

DETAIL NO.

251



STANDARD DETAIL  
ENGLISH

RETURN TYPE DRIVEWAYS

REVISED

01-01-2017

DETAIL NO.

251

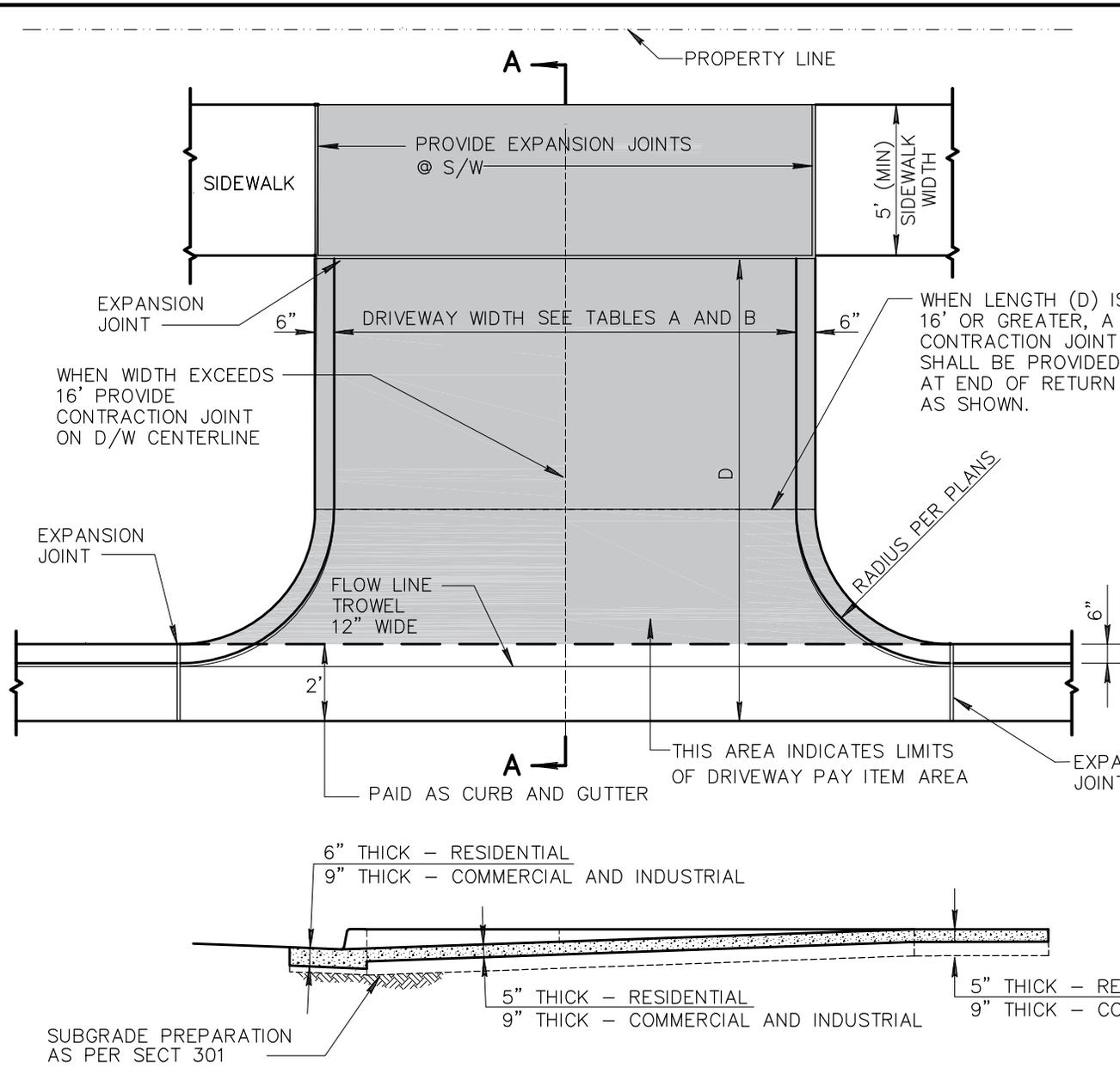


TABLE A		
ZONING	DRIVEWAY WIDTH	
	MIN*	MAX
<b>COMMERCIAL AND INDUSTRIAL</b>		
COMMERCIAL	16'	40'
INDUSTRIAL	16'	40'
* 24' WHERE 2-WAY TRAFFIC IS ANTICIPATED		

TABLE B		
ZONING	DRIVEWAY WIDTH	
	MIN*	MAX
<b>RESIDENTIAL</b>		
MAJOR STREET	16'	30'
COLLECTOR STREET	12'	30'
LOCAL STREET	12'	30'
* 16' WIDTH IS DESIRABLE		

**NOTES:**

1. EXPANSION JOINT SHALL COMPLY TO SECTION 340.
2. THIS TYPE D/W TO BE USED ONLY UPON APPROVAL OF ENGINEER.
3. CONCRETE:  
RESIDENTIAL CLASS B  
COMMERCIAL AND INDUSTRIAL CLASS A

**SECTION A-A**

**NOTES:**

1. A CONCRETE COLLAR IS REQUIRED WHERE PIPES OF DIFFERENT DIAMETERS OR MATERIALS ARE JOINED, OR WHERE THE CHANGE IN ALIGNMENT OR GRADE EXCEEDS THAT ALLOWED FOR ON ORDINARY JOINTS.
2. WHERE PIPES OF DIFFERENT DIAMETERS ARE JOINED WITH A CONCRETE COLLAR, L AND T SHOULD BE THOSE OF THE LARGER PIPE. D=D-1, OR D-2 WHICHEVER IS GREATER.
3. OMIT REINFORCING ON PIPE 24" OR LESS IN DIAMETER.
4. WHERE REINFORCING IS REQUIRED, THE DIAMETER OF THE CIRCULAR TIES SHALL BE THE OUTSIDE DIAMETER OF PIPE+T.
5. FIELD CLOSURES OF PIPE OF THE SAME DIAMETER AND WITHOUT CHANGE IN GRADE OR ALIGNMENT SHALL BE MADE WITH A CONCRETE COLLAR.
6. CONCRETE SHALL BE CLASS B PER SECT. 725.
7. ALL REBAR SHALL HAVE 3" MINIMUM CLEAR COVER.
8. PIPE ENDS TO BE TRIMMED SUCH THAT THE MAXIMUM DISTANCE BETWEEN PIPES AT ANY POINT IS 2".
9. AN ENGINEER APPROVED WATER STOP IS REQUIRED ON ALL PIPES EXCEPT CONCRETE PIPE.

