






# Addendum #2

July 2020

## Street, Storm Drain, and Sanitary Sewer Specifications and Standards

		
City of Columbia, MO 701 E Broadway P.O. Box 6015 Columbia, MO 65205 (573) 874-2489	David Allen Nichols Registered Professional Engineer E-24212	
Approved By: 		7-1-20
Public Works Director		Date

		
City of Columbia, MO 701 E Broadway P.O. Box 6015 Columbia, MO 65205 (573) 441-5530	David Alan Sorrell Registered Professional Engineer PE-2009001129	
Approved By: 		7-1-2020
Columbia Utilities Director		Date

## Summary of Revisions

### Street, Storm Drain, and Sanitary Sewer Specifications and Standards

Revision: July, 2020

#### Section 201: Excavation and Embankment for Street and Storm Sewers

- 201.12.b.1. Changed modified proctor to standard proctor.

#### Section 250: Concrete Structures

- 250.2.1.a. Revised ASTM standard.
- 250.3.8. Revised the welding requirement.

#### Section 260: Storm Sewers

- 260.2. Clarified locations for allowable pipe types, removed VCP and DIP.
- 260.3.2. Revised ASTM designation.
- 260.3.3. Revised AASHTO and ASTM standards.
- 260.3.4. Removed cast iron pipe standard.
- 260.3.5. Removed vitrified clay pipe.
- 260.3.7. Revised pipe diameter. Removed/revised ASTM and ASSHTO standards.
- 260.4.1. Revised ASTM standards.
- 260.5.1. Added ASTM standard.
- 260.5. Removed Joints for Cast Iron Pipe
- 260.6. Removed Joints for Vitrified Clay Pipe
- 260.7.1. Revised ASTM standards.
- 260.8.1. Removed VCP and DIP.
- 260.9.2. Revised concrete specification.
- 260.10.1. Revised concrete specification.
- 260.10.2. Revised concrete specification.
- 260.12. Revised concrete specification.
- 260.14. Revised concrete specification.
- 260.16. Revised section number.
- 260.17. Revised section number.

#### Standard Details:

- Table of Contents:

Details 410.02A, 410.02B. 410.03, 410.04, 410.05: Revised title

- 110.01: Revised sidewalk slope.
- 110.02: Revised sidewalk slope.
- 110.03: Revised sidewalk slope.
- 140.01A: Added pipe gage, sidewalk thickness. Removed Expansion Joint Detail.
- 140.01B: Removed details. Removed notes 4 & 5. Renumbered notes.
- 410.02A: Revised detail name, sidewalk slope.
- 410.02B: Revised detail name, sidewalk slope.
- 410.03: Revised detail name, sidewalk slope.
- 410.04: Revised detail name, sidewalk slope.
- 410.05: Revised sidewalk slope.
- 410.07: Revised sidewalk slope.
- 420.01: Revised sidewalk slope.
- 420.02: Revised sidewalk slope.
- 430.01: Revised landing slope.
- 430.02: Revised landing slope.
- 430.03: Revised landing slope and sidewalk slope.
- 431.01: Revised landing slope.
- 432.01: Revised landing slope.
- 432.02: Revised landing slope.
- 432.03: Revised landing slope and sidewalk slope.
- 433.01: Revised landing slope.
- 500.02: Revised Note 3.
- 505.01B: Revised Notes 1 & 14.
- 505.01C: Revised concrete invert note for Section D-D.
- 505.01D: At Low Point section curb transition change to 10' on both sides.
- 505.02A: Revised Plan-Single detail, Section A-A Alternate detail, Section A-A detail, Section B-B detail, and Notes 1, 4, & 5.
- 505.02B: Revised Plan-Double detail, Section A-A Alternate detail, Section A-A detail, Section B-B detail, and Notes 1, 4, & 5.
- 510.01: Revised Section A-A and Notes 1 & 4.
- 510.02: Revised Section A-A detail, Openings Over details, and Notes 1, 4, & 7.
- 525.01A: Revised Note 1.
- 530.01: Revised note about concrete type.
- 530.02: Revised note about concrete type.
- 1000.02: Revised sidewalk slope.
- 1000.05: Revised sidewalk slope.
- 1000.06: Revised sidewalk slope and landing dimension.

- 1000.07: Revised sidewalk slope.
- 1000.08: Revised landing slope.
- 1000.10A: Revised sidewalk slope.
- Detail 4: Break out detail revised.
- The title block of all Storm Drain Details (500) and Sanitary Sewer Details have been revised with new City Utilities logo and signature.

## SECTION 201

### EXCAVATION AND EMBANKMENT FOR STREET AND STORM SEWERS

201.1. Description. Excavation shall consist of removing all materials necessary for the proper construction of the work and disposing of this material in a satisfactory manner as approved or directed by the Engineer. Embankment shall be formed of suitable material taken from roadway and drainage excavation, borrow excavation and excavation for structures, and placed in successive horizontal layers distributed uniformly over the full width of the cross section. Embankment shall be made of sufficient height and width so that at the time of acceptance by the City, they will conform to the typical section shown on the plans.

201.2. Classification of Excavated Materials. In these specifications, excavating is divided into two classifications, earth and rock, which shall cover all materials encountered. The determination and classification of such excavated materials will be based on the following definitions:

- a. Earth excavation will include all materials not otherwise classified. Decomposed or disintegrated shale which, in the opinion of the Engineer can be effectively plowed, spaded, or removed with power driven excavating equipment, as well as blacktop pavement and gravel base, will be classified as earth.
- b. Rock excavation is defined as being sandstone, limestone, flint, granite, quartzite, or similar material, in masses measuring more than one (1) cubic yard in volume or in ledges four (4) inches or more in thickness, and which requires blasting or jack hammering for its practical and effective removal. Should rock be encountered in two (2) or more ledges, each ledge being not less than three (3) inches thick and with inter-lying strata or earth not over twelve (12) inches thick in each stratum, the entire volume from the top of the top ledge to the bottom of the bottom ledge of rock will be classified as rock.

201.3. General. After all stripping has been done, excavation of every description and of whatever substances encountered within the clearing limits of the project shall be performed to the lines and grades indicated on the drawings. All suitable excavated material shall be transported to and placed in fill areas within the limits of the work as specified and shown on the drawings. All excavated materials which are considered unsuitable by the Engineer and any surplus of excavated material which is not required for fill will be known as "waste" and shall be disposed of by the Contractor at his own expense and responsibility and to the satisfaction of the Engineer. Any additional fill material required which is not available from excavation within the project area shall be supplied by the Contractor. All such material brought to the site by the Contractor shall be subject to the approval of the Engineer. During construction, excavation and fill shall be performed in a manner and sequence that will provide positive drainage at all times.

- a. Unsuitable Material is defined as muck, frozen material, organic material, top soil, rubbish, and rock with a maximum dimension greater than 24 inches.
- b. Suitable Material. Suitable material is defined as entirely imperishable with that portion passing the No. 40 sieve having a liquid limit not exceeding 40 and a plastic

index not exceeding 25, when tested in accordance with ASTM D-423 and D-424, respectively.

1. Rock Embankment. Material for rock embankment shall be free of unsuitable material and shall contain, by volume, greater than 10 percent rock or gravel having a maximum dimension greater than 3 inches but not greater than 24 inches.

2. Earth Embankment. Material for earth embankment shall be free of unsuitable material and shall, contain by volume, less than 10 percent rock or gravel having a maximum dimension greater than 3 inches.

201.4. Excavation for Structures. All structures shall be founded on undisturbed subsoil. Unauthorized excavation below the specified structure subgrade shall be replaced with concrete, at the expense of the Contractor.

Excavation shall be made in open cut to alignment and depth as shown on the profiles and drawings, except as otherwise indicated in the specifications and drawings. The Contractor shall make all necessary excavations for work included in this Contract.

Excavation for manholes, curb inlets, junction boxes and similar structures shall be sufficient to leave at least twelve (12) inches in the clear between their outer surfaces and the embankment or timber which may be used to hold and protect the excavation. In all cases the clearance between the outer face of structures and the surrounding excavation shall be sufficient to allow the proper performance of the work including the plastering of exterior wall surfaces where required by the specifications or plans.

The Contractor shall not open more trench in advance of construction than necessary to expedite the work, and in no case shall the length of open trench be greater than 300 feet. The trench shall be backfilled at the end of each day except as may be required to begin the next day's work. In no case shall more than ten (10) feet of pipe be left exposed. Trenches in the road shall be plated with steel sheets or patched with cold patch overnight. Plates shall be properly anchored and all edges of the plate shall be ramped with asphalt surface mix to prevent rattling.

Wherever necessary to prevent caving, the excavation shall be adequately sheeted, braced and drained so that workmen may work therein safely and efficiently. An engineered plan shall be submitted to Public Works for any sheeting, cribbing or bracing. Where trench bottom is in rock, the excavation limits shall allow solid rock to be exposed and cleaned of all loose material and cut to a firm surface before any foundation concrete is placed.

Whenever wet or otherwise unstable soil that is incapable of properly supporting the structures, as determined by the Engineer, is encountered such soil shall be removed to the depth required and the excavation backfilled to the proper grade with coarse sand, fine gravel, or other suitable material as may be authorized. All excavations for structures shall be kept dry and no pipe or reinforcing steel shall be installed in water and no water shall be permitted to inundate the reinforcing steel before concrete has been placed. All excavations shall be kept dewatered to the extent that water will not come in contact with any concrete within twelve (12) hours after

placing. When excavations are carried below ground water elevations such excavations shall be dewatered by lowering and maintaining the ground water level at least twelve (12) inches below such excavations during all construction, including subgrade excavation, placing of reinforcing steel or pipe, placing of concrete, plastering of masonry, and shall be maintained in a dry condition until all concrete has been placed and allowed to harden for at least twelve (12) hours as specified above.

201.5. Excavation for Roadway. Grading shall conform to the typical sections shown on the drawings and shall be finished within a tolerance of one-half (1/2) inch of the grades indicated. Any soft and unsatisfactory material within the limits of the pavement areas shall be removed and disposed of as directed by the Engineer, and the basis of payment shall be the same as for excavation. Fill material required in excess of that produced by normal grading operations shall be excavated from areas indicated on the drawing or as directed by the Engineer. Excavated material not acceptable for use as fill shall be disposed of by the Contractor at his own expense as directed by the Engineer.

Cut compaction shall be performed at proposed roadway pavement after removal of the roadway excavation material to the required section. A surface parallel to the pavement slope, 12 inches below the bottom of the pavement or lowest base course, shall be temporarily exposed for the full width below roadway inslopes. The exposed material shall be manipulated and compacted to no less than the required density to a depth of 6 inches. The material above this compacted plane shall be spread in layers not exceeding 8-inch loose thickness, each layer being wetted or dried as necessary and compacted to the specified density. The entire volume of material so handled and compacted, including the 6-inch layer compacted in place, will be considered as Cut Compaction. All cut compaction shall be tested per 201.11.b.

Cut compaction shall be performed an additional depth of 12 inches for 50 feet on each side of the intersection of the natural ground and the top of the subgrade, then uniformly graded for 30 feet to meet the depth requirements above.

The existing ground for the full width between roadway slopes under embankments less than 18 inches high shall have cut compaction to a depth to ensure that 18 inches of material of the required density and moisture is below the top of the finished grade.

#### 201.6. Excavation for Storm Sewers.

a. General. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and disposed of off the site, by and at the expense of the Contractor. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and to maintain the flow of water in natural water courses on or adjacent to the site. Any water accumulating in trenches or other excavations, shall be removed by pumping or by other approved methods. Unless otherwise indicated or authorized, excavation shall be by open cut. The use of excavation machinery will be permitted except in places where operation of same will cause damage

to trees, buildings, or existing structures above or below ground, in which case hand methods shall be employed.

b. Trench Bracing and Sheeting. If trench box construction is used, the trench box shall not extend below the top of the pipe. An engineered plan shall be submitted to Public Works for any sheeting, cribbing or bracing. The plan must be approved by the Engineer prior to beginning work.

c. Dewatering of Trenches. During excavation, pipe laying and jointing, or other work necessary for the installation of the storm sewers, trenches shall be kept free from water and in a workable condition. Where the trench bottom is found to be unstable or unsatisfactory because of water, and in all cases where the trench bottom falls below the ground water level by means of well points, pumps or by other means acceptable to the Engineer a sufficient amount to keep the trench free from water and the trench bottom stable at any time that work within the trench is in progress. As specified herein before the Contractor shall take all necessary measures to prevent surface water from entering the trench and he shall further take all necessary measures to prevent the inundation or damage to any private property or structures adjacent to the site of the work.

d. Trench Alignment and Grade. The alignment, depth, and grade of all storm sewer trenches shall be maintained as shown on the drawing. Establish required uniform line and grade in trench from benchmarks identified by the Engineer. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work.

e. Trench Width. Width shall be no wider than is necessary for the proper jointing of the pipe and in no case shall exceed the trench widths in the corresponding bedding details, unless specifically authorized by the Engineer.

f. Unauthorized Trench Widths. Where trench widths as specified above, are exceeded for any reason other than by order of the Engineer, either special pipe embedment, concrete cradle, concrete encasement, or other suitable methods shall be required as demanded by loading conditions and as ordered by the Engineer. Any additional work required, as stipulated above, as a result of unauthorized over excavation shall be performed by and at the expense of the Contractor.

g. Preparation of Pipe Subgrade. Pipe subgrade shall be prepared after rough trenching is complete and shall be done with hand tools immediately prior to installing pipe. The bottom of the trench shall be prepared so as to provide uniform support of the bottom quadrant of the pipe and bell holes or depression shall be hand excavated where bell and spigot pipe is used. The trench bottom shall be evenly graded as indicated on the plans and areas which are too high shall be shaved as required. Any portions of the trench bottom which are found to be too low shall be filled with suitable material, thoroughly rammed and tamped and brought to true grade.

h. Replacement of Unsuitable Pipe Foundation Material. Where, in the opinion of the Engineer, the trench bottom is found to be of a wet or otherwise unstable material or where it is impossible to provide proper bearing for the pipe, or where it is found to be



impossible to carry on construction operation due to the condition of the trench bottom, the Contractor shall remove all unstable or unsuitable material to a depth of not less than four (4) inches below the elevation of the pipe subgrade over the entire width of the trench and shall replace and backfill with a suitable finely divided material of acceptable quality and sufficiently damp for proper compaction. Such material shall be thoroughly compacted by tamping or rolling over the entire width of the trench and shall be brought to proper grade and shape and the proper elevation for the installation of the pipe as shown on the plans.

201.7. Blasting. Contractor is responsible to comply with all regulations and permitting for blasting.

All excavated rock or shale which cannot be handled and compacted as earth shall be kept separate from earth and shall not be mixed with other backfill except as specified and directed.

201.8. Excavation through Pavement. Pavement, pavement base course, concrete walks, and concrete curbing shall be cut and removed only where shown on the plans, where specified or where directed and authorized by the Engineer. Cuts shall be no larger than necessary to provide adequate working space for installation of the pipe appurtenance or structure, except where other miscellaneous removals are required on the drawings. Payment for removal of concrete pavement, sidewalk, floor slabs, and curbing shall be made according to the unit prices shown in the bid form. Measurement of quantities so removed shall be as specified hereinafter in the applicable sections.

All cuts in pavement, walks or curbing shall be neatly sawn and shall be straight and parallel to existing construction joints. Any pavement, curbing, gutter or sidewalks, the removal of which was not required in conjunction with construction under this Contract, which is damaged due to construction operations by the Contractor shall be removed and replaced by the Contractor in first class manner, as hereinafter specified, at his own expense.

201.9. Protection of Existing Utilities. Due care must be taken not to disturb inlet covers, manhole frames, valve boxes, fire plugs, house connections or private water pipes. If not set to the proper grade they will be adjusted by the various City Departments or public utility corporations or private Owners, unless otherwise directed by the Engineer.

The Contractor will be held responsible for any damage done to house connections or private water pipes and accessories, if two (2) feet or more below top of curb and one (1) foot or more back of face line of curb, in the case of street construction, or if two (2) feet or more below the grade of finished pavement in connection with alley construction.

201.10. Pavement Replacement. All pavement, curbing, gutter, or sidewalks removed during construction of the project for any reason shall be replaced unless otherwise shown on the drawings or directed by the Engineer, the replacement construction conforming in type, quality, and dimensions to that of the portion so removed. Replacement shall conform to City patching details where applicable.

201.11. Embankment.

- a. Preparation of Ground Surface for Fill. All vegetation, such as roots, brush, heavy sod, heavy growth or grass, and all decayed vegetable matter, rubbish, and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Sloped ground surfaces steeper than one (1) vertical to four (4) horizontal on which fill is to be placed, shall be plowed, stepped (benched), or broken up in such manner that the fill material will bond with the existing surface.
- b. General. Where filling is required to raise the subgrade under areas to be paved or surfaced, all fill materials shall consist of earth or other approved material. All organic or other undesirable material shall be removed. Where embankments, regardless of height, are placed against hillsides or existing embankments, either of which have a slope steeper than 1 vertical to 4 horizontal, the existing slope shall be benched or stepped in approximately 24 inch rises as the new fill is brought up in 8 inch maximum layers or lifts. The material bladed out, the bottom of the area cut into, and the embankment material being placed, shall be compacted to the required density. Material cut out, bladed into place and compacted shall not be measured and paid for directly but will be considered as incidental work.

All fill under paved surfaces such as streets and parking lots shall be compacted by a power roller or other approved equipment and the subgrade brought to a reasonably true and even plane. Earth used for fill shall be placed in layers not more than eight (8) inches thick, an uncompacted measurement, and shall be compacted as specified before the next layer is placed. Each layer shall be wetted or dried as necessary, and shall be compacted to the required density. Regardless of the type of equipment used, the roadway shall be compacted uniformly and the surface kept reasonably smooth at all times. If large pieces of heavy clay are encountered, the material shall be broken down by suitable manipulation to permit satisfactory embankment construction. If shale is encountered, the shale shall be broken down as much as practical and compacted at or above optimum moisture.

Each layer shall be uniformly spread, moistened as required, and then compacted to ninety percent (90%) of maximum density, obtained at the optimum moisture content, as determined by AASHTO Method T-99-38. The top eighteen (18) inches shall be compacted to ninety-five percent (95%) of maximum density. The field density of the lift will be determined in accordance with AASHTO T 191 or T 205, using the total material or T238, Method B Direct Transmission, for wet density. If nuclear density methods are used, moisture content will be determined in accordance with AASHTO T239. One test shall be taken for every 1,000 linear feet or fraction thereof for each lift. Testing is to be done by a third party independent testing agency or by the Contractor if the Contractor has demonstrated to the Engineer that Contractor employs qualified persons and maintains qualified equipment to conduct density testing. Test results shall be furnished on forms acceptable to Engineer. Contractor shall proof roll the final lift of fill material in accordance with the proof rolling requirements of Section 205.2. Costs of all testing and retesting are the responsibility of the Contractor.

201.12. Backfill.

Classification of backfill materials. Backfill materials in these specifications shall conform to the Standard Installation Direct Design (SIDD) categories per the chart below.

SIDD Soil	USCS	Standard AASHTO
Gravelly Sand (Category I)	SW, SP, GW, GP	A1, A3
Sandy Silt (Category II)	GM, SM, ML, Also GC with less than 20% passing #200 sieve	A2, A4
Silty Clay (Category III)	CL, MH, GC, SC	A5, A6

a. Roadway Backfill. After completion of roadway, curb and gutter, and other construction below the elevation of final grades, all forms shall be removed and the excavation shall be cleaned of trash and debris. Backfill shall be free of all objectionable material and shall be placed in horizontal layers not more than eight (8) inches thick, and shall have a proper moisture content for the required degree of compaction. All parking areas, driveways, streets, and other paved areas shall be backfilled with approved material and compacted to ninety-five percent (95%) of maximum density obtained at the optimum moisture content. Testing is to be done by a third party independent testing agency or by the Contractor if the Contractor has demonstrated to the Engineer that Contractor employs qualified persons and maintains qualified equipment to conduct density testing. Test results shall be furnished on forms acceptable to Engineer. Tests shall be taken once for every 1,000 linear feet or fraction thereof for each lift. Costs of all testing and retesting shall be borne by the Contractor.

Backfilling and grading behind curbs shall be performed to the lines and grades indicated on the drawings. The backfilled area shall provide a smooth, even transition from the existing lawn grades to the curb and shall be done so as to assure desired drainage.

When indicated on the plans and included as a bid item, the top four (4) inches of backfill behind curbs shall be topsoil, free from rocks, gravel, and any undesirable material. This material may be either topsoil available within the limits of the project or it may be topsoil furnished by the Contractor. Payment for topsoil will be made on the basis of the bid quantity, except when:

- Errors are found in the original computation or ground elevations.
- An authorized change in grade or typical section is made.
- An unauthorized deviation decreases the quantities on the plans.
- All driveways, paved or unpaved, which are disturbed by grading or excavation of any kind shall be graded and shaped to provide a reasonable approach, and shall upon completion of the job be left in passable condition. All driveway approaches except those which the Owner is having paved at the time of this Contract shall receive four (4) inches of crushed rock to the extent of the portion disturbed. Crushed rock shall be a

maximum size of one (1) inch surface rock.

b. Trench Backfill

1. Materials. All materials which are to be compacted by tamping or rolling, including all tamped embedment, shall be free from sticks, large roots, or other organic matter coarser than grass roots, stones, hard lumps, and clods, and shall have a moisture content such that optimum compaction is obtained when properly tamped or rolled. Debris, frozen material, large clods, stones, organic matter, or other unstable materials shall not be used for final backfill within 2' of the top of pipe.

Unsuitable Foundation Bedding. Granular material for replacement of unsuitable foundation material removed from trench bottoms shall consist of 6" gabion rock.

Flowable Backfill. Flowable backfill shall be a Controlled Low Strength Material (CLSM). CLSM shall be composed of Portland cement, fly ash (optional), fine aggregate, coarse aggregate (optional), water, and a shrinkage compensator. Cement shall be either Type I or Type II Portland cement. Mixing water shall be potable. Air entrainment admixture shall consist of an organic compound which will result in air contents as prescribed by ASTM C 173 or C 231. Fine aggregate shall be washed and consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without mineral filler. Aggregate shall be free of injurious amounts of salt, alkali, vegetable matter or other objectionable material. Coarse aggregate shall be sound, durable, clean rock or broken concrete (2" to 8" square) to minimize the quantity of CLSM. The CLSM shall be placed to a depth of 2 feet then coarse aggregate may be added to the CLSM mixture until the top of the CLSM and top of aggregate are approximately equal. The process may be repeated until the fill is completed. CLSM shall be removable (less than 100 PSI) and comply with the following mix design:

Cement	144 lbs
Water	396 lbs
Sand	2,698 lbs
Air entrainment	13%

Where CLSM is being placed over or adjacent to crushed stone backfill, a layer of filter fabric shall be installed between the two materials.

Inundated sand backfill is not acceptable.

Coarse aggregate (1-1/2") may also be added at the batch mix plant. Coarse aggregate is not to replace fine aggregate.

Rock Backfill. Rock backfill shall consist of 1" Road Rock. The rock shall be brought up in 6" lifts and have the following gradation.

Sieve Size	% Passing
1"	100
3/4"	85-93
1/2"	65-75
3/8"	52-64
#4	25-45
#30	10-15
#200	5-10

Other gradations may be approved by the engineer provided the material is compactable with minimal settlement and will not provide a conduit for water to enter the subgrade surrounding the trench.

Backfill material shall be near optimal moisture content as determined by the standard proctor.

2. Compaction. All backfill shall be thoroughly compacted by pneumatic tampers, or other approved methods, to the original state of consolidation of the soil encountered. Backfill shall be placed in uncompacted lifts not to exceed six (6) inches and each lift shall be thoroughly and adequately compacted. Care shall be exercised not to disturb the pipe when placing backfill. The compacted earth backfill shall be brought to an elevation of approximately six (6) inches below the finished surface grade and then surface grade constructed. Testing shall be similar to that required at embankments per 201.11.b except that tests shall be taken once for every three hundred (300) linear feet of trench or fraction thereof for every other lift. Backfill using 1" clean aggregate does not require testing.

After backfill and compaction is complete trenches shall be leveled off and grading shall be performed as is necessary to restore yards or other grassed or sodded areas to their original condition or better.

Backfill under pavements shall be flowable fill. Flowable fill shall be placed from a maximum of one foot (1') above top of utility to the underside of pavement base course. If pavement does not have a base course, stop flowable fill six inches (6") below bottom of pavement and provide a six inch (6") cushion course of 1" clean aggregate.

3. CLSM Maximum Depth. – The depth of flowable fill shall comply with the following:

- a. If the distance from the top of the utility/pipe to the subgrade is five feet or less, the entire depth from subgrade to twelve (12) inches above the top of utility/pipe shall be flowable fill.
- b. If the distance from the top of the utility/pipe to the subgrade is over five feet, the top four feet below subgrade shall be flowable fill. The remainder of the backfill may be overfill soil compacted per the specifications or flowable fill at the contractor's option.

4. Utility Crossings. – Where a utility is located above another utility or where two utilities cross, the bedding material shall be extended to properly bed the higher utility then the overfill soil and flowable fill placed per specifications.

5. Plates. – Flowable Fill requires a minimum of 24 hours to set. This will require trenches with flowable fill to be plated or barricaded trenches with traffic detoured in accordance with MUTCD standards. Maximum trench width requiring flowable fill is six (6) feet wide. See details 540.01 and 9A for maximum trench width.

When a backfilling operation of an excavation occurs in the traveled way, whether transverse or longitudinal, and the project cannot be properly completed within a standard work day as defined by section 12A of the City of Columbia Code of Ordinances, steel plate bridging with a non-skid surface and shoring will be required to preserve unobstructed traffic flow. In such cases, the following conditions shall apply:

- a. Steel plates used for bridging must extend a minimum of 12” beyond the edges of the trench.
- b. Steel plate bridging shall be installed to operate with minimum noise.
- c. The trench shall be adequately shored, as mentioned in Section 201, to support the bridging and traffic loads.
- d. Temporary paving with fine graded asphalt concrete shall be used to feather the edges of the plates, if plate installation is used.
- e. Bridging shall be secured against displacement by using adjustable cleats, shims, or other devices.

Approach plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and drilled 2” into the pavement. Subsequent plates shall be butted to each other. Fine graded asphalt concrete shall be compacted to form ramps, maximum slope 8.5% with a minimum 12” taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry or equivalent slurry that is satisfactory to the City of Columbia.

The contractor is responsible for maintenance of the steel plates, shoring, asphalt concrete ramps, and ensuring that they meet minimum specifications. Unless specifically noted in the special provisions, or approved by the City of Columbia, use of steel plate bridging should not exceed 4 consecutive working days in any given week. Backfilled excavations shall be covered with a minimum 3 inches temporary layer of cold asphalt concrete until permanent surface can be installed.

Trench Width	Minimum Plate Thickness
1'	½"
2'	¾"
3'	7/8"
4'	1"
5'	1.25"
6'	1.25"

6. Removed.

7. Trenches wider than 6 feet. – When excavation becomes wider than six (6) feet adhere to the following:

a. Residential Streets

1. Concrete

- a. Minimum of two entire concrete panels are to be removed.
- b. May close street (except in cul-de-sacs) or provide MUTCD compliant traffic control.
- c. Excavate all subgrade within one (1) foot of existing panels to a minimum depth of eighteen (18) inches.
- d. Backfill to be brought up with compacted aggregate in six (6) inch lifts and tested per specifications OR flowable fill may be used.
- e. Four (4) inches of type 3 aggregate base is to be placed under the street.
- f. Dowel Panels per specifications.

2. Asphalt

- a. Minimum size of replacement to be ten (10) foot by ten (10) foot square.
- b. Two (2) foot minimum clearance to be left between edge of pavement replacement and leading edge of gutter.
- c. May close street (except in cul-de-sacs) or provide MUTCD compliant traffic control.
- d. Excavate all subgrade within one (1) foot of existing pavement to a minimum depth of eighteen (18) inches.
- e. Backfill to be brought up with compacted aggregate in six (6) inch lifts and tested per specifications OR flowable fill may be used.
- f. Four (4) inches of type 3 aggregate base is to be placed under the street
- g. Pave per asphalt paving specifications

Arterials and Collector Streets – Will be handled on a case by case basis with City of Columbia Public Works Department.

8. Required Testing. – Testing shall follow section 201.11b, except proof rolling shall not be required.

c. Structure Backfill. Backfilling of all structures shall be permitted only after an adequate curing time, as determined by the Engineer, has elapsed.

All excavations shall be backfilled to the lines and grades shown on the drawings.



In no instance shall backfill be dumped, bull-dozed, or otherwise deposited in bulk upon the newly-constructed structure. After the required curing time, the excavation shall be backfilled by depositing, entirely without shock and with careful pneumatic tamping, suitable earth, sand, or other acceptable material in lifts not to exceed six (6) inches in compacted thickness. Backfill shall be deposited at approximately the same elevation on opposite sides of the structure and shall be compacted in place to a density equal to or greater than ninety-five percent (95%) of maximum density as determined by the Standard AASHTO Method T-99-38. Inundated sand backfill shall not be used.

No trench backfill material containing rock, or debris from rock excavation, shall be placed in the upper eighteen (18) inches of the excavation except with the specific permission of the Engineer. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill compaction will result.

Any deficiency in the quantity of material for backfilling the excavation, or for filling depressions caused by settlement, shall be supplied by the Contractor. All excavated material in excess of that necessary to fill the trench to the grade shown on the drawings shall be removed and disposed of by the Contractor.

- d. Responsibility of Contractor for Backfill Settlement. The Contractor shall be responsible for the satisfactory compaction and maintenance thereof, for all trenches and structural excavation of any description required under this Contract. Contractor shall warrant their work for a period not less than the correction period from the date of acceptance. If prior to the expiration of this warranty, any trenches or other excavations are found to have settled they shall immediately be reworked by the Contractor and restored to the specified grades. Any sod, paving, or other surfacing damaged by settlement of trenches shall be replaced by and at the expense of the Contractor.

#### 201.13. Method of Measurement and Basis of Payment.

a. Roadway Excavation. Final measurement of roadway excavation will not be made unless otherwise designated in the Contract. A partial check of existing ground elevations will be made at the time slope stakes are set, and of the finished work for deviations in the grade, widths or slopes from the authorized grade or typical section. Plan quantities will be used for final payment of Earth Excavation except when:

- Errors are found in the original computation or ground elevations.
- An authorized change in grade or typical section is made.
- Unauthorized deviations decrease the quantities on the plans.
- Rock Excavation is encountered. Roadway excavation will be re-computed for these sections where the ground elevations shown on the plans are found to be erroneous. No re-computation of plan quantities will be made when the actual



ground elevations are considered to generally agree with the ground line shown on the plans. Where the Engineer authorized a change in grade or typical section affecting the volume of excavation, the volume of excavation allowed for payment will be determined by the average end area method on the basis of the revised grade or typical section. Where unauthorized deviations result in a decrease in the quantities the plans, the deviations will be measured and deducted from the plan quantity. The volume of rock excavation will be determined by the average end area method. The volume of earth excavation allowed for payment will be the total volume of roadway excavation shown on the plans or the revised quantity, regardless of classification, minus the measured volume of rock excavation.

**Basis of Payment.** Payment for roadway excavation will be made at the Contract unit price per cubic yard (for each class of excavation) which price shall be full compensation for the excavating and hauling; placing and forming of embankments; preparation of subgrade; clearing grubbing, and any work noted on the plans to be included in the price bid for excavation. Payment will be made under:

Item No. 201.1. Earth excavation, per cubic yard.

Item No. 201.2 . Rock excavation, per cubic yard.

b. Trenching.

1. Earth. Payment for all trench excavation and backfill in earth shall be included in the Contractor's unit price per lineal foot for storm sewer construction as set forth in the proposal. Such unit price shall include cost of all equipment, labor, and materials used in conjunction with the trenching operations. Payment will be made under:

Item No. 201.3. Storm sewer construction, per lineal foot.

2. Rock. Payment for all trench excavation and backfill encountered in rock, as defined in this section of the specifications, shall be made at the unit price per cubic yard for rock excavation, storm sewer as set forth in the proposal. Upper pay limit for rock excavation shall be the top surface of the rock and lower pay limit shall be the bottom stratum or layer of the rock or the flow line of the pipe, whichever is higher in elevation. Width limit for payment for rock excavation shall be per pipe embedment details 540.01 and 540.02. Payment will be made under:

Item No. 201.4. Rock excavation, storm sewer, per cubic yard.

c. Structural Excavation.

1. Earth. Payment for all earth excavation and backfill required in constructing drainage structures such as catch basins, curb inlets, junction boxes, and headwalls, shall be included in the unit price for each such structure as set forth in the proposal. Payment for earth excavation and backfill required in construction of the reinforced concrete boxes and retaining walls shall be included

in the unit price for structural reinforced concrete as set forth in the proposal. No separate pay item for this structural earth excavation shall be included in the Contract.

2. Rock. Where rock, as defined herein, is encountered in the excavation for structures such as those listed above, it shall be paid for at the unit price per cubic yard for rock excavation, storm sewer as set forth in the proposal. Upper and lower pay limits shall be as defined hereinbefore for trenching in rock and the later limits shall be defined as vertical planes spaced eight (8) inches outside the walls of any structure. Payment will be made under:

Item No. 201.5. Rock excavation, storm sewer, per cubic yard.

d. Crushed Rock for Driveways. Crushed rock for driveway approaches shall be paid at the Contract unit price per ton for crushed rock in place. Payment will be made under:

Item No. 201.6. Crushed rock for driveway approaches, per ton.

e. Topsoil for Backfill in Lawns. Topsoil for backfill in lawns shall be paid at the Contract unit price per cubic yard for topsoil in place. Payment will be made under:

Item No. 201.7. Topsoil for backfill in lawns, per cubic yard.

## SECTION 250

### CONCRETE STRUCTURES

250.1. Description. Concrete structures shall include drainage structures such as reinforced concrete boxes, culverts, junction boxes, curb inlets, manholes, side opening inlets, paved channels, etc., also retaining walls and any special concrete structures. Circular junction boxes, side opening inlets, and manhole structures are acceptable in addition to the rectangular structures shown in the details.

#### 250.2. Materials.

##### 250.2.1. Concrete.

All materials, proportioning, slump, and air-entertainment for Portland cement concrete shall conform to requirements of the current MoDOT's Standard Specifications for Highway Construction (MSSHC), Section 501, for Class B-1 air-entrained concrete and all other sections as referenced in the MoDOT MSSHC unless otherwise specified by the Engineer.

Sampling and testing of concrete and materials shall be made under the direction of the Engineer, who shall have access to all places where concrete materials are stored, proportioned, mixed or placed. A recognized testing laboratory, selected by the Contractor and approved by the Engineer, shall be employed by the Contractor to test cement and aggregates proposed for inclusion in the work, to design the concrete mix, and to test all concrete cylinders. The Contractor shall furnish the laboratory with adequate samples of aggregates and cement to permit required testing.

The tests listed below shall be performed by the laboratory with certified test results submitted to the Engineer for his approval. Materials to be tested and testing shall be according to the following:

- a. Cement shall be sampled and tested according to ASTM C 150.
- b. Coarse and fine aggregates shall be sampled and tested as follows:

Sampling	ASTM D 75
Gradation	ASTM C 136 and C 117
Impurities	ASTM C 40 (Sand), C 123, C 142 and AASHTO-T10
Soundness	ASTM C 88, if required
- c. The determination of slump of concrete shall conform to ASTM C 143.
- d. Concrete test cylinders shall be cast and tested in accordance with ASTM C 31 and C 39. The Contractor shall make three (3) job cylinders for each 50 cubic yards or fraction thereof of contract, but not less than one set for any one day's operations, and not less than one set of (3) cylinders for each 5000 square feet of surface area for walls and slabs shall be taken. Surface area shall be considered the area of one face of wall or slab. All cylinders shall be cured under the same

conditions as job concrete. Job cylinders shall be identified at the time cast as to which pour is represented.

The Contractor shall ship or deliver two (2) cylinders to the laboratory on the fourth day, one of which is to be tested on the seventh day, the other to be laboratory cured and tested on the twenty-eighth day. One (1) cylinder shall be shipped on the twenty-fourth day and tested on the twenty-eighth day.

The Contractor shall furnish the City three (3) copies of test reports for concrete test cylinders. Unsatisfactory tests of job cylinders shall make the concrete concerned subject to rejection, with consequent removal and replacement by the Contractor at his expense.

Cold Weather Requirements. Placing of concrete in cold weather shall conform to ACI 306 – Cold Weather Concreting in addition to the following specifications. No concrete shall be placed on iced or frozen subgrade or when temperature is below thirty-two degrees Fahrenheit (32° F.). Concreting shall not be continued when the air temperature is below forty degrees Fahrenheit (40°F.) unless the following conditions are attained:

- a. Mixing water shall be heated to a maximum of one hundred fifty degrees Fahrenheit (150°F.).
- b. Aggregates shall be heated until free of all ice and frost.
- c. The concrete temperature after mixing shall be between fifty degrees Fahrenheit (50°F.) and seventy degrees Fahrenheit (70°F.) if the air temperature is twenty degrees Fahrenheit (20°F.) to forty-five degrees Fahrenheit (45°F.).
- d. After the concrete is placed, it shall be covered, protected, and heated so as to maintain a maximum of seventy degrees Fahrenheit (70°F.) air temperature for the first twenty-four (24) hours and fifty degrees Fahrenheit (50°F.) air temperature for the next six (6) days.
- e. Moist conditions shall be maintained during the heating period.
- f. All covering, heating equipment, etc., shall be on hand and approved by the Engineer before any concrete is placed.

Admixtures shall be used only with the approval of the Engineer. Calcium chloride is not an acceptable admixture.

Hot Weather Requirements. Placing of concrete in hot weather shall conform to ACI 305 – Hot Weather Concreting in addition to the following specifications. No exposed concrete is to be placed in air temperatures above one hundred degrees Fahrenheit (100°F.). Cover, protect and cool work as required to maintain the temperature of the concrete below one hundred degrees Fahrenheit (100°F.). The concrete temperature, after mixing shall not be greater than eighty-five degrees Fahrenheit (85°F.). Spray and/or shade aggregate piles and cool mixing water is required.

250.2.2. Reinforcing steel shall conform to the requirements of Section 238 of these specifications

### 250.3. Construction

250.3.1. Forms for Concrete Structures. Forms shall conform to the shape, lines and dimensions of members called for on plans, and shall be sufficiently rigid and tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain their position and shape when concrete is tamped or vibrated. Forms may be constructed of:

- a. Lumber, No. 2 or better, with a minimum thickness of one (1) inch, and containing no holes or loose knots. Ship lap may be used where so specified on the plans. Form liners shall be one-fourth (1/4) inch plywood or approved fiber board on one (1) inch solid backing.
- b. Plywood forming material may be used if three-fourths (3/4) inch plywood forms have studs on sixteen (16) inch centers or five-eighths (5/8) inch plywood forms have studs on twelve (12) inch centers.
- c. Steel forms may be used if of a reputable manufacturer and in first class order, free from dents, etc.

All exposed corners and edges shall be provided with three-fourths (3/4) inch chamfer. Cleanouts shall be provided as required to remove sawdust and debris. All contact surfaces shall be oiled sparingly.

Wall form ties shall be steel of the loop or snap type with one and a half (1 1/2) inch breakback and with a cone the full depth and not larger than one (1) inch diameter. For other forms use pencil rods and cut back inside the concrete.

The Engineer's approval of forms shall be required before any concrete is placed.

250.3.2. Placing Reinforcing Steel. All reinforcing shall be free from scale, rust or coatings which will reduce the bond on the concrete. Bars shall be accurately bent and placed as indicated on the shop drawings and securely supported and tied with #16 annealed iron tie wire at all intersections to prevent movement during the placement of concrete.

Lap and tie the reinforcing steel together at splices. Splices shall be staggered as shown on the plans.

Reinforcing steel shall be placed for minimum concrete coverage as follows:

- a. Three (3) inch for bottom steel in footings and slabs poured on subgrade
- b. Two (2) inch from surface to be exposed to water or earth backfill
- c. One and a half (1 1/2) inch for walls, beams and columns above ground

- d. One (1) inch from top of slabs

Consult the plans for any exception to the above.

The Engineer's approval is required at the completion of placing reinforcing steel prior to the placing of any concrete.

250.3.3. Placing Concrete. Prior to placing concrete, all water shall be removed from excavations; no concrete shall be placed under water; subgrade for slabs less than twelve (12) inches thick shall be dampened. All debris shall be removed from the forms.

Wall concrete shall be placed continuously in horizontal layers of eighteen (18) inch lifts. Placing locations shall not be more than ten (10) feet apart. Tremies are required when the concrete has to be dropped farther than five (5) feet. Surface water shall be drained off and mixing water shall be reduced as required in the top layers of deep pours.

The working face of the concrete shall be kept plastic and "alive." High frequency vibrators shall be used at all times, supplementing as required with hand tamping, slicing, etc. Avoid vibrator contact against finished face forms of reinforcing steel adjacent to partially set concrete. Vibrators shall not be used to move or push the concrete laterally. Avoid over-vibrating.

Concrete shall be protected against rain or immersion under water for at least twelve (12) hours.

250.3.4. Construction Joints. Construction joints shall be made only at points shown or noted on the Plans, except when otherwise approved by the Engineer. Vertical construction joints in the reinforced concrete boxes shall be spaced at a maximum of thirty (30) feet on center. Reinforcing shall be carried continuously through all construction joints. Construction joints shall be formed straight and true with finished edges.

Where a joint is to be made, the surface of the concrete shall be thoroughly cleaned and all laitance removed. The joint shall be thoroughly wetted and slushed with a coat of cement grout immediately before placing of new concrete. Grout shall be mixed using a ratio of one (1) to two and a half (2 1/2) parts of cement to sand.

250.3.5. Removing Forms. Remove forms only after concrete has safe and sufficient strength and only with approval of the Engineer.

250.3.6. Concrete Finish. Immediately after the removal of forms, the Engineer will examine the exposed concrete. Any concrete not conforming to the lines and grades shown on the Plans, or which shows poor joints, voids, stone pockets, honeycomb and otherwise defective areas shall be considered as not conforming with these specifications, and shall be replaced by the Contractor at his expense, except in cases where the Engineer approves patching the defective parts of the structures. Permission to patch any defective parts of the structure shall not waive the Engineer's right to require the replacement of defective parts if the patching does not, in his opinion, satisfactorily restore the quality and appearance of these defective parts.

Specific concrete finishes required will be as follows:

- a. Top of drainage structure to slab: sand float.
- b. Inside of drainage structure top slab and walls: form-finish with rough spots as well as honeycombing removed; ties to be broken and tie holes grouted.
- c. Drainage structure floor slab: sand float.
- d. Outside of structure wall: ties to be broken and tie holes grouted with honeycombing removed.
- e. Exposed structural concrete surfaces: hand rubbed to a smooth finish with a carborundum brick until form prints are removed.

250.3.7. Curing of concrete shall be maintained continuously for seven (7) days after placing the concrete. Concrete temperature is to be maintained between fifty degrees Fahrenheit (50°F.) and one hundred degrees Fahrenheit (100°F.). Moisture is to be retained in the concrete by the following means:

#### Walls and Structures

- a. Cover with tarps and leave form on seven (7) days, or
- b. Cover with cotton batts continuously wet seven (7) days, or
- c. Spray approved membrane, one (1) gallon to two hundred (200) square feet for unfinished surfaces only.

#### Slabs

- a. Pond, or wet cotton batts, or two (2) inch wet sand blanket, or curing paper with sealed edges. Apply immediately after finishing.

250.3.8. Welding. All welding shall be shielded arc, fusion welding, made in conformity with the requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the A.I.S.C. and the American Welding Society D1.1 Structural Welding Code-Steel, as amended to date. Methods employed and technique shall be subject to the approval of the Engineer.

250.3.9. Maintenance of Storm Sewers During Construction. All storm sewers, drain lines, and appurtenances installed under this Contract must be kept reasonably clean during construction. The Contractor shall at all times maintain the storm sewers and appurtenances so as to prevent obstructing surface water.

250.3.10. Protection from Vandals. It will be the Contractor's responsibility to protect fresh concrete from vandals during the curing process. Any concrete work damaged by vandals will be inspected by the Engineer and subject to removal if the Engineer judge the damage to

create a safety hazard, or would accelerate deterioration of the concrete surface, or if the damage area is unsightly and detracts from the overall aesthetics of the project.

250.4. Basis of Payment. Unless provided otherwise, all concrete structures, complete in place, will be paid for at the Contract unit price per cubic yard, measured to the nearest one-tenth (1/10) cubic yard, which payment shall be full compensation for furnishing and installing all concrete and reinforcing steel, all forming, all excavation and backfill required as set forth in these specifications, and all other labor and incidental items necessary to complete the structures in accordance with the detailed drawings and these specifications. Payment will be made under:

Item No. 250.1. Structural concrete, per cubic yard.



## SECTION 260

### STORM SEWERS

260.1. Description. Storm sewer construction shall consist of furnishing all labor, materials and equipment for the complete installation of sewers and appurtenances in accordance with the standards, drawings, general conditions, and detail specifications. Unless indicated otherwise in these specifications, the word "Sewer" shall refer to pipe sewers, box culvert sewers, or paved channels.

