APPLICATION OF STANDARD PLANS

This book is a compilation of Standard Plans prepared by the Colorado Department of Transportation for use on CDOT construction projects. Others who use the CDOT Standard Plans do so at their own risk.

These Standard Plans are essential contract documents as described in subsection 105.09 of the CDOT Standard Specifications for Road and Bridge Construction book.

Standard Plans that are applicable to a specific project will be identified on the project plans and will not be physically attached to those plans. The designer who specifies any of these Standard Plans for a specific project accepts the responsibility of determining their applicability. Additional information concerning the Standards Plans are available in the CDOT Standard Specifications for Road and Bridge Construction book.

Standard Plans adopted or revised subsequent to the adoption of this book will be listed on the index of the project plans and will be physically included in the plans. The New and Revised Standards Plans may be accessed on the CDOT website here: https://www.codot.gov/business/designsupport/standard-plans.

These Standard Plans are adopted for use as of July 31, 2019.
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EXISTING FEATURES SHOWN AS SCREENED WEIGHT (LIGHT GRAY SCALE), EXCEPT AS NOTED IN THE MORE VITAL; FEATURES SHOWN AS FULL WEIGHT WITHOUT SCREENING, EXCEPT AS NOTED IN THE MORE VITAL.

These symbols are intended to explain the various topographic features involved on the design plan sheets which are prepared at various scales. Notes are added where necessary to clarify the symbols. A legend is provided in the plans. For symbols not shown on the standard symbols sheets. These symbols are intended to explain the various topographic features involved on the design plan sheets which are prepared at various scales. Notes are added where necessary to clarify the symbols. A legend is provided in the plans. For symbols not shown on the standard symbols sheets.

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2. These symbols are intended to explain the various topographic features involved on the design plan sheets which are prepared at various scales. Notes are added where necessary to clarify the symbols. A legend is provided in the plans. For symbols not shown on the standard symbols sheets.

3. GUARDRAIL, CURB AND GUTTER, ETC., ARE REPRESENTED BY A SYMBOL WITH TYPE GIVEN BY NOTE.
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TYPICAL PLANS FOR MEDIAN CROSS OVER

LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT

TYPICAL SECTION FOR MEDIAN CROSS OVER

ANY REQUIRED SIDE INLET FOR MEDIAN DRAINAGE SHALL HAVE A TRANSVERSE DESIGN AS SPECIFIED ON THE PLANS.

MEDIAN WIDTH LESS THAN 50 FT.

TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER

LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT

TYPICAL SECTION FOR MEDIA CROSS OVER

ANY REQUIRED SIDE INLET FOR MEDIAN DRAINAGE SHALL HAVE A TRANSVERSE DESIGN AS SPECIFIED ON THE PLANS.
**GENERAL NOTES**

1. All ditches shall be constructed to the lines and grades as shown on the plans, using the ditch section as shown on the plans, or as specified by the Engineer.

2. Concrete lining will be paid for as concrete slope and ditch paving.

3. Provide a cutoff wall and riprap at the end of concrete-lined ditch.

**CONCRETE-LINED DITCH QUANTITIES**

<table>
<thead>
<tr>
<th>D</th>
<th>Cut per 100 lin. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
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<tr>
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<td>36</td>
<td>12.3</td>
</tr>
<tr>
<td>48</td>
<td>18.4</td>
</tr>
</tbody>
</table>

**Typical Sections for Ditches**

Note: See structure notes on the plans for dimensions W, D, and S. Dimensions x = W/2 with minimum of 2 ft. unless otherwise shown on the plans, x = 1 ft. or 2 ft. of flat or flatter.

**CUT SECTIONS**

**EARTHWORK SECTION**

Riprap Gradation shall be as specified in the contract.

**EXCAVATION**

Excavate ditch section after entire embankment has been placed and compacted to proper density. Excavation will be paid for as structure excavation.

**SECTION C-C**

**RIPRAP-LINED DITCH**

Riprap Gradation shall be as specified in the contract.

**SECTION B-B**

**CUTOFF WALL**

**DITCH TYPES**

**STANDARD PLAN NO. M-203-2**

Issued by the Project Development Branch: July 31, 2019
SUPERELEVATION NOTES

1. THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS RADIAL LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SUPERELEVATION RATE OF 8% OF SUPERELEVATION SHALL BE USED FOR CROWNED HIGHWAYS AND THE MAXIMUM CURVATURE FOR 2-LANE AND 4-LANE HIGHWAYS.

2. VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED. THE MAXIMUM CURVATURE FOR 2-LANE AND 4-LANE HIGHWAYS.

3. NUMBER OF LANES ROTATED:
   A. ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.
   B. TWO LANES ROTATED ARE TYPICAL FOR A FOUR-LANE HIGHWAY.

4. SPURS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPURS ARE COMMERCIAL BUT NOT RECOMMENDED ABOVE THE HEAVY LINE. SPUR LENGTHS MAY BE FOUND IN MULTIPLES OF 50 FEET FOR CALCULATION CONVENIENCE.

5. **SUPERELEVATION RATE**
   R = RADIUS OF CURVE
   
6. **Vd = DESIGN SPEED**
   
7. **L = LENGTH OF SUPERELEVATION**
   
8. **LN = TRAVEL LANE**

<table>
<thead>
<tr>
<th>Vd (mph)</th>
<th>L (ft.)</th>
<th>R (ft.)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tr>
<td>20</td>
<td>15-25</td>
<td>5-10</td>
<td>64-74</td>
<td>82-92</td>
<td>100-110</td>
<td>117-127</td>
<td>134-144</td>
<td>152-162</td>
<td>170-180</td>
<td>180-190</td>
</tr>
</tbody>
</table>

**SUPERELEVATION STANDARD PLAN NO. M-203-11**

STANDARD PLAN NO.
CROWNED AND DIVIDED HIGHWAYS

Issued by the Project Development Branch: July 31, 2019
Project Sheet Number: 1 of 3
**SUPERELEVATION DIAGRAMS FOR CROWNED HIGHWAYS**

- **VC** - To design crown profiles, to prevent edge vertical curves may be provided at the shoulder. These curves should be continuous. The length of vertical curve selected in feet shall be at least numerically equal to the design speed, and no more than 0.4 of the design speed.

- **V** - Maximum rate of superelevation in feet per foot of profile for the given radius of curve and design speed.

- **e max** = 8% total continued from sheet 1.

<table>
<thead>
<tr>
<th>V_d (mph)</th>
<th>e (%)</th>
<th>R (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
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<td></td>
</tr>
</tbody>
</table>

**SUPERELEVATION NOTES**

1. This standard plan shows the required rates of superelevation for various lane lengths at different design speeds for the minimum superelevation rate is to be alternated maximum rate of superelevation, shall be used for crown and divided highways under specified in the plans.

2. Values are for design elements related to design elements noted at speed and horizontal. Curvature for 2-4 lane and 4-6 lane.

3. Number of lanes divided for 3 funeral diverse and divided highways.

4. Spiral are recommended below the heavy line in the table, spirals are permissible but not recommended above the heavy line, spiral lengths may be used at multiples of 50 ft for calculation convenience.

---

**Computer File Information**

- **Creation Date:** 07/13/19
- **Date:** 07/13/19
- **Comments:**
- **Colorado Department of Transportation:**
- **Department:**
- **Location:**
- **Creator:**
- **CAD Ver.:**
- **Scale:** Not to Scale
- **Units:** English

---

**SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS**

**STANDARD PLAN NO.**

M-203-11

**Standard Sheet No.**

2 of 3

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

---

**Issued:**

2829 West Howard Place

Designer Initials: JBC

Phone: 303-757-9021 FAX: 303-757-9868
SUPERELEVATION DIAGRAMS

*e = max = 4%

If the calculated radius falls between two radii, go to the next lowest radius value.

<table>
<thead>
<tr>
<th>V_d</th>
<th>L (FT.)</th>
<th>R (FT.)</th>
<th>1 L (FT.)</th>
<th>2 L (FT.)</th>
<th>1 L (FT.)</th>
<th>2 L (FT.)</th>
<th>1 L (FT.)</th>
<th>2 L (FT.)</th>
<th>1 L (FT.)</th>
<th>2 L (FT.)</th>
<th>1 L (FT.)</th>
<th>2 L (FT.)</th>
<th>1 L (FT.)</th>
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<th>1 L (FT.)</th>
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<tr>
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<td>22.08</td>
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<td>1.79</td>
<td>9.96</td>
<td></td>
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</tbody>
</table>

SUPERELEVATION NOTES

1. The standard plan uses the required rates of superelevation for the various radii. Lengths at different design speeds for the maximum superelevation rate of 6% are calculated. The maximum rate of superelevation shall be used for streets and highways, unless specified on the plans.

2. Values are for design elements related to superelevation.

3. Values are for design elements related to superelevation.

4. Where one lane of the road intersects, the rate of superelevation may be reduced to facilitate a smooth transition of the superelevation.

5. Number of lanes rotated:

   A. 1 lane rotated is typical for a one-lane highway.

   B. 2 or more lanes rotated are typical for a two-lane highway.

6. Spills are recommended below the heavy line in the tables. Spills are permissible but recommended above the heavy lines. Spills on superelevation may be increased to multiples of 50 feet for calculation convenience.

SUPERELEVATION STREETS

STANDARD PLAN NO. M-203-12

Standard Sheet No. 1 of 2

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:
**PROFILE GRAD**

- VC - Vertical Curve
- T.S. - Tangent Section
- S.C. - Shoulder Curvature
- P.C. - Pivot Curve
- E.T. - End of Transition
- B.T. - Beginning of Transition
- RC - Radius of Curve
- LN - Lateral Runout
- SC - Superseded Curvature
- VC - Vertical Curve

**SUPERELEVATION DIAGRAMS**

- $e_{max} = 6\%$

<table>
<thead>
<tr>
<th>Vd (mph)</th>
<th>L (ft.)</th>
<th>R (ft.)</th>
<th>$e$ (%)</th>
<th>$1 \text{LN}$ (%)</th>
<th>$2 \text{LN}$ (%)</th>
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<td>70</td>
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<td>78</td>
<td>84</td>
<td>5.6</td>
<td>75</td>
<td>85</td>
</tr>
</tbody>
</table>

- **SUPERELEVATION NOTES**

1. The table shows the required rates of superelevation for various radius lengths at different design speeds for the maximum superelevation rate of 6%. The maximum rate of superelevation shall be used for streets when specified on the plans.

2. These values are for design elements related to the maximum rate of superelevation for the given radius and design speed.

3. Where the lines are for roads intersect, the superelevation may be reduced to facilitate a smooth transition of the profile grades.

4. The table related to a two-lane highway.

5. The values are rounded to the nearest multiple of 0.2 L/e for calculation convenience.

**STREETS**

- **SUPERELEVATION NOTES**

- **STANDARD PLAN NO.**

- **M-203-12**

- **STANDARD SHEET NO.**

- **2 of 2**
PIPE IN TRENCH

- The bedding material for rigid pipe in soil shall be 3 in. of loose structure backfill, class 1 or 2. Bedding material for flexible pipe in soil shall be 12 in. of loose structure backfill, class 1.

DIMENSION TO SPRING LINE

12" IN ROCK

ARCH OR ELLIPTICAL PIPE IN FILL

- When two or more conduits are laid side-by-side, they shall be placed so that they are 3 ft. apart, outside diameter, or 12 in. outside span, whichever is less. However, if end sections are used, the minimum spacing shall be 1 ft. between end sections.

CIRCULAR PIPE

- When original ground line is between 0.3 ft. and Be + 1 ft. above flowline, the embankment shall be built up to 0.3 ft. above the flowline and trench excavated to the bottom of pipe or as shown.

CIRCULAR PIPE IN FILL

- Applies when the original ground line is less than 1 ft. above the bottom of the box culvert. The embankment shall be built up to 1 ft. above the bottom of the box culvert and then excavated to the bottom of the box culvert. The embankment and excavation will not be measured and paid for separately, but shall be included in the cost of the work.

CONCRETE BOX CULVERT

- By both cases, the trench excavated by the thick solid line shall then be excavated to accommodate construction of the box culvert.

DROP INLETS AND DIVISION BOXES

GENERAL NOTES

1. Excavation and backfill patterns different from those indicated on these sheets will be shown elsewhere in the plans.

2. Excavation for channel change or channel improvement will be either unclassified excavation or muck excavation and will be noted on the plans. Excavation from the channel flowline to the depth required for the new structure and incidental channel excavation will be paid for as structure excavation.

3. Structure footings when located in rock shall be founded cut to undisturbed rock without forming in conformance with subsection 601.09(b).

4. Structural plate culverts shall be constructed as shown in the plans.

5. Be equals the inside diameter of a pipe and Ba equals the outside diameter of a pipe.

6. Approximate structure excavation and backfill quantities, up to 1 ft. over the pipe, will be shown on the plans, for information only.

EXCAVATION AND BACKFILL FOR STRUCTURES

STANDARD PLAN NO.

M-206-1

Standard Sheet No. 1 of 2

Project Sheet Number: 00-00-00-00-00

Issued by: Project Development Branch

July 31, 2019
STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS

\[ B_a = \text{Inside Diameter or Rise of Pipe} \]
\[ B_c = \text{Outside Diameter or Rise of Pipe (Flexible)} \]
\[ 0.3B_a (\text{Flexible}) \]
\[ 0.3B_c (\text{Rigid}) \]
\[ B_c + 3' \]
\[ OR \]
\[ B_c + 8c \]

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS

\[ W + 3' \]

LEGEND

- Structure Excavation Limits
- Structure Excavation and Backfill Class 1 or 2, as shown on plans
- Concrete

RETAINING WALL IN CUT & IN PARTIAL CUT

ANY ADDITIONAL EXCAVATION BEHIND THE LIMITS SHOWN SHALL BE FILLED WITH CLASS I BACKFILL MATERIAL.

THE ADDITIONAL EXCAVATION AND BACKFILL WILL NOT BE MEASURED AND PAID FOR.
GENERAL NOTES
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THIS SHEET WILL BE SHOWN ON THE PLANS.
2. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURLED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMITY WITH SUBSECTION 601.09(b).
3. STRUCTURE EXCAVATION FOR SLIP PAVING NOT SHOWN.

LEGEND
- UNCLASSIFIED EXCAVATION
- STRUCTURE EXCAVATION
- STRUCTURE BACKFILL (FLOW-FILL), OR STRUCTURE BACKFILL (CLASS 1) WITH MECHANICAL REINFORCEMENT AS SHOWN ON THE PLANS
- STRUCTURE BACKFILL CLASS 1
- FILTER MATERIAL

FOR PURPOSES OF QUANTITY CALCULATIONS THIS TEMPLATE APPLIES TO END OF WINGWALL.
- SLOPE TO DRAIN
- SLOPE FOR PAY LIMITS OF EXCAVATION AND BACKFILL

MINIMUM BERM DIMENSION
MINIMUM EMBEDMENT OF ABUTMENT IN STRUCTURE BACKFILL
HORIZONTAL BERM DIMENSION
HORIZONTAL EMBEDMENT OF ABUTMENT IN STRUCTURE BACKFILL

EXCAVATION AND BACKFILL FOR BRIDGES

STANDARD PLAN NO. M-206-2
Standard Sheet No. 1 of 2

Computer File Information
Creation Date: 07/31/19
Designer Initials: JBK
Detailer Initials: LT A
Issued by the Project Development Branch: July 31, 2019

Sheet Revisions
Colorado Department of Transportation
2039 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9888

Project Development Branch: JBK

Issued by the Project Development Branch: July 31, 2019
Project Sheet Number:
GENERAL NOTES

1. Excavation and backfill patterns different from those indicated on this sheet will be shown elsewhere on the plans.
2. Structure footings which are located in rock shall be formed to undisturbed rock without forming in conformance with Subsection 601.09.
3. Structure excavation for slope paving not shown.

LEGEND

- Structure backfill (flow-fill), DR Structure backfill (Class I) with mechanical reinforcement as shown on the plans
- Structure backfill Class 2 (on-site Class 2 materials must meet Class I requirements)
- Filter material

EXCAVATION AND BACKFILL FOR BRIDGES

General Notes:

- Excavation and backfill patterns different from those indicated on this sheet will be shown elsewhere on the plans.
- Structure footings which are located in rock shall be formed to undisturbed rock without forming in conformance with Subsection 601.09.
- Structure excavation for slope paving not shown.

Legend:

- Structure backfill (flow-fill), DR Structure backfill (Class I) with mechanical reinforcement as shown on the plans.
- Structure backfill Class 2 (on-site Class 2 materials must meet Class I requirements).
- Filter material.

ELEVATION

Section E-E (Backfill)

- Minimum berm dimension
- Minimum embedment of abutment into structure backfill

Section F-F (Backfill)

- Planned bottom of mechanically stabilized backfill and limits of structure excavation material calculation
- Filter material is only used in area near the abutment and not at the end of the wingwall

Section G-G (Backfill)

- Filter material is only used in area near the abutment and not at the end of the wingwall
- Planned bottom of mechanically stabilized backfill and limits of structure excavation material calculation

Section H-H (Backfill)

- Planned bottom of mechanically stabilized backfill and limits of structure excavation material calculation
- Filter material is only used in area near the abutment and not at the end of the wingwall

Excavation and Backfill for Bridges


Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 2 of 2

Computer File Information

- Creation Date: 07/31/19
- Project Development Branch: JBK
- Issued by: Project Development Branch
- Date: July 31, 2019

Sheet Revisions

- Date: 07/31/19
- Comments: 

Colorado Department of Transportation
2600 25th Street
Denver, CO 80204

Phone: 303-757-9021 FAX: 303-757-9968

JPEG, GIF, PDF, Image, HTML, MSG.

Scales: Not to Scale, Scale, Detail, ""
TEMPORARY EROSION CONTROL

NOTES:
1. AGGREGATE SHALL CONFORM TO SUBSECTION 208.02 (I).
2. THE CONTRACTOR SHALL PROTECT CURB AND GUTTER THAT CROSSES THE ENTRANCE FROM DAMAGE, WHILE NOT BLOCKING FLOW OF WATER FROM STRUCTURE. PROTECTION OF THE CURB AND GUTTER SHALL BE INCLUDED IN THE COST OF WORK AND NOT PAID FOR SEPARATELY.
3. GEOTEXTILE SHALL CONFORM TO SUBSECTION 712.08.
4. ALL MATERIALS AND LABOR TO COMPLETE THE VEHICLE TRACKING PAD SHALL BE INCLUDED IN THE COST OF WORK AND NOT PAID FOR SEPARATELY.
5. THE PAY ITEM NUMBER FOR VEHICLE TRACKING PAD (EACH) IS 208-00070.
EROSION LOGS SHALL BE TIGHTLY ABUTTING.

FOR JOINING LOGS IN OTHER SITUATIONS, SEE THE JOINING EROSION LOG APPLICATIONS.

A USE TWO WOOD STAKES AT ALL EROSION LOG ENDS OR JOINTS (TYP.)

USE A STAKE EVERY 24 IN.

AND CONTINUE ALTERNATE ORIENTATION THROUGHOUT THE LENGTH OF THE EROSION LOG

USE TWO WOOD STAKES AT ALL EROSION LOG ENDS OR JOINTS (TYP.)

NOTE: THE TOPS OF ALL STAKES SHALL NOT EXTEND MORE THAN 2 INCHES ABOVE THE TOPS OF EROSION LOGS.

NOTE: EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS (TYP.)

NOTE: LOCATE EROSION LOGS AT THE OUTSIDE EDGE OF THE CONCRETE APRON.

NOTE: TOP OF STAKE SHALL NOT EXTEND PAST TOP OF EROSION LOG MORE THAN 2 IN.

NOTE: THE TOPS OF ALL STAKES SHALL NOT EXTEND MORE THAN 2 INCHES ABOVE THE TOPS OF EROSION LOGS.

NOTE: THE TOPS OF ALL STAKES SHALL NOT EXTEND MORE THAN 2 INCHES ABOVE THE TOPS OF EROSION LOGS.

NOTE: TOP OF STAKE SHALL NOT EXTEND PAST TOP OF EROSION LOG MORE THAN 2 IN.
SECTION A-A

NOTES:
1. EROSION LOGS USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
2. EROSION LOGS SHALL BE PLACED ON THE CONTOUR WITH ENDS FLARED UP SLOPE.
3. SEE SHEET 2 OF 11 FOR JOINING LOGS DETAIL.

EROSION LOG TOE OF SLOPE PROTECTION

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<tr>
<td>208-00024</td>
<td>TYPE 3 (20 IN. )</td>
</tr>
</tbody>
</table>

NOTE: THE EROSION LOGS EXTEND 2 IN CHUTES ABOVE THE TOPS OF THE SLOPE.

SECTION B-B

NOTES:
1. SILT FENCE SHALL HAVE A MAXIMUM DRAINAGE AREA OF ONE-QUARTER ACRE PER 100 FEET OF SILT FENCE LENGTH. MAXIMUM SLOPE LENGTH BEHIND BARRIER IS 100 FEET.
2. SILT FENCE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
3. SILT FENCE SHALL BE PLACED PARALLEL TO THE CONTOUR WITH ENDS FLARED UP SLOPE.
4. THE MAXIMUM LENGTH OF EROSION LOGS OR SILT FENCES WITHOUT A FLARED END TURNING UP SLOPE IS 150 FEET.

SILT FENCE TOE OF SLOPE PROTECTION

NOTE: THE PAY ITEM NUMBER FOR SILT FENCE (LF) IS 208-00020.
Aggregate Bag Application

**PLAN VIEW**

Note: Use aggregate bags only when there is a minimum clearance of 3 feet from the edge of the traveled way (including conditions during detours) to the face of curb.

**AGGREGATE BAGS AT STORM DRAIN INLET (TYPE I)**

<table>
<thead>
<tr>
<th>Length (L) of Inlet (ft)</th>
<th>Number of Aggregate Bags Upstream of Inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>1</td>
</tr>
<tr>
<td>6 - 10</td>
<td>2</td>
</tr>
<tr>
<td>L &gt; 10</td>
<td>3</td>
</tr>
</tbody>
</table>

**AGGREGATE BAG APPLICATIONS**

Note: The pay item number for aggregate bag (LF) is 208-00035
STORM DRAIN INLET PROTECTION (TYPE I)

NOTES:
1. INLET PROTECTION DEVICE SHALL EXTEND 12 INCHES PAST EACH END OF THE INLET.
2. THE PAY ITEM NUMBERS FOR STORM DRAIN INLET PROTECTION (TYPE I) ARE 208-00051 (LF), 208-00053 8 INCHES (EACH), 208-00057 144 INCHES (EACH), AND 208-00058 204 INCHES (EACH).
3. FOR STORM DRAIN INLET TYPES I AND II, IF THERE IS A MINIMUM CLEARANCE OF 3 FEET FROM THE EDGE OF THE TRAVELED WAY TO THE FACE OF CURB, USE THE AGGREGATE BAGS AT STORM DRAIN INLET (TYPE I) DETAIL ON SHEET 4 INSTEAD.

STORM DRAIN INLET PROTECTION (TYPE II)

NOTE: THE PAY ITEM NUMBERS FOR STORM DRAIN INLET PROTECTION (TYPE II) ARE 208-00054 (EACH).

STORM DRAIN INLET PROTECTION (TYPE III)

NOTE: THE PAY ITEM NUMBER FOR STORM DRAIN INLET PROTECTION (TYPE III) IS 208-00056.
Aerosion logs shall be higher than overflow.

Anchor trench 6 in. x 6 in. (see M-216-1 for details).

Trench logs into grade 2 in. (typ).

Silt berm:
- Approximately 90° to each other
- Secure blanket with staples
- Secure silt berm with spikes 20 - 22 in. deep (typ).

Erosion log installation:
- Erosion logs shall be embedded 2 inches into the soil.
- Erosion logs shall be tightly abutted with no gaps.
- V-shaped temporary ditches shall not be used. Ditches shall be graded in a parabolic or trapezoidal shape.

Drainage ditch applications:
- For slope and channel spacing, see the section view along ditch flowline detail on sheet 11.
- The pay item number for silt berm (LF) is 208-00004.
NOTES:

1. Berms shall have a height of 18 inches, side slopes of 2:1 or flatter and a minimum base width of 4 ft - 6 in.
2. Berms shall be used to intercept and divert drainage to a designated outlet.
3. Berms shall not be used where drainage area exceeds 10 acres.
4. Berms shall be constructed out of acceptable material that can be compacted and receive at a minimum heavy equipment wheel rolled compaction.
5. Temporary berms shall be constructed out of embankment (subsoil) and in no circumstance constructed out of salvaged topsoil.
6. The pay item number for temporary berm (LF) is 208-00300.

**TEMPORARY BERM**

FOR BERMS TALLER THAN 2 FT., INSTALL THE USE OF SLOPE CONTROL MEASURES. SEE SHEET 5 OF 11 FOR DETAILS.

NOTES:

1. Temporary diversion ditches shall be constructed across the slope to intercept runoff and direct it to a stable outlet or sediment trap.
2. Use the temporary diversion ditch immediately above a new cut, fill slope, or across the perimeter of a disturbed area.
3. The gradient along the flow path shall have a positive grade to assure drainage, but shall not be so steep as to result in erosion due to high velocity.
4. The diversion channel shall always be located a minimum of 20 feet from the outside limits of disturbed area boundary.
5. Temporary berms shall be constructed out of embankment (subsoil) and in no circumstance constructed out of salvaged topsoil.
6. The pay item number for temporary diversion (LF) is 208-00301.

TEMPORARY SLOPE DRAINS

NOTES:

1. Anchor size varies according to pipe size.
2. To secure the pipe, drive stakes into ground, then tie a 12-gauge wire between them above and across the pipe's width.
3. The outlet shall be aligned with the flow direction of the existing grade perpendicular to a channel shall not be acceptable.
4. The grade around the inlet to the pipe shall be compacted.
5. The pay item number for temporary slope drains (LF) is 208-00060.
GEOTEXTILE STAPLED TO POSTS (TYP.
GEOTEXTILE ANCHORED IN TRENCH

SECTION A-A

SILT FENCE

NOTES:
1. GEOTEXTILE SHALL BE ATTACHED TO WOOD POSTS WITH THREE OR MORE STAPLES PER POST. STAPLES SHALL BE HEAVY DUTY WIRE AND AT LEAST 1 INCH LONG.
2. WOOD POST SHALL BE 1 IN. X 1 IN. NOMINAL.
3. THE PAY ITEM NUMBER FOR SILT FENCE (LF) IS 208-00020.

GEOTEXTILE - 12 IN. BURIED IN TRENCH AND FIRMLY ATTACHED TO POST

END SECTION DETAIL (PLAN VIEW)

NOTE:
1. THE END OF THE SILT FENCE FABRIC SHALL BE WRAPPED APPROX. 6 INCHES AROUND A WOODEN POST ONE FULL TURN, THEN SECURED ALONG THE POST WITH 6 HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH LONG.

JOINING SECTION DETAIL (PLAN VIEW)

NOTE:
1. THE ENDS OF THE SILT FENCE FABRIC SHALL BE JOINED TOGETHER BY WRAPPING APPROX. 6 INCHES OF EACH END AROUND A WREST POST ONE FULL TURN, THEN SECURED ALONG THE POST WITH 6 HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH LONG.
2. POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.

SILT FENCE APPLICATIONS

ELEVATION VIEW

ATTACH SILT FENCE PANEL WITH WIRE TIES OR 2 IN. GEOTEXTILE NYLON CABLE TIES TO WIRE FENCING IN 6 IN. MESH SPACING

SIDE VIEW

ATTACH WIRE PANEL TO POST WITH WIRE TIES (MINIMUM 3 PER POST)

6 FT. 0 IN. MAXIMUM ATTACH SILT FENCE FABRIC TO PANEL WITH WIRE TIES OR 2 IN. GEOTEXTILE NYLON CABLE TIES (TYP.)

SILT FENCE (REINFORCED)

NOTES:
1. THE END OF THE SILT FENCE FABRIC SHALL BE WRAPPED APPROX. 6 INCHES AROUND A STEEL T-PDST, THEN SECURED ALONG THE POST WITH WIRE TIES (MINIMUM 3 PER POST).
2. POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.
3. SILT FENCES SHALL NOT BE USED FOR CHECK DAMS.
4. THE PAY ITEM NUMBER FOR SILT FENCE (REINFORCED) (LF) IS 208-00021.

TRENCH 6 IN. X 6 IN.

6 IN. BURIED IN TRENCH

FIRE TIES OR 2 IN. INTERLEAVED NYLON CABLE TIES (TYP.)

STANDARD PLAN NO. M-208-1

TEMPORARY EROSION CONTROL

Issued by the Project Development Branch: July 31, 2019

Computer File Information

Sheet Revisions

Issued by the Project Development Branch: July 31, 2019

Temporary Erosion Control

GEOTEXTILE - ATTACHED TO WIRE FABRIC WITH WIRE TIES OR 2 IN. INTERLEAVED NYLON CABLE TIES (TYP.)

GEOTEXTILE FABRIC - 12 IN. BURIED IN TRENCH AND FIRMLY ATTACHED TO POST

GEOTEXTILE FABRIC - JOINED TOGETHER BY WRAPPING APPROX. 6 INCHES OF EACH END AROUND A STEEL T-PDST, THEN SECURED ALONG THE POST WITH WIRE TIES (MINIMUM 3 PER POST).