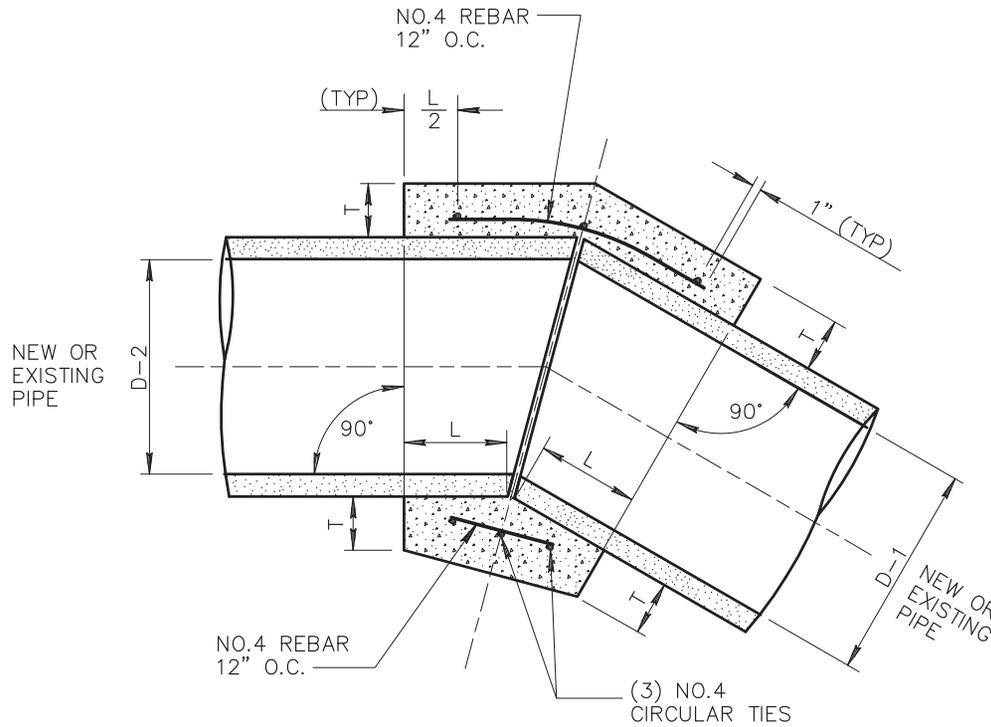
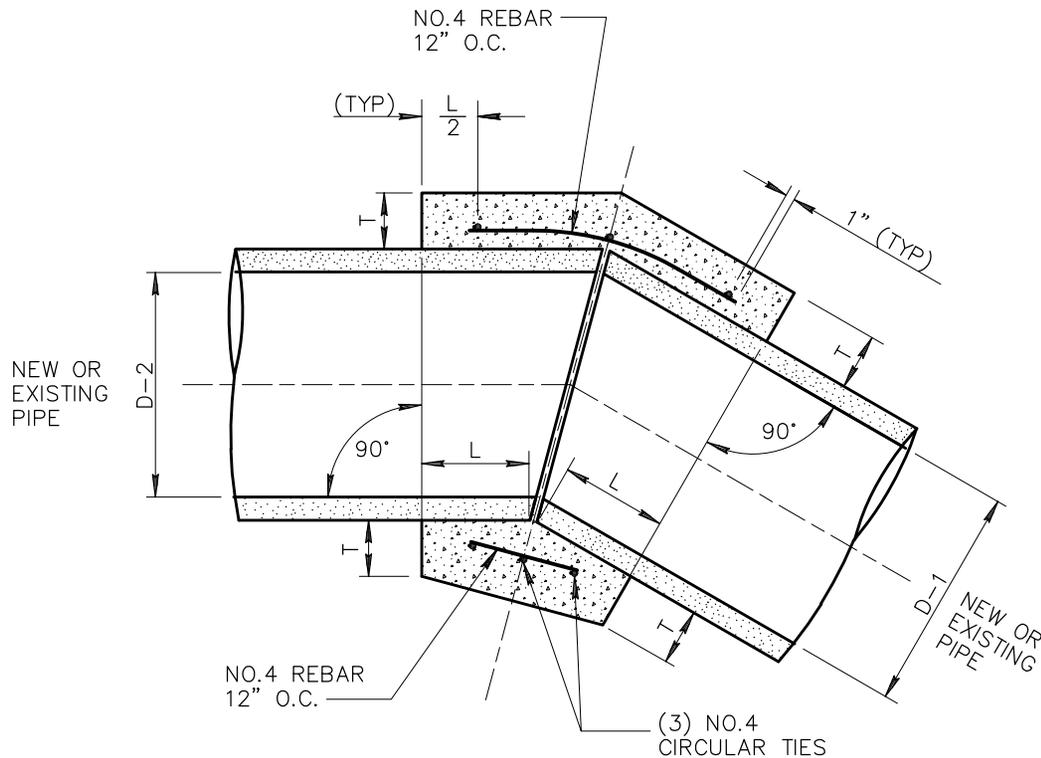


TABLE		
D	L	T
18"	1.0'	5"
24"	1.0'	6"
36"	1.5'	8"
57"	1.5'	10"
66"	1.75'	11"

FOR PIPE SIZES NOT LISTED AND LESS THAN 66" USE THE NEXT SIZE LARGER.



### NOTES:

1. A CONCRETE COLLAR IS REQUIRED WHERE PIPES OF DIFFERENT DIAMETERS OR MATERIALS ARE JOINED, OR WHERE THE CHANGE IN ALIGNMENT OR GRADE EXCEEDS THAT ALLOWED FOR ON ORDINARY JOINTS.
2. WHERE PIPES OF DIFFERENT DIAMETERS ARE JOINED WITH A CONCRETE COLLAR, L AND T SHOULD BE THOSE OF THE LARGER PIPE.  $D=D-1$ , OR  $D-2$  WHICHEVER IS GREATER.
3. OMIT REINFORCING ON PIPE 24" OR LESS IN DIAMETER.
4. WHERE REINFORCING IS REQUIRED, THE DIAMETER OF THE CIRCULAR TIES SHALL BE THE OUTSIDE DIAMETER OF PIPE+T.
5. FIELD CLOSURES OF PIPE OF THE SAME DIAMETER AND WITHOUT CHANGE IN GRADE OR ALIGNMENT SHALL BE MADE WITH A CONCRETE COLLAR.
6. CONCRETE SHALL BE CLASS B PER SECT. 725.
7. ALL REBAR SHALL HAVE 3" MINIMUM CLEAR COVER.
8. PIPE ENDS TO BE TRIMMED SUCH THAT THE MAXIMUM DISTANCE BETWEEN PIPES AT ANY POINT IS 2".
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D	L	T
18"	1.0'	5"
24"	1.0'	6"
36"	1.5'	8"
57"	1.5'	10"
66"	1.75'	11"

FOR PIPE SIZES NOT LISTED AND LESS THAN 66" USE THE NEXT SIZE LARGER.

DETAIL NO.

505



STANDARD DETAIL  
ENGLISH

CONCRETE COLLAR FOR PIPE

REVISED

01-01-2018

DETAIL NO.

