

CITY OF LOCKHART  
TEXAS

CONSTRUCTION  
STANDARDS



Lockhart  
The BBQ Capital of Texas

Adopted January 21, 2020

---

## Table of Contents

<b>CHAPTER 1 - GENERAL PROVISIONS.....</b>	<b>1</b>
I.    PURPOSE AND SCOPE.....	1
II.   DEFINITIONS AND ABBREVIATIONS.....	1
<b>CHAPTER 2 - WATER DISTRIBUTION SYSTEM STANDARDS.....</b>	<b>2</b>
I.    GENERAL REQUIREMENTS.....	2
II.   MATERIALS .....	3
III.  WATER DISTRIBUTION SYSTEM CONSTRUCTION .....	6
IV.   DISTRIBUTION SYSTEM TESTING AND DISINFECTING.....	8
V.    WATER DISTRIBUTION SYSTEM DETAILS.....	10
<b>CHAPTER 3 - WASTEWATER SYSTEM STANDARDS .....</b>	<b>11</b>
I.    GENERAL REQUIREMENTS.....	11
II.   MATERIALS .....	12
III.  WASTEWATER COLLECTION SYSTEM CONSTRUCTION.....	13
IV.   TESTING.....	15
V.    WASTEWATER SYSTEM DETAILS .....	16
<b>CHAPTER 4 - STREET, SIDEWALK, AND DRAINAGE STRUCTURES STANDARDS.....</b>	<b>17</b>
I.    STREET DESIGN REQUIREMENTS .....	17
II.   SURFACING WITH FLEXIBLE BASE MATERIAL .....	18
III.  HOT MIX ASPHALTIC CONCRETE PAVEMENT .....	20
IV.   CONCRETE PAVEMENT CONSTRUCTION.....	23
V.    CURB AND GUTTER AND VALLEY GUTTERS .....	24
VI.   SIDEWALKS .....	26
VII.  DRAINAGE STRUCTURES .....	26
VIII. STREET, SIDEWALK, AND DRAINAGE STRUCTURES DETAILS .....	30
<b>CHAPTER 5 - CONCRETE AND REINFORCING STANDARDS.....</b>	<b>31</b>
I.    GENERAL REQUIREMENTS.....	31
II.   CONCRETE FOR STRUCTURES.....	31
III.  REINFORCING STEEL .....	36
<b>CHAPTER 6 - ELECTRIC DISTRIBUTION SYSTEM STANDARDS .....</b>	<b>40</b>
I.    GENERAL REQUIREMENTS.....	40
II.   OVERHEAD SERVICE.....	40
III.  UNDERGROUND SERVICES.....	41
IV.   GROUNDING .....	42

---

V. METERING, METER LOOPS AND SERVICE DROPS .....	43
VI. STREET LIGHTS .....	44
VII. ELECTRICAL DETAILS .....	47

---

## CHAPTER 1 - GENERAL PROVISIONS

### I. PURPOSE AND SCOPE

These construction standards are a supplement to the Subdivision Ordinance of the City and constitute the minimum requirements for the construction of the municipal improvements within the Corporate Limits of the City and of such improvements in those areas which may be annexed by the City. They provide guidance to sub-dividers, developers, engineers, and contractors with respect to design, materials, and methods which will be used in construction of municipal improvements.

Approval, in writing, of variance from these Construction Standards and of additional design, details, and specifications is required as part of the procedure of the subdivision process or, after approval by the Council of the final plat and engineering plans, by the City Manager, acting on behalf of the Council, and upon recommendation of the City Staff.

### II. DEFINITIONS AND ABBREVIATIONS

A. See Chapter 52 – Subdivision Regulations, Section 52-2.

B. The following definitions and abbreviations are added:

- |     |            |   |
|-----|------------|---|
| 1.  | AASHTO     | American Association of State Highway and Transportation Officials  |
| 2.  | ANSI       | American National Standards Institute   |
| 3.  | ASTM       | American Society for Testing and Materials  |
| 4.  | AWWA       | American Water Works Association  |
| 5.  | BUILDER    | A person or firm engaged by a lot owner to erect one or more structures and make connections to city streets and/or services.       |
| 6.  | CI         | Cast Iron   |
| 7.  | CONTRACTOR | A person or firm engaged by the sub-divider to construct public improvements according to plans and documents approved by the City. |
| 8.  | DI         | Ductile Iron  |
| 9.  | NEC        | National Electrical Code  |
| 10. | NSF        | National Sanitation Foundation  |
| 11. | PPM        | Parts Per Million   |
| 12. | PS         | Pipe Stiffness  |
| 13. | PSI        | Pounds per Square Inch  |
| 14. | PVC        | Polyvinyl Chloride  |
| 15. | RCP        | Reinforced Concrete Pipe  |
| 16. | SDR        | Standard Dimension Ratio  |
| 17. | TCEQ       | Texas Commission on Environmental Quality   |
| 18. | TxDOT      | Texas Department of Transportation  |
| 19. | TWDB       | Texas Water Development Board   |

---

## CHAPTER 2 - WATER DISTRIBUTION SYSTEM STANDARDS

### I. GENERAL REQUIREMENTS

#### A. Standard Requirements

All water line connections shall be in compliance with the following rules, regulations, and standards:

1. Rules and Regulations for Public Water Systems, TCEQ, latest edition.
2. Insurance Services Office's (ISO) Fire Suppression Rating Schedule (FSRS) rating system of the Texas Department of Insurance, latest edition.
3. AWWA, ASTM and ANSI technical standards latest editions.
4. Whenever TCEQ and City of Lockhart Specifications conflict, the more stringent shall apply.

#### B. Design Requirements

1. Minimum Pressure – Water lines shall be sized to provide a minimum dynamic pressure of 35 psi at an instantaneous demand of 2.0 gallons per minute per connection.
2. Minimum Diameter – Except for service lines, all mains shall have a diameter of not less than eight inches (8").
3. Gate Valves – Gate valves shall be provided on all water mains so that repairs can be made without inactivating more than 500 feet of water mains in commercial and industrial areas, nor more than 800 feet in residential areas. Gate valves are required at each fire hydrant connection and every tee and cross fitting. Tees shall have two (2) gate valves and crosses shall have three (3) gate valves.
4. Water Mains – Water mains are defined as pipelines eight inches (8") in diameter or greater. All water mains must extend to the most distant border of the proposed subdivision. A valve, plug, and concrete block shall be provided on the end of each main so that an extension of the main can be made without removing the main from service. See Details for location of water main within street right of way. Dead end mains are not acceptable except in special situations when approved by the City Engineer.
5. Service Lines – Service lines are defined as the lines extending from the mains to the meters. All service lines shall be extended to within one foot (1') of lot lines.
6. Fire Hydrants – In residential areas, fire hydrants shall be spaced at not more than 600 foot intervals along the mains and located so that all areas are not more than 500 feet from a hydrant. In commercial, industrial, and high-density areas, fire

---

hydrants shall be spaced at not more than 300 foot intervals along the mains. Hydrants shall be located at street intersections when practical. If existing mains are present, hydrants shall be installed to meet coverage requirements. Hydrants shall be located between one and a half feet (1'-6") to seven feet (7'-0") from the face of curb.

7. Meters – Meter installations shall be completed and ready for service. The City of Lockhart will furnish and install the meter only.
8. Separation between water and wastewater lines shall comply with Title 30 of the Texas Administrative Code (TAC) §290.44(e).

## **II. MATERIALS**

### **A. General**

All water main pipe used in distribution systems shall be rated for a minimum pressure of 150 psi, shall display the appropriate AWWA specification stamp, shall display the NSF stamp, and be approved by Underwriters Laboratories or Factory Mutual for fire service. Higher rated pressure pipe shall be used where conditions require. All pipe eight inches (8") and larger shall be PVC, concrete steel cylinder, or DI, as detailed below. All main line fittings shall be CI, DI, or concrete steel cylinder.

### **B. PVC Pipe**

All eight inch (8") and larger PVC pipe shall conform to AWWA Specification C-900, ASTM D2241 or latest revision SDR 18, Pressure Class 235. PVC fittings shall not be used with PVC pipe of four inch (4") diameter or larger. PVC pipe for potable water lines shall be blue in color to differentiate it from wastewater PVC pipe.

### **C. Concrete Steel Cylinder**

1. Except as otherwise modified or supplemented herein, the latest revision of AWWA Specification C-301 for "Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids" shall govern the design, component materials, manufacture, and testing of all concrete-steel cylinder pipe furnished.
2. All pipes shall be AWWA Class 150 and shall be designed for a minimum internal working pressure of 150 psi, a maximum surge pressure of 150 psi, minimum surge pressure of -10 psi, and a minimum external load equivalent to six feet (6') of earth cover. Where the depth of bury of the pipe is indicated to be greater than six feet (6') in the engineering plans or job plans the design of the pipe shall be suitable for the earth loads indicated.
3. A tabulated layout schedule with reference to the stationing and grade lines shown on the job plans shall be submitted to the City for approval.

- 
4. Each special section and length of straight pipe shall have plainly marked on the inside of the bell end the class of pipe and identification marks sufficient enough to show the proper location of the pipe by reference to job plans.
  5. Pipe 16 inches through 42 inches (16" - 42") in size shall be furnished in nominal lengths of 20 feet (20') and pipe 48 inches through 72 inches (48" - 72") in size shall be furnished in nominal lengths of 16 feet (16'), except that this requirement may be modified by design requirements of the particular job.
  6. Each joint of pipe shall be furnished with a rubber gasket and a 12 inch diaper.

D. DI Pipe

The requirements for DI pipe shall meet the current AWWA Specification C-151 and shall be Thickness Class 50 at a minimum.

E. Fittings

All fittings shall conform to the current AWWA Specification C-110. Mechanical joints shall be used for all underground fittings, shall be lined with cement mortar, and coated with a bituminous coating. Joint restraints shall be used where required based on pipe materials, site conditions and fitting type. Flanged joints shall be used for all above ground fitting.

F. Fire Hydrants

1. General – Fire hydrants shall conform to AWWA Specification C-502 and shall have one (1) each 4-1/2 inch pumper connection and two (2) each 2-1/2 inch hose connections. Threads for hose connections shall be National Standard Threads.
2. Operating Nut – The operating nut shall be designed to prevent the seepage of rain into the top of the bonnet.
3. Bonnet – The bonnet or hydrant top shall be free-draining easily replaceable without shutting off the hydrant from the water main and shall contain means of automatically lubricating all operating threads.
4. Breakaway Design – The hydrant shall be of such design that the entire top barrel may be broken away, as by traffic collision without causing leakage and the broken hydrant shall be repairable without any excavation.
5. Main Valve – The main valve shall be compression closed with a 5-1/4 inch valve seat and the pipe connection shall be a six inch (6") mechanical joint.
6. Type – Hydrants shall be improved type Mueller.
7. Fire hydrant leads shall be Ductile Iron Pipe.

G. Isolation Valves

- 
1. Gate valves shall be used for isolation of potable water lines and shall conform to the Standard Specifications for Gate Valves for Ordinary Water Works Service, AWWA C 515 or latest revision for valves up to 12", and AWWA C 500, or latest revision for sizes over 12". All gate valves shall be iron body, bronze mounted, resilient seat or double disc, parallel seat, non-rising stem, internal wedging type.
  2. In lieu of gate valves, butterfly valves with rubber seats may be used for all valves larger than or equal to eighteen inches (18"). Valves bodies shall be CI or DI and conform to the latest revision of AWWA Standard C-504, Class 150-B. All interior wetted ferrous surfaces of the valve, including the disc, shall be coated for potable water service in accordance with AWWA C-550, latest revision.
  3. Underground Installations – For underground installations non-rising stem and yoke valves with square operating nuts shall be used. Valve stem shall have a minimum depth of 18" and 24" maximum from finished grade. Valve stems lower than maximum allowed will require an extension to be placed so the stem is within 18" – 24" of finished grade.
  4. Direction of Opening – Direction of opening shall be counter clockwise.
  5. Type – Valves shall be manufactured Mueller, Clow, American or equal as approved by the City, and rated for 300 psi test pressure and 150 psi minimum working pressure.

#### H. Gate Valve Boxes

Valve boxes shall be the two-piece screw type, adjustable by screwing the upper section over the lower section. Flanges on both sections shall serve to locate the upper section and hold it in place. Boxes shall be CI, shall have a cover designed for easy removal for access to the valve operating nut, and shall be marked "WATER" for ready identification.

#### I. Service Connections

Water service shall be provided to each separate tract or lot. The service connection shall include the items as shown in the Details.

1. Service Line – Service lines smaller than 2" from the water mains to the meter installation shall be Type "K" soft copper conforming to ASTM Specification B-88, or latest revision. Service lines larger than or equal to 2" shall include galvanized threaded nipples conforming to ASTM A733 from the main to a gate valve and restrained coupling adapter, then be Schedule 80 PVC (meeting ASTM D1785) or HDPE (meeting AWWA C901) from the coupling to the meter installation. All service line material shall bear the NSF 61 seal of approval for potable water pipe and rated at 150 psi working pressure.
2. Meter Valve – Meter valves shall be Mueller or approved equal angle stop with compression fitting on one end and meter coupling nut on the other end to connect



---

to meter. Meter valves shall have wings for locking the valve in the closed position. Locking holes shall be not less than 7/16-inch diameter.

3. Meter Box – Meter boxes shall be plastic with plastic covers as manufactured by DFW Plastics, Inc. or approved equal.
4. Corporation Stop – Services lines smaller than 2 inches (2”) shall use brass stops for connecting tubing to service clamps by Mueller or approved equal with compression by CC thread fittings.
5. Gate Valve – Services lines larger than or equal to 2” shall have gate valves by Mueller with threaded fittings.
6. Tapping Saddle – Tapping saddles shall be Mueller or approved equal double strap with CC thread.

### **III. WATER DISTRIBUTION SYSTEM CONSTRUCTION**

#### **A. Trench Construction**

1. Not more than 300 feet of trench shall be opened in advance of pipe installation and pipe shall be laid in all opened ditch by the end of the work day. A test type plug shall be installed in the open ends of all pipes at the end of each day.
2. All pipes shall be installed to provide a minimum cover of 36 inches, except that under road side ditches and road crossing, a minimum of 42 inches is required. Additional cover and encasement may be required where conditions dictate.
3. Trenches shall be excavated by a trenching machine, except where hand trenching is required. The banks of trenches shall be vertical above the top of the pipe. Trench width shall extend six inches (6”) beyond each side of the pipe bell. Depth of trench shall provide for installing in the exposed end of line.
4. In rock, the excavation shall be carried three inches (3”) below the bottom of the pipe bell, and loose earth or gravel, thoroughly tamped, shall be used for backfilling to the grade of the bottom of the pipe line.

#### **B. Bedding**

1. Pipe Embedment Materials:
  - a) For pipe 12 inches (12”) in internal diameter and smaller, the embedment material shall meet ASTM C33, No. 67.
  - b) For pipe larger than 12 inches (12”) in internal diameter, the embedment material shall meet ASTM C33, No. 57.

- 
2. Pipe shall be installed on a minimum six inch (6") embedment material. The pipe shall be covered by not less than twelve inches (12") of compacted embedment material.

C. Installation

Pipe shall be installed in accordance with the manufacturer's recommended procedure for each type of pipe, using trench construction and bedding as set forth above.

1. DI pipe shall be wrapped with a polyethylene wrap of at least eight (8) mils thickness. The polyethylene wrap shall be at least two feet (2') longer than the pipe joint to provide overlap at each juncture. Plastic tape used to join pieces of the wrap shall be 1-1/2 inches wide and ten (10) mils thick.
2. Concrete encasement shall be used for protection of water lines where required by City Engineer.

D. Backfill

After inspection of pipe installation and approval by the City given on any completed portion of the work the trench may be backfilled.

1. Backfill Materials for trenches not to be in proposed street areas, existing streets, or within 3' of the back of curb or edge of pavement must include specified embedment material and may be backfilled with excavated materials that are void of rocks and other objects larger than 4" in diameter.
2. Backfill in areas that will be in existing or proposed streets or within 3' of the back of- curb or edge of pavement must include specified embedment material up to the specified sub-grade elevation in the construction plans.

E. Pipe Restraints

1. Pipe restraints shall be used at all valves and fittings. Restraints shall be used a minimum of three (3) joints of pipe from each side of the valve or fitting, for dead end lines, or as required by City. Additional restraint length may be required depending on type of fitting, pipe material, and pipe size.

F. Concrete Thrust Blocks

1. Concrete thrust blocking shall be placed behind bends, tees, crosses, and ends. Concrete support cradles or blocking shall be required for the support of all fire hydrants, valves, and AWWA C110 fittings; such support shall be provided for AWWA C153 fittings when required by the engineer.

---

#### IV. DISTRIBUTION SYSTEM TESTING AND DISINFECTING

##### A. Pressure Testing

1. After a pipeline section has been laid, services installed, valve-off, and at least six inches (6") of compacted backfill have been placed over the top of the pipe. The pipe shall be slowly filled with water in a manner that will expel all air from the pipeline. With the line full, the test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City. The pump, pipe connection, and necessary apparatus shall be furnished by the Contractor. The test pressure (Hydrostatic) shall be 150 psi minimum and shall be maintained for one hour (1) inspected by the City Personnel, allowable leakage shall be determined by a water meter provided by the Contractor. At no time shall two or more lines in different size be tested at the same time. Contractor shall perform a preliminary test prior of calling City Personnel. One gauge shall be located at the pump and the other shall be located at a remote high point location on the line.

Allowable hydrostatic leakage rates must comply with the following formula:

$$L = \frac{SD (P^2)^{\frac{1}{2}}}{148,000}$$

Where  $L$  = Allowable leakage, gallons per hour

$S$  = Length of pipeline tested, in feet

$D$  = Nominal diameter of the pipe, in inches

$P$  = Average test pressure during hydrostatic test, in pounds per square inch gauge (psig)

2. Contractor shall notify the City of Lockhart Water Department 48 hours in advance of opening valve(s) to fill new water mains. City personnel shall witness operation to prevent low water pressure within the area. Caution shall be taken in preventing cross-connection contamination. Contractor shall keep record of water loss when charging and flushing lines and submit records to the Water Department.
3. Final testing of each section shall be observed and approved by the City.

##### B. Disinfection

New mains shall be thoroughly disinfected in accordance with AWWA Standard C651 and then flushed and sampled before being placed in service. Samples shall be collected for microbiological analysis to check the effectiveness of the disinfection procedure. Sampling shall be repeated if contamination persists. A minimum of one sample for each 1,000 feet of completed waterline will be required or at the next available sampling point beyond 1,000 feet as designated by the Engineer.

1. Initial Flushing – Before initial flushing, Contractor shall notify the City's Water Department Inspector to coordinate water availability. The pipeline section shall be

---

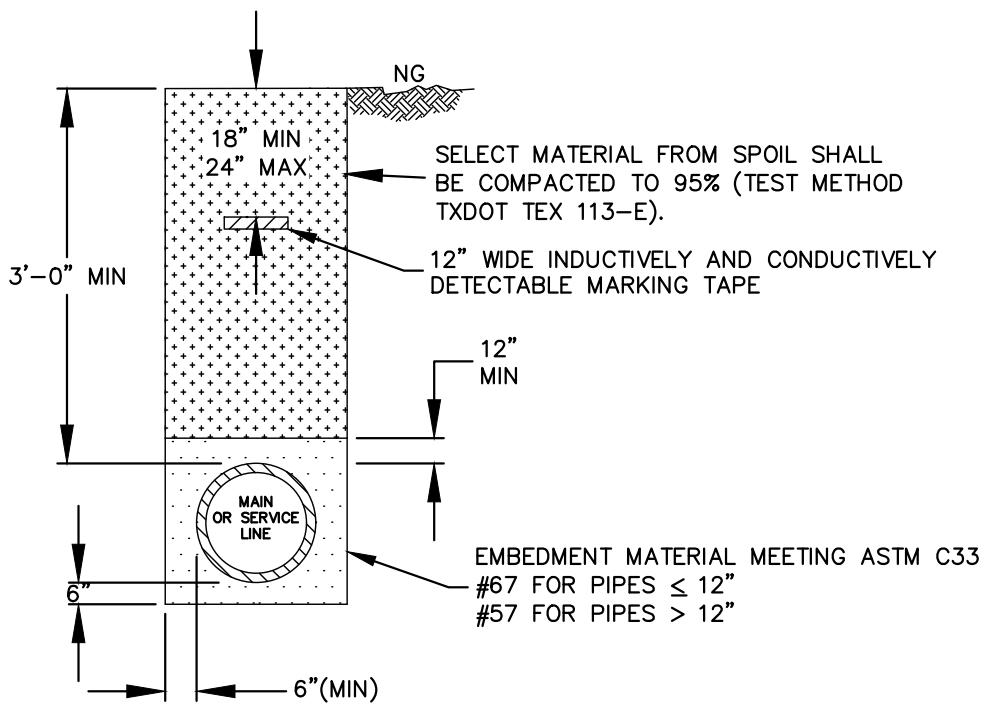
flushed prior to disinfection. Flushing shall be done through a fire hydrant opening if there is a hydrant on the end of the section, or through a tap on the end of the line which provides a two-inch (2") orifice. The line shall be flushed for a period of time equal to one minute for each 100 feet of line, or until the water being discharged is no longer transporting visible particles, whichever is longer.

2. Chlorination – The forms of chlorine that may be used in disinfection operations are sodium hypochlorite and calcium hypochlorite conforming to ANSI/AWWA B300. Chlorination products must be ANSI/NFS 60 certified.
  - a) The chlorinating agent selected shall be applied through a tap on the pressure side of the gate valve controlling the flow of water into the new line. The chlorinating agent shall be added at a rate such that the application shall be at least 50 ppm.
  - b) The application shall be continued until the water being discharged at the far end of the new section shows that the chlorine solution has reached the length of the new section, after which the valves shall be closed, and the new section isolated for at least 24 hours. All valves, hydrants, and meter angle stops shall be operated during the chlorination process.
  - c) If at the end of the detention period of 24 hours the water does not indicate at least 10 ppm residual, a second dosage of 50 ppm shall be applied as before and retained for at least 12 hours, and this process shall be repeated until the residual at the end of the 12 hour period is at least 10 ppm. Isolation shall not exceed 48 hours.
  - d) During all chlorination work, care shall be taken to prevent highly chlorinated water from flowing back into the line supplying the water to the new line.
3. Final Flushing and Testing – Following the chlorination of each section, the section shall be thoroughly flushed until the water being discharged has the same chlorine residual as the water being used to feed the system. A sample of water, taken at the extremity of each newly constructed section, shall be obtained and tested. Microbiological analysis shall be submitted to a laboratory that has National Environmental Laboratory Accreditation (NELAC), accredited by the TCEQ. If the samples are not of the same purity and quality as the water injected into the section, the section will not be accepted. Samples shall be taken from taps located and installed in such a way as to prevent outside contamination. Results of the laboratory analysis shall be provided to the City. Samples shall be taken every 1,000 feet of line from taps already in place or installed by the Contractor at his own expense. City personnel shall witness the operation.

---

**V. WATER DISTRIBUTION SYSTEM DETAILS**

<b>Detail</b>	<b>Detail No.</b>
Trench Detail	W-1A
ROW Trench Detail	W-1B
Concrete Encasement	W-2
Typical Utility Placement	W-3
Standard Valve Installation	W-4
Fire Hydrant	W-5
Single Service Connection	W-6
Double Service Connection	W-7
Multi Service Connection	W-8
2" Blow off Valve	W-9
Thrust Blocking	W-10
Water Main Offset	W-11
Pipe Encasement	W-12



NOTE:

1. THIS DETAIL SHALL ONLY BE USED WHEN TRENCH EDGE IS MORE THAN 3'-0" FROM EXISTING OR FUTURE PAVEMENT.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
TRENCH DETAIL	
SCALE:	DRAWING No.
NTS	W - 1A

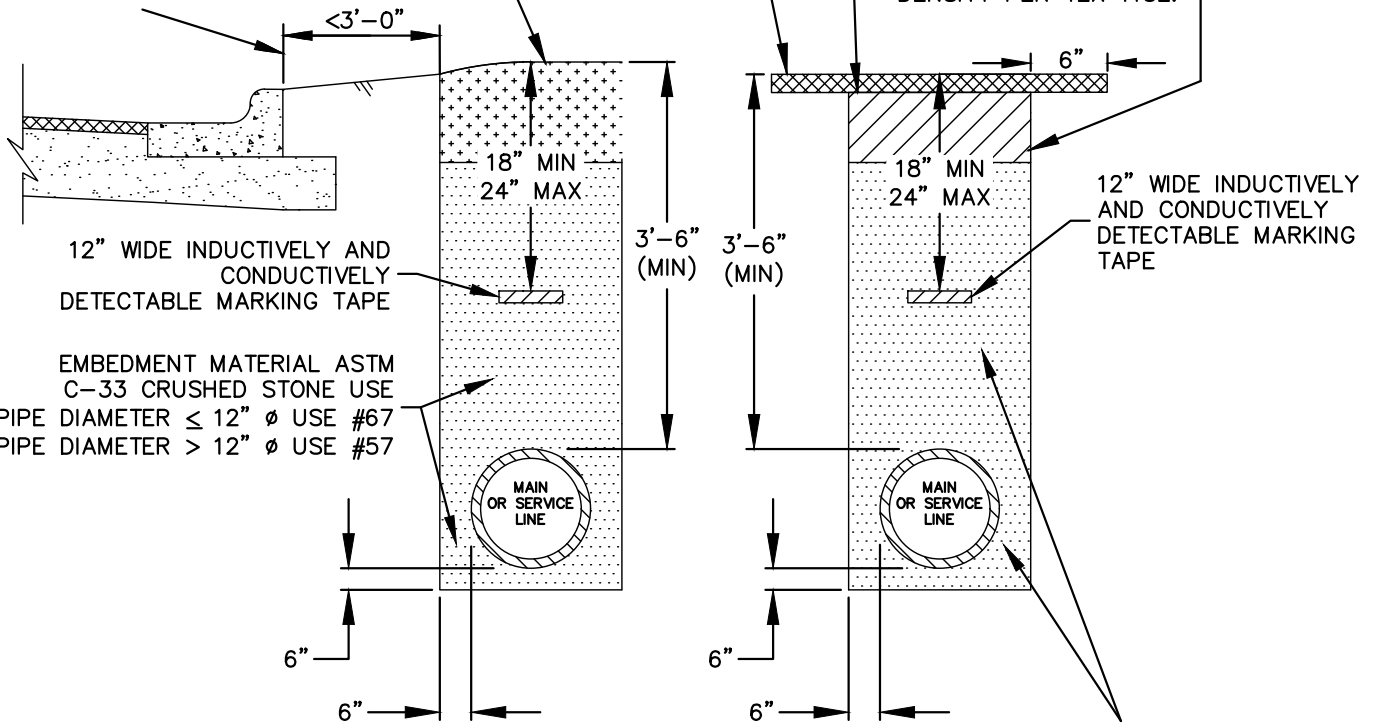
WHEN PAVED SURFACE IS TO BE PERMANENT, SURFACE MATERIAL SHALL BE EQUAL TO MATERIAL REMOVED—MINIMUM AMOUNTS: 2" HMAC (TXDOT ITEM 340, TYPE D) COMPACTED TO 97% DENSITY, OR 6" CONCRETE. EXISTING ASPHALT AND CONCRETE TO BE SAW CUT.

SURFACE SHALL BE CLEANED THOROUGHLY OF LOOSE MATERIAL, RECOMPACTED AND TACK COAT APPLIED BEFORE PAVEMENT SURFACE IS INSTALLED.

12" SELECT MATERIAL SHALL BE COMPACTED TO 95% WITHIN THE ROW (TEST METHOD TXDOT TEX 113-E)

8" FLEX (CRUSHED STONE) BASE (TXDOT ITEM 247, TYPE A, GRADE 1) AND 4" TXDOT ITEM 340 TYPE B HMAC (BLACK BASE) BACKFILL WHEN MAIN OR SERVICE IS UNDER STREET OR DRIVEWAY PAVEMENT. COMPACTED IN 6" LIFTS TO 100% DENSITY PER TEX 113E.

BACK OF CURB, PAVEMENT EDGE OR SIDEWALK EDGE



12" WIDE INDUCTIVELY AND CONDUCTIVELY DETECTABLE MARKING TAPE

12" WIDE INDUCTIVELY AND CONDUCTIVELY DETECTABLE MARKING TAPE

EMBEDMENT MATERIAL ASTM C-33 CRUSHED STONE USE  
PIPE DIAMETER ≤ 12" Ø USE #67  
PIPE DIAMETER > 12" Ø USE #57

EMBEDMENT MATERIAL  
ASTM C-33 CRUSHED STONE  
PIPE DIAMETER ≤ 12" Ø USE #67  
PIPE DIAMETER > 12" Ø USE #57

**NOTES**

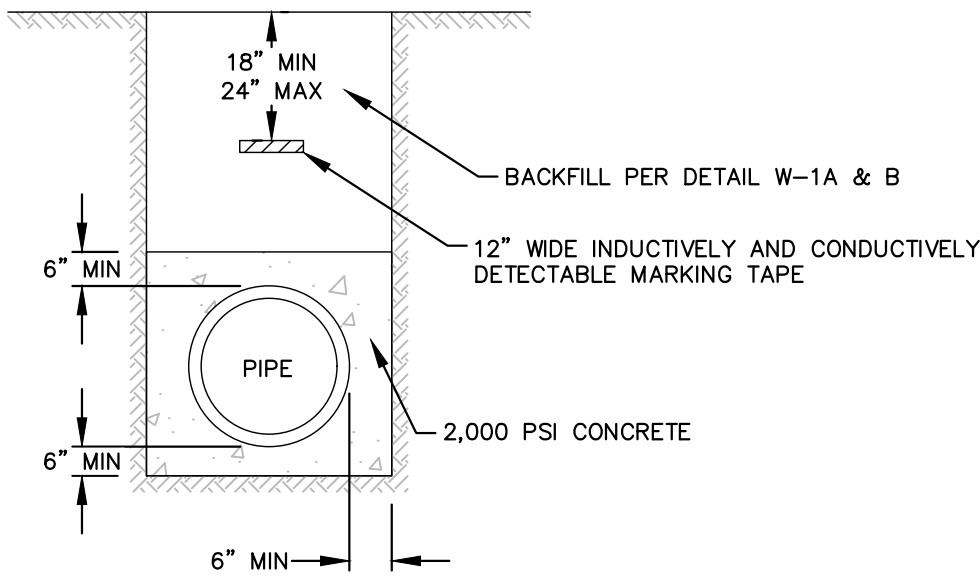
1. WHEN TUNNELING UNDER EXISTING CURB, CRUSHED STONE BASE SHALL BE COMPACTED TWO FEET BEHIND CURB AND TO WITHIN 6" OF THE BOTTOM OF THE CURB. THE 6" VOID UNDER THE CURB SHALL BE FILLED WITH 2,000 PSI CONCRETE.
2. UTILITY TRENCHES PLACED WITHIN THE STREET PAVEMENT OR WITHIN 3' OF THE BACK OF CURB OR EDGE OF EXISTING OR PROPOSED PAVEMENT SHALL COMPLY WITH THIS DETAIL.
3. FOR ASPHALT OR CONCRETE STREET REPAIRS WHERE THE SAW CUT PAVEMENT EDGE WILL BE WITHIN 3' OF EDGE OF EXISTING PAVEMENT OR LIP OF GUTTER, THE EXISTING PAVEMENT SURFACE BETWEEN THE DITCH LINE AND EDGE OF PAVEMENT OR LIP OF GUTTER SHALL BE REMOVED AND REPLACED WITH MATERIAL SPECIFIED.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
R.O.W. TRENCH DETAIL	
SCALE:	DRAWING No.
NTS	W - 1B

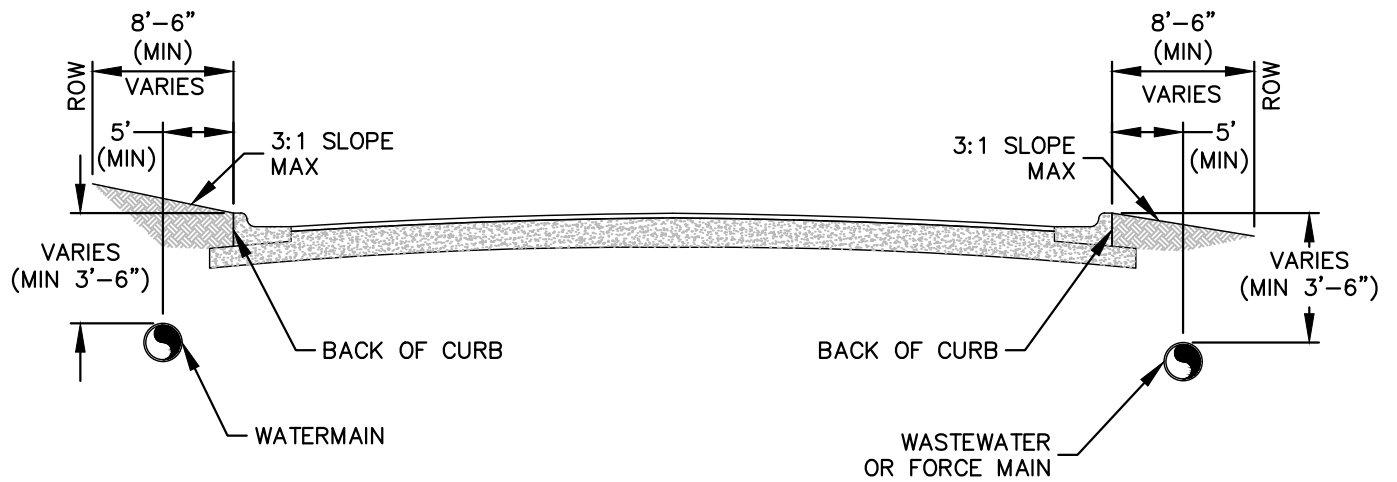


**NOTE:**

1. CONCRETE ENCASEMENT SHALL BE USED FOR PROTECTION OF WATER MAINS WHEN REQUIRED.


	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
			CONCRETE ENCASEMENT
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			SCALE: NTS
			DRAWING No. W - 2



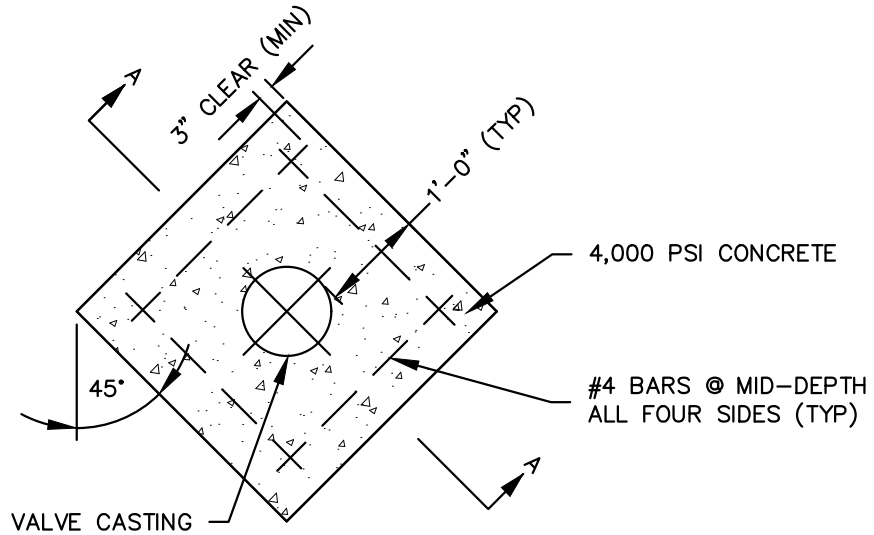


**NOTE:**

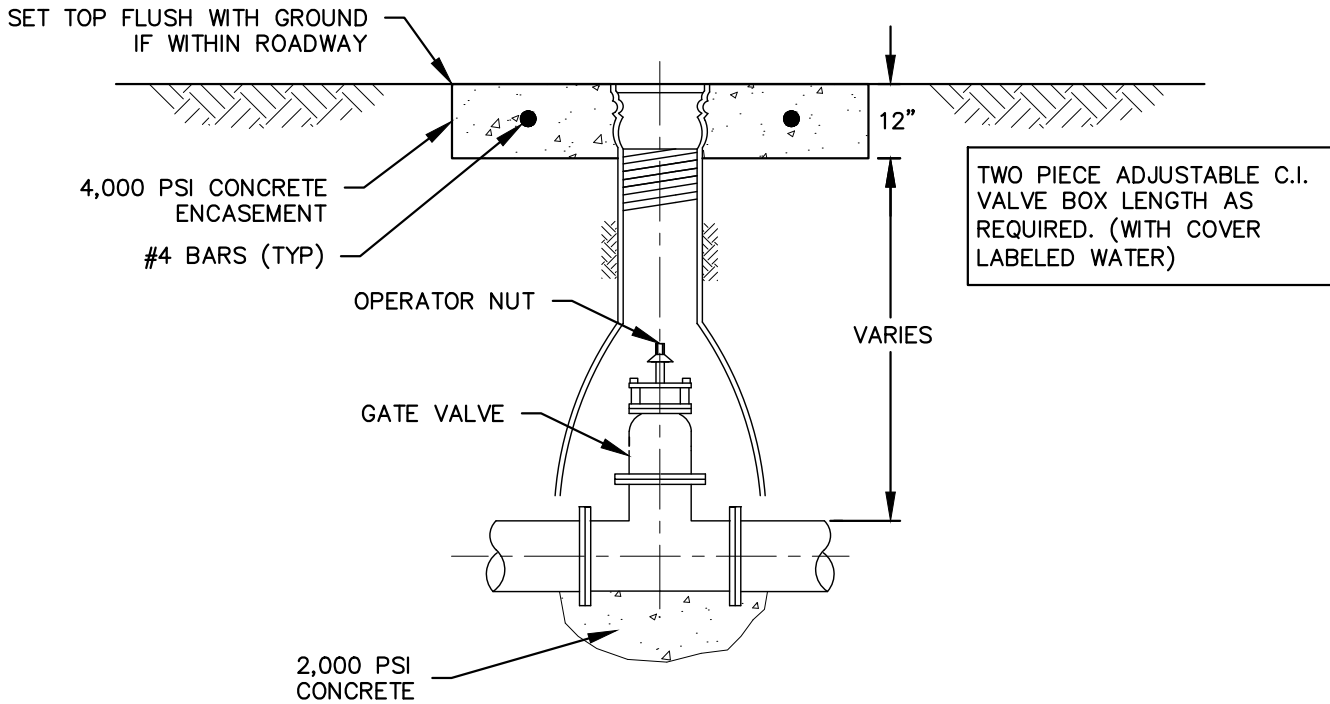
1. WATER MAINS SHALL BE INSTALLED ON THE UPHILL SIDE OF THE STREET AND WASTEWATER MAINS INSTALLED ON THE DOWNHILL SIDE OF THE STREET.
2. CENTERLINE OF UTILITIES SHALL ONLY BE PLACED WITHIN 5' OF BACK OF CURB OR EDGE OF PAVEMENT WITH PRIOR APPROVAL OF CITY.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
TYPICAL UTILITY PLACEMENT			SCALE: NTS
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			DRAWING No. W - 3

