINAL SECTION - WY-BET
FLATTER 10:1 OR 3:1 OR GROUND LINE

GUARDRAIL WIDENING

ELEVATION

NOTES:
1. PLACE A SELF-ADHESIVE OBJECT MARKER ON THE END OF ALL GUARDRAIL SPLICE, RAIL, AND POST WIDTH.
2. PLACE THE END SECTION GUARD (ILLUSTRATED) AT A RATE OF 50 FEET [15.24 m] ALONG THE EDGE OF THE ROAD IN WHICH TRAFFIC IS TO PASS.
3. PLACE THE END SECTION GUARD (ILLUSTRATED) AT A RATE OF 50 FEET [15.24 m] ALONG THE EDGE OF THE ROAD IN WHICH TRAFFIC IS TO PASS.
4. USE DET. DWG. NO. 606-55B FOR TERMINAL SECTION DETAILS.

OPTIONAL BOX BEAM TERMINAL SECTION - BEAT

UNIT SHOWN IN BRACKETS [ ] AND METRIC AND ARE IN MILLIMETERS UNLESS OTHER UNITS ARE SHOWN.

REFERENCE: ENG. NO. 606-35B

Montana Department of Transportation

DETAILED DRAWING

606-55B
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<th>DESIGNATION</th>
<th>DESCRIPTION</th>
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<td>280801</td>
<td>1 1/2&quot; Dia. Standard Bolt &amp; Recess Nut</td>
<td>M20 Hex Bolt</td>
<td>606-11A</td>
<td>R2</td>
</tr>
<tr>
<td>280802</td>
<td>5/8&quot; Dia. Standard Bolt</td>
<td>M20 Hex Bolt</td>
<td>606-23A</td>
<td>R2</td>
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<tr>
<td>280803</td>
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<td>M20 Hex Bolt</td>
<td>606-23B</td>
<td>R2</td>
</tr>
<tr>
<td>280804</td>
<td>1 1/2&quot; Dia. High Strength Hex Bolt*</td>
<td>M20 High Strength Hex Bolt*</td>
<td>606-58</td>
<td>R2</td>
</tr>
<tr>
<td>280805</td>
<td>1 1/2&quot; Dia. High Strength Hex Nut</td>
<td>M20 High Strength Hex Nut</td>
<td>606-53</td>
<td>R2</td>
</tr>
<tr>
<td>280806</td>
<td>5/8&quot; Dia. High Strength Hex Bolt*</td>
<td>M20 High Strength Hex Bolt*</td>
<td>606-60</td>
<td>R2</td>
</tr>
<tr>
<td>280807</td>
<td>5/8&quot; Dia. High Strength Hex Nut</td>
<td>M20 High Strength Hex Nut</td>
<td>606-60</td>
<td>R2</td>
</tr>
<tr>
<td>280808</td>
<td>1 1/2&quot; Dia. High Strength Hex Bolt*</td>
<td>M20 High Strength Hex Bolt*</td>
<td>606-60</td>
<td>R2</td>
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<tr>
<td>280809</td>
<td>1 1/2&quot; Dia. High Strength Hex Nut</td>
<td>M20 High Strength Hex Nut</td>
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</tr>
<tr>
<td>280810</td>
<td>5/8&quot; Dia. High Strength Hex Bolt*</td>
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<td>R2</td>
</tr>
<tr>
<td>280811</td>
<td>5/8&quot; Dia. High Strength Hex Nut</td>
<td>M20 High Strength Hex Nut</td>
<td>606-60</td>
<td>R2</td>
</tr>
</tbody>
</table>

**NOTES:**


2. **QUANTITIES & TOLERANCES**

- **W** = B-Beam Metal, Quadrant
- **W** = Vertical Wall

3. **DIMENSIONS**

   - All Metric Description Dimensions Are Millimeters Unless Otherwise Noted.
GUARDRAIL HARDWARE

HEX BOLTS

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8&quot; DIA.</td>
<td>FBB06</td>
</tr>
<tr>
<td>7/8&quot; DIA.</td>
<td>FBB04</td>
</tr>
<tr>
<td>7/8&quot; DIA.</td>
<td>FBB03</td>
</tr>
<tr>
<td>7/8&quot; DIA.</td>
<td>FBB02</td>
</tr>
<tr>
<td>7/8&quot; DIA.</td>
<td>FBB01</td>
</tr>
<tr>
<td>5/8&quot; DIA.</td>
<td>FBB05</td>
</tr>
</tbody>
</table>

HEX NUT

<table>
<thead>
<tr>
<th>Nut Size</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; DIA.</td>
<td>FBB01</td>
</tr>
<tr>
<td>1 1/4&quot; DIA.</td>
<td>FBB06</td>
</tr>
<tr>
<td>1 1/2&quot; DIA.</td>
<td>FBB04</td>
</tr>
<tr>
<td>1 1/4&quot; DIA.</td>
<td>FBB03</td>
</tr>
<tr>
<td>1 1/2&quot; DIA.</td>
<td>FBB02</td>
</tr>
<tr>
<td>1&quot; DIA.</td>
<td>FBB01</td>
</tr>
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</table>

FLAT WASHERS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBB06</td>
<td>1/2&quot;</td>
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<tr>
<td>FBB04</td>
<td>1 1/4&quot;</td>
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<td>FBB02</td>
<td>1&quot;</td>
</tr>
<tr>
<td>FBB01</td>
<td>1/2&quot;</td>
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METRIC GUARDRAIL HARDWARE

HEX BOLTS

<table>
<thead>
<tr>
<th>Bolt Size</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>FMB06</td>
</tr>
<tr>
<td>M10</td>
<td>FMB10</td>
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<tr>
<td>M12</td>
<td>FMB12</td>
</tr>
<tr>
<td>M16</td>
<td>FMB16</td>
</tr>
<tr>
<td>M20</td>
<td>FMB20</td>
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</table>

HEX NUT

<table>
<thead>
<tr>
<th>Nut Size</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>FMN08</td>
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<tr>
<td>M10</td>
<td>FMN10</td>
</tr>
<tr>
<td>M12</td>
<td>FMN12</td>
</tr>
<tr>
<td>M16</td>
<td>FMN16</td>
</tr>
<tr>
<td>M20</td>
<td>FMN20</td>
</tr>
</tbody>
</table>

FLAT WASHERS

<table>
<thead>
<tr>
<th>Designation</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMB06</td>
<td>1/2&quot;</td>
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<tr>
<td>FMB10</td>
<td>5/16&quot;</td>
</tr>
<tr>
<td>FMB12</td>
<td>9/32&quot;</td>
</tr>
<tr>
<td>FMB16</td>
<td>3/32&quot;</td>
</tr>
<tr>
<td>FMB20</td>
<td>5/32&quot;</td>
</tr>
</tbody>
</table>

NOTES:
1. FOR HEX BOLTS AND ANCHOR RODS MEETING THE REQUIREMENTS OF SUBSECTION 705.01.1.
2. FOR HEX BOLTS AND ANCHOR RODS MEETING THE REQUIREMENTS OF SUBSECTION 711.06.
3. CALIBRATE BOLTS, NUTS AND WASHERS IN ACCORDANCE WITH SUBSECTION 705.01.1.
4. PITCH THREAD ANGLE FOR BOLTS FBB06-07.

DETAIL DRAWING

REFERENCE

DRAWN BY: Dwg. No.: 606-82
SECTION 606-712
MDTX MINING DEPARTMENT OF TRANSPORTATION
NOTES:

1. **ANCHOR BRACKET & END PLATE**
   - Anchor brackets, end plates, and rectangular plate washers are to conform to the requirements of AASHTO M370 (M370M) (ASTM A709 (A709M)) Grade 36 (30) steel plate. Post sleeves are to conform to the requirements of ASTM A53 Grade B.

2. **RECTANGULAR PLATE WASHER**
   - See DTL. DWG. NO. 606-80 for schedule of guardrail hardware.

3. **POST SLEEVE**
   - Galvanize fabricated parts in accordance with subsection 711.08 before swaging.

4. **CABLE ASSEMBLY**
   - 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 1/4" [6.4 mm] plated spring steel pin through the head of the swaged fitting to retain the stud in the proper position.

5. **GUARDRAIL HARDWARE**
   - Wire rope is to conform to the requirements of AASHTO M30 (M30M) and be 3/4" [19.1 mm] (6 x 19), wire strand core or independent wire rope core (WRC). Galvanized right regular lay, manufactured of improved plow steel with a minimum breaking strength of 42,800 pounds [190.4 kN].

6. **STANDARD SWAGED FITTING AND STUD (STUD THREADED ENTIRE LENGTH)**
   - The stud is to conform to the requirements of ASTM F568 (F568M) Class 8.8 and be galvanized in accordance with AASHTO M232 (M232M) (ASTM A153 [A153M]), prior to galvanizing, mill a 3/8" [9.5 mm] slot into the stud end for the locking pin.

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

**DÉTAILS**

**606-84**

**GUARDRAIL HARDWARE**

**MDT**

MONTANA DEPARTMENT OF TRANSPORTATION
W-BEAM END SECTION (FLARED)

RWE01a-b*

W-BEAM TERMINAL CONNECTOR

RWE02a-b*

RWM02a-b*  OR  RWM22a-b*

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

THICKNESS (SEE NOTES)

TOLERANCE

(-O.0,+3/16"

[-0.0,+4.8])

METRIC AND ARE IN MILLIMETERS (mm)

UNITS SHOWN IN BRACKETS [ ] ARE

UNLESS OTHER UNITS ARE SHOWN.

NOTES:

* DESTINATION SUFFIX  METAL THICKNESS

| a | 12 GAUGE [2.7 mm] |
| b | 10 GAUGE [3.5 mm] |

* 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.

W-BEAM METAL GUARDRAIL HARDWARE

MONTANA DEPARTMENT OF TRANSPORTATION
**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. DESIGN SOCKET BASKETS FOR USE WITH THE WEDGE DETAILED IN THIS DRAWING.

4. 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 GUARDRAIL HARDWARE.

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

### COMBINATION WOVEN WIRE & BARBED WIRE FENCE

<table>
<thead>
<tr>
<th>48&quot; [1200] FENCE HEIGHT</th>
<th>51&quot; [1280] FENCE HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>32&quot; [813] WW-2 BW *</td>
<td>32&quot; [813] WW-3 BW *</td>
</tr>
<tr>
<td>39&quot; [990] WW-2 BW *</td>
<td>TYPE F2-32WW [813WW]</td>
</tr>
<tr>
<td>TYPE F3-32WW [813WW]</td>
<td>TYPE F2-39WW [990WW]</td>
</tr>
</tbody>
</table>

### BARBED WIRE FENCE

<table>
<thead>
<tr>
<th>48&quot; [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>
</tbody>
</table>

#### TYPE F2


#### TYPE F3


#### TYPE F4


#### TYPE F5


#### TYPE F6


### Approximate Weight

- **32" [813] Woven Wire Fabric (832-6-12 1/2) per 20 rod (100 m) roll:** 150 lb. (77 kg) [NOTE: 12 1/2 gauge]
- **39" [990] Woven Wire Fabric (939-6-12 1/2) per 20 rod (100 m) roll:** 170 lb. (77 kg) [NOTE: 12 1/2 gauge]

*Other woven wire heights and number of barbed wire combinations are available.*

### Notes:

1. **STAYS**
   - **USE WIRE STAYS ON ALL FENCES UNLESS WOOD STAYS ARE SPECIFIED.**
   - **LOCATE STAYS HALFWAY BETWEEN LINE POSTS.**
   - **WIRE STAYS FOR BARBED WIRE FENCING ARE 2" [50] LONGER THAN THE DISTANCE BETWEEN THE TOP AND BOTTOM WIRES.**
   - **FOR WOVEN WIRE FENCING WITH BARBED WIRE ON TOP, EXTEND WIRE STAYS 6" [150] MINIMUM BELOW THE TOP OF THE WOVEN WIRE.**
   - **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" [41 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.**

2. **BARBED WIRE FENCE**

3. **NOTES:**
   - **STAPLE THE BOTTOM, TOP, CENTER AND ALTERNATE WIRES OF WOVEN WIRE TO WOOD LINE POSTS.**
   - **TIE THE BOTTOM, TOP, CENTER AND ALTERNATE WIRES OF WOVEN WIRE TO STEEL LINE POSTS.**
   - **STAPLE ALL WIRES OF WOVEN WIRE TO WOOD CORNER POSTS OR POSTS USED TO TIE-OFF WIRE.**
   - **"M" DENOTES METAL POSTS, IE. TYPE F3M.**
   - **"W" DENOTES WOOD POSTS, IE. TYPE F4W.**
   - **SEE DET. DWG. NO. 607-05, 607-10, AND 607-15 FOR ADDITIONAL FENCING DETAILS.**

### Detailed Drawing

**Reference**

**Standard Spec.**

**Section 607**

**DHW. NO.**

**FARM FENCE**

**Unites shown in brackets ( ) are Metric and are in millimeters (mm) unless other units are shown.**

**Montana Department of Transportation**

---
WILDLIFE FRIENDLY FENCE

WIRE SPACING TABLE

<table>
<thead>
<tr>
<th>Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Wire</td>
<td>7&quot;</td>
<td>7&quot;</td>
<td>7&quot;</td>
<td>9&quot;</td>
<td>9&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>(12 1/2 gauge)</td>
<td>[175]</td>
<td>[175]</td>
<td>[175]</td>
<td>[225]</td>
<td>[225]</td>
<td>[225]</td>
</tr>
</tbody>
</table>
WOOD FARM ENTRANCE GATE (TYPE G-1)

NOTE: USE 10D NAILS AND CLINCH FOR GATE CONSTRUCTION.

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'-0" [1200] TO 20'-0" [6000] IN 2'-0" [600] INCREMENTS.

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

**Fence Panels**
- For pulling, stretching, and changes in vertical alignment on panels or a run of less than 330' (100 m).

**Wood Bracing**
- Use for pulling, stretching, and changes in horizontal alignment.

**Wood Posts**
- 6" x 6" (150 x 150) round or 4 x 4 (100 x 100) standard

**Metal Line Post**
- 4" (100) round or 4" (100) square

**Brace Railing**
- 4" (100) round or 4 x 4 (100 x 100) standard

**Wood Single Panels**
- Single wood panel
- Wood double panel

**Metal Line Post**
- Metal line post

**Brace Bands**
- Brace bands

**Steel Post Double Panel Bracing**
- Steel post double panel bracing

**Steel Post Single Panel Bracing**
- Steel post single panel bracing

**Installation Details**
- Install 4" x 4" (100 x 100) brace rails and install brace bands.
- Install 2 1/2" (65) dia. nominal steel pipe schedule 40 or 4" (100) standard steel pipe to the brace rails.

**Post and Wire Requirements**
- See the specifications for post and wire requirements.
- Wire post spacing is 10'-0" (3050) center to center.

**Units Shown**
- Units shown in brackets (e.g., [125]) are in millimeters unless otherwise noted.
UNLESS OTHER UNITS ARE SHOWN. METRIC AND ARE IN MILLIMETERS (mm)

**FENCE DETAILS**

### COMBINATION WOVEN/BARBED

<table>
<thead>
<tr>
<th>RUN = L</th>
<th>PANELS REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>LESS THAN 33'</td>
<td>NONE</td>
</tr>
<tr>
<td>33' - 100'</td>
<td>SINGLE</td>
</tr>
<tr>
<td>OVER 100' TO 200' MAX.</td>
<td>DOUBLE</td>
</tr>
</tbody>
</table>

### BARBED

<table>
<thead>
<tr>
<th>RUN = L</th>
<th>PANELS REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>LESS THAN 6'</td>
<td>NONE</td>
</tr>
<tr>
<td>6'-660'</td>
<td>SINGLE</td>
</tr>
<tr>
<td>OVER 660' TO 990' MAX.</td>
<td>DOUBLE</td>
</tr>
</tbody>
</table>

### FENCE PANEL TYPES

1. LIMIT RUN LENGTHS IN POOR SOIL CONDITIONS TO REDUCE RESULTING TENSION AT CORNER OR ANGLE BREAK PANELS.
2. TIE OFF ON ALL CROSS HATCHED OR SHADED POSTS.

