



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

This document summarizes all those Revisions/Amendments to the City of Liberty Design Criteria, Standard Details and Technical Specifications which have been formally adopted.

Any comments/questions should be addressed to the City Engineer. ([jfindlay@libertymo.gov](mailto:jfindlay@libertymo.gov)).

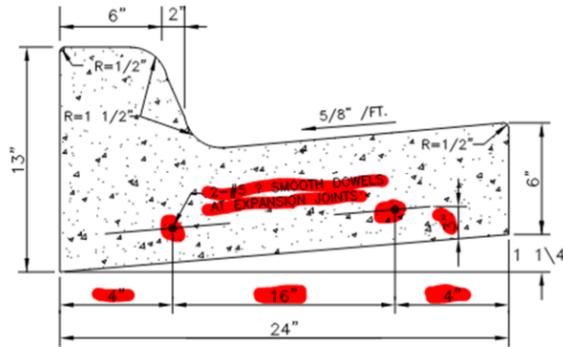
- Detail D21-1 – Adopted 03-25-2023
- Detail D21-2 – Adopted 03-25-2023
- Detail D21-3 – Adopted 03-25-2023
- Detail 50-5A – Adopted 03-25-2023
- Section 7000 – Blasting – Adopted 04-06-2023
- Section 2000 Concrete – Adopted 04-07-2023
- Design Criteria for Street Improvements – Adopted 04-07-2023
- Detail D30-1 – Adopted 04-18-2023
- Detail D30-2 – Adopted 04-18-2023
- Detail D30-3 – Adopted 04-18-2023
- Detail D30-4 – Adopted 04-18-2023
- Detail D30-5 – Adopted 04-18-2023
- Detail D31-1A – Adopted 04-18-2023
- Detail D31-1C – Adopted 04-18-2023
- Detail D31-3 – Adopted 04-18-2023
- Specification 1500 – Concrete Pavement – Adopted 04-27-2023
- Specification 2200 – Standard Sidewalks and Driveways – Adopted 04-27-2023
- Detail 100 – Adopted 04-27-2023
- Detail 101 – Adopted 04-27-2023
- Specification 3000 – Sanitary Sewers – Adopted 05-03-2023
- Section 2000 – Concrete – Adopted 09-24-2023
- Section 2100 – Concrete Curb and Gutter – Adopted 09-24-2023
- Design Criteria for Street Improvements – Adopted 09-24-2023
- D15-1 Concrete Pavement Cross Section & Joint Locations – Adopted 09-24-2023
- D15-2 Concrete Pavement Cross Section & Joint Locations – Adopted 09-24-2023
- D80-2 Embedded Street Plate Detail – Adopted 01-11-2024
- D22-9 Residential Drive at Non-Curbed Street – Adopted 05-15-2024
- D30-8 Creek Crossing – Adopted 05-15-2024
- Section 8000 Restoration of Surface Construction – Adopted 05-15-2024
- Section 8200 Seeding and Sodding – Adopted 05-15-2024
- Section 5000 – Materials Water Mains – Proposed 09-10-2025
- Design Criteria for Water Line Construction – Proposed 09-10-2025
- D50-5A Typical Fire Hydrant Installation Detail – Proposed 09-10-2025

**DETAIL D21-1**

- Proposed 02-24-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 03-25-2023

NOTES:

1. EXPANSION JOINTS SHALL BE FORMED BY A ONE-HALF (1/2) INCH THICK PREFORMED JOINT FILLER, CUT TO THE CONFIGURATION OF THE FULL SIZE OF THE CURB AND GUTTER SECTION AND BEING SECURED SO THAT THEY ARE NOT MOVED BY DEPOSITING AND COMPACTING THE CONCRETE AT THESE JOINTS. THE EDGES OF THESE JOINTS SHALL BE ROUNDED WITH AN EDGING TOOL ONE-EIGHTH (1/8) INCH RADIUS.
2. EXPANSION JOINTS SHALL BE PLACED WHERE CURB AND GUTTER ABUTS OTHER STRUCTURES AND AT ALL TANGENT POINTS TO CURBS. EXPANSION JOINTS SHALL NOT BE SPACED MORE THAN 50 FEET APART ON STRAIGHT RUNS FOR HAND LAID CURB AND GUTTER AND NOT MORE THAN 100 FEET APART FOR MACHINE LAID CURB AND GUTTER PROVIDED 3/4 INCH THICK JOINT FILLER IS USED. ALL JOINTS SHALL BE FORMED AT RIGHT ANGLES TO THE ALIGNMENT OF THE CURB AND GUTTER.
3. CONTRACTION JOINTS SHALL BE CONSTRUCTED BY SAWING THROUGH THE CURB AND GUTTER TO A DEPTH OF NOT LESS THAN ONE AND ONE-FOURTH (1 1/4) INCHES BELOW THE SURFACE AND TO A WIDTH NOT TO EXCEED THREE-EIGHTHS (3/8) INCH OR THEY MAY BE FORMED BY INSERTING A REMOVABLE METAL TEMPLATE IN THE FRESH CONCRETE, OR BY OTHER METHODS APPROVED BY THE ENGINEER. SEALING OF JOINTS IS NOT REQUIRED. CONTRACTION OR CONSTRUCTION JOINTS SHALL BE LOCATED APPROXIMATELY 10 FEET APART.



STRAIGHT - BACK

REV 2009



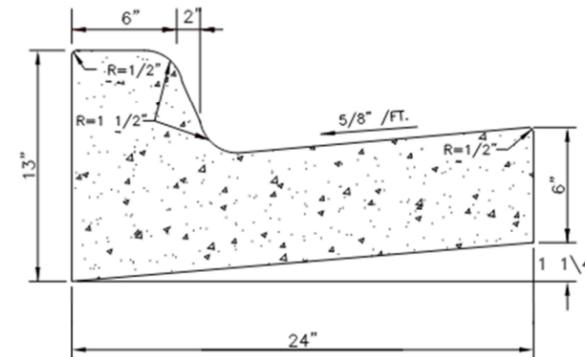
CITY OF LIBERTY, MO  
DEPARTMENT OF  
PUBLIC WORKS

TYPE "CG-1"  
CURB & GUTTER  
DETAILS

D21-1

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4. (2) #5 SMOOTH DOWELS SHALL BE USED AT EACH EXPANSION JOINT. DOWELS SHALL HAVE A 3 INCH BOTTOM COVER AND A SIDE COVER OF 4 INCHES. DOWELS SHALL BE SPACED 16 INCHES ON CENTER.



STRAIGHT - BACK



CITY OF LIBERTY, MO  
DEPARTMENT OF PUBLIC WORKS

TYPE "CG-1" CURB & GUTTER  
DETAILS

D21-1  
(03-26-2023)

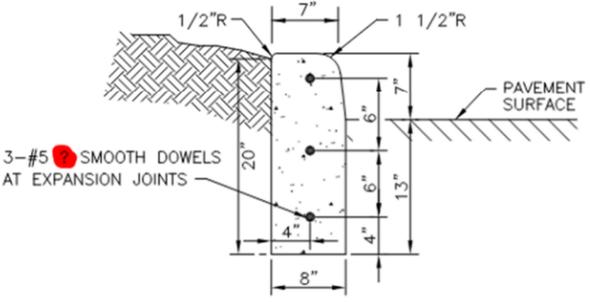
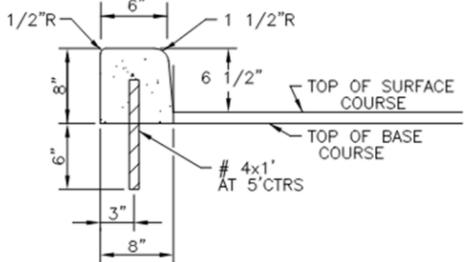
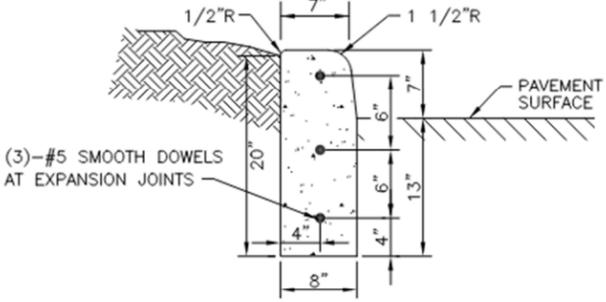
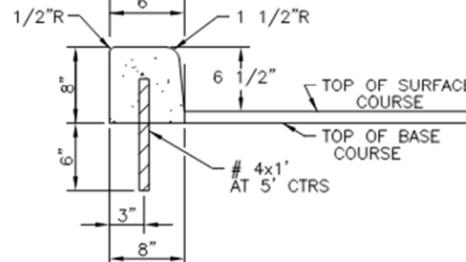
**DETAIL D21-2**

- Proposed 02-24-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 03-25-2023

<p style="text-align: center;"><b>ROLL BACK</b></p> <p>NOTE:</p> <ol style="list-style-type: none"> <li>1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINTS ARE TO BE SAME AS NOTED ON TYPE "CG-1" CURB AND GUTTER DETAIL.</li> <li>2. <del>REBAR IS NOT REQUIRED FOR CURB CONSTRUCTION ON A MINIMUM OF 3" ASPHALT.</del></li> </ol>	<p>NOTES:</p> <ol style="list-style-type: none"> <li>1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINTS ARE TO BE AS NOTED ON TYPE "CG-1" CURB AND GUTTER DETAIL.</li> <li>2. (2) #5 SMOOTH DOWELS SHALL BE USED AT EACH EXPANSION JOINT. DOWELS SHALL HAVE A 3 INCH BOTTOM COVER AND A SIDE COVER OF 4 INCHES. DOWELS SHALL BE SPACED 16 INCHES ON CENTER.</li> </ol> <p style="text-align: center;"><b>ROLL BACK</b></p>				
REV 2009					
<p style="margin: 0;">CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS</p>	<p style="margin: 0;">TYPE "CG-2" CURB &amp; GUTTER DETAIL</p>	<p style="margin: 0;">D21-2</p>	<p style="margin: 0;">CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS</p>	<p style="margin: 0;">TYPE "CG-2" CURB &amp; GUTTER DETAIL</p>	<p style="margin: 0;">D21-2 (03-26-2023)</p>

**DETAIL D21-3**

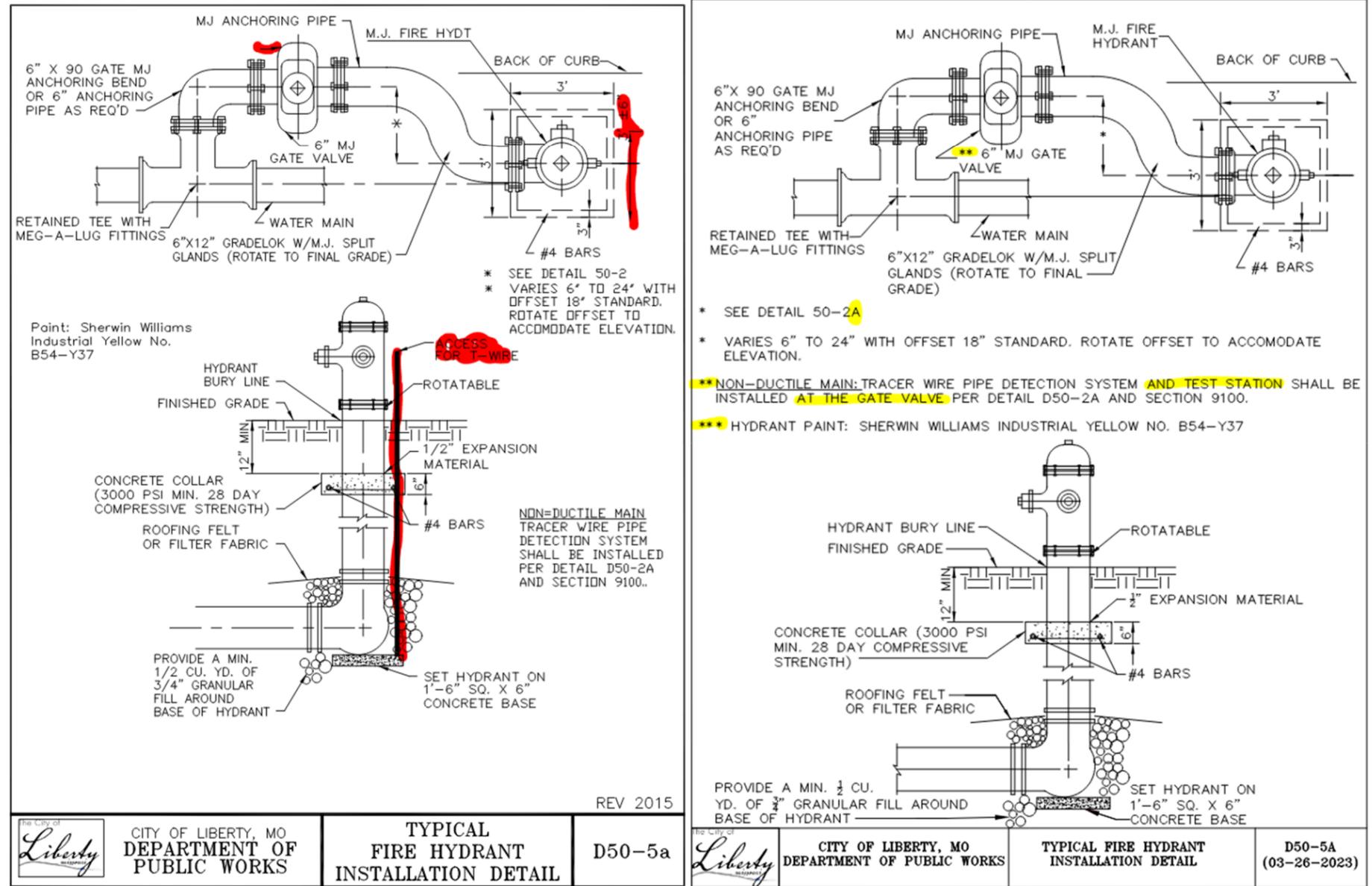
- Proposed 02-24-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 03-25-2023

 <p style="text-align: center;"><b>TYPE "C-1"</b></p>  <p style="text-align: center;"><b>TYPE "DC"</b></p> <p>NOTE:</p> <ol style="list-style-type: none"> <li>1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINTS ARE TO BE SAME AS NOTED ON TYPE "CG-1" CURB AND GUTTER DETAIL.</li> <li>2. ALL CURBS MUST BE CAST IN PLACE.</li> <li>3. TYPE "CG-1" CURB &amp; GUTTER CAN ALSO BE USED IN PARKING LOT CONSTRUCTION.</li> </ol> <p style="text-align: right;">REV 2009</p>	<p><b>NOTES:</b></p> <ol style="list-style-type: none"> <li>1. EXPANSION, CONTRACTION, OR CONSTRUCTION JOINTS ARE TO BE AS NOTED ON TYPE "CG-1" CURB AND GUTTER DETAIL.</li> <li>2. ALL CURBS SHALL BE CAST IN PLACE.</li> <li>3. TYPE "CG-1" CURB &amp; GUTTER MAY ALSO BE USED IN PARKING LOT CONSTRUCTION.</li> </ol>  <p style="text-align: center;"><b>TYPE "C-1"</b></p>  <p style="text-align: center;"><b>TYPE "DC"</b></p>
 <p>CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS</p>	<p>TYPE "C-1" &amp; "DC" CURB</p>
<p>D21-3</p>	 <p>CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS</p> <p>TYPE "C-1" &amp; "DC" CURB</p> <p>D21-3 (03-26-2023)</p>

**RECENTLY ADOPTED REVISIONS/AMENDMENTS**

**DETAIL 50-5A**

- Proposed 02-24-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 03-25-2023





## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **SECTION 7000 - Blasting**

- Proposed 03-07-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-06-2023

## SECTION 7000 BLASTING

### 7001 GENERAL.

The Contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, **transportation** and use of explosives and the protection of life and property. The Contractor shall be responsible for all damage caused by his blasting operations and shall be responsible for responding to all complaints. **The provisions of this standard shall not be construed to amend, supersede, or conflict with any requirement of state or federal law or regulation governing the handling, storage, transportation or use of explosives.**

### 7002 PERMITS.

The Contractor shall not blast any rock or other materials or allow the same to be done in prosecution of the work unless **they** ~~he secures proper insurance coverage and a blasting permit from the City Engineer as required by the Uniform Fire Code as adopted by reference in the Liberty Municipal Code~~ **first secures a blasting permit.**

**Issuance of a Blasting Permit is contingent on the Contractor meeting the following requirements:**

- **Applicant shall submit proof that the person using explosives is registered with the division of fire safety and that blasting will be conducted by a licensed blaster.**
- **Permit shall be obtained no less than 10 days prior to the first use of explosives.**
- **Permit application shall include specifics on the type of explosive to be used and their storage location, if any.**
- **Applicant shall demonstrate an acceptable plan for signage or other means of informing the public of blasting in proximity to public streets or highways and any request for closing of streets or routing traffic**
- **Applicant shall submit proof of commercial general liability insurance in an amount no less than \$1,000,000.00 and no more than \$5,000,000.00**

### 7003 PREBLAST SURVEY.

~~Unless otherwise directed by the Engineer, the Contractor shall provide a preblast survey of all structures located within a minimum 500 feet radius of his blast sites.~~ **The Contractor shall make at least (3) documented attempts to contact the owner of any uncontrolled structures (uncontrolled structure shall be as defined within Missouri State Statue 319.309.) within a scaled distance of thirty-five from the blast site in order to conduct a preblast survey of such structures. The Contractor shall not be required to conduct a preblast survey if the owner of any such structure does not give permission for the survey to be conducted.**

The survey shall be of such nature as to accurately establish the **preblast** structural condition of **uncontrolled structures within the specified scaled distance.** ~~all houses, buildings, bridges, overpasses, etc., within the specified area.~~ No blasting shall be allowed until the preblast survey has been completed and has been reviewed and accepted by the **City Engineer and City Fire Marshall.**

The contractor ~~must submit, or shall submit,~~ to the **City Engineer and City Fire Marshal** preblast survey reports for **uncontrolled structures within the specified scaled distance.** ~~structures within the specified area.~~

The preblast survey shall be performed by qualified personnel regularly engaged in blast operations.

#### 7004 BLASTING OPERATIONS.

Blasting shall only occur between the hours of 8:00 AM and 5:00 PM and shall not be allowed on Sundays.

Where blasting is being conducted in the vicinity of utility lines or rights-of-way, the blaster shall notify the appropriate representatives of the utilities not less than 24 hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notices shall be confirmed with written notice. Notices shall not relieve the blaster of any liability for damages or disruptions to utility services.

Contractor shall allow City Staff access to the site of blasting and shall allow City Staff to observe the blasting from a safe location, as designated by the blaster, upon request.

~~Before blasting is started, the Contractor shall inform all residents within a minimum radius of 500 feet of the blasting location by means of printed information sheets, news releases or other acceptable methods.~~

The Contractor shall provide suitable warning by siren or whistle prior to all blasts.

~~In any instance when the scaled distance value is fifty-five or less, any person using explosives, shall use at least one seismograph calibrated to the manufacturer's standard for use to record the ground vibration and acoustic levels that occur from the use of such explosives or explosive materials. When measuring ground vibration and acoustic levels, the seismograph shall be placed in the proximity of the nearest uncontrolled structure or, at the option of the person using explosives, closer to the blast site. If more than one uncontrolled structure is the same approximate distance from the blast site, then the person using explosives may select one representative structure for placement of the seismograph. Any person using explosives in the state of Missouri in which monitoring with a seismograph is required, as detailed previously, shall limit acoustic values from blasting to one hundred thirty-three decibels using a two hertz flat response measuring system based on the Office of Surface Mining Regulation 816.67(b)(1)(i). When blasting is to occur within 500 feet of any structure adjacent to the blast site, the Contractor shall obtain ground vibration monitoring and interpretation for each blast by qualified personnel regularly engaged in blast operation monitoring and control. One copy of the recorded data from each blast, including the computed interpretations, shall be furnished to the Engineer. Maximum particle velocity allowed shall be 1.0 inches per second. To reduce annoyance to local residents, vibration should be kept as much below the 1 inch per second level as possible and still permit efficient performance of the required demolition work.~~

Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench. All rock shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed by the Engineer. All finished surface areas adjacent to blasting shall be kept free of all blasted materials within the top 12 inches.

The requirements presented herein shall not relieve the contractor from responsibility to avoid

disturbing earth or rock beyond indicated and specified lines and levels.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **SECTION 2000 - Concrete**

- Proposed 03-08-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-07-2023

## SECTION 2000 CONCRETE

2001 SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work.

### 2002 GENERAL.

All cast-in-place concrete shall be accurately formed, and properly placed and finished as shown on the drawings and specified herein. The Contractor shall inform the Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

### 2003 MATERIALS.

All material used in the manufacture of concrete shall conform to the following:

- A. Concrete Control and Quality. The current editions of the "~~Bulletins~~" and ~~Approved Sections of the "Standard Concrete Specifications" issued by the Mid-West Concrete Industry Board, Inc. (MCIB)~~ "2023 KCMMB Concrete Material Specification" and/or "2023 KCMMB Ternary Concrete Material Specification" issued by the Kansas City Metro Materials Board (KCMMB) are made a part hereof by reference. However, when the provisions of such "Bulletins" and "Sections" differ from these specifications, the provisions of this Specification shall govern.
- B. Concrete. Concrete for use in construction shall conform to the requirements of Sections 2005 and 2006.
1. Cement ~~Cementitious Materials:~~ ~~Portland Cement shall conform to ASTM C-150, Type I, II or III.~~ The total mass of cementitious materials shall be a minimum of 600 pounds per cubic yard of concrete. Mix designs shall use ASTM C-150 Type I, II, I/II or III Portland Cement. When used, ASTM C595 Type IL cement shall be substituted on a pound for pound basis for Portland Cement. For the purposes of this specification, Type IL cement is not considered a binary cement.
  2. Coarse Aggregate: Coarse Aggregate sources shall meet the requirements of KCMMB specification section 2. ~~shall conform to MCIB Section 4 except that only limestone of the Bethany Falls or Calloway ledges may be used.~~ Coarse aggregates shall meet the gradation requirements of the current ASTM C33. The acceptable gradation sizes shall be number 1 through 7, 56, 57, 67, 357 or 467. Mix designs shall specify the gradation designation. Maximum Coarse Aggregate size within mixes shall be as defined within section 2006 of this specification.  

Aggregates in mixes must be proportioned to have a minimum of 55% coarse aggregate by weight.
  3. Fine Aggregate and Mixing Water: Fine aggregate ~~and mixing water~~ shall conform to ~~MCIB Section 4.~~ meet the requirements set forth in the current ASTM C33. The percentage by weight of clay lumps and friable particles shall not exceed 0.25%. The percentage by weight of material passing the no. 200 sieve shall not exceed 2%. The percentage by weight of coal and

lignite shall not exceed 0.25%. Soundness shall be determined using magnesium sulfate.

3. Admixtures.

~~Admixtures shall conform to MCIB Section 5 and ASTM 494. Concrete mixes approved for use on projects shall include required admixtures in accordance with the currently approved KCMMB mix design. Requests for admixtures listed as optional on specific mix designs shall be submitted to the Owner and approved by the Owner prior to use on the project. Chemical admixtures shall meet the requirements of ASTM C494. Additionally, any water withheld shall be added to the mix prior to using a superplasticizer.~~

C. Reinforcing Steel.

1. Bars.

Bars shall conform to ASTM A615, ~~A-616, and A-617~~ or **ASTM A996.**

2. Welded Steel Wire.

Welded steel wire fabric shall conform to ASTM A-~~185~~**1064.**

3. Supporting Elements.

Representative samples of supporting elements shall be submitted and approved by the Engineer prior to their use in the project.

D. Expansion Joint Fillers.

Expansion joint fillers shall conform to ASTM D-~~1752-18.~~

E. Joint Sealing Compounds. Joint sealing compounds shall be ~~one or two component rubberized polysulfide urethanes conforming to Federal Specification Numbers TT-00227 or TT-00230-C.~~ **single or multicomponent cold-applied elastomeric joint sealant conforming to ASTM C920-18.**

F. Curing Membrane.

~~All material to be used or employed in curing Portland Cement Concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type (either white or clear) and shall conform to the either ASTM C309-19 or ASTM C1315-19. Application rate and method are to be as prescribed by the manufacturer for applicable conditions. All material to be used or employed in curing Portland Cement Concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type (either white or clear) and shall conform to one of the following:~~

~~1. A two component water insensitive epoxy with a solid epoxy content of 40 to 60 percent. Application rate is 5 to 8 mils wet.~~

~~2. A liquid system of styrene acrylate Type I Class 2 or liquid chlorinated rubber Type II Class 2, complying with Federal Specification No. TT-C-800A. Application rate 6 to 10 mils wet.~~

~~3. A liquid system of a water based compound. Application rate 6 to 10 Mils wet.~~

~~G. Method of Applying Curing Membrane.~~

~~A nozzle producing a uniform fan pattern will be used on all spray equipment when applying the liquid curing membrane. The curing compound shall be stirred prior to and during use to insure a uniform mixing of the compound. Care shall be taken that the tip is clean and unclogged at all times. Should clogging occur spraying shall be stopped immediately and the tip cleaned.~~

2004 PRELIMINARY REVIEW.

A report shall be submitted to the Engineer prior to the placement of concrete and shall include data on proposed concrete mix proportions and the fine and coarse aggregate gradation. Mix proportions shall be selected preferably on the basis of field experience and may be adjusted upon approval of the Engineer where required to produce concrete of proper workability, uniform consistency, and acceptable density and strength. **The report shall specify whether the “2023 KCMMB Concrete Material Specification” or “2023 KCMMB Ternary Concrete Material Specification” is being used.**

A tentative concrete mix shall be designed and tested for each size and gradation of aggregate and for each slump intended to be used on the work. Design quantities and test results of each mix shall be submitted to the Engineer for review and approval.

2005 CONCRETE MIX DESIGNATIONS.

**The 28-day compressive strength for concrete shall be 5,000 psi and designated as "KCMMB 5K", or shall be 4,000 psi and designated as "KCMMB 4K". Compressive strength shall be determined in accordance with ACI 318. All mix designs shall match an approved mix design by the KCMMB. The mix name shall be listed on the concrete delivery ticket or the concrete will be rejected. The following tabulation indicates minimum strengths for the various types of concrete mix designs (MCIB designations) that will be accepted.**

**The following tabulation indicates minimum strengths for the various types of concrete mix designs (MCIB designations) that will be accepted cast-on place or pre-cast applications:**

- pavements – KCMMB 4K
- curbs – KCMMB 4K
- curb and gutter – KCMMB 4K
- sidewalks – KCMMB 4K
- drive approaches – KCMMB 4K
- inlets – KCMMB 4K
- manholes – KCMMB 4K
- reinforced concrete boxes – KCMMB 4K
- bridges – as specified by Design Engineer and approved by Owner

**~~Minimum Compressive Strength—4000 psi  
(2650 psi 7 day, 4000 psi 28 day)~~**

~~❖ Driveways in ROW ————— A 558-1-2 ————— A 618-1-4 ————— WA 487-1-2 ————— WA 530-1-2~~

❖ Curb & Gutter all styles	A 558-1-2	A 618-1-4	WA 487-1-2	WA 530-1-2
❖ Public Sidewalks	A 558-1-2	A 618-1-4	WA 487-1-2	WA 530-1-2
❖ Pavement	A 558-1-2	A 618-1-4	WA 487-1-2	WA 530-1-2
❖ Cast in Place Structures	558-1-2	618-1-4	487-1-2	530-1-2

**Minimum Compressive Strength – 3000 psi  
(2000 psi 7-day, 3000 psi 28-day)**

❖ Inverts, encasements etc	439-1-2	479-1-4
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Bridges (As shown by Design Engineer and approved by City)

All cast in place or pre-cast construction for pavements, curbs, curb and gutter, sidewalks, drive approaches, inlets, manholes, reinforced concrete boxes, bridges and as otherwise required by the Engineer shall be of 4000 psi concrete. The use of 3000 psi concrete shall be confined to non-structural elements such as manhole or inlet inverts and pipe encasements. **Mixes for High Early Strength Concrete shall meet all of the City of Liberty and KCMMB requirements for standard 4K and 5K mixes (designated as "KCMMB HE") as well any additional requirements for High Early Strength Concrete.** When high-early strength cement is to be used for concrete, the mix shall obtain a 7-day strength not less than the minimum 28-day strength specified for concrete of the same class.

2006 LIMITING REQUIREMENTS.

Each concrete mix shall be designed and concrete shall be controlled within the following limits:

Concrete mixes shall meet the following limiting requirements:

- **Maximum Slump for Concrete Pavements shall be 2", (+/-) 1"**
- **Maximum Slump for Concrete Work other than Pavement shall be 4", (+/-) 1"**
- **Maximum Size Coarse Aggregate of 1"**

Cement	Slump	Max. Size Course Aggregate	Cement Content Lbs./C.Y.	Max. Water Cement Weight Ratio	Max. Gals Water Per Saek of Cement
3000 psi	4"	1"	480	.542	6.12
	2"	1"	558	.421	4.75
4000 psi	3"	1"	588	.421	4.75
	4"	1"	618	.421	4.75

The quantity of portland cement shall be not less than that shown in the preceding table. The use of plasticizers in concrete mixes shall only be as approved by the Engineer. If an approved plasticizer is utilized in the concrete mix, the cement factor shown shall be decreased ten (10) percent, or as approved by the Engineer.

Concrete slump shall be kept as low as possible consistent with proper handling and thorough compaction. Maximum slump for portland cement concrete pavement shall be two inches. Slumps for concrete work other than pavement construction shall not exceed four inches. Use of slumps in excess of those specified shall be only when authorized by the Engineer. The use of water to obtain so-called "improved workability" (adding water with a brush to surface, "flipping") shall

not be permitted.

The initial set as determined by ASTM C403 shall be attained 5-1/2 hours, plus or minus one hour, after the water and cement are added to the aggregates. If such use has been approved by the Engineer, the quantity of retarding or accelerating admixture shall be adjusted to compensate for variations in temperature and job conditions.

~~The admixture content shall be in accordance with the recommendations of the manufacturer for compliance with these specifications.~~

The total volumetric air content of concrete after placement shall be six **and one half (6.5)** percent, plus or minus one (1.0) percent.

**Compressive strength** shall ~~The minimum acceptable compressive strengths shall~~ be as determined by ASTM C39.

As the work progresses, the Engineer reserves the right to change the proportions from time to time if conditions warrant such changes to produce a satisfactory job. Any such changes may be made within the limits of the specifications at no additional compensation to the Contractor.

#### 2007 BATCHING AND MIXING.

Concrete shall be furnished by an acceptable ready-mixed concrete supplier and shall conform to ~~MCIB~~ **KCMMB**.

The consistency of concrete shall be suitable for placement conditions. Aggregates shall float uniformly throughout the mass and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

#### 2008 PLACEMENT.

The limits of each concrete pour shall be predetermined by the Contractor and shall be acceptable to the Engineer. All concrete within such limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcements, and embedment shall be rigidly secured in proper position and all dirt, mud, water and debris shall be removed from the space to be occupied by the concrete. Bonding surfaces shall be cleaned of all foreign material and shall be free from laitance. Concrete shall not be placed on frozen subgrade or in excavations that have been dewatered.

Placement of concrete shall conform to requirements of MCIB. Concrete shall be placed within forty-five (45) minutes of mixing operations, with the exception that the Engineer may extend the period to ninety (90) minutes (maximum) dependent upon weather conditions. Concrete shall not be placed in horizontal layers exceeding eighteen (18) inches. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcements and embedment and into the corners of the forms. The concrete shall be vibrated or spaded to produce a solid mass without honeycomb or surface air bubbles.

#### 2009 COLD WEATHER CONCRETING.

Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when the descending air temperature in the shade and away from artificial heat reaches 40 degrees F or when forecast to drop below 40 degrees F within 24 hours of placement,

and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F.

When concrete work is authorized during cold weather, the aggregates may be heated by methods approved by the Engineer prior to being placed in the mixer. No ingredient that is frozen or contains ice shall be placed in the mixer. The temperature of the concrete shall be not less than 60 degrees F and not more than 80 degrees F at the time of placement in the forms. Under no circumstances shall concreting operations continue when the air temperature is less than 20 degrees F. No concrete shall be placed on frozen subgrade. Sudden cooling of concrete shall not be permitted.

**Refer to Section 2011 of this standard for minimum required Cold Weather Curing and Protection measures.**

Concrete injured by frost action or freezing weather shall be removed and replaced at the Contractor's expense.

#### 2010 HOT WEATHER CONCRETING.

The provisions of this section shall apply to all concrete work that is done when the air temperature is above 80 degrees F at the time of placement.