GEOTEXTILE FABRIC - ATTACHED TO WIRE FABRIC WITH WIRE TIES OR 2 IN. INTERLEAVED NYLON CABLE TIES (TYP.)

ENVELOPE RETICLE WIRE FENCING; MAXIMUM MESH SPACING 6 IN.
NOTES
1. The maximum drainage area is 5 acres.
2. The maximum structure life is 2 years.
3. The storage area is 2,000 cubic feet per acre.
4. The minimum embankment height shall be 3 feet measured on the downstream side.
5. The length/width ratio may be adjusted to meet site conditions when approved by the engineer.
6. Width of sediment trap is approximately equal to the weir length (X).
7. Sediment trap design shall be approved by the engineer.
8. The crown grade from weir shall be stable and non-erodible.
9. The pay item number for sediment trap (LT) is 208-00033.

Sediment Trap Design

The length/width ratio is 2:1.

Plan View

Section A-A

Section B-B

Weir Length Table

<table>
<thead>
<tr>
<th>Drainage Area (Acres)</th>
<th>Weir Length (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Temporary Erosion Control

Issued by the Project Development Branch: July 31, 2019
STEP 1. EXCAVATE THE TRENCH.

EROSION BALES

1. EROSION BALES TO BE END EROSION BALES TO BE KEYED INTO FILL SLOPE.

2. PIPE END SECTION

WOOD STAKE (TYP.)

WOOD STAKES (TYP.) WEDGE LOSE CERTIFIED WEED FREE STRAW BETWEEN EROSION BALES

FILTERED FLOW

SECTION A-A

EROSION BALE TRENCHING AND STAKING

PLAN VIEW

EROSION BALE CULVERT INLET PROTECTION

NOTES

1. STAKES SHALL BE WOOD AND SHALL BE 2 IN. X 2 IN. X 30 IN. NOMINAL.

2. EROSION BALES SHALL BE 18 IN. X 18 IN. X 36 IN.

3. EROSION BALES SHALL BE ENTRENCHED 4" DEEP INTO THE SOIL, TIGHTLY ABUTTED WITH NO GAPS, STAKED, AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER.

4. EROSION BALES CANNOT BE USED FOR CHECK DAMS.

5. EROSION BALE FILTER SHALL BE LOWER THAN BERM ELEVATION OR USED IN A SUMP CONDITION.

6. THE PAY ITEM NUMBER FOR EROSION BALES (WEED FREE) (EA) IS 208-00011.

TEMPORARY EROSION CONTROL

STANDARD PLAN NO. M-208-1

Issued by the Project Development Branch: July 31, 2019
GEOTEXTILE EROSION CONTROL (CLASS 2) TO EXTEND UP TO 6 IN. MIN. OF RIPRAP HEIGHT WITH COVER OVER GEOTEXTILE (TYP).

SECTION VIEW ALONG DITCH FLOWLINE

1. RIPRAP SIZE D = 6 IN. OR AS SHOWN ON THE PLANS.
2. THE GEOTEXTILE EROSION CONTROL SHALL BE CLASS 2 AND CONFORM TO THE REQUIREMENTS OF SUBSECTION 712.08.
3. THE ENDS OF RIPRAP CHECK DAM SHALL BE A MINIMUM OF 6 IN. HIGHER THAN CENTER OF CHECK DAM.
4. FOR USE AS TEMPORARY CHECK DAMS ONLY AND NOT FOR PERMANENT INSTALLATIONS.
5. THE PAY ITEM NUMBER FOR ROCK CHECK DAM (EA) IS 208-00041.

NOTE: ALL MATERIALS AND LABOR TO COMPLETE THE ROCK CHECK DAM SHALL BE INCLUDED IN THE COST OF WORK.

ROCK CHECK DAM
6. Exact dimensions of angles, platforms, and shelf brackets, bolt holes, nuts, and multiple mailbox support components may vary from these shown on the sheet so that all components will fit together properly.

7. Plastic newspaper receptacles may be remounted below the mailbox on the support. Plastic newspaper receptacles approved by the Engineer. Associated costs will not be paid for separately but will be included in the work.

8. On roads with curb and gutter, the mailbox supports shall be located in the ground behind the curb edge. The front of the mailbox shall be 42" to 48" above the gutter flow line to the bottom of the mailbox. The height shall be 42" to 48" measured from the gutter flow line to the bottom of the mailbox. Exceptions: A custom built, rural-type mailbox may be used, see detail on sheet 2 of 2.

9. On roads without curb and gutter, the mailbox shall be located in the ground behind the sidewalk. The front of the mailbox shall be in line with or slightly behind the edge of the sidewalk. The mounting height shall be 42" to 48" above the sidewalk.

10. The ground surrounding the mailbox supports shall be firm, undisturbed ground or well-compacted embankment. The supports are normally buried, but they may be placed in a solid metal well-compacted embankment.

11. Proprietary mailbox support systems listed on the cost approved products list will be accepted as equivalent alternatives.

GENERAL NOTES

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11. Proprietary mailbox support systems listed on the cost approved products list will be accepted as equivalent alternatives.
• INCREASE LENGTH 3 FT. FOR EACH ADDITIONAL SINGLE OR DOUBLE MAILBOX SUPPORT, PLUS AN ADDITIONAL 5 FT. FOR EACH MULTIPLE MAILBOX SUPPORT (e.g., 2 MULTIPLE AND 1 DOUBLE ARE 15 FT.).

NOTE: SEE SHEET 1, GENERAL NOTE 7, FOR MOUNTING PLASTIC NEWSPAPER RECEPTACLES.
SOIL FILLED TRM APPLICATION

1. Place 3" topsoil or soil amended with soil conditioners to cover the thickness of the blanket.
2. Install TRM.
3. Place 1" topsoil or soil amended with soil conditioners into the matrix to cover the product's thickness.
4. Apply the remaining half of the specified seed at the broadcast rate and rake it into the soil.
5. Install soil retention blanket (12" O.C.).

GENERAL NOTES

1. Staple check locations should be at least 15 feet from the bottom of the slope.
2. Soil filled TRM application shall be used in accordance with Section 216.
SOIL RETENTION COVERING

TYPICAL STAPLE OR EARTH ANCHOR PATTERN FOR SLOPE APPLICATION

- If earth anchors are not specified on the plans, only staples shall be used. See subsection 216.04.

- Earth anchors will be used instead of staples when specified in the plans.

- Earth anchors shall be paid for separately as specified in Section 216.

SOIL FILLED TRM APPLICATION

1. Place 3" topsoil or soil amended with soil conditioning.
2. Apply half of the specified seed at the broadcast rate and rake it into the soil.
3. Install TRM.
4. Place 1" topsoil or soil amended with soil conditioning into the matrix to cover the product's thickness.
5. Apply the remaining half of the specified seed at the broadcast rate and rake it into the soil.
6. Install soil retention blanket (Class I).

SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) SLOPE APPLICATION

- In accordance with Section 216.

CONSECUTIVE ROLL OVERLAP

- To be used wherever one roll of blanket ends and another begins with the uphill blanket placed on top of the downhill blanket.

STAPLE CHECK

- To be used at the upslope and downslope ends of blanket across the entire width of slope unless slope runs into receiving water (see downslope end staple check).

CONSEQUENT ROLL TERMINATION

- To be used at the downslope end staple check.
GENERAL NOTES

1. THIS STANDARD PLAN DOES NOT APPLY TO THIN CONCRETE OVERLAYS (WHITE TOPPING).

2. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT A © JOINT.

3. THIS JOINT LAYOUT SHALL BE USED AS A STANDARD OF THE JOINT LAYOUT FOR THE PROJECT. IF THE CONTRACTOR PROPOSES VARIATIONS FROM THIS STANDARD OR THE PROJECT HAS UNUSUAL OR IRREGULAR CONDITIONS NOT COVERED HEREIN, THE CONTRACTOR SHALL PREPARE A PAVEMENT JOINT LAYOUT FOR APPROVAL BY THE ENGINEER. SLABS ≥ 13 FT. IN WIDTH SHALL BE CONSTRUCTED ONLY WHERE DESIGNATED ON THE PLANS.

4. ON MULTILANE DIVIDED HIGHWAYS, THE MULTILANE DIRECTIONAL PAVEMENT AND BOTH SHOULDERS SHALL BE PLACED WITH LONGITUDINAL SAWED CONTRACTION JOINTS.

5. ON MULTILANE DIVIDED HIGHWAYS SEPARATED BY A CONCRETE BARRIER, A © JOINT SHALL BE CONSTRUCTED AT ONE OF THE BARRIER FACES.

6. © JOINTS SHALL BE CONSTRUCTED BETWEEN THE TWO OPPOSING DIRECTIONS OF TRAVEL ON A MULTILANE UNDIVIDED HIGHWAY WHEN ALL OF THE FOLLOWING APPLY:
   a. THE PAVEMENT IS CONTINUOUS ACROSS BOTH DIRECTIONS OF TRAVEL.
   b. THERE IS NO MEDIAN BARRIER.
   c. THE WIDTH OF THE PAVEMENT IN ONE DIRECTION IS GREATER THAN 80 FEET.

7. ON VARIABLE WIDTH SLABS, THE END OF SLAB WIDTH DIMENSION MAY VARY ±6 INCHES.

8. (© JOINTS ARE TO BE USED WHEN A TRAFFIC LANE IS ADDED SEPARATELY, OR FOR TAPERS, OR FOR SPEED CHANGE LANES. ALTERNATIVE LONGITUDINAL JOINT LOCATIONS AT SPEED CHANGE LANE DIMENSIONING FOR JOINTS ONLY. SEE PLANS FOR STRIPING LOCATIONS.

9. WHERE © JOINTS ARE SHOWN IN THE SHOULDER, THE DOWEL BARS WILL BE PLACED ON 12" CENTERS STARTING 6" FROM THE ROADWAY © JOINT.

TYPICAL JOINT LAYOUT FOR CONCRETE ROADWAY WITH CONCRETE SHOULDERS

DOWEL BAR DETAIL
FOR © JOINT WITH 13 FT. AND 12 FT. WIDE SLABS

RURAL TWO-LANE

MULTI-LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE SPEED CHANGE LANE
RAMP "A" DOWEL BAR DETAIL FOR C JOINT WITH A 12 FT. LANE

RAMP "B" DOWEL BAR DETAIL FOR C JOINT WITH CENTER LONGITUDINAL SPLIT LANE

MULTI-LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS

OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE ACCELERATION AND DECELERATION LANE

CONCRETE PAVEMENT JOINTS
1. **NOTES**

   1. Longitudinal joints shall be placed adjacent to lane markings when possible and have a maximum spacing of 15 ft. (18 ft. is permitted with monolithic curb and gutter).

   2. Construct transverse joints perpendicular to the centerline of pavement and extend through the curb or curb and gutter.

   3. Place $\frac{1}{2}$ in. non-expansion joint filler in top 6 in. of curb joint at intersection return radii points.

   4. The contractor shall, unless otherwise shown on the plans, select and use a bond breaker at inlets, manholes and similar size structures. Smaller structures such as valve and monument boxes shall not require a bond breaker.

   5. Where a longitudinal joint passes less than 1 ft. from a cast-in-pavement manhole or similar size structure, a typical 2 ft. radial joint, as shown in the details, shall be used.

   6. Transverse joints shall either intersect the center of circular manholes and inlets or be at least 4 ft. away from the edge of circular manholes. See curb joint detail on Sheet 5.

   7. Transverse construction joints shall be located at a $\ominus$ joint.

   8. The contractor shall have an option to use individual dowels in the $\ominus$ joint on short run (2' ± 6") to curb radius returns.

   9. The engineer shall have an option to use individual dowels in the $\ominus$ joint on short run (2' ± 6") to curb radius returns.

   10. A permissible alternative joint with small radii < 16' is allowed.

   11. Rounding of angle by forming or slip-form paving permissible.

   12. Typical curbed pavement joint layout shows integral curb and gutter as poured monolithically with adjacent lane.
NOTES

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHERE POSSIBLE, AND HAVE A MAXIMUM SPACING OF 12 FT. (13 FT. IS PERMITTED WITH MONOLITHIC CURB AND GUTTER).

2. CONSTRUCT TRANSVERSE JOINTS PERPENDICULAR TO THE CENTERLINE OF PAVEMENT AND EXTEND THROUGH THE CURB OR CURB AND GUTTER.

3. PLACE 3.14\text{IN.} MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.

4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES DO NOT REQUIRE A BOND BREAKER.

5. WHERE A LONGITUDINAL JOINT WOULD PASS LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.

6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.

MULTI-LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

HMA PAVEMENT - STANDARD PLAN NO. M-412-1

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 4 of 5
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**TABLE I - 6 IN. x 2 IN. CORRUGATIONS ROUND STEEL PIPE**

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**TABLE III - 9 IN. x 2 1/2 IN. CORRUGATIONS ALUMINUM PIPE-ARCH**

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**General Notes**

1. PIPE OR PIPE-ARCH WITH ENDS CUT TO FIT A SLOPE AND REINFORCED IN ACCORDANCE WITH SUBSECTION 707.09 SHALL MARKING ON ONE-HALF DIAMETER OR ONE-HALF SPAN APART TO PERMIT PIPE BOLT AND NUT.

2. NUTS MADE IN CONFORMANCE WITH ASTM A 194, GRADE 2 THE PLANS WILL BE PERMITTED.

3. NUTS BE INSTALLED TO MEET REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. COVER SHALL BE PROVIDED TO PROTECT THE STRUCTURE FROM DAMAGE. THE COVER DURING CONSTRUCTION SHALL BE AT LEAST ONE-HALF DIAMETER.

4. NOTES DIMENSIONS APPROXIMATELY EQUAL TO THOSE SPECIFIED ON THE PLANS WILL BE PERMITTED.
1. All concrete shall be Class D (Box Cul Vert).

2. Fill height is 2'-0".

3. All construction joints shall be thoroughly cleaned before fresh concrete is placed.

4. The contractor shall maintain the stability of the structure during construction.

5. Any culvert span 20 ft. or greater, a foundation investigation and report are required.

6. Backfill shall not begin until top slab has reached design strength, $f'c$.

7. The minimum lap splice length for black reinforcing bars shall be:
   - 1'-0" (typ.)
   - 1'-1" 1'-4" 1'-7" 1'-11" 2'-6" 3'-1" 3'-11" 4'-10" (typ.)

8..splice quantities for longitudinal and transverse bars are not included.

9. Reinforcing steel shall be grade 60.

10. Any culvert span 20 ft. or greater, a foundation investigation and report are required.

11. All exposed concrete corners shall be chamfered.

12. For fill heights less than 2 ft. a waterproofing membrane shall be provided for the top of the top slab and 18 inches down from the top of the exterior walls.

13. All transverse reinforcing shall be normal to the centerline of the box.

14. The fill height is the distance measured from the top of the top slab to the bottom slab.

15. All exposed concrete corners shall be chamfered.

16. See M-603-3 for precast concrete box culvert details.

17. See M-606-1 for guardrail details.

18. See M-601-20 for standard plan details.
**SINGLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)**

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**HEADWALL AND TOEWALL QUANTITIES**

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**SPECIAL DESIGN IS REQUIRED**

- Site specific considerations and design requirements.
- Additional data and reference materials provided.

**NOTES**

1. Site specific design criteria and requirements.
2. Quantities shown are for design and construction purposes.
3. Additional design considerations and guidelines.

**CONCRETE QUANTITY = 0.086 CYL/cu**

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**Computer File Information**

- Created by: JBE
- Last Modified: 07/31/19
- Design Software: MicroStation VB
- Scale: Not to Scale

**Sheet Revisions**

- Sheet: 2
- Sheet Name: M-601-1
- Created by: JBE
- Last Modified: 07/31/19

**Colorado Department of Transportation**

- Location: CDOT HQ, 3rd Floor
- Phone: 303-757-9001
- Fax: 303-757-9866

**SINGLE CONCRETE BOX CULVERT (CAST-IN-PLACE)**

- Standards: M-601-1
- Standard Sheet: 2 of 2
- Issued by the Project Development Branch: July 31, 2020
- Project Sheet Number: JBE
GENERAL NOTES
1. ALL CONCRETE SHALL BE CLASS B (BLACK CONCRETE).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-200-4.
6. ANY ADDITIONAL JOINTS 1 FT OR GREATER, A PREDOMINANT INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH.
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRAY.
10. THE MINIMUM SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

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SPACING 0'-6" 1'-0" 1'-2" 1'-2"

11. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.
12. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
13. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.
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15. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.
16. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.
17. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 1/8".
18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

REFRIGERATION PLAN

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE CENTERLINE OF THE BOX ONLY.

- THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE I CONSTRUCTION.
- THE J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING BUT SHALL CONFORM TO ASTM A 36 OR ASHSTO M-169 STEEL.
- THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
- ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.
- ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.
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- ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED FOR TOP AND BOTTOM MATS.

HEADWALL CORNER REINFORCING DETAIL

DOUBLE CONCRETE BOX CULVERT (CAST-IN-PLACE)
DOUBLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

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NOTES

1. SCHEDULED SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 1/2 INCH SPACING ELSEWHERE.
2. QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON FREQUENCY UNIT OF HEADWALL, STEEL QUANTITIES INCLUDE ALL REINFORCING QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLAN.
3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS; A SPECIAL DESIGN IS REQUIRED.
4. FOR HEADWALL AND TOEWALL DETAILS SEE W-601-1, SHEET 1 OF 2.
5. WHEN THE NET SPAN IS LESS THAN OR EQUAL TO 2 FT, ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN INTERIORS IN THE HEADWALL, ALL REINFORCING BARS IN THE TOEWALL, AND THE 4# BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.
6. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.
7. WHEN A SPAN OF LESS THAN 6 FT IS REQUIRED, USE THE BAR SIZES AND THE TOEWALL SPANDREL BARS FOR THE 6 FT SPAN AS AVAILABLE ON THE TABLE.
8. FOR SIZES AND SPACING OF THE TOEWALL SPANDREL BARS IN THE TOEWALL SPANK(Table on W-601-1, SHEET 1 OF 2). ALL OTHER BARS ARE BPS AT 90° SPACING; THE NUMBER OF BARS REQUIRED TO BE LISTED ON THIS SHEET AND INCLUDES BOTH 4# BARS AND THOSE FROM THE TABLE.
9. LIVE LOAD IS NEUTRALIZED AS PER ASHDID LD7354, SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE C.D.O.T. RATING MANUAL.
10. FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE FURNISHED FROM THE C.D.O.T. INSPECTION MASTER AND SUBMITTED TO THE BRIDGE RATING UNIT OR INcluded AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE C.D.O.T. RATING MANUAL.
GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT). CLEAR WHEN FILL HEIGHT IS 2'-0".

2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.

3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.

4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.

5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-601-3.

6. FOR ANY CONSTRUCTION JOINTS 3'-0" OR LARGER, A PRELIMINARY INVESTIGATION AND REPORT ARE REQUIRED.

7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH.

8. STRENGTH QUANTITIES FOR CONSTRUCTION AND TEMPORARY LIVE LOADS ARE NOT INCLUDED.

9. REINFORCING STEEL SHALL BE GRADE 60.

10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

11. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION IS REQUIRED.

12. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED.

13. FOR FILL HEIGHTS LESS THAN 2 FT, A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18" DOWN ALONG THE TOPS OF THE EXTERIOR WALLS.

14. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE MAXIMUM CONSOLIDATED FILL ELEVATION.

15. ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.

16. REINFORCING DESIGN SHALL CONFORM TO ASTM A 36 OR AASHTO STANDARD PLANS M-601-3.

17. FOR FULL HEIGHTS LESS 3 FT, A WELDING PROCEDURE SHEET SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB.

18. FOR FULL HEIGHTS LESS THAN 2 FT, THE Z BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)
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<thead>
<tr>
<th>SPAN</th>
<th>90° TO 75°</th>
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**NOTES**

1. 5 ft. (1.5 m) Spacing at each end of the span for a distance of 1/4 of the span length, 2 ft. (600 mm) Spacing elsewhere.

2. Quantities are given for one headwall and one toe wall and are based on per linear foot of headwall. Steel quantities include all reinforcing. Quantities shall be paid for as shown on the plans.

3. Skewed headwalls are not recommended for these spans. A special design is required.

4. For headwall and toe wall details see M-50-1, sheet 1 or 2.

5. When the fill depths are less than or equal to 2 ft., all reinforcing bars in the headwall and toe wall and all reinforcing bars designated by an asterisk (*) in the top wall of the top slab shall be epoxy coated.

6. reinforcing quantities include both epoxy-coated and uncoated bars.

7. When a radius of less than 6 ft. is required, use the bar sizes and the slab and wall thicknesses for the 6 ft. radius available on the table.

8. For the spacing and positions of bars in the top slab see table on M-50-1, sheet 1. All other A bars are bars at 2 ft. spacing. The number of bars required is listed on this sheet and includes both A1 bars and those from the table.

9. Live load is neglected as per AASHTO LRFD Section 3.6.1.2.6. For these structures refer to the design manual.

10. For all new culvert designs, a rating is required. The rating summary sheet should be printed from the CDOT external website and submitted to the bridge rating unit as part of a larger design package for additional information, see the CDOT Rating Manual.
GENERAL NOTES

1. CONCRETE SHALL BE CLASS 8.
2. HEADWALL SHALL BE PERPENDICULAR TO THE PIPE UNLESS OTHERWISE SHOWN ON THE PLANS. TABULATED DIMENSIONS AND QUANTITIES MUST BE ADJUSTED FOR SKEWED INSTALLATIONS.
3. VOLUME OCCUPIED BY PIPE HAS BEEN DEDUCTED FROM STEEL AND CONCRETE QUANTITIES.
4. ALL REINFORCING BARS SHALL HAVE A 2 IN. MINIMUM CLEARANCE.

HEADWALL FOR SINGLE PIPE

- CONCRETE STEEL

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HEADWALL FOR RIGID ROUND PIPE

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HEADWALL FOR FLEXIBLE PIPE ARCH

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HEADWALL FOR STRUCTURAL PLATE ARCH

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REINFORCEMENT CLEARANCES SHOWN ARE TYPICAL FOR ALL WALLS ON THIS SHEET. THIS AREA IS APPROX. 0.50 FT. X 5 FT.

THE FOLLOWING CONCRETE REQUIREMENTS APPLY TO ALL WALLS:

1. CONCRETE SHALL BE CLASS C.
2. CONCRETE CORNERS SHALL BE CHAMFERED EVENLY SPACED AT 19 IN. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED.
3. IF A PRECAST HEADWALL IS USED, A PERMANENT EPOXY BOND, APPROVED BY THE ENGINEER, SHALL BE USED BETWEEN PIPE AND HEADWALL.
4. HEADWALL SHALL BE PERPENDICULAR TO THE CENTERLINE UNLESS OTHERWISE SPECIFIED. TABULATED DIMENSIONS AND QUANTITIES SHALL BE ADJUSTED FOR SKEWED INSTALLATIONS.
5. HEADWALL ANCHOR BOLTS SHALL CONFORM TO THE TABLE STATED. SINGLE MPA SHALL USE #5 BARS IN LENGTH UNDER EACH PIPE PLUS #5 BARS IN LENGTH UNDER EACH PIPE.

HEADWALL FOR METAL PIPE ARCH (MPA)

NOTE: EACH LINE OF THE PIPE ARCH TABLE DESCRIBES A SINGLE HEADWALL THAT WILL ACCOMMODATE SEVERAL SIZES OF PIPE-ARCH.

HEADWALL FOR ROUND PIPE

TYPE "S" SADDLE HEADWALLS FOR PIPE

STANDARD PLAN NO. M-601-11

Issued by the Project Development Branch July 31, 2019

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
Detailer Initials: LT A
Last Modification Date: 07/31/19
Issued by the Project Development Branch: July 31, 2019

Headwalls for Pipe

1. Concrete shall be Class C.
2. Exposed concrete corners shall be chamfered 1/4 in.
3. If a prestressed headwall is used, a permanent epoxy bond, approved by the engineer, shall be used between pipe and headwall.
4. Headwall shall be perpendicular to the centerline unless otherwise specified. Tabulated dimensions and quantities shall be adjusted for skewed installations.
5. Headwall anchor bolts shall conform to the Table stated. Single MPA shall use #5 bars in length under each pipe, plus #5 bars in length under each pipe.

Headwall for Metal Pipe Arch (MPA)

Note: Each line of the pipe arch table describes a single headwall that will accommodate several sizes of pipe-arch. The concrete quantities in this table are based on a standard of concrete from the headwall of the median size pipe in the range of equivalent diameters shown.

Headwall for Round Pipe

- Type "S" Saddle Headwalls for Pipe

Standard Plan No. M-601-11

Issued by the Project Development Branch: July 31, 2019

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
Detailer Initials: LT A
Last Modification Date: 07/31/19
Issued by the Project Development Branch: July 31, 2019
**SINGLE PIPE**

**DOUBLE PIPE**

**CONCRETE HEADWALL INSTALLATIONS**

See standard plan M-601-12 for reinforcing details.

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**CONCRETE QUANTITIES FOR ONE CONCRETE HEADWALL (CUBIC YARDS)**

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**PIECE OUTLET PAVING (CUBIC YARDS)**

Note: Volume occupied by pipe has been deducted.

---

**GENERAL NOTES**

1. For size and location of pipes, see the plans.
2. All concrete shall be class B.
3. Footings in rock shall be formed out to rock and not poured in accordance with subsection 601.09(b).
4. Exposed concrete corners shall be chamfered 1/2 in.
5. Headwall shall have reinforcing steel installed in a pattern similar to standard plan M-601-12.
6. The cost of reinforcing steel shall be included in the work unless the steel quantities are listed in the plans and are paid for separately.

**HEADWALLS AND PIPE OUTLET PAVING**

May be used with multiple pipes.

---

**HEADWALL DIMENSIONS**

**CIRCULAR**

- \( D = \text{PIPE DIAMETER (INSIDE)} \)
- \( H = D + 30" \)
- \( W = 3D + 36" \)
- \( T = 0.4H \) (NEAREST IN) \()
- \( B = \frac{1}{3}D^{1/2} \) (MINIMUM) \()
- \( L = W + B \)

**ARCH OR ELLIPTICAL**

- \( D = \text{EQUIVALENT CIRCULAR DIAMETER (INSIDE)} \)
- \( H = \text{RISE} + 30" \)
- \( W = 3D + 36" \)
- \( T = 0.4H \) (NEAREST IN) \()
- \( B = \frac{1}{3}D^{1/2} \) (MINIMUM) \()
- \( L = W + B \)
CONCRETE APRON, IF SPECIFIED ON PLANS
#5 PLACE ALONG TOP OF WALL

#4 @ 12" HORIZONTAL BARS
NOT SHOWN FOR CLARITY

CONCRETE SEALER AT OR RISE

FRONT, (SEE SHEET 2 OF 2 FOR LIMITS)

TOP OF WALL (TOT. 2)

SKEWED HEADWALL, IF BOX ELEVATION SPECIFIED ON PLANS

m = h, Ba OR RISE + (11/4 " )
UNLESS OTHERWISE SHOWN ON PLANS

1'-9"

DRAINAGE BEHIND J (VERT.)

OF ROADWAY

EQUAL SIZE & SPACING

WINGWALL, SEE NOTE 6

STATIONING EACH FACE: BARS PROJECT 1'-9"
INTO WINGWALL STEM TO SPLICE

d-BARS

SEE TABLE

6 #4 LONGITUDINAL (TYP.)

TOP MAT (SEE DETAIL II)

MIN. INLET APRON IS REQUIRED IF CBC DESIGN EXAMPLE

DOES NOT INCLUDE TOE WALL QUANTITIES

REQUIRED DRAINAGE BEHIND WINGWALLS
SEE NOTE 6

REINFORCING STEEL: fy = 60,000 PSI

CONCRETE CLASS D (BOX CULVERT): f_c = 4,500 PSI

REINFORCEMENT 1.34 LB./SQ. FT.

REINFORCEMENT 5.1 LB./LIN. FT.

LOADING:

AT-REST EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 55 PCF FOR 2 SLOPED BACKFILL
ACTIVE EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 40 PCF FOR 2 SLOPED BACKFILL
LIVE LOAD SURCHARGE = 2'

MINIMUM CLASS B LAP SPLICE LENGTH FOR BLACK REINFORCING BARS:

BAR SIZE: #4 #5 #6 #7

SPLICE LENGTH: 1'-6" 1'-11" 2'-3" 2'-7"

GENERAL NOTES:

4. MINIMUM CLASS B LAP SPLICE LENGTH FOR BLACK REINFORCING BARS:

6. WINGWALL DRAIN SHALL BE REQUIRED IF "h" IS USED AS AN ANIMAL PASS

12.0 FT., SEE SHEET 2 OF 2 FOR DETAILS.

6. WINGWALL DRAIN SHALL BE REQUIRED IF CBC DESIGN EXAMPLE

DOES NOT INCLUDE TOE WALL QUANTITIES

REQUIRED DRAINAGE BEHIND WINGWALLS
SEE NOTE 6

CONCRETE 0.049 CU. YD./LIN. FT.

REINFORCEMENT 5.1 LB./LIN. FT.

