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.
COLORADO DEPARTMENT OF TRANSPORTATION

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JULY 31, 2019

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**ACRONYMS AND ABBREVIATIONS**

- **T&B**: Top and Bottom
- **T&E**: Threatened & Endangered Species
- **T**: Tons
- **TAS**: Threaded Anchor Stud
- **TBC**: Timber Box Culvert
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- **Typ**: Typical

**STANDARD PLAN NO.**

- **M-100-2**

**Sheet Revisions**

- **ACRONYMS AND ABBREVIATIONS**

**SYMBOLS**

- **#4 REBAR BENDING SHAPE**
- **#5 REBAR BENDING SHAPE**
- **#6 REBAR BENDING SHAPE**
- **@**: and
- **&**: at
- **¥**: €
- **$: ¥**
- **@**: ©
- **§**: ©
- **OF**: ©
- **oc**: ©

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MEDIAN WIDTH LESS THAN 50 FT.

TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER
LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT

MEDIAN WIDTH GREATER THAN 50 FT.

TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER
LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT

TYPICAL SECTION FOR MEDIAN CROSS OVER
ANY REQUIRED PIPE OR INLET FOR MEDIAN DRAINAGE SHALL HAVE A TRAVERSABLE DESIGN AS SPECIFIED ON THE PLANS

TYPICAL SECTIONS FOR APPROACH (ACCESS) ROAD
NOTES: 
1. RESIDENTIAL OR AGRICULTURAL FIELD ENTRANCES - PAVE 4 FEET BACK.
2. THREE OR MORE RESIDENTIAL OR COMMERCIAL PROPERTY - PAVE 20 FEET BACK OR TO ROW LINE, whichever is less.
3. PUBLIC STREET - PAVE 50 FEET BACK OR TO ROW LINE, whichever is less.
4. IF EXISTING ACCESS IS PAVED, THEN FEATHER NEW ASPHALT OVERLAY A MINIMUM OF 2 FEET BACK AS DIRECTED BY THE ENGINEER.

VERTICAL ALIGNMENT SIDE APPROACH ROADS INTERSECTING MAIN ROADCROSS
THE SLOPE MAY BE STEEPER, IF REQUIRED, TO MEET EXISTING APPROACH ROAD SLOPE.

MEDIAN WIDTH GREATER THAN 50 FT.

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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

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<th>CUT SECTIONS PER 100 LIN. FT.</th>
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CONCRETE-LINED DITCH TYPES

- Ditch Plan View
- Section A-A: Concrete-Lined Ditch
- Section B-B: Cutoff Wall
- Section C-C: Riprap-Lined Ditch

ENDOWMENT SECTIONS

- Typical Sections for Ditches:
  - Note: See structure notes on the plans for dimensions W, D, and S.
  - Design X = W/2 with minimum of 2 ft unless otherwise shown on the plans, X = 1 ft, sl. 2:1 slope.

RIPRAP GRADATION SHALL BE AS SPECIFIED IN THE CONTRACT.

Vehicles will be required every 20 ft. or as shown on the plans.

RIPRAP EXCAVATION SHALL BE PAID FOR AS STRUCTURE EXCAVATION.

EXCAVATE DITCH SECTION AFTER ENTIRE EMBANKMENT HAS BEEN PLACED AND COMPACTED TO PROPER DENSITY.

EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.

GENERAL NOTES

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EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.
**SUPERELEVATION NOTES**

1. This standard plan shows the required rates of superelevation for various radii of curvature at different design speeds. The maximum superelevation rate of 8% or an alternative maximum rate of superelevation shall be used for divided highways, when specified on the plans.

2. Values are for design elements related to design speed and horizontal curvature for single- and double-lane divided highways.

3. Number of lanes rotated:
   - Two lanes rotated are typical for a two-lane highway.
   - Two lanes rotated are typical for a four-lane highway.

4. Spirals are recommended below the heavy line in the tables. Spirals are permissible but not recommended above the heavy line. Spiral lengths may be rounded to multiples of 50 feet for calculation convenience.

### Table Contained on Sheet 2

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- **Vd** = Assumed Design Speed
- **R** = Radius of Curve
- **ε** = Super elevation Rate
- **L** = Length of Super elevation Runout or Spiral Length
- **LN** = Travel Lane
**SUPERELEVATION DIAGRAMS FOR CROWNED HIGHWAYS**

**SUPERELEVATION NOTES**

1. This standard plan shows the recommended rate of superelevation for various radius lengths at different design speeds. The following values are based on the minimum superelevation rate for a given radius length and design speed. These values are intended to provide a starting point for superelevation calculations in the design process.

2. Values are rounded to the nearest 0.1 feet.

3. Number of lanes: The plan shows values for 2-lane and 4-lane highways.

4. Spiral lengths are recommended below the heavy line in the table, spirals are permissible but not recommended above the heavy line. Spiral lengths may be rounded to multiples of 50 feet for calculation convenience.

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<th>N (ft)</th>
<th>L (ft)</th>
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**Computer File Information**

- **Creation Date:** 07/11/19
- **Designer Initials:** JBK
- **Colorado Department of Transportation:** 2200 Broadway Place
- **CAD Version:** MicroStation V8

**Sheet Revisions**

- **M-203-11**
- **Project Sheet Number:** 2 of 3

**Project Development Branch:** JBK

**Issued by the Project Development Branch:** July 31, 2019
Diagrammatic Profile for Superelevation of Inside Lanes

Diagrammatic Profile for Superelevation of Outside Lanes

Superelevation Diagrams for Divided Highways Shoulder Pivot

Superelevation Diagrams for Divided Highway Center Pivot

Computer File Information

Sheet Revisions

Colorado Department of Transportation

STANDARD PLAN NO.

M-203-11

Project Sheet Number:

Issued by the Project Development Branch: July 31, 2019

Project Development Branch

J BK

BC

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

CAD Ver: MicroStation V8i Scaling Not to Scale Units: English

2829 West Howard Place

Designer Initials: JBK

CAD Ver: MicroStation V8i Scaling Not to Scale Units: English

2039 West Howard Place

Date: Comments

Last Modification Date: 07/31/19

Sheet No. 3 of 3

Detailer Initials: LT A

Sheet Revisions

Designer Initials: JBK

Date: Comments

Last Modification Date: 07/31/19

Sheet No. 3 of 3

Detailer Initials: LT A

Colorado Department of Transportation

STANDARD PLAN NO.

M-203-11

Project Sheet Number:

Issued by the Project Development Branch: July 31, 2019

Project Development Branch

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Colorado Department of Transportation
SUPerelevation diagrams

Vd = 15 mph Vd = 20 mph Vd = 25 mph Vd = 30 mph Vd = 35 mph Vd = 40 mph Vd = 45 mph Vd = 50 mph Vd = 55 mph Vd = 60 mph

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<th>L (FT.)</th>
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<td>e (%)</td>
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*max = 4%

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

**SUPERELEVATION NOTES**

1. The standards shown here are intended for use as a general guide. The designer should adjust the values to suit local conditions.

2. The rate of superelevation may be reduced to a maximum of 4% for urban conditions.

3. Values are for design elements related to the travel lane.

4. Where the street is a single lane, the rate of superelevation may be reduced to a maximum of 2% for urban conditions.

5. The rate of superelevation shall be limited to 4% for urban conditions.

6. The rate of superelevation may be reduced to a maximum of 2% for rural conditions.
**SUPERELEVATION GUIDELINES**

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<th>Design Speed (Vd)</th>
<th>R (FT.)</th>
<th>1 LN</th>
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<th>R (FT.)</th>
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**SUPERELEVATION DIAGRAMS**

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**SUPERELEVATION NOTES**

1. This standard plan shows the required rates of super elevation for various radius lengths at different design speeds. Each maximum rate of super elevation shall be calculated for roads when specified on the plans.
2. Rates are for design elements related to design speed and horizontal curvature for two and four lane highways.
3. Where side strips provide interest, super elevation rate may be reduced to facilitate a smooth transition of the profile shapes.
4. The line related to a typical two lane rural road is used for a standard rural road.
5. Spirals are recommended below the heavy line in the table. Spirals are recommended for travel lanes on streets. The heavy line super elevation may be reduced to materials of 3 feet for calculation convenience.
All excavation and backfill, including bedding material below this line shall be included in the bid price for the pipe above. They shall be paid for as structure excavation and embankment.

- Bedding material for rigid pipe in soil shall be 3 in. of loose structure backfill (Class 1 or 2). Bedding is not required for flexible pipe in soil.
- Bedding material for rigid or flexible pipe in rock shall be 12 in. of loose structure backfill, Class 1.

When two or more conduits are laid side-by-side, they shall be placed so that they are 

\[ \frac{1}{2} \text{ outside diameter, or } \frac{3}{2} \text{ outside span, or } 3 \text{ ft. apart whichever is less.} \]

However, if end sections are used, the minimum spacing shall be 1 ft. between end sections.

- When flow line of culvert is less than 0.5 ft. below the original ground line, embankment shall be built up to 0.5 ft. above the flow line and trench excavated to the bottom of pipe or as shown.
- In both cases, the trench excavated by the thick solid line shall then be excavated to accommodate construction of the box culvert.

**GENERAL NOTES**

1. Excavation and backfill patterns different from those indicated on these sheets will be shown elsewhere on 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 which are located in rock shall be bored out to undisturbed rock without forming in conformance with subsection 601.09(b).
4. Structural plate culverts shall be constructed as shown on the plans.
5. \( B_a \) equals the inside diameter of a pipe and \( B_e \) 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.
LIMITS OF MEASUREMENT FOR STRUCTURE EXCAVATION

**Ba** = Inside Diameter or Rise of Pipe

**Be** = Outside Diameter or Rise of Pipe

\[ \frac{0.3 \times Ba}{Be} (\text{Flexible}) \]

\[ \frac{0.3 \times Be}{Be} (\text{Rigid}) \]

**Limits of Measurement for Pipe Culverts**

- **Profile**
- **Plan**

**Structure Excavation Measurement for Pipe Culverts**

**Profile**

**Structure Excavation Limits**

- **Plan**
- **Profile**

**Structure Excavation Measurement for Concrete Box Culverts**

**Profile**

**Structure Excavation Limits**

- **Plan**
- **Profile**

**Structure Excavation Measurement for Division Boxes**

**Profile**

**Structure Excavation Limits**

- **Plan**
- **Profile**

**Legend**

- **Structure Excavation Limits**
- **Structure 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 or II backfill material.

The additional excavation and backfill shall not be measured and paid for.

**Excavation and Backfill for Structures**

**Standard Plan No.**

**Standard Sheet No.**
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 POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09(b).
3. STRUCTURE EXCAVATION FOR STRUCTURE 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 EMBEDMENT OF ABUTMENT IN STRUCTURE BACKFILL
MINIMUM BERM DIMENSION

EXCAVATION AND BACKFILL FOR BRIDGES

STANDARD PLAN NO.
M-206-2

Project Development Branch
JBJ

Issued by the Project Development Branch: July 30, 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 mixing in concrete with subsection 601.09.

3. Structure excavation for slope paving not shown.

LEGEND

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<tr>
<th>Structure Backfill, Plan-Fill</th>
<th>Structure Backfill, Class I, with Mechanical Reinforcement as shown on the plans</th>
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<tr>
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<td>On-Site Class 2 Materials Must Meet Class 1 Requirements</td>
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EXCAVATION AND BACKFILL

FOR BRIDGES

STANDARD PLAN NO.

M-206-2

Project Sheet Number: 07/31/19

Issued by the Project Development Branch: July 31, 2019
A SIGN
LIMIT OF BERM
1-PF--PF
PF--PF--PF
....
1. I
I
I
....
15 FT.
MIN.
....
....
I
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I
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4 FT.
MIN.
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I
PF
f--- 9 FT.
MIN.
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EXCAVATED AND CONTAINMENT AREA
RAMP
~3:1
TRUCK ACCESS
PLAN VIEW
TEMPORARY BERM
2:1 (TYP.)
---FENCE (PLASTIC)
....
....
....
....
....
....
....
PF
f--- 5 FT. EXCAVATED
AREA
EXISTING
GROUND
MIN.
~~N'.N. _ _l ___ 
IMPERMEABLE SYNTHETIC LINER
AS NEEDED (SEE NOTE 4)
MAXIMUM STORAGE IS
2/3 OF VOLUME AREA
SECTION A-A
NOTES:
I. A FENCE (PLASTIC) CONFORMING TO SECTION 607 SHALL BE
INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT
AT THE OPENING.
2. THE CONCRETE WASHOUT SIGN SHALL HAVE LETTERS
AT LEAST 3 INCHES HIGH AND CONFORM TO
SUBSECTION 630.02.
3. ALL MATERIALS AND LABOR TO COMPLETE THE CONCRETE WASHOUT STRUCTURE
SHALL BE INCLUDED IN THE COST OF WORK AND NOT PAID FOR SEPARATELY.
4. THE BOTTOM OF EXCAVATION SHALL BE A MINIMUM OF FIVE FEET
ABOVE GROUND WATER. IF NOT, THE BOTTOM OF EXCAVATION SHALL
BE IN ACCORDANCE WITH 208.02(j).
5. THE PAY ITEM NUMBER FOR CONCRETE WASHOUT STRUCTURE (EACH) IS 208-00045.

CONCRETE WASHOUT STRUCTURE

Vehicle Tracking Pad

ELEVATION SECTION

GEOGRID TEXTILE EROSION CONTROL (CLASS 2)

SECTION B-B
NOTES:
I. 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. STRUCTURAL PROTECTION OF THE
CURB AND GUTTER SHALL BE INCLUDED IN THE COST OF WORK
AND NOT PAID FOR SEPARATELY.
3. GEOGRID TEXTILE 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.

VEHICLE TRACKING PAD
EROSION LOG ENOS SHALL BE TIGHTLY ABUTTING.

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

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.

PLAN VIEW
TRENCH LOGS INTO GRADE 2 IN. (TYP.)

APPROX. TO EACH EL.

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

SECTION A-A
TYPICAL STAKE INSTALLATION

OVERLAP JOINING DETAIL

JOINT EROSION LOG APPLICATIONS

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

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

LINK EROSION LOG FILTER AT DROP INLET

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

EROSION LOG CULVERT INLET PROTECTION

EROSION LOG CULVERT OUTLET PROTECTION

EROSION LOG CULVERT INLET PROTECTION

EROSION LOG APPLICATIONS

COLORADO DEPARTMENT OF TRANSPORTATION
2829 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9858

Project Development Branch: July 31, 2019

TEMPORARY
EROSION CONTROL

STANDARD PLAN NO.
M-208-1

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 2 of 11
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.

4. THE MAXIMUM LENGTH OF EROSION LOGS OR SILT FENCES WITHOUT A FLARED END TURNING UP SLOPE IS 150 FEET.

5. SILT FENCE POST TOE OF SLOPE PROTECTION

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

Erosion Log Toe of Slope Protection Applications

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.

Silt Fence Toe of Slope Protection

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

SECTION B-B

Erosion Loss Pay Items

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<thead>
<tr>
<th>NUMBER</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>208-C0005</td>
<td>TYPE 1 (9 IN.)</td>
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<tr>
<td>208-C0006</td>
<td>TYPE 1 (12 IN.)</td>
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<tr>
<td>208-C0007</td>
<td>TYPE 1 (18 IN.)</td>
</tr>
<tr>
<td>208-C0008</td>
<td>TYPE 2 (8 IN.)</td>
</tr>
<tr>
<td>208-C0009</td>
<td>TYPE 2 (12 IN.)</td>
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<tr>
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<td>TYPE 3 (9 IN.)</td>
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<tr>
<td>208-C0012</td>
<td>TYPE 3 (12 IN.)</td>
</tr>
<tr>
<td>208-C0013</td>
<td>TYPE 3 (18 IN.)</td>
</tr>
</tbody>
</table>
2 FT. MIN.

AGGREGATE BAG SHALL BE PLACED TIGHTLY AGAINST CURB FACE AND SHALL BE PLACED 5 FT. MIN. UPSTREAM FROM THE INLET OPENING (TYPE)

THE TOPS OF AGGREGATE BAGS SHALL ALWAYS BE 12 IN. BELOW THE HEIGHT OF THE ADJACENT CURB

2 FT. MIN.

AGGREGATE BAG SHALL BE TIGHTLY ABUTTED WITH NO GAPS (TYPE)

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 BAG APPLICATIONS

NOTE: THE PAY ITEM NUMBER FOR AGGREGATE BAG (LF) IS 208-00035

AGGREGATE BAGS AT STORM DRAIN INLET (TYPE I)

LENGTH (L) NUMBER OF AGGREGATE BAGS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>0 - 5</td>
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</tr>
<tr>
<td>6 - 20</td>
<td>2</td>
</tr>
<tr>
<td>L &gt; 20</td>
<td>3</td>
</tr>
</tbody>
</table>

AGGREGATE BAGS AT DROP INLET

NOTE: LOCATE AGGREGATE BAGS AT THE OUTSIDE EDGE OF THE CONCRETE APRON.

SECTION A-A

AGGREGATE BAGS AT DROP INLET

NOTE: THE PAY ITEM NUMBER FOR AGGREGATE BAG (LF) IS 208-00035
STORM DRAIN INLET PROTECTION

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 84 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 TYPES

TEMPORARY EROSION CONTROL

STANDARD PLAN NO. M-208-1

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 5 of 11
EROSION LOGS
ROADWAY ELEVATION SHALL BE HIGHER THAN OVERFLOW
ANCHOR TRENCH 6 IN. X 6 IN. (SEE M-216-1 FOR DETAILS)

NOTE: POINTS "A" SHALL BE A MINIMUM 4 IN. HIGHER THAN POINT "B"

EROSION LOG INSTALLATION
1. EROSION LOGS SHALL BE EMBEDDED 2 INCHES INTO THE SOIL.
2. EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.
3. V-SHAPED TEMPORARY DITCHES SHALL NOT BE USED. DITCHES SHALL BE GRADED IN A PARABOLIC OR TRAPEZOIDAL SHAPE.

SILT BERM INSTALLATION
1. ANCHOR SOIL RETENTION BLANKET INTO TRENCH WITH 8 INCHES MIN. STAPLES PLACED AT 1 FOOT INTERVALS ALONG EDGE.
2. FILL AND COMPACT TRENCH.
3. SECTIONS OF THE SILT BERM SHALL BE OVERLAPPED WITH NO GAPS.
4. FOR SLOPE AND CHANNEL SPACING SEE THE SECTION VIEW ALONG DITCH FLOWLINE DETAIL ON SHEET 11 OF 11.
5. SOIL RETENTION BLANKET SHALL ALWAYS BE REQUIRED.
6. THE PAY ITEM NUMBER FOR SILT BERM (LF) IS 208-00004.

DRAINAGE DITCH APPLICATIONS
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 RECEIVED 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.

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 AROUND 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 FLOWLINE SHALL ALWAYS BE LOCATED A MINIMUM 10 FEET FROM THE OUTSIDE LIMITS OF DISTURBED AREA BOUNDARY.
5. DIVERSION 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.

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.
4. PERPENDICULAR DISCHARGE TO A CHANNEL SHALL NOT BE ACCEPTABLE.
5. THE GRADE AROUND THE INLET TO THE PIPE SHALL BE COMPACTED.
6. 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.
4. THE SILT FENCE SHALL BE PLACED ON THE CONTOUR AT THE SAME ELEVATION ±6 IN.
   THE ENDS SHALL BE FLARED UP SLOPE (MINIMUM ELEVATION GAIN OF 18 IN.)

GEOTEXTILE FABRIC

POST "A"

END 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 WOODEN POST ONE FULL TURN, THEN SECURED ALONG THE POST WITH WIRE TIES (MINIMUM 3 PER POST)
   WIRE TIES ARE ATTACHED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.
2. POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.

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 WOODEN POST ONE FULL TURN, THEN SECURED ALONG THE POST WITH WIRE TIES (MINIMUM 3 PER POST)
   WIRE TIES ARE ATTACHED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.

SILT FENCE APPLICATIONS

SILT FENCE (REINFORCED)

ATTACH SILT FENCE FABRIC TO PANEL WITH WIRE TIE DR OF 11 IN. UV STABLE NYLON CABLE TIES (TYP.)

END SECTION DETAIL

COMMENTS

SILT FENCE APPLICATIONS

TEMPORARY EROSION CONTROL

SILT FENCE (REINFORCED)

Temporary Erosion Control

Issued by the Project Development Branch: July 31, 2019

SILT FENCE APPLICATIONS

SILT FENCE (REINFORCED)
NOTES
1. THE MAXIMUM DRAINAGE AREA IS 5 ACRES.
2. THE MAXIMUM STRUCTURE LIFE IS 2 YEARS.
3. THE STORAGE AREA IS 1800 CUBIC FEET PER ACRE.
4. THE MAXIMUM EMBANKMENT HEIGHT SHALL BE 5 FT.
5. THE LENGTH/WIDTH RATIO MAY BE ADJUSTED TO MEET SITE CONDITIONS WHEN APPROVED BY THE ENGINEER.
6. WIDTH OF SEDIMENT TRAP IS APPROPRIATELY EQUA TO THE WEIR LENGTH (X).
7. SEDIMENT TRAP DESIGN SHALL BE APPROVED BY THE ENGINEER.
8. THE DOWN GRADE FROM WEIR SHALL BE STABLE AND NON-ERODIBLE.
9. THE PAY ITEM NUMBER FOR SEDIMENT TRAP (LF) IS 208-0033.

WEIR LENGTH TABLE

<table>
<thead>
<tr>
<th>DRAINAGE AREA (ACRES)</th>
<th>WEIR LENGTH (FEET)</th>
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<td>4</td>
<td>10</td>
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</tbody>
</table>

SEDAENT TRAP
STEP 1. EXCAVATE THE TRENCH.

1. EROSION BALE APPLICATIONS

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

3. EROSION BALES SHALL BE ENTRENCHED 4 IN. MINIMUM 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.

NOTES

- EROSION BALES TO BE PLACED INTO FULL PIPE.
- WEDGE STAKE CERTIFIED WEED FREE STRAW BETWEEN EROSION BALES.
- WEDGE LOG FILTER AT DROP INLET.

EROSION BALE TRENCHING AND STAKING

SECTION B-B

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

EROSION LOG FILTER AT DROP INLET

STANDARD PLAN NO. M-208-1

TEMPORARY EROSION CONTROL

Issued by the Project Development Branch: July 31, 2019

5th Floor
2019 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch: JBK

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Date: 07/31/19
Designer Initials: JBK
Last Modifier Name: 07/31/19
Examiner Initials: LTA

Sheet Revisions

Date: Comments

Colorado Department of Transportation

CAD Ver: Microstation V8. Scale: Not to Scale Metric: English

1st Floor
2019 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch: JBK
NOTE: ALL MATERIALS AND LABOR TO COMPLETE THE ROCK CHECK DAM SHALL BE INCLUDED IN THE COST OF WORK.

ROCK CHECK DAM
GENERAL NOTES

1. When a mailbox turnout is required, the necessary pay quantities will be shown on the plans.
2. A single mailbox shall be reset at the final designated location. A new type 1 support shall be used if the mailbox is not mounted on a cantilever support. A new type 2 support shall be used if the mailbox is mounted on a cantilever support. A new type 3 support shall be used if the mailbox is mounted on a multiple support.
3. When the engineer determines that the existing mailbox cannot be reused, a new metal mailbox of similar size shall be supplied and erected by the contractor. The new mailbox structure shall be in accordance with the engineering approval.
4. The address information that appeared on the original mailbox shall be placed on the front face of the replacement mailbox. The height shall be 42 in. to 48 in. above the ground.
5. On roads with curb and gutter, the mailbox support shall be located in the ground so the front of the mailbox shall be 8 in. to 12 in. back from the curb face. The height shall be 42 in. to 48 in. above the ground.
6. Existing dimensions of angles, platform and shelf brackets, bolt holes, nuts, and multiple mailbox support components may vary from those shown in the diagram so that all components will fit together properly.
7. Plastic newspaper receptacles may be remounted below the mailbox on the support. Plastic newspaper receptacles shall be mounted in their intended orientation using a provided bracket and hardware or other mounting system approved by the engineer. The cost of supply shall be paid for in accordance with subsection 109.04(b).
8. On roads with curb and gutter, the mailbox support shall be located in the ground so the front of the mailbox shall be 8 in. to 12 in. back from the curb face. The height shall be 42 in. to 48 in. above the ground.
9. On roads with curb and gutter, the mailbox support shall be located in the ground so the front of the mailbox shall be 8 in. to 12 in. back from the curb face. The height shall be 42 in. to 48 in. above the ground.
10. On roads with curb and gutter, the mailbox support shall be located in the ground so the front of the mailbox shall be 8 in. to 12 in. back from the curb face. The height shall be 42 in. to 48 in. above the ground.
11. The ground surrounding the mailbox supports shall be firm, undisturbed ground or well compacted backfill.
12. Proprietary mailbox support systems listed on the portions of the approved products list will be accepted as equivalent alternatives.
**MULTIPLE (TYPE 3) MAILBOX SUPPORT FOR 3, 4, OR 5 MAILBOXES OR APPROVED EQUAL**

- Five size single boxes shown.
- * INCREASE LENGTH 3 FT. PER EACH ADDITIONAL SINGLE OR DOUBLE MAILBOX SUPPORT PLUS AN ADDITIONAL 5 FT. FOR EACH MULTIPLE MAILBOX SUPPORT (2 MULTIPLE AND 1 DOUBLE ARE 15 FT).

**MAILBOX TURNOUT**

- Measure mounting height from edge of paved shoulder in accordance with Mailbox Support Spacing.
- Minimum 6" of earth fill (grading as shown on plans) may be placed with sledge hammer and minimum of 4" of HMA class 6 or flatter.

**SIDE TYPICAL SECTION**

- Measure in accordance with No. 2 Mailbox Support Spacing.
- Minimum 6" of earth fill (grading as shown on plans) may be placed with sledge hammer and minimum of 4" of HMA class 6 or flatter.

**CANTILEVER (TYPE 4) MAILBOX SUPPORT**

- May be placed with shoulder overlay. 13" long Whiteside Newspaper Receptacles.

**MAILBOX SUPPORTS**

- Standard Sheet No. 2 of 2

**STANDARD PLAN NO. M-210-1**

- Issued by the Project Development Branch July 31, 2019

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**MAILBOX TURNOUT**

- Note size mounted, note size for mounting plastic, newspaper receptacles.

