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.
<table>
<thead>
<tr>
<th>PLAN NUMBER</th>
<th>STANDARD SHEET TITLE</th>
<th>PAGE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-001-1</td>
<td>STANDARD SYMBOLS (2 SHEETS)</td>
<td>1-3</td>
</tr>
<tr>
<td>M-102-2</td>
<td>ACRONYMS AND ABBREVIATIONS (4 SHEETS)</td>
<td>4-7</td>
</tr>
<tr>
<td>M-203-4</td>
<td>APPROACH ROADS</td>
<td>8</td>
</tr>
<tr>
<td>M-203-7</td>
<td>DITCH TYPES</td>
<td>9</td>
</tr>
<tr>
<td>M-203-11</td>
<td>SURFACE ELEVATION CROWNED AND DIVIDED HIGHWAYS</td>
<td>10-12</td>
</tr>
<tr>
<td>M-203-12</td>
<td>SURFACE ELEVATIONS (2 SHEETS)</td>
<td>13-14</td>
</tr>
<tr>
<td>M-208-1</td>
<td>EROSION AND BACKFILL FOR STRUCTURES</td>
<td>15-18</td>
</tr>
<tr>
<td>M-206-2</td>
<td>EROSION CONTROL (3 SHEETS)</td>
<td>19-21</td>
</tr>
<tr>
<td>M-214-1</td>
<td>NURSERY STOCK DETAILS</td>
<td>22-23</td>
</tr>
<tr>
<td>M-216-1</td>
<td>SOIL RETENTION CONVEX (2 SHEETS)</td>
<td>24-25</td>
</tr>
<tr>
<td>M-421-2</td>
<td>TREE CONVEX PLANTS (5 SHEETS)</td>
<td>26-27</td>
</tr>
<tr>
<td>M-420-1</td>
<td>STRUCTURAL FLANGE PIPE (3 SHEETS)</td>
<td>28-29</td>
</tr>
<tr>
<td>M-401-1</td>
<td>CONCRETE BOX CULVERT (CAST-IN-PLACE)</td>
<td>30-31</td>
</tr>
<tr>
<td>M-402-2</td>
<td>DOUBLE CONCRETE BOX CULVERT (CAST-IN-PLACE)</td>
<td>32-33</td>
</tr>
<tr>
<td>M-403-3</td>
<td>TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)</td>
<td>34-35</td>
</tr>
<tr>
<td>M-401-10</td>
<td>HEADWALL FOR PIPE</td>
<td>36</td>
</tr>
<tr>
<td>M-401-31</td>
<td>TYPE 4 SKYLIGHT HEADWALL FOR PIPE</td>
<td>37</td>
</tr>
<tr>
<td>M-402-28</td>
<td>HEADWALLS AND PIPE OUTLET PAVING</td>
<td>38</td>
</tr>
<tr>
<td>M-403-30</td>
<td>PIPE INCREASED WIDTH</td>
<td>39-40</td>
</tr>
<tr>
<td>M-403-31</td>
<td>METAL PIPE (4 SHEETS)</td>
<td>41-44</td>
</tr>
<tr>
<td>M-403-32</td>
<td>REINFORCED CONCRETE PIPE</td>
<td>45-46</td>
</tr>
<tr>
<td>M-403-33</td>
<td>PRECAST CONCRETE BOX CULVERT</td>
<td>47-48</td>
</tr>
<tr>
<td>M-403-34</td>
<td>CORRODED CORRUGATED POLYETHYLENE PIPE (AASHTO M348)</td>
<td>49-50</td>
</tr>
<tr>
<td>M-403-35</td>
<td>POLYVINYL CHLORIDE (PVC) PIPE (AASHTO M384)</td>
<td>51-52</td>
</tr>
<tr>
<td>M-403-36</td>
<td>STEEL REINFORCED POLYVINYL</td>
<td>53</td>
</tr>
<tr>
<td>M-403-37</td>
<td>STEEL REINFORCED POLYVINYL</td>
<td>54</td>
</tr>
<tr>
<td>M-403-38</td>
<td>CONCRETE AND METAL ENDS</td>
<td>55</td>
</tr>
<tr>
<td>M-403-39</td>
<td>TRANSVERSE ENDS AND ENDS SAFETY GRATES</td>
<td>56-57</td>
</tr>
<tr>
<td>M-403-40</td>
<td>TYPICAL PIPE TIE DETAILS</td>
<td>58</td>
</tr>
<tr>
<td>M-403-41</td>
<td>TYPICAL PIPE TIE DETAILS</td>
<td>59</td>
</tr>
<tr>
<td>M-403-42</td>
<td>TYPICAL CONCRETE PIPE TIES</td>
<td>60</td>
</tr>
<tr>
<td>M-403-43</td>
<td>TYPICAL CONCRETE PIPE TIES</td>
<td>61</td>
</tr>
<tr>
<td>M-403-44</td>
<td>TYPICAL PIPE TIES</td>
<td>62</td>
</tr>
<tr>
<td>M-403-45</td>
<td>ELECTRICAL GROUNDS</td>
<td>63</td>
</tr>
<tr>
<td>M-403-46</td>
<td>ELLET ELECTRICAL GROUNDS</td>
<td>64</td>
</tr>
<tr>
<td>M-403-47</td>
<td>BARRIER BEAMS (3 SHEETS)</td>
<td>65</td>
</tr>
<tr>
<td>M-403-48</td>
<td>BARRIER BEAMS (5 SHEETS)</td>
<td>66</td>
</tr>
<tr>
<td>M-403-49</td>
<td>SUBSURFACE DRAWS</td>
<td>67</td>
</tr>
</tbody>
</table>

### M&S STANDARDS

**Colorado Department of Transportation**

**TABLE OF CONTENTS**

**M&S STANDARDS**

**JULY 31, 2019**

---

**Computer File Information**

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**Date: Comments**

**Colorado Department of Transportation**

**CAD Version: MicroStation V8**

**View Not To Scale Geometric Details**

---

**STANDARD PLAN NO.**

**TABLE OF CONTENTS**

**Standard Sheet No. 1 of 1**

---

**Project Development Branch**

**JBK**

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

---

**Project Number:**

---

**TABLE OF CONTENTS**

---

**STANDARD PLAN NO.**

---

**TABLE OF CONTENTS**

---

**Standard Sheet No. 1 of 1**

---

**Project Development Branch**

**JBK**

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

---

**Project Number:**

---

**TABLE OF CONTENTS**

---

**STANDARD PLAN NO.**

---

**TABLE OF CONTENTS**

---

**Standard Sheet No. 1 of 1**

---

**Project Development Branch**

**JBK**

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

---

**Project Number:**

---

**TABLE OF CONTENTS**

---

**STANDARD PLAN NO.**

---

**TABLE OF CONTENTS**

---

**Standard Sheet No. 1 of 1**

---

**Project Development Branch**

**JBK**

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

---

**Project Number:**

---

**TABLE OF CONTENTS**

---

**STANDARD PLAN NO.**

---

**TABLE OF CONTENTS**

---

**Standard Sheet No. 1 of 1**

---

**Project Development Branch**

**JBK**

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

---

**Project Number:**

---

**TABLE OF CONTENTS**

---

**STANDARD PLAN NO.**

---

**TABLE OF CONTENTS**

---

**Standard Sheet No. 1 of 1**

---

**Project Development Branch**

**JBK**

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

---

**Project Number:**

---

**TABLE OF CONTENTS**

---

**STANDARD PLAN NO.**

---

**TABLE OF CONTENTS**

---
The image contains a page from a document that appears to be a standard sheet, likely related to transportation or engineering. The page includes various diagonal lines and symbols, which are typical in technical drawings to denote different types of roads, traffic control devices, and other elements. The symbols and lines are used to represent the layout and design standards for highways or urban infrastructure. The page seems to be a part of a larger set of standards, possibly for road design, traffic control, or telecommunications.
<table>
<thead>
<tr>
<th>T</th>
<th>U</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAB</td>
<td>Top and Bottom</td>
<td>UG</td>
</tr>
<tr>
<td>TBE</td>
<td>Threatened &amp; Endangered Species</td>
<td>UNC</td>
</tr>
<tr>
<td>T</td>
<td>Tensile</td>
<td>LN</td>
</tr>
<tr>
<td>TAS</td>
<td>Threaded Arbor Stud</td>
<td>LNFC</td>
</tr>
<tr>
<td>FBC</td>
<td>Timber Box Culvert</td>
<td>LNO</td>
</tr>
<tr>
<td>TC</td>
<td>Timber Curved</td>
<td>LPRC</td>
</tr>
<tr>
<td>TCD</td>
<td>Traffic Control Devices</td>
<td>LPS</td>
</tr>
<tr>
<td>TCP</td>
<td>Traffic Control Plan</td>
<td>LSAE</td>
</tr>
<tr>
<td>TEP</td>
<td>Timber Stinger</td>
<td>USCS</td>
</tr>
<tr>
<td>TM</td>
<td>Total Dynamic Height</td>
<td>USDA</td>
</tr>
<tr>
<td>Tmp</td>
<td>Temperature of Temperature</td>
<td>USDOT</td>
</tr>
<tr>
<td>Thd</td>
<td>Thread</td>
<td>USFWS</td>
</tr>
<tr>
<td>TMHE</td>
<td>Thermoplastic High Mixed-Elasticity, Nylon-coated (Designation for W/O)</td>
<td>USGS</td>
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<tr>
<td>TMHN</td>
<td>Thermoplastic High Water-Resistant, Nylon-coated (Designation for W/O)</td>
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<td>Timber Inert Gas (Welding)</td>
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<td>TLA</td>
<td>Timber Laminated Arches (Glulam)</td>
<td>LV</td>
</tr>
<tr>
<td>TLS</td>
<td>Timber Laminated Structures (Glulam)</td>
<td>LV</td>
</tr>
<tr>
<td>TLT</td>
<td>Timber Laminated Timbers (Glulam)</td>
<td>LV</td>
</tr>
<tr>
<td>TM</td>
<td>Timber Stinger</td>
<td>LV</td>
</tr>
<tr>
<td>TMMD</td>
<td>Timber Stinger-Decked Metal Deck</td>
<td>LV</td>
</tr>
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<td>TMNP</td>
<td>Transportation Management Plan</td>
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<td>Total</td>
<td>Veh</td>
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<tr>
<td>TP</td>
<td>Trenches per Inch</td>
<td>Vert</td>
</tr>
<tr>
<td>TS</td>
<td>Trenched to Spur, Timber Stinger Decked</td>
<td>VFA</td>
</tr>
<tr>
<td>TSMC</td>
<td>Timber Stinger Core</td>
<td>VMA</td>
</tr>
<tr>
<td>TSC</td>
<td>Timber Stinger Core</td>
<td>VNS</td>
</tr>
<tr>
<td>TTD</td>
<td>Timber Stinger- Concrete Deck</td>
<td>Vot</td>
</tr>
<tr>
<td>TTP</td>
<td>Timber Stinger- Metal Deck</td>
<td>VPC</td>
</tr>
<tr>
<td>TTS</td>
<td>Timber Stinger - Timber Deck</td>
<td>VPI</td>
</tr>
<tr>
<td>TT</td>
<td>Timber/Frame</td>
<td>VPT</td>
</tr>
<tr>
<td>TUNC</td>
<td>Timber/Concrete Culvert</td>
<td>Yd</td>
</tr>
<tr>
<td>TUNR</td>
<td>Turn-Through Post-Non-Lining</td>
<td>Yd</td>
</tr>
<tr>
<td>TYP</td>
<td>Typical</td>
<td>Yd</td>
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</tbody>
</table>

**SYMBOLS**
- T: Top
- U: Underground
- W: Water

**ACRONYMS AND ABBREVIATIONS**

**STANDARD PLAN NO.**

M-100-2

**Issue Date:** Project Development Branch - July 31, 2019

**Project Sheet Number:** 4 of 4

**Colorado Department of Transportation**

**CDOT**

**3rd Floor**

**2020 West Highland Place**

**Denver, CO 80204**

**Phone:** 303-757-9021 **Fax:** 303-757-9888

**Project Development Branch**

**JBB**
MEDIAN
---30' - EDGE DF SHOULDER
10:1 CROSS / R=
Y2W
DR FLATTER
V W=MEDIAN
WIDTH,
EDGE OF TRAVELED WAY
MEDIAN WIDTH LESS THAN 50 FT.

MEDIAN WIDTH GREATER THAN 50 FT.