DIRECTION OF TRAFFIC



PLAN VIEW



SECTION A-A

NOTES:

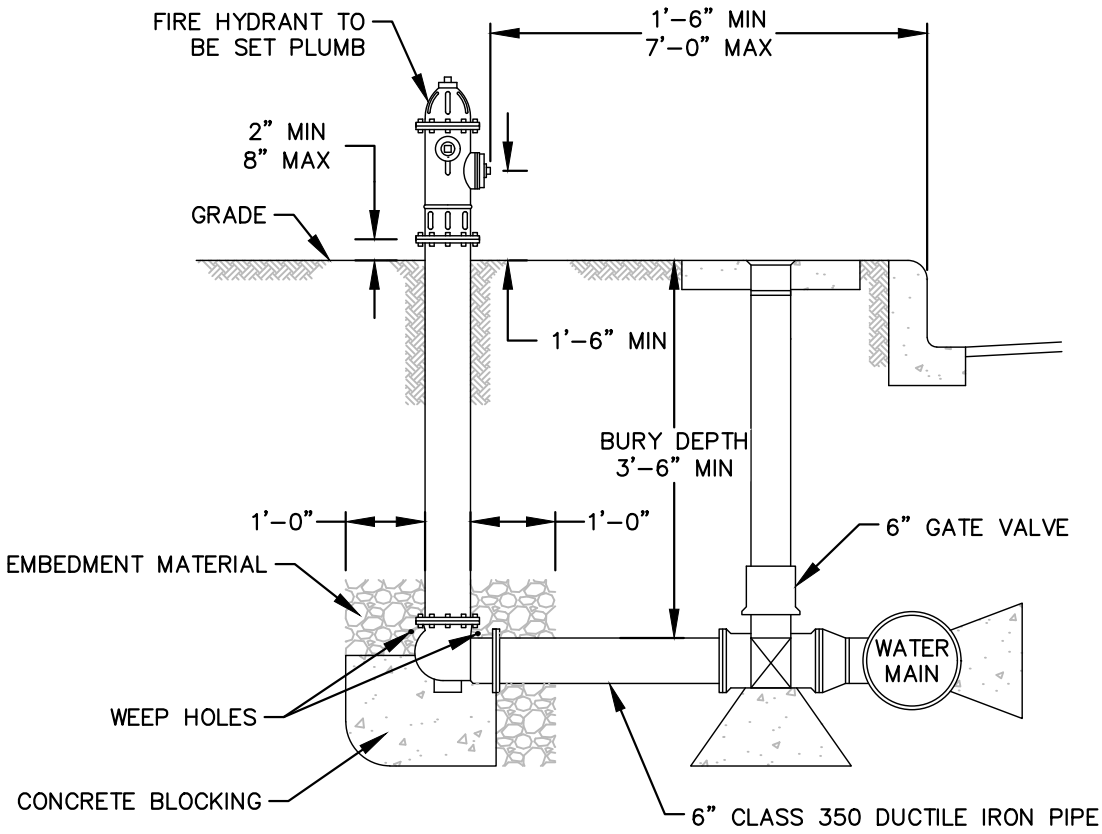
1. VALVE BOX SHALL NOT CONTACT WATERMAIN OR VALVE. VALVE & VALVE BOX SHALL BE SUPPORTED BY CONCRETE BLOCKING.
2. VALVE OPERATOR NUT SHALL BE WITHIN 2' OF SURFACE.
3. CONTRACTOR MAY CONSTRUCT CONCRETE ENCASEMENT AFTER STREET RECONSTRUCTION. ASPHALT SHALL BE SAW-CUT IN NEAT DIMENSIONS.
4. READY MIX OR LEANCRETE IS NOT ACCEPTABLE FOR ENCASEMENT.
5. ALL BACKFILL MATERIAL SHALL MEET ASTM C-33 CRUSHED STONE #57 OR #67 WHEN IN PAVEMENT, PER BACKFILL DETAILS.
6. ALL FITTINGS SHALL INCLUDE MEG-A-LUGS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

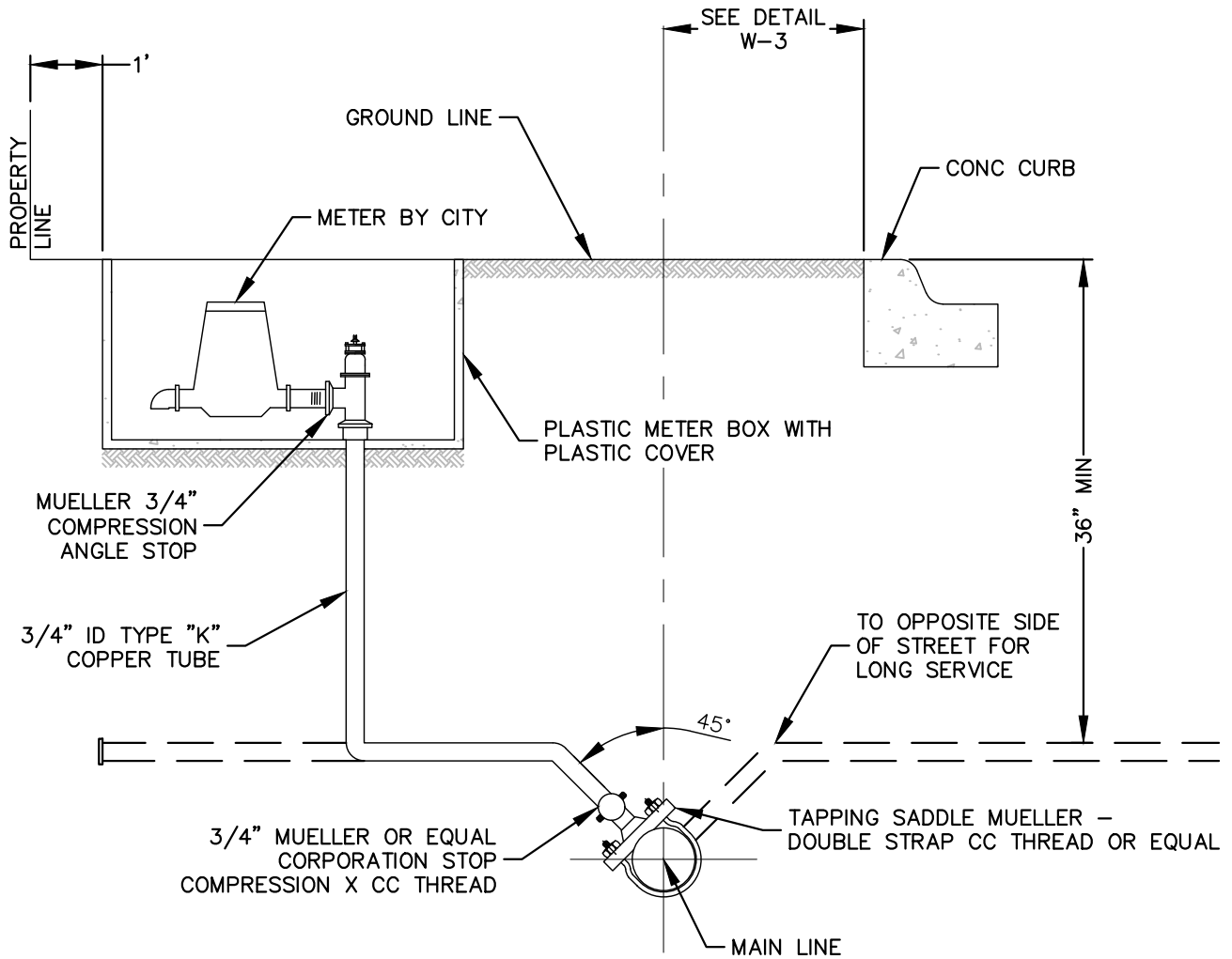
TITLE:	STANDARD VALVE INSTALLATION	
SCALE:		
DRAWING No.	W - 4	



**NOTES:**


1. HYDRANTS SHALL BE LOCATED MINIMUM 1'-6" FEET FROM FRONT OF CURB AND MINIMUM 6" FROM SIDEWALK OR RAMP.
2. ONE BARREL EXTENSION NOT EXCEEDING TWO FEET IN LENGTH SHALL BE INSTALLED DIRECTLY BELOW THE FIRE HYDRANT FOR BURIED DEPTHS GREATER THAN FIVE FEET. INSTALLATIONS ON DEEP WATER MAINS MAY USE NO MORE THAN 2 BENDS (MAX 45°) BETWEEN VALVE AND HYDRANT BARREL.
3. CONCRETE BLOCKING WITH A MINIMUM BEARING AREA OF 1 1/2 SQUARE FEET. 2,000 PSI CONCRETE. DO NOT BLOCK WEEP HOLES.
4. CRUSHED STONE #67 SHALL BE PLACED AROUND THE BOTTOM OF THE HYDRANT FOR A RADIUS OF AT LEAST 12" ABOVE THE OUTLET. DO NOT BLOCK WEEP HOLES.
5. WELD SOCKET 2 1/2" X 2" DEEP TO 1" SCH 40 ROUND STEM EXTENSIONS FITTED ON OPERATING NUT, SCH 80 FOR LENGTHS OVER TEN FEET.
6. VALVE EXTENSIONS ARE REQUIRED ON ALL VALVES THAT EXCEED THREE FEET DEEP FROM FINISHED GRADE VALVE EXTENSIONS SHALL BE PLACED SUCH THAT THE EXTENSION NUT IS BETWEEN 18" AND 24" FROM FINISHED GRADE.
7. FIRE HYDRANT SHALL BE MANUFACTURED BY MUELLER PER CITY OF LOCKHART CONSTRUCTION STANDARDS.
8. FIRE HYDRANT COLOR SHALL BE SELECTED BY THE CITY OF LOCKHART AND SHALL BE FACTORY COATED.
9. FIRE LINE SHALL HAVE ALL JOINTS RESTRAINED FROM MAIN TO FIRE HYDRANT USING MJ RESTRAINING GLAND OR APPROVED EQUAL.

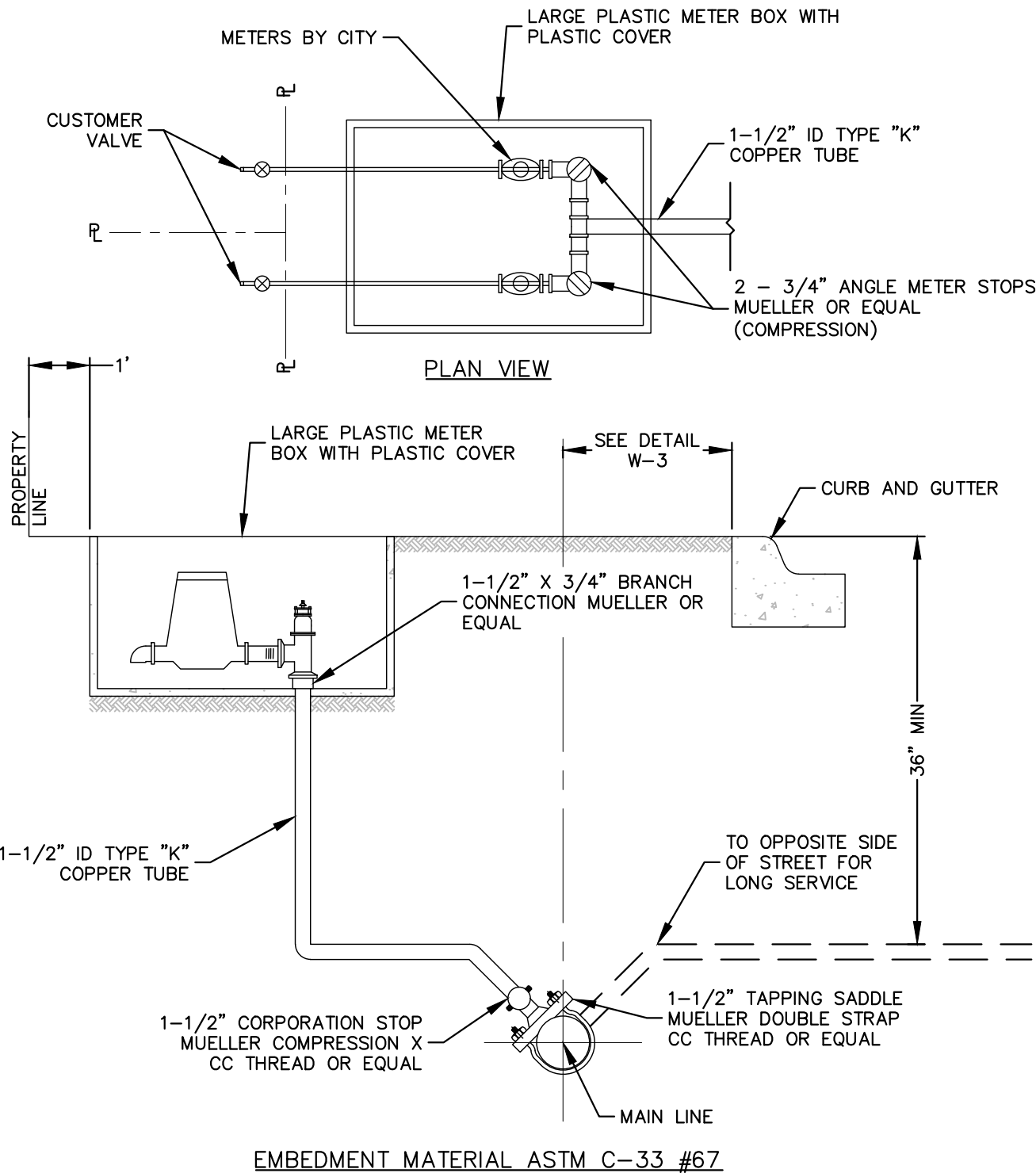
 <p><b>Lockhart</b> TEXAS</p>	DATE ISSUED: APRIL 1987		TITLE:  <b>FIRE HYDRANT</b>	
	REV	DATE		BY
	1	NOV 2002		CS
	2	JAN 2020		JAD
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD	SCALE: NTS		DRAWING No. W - 5	



**NOTES:**

1. WATER SERVICES SHALL BE INSTALLED FROM WATER MAIN TO THE METER.
2. BEDDING AND BACKFILL SHALL BE PER TRENCH BACKFILL DETAILS.
3. METER BOX AND COVER SHALL BE MANUFACTURED BY DFW PLASTICS OR APPROVED EQUAL.


	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
<b>SINGLE SERVICE CONNECTION</b>			SCALE:
<small>THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD</small>			NTS
			DRAWING No. W - 6

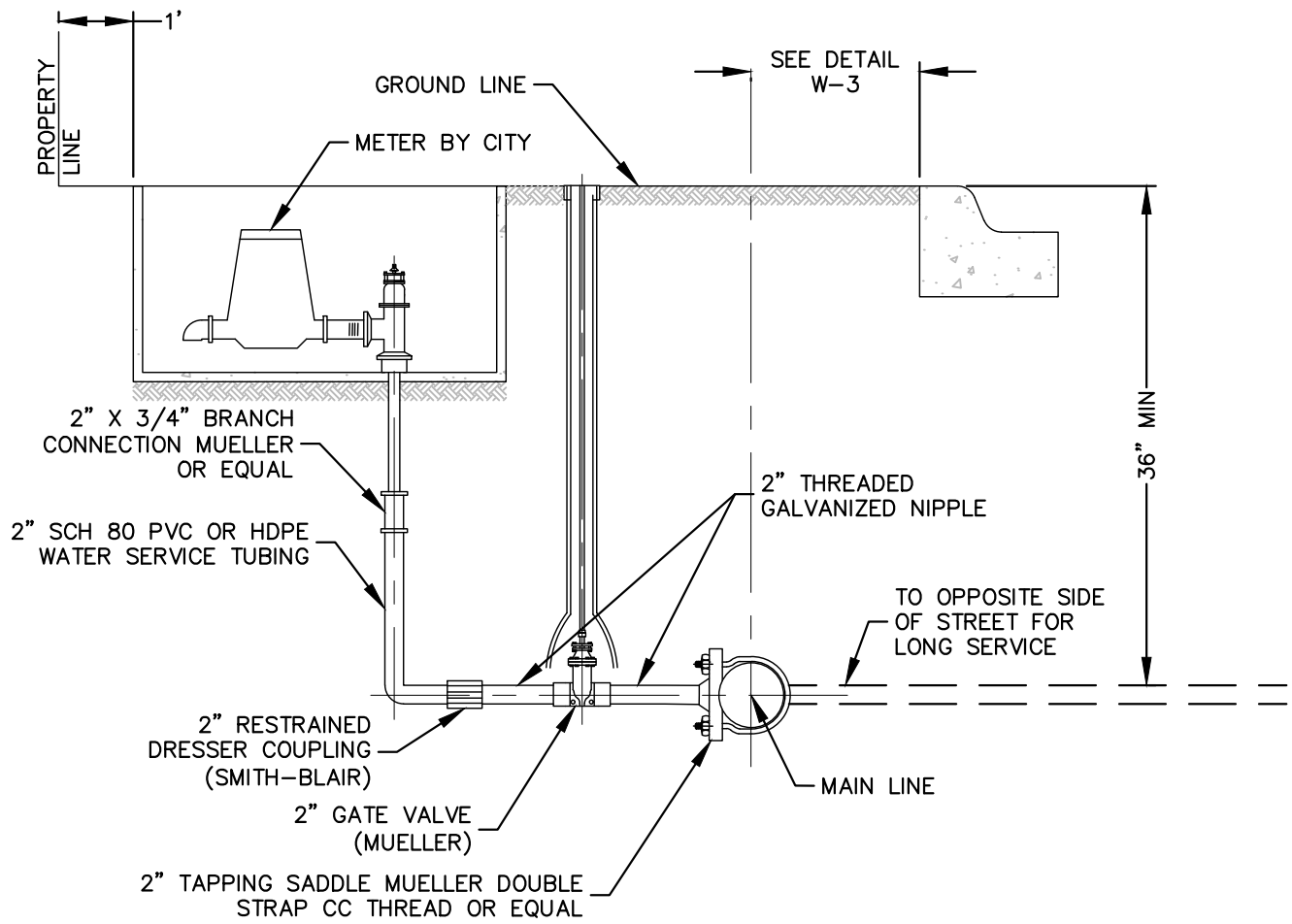
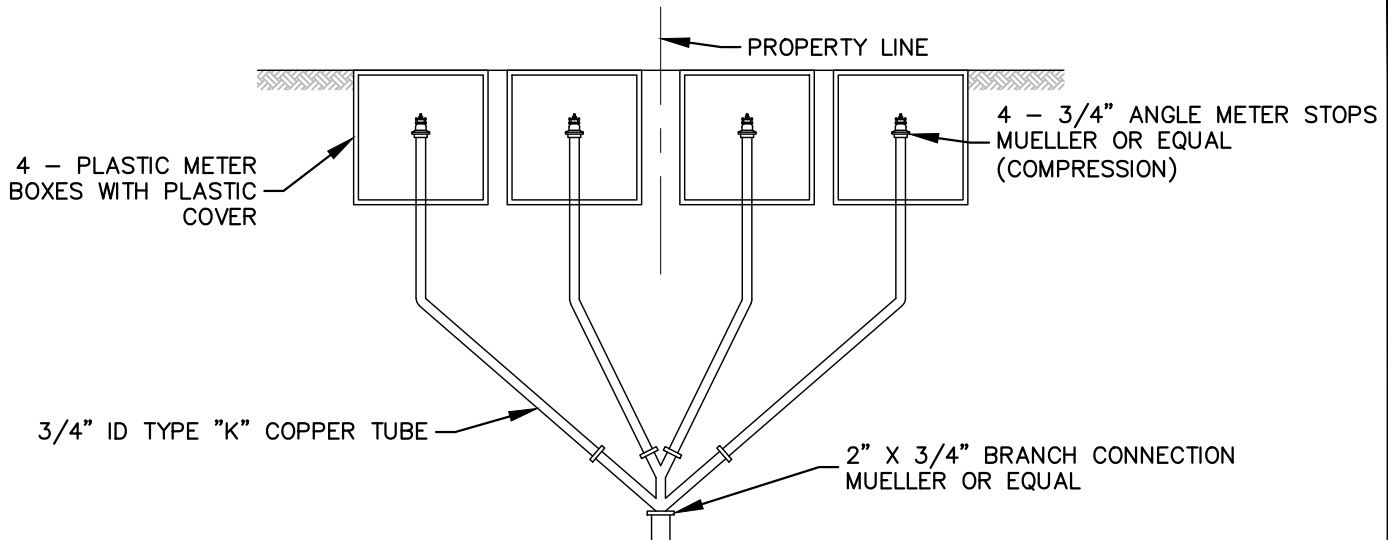


EMBEDMENT MATERIAL ASTM C-33 #67


**NOTES:**

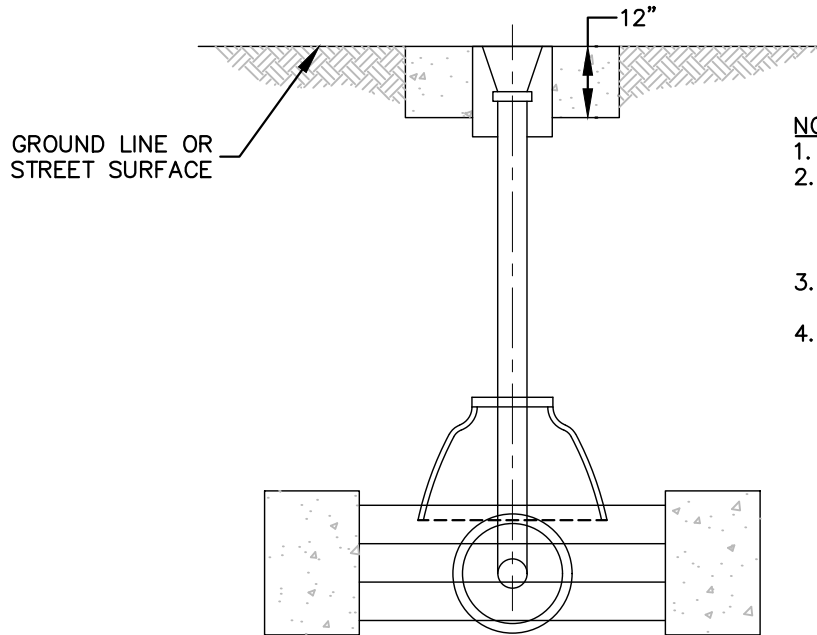
1. WATER SERVICES SHALL BE INSTALLED FROM WATER MAIN TO THE METER.
2. BEDDING AND BACKFILL SHALL BE PER TRENCH BACKFILL DETAILS.
3. METER BOX AND COVER SHALL BE MANUFACTURED BY DFW PLASTICS OR APPROVED EQUAL.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
<b>DOUBLE SERVICE CONNECTION</b>			SCALE: NTS
<small>THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD</small>			DRAWING No. W - 7



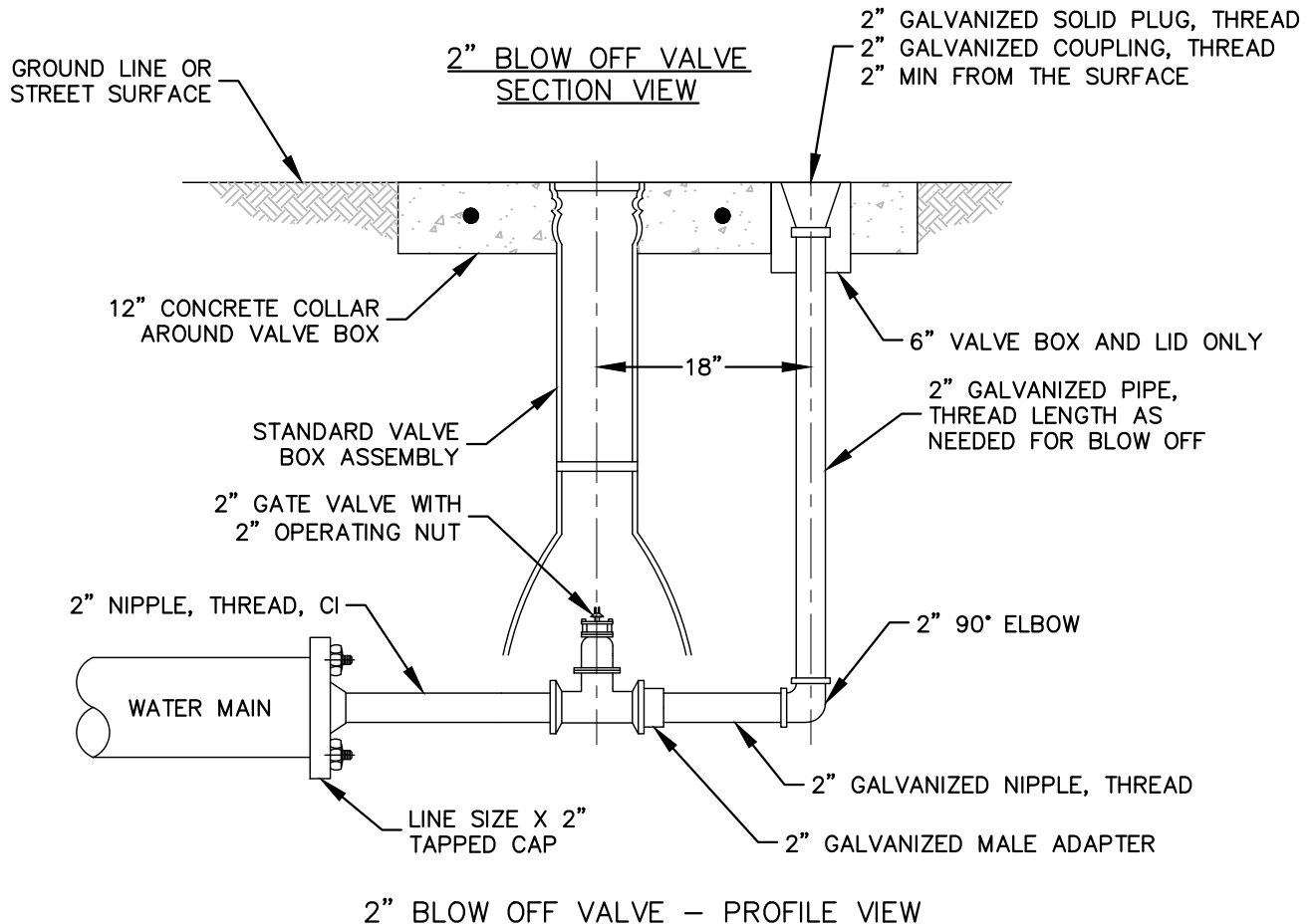
- NOTES:**
1. WATER SERVICES SHALL BE INSTALLED FROM WATER MAIN TO THE METER. ALL FITTINGS SHALL BE RESTRAINED.
  2. BEDDING AND BACKFILL SHALL BE PER TRENCH BACKFILL DETAILS.
  3. METER BOX AND COVER SHALL BE MANUFACTURED BY DFW PLASTICS OR APPROVED EQUAL.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
			<b>MULTI SERVICE CONNECTION</b>
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			SCALE: NTS
			DRAWING No. W - 8



**NOTES:**

1. EMBED ALL DI FITTINGS IN #67 ROCK.
2. BLOCKING ARRANGEMENT AND BEAM SCHEDULE SHALL BE USED FOR END CAPS AND PLUGS, OMITTING BLOW-OFF FITTINGS.
3. BEAMS SHALL BE EXTENDED 3' BEYOND TRENCH WALL.
4. CONCRETE BLOCKING SHALL BEAR ON UNDISTURBED SOIL IN TRENCH WALL.



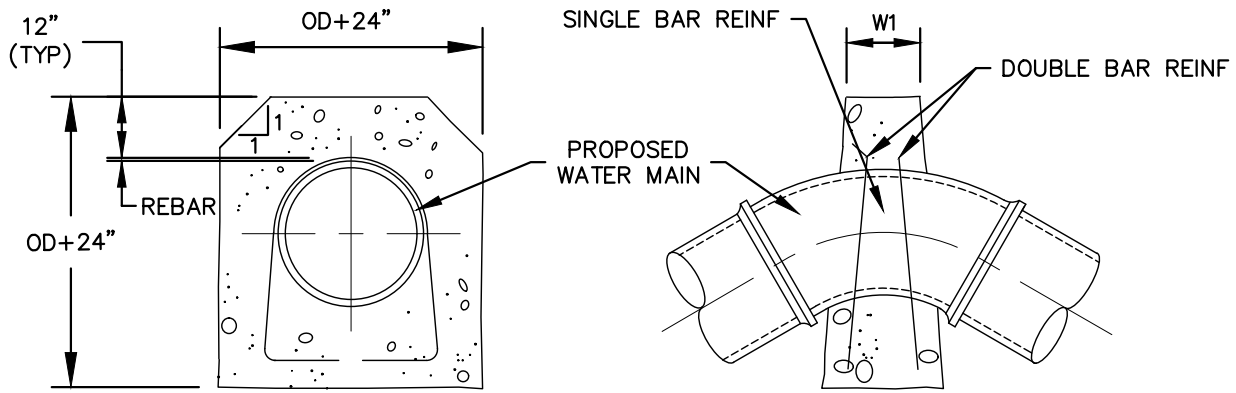
**2" BLOW OFF VALVE - PROFILE VIEW**



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
<b>2" BLOW OFF VALVE</b>	
SCALE:	DRAWING No.
NTS	W - 9



REINFORCEMENT SHALL BE PROVIDED AS FOLLOWS:

- 6" - 12" PIPE 1 #5
- 14" - 30" PIPE 2 #5'S
- 36" - 48" PIPE 2 #7'S

VARIES SEE TABLE A

### VERTICAL DOWN BEND

TABLE A UPWARD THRUST GRAVITY BLOCKS			
PIPE DIAMETER	MIN TOP WIDTH W1	ANGLE (degrees)	BOTTOM WIDTH-W2 (in)
6"	6"	0-5	NOTE 2
		5-15	24
		15-25	48
		>25	NOTE 1
8"	6"	0-5	NOTE 2
		5-9	30
		9-15	36
		>15	NOTE 1
10"	6"	0-5	NOTE 2
		5-9	48
		9-15	60
		>15	NOTE 1
12"	6"	0-5	NOTE 2
		5-15	48
		>15	NOTE 1
		0-5	NOTE 2
16"	12"	5-10	60
		10-15	96
		>15	NOTE 1
		20" THRU 36" DIAMETER	>5.0
42" THRU 48" DIAMETER	>3.0	NOTE 1	

**NOTES:**

1. FOR ANGLES GREATER THAN THOSE INDICATED RESTRAINED JOINTS SHALL BE INSTALLED
2. FOR JOINT DEFLECTIONS LESS THAN 5 DEGREES, NO HORIZONTAL OR VERTICAL THRUST RESTRAINT IS REQUIRED FOR PIPES LESS THAN 42" IN DIAMETER.

**THRUST BLOCK DESIGN AS FOLLOWS:**

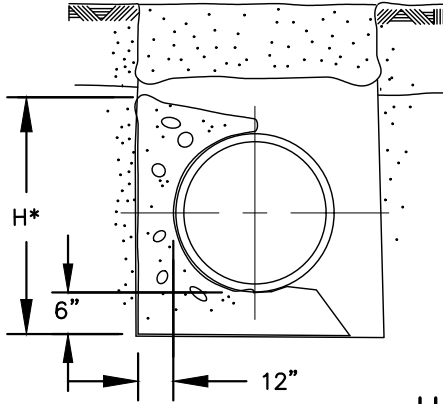
- A. PRESSURE OF 150 PSI (ACTUAL IF HIGHER) + 50 % SURGE ALLOWANCE
- B. MAXIMUM SOIL BEARING SEE TABLE BELOW

<u>PRESSURE</u>	<u>SOIL TYPES</u>
LOOSE OR SPONGY SOIL	1500 LB/SQ FT
UNDISTURBED SOIL, CALICHE	2000 LB/SQ FT
LIMESTONE ROCK	4000 LB/SQ FT

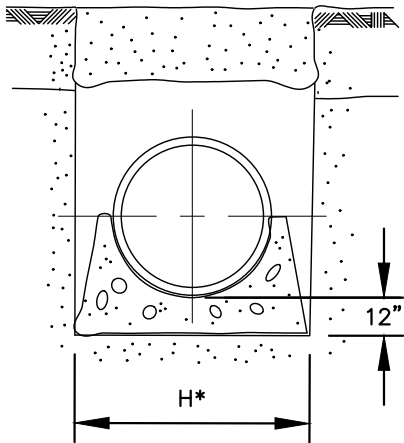
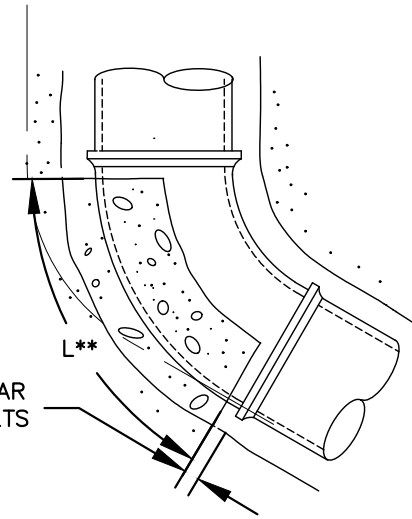
- \* THE DIMENSION FOR "H" MUST BE GREATER THAN DIAMETER OF THE PIPE
- \*\* LENGTH "L" ALONG THE BEND MUST BE GREATER THAN "H" AND LESS THAN 2 TIMES "H"

<p style="font-size: 24px; font-weight: bold; margin: 0;">Lockhart</p> <p style="font-size: 12px; font-weight: bold; margin: 0;">TEXAS</p>	DATE ISSUED: APRIL 1987		<p style="font-weight: bold; margin: 0;">TITLE:</p> <p style="font-weight: bold; margin: 0;">THRUST BLOCKING</p> <p style="margin: 0;">(PAGE 1 OF 2)</p>	
	REV	DATE		BY
	1	NOV 2002		CS
	2	JAN 2020		JAD
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD	SCALE: NTS		DRAWING No. W - 10	

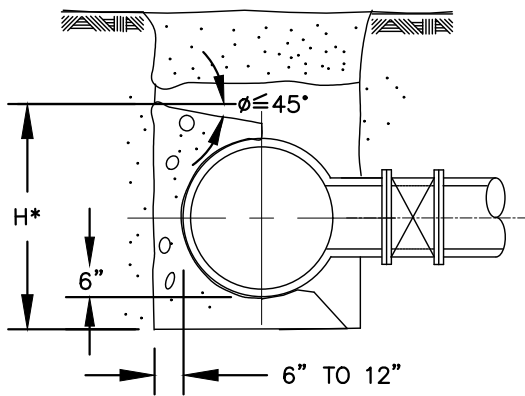
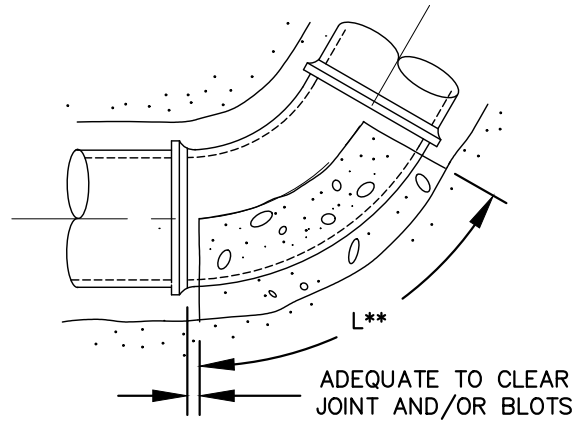




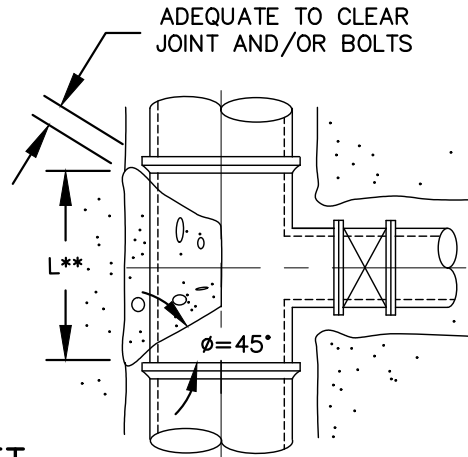
ADEQUATE TO CLEAR  
JOINT AND/OR BOLTS  
**HORIZONTAL BEND**



**VERTICAL BEND UPWARD**



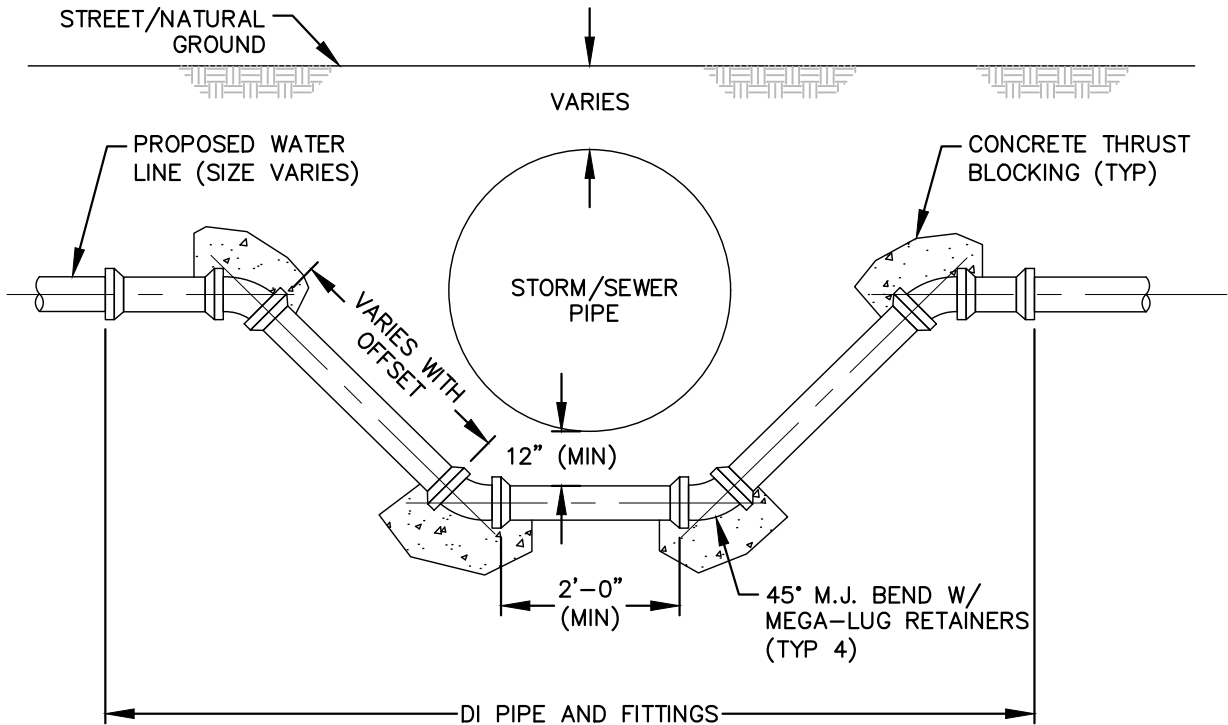
**TEE / OUTLET**



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY  
FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