**SUPPORT SPACING**

- Measure in accordance with No. 2 Mailbox Support Spacing.
- Minimum 6" of earth fill (grading as shown on plans) may be placed with sledge hammer and minimum of 4" of HMA class 6 or flatter.
SOIL FILLED TRM APPLICATION

1. Place 3" topsoil or soil amended with soil conditioners.
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 conditioners 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 1).

CONSECUTIVE ROLL OVERLAP

To be used whenever one roll of blanket ends and another begins with upstream blanket placed on top of the blanket on the downstream side.

SIDE SEAM OVERLAP

To be used for overlap when 2 widths of blanket are applied side by side with the uphill blanket placed on top of the blanket on the downhill side.

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

IN ACCORDANCE WITH SECTION 216.
**SOIL RETENTION COVERING**

**STANDARD PLAN NO. M-216-1**

**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 1.

**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 shall be used for retention as specified in Section 216.

**Soil Anchors Pattern for Slope Application**
- 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).
- Consecutive Roll Overlap:
  - To be used whenever one roll of blanket ends end another begins with the downhill blanket placed on top of the blanket on the downhill side.

**Load Bearing Plate**
Tendon

**EARTH ANCHOR**

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

**NOTES:**
1. Earth anchors will be used instead of staples when specified in the plans.
2. Earth anchors shall be used for retention as specified in Section 216.

**CONSECUTIVE ROLL OVERLAP**
- To be used whenever one roll of blanket ends and another begins with the downhill blanket placed on top of the blanket on the downhill side.

**SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) SLOPE APPLICATION**
- Install soil retention blanket class 1.

**CONSTRUCTION OF SOIL COVER**
- Prior to covering compacted soil with blanket:
  - Apply seed and any required soil conditioners prior to covering compacted soil with blanket.

**TERMINATION OF CHANNEL**
- STAPLE 12" O.C.

**STAPLE CHECK**
- To be used when one staple runs into a receiving water and cannot be extended 3 feet before slope.

**Project Development Branch**
- Designer Initials: JBK
- Last Modification Date: 07/31/19
- CAD Ver.: MicroStation V7

**Colorado Department of Transportation**
- Project Sheet Number: 2 of 2

**Computer File Information**
- Creation Date: 07/31/19
- Designer Initials: JBK
- CAD Ver.: MicroStation V7
- Scale: Not to Scale; Views: Detailed

**Computer File Information**
- Last Modification Date: 07/31/19
- CAD Ver.: MicroStation V7
- Scale: Not to Scale; Views: Detailed

**Project Development Branch**
- Designer Initials: JBK
- Last Modification Date: 07/31/19
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 (1) LONGITUDINAL CONSTRUCTION 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. 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 WIDE SLABS, THE 2 FT. OR 4 FT. 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 LANES MAY BE USED IF APPROVED.

9. WHERE © JOINTS ARE SHOWN IN THE SHOULDER, THE DOWEL BARS WILL BE PLACED ON 12" CENTERS STARTING 6" FROM THE ROADWAY © JOINT.
RAMP "A" DOWEL BAR DETAIL FOR C JOINT WITH A 12 FT. LANE

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

MULTI-LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS

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

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE AND HAVE A MAXIMUM SPACING OF 13 FT. (15 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 Y1/2 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 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 INLET BOXOUT DETAIL ON SHEET 5.

7. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT A JOINT.

8. THE ENGINEERS SHALL HAVE AN OPTION TO USE INDIVIDUAL DOWELS IN THE JOINT ON SHORT RUN (2' ± 6") TO CURB RADIUS RETURNS.

9. JOINT IS NOT REQUIRED IF CURB AND GUTTER IS Poured MONOLITHICALLY WITH ADJACENT LANE.

10. PERMISSIBLE ALTERNATIVE JOINTS WITH SMALL RADII < 16'手里.
NOTES

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LINE MARKINGS WHEN 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 1/2 IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS

4. THE CONTRACTOR SHALL USE A BOND BREAKER AT INLETS, MANHOLE AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVES 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

CONCRETE PAVEMENT JOINTS

Issued by the Project Development Branch: July 31, 2019
NOTE

1. PAVEMENT THICKNESS (T) SHALL BE AS SHOWN ON THE PLANS.

<table>
<thead>
<tr>
<th>PAVEMENT THICKNESS (T)</th>
<th>DOWEL BAR DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &lt; 2 IN.</td>
<td>1/4 IN.</td>
</tr>
<tr>
<td>2 IN. &lt; T &lt; 4 IN.</td>
<td>3/16 IN.</td>
</tr>
<tr>
<td>T &lt; 8 IN.</td>
<td>1/8 IN.</td>
</tr>
<tr>
<td>T &lt; 10 IN.</td>
<td>5/32 IN.</td>
</tr>
<tr>
<td>T &gt; 10 IN.</td>
<td>3/16 IN.</td>
</tr>
</tbody>
</table>

REINFORCING SIZE TABLE

The bar size is No. 5 when pavement is placed on unbound bases.
The bar is No. 6 when pavement is placed on live treated soil, asphalt or cement treated, milled asphalt, or recycled asphalt bases.

INLET OR MANHOLE
CAST IN PAVEMENT

SECTION A-A

SECTIONS B-B

BOND BREAKER SHALL BE COMPOSED OF PLASTIC SHEET, BUILDING PAPER OR OTHER APPROVED MATERIAL THAT PREVENTS BONDING.

SECTION 8-8

INLET OR MANHOLE
4:1 TAPER TO MEET APRON

INLET OR MANHOLE
BOND BREAKER INLET BOXOUT

CONCRETE
PAVEMENT JOINTS

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-412-1
Standard Sheet No. 5 of 5
## General Notes

1. PIPE OR PIPE-ARCH WITH ENDS CUT TO FIT A SLOPE AND FILL HEIGHTS GREATER THAN MAXIMUM ALLOWED IN THE FILL "PIPE-ARCH DESIGN IS BASED ON CORNER BEARING PRESSURE "

2. BOLTS SHALL BE PLACED LOOSE TO ALIGN PLATES, THEN TIGHTENED TO MAINTAIN STRUCTURE SHAPE.

3. V - PIPE ARCH WITH EQUILIBRIUM PRESSURES FOR FILL OVER 15 FT. SHALL BE SPECIFIED ON THE PLANS AND COMPLIANCE WITH SECTION 449 IS REQUIRED.

### Table I - 6 in. x 2 in. Corrugations

<table>
<thead>
<tr>
<th>PIPE SIZE (IN.)</th>
<th>MIN. COVER WALL THICKNESS (IN.)</th>
<th>MAX. COVER WALL THICKNESS (IN.)</th>
<th>SPAN (IN.)</th>
<th>RISE (IN.)</th>
<th>MIN. COVER WALL RADII (IN.)</th>
<th>MAX. COVER WALL RADII (IN.)</th>
<th>HEIGHT OF COVER H (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.109</td>
<td>0.138</td>
<td>4 1/2</td>
<td>30</td>
<td>0.150</td>
<td>0.175</td>
<td>0.200</td>
</tr>
</tbody>
</table>

### Table II - 6 in. x 2 in. Corrugations

<table>
<thead>
<tr>
<th>PIPE SIZE (IN.)</th>
<th>MIN. COVER WALL THICKNESS (IN.)</th>
<th>MAX. COVER WALL THICKNESS (IN.)</th>
<th>SPAN (IN.)</th>
<th>RISE (IN.)</th>
<th>MIN. COVER WALL RADII (IN.)</th>
<th>MAX. COVER WALL RADII (IN.)</th>
<th>HEIGHT OF COVER H (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.100</td>
<td>0.125</td>
<td>4 1/2</td>
<td>30</td>
<td>0.150</td>
<td>0.175</td>
<td>0.200</td>
</tr>
</tbody>
</table>

### Table III - 9 in. x 2 1/2 in. Corrugations

<table>
<thead>
<tr>
<th>PIPE SIZE (IN.)</th>
<th>MIN. COVER WALL THICKNESS (IN.)</th>
<th>MAX. COVER WALL THICKNESS (IN.)</th>
<th>SPAN (IN.)</th>
<th>RISE (IN.)</th>
<th>MIN. COVER WALL RADII (IN.)</th>
<th>MAX. COVER WALL RADII (IN.)</th>
<th>HEIGHT OF COVER H (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>0.150</td>
<td>0.175</td>
<td>7 1/2</td>
<td>45</td>
<td>0.200</td>
<td>0.225</td>
<td>0.250</td>
</tr>
</tbody>
</table>

### Table IV - 9 in. x 2 1/2 in. Corrugations

<table>
<thead>
<tr>
<th>PIPE SIZE (IN.)</th>
<th>MIN. COVER WALL THICKNESS (IN.)</th>
<th>MAX. COVER WALL THICKNESS (IN.)</th>
<th>SPAN (IN.)</th>
<th>RISE (IN.)</th>
<th>MIN. COVER WALL RADII (IN.)</th>
<th>MAX. COVER WALL RADII (IN.)</th>
<th>HEIGHT OF COVER H (FT.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>0.150</td>
<td>0.175</td>
<td>7 1/2</td>
<td>45</td>
<td>0.200</td>
<td>0.225</td>
<td>0.250</td>
</tr>
</tbody>
</table>
GENERAL NOTES
1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT). FILL HEIGHT IS 2'-0".
2. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
5. THE CONTRACTOR SHALL INSTALL AND ENCLOSE THE GUARDRAIL WHEN REQUIRED.
6. ALTERNATE CONSTRUCTION JOINTS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
7. ALL REINFORCING STEEL SHALL BE GRADE 60.

REINFORCING PLAN

SECTION A-A

SECTION B-B

SECTION C-C

HEADWALL CORNER REINFORCEMENT DETAIL

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL CAN BE USED FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE CULVERT OR FOR CONSTRUCTION JOINTS INSTALLED ALONG THE CULVERT.

STAGE 1

STAGE 2

NOT TO SCALE

BEFORE USING THIS DETAIL, PROJECT DEVELOPMENT BRANCH M-601-1, SHEET 20, ORDER FROM THE JBL SHEET 20.

NOT AT SCALE

ADD CLIPS TO EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE DESIGN BUT EXCLUDED FROM THE RATING AS PER THE AASHTO LRFD MANUAL FOR SPECIFIC EVALUATION.

LOADING DATA: 
- LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK, AND NRL
- DEAD LOAD - TYPE 7 BARRIER
- WEARING SURFACE - 12 INCHES THICK CONCRETE PAVEMENT
- THRUST IS NOT CONSIDERED - ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE CULVERT ONLY.

NOTE: THIS DETAIL CAN BE USED FOR CONSTRUCTION JOINTS INSTALLED ALONG THE CULVERT.
### SINGLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

#### HEADWALL AND TOEWALL QUANTITIES

<table>
<thead>
<tr>
<th>Class</th>
<th>Headwall Type</th>
<th>Width (ft)</th>
<th>Height (ft)</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### NOTES

1. Six inch spacing at each end of the span for a distance of 1/4 of the span length is six inch spacing everywhere.

2. Quantities are given for one headwall and one toewall and are based on per linear foot of headwall. Steel quantities include all reinforcing quantities, and 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 toewall details, see V-401-1, sheet 1 of 2.

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

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

7. When a grate of less than 6 ft is required, use the bars in the slab. All reinforcing bars in the grate should be epoxy coated for the 6 ft grate.

8. For size and spacing of the bottom mat bars in the top slab, see Table 1-1.4 of V-401-1, sheet 1 of 2. The number of bars required is listed on this sheet and includes all bars from the table.

9. Live load is neglected as per ASHTO LRFD Section 5.8.1.2. For these structures, refer to the load rating manual.

10. For all new culvert designs, a rating is required. The rating quantity sheet should be prepared from the load external website and submitted to the bridge rating unit or included as part of a larger design package for additional information, see the load rating manual.
GENERAL NOTES
1. ALL CONCRETE SHALL BE CLASS D (BOX CUL VERT) .

2. ALL CONSTRUCTION JOINTS SHALL BE TIGHTLY CLOSED BEFORE CONCRETE IS PLACED.

3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED AS SHOWN ON THE PLANS.

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-200-1.

6. ANY HOE CUTTING LESS THAN 3 FT. IN DIAMETER, A RECONSTRUCTION INVESTIGATION AND REPORT ARE REQUIRED.

7. BACKFILL NOT BELOW CENTRAL TOP SLAB WAS INCLUDED DESIGN STRENGTH.

8. SPACIAL QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT REQUIRED.

9. REINFORCING STEEL MUST BE OF ASTM A 36 OR AASHTO M-169 STEEL.

10. THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.

11. THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH THE AASHTO MANUAL FOR BRIDGE EVALUATION.

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 TOP OF PAVEMENT.

15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 1/2".

16. FOR FILL HEIGHTS LESS THAN 2 FT, THE D1 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

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

18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

DEAD LOAD = TYPE 7 BARRIER.

WEARING SURFACE - 12 IN. THICK CONCRETE PAVEMENT.

LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK AND NRR.

DEAD LOAD CASE: VERTICAL EARTH LOAD = 120 LBS./CU. FT.

HORIZONTAL EARTH LOAD = 30 LBS./CU. FT.

HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.

EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.

HEADWALL CORNER REINFORCING DETAIL
NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE EDGE OF THE BOX ONLY. THE CONSTRUCTION JOINTS INSTALL AND DETAIL JOINTS ARE NOT TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE CONSTRUCTION. REINFORCING BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION
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## Double Concrete Box Culvert Dimensions, Quantities & Rating Factors (Excluding Headwall & Toe Wall Quantities)

### Dimensions

<table>
<thead>
<tr>
<th>Box Size</th>
<th>Length</th>
<th>Height</th>
<th>Width</th>
<th>Flange</th>
<th>Width</th>
<th>Height</th>
<th>Depth</th>
<th>Quantity</th>
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### Quantities

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Description</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
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### Notes

1. **NOTES**
   - **1.** For design, see W-90-2, Sheet 2 of 2.
   - **2.** For design, see W-90-2, Sheet 2 of 2.
   - **3.** For design, see W-90-2, Sheet 2 of 2.
   - **4.** For design, see W-90-2, Sheet 2 of 2.
   - **5.** For design, see W-90-2, Sheet 2 of 2.
   - **6.** For design, see W-90-2, Sheet 2 of 2.
   - **7.** For design, see W-90-2, Sheet 2 of 2.
   - **8.** For design, see W-90-2, Sheet 2 of 2.
   - **9.** For design, see W-90-2, Sheet 2 of 2.
   - **10.** For design, see W-90-2, Sheet 2 of 2.

### Designer Initials

Designer Initials: JBE CR-X l CDOT HQ, 3rd Floor

CAD Ver.: MicroStation V8, Scale: Not to Scale, Units: English CR-X l

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**Headwall and Toe Wall Quantities**

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

### Concrete Quantity

- **Concrete Quantity:** 0.086 CY/FT
GENERAL NOTES
1. ALL CONCRETE SHALL BE CLASS D (BOX CUL VERT).
2. SEE TABLE FOR BOTTOM MAT.
3. CONCRETE BOX CULVERT ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. FOR ANY CULVERT 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:
   - #4: 1'-0" (TYP.)
   - #6: 1'-0" (TYP.)
   - #8: 1'-0" (TYP.)
   - #10: 1'-0" (TYP.)
   - #12: 1'-0" (TYP.)
   - #14: 1'-0" (TYP.)
   - #16: 1'-0" (TYP.)
   - #18: 1'-0" (TYP.)
   - #20: 1'-0" (TYP.)
7. THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:
   - #4: 1'-0" (TYP.)
   - #6: 1'-0" (TYP.)
   - #8: 1'-0" (TYP.)
   - #10: 1'-0" (TYP.)
8. THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.
9. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
10. FOR ALL CONCRETE BOX CULVERT DETAILS, SEE M-603-3.
11. ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
12. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A 36 OR AASHTO M320.
13. EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.
14. EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDOT DRAINAGE MANUAL.
15. HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL CONFORM TO STANDARD PLAN M-606-1, SHEET 19.
16. POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
17. POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT GUARDRAILS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
18. POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M320.
19. POST ANCHORS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT WILL BE INCLUDED IN THE WORK.
20. POST ANCHORS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT WILL BE INCLUDED IN THE WORK.
21. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
22. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
23. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
24. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
25. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
26. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
27. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
28. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
29. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
30. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
31. EXCEPT AS SPECIFIED IN THE PLANS, THE CONTRACTOR SHALL INSTALL TEMPORARY LIVE LOADS TO SUPPORT CONSTRUCTION JOINTS.
### TRIPLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>Dimensions</th>
<th>Quantities</th>
<th>Rating Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>4</td>
<td>1</td>
<td>0.96 Cu/lf</td>
</tr>
</tbody>
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### HEADWALL AND TOEWALL QUANTITIES

<table>
<thead>
<tr>
<th>HEADWALL</th>
<th>QUANTITY</th>
</tr>
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<tbody>
<tr>
<td>90°</td>
<td></td>
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<tr>
<td>74°</td>
<td></td>
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<tr>
<td>58°</td>
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<table>
<thead>
<tr>
<th>HEADWALL</th>
<th>SIZES</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td></td>
</tr>
</tbody>
</table>

### NOTES
1. 311 inch spacing at each end of the span for a distance of 1/4 of the span length is 311 inch 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. Splayed headwalls are not recommended for these spans. A special design is required.
4. For headwall and toe wall details see M-601-1, SHEET 1 OF 2.
5. Head the fill details are less than or equal to 1 ft, all reinforcing bars in the headwall are placed horizontally and the top of the top slab shall be epoxy coated.
6. Reinforcing quantities include both body/capenter and ungauged bars.
7. When a recess of less than 8 ft is required, use the bar sizes and the slab and may be modified for the 8 ft size of available on the table.
8. For site and spacing of the bottom slab bars in the toe wall see Table on M-601-1, SHEET 2. All other bars are bars at 5/8 spacing. The number of bars required is listed on this sheet and includes both 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 CDOT rating manual.
10. For all new culvert designs a rating is required. The rating summary sheet should be included with the contract documents and submitted to the CDOT for review.

### TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

#### STANDARD PLAN NO.
- M-601-3
- Standard Sheet No. 2 of 2
**GENERAL NOTES**

1. CONCRETE SHALL BE CLASS B.
2. HEADWALL SHALL BE PERPENDICULAR TO THE PIPE unless otherwise shown in the plans. All related dimensions and quantities must be adjusted for skewed installations.
3. FOR ADDITIONAL DETAILS, SEE STANDARD PLAN M-601-10.
4. VARIOUS DEPARTMENTS OF PIPE SHOWN EXCEPT FROM STEEL AND CONCRETE.
5. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED.
6. ALL REINFORCING BARS SHALL HAVE A 2"

**QUANTITIES**

<table>
<thead>
<tr>
<th>EQUIV.</th>
<th>RISE</th>
<th>HEAD</th>
<th>FT-3</th>
<th>IN.</th>
<th>FT-3</th>
<th>IN.</th>
<th>FT-3</th>
<th>IN.</th>
<th>CONCRETE</th>
<th>STEEL</th>
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<td>108</td>
<td>150</td>
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<td></td>
<td>112</td>
<td>128</td>
<td>15-8</td>
<td>75</td>
<td>22-10</td>
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<td>75</td>
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<td>1.004</td>
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<tr>
<td></td>
<td>103</td>
<td>128</td>
<td>15-4</td>
<td>75</td>
<td>22-10</td>
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<td>1.000</td>
<td>1.004</td>
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<tr>
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<td>128</td>
<td>15-2</td>
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<td>1.004</td>
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<td>128</td>
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<td>15-0</td>
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<td>1.000</td>
<td>1.004</td>
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<td></td>
<td>93</td>
<td>128</td>
<td>15-0</td>
<td>75</td>
<td>22-10</td>
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<td></td>
<td>1.000</td>
<td>1.004</td>
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</tbody>
</table>

**HEADWALL FOR PIPES**

**STANDARD PLAN NO.**

M-601-10

**Standard Sheet No.**

1 of 1

**Issued by the Project Development Branch:**

July 31, 2010

**Project Sheet Number:**

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**NOTES:**

1. Concrete shall be Class B above.
2. Exposed concrete corners shall be chamfered 3" clr.
3. A precast headwall is used, a flexible pipe, and pipe-arch shall be shown are typical for all walls on this sheet.
4. Reinforcement clearances shown are typical for all walls on this sheet.
5. This area is approximately 250 ft.

**GENERAL NOTES:**

1. Concrete shall be Class B above.
2. Exposed concrete corners shall be chamfered 3" clr.
3. If a precast headwall is used, a flexible pipe, and pipe-arch shall be shown are typical for all walls on this sheet.
4. Reinforcement clearances shown are typical for all walls on this sheet.

**REINFORCEMENT CLEARANCES**

1. Concrete shall be Class B above.
2. Exposed concrete corners shall be chamfered 3" clr.
3. If a precast headwall is used, a flexible pipe, and pipe-arch shall be shown are typical for all walls on this sheet.

**HEADWALL FOR METAL PIPE ARCH (MPA)**

- Flexible pipe and pipe-arch shall be used only with flexible pipe, both round and arch.

**TYPE "S" SADDLE HEADWALLS FOR PIPE**

- Flexible pipe and pipe-arch shall be used only with flexible pipe, both round and arch.
**SINGLE PIPE**

**DOUBLE PIPE**

### CONCRETE HEADWALL INSTALLATIONS

SEE STANDARD PLAN M-601-10 FOR REINFORCING DETAILS.

| PIPE TYPE | MATERIAL | PIPE DIAMETER (IN.) | SINGLE PIPE | DOUBLE PIPE | SINGLE PIPE | DOUBLE PIPE | SINGLE PIPE | DOUBLE PIPE | SINGLE PIPE | DOUBLE PIPE |
|-----------|----------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| CIRCULAR  | Rigid    | 18                  | 0.9         | 1.3         | 1.5         | 2.0         | 2.0         | 2.7         | 2.6         | 2.6         | 3.6         |
|           | Flexible | 11                  | 0.9         | 1.2         | 1.2         | 2.2         | 2.0         | 3.0         | 3.5         | 3.4         | 4.6         |
| ELLIPTICAL| Rigid    | 23 x 14             | 0.9         | 1.1         | 1.3         | 1.7         | 2.0         | 1.3         | 2.1         | 2.3         | 3.0         |
| ARCH      | Metal    | 22 x 13             | 0.9         | 1.1         | 1.1         | 1.6         | 2.0         | 1.5         | 1.5         | 2.0         | 2.2         |

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

| THICKNESS | MATERIAL | PIPE DIAMETER (IN.) | SINGLE PIPE | DOUBLE PIPE | SINGLE PIPE | DOUBLE PIPE | SINGLE PIPE | DOUBLE PIPE | SINGLE PIPE | DOUBLE PIPE |
|-----------|----------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 4"        | Concrete | 0.4                 | 0.8         | 1.2         | 2.0         | 2.6         | 2.6         | 4.7         | 4.7         | 7.0         | 9.0         |
| 6"        | Riprap   | 3.0                 | 3.5         | 5.4         | 7.8         | 10.7        | 15.0        |

**PIPE 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 CENTERED IN THE ROCK AND NOT PULLED IN ACCORDANCE WITH INSTRUCTION 506.05.09.
4. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¼ IN.
5. HEADWALL SHALL HAVE REINFORCING STEEL INSTALLED IN A PATTERN SIMILAR TO STANDARD PLAN M-601-10.
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.

**HEMWALLS AND PIPE OUTLET PAVING**

**STANDARD PLAN NO.**

M-601-12

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

**Project Sheet Number:**

1 of 1
### Reinforcing Steel Quantity Includes Stem and Footing Quantities, but Does Not Include the Wall Quantities.

<table>
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<tr>
<th>L, MULTIPLE OF ft</th>
<th>1.0 ft</th>
<th>2.0 ft</th>
<th>3.0 ft</th>
<th>4.0 ft</th>
<th>5.0 ft</th>
<th>6.0 ft</th>
<th>7.0 ft</th>
<th>8.0 ft</th>
<th>9.0 ft</th>
<th>10.0 ft</th>
<th>11.0 ft</th>
<th>12.0 ft</th>
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<tbody>
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<td>3.00 m</td>
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<tr>
<td>3.50 m</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Example:**

1. **Reinforcement Length in Multiple of ft:**
   \[ L = \frac{V_{max}}{V_{min}} \]
   \[ V_{max} = 11.8 \text{ ft} \]
   \[ L = \frac{11.8}{2.12} = 5.58 \text{ ft} \]

2. **Round to Nearest Whole Number for ft and \( k = 6.3 \text{ ft} \):**
   \[ L = 5.6 \text{ ft} \]
   \[ k = 6.3 \text{ ft} \]

3. **Determine \( \pi \) and \( \ell \):**
   \[ \pi = 3.14 \]
   \[ \ell = 6.3 \text{ ft} \]

4. **Determine reinforcing steel quantity of wall (y):**

   **SOLUTION:**

   - **Example:**
     - \( 11.8 \text{ ft} \)
     - \( 6.3 \text{ ft} \)

   **Apply Concrete Sealer and Wingwall Drain Details**

   **Notes:**
   - The geosynthetic will be secured to the wall to prevent movement during backfilling.
   - 2% of reinforcing steel and concrete sealer should be included in the work.
**INSTALLATION OF METAL PIPE**

**GENERAL NOTES**

1. STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M36.
2. ALUMINIZED STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M39.
3. PIPE SHALL BE PLACED WITH LONGITUDINAL SEAMS AT THE SIDES OR QUARTER POINTS BUT NOT ALONG TOP OF VERTICAL AXIS.
4. STRUCTURAL PLATE PIPES OF EQUAL OR GREATER DIAMETER THAT CONFORM TO SECTION 510 MAY BE SUBSTITUTED FOR THE PIPES ON THESE SHEETS AT THE CONTRACTOR'S EXPENSE.
5. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE BOTTOM OF THE POST MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE.
6. WHEN INSTALLING A SIGN POST DIRECTLY ABOVE A PIPE, THE BOTTOM OF THE POST MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE.
7. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE BOTTOM OF THE POST MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE.
8. PIPE COVER GREATER THAN 90 FT. SHALL REQUIRE AN INVESTIGATION OF THE FOUNDATION MATERIAL.