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

TYPICAL PLANS FOR SIDE APPROACH ROAD
NOTE: SIDE APPROACHES WHICH REQUIRE MAG. PAVEMENT SHALL BE PLACED AT THE FOLLOWING DISTANCES BACK FROM THE ROADWAY EDGE OF PAVEMENT:
1. RESIDENTIAL OR AGRICULTURAL FIELD ENTRANCES - PAVE 4 FEET BACK.
2. THREE OR MORE RESIDENCES OR COMMERCIAL PROPERTY - PAVE 20 FEET BACK OR TO ROW LINE, WHICHER IS LESS.
3. PUBLIC STREET - PAVE 50 FEET BACK OR TO ROW LINE, WHENEVER IS LESS.
4. IF EXISTING ACCESS IS PAVED, THEN FEATHER NEW ASPHALT OVERLAY A MINIMUM OF 2 FEET BACK OR TO DIRECTED BY THE ENGINEER.

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

TYPICAL SECTION FOR APPROACH (ACCESS) ROAD
NOTE: ROAD APPROACHES WHICH REQUIRE MAG. PAVEMENT SHALL BE PLACED AT THE FOLLOWING DISTANCES BACK FROM THE ROADWAY EDGE OF PAVEMENT:
1. RESIDENTIAL OR AGRICULTURAL FIELD ENTRANCES - PAVE 4 FEET BACK.
2. THREE OR MORE RESIDENCES OR COMMERCIAL PROPERTY - PAVE 20 FEET BACK OR TO ROW LINE, WHICHER IS LESS.
3. PUBLIC STREET - PAVE 50 FEET BACK OR TO ROW LINE, WHENEVER IS LESS.
4. IF EXISTING ACCESS IS PAVED, THEN FEATHER NEW ASPHALT OVERLAY A MINIMUM OF 2 FEET BACK OR TO DIRECTED BY THE ENGINEER.

VERTICAL ALIGNMENT SIDE APPROACH ROADS INTERSECTING MAIN ROADWAY
TYPICAL PLANS FOR MEDIAN CROSS OVER
LOCATIONS OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT

STANDARD CROWNED SECTION

SUPERELEVATED CUT SECTION

SUPERELEVATED FILL SECTION

TYPICAL CUT SECTION 1/2 FILL SECTION
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.

SECTION A-A

CONCRETE-LINED DITCH

* FOR SECTIONS WHERE W ≥ 10" AND D ≥ 24" USE T = 3" CU. YDS. PER 100 UN. FT.

<table>
<thead>
<tr>
<th>W (INCHES)</th>
<th>DITCH QUANTITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>110</td>
</tr>
<tr>
<td>24</td>
<td>210</td>
</tr>
<tr>
<td>36</td>
<td>279</td>
</tr>
</tbody>
</table>

SECTION B-B

CUTOFF WALL

EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.

Typical Sections for Ditches

Note: See structure notes on the plans for embankments A: B, and C.

Embankment Sections

Ditch Types

STANDARD PLAN NO. M-203-2

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Project Sheet Number: 1 of 1

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Project Sheet Number: 1 of 1

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Project Sheet Number: 1 of 1

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Project Sheet Number: 1 of 1

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Project Sheet Number: 1 of 1

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Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 1 of 1

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Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 1 of 1

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK
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Scale: Not to Scale
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Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 1 of 1

Computer File Information

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

Project Sheet Number: 1 of 1

Computer File Information

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Project Sheet Number: 1 of 1

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Detailer Initials: LT
CAD Ver.: MicroStation V7
Scale: Not to Scale
Units: English

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Project Sheet Number: 1 of 1
### SUPERELEVATION NOTES

1. This standard plan shows the required rates of superelevation for various radius lengths at different design speeds. The maximum superelevation rate is given in the table. The alternative maximum rate of superelevation shall be used for crowned highways when specified on the plans.

2. Values are for design elements related to design speed and horizontal curvature for 2-lane and 4-lane highways.

3. Number of lanes rotated:
   - $e_{max} = 8\%$

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>
<thead>
<tr>
<th>e (mph)</th>
<th>R (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
<th>L (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>14</td>
<td>32</td>
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<td>48</td>
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<td>100</td>
<td>145</td>
<td>250</td>
<td>375</td>
<td>525</td>
<td>750</td>
</tr>
</tbody>
</table>

* $e = SUPERELEVATION RATE*

* $R = RADIUS OF CURVE*

* $L = LENGTH OF SUPERELEVATION*

* $V_d = ASSUMED DESIGN SPEED*

* $LN = TRAVEL LANE*
### Superelevation Diagrams for Crowned Highways

- **e(max) = 8%**
- **Table continued from Sheet 1.**

<table>
<thead>
<tr>
<th>Vd (mph)</th>
<th>L (ft.)</th>
<th>N.S.</th>
<th>L (ft.)</th>
<th>N.S.</th>
<th>L (ft.)</th>
<th>N.S.</th>
<th>L (ft.)</th>
<th>N.S.</th>
<th>L (ft.)</th>
<th>N.S.</th>
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<tbody>
<tr>
<td>50</td>
<td>0.0</td>
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</tbody>
</table>

**Superelevation Notes:**
- The standard plan shows the required rates of superelevation for the various radius lengths at different design speeds for the various highway classifications. In many cases, the rate of superelevation shall be used for crownings and divided highways.
- Values are for design elements related to design speed and horizontal curvature for 2-lane and 3-lane highways.
- Number of lanes required or typical for a two-lane highway.
- Two lanes required or typical for a four-lane highway.
- Superelevation is continued over the entire length of the transition, except for the first and last foot.

---

**Superelevation for Crowned and Divided Highways**

<table>
<thead>
<tr>
<th>Vd (mph)</th>
<th>Superelevation (°)</th>
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<tbody>
<tr>
<td>50</td>
<td>3.2</td>
</tr>
<tr>
<td>55</td>
<td>3.8</td>
</tr>
<tr>
<td>60</td>
<td>4.2</td>
</tr>
<tr>
<td>65</td>
<td>4.6</td>
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<td>5.8</td>
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**Computer File Information:**
- Creation Date: 07/31/19
- Sheet Revisions: 07/31/19
- Colorado Department of Transportation
- CAD Ver.: MicroStation V7i
- STD: Not to Scale
- CAD Ext.: .dgn

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**Standard Plan No:**
- M-203-11

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**Project Development Branch:**
- J BK

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

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**Project Sheet Number:**
- 02 of 3
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

SUPERELEVATION
CROWNED AND DIVIDED
HIGHWAYS

STANDARD PLAN NO.

M-203-11

Project Sheet Number:

Issued by the Project Development Branch: July 31, 2019

STD. PLAN NO. 3 of 3
### Superelevation Diagrams

The superelevation should be set at 4% maximum for the given speed and horizontal curvature. Here are the standard plans showing the required superelevation for various design elements:

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>R (ft)</th>
<th>L (ft)</th>
</tr>
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<tbody>
<tr>
<td>15</td>
<td></td>
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<td>45</td>
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<td></td>
<td></td>
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<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Superelevation Notes

1. The standard plan shows the required rates of superelevation for the various speeds. Superelevation should be set to the maximum rate for the curve and design speed, unless a lower rate is desired. Superelevation shall be used for streets when specified on the plans.

2. Use of a rate should be limited to urban conditions.

3. Values are for design elements related to the curve and design speed, as shown in the plan.

4. Where the street is not of uniform curvature, the rate of superelevation may be reduced to facilitate a smooth transition of the profile grades.

5. Number of lanes rotated:
   - A two-lane rotated is typical for a one-lane roadway.
   - A three-lane rotated is typical for a two-lane roadway.

6. Spirals are recommended below the heavy line by the tables should be permissible, but not recommended above the heavy line. The length of the spirals may be increased in accordance with 30 feet for calculation convenience.
**SUPERELEVATION NOTES**

1. THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS CURVING LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SYLVESE LANE. WHEN LANE WIDTH IS NOT SUITABLE, THE DESIGNER SHALL CHOOSE ANOTHER LANE TO SUIT CONDITIONS.

2. VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR TWO LANE AND FOUR LANE ROADS.

3. WHERE SIDE STREETS OR ROADS INTERSECT, SPIRALS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPIRALS ARE PERMISSIBLE BUT NOT RECOMMENDED ABOVE THE HEAVY LINE. SPIRAL LENGTHS MAY BE REQUIRED TO AVOID 50 FEET FOR CALCULATION CONVENIENCE.

4. NUMBER OF LANES ROTATED: 4.6 ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.

5. SPIRALS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPIRALS ARE PERMISSIBLE BUT NOT RECOMMENDED ABOVE THE HEAVY LINE. SPIRAL LENGTHS MAY BE REQUIRED TO AVOID 50 FEET FOR CALCULATION CONVENIENCE.

6. STANDARD PLAN NO. M-203-12

**SUPERELEVATION DIAGRAMS**

<table>
<thead>
<tr>
<th>Vd=15 mph</th>
<th>Vd=20 mph</th>
<th>Vd=25 mph</th>
<th>Vd=30 mph</th>
<th>Vd=35 mph</th>
<th>Vd=40 mph</th>
<th>Vd=45 mph</th>
<th>Vd=50 mph</th>
<th>Vd=55 mph</th>
<th>Vd=60 mph</th>
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<td>L (FT.)</td>
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<tr>
<td>0.2 614</td>
<td>0.8 688</td>
<td>1.7 783</td>
<td>2.6 886</td>
<td>3.5 989</td>
<td>4.4 1093</td>
<td>5.3 1196</td>
<td>6.2 1299</td>
<td>7.1 1403</td>
<td>8.0 1506</td>
</tr>
<tr>
<td>0.2 614</td>
<td>0.8 688</td>
<td>1.7 783</td>
<td>2.6 886</td>
<td>3.5 989</td>
<td>4.4 1093</td>
<td>5.3 1196</td>
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<td>7.1 1403</td>
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<td>4.4 1093</td>
<td>5.3 1196</td>
<td>6.2 1299</td>
<td>7.1 1403</td>
<td>8.0 1506</td>
</tr>
</tbody>
</table>
PIPE IN TRENCH

- The 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.

CIRCULAR PIPE IN FILL

ARCH OR ELLIPTICAL PIPE IN FILL

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 founded to undisturbed rock without forming in conformance with subsection 601.09(b).
4. Structure plate culverts shall be constructed as shown on the plans.
5. Bc equals the inside diameter of a pipe; B, equals the outside diameter of a pipe. For thin walled pipe, it is assumed that Bc = B.
6. Approximate structure excavation and backfill quantities up to 1ft. over the pipe will be shown on the plans, for information only.

EXCAVATION AND BACKFILL FOR STRUCTURES

STANDARD PLAN NO.
M-206-1

Sheet Revisions
Project Development Branch: July 31, 2019
Project Sheet Number:

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

Colorado Department of Transportation
200 West Howard Place
CDOT M2, 3rd Floor
Boulder, CO 80304
Ph: 303-757-9021 FAX: 303-757-9868

Issued by the Project Development Branch: July 31, 2019
LIMITS OF MEASUREMENT FOR STRUCTURE EXCAVATION

\[ B_a = \text{INSIDE DIAMETER OR INSIDE SPAN OF PIPE} \]
\[ B_c = \text{OUTSIDE DIAMETER OR RISE OF PIPE} \]
\[ 0.3 B_a (FLEXIBLE) \]
\[ 0.3 B_c (RIGID) \]
\[ B_c + 3' \]
\[ \text{OR} \]
\[ 8c + 6' \] FOR STRUCTURAL PLATE PIPE CULVERTS

THIS HATCHED AREA REPRESENTS STRUCTURE EXCAVATION PAY QUANTITY FOR PIPES

\[ \text{BOTTOM OF TRENCH} \]
\[ \text{ORIGIN GROUND} \]
\[ \text{LENGTH OF STRUCTURE PLUS } 3' \]

FOR APPLICABLE LIMITS OF STRUCTURE EXCAVATION, SEE BEDDING DETAILS ON SHEET 1 OF THESE DETAILS.

STRUCTURE EXCAVATION UP TO 1 FT. ABOVE THE TOP OF THE PIPE SHALL BE INCLUDED IN THE BID PRICE OF THE PIPE.

STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS

\[ W (\text{OUTSIDE WIDTH OF STRUCTURE}) \]
\[ W + 3' \]

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS

\[ W (\text{OUTSIDE WIDTH OF BOX}) \]
\[ W + 3' \]

LEGEND

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- CONCRETE

EXCAVATION AND BACKFILL FOR STRUCTURES

STANDARD PLAN NO. M-206-1

Standard Sheet No. 2 of 2

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: 2829 West Howard Place

Phone: 303-757-9021 Fax: 303-757-9868

Colorado Department of Transportation

2029 West Howard Place

CDOT RD, 2nd Floor

Boulder, CO 80304

JDK

Designer Initials: JBK

Last Modification Date: 07/31/19

Project Development Branch: July 31, 2019

CAD Version: MicroStation V8i, Scale Not to Scale, Units: English

Computer File Information

Sheet Revisions
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 END PAVING NOT SHOWN.