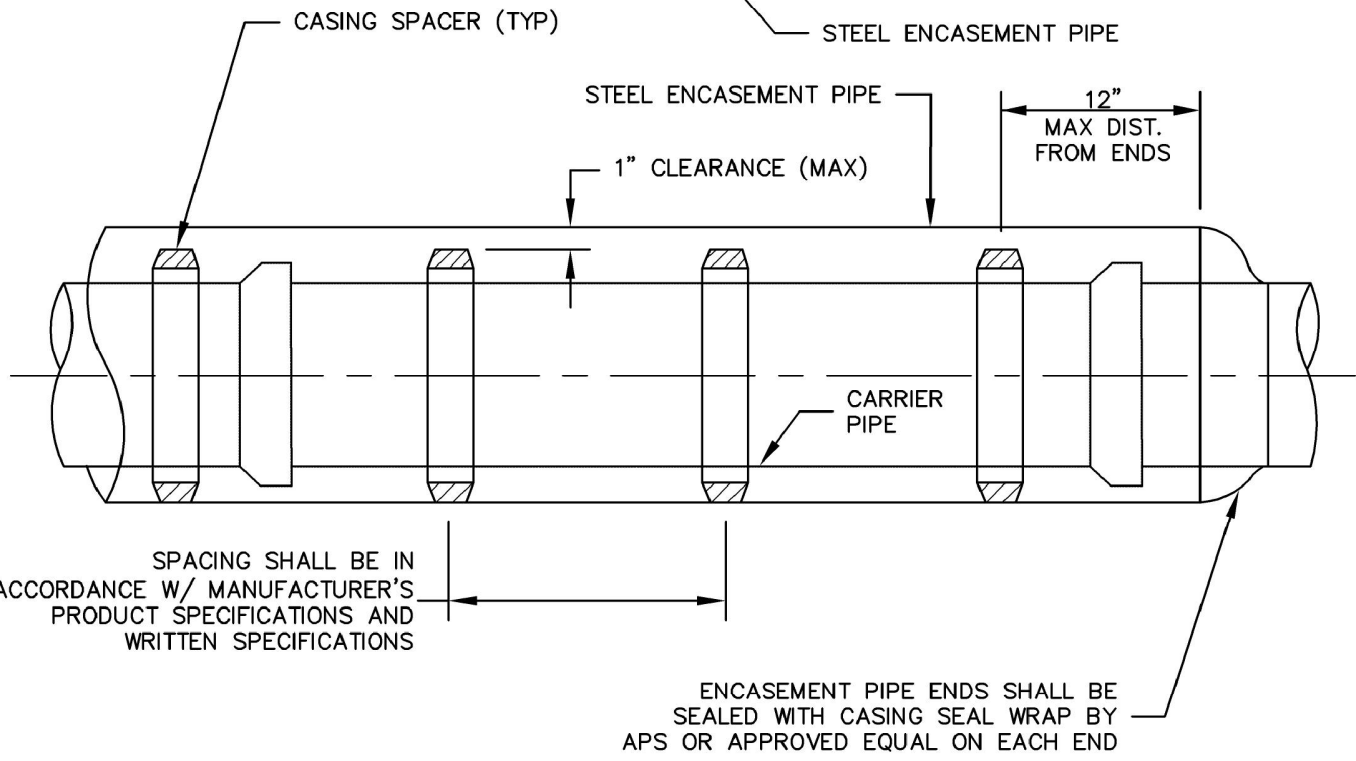
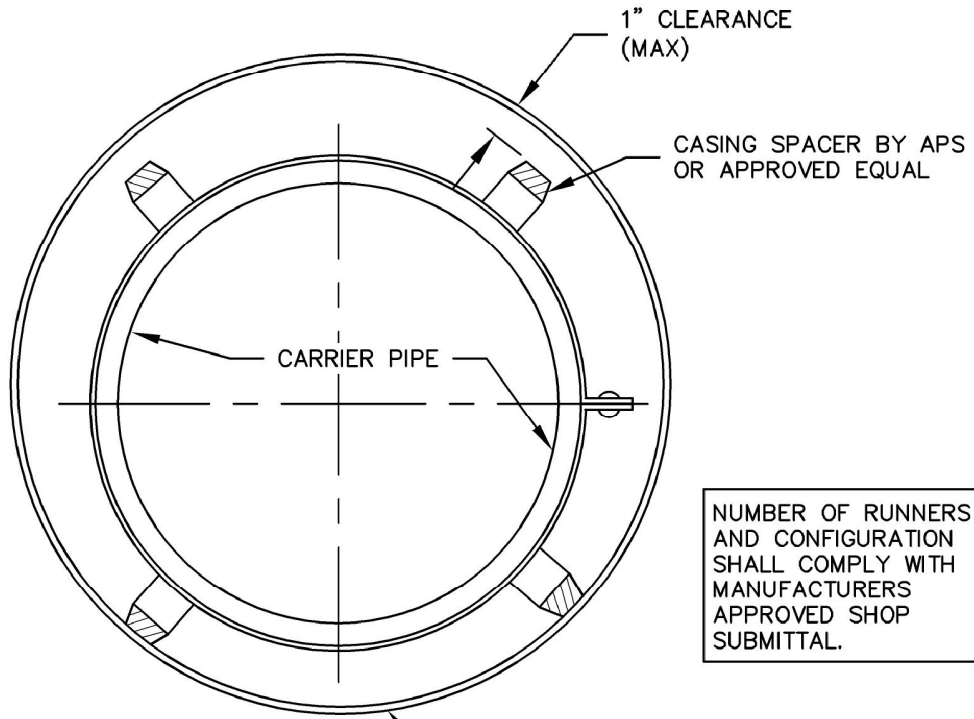
TITLE:	THRUST BLOCKING (PAGE 2 OF 2)	
SCALE:	NTS	DRAWING No. W - 10




**NOTES:**

1. MATERIALS AND COATING TO BE IN ACCORDANCE WITH WATER DISTRIBUTION SYSTEM STANDARDS.
2. RESTRAIN EXISTING PIPING BEYOND SECTION AS REQUIRED TO PREVENT MOVEMENT.
3. DUCTILE IRON PIPE FOR WATER LINE CONSTRUCTION SHALL BE ANSI/AWWA-A21.50/C150 PRESSURE CLASS 250 UNLESS OTHERWISE NOTED.
4. FITTINGS SHALL CONFORM TO ANSI/AWWA-A21.10/C110 OR ANSI/AWWA-A21.53/C153 AND ANSI/AWWA-A21.11/C111 STANDARDS.
5. ALL FITTINGS SHALL BE CEMENT LINED ACCORDING TO ANSI/AWWA-A21.4/C104.
6. FITTINGS SHALL BE DUCTILE IRON OR COMPACT DUCTILE IRON.
7. DUCTILE IRON PIPE SHALL INCLUDE POLYETHYLENE WRAP.
8. FOR NEW WATERLINES CROSSING UNDER A WASTEWATER MAIN OR LATERAL, THE WATERLINE SHALL BE ENCASED IN AN 18 FOOT (MIN) SECTION OF PIPE OR CONSTRUCTED OF DUCTILE IRON PIPE WITH MECHANICAL JOINTS. REFER TO TCEQ 30 TAC 290 SUBCHAPTER D: RULES AND REGULATIONS FOR PUBLIC WATER SYSTEMS, SECTION 44(e)(4)(B)(IV)(III).
9. ALL FITTINGS SHALL INCLUDE MEGA-LUGS.

	DATE ISSUED: <span style="float: right;">JANUARY 2020</span>		TITLE:  <b>WATER MAIN OFFSET DETAIL</b>	
	REV	DATE		BY
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			SCALE: <div style="text-align: center;">NTS</div>	
			DRAWING No. <div style="text-align: center;">W - 11</div>	



**NOTE:**  
 1. CASING SPACERS SHALL BE STAINLESS STEEL CLEAR BELL SPACERS (TYP) APS MODEL SSI OR APPROVED EQUAL.

 <b>Lockhart</b> TEXAS	DATE ISSUED: <span style="float: right;">JANUARY 2020</span>		TITLE:	
	REV	DATE	BY	<b>PIPE ENCASEMENT</b>
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD		SCALE: NTS	DRAWING No. W - 12	

---

## CHAPTER 3 - WASTEWATER SYSTEM STANDARDS

### I. GENERAL REQUIREMENTS

#### A. Standard Requirements

All wastewater systems shall be in compliance with the following rules, regulations, and standards:

1. Rules and Regulations for Wastewater Systems, Texas Commission on Environmental Quality (TCEQ), latest edition.
2. AWWA, ASTM and ANSI technical standards latest edition.
3. Whenever TCEQ and the City of Lockhart Specifications conflict, the more stringent shall apply.

#### B. Design Requirements

1. No wastewater main shall be less than six inches (6") in diameter and shall have a minimum velocity, flowing full or one-half full, of two feet per second (2 ft/sec) based on Manning's formula. Minimum grade for gravity wastewater shall be per TCEQ requirements.
2. Gravity wastewater line shall be designed and constructed with straight alignment. Horizontal curves must be accomplished using additional manholes or joint offset. Joint offset shall be less than the least of the following:
  - a) Five degrees of deflection;
  - b) 80% of the manufacture's recommended maximum joint offset; or
  - c) 80% of the appropriate ASTM, AWWA, ANSI, or other nationally established standard for joint offset.
3. All lines must be designed for trench and dynamic loads.
4. A collection system must be designed to transport the peak flow from the service area, plus infiltration and inflow. The design must minimize inflow and infiltration. Flow calculations must be included in an engineering report provided to the City Engineer for review and approval.
5. The flow calculations must include the details of the average flow, the flow peaking factor, and the infiltration and inflow.
6. Unless otherwise approved, manholes shall be constructed at all changes in grade, at changes in pipe size, at intersections with other mains, and any change in direction. When required by the City Engineer, a manhole with stub-outs shall be

installed at the termination of a line. In straight-ways manholes shall be spaced as shown in Table 3.1.

**Table 3.1 – Maximum Manhole Spacing**

<b>Pipe Diameter (inches)</b>	<b>Maximum Manhole Spacing (Feet)</b>
6-15	500
18-30	800
36-48	1,000
54 or larger	2,000

7. Where water and wastewater lines are installed in the same area, separation between water and wastewater lines must comply with Title 30 of the Texas Administrative Code §217-53(d).
8. Wastewater service lines shall be extended to the street right-of-way lines. Wastewater service lines shall have an inside diameter of not less than four inches (4"). The minimum grade allowed for service lines is two percent (2%).
9. Wastewater cleanouts are not allowed in sidewalks or driveways. Cleanouts shall be placed just inside the right of way where the City Maintenance begins and private maintenance ends.
10. Lift Stations shall only be installed where gravity flow is not possible and shall be considered by the City on a case by case basis. An engineering report sealed by a professional engineer registered in the state of Texas detailing the lift station design shall be submitted for review and approval.
11. Force main valves – The discharge side of each lift station pump followed by a full-closing isolation valve must also have a check valve.
  - a) A check valve must be the swing type valve with an external lever.
  - b) A valve must include a position indicator to show its open and closed positions, unless a full-closing valve is a rising-stem gate valve.
  - c) A grinder pump installation may use a rubber-ball check valve or a swing-type check valve.
  - d) A butterfly valve, tilting-disc check valve, or any other valve using a tilting-disc in a flow pipe is prohibited.

## **II. MATERIALS**

### **A. Gravity Flow Lines**

Gravity flow wastewater lines shall be constructed of PVC pipe which conforms to ASTM Specification ASTM D-3034 SDR-26 (4" up to 15" diameter) and ASTM F-679 PS115 (18" and larger diameter). Joints shall meet ASTM D3212. Gaskets shall meet ASTM F477. Minimum pipe stiffness of 115 psi.

---

B. Pressure Lines

Force mains shall be constructed of four inch (4") or larger PVC or DI pipe with restrained DI fittings.

PVC pipe shall meet the requirements of AWWA C-900, or the latest revision thereof, and must have a minimum dimension ratio (DR) of 25 and pressure rating of 165 psi. Fittings shall conform to ANSI/AWWA A21.10/C110 or ANSI/AWWA A21.53/C153 standards. PVC pipe used for wastewater shall be green in color to differentiate it from potable water lines.

DI pipe shall comply with AWWA C151 (and C115 for flanged pipe only). Wastewater force main pipe shall be lined with corrosion resistant material equal to Protecto 401 or SewPerCoat or City approved alternative. Lining to be used shall be shown on submittal, with type, brand, and lot number marked on each pipe. No more than one type or brand of lining shall be used for any project. This pipe is not to be used for gravity flow wastewater lines except when in the opinion of the Engineer the strength of DI makes its use appropriate; it may be used only if specifically shown on approved engineering drawings.

C. Aerial Crossings

Aerial crossings shall be avoided and only used with prior approval from City Engineer. Where aerial crossings of creeks are required to maintain grade for gravity flow wastewater lines, the PVC pipe shall be encased in a steel pipe conforming to ASTM A134 with a minimum thickness of 3/8 inch. Steel pipe shall be minimum two pipe diameters larger than PVC carrier pipe or of sufficient size to be used with casing spacers. Steel casing shall be supported with not less than one concrete support per joint of PVC carrier pipe. Support size design criteria shall be based upon there being no damage to the line from a 100-year frequency flood.

D. Manholes

Manhole lids and covers, specification ASTM A48 Class 30. Outside diameter of the lid shall be 32 inches (32"). Manhole ring and cover shall be specified for the standard, gasketed and bolted water tight or as approved by the City Engineer. All wastewater manholes shall have the interior lined with corrosion resistant epoxy coating Raven 405, or equal, to a thickness of 100 mil.

E. Cleanouts

Cleanouts shall be provided at the end of each line when a manhole is not required. A CI cleanout casting Sigma Corp. VB-103 or approved equal shall be used.

### **III. WASTEWATER COLLECTION SYSTEM CONSTRUCTION**

A. General

Batter boards shall not be used for grade control; laser beam grade control shall be the only method that will be acceptable.

- 
1. Construction will begin at the lowest pipe elevation and continue upgrade with bells facing upgrade. Construction shall be continuous with construction of branch mains deferred until the main is constructed to the manholes at the branch junction point.
  2. Not more than 300 feet of trench shall be opened in advance of the pipe installation and pipe shall be laid in all opened ditch by the end of the work day. A test type plug shall be installed in the open ends of all pipes at the end of each day.

B. Trench Construction

1. The trench width shall be equal to the pipe outside diameter plus twelve inches (12”).
2. The trench shall be excavated to a depth to permit a minimum bedding thickness of six inches (6”) under the pipe.
3. A minimum clearance of six inches (6”) below and on each side of the bell of all pipes to the trench walls and floor is required.
4. Wastewater collection system pipes shall be installed in trenches separate from water supply trenches.

C. Embedment and Backfill

1. Embedment – Specified embedment material shall be placed as shown in trench details.
2. Backfill Material for the trenches not to be in proposed street areas, existing or within 3 feet of the back of the curb or edge of pavement must include specified embedment material and may be backfilled with excavated select fill material that are void of rocks and other objects larger than 4 inches (4”) in diameter.
3. Backfill in the areas that will be in existing or proposed streets or within 3 feet of the back of the curb or edge of pavement must include specified embedment material up to the specified sub-grade elevation in the construction plans.

D. Trenchless Pipe Installation

Trenchless methods of pipe installation shall be considered on a case-by-case basis upon approval by the City Engineer.

E. Manholes

Manholes shall be constructed of four-foot (4’) diameter or larger reinforced precast concrete pipe meeting the requirements of ASTM standard C478 specification or poured monolithically. Concrete rings shall be used to adjust manhole heights to match existing grade. Maximum height shall not exceed 12 inches (12”). Cast Iron frame and covers shall conform to ASTM A48 Class 30 specification. Outside diameter of the lid shall be thirty-two inches (32”).

---

Lids are to be solid with no pick holes. Manhole covers shall be marked “Wastewater”. When required by the City, sealed bolted type (water tight) cover shall be used. Pipe connections to manholes shall be cored and water tight manhole connectors Kor-N-Seal I & II or equal ASTM C923.

1. The invert shall be built of concrete or half-section of pipe. If built of concrete, the invert shall be true and trowel to a smooth hard finish.
2. Pipe connections to manholes shall be made water tight using a gasket around the pipe. The gasket pipe shall then be grouted into place, using a stiff mix non-shrink grout, via knocked out holes in concrete pipe walls. Steps shall not be provided.
3. All wastewater manholes shall have an interior coating with a 100 mil epoxy, Raven 405 or equal.

#### **IV. TESTING**

##### **A. Deflection Testing for PVC Pipe**

After backfilling, the line shall be tested for excessive deflection. A deflection test must be performed on any flexible or semi-rigid pipe. The contractor shall supply a mandrel or rigid ball with diameter equal to 95% of the inside diameter pipe. This mandrel shall be pulled through all of the new wastewater pipe without mechanical pulling devices, and in the presence of the City’s representative. The test for deflection shall be performed after the final backfill has been in place at least 30 days. Any pipe exceeding 5% deflection must be replaced by the Contractor. Another deflection test will then be required for the replaced section.

##### **B. Infiltration-Exfiltration Testing or Low-Pressure Air Test**

1. Any collection system pipe that will transport wastewater by gravity flow shall be tested with an infiltration-exfiltration leakage test or low-pressure air test.
2. A low-pressure air test must follow the procedures described in ASTM C828, ASTM C924 or ASTM F1417. The testing times listed in Table C.4 in Figure 30 Texas Administrative Code §217.57(a)(1)(C) or equation C.3 in Figure 30 Texas Administrative Code §217.57(a)(1)(B)(ii) must be used regardless of the testing procedure.
3. The total exfiltration, as determined by a hydrostatic head test, must not exceed ten (10) gallons per inch of diameter per mile of pipe per 24 hours at a minimum test head of two feet (2’) above the crown of a pipe at an upstream manhole, or at least two feet (2’) above existing groundwater level, whichever is greater.
4. An infiltration test can be performed in lieu of an exfiltration test when pipes are installed below the groundwater level.
5. Final testing of each section shall be observed and approved by the City.



---

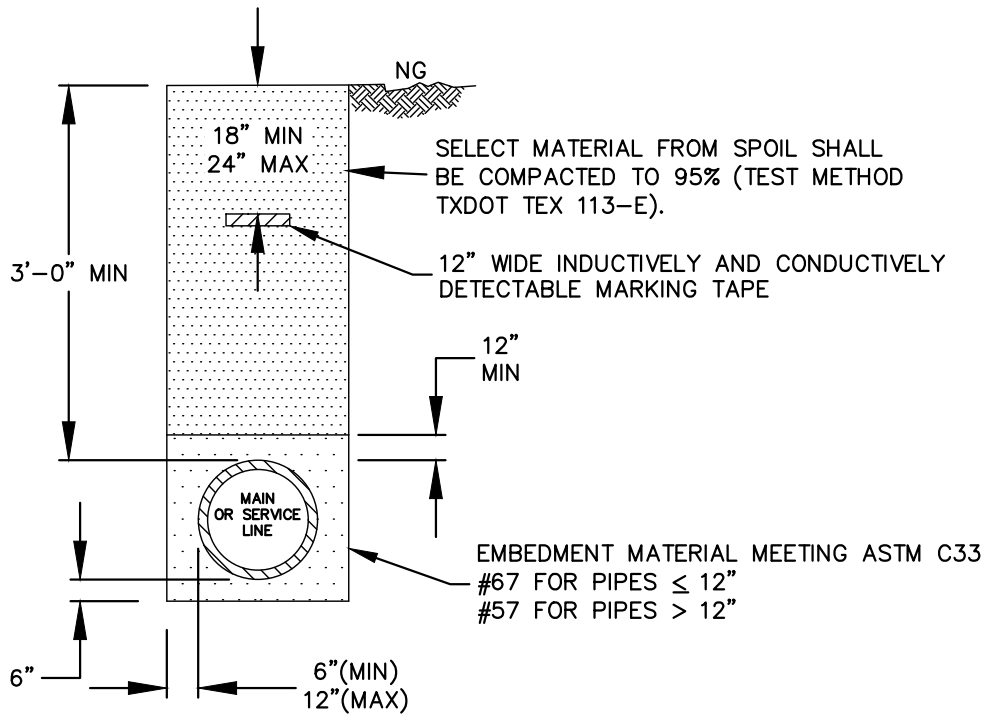
C. Manhole Testing

Manholes shall be tested for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing, or other methods acceptable by the City Engineer. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour. Alternative test methods must ensure compliance with the above allowable leakage. Hydrostatic exfiltration testing shall be performed as follows: all wastewater lines coming into the manhole shall be sealed with an internal pipe plug, then the manhole shall be filled with water and maintained full for at least one hour. For concrete manholes a wetting period of 24 hours may be used prior to testing in order to allow saturation of concrete.

Should the test disclose a water loss greater than permitted, the contractor shall, at his own expense, locate and repair defective joints, pipes, etc. and retest until losses are within specified allowances.

V. WASTEWATER SYSTEM DETAILS

<b>Detail</b>	<b>Detail No.</b>
Trench Detail	WW-1A
ROW Trench Detail	WW-1B
Concrete Encasement	WW-2
Standard and Deep Service Connection	WW-3
Precast Concrete Wastewater Manhole	WW-4
Wastewater Drop Manhole	WW-5
Wastewater Manhole Ring Encasement Detail	WW-6
Clean-out Detail	WW-7
Single and Dual Wastewater Service Connection	WW-8



NOTE:

1. THIS DETAIL SHALL ONLY BE USED WHEN TRENCH EDGE IS MORE THAN 3'-0" FROM EXISTING OR FUTURE PAVEMENT.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
TRENCH DETAIL	
SCALE:	DRAWING No.
NTS	WW - 1A

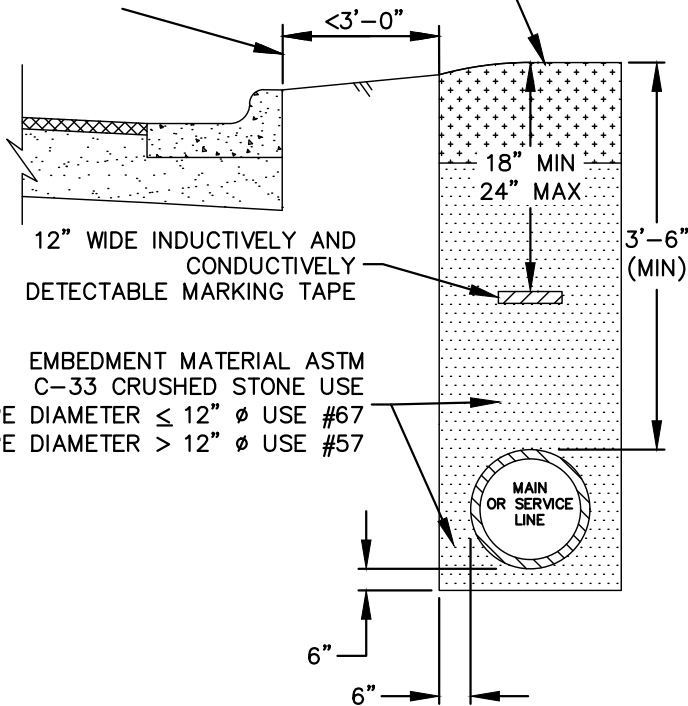
WHEN PAVED SURFACE IS TO BE PERMANENT, SURFACE MATERIAL SHALL BE EQUAL TO MATERIAL REMOVED—MINIMUM AMOUNTS: 1-1/2" HMAC (TXDOT ITEM 340, TYPE D) COMPACTED TO 97% DENSITY, OR 6" CONCRETE. EXISTING ASPHALT AND CONCRETE TO BE SAW CUT.

SURFACE SHALL BE CLEANED THOROUGHLY OF LOOSE MATERIAL, RECOMPACTED AND TACK COAT APPLIED BEFORE PAVEMENT SURFACE IS INSTALLED.

12" SELECT MATERIAL SHALL BE COMPACTED TO 95% WITHIN THE ROW (TEST METHOD TXDOT TEX 113-E)

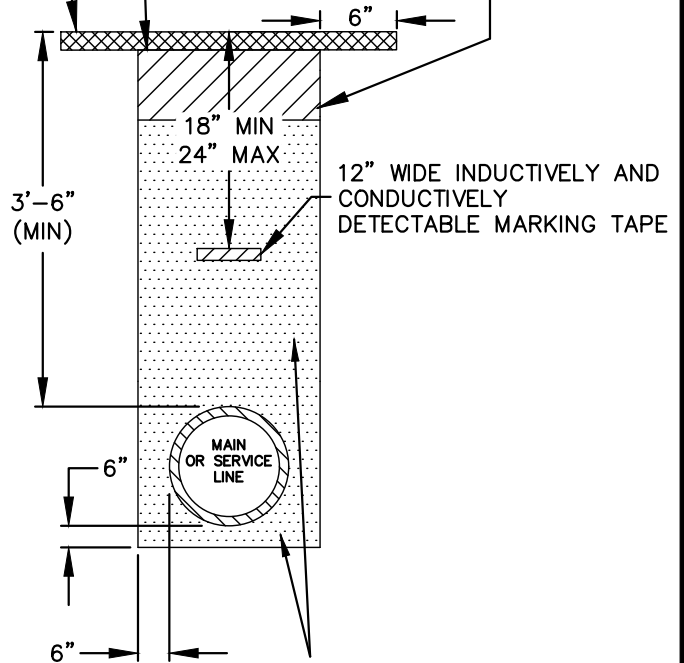
8" FLEX (CRUSHED STONE) BASE (TXDOT ITEM 247, TYPE A, GRADE 1) AND 4" TXDOT ITEM 340 TYPE B HMAC (BLACK BASE) BACKFILL WHEN MAIN OR SERVICE IS UNDER STREET OR DRIVEWAY PAVEMENT. COMPACTED IN 6" LIFTS TO 100% DENSITY PER TEX 113E.

BACK OF CURB, PAVEMENT EDGE OR SIDEWALK EDGE



12" WIDE INDUCTIVELY AND CONDUCTIVELY DETECTABLE MARKING TAPE

EMBEDMENT MATERIAL ASTM C-33 CRUSHED STONE USE PIPE DIAMETER ≤ 12" Ø USE #67 PIPE DIAMETER > 12" Ø USE #57



12" WIDE INDUCTIVELY AND CONDUCTIVELY DETECTABLE MARKING TAPE

EMBEDMENT MATERIAL ASTM C-33 CRUSHED STONE PIPE DIAMETER ≤ 12" Ø USE #67 PIPE DIAMETER ≥ 12" Ø USE #57

**NOTES**

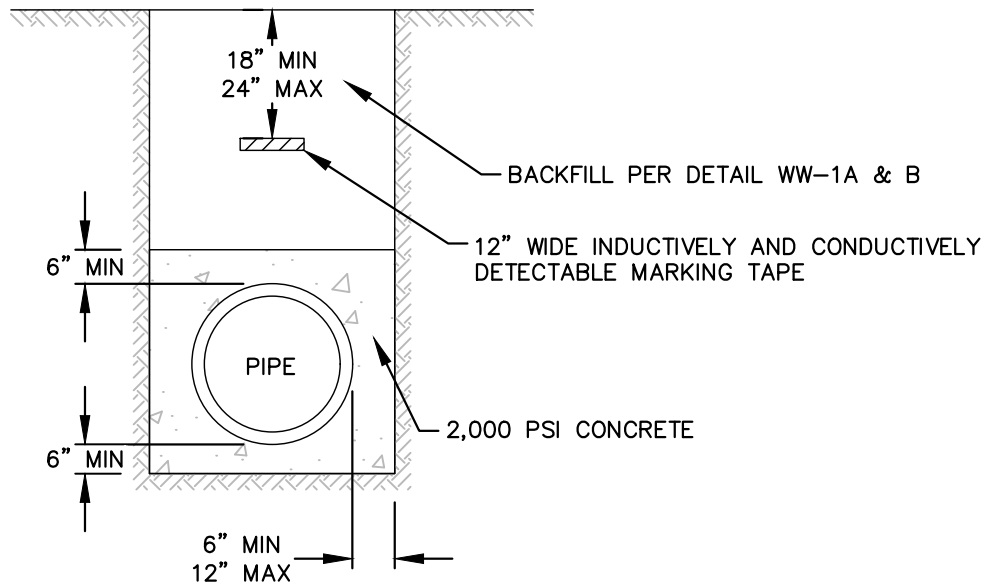
1. WHEN TUNNELING UNDER EXISTING CURB, CRUSHED STONE BASE SHALL BE COMPACTED TWO FEET BEHIND CURB AND TO WITHIN 6" OF THE BOTTOM OF THE CURB. THE 6" VOID UNDER THE CURB SHALL BE FILLED WITH 2,000 PSI CONCRETE.
2. UTILITY TRENCHES PLACED WITHIN THE STREET PAVEMENT OR WITHIN 3' OF THE BACK OF CURB OR EDGE OF EXISTING OR PROPOSED PAVEMENT SHALL COMPLY WITH THIS DETAIL.
3. FOR ASPHALT OR CONCRETE STREET REPAIRS WHERE THE SAW CUT PAVEMENT EDGE WILL BE WITHIN 3' OF EDGE OF EXISTING PAVEMENT OR LIP OF GUTTER, THE EXISTING PAVEMENT SURFACE BETWEEN THE DITCH LINE AND EDGE OF PAVEMENT OR LIP OF GUTTER SHALL BE REMOVED AND REPLACED WITH MATERIAL SPECIFIED.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	R.O.W. TRENCH DETAIL	
SCALE:	NTS	DRAWING No. WW - 1B



**NOTE:**

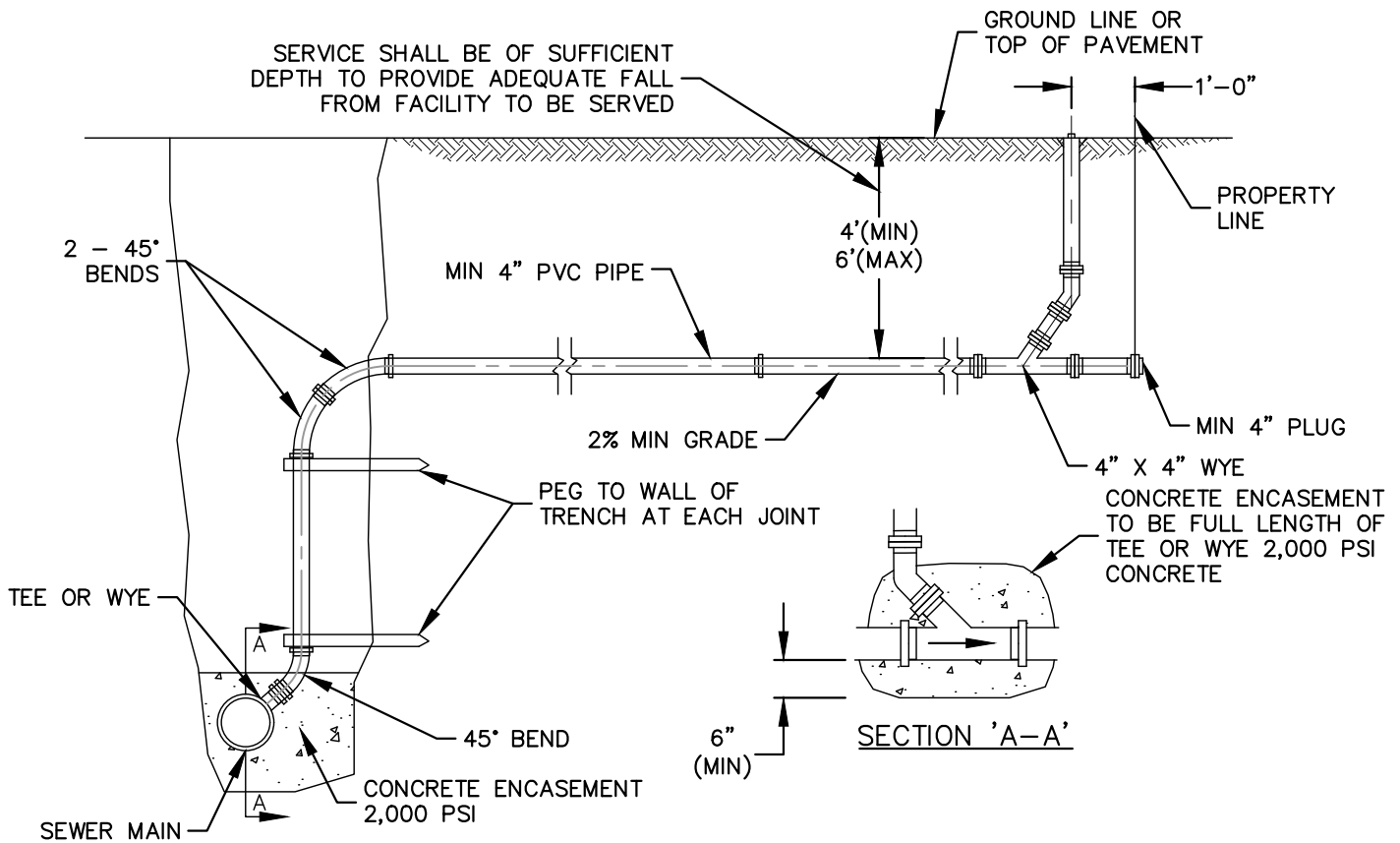
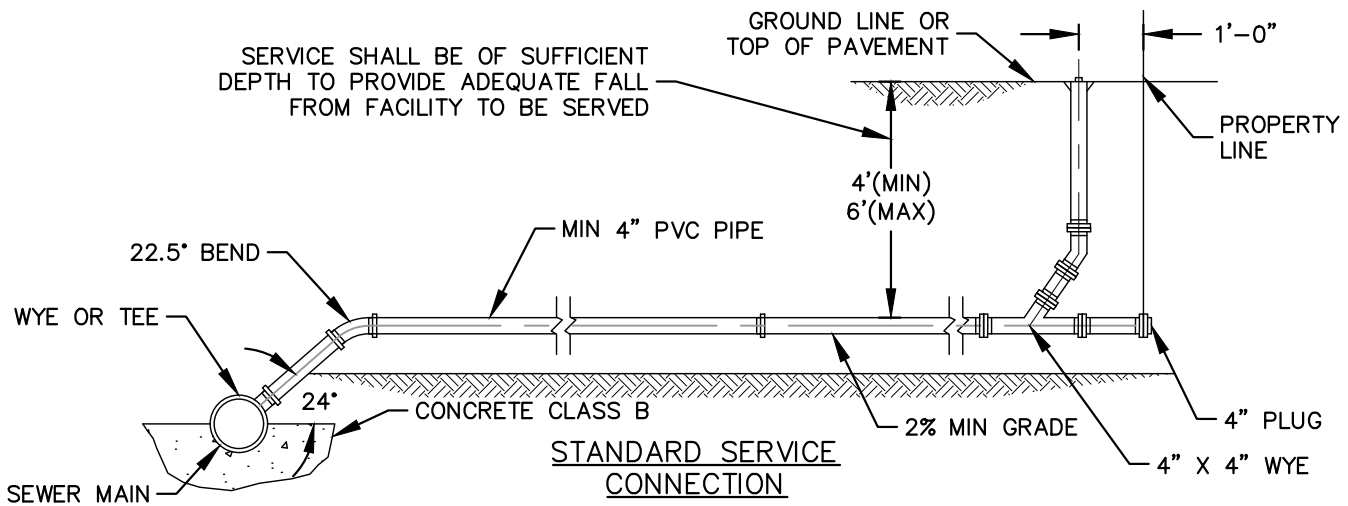
1. CONCRETE ENCASEMENT SHALL BE USED FOR PROTECTION OF WATER MAINS WHEN REQUIRED.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
CONCRETE ENCASEMENT	
SCALE:	DRAWING No.
NTS	WW - 2



**NOTES:**

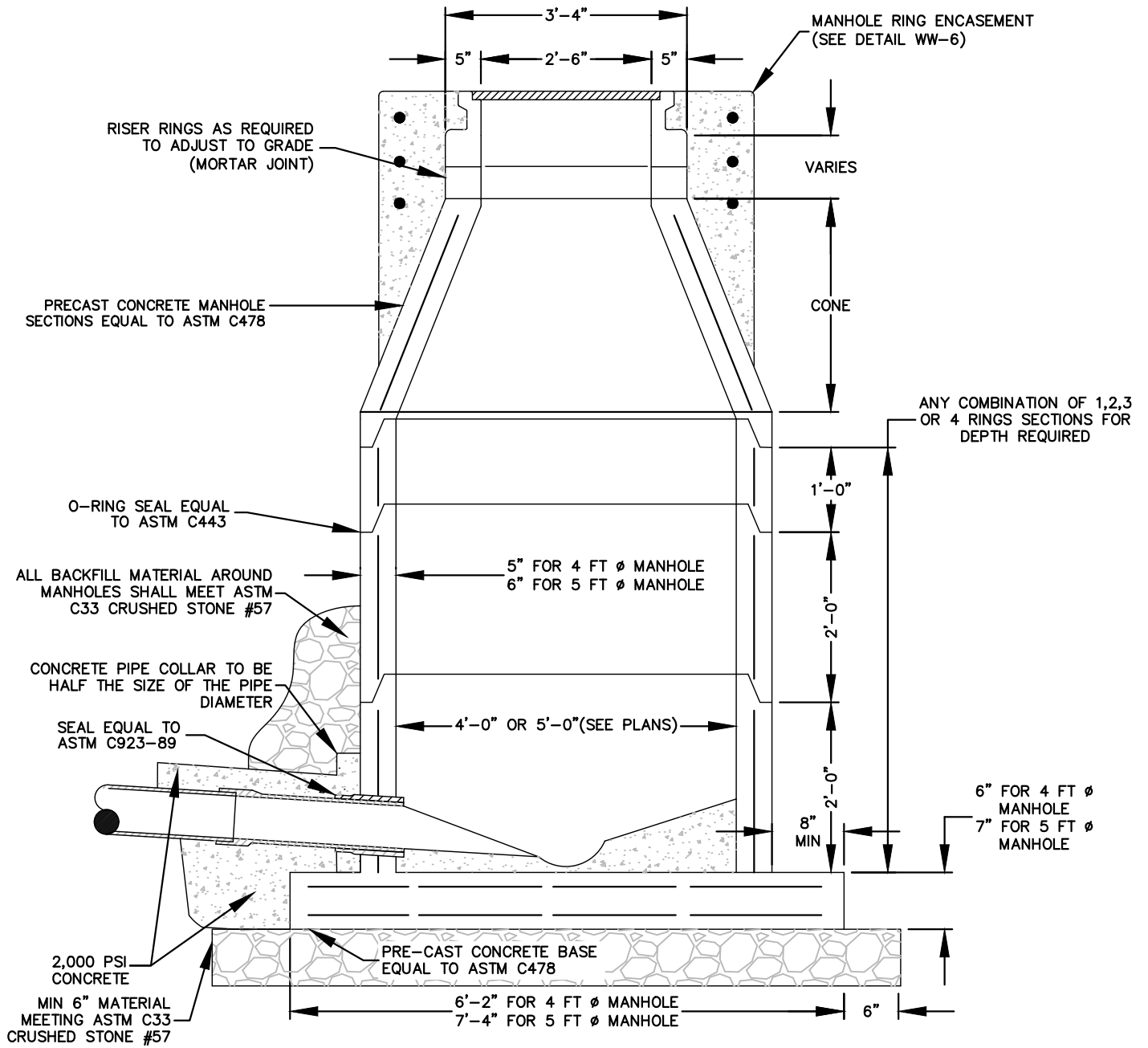
1. DEEP SERVICE CONNECTION SHALL BE USED WHEN WASTEWATER MAIN DEPTH IS MORE THAN SIX FEET (6') BELOW GROUND LINE.
2. WASTEWATER SHALL BE INSTALLED FROM WASTEWATER MAIN TO THE CLEANOUT.
3. BEDDING AND BACKFILL SHALL BE PER TRENCH BACKFILL DETAILS.
4. VERTICAL RISE SECTION SHALL OCCUR OUTSIDE THE LIMITS OF PAVEMENT.
5. CLASS OF CONCRETE SHALL ADHERE TO LATEST TXDOT SPECIFICATIONS, ITEM 421



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	<b>STANDARD AND DEEP WASTEWATER SERVICE CONNECTION</b>	
SCALE:	NTS	DRAWING No. WW - 3



**NOTES:**

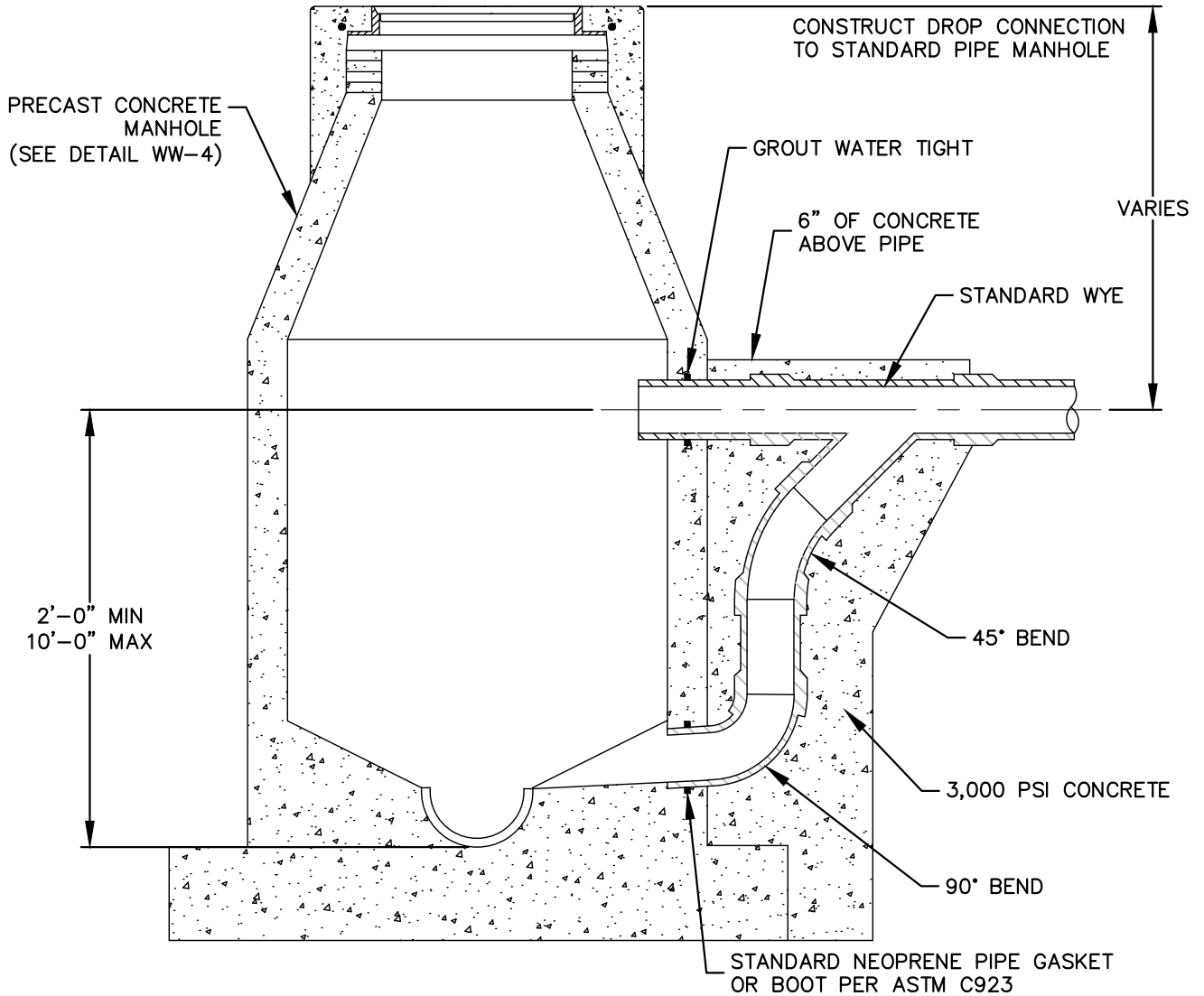
1. DROP MANHOLES SHALL BE REQUIRED WHEN THE INFLOW ELEVATION IS MORE THAN TWENTY-FOUR INCHES (24") ABOVE THE OUTFALL ELEVATION.
2. WHERE UNEQUAL PIPES ENTER A MANHOLE, THE CROWN OF THE PIPES SHALL BE SET AT THE SAME ELEVATION.
3. PRECAST SECTIONS SHALL MEET OR EXCEED ASTM C-478.
4. LOWER MANHOLE SECTION SHALL HAVE A MINIMUM OF 9" WALL THICKNESS.
5. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SEALED AND SIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS ON ALL MANHOLES AND APPURTENANCES PRIOR TO FABRICATION.
6. SUBMIT INFLOW PROTECTION DEVICE FOR CITY APPROVAL.
7. FOR ALL MANHOLES, THE CONTRACTOR SHALL BACKFILL WITH ASTM C-33 #57 CRUSHED STONE, MINIMUM 1'-0" ENVELOPE AROUND ENTIRE MANHOLE, BASE, RISER AND CONE SECTIONS.
8. LIDS SHALL BE CONCENTRIC WITH MANHOLE. ECCENTRIC LIDS ARE NOT ACCEPTABLE.
9. CONTRACTOR SHALL GROUT FILL AROUND ALL PIPE CONNECTIONS IN THE MANHOLE.
10. ALL MANHOLES SHALL HAVE AN INTERIOR COATING WITH A 100 MIL EPOXY RAVEN 405 OR EQUAL.
11. INVERT CHANNEL DEPTH AND TESTING SHALL ADHERE TO TCEQ REQUIREMENTS.
12. ALL MANHOLES DEEPER THAN 12'-0" SHALL BE MIN 5'-0" IN DIAMETER



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

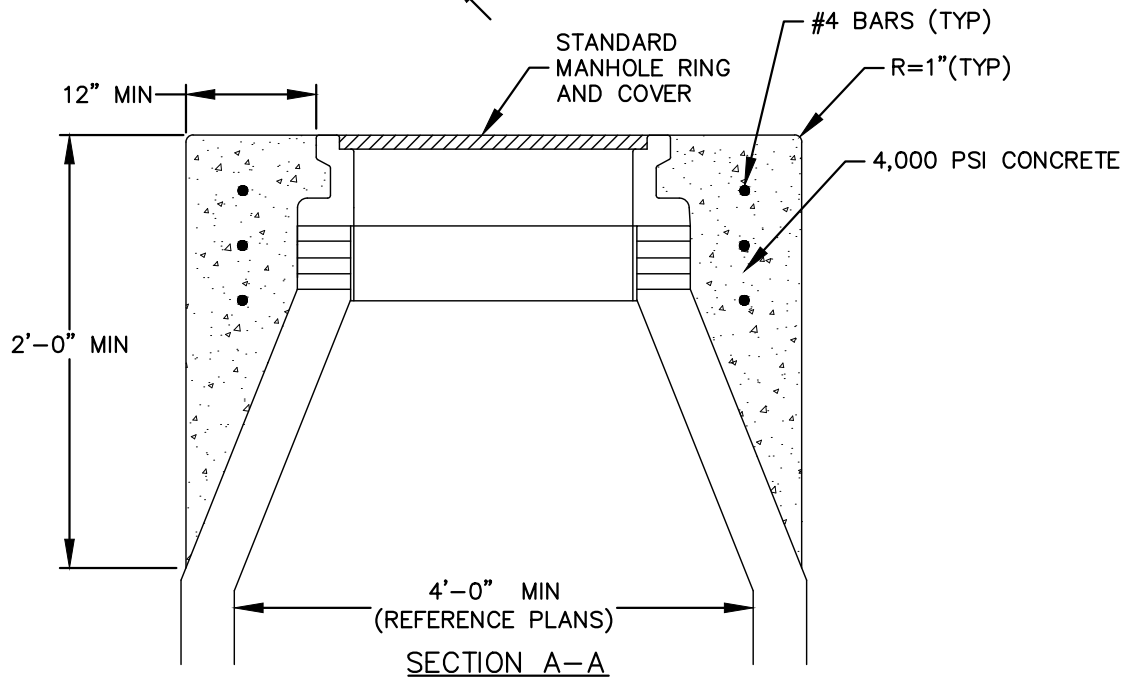
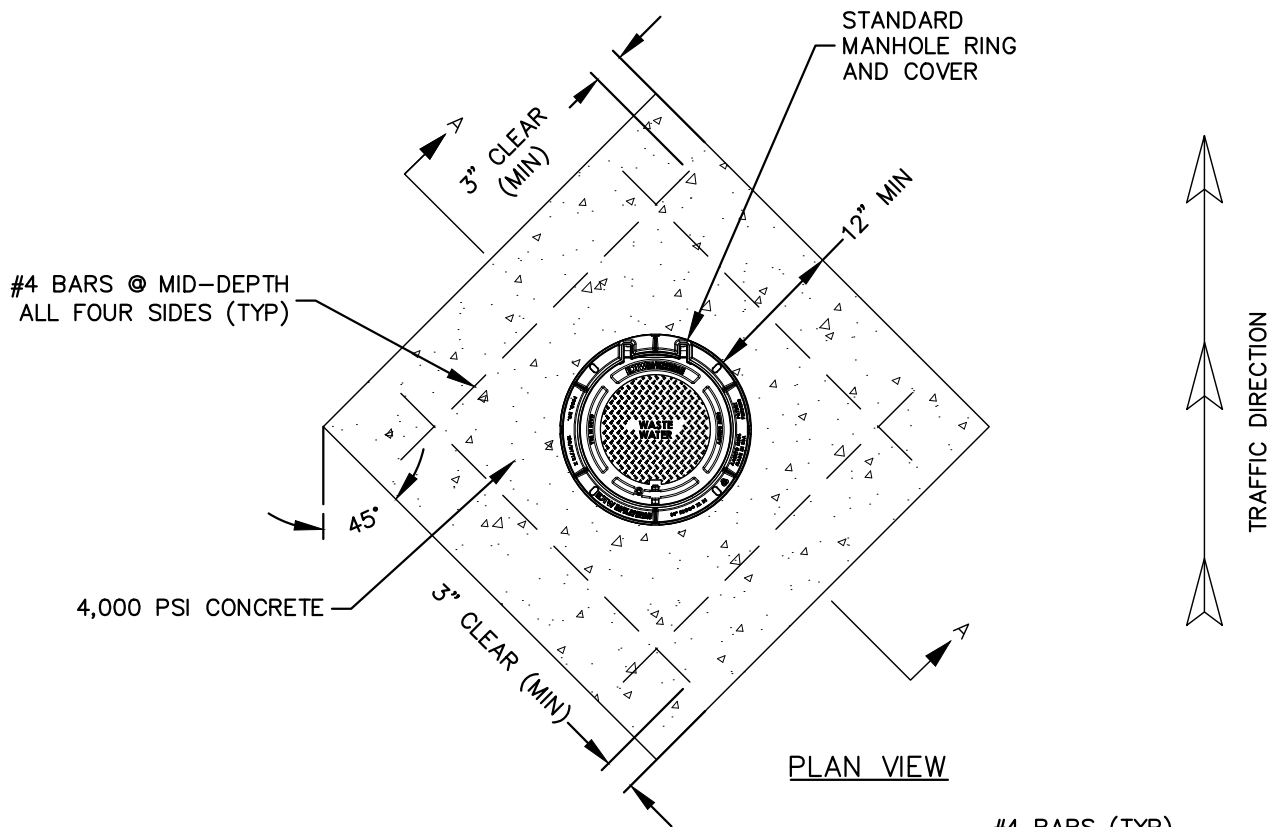
TITLE:	PRECAST CONCRETE WASTEWATER MANHOLE	
SCALE:	NTS	DRAWING No. WW - 4



**NOTES:**

1. CONTRACTOR SHALL GROUT THE INTERNAL AND EXTERNAL JOINTS FOR EACH RING SECTION AND PIPE PENETRATION.
2. DEEP SECTION OF PIPE SHALL BE THE SAME DIAMETER AS SEWER MAIN.
3. ALL TESTING SHALL BE IN ACCORDANCE WITH TCEQ, CHAPTER 217.
4. ALL MANHOLES SHALL HAVE AN INTERIOR COATING WITH A 100 MIL EPOXY RAVEN 405 OR EQUAL.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
<b>WASTEWATER DROP MANHOLE</b>			SCALE: NTS
<small>THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD</small>			DRAWING No. WW - 5



**NOTE:**

1. MANHOLE RING ENCASEMENT IS REQUIRED ON ALL MANHOLES.
2. COVERS SHALL BE 32" IN DIAMETER.
3. MANHOLE RING AND COVER SHALL BE MANUFACTURED BY EJIW OR APPROVED EQUAL, HAVE SLIP RESISTANT SURFACE, AND HAVE MACHINE CAST LETTERING WITH MFR. LOGO, COUNTRY OF ORIGIN, LABELED FOR WASTEWATER SERVICE, LIP WEIGHT, DATE, AND STATE "LOCKHART, TEXAS".

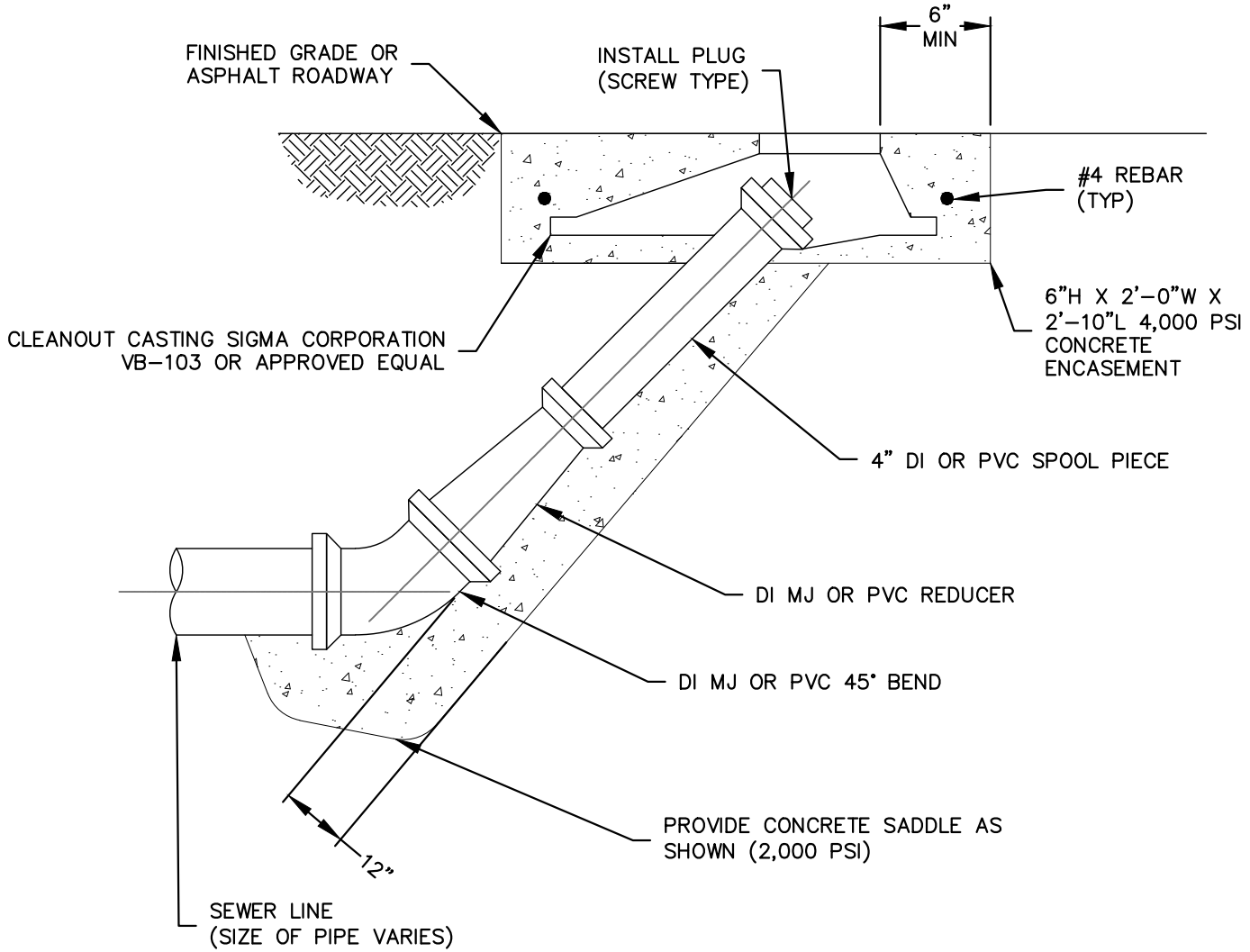


THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	<b>WASTEWATER MANHOLE RING ENCASEMENT DETAIL</b>	
SCALE:	NTS	DRAWING No. WW - 6

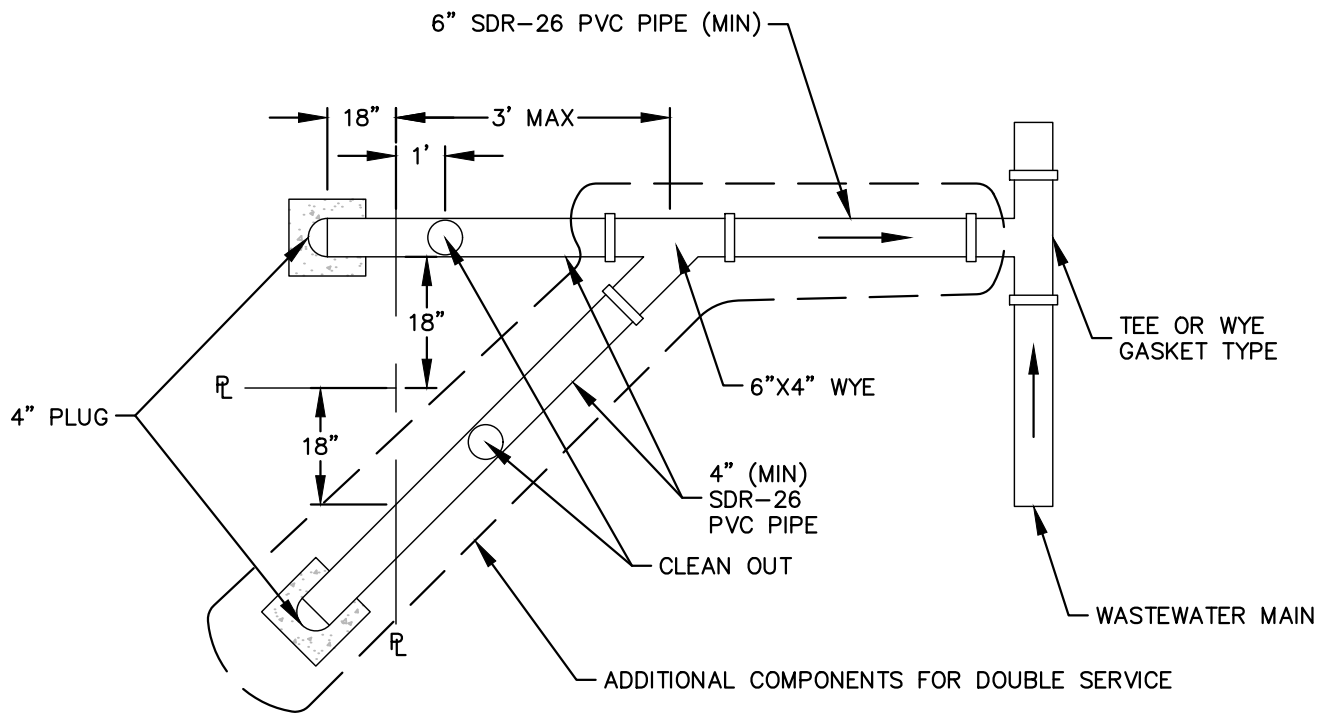




THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	<b>CLEAN-OUT DETAIL</b>
SCALE:	
NTS	DRAWING No. WW - 7



**NOTES:**

1. WASTEWATER SERVICE SHALL BE INSTALLED FROM WASTEWATER MAIN TO CLEANOUT.
2. BEDDING AND BACKFILL SHALL BE PER TRENCH BACKFILL DETAILS.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			SINGLE AND DUAL WASTEWATER SERVICE CONNECTION  SCALE: NTS      DRAWING No. WW - 8

---

## CHAPTER 4 - STREET, SIDEWALK, AND DRAINAGE STRUCTURES STANDARDS

### I. STREET DESIGN REQUIREMENTS

#### A. Horizontal Alignment

Minimum Horizontal Radii. The following design criteria is based on material from the American Association of State Highway and Transportation Officials (AASHTO) Manual, A Policy on Geometric Design of Highways and Streets, 2011, Table 3-13b “Minimum Radii and Superelevation for Low-Speed Urban Streets”.

For a superelevation ( $e$ ) = -0.02, typical for normal crown

A design speed of:

1. 15 mph relates to a minimum allowable radius of 50 ft.
2. 20 mph relates to a minimum allowable radius of 107 ft.
3. 25 mph relates to a minimum allowable radius of 198 ft.
4. 30 mph relates to a minimum allowable radius of 333 ft.
5. 35 mph relates to a minimum allowable radius of 510 ft.
6. 40 mph relates to a minimum allowable radius of 762 ft.
7. 45 mph relates to a minimum allowable radius of 1039 ft.

#### B. Vertical Alignment

##### 1. Minimum Grade

No streets shall be designed having a slope of less than 0.40 feet per 100 feet.

##### 2. Maximum Grades

- a) Major Road/Arterial Street: 5% maximum vertical grade.
- b) Collector Street: 6% maximum vertical grade.
- c) Minor Street: 60-foot R.O.W.: 6% maximum vertical grade.
- d) Minor Street: 50-foot R.O.W.: 10% maximum vertical grade.

##### 3. Design Controls

The minimum lengths of vertical curves for different values of the algebraic difference in grades to provide the minimum stopping sight distances for each design speed are shown in the table below.

Design Speed (MPH)	Stopping Sight Distance, (ft)	Rate of Vertical Curvature, $K^a$	
		Crest	Sag
15	80	3	10
20	115	7	17
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79
50	425	84	96
55	495	114	115
60	570	151	136
65	645	193	157
70	730	247	181
75	820	312	206
80	910	384	231

<sup>a</sup> Rate of vertical curve, K, is the length of curve per percent algebraic difference in intersecting grades (A).  
 $K = L/A$

- a) Curb and Gutter – Streets shall have standard concrete curb and gutter per the standard detail.
- b) Stub Streets – All stub streets will terminate with a header and barricade.
- c) Minimum Pavement Requirements – The minimum pavement requirements for streets shall be as shown in the Typical Street Section Details or as approved by the City Engineer.

C. Soils Testing

A soils investigation and report shall be performed and submitted by a qualified and independent geotechnical engineer licensed in the state of Texas. The sealed geotechnical report shall provide recommendations for lime treatment of the subgrade, an analysis of the sulfate levels in the soil, and shall be used to determine actual thicknesses for the pavement design section. However, the minimum pavement requirements for streets shall be as shown in the Typical Street Section Details or as approved by the City Engineer.

**II. SURFACING WITH FLEXIBLE BASE MATERIAL**

A. Flexible Base Material

- 1. Flexible base material shall be composed of crushed or broken stone and shall be constructed with a maximum of six inch (6") compacted lifts.
- 2. The materials shall be obtained from a source acceptable to TxDOT, shall be crushed, and shall consist of durable particles of stone mixed with soil binders as

---

specified herein. Should a stockpile be required, it shall be made up of layers of processed material and the material shall be loaded for delivery by making successive vertical cuts through the entire depth of the stockpile. Approval of material by the City is required.

3. The processed material, when properly slaked and tested by standard laboratory methods, shall meet TxDOT Item 247, Type A, Grade 1 for flexible base material.
4. Material passing the No. 40 sieve is the soil binder and shall meet the following requirements:
  - a) The liquid limit shall not exceed 30%
  - b) The plasticity index shall not exceed 12%
  - c) The linear shrinkage shall not exceed 7%
  - d) NOTE: The linear shrinkage shall be calculated from the volumetric shrinkage at the liquid limit.

**B. Construction Methods**

1. Treated Sub-Grade – Flexible base shall not be placed until the Contractor has verified that the new subgrade has been prepared and compacted to the typical sections, lines and grades indicated on the appropriate construction drawings and standard details. Before the flexible base material is placed, the on-site surficial subgrade soils shall be treated with lime in accordance with the TxDOT Item 260 to a minimum 8 inches in depth and two feet (2') behind the curb. The actual quantity of the lime should be determined at the time of construction based on testing conducted on mixtures of the subgrade soils with lime. The lime used shall be lime or commercial lime slurry conforming to TxDOT Item 260. The subgrade should be compacted to a minimum of 95 percent of Standard Proctor (ASTM D 698) maximum dry density within 2 percent of the optimum moisture content.
2. Flexible base shall be placed two feet (2') behind the curb, with additional flexible base behind the curb four inches (4'') below top of curb (eight inches (8'') in depth) and two feet (2') wide. Four inches (4'') of top soil shall be placed for finish grade, sloped to drain to the street.
3. First and Intermediate Lifts – Flexible base material deposited upon the treated subgrade shall be spread, shaped and rolled the same day unless otherwise authorized by the City, in which case the City will provide directions for avoiding damage from the delay. This lift shall be wetted, bladed, and rolled until a minimum of 95% density for the first lift and 98% density for the second lift has been attained as per TxDOT Test Procedure Tex-113-E.
4. Final Lift – Construction methods for the final lift shall be the same as prescribed for the first lift with the addition of the following:

- a) This lift shall be wetted, bladed, and rolled until a minimum of 100% density has been attained as per TxDOT Test Procedure Tex-113-E.
- b) Any deviation, in the finished surface in excess of ¼ inch, in cross-section or in a length of 16 feet (16') measured longitudinally, shall be corrected by loosening, adding or removing material, reshaping, and recompacting by sprinkling and rolling.
- c) The completed flexible base shall have a minimum compacted depth as specified.

### III. HOT MIX ASPHALTIC CONCRETE PAVEMENT

#### A. General

- 1. Asphaltic concrete pavement shall conform to TxDOT Item 340 and consist of a fine base course and fine surface course to be composed of a compacted mixture material as specified herein and shall be constructed on a flexible base constructed in accordance with the standards set out above.
- 2. The asphaltic mixture, prime coat, or tack coat shall be applied when the air temperature is at or above 50 degrees, or when the air temperature is above 40 degrees and is steady or rising.
- 3. All materials and design of mixes shall be subject to the approval of the City and, when tested in accordance with these specifications and methods outlined in TxDOT Test Procedures Tex-204-F, Tex-208-F, and Tex-227-F. Materials and design mixes shall conform with the City's requirements and shall meet the following laboratory density and stability requirements:

	Optimum Laboratory Density (%)	Laboratory Density (%)		Stability (%)
		Min.	Max.	
Local Streets– Surface Courses	97	95	99	35 min.
Collectors and Arterials – Surface Courses	97	95	99	40-60
All Base Courses	97	95	99	35 min.

#### B. Materials

- 1. Aggregates
  - a) The aggregate gradation for the hot-mix asphaltic concrete (HMAC) shall be Type D for the surface finish and Type B for the base course in depths shown in the standard details. The asphalt material for Type D HMAC shall be PG 70-22 or approved equal. The asphalt material for Type B HMAC

shall be PG 64-22 or approved equal. The aggregate for hot-mix asphaltic concrete shall meet the Aggregate Quality Monitoring Program (AQMP) Class B requirements.

- b) The asphaltic material shall form 4-1/2% to 7% of the mixture weight. The course shall be gravel or crushed stone, uniform in quality throughout, shall be free from dirt, organic, or other injurious matter occurring either free or as coating on the aggregate. The percent of wear, as determined by TxDOT Test Method Tex-410-A (Los Angeles Abrasion Test), for each of the materials, except natural limestone rock asphalt (LRA), shall not exceed 35 percent. The percent of wear on natural limestone rock asphalt aggregate (LRA) shall not exceed 40 percent.
- c) The fine aggregate shall consist of sand, stone screenings, or a combination of both. Sand shall be composed of sound, durable stone particles free from loams or other injurious foreign matter. Screenings shall be of the same or similar material as specified for coarse aggregate. The plasticity index of that part of the fine aggregate passing the No.40 sieve shall be not more than three (3) when tested by TxDOT Test Procedure Tex-107-E, II.

2. Asphalt Cement – AC-10 shall be used in the cooler months (October through April), and AC-20 shall be used in the warm summer months of the year. The material shall be homogenous, shall be free from water, shall not foam when heated to 350°F, and shall meet the following requirements:

Property	Test Procedure	Viscosity Grade			
		AC-10		AC-20	
		Min.	Max.	Min.	Max.
Viscosity, 140°F, Poise	T 202	800	1,200	1,600	2,400
Viscosity, 275°F, Stokes	T 202	1.9	-	2.5	-
Penetration, 77°F, 100g. 5 sec.	T 49	85	-	55	-
Flash Point, C.O.C. °F	T 48	450	-	450	-
Solubility in trichloroethylene, %	T 44	99.0	-	99.0	-
Test on residues from thin film oven test:	T 179	-		-	
Viscosity, 140°F, Stokes	T 202	-	3,000	-	6,000
Ductility, 77°F, 5 cm per min., cm	T 51	70	-	50	-
Spot Test	TEX-509-C	Negative		Negative	

- a) The recommended heating range of the asphaltic material during mixing and application shall be from 275°F to 350°F. For heating and storage, the maximum allowable temperature is 350°F.
- b) The asphalt shall be from a source acceptable by TxDOT and shall not be cracked.

3. Prime and Tack Coats – MC-30 cut-back asphalt shall be used for priming the base course. RC-250 cut-back asphalt shall be used for tack coat. They shall meet the following requirements:

Type	MC-30		RC-250		
Properties	Test Method	Min.	Max.	Min.	Max.
Water, %	T55	-	0.2	-	0.2
Flash Point, T.O.C., °F	T79	100	-	80	-
Kinematic viscosity, @ 140°F. cst	T201	30	60	250	400
Distillation Test:	T78				
Distillate, as % by volume to total distillate to 680°F (360°C):, shall be as follows:					
to 437°F		-	25	40	75
to 500°F		40	70	65	90
to 600°F		75	93	85	-
Residue from 680°F Distillation, Volume, %		50	-	70	-
Tests on Distillation Residue:					
Penetration @77°F (25°C), 100g, s, 01 mm:	T49	120	250	80	120
Ductility @ 77°F, 5 cm/min, cms	T51	100*	-	100	-
% Solubility in trichloroethylene	T44	99.0	-	99.0	-
Spot Test	Tex 509-C	All Negative			

(Tex = TxDOT, T = AASHTO for this table)

\* If penetration of residue is more than 200 and the ductility at 77°F (25°C) is less than 100 cm (1000 mm), the material will be acceptable if its ductility at 60°F (16°C) is more than 100cm (1000 mm).

### C. Construction Methods

1. The prime coat shall consist of MC-30 asphalt as specified herein, applied evenly and smoothly at the rate of 0.32 gallons per square yard, at a pressure necessary for even distribution.
2. If the prime coat is allowed to become over-dry and dusty, or traffic is allowed on the prime coat, and the new hot-mix asphaltic course, in the opinion of the Engineer, will not adhere to the base course, a tack coat shall be applied. The tack coat shall consist of RC-250 cut-back asphalt, as specified herein, applied evenly and smoothly at the rate of 0.10 gallons per square yard, at a pressure necessary for even distribution.



- 
3. The hot mix-asphaltic concrete shall arrive on the job site at a temperature between 225°F and 300°F. In no case shall hot-mix be compacted in place at a temperature less than 175°F.
  4. After approval of the base by the City, the asphaltic mixture shall be applied with a spreading and finishing machine acceptable to the City that will produce a smooth and uniformed textured surface. Adjacent strips of surfacing will be laid to the extent possible so that the longitudinal joints will be hot joints. Rolling will not be permitted within one foot (1') of exposed longitudinal joint until adjacent strip has been laid, unless the adjacent strip cannot be laid before the asphaltic material laid will cool below the proper rolling temperature. Transverse joints at the end of placement, and those which have become cold, will be cut out to a vertical joint. Transverse joints for adjacent strips will be offset by two times the width of the strip.
  5. Compaction of the asphaltic mixture shall be by the use of the steel wheel roller followed by the tandem and/or pneumatic roller(s), each starting at the low side and progressing toward the high center of high side of the pavement. Rolling shall be continued until no further compression can be obtained and until the roller marks are eliminated.
  6. No traffic shall be permitted on surfacing during or after rolling until the asphaltic material has cooled sufficiently to preclude marking or damage.

D. Testing

Prior to construction of the hot-mix asphaltic concrete base and surface courses, a sieve analysis of the aggregate and laboratory test results of the density and stability of the hot-mix to be used on this project shall be furnished to and approved by the City.

#### **IV. CONCRETE PAVEMENT CONSTRUCTION**

A. Materials

1. Concrete – Concrete used in paving shall be in accordance with Concrete and Reinforcing Standards, Chapter 5, and as shown on the Details.
2. Reinforcing – Steel for concrete paving shall be in conformity with all requirements of Concrete and Reinforcing Standards, Chapter 5, and as shown on the Details.

B. Construction Methods

1. Treated Subgrade – Concrete shall not be placed until the Contractor has verified that the new subgrade has been prepared and compacted to the typical sections, lines and grades indicated on the appropriate construction drawings and standard details. Before the concrete is placed, the on-site surficial subgrade soils shall be treated with lime in accordance with the TxDOT Item 260 to a minimum 8 inches in depth and two feet (2') behind the curb. The actual quantity of the lime should

---

be determined at the time of construction based on testing conducted on mixtures of the subgrade soils with lime. The lime used shall be lime or commercial lime slurry conforming to TxDOT Item 260. The subgrade should be compacted to a minimum of 95 percent of Standard Proctor (ASTM D 698) maximum dry density within 2 percent of the optimum moisture content.

2. Forms – Forms shall be accurately set to a minimum distance of 300 feet. Form sections shall be tightly joined and keyed to prevent relative displacement. They shall be cleaned and oiled each time they are used. Forms must be inspected by the City before any concrete is placed. If forms settle and/or deflect over 1/8 inch (1/8”) under finishing operations, paving operations shall be stopped and the forms shall be reset to line the grade.
3. Placement - Concrete shall not be placed when the temperature is below 40 °F and falling. Concrete may be placed when the temperature is above 35 °F and steady or rising. Salt or other chemical additives shall not be added to concrete to prevent freezing. The contractor shall be responsible for replacing any concrete that freezes during curing. All concrete shall be constructed monolithically unless otherwise stated on construction drawings or typical sections.
4. Finishing – Where hand distribution is necessary, concrete shall be distributed to required depth by use of shovels. The use of rakes will not be permitted. Immediately upon unintended stoppage of placement operation, a standard bulkhead shall be installed at right angles to the centerline of the pavement. Joint-sealing material shall be placed in sawed and other joints as required. Pavement shall be finished with a brush finish or as otherwise specified. After finishing is complete and the concrete is still workable the gutter and surface shall be tested by the contractor for trueness with a ten foot (10’) steel straightedge. The maximum ordinate measurement shall be 1/16 inch (1/16”).

**V. CURB AND GUTTER AND VALLEY GUTTERS**

**A. Materials**

1. Concrete – Concrete used in paving shall be in accordance with Concrete and Reinforcing Standards, Chapter 5, and as shown on the Details.
2. Reinforcing – Steel for concrete paving shall be in conformity with all requirements of Concrete and Reinforcing Standards, Chapter 5, and as shown on the Details.
3. Materials for machine laid curb shall conform to the requirements as specified in the Concrete and Reinforcing Standards , Chapter 5, except that the slump shall not exceed one inch (1”), the concrete shall contain a minimum of six (6) sacks of cement per cubic yard and the coarse aggregate when tested by approved methods shall conform to the following grading requirements:
  - a) Retained on 1/2” sieve 0%

---

b)	Retained on 3/8" sieve	0-5%
c)	Retained on #4 sieve	35-60%
d)	Retained on #10 sieve	90-100%

#### B. Formed Curb and Gutter

Curb and gutter or separate gutter installation grades shall conform to the engineering plans and shall be constructed as shown on the Details. In not more than one hour after the concrete has been placed, a thin coating not over 1/2" nor less than 1/4" thick of finish mortar, composed of one-part cement and two parts of fine aggregate, shall be worked into the exposed faces of the curb and gutter by means of a molding form. The curb and gutter shall then be finished true to line and grade with the aid of a straight edge, steel trowel, steel finishing tool, and fine brush. After work has become firm, it is to be brushed lightly with a final crosswise brushing. The forms shall remain in place a minimum of 24 hours unless approved otherwise by the Engineer or designated representative.