**MINIMUM COVER FOR CONSTRUCTION LOADS**

- **H**: THE MAXIMUM ALLOWABLE HEIGHTS OF FILL OVER THE TOP OF THE PIPE, EXCLUDING PAVER THICKNESS, ARE SHOWN IN THE TABLES OF THIS STANDARD.
- **MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT/HMA OR PCCP.**
- **MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE SUBGRADE FOR CONSTRUCTION LOADS.**

**MINIMUM COVER ONLY FOR INDICATED AXLE LOADS, pipe**

<table>
<thead>
<tr>
<th>Pipe Span</th>
<th>12.0 - 24.0</th>
<th>24.0 - 36.0</th>
<th>36.0 - 48.0</th>
<th>48.0 - 60.0</th>
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<tbody>
<tr>
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<td>Aluminum</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Galvanized</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>

**CONVERSION FROM MINIMAL GAUGE TO THICKNESS**

<table>
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<th>GAUGE NO.</th>
<th>10</th>
<th>14</th>
<th>18</th>
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<th>24</th>
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<tr>
<td>ALUMINUM THICKNESS - IN.</td>
<td>0.060</td>
<td>0.075</td>
<td>0.095</td>
<td>0.125</td>
<td>0.150</td>
</tr>
<tr>
<td>ALLUMINIZED OR GALVANIZED STEEL THICKNESS - IN.</td>
<td>0.064</td>
<td>0.079</td>
<td>0.099</td>
<td>0.138</td>
<td>0.168</td>
</tr>
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</table>

**MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR \( \frac{\sqrt{2}}{2} \) D, WHICHERVER IS GREATER, BUT NOT TO EXCEED 36".
### Table of Corrugated Steel Pipe Specifications

**Corrugated Steel Pipe**

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>Minimum Cover (in)</th>
<th>Maximum Cover (ft)</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>0</td>
<td>0.25</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0.40</td>
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<tr>
<td>12</td>
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<td>0.55</td>
</tr>
<tr>
<td>14</td>
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</tr>
<tr>
<td>16</td>
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### Corrugated Steel Pipe Arch

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

### Additional Notes
- GALVANIZED CORRUGATED STEEL PIPE (CSP)
- ALUMINIZED 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)

### Notation
- 2-1/8" X 1/4" CORRUGATIONS
- 2-1/2" X 1/4" CORRUGATIONS
- 3/3 X 1/2" CORRUGATIONS
- 3" X 1/2" CORRUGATIONS
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 (AL T2 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>GAGE</th>
<th>MINIMUM COVER (IN.)</th>
<th>H MAXIMUM COVER (FT.)</th>
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</thead>
<tbody>
<tr>
<td>16</td>
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<td>8</td>
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<table>
<thead>
<tr>
<th>SPAN ROUND</th>
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<tr>
<td>H X MINIMUM</td>
</tr>
<tr>
<td>PIPE</td>
</tr>
<tr>
<td>X MAXIMUM</td>
</tr>
<tr>
<td>H GAGE</td>
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<table>
<thead>
<tr>
<th>DIAMETER (IN.)</th>
<th>GAGE</th>
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<th>H MAXIMUM COVER (FT.)</th>
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<td>12</td>
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<table>
<thead>
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<tbody>
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<tr>
<td>PIPE</td>
</tr>
<tr>
<td>X MAXIMUM</td>
</tr>
<tr>
<td>H GAGE</td>
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</table>

5" X 1" CORRUGATIONS
CORRUGATED STEEL PIPE ARCH

<table>
<thead>
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<th>DIAMETER (IN.)</th>
<th>GAGE</th>
<th>MINIMUM COVER (IN.)</th>
<th>H MAXIMUM COVER (FT.)</th>
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</table>

3/4" X 7/8" CORRUGATIONS
CORRUGATED STEEL 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. 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)

### Diameter (IN.)

<table>
<thead>
<tr>
<th>Diameter (IN.)</th>
<th>H MINIMUM COVER (IN.)</th>
<th>H PIPE GAGE</th>
<th>H PIPE GAGE</th>
<th>H MAXIMUM COVER (FT.)</th>
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</table>
GENERAL NOTES

1. Fill heights greater than maximum allowed in the Heights of Fill table on this sheet require special design of structure.
2. Fire design is based on safety factor of 1.33 on ultimate strength.
3. The heights of fill over top of pipe are based on unit weight of soil at 1000 D 1350 D 2000 D 3000 D 4000 D

<table>
<thead>
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<th>CLASS</th>
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<td>V</td>
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<td>VI</td>
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</tbody>
</table>

- Class CIR II: Maximum fill height is 10 ft.
- Class CIR III: Maximum fill height is 20 ft.
- Class CIR IV: Maximum fill height is 30 ft.
- Class CIR V: Maximum fill height is 40 ft.
- Class CIR VI: Maximum fill height is 50 ft.

4. Pipe class is determined from 0.01 in. crack load.
5. Selecting Class II or III from concrete pipe design manual requires special consideration.
6. Reinforcement material for rigid pipe to be used shall be in accordance with AASHTO M170.
7. The height of fill over top of pipe is based on unit weight of soil at 1000 D 1350 D 2000 D 3000 D 4000 D

8. Changes in design factors require compensating changes in pipe design.
9. When a pipe is to be extended, the same pipe material and size as in the original pipe installation shall be used.

NONREINFORCED CONCRETE PIPE

1. At the option of the contractor, nonreinforced concrete pipe conforming to AASHTO M86 may be used in lieu of reinforced concrete pipe for all sizes 36 inches in diameter and smaller. The nonreinforced concrete pipe shall be in accordance with AASHTO M170. The contractor shall provide written certification of conformance. The wall thickness of the nonreinforced pipe may be increased as required to meet D-load requirements.
2. All requirements for reinforced concrete pipe, except those referring to reinforcement, shall apply to nonreinforced concrete pipe.

<table>
<thead>
<tr>
<th>Dimensions for Reinforced Concrete Pipe</th>
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<td><strong>Pipe Size</strong></td>
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Construction Minimum Cover for Rigid Pipe

<table>
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<th>Type of Pipe</th>
<th>Minimum Cover</th>
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<td>CIRCULAR</td>
<td>10 in.</td>
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<tr>
<td>HORIZONTAL</td>
<td>6 in.</td>
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Allowable Range of Heights for Fill Over Reinforced Concrete Pipe

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<th>Type of Pipe</th>
<th>Allowable Range</th>
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<tr>
<td>HORIZONTAL</td>
<td>6 in.</td>
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REINFORCED CONCRETE PIPE

STANDARD PLAN NO. M-603-2

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

GENERAL NOTES

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

<table>
<thead>
<tr>
<th>Type of Cover</th>
<th>Min. Cover</th>
<th>ASTM Equivalent</th>
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<tbody>
<tr>
<td>2 ft. or more</td>
<td>2 ft.</td>
<td>M 205: Table 2</td>
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<td>Less than 2 ft</td>
<td>0 ft.</td>
<td>M 273: Table 2</td>
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<td>(AS), Table 2</td>
<td></td>
<td>(C), Table 2</td>
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<tr>
<td>Preformed Joint Material</td>
<td>2 in. or 2 1/2 in.</td>
<td>C 1433, Table 2</td>
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<td>C 1433, Table 2</td>
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THE SPECIFICATIONS LISTED ABOVE SHOW REINFORCING PLACEMENT, EARTH COVER AND OTHER DETAILS NEEDED TO MANUFACTURE THE BOX CULVERT.

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

3. BEDDING ALTERNATIVE 1 OR 2 IS REQUIRED. BEDDING ALTERNATIVE 1 CONSISTS OF 6 IN. OF AGGREGATE BASE COURSE (CLASS 6) COMPACTED TO NOT LESS THAN 95% MAXIMUM DENSITY DETERMINED IN ACCORDANCE WITH AASHTO T 180.

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

5. CLASS I DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS WHICH DO NOT HAVE RUBBER GASKETS. THE GEOTEXTILE SHALL EXTEND A MINIMUM OF 1 FT. ON EACH SIDE OF JOINTS AND SHALL OVERLAP AND BE SECURELY ATTACHED FOR AT LEAST 1 FT. AT ITS ENDS.

6. PRECAST CONCRETE BOX AS SHOWN. 1'-0" BEDDING ALTERNATIVE 1 OR 2 CONSISTS OF AN 3 IN. THICK, MINIMUM, LEAN CONCRETE. AGGREGATE GRADATION FOR ALTERNATIVE 2 BEDDING:

- PASSING 2 IN. SIEVE 100%
- PASSING NO. 4 SIEVE 20% TO 70%
- PASSING NO. 200 SIEVE 5% TO 15%

EXCAVATION & BACKFILL

EXCAVATION & BACKFILL

OUTLINE

TYPICAL joints

CORNERS

TYPICAL CULVERT INSTALLATION

SEGMENT LENGTH SHALL BE SPECIFIED BY MANUFACTURER

VASCULARITY

THE CONTRACTIONS HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577.LICENSED ENGINEER'S DRAWING

FOR INFORMATION ONLY, PRIOR TO FABRICATION.

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

5. CLASS I DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS WHICH DO NOT HAVE RUBBER GASKETS. THE GEOTEXTILE SHALL EXTEND A MINIMUM OF 1 FT. ON EACH SIDE OF JOINTS AND SHALL OVERLAP AND BE SECURELY ATTACHED FOR AT LEAST 1 FT. AT ITS ENDS.

6. PRECAST CONCRETE BOX AS SHOWN. 1'-0" BEDDING ALTERNATIVE 1 OR 2 CONSISTS OF AN 3 IN. THICK, MINIMUM, LEAN CONCRETE. AGGREGATE GRADATION FOR ALTERNATIVE 2 BEDDING:

- PASSING 2 IN. SIEVE 100%
- PASSING NO. 4 SIEVE 20% TO 70%
- PASSING NO. 200 SIEVE 5% TO 15%

EXCAVATION & BACKFILL

EXCAVATION & BACKFILL

OUTLINE

TYPICAL joints

CORNERS

TYPICAL CULVERT INSTALLATION

SEGMENT LENGTH SHALL BE SPECIFIED BY MANUFACTURER

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- PASSING 2 IN. SIEVE 100%
- PASSING NO. 4 SIEVE 20% TO 70%
- PASSING NO. 200 SIEVE 5% TO 15%
### 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 M294 for polyethylene and AASHTO M330 for polypropylene, pipe and polyethylene pipe respectively, with smooth inner linears.

2. 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 drill into the soil.

3. Structure backfill material shall be class 1.

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 drill into the soil.

### Minimum and Maximum Cover

<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>
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<tr>
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**NOTE:** The values for polypropylene pipes (AASHTO M530) are shown in parentheses.

### Construction Minimum Cover for Pipe

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter (in.)</th>
<th>Minimum Cover (ft.) for Indicated Axle Loads (Kips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-50.0</td>
<td>18-100.0</td>
</tr>
<tr>
<td>50.0-75.0</td>
<td>50.0-150.0</td>
</tr>
<tr>
<td>75.0-100.0</td>
<td>75.0-200.0</td>
</tr>
</tbody>
</table>

### Installation of Multiple Pipes

- **Installation of Multiple Pipes:**
  - Trench width shall be based on loose structure backfill.
  - Minimum cover shall be based on dual axle loads up to 50,000 pounds.

### Table: Pipelines with End Sections vs. Without End Sections

<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>
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<td>2</td>
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</tbody>
</table>

**NOTE:** The values for polypropylene pipes (AASHTO M330) are shown in parentheses.

### Table: Nominal Pipe Diameter vs. Minimum Cover

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter (in.)</th>
<th>Minimum Cover (ft.) for Indicated Axle Loads (Kips)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-50.0</td>
<td>18-100.0</td>
</tr>
<tr>
<td>50.0-75.0</td>
<td>50.0-150.0</td>
</tr>
<tr>
<td>75.0-100.0</td>
<td>75.0-200.0</td>
</tr>
</tbody>
</table>

### Notes

- The values for polypropylene pipes (AASHTO M330) are shown in parentheses.
**LEGEND**

- **H** = Maximum allowable height of cover over the top of the pipe, excluding pavement thickness.

**FILL HEIGHTS**

- Fill heights are based on AASHTO M304 Polyvinyl Chloride (PVC) pipe with outer, ribbed wall and smooth inner wall, and on AASHTO T180 minimum relative compaction of 95% or 90%.

- Fill heights, for installation with high water table, require a special design. The maximum height in high water locations should be 15 feet or based on AASHTO LRFD design specifications.

- The minimum cover shall be as shown on these tables or conform to AASHTO requirements, whichever is greater.

- The minimum cover for pipe is measured from the top of the pipe to the bottom of the pavement: HMA or PCCP.

- The minimum cover is measured from the top of the pipe to the top of the subgrade during construction.

- The minimum cover is based on dual axle loads up to 50,000 pounds.

**EMBANKMENT OR SUITABLE MATERIAL**

- Structure backfill material shall be Class 1.

- 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.

**GENERAL NOTES**

1. All pipes shall meet the requirements of AASHTO M44 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 pipes meeting AASHTO T180 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. Minimum 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.

7. 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.

**INSTALLATION OF PIPE**

- Metal for section.

- Use the H that is greater for maximum allowable fill height.

**PIPE WITH END SECTIONS**

<table>
<thead>
<tr>
<th>PIPEDIAMETER, d (IN.)</th>
<th>H MINIMUM HEIGHT OF COVER (FT.)</th>
<th>H MAXIMUM HEIGHT OF COVER (FT. 90% COMPACTION</th>
<th>H MAXIMUM HEIGHT OF COVER (FT. 90% COMPACTION)</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>26</td>
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<td>56</td>
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</tbody>
</table>

**MINIMUM AND MAXIMUM COVER**

**INSTALLATION OF MULTIPLE PIPES**

- Trench width assures stable backfill side wall.

**CONSTRUCTION MINIMUM COVER FOR PIPE**

**AASHTO MINIMUM COVER FOR CONSTRUCTION LOADS**

- AASHTO minimum cover for construction loads.
LEGEND

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

FULL HEIGHTS AND DESIGN ASSUMPTIONS ARE BASED ON AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, SECTION 12.7.

FULL HEIGHTS ARE BASED ON AASHTO MP 20, TYPE S PIPES WITH RIBBED REINFORCED STEEL WALLS.

FULL HEIGHTS FOR INSTALLATION WITH HIGH WATER TABLE REQUIRE A SPECIAL DESIGN.

THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER.

THE MINIMUM COVER IS BASED ON DUAL AXLE LOADS UP TO 50,000 POUNDS.

CHILDREN'S NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

GENERAL NOTES

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO MP 20 FOR STEEL REINFORCED, POLYETHYLENE, TYPE S RIBBED PIPE WITH SMOOTH INNER SURFACE.

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.

 Pipes

<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>
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<tbody>
<tr>
<td>30</td>
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</tr>
<tr>
<td>60</td>
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</table>

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

MINIMUM AND MAXIMUM COVER

CONSTRUCTION MINIMUM COVER FOR PIPE

STEEL REINFORCED POLYETHYLENE RIBBED PIPE (AASHTO MP 20)

STANDARD PLAN NO. M-503-6

Standard Sheet No. 1 of 1

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

1. END SECTIONS MAY VARY SLIGHTLY FROM THOSE SHOWN ON THE TABLES DUE TO DIFFERENT MANUFACTURER'S CONFIGURATIONS.

2. DESIGN LENGTH OF PIPE OR SIDE DRAIN IS BASED ON LENGTH OF END SECTION SHOWN IN TABLE. ANY ADDITIONAL PIPE REQUIRED TO PROVIDE THE DESIGN LENGTH SHALL BE FURNISHED BY THE CONTRACTOR AT NO COST TO THE PROJECT.

3. PIPE END SECTIONS FOR CMP ARCH PIPE SHALL MATCH THE DIMENSIONS OF THE PIPE SHOWN ON THE PLANS.

4. PIPE END SECTIONS FOR REINFORCED CONCRETE CIRCULAR PIPE SHALL BE APPROVED BY THE ENGINEER.

5. CONCRETE JOINT FASTENERS, WHERE SHOWN ON PLANS, SHALL BE INSTALLED SO THAT A MINIMUM OF 15 INCHES IS REQUIRED.

6. END SECTIONS FOR REINFORCED CONCRETE MUST BE APPROVED BY THE ENGINEER.

7. GALVANIZED STEEL SHALL CONFORM TO AASHTO M218 OR M232.

8. THE END SECTION STYLE, EITHER REGULAR OR SAFETY, SHALL BE AS SHOWN ON THE PLANS.

9. CONCRETE END SECTIONS MAY BE MADE WITH SYNTHETIC FIBERS INSTEAD OF STEEL FOR PIPES 36 INCHES IN DIAMETER AND SMALLER AND CONFORM TO AASHTO M86 AND SUBSECTION 601.03.

10. THE END SECTION STYLE, EITHER REGULAR OR SAFETY, SHALL BE AS SHOWN ON THE PLANS.

11. AT THE OPTION OF THE CONTRACTOR AND APPROVAL OF THE CIVIL ENGINEER, REINFORCED CONCRETE END SECTIONS MAY BE MADE WITH SYNTHETIC FIBERS INSTEAD OF STEEL FOR PIPES 36 INCHES IN DIAMETER AND SMALLER AND CONFORM TO AASHTO M86 AND SUBSECTION 601.03.

**PIPING CHART DIMENSIONS**

<table>
<thead>
<tr>
<th>PIPE DIA</th>
<th>THICKNESS</th>
<th>A</th>
<th>B</th>
<th>H</th>
<th>L</th>
<th>W</th>
<th>T</th>
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</tbody>
</table>

**END SECTIONS AND CONNECTION DETAILS FOR ROUND AND ARCH METAL PIPES**

**CONNECTING PIPE**

- **PIPE ID**: 12, 21, 25, 29, 33, 35, 40, 42, 48, 54, 60
- **THICKNESS**: 0.064
- **A**: 6
- **B**: 6
- **H**: 6
- **L**: 6
- **T**: 6

**ELEVATIONS**

- **SPN-1**: 18
- **RISE**: 0.064
- **MAX**: 8
- **MIN**: 6
- **T**: 3

**PLAN VIEW**

- **REINFORCED CONCRETE CIRCULAR PIPE**

**SECTION X-X END VIEW**

- **STEEL END SECTION FOR CONCRETE CIRCULAR PIPE**
  - **HOLE FOR TOE PLATE**: 12 INCHES
  - **HOLE SPACING**: 12 INCHES

**CONCRETE AND METAL END SECTIONS**

**STANDARD PLAN NO.**

- **M-603-10**

**Sheet Revisions**

- **Computer File Information**

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

**Project Sheet Number**

- **CAD Ver.: MicroStation VB**
- **Scale: Not to Scale**
- **Units: English**
1. Use end sections on 1V:4H to 1V:6H slopes DNLY. Use toeplate (see Section A-A)

2. Fabricate safety and longitudinal bars from steel pipe conforming to ASTM A53 Schedule 40 Specifications.

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 and longitudinal bars are not required on 30 inches or smaller cross drainage end sections.

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

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

CONNECTOR DETAILS

Note sizes: type 1 attach to pipe with type 1 straps. All other sizes attach with type 2 rods and lugs.

Metal End Sections for Round Pipe Culvert

Metal End Sections for Pipe Arch Culvert

Metal End Sections for Metal End Sections

TRAVERSABLE END SECTIONS

SAFETY BAR DETAILS

STANDARD PLAN NO. M-603-12

Issued by the Project Development Branch July 31, 2019

Project Sheet Number: 1 of 3
INSTALLATION TYPES

Grate bars shall be perpendicular to direction of traffic flow.

TYPE 1
- STRAIGHT CULVERT

TYPE 2
- SKEWED CULVERT

TYPE 3
- FLARED CULVERT

TYPE 4
- FLARED-SKEWED CULVERT

INSTALLATION PLAN

SECTION A-A
- TOP VIEW
- SIDE VIEW

SECTION B-B
- DETAIL "AA"

SECTION C-C
- DETAIL "BB"

TRAVERSABLE END SECTIONS AND SAFETY GRATES

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 A522.
3. Designed for use on terrains xx slightly with a clear radius for efficient drainage. Otherwise, a prefabricated option on steep terrains with higher traffic volumes.
4. Minimum schedule of pipe shall be 40 pipe schedule for all exposed pipe, 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 in inches min to 10 inches max from side of embankment to center of bracket, or from center to center of bracket.
7. The cross bar diameter shall be equal to or greater than the grate bar diameter.
8. If more than 20 feet than a midspan support shall be required. See sheets 3 and 4.
9. Drill holes using equipment designed to cut through concrete and reinforcing steel.
10. A 1/4 inch hole, lock nut, and washer. All holes are to be 1/4 inch in diameter.
11. Bend plates or strips without cracking material.
12. Shown thickness equals the difference in radii of the grate bar and cross bar.
NOTES

1. LENGTH OF SPAN 120 FEET MAXIMUM
2. ALL HOLE BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

CASE 1
SEE NOTE 8, SHEET 2

CASE 2

SECTION D-D

DETAIL "C"

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

SECTION D-D

DETAIL "D"

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

SECTION D-D

DETAIL "D"

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

SECTION D-D

DETAIL "D"

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

SECTION D-D

DETAIL "D"

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

SECTION D-D

DETAIL "D"

NOTES

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SECTION D-D

DETAIL "D"

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SECTION D-D

DETAIL "D"

NOTES

1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GRADED IN PLACE WITH A NONSHRIKING OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.
Inlet with Ditch Paving

Steel Grate Quantities

<table>
<thead>
<tr>
<th>Description</th>
<th>Length (ft)</th>
<th>Width (in)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; x 7.7&quot; Beam</td>
<td>36</td>
<td>11</td>
<td>106</td>
</tr>
<tr>
<td>36&quot; Flange</td>
<td>24</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>36&quot; Flange</td>
<td>48</td>
<td>3</td>
<td>144</td>
</tr>
<tr>
<td>36&quot; Flange</td>
<td>72</td>
<td>3</td>
<td>216</td>
</tr>
</tbody>
</table>

General Notes:
1. Inlet type C is not HD-20 rated and shall not be placed in paved roadways. This inlet shall be used only in unpaved roadways.
2. Concrete shall be Class B. Inlet may be cast-in-place of precast.
3. Reinforcing bars shall be Grade 40, hot-dip galvanized, and conform to AASHTO M 199.
4. Concrete deck and ditch paving shall be made in accordance with Section 10.3.2.1.1. Concrete slope paving shall be made in accordance with Section 10.3.2.1.1.
5. Structural steel for grates and grate installation hardware shall be galvanized, and shall be in accordance with Standard 727-2.
6. The standard grate grates shall be used on all Type C Inlets unless closer mesh inlet grates are specified on the plans.
7. Close mesh grates are recommended where foot traffic or bicycle routes are in close proximity to grate. This grate is not considered to be bicycle friendly and shall not be placed directly in sidewalks, crosswalks, or bike paths.
8. Steps shall be provided when inlet dimension "H" is equal to or greater than 3 feet - 6 inches and shall conform to AASHTO M 199.
10. All grates shall have a 4% grade metal washers with a 4" table to ease movement on the inlet. The washers shall be a 4" x 6" washer available from the manufacturer.

Bar List for H = 2 ft - 6 in.

<table>
<thead>
<tr>
<th>Section</th>
<th>Detail</th>
<th>Description</th>
<th>Length (in)</th>
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<td>Washer</td>
<td>4&quot; x 6&quot;</td>
<td>48</td>
<td>12</td>
<td>3</td>
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<tr>
<td>11'-6&quot;</td>
<td>Washer</td>
<td>4&quot; x 6&quot;</td>
<td>48</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>12'-0&quot;</td>
<td>Washer</td>
<td>4&quot; x 6&quot;</td>
<td>48</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

AlTERNATE SLOT AND HOLD DOWN PLATE DETAIL

Inlet Connected to a Skewed Cross Pipe

Inlet Connected to a Cross Pipe

Inlet on Grade (Flow from One Direction)

Inlet Connected to a Skewed Cross Pipe

Standard Inlet Grate

Close Mesh Inlet Grate

Quantities for One Inlet

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Length (ft)</th>
<th>Width (in)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete Grate</td>
<td>48</td>
<td>7.7</td>
<td>106</td>
</tr>
<tr>
<td>2</td>
<td>Steel Grate</td>
<td>24</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>Steel Grate</td>
<td>48</td>
<td>3</td>
<td>144</td>
</tr>
<tr>
<td>4</td>
<td>Steel Grate</td>
<td>72</td>
<td>3</td>
<td>216</td>
</tr>
</tbody>
</table>

Medallion

QuanTITIES for ONE InLET

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Length (ft)</th>
<th>Width (in)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete Grate</td>
<td>48</td>
<td>7.7</td>
<td>106</td>
</tr>
<tr>
<td>2</td>
<td>Steel Grate</td>
<td>24</td>
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<tr>
<td>3</td>
<td>Steel Grate</td>
<td>48</td>
<td>3</td>
<td>144</td>
</tr>
<tr>
<td>4</td>
<td>Steel Grate</td>
<td>72</td>
<td>3</td>
<td>216</td>
</tr>
</tbody>
</table>
GENERAL NOTES
1. 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 TYPED 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 M-199.

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 AND HOLD DOWN 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.

STANDARD PLAN NO. M-604-11
Standard Sheet No. 1 of 1
Issued by the Project Development Branch: July 31, 2019

INLET, TYPED

CREATION DATE: 07/31/19
DATE: 07/31/19
LAST MODIFICATION DATE: 07/31/19
DESIGNER INITIALS: JBK
DETAILER INITIALS: LAT
DESIGNER: JBK
DETAILER: LAT
PROJECT DEVELOPMENT BRANCH: JBK
CREATION DATE: 07/31/19
DATE: 07/31/19
LAST MODIFICATION DATE: 07/31/19
DESIGNER INITIALS: JBK
DETAILER INITIALS: LAT
DESIGNER: JBK
DETAILER: LAT
PROJECT DEVELOPMENT BRANCH: JBK

INLET, TYPE D

ALTERNATE SLOT AND HOLD DOWN PLATE DETAIL

TRANSVERSE CROSS SECTION

LONGITUDINAL CROSS SECTION

LEVEL GRATE INSTALLATION

SLOPING GRATE INSTALLATION

CLOSE MESH GRATE

TWO STEEL GRATE PER INLET QUANTITIES

Computer File Information
Sheet Revisions
Colorado Department of Transportation
1900 West Howard Place
CGT No. 3rd Floor
Englewood, CO 80110
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch: JBK
Issued by the Project Development Branch: July 31, 2019

INLET, TYPE D

QUANTITIES FOR ONE INLET

NOTE: ALL MATERIALS ARE FOR THE ENTIRE INLET STRUCTURE EXCEPT FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.
A 10'-0" FOR LENGTH (L) 10 FT. OR MORE, PROVIDE MAINTENANCE ACCESS AT BOTH ENDS WITH AN ACCESSIBLE HAMMER KING AND COVER. CLEAR REINFORCEMENT BAR ACCURATELY.