LOADING:

AT-REST EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 55 PCF FOR 2 SLOPED BACKFILL
ACTIVE EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 40 PCF FOR 2 SLOPED BACKFILL
LIVE LOAD SURCHARGE = 2'

MINIMUM CLASS B LAP SPLICE LENGTH FOR BLACK REINFORCING BARS:

BAR SIZE: #4 #5 #6 #7

SPLICE LENGTH: 1'-6" 1'-11" 2'-3" 2'-7"

GENERAL NOTES:

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 1/8"

2. WINGWALL FOOTING AND FLOOR OF BOX CULVERTS SHALL BE PLACED MONOLITHICALLY

3. ENHANCING M = 2'-3", #6 LONGITUDINAL BARS (TOP MAT), PROJECT 1'-9" INTO STEM TO SPLICE d-BARS

4. MINIMUM CLASS B LAP SPLICE LENGTH FOR BLACK REINFORCING BARS:

5. DESIGN DOES NOT CONSIDER ANY SCOUR EFFECTS.

6. WINGWALL DRAIN SHALL BE REQUIRED IF CBC DESIGN EXAMPLE

DOES NOT INCLUDE TOE WALL QUANTITIES

REQUIRED DRAINAGE BEHIND WINGWALLS
SEE NOTE 6

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INSTALLATION OF METAL PIPE

INSTALLATION OF METAL PIPE

MINIMUM COVER FOR CONSTRUCTION LOADS

MINIMUM COVER FOR CONSTRUCTION LOADS

METAL PIPE WITH END SECTIONS

METAL PIPE WITHOUT END SECTIONS

MINIMUM COVER FOR INDICATED AXLE LOADS, ft

MINIMUM COVER FOR INDICATED AXLE LOADS, ft

CONSTRUCTION MINIMUM COVER FOR PIPE

CONSTRUCTION MINIMUM COVER FOR PIPE

H = THE MAXIMUM ALLOWABLE HEIGHTS OF FILL OVER THE TOP OF THE PIPE, EXCLUDING PAVEMENT THICKNESS, ARE SHOWN IN THE TABLES OF THIS STANDARD. THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER.

GENERAL NOTES

1. STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M36.
2. ALUMINUM PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M196.
3. ALUMINIZED STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M274.

MINIMUM COVER FOR CONSTRUCTION LOADS

MINIMUM COVER FOR CONSTRUCTION LOADS

LEGEND

LEGEND

CAL WIDE-LOAD STANDARD SHEET NO. 1 OF 4

METAL PIPE

METAL PIPE

CONVERSION OF MINIMAL GAGE TO THICKNESS

ALUMINUM THICKNESS - In.

ALUMINIZED OR GALVANIZED STEEL THICKNESS - In.

ALLOWED WALL THICKNESS

STANDARD PLAN NO. M-603-1

CR-340

CR-340

CR-340

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CR-340
## These Tables Are Applicable for the Following List

- Galvanized Corrugated Steel Pipe (CSP)
- Aluminum Coated Corrugated Steel Pipe Type 2 (ALT2 CSP)
- Bituminous Coated Corrugated Steel Pipe (BIT. CO. CSP)
- Aramid Fiber Bonded Corrugated Steel Pipe (A.F. BO. CSP)
- Precoated Corrugated Steel Pipe (PCSP - Both Sides)

### Diameter Minimum of Corrugated Steel Pipe

<table>
<thead>
<tr>
<th>Diameter (IN)</th>
<th>CSP</th>
<th>ALT2 CSP</th>
<th>BIT. CO. CSP</th>
<th>A.F. BO. CSP</th>
<th>PCSP</th>
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### Span & Rise

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<th>Span X Rise (IN X X)</th>
<th>Round Equivalent (IN)</th>
<th>H Minimum Cover (IN)</th>
<th>Pipe Gage</th>
<th>H Maximum Cover (FT)</th>
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**Notes:**
- **2-1/4" X 1/2" Corrugations**
- **CSP Corrugated Steel Pipe**
- **3-1/4" X 1/4" Corrugations**
- **CSP Corrugated Steel Pipe**
- **3" X 1" Corrugations**
- **CSP Corrugated Steel Pipe**
- **CORNER BEARING PRESSURE OF 2 TONS PER SQ. FT.**

---

**Computer File Information**
- Created Date: 07/26/19
- Designer Initials: JBK
- Last Modification Date: 07/31/19
- Designer Initials: jb
- CAD Ver.: MicroStation V8i
- Project Development Branch: JBK

**Colorado Department of Transportation**
- 2030 West Howard Place
- CDOT HQ, 3rd Floor
- Denver, CO 80204
- Phone: 303-757-9021  FAX: 303-757-9868

**Project Development Branch:**
- Issued by the Project Development Branch: July 31, 2019
- Standard Sheet No. 2 of 4

**STANDARD PLAN NO.**
- M-603-1

---

**METAL PIPE**
These tables are applicable for the following list of corrugated steel pipe:

1. Galvanized Corrugated Steel Pipe (CSP)
2. Aluminized Corrugated Steel Pipe Type 2 (ALT2 CSP)
3. Duruminous Coated Corrugated Steel Pipe (UTC CSP)
4. Aramid Fiber Bonded Corrugated Steel Pipe (AFB CSP)
5. Precoated Corrugated Steel Pipe (PCSP—both sides)

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>H Minimum Cover (in.)</th>
<th>H Maximum Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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5" x 1" Corrugations
Corrugated Steel Pipe

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5/8" x 3/4" Corrugations
Corrugated Steel Pipe

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3/4" x 7/8" Corrugations
Corrugated Steel Pipe

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>H Minimum Cover (in.)</th>
<th>H Maximum Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
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<tr>
<td>84</td>
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<td>84</td>
</tr>
</tbody>
</table>

3/4" x 7/8" Corrugations
Corrugated Steel Pipe

* Corner bearing pressure of 2 tons per 50 ft.
These tables are applicable for the following list of corrugated steel pipe:
1. Galvanized Corrugated Steel Pipe (CSP)
2. Aluminized Corrugated Steel Pipe Type 2 (ALT2 CSP)
3. Bituminous Coated Corrugated Steel Pipe (BIT. CO. CSP)
4. Aramid Fiber Bonded Corrugated Steel Pipe (A.F. BO. CSP)
5. Precoated Corrugated Steel Pipe (PCSP - BOTH SIDES)

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>H Minimum Cover (in.)</th>
<th>H Maximum of Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

1-3/4" x 1/4" Corrugations
Corrugated Aluminum Pipe

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>H Minimum Cover (in.)</th>
<th>H Maximum of Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>18</td>
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<td>24</td>
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<td>30</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>36</td>
<td>24</td>
<td>18</td>
</tr>
</tbody>
</table>

2-3/4" x 1/4" Corrugations
Corrugated Aluminum Pipe

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>H Minimum Cover (in.)</th>
<th>H Maximum of Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>28</td>
<td>24</td>
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<td>32</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>36</td>
<td>24</td>
<td>18</td>
</tr>
</tbody>
</table>

3" x 1" Corrugations
Corrugated Aluminum Pipe

---

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Issued by the Project Development Branch: July 31, 2019

---

METAL PIPE
STANDARD PLAN NO. M-603-1
Standard Sheet No. 4 of 4
Issued by the Project Development Branch: July 31, 2019
Project Sheet Number:

---

Project Development Branch: JBK
GENERAL NOTES

1. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

2. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

3. MAXIMUM ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE.

REINFORCED CONCRETE PIPE

1. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

2. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

3. MAXIMUM ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE.

NOTE: Be IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

REINFORCED CONCRETE PIPE

1. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

2. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

3. MAXIMUM ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE.

NOTE: Be IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

REINFORCED CONCRETE PIPE

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REINFORCED CONCRETE PIPE

1. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

2. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

3. MAXIMUM ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE.

NOTE: Be IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

REINFORCED CONCRETE PIPE

1. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

2. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.

3. MAXIMUM ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE.

NOTE: Be IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.
GENERAL NOTES

1. PRECAST CONCRETE BOX CULVERTS SHALL CONFORM TO THE REQUIREMENTS OF THE FOLLOWING SPECIFICATIONS:

<table>
<thead>
<tr>
<th>ITEM OR CONDITION</th>
<th>MIN.</th>
<th>AASHTO EQUIV.</th>
<th>ASTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 FT. OF MORE COVER</td>
<td>2 FT.</td>
<td>w 256, TABLE 2</td>
<td>C (433), TABLE 2</td>
</tr>
<tr>
<td>LESS THAN 2 FT. COVER</td>
<td>0 FT.</td>
<td>w 257, TABLE 2</td>
<td>C (433), TABLE 2</td>
</tr>
<tr>
<td>PREFORMED JOINT MATERIAL</td>
<td>0 FT.</td>
<td>w 259, 6.2</td>
<td>C (433), 6.2</td>
</tr>
<tr>
<td>SPAN 28 FT. OR MORE</td>
<td>0 FT.</td>
<td>C 1277</td>
<td></td>
</tr>
</tbody>
</table>

2. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

3. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

4. CBC JOINTS USING RUBBER GASKETS SHALL MEET ASTM C1677.

5. PCC ELEMENTS (TYP.) OF CENTRAL INDUSTRY SHALL BE FITTED TO MANUFACTURER'S RECOMMENDATIONS.

6. THE CONTRACTOR HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577 FOR SPANS LESS THAN 20 FT.

7. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

8. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED. A LOAD-AND-RESISTANCE FACTOR DESIGN (LRFD) STRUCTURAL DESIGN IS REQUIRED USING ASTM C 277.

9. THE SPECIFICATIONS GIVEN ABOVE SHOW REINFORCING PLACEMENT, EARTH COVER AND OTHER DETAILS NEEDED TO MANUFACTURE THE BOX CULVERTS.

10. THE WRAP SHALL BE A SMOOTH FIT (NOT LOOSE OR STRETCHED) JUST PRIOR TO BACKFILL.

11. THE SEGMENT LENGTH SHALL BE SPECIFIED BY MANUFACTURER.

12. THE CONTRACTOR HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577 FOR SPANS LESS THAN 20 FT.

13. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

14. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

15. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

16. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

17. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

18. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

19. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

20. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

21. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

22. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

23. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

24. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

25. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

26. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

27. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

28. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

29. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

30. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

31. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

32. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

33. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

34. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

35. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

36. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

37. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY PRIOR TO FABRICATION.

38. BEDDING ALTERNATIVE 2 IS AT THE CONTRACTOR'S OPTION. BEDDING AND LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

39. THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THAN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.
1. All pipes shall meet the requirements of AASHTO M294 for Polyethylene and AASHTO M330 for Polypropylene, type P Pipes with outer, corrugated walls and smooth inner liners.

2. When a pipe is to be extended, the same pipe material and size as in the original installation shall be used.

3. Minimum cover shall be provided during construction to protect the pipe from damage.

4. When installing a guardrail or a sign post directly above a pipe, the post's bottom must be at least 1 foot above the top of the pipe. The hole for the post shall be drilled into the soil.

5. Structure backfill material shall be Class 1.

6. For pipes 24 inches or less in diameter, H Min. may be reduced to one foot for low volume approach roads not on state highways.

**LEGEND**

- \( H \) = maximum allowable height of cover over the top of the pipe, excluding pavement thickness.
- \( L_1 \) = length of pipe to be installed in accordance with Section 624.
- \( L_2 \) = maximum spacing between the outside walls of multiple pipes or end sections in ft. 30%, whichever is greater.

**TABLE**

<table>
<thead>
<tr>
<th>Pipe Diameter, d (in)</th>
<th>H Minimum Height of Cover (ft.)</th>
<th>H Maximum Height of Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95% Compaction</td>
<td>90% Compaction</td>
</tr>
<tr>
<td>12</td>
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<td>48</td>
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<tr>
<td>60</td>
<td>2</td>
<td>2</td>
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</tbody>
</table>

**GENERAL NOTES**

1. All pipes shall meet the requirements of AASHTO M294 for Polyethylene and AASHTO M330 for Polypropylene, type P Pipes with outer, corrugated walls and smooth inner liners.

2. When a pipe is to be extended, the same pipe material and size as in the original installation shall be used.

3. Minimum cover shall be provided during construction to protect the pipe from damage.

4. When installing a guardrail or a sign post directly above a pipe, the post's bottom must be at least 1 foot above the top of the pipe. The hole for the post shall be drilled into the soil.

5. Structure backfill material shall be Class 1.

6. For pipes 24 inches or less in diameter, H Min. may be reduced to one foot for low volume approach roads not on state highways.
**Legend**

\[ H = \text{maximum allowable height of cover over the top of the pipe, excluding pavement thickness.} \]

**Pipe with End Sections**

<table>
<thead>
<tr>
<th>Pipe Diameter (in.)</th>
<th>( H ) Minimum Height of Cover (ft.)</th>
<th>( H ) Maximum Height of Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
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<td>24</td>
<td>2</td>
<td>69</td>
</tr>
<tr>
<td>26</td>
<td>2</td>
<td>56</td>
</tr>
</tbody>
</table>

**Minimum and Maximum Cover**

- **Environment of Suitable Material**
- **Structure Backfill**

**Installation of Pipe**

**General Notes**

1. All pipes shall meet the requirements of AASHTO M304 for Polyvinyl Chloride (PVC) profile wall drain pipe with 46 PSI wall stiffness per ASTM F949.
2. For pipes with diameters of 15 inches or less, solid wall PVC pipe meeting AASHTO M304 may be used.
3. When a pipe is to be extended, the same pipe material and size as in the original installation shall be used.
4. Minima cover shall be provided during construction to protect the pipe from damage.
5. When installing a guardrail or a sign post directly above a pipe, the post's bottom must be at least 1 foot above the top of the pipe. The hole for the post shall be drilled into the soil.
6. Structure backfill material shall be class 1.

**Trench Width**

**Note:** Use the \( H \) that is greater for maximum allowable fill heights.

**Construction Minimum Cover for Pipe**

**NOMINAL PIPE DIAMETER (IN.)**

<table>
<thead>
<tr>
<th>Diameter (in.)</th>
<th>Minimum Cover (in.) for Indicated Axle Loads (Kips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 - 36</td>
<td>24.0, 30.0, 36.0, 36.0, 36.0, 36.0</td>
</tr>
</tbody>
</table>

**AASHTO Minimum Cover for Construction Loads**
LEGEND

H = MAXIMUM ALLOWABLE HEIGHT OF COVER OVER THE TOP OF THE PIPE, EXCLUDING PAVEMENT THICKNESS.

GENERAL NOTES
1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO MP 20 FOR STEEL REINFORCED, POLYETHYLENE PIPE WITHOUT ENO SECTIONS. INSTALLATION SHALL CONFORM TO AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, SECTION 12.7.
2. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
3. MINIMUM COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE.
4. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE POST'S BOTTOM MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE. THE HOLE FOR THE POST SHALL BE DRILLED INTO THE SOIL.
5. STRUCTURE BACKFILL MATERIAL SHALL BE CLASS 1.

TRENCH WIDTH
TRENCH WIDTH ASSUMES STABLE IN-SITU SIDE WALL.

STANDARD PLAN NO.
M-603-6

STANDARD SHEET
No. 1 of 1

PROJECT SHEET NUMBER:

CONSTRUCTION MINIMUM COVER FOR PIPE

MINIMUM AND MAXIMUM COVER

PIPE DIAMETER, d (IN.)  H MINIMUM HEIGHT OF COVER (FT.)  H MAXIMUM HEIGHT OF COVER (FT.)+
30  2  50
48  2  50
54  2  50
60  2.5  50

* A MANUFACTURER'S CERTIFICATION OF MAXIMUM ALLOWABLE FILL HEIGHT IS REQUIRED PRIOR TO INSTALLATION.

+ THE MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR d/2, WHICHEVER IS GREATER.

COMMENTS

EMBANKMENT OR SUITABLE MATERIAL

18" < TYP.>
1. Pipe end sections shall be furnished with Tongue or Groove as required.

2. Thickness of pipe end sections shall be the same as the thickness of the pipe shown on the plans.

3. Design length of pipe or side drain is based on length of end section shown in Table 1.

4. Concrete end sections shall be furnished with tongue or groove as required.

5. The inside configuration and the joint of concrete end section and pipe shall match.

6. End sections for CMP arch pipe shall match the dimensions of the pipe shown on the plans.

7. Steel pipe and shall be the same thickness as end sections. The plate shall be field-soldered to end section with % in. galvanized bolts, nuts, and washers.

8. Concrete pipe joint fasteners, where shown on plans, shall be installed so that a minimum of 30 in. of the end of the pipe is free of obstructions.

9. Connections of metal end sections to plastic pipe shall be approved by the engineer.

10. The end section style, either Regular or Safety, shall be as shown on the plans.

11. Acceptable equivalent culvert pipe length, Item 617-10, shall be as shown on the plans.

12. Concretes joint fastener (two per joint).

CONCRETE AND METAL END SECTIONS

STANDARD PLAN NO.
M-603-10
Standard Sheet No. 1 of 1

Issued by the Project Development Branch: July 31, 2019
Project Sheet Number: 2020-004

CONCRETE AND METAL END SECTIONS

Computer File Information
Creator: John Black
Date: 07/31/19
Comments:

Colorado Department of Transportation
20200 South Howard Place
CGT No., 3rd Floor
Phone: (303) 757-9021 FAX: (303) 757-9868
Project Development Branch: Daniel H. Black

NOTE: METAL END SECTION SHALL BE FIRMLY WEDGED INTO PIPE END BEFORE BACKFILLING.
1. Use end sections on 1V:4H to 1V:6H slopes DNL Y. Use toe plate (see sec. A-A).

2. For round and elliptical pipes with 24 inches or less diameters, use additional longitudinal bars if spacing exceeds 30 inches on larger end sections.

3. A longitudinal bar is required for cross drainage end sections when the span is greater than 30 inches. Use additional longitudinal bars if spacing exceeds 30 inches on larger end sections.

4. Safety bars are not required on 30 inches and smaller cross drainage end sections.

5. Safety bars are not required on 18 inches and smaller parallel drainage end sections.

6. When required, toe plate extensions shall be the same gage as end sections. Dimensions shall be overall width less 6 inches by 8 inches high.

7. Optional toe plate extensions are shown with note 7.

**METAL END SECTIONS FOR ROUND PIPE CULVERT**

**CONNECTOR DETAILS**

**GENERAL NOTES**

1. Use end sections on 1V:4H to 1V:6H slopes DNL Y. Use toe plate extensions where shown on plans.

2. Fabricate safety and longitudinal bars from steel pipe conforming to ASTM A53 Schedule 40 specifications. Galvanized bars may be turned after fabrication.

3. A longitudinal bar is required for cross drainage end sections when the span is greater than 30 inches. Use additional longitudinal bars if spacing exceeds 30 inches on larger end sections.

4. Safety bars are not required on 30 inches and smaller cross drainage end sections.

5. Safety bars are not required on 18 inches and smaller parallel drainage end sections.

6. When required, the plate extensions shall be the same gage as end sections. Dimensions shall be overall width less 6 inches by 8 inches high.

**METAL END SECTIONS FOR PIPE ARCH CULVERT**

**SAFETY BAR DETAILS**

**TRAvERSABLE END SECTIONS AND SAFETY GRATES**

**STANDARD PLAN NO.**

M-603-12

**Standard Sheet No. 1 of 3**
INSTALLED TYPES
Grate bars shall be perpendicular to direction of traffic flow.

SKEW ANGLE DETERMINATION

SHIM DETAIL

SECTION A-A

SECTION B-B

SECTION C-C

NOTES
1. Shop drawings shall be submitted per 105-02.
2. Hardware such as bolts, washers, and lock nuts shall be hot-dipped galvanized per ASTM A 123.
3. Provide for use on terrain XX slopes with a clear runout for errant vehicles. Guardrail is the preferred option on steeper terrains or with higher traffic volumes.
4. Minimum schedule 8 pipe shall be used galvanize all pipes, fittings and hardware after all cutting, bending, drilling, and fabrication.
5. Both ends of culvert shall be treated to prevent erosion from entering.
6. Equally spaced supports min 10 inches max from edge of centerline to edge of support, or from center to center of bracket.
7. The crossbar diameter shall be equal to or greater than the grate bar diameter.
8. If more than 20 feet below the center of support shall be required. See sheets 3 and 4.
9. Small holes using equipment designed to cut through concrete and reinforcing steel.
10. A % inch bolt, lock nut and washers. All holes are to be % inch in diameter.
11. Bend plates or strips without cracking material.
12. Shim thickness equals the difference in diameters of the grate bar and cross bar.

COLORADO DEPARTMENT OF TRANSPORTATION

2829 West Howard Place
Denver, CO 80204

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Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-603-12

Standard Sheet No. 2 of 3

TRAVERSABLE END SECTIONS
AND SAFETY GRATES
I. INLET TYPE D IS NOT HS-20 RATED AND SHALL NOT BE PLACED IN PAVED ROADWAYS. THIS INLET SHALL BE USED ONLY OUTSIDE PAVED ROADWAYS.

2. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.

3. SEE PLANS FOR SIZE AND LOCATION OF PIPE.

4. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.

5. STANDARD INLET GRATES SHALL BE USED ON ALL TYPE D INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.

6. CLOSE MESH GRATES ARE RECOMMENDED WHERE FOOT TRAFFIC OR BICYCLE ROUTES ARE IN CLOSE PROXIMITY TO GRATE. THIS GRATE IS NOT ADA COMPLIANT OR BICYCLE FRIENDLY AND SHALL NOT BE PLACED DIRECTLY IN SIDEWALKS, CROSSWALKS OR BIKE PATHS.

7. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO CLEARANCE OR GREATER THAN 3 FEET-6 INCHES AND SHALL CONFORM WITH AASHTO M199.

8. REINFORCING BARS SHALL BE GRADE 60, EPOXY COATED, AND DEFORMED #4, AND #4 AT 12" CTRS. SHALL HAVE A 2 INCH MIN. CLEARANCE. CUT OR BEND BARS AROUND PIPE AS REQUIRED.

9. ALL INLETS SHALL HAVE A 4 INCH DIA. METAL MEDALLION WITH A "NO DUMPING DRAINS TO STREAM" MESSAGE ON IT. THE MEDALLION SHALL HAVE A FISH SYMBOL WITH A BLUE BACKGROUND. IT SHALL BE FIRMLY ATTACHED TO THE INLET'S SURFACE WITH A PERMANENT FASTENER.

**TABLE OF STANDARD INLET GRATE TWO STEEL GRATE PER INLET QUANTITIES**

<table>
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<th>LIFE</th>
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<td>20 3/4&quot;</td>
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</table>

**TOTAL LBS. = 256**

**INLET, TYPE D QUANTITIES FOR ONE INLET**

**CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE.**

**WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.**

**CLOSE MESH GRATE**

**STANDARD INLET GRATE**

**LEVEL GRATE INSTALLATION**

**SLOPING GRATE INSTALLATION**

**TRANSVERSE CROSS SECTION**

**LONGITUDINAL CROSS SECTION**

**PLAN VIEW**

**CONCRETE PIPE CIRCULAR PIPE RANGE**

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<tr>
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<td>135-165</td>
<td>165-200</td>
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**INLET, TYPE D**

**STANDARD PLAN NO. M-604-11**

**Project Development Branch**

**Issued by the Project Development Branch July 31, 2019**

**Project Sheet Number:**

**CAD Ver.: MicroStation V8i**  Scales Not to Scale. Units: English
GENERAL NOTES

1. CONCRETE SHALL BE CLEARLY MARKED ON THE EXTERIOR FACE OR PRECAST.
2. CONCRETE WALLS SHALL BE DRIED FOR AT LEAST 3 DAYS BEFORE CURB INSTALLATION.
3. CURB AND GUTTER ASSEMBLY SHALL BE IN CONFORMANCE WITH AASHTO M 199.
4. CURB FACE ASSEMBLY SHALL BE GTX-030, GP-060, GP-070 OR GP-080.
5. CONCRETE CORNERS SHALL BE CHAMFERED 1/8 IN. CURB AND GUTTER CORNERS SHALL BE CHAMFERED 3/16 IN. FOR A HORIZONTAL CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
6. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
7. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
8. STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
9. ALL MANHOLE COVERS SHALL BE CAST WITH A "NO DUMPING DRAINS TO STREAM" MARK.

TABLE ONE ~ BAR LIST FOR CURB INLETS, TYPE "R"

<table>
<thead>
<tr>
<th>LENGTH</th>
<th>CONC. STEEL</th>
<th>STUCCO STEEL</th>
<th>CONC. STEEL</th>
<th>STUCCO STEEL</th>
<th>CONC. STEEL</th>
<th>STUCCO STEEL</th>
<th>CONC. STEEL</th>
<th>STUCCO STEEL</th>
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<td>2'-2&quot;</td>
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TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"
GENERAL NOTES

1. CONCRETE SHALL BE CLASS B INLET MAY BE CAST-IN-PLACE OR PRECAST.

2. CAST-IN-PLACE CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES.

3. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 1/8 INCH TO PREVENT ROCKING.

4. REINFORCING BARS SHALL BE EXTENDED 4 IN AND SHALL HAVE A 2 INCH MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED.

5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FEET-0 INCHES AND SHALL CONFORM TO AASHTO M-604-13.

6. ALL GRATES AND FRAMES SHALL BE GRAY OR DUCTILE CAST IRON. NO. 13 GRATING SHALL BE DESIGNED TO WITHSTAND HS-20 Loading.

7. STATION POINT IS AT THE CENTER OF THE INLET.

8. WHEN HMA MATERIAL IS TO EXTEND TO THE EDGE OF THE GUTTER, CONCRETE MAY BE DEPRESSED.

9. INCLUDES 6 IN. TO THIS DIMENSION FOR EACH 6 IN. INCREASE OF "H" OVER 3 FT. -0 IN.

Note: Concrete quantities include volume occupied by pipe. Quantities for one inlet are:

- Concrete: 1,890 cu. yds.
- Rebars: 420 lb.
- Grates: 100 lb.
- Frames: 120 lb.

Bar List for H = 3 FT - 0 IN.

- 4/16" 13, 20, 30, 40
- 5/16" 8, 20, 30, 40
- 3/8" 5, 10, 20, 30
- 7/16" 5, 8, 20, 30
- 1/2" 10, 15, 20, 25

Approximate weight = 550 lb.
2-501 IN TOP SLAB (TYP.)

THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE. THE ECCENTRIC CONE MAY BE USED WHEN THE MANHOLE "H" HEIGHT IS AT LEAST 8 FT.

THE MANHOLE RING FRAME SHALL BE SET IN A BED OF GROUT.

FLEXIBLE JOINT SEAL SHALL CONFORM AROUND OPENING.

SHARP ANGLE

TYPICAL CHANNELIZATION DETAILS

GENERAL NOTES

QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS SHOWN.

THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.

STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL OF MANHOLE AND BE SATISFACTORY PLUGGED.

FLOW CHANNELS AND INVERTS SHALL BE FORMED BY SHAPING THE SLAB THROUGH PIPE ONE LATERAL

ONE LATERAL ANGLED LATERALS

TYPICAL CHANNELIZATION DETAILS

CONCRETE - CUBIC YARDS - TOTAL

REINFORCING STEEL TOT AL

CONCRETE - CUBIC YARDS - TOTAL

REINFORCING STEEL TOT AL

CONCRETE - CUBIC YARDS - TOTAL

REINFORCING STEEL TOT AL

CONCRETE - CUBIC YARDS - TOTAL

REINFORCING STEEL TOT AL
FLEXIBLE JOINT SEAL SHALL CONFORM TO AASHTO M198 (TYP.) CLASS B CONCRETE BASE

TOE POCKETS AT 24" O.C. IF TOP OF RECH 2" ABOVE INVERT

4" U IN 12" ALL BASES

MANHOLE REFER CE 4" E RIDGES

SECTION B-B

SECTION D-D

SECTION C-C

CAST-IN-PLACE SLAB BASE

SECTION E-E

PRECAST SLAB BASE

INVERT ELEVATION SHOWN IN PROFILE

INERT ELEVATION SHOWN IN PROFILE

INVERT ELEVATION SHOWN IN PROFILE

TYPICAL TIE BAR

BASE MAY BE POURED SQUARE AT CONTRACTOR'S OPTION.

MANHOLE RING AND COVER RAW ELEVATION

A FINAL GRADE IN UNPAVED AREA USE CONCRETE GRADE RINGS OR BRICK COURSES

PRECAST MANHOLE BASES NOTES:

1. THE BASE SLAB SHALL BE POURED MONOLITHICALLY WITH BOTTOM RISER SECTION.

2. PRECAST MANHOLE BASES SHALL FIT THE CONDITIONS AND LOCATIONS FOR WHICH THEY ARE SPECIFIED AND FIELD MODIFICATIONS OR REQUIRED FIELD CUTTING OR ADJUSTMENT IN ORDER TO FIT THE LOCATIONS INTENDED WILL BE PERFORMED BY THE ENGINEER AND REMOVED AND REPLACED AT THE CONTRACTOR'S COST TO THE DEPARTMENT.

3. PRECAST MANHOLE BASES SHALL BE BEMMED ON AN APPROVED GRANULAR BEDDING MATERIAL AS SHOWN ABOVE.

LEGEND

STANDARD PLAN NO. M-604-20

MANHOLES

MANHOLE RISER DETAIL

PROJECT DEVELOPMENT BRANCH: JULY 31, 2019

MANHOLE RING AND COVER

TOTAL WEIGHT APPROXIMATELY 400 LBS.