#### C. Machine Laid Curb

1. Curb and gutter or separate gutter installation grades shall conform to the engineering plans and shall be constructed as shown on the Details. To provide a continual check on the curb grade, a pointer or gauge shall be attached to the machine in such a manner that a comparison can be made between the curb and the guideline.
2. The mix shall be fed into the machine in such a manner and of such consistency that the finished curb will present a well compacted mass true to the established shape, line and grade, with a surface free of voids or honeycomb. Any additional surface finishing specified and/or required shall be performed immediately after extrusion. The completed curb shall be cured for a period of not less than 72 hours.

#### D. Dummy and Expansion Joints

Dummy Joints shall be formed as a 1/2 inch (1/2") deep transverse tooled joints at 20 foot intervals. 1/2 inch expansion joints shall be installed where a curb intersects, joins, or abuts a structure as well as at not less than 600 feet (600') intervals or in the middle of a block when a block length is less than 600 feet (600'). The joint material shall be bitumastic fiber.

#### E. Valley Gutters

Concrete valley gutters shall be constructed to carry water flows across asphaltic streets only as approved by the City Engineer. Storm drain inlets and pipe shall be installed to avoid the installation of valley gutters at places other than street intersections unless approved by the City Engineer. The valley gutter shall be extended to include the area formed by the intersection of the back-face of the valley gutter, the projections of gutter face and the intersecting street, and the circular curb return.

---

## **VI. SIDEWALKS**

### **A. General**

Sidewalks shall be minimum four foot (4'-0") width, four-inch (4") thick 3,000 psi concrete, with #3 reinforcing bars placed no more than 16 inches (16") on center each way. All reinforcement shall be placed at mid-depth of the concrete. All design and installation shall meet the latest code for the Americans with Disabilities Act (ADA) and the Texas Accessibility Standards (TAS). When placed against the curb, all sidewalks shall be doweled into the back of curb with #3 reinforcing bars at 16 inches (16") on center per the Details.

### **B. Materials**

Concrete used in the construction of sidewalks shall be in accordance with the specifications set out in Chapter 5, Concrete and Reinforcing Standards.

### **C. Construction Methods**

1. Sidewalks shall be constructed on a two-inch (2") sand cushion over undisturbed natural soil or compacted fill.
2. Splices in the #3 bars shall have a minimum lap of 12 inches (12") to maintain a uniform strength.
3. No concrete shall be placed until the City has inspected and approved the type and placement of the reinforced steel.
4. One inch (1") deep transverse tooled dummy joints shall be placed at ten-foot (10') intervals.

## **VII. DRAINAGE STRUCTURES**

### **A. Design Requirements**

1. Inlets – A minimum curb inlet length of ten feet (10') with six-inch (6") throat opening shall be provided. Inlets shall be sized to achieve a capability of one cubic foot per second (1 cf/sec) of opening for the throat height of five inches (5").
2. Inlets to storm water drainage systems shall be provided at such locations as are necessary to prevent street hydraulic capacity being exceeded as defined in the City of Lockhart Drainage Ordinance.
3. Storm Drains – Storm drains shall be minimum diameter 18 inches (18"). Outfalls from storm drains and ditches into natural drainage ways shall enter the grade of the natural drainage channel. Drop-type outfall structures, headwalls and wing-walls as specified by TxDOT standards shall be provided along with energy dissipators to control erosion.

- 
4. Manholes – Manholes shall be provided at all changes in grade or alignment, at all storm drain intersections, and at intervals of no more than 1,000 feet on straight lines. Design of manholes shall conform to the Details.
  5. Open Channel Design – All open channels shall be sized for design flow and shall be concrete lined unless otherwise approved by the City. Channel invert and sides shall be a minimum of five inches (5”) thick with No. 3 reinforcing bars at twenty-four inches on center each way (24” OCEW). Side slopes shall have a horizontal/vertical ratio of two to one (2:1) or greater.
  6. Detention facilities – All detention facilities shall be constructed to meet the City’s currently adopted hydraulic manual and drainage requirements. Requirements with outfall structures designed to accommodate runoff from a 2, 10, 25, 50, and 100-year events or as approved by the City Engineer. All detention facilities shall contain a concrete pilot channel at least three feet (3’) wide with 12” toe-downs, or as approved by the City Engineer. All earthen areas in such facilities shall be “hydro-mulched” or “sod covered”.

B. Materials for Drainage Structures.

1. Concrete – All concrete and reinforcing steel used in drainage structures shall be in accordance with the specifications set out in Chapter 5, Concrete and Reinforcing Standards. Cast in place concrete shall be Class A and precast shall be Class C.
2. Pipe – Pipe for storm drains shall be concrete pipe in sizes as shown on the approved plans. All concrete pipes shall be RCP ASTM Specification C76. The pipe shall be Class III at a minimum. Where added strength of pipe is needed for traffic loads over a minimum cover or for excessive height of backfill, extra strength pipe shall be used. Pipe shall have minimum cover of not less than one foot (1’) over the top of the pipe. All pipes shall have integral tongue and groove joints. All concrete pipe bends or fittings shall be prefabricated construction using RCP.
3. Manholes – Manholes shall be constructed as shown on the Details. Cast iron frame and covers shall conform to ASTM A48 Class 30 Specification. Covers shall have a 32 inch opening and weight of at least 210 pounds. The cover shall be marked “STORM”.
4. Pipe and Joint Materials:
  - a) Asphalt compounds – Asphalt compounds shall consist of asphalt base, volatile solvents, and inert filter. The joint compound shall conform to current TxDOT Standards.
  - b) Mortar Mix – Mortar joint mix shall be composed of one-part cement or two parts of mortar sand.
  - c) Rubber Gaskets – Joints for storm drain pipe using rubber gaskets shall adhere to ASTM C443

---

## C. Drainage Structure Construction

### 1. General

- a) Batter boards shall not be used for grade control; laser beam grade control shall be the only method that will be acceptable.
- b) Construction must begin at the lowest pipe elevation and continue upgrade with bells facing upgrade. Construction shall be continuous with construction of branch mains deferred until the main is constructed to the branch manholes junction points.

### 2. Trench Safety

- a) Trench Width – The trench width shall be equal to the pipe outside diameter plus twelve inches (12”).
- b) Trench sides – The sides of the trench shall be excavated vertically to a minimum distance of one foot (1’) over the top of the pipe, above which point, trench sides shall be excavated as near vertical as possible and safe.
- c) Protection from Rock – When rock is encountered; a minimum of six inches (6”) of granular embedment shall be placed under the pipe.
- d) Installation – The pipe or conduit shall be assembled in the trench with the barrel resting uniformly on bedding and to the grade specified.

### 3. Embedment and Backfill

- a) Embedment – Specified embedment material shall be placed as shown in the trench details.
- b) Inspection and Backfill – The trench may be backfilled after inspection and approval by the City.
- c) Backfill Materials – Trenches not to be in proposed street area, existing streets, or within three feet (3’) of the back of the curb or edge of pavement must include specified embedment material and may be backfilled with excavated select fill materials that are void of rocks and other objects larger than four inches (4”) in diameter. Backfill shall be carefully placed in the trench to avoid damage to the pipe.
- d) Backfill in areas that will be in existing or proposed streets or within 3’ of the back of curb or edge of pavement must include specified embedment material up to the specified sub-grade elevation in the construction plans.

### 4. Joints

- a) Mortar Joints – The storm drain pipe shall be laid to grade in the trench. The joint areas shall be thoroughly wetted. The lower one-half (1/2) of the groove shall be packed with mortar from the interior. The remaining groove

---

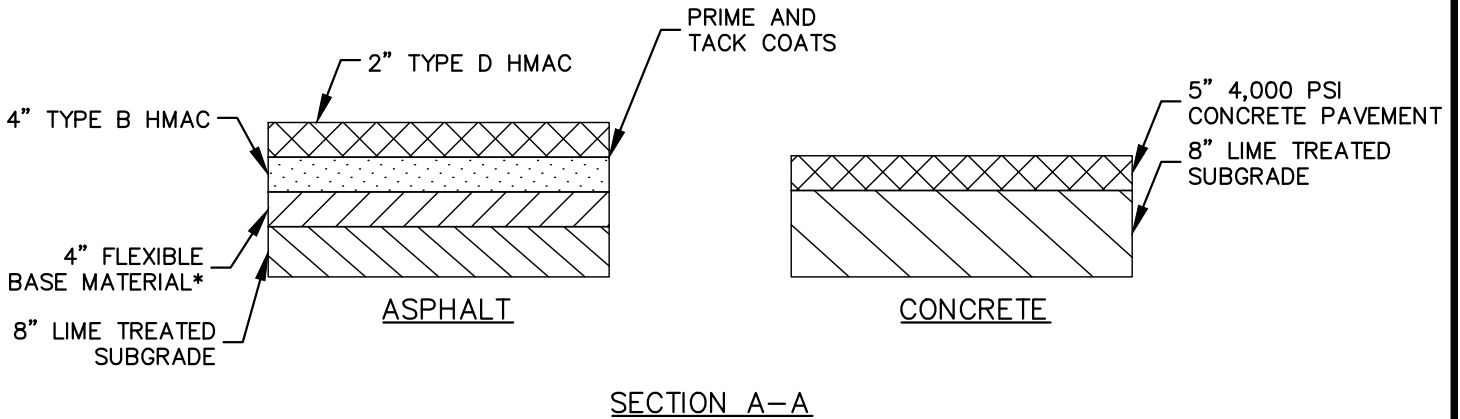
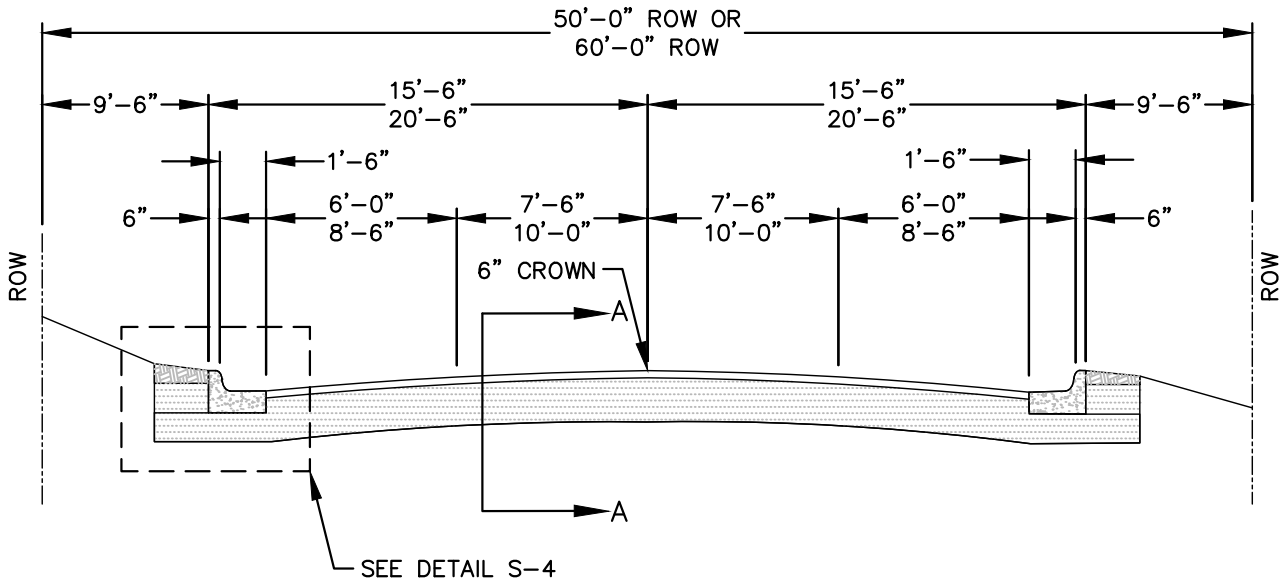
area shall be quickly packed with mortar from the exterior. A mortar bead shall be formed around the pipe joint. The bead shall extend a minimum of one inch (1") on each side of the joint and project outward a distance of one inch (1"). The inside of pipe joint shall be furnished smooth with the inside of the pipe. The joint shall be protected from sun and air by approved wet wrapping or wet oil cover for a minimum of 48 hours or until backfilled. Joints shall not be made when temperature is 40 °F or below.

- b) Flexible Joints – Install joint sealants in accordance with the pipe and joint manufacturer's recommendations. Preformed flexible joint sealants shall comply with ASTM C990. Rubber gasket joint sealants shall comply with ASTM C443. Place joint sealer so that no dirt or other deleterious materials come in contact with the joint sealing material. Pull or push home the pipe with enough force to properly seal the joint with the final joint opening on the inside of the installed pipe being less than or equal to the pipe manufacturer's recommended dimensions. Protrusion of a joint material greater than one-eighth inch (1/8") into interior of pipe will not be accepted.

## VIII. STREET, SIDEWALK, AND DRAINAGE STRUCTURES DETAILS

<b>Detail</b>	<b>Detail No.</b>
Typical Section for Minor/Collector Streets	S-1
Typical Section of Major/Arterial Streets	S-2
Typical Section of Major/Arterial Streets with Median	S-3
Behind Curb Detail	S-4
Curb and Gutter	S-5
Concrete Paving Plan of Steel Layout	S-6
Concrete Paving Joint Spacing	S-7
Expansion and Tooled Dummy Joints	S-8
Longitudinal Construction Joint and Sawed Dummy Joint	S-9
Street Stub Header	S-10
25' Alley Section (Asphalt Pavement)	S-11
15' Alley Section (Asphalt Pavement)	S-12
25' Alley Section (Concrete Pavement)	S-13
15' Alley Section (Concrete Pavement)	S-14
Concrete Valley Gutter	S-15
Street Stub Barricade	S-16
Typical Curb Inlet Section View	S-17
10' Curb Inlets	S-18
15' and 20' Curb Inlets	S-19
Recessed Curb Inlet	S-20
4' - 0" to 6' - 0" Square Storm Drain Manhole	S-21
Sidewalk Detail	S-22
Parallel & Perpendicular Curb Ramps	S-23
Directional Curb Ramp	S-24
Curb Ramp Notes	S-25
Sidewalk Across Driveway	S-26
ROW Trench Detail	S-27
Trench Detail	S-28
Concrete Pilot Channel	S-29





**NOTES:**

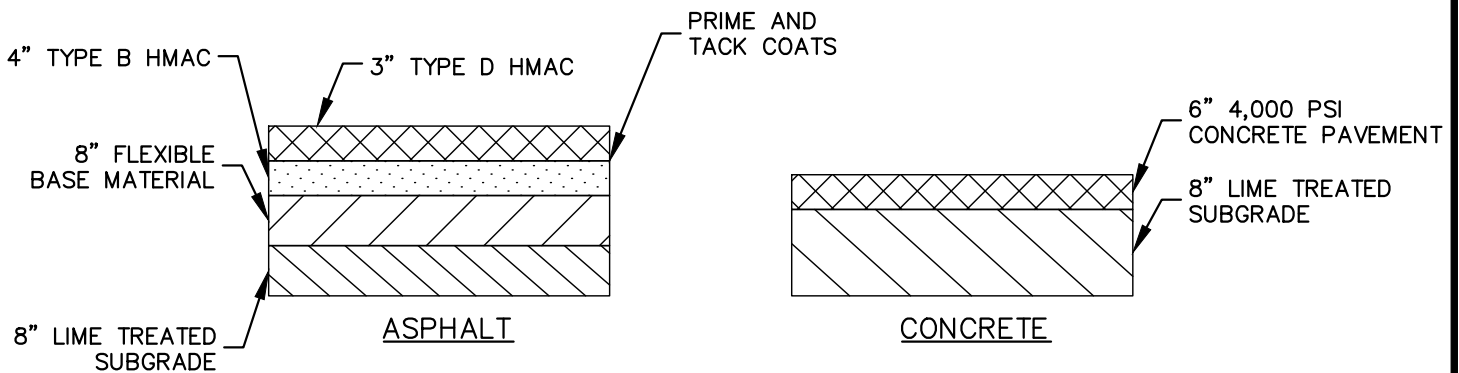
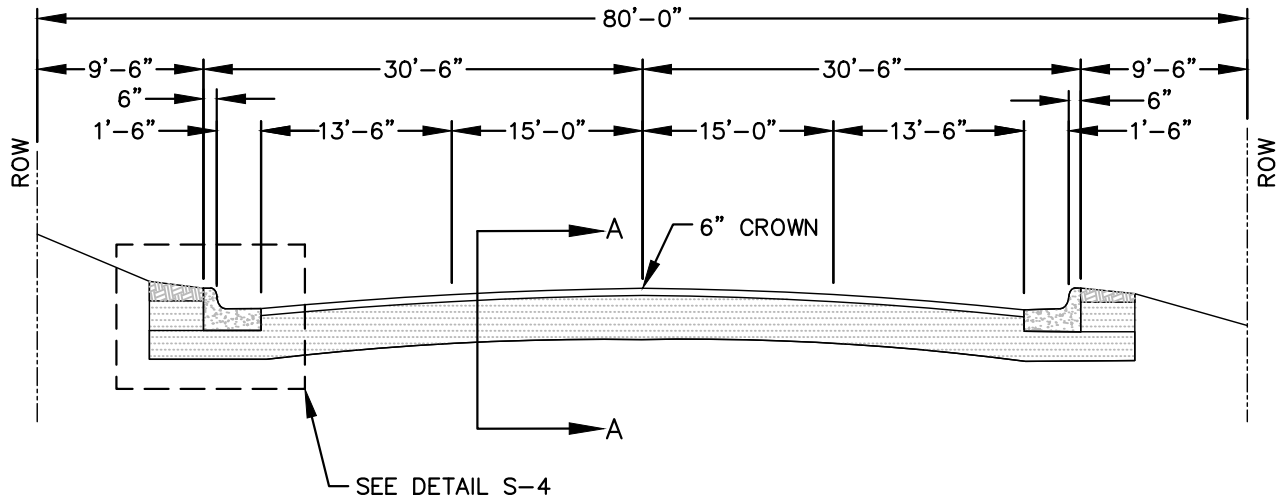
1. 6" PARABOLIC CROWN EXCEPT AT INTERSECTIONS OR AS APPROVED BY THE CITY ENGINEER. (CROWN HEIGHT DEVIATIONS NOT PERMITTED FOR DRAINAGE REASONS.)
2. UTILITY TRENCHES PLACED WITHIN THE STREET OR WITHIN 3' FROM BACK OF CURBS THAT ARE 3' OR MORE IN DEPTH SHALL COMPLY WITH THE TRENCH DETAILS. (FOR PIPE SIZE 6" AND LARGER)
3. THICKNESSES SHOWN ARE MINIMUMS. ACTUAL THICKNESSES SHALL BE BASED ON APPROVED GEOTECHNICAL REPORT.
4. REFERENCE CHAPTER 4 OF THE CITY CONSTRUCTION STANDARDS FOR ADDITIONAL REQUIREMENTS.
- \*5. FOR COLLECTOR STREETS, FLEX BASE THICKNESS SHALL BE 6".



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
TYPICAL SECTION FOR MINOR / COLLECTOR STREETS	
SCALE:	DRAWING No.
NTS	S - 1



SECTION A-A

**NOTES:**

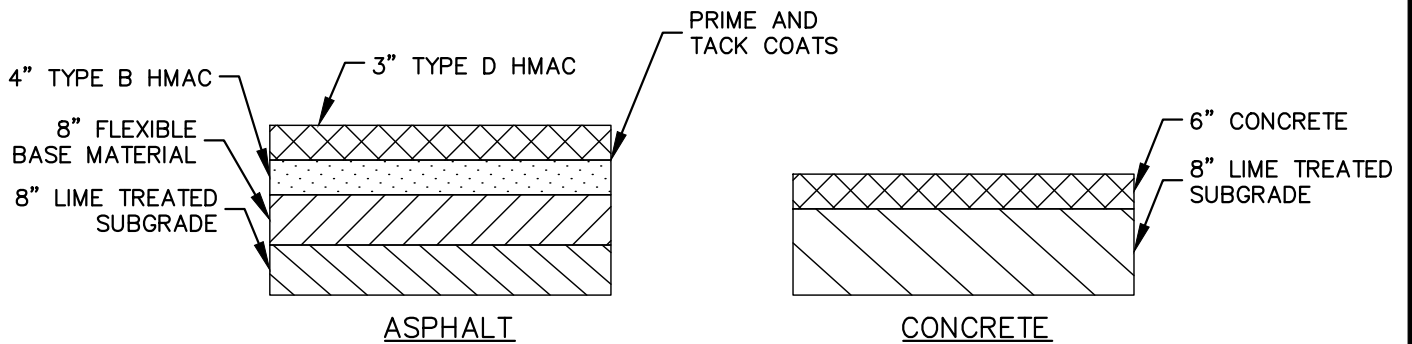
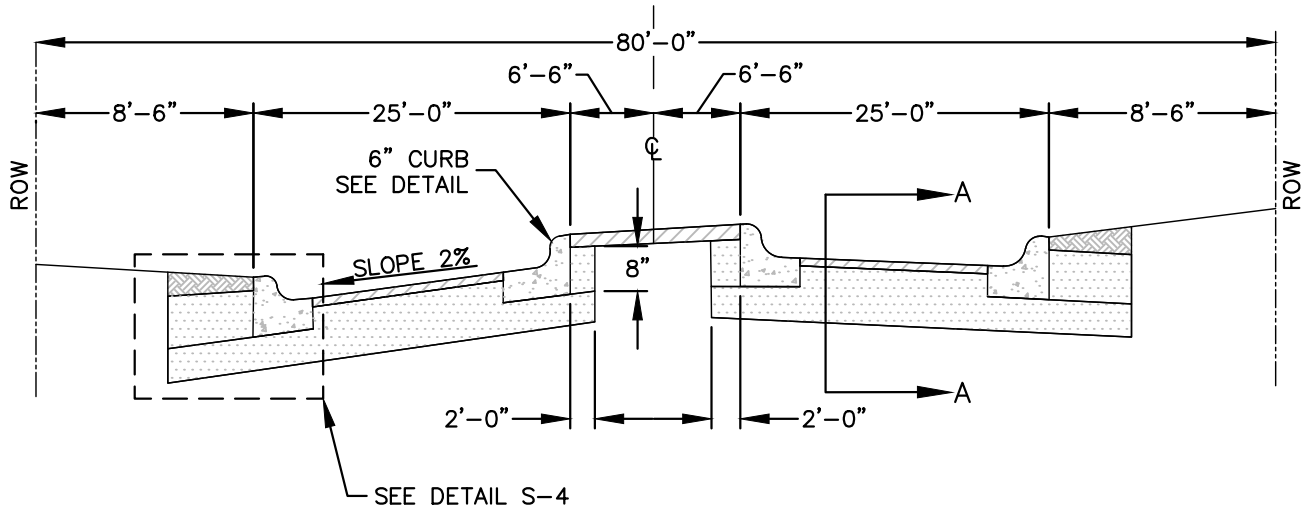
1. 6" PARABOLIC CROWN EXCEPT AT INTERSECTIONS OR AS APPROVED BY THE CITY ENGINEER. (CROWN HEIGHT DEVIATIONS NOT PERMITTED FOR DRAINAGE REASONS)
2. UTILITY TRENCHES PLACED WITHIN THE STREET OR WITHIN 3' FROM OF CURBS THAT ARE 3' OR MORE IN DEPTH SHALL COMPLY WITH THE TRENCH DETAILS. (FOR PIPE SIZE 6" AND LARGER)
3. THICKNESSES SHOWN ARE MINIMUMS. ACTUAL THICKNESSES SHALL BE BASED ON APPROVED GEOTECHNICAL REPORT.
4. REFERENCE CHAPTER 4 OF THE CITY CONSTRUCTION STANDARDS FOR ADDITIONAL REQUIREMENTS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
TYPICAL SECTION OF MAJOR/ARTERIAL STREETS	
SCALE:	DRAWING No.
NTS	S - 2



SECTION A-A

**NOTES:**

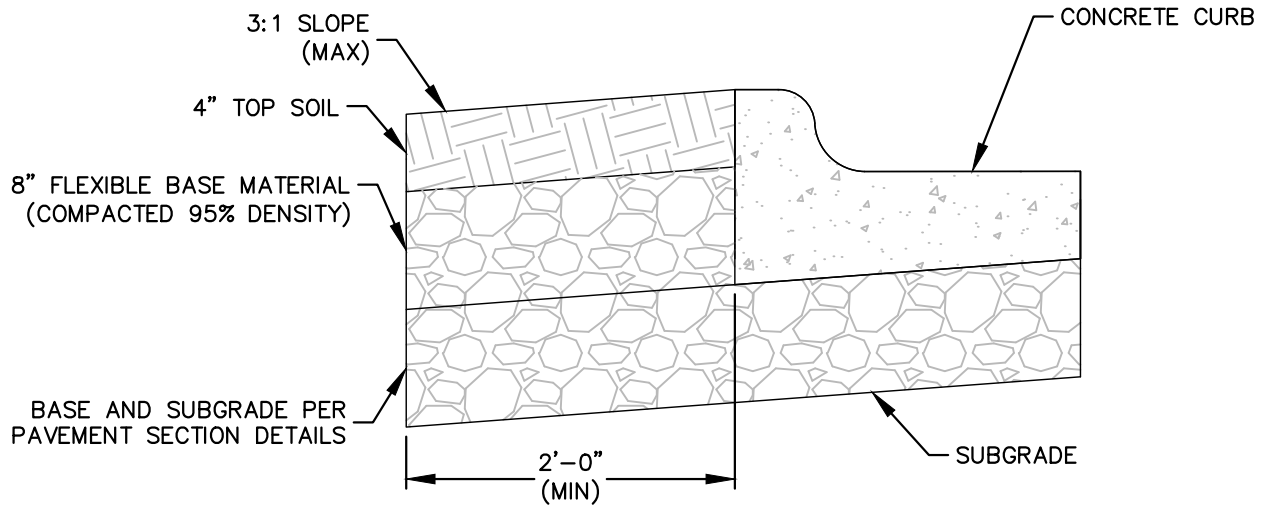
1. UTILITY TRENCHES PLACED WITHIN THE STREET OR WITHIN 3' FROM BACK OF CURBS THAT ARE 3' OR MORE IN DEPTH SHALL COMPLY WITH THE TRENCH DETAILS. (FOR PIPE SIZE 6" AND LARGER)
2. THICKNESSES SHOWN ARE MINIMUMS. ACTUAL THICKNESSES SHALL BE BASED ON APPROVED GEOTECHNICAL REPORT.
3. REFERENCE CHAPTER 4 OF THE CITY CONSTRUCTION STANDARDS FOR ADDITIONAL REQUIREMENTS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	TYPICAL SECTION OF MAJOR/ARTERIAL STREETS WITH MEDIAN	
SCALE:	NTS	DRAWING No. S - 3



**NOTES:**

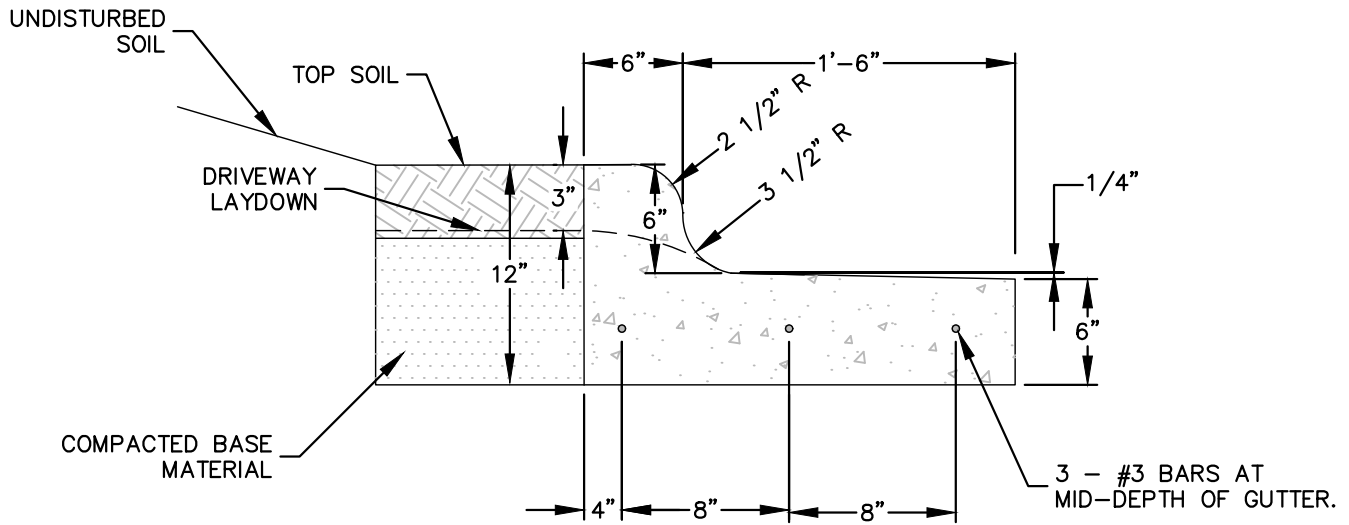
1. ALL COMPACTION SHALL BE PER TxDOT TEX-113-E
2. FOR ASPHALT PAVEMENT, PLACE MINIMUM OF 4" FLEX BASE AND 8" LIME TREATED SUBGRADE BENEATH CURB. FOR CONCRETE PAVEMENT, PLACE MINIMUM 8" LIME TREATED SUBGRADE BENEATH CURB. SEE TYPICAL STREET SECTION DETAILS.



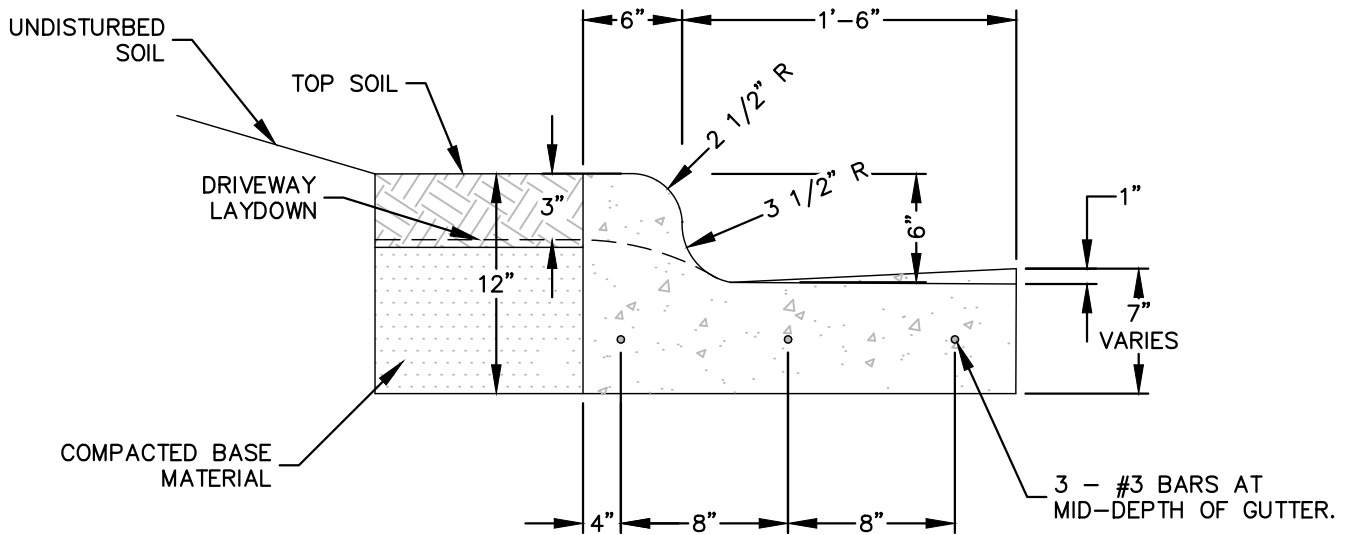
DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
BEHIND CURB DETAIL	
SCALE:	DRAWING No.
NTS	S - 4

THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD



SPILL



CATCH

**NOTES:**

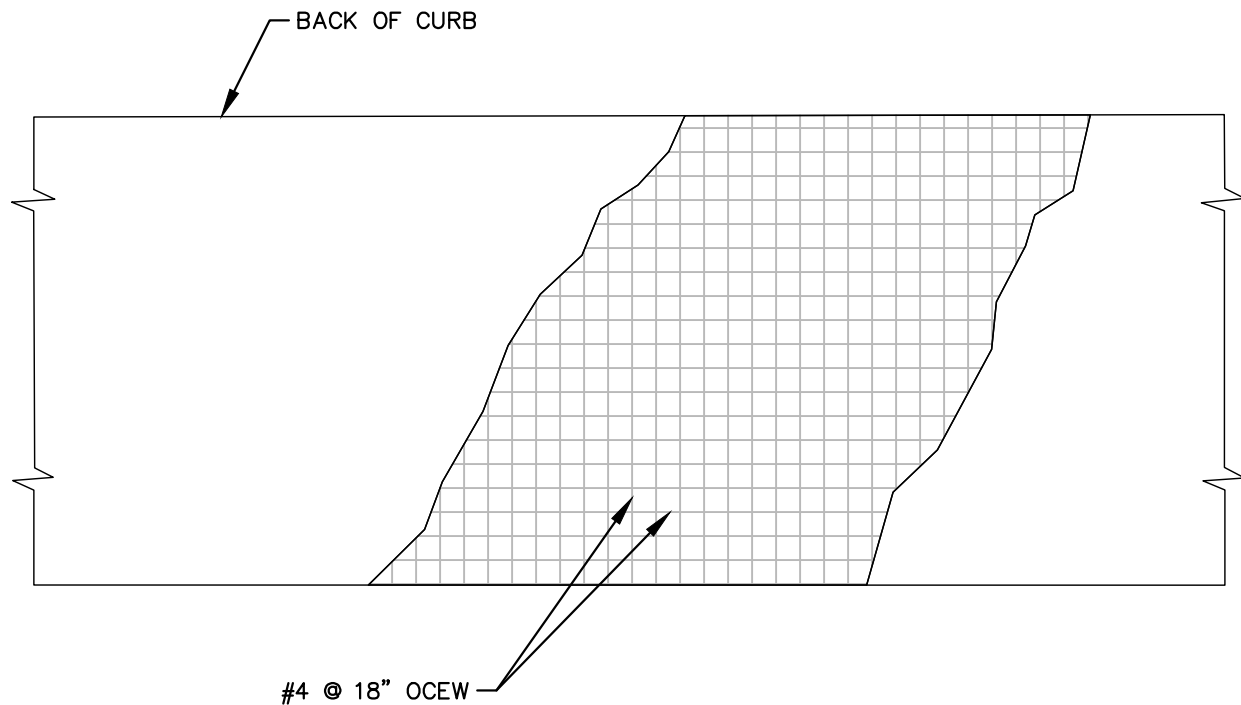
1. SPILL GUTTER TO BE USED ON UPGRADE OF VALLEY GUTTERS.
2. FOR CONCRETE CURB AND GUTTER REMOVAL/REPLACEMENT, INSTALLED SECTION SHALL MATCH EXISTING CURB RADII.
3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
4. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.
5. REFERENCE BEHIND CURB DETAIL FOR BACKFILL REQUIREMENTS BEHIND AND UNDERNEATH CURB.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
CURB AND GUTTER	
SCALE:	DRAWING No.
NTS	S - 5



**NOTE:**

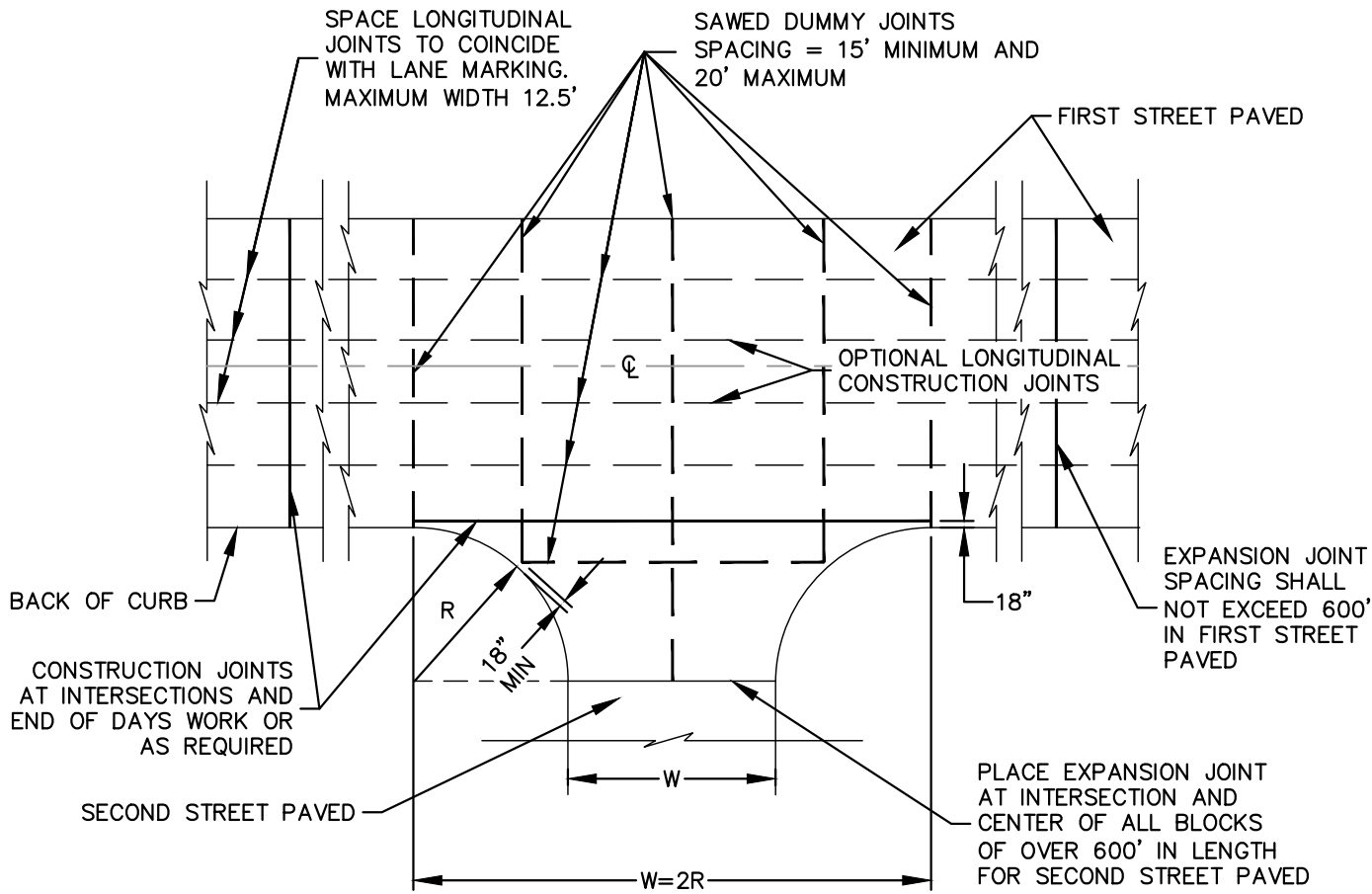
1. THE REINFORCING STEEL SHALL EXTEND THROUGH BOTH DUMMY AND CONSTRUCTION JOINTS. LAP BARS 40 DIAMETERS AND TIE. REBAR SIZE AND SPACING SHOWN ARE MINIMUMS. PAVEMENT SECTION SHALL BE PER APPROVED GEOTECH REPORT.
2. ALL CONCRETE AND REINFORCING STEEL SHALL BE INSTALLED PER ACI CODE.
3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
CONCRETE PAVING PLAN OF STEEL LAYOUT	
SCALE:	DRAWING No.
NTS	S - 6



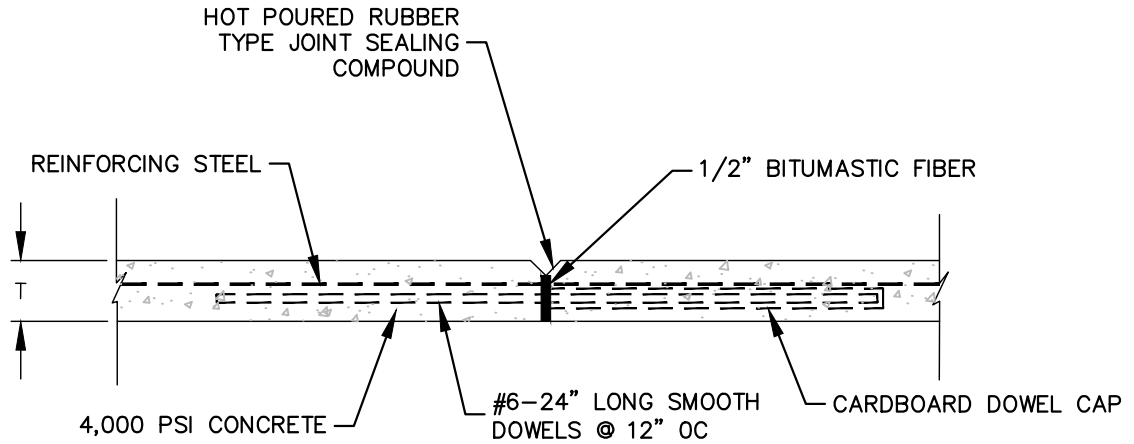
PLAN VIEW



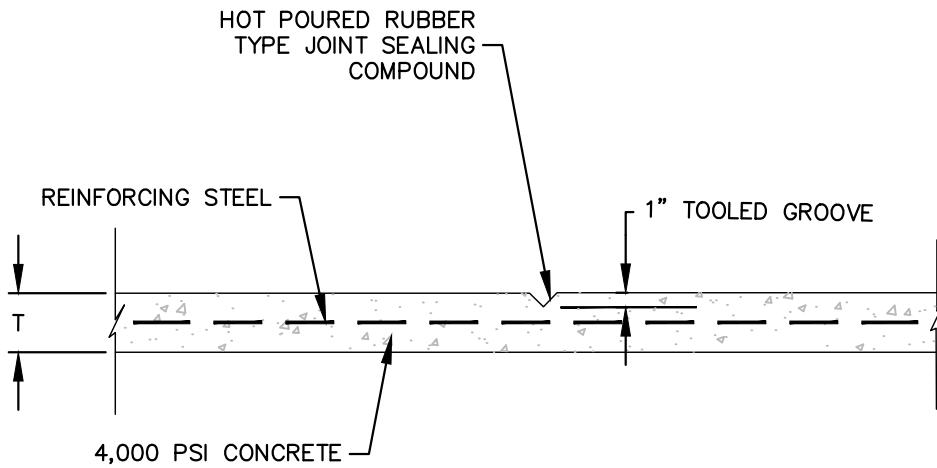
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
<b>CONCRETE PAVING JOINT SPACING</b>	
SCALE:	DRAWING No.
NTS	S - 7



EXPANSION JOINT



DUMMY JOINT

**NOTES:**

1. T = CONCRETE PAVEMENT THICKNESS.

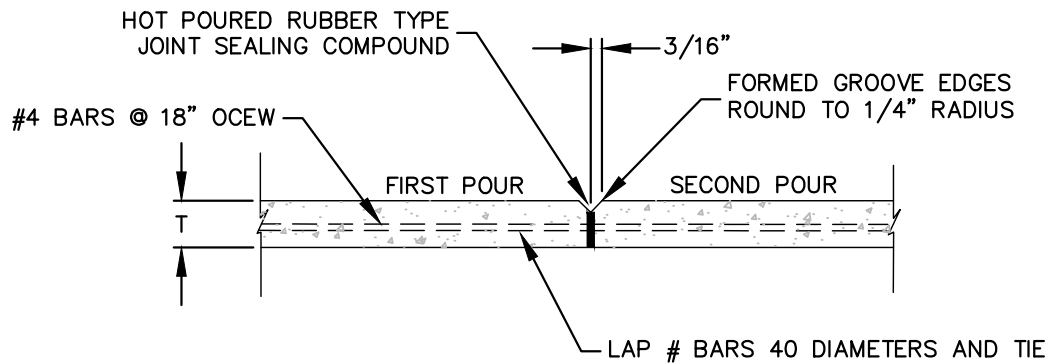


THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

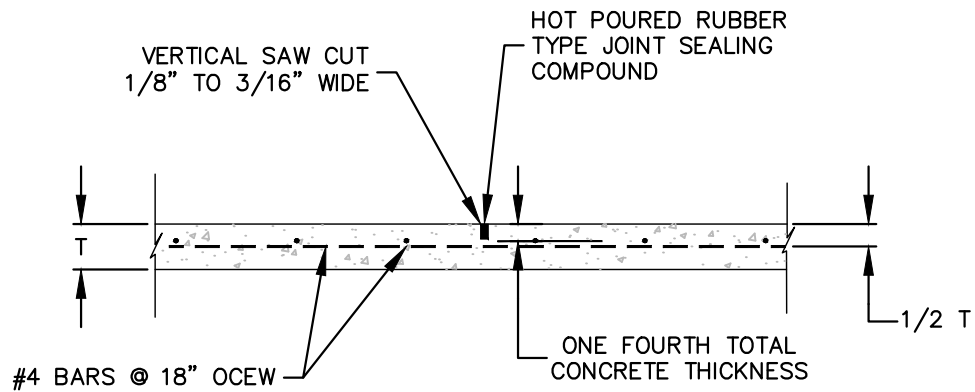
DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
EXPANSION & TOOLED DUMMY JOINT DETAILS	
SCALE:	DRAWING No.
NTS	S - 8






LONGITUDINAL CONSTRUCTION JOINT

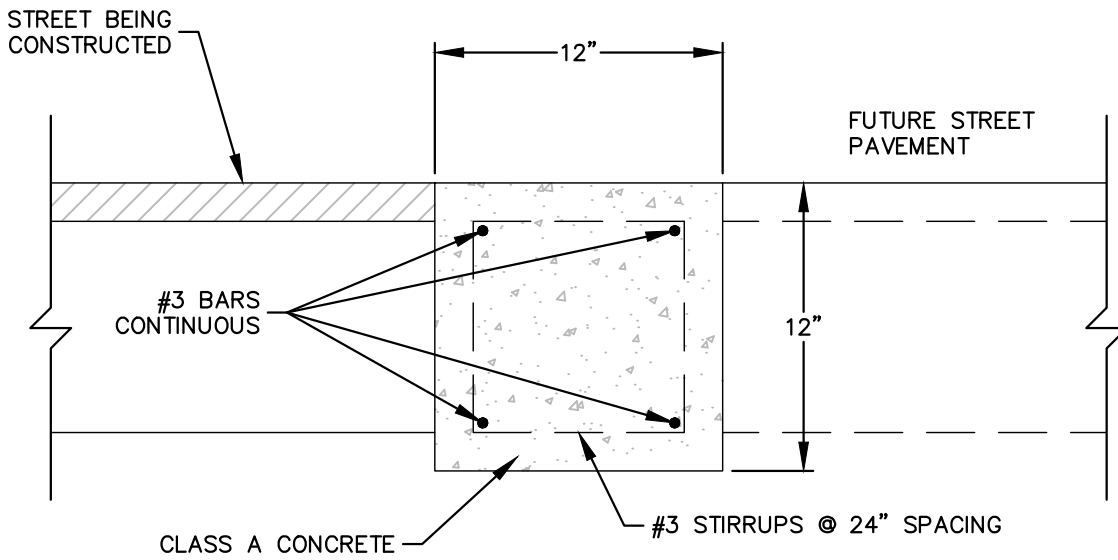


SAWED DUMMY JOINT

**NOTE:**

1. T = CONCRETE PAVEMENT THICKNESS


	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			LONGITUDINAL CONSTRUCTION JOINT & SAWED DUMMY JOINT  SCALE: NTS      DRAWING No. S - 9

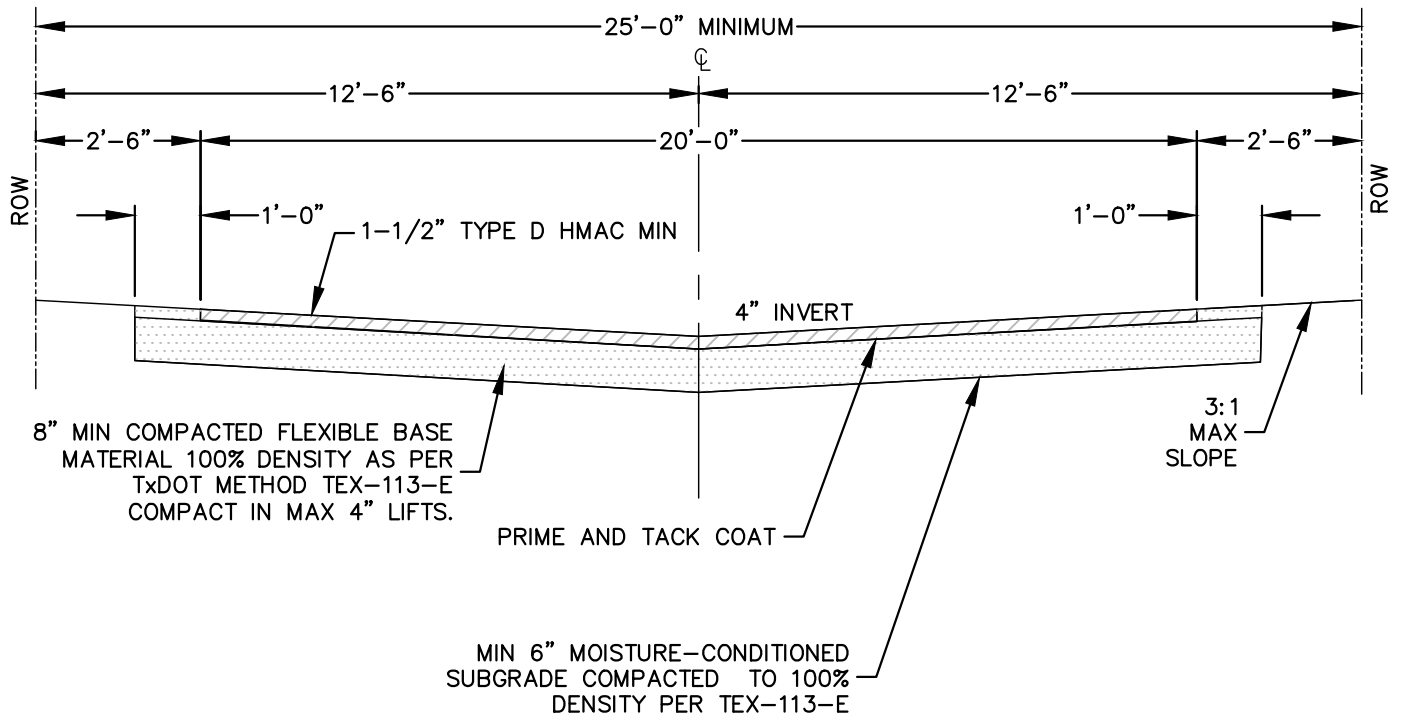


SECTION VIEW

NOTES:


1. WHEN EXTENDING AN EXISTING STREET THAT HAS A CONCRETE HEADER THE CONTRACTOR SHALL REMOVE THE HEADER AND 4'-0" OF HMAc BEHIND THE HEADER. EXISTING HMAc SHALL BE SAW CUT, NEW HMAc SHALL THEN BE PLACED OVER THE EXISTING BASE DURING PAVING OPERATION.
2. STREET STUB HEADER SHALL BE INSTALLED AT END OF ALL STREET STUBS.

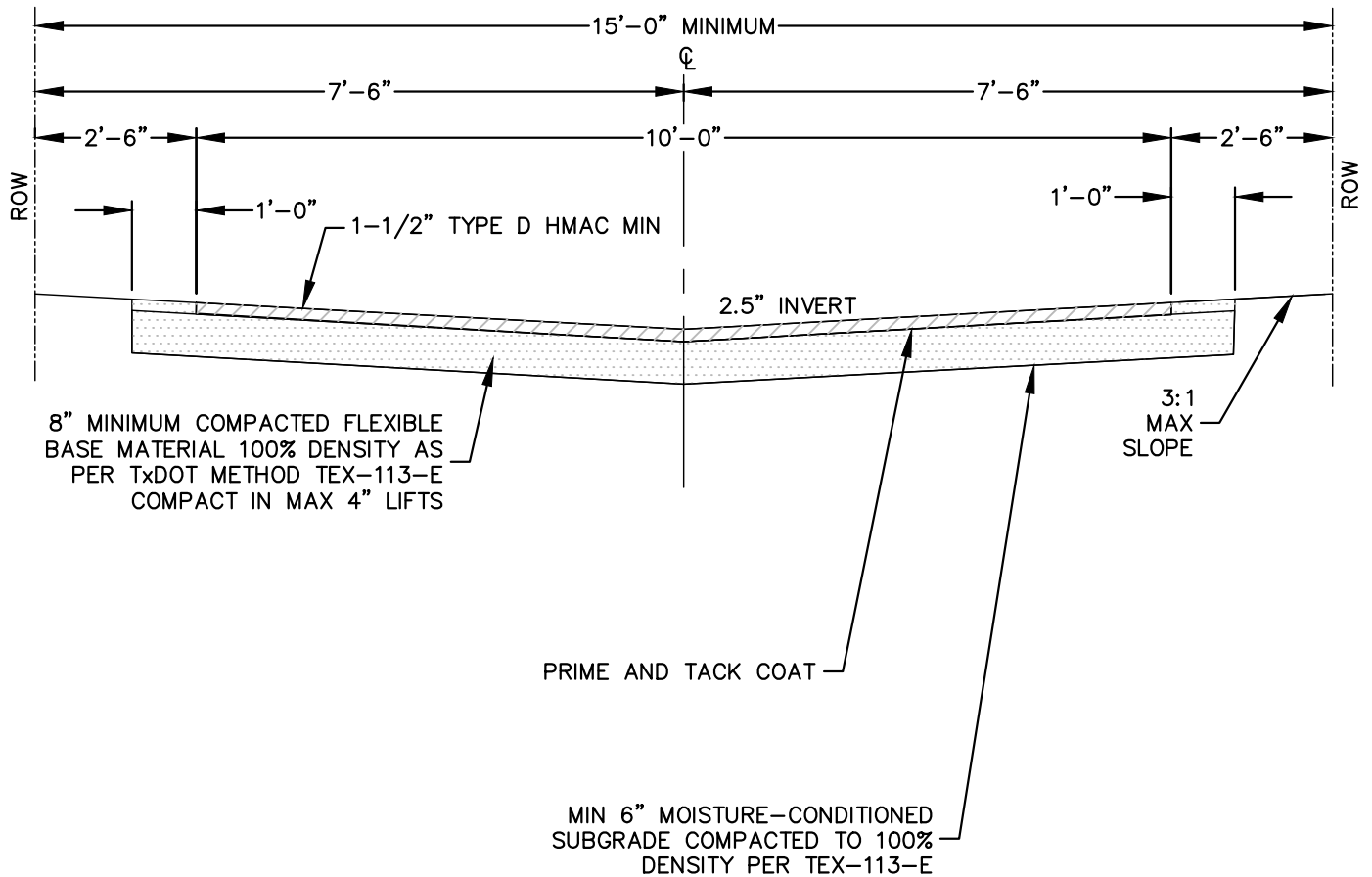
	DATE ISSUED: APRIL 1987			TITLE:  <b>STREET STUB HEADER</b>
	REV	DATE	BY	
	1	NOV 2002	CS	
	2	JAN 2020	JAD	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD				SCALE: NTS
				DRAWING No. S - 10



**NOTE:**

1. PAVEMENT SECTION SHALL BE PER APPROVED GEOTECHNICAL REPORT. THICKNESSES SHOWN ARE MINIMUMS.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			25' ALLEY SECTION (ASPHALT PAVEMENT)  SCALE: NTS      DRAWING No. S - 11



**NOTE:**

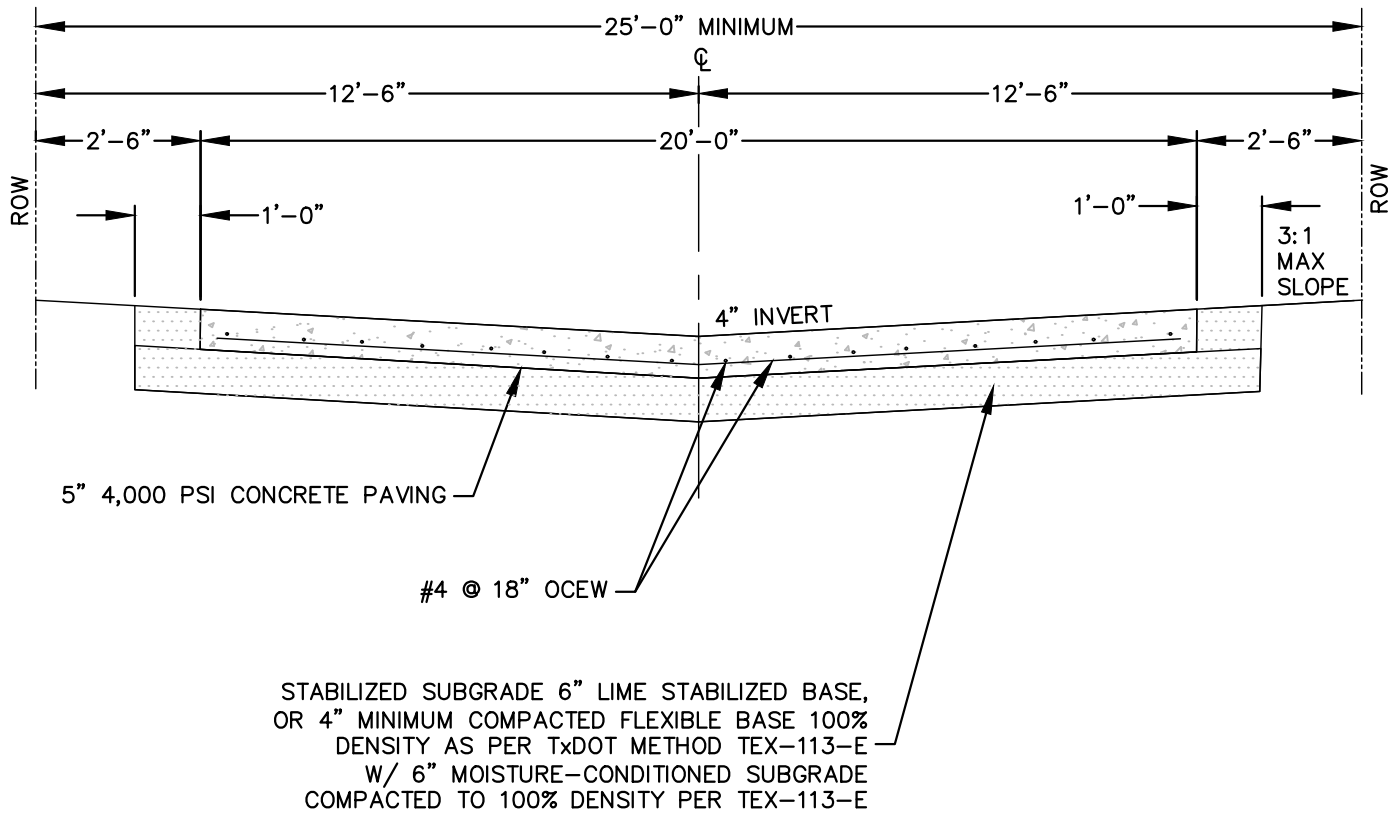
1. PAVEMENT SECTION SHALL BE PER APPROVED GEOTECHNICAL REPORT. THICKNESSES SHOWN ARE MINIMUMS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
15' ALLEY SECTION (ASPHALT PAVEMENT)	
SCALE:	DRAWING No.
NTS	S - 12



**NOTE:**

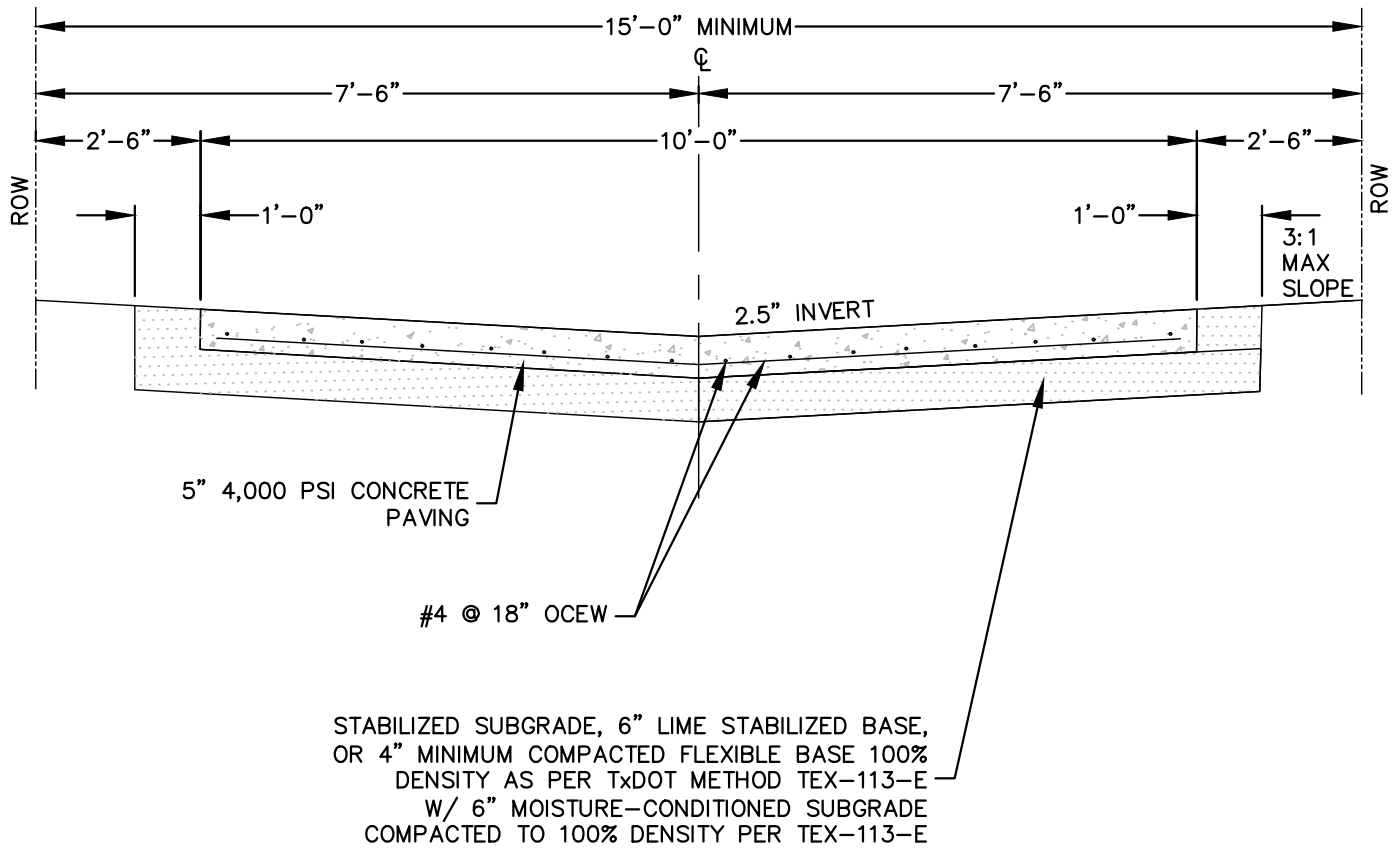
1. PAVEMENT SECTION SHALL BE PER APPROVED GEOTECHNICAL REPORT. THICKNESSES, REBAR SIZE AND SPACING SHOWN ARE MINIMUMS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
25' ALLEY SECTION (CONCRETE PAVEMENT)	
SCALE:	DRAWING No.
NTS	S - 13



**NOTE:**

1. PAVEMENT SECTION SHALL BE PER APPROVED GEOTECHNICAL REPORT. THICKNESSES, REBAR SIZE AND SPACING SHOWN ARE MINIMUMS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:

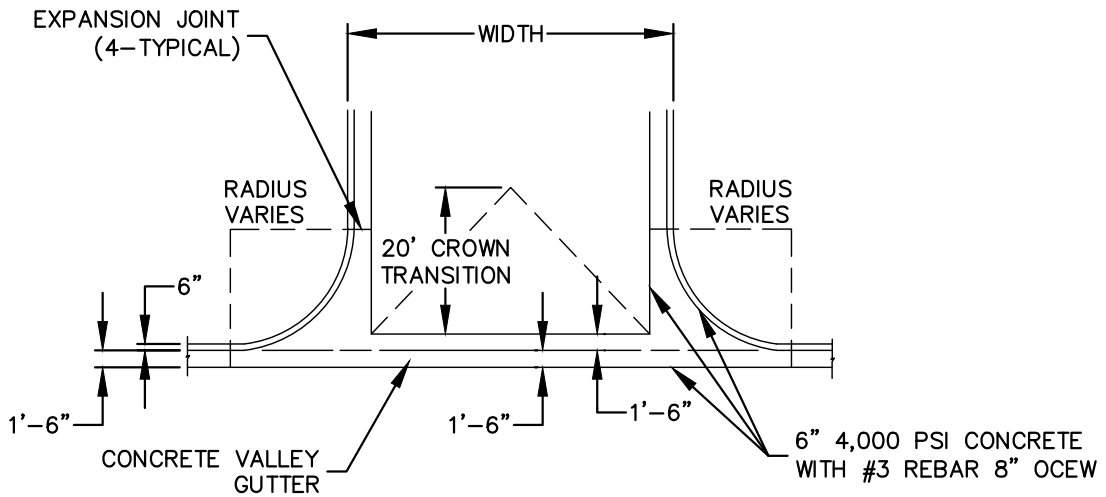
15' ALLEY SECTION  
(CONCRETE PAVEMENT)

SCALE:

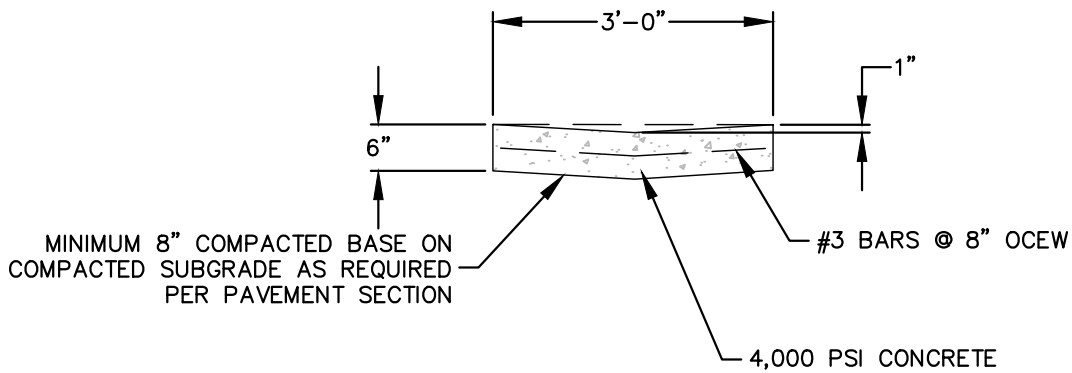
NTS

DRAWING No.

S - 14



PLAN



SECTION

NOTES:

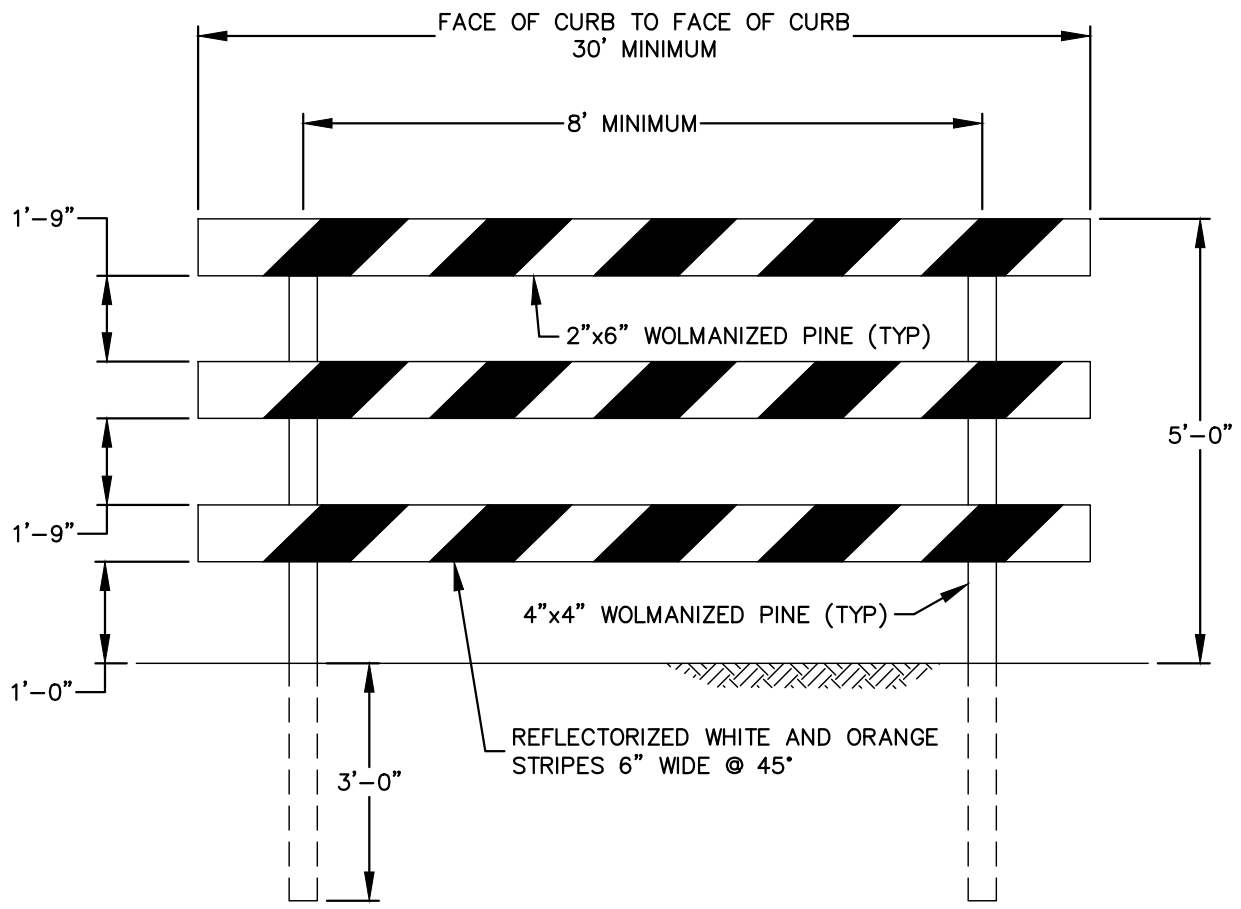
1. VALLEY GUTTER AND CURB SHALL BE Poured MONOLITHICALLY.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
3. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.
4. VALLEY GUTTER ARE REQUIRED ON ASPHALT PAVEMENT SECTIONS WHERE RUNOFF CROSSES THE STREET.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	CONCRETE VALLEY GUTTER	
SCALE:	NTS	DRAWING No. S - 15



**NOTE:**

1. STREET STUB BARRICADE SHALL BE INSTALLED AT END OF ALL STUB STREETS.

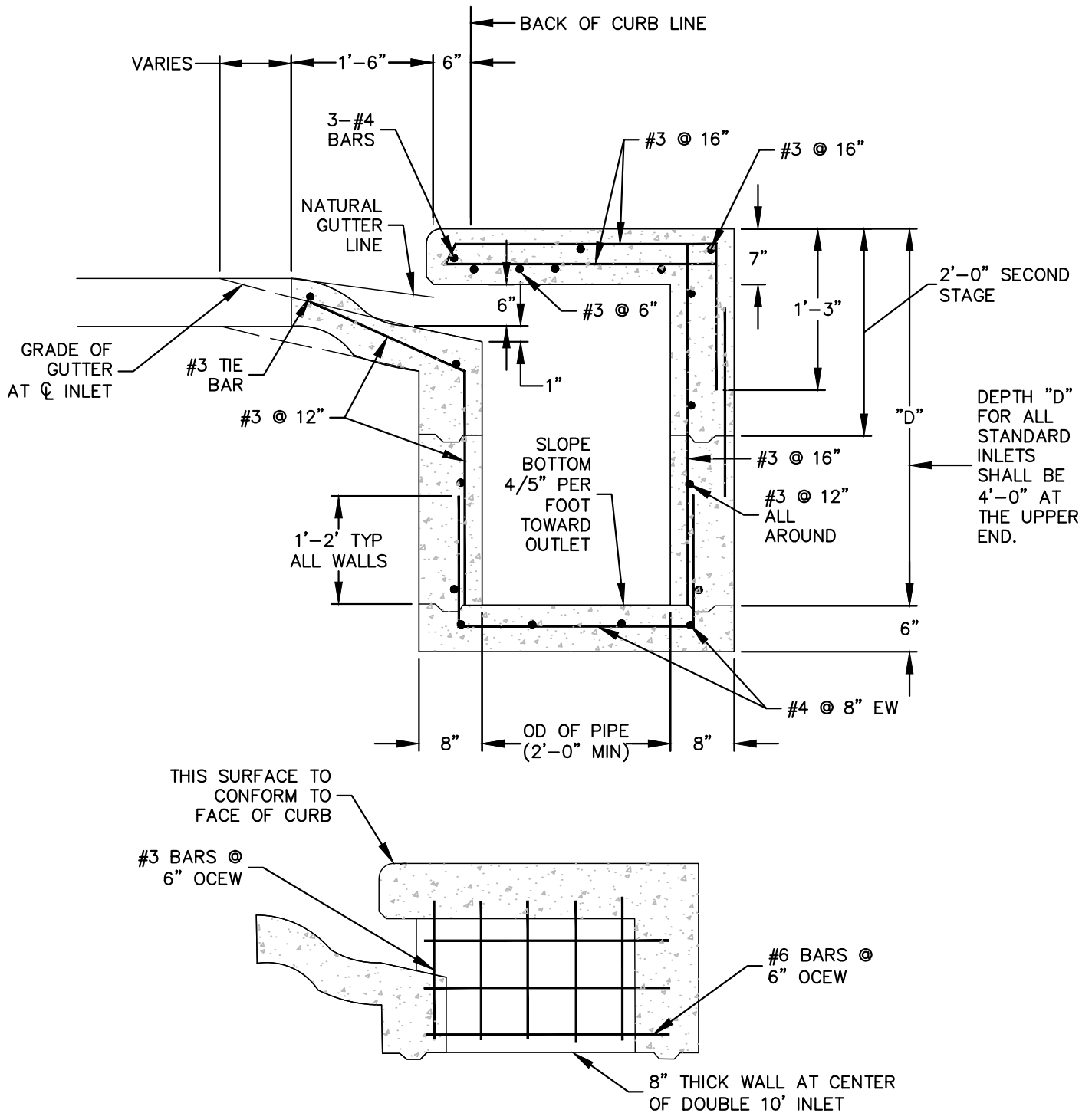


THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
STREET STUB BARRICADE	
SCALE:	DRAWING No.
NTS	S - 16





**NOTES:**

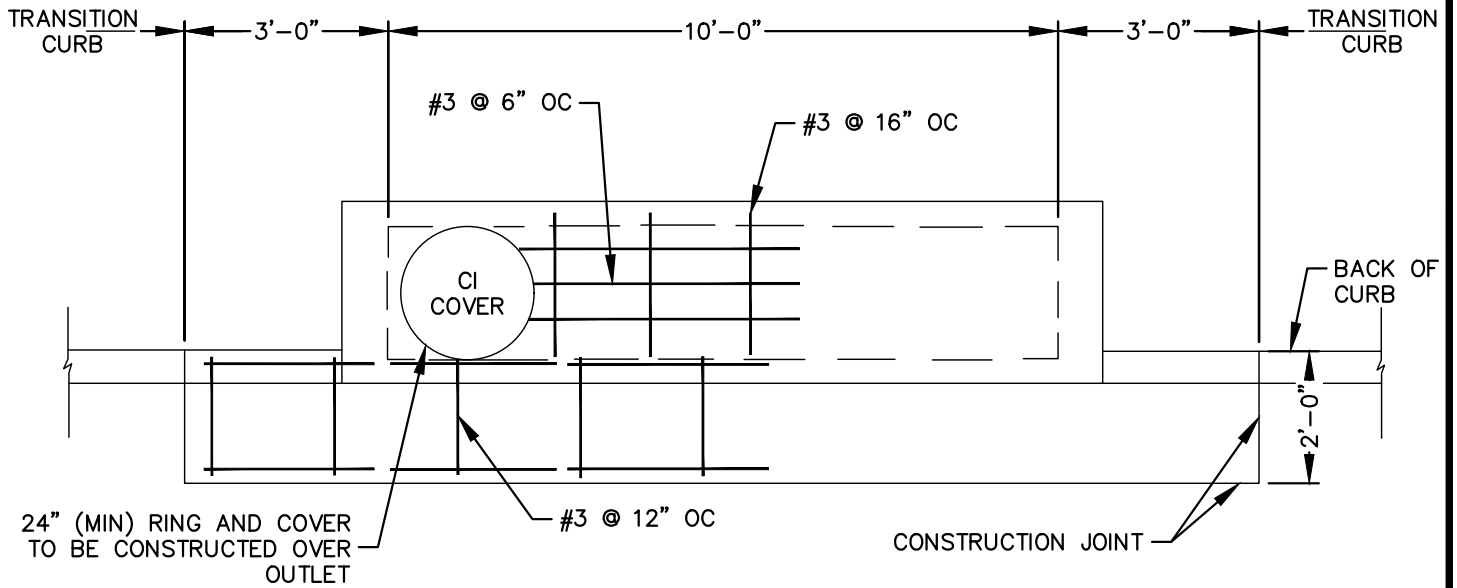
1. TxDOT STANDARD CURB INLETS MAY BE USED IN LIEU OF DETAIL.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
3. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.