260.2. Standards. Whenever any reference is made to ASCE, ASTM, AASHTO, AWWA, and ASA Standard Specifications, the specification referred to shall be understood to mean the latest revision of said specifications or standards as amended to date of letting of Contract. RCP, HP, HDPE, and CMP shall be the only pipe material used in the right of way. Only RCP and HP shall be used under arterials, collectors, and cul-de-sacs. In situations where the pipe enters or exits the right of way directly to or from an inlet or junction (i.e. not paralleling the pavement) HDPE and CMP may be used. HDPE and CMP may be used under driveways on any class of unimproved street.

	Acceptable location		
Pipe	Right of Way: Arterials, Collectors, Cul-de-sacs	Right of Way: Local Roads	Easements
RCP	X	X	X
HP	X	X	X
HDPE		X	X
CMP		X	X

#### 260.3. Materials.

260.3.1. Concrete. Concrete used in the construction of concrete storm sewers and drainage structures and appurtenances shall conform to Section 250 - Concrete Structures.

260.3.2. Reinforced Concrete Pipe (RCP). All reinforced concrete pipe shall conform to ASTM Designation C 76. RCP shall be Class III with a D-load of 1350. This specification covers reinforced concrete pipe of twelve (12) to one hundred eight (108) inches, depths of fill of up to 13 feet above pipe, and is intended for use in conveyance of storm water and for the construction of culverts. All other installations shall be approved by the Engineer.

The interior surfaces of the pipe shall be a smooth true cylindrical surface free from undulations or corrugations. Each pipe shall be marked by the manufacturer with a "Q Cast" stamp to certify the pipe was produced by an American Concrete Pipe Association (ACPA) certified plant. The following additional information shall be clearly marked on the inside of each section of pipe by indenting on the pipe section or by painting thereon with waterproof paint:

- a. Pipe class.
- b. Date of manufacture.
- c. Name or trade-mark of the manufacturer.

260.3.3. High Density Poly Ethylene Pipe (HDPE). All HDPE pipe shall conform to AASHTO M294, Type S. HDPE pipe to be ADS N-12 WT IB (water tight, integral bell) smooth interior, dual wall or approved equal. For 48" diameter pipe and smaller, minimum cover shall be one foot. For 54" and 60" diameter pipe, minimum cover shall be two feet. All HDPE pipe shall contain a minimum content of 2% carbon black as required by ASTM D3350. Pipe shall be furnished with an integral reinforced bell with a bell tolerance device and elastomeric gasket to meet ASTM F477 and ASTM D3212.

260.3.4. Cast Iron Castings.

- a. Cast Iron: All iron castings used in connection with storm sewers and their appurtenance structures (manhole and catch basin rings and covers, catch basin castings, inlet plates and grating, manhole steps or ladder irons, etc.) shall be made from tough, gray iron of even grain and tensile strength of not less than 35,000 pounds per square inch, conforming to ASTM Designation A 48, Class No. 35B. The castings shall conform to the shapes and dimensions shown on the standard drawings, be clean and whole, and without blow or sand holes or other defects, and all parting fins and pouring gates shall have been removed. No plugging or filling in of holes will be permitted and all such castings, except the buried portion of manhole steps or ladder rungs shall be cleaned and painted with one (1) coat of coal tar before being delivered to the site.

260.3.5. Not used.

260.3.6. Corrugated Metal Pipe (CMP). Wherever shown on the plans and profiles, or required by the Engineer, corrugated metal storm sewer culvert pipe, complete with connecting bands, elbows, and fittings, may be used.

CMP shall be aluminized type 2 (AASHTO M36 & M274) or polymeric precoated (AASHTO M36, M245 & M246) galvanized (AASHTO M36 & M218) sheet or coils. Polymeric coating shall be Dow "TRENCHCOAT" or approved equal, 10 mils thick on both inside and outside of pipe.

Corrugated metal culvert pipe gage requirements shall conform to the specifications of the following table unless otherwise specified by the plans and specifications or by the Engineer.

Where zinc coated sheets and coils (M218) are to be used, the gage requirements of the following tables shall be increased to the next heaviest gauge.

### Circular Culvert Pipe

<u>Diameter</u>	<u>Gage</u>	<u>Diameter</u>	<u>Gage</u>
12"	16	42"	14
15"	16	48"	14
18"	16	54"	12
24"	16	60"	12
30"	16	72"	10 up to 16 feet
36"	16		

### Arch Culvert Pipe

<u>Equivalent Diameter</u>	<u>Gage</u>	<u>Span</u>	<u>Rise</u>
15"	16	18"	11"
18"	16	22"	13"
21"	16	25"	16"
24"	14	29"	18"
30"	14	36"	22"
36"	14	43"	27"
42"	12	50"	31"
48"	12	58"	36"
54"	12	65"	40"

Wherever corrugated metal culverts are installed on railroad property which is occupied by tracks or which may be occupied by tracks at any time in the future, then it shall conform to the A.R.E.M.A. "Specifications for Corrugated Metal Culverts."

<u>Diameter of Pipe</u>	<u>Minimum Gage of Metal</u>
12" to 18"	14
20" to 24"	12
26" to 36"	10
38" to 60"	8

Pipes larger than sixty (60) inches require special considerations and special specifications.

Corrugated metal storm sewer pipe shall be handled in such a manner that it is not chipped, dented or bent. If in handling the culvert the base metal is exposed in any way then it shall be rejected or repaired to the satisfaction of the Engineer.

260.3.7. High Performance Polypropylene Pipe (HP). HP pipe shall have a smooth interior and an annular corrugated exterior. Twelve (12)-inch through sixty (60)-inch HP pipe shall meet or exceed ASTM F2881 and AASHTO M330. The HP pipe is intended for use in conveyance of storm water and for the construction of culverts.

The minimum depth of fill above the pipe shall be one foot for twelve (12)-inch through forty-eight (48)-inch HP pipe. The minimum depth of fill above the pipe shall be two feet for sixty (60)-inch HP pipe. The maximum depth of fill above pipe shall be 9 feet. Backfill for minimum and maximum applications shall meet manufacture's specifications. All other installations shall be approved by the Engineer.

Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2881, Section 5 and AASHTO M330, Section 6.1.

All drainage structures used with HP pipe, including inlets, junction boxes, and flared end sections, shall be precast concrete, as specified for RCP pipe.

260.3.8. Encasement Pipe. When circular corrugated iron lineal plate or structural plate pipes or tunnels are installed on railroad property which is occupied by tracks or by tracks at any time in the future, then it shall conform to A.R.E.M.A. "Specifications for Corrugated, Structural, Plate Culverts and Arches." The minimum gage of the metal shall be as follows:

<u>Neutral Axis Diameter</u>	<u>Minimum Gage</u>
48"	8
60"	8
62"	7
72"	7
74"	5
84"	5

#### 260.4. Joints for Reinforced Concrete Pipe.

260.4.1. Flexible Compression Joints. Flexible compression joints may be made with rubber gasket, rubber "O" rings, preformed plastic compound, mastic, or butyl sealants. Rubber gasket and rubber "O" rings which shall conform with ASTM C 443. Preformed plastic compound shall be either rope form or flat tape form conforming to ASTM C990. Primer, as recommended by the manufacturer, shall be used to maintain the material in position while pipe sections are being joined. Mastic and butyl sealants may be used in accordance with ASTM C990. Mastic shall be applied to the bottom half of the bell or groove and the top half of the spigot or tongue.

#### 260.5. Joints for High Density Poly Ethylene Pipe.

260.5.1. Pipe shall be joined using a bell & spigot joint meeting AASHTO M252, AASHTO M294 or ASTM F2306. The joint shall be water-tight according to the requirements of ASTM D3212 and gaskets, when applicable, shall meet the requirements of ASTM F477. Gaskets shall be factory installed with a removable wrap to ensure gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly. Field joints shall provide circumferential and longitudinal strength to maintain the pipe alignment, prevent separation of pipe and prevent infiltration of fill material.

260.5. Not Used.

260.6. Not Used.

#### 260.7. Joints for High Performance (HP) Polypropylene Pipe.

260.7.1. Pipe shall be joined with a gasketed integral bell and spigot joint meeting the requirements of ASTM F2881, for applicable diameters. HP pipe shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. HP pipe shall have a reinforced bell with a polymer composite band installed by the manufacturer.

Fittings shall conform to ASTM F2881, for applicable diameters. Bell and spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Fitting joints shall meet the watertight joint performance requirements of ASTM D3212.

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Use manufacturer's recommendation for leakage rates.

#### 260.8. Sewer Construction.

260.8.1. Excavation and Backfill. All excavation for structures, trench excavation, and backfilling for storm sewer construction and all related work shall be performed in accordance with Section 201 of the specifications. RCP shall be considered rigid pipe. HDPE and CMP shall be considered flexible pipe.

##### 260.8.2. Pipe Bedding.

260.8.2.1 RCP. Pipe shall be bedded according to the Type 3 installation as recommended by the American Concrete Pipe Association and details bound in this manual.

260.8.2.2 CMP and HDPE. Pipe shall be bedded according to manufacturer's recommendations and the details for flexible pipe bound in this manual.

Should any excess material be removed from the ditch bottom, the space shall be filled with the approved material and thoroughly tamped, with a pneumatic tamper to the satisfaction of the Engineer, or replaced with a six (6) inch thick layer of approved granular material on top of other approved compacted materials.

Regardless of the method used to transfer the line and grade from the stakes to the sewer, each pipe shall be checked for line and grade using a method approved by the Engineer.

260.8.3. Laying the Pipe. All pipe shall be protected during handling against shock and free fall.

RCP shall, at the Contractor's option, be furnished with factory cast lift holes. Lift holes shall be 2.5 inches in diameter or less for pipes with inside diameter of 60 inches or less. Lift holes shall be 3.5 inches in diameter or less for pipes with inside diameter greater than 60 inches. No more than two (2) holes will be allowed in any one (1) piece of pipe. Drilling of lift holes on site is not acceptable. Any rebar visible in a lift hole shall be cause for rejection. Lift holes shall be plugged with a pre-manufactured plug designed specifically for plugging RCP holes (Popit or equal) or grouted full. The filled hole shall then be covered with an adhering sheet membrane (Grace Ice and Water Shield or equal) or a coat of bituminous material. Regardless of the method used, Contractor shall be responsible for the final water tightness of the pipe.

The laying of pipe in finished trenches shall be commenced at the lowest point and installed with the bell end forward or upgrade. All pipe shall be laid with ends abutting and true to line and grade established with a laser. They shall be carefully centered so that when laid they will form a sewer with a uniform invert.

Each piece of pipe shall be checked for vertical and horizontal alignment immediately after being laid.

Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed, or of the factory made jointing materials, shall be clean and dry. Lubricants, primer, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications.

The joints shall be wiped inside, removing all surplus joint compound and dirt from the interior of the pipe. Twelve (12) inch pipe and smaller shall be wiped by means of a disc attached to a rod not less than four (4) feet long worked continuously through the line of pipe.

When cement mortar, Kalktite or other approved joint compounds are used to make the joint in reinforced concrete pipe, it shall be made as follows:

In the bottom half of the bell shall be placed a sufficient amount of joint compound to thoroughly fill the annular space, and the next pipe inserted into place. The remainder of the annular space shall be completely filled on the inside and outside of the joint, around the circumference of the pipe, and the joint wiped on the inside of the pipe to remove all excess joint material.

No pipes may be trimmed unless by order of the Engineer. Pipes having defects that do not cause their rejections shall be so laid as to place these defects where they will be of least consequence.

Trenches shall be kept water-free and as dry as possible during bedding, laying and jointing and for as long a period as required to protect the pipe joints and concrete in structures.

As soon as possible after the joint is made, sufficient material shall be placed alongside each side of the pipe to offset conditions that might tend to move the pipe off line and grade.

#### 260.9. Manholes and Junction Chambers.

260.9.1.       Precast Manholes. Precast manholes shall be constructed as shown in the standard drawings, as specified herein and as directed by the Engineer.

260.9.2.       Manhole Base and Invert. The manhole base and invert shall conform to Section 250 of these specifications. All bases and inverts shall be poured individually in one continuous pour for each, unless otherwise specified and particular care taken to make channels smooth and perfect. All manhole inverts and bases shall conform to the applicable manhole standards.

Precast manhole bases may be used with precast manholes provided the design of the base has been approved.

260.9.3.       Manhole Rings and Covers. The rings and covers of all manholes shall be set at the elevation shown on the drawings and solidly built into place. Concrete rings shall be grouted with cement mortar.

Plastic adjusting rings shall be injection molded-recycled HDPE as manufactured by LADTECH, Inc. or approved equal and installed as per manufacturer's recommendations. The manhole adjusting rings shall be molded from high density polyethylene as defined in ASTM Specification D-4976. The annular space between the rings and cone basin, the rings, and the rings and cover frame shall be sealed utilizing an approved butyl sealant. The Contractor shall utilize flat and sloping units to match the required slope and or grade of the structure.

260.10.       Inlets.

260.10.1.       Precast inlets shall be constructed in accordance with the standards or approved equal. Concrete for precast concrete inlets shall conform to Section 250 of these specifications.

260.10.2.       Reinforced concrete inlets shall conform to the standard drawings and Section 250 of these specifications. Concrete cover over steel reinforcement shall be not less than one (1) inch for covers and one and one-half (1 1/2) inches for walls and floors. All exposed concrete shall have smooth steel trowel or brushed finish. Interiors of structures shall have the forms removed and surface voids filled.

260.11.       Reinforced Concrete Box Culverts.

260.11.1.       General. Reinforced concrete box culverts shall be constructed in strict accordance with this section and Section 250 of these specifications.

260.11.2 .       Composition of Concrete. To determine the actual mixed proportions of cement, aggregates and water proposed for use on the project, the Contractor shall furnish all the information required by the testing laboratory retained by the Engineer. The testing laboratory will proportion a concrete mix based upon the requirements of these specifications and will determine the compressive breaking strength of these specimens at seven (7) days and will determine that the mix is in strict compliance with the specifications.

260.12.       Paved Ditches and Rip-Rapping. Paving concrete for paved ditches shall



conform to Section 250 of these specifications and shall correspond with the standard drawings or approved equal.

The material for riprap shall consist of a predominantly one-sized, durable stone, shot rock or broken concrete. Acceptance by the Engineer may be made by visual inspection. Riprap material shall be either Type 1 or 2 per below.

Type 1 Riprap shall consist of at least 40 percent of the mass being pieces having a volume of one cubic foot or more.

Type 2 Riprap shall consist of at least 60 percent of the mass being pieces having a volume of one cubic foot or more.

A geotextile material shall separate the subgrade from the riprap. Geotextile material shall be AASHTO M288-96 Class 2 with a minimum permittivity of  $1.0 \text{ sec}^{-1}$  and an apparent opening size of 0.22 mm MARV. Lap seams per manufacturers recommendations.

Riprap shall be placed to the approximate shape and thickness shown on the plans for the specified ditch or as directed by the Engineer. The rock shall be dumped on a subgrade of reasonably uniform density and left in a rough condition meeting the approval from the Engineer.

Grouted riprap shall not be allowed unless approved by the Engineer.

260.13. Toewalls. A toewall or extension plate shall be provided where any pipe daylights.

260.14. Headwalls, Wingwalls and Endwalls. Design of these structures shall conform to the standards attached or to the approved details as submitted by the Engineer. Concrete shall conform to Section 250 of these specifications.

260.15. Railroad Crossings. Wherever a railroad crossing is being constructed beneath or at grade the necessary permit for the construction will have been previously secured by the Contractor. It shall also be the responsibility of the Contractor to contact the railroad company prior to beginning of such crossings, and to proceed with the construction as directed by the railroad company.

All railroad crossings shall be made at right angles to the railroad tracks wherever possible, and shall be laid by jacking or tunneling.

260.16. Traffic. Provision shall be made for taking care of traffic in accordance with Section 241 of these specifications and as may be provided in Special Provisions of the Proposal. Contractor shall protect installed material from damage from construction loads.

260.17. Existing Utilities. The Contractor shall provide for existing utilities in accordance with Section 4.4 and 201.9 of these specifications.

260.18. Replacement of Pavement. All pavement, surfacing, driveways, curb,



walks, buildings, utility poles, guy wires, and other surface structures affected by construction operations in connection with the performance of the Contract, together with all sod and shrubs in yards, parks, and parking lots, shall be maintained and if removed, or otherwise damaged, shall be restored to the original condition thereof, as determined and approved by the Engineer, unless otherwise specified on the plans.

The Contractor shall be responsible for, including any damage caused by settlement of backfill placed beneath pavements, street, road, and driveway surfacing, and drainage and other structures, and beneath sod in yards, parking lots, and parks, which may occur at any time prior to, and during the correction period after the date of final acceptance of the work covered by the Contract; during such period the Contractor shall at his own cost and expense refill all excavations where backfill damage to structures, pavements, surfacing, and sod caused by such settlement, to the satisfaction of the City. Should the Contractor fail to repair settlement which may occur as described above within thirty (30) days after being given notice thereof, the Owner shall have the right to repair such settlement and charge the cost of such repairs to the Contractor.

The Contractor will be held responsible for all damage to roads, highways, shoulders, ditches, embankments, bridges, culverts and other property, caused by him or any of his Subcontractors in hauling or otherwise transporting materials to and from the several sites of the work, regardless of the location of such damage. The Contractor shall make arrangements relative to the payment for, or repair or replacement of, such damage or damaged surfaces or structures which are satisfactory and acceptable to the Owners or Owner of such damaged surfaces or structures, or to their legally responsible officers, agents or other representatives, at the Contractor's own cost and expense.

260.19. Video Inspection. All storm drains including pipes, inlets, junction boxes, etc. shall be inspected using a video camera. Immediately prior to video inspection all storm drain facilities must be flushed with clean water, debris flushed from the facilities must be removed and properly disposed. The contractor shall provide and run a video camera to check for the presence of sags or other evidence of improper construction. The video shall show the restoration of all surface areas disturbed during construction as well as document that the tops of all inlets and junction boxes are properly adjusted to grade.

1. Furnish one copy of the video to Stormwater Utility. Video shall comply with the following requirements:

- a. Full color (Not black and white)
- b. Date and time of inspection
- c. Inlet and Junction Box labels
- d. Real time stationing of camera in pipe
- e. Inspection of all joints, fittings, and lateral connections
- f. Locations of observed deficiencies (i.e. bad joints, breaks, leaks, infiltration, etc.)
  - g. Pipe ponding in excess of ¾" identified by location
  - h. Minimum resolution of 800x600 pixels
  - i. Single sided DVD or CD utilizing MPEG compression
- j. DVD/CD and box shall be labeled with manhole numbers, project title, and date

2. The City of Columbia reserves the right to reject storm drains based upon the video inspection, and complete own video inspection.
3. Faulty sections of storm drains, junction boxes or inlets rejected by the City shall be repaired or replaced at the Contractors expense to produce a like new product in a manner acceptable to the Engineer.
4. The Contractor shall provide the City a video inspection to document the repair or replacement of any rejected work.
5. Camera Speed shall not be greater than 30 feet per minute.
6. Payment. There will be no direct payment for testing and inspections. The cost and expense of such work to the Contractor must be included in the price of the bid for storm drains and concrete structures.
  - a. The City of Columbia may complete a video inspection at no cost to the Contractor for the first video inspection.
  - b. All subsequent inspections completed by the City of Columbia will have a fee associated with it.

260.20. Measurement and Payment.

260.20.1. Pipe. Pipe shall be measured to the nearest lineal foot of the various sizes and types installed. This unit price shall include trenching, installation, pipe materials, bedding, backfill, compaction, restoration of private property, and all other items required to complete the installation of the pipe. Payment will be made under:

- Item No. 260.1. Reinforced concrete pipe, per lineal foot
- Item No. 260.2. High density polyethylene pipe, per lineal foot
- Item No. 260.3. Cast iron pipe, per lineal foot.
- Item No. 260.4. Vitrified clay pipe, per lineal foot.
- Item No. 260.5. Corrugated metal pipe, per lineal foot.

260.20.2. Standard Drainage Structures and Appurtenances. Standard drainage structures shall be measured as a unit, complete and in place of the various types constructed. Payment will be made under:

- Item No. 260.6. Description of structure, per each unit.

260.20.3. Reinforced Concrete Box Culverts and Special Concrete Structures. Reinforced concrete box culverts, special concrete structures, headwalls, wingwalls, endwalls, and paved channels may be measured by the lineal foot or by the cubic yard of concrete in accordance with Section 250, whichever is specified in the proposal form, and payment will be made accordingly for structures complete and in place, at the Contract unit price.

260.20.4. Connection to Existing Structures. The connections to existing structures

required during construction shall be measured as a unit, complete. Payment will be made at the Contract unit price for connection to existing structure.

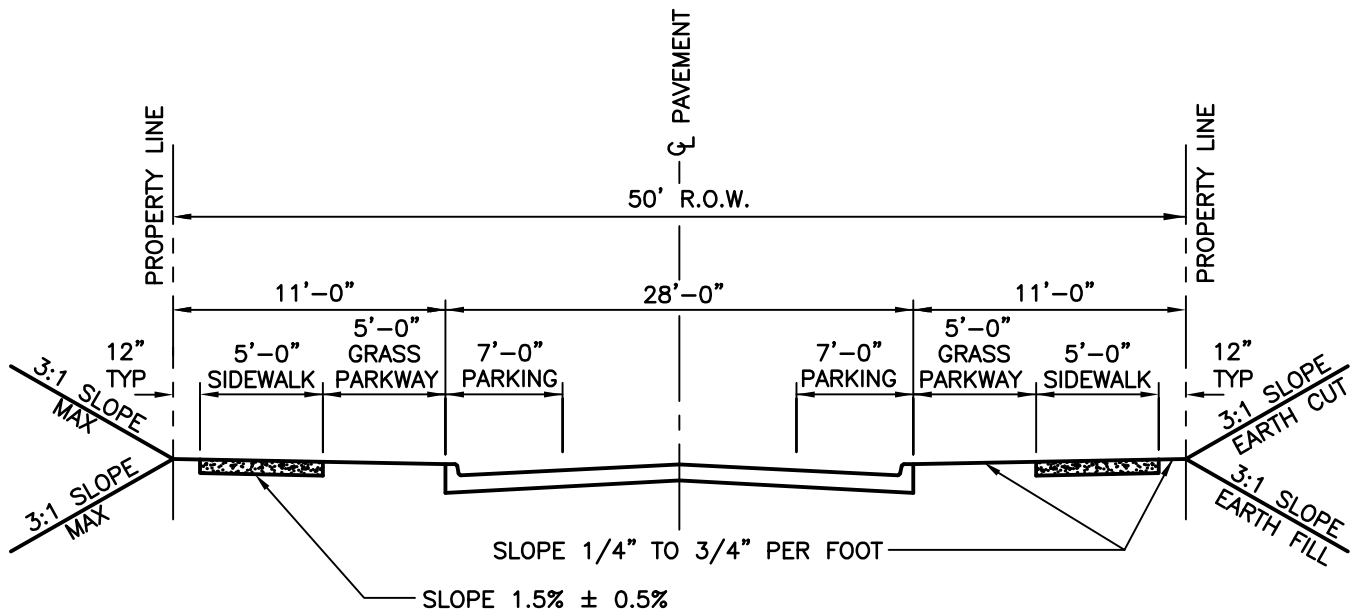
Item No. 260.7. Connection to existing structure, per each.

260.20.5. Pavement Replacement. Pavement replacement, whether asphaltic or concrete pavement, shall be measured by the square yard of acceptable material replaced within the project limits. Payment will be at the Contract unit price under:

Item No. 260.8. Concrete/Asphaltic pavement replacement, per square yard.

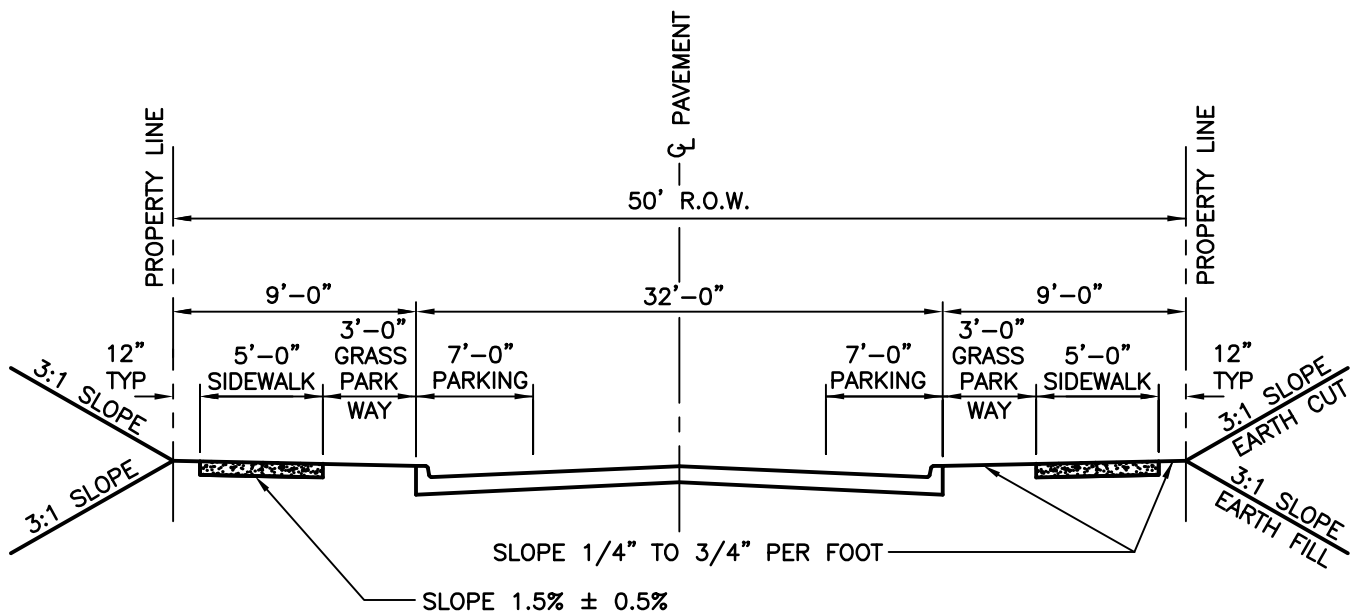
260.20.6. Riprap. Riprap, including excavation and geotextile, shall be measured by the square yard. Payment will be made at the Contract unit price under:

Item No. 260.9. Riprap Type 1 or 2, per square yard.



### 28 FT. PAVEMENT

(Standard Residential Street)



### 32 FT. PAVEMENT

(Residential Feeder)

#### NOTE:

SEE CROSS SECTION SHEETS FOR VARIATIONS DUE TO ROCK EXCAVATION.  
EXISTING LAWN GRADES, ETC. SEE PLAN SHEETS FOR LOCATION OF  
PAVEMENT AND SIDEWALKS WITHIN RIGHT-OF-WAY.  
SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.00%.

  
Approved

07/01/20  
Date

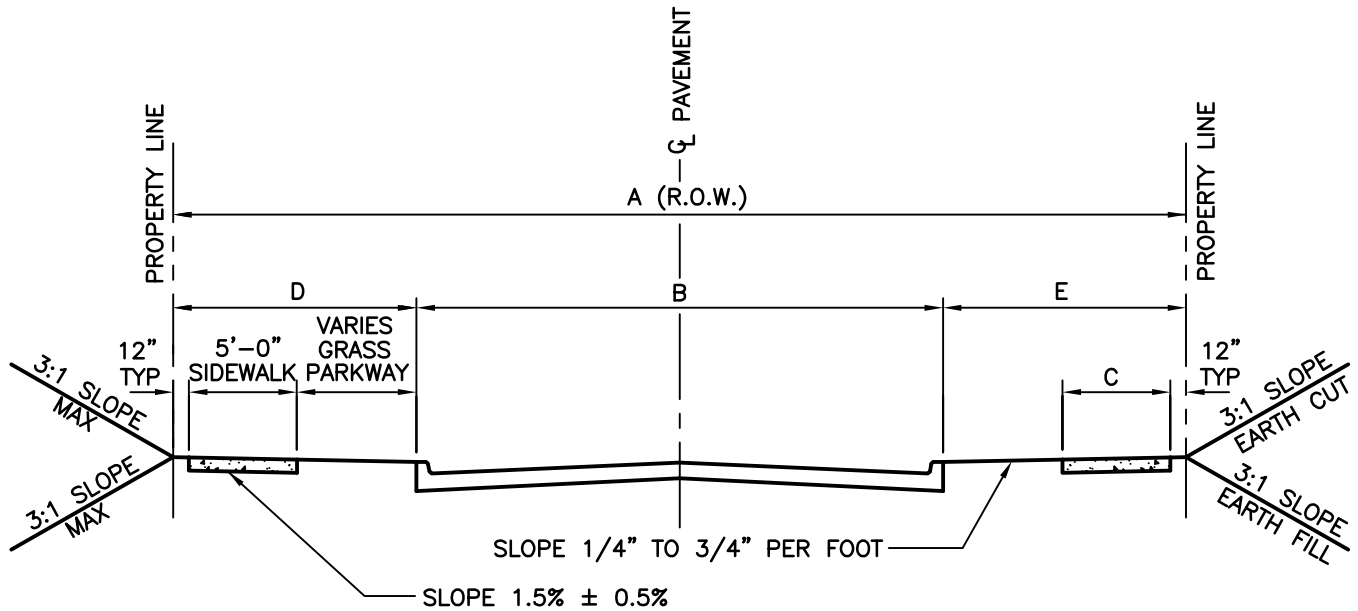
#### Revisions



City of Columbia  
Public Works Department

## RESIDENTIAL STREET TYPICAL CROSS SECTIONS

110.01



**NOTE:**

SEE CROSS SECTION SHEETS FOR VARIATIONS DUE TO ROCK EXCAVATION. EXISTING LAWN GRADES, ETC. SEE PLAN SHEETS FOR LOCATION OF PAVEMENT AND SIDEWALKS WITHIN RIGHT-OF-WAY. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.00%.

	A	B	C	D	E	F
1	ITEM	A	B	C	D	E
2	NON-RESIDENTIAL STREET	66'	36'	5'	15'	15'
3	NON-RESIDENTIAL STREET OPTION A	60'	30'	5'	15'	15'
4	NON-RESIDENTIAL STREET OPTION B	60'	30'	5'	15'	15'
5	NON-RESIDENTIAL STREET OPTION C	66'	38'	5'	14'	14'

  
Approved

07/01/20  
Date

Revisions



City of Columbia  
Public Works Department

# LOCAL NON-RESIDENTIAL STREET TYPICAL CROSS SECTION

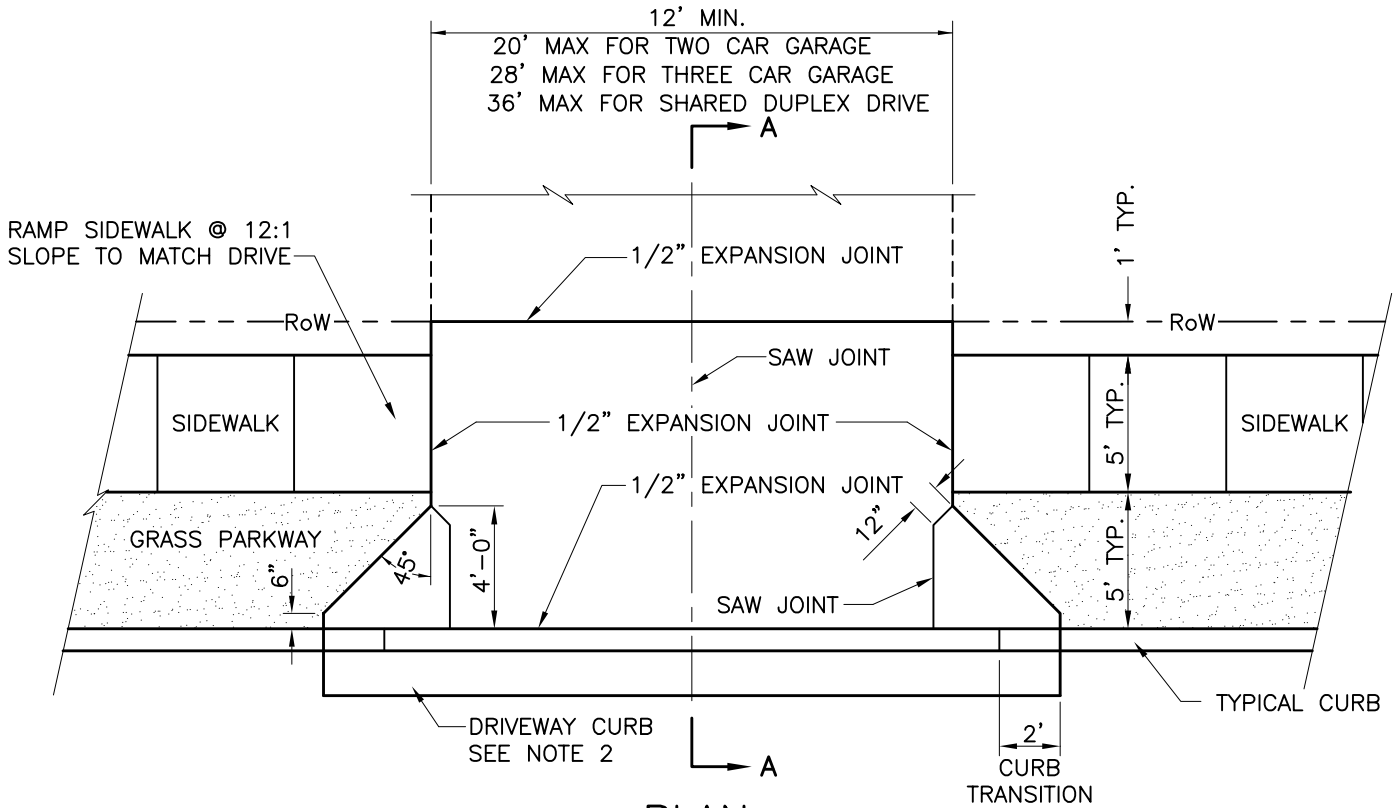
110.03



**GENERAL NOTES:**

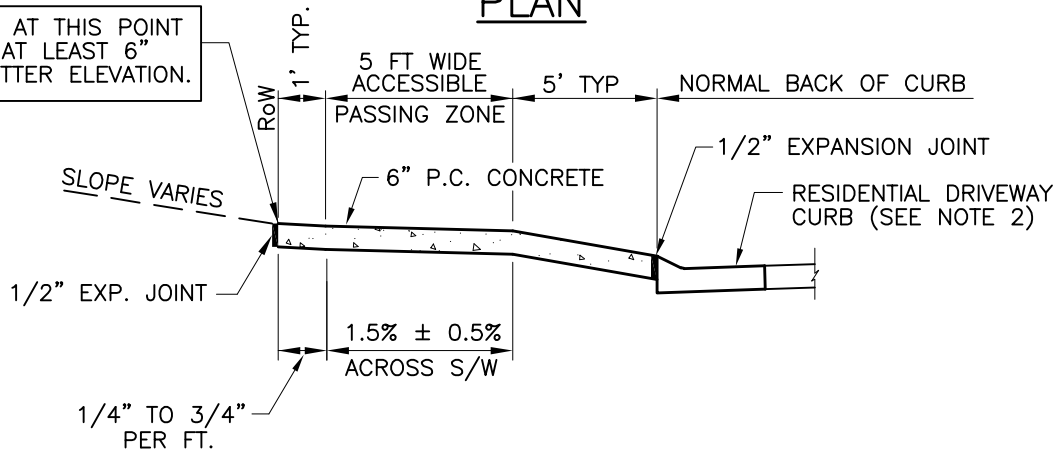
1. MATERIALS. HANDRAIL SHALL BE ORNAMENTAL STEEL OF THE SIZE AS DETAILED. TAILINGS SHALL BE CONSTRUCTED OF BAR SECTIONS AS DETAILED.
2. THE FENCE SHALL BE MONTAGE PLUS 2/3 RAIL MAJESTIC (BY AMERISTAR FENCE), WINDSOR PLUS (BY JERITH FENCE), UAF-200 (BY ULTRA FENCE), OR APPROVED EQUAL. THE COLOR OF THE FENCE SHALL BE BLACK. THE MAXIMUM FENCE POST SPACING SHALL BE 8'.
3. RAILS AND BASE PLATES SHALL BE SET PARALLEL TO TOP OF SLAB. ALL POSTS AND BALUSTERS SHALL BE SET VERTICAL. GROUT SHALL BE USED BETWEEN CONCRETE AND BASE PLATE OF POST.
4. ALL MATERIAL, LABOR, SPLICES, GROUT, AND INSTALLATION SHALL BE PAID FOR UNDER THE BID ITEM "PEDESTRIAN FENCE" PER LINEAR FOOT.
5. A GROUTED LEVELING PAD SHALL BE USED TO ERECT THE POSTS VERTICAL. THE LEVELING PADS SHALL BE A NON-SHRINK GROUT AS APPROVED BY THE ENGINEER. THE GROUT SHALL BE MIXED, APPLIED AND CURED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.
6. CONCRETE ANCHORS, NUTS AND WASHERS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 AND SEC.1081.
7. NUTS SHALL CONFORM TO ASTM A307. NUTS SHALL BE REGULAR HEXAGON TYPE. WASHERS SHALL BE OF STANDARD COMMERCIAL QUALITY.
8. THE CONCRETE ANCHORS SHALL HAVE A MINIMUM ULTIMATE PULLOUT STRENGTH OF 7900 LBS. BASED ON THE CONCRETE. THE LENGTH OF EMBEDMENT INTO CONCRETE SHALL CONFORM TO MANUFACTURER'S RECOMMENDATIONS.

<div data-bbox="126 1816 259 1879"></div> <div data-bbox="289 1843 393 1894"><div>07/01/20</div><div>Date</div></div> <div data-bbox="214 1902 310 1929">Revisions</div>	<div data-bbox="464 1824 558 1919"></div> <div data-bbox="418 1919 597 1988">City of Columbia Public Works Department</div>	<div data-bbox="639 1875 1243 1927">STEEL PEDESTRIAN FENCE</div>	<div data-bbox="1315 1875 1500 1927">140.01B</div>
---	--	--	--



## PLAN

ELEVATION AT THIS POINT  
MUST BE AT LEAST 6"  
ABOVE GUTTER ELEVATION.



## SECTION A-A

### NOTES:

1. DRIVEWAY APPROACH SHALL BE 6" THICK MoDOT PAVEMENT CONCRETE ON COMPACTED SUBGRADE.
2. REPLACE STANDARD CURB & GUTTER SECTION WITH DRIVEWAY CURB SECTION. SEE DETAIL 400.02.
3. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
4. ALL DRIVEWAY APPROACHES SHALL SLOPE TOWARD THE STREET.
5. ALL DRIVEWAY APPROACHES SHALL BE CONSTRUCTED TO ACCOMMODATE SIDEWALKS. (EXISTING AND FUTURE) STANDARD SIDEWALK LOCATION IS 1 FT OFF OF RoW LINE
6. DRIVEWAY APPROACH SHALL PROVIDE A MINIMUM 5' WIDE ACCESSIBLE SIDEWALK PASSING ZONE.
7. DRIVEWAY SLOPE ACROSS ACCESSIBLE SIDEWALK PASSING ZONE IS 1.5% ± 0.5%. CROSS SLOPE SHALL NOT EXCEED 2.00%.
8. MINIMIZE SIDEWALK WARPING ADJACENT TO DRIVEWAY APPROACH.
9. GREENSPACE SLOPE WITHIN RIGHT OF WAY SHALL NOT EXCEED 3/4" PER FOOT.
10. DRIVEWAY MAY BE REINFORCED AT OWNER'S OPTION. ON CITY BID PROJECTS DO NOT REINFORCE.
11. MEASURE FROM TOP OF CURB.



07/01/20

Approved

Date

Revisions

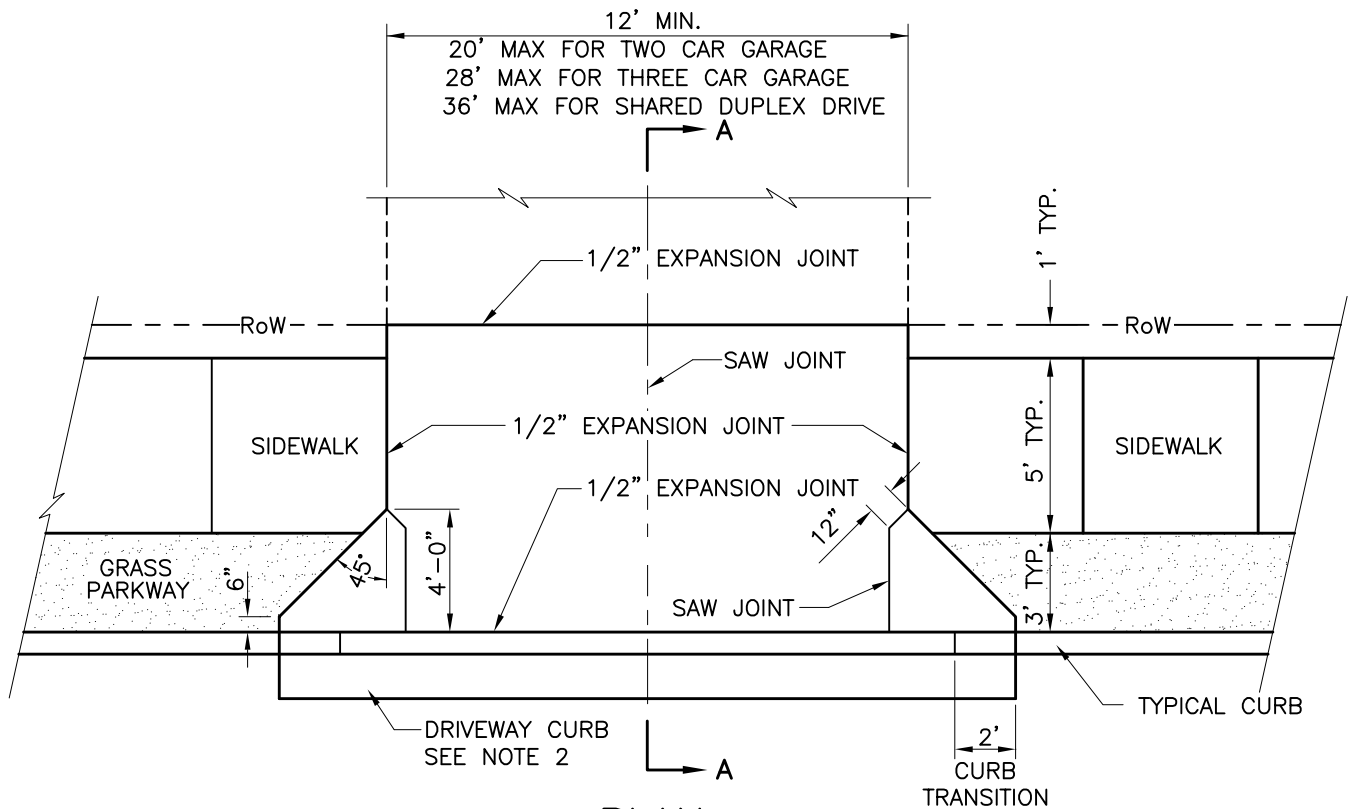


City of Columbia  
Public Works Department

DRIVE APPROACH  
(Residential, 28' street)

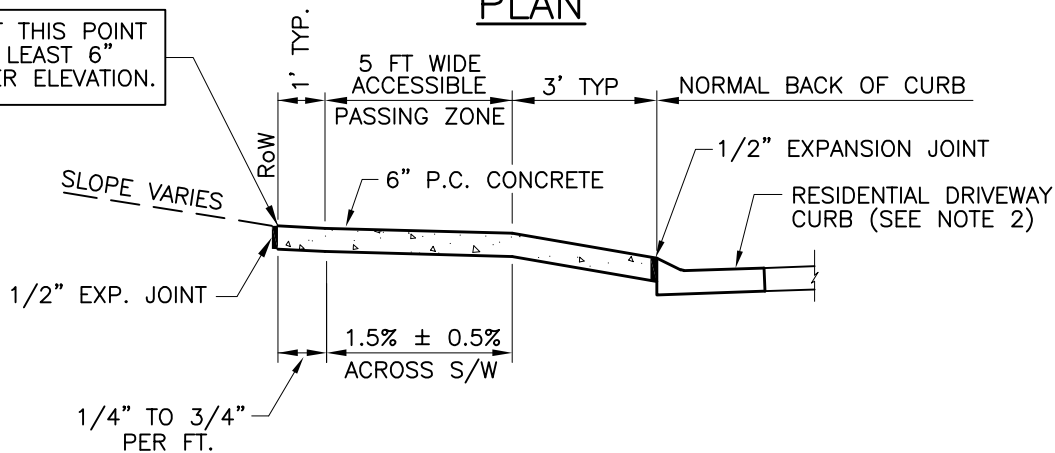
410.02A





## PLAN

ELEVATION AT THIS POINT  
MUST BE AT LEAST 6"  
ABOVE GUTTER ELEVATION.