SHALL BE GRAY DR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
WHEN ADJUSTMENT HEIGHT IS 3 IN. OR LESS, METAL ADJUSTMENT RINGS COMPATIBLE WITH THE EXISTING MANHOLE RING AND COVER MAY BE USED IF APPROVED BY THE ENGINEER.

Concrete Collar or Full Depth HMA Patching

T-BASE MANHOLES NOTES
1. THE T-BASE SECTION SHALL BE SHOP-FABRICATED FOR DELIVERY TO THE CONSTRUCTION SITE AS A COMPLETE UNIT.
2. THESE DETAILS SHOW ONLY THE CONCEPTUAL AND STANDARD DIMENSIONAL REQUIREMENTS FOR T-BASE MANHOLES. THE CONTRACTOR SHALL FURNISH DETAILED SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION. THE DETAILS SHOWN HEREBY APPLY ONLY TO 48 IN. AND GREATER DIAMETER PIPES.
3. EXCEPT FOR CLASS OF PIPE, SPECIFICATIONS FOR THE MANHOLE SHALL BE THE SAME AS THOSE DESIGNED FOR THE ADJOINING PIPE.
4. THE T-BASE SECTION SHALL MAINTAIN ITS INTERNAL SHAPE AND FLOW AREA; GROUTING OR FILLING SHALL BE APPLIED SO AS NOT TO DISTURB THE NORMAL FLOW OR REDUCE THE AREA.

CONCRETE COLLAR OR FULL DEPTH HMA PATCHING

PRECAST RISER SECTION

CIRCULAR RIGID PIPE (LONGITUDINAL SECTION)

CIRCULAR RIGID PIPE (TRANSVERSE SECTION)

MANHOLE T-BASE

MANHOLES M-604-20

MANHOLES M-604-20

STANDARD PLAN NO.

MANHOLES

MANHOLES

STANDARD PLAN NO.

MANHOLES

MANHOLES

STANDARD PLAN NO.

MANHOLES

MANHOLES

STANDARD PLAN NO.

MANHOLES
GENERAL NOTES

1. FOR THE 32 INCH AND 36 INCH INSIDE INLET DIMENSIONS, THE ALLOWABLE PIPE ID IS 30 INCHES OR LESS, FOR THE 72 INCH INSIDE DIAMETER, THE ALLOWABLE PIPE ID IS 66 INCHES OR LESS, UP TO A MAXIMUM OF 66 INCHES FOR "H" OF 7 FEET OR MORE.

2. ALL CONCRETE SHALL BE CLASS III.

3. PIPING MAY BE CAST-IN-PLACE OR PRECAST.

4. REINFORCING BARS SHALL BE #4 UNLESS SHOWN OTHERWISE.

5. ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED.

6. ALL EDGE DISTANCES ARE TO THE CENTERLINE OF THE BAR.

7. CUT OR BEND REINFORCING BARS AROUND PIPES AS REQUIRED.

8. STEPS SHALL BE REQUIRED WHEN THE INLET DEPTH "H" IS EQUAL TO OR GREATER THAN 4 FT AND SMALL CONCRETE TO ADJACENT AREA.

9. THE INVERT OF THE BOX SHALL BE SLOPED TO DRAIN.

10. THE CONTRACTOR SHALL STAMP FLOW ARROWS INTO THE TOP SURFACE OF THE INLET BOX SIDEWALLS TO INDICATE THE DIRECTION OF RUNOFF. THE STAMPED ARROWS SHALL BE 6 IN. LONG, 1 IN. HIGH, AND 3/16 IN. DEEP.

11. A 4 IN. DIA. STAINLESS STEEL MEDALLION WITH "NO DUMPING DRAINS TO STREAM" OR SIMILAR MESSAGE SHALL BE ATTACHED TO THE TOP OF THE INLET SURFACE WITH A PERMANENT FASTENER. THE MEDALLION WILL HAVE A FISH SYMBOL AND BLUE COLOR BACKGROUND. ALTERNATIVELY, THIS MESSAGE MAY BE CAST IN 1 IN. HEIGHT LETTERS INTO THE TOP OF THE INLET'S CONCRETE SURFACE OR SURROUNDING CONCRETE APRON. THE NO DUMPING MESSAGE SHALL BE ELIMINATED FOR INLETS LOCATED WITHIN THE SHOULDERS OF CONTROLLED ACCESS FREEWAYS WHEN SPECIFIED IN THE PLANS.

LEGEND

Grate to be installed during construction of the box with the vane grate bolted in place to the frame.

To facilitate removal of the grate plate, provide 1/8 IN x 1/16 IN knock-out holes along edge of the grate as shown.

Flow arrows point in direction of flow (Typ.)
VANE GRATE INLET

LEGER

1. HOOP REBAR 2-503 AROUND PIPE PENETRATION

2. 2-503 AROUND PIPE PENETRATIONS

SECTION B-B

LEGEND

\[ VANE \] GRATE STANDARD PLAN NO.

\[ \text{INLET} \] Standard Sheet No. 2 of 5

\[ \text{VANE} \] GRATE

\[ \text{INLET} \]
### Quantities for One 36 in. Inlet

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### Notes
1. Concrete quantity includes volume occupied by pipes.
2. Reinforcing steel quantity assumes two 503 hoops for each 24 in. pipe.
3. Bars numbered in 400 series indicates #4 size bar.
   Bars numbered in 500 series indicates #5 size bar.
4. All reinforcing bars shall be grade 40 and epoxy coated.

### Quantities for One 72 in. Inlet

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### Bar List for Concrete Apron

#### Bar List for H = 4'-0" 36 in. Inlet

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<td>120&quot;</td>
</tr>
<tr>
<td>403</td>
<td>4</td>
<td>30&quot;</td>
<td>120&quot;</td>
</tr>
</tbody>
</table>

#### Bar List for H = 4'-0" 72 in. Inlet

<table>
<thead>
<tr>
<th>Mark</th>
<th>No. Req.</th>
<th>Height (in)</th>
<th>Length (each)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>4</td>
<td>40&quot;</td>
<td>80&quot;</td>
</tr>
<tr>
<td>501</td>
<td>6</td>
<td>40&quot;</td>
<td>80&quot;</td>
</tr>
<tr>
<td>402</td>
<td>7</td>
<td>30&quot;</td>
<td>140&quot;</td>
</tr>
<tr>
<td>403</td>
<td>7</td>
<td>30&quot;</td>
<td>140&quot;</td>
</tr>
</tbody>
</table>

### Inlet Apron Bending Diagram for 36 in. Inlet

#### Diagram Description
- Increase dimension in "H" for each 1 ft. above 4 ft.
- Two bars for each 1 ft. increase of "H" above 4 ft.

### Inlet Apron Bending Diagram for 72 in. Inlet

#### Diagram Description
- Increase dimension in "H" for each 1 ft. above 4 ft.
- Two bars for each 1 ft. increase of "H" above 4 ft.

### Notes
1. Concrete quantity includes volume occupied by pipes.
2. Reinforcing steel quantity assumes two 503 hoops for each 24 in. pipe.
3. Bars numbered in 400 series indicates #4 size bar.
   Bars numbered in 500 series indicates #5 size bar.
4. All reinforcing bars shall be grade 40 and epoxy coated.
CONCRETE APRON FOR 72 INLET

SECTION E-E

CONCRETE APRON FOR 36 INLET

SECTION F-F

NOTES
1. A 2 FT CONCRETE TRANSITION APRON SHALL BE
   CONSTRUCTED AS SHOWN AND SHALL BE KEYED
   INTO THE INLET.
2. CONCRETE APRON SHALL BE THE SAME THICKNESS
   AND TYPE AS THE SURROUNDING CONCRETE.
3. THE COST OF THE CONCRETE APRON SHALL
   BE INCLUDED IN THE COST OF THE INLET.
4. IF THE INLET IS OFFSET FROM THE BARRIER,
   SLOPE THE APRON ADJACENT TO THE BARRIER
   TO DIRECT FLOW TOWARD THE GRATE.
GENERAL NOTES

1. THE LOCATION AND SIZE OF SUBSURFACE DRAINS AND OUTLET PIPES WILL BE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

2. OUTLETS FOR THE EDGE DRAINS ARE TO BE SPACE AT MAXIMUM 600 FT INTERVALS OR AS SHOWN ON THE PLANS. GEOCOMPOSITE EDGE DRAIN CONNECTIONS SHALL CONFORM TO MANUFACTURER'S RECOMMENDATIONS.

3. WHERE THE UNDERDRAIN PIPE OUTLETS ONTO A SLOPE OR DITCH, THE OUTLET PIPE END SHALL BE MARKED WITH A DELINEATOR POST, HAVE AN ANIMAL GUARD AND AN EROSION CONTROL PAD.

4. THE GEOCOMPOSITE SHALL BE SECURED TO THE WALL OR TO THE TRENCH SIDE TO PREVENT MOVEMENT DURING BACKFILLING.

5. DRAIN HOLES IN RETAINING WALL SHALL BE SPACED AT 10 FT INTERVALS AS SHOWN ON THE PLANS.

6. STRUCTURE EXCAVATION AND BACKFILL LIMITS FOR RETAINING WALLS ARE SHOWN ON STANDARD PLAN M-206-1. ALL EXTRA EXCAVATION AND BACKFILL WORK NECESSARY TO COMPLETE RETAINING WALL, AGGREGATE, AND GEOCOMPOSITE DRAIN WORK IS INCLUDED IN THE DRAIN WORK.

7. FILTER MATERIAL SHALL BE TAMPED WITH A LIGHT VIBRATORY TAMPER PRIOR TO OVERLAPPING THE GEOSYNTHETIC FABRIC.

8. THE EDGE DRAIN TRENCH SHALL BE CONSTRUCTED AFTER PLACEMENT OF THE AGGREGATE BASE AND SUBBASE.
GENERAL NOTES

1. TOLERANCE FOR TOP OF GUARDRAIL FROM 25 GUAGE.

2. RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
   - For guardrail face within 2 ft of normal edge of paved shoulder, the slope is ±1 in 8.
   - For guardrail face more than 2 ft from the normal edge of the paved shoulder, the slope shall be in 6.

3. When specified on the plans, extend a 2 in wide thickness of paved surface to 1 ft beyond the guardrail posts or to the centerline of curb as shown on plan. Guardrail cutting and patching of other approved method shall be used to ensure damage to all paved surfaces under guardrail installations. All work to the paved area will be measured and paid for separately. Bases for paved surface shall be compacted concrete or other approved method. Payment for paving beneath the guardrail shall be paid under a pavement or concrete pay item with quantities shown on the plans.

4. The normal guardrail offset from paved shoulder shall be:
   - 3 ft. for shoulders 8 ft. or less from the normal edge of paved shoulder.
   - 2 ft. for shoulders 8 ft. or less from the normal edge of paved shoulder.

5. The usage of greater than minimum offset dimensions is encouraged to meet the desirable short distances, while providing a smooth change in guardrail alignment.

6. Leave-out areas shall be provided for all guardrail posts located in pavement to allow the posts to penetrate in their embedment such that vehicle impact loads are distributed through the post into the embedment material prior to the posts breaking prematurely.

OPTION A

OPTION B (PREFERRED)

NORMAL CENTER-TO-CENTER POST SPACING

LOCATION

SPACING

ALL LOCATIONS EXCEPT BRIDGE OR STRUCTURE APPROACH

1 M

NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL

NORMAL EMBANKMENT WITH GUARDRAIL

NOTE: THE CATCHPOINT REMAINS THE SAME AS THAT FOR VARIABLE SLOPE EXTENSION FOR THE ADDITIONAL EXTENSION, THE VARIABLE SLOPE MAY "CATCH" AT THE POSS.

SECTION A-A

LEAVE-OUT AREA FOR GUARDRAIL POSTS LOCATED IN PAVEMENT

NOTE: LEAVE-OUT AREAS SHALL BE PROVIDED FOR ALL GUARDRAIL POSTS LOCATED IN PAVEMENT TO ALLOW THE POSTS TO PENETRATE TO THEIR EMBREEDMENT SUCH THAT VEHICLE IMPACT LOADS ARE DISTRIBUETED THROUGH THE POST INTO THE EMBEDMENT MATERIAL PRIOR TO THE POSTS BREAKING PREMATURELY.

NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL

RESTRICTIVE ROADSIDE INSTALLATION WITH 7 FOOT GUARDRAIL POSTS

GUARDRAIL SYSTEM (MGS)

TYPE 3 W-BEAM 31 INCHES

STANDARD PLAN NO.

M-606-1

Standard Sheet No. 1 of 19

Issued by the Project Development Branch July 31, 2019

Project Sheet Number
GENERAL NOTES

1. SEE SHEETS 7 AND 9 FOR CURB TREATMENTS AT GUARDRAIL TERMINALS.

2. IF THIS DIMENSION WILL BE LESS THAN 28 INCHES, RESET GUARDRAIL HEIGHT TO 28 INCHES OR ABOVE.

3. REFERENCES SUCH AS 66PDB01, 66PDE01, AND 66PWEO1 IN THIS STANDARD PLAN SPECIFY HARDWARE DETAILS FROM 66A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE PREPARED BY THE AASHTO-AGC-ARTBA JOINT COOPERATIVE COMMITTEE.

4. IF THIS DIMENSION WILL BE LESS THAN 28 INCHES, RESET GUARDRAIL HEIGHT TO 28 INCHES OR ABOVE.

5. W-BEAM SPLICES, AND SPLICES OF TERMINAL CONNECTORS TO W-BEAM WILL BE ACCEPTED IN THE PLANS DRAWN BY THE MANUFACTURER.

6. MATERIALLY TYPE AND SHAPE OF POSTS AND BLOCKS SHALL BE THE SAME THROUGHOUT THE PROJECT EXCEPT WHEN SPECIFIC POSTS AND BLOCKS ARE SPECIFIED, i.e., AT CURVES, ANGLES, AND GUARD Rail CURVES.

7. THE STANDARD 3 IN. X 11'4 IN. X 2 IN. WOOD POSTS PROVIDED MAY ALSO HAVE ADDITIONAL HOLES (UP TO 4 PER FLANGE) PROVIDED MAY ALSO HAVE ADDITIONAL HOLES (UP TO 4 PER FLANGE) FOR FUTURE RAISING OF THE RAIL ELEMENTS AND BLOCKS FOR OVERLAYS.

8. W6 X 8.5 WIDE FLANGE STEEL POSTS ARE AN ACCEPTABLE ALTERNATIVE TO THE W6 X 9.1 IN. STANDARD POST SPECIFIED FOR MEDIAN BARRIERS.

9. GLULAM POSTS AND BLOCKS WILL BE ACCEPTED AS ALTERNATIVES PROVIDED THAT THE SUPPLIED MATERIALS HAVE BEEN CERTIFIED AS IDEAal TO THE SPECIFICATIONS USED FOR TESTING AND APPROVAL.

10. PRESSURE TREATMENT OF POSTS AND BLOCKS SHALL CONFORM TO AASHTO M 111 (ASTM A 123) UNLESS CORROSION-RESISTANT STEEL IS USED. WHEN CORROSION-RESISTANT STEEL IS USED, THE POST SHALL BE PAINTED OR OTHERWISE TREATED.

11. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT INTERVALS. W-BEAM AND TYPE 3 GUARDRAIL POSTS SHALL BE OF TIMBER WITH AN EXTREME FIBER STRESS OF 1200 PSI STRESS GRADE AND POST DIMENSIONS SHALL BE A MINIMUM 2 IN. TALL AND LOCATED AS SHOWN ON THE STANDARD PLAN.

12. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS. THE TABS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

13. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

14. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

15. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

16. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

17. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

18. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

19. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

20. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

21. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

22. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

23. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

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25. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

26. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

27. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

28. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

29. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

30. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.

31. THE DURAFLO POSTS & BLOCKS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS.
NOTES

1. THE MGS TRANSITION FROM A TYPE 3 GUARDRAIL SHALL BE COMPLETED OUTSIDE THE MGS END ANCHORAGE LIMITS.

ELEVATION VIEW

TRANSITION FROM 28 INCH GUARDRAIL TO 31 INCH MGS

ALTERNATE PLAN VIEW - ALIGNMENT TAPER
END ANCHORAGE TYPE 3B

TOP OF GUARDRAIL MAY SLOPE
TOP RAIL HEIGHT PARALLELS SHOULDER EDGE SLOPE
STEEPER THAN SHOULDER EDGE SLOPE
50 FT. FLARE MAY BE ADJUSTED TO FIT FIELD CONDITIONS

SEE TYPE 3B RAIL RAIL PLAN VIEW FOR ALIGNMENT. THE 300 FT. LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

END ANCHORAGE TYPE 38 (RUB RAIL)

MOUNT A W-BEAM RUB RAIL 1/2 IN. BELOW THE TOP RAIL WHEN THE TOP RAIL HEIGHT EXCEEDS 33 IN. ABOVE THE GROUND

NOTE: ALL PARTS SHALL BE GALVANIZED

END ANCHORAGE TYPE 3D DEPARTURE TERMINAL

MIDWEST GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

STANDARD PLAN NO.
M-606-1

STANDARD SHEET NO.
Standard Sheet No. 5 of 19

Issued by the Project Development Branch: July 31, 2019

Jlk

Project Sheet Number:

This dimension locates the first hole in the W-beam and the type 3D hardware 1/2 in center to center from post bolt hole.
1. POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF POSTS.

2. THE GUARDRAIL BETWEEN POST 1 THRU 5 IS ON A STRAIGHT LINE FLARE.

FIRST LINE POST OF APPROVED
31" HIGH GUARDRAIL SYSTEM

POSTS YIELDING HOLES AT GROUND LEVEL

POSTS 2 THRU 5

POST 1 YIELDING HOLES AT GROUND LEVEL

SLOTTED RAIL TERMINAL (SRT-31)
(NCHRP 350 CERTIFIED)

GUARDRAIL PANELS ARE NOT ATTACHED TO POSTS 3 THRU 5

FLANGE PROTECTOR ATTACHED TO POSTS 3, 4, AND 5

AFTER FINAL ASSEMBLY,
- REDRILL CABLE TO MAKE SURE IT IS TAUT AND HAS NOT RELAXED

END OF GUARDRAIL PAY LENGTH

END ANCHORAGES (FLARED)
NOTES

1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 45 CU. YDS.) FOR END ANCHORAGE (FLARED) PAY LIMIT

   - THE FLARE SHALL BE AS FOLLOWS:
     A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203
     B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 203 (SEE NOTE 2)

   1. The added embankment shall be constructed in accordance with Subsection 203.07, AASHTO T99.

2. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 70 SQ. YDS.) SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 403 OR 412 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 403 OR 412
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 403 OR 412 (SEE SHEET 1, NOTE 2 FOR PAVEMENT TYPES)

3. CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF

4. WHEN OVERLAY PAVING, THE FINISHED SURFACE AT EACH POST SHALL NOT BE ABOVE END OF GUARDRAIL PAY LENGTH

5. THE COST OF THE GUTTER WILL BE PAID FOR AS "GUTTER TYPE 2 (2 FT.)" FOR A LENGTH OF 134 FT.

6. "GUTTER TYPE 2 (3 FT.)" FOR A LENGTH OF 40 FT.

7. INLETS OR RUNDOWNS MAY BE USED INSTEAD OF THE GUTTER IF SPECIFIED ON THE PLANS. NO ADDITIONAL CURB SHALL BE ADDED IN THE VICINITY OF THE END ANCHORAGE.

8. 4:1 OR FLATTER SLOPES IN THE TRAVERSABLE AREA SHALL BE USED BEHIND THE END ANCHORAGE, AND IN ADVANCE OF POST (IF THIS IS NOT POSSIBLE, A MINIMUM 3:1 SLOPE MAY BE USED IF APPROVED BY THE ENGINEER).

9. THE WIDENED AREA, EXCEPT FOR CURB OPTION A, SHALL HAVE THE SAME GRADING AS THE ADJACENT GUARDRAIL: 10:1 OR FLATTER IF MORE THAN 2 FT. FROM SHOULDER OR SLOPE EQUAL TO ROADWAY SLOPE IF 2 FT. OR LESS FROM SHOULDER.

10. WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.

11. CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF AS REQUIRED BY THE ENGINEER.


13. END ANCHORAGE SHALL NOT BE OVERLAYED UNLESS PAVEMENT CONDITIONS WARRANT IT.

14. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 70 SQ. YDS.) SHALL BE AS FOLLOWS:

   - THE FLARE SHALL BE AS FOLLOWS:
     A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203
     B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 203 (SEE NOTE 2)

   1. The added embankment shall be constructed in accordance with Subsection 203.07, AASHTO T99.

2. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 70 SQ. YDS.) SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 403 OR 412 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 403 OR 412
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 403 OR 412 (SEE SHEET 1, NOTE 2 FOR PAVEMENT TYPES)

3. CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF

4. WHEN OVERLAY PAVING, THE FINISHED SURFACE AT EACH POST SHALL NOT BE ABOVE END OF GUARDRAIL PAY LENGTH

5. THE COST OF THE GUTTER WILL BE PAID FOR AS "GUTTER TYPE 2 (2 FT.)" FOR A LENGTH OF 134 FT.

6. "GUTTER TYPE 2 (3 FT.)" FOR A LENGTH OF 40 FT.

7. INLETS OR RUNDOWNS MAY BE USED INSTEAD OF THE GUTTER IF SPECIFIED ON THE PLANS. NO ADDITIONAL CURB SHALL BE ADDED IN THE VICINITY OF THE END ANCHORAGE.

8. 4:1 OR FLATTER SLOPES IN THE TRAVERSABLE AREA SHALL BE USED BEHIND THE END ANCHORAGE, AND IN ADVANCE OF POST (IF THIS IS NOT POSSIBLE, A MINIMUM 3:1 SLOPE MAY BE USED IF APPROVED BY THE ENGINEER).

9. THE WIDENED AREA, EXCEPT FOR CURB OPTION A, SHALL HAVE THE SAME GRADING AS THE ADJACENT GUARDRAIL: 10:1 OR FLATTER IF MORE THAN 2 FT. FROM SHOULDER OR SLOPE EQUAL TO ROADWAY SLOPE IF 2 FT. OR LESS FROM SHOULDER.

10. WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.

11. CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF AS REQUIRED BY THE ENGINEER.
NOTES FOR NONFLARED


2. DO NOT ATTACH THESE END ANCHORAGES DIRECTLY TO A RIGID BARRIER (EX. CONCRETE BARRIER, STEEL BARRIER, CONCRETE STRUCTURE) WITHOUT A PROPER TRANSITION.

3. CONNECTIONS TO W-BEAMS WHERE THE SPLICE IS NOT AT MID-SPAN BUT AT A POST CAN BE MADE USING A 3'-11/2", 9'-4" OR 15'-7/2" W-BEAM PANEL DOWNSTREAM OF TRAFFIC.

4. FOR MSKT END ANCHORAGES (NONFLARED), USE THE MANUFACTURER’S SPECIFIED STEEL FOUNDATION TUBES FOR POSTS CD AND 0.

5. RETROREFLECTOR TABS SHALL NOT BE USED ON END ANCHORAGE POSTS.

1. Payment for the added embankment (approximately 25 cu. yds.) for the traversable embankment slope shall be as follows:
   A. Under Pay Item 203 when the contract plan includes Pay Item 203. See Note 2 for payment types.
   B. Included in the cost of the end anchorage (nonflared) when the contract plan does not include Pay Item 203. See Sheet 1 and/or Earthwork.

2. When the widened area is paved, payment for the pavement (approx. 39 sq. yds.) shall be as follows:
   A. Under Pay Item 403 or 412 when the contract plan includes Pay Item 403 or 412.
   B. Included in the cost of the end anchorage (nonflared) when the contract plan does not include Pay Item 403 or 412, (see Sheet 1, Note 2 for payment types).

3. When overlay paving, the finished surface at each post shall not be above the top breakaway hole or strut assembly. The widened area at the end anchorage (nonflared) shall not be overlayed unless pavement conditions warrant it being overlayed. Any overlay pavement abutting the end anchorage (nonflared) shall be treated to prevent a drop in the paved surface below the rail.

4. See Sheets 1, 2, and 3 for standard Type 3 guardrail installation details.

5. The cost of the gutter will be paid for as "Gutter Type 2 (2 ft.)" for a length of 111 ft., or "Gutter Type 2 (3 ft.)" for a length of 50 ft.

6. Inlets or rundowns may be used instead of the gutter if specified on the plans or earthwork.

7. 4:1 or flatter slopes in the traversable area shall be used behind the end anchorage area, and in advance of post breakpoint. If this is not possible a minimum 3:1 slope may be used if approved by the engineer.

8. The widened area, except for curb option A, shall have the same grading as beneath the adjacent guardrail. If flatter than 2 ft. from shoulder, or slope equal to roadway slope if less than 2 ft. from shoulder.

9. Widening for end anchorages shall be paved on interstates and freeways. For other highways, paving shall be as shown on the plans.
MEDIAN TERMINAL NOTES

1. The median terminal shall be the Max-Tension median as manufactured by Barrier System by Lindsey (Lindsey Transportation Solutions) or other barriers where the device is not Max-Tension shall be accompanied using a 3 ft.-2 in.-2 in.-3 ft.-2 in. of 2 ft.-2 in. iron panels after the Max-Tension system shall if 50 ft. downstream of the first post.

2. The Max-Tension shall be applied directly to W-Beam guardrail systems and other barriers without the devices being installed directly downstream of the W-Beam guardrail systems. The Max-Tension system shall also be installed at a minimum 25 ft. downstream from the first post.

3. The Max-Tension shall not be attached directly to rigid barriers such as concrete barriers, steel barriers, or concrete structures without proper transitions if rock or debris is encountered. The Max-Tension shall be installed by adjusting and maintaining the barrier.

4. Either 3 ft. or 2 ft. composite or timber blocks shall be used for either side of the barrier.

5. Rail panels shall be lapped per manufacturer's installation manual, regardless of an upstream or downstream end system position.

6. Rail panels shall be lapped per manufacturer's installation manual, regardless of an upstream or downstream end system position.

7. All steel components shall be galvanized per ASTM A123 by Barrier System by Lindsey (Lindsey Transportation Solutions) or other barriers where the device is not Max-Tension shall be accompanied using a 3 ft.-2 in.-2 in.-3 ft.-2 in. of 2 ft.-2 in. iron panels after the Max-Tension system shall if 50 ft. downstream of the first post.

8. One median terminal shall include all posts, rail, and hardware.

9. Unless otherwise specified on the plans, all other barriers shall be installed for bidirectional traffic application.

10. Each installation shall be supervised and certified as correct.

11. The cutting teeth friction plate, and primary cables are installed only on the approaching traffic side.

12. The certified installer shall have completed device training and parts lists to the engineer prior to the installation of the device.

13. The certified installer shall have completed device training and parts lists to the engineer prior to the installation of the device.

14. The certified installer shall have completed device training and parts lists to the engineer prior to the installation of the device.

15. The certified installer shall have completed device training and parts lists to the engineer prior to the installation of the device.
NOTES

1. APPLICATION: THE TRANSITION TYPE 3J MAY BE USED TO SHIELD HAZARDS AT THE INTERSECTION OF TWO ROADWAYS BY APPLYING IN-LINE BF/FR BUT ARE NOT LIMITED TO THE FOLLOWING:
   - A SINGLE OBJECT TO BE PROTECTED.
   - INTERSECTION BY GUARDRAILS AT INTERSECTING HIGHWAYS, ETC.

2. THE LOW SPEED (≤45 MPH) END ANCHORAGE TYPE 3K SHALL BE USED ONLY ON DRIVEWAYS AND LOW SPEED SERVICE ROADS. WHEN AN APPROVED CRASH-TESTED END TREATMENT IS REQUIRED USE THE END ANCHORAGE TREATMENT ON NON-MOTORIZED VEHICLES LANE LENGTH.

3. THE RAIL IS NOT BOLTED TO THE CRT POST AT THE CENTER OF THE CURVE FOR THE 8 FT-6 IN., 16 FT, AND 25 FT-6 IN. RADII. PLATES SHALL CONFORM TO ASTM A 500. WELDING SHALL MEET ALL REQUIREMENTS OF THE AMERICAN WELDING SOCIETY.

4. THE 25' 6" GALVANIZED WIRE ROPE (CABLE) SHALL CONFORM TO AASHTO M30 TYPE II. ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN CONFORMANCE WITH ASTM A 123. POSTS SHALL NOT BE PUNCHED, DRILLED, CUT, OR WELDED AFTER GALVANIZING.

5. ALL STRUCTURAL STEEL SHALL BE STEEL TUBE CONNECTIONS SELECTED, SOIL PLATE CONNECTION BOLT WASHERS (2 REQUIRED PER POST) FOR ANGLE STEEL TUBE CONNECTIONS TO STEEL TUBE TO SSTM TO ASTM A 500. TUBE CONNECTIONS TO SSTM TO ASTM A 500. TUBE CONNECTIONS TO SSTM TO ASTM A 500.

6. ALL STRUCTURAL STEEL SHALL BE STEEL TUBE CONNECTIONS SELECTED, SOIL PLATE CONNECTION BOLT WASHERS (2 REQUIRED PER POST) FOR ANGLE STEEL TUBE CONNECTIONS TO SSTM TO ASTM A 500.