* STATION POINT AT MIDPOINT OF INLET ALONG FLOWLINE

* TRANSITION CURB

* CURB INLET TYPE P

* FOR A 1'-0" PAN SLOPE 2" PER FT.

* WHEN A TYPE P INLET IS USED WITH MOUNTABLE CURB AND GUTTER, 5 FT. TRANSITION SHALL BE CONSTRUCTED. TRANSITION SHALL BE PAIRED FOR ALL CURB AND GUTTER.

* TRANSITION CURB FACE

* CURB AND GUTTER TRANSITION CURB

* STANDARD PLAN NO. M-604-12

* END VIEW

* NOTE: MANHOLE RING AND COVER, STATION POINT AND OUTFLOW PIPE SHALL BE LOCATED AT THE SAME END OF THE INLET.
GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLETS MAY BE CAST-IN-PLACE OR PRECAST.
2. CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 INCHES THICK.
3. INLET STEPS SHALL BE IN CONFORMANCE WITH AASHTO M 199.
4. CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING.
5. REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 INCH MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED.
6. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
7. ALL MANHOLE COVERS SHALL BE CAST WITH A "NO DUMPING DRAINS TO STREAM" HAVE A NON-SLIP PATTERN.
8. STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.

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

<table>
<thead>
<tr>
<th>NO.</th>
<th>LENGTH</th>
<th>BAR</th>
<th>REGULAR</th>
<th>DROP BOX</th>
<th>L = 5 FT</th>
<th>L = 10 FT</th>
<th>L = 15 FT</th>
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<td>12</td>
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</tbody>
</table>

NOTES:
1. VARIABLE REFER TO TABLE TWO.
2. INCLUDE #4, 18 IN. BARS (SEE CHANNEL LAYOUT) . REGULAR INLETS DROP BOX INLETS
3. FOR L=5 FT, L=10 FT, AND L=15 FT.
4. STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL CHANNEL.

TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"

<table>
<thead>
<tr>
<th>NO.</th>
<th>LENGTH</th>
<th>BAR</th>
<th>REGULAR</th>
<th>DROP BOX</th>
<th>L = 5 FT</th>
<th>L = 10 FT</th>
<th>L = 15 FT</th>
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<td>409</td>
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<td>412</td>
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<td>4</td>
<td>12</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

BARS AND QUANTITIES VARIABLE WITH 11 H 11 BAR BENDING DIAGRAMS

ELEVATION VIEW
MANHOLE COVER (TYP.)

PLAN VIEW
CHANNEl LAYOUT DETAILS
SEE CURB FACE ACCORDANCE ON SHEET 2

ELEVATION VIEW
MANHOLE RING (TYP.)

PLAN VIEW
BAR BENDING DIAGRAMS ~ (DIMENSIONS ARE OUT-TO-OUT OF BAR)
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" OF A INCH.
4. REINFORCING BARS SHALL BE DESIGNED AND SHALL HAVE 2 " MINIMUM CLEARANCE. ALL RENEFRACING BARS SHALL BE GRADE 60 STEEL AND BE DEFORMED.
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 IN ACCORDANCE WITH SUBSECTION 712.06.
7. STATION POINT IS AT THE CENTER OF THE INLET.

PLAN VIEW
TYPE 13 INLET FOR GUTTER TYPE 2

SECTION A-A
B = 3/4" FOR H up to 3' 0"

SECTION B-B
B = 1 1/2" FOR ALL H

BENDING DIAGRAMS
ALL DIMENSIONS ARE OUT-OF-PLANE

SECTION C-C

SECTION D-D

SECTION E-F
APPROXIMATE WEIGHT = 600 LB

SECTION F-F

CONCRETE INLET
TYPE 13

BAR LIST FOR H = 3 FT-0 IN
2. The precast flat top may be used on any manhole. The eccentric cone may be used when the manhole "H" height (min.) is at least 8 ft.

3. The manhole ring frame shall be set in a bed of concrete. The frame shall be surrounded with a concrete insert in unlined area, or a concrete collar in paved areas (see details on sheets 2 and 3).

4. Design of box base is based on straight runs of pipe or change in direction of less than 45°. Special design is required for 45° or greater.

5. Precast manholes and reinforcement shall conform to AASHTO M-199 (ASTM C 478).

6. Cast-in-place manholes shall be Class B concrete.

7. Steps shall be required when the manhole depth exceeds 3" (openings).

8. All reinforcing steel shall be Grade 60 and epoxy coated.

9. All pipe entries into the base of manhole shall be Class B concrete - cubic yards - total.

10. Flow channels and invert shall be formed by shaping through pipe and invert shall match the roadway profile and cross slope.

11. Stub-outs shall extend 2'-0" into the manhole and be satisfactorily plugged.

12. The slope of the manhole cover shall match the roadway profile and cross slope.

NOTE: Quantities are based on one lateral. One entrance to and exit from each lateral is considered. See details on sheets 2 and 3.
FLEXIBLE JOINT SEAL SHALL CONFORM TO AASHTO M198 (TYP.) CLASS B CONCRETE BASE

TOE POCKETS AT 16" O.C. IF TOP OF BENCH ~ 18" ABOVE INVERT MANHOLE RISER • Y2" SLOPE • #4 U@ 12" • ALL BASES

SECTION 8-8 BASE MAY BE POURED SQUARE AT CONTRACTOR'S OPTION.

SECTION A-A 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 ISSUED AND FIT FIELD CONDITIONS, ANY MANHOLE BASE WHICH IS NOT FIT FOR PURPOSES OF INSTALLATION IN ORDER TO FIT THE LOCATIONS INTENDED WILL BE REJECTED BY THE ENGINEER AND REMOVED AND REPLACED BY THE CONTRACTOR AT NO COST TO THE DEPARTMENT.
3. PRECAST MANHOLE BASES SHALL BE BEDDED ON AN APPROVED GRANULAR BEDDING MATERIAL AS SHOWN ABOVE.

SECTION C-C CAST-IN-PLACE SLAB BASE INVERT ELEVATION SHOWN IN PROFILE

SECTION E-E PRECAST SLAB BASE INVERT ELEVATION SHOWN IN PROFILE

MANHOLE RISER DETAIL

MANHOLE RISER DETAIL

FLAT TOP SECTION DETAIL

S TANDARD PLAN NO. M-604-20

Sheet Revisions

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
Last modification Date: 07/31/19
Detailer Initials: LT A
CAD File Information

Colorado Department of Transportation
2829 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch: JBK

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:
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

SECTION F-F

ADJUST MANHOLE 20 IN. OR LESS

SECTION F-F

MODIFY MANHOLE GREATER THAN 20 IN.

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 SUPPLY PROJECT DRAWINGS FOR APPROVAL PRIOR TO FABRICATION. THE DETAILS SHOWN HEREIN 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 REQUIRED 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 TO NOT DISTURB THE NORMAL FLOW OR REDUCE THE AREA.
GENERAL NOTES


2. ALL CONCRETE SHALL BE GRADE III.

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

4. ALL REINFORCING BARS SHALL BE GRADE 60.

5. ALL CONCRETE SHALL BE CLASS B.

6. ALL CONCRETE SHALL BE CAST-IN-PLACE OR PRECAST.

7. ALL EDGE DISTANCES NOT MARKED "CLEAR" ARE TO THE CENTERLINE OF THE BAR.

8. STEPS SHALL BE REQUIRED WHEN THE INLET DEPTH "H" IS EQUAL TO OR GREATER THAN 4 FT AND SHALL CONFORM TO AASHTO M-604-25.

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


11. A 4 IN. DIAMETER 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 BACKGROUND. ALTERNATIVELY, THIS MESSAGE MAY BE CAST WITH 1 IN. HEIGHT LETTERS INTO THE TOP OF THE INLET CONCRETE SURFACE. THE MEDALLION WILL HAVE A FISH SYMBOL AND BLUE BACKGROUND. ALTERNATIVELY, THIS MESSAGE MAY BE CAST WITH 1 IN. HEIGHT LETTERS INTO THE TOP OF THE INLET CONCRETE SURFACE. THE NO DUMPING MESSAGE SHALL BE ELIMINATED FOR INLETS LOCATED WITHIN THE SHOULDER OF CONTROLLED ACCESS FREEWAYS WHEN SPECIFIED IN THE PLANS.

LEGEND

© FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.)
Plan Section

Vane Grate Standard Plan No.

Inlet Standard Sheet No. 2 of 5

Legend

- Vane 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 baffle 3 in. x 1 in. x 3 in. x 3 in. along edge of the grate as shown.
- Flow arrow shows direction of flow (Typ.)

Sections A-A and B-B

Computer File Information

Sheet Revisions

Colorado Department of Transportation

2019 West Howard Place

CDOT NO. 3rd Floor
Denver, CO 80204

Phone: 303-757-9001 FAX: 303-757-9868

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

STANDARD PLAN NO.
M-604-25

Project Development Branch

Inlet

June 3, 2019

Designer Initials: JBK

Date: 07/31/19

Last Modification Date: 07/31/19 CR-X 1 Denver, CO 80204

CAD Ver.: MicroStation VB Scale: Not to Scale Units: English

Project Sheet Number:

VANE GRATE

INLET

LEGEND

- Vane 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 baffle 3 in. x 1 in. x 3 in. x 3 in. along edge of the grate as shown.
- Flow arrow shows direction of flow (Typ.)

Sections A-A and B-B

Computer File Information

Sheet Revisions

Colorado Department of Transportation

2019 West Howard Place

CDOT NO. 3rd Floor
Denver, CO 80204

Phone: 303-757-9001 FAX: 303-757-9868

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

STANDARD PLAN NO.
M-604-25

Project Development Branch

Inlet

June 3, 2019

Designer Initials: JBK

Date: 07/31/19

Last Modification Date: 07/31/19 CR-X 1 Denver, CO 80204

CAD Ver.: MicroStation VB Scale: Not to Scale Units: English

Project Sheet Number:

VANE GRATE

INLET

LEGEND

- Vane 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 baffle 3 in. x 1 in. x 3 in. x 3 in. along edge of the grate as shown.
- Flow arrow shows direction of flow (Typ.)

Sections A-A and B-B

Computer File Information

Sheet Revisions

Colorado Department of Transportation

2019 West Howard Place

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June 3, 2019

Designer Initials: JBK

Date: 07/31/19

Last Modification Date: 07/31/19 CR-X 1 Denver, CO 80204

CAD Ver.: MicroStation VB Scale: Not to Scale Units: English

Project Sheet Number:
QUANTITIES FOR ONE 36 IN. INLET

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QUANTITIES FOR ONE 72 IN. INLET

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NOTE:
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.
DETAIL A
BOLT SLOT AT CORNER (TYP.)

SECTION A-A

SECTION B-B

DETAIL B

NOTES
1. FREE OPEN AREA: 190 SQ. IN./GRATE.
3. FINISH: ND PAINT.
4. VANE GRATE 320 LBS EACH; FRAME 70 LBS EACH.
5. ALL REINFORCING BARS SHALL BE EPOXY COATED.

SECTION C-C

SECTION D-D

STANDARD PLAN NO.
M-604-25

Issued by the Project Development Branch July 31, 2019

Project Sheet Number: 4 of 5

COLORADO DEPARTMENT OF TRANSPORTATION
2039 West Horndale Place
Capture, CO 80224
Phone: 303-757-9021 Fax: 303-757-9868

VANE GRATE
INLET

Standard Sheet No. 4 of 5

Computer File Information
Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19

Sheet Revisions
Date: Comments

Colorado Department of Transportation
Project Development Branch
Issued by the Project Development Branch July 31, 2019
CONCRETE APRON FOR 72 INLET

CONCRETE APRON FOR 36 INLET

NOTES
1. A 2 FT CONCRETE TRANSITION APRON SHALL BE CONSTRUCTED AS SHOWN AND SHALL BE KEYS 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 TOWARDS THE GRATE.

SECTION E-E

SECTION F-F

STANDARD PLAN NO. M-604-25

VANE GRATE INLET

STANDARD SHEET NO. 5 of 5

Computer File Information

Sheet Revisions

Date: Comments

07/31/19

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

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

2. OUTLETS FOR THE DRAIN PIPES ARE TO BE SPACED AT MAXIMUM 600 FT INTERVALS OR AS SHOWN ON THE PLANS. GEODETIC UNDERDRAIN OUTLET 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 TELEGRAPH POST, HAVE AN ANIMAL GUARD AND AN EROSION CONTROL PAD.

4. THE GEODETIC SHALL BE SECURED TO THE WALL ON THE TRENCH SIDE TO PREVENT MOBILITY DURING BACKFILLING.

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

6. STRUCTURAL 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 GEODETIC DRAINS IS INCLUDED IN THE DRAIN WORK.

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

8. THE EDGE DRAIN TRENCH SHALL BE CONSTRUCTED AFTER PLACEMENT OF THE AGGREGATE BASE AND SUBGRADE.
1. TOLERANCE FDR TOP OF GUARDRAIL BEAM IS ±1 IN.

2. RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
   - A. FOR GUARDRAIL FACE 2 FT. OR LESS FROM THE NORMAL EDGE OF PAVED SHOULDER, THE GUARDRAIL SHALL BE LEVEL.

3. WHEN SPECIFIED ON THE PLANS, EXTEND A 2 IN. WIDE THICKNESS PAVEMENT SURFACE TO 1 FT. BEHIND THE GUARDRAIL POSTS OR TO THE EROSION CONTROL CURB AS SHOWN ON PLANS. GUARDRAIL CUTTING & PATCHING OF OTHER APPROVED METHODS SHALL BE USED TO MINIMIZE DAMAGE TO ALL PAVEMENT SURFACES UNDER GUARDRAIL INSTALLATIONS. ALL REPAIR TO THE PAVEMENT AREA WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. A WOOD POST IN A PAVED AREA REQUIRES CONCRETE PAYMENT MAY ALSO BE USED FOR PAYING REBATE OF THE GUARDRAIL INSTALL THE POST IN A 3'-6" X 6'-3" X 3'-6" REBAR PLATE TURNED HORIZONTALLY. CONCRETE REBAR PLATE TURNED HORIZONTALLY.

4. THE MINIMUM GUARDRAIL OFFSET FROM PAVED SHOULDER EDGE SHALL BE:
   - 0 FT. FOR SHOULDERS 8 FT. OR WIDER
   - 2 FT. FOR SHOULDERS 6 FT. OR LESS

5. THE GOAL OF PLACING THE GUARDRAIL AS FAR AS POSSIBLE FROM THE TRAVEL WAY, EVEN FOR SHORT DISTANCES, WHILE PROVIDING A SMOOTH CHANGE IN GUARDRAIL ALIGNMENT.

6. WHEN SPECIFIED ON THE PLANS, INSTALL 4" MIN. HIGH TYPE 6 CURB WITH ITS FACE AT 2 FT. BEHIND THE GUARDRAIL. IF THE 2 FT. GUARDRAIL TO SHOULDER OFFSET IS NOT REQUIRED, USE 7 FT. GUARDRAIL POSTS. REFER TO THE "RESTRICTIVE ROADSIDE INSTALLATION" DETAIL.

7. THE GUARDRAIL POSTS SHALL BE EMBEDDED AT LEAST 3 FT. INTO THE EMBEDMENT MATERIAL PRIOR TO THE POSTS BREAKING PREMATURELY.

8. THE RAMP SHOULDERS ARE 4 FT. OR WIDER.
   - A. FOR AN EXISTING HIGHWAY WITH A DESIGN SPEED LESS THAN 100 MPH, THE MINIMUM OFFSET IS 2 FT. FROM THE TRAVELLED WAY.
   - B. FOR A ONE-WAY ONE-LANE RAMP, AND WHERE ONE OR MORE OF THE FOLLOWING ARE TRUE:
     - (1) THE GUARDRAIL IS NOT LOCATED ON THE RAMP EXIT OR ENTRANCE CURVE CONNECTION TO THE MAJOR HIGHWAY.
     - (2) THE RAMP SHOULDERS ARE 4 FT. OR WIDER.
     - (3) THE GUARDRAIL IS NOT LOCATED ON THE RAMP EXIT OR ENTRANCE CURVE CONNECTION TO THE MAJOR HIGHWAY.

9. LEAVE-OUT AREA FOR GUARDRAIL POSTS LOCATED IN PAVEMENT.

**GENERAL NOTES**

CONTINUE ON SHEET 2.

STANDARD PLAN NO.

M-606-1

GuARDRAIL SYSTEM (MGS)

TYPE 3 W-BEAM 31 INCHES

MIDWEST

COLORADO DEPARTMENT OF TRANSPORTATION

Jbk

CREATION DATE: 07/21/19

DATE: COMMENTS

DESIGNER INITIALS: JBK

PASSENGER INITIALS: JBK

ENGINEER INITIALS: LTA

COMPUTER FILE INFORMATION

CREATION DATE: 07/21/19

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DESIGNER INITIALS: JBK

PASSENGER INITIALS: JBK

ENGINEER INITIALS: LTA

COMPUTER FILE INFORMATION
GENERAL NOTES

7. See sheets 7 and 8 for curb treatments at Guardian terminals.  
8. If this dimension will be less than 28 inches, select curbstone made from 28 inches up.  
9. All W-beam splices and splices of terminal connectors to W-beam shall be in the direction of traffic unless otherwise stated in the plans or by the manufacturer.  
10. Material type and shape of posts and blocks shall be the same throughout the project except where specific posts and blocks are specified, i.e., cut wood and box culverts.  
11. Standards specified in the contract.  
12. Steel posts shall be standard grade steel unless otherwise specified.  
13. Standard galvanized round steel washers shall be used under all nuts to facilitate field installation.  
14. Additional holes provided in the posts to facilitate field assembly shall be the same size as the standard hole.  
15. Retractive tab shall be installed at 25 ft intervals (see sheets 6 and 8 for exceptions).  
16. W-beam and three-beam guardrail posts shall be manufactured according to AASHTO M 133 (ASTM A 709) Grade 36 steel unless corrosion resistant steel is required, in which case the post shall be manufactured from A572 Grade 50W steel.  
17. Wood blocks shall be cut from the same cross-section, species, and grade, and shall receive the same preservative treatment as the posts when used.  

W-Beam and Three-Beam Guardrail Posts

The dimensions of the cross-section shall conform to a W6 x 9 1/2" Inch wide flange (see sheets 6 and 8 for exceptions). Retractive tabs will be retroreflective, so that delineation is extended the full length of the piece.  

Wood Blocks

Wood blocks shall be cut from the same cross-section, species, and grade, and shall receive the same preservative treatment as the posts when used.

Steel Post & Notched Block

To install the bolts in the post, the post shall be placed in the block in the correct orientation.  

Guardrail System (MGS)

Type 3 W-Beam 31 Inches

Midwest

Standard Plan NO.
M-606-1

Colorado Department of Transportation

Project Development Branch: JKB

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

Standard Sheet No. 2 of 19

Guards & Barriers

General Notes (Continued from sheet 3)

18. References shown on the map provide guidance.  
19. W-beam and three-beam guardrail posts shall be manufactured according to AASHTO M 133 (ASTM A 709) Grade 36 steel unless corrosion resistant steel is required, in which case the post shall be manufactured from A572 Grade 50W steel.  
20. Wood posts shall be made of timber with an extreme fire rating in accordance with the fire resistance standard.  
21. Timers for posts shall be either galvanized or painted in accordance with the fire resistance standard.  
22. Only one type of surface finish shall be used for posts and blocks.  
23. Wood posts are an acceptable alternative to the W6 x 9.  
24. After the section is cut and all holes are drilled or punched, the tabs shall be installed on the post, not on the block.  
25. Field modification to rail elements is allowed.  

Stein Post & Notched Block

Double Block and Guardian Type 3 (Double) for Median Barrier

Steel
NOTES

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

PLAN VIEW

ELEVATION VIEW

TRANSITION FROM 28 INCH GUARDRAIL TO 31 INCH MGS

ALTERNATE PLAN VIEW - ALIGNMENT TAPER
NOTES

1. THE END ANCHORAGES (FLARED) SHALL EITHER BE THE SLOTTED RAIL TERMINAL, SRT-31, AS MANUFACTURED BY TRINITY HIGHWAY PRODUCTS LLC (TELEPHONE # 1-888-356-2363), OR THE FLEAT-350, AS MANUFACTURED BY ROAD SYSTEMS INC. (TELEPHONE # 432-263-2435). ONE END ANCHORAGE (FLARED) SHALL INCLUDE ALL POST, RAIL, AND ALL HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (FLARED) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO INSTALLATION OF THE DEVICE.

2. AFTER INSTALLATION AND IN HEAVY SNOW LOCATIONS, TRIM POSTS AND (IF THEY ARE WOODEN) FLUSH WITH RAIL TOP AND TREAT END WITH SEALANT, IN CONFORMANCE WITH AASHTO M 133.

3. POSTS SHALL BE DRILLED FOR BREAKAWAY ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.

4. SEE SHEETS 1, 3 AND 5 FOR STANDARD GUARDRAIL TYPE 3 AND INSTALLATION DETAILS.

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

6. DELINEATION SHALL BE APPLIED TO THE END PIECE, AND SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

1. POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF POSTS.
2. THE GUARDRAIL BETWEEN POST 1 THRU 3 IS ON A STRAIGHT LINE FLARE.
A. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 45 CU. YDS.) FOR END ANCHORAGE (FLARED) PAY LIMIT

- The flare shall be as follows:
- Included in the cost of the end anchorage (flared) when the contract plans include pay item 403 or 412 (see sheet 1, note 2 for pavement types)
- When the widened area is paved, payment for the pavement (approximately 70 SQ. YDS.) shall be as follows:
  - Under pay item 403 or 412 when the contract plan includes pay item 403 or 412
  - Included in the cost of the end anchorage (flared) when the contract plan does not include pay item 403 or 412

4'-8" 10:1 MAX

NORMAL SHOULDER EDGE LOCATION

PLAN VIEW

WIDENING FOR END ANCHORAGE (FLARED)

PLAN VIEW

WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION A

PLAN VIEW

WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION B

NOTES

2. Payment for the added embankment (approximately 45 cu. yds.) for the flare shall be as follows:
- Under pay item 403 when the contract plan includes pay item 403
- Included in the cost of the end anchorage (flared) when the contract plans do not include pay item 403. The added embankment shall be constructed in accordance with subsection 203.76 and item 1 of pay item 403.

3. Concrete paved areas shall have their tapered ends squared off as directed by the engineer.

5. See sheets 1, 2, 3, and 5 for standard type 3 guardrail installation details.

6. The cost of the gutter will be paid for "GUTTER TYPE 2 (2 FT.)" for a length of 134 FT. or "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 (d) 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, or in the case of pay item 403, a maximum of 2 FT. or less from shoulder to curb equal to roadway slope if 2 FT. or less from shoulder.

20. Widening for end anchorage shall be as shown on the plan.
GUARDRAIL TYPE 3

PAY LENGTH I

LENGTH OF MAX-TENSION TERMINAL BOLT DOES NOT PASS THROUGH 55'-1/2" THE GUARDRAIL PANEL AT POST?

GUARDRAIL PANEL

GROUND LINE

TRAFFIC SIDE

SLIDER

REAR SIDE

SLIDER

3'-1 1/2"

3'-1 1/2"

3'-1 1/2"

6'-3" --- 6'-3" --- 6'-3" --- 6'-3" ---- 6'-3" --- 6'-3" --- 6'-3"

12'-6"

GUARDRAIL PANEL

NOTES FOR NONFLARED


2. DO NOT ATTACH THESE END ANCHORAGE 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'-1 1/2", 9'-4 1/2", OR 15'-7 1/2" W-BEAM PANEL DOWNSTREAM OF TRAFFIC.

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

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

6. DELINEATION SHALL BE APPLIED TO THE END PIECE AND SHALL NOT BE PAID FOR SEPARATELY BUT BE INCLUDED IN THE COST OF THE WORK. SEE STANDARD PLAN S-612-I.

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Last Modification Date: 07/31/19
Detailer Initials: LT A
Project Development Branch: Project Development Branch JBK
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Colorado Department of Transportation

2020 West Howard Place
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch: JBK
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-606-1

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

STANDARD PLAN NO. M-606-1

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

STANDARD PLAN NO. M-606-1

MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES
1. Payments for the added embankment (approximately 25 cu. yds.) for the traversable embankment slope
   a. Under payment Item 203 when the contract plan includes payment Item 203.
   b. Included in the cost of the end anchorage (nonflared) when the contract plan does not include payment Item 203.

2. When the width area is paved, payment for the pavement (approx. 39 sq. yds.) shall be as follows:
   a. Under payment Item 403 or 412 when the contract plan includes payment Item 403 or 412.
   b. Included in the cost of the end anchorage (nonflared) when the contract plan does not include payment Items 403 or 412.

3. When overlay paving the finished surface at each post shall not be above the top breakway hole or strut assembly. The widened area at the end anchorage (nonflared) shall be tapered to prevent a drop in the paved surface below the rail.

4. See Sheets 1, 2, 3, and 5 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. No additional curb shall be added in the vicinity of the end treatment.

7. 4:1 or flatter slopes in the traversable area shall be used behind the end anchorage area, and in advance of posts if this is not possible a minimum of 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 3:1, it shall be equal to roadway slope 2 ft. or less from shoulder.