## SECTION A-A

### NOTES:

1. DRIVEWAY APPROACH SHALL BE 6" THICK M&DOT PAVEMENT CONCRETE ON COMPACTED SUBGRADE.
2. REPLACE STANDARD CURB & GUTTER SECTION WITH DRIVEWAY CURB SECTION. SEE DETAIL 400.02.
3. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
4. ALL DRIVEWAY APPROACHES SHALL SLOPE TOWARD THE STREET.
5. ALL DRIVEWAY APPROACHES SHALL BE CONSTRUCTED TO ACCOMMODATE SIDEWALKS. (EXISTING AND FUTURE) STANDARD SIDEWALK LOCATION IS 1 FT OFF OF RoW LINE
6. DRIVEWAY APPROACH SHALL PROVIDE A MINIMUM 5' WIDE ACCESSIBLE SIDEWALK PASSING ZONE.
7. DRIVEWAY SLOPE ACROSS ACCESSIBLE SIDEWALK PASSING ZONE IS 1.5% ± 0.5%. CROSS SLOPE SHALL NOT EXCEED 2.00%.
8. MINIMIZE SIDEWALK WARPING ADJACENT TO DRIVEWAY APPROACH.
9. GREENSPACE SLOPE WITHIN RIGHT OF WAY SHALL NOT EXCEED 3/4" PER FOOT.
10. DRIVEWAY MAY BE REINFORCED AT OWNER'S OPTION. ON CITY BID PROJECTS DO NOT REINFORCE.
11. MEASURE FROM TOP OF CURB.

Approved

07/01/20

Date

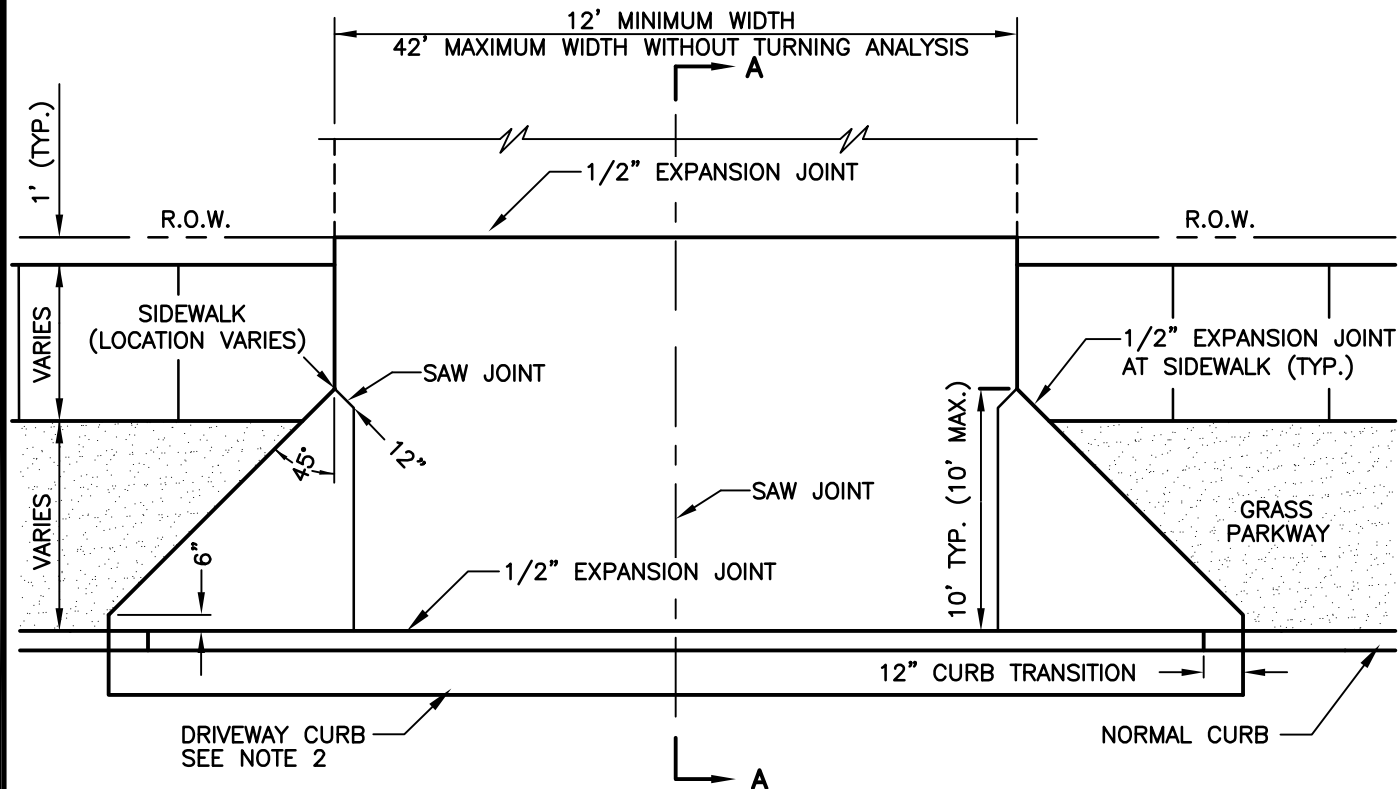
Revisions



City of Columbia  
Public Works Department

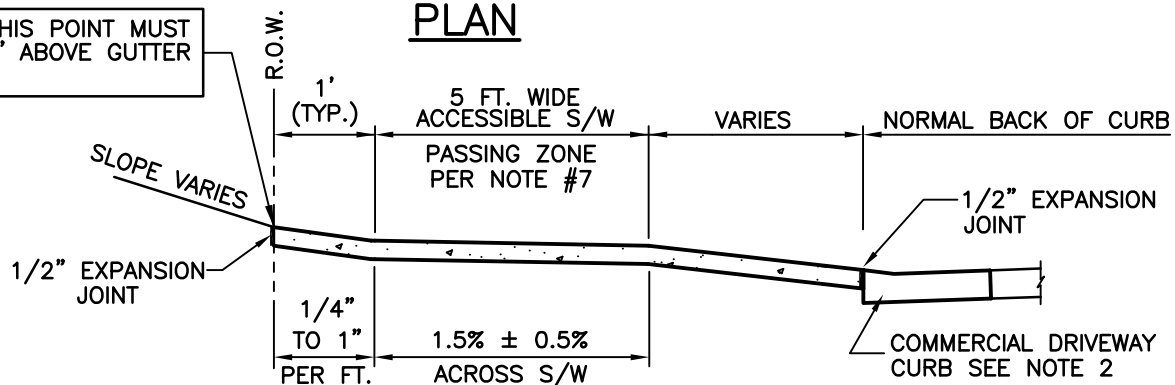
DRIVE APPROACH  
(Residential, 32' street)

410.02B



## PLAN

ELEVATION AT THIS POINT MUST BE AT LEAST 6" ABOVE GUTTER ELEVATION.



## SECTION A-A

### NOTES:

1. DRIVEWAY APPROACH SHALL BE 7" THICK M&DOT PAVEMENT CONCRETE.
2. REPLACE STANDARD CURB & GUTTER SECTION WITH DRIVEWAY CURB SECTION. SEE DETAIL 400.03.
3. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
4. ALL DRIVEWAY APPROACHES SHALL SLOPE TOWARD THE STREET.
5. ALL DRIVEWAY APPROACHES SHALL BE CONSTRUCTED TO ACCOMMODATE SIDEWALKS. (EXISTING AND FUTURE) STANDARD SIDEWALK LOCATION IS 1 FOOT OFF OF RIGHT OF WAY LINE.
6. DRIVEWAY APPROACH SHALL PROVIDE A MINIMUM 5' WIDE ACCESSIBLE SIDEWALK PASSING ZONE.
7. DRIVEWAY SLOPE ACROSS ACCESSIBLE SIDEWALK PASSING ZONE IS 1.5% ± 0.5%. CROSS SLOPE SHALL NOT EXCEED 2.00%.
8. MINIMIZE SIDEWALK WARPING ADJACENT TO DRIVEWAY APPROACH.
9. GREENSPACE SLOPE WITHIN RIGHT OF WAY SHALL NOT EXCEED 3/4" PER FOOT.
10. DRIVEWAY MAY BE REINFORCED AT OWNER'S OPTION. ON CITY BID PROJECTS DO NOT REINFORCE.
11. MEASURE FROM TOP OF CURB.

Approved

07/01/20  
Date

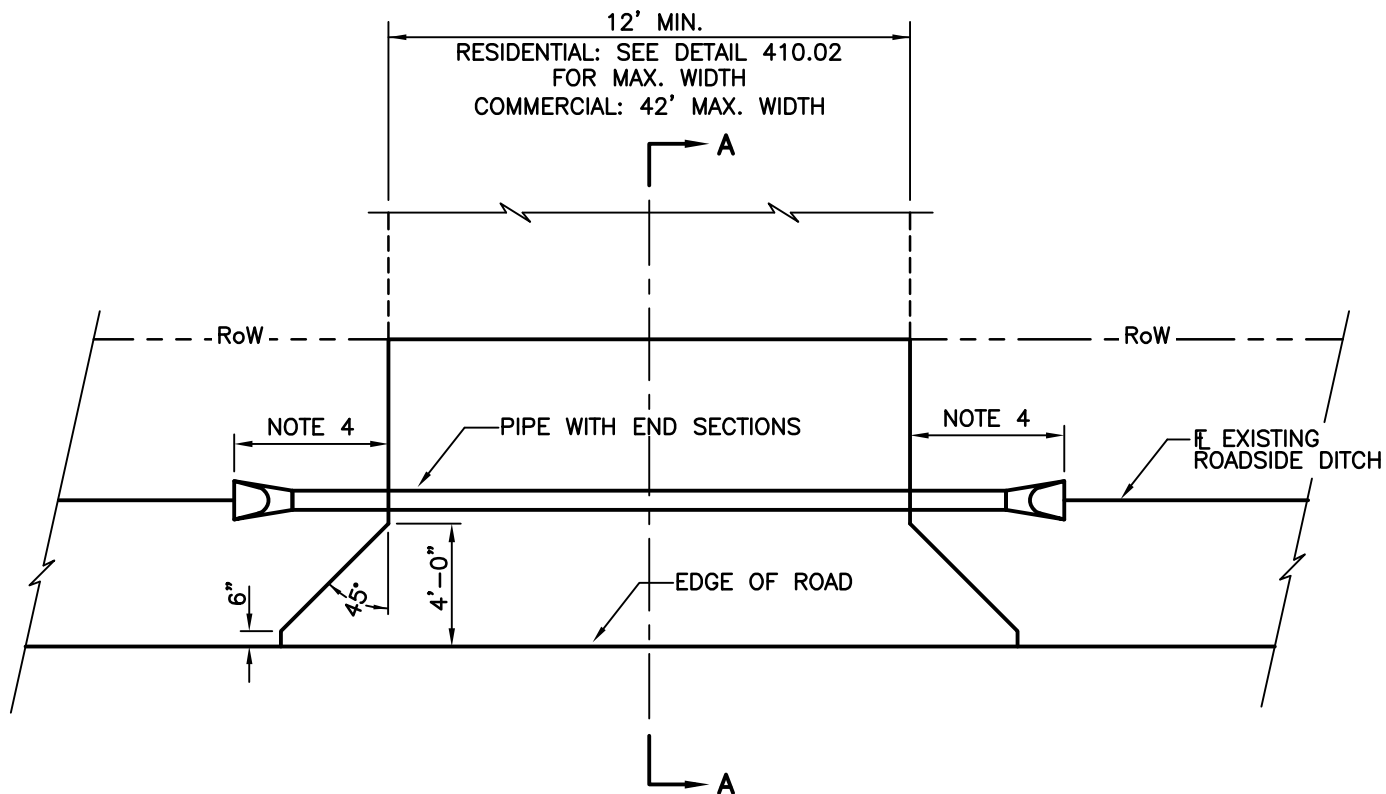
Revisions



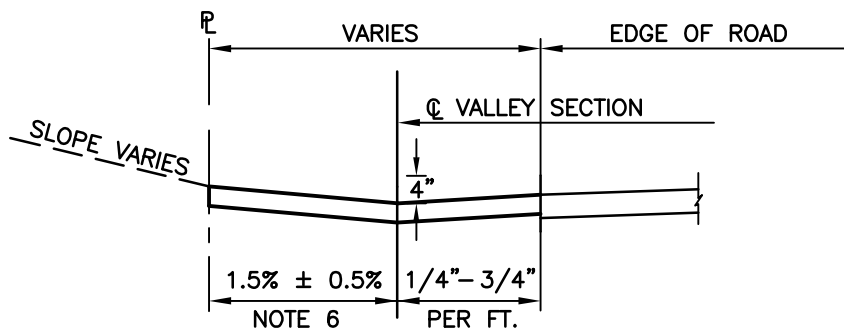
City of Columbia  
Public Works Department

DRIVE APPROACH  
(Commercial)

410.03



## PLAN



## SECTION A-A

### NOTES:

1. DRIVEWAY APPROACH SHALL BE 6" FULL DEPTH ASPHALTIC CEMENT CONCRETE OR MoDOT PAVEMENT CONCRETE
2. VALLEY SECTION REQUIRED, VALLEY SHALL BE 4" BELOW EDGE OF ROAD
3. PIPE UNDER DRIVEWAY SHALL BE SIZED TO CARRY 10 YR STORM, MINIMUM 12" DIAMETER.
4. PIPE LENGTH BASED ON 3:1 FILL SLOPE, USE FLARED END SECTION OR BEVEL END OF PIPE TO MATCH 3:1 SLOPE. HEADWALLS NOT ALLOWED.
5. WHERE THE ROADSIDE DITCH AT A DRIVEWAY DRAINS LESS THAN 10,000 SQ. FT. THE PIPE CAN BE OMITTED, INCREASE VALLEY SECTION DEPTH TO 6".
6. DRIVEWAYS SHALL PROVIDE FOR FUTURE SIDEWALKS AND ROAD IMPROVEMENTS, DRIVEWAY SLOPE BETWEEN VALLEY AND R.O.W. LINE SHALL NOT EXCEED 2.0%.

Approved

07/01/20  
Date

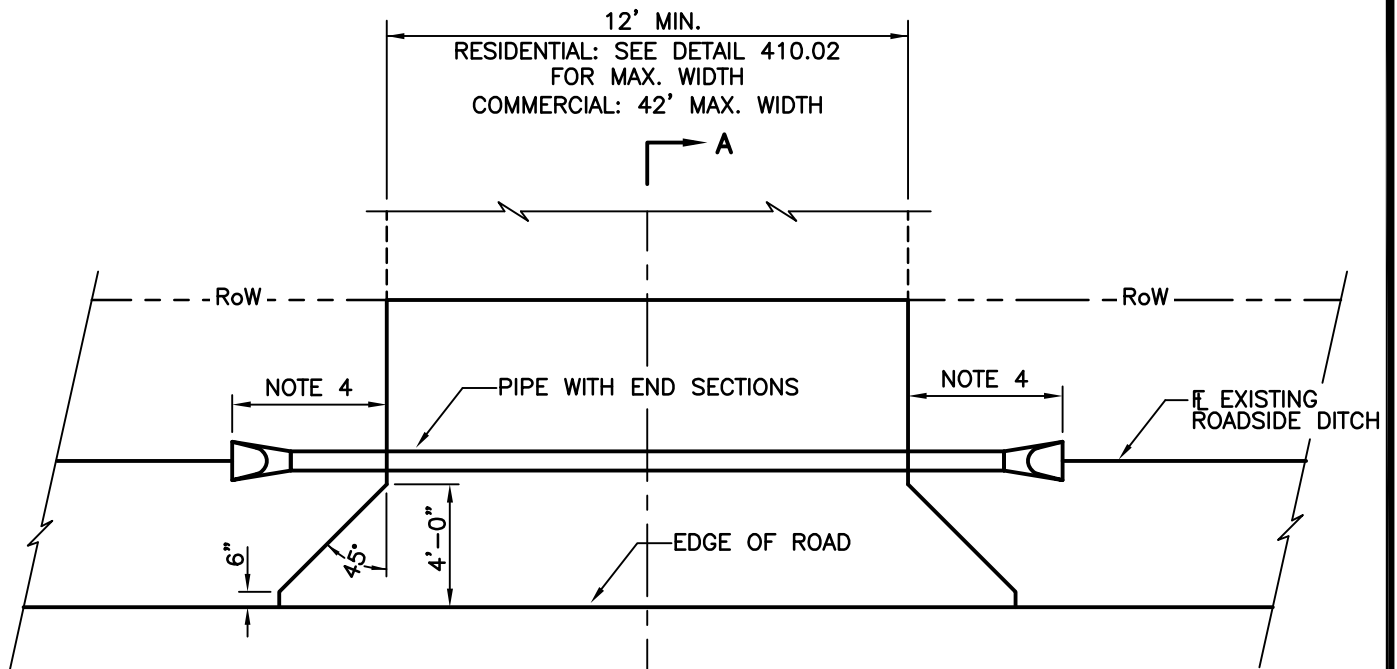
Revisions



City of Columbia  
Public Works Department

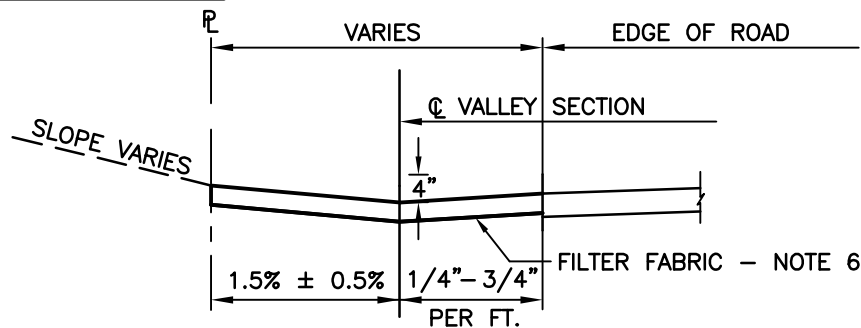
DRIVE APPROACH  
(Unimproved Street)

410.04



**THIS DETAIL APPLIES ONLY TO DRIVE APPROACHES ABUTTING GRAVEL ROADS.**

**PLAN**



**SECTION A-A**

NOTE:

1. DRIVEWAY APPROACH SHALL BE A MINIMUM OF 8" OF 2 1/2" MINUS ROCK OR SHALL BE A MINIMUM OF 5" OF HOT MIX ASPHALT OR 6" OF MoDOT PAVEMENT CONCRETE. IN THE CASE OF A HARD SURFACED APPROACH, THE APPROACH SHALL BE SET BACK A MINIMUM OF 12" BEYOND EDGE OF ROAD.
2. VALLEY SECTION REQUIRED, VALLEY SHALL BE 4" BELOW EDGE OF ROAD
3. PIPE UNDER DRIVEWAY SHALL BE SIZED TO CARRY 10 YR STORM, MINIMUM 12" DIAMETER.
4. PIPE LENGTH BASED ON 3:1 FILL SLOPE, USE FLARED END SECTION OR BEVEL END OF PIPE TO MATCH 3:1 SLOPE. HEADWALLS NOT ALLOWED.
5. WHERE THE ROADSIDE DITCH AT A DRIVEWAY DRAINS LESS THAN 10,000 SQ. FT. THE PIPE CAN BE OMITTED, INCREASE VALLEY SECTION DEPTH TO 6".
6. INSTALL HEAVY GAUGE FILTER FABRIC (MIRAFI 180N OR EQUAL) UNDER ENTIRE DRIVE APPROACH.

*[Signature]*  
Approved

07/01/20  
Date

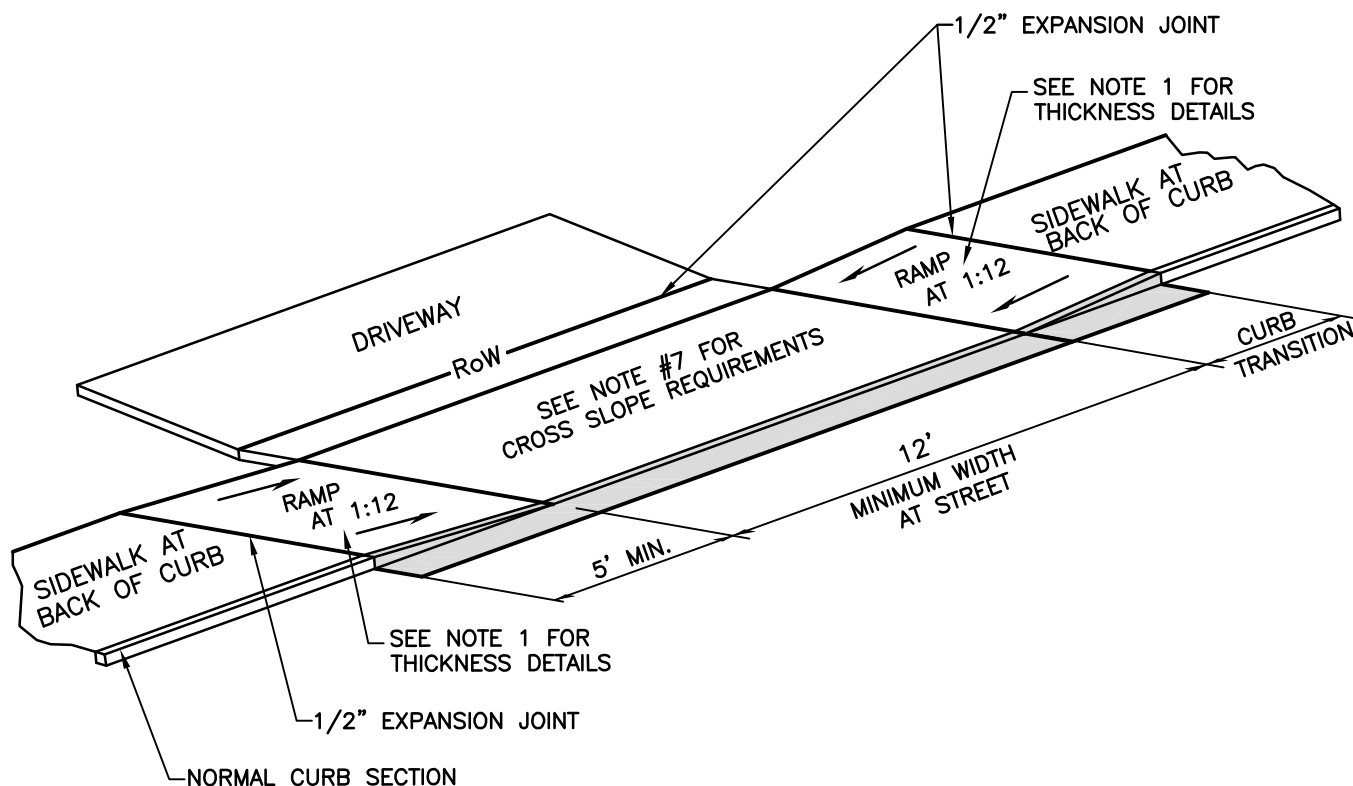
Revisions



City of Columbia  
Public Works Department


**DRIVE APPROACH  
(Gravel Roadways)**

**410.05**



NOTE:

1. RAMP SHALL BE 6" THICK MoDOT PAVEMENT CONCRETE FOR RESIDENTIAL, 7" THICK MoDOT PAVEMENT CONCRETE FOR COMMERCIAL.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. DRIVEWAY CROSS SLOPE SHALL NOT EXCEED 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. REPLACE STANDARD CURB SECTION DRIVEWAY CURB SECTION - DETAIL 400.02 OR 400.03
6. RAMP LENGTH IS DEPENDENT UPON 1:12 MAX. SLOPE AT 5' MINIMUM TRANSITION AREA. USE FLATTER WHEN POSSIBLE.
7. A PEDESTRIAN ACCESSIBLE ROUTE SHALL BE PROVIDED THAT IS 4'-0" WIDE MINIMUM WITH A CROSS SLOPE OF 1.5%  $\pm$  0.5% (MAXIMUM CROSS SLOPE OF 2.0%).
8. DRIVEWAY MAY BE REINFORCED AT OWNERS OPTION. ON CITY BID PROJECTS DO NOT REINFORCE.

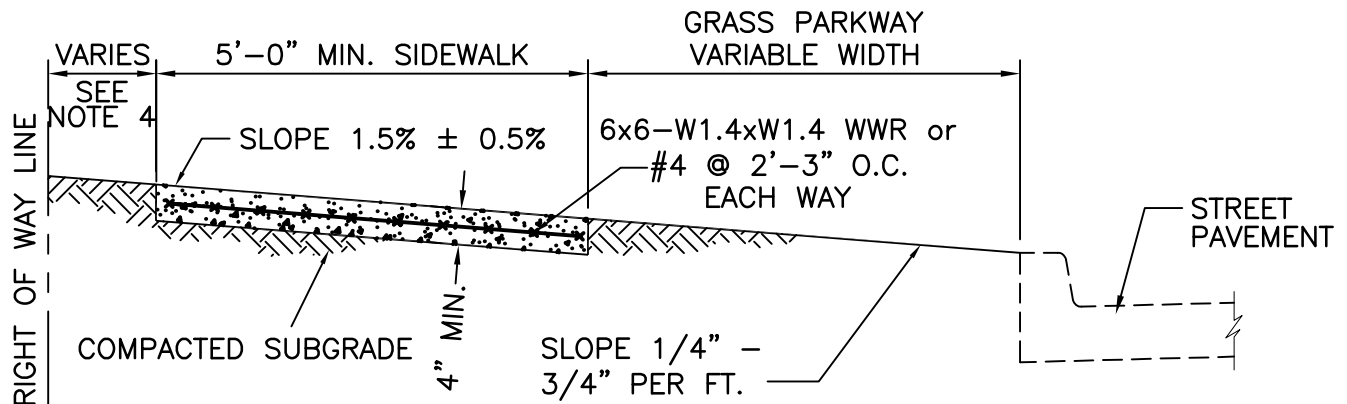
	07/01/20
Approved	Date
Revisions	



## SIDEWALK DRIVEWAY DETAIL

### Sidewalk at Back of Curb


410.07



## SIDEWALK WITH GRASS PARKWAY

### NOTE:

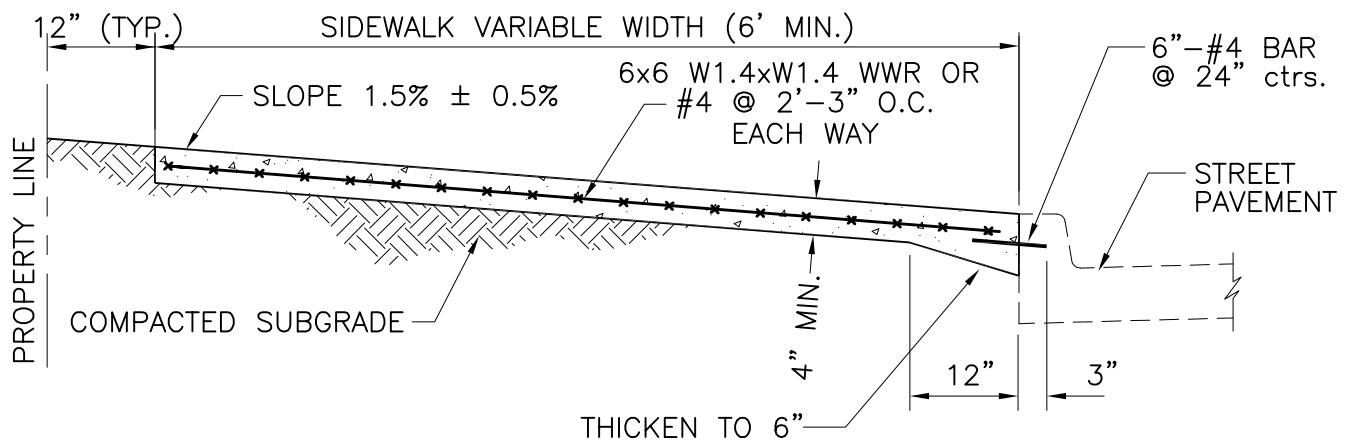
1. SIDEWALK SHALL BE 4" THICK MoDOT PAVEMENT CONCRETE.
2. INSTALL 1/2" EXPANSION JOINTS AT INTERSECTIONS, RAMPS, STRUCTURES, DRIVEWAY APPROACHES, OR EVERY 100'.
3. INSTALL TRANSVERSE SAW JOINTS AT SPACING EQUAL TO SIDEWALK WIDTH.
4. STANDARD SIDEWALK PLACEMENT IS 12" FROM RIGHT OF WAY LINE.
5. NO STEEL TO BE PLACED THROUGH EXPANSION JOINT.
6. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.00%.
7. DAMAGED SIDEWALK MUST BE PINNED TO EXISTING SIDEWALK.
8. WWR OR REBAR SHALL BE ACCURATELY PLACED AND FIRMLY HELD IN PLACE DURING CONCRETE PLACEMENT BY APPROVED METHODS, SEE SECTION 238.9.

 Approved	07/01/20 Date
Revisions	



SIDEWALK

420.01



NOTE:

1. SIDEWALK SHALL BE 4" THICK MoDOT PAVEMENT CONCRETE.
2. INSTALL 1/2" TRANSVERSE EXPANSION JOINTS TO MATCH STREET OR CURB AND GUTTER EXPANSION JOINTS AND AT ALL DRIVEWAY APPROACHES, AND SIDEWALK RAMPS.
3. INSTALL TRANSVERSE SAW JOINTS AT SPACING EQUAL TO SIDEWALK WIDTH.
4. FOR DOWNTOWN SIDEWALK DETAIL SEE SECTION 1000.
5. NO STEEL TO BE PLACED THROUGH EXPANSION JOINT
6. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.00%.
7. NEW SIDEWALK MUST BE PINNED TO EXISTING SIDEWALK.
8. WWR OR REBAR SHALL BE ACCURATELY PLACED AND FIRMLY HELD IN PLACE DURING CONCRETE PLACEMENT BY APPROVED METHODS, SEE SECTION 238.9.

*[Signature]*

Approved

07/01/20

Date

Revisions

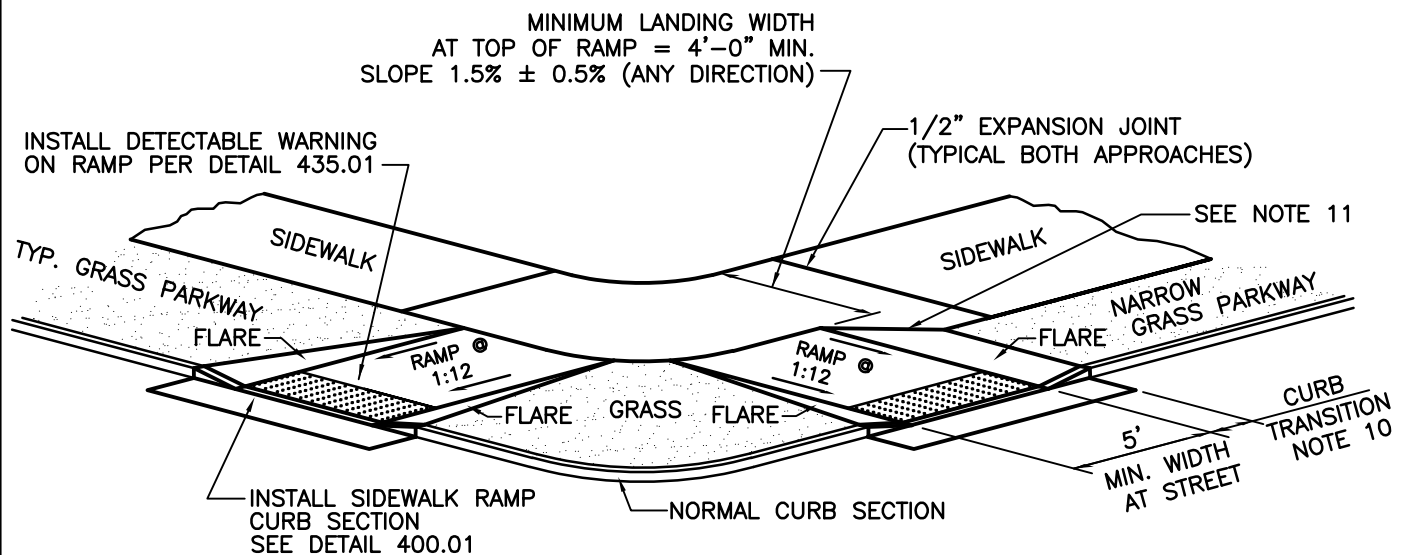


City of Columbia  
Public Works Department

SIDEWALK AT BACK OF CURB

420.02





NOTE:

1. RAMP SHALL BE 6" THICK MoDOT PAVEMENT CONCRETE WITH #4 BARS @ 12" O.C. EACH WAY.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. REPLACE STANDARD CURB SECTION WITH SIDEWALK RAMP CURB SECTION - DETAIL 400.01
6. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
7. LANDING AREA AT TOP OF RAMP SHALL BE 4'-0" MIN WIDTH, CROSS SLOPE OF LANDING SHALL NOT EXCEED 2.00%, INCREASE SIDEWALK RADIUS TO OBTAIN MINIMUM 4'-0" LANDING.
8. TYPE "A" RAMP NOT APPLICABLE IF SIDEWALK AND PARKWAY WIDTH DOES NOT PROVIDE 4'-0" LANDING AT TOP OF RAMP.
9. FLARES ARE REQUIRED AT RAMPS TO KEEP GRASS PARKWAY SLOPES IN CONFORMANCE WITH THE TYPICAL CROSS SECTION.
10. CURB TRANSITION LENGTH IS DEPENDENT ON FLARE SLOPE
11. IF RAMP EXTENDS INTO NORMAL SIDEWALK, FLARE SLOPE MUST NOT EXCEED 1:10. A LANDING IS REQUIRED, SEE NOTE 7.

  
Approved

07/01/20  
Date

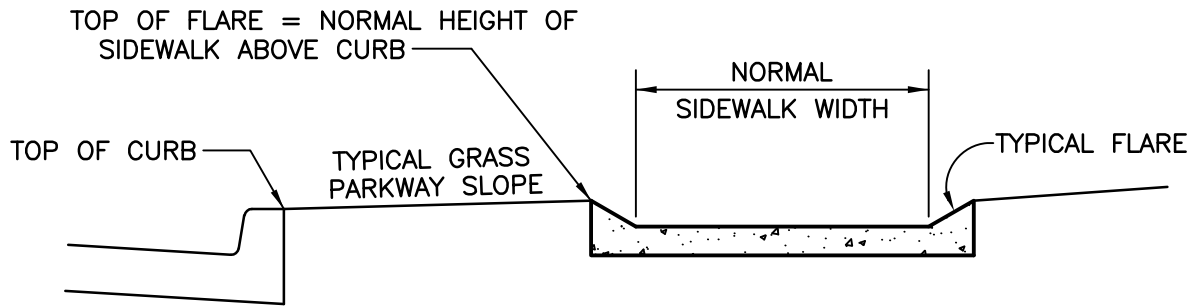
Revisions



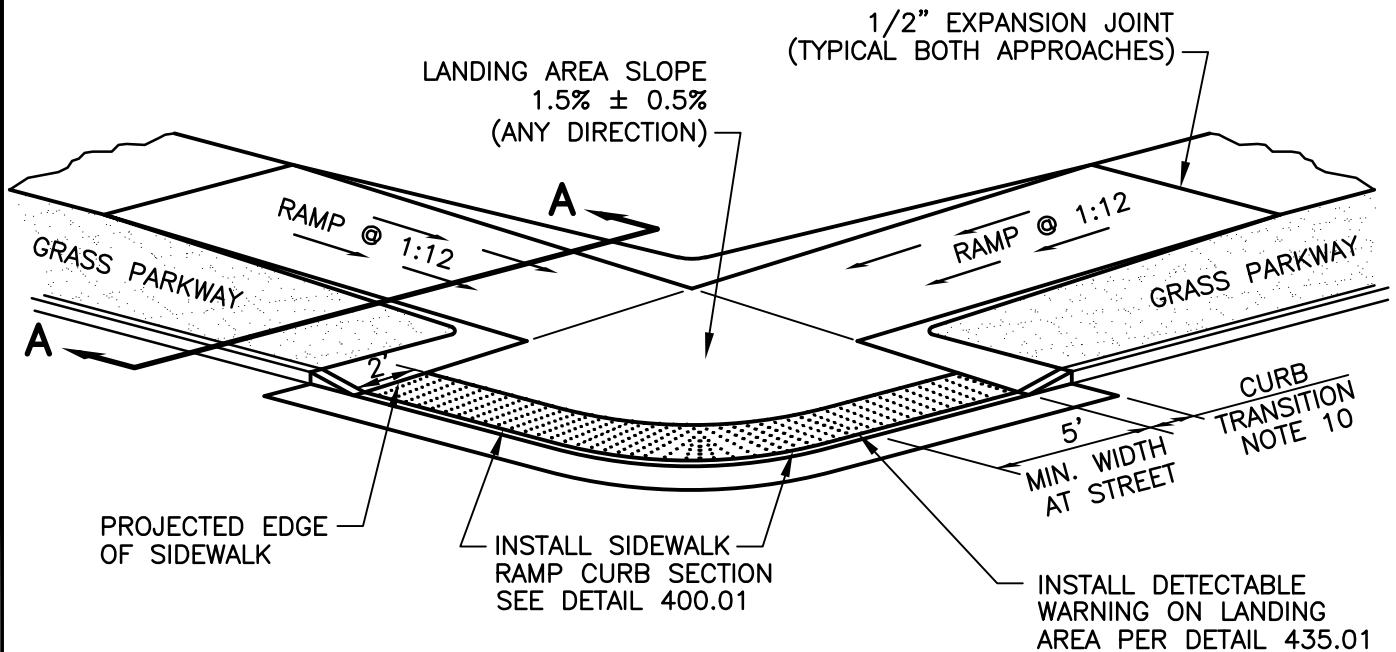
City of Columbia  
Public Works Department

# SIDEWALK RAMP Sidewalk with Grass Parkway (Type A)

430.01

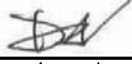


**SECTION A-A**



**NOTES:**

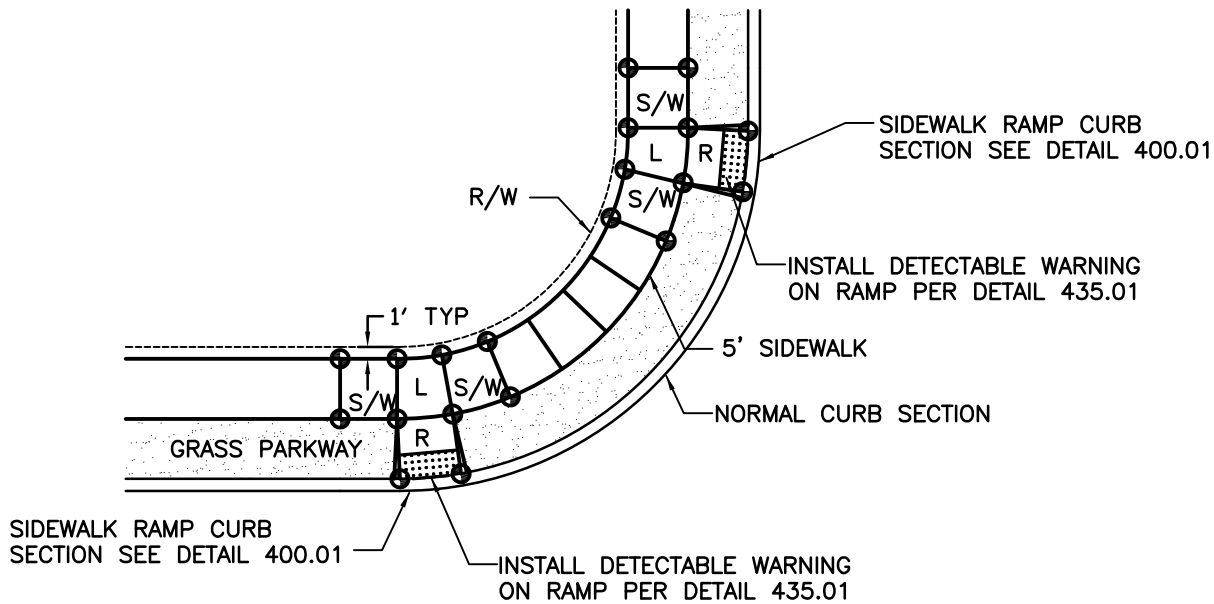
1. RAMP AND LANDING SHALL BE 6" THICK MoDOT PAVEMENT CONCRETE WITH #4 BARS AT 12" O.C. E.W.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. REPLACE STANDARD CURB SECTION WITH SIDEWALK RAMP CURB SECTION – DETAIL 400.01
6. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
7. LANDING AREA SHALL BE 4'-0" MIN WIDTH. MAXIMUM RAMP SLOPE 2.0% ANY DIRECTION.
8. USE TYPE "B" RAMP ONLY IF TYPE "A" IS NOT FEASIBLE.
9. FLARES ARE REQUIRED AT RAMPS TO KEEP GRASS PARKWAY SLOPES IN CONFORMANCE WITH THE TYPICAL CROSS SECTION. (SEE SECTION A-A)
10. CURB TRANSITION LENGTH IS DEPENDENT ON FLARE SLOPE.