7. THE GUARDRAIL TO WHICH THEY ARE ATTACHED, AND THE CENTER OF THE CURVE FOR THE 8 FT-6 IN., 16 FT, AND 25 FT-6 IN. RADII. PLATES SHALL CONFORM TO ASTM A 500. WELDING SHALL MEET ALL REQUIREMENTS OF THE AMERICAN WELDING SOCIETY.

8. ALL GUARDRAIL SHALL BE SHOP BENT.

9. ALL GUARDRAIL SHALL BE SHOP BENT.

10. SEE SHEET 5 FOR ANCHOR PLATE AND OTHER DETAILS.
GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.

GRADING FOR MEDIAN OBSTRUCTION

NARROW MEDIAN DETAIL

STANDARD PLAN NO.
M-606-1

GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

MIDWEST

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.
NOTE: FOR OBSTRUCTIONS THAT ARE WIDER THAN 30 FT IN MEDIANS USE SHEET 31.

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.
NOTE: FOR OBSTRUCTIONS THAT ARE WIDER THAN 30 FT IN MEDIANS USE SHEET 31.

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LT A

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2329 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868

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Project Sheet Number:
NOTES

1. MEDIAN BARRIERS ADJACENT TO THE ROADWAY MAY BE USED WHERE THE SHOULDER SLOPES IN THE MEDIAN ARE STEEP.

2. BARRIER LENGTHS SHALL BE INCREASED TO ACCOUNT FOR STEEP EMBANKMENTS OR OTHER HAZARDS WITHIN CLOSE PROXIMITY OF BRIDGES.

@ - DO NOT CONSTRUCT THE TR AND GUARDRAIL ON THE TRAILING EDGE END OF THE TRANSITIONS TO AVOID THE USE OF GUARDRAIL.

N - SHOWN ON PLANS LENGTH TO SHIELD ALL HAZARDS IS BASED ON GUARDRAIL'S LENGTH OF NEED COMPUTATION SEE AASHTO ROADWAY DESIGN GUIDE. THE MINIMUM SHOULDER WIDTH SHALL BE 6 FT. WHERE SITE CONDITIONS ALLOW THE TOTAL LENGTH OF NEED WILL INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIl, AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.

TR - 25 FEET FOR TRANSITION TYPES 3G AND 3H.

A - EDGE OF 8 FT. OR 10 FT. SHOULDER.

B - EDGE OF 4 FT. OR LESS SHOULDER.

☆ - END ANCHORAGE CAN BE FLARED OR NONFLARED.

MULTILANE DIVIDED HIGHWAYS FOR STEEP EMBANKMENTS IN MEDIAN
SHOULDER TRAFFIC...

* END ANCHORAGE LENGTH AND FLARE RATES VARY BY DEVICE.
SEE MANUFACTURER/SUPPLIER FOR INSTALLATION REQUIREMENTS.

MEDIANS 60 FT. AND OVER WITH 10 FT. OR WIDER SHOULDERS,
SEE MANUFACTURER/SUPPLIER FOR INSTALLATION REQUIREMENTS.

MEDIAN, M

* END ANCHORAGE LENGTH AND FLARE RATES VARY BY DEVICE.
SEE MANUFACTURER/SUPPLIER FOR INSTALLATION REQUIREMENTS.

MEDIAN, M

M-606-1
STANDARD PLAN NO.

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 25 FEET BASED ON POST OFFSET DIMENSIONS SHOWN.
2. SEE SHEET 14 FOR THE RIGHT SHOULDER GUARDRAIL LAYOUT.

NOTES

MULTILANE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 60 FT. AND OVER WITH OPEN HAZARDS OR OBSTRUCTIONS)
**NOTES**

1. Guardrail transitions from parallel to roadway should at 3G segment to 15:1 taper within 25 feet based on post offset dimensions shown.

2. The Option 1 Layout shall be used when Y exceeds 25 feet or when median barrier is continuous.

3. Option 2 Layout shall be used when Y is 25 feet or less.

4. See Sheet 14 for right shoulder guardrail layout.

**MULTILINE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 21 - 59 FT. WITH OPEN HAZARDS OR OBSTRUCTIONS)**
NOTES
1. A TYPE 3G OR 3H TRANSITION (SEE SHEET 12) SHALL BE USED TO CONNECT THE TYPE 3 W-BEAM TO A TYPE 9 CONCRETE BARRIER (SEE W-606-15) OR TO A TYPE 5 OR 6 BRIDGE RAIL.
2. "TR" SHALL BE 25 FEET FOR THE TRANSITION TYPES 3G AND 3H.
3. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE WIDTH IS 12'-6" IN DIRECTION OF TRAFFIC.

GUIARDRAIL FOR ROADSIDE OBSTRUCTIONS

GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION

GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION

LAYOUT FOR DRIVEWAY APPROACH

2-WAY NARROW APPLICATION

INTERUPTED STRUCTURE APPROACH (USE TYPE 3J ON SHEET 12 WHEN PRACTICAL)

GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

STANDARD PLAN NO. M-606-1

Project Development Branch: July 31, 2019

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:
**NOTES**

1. POSTS 1, 2, 3, 4, and 5 may be timber or steel.

2. The number of omitted posts is dependent on the length of the gap.

3. One post may be omitted without any modification to the guardrail run.

---

**LONG-SPAN RAILING FOR ONE, TWO, OR THREE OMITTED POSTS AT GAP**

**TIMBER POST**

- Posts 1-2 are @ without modification to the guardrail run.
- Posts 2-3 are @ with modification to the guardrail run.
- Posts 3-4 are @ without modification to the guardrail run.

**STEEL POST**

- Posts 1-2 are @ without modification to the guardrail run.
- Posts 2-3 are @ with modification to the guardrail run.
- Posts 3-4 are @ without modification to the guardrail run.

**BREAKWAY TIMBER POST**

- Posts 1-2 are @ without modification to the guardrail run.
- Posts 2-3 are @ with modification to the guardrail run.
- Posts 3-4 are @ without modification to the guardrail run.
NOTES
1. Location and length of median guardrail approaches to culverts with full headwall and approach panels shall be as shown for bridges on sheet 5 of the Guardrail Type 3 manual. The approach to the culvert shall be continued across the culvert as shown on this sheet.
2. Light guardrail for culvert treatment is shown on this sheet for culverts 20 ft. or less in length.
3. Construction and payment for fill heights shall be included in the cost of the guardrail Type 3.
4. Anchorage D shown for base plate A with inside mount. The bolts shall be 71/8 in. or 10 in. or 11/4 in. long, depending on the bolt length. The bolts shall be galvanized. All nuts and washers shall be galvanized. The nuts shall be tightened to the recommended torque. The bolts shall be cast-in-place for new structures. For existing structures, the bolts shall be installed in 1 1/4 in. holes with non-shrink grout or epoxy. The nuts shall be tightened to the recommended torque.
5. The guardrail length dimension "N" is the length as determined by the length of need computation and is shown on the plans. The minimum is 12 ft. 6 in. The overall required length of need can include the length of protection, the length of rail, and any required length in the rail end treatment.
6. All posts, base plates, and anchor bolts shall be fabricated from ASTM A36 steel. The above material, washers, and all anchor bolts and miscellaneous bolts, nuts, and washers shall be galvanized after fabrication in accordance with Section 509. Concrete, reinforcing steel, and structural steel elements shall be in accordance with Sections 601, 602, and 509, respectively.
7. Post anchors, encased in concrete, shall be ASTM A36 steel and need not be galvanized.
8. Prior to installation of guardrail on culverts, three sets of working drawings must comply with the requirements of Section 202. The drawings shall be submitted to the engineer for information only.
JOINTS TO MATCH JOINT TYPE AND 7' MIN. SPACING IN CONCRETE BARRIER.

* *= SPACING IN CONCRETE BARRIER) FROM 2' 2' 5 BARS EQUALLY 2' 2' JOINT

#5 REINFORCEMENT CONTINUOUS BARS 4 #5 x 24" TIE BARS SPACED AT 4' CENTERS

OPTIONAL CONSTRUCTION JOINT

BAR A

Bar A AT 6" SPACING (SEE SHEET I)

SECTION F-F

SECTION 1-1

SECTION H-H

SECTION J-J

SECTION 6-G

SECTION E-F

ELEVATION

CONCRETE GLARE SCREEN

GLARE SCREEN AT MEDIAN OBSTRUCTIONS

CONCRETE GLARE SCREEN

ELEVATION

AS REINFORCEMENT CONTINUOUS BARS

NOTE: VERTICAL TIE BARS ARE NOT REQUIRED WHEN THE GLARE SCREEN IS POURRED MONOLITHICALLY WITH THE BARRIER SEE SHEETS 1 AND 2 FOR BARRIER DIMENSIONS

SECTION 6-G

SECTION J-J

SECTION 1-1

SECTION F-F

PLAN

SECTION E-F

ELEVATION

THIS SECTION PROVIDES A TRANSITION FOR THE SHAPE OF THE BRIDGE RAIL TYPE 7 TO THE ROADWAY GUARDRAIL TYPE 7, REQUIRED AND PAID FOR AS GUARDRAIL TYPE 7 (SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)

BRIDGE RAIL TYPE 7 TO ROADWAY SHOULDER TYPE 7 TRANSITION AND ANCHORAGE

GUARDRAIL TYPE 7 F-SHAPE BARRIER

STANDARD PLAN NO. M-606-13

Standard Sheet No. 2 of 4

Issued by the Project Development Branch: July 31, 2019

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Project Development Branch: JBK

Field: 303-757-9021

FAX: 303-757-9868

Colorado Department of Transportation

2620 West Howard Place

CDOT No., 3rd Floor

Project Sheet Number:

Project Development Branch: JBK
NOTES

1. The design in these applications shall be paid on a linear basis from the adjacent paved shoulder to a 10:1 slope.

2. The pay length for barriers on both sides of an obstruction shall be determined by one linear measurement along the guardrail centerline. The backfill and cap between columns or obstructions will not be measured and paid separately, but shall be included in the work.

3. Guardrail between columns or obstructions may be styles CD or CA as shown on the plans.

**Table of Flare Rates for Permanent Concrete Barrier**

<table>
<thead>
<tr>
<th>Obstruction Width</th>
<th>Flare Rate</th>
<th>Flare Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ft. or less</td>
<td>20:1</td>
<td>20:1</td>
</tr>
<tr>
<td>3 ft. to 6 ft.</td>
<td>20:1</td>
<td>20:1</td>
</tr>
<tr>
<td>6 ft. to 9 ft.</td>
<td>18:1</td>
<td>18:1</td>
</tr>
<tr>
<td>9 ft. to 12 ft.</td>
<td>16:1</td>
<td>16:1</td>
</tr>
<tr>
<td>12 ft. or more</td>
<td>14:1</td>
<td>14:1</td>
</tr>
</tbody>
</table>

**Flare Rates for Barriers on Both Sides of an Obstruction**

- **Perpendicular to Roadway:**
  - 3 ft. or less: 20:1
  - 3 ft. to 6 ft.: 20:1
  - 6 ft. to 9 ft.: 18:1
  - 9 ft. to 12 ft.: 16:1
  - 12 ft. or more: 14:1

- **Parallel to Roadway:**
  - 3 ft. or less: 20:1
  - 3 ft. to 6 ft.: 20:1
  - 6 ft. to 9 ft.: 18:1
  - 9 ft. to 12 ft.: 16:1
  - 12 ft. or more: 14:1

**Guardrail Type 7**

- **F-Shape Barrier**

<table>
<thead>
<tr>
<th>Design Info</th>
<th>DATE</th>
<th>Flare Rate for Barrier Inside</th>
<th>Flare Rate for Barrier Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ft. or less</td>
<td>20:1</td>
<td>20:1</td>
<td>20:1</td>
</tr>
<tr>
<td>3 ft. to 6 ft.</td>
<td>20:1</td>
<td>20:1</td>
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</tr>
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<td>6 ft. to 9 ft.</td>
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</tr>
<tr>
<td>9 ft. to 12 ft.</td>
<td>16:1</td>
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<td>16:1</td>
</tr>
<tr>
<td>12 ft. or more</td>
<td>14:1</td>
<td>14:1</td>
<td>14:1</td>
</tr>
</tbody>
</table>

**Hazard in Narrow Medians**

- **Obstruction Wider Than 3 ft.:**
  - Flared Barriers or M-606-13

- **Obstruction 3 ft. Wide or Less:**
  - Flared Barriers or M-606-13

**Guardrail Centerline for Pay Length Measurement**

- The pay length is measured from the edge of the traveled way.

**Guardsrail Type 7 F-Shape Barrier**

- **Median Barrier End Treatment**
- **Bridge Approach**
- **Impact Attenuator or Other Acceptable Safety End Treatment**

**Computer File Information**

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- Issued Date: July 31, 2019
- Project Sheet Number: CAD Ver. 1
NOTES

1. Two ft. is desirable for this dimension with a 4 ft. left shoulder. The normal is 0 ft., which is acceptable for a 6 ft. or wider shoulder.

2. Rate of slope depends on guardrail location:
   A. For guardrail face 2 ft. or less from the normal edge of paved shoulder, continue the rate of slope of the normal paved shoulder to the breakpoint.
   B. For guardrail face more than 2 ft. from the normal edge of the paved shoulder, the slope shall be 10:1 or flatter.

3. If the distance from the edge of fuel tank to the breakpoint exceeds 4 ft.-7 in., Type 3-G beam guardrail may be specified on the plans instead of Type 7 (see plans and detail below).

4. Style CD barriers are shown; Style BC may be used as appropriate. See Note 3 for Type 3 to Type 3G transition.

5. The area between shoulder and the Type 7 shall be paved. Payment for the paved surface will be made under a payment for Type 7 or concrete, with quantities shown on the plans.

6. The guardrail length dimension "N" is the length as determined by the length of need computation and as shown on the plans. Minimum shall be 12 ft.-6 in. wherever site conditions allow.

7. The guardrail length dimension "N" is the length as determined by the length of need computation and as shown on the plans. Minimum shall be 12 ft.-6 in. wherever site conditions allow.

8. The guardrail length dimension "N" is the length as determined by the length of need computation and as shown on the plans. Minimum shall be 12 ft.-6 in. wherever site conditions allow.

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42. The guardrail length dimension "N" is the length as determined by the length of need computation and as shown on the plans. Minimum shall be 12 ft.-6 in. wherever site conditions allow.
GENERAL NOTES

1. All steel reinforcing shall be 2 in. clear of the nearest surface of concrete. Unless otherwise shown, reinforcing steel shall be Grade 40 minimum.

2. Concrete shall be Class B.

3. All permanent precast barriers used to replace other concrete barriers shall in new condition, undamaged, and with no repairs.

4. For temporary installations, install with a minimum 4 ft. distance from the centerline of the concrete barrier to any obstruction. For temporary installations with less than a 4 ft. minimum, stabilizers shall be used on each barrier unit adjacent to the one within 50 ft. of both sides of the obstruction. See SHEET 3 for stabilization details.

5. The flare rate for temporary installations shall be 10:1 or flatter, unless otherwise approved by the Engineer for permanent installations. See the flare rates table on STANDARD M-606-13, SHEET 3.

6. Stabilization pins shall be used to anchor each 20 ft. unit in all permanent installations. See SHEET 3 for stabilization details.

7. For all permanent installations that require end anchorages, see STANDARD M-606-13, SHEET 3, for anchorage details.

8. The month and year the precast type 7 concrete barrier was manufactured shall be molded into one end of each 10 ft. barrier unit.

9. Approved non-shrink grout shall be used for grouting over all pins and grouting of scuppers.

10. When hydraulic analysis allows, scuppers may not be needed on:

   A. Median installation with inlet drainage.
   B. Shoulder barrier on high edge of a super-elevated shoulder.
   C. Median barrier on a crest vertical curve.
   D. Permanent barrier, if specified on plans.

11. All incidental work and materials, such as connecting pins, anchors, bolts, grout, and excavation for end anchorages, will not be paid for separately, but shall be included in the cost of the work.

12. The precast barrier members may be cast-in-place to facilitate lifting for temporary barrier applications only.

13. Retroreflectores are required on barriers. See RETROREFLECTOR NOTES on STANDARD M-606-13.

14. One in. diameter threaded inserts may be cast-in-place to facilitate lifting for temporary barrier applications only.

15. Stabilization pins shall be used to anchor each 10 ft. barrier unit in all permanent installations. See SHEET 3 for stabilization details.

16. For all permanent installations that require end anchorages, see STANDARD M-606-13, SHEET 3, for anchorage details.

17. The precast type 7 concrete barrier was manufactured shall be molded into one end of each 10 ft. barrier unit.

18. Approved non-shrink grout shall be used for grouting over all pins and grouting of scuppers.

19. When hydraulic analysis allows, scuppers may not be needed on:

   a. Median installation with inlet drainage.
   b. Shoulder barrier on high edge of a super-elevated shoulder.
   c. Median barrier on a crest vertical curve.
   d. Permanent barrier, if specified on plans.

20. All incidental work and materials, such as connecting pins, anchors, bolts, grout, and excavation for end anchorages, will not be paid for separately, but shall be included in the cost of the work.

21. The precast barrier members may be cast-in-place to facilitate lifting for temporary barrier applications only.

22. Retroreflectores are required on barriers. See RETROREFLECTOR NOTES on STANDARD M-606-13.

23. One in. diameter threaded inserts may be cast-in-place to facilitate lifting for temporary barrier applications only.

24. Approved non-shrink grout shall be used for grouting over all pins and grouting of scuppers.

25. When hydraulic analysis allows, scuppers may not be needed on:

   a. Median installation with inlet drainage.
   b. Shoulder barrier on high edge of a super-elevated shoulder.
   c. Median barrier on a crest vertical curve.
   d. Permanent barrier, if specified on plans.

26. All incidental work and materials, such as connecting pins, anchors, bolts, grout, and excavation for end anchorages, will not be paid for separately, but shall be included in the cost of the work.

27. The precast barrier members may be cast-in-place to facilitate lifting for temporary barrier applications only.

28. Retroreflectores are required on barriers. See RETROREFLECTOR NOTES on STANDARD M-606-13.

29. One in. diameter threaded inserts may be cast-in-place to facilitate lifting for temporary barrier applications only.
NOTES

1. WASHERS SHALL BE FORGED AS AN INTEGRAL PART OF THE PIN, OR SHALL BE WELDED AS SHOWN.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
3. IF AN ALTERNATIVE TOP CONFIGURATION IS USED FOR LIFTING, THE LIFTING PIN SHALL BE PROVIDED. PINS SHALL CONFORM TO CRITICAL DIMENSIONS (PIN LENGTH TOLERANCES).
4.-pin SHALL CONFORM TO ASTM A449.
5. APPROXIMATE NON-SHRINK GROUT SHALL BE USED FOR CONNECTING OVER ALL PINS AND LININGS OF SCUPPERS.
6. BOTH ENDS OF THE BARRIER SHALL HAVE A 24:1 TAPER IN EACH DIRECTION FROM THE CENTER PIN RECESS TO ITS OUTER EDGE TO FACILITATE PLACEMENT ON CURVES.
7. JOINTS BETWEEN CAST-IN-PLACE GUARDRAIL TYPE 7 AND PERMANENT INSTALLATION PRECAST TYPE 7 CONCRETE BARRIER SHALL INCLUDE ALL REGRESSES AND LOOPS IN THE CAST-IN-PLACE END, ALONG WITH THE PIN TO COMPLETE THE TYPICAL PRECAST TYPE 7 CONCRETE BARRIER JOINT.

DETAILS FOR PIN AND LOOP CONNECTION

CONNECTING PIN DETAIL

ALTERNATIVE PIN DETAIL
NOTES

1. SEE SHEET 1 FOR REINFORCEMENT AND OTHER DETAILS NOT SHOWN HERE.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
3. FOR TERMINAL ANCHORING OF THE PERMANENT INSTALLATION OF PRECAST TYPE 7 CONCRETE BARRIER, SEE THE END ANCHORAGE DETAIL IN STANDARD PLAN M-606-13, SHEET 1.
4. AN OPTIONAL 3 IN MAXIMUM TAPERED END PIN MAY BE PROVIDED ON THE STABILIZATION PIN TO FACILITATE DRIVING.

TABLE OF STABILIZATION PIN LENGTHS

<table>
<thead>
<tr>
<th>Surface</th>
<th>Pin Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>2 ft - 3 ft</td>
</tr>
<tr>
<td>HMA</td>
<td>3 ft</td>
</tr>
<tr>
<td>Soil</td>
<td>3 ft - 4 ft</td>
</tr>
</tbody>
</table>

STABILIZATION PIN

(1 in. 4.5 mm steel)

ELEVATION VIEW WITH PINS

DETAILS FOR STABILIZATION OF PERMANENT OR TEMPORARY PINNED PRECAST TYPE 7 CONCRETE BARRIER
GENERAL NOTES

1. SEE SHEET 2 FOR DETAILS OF CONCRETE BARRIER STYLE CA FOR ANCHOR CONNECTIONS TO STRUCTURES OR TRANSITION TO GUARDRAIL TYPE C.
2. SEE SHEET 4 FOR CONCRETE BARRIER STYLE CC TRANSITIONS AT MEDIAN COLUMNS AND SIGN POSTS IN MEDIANS.
3. WHERE GLARE SCREENS ARE REQUIRED, USE CONCRETE BARRIER STYLE CG ON SHEET 4.
4. ANCHOR REQUIREMENTS FOR CONCRETE BARRIER STYLE CA ARE SHOWN ON SHEET 2.
5. BARRIER MAY BE CAST-IN-PLACE OR SLIP FORMED.
6. NO ANCHORAGE IS REQUIRED (TYP.) EXCEPT FOR THE 10 FOOT ANCHORAGE.
7. NO REINFORCING STEEL SHALL BE GRADE 60 EPOXY COATED DEFORMED BARS AND SHALL BE A MINIMUM OF 2 INCHES IN FROM THE NEAREST CONCRETE SURFACE, UNLESS OTHERWISE NOTED.
8. CONSTRUCTION JOINTS SHALL BE USED ON ALL BARRIER TYPES SHOWN, INCLUDING THE LOWEST LAYER OF TRANSVERSE CONTRACTION JOINTS.
9. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS POURED.
10. CONTINUOUS LONGITUDINAL REINFORCEMENT SHALL BE EITHER GRADE 60 EPOXY COATED DEFORMED BARS OR WIRE STRAND WITH MINIMUM ULTIMATE STRENGTH AS NOTED.
11. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER.
12. CONCRETE SHALL BE CLASS D.
13. ADDITIONAL MATERIAL FOR BARRIER EMBEDMENT GREATER THAN 12 INCH WILL NOT BE INCLUDED IN THE COST OF GUARDRAIL.
14. EPOXY COATED LONGITUDINAL REBAR SHALL HAVE A MINIMUM LAP SPLICE OR MECHANICALLY SPLICED TO MAINTAIN 100 PERCENT OF THE MINIMUM REQUIRED TENSILE STRENGTH.
15. ALL BARRIER TYPES ARE REQUIRED TO HAVE Construction Jointing as Shown for all transitions shown.
16. REFLECTOR NOTES ON STANDARD PLAN 5-622.
NOTES

1. SEE SHEET 3 FOR END ANCHORAGE REQUIREMENTS. AT A MINIMUM, THE BARRIER SHALL BE ANCHORED AT THE ENDS AND AT INTERRUPTIONS WITH THE 6-27 FOOT ANCHORAGE. THE ANCHORAGE SHALL BE MONOLITHIC OR DOWELED WITH 2-#8 X 8" @ 2'-0" EASE.

2. SEE SHEET 5 FOR CONCRETE BARRIER STYLE CA AND STYLE CC.

3. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER.

4. SEE SHEET 6 FOR CONCRETE BARRIER STYLE CA TRANSITIONS AT BRIDGE COLUMNS AND SIGN PEDESTALS IN MEDIANs.

5. FOR STYLE CA CONNECTIONS TO STRUCTURES, SEE THE BRIDGE PLANS.

TRANSITION CONCRETE BARRIER TYPE 9 TO CONCRETE BARRIER TYPE 7 OR EXISTING
1. See plans for concrete barrier lengths less than 150 feet and/or hinge widths equal to or less than 1 foot behind the concrete barrier.

2. See Sheet 2 for reinforcing bar details.

3. New concrete barriers under 150 feet shall be dowelled into existing concrete bridge barriers or wingwalls to minimize rotations to any of them. See Sheet 2 for dowel placement layout.

4. For end anchorages under 150 feet, construct the anchorage for the entire length of the concrete barrier.

5. For concrete barrier runs greater than 150 feet but less than 500 feet, the run shall be anchored at the ends and at gaps, such as an emergency access.

6. For end anchorages over 500 feet, construct anchorages every 250 feet.

7. Reinforcing steel in anchorage shall be Grade 60 epoxy coated deformed bars.

8. Concrete shall be Class B.

9. All incidental work and additional materials shall be included in the cost of the concrete barrier.
NOTE

1. SEE SHEET 5 FOR DETAILS OF CONCRETE BARRIER STYLE CG/CG END ANCHORS CONNECTIONS TO STRUCTURES AND TRANSITIONS TO GUARDRAIL TYPE 9.

2. WHERE ROADBED OFFSET IS GREATER THAN 36 INCH, SEE CONCRETE BARRIER TYPE CG.

3. BARRIER FOUNDATION SHALL BE PAVER, OR COMPACTED AGGREGATE BASE, OR COMPACTED EMBANKMENT MATERIAL.

4. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE THE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN M-624.

NOTES

1. SEE SHEET 5 FOR DETAILS OF CONCRETE BARRIER STYLE CGE/CG END ANCHORS CONNECTIONS TO STRUCTURES AND TRANSITIONS TO GUARDRAIL TYPE 9.

2. WHERE ROADBED OFFSET IS GREATER THAN 36 INCH, SEE CONCRETE BARRIER TYPE CGE.

3. BARRIER FOUNDATION SHALL BE PAVER, OR COMPACTED AGGREGATE BASE, OR COMPACTED EMBANKMENT MATERIAL.

4. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE THE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN M-624.
NOTES
1. SEE SHEET 3 FOR END ANCHORAGE REQUIREMENTS. AT A MINIMUM,
   THE BARRIER SHALL BE ANCHORED AT THE ENDS AND AT INTERRUPTIONS
   WITH THE 20 FOOT ANCHORAGE REQUIREMENTS. THE 20 FOOT ANCHORAGE SHALL BE MONOLITHIC OR
   DOWELED WITH 2-8 X 8" X 8" BARS.
2. SEE SHEET 4 FOR CONCRETE BARRIER STYLE CG AND STYLE CGC.
3. SEE SHEET 6 FOR TRANSITION TO EXISTING BARRIERS.
4. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF SIMILAR
   SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER.
5. SEE SHEET 5 FOR CONCRETE BARRIER STYLE CG TRANSITIONS
   AT BRIDGE COLUMNS AND SIGN PEDESTALS IN MEDANS.
6. FOR STYLE CG CONNECTIONS TO STRUCTURES, SEE THE BRIDGE PLANS.

FINISHED GRADE

CONCRETE BARRIER

SECTION A-A

ANCHORAGE
BARREI S ELEVATION VIEW SHOWING REINFORCED ANCHORAGE AT END.

TRANSITION CONCRETE BARRIER STYLE CG/CG TO CONCRETE BARRIER TYPE 7 OR EXISTING
LIMITS OF PAYMENT FOR CONCRETE BARRIER STYLE CD (SPECIAL)

4" EXPANDED POLYSTYRENE BETWEEN COLUMN AND CONCRETE BARRIER (TYP.)

CONSTRUCTION JOINT

1'-0" (TYP.)

---, r-----------------,

COLUMN

I - - - .J I----------------- I

1'-0~

---, r---

I

L---

1'-0~

---, r---

I

NOTES

1. THE CONTRACTOR'S OPTIONS FOR FILL BETWEEN CONCRETE BARRIER WALLS:
   A. PLACE 4 INCHES OF POLYSTYRENE AT BASE BETWEEN CONCRETE BARRIER WALLS.
   B. PLACE 1 FOOT OF GRANULAR MATERIAL AT BASE BETWEEN WALLS.
   C. PLACE GRANULAR MATERIAL FROM BASE TO BOTTOM OF 4 INCH CAP.
   D. MONOLITHIC CONCRETE WITH FOAM BLOCKS IS NOT PERMITTED.

2. REINFORCING STEEL SHALL EXTEND CONTINUOUS THROUGH CONSTRUCTION JOINTS.

3. SEE OVERHEAD SIGN PLANS FOR SIGN PEDESTAL ELEVATIONS FOR NEW CONSTRUCTION.

4. ADJUST HEIGHT OF CONCRETE BARRIER WALL ON LOW SIDE OF OFFSET DR SUPERELEVATED ROADWAYS TO PROVIDE LEVEL GRADE ACROSS TOP OF CONCRETE BARRIER CAP.

5. FOR OVERHEAD SIGNS, SEE STANDARD PLAN 9404-80.

CONCRETE BARRIER TRANSITION AT BRIDGE COLUMNS

SECTION A-A

SECTION B-B

SECTION C-C

CONCRETE BARRIER TRANSITION AT SIGN PEDESTAL

GUARDRAIL TYPE 9
SINGLE SLOPE BARRIER

STANDARD PLAN NO.
M-606-15

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:
NOTES

1. The Contractor's options for fill between concrete barrier walls:
   a. Place 4 inches of polystyrene at base between concrete barrier walls.
   b. Place 1 foot of granular material at base between walls.
   c. Place granular material from base to bottom of 4 inch cap.
   d. Monolithic concrete with form bled is not permitted.