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

FOR PURPOSES OF QUANTITY CALCULATIONS THIS TEMPLATE APPLIES TO END OF WINGWALL.

SLIDE TO DRAIN
SLIDE FOR PAY LIMITS OF EXCAVATION AND BACKFILL

MINIMUM BERM DIMENSION
MINIMUM EMBEDMENT OF ABUTMENT IN STRUCTURE BACKFILL

EXCAVATION AND BACKFILL FOR BRIDGES

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

Issued by the Project Development Branch: July 31, 2019

EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THIS SHEET WILL BE SHOWN ON THE PLANS.

STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING, IN CONFORMANCE WITH SUBSECTION 601.09(b).

STRUCTURE EXCAVATION FOR END PAVING NOT SHOWN.

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.

SLIDE TO DRAIN
SLIDE FOR PAY LIMITS OF EXCAVATION AND BACKFILL

MINIMUM BERM DIMENSION
MINIMUM EMBEDMENT OF ABUTMENT IN STRUCTURE BACKFILL

EXCAVATION AND BACKFILL FOR BRIDGES

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

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

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

**LEGEND**

- Structure backfill (flow-fill), or structure backfill (class I) with mechanical reinforcement as shown on the plans.
- Structure backfill (class 2) ( onsite class 2 materials must meet class 1 requirements).
- Filter material.

**GENERAL NOTES**

- Four MIN.
- Elevation

**ITEM 203 EMBANKMENT MATERIAL**

- Planned subgrade

**MINIMUM BERM DIMENSION**

**MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL**

**GENERAL NOTES**

1. Excavation and backfill patterns different than those indicated on this sheet will be shown elsewhere on the plans.
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- Filter material.

**GENERAL NOTES**

- Four MIN.
- Elevation

**ITEM 203 EMBANKMENT MATERIAL**

- Planned subgrade

**MINIMUM BERM DIMENSION**

**MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL**

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**GENERAL NOTES**

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- Elevation

**ITEM 203 EMBANKMENT MATERIAL**

- Planned subgrade

**MINIMUM BERM DIMENSION**

**MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL**

**GENERAL NOTES**

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- Structure backfill (class 2) ( onsite class 2 materials must meet class 1 requirements).
- Filter material.

**GENERAL NOTES**

- Four MIN.
- Elevation

**ITEM 203 EMBANKMENT MATERIAL**

- Planned subgrade

**MINIMUM BERM DIMENSION**

**MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL**

**GENERAL NOTES**

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2. Structure footings which are located in rock shall be founded to undisturbed rock without forming in conformance with Subsection 601.09.
3. Structure excavation for slope paving not shown.

**LEGEND**

- Structure backfill (flow-fill), or structure backfill (class I) with mechanical reinforcement as shown on the plans.
- Structure backfill (class 2) ( onsite class 2 materials must meet class 1 requirements).
- Filter material.

**GENERAL NOTES**

- Four MIN.
- Elevation

**ITEM 203 EMBANKMENT MATERIAL**

- Planned subgrade

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**MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL**

**GENERAL NOTES**

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

**LEGEND**

- Structure backfill (flow-fill), or structure backfill (class I) with mechanical reinforcement as shown on the plans.
- Structure backfill (class 2) ( onsite class 2 materials must meet class 1 requirements).
- Filter material.

**GENERAL NOTES**

- Four MIN.
- Elevation

**ITEM 203 EMBANKMENT MATERIAL**

- Planned subgrade

**MINIMUM BERM DIMENSION**

**MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL**

**GENERAL NOTES**

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

**LEGEND**

- Structure backfill (flow-fill), or structure backfill (class I) with mechanical reinforcement as shown on the plans.
- Structure backfill (class 2) ( onsite class 2 materials must meet class 1 requirements).
- Filter material.
**CONCRETE WASHOUT STRUCTURE**

**NOTES:**

1. A fence planted 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 208.002(c).
5. The pay item number for concrete washout structure (each) is 208-00045.

**TEMPORARY EROSION CONTROL**

**NOTES:**

1. Aggregate shall conform to Subsection 208.02(c).
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. Geotextile shall conform to Subsection 712.08.
4. All materials and labor to complete the vehicle tracking pad shall be included in the cost of work and not paid for separately.
5. The pay item number for vehicle tracking pad (each) is 208-00070.
EROSION LOG ENDS 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.

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

EROSION LOGS SHALL BE TIGHTLY ABUTTING WITH NO GAPS (TYP.)

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

OVERLAP JOINING DETAIL

SECTION A-A
TYPICAL STAKE INSTALLATION

NOTE: STAKES SHALL BE INCLUDED IN
THE COST OF THE EROSION LOGS.

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

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

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

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

SECTION A-A
TYPICAL STAKE INSTALLATION

NOTE: STAKES SHALL BE INCLUDED IN
THE COST OF THE EROSION LOGS.

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

NOTE: STAKES SHALL BE INCLUDED IN
THE COST OF THE EROSION LOGS.

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

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

SECTION A-A
TYPICAL STAKE INSTALLATION

NOTE: STAKES SHALL BE INCLUDED IN
THE COST OF THE EROSION LOGS.
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 FOR JOINING LOGS DETAIL.
4. THE MAXIMUM LENGTH OF EROSION LOGS OR SILT FENCES WITHOUT A FLARED END TURNING UP SLOPE IS 150 FEET.

EROSION LOG TOE OF SLOPE PROTECTION

TOE OF SLOPE PROTECTION APPLICATIONS

SILT FENCE TOE OF SLOPE PROTECTION

NOTES

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

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.

<table>
<thead>
<tr>
<th>LENGTH (L) OF INLET (FT)</th>
<th>NUMBER OF AGGREGATE BAGS UPSTREAM OF INLET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>1</td>
</tr>
<tr>
<td>6 - 10</td>
<td>2</td>
</tr>
<tr>
<td>L &gt; 10</td>
<td>3</td>
</tr>
</tbody>
</table>

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

AGGREGATE BAGS AT STORM DRAIN INLET (TYPE I)

PLAN VIEW

- AGGREGATE BAGS AT DROP INLET
  - AGGREGATE BAGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS (TYPE)

SECTION A-A

- AGGREGATE BAGS AT STORM DRAIN INLET

FLOW
STORM DRAIN INLET PROTECTION (TYPE I)

NOTES:
1. INLET PROTECTION DEVICE SHALL EXTEND 12 INCHES PAST EACH END OF THE INLET.
2. THE PAY ITEM NUMBERS FOR STORM DRAIN INLET PROTECTION (TYPE I) ARE 208-00051 (LF), 208-00053 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 (TYPE II)

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

STORM DRAIN INLET PROTECTION (TYPE III)

NOTE: THE PAY ITEM NUMBER FOR STORM DRAIN INLET PROTECTION (TYPE III) IS 208-00056.
**EROSION LOGS**

ROADWAY ELEVATION SHALL BE HIGHER THAN OVERFLOW

ANCHOR TRENCH 6 IN. X 6 IN. (SEE M-216-1 FOR DETAILS)

OVERFLOW RELEASE

SILT BERM

2 FT. MIN. (TYP.)

SOIL RETENTION BLANKET

PLAN VIEW

NOTE: POINTS "A" SHALL BE A MINIMUM 4 IN. HIGHER THAN POINT "11"

ELEVATION

STAKES APPROXIMATELY 90° TO EACH OTHER

SECTION A-A

NOTES:
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.

EROSION LOG INSTALLATION

1. Anchor trench 6 in. X 6 in. (see M-216-1 for details)
2. Secure blanket with staples 12 in. (typical)
3. Secure STAKES 6 in. X 6 in. (typical)

PLAN VIEW

SILT BERM (1) SECTION VIEW

ANCHOR TRENCH 6 IN. X 6 IN. (SEE M-216-1 FOR DETAILS)

SILT BERM (2) SECTION VIEW

NOTE:
1. Minimum 4 nails per segment upstream.
2. Minimum 2 nails per segment downstream.
3. Minimum 2 wood stakes per segment.

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 soil berm shall be overlapped with no gaps.
4. For slope and channel spacing see the section view along ditch flowline detail on sheet 6 of 11.
5. Soil retention blanket shall always be required.
6. The pay item number for soil berm is 208-00004.

DRAINAGE DITCH APPLICATIONS
NOTES:

1. BERM 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. BERM SHALL BE USED TO INTERCEPT AND DIVERT DRAINAGE TO A DESIGNATED OUTLET.

3. BERM SHALL NOT BE USED WHERE DRAINAGE AREA EXCEEDS 10 ACRES.

4. BERM SHALL BE CONSTRUCTED OUT OF ACCEPTABLE MATERIAL THAT CAN BE COMPACTED AND RECEIVED AT A MINIMUM HEAVY EQUIPMENT WHEEL ROLLED COMPACTION.

5. TEMPORARY BERM 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.

7. TEMPORARY DIVERSION DITCHES SHALL BE CONSTRUCTED ACROSS THE SLOPE TO INTERCEPT RUNOFF AND DIRECT IT TO A STABLE OUTLET OR SEDIMENT TRAP.

8. USE THE TEMPORARY DIVERSION DITCH IMMEDIATELY ABOVE A NEW CUT, FILL SLOPE, OR AROUND THE PERIMETER OF A DISTURBED AREA.

9. 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.

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

11. DIVERSION BERM SHALL BE CONSTRUCTED OUT OF EMBANKMENT (SUBSOIL) AND IN NO CIRCUMSTANCE CONSTRUCTED OUT OF SALVAGED TOPSOIL.

12. THE PAY ITEM NUMBER FOR TEMPORARY DIVERSION (LF) IS 208-00301.

13. ANCHOR SIZE VARIES ACCORDING TO PIPE SIZE.

14. TO SECURE THE PIPE, DRIVE STAKES INTO GROUND, THEN TIE A 12 GAUGE WIRE BETWEEN THEM ABOVE AND ACROSS THE PIPE'S WIDTH.

15. THE OUTLET SHALL BE ALIGNED WITH THE FLOW DIRECTION OF THE EXISTING GRADE. PERPENDICULAR DISCHARGE TO A CHANNEL SHALL NOT BE ACCEPTABLE.

16. THE GRADE AROUND THE INLET TO THE PIPE SHALL BE COMPACTED.

17. 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.

END SECTION DETAIL (PLAN VIEW)

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

JOINING SECTION DETAIL (PLAN VIEW)

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

SIDE VIEW

NOTE:
1. THE ENDS OF THE SILT FENCE FABRIC SHALL BE JOINED TOGETHER BY WRAPPING APPROX. 6 INCHES OF EACH END AROUND A STEEL T-PDST, THEN SECURED ALONG THE POST WITH WIRE TIES (MINIMUM 3 PER POST).
2. POSTS SHALL BE 66 IN. STEEL T-POST, 14-GUAGE WELDED WIRE FENCING. MAXIMUM MESH SPACING 6 IN.

SILT FENCE APPLICATIONS

Temporary Erosion Control

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-208-1

Standard Sheet No. 8 of 11
INLET FLOW...

GEOTEXTILE EROSION CONTROL (CLASS 1)

THE LENGTH TO WIDTH RATIO IS 2:1

PLAN VIEW

WEIR LENGTH (DO)

Wisconsin DOT

1. THE MAXIMUM DRAINAGE AREA IS 5 ACRES.
2. THE MAXIMUM STRUCTURE LIFE IS 2 YEARS.
3. THE STORAGE AREA IS 2000 CUBIC FEET PER ACRE.
4. THE MAXIMUM EMBANKMENT HEIGHT SHALL BE 5 FT.

SEEDTRAP DESIGN SHALL BE APPROVED BY THE ENGINEER.

5. THE MAXIMUM EMBANKMENT HEIGHT SHALL BE 5 FT. MEASURED ON THE DOWNSTREAM SIDE.
6. THE LENGTH/WIDTH RATIO MAY BE ADJUSTED TO MEET SITE CONDITIONS WHEN APPROVED BY THE ENGINEER.
7. SEEDTRAP DESIGN SHALL BE APPROVED BY THE ENGINEER.
8. THE EMBANKMENT HEIGHT SHALL BE 5 FT.