9. Widening for end anchorages shall be paved on interstates and freeways.
I. **THE MEDIAN TERMINAL SHALL BE THE MAX-TENSION MEDIAN AS MANUFACTURED BY**
   **BARRIER SYSTEM BY LINDSAY (LINDSAY TRANSPORTATION SOLUTIONS)**
   **(TEL #: 888 800-3691).**

2. **ALL STEEL COMPONENTS SHALL BE GALVANIZED PER ASTM A123**
   **BY BARRIER SYSTEM BY LINDSAY (LINDSAY TRANSPORTATION SOLUTIONS)**
   **OR EQUIVALENT UNLESS OTHERWISE STATED.**

3. **ONE MEDIAN TERMINAL SHALL INCLUDE ALL POSTS, RAIL, AND HARDWARE**
   **REQUIRED FOR A COMPLETE UNIT. THE DEVICE SHALL BE INSTALLED**
   **AT, OR TRANSITIONED TO, 31 INCH PANELS AND POST SPACING**
   **CONFIGURED IN CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS.**

4. **THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS**
   **AND PARTS LISTS TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE**
   **DEVICE.**

5. **THE MAX-TENSION SYSTEM (MIN. OF 50 FT. DOWNSTREAM OF THE FIRST POST).**

6. **UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL**
   **TRANSITIONS TO OTHER BARRIER SYSTEMS SHALL ALSO BE AT**
   **A MIN. OF 50 FT.**

7. **ALL STEEL COMPONENTS SHALL BE GALVANIZED FOR AESTHETIC AND**
   **EQUIPMENT GREEN STANDARDS.**

8. **THE MEDIAN TERMINAL SHALL INCLUDE ALL POSTS, RAIL, AND HARDWARE**
   **REQUIRED FOR A COMPLETE UNIT. THE DEVICE SHALL BE INSTALLED**
   **IN CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS. THE CONTRACTOR**
   **SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS**
   **AND PARTS LISTS TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE**
   **DEVICE.**

9. **UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL**
   **TRANSITIONS TO OTHER BARRIER SYSTEMS SHALL ALSO BE AT**
   **A MIN. OF 50 FT.**

10. **EACH INSTALLATION SHALL BE SUPERVISED AND CERTIFIED AS CORRECT**
    **UPON COMPLETION BY A REPRESENTATIVE OF THE DEVICE MANUFACTURER**
    **AND PARTS LISTS TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE**
    **DEVICE.**

11. **DELINERATION, IF REQUIRED, SHALL BE APPLIED TO THE END PIECE AND WILL**
    **TRANSITION TO THE WORK.**

**NOTE:**
- **SECTION A-A DETAIL A**
- **ELEVATION MAX-TENSION MEDIAN (MASH CERTIFIED)**
- **SIDE VIEW**

---

**MIDWEST GUARDRAIL SYSTEM (MGS)**

**TYPE 3 W-BEAM 31 INCHES**

**Project Development Branch: JBK**

**STANDARD PLAN NO. M-606-1**

**Project Sheet Number:**

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**Computer File Information**

**Creation Date: 07/31/19**
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**Project Development Branch JBK**

**Designer Initials: JMK**
**Detailer Initials: LT A**
**CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English**

**COMPUTER FILE INFORMATION SHEET REVISIONS**

**203 West Howard Place**
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**COLORADO DEPARTMENT OF TRANSPORTATION**

**DESIGNER INITIALS: JMK**
**DATE: 07/31/19**
**DEPARTMENT OF TRANSPORTATION**

**DESIGNER INITIALS: JMK**
**DATE: 07/31/19**
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**DESIGNER INITIALS: LT A**
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**DEPARTMENT OF TRANSPORTATION**

**CADD VERION: MICROSTATION V8 SCALE: NOT TO SCALE UNITS: ENGLISH**

**CAUTION:**
- **MAX-TENSION MEDIAN**
- **SIDE VIEW**

---

**END OF GUARDRAIL PAY LENGTH**

**PLAN**

**SIDE VIEW**

**ELEVATION MAX-TENSION MEDIAN (MASH CERTIFIED)**

---

**MIDWEST GUARDRAIL SYSTEM (MGS)**

**TYPE 3 W-BEAM 31 INCHES**

**Project Development Branch: JBK**

**STANDARD PLAN NO. M-606-1**

**Project Sheet Number:**

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**DEPARTMENT OF TRANSPORTATION**

**CADD VERION: MICROSTATION V8 SCALE: NOT TO SCALE UNITS: ENGLISH**

**CAUTION:**
- **MAX-TENSION MEDIAN**
- **SIDE VIEW**

---

**MIDWEST GUARDRAIL SYSTEM (MGS)**

**TYPE 3 W-BEAM 31 INCHES**

**Project Development Branch: JBK**

**STANDARD PLAN NO. M-606-1**

**Project Sheet Number:**

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

NOTES
1. Transition type 3g is for use at both ends of bridges on two-way
   highways and at the approach end of bridges on one-way
   highways.
2. Transition type 3h is for use at the trailing end of bridges
   on one-way highways.
3. Where the rail section in transitioning types 3g and 3h may be
   used next to rail ends that are greater than or equal to a 21 ft.
   panel, however, the 3h-3h transition section shall not be used.
4. A 3t rail in concrete transition 2 is required between type 3g
   or 3h and 3t type 7 bridge rail, see standard plan no. 6200 for
   the transition between 3t type 3h and 3t type 7 guardrail.
5. Transition type 3g and 3t type 7 are also used to connect to type
   8 and type 2 guide rail. See standard plans for connection details.
   Back-up plate is not required at posts on type 3g and 3t.
6. To be used in the elevation drawings showing the location where
   the rail section is used, the rail section is shown in the plan view
   of the rail section may be specified in concrete. The cost of rail
   is included in the plan, unless a separate price is furnished for
   the rail section.
7. For type 3g posts (21 ft. or less) are not to be used.
8. Transition type 3h is for use at the trailing end of bridges
   on one-way highways
   a. Type 3h transition section is for use at the trailing end.
      b. Type 3h transition section is for use at the trailing end.
      c. Type 3h transition section is for use at the trailing end.
      d. Type 3h transition section is for use at the trailing end.
      e. Type 3h transition section is for use at the trailing end.
      f. Type 3h transition section is for use at the trailing end.
      g. Type 3h transition section is for use at the trailing end.
      h. Type 3h transition section is for use at the trailing end.
      i. Type 3h transition section is for use at the trailing end.
      j. Type 3h transition section is for use at the trailing end.
      k. Type 3h transition section is for use at the trailing end.
      l. Type 3h transition section is for use at the trailing end.
      m. Type 3h transition section is for use at the trailing end.
      n. Type 3h transition section is for use at the trailing end.
      o. Type 3h transition section is for use at the trailing end.
      p. Type 3h transition section is for use at the trailing end.
      q. Type 3h transition section is for use at the trailing end.
11. APPLICATION: THE TRANSITION TYPE 3J MAY BE USED TO SEAL MACHINES AT THE INTERSECTION OF TWO ROADS OR INTERSECTING OUTLINES. BUT ARE NOT LIMITED TO THE FOLLOWING:

- A CURB, OVERHEAD, OR PARAPET.
- INTERSECTIONS IN GUARDRAILS BY INTERSECTING ROADS.

- THE LOW SPEED END ANCHOR PLATE AND FIRST POST.
- CONSTRUCTION

- THE STEEL TUBE MAY BE DRIVEN WITH WOOD POST INSERTED IF NO DAMAGE OCCURS TO THE POST OR BOLTS.

- ALL CURVED GUARDRAIL SHALL BE SHOP BENT.

- ALL CURVED GUARDRAIL SHALL BE SHOP BENT.

- THE STEEL TUBE MAY BE DRIVEN WITH WOOD POST INSERTED IF NO DAMAGE OCCURS TO THE POST OR BOLTS.

- INTERSECTING ROADWAYS TRANSITION - TYPE 3J TRANSITION

- END OF GUARDRAIL PAY LENGTH

- SOIL PLATE

- BEARING PLATE FOR STEEL TUBE

- TYPE 3 W-BEAM 31 INCHES

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

- STANDARD PLAN NO.

- M-606-1

- Standard Sheet No. 12 of 19

- Issued by the Project Development Branch: July 31, 2019

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- Detailer Initials: LT A

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- Colorado Department of Transportation

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- Last Modification Date: 07/31/19

- Project Development Branch: JBK

- Project Sheet Number:

- CAD Ver.: MicroStation VB

- Scale: Not to Scale

- Units: English
EDGE OF
PAVED SHOULDER

VARIABLE SLOPE
GRADE TD DRAIN

SLOPE 10:1
DR FLATTER

MEDIAN BARRIER PAY FOR AS TWO SEPARATE LENGTHS OF
GUARDRAIL TYPE 3
GUARDRAIL TYPE 3
PAY AS TWO LENGTHS OF GUARDRAIL TYPE 3
SPAN OBSTRUCTION TD NEAREST 12'-6"

TRANSITION TD 15:1 TAPER
(SEE SHEET 15 FOR TAPER LAYOUT)

TRAFFIC

SECTION J-J

EXTRA EARTHWORK
TD BE MEASURED AND
PAID FOR AS ITEM 203.
EXISTING OR
STANDARD SLOPE
TRAFFIC

OBSTRUCTION IN MEDIAN 30 FT. WIDE OR LESS
NOTE: FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 20 FT. IN MEDIAN USE SHEET 16.

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.
NOTE FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 30 FT. IN MEDIAN USE SHEET 16.

GUARDRAIL FOR OBSTRUCTION IN MEDIAN 30 FT. WIDE OR LESS
NOTE FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 20 FT. IN MEDIAN USE SHEET 16.
1. MEDIAN BARRIERS TANGENT 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 END OF THE TRANSITIONS TO NOT INFRINGE THE USE OF ADJACENT LAND.

- SHOWN ON PLANS LENGTH TO COVER ALL MARGINS.

- MEDIAN LENGTH OF GUARDRAIL DESIGNED ACCORDING TO MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES. LENGTH TO SHIELD ALL HAZARDS IS BASED ON MEDIAN LENGTH OF NEED COMPUTATION. THE TOTAL LENGTH OF GUARDRAIL IN EACH TRANSITION WILL INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAILS (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.

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

- EDGE OF A FT OR 10 FT SHOULDER.

- EDGE OF A FT OR LESS SHOULDER.

- END ANCHORAGE CAN BE FLARED OR NONFLARED.
SHOULDER TRAFFIC...

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

END ANCHORAGE (NON-FLARED)

MEDIAN, M

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

SLOPE VARIES

---------

100'

END ANCHORAGE (NON-LINED)

200'

GUARDRAIL TYPE 3 MEDIAN, M

W - 25 FEET FOR TRANSITION TYPE 3G.
C - CHANGE 100 FT. TRANSITION TO NORMAL SLOPE.
W = WIDTH OF MEDIAN

GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 25 FEET BASED ON POST OFFSET DIMENSIONS SHOWN.

M - WIDTH OF MEDIAN.

SEE SHEET 14 FOR THE RIGHT SHOULDER GUARDRAIL LAYOUT.

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

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. Option 1 layout shall be used when **Y** is 16 feet or less.

3. Option 3 layout shall be used when **Y** is 30 feet or more.

4. See Sheet 14 for right shoulder guardrail layout.

**MULTILINE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 21 - 59 FT. WITH OPEN HAZARDS OR OBSTRUCTIONS)**

- **SLOPE I**
- **MEDIAN, M VARIES**
- **MEDIAN END TERMINAL TRAFFIC**

*L must meet the length of need and should not exceed 250 ft. unless site conditions warrant.*

**OPTION 1**

- TRAVEL LANE
- 3G TRANSITION TO TYPICAL 15:1 TAPER

**OPTION 2**

- TRAVEL LANE
- 3G TRANSITION TO TYPICAL 15:1 TAPER

**TRANSITION TO TYPICAL 15:1 TAPER**

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. Option 1 layout shall be used when **Y** is 16 feet or less.

3. Option 3 layout shall be used when **Y** is 30 feet or more.

4. See Sheet 14 for right shoulder guardrail layout.
NOTES

1. A TYPE 3G OR 3H TRANSITION (SEE SHEET 11) SHALL BE USED TO CONNECT THE TYPE 3 W-BEAM TO A TYPE 9 CONCRETE BARRIER (SEE M-606-7) OR TO A TYPE 8 OR 10 BRIDGE RAIL.

2. "N" 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 NUMBER IS 12'-6" WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY ADDITIONAL LENGTH IN THE RAIL ENTRANCE OR TERMINAL (N) PRIOR TO THE OBSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER.

4. ENDOANCHORAGE CAN BE FLARED OR NONFLARED.

5. GUARDRAIL TYPE 3 WITH BLOCKED OUT POSTS SPACED AT 3'-11/2" FROM STRUCTURE ARROUND CURVE.

6. "END APPROACH PRIOR TO ENDOANCHORAGE TO BE PROVIDED".

7. GUARDRAIL TYPE 3 WITH REMOVED B Description Spacing AT 3'-11/2" FROM STRUCTURE ARROUND CURVE.
NOTES

1. POSTS 1, 2, 5, and 6 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.

END ANCHORAGE OF GUARDRAIL TYPE 3

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

TRAFFIC

GAP

RAIL SPLICE

12'-6" 6'-3"

(TYP.)

(TYP.)

(TYP.)

OMITTED POST

OMITTED POST

OMITTED POST

STEEL POST

BREAKWAY TIMBER POST

POSTS 1-2 ARE 5-1/2 - 8" BOLT IN 3" HOLE

MIDWEST GUARDRAIL SYSTEM (MGS)

TYPE 3 W-BEAM 31 INCHES

STANDARD PLAN NO.

M-606-1

Standard Sheet No. 18 of 19

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

1. POSTS 1, 2, 5, and 6 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.
TRAVERSABLE -- ONE-WAY -- TWO-WAY -- END ANCHORAGE CAN BE FLARED OR NDNFLARED.

--- APPROACH --

37'-6" (SEE NOTE 5)

TRAFFIC

GUARDRAIL FOR CULVERTS

RAIL PLACEMENT FOR INSIDE MOUNT

BASE PLATE B

ANCHORAGE D

INSIDE MOUNT ON CBC

NOTES

1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND ANCHOR WALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 15. THE GUARDRAIL TYPE 3 SHALL CONTINUE ACROSS THE CULVERT AS SHOWN ON THIS SHEET.

2. LIGHT-WEIGHT BOX 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: SIX BOLTS FOR BASE PLATE "B" WITH INSIDE MOUNT. THE BOLTS SHALL BE 7/8 IN. DIA X 10 IN. HIGH STRENGTH RODS THREADED FULL LENGTH AND ALL GALVANIZED. THE BOLTS SHALL BE 7/8 IN. DIA X 10 IN. HIGH STRENGTH RODS THREADED FULL LENGTH AND ALL GALVANIZED. THE BOLTS SHALL BE CAST-IN-PLACE FOR NEW STRUCTURES. FOR EXISTING STRUCTURES, THE BOLTS SHALL BE INSTALLED IN CAST-IN-PLACE HOLES WITH NON-SHRINK GROUT OR EPOXY CONTINUOUS TO 8" IN. THE THICKNESS OF A CULVERT'S TOP PANEL REQUIRES BOLTS TO BE LESS THAN 30 IN. LONG. THE BOLTS SHALL BE APPROVED BY THE ENGINEER.

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 3'-0" IN., WHERE SITE CONDITIONS ALLOW THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL, AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.


7. POST ANCHORS, ENGAGED 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 WHICH COMPLY WITH THE REQUIREMENTS OF SECTION 105 SHALL BE SUBMITTED TO THE ENGINEER FOR INFORMATION ONLY.
JOINTS TO MATCH JOINT TYPE AND 7' MIN. SPACING IN CONCRETE BARRIER

The minimum acceptable dimension is 6 in.

Vertical Tie Bars are not required when the glare screen is poured monolithically with the barrier. See Sheets 1 and 2 for barrier dimensions.

CONNECTS TO MEDIUM OBSTRUCTIONS

CONCRETE GLARE SCREEN

GLARE SCREEN AT MEDIUM OBSTRUCTIONS

CONCRETE GLARE SCREEN

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

This Section Provides a Transition for the Shape of the Bridge Rail Type 7 to the Roadway Guardrail Type 7. Measured 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

Issued by the Project Development Branch: July 31, 2019
BACKFILL, CLASS 2 THE CONTRACTOR AT HIS EXPENSE, AND THE OPTION OF USING CONCRETE OR OTHER MATERIAL
ACCEPTABLE TO THE ENGINEER IN LIEU OF BACKFILL, CLASS 2

WIDTH OF COLUMN OR PIER TREATMENT BETWEEN COLUMNS OR OBSTRUCTIONS

OBSTRUCTION WIDER THAN 3 FT.

1/2" PREFORMED JOINT MATERIAL

PIER COLUMN, ROD SUPPORT FEETING, CONCRETE WALL OR SIMILAR OBSTRUCTIONS.

OBSTRUCTION 3 FT. WIDE OR LESS

HAZARDS IN NARROW MEDIANs

NOTES
1. THE MEDIAN IN THESE APPLICATIONS SHALL BE PAVED ON A SLOPE CONTINUED FROM THE ADJACENT PAVED SHOULDER OR A 10:1 OR FLATTER SLOPE.

2. THE PAY LENGTH FOR BARRELS ON BOTH SIDES OF AN OBSTRUCTION WILL BE DETERMINED BY ONE LINEAR MEASUREMENT ALONG THE GUARDRAIL CENTERLINE. THE INSTALL AND CAP BETWEEN COLUMNS OR OBSTRUCTIONS WILL NOT BE MEASURED OR PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

3. GUARDRAIL BETWEEN COLUMNS OR OBSTRUCTIONS MAY BE STYLES OR OF CA AS SHOWN ON THE PLANS.

Computer File Information

Sheet Revisions

Colorado Department of Transportation

STANDARD PLAN NO. M-606-13

Standard Sheet No. 3 of 4
NOTES

1. TWO FT. IS DESIRABLE FOR THIS DIMENSION WITH A 4 FT. LEFT SHOULDER. THE MINIMUM IS 0 FT., WHICH IS ACCEPTABLE FOR 6 FT. OR WIDER SHOULDER.

2. RATE OF SLOPE DEFINES 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 FLATTER.

3. IF THE DISTANCE FROM THE EDGE OF GUARDRAIL TO THE OBSTRUCTION EXCEEDS 4 FT.-7 IN., TYPE 7 W-beam guardrail may be specified on the plans instead of Type 7 (see plans and detail below).

4. STYLE CA BARRIERS ARE ShOWN. STYLE CD MAY BE USED AS APPROPRIATE. SEE SHEET 2 FOR TYPE 7 TO SINGLE TYPE 3G TRANSITION.

5. THE AREA BETWEEN SHOULDER AND THE TYPE 7 SHALL BE PAIRED. PAYMENT FOR THE PAIRED SURFACE WILL BE MADE UNDER A PAYMENT FOR TREMIA 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. WHERE SITE CONDITIONS ALLOW.

7. GUARDRAIL TYPE 7

F-SHAPE BARRIER

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Project Development Branch JBK

STANDARD PLAN NO. M-606-13
Standard Sheet No. 4 of 4

GUARDRAIL TYPE 7

F-SHAPE BARRIER
GENERAL NOTES

1. ALL STEEL REINFORCING SHALL BE 2 IN. CLEAR OF THE NEAREST SURFACE OF CONCRETE UNLESS OTHERWISE SHOWN. ALL STEEL REINFORCING SHALL BE CLASS B.

2. CONCRETE SHALL BE CLASS C.

3. ALL PERMANENT PRECAST BARRIERS SHALL BE 2 IN. CLEAR OF THE NEAREST SURFACE OF CONCRETE UNLESS OTHERWISE SHOWN. ALL STEEL REINFORCING SHALL BE CLASS B.

4. CONCRETE SHALL BE CLASS C.

5. STABILIZATION PINS SHAL BE USED ON EACH BARIER UNIT ADJACENT TO, AND WITHIN 10 FT. OF BOTH SIDES OF THE OBSTRUCTION. SEE SHEET 3 FOR STABILIZATION FINDING DETAILS.

6. 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.

7. STABILIZATION PINS SHALL BE USED TO ANCHOR EACH 10 FT. UNIT IN ALL PERMANENT INSTALLATIONS. SEE SHEET 3 FOR STABILIZATION FINDING DETAILS.

8. FOR ALL PERMANENT INSTALLATIONS THAT REQUIRE END ANCHORAGE. SEE STANDARD PLAN M-606-13, SHEET 3, FOR ANCHORAGE DETAILS.

9. FOR ALL PERMANENT INSTALLATIONS THAT REQUIRE END ANCHORAGE. SEE STANDARD PLAN M-606-13, SHEET 3, FOR ANCHORAGE DETAILS.

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 SUPERELEVATED SHOULDER.
C. MEDIAN BARRIER ON A CREST VERTICAL CURVE.
D. PERMANENT BARRIER, IF SPECIFIED ON PLANS.

11. THE MONTH AND YEAR THE PRECAST TYPE 7 CONCRETE BARRIER WAS MANUFACTURED SHALL BE MOLDED INTO ONE END OF EACH 10 FT. BARRIER UNIT.

12. APPROVED NON-SHRINK GROUT SHALL BE USED FOR GROUTING OVER ALL PINS AND GROUTING OF SCUPPERS.

13. RETROREFLECTORIZER IS REQUIRED ON BARRIERS. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN M-606-13, SHEET 1.

STIRrup "#5 REBAR PAIR

ELEVATION BARRIER

SECTION A-A

SECTION B-B

SECTION C-C

COMMENTS

REFERENCE SHEET M-606-13, DETAIL STYLE PD, FOR ANCHOR BOLT DETAIL.
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 EXCEPTED)
4. PINS MAY BE BEVELED TO FACILITATE PLACEMENT.
5. PINS SHALL CONFORM TO ASTM A449.
6. PINS SHALL CONFORM TO ASTM A449.
7. 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.
8. 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 ENDALONG WITH THE PIN TO COMPLETE THE TYPICAL PRECAST TYPE 7 CONCRETE BARRIER JOINT.

NOTES

CONNECTING PIN DETAIL

ALTERNATIVE PIN DETAIL

DETAILS FOR PIN AND LOOP CONNECTION

JOINT STYLE

PRECAST TYPE 7 CONCRETE BARRIER

STANDARD PLAN NO. M-606-14

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Prepared by the Project Development Branch: July 31, 2019

2" DIA. CONNECTING LOOPS (TYPE)
NOTES
1. SEE SHEET 1 FOR REINFORCEMENT AND OTHER DETAILS NOT SHOWN HERE.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
3. FOR TIGHTENING ANCHORING OF THE PERMANENT INSTALLATION OF PRECAST TYPE 7 CONCRETE BARRIER, SEE THE END ANCHORAGE DETAIL IN STANDARD PLAN M-606-14, SHEET 1.
4. AN OPTIONAL 3-INCH TAPERED END PIN MAY BE PROVIDED IN THE STABILIZATION PIN TO FACILITATE DRIVING.

ELEVATION VIEW WITH PINS

PLAN VIEW OF S BAR ENDS

STABILIZATION PIN

OPTIONAL TAPERED END PIN

TABLE OF STABILIZATION PIN LENGTHS

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<tr>
<td>SOIL</td>
<td>3 FT-4 IN</td>
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ROAD SURFACE PIN LENGTH

- CONCRETE: 2 FT-4 IN
- HMA: 3 FT
- SOIL: 3 FT-4 IN

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

Computer File Information

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

STANDARD PLAN NO. M-606-14
Sheet Revisions
Standard Sheet No. 3 of 3

Issued by the Project Development Branch July 31, 2019
STANDARD PLAN NO. M-606-14
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Standard Sheet No. 3 of 3

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

1. SEE SHEET 2 FOR DETAILS OF CONCRETE BARRIER STYLE CA END ANCHOR
   PREFORMED 8" - 10" I I I
   JOINT MATERIAL ----JI· •
   CONNECTIONS TO STRUCTURES OR TRANSITION TO GUARDRAIL TYPE 7.

2. SEE SHEET 6 FOR CONCRETE BARRIER STYLE CA TRANSITIONS AT BRIDGE
   COLUMNS AND SIGN POSTS IN MEDIANS.

3. WHERE GLARE SCREENS ARE REQUIRED, USE CONCRETE BARRIER STYLE CG
   ON SHEET 4.

4. WHERE ROADBED OFFSET IS GREATER THAN 1/2 INCH, SEE CONCRETE BARRIER
   WALL OR CAST-IN-PLACE BARRIERS.

5. BARRIER MAY BE CAST-IN-PLACE OR SLIP FORMED.

6. BARRIER FOUNDATION SHALL BE PAVEMENT, OR COMPACTED AGGREGATE BASE,
   CONCRETE OR COMPACTED EMBANKMENT MATERIAL.

7. NO ANCHORAGE IS REQUIRED (TYP.) EXCEPT FOR THE 10 FOOT ANCHORAGE.
   SEE SHEETS 2 AND 3 FOR DETAILS.

8. CONSTRUCTION JOINTS SHALL BE USED ON ALL BARRIER TYPES SHOWN,
   AT THE END OF THE DAY'S POUR OR AFTER ANY INTERRUPTION LONGER
   THAN 30 MINUTES. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY
   CLEANED BEFORE FRESH CONCRETE IS POURED.

9. ALL 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.

10. CONTINUOUS LONGITUDINAL REINFORCEMENT SHALL BE EITHER GRADE 60
    @ 24" FOR STYLE CC BARRIER.

11. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE BARRIER
    RETROREFLECTOR NOTES ON STANDARD PLANS S-612-1.

12. CONCRETE SHALL BE CLASS D.

13. ADDITIONAL MATERIAL FOR BARRIER EMBEDMENT GREATER THAN 30"
    WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

14. EPOXY COATED LONGITUDINAL REBAR SHALL HAVE A MINIMUM LAP SPLICE
    OF 38 INCHES. WIRE STRAND LONGITUDINAL REINFORCEMENT SHALL BE
    BUTT WELDED OR MECHANICALLY SPLICED TO MAINTAIN 100 PERCENT OF
    THE MINIMUM REQUIRED TENSILE STRENGTH.

15. ALL INCIDENT WORK AND MATERIAL SUCH AS DOWELS, GROUT, ANCHORS, BOLTS,
    PINS, JOINT MATERIAL, EXCAVATION FOR BASES, CONTINUOUS LONGITUDINAL
    REINFORCEMENT, SHALL BE INCLUDED IN THE COST OF GUARDRAIL.

16. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE BARRIER
    RETROREFLECTOR NOTES ON STANDARD PLANS S-612-1.