505

## SECTION 787

## GRAY IRON CASTINGS

**787.1 GENERAL:**

The castings shall be true to pattern in form and dimension and free from pouring faults, spongings, cracks, blowholes, or other defects in locations affecting their strength and value for the service intended. Castings shall be filleted boldly at angles, and the arises shall be sharp and true.

Before the castings are removed from the foundry, they shall be thoroughly cleaned and the parting lines, gates, and risers ground flush.

**787.2 TEST SPECIMENS:**

Test coupons shall be cast separately of the castings, using a mold as described in ASTM [A48](#). A representative of the Engineer may be present at the time a melt is poured to identify both coupons and castings.

Two test coupons are required for each melt poured. Additional coupons shall be cast for use as replacements or in case a retest is required.

A representative of the Engineer may discard and replace specimens which show obvious lack of continuity of metal or if the machining is defective.

The manufacturer shall machine the tension specimens to the dimension specified for specimen B of ASTM [A48](#), at no additional cost to the Contracting Agency.

When approved by the Engineer transverse tests may be made in lieu of tensile tests, in which case the castings shall meet the requirements of ASTM [A48](#).

**787.3 MANHOLE FRAME AND COVER SETS:** Change from Class 30 to Class 35 to match manhole cover details.

Castings shall conform to ASTM [A48](#), Class 35 and AASHTO M306. The bearing surfaces of the frames and covers shall be machined and the cover shall seat firmly onto the frame without rocking.

Covers shall be the types and shall be imprinted as shown on the plans or standard details.

**787.4 RAILINGS, RAILING POSTS, AND WHEEL GUARDS:**

Castings shall conform to ASTM [A48](#), Class 40.

**787.5 ROCKERS, ROCKER PLATE BEARINGS, AND BEARING PLATES FOR BRIDGES:**

Castings shall conform to ASTM [A48](#), Class 50.

Castings shall be machined and finished as specified on the plans provided that tool marks on sliding contact surfaces shall run in the direction of plate movement, or in the case of rocker plate bearings, perpendicular to the rocker movement. Tool marks shall be not more than 1/32 inch apart.

**787.6 UNCLASSIFIED CASTINGS:**

All castings not specifically classified, shall conform to the requirements of ASTM [A48](#), Class 30.

- End of Section -

## SECTION 714

Delete  
Test >>

TABLE 714-2			
MICRO-SURFACING JOB MIX FORMULA			
ASTM TEST METHOD	ISSA TECHNICAL BULLETIN	TEST	REQUIREMENTS
<a href="#">D244</a>		Residual Asphalt, % by dry weight of aggregate	6.0 – 11.5
<a href="#">D242</a>		Mineral Filler, % by dry weight of aggregate.	0.1 – 2.0
		Modifier Content, % (see Section <a href="#">714.6</a> )	4, minimum.
		Additive	As required for mix properties
		Water	As required for mix properties
<a href="#">C136/ C117</a>		Aggregate Grading	Meets requirements of Table <a href="#">714-1</a>
	TB-106	Consistency, cm.	2.5-3.0
	TB-100	Abrasion Loss (Wet Track Abrasion Test) One Hour Soak, g/ft <sup>2</sup> Six Day Soak, g/ft <sup>2</sup>	50, maximum 75, maximum
	TB-114	Wet Stripping, %	90, minimum
	TB-139	Wet Cohesion Test, at 77° F Set Time Test: (30 minutes), kg-cm Early Rolling Traffic Time: (60 minutes), kg-cm	12, minimum 20, minimum
	TB-102	Quick Set Emulsion Mix Properties Micro-Surfacing Setting Test, 70-85 ° F. (1-hour cure) Micro-Surfacing Water Resistance Test, 70-85 ° F. (30-minute cure)	No Brown Stain No More Than Slight Discoloration
	TB-115	Split Consistency Test	Uniform
	TB-113	Mix Time Micro-Surfacing Mixing, 70-85 ° F., Sec.	120, minimum
	TB-147	Measurement of Stability and Resistance to Compaction, Vertical and Lateral Displacement of Multi-layered Fine Aggregate Cold Mixes	Lateral Displacement 5%, maximum Specific Gravity 2.10, maximum
	TB-109	Loaded Wheel Sand Adhesion	50 g/ft <sup>2</sup> , maximum

**714.7.2.1 Bulking Effect (ASTM [C29](#) Modified):** The laboratory shall further report the quantitative effects of moisture content in the unit weight of the aggregate (bulking effect).

#### 714.8 TEST CERTIFICATES AND REPORTS:

Test certificates and reports for the bituminous material shall be furnished in accordance with Section [711](#).

#### 714.9 CONVERSION OF QUANTITIES:

Volumetric conversions shall be accomplished in accordance with Section [713](#).

- End of Section -

## SECTION 715

**TABLE 715-2**  
**SLURRY SEAL JOB MIX FORMULA**

ASTM TEST METHOD	ISSA TECHNICAL BULLETIN	TEST	REQUIREMENTS
<del>D244</del>		Residual Asphalt, % by dry weight of aggregate: Type I Type II Type III	10.0 – 16.0 7.5 – 13.0 6.5 – 12.0
D242		Mineral Filler, % by dry weight of aggregate.	0.1 – 2.0
		Modifier Content, % (see Section 715.4), if applicable	3, minimum.
		Additive	As required for mix properties
		Water	As required for mix properties
C136/ C117		Aggregate Grading	Meets requirements of Table 715-1
	TB-106	Consistency, cm.	2.0-3.0
	TB-100	Abrasion Loss (Wet Track Abrasion Test) One Hour Soak, g/ft <sup>2</sup> Six Day Soak, g/ft <sup>2</sup>	75, maximum 75, maximum
	TB-114	Wet Stripping, %	90, minimum
	TB-139	Modified Cohesion Test, at 77° F Set Time Test: (30 minutes), kg-cm Early Rolling Traffic Time: (60 minutes), kg-cm	12, minimum 20, minimum
	TB-102	Quick Set Emulsion Mix Properties Slurry Seal Setting Test, 70-85 ° F (1-hour cure) Slurry Seal Water Resistance Test, 70-85 ° F (30-minute cure)	No Brown Stain No More Than Slight Discoloration
	TB-115	Split Consistency Test	Uniform
	TB-113	Mix Time Slurry Seal Mixing, 70-85 ° F, Sec.	120, minimum
	<del>TB-147</del>	<del>Measurement of Stability and Resistance to Compaction, Vertical and Lateral Displacement of Multi-layered Fine Aggregate Cold Mixes</del>	<del>Lateral Displacement 5%, maximum</del> Specific Gravity 2.10, maximum
	TB-109	Loaded Wheel Sand Adhesion	50 g/ft <sup>2</sup> , maximum

**715.7.2.1 Bulking Effect (ASTM C29):** The laboratory shall further report the quantitative effects of moisture content in the unit weight of the aggregate (bulking effect).