The temperature of the concrete, when placed, shall not be high enough to cause excessive loss of slump, flash set or cold joints. In no case shall the temperature of the concrete, when placed, exceed 90 degrees F. Forms, reinforcing and subgrade surfaces against which the concrete is to be placed shall be wetted down immediately before placement.

When the air temperature exceeds 90 degrees F and as soon as practicable without causing damage to the surface finish, all exposed concrete shall be kept continuously moist by means of fog sprays, wet burlap, cotton mats, or other means acceptable to the Engineer. This cooling with water shall be in addition to the initial sealing by membrane curing compound.

#### 2011 CURING AND PROTECTION.

Concrete shall be cured by protecting it against loss of moisture, rapid temperature changes and mechanical injury for at least 4 days after placement. Acceptable methods shall be moist curing, waterproof paper, white polyethylene sheeting, liquid membrane-forming compounds, or a combination thereof. After concrete finishing operations have been completed, the entire surface of the newly placed concrete shall be covered by the curing medium applicable to local conditions and acceptable to the Engineer. The Contractor shall have the necessary equipment for adequate curing on hand and be ready to install prior to concrete placement.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire surface of the work and lapped at joints to prevent drying between adjacent sheets.

Waterproof paper or white polyethylene sheets shall be large enough to cover the entire surface of the work and shall be lapped not less than eighteen (18) inches. The sheets shall be adequately weighted to prevent displacement or billowing due to wind. Tear holes appearing in the material

during the curing period shall be immediately repaired or replaced with material in acceptable condition.

Clear or white membrane curing compound shall be applied after finishing operations have been completed and immediately after the free water has left the surface. The surface of the work shall be completely coated and sealed with a uniform layer of the curing compound at a rate of not less than one gallon per 150 square feet. The compound shall not be thinned and shall be kept agitated to prevent settlement of pigment. On surfaces where forms are removed prior to the end of the specified curing period, the entire exposed surface shall be coated at the specified rate of coverage. If rain falls on the newly coated surface before the film dries sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply a new coat of compound to the affected area.

During cold weather concreting when the ambient air temperature is expected to drop below 40 degrees F, sufficient supply of burlap, straw, hay, or other blanketing material shall be provided along the work to protect the concrete and maintain a minimum temperature of 40 degrees F in the concrete as measured on the surface. An approved moisture barrier such as wet burlap or plastic sheeting shall be placed on the concrete prior to placement of the blanketing material. This type of curing shall be maintained for a period of six (6) days as the initial cure.

Sidewalks, curb and gutter, and miscellaneous concrete shall be protected and cured for a period of not less than seventy-two (72) hours after the placing of the concrete by covering with wet burlap or by the application of a membrane curing compound as specified above.

**2012 FORMS.**

Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement.

Forms may be of wood or metal and shall be designed to permit easy removal without injury to the concrete. Forms for all exterior exposed surfaces which will be visible after backfilling shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms shall be coated with an approved light oil to prevent concrete from adhering and shall be thoroughly cleaned and re-oiled before re-use.

Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete. The following table gives the approximate minimum time that forms shall be left in place.

<b><u>Average Air Temperature Greater Than</u></b>	<b>70 Deg</b>	<b>60 Deg</b>	<b>50 Deg</b>	<b>40 Deg</b>
<b><u>Structural Member</u></b>	<b>Time in Place (24 Hour Days)</b>			
Slab Shoring	10	12	14	21
Slab Forms	7	7	7	7
Beams Soffits and Shoring	10	12	14	21
Beam Side Forms	1	1	2	3

Wall Side Forms		2	2	3	4
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**2013 FINISHING FORMED SURFACES.**

Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be in contact with backfill. A power grinder shall be used, if necessary, to remove projections and provide a flush surface. Surfaces to be damp-proofed shall have fins removed and tie holes filled, but no additional finishing will be required.

Tie holes in all formed surfaces shall be cleaned, wetted, and filled with patching mortar. Tie hole patches shall be finished flush and shall match the texture of the adjacent concrete.

The surface of all exposed formed exterior surfaces not in contact with backfill shall be finished by rubbing or by other means as directed by the City Engineer.

Sidewalks shall be “picture framed” as depicted in City of Liberty Standard details D22-1 thru D22-5.

**2014 REPAIRING DEFECTIVE AND DAMAGED CONCRETE.**

Any concrete found not to be formed as indicated on the plans, or out of alignment or level, or having a defective surface, or damaged prior to acceptance of the project by the City, shall be considered as not conforming to the intent of these specifications and may be ordered removed and replaced by the contractor at his expense unless the Engineer authorizes patching of the defective or damaged area. Surface defects such as ridges and bulges shall be removed by grinding. Honeycombed and other defective concrete that does not affect the structural integrity of the structure shall be chipped out and the vacated area shall be filled. The Engineer shall approve the methods used in this type of repair. Material used for patching shall be a non-shrink, non-metallic grout with a minimum 28-day compressive strength of 5000 psi or a similar material approved by the Engineer. Prior to placement of the repair filling, the contact surface of the affected area shall be thoroughly cleaned of all loose and foreign material and shall be coated with an epoxy-bonding agent.

Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing or surrounding concrete. Repair work shall be adequately cured and protected from further damage.

**2015 REINFORCEMENTS.**

The metal reinforcement shall be protected by the thickness of concrete indicated on the construction drawings. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

<b><u>Location of Reinforcement</u></b>	<b><u>Cover in Inches</u></b>
Surfaces where concrete is deposited directly against the ground.	3
Formed surfaces exposed to the ground, to water, or to weathering.	2
Beams, girder, and columns not exposed to ground, water or weathering.	1 ½
All surfaces other than those above.	1

Reinforcing steel shall be accurately placed and positioned on supports, spacers, hangers, or other reinforcing steel as approved by the Engineer and shall be secured in place with wire ties or suitable clips. The minimum clear distance between parallel bars shall not be less than 1-2 times the

diameter of round bars, except that in no case shall clear spacing between parallel bars be less than 2 inches or less than 1-2 times the nominal size of the coarse aggregate.

Splices in reinforcing steel will not be permitted at points of maximum stress. When it becomes necessary to splice reinforcing steel at points other than those shown on the contract drawings, the Engineer shall approve the character and location of the splice. Welding or tack welding of reinforcement will not be permitted. Reinforcements upon which unauthorized welding has been done shall be removed and replaced as directed by the Engineer. Spliced bars shall be placed in contact and securely tied together.

Metal reinforcement at the time concrete is placed shall be free from rust, scale, or other contaminants that will destroy or reduce the bond.

2016 CONSTRUCTION JOINTS. Construction joints shall be made at locations indicated on the drawings or specified, and shall conform to the requirements of ACI 318. When the Contractor desires to make construction joints at other locations, he shall anticipate such changes far enough in advance of the construction operations to allow the Engineer to investigate such changes and approve additional construction joints.

Sidewalk joints shall be “picture framed” in accordance with City of Liberty Standard details D22-1 thru D22-5.

2017 EXPANSION AND CONTRACTION JOINTS.

Expansion and contraction joints shall be at locations and depths indicated on the drawings (details).

Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the concrete. Formed grooves shall be made by depressing an approved tool or devise into the plastic concrete. Sawed joints shall be constructed by sawing through the surface of the concrete with an approved concrete saw. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to prevent excessive raveling.

Expansion joints shall be formed with pre-formed expansion joint filler of the non-extruding and resilient types which shall include the following; Cork, self-expanding cork, sponge rubber, cork rubber, and bituminous fiber. These materials shall meet the requirements of ASTM D994, D1751 and D1752.

Sidewalk joints shall be “picture framed” in accordance with City of Liberty Standard details D22-1 thru D22-5.

2018 REINFORCED CONCRETE BOX FORMING SEQUENCE.

Wall forms may be placed the day following the placement of the bottom slab, as long as care is taken to protect the slab against rough or abusive handling of forms and or placing equipment. The actual placement of concrete shall not occur prior to the fifth day after placing the bottom slab. Top forms may be placed with wall forms if the walls and top are to be of monolithic construction, otherwise top forms are not to be placed until the third day after placing the walls. The actual placement of concrete for the top shall not occur prior to the fifth day after placing the walls (for base to top shoring) or until the walls have reached their design minimum of two days after the walls are poured. Wall forms shall remain in place a minimum of two days after the walls are

poured. Supports for the top slab shall be left in place according to the schedule shown on page 20-5, in Section 2012, Forms.

The above guidelines for placing forms for reinforced concrete boxes are based on the use of standard forming procedures and with the use of concrete containing no admixtures to achieve high early strength. Variations in forming techniques and/or the use of high early strength concrete shall only be allowed after the contractor obtains the written approval of the City Engineer.

### 2019 EXCAVATABLE FLOWABLE FILL.

#### A. Flowable Fill

Flowable Fill is a Controlled Low Strength Material (CLSM) which is often referred to as controlled density fill, flowcrete, liquid dirt or by other various trademark names. For the sake of this specification the terms Flowable Fill and CLSM shall be used interchangeably. Flowable Fill is a self-compacting and self-leveling backfill material that is used in lieu of compacted fill.

#### B. Sources and proportions of CLSM ingredients

Prior to the start of CLSM placement, the CONTRACTOR shall submit a description of the proposed CLSM mixture design. Based on the application, the ENGINEER may require the CONTRACTOR to submit appropriate laboratory or field test data documenting compliance to specified material and or performance properties.

#### C. Materials

CLSM shall be manufactured with materials conforming to the standards listed below. The ENGINEER shall approve the use of all non-conforming materials. Approval shall be based on documentation that controlled low strength material mixtures manufactured with the non-conforming materials meet the specified plastic and hardened properties and are suited for the intended application.

- Hydraulic Cement - AASHTO M 85 or M 240
- Fly Ash - AASHTO M 295
- Granulated Blast Furnace Slag - AASHTO M 302
- Fine Aggregate - AASHTO M 6
- Coarse Aggregate - AASHTO M 80
- Lightweight Aggregate - AASHTO M 195
- Water - AASHTO M 157
- Chemical Admixtures - AASHTO M 194
- Air Entrainment Admixtures - Approved by the ENGINEER.
- Foaming Admixture - ASTM C 869

#### D. Flowability

Normal flowable material shall have a flow of 6 to 8 inches tested in accordance with ASTM D6103. Low flowable material shall have a maximum flow of 6 inches. High flowable material shall have a minimum flow of 8 inches. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D6103.

#### E. Unconfined Compressive Strength for Excavatable CLSM

Excavatability shall be evaluated on the basis of past performance and experience. When past performance records are not available, excavatability shall be evaluated on the basis of unconfined compressive strength tested in accordance with ASTM D4832. Excavatable CLSM shall have a minimum strength of 30 psi. The one-year strength shall not exceed 150 psi. In place of one year test data, the ENGINEER, may approve the CLSM mixture based on sufficient documentation, provided by the ready mix producer, that indicates the strength gain has ceased. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D4832.

F. Permeability

When required, the coefficient of permeability of CLSM shall be specified by the ENGINEER. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D5084.

G. California Bearing Ratio

When required, the CBR value shall be specified by the ENGINEER. The ENGINEER may elect to specify a minimum 28-day compressive strength in place of specifying a CBR test. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D1883.

H. Penetration Resistance

The ENGINEER may elect to specify a minimum penetration resistance (ASTM C403), hardening time, proof rolling, drop ball test (ASTM D6024), or proof that the CLSM mixture will support an individuals weight. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM C403.

I. Unit Weight

When required, the unit weight shall be specified by the ENGINEER. The manufacturer shall be permitted to select and proportion the ingredients of the CLSM mixture to meet specified requirements. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D6023.

J. Proportioning

CLSM shall be proportioned by the ready mixed concrete supplier on the basis of field experience and/or laboratory trial mixtures to produce a cohesive and non-segregating mixture meeting the specified properties.

K. Pumpable CLSM

Shall be proportioned to allow transport by pumping methods without segregating or excessive bleeding.

L. Sampling

Sampling shall be provided as requested by the ENGINEER at no cost to the City, sampling shall be done in accordance with ASTM D5971.

M. Air Content

When required the Air Content shall be specified by the Engineer. Testing shall be

provided as requested by the Engineer at no cost to the City, testing shall be done in accordance with ASTM D6023.

N. Batch Records

Batch plant recordation or certified batch report should be used when a ready mixed truck is used and when it is not (ie., a volumetric mixer) then such other verification method as the supplier and customer can agree to. Acceptance shall be based on verification that the constituent materials were batched in accordance with the design. Verification shall be by inspection, automated batch plant recordation, or certified batch report. The method of verification shall be approved by the ENGINEER.

O. CLSM Properties

As required by the application, the ENGINEER shall specify acceptance tests for appropriate material properties. The testing frequency shall be specified by the ENGINEER.

P. Batching And Delivery

Material shall be batched and delivered in accordance with AASHTO M 157-86 (1996), Sections 8, 9, 10 and 11 except the temperature requirements of 11.8 and 11.9 which shall be waived.

Q. Water and Admixture Addition

The addition of water and admixtures on the jobsite is permitted. The amount of water and admixture added shall be recorded. The CLSM mixture shall be mixed for a minimum of 30 revolutions after the addition of the water or admixture.

R. Temperature

Material shall not be placed on frozen ground. The ambient temperature shall be 35 deg F and rising at the time of placement.

S. Standing Water

CLSM may be placed in confined spaces containing standing water.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Design Criteria for Street Improvements**

- Proposed 03-08-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-07-2023

DESIGN CRITERIA FOR  
STREET IMPROVEMENTS

- A. GENERAL. Proposed street improvements within the City shall conform to the pattern established in the Major Street Plan as adopted by the City of Liberty.

Street improvements shall be designed to conform to applicable codes, regulations, ordinances, and the provisions set forth in these criteria as established by the City of Liberty. Plans for said improvements shall be submitted to the City Engineer for approval and shall include all information as may be required or described hereinafter.

- B. FUNCTIONAL CLASSIFICATION OF STREETS. The classification of streets shall be generally defined as follows:

1. Local Streets. A street designed to provide access to abutting property from collector and arterial streets.
2. Collector/Commercial Streets. Streets, which, in addition to serving abutting properties, intercept local streets, connect with community facilities and carry neighborhood traffic to the arterial street systems. Commercial streets serve areas predominately zoned for commercial or industrial uses.
3. Arterial Streets. A street or road of considerable continuity which serves or is intended to serve as a principal trafficway between separated areas or districts and which is the main means of access to the collector street system, highways or expressways.

- C. STREET DESIGN STANDARDS.

	ARTERIAL		COLLECTOR	LOCAL
	<u>Major</u>	<u>Minor</u>	<u>2-Lane*</u>	<u>2-Lane</u>
Right-of-Way Width (ft)	120	100	64	54
Street Width(ft)	62' min.	40' min	30' min.	26' min.
Median Width(ft)	15' min.	-0-	-0-	-0-
Minimum Pavement Depth - Asphaltic Concrete (inches)	10.5	10.5	8.5	6.5
Minimum Depth Crushed Aggregate Base (inches)	6	6	6	6
Design Volume (VPD) Range	24,000 – 36,000	12,000 - 24,000	1,500 – 12,000	Less than 1,500
**Design Speed (MPH)	50	35	30-35	25-30
Maximum Grade	6%	6%	8%	10%
Minimum Grade	1%	1%	1%	1%
Curb Return Radius	50' See Section S of this	50' See Section S of this	30' See Section S of this	25'

	Standard	Standard	Standard	
Minimum Radii Horizontal Curve	1300'	700'	300'	185'
Minimum K Crest Vertical Curve	110-150	60-80	30	20
Minimum K Sag Vertical Curve	90-110 (55 w/lights)	60-70 (35 w/lights)	50 (20 w/lights)	30 14 (w/lights)
Minimum Private Curb Cut Spacing (ft)	350'	One per Property	One per Property	One per Property
Minimum Distance from Intersection of R.O.W. to curb cut ( ft.)	250	200	150	25
***Sidewalk width(ft)	5	5	5	5
Parking Permitted	No	No	One Side Only	One Side Only
Storm Sewers	Yes	Yes	Yes	Yes
Curb & Gutter	CG-1	CG-1	CG-1	CG-1
Pavement Markings	Yes	Yes	Yes	No
Turn Lanes	Required	Required	Required (at significant intersections)	Not Required

\* Also applicable to commercial streets.

\*\* Design Speed criteria for horizontal and vertical alignment should meet the requirements of the current edition of "A Policy on Geometric design of Highways and Streets, AASHTO".

\*\*\* Both sides of roadway.

- D. OFF-CENTER STREET INTERSECTIONS. Off-center street intersections shall be separated by a minimum centerline to centerline distance of one hundred and fifty feet (150).
- E. INTERSECTION VERTICAL ALIGNMENT. In all cases where a higher functional street intersects with a lower functional street, normal street crown shall be maintained on the higher functional street. Where streets of equal function intersect, street grades shall coincide in the center of the intersection with reduced rideability for both streets, or a warping of the cross slope for both streets. (Design Aid No. 5)
- F. MINIMUM ANGLE OF INTERSECTION. It is desirable for all intersections to meet at approximately a 90 degree angle. Skewed intersections should be avoided, and in no case should the angle be less than 60 degrees.
- G. MAXIMUM GRADIENT. The maximum gradient for streets as noted in Section C may be exceeded only upon written approval of the City Engineer. Such approval will only be granted in unusual cases where grades within the acceptable limits cannot be obtained.
- H. GRADING GRADIENTS. The finished grade within the limits of the right-of-way shall slope from one-quarter (1/4) inch vertical to one (1) foot horizontal minimum, to one-half (1/2) inch vertical to one (1) foot horizontal maximum measured above the back of the curb. The grading gradients may be varied only upon written approval of the City

Engineer.

- I. TANGENT LENGTH. The minimum tangent length between reverse curves shall be fifty (50) feet for local streets and one hundred (100) feet for collector/commercial and arterial streets, except that no tangent will be required for radii longer than five hundred (500) feet.
- J. CONNECTIONS TO EXISTING PAVEMENTS. Where a new street is to connect to an existing street, all deteriorated or cracked asphalt within five (5) feet of the connection point shall be removed to a point where sound material is found. If full-depth pavement removal is required the subgrade will be recompact to 95% of standard density.
- K. STORM DRAINAGE. All storm drainage works constructed in connection with street improvements shall be designed in accordance with the City of Liberty Design Criteria for Storm Sewers and Appurtenances.
- L. CUL-DE-SACS. At locations where streets are to be terminated and a vehicular connection between adjacent streets is not required a cul-de-sac may be permitted. Such cul-de-sac shall be constructed with a minimum radius of thirty-nine (39) feet to the back of the curb.
- M. TEMPORARY TURN-AROUNDS. At locations where streets are to be temporarily terminated which will be extended at a later date, and said street extends beyond the intersection of an adjacent street more than five (5) lots, a temporary cul-de-sac shall be constructed with a minimum radius of thirty-five (35) feet. The temporary cul-de-sac shall be constructed of asphaltic concrete with a minimum depth of six (6) inches. Curb and gutter will not be required. The cul-de-sac shall be constructed within the limits of a permanent construction easement.
- N. MONUMENT BOXES. Monument boxes conforming to the Standard Drawings shall be installed at all quarter section corners and any other monuments involved in the street construction.
- O. OTHER DESIGN CRITERIA. All other street design elements not contained within this criteria shall be in accordance with the most current edition of "A Policy on Geometric Design of Highways and Streets" authored by the American Association of State Highway and Transportation Officials (AASHTO) or other applicable AASHTO design guides.
- P. DRIVEWAY ELEVATIONS. Driveways shall attain top of curb elevation within the right-of-way. Driveway grades within right-of-way shall be 8% maximum until curb height is reached. Break over grades for crest drives shall be 8% maximum and sag drives shall be 12% maximum. Driveway elevation shall not be more than 6" above or below the normal shoulder elevation at the right-of-way line, to allow for a smooth sidewalk profile.
- Q. DRIVEWAY WIDTHS: Residential driveways shall have a minimum driveway width of 10' and a maximum of 20'. A lot having two (2) driveway access points (i.e. circle drive) must have at least 100' width at the right-of-way line. An existing driveway may be replaced at its existing width.
- R. SIGNAGE. Street name and regulatory traffic signs conforming to the Standard Drawings shall be furnished and installed at the appropriate locations in connection with the street improvement. All regulatory signage shall be in conformance with MUTCD requirements

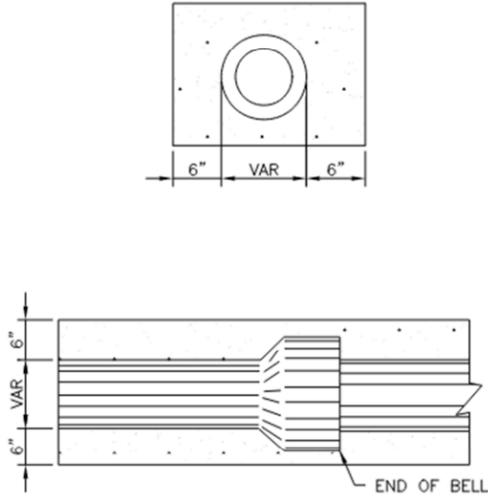
and shall be approved by the City Engineer.

- S. Curb Return Radius. The minimum curb return radius for local streets shall be as defined within section C of this standard. For Collector and Arterial Streets (minor and major) the minimum curb return radius shall be as determined by a Semi-Trailer Truck Turning Template.



**DETAIL D30-2**

- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023

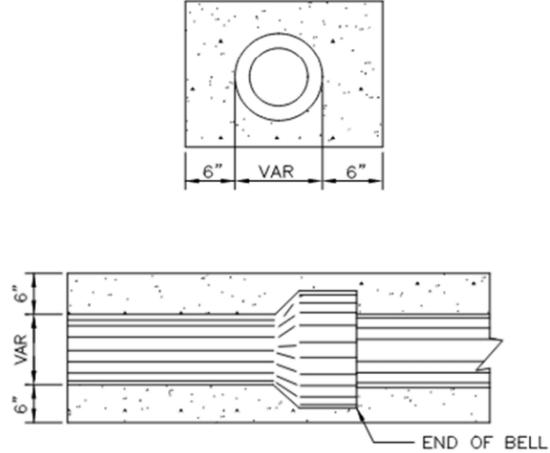


FOR USE ONLY WHERE INDICATED ON PLANS THE CONCRETE ENCASEMENT SHALL BE OF ~~MCD-548~~ CONCRETE WITH A MINIMUM THICKNESS ON ALL SIDES OF 6".

1. 8" DIA = .11 C.Y. OF CONCRETE PER LINEAL FT
2. 10" DIA = .12 C.Y. OF CONCRETE PER LINEAL FT
3. 12" DIA = .14 C.Y. OF CONCRETE PER LINEAL FT
4. 15" DIA = .15 C.Y. OF CONCRETE PER LINEAL FT

REV 2009

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	CONCRETE ENCASEMENT DETAIL	D30-2
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NOTES:

1. FOR USE ONLY WHERE INDICATED ON PLANS
2. THE CONCRETE ENCASEMENT SHALL BE ~~KCMB 4K~~ (REFER TO SPECIFICATION ~~2000~~) WITH A MINIMUM THICKNESS ON ALL SIDES OF 6".
3. VOLUME OF CONCRETE PER LINEAL FOOT:
  - 3.1. 8" DIA PIPE = 0.11 C.Y. OF CONCRETE
  - 3.2. 10" DIA PIPE = 0.12 C.Y. OF CONCRETE
  - 3.3. 12" DIA PIPE = 0.14 C.Y. OF CONCRETE
  - 3.4. 15" DIA PIPE = 0.15 C.Y. OF CONCRETE

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	CONCRETE ENCASEMENT DETAIL	D30-2 (REV. 04-2023)
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**RECENTLY ADOPTED REVISIONS/AMENDMENTS**

**DETAIL D30-3**

- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023

SECTION A-A

C.L. OF PIPE

FOR USE ONLY WHERE INDICATED ON PLANS.  
THE CONCRETE SHALL BE ~~3000 PSI CONCRETE~~.  
THE MIN THICKNESS, ON THE SIDES AND BOTTOM SHALL BE 6" THE TOP OF THE CONCRETE SHALL BE AT LEAST TO THE CENTER OF THE PIPE.

REV 2009

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	CONCRETE CRADLE DETAIL	D30-3
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C.L. OF PIPE

SECTION A-A

NOTES:

1. FOR USE ONLY WHERE INDICATED ON PLANS
2. THE CONCRETE CRADLE SHALL BE ~~KOMMB 4K (REFER TO SPECIFICATION 2000)~~.

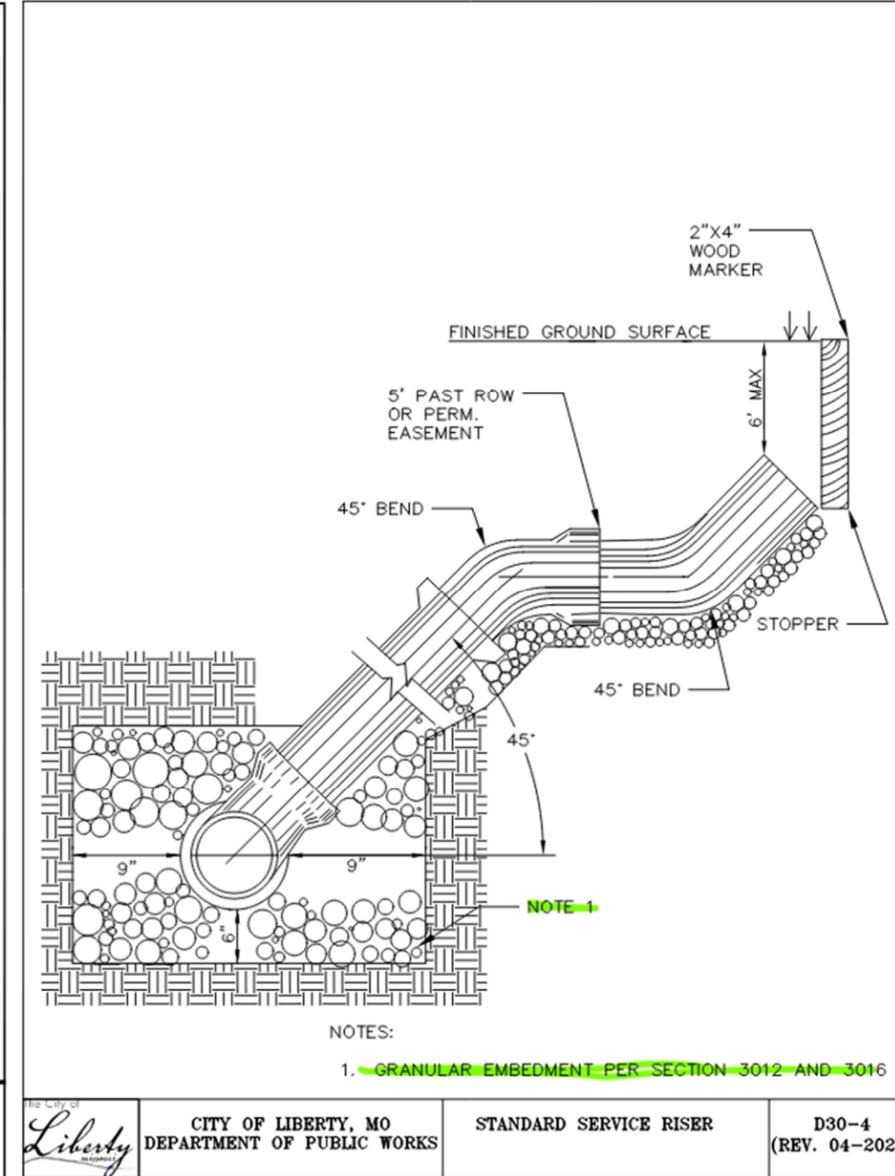
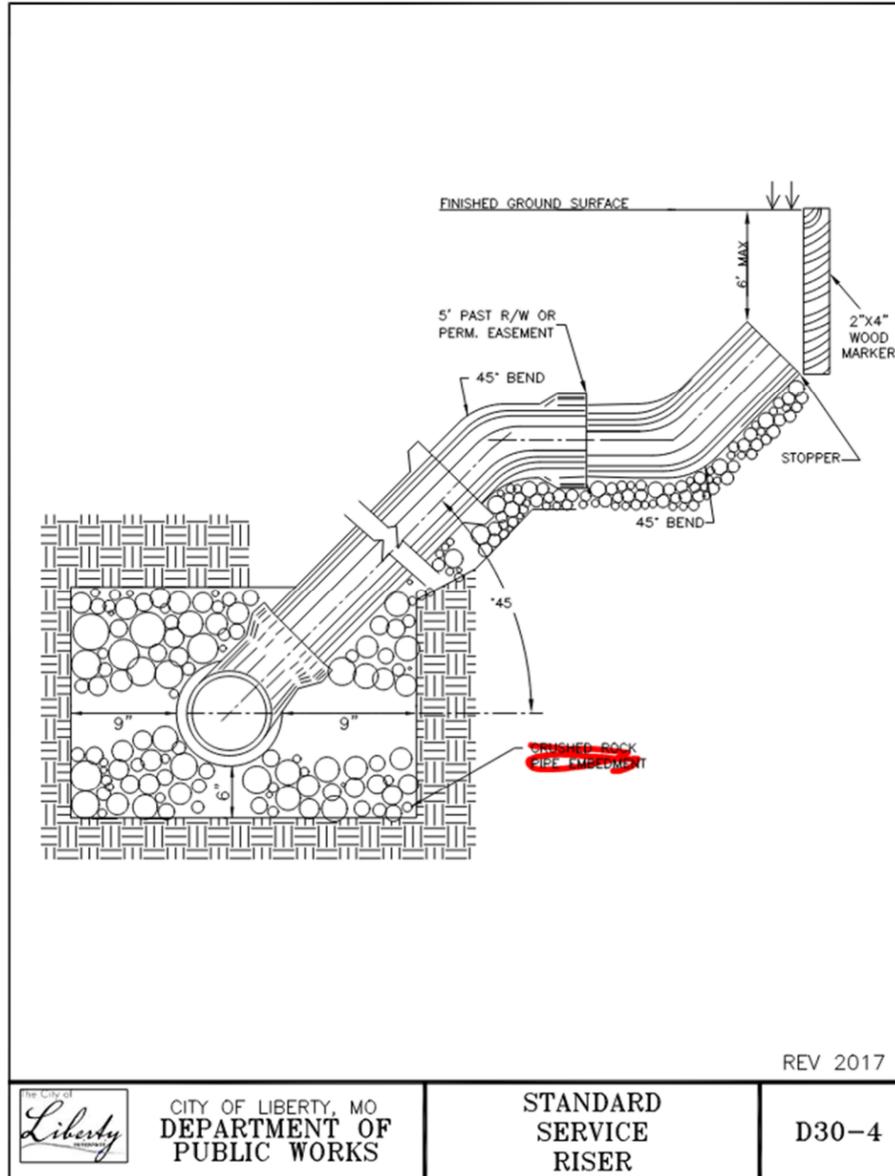
THE MINIMUM THICKNESS, ON THE SIDES AND BOTTOM SHALL BE 6", THE TOP OF THE CONCRETE SHALL BE AT LEAST TO THE CENTER OF THE PIPE.