CONCRETE BARRIER STYLE CA

CONCRETE BARRIER STYLE CC

CONCRETE BARRIER STYLE CD
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' 30" FOOT ANCHORAGE. THE ANCHORAGE SHALL BE CONCRETE OR CONCRETE WITH 2 #8 X 8" @ 2'-0" BARS.

2. SEE SHEET 1 FOR CONCRETE BARRIER STYLE CA AND STYLE CC.

3. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISTINGUISHABLE 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 PEDISTALS IN MEDIAN.

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

TRANSITION CONCRETE BARRIER TYPE 9 TO CONCRETE BARRIER TYPE 7 OR EXISTING
**NOTES**

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 DOWELED INTO EXISTING CONCRETE BARRIER BARRIERS OR WINGWALLS TO MINIMIZE ROTATIONS TO ANY OF THEM. SEE SHEET 1 FOR DOWEL PLACEMENT LAYOUT.

4. FOR END ANCHORAGE 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 ANCHORAGE OVER 500 FEET, CONSTRUCT ANCHORAGE EVERY 250 FEET.

7. REINFORCING STEEL IN ANCHORAGE SHALL BE GRADE 60 EPOXY COATED DEFORMED BARS.

8. CONCRETE SHALL BE CLASS D.

9. ALL INCIDENTAL WORK AND ADDITIONAL MATERIALS SHALL BE INCLUDED IN THE COST OF THE CONCRETE BARRIER.

**SECTION A-A**

CONCRETE BARRIER END ANCHORAGE UNDER 150 FEET

**SECTION B-B**

CONCRETE BARRIER END ANCHORAGE BETWEEN 150 FEET AND 500 FEET

**SECTION C-C**

CONCRETE BARRIER END ANCHORAGE OVER 500 FEET

**SECTION D-D**

**GUARDRAIL TYPE 9**

**SINGLE SLOPE BARRIER**

**STANDARD PLAN NO.**

M-606-15

**STANDARD SHEET NO.**

3 of 11
CONCRETE BARRIER STYLE CG (56°) DETAILS SIMILAR TO STYLE CG EXCEPT AS NOTED.

CONCRETE BARRIER STYLE CGG DETAILS SIMILAR TO STYLE CGG EXCEPT AS NOTED.

NOTES

1. SEE SHEET 5 FOR DETAILS OF CONCRETE BARRIER STYLE CGE/CG END ANCHORS CONNECTIONS TO STRUCTURES AND TRANSITIONS TO GUARDRAIL TYPE 7.

2. WHERE ROADBED OFFSET IS GREATER THAN 3 INCHES SEE CONCRETE BARRIER TYPE CGE.

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

4. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE THE RETROREFLECTOR NOTES IN STANDARD PLAN 5-124.

OPTIONAL CONSTRUCTION JOINT (NOT TO BE LEVEL WITH TANGENT FLDWLINES FOR CAST-IN-PLACE BARRIERS)

CONCRETE BARRIER STYLE CG (56°) DETAILS SIMILAR TO STYLE CG EXCEPT AS NOTED.

CONCRETE BARRIER STYLE CGG DETAILS SIMILAR TO STYLE CGG EXCEPT AS NOTED.

CONCRETE BARRIER STYLE CGE DETAILS SIMILAR TO STYLE CGE EXCEPT AS NOTED.

USE CONCRETE BARRIER END ANCHOR WHEN NECESSARY. SHOWN WITH A 36 INCH ROADBED SURFACE OFFSET. BARRIER FOR OFFSET ROADWAYS.

FINISHED GRADE TRANSVERSE CONTRACTION JOINTS FORMED OR SAWED TRANSVERSE CONTRACTION JOINTS ARE REQUIRED AT 20 FT. INTERVALS. THE INTERVALS SHALL MATCH THE CONCRETE PAVEMENT JOINTS FOR INSTALLATIONS THAT ARE ON TOP OF THE CONCRETE ROADWAY PAVEMENT. SEE CONCRETE BARRIER STYLE CG FOR TYPICAL DIMENSIONS.
NOTES
1. SEE SHEET 1 FOR ANCHORAGE REQUIREMENTS AT A MINIMUM.
   THE BARRIER SHALL BE ANCHORED AT THE ENDS OR AT INTERRUPTIONS.
   THE 10 FOOT ANCHORAGE MONOLITHIC SHALL BE MONOLITHIC OR
   DOWELED WITH 2-8/8 X 8" X 2" BARS.
2. SEE SHEET 4 FOR CONCRETE BARRIER STYLE CG AND STYLE CGC.
3. SEE SHEET 5 FOR TRANSITION TO BEGIN.
4. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATION OF DECK Сох RATE
   SHALL BE ACCOMPLISHED IN ONE 10 FOOT LONG SEGMENT OF BARRIER.
5. SEE SHEET 6 FOR CONCRETE BARRIER STYLE CG TRANSITIONS
   AT BRIDGE COLLIINS AND SIGN PEDISTANS IN MEDIANS.
6. FOR STYLE CG CONNECTIONS TO STRUCTURES, SEE THE BRIDGE PLANS.

TRANSITION CONCRETE BARRIER STYLE 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**

---

**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 granular material at base to bottom of a inch gap.
   - C. Place concrete with granular material 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 9404-60.
CONSTRUCTION JOINTS

LIMITS OF PAYMENT FOR CONCRETE BARRIER STYLE CGD (SPECIAL)

B CONCRETE BARRIER

Expanded Polystyrene between Column and Concrete Barrier (Typ.)

CONCRETE BARRIER TRANSITION AT BRIDGE COLUMNS

SECTION A-A

SECTION B-B

SECTION C-C

CONCRETE BARRIER TRANSITION AT SIGN PEDESTAL

Electrical Pull Box for Sign, Flush with Concrete Barrier Top

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 blockouts 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 S-614-60.

Concrete Barrier Transition at Bridge Columns

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: 
TYPE 9 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE OPTION

SEE SHEET 1 FOR REINFORCEMENT INFORMATION AND SHEET 3 FOR ANCHORAGE DETAILS.
NOTES
1. Where beveled metal box spacers are installed, place a 1 1/4" x 3 1/4" inch and 4 1/2" inch 1/8" thick pipe spacers on 1 inch MS bolts passing through the interior of box.
2. All metal boxes shall be galvanized.
[Diagram and text content from the image provided]
1. **GENERAL NOTES**

   I. **ALL MATERIAL DIMENSIONS AND WEIGHTS ON THIS STANDARD ARE NOMINAL UNLESS OTHERWISE SPECIFIED.**

   II. **POSTS:**

      A. **Driveway Gates (Single):**
         - Height: 42 in.
         - Weight: Not less than 90 lbs. complete with latch and hinges.

      B. **Metal posts and Gate Posts:**
         - Type: 2 in. x 2 in. x 1 in. Structural Steel Angles
         - Number of braces: 1
         - Length: 6 ft. - 6 in. Min. Minimum
         - Beam: 7 in. x 7 in. x 1/2 in. Nominal Panel Gate, 7 ft. - 0 in. Maximum

   III. **GROUNDING:**

      A. **Metal Line Posts:**
         - Type: 2 in. x 2 in. x 1 in. Structural Steel Angles
         - Number of braces: 1
         - Length: 6 ft. - 6 in. Min. Minimum
         - Panel Gate: 7 ft. - 0 in. Minimum

   IV. **Turnouts (for circles, end or line brace posts):**

      A. **Concrete:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

      B. **Wood posts:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

   V. **WOOD STAYS:**

      A. **Concrete:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

      B. **Wood posts:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

   VI. **Alternatives (Contractor's Option):**

      A. **Concrete:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

      B. **Wood posts:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

   VII. **Metal Line Posts:**

      A. **Concrete:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

      B. **Wood posts:**
         - Minimum three No. 10 rivets where diagonal braces connect to horizontal panels.

---

**Computer File Information**

- **Creation Date:** 07/31/19
- **Designer Initials:** JBK
- **CAD Ver.:** MicroStation V8
- **Scale:** Not to Scale
- **Units:** English
- **Project:** WIRE FENCES AND GATES
- **Standard Sheet No.:** 1 of 3

**Colorado Department of Transportation**

200 West Colfax Avenue

CDOT Bldg., 3rd Floor

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

- **Project Development Branch:** JBK
- **Standard Plan No.:** M-607-1
- **Updated by the Project Development Branch:** 7/31/2019

**FENCE AND GATE DETAILS**

- **Location:** 42 in. panels
- **Height:** 42 in.
- **Weight:** Not less than 90 lbs. complete with latch and hinges.
- **Width of gate opening:** 16 ft. - 0 in. minimum to 20 ft. - 0 in. maximum.
- **Gate frame:** 1 in. standard galvanized pipe of acceptable equivalent and shall be of all welded construction.
- **Wire fence shall comply with the American Wire Gauge No. 8 stranded copper wire included in the work.
- **Grounding:**
   - Minimum four No. 8 stranded copper wires.
   - Grounding will be paid for separately but shall be included in the work.

---

**WIRE FENCES AND GATES**

- **Type:** 2 in. x 2 in. x 1 in. Structural Steel Angle
- **Number of braces:** 1
- **Length:** 6 ft. - 6 in. Min. Minimum
- **Panel Gate:** 7 ft. - 0 in. Minimum

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**Computer File Information**

- **Creation Date:** 07/31/19
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- **Grounding:**
   - Minimum four No. 8 stranded copper wires.
   - Grounding will be paid for separately but shall be included in the work.

---

**WIRE FENCES AND GATES**

- **Type:** 2 in. x 2 in. x 1 in. Structural Steel Angle
- **Number of braces:** 1
- **Length:** 6 ft. - 6 in. Min. Minimum
- **Panel Gate:** 7 ft. - 0 in. Minimum

---

**Computer File Information**

- **Creation Date:** 07/31/19
- **Designer Initials:** JBK
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- **Scale:** Not to Scale
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- **Project:** WIRE FENCES AND GATES
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- **Location:** 42 in. panels
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- **Weight:** Not less than 90 lbs. complete with latch and hinges.
- **Width of gate opening:** 16 ft. - 0 in. minimum to 20 ft. - 0 in. maximum.
- **Gate frame:** 1 in. standard galvanized pipe of acceptable equivalent and shall be of all welded construction.
- **Wire fence shall comply with the American Wire Gauge No. 8 stranded copper wire included in the work.
- **Grounding:**
   - Minimum four No. 8 stranded copper wires.
   - Grounding will 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 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" NORMAL SPACING.
WOODEN STAYS SHALL REST ON THE NATURAL GROUND AND MAY BE
STAPLED, OR DRILLED AND TIED WITH WIRE.

COMBINATION WIRE FENCE WITH WOODEN POSTS

COMBINATION WIRE FENCE WITH METAL POSTS

TYPICAL INSTALLATION AT FENCE INTERSECTIONS

NOTES
1. FOR EXISTING CONCRETE, THE \( \frac{1}{2} \) IN. HOLES SHALL BE EXPANDED AND CROWNED INTO DRILLED HOLES.
2. PINS SHALL BE MADE OF \( \frac{1}{2} \) IN. ROUND BARS WITH A MINIMUM OF 6 IN. OF BODY LENGTH EMBEDDED (HOOKED OR BENT) IN FRESH CONCRETE.
3. EYEBOLTS SHALL HAVE A MINIMUM OF 1 IN. INSIDE EYE DIAMETER.
4. EYEBOLTS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

WIRE FENCES
AND GATES

STANDARD PLAN NO.
M-607-1

Issued by the Project Development Branch: July 31, 2019
1. At each location where an electric transmission, distribution, or secondary line crosses a fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electric Code. A ground shall also be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

2. A ground shall be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

3. At each location where an electric transmission, distribution, or secondary line crosses a fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electric Code. A ground shall also be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

4. At each location where an electric transmission, distribution, or secondary line crosses a fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electric Code. A ground shall also be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

5. At each location where an electric transmission, distribution, or secondary line crosses a fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electric Code. A ground shall also be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

6. A ground shall be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

7. At each location where an electric transmission, distribution, or secondary line crosses a fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electric Code. A ground shall also be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

8. A ground shall be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

9. A ground shall be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

10. At each location where an electric transmission, distribution, or secondary line crosses a fence, the contractor shall furnish and install a ground conforming to Article 250 of the National Electric Code. A ground shall also be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

11. A ground shall be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.

12. A ground shall be installed a maximum of every 500 ft along the fence. The ground rod shall be a minimum diameter of \( \frac{1}{2} \) in. and 8 ft. in length, and driven at least \( \frac{7}{2} \) 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 cost of the fence.
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 M281. END POSTS AS DESCRIBED IN THE SPECIAL CONDITIONS AND ANY ADDITIONAL END POSTS SHALL BE SUPPLIED FOR FULL BRACE POSTS WHEN REQUIRED BY THE ENGINEER.

2. LINE BRACE POSTS SHALL BE INSTALLED EVERY 600 FT. OR LESS WHERE THE FENCING IS CONTINUOUS THE COST SHALL BE INCLUDED IN THE WORK. SEE STANDARD PLAN M-607-3.

3. WOVEN WIRE FENCE FABRIC, USED AS SHOWN, SHALL BE GALVANIZED (ZINC-COATED) CLASS 1 AND CONFORM TO AASHTO M279 (ASTM A116).

4. CONCRETE FOOTINGS SHALL HAVE TOPS CROWNED AT GROUND LEVEL AND SHALL BE CLASS B CONCRETE WITH LIGHT WEIGHT AGGREGATE, CONFORMING TO AASHTO M195 (ASTM C330) WILL BE PERMITTED. THE COST OF THE CONCRETE SHALL BE INCLUDED IN THE WORK.

5. ON CURVES FENCE WIRE 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 3/8" IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7 1/2 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.

NOTE: HOLES IN END POSTS AND BRACES SHALL ACCOMMODATE 1/2" DIA. GALVANIZED MACHINE BOLTS.
GENERAL NOTES

2. At each location where an electric transmission, distribution, or secondary line crosses a barrier fence, the contractor shall paint and install a ground conforming to Article 250 of the National Electrical Code. The ground rod shall be of a minimum diameter of 3/4 in. and 8 ft. in length and driven at least 7½ ft. into the ground. The rod shall be connected to each wire with a ground wire of No. 8 stranded copper wire. Grounding will not be used for separately but shall be included in the work.

5. Fence wire may be placed on either the road side or the field side of posts, depending on local conditions. On curves, the wire should be placed on the side which would result in the least amount of tension on the staples and which would not affect the road. Where wind drift or other conditions would exert unusual pressure against the wire, the wire should be placed on the side where it would be least affected.

6. Where concrete structures are used as a deer pass, the fence shall be placed at a distance from the structural member. In fresh concrete, it shall be 8 ft. in front, and 4 ft. behind. It shall be 8 ft. behind the concrete slab shall be reinforced, and a skirt into freestall miles. Easements shall have a minimum of 2 in. Bore eye shall be furnished and installed in the roadway. The easement cost of easements shall be included in the contract price for fencing.

7. When wire fence is used, the contractor shall install a ground in accordance with Section 250 of the National Electrical Code.

8. All fence wire ties, brace wires, staples, and other wire appurtenances shall be made of copper in accordance with Article 250 of the National Electrical Code.

9. The contractor shall re-establish disturbed or destroyed survey monuments to the approximate accuracy in accordance with Subsection 625.08 of the Standard Specifications.

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

11. Deer gate and top braces shall be painted with green paint according to Subsection 708.03 and Color No. 14109 of Federal Standard 5958.

DEER FENCE WIRE FABRIC

TYPICAL STAPLING

WIRE SPLICE

CROSS BRACE Doweling

DEER FENCE, GATES, AND GAME RAMPS

STANDARD PLAN NO. M-607-4

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 1 of 5
**ANIMAL HABITAT**

**END POSTS**

----

**r**

**•----40'-----------64' MIN .. --------i-----40'----• 1**

**ONE-WAY**

**DEER GATE**

**VARIABLE IN MULTIPLES OF 24" WIDTH WITH LINE POSTS TO THIS SECTION.**

**ONE-WAY**

**LINE POSTS**

**NOTES**

1. **SIX IN DOUBLE ACTING SPRING DOOR HINGE WITH FLAT BUTTON TIPS**
   - SHALL BE USED AS A SINGLE SWING HINGE AND BE PROVIDED WITH A GREASING NIPPLE AND WELDED TD SUPPORT PLATE.

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

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**PLAN VIEW - TYPICAL DEER GATE INSTALLATION**

**SECTION A-A**

**FRONT VIEW - DEER GATE**

**TYPICAL HINGE DETAIL**

**TYPICAL TINE DETAIL**

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**LEGEND**

- **LINE POST**
- **HIDDEN STAY**
- **END POST**
- **BRACE**

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**COMPUTER FILE INFORMATION**

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

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**DEER FENCE, GATES, AND GAME RAMPS**

**STANDARD PLAN NO.**

M-607-4

**Standard Sheet No. 2 of 5**

**DEER-GATE CENTERLINE**

**TYPICAL BRACE DETAIL**

**FRONT VIEW - DEER GATE**

**SECTION A-A**

**TOP VIEW - DEER GATE**

**TOP BRACE 7/2"**

**POST CTRS. 10"**

**TINE, SEE DETAIL**

**TOP VIEW - DEER GATE**

**SUPPORT PLATE 3" X 5/16" X 37" TINE**

**TOP BRACE & BOLTS SHOWN**

**SHOULD BE INCLUDED IN THE**

**UNIT PRICE FOR DEER GATE.**

**2 L 3/4" X 1/4" TOP BRACES HELD BY**

**5/16" BOLTS SILVER WELDED**

**TD SUPPORT PLATES**
DEER FENCE WIRE FABRIC TRANSITIONED TO WINGWALL EYEBOLTS AT 3' MAX. SPACING.

1. Locations of deer fence in the clear zone shall be shown in the plans.
2. Posts within the clear zone shall be drilled.
3. Holes need to be perpendicular to the roadway.
4. Knots shall be omitted from any end post or corner post within the clear zone.

Notes:
- Post within the clear zone shall be drilled.
- Holes need to be perpendicular to the roadway.
- Knots shall be omitted from any end post or corner post within the clear zone.

GAP CLOSURES
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.
1. The landing zone shall be flat, stable, and earthed. The area shall be free 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 easements.

3. Fill material shall be structure backfill (Class 2) and meet the requirements of Section 206 with a minimum composition of 90%.

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

5. Finished grade of backfill/topsoil shall be 12" active earthed.

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.

2" X 8" TREATED LUMBER END POST OR CORNER AND \ LINE BRACE POST OR EQUIVALENT AS APPROVED BY THE ENGINEER

FILL GAME RAMP

DEER FENCE WIRE FABRIC (TYP.)

TOPSOIL, SOIL CONDITIONING, AND SEEDING (NATIVE) FOR ALL DISTURBED AREAS

DEER FENCE, GATES, AND GAME RAMPS

STANDARD PLAN NO. M-607-4

Standard Sheet No. 4 of 5

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:
CUT SECTION PERPENDICULAR TO GAME RAMP

FILL SECTION PERPENDICULAR TO GAME RAMP

SECTION A-A

CUT SECTION B-B

FILL SECTION C-C

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 underneathimonial shingles or tiles.
4. Minimum splice of all geotextile shall consist of 1 foot of overlap.
5. Geotextile reinforcement wrap at back face of game ramp 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 shim tiles or tiles. 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.

DEER FENCE, GATES, AND GAME RAMPS

STANDARD PLAN NO. M-607-4

Issued by the Project Development Branch: July 31, 2019
1. 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-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 lb. 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 work.

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 wires, each horizontal wire shall be fastened securely to each fence post by means of 12-gage wire clamps or 12-gage wire ties.
GENERAL NOTES

1. Steel light standards shall have an 8 in. outside diameter at the base with a 7 3/8 in. minimum wall thickness and a uniform taper throughout. Light standards shall be round or square, and fabricated in accordance with Sections 613 and 715.


3. The gate arm shall be fabricated from high-strength rectangular fiberglass and high-strength rectangular aluminum tubing. The maximum arm length shall be 45 ft. The fiberglass/steel/aluminum gate shall be supplied by Safetrax, B&B Electronic, or an approved equivalent.

4. The contractor shall survey the cross section of the roadway, determine each gate arm length and submit the information to the Engineer before ordering material. The location of the road closure gates and the required mounting height of the gate arm pivot shall be verified by the contractor and submitted to the Engineer.

5. A breakaway shear pin base is required for the lightweight aluminum/fiberglass arm. An excessive force applied to the gate arm, either by the steel plate, the tie down, the chain, or the arm shall cause it to shear horizontally and free of the gate operator, minimizing damage to the vehicle and the gate.

6. The heights of the gate arm guides were determined for a 29 ft. tall tapered light standard with a base diameter of 8 in. and a top diameter of 4 in. In all cases locations may be adjusted for various gate arm lengths and bending light standards. The height of the gate arm over the roadway shall be 3 ft. 6 in. to 4 ft. 6 in. from the bottom of the arm to the roadway.

7. The worm gear which are case hardened shall be manufactured by Johnson-Laird, Inc., wheel and worm, with a 7 3/4 in. pitch circle, and a full capacity of 2000 lbs.

8. When the gate is fully raised, the nut and washer shall fit snugly against the outside of the rear channel, and will be placed in place. The Contractor shall supply one heavy, weatherproof lockset with two keys for each gate arm pivot. Information on the key type requirements will be provided by the Engineer. Details for locksets shall be keyed alike.

9. Electrical connections to the power source shown on the plans shall be paid for by force account if no source is available. Only the lamp, and use battery or solar panel power for the LED lights as approved by the Engineer.

10. Gate warning lights shall be red LED in high intensity. The lights at the end of the arm, near the centerline of the roadway shall be steady burn. The other two lights shall flash at the rate required by the Master Spacing of the lights shall vary based on roadway width and gate arm length. The Contractor shall determine the spacing and submit the LED layout to the Engineer for verification prior to placement.

11. Galvanizing: The steel light standards, mast arms, drop gate pivots, supports, guides, and all associated hardware shall be galvanized in accordance with Section 715. All rough edges and burrs shall be ground smooth prior to galvanizing.

12. Bolted connections: All bolts shall be CSA Grade A, unless modified as noted. The Contractor shall furnish all necessary bolts and nuts, and all exposed bolts shall be painted with two coats of aluminum paint.

13. Field Assembly: In some installations, the connection plates for the luminaire arms may require modification to allow the pivot sleeve to slip over the arm to the roadway. The luminaire shall meet the requirements of subsection 705.0.4.

14. Field assembly in some installations, the connection plates for the luminaire arms may require modification to allow the pivot sleeve to slip over the arm to the roadway. The luminaire shall meet the requirements of subsection 705.0.4.
DIVIDED HIGHWAY INSTALLATION
(TWO GATES REQUIRED)

INTERSTATE MAINLINE

LUMINAIRE AND GATE
(RAMP LOCATIONS)
DROP GATE ARM

STEEL LIGHT STAND ARM

PADLOCK IN PLACE WHEN GATE IS RAISED

SECURE CABLE TO PIVOT WITH SHEAR PIN BASE OR BREAK-AWAY TRANSFORMER BASE.

WEATHERTIGHT ELECTRICAL RECEPTACLE (LOCKABLE)

ROAD CLOSED

HALTED-RED AND WHITE RETRO-REFLECTIVE MATERIAL,

ALUMINUM GATE ARM SECTION

1'-0" 4" x 1/4" x 7" WALL THICKNESS

SECTION A-A

DROP GATE DETAIL

NOTE: PLACE THE BLACK AND WHITE "ROAD CLOSED" SIGN IN THE CENTER OF THE THROUGH LANE. THE SIGN LETTERS WILL BE 18" IN HEIGHT.

LUMINAIRE POLE - FIBERGLASS GATE ARM SECTION • LIGHT (TYPE B)

ROAD CLOSED

ALTERNATING RED AND WHITE RETRO-REFLECTIVE MATERIAL,

5" x 2" 4" x 1/4" x 10" SQUARE TUBING • BOLTS NOT SHOWN.

GATE ARM AND BOLTS NOT SHOWN.
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)
17" TO
BOLT CIRCLE DIAMETER SHALL FIT
THE LIGHT STANDARD FOUNDATION

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.
3. 8 #7 REBARS (SPACE EVENLY)
4. 2-W2" MIN. DIA. CONDUITS (LOCATION
OPTIONAL)
5. 3" CLR.
6. 18" R" \I
7. 48" MAX.
8. WARNING TAPE 6" TO 12" DEEP
9. COMPACTED BACKFILL
TYPICAL FOUNDATION SECTION

TYPICAL CONDUIT BURIAL SECTION
NOTES:
1. THE CONTRACTOR SHALL CORRECTLY TRACING WITH OTHER UNDERGROUND
UTILITY LAY MATERIALS AND INFORM THE CONTRACTOR SHALL USE
CONJUNCTIONS AT ALL ROAD CROSSINGS WHERE POSSIBLE.
2. ONE R/A AND LOCATE WIRE AT A HOLE FULL STRAND IN ALL EMPTY CONDUCTS.

Typical Break-Away Type Transformer Base Detail

Typical Concrete Foundation

Typical Conduit Burial Section

Foundation Notes
1. See Pole Supplier Details for Bolt Circle and Projection.
2. All Breakaway Support Couplings shall meet the
Breakaway requirements stated in the Latest Edition of
AASHTO "Standard 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,
The contractor shall have a coupling manufacturer's
representative on the project prior to construction
to instruct the contractor and project personnel
in the proper installation of the Breakaway Support
Couplings.
4. Light Standard Foundations may be Precast Concrete or
Cast-in-place Concrete.
5. Concrete shall be Class B.
6. Each Light Standard shall be wired with a Breakaway
Fused Connector and be terminated as stated in the
Specifications.
7. Light Standard shall not be placed in cutouts or other
low areas or embankments and backfill shall be compacted
in conformance with Section 203.
8. The physical shapes of the pole caps, brackets, and
Concrete Pull Boxes shall be considered approximate
as shown.
9. All nuts, bolts, studs and washers shall be galvanized
in conformance with AASHTO M 232 (LRW A 490).

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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 7/8 in. x 11/4 in. bolts from shear pin base. See the shear pin base detail.
2. Swivel arm using the 7/8 in. x 8 in. HS bolt as a pivot.
3. Swivel arm clear of roadway and secure to a delineator post.
4. Reset arm to upright position when weather permits.