2. Reinforcing steel shall extend continuous through construction joints.

3. See overhead sign plans for sign pedestal elevations for new construction.

4. Adjust height of concrete barrier wall on low side of offset or super-elevated roadways to provide level grade across top of concrete barrier cap.

5. For overhead signs, see standard plan 5-604-60.
SINGLE TYPE 3G TRANSITION AND ANCHORAGE

CONCRETE AND REINFORCEMENT DETAIL

TYPE 9 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE OPTION

SEE SHEET 1 FOR REINFORCEMENT INFORMATION AND SHEET 3 FOR ANCHORAGE DETAILS.
NOTES

1. Use %-" button head bolts and hex nuts for connections to posts or bar on rail face for bolted connections to post.

2. The nested rail elements, end cap and single 10 gauge three rail elements may be nested together prior to bolting the element to the wood post and concrete barrier or railing.

3. Exposed splice exit holes for rail element splices at post 0 and the connection to the concrete barrier or railing shall be the standard %-", %-", and %-" slot size. Interior splice exit holes at these locations may be increased to %-", %-", or %-", or railings or the bottom side. Plate washers and nuts are required for rail splices at post 0 and the connection to the concrete barrier or railing.

4. The top elevation of posts 0 and 0 shall not project more than 1" above the top elevation of the rail element.

5. The depth of the metal box spacer varies from the %-" wood post to %-" drilled holes for existing structure. The depth of the box spacer plus the width of railing or wall is typically %-", where the space between the adjacent of the concrete rail elements and the rear three rail elements is less than %-". Metal plates similar to plate 0 are used as spacers.

6. Where the width of the concrete rail or wall is greater than %-", these elements are to be secured to the face of the post. The minimum space between the inside of post 0 and 0 and the rear rail element must be %", in addition to the one-half inch thickness of the concrete barrier or railing. The elements for railings or the bottom side. Plate washers and nuts are required for rail splices at post 0 and the connection to the concrete barrier or railing.
Backfill, Class 2. The Contractor, at his expense, has the option of using concrete or other material acceptable to the Engineer in lieu of backfill, Class 2.

The width of column or pier treatment between columns or obstructions.

Obstruction wider than 3 ft.

- 1/2" preformed joint material
- Pier column, tie, support footing, concrete wall, or similar obstructions.

Obstruction 3 ft. wide or less.

Hazards in narrow medians.

TABLE OF FLARE RATES FOR PERMANENT CONCRETE BARRIER

<table>
<thead>
<tr>
<th>Continuous</th>
<th>MEDIAN BARRIER</th>
<th>BRIDGE APPROACH</th>
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The shy line offset is measured from the edge of the traveled way.
GENERAL NOTES

1. All material dimensions and weights in this standard are nominal unless otherwise specified.

2. At each location where an electric transmission or distribution line crosses a wood post fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electrical Code. The ground shall be a minimum depth of 1 ft. (406 mm) in length, be driven at least 3 ft. (914 mm) under the fence, and be connected to each wire with a ground and no 5 strander copper grounding wire. Grounding wire will not be paid for separately, but shall be included in the work.

3. Metal line post shall be installed a minimum of 4 ft. (1219 mm) from the line side of the fence to prevent the metal post from being within 4 ft. of the nearest wood post, and shall be tied to each strand with a wire clamp.

4. Fence wire shall be evenly spaced and tied off at end posts. Wood posts are line branch posts. Fence shall be connected to each 4 ft. (1219 mm) in the same manner.

5. Woven wire shall be placed on either side of field line of posts, depending on local conditions, as on curve. The woven wire shall be placed within the tension on fence ties and also apply evenly. Where there is other condition, every 4 ft. (1219 mm) of wire will be placed on the livestock side of the post. Where possible, wire shall be placed on the side of the post.

6. Where steel posts are specified, every fifth post shall be wood, when specified in the plans.

7. Right of way fences shall be constructed approximately 4 ft. (1219 mm) from the boundary of the right of way as shown on the plans, or as stated.

8. The contractor shall be responsible for re-establishing the location of survey monuments to the approximate accuracy in accordance with Subsection 2.8.2 of the standard specifications.

WIRE POSTS:

- All wire posts shall have a minimum diameter of 4 in. (102 mm) at a minimum of 4 ft. (1219 mm) in the ground.
- Wire posts shall be driven into the ground, and the largest diameter post end in the ground. A fence shall be made to start on the post or tie to metal posts as shown in wire fence tie details. All wire posts should be driven at least 4 ft. (1219 mm) in the ground.
- Metal posts:
  - Metal and steel shall be the types and quantities shown or determined by the engineer. All metal posts shall be driven into the ground at least 4 ft. (1219 mm) in the ground.
  - All fence and wire posts shall be connected to each other with a ground and no 5 strander copper grounding wire. Grounding wire will not be paid for separately, but shall be included in the work.

CONCRETE POSTS:

- Concrete post shall be of standard tolerance and shall be of all-welded construction.
- Concrete shall be a minimum 16 in. (406 mm) in diameter and 20 ft. (6100 mm) in length.
- Concrete shall be of the same construction as shown in the plans, or as stated.

WIRE FENCES:

- Woven wire fences shall be of the same construction as shown in the plans, or as stated.
- All woven wire fences shall be of the same construction as shown in the plans, or as stated.
- All woven wire fences shall be connected to each other with a ground and no 5 strander copper grounding wire. Grounding wire will not be paid for separately, but shall be included in the work.

WIRE FENCES AND GATES:

- All woven wire fences shall be connected to each other with a ground and no 5 strander copper grounding wire. Grounding wire will not be paid for separately, but shall be included in the work.
NORMAL SPACING BETWEEN LINE POSTS

METAL STAYS (GALVANIZED)

NUMBER REQUIRED:
ONE BETWEEN LINE POSTS AND POSTS HAVING BRACES.

TWO EQUALLY SPACED BETWEEN LINE POSTS MAY BE TIED TO THE BOTTOM WIRE.

WOODEN STAYS FOR BARBED WIRE OR COMBINATION WIRE FENCES:
WHEN WOODEN STAYS ARE SPECIFIED ON PLANS, LINE POSTS SHALL BE SPACED ON 16'-0 CENTERS, IN LIEU OF 20'-0 CENTERS.
WOODEN STAYS SHALL REST ON THE NATURAL GROUND AND MAY BE STAPLED, OR DRILLED AND TIED WITH WIRE.

16'-0 NORMAL SPACING BETWEEN LINE POSTS

NORMAL SPACING BETWEEN LINE POSTS

---7'-0"---

ALTERNATIVE INSTALLATION (WHERE 26 MESH IS NOT ACCEPTABLE TO LANDOWNER)

ANCHOR LINE POST WITH BRACE

COMBINATION WIRE FENCE WITH WOODEN POSTS

COMBINATION WIRE FENCE WITH METAL POSTS

TYPICAL INSTALLATION AT FENCE INTERSECTIONS

TYPICAL CORNER POST INSTALLATION

WIRE FENCES AND GATES

STANDARD PLAN NO. M-607-1

Standard Sheet No. 2 of 3

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

GENERAL NOTES

1. All posts and braces shall be of the types and weights shown on this sheet or acceptable equivalents. All in conformance with AASHTO M-281. Additional end posts shall be supplied for full brace posts when required by the engineer.

2. Line brace posts shall be installed every 800 ft. or less where the fencing is continuous. The cost shall be included in the work, see Standard Plan No. M-607-4.

3. Woven wire fence fabric, used as shown, shall be galvanized (zinc-coated) Class 1 and conform to AASHTO M-279 (ASTM A 116).

4. Concrete footings shall have tops crowned at ground level and shall be Class B. Concrete with lightweight aggregate, conforming to AASHTO M-195 (ASTM C 330) will be permitted. The cost of the concrete shall be included in the work.

5. On curves, fence shall be placed on side of post which will result in the least amount of tension on fence ties.

6. At each location where an electric transmission, distribution or secondary line crosses a barrier fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electrical Code. The ground rod shall be a minimum diameter of 0.5 in. and 8 ft. in length, driven at least 7.5 ft. into the ground. The rod shall be connected to each wire with a minimum AWG No. 8 stranded copper wire. Grounding will not be paid for separately but shall be included in the work.

SPECIFICATIONS

END POSTS:
- Type: 2½" x 2½" x ¼" Structural Steel Angles
- Height: 1½ ft. per lin. ft. nominal (0.8)
- Length: 6'-6" minimum
- No. of braces: 2

LINE POSTS:
- Type: 2½" x 2½" x ¼" post
- Height: 1½ ft. per lin. ft. nominal without anchor (0.8)
- Length: 6'-6" minimum
- Anchor: securely fastened with bearing surface sufficient to resist movement of post not cast less than

BRACES:
- Type: 2½" x 2½" x ¼" Structural Steel Angles
- Height: 1½ ft. per lin. ft. nominal (0.8)
- Length: 6'-6" minimum

Woven Wire Fence Fabric:
- Style or design number: 726-6-12½

TIES:
- For end posts: Each horizontal wire of woven wire fabric to be wrapped around post and fastened in addition to two tie wires.
- Line posts: Minimum three ties per post for woven wire fabric.
2. At each location where an electric transmission, distribution or secondary line crosses a barrier fence, the contractor shall provide and install a ground electrode conforming to Article 250 of the National Electrical Code. The ground electrode shall be a minimum of 3/4 in. in diameter and driven at least 7 1/2 ft. into the ground. The electrode shall be connected to each wire with a minimum of No. 6 stranded copper wire and grounding will not be paid for separately but shall be included in the work.

3. End posts, corner posts, and line brace posts shall be assembled by the unit and paid for as such. All work and materials associated with each assembly shall be included in the unit price for that assembly.

4. Line brace posts shall be spaced at 400 ft. intervals where fencing is continuous and where end, corner & line brace posts are not specified.

5. Fencing wire may be placed on either the road side or the field side of posts, depending on local conditions; i.e., on curves, the wire should be placed on the side which would result in the least amount of tension on the staples. This also applies where wind drift or other conditions would cause unusual pressure against the wire.

6. Where concrete structures are used as a Deer Pass, the fence shall be at least 4 ft. high and shall be in the structural concrete in front of the fence. If the concrete is poured over the top of the fence, the fence shall be supported with a minimum of No. 4 wire and a minimum of No. 3 wire shall be furnished and installed in the concrete. The contractor cost of staples shall be included in the contract price for fencing.

7. Hidden wire fence panels shall contain a minimum of 4 ft. of a 3/4 in. spaced wire, No. 6 stranded galvanized wire. AASHTO M 150, GRADE 60, WALL TYPE 2.

8. All fence wire ties, brace wires, staples and other wire appliances shall be furnished in compliance with AASHTO M 232.

9. The contractor shall re-establish disturbed or destroyed survey monuments to the approximate accurate in accordance with Section 250 of the standard specifications.

10. Continuous line wire shall be high tension (175 Kmin.). Continuous stay wires shall be mid-tension (125 Kmin.). Fixed knot 13 gauge wire (60 Kmin.) shall connect line wire with the vertical stay wire.

11. Deer gate and top braces shall be painted with green paint according to AASHTO M 230, GRADE 60, WALL TYPE 2.

12. Deer fence, gates, and game ramps shall be painted with green paint according to AASHTO M 230, GRADE 60, WALL TYPE 2.
ANIMAL HABITAT

LEGEND

- LINE POST
- WOODEN STAY
- END POST
- BRACE

NOTES

1. SIX IN DOUBLE ACTING SPRING DOOR HINGE WITH FLAT BUTTON TIPS CUT IN TWO SHALL BE USED AS A SINGLE SWING HINGE AND BE PROCURED WITH A GREASING NIPPLE AND WELDED TO SUPPORT PLATE.

2. TINES SHALL BE MOLDED IN ONE PIECE OF STEEL (AASHTO M169, GRADE 1050) WITH NO WELDS ALLOWED.

PLAN VIEW - TYPICAL DEER GATE INSTALLATION

SECTION A-A

FRONT VIEW - DEER GATE

TYPICAL HINGE DETAIL

TYPICAL TINE DETAIL

DEER FENCE, GATES, AND GAME RAMPS

STANDARD PLAN NO. M-607-4 Standard Sheet No. 2 of 5

Issued by the Project Development Branch: July 31, 2019
DEER FENCE WIRE FABRIC TRANSITIONED TO WINGWALL EYEBOLTS AT 3' MAX. SPACING.

I. LOCATIONS OF DEER FENCE IN THE CLEAR ZONE SHALL BE SHOWN IN THE PLANS.
II. POSTS WITHIN THE CLEAR ZONE SHALL BE DRILLED.
III. DRILL HOLES PERPENDICULAR TO THE ROADWAY.
IV. KNEE BRACE SHALL BE OMITTED FROM ANY END POST OR CORNER POST WITHIN THE CLEAR ZONE.

8' WOOD STAYS LINE POST

FIVE FOOT POSTS AND WIRE FABRIC SHALL BE INSTALLED WHERE THE FENCE PASSES OVER A CBC AT LOCATIONS SHOWN IN THE PLANS. THIS WORK WILL BE PAID FOR AS FENCE DEER SPECIAL.

END POST AND CORNER POST

SIDE VIEW

MODIFIED FOR PLACEMENT WITHIN ROADWAY CLEAR ZONE

GAP CLOSURE

USE THIS DETAIL TO CLOSE ALL GAPS BETWEEN 6 INCHES AND 3 FEET. GAP CLOSURES SHALL BE INCLUDED IN THE PRICE OF THE FENCE AND NOT BE PAID FOR SEPARATELY.

DEER FENCE, GATES, AND GAME RAMPS

STANDARD PLAN NO.  M-607-4

Issued by the Project Development Branch: July 31, 2019

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LT A
CAD Version: MicroStation V8. Scale: Not to Scale. Units: English

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Project Development Branch
J BK

Sheet Revisions

Comments

Standard Sheet No. 3 of 5
NOTES

1. The landing zone shall be flat, stable, and earthed. The area shall be void of objects that may hinder or endanger wildlife. The engineer may adjust the game ramp location as needed.

2. There shall be no disturbance beyond the row of temporary/permanent earthworks.

3. Fill material shall be structure backfill (Class 2) and meet the requirements of Section 206 with a minimum composition of 95%.

4. Four inches of topsoil shall be placed in accordance with Section 207.

5. Finished grade of fill/ensalts shall be a 2% active layer.

6. Seeding shall be completed after the engineer approves grading.

7. See the Stormwater Management Plan for the seeding plan.

8. Game ramp is paid per revision of Section 607, Fences.

9. Fill Game Ramps:

   - 2" x 8" treated lumber or equivalent as approved by the engineer.
   - All game ramp posts shall be a minimum 4" below ground, and a minimum lift in earthed, and encased in concrete.
   - No greater than 2" out of vertical.

10. Deer Fence Wire Fabric (Typ.)

   - Topsoil, soil conditioning, and seeding (native) for all disturbed areas.

11. Geotextile Class 2 placed at 1 foot lift wrap faced installation with 3 foot lap at front face, see sheet 5 for approved detail.

12. Cut Game Ramp:

   - Topsoil, soil conditioning, and seeding native for all disturbed areas.

13. Deer Fence, Gates, and Game Ramps

   - Standard Plan No. M-607-4
   - Sheet Revisions
   - Computer File Information
   - Date: 07/31/19
   - Designer Initials: JBK
   - Multi-Member Branch: JBK
   - CAD View: AutoCAD LT
   - Issued by the Project Development Branch: July 31, 2019
   - Project Sheet Number: 4 of 5

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Project Development Branch: JBK
CUT SECTION PERPENDICULAR TO GAME RAMP

FILL SECTION PERPENDICULAR TO GAME RAMP

SECTION A-A

NOTES

1. GEOTEXTILE REINFORCEMENT SHALL BE WOVEN FABRIC WITH A MINIMUM AVERAGE ROLL VALUE OF 4800 LB/FT FOR INSTALLATIONS WITH A GAP AND 2400 LB/FT FOR INSTALLATIONS WITHOUT A GAP BASED ON ASTM D4595.

2. GEOTEXTILE REINFORCEMENT SHALL BE PLACED BY ALTERNATING MACHINE DIRECTION (MD) WITH CROSS MACHINE DIRECTION (XD) FROM LAYER TO LAYER.

3. THE GEOTEXTILE REINFORCEMENT WRAP AT BACK FACE OF GAME RAMP SHALL BE PULLED BACK SLACK FREE WITH ITS END ANCHORED TO SOIL UNDERNEATH WITH STAPLES OR PINS.

4. MINIMUM SPICE OF ALL GEOTEXTILE SHALL CONSIST OF 1 FOOT OF OVERLAP.

5. GEOTEXTILE REINFORCEMENT WRAP AT BACK FACE OF GAME RAMP WALL SHALL BE TEMPORARILY HUNG WITH A SPACER BOARD AND TACK STRIP. AFTER REACHING A TOTAL OF 2'-0" COMPACTED LIFT, THE TACK STRIP SHALL BE REMOVED AND GEOTEXTILE REINFORCEMENT SHALL BE PULLED BACK SLACK FREE WITH ITS END ANCHORED TO SOIL UNDERNEATH WITH STAPLES OR PINS BEFORE THE SPACER BOARD IS PULLED.

6. DO NOT USE SPACER FOR THE TOP LIFT (FINAL LIFT). TOP LIFT SHALL ABUT THE GAME RAMP WALL.
I. Wire-bound picket fence, conforming to ASTM F 537, shall be stretched tight and securely fastened to all posts with 12-gage galvanized steel wire clamps or 12-1/2-gage galvanized steel wire ties.

2. All fence posts complete with anchor plate shall be hot-dipped galvanized conforming to AASHTO M 281. Line posts (without anchor) shall weigh at least 1.33 lbs. per linear ft. Suitable anchor plates shall be securely fastened to each line post and shall weigh 0.67 lbs. nominal.

3. In general, snow fence shall be placed 100 to 150 ft. from the centerline of roadway. However, the specific location on each project will be shown on the plans or as determined by the Engineer.

4. Snow fence may be placed immediately in front of the right of way fence on the highway side when such location is suitable. This will avoid trapping of weeds and debris between the fences. In such installations the snow fence shall not be tied or fastened to the right of way fence.

5. Fence shall be securely braced at each end panel with a regular line post and 1 diagonal cable consisting of 2 strands of twisted wire. Each strand to consist of two 12-gage galvanized wires.

6. Line brace posts shall be installed every 400 ft. or less where the fencing is continuous and shall not be paid for separately but be included in the contract.

7. Two horizontal wires shall be strung behind the pickets for the full length of the fence. Each horizontal wire shall consist of 12-gage twisted galvanized wire. Each horizontal wire shall be fastened securely to each fence post by means of 12-gage wire clamps or 12-1/2-gage wire ties.
GENERAL NOTES

1. Steel light standards shall have an 8 in. outside diameter at
the base with a 5 in. in height. All standards shall be attached
to the roadway via a concrete base with the following:

   - A Certificate of Conformance (C.O.C.) shall be submitted
     with the standards and fabricated in accordance with Section 13.

2. A steel plate with a 6 in. outside diameter
   at the base shall be attached to the roadway to support
   the standards. The plate shall be fabricated in accordance
   with Section 13.

3. The gate arm shall be fabricated from high
   strength rectangular steel and formed rectangular aluminum
   tubing. The maximum
   arm length shall be 8 ft.

4. The ends of the gate arm shall be
   fabricated with a bolted connection,
   and the ends shall be ground to
   prevent any damage to the vehicle and
   the gate.

5. The gate arm shall extend from the
   roadway to the centerline of the
   roadway.

6. The height of the gate arm and gate shall be 8 ft.
   from the bottom of the arm to the roadway.

7. The gate arm shall be supplied by
   the contractor and submitted to the
   client for inspection.

8. When the gate is fully raised, the nut and washer shall fit
   snugly against the outside of the rear channel and be
   held in place by the bolt. The bolt shall be.
   The gate shall be raised at a height not less than
   3 ft. from the bottom of the arm.

9. Electrical connections for the power source shown on the plans
   shall be made with a 6/3 or 6/4 copper
   cable, and the cable shall be
   stranded and run in a protective
   conduit.

10. The gate shall be supplied by
    the contractor and be
    installed in accordance with
    the plans.

11. Galvanizing: The steel light standards, mast arms, drop gate
    pivots, supports, guides, and all associated hardware shall
    be galvanized in accordance with Section 13. All
    rough edges and burrs shall
    be ground smooth prior to galvanizing.

12. Bolted connections: All bolts shall conform to
    the specifications and be
    painted with two coats of
    aluminum or equivalent.

13. Field assembly: In some installations, the connection plates for
    the luminaire arms may require modification to allow the pivot
    sleeves to slip over the gate arms. The
    bolted connections shall be
    painted with two coats of
    aluminum paint.

14. The luminaire arms may require modification to allow the pivot
    sleeves to slip over the gate arms. The
    bolted connections shall be painted
    with two coats of aluminum paint.
DIVIDED HIGHWAY INSTALLATION
(TWO GATES REQUIRED)

INTERSTATE MAINLINE

LUMINAIRE AND GATE (RAMP LOCATIONS)
**ANCHOR BASE**

**BOLT CIRCLE DIAMETERS SHALL BE COMPATIBLE**

1" TO 1'/4" x 3" TO 4" CONNECTOR BOLTS WITH TWO FLAT LOCK WASHERS IN CONFORMANCE WITH ASTM A 307 (FOUR REQUIRED)

**TYPICAL BREAK-AWAY TYPE TRANSFORMER BASE DETAIL**

**NOTES:**
1. HARDWARE SHALL CONFORM TO MANUFACTURER'S REQUIREMENTS.
2. A HAND HOLE IS NOT REQUIRED IN POLE IF A BREAK-AWAY TRANSFORMER BASE IS USED.

**TYPICAL CONDUIT BURIAL SECTION**

**NOTES:**
1. THE CONTRACTOR SHALL CONVEY THE TRENCHING WITH OTHER UNDERGROUND UTILITIES, AND INSTALLATION THE CONTRACTOR SHALL SITE CONDUIT TRENCHES AT ALL ROAD CROSSINGS WHERE POSSIBLE.
2. ONE R/A AND LOCATE WIRED A WIRE FULL STRING IN ALL EMPTY CONDUITS.

**TYPICAL CONCRETE FOUNDATION**

**NOTES:**
1. SEE POLE SUPPLIER DETAILS FOR BOLT CIRCLE AND PROJECTION.
2. ALL BREAK-AWAY SUPPORT COUPLINGS SHALL MEET THE BREAKAWAY REQUIREMENTS STATED IN THE LATEST EDITION OF THE LATEST EDITION OF MANUFACTURER'S SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS.
3. BREAKAWAY SUPPORT COUPLINGS SHALL BE INSTALLED IN CONFORMANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
4. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN-PLACE CONCRETE.
5. CONCRETE SHALL BE CAST IN CONFORMANCE WITH AASHTO M 232 (ASTM A 153).
6. ALL NUTS, BOLTS, STUDS AND WASHERS SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232 (ASTM A 153).
HIGH WIND STOWING PROCEDURE

If arm cannot be brought back to the upright position because of high winds, the following procedure can be used:

1. With arm in down position, remove two 1/2" x 20' bolts from shear pin base, see the shear pin base detail.
2. Swivel arm using the 3/8" x 8 HS bolt as a pivot.
3. Swivel arm clear of roadway and secure by a delineator post.
4. Reset arm to upright position when weather permits.

NOTE: See details below.

DETAIL FOR HIGH WIND STOW POSITION

DETAIL TO SECURE GATE IN HIGH WIND

ROAD CLOSURE GATE

Issued by the Project Development Branch: July 31, 2019
1. Pole base plate shall conform to ASTM A572, Grade 42.
2. Bottom plate of slip base assembly shall conform to ASTM A572, Grade 50.
3. All structural steel shall be galvanized after fabrication in conformance with ASTM A123. All contact areas of the structural steel shall be free of galvanizing beads and runs.
4. Slip base connecting hardware shall conform to ASTM A325, and shall be electroplated cadmium in conformance with ASTM B766 Type NS.
5. Keeper plate shall conform to ASTM A653, Grade 33, and coating G90.
CURB RAMP GENERAL NOTES:

1. In new construction or full-depth reconstruction, provide a separate curb ramp for each marked or unmarked pedestrian street crossing. Curb ramps shall be contained wholly within the width of the pedestrian street crossing or crosswalk they serve, or as shown on the plans.

2. Alternatives are defined as changes to an existing highway that affect pedestrian access, circulation, or use. Alternatives include, but are not limited to, repositioning, realignment, reconstruction, curb ramp relocation, historic restoration, or changes or modifications to structural or elements of a pedestrian facility.

3. A walkable surface is defined as a paved surface adjacent to a curb ramp or turning space, without raised obstacles, that could be traversed by a user in a wheelchair.

4. Where an existing physical constraint prevents providing a separate curb ramp for each pedestrian street crossing, a single ramp may be provided, subject to the following limitations:

   a. The total length of the ramp shall not exceed 15 feet or exceed 2 percent grade.

   b. Ramps shall be designed for use by persons with disabilities, including persons who are visually impaired.

   c. Ramps shall be designed to be compatible with existing pedestrian facilities.

   d. Ramps shall be designed to be accessible by persons who use wheelchairs or other mobility aids.

5. Where snow removal equipment will be used to clear the pedestrian access route, consult the engineer prior to construction to ensure the width and thickness of curb ramps is sufficient to accommodate such equipment.

6. Where a sidewalk is not provided adjacent to a curb ramp or turning space, the walkable surface shall be provided within the limits of the street.

7. Where snow removal equipment will be used to clear the pedestrian access route, consult the engineer prior to construction to ensure the width and thickness of curb ramps is sufficient to accommodate such equipment.

CURB RAMP PAY AREAS

- Type 1
- Type 2 - Two Ramps
- Type 2 - One Ramp
- Type 2 - Directional Blended Transition
- Depressed Corner

DETECTABLE WARNING SURFACES:

- Provide detectable warning surfaces at the bottom of curb ramps and turning spaces.
- The detectable warning surface shall contrast visually with the adjacent gutter, highway, or pedestrian access route surface, either light-on-dark or dark-on-light. Federal yellow color is preferred, however, other colors may be used if approved by the Engineer.

CURB RAMP SLOPE TABLE

<table>
<thead>
<tr>
<th>Percent Slope</th>
<th>1.8</th>
<th>2.0</th>
<th>3.0</th>
<th>5.0</th>
<th>7.1</th>
<th>8.3</th>
<th>10.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent Run/Rise</td>
<td>110:1</td>
<td>55:1</td>
<td>35:1</td>
<td>20:1</td>
<td>14:1</td>
<td>12:1</td>
<td>10:1</td>
</tr>
</tbody>
</table>

DESIGN AND CONSTRUCT CURB RAMPS, TURNING SPACES, AND FLARED SLOPES WITH THE FLATTEST SLOPES POSSIBLE. THE SLOPES INDICATED IN THESE DETAILS ARE BASED ON CONSIDERATION OF THE REQUIREMENTS OF THE AMERICAN NATIONAL STANDARDS INSTITUTE AND THE AMERICAN NATIONAL STANDARDS FOR THE DESIGN OF CURB RAMPS AND TURNING SPACES.

- Ramp Running Slope
- Ramp Cross Slope
- Flared Slope

PERCENT SLOPE 1.8% 2.0% 3.0% 5.0% 7.1% 8.3% 10.0%

EQUIVALENT RUN/RISE 110:1 55:1 35:1 20:1 14:1 12:1 10:1
PERPENDICULAR RAMP (TYPICAL)

PERPENDICULAR RAMP (WITH VERTICAL RETURN CURB)

PERPENDICULAR RAMP NOTES

1. RAMP WIDTH - PROVIDE 5 FT. OR GREATER WHERE POSSIBLE. IF SITE CONSTRAINTS DO NOT PERMIT, PROVIDE 4 FT. RAMP SERVING SHARED USE PATHS SHALL BE MINIMUM WIDTH OF THE PATH.

2. RAMP RUNNING SLOPE - 0.33 MAX.

3. TURNING SPACE RUNNING SLOPE - 2.0% MAX. TURNING SPACE RUNNING SLOPE IS MEASURED IN THE SAME DIRECTION AS THE RAMP RUNNING SLOPE.

4. TURNING SPACE CROSS SLOPE - 2.0% TYPICAL. AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE PEDESTRIANS CAN PROCEED THROUGH THE INTERSECTION WITHOUT STOPPING OR SLOWING, THE CROSS SLOPE OF RAMPS AND TURNING SPACES SHALL EQUAL THE HIGHWAY GRADE AT WINDWARD-FACING STREET CROSSINGS. THE RAMP AND TURNING SPACE CROSS SLOPE SHALL EQUAL THE NORMAL GRADE.

5. TURNING SPACE DIMENSIONS - PROVIDE A TURNING SPACE AT THE TOP OF PERPENDICULAR RAMPS WITH A WIDTH EQUAL TO THE WIDTH OF THE CURB RAMP. TURNING SPACE LENGTH MUST BE 4 FT. MINIMUM.