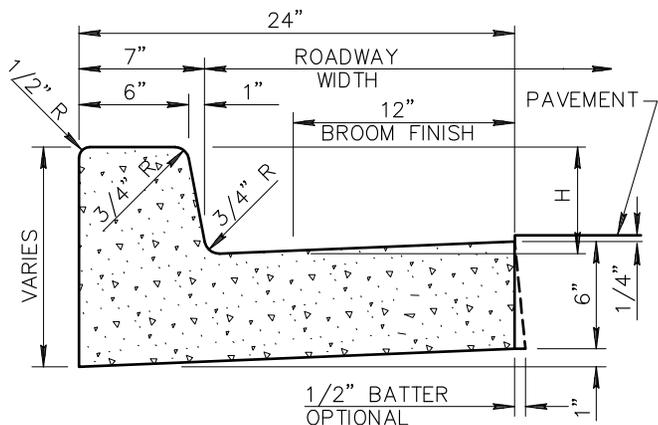
#### 715.8 TEST CERTIFICATES & REPORTS:

Test certificates and reports for the bituminous material shall be furnished in accordance with Section 711.

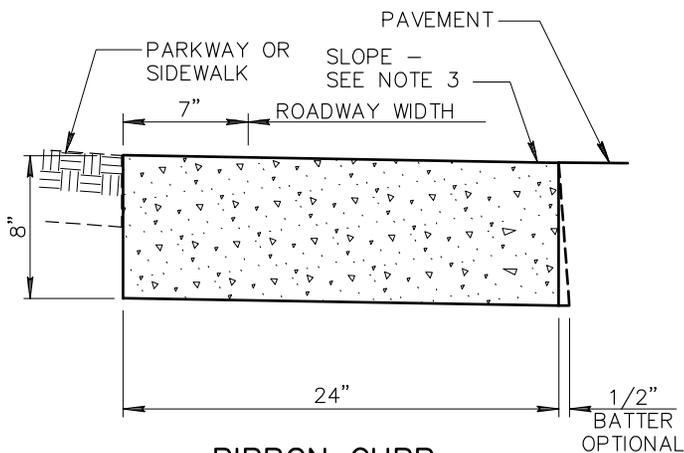
#### 715.9 CONVERSION OF QUANTITIES:

Volumetric conversions shall be accomplished in accordance with Section 713.

- End of Section -



**VERTICAL CURB AND GUTTER  
(TYPE A)**



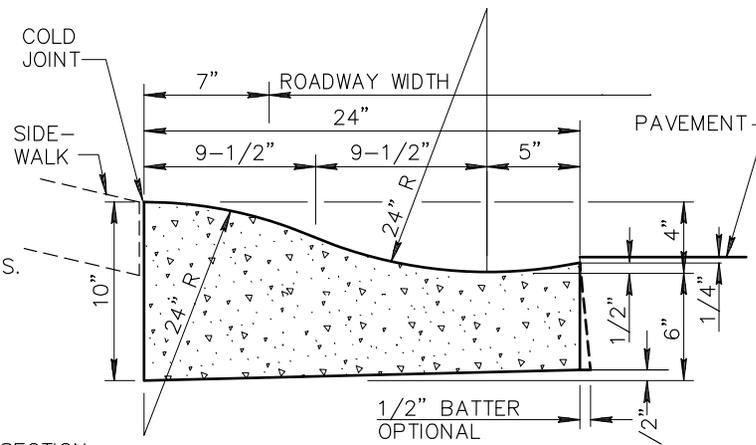
**RIBBON CURB  
(TYPE B)**

**NOTES: (TYPE A)**

1. ALL EXPOSED SURFACES TO BE TROWEL FINISHED EXCEPT AS SHOWN. SEE SECT. 340.
2. H=6" OR AS SPECIFIED ON PLANS.
3. CONTRACTION JOINT SPACING 10' MAXIMUM.
4. EXPANSION JOINTS AS PER SECT. 340.
5. CLASS 'B' CONCRETE PER 725.
6. WHEN THE ADJACENT PAVEMENT SECTION SLOPES AWAY FROM THE GUTTER, THE SLOPE OF THE GUTTER PAN SHALL MATCH PAVEMENT CROSS SLOPE.

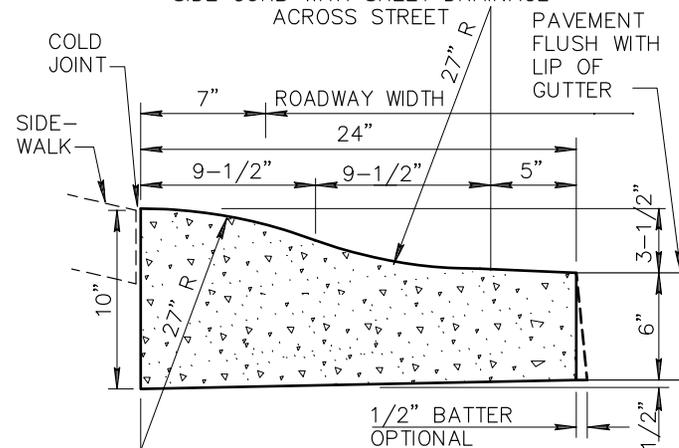
**NOTES: (TYPE B)**

1. CONSTRUCT CURB AND INSTALL 1/2" MASTIC EXPANSION JOINTS, A.S.T.M. D-1751. SECT. 340.
2. BROOM FINISH ALL SURFACES.
3. RIBBON CURB MAY SLOPE TOWARDS PAVEMENT OR PARKWAY AS INDICATED ON PLANS.
4. CONTRACTION JOINT SPACING 10' MAXIMUM.
5. CONCRETE SHALL BE CLASS 'B' PER SECT. 725 AND INSTALLED PER SECT. 505.



**ROLL CURB AND GUTTER  
(TYPE C)**

SPECIAL SECT. USE FOR HIGH SIDE CURB WITH SHEET DRAINAGE ACROSS STREET

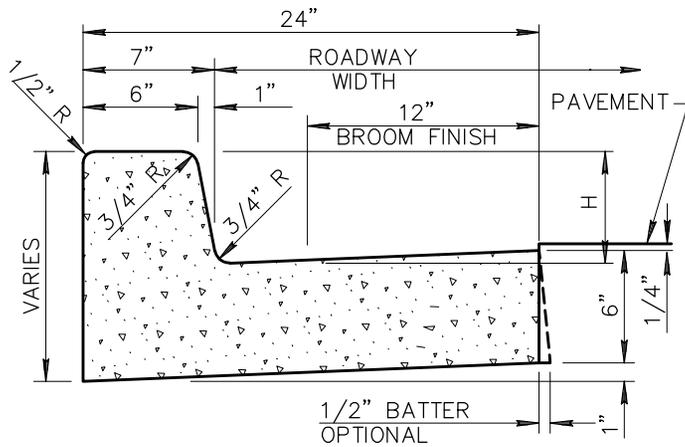


**(TYPE D)**

**NOTES: (C & D)**

1. ALL WORK AND MATERIALS SHALL CONFORM TO SECT. 304, 505 AND 725. BROOM FINISH TO EXPOSED SURFACE.
2. CONTRACTION JOINT SPACING 10' MAXIMUM.
3. EXPANSION JOINTS AS PER SECT. 340.
4. CLASS 'B' CONCRETE PER 725.