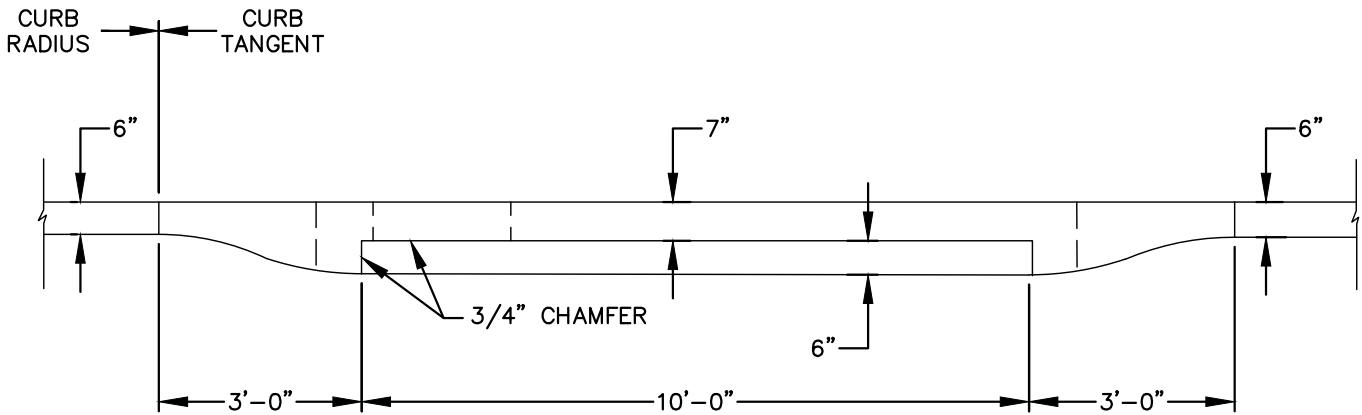
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	TYPICAL CURB INLET SECTION VIEW	
SCALE:	NTS	DRAWING No. S - 17



PLAN



ELEVATION

**NOTES:**

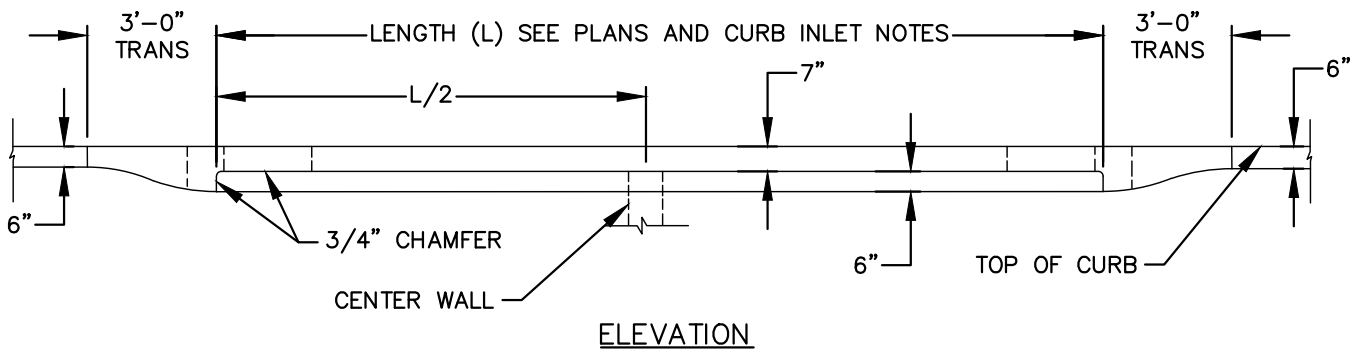
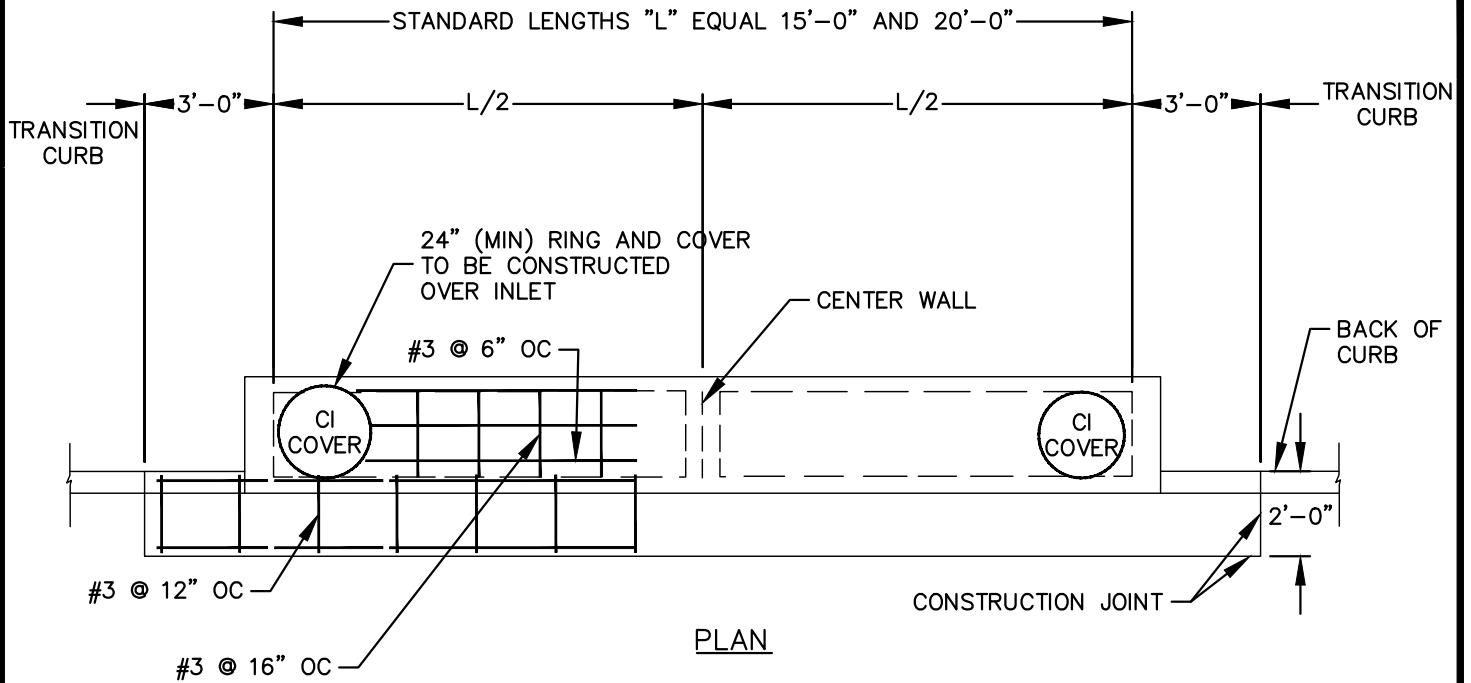
1. TxDOT STANDARD CURB INLETS MAY BE USED IN LIEU OF DETAIL.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
3. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	10' CURB INLET	
SCALE:	NTS	DRAWING No. S - 18



**NOTES:**

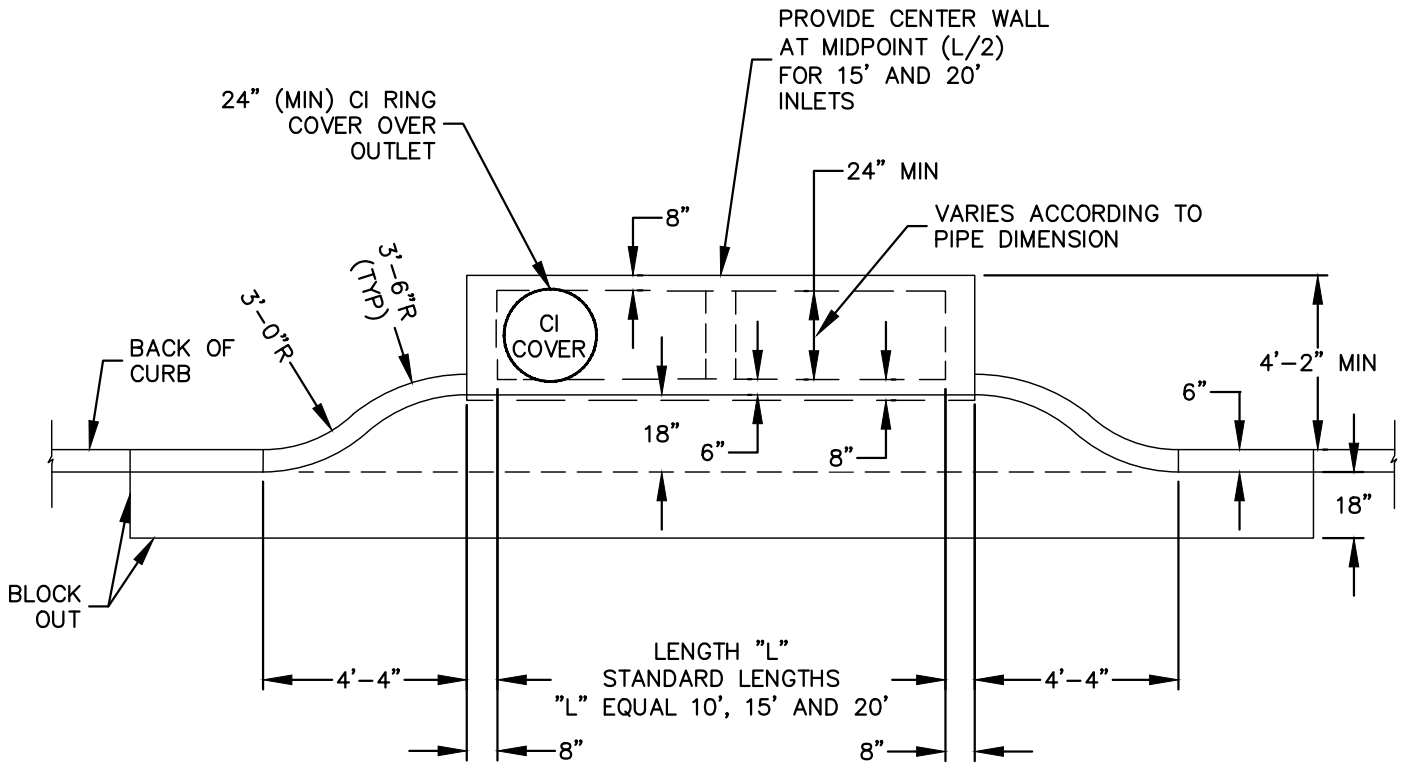
1. PROVIDE CENTER WALL AT MIDPOINT (L/2) FOR 15'-0" AND 20'-0" INLETS.
2. PROVIDE TWO FRAMES AND COVERS FOR 15'-0" AND 20'-0" INLETS.
3. TxDOT STANDARD CURB INLETS MAY BE USED IN LIEU OF DETAIL.
4. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
5. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

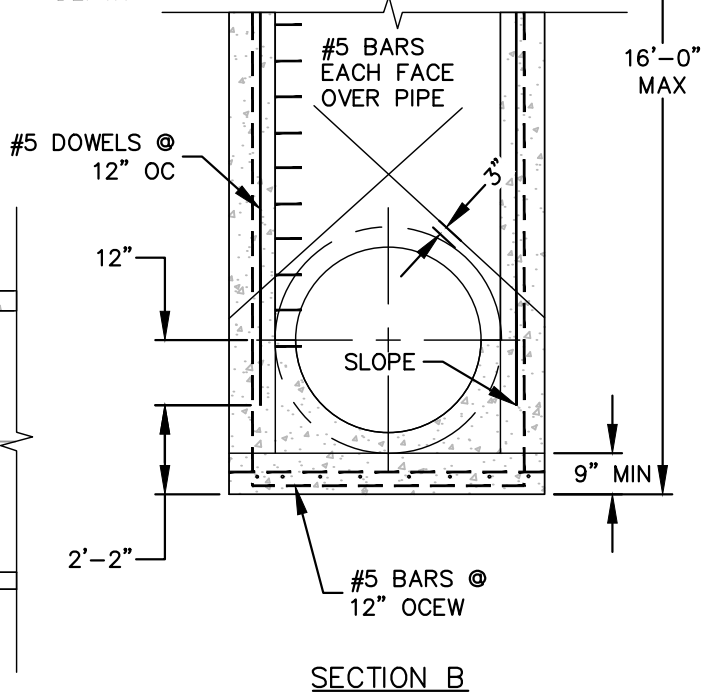
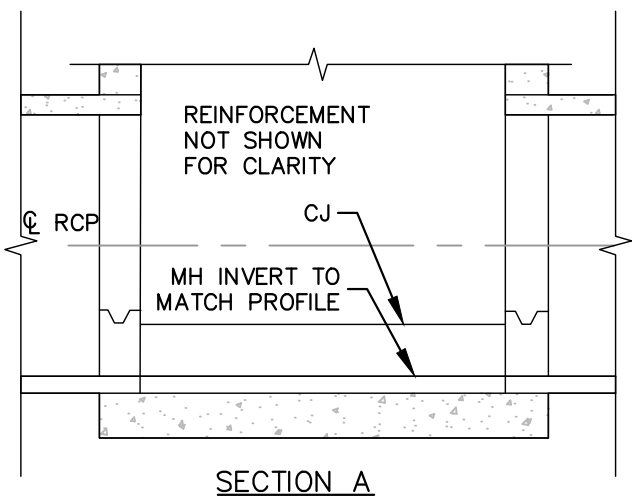
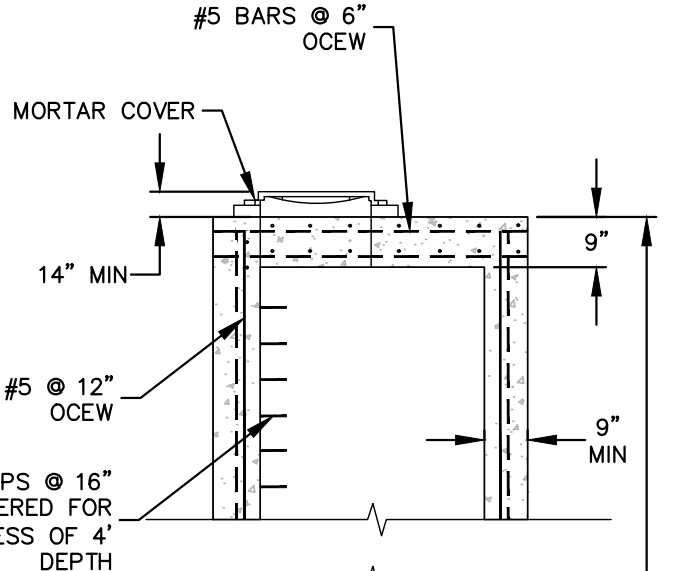
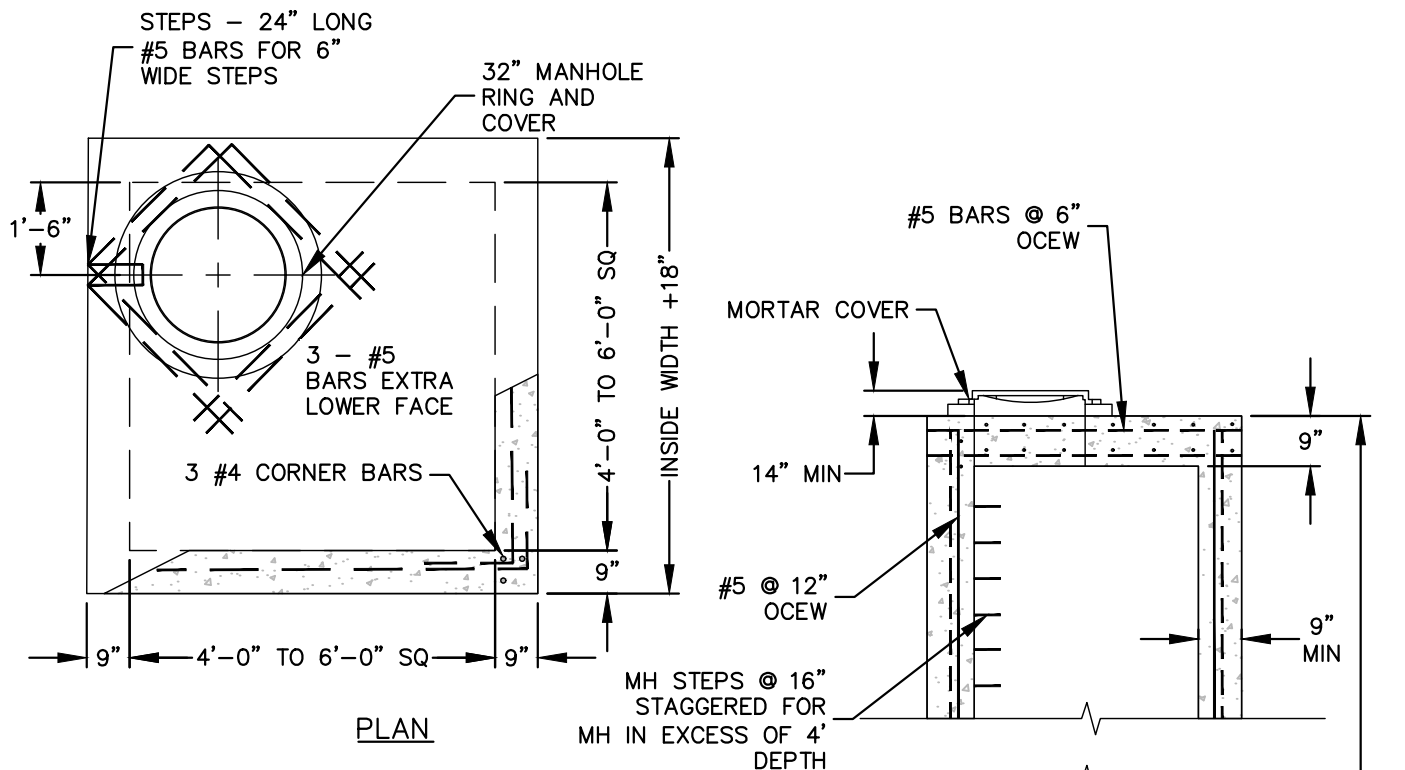
TITLE:	
15' AND 20' CURB INLETS	
SCALE:	DRAWING No.
NTS	S - 19



**NOTE:**


1. RECESSED CURB INLET TO BE USED ON ALL STREETS THAT ARE WIDER THAN 31' BACK OF CURB TO BACK OF CURB.
2. TxDOT STANDARD CURB INLETS MAY BE USED IN LIEU OF DETAIL.
3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
4. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.

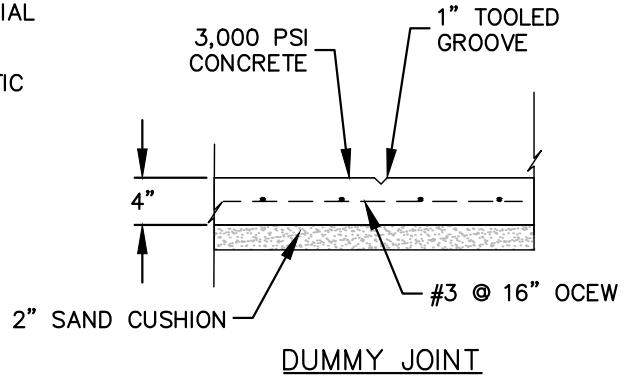
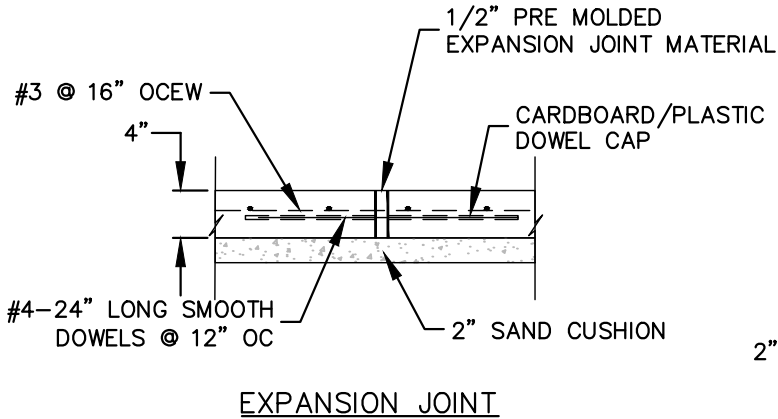
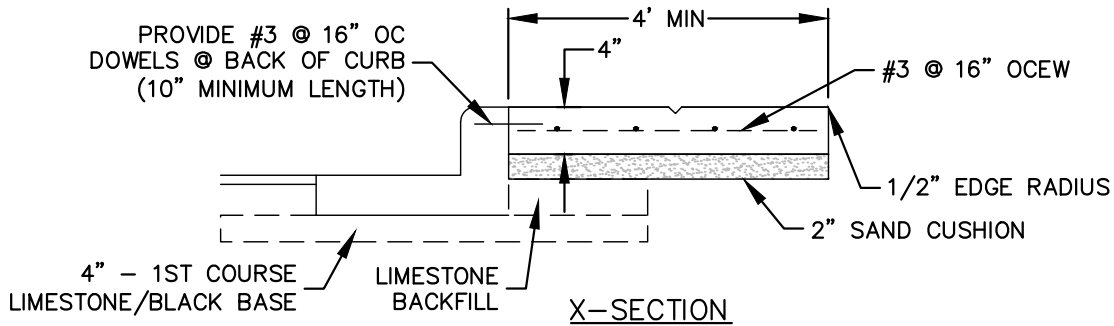
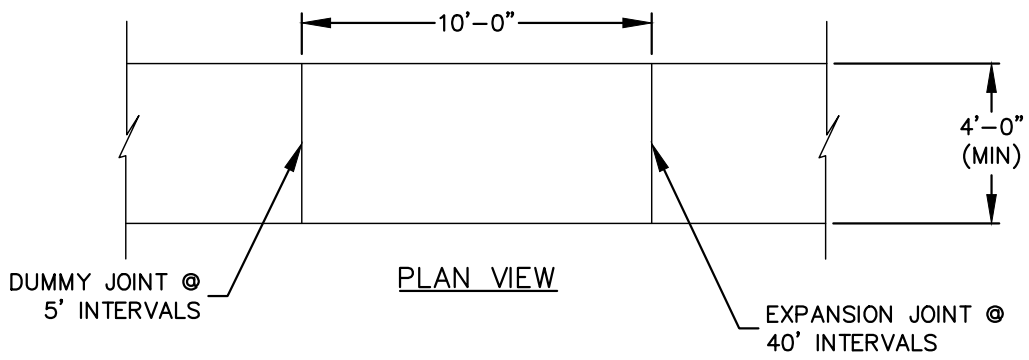
	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
	2	JAN 2020	JAD
RECESSED CURB INLET			SCALE: NTS
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			DRAWING No. S - 20



**NOTES:**

1. TxDOT STANDARD STORM DRAIN MANHOLES MAY BE USED IN LIEU OF DETAIL.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
3. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.

 <b>Lockhart</b> TEXAS	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	NOV 2002	CS
2	JAN 2020	JAD	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			4'-0" TO 6'-0" SQUARE STORM DRAIN MANHOLE  SCALE: NTS DRAWING No. S - 21



**NOTES:**

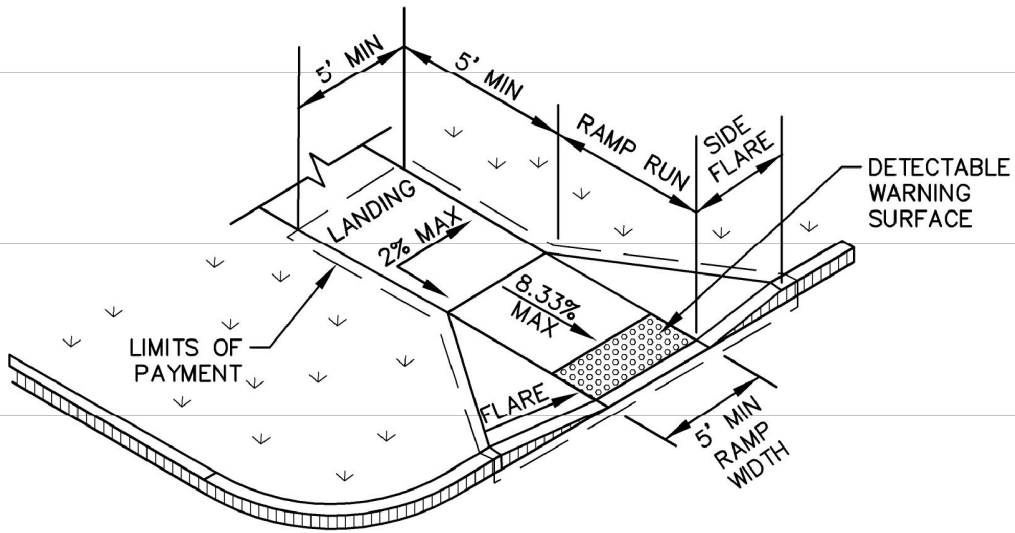
1. EXACT SIDEWALK LOCATION AND DIMENSIONS MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY CITY STAFF IF NOT CLEARLY SHOWN ON PLANS, OR REQUIRED DUE TO EXISTING SITE CONDITIONS.
2. CONTRACTOR SHALL LOCATE TOP OF SIDEWALK SO THAT IT DOES NOT ALTER EXISTING DRAINAGE PATTERNS. ALL DRAINAGE SHALL BE DIRECTED TO THE STREET.
3. LONGITUDINAL DUMMY JOINT REQUIRED AT MIDPOINT OF SIDEWALK 10'-0" OR WIDER.
4. SIDEWALK TO CONFORM TO ALL A.D.A. AND TEXAS ACCESSIBILITY STANDARDS (TAS).
5. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI.
6. ALL CONCRETE AND REBAR SHALL BE INSTALLED PER ACI CODE.
7. SIDEWALKS INSTALLED ACROSS DRIVEWAYS SHALL BE MINIMUM 6" IN THICKNESS.
8. SIDEWALKS INSTALLED ALONG STATE ROADS AND HIGHWAYS SHALL BE A MINIMUM OF 5' WIDE.



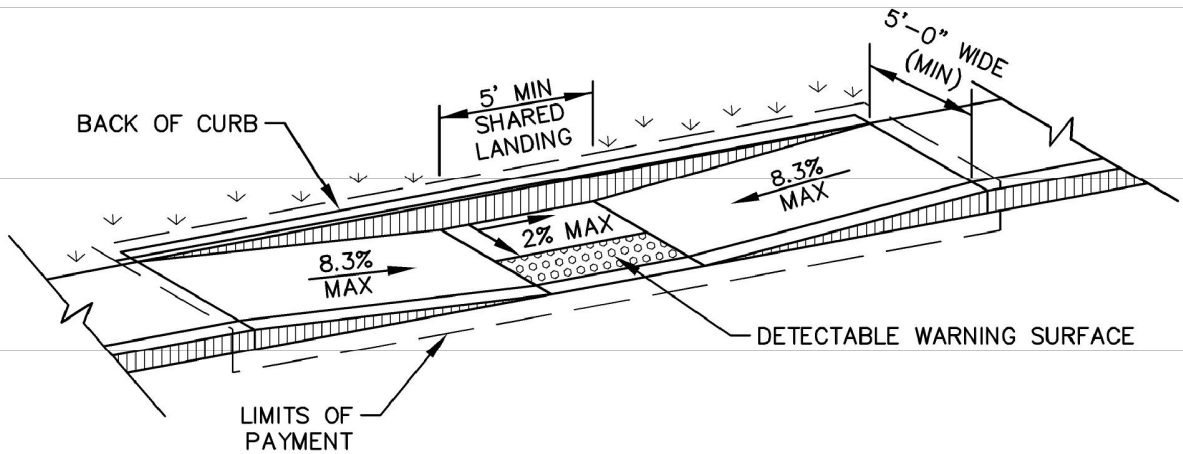
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	
2	NOV 2007	
3	DEC 2017	
4	JAN 2020	JAD

TITLE:	SIDEWALK DETAIL	
SCALE:	NTS	DRAWING No. S - 22



PERPENDICULAR CURB RAMP



PARALLEL CURB RAMP

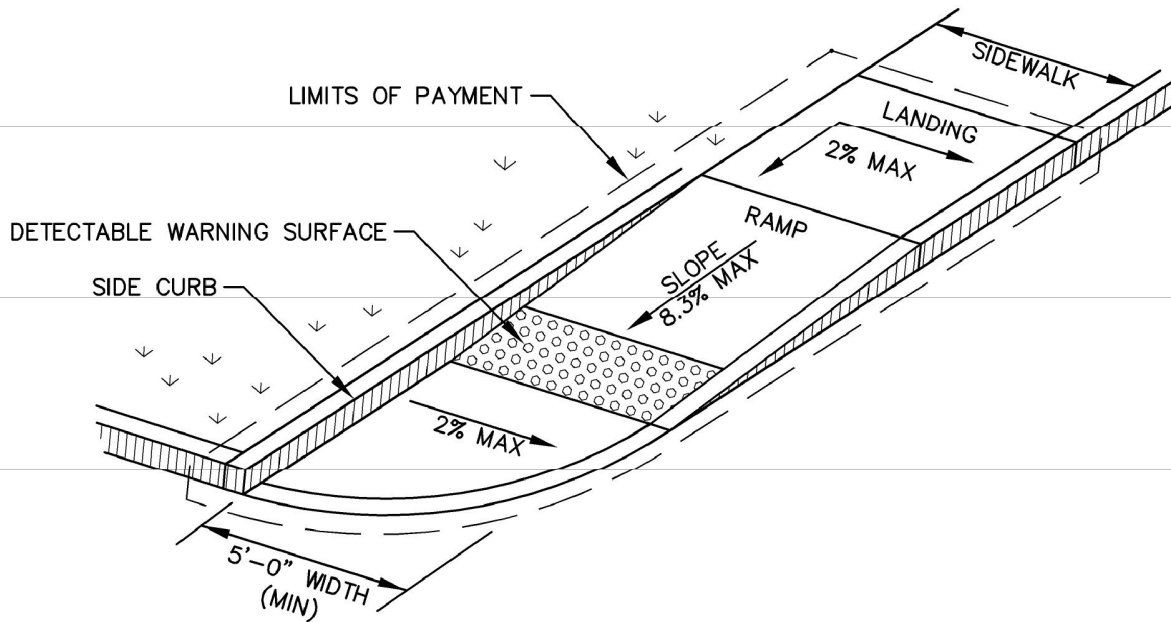
NOTE:  
SEE CURB RAMP NOTES ON DETAIL S-25.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987		
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	<b>PARALLEL &amp; PERPENDICULAR CURB RAMPS</b>	
SCALE:		
DRAWING No.	S - 23	



SIDEWALK ADJACENT TO CURB

**NOTE:**  
SEE CURB RAMP NOTES ON DETAIL S-25.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	NOV 2002	CS
2	JAN 2020	JAD

TITLE:	DIRECTIONAL CURB RAMP	
SCALE:	NTS	DRAWING No. S - 24



**NOTES:**

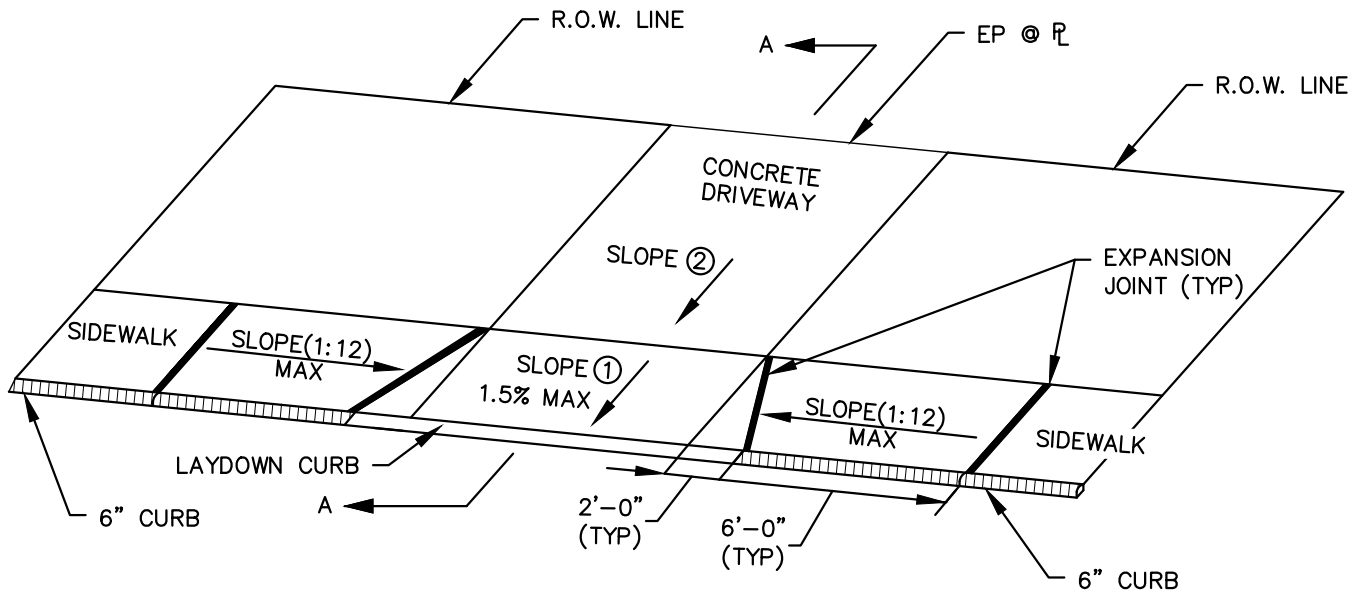
1. ALL CURB RAMPS SHALL COMPLY WITH ALL APPLICABLE TEXAS ACCESSIBILITY STANDARDS (TAS) AND ADA REQUIREMENTS.
2. ALL SLOPES ARE MAXIMUM ALLOWABLE. LESSER SLOPES THAT WILL STILL DRAIN PROPERLY SHOULD BE USED. ADJUST CURB RAMP LENGTH OR GRADE OF APPROACH SIDEWALKS AS REQUIRED.
3. MAXIMUM ALLOWABLE CROSS SLOPE ON ANY PORTION OF CURB RAMPS AND LANDINGS IS 2%
4. MAXIMUM ALLOWABLE RUNNING SLOPE ON CURB RAMP IS 8.33%.
5. MAXIMUM ALLOWABLE SLOPE ON SIDE FLARES IS 10%.
6. LANDINGS SHALL BE 5'-0" SQ. MINIMUM WITH A MAXIMUM SLOPE OF 2% IN ANY DIRECTION.
7. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI AND SHALL BE PLACED AT A MINIMUM DEPTH OF 5" FOR RAMPS, LANDINGS, AND FLARES, EXCLUSIVE OF AREAS UNDER THE DETECTABLE WARNING SURFACE.
8. CONTRACTOR SHALL FURNISH AND INSTALL A PREFABRICATED DETECTABLE WARNING PANEL MEETING TxDOT SPECIFICATIONS.
9. DETECTABLE WARNING SURFACES SHALL COVER A MINIMUM OF 24" IN DEPTH IN THE DIRECTION OF TRAVEL AND SPAN THE FULL WIDTH OF THE CURB RAMP OR LANDING.
10. DETECTABLE WARNING SURFACES SHALL BE LOCATED SO THAT THE EDGE NEAREST THE CURB IS AT THE BACK OF CURB.
11. ALL CONCRETE AND STEEL REINFORCEMENT SHALL BE INSTALLED PER ACI CODE.
12. STEEL REINFORCEMENT SHALL BE #3 BARS @ 16" OCEW AND SHALL EXTEND UNDER THE DETECTABLE WARNING SURFACE. REINFORCEMENT SHALL ALSO BE INSTALLED IN ADJACENT CONCRETE FEATURES.
13. CURB RAMPS, LANDINGS, AND FLARES SHALL BE TIED IN TO EXISTING CONCRETE FEATURES USING 18" LONG #4 SMOOTH DOWELS @ 12" O.C. DRILLED 6" INTO EXISTING CONCRETE. INSTALL STANDARD EXPANSION JOINTS AT BOUNDARIES BETWEEN EXISTING AND PROPOSED CONCRETE AS INSTRUCTED BY CITY PERSONNEL. NO SEPARATE PAY.
14. CHANGES IN SURFACE ELEVATION SHALL NOT EXCEED ONE-FOURTH INCH.
15. CURBS SHOWN WITHIN THE LIMITS OF PAYMENT INCLUDING CONCRETE CURBS, SIDE AND BACK CURBS, GUTTER, AND COMBINED CURB AND GUTTER, ARE CONSIDERED PART OF THE CURB RAMP FOR PAYMENT.
16. ALL RAMPS SHALL BE INSTALLED SO THAT WATER DOES NOT POND IN THE RAMP OR LANDING.
17. OTHER CURB RAMP TYPES ADHERING TO TxDOT STANDARDS MAY BE USED UPON CITY APPROVAL.