6. RAMP ALIGNMENT - RAMPS SHALL BE ALIGNED TO BE FULLY CONTAINED WITHIN THE CROSSWALK OR STREET CROSSING THEY SERVE, PROVIDE ONE RAMP FOR EACH STREET CROSSING DIRECTION. IN ALTERNATIVELY, WHERE EXISTING PHYSICAL CONSTRAINTS PREVENT PROVIDING ONE CURB RAMP FOR EACH CROSSING DIRECTION, A SINGLE DIAGONAL CURB RAMP ON THE Apex OF A CORNER SHALL BE PERMITTED TO SERVE BOTH PERPENDICULAR STREET CROSSINGS IF A DIAGONAL RAMP IS USED. A CLEAR SPACE 4 FT. X 4 FT. MUST BE PROVIDED AT THE BASE OF THE RAMP. THE CLEAR SPACE MUST BE WITHIN BOTH CROSSWALKS AND WHOLLY OUTSIDE OF ANY ADJACENT VEHICULAR TRAVEL LANES. DIAGONAL RAMPS ARE NOT ACCEPTABLE IN NEW CONSTRUCTION, OR FULL-DEPTH RECONSTRUCTION.

7. RAMP LENGTH - PERPENDICULAR RAMP LENGTH IS DEPENDENT UPON THE RAMP SLOPE, HEIGHT OF CURB, AND ADJACENT SIDEWALK CROSS-SLOPE WHICH MUST BE INTERCEPTED. SEE DETAIL A FOR CALCULATING RAMP LENGTH WHEN CHASING SIDEWALK CROSS-SLOPE OR WHERE TERRAIN IS SLOPING. A RAMP IS NOT REQUIRED TO CHASE GRADE MORE THAN 15 FT. REGARDLESS OF THE RESULTING RAMP SLOPE.

8. RAMP FLARES - WHERE A RAMP EDGE ABUTS A WALKABLE SURFACE, A FLARED SIDE SHALL BE PROVIDED. RAMP FLARES SLOPES SHALL NOT EXCEED 10.0%.

9. VERTICAL CURB RETURNS - VERTICAL CURB RETURNS MAY BE USED ONLY WHERE A RAMP EDGE ADJOIN A NON-WALKABLE SURFACE, OR WHERE A RAMP IS PROTECTED FROM PEDESTRIAN CROSS TRAFFIC (FOR EXAMPLE BY A SIGNAL CABINET OR UTILITY POLE WHICH BLOCKS PASSAGE).

10. GUTTER COUNTERSLOPE - 0.5% MAX.

PERPENDICULAR RAMP NOTES

1. RAMP Width - PROVIDE 5 FT. OR GREATER WHERE POSSIBLE. IF SITE CONSTRAINTS DO NOT PERMIT, PROVIDE 4 FT. RAMP SERVING SHARED USE PATHS SHALL BE MINIMUM WIDTH OF THE PATH.

2. RAMP RUNNING SLOPE - 0.33 MAX.

3. TURNING SPACE RUNNING SLOPE - 2.0% MAX. TURNING SPACE RUNNING SLOPE IS MEASURED IN THE SAME DIRECTION AS THE RAMP RUNNING SLOPE.

4. TURNING SPACE CROSS SLOPE - 2.0% TYPICAL. AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE PEDESTRIANS CAN PROCEED THROUGH THE INTERSECTION WITHOUT STOPPING OR SLOWING, THE CROSS SLOPE OF RAMPS AND TURNING SPACES SHALL EQUAL THE HIGHWAY GRADE AT WINDWARD-FACING STREET CROSSINGS. THE RAMP AND TURNING SPACE CROSS SLOPE SHALL EQUAL THE NORMAL GRADE.

5. TURNING SPACE DIMENSIONS - PROVIDE A TURNING SPACE AT THE TOP OF PERPENDICULAR RAMPS WITH A WIDTH EQUAL TO THE WIDTH OF THE CURB RAMP. TURNING SPACE LENGTH MUST BE 4 FT. MINIMUM, MEASURED IN THE DIRECTION OF THE RAMP RUN. WHEN A TURNING SPACE IS CONSTRAINED AT THE BACK OF SIDEWALK, INCREASE LENGTH TO 5 FT. MINIMUM IN THE DIRECTION OF THE RAMP RUN.

6. RAMP ALIGNMENT - RAMPS SHALL BE ALIGNED TO BE FULLY CONTAINED WITHIN THE CROSSWALK OR STREET CROSSING THEY SERVE, PROVIDE ONE RAMP FOR EACH STREET CROSSING DIRECTION. IN ALTERNATIVELY, WHERE EXISTING PHYSICAL CONSTRAINTS PREVENT PROVIDING ONE CURB RAMP FOR EACH CROSSING DIRECTION, A SINGLE DIAGONAL CURB RAMP ON THE Apex OF A CORNER SHALL BE PERMITTED TO SERVE BOTH PERPENDICULAR STREET CROSSINGS IF A DIAGONAL RAMP IS USED. A CLEAR SPACE 4 FT. X 4 FT. MUST BE PROVIDED AT THE BASE OF THE RAMP. THE CLEAR SPACE MUST BE WITHIN BOTH CROSSWALKS AND WHOLLY OUTSIDE OF ANY ADJACENT VEHICULAR TRAVEL LANES. DIAGONAL RAMPS ARE NOT ACCEPTABLE IN NEW CONSTRUCTION, OR FULL-DEPTH RECONSTRUCTION.

7. RAMP LENGTH - PERPENDICULAR RAMP LENGTH IS DEPENDENT UPON THE RAMP SLOPE, HEIGHT OF CURB, AND ADJACENT SIDEWALK CROSS-SLOPE WHICH MUST BE INTERCEPTED. SEE DETAIL A FOR CALCULATING RAMP LENGTH WHEN CHASING SIDEWALK CROSS-SLOPE OR WHERE TERRAIN IS SLOPING. A RAMP IS NOT REQUIRED TO CHASE GRADE MORE THAN 15 FT. REGARDLESS OF THE RESULTING RAMP SLOPE.

8. RAMP FLARES - WHERE A RAMP EDGE ABUTS A WALKABLE SURFACE, A FLARED SIDE SHALL BE PROVIDED. RAMP FLARES SLOPES SHALL NOT EXCEED 10.0%.

9. VERTICAL CURB RETURNS - VERTICAL CURB RETURNS MAY BE USED ONLY WHERE A RAMP EDGE ADJOIN A NON-WALKABLE SURFACE, OR WHERE A RAMP IS PROTECTED FROM PEDESTRIAN CROSS TRAFFIC (FOR EXAMPLE BY A SIGNAL CABINET OR UTILITY POLE WHICH BLOCKS PASSAGE).

10. GUTTER COUNTERSLOPE - 0.5% MAX.
CURB HEIGHT MAY BE REDUCED TO 3" MIN.

BACK OF SIDEWALK

TURNING SPACE MAY OVERLAP

CURB HEIGHT MAY BE REDUCED TO 3" MIN.

CLEAR SPACE (SEE NOTE 6 - SHEET 2)

CROSSWALK BAR (TYPICAL)

NOTE: PLACEMENTS SHOWN ARE TYPICAL CONFIGURATIONS ONLY AND NOT INDICATIVE OF ALL OPTIONS. OTHER RAMPS CONFIGURATIONS MAY BE ACCEPTABLE AS LONG AS THEY CONFORM TO THE CRITERIA IN THESE STANDARDS, AND ARE APPROVED BY THE ENGINEER.

TYPE 1 RAMPS FOR WIDE SIDEWALK

(3" REDUCED CURB)

TYPE 1 PERPENDICULAR RAMPS

NOTE: NOT ALLOWABLE IN NEW CONSTRUCTION/FULL DEPTH RECONSTRUCTION. SEE GENERAL NOTE 4

TYPE 1 DIRECTIONAL RAMPS

(3" REDUCED CURB)

TYPE 1 DIRECTIONAL RAMPS

(LARGE RADIUS)

TYPE 1 RAMPS FOR WIDE SIDEWALK

(TYPE 1 PERPENDICULAR RAMPS)

LANDING AREA RUNNING SLOPE 2% PREF., 5% MAX. MATCH RAMP CROSS SLOPE

TURNING SPACES MAY OVERLAP

CROSSWALK BAR (TYPICAL)

LANDING AREA RUNNING SLOPE 2% PREF., 5% MAX. MATCH RAMP CROSS SLOPE

CURB HEIGHT MAY BE REDUCED TO 3" MIN.

Landing Area Running SLOPE 2% PREF., 5% MAX. MATCH RAMP CROSS SLOPE

NOTE: PLACEMENTS SHOWN ARE TYPICAL CONFIGURATIONS ONLY AND NOT INDICATIVE OF ALL OPTIONS. OTHER RAMPS CONFIGURATIONS MAY BE ACCEPTABLE AS LONG AS THEY CONFORM TO THE CRITERIA IN THESE STANDARDS, AND ARE APPROVED BY THE ENGINEER.

TYPE 1 CURB RAMPS TYPICAL CONFIGURATIONS

CURB RAMPS

STANDARD PLAN NO.

M-608-1

CURB RAMPS

STANDARD PLAN NO.

M-608-1

Standard Sheet No. 3 of 10

 Issued by: Project Development Branch: July 31, 2019

Project Sheet Number:
CURB RAMPS

STANDARD PLAN NO. M-608-1

SECTION C-C

PARALLEL RAMP

- Ramp Width - Provide a ramp width equal to the adjoining sidewalk, provide a 4 ft. width minimum. Ramps servicing shared use paths shall match the width of the path.
- Ramp Running Slope - 8.3% max.
- Ramp Cross Slope - 2.0% max.
- Turning Space Running Slope - 2.0% max. Turning space running slope is measured perpendicular to the back of curb.
- Turning Space Cross Slope - 2.0% typical, at crossings without yield or stop control, or within a signal where vehicles can proceed through the intersection without slowing or stopping, the cross slope of the turning space may equal the highway grade. At vehicle pedestrian street crossings, the turning space cross slope may equal the highway grade. Turning space cross slope is measured in the direction of the ramp run.
- Turning Space Dimensions - Provide a turning space at the bottom of parallel ramps with a width equal to the width of the curb ramp. Provide a 4 ft. minimum measured in the direction of the ramp run. If the turning space is constrained on two sides, provide 5 ft. measured in the direction of pedestrian street crossing. The turning space may contain the detectable warning surface.
- Ramp Alignment - Ramps shall be aligned so the turning space is fully contained within the crosswalk or street crossing they serve. Provide one ramp for each street crossing direction. In alterations where existing physical constraints prevent providing one curb ramp for each crossing direction, a single diagonal curb ramp on the side of the crossing shall be permitted to serve both pedestrian street crossings. Diagonal ramps are not acceptable in new construction, or full-depth reconstruction.
- Ramp Length - Parallel ramp length is dependent upon the ramp slope and the change of elevation from the turning space to the sidewalk, where typical is selecting a ramp that is not recessed to coincide more than 3 ft. regardless of the resulting ramp slope.
- Gutter Counter Slope - 6.0% max.

SECTION B-B

CURB RAMP

- Weight - Provide a curb ramp weight equal to the adjoining sidewalk, provide a 4 ft. width minimum. Ramps servicing shared use paths shall match the width of the path.
- Running Slope - 8.3% max.
- Cross Slope - 2.0% typical, at crossings without yield or stop control, or within a signal where vehicles can proceed through the intersection without slowing or stopping, the cross slope of the turning space may equal the highway grade. At vehicle pedestrian street crossings, the turning space cross slope may equal the highway grade. Turning space cross slope is measured in the direction of the ramp run.
- Dimensions - Provide a turning space at the bottom of parallel ramps with a width equal to the width of the curb ramp. Provide a 4 ft. minimum measured in the direction of the ramp run. If the turning space is constrained on two sides, provide 5 ft. measured in the direction of pedestrian street crossing. The turning space may contain the detectable warning surface.
- Alignment - Ramps shall be aligned so the turning space is fully contained within the crosswalk or street crossing they serve. Provide one ramp for each street crossing direction. In alterations where existing physical constraints prevent providing one curb ramp for each crossing direction, a single diagonal curb ramp on the side of the crossing shall be permitted to serve both pedestrian street crossings. Diagonal ramps are not acceptable in new construction, or full-depth reconstruction.
- Length - Parallel ramp length is dependent upon the ramp slope and the change of elevation from the turning space to the sidewalk, where typical is selecting a ramp that is not recessed to coincide more than 3 ft. regardless of the resulting ramp slope.
- Gutter Counter Slope - 6.0% max.

SECTION A-A

TYPE 2 PARALLEL CURB RAMPS

- Ramp Width - Provide a ramp width equal to the adjoining sidewalk, provide a 4 ft. width minimum. Ramps servicing shared use paths shall match the width of the path.
- Ramp Running Slope - 8.3% max.
- Ramp Cross Slope - 2.0% max.
- Turning Space Running Slope - 2.0% max. Turning space running slope is measured perpendicular to the back of curb.
- Turning Space Cross Slope - 2.0% typical, at crossings without yield or stop control, or within a signal where vehicles can proceed through the intersection without slowing or stopping, the cross slope of the turning space may equal the highway grade. At vehicle pedestrian street crossings, the turning space cross slope may equal the highway grade. Turning space cross slope is measured in the direction of the ramp run.
- Turning Space Dimensions - Provide a turning space at the bottom of parallel ramps with a width equal to the width of the curb ramp. Provide a 4 ft. minimum measured in the direction of the ramp run. If the turning space is constrained on two sides, provide 5 ft. measured in the direction of pedestrian street crossing. The turning space may contain the detectable warning surface.
- Ramp Alignment - Ramps shall be aligned so the turning space is fully contained within the crosswalk or street crossing they serve. Provide one ramp for each street crossing direction. In alterations where existing physical constraints prevent providing one curb ramp for each crossing direction, a single diagonal curb ramp on the side of the crossing shall be permitted to serve both pedestrian street crossings. Diagonal ramps are not acceptable in new construction, or full-depth reconstruction.
- Ramp Length - Parallel ramp length is dependent upon the ramp slope and the change of elevation from the turning space to the sidewalk, where typical is selecting a ramp that is not recessed to coincide more than 3 ft. regardless of the resulting ramp slope.
- Gutter Counter Slope - 6.0% max.
COMBINATION CURB RAMP NOTES:

1. The curb ramp placements shown are typical configurations only and not indicative of all criteria. Other curb ramp configurations may be acceptable as long as they conform to the criteria in these standards and are approved by the engineer.

2. Ramp and turning space cross slope - 2.0% typical; at crossings without yield or stop control or when a signal where vehicles can proceed through the intersection without stopping, the cross slope of the ramp and turning space may equal the highway grade at midblock pedestrian street crossings. The ramp and turning space cross slope may equal the highway grade.

3. Where it is acceptable for a ramp or turning space cross slope to exceed 2.0% and match the highway grade, the ramp above the turning space may be warped to tie into the adjoining sidewalk cross slope. The transition to the sidewalk cross slope shall be smooth within over the length of the ramp to minimize warping. The rate of change in cross slope may not exceed 3.0% per linear foot.

COMBINATION CURB RAMPS TYPICAL CONFIGURATIONS
BLENDED TRANSITION & DEPRESSED CORNER NOTES

1. Perpendicular and parallel ramp configurations are preferred. Blended transitions and depressed corners should only be used where site conditions make them a more appropriate option, or where perpendicular or parallel ramps cannot be installed due to a physical site constraint.

2. Ramp width - Provide 5 ft or greater where possible. If site constraints do not permit, provide 4 ft. North American ramps receiving shared use paths shall match the width of the path.

3. Ramp running slope - 8.3% max.

4. Blended transition running slope - 5% max.

5. Ramp and turning space cross slope - 2% typical. At crossings without yield or stop control, or with a signal where vehicles can proceed through the intersection without slowing or stopping, the cross slope of ramps and turning spaces may equal the highway grade.

6. Turning space dimensions - Provide a 4 ft x 4 ft or turning space at the bottom of ramp runs. The turning space may contain the detectable warning surface.

7. Ramp alignment - Turning space shall be aligned to be fully contained within the crosswalk or street crossings not serve.

8. Ramp length - Ramp length is dependent upon the ramp slope and the change of elevation from the turning space to the sidewalk, where terrain is sloping a ramp is not required to change grade more than 25 ft, regardless of the resulting ramp slope.

9. Ramp landings - Where a ramp edge abuts a walkable surface, a flared side must be provided. Ramp landings shall not exceed 25%.

10. Vertical curb returns - Vertical curb returns may be used only where a ramp enters a non-walkable surface, or where a ramp is protected from pedestrian cross traffic. For example by a fire lane or utility pole which blocks passage.

11. Gutter counter slope - 5% max.

12. DWS placement - DWS shall be placed around the radius and located at the back of curb on blended transitions and depressed corner ramps.
NOTES:
1) DETECTABLE WARNING SURFACES SHALL BE PLACED IN ALIGNMENT WITH THE BACK OF CURB.
2) FLARED SIDES ARE PREFERENTIAL ON RAISED INTERSECTION ISLANDS AND SHOULD BE PROVIDED ON ISLANDS WHICH SERVE SHARED USE PATHS, OR AT LOCATIONS WHERE BICYCLE USE IS EXPECTED.
3) FOR CUT-THROUGH MEDIAN ISLANDS, DETECTABLE WARNING SURFACES SHALL BE PLACED IN ALIGNMENT WITH THE BACK OF CURB AND BE SEPARATED BY A MINIMUM 2 FOOT SPACE WITHOUT DWS. IF A 2 FOOT SEPARATION BETWEEN DETECTABLE WARNING SURFACES CANNOT BE PROVIDED NO DETECTABLE WARNING SURFACE SHALL BE INSTALLED.
4) CURB RAMP AND CUT-THROUGH WIDTHS SHOULD BE THE SAME WIDTH AS ANY SHARED USE PATH WHICH THEY SERVE.

INTERSECTION ISLANDS

SQUARE CURB TO ORIENT PEDESTRIANS IN THE DIRECTION OF THE CROSSING

AT-GRADE RAIL CROSSING

MEDIAN ISLANDS

CURB RAMPS

STANDARD PLAN NO. M-608-1

Issued by the Project Development Branch: July 31, 2019
Project Sheet Number:

Computer File Information

Sheet Revisions

Colorado Department of Transportation
2029 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch: JBK
DETECTABLE WARNING SURFACE PLACEMENT

DETECTABLE WARNING SURFACE NOTES:

1. DETECTABLE WARNING SURFACES (DWS) SHALL BE INSTALLED AT SIDEWALKS, SHARED USE PATHS, STREET TRANSITIONS, AND SHALL CONSIST OF TRUNCATED DOME PANELS. ANY TRUNCATED DOME PANELS WHICH ARE USED MUST BE IN THE CDOT APPROVED PRODUCTS LIST.

2. THE DETECTABLE WARNING SURFACE SHALL SPAN THE FULL WIDTH OF THE CURB RAMP, SHARED USE PATH, OR OTHER ROADWAY ENTRANCE AS APPROPRIATE. A GAP OF 2 INCHES FROM THE EDGE OF THE DETECTABLE WARNING SURFACE TO THE EDGE OF THE CURB RAMP OR SHARED USE PATH IS PERMITTED.

3. WHEN DETECTABLE WARNING SURFACES ARE PLACED ON A SLOPE GREATER THAN 5.0%, TRUNCATED DOMES SHOULD BE ALIGNED IN THE DIRECTION OF THE RAMP RUN; OTHERWISE, DOMES ARE NOT REQUIRED TO BE ALIGNED. TRUNCATED DOMES SHALL BE IN A SQUARE GRID OR RADIAL PATTERN. WHEN PLACED RADIALLY, PLACE ADJACENT DWS PLATES EDGE TO EDGE.


5. WHERE PERPENDICULAR DIRECTIONAL RAMPS ABUT A WALKABLE SURFACE, THE LEADING EDGE OF THE DWS SHALL NOT BE PLACED FURTHER THAN 2 FEET FROM THE BACK OF CURB. IF THE RADIUS OF A CORNER MAKES THIS IMPOSSIBLE, ORIENT THE CURB RAMP PERPENDICULAR TO THE CURB AND GUTTER.

6. IF THE DETECTABLE WARNING SURFACE IS CUT, GRIND OFF THE REMAINING PORTION OF ANY CUT TRUNCATED DOMES. SEAL ALL CUT PANEL EDGES WITH AN APL SEALANT TO PREVENT WATER DAMAGE.

7. TRUNCATED DOME PLATES SHALL BE EMBEDDED IN THE CONCRETE CURB RAMP WHILE THE CONCRETE IS PLASTIC.

8. DWS SHALL NOT BE PLACED OVER GRADE BREAKS.
DWS SPANS WIDTH OF CURB RAMP (WITHIN 2" OF EACH EDGE)

FLARED SIDE OR RETURN CURB

SECTION VIEW OF DETECTABLE WARNING SURFACE PLATE
(LOOKING AT PERPENDICULAR RAMP RUN FROM STREET)

SECTION VIEW FOR PARALLEL CURB RAMP TYPES
(LOOKING PERPENDICULAR TO TURNING SPACE)

TRUNCATED DOME PLATE(S)

PLATE SPANNED WIDTH OF CURB RAMP (WITHIN 2" OF EACH EDGE)

SECTION VIEW FOR PERPENDICULAR CURB RAMP TYPES
(LOOKING PERPENDICULAR TO RAMP RUN)

DETECTABLE WARNING SURFACE DETAILS

Detectable Warning Surface Details

Colorado Department of Transportation

2829 West Howard Place

Boulder, CO 80304

Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch: July 31, 2019

STANDARD PLAN NO.

M-608-1

Issued by the Project Development Branch: July 31, 2019
GENERAL NOTES

1. In roadway curves with a radius of 1,900 ft or less, curbs and gutters are to be placed in the arc of the curve. Unless otherwise noted on the plans, a maximum chord length of 50 ft may be used when the curve radius is greater than 1,900 ft.

2. Concrete shall be class B.

3. Profile grade of curbs and gutters shall be located at the flow line.

4. Curb and gutter type A may be used in lieu of curb and gutter type B, C, D, and E unless otherwise specified on the plans.

5. Gutter cross slopes may be adjusted to facilitate drainage for profile grades as shown on the plans.

6. Profiles of curbs and gutter section shall match concrete pavement thickness if shown on the plans. Gutter shall be class P concrete if placed monolithically with concrete pavement.

7. Increase sidewalk thickness to 4 ft at locations shown on the plans.

8. Minimum sidewalk width is 4 ft.

EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE 1/2 IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE.

CURB AND GUTTER TYPE

A. Expansion joints shall be installed when grouting existing concrete or fixed structure. Expansion joint material shall be 1/2 in. thick and shall extend the full depth of contact surface.

B. Gutter cross slopes shall be 1/2 in./ft. when draining away from curb and 1/2 in./ft. when draining toward curb (with exception to immediately adjacent to curb ramps — see standard plan M-608-1 for slope requirements).

C. When tie bars are required, the gutter thickness shall be increased to the full thickness of the gutter shall be 1/2 in. spaced at 3 ft intervals. They shall be spotter 1/2 in. and 2 1/2 in. length into the gutter.

CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTION

FOR RADII A = 1/4" TO 1/2" B = 1/4" C = 1/8" D = 5/32" TO 1/2"
CURB TYPE 2
(SECTION B)
6 IN. BARRIER

CURB TYPE 2
(SECTION M)
6 IN. MOUNTABLE

CURB TYPE 4
(SECTION B)
6 IN. BARRIER

CURB TYPE 4
(SECTION M)
6 IN. MOUNTABLE

5/8" EA. 12" REINFORCING BARS AT 6 FT SPACING
SHALL BE PLACED IN SHOULDER HOLES IN EXISTING CONCRETE.
CURB MAY CONSIST OF 2 PARTS: CLEAR CURB AND 3 PART CURB.
COST OF INSTALLATION SHALL BE INCLUDED IN THE PRICE BID FOR CURB.

6" · 41/2" DIA. HOLES (6 FT SPACING)
GROUT SHALL CONSIST OF 2 PARTS SANO AND 1 PART CEMENT.
COST OF INSTALLATION SHALL BE INCLUDED IN THE PRICE BID FOR CURB.

CURB TYPE 6
(SECTION M)
4 IN. MOUNTABLE

NOTE: RETAINED BARRIER UNLESS OTHERWISE SPECIFIED ON THE PLANS.
* KEY-WAY MAY BE OMITTED WHEN PLACED UNDER GUARDRAIL.

LEGEND
FOR RADII
A=Ya
B=1"
C=W2"
D=W2"
TD 2"

TRANSITION WHEN THERE IS NO
SIDEWALK AT BACK OF CURB OR WHEN
SIDEWALK IS SET BACK FROM CURB

CURB CUT FOR DRIVEWAYS
(WITHOUT ATTACHED SIDEWALK)

TRANSVERSE CONTRACTION JOINT
FOR CONCRETE PAVEMENT (DRIVEWAYS)

SECTION A-A
CONCRETE PAVEMENT (DRIVEWAYS)

NOTE: RECOMMEND JOINT SPACING IS EVERY 8 FOOT
ALONG THE WIDTH AND LENGTH OF DRIVEWAY.
FOR DRIVEWAYS WIDER THAN 12 FEET, JOINTS
ARE REQUIRED.
DRIVEWAY WIDTH SHOWN ON PLANS

SIDEWALK WIDTH SHOWN ON PLANS

CONCRETE CURB & GUTTER

SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

NOTES

1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHALL NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.

2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.

3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.

4. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE PAVEMENT.

CURB, GUTTERS, AND SIDEWALKS

STANDARD PLAN NO. M-609-1

Standard Sheet No. 3 of 4

Issued by the Project Development Branch: July 31, 2019
NOTES

1. DRIVEWAY STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, ANOTHER RAMP AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.

2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.

3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.

CONCRETE DRIVEWAY ENTRANCE TYPE 3

SECTION A-A

SECTION B-B

CURB, GUTTERS, AND SIDEWALKS

STANDARD PLAN NO.
M-609-1

Standard Sheet No. 4 of 4
GENERAL NOTES

1. CONCRETE SHALL BE CLASS I, FRICTION May BE CAST-IN-PLACE OR PRECAST.
2. REINFORCING BARS SHALL BE #4, GRADE 60.
3. ALL Timber SHALL Be TREATED IN CONFORMANCE WITH ASSHTO M 133 AND AWPA C14.
4. WING POSTS MAY BE MADE FROM 8 IN. ROUND NATIVE TIMBER.
5. ALL STRUCTURAL STEEL SHALL Be FABRICATED AND FINISHED WITH ALUMINUM PLATING IN ACCORDANCE WITH SECTION 509. ALL HARDWARE SHALL Be GALVANIZED IN CONFORMANCE WITH ASSHTO M 90. ALL FASTENERS WITH 24-GAUGE GALEVANIZED STEEL NAILS AND WIRE TIES.
6. ALL STRUCTURAL STEEL SHALL Conform To ASSHTO M 270 GRADE 36. ALL STRUCTURAL STEEL MAY BE USED.
7. WELDING SHALL Conform To THE ASSHTO STRUCTURAL WELDING CODE AND ASSHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
8. WHEN A CATTLE GUARD IS TO BE INSTALLED IN IMPERVIOUS MATERIAL, ADEQUATE DRAINAGE SHALL BE PROVIDED TO INSURE AGAINST POSSIBLE SUBGRADE DAMAGE. DRAINAGE DETAILS SHALL Be AS SHOWN ON THE PLANS. AN OUTLET PIPE MAY Be CONSIDERED.
9. TYPE OF WING TIMBER OR STEEL SHALL Be STEEL UNLESS OTHERWISE ShOWN ON THE PLANS.
10. STRUCTURE EXCAVATION AND STRUCTURE BACKFILL WILL NOT Be Measured AND PAID FOR SEPARATELY, BUT SHALL Be INCLUDED IN THE WORK.
11. ALTERNATIVE CATTLE GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.
## Precast Cast-In-Place Use

<table>
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<tr>
<th>ROADWAY WIDTH (FT.)</th>
<th>USE GRILL UNITS (FT.)</th>
<th>PRECAST CONCRETE REINFORCED STEEL CONCRETE STEEL (CU. YD.)</th>
<th>CAST-IN-PLACE CONCRETE STEEL LENGTH (LBS.)</th>
<th>USE (LBS.)</th>
<th>TOTAL STEEL (LBS.)</th>
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<tr>
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### Foundation Quantities

**Foundation Quantities**

- **Steelwing Wing Quantities**
- **Welded Grill Units**
- **Lateral Support Section B-B**
- **Elevation of Lateral Support**
- **Foundation Elevation**
- **Precast Portable Foundation**
- **Cast-In-Place Foundation**
- **Total Steel = 106.5 lbs**

### Other Details

- **Computer File Information**
- **Sheet Revisions** Colorado Department of Transportation
- **STANDARD PLAN NO. M-611-1**
- **Standard Sheet No. 2 of 2**
- **CATTLE GUARD**
- **Issued by the Project Development Branch: July 31, 2019**
- **Project Sheet Number:**
- **CAD Ver.:** MicroStation V8 Scale: Not to Scale Units: English
GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. FOUNDATION MAY BE CAST-IN-PLACE OR PRECAST.
2. REINFORCING BARS SHALL BE #4, GRADE 60.
3. ALL TIMBER SHALL BE TREATED IN CONFORMANCE WITH ASSHTO M 133 AND AWPA C14.
4. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND PAINTED WITH ALUMINUM PAINT IN ACCORDANCE WITH SECTION 509. ALL HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH MILITARY SPECIFICATION DDD-P-21035.
5. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36.
6. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
7. OUTLET PIPES WILL BE REQUIRED AND PAID FOR AS SHOWN IN THE PLANS. A 6 INCH SLEEVE MAY BE USED THROUGH THE CENTRAL SUPPORT TO DRAIN FROM ONE CELL TO THE OTHER TO MINIMIZE THE NUMBER OF OUTLET PIPES.
8. TYPE OF WING (TIMBER OR STEEL) SHALL BE STEEL UNLESS OTHERWISE SHOWN ON THE PLANS.
9. EXPANSION JOINT MATERIAL SHALL BE USED BETWEEN THE 4 INCH CONCRETE FLOOR AND THE FOUNDATION. THIS QUANTITY WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
10. TOOLLED OR SAWCUT JOINTS WILL BE REQUIRED IN THE 4 INCH CONCRETE FLOOR AS DIRECTED.
11. HIGHWAY LOADING DESIGN DATA: HL-93 (DESIGN TRUCK OR TANDEM, AND DESIGN LANE LOAD).
12. A TREATED 2X6 MAY BE USED AT THE OPEN END OF THE DEER GUARD TO KEEP FILL MATERIAL FROM FALLING IN.
13. ALTERNATIVE DEER GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.