	07/01/20
Approved	Date
Revisions	



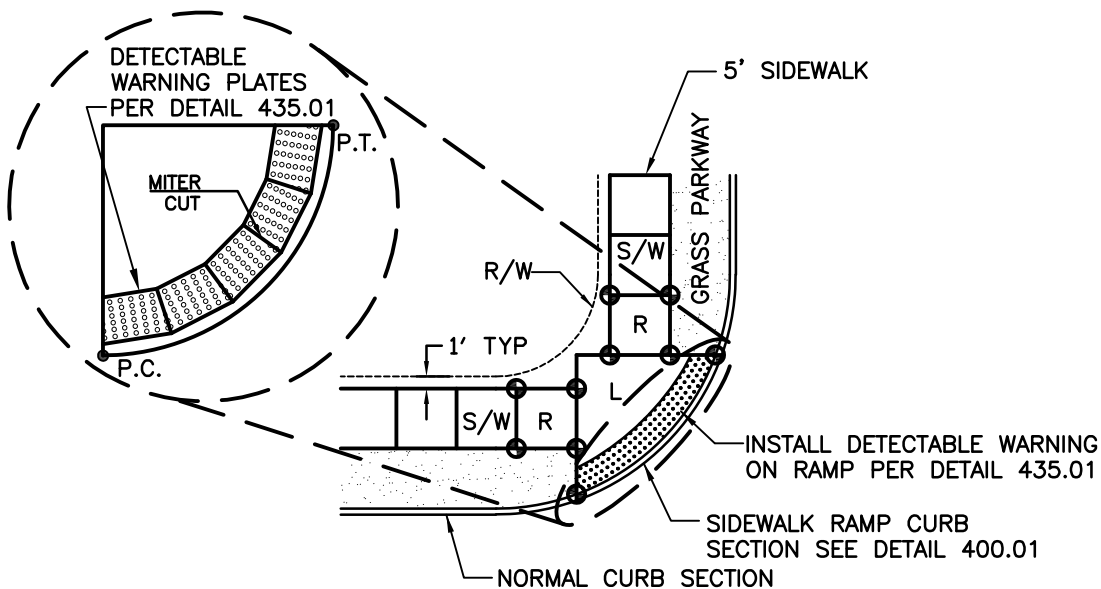
**SIDEWALK RAMP**  
Sidewalk with Grass Parkway  
(Type B)

**430.02**



1. ① DENOTES SPOT ELEVATION REQUIRED

## TYPE "A" SIDEWALK WITH GRASS PARKWAY



1. ① DENOTES SPOT ELEVATION REQUIRED


2. DETECTABLE WARNING PLATES ARE TO BE MITERED EQUALLY ON BOTH SIDES TO BE FLUSH.

## TYPE "B" SIDEWALK WITH GRASS PARKWAY

R = RAMP RUNNING SLOPE 1:12 (8.3%) MAXIMUM

L = LANDING SLOPE 1.5% ± 0.5% (2.0% SLOPE MAXIMUM ANY DIRECTION)

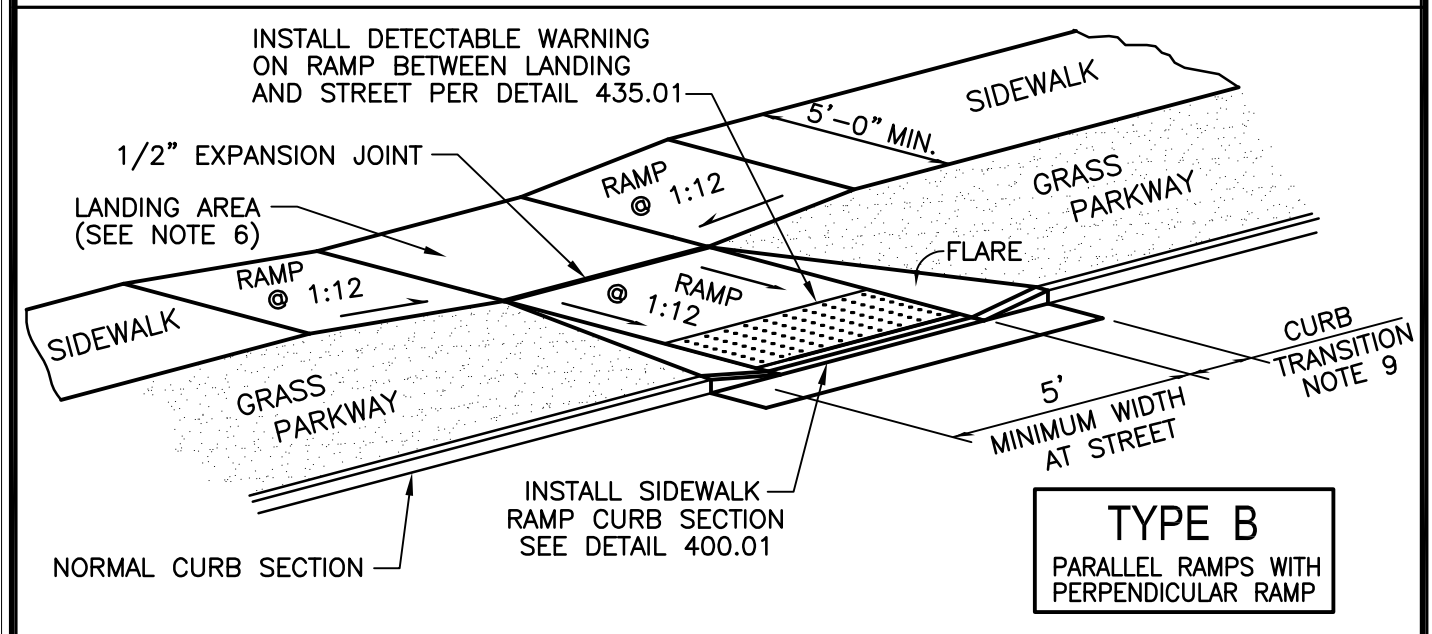
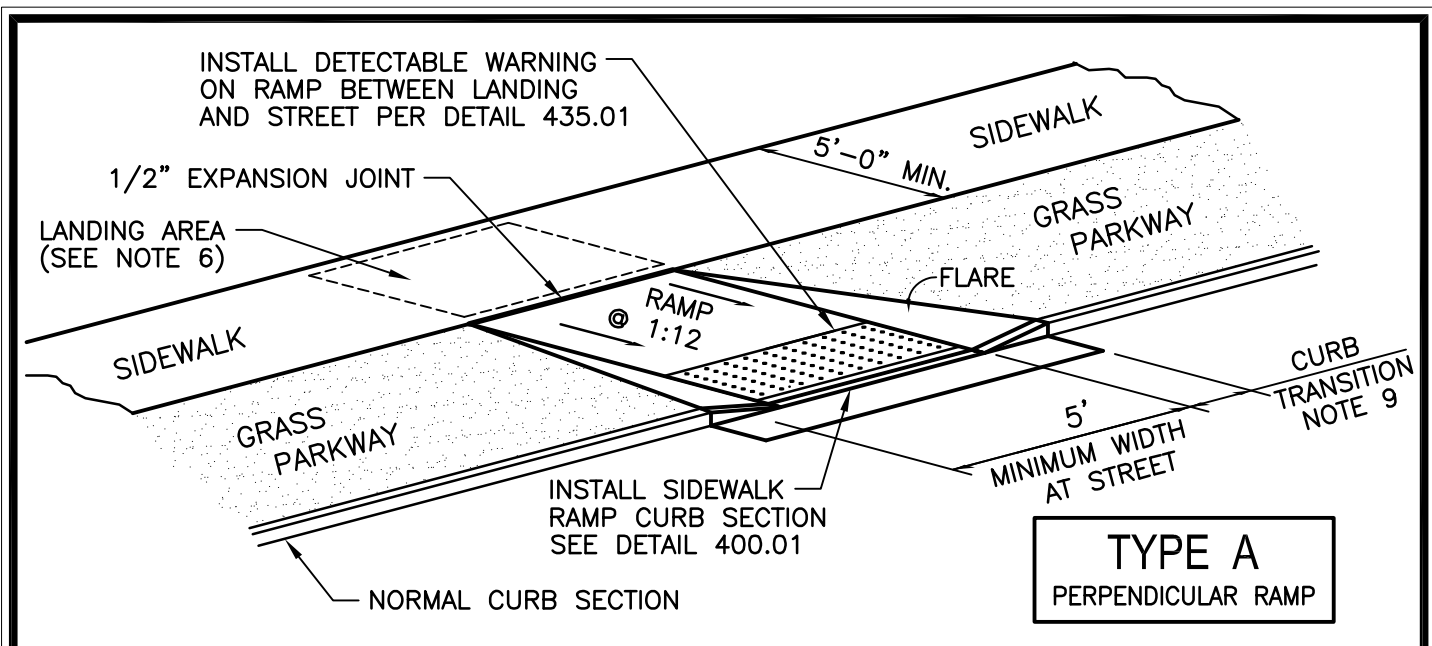
S/W = SIDEWALK CROSS SLOPE 1.5% ± 0.5% (2.0% CROSS SLOPE MAXIMUM)

	07/01/20
Approved	Date
Revisions	



SIDEWALK RAMP PLAN VIEW  
Sidewalk with Grass Parkway  
(Type A & B)

430.03



**NOTE:**

1. RAMP SHALL BE 6" THICK MoDOT PAVEMENT CONCRETE WITH #4 BARS AT 12" O.C. EACH WAY
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
4. REPLACE STANDARD CURB SECTION WITH SIDEWALK RAMP CURB SECTION - DETAIL 400.01
5. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
6. LANDING AREA AT TOP OF RAMP SHALL BE 4'-0" MIN. WIDTH. SLOPE OF LANDING SHALL BE 1.5% ± 0.5% (2.0% MAXIMUM ANY DIRECTION).
7. TYPE "A" RAMP NOT APPLICABLE IF PARKWAY WIDTH DOES NOT PROVIDE ENOUGH LENGTH FOR PERPENDICULAR RAMP AT 1:12 SLOPE.
8. FLARES ARE REQUIRED AT RAMPS TO KEEP GRASS PARKWAY SLOPES IN CONFORMANCE WITH THE TYPICAL CROSS SECTION.
9. CURB TRANSITION LENGTH IS DEPENDENT ON FLARE SLOPE.

  
Approved

07/01/20  
Date

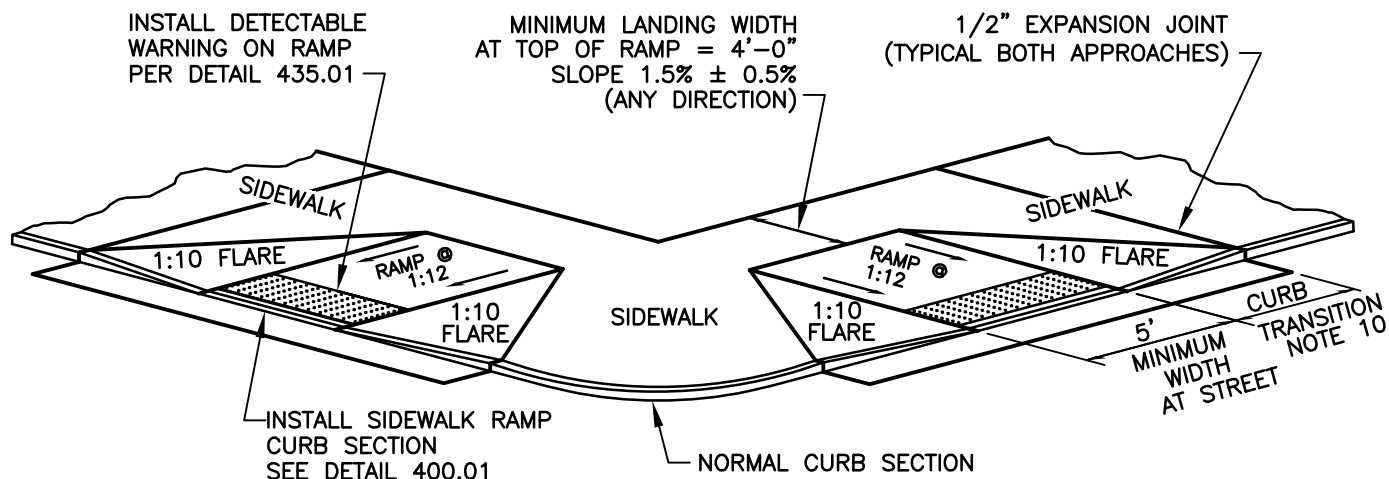
**Revisions**



City of Columbia  
Public Works Department


# MIDBLOCK SIDEWALK RAMP Sidewalk with Grass Parkway

431.01



**NOTE:**

1. RAMP SHALL BE 6" THICK MoDOT PAVEMENT CONCRETE WITH #4 BARS AT 12" O.C. E.W.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. REPLACE STANDARD CURB SECTION WITH SIDEWALK RAMP CURB SECTION - DETAIL 400.01
6. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
7. LANDING AREA AT TOP OF RAMP SHALL BE 4'-0" MIN WIDTH, CROSS SLOPE OF LANDING SHALL NOT EXCEED 2.00%.
8. TYPE "A" RAMP NOT APPLICABLE IF SIDEWALK WIDTH DOES NOT PROVIDE 4'-0" LANDING AT THE TOP OF RAMP. USE TYPE "B" RAMP.
9. RAMP EXTENDS INTO SIDEWALK, FLARE SLOPE MUST NOT EXCEED 1:10.
10. CURB TRANSITION LENGTH IS DEPENDENT ON 1:10 FLARE SLOPE

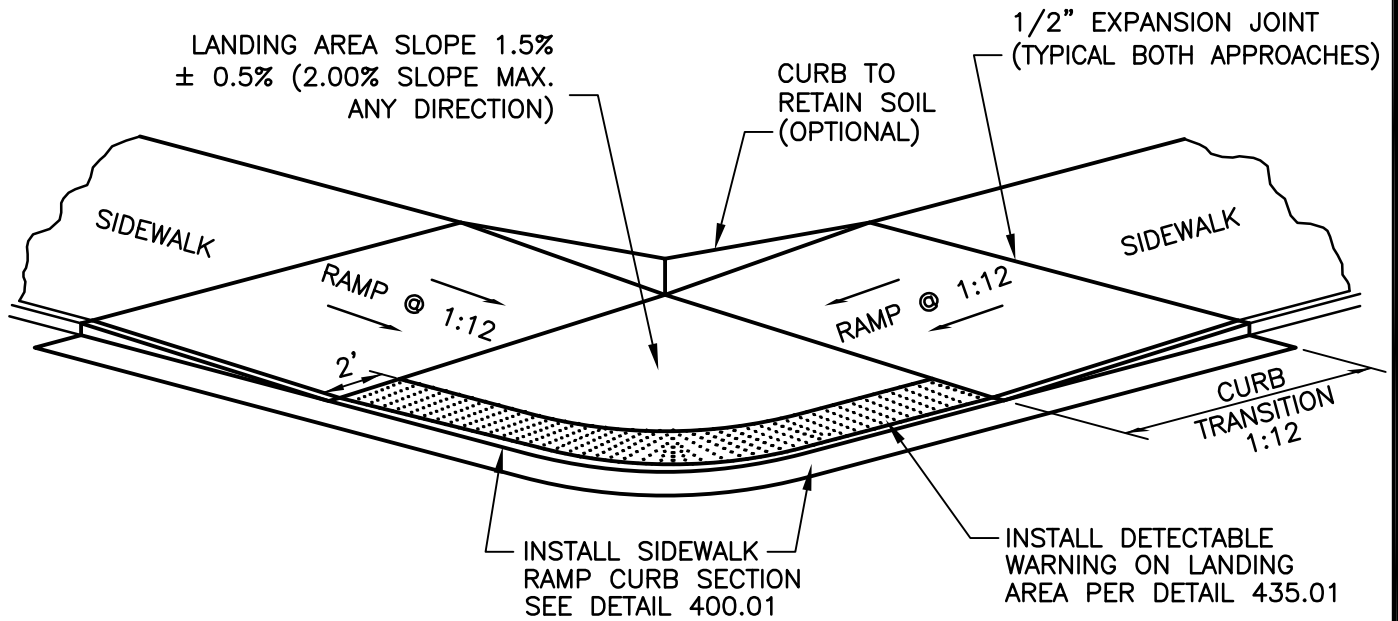
	07/01/20
Approved	Date
Revisions	



## SIDEWALK RAMP


### Sidewalk at Back of Curb (Type A)

432.01



**NOTES:**

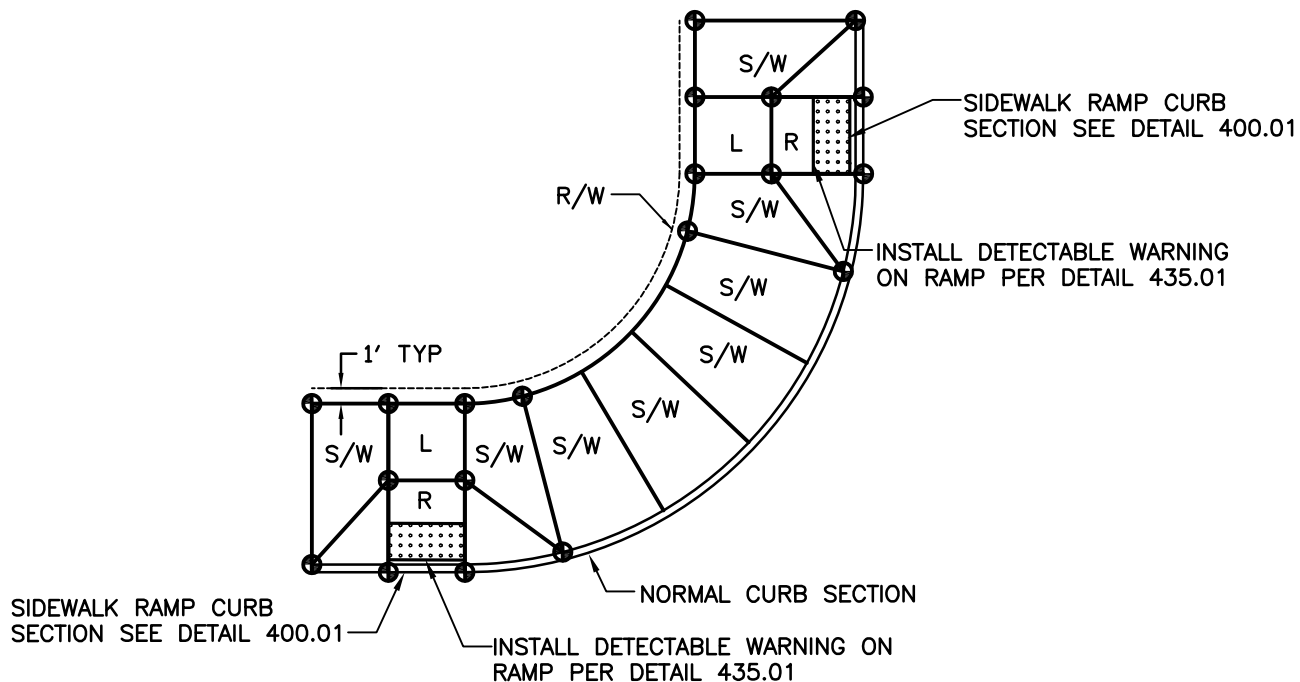
1. RAMP AND LANDING SHALL BE 6" THICK REINFORCED MoDOT PAVEMENT CONCRETE W/#4 BARS @ 12" O.C.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. REPLACE STANDARD CURB SECTION WITH SIDEWALK RAMP CURB SECTION – DETAIL 400.01
6. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
7. LANDING AREA SHALL BE 4'-0" MIN WIDTH.
8. USE TYPE "B" RAMP ONLY IF TYPE "A" IS NOT FEASIBLE.

	07/01/20
Approved	Date
Revisions	

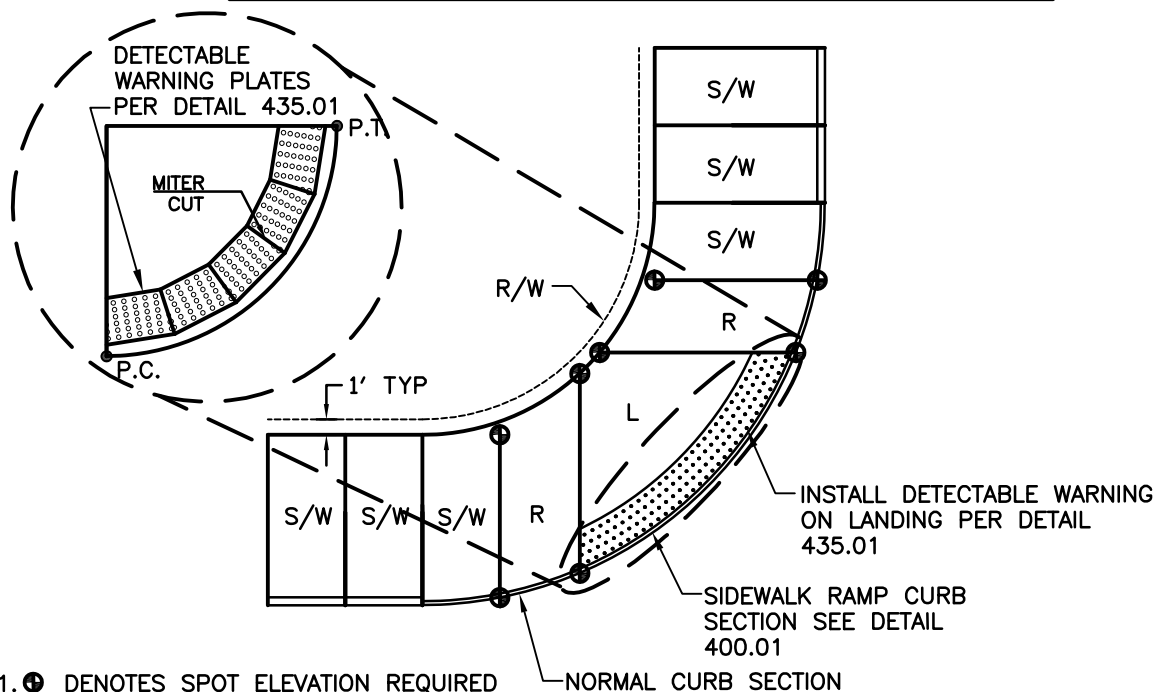


**SIDEWALK RAMP**  
Sidewalk at Back of Curb  
(Type B)

432.02



## TYPE "A" SIDEWALK AT BACK OF CURB




## TYPE "B" SIDEWALK AT BACK OF CURB

R = RAMP RUNNING SLOPE 8.3% (1:12) MAXIMUM

L = LANDING SLOPE 1.5% ± 0.5% (2.0% MAXIMUM ANY DIRECTION)

S/W = SIDEWALK CROSS 1.5% ± 0.5% (2.0% MAXIMUM)

Approved:  07/01/20  
Date

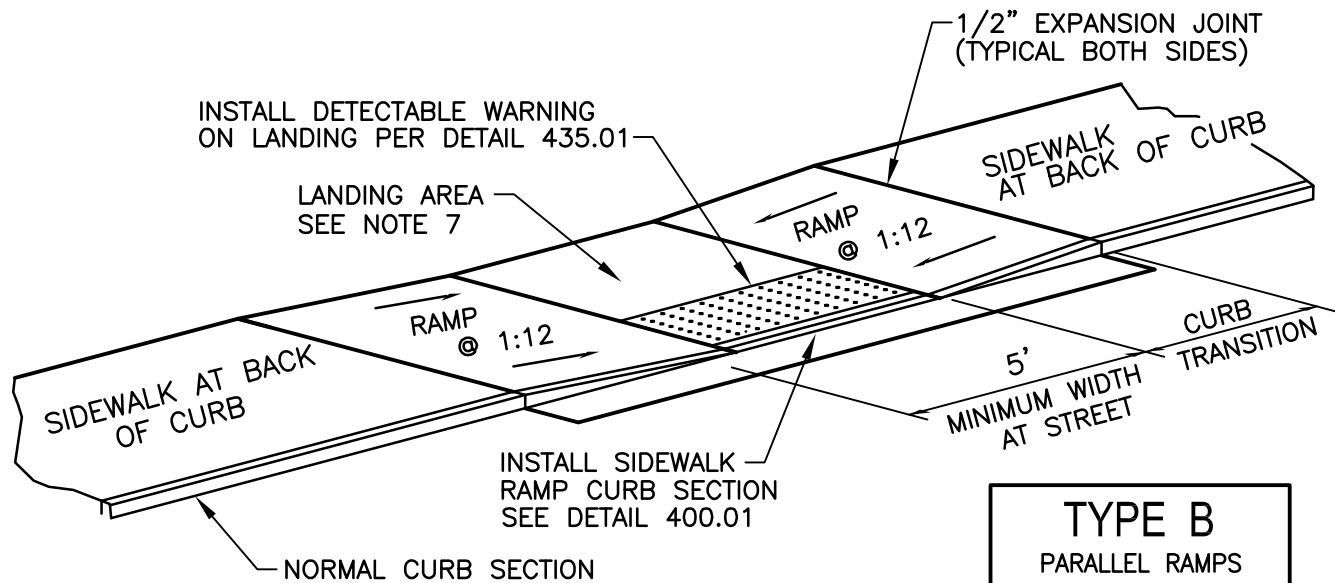
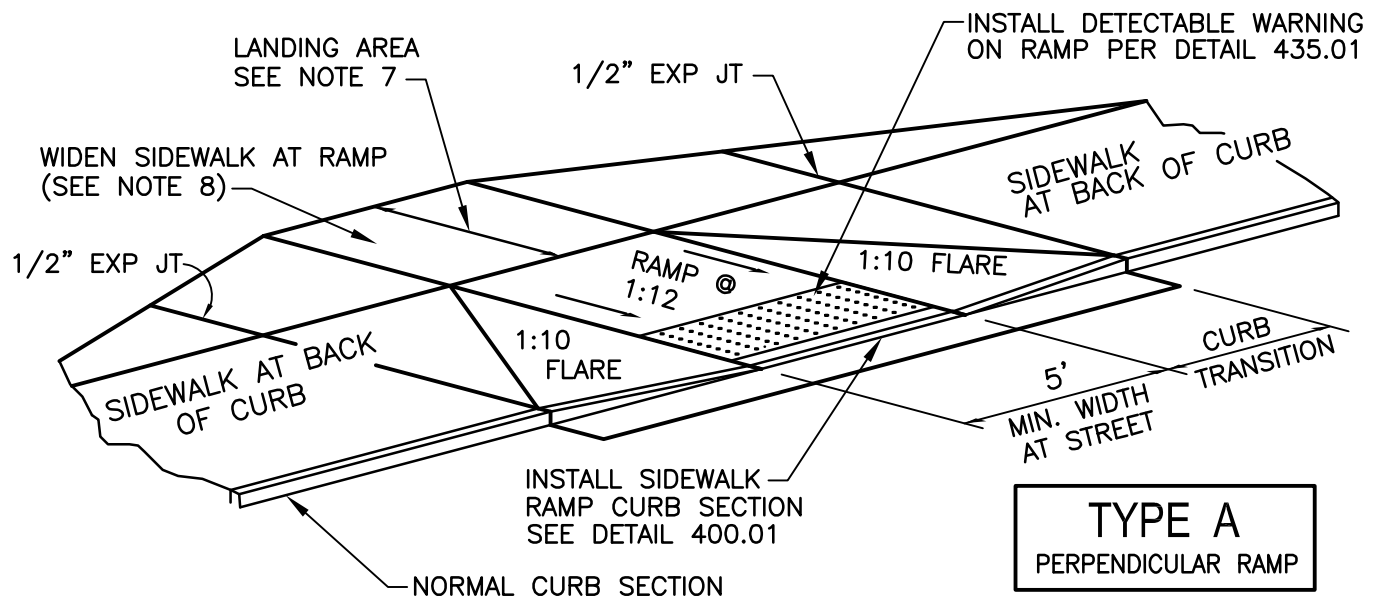
Revisions



City of Columbia  
Public Works Department

SIDEWALK RAMP PLAN VIEW  
Sidewalk at Back of Curb  
(Type A & B)

432.03



**NOTE:**

1. RAMP SHALL BE 4" THICK REINFORCED MoDOT PAVEMENT CONCRETE SAME AS SIDEWALK.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. REPLACE STANDARD CURB SECTION WITH SIDEWALK RAMP CURB SECTION – DETAIL 400.01
6. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
7. LANDING AREA SHALL BE 4'-0" MIN. WIDTH. SLOPE OF LANDING SHALL BE 1.5% ± 0.5% (2.0% MAXIMUM ANY DIRECTION)
8. TYPE "A" RAMP NOT APPLICABLE WHEN NORMAL SIDEWALK WIDTH DOES NOT PROVIDE 4'-0" LANDING AT THE TOP OF RAMP, WIDEN SIDEWALK OR USE TYPE "B" RAMP.
9. 1:10 FLARES ARE REQUIRED ON TYPE "A" RAMPS.

  
Approved

07/01/20  
Date

**Revisions**

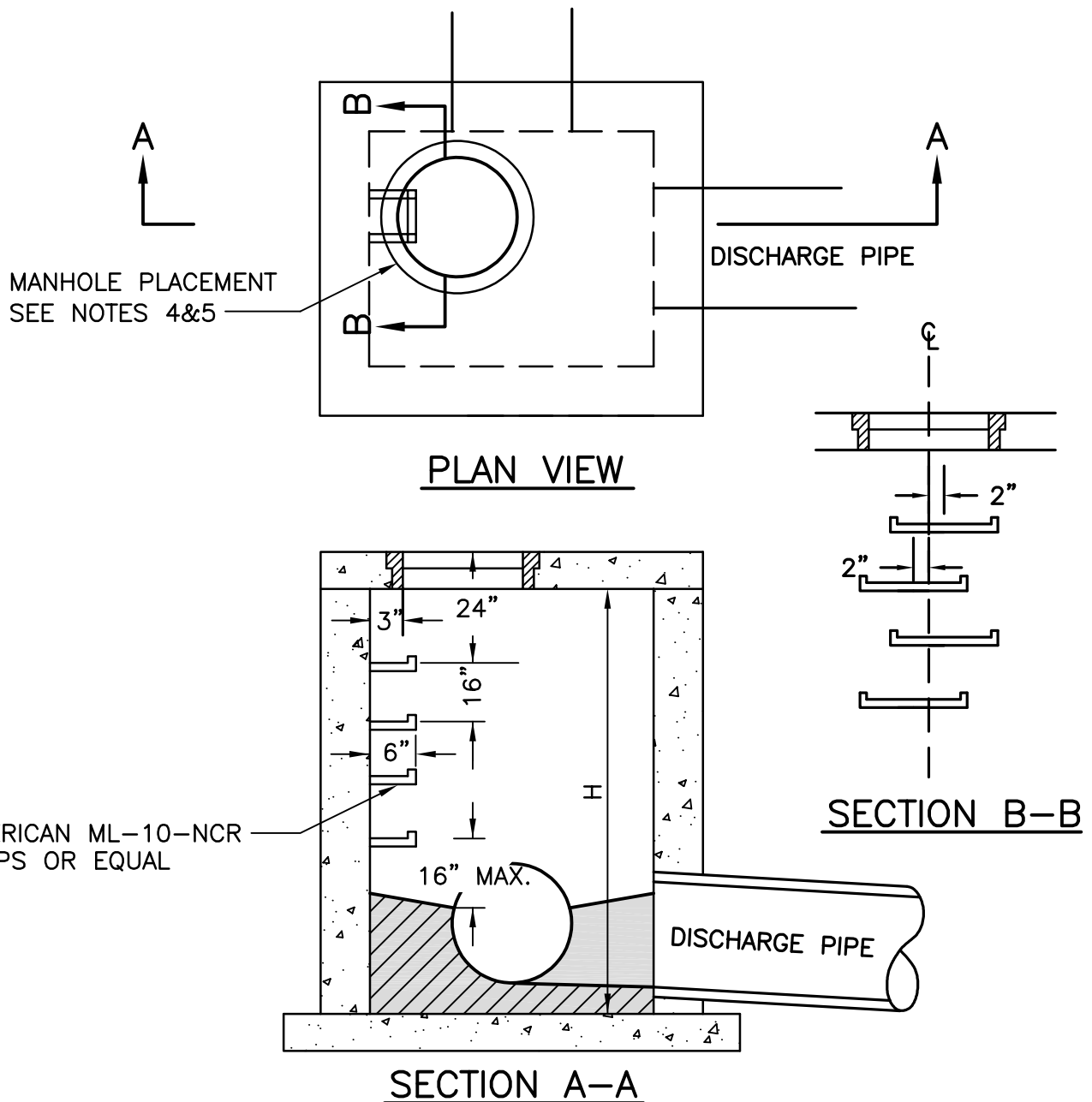


City of Columbia  
Public Works Department

# MIDBLOCK SIDEWALK RAMP Sidewalk at Back of Curb

433.01





NOTES:

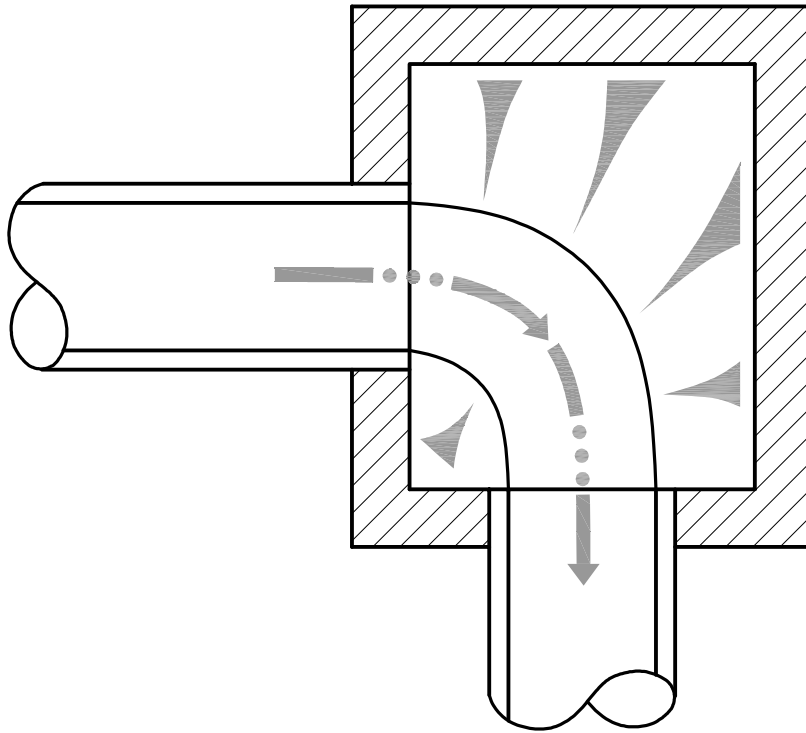
1. STEPS NOT REQUIRED WHERE H IS LESS THAN 4'.
2. STEPS SHALL BE ML-10-NCR OR EQUAL
3. STEPS SHALL BE PLACED ON VACANT WALL WHEN POSSIBLE
4. MANHOLE RING SHALL BE OFFSET TOWARD WALL WITH STEPS.
5. MANHOLE RING SHALL BE CENTERED ON CENTERLINE OF STEPS
6. STAGGER STEPS 2" EACH WAY FROM CENTERLINE OF MANHOLE RING.
7. TOP STEP 24" BELOW TOP OF SLAB
8. STEP SPACING TO BE 16", BOTTOM STEP TO BE NO HIGHER THAN 16" FROM INVERT.

<i>PKS</i>	07/01/20
Approved	Date
Revisions	

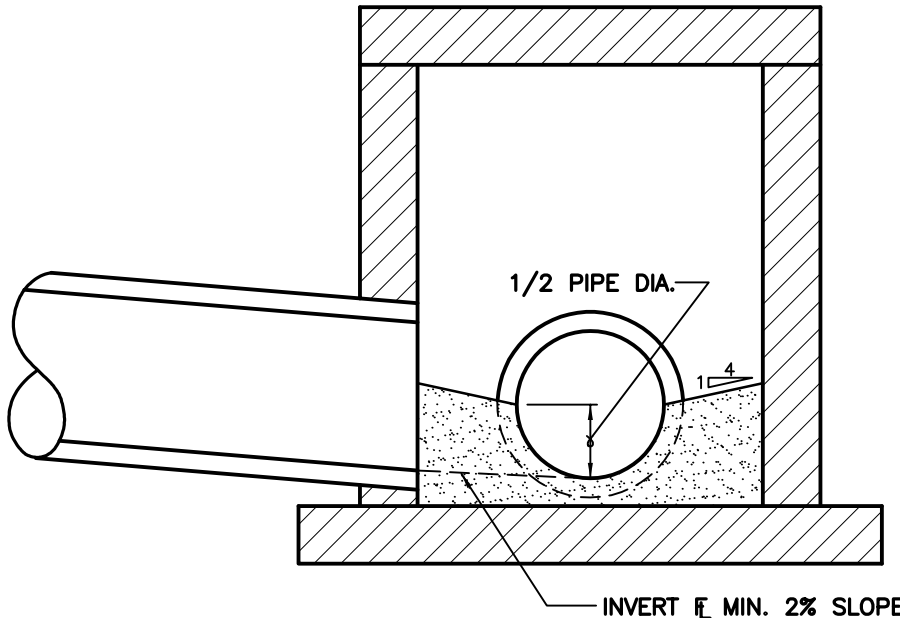


## DRAINAGE STRUCTURE STEPS

500.01



PLAN



INVERT  $\nabla$  MIN. 2% SLOPE

SECTION

**NOTES:**

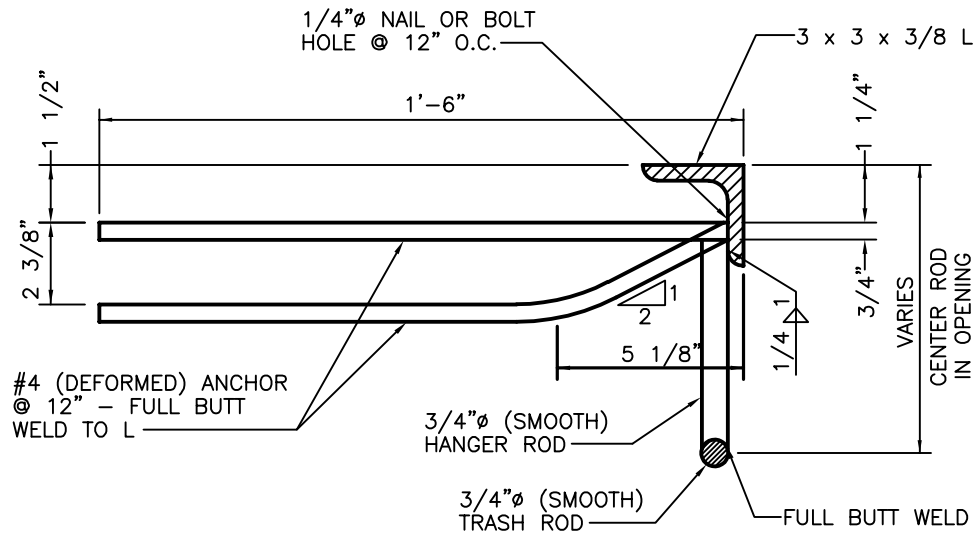
1. FORM ALL INVERTS FOR SMOOTH FLOW THRU STRUCTURE.
2. INVERT SHALL BE FORMED UP TO 1/2 THE PIPE DIAMETER.
3. INVERT SHALL CONFORM TO SECTION 250 CONCRETE.

<i>PKS</i>	07/01/20
Approved	Date
Revisions	

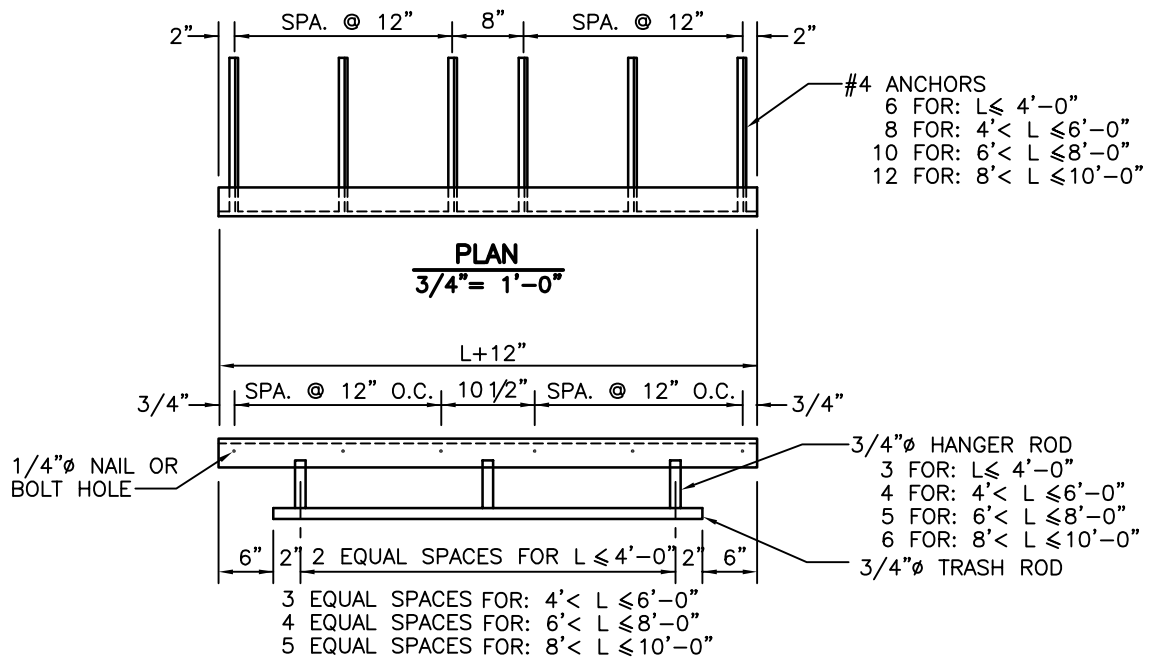


# DRAINAGE STRUCTURE INVERT

500.02



### SECTION



### FRONT ELEV.

#### NOTES:

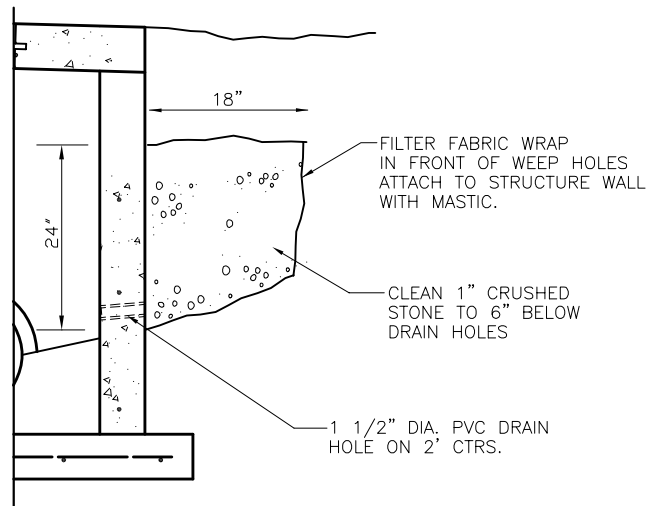
1. STRUCTURAL STEEL SHALL BE GRADE A-36
2. EXPOSED STEEL SURFACES TO BE FINISHED SMOOTH.
3. HOT DIP GALVANIZE ASSEMBLY. CHIPPING NOT REQUIRED ON ANCHOR WELDS.
4. NAILS OR BOLTS USED TO ANCHOR ANGLE ASSEMBLY TO FORM SHALL BE REMOVED OR CUT OFF FLUSH WITH SURFACE OF ANGLE. DO NOT MAR GALVANIZING.
5. DIMENSION "L" REPRESENTS THE INSIDE INLET DIMENSION.

<i>PKS</i>	07/01/20
Approved	Date
Revisions	

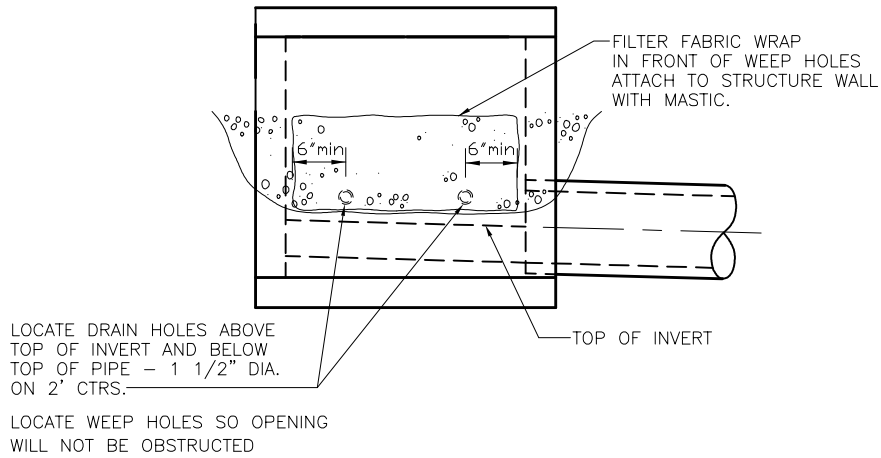


## INLET OPENING TRASH RACK

500.03



PARTIAL SECTION



FRONT ELEVATION

**NOTE:**

1. PLACE WEEP HOLES ON UPSTREAM FACE OF ALL STRUCTURES AND ON ROADWAY FACE OF CURB INLET STRUCTURES.
2. WEEP HOLE FILTER FABRIC SHALL CONSIST OF A NON-WOVEN, POLYPROPYLENE TYPE FABRIC SUCH AS: AMOCO 4553 NON-WOVEN GEOTEXTILE FABRIC OR APPROVED EQUAL.

<i>PKS</i>	07/01/20
Approved	Date
Revisions	



**DRAINAGE STRUCTURE  
WEEP HOLES**

**500.04**

505.01A

## TYPE M INLET NOTES

1. CONCRETE SHALL CONFORM TO SECTION 250.
2. REINFORCING STEEL SHALL BE GRADE 60
3. THIS DESIGN IS FOR L = 4'-0", 6'-0", 8'-0", OR 10'-0".
4. INLET WILL BE CALLED OUT ON PLANS AS 'L'x'W' STD. CURB INLET, OR 'L'x'W' DEFLECTOR CURB INLET. DIMENSIONS 'L'&'W' GIVEN ON PLANS AS 'L'x'W'.
5. STA AND OFFSET OR COORDINATES SHOWN ON PLAN ARE GIVEN TO CENTER OF INLET WALLS.
6. THE ELEVATION OF THE TOP OF INLET GIVEN ON THE PLAN SHEET IS AT THE CENTER OF THE FRONT EDGE OF THE EDGE ANGLE ASSEMBLY. SLOPE THE TOP TO MATCH STREET GRADE, AND CROSS SLOPE OF RIGHT OF WAY.
7. DIMENSIONS TU AND TD AS SHOWN EXCEPT WHERE NOTED OTHERWISE IN PLANS.
8. TRANSITIONS ALONG LENGTH TU & TD MUST BE UNIFORM BETWEEN STANDARD CURB & GUTTER CROSS SECTION & THAT SHOWN AT INLET. FORM CURB FACE WITH FLEXIBLE FORM.
9. REINFORCEMENT:
  - (A) BEND AROUND MH RING WHEREVER FEASIBLE. (SEE PLAN)
  - (B) MINIMUM 2" COVER REQUIRED UNLESS NOTED OTHERWISE.
10. BROOM FINISH TOP SLAB.
11. HORIZONTAL PROJECTION OF PIPE CENTERLINE SHALL INTERSECT AT THE CENTER OF INLET, UNLESS OTHERWISE SHOWN.
12. TRIM PIPE FLUSH WITH INSIDE WALLS.
13. STEPS, FRAME, AND LID:

STEPS NOT REQUIRED WHERE H IS LESS THAN 4'.

STEPS SHALL BE ML-10-NCR OR EQUAL

STEPS SHALL BE PLACED ON VACANT WALL WHEN POSSIBLE


MANHOLE RING SHALL BE OFFSET TOWARD WALL WITH STEPS.

MANHOLE RING SHALL BE CENTERED ON CENTERLINE OF STEPS

STAGGER STEPS 2" EACH WAY FROM CENTERLINE OF MANHOLE RING.

TOP STEP 24" BELOW TOP OF SLAB

STEP SPACING TO BE 16", BOTTOM STEP TO BE NO HIGHER THAN 16" FROM INVERT.
14. CONCRETE INVERT SHALL BE FORMED UP TO 1/2 THE PIPE DIAMETER.
15. WEEP HOLE FILTER FABRIC SHALL CONSIST OF A NON-WOVEN, POLYPROPYLENE TYPE FABRIC SUCH AS PROPEX GEOTEX 801 NON-WOVEN GEOTEXTILE FABRIC OR APPROVED EQUAL.
16. DRIVEWAYS ARE TO BE AT LEAST 5' FROM END OF CURB TRANSITION (TU AND TD).