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	CONCRETE CRADLE DETAIL	D30-3 (REV. 04-2023)
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**RECENTLY ADOPTED REVISIONS/AMENDMENTS**

**DETAIL D30-4**

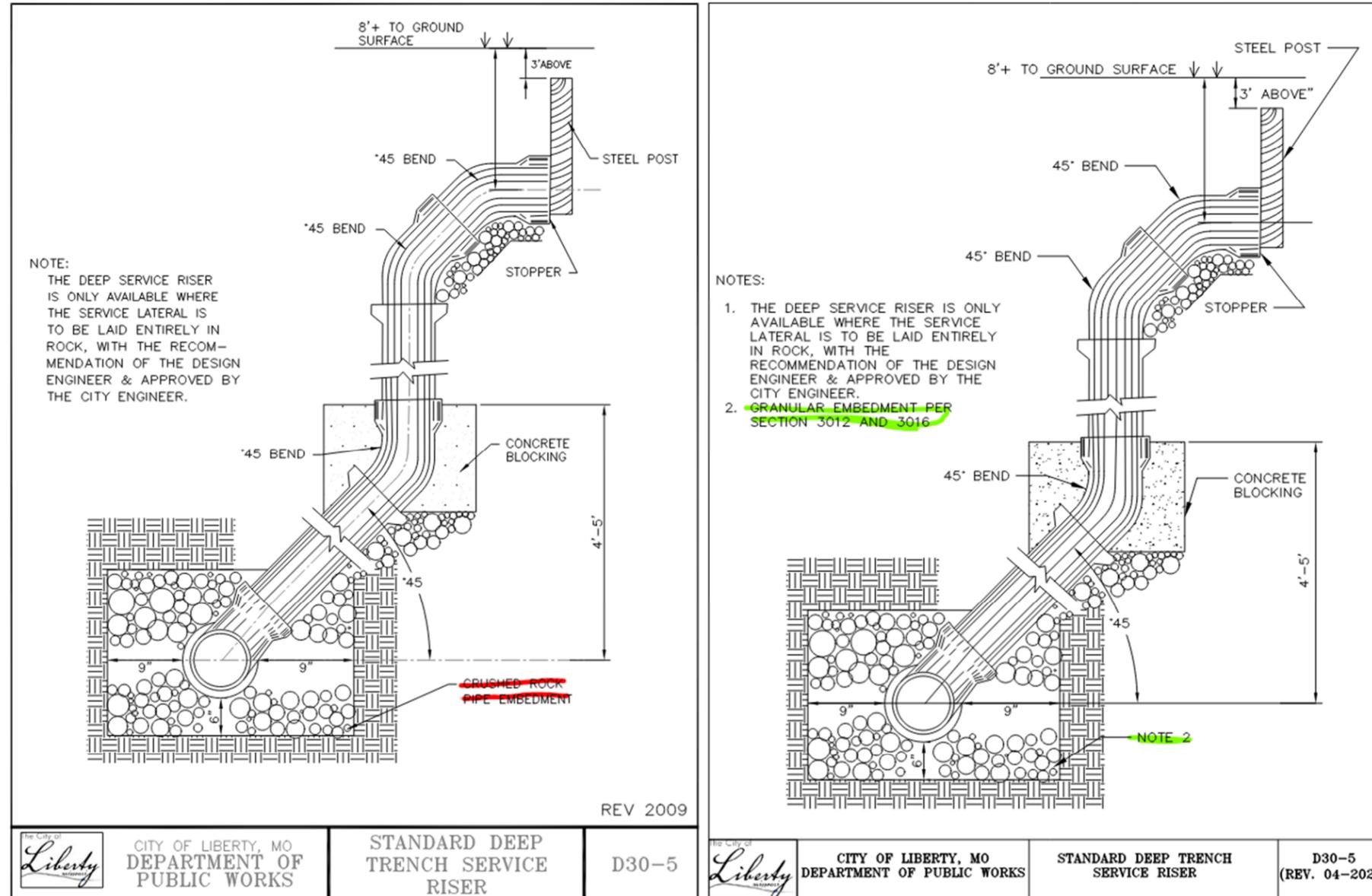
- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### DETAIL D30-5

- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023



**DETAIL D31-1A**

- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023

**SECTION**

NOTES:

1. PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C478 EXCEPT AS MODIFIED BY THE SPECIFICATIONS.
2. BASES NOT BUILT MONOLITHIC WITH BOTTOM SECTION SHALL BE POURED OF 3000 PSI CONCRETE.
3. MANHOLE MAY BE TRANSITIONED TO 4' DIA., 8' ABOVE F.L. OF OUTFALL FOR 5' & 6' MANHOLES.
4. THE BOTTOM SECTION OF ALL PRECAST MANHOLES NOT BUILT MONOLITHIC WITH THE BASE SHALL BE SET INTO A STEEL REINFORCED POURED CONCRETE BASE A MIN OF 4'. (#4 @ 6' C.W.)
5. WATERPROOFING WILL BE REQUIRED ON THE EXTERIOR SURFACE OF MANHOLE STRUCTURES FROM BASE TO MANHOLE RINGS. PRECAST MANHOLES WILL BE SHOP COATED. THE WATERPROOF COATING SHALL BE KOPPERS COMPANY, INC. BITUMASTIC NO. 50 OR TNEPEC COMPANY, INC. ASPHALT BASE FOUNDATION COAT AND SHALL CONSIST OF TWO COATS WET THICKNESS OF 22-26 MILS WITH A COMBINED DRY THICKNESS OF 31 MILS.
6. THE COMPRESSIVE STRENGTH OF CONCRETE USED IN THE CONSTRUCTION OR PRECAST REINFORCED CONCRETE MANHOLES SHALL NOT BE LESS THAN 4000 PSI.
7. ONLY ECCENTRIC MANHOLE CONES WILL BE ALLOWED UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
8. ADDITIONAL BASE THICKNESS FOR MANHOLES GREATER THAN 20' DEEP SHALL BE APPROVED BY CITY ENGINEER WITH SUBMITTAL OR APPROPRIATE CALCULATIONS.
9. ALL MANHOLE JOINTS SHALL BE SEALED WITH AN EXTERNAL RUBBER SLEEVE, INFI-SHIELD GATOR WRAP AS MANUFACTURED BY SEALING SYSTEMS, INC., OR APPROVED EQUAL.

REV 2016

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	STANDARD PRECAST MANHOLE DETAIL	D31-1A
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**SECTION**

NOTES:

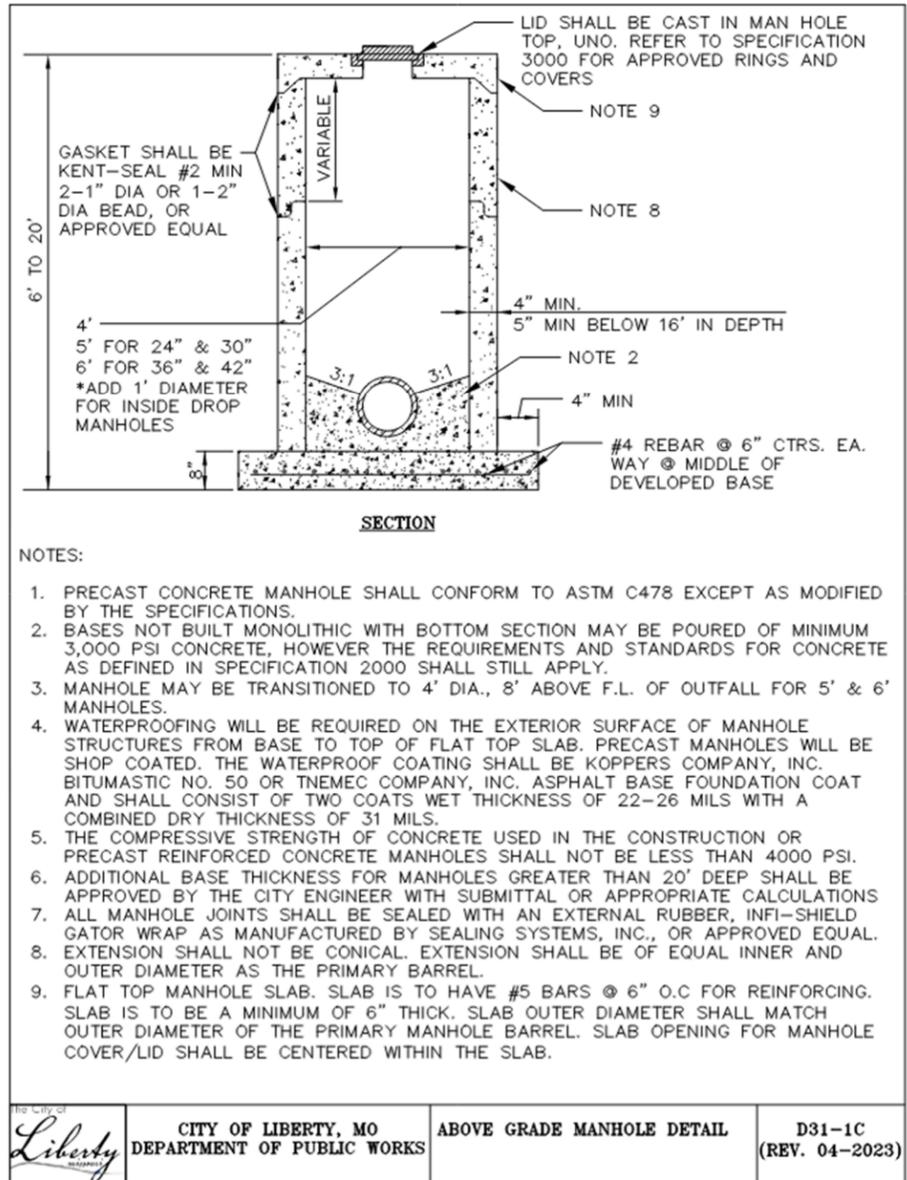
1. PRECAST CONCRETE MANHOLE SHALL CONFORM TO ASTM C478 EXCEPT AS MODIFIED BY THE SPECIFICATIONS.
2. BASES NOT BUILT MONOLITHIC WITH BOTTOM SECTION MAY BE POURED OF MINIMUM 3,000 PSI CONCRETE, HOWEVER THE REQUIREMENTS AND STANDARDS FOR CONCRETE AS DEFINED IN SPECIFICATION 2000 SHALL STILL APPLY.
3. MANHOLE MAY BE TRANSITIONED TO 4' DIA., 8' ABOVE F.L. OF OUTFALL FOR 5' & 6' MANHOLES.
4. WATERPROOFING WILL BE REQUIRED ON THE EXTERIOR SURFACE OF MANHOLE STRUCTURES FROM BASE TO MANHOLE RINGS. PRECAST MANHOLES WILL BE SHOP COATED. THE WATERPROOF COATING SHALL BE KOPPERS COMPANY, INC. BITUMASTIC NO. 50 OR TNEPEC COMPANY, INC. ASPHALT BASE FOUNDATION COAT AND SHALL CONSIST OF TWO COATS WET THICKNESS OF 22-26 MILS WITH A COMBINED DRY THICKNESS OF 31 MILS.
5. THE COMPRESSIVE STRENGTH OF CONCRETE USED IN THE CONSTRUCTION OR PRECAST REINFORCED CONCRETE MANHOLES SHALL NOT BE LESS THAN 4000 PSI.
6. ONLY ECCENTRIC MANHOLE CONES WILL BE ALLOWED UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
7. ADDITIONAL BASE THICKNESS FOR MANHOLES GREATER THAN 20' DEEP SHALL BE APPROVED BY THE CITY ENGINEER WITH SUBMITTAL OR APPROPRIATE CALCULATIONS
8. ALL MANHOLE JOINTS SHALL BE SEALED WITH AN EXTERNAL RUBBER, INFI-SHIELD GATOR WRAP AS MANUFACTURED BY SEALING SYSTEMS, INC., OR APPROVED EQUAL.

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	STANDARD PRECAST MANHOLE DETAIL	D31-1A (REV. 04-2023)
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## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### DETAIL D31-1C

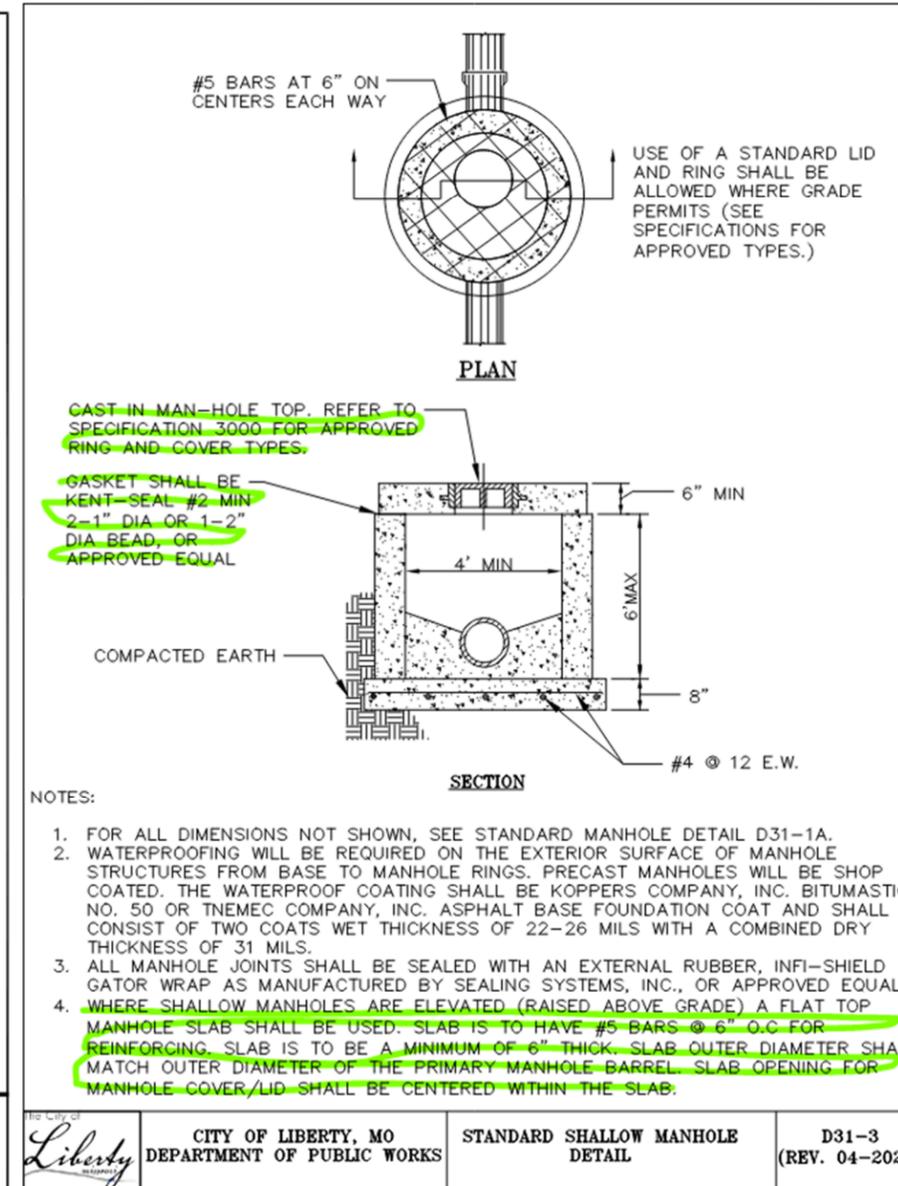
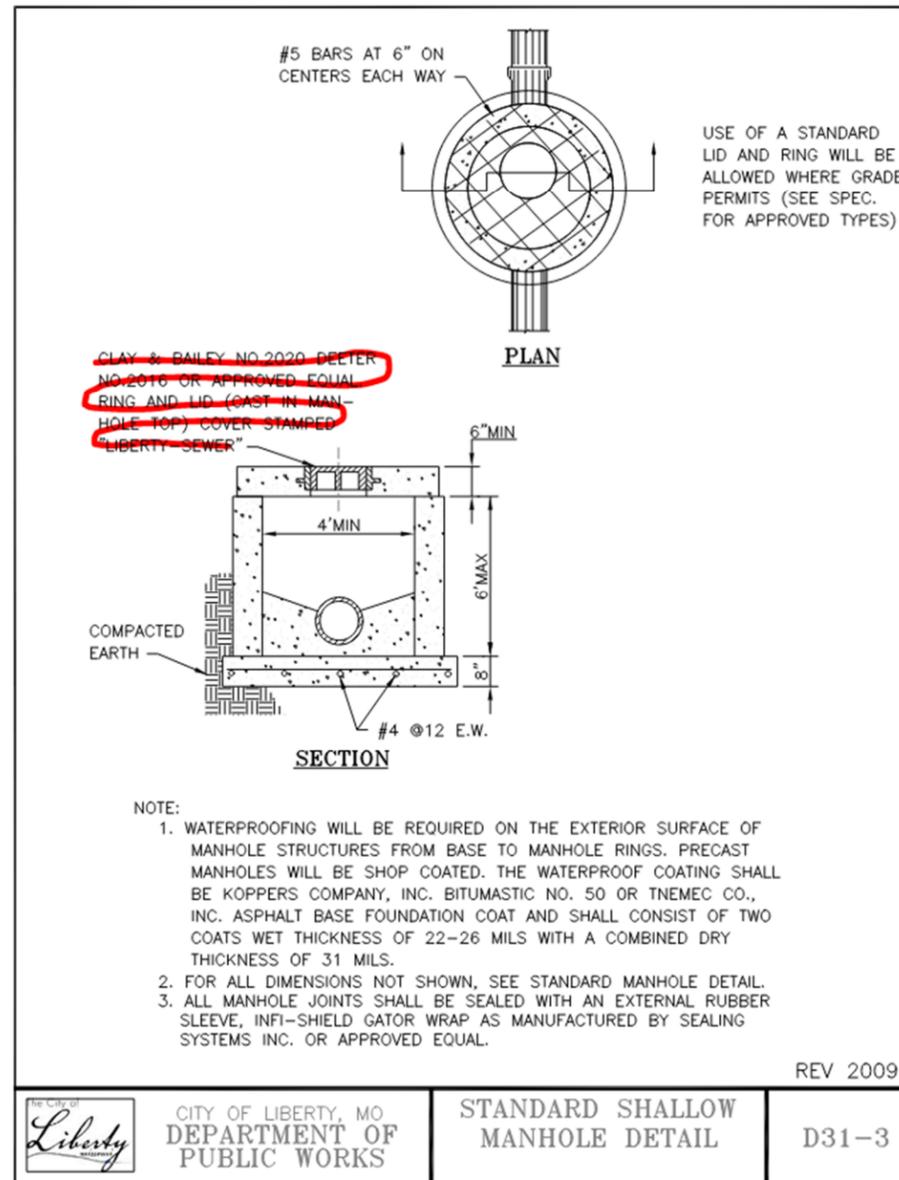
- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### DETAIL D31-3

- Proposed 03-16-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-18-2023





## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Specification 1500 – Concrete Pavement**

- Proposed 03-27-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-27-2023

## SECTION 1500 PORTLAND CEMENT CONCRETE PAVEMENT

### 1501 SCOPE.

This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct Portland Cement Concrete Pavement.

### 1502 MATERIALS.

Except as modified herein, all materials used for construction of Portland Cement Concrete pavement shall conform to the requirements stipulated in applicable sections of these Specifications.

- A. Concrete. The concrete for the use in construction of Portland Cement Concrete pavement shall conform to the requirements established in Section 2000, "Concrete" with the following modifications.

Cement	Portland Cement shall conform to ASTM C150, Type II. Type III cement may be used only upon written approval of the City Engineer.
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- B. Reinforcing Steel. Refer to section 2000 for Bars, Welded Steel Wire and Supporting Elements.

<del>Bars</del>	<del>Bars shall conform to ASTM A615, A616, and A617.</del>
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<del>Welded Steel Wire Fabric</del>	<del>ASTM A185</del>
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<del>Supporting Elements</del>	<del>Representative samples of supporting elements shall be submitted and approved by the Engineer prior to their use in the project.</del>
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- C. Expansion Joint Fillers. Expansion joint fillers shall conform to ASTM D994, D1751 or D1752.

- D. Joint Sealing Compounds. Joint sealing compounds shall conform to ASTM ~~D1190~~ **D6690-21**.

- E. Curing Membrane. All material to be used or employed in curing Portland Cement Concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type and shall conform to ASTM C309-19.

### 1503 CONSTRUCTION DETAILS.

The Portland Cement Concrete pavement shall be constructed to the configuration, and to the lines and grades shown on the plans.

- A. Grading and Subgrade Preparation. All excavation or embankment required shall

be as defined in Sections 1100 and 1200 of these Technical Specifications entitled "Grading" and "Subgrade Preparation".

- B. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than 1/4 inch in horizontal and vertical alignment for each 10 feet in length.
1. Material & Size. Forms shall be made of metal and shall have a height equal to or greater than the prescribed edge thickness of the pavement slab.
  2. Strength. Forms shall be of such cross-section and strength, and so secured as to resist the pressure of the concrete when struck off, vibrated, and finished, and the impact and vibration of any equipment which they may support.
  3. Installation. Forms shall be set true to line and grade, supported through their length and, joined neatly in such a manner that the joints are free from movement in any direction.
  4. Preparation. Forms shall be cleaned and lubricated prior to each use and shall be so designed to permit their removal without damage to the new concrete.
  5. Paving Machine. A slip-form paving machine may be used in lieu of forms. The machine must be equipped with mechanical internal vibrators, and be capable of placing the Portland Cement Concrete pavement to the correct cross-section, thickness, line and grade within the allowable tolerances.

#### 1504 JOINTS.

Generally joints shall be formed at right angles to the true alignment of the pavement and to the depths and configuration specified by the standard drawings or as modified by the plans and specifications.

- A. Expansion Joints. Expansion joints shall be placed at all locations where shown on the plans and standard details or as directed by the Engineer.
1. General. Expansion joints shall extend the entire width of the pavement and from the sub-grade to one inch below the surface of the pavement or the material will have a suitable tear strip provided to allow for the application of the joint sealer.  
  
Under no circumstances shall any concrete be left across the expansion joint at any point.
  2. Material. Expansion joints shall be formed by a one piece, one inch thick preformed joint filler cut to the configuration of the correct pavement section.

3. Stability. Expansion joints shall be secured in such a manner that they will not be disturbed during the placement, consolidation and finishing of the concrete.
  4. Dowels. If expansion joints are to be equipped with dowels they shall be of the size and type specified, and shall be firmly supported in place, by means of a dowel basket which shall remain in place. One half of each dowel shall be pointed, greased or fitted with a dowel sleeve of the dimensions shown on the plans or standard drawings.
- B. Contraction Joints. Contraction joints shall be placed where indicated and to the depth indicated by the plans and specifications or standard drawings.
1. Templates. The templates shall be removed as soon as the concrete has attained its initial set and finished as outlined for tooling joints.
  2. Sawing. When transverse contraction joints are to be formed by sawing, care must be taken to saw the grooves soon after placing the concrete to prevent the formation of cracks due to contraction of the slab. All transverse joints shall be sawed at least 1/4 of the slab depth. Any procedures for sawing joints that result in premature and uncontrolled cracking shall be revised immediately by adjusting the time intervals between the placing of the concrete and the cutting of the joints.
  3. Tooling. Tooling or contraction joints will be permitted if completed to the width and depth specified on the construction plans or the standard drawings, and shall be true to line.
  4. Pre-molded Strip Joints. Pre-molded strip joints shall be of the proper dimensions as shown on the plans and standard drawings and shall be secured at the proper location so as not to be disturbed by the finishing of the concrete.
- C. Longitudinal and Construction Joints. Longitudinal joints or construction joints shall be placed as shown on the plans or where the Contractor's construction procedure may require them to be placed.
1. Center Joints. Longitudinal center joints shall be constructed using the methods specified in Section 1504(B) "Contraction Joints".
  2. Longitudinal Construction Joints. Longitudinal construction joints (joints between construction lanes) shall be keyed joints of the dimensions shown on the plans or standard drawings.
  3. Transverse Construction Joints. Transverse construction joints of the type shown on the plans or standard drawings shall be placed wherever concrete placement is suspended for more than 30 minutes.

4. Tiebars. Tiebars shall be of deformed steel of the dimensions specified by the plans or standard drawings. Tiebars shall be installed at the specified spacing and firmly secured so as not to be disturbed by the construction procedure.

#### 1505 PLACING, FINISHING, CURING, AND PROTECTION.

Concrete shall be furnished in quantities required for immediate use and shall be placed in accordance with the requirements of Section 2000 of these Technical Specifications and as specified herein.

- A. Concrete Placement. Prior to placement of the concrete pavement, all debris and foreign material shall be removed from the inner surfaces of the forms and all forms and subgrade properly moistened. All required reinforcement and other special metal parts shall be properly and firmly set into position to preclude movement during placement of the concrete. The concrete shall be deposited on the prepared subgrade to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. The concrete shall be placed as uniformly possible in order to minimize the amount of additional spreading necessary. While being placed, the concrete shall be vibrated and compacted with suitable tools so that the formation of voids or honeycomb pockets is prevented. In no case shall Ajitterbug≅ vibrators be used.

The concrete shall be well vibrated and tamped against the forms and along all joints. Care shall be taken in the distribution of the concrete to deposit a sufficient volume along the outside form lines so that the curb section can be consolidated and finished simultaneously with the slab.

No concrete shall be placed around manholes or other structures until they have been brought to the required grade, alignment, and cross slope. Concrete shall not be allowed to extrude below the forms.

- B. Concrete Finishing. The pavement shall be struck off and consolidated with a mechanical finishing machine or by hand-finishing methods.

When a mechanical finishing machine is used, the concrete shall be struck off at such a height that after consolidation and final finishing it shall be at the exact elevations as shown on the plans. A depth of at least 2 inches of concrete shall be carried in front of the strike-off screed for the full width of the slab, whenever the screed is being used to strike off the pavement. The finishing machine shall be provided with a screed which will consolidate the concrete by pressure. The concrete shall, through the use of this machine, be brought to a true and even surface, free from rock pockets, with the fewest possible number of passes of the machine. The edge of the screeds along the curb line may be notched out to allow for sufficient concrete to form the integral curb. Hand-finishing tools shall be kept available for use in case the finishing machine breaks down.

When hand finishing is used, the pavement shall be struck off and consolidated by

a vibrating screed to the exact elevation as shown on the plans. When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off; it shall not be allowed to idle on the concrete. Internal mechanical vibration shall be used along all formed surfaces.

1. Longitudinal Floating. After the concrete has been struck off and consolidated, it shall be further smoothed by means of a mechanical longitudinal float or float finishers using a longitudinal hand float. If a longitudinal hand float is used, it shall be operated from foot bridges spanning the pavement and shall be worked with a wiping motion parallel to the centerline, and passing from one side of the pavement to the other. Movement ahead along the centerline of the pavement shall be in successive advances of not more than 1/2 of the length of the float. The float shall not be less than 12 feet in length and 6 inches in width, and shall be properly stiffened and provided with handles at each end. This operation may be eliminated if specified tolerances can be attained by some other approved method.

In cases where the longitudinal floating operation has been eliminated, the pavement shall be scraped with a straight edge 10 feet long, equipped with a handle to permit it to be operated from the edge of the pavement. The longitudinal float and straight edge shall be operated so that any excess water and laitance are removed from the surface of the pavement. After the scraping operation, the surface of the pavement shall be within the specified tolerances.

2. Straight Edging. While the concrete is still plastic, the slab surface shall be tested for smoothness with a 10 foot straight edge swung from handles 3 feet longer than one-half the width of the slab. The straight edge shall be placed on the surface parallel to the centerline of the pavement and at not more than 5 foot intervals transversely. After each test the straight edge shall be moved forward one-half its length and the operation repeated. When irregularities are discovered, they shall be corrected by adding or removing concrete. All disturbed places shall be smoothed with a float not less than 3 feet long and not less than 6 inches wide, and again straight edged. The pavement surface shall have no depression in which water will stand.
3. Edging. Before final finishing is completed and before the concrete has taken its initial set, the edges of the slab and curb shall be carefully finished with an edger of the radius shown on the plans or standard details.
4. Final Surface Finish. A burlap drag or a broom finish shall be used as the final finishing method. When a drag is used it shall be at least 3 feet in width and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the surface of the pavement and dragged in the direction in which the pavement is being laid. When broom finishing, a hard bristle broom shall be used. The broom shall be kept

clean and used in such a manner as to provide a uniform texture surface. The curb shall have the same final finish as the pavement.

The final surface of the concrete pavement and curb shall have a uniform gritty texture free from excessive harshness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

- C. Curing. Curing shall conform to the requirements set forth in Section 2000, "~~Concrete~~" with the exception that water proof paper, or polyethylene sheeting, shall not be acceptable as curing methods for concrete pavement. The use of straw or burlap for curing shall be as approved by the Engineer.

As soon as practical after the concrete is finished it shall be cured with one of the acceptable methods. If a liquid curing membrane is used, it shall be according to the manufacturer's directions.

A nozzle producing a uniform mist pattern will be used on all spray equipment when applying the liquid curing membrane. Rate of application to the pavement shall be ~~(1 gallon/175 ft) with a wet thickness of 6 to 10 mils~~ in accordance with the manufacturers recommendation for said type and application.

If the forms are removed from finished concrete pavement within a period of 72 hours or if a slip form paving machine has been used, these surfaces shall also be cured.

- D. Protection. The Contractor shall, at his own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the City.

All vehicular traffic shall be prohibited from using the new concrete pavement until it has attained 70 percent of the 28 day compressive design strength.

Concrete pavement which is not acceptable to the Engineer because of damage or defacement, shall be removed and replaced, or repaired to the satisfaction of the Engineer, at the expense of the Contractor.

- E. Temperature Limitation. Concrete work shall proceed in accordance with the requirements established in Section 2000, "~~Concrete~~".

#### 1506 BACKFILL.

A minimum of 24 hours shall lapse before forms are removed and 5 days shall lapse before pavement shall be backfilled unless otherwise approved by the Engineer.

Backfill shall be accomplished in accordance with Section 1100 and 1200 entitled "Grading" and "Subgrade Preparation".

The Contractor shall be responsible for the repair of any existing street pavement disturbed by the

construction to the satisfaction of the Engineer.

1507 JOINT SEALING AND CLEAN-UP.

All joints shall be sealed with an approved joint sealer applied in accordance with the manufacturer's directions within 7 days of the placement of the concrete and prior to the opening of the pavement to traffic.

The Contractor shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of the construction.

1508 INTEGRAL CURB.

Integral curbs shall be required along the edges of all street pavement as indicated on the plans or standard drawings except at such locations as the Engineer may direct.

The integral curb shall be constructed immediately following the finishing operation unless otherwise shown on the plans. Special care shall be taken so that the curb construction does not lag the pavement construction and form a "cold joint".

Steel curb forms shall be required to form the backs of all curbs except where impractical because of small radii street returns or other special sections.

In placing curb concrete, sufficient spading shall be done to secure adequate bond with the paving slab and eliminate all voids in the curb.

Curbs shall be formed to the cross section as shown on the drawings with a mule or templates supported on the side forms and with a float not less than 4 feet in length.

The finished surface of the curb and gutter shall be checked by the use of a 10 foot straight edge and corrected if necessary. Where grades are flat and while the concrete is still plastic, the drainage of the gutter should be checked by pouring water at the gutter summit and observing its flow to the inlet.

1509 SURFACE TOLERANCES.

Concrete pavement shall have a surface tolerance in all directions of 1/4 inch in 10 feet when checked with a 10 foot straight edge.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Specification 2200 – Standard Sidewalks and Driveways**

- Proposed 03-27-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-27-2023

## SECTION 2200 STANDARD SIDEWALKS AND DRIVEWAYS

### 2201 SCOPE.

This section governs the furnishing of all labor, equipment, tools, material, and the performance of all work necessary to construct or reconstruct sidewalks and driveways.

### 2202 MATERIALS.

All items of material included in this section shall conform in general to the requirements of Section 2000, "~~Concrete~~" for ~~MCIB A-618-1-4 concrete~~.

- A. Concrete Mix. Concrete shall conform to the requirements. When the ambient air temperature is 90 deg F. or higher, a retarder will be used in all concrete mixes. Any additional additives, including color, shall be approved by City Engineer.
- B. Reinforcement. Reinforcement shall be 6x6-W2.9 x W2.9, welded steel wire fabric or as shown by the plans and specifications.

### 2203 CONSTRUCTION DETAILS.

The sidewalks or driveways shall be constructed or reconstructed to the configuration, and to the lines and grades indicated by the plans. Generally, sidewalks and driveways should be constructed after the curbing if applicable.

- A. Removal. Existing sidewalks or driveways shall be totally removed to the nearest contraction or expansion joint. With the approval of the Engineer, the sidewalk or driveway may be sawed provided no "free section" is left of less than 15 square feet. The section shall be sawed full depth.
- B. Grading and Subgrade Preparation. All excavation or embankment required in the grading or subgrade preparation shall be defined in the Sections 1000 and 1200, except as follows:

The top 6 inches of the subgrade shall be compacted to obtain a density of 95 percent of maximum in conformance with Section 1205(A).

If during construction operations additional fill material is needed beneath sidewalks or driveways it shall be of crushed limestone, placed in maximum lifts of 4 inches, moistened if necessary, and compacted by mechanical tampers to a density of 95 percent of the maximum. Uncontained crushed limestone fill shall not exceed 8" in depth.

- C. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than 1/4 inch in horizontal or vertical alignment for each 10 feet in length.
  - 1. Size. Forms shall have a height equal to or greater than the depth of the sidewalk or driveway section.
  - 2. Installation. The forms shall be set true to line and grade, and shall be supported to remain in position while depositing and consolidating the

concrete.

3. Preparation. The forms shall be lubricated and shall be designed to permit their removal without damage to the concrete.

#### 2204 JOINTS.

Unless directed by the Engineer the joints shall be formed at right angles to the alignment of the sidewalk or driveway, and to the configuration specified by the plans or standards.

##### A. Joint Patterns.

1. Sidewalks. Sidewalk surfaces shall be marked with a transverse joint spaced at a distance equal to the width of the sidewalk. Sidewalks greater than 6 feet in width shall be divided by longitudinal joints spaced not less than 30 inches nor more than 48 inches. Transverse joints shall be spaced to form a square (picture frame) pattern. 4" squared edger tool marks shall remain showing.
2. Wide driveways. Driveways in excess of 10 feet in width shall have a longitudinal joint located in the center.

