<table>
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<tr>
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<tr>
<td>RC-12M (1 of 1)</td>
<td>• Changed skewed joints perpendicular to the centerline.</td>
</tr>
<tr>
<td>RC-20M (General) (1 of 3)</td>
<td>• Changed the maximum height, in the pipe excavation detail, to agree with revised OSHA safety regulations (29 CFR, Sec. 1926.652).</td>
</tr>
<tr>
<td>RC-21M (1 of 1)</td>
<td>• Added details for a two-piece cast iron inlet grate approved for HS25 loading.</td>
</tr>
<tr>
<td>RC-25M (3 of 5)</td>
<td>• Revised Note 5 relative to pipe location on precast inlet boxes.</td>
</tr>
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<td>RC-28M (1 of 1)</td>
<td>• Added Note 13 relative to blockouts.</td>
</tr>
<tr>
<td>RC-30M (3 of 4)</td>
<td>• Revised Note 4 to indicate the maximum height of inlets to be the grade elevation.</td>
</tr>
<tr>
<td>RC-34M (4 of 10)</td>
<td>• Revised Note 2 to be the same as Note 4 on Sheet 8 of 10.</td>
</tr>
<tr>
<td>RC-52M (1 of 6)</td>
<td>• Deleted details for 150 Cold Formed C-Post since it is no longer being used. Also revised Note 2.</td>
</tr>
<tr>
<td>RC-53M (1 of 2)</td>
<td>• Deleted Note 6 to indicate that backing plates are no longer required since we changed to wood or plastic offset brackets.</td>
</tr>
<tr>
<td>RC-54M (1 of 7)</td>
<td>• Deleted detail for steel bracket to steel post bolt and nut.</td>
</tr>
<tr>
<td>RC-61M (1 of 1)</td>
<td>• Revised the Type 2 Strong Post End Treatment detail to show a 1220 mm offset and deleted the detail for 150 C-Post.</td>
</tr>
<tr>
<td>RC-64M (4 of 7)</td>
<td>• Added notes to indicate that steel posts may be used as alternates to wood posts for guide rail across low-fill culverts and made reference to DM-2 for trailing end terminals.</td>
</tr>
<tr>
<td>RC-65M (1 of 6)</td>
<td>• Revised Note 3 to indicate that support bolts remain in place after construction.</td>
</tr>
<tr>
<td>RC-67M (1 of 1)</td>
<td>• Revised Note 1 to indicate that proper terminals should be used with 2-W guide rail with a 30° transition of 2-8 guide rail for high-speed facilities.</td>
</tr>
<tr>
<td>RC-68M (3 of 5)</td>
<td>• Modified the typical details to indicate that 7620 mm (25') of Type 2-WC guide rail is not required on trailing end of an obstruction.</td>
</tr>
<tr>
<td>RC-69M (4 of 5)</td>
<td>• Added a post end anchorage detail to develop the strength of the guide rail at the trailing end as an alternate to the Type 2-8 end treatment.</td>
</tr>
<tr>
<td>RC-70M (5 of 5)</td>
<td>• Revised Note 4 to indicate the use of 280C or double nested guide rail when the required deflection is not available.</td>
</tr>
<tr>
<td>RC-71M (1 of 1)</td>
<td>• Modified the grading details for the flared and parallel terminals to indicate 1:15 max. (1:10 min.) transition upstream of the terminal. Also made reference to the end anchorage detail.</td>
</tr>
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<thead>
<tr>
<th>Sheet #</th>
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<tr>
<td>RC-25M (3 of 5)</td>
<td>• Same changes as in Sheet 4.</td>
</tr>
</tbody>
</table>
- Modified the length of need detail to indicate that the length of need is at the nose of the terminal.

- These three sheets were developed and added to RC-54 to provide installation guidelines for the Backslope Anchor Terminal.

- When the guide rail length of need falls near a cut to fill slope, the preferred treatment is to anchor the guide rail to the cut slope.

- The Backslope Anchor Terminal has been crash tested to NCHRP 350 criteria for a 6:1 slope (rehab.) and a 10:1 slope (new construction). It can be anchored with a concrete block or a post anchor.

- Revised Note 3 to indicate that the barrier should be buried into the existing slope one foot deep and in a straight flare.

- Revised trailing end detail to show the 7620 mm (25') of 2-WC guide rail is not required.

- Changed the 1:8 approach slope to 1:20 and the rounding to 1.5m for the earth mound details.
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BACKFILL OR ENDO DIAPHRAGM

BACKFILL & EMBANKMENT CONSTRUCTION AT STRUCTURES

TYPICAL CROSS SECTIONS - ABUTMENTS ON FILL

TYPICAL CROSS SECTIONS - ABUTMENTS IN CUT

NOTES

1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUB 408M. PLACE BACKFILL AND EMBANKMENT IN ACCORDANCE WITH THIS STANDARD DRAWING UNLESS OTHERWISE SHOWN ON THE STRUCTURE DRAWINGS.

2. USE ONLY R-3 ROCK LINING, MEETING THE REQUIREMENTS OF PUB 408M, SECTION 850.2. TABLE B-1. USE ONE OF THE FOLLOWING MATERIALS, MEETING THE REQUIREMENTS OF PUB 408M, TABLE B-1. USE COARSE AGGREGATE, 12A, TYPE C.

3. PAY LIMITS OF STRUCTURE BACKFILL AND ADJACENT EMBANKMENT MATERIAL TO BE THE SAME AS FOR CULVERTS THE SAME AS FLARED ABUTMENT WINGWALLS.

4. TREAT BACKFILL CONSTRUCTION AT RC BOX CULVERTS WITH THE TOP SLAB AT ROADWAY GRADE THE SAME AS ABUTMENTS.

5. TREAT BACKFILL CONSTRUCTION AT RC BOX CULVERTS WHERE THE TOP OF THE CULVERT IS NEAR SUBGRADE, AS SHOWN ON THE STRUCTURE DRAWINGS OR AS DIRECTED BY THE ENGINEER.

6. PLACE STRUCTURE BACKFILL AND ADJACENT EMBANKMENT SIMULTANEOUSLY UNLESS OTHERWISE PERMITTED BY THE ENGINEER.

7. REPLACE MATERIAL REMOVED BEYOND THE SPECIFIED LIMITS OF CLASS 1, 2 OR 3 EXCAVATION WITH STRUCTURE BACKFILL, COARSE AGGREGATE, MEETING THE REQUIREMENTS OF PUB 408M, TABLE B-1. USE COARSE AGGREGATE, 12A, TYPE C.

8. REFER TO STRUCTURE DRAWINGS FOR DRAINAGE DETAILS, WEEP HOLES, ETC.

9. INDICATE STRUCTURE BACKFILL QUANTITIES ON THE STRUCTURE DRAWINGS.

10. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES) EXCEPT AS NOTED.
1. Place an approved tube over the lubricated end of all dowel bars used in type E joints and provide a minimum 25 clearance pocket assured by means of a positive spacing device.

2. Cut expansion joint filler material to conform to the cross section of the pavement and turn it into strips equal to the width of the pavement slab. Make the top surface smooth and have holes punched for the dowel bars snug fit without loss in thickness of the material.

3. Construct all transverse joints perpendicular to the centerline.

4. Use minimum No. 32 x 4.0 x long dowel bars for pavement depths 75 or less and minimum No. 38 x x long dowel bars for pavement depths greater than 75. Alternate dowel bars having equivalent properties to conventional round dowel bars may be used.

5. Place dowel bars parallel to the centerline and surface of the slab.

6. Use only approved neoprene seals, as listed in Bulletin 15. Install neoprene seals to a uniform depth of 4 in. or more than 10 below the level of the pavement surface.

7. Make the top of the joint sealing material no less than 2 nor more than 8 below the surface of the pavement.

8. The initial saw cut for type D and type G joints is not required for construction joints.

9. Saw depths of neoprene seals to a uniform depth of 4 in.

10. Adjust the width of the saw cut to the seal size and pavement surface temperature at the time of sawing, as follows:

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<tr>
<th>JOINT SEAL SPACING SIZE</th>
<th>WIDTH OF SAW CUT</th>
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<tbody>
<tr>
<td>5.0 x 5.0 m</td>
<td>20 ± 5</td>
</tr>
<tr>
<td>6.0 x 6.0 m</td>
<td>25 ± 5</td>
</tr>
<tr>
<td>7.5 x 7.5 m</td>
<td>30 ± 5</td>
</tr>
</tbody>
</table>

11. When silicone joint sealing material, as specified in Bulletin 49, is selected for use in transverse joints, type P or type G dowel bars may be used. Alternate type P and type G dowel bars may be used in transverse shoulder joints, use the same joint sealing material in the longitudinal joints alternatively type L and alternate longitudinal shoulder joints.

12. All dimensions are in millimeters (mm) except as noted.

13. Provide materials and workmanship in accordance with the requirements of publication 490.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

CONCRETE PAVEMENT JOINTS

DRAFTED: AUG-16-1992
REVISION: AUG-16-1992

SH1_1 OF 9

DIRECTOR OF ENGINEERING
DEPARTMENT OF TRANSPORTATION

RC-20M
DOWEL BAR KEEPER CLIP, SEE NOTE 6.

DOWEL BAR KEEPER CLIP

"J" DESIGN "A" DESIGN

UPPER SIDE FRAME WIRE

SUBBASE SIDE SUPPORT WIRE

75

BAR COATED DOWEL

90

EDGE OF PAVEMENT

166

~- 300

300 300 300

CENTER FRAME WIRE DETAIL

EDGE OF PAVEMENT

UPPER SIDE WIRE CENTER FRAME WIRE

166

35 48 300

BAR 2 ± 25

SIDE SUPPORT WIRE

10 REBAR OR SMOOTH 7.94 ROD

300 300

LOWER SIDE WIRE CENTER FRAME WIRE

TYPICAL EDGE FILLER ASSEMBLY

EXPANSION JOINT ASSEMBLY

DOWEL BAR EPOXY COATED SEE NOTE 4, SHT.

FABRICATE AND SHIP NEST ALL DOWEL, SIDE SUPPORT AND CENTER SUPPORT ASSEMBLIES. ASSEMBLE EXPANSION JOINTER FILLER, ANCHOR STAKES AND DOWEL CAPS IN THE FIELD.

1. THIS STANDARD DEPICTS THE DIMENSIONS REQUIRED FOR UNIFORMITY AND COMPATIBILITY. IT DOES NOT INCLUDE ALL THE DETAILS REQUIRED FOR FABRICATION. ONLY ITEMS SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15 SHALL BE PERMITTED.