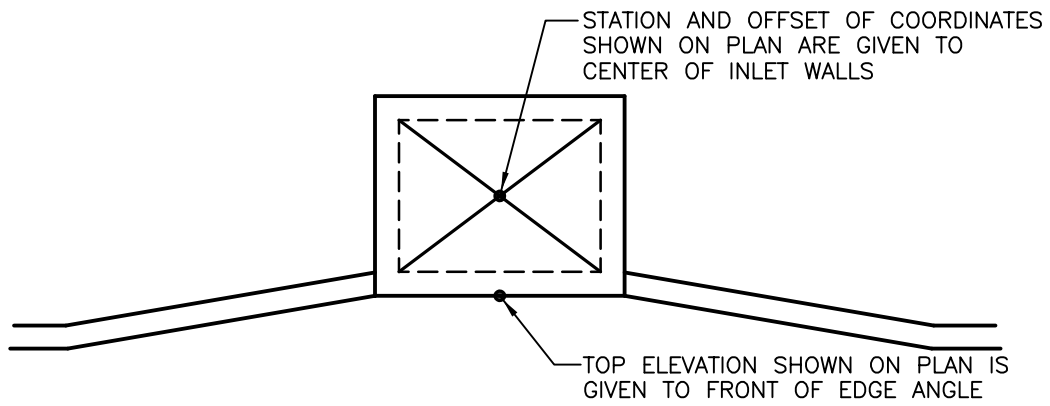
 Approved	07/01/20 Date
Revisions	



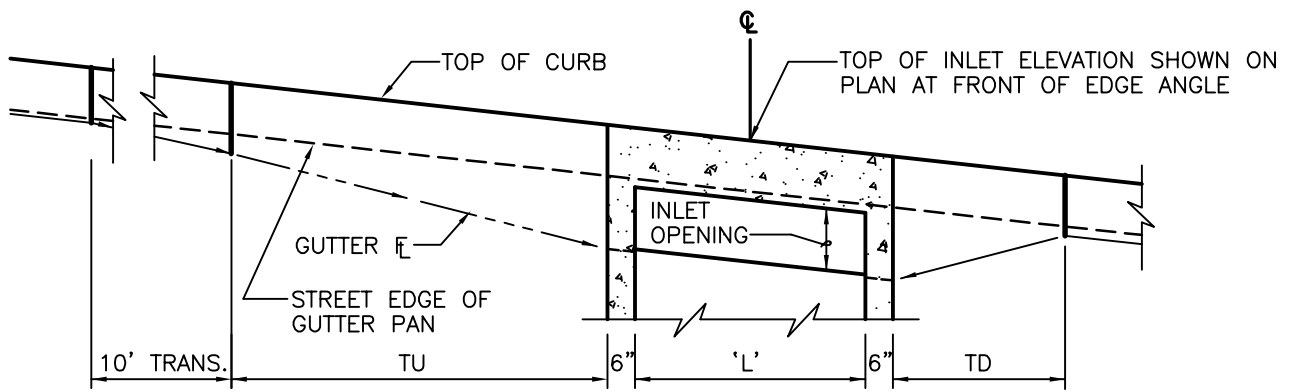
## TYPE M INLET NOTES

505.01B

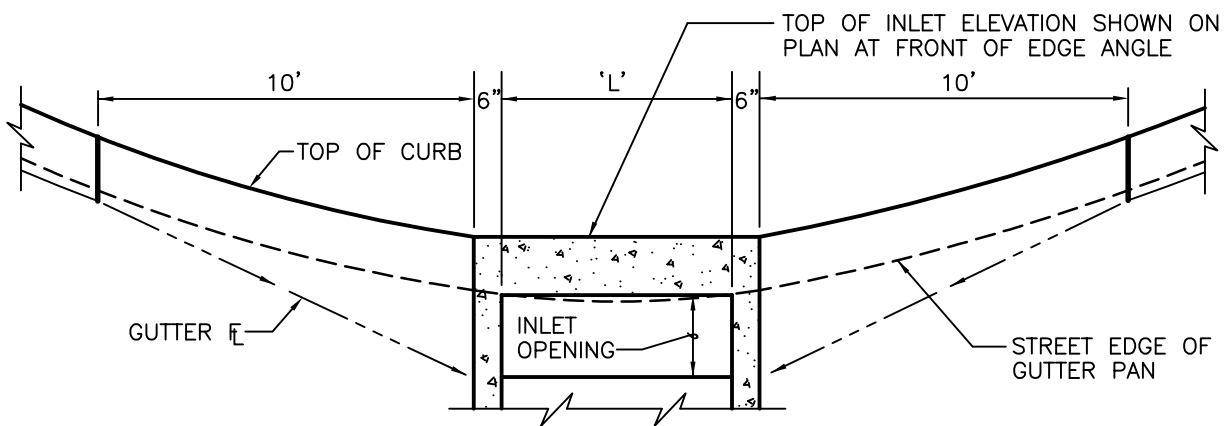




### INLET PLAN INFORMATION



### ON SLOPE



### AT LOW POINT

## INLET SETTING DIAGRAMS

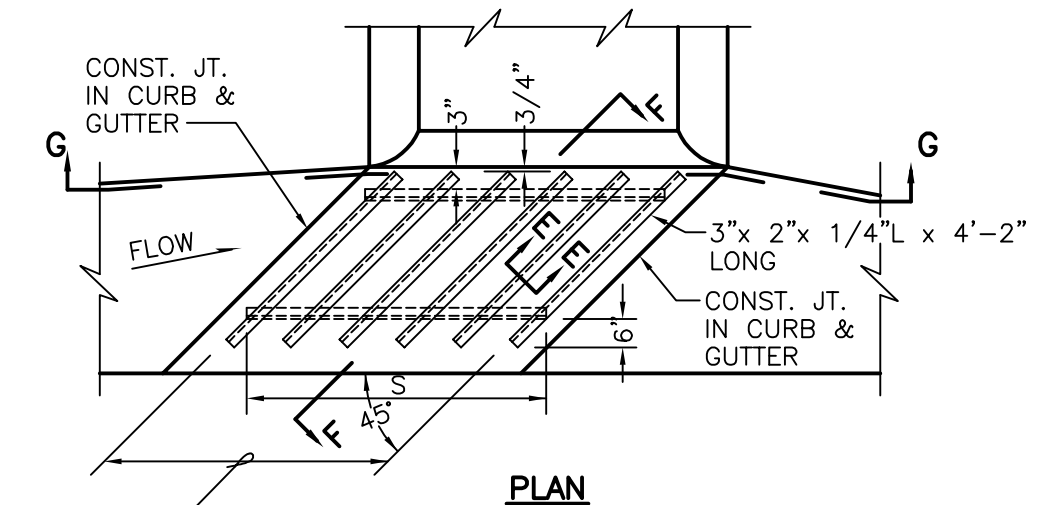
<i>PKS</i>	07/01/20
Approved	Date
Revisions	



TYPE M INLET  
SETTING DIAGRAM

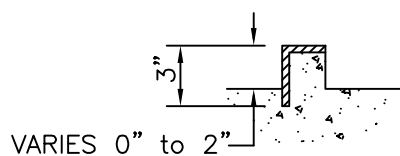
505.01D



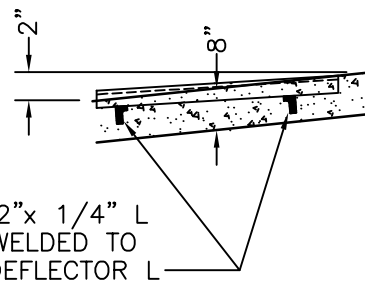


DEFLECTORS TO BE EQUALLY SPACED

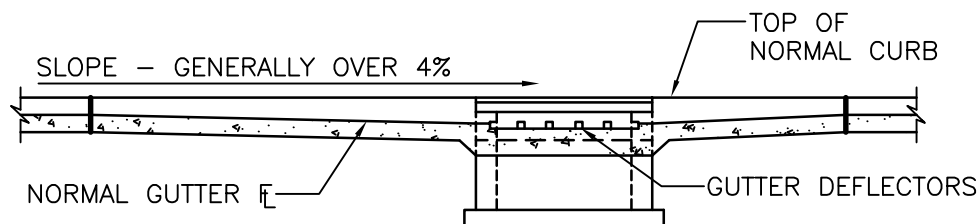
{	FOR L=4'; 6 DEFLECTORS-S=4'-6"
	FOR L=6'; 8 DEFLECTORS-S=6'-6"
	FOR L=8'; 11 DEFLECTORS-S=8'-6"
	FOR L=10'; 13 DEFLECTORS-S=10'-6"



**SECTION E-E**



**SECTION F-F**



**SECTION G-G**

**GUTTER DEFLECTOR NOTES:**

1. ASSEMBLY TO BE HOT DIP GALVANIZED.
2. TO BE USED WHERE DEFLECTOR CURB INLET IS SPECIFIED
3. BEFORE PLACING CONCRETE; SUPPORT UNIT SECURELY IN FINAL POSITION BY ATTACHING TO METAL RODS DRIVEN INTO SUBGRADE

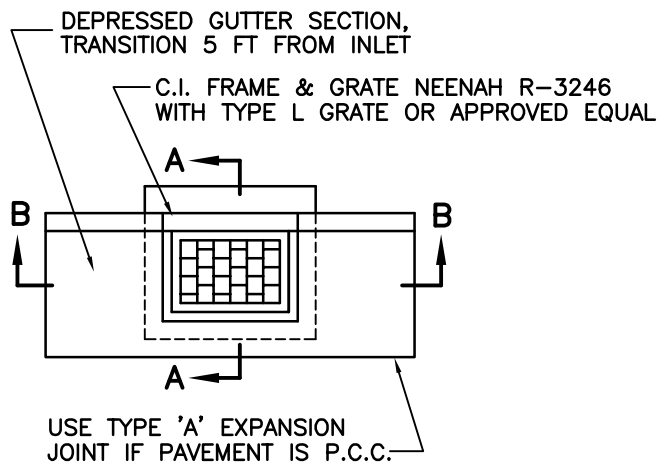
<i>PKS</i>	07/01/20
Approved	Date
Revisions	



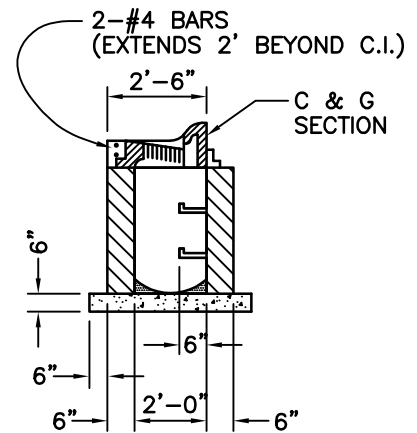
**TYPE M INLET  
DEFLECTOR DETAIL**

**505.01E**

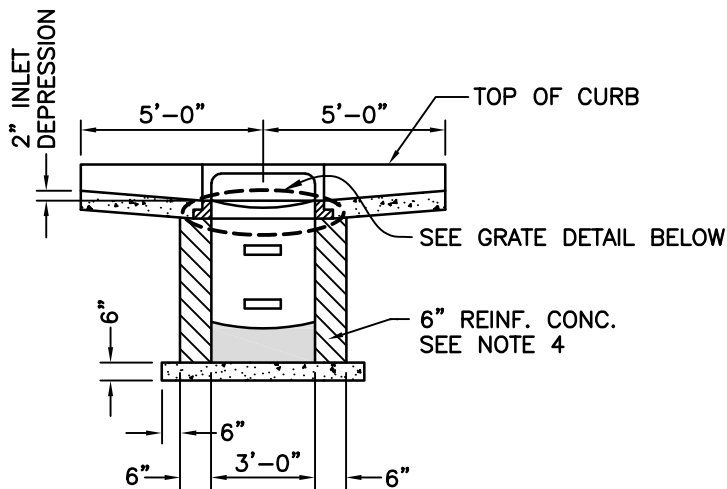




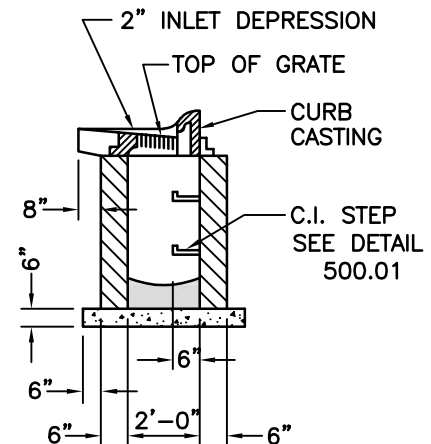
**PLAN — SINGLE**



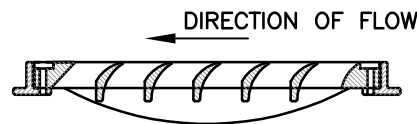
**SECTION A-A  
ALTERNATE**



**SECTION B-B**



**SECTION A-A**



**GRATE DETAIL**

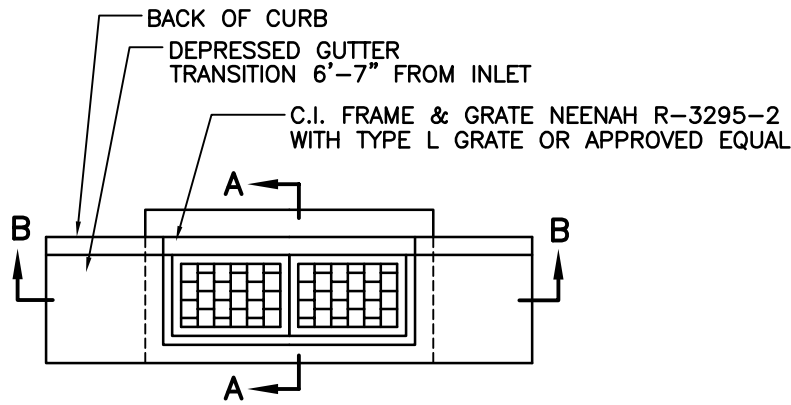
- NOTES:
1. CONCRETE SHALL CONFORM TO SECTION 250
  2. REINFORCING STEEL SHALL BE GRADE 60
  3. INSTALL WEEP HOLES AS PER DETAIL 500.04
  4. USE #4 BARS AT 12" CTRS, BOTH WAYS AND #4 BARS DIAGONAL AT PIPE OPENINGS
  5. SEE DETAIL 310.01 FOR TYPICAL CURB AND GUTTER SECTION

<i>PHS</i>	07/01/20
Approved	Date
Revisions	

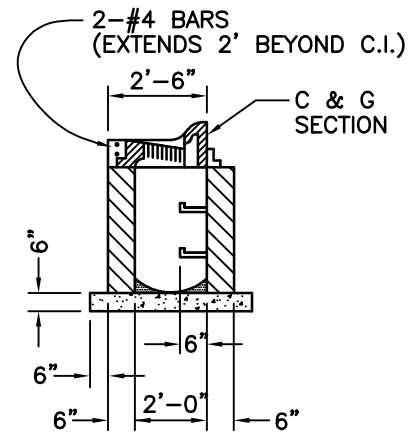


**SINGLE TYPE "A" INLET**

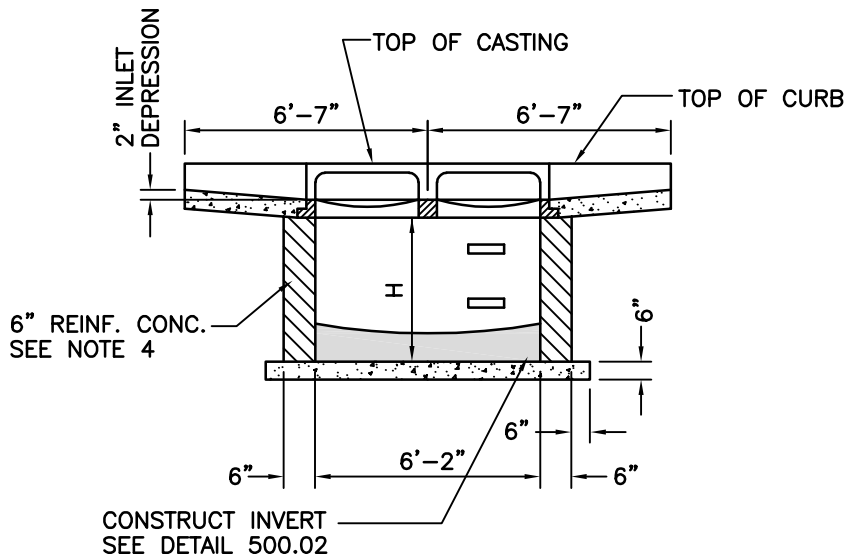
**505.02A**



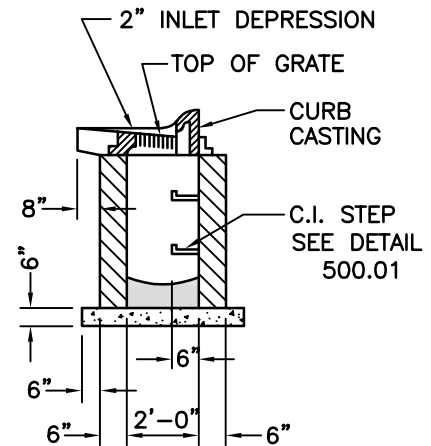
**PLAN - DOUBLE**



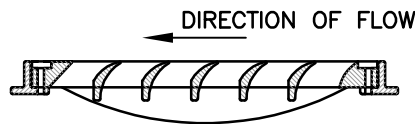
**SECTION A-A  
ALTERNATE**



**SECTION B-B**



**SECTION A-A**



**GRATE DETAIL**

- NOTES:
1. CONCRETE SHALL CONFORM TO SECTION 250
  2. REINFORCING STEEL SHALL BE GRADE 60
  3. INSTALL WEEP HOLES AS PER DETAIL 500.04
  4. USE #4 BARS AT 12" CTRS, BOTH WAYS AND #4 BARS DIAGONAL AT PIPE OPENINGS
  5. SEE DETAIL 310.01 FOR TYPICAL CURB AND GUTTER SECTION

*PHS*  
Approved

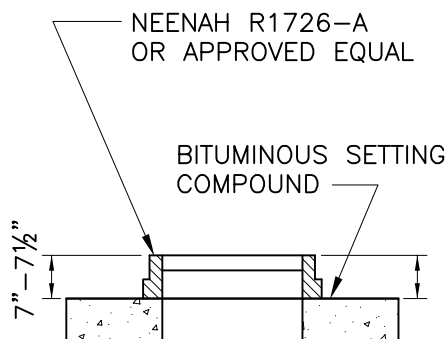
07/01/20  
Date

Revisions



**DOUBLE TYPE "A" INLET**

**505.02B**



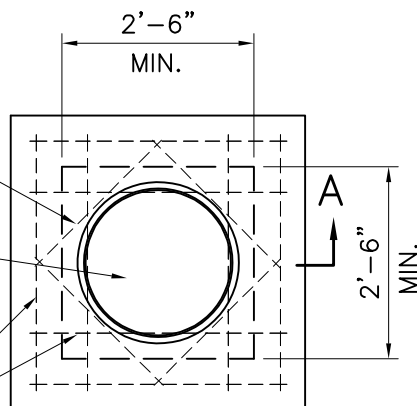
### ALTERNATE TOP

(MUST BE USED UNDER PAVEMENTS ONLY)

#4 BARS DIAG.

MANHOLE FRAME  
AND LID PER  
NOTE 5.

#4 BARS @ 8"  
O.C. BOTH WAYS



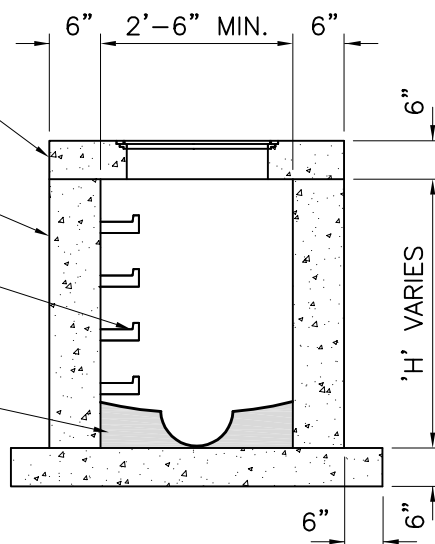
### PLAN VIEW

REINF. CONCRETE TOP

6" REINF. CONC.  
SEE NOTE 4

CAST IRON STEPS  
SEE DETAIL 500.01

CONSTRUCT INVERT  
SEE DETAIL 500.02



### SECTION A-A

(SHOWING STANDARD FLUSH TOP)

- NOTES:
1. CONCRETE SHALL CONFORM TO SECTION 250.
  2. REINFORCING STEEL SHALL BE GRADE 60
  3. INSTALL WEEP HOLES AS PER DETAIL 500.04
  4. USE #4 BARS AT 12" CTRS, BOTH WAYS AND #4 BARS DIAGONAL AT PIPE OPENINGS.
  5. FRAME AND LID SHALL BE NEENAH 4-1960-A (TYPE C LID) OR APPROVED EQUAL.  
SEE DETAIL 500.01 FOR PLACEMENT.

<i>PAS</i>	07/01/20
Approved	Date
Revisions	



JUNCTION BOX

510.01

510.02

FINISH EARTH SLOPE  
AS REQUIRED

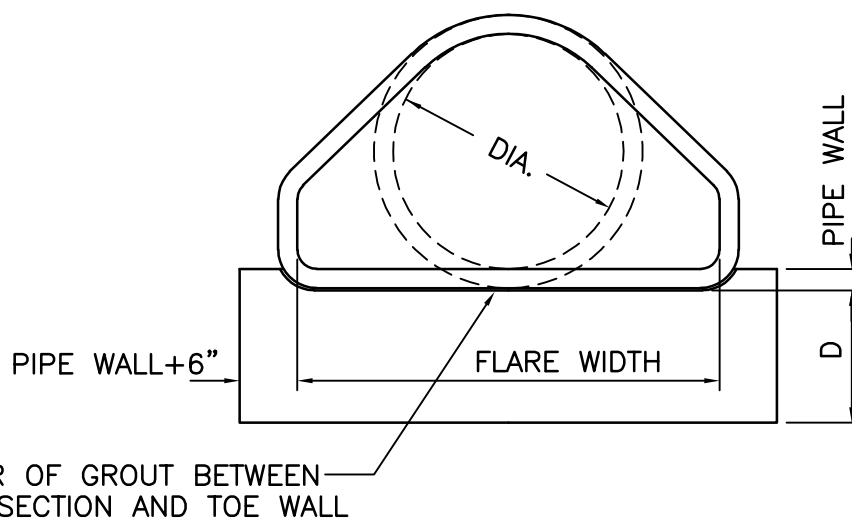
CULVERT

FLARED END SECTION

8"

D

### SECTION VIEW



### END VIEW

**NOTE:**

1. CONCRETE FOR TOE WALL SHALL CONFORM TO SECTION 250.
2. D=18" FOR PIPES WITH INSIDE DIAMETER 21" OR LESS.
3. D=24" FOR PIPES WITH INSIDE DIAMETER FROM 24" TO 48".
4. D=36" FOR PIPES WITH INSIDE DIAMETER 54" OR MORE.

<i>PKS</i>	07/01/20
Approved	Date
Revisions	



TOEWALL & END SECTION  
FOR RCP

525.01A

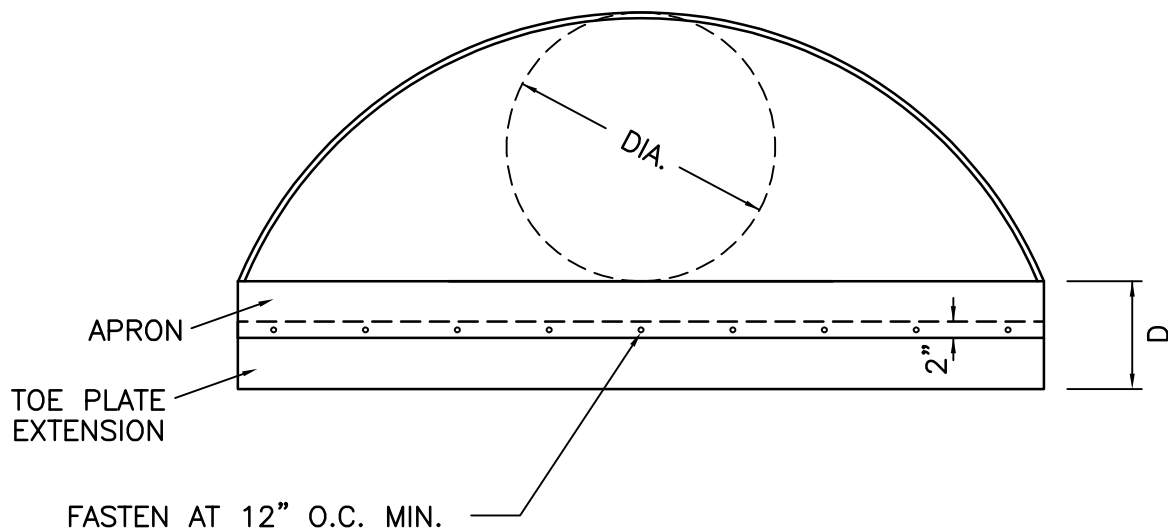
FINISH EARTH  
SLOPE AS REQ'D.

CULVERT

FLARED END SECTION

D

### SECTION VIEW



### END VIEW

NOTE:

1. D=12" FOR PIPES WITH INSIDE DIAMETER 24" OR LESS.
2. D=18" FOR PIPES WITH INSIDE DIAMETER 27" OR MORE.
3. EXTENSION PLATE SHALL BE SAME MATERIAL AS PIPE. THICKNESS SHALL BE EQUAL TO EQUIVALENT DIAMETER CMP GAUGE.
4. APRON AND TOE PLATE SHALL BE SECURELY FASTENED WITH SPOT WELDS, BOLTS, OR RIVETS.

*RAS*  
Approved

07/01/20  
Date

Revisions



END SECTION  
FOR HDPE AND CMP

525.01B

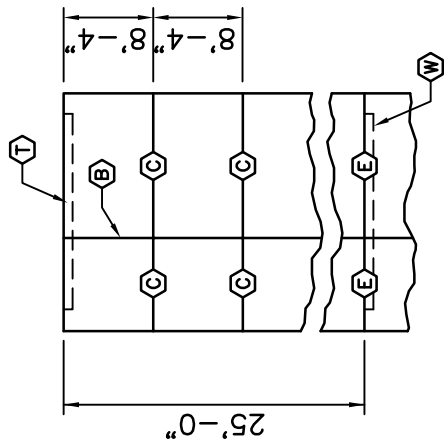


<i>PKS</i> Approved	07/01/20 Date
Revisions	

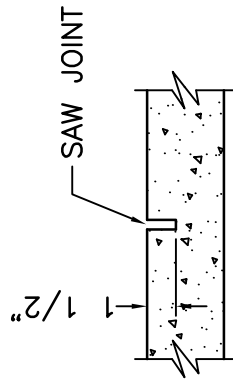


# CONCRETE SWALE (V-Type)

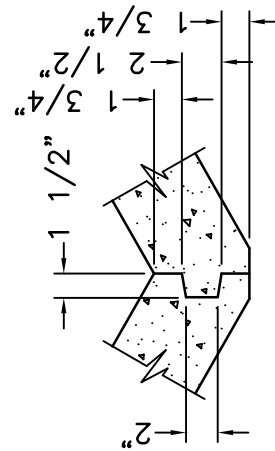
530.01



PLAN VIEW



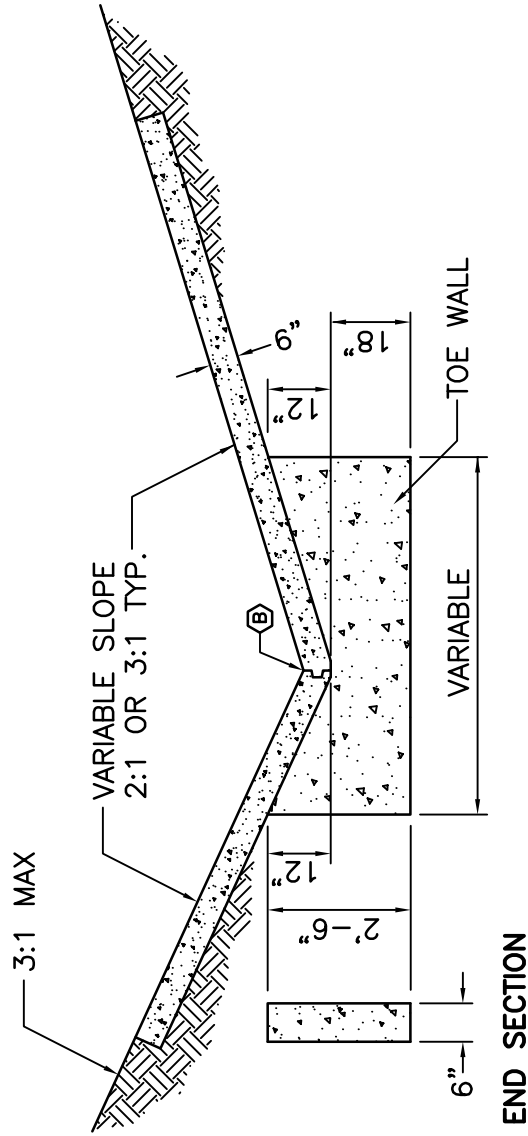
C JOINT DETAIL



B JOINT DETAIL

**LEGEND**

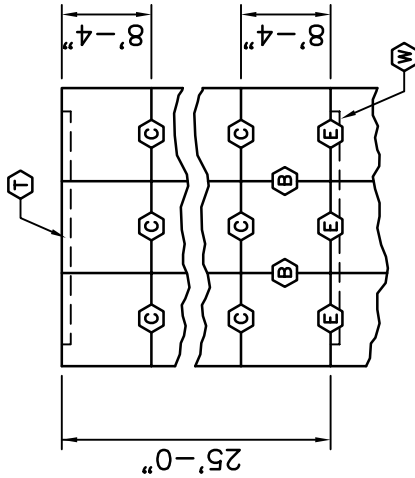
- SAW JOINT, FILL WITH BITUMASTIC JOINT SEALANT – SEE DETAIL.
- 1/2" EXPANSION JOINT AT 50' INTERVALS.
- TOE WALL TO BE CONSTRUCTED AT INLET & OUTLET END OF PAVED DITCHES.
- KEY JOINT (SEE DETAIL)
- CUT-OFF WALL @ 25'-0" SPA.



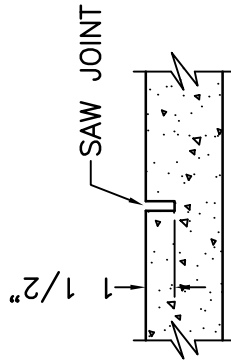
END SECTION

## SECTION THROUGH SWALE SHOWING TOE WALL OR CUT-OFF WALL

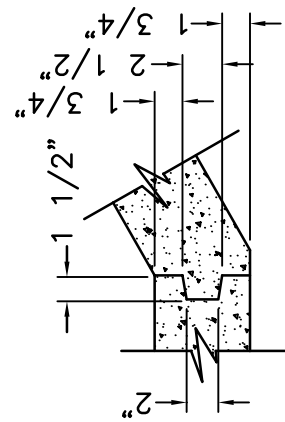
NOTE:  
CONCRETE SHALL CONFORM TO SECTION 250



**PLAN VIEW**



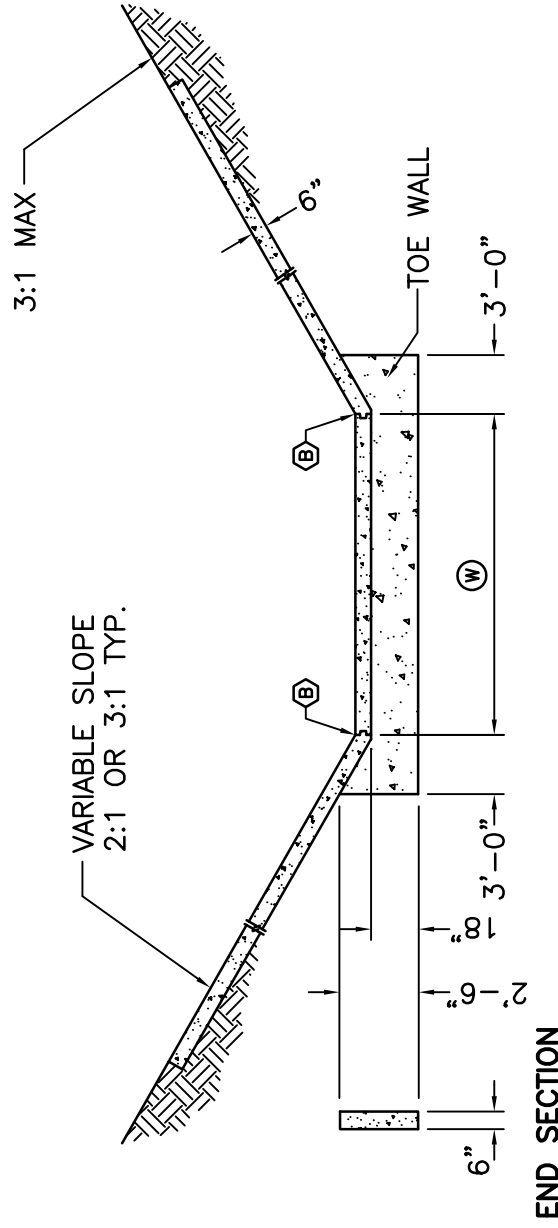
**JOINT DETAIL**



**B JOINT DETAIL**

**LEGEND**


- (C) SAW JOINT, FILL WITH BITUMASTIC JOINT SEALANT – SEE DETAIL.
- (E) 1/2" EXPANSION JOINT AT 50' INTERVALS
- (B) KEY JOINT (SEE DETAIL)
- (T) TOE WALL TO BE CONSTRUCTED AT INLET & OUTLET END OF PAVED DITCHES.
- (W) CUT-OFF WALL @ 25'-0" SPA.



**SECTION THROUGH SWALE**

SHOWING TOE WALL OR CUT-OFF WALL

NOTE:  
CONCRETE SHALL CONFORM TO SECTION 250

	<b>07/01/20</b> Date
<b>Revisions</b>	



**CONCRETE SWALE**  
(Flat-Bottom Type)

**530.02**

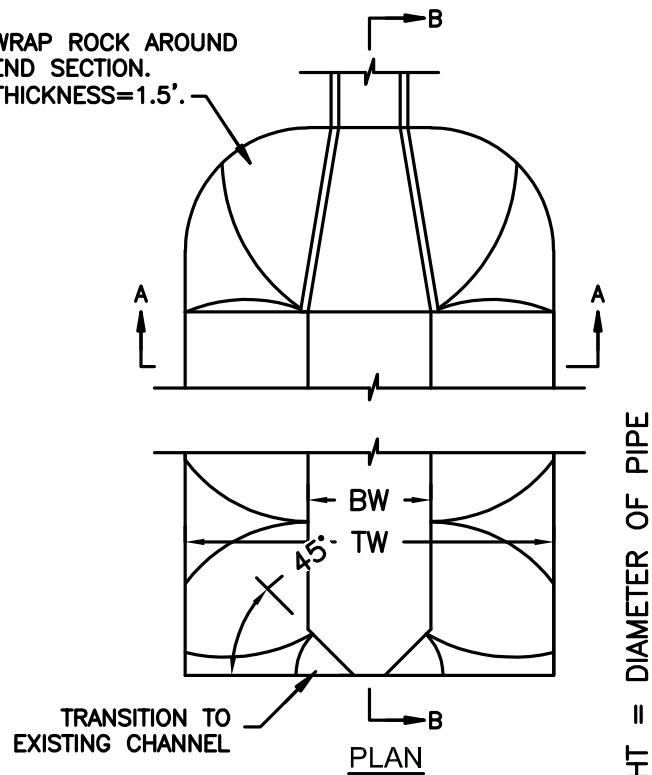
Pipe Size (in)	Maximum Pipe Slope (%)	Length L (ft)	Bottom Width BW Minimum (ft)	Top Width TW Minimum (ft)	Thickness T Minimum (ft)
12	3.50	12	4	8	2
15	2.60	15	4	9	2
18	2.00	16	4	10	2
24	1.70	20	4	12	2
30	1.40	24	6	16	2
36	1.00	28	6	18	2
42	0.80	32	6	20	3
48	0.65	36	6	22	3
54	0.55	40	8	26	3
60	0.45	44	8	28	3
72	0.40	48	8	32	3

RIP RAP TO BE TYPE 1: ROCK MUST BE ANGULAR, HARD AND DURABLE.

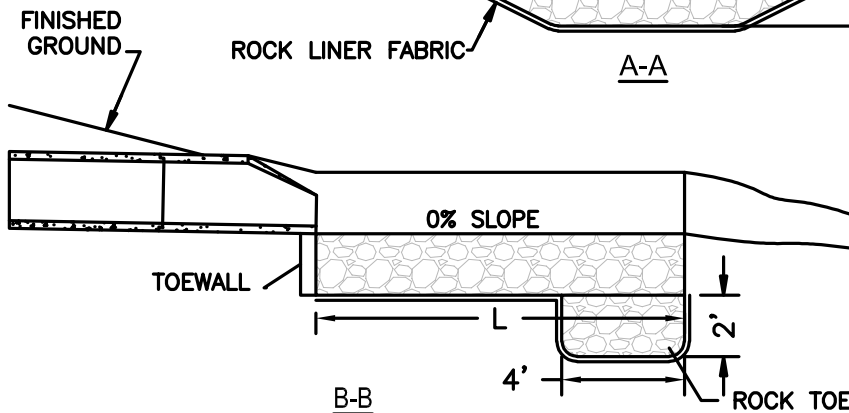
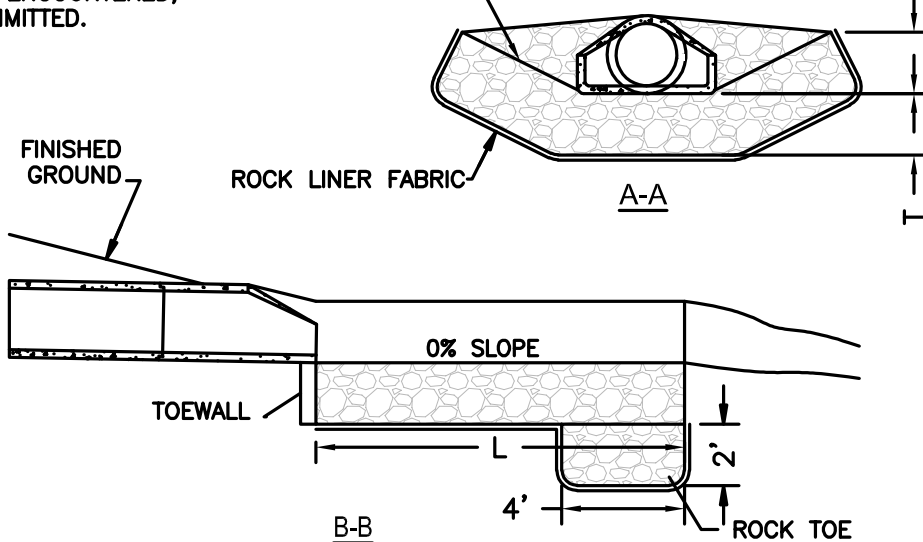
ROCK LINER FABRIC SHALL BE PROPEX GEOTEX 801 OR APPROVED EQUAL. ALTERNATIVELY, AN 8 INCH BED OF WELL GRADED SAND AND GRAVEL WITH GRAVEL UP TO 3" IS ACCEPTABLE.

WHERE BEDROCK IS ENCOUNTERED, RIP RAP MAY BE OMITTED.

WRAP ROCK AROUND END SECTION. THICKNESS=1.5'.