### 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.
Fence Layout on Steep Slopes

Some must be steep enough to deter passage of trespassers.

Section A-A

Fence Layout at Cross-Fence Connection

Fence Connection to Cattle Guard

1. Place single in single 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 on Sharp Vertical Curves

To avoid trying to conform woven wire to uneven terrain.

Fence Layout at Interstate

Change in R/W Width on Interstate

R/W Fence

Panel

Cattle Guard

Panel

Fence Layout at Local Road

Fence Under Structure Behind Bridge Bents

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

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 boll in other approved object weighing at least 150 lb. Bury the deadman in the ground both at least 24 in. below the surface.

Attach the deadman to the fence with three strands of 9 gauge wire or 9 strands of 1/2 gauge wire.

Metal line posts driven into ground at least three feet [900]

Three strands of 9 gauge wire tied around all wires and around the deadman and into metal posts.
**Fence Details**

**Uphill Fence Layout at Corrugated Steel Pipe (CSP) Stockpass**

1'-0" [300] * ONE FOOT OFFSET APPLIES TO INTERSTATE FENCING ONLY.

- 4'-0" [1220] APPROXIMATE SPACING
- 4'-6" [1370] MAX RAIL LENGTH

**Adjust Length to Meet Above Inlet On Incline**

**Rail Notching**

- 2'-6" [760] SLOPE OF RCB INLET
- CUT RAILING TO MATCH SLOPE OF RCB INLET
- AT POINTS OF CONTACT WITH POSTS, NOTCH RAILS TO A DEPTH OF 2" [50] MIN.

**Interstate Fencing Only.**

* ONE FOOT OFFSET APPLIES TO INTERSTATE FENCING ONLY.

**Fence Layout for Reinforced Concrete Box (RCB) Stockpass**

1'-0" [300] * ONE FOOT OFFSET APPLIES TO INTERSTATE FENCING ONLY.

- 4'-0" [1220] APPROXIMATE SPACING
- 4'-6" [1370] MAX RAIL LENGTH

**Adjust Length to Meet Above Inlet On Incline**

**Rail Notching**

- 2'-6" [760] SLOPE OF RCB INLET
- CUT RAILING TO MATCH SLOPE OF RCB INLET
- AT POINTS OF CONTACT WITH POSTS, NOTCH RAILS TO A DEPTH OF 2" [50] MIN.

**Notes:**
- Wood items will be treated with one 6" [150] ringed nail.
- Attach rails to posts using wood items or reinforced concrete box (RCB).
- Units shown in brackets (1) are inches and are in millimeters (2).
- Unless other units are shown.
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.
Note:
1. Do not install double panels more than 30 feet (9 m) apart on islands or more than 30 feet (9 m) apart on any post. For each 10° of deflection, evenly spaced, between panels. Set in concrete block at least six inches (150).
2. Pull post and corner post bracing is the same as corner bracing.
3. A drop bar locking device is required for all double gate installations. The deep bar must be able to be inserted into the concrete block at least six inches (150).
4. All concrete is lean or better.
5. Install a 1/2" (13 mm) diameter galvanized steel top cable along all fence. Top cable with galvanized cable turnbuckles fastened for fabric band at the post.
GENERAL NOTES

1. Anchor system detail unless soil and moisture conditions necessitate the use of an alternate system or as directed by the project manager. Consult drawing numbers 607-40 and 607-45 for anchor system details (rocky conditions) and #2 (swampy conditions).

2. Flat fastening:
   - Fasten slats to the frame with 3 ~ 12d common barbed shank nails at each location.

3. Brace fastening:
   - Fasten braces to the frame with 4 ~ 8d common nails at each location and clinch.

4. Frame to sill, and frame to frame fastening:
   - Fasten the sill and frame members to the frame at each location with 2 ~ 3/4" x 2 1/4" #10 x 3/8" standard machine bolts, each with a hex nut and two flat washers. See note #4 at right.

5. Fasten the sill using 12 gauge or heavier galvanized wire to form the wire ties.

6. Slope brace fastening:
   - Fasten slope braces with 3 ~ 16d common barbed shank nails at each location.

NOTE: Pressure treat all 2" x 6" x 12'(62') members (see frame).

7. Use: 300 Series #15 (19) x 12'(3.7) standard machine bolts with 5/8" flats and #2 (swampy conditions).

8. Use anchor system #1 unless soil and moisture conditions necessitate the use of an alternate system, or as directed by the project manager. Consult drawing numbers 607-40 and 607-45 for anchor system details.

LUMBER - 8' (2.4 m) SNOW FENCE WITH ANCHOR SYSTEM #1

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>2&quot; x 6&quot; x 8' (150 x 150 x 2438.4) frame (solid)</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2&quot; x 6&quot; x 7' (150 x 150 x 2286) frame</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2&quot; x 6&quot; x 6' (150 x 150 x 2009.6) frame</td>
</tr>
</tbody>
</table>

* NOTE: Pressure treat all 2" x 6" x 12' (62') members (see frame).

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2&quot; x 6&quot; x 10' (150 x 150 x 3048) brace</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>3/4&quot; x 14' (115 x 150 x 4876.8) slat</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2&quot; x 6&quot; x 8' (150 x 150 x 2438.4) slope brace</td>
</tr>
</tbody>
</table>

** NOTE: Use only when slope is 5:1 or steeper.

HARDWARE - 8' (2.4 m) SNOW FENCE WITH ANCHOR SYSTEM #1

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>5/8&quot; dia. x 9&quot; (150 x 228.6) x 3/4&quot; flange bolt (threaded full length and nut)</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>Flat washer for 5/8&quot; dia. flange bolt</td>
</tr>
<tr>
<td>3</td>
<td>6lb (2.72 kg)</td>
<td>120 common barbed shank nail</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>#24 (101.6 mm) x 5&quot; (127 x 130) washer</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>12 gauge tie wire x 5'-0&quot; (1524) x 8 lb. (3.63 kg)</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>120 common barbed shank nails</td>
</tr>
</tbody>
</table>

* NOTE: Use 5/8" dia. (16) bolts have been tightened. Bluw tie bars bottom right. Two nails prevent eventual loosening of the bolts.

ANCHOR SYSTEM #2

(SEE DTL. DWG. NO. 607-30 FOR ANCHOR SYSTEM #2).

All nails may be either hand driven or driven with a pneumatic driver.

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 necessitate the use of an alternate system. See anchor system details for anchor system #2 (wetland conditions) and #3 (flood conditions).

2. **SLAT FASTENING**
   - Fasten slats to the frame with 3 - 12d common barbed shank nails at each location and clinch.

3. **BACK BRACE FASTENING**
   - Secure back braces to the frame with 12d common nails at each location.

4. **FRAME TO SILL AND FRAME TO FRAME FASTENING**
   - Clinch.

5. **SLOPE BRACE**
   - When required.

6. **NOTE:** Pressure treat all 2" x 6" members (entire frame).

---

**BILL OF MATERIALS FOR ONE PANEL**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>NO. OF PIECES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>12'-0&quot; [3.6 m] wood snow fence w/ anchor system  #1</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>1 1/2&quot; x 6&quot; x 16'-0&quot; [38.1 x 150 x 4876.8]</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>3/4&quot; x 6&quot; x 13'-0&quot; [19.05 x 150 x 3962.4]</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>1&quot; x 6&quot; x 18'-0&quot; [25 x 150 x 5486.4]</td>
</tr>
<tr>
<td>E</td>
<td>3</td>
<td>1&quot; x 4&quot; x 12'-0&quot; [25 x 100 x 3657.6]</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>1&quot; x 4&quot; x 12'-0&quot; [25 x 100 x 3657.6]</td>
</tr>
<tr>
<td>G</td>
<td>2</td>
<td>2&quot; x 6&quot; x 12'-0&quot; [50 x 150 x 3962.4]</td>
</tr>
<tr>
<td>H</td>
<td>2</td>
<td>2&quot; x 6&quot; x 7'-0&quot; [50 x 150 x 2133.6]</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>2&quot; x 6&quot; x 13'-0&quot; [50 x 150 x 3962.4]</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>2&quot; x 6&quot; x 13'-0&quot; [50 x 150 x 3962.4]</td>
</tr>
</tbody>
</table>

**HARDWARE - 12 [3.6 m] SNOW FENCE W/ ANCHOR SYSTEM #1**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>B</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>C</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>D</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>E</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>F</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>G</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>H</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>I</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
<tr>
<td>J</td>
<td>3/4&quot; [19.05] dia. holes (typ.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6 PIECES</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
</tr>
<tr>
<td>G</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
</tr>
</tbody>
</table>

**STANDARD SPEC.**

- Flat washer for 5/8" dia. [M16] bolt (threaded full length) and nut
- 5/8" dia. x 5" [M16 x 127] hex bolt
- #6 rebar x 5'-0" [1524]
- 12 ga. tie wire x 5'-0" ±

---

**DETAILED DRAWING**

- Reference Drawing No. 607-35

**NOTE:** After 5/8" dia. bolts have been tightened, turn the thread directly behind the nut to prevent eventual loosening of the nuts.

All nails may be either hand driven or driven with a pneumatic nailer.
ANCHOR SYSTEM #3
(FOR ROCKY CONDITIONS)

NOTE:
- Holes shown in details below are for left end of fence. Holes shown hidden are for right end of fence.
- 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.

LUMBER - SNOW FENCE W/ ANCHOR SYSTEM #3
BILL OF MATERIALS FOR ONE PANEL
SAME AS FOR SNOW FENCE W/ ANCHOR SYSTEM #1

HARDWARE - SNOW FENCE W/ ANCHOR SYSTEM #3
BILL OF MATERIALS FOR ONE PANEL
SAME AS FOR SNOW FENCE W/ ANCHOR SYSTEM #1

NOTE:
- Nails required are same as shown on hardware summary for snow fence w/ anchor system #1.

SUMMARY FOR SNOW FENCE W/ ANCHOR SYSTEM #1
NOTE: 4 PIECES
- #6 #19 rebar x 2'-0" (3/4" [19.05] dia.)
- 4 hex nuts
- 4 flat washers for 5/8" [16] dia. bar

UNIT: 0.122 m³ (4.4 C.Y.)
4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt
- 4" x 4" x 1/2" wood post

NOTE: 4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

UNIT: 0.16 C.Y.
4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

NOTE: 3 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

UNIT: 0.122 m³ (4.4 C.Y.)
4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

UNIT: 0.16 C.Y.
4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

UNIT: 0.16 C.Y.
4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

UNIT: 0.16 C.Y.
4 PIECES
- 5/8" dia. x 4' long [M16 x 127] hex bolt
- 3 flat washers for 5/8" dia. bolt

NOTE:
- After Step 3, washers have been tightened. Capping washers with nuts prevents this from happening. Bolt is used to prevent eventual loosening of the nuts.

NOTE:
- After Step 3, washers have been tightened. Capping washers with nuts prevents this from happening. Bolt is used to prevent eventual loosening of the nuts.
ANCHOR SYSTEM #2
(FOR SWAMPY CONDITIONS)

BILL OF MATERIALS FOR ONE PANEL:

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>9&quot; x 3' x 3/8&quot; x 9&quot; (762 x 900 x 6.35 x 900)</td>
</tr>
<tr>
<td>8</td>
<td>3/4&quot; (19.05) MILE CLIPS</td>
</tr>
<tr>
<td>4</td>
<td>FLAT WASHERS FOR 1/2&quot; (12.7) DIA. EYE BOLT</td>
</tr>
<tr>
<td>4</td>
<td>NO LEADS WANTED x 6&quot; (152.4)</td>
</tr>
<tr>
<td>64</td>
<td>1/2&quot; (12.7) EXPOSED THREADS NUT &amp; WASHERS (TYP.)</td>
</tr>
</tbody>
</table>

NOTE: HUES DESIGNED ARE SAME AS SHOWN OR HARDWARE SUMMERY FOR SNOW FENCE W/ ANCHOR SYSTEM #1

DEADMAN DETAIL

PLACE 3'-0" (900) REBAR (SEE DETAIL H) ¥ 2 WRAPS WITH 12" OF EYEBOLT TIE WIRE ROPE. PLACE 3'-0" (900) REBAR FOR PLACEMENT OF THE WIRE ROPE. AS POSSIBLE WHEN EXCAVATING DISPLACE AS LITTLE MATERIAL AS POSSIBLE WHEN EXCAVATING EARTH UNDISTURBED DEADMAN AND HARDWARE. REQUIRE TWO ADDITIONAL DEADMAN AND HARDWARE. FIRST AND LAST PANELS REQUIRE TWO ADDITIONAL DEADMAN AND HARDWARE.

NOTE: NAILS REQUIRED ARE SAME AS SHOWN ON HARDWARE.

INDEX:

LEFT END VIEW

FRONT VIEW

NOTE: SHOWN IN DETAILS BELOW ARE FOR LEFT END OF FENCE. HOLES SHOWN HIDDEN ARE FOR RIGHT END OF FENCE.

NOTE: ITEMS SHOWN IN BRACKETS = items are סלולaries (UNLESS OTHER ITEMS SHOWN)
**WILDLIFE FENCE WITH DIG BARRIER**

**Metal Maintenance Access Gate**
- Single or Double Panel (See Contract)
- Concrete Dig Barrier Apron

**WILDLIFE FENCE**
- Single Panel (See Contract)
- Concrete Dig Barrier Apron

**WILDLIFE FENCE W/ DIG BARRIER**
- Single Panel
- Concrete Dig Barrier Apron

**Fence Panel Types**
- Metal Equine Gate
- Metal Maintenance Access Gate

**Metal Equine Gate**
- Single or Double Panel (See Contract)
- Concrete Dig Barrier Apron

**Tie Bar Mounting Detail**
- For Gate Closers

**Section A-A**
- Center Concrete Dig Barrier Apron under Closed Gate

---

**Notes:**
- Place all fence wire on pasture side of post, except on curves. For gate wire on outside of curve.
- Place the wire on outside of curve.
- Post spacing is generally measured parallel to fence line.
- Unless other units are shown, use metric and are in millimeters (mm).
- Units shown in brackets [ ] are in inches (in). Metric and are in millimeters (mm).

**Materials:**
- Wood line posts: 5" [125] dia. treated
- Wood corner posts: 7" [180] dia. treated wood posts
- Woven wire fence fabric: ASTM 939-6-12 1/2 [12.5] gauge
- Steel tube: 2" [50] dia. painted
- Bolt hook (Typ. Top and Bottom) 7/8" dia. x 10" long
- Steel plate: 1/8" x 6" x 1'-10" long
- Steel plate, pattern with 6 - 1/4" dia. galvanized steel bolt with nut and lock washer
- Wood post to mount bracket hinge
- Center concrete dig barrier apron under closed gate

---

**Reference Drawings:**
- Dwg. No. 607-10 for Alternate Deadman
- Dwg. No. 607-11 for Alternate Deadman
- Dwg. No. 607-12 for Alternate Deadman

**Section A-A**
- Center concrete Dig Barrier Apron under Closed Gate

---

**Table:**
- Fence Panel Types
- Metal Maintenance Access Gate
- Tie Bar Mounting Detail

**Dimensions:**
- Length (L)
- Width (W)
- Height (H)

---

**additional information:**
- Include any necessary notes or specifications as required by the project.
AT POINTS OF CONTACT WITH JACKS, NOTCH POLES TO A DEPTH PREVENTING 3" [75] MIN. PENETRATION OF THE 6" [150] RINGED NAIL INTO JACK.