CAST-IN-PLACE FOUNDATION FOR 10 FT. THRU 72' ROADWAYS

DRILLING LAYOUT

MULTIPLE GRILL UNIT CONNECTION

CAST-IN-PLACE FOUNDATION FOR 10 FT. THRU 14 FT., AND 16 FT. ROADWAYS

ELEVATION VIEW

WELDED GRILL CROSS SECTIONS

SIDE VIEW

DEER GUARD

STANDARD PLAN NO. M-611-2

Standard Sheet No. 1 of 2

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:
GENERAL NOTES

1. Rumble strips shall be omitted at turn and auxiliary lanes, road approaches, residences, 250 ft before road intersections, and other interruptions as directed by the engineer.

2. Rumble strips may be installed by grinding, rolling, or forming on concrete pavement and by grinding only on HMA pavement. Rumble strip width shall be 12 in for grind-in and 18 in for formed or rolled.

3. Minimize the distance between rumble strip and edge line on concrete pavements with 14 ft wide slabs.

4. Begin rumble strips on the outside edge of the travel lane edge line.

5. Do not install rumble strips on shoulders less than 6 ft wide when guardrail is placed along the edge of the shoulder.

6. Apply the 60 ft gap pattern when rumble strips (grind-in) are installed in concrete pavement.

7. Do not install rumble strips on shoulders.

8. Apply the 60 ft gap pattern when rumble strips (grind-in) are installed in concrete pavement.

9. Apply the 60 ft gap pattern when rumble strips (grind-in) are installed in concrete pavement.

10. Apply the 60 ft gap pattern when rumble strips (grind-in) are installed in concrete pavement.

RUMBLE STRIPS
NOTES
1. RUMBLE STRIP WIDTH SHALL BE 12 in. FOR GRIND-IN, FORMED, OR ROLLED.
2. CENTERLINE RUMBLE STIPS MAY BE CONTINUOUS THROUGH PASSING ZONES AS DETERMINED BY THE ENGINEER AND SHOWN ON THE PLANS.

TYPICAL SECTIONS A-A AND B-B
FOR GRIND-IN RUMBLE STRIP
ON EXISTING ASPHALT OR CONCRETE PAVEMENT

TYPICAL SECTION B-B
FOR FORMED OR ROLLED ON CONCRETE PAVEMENT ONLY

DETAILS FOR CENTER LINE RUMBLE STRIPS
1. Grooved Rumble Strip Shear or Cluster Spacing Shall Be Modified To Avoid Locating a Shear on a Concrete Pavement Transverse Joint.

2. Permanent Travel Lane Rumble Strips Shall Be the Groove Design and May Be Cut in Existing New HMA or Concrete Pavement. The Grooves May Be Cut by Sawing, Grinding, or Other Method as Approved.

3. Temporary Rumble Strips Should Normally Be the Raised Design. They May Be Grooved if Located in a Pavement That Will Be Repaired or Covered With a Pavement Course Before Completion of the Project. Typical Uses of Temporary Rumble Strips Are for Lane Closures or Alignment Changes in Construction Zones.


5. Rumble Strip Grooves in HMA or Concrete Surface 12 Strips Per Cluster Typical.

6. Edges May Be Rounded or Tapered.

7. The Raised Groove shall be placed in a clean, tack coated, treated pavement in % in HMA forming. The forming shall be removed and the asphalt compressed by rolling along the strips. Every mortar shall be placed, troweled, and leveled with a roller and the top edges rounded. Thermostrip strips shall be applied by the extrusion process, preformed plastic shall be installed in conformance with the instructions of the manufacturer.


9. The Raised Groove shall be placed in a clean, tack coated, treated pavement in % in HMA forming. The forming shall be removed and the asphalt compressed by rolling along the strips. Every mortar shall be placed, troweled, and leveled with a roller and the top edges rounded. Thermostrip strips shall be applied by the extrusion process, preformed plastic shall be installed in conformance with the instructions of the manufacturer.
GENERAL NOTES

1. SAND SHALL BE MIXED WITH 5% SALT BY WEIGHT.

2. WHEN ARRAYS ARE PLACED ON STRUCTURES WHERE THE VIBRATIONS FROM MOVING TRAFFIC MAY CAUSE THE MODULES TO SHIFT, STEEL OR FORMED-IN-PLACE HMA HALF-RINGS MAY BE PLACED ON THE DOWNHILL SIDE OF THE MODULES TO PREVENT MOVEMENT. BOLTS MAY BE PLACED THROUGH THE BOTTOM OF THE OUTER CONTAINER INTO THE ROADWAY TO PREVENT MODULE MOVEMENT.

3. OFFSET THE ARRAY TO AVOID IMPACT TO THE REAR MODULE FROM WRONG-WAY VEHICLES.

4. ARRAYS SHALL NOT BE PLACED ON SLOPES WITH LATERAL OR HORIZONTAL GRADES OF 5% OR GREATER.

5. CURBS AND RAISED ISLANDS SHALL BE NO MORE THAN 4 IN. HIGH.

6. FOUNDATION PADS SHALL BE FLAT AND MADE OF 6 IN. THICK CONCRETE OR HMA.

7. MIXING OF DIFFERENT BRANDS OF MODULES ARE ACCEPTABLE, IF THE MODULES ARE FHWA APPROVED, AND THE ARRAY MEETS THE DESIGN CRITERIA.

8. ARRAY CONFIGURATION MAY VARY IN LAYOUT AND SAND WEIGHT (LBS) PROVIDED THEY CONFORM TO MANUFACTURER'S DETAILS.

WIDE ARRAYS ARE ACTUALLY SEVERAL NARROW ARRAYS PLACED SIDE BY SIDE TO PROVIDE THE REQUIRED WIDTH.
DESIGN SPEED 25 MPH

DESIGN SPEED 30 MPH

DESIGN SPEED 35 MPH

DESIGN SPEED 40 MPH

DESIGN SPEED 45 MPH

DESIGN SPEED 50 MPH

NOTES
1. SAND WEIGHT (LBS) IN MODULES IS DENOTED BY THE NUMBERS IN THE ARRAY DETAILS.
2. ARRAY CONFIGURATION MAY VARY IN LAYOUT AND SAND WEIGHT (LBS) PROVIDED THEY CONFORM TO MANUFACTURER'S DETAILS.

DESIGN SPEED 55 MPH

DESIGN SPEED 60 MPH

DESIGN SPEED 65 MPH

DESIGN SPEED 70 MPH

DESIGN SPEED 75 MPH

STANDARD PLAN NO. M-614-2

SAND BARREL ARRAYS

Project Development Branch

Issued by the Project Development Branch July 31, 2019

Project Sheet Number:

COOT HQ, 3rd Floor
2829 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868

Computer File Information

Creation Date: 07/22/19
Designer Initials: JBK (R-X)
Detailer Initials: LTA (R-X)

Issued by the Project Development Branch: July 31, 2019

SAND BARREL ARRAYS

Project Development Branch

Issued by the Project Development Branch July 31, 2019

Project Sheet Number:
GENERAL NOTES

1. If the embankment protector is located in the bottom of a vertical curve, flare the curb on each side of the inlet to allow for flow from both directions.

2. Details of guard rail installation are shown in Standard Plan M-606-4.

3. The end section of pipe joint for corrugated metal pipe shall be in accordance with the type 2 typical connection detailed in Standard Plan M-603-10. The type 1 or type 2 typical connections are not acceptable. As an option, the end section may be connected directly to a section of pipe, joints between the stub and pipe, or sections of pipe shall be in accordance with section 603. Connections for plastic pipe shall provide a firm direct connection similar to the type 3 plastic end sections are not allowed. All plastic pipe joints shall be as recommended by the pipe manufacturer and approved by the engineer.

4. Plastic pipe shall conform to AASHTO M294 Type C.

5. Details of bituminous curbing are shown in Standard Plan M-609-1.

6. Structure backfill material shall not be used with the embankment protector type 3. Embankment material shall be used with construction requirements in accordance with Section 203. Payment for this embankment material shall be included in the pay item for embankment protector type 3.

Payment for the quantities shown on the plans for this work shall be as follows:

506 or 507 - Pay items as specified on the plans.
603 - Curb type 4 or type 5 section M - 609-1 - Curbing, type 4 or type 6 (section M) - lineal ft.
615 - Embankment protector type 3 - Each

Note: This payment includes the end section, the trash guard (if specified on the plans), the pipe connection, the structure excavation, embankment material, and any extra work required to modify other pay items.

603 - 12 in to 18 in pipe - lineal ft.

END OF SPECIFICATIONS
GENERAL NOTES

1. If the embankment protector is located in the bottom of a sag vertical curve, flare the curb on each side of the inlet to allow for flow from both directions.

2. Details of curbing are shown in standard plan M-609-1.

3. Structure backfill material shall not be used in this work. Embankment material shall be used with construction requirements in accordance with Section 203. Embankment material will not be paid for separately, but shall be included in the pay item for embankment protector (Type 5).

4. Payment for the quantities shown on the plan for this work shall be as follows:
   - 507 - Bituminous slope and ditch paving (asphalt) ... TON
   - 507 - Concrete slope and ditch paving .... Cu. YD.
   - 609 - Curb, Type 4 or Type 6 (Section M) ...
   - 615 - Embankment protector (Type 5) ....

5. Payment for the quantities shown on the plans for this work shall be as follows:
   - 507 - Bituminous slope and ditch paving (asphalt) ... TON
   - 507 - Concrete slope and ditch paving .... Cu. YD.
   - 609 - Curb, Type 4 or Type 6 (Section M) ...
   - 615 - Embankment protector (Type 5) ....

6. No extra work is required to alter other pay items.

ENDNOTE: This payment includes the structure excavation, any other earthwork, and any extra work required to modify other pay items.
**Plan View**

- **Inlet or Outlet Flowline Elevation**
- **Slop**

**General Notes**

1. Siphon Drain, Valve, and Valve Box, and Trash Guards are to be provided only when called for on the plans.
2. Concrete shall be Class C.
3. All exposed concrete corners shall be chamfered % in.
4. The location, size, pipe material, and governing dimensions of siphons will be shown on the plans.
5. To determine wall thicknesses or class for siphon pipe, see appropriate tables on Standard Plan M-603-2.
6. Costs of joint sealers, gaskets, fittings, and connections shall be included in the bid price for siphon pipe.
7. Trash guards and appurtenances shall be galvanized in conformance with AASHTO M-111.

**Pipe Diameter Concrete Reinforced Steel**

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**Headwall Dimensions**

**Pipe Diameter**

- **12**: 1'-0" 1'-6" 2'-6"
- **18**: 1'-7" 2'-6" 3'-10"
- **24**: 2'-2" 3'-6" 5'-2"
- **30**: 2'-9" 4'-6" 6'-6"
- **36**: 3'-4" 5'-6" 7'-10"

**Concrete Base**

- **Approx. 0.3 cu. yds.**

**Trash Guard Details**

- **3/4" x 14" bolt with nut and two washers**
- **1'-3" x 2" fire sleeve pipe**

**Pipe Diameter Dimensions**

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<th>B</th>
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**Headwall Quantities**

For one headwall after deduction for pipe.
I. CLASS 1 FIELD LABORATORIES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPERED GLASS TWO TELEPHONES. TWO PRIVATE LINES (FIB) WITH TOUCH TONE TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODES SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS:

2. 26 FT. LONG x 8 FT. WIDE OUTSIDE, 7 FT. 6 IN. HEIGHT INSIDE.

3. INCLUDE FOUR BOXES EQUIPPED WITH RJ-11 JACKS (TWO WIRE PAIRS PER JACK) TWO AT EACH END OF THE TRAILER. LOCATIONS WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE TELEPHONE LINE.

4. ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS

5. FLOOR: ADEQUATE INSULATION UNDER THE FLOOR. FLOOR COVERING SHALL BE SKID RESISTANT.

6. HEATING: ONE, 8,300 BTU MINIMUM.

7. AIR CONDITIONING:

8. ELECTRICAL WORK SHALL Conform to the NATIONAL ELECTRICAL CODE FOR

9. WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR

10. VENTILATION:

11. LIGHTING:

12. STORAGE CABINETS:

13. SINK:

14. STORAGE CABINETS:

15. DRINKING WATER SUPPLY:

16. WALL SHELVING:

17. TESTING WATER SUPPLY: THE NEEDED GALLON WATER CAPACITY, VENTS, WITH ADEQUATE OF DETERMINING WATER LEVEL WITH THE PRESSURE DEVICES. SINK 30 PSI DELIVERY PRESSURE THE COLD WATER FACET WITH EACH FLOOR PREVENTED LOCATION OUTSIDE OF TRAILER WATER F NICE, LOCATED ON THE ENDS OF THE EQUIPMENT STORED AVAILABLE FROM THE COLD WATER SUPPLY BY THE CONTRACTOR USE TOTALLY WATER ONLY.

18. TELEPHONE: TWO TELEPHONES, THE PRIVATE LINES CPE WITH TYPICAL TELEPHONE!

19. SAFETY SHOE ON SIDE BElFT: AN ADJUSTABLE SHOE SUPPORT LOCATED ON THE SHOEMARKER, 6 IN. 25 IN. DIAMETER.

20. THE SHOWER SHALL BE CURVED OF A 1/2 IN. OR 3 IN. DIAMETER FOR MORE REQUIREMENTS.

21. FOOD SERVICE REQUIREMENTS.

22. FORCED AIR OVEN:

23. FORCED AIR OVEN: ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.

24. ELECTRONIC BALANCE: THE BALANCE SHALL COMPLY WITH APPENDIX 231 FOR GENERAL PURPOSES OR CLASS 2 BALANCES, AND THE FOLLOWING:

25. SECURITY: THIS SYMBOL ON THE FLOOR PLAN IDENTIFIES AREAS IN THE TRAILER WHERE THE AGENT PROTECTS AGAINST ILLEGAL ENTRY, VANDALISM AND SHOES SHALL BE PROVIDED.

26. THE REQUIREMENTS LISTED ABOVE ARE INTENDED TO MEET THE NEEDS OF THE FIELD LABORATORY. PERSONNEL CONCERNING TESTING FACILITIES. THERE IS NO OBJECT TO SPECIFY ANY STRUCTURAL, LOCATION OF WATERLINES, THE CONTRACTOR MAY SUBSTITUTE CLASS 2 FIELD LABORATORY FOR CLASS 1 FIELD LABORATORY.
1. **CLASS 2 FIELD LABORATORIES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODE SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE REQUIREMENTS FOR WORKING CONDITION, SPACE, AND SECURITY.

2. **SIEVE SHAKER**: TYPE TRAILER, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. THE SHAKER SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES AS REQUIRED.

3. **FLOOR**: A SAFETY SHIELD ON DRIVE BELT. AN ADJUSTABLE TIMED - ON/OFF SWITCH LOCATED NEAR THE SHAKER. A COLD WATER FAUCET. AN ENVIRONMENTAL EQUIPMENT OPERATING AT ONE TIME. PROVIDE A SEPARATE ELECTRICAL CIRCUIT FOR THE ELECTRICAL OR MECHANICAL TYPE.

4. **GLASS WINDOW**: EQUIPPED WITH HORIZONTAL PUSH BAR, HEAVY DUTY DOOR CLOSER, AND PULL HANDLE MOUNTED ABOVE PUSH BAR.

5. **HANDRAILS**: THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE DECK AND STEPS WITH DECK OR FROM THE FRONT OF THE TRAILER, AND STEPS SHALL MEET CAL-OCP REQUIREMENTS.

6. **H. WEIGHING SURFACE DIMENSION**: MINIMUM OF 9 IN. WIDE BY 12 IN. DEEP.

7. **I. BASE**: SHALL HAVE ADJUSTABLE LEVELING FEET AND A LEVEL VIAL ATTACHED.

8. **J. FURNACE**: 55,000 BTU, FORCED AIR TYPE.

9. **K. MICROWAVE OVEN**: ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR.

10. **L. SECURITY**: ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.

11. **M. FIRE EXTINGUISHER**: ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.

12. **N. COMPUTER FILE INFORMATION SHEET**: REVISIONS Made TO The DESIGNER INITIALS: JBK.

13. **O. DESIGNER INITIALS**: JBK.


15. **Q. SCALE**: NOT TO SCALE.

16. **R. UNITS**: ENGLISH.

17. **S. STANDARD SHEET NO.**: 1 of 2.


19. **U. DESIGNER REVISIONS**.


21. **W. PROJECT SHEET NUMBER**: J8K.

22. **X. COLORADO DEPARTMENT OF TRANSPORTATION**.

23. **Y. FIELD LABORATORY CLASS 2**.

24. **Z. THE GENERAL NOTES ARE CONTINUED ON SHEET 2.**
GENERAL NOTES (CONTINUED FROM SHEET 1)

27. FORCED AIR CONVECTION OVEN: REQUIRED ON PROJECTS WITH 5,000 OR MORE TONS OF HMA OR WHEN SPECIFIED IN THE PLANS. THE FORCED AIR OVEN REPLACES THE RANGE THE OVEN SHALL BE RATED TO AT LEAST 2000 WATTS INCLUDING:

1. AT LEAST TWO BLOWERS TO CIRCULATE AIR INSIDE WITHOUT DISTURBING FINE GRAINED SOILS PLACED IN THE OVEN.
2. A MINIMUM ENTER CAPACITY OF 4.8 CUBIC FEET.
3. AN EXHAUST CHAMBER ADAPTOR TO CONNECT TO A 3 INCH PIPE WHICH SHALL BE VENTED TO THE OUTSIDE.
4. AT LEAST TWO ADJUSTABLE SHELVES.
5. AN OVER-Temperature PROTECTION DEVICE.
6. AN ELECTRONIC CONTROL SYSTEM WITH DIGITAL TEMPERATURE REA-DOUT AND DIGITAL TEMPERATURE SET POINTS TO PRECISELY READ AND SET THE OVEN TEMPERATURE.

THE OVEN SHALL HAVE A TEMPERATURE RANGE FROM 104 °F TO 464 °F AND HAVE A UNIFORM TEMPERATURE OF ± 3 °F AT 230 °F. THE OVEN SHALL BE CAPABLE OF MAINTAINING A CONSTANT TEMPERATURE, ± 5 °F, THROUGHOUT ITS TEMPERATURE RANGE. THE OVEN HEATING ELEMENTS SHALL NOT BE ALLOWED TO OPERATE WITHOUT THE BLOWER.

THE FIELD LABORATORY SHALL BE EQUIPPED WITH A SEPARATE ELECTRICAL CIRCUIT TO SUPPLY POWER TO THE FORCED CONVECTION OVEN.

IN ADDITION TO THE ABOVE FORCED AIR CONVECTION OVEN, A HOT PLATE CONFORMING TO THE FOLLOWING SHALL BE PROVIDED:

1. TWO BURNER PORTABLE ELECTRICAL "CAL-ROD" OR "RANGETTE" TYPE.
2. AT LEAST ONE BURNER SHALL BE RATED A MINIMUM OF 800 WATTS.
3. EACH HOT PLATE SHALL BE EQUIPPED WITH AN ON-OFF INDICATOR LIGHT.

28. CURING TANK: MINIMUM 95 GALLON CAPACITY WITH A CIRCULATING PUMP WITH A 120 GPM RATING. TANK CAPACITY WILL INCREASE FOR LARGE CONCRETE PROJECTS WHEN SPECIFIED IN THE PLANS.
GENERAL NOTES

1. CLASS I FIELD OFFICES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER CONSTRUCTED TO THE UNIFORM BUILDING CODE STANDARDS. FOR FURTHER INFORMATION, SEE THE DRAWING ON THIS SHEET TO DETERMINE THE FOLLOWING REQUIREMENTS:

2. DIMENSIONS: 20 FT. LONG X 8 FT. WIDE OUTSIDE, 7 FT. 6 IN. HEIGHT INSIDE.

3. WINDOWS: A MINIMUM OF 4, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.

4. OUTSIDE DOORS: TWO, REINFORCED WITH DEADBOLT LOCKS, DECK, STEPS, AND HANDRAILS AT EACH DOOR. THE STEPS SHALL BE PLACED AT THE DECK AND STEPS WITH THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.

5. HEATING: A THERMOSTAT CONTROLLED FORCED AIR UNIT WITH A MINIMUM INPUT CAPACITY OF 200 BTU PER SQUARE FT. OF FLOOR AREA.

6. AIR CONDITIONING: ONE, 8,300 BTU MINIMUM.

7. ELECTRICAL: WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.

8. LIGHTING: ADEQUATE FLUORESCENT LIGHTING OVER ALL DRAFTING TABLES AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.

9. DESKS: FULL INSIDE WIDTH X 30 IN. HIGH, AT EACH END OF THE TRAILER, SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER PEDESTAL. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.

10. DRAFTING TABLES: ONE 26 IN. X 72 IN. HINGED BOARD WITH DOUBLE STORAGE BELOW ELITE BOARD 32 IN. DRAWERS. EACH DRAFTING TABLE SHALL BE EQUipped WITH A LIGHT FIXTURE 5' 0" MIN. (TYP.) ABOVE THE TABLE.

11. FURNITURE: FOUR CHAIRS WITH ROLLERS AND TWO DRAFTING STOOLS. EACH CHAIR OF APPROPRIATE HEIGHT. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.

12. PLAN STORAGE: A PLAN RACK FOR FULL SIZE PLANS.

13. CLOSET: A LOCATED STORAGE AREA OF 15 SF.

14. DRINKING WATER SUPPLY: DRINKING WATER SUPPLIED FROM AN ACCEPTABLE WATER COOLING DECK.

15. TELEPHONES: TWO TELEPHONES, TWO PRIVATE LINES (IFB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND A FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FACSIMILE MACHINE.

16. SECURITY: THIS SYMBOL ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE AIDS AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.
GENERAL NOTES

1. CLASS 2 FIELD OFFICE SHAL CONSIST OF A WEATHERPROOF, INSULATED, TEMPERATURE CONTROLLED TRAILER BUILT TO THE UNIFORM BUILDING CODE SERIES OF CODES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.

2. DIMENSIONS: 50 FT LONG X 12 FT WIDE OUTSIDE, 7 FT-6 IN. HEIGHT INSIDE.

3. WINDINGS: A HIDDEN WINDING FOR CROSS VENTILATION AND LOCKING.

4. DOORS: TWO PASSAGE DOORS MAY BE LOCATED AT CENTER OF FRONT AND TO CENTER OF SIDE OF TRAILER. ONE DOOR PER SIDE IS RECOMMENDED, AND MUST BE DETACHABLE. ALL DOORS AND THE DOOR SILL AT EACH SIDE DOOR SHALL BE PLACED IN SUCH A WAY THAT THE DOOR CAN BE ACCESSIBLE EITHER FROM THE INSIDE OR FROM THE FRONT. THE DOOR PANS, DOOR SILLS, AND STAIRS SHALL MEET REQUIREMENTS.

5. HEATING & AIR CONDITIONING: THREE TON CAPACITY AIR CONDITIONER AND 50,000 BTU CAPACITY HEATER, CONNECTED TO HOT AND COLD THERMOSTATIC CONTROLLED.

6. ELECTRICAL: WORK SHALL COMPLY WITH THE NATIONAL ELECTRICAL CODE FOR 3,000 VOLT, 60 HZ, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.

7. LIGHTING: ADEQUATE FLUORESCENT LIGHTING OVER ALL DRAWING TABLES AND WORK AREAS. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.

8. DRAFTING TABLE: ONE 30 IN. X 96 IN. TABLE, SLOPED 1:12 TO 37 IN. HEIGHT AT FRONT EDGE AND HAVE DEADBOLT LOCKS.

9. WORK TABLE: ONE 72 IN. X 36 IN. TABLE, THE TOP OF THE TABLE SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.

10. OFFICE DESK: ONE 72 IN. X 36 IN. DESK WITH SIX DRAWERS AND ONE CENTER PEN DRAWER. THE TOP OF THE DESK SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.

11. FURNITURE: APPROPRIATE HEIGHT. ONE WORK TABLE OR DESK. ALL CHAIRS SHALL BE WITH HANDRAIL.

12. PLAN STORAGE: A PLAN RACK OR FILE FOR FULL SIZE PLANS.

13. PLAN STORAGE: ELECTRICAL OUTLET WITH HANDRAIL.

14. CLOSET: A LOCKED STORAGE AREA OF 15 SQ. FT.

15. DRINKING WATER SUPPLY: DRINKING WATER SUPPLIED FROM AN ACCEPTABLE WATER COOLING DEVICE.

16. TELEPHONE: THREE 2-LINE TELEPHONES. FOUR PRIVATE LINES (1 FB) WITH TOUCH TONE SERVICE. TWO LINES FOR TELEPHONE SERVICES, WITH ONE LINE AT EACH END OF THE OFFICE, AND IN THE CENTER AREA OF THE OFFICE.

17. EXTINGUISHER: TWO, DRY CHEMICAL, 10 LBS. CLASS ABC, ROLL-OVER CAPABILITY FOR THE THREE TELEPHONES. ONE LINE SHALL BE USED FOR THE COMPUTER, AND ONE LINE SHALL BE USED FOR THE FACSIMILE MACHINE.

18. SECURITY: TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.
ALL MONUMENTATION MATERIALS WILL BE FURNISHED BY CDOT.

THE MONUMENT TYPE SHALL MEET THE MINIMUM STANDARDS AS DETERMINED BY THE COLORADO STATE BOARD OF REGISTRATION FOR PROFESSIONAL LAND SURVEYORS RULES (STATE BOARD RULES).

This monument shall be used for row or reference monuments or may be used for an aliquot corner monument. When used as an aliquot corner monument, installation and record filing requirements shall be as stated for type 2A monuments. Monuments shall be installed by attaching the proper side to one end of a section of finned rod, and a 3 in. x 3 in. stainless steel adapter to the other end. The rod is then placed into the stainless steel adapter before it is driven into the ground. When sufficient rock or concrete is encountered less than 3 ft. below the ground surface, the rod shall be extended to a depth of at least 6 in. in rock or concrete at least 3 ft. in diameter to accommodate the conditions.

When unstable soil conditions are encountered, additional sections of rod shall be added to achieve stability. Horizontal and vertical stability is required.

When used as an aliquot corner, installation and record filing requirements shall be as stated for type 3 and type 3A monuments.

When used as a permanent easement corner, installation and record filing requirements shall be as stated for type 3 and type 3A monuments.

When used as a row point, installation and record filing requirements shall be as stated for type 3 and type 3A monuments.

When used as a project point, installation and record filing requirements shall be as stated for type 3A monuments.

This monument may be installed in lieu of replacing the entire monument when rebar is in place at an aliquot corner location. Refer to the state board rules for placement in existing side wall, curb, or gutter. A minimum 2 in. dia. cap shall be used on 5/8 in. (No. 6) rebar.

This monument may be installed in lieu of all of the other cost monuments, when the position is located in concrete or stable rock formation.

This monument may be installed in lieu of all of the other cost monuments, when the position is located in a concrete sidewalk, curb, or gutter, or when setting a type 5 would compromise the integrity of the recording structure.

This monument may be installed in lieu of all of the other cost monuments, when the position is located in concrete or stable rock formation.

This monument may be used for permanent easements, project bench marks, project points, or references. An aluminum cap with a minimum diameter of 1 in. shall be used on 5/8 in. (No. 6) rebar.

WITNESS POSTS

The witness post will be supplied by CDOT and installation shall be included in the work. It shall be driven within 1 ft. of the monument when possible. A witness post is a metal sleeve panel of 3 in. x 3 in. x 36 in. in length, driven into the ground, the cap, or the end of the finned rod. This post shall contain 5/8 in. x 10 in. rebar. The cap of the post shall be marked with a unique identification number by the project survey coordinator. The position of the cap shall be marked on the monument when the application is a control point. A unique identification number shall be attached to the cap by the project survey coordinator. The position of the cap shall be marked on the monument when the application is a permanent control point. A unique identification number shall be attached to the cap by the project survey coordinator.

TYPE 6 ALUMINUM MONUMENT

This monument may be used for permanent benchmarks, project bench marks, project points, or references. An aluminum cap with a minimum diameter of 1 in. shall be used on 5/8 in. (No. 6) rebar.