Sediment Trap Design Table

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NOTES

1. THE MAXIMUM DRAINAGE AREA IS 5 ACRES.
2. THE MAXIMUM STRUCTURE LIFE IS 2 YEARS.
3. THE STORAGE AREA IS 2000 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. THE EMBANKMENT HEIGHT SHALL BE 5 FT.
7. SEEDTRAP DESIGN SHALL BE APPROVED BY THE ENGINEER.
**STEP 1. EXCAVATE THE TRENCH.**

**Erosion Bales**

1. Erosion bales shall be placed 2 in. x 2 in. x 36 in. in nominal.
2. Erosion bales shall be 2 in. x 2 in. x 36 in. in nominal.
3. Erosion bales shall be entrenched a full width to the toe of fill, 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 slant condition.
6. The pay item number for erosion bales (weed-free) is 208-00011.

**WOOD STAKE (TYP.)**

**NOTES**

1. Stakes shall be wood and shall be 2 in. x 2 in. x 30 in. nominal.
2. Erosion bales shall be 2 in. x 2 in. x 36 in. in nominal.
3. Erosion bales shall be entrenched a full width to the toe of fill, 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 slant condition.
6. The pay item number for erosion bales (weed-free) is 208-00011.

**Erosion Bales Culvert Inlet Protection**

**SECTION A-A**

**Erosion Bale Trenching and Staking**

**SECTION B-B**

**Erosion Log Filter at Drop Inlet**

**Erosion Bale Applications**
SECTION VIEW ALONG DITCH FLOWLINE

SECTION A-A

NOTES:
1. RIPRAPH SIZE D = 6 in. or as shown on the plans.
2. THE GEOTEXTILE EROSION CONTROL SHALL BE CLASS 2 AND CONFORM TO THE REQUIREMENTS OF SUBSECTION 712.08.
3. THE ENDS OF RIPRAPH CHECK DAM SHALL BE A MINIMUM OF 6 in. HIGHER THAN CENTER OF CHECK DAM.
4. FOR USE AS TEMPORARY CHECK DAMS ONLY AND NOT FOR PERMANENT INSTALLATIONS.
5. THE PAY ITEM NUMBER FOR ROCK CHECK DAM (EA) IS 208-00041.

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

ROCK CHECK DAM
GENERAL NOTES

6. EXACT DIMENSIONS OF ANGLES, PLATFORM AND SHELF BRACKETS, BOLT HOLE, SLOTS AND MULTIPLE MAILBOX SUPPORT COMPONENTS MAY VARY FROM THOSE SHOWN OR IMPLIED HEREIN 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 GALVANIZED U-BOLT AND HARDWARE OR OTHER MOUNTING SYSTEM APPROVED BY THE ENGINEER. ASSOCIATED COSTS WILL NOT BE PAID FOR SEPARATELY BUT WILL BE INCLUDED IN THE WORK.

2. A SINGLE MAILBOX SHALL BE RESET AT THE FINAL DESIGNATED LOCATION ON A NEW TYPE 1 SUPPORT. TWO MAILBOXES RESET AT THE SAME LOCATION SHALL BE RESET ON ONE DOUBLE (TYPE 2) SUPPORT OR ON TWO SINGLE (TYPE 1) SUPPORTS AS APPROVED BY THE ENGINEER. AN EXISTING MAILBOX LARGER THAN A SIZE NO. 2 SHALL BE REPLACED WITH A NEW SIZE NO. 2 MAILBOX. THE COST OF SUPPLYING THE NEW MAILBOX SHALL BE PAID FOR IN ACCORDANCE WITH SUBSECTION 109.04(b).

4. THE ADDRESS INFORMATION THAT APPEARED ON THE ORIGINAL MAILBOX MOUNTING HARDWARE SHALL CONFORM TO THE REQUIREMENTS OF ASTM A 513.


5. WHEN A MAILBOX TURNOUT IS REQUIRED, THE NECESSARY PAY QUANTITIES WILL BE SHOWN ON THE PLANS. WHEN A MAILBOX TURNOUT IS REQUIRED, THE NECESSARY PAY QUANTITIES WILL BE SHOWN ON THE PLANS.

3. WHEN THE ENGINEER DETERMINES THAT THE EXISTING MAILBOX CAN NOT BE REUSED, A NEW METAL MAILBOX OF SIMILAR SIZE, SHAPE AND DESIGN MAY BE USED, SEE DETAIL ON SHEET 2 OF 2.

8. POSTS, BRACKETS, AND ALL MOUNTING HARDWARE SHALL BE IN CONFORMANCE WITH AASHTO M 210-1 AND M 111.

11. PROPRIETARY MAILBOX SUPPORT SYSTEMS LISTED ON THE COST APPROVED PRODUCTS LIST WILL BE ACCEPTED AS EQUIVALENT ALTERNATIVES.

6. EXACT DIMENSIONS OF ANGLES, PLATFORM AND SHELF BRACKETS, BOLT HOLE, SLOTS AND MULTIPLE MAILBOX SUPPORT COMPONENTS MAY VARY FROM THOSE SHOWN OR IMPLIED HEREIN SO THAT ALL COMPONENTS WILL FIT TOGETHER PROPERLY.

1. WHEN A MAILBOX TURNOUT IS REQUIRED, THE NECESSARY PAY QUANTITIES WILL BE SHOWN ON THE PLANS.

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 GALVANIZED U-BOLT AND HARDWARE OR OTHER MOUNTING SYSTEM APPROVED BY THE ENGINEER. ASSOCIATED COSTS WILL NOT BE PAID FOR SEPARATELY BUT WILL BE INCLUDED IN THE WORK.
NOMINAL 30"

INCREASE LENGTH 3 FT. FOR EACH ADDITIONAL SINGLE OR DOUBLE MAILBOX SUPPORT, PLUS AN ADDITIONAL 5 FT. FOR EACH MULTIPLE MAILBOX SUPPORT (i.e., 2 MULTIPLE AND 1 DOUBLE ARE 15 FT.).

EDGE OF PAVED SHOULDER

W2" x 18" x 13/4" BOLTS CANTILEVER (TYPE 4) MAILBOX SUPPORT

MAXIMUM MOUNTING HEIGHT FROM EDGE OF PAVED SHOULDER

NOTE: SEE SHEET 1, GENERAL NOTE 7, FOR MOUNTING PLASTIC NEWSPAPER RECEPTACLES.

STANDARD PLAN NO. M-210-1
Standard Sheet No. 2 of 2
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).

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

GENERAL NOTES

1. T-shaped fill to be used on slope every 3 to 5 feet maximum.
2. Staple check locations should be at least 15 feet from the bottom of slope.
3. Anchor Trench to be used at the beginning and end of the channel across its entire width.
4. Consecutive Roll Overlap to be used wherever one roll of blanket ends and another begins with upstream blanket placed on top of the blanket on the downstream side.
5. Side Seam Overlap to be used for overlap when two widths of blanket are applied side by side with the uphill blanket placed on top of the blanket on the downhill side.
6. Channel Check Slot to be used at 30’ intervals in channel flowline.

TYPICAL STAPLE PATTERN FOR CHANNEL APPLICATION

SEE SUBSECTION 216.05.
SOIL RETENTION COVERING

CONSECUTIVE ROLL OVERLAP

TO BE USED WHEREVER ONE ROLL OF BLANKET ENDS AND ANOTHER BEGINS WITH THE UPHILL BLANKET PLACED ON TOP OF THE BLANKET ON THE DOWNHILL SIDE.

STAPLE CHECK

TO BE USED ANYWHERE THE DOWNSLOPE END OF THE BLANKET CUTS INTO RECEIVING WATER AND CANNOT BE EXTENDED 3 FEET BEYOND SLOPE.

STANDARD PLAN NO. M-216-1

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

SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM)

SLOPE APPLICATION IN ACCORDANCE WITH SECTION 216.
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.

4. ON MULTILANE DIVIDED HIGHWAYS, MULTILANE DIRECTIONAL PAVEMENT AND BOTH SHOULDERS SHALL BE PLACED WITH © JOINTS.

5. © 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.

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

7. DOWEL BARS WILL BE PLACED ON © CENTERS STARTING © FROM THE ROADWAY © Joint.

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.


RURAL TWO-LANE

MULTI-LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

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

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

MULTI-LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS

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

1. Longitudinal joints shall be placed adjacent to lane markings when possible, and have a maximum spacing of 15 ft. (20 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 2 1/2 in. unexpansion joint filler in the top 6 in. of curb joint at intersection return radii points.

4. The contractor shall, unless otherwise shown on the plans, select and use a bond breaker at 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 inlet 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 1/4 joint.

8. The engineers shall have an option to use individual dowels in the 1/4 joint on short run (2' ± 6") to curb radius returns.

CONCRETE PAVEMENT JOINTS

STANDARD PLAN NO. M-412-1

Standard Sheet No. 3 of 5

Issued by the Project Development Branch: July 31, 2019
Project Sheet Number:
NOTES
1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LINE 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 ON AN EXPANSION JOINT FILLER IN THE 6 IN. CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL PLACE TRANSVERSE JOINTS ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLE, AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES DO NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT WOULD PASS LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLE AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLE. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.

MULTI-LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS
TABLE IV - 9 IN. x 2½ IN. CORRUGATIONS
ROUND STEEL PIPE

GENERAL NOTES
1. PIPE OR PIPE-ARCH WITH ENDS CUT TO FIT A SLOPE AND MARKING ON MINIMUM COVER FOR STRUCTURAL PLATE PIPE OR PIPE ARCH
2. PIPE ARCHES ARE BASED ON CORNER BEARING PRESSURE
3. BOLTS SHALL BE PLACED LOOSE TO ALIGN PLATES, THEN TIGHTENED TO MAINTAIN STRUCTURE SHAPE

PIPE BOLT AND NUT

NOTES:
1. NUTS MADE IN CONFORMANCE WITH ASTM A 194, GRADE 2 THE PLANS WILL BE PERMITTED.
2. BOLTS WITH THE GRADE SYMBOL ARE RECOMMENDED AS SHOWN IN THE PLANS
3. BOLTS SHALL BE PLACED LOOSE TO ALIGN PLATES, THEN TIGHTENED TO MAINTAIN STRUCTURE SHAPE

TABLE I - 6 IN. x 2 IN. CORRUGATIONS
ROUND STEEL PIPE

TABLE II - 6 IN. x 2 IN. CORRUGATIONS
STEEL PIPE-ARCH

TABLE III - 9 IN. x 2½ IN. CORRUGATIONS
ALUMINUM PIPE-ARCH

STRUCTURAL PLATE PIPE H-20 LOADING

PROJECT DEVELOPMENT BRANCH

STANDARD PLAN NO.
M-510-1

Project Sheet Number: 1 of 1

Computer File Information
Creation Date: 07/31/19
Designer Initials: JBK CR-X

Sheet Revisions
Colorado Department of Transportation
2020 West Howard Place
Project Development Branch

rarian Initials: LTA
CAD: MicroStation V8I.
Scale: Not to Scale Units: English CR-X
POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT

- CLEAR WHEN

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

- BARS TOP SLAB 4" BY 2'-0" WHEN AN AREA IS REQUIRED ON THE EXIT END, PROTECTED OUT 2'-0".

- DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

- LIVE LOAD = WEIGHT LIVE-ALONG TRUCK, ALONG A 5'- 3" TANDEM CULVERT TRUCK, AND ALL LANE CASE 3. VERTICAL EARTH LOAD = 200 LBS./FT.

- BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

- BOTTOM SLAB REINFORCING.

- MIN. LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

- TOP SLAB REINFORCING.

- SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.

- TO SUPPLEMENTARY.

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

- MIN. LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

- SECTION C-C

- CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION.

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

- BUILD WALL DIMENSION AND CONCRETE QUANTITY

- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 20. 6 3-3

- ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.

- REINFORCING STEEL SHALL BE GRADE 60.

- ALL CONSTRUCTION JOINTS ARE SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.

- 6 BARS 4" BY 2'-0" (TYP.) EACH FACE OF ALL WALLS.

- MIN. LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

- TOP SLAB REINFORCING.

- BOTTOM SLAB REINFORCING.

- SPLICE LENGTH: 1'-0" 1'-3" 1'-7" 2'-5" 2'-10" 3'-8" 4'-8" 5'-11" 7'-3".

- MIN. LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

- TOP SLAB REINFORCING.

- BOTTOM SLAB REINFORCING.

- SPLICE LENGTH: 1'-1" 1'-4" 1'-7" 1'-11" 2'-6" 3'-1" 3'-11" 4'-10".

- REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.

- MIN. LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

- TOP SLAB REINFORCING.

- BOTTOM SLAB REINFORCING.

- SPLICE LENGTH: 1'-0" 2'-0" 3'-0" 4'-0" 5'-0" 6'-0" 7'-0" 8'-0" 9'-0" 10'-0".