NOTE: ALL POLES, POSTS, NAILS, OR WOOD ITEMS WILL BE TREATED. UNLESS OTHER UNITS ARE SHOWN.
Jack and Pole Assembly

Jack Leg Notching

Mud Sill

Detail "A"

Note: All poles, posts, rails, or wood items will be treated unless otherwise noted. Units shown in brackets are in millimeters (mm).
**CURB RAMP TYPES**

**WIDE SIDEWALK OR SIDEWALK WITH BUFFER AREA**

**PLANTING OR OTHER NON-WALKING SURFACE BUFFER AREA**

**FLARED SIDE (CONCRETE OR BUFFER AREA MATERIAL)**

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

**FLARED SIDE**

**TRANSITION PANEL**

**RAMP**

**LANDING**

**RAMP**

**TRANSITION PANEL**

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

**PLANTING OR OTHER NON-WALKING SURFACE BUFFER AREA**

**FLARED SIDE (CONCRETE OR BUFFER AREA MATERIAL)**

**COMBINED (PARALLEL/PERPENDICULAR) CURB RAMP** (SEE DETAILED DRAWING NUMBERS 608-25 AND 608-30 FOR ADDITIONAL DETAILS)

**CURB RAMP TYPES**

**LANDING**

**TRANSITION PANEL**

**RAMP**

**FLARED SIDE**

**TRANSITION PANEL**

**SIDEWALK**

**TRANSITION PANEL**

**TRANSITION PANEL**

**LANDING**

**RAMP**

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

**NEW CONSTRUCTION CURB RAMPS**

**REFERENCES**

**STANDARD SPEC.**

**REFERENCE**

**DWG. NO.**

**SECTION 608**

**MDT® MONTANA DEPARTMENT OF TRANSPORTATION**

**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. **EXISTING CONDITIONS SUCH AS R/W, SIDEWALK WIDTH, AND TYPE OF SIDEWALK (CURB-TIGHT OR BUFFER AREA) Usualy DETERMINE THE TYPE OF CURB RAMPS TO USE.**

3. **A SINGLE CURB RAMP OR BLENDED TRANSITION CORNERS SERVING TWO STREET CROSSING DIRECTIONS ARE NOT ALLOWED IN NEW CONSTRUCTION AND NOT RECOMMENDED WHEN ALTERING EXISTING FACILITIES.**

4. **WHEN ALTERING EXISTING FACILITIES, MEET NEW CONSTRUCTION REQUIREMENTS FOR CURB RAMPS TO THE MAXIMUM EXTENT FEASIBLE. DOCUMENT WITH AN ADA STATEMENT OF TECHNICAL INFEASIBILITY FORM WHEN ADA STANDARDS CAN'T BE ACHIEVED.**

5. **IF POSSIBLE, DO NOT PLACE DRAINAGE STRUCTURES IN CONFLICT WITH CURB RAMPS. LOCATION OF CURB RAMPS TAKES PRECEDENCE OVER LOCATION OF DRAINAGE STRUCTURES EXCEPT WHERE EXISTING DRAINAGE STRUCTURES ARE BEING UTILIZED. IF A DRAINAGE STRUCTURE MUST BE PLACED IN THE PEDESTRIAN ACCESS ROUTE, AN ADA COMPLIANT GRATE, HAVING SLOT OPENINGS 1/2” [13] OR LESS IN ONE DIRECTION, MUST BE USED.**

6. **TAKE CARE DURING CONSTRUCTION TO ASSURE UNIFORM RAMP GRADES, FREE OF SAGS AND SHARP GRADE CHANGES.**

**CONSTRUCTION REQUIREMENTS:**

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

**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.**

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

**PEDESTRIAN ACCESS POINTS AT CROSSWALKS ARE TO BE WHOLLY CONTAINED WITHIN THE CROSSWALK LINE.**

**FOR ADDITIONAL INFORMATION CONSULT: DRAFT PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG).**

**USA寬 USE CURB RAMPS IN THE FOLLOWING ORDER OF PREFERENCE: A. PERPENDICULAR CURB RAMP B. COMBINED (PARALLEL/PERPENDICULAR) CURB RAMP C. PARALLEL CURB RAMP EXISTING CONDITIONS SUCH AS R/W, SIDEWALK WIDTH, AND TYPE OF SIDEWALK (CURB-TIGHT OR BUFFER AREA) USUALLY DETERMINE THE TYPE OF CURB RAMPS TO USE. A SINGLE CURB RAMP OR BLENDED TRANSITION CORNERS SERVING TWO STREET CROSSING DIRECTIONS ARE NOT ALLOWED IN NEW CONSTRUCTION AND NOT RECOMMENDED WHEN ALTERING EXISTING FACILITIES. WHEN ALTERING EXISTING FACILITIES, MEET NEW CONSTRUCTION REQUIREMENTS FOR CURB RAMPS TO THE MAXIMUM EXTENT FEASIBLE. DOCUMENT WITH AN ADA STATEMENT OF TECHNICAL INFEASIBILITY FORM WHEN ADA STANDARDS CAN'T BE ACHIEVED. IF POSSIBLE, DO NOT PLACE DRAINAGE STRUCTURES IN CONFLICT WITH CURB RAMPS. LOCATION OF CURB RAMPS TAKES PRECEDENCE OVER LOCATION OF DRAINAGE STRUCTURES EXCEPT WHERE EXISTING DRAINAGE STRUCTURES ARE BEING UTILIZED. IF A DRAINAGE STRUCTURE MUST BE PLACED IN THE PEDESTRIAN ACCESS ROUTE, AN ADA COMPLIANT GRATE, HAVING SLOT OPENINGS 1/2” [13] OR LESS IN ONE DIRECTION, MUST BE USED. TAKE CARE DURING CONSTRUCTION TO ASSURE UNIFORM RAMP GRADES, FREE OF SAGS AND SHARP GRADE CHANGES. 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. FINAL FIELD LOCATION OF THE CURB RAMPS WILL BE DETERMINED BY THE PROJECT MANAGER. PEDESTRIAN ACCESS POINTS AT CROSSWALKS ARE TO BE WHOLLY CONTAINED WITHIN THE CROSSWALK LINE. FOR ADDITIONAL INFORMATION CONSULT: DRAFT PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG). USA寬 USE CURB RAMPS IN THE FOLLOWING ORDER OF PREFERENCE: A. PERPENDICULAR CURB RAMP B. COMBINED (PARALLEL/PERPENDICULAR) CURB RAMP C. PARALLEL CURB RAMP EXISTING CONDITIONS SUCH AS R/W, SIDEWALK WIDTH, AND TYPE OF SIDEWALK (CURB-TIGHT OR BUFFER AREA) USUALLY DETERMINE THE TYPE OF CURB RAMPS TO USE. A SINGLE CURB RAMP OR BLENDED TRANSITION CORNERS SERVING TWO STREET CROSSING DIRECTIONS ARE NOT ALLOWED IN NEW CONSTRUCTION AND NOT RECOMMENDED WHEN ALTERING EXISTING FACILITIES. WHEN ALTERING EXISTING FACILITIES, MEET NEW CONSTRUCTION REQUIREMENTS FOR CURB RAMPS TO THE MAXIMUM EXTENT FEASIBLE. DOCUMENT WITH AN ADA STATEMENT OF TECHNICAL INFEASIBILITY FORM WHEN ADA STANDARDS CAN'T BE ACHIEVED. IF POSSIBLE, DO NOT PLACE DRAINAGE STRUCTURES IN CONFLICT WITH CURB RAMPS. LOCATION OF CURB RAMPS TAKES PRECEDENCE OVER LOCATION OF DRAINAGE STRUCTURES EXCEPT WHERE EXISTING DRAINAGE STRUCTURES ARE BEING UTILIZED. IF A DRAINAGE STRUCTURE MUST BE PLACED IN THE PEDESTRIAN ACCESS ROUTE, AN ADA COMPLIANT GRATE, HAVING SLOT OPENINGS 1/2” [13] OR LESS IN ONE DIRECTION, MUST BE USED. TAKE CARE DURING CONSTRUCTION TO ASSURE UNIFORM RAMP GRADES, FREE OF SAGS AND SHARP GRADE CHANGES. 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. FINAL FIELD LOCATION OF THE CURB RAMPS WILL BE DETERMINED BY THE PROJECT MANAGER. PEDESTRIAN ACCESS POINTS AT CROSSWALKS ARE TO BE WHOLLY CONTAINED WITHIN THE CROSSWALK LINE. FOR ADDITIONAL INFORMATION CONSULT: DRAFT PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG).
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).

2. The desirable length of the landing at the top of the curb ramp (dimension "L" above) is 5 feet (1524). The minimum length "L" is 4 feet (1220). If the landing is constrained at the back of the sidewalk, the minimum length "L" is 5 feet (1524). The landing width is equal to the ramp width.

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 cannot 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.

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

DETAILED DRAWING
REFERENCE: DWG. NO. 608-25
STANDARD SPEC. SECTION 608
PERPENDICULAR CURB RAMPS

MONTANA DEPARTMENT OF TRANSPORTATION
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.
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 from the department's qualified products list (QPL).
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.
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 5 – #4 x 36” (#13 x 900) EPOXY PAINTED DEFORMED REBARS EVENLY SPACED ON 6” (150) CENTERS WITH 3 1/2” (90) COVER

CONTRACTION JOINTS ARE REQUIRED APPROX. EVERY 10 FEET (3000)

PLAN

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 PCC PROJECTS.

FINISHED STREET SURFACE IS 1/8” (3) TO 1/4” (6) ABOVE EDGES OF DOUBLE GUTTER

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

DETAILED DRAWING
REFERENCE
STANDARD SPEC. 609
SECTION 609
CONCRETE VALLEY GUTTER

MONTANA DEPARTMENT OF TRANSPORTATION
CONCRETE CURBS

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.

CONCRETE ADA LAYDOWN CURBS

USE WHEN LANDING IS PLACED INTEGRAL WITH CURB & GUTTER (SEE DTL. DWG. NO. 608-35)

CONCRETE ADA LAYDOWN CURBS

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

1 CUBIC FOOT (0.305 cu m) OF CONCRETE WILL MAKE ABOUT 5 LINEAR FEET (1.52 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.

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

DETAILED DRAWING

REFERENCE

DWG. NO. 609-05

STANDARD SPEC. SECTION 609.707

MISCELLANEOUS CURBS
INCLUDED IN THE UNIT PRICE BID FOR THE
THE COST OF THE DROP INLET APRON IS
ELEVATION.
IS 1" LOWER THAN THE CURB FLOWLINE
THE REFERENCED GRATE ELEVATION
WITH CLASS GENERAL CONCRETE.
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 [ ] ARE

REFERENCE
STANDARD SPEC.
609
609-07

DWG. NO.
DETAILED DRAWING
APRONS

INLET TYPE
LENGTH

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<th>TYPE IV</th>
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<td>3'-11 1/2&quot;</td>
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DROOP INLET APRON
PLAN VIEW

SECTION A-A

SECTION B-B

DROP INLET TYPE I, II, III, V, VI

ROADWAY % CROSS SLOPE

<table>
<thead>
<tr>
<th>DROP INLET FRAME TYPE</th>
<th>TOP BACK OF CURB</th>
<th>GRATE &amp; APRON SLICE</th>
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<td>0.116</td>
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NOTE:
ALL CONCRETE IS CLASS GENERAL
OR APPROVED EQUAL.
SHOW DROP INLET FRAME TO MATCH
THE REFERENCED GRATE ELEVATION
AND ADJUSTING RING
WITH CLASS GENERAL CONCRETE.
THE REFERENCED GRATE ELEVATION
IS 1" LOWER THAN THE CURB FLOWLINE
ELEVATION.
THE COST OF THE DROP INLET APRON IS
INCLUDED IN THE UNIT PRICE BID FOR THE
DROP INLET.

DROP INLET TYPE IV

ROADWAY % CROSS SLOPE

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NOTE:
SEE CROSS SECTIONS FOR CROSS SLOPES ON STREET.

INLET TYPE
LENGTH

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<th>TYPE I, II, III, V, VI</th>
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<tr>
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<tr>
<td>0.43</td>
<td>3'-11 1/2&quot;</td>
</tr>
<tr>
<td>0.40</td>
<td>3'-11 1/2&quot;</td>
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</table>

UNIT SHOWN IN BRACKETS [ ] ARE
UNLESS OTHER UNITS ARE SHOWN.

DROPPED INLET
APRONS

REFERENCE
STANDARD SPEC.
SECTION 609

MDTX
MONTANA DEPARTMENT
OF TRANSPORTATION
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)).

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

DETAIL DRAWING

REFERENCE DWG. NO.
STANDARD SPEC. SECTION 609, 707
609-10

MEDIAN CONCRETE CURBS

MONTANA DEPARTMENT OF TRANSPORTATION
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.

NOTES:

1. INSTALL PREFORMED EXPANSION JOINT FILLER, PER SECTION 707, AT ALL EXPANSION JOINTS, FOR THE FULL THICKNESS OF THE CONCRETE MEDIAN CAP.

2. INSTALL A BOND BREAKER FOR THE FULL THICKNESS OF THE CONCRETE MEDIAN CAP BETWEEN THE CAP AND THE CURB. USE A 15 OR 30 POUND (6.8 OR 13.6 kg) ROOFING FELT MATERIAL, OR OTHER PRODUCT AS APPROVED BY THE PROJECT MANAGER, FOR THE BOND BREAKER. DO NOT USE EXPANSION JOINT MATERIAL AS A BOND BREAKER.

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.

4. PROVIDE CONTRACTION JOINTS NO LESS THAN 1/8" (3) WIDE AND NO MORE THAN 1/4" (6) WIDE. CONTRACTION JOINTS MAY BE CUT BY A GROOVE FORMING TOOL.

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 ЕQUAL 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.

REFERENCE

DWG. NO. 609-12

SECTION 609, 707

CONCRETE MEDIAN CAPS

MONTANA DEPARTMENT OF TRANSPORTATION
### Seeding

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<th>Definition</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>1</td>
<td>3:1 or flatter slopes</td>
<td>Condition seedbed, seed &amp; fertilize</td>
</tr>
<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>
</tr>
</tbody>
</table>

**Notes:**

1. Do not place topsoil within 1'-8" [0.5 m] of the edge of pavement.
2. Place topsoil on the surfacing inslope to a depth of 4" [100] (±) not less than 2'-0" [0.6 m] from the edge of seeding. Feather topsoil to the edge of seeding.
3. Seed areas beyond the construction limits within the right-of-way or permit boundaries that have been disturbed (e.g., staging areas, topsoil piles, equipment trails, etc.).
4. 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 (¹) are metric and are in millimeters (mm). Unless other units are shown.
SLOPE INSTALLATION

* UNLESS OTHERWISE NOTED IN PLANS

INITIAL ANCHOR TRENCH

TURF REINFORCEMENT MEAT (TRM) WOOD STAKE

CONTROL BLANKET MAT OR EROSION TURF REINFORCEMENT

TERMINAL TRENCH

TURF REINFORCEMENT MEAT (ECB) WOOD STAKE

CONTROL BLANKET MAT OR EROSION TURF REINFORCEMENT

CHECK SLOT/CONSECUTIVE ROLL JOINT TRENCH

TURF REINFORCEMENT MEAT OR EROSION CONTROL BLANKET

NOTES:

1. PROVIDE A SOIL SURFACE STABLE, FREE OF ROCKS, AND TO PLAN SPECIFICATIONS
2. SEED, FERTILIZER AND/OR APPLY OTHER SPECIFIED (IF APPLICABLE) SOIL AMENDMENTS PRIOR TO INSTALLATION; RAKE ALL SEED INTO THE UPPER 0.5" [13] OF SOIL PRIOR TO TRM OR ECB PLACEMENT.
3. INSTALL THE TRM OR ECB PARALLEL TO THE PRIMARY DIRECTION OF FLOW AND PLACE IT IN DIRECT CONTACT WITH SOIL SURFACE. DO NOT STRETCH OR ALLOW TRM OR ECB TO BRIDGE OVER SURFACE INCONSISTENCIES.
4. INITIAL ANCHOR TRENCH: PROVIDE AN INITIAL ANCHOR TRENCH AT THE BEGINNING OF THE SLOPE OR DITCH INSTALLATION FOR THE PLAN WIDTH OF THE TRM OR ECB.
5. TERMINAL TRENCH: PROVIDE A TERMINAL TRENCH AT THE END OF THE SLOPE OR DITCH INSTALLATION FOR THE PLAN WIDTH OF THE TRM OR ECB.
6. CHECK SLOT/CONSECUTIVE ROLL JOINT TRENCH: PROVIDE A CHECK SLOT A MINIMUM OF EVERY 25'-6" [7.6 m] TO ALLOW A CHECK SLOT AT A DISTANCE FLUVIAL OR WHERE A CONSTRUCTED SLOPE AND IN-PLACE SLOPE MEET.
NOTES:

1. USE ONLY ON FIELD OR PRIVATE APPROACHES.

2. PROVIDE CAST-IN ANCHOR BOLTS AS SHOWN IN DETAIL NO. 411-10 IN THE APPROPRIATE LOCATIONS.

3. ALL REINFORCING STEEL IS OF THE DEPTH WHEREST, MEETING THE REQUIREMENTS OF ABAGAMEC RM.

4. FOR DETAILS OF STEEL GRATES AND STEEL WINDOWS SEE DETAIL NO. 411-88.
FLAT BAR LAG PLATE
TYP. CAST IN
1/4" [19] DIA.
MANAGER (TYP.)
DIRECTED BY PROJECT DIA. DRAIN PIPE AS FIELD PLACED 4".
PIPE SLEEVE (TYP.)
1 1/4" [31] DIA.
PLATES (TYP.)
LAG 3'-5 1/8" 6'-4 1/4" 4'-11 3/4" 2'-8 7/8"

FLAT BAR LAG PLATE
[6 x 50 x 1370]
1/4" x 2" x 4'-6"
TYP. CAST IN
9" [230] (TYP.)