ALLOWABLE SIDE SLOPES 2:1-4:1

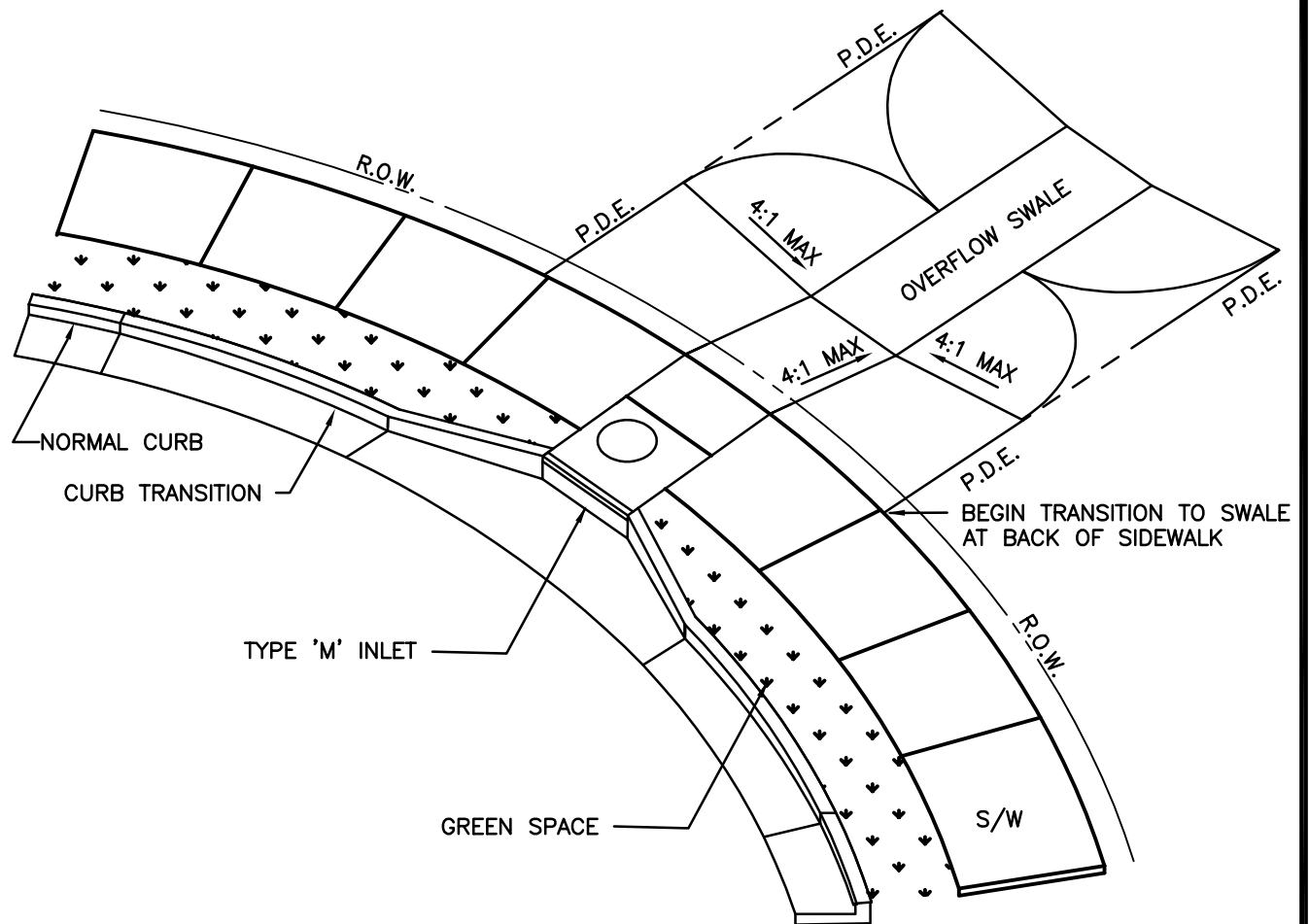


<i>PKS</i>	07/01/20
Approved	Date
Revisions	



RIP RAP WITH FILTER FABRIC

530.03

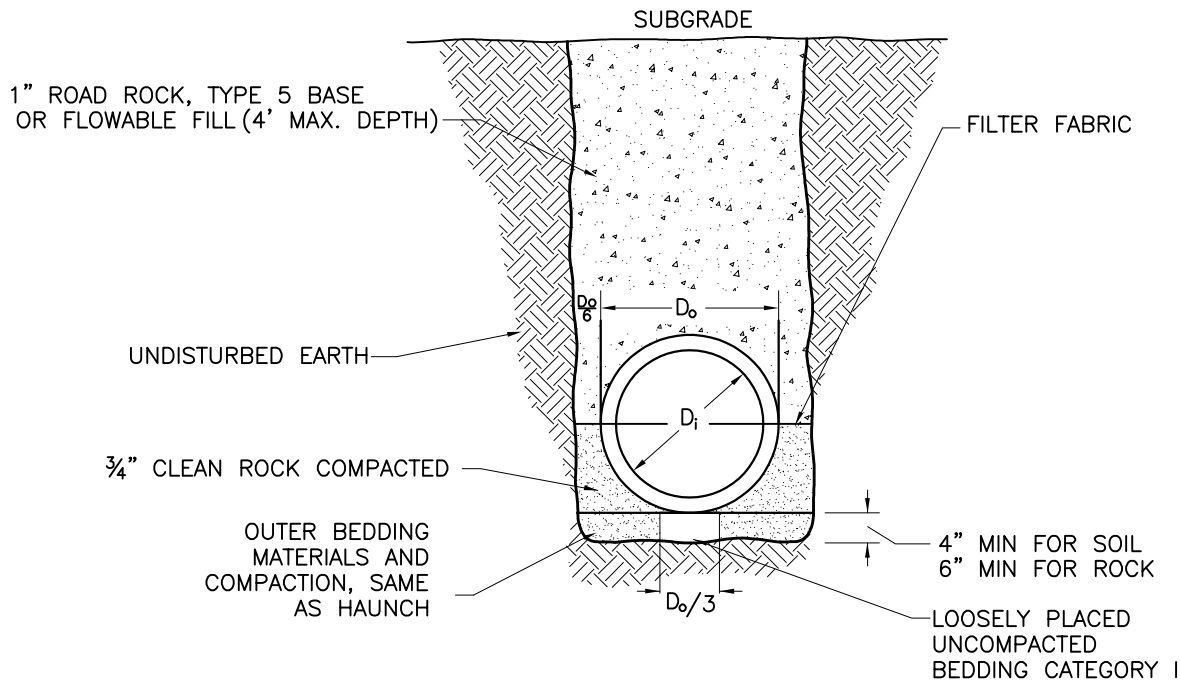


<i>PKS</i>	07/01/20
Approved	Date
Revisions	



## OVERFLOW SWALE AT CUL-DE-SAC

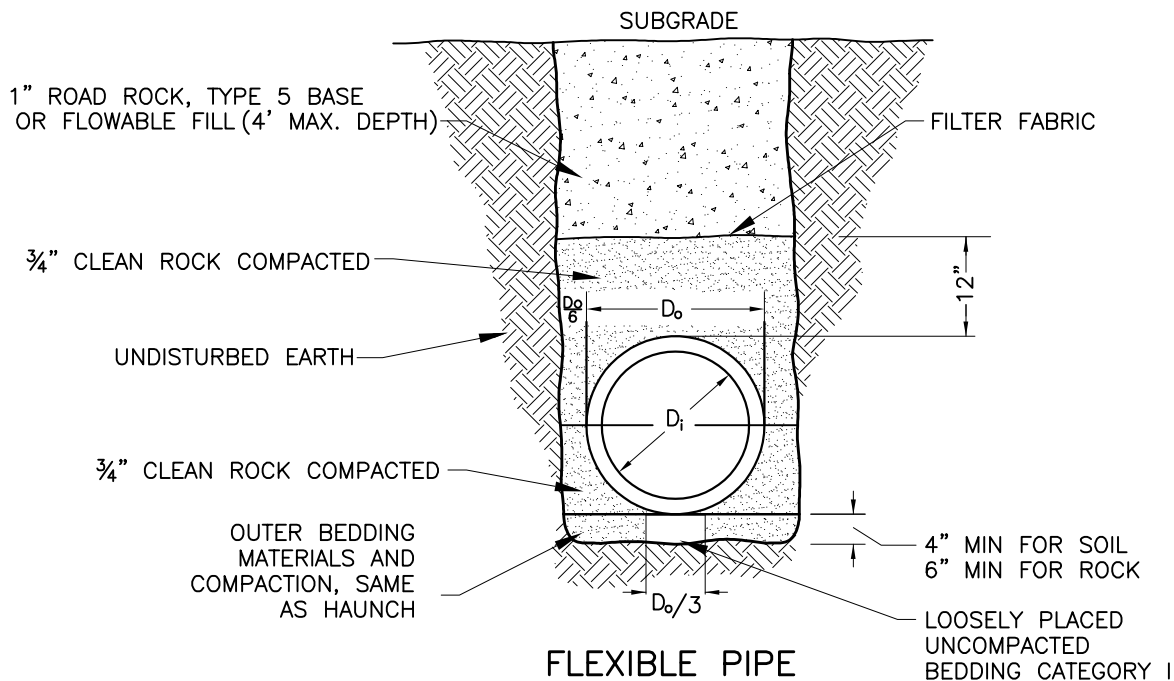
530.04



### RIGID PIPE

NOTE: SEE SECTION 201.12.10.1 FOR 1" ROAD  
ROCK GRADATION AND FOR CATEGORY I,II,AND III  
SPECIFICATIONS

PIPE DIAMETER	PAYLINE/ MIN. TRENCH WIDTH	MAX. TRENCH WIDTH
8"-36"	$D_o + 12"$	$D_o + 24"$
42"-72"	$D_o + (D_o/3)$	$D_o + 30"$
72"+	$D_o + (D_o/3)$	$D_o + 48"$



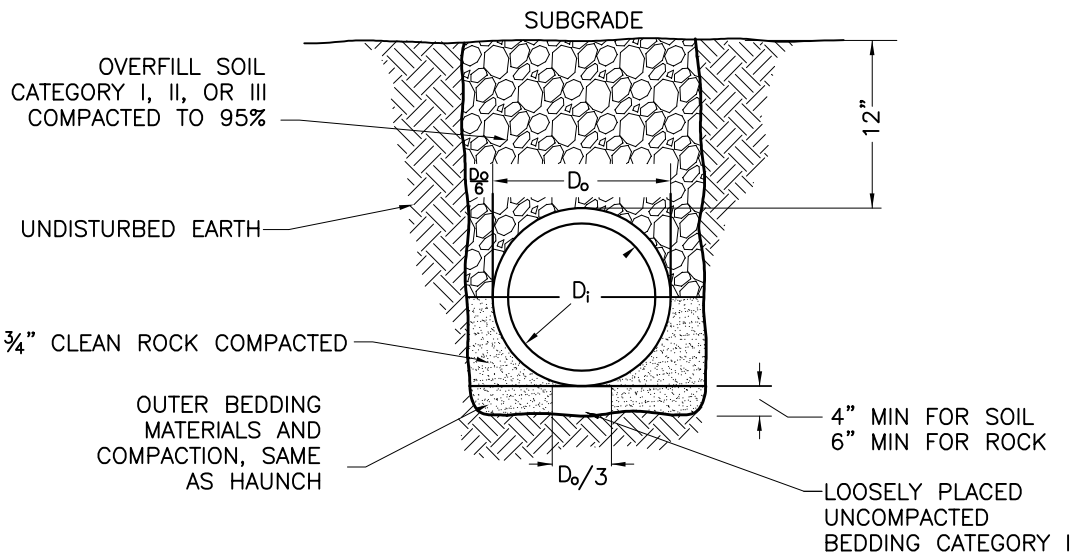
### FLEXIBLE PIPE

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



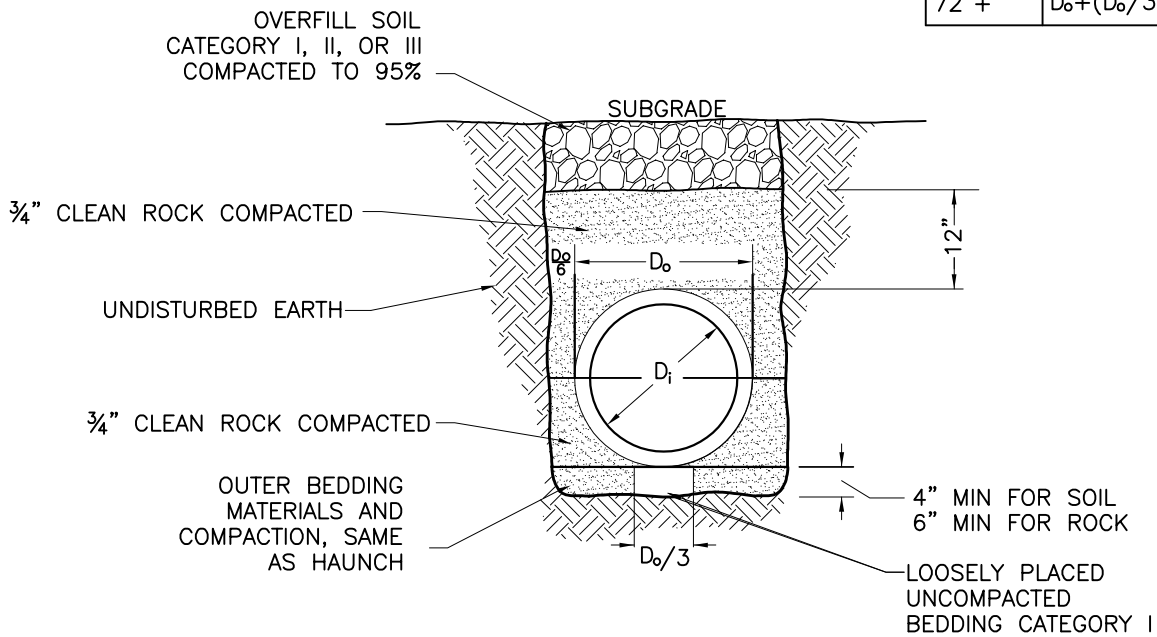
PIPE EMBEDMENT  
(In the Right of Way)

540.01



### RIGID PIPE

PIPE DIAMETER	PAYLINE/ MIN. TRENCH WIDTH	MAX. TRENCH WIDTH
8"-36"	$D_o + 12"$	$D_o + 24"$
42"-72"	$D_o + (D_o/3)$	$D_o + 30"$
72"+	$D_o + (D_o/3)$	$D_o + 48"$



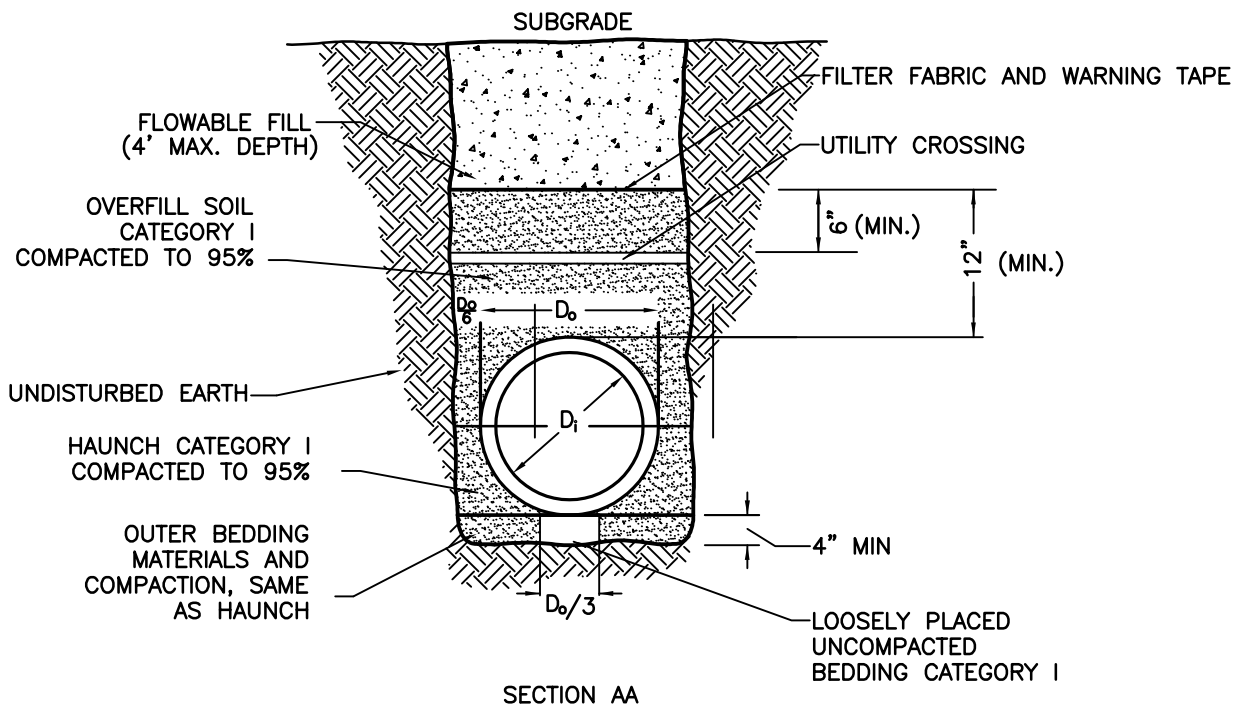
### FLEXIBLE PIPE

<i>RAS</i>	07/01/20
Approved	Date
Revisions	

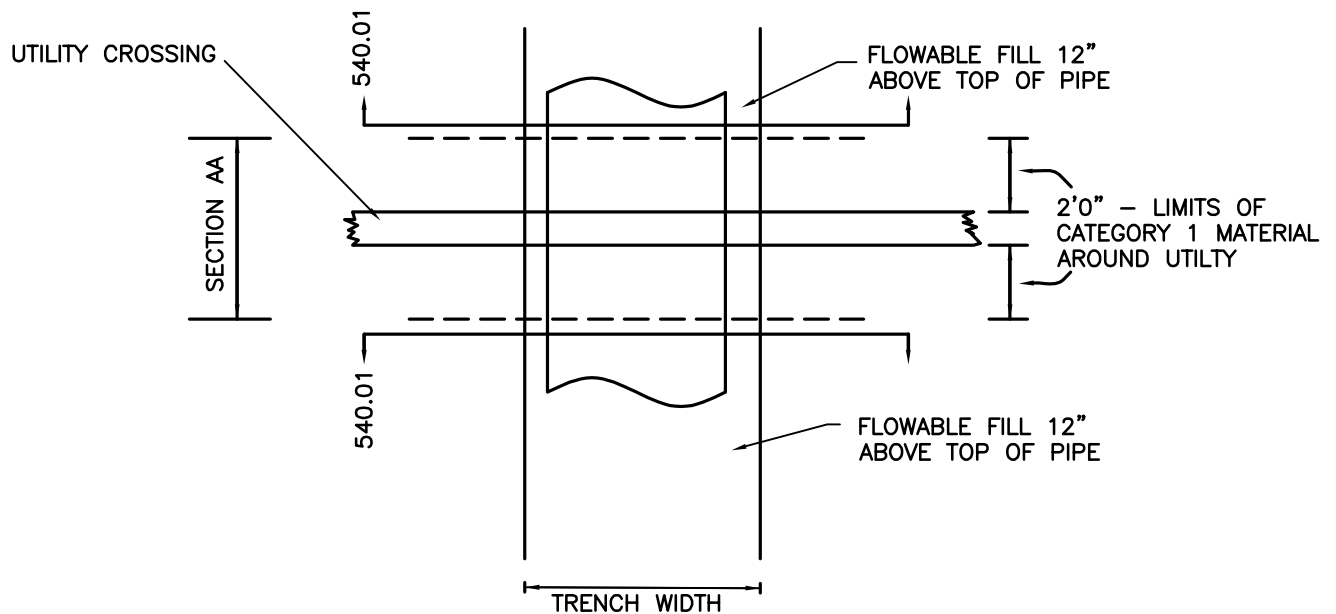


## PIPE EMBEDMENT (Out of the Right of Way)

540.02



PIPE DIAMETER	PAYLINE/ MIN. TRENCH WIDTH	MAX. TRENCH WIDTH
12"–36"	$D_o + 12"$	$D_o + 24"$
42"–72"	$D_o + (D_o/3)$	$D_o + 30"$
72"+	$D_o + (D_o/3)$	$D_o + 48"$

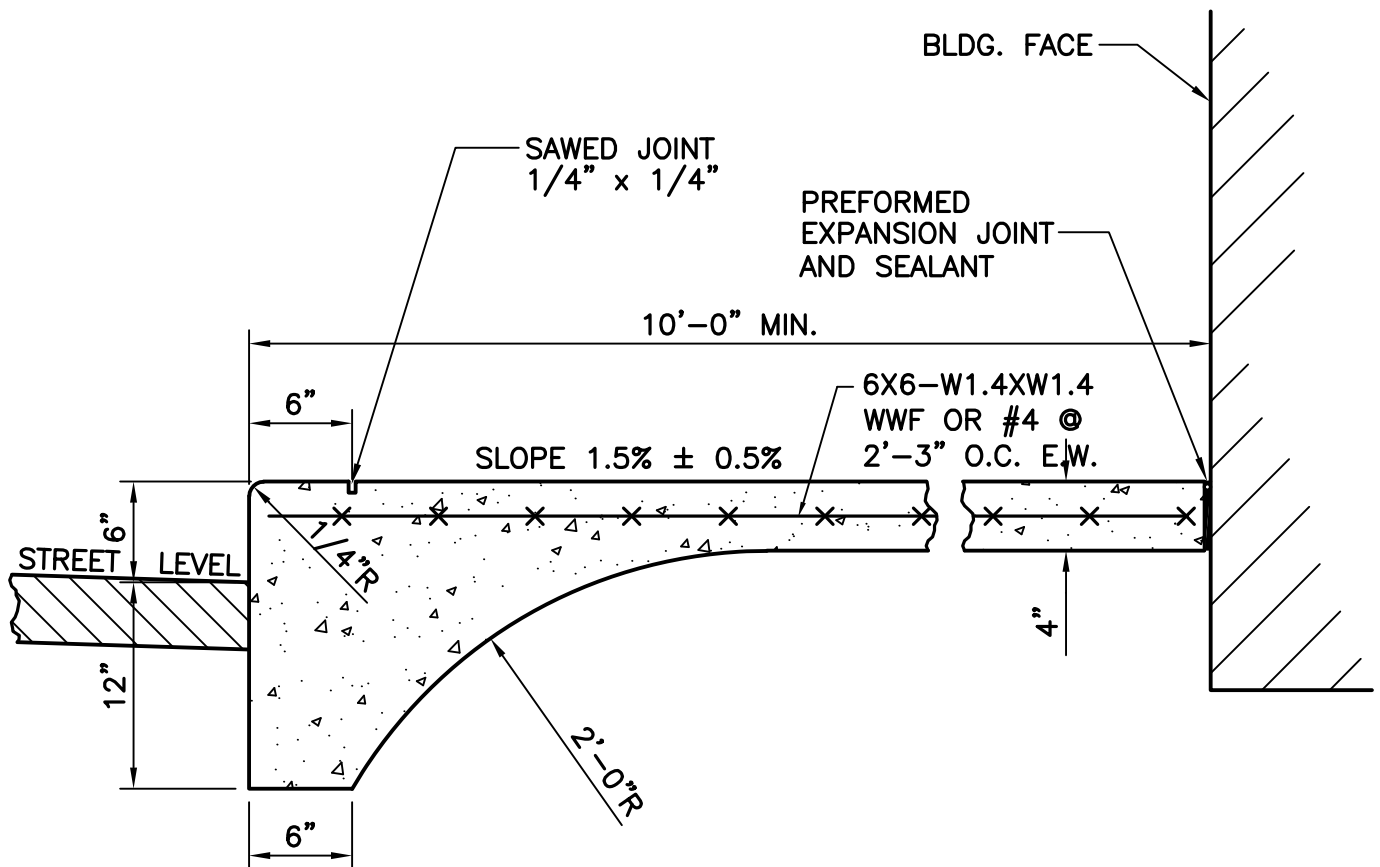


<i>RAS</i>	07/01/20
Approved	Date
Revisions	




## UTILITY CROSSING (In the Right of Way)

541.01



### NOTES:

1. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.00%.
2. SAW AND PATCH STREET PAVEMENT AS NECESSARY FOR CONSTRUCTION OF NEW CURB.
3. SEE JOINT DETAILS – 1000.03.
4. SEE SPECIFICATIONS – 1000.01B THRU 1000.01D.
- 5 NO STEEL TO BE PLACED THROUGH EXPANSION JOINT

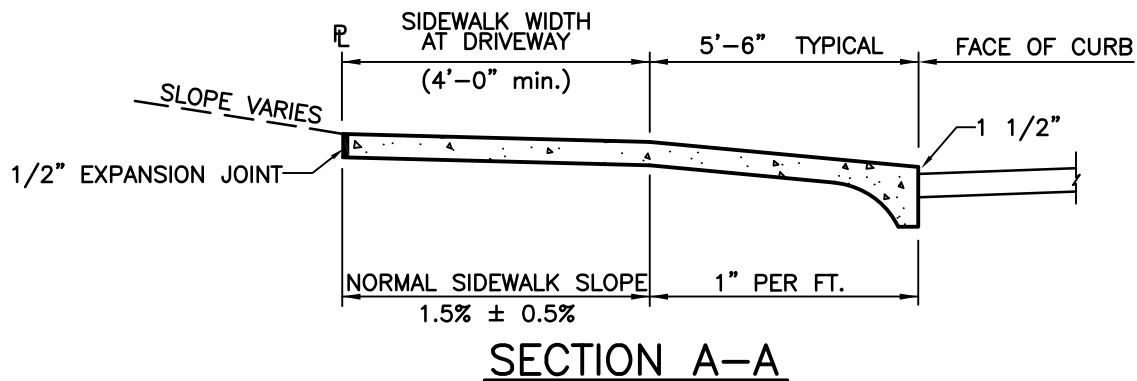
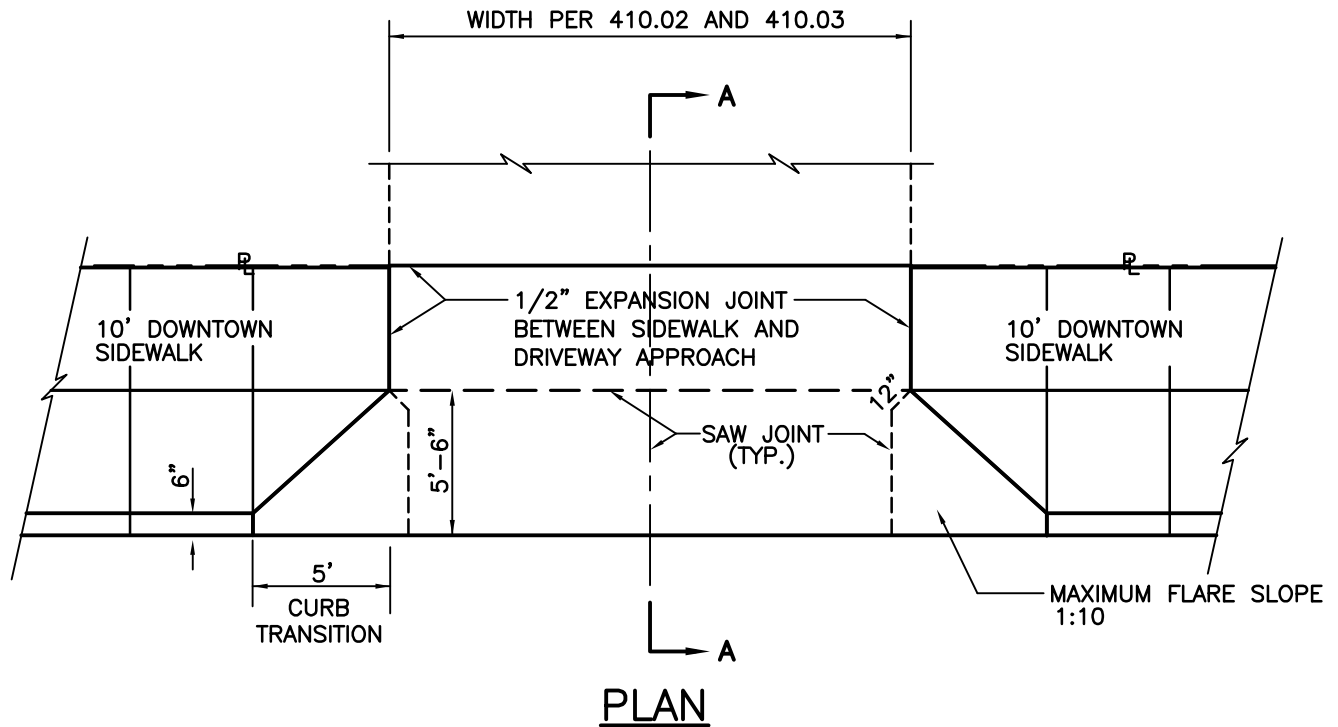
	07/01/20
Approved	Date
Revisions	



DOWNTOWN SIDEWALK


1000.02





**NOTES:**

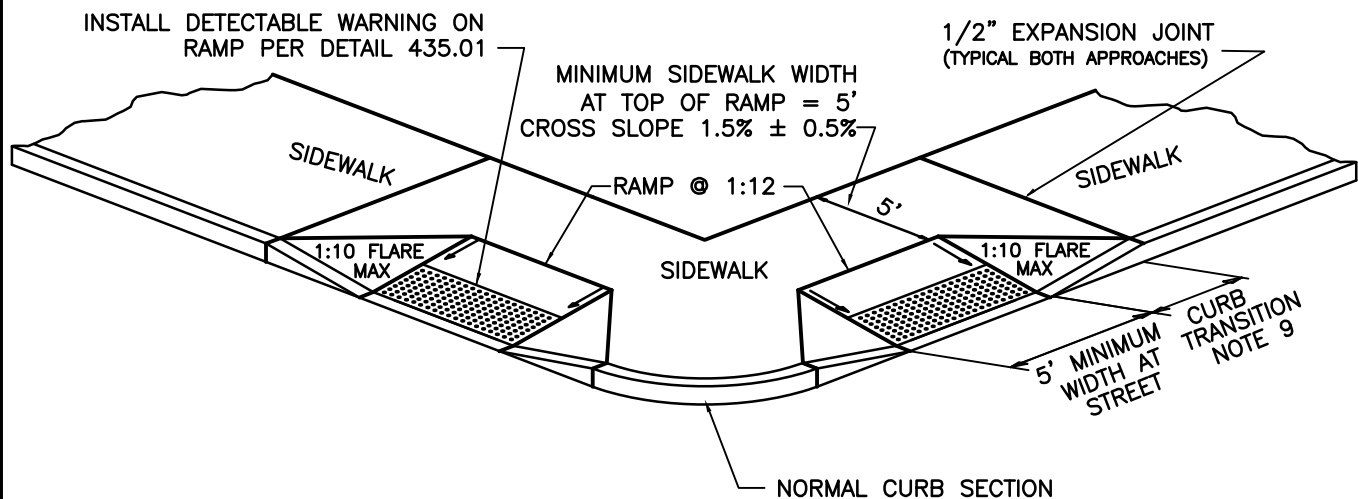
1. DRIVEWAY APPROACH SHALL BE 7" THICK M&D PAVEMENT CONCRETE.
2. SEE JOINT DETAILS - 1000.03.
3. ALL DRIVEWAY APPROACHES SHALL SLOPE TOWARD THE STREET.
4. ALL DRIVEWAY APPROACHES SHALL BE CONSTRUCTED TO ACCOMMODATE SIDEWALKS. (EXISTING AND FUTURE)
5. OMIT 1 1/2" EDGE AT GUTTER IF DRIVE APPROACH ALSO SERVES AS ACCESSIBLE SIDEWALK RAMP.
6. DRIVEWAY MAY BE REINFORCED AT OWNERS OPTION. DO NOT REINFORCE ON CITY BID PROJECTS.
7. SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2.00%.

 Approved	07/01/20 Date
Revisions	



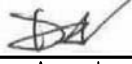
## DRIVEWAY AND ALLEY (Downtown)

1000.05



**NOTE:**

1. RAMP, LANDING AND AREA BETWEEN RAMPS SHALL BE 6" THICK REINFORCED W/ #4 @ 12" O.C. MoDOT PAVEMENT CONCRETE.
2. SEE DETAIL 1000.03 FOR JOINT DETAILS.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
6. LANDING AREA AT TOP OF RAMP SHALL BE 5' MIN WIDTH, CROSS SLOPE OF LANDING SHALL NOT EXCEED 2.00%.
7. TYPE "A" RAMP NOT APPLICABLE IF SIDEWALK WIDTH DOES NOT PROVIDE 5' LANDING AT THE TOP OF RAMP. USE TYPE "B" RAMP.
8. RAMP EXTENDS INTO SIDEWALK, FLARE SLOPE MUST NOT EXCEED 1:10.
9. CURB TRANSITION LENGTH IS DEPENDENT ON 1:10 FLARE SLOPE

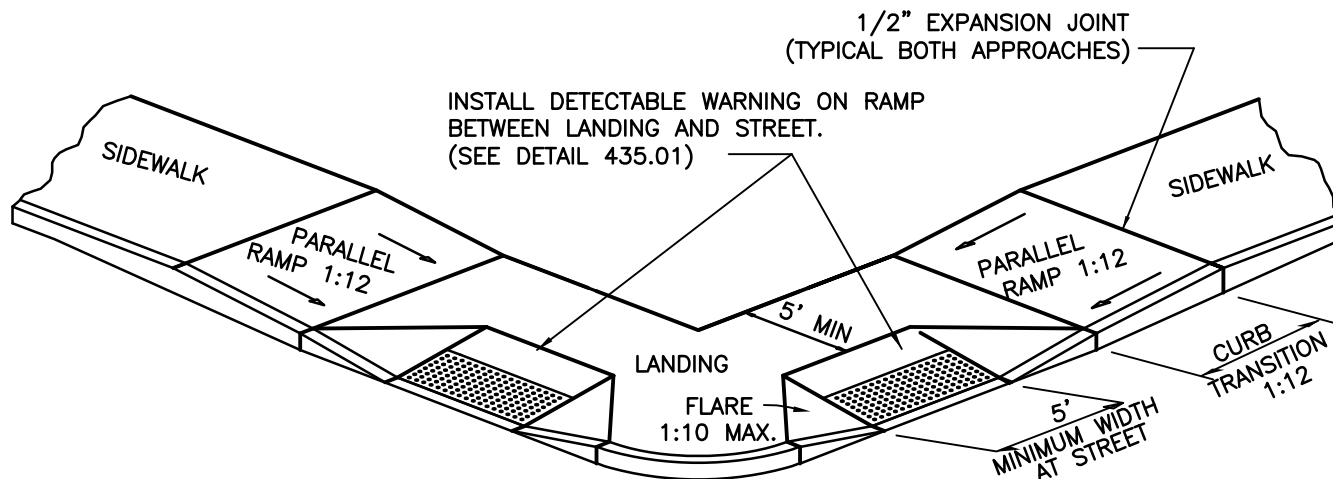
	07/01/20
Approved	Date
Revisions	



## SIDEWALK RAMP


### Sidewalk at Back of Curb (Type A)

1000.06



NOTE:

1. RAMP, LANDING AND AREA IN BETWEEN SHALL BE 6" THICK REINFORCED W/#4@12" O.C. MoDOT PAVEMENT CONCRETE.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. RAMP SLOPE 1:12 MAX. USE FLATTER WHEN POSSIBLE.
6. LANDING AREA SHALL BE 5'-0" MIN WIDTH, LANDING CROSS SLOPE 1.5%  $\pm$  0.5% (2.0% MAXIMUM ANY DIRECTION).
7. TYPE "B" RAMP PROVIDES PARALLEL RAMPS TO REDUCE THE PERPENDICULAR RAMP LENGTH AND PROVIDE ADEQUATE LANDING.
8. RAMP EXTENDS INTO SIDEWALK, FLARE SLOPE MUST NOT EXCEED 1:10.

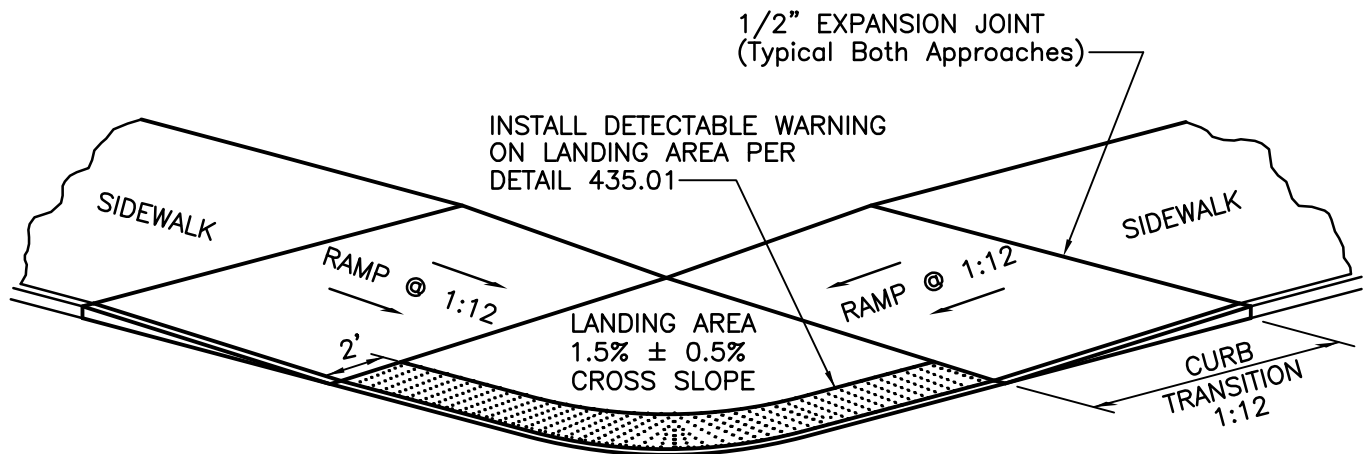
	047/01/20
Approved	Date
Revisions	



## SIDEWALK RAMP


### Sidewalk at Back of Curb (Type B)

1000.07



**NOTE:**

1. RAMP AND LANDING SHALL BE 6" THICK REINFORCED W/#4@12" O.C. MoDOT PAVEMENT CONCRETE.
2. EXPANSION JOINT SHALL BE 1/2" PREFORMED CORK OR BITUMINOUS EXPANSION JOINT MATERIAL.
3. MAXIMUM RAMP CROSS SLOPE IS 2.00%.
4. ALL SLOPES ARE MEASURED FROM THE HORIZONTAL.
5. RAMP LENGTH IS DEPENDENT ON 1:12 MAX. SLOPE. USE FLATTER WHEN POSSIBLE.
6. LANDING AREA SHALL BE 5'-0" MIN WIDTH, CROSS SLOPE OF LANDING SHALL NOT EXCEED 2.00%.
7. USE TYPE "C" RAMP ONLY IF TYPE "A" & "B" ARE NOT FEASIBLE.

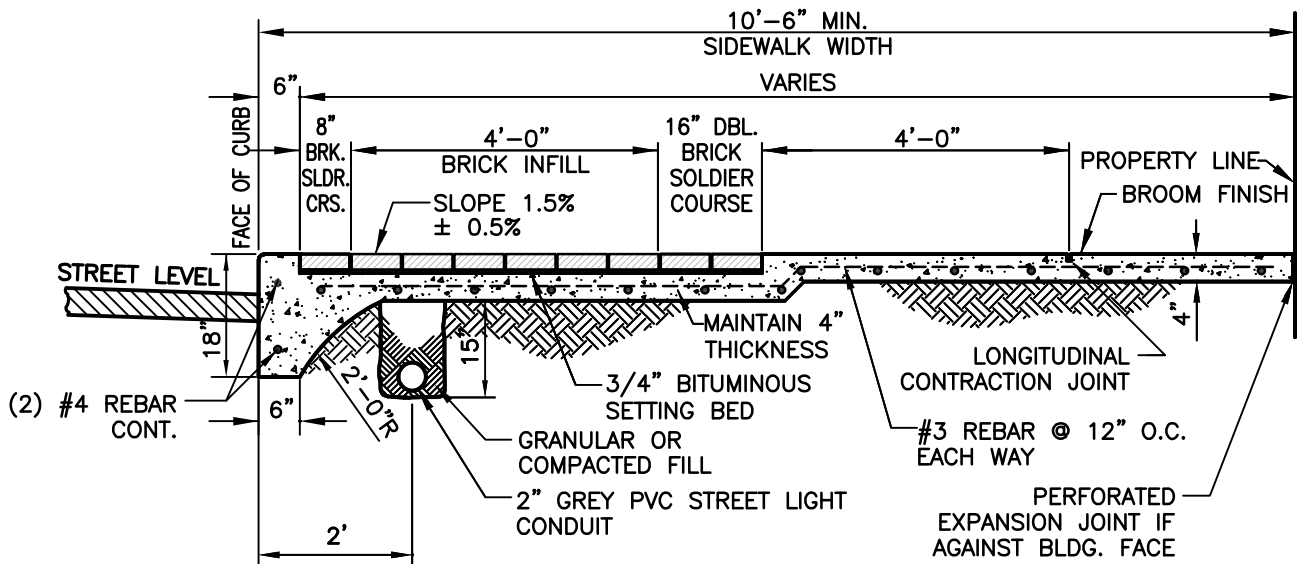
	07/01/20
Approved	Date
Revisions	



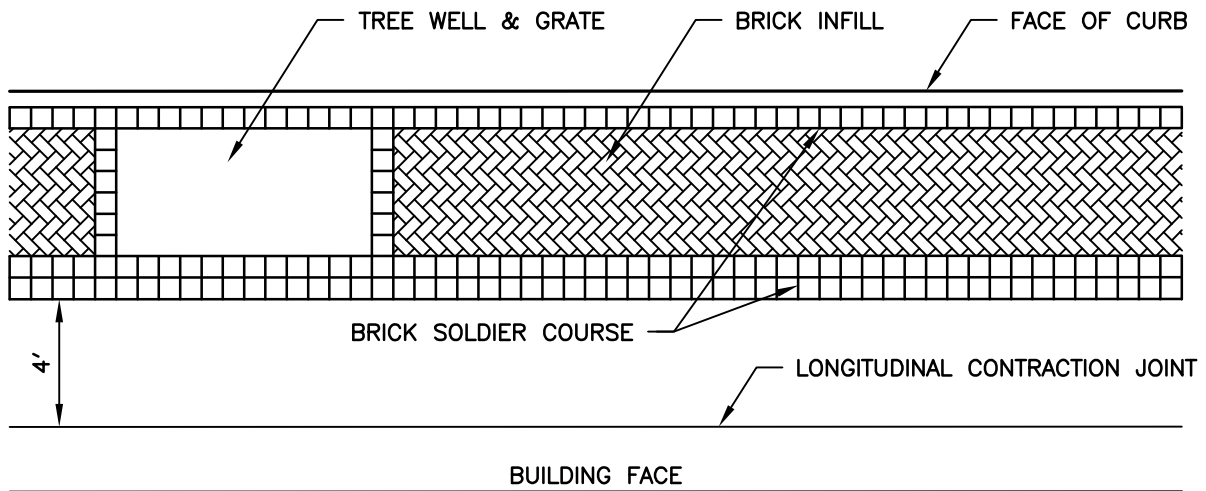
## SIDEWALK RAMP

### Sidewalk at Back of Curb (Type C)

1000.08



**TYPICAL SECTION**



**PLAN VIEW**

**NOTES:**

1. SIDEWALK CROSS SLOPE 1.5%  $\pm$  0.5% (2.0% MAXIMUM).
2. SAW AND PATCH STREET PAVEMENT AS NECESSARY FOR CONSTRUCTION OF NEW CURB.
3. SEE JOINT DETAILS - 1000.03.
4. SEE SPECIFICATIONS - 1000.01
5. NO STEEL TO BE PLACED THROUGH EXPANSION JOINT
6. FOR SIDEWALK SECTIONS LESS THAN 10'-6" A MODIFIED DETAIL WILL BE REQUIRED.

Approved	07/01/20
Date	
Revisions	

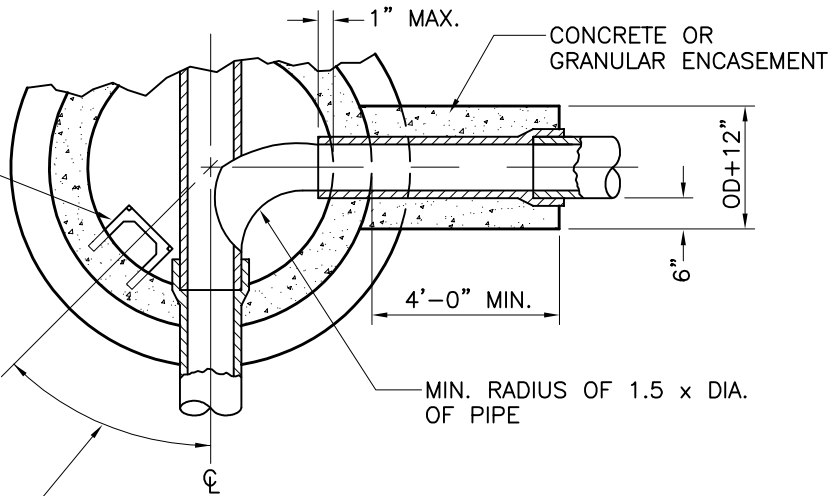


**DOWNTOWN SIDEWALK -  
ALONG 8th STREET & BROADWAY**

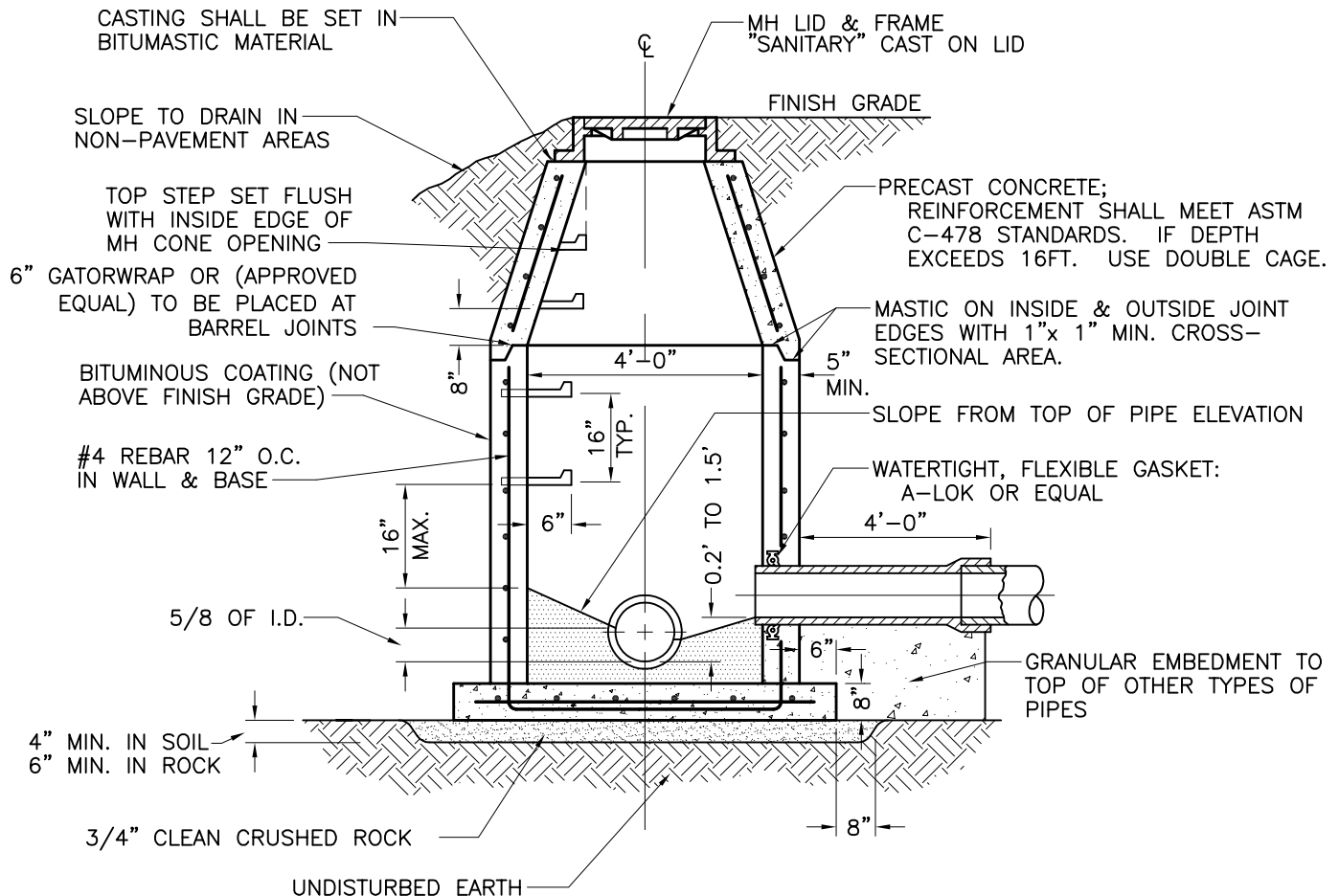
**1000.10A**

STEPS SHALL BE SET IN EXPANDING GROUT AND IN VERTICAL ROW 16" O.C.

LOCATE MH STEPS 45° FROM OUTLET PIPE (CENTERLINE TO CENTERLINE) OR ON LARGEST CLEAR WALL EQUAL DISTANCE FROM PIPES TO AVOID LOCATING STEPS OVER PIPE.