- REINFORCING STEEL SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 20.

- POST ANCHORS SHALL BE PROTECTED ACCORDING TO STANDARD PLAN M-606-1, SHEET 20.

- POST ANCHORS ARE CONCRETE FOR MOUNTING GUARDRAIL WILL NOT BE MEASURED.

- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE.

- HEADWALL MOUNT GENERAL IS USED.

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- POST ANCHORS ARE CONCRETE FOR MOUNTING GUARDRAIL WILL NOT BE MEASURED.

- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE.

- HEADWALL MOUNT GENERAL IS USED.
**SINGLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)**

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**BAR SIZES**

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<th>Size</th>
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<td>2</td>
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**NOTES**

1. **S½ INCH SPACING AT EACH END OF THE SLAB FOR A DISTANCE OF 1/4 OF THE SLAB LENGTH IS INCH SPACING EVERYWHERE.**

2. **QUANTITIES ARE GIVING FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL, STEEL QUANTITIES INCLUDE ALL REINFORCING.**

3. **SHEARED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS, A SPECIAL DESIGN IS REQUIRED.**

4. **HEADWALL AND TOEWALL DETAILS SEE M-601-1, SHEET 1 OF 2.**

5. **REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.**
GENERAL NOTES
1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE thorougly cleaned before fresh concrete is placed.
3. ALL CONCRETE JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206.
6. I46 ALL CONSTRUCTION JOINTS shall be 30 FT FOR SEPARATE, A SEDIMENT INVESTIGATION AND REPORTS ARE REQUIRED.
7. BACKFILL SHALL NOT BE PLACED UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH.
8. SPADE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT REQUIRED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.

11. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
12. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
13. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
14. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
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18. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
19. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
20. ALL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.

REINFORCING PLAN

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE LINES OF THE BOX ONLY.
THE CONSTRUCTION JOINTS SHOWN ON THE PLANS ARE FOR USE IN SUPPORTING TEMPORARY LIVE LOADS DURING STAGE CONSTRUCTION.
THE JOINTS SHOWN ON THE PLANS ARE NOT THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

SECTION C-C
HEADWALL CORNER REINFORCING DETAIL

COMMENTS

DOUBLE CONCRETE BOX
CULVERT (CAST-IN-PLACE)

STANDARD PLAN NO.
M-601-2

Project Development Branch: July 31, 2019
Issued by the Project Development Branch: July 31, 2019
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English
### DOUBLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

#### HEADWALL AND TOEWALL QUANTITIES

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<tr>
<th>HEWALL</th>
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<tr>
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<tr>
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<td>4</td>
</tr>
<tr>
<td>12</td>
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**NOTES**

1. **Six inch spacing at each end of the span for a distance of 1/4 of the span length is not required 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 and shall be paid for as shown on the plans.
3. **Skewed headwalls are not recommended for these spans. A special design is required.**
4. **For headwall and toe wall details, see W-502, Sheet 1 of 2.**
5. When the full heads are less than or equal to 2 ft, all reinforcing bars in the headwall all reinforcing bars designated by an asterisk [*] and all bars in the top or the top slab shall be epoxy coated.
6. Reinforcing quantities include both epoxy-coated and uncoated bars.
7. When a headwall or toe wall is less than 6 ft, 4 ft, use the bare steel from the centerline to the wall thickness for the 6 ft righthand availability on the table.
8. **For size and spacing of the bottom mat bars in the top slab, see W-502, Sheet 1 of 2. All other bars are listed in W-502, spacing the number of bars required to be listed on this sheet and included in both the bottom mat and these structures refer to the DOT Rating Manual.**
9. **Live load is a base for ASHTO Uniform Section S-12.5, for these structures refer to the DOT Rating Manual.**
10. **For all new culvert designs, a rating is required. The rating summary sheet should be printed from the DOT external website and submitted to the bridge rating unit of the same as part of the design process for additional information, see the DOT Rating Manual.**
GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS B CONCRETE.

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

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

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

5. STRUCUTURAL EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.

6. FOR ANY CONSTRUCTION JOINTS 2 FT OR MORE, A PRESIZATION JOURNAL AND REPORT ARE REQUIRED.

7. BACKFILL SHALL NOT BE USED UNTIL THE TOP SLAB HAS REACHED DESIGNED STRENGTH.

8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.

9. REINFORCING STEEL SHALL BE GRADE 60.

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

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

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

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.

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

17. FOR FILL HEIGHTS LESS THAN 2 FT, THE #4 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

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

REINFORCING PLAN

SECTION C-C

HEADWALL CORNER REINFORCING DETAIL

CONSTRUCTION JOIN DETAIL FOR STAGED CONSTRUCTION

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

THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

FOR FULL HEIGHTS LESS THAN 2 FT, THE #4 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

SPECIFICATIONS

- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ALL SPECIFICATIONS FOR STEEL WILL BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL SPACE AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-603-3 SHEET 19.
- POST ANCHORS SHALL BE PROPERLY ACCORDING TO STANDARD PLAN M-603-3 SHEET 19.
- HEADWALL MOUNT GUARDRAIL SHALL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- ANY SPECIAL REINFORCING DETAILS FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
### TRIPLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOE WALL QUANTITIES)

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### HEADWALL AND TOE WALL QUANTITIES

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### NOTES

1. SHEER HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

2. COINCRETE QUANTITY = 0.086 CY/LF

3. SHEER HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

4. FOR HEADWALL AND TOE WALL DETAILS SEE M-601-3, SHEET 1 OF 2.

5. WHEN THE FILL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT. ALL REINFORCING BARS IN THE HEADWALL ARE DESIGNATED BY AN Astrophet (A) AND ALL REINFORCING BARS IN THE TOE WALL ARE DESIGNATED BY A "W" (W). HEADWALL AND TOE WALL BARS ARE DESIGNATED BY AN "H" (H).

6. CONCRETE QUANTITY = 0.086 CY/LF
1. **Concrete shall be Class 8.**

2. The headwall shall be perpendicular to the pipe unless otherwise shown on the plans. Tabulated dimensions and quantities must be adjusted for skewed installations.


---

4. Exposed concrete corners shall be chamfered 1.5 in. by 0.75 in.

5. All reinforcing bars shall have a 2 in. clearance.

6. Concrete shall be placed so that the adjacent pipes will be 1/2 in. inside span apart, or 3 ft. apart (including wall thickness), whichever is less.

---

**Skew Factor Table**

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**Concrete Quantities**

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<th>CU- YD</th>
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**Headwall for Rigid Round Pipe**

**Headwall for Flexible Pipe Arch**

**Headwall for Structural Plate Arch**
CONCRETE HEADWALL INSTALLATIONS
SEE STANDARD PLAN M-601-10 FOR REINFORCING DETAILS.

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CONCRETE QUANTITIES FOR ONE CONCRETE HEADWALL (CUBIC YARDS)

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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 CUSHIONED OR ROCK AND NOT FORMED IN ACCORDANCE WITH SECTION 601.09.
4. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 1/8".
5. HEADWALLS 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 PAID FOR SEPARATELY.

PROJECT DEVELOPMENT BRANCH
Issued by: Project Development Branch Date: July 31, 2019
Project Sheet Number: M-601-12

HEADWALL DIMENSIONS
CIRCULAR: H = D + 30" W = 3D + 36" T = 0.4 H (NEAREST IN) B = 0.6 D (NEAREST IN) L = W + B
ARCH OR ELLIPTICAL: H = D + 30" W = 3D + 36" T = 0.4 H (NEAREST IN) B = 0.6 D (NEAREST IN) L = W + B

PIPE OUTLET PAVING
MAY BE USED WITH MULTIPLE PIPES.
CONCRETE APRON, IF NOT SHOWN FOR CLARITY

#5 PLACE ALONG TOP OF WALL (TOT. 2)

#4 @ 12" HORIZONTAL BARS

CONCRETE SEALER AT OR RISE

FRONT, (SEE SHEET 2)

OF 2 FOR LIMITS)

TOP OF WALL (TOT. 2)

SKEWED HEADWALL, IF SPECIFIED ON PLANS

= h, Ba = h, Ba OR RISE + (1 1-4 11 ) UNLESS OTHERWISE SHOWN ON PLANS

1'-9" DRAINAGE BEHIND c-BARS (VERT.)

WINGWALL, SEE NOTE 6

EQUAL SIZE & SPACE

THE STEM TO SPLICE d-BARS

SEE TABLE

NO. 4 X 2'-8" 12 11

INTO STEM

TOP MAT (SEE DETAIL "A")

MINOR AASHTO LRFD EIGHTH EDITION, 2017

DESIGN DATA:

LOADING:

ATTACHED EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 55 PCF FOR 2 SLOPED BACKFILL

ACTIVE EARTH (FLUID) PRESSURE FOR CONCRETE FOOTING DESIGN = 40 PCF FOR 2 SLOPED BACKFILL

MINIMUM RESISTANCE FOR SOIL BEARING = 5.5 KSF

SOIL BEARING RESISTANCE FACTOR = 0.45

GENERAL NOTES:

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 1/4".

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

3. DIMENSIONS "h" , "k", "L", "m" AND ANGLE "S" FOR WINGWALL SHALL BE AS SHOWN ON THE PLANS.

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

5. DESIGN DOES NOT CONSIDER ANY SCOUR EFFECTS.

6. WINGWALL DRAIN SHALL BE REQUIRED IF "h" > 12.0 FT., SEE SHEET 2 OF 2 FOR DETAILS.
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**EXAMPLE:**

1. Determine reinforcing steel quantity in multiple of ft:
   - $L / m = 50.0 / 10 = 5.0$
   - $S / ft = 15.0 / (12.5) = 1.2$
   - Round to nearest whole number for $m = 50.0 / 10 = 5.0$

2. Determine reinforcing steel quantity of whole wall:
   - #5 @ 10" = 75.00 lb/ft, #6 @ 12" = 103.93 lb/ft, #6 @ 10" = 93.73 lb/ft

**SELECT THE c-BARS SIZE, SPACING AND STEEL QUANTITY FOR A**

- 11.8 FT. AND $k = 6.3$ FT.

**SOLUTION:**

- #5 @ 10" = 75.00 lb/ft, #6 @ 12" = 103.93 lb/ft, #6 @ 10" = 93.73 lb/ft

**LIMITS OF CONCRETE SEALER AND WINGWALL DRAIN DETAILS**

- The geosynthetic is placed on the wall to prevent moisture during backfilling.
- The cost of reinforcing steel and concrete sealer shall be included in the work.
INSTALLATION OF METAL PIPE

GENERAL NOTES

1. STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M36.
2. ALUMINUM PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M196.
3. STRUCTURAL PIPE FIFE IN ALUMINIZED STEEL SHALL CONFORM TO SECTION 603.
4. STRUCTURAL PIPE FIFE IN ALUMINIZED STEEL SHALL CONFORM TO SECTION 603.
5. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
6. EXTENSIONS FOR CMP ARCH PIPE SHALL MATCH THE CORRUGATIONS AND THE SPAN AND RISE DIMENSIONS OF THE PIPE TO BE EXTENDED.
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. THE HOLE FOR THE POST SHALL BE DRILLED INTO THE SOIL.
8. PIPE ARCH WITH EQUAL PERIPHERY AND WITH SPAN AND RISE DIMENSIONS APPROXIMATELY EQUAL TO THOSE SPECIFIED ON THE PLANS WILL BE PERMITTED.
9. PIPE ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. WHEN COVER EXCEEDS 1 FOOT, USE ROUND PIPE.
10. PIPE COVER GREATER THAN 90 FT. SHALL REQUIRE AN INVESTIGATION OF THE FOUNDATION MATERIAL.

M-603-1

Standard Plan No.

STANDARD PLAN NO.

M-603-1

Standard Sheet No. 1 of 4
### H Pipe G.N.E

**Minimum Diameter of Corrugated Steel Pipe:**

<table>
<thead>
<tr>
<th>Diameter (IN.)</th>
<th>CSP (Galvanized)</th>
<th>ALT2 CSP</th>
<th>BCP (Bituminous)</th>
<th>AFB CSP</th>
<th>PCSP (Precoated)</th>
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**Cover (IN.)**

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**Pipe Gage**

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**Minimum Cover (IN.)**

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**Maximum Cover (FT.)**

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**Corner Bearing Pressure**

- **2 1/2" x 1/2" Corrugations**
  - Corner Bearing Pressure of 2 Tons per sq. ft.