3'-9 7/16" 3'-5 1/8" 6'-4 1/4" 4'-11 3/8" 7'-0 1/2" 3'-7 3/4"

3'-0 1/4" 4'-11 3/4" 7'-0 1/2"

FLAT BAR LAG PLATE
[6 x 50 x 815]
1/4" x 2" x 2'-8"
TYP. CAST IN
9" [230] (TYP.)

20'-3" [6175] (END SUPPORT FOR 40' [12.0 m] C.G.)
18'-3" [5565] (END SUPPORT FOR 36' [10.8 m] C.G.)
16'-3" [4955] (END SUPPORT FOR 32' [9.6 m] C.G.)
15'-3" [4650] (END SUPPORT FOR 30' [9.0 m] C.G.)
12'-3" [3735] (END SUPPORT FOR 24' [7.2 m] C.G.)

GRADED TO DRAIN 1'-6" [450] OF FILL
FOR DIMENSIONS C.G. WIDTH, SEE END SUPPORT DETAILS
LAG PLATE SIZE AND SPACING VARIES WITH

SPLICE CONNECTION
8" [204] (TYP.)
LAG PLATE


END SUPPORT SECTION VIEW
3'-0 1/4" 4'-11 3/4" 2'-8 7/8"

LATERAL SUPPORT SECTION VIEW
3'-7 3/4" 6'-4 1/4" 4'-11 3/8"

HEAVY DUTY CATTLE GUARD - PRECAST
MONTANA DEPARTMENT OF TRANSPORTATION

NOTES:
1. METRIC CATTLE GUARD SIZES ARE NOMINAL, STANDARD HIGHWAY LIVE LOADING IS MEASURED FOR HEAVY DUTY CATTLE GUARDS.
2. USE SPLICE CONNECTIONS WHEN A CROWNED INSTALLATION IS REQUIRED FOR HEAVY DUTY CATTLE GUARDS.
3. METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.
4. SEE ELEVATION VIEW
5. SEE DTL. DWG. NO. 611-20 FOR ADDITIONAL PRE-CAST CONCRETE CATTLE GUARD BASE AND MATERIAL QUANTITY DETAILS.
6. SEE DTL. DWG. NO. 611-00 FOR DETAILS OF STEEL GRATES AND STEEL GUARD BASE AND MATERIAL QUANTITY DETAILS.
7. INSTALLATION PRECAUTIONS:
   EMERGENCY 2'-0" BELOW THE ELEVATION OF THE BOTTOM OF THE CATTLE GUARD BASE. EXTEND THE EXCAVATION HORIZONTALLY AT LEAST 1'-0" (300 mm) IN ALL DIRECTIONS BEYOND THE CATTLE GUARD BASE AT EXCAVATION DIMENSIONS.
   FILL THE EXCAVATION WITH CA.C. TO THE LEVEL OF THE BOTTOM OF THE CATTLE GUARD BASE. CONSIDER ADDING TO SECTION 203.
   AFTER PLACING THE CATTLE GUARD, FILL THE EXTERIOR PORTION OF THE EXCAVATION TO GRADE WITH THE SAME MATERIAL. 
   CATTLE GUARD BASES EXTEND TO A DEPTH OF 1'-0" (300 mm) WITH THE SIMILARLY COMPACTED MATERIAL.

UNIT SIZES SHOWN IN INCHES. MILLIMETERS ARE IN PARENTHESES (mm) UNLESS OTHER UNITS ARE SHOWN.

REFERENCE: DWG. NO. STANDARD SPEC. 611-15
HEAVY DUTY CATTLE GUARD - PRECAST

PLAN VIEW

ELEVATION VIEW

LATERAL SUPPORT SECTION VIEW

OPTIONAL SPLICE CONNECTION

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE

FLAT BAR LAG PLATE
ROUND PIPE

CONCRETE EDGE PROTECTION ON INLET AND/OR OUTLET END (WHEN SPECIFIED IN PLANS)

3/4" DIA. [M20] ANCHOR BOLTS AT APPROX. 18" [455] O.C. AROUND ENTIRE PERIPHERY OF PIPE EMBEDDED IN CONCRETE (TYP. ALL STRUCTURES THIS SHEET), SEE DTL. DWG. NO. 552-00

ARCH PIPE

CONCRETE EDGE PROTECTION ON INLET AND/OR OUTLET END (WHEN SPECIFIED IN PLANS)

FOR ANCHOR BOLT SPACING AND WIRE MESH SEE NOTES ABOVE

SIDE ELEVATION

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

SECTION A-A

#4 BARS [#13 BARS]

FRONT ELEVATION MULTIPLE PIPES

4'-0" [1200]

6" [150]

6" [150]

FRONT ELEVATION

CONCRETE CUTOFF WALL INLET AND OUTLET END SEE DTL. DWG. NO. 552-00

SIDE ELEVATION

6" x 6" x W2.9 [152.4 x 152.4 x MW18.71] WIRE MESH THROUGHOUT ENTIRE STRUCTURE (TYPICAL ALL STRUCTURES THIS SHEET)

SECTION B-B

#4 BARS [#13 BARS]

FRONT ELEVATION MULTIPLE PIPES

4'-0" [1200]

6" [150]

6" [150]
**NOTES:**

1. ALL CONCRETE IS CLASS GENERAL CONCRETE OR EQUAL.
2. SEE DET. DWG. NO. 552-00 FOR RCP AND RCPA CULVERTS WITH EFTS.
   FOR RCP AND RCPA CULVERTS WITH SQUARE ENDS, THE "A" DIMENSION IS 0.14 OR R/3.

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

**SECTION A-A**

CONCRETE CUTOFF WALL INLET AND OUTLET END SEE DET. DWG. NO. 552-00 (WHEN SPECIFIED IN PLANS).
CULVERT RIPRAP

613-14

2'-0" [600]

[1200]

4'-0"

[600]

UNLESS OTHERWISE SPECIFIED

CLASS 1 RIPRAP UNLESS

CUTOFF WALL

ROADWAY

SUBGRADE SHOULDER OF ROADWAY

FILL SLOPE

FLOW LINE

CONCRETE CUTOFF WALL
(SEE DTL. DWG. NO. 552-00)

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 METRIC 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]

TOP OF SLOPE

PLACE RIPRAP UP SLOPE

1' [300] MIN. DEPTH
RIPRAP PLACED ON TOP OF PERMANENT EROSION CONTROL GEOTEXTILE KEYED INTO RIPRAP

GEOTEXTILE PLACEMENT DETAIL

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

NOTES:
1. INSTALL PERMANENT EROSION CONTROL GEOTEXTILE PER SECTION 622.

GEOTEXTILE TO SUBGRADE SOIL

ENSURE INTIMATE CONTACT OF GEOTEXTILE TO SUBGRADE SOIL

ADJACENT ROLL ENDS

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

PERMANENT EROSION CONTROL GEOTEXTILE PER SECTION 716

TOP OF STREAM BANK

CURRENT STREAM DIRECTION OF

PROTECTION OF STREAM BANKS

EROSION CONTROL GEOTEXTILE FOR METHOD FOR PLACING PERMANENT

GEOTEXTILE PER SECTION 622.

NOTES:
1. INSTALL PERMANENT EROSION CONTROL GEOTEXTILE PER SECTION 622.

GEOTEXTILE PLACEMENT DETAIL

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

NOTES:
1. INSTALL PERMANENT EROSION CONTROL GEOTEXTILE PER SECTION 622.

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

**SECTION A-A**
- **RIPRAP & GROUTED RIPRAP CHUTE:**
  - **Top of Cut or Full Slope:**
  - **Existing Ground Slope:**
  - **SETTLING BASIN RIPRAP OR GROUTED RIPRAP:**
  - **SECTION B-B**

**SECTION B-B**
- **RIPRAP & GROUTED RIPRAP CHUTE:**
  - **Top of Cut or Full Slope:**
  - **Existing Ground Slope:**
  - **SETTLING BASIN RIPRAP OR GROUTED RIPRAP:**

---

**SECTION A-A**
- **DRAINAGE BOTTOM TO PREVENT FLOW FROM DEPRESS THE INLET BELOW THE NATURAL INLET CONDITIONS (TYP. FOR ALL TYPES):**
- **SHOULDER BERM DETAIL (TYP. FOR ALL TYPES):**
  - **DIRECT DRAINAGE AS REQUIRED TO BERM SHOULDER:**
  - **INTO CHUTE:**
  - **RIPRAP & GROUTED RIPRAP CHUTE:**
  - **TURF REINFORCEMENT MAT DRAINAGE CHUTE:**

---

**SECTION B-B**
- **DRAINAGE BOTTOM TO PREVENT FLOW FROM DEPRESS THE INLET BELOW THE NATURAL INLET CONDITIONS (TYP. FOR ALL TYPES):**
- **SHOULDER BERM DETAIL (TYP. FOR ALL TYPES):**
  - **DIRECT DRAINAGE AS REQUIRED TO BERM SHOULDER:**
  - **INTO CHUTE:**
  - **RIPRAP & GROUTED RIPRAP CHUTE:**
  - **TURF REINFORCEMENT MAT DRAINAGE CHUTE:**

---

**TABLE:**

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<thead>
<tr>
<th>TYPE</th>
<th>DIMENSIONS</th>
<th>RAPRAP CLASS</th>
<th>QUANTITIES</th>
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<td></td>
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<td>RIPRAP</td>
<td>GROUTED RIPRAP</td>
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<td>1</td>
<td>2'-0&quot; 4'-0&quot; 1'-0&quot;</td>
<td>3.21 CF + (N x 0.3920) CF/LF</td>
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<td>600</td>
<td>1500</td>
<td>4.25 m² + (N x 1.437) m²/m</td>
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* USE CLASS-I RIPRAP FOR ALL GROUTED RIPRAP TYPES & TRM CHUTES
* USE CLASS-I RIPRAP FOR ALL GROUTED RIPRAP TYPES & TRM CHUTES

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

**REFERENCE:**
- DWG. NO.: 613-18
- SECTION: 813,701,713,716
- DWG. NO.: 613-18
- SECTION: 813,701,713,716
- DWG. NO.: 613-18
- SECTION: 813,701,713,716
- DWG. NO.: 613-18
- SECTION: 813,701,713,716

**SUMMARY:**
- USE TURF REINFORCEMENT MAT (TRM) PER SECTION 713.12 OF THE STANDARD SPECIFICATIONS.
**CSP**

**METRIC CSP**

**RCP**

**METRIC RCP**

**DIMENSIONS (FT.)**

<table>
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<tr>
<th>Diameter</th>
<th>Inlet/Outlet</th>
<th>Dimensions (In)</th>
<th>Dimensions (CSP)</th>
<th>Dimensions (CSP)</th>
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**NOTES:**
- Paint all CIP and other non-compacted parts with one coat of zinc-rich paint and two coats of aluminum paint per Section 710.
- B = Center to center pipe spacing.
- CSP 1/2" (13) DIA. 1/8"-20 and Plate Assemblies Needed for Trailing Ramadan for Concrete Inlet and Outlet Transition Structures.

**TOP OF HEADWALL UNLESS OTHER UNITS ARE SHOWN. UNITS SHOWN IN BRACKETS [ ] ARE STANDARD SPEC. REFERENCE DWG NO. 615-02.**
INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

PLAN VIEW

NORMAL WATER LEVEL

SECTION A-A

SPACE REINFORCING BARS APPEAR 12" EACH WAY THROUGHOUT STRUCTURE - USE CONSISTENT BARS.

PLATE SPACES ARE MADE, Lap reinforcing bar 1'-0".

INLET AND OUTLET CONCRETE TRANSITIONS FOR CSP

METRIC INLET AND OUTLET CONCRETE TRANSITIONS FOR CSP

METRIC INLET AND OUTLET CONCRETE TRANSITIONS FOR RCP

DIMENSIONS

ISOMETRIC VIEW OF TRANSITION

DIA. D

SPECIFIED.

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

METRIC INLET AND OUTLET TRANSITION

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

SECTION A-A

FOR CSP

SECTION A-A

FOR RCP

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

SECTION A-A

FOR RCP

FOR CSP

SLOPING WALL

VERTICAL WALL

VERTICAL WALL

NORMAL WATER LEVEL

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

VERTICAL WALL

METRIC INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

METRIC INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

SECTION A-A

FOR CSP

SECTION A-A

FOR RCP

NORMAL WATER LEVEL

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

NORMAL WATER LEVEL

SECTION A-A

FOR CSP

SECTION A-A

FOR RCP

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

NORMAL WATER LEVEL

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

NORMAL WATER LEVEL

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.

INLET AND OUTLET TRANSITION

PLACE REBAR IN CENTER OF WALLS, Slabs, etc. unless otherwise specified.

IN FLOORS AND WALLS WHENEVER SPACE REINFORCING BARS APPROX.

INSTALL STRUCTURES OUTSIDE THE CLEAR ZONE.
**Type 2 Object Marker**

**Type 2 Object Marker Notes:**
1. Use Type 2 Object Markers to delineate roadside constructions in the clear zone (i.e., drop offs, obstructions, 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.

**Flexible Guide Post (Tubular Marker):**

**Flexible Guide Post Notes:**
1. Use flexible guide posts and plastic drums as channelizing devices.
2. Use ASTM Type III retro-reflective sheathing on all plastic drums and flexible guide posts.
3. Use one size guide post for continuous runs.

**Plastic Drum:**

**Plastic Drum Notes:**
1. Plastic drums have closed tops.
2. Use ballast according to the manufacturer's recommendations to hold the drum in place.

**Portable Vertical Panel (VP-1R shown; reverse for VP-1L):**

**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 vertical panels designated "L" are placed to the left side.
3. Use high-visibility sheathing as per the contract.