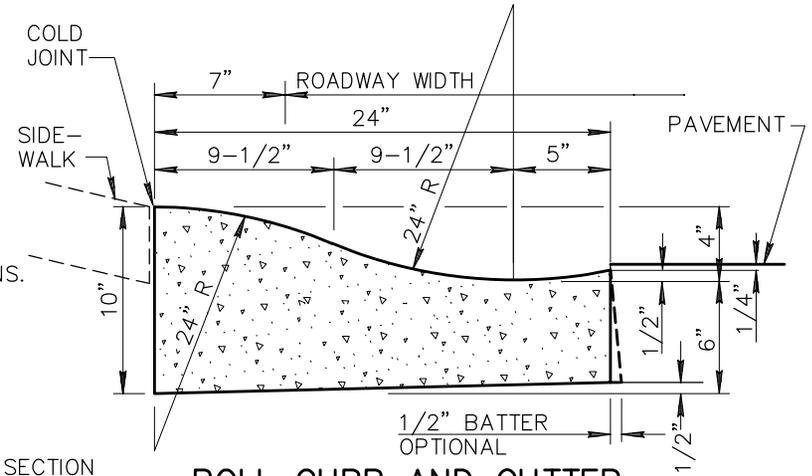
340



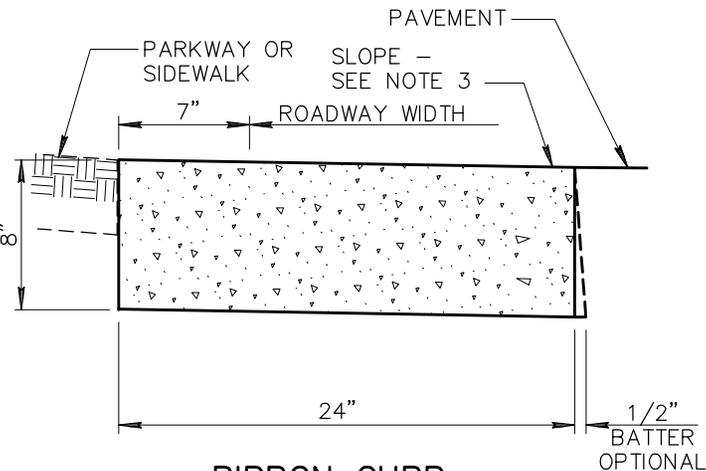
**VERTICAL CURB AND GUTTER  
(TYPE A)**

**NOTES: (TYPE A)**

1. ALL EXPOSED SURFACES TO BE TROWEL FINISHED EXCEPT AS SHOWN. SEE SECT. 340.
2. H=6" OR AS SPECIFIED ON PLANS.
3. CONTRACTION JOINT SPACING 10' MAXIMUM.
4. EXPANSION JOINTS AS PER SECT. 340.
5. CLASS 'B' CONCRETE PER 725.
6. WHEN THE ADJACENT PAVEMENT SECTION SLOPES AWAY FROM THE GUTTER, THE SLOPE OF THE GUTTER PAN SHALL MATCH PAVEMENT CROSS SLOPE.



**ROLL CURB AND GUTTER  
(TYPE C)**

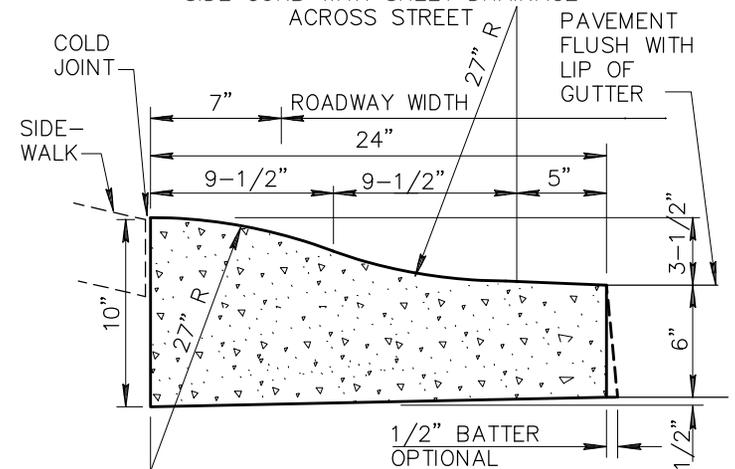


**RIBBON CURB  
(TYPE B)**

**NOTES: (TYPE B)**

1. CONSTRUCT CURB AND INSTALL 1/2" MASTIC EXPANSION JOINTS, A.S.T.M. D-1751. SECT. 340.
2. BROOM FINISH ALL SURFACES.
3. RIBBON CURB MAY SLOPE TOWARDS PAVEMENT OR PARKWAY AS INDICATED ON PLANS.
4. CONTRACTION JOINT SPACING 10' MAXIMUM.
5. CONCRETE SHALL BE CLASS 'B' PER SECT. 725 AND INSTALLED PER SECT. 505.

SPECIAL SECT. USE FOR HIGH SIDE CURB WITH SHEET DRAINAGE ACROSS STREET



**(TYPE D)**

**NOTES: (C & D)**

1. ALL WORK AND MATERIALS SHALL CONFORM TO SECT. 340, 505 AND 725. BROOM FINISH TO EXPOSED SURFACE.
2. CONTRACTION JOINT SPACING 10' MAXIMUM.
3. EXPANSION JOINTS AS PER SECT. 340.
4. CLASS 'B' CONCRETE PER 725.

DETAIL NO.

220-1



STANDARD DETAIL  
ENGLISH

**CURB AND GUTTER  
TYPES A, B, C AND D**

REVISED

01-01-2021

DETAIL NO.