**3" x 1" Corrugations**

### 1 1/4" x 1/4" Corrugations

**Corrugated Steel Pipe**

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**Corner Bearing Pressure**

- **2 1/2" x 1/2" Corrugations**
  - Corner Bearing Pressure of 2 Tons per sq. ft.

**3" x 1" Corrugations**

### 3" x 1" Corrugations

**Corrugated Steel Pipe**

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<th>Diameter (IN.)</th>
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**Corner Bearing Pressure**

- **2 1/2" x 1/2" Corrugations**
  - Corner Bearing Pressure of 2 Tons per sq. ft.
<table>
<thead>
<tr>
<th>DIA. (IN.)</th>
<th>MINIMUM COVER (IN.)</th>
<th>PIPE GAGE</th>
<th>H MAXIMUM OF COVER (FT.)</th>
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These tables are applicable for the following list of corrugated steel pipe:
1. Galvanized corrugated steel pipe (CSP)
2. Aluminum corrugated steel pipe type 2 (ALT2 CSP)
3. Bituminous coated corrugated steel pipe (BIT CO CSP)
4. Aramid fiber bonded corrugated steel pipe (AFB CSP)
5. Precoated corrugated steel pipe (PCSP - both sides)

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

<table>
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<th>SPAN X RISE (IN. X IN.)</th>
<th>ROUND EQUIVALENT (IN.)</th>
<th>H MINIMUM COVER (IN.)</th>
<th>PIPE GAGE</th>
<th>H MAXIMUM COVER (FT.)</th>
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5" x 1" corrugations corrugated steel pipe

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<th>H MAXIMUM OF COVER (FT.)</th>
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5/8" x 3/4" corrugations corrugated steel pipe

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1/4" x 3/4" corrugations corrugated steel pipe

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* Corner bearing pressure of 2 tons per 50 ft.
### Corrugated Steel Pipe

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

### Corrugated Aluminum Pipe

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>Minimum Cover (in)</th>
<th>Maximum Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>21</td>
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<td>24</td>
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<td>28</td>
</tr>
<tr>
<td>24</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

### Corrugated Aluminum Pipe Arch

<table>
<thead>
<tr>
<th>Diameter (in)</th>
<th>Minimum Cover (in)</th>
<th>Maximum Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>21</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Note:**
- The tables are applicable for the following list of corrugated steel pipe:
  1. Hot-Dipped Galvanized Corrugated Steel Pipe (CSP)
  2. Aluminized Corrugated Steel Pipe Type 2 (ALT2 CSP)
  3. Bituminous Coated Corrugated Steel Pipe (BTC CSP)
  4. Aramid Fiber Bonded Corrugated Steel Pipe (AFB CSP)
  5. Precoated Corrugated Steel Pipe (PCSP - BOTH SIDES)

**Corrugated Steel Pipe**

1. **1-3/4” x 1/4” Corrugations**
   - Corrugated Aluminum Pipe

2. **2-3/8” x 1/4” Corrugations**
   - Corrugated Aluminum Pipe

3. **3” x 1” Corrugations**
   - Corrugated Aluminum Pipe

---

**Computer File Information**

- **Project Development Branch:** JBK
- **Issued by:** Project Development Branch: July 31, 2019
- **CAD Ver.:** Microstation VB
- **Scale:** Not to Scale
- **Units:** English

**STANDARD PLAN NO.**

- **METAL PIPE**
- **M-603-1**

---

**Construction Documents**

- **Design:** JBK
- **Detail:** LT A
- **Issued by:** Project Development Branch: July 31, 2019
- **Revision History:**
  - Creation Date: 07/31/19
  - Date: Comments...
  - Phone: 303-757-9021
  - FAX: 303-757-9868

---

**Sheet Revisions**

- **Creation Date:** 07/31/19
- **Date:** Comments...
- **Phone:** 303-757-9021
- **FAX:** 303-757-9868
- **Detailer Initials:** LT A

---

**Project Development Branch:**

- **JBK**
- **Design:** JBK
- **Detail:** LT A
- **Issued by:** Project Development Branch: July 31, 2019
- **Revision History:**
  - Creation Date: 07/31/19
  - Date: Comments...
  - Phone: 303-757-9021
  - FAX: 303-757-9868
GENERAL NOTES

1. Fill heights greater than maximum allowed in the heights of fill table in this sheet require special design of structure.
2. Pipe 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 1150 lbs per cubic foot.
4. Fire class is determined from 0.01 in crack damage.
5. Bedding is class B (modified) from concrete pipe design manual-American Concrete Pipe Association with settlement ratio R = 0.01 on rigid pipe in soil shall be 2 inches thickness structure backfill class 1.
6. Changes in design factors require compensating changes in pipe design.
7. Minimum wall thickness dimensions are based on AASHTO M170 (wall B) for circular pipe, and AASHTO M207 for elliptical pipe.

REINFORCED 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 meet the same design to produce the ultimate load under the three-edge bearing method as specified for reinforced concrete pipe in conformance with AASHTO. 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.

NONREINFORCED CONCRETE PIPE

1. Dimensions for reinforced concrete pipe (for information only) are also equivalent round dimensions for elliptical pipe.
2. All requirements for reinforced concrete pipe, except those referring to reinforcement, shall apply to nonreinforced concrete pipe.

DIMENSIONS FOR REINFORCED CONCRETE PIPE

| TYPE OF PIPE | WEIGHT OF FILL OVER TOP OF PIPE | ALLOWABLE RANGE OF HEIGHTS FOR FILL | REINFORCED CONCRETE PIPE | STANDARD PLAN NO. | M-603-2 | 1 of 1 |
|-------------|---------------------------------|-------------------------------------|--------------------------|-------------------|--------|
| CIRCULAR (CIR) | CLASS CIR II | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR II | CLASS CIR III | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR III | CLASS CIR IV | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR IV | CLASS CIR V | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR V | CLASS CIR VI | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR (CIR) | CLASS VE II | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR II | CLASS VE III | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR III | CLASS VE IV | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR IV | CLASS VE V | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |
| CIRCULAR V | CLASS VE VI | 1 TO 18 | 1 TO 25 | 1 TO 25 | 4 TO 35 | 1 TO 25 | 4 TO 35 | 45 TO 62 |

NOTES:
- Use the length that is greater for maximum allowable fill height.
- Minimum cover for rigid pipe is based on AASHTO M170 for circular pipe, and AASHTO M207 for elliptical pipe.
- Nonreinforced concrete pipe shall meet the same design to produce the ultimate load under the three-edge bearing method as specified for reinforced concrete pipe in conformance with AASHTO. 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.
GENERAL NOTES

1. PRECAST CONCRETE BOX CULVERT SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING SPECIFICATIONS:

| ITEM OR CONDITION | MIN. COVER | AASHTO EQUIV. | ASTM
|-------------------|------------|---------------|-------|
| 2 FT. OR MORE COVER | 2 FT. | M 259, TABLE 2 | C 1433, TABLE 2
| LESS THAN 2 FT. COVER | 0 FT. | M 373, TABLE 2 | C 1433, TABLE 2
| PREFORMED JOINT MATERIAL | 0 FT. | M 199, CL. 6.2 | C 990, CL. 6.2

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

3. LIFTING BEDDING ALTERNATIVE IS AT THE CONTRACTOR’S OPTION. BEDDING AND ANCHOR RECESSES MAY NOT BE FILLED. EXCAVATION FOR BEDDING WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

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

5. CLASS 1 DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS WHICH DO NOT HAVE RUBBER GASKETS. THE GEOTEXTILE WRAP SHALL BE A SMOOTH FIT (NOT LOOSE OR STRETCHED) JUST PRIOR TO BACKFILLING. THE GEOTEXTILE MATERIAL SHALL MEET THE APPLICABLE REQUIREMENTS OF SECTION 420. COST FOR GEOTEXTILE WILL NOT BE MEASURED AND PAID FOR SEPARATELY.

6. FOR ANY CBC SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT IS REQUIRED. THE CONTRACTOR HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577 FOR SPANS LESS THAN 20 FT.

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

8. SEE M-601-1, 2, AND 3 FOR CAST-IN-PLACE CONCRETE BOX CULVERT DETAILS.

LEGEND

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLAY/CLAYE
- EARTH
- FILLING MATERIAL
- REBAR
- CONCRETE

Z-BARS (CONT.)

HOOKED BARS: 1′ = 10 IN. HOOKED BARS SHALL MEET THE REQUIREMENTS OF SECTION 308. SEGMENT LENGTHS SHALL BE SPECIFIED BY MANUFACTURER. THE DESIGN FOR A PRECAST CONCRETE BOX CULVERT WITH A SPAN LARGER THEN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

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

5. CLASS 1 DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS WHICH DO NOT HAVE RUBBER GASKETS. THE GEOTEXTILE WRAP SHALL BE A SMOOTH FIT (NOT LOOSE OR STRETCHED) JUST PRIOR TO BACKFILLING. THE GEOTEXTILE MATERIAL SHALL MEET THE APPLICABLE REQUIREMENTS OF SECTION 420. COST FOR GEOTEXTILE WILL NOT BE MEASURED AND PAID FOR SEPARATELY.

6. FOR ANY CBC SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT IS REQUIRED. THE CONTRACTOR HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577 FOR SPANS LESS THAN 20 FT.

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

8. SEE M-601-1, 2, AND 3 FOR CAST-IN-PLACE CONCRETE BOX CULVERT DETAILS.
1. All pipes shall meet the requirements of AASHTO M294 for polyethylene and AASHTO M330 for polypropylene, respectively, with smooth inner liner.

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. Maximum height in high water locations shall be 1 foot above the top of the pipe. The hole for the post shall be drilled into the soil.

5. Structure backfill material shall be Class 1.

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

Legend:

- **H** = maximum allowable height of cover over the top of the pipe, excluding pavement thickness.
- **L1** = length of pipe to be measured when placed in accordance with Section 624.
- **L2** = length of pipe to be measured when placed in accordance with Section 603.
- **T** = the minimum spacing between the outer walls of multiple pipes or end sections is 18" or \( \frac{1}{2}(d) \), whichever is greater.

---

**Trench Width Assumed Stable In-Situ Side Wall**

**Installation of Pipe**

**Installation of Multiple Pipes**

---

**General Notes**

1. All pipes shall meet the requirements of AASHTO M294 for polyethylene and AASHTO M330 for polypropylene, respectively, with smooth inner liner.

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

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

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

5. Structure backfill material shall be Class 1.

6. For pipes 24 inches or less in diameter, Hmin. 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 M304 for Polyvinyl Chloride (PVC) profile wall drain pipe with 46 PSI wall stiffness per ASTM F949.

2. For pipes with diameters of 15 inches or less, solid wall PVC pipes meeting AASHTO M278 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 posts' bottoms 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, the minimum cover may be reduced to one foot for low volume approach roads not on state highways.

---

**General Diagram**

- **Installation of Pipe**
  - Minimum and maximum cover
  - Elevation of suitable material
  - Bottom of patient area of pipe
  - Backfill structure

- **Installation of Multiple Pipes**
  - Trench width assumes stable in-situ side wall

---

**Legend**

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

---

**Table: Minimum and Maximum Cover**

<table>
<thead>
<tr>
<th>Pipe Diameter (in.)</th>
<th>H Minimum Height of Cover (ft.)</th>
<th>H Maximum Height of Cover (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95% Compaction</td>
<td>90% Compaction</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>58</td>
</tr>
<tr>
<td>18</td>
<td>2</td>
<td>62</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td>24</td>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td>26</td>
<td>2</td>
<td>56</td>
</tr>
</tbody>
</table>

---

**Notes**

- **L1** = Length of pipe to be measured when placed in accordance with Section 603.
- **L2** = Length of pipe to be measured when placed in accordance with Section 624.

---

**General Information**

- Created Date: 07/31/19
- Designer Initials: JBK
- Last Modification Date: 07/31/19
- Project Development Branch: JBK
- Colorado Department of Transportation 2039 West Howard Place CDOT M, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868

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**Polyvinyl Chloride (PVC) Pipe**

- (AASHTO M304)

---

**Standard Plan No.**

- M-503-5
- Standard Sheet No. 1 of 1

---

**Computation Information**

- Computer File Information
- Sheet Revisions
- Issued by the Project Development Branch July 31, 2019
- Project Sheet Number:
**LEGEND**

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

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

**GENERAL NOTES**

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO MP 20 FOR STEEL REINFORCED, POLYETHYLENE RIBBED PIPE WITH SMOOTH INNER SURFACE. INSTALLATION SHALL CONFORM TO AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, SECTION 26.

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.