2. PROVIDE SIDE SUPPORT WIRES COMPLIANT TO THE CURTAIN ASH DESIGNATION AS AND SPECIFICATIONS ARE THE NECESSARY TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVING STAGES TO SECURE UNIT PAVI
WIRE FABRIC REINFORCEMENT

NOTES

1. FOR VARIABLE WIDTH PAVEMENT CUT THE REINFORCEMENT AS REQUIRED.

2. WIRE FABRIC REINFORCEMENT MAY BE PLACED WITH TRANSVERSE WIRES ABOVE OR BELOW LONGITUDINAL WIRES.

3. PROVIDE LONGITUDINAL WIRES FOR WIRE FABRIC REINFORCEMENT OF THE FOLLOWING MINIMUM SIZES:

<table>
<thead>
<tr>
<th>PAYT DEPTH</th>
<th>MIN LONG WIRE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>MW 35 or MD 35</td>
</tr>
<tr>
<td>230</td>
<td>MW 40 or MD 35</td>
</tr>
<tr>
<td>250</td>
<td>MW 45 or MD 45</td>
</tr>
<tr>
<td>280</td>
<td>MW 50 or MD 45</td>
</tr>
<tr>
<td>300 ± 75</td>
<td>MW 55 or MD 50</td>
</tr>
</tbody>
</table>

4. MINIMUM LAP 300

5. WIRE FABRIC REINFORCEMENT MAY BE CONSTRUCTED OF SMOOTH WIRE SIZES DESIGNATED BY MW) OR DEFORMED WIRE SIZES DESIGNATED BY MD. OR A COMBINATION OF BOTH.

5. SEE RC-20M FOR JOINT DETAILS.

6. PROVIDE A MINIMUM DEPTH FOR PLACEMENT OF WIRE FABRIC REINFORCEMENT, MEASURED FROM TOP OF PAVEMENT TO TOP OF FABRIC OF 60 TO A MAXIMUM OF ONE HALF THE PAVEMENT DEPTH MINUS 15.

7. WHEN THE RAMP OR LANE WIDTH EXCEEDS 4.2 m, A TYPE L JOINT IS REQUIRED AT THE MID-POINT.

8. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT AS NOTED.
NOTES
1. CONSTRUCT AGGREGATE BASE AS SPECIFIED IN PUBLICATION 40BM, SECTION 350.3 AND CONSIDER AS PART OF THE SHOULDER.
2. CONSIDER THE PAYMENT FOR THIS AREA OF SUBBASE MATERIAL INCIDENTAL TO THE SHOULDER.
3. MAKE DEPTH OF SHOULDER THE COMBINED DEPTH OF SURFACE AND BASE COURSE.
4. SLOPE SHOULDER AT 6.0% FOR EFFECTIVE SHOULDER WIDTHS ≤ 2.4 m.
   SLOPE SHOULDER AT 4.0% FOR EFFECTIVE SHOULDER WIDTHS > 2.4 m.
5. FOR EFFECTIVE SHOULDER WIDTHS 1.8 m AND LESS, PAVE OUT-TO-OUT OF SHOULDER REGULAR DOUBLE SLURRY SEAL, MINIMUM 20 DEPTH.
6. FOR SHOULDERS THAT SPECIFY MSRS INSTALLATIONS, USE ONLY BITUMINOUS WEARING COURSE, ID-2 OR ID-3, REGULAR OR HEAVY DUTY, 40 DEPTH MINIMUM.
7. WHEN INSTALLING WERS ON A TYPE 1-1 SHOULDER, CONSTRUCT THE PAVEMENT/SHOULDER JOINT AT THE BEGINNING OF THE EFFECTIVE SHOULDER, OR PAVE FULL DEPTH INTO THE EFFECTIVE SHOULDER FAR ENOUGH SO THAT THE WERs ARE NOT CONSTRUCTED OVER THE LONGITUDINAL JOINT.
8. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT AS NOTED.
9. SEE SHEETS 4 AND 5 FOR WERs DETAILS.
NOTES

1. FOR TYPE 4 AND TYPE 6 SHOULDERS PROPERLY PREPARE SURFACE BY EITHER SHAPING AND/OR SCARIFYING AND/OR COMPACTING. SHAPING INCLUDES REMOVAL OF EXISTING SHOULDER MATERIAL AND THE PLACEMENT OF GRADED MATERIAL FROM THE SHAPING OPERATION INTO THE LOW AREAS. WHERE THERE IS INSUFFICIENT GRADED MATERIAL FROM THE SHAPING OPERATION, COMPLETE THE WORK BY EITHER ADDING ADDITIONAL AGGR BASE CRSE MATERIAL MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 350 OR MILLED BITUMINOUS MATERIAL. THE ADDITIONAL MATERIAL IS INCIDENTAL TO THE SHOULDER ITEM.

2. FOR TYPE 7 SHOULDERS PROPERLY PREPARE EXISTING PAVED SHOULDER BY CLEANING AND PATCHING.

3. THE GUIDE RAIL TYPE, HEIGHT AND LOCATION FROM SHOULDER MAY VARY, BUT WHEN THE HEIGHT FROM THE TOP OF RAIL TO PROPOSED SURFACE BECOMES LESS THAN 610, REMOVE AND REPLACEMENT OF THE GUIDE RAIL IN ACCORDANCE WITH CURRENT GUIDE RAIL STANDARDS. WHERE GUIDE RAIL HAS RUBBING RAIL ATTACHED, REMOVE THE RUBBING RAIL WHEN THE HEIGHT OF GUIDE RAIL BECOMES LESS THAN 700.

4. REMOVE UNSUITABLE MATERIAL AS DIRECTED, EXCAVATE, AND BACKFILL WITH MATERIAL MEETING THE REQUIREMENTS OF PUBLICATION 40BM, SECTION 350. MEASURE AND PAY FOR SHOULDER EXCAVATION AND BACKFILL IN ACCORDANCE WITH PUBLICATION 408M, SECTIONS 654 AND 656. (CROSS SECTIONS ARE NOT REQUIRED.)

5. CONSIDER GRADING INCIDENTAL TO THE SHOULDER PAY ITEM. WHERE THERE IS INSUFFICIENT GRADED MATERIAL FROM THE GRADING OPERATION TO COMPLETE THIS OPERATION, USE MATERIAL MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 350 AND PAY FOR AS TONNES OF SELECTED BORROW EXCAVATION. WHERE THERE IS AN EXCESS OF MATERIAL FROM THE SHOULDER EXCAVATION OR GRADING OPERATION, REMOVE THIS MATERIAL AS SOON AS POSSIBLE AND CONSIDER AS INCIDENTAL TO THE SHOULDER PAY ITEM.

6. PROVIDE BITUMINOUS TAPER SHOULDER WEDGE 250 TO 300 UP SLOPE WHEN INDICATED ON THE PLANS AND CONSIDER AS INCIDENTAL TO THE SHOULDER PAY ITEM.

7. "LUMP SUM" ITEMS INCLUDE ALL MATERIALS AND OPERATIONS OF WORK NECESSARY TO COMPLETE THAT ITEM WHETHER TABULATED OR NOT.

8. FOR SHOULDERS THAT SPECIFY WIDE INSTALLATIONS, USE ONLY BITUMINOUS WEARING COURSE, ID-2 OR ID-3, REGULAR OR HEAVY DUTY, 40 DEPTH MINIMUM.

9. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

10. SEE SHEETS 4 AND 5 FOR MORE DETAILS.
CONCRETE SHOULDERS ADJACENT TO PLAIN CONCRETE PAVEMENT FOR COLLECTORS AND LOCAL ROADS

CONCRETE SHOULDERS ADJACENT TO RC PAVEMENT AND PLC PAVEMENT FOR INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS, ARTERIALS AND RAMPS

CONCRETE SHOULDER, TYPE 2

REINFORCEMENT AT OPENINGS

CONCRETE SHOULDER - TYPE 1

CONCRETE SHOULDER - TYPE 2

TYPICAL SECTIONS

NOTES:
1. SPECIFY THE AGGREGATE BASE AS IN PUBLICATION 408M, SECTION 350.3 AND CONSIDER INCIDENTAL TO THE SHOULDER.
2. SEAL ALL SHOULDER JOINTS IN ACCORDANCE WITH PUBLICATION 408M, SECTION 501.3 (a).
3. FOR JOINT DETAILS, SEE RC-20M.
4. A TYPICAL SHOULDER "TRANSVERSE SHOULDER JOINT" PAVEMENT JOINTS.
5. SEE RC-25M, SHEET 1, FOR SHOULDER ROUNDING DETAIL ON HIGH SIDE OF SUPERELEVATION.
6. AT THE CONTRACTOR'S OPTION, TYPE 2 CONCRETE SHOULDERS MAY BE CONSTRUCTED ON A TAPER, WITH A 150 MINIMUM DEPTH, OR AT THE SAME DEPTH AS THE PAVEMENT, AT NO ADDITIONAL EXPENSE TO THE DEPARTMENT.
7. TYPICALLY, DO NOT PLACE TIE BARS OR TIEBOLTS ON EITHER SIDE OF INTERMEDIATE SHOULDER JOINTS ADJACENT TO RC PAVEMENTS.
8. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.
9. WHEN THE SHOULDER IS STRUCTURALLY PART OF A PARAPET RESISTANCE SLAB (i.e. PARAPET/SLAB ON AN MSE WALL) SEE BC-799 SHEET 3 FOR REQUIRED MINIMUM SPACING OF THE TRANSVERSE SHOULDER JOINTS.
10. SEE SHEETS 4 AND 5 FOR WORKS DETAILS.
TYPICAL PLAN VIEW FOR MSRS PATTERN ON BITUMINOUS SHOULDERS

TYPICAL PLAN VIEW FOR MSRS PATTERN ON CONCRETE SHOULDERS

SECTION DETAILS OF MSRS PATTERN

NOTES
1. IF THERE IS NO ACTUAL PAVEMENT SHOULDER JOINT, MEASURE FROM THE PAVEMENT SHOULDER TRAFFIC LINE.
2. DO NOT MILL SHOULDER RUMBLE STRIPS ACROSS A JOINT.
3. CONSTRUCT MSRS IN ACCORDANCE WITH PUBLICATION 408M SECTION 660.
4. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.
1. MILLED SHOULDER RUMBLE STRIPS (MSRS) FOR FREE ACCESS HIGHWAYS ARE CONSIDERED ON A PROJECT-BY-PROJECT BASIS AS INDICATED ON THE CONSTRUCTION PLANS.