220-1

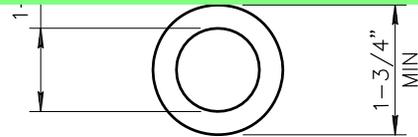
# PIPE SLEEVE DETAIL

MATERIAL: STEEL PER ASTM A513 2" SQUARE OPERATING NUT (WITH

3/16" (0.1875) weld shown on the CAD files used for MAG approval

3/16" (0.1875) weld shown on the 2017 shop drawing

3/16" (0.1875) weld 2014 shop drawing



3/8" (0.375) weld shown on the CAD files used for MAG approval

3/16" (0.1875) weld shown on the 2017 shop drawing.

sleeve not shown on the 2014 shop drawing

## NOTES:

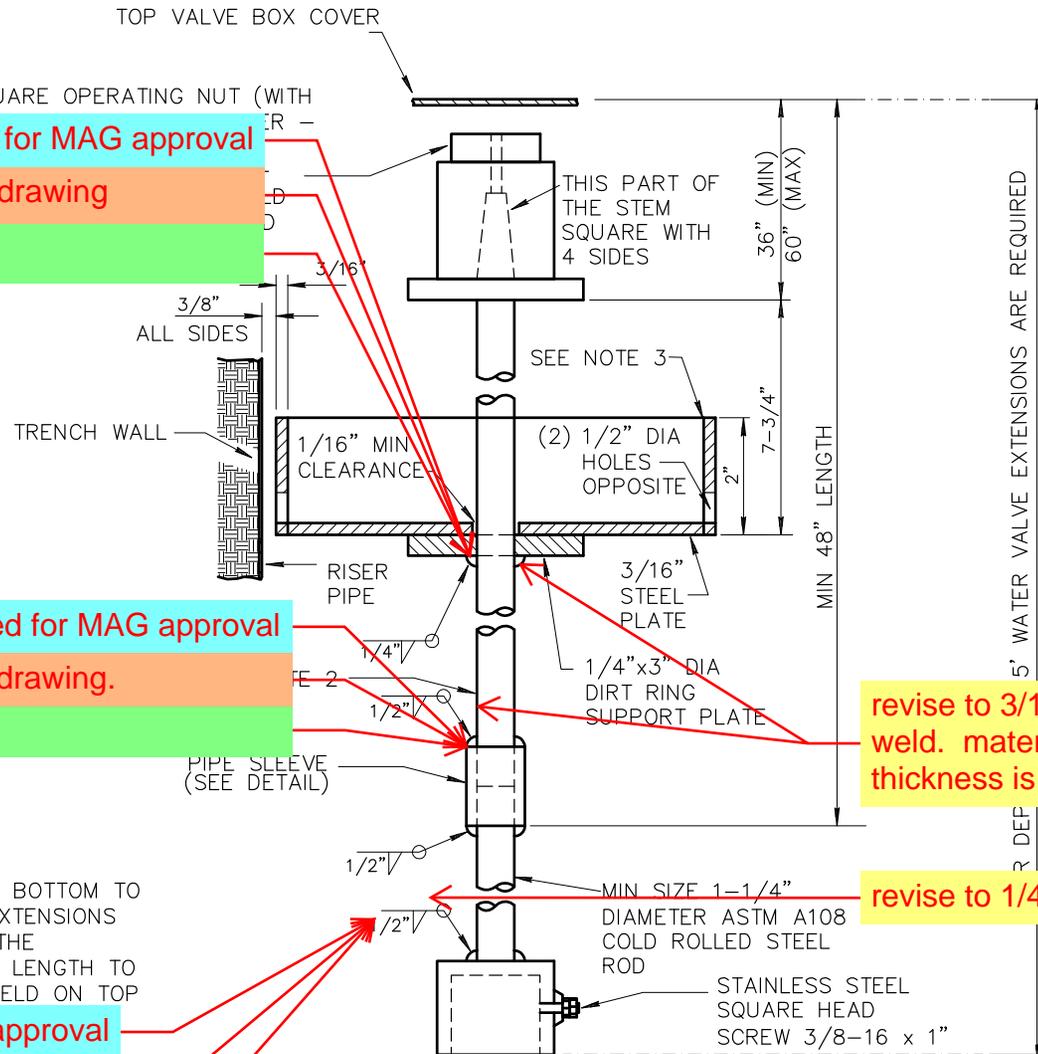
- EXTENSION STEM: WITH A SQUARE SOCKET ON THE BOTTOM TO FIT A 2" SQUARE VALVE OPERATING NUT. VALVE EXTENSIONS ARE REQUIRED ON ALL VALVES INSTALLED WHERE THE OPERATING NUT IS OVER 5' BELOW THE SURFACE. LENGTH TO FIT EACH INSTALLATION. OPERATING NUT TO BE HELD ON TOP

weld not shown on the CAD files used for MAG approval

3/6" (0.1875) weld shown on the 2017 shop drawing

1/4" (0.25) weld 2014 shop drawing.

LOWER PORTION OF THE 1-1/4" EXTENSION ROD.

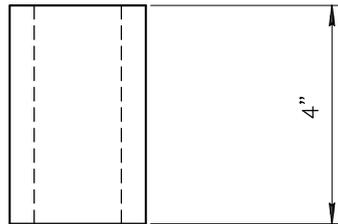
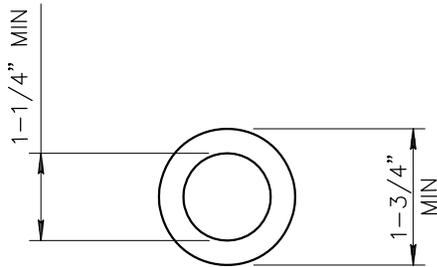


revise to 3/16 inch weld. material thickness is 1/4 inch.

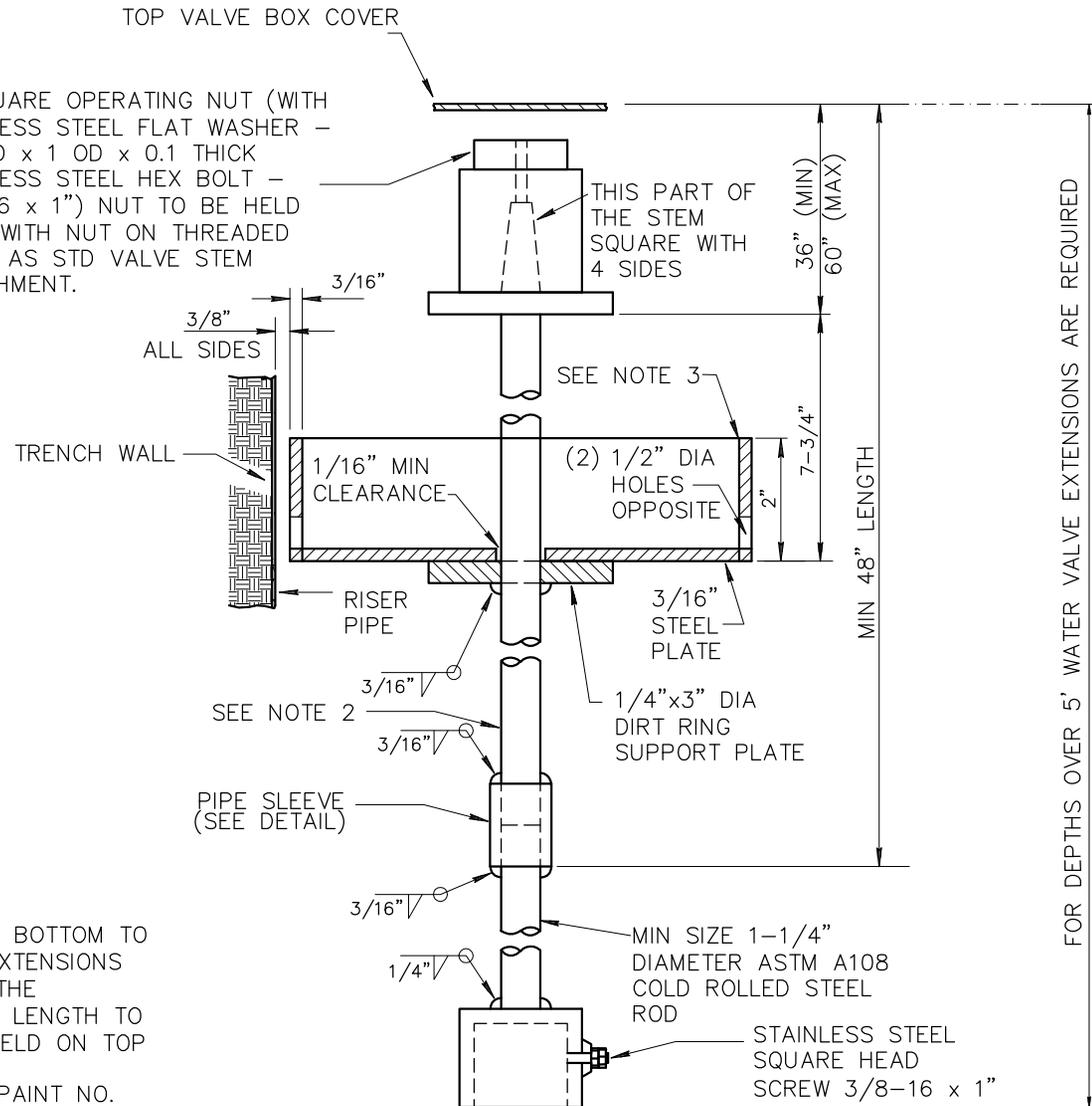
revise to 1/4 inch weld

# PIPE SLEEVE DETAIL

MATERIAL: STEEL PER ASTM A513



2" SQUARE OPERATING NUT (WITH STAINLESS STEEL FLAT WASHER - 0.43 ID x 1 OD x 0.1 THICK STAINLESS STEEL HEX BOLT - 3/8-16 x 1") NUT TO BE HELD DOWN WITH NUT ON THREADED SHAFT AS STD VALVE STEM ATTACHMENT.



## NOTES:

1. EXTENSION STEM: WITH A SQUARE SOCKET ON THE BOTTOM TO FIT A 2" SQUARE VALVE OPERATING NUT. VALVE EXTENSIONS ARE REQUIRED ON ALL VALVES INSTALLED WHERE THE OPERATING NUT IS OVER 5' BELOW THE SURFACE. LENGTH TO FIT EACH INSTALLATION. OPERATING NUT TO BE HELD ON TOP OF EXTENSION WITH STOP NUT.
2. PAINTING: ALL STEEL TO HAVE A PRIME COAT OF PAINT NO. 1-D AND ONE HEAVY APPLICATION (FINISH COAT) OF PAINT NO. 9 AS PER SECTION 790.
3. DIRT RING TO FLOAT FREELY ON THE TOP OF THE SUPPORT PLATE.
4. PIPE SLEEVE SHALL BE SECURELY WELDED TO THE UPPER AND LOWER PORTION OF THE 1-1/4" EXTENSION ROD.

## SECTION 345

### ADJUSTING FRAMES, COVERS AND VALVE BOXES

#### 345.1 DESCRIPTION:

The Contractor shall furnish all labor, materials, and equipment necessary to adjust all frames, covers and valve boxes as indicated on the plans or as designated by the Engineer. The frames shall be set to grades established by the Engineer.

The Contractor may elect to remove old frames, covers, and valve boxes and then install new frames and/or boxes in accordance with standard detail drawings at no additional cost to the Contracting Agency.

The Contractor shall be responsible for maintaining an accurate description and location of all items to be adjusted. The locations shall be referenced with map documentation by the use of swing ties or GPS locations. This information shall be supplied to the Engineer and utility owner(s) prior to taking any action that would hide or restrict access to the items to be adjusted.

Any missing or defective frames, covers, valve boxes or related hardware shall be reported to the Engineer in writing during the initial location process to allow for timely replacement. The Engineer shall be responsible for providing replacement items to the contractor. The contractor is responsible for providing items required to accomplish the required adjustments such as additional adjusting rings, valve box extensions, meter box extensions, and pull box extensions.

#### 345.2 LOWERING PROCEDURE:

If required, manholes, valve boxes, or survey monuments located within the paved areas to be milled or reconstructed shall be lowered to an elevation that will allow required work to be accomplished without damaging the facilities. Care shall be taken to prevent entrance of any material into the lowered facilities. Lowering shall be to a depth that will prevent damage to the utility during the construction activities.

All manhole frames, valves boxes, survey hand hole frames and related items removed by the contractor during the lowering process shall be maintained in a secure area, and the contractor shall bear full responsibility for the material. Any hardware items lost or damaged by the contractor shall be replaced in kind, at no additional cost to the Contracting Agency.

**Preparation for Milling:** Temporary asphalt concrete shall be placed over the steel plate filling the excavated area. The temporary pavement shall be maintained until removed during the adjustment to final grade. For manholes located on major streets that are to be kept opened to vehicular traffic, hot mix asphalt shall be used to backfill the excavated areas and compacted flush with the existing pavement prior to opening up to traffic. In residential or low volume streets with minimal traffic, cold mix or other approved product may be used for temporary pavement. No measurement or payment shall be made for temporary pavement placement or removal.

#### 345.3 ADJUSTING FRAMES:

sanitary sewers or storm drains.

The Contractor shall loosen frames in such a manner that existing monuments, cleanouts, manholes, and valve boxes will not be disturbed or damaged. Debris shields shall be used to prevent debris from entering sanitary or storm sewers. All loose material and debris shall be removed from the excavation and the interiors of structures prior to resetting frames. If dirt or debris enters the sewer system, the contractor shall be responsible for cleaning the sewer system for a minimum of one reach (the next downstream structure from the contamination point.)

Frames shall be set to match finished grade or the elevations and slopes established by the Engineer. Manhole frames shall be firmly blocked in place with masonry or metal supports. Spaces between the frame and the facility shall be sealed on the inside to prevent any concrete from entering the hand hole or manhole. A Class AA concrete collar shall be placed around and under the frames to provide a seal and properly seat the frame at the required elevation and slope. Concrete shall be struck off flush with the top of the existing pavement.

Adjustments of utilities, if located within the asphalt pavement, shall be made after placing the final surface course when there is only a single lift of pavement required. When there are multiple lifts of pavement required, adjustments may be made before the final surfacing or as directed by the Engineer.

## SECTION 620

### CAST-IN-PLACE CONCRETE PIPE

#### 620.1 GENERAL:

storm drains

This specification covers cast-in-place non-reinforced concrete pipe intended for use as storm sewers or irrigation lines. The abbreviated title is CIPP. CIPP is conduit made of Portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only:

- (A) By experienced operators. The Engineer will be the sole judge as to experience level.
- (B) In the presence of the Engineer.
- (C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.
- (D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.

#### 620.2 MATERIALS:

**620.2.1** Cement shall be ASTM [C150](#), Type II, and low alkali as per Section [725](#).

**620.2.2** Sand aggregate used for concrete and mortar shall conform to Section [725.3](#). Maximum size of the aggregate shall not be greater than  $\frac{1}{3}$  of the minimum wall thickness up to and including a wall thickness of 4  $\frac{1}{2}$  inches. The maximum aggregate size is 1  $\frac{1}{2}$  inches.

**620.2.3** Water used for concrete and for curing the pipe shall be as per Section [725](#).

**620.2.4** Concrete shall be Class A in accordance with Section [725](#). Slump shall be the minimum required for satisfactory placement of the concrete by the equipment used by the Contractor. The slump shall not exceed 3 inches.

**620.2.5** Bonding mortar shall consist of two (2) or more parts of cement to three (3) parts of sand by volume.

#### 620.3 CONSTRUCTION METHODS:

**620.3.1 Excavation:** The trench will be neatly excavated with vertical sides and semi-circular bottom. The trench shall be shaped to form the bottom outside of the pipe on the alignment and to the grades specified in the plans. Departure from and return to established grade shall not exceed 1 inch per 10 linear feet with a maximum allowable departure of 1  $\frac{1}{2}$  inches. Departure from and return to specified alignment shall not exceed 2 inches per 10 linear feet with a maximum allowable alignment departure of 4 inches. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, firm, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe. Density of the fill shall be at least five percent (5%) greater than the natural in-place soil, but in no case less than 85 percent (85%) when tested in accordance with AASHTO T-99, Method A and T-191 or ASTM [D6938](#).

When it is necessary to install the pipe in rocky areas, the rock will be removed and replaced with suitable fill material compacted to proper density. The rock will be over-excavated to leave 6 inches minimum compacted soil cushion between the rock and the pipe. For construction accuracy, areas left void by rock removal will be completely filled with compacted material, then trenched for the pipe as though natural ground. If the rock below the pipe subgrade is fractured or fragmented or if it consists of large cobblestones or boulders, the replacement fill material will be carefully selected to insure that it is of such gradation that it will not be removed downward by fluctuation of the water table. In no case will expansive soils be used for fill. A similar procedure of over-excavation, backfill, compaction, and retrenching will be used where sloughing sand or where soft or spongy soil conditions are encountered. When expansive clays are encountered, they will be thoroughly moistened by ponding, to completely expand the soil, and the moisture maintained until the concrete is placed.

Where the pipe is to be constructed through fill materials, such fill shall have stability in the zone of the trench form equal to firm undisturbed earth, in the area adjacent to the fill.

## SECTION 621

### CORRUGATED METAL PIPE AND ARCHES

#### 621.1 DESCRIPTION:

##### storm drains

These specifications cover plain galvanized, bituminous coated, and bituminous coated and paved galvanized corrugated metal pipe for use in storm sewers. The pipe shall be of the types, constructed as specified, and shall be manufactured in accordance with the requirements of the stated specifications. Except as otherwise required, corrugated metal pipe shall conform to AASHTO M-36 for Type I, Type IA, II and Type IIA. The external coating and internal lining shall be in accordance with AASHTO M-190 and Section [760](#).

#### 621.2 MATERIALS:

The types of pipe and fabrication shall be in accordance with Section [760](#).

All helically-wound corrugated metal pipe shall have a marking system, which shall provide a quick external visual check of diameter variations during and after the manufacturing process.

#### 621.3 INSTALLATION:

Excavation, bedding and backfill shall be in accordance with Section [601](#), except as modified by standard details.

No pipe shall be laid except in the presence of an inspector. Each pipe shall be carefully inspected immediately before it is laid and defective pipe will be rejected. Pipe lines shall be laid to the grades and alignment indicated on the drawings. Variation from prescribed grade and alignment shall not exceed 0.10 foot, and the rate of departure from, or return to established grade or alignment shall be no more than 1 inch in 10 feet, unless otherwise approved by the Engineer. Proper facilities shall be provided for lowering sections of pipe into trenches. All pipes, elliptical or round, as well as pipe arches requiring external coating or internal lining shall be equipped with lifting lugs as required and shall have connecting bands designed to provide positive connection without damaging the coating on the pipe or pipe arch.

All field repairs to the bituminous coating or paving shall be made with approved fiber reinforced bituminous mastic.

Corrugated metal pipe and/or pipe arches shall be laid with separate section joined together in such a manner that the joint space shall not exceed ½ inch, with the outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Elliptical pipe shall be installed so that the major or minor axis, whichever the case may be, and which should be indicated by suitable markings on the top of each end of the pipe sections, coincides with the survey alignment of the trench excavation. Any metal in the joints, which is not thoroughly protected, shall be coated with bituminous mastic. During the installation, the pipe shall be handled with care so as not to damage the external coating or internal lining. Coupling band bolts and damaged areas of the coupling bands and pipe shall be given a coating of bituminous mastic as specified above prior to placing the backfill. As determined by the Engineer, pipe that is damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced at no additional cost to the Contracting Agency.

**621.3.1 Joints:** Before the connecting band is placed around the pipe, the ends of the pipe that will be beneath the band shall be coated with bituminous mastic or, if of suitable design, fitted with circular rubber gaskets to provide a watertight joint. The band shall be tightened evenly, keeping equal tension on the bolts. If mastic is used, tension shall be maintained over an interval of time until the flow of mastic terminates. The joint shall remain uncovered over a period designated by the Engineer, and before covering the joint the nuts shall be tested for tightness. If the nut has a tendency to loosen its grip on the bolt, it shall be tightened again and remain uncovered until a tight, permanent joint can be obtained. Prior to backfilling around the joint, the bolts, lugs, and nuts shall be given a coating of bituminous mastic. The annular space between abutting pipe sections shall be filled with bituminous mastic after jointing.

**621.3.2 Pipe Elongation:** Except as otherwise specified, the standard details shall control as to conditions under which pipe must be elongated. Pipe shall be elongated  $5 \pm \frac{1}{2}$  percent of the nominal diameter to take advantage of the buildup of side support as it settles back toward a full round shape under the backfill load. The method or technique for obtaining and releasing the elongation shall be optional to the Contractor. Under no circumstances shall the vertical diameter of the pipe at any point along the pipe section, after backfill and compaction is completed, be less than the nominal diameter of the pipe, or more than

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