**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>30</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>42</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>54</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>60</td>
<td>2.5</td>
<td>50</td>
</tr>
</tbody>
</table>

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

**CONSTRUCTION MINIMUM COVER FOR PIPE**

<table>
<thead>
<tr>
<th>NOMINAL PIPE DIAMETER (IN.)</th>
<th>MINIMUM COVER (IN.) FOR INDICATED AXLE LOADS (KIPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 36</td>
<td>24.0, 30.0, 30.0, 36.0</td>
</tr>
<tr>
<td>42 - 48</td>
<td>36.0, 42.0</td>
</tr>
<tr>
<td>54 - 60</td>
<td>40.0, 46.0</td>
</tr>
</tbody>
</table>

**STANDARD PLAN NO.**

M-603-6

**STANDARD SHEET NO.**

1 of 1

**CREATED BY THE PROJECT DEVELOPMENT BRANCH: JULY 31, 2019**
1. Dimensions of end sections may vary slightly from those shown on the tables due to different manufacturers' configurations.

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

3. 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 his own cost.

4. The inside configuration and the joint of concrete end section and pipe shall match. End sections for CMP arch pipe shall match the dimensions of the pipe shown on the plans. Steel pipe and shall be the same thickness as end sections. The plate shall be field-soldered to end section with % in. galvanized bolts, nuts, and washers.

5. Concrete pipe joint fasteners, where shown on plans, shall be installed so that a minimum of linear feet of the outlet end of the pipe are mechanically locked together. End section lengths when used shall be included in the 15 LF requirement.

6. Steel end sections shall be furnished with tongue or groove as required to differ from those shown on the tables due to different manufacturers' configurations.

7. Concrete and metal end sections may vary slightly from those shown on the tables due to different manufacturers' configurations.
1. USE END SECTIONS ON 1V:4H TO 1V:6H SLOPES DNL Y. USE TOE PLATE (SEE SEC. A-A) LONGITUDINAL SLOPE EXTENSION WHERE SHOWN ON THE PLANS.

2. FABRICATE SAFETY AND LONGITUDINAL BARS FROM STEEL PIPE REINFORCED EDGE FULL LENGTH OF ----- TO HOLD THE SURFACES CONFORMING TD ASTM A53 SCHEDULE 40 SPECIFICATIONS. GALVANIZE BARS HOT DIPPED AFTER FABRICATION.

3. A LONGITUDINAL BAR IS REQUIRED FOR CROSS DRAINAGE END SECTIONS WHEN THE SPAN IS GREATER THAN 30 INCHES. USE ADDITIONAL LONGITUDINAL BARS IF SPACING EXCEEDS 30 INCHES ON LARGER END SECTIONS.

4. SAFETY AND LONGITUDINAL BARS ARE NOT REQUIRED ON 30 INCHES THICKNESS AS END SECTION AND SMALLER CROSS DRAINAGE END SECTIONS.

5. SAFETY BARS ARE NOT REQUIRED ON 18 INCHES AND SMALLER PARALLEL DRAINAGE END SECTIONS.

6. WHEN REQUIRED, TOE PLATE EXTENSIONS SHALL BE THE SAME GAGE AS END SECTIONS. DIMENSIONS SHALL BE OVERALL WIDTH LESS 6 INCHES BY 8 INCHES HIGH.

---

**METAL END SECTIONS FOR ROUND PIPE CULVERT**

<table>
<thead>
<tr>
<th>PIPE SIZE (INCHES)</th>
<th>METAL THICKNESS (INCH/GAGE)</th>
<th>A</th>
<th>H</th>
<th>OVERALL WIDTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>0.064/16</td>
<td>8</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>18</td>
<td>0.064/16</td>
<td>12</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>24</td>
<td>0.064/16</td>
<td>16</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>36</td>
<td>0.064/16</td>
<td>20</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>42</td>
<td>0.064/16</td>
<td>24</td>
<td>18</td>
<td>52</td>
</tr>
<tr>
<td>48</td>
<td>0.064/16</td>
<td>28</td>
<td>21</td>
<td>60</td>
</tr>
<tr>
<td>54</td>
<td>0.064/16</td>
<td>32</td>
<td>24</td>
<td>66</td>
</tr>
<tr>
<td>60</td>
<td>0.064/16</td>
<td>36</td>
<td>27</td>
<td>72</td>
</tr>
</tbody>
</table>

**METAL END SECTIONS FOR PIPE ARCH CULVERT**

<table>
<thead>
<tr>
<th>PIPE SIZE (INCHES)</th>
<th>METAL THICKNESS (INCH/GAGE)</th>
<th>A</th>
<th>H</th>
<th>OVERALL WIDTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>0.064/16</td>
<td>8</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>18</td>
<td>0.064/16</td>
<td>12</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>24</td>
<td>0.064/16</td>
<td>16</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>36</td>
<td>0.064/16</td>
<td>20</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>42</td>
<td>0.064/16</td>
<td>24</td>
<td>18</td>
<td>52</td>
</tr>
<tr>
<td>48</td>
<td>0.064/16</td>
<td>28</td>
<td>21</td>
<td>60</td>
</tr>
<tr>
<td>54</td>
<td>0.064/16</td>
<td>32</td>
<td>24</td>
<td>66</td>
</tr>
<tr>
<td>60</td>
<td>0.064/16</td>
<td>36</td>
<td>27</td>
<td>72</td>
</tr>
</tbody>
</table>

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**SAFETY BAR DETAILS**
Installation Types

GRADE BARS SHALL BE PERPENDICULAR TO DIRECTION OF TRAFFIC FLOW.

SKEW ANGLE DETERMINATION

THE CROSS BAR DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE GRATE BAR DIAMETER.

THE CROSS BAR DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE GRATE BAR DIAMETER.

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 A123
3. Designed for use on terrain XX slopes with a clear radius for errant vehicles. Guidance in the preferred option on steep terrain or with higher traffic volumes.
4. Minimum schedule pipe shall be hot galvanized all times. Fittings and hardware after all cutting, welding, drilling, and fabrication.
5. Both ends of culvert shall be treated to prevent erosion from entering.
6. Equally spaced 24 inches to 30 inches away from edge 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 longer than a horizontal support shall be required. See Table 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 washers, all holes to be 1/4 inch in diameter.
11. Bend plates or strips without cracking material.
12. Shim thickness equals the difference in diameters of the grate bar and cross bar.

Installation Plan (Type 4 - Flared-Skewed Culvert Shown)
NOTES
1. LENGTH OF SPAN (120 FEET MAXIMUM)
2. ALL ANCHOR BOLTS SHALL BE GRouted IN PLACE WITH A NONSHRINK OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.

CASE 1

CASE 2

SECTION D-D

DETAIL "D"

DETAIL "D"'

SECTION D-D

DETAIL "D"'

DETAIL "D"'

TRAVERSABLE END SECTIONS AND SAFETY GRATES

STANDARD PLAN NO.
M-603-12

Issued by the Project Development Branch: July 31, 2019
Additional notes include:

- All inlets shall have a 4-inch-diameter metal medallion with a "No Dumping Drains To Stream" message on it. The medallion shall be firmly attached to the top of the inlet with a permanent fastener.

- Close mesh gratings are recommended for foot traffic or bicycle routes that are in close proximity to the grate. This grate is not ADA compliant or bicycle rated. It shall be firmly attached to the top of the grate with a permanent fastener.

- Close mesh gratings shall be installed on all Type C inlets unless close mesh gratings are specified on the plans.

- The standard steel grate shall be used on all Type C inlets unless close mesh gratings are specified on the plans.

- The structural steel for graters and grate installation hardware shall be galvanized and shall be in accordance with Subsection 712.06.

- Concrete and steel quantities are for the Type B grate before deduction for volume occupied by pipe. Weight of steel includes a ring for the pipe diameter.
I. INLET TYPE D IS NOT HS-20 RATED AND SHALL NOT BE PLACED IN PAVED ROADWAYS. THIS INLET SHALL BE USED ONLY OUTSIDE PAVED ROADWAYS.

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 M199.

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

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

* When a Type R inlet is used with a mountable curb and gutter, a 5 ft transition shall be constructed. The transition shall be paid for as curb and gutter.
* Station point at front of inlet along alignment.

TRANSITION CURB

A curb and gutter shall be constructed along the alignment of the inlet.

SECTION A-A REGULAR INLET

- For length of 15 ft or more, provide maintenance access at both ends with an inspection, service, and access cut reinforcement bar accordingly.
- Station point at front of inlet along alignment.

PLAN VIEW

- Cut off or bend bars to clear manhole.
- 2" CLR.
- Inlet steps are 3'-6" max.
- For a 1'-0" pan slope 2% per ft.

SECTION A-A INLET WITH DROP BOX ~ 155 FT.

- NOTE: Manhole ring and cover, station point, and outflow pipe shall be located at the same end of the inlet.

CURB INLET TYPE R

- Station point at front of inlet along alignment.
- Cut off or bend bars to clear manhole.

SECTION B-B END VIEW

- NOTE: Manhole ring and cover, station point, and outflow pipe shall be located at the same end of the inlet.

END VIEW

- Station point at front of inlet along alignment.

END VIEW

- Station point at front of inlet along alignment.

SECTION A-A INLET WITH DROP BOX ~ 155 FT.

- NOTE: Manhole ring and cover, station point, and outflow pipe shall be located at the same end of the inlet.

CURB INLET TYPE R
**GENERAL NOTES**

1. Concrete shall be Class B. Inlet may be cast-in-place or precast.
2. Concrete walls shall be reinforced on both sides and shall be 5 inches thick.
3. Inlet steps shall be in compliance with ASHRAE 90D.
4. Concrete face assembly shall be chamfered after placing.
5. Exposed concrete corners shall be chamfered 1/4 inch. Curbs and gutters shall be formed to match the existing curb and gutter beyond the transition gutter.
6. Reinforcing bars shall be deformed and shall have a 2 inch minimum clearance between bars.
7. Dimensions and weights of typical manhole ring and cover are nominal.
8. Material for manhole rings and covers shall be gray or ductile cast iron in accordance with Subsection 712.06.
9. Structural steel shall be galvanized and shall be in accordance with Subsection 712.06.
10. All manhole covers shall be cast with a "No Dumping Drains to Stream" message and a fish symbol. The surface of the manhole cover shall have a non-slip pattern.

---

### TABLE ONE — BAR LIST FOR CURB INLETS, TYPE "R"

<table>
<thead>
<tr>
<th>WORK</th>
<th>BAR</th>
<th>TOP SPECIFICATION</th>
<th>BAR</th>
<th>TOP SPECIFICATION</th>
<th>BAR</th>
<th>TOP SPECIFICATION</th>
<th>BAR</th>
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<td>L10FT</td>
<td>L15FT</td>
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<td>L10FT</td>
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<tr>
<td>501</td>
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<td>503</td>
<td>30 4 1/2</td>
<td>505</td>
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<td>512</td>
</tr>
</tbody>
</table>

**NOTES:**
- Include #4, 18 in. bars (see channel layout).
- Regular inlets drop box inlets: Total quantities needed are inside the heavy black line.
- Steel weights do not include structural steel channel.

---

### TABLE TWO — BARS AND QUANTITIES VARIABLE WITH "H"

**VARIES**
- Dimensions are out-to-out of bar
- Bars and quantities variable with 11 H 11 bar bending diagrams

---

**PLAN VIEW**

**ELEVATION VIEW**

**MANHOLE COVER (TYP.)**

**MANHOLE RING (TYP.)**

---

**CHANNEL LAYOUT DETAILS**

See curb face assembly on sheet 1.

---

**BAR BENDING DIAGRAMS**

~(Dimensions are out-to-out of bar)
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 AN INCH.
4. REINFORCING BARS SHALL BE DEFORMED #4 AND SHALL HAVE A 2 INCH MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT-6 INCHES AND SHALL CONFORM TO AASHTO M 199.
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.

NOTE: CONCRETE QUANTITIES INCLUDE VOLUME OCCUPIED BY PIPE.

BAR LIST FOR H = 3 FT-0 IN.

<table>
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<tr>
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<th>M.</th>
<th>No. of</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
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<td>39&quot;</td>
<td>39&quot;</td>
<td>39&quot;</td>
</tr>
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<td>402</td>
<td>2</td>
<td>34&quot;</td>
<td>34&quot;</td>
<td>34&quot;</td>
</tr>
<tr>
<td>403</td>
<td>5</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
</tr>
</tbody>
</table>

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

QUANTITIES FOR ONE INLET

CONCRETE QUANTITIES INCLUDE VOLUME OCCUPIED BY PIPE.
1. Since all pipe entries into the base are variable, the dimensions shown are typical. Actual dimensions and quantities for concrete and reinforcement shall be as required in the plan.