## HORIZONTAL SECTION

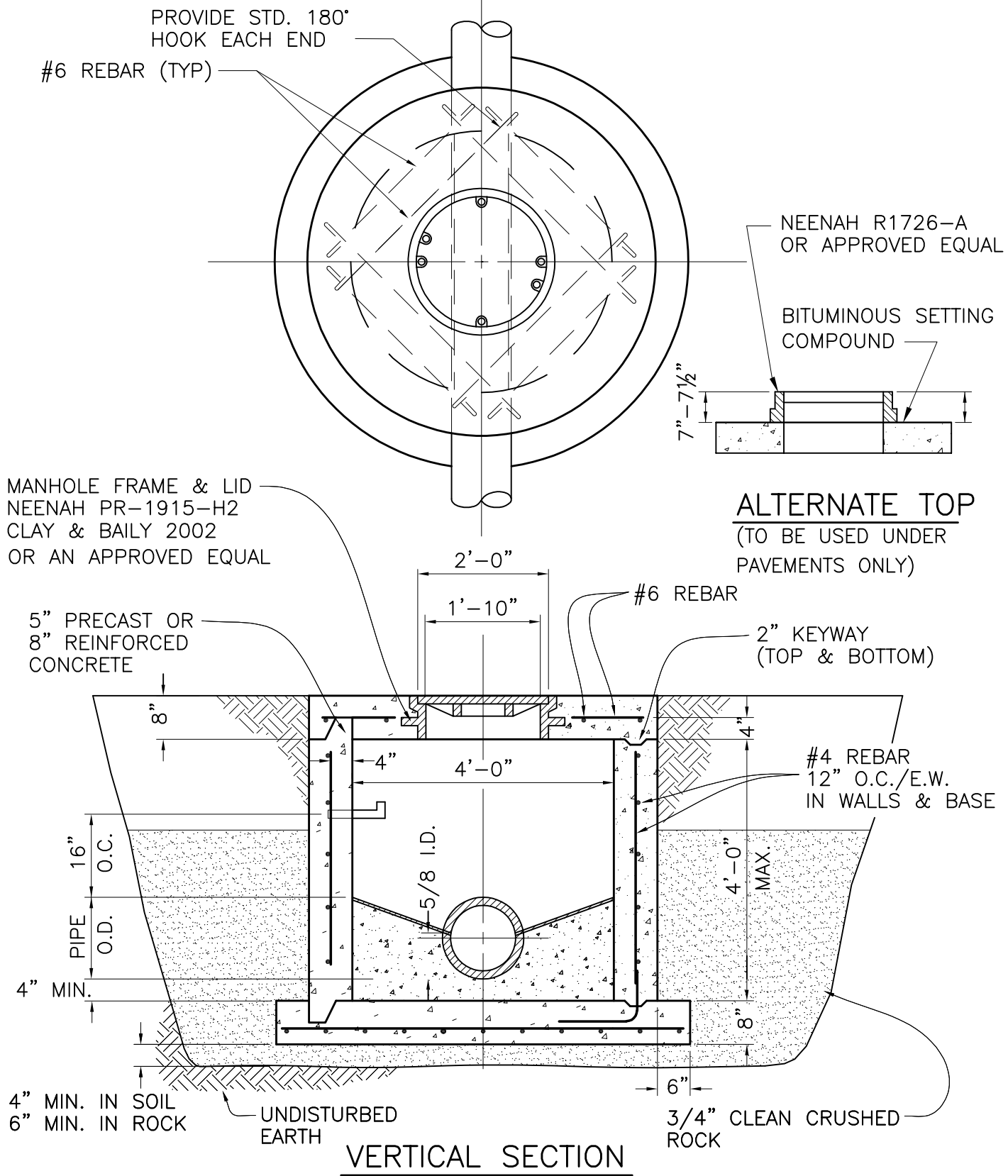


## VERTICAL SECTION

<i>RAS</i>	07/01/20
Approved	Date
Revisions	

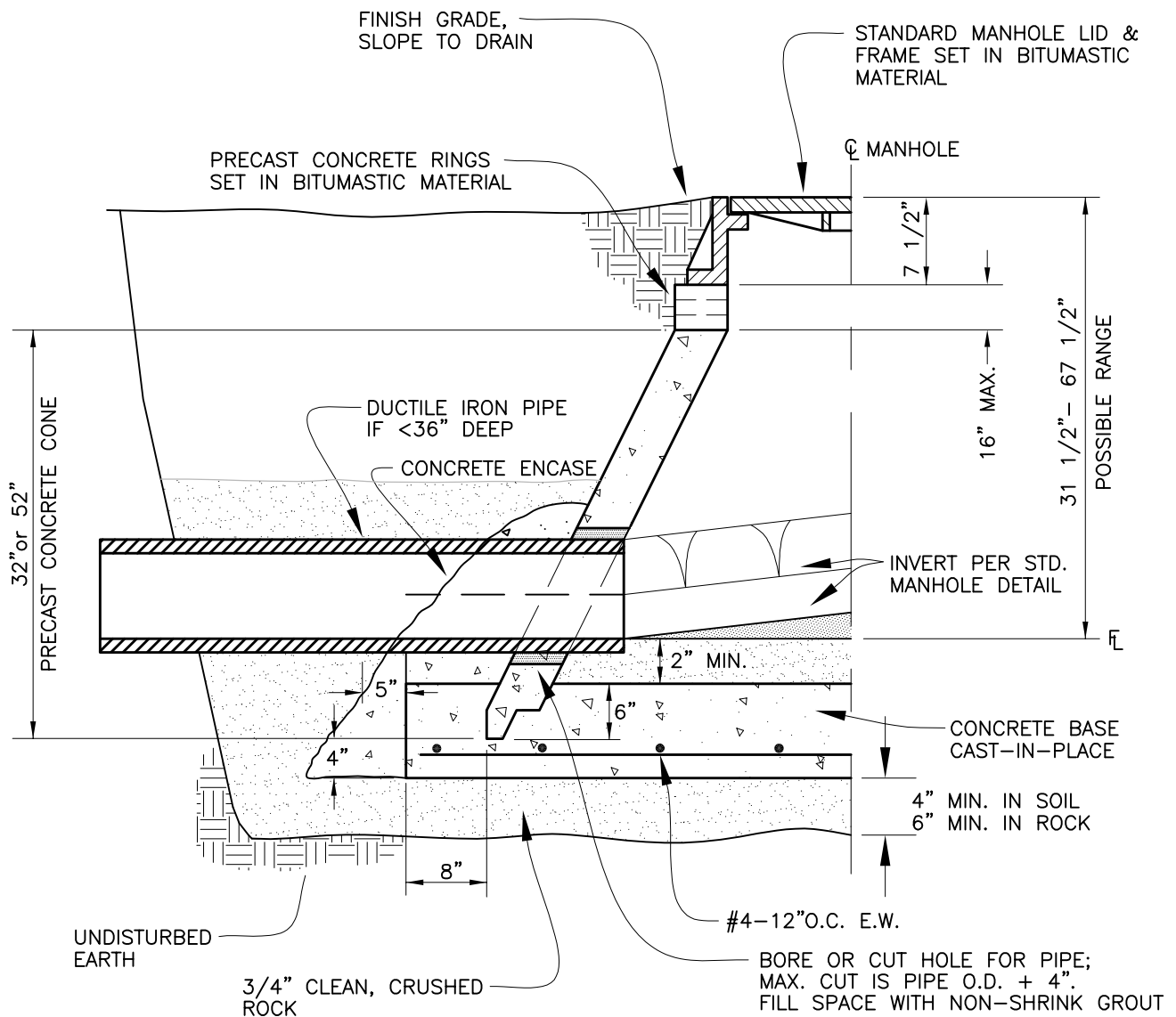


# STANDARD MANHOLE




**ALTERNATE TOP**  
(TO BE USED UNDER  
PAVEMENTS ONLY)

<div>  <div> 07/01/20 Date </div> </div> <div> Revisions </div>		<div> FLAT TOP SHALLOW MANHOLE </div>	<div> 2 </div>
--	---	---	----------------



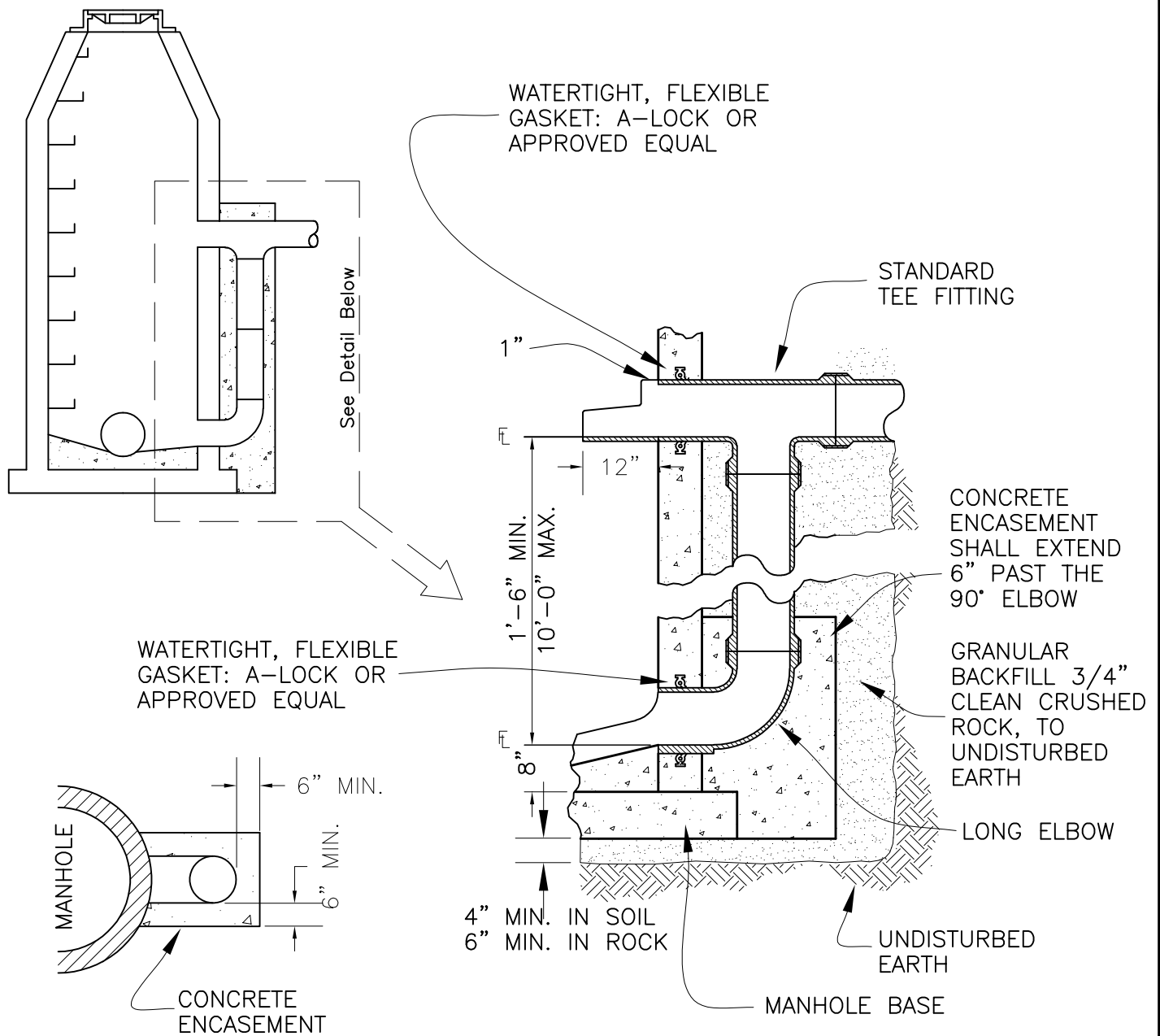
## VERTICAL HALF-SECTION

 Approved	07/01/20 Date
Revisions	



# STANDARD SHALLOW MANHOLE





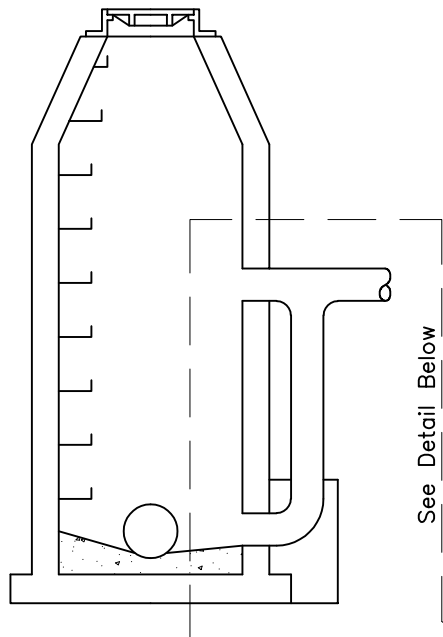
NOTES:

1. DROP INLET PIPE TO BE SAME SIZE AND MATERIAL AS SEWER MAIN.
2. ALIGNMENT OF TEE: DROP INLET PIPE AND LONG ELBOW MAY BE ADJUSTED TO MAXIMUM OF 5% DEFLECTION TO COMPENSATE FOR SLOPE OF SEWER LINE.

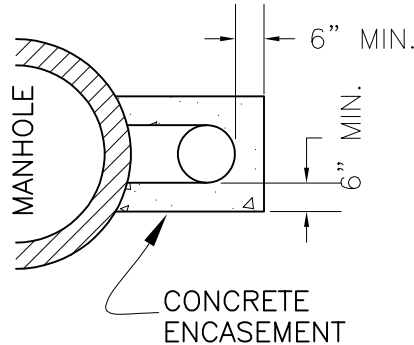
<i>PAS</i>	7/01/20
Approved	Date
Revisions	



## STANDARD DROP MANHOLE



See Detail Below



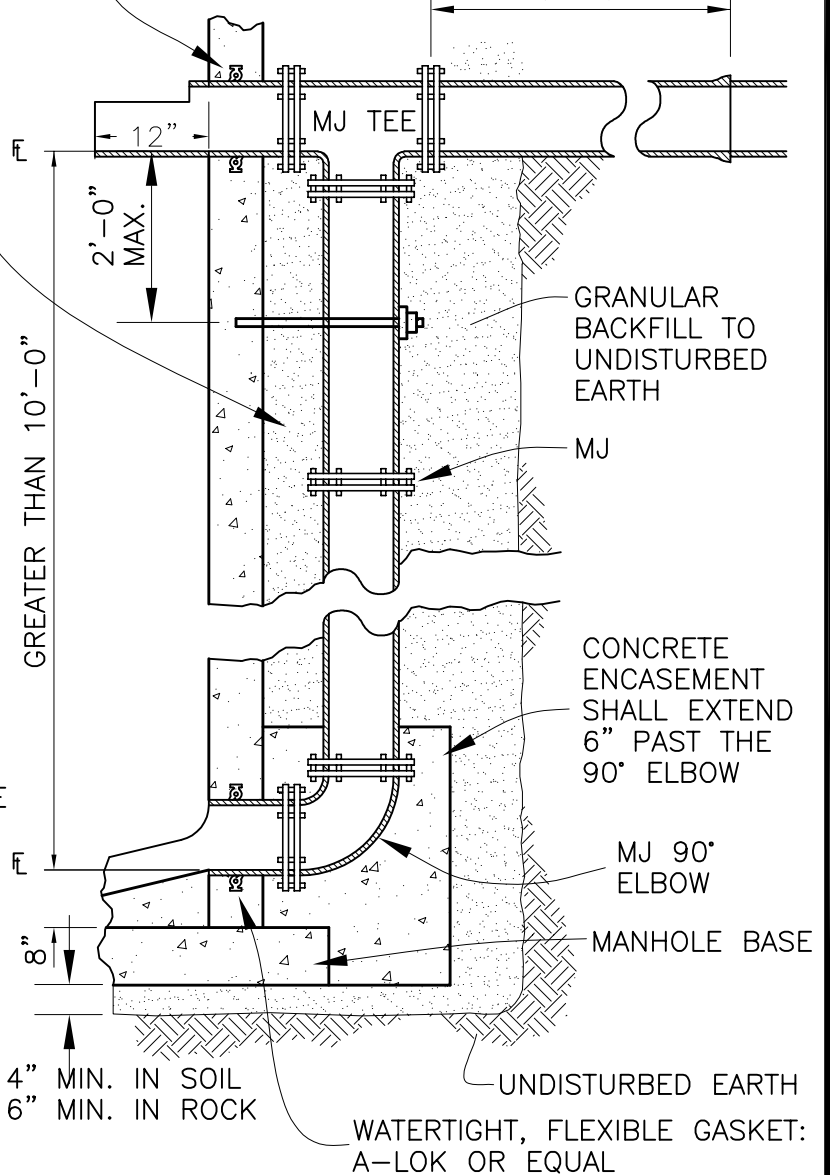
#### NOTES:

1. DROP INLET PIPE TO BE SAME SIZE AND MATERIAL AS SEWER MAIN.
2. ALIGNMENT OF TEE: DROP INLET PIPE AND LONG ELBOW MAY BE ADJUSTED TO MAXIMUM OF 5% DEFLECTION TO COMPENSATE FOR SLOPE OF SEWER LINE.
3. PIPE MATERIAL IN THE DROP ASSEMBLY SHALL CONFORM TO SECTION 505.2.b OF THE STANDARD SPECIFICATIONS.
4. DROP ASSEMBLY SHALL UTILIZE MECHANICAL COUPLINGS. THE COUPLINGS SHALL BE A MEGALUG MECHANICAL JOINT RESTRAINT, OR APPROVED EQUAL.

STAINLESS STEEL HALF CLAMP  
ATTACHED WITH 2-3/4" STAINLESS  
STEEL ANCHORS, MAX. 6' VERTICAL  
SPACING.

WATERTIGHT, FLEXIBLE GASKET:  
A-LOK OR EQUAL

ONE FULL SECTION  
OF DROP ASSEMBLY  
PIPE (MIN.)



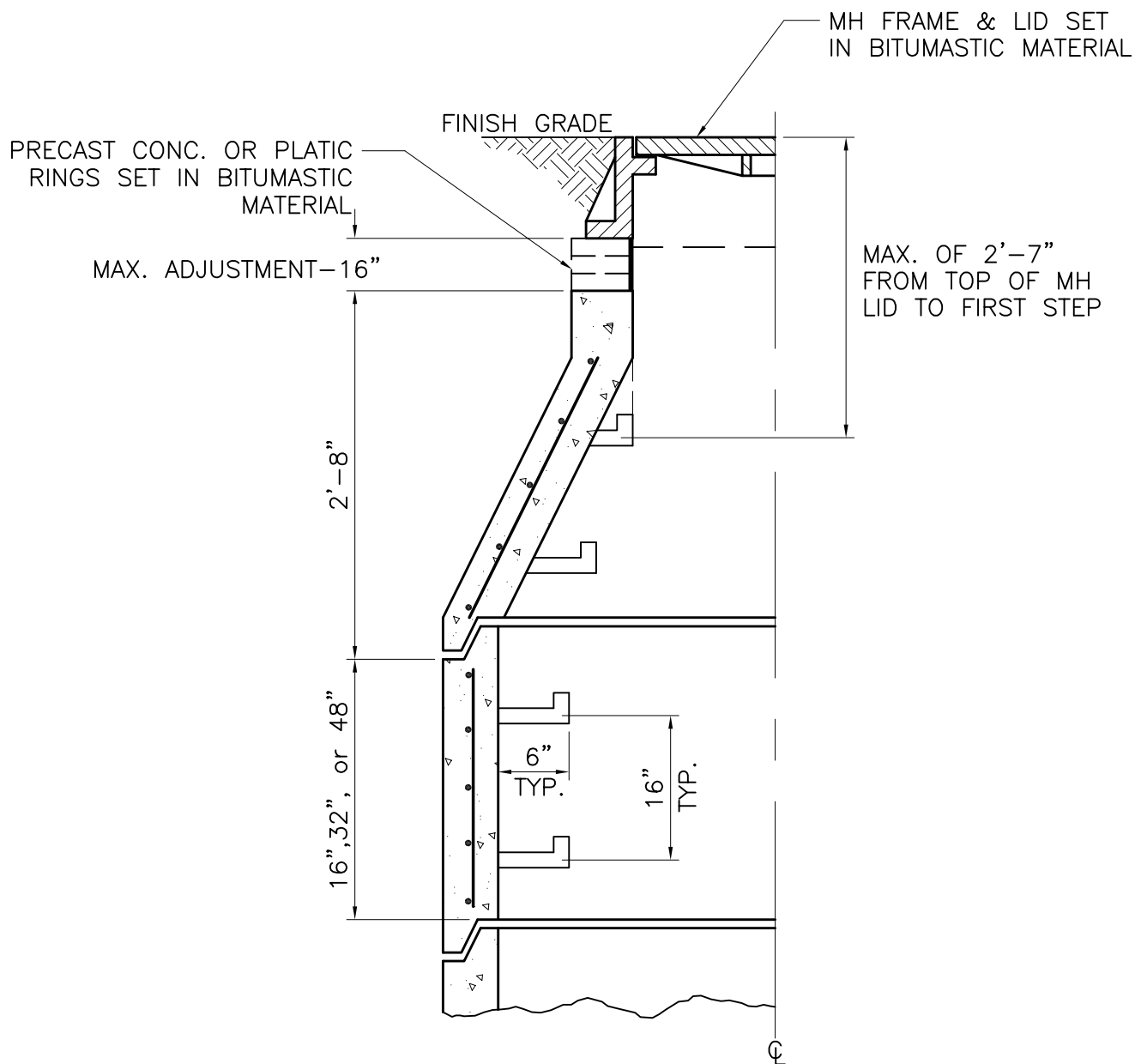
WATERTIGHT, FLEXIBLE GASKET:  
A-LOK OR EQUAL

*RAS*  
Approved Date  
07/01/20

Revisions



## DEEP DROP MANHOLE



## BARREL SECTION

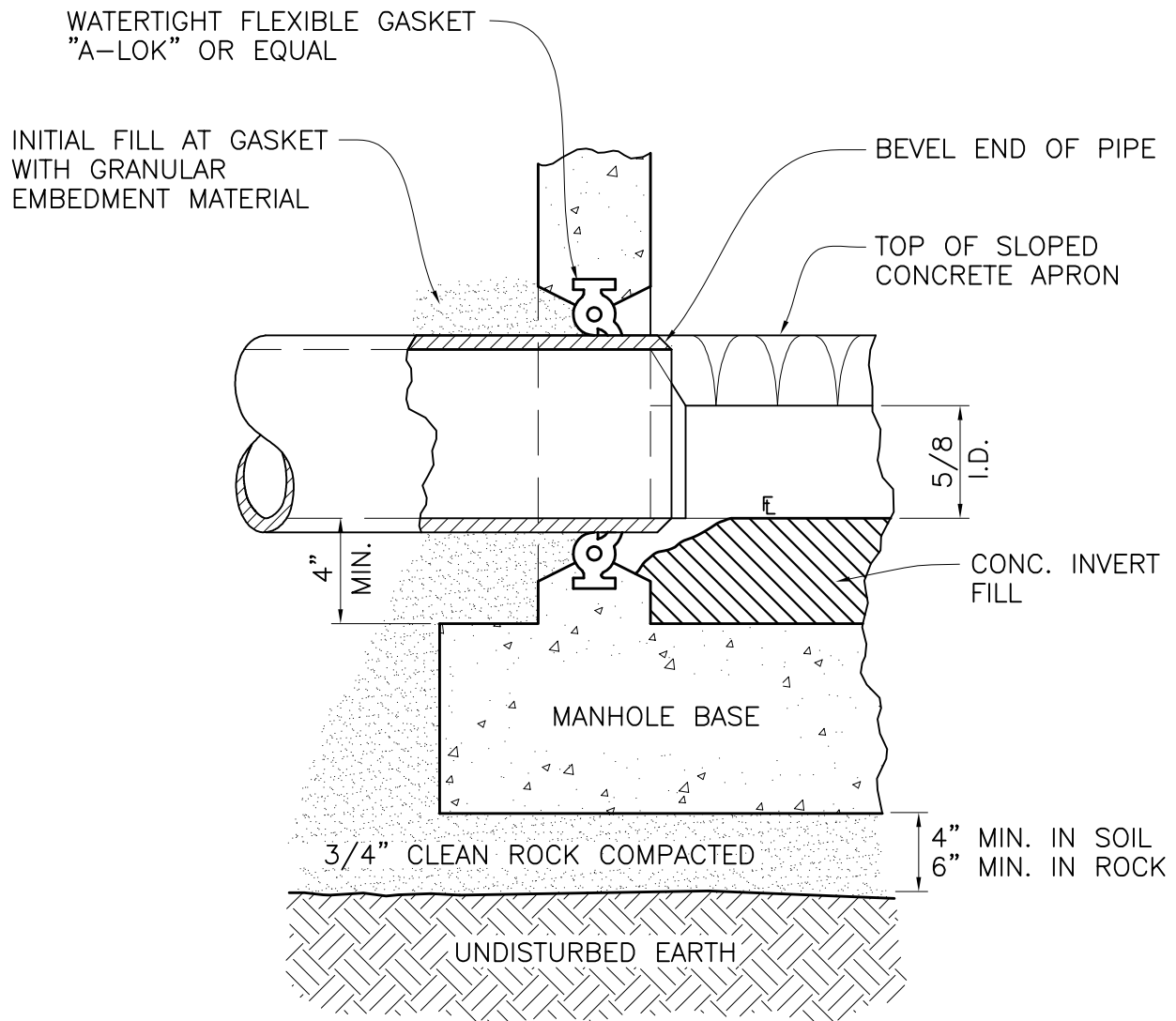
### NOTE:

IF MORE THEN 16" OF ADJUSTMENT IS NEEDED, REMOVE CONE SECTION AND ADD OR REMOVE BARREL SECTIONS AS NECESSARY.

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## MANHOLE ADJUSTMENT



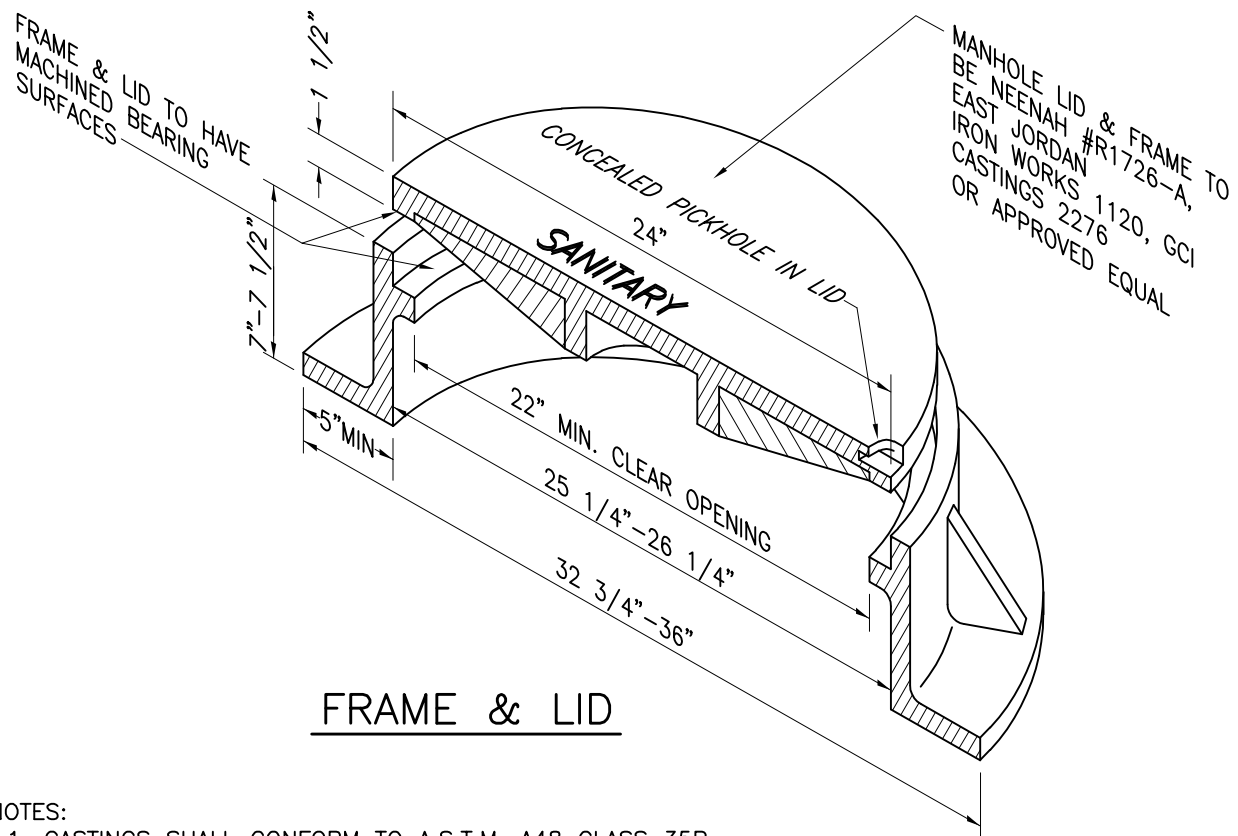
NOTE:

1. BITUMINOUS COATING ON EXTERIOR SURFACE OF MANHOLE SHALL NOT COME IN CONTACT WITH PIPE GASKET.
2. FOR CAST-IN-PLACE CONCRETE MANHOLES OR PRE-CAST WITH BOX-OUTS, THE PIPE GASKET SHALL BE A RUBBER LABYRINTH WATERSTOP WITH STAINLESS STEEL CLAMPING BANDS LOCATED AT CENTER OF WALL AND THE SPACE BETWEEN PIPE & WALL COMPLETELY GROUTED WITH NONSHRINKING MORTAR.
3. PIPE MAY PROJECT 1" MAXIMUM PAST INSIDE WALL OF MANHOLE. NO CONTACT BETWEEN PIPE & INVERT MAY OCCUR.

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



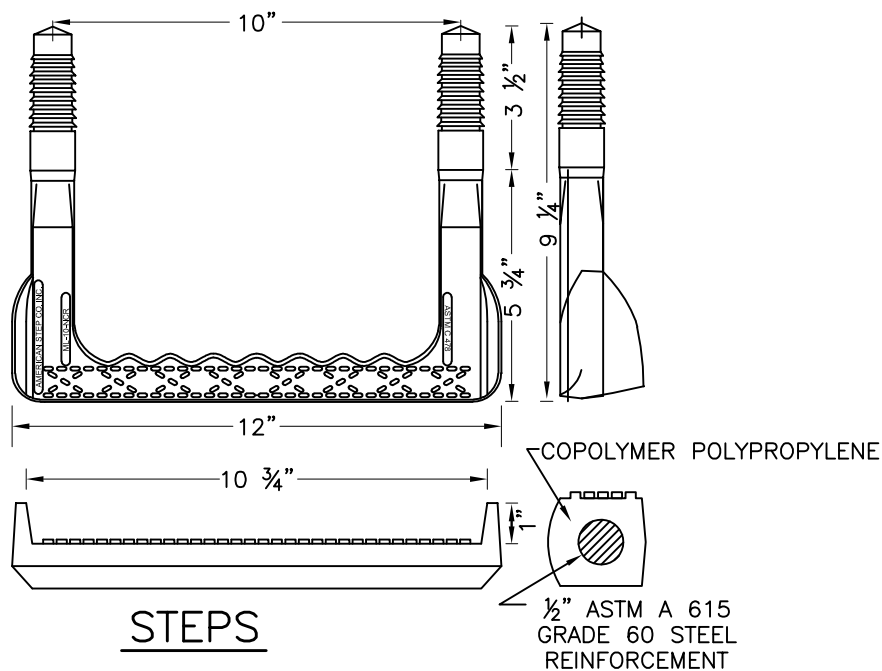
## MANHOLE GASKET (Pipe Gasket Detail)





## FRAME & LID

### NOTES:

1. CASTINGS SHALL CONFORM TO A.S.T.M. A48 CLASS 35B.
2. LIDWEIGHT 135 lbs.  $\pm 5\%$ . TOTAL WEIGHT OF 350 lbs.  $\pm 5\%$ .
3. WATERTIGHT LID AND FRAME TO BE NEENAH #R-1916-F, OR APPROVED EQUAL
4. MANHOLE STEP AMERICAN ML-10-NCR OR APPROVED EQUAL
5. BOLT DOWN LIDS SHALL HAVE FRAMES BOLTED TO THE CONE SECTION

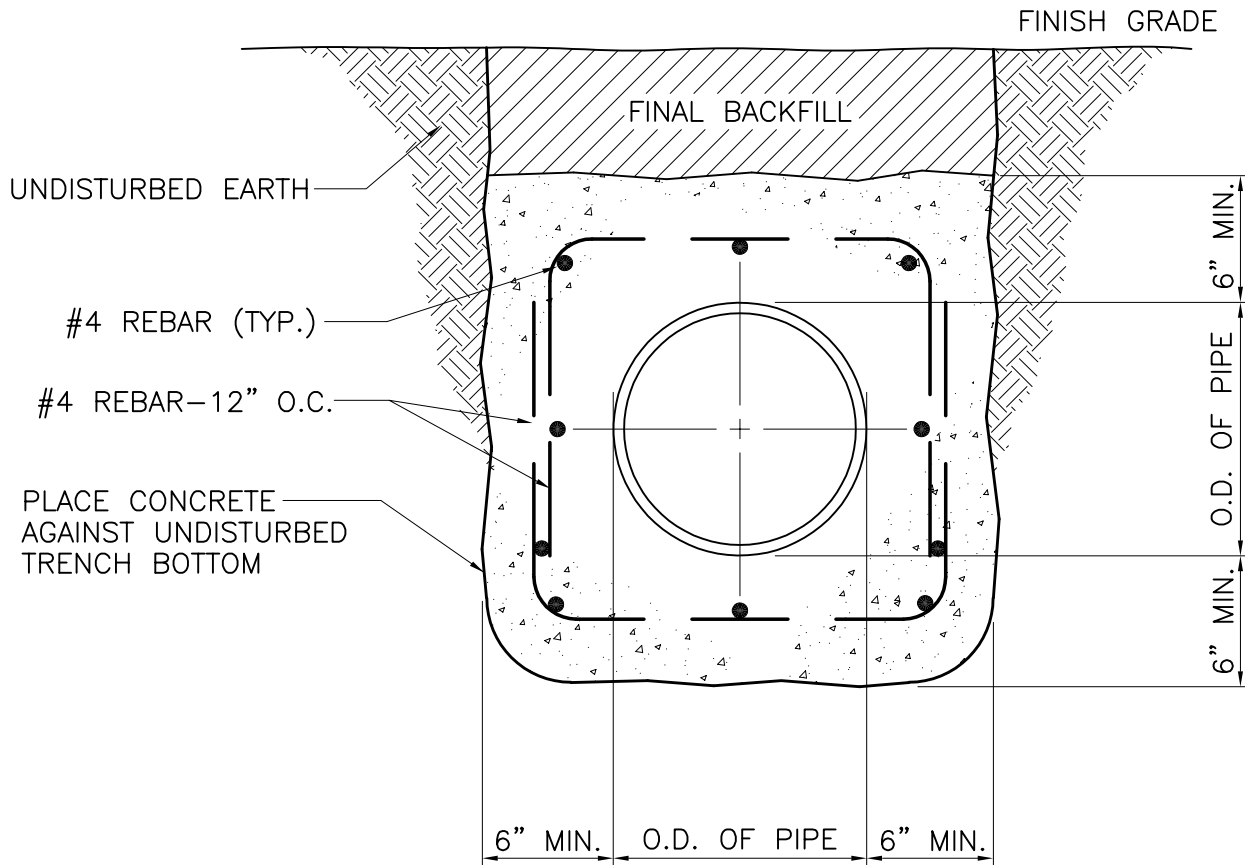


## STEPS

	07/01/20
Approved	Date
Revisions	
 Revised casting weight	



## MANHOLE CASTINGS (Frame, Lid & Steps)



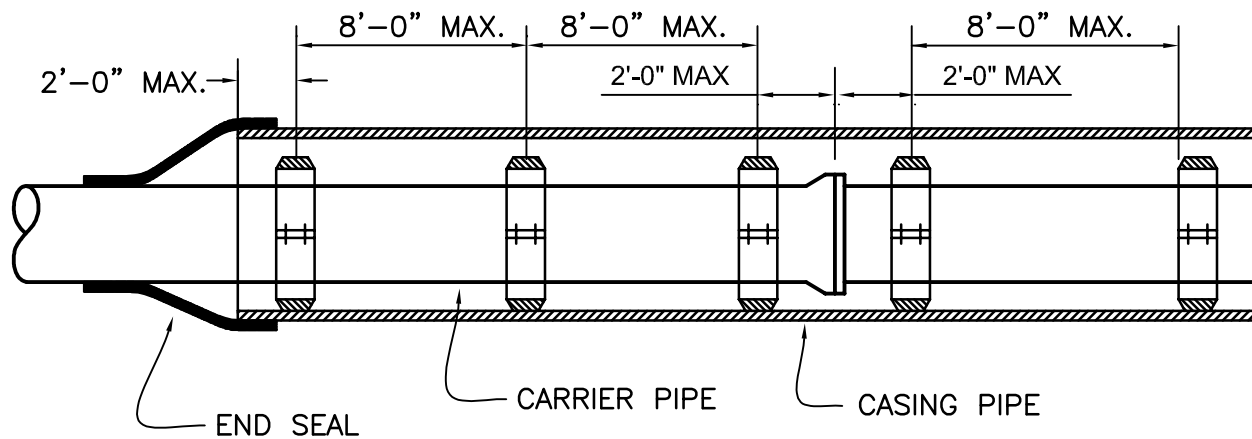
NOTES:

1. FOR PIPE LARGER THAN 12" DIAMETER THE MINIMUM CONCRETE COVER SHALL BE 8" WITH # 5 REBAR @ 12" O.C. EACH WAY.
2. BRACE OR TIE PIPE TO PREVENT FLOTATION OR DEFLECTION, DURING CONCRETE PLACEMENT.
3. VERTICAL CLEARANCE BETWEEN SEWER AND WATER MAINS SHALL BE A MINIMUM OF 2 FEET.

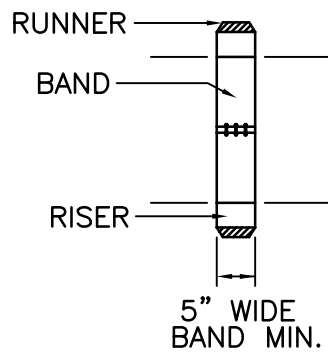
<i>RAS</i>	07/01/20
Approved	Date
Revisions	



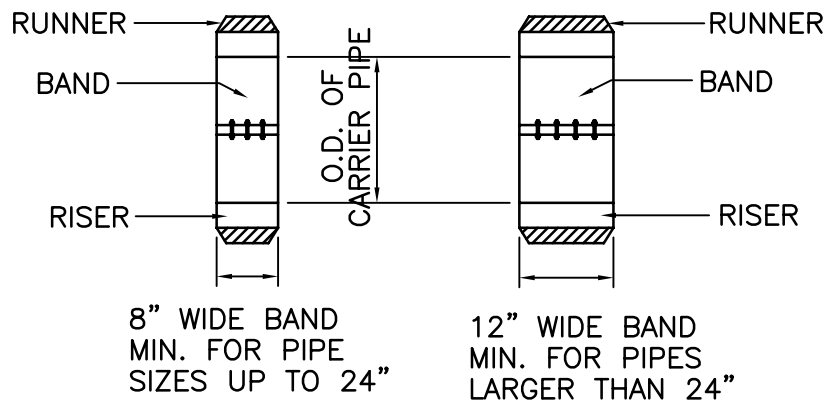
## PIPE ENCASEMENT (Concrete)



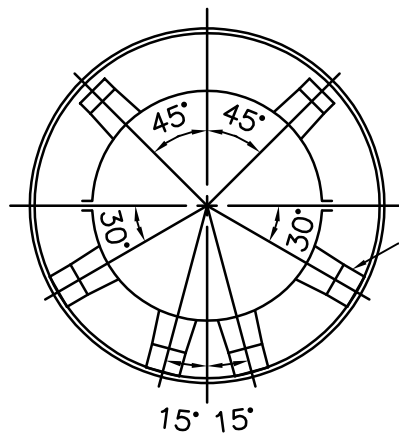
#### TYPE I SPACERS



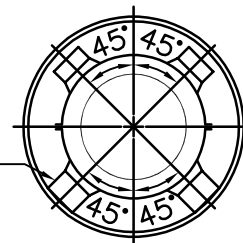
#### TYPE II SPACERS




SIZES 14" THRU 36"



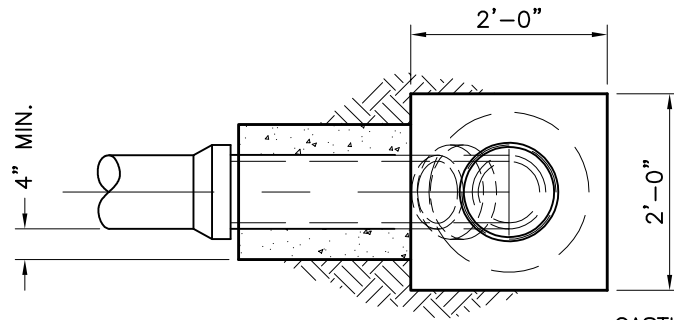
SIZES 4" THRU 12"



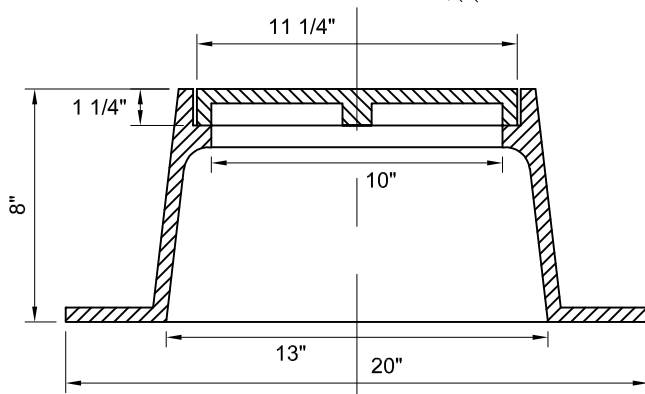
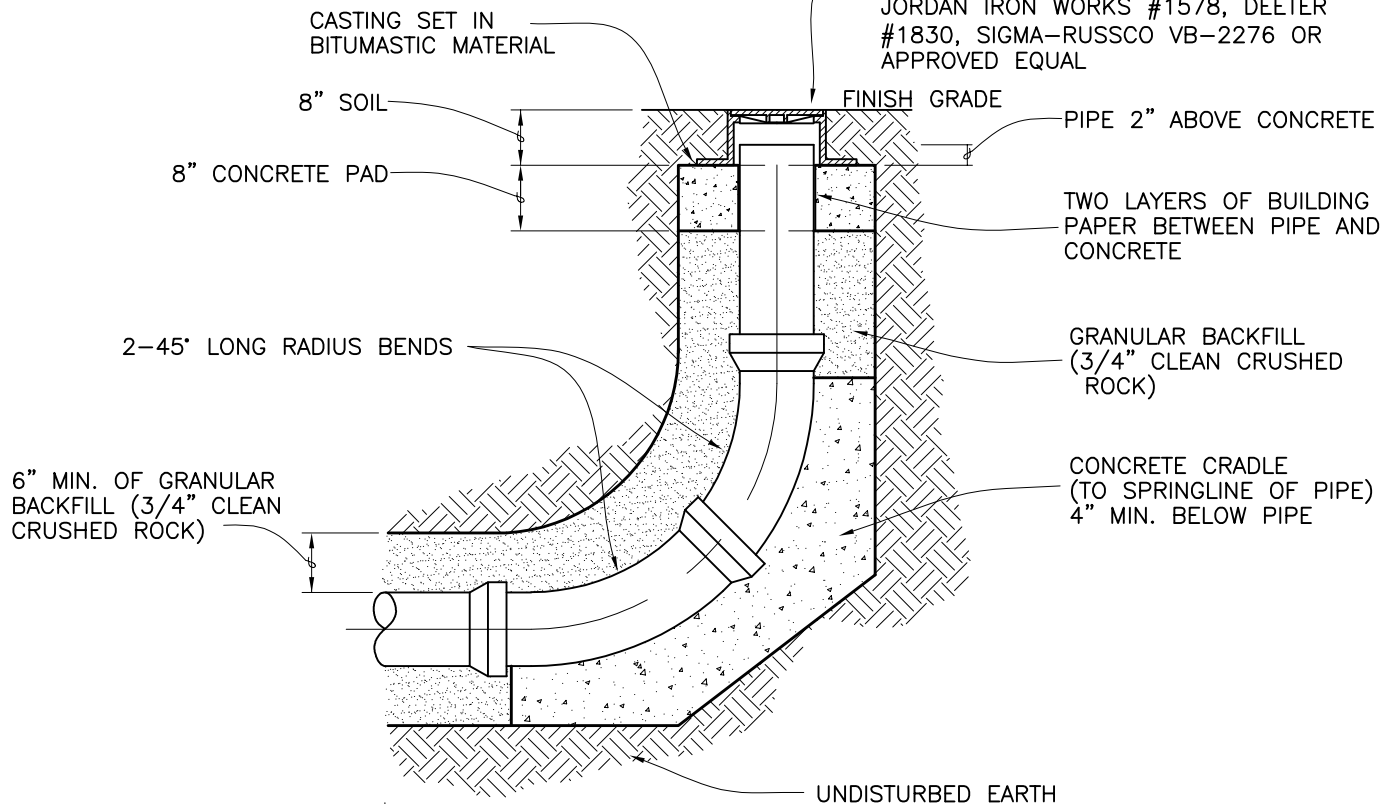
 Approved	07/01/20
	Date
	Revisions



## PIPE ENCASEMENT (Steel)



CASTING WEIGHT 90 lbs  $\pm$ 5%. (NO VENT HOLES OR OPEN PICK HOLES) NEENAH #R-1976, GCI CASTINGS #G1000, EAST JORDAN IRON WORKS #1578, DEETER #1830, SIGMA-RUSSCO VB-2276 OR APPROVED EQUAL



FRAME & LID

NOTE:  
DISTANCE FROM CENTER OF  
DOWNSTREAM MANHOLE TO CENTER  
OF CLEANOUT SHALL BE 150 FEET  
OR LESS.