##### B. Expansion Joints. Expansion joints shall be placed where directed by the plans or Engineer. The expansion joints shall be located to give the sidewalk or driveway an appearance of continuity.

1. General. The preformed expansion joint material shall either be left 1/2 inch below the surface, or a suitable tear strip will be provided to allow for the application of the joint sealer.
2. Material. Expansion joints shall be formed by a 1 piece, 1/2 inch preformed joint filler cut to the configuration of the correct section. The filler material shall be as specified in Section 2003 (D).
3. Stability. Expansion joints shall be secured in a manner so they will not be disturbed by depositing and consolidating the concrete.
4. Edging. The edges of these joints shall be rounded with an edging tool of 1/4 inch radius.

##### C. Joints. Contraction joints or false joints shall be one inch deep by 1/8 inch wide with 1/4 inch radii edging.

1. Edging. Tooled joints shall be left on sidewalk and driveways. Joints shall be straight and true to line. All intersecting joints shall be clean and unfilled. No "Ribbons" shall exceed 1/8 inch above the tool mark.
2. Contraction Joints. Contraction joints may be sawed with the approval of the Engineer. Sawing of contraction joints may be permitted when machine

laid. The sawing of joints shall be equal to 1/3 of the thickness and shall be completed within 24 hours of the placing of concrete.

3. Joint Sealer. Joint Sealer is not required on contraction joints.

#### 2205 CONCRETE WORK.

Concrete work for sidewalks and driveways shall be placed in accordance with the requirements of MCIB Standard Concrete Specifications. Joints shall be constructed as in Section 2204 or as modified by the plans or special provisions.

- A. Concrete Placement. Concrete shall not be allowed to extrude from below the forms. Vibration is not required for sidewalks or driveways.
- B. Finishing. After placing and the initial strike off, if the surface of the concrete is sufficiently wet that a ridge is formed at the inside of the edging tool, finishing will cease until the excessive moisture has evaporated. No water, dryer or additional mortar shall be applied to the free surface of the concrete.

After finishing, the surface of the concrete shall be broomed with a fine clean broom to provide an antiskid surface, and the edges and joints retooled.

In all cases the finished sidewalk or driveway shall have a true surface, free from sags, twists, spalls, or warps, and shall have a uniform color and appearance.

- C. Curing. As soon as practical after the concrete is finished it shall be cured with one of the acceptable liquid curing membranes applied according to manufacturers directions.

If forms are removed from sidewalks or driveways within a period of 72 hours of placement those surfaces shall also be cured.

Wet burlap, cotton mats, waterproof paper, polyethylene sheeting or earth backfill shall not be acceptable as curing methods for sidewalks or driveways.

- D. Protection. The Contractor shall protect the concrete work against damage or defacement of any kind until it has been accepted by the City. Concrete which is damaged or defaced, shall be removed and replaced or repaired to the satisfaction of the Engineer, at the expense of the Contractor.
- E. Temperature Limitations. Concrete shall be placed in accordance with requirements of Section 2009 and 2010.

#### 2206 BACKFILL.

A minimum of 24 hours shall lapse before forms are removed and sidewalks or driveways are backfilled unless otherwise approved by the Engineer.

Backfill shall be accomplished in accordance with Sections 1100 and 1200.

The Contractor shall be responsible for the repair of any street pavement disturbed by the construction.

2207 JOINT SEALING AND CLEAN-UP.

All expansion joints shall be sealed with an approved joint sealer applied in accordance with Section 2003 within 7 days of the placement of the concrete.

The Contractor shall be responsible for the removal of excess dirt, rock, broken concrete, splatters and over spray from the area of the construction within 10 days of the date of placement.

2208 SURFACE TOLERANCES.

Sidewalks or driveways shall have a surface tolerance of 1/4 inch in 10 feet when checked with a 10 foot straightedge.

**Detail 100**

- Proposed 03-27-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-27-2023

- Color: White background, no colored border.
- Text: Dark blue lettering, centered, Arial font, larger lettering – font size 32; smaller lettering – font size 20.
- Material: Aluminum – new stock, shall conform to the requirements of ASTM B209 for alloy 5052-H38 or 6061-T6 aluminum.
- Thickness: .063 inch.
- Corner Radii: ½ inch.
- Hole Size: ⅜ inch pre-drilled holes for field post mounting; center of holes shall be approximately 3 inches apart from each other and 1½ inches from top and bottom edges and centered from left/right edges.
- Reflective Sheeting: White background and blue text layer shall be a reflective sheeting material.
- Height: Minimum mounting height of 36 inches from finished ground surface to bottom of sign.
- Location: Sign shall be located at each property line intersection with the conservation easement or each deflection point within the conservation easement.

REV 2017

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	CONSERVATION EASEMENT BOUNDARY MARKER	D-100
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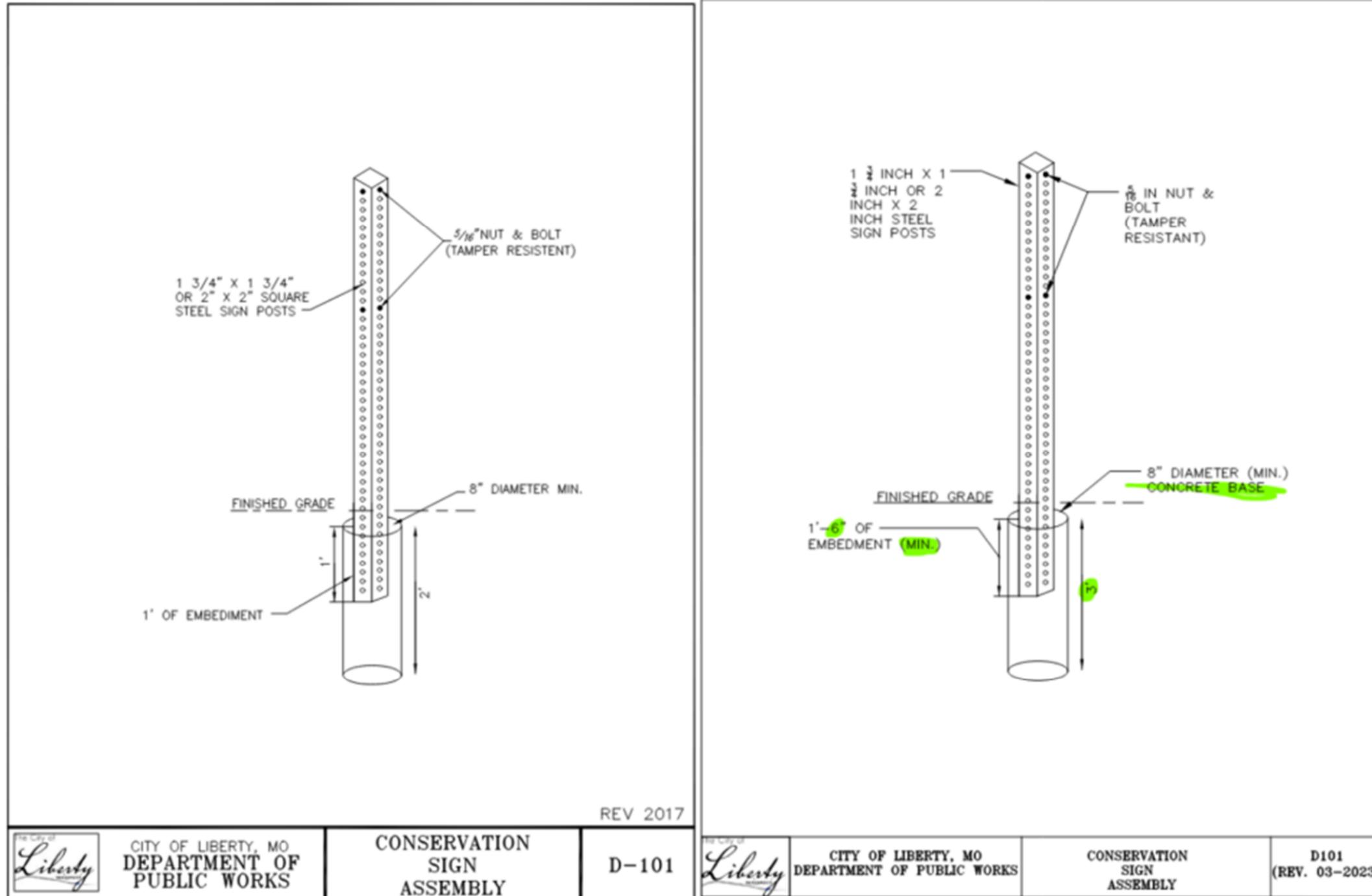
- COLOR: WHITE BACKGROUND, NO COLORED BORDER
- TEXT: DARK BLUE LETTERING, CENTERED ARIAL FONT, LARGER LETTERING – FONT SIZE 48; SMALLER LETTERING – FONT SIZE 28
- MATERIAL: ALUMINUM – NEW STOCK, SHALL CONFORM TO THE REQUIREMENTS OF ASTM B209 FOR ALLOY 5052-H38 OR 6061-T6 ALUMINUM.
- THICKNESS: 0.080 INCHES
- CORNER RADII: ½ INCH
- HOLE SIZE: ⅜ INCH PRE-DRILLED HOLES FOR FIELD POST MOUNTING; CENTER OF HOLES SHALL BE APPROXIMATELY 3 INCHES APART FROM EACH OTHER AND 1 ½ INCHES FROM TOP AND BOTTOM EDGES AND CENTERED FROM LEFT/RIGHT EDGES.
- REFLECTIVE SHEETING: WHITE BACKGROUND AND BLUE TEXT LAYER SHALL BE A REFLECTIVE SHEETING MATERIAL.
- HEIGHT: MINIMUM MOUNTING HEIGHT OF 60 INCHES FROM FINISHED GROUND SURFACE TO BOTTOM OF SIGN.
- LOCATION: SIGNS SHALL BE LOCATED AT EACH PROPERTY LINE INTERSECTION WITH THE CONSERVATION EASEMENT OR EACH DEFLECTION POINT WITHIN THE CONSERVATION EASEMENT.

	CITY OF LIBERTY, MO DEPARTMENT OF PUBLIC WORKS	CONSERVATION EASEMENT BOUNDARY MARKER	D100 (REV. 03-2023)
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RECENTLY ADOPTED REVISIONS/AMENDMENTS

Detail 101

- Proposed 03-27-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 04-27-2023



CITY OF LIBERTY, MO  
DEPARTMENT OF  
PUBLIC WORKS

CONSERVATION  
SIGN  
ASSEMBLY

REV 2017

D-101



CITY OF LIBERTY, MO  
DEPARTMENT OF PUBLIC WORKS

CONSERVATION  
SIGN  
ASSEMBLY

D101  
(REV. 03-2023)



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### Specification 3000 – Sanitary Sewers

- Proposed 04-03-2023
- Comments/Questions Received:
  - Comments on requiring CI in streets
  - Comment on requiring composite in all non-street locations
  - Comment on listing CAP and EJCO as pre-approved manufacturers
- Public Informational Meeting – None
- Adopted 05-03-2023

## SECTION 3000 MATERIALS AND CONSTRUCTION - SANITARY SEWERS

### 3001 GENERAL:

This section governs materials that may be required to complete pipeline construction, exclusive of structures, as shown on the Plans and/or as provided in the Special Provisions.

### 3002 SPECIFICATION MODIFICATIONS:

It is understood that throughout this section these specifications may be modified or deleted by appropriate items in the contract drawings or Special Conditions.

### 3003 REVISIONS OF STANDARDS:

When reference is made to a Standard Specification, i.e. ASTM, ANSI, AWWA, MCIB, the specification referred to shall be understood to mean the latest revision of said specification as amended at the time of the Notice to Bidders, except as noted on the Plans or in the Special Provisions.

### 3004 MATERIALS AND TESTING:

Furnish pipe of materials, joint types, sizes, and strength classes indicated and specified. Higher strengths may be furnished at the Contractor's option and at no additional cost to the Owner.

The manufacturer shall be experienced in the design, manufacture and commercial supplying of the specific material.

Testing is to be performed by the Manufacturer's quality control personnel in conformance with applicable standards. Testing may be witnessed by Owner, or approved independent testing laboratory. The Contractor shall provide three (3) copies of certified test reports indicating that the material does conform to the specifications.

Handling: The manufacturer and contractor shall use equipment and methods adequate to protect pipe, joint elements and prevent shock contact of adjacent units during moving or storage. Damaged sections that cause reasonable doubt as to their structural strength or water tightness will be rejected. No pipe or fitting shall be delivered until approved by the said Materials Laboratory and are so marked.

### 3005 HIGH DENSITY POLYETHYLENE PIPE (HDPE):

General: High Density Polyethylene Pipe (HDPE) and fittings shall conform to ASTM F714, ASTM D-1248, ASTM D-3550, except as otherwise noted herein. Furnish maximum lengths manufactured by supplier, except for fittings, closures and specials. All HDPE pipe shall be marked with a green stripe to signify its use for sanitary sewer facilities.

### 3006 DUCTILE-IRON PIPE:

Ductile Iron Pipe shall be used only where structural concerns are paramount and corrosive conditions do not exist. Material shall conform to ANSI A21.51; ASTM A536, Grade 60-42-10, except as otherwise noted herein.

- A. Design. Design of pipe shall be in accordance with ANSI A21.50 laying conditions S, Type 2 or 3. Minimum wall thickness shall be Class 50. Polyethylene Encasement is not permitted.

- B. Joints. Mechanical and push-on joints for ductile-iron pipe and fittings shall conform to the requirements of ANSI A21.11. Gaskets shall be neoprene or other synthetic rubber material. Natural rubber gaskets will not be acceptable.
- C. Fittings. Fittings shall be in accordance with ANSI A21.10/AWWA C 110 and shall have a pressure rating of not less than that specified for pipe. Fittings used with ductile-iron pipe shall be ductile-iron or cast iron. Fittings for pipe with mechanical joints shall have mechanical joints. Fittings for pipe with push-on joints shall be either mechanical joint or push-on joint.
- D. Lining & Coating. All ductile-iron pipe, fittings and specials shall be cement mortar lined in accordance with ANSI A21.51. Coat all pipe, fittings and specials with manufacturer's standard coal tar coating.

3007 POLY VINYL CHLORIDE (PVC) SEWER PIPE:

Conform to ASTM D3034, except as otherwise specified herein.

- A. General. Furnish maximum pipe lengths manufactured by the supplier, except for fitting, closures and specials.
- B. Design. The minimum wall thickness for PVC Pipe shall conform to SDR-35 (SDR-26 for stub lines). PVC Material shall conform to ASTM D1784 and shall have a cell classification of 12454-B, 12454-C, 12364-C, or 13364-B.
- C: Joints. Flexible gasketed joints shall be compression type with a gasket confined in a machined groove in the spigot end of the pipe. Oil resistant rubber gasket rings shall conform to the requirements of ASTM D 1869. Gaskets shall be neoprene or other synthetic material. Natural rubber gaskets will not be acceptable.
- D. Fittings. Fittings defined as tee or wye connections suitable for assembly to 4-inch or 6-inch house or building sewers shall be saddle-type fittings molded of PVC plastic.

3008 CONCRETE:

Concrete, whether reinforced or non-reinforced, shall conform to MCIB Specifications and to the requirements set forth in Section 2000 "Concrete".

3009 REINFORCING STEEL:

Reinforcing steel shall be placed as shown on the plans and shall conform to ASTM Specifications as follows:

- A. Bars and rods shall be deformed billet-steel conforming to ASTM A 615, Grade 40.
- B. Welded wire fabric shall conform to ASTM A 185, Grade 40.
- C. Fabricated steel bar and rod mats shall conform to ASTM A 184. Bar material shall conform to ASTM A 615, Grade 40.
- D. Smooth bars shall be round carbon steel bars conforming to ASTM A 306, Grade

3010 MANHOLE MATERIALS:

- A. General. Manholes shall conform to the Standard Drawings included in these specifications.
- B. Pre-cast Concrete. Pre-cast concrete manholes shall conform to ASTM C 478. Joints shall be of material as specified for reinforced concrete pipe joints or a bitumastic material or preformed flexible joint sealants applied in accordance with manufacturer's recommendations.
- C. Waterproofing. Waterproofing will be required on all manholes. The bitumen shall consist of two coats of Koppers Bitumastic No. 50 or approved equal. Pre-cast manholes shall be shop coated.
- D. Sealed Joints: All manholes shall be sealed at the joints. The casting shall be sealed to the structure with an external sealing system as manufactured by Sealing Systems, Inc. or approved equal. The seal shall be a continuous band made of high quality EPDM (Ethylene Propylene Diene Monomer) rubber with a minimum thickness of 65 mils. Each unit shall have a 2" wide mastic strip on the top and bottom of the band. The mastic shall be non-hardening butyl rubber sealant, with a minimum thickness of 3/16", and shall seal to the cone/top of the manhole section and over the flange of the casting. The external sealing system shall be installed according to the manufacturer's recommendations.

3011 MANHOLE CASTINGS FRAMES RINGS AND COVERS:

All covers shall have "Liberty – Sewer" cast or molded onto the top surface. No other wording shall be visible on the surface of the manhole. Only Cast Iron Frames, Rings and Covers shall be allowed within Public Streets.

- A. Cast Iron. General: ~~Cast iron rings, covers, and steps shall conform to City Standard Drawing.~~
  - a. **Standard** Manholes rings and covers shall be **utilize** Clay and Bailey No. 2008BV, Deeter No. 1315, or approved equal.
  - b. ~~The exception shall be for use on~~ **Shallow** manholes where manhole covers shall be **utilize** Clay & Bailey No. 2020, Deeter No. 2016 or approved equal.

When bolt-down type manhole rings and covers are required and specified, Clay and Bailey No. 2014, Deeter 1310 or approved equal, with rubber gaskets and stainless steel cover bolts 5/8-inch diameter with hexagonal-head bolts shall be furnished. Bolt-down type manhole rings shall be anchored to the manhole with not less than four (4) 3/4-inch diameter anchor bolts having a minimum of fourteen (14) inches of embedment, (excluding adjustment rings) except in concrete manholes in which the ring is embedded in concrete.

~~All covers shall have Liberty – Sewer cast onto the top surface. No other wording shall be visible on the surface of the manhole castings.~~

Frame and grade adjustments on all manholes or manholes in paved surfaces shall

be sealed with an internal or external rubber chimney seal as manufactured by Cretex Specialty Products, or approved equal.

All manhole covers shall be solid and sealed. Rehabilitated manholes shall include a manhole insert per section 3304.

~~Cast iron manhole steps shall be Clay and Bailey, or approved equal, No. 2102 for precast concrete manholes and No. 2104 for concrete manholes.~~

~~Polypropylene coated steel reinforced "plastic steps" shall be M.A. Industries, Inc. model PS-2-PF or approved equal manhole step for precast concrete manholes.~~

The castings shall meet or exceed the following minimum requirements:

1. Iron castings shall conform to the requirements of ASTM A 48, Class 25.
2. Castings shall be clean and whole, and without blow or sand holes or any other surface defects which would impair serviceability. Plugging or filling of holes or other defects will not be permitted.
3. Parting fins and pouring gates shall be removed.

**B. Non-Metallic.** All rings and cover units shall be made from high strength nonmetallic fiber reinforced polymer/composite materials.

1. Detectability: All Non-Metallic lids shall be detectable with a metal detector.
2. Load Ratings - Frames, rings and covers intended for traffic service shall be "Proof Tested" in accordance with AASHTO M306: Proof Testing using a load of 50,000 lbs. During the load testing visible cracks or delamination will be cause for rejection. When load is removed, Permanent Set Deflection of more than 1/8" measured at center of load area will be cause for rejection.
3. Ultraviolet Resistance – Specimens shall be tested for resistance to Ultraviolet radiation in accordance with ASTM G154 Cycle 1 for a minimum of 1000 hours. Specimens shall be tested for ultimate flexural strength , retaining at least 75% of control values for load and deflection at failure.
4. Coefficient of Friction – The coefficient of friction shall be greater than 0.6 when tested in accordance with ASTM C1028.
5. Water Tight –frames and covers shall be water tight through the usage of a systems utilizing 316SS bolts, paddle locks or other approved locking system. Locking mechanism shall have a 3/8" Allen head top.

Fabricate rings and covers to conform to shapes, dimensions, and with wording or logos shown on Utility Drawings. Installation shall be done in accordance with

manufacturers specifications.

Approved Manufacturers:

1. CAP (Composite Access Products) McAllen TX
2. EJCO 2600 Durostreet East Jordan MI

3012 BEDDING AGGREGATE:

All crushed stone materials used for pipe bedding shall conform to the requirements of Class I, II, or III and installed as required in ASTM D2321, latest edition. Bedding material shall be placed as indicated in Detail D30-1.

3013 CONSTRUCTION REQUIREMENTS:

A. Grading and Excavation.

1. Scope. Excavation and trenching work shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation and disposal of all excavated material; all necessary sheeting, shoring and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; and other appurtenant work.
2. General. Excavation and trenching work shall be performed in a safe and proper manner with suitable precautions being taken against all hazards. The Contractor shall explore and expose any and all obstructions in advance of excavation so that minor changes in grade and alignment may be made.

In paralleling present water and gas mains, the Contractor shall protect all service connections and shall arrange to furnish service to the consumers with minimum interruption. Door hanger notifications will be furnished by the City and the Contractor shall inform consumers 24 hours in advance of any interrupted service.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

Siltation and erosion. Construction methods that will minimize siltation and erosion shall be employed. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers in or near streams. Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping of soil or debris, or pumping siltladen water into the stream. Specifications shall require that clean-up, grading, seeding, planting, or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven (7) days.

3. Classification of Excavated Material. When specifically indicated in the proposal and contract, classification of excavated materials will be made as follows:

- a. Rock. Rock excavation will be so classified when sandstone, limestone, blue shale or other similar material is encountered and, in the opinion of the Engineer, requires drilling or blasting to remove the material.
  - b. Earth. All material not classified as rock.
4. Clearing. The Contractor shall do all clearing necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.
  5. Unauthorized Excavation. Any part of the trench excavated below grade shall be corrected with material approved by the Engineer placed and compacted by the Contractor.
  6. Dewatering. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during sub-grade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.

All excavations for concrete structures or trenches which extend down to or below static groundwater elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations a distance of not less than 12 inches below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduit shall be left clean and free of sediment.

7. Sheeting and Shoring. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, or shored as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing and shoring shall be designed and built to withstand all loads that might be caused by earth movement of pressure and shall be rigid, maintaining shape and position under all circumstances.

Trench sheeting shall not be pulled unless pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Sheeting shall not be pulled after backfilling.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

8. Stabilization. Trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Trench bottoms which are otherwise solid but which become mucky on top due to construction operations shall be reinforced with one or more layers of crushed stone or gravel. Not more than 1/2 inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

9. Trench Excavation. The Contractor shall not open more trenching advance of pipe laying than is necessary to expedite the work. One block or 300 feet whichever is the shorter, shall be the maximum length of open trench ahead of pipe laying unless by written permission of the Engineer.

Except where tunneling or boring and jacking is specified and shown on the plan by the Engineer, all trench excavations shall be open cut.

10. Alignment and Grade. The alignment and grade or elevation of the pipeline shall be as shown on the plans.

The Contractor must maintain a constant check of the pipe alignment and trench depth and will be held responsible for any deviations therefrom. Sewers twenty-four inches (24") (61 cm) or less shall be laid with straight alignment between manholes. Straight alignment shall be checked by either using a laser beam or lamping.

11. Limiting Trench Width. Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. Ledge rock, boulders, and large stones shall be removed to provide a clearance of six (6) inches below and on each side of all pipe. These distances are minimum clear distances which will be permitted between any part of the pipe and appurtenances being laid on any part, projection, or point of such rock, boulder, or stone.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one (1) foot above the top of the pipe.

Limiting trench widths below an elevation of one (1) foot above the exterior

top of the installed pipe shall be not less than fifteen (15) inches nor more than twenty-four (24) inches greater than the nominal outside diameter of the pipe.

12. Unauthorized Trench Widths. When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the Contractor's expense.
13. Trench Bottom in Earth. The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to grade 4-inches below bottom of the pipe to be laid. Granular pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length
14. Rock Exploration. Unless shown otherwise on the plans or noted in the Special Provisions, no rock exploration has been made. On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the plans or subsurface information report to determine the approximate location and depth of rock. Resistance to penetration was assumed to be "solid rock". This information is furnished for general reference purposes only.
15. Trench Bottoms in Rock. All rock excavation shall be carried to a minimum of 6 inches below the bottom of the pipe. Granular pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.
16. Mechanical Excavation. The use of mechanical equipment will not be permitted in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand-excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of the type, design and construction and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the

Engineer.

- 17. Stream Crossings. Stream crossings shall be made in accordance with these specifications and as shown on the plans.

The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give minimum cover shown on the plans, Pipe encasement, where required, shall be in accordance with the specifications and placed as indicated on the plans.

- 18. Highway and Railroad Crossings. The Contractor shall make highway and railroad crossing in accordance with these specifications, the Special Provisions and as shown on the plans.

All construction or work performed and all operations of the Contractor, his employees, or his subcontractors within the limits of highway or railroad right-of-ways shall be in conformity with all the requirements, regulations and be under the control of the authority owning or having jurisdiction over and control of the right-of-way. All notifications of the owning authority shall be through the Engineer

The Contractor shall pay fees and obtain permits to make the crossings unless otherwise directed.

3014 HANDLING:

Handle pipe materials and fittings in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements and coatings. In handling plastic pipe of ten (10) feet in length or greater, a double sling will be required unless otherwise approved by the Engineer.

Materials shall be shipped, moved and stored with provisions to prevent movement or shock contact with adjacent units.

3015 INSTALLATION:

- A. All work shall be in accordance with the following standards:

Flexible Thermoplastic Pipe; ASTM C600  
Ductile Iron Water Mains; AWWA C600

- B. Utilize equipment, methods and materials insuring installation to lines and grades indicated.

- 1. Maintain the following tolerances from true alignment and grade between manholes:

Alignment 3 inches

Grade +- 1

inch

Joint deflection shall not exceed the maximum allowable deflection per joint according to ASTM C 425, ASTM C 594 and AWWA C 600. Only one correction for alignment and/or grade shall be made between adjacent manholes.

2. Except where pipe sections are being encased in concrete, no pipe is to be supported by blocks.
- C. Install pipe of size, material, strength class, and joint type with embedment as shown on the Plans.
- D. Insofar as possible, commence laying at downstream end of line and install pipe with spigot or tongue end downstream.
- E. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation. Close open ends of pipe with snug fitting closures. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.
- F. Install pipe only when weather and trench conditions are suitable. Do not lay pipe in water. Brace or anchor pipe as required preventing displacement after establishing final position.
- G. Ledge rock, boulders, and large stones shall be removed to provide a minimum clearance of four inches (4") (10 cm) below and on each side of all pipe(s).

#### 3016 PIPE BEDDING:

The sewer trench shall be carried to a point not less than two (2) inches below bottom of pipe bell, or less than four (4) inches below bottom of pipe barrel, whichever is greater. Crushed stone pipe bedding, compacted to full width of trench, shall then be placed and compacted to bottom of pipe with proper allowance for bell joints or couplings. After each length of pipe being laid has been shoved "home" and placed in proper alignment, it shall be securely anchored and held in position by crushed stone backfill extending to a point not less than six (6) inches above the top of the pipe bell or coupling. If unstable subgrade conditions are encountered and it is determined by the Engineer that the bedding specified will not provide suitable support for the pipe, additional excavation to the limits determined by the Engineer will be required. This additional excavation shall be backfilled with crushed stone material approved by the Engineer.

Rigid pipe. Bedding Classes A, B, C, or crushed stone, as described in ASTM C12, shall be used and carefully compacted for all rigid pipe provided the proper strength pipe is used with the specified bedding to support the anticipated load based on the type of soil encountered and potential groundwater conditions.

Composite pipe. Except as described in ASTM D2680, the bedding, haunching, and initial backfill requirements for composite pipe shall be the same as for plastic pipe.

### 3017 JOINTING:

#### A. General Requirements.

1. Locate joints to provide for differential movement at changes in type of pipe embedment, concrete collars, and structures. Support pipe from wall of manhole at first joint in normal sewer trench with concrete cradle structurally continuous with base slab or footing.
2. Clean and lubricate all joint and gasket surfaces with lubricant recommended by pipe manufacturer.
3. Utilize methods and equipment capable of fully homing or making up joints without damage.
4. Check joint opening and deflection for specification limits.
5. Examine each piece of pipe prior to installation for soundness and specification compliance.

#### B. Provisions for Jointing Ductile Iron Pipe.

1. Conform with AWWA C 600.
2. Paint suspected damaged portions with turpentine and dust with cement to check for cracks. Remove turpentine and cement by washing when crack test is satisfactorily completed. If cracks are found, the pipe shall be rejected.
3. Check gasket position and condition after assembly prior to installation of next pipe section.

C. Provisions for Jointing PVC Pipe. Check gasket for position and condition after assembly prior to installation of next pipe section.

D. Provisions for Jointing HDPE Pipe. Connection shall be made in conformance with manufacturer's recommendations.

### 3018 CUTTING:

Cut in neat workmanlike manner without damage to pipe. Observe specification regarding joint locations. Smooth cut by power grinding to remove burrs and sharp edges. Repair lining as required and approved.

### 3019 TEMPORARY PLUGS:

A. Plugs. Provide and install plugs as manufactured by pipe supplier or as fabricated by Contractor if approved. Plugs shall be water-tight against heads up to 20 feet of water. Secure plugs in place in a manner to facilitate removal when required to connect pipe.

B. Location. Plugs shall be installed as specified or where shown on Plans. Also the

open end of the sewer shall be plugged at the end of the work day with a suitable mechanical plug to prevent entry of foreign material until work is resumed.

3020 CONNECTIONS TO EXISTING PIPELINES AND STRUCTURES:

- A. Connect pipe to existing structures and pipelines where indicated. Observe pertinent articles of specifications pertaining to joint locations.
- B. Openings in manhole sections for sewer connections shall be core-drilled and shall be done to produce a smooth, uniform, cylindrical hole of proper size to accommodate a resilient connector meeting requirements of ASTM C 923. The resilient connectors shall be either Fernco or PSX Gasket or approved equals. Any additional holes cut in the field shall be drilled with a core-drill or in a manner approved by the Engineer.
- C. Manholes to be built on an existing sewer shall be constructed in such a manner as will not disrupt service of the existing sewer. The manhole base, walls and invert shall be completed before the top half of the sewer pipe is cut or broken away. Rough edges of the pipe thus exposed shall be covered with expansive grout, in such a manner as to produce a smooth and acceptable finish. Any portion of the existing sewer damaged by the Contractor shall be repaired or replaced at no expense to the City.
- D. Connections between pipes shall be made using a proprietary transition coupling or stainless steel Fernco gasket or approved equal, unless otherwise specified on the Plans.

Service connections. Service connections to the sewer main shall be watertight and not protrude into the sewer. If a saddle type connection is used, it shall be a device designed to join with the types of pipe which are to be connected. All materials used to make service connections shall be compatible with each other and with the pipe materials to be joined and shall be corrosion proof.

3021 TRENCH BACKFILL:

- A. **Traditional Backfill.** Compacted backfill shall be required for the full depth of the trench above the embedment where beneath structures, street, road, or highway right-of-way, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work.

Final backfill shall be of a suitable material removed from excavation except where other material is specified. Debris, frozen material, large clods, stones, organic matter, or other unstable materials shall not be used for final backfill within two feet (2') (0.6 m) of the top of the pipe.

The top portion of the backfill beneath established sod areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. Topsoil shall be approved by the Engineer prior to placement, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to

dumping and spreading topsoil, the surface shall be loosened by disking or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

At the option of the Contractor, compacted backfill may be job-excavated material or material obtained off site, except that all street crossings shall be backfilled with MoDOT Type I rock, four (4) feet back of curb to four (4) feet back of curb, unless authorized by the City Engineer. Job-excavated material may be used for compacted backfill (outside of Street Right of Ways) when the job-excavated material is finely divided and free from debris, organic material, cinders, or other corrosive material, and stones larger than three (3) inches in greatest dimension. Large masses of moist, stiff clay shall not be used. Job-excavated material shall be compacted to ninety-five (95) percent of maximum density at optimum moisture content as determined by ASTM D698 when the test is appropriate, or to seventy (70) percent relative density as determined by ASTM D2049 when that test is appropriate.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The combination of the thickness of the layer, the method of compaction and the type of compaction equipment used shall be at the discretion of the Contractor subject to obtaining the densities as specified above.

Backfill shall not be placed when material contains frost, is frozen, or a blanket or snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind.

Trench backfill above pipe embedment in locations other than those specified shall be compacted to ninety (90) percent of maximum density at optimum moisture content as determined by ASTM D698, unless otherwise permitted by the Engineer.

Uncompacted earth backfill material to be placed above embedments shall be free of brush, roots, rocks more than two (2) inches in diameter, debris, cinders, or other corrosive material, and junk, but may contain rubble and debris from rock excavation, stones, and boulders in certain portions of the trench depth. Uncompacted backfill material above embedments may be placed by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on and which will not result in displacement of installed pipe. Uncompacted backfill shall be placed to the extent necessary to prevent excessive future settlement.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of loose backfill above pipe embedment.

No un-compacted trench backfill material containing rocks, or rock excavation detritus, shall be placed in the upper eighteen (18) inches of the trench except with specific permission of the Engineer, nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and so arranged that no interference with backfill settlement will result.

All excess bedding rock and other excavation debris shall be removed from surface before final grading can be accepted for seeding or sodding.

**B. Flowable Fill is an acceptable Backfill material. Refer to Specification 2000 for Flowable Fill requirements.**

**3022 STRUCTURE BACKFILL:**

Backfill around structures shall be compacted to the extent necessary to prevent future settlement by tamping or other means acceptable to the Engineer.

Material for backfill shall be composed of earth only and shall contain no wood, grass, roots, broken concrete, stones, trash, or debris of any kind. No tamped or otherwise mechanically-compacted backfill shall be deposited or compacted in water.

No backfill shall be placed over or around any structure until the concrete or mortar therein has attained a minimum strength of 2000 psi and can sufficiently support the loads imposed by the backfill without damage.

The Contractor shall use utmost care to avoid any wedging action between the side of the excavation and structure that would cause any movement of the structure. Any damage caused by premature backfill or by the use of equipment on or near a structure will be the responsibility of the Contractor.

Backfill shall be placed and compacted on all sides of the structure simultaneously, and operations shall be so conducted that the backfill is approximately the same elevation on all sides of the structure.

No excavated rock larger than four (4) inches maximum dimension shall be placed within one (1) foot of the exterior surface of any structure.

**3023 DENSITY TESTING:**

At the option of the Engineer, in-place field density testing to determine compliance with specified compaction requirements may be performed using a nuclear moisture-density measuring device. Such testing shall be performed in trenches with no more than one (1) foot lifts. The field testing results shall be immediately available to the inspector. If, as a result of this field testing, the engineer determines that further compaction is required, the Contractor shall revise his compaction procedures to obtain the results specified.

**3024 DRAINAGE MAINTENANCE:**

Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially-filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

### 3025 PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES:

Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. When the grade of the ditch exceeds one (1) percent, ditch checks shall be installed. Unless otherwise shown on the drawings or directed by the Engineer, ditch checks shall be concrete. Ditch checks shall extend not less than two (2) feet below the original ditch or water course bottom for the full bottom width and at least eighteen (18) inches into the side slopes and shall be at least twelve (12) inches thick.

### 3026 DISPOSAL OF EXCESS EXCAVATED MATERIALS:

Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site or work.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk, and debris encountered in excavation work and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavation located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly. Drag with blade machine or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the contractor.

### 3027 SETTLEMENT:

The Engineer may perform periodic inspections to insure that no settlement has occurred. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within two (2) years of time after final acceptance of the contract under which the work was performed.

The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after notice from the Engineer. Should the Contractor fail to make such repairs the City Engineer may cause repairs to be made and the cost of these repairs shall be the responsibility of the Contractor. Within sixty (60) days of the expiration of the Warranty period, an inspection will be held by the Owner. The Contractor is invited to attend the Inspection

### 3028 PROTECTION OF DRINKING WATER SUPPLIES:

- A. Cross Connections Prohibited. There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any wastewater or polluted water into the potable supply. No water pipe shall pass through or come in contact with any part of a sewer manhole.
- B. Relation to Water Works Structures.

1. While no general statement can be made to cover all conditions, it is recognized

that sewers shall meet the requirements of 10 CSR 23-3.010, Rules of the Missouri Department of Natural Resources, with respect to minimum distances from public water supply wells or other water supply sources and structures.

2. All existing water works units, such as basins, wells, or other treatment units, within two hundred feet (200') (60 m) of the proposed sewer shall be shown on the engineering plans.

### C. Relation to Water Mains.

#### 1. Horizontal and vertical separation.

- A. Sewer mains shall be laid at least ten feet (10') (3.0 m) horizontally from any existing or proposed water main. The distances shall be measured edge-to-edge. In cases where it is not practical to maintain a ten-foot (10') (3.0 m) separation, the department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such a deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one (1) side of the sewer and at an elevation so the bottom of the water main is at least eighteen inches (18") (46 cm) above the top of the sewer.
- B. If it is impossible to obtain proper horizontal and vertical separation as described above for sewers, the sewer must be constructed of slip-on or mechanical joint pipe or continuously encased and be pressure tested to one hundred fifty pounds per square inch (150 psi) (1,034 kPa) to assure watertightness.
- C. Manholes should be located at least ten feet (10') (3.0 m) horizontally from any existing or proposed water main.

#### 2. Crossings.

- A. Sewers crossing water mains shall be laid to provide a minimum vertical distance of eighteen inches (18") (46 cm) between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.
- B. When it is impossible to obtain proper vertical separation as stipulated above, one (1) of the following methods must be specified:
  - (I) The sewer shall be designed and constructed equal to water pipe and shall be pressure tested to assure watertightness prior to backfilling; or
  - (II) Either the water main or sewer line may be continuously encased or enclosed in a watertight carrier pipe which extends ten feet (10') (3.0 m) on both sides of the crossing, measured perpendicular to the water main. The carrier pipe

shall be of materials approved by the department for use in water main construction.

3029 LOCATION TRACER WIRE SYSTEM AND DETECTION MARKING TAPE:

Tracer wire shall be installed on all service lines between the mainline and two-way cleanout within the public right-of-way per Section 9100 Tracer Wire Pipe Detection System.

3030 CLEANOUTS:

A two-way cleanout shall be installed on proposed service lines near the edge of the right-of-way. The service line shall be stubbed approximately 5 feet beyond the cleanout from the main. The riser pipe and threaded cleanout adapter fitting shall match service line pipe size and material. Cleanout cover and frame shall be Neenah R-1976, or approved equal, color coded green, and shall rest on a 4" thick concrete support pad, top of pad being 8" from the surface grade. Tracer wire shall be terminated within the cleanout frame per detail D30-6.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Specification 2000 – Concrete**

- Proposed 08-24-2023
- Comments/Questions Received: None
- Public Informational Meeting – None
- Adopted 09-24-2023

## SECTION 2000 CONCRETE

2001 SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work.

### 2002 GENERAL.

All cast-in-place concrete shall be accurately formed, and properly placed and finished as shown on the drawings and specified herein. The Contractor shall inform the Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

### 2003 MATERIALS.

All material used in the manufacture of concrete shall conform to the following:

- A. Concrete Control and Quality. The current editions of the “2023 KCMMB Concrete Material Specification” and/or “2023 KCMMB Ternary Concrete Material Specification” issued by the Kansas City Metro Materials Board (KCMMB) are made a part hereof by reference. However, when the provisions of such "Bulletins" and "Sections" differ from these specifications, the provisions of this Specification shall govern.
- B. Concrete. Concrete for use in construction shall conform to the requirements of Sections 2005 and 2006.
  1. Cementitious Materials: The total mass of cementitious materials shall be a minimum of 600 pounds per cubic yard of concrete. Mix designs shall use ASTM C-150 Type I, II, I/II or III Portland Cement. When used, ASTM C595 Type IL cement shall be substituted on a pound for pound basis for Portland Cement. For the purposes of this specification, Type IL cement is not considered a binary cement.
  2. Coarse Aggregate: Coarse Aggregate sources shall meet the requirements of KCMMB specification section 2. Coarse aggregates shall meet the gradation requirements of the current ASTM C33. The acceptable gradation sizes shall be number 1 through 7, 56, 57, 67, 357 or 467. Mix designs shall specify the gradation designation. Maximum Coarse Aggregate size within mixes shall be as defined within section 2006 of this specification.

Aggregates in mixes must be proportioned to have a minimum of 55% coarse aggregate by weight.
  3. Fine Aggregate and Mixing Water: Fine aggregate shall meet the requirements set forth in the current ASTM C33. The percentage by weight of clay lumps and friable particles shall not exceed 0.25%. The percentage by weight of material passing the no. 200 sieve shall not exceed 2%. The percentage by weight of coal and lignite shall not exceed 0.25%. Soundness shall be determined using magnesium sulfate.

3. Admixtures.  
Concrete mixes approved for use on projects shall include required admixtures in accordance with the currently approved KCMMB mix design. Requests for admixtures listed as optional on specific mix designs shall be submitted to the Owner and approved by the Owner prior to use on the project. Chemical admixtures shall meet the requirements of ASTM C494. Additionally, any water withheld shall be added to the mix prior to using a superplasticizer.

C. Reinforcing Steel.

1. Bars.  
Bars shall conform to ASTM A615, or ASTM A996.
2. Welded Steel Wire.  
Welded steel wire fabric shall conform to ASTM A-1064.
3. Supporting Elements.  
Representative samples of supporting elements shall be submitted and approved by the Engineer prior to their use in the project.

D. Expansion Joint Fillers.

Expansion joint fillers shall conform to ASTM D-1752-18.

- E. Joint Sealing Compounds. Joint sealing compounds shall be single or multicomponent cold-applied elastomeric joint sealant conforming to ASTM C920-18.

F. Curing Membrane.

All material to be used or employed in curing Portland Cement Concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type (either white or clear) and shall conform to the either ASTM C309-19 or ASTM C1315-19. Application rate and method are to be as prescribed by the manufacturer for applicable conditions.

2004 PRELIMINARY REVIEW.

A report shall be submitted to the Engineer prior to the placement of concrete and shall include data on proposed concrete mix proportions and the fine and coarse aggregate gradation. Mix proportions shall be selected preferably on the basis of field experience and may be adjusted upon approval of the Engineer where required to produce concrete of proper workability, uniform consistency, and acceptable density and strength. The report shall specify whether the “2023 KCMMB Concrete Material Specification” or “2023 KCMMB Ternary Concrete Material Specification” is being used.

A tentative concrete mix shall be designed and tested for each size and gradation of aggregate and for each slump intended to be used on the work. Design quantities and test results of each mix shall be submitted to the Engineer for review and approval.

## 2005 CONCRETE MIX DESIGNATIONS.

The 28-day compressive strength for concrete shall be 5,000 psi and designated as "KCMMB 5K", or shall be 4,000 psi and designated as "KCMMB 4K". Compressive strength shall be determined in accordance with ACI 318. All mix designs shall match an approved mix design by the KCMMB. The mix name shall be listed on the concrete delivery ticket or the concrete will be rejected. The following tabulation indicates minimum strengths for the various types of concrete mix designs (~~MCIB designations~~) that will be accepted.

The following indicates minimum strengths for cast-on place or pre-cast applications:

- pavements – KCMMB 4K
- curbs – KCMMB 4K
- curb and gutter – KCMMB 4K
- sidewalks – KCMMB 4K
- drive approaches – KCMMB 4K
- inlets – KCMMB 4K
- manholes – KCMMB 4K
- reinforced concrete boxes – KCMMB 4K
- bridges – as specified by Design Engineer and approved by Owner

Mixes for High Early Strength Concrete shall meet all of the City of Liberty and KCMMB requirements for standard 4K and 5K mixes (designated as "KCMMB HE") as well any additional requirements for High Early Strength Concrete. When high-early strength cement is to be used for concrete, the mix shall obtain a 7-day strength not less than the minimum 28-day strength specified for concrete of the same class.

## 2006 LIMITING REQUIREMENTS.

Concrete mixes shall meet the following limiting requirements:

- Maximum Slump for Concrete Pavements shall be 2", (+/-) 1"
- Maximum Slump for Concrete Work other than Pavement shall be 4", (+/-) 1"
- Maximum Size Coarse Aggregate of 1"

Use of slumps in excess of those specified shall be only when authorized by the Engineer. The use of water to obtain so-called "improved workability" (adding water with a brush to surface, "flipping") shall not be permitted.

The initial set as determined by ASTM C403 shall be attained 5-1/2 hours, plus or minus one hour, after the water and cement are added to the aggregates. If such use has been approved by the Engineer, the quantity of retarding or accelerating admixture shall be adjusted to compensate for variations in temperature and job conditions.

The total volumetric air content of concrete after placement shall be ~~six and one half (6.5) percent, plus or minus one (1.0) percent~~ as prescribed by KCMMB.

Compressive strength shall be determined by ASTM C39.

As the work progresses, the Engineer reserves the right to change the proportions from time to time if conditions warrant such changes to produce a satisfactory job. Any such changes may be made within the limits of the specifications at no additional compensation to the Contractor.

### 2007 BATCHING AND MIXING.

Concrete shall be furnished by an acceptable ready-mixed concrete supplier and shall conform to KCMMB.

The consistency of concrete shall be suitable for placement conditions. Aggregates shall float uniformly throughout the mass and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

### 2008 PLACEMENT.

The limits of each concrete pour shall be predetermined by the Contractor and shall be acceptable to the Engineer. All concrete within such limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcements, and embedment shall be rigidly secured in proper position and all dirt, mud, water and debris shall be removed from the space to be occupied by the concrete. Bonding surfaces shall be cleaned of all foreign material and shall be free from laitance. Concrete shall not be placed on frozen subgrade or in excavations that have been dewatered.

Placement of concrete shall conform to ~~requirements of MCIB~~ **accepted professional industry and this specification**. Concrete shall be placed within forty-five (45) minutes of mixing operations, with the exception that the Engineer may extend the period to ninety (90) minutes (maximum) dependent upon weather conditions. Concrete shall not be placed in horizontal layers exceeding eighteen (18) inches. During and immediately after placement, concrete shall be thoroughly compacted and worked around all reinforcements and embedment and into the corners of the forms. The concrete shall be vibrated or spaded to produce a solid mass without honeycomb or surface air bubbles.

### 2009 COLD WEATHER CONCRETING.

Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when the descending air temperature in the shade and away from artificial heat reaches 40 degrees F or when forecast to drop below 40 degrees F within 24 hours of placement, and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F.

When concrete work is authorized during cold weather, the aggregates may be heated by methods approved by the Engineer prior to being placed in the mixer. No ingredient that is frozen or contains ice shall be placed in the mixer. The temperature of the concrete shall be not less than 60 degrees F and not more than 80 degrees F at the time of placement in the forms. Under no circumstances shall concreting operations continue when the air temperature is less than 20 degrees F. No concrete shall be placed on frozen subgrade. Sudden cooling of concrete shall not be permitted.

Refer to Section 2011 of this standard for minimum required Cold Weather Curing and Protection measures.

Concrete injured by frost action or freezing weather shall be removed and replaced at the Contractor's expense.

### 2010 HOT WEATHER CONCRETING.

The provisions of this section shall apply to all concrete work that is done when the air temperature is above 80 degrees F at the time of placement.

The temperature of the concrete, when placed, shall not be high enough to cause excessive loss of slump, flash set or cold joints. In no case shall the temperature of the concrete, when placed, exceed 90 degrees F. Forms, reinforcing and subgrade surfaces against which the concrete is to be placed shall be wetted down immediately before placement.

When the air temperature exceeds 90 degrees F and as soon as practicable without causing damage to the surface finish, all exposed concrete shall be kept continuously moist by means of fog sprays, wet burlap, cotton mats, or other means acceptable to the Engineer. This cooling with water shall be in addition to the initial sealing by membrane curing compound.

#### 2011 CURING AND PROTECTION.

Concrete shall be cured by protecting it against loss of moisture, rapid temperature changes and mechanical injury for at least 4 days after placement. Acceptable methods shall be moist curing, waterproof paper, white polyethylene sheeting, liquid membrane-forming compounds, or a combination thereof. After concrete finishing operations have been completed, the entire surface of the newly placed concrete shall be covered by the curing medium applicable to local conditions and acceptable to the Engineer. The Contractor shall have the necessary equipment for adequate curing on hand and be ready to install prior to concrete placement.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire surface of the work and lapped at joints to prevent drying between adjacent sheets.

Waterproof paper or white polyethylene sheets shall be large enough to cover the entire surface of the work and shall be lapped not less than eighteen (18) inches. The sheets shall be adequately weighted to prevent displacement or billowing due to wind. Tear holes appearing in the material during the curing period shall be immediately repaired or replaced with material in acceptable condition.

Clear or white membrane curing compound shall be applied after finishing operations have been completed and immediately after the free water has left the surface. The surface of the work shall be completely coated and sealed with a uniform layer of the curing compound at a rate of not less than one gallon per 150 square feet. The compound shall not be thinned and shall be kept agitated to prevent settlement of pigment. On surfaces where forms are removed prior to the end of the specified curing period, the entire exposed surface shall be coated at the specified rate of coverage. If rain falls on the newly coated surface before the film dries sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply a new coat of compound to the affected area.

During cold weather concreting when the ambient air temperature is expected to drop below 40 degrees F, sufficient supply of burlap, straw, hay, or other blanketing material shall be provided along the work to protect the concrete and maintain a minimum temperature of 40 degrees F in the concrete as measured on the surface. An approved moisture barrier such as wet burlap or plastic sheeting shall be placed on the concrete prior to placement of the blanketing material. This type

of curing shall be maintained for a period of six (6) days as the initial cure.

Sidewalks, curb and gutter, and miscellaneous concrete shall be protected and cured for a period of not less than seventy-two (72) hours after the placing of the concrete by covering with wet burlap or by the application of a membrane curing compound as specified above.

#### 2012 FORMS.

Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement.

Forms may be of wood or metal and shall be designed to permit easy removal without injury to the concrete. Forms for all exterior exposed surfaces which will be visible after backfilling shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms shall be coated with an approved light oil to prevent concrete from adhering and shall be thoroughly cleaned and re-oiled before re-use.

Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete. The following table gives the approximate minimum time that forms shall be left in place.

<u>Average Air Temperature Greater Than</u>		<b>70 Deg</b>	<b>60 Deg</b>	<b>50 Deg</b>	<b>40 Deg</b>
<u>Structural Member</u>		<b>Time in Place (24 Hour Days)</b>			
Slab Shoring		10	12	14	21
Slab Forms		7	7	7	7
Beams Soffits and Shoring		10	12	14	21
Beam Side Forms		1	1	2	3
Wall Side Forms		2	2	3	4

#### 2013 FINISHING FORMED SURFACES.

Fins and other surface projections shall be removed from all formed surfaces except exterior surfaces that will be in contact with backfill. A power grinder shall be used, if necessary, to remove projections and provide a flush surface. Surfaces to be damp-proofed shall have fins removed and tie holes filled, but no additional finishing will be required.

Tie holes in all formed surfaces shall be cleaned, wetted, and filled with patching mortar. Tie hole patches shall be finished flush and shall match the texture of the adjacent concrete.

The surface of all exposed formed exterior surfaces not in contact with backfill shall be finished by rubbing or by other means as directed by the City Engineer.

Sidewalks shall be “picture framed” as depicted in City of Liberty Standard details D22-1 thru D22-5.

#### 2014 REPAIRING DEFECTIVE AND DAMAGED CONCRETE.

Any concrete found not to be formed as indicated on the plans, or out of alignment or level, or having a defective surface, or damaged prior to acceptance of the project by the City, shall be considered as not conforming to the intent of these specifications and may be ordered removed and replaced by the contractor at his expense unless the Engineer authorizes patching of the defective or damaged area. Surface defects such as ridges and bulges shall be removed by grinding. Honeycombed and other defective concrete that does not affect the structural integrity of the structure shall be chipped out and the vacated area shall be filled. The Engineer shall approve the methods used in this type of repair. Material used for patching shall be a non-shrink, non-metallic grout with a minimum 28-day compressive strength of 5000 psi or a similar material approved by the Engineer. Prior to placement of the repair filling, the contact surface of the affected area shall be thoroughly cleaned of all loose and foreign material and shall be coated with an epoxy-bonding agent.

Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing or surrounding concrete. Repair work shall be adequately cured and protected from further damage.

**2015 REINFORCEMENTS.**

The metal reinforcement shall be protected by the thickness of concrete indicated on the construction drawings. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

<b>Location of Reinforcement</b>	<b>Cover in Inches</b>
Surfaces where concrete is deposited directly against the ground.	3
Formed surfaces exposed to the ground, to water, or to weathering.	2
Beams, girder, and columns not exposed to ground, water or weathering.	1 ½
All surfaces other than those above.	1

Reinforcing steel shall be accurately placed and positioned on supports, spacers, hangers, or other reinforcing steel as approved by the Engineer and shall be secured in place with wire ties or suitable clips. The minimum clear distance between parallel bars shall not be less than 1-2 times the diameter of round bars, except that in no case shall clear spacing between parallel bars be less than 2 inches or less than 1-2 times the nominal size of the coarse aggregate.

Splices in reinforcing steel will not be permitted at points of maximum stress. When it becomes necessary to splice reinforcing steel at points other than those shown on the contract drawings, the Engineer shall approve the character and location of the splice. Welding or tack welding of reinforcement will not be permitted. Reinforcements upon which unauthorized welding has been done shall be removed and replaced as directed by the Engineer. Spliced bars shall be placed in contact and securely tied together.

Metal reinforcement at the time concrete is placed shall be free from rust, scale, or other contaminants that will destroy or reduce the bond.

**2016 CONSTRUCTION JOINTS.** Construction joints shall be made at locations indicated on the drawings or specified, and shall conform to the requirements of ACI 318. When the Contractor desires to make construction joints at other locations, he shall anticipate such changes far enough in advance of the construction operations to allow the Engineer to investigate such changes and approve additional construction joints.

Sidewalk joints shall be “picture framed” in accordance with City of Liberty Standard details D22-1 thru D22-5.

#### 2017 EXPANSION AND CONTRACTION JOINTS.

Expansion and contraction joints shall be at locations and depths indicated on the drawings (details).

Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the concrete. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. Sawed joints shall be constructed by sawing through the surface of the concrete with an approved concrete saw. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to prevent excessive raveling.

Expansion joints shall be formed with pre-formed expansion joint filler of the non-extruding and resilient types which shall include the following; Cork, self-expanding cork, sponge rubber, cork rubber, and bituminous fiber. These materials shall meet the requirements of ASTM D994, D1751 and D1752.

Sidewalk joints shall be “picture framed” in accordance with City of Liberty Standard details D22-1 thru D22-5.

#### 2018 REINFORCED CONCRETE BOX FORMING SEQUENCE.

Wall forms may be placed the day following the placement of the bottom slab, as long as care is taken to protect the slab against rough or abusive handling of forms and or placing equipment. The actual placement of concrete shall not occur prior to the fifth day after placing the bottom slab. Top forms may be placed with wall forms if the walls and top are to be of monolithic construction, otherwise top forms are not to be placed until the third day after placing the walls. The actual placement of concrete for the top shall not occur prior to the fifth day after placing the walls (for base to top shoring) or until the walls have reached their design minimum of two days after the walls are poured. Wall forms shall remain in place a minimum of two days after the walls are poured. Supports for the top slab shall be left in place according to the schedule shown on page ~~20-5~~, in Section 2012, Forms.

The above guidelines for placing forms for reinforced concrete boxes are based on the use of standard forming procedures and with the use of concrete containing no admixtures to achieve high early strength. Variations in forming techniques and/or the use of high early strength concrete shall only be allowed after the contractor obtains the written approval of the City Engineer.

#### 2019 EXCAVATABLE FLOWABLE FILL.

##### A. Flowable Fill

Flowable Fill is a Controlled Low Strength Material (CLSM) which is often referred to as controlled density fill, flowcrete, liquid dirt or by other various trademark names. For the sake of this specification the terms Flowable Fill and CLSM shall be used interchangeably. Flowable Fill is a self-compacting and self-leveling backfill material that is used in lieu of compacted fill.

##### B. Sources and proportions of CLSM ingredients

Prior to the start of CLSM placement, the CONTRACTOR shall submit a description of the proposed CLSM mixture design. Based on the application, the ENGINEER may require the CONTRACTOR to submit appropriate laboratory or field test data documenting compliance to specified material and or performance properties.

C. Materials

CLSM shall be manufactured with materials conforming to the standards listed below. The ENGINEER shall approve the use of all non-conforming materials. Approval shall be based on documentation that controlled low strength material mixtures manufactured with the non-conforming materials meet the specified plastic and hardened properties and are suited for the intended application.

- Hydraulic Cement - AASHTO M 85 or M 240
- Fly Ash - AASHTO M 295
- Granulated Blast Furnace Slag - AASHTO M 302
- Fine Aggregate - AASHTO M 6
- Coarse Aggregate - AASHTO M 80
- Lightweight Aggregate - AASHTO M 195
- Water - AASHTO M 157
- Chemical Admixtures - AASHTO M 194
- Air Entrainment Admixtures - Approved by the ENGINEER.
- Foaming Admixture - ASTM C 869

D. Flowability

Normal flowable material shall have a flow of 6 to 8 inches tested in accordance with ASTM D6103. Low flowable material shall have a maximum flow of 6 inches. High flowable material shall have a minimum flow of 8 inches. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D6103.

E. Unconfined Compressive Strength for Excavatable CLSM

Excavatability shall be evaluated on the basis of past performance and experience. When past performance records are not available, excavatability shall be evaluated on the basis of unconfined compressive strength tested in accordance with ASTM D4832. Excavatable CLSM shall have a minimum strength of 30 psi. The one-year strength shall not exceed 150 psi. In place of one year test data, the ENGINEER, may approve the CLSM mixture based on sufficient documentation, provided by the ready mix producer, that indicates the strength gain has ceased. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D4832.

F. Permeability

When required, the coefficient of permeability of CLSM shall be specified by the ENGINEER. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D5084.

G. California Bearing Ratio

When required, the CBR value shall be specified by the ENGINEER. The ENGINEER may elect to specify a minimum 28-day compressive strength in place of specifying a

CBR test. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D1883.

H. Penetration Resistance

The ENGINEER may elect to specify a minimum penetration resistance (ASTM C403), hardening time, proof rolling, drop ball test (ASTM D6024), or proof that the CLSM mixture will support an individuals weight. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM C403.

I. Unit Weight

When required, the unit weight shall be specified by the ENGINEER. The manufacturer shall be permitted to select and proportion the ingredients of the CLSM mixture to meet specified requirements. Testing shall be provided as requested by the ENGINEER at no cost to the City, testing shall be in accordance with ASTM D6023.

J. Proportioning

CLSM shall be proportioned by the ready mixed concrete supplier on the basis of field experience and/or laboratory trial mixtures to produce a cohesive and non-segregating mixture meeting the specified properties.

K. Pumpable CLSM

Shall be proportioned to allow transport by pumping methods without segregating or excessive bleeding.

L. Sampling

Sampling shall be provided as requested by the ENGINEER at no cost to the City, sampling shall be done in accordance with ASTM D5971.

M. Air Content

When required the Air Content shall be specified by the Engineer. Testing shall be provided as requested by the Engineer at no cost to the City, testing shall be done in accordance with ASTM D6023.

N. Batch Records

Batch plant recordation or certified batch report should be used when a ready mixed truck is used and when it is not (ie., a volumetric mixer) then such other verification method as the supplier and customer can agree to. Acceptance shall be based on verification that the constituent materials were batched in accordance with the design. Verification shall be by inspection, automated batch plant recordation, or certified batch report. The method of verification shall be approved by the ENGINEER.

O. CLSM Properties

As required by the application, the ENGINEER shall specify acceptance tests for appropriate material properties. The testing frequency shall be specified by the ENGINEER.

P. Batching And Delivery

Material shall be batched and delivered in accordance with AASHTO M 157-86 (1996),

Sections 8, 9, 10 and 11 except the temperature requirements of 11.8 and 11.9 which shall be waived.

Q. Water and Admixture Addition

The addition of water and admixtures on the jobsite is permitted. The amount of water and admixture added shall be recorded. The CLSM mixture shall be mixed for a minimum of 30 revolutions after the addition of the water or admixture.

R. Temperature

Material shall not be placed on frozen ground. The ambient temperature shall be 35 deg F and rising at the time of placement.

S. Standing Water

CLSM may be placed in confined spaces containing standing water.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Specification 2100 – Concrete Curb & Gutter**

- Proposed 08-24-2023
- Comments/Questions Received: None
- Public Informational Meeting – None
- Adopted 09-24-2023

## SECTION 2100 CONCRETE CURB AND CURB AND GUTTER

2101 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct or reconstruct curbing and/or curb and gutter.

2102 MATERIALS. All items of material included in this section shall conform to Section 2000 except as follows:

- A. Concrete Mix. Any substitute mix design shall be approved by the Engineer.
- B. Expansion Material. Expansion material shall be a preformed, one-piece, non-extruding material such as "Bondex" No. 941 pre-formed rubber joint, "Rubatex" both manufactured by Rubatex Co., or "Homex" as manufactured by Homasote Co. or equal. Any substitute material requires the approval of the Engineer.
- C. Joint Sealer. Joint sealer shall be a one component, gun-grade, moisture cured epoxy or urethane such as "Vulcum 45" as manufactured by Maneco International, "Sidaflex 1-A" by Sika Chemical Corporation or "Pecora CG-9" by Pecora Co., or equal as approved by the Engineer.
- D. Curing Membrane. Curing membrane shall be as specified in Section 2003 (F).

2103 CONSTRUCTION DETAILS. The curbing shall be constructed or reconstructed to the configuration and to the lines and grades shown on the plans. Generally the curbing shall be placed prior to the placement of pavement or sidewalk sections, except when curb and gutter is integral with the pavement, and as directed by the Engineer.

- A. Removal of Existing Curbing for Reconstruction. Existing curbing shall be totally removed to the nearest contraction or expansion joint or with the approval of the Engineer it may be sawed provided no free section is left that is less than 5 lineal feet in length, and provided the entire curbing section is sawed a minimum of 2 inches below top of pavement elevation.
- B. Grading and Subgrade Preparation. All excavation or embankment shall conform to Section 1000, Site Preparation and 1200, Subgrade Preparation; and as follows:

The top 6 inches of the subgrade shall be compacted to obtain a density of 95 percent of the maximum in conformance with Section 1205(A).

If during reconstruction operations, additional fill material is needed beneath the curb, it shall be of crushed limestone, placed in lifts of 4 inches not to exceed 12 inches maximum thickness, moistened if necessary, and compacted by mechanical tampers to a density of 95 percent of the maximum.

- C. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than 1/4 inch in horizontal and vertical alignment for each 10 feet in length.
  - 1. General. Face forms will be used with all curb standards as applicable.

Forms shall have a height equal to or greater than the height of the curb section.

The forms shall be set true to line and grade and shall be supported to stay in position while depositing and consolidating the concrete. The forms shall be designed to permit their removal without damage to the concrete. The forms shall be lubricated.

2. Curb Machine. A slip-form curb machine may be used in lieu of forms. The machine must be equipped with mechanical internal vibrators and be capable of placing curb to the correct cross section, line and grade within the allowable tolerances.

2104 JOINTS. The joints shall be formed at right angles to the alignment of the curbing and to the depth specified by the appropriate standard or as modified by the plans.

- A. Expansion Joints. Expansion joints shall be placed at all radius points, driveways, curb inlets, or where directed by the plans or Engineer. In no case shall expansion joints be placed more than three hundred (300') apart.

1. Material. Expansion joints shall be formed by a one piece 3/4 inch thick preformed joint filler cut to the configuration of the correct curb section.
2. Stability. Expansion joints shall be secured in a manner so they will not be disturbed by depositing and consolidation of concrete.
3. Edging. The edges of the joints shall be rounded with an edging tool of 1/4 inch radius.

- B. Contraction Joints. Curbing shall have contraction joints formed at intervals of not less than 10 feet. They shall extend through the entire curb section from the top of the curb to a depth 1 inch below curb surface for tooled joints and 2 inches for sawed joints.

1. Method. Contraction joints may be formed by a template, tooling, or sawing.
  - a. Templates. Templates shall be 1/8 inch metal cut to the configuration of the curbing section. The templates shall be secured at the proper locations so that they will not be disturbed by the depositing of concrete. The templates shall be removed as soon as the concrete has attained its initial set and finished as outlined below.
  - b. Tooling. Tooling of contraction joints will be permitted if done to the depths specified on the appropriate standard. Tooled contraction joints shall be constructed with a 1/4 inch radius on all exposed edges.

- c. Sawing. Sawing of contraction joints is permitted only when a curb machine has been used. The sawing of joints must be completed within 24 hours of the placing of concrete.

2. Joint Sealer. Joint sealer is not required on contraction joints.

2105 CONCRETE WORK. Concrete for curbing shall be placed in accordance with ~~the requirements of MCIB Standard Concrete Specifications~~ **accepted professional industry standards and City of Liberty Specifications**. Expansion and contraction joints shall be constructed as shown on the plans, standards, or where directed by the Engineer.

- A. Concrete Placement. Concrete shall be mechanically vibrated when directed by the Engineer and shall not be allowed to extrude below the forms to cause an irregular alignment of the abutting street pavement.
- B. Finishing. After placing and initial strike-off the curb shall be tooled to the required radii. If the surface of the concrete is sufficiently wet that a ridge is formed at the inside of the radius tool, finishing will cease until the excessive moisture has evaporated.

After initial set, the face forms and templates, if used, shall be removed and the surface finished to the required dimensions. No water, dryer, or additional mortar shall be applied to the free surface of the concrete.

The finished surface of the concrete shall be broomed with a clean broom to provide an antiskid surface.

In all cases the finished curb shall have a true surface, free from sags, twists, or warps, and shall have a uniform color and appearance.

- C. Curing. As soon as practical after the concrete is finished it shall be cured with one of the acceptable liquid curing membranes applied according to the manufacturer's directions.

If front and/or back forms are removed from finished curbing within a period of 72 hours of placement these surfaces shall also be cured.

Wet burlap, cotton mat, waterproof paper, polyethylene sheeting or earth backfill is not an acceptable curing method for curbing.

- D. Protection. The Contractor shall protect the concrete work against damage or defacement of any kind until it has been accepted by the City. Concrete which is damaged or defaced, shall be removed and replaced, or repaired to the satisfaction of the Engineer, at the expense of the Contractor.
- E. Temperature Limitations. Concrete work shall be placed in accordance with requirements of Section 2009 and 2010.

2106 BACKFILL. A minimum of 24 hours shall lapse before forms are removed and curb sections are backfilled unless otherwise approved by the Engineer. Backfill shall be accomplished in accordance with Sections 1100 and 1200 entitled "Site Preparation" and "Subgrade Preparation".

The Contractor shall be responsible for the repair of any street pavement disturbed by the construction to the satisfaction of the Engineer.

2107 JOINT SEALING AND CLEAN-UP. Only the sidewalk portion of the curbing will require joint sealing. An approved joint sealer shall be applied in accordance with the manufacturer's directions within 7 days of the placement of the concrete.

The Contractor shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of construction.

2108 SURFACE TOLERANCES. Curbing shall have a surface tolerance of 1/4 inch in 10 feet when checked with a ten foot straightedge.

2109 REINFORCEMENT (CURB AND GUTTER). Reinforcement for concrete curb and gutter shall be as designated on the Standard Details. The exception to this shall be when the curb and gutter is to be constructed on an asphaltic concrete base with a minimum depth of three (3) inches. In this case, no reinforcement shall be required unless otherwise determined by the City Engineer.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Design Criteria for Street Improvements**

- Proposed 08-24-2023
- Comments/Questions Received: None
- Public Informational Meeting – None
- Adopted 09-24-2023

DESIGN CRITERIA FOR  
STREET IMPROVEMENTS

- A. GENERAL. Proposed street improvements within the City shall conform to the pattern established in the Major Street Plan as adopted by the City of Liberty.

Street improvements shall be designed to conform to applicable codes, regulations, ordinances, and the provisions set forth in these criteria as established by the City of Liberty. Plans for said improvements shall be submitted to the City Engineer for approval and shall include all information as may be required or described hereinafter.

- B. FUNCTIONAL CLASSIFICATION OF STREETS. The classification of streets shall be generally defined as follows:

1. Local Streets. A street designed to provide access to abutting property from collector and arterial streets.
2. Collector/Commercial Streets. Streets, which, in addition to serving abutting properties, intercept local streets, connect with community facilities and carry neighborhood traffic to the arterial street systems. Commercial streets serve areas predominately zoned for commercial or industrial uses.
3. Arterial Streets. A street or road of considerable continuity which serves or is intended to serve as a principal trafficway between separated areas or districts and which is the main means of access to the collector street system, highways or expressways.

- C. STREET DESIGN STANDARDS.

	ARTERIAL		COLLECTOR	LOCAL
	<u>Major</u>	<u>Minor</u>	<u>2-Lane*</u>	<u>2-Lane</u>
Right-of-Way Width (ft)	120	100	64	54
Street Width(ft)	62' min.	40' min	30' min.	26' min.
Median Width(ft)	15' min.	-0-	-0-	-0-
Minimum Pavement Depth - Asphaltic Concrete (inches)	10.5	10.5	8.5	6.5
Minimum Depth Crushed Aggregate Base (inches)	6	6	6	6
Design Volume (VPD) Range	24,000 – 36,000	12,000 - 24,000	1,500 – 12,000	Less than 1,500
**Design Speed (MPH)	50	35	30-35	25-30
Maximum Grade	6%	6%	8%	10%
Minimum Grade	1%	1%	1%	1%
Curb Return Radius	See Section S of this Standard	See Section S of this Standard	See Section S of this Standard	25'

Minimum Radii Horizontal Curve	1300'	700'	300'	185'
Minimum K Crest Vertical Curve	110-150	60-80	30	20
Minimum K Sag Vertical Curve	90-110 (55 w/lights)	60-70 (35 w/lights)	50 (20 w/lights)	30 14 (w/lights)
Minimum Private Curb Cut Spacing (ft)	350'	One per Property	One per Property	One per Property
Minimum Distance from Intersection of R.O.W. to curb cut (ft.)	250	200	150	25
***Sidewalk width(ft)	5	5	5	5
Parking Permitted	No	No	One Side Only	One Side Only
Storm Sewers	Yes	Yes	Yes	Yes
Curb & Gutter	CG-1	CG-1	CG-1	CG-1
Pavement Markings	Yes	Yes	Yes	No
Turn Lanes	Required	Required	Required (at significant intersections)	Not Required

\* Also applicable to commercial streets.

\*\* Design Speed criteria for horizontal and vertical alignment should meet the requirements of the current edition of "A Policy on Geometric design of Highways and Streets, AASHTO".

\*\*\* Both sides of roadway.

- D. OFF-CENTER STREET INTERSECTIONS. Off-center street intersections shall be separated by a minimum centerline to centerline distance of one hundred and fifty feet (150).
- E. INTERSECTION VERTICAL ALIGNMENT. In all cases where a higher functional street intersects with a lower functional street, normal street crown shall be maintained on the higher functional street. Where streets of equal function intersect, street grades shall coincide in the center of the intersection with reduced rideability for both streets, or a warping of the cross slope for both streets. (Design Aid No. 5)
- F. MINIMUM ANGLE OF INTERSECTION. It is desirable for all intersections to meet at approximately a 90 degree angle. Skewed intersections should be avoided, and in no case should the angle be less than 60 degrees.
- G. MAXIMUM GRADIENT. The maximum gradient for streets as noted in Section C may be exceeded only upon written approval of the City Engineer. Such approval will only be granted in unusual cases where grades within the acceptable limits cannot be obtained.
- H. GRADING GRADIENTS. The finished grade within the limits of the right-of-way shall slope from one-quarter (1/4) inch vertical to one (1) foot horizontal minimum, to one-half (1/2) inch vertical to one (1) foot horizontal maximum measured above the back of the curb. The grading gradients may be varied only upon written approval of the City Engineer.

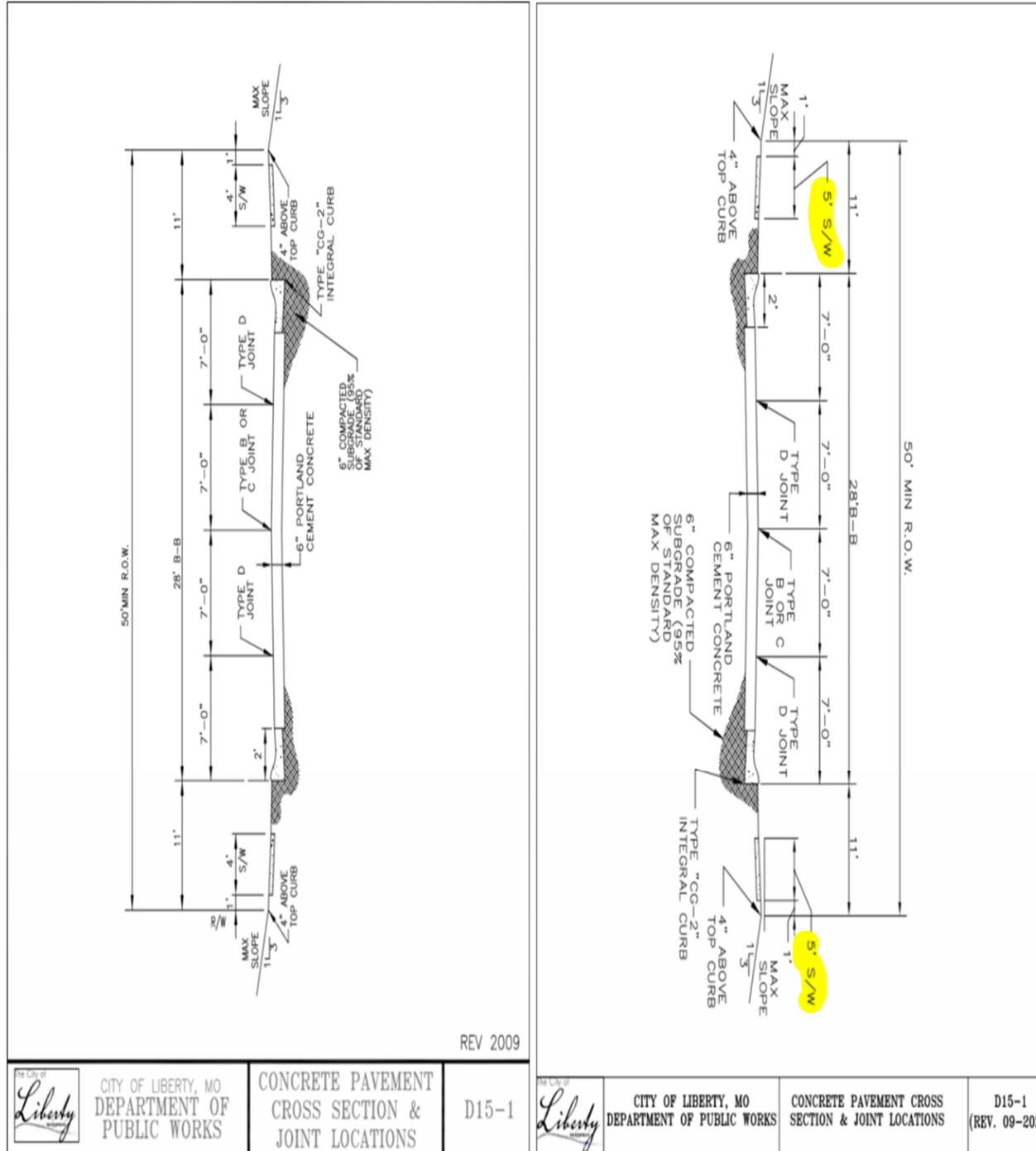
- I. TANGENT LENGTH. The minimum tangent length between reverse curves shall be fifty (50) feet for local streets and one hundred (100) feet for collector/commercial and arterial streets, except that no tangent will be required for radii longer than five hundred (500) feet.
- J. CONNECTIONS TO EXISTING PAVEMENTS. Where a new street is to connect to an existing street, all deteriorated or cracked asphalt within five (5) feet of the connection point shall be removed to a point where sound material is found. If full-depth pavement removal is required the subgrade will be recompacted to 95% of standard density.
- K. STORM DRAINAGE. All storm drainage works constructed in connection with street improvements shall be designed in accordance with the City of Liberty Design Criteria for Storm Sewers and Appurtenances.
- L. CUL-DE-SACS. At locations where streets are to be terminated and a vehicular connection between adjacent streets is not required a cul-de-sac may be permitted. Such cul-de-sac shall be constructed with a minimum radius of thirty-nine (39) feet to the back of the curb.
- M. TEMPORARY TURN-AROUNDS. At locations where streets are to be temporarily terminated which will be extended at a later date, and said street extends beyond the intersection of an adjacent street more than five (5) lots, a temporary cul-de-sac shall be constructed with a minimum radius of thirty-five (35) feet. The temporary cul-de-sac shall be constructed of asphaltic concrete with a minimum depth of six (6) inches. Curb and gutter will not be required. The cul-de-sac shall be constructed within the limits of a permanent construction easement.
- N. MONUMENT BOXES. Monument boxes conforming to the Standard Drawings shall be installed at all quarter section corners and any other monuments involved in the street construction.
- O. OTHER DESIGN CRITERIA. All other street design elements not contained within this criteria shall be in accordance with the most current edition of "A Policy on Geometric Design of Highways and Streets" authored by the American Association of State Highway and Transportation Officials (AASHTO) or other applicable AASHTO design guides.
- P. DRIVEWAY ELEVATIONS. Driveways shall attain top of curb elevation within the right-of-way. Driveway grades within right-of-way shall be 8% maximum until curb height is reached. Break over grades for crest drives shall be 8% maximum and sag drives shall be 12% maximum. Driveway elevation shall not be more than 6" above or below the normal shoulder elevation at the right-of-way line, to allow for a smooth sidewalk profile.
- Q. DRIVEWAY WIDTHS: Residential driveways shall have a minimum driveway width of 10' and a maximum of 20'. A lot having two (2) driveway access points (i.e. circle drive) must have at least 100' width at the right-of-way line. An existing driveway may be replaced at its existing width.
- R. SIGNAGE. Street name and regulatory traffic signs conforming to the Standard Drawings shall be furnished and installed at the appropriate locations in connection with the street improvement. All regulatory signage shall be in conformance with MUTCD requirements and shall be approved by the City Engineer.

- S. Curb Return Radius. The minimum curb return radius for local streets shall be as defined within section C of this standard. For Collector and Arterial Streets (minor and major) the minimum curb return radius shall be as determined by a Semi-Trailer Truck Turning Template (WB-67 minimum).

**RECENTLY ADOPTED REVISIONS/AMENDMENTS**

**Detail D15-1**

- Proposed 08-24-2023
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 09-24-2023





**Detail D80-2**

- Proposed 12-11-2023
- Comments/Questions Received – None Currently Received
- Public Informational Meeting – None Currently Scheduled
- Adopted 01-11-2024

<p>STREET PLATES MUST BE SECURED INTO THE PAVEMENT. DETERMINATION OF THE DEPTH, NUMBER AND PLACEMENT OF ANCHORS IS THE CONTRACTORS RESPONSIBILITY.</p> <p style="text-align: center;"><b>STREET PLATE DETAIL (N.T.S)</b></p>	<p><b>GENERAL NOTES:</b></p> <ol style="list-style-type: none"> <li>1. USAGE OF STREET PLATES BETWEEN NOVEMBER 1<sup>ST</sup> TO APRIL 1<sup>ST</sup> SHALL ONLY BE WITH THE WRITTEN PERMISSION OF THE DIRECTOR OF PUBLIC WORKS OR THEIR DESIGNEE.</li> <li>2. ALL STREET PLATES USED BETWEEN NOVEMBER 1<sup>ST</sup> TO APRIL 1<sup>ST</sup> SHALL BE EMBEDDED.</li> <li>3. WHEN APPROVAL FOR STREET PLATES IS NOT GRANTED BETWEEN NOVEMBER 1<sup>ST</sup> TO APRIL 1<sup>ST</sup> OPENINGS SHALL BE FLUSH FILLED WITH CONCRETE AS TEMPORARY PAVING.</li> <li>4. STREET PLATES SHALL BE PLACED:             <ol style="list-style-type: none"> <li>a. IN A SECURE MANNER;</li> <li>b. TO MINIMIZE NOISE GENERATED BY TRAFFIC TRAVELING OVER THEM;</li> <li>c. TO MINIMIZE THE EFFECT ON TRAFFIC.</li> </ol> </li> <li>5. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING STREET PLATE(S):             <ol style="list-style-type: none"> <li>a. REMAIN IN PLACE OVER THE OPENING;</li> <li>b. DOES NOT ROCK;</li> <li>c. DOES NOT GENERATE NOISE;</li> <li>d. HAVE A NON SKID SURFACE;</li> <li>e. FULLY SUPPORTS ALL APPLIED LOADS FOR THE LENGTH OF TIME THE PLATE(S) ARE IN PLACE;</li> <li>f. ANCHORS ARE APPROPRIATELY PLACED FOR THE INTENDED SPANS, LOADS AND DURATION.</li> </ol> </li> <li>6. EACH ABUTTING PLATE SHALL BE SECURED SEPARATELY.</li> <li>7. ALL STREET PLATE(S) SHALL BE CONSPICUOUSLY MARKED WITH THE OWNERS NAME AND TELEPHONE NUMBER.</li> <li>8. CONTRACTOR TO PLACE A WARNING SIGN STATING "STEEL PLATE AHEAD" AT LEAST THREE HUNDRED (300) FEET BEFORE THE STREET PLATE. SIGN TO BE MUTCD W8-24 OR APPROVED EQUAL AND SIZED FOR THE APPROPRIATE SPEED LIMIT.</li> </ol>
<p>EMBEDDED PLATES SHALL MATCH THE ROADWAY SURFACE IN PROFILE, CONTOUR AND ELEVATION. PLATES MUST BE SECURED INTO THE PAVEMENT. ANCHORS MUST BE FLUSH WITH THE PLATE SURFACE. DETERMINATION OF THE DEPTH, NUMBER AND PLACEMENT OF ANCHORS IS THE CONTRACTORS RESPONSIBILITY.</p> <p style="text-align: center;"><b>EMBEDDED STREET PLATE DETAIL (N.T.S)</b></p>	

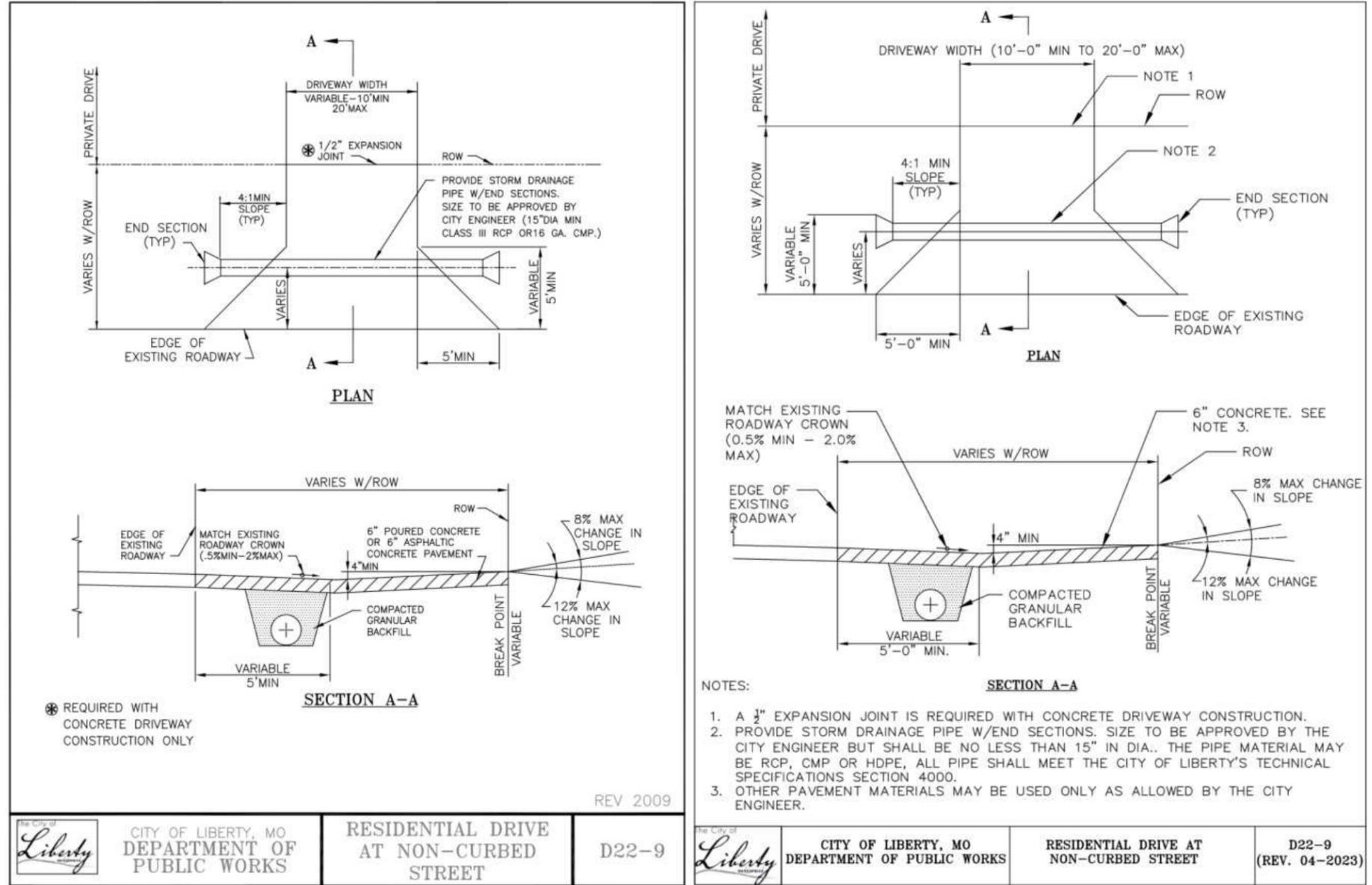
D80-2  
(REV. 12-2023)

STREET PLATE DETAIL

CITY OF LIBERTY, MO  
DEPARTMENT OF PUBLIC WORKS

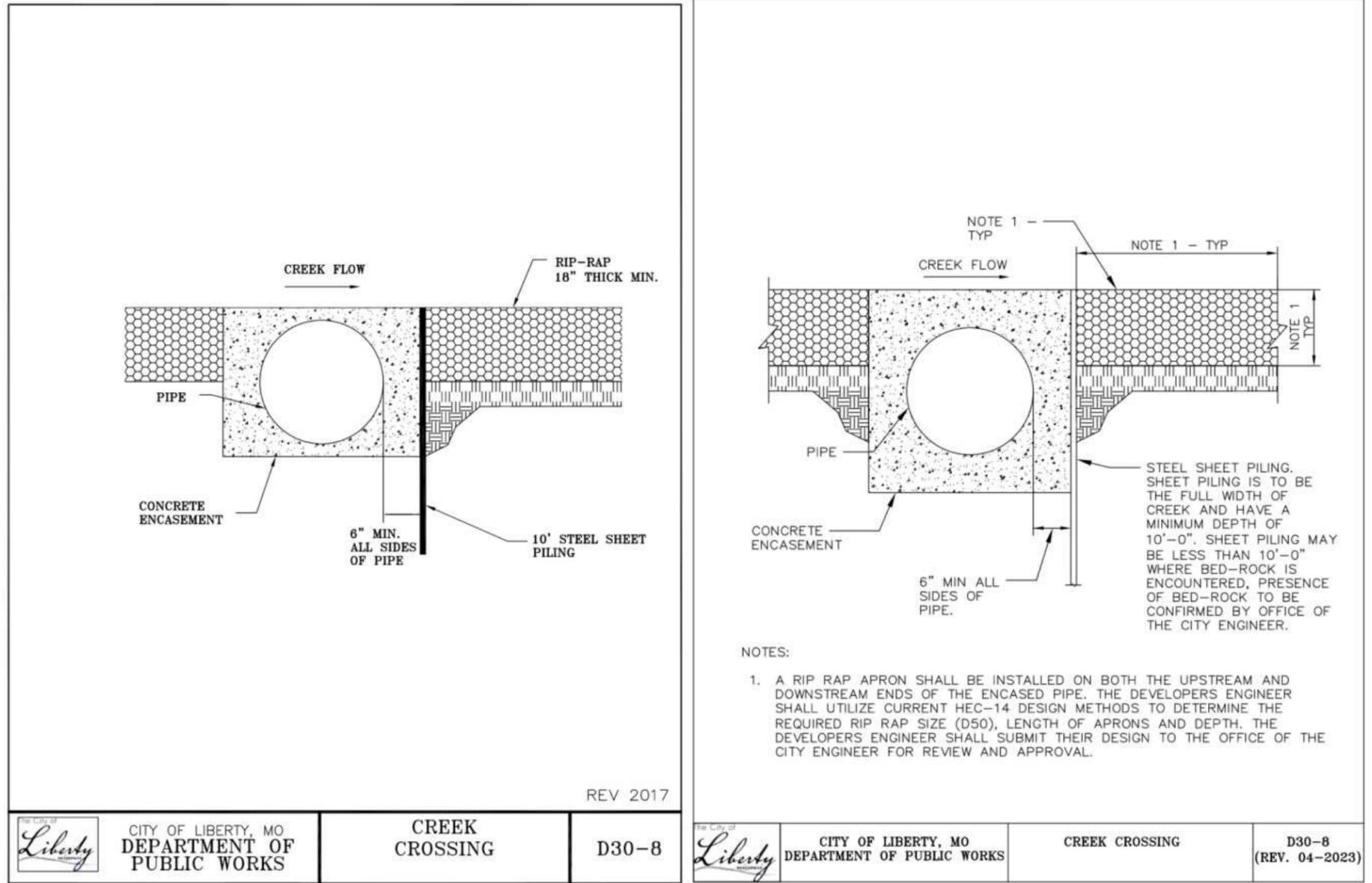
**D22-9 Residential Drive at Non-Curbed Street**

- Proposed 04-15-2024
- Comments/Questions Received – None Currently Received
- Public Informational Meeting – None Currently Scheduled
- Adopted 05-15-2024



**D30-8 Creek Crossing**

- Proposed 04-15-2024
- Comments/Questions Received – None Currently Received
- Public Informational Meeting – None Currently Scheduled
- Adopted 05-15-2024





## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### Section 8000 Restoration of Surface Construction

- Proposed 04-15-2024
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 05-15-2024

## SECTION 8000 RESTORATION OF SURFACE CONSTRUCTION

8001 SCOPE This section covers restoration of concrete and asphalt pavement, gravel surfacing, walks, drives, curbs, and other surface construction removed or damaged during construction.

8002 GENERAL. All pavement or other surface construction which is removed or damaged during the progress of the work shall be restored to its original or better condition by the Contractor. All restoration work shall be subject to acceptance by the Engineer and the Owner or the agency having jurisdiction thereof. All materials used for restoration work shall be new.

8003 REFERENCE STANDARD. Materials and construction methods, as referred to herein, shall conform to all applicable sections of these technical specifications.

8004 PAVEMENT REPLACEMENT. The replacement of all street surfacing shall be in accordance with the pavement replacement detail shown on the Standard Detail. The replacement concrete and asphalt pavement shall be composed of a concrete base course at least seven (7) inches thick and an asphaltic concrete overlay at least two (2) inches thick. New concrete base shall set on a bench of undisturbed subgrade material extending at least 3' beyond the limits of the excavation area. Materials and workmanship shall conform to the following:

Concrete	As specified in Section 2000
Asphaltic Concrete	As specified in Section 1400
Trench Backfill	MoDot Type 1 granular material

All drives, parking areas, and other pavement or asphalt surfaces which are removed or damaged shall be replaced to at least their original thickness. Materials used shall be new and shall match the existing surfacing as closely as possible in type, kind and quality.

8005 CONCRETE WALKS. Concrete walks removed in connection with, or damaged as a result of, construction operations shall be replaced with new construction. Any replaced walk that intersects a street shall have an ADA ramp installed per Section 2200. Such walks shall be constructed of concrete on a thoroughly compacted sub-grade, shall have a vertical thickness at least as thick as the existing walks, but not less than four (4) inches thick, shall be constructed with expansion joints spaced not exceeding fifty (50) feet apart, and shall be sloped for drainage at right angles to the longitudinal centerline in the amount of approximately one-fourth (1/4) inch per foot of walk width.

Concrete materials and workmanship shall conform to the applicable requirements of Section 2000, "Concrete" of these specifications.

Surface finish of concrete walks replaced shall conform to, and shall match as closely as possible, that of existing concrete walk surfaces.

8006 CONCRETE CURBS AND GUTTERS. Concrete curbs and gutters which have been removed or damaged by reason of construction operations or any other cause shall be replaced with new concrete construction. New curb and gutter sections shall be as designated on the drawings and as detailed on the Standard Details.

Concrete materials and workmanship shall conform to the applicable requirements of Section 2000.

Construction and expansion joints, dimensions, elevations and surface finish of curb and gutter replacements shall conform to, and shall match as closely as possible, that of adjacent existing concrete curbs and gutters.

8007 GRAVEL SURFACING. Existing gravel drives, parking and surfacing which is removed or damaged during the progress of the work shall be replaced with an aggregate surfacing at least as thick as that removed, but in no case less than four (4) inches.

New aggregate surfacing shall match existing surfacing as nearly as possible in size, gradation, color, and compaction.

8008 MISCELLANEOUS REPAIR WORK. All existing items and construction, whether or not indicated by the drawings but which are removed or damaged as a result of construction operations, shall be repaired or replaced unless otherwise required by the drawings.

Repair and replacement of existing grass area shall be as follows:

- Existing privately owned yards outside of the ROW shall be replaced with sod of a like type.
- Other yards, ROW's and rural areas shall be seeded according to Section 8200 of these specifications.

Repair or replacement shall be with materials similar to those existing, and shall in each case restore the item to its original or better condition as acceptable to the Engineer and the Owner thereof.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### Section 8200 Seeding and Sodding

- Proposed 04-15-2024
- Comments/Questions Received – None
- Public Informational Meeting – None
- Adopted 05-15-2024

SECTION 8200 SEEDING AND SODDING

8201 SEEDING.

- A. Scope. This section governs the furnishing of all labor, equipment, tools, materials and performance of all work for seeding and sodding.

All areas ~~of established yards~~ shall be restored by ~~sodding~~ seeding unless directed otherwise ~~approved~~ by the City Engineer.

- B. Materials, Definitions and Equipment.

1. Seeds. Seeds for cover crops shall comply with the requirements of the applicable state seed laws and shall be the mixture of seeds specified in the Special Provisions. Seeds shall be free of prohibited weed seeds and shall not have more than 1 percent (1%) noxious weed seeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trade name, or trade mark, and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified.

2. Pure Live Seed. The following formula shall be used to determine the amount of commercial seed required to provide each kind of seed for the specified quantities of pure live seeds:

$$\text{Pounds of Commercial Seed Required} = \frac{10,000 \times \text{Pure Live Seed (lbs per acre)}}{\text{Purity (percent)} \times \text{Germination (percent)}}$$

3. Fertilizer. Fertilized shall be inorganic 12-12-12 or 13-13-13 grade, uniform in composition free flowing and suitable for application with approved equipment, deliver to the site in convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, bearing the name, trade mark, or trade name, and a warranty of the producer.

4. Mulch. Mulch shall be either the vegetative type or wood cellulose fiber type, whichever is specified in the Special Provisions, or as approved by the Engineer.

- a. Vegetative Type. The vegetative type shall be the cereal straw from stalks of oaks, rye, wheat or barley and shall be free of prohibited and noxious weed seeds.

- b. Wood Cellulose Fiber Mulch. Wood cellulose fiber shall contain no germination or growth inhibiting ingredients, and shall be dyed an appropriate color to aid in visual metering in its application. It shall be easily and evenly dispersed and suspended when agitated in

water, and when sprayed uniformly on the soil surface, shall form a blotter like cover, which readily absorbs the water and allows infiltration to the underlying soil. The mulch material shall be supplied in packages of not more than 100 pounds gross weight, and shall be marked by the manufacturer to show the air dry weight content. (Air dry weight shall contain not more than 10 per cent moisture).

5. Equipment. The seeding operation shall be accomplished with equipment suitable for preparing the seed bed, sowing the seed, fertilizing, spreading the vegetative type mulch, or spreading the wood cellulose fiber mulch in accordance with the applicable requirements of the following sub-section entitled "Construction Details".

C. Construction Details. All equipment used in the project and all workmanship shall meet the approval of the engineer.

1. Application of Fertilizer. Before tilling the soil the fertilizer shall be distributed uniformly at the rate of 600 pounds per acre and incorporated into the soil to a depth of at least 2 inches by discing or harrowing methods. Fertilizing rate is equivalent to 7 pounds per 500 square feet.
2. Tilling the Seed Bed. Areas shown on the plans or specified to be seeded shall be cleared and graded as required preparatory to tilling the surface for seeding. The surface shall be tilled to a depth of at least 2 inches by discing or other approved methods until the soil is suitable for seeding. Areas tilled shall be maintained until seeding and mulching is complete to insure a smooth area with no gullies or depressions.
3. Planting Seeds. The kinds of seeds and the rate of sowing pure live seed shall be as specified on the Plans or in the Special Provisions, but shall be one of the following mixtures:
  - a. Type "A" Seed. This seeding mixture will normally be used where seeding is required in areas of established yards, shoulders and slopes in street right of way, and any other areas where a high-type seeding is deemed necessary. The seed mixture will be as follows:

Application	Minimum Pure	Rate	of
<u>Ft.</u>	<u>Live Seed %</u>	<u>Per 1,000 Sq.</u>	

City of Liberty

Revised 2009

pound	Rye Grass (Lolium Perenne or L. Multiflorum)	85%	3
pounds	Rebel II Tall Fescue	95%	7

All seeding work shall be done between the dates of February 1 and April 15 for spring planting or August 15 and October 15 for fall planting. Sowing shall be accomplished by use of an approved mechanical seeder or drill (hand spreader can be used in small areas), making sure that successive seed strips overlap to provide uniform coverage. Seed should be drilled to a depth of 1/2 inch.

4. Compaction. Immediately following the completion of seeding operation, the entire area shall be compacted by means of a roller weighing at least 60 but not more than 90 pounds per linear foot of roller.
5. Mulching. Mulching shall be done within 24 hours following the seeding operation except in the case of wood cellulose fiber type mulch.

- a. Vegetative Type Mulch. After compacting the surface, mulch shall be uniformly spread at the rate of 1-1/2 tons per acre by means of a mechanical spreader or other approved means.

As soon as the mulch is spread it shall be anchored to the soil a minimum depth of 3 inches by use of a heavy disc harrow, set nearly straight, or similar approved tool. Discs of the anchoring tool shall be set approximately 9 inches.

Anchoring shall be accomplished by not more than two passes of the tool.

- b. Wood Cellulose Fiber Type. Wood cellulose fiber mulch shall be added to the hydraulic seeder after the proportionate amounts of seed, fertilizer and water, and other approved materials are added. These ingredients shall be mixed to form a slurry which shall be applied at the rate of 1,000 pounds per acre. The mulch shall make a uniform coverage of the soil surface that will be satisfactory to the Engineer.

- D. Protection and Repair. The seeded area shall be kept free of traffic until accepted.

City of Liberty

Revised 2009

If at any time before acceptance of the completed contract, any portion of seeded surface becomes gullied or otherwise damaged, or the seeding has been damaged or destroyed, the affected portion shall be repaired to re-establish the specified condition prior to the acceptance of the work.

## 8202 SODDING.

- A. Scope. This section governs the furnishing of all labor, equipment, tools and materials, and the performance of all work for sodding.
- B. Materials and Definitions.
1. Sod. The sod shall be densely rooted nursery grown Kentucky Blue Grass or other as approved by City Engineer. The sod shall contain a growth of not more than 10 percent of other grasses and clovers, shall be free from all prohibited and noxious weeds, and shall be cut in strips of uniform thickness, the range of acceptable thickness shall be 3/4 to 1-1/4 inch; each strip containing at least one (1) square yard. Sod shall be cut in strips not less than 12 inches wide.
  2. Fertilizer. Fertilizer shall be inorganic 12-12-12 or 13-13-13 grade, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in convenient containers, each fully labeled, conforming to applicable state fertilizer laws, bearing the name, trade name, or trademark and warranty of the producer.
- C. Construction Details.
1. Fertilizing. Before tilling operations, fertilizer shall be spread uniformly at the rate of 300 pounds per acre. Fertilizing rate is equivalent to 3.5 pounds per 500 square feet.
  2. Tilling the Sod Bed. The sod bed shall have a uniform surface free from washes and depressions; and shall conform to the finished grade profile and cross-section shown on the plans. The soil except where fresh top soil has just been applied and compacted, shall be thoroughly tilled to a depth of 2". Freshly graded areas, which have set long enough to become dry and crusted over shall be tilled as specified above, preparatory to placing the sod.
  3. Placing Sod. Sod shall not be placed during a drought nor during the period from June 1 to September 1, unless authorized by the Engineer, and shall not be placed on frozen ground. Sod shall be moist when it is placed. Sod strips shall be laid along contour lines, commencing at the lowest point of the area and working upward. The transverse joints of sod strips shall be staggered and the sod carefully placed to produce tight joints. The sod shall be firmed and watered immediately after it is placed. The "firming" shall be accomplished by application of a roller weighing not less than 60

nor more than 90 pounds per lineal foot of roller.

4. Anchoring Sod. On 2:1 slopes, or steeper, the sod shall be anchored with 1/2 inch square by 8 inch long wooden pegs driven into the grounds, 3 pegs to the square yard or other approved methods. Pegging shall be done immediately after sod is firmed. The area shall then be cleared of loose sod, excess or broken anchors, excessive soil, or other foreign materials.
5. Maintenance. The sodded area shall be thoroughly watered daily for a period of fifteen days after placing except when thoroughly wetted by rain. Any portion of the sod that is not in good growing condition following the first full growing season (Spring to Fall) shall be replaced with fresh live sod.

#### 8203 TEMPORARY SEEDING.

- A. Scope: Establishment of fast-growing annual vegetation to provide economical erosion control for up to 12 months and reduce the amount of sediment moving off the site.
- C. Materials: Furnished and installed per Section 8201.B. Annual plants which sprout rapidly and survive for only one growing season are suitable for establishing temporary vegetative cover.
- B. Construction Details: Temporary seeding is required in disturbed areas where no activity has taken place within 14 days. To ensure emergence, vigorous growth of seedlings, and continued plant growth, prepare seedbed, add lime and fertilizer according to soil tests, mulch all but the most ideal sites, and follow seeding dates.

#### 8204 HYDROSEEDING.

- A. Scope: Seed and fertilizer, mixed in proportions previously specified, may be broadcast in a hydromulch with water which forms an emulsion and covers the prepared designated areas in a uniform manner.
- B. Materials: Areas to be hydroseeded shall be fertilized at rates specified in Section 8201. The seed-bed shall be free of any irregularities in the surface, and shall be corrected to prevent formation of water pockets.

Hydromulch used shall be a wood fiber mulch with tackifier, such as Conwit 2000, or approved equivalent. Hydromulch shall be applied at the rate of 1500 lbs. per acre.

- C. Construction Details: Hydroseeder filling tank should be ½ full of water before adding seed, fertilizer and hydromulch components. Begin agitation while adding remaining water so that a uniform mixture is obtained. Seed, fertilizer and

hydromulch components shall not be added to water more than four (4) hours prior to application.

Discharge hydromulch slurry mix on prepared soil for uniform distribution.

Keep all areas seeded moist throughout germination period. Protect all turf areas by erecting temporary fences, barriers, signs, etc. as necessary to prevent trampling and disturbance.

The seeded areas will be inspected for acceptable grass coverage and will be acceptable when grasses designated are growing and are in good condition and no area more than ½ of one percent of the total areas shall be bare, of which no single area shall be more than one foot square in area. Any bare area larger than this will not be acceptable and shall be reseeded.

8205 GUARANTEE. The contractor shall guarantee all work and materials for a period of one full growing season (Spring to Fall) after the date of final acceptance of the project. During the guarantee period, all turf which dies or exhibits weed growth shall be replaced with like material at the expense of the contractor.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### Section 5000 – Materials Water Mains

- Proposed 09-10-2025
- Comments/Questions Received – None Currently Received
- Public Informational Meeting – None Currently Scheduled
- Anticipated Adoption Date 10-10-2025

## SECTION 5000 MATERIALS, CONSTRUCTION AND TESTING - WATER LINES

5001 GENERAL. The purpose of this specification is to govern the furnishing of all materials, labor, equipment, tools, superintendence, and other services necessary to construct water mains, complete with appurtenances including extensions and relocations at the locations shown on the plans.

### 5002 MATERIALS.

A. Scope. This section governs materials for water mains having diameter of four inches and larger.

B. Pipe and Fittings.

1. Ductile-Iron Pipe. Unless indicated otherwise on the construction plans or directed by the Engineer, all 6 inch pipes and larger shall be Class 50 ductile iron, all 4 inch pipes shall be Class 51 Ductile iron complete with all accessories and conforming to ANSI A21.51, AWWA C151, ASTM A536, and Grade 60-42-10.

The outside coating used under normal conditions shall be an asphaltic coating approximately 1 mil thick. The coating shall be applied to the outside of all pipes, unless otherwise specified. The finished coating shall be continuous and smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe.

The lining for use under normal conditions shall be a cement-mortar lining in accordance with ANSI/AWWA C104/A21.4, unless otherwise specified.

Joints, unless otherwise specified, shall be of the push-on type conforming to ANSI A21.11/AWWA C111, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable.

Restrained joints (if required) shall be Loc-Tite, Meg-a-Lug, or approved equal.

2. Ductile-Iron Fittings. Ductile-iron fittings shall be complete with all accessories and shall be ASTM A536, Grade 70-50-05, conforming to ANSI A21.10/AWWA C110, ANSI A21.53/AWWA C153, 350 psi pressure rating. Joints shall be of the standard mechanical joint type conforming to ANSI A21.11/AWWA C104 and shall be coated inside and out with a bituminous coating. Fittings shall have distinctly cast upon them the pressure rating and letters "DI" or "DUCTILE".
3. PVC Pipe. The non-restrained PVC pipe will be push-on joints. PVC pipe will be DR14 C-900/~~DR18 C-905~~ DIPS or C-909 PC150 DIPS. Restrained joints will be Certainteed Certa-lok C-900 Restrained Joint Pipe, EBAA bell restrained harnesses, or Diamond Plastic Bulldog Restraint Joint System.

Bends may either be Certa-lok sweeps or MJ ductile iron bends. Tees and valves will be ductile iron mechanical joints. For changes in alignment less than 11-1/4 degrees but more than the allowable joint deflection, then Certainteed High Deflection Couplings shall be used. Romac Grip Rings or EBAA Iron Mega-Lugs designed for PVC for MJ fittings and valves shall be used.

4. HDPE Pipe. HDPE will be AWWA C906 with a working pressure rating of PC 160 (Diameter Ratio, DR11), nominal Ductile Iron Pipe Size (DIPS).
  - A. Butt Fusion Fittings – All butt fusion fittings will be AWWA C906 and have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.
  - B. Electrofusion Fittings – All electrofusion fittings will be PE3408 HDPE. Electrofusion fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the working pressure rating (WPR) of the fitting.
  - C. Mechanical Joint Adapters – Mechanical joint adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

C. Valves and Valve Boxes.

1. Gate Valves. Generally, and unless otherwise directed by the Engineer, gate valves shall be used on all water mains, 12 inches nominal diameter and smaller. The type, size and location of valves shall be as shown on the Plans. Except as modified or provided herein all gate valves in pipelines shall be 250 psi, ductile iron body, gate valves with non-rising stems. Gate valves shall be resilient-seated conforming to all applicable requirements of ANSI/AWWA C509 and shall be epoxy coated inside and outside conforming to ANSI/AWWA C550. All exposed valve bolts and nuts shall be stainless steel. Acceptable resilient wedge gate valve manufacturers are as follows:

Clow Model 2639  
Kennedy Model KS-RW  
American Series 2500  
American Series 2500 with ALPHA restrained joint ends  
EJ FlowMaster Resilient Wedge

2. Butterfly Valves. Butterfly valves shall be used for water line valves larger than twelve (12) inches in diameter otherwise directed by the City Engineer. Butterfly valves shall be of the rubber-seat, tight-closing type. Valve discs

shall seat at 90 deg. with the pipe axis. Mechanical joint end valves shall be of the short body type. Packing shall be O-ring cartridge designed for permanent duty in underground service.

All butterfly valves and operators shall conform to AWWA C504. Metal mating seat surfaces shall be 18-8 stainless steel or more. Each valve shall be provided with an operator with a torque rating at least equal to the torques listed in AWWA C504, Table 1. Butterfly valves shall be epoxy coated inside and outside conforming to ANSI/AWWA C550. All exposed valve bolts and nuts shall be stainless steel. Acceptable Butterfly valve manufacturers are as follows:

Clow Style 4500  
Kennedy 4500  
Mueller Linesal Series

3. Valve Ends. Valve ends shall be of the mechanical joint type, conforming to ANSI A21.11/AWWA C111 except where flange ends are required on the plans.

The end flanges of flange gate valves shall conform in dimensions and drilling to ANSI B16.1 for cast-iron flanges and flange fittings, Class 125, unless explicitly provided otherwise on the plans and Special Provisions. The laying lengths of the flange valves shall conform to the dimensions of ANSI B16.10.

4. Bonnet Thrust Plates. The bonnet shall have a removable thrust plate to permit the removal and replacement of the valve stem and "O" ring seal while the valve is in service. All bolts and nuts in bonnet shall be stainless steel.
5. Tapping Valves and Sleeves. The size and location of the tapping valves, shall be as shown on the plans. The valves shall be 200 psi, iron body, resilient-seated gate valves with non rising stems conforming with all applicable requirements of ANSI/AWWA C509, except that the outlet end shall be standard mechanical joint end conforming to ANSI A21.11/AWWA C111 and the inlet end shall have an inlet flange conforming to ANSI B16.1 for cast iron flanges, Class 125.

Tapping sleeves shall have a body of 18-8 Type 304 Stainless Steel. The flange shall be CF8 cast Stainless Steel - equivalent to 18-8 Type 304 Stainless Steel. ANSI 150 lb. Drilling, recessed for tapping valve per MMSS-SP 60. Bolts shall be Stainless Steel, Type 304. The Branch Outlet shall be heavy Stainless Steel Pipe. The body shall be provided with anti-extrusion rings welded to each end of the sleeve body. The gasket shall be full circumferential compounded for use with water, salt solutions, mild acids, bases and sewage.

6. Stem Seals and Coatings. All valves shall be provided with stem seals of the "O" ring type. Two "O" rings shall be used with at least one "O" ring

inserted above the thrust collar. The packing plate shall be attached to the valve bonnet by not less than three (3) bolts and one "O" ring below the thrust collar.

7. Valve Operation. All valves shall be equipped with a 2 inch square wrench nut and the direction of rotation to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word "Open" and an arrow indicating the direction to open.
8. Extension Stems. Extension stems and stem guides shall be provided where shown, specified, or required for proper operation. Extension stems shall be fabricated from solid steel shafting not smaller in diameter than the stem of the valve or from galvanized steel piping having an ID not smaller than the OD of the valve stem. Extension stems shall be connected to the valve by a flexible, socket-type coupling. All connections shall be pinned, keyed, or socket type. Pipe couplings will not be acceptable.

Extension stems shall be provided for buried valves when the operating nut is more than three feet below finished grade. Each extension stem for a buried valve shall extend to between three (3) feet and three (3) feet six (6) inches of the ground surface, NO EXCEPTIONS WILL BE ALLOWED, and shall be provided with spacers, which will center the stem in the valve box, and shall be equipped with a wrench nut.

9. Valve boxes, Bases, Lids and Covers.
  - a. All buried valves shall be provided with valve boxes. Valve boxes shall be of cast iron, extension sleeve screw type, suitable for the depth of cover required by the drawings. Valve boxes shall be Clay & Bailey No. P-1108 or approved equal. Valve boxes outside of the traveled roadway may be 6 inch, PVC Class 150 pipe.
  - b. All parts of valve boxes, bases, and covers shall be coated by dipping in bituminous varnish.

Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. Each valve box shall be fitted with a debris plug equipped with a handle for easy removal. CKR, Infactory or approved equal shall be used. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped on each side of the box. An 18" square reinforced (#4 steel rebar), concrete collar, 6 inches thick shall be placed around the valve box flush with the surface.

- D. Fire Hydrants. Fire hydrants shall be furnished with a six (6)-inch auxiliary gate valve. The fire hydrants shall be pressure rated at 150 psi. working pressure and 300 psi. test pressure. Hydrants shall be traffic model with breakaway flange or coupling. Fire hydrants shall conform to AWWA C502 with information

required as follows:

Type of Shutoff	Compression
Size of Hydrant	5 1/4 inches
Inlet Connection	6 inches
Outlet Nozzles	2 – 2 ½ inch hose and 1 – 4 inch <b>Storz pumper connection with integral locking mechanism</b>
Outlet Nozzle Threads	ANSI B-26
Direction to Open	Counterclockwise (left)
Stem Seals	O-ring
Outlet Nozzle Cap Chains	Required
Drain Outlet	Required
Finish Paint	Factory or field painted above the ground line with yellow enameled paint. Sherwin Williams industrial yellow No. B54 Y37.
Operating Nut	Pentagon shaped
Weather Cap on Operating Nut	Required
Oil Reservoir	Required
Boot Connection	4” M.J. boot

Acceptable Fire Hydrant manufacturers are as follows:

Clow Medallion  
Kennedy Guardian K-81D  
American Darling B-84-B5  
EJ 5CD250

Hydrants shall be furnished with all joint glands, gaskets, bolts, and nuts required for installation. Hydrants shall be set so that at least the minimum pipe cover is provided for the branch supply line. Each hydrant shall be set on a concrete foundation at least eighteen (18) inches square and 6 inches thick. Each hydrant shall be suitably anchored.

Hydrant drainage shall be provided by installing around the hydrant, and below the top of the hydrant supply pipe, at least one-half (1/2) cubic yard of three-fourths (3/4)-inch rock.

Fire hydrant installations shall conform to the Standard Detail. All hydrants shall stand plumb. The Engineer shall determine the exact direction the nozzles will be facing.

An 18” square, reinforced (#4 steel rebar), concrete collar, 6 inches thick shall be placed around the valve box flush with the surface.

- E. Flushing Assembly. The flushing assembly shall include a line valve, straddle block, adequate piping to reach the surface, and concrete collar as shown in detail drawing D50-6.

F. Specials:

1. General. Air release, meter, and pressure-reducing valve vaults shall be precast concrete conforming to ASTM C478. Access lid castings shall be as noted in the Special Provisions or as shown on the plans.

Vaults, which, by their special nature, must be cast in place, shall conform to the plans and concrete specifications in Section 2000 "Concrete".

2. Pressure-Reducing Valves. Pressure-reducing valves shall be designed to provide tight shutoff under conditions of no flow and shall not "hunt" under ordinary flow conditions. Pressure-reducing valves shall be as noted in the Special Provisions, selected and sized as recommended by the valve manufacturer. Pressure-reducing valves shall be suitable for operation under the pressure and flow conditions as shown on the plans.

3. Combination Air Valves. Combination air-release and vacuum-relief valves shall be installed at the locations indicated on the plans. Each valve assembly shall be installed complete with appropriate piping and valves as shown on the plans. All piping and isolation valves shall be brass except for the air outlet from the valve, which shall be brass or copper tubing.

Air releases for mains 12 inches in diameter or smaller shall have 1 inch combination air-release valves, APCO No. 143C or approved equal.

- G. Bedding Aggregate. All materials used for pipe bedding shall be one half (1/2) to three-quarter (3/4) inch clean/screened rock and conform to the requirements of MCIB Section 4 – Materials for Coarse Aggregate – Table 2, Column III, modified to meet the following gradations:

<u>Sieve Size Gradations</u>	<u>Percentage Passing</u>
3/8"	20-35
No. 4	0-5
No. 8	0-2

Bedding aggregate shall fully encase the pipe from six (6) inches below bottom of pipe to six (6) inches above top of pipe, trench wall to trench wall.

5003 CONSTRUCTION REQUIREMENTS.

A. Grading and Excavation.

1. Scope. Excavation and trenching work shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation

and disposal of all excavated material; all necessary sheeting, shoring and protection work; preparation of sub-grades; pumping and dewatering as necessary or required; protection of adjacent property; and other appurtenant work.

2. General. Excavation and trenching work shall be performed in a safe and proper manner with suitable precautions being taken against all hazards.

The Contractor shall explore and expose any and all obstructions in advance of excavation so that minor changes in grade and alignment may be made.

In paralleling existing water, sewer, and gas mains, the Contractor shall protect all service connections and shall arrange to furnish service to the consumers with minimum interruption.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

3. Classification of Excavated Material. No classification of excavated materials will be made unless otherwise indicated on the contract drawings. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work regardless of the type, character, composition, or condition thereof.
4. Unauthorized Excavation. Any part of the trench excavated below grade shall be corrected with material approved by the Engineer placed and compacted by the Contractor.
5. Removal of Water. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during sub grade preparation and continually thereafter until the structure is built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.

All excavations for concrete structures or trenches which extend down to or below static groundwater elevations shall be dewatered by lowering and maintaining the groundwater surface beneath such excavations a distance of not less than 12 inches below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The Contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

6. Sheeting and Shoring. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be properly and substantially sheeted, braced, or shored as necessary to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheeting, bracing, shoring, and trench boxes shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances.

Trench sheeting shall not be pulled unless pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Sheeting may not be pulled after backfilling, as directed by the Engineer.

Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner, which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

7. Stabilization. Trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Trench bottoms which are otherwise solid but which become mucky on top due to construction operations shall be reinforced with one or more layers of crushed stone or gravel. Not more than 1/2 inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon.

8. Trench Excavation. The Contractor shall not open more trenches in advance of pipe laying than is necessary to expedite the work. One block or 300 feet whichever is the shorter, shall be the maximum length of open trench ahead of pipe laying unless by written permission of the Engineer.

Except where tunneling or boring and jacking is specified and shown on the plan by the Engineer, all trench excavations shall be open cut.

9. Alignments and Grade. The alignment and grade or elevation of the pipeline shall be as shown on the plans.

The Contractor must maintain a constant check of the pipe alignment and trench depth and will be held responsible for any deviations there from.

Unless otherwise shown or indicated on the plans or unless otherwise set forth by the Engineer, the horizontal and vertical alignment of the water main shall be maintained to within the following tolerances:

Horizontal

Vertical

3"

42" to 48"  
Depth of Cover

- 10. Minimum Cover. Except where otherwise shown, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe as indicated above. Greater pipe cover depths may be necessary on existing pipe, conduits, drains, drainage structures, or other obstruction encountered at normal pipe grades.

Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finish grade or pavement surface elevations.

- 11. Limiting Trench Width. Trenches shall be excavated to a width, which will provide adequate working space and pipe clearances for proper pipe installation, jointing and embedment. However, the limiting trench width below an elevation 6 inches above the top of the installed pipe shall be as follows:

Pipe Size	Minimum Trench Width in Earth	Maximum Trench Width In Earth	Minimum Clearance In Rock
4"	18"	30"	6"
6"	24"	30"	6"
8"	26"	32"	6"
10"	28"	34"	6"
12"	28"	34"	6"

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than 1 foot above the top of the pipe.

- 12. Unauthorized Trench Widths. When, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the Contractor's expense.
- 13. Trench Bottom in Earth. The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the pipe is to be laid. The surface shall be graded to provide a uniform bearing and continuous support for each pipe at every point along its entire length.
- 14. Rock Exploration. Unless shown otherwise on the plans or noted in the Special Provisions, no rock exploration has been made. On those projects where rock exploration has been made, test holes have been drilled at locations and intervals as shown on the plans or subsurface information report to determine the approximate location and depth of rock. Resistance to penetration was assumed to be "solid rock". This information is furnished

for general reference purposes only.

The Contractor must form his own opinion as to the character of materials, which will be encountered from an inspection in the ground, from his own investigation of the test hole information, or from such other investigations, as he may desire.

15. Trench Bottoms in Rock. All rock excavation shall be carried to a minimum of 6 inches below the bottom of the pipe. Granular pipe embedment material shall be used to restore the trench bottom to the desired elevation and grade and to provide a uniform bearing and continuous support for the pipe along its entire length. Care shall be exercised to prevent any portion of the pipe from coming to bear on solid rock or boulders.
16. Mechanical Excavation. The use of mechanical equipment will not be permitted in locations where its operations would cause damage to trees, buildings, culverts, or other existing property, utilities or structures above or below ground. In all such locations, hand-excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of the type, design and construction and shall be so operated that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from the bottom of the trench, and that trench alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

All mechanical trenching equipment, its operating conditions, and the manner of its operations shall be subject at all times to the approval of the Engineer.

17. Stream Crossings. Stream crossings shall be made in accordance with these specifications and as shown on the plans.

The trench width shall be as required for proper pipe installation and the trench depth shall be as required to give minimum cover shown on the plans. Pipe encasement, where required, shall be in accordance with the specifications and placed as indicated on the plans.

18. Highway and Railroad Crossings. The Contractor shall make highway and railroad crossing in accordance with these specifications, the Special Provisions and as shown on the plans.

All construction or work performed and all operations of the Contractor, his employees, or his subcontractors within the limits of highway or railroad right-of-ways shall be in conformity with all the requirements, regulations and be under the control (through the Engineer) of the authority owning or having jurisdiction over and control of the right-of-way.

The Contractor shall pay fees and obtain permits to make the crossings unless otherwise directed.

#### 5004 INSTALLATION.

A. General. Laying of ductile-iron pipe; PVC pipe; HDPE pipe; installation of valves, and hydrants; and embedment and backfill shall conform to the following specifications and the details as shown on the plans.

1. Unless otherwise specified or shown on the plans, the water mains shall be laid to have a minimum cover of 42 inches, measured from the finished grade or from established street grades shown on the plans.
2. Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug that will prevent trench water from entering the pipe.
3. Where the pipe is to be installed inside a casing pipe or tunnel liner, polyethylene casing spacers shall be strapped to each pipe before it is placed in the casing pipe or tunnel liner in accordance with these specifications and as shown on the plans. The ends of each casing pipe or tunnel liner shall be closed with a minimum 1/8-inch neoprene rubber end seal with stainless steel bands or as shown on the plans. The closures for each casing pipe or tunnel line shall not be constructed until all testing of the line has been completed and accepted.

B. Ductile-Iron Pipe.

1. Handling. Pipe, fittings and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe, pipe coating, and fittings are not damaged. Hooks shall not be used. Under no circumstances shall pipe or accessories be dropped or dumped.

The Contractor shall repair all pipe coating, which has been damaged, before installing the pipe.

2. Cutting Pipe. Ductile-iron pipe shall be cut with either a saw or an abrasive wheel. Cutting of existing cast-iron pipe shall be done with mechanical pipe cutters. The cutting of pipe with a torch will not be permitted.

Cutting shall be done in a neat manner without damage to the pipe, or the cement lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file or beveled by mechanical means to remove all roughness and sharp corners.

3. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted. Such surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.

4. Inspection. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective, damaged, or unsound pipe and fittings shall be rejected and marked as such and removed from the site of the work.
5. Push-on Joints. The gasket seat in the bell shall be wiped clean after which the gasket should be placed. A thick film of lubricant should be applied to the entire inner surface of the gasket and on the spigot end of the pipe.

The lubricant and the gaskets shall be as recommended and supplied by the manufacturer of the pipe being used. The lubricant shall be odorless, tasteless, nontoxic, and suitable for use in potable water.

Field-cut pipe shall be beveled by filing or by mechanical means to remove any sharp or rough edges that might otherwise damage the gasket.

6. Mechanical Joints. Mechanical joint pipe shall be used only when shown on the plans and shall be installed in strict accordance with the manufacturer's recommendations.
7. Flanged Joints. When bolting flanged joints, care shall be taken to ensure that there is no restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bell-and-spigot joints shall not be packed or assembled until all flanged joints affected thereby have been tightened. Bolts shall be tightened gradually and at a uniform rate so that gasket compression is uniform.
8. Restrained Joints. Restrained joints and anchoring joints shall be installed in strict accordance with the pipe manufacturer's recommendations.
9. Alignment of Bell-and-Spigot Pipe. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the quantities stipulated in Tables 4 and 5 of ANSI/AWWA C600.
10. Laying Pipe. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified. Under no circumstances shall the pipe be laid in water, and no pipe shall be laid under unsuitable trench conditions.

C. PVC Pipe. This section covers installation of AWWA C-900, C-905, and C-909 PVC pipe. Ductile Iron fittings and valves are covered in other sections. PVC pipe shall be installed to the minimum of AWWA C605 latest revision and per these specifications.

1. Handling. PVC Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools,

and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces.

2. Laying Pipe. Pipe shall be laid with the bell ends facing the direction of laying except when reverse laying is specifically authorized or as directed by the Engineer.
3. Assembly. For push on pipe, the spigot shall be inserted into the bell to the line on the spigot. The previously completed joints must be braced so the line does not become “stacked”, “over belled”, or inserted past the reference mark on the spigot. If the insertion mark is not visible after assembly, the joints shall be disassembled and done correctly.
4. Alignment. Piping shall be laid to the lines and grades as specified, as indicated on reference points, or as indicated on the drawings. The Contractor must obtain approval from the Engineer for any changes in the alignment or grade.
5. Joint Deflection. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line using joint deflection shall not exceed the pipe manufacturer’s published axial joint deflection or 1°, whichever is less.
6. Bending pipe. The Contractor will not be allowed to bend PVC pipe. The Contractor shall use the Ceterainteed High Deflection Coupling if joint deflection is insufficient and an 11-1/4 bend is too large of an angle.
7. Mechanical Joints. Mechanical joints shall be carefully assembled in accordance with the manufacturer’s recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Kor-Blue bolts, or approved equal, shall be used for all necessary assembly. Bolts shall be uniformly tightened to the torque values listed in ANSA/AWWA C111/A21.11. Over-tightening of bolts to compensate for poor installation practice will not be permitted.
8. Push-on Joints. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be stored in closed containers and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.
9. Fittings. Unless directed otherwise by Engineer, Contractor shall determine the type and locations of bends required to complete the main installation. Mains shall be installed with the least number of bends practical.  
  
The Contractor will cut off the bevel of the PVC pipe before insertion into an MJ fitting.
10. Trace Wire. The Contractor shall install trace wire in the trench with the PVC pipe per the Tracer Wire detail in 50-11.

11. Thrust Restraint for PVC. Certa-lok restrained joint PVC shall be used or installed using the EBBA Iron 1900 Series restraint harness or approved equal according to the manufacturer's recommendations.

Thrust restraint devices shall be provided on all pipe installed in encasement pipes and installed for street crossings.

12. Reaction Anchorage and Blocking. Where thrust restraint devices are inappropriate or when directed by the Engineer, concrete thrust blocks, thrust collars, or gravity blocks shall be used to prevent movement of the pipe caused by internal pressure. Reaction Anchorages and Blocking are covered in the Thrust Restraint section and should be installed according to Thrust Block detail 50-7.
13. Cutting Pipe. PVC cutting shall be done in a neat manner, without damage to the pipe. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be deburred to remove the PVC shavings. The cut ends of push-on joint pipe shall be suitably beveled as necessary to provide proper installation. When cutting pipe with couplings, mark the field cut pipe at the same distance in as the mark appeared on the original full-length pipe section.
14. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter before being installed and shall be kept clean until the work has been accepted. Such surfaces shall be wire brushed, if necessary, wiped clean, and kept clean until jointing is completed.

D. HDPE Pipe.

1. Handling. HDPE pipe and fittings shall be handled to insure installation in a sound undamaged condition.

During loading, transportation and unloading, every precaution shall be taken to prevent injury to the pipe. No pipe shall be dropped from cars or trucks, or allowed to roll down slides without proper retaining ropes. During transportation each pipe shall rest on suitable pads, strips, skids, or blocks securely wedged or tied in place. Any pipe that is scratched more than 10% of the wall thickness shall not be used.

2. Laying Pipe. HDPE pipe shall not be installed when trenches or weather conditions are not suitable for such work.

HDPE pipe shall be installed in a trench with engineered embedment and backfill per the Excavation and Trenching section, except the bedding material particle size shall not exceed ½ inch for pipe smaller than 4 inches in diameter. The bedding material may be sliced in around the pipe.

3. Fusion. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The preferred joining method shall be the butt fusion method. The butt fusion equipment used in the joining procedures should be capable of temperature requirements of 400 degrees Fahrenheit, alignment, and an

interfacial fusion pressure of 75 PSI.

Electrofusion couplings shall be used when butt fusion equipment cannot be used. Electrofusion coupling assembly shall be completed as scribed in the attachment at the end of this section.

Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

The operator of the butt fusion or electrofusion machine shall be trained and certified by the fusion equipment supplier to operate the fusion machine.

4. Trace Wire. The Contractor shall install trace wire in the trench with the HDPE pipe per the Tracer Wire detail in 50-11.

5005 TRACER WIRE SYSTEM AND DETECTION MARKING TAPE. Tracer wire and detection tape shall be installed on all plastic sanitary sewer mains and service lines within the public right-of-way per Section 9100 Tracer Wire Pipe Detection System.

5006 CONNECTION TO EXISTING MAINS. The Contractor shall furnish and install all fittings necessary to join the existing and new water mains as shown on the plans.

No connections to existing mains shall be started without prior approval of the Engineering Department, and each connection with an existing main shall be made at a time and under conditions which will least interfere with service to customers affected thereby.

In all cases where it is necessary to take an existing main or service line out of service in order to accomplish the work to be performed, the Contractor shall notify the Engineering Department at least twenty-four (24) hours in advance as to the approximate length of time the main or service line will be out of service. The contractor shall also be responsible for notifying all customers to be affected by loss or interruption of service by means of printed information sheets (door hangers, furnished by the City) forty-eight (48) hours in advance of taking the main or service line out of operation.

When the closing of a valve to make the connections affects a customer who cannot be without service, the Contractor shall arrange to supply a temporary service and schedule the time, which is most convenient to the customer for making the connection to the existing mains.

Facilities shall be provided for properly dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

5007 POLYETHYLENE ENCASUREMENT. Polyethylene encasement shall be used around all mechanical connections, including mechanical joints, valves and fire hydrant assemblies. Polyethylene protection shall be installed in accordance with ANSI/AWWA C105/A21.5, Method A. Preparation of the pipe fittings shall include, but is not limited to, removing lumps of clay, mud, cinders, etc., prior to installation. Where pipe is also embedded or encased in concrete, the polywrap shall be installed over the pipe fittings prior to placing the concrete.

5008 SETTING VALVES, FITTINGS AND HYDRANTS.

- A. Valves and Fittings. All valves, fittings, plugs and caps shall be set and joined to

the pipe in the manner heretofore specified for cleaning, laying and joining pipe, except that large valves may require special support so that the pipe will not be required to support the valve weight.

Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body, and shall be opened and closed to see that all parts are in first-class working condition. Gate valves shall be set vertical in the horizontal pipeline. Valves and pipe shall be supported in such a manner as to prevent stress in either with no deflection in the valve/pipe joint.

Valve boxes and lids shall be installed at each valve and shall be supported and maintained centered and plumb over the operating nut of the valve. The valve box shaft shall not transmit shock or stress to the valve. Install valve box covers flush with the surface of the finished area or as directed by the Engineer.

All bends and tees shall be provided with thrust blocks of plain concrete, as specified. All dead ends on new mains shall be closed with plugs or caps suitably restrained to prevent blowing off under test pressure.

- B. Hydrants. All new hydrant installations shall be as shown on the plans or Standard Drawings and shall include all necessary excavation and backfill to make the installation complete.

Each hydrant shall be inspected before installation for direction of opening, nozzle size and threading, nozzle caps and chains, operating nut, and cap nut dimensions, tightness of pressure-containing bolting, cleanliness of inlet elbow and weep hole openings, and handling damage and cracks. Defective hydrants shall be corrected or replaced.

All hydrants shall stand plumb. The weep holes of the hydrant shall be kept clear and free to drain. The areas around each hydrant and hydrant valve shall be thoroughly compacted to prevent settlement of these areas.

Hydrants shall be set to a grade that allows their proper operation. Traffic hydrants with breakaway joint must be set with the joint above the ground line. Hydrants behind curbs shall be placed with the hydrant centerline at least 30 inches from the back of curb. Hydrants shall be rotated so as to have the pumper nozzle facing the street or rotated to face any direction as required by the Engineer.

#### 5009 THRUST RESTRAINTS

- A. Hydrants. The back of the base elbow of each hydrant shall be braced against a sufficient area of unexcavated earth or rock and be restrained by suitable restrained joints as shown on the plans or the Standard Drawings.
- B. Fittings. All plugs, caps, tees, bends and other fittings, unless otherwise specified, shall be provided with reaction blocking or suitable restrained joints as shown on the plans or Standard Drawings.
- C. Thrust Blocks. Vertical and horizontal reaction blocking shall be concrete as

specified herein. Thrust blocks shall be installed between solid ground and the fitting to be restrained. Concrete shall be located to contain the resultant thrust force and permit access to pipe and fitting joint for repairs and installed according to the Thrust Block detail 50-7. All nuts and bolts shall be protected with polyethylene encasement to prevent covering or contaminating with concrete.

- D. Restrained Joints. Restrained push-on or mechanical joints, mechanical joint anchoring fittings, and Meg-A-Lug retainer glands may be used in lieu of concrete thrust blocking if so indicated on the plans or approved by the Engineer.

5010 TRENCH BACKFILLING. Compacted backfill shall be required for the full depth of the trench above the embedment where beneath structures, street, road, or highway right-of-way or abutting easements, driveways, walks, parking areas, and at all locations shown on the plans or as directed by the Engineer during the progress of the work.

The top portion of the backfill beneath established sodded areas shall be finished with at least twelve (12) inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas. The Engineer prior to placement shall approve topsoil, and unless otherwise directed, shall be material previously excavated and stockpiled for the purpose during excavating and grading operations. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by disking or scarifying to a depth of two (2) inches to permit bonding of the topsoil to the underlying surface.

At the option of the Contractor, compacted backfill may be job-excavated material or material obtained "off-site" except that all street crossings shall be backfilled with MoDOT Type I rock, or on-site material provided testing is performed in one (1) foot lifts in the trench four (4) feet back of curb to four (4) feet back of curb. Job-excavated material may be used for compacted backfill (outside of Street Right of Ways) when the job-excavated material is finely divided and free from debris, organic material, cinders, or other corrosive material, and stones larger than three (3) inches in greatest dimension. Large masses of moist, stiff clay shall not be used. Job-excavated material shall be compacted to ninety-five (95) percent of maximum density at optimum moisture content as determined by ASTM D698 when the test is appropriate, or to seventy (70) percent relative density as determined by ASTM D2049 when that test is appropriate.

The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.

The combination of the thickness of the layer, the method of compaction and the type of compaction equipment used shall be at the discretion of the Contractor subject to obtaining the densities as specified above.

Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind.

Trench backfill above pipe embedment in locations other than those specified shall be compacted to ninety (90) percent of maximum density at optimum moisture content as determined by ASTM D698, unless otherwise permitted by the City Engineer.

Uncompacted earth backfill material to be placed above embedment shall be free of brush, roots more than two (2) inches in diameter, debris, cinders, or other corrosive material, and junk, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth. Uncompacted backfill material above embedment may be placed by any method acceptable to the Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on and which will not result in displacement of installed pipe. Uncompacted backfill shall be placed to the extent necessary to prevent excessive future settlement.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume shall not be permitted to fall more than five (5) feet into the trench unless cushioned by at least two (2) feet of loose backfill above pipe embedment.

No uncompacted trench backfill material containing rocks, or rock excavation detritus, shall be placed in the upper eighteen (18) inches of the trench except with specific permission of the Engineer, nor shall any stone larger than eight (8) inches in its greatest dimension be placed within three (3) feet of the top of pipe.

5011 DENSITY TESTING. At the option of the Engineer, in-place field density testing to determine compliance with specified compaction requirements may be performed using a nuclear moisture-density measuring device. The laboratory shall furnish field results to the inspector immediately. If, as a result of this field-testing, the engineer determines that further compaction is required, the Contractor shall revise his compaction procedures to obtain the results specified.

5012 DRAINAGE MAINTENANCE. Trenches across roadways, driveways, walks, or other traffic ways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the traffic way, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary.

5013 DISPOSAL OF EXCESS EXCAVATED MATERIALS. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site of work at a site approved by the Engineer, unless otherwise specified in the plans. Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be and actually installed in trench backfill, junk, and debris encountered in excavation work and other similar waste materials shall be disposed of away from the site of the work.

Excess earth from excavations located in unimproved property shall be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of six (6) inches above the original ground surface elevation at and across the trench and sloping uniformly. Drag with blade machine or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste and excess excavated materials, including hauling, handling, grading, and surfacing shall be a subsidiary obligation of the contractor and no separate payment will be made therefore.

5014 SETTLEMENT. The contractor shall be responsible for all settlement of backfill, fills and embankments, which may occur within two (2) years of time after final acceptance of the contract under which the work was performed.

The Contractor guaranteeing the maintenance of the construction under which the contract was performed shall furnish a suitable maintenance bond in an amount approved by the City Engineer to the City of Liberty. Said bond shall remain in effect for the period mentioned above from the date of completion and acceptance of the work by the City.

5015 DISINFECTION AND TESTING.

- A. Disinfection. After installation, the entire main shall be flushed and disinfected by chlorination. Flushing shall be carried out until turbidity-free water is obtained from all points along the main.

Immediately prior to disinfection, the main to be disinfected shall be flushed at the maximum velocity, which can be developed. The flushing velocity shall be at least 2.5 feet per second.

All flushing work shall be done in the presence of the Engineer. The contractor shall notify the Engineer at least 24 hours in advance of the times and places at which flushing work is to be done.

- 1. Chlorination by the Contractor shall conform to AWWA C651 and be performed using a 1 percent chlorine solution prepared from granular calcium hypochlorite (1 pound of HTH per 8 gallons of water). Water entering the new main shall receive a dose of the chlorine solution fed at a constant rate such that the water will have not less than 50 mg/l free chlorine.

**Chlorine Required to Produce 50 mg/l Concentration  
in 100 feet of Pipe**

Pipe Diameter (in)	1 percent Chlorine Solution (gal)
4	0.16
6	0.36
8	0.65
10	1.02
12	1.44

- 2. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances.
- 3. At the end of the 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine.
- 4. Mains shall be flushed prior to placing in service. The water shall be disposed

of without damage to public or private property. Disposal of Heavily-Chlorinated Water: The heavily-chlorinated flush water shall be dechlorinated in a manner complying with AWWA C651.

Pounds of Chemicals Required to Neutralize Various Residual Chlorine Concentrations in 100,000 gal of water:

<b>Residual Chlorine Concentration (mg/L)</b>	<b>Sulfur Dioxide (SO<sub>2</sub>)</b>	<b>Sodium Bisulfate (NaHSO<sub>3</sub>)</b>	<b>Sodium Sulfite (Na<sub>2</sub>SO<sub>3</sub>)</b>	<b>Sodium Thiosulfate (Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>·5H<sub>2</sub>O)</b>
1	0.8	1.2	1.4	1.2
2	1.7	2.5	2.9	2.4
10	8.3	12.5	14.6	12.0
50	41.7	62.6	73.0	60.0

5. Following the flushing of the mains, water samples shall be taken from the new main and tested by the City for bacteria. In accordance with AWWA Standard 651, additional samples shall be taken at least 24 hours later and tested by the City for bacteria. No less than three (3) sample points shall be installed on any water main. A corporation cock with a copper-tube gooseneck assembly shall be used at all line sampling locations. Locations shall be as follows:
  - a. Within fifty (50) feet of the beginning of the pipeline, mid-way in the pipeline, and within fifty (50) feet of the end of the pipeline.
  - b. Sample points shall be located at a minimum of every one thousand (1000) feet in addition to the locations at the beginning and end of the line, in addition to which sample points shall be located on all branch lines.
6. The contractor shall repeat disinfection procedure should initial treatment fail to yield satisfactory results.

B. Pressure and Leakage Testing of Water Mains. All newly installed mains must be pressure and leakage tested prior to final acceptance. This memorandum provides recommended standards for pressure and leakage testing ductile iron and PVC water mains. These recommendations closely follow relevant AWWA Standards and industry specifications. The applicable AWWA Standards are C600 for ductile iron mains and C605 for PVC mains, or their most recent revision. Pressure and leakage testing requirements for materials other than ductile iron or PVC will be determined on a case-by-case basis. Alternate pressure and leakage criteria for ductile iron or PVC mains are acceptable provided they are shown to be at least as stringent as the criteria presented in this memorandum or most recent revision of applicable AWWA Standards.

Simultaneous or separate pressure and leakage tests may be performed. The test durations and pressures for each option are specified in Table 1. If separate tests are made, the pressure test should be conducted prior to the leakage test.

**TABLE 1 – PRESSURE AND LEAKAGE TEST METHODS**

<b>Procedure</b>	<b>Test Pressure</b>	<b>Duration of Test</b>
Simultaneous Pressure & Leakage Test	150% of working pressure* at point of test, but not less than 125% of normal working pressure at highest elevation.	2 Hours
Separate Pressure Test	150% of working pressure* at point of test, but not less than 125% of normal working pressure at highest elevation.	1 Hour
Separate Leakage Test	150% of working pressure* of segment tested.	2 Hours

\* Working pressure is defined as the maximum anticipated sustained operating pressure. However, in no case shall the test pressure exceed the pressure rating for the pipe, valves, appurtenances, or thrust restraints.

1. Pressure Test. The purpose of the pressure test is to locate defects in materials or workmanship. Before testing, the pipeline must be backfilled and braced sufficiently to prevent movement under pressure.

If concrete thrust blocks are used, sufficient time must be allowed before testing to ensure that the concrete has cured sufficiently. The test ends also should be restrained to withstand thrusts potentially developed under the test pressures.

A pressure test should be conducted at 150 psi in the line. Care must be taken not to exceed the pressure rating of pipes, valves, fittings, thrust restraints, or other appurtenances. Pressures in the main may exceed the specified test pressure if the water pressure is read from a gauge located at a high point in the main.

Potable water is introduced into the main through a temporary connection to a hydrant, corporation stop in the new main, or valved connection with the existing line. While filling the new main, air must be expelled from the pipeline by venting through service connections, hydrants, or air-release valves. Corporation stops may be required at high points in the line if there are insufficient valves to release air from the main. It is important to completely expel air from each section of the main to be tested. Compressed entrapped air may amplify surges within the main or cause erroneous pressure test results.

After filling the main with water and expelling air, a pump is utilized to increase the water pressure within the line up to the required test pressure and to maintain that pressure for the required duration (See Table 1). An accurate method for measuring the amount of water pressure within the line must be provided. A key criterion for the pressure test is that the measured water pressure within the main (after reaching the required test pressure) should not vary by more than 5 psi during the duration of the test. While the line is under pressure, the system and all exposed pipe, fittings, valves, and hydrants should be examined for leakage. Any damaged or defective pipe, fittings, valves,

hydrants, or joints should be repaired or replaced and the pressure test repeated until satisfactory results are obtained.

2. Leakage Test. The purpose of the leakage test is to establish that the section of main being tested, including all joints, fittings and other appurtenances, will not leak or that leakage is within acceptable limits. If the leakage test is to be performed simultaneously with the pressure test, the system should be allowed to stabilize at the test pressure before conducting the leakage test.

Equipment necessary for conducting the leakage test includes a pump equipped with a make-up reservoir and a pressure gauge for measuring water pressure in the main. In addition, there must be an accurate method for measuring the quantity of water pumped into the main being tested. Methods used to measure water volume include a calibrated make-up reservoir, a calibrated positive-displacement pump, or a water meter.

The specified test pressure for the leakage test is the same as for the pressure test (See Table 1) and the test should be conducted for at least 2 hours in duration. Leakage is defined as the quantity of water that must be supplied into the main in order to maintain the water pressure within 5 psi of the specified test pressure after the pipe has been filled with water and air expelled. No pipe installation will be acceptable if the leakage is greater than that determined by the following formulas:

For PVC or DIP:

$$L = \frac{SD\sqrt{P}}{148,000}$$

where,

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch

The above equation is based on a leakage rate of 10.5 gallons per day per mile per inch of nominal diameter of pipe. Leakage values determined by the above formula for 1000 feet of pipe are presented in Table 2.

TABLE 2 - ALLOWABLE LEAKAGE (gal/hr) FOR 1000 FT OF GASKETED PVC OR DIP PIPE

Nominal Pipe Size (in)	Average Test Pressure in Pipeline, psi													
	50	75	100	125	150	175	200	225	250	275	300	350	400	450
2	0.10	0.12	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.25	0.27	0.29
3	0.14	0.18	0.20	0.23	0.25	0.27	0.29	0.30	0.32	0.34	0.35	0.38	0.41	0.43
4	0.19	0.23	0.27	0.30	0.33	0.36	0.38	0.41	0.43	0.45	0.47	0.51	0.54	0.57
6	0.29	0.35	0.41	0.45	0.50	0.54	0.57	0.61	0.64	0.67	0.70	0.76	0.81	0.86
8	0.38	0.47	0.54	0.60	0.66	0.72	0.76	0.81	0.85	0.90	0.94	1.01	1.08	1.15
10	0.48	0.59	0.68	0.76	0.83	0.89	0.96	1.01	1.07	1.12	1.17	1.26	1.35	1.43
12	0.57	0.70	0.81	0.91	0.99	1.07	1.15	1.22	1.28	1.34	1.40	1.52	1.62	1.72
14	0.67	0.82	0.95	1.06	1.16	1.25	1.34	1.42	1.50	1.57	1.64	1.77	1.89	2.01
16	0.76	0.94	1.08	1.21	1.32	1.43	1.53	1.62	1.71	1.79	1.87	2.02	2.16	2.29
18	0.86	1.05	1.22	1.36	1.49	1.61	1.72	1.82	1.92	2.02	2.11	2.28	2.43	2.58
20	0.96	1.17	1.35	1.51	1.66	1.79	1.91	2.03	2.14	2.24	2.34	2.53	2.70	2.87
24	1.15	1.40	1.62	1.81	1.99	2.15	2.29	2.43	2.56	2.69	2.81	3.03	3.24	3.44
30	1.43	1.76	2.03	2.27	2.48	2.68	2.87	3.04	3.21	3.36	3.51	3.79	4.05	4.30
36	1.72	2.11	2.43	2.72	2.98	3.22	3.44	3.65	3.85	4.03	4.21	4.55	4.86	5.16
42	2.01	2.46	2.84	3.17	3.48	3.75	4.01	4.26	4.49	4.71	4.92	5.31	5.68	6.02
48	2.29	2.81	3.24	3.63	3.97	4.29	4.59	4.86	5.13	5.38	5.62	6.07	6.49	6.88
54	2.58	3.16	3.65	4.08	4.47	4.83	5.16	5.47	5.77	6.05	6.32	6.83	7.30	7.74
60	2.87	3.51	4.05	4.53	4.97	5.36	5.73	6.08	6.41	6.72	7.02	7.58	8.11	8.60
64	3.06	3.75	4.32	4.83	5.30	5.72	6.12	6.49	6.84	7.17	7.49	8.09	8.65	9.17

Note: The allowable leakage for test sections with different diameters is the sum of the computed leakage for each pipe size.

When testing against closed metal seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size is allowed.

Leakage less than the quantity specified by the above equation may be considered "allowable leakage" resulting from such factors as trapped air, take-up of restraints, and temperature variations during testing. However, observed leaks should be repaired regardless of leakage measurements through metering equipment.

A swift loss of water pressure in the main could be the result of a break in the line, major valve opening, loose mechanical joint bolts, missing or dislodged gasket, or inadequate thrust block. A slow loss of pressure in excess of allowable limits could be the result of minor problems such as a leaking valve or a corporation stop not completely shut off. In addition, air entrapped in the line can result in an apparent leakage in excess of the allowable limit.

Recommendations for avoiding minor leaks include the following:

- a. Vent all high points in the line by use of air release valves or corporation stops.
- b. Check all mechanical joint bolted connections.
- c. Cure thrust blocks before testing.
- d. Insure that exposed gasket grooves are properly cleaned before inserting gaskets.
- e. When inserting pipe into a mechanical joint or gasket joint, insure that the spigot end is squarely cut and beveled properly for the hub.

One approach for determining if the apparent leakage is the result of air entrapped in a line is to immediately repeat the leakage test (i.e., continue the test for another two hours) and determine the amount of make-up water required to fill the line a second time. If this amount is significantly less than the first filling, the difference in apparent leakage is probably the result of air being present in the line. If no significant difference in make-up water is recorded, a leak is probable.

#### 5016 SEPARATION OF WATER MAINS AND SANITARY SEWERS.

- A. General. The following factors should be considered in providing adequate separation:
- a. Materials and type of joints for water and sewer pipes;
  - b. Soil conditions;
  - c. Service and branch connections into the water main and sewer line;
  - d. Compensating variations in the horizontal and vertical separations;
  - e. Space for repair and alterations of water and sewer pipes; and
  - f. Off-setting of water mains around manholes.
- B. Parallel Installation. Water mains shall be laid at least ten feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer and on either case, at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. In areas where the recommended separations cannot be obtained, either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing.
- C. Crossings. Water mains crossing sewers shall be laid to provide a minimum vertical clear distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, the full length of water pipe shall be located so both joints will be as far from the sewer as possible but in no case less than ten feet. Special structural support for the water and sewer pipes may be required. In areas where the recommended separations cannot be obtained either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing that extends no less than ten feet on both sides of the crossing.
- D. Exceptions. Any variance from the specified separation distances in paragraphs 5016.B and 5016.C must be approved by the City Engineer.
- E. Force Mains. There shall be at least a ten-foot horizontal separation between water mains and sanitary sewer force mains and they shall be in separate trenches. In areas where these separations cannot be obtained, either the waterline or the sewer line shall be cased in a continuous casing.

- F. Sewer Manholes. No waterline shall be located closer than ten (10) feet to any part of a sanitary or combined sewer manhole.
- G. Disposal Facilities. No waterline shall be located closer than 25 feet to any on-site wastewater disposal facility, agricultural waste disposal facility, or landfill.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **Design Criteria for Water Line Construction**

- Proposed 09-10-2025
- Comments/Questions Received – None Currently Received
- Public Informational Meeting – None Currently Scheduled
- Anticipated Adoption Date 10-10-2025

DESIGN CRITERIA FOR  
WATER LINE CONSTRUCTION

- A. GENERAL. Proposed extensions of the water distribution system shall, in general, follow the pattern established in the Water Facilities Plan as adopted by the City of Liberty. Deviations from this general policy may be deemed necessary by the City Engineer should the provision of adequate service to prospective customers or fire protection needs, existing or anticipated, in the area to be served warrant said deviations.

No public water line shall be constructed less than six (6) inches in diameter.

- B. LOCATION OF WATER MAINS AND APPURTENANCES. Proposed water mains shall be so located within street right-of-way to provide the least interference with the location of other utility lines. Street grades and elevations of proposed main shall be taken into consideration so that once constructed they will not require regrading or relocation.
- C. DEPTH. All water mains shall have a minimum cover of forty-two (42) inches.
- D. MATERIALS OF CONSTRUCTION. Water main material may be ductile-iron, PVC or HDPE described as follows:

1. Ductile-Iron Pipe. Unless indicated otherwise on the construction plans or directed by the Engineer, all 6 inch pipes and larger shall be Class 50 ductile iron, all 4 inch pipes shall be Class 51 Ductile iron complete with all accessories and conforming to ANSI A21.51, AWWA C151, ASTM A536, and Grade 60-42-10.

The outside coating used under normal conditions shall be an asphaltic coating approximately 1 mil thick. The coating shall be applied to the outside of all pipes, unless otherwise specified. The finished coating shall be continuous and smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe.

The lining for use under normal conditions shall be a cement-mortar lining in accordance with ANSI/AWWA C104/A21.4, unless otherwise specified.

Joints, unless otherwise specified, shall be of the push-on type conforming to ANSI A21.11/AWWA C111, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable.

Restrained joints (if required) shall be Loc-Tite, Meg-a-Lug, or approved equal.

2. Ductile-Iron Fittings. Ductile-iron fittings shall be complete with all accessories and shall be ASTM A536, Grade 70-50-05, conforming to ANSI A21.10/AWWA C110, ANSI A21.53/AWWA C153, 350 psi pressure rating. Joints shall be of the standard mechanical joint type conforming to ANSI A21.11/AWWA C104 and shall be coated inside and out with a bituminous coating. Fittings shall have distinctly cast upon them the pressure rating and letters "DI" or "DUCTILE".

3. PVC Pipe. The non-restrained PVC pipe will be push-on joints. PVC pipe will be DR14 C-900/~~DR18 C-905~~ DIPS or C-909 PC150 DIPS. Restrained joints will be Certainteed Certa-lok C-900 Restrained Joint Pipe, EBAA bell restrained harnesses, or Diamond Plastic Bulldog Restraint Joint System.

Bends may either be Certa-lok sweeps or MJ ductile iron bends. Tees and valves will be ductile iron mechanical joints. For changes in alignment less than 11-1/4 degrees but more than the allowable joint deflection, then Certainteed High Deflection Couplings shall be used. Romac Grip Rings or EBAA Iron Mega-Lugs designed for PVC for MJ fittings and valves shall be used.

4. HDPE Pipe. HDPE will be AWWA C906 with a working pressure rating of PC 160 (Diameter Ratio, DR11), nominal Ductile Iron Pipe Size (DIPS).
  - a. Butt Fusion Fittings – All butt fusion fittings will be AWWA C906 and have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.
  - b. Electrofusion Fittings – All electrofusion fittings will be PE3408 HDPE. Electrofusion fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the working pressure rating (WPR) of the fitting.
  - c. Mechanical Joint Adapters – Mechanical joint adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

- E. FIRE HYDRANTS. Fire hydrants shall conform to AWWA C502 and shall be traffic models with breakaway flanges and shall have one (1) 24-inch **Storz** pumper nozzle **with integral locking mechanism** and two (2) 2 1/2 inch nozzles. All hydrants shall be furnished with auxiliary gate valves, and conform to acceptable models as listed in Appendix “A” of Section 5000 Water Lines as set forth in the Technical Specifications of the City of Liberty.

Hydrants should be placed at or near street intersections and at intermediate points when block lengths become long. Under no circumstances shall the spacing of fire hydrants exceed five hundred (500) feet in residential areas or three hundred (300) feet in commercial areas.

Fire Hydrant installations shall conform to the Standard Drawings.

- F. LINE VALVES. Gate valves shall be of the resilient-seated configuration and shall conform to the applicable requirements of AWWA C509. Gate valves shall be used in all

water mains twelve (12) inches in diameter and smaller. Butterfly valves shall conform to AWWA C504. Butterfly valves shall be used in mains larger than twelve (12) inches in diameter or where otherwise approved by the City Engineer.

Valves shall be placed in all straight runs of pipe at intervals not to exceed 800 feet. Valves should be placed so that no more than an average of 25 customers (maximum of 30) would be without service due to a line being shutdown.

Extension stems shall be provided for buried valves when the operating nut is more than three feet below finished grade. Each extension stem for a buried valve shall extend to within three feet of the ground surface, shall be provided with spacers which will center the stem in the valve box, and shall be equipped with a wrench nut.

- H. TAPPING SLEEVES AND VALVES. Tapping sleeves and valves shall be used where required to connect to existing in-service mains.

The valves shall be Stainless Steel as set forth in the Technical Specifications of the City of Liberty.

Tapping sleeves shall be of the flanged-outlet type designed for attachment to the flanged inlet end of the tapping valve, and shall be provided with mechanical joint ends at each end of the run.

- I. CONNECTIONS TO EXISTING WATER MAINS. Connections to existing water mains shall be made in such a manner as to provide the least amount of interruption to water service. In the event closing of valves to make a connection will affect a customer who cannot be without service, provisions shall be made on the plans for a temporary service.

- J. PROVISIONS FOR FUTURE EXTENSIONS OF WATER MAINS. At the termination of all water mains or at locations as specified by the City Engineer, a dead end assembly in accordance with the Standard Drawings of Section 5000 of the Technical Specifications of the City of Liberty shall be provided to allow for future water main extensions.

Flushing assemblies shall be used only at locations approved by the Engineer to provide for thorough flushing of all water mains in the project area. Whenever practical, water mains five hundred (500) feet and longer shall be provided with a fire hydrant for flushing.

- K. THRUST BLOCKING. Reaction blocking of adequate size shall be provided at all tees, elbows and bends to resist all resultant thrusts due to hydrostatic pressure. All blocking shall conform to the Standard Drawings. Restrictive joints may be used as set forth in the Technical Specifications of the City of Liberty.

- L. HIGHWAY AND RAILROAD CROSSINGS. All crossings of highways or railroads shall be made by boring or tunneling. The work shall be in conformity with all requirements and regulations and be under the control of the authority owning or having jurisdiction over and control of the right-of-way in each case.

- M. STREET CROSSINGS. Open cutting of streets shall be allowed only where permitted by the City Engineer. At locations where open cutting is not permitted, the crossing shall be made by boring or tunneling. Crossings made by boring or tunneling shall require a casing

pipe unless otherwise approved by the City Engineer. All work and materials shall be in conformity with all requirements of Section 6000 Tunneling, Boring, and Jacking (Pipelines) of the Technical Specifications of the City of Liberty. The diameter and length of the casing pipe to be used shall be as determined by the City Engineer.

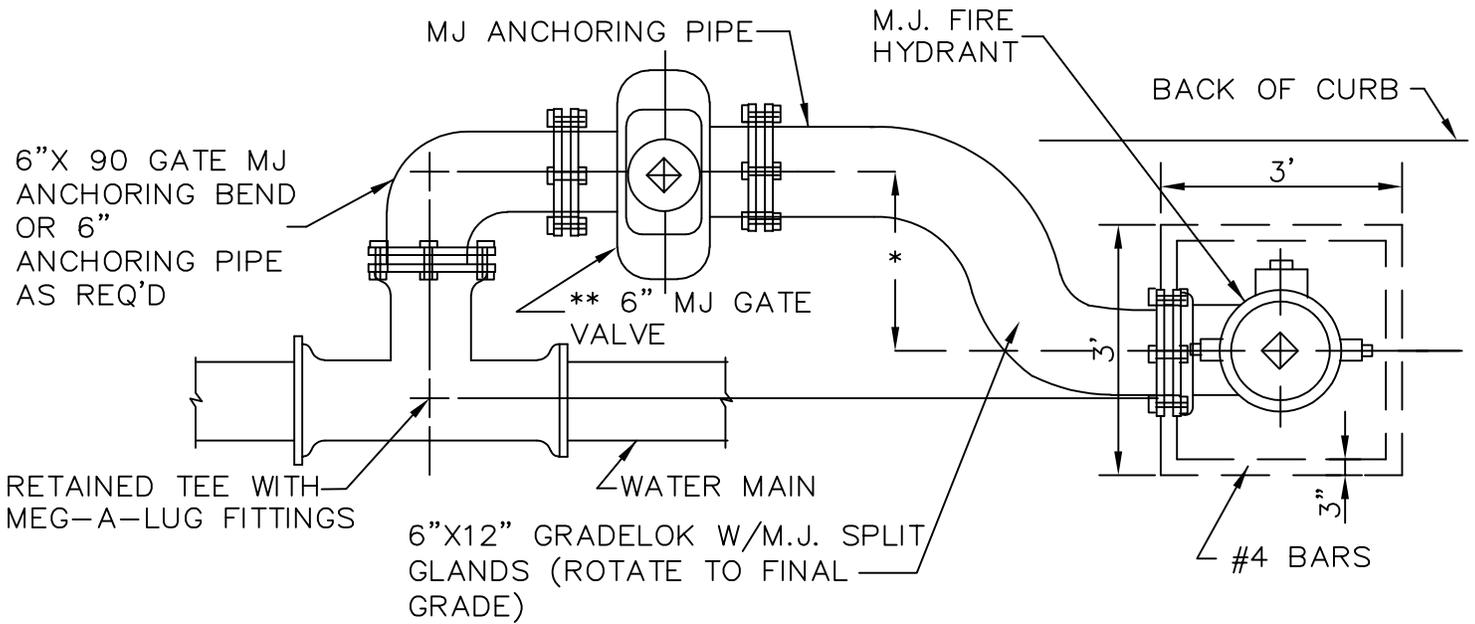
- N. FIRE FLOW REQUIREMENTS. Public improvement plans for water line projects serving development sites other than single family or duplex subdivisions shall be reviewed for fire protection sufficiency. The ~~Chief Building~~ **Fire Code** Official shall determine the amount of water that is required for fire protection based on ~~I.S.O. guidelines~~ **Appendix B Section 105 Table 105.1 (2) of the Liberty Fire Code** for the proposed type of structures to be built within the development. The design engineer shall obtain the flow requirement and then determine if the existing and proposed water lines can provide this flow based on existing operating conditions. Calculations verifying that the required flows can be met shall accompany the drawings when submitted for approval.
- O. BACKFLOW PREVENTION. All private, non-potable water uses shall require backflow prevention devices at all connections to the public main. This shall include but not be limited to fire protection lines.
- O. EASEMENTS. Public water mains outside of the public right-of-way shall be encompassed entirely by a public water line easement, at least fifteen (15) feet minimum width, and centered over the facilities. Excessively deep facilities, or other special circumstances may require a wider easement as determined by the City Engineer.
- P. TRACER WIRE PIPE DETECTION SYSTEM. Tracer wire pipe detection shall be installed on non-ductile public mains and private service lines within the public right-of-way per Section 9100 Tracer Wire Pipe Detection System.



## RECENTLY ADOPTED REVISIONS/AMENDMENTS

### **D50-5A Typical Fire Hydrant Installation Detail**

- Proposed 09-10-2025
- Comments/Questions Received – None Currently Received
- Public Informational Meeting – None Currently Scheduled
- Anticipated Adoption Date 10-10-2025



\* SEE DETAIL 50-2A

\* VARIES 6" TO 24" WITH OFFSET 18" STANDARD. ROTATE OFFSET TO ACCOMODATE ELEVATION.

\*\* NON-DUCTILE MAIN: TRACER WIRE PIPE DETECTION SYSTEM AND TEST STATION SHALL BE INSTALLED AT THE GATE VALVE PER DETAIL D50-2A AND SECTION 9100.

\*\*\* HYDRANT PAINT: SHERWIN WILLIAMS INDUSTRIAL YELLOW NO. B54-Y37