Note: See details below.

- 5/16 in. x 1 1/4 in. bolts
- 1 1/4 in. x 8 in. HS bolt
- 1 1/4 in. x 4 in. fiberglass tube
- 1 1/4 in. x 1 3/4 in. fiberglass tube

High Wind Stowing Procedure

Road Closure Gate

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

1. POLE BASE PLATE SHALL CONFORM TO ASTM A 572, GRADE 42.
2. BOTTOM PLATE OF SLIP BASE ASSEMBLY SHALL CONFORM TO ASTM A 572, GRADE 50.
3. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION IN CONFORMANCE WITH ASTM A 123. ALL CONTACT AREAS OF THE STRUCTURAL STEEL SHALL BE FREE OF GALVANIZING BEADS AND RUNS.
4. SLIP BASE CONNECTING HARDWARE SHALL CONFORM TO ASTM A 325, AND SHALL BE ELECTROPLATED CADMIUM IN CONFORMANCE WITH ASTM B 766 TYPE NS.
5. KEEPER PLATE SHALL CONFORM TO ASTM A 653, GRADE 33, AND COATING G 90.

ANCHOR BOLTS

GALVANIZED SHEET METAL

PLATE WASHER

GALVANIZED SHEET METAL TO KEEP SHEET FROM SLIP BOLTS

BREAK-AWAY BASE

FOR INFORMATION ONLY

SLIP BASE ASSEMBLY

OPTIONAL BREAK-AWAY TYPE BASE

ROAD
CLOSURE GATE

STANDARD PLAN NO.
M-607-15

Standard Sheet No. 9 of 9

Issued by the Project Development Branch: July 31, 2019
**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 on which they serve, or as shown on the contact plans.

2. Alternatives are defined as changes to existing roadway that may affect pedestrian access. Construction, or use alternatives include, but are not limited to, realigning, realigning, reconstruction, curb ramp relocations, historic restoration, or changes to realignment to structural parts of 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 reasonably traversed by a user and visually discerned.

4. In alterations, where an existing physical constraint prevents providing a separate curb ramp for each pedestrian street crossing, a single diagonal ramp in the area shall be permitted to serve both pedestrian street crossings. The use of a single diagonal ramp shall be approved by the designer prior to construction. Diagonal ramps are not acceptable in new construction or full-depth reconstruction.

5. Detectable warning surfaces (DWS) are intended to indicate the boundary between a pedestrian route and vehicular route where there is a flush rather than curbed connection. DWS are not intended to provide warning to pedestrians and shall be applied at the following locations:
   - Curb ramps, blended transitions, and depressed corners at pedestrian street crossings;
   - Pedestrian refuge platforms at transit stops where the edge of the platform is not protected to pedestrian cross traffic;
   - Curb ramps at median or street level transit stops where the area is not protected to pedestrian cross traffic.

6. Detectable warning surfaces shall contrast visually with the adjacent gutter, highway, or pedestrian access route surface. Efforts should be made to ensure that the color of the detectable warning surface is different from adjacent surfaces.

7. All slopes are measured with respect to a level plane.

8. Drainage structures, traffic control devices, or other obstructions shall not be installed on the curb ramp, or turning space areas.

9. In new construction, full-depth, median, or blend transitions, maintenance hole covers, street signs, or similar, shall not be constructed within any part of curb ramp or turning space. In alterations, where these items cannot be relocated outside of the curb ramp or turning space, they shall not be installed on the outer edge of the curb ramp or turning space. Any vertical discontinuity between 1/2 inch and 1 inch shall be reduced with a slope not steeper than 1:12 and the horizontal level shall be applied across the entire surface discontinuity.

10. Construction of any required curb shall be included in the bid price of the concrete curb ramp and will not be paid for separately.

11. All curb ramp joints and grade breaks shall be flush (0/0). The joint between the roadway surface and the gutter pan shall be flush.

12. The contractor shall verify removal limits are sufficient to provide positive drainage, maintain existing drainage patterns, and avoid pooling in the final construction.

13. Flared side slopes may exceed 10.0% only where they abut a non-walkable surface, or where the adjacent ramp surface is to pedestrian traffic.

14. The change in grade at the bottom of the curb ramp shall not exceed an algebraic difference of 10.0%. The center slope of the gutter at the exit of a ramp, turning space, or blended transition shall not exceed 0.01.

15. Grade breaks at the top and bottom of a ramp ramp shall be perpendicular to the direction of the curb ramp or turning space.

16. A curb ramp may be flared with a slope not steeper than 1:12 and the horizontal level shall be applied across the entire surface discontinuity.

17. In alterations, where a ramp or turning space must tie into an existing grade that cannot be altered, the ramp or turning space may be flare shaped at the required grade. The length of the flame area of a turning space to minimize the degree of warping. The rate of change on a ramp or turning space shall not exceed 3.0% per linear foot.

18. Design and construct curb ramps, turning spaces, and flared slopes with the flattest slopes possible. The slopes described in this details shall be used during design, layout, and construction area.

**GENERAL NOTES & PAY AREAS**

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2 - Two Ramps</th>
<th>Type 2 - One Ramp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curb Ramp</td>
<td>Turning Space</td>
<td>Flared Transition</td>
</tr>
<tr>
<td>Threshold</td>
<td>Side</td>
<td>Transition</td>
</tr>
</tbody>
</table>

**CURB RAMPS PAY AREAS**

- **Curb Ramps M-608-1**
- **Standard Plan No.** M-608-1
- **Standard Sheet No.** 1 of 10

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**Notes:**
- Where snow removal equipment is 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.
- Provide expansion joint material, if the entire curb ramp is not included in the street or sidewalk, to provide for the full depth of the concrete surface.
- Provide the required reduction between different concrete curb and gutter cuts, and shall not be No. 4 or larger. Reductions made at 90 degree center to center working.

**DESIGN AND CONSTRUCTION:**
- Curb ramps, turning spaces, and flared slopes shall be constructed with the flattest slopes possible. The slopes described in this details shall be used during design, layout, and construction area.
- **Flared Slope Limit:**
  - **Percent Slope:** 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0%
  - **Equivalent Ramp:** 50:1, 40:1, 30:1, 24:1, 20:1, 18:1, 16:1, 14:1, 12:1, 10:1, 8:1, 6:1, 4:1, 3:1, 2:1, 1:1, 50:1
  - **Combination:**
    - **Percent Slope:** Flared Slope, Threshold Slope, Turning Slope, Curb Ramp Slope
    - **Equivalent Ramp:** Flared Slope, Threshold Slope, Turning Slope, Curb Ramp Slope

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- **Creation Date:** 07/31/19
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- **Detailer:** L. T. A.
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**Sheet Revisions**

- **Issued by the Project Development Branch:** July 31, 2019
- **Project Sheet Number:** Standard Sheet No. 1 of 10

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**Colorado Department of Transportation**

**Project Development Branch**

- **Project No.:** M-608-1
- **Standard Plan No.:** M-608-1
- **Standard Sheet No.:** 1 of 10
- **Issued by the Project Development Branch:** July 31, 2019
- **Project Sheet Number:** Standard Sheet No. 1 of 10
PERPENDICULAR RAMP (TYPICAL)

- CURB & GUTTER

PERPENDICULAR RAMP (WITH VERTICAL RETURN CURB)

- CURB & GUTTER

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 MATCH THE WIDTH OF THE PATH.

2. RAMP RUNNING SLOPE - 0.03 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. RAMP AND TURNING SPACE CROSS-SLOPE - 2.0% TYPICAL. AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE CUES CAN PROCEED THROUGH THE INTERSECTION WITHOUT STOPPING OR SLOWING, THE CROSS-SLOPE OF RAMPS AND TURNING SPACES MAY EQUAL THE HIGHWAY GRADE. AT MIDBLOCK PEDESTRIAN STREET CROSSINGS THE RAMP AND TURNING SPACE CROSS-SLOPE MAY 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 ALTERNATIVES WHERE EXISTING PHYSICAL CONSTRAINTS PREVENT PROVIDING ONE CURB RAMP FOR EACH CROSSES DIRECTION, A SINGLE DIAGONAL CURB RAMP ON THE APPEX OF A CORNER MAY BE PERMITTED TO SERVE BOTH PEDESTRIAN STREET CROSSINGS. IF A DIAGONAL RAMP IS USED, A CLEAR SPACE 4 FT X 4 FT MUST BE PROVIDED AT THE FACE 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, 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 ABUTS A NON-WALKABLE SURFACE, OR WHERE A RAMP IS PROTECTED FROM PEDESTRIAN CROSS TRAFFIC (FOR EXAMPLE BY A SIGNAL CABSINET OR UTILITY POLE WHICH BLOCKS PASSAGE).

GUTTER COUNTER SLOPE - 0.03 MAX.

TYPE 1 PERPENDICULAR CURB RAMPS

**STANDARD PLAN NO.**

**CURB RAMPS**

**STANDARD PLAN NO.**

**M-608-1**

**STANDARD SHEET NO. 2 of 10**

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

**Project Sheet Number:**
CURB HEIGHT MAY BE REDUCED TO 3" MIN.

TYPE 1 RAMPS FOR WIDE SIDEWALK
(3" REDUCED CURB)

TYPE 1 RAMP (DIAGONAL)
NOT ALLOWABLE IN NEW CONSTRUCTION/FULL DEPTH RECONSTRUCTION
SEE GENERAL NOTE 4

TYPE 1 DIRECTIONAL RAMPS (LARGE RADIUS)

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

STANDARD PLAN NO.
M-608-1

Issued by the Project Development Branch July 31, 2019
PARALLEL CURB RAMPS

PARALLEL RAMPS (TYPICAL)

CURB RAMP

LANDING AREA RUNNING SLIDE 2% MAX., SEE NOTE C.

CURB RAMP

GUTTER COUNTER SLOPE 5.0% MAX.

SECTION C-C

SECTION B-B

SECTION A-A

TYPE 2 PARALLEL CURB RAMPS

CURB RAMP

LANDING AREA RUNNING SLIDE 2% MAX., SEE NOTE C.

CURB RAMP

GUTTER COUNTER SLOPE 5.0% MAX.

SIDEWALK TO SHOULDER TRANSITION
PEDESTRIAN CURB OR VERTICAL OBSTRUCTION

CROSSWALK BAR (TYPICAL)

PEDESTRIAN CURB

+ + + + + + + + +
+ + + + + + + + +
+ + + + + + + + +
+ + + + + + + + +
...................................

TYPE 2 RAMPS SMALL RADIUS

(3" REDUCED CURB)

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 (MID RAMP CONFIGURATIONS) MAY BE ACCEPTABLE AS LONG AS THEY CONFORM TO THE CRITERIA IN THESE STANDARDS, AND ARE APPROVED BY THE ENGINEER.

ALL GRADE BREAKS PERPENDICULAR TO PATH OF PEDESTRIAN TRAVEL

CURB FACE MAY BE ORIENTED PERPENDICULAR TO FACE OF CURB OR IN THE DIRECTION OF THE CROSSING AS SHOWN.

TURNING SPACE

SEE NOTE 4, 5, 6 - SHEET 4

DETECTABLE WARNING SURFACE (DWS)

SEE DWS SHEETS FOR PLACEMENT DETAILS

RAMP RUNNING SLOPE

RAMP CROSS SLOPE

NOTE

CURB RAMPS

Designer Initials: JBK

Last Modification Date: 07/31/19

Detailer Initials: LT A

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: CAD Ver.: MicroStation VB Scale: Not to Scale Units: English
All grade breaks perpendicular to path of pedestrian travel

Combination curb ramp notes:

1. The curb ramp placements shown are typical configurations only and not indicative of all possible curb ramp configurations which 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 where 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 exceed the highway grade when 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 and 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
**TOP OF PAVEMENT**

**GUTTER SLOPE**

**5% MAX.**

**VARIES TO FL**

**2' MIN.**

**4' MIN.**

**5% MAX.**

**DETECTABLE WARNING SURFACE**

**SECTION A-A**

**BLENDED TRANSITION**

**CONCRETE SIDEWALK**

**CROSSWALK BAR (TYPICAL)**

**SIDEWALK 5%**

**GRADE BREAK**

**SECTION B-B**

**DEPRESSED CORNER**

**DETECTABLE WARNING SURFACE (DWS)**

**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 physical site constraints.

2. Ramp Width - Provide 5 ft. or greater where possible. In site constraints not permit, provide at least a 4 ft. North Approach ramps. Elevating share-the-path ramps shall not match the width of the path.

3. Ramp Running Slope - 6.0% MAX.

4. Blended Transition Running Slope - 5.0% MAX.

5. Ramp and Turning Space Cross Slope - 2.0% TYPICAL at crossings without yield or stop control. With a 24 in. clearance vehicle can proceed through the intersection without slowing or stopping. The cross slope of ramps and turning spaces may equal the roadway grade.

6. Turning Space Dimensions - Provide a 4 ft. x 4 ft. min. Turning Space at the bottom of ramp runs. The Turning Space may contain the Detectable Warning Surfaces.

7. Ramp Alignment - Turning Space shall be aligned to be fully contained within the crosswalk or street crossings they serve.

8. Ramp Length - Ramp length is dependent upon the ramp slope and the grade elevation from the Turning Space to the Sidewalk. Where terrain is sloping a ramp is not required to change grade more than 12 ft. regardless of the resulting ramp slope.

9. Ramp Flares - Where a ramp edge abuts a valuable surface, a flared side must be provided. Ramp flare slopes shall not exceed 2.0%.

10. Vertical Curb Returns - Vertical Curb Returns may be used where a ramp axes a non-valuable surface, or where a ramp is protected from pedestrian cross traffic (for example by a traffic island or utility pole which blocks passage).

11. Gutter Counter Slope - 5.0% MAX.

12. Pipe Placement - Pipe shall be placed around the ramps and located at the back of curb on blended transition and depressed corner ramps.

**CURB RAMPS**

**STANDARD PLAN NO. M-608-1**

** issuanced by the Project Development Branch: July 31, 2019**
**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. If a 2-foot separation cannot be provided, no detectable warning surface shall be installed.
4. Curb ramp and cut-through widths shall be the same width as any shared-use path which they serve.

**Median Islands**

- **Square Curb to Orient Pedestrians in the Direction of the Crossing**
  - Less than 6'
  - Greater
- **Eliminate DS if Median Width is Less Than 6' in Length in the Direction of Pedestrian Travel**

**Intersection Islands**

- **Square Curb to Orient Pedestrians in the Direction of the Crossing**
  - 5' Min.

**AT-Grade Rail Crossing**

- **Path of Travel**
- **CROSSWALK BAR** (TYPICAL)
- **Turning Space**
DETECTABLE WARNING SURFACE NOTES:

1. DETECTABLE WARNING SURFACES (DWS) SHALL BE INSTALLED AT SIDEWALKS, OR SHARED USE PATHS, AT STREET TRANSITIONS, AND SHALL CONSIST OF TRUNCATED DOME SURFACES. ANY TRUNCATED DOME PANELS OR PAVINGS WHICH ARE USED MUST BE ON 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 APPLICABLE. 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. EDGES OF CUT PLATES SHALL BE STRAIGHT.


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.
CURB AND GUTTER TYPE 2
(SECTION IB)
(6 IN. BARRIER - 1 FT. GUTTER)

CURB AND GUTTER TYPE 2
(SECTION IIB)
(6 IN. BARRIER - 2 FT. GUTTER)

CURB AND GUTTER TYPE 2
(SECTION IM)
(6 IN. MOUNTABLE - 1 FT. GUTTER)

CURB AND GUTTER TYPE 2
(SECTION IM)
(6 IN. MOUNTABLE - 2 FT. GUTTER)

CURB AND GUTTER TYPE 2
(SECTION MS)
(4 IN. MOUNTABLE WITH SIDEWALK)

CONCRETE SIDEWALK

SIDEWALK EXPANSION JOINT

NOTES:
1. EXPANSION JOINTS SHALL BE PLACED IN THE SIDEWALK AT INTERVALS OF NOT MORE THAN 500 FT. WHERE THERE IS A CURB OR AT INTERSECTIONS OR MONOLITHICALLY.
2. EXPANSION JOINTS MAY BE SEALER WHEN SPECIFIED ON THE PLANS.

GENERAL NOTES
1. CURB AND GUTTERS ARE TO BE PLACED ON THE ARC OF THE CURVE. UNLESS OTHERWISE SPECIFIED ON THE PLANS, A MAXIMUM CHORD LENGTH OF 15 FT. MAY BE USED WHEN THE CURVE RADIUS IS GREATER THAN 1000 FT.
2. CURB AND GUTTERS SHALL BE CLASS B.
3. PROFILE GRADE OF CURBS AND GUTTERS SHALL BE LOCATED AT THE FLOW LINE.
4. CURB TYPE A IS REQUIRED TO BE USED IN LIEU OF CURB AND GUTTER TYPE 2 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. PROFILE RADIUS OF CURB AND GUTTER SECTION SHALL MATCH CURB AND GUTTER THICKNESS IF SHOWN ON THE PLANS. CURB AND GUTTER SHALL BE CLASS P CONCRETE IF PLACED MONOLITHICALLY WITH CONCRETE PAVEMENT.
7. INCREASE SIDEWALK THICKNESS TO 6 IN. AT LOCATIONS SHOWN ON THE PLANS.
8. MINIMUM SIDEWALK WIDTH IS 4 FT.
9. EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE Y2 IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE.

LEGEND

CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTION

EXANSION JOINTS MAY BE SEALER WHEN SPECIFIED ON THE PLANS.

NOTE:
1. EXPANSION JOINTS SHALL BE PLACED IN THE SIDEWALK AT INTERVALS OF NOT MORE THAN 500 FT. WHERE THERE IS A CURB OR AT INTERSECTIONS OR MONOLITHICALLY.
2. EXPANSION JOINTS MAY BE SEALER WHEN SPECIFIED ON THE PLANS.

EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE Y2 IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE.

EXPANSION JOINTS MAY BE SEALER WHEN SPECIFIED ON THE PLANS.
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

CURB TYPE 4 (KEY-WAY)

CURB CUT FOR DRIVEWAYS
(WITHOUT ATTACHED SIDEWALK)

LEGEND
FOR RADII
A = 1/4"
B = 1"
C = 3/4"
D = 2"

CURB TYPE 6
(SECTION M)
4 IN. MOUNTABLE

NOTE: EXTRUDED OR CONCRETE* UNLESS OTHERWISE SPECIFIED ON THE PLANS.
* KEY-WAY MAY BE OMITTED WHEN PLACED UNDER GUARDRAIL.

CURB TYPE 4 (KEY-WAY)
TRANSITION WHEN THERE IS NO SIDEWALK AT BACK OF CURB OR WHEN SIDEWALK IS SET BACK FROM CURB

SECTION A-A
CONCRETE PAVEMENT (DRIVEWAYS)

CURB, GUTTERS,
AND SIDEWALKS

STANDARD PLAN NO.
M-609-1

Project Development Branch
JJK

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

1. Drainage structures, traffic signal equipment, junction boxes, 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.

4. Construction of the concrete pedestrian curb shall be included in the bid price of the concrete pavement.

CONCRETE DRIVEWAY ENTRANCE TYPE 1

CONCRETE DRIVEWAY ENTRANCE TYPE 2

SECTION A-A

SECTION B-B

SECTION C-C

SECTION D-D

NOTES

1. Drainage structures, traffic signal equipment, junction boxes, 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.

4. Construction of the concrete pedestrian curb shall be included in the bid price of the concrete pavement.
1. Drainage structures, traffic signal equipment, sanitary boxes, 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% or flatter.
GENERAL NOTES

1. CONCRETE SHALL BE CLASS B, PLACEMENT MAY BE CAST-IN-PLACE OR PRECAST.
2. REINFORCING BARS SHALL BE #4, GRADE 60.
3. ALL TIMBER SHALL BE TREATED IN CONFORMITY WITH ASHTE 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 PAINTED WITH ALUMINUM PAINT IN
   ACCORDANCE WITH SECTION 509. ALL HARDWARE SHALL BE GALVANIZED IN CONFORMITY
   WITH AASHTO M 111 OR PAINTED WITH ZINC-RICH PAINT MEETING MILITARY SPECIFICATION
   DOD-P-21035.
6. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36.
7. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO
   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.

CAST-IN-PLACE FOUNDATION FOR
10 FT. THRU
42' ROADWAYS

PRECAST PORTABLE
FOUNDATION FOR
10 FT., 12 FT., 14 FT.,
AND 16 FT. ROADWAYS

TYPICAL CATTLE GUARD INSTALLATIONS

CAST-IN-PLACE
FOUNDATION FOR
10 FT. THRU
42' ROADWAYS

ELEVATION VIEW

WELDED GRILL CROSS SECTIONS
### Precast Portable Foundation

#### Elevation of Foundation

**When cast in place, longitudinal bars extending from and into the lateral supply shall be bent 90° with a 2 in. radius and continue perpendicular 2 in. from the bend.**

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<th>Size of Foundation</th>
<th>Bar - 2.13 lbs.</th>
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<tr>
<td>3/4 in. x 3/4 in. x 7/8 in.</td>
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<th>Size of Foundation</th>
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### Cast-in-Place Foundation

#### Foundation Quantities

- **One Steel Wing**
- **Wing Quantities**
- **Total lbs. steel = 106.5**

### Welded Grill Units

#### Cattle Guard

**Standard Plan No. M-611-1**

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

---

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<th>Grill Units (FT.)</th>
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**ELEVATION OF LATERAL SUPPORT**

- **Lateral Support Section B-B**
- **End Section of Foundation Section A-A**

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**Computer File Information**

- **Creation Date:** 07/01/19
- **Designer Initials:** JBK
- **Date:** 07/31/19
- **Comments:**
- **Last Modification Date:** 07/31/19
- **Standard Plan No.:** M-611-1
- **Issued by the Project Development Branch:** July 31, 2019
- **Project Sheet Number:**

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**Standard Sheet No. 2 of 2**

- **Colorado Department of Transportation**
- **M-611-1**
- **Standard Sheet No. 2 of 2**
- **Issued by the Project Development Branch: July 31, 2019**

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**Project Development Branch:**

- **JBK**
- **CAD Ver.: MicroStation V8**
- **Scale:** Not to Scale
- **Units:** English

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**Cattle Guard**
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. TIMBER POSTS MAY BE MADE FROM 6 IN. DIAMETER AND TREATED IN CONFORMANCE WITH 710.07.
5. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND PAINTED WITH ALUMINUM PAINT IN ACCORDANCE WITH SECTION 509. ALL HARDWARE SHALL BE GALVANIZED IN CONFORMANCE WITH ASSHTO M 111 OR PAINTED WITH MILITARY SPECIFICATION DDD-P-21035.
6. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36.
7. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
8. STRUCTURAL STEEL SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36.
9. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
10. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
11. 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 THIS WORK.
12. TOOLIZED OR SAWCUT JOINTS WILL BE REQUIRED IN THE 4 INCH CONCRETE FLOOR AS DIRECTED. THIS WORK WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THIS WORK.
13. HIGHWAY LOADING DESIGN DATA: HL-93 (DESIGN TRUCK OR TANDEM, AND DESIGN LANE LOAD).
14. A TREATED 2X6 MAY BE USED AT THE OPEN END OF THE DEER GUARD TO KEEP FILL MATERIAL FROM FALLING IN.
15. ALTERNATIVE DEER GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.
16. STEEL WING (TIMBER OR STEEL) SHALL BE STEEL UNLESS OTHERWISE SHOWN ON THE PLANS.
17. STRUCTURAL EXCAVATION, STRUCTURE BACKFILL, AND SURVEY WORK WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
18. A 4 IN. CONCRETE FLOOR SHALL BE PLACED IN THE DEER GUARD AND SHALL BE GRADED TO DRAIN. THIS QUANTITY WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
19. Outlet pipes will be required and paid for as shown in the plans. A 6 INCH SLICE MAY BE USED Physically to the central support to drain from one cell to the other AND IF NEEDED THE NUMBER OF OUTLET PIPES
20. TYPE OF WING (TIMBER OR STEEL) SHALL BE STEEL UNLESS OTHERWISE SHOWN ON THE PLANS.
21. STRUC TURAL EXCAVATION, STRUCTURE BACKFILL, AND SURVEY WORK WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
22. Toolized or sawcut joints will be required in the 4 inch concrete floor as directed. This work will not be paid for separately, but shall be included in this work.
23. HIGHWAY LOADING DESIGN DATA: HL-93 (DESIGN TRUCK OR TANDEM, AND DESIGN LANE LOAD).
24. ALTERNATIVE DEER GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.
25. A TREATED 2X6 MAY BE USED AT THE OPEN END OF THE DEER GUARD TO KEEP FILL MATERIAL FROM FALLING IN.
26. Toolized or sawcut joints will be required in the 4 inch concrete floor as directed. This work will not be paid for separately, but shall be included in this work.
27. HIGHWAY LOADING DESIGN DATA: HL-93 (DESIGN TRUCK OR TANDEM, AND DESIGN LANE LOAD).
28. A TREATED 2X6 MAY BE USED AT THE OPEN END OF THE DEER GUARD TO KEEP FILL MATERIAL FROM FALLING IN.
29. ALTERNATIVE DEER GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.
GENERAL NOTES

1. Rumble strips shall be omitted at turn and auxiliary lanes, road approaches, residences, 25 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. For formed or rolled on concrete pavements only.

8. 12" Rumble Strip (SEE NOTES 2 AND 4)

9. Maximum 2% grade.

10. TYPICAL SECTION C-C

11. TYPICAL SECTION A-A and B-B

12. STANDARD PLAN NO. M-614-1

13. Project Sheet Number: 1 of 3
SHOULDER
PAVEMENT----<--------------.---------,-------
MARKING l TRAVEL
TRAFFIC LANE

SAFE PASSING
ZONE 

r

A RUMBLE STRIPS IN
DOUBLE YELLOW LINE
SECTION ONLY (SEE NOTE 2)

SHOULDER
PAVEMENT----<---------------,.----- ....... ----------
MARKING

TWO LANE HIGHWAY (HMA AND CONCRETE)
CONTINUOUS CENTER LINE RUMBLE STRIPS

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 PAVEMENTS ONLY

NOTES
1. RUMBLE STRIP WIDTH SHALL BE 12 IN. FOR GRIND-IN, FORMED, OR ROLLED.
2. CENTERLINE RUMBLE STRIPS MAY BE CONTINUOUS THROUGH PASSING ZONES AS DETERMINED BY THE ENGINEER AND SHOWN ON THE PLANS.

SHOULDER
PAVEMENT----<-------------+------------------
MARKING

TRAVEL
LANE TRAFFIC

TRAFFIC

TRAFFIC

TRAFFIC

TRAFFIC

SHOULDER
PAVEMENT----<-----------------------+--------
MARKING

FOUR LANE UNDIVIDED HIGHWAY (HMA AND CONCRETE)
CONTINUOUS CENTER LINE RUMBLE STRIPS

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 PAVEMENTS ONLY

DETAILS FOR CENTER LINE RUMBLE STRIPS

Computer File Information

Sheet Revisions

Colorado Department of Transportation
2063 West Howard Place
CDOT HO, 3rd Floor
Denver, CO 80204
Phone: 303-757-9021 FAX: 303-757-9868
Project Development Branch JBK

Issued by the Project Development Branch July 31, 2019
Project Sheet Number:
STOP SIGN APPROACH

LANE REDUCTION TRANSITION

CURVE APPROACH

TRAVEL LANE RUMBLE STRIPS

TYPICAL RUMBLE STRIP CLUSTER

SECTION A-A

SECTION B-B

PERMANENT GROOVED RUMBLE STRIPS

TEMPORARY RAISED RUMBLE STRIPS

NOTES

1. GROOVED RUMBLE STRIP CLUSTER SPACING SHALL BE MODIFIED TO AVOID LOCATING A GROOVE ON A CONCRETE PAVEMENT TRANSVERSE JOINT.

2. PERMANENT TRAVEL LANE RUMBLE STRIPS SHALL BE THE GROOVE DESIGN AND MAY BE CUT IN EXISTING CONCRETE OR CONCRETE PAVEMENT. THE GROOVES MAY BE CUT BY SAWING, GRINDING, OR OTHER METHOD AS APPROVED.

3. TEMPORARY RUMBLE STRIPS SHOULD BE THE RAISED DESIGN, THEY MAY BE LOCATED AT LOCATIONS THAT WILL BE REMOVED OR COVERED WITH A PAVING COURSE DURING COMPLETION OF THE PROJECT. TYPICAL USES OF TEMPORARY RUMBLE STRIPS ARE FOR LANE CLOSURES OR ALIGNMENT CHANGES IN CONSTRUCTION ZONES.

4. THE MAX RAISED RUMBLE STRIPS SHALL BE PLACED ON A CLEANSrenched TREATED PAVEMENT IN 4%, IN NEW PAVEMENT, THE PAVEMENT SHALL BE REMOVED AND THE ASPHALT COMPACTED BY ROLLING ALONG THE STRIPS. EDGES MAY BE TAPERED OR TREATED WITH A ROLLER AND THE TOP EDGES ROUNDED. THERMOPLASTIC 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. 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. INTERMIXING OF DIFFERENT BRANDS OF MODULES ARE ACCEPTABLE IF THE MODULES ARE FHWA APPROVED AND THE ARRAY MEETS THE DESIGN CRITERIA.
8. WIDE ARRAYS ARE ACTUALLY SEVERAL NARROW ARRAYS PLACED SIDE BY SIDE TO PROVIDE THE REQUIRED WIDTH.

WIDE ARRAY CONFIGURATION MAY VARY IN LAYOUT AND SAND WEIGHT (LBS) PROVIDED THEY CONFORM TO MANUFACTURER'S DETAILS.

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SAND BARREL ARRAYS

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Project Sheet Number:

STANDARD PLAN NO.
M-614-2
Standard Sheet No. 1 of 2
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.
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-L.

3. The end section-to-plate joint for corrugated metal pipe shall be in accordance with the Type 1 or Type 2 Typical connection detailed in Standard Plan M-603-10. The Type 3 or Type 4 Typical connection is 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 604. 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 in accordance with the manufacturer's specifications and shall be approved by the Engineer.

4. Plastic pipe shall conform to AASHTO M294 Type C.

5. Details of miscellaneous curbing are shown in Standard Plan M-605-L.

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 the work shall be as follows:

- 506 - Pipe (506 - Pay items as specified on the plans).
- 609 - Curved Type 4 or Type 6 (Section M) - Lineal Ft.
- 615 - Embankment Protector (Type 3) - Each

NOTE: Payment includes the end section, the trash guard (when specified on the plans), the pipe connection, 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 Payment for this work shall be as per standards:

NOTE: Payment includes the end section, the trash guard (when specified on the plans), the pipe connection, structure excavation, embankment material, and any extra work required to modify other pay items.

- 603 - 12 in to 18 in pipe - Lineal Ft.
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 WILL NOT BE USED IN 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 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 LINEAR FT.
   615 - EMBANKMENT PROTECTOR (TYPE 5) EACH

   NOTE: THIS PAYMENT INCLUDES THE STRUCTURE EXCAVATION, ANY OTHER EARTHWORK, AND ANY EXTRA WORK REQUIRED TO MODIFY OTHER PAY ITEMS.
I. TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODES SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER SWITCH (AB SWITCH) FOR THE COMPUTER AND FAX. TRAILER WIRING SHALL 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.

II. DIMENSIONS: 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.

III. WINDOWS: EQUIPPED WITH HORIZONTAL PUSH BAR, EQUIPPED WITH A SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, EQUIPPED WITH A SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, EQUIPPED WITH A SMALL CLEAR GLASS WINDOW.

IV. DOORS: TWO, EQUIPPED WITH DEADBOLT LOCKS, 36 IN. x 80 IN., INSULATED STEEL WITH A SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, EQUIPPED WITH A SMALL CLEAR GLASS WINDOW.

V. FLOOR: ADEQUATE INSULATION UNDER THE FLOOR. FLOOR COVERING SHALL BE SKID RESISTANT.

VI. HEATER: FURNACE, 41,000 BTU, FORCED AIR TYPE.

VII. BOOKSHELVES: OVER DESK AREA. TOP SHELF SHALL BE AT LEAST 14 IN. BELOW CEILING.

VIII. WORK BENCHES: 30 IN. WIDE x 36 IN. HIGH WITH A DURABLE WORKING SURFACE SUCH AS FORMICA.

IX. STORAGE CABINETS: TWO, ONE REMOVABLE, WITH OPEN BOTTOM, LOCK EQUIPPED TO SECURE CABINET TO WORK BENCH, LARGE ENOUGH TO COVER A 22 IN. x 18 IN. x 18 IN. SINK.

X. SHELVES: ONE HUNDRED GALLON WATER CAPACITY, VENTED, WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, WITH AUTOMATIC WATER SHUT-OFF SYSTEM IN PLACE AT THE LOCATION WHERE THE SINK IS PLACED. A SINGLE 110 VOLT 2200 WATT HEATER AND A SINGLE 110 VOLT 1500 WATT HEATER, TOGETHER WITH THE ABOVE MENTIONED EQUIPMENT, SHALL BE PROVIDED.

XI. DINING TENTS: ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.

XII. ELECTRIC VENT: ONE, GENERAL VENTILATION WITH 500 CFM CAPACITY AND TWO-SPEED SWITCH. MOUNTED IN THE ROOF OR AT TOP OF WALL NEAR THE HEATERS. THE OVEN IS PLACED SHALL HAVE A MINIMUM 3 IN. DIAMETER PIPE INSTALLED AND VENTED TO THE OUTSIDE. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR REQUIRED DUCT SIZE.)

XIII. RANGE: ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.

XIV. DISPLAY PANEL: SHALL BE EQUIPPED WITH THE FOLLOWING: LED DISPLAY ON/OFF KEY, PRINT KEY, RE-ZERO KEY, WEIGHTING MODE KEY, SAMPLE % KEY, SERIAL RS-232C 1/0 PORT, AND A CALIBRATION SWITCH.

XV. SECURITY: THEFT SHALL BE PROVIDED.

XVI. ELECTRONIC BALANCE: THE BALANCE SHALL COMPLY WITH ADF-2W 25 G IN ACCURACY IN CLASSES 1 AND 2.

XVII. WATER COOLING DEVICE.

XVIII. OVEN: ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.

XIX. WATER COOLER: ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 IN. EQUIPPED WITH A HINGED OPENING HAVING HINGED OPENINGS. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR REQUIRED DUT SIZE.)

XX. DRINKING WATER SUPPLY: WATER COOLING DEVICE.

XXI. SINK: ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 IN. EQUIPPED WITH A HINGED OPENING HAVING HINGED OPENINGS. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR REQUIRED DUT SIZE.)

XXII. FIRE EXTINGUISHER: ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.

XXIII. FIRE HOSE: ONE, 100 GALLON WATER CAPACITY, VENTED, WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, WITH AUTOMATIC WATER SHUT-OFF SYSTEM IN PLACE AT THE LOCATION WHERE THE SINK IS PLACED. A SINGLE 110 VOLT 2200 WATT HEATER AND A SINGLE 110 VOLT 1500 WATT HEATER, TOGETHER WITH THE ABOVE MENTIONED EQUIPMENT, SHALL BE PROVIDED.

XXIV. MICROWAVE OVEN: ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.

XXV. WATER SHAKER: SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES IN A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

XXVI. AC GAUGE: ONE HUNDRED GALLON WATER CAPACITY, VENTED, WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, WITH AUTOMATIC WATER SHUT-OFF SYSTEM IN PLACE AT THE LOCATION WHERE THE SINK IS PLACED. A SINGLE 110 VOLT 2200 WATT HEATER AND A SINGLE 110 VOLT 1500 WATT HEATER, TOGETHER WITH THE ABOVE MENTIONED EQUIPMENT, SHALL BE PROVIDED.

XXVII. BURNERS AND A 3.5 CU. FT. OVEN WITH REINFORCED OVEN RACKS.

XXVIII. CABINET: ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 IN. EQUIPPED WITH A HINGED OPENING HAVING HINGED OPENINGS. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR REQUIRED DUT SIZE.)

XXIX. CABINET: ONE, 30 IN. WIDE x 36 IN. HIGH WITH A DURABLE WORKING SURFACE SUCH AS FORMICA.

XXX. CABINET: ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 IN. EQUIPPED WITH A HINGED OPENING HAVING HINGED OPENINGS. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR REQUIRED DUT SIZE.)

XXXI. CABINET: ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 IN. EQUIPPED WITH A HINGED OPENING HAVING HINGED OPENINGS. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR REQUIRED DUT SIZE.)
GENERAL NOTES

1. CLASS I FIELD LABORATORIES SHALL CONSIST OF A MEETING AREA IN THE BUILDING CORE AREAS, WITH FLOOR PLANS AND EQUIPMENT LAYOUTS SUCH AS SHOWN ON THIS SHEET SHALL NOT EXCEED THE FOLLOWING REQUIREMENTS:

2. DIMENSIONS: 20 FT. X 22 FT. X 12 FT. HIGH, AT LEAST

3. HANDICAP ACCESSIBILITY AND HANDICAP ACCESSIBLE MINIMUMS

4. DOORS AND OPENINGS WITH HANDICAP ACCESSIBLE否則ノースTOILET EQUPPED WITH A SEPARATE ELECTRICAL CIRCUIT, TO BE LOCATED IN THE STORAGE CABINET UNDER THE WORK BENCH.

5. FLOOR-LEVEL ELEVATION MUST BE ABOVE THE FLOOR LEVEL OF THE WORK AREA

6. HEATING PLANNING FOR EYECOMPLIMATE WINTER BALANCE

7. AIR CONDITIONING:

8. ELECTRICAL:

9. LABORATORY EQUIPMENT.

10. ALL TRAILERS CONSTRUCTED AFTER JULY 1, 2006 SHALL HAVE AN APPROPRIATELY SIZED CIRCUIT BREAKER TO HANDLE THE LOAD OF ALL LABORATORY AND ELECTRICAL EQUIPMENT.

11. WORK BENCHES:

12. STORAGE CABINETS:

13. TELEPHONES:

14. FIRE extinguisher:

15. FIELD LABORATORY:

FOLLOWING REQUIREMENTS:

COLD WATER FAUCET

WELL AS 12 IN. SIEVES, AND SHALL BE MOUNTED 24 IN. ABOVE THE FLOOR IN

WINDOWS:

SIX, 30 IN x 27 IN., CAPABLE OF OPENING AND LOCKING.

A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

THE SIEVE SHAKER SHALL BE A RO-TAP, ENDOCOTT FROM S0ILTEST, SS-12R HANDLE MOUNTED ABOVE PUSH BAR. EACH DOOR SHALL HAVE A SET OF STEPS WITH DECK, AND HANDRAIL ON EACH SIDE

BENCH

DOORS:

EACH DOOR SHALL HAVE A SET OF STEPS WITH DECK, AND HANDRAIL ON EACH SIDE

ELECTRONIC BALANCE:

THE BALANCE SHALL COMPLY WITH ASSHTO M 231 FOR GENERAL

PURPOSE, CLASS G2 BALANCES, AND THE FOLLOWING:

A. THE ELECTRICAL RECORDING THERMOMETER SHALL BE EQUIPPED WITH THE FOLLOWING:

(I) MINIMUM 6 IN. DIAMETER PRESSURE SENSITIVE PAPER CHART WITH A BOX OF BLANK CHARTS.

(2) THE STEM OF THE THERMOMETER SHALL BE A MINIMUM OF 12 IN. LONG.

(3) A SELECTABLE TEMPERATURE SCALE WITH ONE SCALE THAT HAS A RANGE FROM 50° F. TO 120° F.

(4) THE DRIVE MECHANISM SHALL BE CAPABLE OF OPERATING BEYOND ITS FULL SCALE RANGE BY A MINIMUM OF 20%.

B. THE RECORDING PEN SHALL BE AN INK TYPE WITH A SPARE PEN INCLUDED.

C. THE TEMPERATURE PROBE SHALL BE SUBMERSIBLE TYPE J THERMOCOUPLE WITH A 15 FT. MINIMUM CORD LENGTH.

D. THE RECORDING THERMOMETER SHALL BE MOUNTED IN SUCH A WAY THAT A MINIMUM 8 IN. OF THE STEM IS IMMERSED IN THE CURING TANKS AND IS EASILY ACCESSIBLE TO CHANGE THE RECORDING TEMPERATURE CHARTS.

E. THE GENERAL NOTES ARE CONTINUED ON SHEET 2.
GENERAL NOTES (CONTINUED FROM SHEET 1)

27. **FORCED AIR CONVECTION OVEN**:
   - RECOMMENDED FOR 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 ONE BLOWER TO CIRCULATE AIR INSIDE WITHOUT DISTURBING FINE GRAINED SOILS PLACED IN THE OVEN.
     2. A MINIMUM INTERNAL CAPACITY OF 4.8 CUBIC FEET.
     3. AN EXHAUST CHAMBER ADAPTER 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 READ-OUT AND DIGITAL TEMPERATURE SET POINTS TO PRECISELY READ AND SET THE OVEN TEMPERATURE.
   - THE OVEN SHALL HAVE A TEMPERATURE RANGE FROM 104 °F TO 484 °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 SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET THE FOLLOWING REQUIREMENTS.

2. DIMENSIONS: 26 FT x 8 FT, RISE OUTSIDE, 7 FT-6 IN. HEIGHT INSIDE.

3. WINDOWS: A MINIMUM OF 4, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.

4. DRAFTING TABLES: TWO, REINFORCED WITH DEAD-BLACK LOCKS. DECK, STEPS, AND RAILS SHALL BE STRENGTHENED TO SUPPORT A SLOPE BOARD 12:1 DOWN TO 37 IN. HEIGHT AT FRONT EDGE.

5. HEATING: 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: ONE 30 IN. x FULL INSIDE WIDTH x 30 IN. HIGH, AT EACH END OF THE TRAILER, SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF 8" MIN.

10. FURNITURE: FOUR CHAIRS WITH ROLLERS AND TWO DRAFTING STOOLS. EACH OF APPROPRIATE HEIGHT. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.

11. PLAN STORAGE: A PLAN RACK OR FILE FOR FULL SIZE PLANS.

12. SECURITY: A LOCKED STORAGE AREA OF 15 SQ. FT.

13. DRINKING WATER SUPPLY: DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.

14. FIRE EXTINGUISHER: ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.

15. TELEPHONES: TWO TELEPHONES. TWO PRIVATE LINES (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. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ-11 JACKS (TWO WIRE PAIRS PER JACK) AT EACH END OF THE TRAILER. WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE TELEPHONE LINE.

16. PLAN STORAGE: A PLAN RACK OR FILE FOR FULL SIZE PLANS.

17. SECURITY: A LOCKED STORAGE AREA OF 15 SQ. FT.

18. DRINKING WATER SUPPLY: DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.

19. FIRE EXTINGUISHER: ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.

20. SECURITY: A LOCKED STORAGE AREA OF 15 SQ. FT.

21. DRINKING WATER SUPPLY: DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
GENERAL NOTES

1. CLASS 2 FIELD OFFICES SHALL CONSIST OF A WEATHERPROOF, INSULATED, AND FULLY INSULATED TRAILER "B" DOUBLE TRAILER OR SIMILAR MULTI-PURPOSE TRAILER. EACH TRAILER SHALL BE CONNECTED TO WATER AND SEWERS AT THE SITE.

2. DIMENSIONS: 50 FT. LONG X 12 FT. WIDE OUTSIDE, 7 FT.-6 IN. HEIGHT INSIDE. TRAILER SHALL BE 24 FT.-0 IN. LONG X 12 FT. WIDE X 7 FT.-6 IN. DEEP. TRAILER SHALL BE 12 FT. X 12 FT. X 7 FT.-6 IN. DEEP. TRAILER SHALL BE SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER PEDESTAL.

3. WINDOWS: A MINIMUM OF 6, WITH PROVISION FOR CROSS VENTILATION AND LOCKING. ALL WINDOWS (TYP.) HEATING AND COOLING. THREE TON CAPACITY AIR CONDITIONING AND 80,000 BTU CAPACITY HEATING, CONNECTED TO DUCTING & THERMOSTAT CONTROLLED. ELECTRICAL WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 120/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.

4. DOORS: TWO INSIDE DOORS, MAY BE LOCATED EITHER TO ONE SIDE OR AT CENTER OF PARTITION. ONE CLOSET DOOR. REINFORCED DOORS SHALL BE REINFORCED AND HAVE MECHANICAL LOCKS. ENTRANCE DOORS SHALL BE REINFORCED AND HAVE MECHANICAL LOCKS. DECK, STEPS, AND HANDRAILS AT EACH OUTER DOOR. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE STEPS SHALL MEET OSHA REQUIREMENTS.

5. HEATING & AIR CONDITIONING: THREE TON CAPACITY AIR CONDITIONING AND 85,000 BTU CAPACITY HEATING, CONNECTED TO DUCTING & THERMOSTAT CONTROLLED.

6. ELECTRICAL WORK: ALL ELECTRICAL WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 120/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.


8. TABLES: ONE 72 IN. X 36 IN. TABLE. THE TOPS OF THE TABLES SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.

9. WORK TABLE: ONE WORK TABLE OR DESK. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.

10. OFFICE DESK: ONE 30 IN. X 60 IN. TABLE. THE TOPS OF THE TABLES SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.

11. DRAFTING TABLE: ONE 30 IN. X 96 IN. DRAFTING TABLE. DRAFING TABLES SHALL BE ONE 30 IN. FLOOR LEVEL EXTENDED FROM EACH EXTERIOR DOOR. EACH DRAFTING TABLE SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.

12. DIMENSIONS: 50 FT. LONG X 12 FT. WIDE OUTSIDE, 7 FT.-6 IN. HEIGHT INSIDE. TRAILER SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.

13. FURNITURE: A PLAN RACK DR FILE FOR FULL SIZE PLANS.

14. SECURITY: TWO, DRY CHEMICAL, 10 LBS. CLASS ABC, FIRE EXTINGUISHERS. TWO, DRY CHEMICAL, 10 LBS. CLASS ABC, FIRE EXTINGUISHERS. TWO, 10 LB. ABC. FIRE EXTINGUISHERS SHALL BE PROVIDED.

15. DRINKING WATER SUPPLY: DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.

16. TELEPHONES: THREE, 2-LINE TELEPHONES, FOUR PRIVATE LINES (TYP.) FULLY WIRING CAPABLE FOR THE THREE TELEPHONES AND FOUR PRIVATE LINES. TWO LINES ARE FOR TELEPHONE SERVICES, WITH TOUCH TONE SERVICE. TWO LINES ARE FOR THE COMPUTER, AND ONE LINE SHALL BE USED FOR THE FACSIMILE MACHINE.

17. DRINKING WATER: DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.

18. TELEPHONE OUTLET ON THE FLOOR PLAN DENOTES AREAS ON THE FLOOR PLAN WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.

19. PLAN STORAGE: A PLAN RACK OR FILE FOR FULL SIZE PLANS.

FIELD OFFICE
CLASS 2

FLOOR PLAN

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STANDARD PLAN NO.
M-620-12
DATE
STANDARD PLAN NO.
ALUMINUM OR BRASS CAP

4" TAPE MAGNET TO ROD

---2"

ALUMINUM CAP

Ys"

DELINEATOR POST

TAPE MAGNET TO ROD

SECTION A-A

SECTION B-B

SECTION C-C

ALUMINUM FINNED ROD

3' (TYP.)

DIA. ALUMINUM FINNED ROD

NOTE:

5" DIA. x 20" P.V.C. PIPE

COARSE SAND OR PEA GRAVEL

1'4 DIA. ALUMINUM FINNED ROD

TYPE 1A MONUMENT

INCLUDES MONUMENT BOX

LOCKING CAST IRON ACCESS COVER

MINIMUM OF ONE MAGNET

MIN. DEPTH

ALUMINUM OR BRASS CAP

16" , TYPE 6

MIN. DEPTH

30", TYPE 4

A MOISTURE BARRIER OF CAULK, GROUT, OR EPOXY IS REQUIRED BETWEEN THE ALUMINUM MONUMENT BOX AND THE PAVEMENT .

TYPE 5 MONUMENT

ALUMINUM CAP AND TYPE 5(S)

DETAILS SHOWN ON SHEET 2

LOCKING CAST IRON ACCESS COVER

WITH SURVEY EMBOSSED

TYPE 2 MONUMENT

TYPE 2A INCLUDES MONUMENT BOX

SURVEY MONUMENTS

STANDARD PLAN NO.

M-629-1

Standard Sheet No. 1 of 2

Surveyed by the Project Development Branch: July 31, 2019

Project Sheet Number:
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).

The cost survey coordinator shall approve all exceptions for stamping monuments differing from the standards.

Type 1 and Type 1A Aluminum Finned Rod Monuments

This monument shall be used for row or reference monuments. When used as an aliquot corner monument, and used in an aliquot corner installation and record filing requirements shall be as stated for the aliquot corner monuments. Monuments shall be installed by attaching the proper size tip to one end of a section of finned rod, and a 3 in. Dia Stainless Steel adapter to the other end. The rod is then placed over the Stainless Steel adapter to receive the rod in the hole. When Substrate Rock or concrete is encountered less than 3 ft. below the ground surface, the rod shall be installed at least 6 ft. deep to accommodate the condition. When unstable soil conditions are encountered, additional sections of rod shall be added to achieve stability. Horizontal and vertical stability are required.

Type 2 and Type 2A Aluminum Finned Rod Monuments

This monument shall be used for horizontal and vertical control monuments. When horizontal and vertical control conditions are encountered, additional sections of rod shall be added to achieve stability. Horizontal and vertical stability are required. When used in a horizontal control installation and record filing, requirements shall be as stated for the horizontal control monuments. Monuments shall be installed by attaching the proper size tip to a 3 ft. long x 4 in. Dia. stainless steel adapter to the other end. The rod is then placed over the Stainless Steel adapter to receive the rod in the hole. When Substrate Rock or concrete is encountered less than 3 ft. below the ground surface, the rod shall be installed at least 6 ft. deep to accommodate the condition. When unstable soil conditions are encountered, additional sections of rod shall be added to achieve stability. Horizontal and vertical stability are required.

Type 3 and Type 3A Aluminum Pipe Monuments

This monument shall be used for an aliquot corner monument. The installation of this monument and record filing shall be done in accordance with the State Board Rules. The Bureau of Land Management Requirements for Monument Installation. The Land Surveyor’s License Number and the “CP” shall be stamped on the last section of rod. Type 3A monuments include monuments for a listing cast iron access cover shall be installed when the monument is located in the roadway pavement.

Type 4 Aluminum Monuments

This monument may be installed in lieu of all other CDOT monuments. It shall be used in the position located in concrete or stable rock formation.

Type 5(S) Copper/Alloy Cap Monument - Small

This monument may be installed in lieu of a Type 5 monument. When the position is located in a concrete sidewalk, curb or gutter, or when setting a Type 5 would cause an unevenly distributed reading point, a Type 5(S) shall be used. The Rod shall be installed by attaching the proper size tip to a 3 ft. long x 4 in. Dia. stainless steel adapter to the other end. The rod is then placed over the Stainless Steel adapter to receive the rod in the hole. When substrate Rock or concrete is encountered less than 3 ft. below the ground surface, the rod shall be installed at least 6 ft. deep to accommodate the condition. When unstable soil conditions are encountered, additional sections of rod shall be added to achieve stability. Horizontal and vertical stability are required.

Type 6 Monuments

This monument shall be used for permanent monuments, project bench marks, project points, and references. An aluminum cap with a minimum diameter of 3 in. shall be used on 5% or 10% bench marks.

WITNESS POSTS

The witness post will be supplied by CDOT and installation shall be included in the work. It shall be driven within 0.5 ft. of the monument. When possible, a reflective post with a 4 in. Dia metal sleeve may be used to facilitate installation. The witness post shall be installed by a 3 ft. long x 4 in. Dia stainless steel adapter to the other end. The rod is then placed over the Stainless Steel adapter to receive the rod in the hole. When substrate Rock or concrete is encountered less than 3 ft. below the ground surface, the rod shall be installed at least 6 ft. deep to accommodate the condition. When unstable soil conditions are encountered, additional sections of rod shall be added to achieve stability. Horizontal and vertical stability are required.

SURVEY MONUMENTS

STANDARD PLAN NO. M-629-1

Created by the Project Development Branch, July 31, 2019

Project Sheet Number: 2 of 2