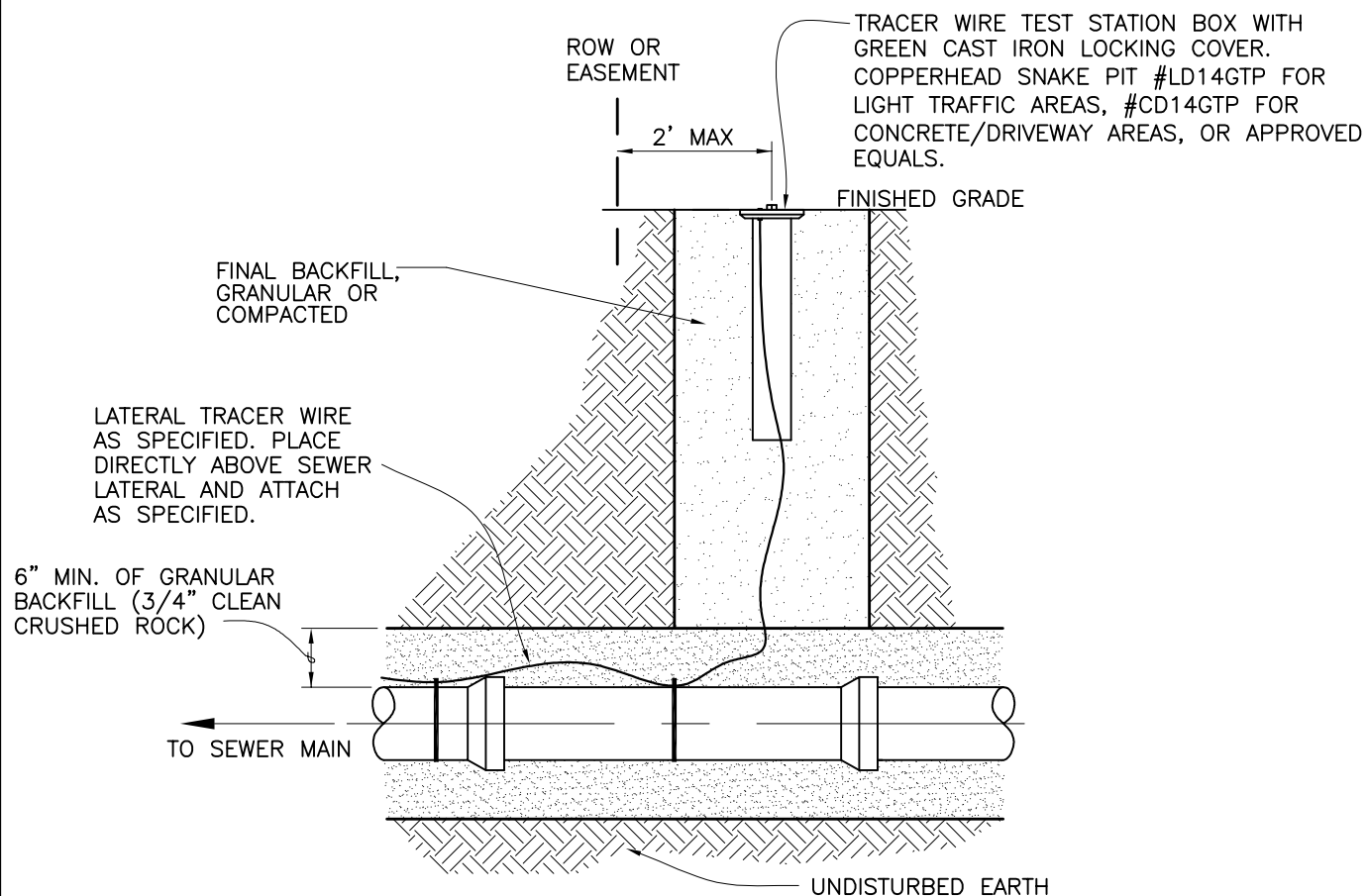
<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## STANDARD CLEANOUT

12





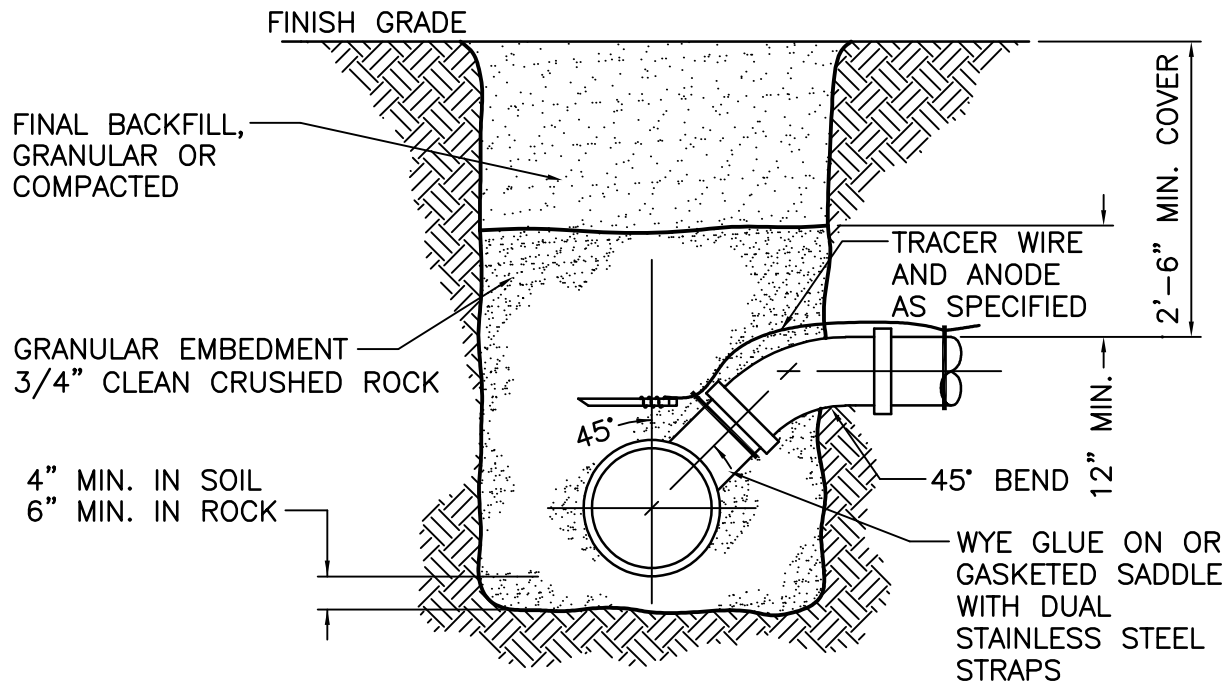
1. TRACER WIRE TEST STATIONS FOR NEW CONSTRUCTION SHALL EXTEND 1' ABOVE THE PROPOSED FINAL GRADE USING SNAKEPIT #LD14GTP-ADJ OR APPROVED EQUAL. UPON COMPLETION OF FINAL GRADING, CONTRACTOR SHALL ADJUST THE TEST STATION BOX TO MEET FINAL GRADE.

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## STANDARD TRACER WIRE TEST STATION

12A



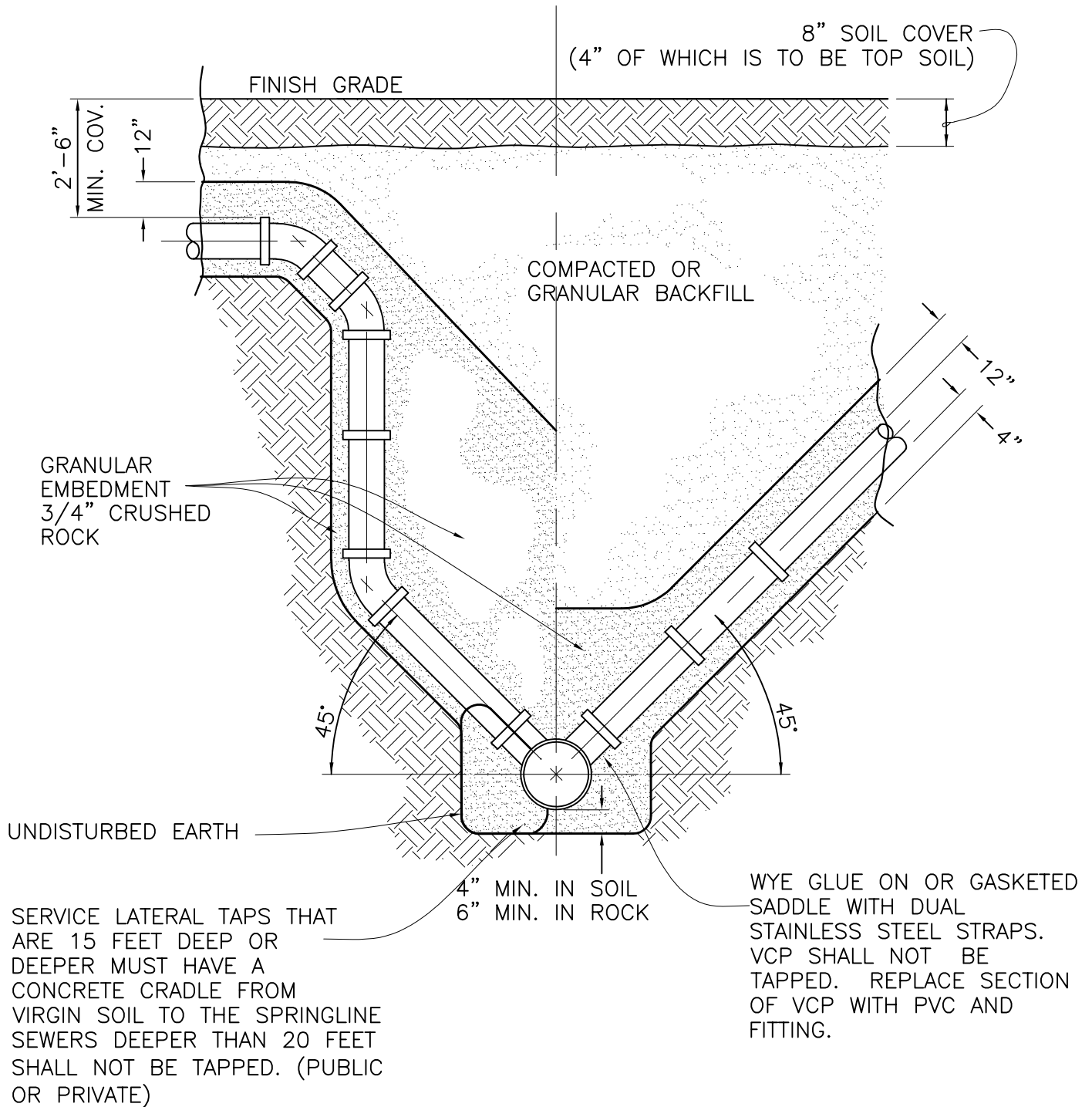
NOTES:

1. VCP PIPES SHALL NOT BE TAPPED. REPLACE SECTION OF VCP WITH PVC AND FITTING.

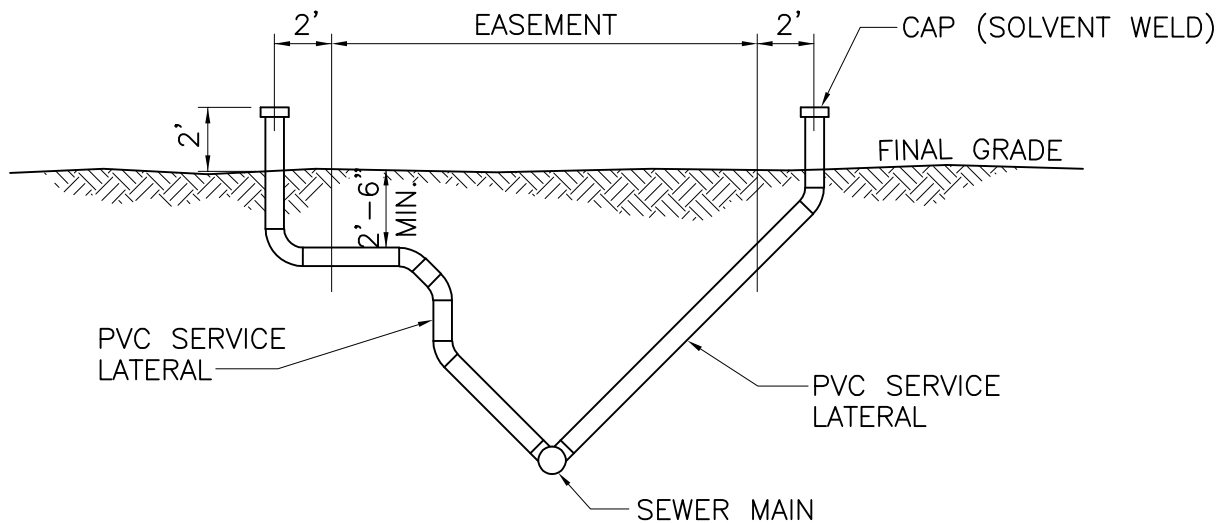
<i>RAS</i>	07/01/20
Approved	Date
Revisions	



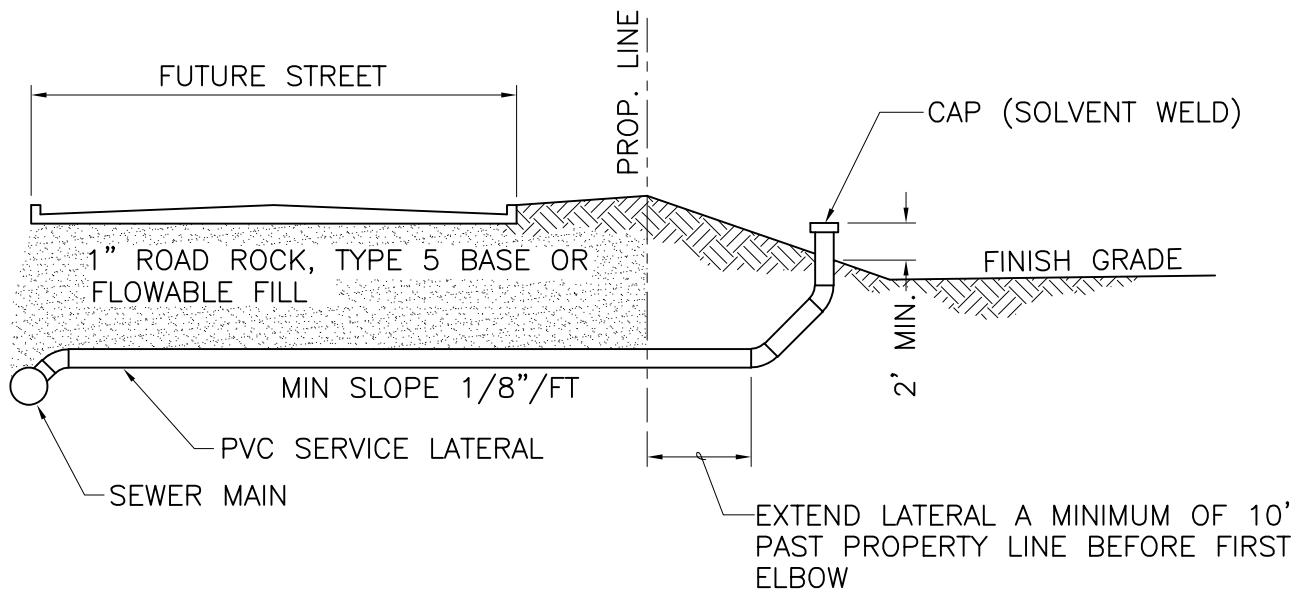
## STANDARD SERVICE CONNECTION



<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## SERVICE LATERAL EXTENSION FROM DEEP SEWER



## SERVICE LATERAL EXTENSION UNDER FUTURE STREETS

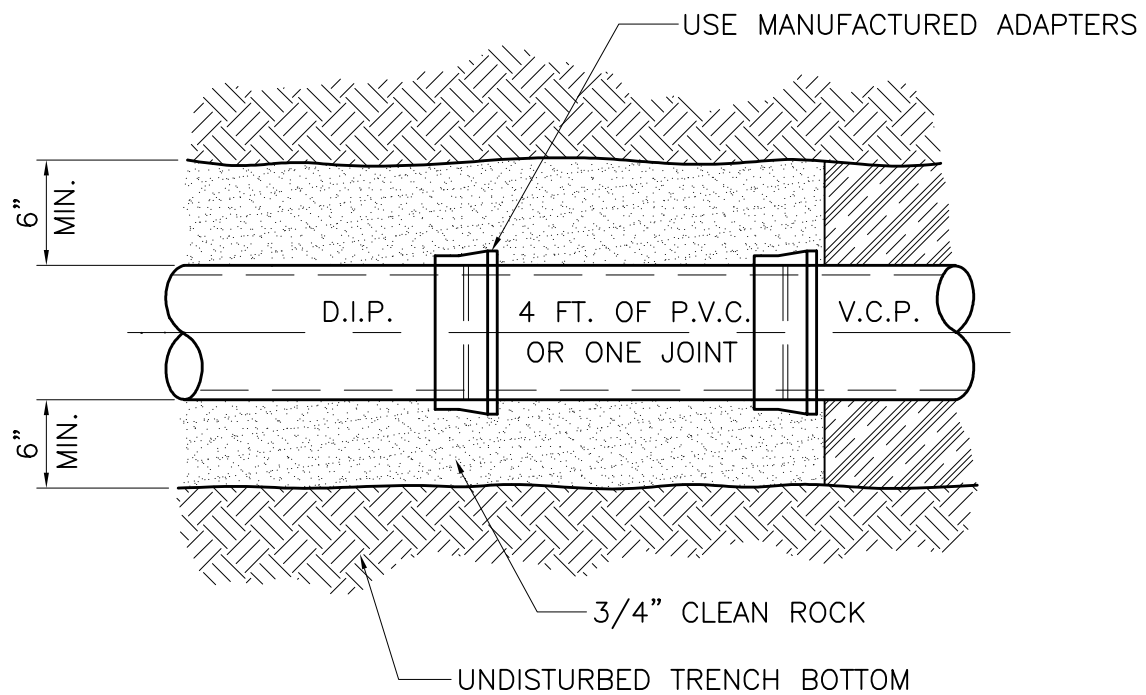
**NOTE:**

THIS DETAIL IS FOR USE WHENEVER LATERALS ARE EXTENDED FROM THE SEWER MAIN DURING NEW CONSTRUCTION. IN ALL CASES WHEN SERVICE LATERALS ARE EXTENDED THE PIPE SHALL EXTEND A MINIMUM OF TWO (2) FEET ABOVE THE PROPOSED FINAL GRADE AND SHALL BE FITTED WITH A CAP THAT IS SOLVENT WELDED IN PLACE.

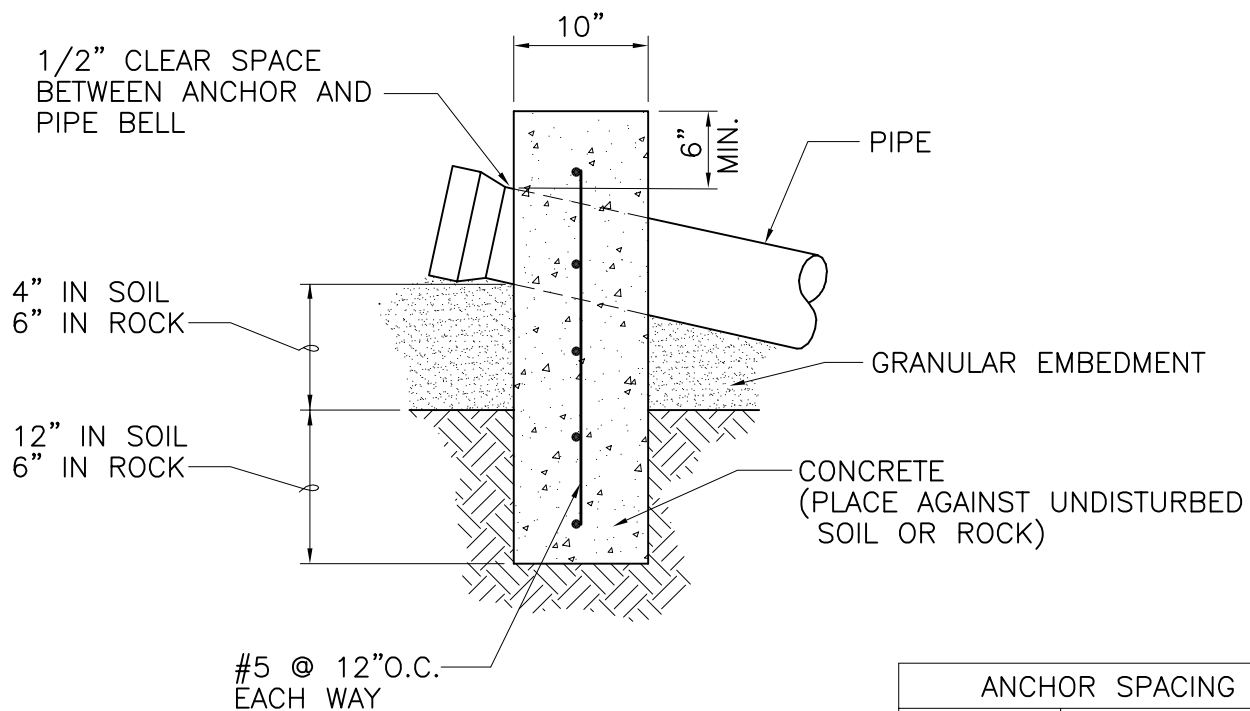
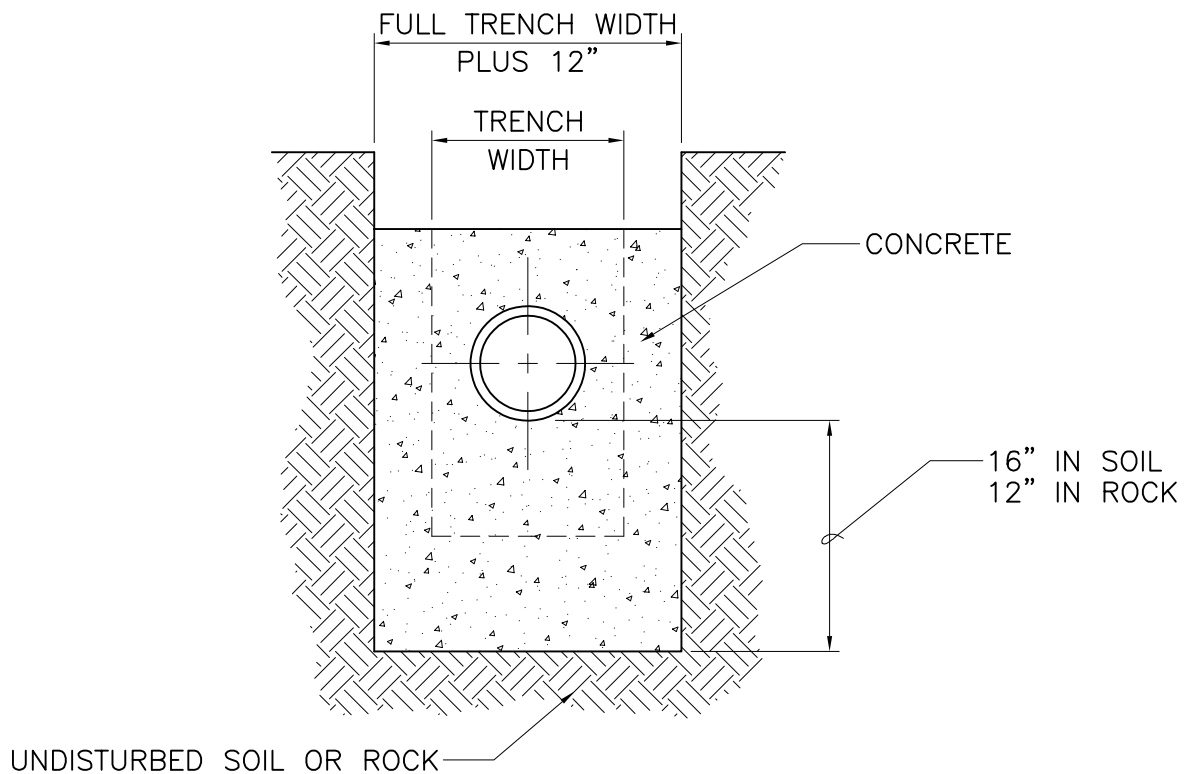
<i>RAS</i> Approved	07/01/20 Date
Revisions	



## LATERAL EXTENSION FOR NEW CONSTRUCTION



<i>RAS</i>	07/01/20
Approved	Date
Revisions	



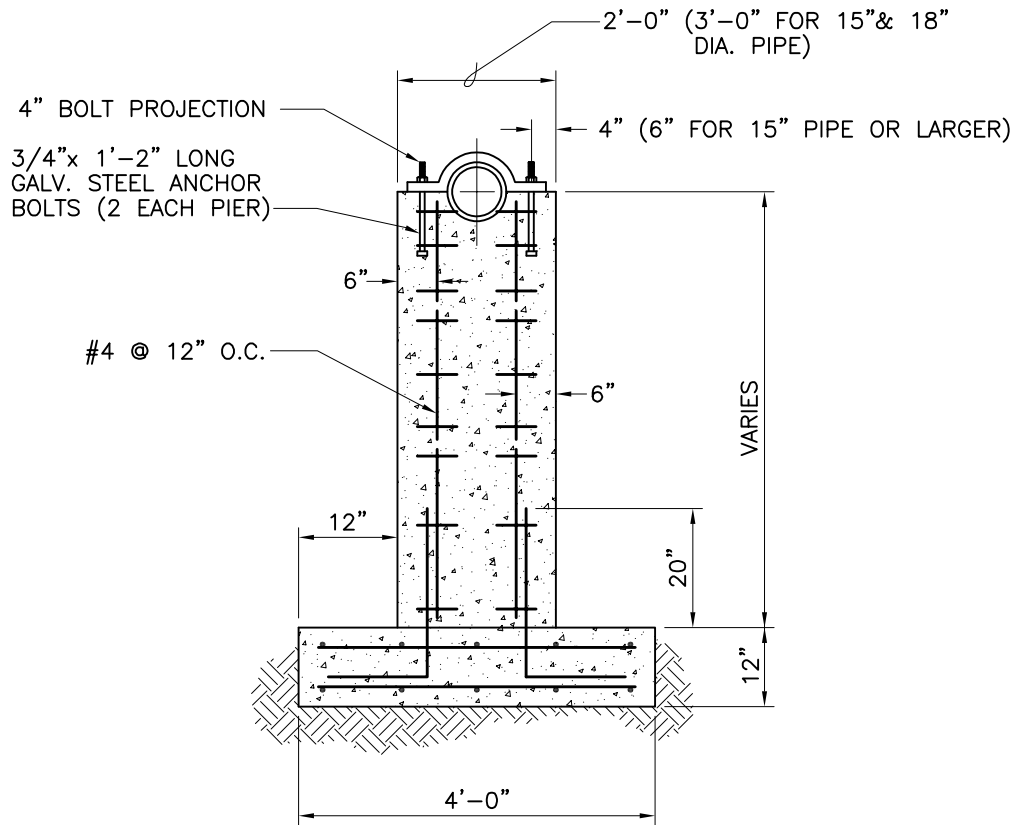
SIDE ELEVATION

ANCHOR SPACING	
SLOPE	MAX. DISTANCE
20%–35%	36'
35%–50%	24'
>50%	12' OR ONE PER JOINT OF PIPE

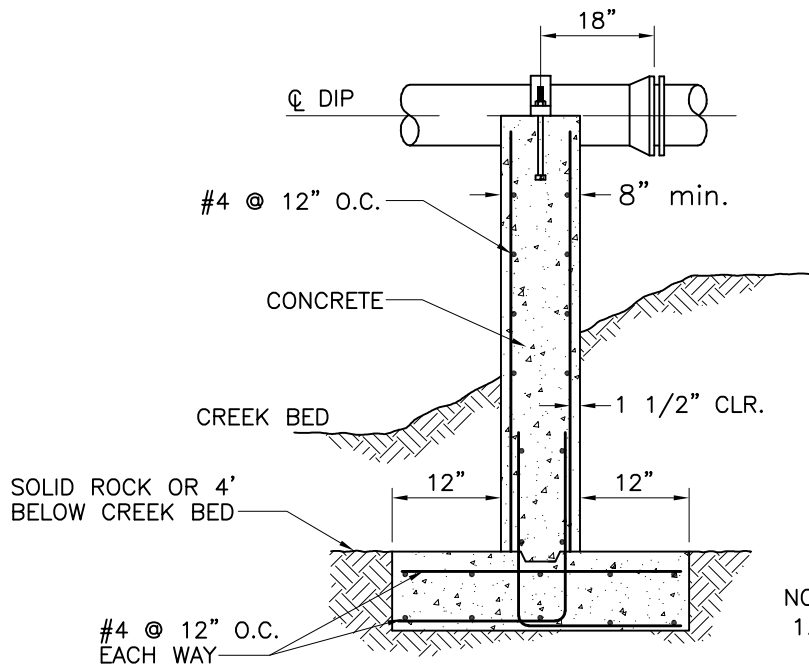
<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## ANCHOR DETAIL



FRONT ELEVATION



SIDE ELEVATION

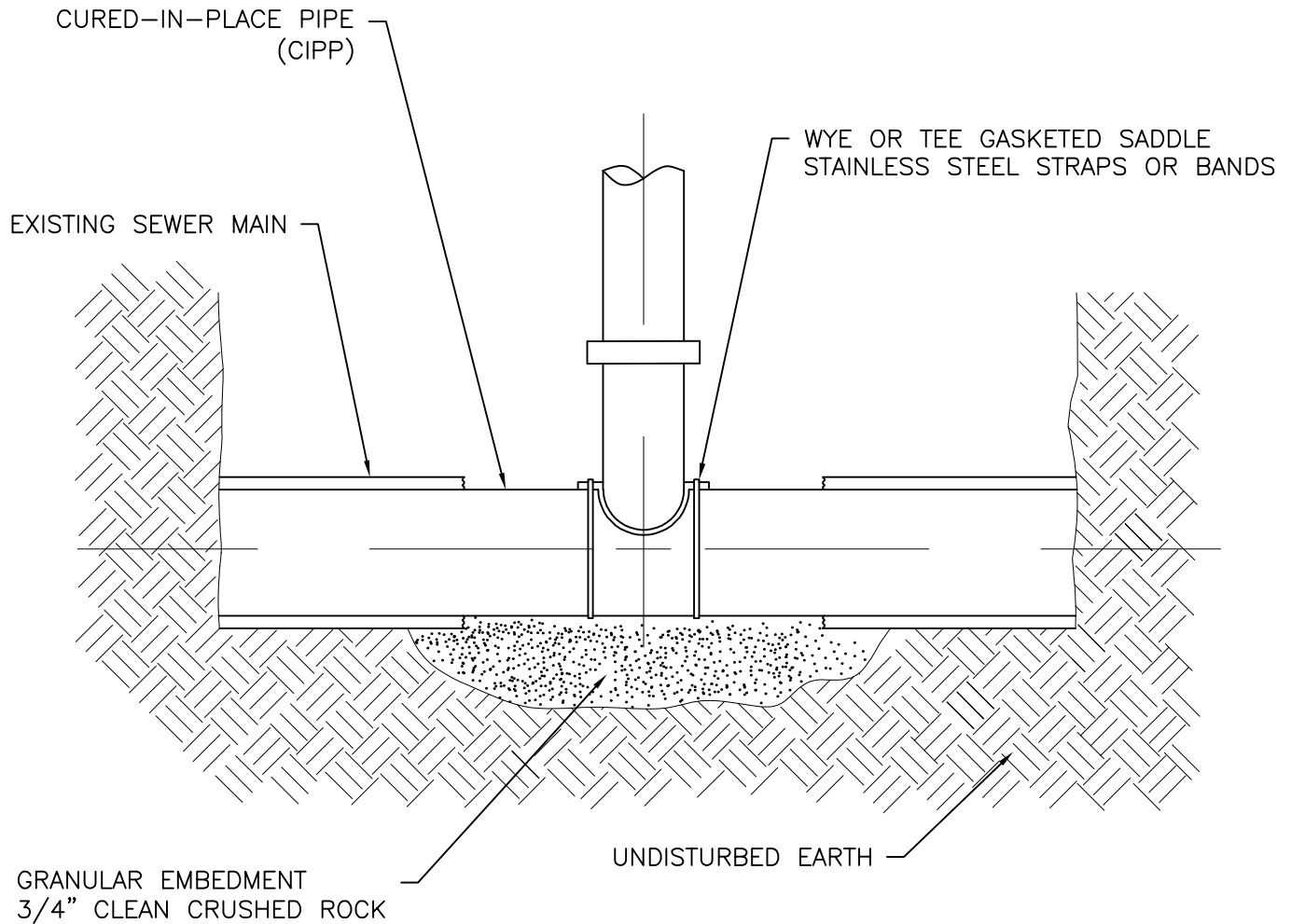
NOTE:

1. PIERS SHALL BE LOCATED AS NEAR TO THE BANK AS POSSIBLE.
2. TOP OF FOOTING AT SOLID ROCK OR 4 FT. BELOW CREEK BED.

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



PIER DETAIL



NOTES:

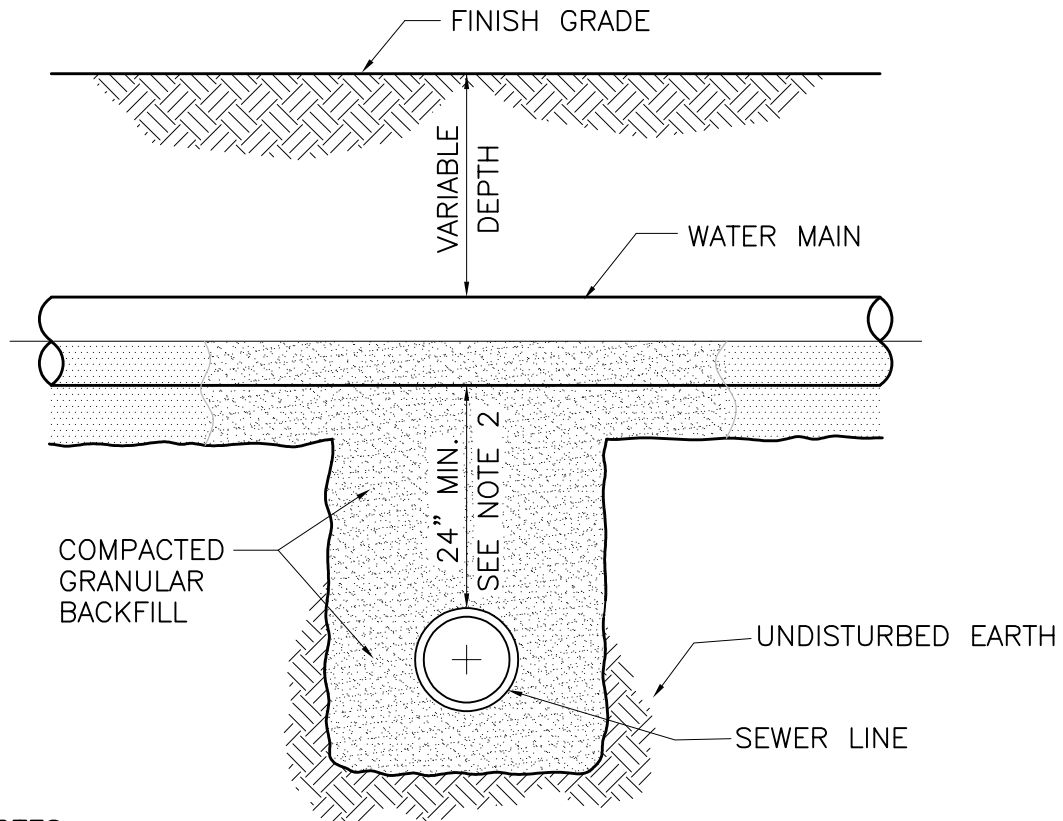
1. REFER TO THIS DETAIL TO CONNECT NEW SERVICE LATERALS OR TO REPLACE EXISTING LATERAL CONNECTIONS TO SEWERS LINED WITH CIPP.
2. REMOVE VCP OR OTHER HOST PIPE FROM AREA TO BE TAPPED. AREA SHALL BE SANDED TO PROVIDE A SMOOTH FLAT SURFACE FOR THE INSTALLATION OF THE SADDLE.
3. IF A NEW TAP IS INSTALLED A HOLE SHALL BE NEATLY CUT WITH AN APPROPRIATE SIZED HOLE SAW AND TAPPED AT A 45 DEGREE ANGLE PER DETAIL 13 STANDARD SERVICE CONNECTION.
4. IF REPLACING A TAP THE HOLE IN THE MAIN, REGARDLESS OF TAP POSITION, SHALL BE CLEANED AND TRIMMED TO THE APPROPRIATE SIZE. IF THE HOLE IS TOO LARGE FROM THE TAP CUTTING PROCESS THE NEXT SIZE UP TAPPING SADDLE SHALL BE USED AND REDUCED IN THE VERTICAL SECTION OF PIPE BEFORE CONNECTING TO THE EXISTING LATERAL.
5. IN ADDITION TO THE GASKETED SADDLE A FAST CURE SEALANT SUCH AS 3M 4200 OR APPROVED EQUAL SHALL BE USED.

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## SERVICE LATERAL CONNECTION TO CURED-IN-PLACE PIPE (CIPP)





NOTES:

1. SEWERS CROSSING WATER MAINS SHALL BE LAID TO PROVIDE A VERTICAL SEPARATION THAT IS NO LESS THAN 24 INCHES BETWEEN THE OUTSIDE OF THE WATER MAIN AND THE OUTSIDE OF THE SEWER MAIN.
2. THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER LINE CROSSES BELOW THE WATER LINE. CROSSINGS IN WHICH THE SEWER LINE IS ABOVE THE WATER LINE WILL ONLY BE APPROVED ON A CASE BY CASE BASIS.
3. THE CROSSING SHALL BE ARRANGED SO THAT THE ENDS OF A FULL JOINT OF PIPE WILL BE EQUIDISTANT FROM THE WATER MAIN AND AS FAR AS POSSIBLE FROM THE WATER MAIN JOINTS.
4. IF THE VERTICAL SEPARATION BETWEEN THE WATER MAIN AND SEWER MAIN IS LESS THAN 18 INCHES, THE SEWER MAIN SHALL BE D.I.P. OR PRESSURE RATED PVC PIPE WITH A PRESSURE RATING THAT IS EQUAL TO OR GREATER THAN THE WATER MAIN. THE D.I.P. OR PRESSURE RATED P.V.C. MUST BE EXTENDED A DISTANCE 10 FEET ON BOTH SIDES OF THE WATER MAIN. THE TRANSITION BETWEEN PIPE MATERIALS SHALL BE ACCOMPLISHED WITH A RESTRAINED MECHANICAL TYPE JOINT OR FITTING. FLEXIBLE TYPE (FERNCO) FITTINGS ARE NOT ACCEPTABLE.
5. PRESSURE SEWER LINE AND WATER LINE CROSSINGS SHALL BE REVIEWED ON A CASE BY CASE BASIS.

<i>RAS</i>	07/01/20
Approved	Date
Revisions	



## GRAVITY SEWER AND WATER LINE CROSSING

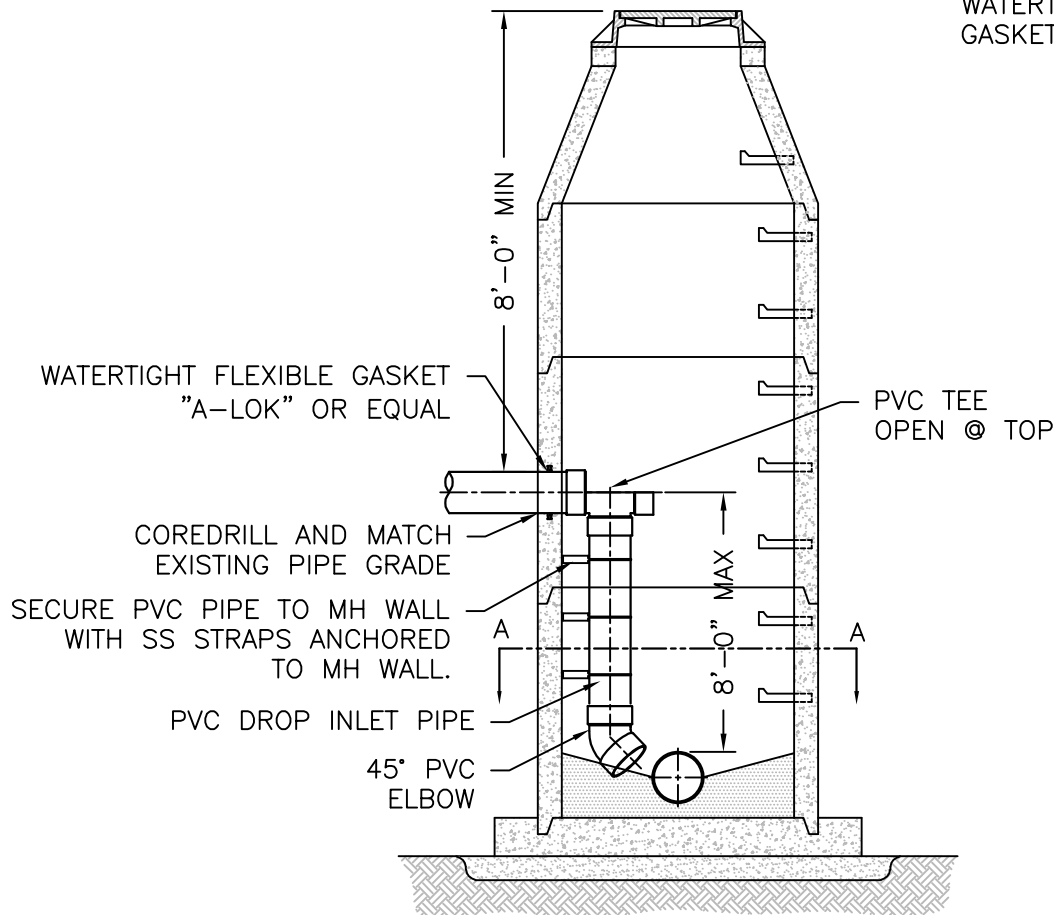
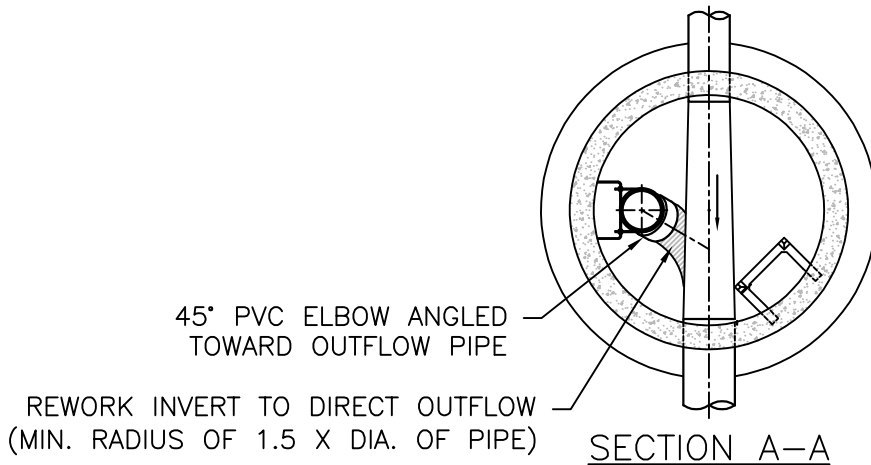
NOTES:

1. INSIDE DROP CONNECTION ONLY ALLOWED WITH PUBLIC WORKS DEPT. APPROVAL, WHEN PW DEPT. DEEMS UNFEASIBLE, UNPRACTICAL OR DANGEROUS TO PROVIDE OUTSIDE DROP.

2. DROP INLET PIPE TO BE SAME SIZE AND MATERIAL AS SEWER LINE.

3. ALIGNMENT OF TEE: DROP INLET PIPE MAY BE ADJUSTED TO A MAXIMUM OF 5% DEFLECTION.

4. ANNULAR SPACE AROUND NEW PIPE TO BE SEALED WITH NON-SHRINK GROUT, LINK SEAL, OR WATERTIGHT AND FLEXIBLE GASKET.



<i>RAS</i>	07/01/20
Approved	Date
Revisions	



# INSIDE DROP MANHOLE CONNECTION

1. EXISTING MAIN SEGMENT REPLACEMENT  
AT DISCRETION OF ENGINEER



22

## Revisions