**Retro-Reflective Material:**

**Retro-Reflective Material Notes:**
1. Use retro-reflective sheathing as per the contract.
2. Reduce or eliminate distances when obstacle or hazard is less than 2'-0" [0.6 m] from the edge of the driving lane.

**General Notes:**
1. See the Manual on Uniform Traffic Control Devices (MUTCD) Part 6 for additional information.
TYPICAL MULTIPLE POST INSTALLATIONS (FOR CONSTRUCTION SIGNING ONLY)

NOTES:
1. FURNISH AND INSTALL POSTS OR POLES MEETING AASHTO M200 REQUIREMENTS.
2. FURNISH POST OR POLE LENGTHS TO ACCOMMODATE THE FOUNDATION DEPTH, THE MOUNTING HEIGHT AND THE MOUNTINGS.
3. BACKEER FOUNDATION HOLES (OR #12 DEEPS) LIFTS, THOROUGHLY TAMPING EACH LIFT.
4. IN HIGH WIND AREAS INSTALL LARGER POSTS OR POLES COMPLYING WITH THE FOUNDATION AND BREAKAWAY REQUIREMENTS OF DTL. DWG. NO. 413-20.  THE MINIMUM POST SPACING FOR MULTIPLE POSTS LARGER THAN #4 (100) IS 7'-0" (2135).
5. HORIZONTAL ALIGNMENT OF SIGNS IS TO BE WITHIN 9" OF CENTER OF MOUNTING (OR 6" IN RURAL).  THE MOUNTING HEIGHTS AND THE MOUNTINGS.
6. USE THE URBAN MOUNTING HEIGHTS IN BUSINESS, COMMERCIAL, AND RESIDENTIAL DISTRICTS WHERE PARKING AND/OR PEDESTRIAN MOVEMENT IS LIKELY TO OCCUR, OR USE THE URBAN MOUNTING HEIGHTS IN BUSINESS, COMMERCIAL, AND RESIDENTIAL DISTRICTS WHERE PARKING AND/OR PEDESTRIAN MOVEMENT IS LIKELY TO OCCUR, OR WHERE THERE ARE OTHER OBSTRUCTIONS TO VIEW. URBAN MOUNTING HEIGHTS MAY ALSO BE USED IN RURAL AREAS FOR INCREASED VISIBILITY.
7. ENJOY THE URBAN MOUNTING HEIGHTS OF STANDARD SPECIFICATION 715.

UNITs SHOWN IN BRACKETS [] ARE METRIC AND ARE MILLIMETERS (Mm) UNLESS OTHER UNITS ARE SHOWN.
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.
PORTABLE BARRICADES

1. Rail Stripes and 8" (200) in width for barricades 3 (0.9 m) or greater in length. For barricades less than 3 (0.9 m) in length, 6" (150) stripes may be used.

2. The predominant color for other barricade components is white. Black components may be used for barricades 6 (1.8 m) or greater in length.

3. When 600 barricades are to face traffic from two directions, stripping on both the front and rear sides is required.

4. Reline materials for barricade framework, assembly, attached signs, and means of sign attachment that must comply with MUTCD and/or MASH requirements for work zone devices. Options for sign attachment are:
   - Signs up to 10 sq ft (3.0 sq m) must be bolted to the top rail.
   - Signs over 16 sq ft (4.9 sq m) must be bolted to the top rail and both upright supports.
   - Signs may be mounted behind the barricade on a variable width 200 mm x 200 mm angle iron bolted sign support.

5. Rail stripes are 6" (150) in width for barricades 3' (0.9 m) or greater in length. For barricades less than 3' (0.9 m) in length, 4" (100) stripes may be used.

6. Use retro-reflective sheeting as per the contract.

7. Use sandbags of sufficient weight to hold the barricades in place. Waterproof sandbags during periods of freezing weather.

8. Position barricades so the stripes slope downward in both directions.

9. Where both left and right turns are permitted, position barricades so the stripes slope downward in the direction toward which the road users must turn.

10. Position barricades so the stripes slope downward in the direction away from the center of the barricade or barricades.

11. Where no turns are permitted, position the barricades toward the center of the barricade or barricades.

12. 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 are:
   - Signs up to 10 sq ft (3.0 sq m) must be bolted to the top rail.
   - Signs over 16 sq ft (4.9 sq m) must be bolted to the top rail and both upright supports.
   - Signs may be mounted behind the barricade on a variable width 200 mm x 200 mm angle iron bolted sign support.

13. Rail stripes are 6" (150) in width for barricades 3' (0.9 m) or greater in length. For barricades less than 3' (0.9 m) in length, 4" (100) stripes may be used.

14. Use retro-reflective sheeting as per the contract.

15. Use sandbags of sufficient weight to hold the barricades in place. Waterproof sandbags during periods of freezing weather.

16. Position barricades so the stripes slope downward in both directions.

17. Where both left and right turns are permitted, position barricades so the stripes slope downward in the direction toward which the road users must turn.

18. Position barricades so the stripes slope downward in the direction away from the center of the barricade or barricades.

19. Where no turns are permitted, position the barricades toward the center of the barricade or barricades.

20. 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 are:
   - Signs up to 10 sq ft (3.0 sq m) must be bolted to the top rail.
   - Signs over 16 sq ft (4.9 sq m) must be bolted to the top rail and both upright supports.
   - Signs may be mounted behind the barricade on a variable width 200 mm x 200 mm angle iron bolted sign support.

21. Rail stripes are 6" (150) in width for barricades 3' (0.9 m) or greater in length. For barricades less than 3' (0.9 m) in length, 4" (100) stripes may be used.

22. Use retro-reflective sheeting as per the contract.

23. Use sandbags of sufficient weight to hold the barricades in place. Waterproof sandbags during periods of freezing weather.

24. Position barricades so the stripes slope downward in both directions.

25. Where both left and right turns are permitted, position barricades so the stripes slope downward in the direction toward which the road users must turn.

26. Position barricades so the stripes slope downward in the direction away from the center of the barricade or barricades.

27. Where no turns are permitted, position the barricades toward the center of the barricade or barricades.

28. 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 are:
   - Signs up to 10 sq ft (3.0 sq m) must be bolted to the top rail.
   - Signs over 16 sq ft (4.9 sq m) must be bolted to the top rail and both upright supports.
   - Signs may be mounted behind the barricade on a variable width 200 mm x 200 mm angle iron bolted sign support.
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 (Dwg. No. 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.
NOTES:

1. THESE SIGN LAYOUTS ALSO USED IN CONJUNCTION WITH THE PERMANENT LAYOUT ILLUSTRATED ON DETAIL 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 DETAIL DWG. 618-01.

9. 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.

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

DETAILED DRAWING

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

TWO-LANE WORK AREAS
**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 descents and other conditions that affect stopping distance.
4. XX = Speed determined by the Project Manager.
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. Remove any conflicting pavement markings between the stop line and work zone boundary.
7. Place temporary pavement markings as shown when roadway surface is paved. Removable pavement markings may be used. Upon removal of the temporary traffic control signals, remove all temporary pavement markings and restore permanent or interim pavement markings.
8. Temporary traffic control signals are to meet the physical display and operational requirements of permanent traffic control signals.
9. Establish temporary traffic control signal timing by consulting with an authorized traffic engineer. Ensure that the durations of red clearance intervals are adequate to clear the one-lane section of conflicting vehicles. Incorporate safeguards to avoid the possibility of conflicting signal indications at each end of the work zone.
10. Incorporate 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.
11. Include these signs with all flaggers. Include these signs within work zones when step down is 20 M.P.H. or greater.
12. Insure the amber LED flashers meet requirements of Standard Specification 715 and DTL. DWG. 618-01.

* Denotes signs that are unique to Montana.
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.
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.

* 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, 715

618-16

TWO-LANE EQUIPMENT ENTRANCES
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
REFERENCE DWG. NO.
STANDARD SPEC. 618-20
SECTION 618

DIVIDED FOUR-LANE WORK ZONE
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.
OBLITERATE CONFLICTING PAVEMENT MARKINGS AND FILL ANY EXISTING RUMBLE STRIPS WITH PMS
- PLASTIC DRUMS (SEE NOTES FOR SPACING)
- RAISED RIGID PAVEMENT MARKERS TYPE 1 (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)

LEGEND

- OBLITERATE CONFLICTING PAVEMENT MARKINGS AND FILL ANY EXISTING RUMBLE STRIPS WITH PMS
- PLASTIC DRUMS (SEE NOTES FOR SPACING)
- RAISED RIGID PAVEMENT MARKERS TYPE 1 (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. PROVIDE ADDITIONAL SIGNING FOR EXIT DESTINATION WHEN EXIT DELINEATION IS NOT VISIBLE.
5. SEE DET. DWG. 618-03.
NOTE:
- THIS DETAIL IS IDENTICAL FOR BOTH
- WORK AREAS SHOWN IN
- THIS DETAIL.

MATCH LINE

EXISTING NORMAL POSTED SPEED LIMIT(S)

R2-1

= 150 (50 m)

MATCH LINE

- 500 (150 m)

- 250 (75 m)

- 200 (60 m)

- 150 (45 m)

- 100 (30 m)

MATCH LINE

EQUIPMENT ENTRANCE WITH NO FLAGGER

EQUIPMENT ENTRANCE WITH FLAGGER

NOTES:
- INCLUDE SPEED LIMIT SIGNS WHEN THERE IS REASON TO
- REDUCE SPEED WITHIN THE
- WORK ZONE. ALWAYS IN COLOUR
- ENSURE THE AMBER LED FLASHERS MEET
- REQUIREMENTS OF SECTION 715 AND
- ENSURE THE AMBER LED FLASHERS MEET
- REQUIREMENTS OF SECTION 715 AND
- THE BUFFER SPACE MAY BE
- INCREASED FOR DOWNGRADES
- INCREASED FOR DOWNGRADES
- Post the speed limit appropriate
- for all vehicles for the
- remainder of the work zone
- Post the speed limit at the end
- of the work zone.
- Post the speed limit appropriate
- for all vehicles for the
- remainder of the work zone
- Post the speed limit at the end
- of the work zone.
- Preview the Amber LED Flashers
- During Construction Projects
- Post the speed limit consisting
- of one limit when
- the normal posted speed limit
- for all vehicles is the same.
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- During Construction Projects
- Post the speed limit consisting
- of one limit when
- the normal posted speed limit
- for all vehicles is the same.
NOTE: THIS DETAIL SHOWN IS GENERAL IN NATURE AND SHOULD BE MATCHED TO LOCAL REQUIREMENTS.

WORK AREAS SHOWN ON THIS DETAIL.

-2250' (-675 m)
-2000' (-600 m)
-1750' (-525 m)
-1500' (-450 m)
-1250' (-375 m)
-1000' (-300 m)
-750' (-225 m)
-500' (-150 m)
-250' (-75 m)
-125' (-37.5 m)
-62.5' (-18.75 m)
-31.25' (-9.375 m)
-15.625' (-4.75 m)
-7.8125' (-2.3125 m)
-3.90625' (-1.1875 m)
-1.953125' (-0.59375 m)
-0.9765625' (-0.29765625 m)

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-15.625' (-4.75 m)
-7.8125' (-2.3125 m)
-3.90625' (-1.1875 m)
-1.953125' (-0.59375 m)
-0.9765625' (-0.29765625 m)
DO NOT SPEED

NEXT 500 FEET

LIMIT SPEED XX

NEXT XX MILES

500 FEET

LIMIT SPEED XX

KEEP RIGHT

PLASTIC DRUMS (SEE NOTES FOR SPACING)

19

ADDITIONAL SURFACING DETAIL

DOUBLE YELLOW PAINT OR DOUBLE PLASTIC PAVEMENT MARKERS

POST BOTH LIMITS ON A SINGLE SIGN.

SAME. WHEN CAR AND TRUCK SPEED LIMITS DIFFER, NORMAL POSTED SPEED LIMIT FOR ALL VEHICLES IS THE SPEED LIMIT CONSISTING OF ONE LIMIT WHEN THE

WHEN AT THE END OF A CONSTRUCTION PROJECT, POST THE SPEED LIMIT APPROPRIATE FOR

CONSTRUCTION PROJECT.

POSTED SPEED LIMITS AT THE END OF THE

ADJACENT REGULATIONS.

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

ADJACENT REGULATIONS.

THE WORK ZONE REFERS TO THE AREA WITHIN THE CONSTRUCTION PROJECT WHERE WORK IS ACTUALLY TAKING PLACE.

THE WORK ZONE REFERS TO THE AREA WITHIN THE CONSTRUCTION PROJECT WHERE WORK IS ACTUALLY TAKING PLACE.

TAKING PLACE.

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THE WORK ZONE REFERS TO THE AREA WITHIN THE CONSTRUCTION PROJECT WHERE WORK IS ACTUALLY TAKING PLACE.

TAKING PLACE.
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

SPEED LIMIT XX

1  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.
2  TEMPORARY POSITIVE PROTECTION BARRIER CAN TERMINATE AT THE CENTER OF THE CLOSED LANE FOR ACCESS PURPOSES IF AN APPROVED TEMPORARY IMPACT ATTENUATOR IS USED.
3  PLACE REFLECTIVE MARKERS ALONG THE TOP OF TEMPORARY BARRIER AND ENSURE REFLECTORS ON EXISTING BARRIER ARE INTACT.
4  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.
5  OBLITERATE CONFLICTING PAVEMENT MARKINGS BEGINNING AT THE SHIFTING TAPER AND CONTINUING THROUGH THE WORK AREA.
6  * 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  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.

WORK AREA

END WORK AREA

BEGIN WORK AREA

BEGINNING OF PROJECT (WHEN APPLICABLE)

TEMPORARY POSITIVE PROTECTION BARRIER (WHEN REQUIRED)

FLEXIBLE GLUE-DOWN GUIDE POSTS

PLASTIC DRUMS

TEMPORARY TRANSVERSE Rumble STRIPS (OPTIONAL)

WORK AREA SERIES

MATCH LINE FROM DTL. DWG. 618-28

LANE CLOSURE

NOTE:
A 45 M.P.H. DESIGN SPEED.

+500 [+150 m]

500 [150 m]

-500 [-150 m]

-180 [-55 m]

180 [55 m] FLARE (LENGTH ASSUMES A 45 M.P.H. DESIGN SPEED)

-320 [-100 m] TAPER

-500 [-150 m]

-1000 [-300 m]

-1500 [-450 m]

-2000 [-600 m]

-2500 [-675 m]

500 [150 m]

-250 [75 m]

-750 [-225 m]

-1000 [-300 m]

500 [150 m]

-4500 [-1500 m]

-2250 [-750 m]

48' x 60'

[1200 x 1500]

R2-1

48' x 60'

[1200 x 1500]

W1-4

48' x 48'

[1200 x 1200]
NOTES:

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

2. THE REGULATORY SPEED SIGNS MUST MOVE AS NEEDED TO REMAIN WITHIN 500 FEET [150 m] OF THE WORK AREA.

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

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

5. USE REFLECTIVE DEVICES.

6. 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.
NOTES:

1. **MINIMUM REGULATORY SIGN SIZE IS 24" X 20" ([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.**

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 [22.5 m]]. ASSURE 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.

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

** REFERENCES **

DWG. NO. 618-M3
SECTION 618
MTA MONTANA DEPARTMENT OF TRANSPORTATION

MAINTENANCE GUIDELINE FOR SHORT-TERM LANE CLOSURE ON INTERSTATE
MOBILE OPERATIONS ON MULTILANE ROAD

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 3 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 on a directional roadway having a right shoulder 10 feet (3 m) or more in width, drive Shadow Vehicle 1 along the right-hand shoulder with a sign indicating work in 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 spanning the edge line and Shadow Vehicle 3 on the shoulder. Where adequate shoulder width is not available, Shadow Vehicle 2 may also span the edge line.
6. The minimum arrow board size is Type B, 60 inches x 30 inches (1500 x 750).
7. Maintain a minimum spacing between the work vehicle and Shadow Vehicles, and between each Shadow Vehicle to vehicular users from driving in between.
8. Vary the distance between the work location and Shadow Vehicle 2 to provide adequate sight distance for vehicular traffic approaching from the rear.

MOBILE OPERATIONS ON TWO-LANE ROAD

1. Truck-mounted attenuator is required for Shadow Vehicle.
2. Equip Shadow Vehicle with vehicle-mounted sign, use sign shape and legends appropriate to the type of work.
3. Cover or turn the sign legends on vehicle-mounted signs from view when work is not in progress.
4. Wherever adequate stopping sight distance exists to the rear, maintain a minimum distance from the work vehicle with the shadow vehicle and proceed at the same speed.
5. Slow down the shadow vehicle in advance of vertical or horizontal curves that restrict sight distance.

NOTES:
- Place appropriate lane closure sign on Shadow Vehicle 2 so as not to obscure the arrow board.
- Follow the work operation with Shadow Vehicle 3 so as to provide adequate sight distance for vehicular traffic approaching from the rear.
- Cover or turn the sign legends on vehicle-mounted signs from view when work is not in progress.
- Place appropriate lane closure sign on Shadow Vehicle 2 so as not to obscure the arrow board.
- Maintain a minimum spacing between the work vehicle and Shadow Vehicles, and between each Shadow Vehicle to vehicular users from driving in between.

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

REFERENCES
- MDTX STANDARD SHEET
- DWG. NO. 618-M4
- SECTION 6-18
<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT FOR WORK ZONE</th>
<th>SIGN SPACING (A)</th>
<th>SPACING OF CHANNELIZING DEVICES (MAX.) (B)**</th>
<th>BUFFER SPACE (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(M.P.H.)</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
<td>FEET [m]</td>
</tr>
<tr>
<td>25</td>
<td>100 (30)</td>
<td>25 (8)</td>
<td>50 (15)</td>
</tr>
<tr>
<td>35</td>
<td>100 (30)</td>
<td>35 (172)</td>
<td>100 (30)</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 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 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. 618-01.

†

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.
**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' [3.0 m] in width between the channelizing devices and the edge of pavement.
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-U03.

**LEGEND**

- **XX** = Speed determined by the project manager (25 M.P.H. or 35 M.P.H.)
- **** = Flexible guide posts
- * = Plastic drums
- ** = Denotes signs that are unique to Montana.

**UNIT** = Meters

---

**POSTED SPEED LIMIT FOR WORK ZONE**

<table>
<thead>
<tr>
<th>SPEED LIMIT</th>
<th>SIGN SPACING</th>
<th>TAPER LENGTH</th>
<th>SPACING OF CHANNELIZING DEVICES (MAX.)</th>
<th>BUFFER SPACE</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>

---

**DESCRIPTION**

- **W20-1** 30' x 36' [900 x 900]
- **W24-1L** 36' x 36' [900 x 900]
- **G20-2** 36' x 18' [900 x 450]
- **R2-15** 24' x 30' [600 x 750]
- **R(111)-L** 10'-0" [3.0 m]
- **W1-6** 48' x 24' [1200 x 600]
- **R(111)-R** 10'-0" [3.0 m]

---

**REFERENCES**

- Detailed Drawing: DWG. NO. 618-U02
- Standard Spec. Section 618

**WORK ZONE OCCUPIES ONE HALF OF ROAD (LOW SPEED URBAN TWO-LANE, TWO-WAY ROAD)**

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**DETAILS**

- If pedestrian traffic is impacted, see DTL. DWG. 618-U05
- See Note B
- Use this sign layout in urban applications only. Use the rural, open roadway signing details when higher speed limits are used.

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**METRIC CONVERSIONS**

- 1 foot = 0.3048 meters
- 1 inch = 2.54 centimeters

---

**REFERENCES**

- Detailed Drawing: DWG. NO. 618-U02
- Standard Spec. Section 618
**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 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.**

---

**LEGEND**

- **FLEXIBLE GUIDE POSTS**

---

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

---

**MTA**
MONTANA DEPARTMENT OF TRANSPORTATION

**DETAILED DRAWING**

**REFERENCE DWG. NO. 618-U05**

**STANDARD SPEC. SECTION 618**

**SIDEWALK CLOSURES AND BYPASS WALKWAY**
### TABLE: Posted Speed Limit for Work Zone

<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 signs at end of project limits.
6. Post existing speed limit if changed by work zone.
7. 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.)

---

**DETAILED DRAWING:**

**REFERENCE DWG. NO.**

Standard Spec.

**SECTION 618**

**MDT** Montana Department of Transportation

**NOTE:** Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.
<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. THE SHOULDER TAPER MAY BE OMITTED WHEN PAVED SHOULDER IS LESS THAN 2' (0.6 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.

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.

MDT® MONTANA DEPARTMENT OF TRANSPORTATION
<table>
<thead>
<tr>
<th>POSTED SPEED LIMIT FOR WORK ZONE</th>
<th>SIGN SPACING (A)</th>
<th>CHANNELIZING DEVICE SPACING (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>
</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.)

Detailed Drawing Reference:
- DWG. No.
- Standard Spec.
- Section 618
- MDTA Montana Department of Transportation
- LEFT LANE CLOSURE
  - LOW SPEED URBAN MULTI-LANE, UNDIVIDED ROAD
- 618-U25

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

- Use this sign layout in urban applications only.
- Include speed limit signs only if there is a reason to restrict speed, cover or remove conflicting existing speed limit signs.
- Use the rural, open roadway signing details when higher speed limits are used.
- Place end road work signs at end of project limits.
- Place existing speed limit if changed by work zone.
- Place end road work signs at end of project limits.
- Place existing speed limit if changed by work zone.
- Place end road work signs at end of project limits.
- The buffer space may be increased for downgrades and other conditions that affect stopping distance.

---

**Legend:**

- Flexible guide posts
- Plastic drums
- Signs that are unique to Montana
- Speed determined by the project manager (25 mph or 35 mph)

---

**Signs and Layouts:**

- Use this sign layout in urban applications only.
- Include speed limit signs only if there is a reason to restrict speed, cover or remove conflicting existing speed limit signs.
- Normal procedure is to completely close the left lane, but if the left lane has significant left-turning traffic, the option shown may be used.
- Larger sign sizes may be approved by the project manager.
- If limited sight distance from either approach, consider right turns only or closing each approach when conditions warrant.
- Place end road work signs at end of project limits.
- Place existing speed limit if changed by work zone.
- Place end road work signs at end of project limits.
- The buffer space may be increased for downgrades and other conditions that affect stopping distance.

---

**NOTES:**

- Use this sign layout in urban applications only.
- Include speed limit signs only if there is a reason to restrict speed, cover or remove conflicting existing speed limit signs.
- Normal procedure is to completely close the left lane, but if the left lane has significant left-turning traffic, the option shown may be used.
- Larger sign sizes may be approved by the project manager.
- If limited sight distance from either approach, consider right turns only or closing each approach when conditions warrant.
- Place end road work signs at end of project limits.
- Place existing speed limit if changed by work zone.
- Place end road work signs at end of project limits.
- The buffer space may be increased for downgrades and other conditions that affect stopping distance.

---

**All dimensions are kilometers (unless otherwise noted).**

---

**Reference:**

DWG NO. 618-U45

**Section:**

618

**Left Lane Closure Work Area:**

Beyond intersection (urban multi-lane, undivided road)
**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.

**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.)

**UNITED STATES OF AMERICA**

**MONTANA DEPARTMENT OF TRANSPORTATION**

**DETAILED DRAWING**

**REFERENCE**

DTL. DWG. 618-03

**SECTION**

618

**DESCRIPTION**

LEFT LANE CLOSURE (URBAN)

LOW SPEED, MULTI-LANE, UNDIVIDED ROAD WITH TWO-WAY LEFT TURN LANE

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

ROUTE MARKERS

WARNING

REGULATORY

EXCEPT R1-1 / R1-2

REGULATORY

EXCEPT R1-1 / R1-2

NOTES:
1. PLACE ALL SIGNS AT THE CLEARANCE AND MOUNTING HEIGHTS SHOWN.
2. FOR REGULATORY, WARNING, AND ROUTE MARKER SIGNS AND THEIR ASSEMBLIES, CONSIDER ALL TABLES AND SPECIFICATIONS SHOWN IN COLUMN 2.
3. THE MAXIMUM CLEARANCE OF THESE SIGNS IS 50' IN ANY CONDITION. COLUMNS 2 AND 3 REMAIN AS SHOWN.
4. WITHIN THE CITY LIMITS OR IN A SIDEWALK AND CURB AREA, MOUNT SIGNS TO THE CURB OR FACE OF PAVEMENT AS SHOWN.
5. FOR REGULATORY SIGN LOCATION OR CLEARANCE SLIGHTLY TO AVOID PLACING PARTS IN GUTTERS, SEE NOTE 4C BELOW.
6. THE CLEARANCE IS 20' FROM THE EDGE OF PAVEMENT IN COLUMN 1.
7. USE FIGURES LISTED ABOVE WHEN PLACING THESE SIGNS IN URBAN CONDITIONS.
8. THE CLEARANCE IS 20' FROM THE EDGE OF PAVEMENT IN COLUMN 1.

HORIZONTAL CURVE ADJUSTMENTS

APPLICABLE ON OUTSIDE OF CURVE ONLY

REFERENCE STANDARDS

SIGN CLEARANCES AND MOUNTING HEIGHTS

SIGN MOUNTING HIGHLIGHTS

MONTANA DEPARTMENT OF TRANSPORTATION

DIAGRAM MICROFICHE
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.
BACKBRACING TABLE - ALUMINUM SIGNS

MAXIMUM WIDTH "B" (mm)

<table>
<thead>
<tr>
<th>SPACING &quot;A&quot; (mm)</th>
<th>2 POST</th>
<th>3 POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'-0&quot;</td>
<td>15&quot;</td>
<td>20&quot;</td>
</tr>
<tr>
<td>3'-6&quot;</td>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>5'-0&quot;</td>
<td>27&quot;</td>
<td>32&quot;</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>30&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

FOR ALUMINUM PLATE THICKNESS INFORMATION SEE SECTION 704.

METRIC BACKBRACING TABLE - ALUMINUM SIGNS

SPACING "A" (mm)

<table>
<thead>
<tr>
<th>SPACING &quot;A&quot; (mm)</th>
<th>2 POST</th>
<th>3 POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>450</td>
<td>600</td>
</tr>
<tr>
<td>550</td>
<td>700</td>
<td>850</td>
</tr>
<tr>
<td>600</td>
<td>750</td>
<td>900</td>
</tr>
</tbody>
</table>

MAXIMUM WIDTH "B" (mm)

<table>
<thead>
<tr>
<th>SPACING &quot;A&quot; (mm)</th>
<th>2 POST</th>
<th>3 POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'-0&quot;</td>
<td>1200</td>
<td>1500</td>
</tr>
<tr>
<td>5'-0&quot;</td>
<td>1500</td>
<td>1800</td>
</tr>
<tr>
<td>6'-0&quot;</td>
<td>1800</td>
<td>2100</td>
</tr>
<tr>
<td>7'-0&quot;</td>
<td>2100</td>
<td>2400</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>2400</td>
<td>2700</td>
</tr>
</tbody>
</table>

FOR ALUMINUM PLATE THICKNESS INFORMATION SEE SECTION 704.

NOTES:

1. CONFORM ALL ALUMINUM SIGNS TO SECTIONS 619 AND 704.
2. For signs 4'-0" (1200) high by 4'-0" (1200) long or less use a single sheet of aluminum.
3. Do not use horizontal joints in signs 4'-0" (1200) in height smaller. The minimum sheet width is 4'-0" (1200).
4. Signs over 4'-0" (1200) high may have horizontal and vertical joints. The minimum sheet size 4'-0" (1200) high by 4'-0" (1200) high.
5. Clean and dry post clip nuts, then torqueto 225 inch-pounds (25.4 Nm).
6. Locate all horizontal joints at a "T"-section.
7. No splices and allowed in extended "T"-sections.
8. Use screws, bolts and lockwashers meeting the requirements of section 704.
9. Use only aluminum rivets.
10. The maximum gap between individual sheet panels at joints is 1/16" (1.6) at any point.
11. The project manager may approve additional methods to prevent light leakage through sign panel seams.

DETAILED DRAWING

REFERENCE DWG. NO. 619-24

SECTION 619-24

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

ALUMINUM SHEET INCREMENT SIGN

CONSTRUCTION DETAILS

MTX DEPARTMENT OF TRANSPORTATION
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
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"
IN HEIGHT.

DO NOT USE HORIZONTAL JOINTS ON SIGNS LESS THAN 4'-0"
PANELS LESS THAN 4'-0" [1200] IN HEIGHT.

ON SIGNS 4'-0" [1200] HIGH AND GREATER, DO NOT USE ANY
CONFORM ALL PLYWOOD SIGNS TO SECTIONS 619 AND 704.

NOTES:

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 PANEL ON THE INSIDE EDGE.
5. FOR SIGNS OVER 10'-0" (3000) IN HEIGHT, THE FULL HEIGHT
   MAY BE OBTAINED WITH PANELS HAVING A FACTORY SCARFED
   JOINT IN LIEU OF USING STANDARD (CENTER) PANEL AS SHOWN.
6. THE MINIMUM SIZE PANEL IS 1'-6" (450) 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.
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 PANELS PLACED DIRECTLY TO WOOD POLES OR POSTS, WHERE SPECIFIED IN THE PLANS, BY BOLTING THROUGH THE SIGN PLATE AND THE POLE AS REQUIRED BY THE DETAIL DRAWINGS, SPECIFICATIONS AND DESIGN.

5. BIW-T-section wind braces when provided by DTL. DWG. NO. 619-06.

6. USING LARGE SUPPLEMENTAL SIGNS ADD TO INITIAL SIGN INSTALLATION FROM MAJOR SIGN PANEL 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 INSTRUCTION REGARDING APPLIANCES BREAKAWAY DEVICES FOR NEW INSTALLATIONS NOT SUPPORTED BY THE PLANS, CONTACT THE TRAFFIC UNIT.

8. IN ISSUE SIGNS, AVOID PLACING POSTS IN DITCH BOTTOMS WHERE THEY WOULD IMPede DRAINAGE.

9. 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 ADOHESIVE-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 ADOHESIVE-BACKED ALUMINUM.
   APPLY ADOHESIVE-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 ADOHESIVE ALLOY TYPE 6061-T6 OR AAS052-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.
   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.

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

- **Material:**
  - **Bolt:** M12 x 63
  - **Washer:** 2 1/2" DIA.

### Foundation Table of Weights

<table>
<thead>
<tr>
<th>Normal Pipe Dia.</th>
<th>Normal Weight (lbs./ft.) of Pipe</th>
<th>Weight of Base Plate &amp; Sign Post (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1/2&quot; O.D.</td>
<td>7.09</td>
<td>62.79</td>
</tr>
<tr>
<td>3 1/2&quot; O.D.</td>
<td>9.11</td>
<td>85.89</td>
</tr>
<tr>
<td>4&quot; O.D.</td>
<td>10.79</td>
<td>98.64</td>
</tr>
<tr>
<td>5&quot; O.D.</td>
<td>14.09</td>
<td>111.33</td>
</tr>
<tr>
<td>6&quot; O.D.</td>
<td>16.98</td>
<td>123.34</td>
</tr>
</tbody>
</table>

**NOTES:**
- **Use steel pipe conforming to the requirements of ASTM A 53 (ERW, Type 2 or S, Grades B or A 500, Grades B or D).**
- **Use class general concrete with a smooth finish on top. Form top 12 inches (300mm) of foundation.**
- **Submit shop plans for approval prior to fabrication.**
- **For size placement and details see the sign making the detailed drawings.**
- **Gravel pipe per Section 711.**

### Metric Table of Weights

<table>
<thead>
<tr>
<th>Normal Pipe Dia. (mm)</th>
<th>Normal Weight (kg/m) of Pipe</th>
<th>Weight of Base Plate &amp; Sign Post (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>1.64</td>
<td>3.90</td>
</tr>
<tr>
<td>102</td>
<td>2.45</td>
<td>5.63</td>
</tr>
<tr>
<td>127</td>
<td>3.14</td>
<td>6.92</td>
</tr>
<tr>
<td>168</td>
<td>3.85</td>
<td>8.23</td>
</tr>
<tr>
<td>210</td>
<td>4.57</td>
<td>9.54</td>
</tr>
</tbody>
</table>

**NOTES:**
- **Use steel pipe conforming to the requirements of ASTM A 53 (ERW, Type 2 or S, Grades B or A 500, Grades B or D).**
- **Use class general concrete with a smooth finish on top. Form top 12 inches (300mm) of foundation.**
- **Submit shop plans for approval prior to fabrication.**
- **For size placement and details see the sign making the detailed drawings.**
- **Gravel pipe per Section 711.**

### Post Clip Details

- **Material:**
  - **Bolt:** 3/16" [5 mm]
  - **Washer:** 3/16" [5 mm]

### Typical Elevation

- **Details:**
  - **Mounting with 2" dia. washer at sign face.**
  - **Size dia. 4# bolts and lock washer.**

### Procedure for Base Connection Assembly

1. **Assemble post to stub with bolts and one flat washer between plates.**
2. **Shim as required to plumb post.**
3. **Tighten bolts in a systematic order to preclude loosening.**
4. **Looen each bolt and retighten to the prescribed torque (see table below).**
5. **Burrs threads at junction with nut using original tightening. Do not overtighten.**

### Metric Base Connection Data

<table>
<thead>
<tr>
<th>Normal Pipe Dia. (mm)</th>
<th>Nominal DIAM.</th>
<th>DIA.+ 1/32&quot;</th>
<th>R = 0.5 BOLT DIAM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>1.45</td>
<td>0.8</td>
<td>0.5 B</td>
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<tr>
<td>102</td>
<td>1.92</td>
<td>1.0</td>
<td>0.5 B</td>
</tr>
<tr>
<td>127</td>
<td>2.45</td>
<td>1.2</td>
<td>0.5 B</td>
</tr>
<tr>
<td>168</td>
<td>3.14</td>
<td>1.6</td>
<td>0.5 B</td>
</tr>
<tr>
<td>210</td>
<td>3.85</td>
<td>2.0</td>
<td>0.5 B</td>
</tr>
</tbody>
</table>

### Metric Foundation Data

<table>
<thead>
<tr>
<th>Normal Pipe Dia. (mm)</th>
<th>Nominal DIAM.</th>
<th>DIA.+ 1/32&quot;</th>
<th>R = 0.5 BOLT DIAM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>1.45</td>
<td>0.8</td>
<td>0.5 B</td>
</tr>
<tr>
<td>102</td>
<td>1.92</td>
<td>1.0</td>
<td>0.5 B</td>
</tr>
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<td>1.2</td>
<td>0.5 B</td>
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<tr>
<td>168</td>
<td>3.14</td>
<td>1.6</td>
<td>0.5 B</td>
</tr>
<tr>
<td>210</td>
<td>3.85</td>
<td>2.0</td>
<td>0.5 B</td>
</tr>
</tbody>
</table>

### Reference

**MDTX Montana Department of Transportation**

**DWG. NO.:** 619-32
**BASE CONNECTION DATA**

<table>
<thead>
<tr>
<th>POST SIZE</th>
<th>BOLT SIZE</th>
<th>BOLT THREAD</th>
<th>DIMENSIONS</th>
<th>BASE PLATE THICKNESS</th>
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</thead>
<tbody>
<tr>
<td>M20 x 19</td>
<td>M20 x 70</td>
<td>48.0 x 1.5</td>
<td>31.7 x 12.5</td>
<td>0.73</td>
</tr>
<tr>
<td>M20 x 19</td>
<td>M20 x 70</td>
<td>48.0 x 1.5</td>
<td>31.7 x 12.5</td>
<td>0.73</td>
</tr>
<tr>
<td>M20 x 19</td>
<td>M20 x 70</td>
<td>48.0 x 1.5</td>
<td>31.7 x 12.5</td>
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<td>31.7 x 12.5</td>
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<td>M20 x 70</td>
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**FUZE PLATE DATA**

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<thead>
<tr>
<th>POST SIZE</th>
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<th>BOLT THREAD</th>
<th>DIMENSIONS</th>
<th>FUSE PLATE THICKNESS</th>
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<tr>
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**FOUNDATION DATA**

<table>
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<tr>
<th>POST SIZE</th>
<th>BOLT SIZE</th>
<th>BOLT THREAD</th>
<th>DIMENSIONS</th>
<th>FUSE PLATE THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>M20 x 19</td>
<td>M20 x 70</td>
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<td>31.7 x 12.5</td>
<td>0.73</td>
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<td>M20 x 70</td>
<td>48.0 x 1.5</td>
<td>31.7 x 12.5</td>
<td>0.73</td>
</tr>
</tbody>
</table>

**NOTES:**
- All bolts must be ASTM A 325M and be tightened by use of a direct tensioning device (load indicating washer) in accordance with the manufacturer specifications.
- All dimensions are millimeters.
- Use hardware meeting the requirements of Section 704.
- See Table for bolt sizes and appropriate washers.
- Use only with single post signs.

**PROCEDURE FOR BASE CONNECTION ASSEMBLY:**
1. Assemble post to stub with bolts and one flat washer between plates.
2. Check as required to plum post.
3. Tighten bolts in a systematic order to the prescribed torque shown in Tables.
4. Loosen each bolt and retighten to specified torque in the same order as original tightening.
5. Use a center punch to prevent nut loosening.

**PROCEDURE FOR FRICTION FUSE PLATE ASSEMBLY:**
1. Assemble post to stub with bolts and one flat washer between plates.
2. Show as required to plum post.
3. Tighten bolts in a systematic order to the prescribed torque shown in Tables.
4. Loosen each bolt and retighten to specified torque in the same order as original tightening.
5. Use a center punch to prevent nut loosening.

**NOTE:**
All bolts must be ASTM A 325M and be tightened by use of a direct tensioning device (load indicating washer) in accordance with the manufacturer specifications.
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 BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

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5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,

5/16" DIA. HEX

HEAD BOLT, PLATE WASHER,
RIVET SPACING

SEE RIVET SPACING DTL.
RIGHT

SIGN FACE
36" x 48"
[900 x 1200]

48" x 60"
SIGN FACE

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)

STRUCTURAL
STEEL POST

NOTES:

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.
**Street Name Sign Installation**

- When installing street name signs, refer to the typical layout shown in the diagram.
- The cost for mounting D-3 signs is absorbed in other bid items of the contract.
- For signs requiring backbracing, consult DTL. Dwg. No. 619-21 and 619-22 for backbracing options and details.

**Breakaway and Footing Details**

- Drilled breakaway holes for unprotected post installations. The maximum cross-sectional area at a point 4" (100) above ground level must not exceed 24 square inches (154 mm²) exclusive of unbraced breakaway holes for unprotected post installations. The hole diameter may be enlarged if necessary to ensure this requirement is met.
- Use soil cement for the foundation - per Section 619.
- The level may not exceed 24 square inches (154 mm²) exclusive of unbraced breakaway holes for unprotected post installations.
- The maximum cross-sectional area at a point 4" (100) above ground level must not exceed 24 square inches (154 mm²).

**Clear Zone**

- Breakaway and footing details are standard for all wood poles listed on the table, on single and multiple sign supports.
- Use hardware meeting the requirements of Section 704.
- The table, for half the length of each pole.
- Different size holes are shown, in brackets ( ), are metric and are in millimeters (mm). Units other than those shown, unless otherwise noted are shown.

**Sign Mounting Details**

- The top end treatment is standard for all wood poles listed in the table, on single and multiple sign supports.
- Use hardware meeting the requirements of Section 704.
- The table, for half the length of each pole.
- Different size holes are shown, in brackets ( ), are metric and are in millimeters (mm). Units other than those shown, unless otherwise noted are shown.

**Embedment**

- The sign panel must be protected on top of a clean zone. The embedment is shown as 10" (250) for this drawing. The embedment may be changed if necessary to install the sign on the ground.
**REGULATORY SIGNS**

**WARNING SIGNS**

**ROUTE MARKER ASSEMBLY**

**WOOD BACKBRACE INSTALLATIONS**

**SIGN MOUNTING DETAIL**

**DETAIL A**

**NOTES:**

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.**

**DETAILS DRAWING**

**REFERENCE** Dwg. No. 619-21

**MONTANA DEPARTMENT OF TRANSPORTATION**

**TREATED WOOD POLE**

**SIGN MOUNTING DETAILS**

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

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>Dimension A</th>
<th>Dimension B</th>
<th>Dimension C</th>
<th>Dimension D</th>
<th>Dimension E</th>
</tr>
</thead>
<tbody>
<tr>
<td>450 x 600</td>
<td>6 x 50 x 800</td>
<td>380</td>
<td>275</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>

**METRIC DIMENSIONS (mm)**

- **A**: Width of sign
- **B**: Height of sign
- **C**: Depth of sign
- **D**: Angle of sign
- **E**: Spacing between signs

**WOOD POST MOUNTING**

Mount 2 chevron signs on each post with each panel adjusted to approximate right angle to roadway centerline. Exact location and angle to be determined by the project manager.

**STEEL PIPE MOUNTING**

Chevron mounting details

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. Use 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.

**NOTES:**

- Units shown in brackets [ ] are metric and are in millimeters (mm) unless other units are shown.
MAJOR SIGN PANEL
CLOSED
OPEN

2000 UPPER CASE SERIES "O" MODIFIED
HINGE
HINGE

HASP KEEPER (TYP.)
1 SHT. INC. SIGN PANEL
0.125" [3.2] ALUMINUM SIGN PANEL
0.100" [2.5] ALUMINUM SIGN PANEL
0.200" [5] ALUMINUM SHIM
0.100" [2.5] ALUMINUM SHIM
5'-0" [1.5 m]
THE MINIMUM MOUNTING HEIGHT TO THE BOTTOM OF THE SECONDARY PANEL IS
4'-8" [1422.4]
2'-8" [304.8]
1'-0" [304.8]

NOTES:
1. SEE SIGNS AND SIGNING MATERIALS CATALOG FOR COMPLETE LISTING OF SIGNS
   AND SIGN SIZES. DESIGNS ARE AVAILABLE FROM THE TRAFFIC ENGINEERING
   SIGNALS UNIT FOR SIGNS UNIQUE TO MONTANA.
2. THE SIGN PANEL CONSISTS OF 3/4" [19] HIGH DENSITY PLYWOOD OR 0.125" [3.2]
   ALUMINUM SHEET MOUNTING AS SPECIFIED ON THE PLANS. THE MOUNTED
   PANEL CONSISTS OF 0.100" [2.5] SHEET ALUMINUM.
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 LETTERS AND BACKGROUND MATCHING COLORS OF MAJOR PANEL.
6. THE MINIMUM MOUNTING HEIGHT TO THE BOTTOM OF THE SECONDARY PANEL IS
   2'-0" [60.96].
7. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 704.
**PANEL DIMENSION INFORMATION**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>D10-1</th>
<th>D10-2</th>
<th>D10-4</th>
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<tbody>
<tr>
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**METRIC PANEL DIMENSION INFORMATION**

<table>
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<tr>
<th>Dimension</th>
<th>D10-1</th>
<th>D10-2</th>
<th>D10-4</th>
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<tbody>
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</tr>
<tr>
<td>1000</td>
<td>900</td>
<td>900</td>
<td></td>
</tr>
</tbody>
</table>

**Placement Dimensions**

- **Interstate**
  - Dimension: 100 ft (30.48 m)
  - Placement: 10 ft (3.048 m)
  - Min. 3 lb/ft (4.5 kg/m)
  - Use galvanized or cadmium plated 5/16" [M8] bolt, nut, and washer, and jam threads after tightening.
  
- **Non-Interstate**
  - Dimension: 100 ft (30.48 m)
  - Placement: 10 ft (3.048 m)
  - Min. 3 lb/ft (4.5 kg/m)
  - Use 5/16" [M8] bolt, nut, and washer, and jam threads after tightening.
  
**NOTES:**

1. Use hardware meeting the requirements of Section 704.
2. Do not relocate or move a milepost once it has been properly placed.
3. Use hardware meeting the requirements of Section 704.

**Detailed Drawing**

- DWG. NO.: 619-32
- Reference: MONTANA DEPARTMENT OF TRANSPORTATION
- MILEPOST (REFERENCE POST) DETAILS

- Units shown in brackets [ ] and metric units are in millimeters only unless other units are shown.
DESIGN A USAGE:
USE FOR CONTINUOUS DELINEATION AND RT. SHOULDER OF INTERSTATE ROUTES.

DESIGN B USAGE:
USE ON LT. SHOULDER OF INTERSTATE ROUTES.

DESIGN C USAGE:
USE ON LT. SHOULDER OF INTERSTATE ROUTES.

DESIGN D USAGE:
USE AT INTERSECTIONS OF INTERSTATE RAMPS AND URBAN INTERSECTIONS.

DESIGN E USAGE:
USE AT APPROACHES TO INTERSTATE ROUTES.

DESIGN F USAGE:
USE FOR TRUCK EGRESS RAMPS AND INTERCHANGE RAMPS FROM INTERSTATE TO USE RT. & LT. FOR WRONG WAY TRAVELERS.

DESIGN G USAGE:
USE FOR TRUCK EGRESS RAMPS AND INTERCHANGE RAMPS FROM INTERSTATE TO USE RT. & LT. FOR WRONG WAY TRAVELERS.

DESIGN H USAGE:
USE FOR TRUCK EGRESS RAMPS AND INTERCHANGE RAMPS FROM INTERSTATE TO USE RT. & LT. FOR WRONG WAY TRAVELERS.

DESIGN J USAGE:
USE FOR TRUCK EGRESS RAMPS AND INTERCHANGE RAMPS FROM INTERSTATE TO USE RT. & LT. FOR WRONG WAY TRAVELERS.

REQUIREMENTS OF SECTION 704.

USE HARDWARE MEETING THE MUTCD FOR SPECIFIC GUIDANCE.

FOR EACH DESIGN. REFER TO THE SOME TYPICAL USES ARE SHOWN NOTED:

1. USE ON LT. SHOULDER OF INTERSTATE RAMPS
2. USE ON RT. SHOULDER OF INTERSTATE ROUTES
3. USE FOR CONTINUOUS DELINEATION AND RT. SHOULDER OF INTERSTATE RAMPS
4. USE FOR TRUCK EGRESS RAMPS AND INTERCHANGE RAMPS FROM INTERSTATE TO USE RT. & LT. FOR WRONG WAY TRAVELERS.

NOTES:

1. SOME TYPICAL USES ARE SHOWN FOR EACH DESIGN. REFER TO THE NOTES SHOWN FOR THE DESIGN.
2. USE HARDWARE MEETING THE REQUIREMENTS OF SECTION 204.

SNOWPOLE DELINEATOR NOTES:

- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 1/4" x 1" (6 x 25) BOLT
- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT

U-CHANNEL - SEE DETAILED DRAWINGS

SNOWPOLE DELINEATOR DETAILS

C - 5/16" FLAT WASHER
D - 1/4" HEX NUT
E - REFLECTOR
F - MATCH SNOWPOLE DELINEATOR WITH ROADWAY DELINEATOR

SNOWPOLE DELINEATOR DETAILS

2" (50) MIN.

SNOWPOLE DELINEATOR NOTES:

- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 1/4" x 1" (6 x 25) BOLT
- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT

SNOWPOLE DELINEATOR NOTES:

- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 1/4" x 1" (6 x 25) BOLT
- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT

SNOWPOLE DELINEATOR NOTES:

- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT
- 1/4" x 1" (6 x 25) BOLT
- 1/4" x 3" (6 x 75) BOLT
- 5/16" x 6 (8 x 75) BOLT

UNITED STATES DEPARTMENT OF TRANSPORTATION

DELINEATOR DELEMENTS

REFERENCE: DWG. NO. 619-34

DELINEATOR DETAILS

D - DESIGN "D" E - DESIGN "E" F - DESIGN "F" G - DESIGN "G" H - DESIGN "H" J - DESIGN "J"
HORIZONTAL CURVE SPACING TABLE

<table>
<thead>
<tr>
<th>RADIUS (ft)</th>
<th>SPACING ON CURVE</th>
<th>SPACING ON BOTH APPROACH TANGENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>5730 &amp; UP</td>
<td>30'</td>
<td>400'</td>
</tr>
<tr>
<td>2865 - 5729</td>
<td>225'</td>
<td>400'</td>
</tr>
<tr>
<td>1910 - 2864</td>
<td>160'</td>
<td>320'</td>
</tr>
<tr>
<td>1433 - 1909</td>
<td>130'</td>
<td>260'</td>
</tr>
<tr>
<td>955 - 1432</td>
<td>110'</td>
<td>220'</td>
</tr>
<tr>
<td>716 - 954</td>
<td>90'</td>
<td>185'</td>
</tr>
<tr>
<td>478 - 715</td>
<td>75'</td>
<td>150'</td>
</tr>
<tr>
<td>287 - 477</td>
<td>60'</td>
<td>125'</td>
</tr>
<tr>
<td>0 - 286</td>
<td>45'</td>
<td>90'</td>
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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></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1750 &amp; UP</td>
<td>90</td>
<td>120</td>
</tr>
<tr>
<td>900 - 1749</td>
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<td>120</td>
</tr>
<tr>
<td>600 - 899</td>
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<td>300 - 449</td>
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<tr>
<td>200 - 299</td>
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<td>20</td>
<td>45</td>
</tr>
<tr>
<td>100 - 149</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>0 - 99</td>
<td>15</td>
<td>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.

2. Mount delineators on metal U-posts (1.12 lb/ft (1.7 kg/m) min. and 2 lb/ft (3 kg/m) max. with 3/16 (5) dia. cadmium plated bolts). Drill or punch twelve 3/8 (9.5) maximum diameter holes on 1 inch (25) centers measured from the top of the post. 1/4 (6.4) square holes may be used. If square holes are used, use a large headed bolt or an appropriate washer. Jam threads after tightening the nut to prevent removal.

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” to 12” (1.8 m to 3.0 m) on primary and secondary highways and 4” to 60” (1.2 m to 1.8 m) on interstate highways. 2” to 4” (0.6 m to 1.2 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, should a 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 "E".

6. Mount the delineator reflector 1” (25) below the top of the metal U-post.

7. Use hardware meeting the requirements of Section 704.

Units shown in brackets [] are metric and are in millimeters (mm) 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

FLEXIBLE DRIVABLE 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.

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.
UP TO $250 FINE AND /OR 60 DAYS IMPRISONMENT FOR INJURY TO OR POSSESSION OF THIS SIGN
INSTALLED 2010
SIGN FABRICATOR'S NAME HERE

DATE TAG DETAIL

DATE TAG COLOR SEQUENCE
DATE TAG COLOR CORRESPONDS TO THE LAST DIGIT OF THE INSTALLATION YEAR AS FOLLOWS:
0 - YELLOW
1 - WHITE
2 - LIGHT BLUE
3 - GRAY
4 - LIGHT GREEN
5 - RED
6 - PURPLE
7 - ORANGE
8 - BLUE
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.
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 SMALLER THAN SUGGESTED, BUT TO THE RELATIVE SCALE.
QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN AND ARE FOR ESTIMATING PURPOSES ONLY.
PAINT VOLUMES ASSUME A 17 MIL [0.432] THICKNESS.
EPOXY VOLUMES ASSUME A 22 MIL [0.559] THICKNESS.

### QUANTITIES

<table>
<thead>
<tr>
<th>#</th>
<th>AREA (FT²)</th>
<th>PAINT (GAL)</th>
<th>EPOXY (GAL)</th>
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<td>0.06</td>
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<td>0.11</td>
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<td>7.11</td>
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### METRIC QUANTITIES

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<tr>
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<td>0.62</td>
<td>0.27</td>
<td>0.35</td>
</tr>
</tbody>
</table>

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. 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.
5. DO NOT EXCEED MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT 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 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 NUMBERS MAY BE SMALLER THAN SUGGESTED, BUT TO THE RELATIVE SCALE.
9. QUANTITIES ARE BASED ON THE SIZES OF PAVEMENT MARKINGS SHOWN.
10. UNITS SHOWN IN BRACKETS [ ] ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.

### DETAILED DRAWING

REFERENCE DWG. NO. 620-05
STANDARD SPEC. 620
PAVEMENT MARKINGS (NUMBERS)

MDT® MONTANA DEPARTMENT OF TRANSPORTATION
NOTES:
1. UNLESS OTHERWISE NOTED EACH SQUARE EQUALS 4 [100] INCHES.
2. ALL PAVERMENT 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 SCALED 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 PAVERMENT 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 PAVERMENT 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.
**NOTES:**

1. ALL PAVEMENT MARKINGS ARE TO CONFORM TO THE REQUIREMENTS OF THE ORIGIN OF UNIFORM TRAFFIC CONTROL DEVICES AND "STANDARD HIGHWAY SIGN" PUBLICATIONS, FROM THE FEDERAL HIGHWAY ADMINISTRATION.

2. DO NOT EXTEND MORE THAN ONE LANE IN WIDTH FOR ANY PAVEMENT MARKINGS EXCEPT IF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" AND "STANDARD HIGHWAY SIGN" PUBLICATIONS, FROM THE FEDERAL HIGHWAY ADMINISTRATION.

3. WHEN WORDS AND SYMBOLS ARE USED IN COMBINATION, SPACE THEM AT LEAST FOUR TIMES THE HEIGHT OF CHARACTERS FOR UNMARKED ROADS, 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 AND ARE FOR ESTIMATING PURPOSES ONLY.

5. (E) - EPOXY VOLUMES ASSUME A 22 MIL [0.559] THICKNESS.

6. (P) - PAINT VOLUMES ASSUME A 17 MIL [0.432] THICKNESS.

7. UNITS SHOWN IN BRACKETS [] ARE FOR ESTIMATING PURPOSES ONLY UNLESS OTHER UNITS ARE SHOWN.

**BIKE LANE SYMBOL**

AREA = 0.029 FT\(^2\) (0.46 m\(^2\))

- E = 0.05 GAL. (0.19 L)
- P = 0.03 GAL. (0.12 L)

(1 SQUARE = 4" [100])

**PREFERENTIAL LANE SYMBOL**

AREA = 0.033 FT\(^2\) (0.30 m\(^2\))

- E = 0.06 GAL. (0.23 L)
- P = 0.04 GAL. (0.15 L)

(1 SQUARE = 4" [100])

**DRAWING REFERENCES**

REFERENCE | DWG. NO. | STANDARD SPEC.
-----------|---------|------------------
620-25     | 620-25  | 420-25...
DOUBLE YELLOW TURN LANE RUMBLE STRIPE

NOTES:
1. SEE CENTERLINE RUMBLE STRIPS DET. DWG. NO. 455-00 FOR ADDITIONAL INFORMATION.
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.
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
CONCRETE APRON QUANTITIES

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DIMENSIONS</th>
<th>CONCRETE APRON QUANTITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANHOLE</td>
<td>1'-0&quot; (300)</td>
<td>0.3 C.Y. (0.3 m³)</td>
</tr>
<tr>
<td>VALVE</td>
<td>0'-6&quot; (150)</td>
<td>0.1 C.Y. (0.1 m³)</td>
</tr>
</tbody>
</table>

NOTES:
1. ADJUST MANHOLES DOWNWARD BY REMOVING CONE AND BARREL SECTIONS AS NECESSARY AND REPLACING WITH SECTIONS OF LENGTH REQUIRED TO MATCH GRADE.
2. SLOPE MANHOLE FRAME AS REQUIRED TO MATCH SLOPE OF STREET.
3. CONSTRUCT CONCRETE APRON OF CLASS GENERAL CONCRETE OR APPROVED EQUAL.

CONCRETE COLLAR

VALVE BOX ADJUSTMENT DETAIL

NOTES:
1. ADJUST MANHOLE OR WATER VALVE UPWARD OR DOWNWARD AS REQUIRED.
2. CONSTRUCT CONCRETE APRON OF CLASS GENERAL CONCRETE OR APPROVED EQUAL.

MANHOLE ADJUSTMENT DETAIL

NOTES:
1. ADJUST WATER VALVES UPWARD OR DOWNWARD AS REQUIRED.
2. CONSTRUCT CONCRETE APRON OF CLASS GENERAL CONCRETE OR APPROVED EQUAL.
**Traffic Mailbox Location Detail**

### Notes:

1. **The Minimum Distance from the Edge of Driving Lane to the First Mailbox Should Be the Clear Zone Distance Plus 0'-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.**

### Units:
- **Metric and Are in Millimeters (mm) Unless Other Units Are Shown.**

### Details:
- **See Mailbox Location Detail**
- **See Detailed Drawing Number 203-05 For Additional Guidance.**

---

**Approach Mailbox Turnout**

**References**
- DWG. NO.
- Standard Spec.
- Section 623

**Approach Mailbox Turnout**

**Detailed Drawing**

**Montana Department of Transportation**
TURNOUT WITHOUT APPROACH

NOTE:
ACTUAL SIZE AND LOCATION TO BE DETERMINED BY
THE PROJECT MANAGER.

TURNOUT WITH APPROACH

NOTES:

1. LOCATE NEW INSTALLATIONS, IF POSSIBLE, ON THE FAR
RIGHT SIDE OF AN INTERSECTION WITH A PUBLIC ROAD OR
PRIVATE DRIVEWAY.

2. APPROACH QUANTITIES ARE NOT INCLUDED IN TURNOUT
QUANTITIES.

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.
NOTES:

1. GALVANIZE ALL MATERIALS MEETING SECTION 711.
2. STAKE MAILBOX LOCATIONS BEFORE INSTALLATION FOR PROPER HEIGHT AND DISTANCE FROM THE ROADWAY. ONLY STAKE WITHIN 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 WOOD OR WOODEN CRASH TESTED MAILBOX SUPPORTS AND ASSEMBLIES MAY ALSO BE USED.
4. LOCATE THE MAILBOX 8" TO 12" OUTSIDE THE EDGE OF THE SHOULDER.
5. FOR MULTIPLE MAILBOX INSTALLATIONS, SPACE THE MAILBOX SUPPORTS A MINIMUM DISTANCE OF 42" (1.05 m) APART.
6. FOR RURAL LOCATIONS USE A 38" TO 42" MOUNTING HEIGHT. FOR URBAN LOCATIONS USE A 45" TO 48" MOUNTING HEIGHT.
7. SEE "A GUIDE TO MAILBOX SAFETY IN MONTANA" FOR ADDITIONAL INFORMATION.
REFERENCES
DETAILED DRAWING

SECTION A-A

MAILBOX SUPPORT
STEEL PIPE WITH FITTINGS AND STEEL FENCE POST

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
SECTION 704
OPTIONAL MAILBOX DETAIL

MONTANA DEPARTMENT OF TRANSPORTATION
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.

4. FOR THE POST USE EITHER DOUGLAS FIR OR HEM FIR, WHICH IS SURFACED FOUR SIDES (2x4) AND FREE OF HEART CENTER (FOHC).

ELEVATION VIEW

1 - 4" x 4" x 3/8" [100 x 100 x 1160] LAG SCREWS
2 - 3/8" x 3" [10 x 75] LAG SCREWS
4 - 3/8" x 4" [10 x 100] LAG SCREWS

FRONT VIEW

1 - 3/8" DIA. [M10] BOLT
1 - 3/8" DIA. [M10] BOLT
2 - 3/8" DIA. [M10] BOLTS
1 - 3/8" DIA. [M10] BOLT

PLAN VIEW

1 - 2" x 4" [50 x 100]
40" [1016]
2 - 2" x 4" [50 x 100]
60" [1524]

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

**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.

**UNITS SHOWN IN BRACKETS - (1) ARE METRIC AND ARE IN MILLIMETERS (mm) UNLESS OTHER UNITS ARE SHOWN.**

**DETAILED DRAWING**

**REFERENCE DWG. NO.**

**STANDARD SPEC.**

**SECTION 623**

**TEMPORARY MAILBOX SUPPORT BRACKET DETAILS**
STANDARD U-TURN FOR NARROW MEDIANS

PROFILE

PLAN

(IN INTERSTATE LAYOUT SHOWN)

PROFILE

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.
1. INSTALL THE 4" (102) DIA. PIPE, CONCRETE BASE AND ADJUSTABLE MONUMENT BOX AS DETAILED. PLACE CONCRETE IN THE PIPE UNLESS OTHER UNITS ARE SHOWN (UNITS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS [mm]) 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 MONUMENT BOX UNDER THE DIRECT SUPERVISION OF A MONTANA LICENSED PROFESSIONAL LAND SURVEYOR OR CONTRACTOR PIPES UNDER THE DIRECT SUPERVISION OF THE DISTRICT SURVEY MANAGER. FILL THE REMAINING 10" (255) OF THE 4" (102) DIA. PIPE WITH CONCRETE. SET AND MARK THE BRASS OR BRONZE MONUMENT WITHIN THE BOX AFTER CONSTRUCTION. THE MONTANA LICENSED PROFESSIONAL LAND SURVEYOR IS REQUIRED TO PREPARE AND FILE CORNER RECORDATIONS IN ACCORDANCE WITH STATE STATUTES, ADMINISTRATIVE RULES OF MONTANA AND PROVISIONS OF THE MONTANA LICENSED PROFESSIONAL LAND SURVEYOR OR CONTRACTOR FORCES UNDER THE DIRECT SUPERVISION OF A MONTANA LICENSED PROFESSIONAL LAND SURVEYOR OR CONTRACTOR FORCES UNDER THE DIRECT SUPERVISION OF THE DISTRICT SURVEY MANAGER.

4. AN ACCEPTABLE BRASS MONUMENT IS THE "BERNTSEN C25DB" OR APPROVED EQUAL. AN ACCEPTABLE BRONZE MONUMENT IS THE "SURV-KAP M/M-BCS-2 1/2 D" OR APPROVED EQUAL.

5. USE CLASS GENERAL CONCRETE OR APPROVED EQUAL.

6. DEPENDING ON CONTRACT REQUIREMENTS, EITHER MDT FORCES OR CONTRACTOR TO FILL THE REMAINING 10" (255) OF THE 4" (102) DIA. PIPE WITH CONCRETE.

7. A MONTANA LICENSED PROFESSIONAL LAND SURVEYOR IS REQUIRED TO SET AND MARK THE BRASS OR BRONZE MONUMENT WITHIN THE BOX AFTER CONSTRUCTION. THE MONTANA LICENSED PROFESSIONAL LAND SURVEYOR IS REQUIRED TO PREPARE AND FILE CORNER RECORDATIONS IN ACCORDANCE WITH STATE STATUTES, ADMINISTRATIVE RULES OF MONTANA AND PROVISIONS OF THE MONTANA LICENSED PROFESSIONAL LAND SURVEYOR OR CONTRACTOR FORCES UNDER THE DIRECT SUPERVISION OF A MONTANA LICENSED PROFESSIONAL LAND SURVEYOR OR CONTRACTOR FORCES UNDER THE DIRECT SUPERVISION OF THE DISTRICT SURVEY MANAGER.

8. UNLESS OTHER UNITS ARE SHOWN.