2. CONSTRUCT MSRS IN ACCORDANCE WITH PUBLICATION 408M, SECTION 660.

3. DO NOT MILL SHOULDER RUMBLE STRIPS ACROSS A JOINT.

4. 300 ± 13 FOR LEFT (MEDIAN) SHOULDERS, 450 ± 13 FOR RIGHT SHOULDERS. 4.5 + 13 FOR RIGHT SHOULDER MORE THAN 2.4 m WIDE. FOR RIGHT SHOULDERLESS THAN 2.4 m WIDE, SEE CONSTRUCTION PLANS FOR OFFSET DIMENSIONS.

5. IF THERE IS NO ACTUAL PAINTED SHOULDER JOINT, MEASURE FROM THE PAINTED SHOULDER TRAFFIC LINE.

6. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.
OVERLAY TRANSITION WITH PAVING NOTCH ON CONCRETE AND BITUMINOUS PAVEMENTS.

**NOTES**

1. Use higher appropriate criteria if a cross street has a functional classification of collectors and local roads or higher.
2. Use 85th percentile speed, if available. Otherwise, use the posted speed.
3. Place edge flush with existing pavement and seal as specified in publication C584M, Section 401.3(j).
4. All dimensions are in millimeters except as noted.

**TABLE A**

<table>
<thead>
<tr>
<th>FUNCTIONAL CLASSIFICATION</th>
<th>SLOPE MINIMUM</th>
<th>PAVING NOTCH MINIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERSTATE AND OTHER</td>
<td>0.17%</td>
<td>15 m</td>
</tr>
<tr>
<td>LIMITED ACCESS FREEWAYS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTERVIALS &gt; 70 km/h</td>
<td>0.28%</td>
<td>9 m</td>
</tr>
<tr>
<td>SEE NOTE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTERVIALS &lt; 70 km/h</td>
<td>0.43%</td>
<td>3 m</td>
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<tr>
<td>COLLECTORS AND LOCAL ROADS</td>
<td>0.83%</td>
<td>3 m</td>
</tr>
<tr>
<td>CROSS STREETS</td>
<td>0.53%</td>
<td>0.3 m</td>
</tr>
<tr>
<td>DRIVEWAYS</td>
<td>0.53%</td>
<td>NO NOTCH</td>
</tr>
</tbody>
</table>
NOTES

1. PROVIDE MATERIALS AND CONSTRUCT AS SPECIFIED IN PUBLICATION 408M, SECTION 610 FOR PIPE UNDERDRAIN AND PAVEMENT BASE DRAIN.

2. PROVIDE BITUMINOUS PAPER WHEN GEOTEXTILE MATERIAL IS NOT INDICATED.

3. FOR THE SUBSURFACE DRAIN OUTLET PROVIDE MATERIALS MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 614, A MINIMUM OF 600 OF NO. 8 COARSE AGGREGATE IS PAYABLE AS CLASS 4 EXCAVATION. USE SUBSURFACE DRAIN OUTLETS FOR ALL PIPE UNDERDRAIN AND PAVEMENT BASE DRAINS.

4. USE THE WIRE MESH SHIELD IN AREAS NOT SUBJECT TO MOWING OR DAMAGE BY EQUIPMENT OR VEHICLES. REFER TO RC-30M FOR CONSTRUCTION OF ENDWALLS FOR OUTLET PROTECTION.

5. LINEAR BASE DRAINS MAY RUN CONTINUOUSLY THROUGH THE I/P (OUTLET), USE A 45° ELBOW ON THE THIRD OUTLET OF A SERIES. BEGIN A DRAIN FOLLOWING THE THIRD OUTLET WITH AN END CAP.

6. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.
1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUBLICATION NO. 408M, SECTION 610 FOR PAVEMENT BASE DRAIN, SECTION 612 FOR SUBGRADE DRAIN, AND SECTION 604 FOR COMBINATION STORM SEWER AND UNDERDRAIN.

2. PROVIDE BITUMINOUS PAPER WHEN GEOTEXTILE MATERIAL IS NOT INDICATED.

3. PREFabricated PAVEMENT BASE DRAIN IS NOT RECOMMENDED UNDER CURVED SECTIONS AND ADJACENT TO WIDENED PAVEMENT.

4. ALL DIMENSIONS ARE IN MILLIMETERS (IN) EXCEPT AS NOTED.
COMPACTED 2A MATERIAL, SEE SHEET 4.

BACKFILL DETAIL AT ENDWALL
(FOR CONCRETE PIPE)

BACKFILL DETAIL AT END SECTION
(FOR CONCRETE PIPE)

BACKFILL DETAIL AT LAST SECTION OF PIPE
(FOR CONCRETE PIPE)

EXCAVATION FOR ENDWALLS

EXCAVATION FOR ENDWALLS

PAY LIMITS FOR PIPE EXCAVATION

VARIABLE DEPTH CONCRETE PIPE UNDERDRAIN AND PAVEMENT BASE DRAIN

EXTRA DEPTH FOR PIPE UNDERDRAIN AND PAVEMENT BASE DRAIN

DETAIL A - PIPE INLET OR OUTLET PROTECTION

BOTTOM OF TAMPERED SOIL (PIPE UNDERDRAIN OR SECTION OF SUBBASE (PAVEMENT BASE DRAIN)

PLACE IN LAYERS, THICKNESS MAXIMUM 100-300

EXTRA DEPTH FOR PIPE UNDERDRAIN AND PAVEMENT BASE DRAIN

100 MIN
50 MIN

GROUND LEVEL

1050 MIN
50 MIN

1. PROVIDE MATERIALS AND CONSTRUCT AS SPECIFIED IN PUBLICATION 408M, SECTION 601 FOR PIPE CULVERTS, SECTION 602 FOR CORRUGATED METAL PIPE-ARCH CULVERTS AND SECTION 603 FOR METAL PLATE CULVERTS.

2. SHORING OR TRENCH BOX INSTALLATION FOR SOIL PIPE IS NOT RECOMMENDED. IF SHORING OR TRENCH BOX INSTALLATION IS RECOMMENDED, REFER TO PUBLICATION 408M, SECTION 601.

3. IN ALL EXCAVATION AREAS FOLLOW OSHA SAFETY REQUIREMENTS.

4. DO NOT COMPACT NO. 8 MATERIAL USED FOR BEDDING UNDER CONCRETE PIPES.

5. ALLOW NO PAYMENT FOR EXCAVATION IN EXCESS OF MATERIAL SPECIFIED.

6. PAYMENT FOR THE BACKFILL ENVELOPE, INCLUDING MATERIALS AND METHOD OF EXECUTION, EXCEPT FOR MATERIALS SPECIFIED OR REQUIRED, UP TO 500 ABOVE THE Pipe IS INCENTIVE TO THE Pipe.

7. FOR BOTTOM FRENCH MASTERS 22.5 M, ALL EXCAVATION IS CLASS 1.

8. FOR INLET OR OUTLET PROTECTION SEE DETAIL A.

9. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT AS NOTED.

LEGAL

CLASS 4 EXCAVATION

CLASS 1 EXCAVATION

AGGREGATE FOR BEDDING (AASHTO NO. 8)

COARSE AGGREGATE (C2A)

DO = OUTSIDE DIAMETER OF Pipe, MILLIMETERS.

EXCAVATION - BEDDING - BACKFILL
PIECE INSTALLATION PROCEDURES

CONSTRUCTION DETAILS BELOW COVER THE FOLLOWING CONDITIONS:

(A) PIPE IS LAYING ON TOP OF THE NATURAL GROUND, ROCK OR COMPACTED FILL.
(B) THE EXISTING GROUND IS BETWEEN THE TOP AND THE BOTTOM OF THE PIPE AND THE PIPE IS TO BE COVERED WITH EARTH FILL.
(C) THE TOP OF PIPE IS ABOVE THE LEVEL OF THE NATURAL GROUND, ROCK OR COMPACTED FILL, IT IS NOT MINIMUM ID INSIDE DIAMETER AND THE PIPE IS TO BE COVERED WITH EARTH FILL.

STEP 1 REMOVE TOPSOIL (COMPRESSIBLE LAYER, FOR EXAMPLE, ORGANIC MATERIAL) TO A WIDTH EQUAL TO 5 OUTSIDE DIAMETERS OF THE PIPE, IN ALL CONDITIONS ABOVE (A) (NOTE 1). ALSO REMOVE TOPSOIL ABOVE THE LEVEL OF THE NATURAL GROUND, ROCK OR HARD SHALE, OR IN AREAS OF UNDERCUT, PROVIDE 150+40 MIN. UNDERCUT FOR METAL PIPE AND METAL PLATE PIPE, SEE STEP 6D, FOR THERMOPLASTIC PIPE, SEE STEP 6C.

STEP 2 CONSTRUCT THE EMBANKMENT TO 1200 ABOVE THE PIPE OR TO THE SUBGRADE ELEVATION, THE DEPTH BELOW THE BEDDING AS SHOWN BY DESIGN (MAKE MIN. UNDERCUT FOR METAL PIPE AND METAL PLATE PIPE, SEE STEP 6D, FOR THERMOPLASTIC PIPE, SEE STEP 6C).

STEP 3 EXCAVATE THE TRENCH TO THE WIDTH OF THE OUTSIDE DIAMETERS OF THE PIPE PLUS 1200 AND CREATE AN APPROPRIATE BEDDING (SEE NOTE 2).

STEP 4 FOR CONCRETE PIPE, IF THIS EXCAVATION IS THROUGH ROCK, OR HARD SHALE, OR IN AREAS OF UNDERCUT, PROVIDE 150+40 MIN. UNDERCUT BELOW THE INTENDED BOTTOM ELEVATION OF THE PIPE, 150 MIN.

STEP 5 LAY PIPE ON APPROPRIATE BEDDING, SEE STEP 6 FOR METAL PIPE AND METAL PLATE PIPE ARCH, FOR SPECIAL APPLICATIONS, LOCATE BEDDING 200+20 MIN. ABOVE THE TOP OF PIPE.

NOTE: IF UNCOMPACTED MATERIAL IS FOUND UNDERNEATH AS DIRECTED BY NOTE 4, ADDITION TO THE BOTTOM OF BEDDING ELEVATION, TIMES THREE TIMES DIRECTLY.

STEP 6 A CONCRETE PIPE

PLACE 2A COARSE AGGREGATE MATERIAL (IN LIFTS 100 THICK) OVER TOP OF PIPE AND COMPACT TO 97% SPO STANDARD PROCTOR DENSITY (SEE NOTE 7).

PLACE UNCOMPACTED SUITABLE MATERIAL OVER PIPE, (DO NOT COMPACT.) BACKFILL SIDES AND COMPACT. CONTINUE EMBANKMENT.

NOTE: PAYMENT FOR THE BACKFILL ENVELOPE INCLUDING BEDDING, COARSE AGGREGATE, AND SUITABLE MATERIAL, UP TO THE DEPTH OF THE PIPE IN ALL FILL CONDITIONS ABOVE (A) (NOTE 3).

NOTE: NOTE A AS PER NOTE 3.

CONCRETE PIPE

PLACE 2A COARSE AGGREGATE MATERIAL (IN LIFTS 100 THICK) OVER TOP OF PIPE AND COMPACT TO 97% SPO STANDARD PROCTOR DENSITY (SEE NOTE 7).

PLACE UNCOMPACTED SUITABLE MATERIAL OVER PIPE, (DO NOT COMPACT.) BACKFILL SIDES AND COMPACT. CONTINUE EMBANKMENT.

METAL PIPE AND METAL PLATE PIPE ARCH

PLACE 2A COARSE AGGREGATE MATERIAL (IN LIFTS 100 THICK) OVER TOP OF PIPE AND COMPACT TO 97% SPO STANDARD PROCTOR DENSITY (SEE NOTE 7).

PLACE UNCOMPACTED SUITABLE MATERIAL OVER PIPE, (DO NOT COMPACT.) BACKFILL SIDES AND COMPACT. CONTINUE EMBANKMENT.

THERMOPLASTIC PIPE

PLACE 2A COARSE AGGREGATE MATERIAL (IN LIFTS 100 THICK) OVER TOP OF PIPE AND COMPACT TO 97% SPO STANDARD PROCTOR DENSITY (SEE NOTE 7).

PLACE 2A SUITABLE MATERIAL OVER PIPE, COMPACT TO 97% SPO STANDARD PROCTOR DENSITY (SEE NOTE 7).

PLACE UNCOMPACTED SUITABLE MATERIAL OVER PIPE, (DO NOT COMPACT.) BACKFILL SIDES AND COMPACT. CONTINUE EMBANKMENT.

NOTE: IF UNCOMPACTED MATERIAL IS FOUND UNDERNEATH AS DIRECTED BY NOTE 4, ADD TO THE BOTTOM OF BEDDING ELEVATION, TIMES THREE TIMES DIRECTLY.

NOTE: PAYMENT FOR THE BACKFILL ENVELOPE INCLUDING BEDDING, COARSE AGGREGATE, AND SUITABLE MATERIAL, UP TO THE DEPTH OF THE PIPE IN ALL FILL CONDITIONS ABOVE (A) (NOTE 3).

NOTE: NOTE A AS PER NOTE 3.

CONSTRUCTION DETAILS BELOW COVER THE FOLLOWING CONDITIONS:

(A) PIPE IS LAYING ON TOP OF THE NATURAL GROUND, ROCK OR COMPACTED FILL.
(B) THE EXISTING GROUND IS BETWEEN THE TOP AND THE BOTTOM OF THE PIPE AND THE PIPE IS TO BE COVERED WITH EARTH FILL.
(C) THE TOP OF PIPE IS ABOVE THE LEVEL OF THE NATURAL GROUND, ROCK OR COMPACTED FILL, IT IS NOT MINIMUM ID INSIDE DIAMETER AND THE PIPE IS TO BE COVERED WITH EARTH FILL.

NOTE: IF UNCOMPACTED MATERIAL IS FOUND UNDERNEATH AS DIRECTED BY NOTE 4, ADDITION TO THE BOTTOM OF BEDDING ELEVATION, TIMES THREE TIMES DIRECTLY.

NOTE: PAYMENT FOR THE BACKFILL ENVELOPE INCLUDING BEDDING, COARSE AGGREGATE, AND SUITABLE MATERIAL, UP TO THE DEPTH OF THE PIPE IN ALL FILL CONDITIONS ABOVE (A) (NOTE 3).

NOTE: NOTE A AS PER NOTE 3.

CONSTRUCTION DETAILS BELOW COVER THE FOLLOWING CONDITIONS:

(A) PIPE IS LAYING ON TOP OF THE NATURAL GROUND, ROCK OR COMPACTED FILL.
(B) THE EXISTING GROUND IS BETWEEN THE TOP AND THE BOTTOM OF THE PIPE AND THE PIPE IS TO BE COVERED WITH EARTH FILL.
(C) THE TOP OF PIPE IS ABOVE THE LEVEL OF THE NATURAL GROUND, ROCK OR COMPACTED FILL, IT IS NOT MINIMUM ID INSIDE DIAMETER AND THE PIPE IS TO BE COVERED WITH EARTH FILL.

NOTE: IF UNCOMPACTED MATERIAL IS FOUND UNDERNEATH AS DIRECTED BY NOTE 4, ADDITION TO THE BOTTOM OF BEDDING ELEVATION, TIMES THREE TIMES DIRECTLY.

NOTE: PAYMENT FOR THE BACKFILL ENVELOPE INCLUDING BEDDING, COARSE AGGREGATE, AND SUITABLE MATERIAL, UP TO THE DEPTH OF THE PIPE IN ALL FILL CONDITIONS ABOVE (A) (NOTE 3).

NOTE: NOTE A AS PER NOTE 3.

CONSTRUCTION DETAILS BELOW COVER THE FOLLOWING CONDITIONS:

(A) PIPE IS LAYING ON TOP OF THE NATURAL GROUND, ROCK OR COMPACTED FILL.
(B) THE EXISTING GROUND IS BETWEEN THE TOP AND THE BOTTOM OF THE PIPE AND THE PIPE IS TO BE COVERED WITH EARTH FILL.
(C) THE TOP OF PIPE IS ABOVE THE LEVEL OF THE NATURAL GROUND, ROCK OR COMPACTED FILL, IT IS NOT MINIMUM ID INSIDE DIAMETER AND THE PIPE IS TO BE COVERED WITH EARTH FILL.

NOTE: IF UNCOMPACTED MATERIAL IS FOUND UNDERNEATH AS DIRECTED BY NOTE 4, ADDITION TO THE BOTTOM OF BEDDING ELEVATION, TIMES THREE TIMES DIRECTLY.

NOTE: PAYMENT FOR THE BACKFILL ENVELOPE INCLUDING BEDDING, COARSE AGGREGATE, AND SUITABLE MATERIAL, UP TO THE DEPTH OF THE PIPE IN ALL FILL CONDITIONS ABOVE (A) (NOTE 3).

NOTE: NOTE A AS PER NOTE 3.

CONSTRUCTION DETAILS BELOW COVER THE FOLLOWING CONDITIONS:

(A) PIPE IS LAYING ON TOP OF THE NATURAL GROUND, ROCK OR COMPACTED FILL.
(B) THE EXISTING GROUND IS BETWEEN THE TOP AND THE BOTTOM OF THE PIPE AND THE PIPE IS TO BE COVERED WITH EARTH FILL.
(C) THE TOP OF PIPE IS ABOVE THE LEVEL OF THE NATURAL GROUND, ROCK OR COMPACTED FILL, IT IS NOT MINIMUM ID INSIDE DIAMETER AND THE PIPE IS TO BE COVERED WITH EARTH FILL.

NOTE: IF UNCOMPACTED MATERIAL IS FOUND UNDERNEATH AS DIRECTED BY NOTE 4, ADDITION TO THE BOTTOM OF BEDDING ELEVATION, TIMES THREE TIMES DIRECTLY.

NOTE: PAYMENT FOR THE BACKFILL ENVELOPE INCLUDING BEDDING, COARSE AGGREGATE, AND SUITABLE MATERIAL, UP TO THE DEPTH OF THE PIPE IN ALL FILL CONDITIONS ABOVE (A) (NOTE 3).

NOTE: NOTE A AS PER NOTE 3.
NOTES

1. CONSTRUCTION REQUIREMENTS:
   A. CONSTRUCT IN ACCORDANCE WITH PUBLICATION 408M, SECTIONS 605, 606, AND 709, AS MODIFIED HEREIN.
   B. MINIMUM CONCRETE CLASS:
      - CAST-IN-PLACE: CLASS A
      - PRECAST: CLASS AA
   C. PROVIDE STEEL REINFORCEMENT IN ACCORDANCE WITH PUBLICATION 408M, SECTION 709. PROVIDE MINIMUM YIELD STRENGTH OF 400 MPa.
   D. CLEAR COVER FOR STEEL:
      - WALLS: CAST-IN-PLACE 50
      - PRECAST 40
    FOOTING:
      - CAST-IN-PLACE 60 (TOP BARS)
      - PRECAST 50 (TOP BARS)
      - PRECAST 40 (BOTTOM BARS)
    SLAB:
      - CAST-IN-PLACE 50 (TOP & BOTTOM BARS)

2. THIS SHEET DEPICTS THE VARIOUS COMPONENTS REQUIRED FOR COMPLETE INLET ASSEMBLIES. FOR INDIVIDUAL COMPONENTS AND OTHER SPECIAL DETAILS, SEE THE FOLLOWING SHEETS:
   • SHEET 2 OF 10 FOR CONCRETE TOP UNITS.
   • SHEET 3, 4, 5 OF 10 FOR GRATES AND GRADE ADJUSTMENT RINGS.
   • SHEET 6 OF 10 FOR FRAMES.
   • SHEET 7 OF 10 FOR STANDARD INLET BOXES (CAST-IN-PLACE).
   • SHEET 8 OF 10 FOR STANDARD INLET BOXES (PRECAST).
   • SHEET 9 OF 10 FOR MODIFIED INLET BOXES (CAST-IN-PLACE AND PRECAST).
   • SHEET 10 OF 10 FOR TYPE D-H INLET.

3. EACH TYPE OF INLET SHOWN IS SUITABLE FOR A PARTICULAR SITUATION AS FOLLOWS:
   • TYPE C INLET IS DESIGNATED FOR INSTALLATION WITH NON-MOUNTABLE CURBS.
   • TYPE M INLET IS DESIGNATED FOR INSTALLATION IN MEDIAN AREAS AND MOUNTABLE CURBS.
   • TYPE S INLET IS DESIGNATED FOR INSTALLATION IN SHOULDER SWALE AREAS.

4. THE SELECTION OF COMPONENTS TO ACHIEVE A SPECIFIED INLET ASSEMBLY IS THE CONTRACTOR'S RESPONSIBILITY.

5. USE PRECAST CONCRETE OR STEEL GRADE ADJUSTMENT RINGS WHEN REQUIRED. (REHABILITATION PROJECTS)

6. FOR WALL REINFORCEMENT, BOTH DIRECTIONS, USE 250 mm @ 200 mm EACH WAY, EACH FACE.

7. FOR FOOTING REINFORCEMENT, TOP AND BOTTOM, USE NO. 13 BARS, 150 mm CENTER EACH WAY OR 400 mm 1/4 BANK SPACING.

8. ALL DIMENSIONS ARE IN MILLIMETERS. 1/8" EXCEPT AS NOTED.

9. PROVIDE WEEP HOLES ON INLET BOXES WHERE NECESSARY.
1. THIS SHEET DEPICTS THE SHAPE AND DIMENSIONS NEEDED FOR UNIFORMITY AND COMPATIBILITY. IT DOES NOT INCLUDE DETAILS REQUIRING FOR MANUFACTURING AND HANDLING PRECAST TOP UNITS. PERMIT ONLY TOP UNITS SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15. FOR A BULLETIN 15 LISTING, SUBMIT AN 8½ X 11 REPRODUCIBLE SHOP DRAWING TO THE BUREAU OF CONSTRUCTION AND MATERIALS, MATERIALS AND TESTING DIVISION FOR REVIEW AND APPROVAL.

2. CAST-IN-PLACE TOP UNITS MAY BE MONOLITHIC WITH THE INLET BOX.

3. PROVIDE ANGLES EMBEDDED IN THE CONCRETE AS A BEARING AREA FOR THE GRATE FOR ALL TOP UNITS WHICH SEAT THE GRATE DIRECTLY WITHIN THE UNIT.

4. PLACE A TYPE M INLET ADJACENT TO THE BACK EDGE OF THE CURB, FLUSH WITH THE PAVEMENT SURFACE, WHEN REQUIRED WITHIN A CONCRETE MOUNTABLE CURB SECTION.

5. DOWEL TYPE C TOP UNITS WITH 2-NO. 25 X 300 DOWEL BARS AND PLACE PREMOULDED EXPANSION JOINT FILLER 2 INCHES WHEN CONNECTING TO ADJACENT CURB SECTIONS.


7. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

INLETS
CONCRETE TOP UNITS
1. THIS SHEET DEPICTS THE DIMENSIONS REQUIRED FOR UNIFORMITY AND INTERCHANGEABILITY. IT DOES NOT INCLUDE DETAILS REQUIRED FOR FABRICATION OR MANUFACTURING. PERMIT ONLY GRATES SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15. FOR A BULLETIN 15 LISTING, SUBMIT AN 841 x 594 REPRODUCIBLE SHOP DRAWING TO THE BUREAU OF CONSTRUCTION AND MATERIALS AND TESTING DIVISION FOR REVIEW AND APPROVAL.

2. WELD STRUCTURAL STEEL GRATES IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION 408M, SECTION 1105.03.

3. PROVIDE TRANSVERSE BARS MEETING THE REQUIREMENTS OF PUBLICATION 408M.

4. PROVIDE BICYCLE-SAFE STRUCTURAL STEEL OR CAST IRON VANE GRATES FOR INSTALLATION WHERE BICYCLE TRAFFIC IS ANTICIPATED, SUCH AS CURBED ROADWAYS OR ROADWAYS SPECIFICALLY ESTABLISHED AND SIGNED AS BIKEWAYS OR HAVING BIKE LANES. ALTERNATIVE BICYCLE-SAFE GRATE DESIGNS SHALL REQUIRE A SHOP DRAWING SUBMISSION, AS SPECIFIED IN NOTE 1, AND SHALL CONFORM TO THE DIMENSIONAL REQUIREMENTS FOR PROPER INSTALLATION WITH THE CURRENT CONCRETE TOP UNITS.

5. FABRICATE SLOTS BY BURNING, DRILLING, SHEARING OR PUNCHING. HAVE THE BOTTOM OF ALL BURNED OR DRILLED SLOTS CONFORM TO THE SHAPE OF THE ROD.

6. PROVIDE STRUCTURAL STEEL GRATES WITH THE GRATE SPACERS LOCATED FLUSH ALONG THE TOP SURFACE OF THE GRATE.

7. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.
1. THIS SHEET DEPICTS THE DIMENSIONS REQUIRED FOR UNIFORMITY AND INTERCHANGEABILITY. IT DOES NOT INCLUDE DETAILS REQUIRED FOR FABRICATION OR MANUFACTURING. PERMIT ONLY GRATES SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15. FOR A BULLETIN 15 LISTING, SUBMIT AN 841 x 594 REPRODUCIBLE SHOP DRAWING TO THE BUREAU OF CONSTRUCTION AND MATERIALS, MATERIALS AND TESTING DIVISION FOR REVIEW AND APPROVAL.

2. PROVIDE BICYCLE-SAFE, STRUCTURAL STEEL OR CAST IRON VANE GRATES FOR INSTALLATION WHERE BICYCLE TRAFFIC IS ANTICIPATED, SUCH AS CURBED ROADWAYS IN URBAN AREAS OR ROADWAYS SPECIFICALLY ESTABLISHED AND SIGNED AS BIKEWAYS OR BIKE LANE LINES. ALTERNATE BICYCLE-SAFE GRATE DESIGNS SHALL REQUIRE A SHOP DRAWING SUBMISSION, AS SPECIFIED IN NOTE 1, AND SHALL CONFORM TO THE DIMENSIONAL REQUIREMENTS FOR PROPER INSTALLATION WITH THE CURRENT CONCRETE TOP UNITS.

3. CAST IRON GRATES MAY BE USED AS AN ALTERNATIVE TO STRUCTURAL STEEL GRATES SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15 AND APPROVED FOR HS25 LOADING. CAST IRON GRATES NOT APPROVED FOR HS25 LOADING MAY BE USED OUTSIDE OF THE TRAVEL LANES, AT THE EDGES OF CURB MEDIAN DIVIDERS, SHOULDER MEDIAN DIVIDERS AND MEDIAN AREAS.

4. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
INLET GRATES

CAST IRON GRATES
ASTM A-48, CLASS 358 (SEE NOTE 3)

SECTION C-C

SECTION B-B

SECTION A-A

SECTION D-D

SECTION E-E

SECTION F-F
1. PROVIDE MATERIALS AND CONSTRUCTION IN ACCORDANCE WITH THE REQUIREMENTS OF PUB. 408M, SECTIONS 605, 606 AND 714. PERMIT ONLY GRATES AND GRADE ADJUSTMENT SYSTEMS SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15. FOR A BULLETIN 15 LISTING, SUBMIT AN 8 1/2 X 11 REPRODUCIBLE SHOP DRAWING TO THE MATERIALS AND TESTING DIVISION, BUREAU OF CONSTRUCTION AND MATERIALS FOR REVIEW AND APPROVAL.

2. INSTALL VANE GRATES WITH CURVE VANES FACING THE DIRECTION OF FLOW.

3. GRADE ADJUSTMENT RINGS:
   A. CUSTOM FABRICATE EACH ADJUSTMENT RING FROM MEASUREMENTS PROVIDED WITH EACH ORDER.
   C. REQUIRE FULL CIRCUMFERENTIAL WELDS ON BOTH TOP AND BOTTOM RINGS. MAKE THE INNER WELD A BEVEL GROOVE WELD FOR PROPER SEATING OF GRATE AND MAKE THE OUTER WELD A FILLET WELD.
   D. PROVIDE AN ADJUSTMENT RING WHICH IS FLUSH WITH COVER AND DOES NOT ALLOW EXCESSIVE MOVEMENT.
   E. PROVIDE AN ADJUSTMENT RING WHICH CONFORMS TO THE SHAPE OF THE ORGINAL FRAME.

4. PROVIDE RADIUS OF 3 TYPICAL FOR ALL FILLETS AND ROUNDS, UNLESS NOTED.

5. ATTACH STEEL GRADE ADJUSTMENT RINGS RIGIDLY TO THE FRAME AND SET PRECAST CONCRETE GRADE ADJUSTMENT RINGS ON A MORTAR BED.

6. CAST IRON GRATES MAY BE USED AS ALTERNATES TO STRUCTURAL STEEL GRATES PROVIDED THEY ARE SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15 AND APPROVED FOR HS25 LOADING.

7. PROVIDE RADUS OF 3 TYPICAL FOR ALL FILLETS AND ROUNDS, UNLESS NOTED.

8. ATTACH STEEL GRADE ADJUSTMENT RINGS RIGIDLY TO THE FRAME AND SET PRECAST CONCRETE GRADE ADJUSTMENT RINGS ON A MORTAR BED.

9. CAST IRON GRATES MAY BE USED AS ALTERNATES TO STRUCTURAL STEEL GRATES PROVIDED THEY ARE SUPPLIED BY A MANUFACTURER LISTED IN BULLETIN 15 AND APPROVED FOR HS25 LOADING.

10. PROVIDE RADIUS OF 3 TYPICAL FOR ALL FILLETS AND ROUNDS, UNLESS NOTED.
1. THIS SHEET DEPICTS THE DIMENSIONS REQUIRED FOR UNIFORMITY AND INTERCHANGEABILITY.

2. PROVIDE EITHER GRAY, MALLEABLE OR DUCTILE IRON CASTINGS OR STRUCTURAL STEEL FRAMES.

3. WELD STRUCTURAL STEEL FRAMES IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION 4081.1, SECTION 1105.03.

4. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.

NOTES
1. Construct inlet boxes in accordance with the requirements of Publication 406M, Section 605.

2. Provide inlet boxes with 150 x 150 standard opening to accommodate the standard top components.

3. For cast-in-place or precast construction, provide inlet walls 150 thick, unless otherwise indicated.

4. Inlets that exceed the maximum height shown shall require special details and design for the inlet walls and base. Each wall shall be cast monolithically with steps similar to manholes. See RC-39M.

5. Locate pipe or pipes, as indicated, in the inlet box. Provide an additional 150 thick at the top of the inlet box. Provide an additional 150 thick at the top of the inlet base, full width along the inlet face, if designed concrete pipe is used. The pipe breakout may be formed "flush" with the inlet base.

6. Place #13 reinforcement bars, minimum 100 long, spaced at 200 c to c, as shown between the inlet base and top of the pipe. Provide an additional 100 thick to the top of the inlet box, providing an additional 100 thick at the top of the inlet base.

7. For cast-in-place construction, when the base is constructed monolithically, the highlighted concrete may be eliminated if an alternate joint is constructed as shown in details A & B.

8. For pipe diameters larger than 1500 RCP or 1350 CMP, use a modified inlet box. See sheet 9.

9. For inlets other than as shown on the standards, provide reinforcement based on PHL 93 loading and in accordance with Publication 406M.

10. Construction joints and keys may be constructed upwards or downwards. Clean joints and keys thoroughly before placing next concrete segment.

11. All dimensions are in millimeters (mm) except as noted.

12. For subbase, see Note 6 on sheet B.

13. When necessary, the blockout may remove up to 25 mm (1") of each wall at 300 c to c locations for RC pipe connections.
NOTES
1. Construct inlet boxes in accordance with the requirements of Publication 400M, Section 114.
2. Permit only precast inlet boxes supplied by a manufacturer listed in Bulletin 330. Submit an A4 x 3 ½ in. sample of the material and testing data for review and approval. Use glass or cement pipe for precast boxes.
3. Provide standard inlet boxes before forming the inlets.
4. Locate the inlets with a maximum height to be the same elevation as the required height. Provide special details and design for the inlets in place. Construct inlets that exceed 1520 in. in height with a few similar to standards.
5. Provide standard inlet boxes and cover adjustment slabs with a 610 x 1120 opening to accommodate standard top components.
6. Provide inlets with a maximum height to the same elevation. When the required height exceeds 2750, show special details and design for the inlets and base. Construct inlet boxes that exceed 1520 in. in height with a few similar to standards.
7. For pipe diameters larger than 1200 RCP or 1350 CMP, use a modified inlet box.
8. Provide longitudinal reinforcement as required for inlet boxes that are not within the standards. See sheet 5.
9. For inlets other than those shown on the standards, provide reinforcement based on PHL 93 loading and in accordance with Publication 400M.
10. All dimensions are in millimeters.
1. Construct in accordance with the requirements of Publication 408M, Section 605 and Section 714.

2. Provide inlets with a maximum height to be the center elevation of the required height measured to the centerline of the inlet. When the required height exceeds 2700, show special details and dimensions on detail plans and on section views. Inlets of Type II exceeds 2000, show special details and dimensions on section views. Inlets that exceed 2000 should be designed and constructed in accordance with Bulletin 15-94.

3. When a situation cannot be satisfied by the modified inlet boxes shown, provide special details and dimensions.

4. For orientation of the Type C inlet with modified Type I inlet boxes, the typical installation details are shown below. Show any variation on the construction drawings by special details.

5. Provide a minimum height of 508 measured from the top surface of the top unit to the inside top of the pipe when the top unit and either a modified Type I or a modified Type II inlet box are constructed monolithically.

6. Permit only precast modified inlet boxes supplied by a manufacturer listed in Bulletin 15. For a precast modified Type I inlet box, submit a reproducible drawing to the Bureau of Design and Testing Division for review and approval. For a precast modified Type II inlet box, submit a reproducible drawing to the Bureau of Construction and Testing Division for review and approval.

7. All dimensions are in millimeters (mm) except as noted.

[Diagram showing details of modified inlet boxes]

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN
INLETS
MODIFIED INLET BOXES
(CAST-IN-PLACE AND PRECAST)

RECOMMENDED: AUG. 16, 1999
RECOMMENDED: AUG. 16, 1999
SHEET B OF 10

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN
INLETS
MODIFIED INLET BOXES
(CAST-IN-PLACE AND PRECAST)
NOTES
1. CONSTRUCT IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION P605, SECTION 605.
2. THIS SHEET DEPICTS THE DIMENSIONS REQUIRED FOR UNIFORMITY AND INTERCHANGEABILITY. IT DOES NOT INCLUDE DETAILS REQUIRED FOR MANUFACTURING. PRINT CHILD DETAILS REQUIRED FOR MANUFACTURING ON A SEPARATE SHEET TO BE SUBMITTED TO THE BUREAU OF CONSTRUCTION AND MATERIALS, MATERIALS AND TESTING DIVISION FOR REVIEW AND APPROVAL.
3. WELD STRUCTURAL STEEL GRATES IN ACCORDANCE WITH THE REQUIREMENTS OF PUBLICATION 408M, SECTION 1105.03.
4. PROVIDE ANGLES EMBEDDED IN THE CONCRETE AS A BEARING AREA FOR THE GRATES. FOR TYPE D-H INLETS WHICH SEAT THE GRATES DIRECTLY WITHIN THE UNIT.
5. FOR PIPE LOCATION AND MAXIMUM ALLOWABLE SIZES, SEE SHEET B OF 10.
6. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

INLETS
TYPE D-H INLET

RECOMMENDED AUG. 15, 1999
RECOMMENDED SEPT. 15, 1999
DATE OF ISSUE

DIRECTOR, BUREAU OF DESIGN
PRINTED BY

RC-34M
1. Provide materials and construction meeting the requirements of Publication 408M, Section 6.2.
2. Provide steel I-beam (W15Dx13.5) posts with routed wood, plastic or composite offset brackets listed in Bulletin 15.
3. Make no separate payment for installation of guide rail over underground structures. Concrete, reinforcement bars and hardware are incidental to the guide rail pay item.
4. Provide rubbing rail when the height of strong post guide rail is over 7.1 m in transition areas to existing guide rail.
5. Attach W-beam rail elements to each post. Splice rail elements only at posts and lap in the direction of traffic.
6. All dimensions are in millimeters (mm) except as noted.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

TYPE 2 STRONG POST
GUIDE RAIL

STREET NAME: overriding structure

1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 6.2.
2. PROVIDE STEEL I-BEAM (W15Dx13.5) POSTS WITH ROUTED WOOD, PLASTIC OR COMPOSITE OFFSET BRACKETS LISTED IN BULLETIN 15.
3. MAKE NO SEPARATE PAYMENT FOR INSTALLATION OF GUIDE RAIL OVER UNDERGROUND STRUCTURES. CONCRETE, REINFORCEMENT BARS AND HARDWARE ARE INCIDENTAL TO THE GUIDE RAIL PAY ITEM.
4. PROVIDE RUBBING RAIL WHEN THE HEIGHT OF STRONG POST GUIDE RAIL IS OVER 7.1 M IN TRANSITION AREAS TO EXISTING GUIDE RAIL.
5. ATTACH W-BEAM RAIL ELEMENTS TO EACH POST. SPICE RAIL ELEMENTS ONLY AT POSTS AND LAP IN THE DIRECTION OF TRAFFIC.
6. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.
SAME SECTION AS W-BEAM RAIL ELEMENT

DETAIL A

TYPE A PLAIN WASHER

TERMINAL TO BE PLACED ON BACK OF RAIL ELEMENT

TERMINAL TO BE PLACED ON FACE OF RAIL ELEMENT

ALTERNATE TERMINAL SECTIONS

FACE OF WALL

* OR TO BE DETERMINED BY ENGINEER.

324 Holes in FL 

SEE DETAIL A FOR MODIFICATION WITH PLATED SAFETY WALL OR WHERE REQUIRED.

24 HOLES FOR CAP SCREWS AND WASHERS

** PROVIDE SPLICE BOLTS WITH A LOCK NUT OR DOUBLE NUT AND TIGHTEN ONLY TO A POINT THAT ALLOWS GUIDE RAIL TO BE FREE TO MOVE. CENTER SPLICE BOLTS IN THE SLOTTED HOLES. SEE CURRENT BRIDGE CONSTRUCTION STANDARD DRAWING, BC-72M, FOR ATTACHMENT DETAILS.

DETAIL A

24 HOLES FOR 27 HEXAGON HEAD CAP SCREWS AND WASHERS. SEE CURRENT BRIDGE CONSTRUCTION STANDARD DRAWING, BC-72M, FOR ATTACHMENT DETAILS.

TERMINAL SECTION BRIDGE CONNECTION

NOTES

1. USE SPLICE BOLTS TO DEVELOP THE DESIGN STRENGTH OF THE RAIL ELEMENT.
2. PROVIDE TERMINAL SECTION BRIDGE CONNECTION, WITH WELDED PLATE FOR SAFETY, AS AN INCIDENTAL ITEM.
3. USE SLOTTED ROUND-HEADED BOLTS TO PROVIDE FOR WRENCH OR SCREWDRIVER.
4. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.
POSITIONING OF ROTATING BRACKET

TABLE A

<table>
<thead>
<tr>
<th>HEIGHT OF POST</th>
<th>1430</th>
<th>1370</th>
<th>1300</th>
<th>215</th>
<th>115</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROTATION ANGLES</td>
<td>15°</td>
<td>30°</td>
<td>45°</td>
<td>60°</td>
<td>75°</td>
</tr>
</tbody>
</table>

TYPICAL FOR 15° THROUGH 75° POSITIONS

NOTES

1. PAYMENT FOR TYPE 2 STRONG POST END TREATMENT INCLUDES 1/430 OF SLOPING RAIL, TERMINAL SECTION, HARDWARE, EXCAVATION AND CONCRETE.

2. INSTALL DELINEATION ASSEMBLIES UNDER SEPARATE PAY ITEM OR CONTRACT. FOR ADDITIONAL DETAILS, SEE TRAFFIC STANDARD TC-8709.

3. VERIFY OF NECESSARY DIMENSIONS FOR UNIFORMITY AND INTERCHANGEABILITY SUPPLIED BY A MANUFACTURER AS LISTED IN BULLETIN NO. 10 BRACKETS.

4. MEASURE OFFSETS FROM THE PROJECTED FRONT FACE OF THE GUIDE RAIL TO THE FRONT FACE OF THE POST.

5. TYPE 2 STRONG POST END TREATMENTS MAY BE USED TO TERMINATE STRONG POST GUIDE RAIL ON HIGHWAYS WITH POSTED SPEEDS LESS THAN 60 KMPH AND WITH CURRENT TRAFFIC VOLUMES LESS THAN 6000 VEHICLES PER DAY.

6. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

TYPE 2 STRONG POST END TREATMENTS

SEE NOTE 1.

FOR ALTERNATE TYPE A INSERT ASSEMBLY, SEE BRIDGE CONSTRUCTION STANDARD DRAWINGS.

FOR GUIDE RAIL Delineator, See Note 2.
TYPICAL EARTH MOUND FOR BURYING GUIDE RAIL

SECTION A-A

SECTION B-B

SECTION C-C

NOTES

1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUBLICATION 408M.

2. ALL MATERIAL NECESSARY TO CONSTRUCT EARTH MOUNDS ARE IN ACCORDANCE WITH APPLICABLE SECTIONS OF PUBLICATION 408M.

3. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

TABLE B

<table>
<thead>
<tr>
<th>Design Speed (km/h)</th>
<th>Maximum Flare Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Guide Rail</td>
</tr>
<tr>
<td>120</td>
<td>15 x 1</td>
</tr>
<tr>
<td>110</td>
<td>15 x 1</td>
</tr>
<tr>
<td>100</td>
<td>14 x 1</td>
</tr>
<tr>
<td>90</td>
<td>12 x 1</td>
</tr>
<tr>
<td>80</td>
<td>11 x 1</td>
</tr>
<tr>
<td>70</td>
<td>10 x 1</td>
</tr>
<tr>
<td>60</td>
<td>9 x 1</td>
</tr>
<tr>
<td>50</td>
<td>7 x 1</td>
</tr>
</tbody>
</table>
WOOD OR PLASTIC OFFSET BRACKET
TO BE USED WITH WOOD POSTS

ROUTED WOOD OR PLASTIC OFFSET BRACKET
TO BE USED WITH STEEL POSTS

NOTES
1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUBLICATION 408M.
2. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT AS NOTED.
3. WOOD POSTS ARE TO BE USED FOR END TREATMENTS AND SPECIAL CONDITIONS ON A CASE-BY-CASE BASIS. THEY ARE NOT TO BE USED AS ALTERNATIVES TO STEEL POSTS FOR GUIDE RAIL.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

TYPE 2 STRONG POST
GUIDE RAIL
POSTS AND OFFSET BRACKETS

RECOMMENDED STANDARDS
RECOMMENDED PUBLICATION
SHEET, SCALE: M.S.
commonwealth of pennsylvania
department of transportation
bureau of design
type 2 strong post
guide rail
across culverts

details of nested w-beam guiderail
across low-fill culverts.

details of nested w-beam guiderail
across low-fill culverts.

1. all dimensions are in millimeters (mm) except as noted.
DETAIL D
BASE PLATE

USE BASE PLATE FOR 86 x 57 COLD FORMED CHANNEL POST, ALUMINUM ALLOY POST AND 75 x 8.5 POST.

NOTES

1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 620, 16000

2. THE 86 x 57 COLD FORMED CHANNEL POST, 75 x 8.5 ALUMINUM ALLOY POST, AND 8.5 POST ARE NOT ACCEPTABLE FOR USE IN THIS SYSTEM.

3. DURING ERECTION, USE SUPPORT BOLTS TO SUPPORT BALANCED ELEMENTS. THE SUPPORT BOLTS MUST BE REMOVED AFTER CONSTRUCTION.

4. ATTACH W-BEAM RAIL ELEMENT TO EACH POST. PROVIDE ONLY AT POSTS AND CAP IN THE DIRECTION OF TRAFFIC.

5. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

6. BE CUT IN ELEVATION.

[Diagram of BASE PLATE with dimensions and notes]

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

TYPE 2 WEAK POST GUIDE RAIL

OVER UNDERGROUND STRUCTURES

MAKE NO SEPARATE PAYMENT FOR INSTALLATION OF GUIDE RAIL OVER UNDERGROUND STRUCTURES. CONSIDER CONCRETE, REINFORCEMENT BARS AND HARDWARE INCIDENTAL TO THE GUIDE RAIL PAY ITEM.
1. For High-Speed High-Volume (80 km/h and above), and with current traffic volumes 6000 vehicles per day and above roadways, use crush worthy end treatments on the approach end with a 10.2 m Type 2S guide rail. On 2-lane roadways, use crush worthy end treatment on both, the approach and trailing, ends.

2. See RC-53M, for end treatments buried into earth mounds.

3. All dimensions are in millimeters unless noted.
**TABLE 1**

<table>
<thead>
<tr>
<th>Type of Required Guide Rail Clearances</th>
<th>2-SCC</th>
<th>0.3 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-SCC</td>
<td>0.6 m</td>
<td></td>
</tr>
<tr>
<td>2-SC</td>
<td>0.9 m</td>
<td></td>
</tr>
<tr>
<td>2-SCC Double Nested Guide Rail</td>
<td>1.2 m</td>
<td></td>
</tr>
<tr>
<td>2-V</td>
<td>1.5 m</td>
<td></td>
</tr>
<tr>
<td>2-Y</td>
<td>2.1 m</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

1. The treatments shown are for four lane divided highways. Use the approach end treatment at both sides of the obstruction on two-lane facilities with two-ray traffic.

2. This standard has been prepared as a guide for the placement of guide rail and median barriers. It is impractical to provide a standard for all possible conditions. Modifications of treatments can be made to fit existing conditions. Follow the recommended guidelines in Publication 795, Chapter 10.

3. This distance varies. Determine the required length using the guidelines found in Publication 795, Chapter 12, and show on the tabulation. Where calculations show a distance less than 15 m, use 15 m as a minimum distance.

4. Where the 0.6 m required clearance to obstruction is not available, use 2-SCC guide rail and 2-SCC double nested rail when the deflection is less than 0.3 m.

5. The typical distance from the edge of shoulder to the front face of the W-beam rail element is 840. This may vary. Base the actual placement of the guide rail system selected on field conditions. Locate the system as far from the edge of shoulder as possible and still maintain required clearances determined from Table 1.

6. All dimensions are in millimeters (mm) except as noted.

**Typical Continuous Guide Rail Treatment**

When the required clearance to obstruction is available

**Typical Non-Continuous Guide Rail Treatment**

When the required clearance to obstruction is available

**Treatments When the Required Clearance to Obstruction is Not Available**
TREATMENT AT OBSTRUCTION FOR MEDIAN WIDTHS 6.0 m OR LESS WHERE CONTINUOUS BARRIER IS REQUIRED

TREATMENT AT OBSTRUCTION FOR MEDIAN WIDTHS 6.0 m TO 10.0 m WHERE CONTINUOUS BARRIER IS REQUIRED

TABLE 2
PLANE RATES FOR BARRIER DESIGN

<table>
<thead>
<tr>
<th>DESIGN MAXIMUM FLARE RATES</th>
<th>CONCRETE BARRIER</th>
<th>GUIDE RAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>20 x 1</td>
<td>15 x 1</td>
</tr>
<tr>
<td>110</td>
<td>20 x 1</td>
<td>15 x 1</td>
</tr>
<tr>
<td>100</td>
<td>18 x 1</td>
<td>14 x 1</td>
</tr>
<tr>
<td>90</td>
<td>16 x 1</td>
<td>12 x 1</td>
</tr>
<tr>
<td>80</td>
<td>14 x 1</td>
<td>11 x 1</td>
</tr>
<tr>
<td>70</td>
<td>12 x 1</td>
<td>10 x 1</td>
</tr>
<tr>
<td>60</td>
<td>10 x 1</td>
<td>8 x 1</td>
</tr>
<tr>
<td>50</td>
<td>8 x 1</td>
<td>7 x 1</td>
</tr>
</tbody>
</table>

NOTES
1. THIS STANDARD HAS BEEN PREPARED AS A GUIDE FOR THE PLACEMENT OF GUIDE RAIL AND MEDIAN BARRIER. IT IS IMPRACTICAL TO PROVIDE A STANDARD FOR ALL POSSIBLE CONDITIONS. MODIFICATIONS OF TREATMENTS CAN BE MADE TO FIT EXISTING CONDITIONS HOWEVER, FOLLOW RECOMMENDED GUIDELINES IN DESIGN MANUAL, PART 2.
2. PROVIDE SINGLE FACE CONCRETE BARRIER THROUGH THE AREA OF THE OBSTRUCTION. NO MINIMUM BARRIER-TO-OBSTRUCTION DISTANCE IS REQUIRED. FOR DETAILS, SEE RC-SBM.
3. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.
TRAFFIC DIRECTION
FOR APPROPRIATE TYPE END TREATMENT SEE DESIGN MANUAL PART 2, PUB. 13M.

FOR FLARE RATE, SEE TABLE 2, SHEET 2

EDGE OF PAVEMENT
EDGE OF SHOULDER

1:10 SLOPE
MAX.

GRADING DETAIL FOR PARALLEL TERMINALS

TRAVERSABLE SLOPE WHEN POSSIBLE

1:10 OR FLATTER

MEDIAN TREATMENT AT DUAL STRUCTURES

APPROPRIATE TYPE END TREATMENT

TRAFFIC DIRECTION

MEDIAN TREATMENT AT OBSTRUCTIONS FOR MEDIAN WIDTHS GREATER THAN 6.0 m
WHERE CONTINUOUS BARRIER IS NOT REQUIRED

LENGTH OF BARRIER NEED (LON)

NOTES:
1. FOR FURTHER END TREATMENT DETAILS SEE DM-2, CHAPTER 12 FOR GUIDELINES.
2. ALL DIMENSIONS ARE IN MILLIMETERS (MM), UNLESS SHOWN OTHERWISE.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

BARRIER PLACEMENT
AT OBSTRUCTIONS

RECOMMENDED DATE: 7/1/1989

DIRECTOR, BUREAU OF DESIGN
SHEP WATSON

RC-54M
NOTES
1. THIS STANDARD HAS BEEN PREPARED AS A GUIDE FOR THE PLACEMENT
   OF EARTH MOUNDS IN THE MEDIAN. IT IS IMPrACTICAL TO PROVIDE
   A STANDARD FOR ALL POSSIBLE CONDITIONAL WtTATIONS CAN BE MADE TO FIT EXISTING CONDITIONS.
2. FOR FLARE RATES, SEE TABLE 2, SHEET 2.
3. CONSIDER EXPANSION JUNCTION MATERIAL, coarse aggregate, filter
   DRAIN AND WEEP HOLES INCIDENTAL TO SINGLE FACE CONC. BARRIER.
4. ALL MATERIALS NECESSARY TO CONSTRUCT EARTH MOUNDS ARE IN
   ACCORDANCE WITH APPLICABLE SECTIONS OF PUBLICATION 408M.
5. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BARRIER PLACEMENT
AT OBSTRUCTIONS
EARTH MOUNDS

RC-54M
GENERAL NOTES:
1. A 1:4.5 back slope is desirable; however, steeper slopes may be used.
2. Height of guide rail may be tapered down in elevation to maintain 450 maximum height from ground elevation to bottom of the rail element.
3. All dimensions are in millimeters (mm) except as noted.
4. When the guide rail length of need falls near a cut to fill slope, the preferred treatment is to anchor the guide rail to the cut slope.
5. The back-slope anchor terminal has been crash tested to NCHRP 350 criteria for a 6:1 slope (prehobt) and a 10:1 slope (new construction). It can be anchored with a concrete block or a post anchor.

SECTION A-A

PLAN VIEW

HEIGHT OF GUIDE RAIL IS PARALLEL TO ROADWAY GRADE

ELEVATION VIEW (PROFILE ALONG RAIL)

ALTERNATE END ANCHORAGE

SHOULDER VARIABLE

SECTION B-B

SECTION C-C

**Rock anchorages do not require the 300 ft² burial.**

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

GUIDE RAIL
BACKSLOPE
ANCHOR TERMINAL
(NEW CONSTRUCTION OR RECONSTRUCTION)

SHEET OF DRAWING

R.C-54M
GENERAL NOTES:

1. A 1:4 BACK SLOPE IS DESIRABLE. HOWEVER, STEEPER SLOPES MAY BE USED.

2. THE TOP OF THE W-BEAM RAIL IS HELD CONSTANT RELATIVE TO ROADWAY PROFILE GRADE. A SECOND W-BEAM RAIL IS REQUIRED WHERE THE DISTANCE BETWEEN THE GROUND AND BOTTOM OF THE RAIL IS EXCEEDING MAXIMUM HEIGHT OF DOUBLE RAIL SYSTEM IS 17" (AND INCREASING). MAXIMUM HEIGHT OF SINGLE RAIL SYSTEM IS 12" (AND INCREASING). MAXIMUM HEIGHT OF SINGLE RAIL SYSTEM IS 17" (AND INCREASING).

3. USE 2449 18' LONG POSTS FOR ALL POST LOCATIONS WITH A RUB RAIL. POSTS FOR THE POST ANCHOR ARE 1830 (6') LONG.

4. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.

5. WHEN THE GUIDE RAIL LENGTH OF NEED FALLS NEAR A CUT TO FILL SLOPE, THE PREFERRED TREATMENT IS TO ANCHOR THE GUIDE RAIL TO THE CUT SLOPE.

6. THE BACKSLOPE ANCHOR TERMINAL HAS BEEN CRASH TESTED TO NCHRP 350 CRITERIA FOR A 6:1 SLOPE (REHAB) AND A 10:1 SLOPE (NEW CONSTRUCTION). IT CAN BE ANCHORED WITH A CONCRETE BLOCK OR A POST ANCHOR.

COMMONWEALTH OF PENNSYLVANIA 
DEPARTMENT OF TRANSPORTATION 
SUMMARY OF DRAWING

GUIDE RAIL 
BACKSLOPE 
ANCHOR TERMINAL 
(REHAB. PROJECTS)

RECOMMENDED: JUL. 20, 1993 
RECOMMENDED: JUL. 10, 1995 
SHEET 6 OF 11 
RC-54M
350 200 150 100

STEEL PLATE - 13 mm

SQUARE WASHER
S 300 THICK - GALVANIZED

WOOD BLOCK

NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN
BACKSLOPE
ANCHOR TERMINAL
END ANCHORAGE DETAILS

POST ANCHOR DETAIL
DIMENSIONS ARE TYPICAL

RUBRAIL ANCHOR ATTACHMENT

WOOD BLOCK

GUIDE RAIL

GUIDE RAIL

STEEL PLATE

STEEL PLATE

GUIDE RAIL

GUIDE RAIL

STEEL PLATE

STEEL PLATE

GUIDE RAIL

GUIDE RAIL

STEEL PLATE

STEEL PLATE

GUIDE RAIL

GUIDE RAIL

STEEL PLATE
NOTES

1. PROVIDE SINGLE FACE CONCRETE BARRIER MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 623.

2. PROVIDE PRECAST SINGLE FACE CONCRETE BARRIER SUPPLIED BY A MANUFACTURER AS LISTED IN BULLETIN 15. FOR A BULLETIN 15 LISTING, SUBMIT AN 841 x 594 REPRODUCIBLE SHOP DRAWING TO THE BUREAU OF CONSTRUCTION AND MATERIALS, MATERIALS AND TESTING DIVISION FOR REVIEW. MODIFICATIONS OR DEVIATIONS FROM THE STANDARD ALSO REQUIRE THE SUBMISSION OF SHOP DRAWINGS FOR REVIEW.

3. PROVIDE BARRIER-MOUNT OR REFLECTOR UNIT DELINEATORS, AS INDICATED ON RC-57M.

4. PROVIDE END TRANSITIONS OR IMPACT ATTENUATING DEVICES AS INDICATED ON RC-57M.

5. PROVIDE ROUND ALL EDGES WITH A RADIUS OF 24 EXCEPT AS SHOWN.

6. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

TYPICAL PRECAST OR CAST-IN-PLACE SINGLE FACE CONCRETE BARRIER
TYPICAL REINFORCEMENT DETAILS FOR 1040 BARRIER

REINFORCEMENT STEEL

EPOXY COATED NO. 13 BAR (TYP)

LIFTING SLOTS, SEE NOTE 1:

L = 9.0 m MAX

SECTION C-C

SECTION D-D

END TRANSITION

WELDED WIRE FABRIC

NO. 13 BAR (TYP)

EPOXY COATED

40 WIN

2.1 m

SECTION A-A

SECTION B-B

END TRANSITION

END TRANSITION

REINFORCEMENT STEEL

EPOXY COATED

LIFTING SLOTS, SEE NOTE 1:

L = 9.0 m MAX

NOTES

1. PROVIDE SLOTS FOR HANDLING, INSTALLING AND REMOVING PRECAST CONCRETE BARRIERS. ALTERNATE METHODS OR DEVICES MAY BE USED AS APPROVED BY THE BUREAU OF DESIGN. GALVANIZE METAL DEVICES AS SPECIFIED IN PUBLICATION 408M, SECTION 1105.02 (S).

2. ROUND ALL EDGES WITH A RADIUS OF 24 EXCEPT AS NOTED.

3. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.

LEGEND

@ PROVIDE REINFORCEMENT MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTION 709 WITH A MINIMUM CONCRETE COVER OF 40. KEEP WIRE FABRIC OR BAR LIMITS AT 140 MINIMUM FOR PRECAST BARRIER WITH PLATE CONNECTIONS.
NOTES

1. PROVIDE SINGLE FACE CONCRETE BARRIER AND GUIDE RAIL MEETING THE REQUIREMENTS OF PUBLICATION 408M, SECTIONS 620 AND 623.

2. THE TREATMENTS SHOWN ARE FOR FOUR-LANE DIVIDED HIGHWAYS. USE A FLARE TREATMENT ON THE OUTSIDE OF THE OBSTRUCTION ON TWO-LANE FACILITIES WITH TWO-WAY TRAFFIC.

3. WHEN THE END OF CONCRETE BARRIER TERMINATES WITHIN THE CLEAR ZONE, BURY IT INTO THE EXISTING SLOPE. OTHERWISE, USE AN IMPACT ATTENUATING DEVICE.

4. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT AS NOTED.

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<thead>
<tr>
<th>TABLE 1</th>
<th>FLARE RATES FOR BARRIER DESIGN</th>
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<tbody>
<tr>
<td>DESIGN</td>
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<td>FLARE RATES</td>
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COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF DESIGN

SINGLE FACE CONCRETE BARRIER
PLACEMENT AT SHOULDER PIERS

FOR FLARE RATES SEE TABLE 1.

TYPICAL NONCONTINUOUS SINGLE-FACE BARRIER TREATMENT AT PIERS

TYPICAL TREATMENT WHEN CONTINUOUS GUIDE RAIL IS REQUIRED

TYPICAL TREATMENT WHEN CONTINUOUS GUIDE RAIL IS REQUIRED

SEE NOTE 3.

TABLE 1 PLAN VIEW

SEE TRAILING END GUIDE RAIL CONNECTION.

CONTINUOUS GUIDE RAIL WITH SINGLE FACE BARRIER AT PIER

IF ADEQUATE DEFLECTION DISTANCE IS PROVIDED (TABLE 1, RC-54M) BETWEEN THE BACK OF THE GUIDE RAIL POST AND FRONT OF OBSTRUCTION, DO NOT USE CONCRETE BARRIER CONTINUE THE GUIDE RAIL.
NOTES

1. REFER TO BRIDGE STANDARD DRAWINGS BD-601M FOR DETAILS OF CONCRETE MEDIAN BARRIER ACROSS STRUCTURES.
2. ALLOW NO ADDITIONAL COMPENSATION FOR TRANSITIONS IN THE CONCRETE MEDIAN BARRIER AT PIERS OR STRUCTURES.
3. CAST ADDITIONAL HOLES IN THE TAMPERED ENDO SECTIONS MEETING THE REQUIREMENTS PRESENTED IN SECTION D-D.
4. PROVIDE NO. 57 COARSE AGGREGATE THAT MEETS THE REQUIREMENTS PUBLICATION 408M, SECTION 703.2. ALTERNATE SUITABLE GRANULAR MATERIAL MAY BE USED AS FILLER MATERIAL.
5. TO PREVENT INTRUSION OF COARSE AGGREGATE INTO WEEP HOLES, USE WIRE MESH SCREENING, GEOTEXTILES OR OTHER SUITABLE MATERIAL.
6. ROUND ALL EDGES WITH A RADIUS OF 24 EXCEPT AS SHOWN.
7. ALL DIMENSIONS ARE IN MILLIMETERS (MM) EXCEPT AS NOTED.
TYPICAL EARTH MOUND FOR BURYING CONCRETE BARRIER

TABLE 2
FLARE RATES
FOR BARRIER DESIGN

<table>
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<tr>
<th>DESIGN</th>
<th>MAXIMUM</th>
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</tbody>
</table>

NOTES
1. PROVIDE MATERIALS AND CONSTRUCTION MEETING THE REQUIREMENTS OF PUBLICATION 408M.
2. ALL MATERIALS NEEDED TO BURY CONCRETE BARRIERS ARE TO BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF PUBLICATION 408M.
3. EARTH MOUNDS MAY BE USED TO BURY CONCRETE BARRIERS ON HIGHWAYS WITH POSTED SPEEDS LESS THAN 60 KMPH AND WITH CURRENT TRAFFIC VOLUME LESS THAN 6000 VEHICLES PER DAY OR WHEN THEY ARE CONSTRUCTED OUTSIDE THE CLEAR ZONE.
4. ALL DIMENSIONS ARE IN MILLIMETERS (mm) EXCEPT AS NOTED.