2. The precast flat top may be used on any manhole. The eccentric cone may be used when the manhole "H" height (1'-2" min.)

3. The manhole ring frame shall be set in a bed of grout. Joint seal shall conform between steps.

4. Flexi-fill may be used at a depth of 7'-2" to 11'-10".

5. Precast manholes and reinforcement shall conform to ASTM C 478.

6. Cast-in-place manholes shall be class B concrete. Special design is required for 45° or greater.

7. Vertical steel shall be placed at centerline of wall. All bars shall have a 2" minimum clearance.

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

9. All invert bars shall be 3" minimum. Elevation when final grade is pavement surface, recess manhole ring and cover 1/4" min. to invert.

10. Stub-outs shall extend 2 ft. minimum beyond outside wall of manhole box base.

11. Section A-A will be used for channelization details. Typical channelization details will be shown on the plan.

12. Pipe diameters shall be shown with class B concrete or approved grout.

13. Allinvert bars shall be placed at centerline of wall. All bars shall have a 2" minimum clearance.

14. Cast-in-place manholes shall be class B concrete. Special design is required for 45° or greater.

15. The slope of the manhole cover shall watch the roadway profile and cross slope.

16. Manhole rings and covers shall be used for channelization details. Special design details in channelization shall be shown on the plan.

17. Pipe diameters shall be shown with class B concrete or approved grout.

18. All invert bars shall be placed at centerline of wall. All bars shall have a 2" minimum clearance.

Concrete quantities are based on same size pipe entrance to and exit from base and a 2 ft. manhole entrance into top slab of base.

NOTE: Quantities are based on same size pipe entrance to and exit from base and a 2 ft. manhole entrance into top slab of base.

MANHOLES

STANDARD PLAN NO. M-604-20
Standard Sheet No. 1 of 3

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK

Colorado Department of Transportation
2029 West Howard Place
Denver, CO 80224
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch: JBK

Computer File Information Sheet Revisions

Parent File Information: 07/31/19

Designer Initials: JBK

Colorado Department of Transportation
2029 West Howard Place
Denver, CO 80224
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch: JBK
FLEXIBLE JOINT SEAL SHALL CONFORM TO AASHTO M198 (TYP.) CLASS B CONCRETE BASE

TOE POCKETS AT 16" O.C. IF TOP OF RISE 2.5" ABOVE INVERT

SECTION B-B

SECTION D-D

SECTION C-C

CAST-IN-PLACE SLAB BASE

SECTION E-E

PRECAST SLAB BASE

INVERT ELEVATION SHOWN IN PROFILE

INVERT ELEVATION SHOWN IN PROFILE

INVERT ELEVATION SHOWN IN PROFILE

INVERT ELEVATION SHOWN IN PROFILE

SECTION A-A

MANHOLE RING AND COVER

LEGEND

CONCRETE

MANHOLE BASES NOTES:

1. MANHOLE BASES SHALL BE GRAY DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.

2. PRECAST MANHOLE BASES SHALL FIT THE CONDITIONS AND LOCATIONS FOR WHICH THEY ARE SUPPLIED AND FIELD MODIFICATIONS WHICH REQUIRE FIELD CUTTING OR MODIFICATION IN ORDER TO FIT THE LOCATIONS SHOWN, SHALL BE ACCEPTED BY THE ENGINEER AT NO COST TO THE DEPARTMENT.

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

PERMITTED SUBGRADE

GRANULAR BEDDING MATERIAL

FLAT TOP SECTIONS DETAIL

MANHOLE RISER DETAIL

TOTAL WEIGHT: APPROXIMATELY 400 LBS.

SHALL BE GRAY DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.

SECTION A-A

MANHOLE RING AND COVER

LEGEND

CONCRETE

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 SUPPLIED AND FIELD MODIFICATIONS WHICH REQUIRE FIELD CUTTING OR MODIFICATION IN ORDER TO FIT THE LOCATIONS SHOWN, SHALL BE ACCEPTED BY THE ENGINEER AT NO COST TO THE DEPARTMENT.

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

PERMITTED SUBGRADE

GRANULAR BEDDING MATERIAL

FLAT TOP SECTIONS DETAIL

MANHOLE RISER DETAIL

TOTAL WEIGHT: APPROXIMATELY 400 LBS.

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

CONCRETE COLLAR OR FULL DEPTH HMA PATCHING

SECTION F-F

ADJUST MANHOLE 20 IN. OR LESS

CIRCULAR RIGID PIPE (LONGITUDINAL SECTION)

MODIFY MANHOLE GREATER THAN 20 IN.

SECTION F-F

CIRCULAR RIGID PIPE (TRANSVERSE SECTION)

T-BASE MANHOLES NOTES

1. THE T-BASE SECTION SHALL BE SHIP-FABRICATED FOR DELIVERY TO THE CONSTRUCTION SITE AS A COMPLETE UNIT.

2. THESE DETAILS SHOW ONLY THE CONCEPTUAL AND STANDARD DIMENSIONAL REQUIREMENTS FOR T-BASE MANHOLES. THE CONTRACTOR SHALL FURNISH IMPRESSED SHOWN DRAWINGS FOR APPROVAL PRIOR TO FABRICATION. THE DETAILS SHOWN APPLY ONLY TO 48 IN. AND GREATER DIAMETER PIPES.

3. EXCEPT FOR CLASS OF PIPE, SPECIFICATIONS FOR THE MANHOLE SHALL BE THE SAME AS THOSE DESIGNED FOR THE ADJOINING PIPE.

4. THE T-BASE SECTION SHALL MAINTAIN ITS INTERNAL SHAPE AND FLOW AREA. GROUTING OR FILLING SHALL BE APPLIED SO AS NOT TO DISTURB THE NORMAL FLOW OR REDUCE THE AREA.

HMA PAVEMENT SHALL BE IN ACCORDANCE WITH SECTIONS 403 OR 412. WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/8 IN. TO 1/4 IN.

RESET ECCENTRIC CONE. WORK WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

CIRCULAR RIGID PIPE (LONGITUDINAL SECTION)

CIRCULAR RIGID PIPE (TRANSVERSE SECTION)

MANHOLE T-BASE

STANDARD PLAN NO. M-604-20

Project Sheet Number: Project Development Branch JBK

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

1. For the 32-inch and 36-inch inside inlet dimensions, the allowable pipe OD is 24 inches or less. For the 72-inch inside inlet dimension, the allowable pipe OD is 36 inches or less. For the 96-inch inside inlet dimension, the allowable pipe OD is 48 inches or less. For the 120-inch inside inlet dimension, the allowable pipe OD is 60 inches or less.

2. Concrete shall be Class III.

3. Inlets may be cast-in-place or precast.

4. Reinforcing bars shall be ”16 unless shown otherwise.

5. All reinforcing bars shall be grade 50 or higher.

6. Concrete shall have a minimum clearance of 2 in.

7. Flow arrows shall be placed at the center of the box.

8. All concrete shall be Class B.

9. Inlets may be cast-in-place or precast.

10. Reinforcing bars shall be #4 unless shown otherwise.

11. All reinforcing bars shall be Grade 60 and epoxy coated. Reinforcing bars shall have a minimum clearance of 2 in.

12. All edge distances not marked "clear" are to the centerline of the bar.

13. Concrete shall be placed around pipes as required.

14. Steps shall be required when the depth "H" is equal to or greater than 4 ft and shall conform to AASHTO M 199.

15. The invert of the box shall be sloped to drain.

16. The contractor shall stamp flow arrows into the top surface of the inlet box to indicate the direction of runoff. The stamped arrows shall be 6 in. long, 1 in. high, and 1/8 in. deep. For inlets in sump conditions, the stamped flow arrows shall indicate the predominant direction of runoff.

17. The invert of the box shall be sloped to drain.

18. Flow arrows shall be placed at the center of the box.

19. Flow arrows shall be placed at the center of the box.

20. The contractor shall stamp flow arrows into the top surface of the inlet box to indicate the direction of runoff. The stamped arrows shall be 6 in. long, 1 in. high, and 1/8 in. deep. For inlets in sump conditions, the stamped flow arrows shall indicate the predominant direction of runoff.

21. The contractor shall stamp flow arrows into the top surface of the inlet box to indicate the direction of runoff. The stamped arrows shall be 6 in. long, 1 in. high, and 1/8 in. deep. For inlets in sump conditions, the stamped flow arrows shall indicate the predominant direction of runoff.

LEGEND

\[\text{Grate to be installed during construction of the box with the vane grate bolted in place to the frame.}\]

\[\text{Flow arrows shall be placed at the center of the box.}\]

\[\text{Flow arrows shall be placed at the center of the box.}\]
LEGEND

- HOOP REBAR 3-403 AROUND PIPE PENETRATIONS
- HOOP REBAR 2-503 AROUND PIPE PENETRATIONS

SECTION A-A

SECTION B-B

PLAN

RECESS FOR GRATE FRAME (GRATE NOT SHOWN FOR CLARITY)

VANE GRATE INLET

M-604-25

INLET Standard Sheet No. 2 of 5

Computer File Information

Creation Date: 07/31/19
Designer Initials: JBK

Last Modification Date: 07/31/19
Revisor: CR-X 

CAD Ver.: MicroStation V9.5 Scale: Not to Scale Units: English
Issued by the Project Development Branch: July 31, 2019

Issued by the Project Development Branch: July 31, 2019
QUANTITIES FOR ONE 36 IN. INLET

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NOTES
1. CONCRETE QUANTITY INCLUDES VOLUME OCCUPIED BY PIPES.
2. REINFORCING STEEL QUANTITY ASSUMES TWO 503 HOOPS FOR EACH 24 IN. PIPE.
3. BARS NUMBERED IN 400 SERIES INDICATES #4 SIZE BAR.
4. ALL REINFORCING BARS SHALL BE GRADE 40 AND EPOXY COATED.

QUANTITIES FOR ONE 72 IN. INLET

<table>
<thead>
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<th>STEEL QTY</th>
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<td>9'-6&quot;</td>
<td>6</td>
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<td>462</td>
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</table>


**NOTES**

1. FREE OPEN AREA: 20% IN/GRATE.
3. FINISH: UNPAINTED.
4. VANE GRATE 25% LESS EACH FRAME 20% LESS EACH.
5. ALL REINFORCING BARS SHALL BE EPOXY COATED.
CONCRETE APRON FOR 72 INLET

EXPANSION JOINT (TYP.)

EXPANSION JOINT (TYP.)

SECTION E-E

SECTION F-F

NOTES

1. A 2 FT CONCRETE TRANSITION APRON SHALL BE CONSTRUCTED AS SHOWN AND SHALL BE KEYED INTO THE INLET.

2. CONCRETE APRON SHALL BE THE SAME THICKNESS AND TYPE AS THE SURROUNDING CONCRETE.

3. THE COST OF THE CONCRETE APRON SHALL BE INCLUDED IN THE COST OF THE INLET.

4. IF THE INLET IS OFFSET FROM THE BARRIER, SLOPE THE APRON ADJACENT TO THE BARRIER TO DIRECT FLOW TOWARD THE GRATE.

VANE GRATE INLET

STANDARD PLAN NO. M-604-25

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:

Colorado Department of Transportation
2039 West Howard Place
Denver, CO - 80204

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

Project Development Branch: JBK
GENERAL NOTES

1. The location and size of subsurface drains and outlet pipes will be as shown on the plans or as directed by the engineer.

2. Outlet pipes for the pipe drains are to be spaced at maximum 600 ft. intervals or as shown on the plans. Geocomposite outlet connections shall conform to manufacturer's recommendations.

3. Where the underground pipe outlets into a slope or ditch, the outlet pipe end shall be marked with a delineator post and have an animal guard and an erosion control pad.

4. The geocomposite shall be secured to the wall or to the trench side to prevent movement during backfilling.

5. Drain holes in retaining wall shall be spaced at 10 ft. intervals or as shown on the plans.

6. Geocomposite excavation and backfill limits for retaining walls are shown on standard plan M-206-1. All extra excavation and backfill work necessary to complete retaining wall aggregate and geocomposite drains is included in the drain work.

7. Filter material shall be tamped with a light vibratory tamper prior to overlapping the geotextile fabric.

8. The edge drain trench shall be constructed after placement of the aggregate base and subbase.

Computer File Information

- Creation Date: 07/31/19
- Designer Initials: JBK
- Last Modifcation Date: 07/31/19
- Computer File Information Sheet Revisions
  - Computer File Information Sheet
  - Erosion Control Pad
  - Subsurface Drains
  - General Notes
  - Profile
  - Plan

_Subsurface Drains_ Standard Plan No.

M-605-1

Standard Sheet No. 1 of 1

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number: