June, 2020

TO: All holders of Wastewater Standard Details

SUBJECT: Revisions to Wastewater Standard Details

The attached Wastewater Standard Details drawings were revised to reflect current standard construction methods, practices and procedures, and details were cleaned up to remove conflicting information, and for better clarity. Materials were not reviewed, vetted, or revised as a part of these revisions. Future revisions may include structural and material updates.

The most prominent, and only structural update in this set of revisions was to the inlet details. The original details were only to be used for inlets up to 6 feet deep, and were limited in length to a single, double or triple Number 16 inlet, or 6', 9' or 12' for Number 14 inlets. The new inlet details are applicable for inlets up to 12 feet deep, and up 75 feet long.

The attached Standard Details are to be used for all storm and sanitary sewer construction done under the jurisdiction of the City and County of Denver, Department Transportation and Infrastructure. These standards are to be used in conjunction with the technical specifications and the established ordinances of the City and County of Denver and in case of conflict, the technical specifications which are to be used in conjunction with these standards shall govern.

These drawings may be updated from time to time and the user is responsible for obtaining updated or revised standards. The City shall not be held liable for use of outdated standards by the contractor, consultant, developer, or engineer.
CITY AND COUNTY OF DENVER
WASTEWATER STANDARD DETAILS

APPROVED BY:

_______________________
CITY ENGINEER
JUNE 2020
<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>DETAIL NO.</th>
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<td>SINGLE NUMBER 16 INLET</td>
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<td>23</td>
<td>S-750</td>
<td>MANHOLE STEPS</td>
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TABLE 1. Bd, Bf, Bp VALUES

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<tr>
<th>D (ft)</th>
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<th>Bf (kN/m)</th>
<th>Bp (kN/m)</th>
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<td>3.5</td>
<td>8.0</td>
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<td>6' 6&quot;</td>
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<td>13.0</td>
<td>12.0</td>
<td>16.0</td>
</tr>
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TABLE NOTES:
1. DOES NOT APPLY TO PRIVATE DETENTION SYSTEMS.
2. WHEN SHARING IS NOT APPLICABLE, MINIMUM TRENCH WIDTH SHALL BE 12" FROM OUTSIDE OF PIPE OR OTHER SIDE OF TRENCH.

PAY ITEM NOTES:
1. Bd = PAY ITEM FOR PAY ITEM 20-1 ASPHALT SURFACE COURSE PAYMENT–BY LINN THICKNESS (2" NAIL THICKNESS) AS GIVEN AS GIVEN AS TABLE UNLESS OTHERWISE SHOWN ON PLANS.
2. Bd = PAY ITEM FOR PAY ITEM 20-1 ASPHALT BASE COURSE PAYMENT–BY LINN THICKNESS (2" NAIL THICKNESS) AS GIVEN AS TABLE UNLESS OTHERWISE SHOWN ON PLANS.
3. SEE PAY ITEM 20-4 FOR ROTTINGWALL. ROTTINGWALL WILL BE PAID FOR THE 2" EACH SIDE OF IF THE PIPE. BEFORE PLACEMENT OF THE 2" ASPHALT SURFACE COURSE PAY ITEM 20-2. ROTTINGWALL FOR THE PIPE LINING WILL BE CALCULATED IN THE PIECE OF PIPE.
4. PAYMENT WILL NOT BE MADE FOR EXCAVATION OUTSIDE OF THE LIMITS SHOWN ABOVE DUE TO SLEEPING OR INCREASING TRENCH OR OTHER CONSTRUCTIONS MEANS OR METHODS.
5. PAYMENT WILL BE MADE ON THE PLANS, NO PAYMENT WILL BE MADE FOR REMOVAL, REPLACEMENT, OR RELOCATION OF CURB AND GUTTER, UTILITIES, SIGNALS, STRUCTURES, ETC. OUTSIDE THE MAXIMUM LIMITS OF EXCAVATION.
TYPICAL CUTOFF WALL LOCATIONS

CONCRETE CUTOFF WALL

CLAY CUTOFF WALL

TABLE 2. CONCRETE BEDDING REQUIREMENTS

<table>
<thead>
<tr>
<th>NOMINAL DIAMETER (D)</th>
<th>MINIMUM THICKNESS (T)</th>
<th>MIN. WIDTH OF CONCRETE ARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot; &amp; SMALLER</td>
<td>4&quot;</td>
<td>0&quot; + 4&quot;</td>
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<tr>
<td>21&quot; TO 24&quot;</td>
<td>5&quot;</td>
<td>0&quot; + 4&quot;</td>
</tr>
<tr>
<td>27&quot; TO 33&quot;</td>
<td>6&quot;</td>
<td>0&quot; + 4&quot;</td>
</tr>
<tr>
<td>36&quot; TO 42&quot;</td>
<td>7&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>48&quot; &amp; LARGER</td>
<td>1-1/4&quot;</td>
<td>1-1/2&quot;</td>
</tr>
</tbody>
</table>
GRANULAR BEDDING REQUIREMENTS

1. Ideal trench conditions for concrete 15" Ø and smaller, and all flexible conduits.

2. Rock excavation.


Granular Bedding Notes:

1. Types of bedding material:
   - Type 1 (A-300): Rock (crushed or compacted to a specified grading).
   - Type 2 (A-300): Gravel (crushed or compacted to a specified grading).
   - Type 3 (A-300): Sand (crushed or compacted to a specified grading).

2. Table 3. Class 67 Gradation

3. Table 4. Minimum depth of bedding material below bottom of pipe

4. Table 5. Maximum size of bedding material.
**GENERAL NOTES FOR TYPE I, I & II ENCASEMENT:**

4.1 Concrete to be cast against undisturbed soil, or sanding if optional construction joint is used and bottom half of encasement is poured separately, a one inch layer of sand or mortar shall be placed between bottom of sanitary sewer and top of concrete.

4.2 Width of encasement for:

(a) TYPE I & II ENCASMENT SHALL EXTEND FULL TRENCH WIDTH EXCEPT FOR PROPOSED SEWER OR CONDUIT.
(b) TYPE I & II ENCASMENT SHALL EXTEND AT LEAST 10 FEET EACH SIDE OF WATER MAIN.
(c) UNLESS OTHERWISE NOTED ON DRAWINGS, ENCASMENTS FOR TYPE I, I & II ENCASMENTS NEED NOT BE REINFORCED. REINFORCEMENT, IF REQUIRED, TO BE SPECIFIED AND DRAWN SEPARATELY ON PLAN AND PROFILE DRAWINGS.

4.3 Type I & II encasement required under following conditions:

(a) TYPE I OR I & II ENCASMENTS CROSSING OVER WATER MAINS.
(b) TYPE I & II ENCASMENTS CROSSING UNDER WATER MAINS AND D<4" (D<4"").
(c) TYPE I & II ENCASMENTS CROSSING UNDER TOP OF WATER MAINS, REGARDLESS OF DIMENSION "D1".
(d) ENCASMENTS FOR SANITARY SEWERS CROSSING OVER UNDERGROUND SEWERS, REGARDLESS OF DIMENSION "D1".
(e) ENCASMENTS FOR SANITARY SEWERS CROSSING OVER UNDERGROUND SEWERS, REGARDLESS OF DIMENSION "D1".
(f) IF THE SANITARY SEWER IS RESTORED OR CONSTRUCTED OF CAST IRON PIPE (D<4" OR D<4"") OR STEEL IRON PIPE (D>4" OR D>4"") CONCRETE ENCASMENT MAY NOT BE REQUIRED.

4.4 Fillers Material Between Conduits to be:

(a) Approved compatible material such as sintered, etc., if D<4".
(b) Compacted granular sediments if D<4". If D>4" for TYPE III ENCASMENT FOR CONCRETE ON UNDISTURBED SOIL.
(c) OR DETAILED BY UTILITY OWNER.
(d) SANDING OR SANDING, IF USED, TO BE CUTOFF AT TOP OF ENCASMENT.

4.6 All encasements (except) may also be adaptable for conduits other than sewer or sanitary sewer installations.

4.8 In certain situations where the existing conduit diameter is extremely large, fillers supports on each side of sanitary sewer may also be required. If required, supports to be specified and detailed separately on plan and profile drawings. No pipe joints or top of pipe.

4.9 International Plumbing Code approved materials allowed.

**NOTES:**

- Fillers Material (See Note 4.8)
- Concrete Arch (See Note 4.8)
- Full Concrete Encasement (See Note 4.8)
- Sanitary Sewer (See Note 4.8)
- Full Concrete Encasement (See Note 4.8)
- Sanitary Sewer (See Note 4.8)
- Full Concrete Encasement (See Note 4.8)
PIPE JOINT NOTES:

5.1 THE CONTRACTOR SHALL SUBLIMATE ALL TOLERANCES AND DIMENSIONS, REQUIRED BY THE SPECIFIC PIPE JOINT DETAILS SHOWN IN THE ENGINEERED PIPED TO AGREEMENT.
5.2 ALL DIMENSIONS SHOWN IN IN CHARTS, UNLESS OTHERWISE NOTED, AND ARE FOR BELL AND SPIGOT IN CONCRETE POSITION. DEFLECTED PIPE JOINT TOLERANCES A DIMENSIONS SHALL ALSO BE FURNISHED.
5.3 JOINT CLEARANCE DIMENSIONS X ARE AT CLOSEST POINT WITHIN DISTANCE A.
5.4 SPIGOT "O" RING GASKETS SHALL BE IN CONFORMANCE W/ ASTM C-413 OR C-381.
5.5 APPLICABLE CONCRETE PIPE JOINT SPECIFICATIONS:
   A. ASTM C-369
   B. ASTM C-381
5.6 STEEL REINFORCEMENT SHALL BE IN ACCORDANCE WITH THE APPROPRIATE ASTM SPECIFICATION FOR THE PIPE SIZE AND STRUCTURAL CLASS AS SPECIFIED IN PLAN/PROFILE DRAWINGS.
5.7 NO CONNECTION TO GOTO JOINT WITHOUT PRIOR CITY APPROVAL.

SPIGOT GROOVE DETAIL
TYPICAL FOR CONCRETE PIPE JOINT
NO SCALE
INLET CONNECTION NOTES:

6.1 The type of connection shall only be used if the following conditions are met:
   (A) D_0 ≤ 3/4 D  & 4 ≤ 25 ft.
   (B) The point of connection to the sewer line is not more than 75 feet from the nearest manhole on
       the sewer main.
   (C) Inlets are not connected in series.
   (D) Only one inlet connection allowed per joint of sewer main pipe.

6.2 For conditions other than those specified in note 6.1, a manhole on the sewer main will be required.

6.3 The detail applies to storm sewer connections only. Sanitary sewer connections shall be made only with
   approved mechanical coupling equipment and approved coating materials.

INLET CONNECTION INTO STORM SEWER MAIN
(STORM SEWER INSTALLATION ONLY)

NO SCALE

TABLE 5. MINIMUM PIPE COLLAR DIMENSIONS

<table>
<thead>
<tr>
<th>D</th>
<th>L</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>18&quot;</td>
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<td>12&quot;</td>
</tr>
<tr>
<td>21&quot;</td>
<td>18&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

PIPE COLLAR NOTES:

6.4 For storm sewer lines only, not to be used on sanitary or mainline storm sewers.

6.5 A concrete collar is required where the change in grade exceeds 0.20 foot per foot, and where gap limits exceed the pipe manufacturer's recommendations.

6.6 If the gap exceeds 1 inch, a manhole structure is required.

6.7 Reinforcing shall be used where the gap is 2 1/2" or larger. Three circular ties shall be used per the vertical section above.

6.8 Concrete collar shall not be used for a pipe change on the main line.

6.9 For pipe size not listed, the next size larger.

6.10 Where reinforcing is required, the diameter of the circular ties shall be 40% wall thickness.

6.11 An interior form of expanded polystyrene or foam shall be used to provide a smooth interior joint. The paper form may be left in place.

6.12 Pipes 24" and larger to be designed by engineer and approved by city.

STORM LATERAL PIPE COLLAR DETAIL (21" Dia. or Less)
(TO BE USED ONLY WHERE NECESSARY AND AS AUTHORIZED BY THE CITY)

NO SCALE
MANHOLE NOTES:

7.1 Flow top sections may be used in lieu of concentric manholes when specifically approved by the project engineer.

7.2 For manholes deeper than 48 in., or where pipe diameter exceeds 60 in., the flow top sections are required.

7.3 All flow top sections, including the section below the flow top, shall be cast to the latest revision of ASTM C-478, Standard Specification for Precast Concrete Manhole Sections.

7.4 Flow top sections shall be capable of withstanding 40 lb. live loads.

7.5 Manholes deeper than 48 in. shall be fabricated to meet requirements of the engineer or project engineer.

7.6 For diameters greater than 48 in., flow top sections shall be used.

7.7 Design engineers may request the use of flow top sections in lieu of manhole sections.

7.8 Design engineers may require the use of flow top sections in lieu of manhole sections.

7.9 Manhole sections shall be used only with special design considerations.

7.10 Flow top sections shall be used only with special design considerations.

7.11 All flow top sections shall be used only with special design considerations.

TABLE 6. MIN. MH RISER DIAMETER & WALL THICKNESS

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Min. Riser ID</th>
<th>Min. Wall Thickness, T</th>
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<tr>
<td>36 in.</td>
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<tr>
<td>42 in.</td>
<td>5</td>
<td>0.25</td>
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</table>

Note: Min. pipe diameters specified in Table 7.1 for situations where one pipe diameter and one flow top section shall be used. For situations other than those specified, the flow top section shall be increased in size for all structures on pipe.
CAST-IN-PLACE MANHOLE BASE NOTES:

8.1 MANHOLE BASE MINIMUM SLOPE SHALL CONFORM TO TABLE 8, S-501.1.

8.2 GROUTED FLOW CHANNELS AND INSERTS MAY BE FORMED BY SHAPING WITH LEAN CONCRETE (f = 2000 PSI Min.). ALL OTHER CONCRETE SHALL BE MIN. f = 4,000 PSI.

8.3 ALL ROADWELL MANHOLE BASES SHALL BE CRACKED AT 8 IN. MAXIMUM SLOPE.

8.4 STEEL CAST-OUTS SHALL EXTEND 2-1/2 IN. PAST MANHOLE GCO. AND BE FACTORY PEGGED.

8.5 HYDROPRISMING REQUIRED FOR ALL MANHOLE BASES.

8.6 SLIP MANHOLE RINGS 7/8 IN. MAXIMUM TOWARD FLOW CHANNEL.

8.7 FOR SANITARY SEwers, IF 2-1/2" AN OUTSIDE DRIP MANHOLE IS REQUIRED (S-530).

8.8 SHIM LISTS ON MANHOLE BASE RINGS CONFORM TO ORGAN STANDARDS AND SPECIFICATIONS (S-403).

8.9 ALL MANHOLE & SPECIAL STRUCTURES TO BE PLACED ON SUITABLE SURFACE MATERIAL. IF SUBGRADE CONTAINING MMITTED, UNSTABLE FOUNDATION MATERIAL WILL BE OVERLAYS. A SELECT SURFACE MATERIAL WILL BE PLACED AS PER SECTION 5.20 OF THE AWWA STANDARD CONSTRUCTION SPECIFICATIONS.

8.10 GRANULAR FILLING MATERIAL SHALL BE COMPACTED TO 85% MAXIMUM DRY DENSITY IN ACCORDANCE WITH AWWA T-160.

8.11 ALL PIPE OPENINGS SHALL BE CONSTRUCTED WITH AN APPROVED FLEXIBLE RING-TYPE GASKET CONFORMING TO AWWA C-443. WHICH SHALL BE CAPABLE OF WITHSTANDING A WATER HEAD OF 50 FT ZERO LEAKAGE AROUND THE INSTALLED PIPE. CONCRETE TO CONCRETE (OR WITHOUT WATER STOP GASKETS) FOR STORM SEWERS WILL BE AT THE DISCRETION OF THE CITY (S-500).

8.12 ALL PRECAST MANHOLE BASES, DOWELS, GRANULAR FILLING, ETC. SHALL CONFORM TO THE LATEST EDITION OF AWWA C-478, STANDARD SPECIFICATION FOR CIRCULAR PRECAST CONCRETE MANHOLE BASES.

8.13 NO MODIFICATIONS TO A CAST-IN-PLACE MANHOLE BASE WILL BE ACCEPTED ONCE CASTED.
TYPE B MANHOLE NOTES:

1. This standard manhole detail is applicable to circular pipes with 42" ID. and larger, and non-circular pipes with a span of 42" ID. and larger.

2. Pipes entering the manhole may be deflected up to 10° (maximum) each pipe for a total change of direction of 20° (maximum).

3. For 'V' shapes, FL Pipe Drawing by T. J. D. Wall, and T. B. Wall shall be submitted for approval.

4. Get piping detail and B-Bare elevation. No more than 12" below finished grade is shown below to avoid issues with the manhole steps.

5. Product manhole steps and T-Bars shall be certified to ASTM C-51. In addition, manhole steps, rings, and cover shall conform to applicable and standard details.

6. Concrete in top slab and manhole shall be cast as concrete and have a 28 day strength of 3,000 psi. Minimum slump shall be 3 to 5", and an entrainment will be 3% - 5%.

7. Base concrete shall have a 28 day strength of 2,000 psi. (Type B concrete).

8. Repetitive steel bars shall conform to ASTM A-615. Grade 30 and 36 bars. Cover and reinforcement shall be certified as shown on the drawings.

9. All structures shall be designed to top of pipe.

10. All manholes shall be designed to all other reinforcement. If reinforcement exists, manholes shall be designed to accommodate and select reinforcement material shall be placed per Section 3.03 of the AWWA Standard Construction Specifications.

11. Manhole reinforcement material shall be computed to provide minimum 2" embedment in accordance with AWWA T-130.

12. Structures shall be formed both inside and outside. Casting of sidewalks against earth is not permitted.

13. Material support shall be provided and maintained for walls during backfilling operations.

14. All material shall be 24" or shall be covered by a single sheet of pipe by a special structural design is required. See S-601 for "Bearing Details."
TABLE 7A. TYPE P MH - 30° BEND STRUCTURE DIMENSIONS

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<th>DYE SIZE</th>
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<th>B</th>
<th>C</th>
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<td>3''</td>
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<td>46''</td>
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<tr>
<td>54''</td>
<td>4''</td>
<td>3''</td>
<td>3''</td>
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<tr>
<td>60''</td>
<td>4''</td>
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<td>3''</td>
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<td>68''</td>
<td>4''</td>
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<td>3''</td>
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<td>72''</td>
<td>4''</td>
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<td>76''</td>
<td>4''</td>
<td>3''</td>
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</table>

TABLE 7B. TYPE P MH - 45° BEND STRUCTURE DIMENSIONS

<table>
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<tr>
<th>DYE SIZE</th>
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<td>76''</td>
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TABLE 8. SPLICE LENGTH

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NOTE: DRS TO BE SPLICE ONLY AT LOCATIONS SHOWN.

PLAN

SECTION

TOP SLAB TYPE A (X>2')

NO SCALE

SECTION

TOP SLAB TYPE B (X>2')

NO SCALE

PREFERRED

OPTIONAL

SET TOP OF PIPE - PLANT WITH INNER WALL (TOP)

DO NOT END DRS END SHOWN FOR DETENTION PURPOSES ONLY (TOP)

INVERT

INVERT

CLASS O CONCRETE 4500 PSI

CLASS O CONCRETE 4500 PSI

SHOULDER PIPE PARALLEL TO INNER WALL

SHOULDER PIPE PARALLEL TO INNER WALL

PIPE END TREATMENT DETAIL

CORNER DETAIL

WALL-TO-BASE JOINT DETAIL

STEP BLOCK OUT DETAIL

LEGEND

R: TOTAL DEPTH OF MANHOLE
T: TOP FACE
B: BOTTOM FACE
E: EACH FACE
ER: EACH WAY

JUNE 2020
TYPICAL MANHOLE BASE CHANNELIZATION

CHANNELIZATION NOTES:
12.1 DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INLETS AT SAME RELATIVE ELEVATION.
12.2 FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INLETS, ETC. SPECIAL BASE/CHANNEL DETAILS SHALL BE SHOWN ON PLANS.
12.3 CHANNEILZATION DETAILS & STEP PLACEMENT TYPICAL FOR BOTH STORM AND SANITARY DESIGN M44.
12.4 THE MINIMUM VERTICAL DROP THRU MANHOLE BASE SHALL BE 0.10 FOOT FOR STORM SEwers AND 0.2 FOOT FOR SANITARY SEwers.
12.5 FOR SANITARY SEwers, VERTICAL DROPS IN EXCESS OF 18° REQUIRE AN OUTLET DROP. SEE S-530.
### MANHOLE OUTSIDE DROP NOTES:

1. Outside drop required for any drop greater than 18".
2. All pipe and fittings to be ASTM and City approved.
3. For pavement purposes, all fittings, pipe, concrete encasement shall be included in the unit price of the outside drop.
4. Diameter of the pipe shall not be less than main line pipe diameter.
5. For 18" diameter and larger, outside drop shall be a special design.
6. Pipe material and encasement shall be approved by the City.
7. Outside drop shall be constructed of C150 PVC.
8. Concrete encasement shall be a minimum of 6" thick all around.
9. Pipe dimensions are approximate and may vary from the manufacturer to another.
10. All required wall openings shall be precut block-outs or core drilled for manholes of openings of 18" and larger.

### TABLE 9. MINIMUM DROP DIMENSIONS FOR PVC PIPE

<table>
<thead>
<tr>
<th>Dimensions (Inches)</th>
<th>A</th>
<th>B</th>
<th>Y1</th>
<th>Y2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Diameter (Inches)</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Man Diameter (Inches)</td>
<td>42</td>
<td>43</td>
<td>51</td>
<td>61</td>
</tr>
<tr>
<td>Man Diameter (Inches)</td>
<td>42</td>
<td>43</td>
<td>51</td>
<td>61</td>
</tr>
</tbody>
</table>
S-550
KRC
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-81(
2020
14 WATER STOP GASKET
SHEET NO.:
DATE:
DRAWING NAME:
APPROVED BY:
DESIGNED BY:
DRAWN BY:

MH WATER STOP GASKET

CAST-IN-PLACE MANHOLE CONNECTION DETAILS FOR DISSIMILAR PIPE (NON-POROUS PIPE)

PRECAST MANHOLE CONNECTION DETAILS FOR ANY TYPE OF PIPE

WATER STOP GASKET NOTES:

14.1 PLACE STOP ON PIPE NEAR CENTER OF MANHOLE WALL
14.2 STAINLESS STEEL RING TO AID IN TIGHT SEAL AGAINST PIPE OUTSIDE.
14.3 CONCRETE MANHOLE IS NOT ACCEPTABLE.
14.4 MORTAR OR LEANMIXER SEALANT, OR APPROVED EQUAL, MAY BE USED FOR LARGE DIA. PIPE UP TO 48 IN. IN DIAMETER AT THE DISCRETION OF THE CITY.
SINGLE NUMBER 16 INLET NOTES:

15.1 For project purposes, inlet structures shall also include 2-1/2" curb & gutter transition section at each end of inlet plus nearby sections where required beyond inlet structure and transition sections.

15.2 Sub-grade shall be 6-12" of class A instead of A-2020 standard. Construction specifications, on surface/unsurfaced material, if unsuitable, the surface shall be overlaid and stabilized with class A instead of A-2020 standard construction specifications.

15.3 Floor slope may be poured without base.

15.4 Se = slope of connection = 2% min.

15.5 Unless otherwise specified on the drawings or otherwise approved, all No. 16 inlets shall be constructed with an adjustable cast iron curb box (5-716).

15.6 Design conditions for inlet allowing get-off of 12-3/4" (max). For inlets more than 12-3/4" feet in depth, shop drawings and design analysis shall be submitted for approval.

15.7 All reinforcing steel shall be ASTM A-615, grade 60 deformed bars. Diameter of bends measured on the inside of the bar shall be a minimum of 5/8" diameters.


15.9 No proposed small move remain voice structure when complete.

15.10 Concrete is for gutter and any aged street panels shall be made with a 10" thick slab, in accordance with the cost-standard Section 1.204 on streets. Where necessary, chalk marks chemical cements are applied. Refer to AASHTO LRFD Bridge Design Specifications Section 11 for requirements for concrete structures in concrete exposed to bearing.

15.11 Splicing of reinforcing steel shall be permitted only where detailed in drawings.

15.12 Inlet walls shall be formed with inside and outside coating of sealcoats against rain (rain is not permitted).

15.13 Lash concrete fill to be 

15.14 For through structures, design strength to be 

15.15 No corner penetrations on structure.

15.16 See AASHTO LRFD Bridge Design Specifications Section 11.04 storm inlets for more information. Use of this detail without specifications shall be considered non-conformant.

15.17 See S-616.2 for rain placement at wall termination detail.

15.18 Refer to "Transportation Standards and Details for the Engineering Division" for adjacent roadway and sidewalk design criteria.
6" VERTICAL CURB AND GUTTER

COMBINATION CURB GUTTER AND SIDEWALK

PLAN
NO SCALE

SECTION
NO SCALE

DETAIL - CONNECTOR OUTLET

DETAIL - REBAR PLACEMENT AROUND CONNECTOR PIPE

DETAIL - PLACEMENT OF ADJ. CURB BOX ON SUPPORT RAIL (TYP.)

DETAIL - FRAME PLACEMENT ON SUPPORT RAIL (TYP.)

DOUBLE NUMBER 16 INLET NOTES:

16.1 See design specifications section 11.05 storm inlets for more information. Use of this detail without specifications shall be considered non-compliant.

16.2 See general notes on S-818.1.

16.3 Expansion joint material shall be placed full depth of the curb and gutter, sidewalk, concrete pavement, as applicable. The top portion of the joint shall be sealed with flexible sealant.

16.4 See S-818.1 for rebar placement at wall penetration detail.

* Standard detail S-716 applies to all of the grate & frame geometry; dimensions for the double number 16 inlet except for the frame length. Frame length should be manufactured for the dimensions called out on this sheet.
NUMBER 16 VALLEY INLET NOTES:

18.1 See WCPM standard construction specifications section 1.05 storm inlets for more information. Use of the details without specifications shall be considered non-compliant.

18.2 See general notes on S-816.1

18.4 See standard detail S-718 for frame and grate details.

18.5 See standard detail S-816.5 for additional structure and backfill notes.

* Standard detail S-718 applies to all of the grate and frame geometric dimensions for the number 16 valley inlet except for the frame length. Frame length should be manufactured for the dimensions called out on this sheet.

A - Reinforcement also applicable to single and double number 16 valley inlets.

TABLE 10v. NO. 16 VALLEY TOTAL INLET LENGTH

<table>
<thead>
<tr>
<th>VALLEY CONFIGURATION</th>
<th>L1 OR L2</th>
<th>TOTAL INLET LENGTH</th>
<th>W1 OR W2</th>
<th>TOTAL BOTTOM SPAN LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>SINGLE NO. 16 VALLEY</td>
<td>12'-8&quot;</td>
<td>13'-0&quot;</td>
<td>6'-4&quot;</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>DOUBLE NO. 16 VALLEY</td>
<td>10'-6&quot;</td>
<td>13'-0&quot;</td>
<td>6'-4&quot;</td>
<td>7'-0&quot;</td>
</tr>
</tbody>
</table>
NUMBER 14 INLET NOTES:

20.1 See AWSM STANDARD CONSTRUCTION SPECIFICATIONS Section 11.05 Storm Inlets for more information. Use of this detail without specifications shall be considered non-compliant.

20.2 See General Notes on S-618.1 and S-820.1.

DETAIL - REBAR PLACEMENT AT INLET PENETRATION (TYP.)

DETAIL - TYPICAL CORNER REINFORCEMENT

STANDARD DETAILS
NUMBER 14 INLET
S-820.2
PAGE 2

DETAILED ENGINEERING
S-619.1

SECTION - NO SCALE

DETAIL - BENDING DIAGRAM FOR PRIMARY STEEL NO SCALE

SECTION - NO SCALE

DETAIL - AT END WALL (TOP VIEW) NO SCALE

DETAIL - J-BARS NO SCALE

DETAIL - TYPICAL INTERIOR WALL BLOCK-OUT NO SCALE

DETAIL - TYPICAL ANCHOR BAR NO SCALE
GRADE RING NOTES:

21.1 CONCRETE SHALL BE TYPE II CEMENT, M(3,000 PSI) ENHANCED OR #9 O/B CONCRETE PER WORK STANDARD CONSTRUCTION SPECIFICATIONS.

21.2 WEAR-RESISTANT SURFACES SHALL BE 3,000 PSI AND ACTING AS A RING SHALL BE FULL PENTRATION-RECEIVED TO DEVELOP RING STRENGTH. CENTER HOOP VERTICALLY.

21.3 STACKED RINGS TO BE OBTAINED IN PLACE. TOTAL WEIGHT OF STACKED RINGS SHALL NOT EXCEED 48.

21.4 RING/HOLE & 2 RISER SHALL BE SET ON A FULL BED OF NON-SHRINK GROUT.

21.5 SET 24" MANHOLE RING 1/4" BELOW MANHOLE COVER ON ALL MANHOLES. (TYPICAL FOR ALL APPLICATIONS UNLESS DETAIL SPECIFIED)

CAST IRON LID NOTES:

21.6 ALL MANHOLES SHALL HAVE A 4" FRAME, 2-1/2" RISER, AND 1-1/2" RISER SET ON FULL BED OF NON-SHRINK GROUT.

21.7 THE CASTING SHALL BE OF GRAY CAST IRON, ASTM DESIGNATION A47 CAST IRON. THE MINIMUM TENSILE STRENGTH SHALL BE 25 KSI. THE TEST BAR DESIGNATION IS NOT DEEMED AT THIS TIME.

21.8 CASTINGS SHALL NOT BE CRACKED OR FITTED, AND SHALL BE CLEAN, FREE OF PULLED SAND AND REASONABLY SMOOTH. THERE SHALL BE NO PROTRUSION FROM HOLES, NO CRACKS OR REJECTIONS, AND NO OBSERVED INCOMPLETE CASTING OF THE HOLES.

21.9 A CAST-IN PLACE CONCRETE COLLAR IS REQUIRED IN NON-PAVED AREAS, AND OPTIONAL IN PAVED AREAS, AT THE REQUEST OF THE PROJECT ENGINEER.

21.10 COVERS TO DISPLAY ON VISIBLE SURFACE, 698-35 (FOR 2020 CE, WHO'S LOGO OR NAME, YEAR (2 Digits), AND COUNTRY OF ORIGIN IF IMPORTED).
POLYPROPYLENE REINFORCED PLASTIC STEP

NO SCALE

MANHOLE STEP NOTES:

23.1 ASTM SPECIFICATIONS:
   (A) ASTM C-476 (Manhole Steps and Ladders)
   (B) ASTM A-585 (Steel Rebars)
   (C) ASTM D-376 (Polypropylene)

23.2 Steps shall be installed by the "press-fit" method utilizing a specially treated pin to form the insert hole as shown. Following manufacturer's recommended procedure and shall not be driven in place.

23.3 Installed steps shall be capable of withstanding a pull out force of 2200 lb. per leg for a minimum period of two minutes.

23.4 Pins must be smooth and continuously tapered. Hard installations require a matching combination of a tapered pin, and manhole step, as recommended by specific manufacturer of the step to be used.

23.5 This step can also be used in the pocket installations provided 6" clearance is allowed. Manhole steps shall not be installed over the floor channel. They shall be placed 12" minimum or 18" maximum in straight vertical alignment with the bottom step 8" above the trench minimum. See Standard Details S-701, S-702.