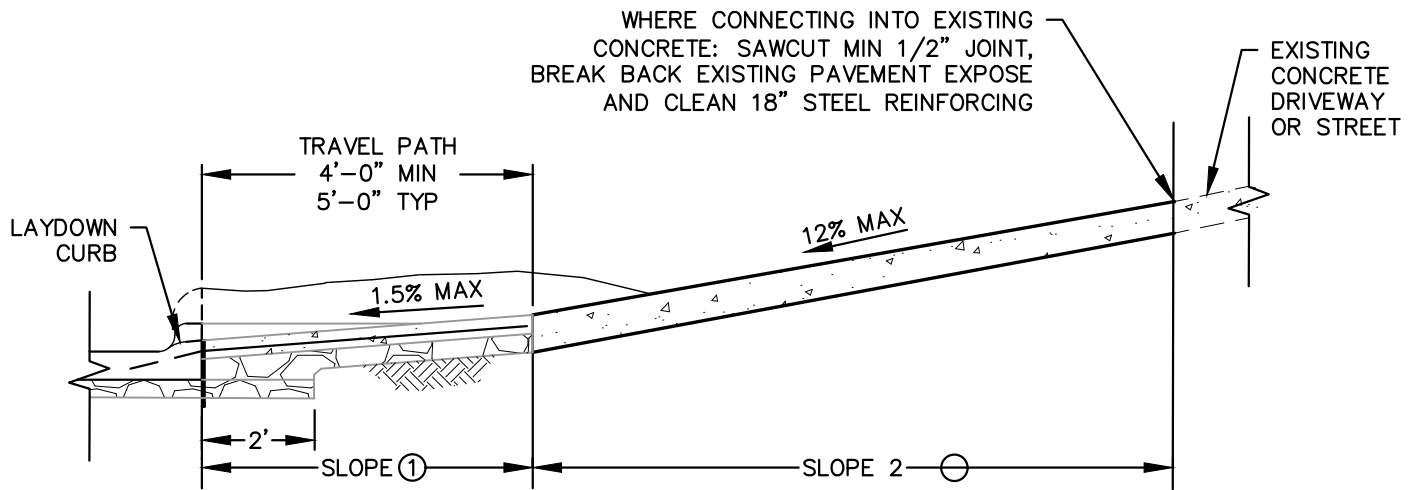
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	


TITLE:	
CURB RAMP NOTES	
SCALE:	DRAWING No.
NTS	S - 25



SIDEWALK ADJACENT TO CURB DETAIL



SECTION A-A

	DATE ISSUED: JANUARY 2020			TITLE:
	REV	DATE	BY	<b>SIDEWALK ACROSS DRIVEWAY</b>
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD				SCALE: NTS DRAWING No. S - 26

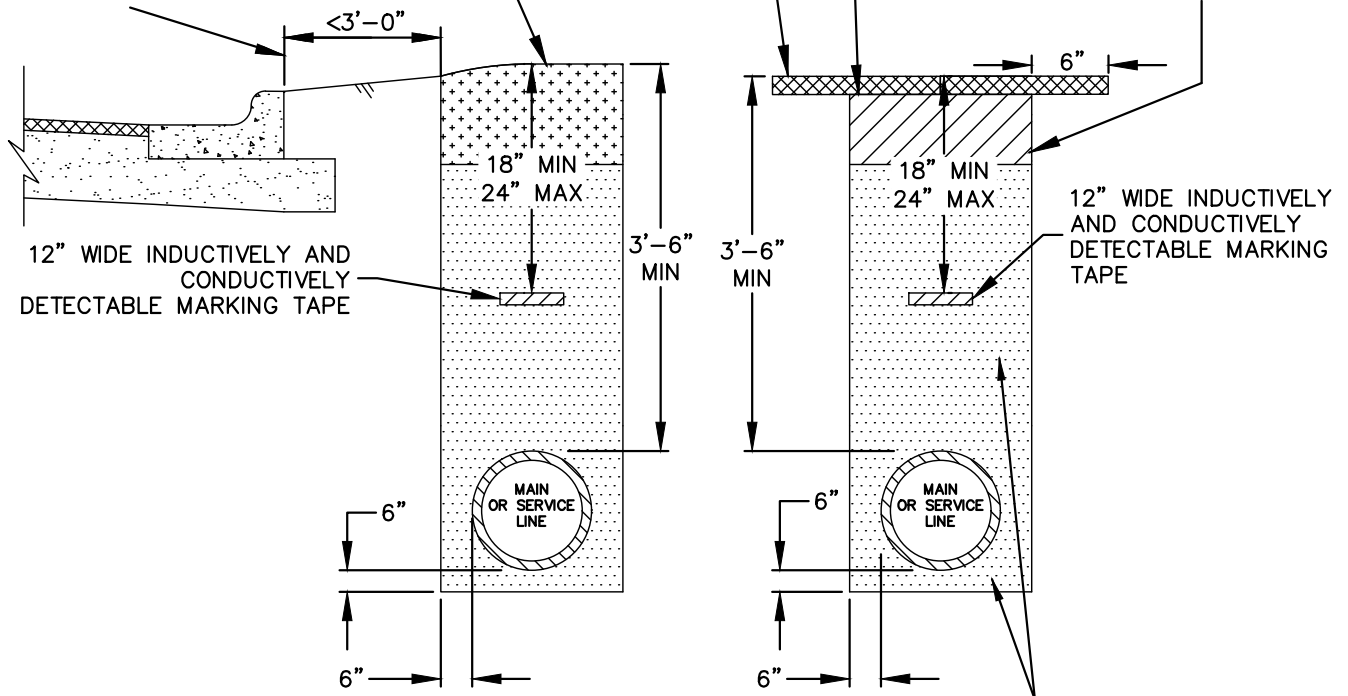
WHEN PAVED SURFACE IS TO BE PERMANENT, SURFACE MATERIAL SHALL BE EQUAL TO MATERIAL REMOVED—MINIMUM AMOUNTS: 1-1/2" HMAC (TXDOT ITEM 340, TYPE D) COMPACTED TO 97% DENSITY, OR 6" CONCRETE. EXISTING ASPHALT AND CONCRETE TO BE SAW CUT.

SURFACE SHALL BE CLEANED THOROUGHLY OF LOOSE MATERIAL, RECOMPACTED AND TACK COAT APPLIED BEFORE PAVEMENT SURFACE IS INSTALLED.

12" SELECT MATERIAL SHALL BE COMPACTED TO 95% WITHIN THE ROW (TEST METHOD TXDOT TEX 113-E)

8" FLEX (CRUSHED STONE) BASE (TXDOT ITEM 247, TYPE A, GRADE 1) AND 4" TXDOT ITEM 340 TYPE B HMAC (BLACK BASE) BACKFILL WHEN MAIN OR SERVICE IS UNDER STREET OR DRIVEWAY PAVEMENT. COMPACTED IN 6" LIFTS TO 100% DENSITY PER TEX 113E.

BACK OF CURB, PAVEMENT EDGE OR SIDEWALK EDGE



12" WIDE INDUCTIVELY AND CONDUCTIVELY DETECTABLE MARKING TAPE

12" WIDE INDUCTIVELY AND CONDUCTIVELY DETECTABLE MARKING TAPE

EMBEDMENT MATERIAL ASTM C-33 CRUSHED STONE  
 PIPE DIAMETER ≤ 12" Ø USE #67  
 PIPE DIAMETER > 12" Ø USE #57

**NOTES**

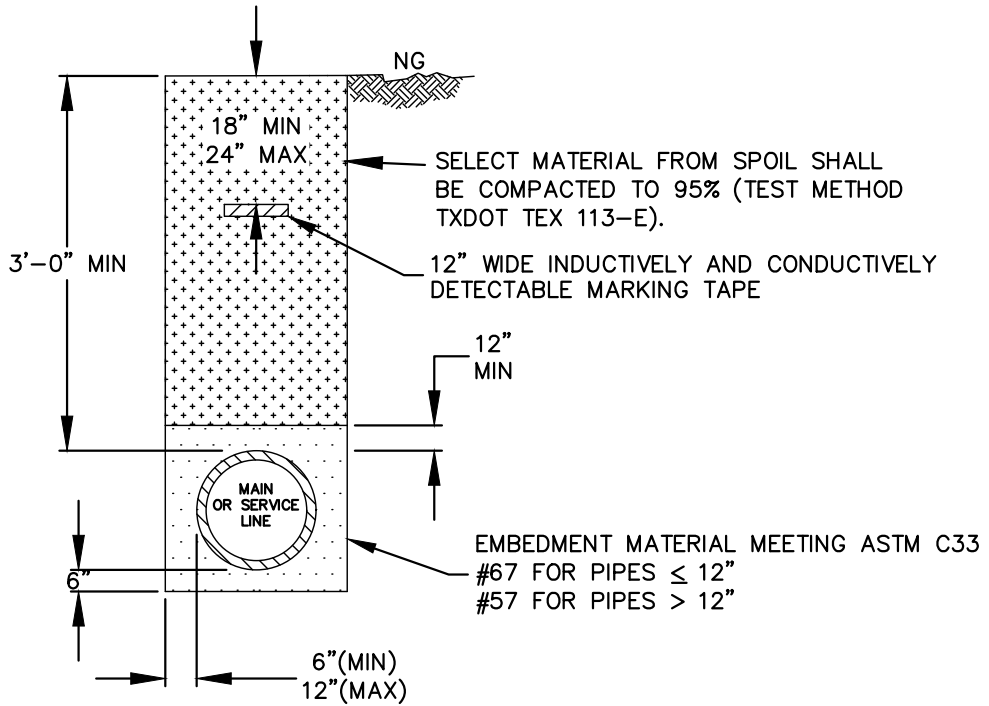
1. WHEN TUNNELING UNDER EXISTING CURB, CRUSHED STONE BASE SHALL BE COMPACTED TWO FEET BEHIND CURB AND TO WITHIN 6" OF THE BOTTOM OF THE CURB. THE 6" VOID UNDER THE CURB SHALL BE FILLED WITH 2,000 PSI CONCRETE.
2. UTILITY TRENCHES PLACED WITHIN THE STREET PAVEMENT OR WITHIN 3' OF THE BACK OF CURB OR EDGE OF EXISTING OR PROPOSED PAVEMENT SHALL COMPLY WITH THIS DETAIL.
3. FOR ASPHALT OR CONCRETE STREET REPAIRS WHERE THE SAW CUT PAVEMENT EDGE WILL BE WITHIN 3' OF EDGE OF EXISTING PAVEMENT OR LIP OF GUTTER, THE EXISTING PAVEMENT SURFACE BETWEEN THE DITCH LINE AND EDGE OF PAVEMENT OR LIP OF GUTTER SHALL BE REMOVED AND REPLACED WITH MATERIAL SPECIFIED.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

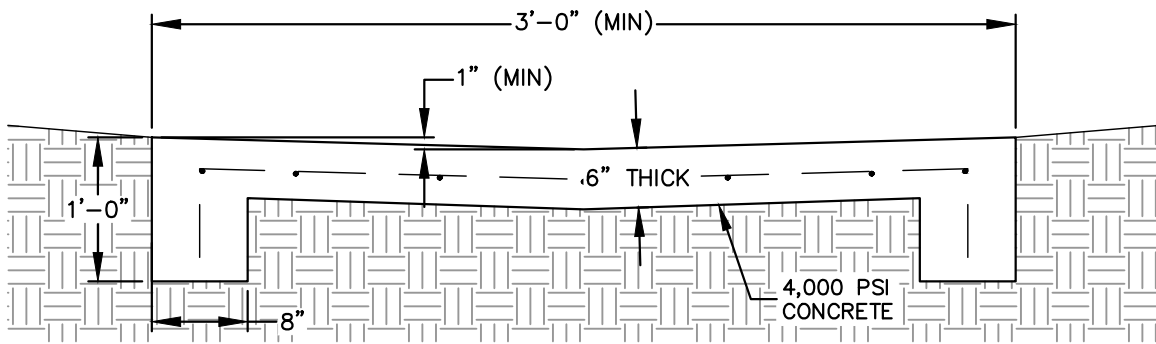
TITLE:	
R.O.W. TRENCH DETAIL	
SCALE:	DRAWING No.
NTS	S - 27




THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:		JANUARY 2020	
REV	DATE	BY	
1	NOV 2002	CS	
2	JAN 2020	JAD	

TITLE:	
TRENCH DETAIL	
SCALE:	DRAWING No.
NTS	S - 28



**NOTE:**  
 REINFORCING STEEL TO BE #3 BARS @ 12" OCEW

	DATE ISSUED: JANUARY 2020		TITLE:
	REV	DATE	BY
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD			CONCRETE PILOT CHANNEL  SCALE: NTS DRAWING No. S - 29

---

## CHAPTER 5 - CONCRETE AND REINFORCING STANDARDS

### I. GENERAL REQUIREMENTS

The materials and methods employed for the proportioning and mixing concrete used for paving and other concrete structures and materials used for reinforcing such concrete shall conform to the requirements detailed herein. The concrete shall be composed of Portland cement, mineral filler, and natural aggregates proportioned and mixed as provided herein. All concrete pours shall be confined by forming designated area. All concrete work shall be well compacted, and the mortar flushed to the surface of the forms by continuous working with concrete spading instruments or mechanical vibrators of an approved type. The vibrators shall be applied to the concrete immediately after deposit and shall be moved throughout the mass, thoroughly working the concrete around the reinforcement, embedded fixtures, and into the corners and angles of the forms until it has been reduced to a plastic mass. Vibration shall be supplemented by hand spading if necessary to insure the flushing of mortar to the surface of all forms.

Contractor is responsible for the protection of concrete placed under any and all weather conditions.

One (1) hour escape time will be allowed between pours, concrete pours will be rejected after the time frame. Concrete shall not have a free fall more than three feet (3').

### II. CONCRETE FOR STRUCTURES

#### A. Materials

1. Cement – The cement shall be Type I, Type II, or Type III of a standard brand of Portland cement conforming to ASTM Specification C150. Only cement from the same source and of the same type shall be permitted in any structure.
2. Mixing Water – The water used with the cement shall be clean and suitable for drinking or ordinary household use.
3. Coarse Aggregate – The coarse aggregate shall consist of gravel, crushed stone, or a combination thereof. Coarse aggregate shall conform to ASTM Specification C33 (#67). Gravel shall consist of durable particles of crushed or uncrushed stone of uniform quality throughout. It shall have a wear of not more than 40% when tested according to TxDOT Test Procedure Tex-410-A or AASHTO Method T-96. Crushed stone shall consist of durable particles of stone of uniform quality and having the same wear as that required for gravel.
  - a) The coarse aggregate shall be free of an excess of salt, alkali, roots, and other objectionable matter. The grade of aggregate shall be governed by the Class of concrete as specified in Table 5.1 below.
  - b) The maximum size and the percentage of smaller sizes of material acceptable for the various aggregate grade numbers shall be within the following limits:

**Table 5.1 – Coarse Aggregates Gradation Chart**

Aggregate Grade No. <sup>1</sup>	Maximum Nominal Size	Percent Passing on Each Sieve								
		2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8
1	2"	100	80-100	50-85		20-40			0-10	
2	1-1/2"		100	95-100		35-70		10-30	0-10	
3	1-1/2"		100	95-100		60-90	25-60		0-10	
4 (57)	1"			100	95-100		25-60	5-30	0-10	0-5
5 (67)	3/4"				100	90-100		20-55	0-10	0-5
6 (7)	1/2"					100	90-100	40-70	0-15	0-5
7	3/8"						100	70-95	0-25	
8	3/8"						100	95-100	20-65	0-10

1. Corresponding ASTM C33 Gradation shown in parentheses.

4. Fine Aggregate – Fine aggregate shall consist of natural sand and be free from broken material, foreign matter, excess salt, alkali, and vegetable matter. It shall not contain more than 0.5 percent by weight of clay lumps in accordance with Tex-413-A. Fine aggregate shall conform to the gradation requirements shown in Table 5.2 when tested in accordance with Tex-401-A.
- a) To be acceptable as fine aggregate, the sizes and mix of the material shall be within the following limits:

**Table 5.2 – Fine Aggregate Gradation Chart (Grade 1)**

Sieve	Percent retained
3/8"	0%
No. 4	0-5%
No. 8	0-20%
No. 16	15-50%
No. 30	35-75%
No. 50	75-90%
No. 100	90-100%
No. 200	97-100%
The sand equivalent shall not be less than 80%.	

- b) For concrete of Classes A, C, E, and F the fineness modulus shall be between 2.30 and 3.10, determined by adding the percentages by weight retained on sieves 4, 8, 16, 50, 100 then dividing by 100.

**B. Admixtures**

1. Water reducing admixtures shall conform to Type A or Type D, as set forth in ASTM Specification C494. Air entraining admixtures shall conform to the requirements of ASTM Specification C260. Before using an admixture, the contractor shall secure, and retain for inspection, certification from the manufacture that the admixture meets the required specification.

- 
2. Calcium chloride will not be permitted as an admixture.

C. Mix Design and Delivery

1. Design and Testing – It shall be the responsibility of the contractor to develop the mix design and to submit it to the City for approval. Testing of all mix design specimens shall be made in an independent testing laboratory.
2. Trial Batches – When trial batches of a mix design are required, they will be made and tested prior to placing the concrete on the job. A mix design from a previous or concurrent job may be used without trial batches if it can be shown that no substantial change in any of the ingredients has been made.
3. Coarse Aggregate Factor – The coarse aggregate factor shall not be more than 0.82 percent except that when the voids in the coarse aggregate exceed 48% of the total dry loose volume. The coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor shall not be less than 0.70 for aggregates of Grades 1, 2, and 3.
4. Water Reducing or Retarding Agents – Water reducing or retarding agents are required for hot weather placement and for continuous slab placement. Otherwise, water reducing or retarding agents may be used with all classes of concrete at the option of the contractor.
5. Batch Size – When transit mix concrete is used, the batch size shall not be less than 50% of the rated capacity of a representative truck.
6. Entrained Air – Entrained air will be required for concrete of Class A and C. The Concrete shall be designed to entrain 5% air when Grade 5 coarse aggregate is used and 5-1/2% air when Grade 4 coarse aggregate is used. Concrete as place in the structure shall contain the amounts of air as stated above with a tolerance of plus or minus 1-1/2%. Occasional variations beyond this tolerance will not be cause for rejection. When the quantity of entrained air is found to be above 7% with grade 5 coarse aggregate, or above 7-1/2% for Grade 4 coarse aggregate, additional test beams or cylinders shall be made and tested. If these beams or cylinders pass the minimum flexural or compressive requirements, the concrete will not be rejected because of the variation in entrained air.

D. Consistency

1. General – Concrete shall be of such consistency as to insure the required workability and result in compact masses with dense and uniform surfaces; the consistency of concrete mixtures shall be as such:
  - a) The aggregates will not segregate and mortar will cling to the coarse aggregate.
  - b) The concrete when dropped from discharge chute will flatten out at the center of the pile, but the edges will not flow.



- c) The concrete will not show free water.
  - d) The concrete will slide and not flow into place when discharged from metal chutes at an angle of 30° from the horizontal.
2. Variations – The mix design shall not be varied unless authorized by the City. In cases where the characteristics of aggregates are such that, with the maximum allowable amount of water, the consistency requirements cannot be satisfied, the contractor may furnish additional cement, aggregates, mineral filler, or aggregate of a different character which will produce the desired results. The addition of water to the approved batch design to provide workability will not be permitted.
3. Slump Requirements – Slump Requirements for designated structures shall be within the following limits:

**Table 5.3 – Placement Slump Requirements**

General Usage(a)	Placement Slump Range(b), in.
Walls (over 9 in. thick), caps, columns, piers, approach slabs, concrete overlays	3 to 5
Bridge slabs, top slabs of direct traffic culverts, latex-modified concrete for bridge deck overlays	3 to 5-1/2
Inlets, manholes, walls (less than 9 in. thick), bridge railing, culverts, concrete traffic barrier, concrete pavement (formed), seal concrete	4 to 5-1/2
Precast concrete	4 to 9
Drilled shafts, slurry displaced and underwater drilled shafts	See Table 5.4, “Drilled Shaft”
Curb, gutter, curb and gutter, concrete retards, sidewalk, driveways, anchors, riprap, small roadside sign foundations, concrete pavement repair, concrete repair	As approved by City

<sup>(a)</sup>For information only.

<sup>(b)</sup>For fiber reinforced concrete, perform slump before addition of fibers.

**Table 5.4 – Slump Requirements Drilled Shafts**

Placement Type	Minimum Acceptable Placement Slump, in.	Recommended Design and Placement Slump, in.	Maximum Acceptable Placement Slump, in.
Dry	5-1/2	6-1/2	7-1/2
Underwater and Under Slurry	7	8	9

4. Rejection – Remedial Measures – Any concrete failing to meet the above consistency requirements will be considered unsatisfactory although the concrete

meets the required slump test. In cases where the characteristic of the aggregate furnished are such that, with the maximum allowable amount of water, the specified slump and consistency requirements are not met, the contractor may provide additional cement or aggregates of an improved grading, to cause the concrete to meet the slump and consistency requirements.

E. Classification

Concrete shall be classified as set forth below. Class A shall be utilized if engineering plans do not designate the classification to be used in a particular structure.

**Table 5.5 – Concrete Classes**

Class	Sacks of Cement Per C.Y.	Minimum Strength, psi		Maximum W/C Ratio <sup>(a)</sup>	Coarse Aggregate Grade No. <sup>(b),(c),(d)</sup>	Air Entrained
		28 Days	7 Days			
A	5.0	3,000	2,100	0.6	1,2,3,4,8	Yes
B	4.0	2,000	1,400	0.6	2,3,4,5,6,7	No
C <sup>(e)</sup>	6.0	3,600	2,520	0.45	1,2,3,4,5,6	Yes
D	4.5	2,500	1,750	0.6	2,3,4,5,6,7	No
H <sup>(e)</sup>	6.0	As Indicated	As Indicated	0.45	3,4,5,6	Yes
I	5.5	3,500	2,450	0.45	2,3,4,5	Yes
J	2.0	800	560	N/A	2,3,4,5	No
S <sup>(e)</sup>	6.0	4,000	2,800	0.45	2,3,4,5	Yes

<sup>(a)</sup> Maximum water-cement or water cementitious ratio by weight.

<sup>(b)</sup> Unless otherwise allowed, Grade 1 coarse aggregate shall only be used in massive foundations with 4-in minimum clear spacing between reinforcing steel bars.

<sup>(c)</sup> Grade 1 coarse aggregate grading shall not be used in drill shafts.

<sup>(d)</sup> Unless otherwise allowed, Grade 8 coarse aggregate shall be used in extruded curbs.

<sup>(e)</sup> Structural concrete classes.

<sup>(g)</sup> When Type II cement is used in Class C, S or A concrete, the 7-day compressive strength requirement will be 2,310 psi for Class C, 2,570 psi for Class S and 1,925 psi for Class A minimum.

F. Testing of Concrete

1. During the progress of the work, an independent testing laboratory shall cast cylinders and/or test beams for testing of compressive and/or flexural strength. The City may waive the actual testing for small structures such as manholes, culverts, inlets, or small riprap placements; however, no such waiver shall be given if the placement equals or exceeds 25 cubic yards (25 yd<sup>3</sup>)
2. If testing is required before removal of forms or falsework, the cylinders or beams shall be cured at the jobsite and in the same method as the concrete which the test sample represents. Test made for design strength concrete shall be cured in accordance with TxDOT 400-A Series Test Procedures.

3. Quality control shall be based on seven day (7-day) compressive strengths which are compatible with the strengths of the design mix. A new batch shall be made if these tests do not meet the expected design requirements.

G. Placement Conditions

1. The concrete shall be mixed in quantities required for immediate use. Concrete shall be placed within the time limits, corresponding to the temperature limits set out below. Re-tempering of the mix shall not be allowed.

**Table 5.6 – Temperature Limits**

Air Temp. or Concrete Temp.	Maximum Time in Mixer
40 °F to 74 °F	90 minutes
75 °F to 89 °F	60 minutes
90 °F and above	45 minutes

2. In threatening weather, which may result in conditions which will affect the quality of concrete, the City may order postponement of the work. Where work has started and changes in weather conditions require protective measures, the contractor shall furnish adequate shelter to protect the concrete against damage from rainfall or freezing temperatures.

**III. REINFORCING STEEL**

A. Description

The provisions of this section shall govern the furnishing and placing of reinforcing steel where indicated in these specifications and/or as shown on the Details.

B. Materials

1. General – Except where otherwise designated on the plans, all bar reinforcement shall be Grade 60 and deformed. Reinforcing steel shall conform to ASTM Specification A615, Grades 40, 60, 75 or 80; and shall be open hearth, basic oxygen, or electric furnace new billet steel.
2. Spiral Reinforcement – Spiral Reinforcement shall be smooth (not deformed) bars or wire of the minimum diameter shown on the plans and shall be made by one or more of the following processes: open hearth, basic oxygen, or electric furnace. Bars shall be rolled from billets reduced from ingots and shall comply with ASTM Specification A615, Grades 40 or 60, except for deformation. Smoothed wire and deformed wire shall comply with ASTM A1064
3. Welded Wire Reinforcement – Welded wire reinforcement shall comply with ASTM A1064.

---

C. Bending

Fabricate reinforcing steel bars as prescribed in the Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice to the shape and dimensions shown on the plans. Preferably, the bending shall be done in the shop. Field-fabricated, if permitted shall be bent cold. Irregularities in bending will be cause for rejection.

D. Storing

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected as far as practicable from surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil, or other foreign materials. Rust, surface seams, surface irregularities, or mill scale will not be cause for rejection, provided the minimum dimensions, cross-sectional area, and tensile properties of a specimen, wire brushed by hand, meet the physical requirements for the size and grade of steel specified.

E. Splices

1. No splicing of bars, except when provided on the plans, or specified herein, will be permitted. Splices will not be permitted in the main reinforcement at points of maximum stress. When permitted in the main bars, splices in adjacent bars must be staggered a minimum of two splice lengths.
2. When splicing of reinforcement bars is permitted in the plans and specifications, the splice overlap must conform to the limits set out below.

**Table 5.7 – Minimum Lap Requirements for Steel Bar Sizes through No. 11**

<b>Bar Size Number (in.)</b>	<b>Uncoated Lap Length</b>	<b>Coated Lap Length</b>
3	1 ft. 4 in.	2 ft. 0 in.
4	1 ft. 9 in.	2 ft. 8 in.
5	2 ft. 2 in.	3 ft. 3 in.
6	2 ft. 7 in.	3 ft. 11 in.
7	3 ft. 5 in.	5 ft. 2 in.
8	4 ft. 6 in.	6 ft. 9 in.
9	5 ft. 8 in.	8 ft. 6 in.
10	7 ft. 3 in.	10 ft. 11 in.
11	8 ft. 11 in.	13 ft. 5 in.

<sup>(a)</sup>Do Not lap No. 14 or No. 18 bars.

<sup>(b)</sup>Lap spiral steel at least 1 turn.

<sup>(c)</sup>Splice WWR using a lap length that includes the overlap of at least 2 cross wires plus 2 in. on each sheet or roll. Splices using bars that develop equivalent strength and are lapped in accordance with Table 5.7 are permitted.

<sup>(d)</sup>Lap the existing longitudinal bars with the new bars as shown in table 5.7 for box culvert extensions with less than 1 ft. of fill. Lap at least 1 ft. 0 in. for extensions with more than 1 ft. of fill.

<sup>(e)</sup>Ensure welded splices conform to the requirements of the plans and of Item 440, “Structural Field Welding”. Field-prepare ends of reinforcing bars if they will be butt-welded. Delivered bars must be long enough to permit weld preparation.

<sup>(f)</sup>Install mechanical coupling devices in accordance with the manufacture’s recommendations at location shown on the plans. Protect threaded male or female connections, and ensure the threaded connections are clean when making the connection. Do not repair damaged threads.

<sup>(g)</sup>Mechanical coupler alternate equivalent strength arrangements, to be accomplished by substituting larger bar sizes or more bars, will be considered if approved in writing before fabrication of the systems.

3. Splices not provided for on the plans will be permitted subject to the following limitations:
  - a) Applicable to Grade 40 bars only, sizes No. 8 and smaller.
  - b) Splices will not be permitted in bars of less than 30 feet in plan length.
  - c) The bars to be placed in firm contact and firmly wired together.
  - d) All such splices must have the minimum specified concrete cover.
  - e) In no case will welding of reinforcement bars be permitted.

**F. Placing of Reinforcement**

1. Reinforcement shall be placed as near as possible in the position shown on the plans. Unless otherwise shown on the plans, dimensions shown for reinforcement are to the centers, bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from the plan placement measurement by more than one-twelfth (1/12) of the spacing between the bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than one-fourth inch (1/4”). Cover of concrete to the nearest surface of steel shall meet the above requirements but shall never be less than one inch (1”).

- 
2. Vertical stirrups shall always pass around the main members and be attached securely thereto. The reinforcing steel shall be spaced the required distance from the from surface by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, or plastic spacers.
  3. Mats of wire fabric shall overlap each other sufficiently to maintain uniform strength and shall be fastened securely at the ends and edges.
  4. No concrete shall be placed until the City has inspected the assembly of the reinforcing steel and given permission to proceed.

---

## CHAPTER 6 - ELECTRIC DISTRIBUTION SYSTEM STANDARDS

### I. GENERAL REQUIREMENTS

- A. The City of Lockhart is capable of supplying primary service through the city electrical distribution system. Available voltages include, single-phase 7.2 KV and three-phase 12.47 KV.
- B. In those developments having distribution and design requirements which are not adequately served by the requirements of this chapter, the developer will have an electrical distribution system designed by a professional electrical engineer licensed in the state of Texas. The design plans, and details required by such system shall be certified by the design engineer and must be approved by the City prior to construction.
- C. Primary underground service in overhead distribution areas will be provided where the City determines the size or service requirements of the load make such installation necessary or desirable.
- D. Meter loops, whether for overhead or underground secondary service, shall not be installed on the same pole with transformers, re-closures, voltage regulators, or any other distribution devices unless approved by the City.
- E. All equipment installed shall be new and shall meet the minimum requirements of the NEC.
- F. All secondary current exceeding 1200 amps shall utilize a City approved weatherproof bus trough at the meter installation. Troughs on the supply side of the meter installation shall be so constructed that a City seal can be used to prevent unauthorized opening.
- G. No pole, anchor, trench wall, or concrete pad shall be placed closer than 2 feet (2') to a property line.
- H. All electrical facilities installed are subject to inspection by the City during any phase of construction. Prior to backfill of trenches in underground installation, the City must inspect and approve the installation. Prior to placement of concrete, the City must approve such installations. Before the system is energized, approval from the City must be obtained.
- I. **Note: All electrical lines, both primary and secondary, shall be underground in subdivisions consisting of more than ten lots or more than ten acres, unless otherwise approved by the City in writing.**

### II. OVERHEAD SERVICE

#### A. Primary

When allowed by the City, in new subdivisions, the minimum conductor size shall be No. 1/0 aluminum on 40-foot Class 3 poles. Larger conductors may be required by the City if determined necessary. Poles shall be placed a minimum of six feet (6') into the ground and in such location as necessary to provide service to each lot, but not more than 300 feet (300') apart,

---

depending upon wire size. Main line disconnects shall be installed where connection will be made to the existing system.

**B. Transformers**

1. The largest pole mounted transformer shall be 167 KVA.
2. The largest pole mounted transformer bank shall be three (3) 167 KVA transformer on a Class 2 pole.
3. In all residential subdivisions the minimum transformer size shall be 50 KVA.
4. Permanent access shall be provided, suitable for the heavy equipment, required to service any ground mounted transformer bank.
5. Transformers shall not contain PCB's and shall be so marked.

**C. Secondary**

A minimum of 65 feet of secondary conductor for each lot to be served shall be furnished at each transformer pole.

**D. Clearances**

1. The point of attachment of a service drop to a building or other structure shall be high enough to provide the following minimum clearances:

<b>Feature</b>	<b>Clearance</b>
Sidewalk	10 feet
Residential	15 feet
Commercial Driveways and Parking Lots	18 feet
Public Streets, Roads, Highways and Alleys	27 feet

2. The point of attachment shall not be higher than 30 feet unless necessary to obtain the required clearance.
3. The City may require extra service poles be set to clear obstructions.

**III. UNDERGROUND SERVICES**

**A. Primary**

In subdivisions, the minimum conductor size shall be City approved, URD Type, 1/0 aluminum in a two-inch (2") Schedule 40 conduit. Larger conductors may be required by the City of determined necessary. Pull boxes shall be installed where required to ensure that conduit ends are accessible at intervals of not more than 200 feet (200'). The developer shall furnish primary terminators where connection is made to the existing system and the City will assist termination.



---

B. Transformers

1. In all residential subdivisions the minimum transformers size shall be 50 KVA.
2. Transformers shall be furnished with primary elbows, secondary lugs, and automatic reset fault indicators for each phase on the primary elbow.
3. Transformers shall not contain PCB's and shall be so marked.
4. Each transformer will be mounted on a reinforced concrete slab. See Details.

C. Secondary

1. Each junction box shall include a secondary conduit for each lot to be served, extending not less than three feet (3') from under the pad and in the general direction that such service is to be provided, and such other conduits as are necessary for installation of street lights and services.
2. Street light service conduit shall be minimum of 1-1/4 inch diameter.
3. CT metered services shall have minimum of a one inch (1") conduit between the pad-mounted transformer and the meter socket.
4. Single-phase riser and conduit from transformers and/or secondary pads shall have minimum size of two-inch (2") for meter loops up to 200 amps, three-inch (3") conduit for meter loops greater than 200 amps, and such other additional runs of conduit as may be required for larger loads. A three-phase riser and conduit from transformers and/or secondary pads shall have a minimum of three (3) each two-inch (2") conduits.

D. Trench Safety

1. All trenches having a depth of more than five feet (5') shall be provided with a suitable form of safety system to prevent trench collapse.
2. Such safety system shall be designed by the sub-divider's or contractor's engineer to meet the Occupational Safety and Health Administration standards.
3. The contractor shall ensure the safety system is properly utilized at all times that there is a requirement for the safety system.
4. The engineer designing the safety system shall inspect such system to ensure its proper installation and utilization.

**IV. GROUNDING**

- A. A permanent ground-connection from a driven ground rod and attached to the neutral terminal of the meter socket shall be provided.

---

B. The grounded neutral conductor shall be electrically continuous from the weather-bead through the meter loop for all service entrance conductors. The grounded conductor shall be positively identified by the use of white tape or other suitable method.

C. Service grounding from the ground rod to the meter socket shall use a minimum No.6 copper wire or equivalent.

## **V. METERING, METER LOOPS AND SERVICE DROPS**

A. The builder shall be responsible for furnishing and correctly installing all equipment for meter loops, including trough, meter sockets, riser conduit and fittings, weather-bead, and sufficient approved conductors of five feet (5') minimum excess length out of the weather-bead.

B. City must inspect the meter loop from the socket to the weather-bead to insure acceptable wiring and termination practices.

C. Standard permanent poles for meter loop services shall be nominally 25 feet in height from grade, except where certain clearance conditions exist, with the meter socket between five feet (5') and six feet (6') in height from grade, with a minimum conduit riser length to the weather-bead of fifteen feet (15').

D. Meter loops will no longer be set on City poles. If a pole is required on private property, the customer will be responsible for installing a City approved pole (30-4) and for requesting and obtaining an approved inspection by the City.

E. The developer shall furnish all CIT/metering and meters, including primary metering. The City will assist with installation of meters.

F. Bare or insulated wire shall be furnished and installed in service entrance as a bond between equipment ground and the City's common neutral system. The conductor shall be appropriately sized but in no case shall it be less than No. 6 copper or equivalent.

G. A solid point of attachment for supporting the service drop on the building shall be provided.

H. A service pole shall be set in those cases where proper clearance from ground, trees, and other obstructions can be obtained, but the distance from the transformer pole to the point of attachment is more than 100 feet.

I. Meters will not be located where they will interfere with traffic, on sidewalks or driveways, or where they will obstruct the opening of doors or windows.

J. Meter mounting devices shall be installed so that the disc of the meter when installed will be exactly level.

K. When more than one meter is installed, as on duplex apartments or apartment house, the meters are to be grouped at a point accessible at all times to the City. Each meter socket shall be

---

clearly and permanently marked by the person installing it to show the apartment and/or address to be served by the meter.

## **VI. STREET LIGHTS**

A. Street lights shall not be installed on private property.

B. New Subdivisions

All new subdivisions construction plans shall have developer installed **LED** street lights based upon these standards, and the City's Subdivision Ordinance. Any variance to these standards must be approved by the City Manager or designee.

1. The developer shall submit a streetlight plan as part of the final subdivision plat package in conjunction with the utility plans and in conformance with these standards.
2. The staff shall review, coordinate with the electric utility, and recommend LED street lighting plans to the Electric Distribution Superintendent or other City Manager designee.
3. Metal poles with a minimum Height of 30 feet (30') shall be required for all public LED street lighting with a minimum 8 foot (8') long, 80 gauge aluminum arms.
4. The City may reject subdivision and development construction plans involving streets that fail to comply with the standards set forth in this section.

In new subdivisions where underground primary and secondary must be provided by the developer, the developer shall provide all required easements and pay for the installation/materials/equipment for street lights in accordance with the standards set forth in this section.

C. Spacing

Streetlights shall be placed in accordance with the following spacing requirements in all public streets:

1. Typical spacing of lights shall be one per intersection as described in Street LED Watts/Lumens Chart of this section; where two street types intersect, the heavier traffic street type lighting shall apply.
2. Lights shall be provided along arterial and collector streets, with a maximum spacing between lights of 250 feet (250') and in compliance with the LED Watt/Lumens Chart.
3. If the block length is over 600 feet (600') but less than increments of 300 feet (300'), the light shall be placed in mid-block to the degree practical.

4. In a cul-de-sac turnaround, if the cul-de-sac length is longer than 300 feet (300’).
5. In all vertical curve points of 10% or more in all streets.
6. All roundabouts, bulb outs, and marked crosswalks.
7. Streetlights shall be placed in the subdivision in compliance with the final approved LED lighting plan.

**Table 6.1 Street LED Watts/Lumens Chart**

Type of Street, Intersections, Other Locations	Watts/Lumens (Minimum)
	<b>30’ Metal Poles, 8’ aluminum mast arms, photoelectric control, and fused – Submittal approval required.</b>
Arterial	148/8,600
Arterial/Arterial Intersections	148/10,300
Arterial/Collector Intersections	130/9,100
Arterial/Residential Intersections	130/9,100
Arterial Other Specified Locations	45/3,500
Collector	95/5,600
Collector/Residential Intersections	130/9,100
Collector/Collector Intersections	130/9,100
Collector/Arterial Intersections	130/9,100
Collector Other Specified Locations	45/3,500
Residential-Local (Low Traffic)	45/3,500
Residential/Residential Intersections	95/8,000
Residential/Collector Intersections	130/9,100
Residential/Arterial Intersections	45/3,500
Residential Other Specified Locations	45/3,500

**D. Private Streets and Mobile Home Park Subdivision Streets**

No street or intersection shall be illuminated at public expense by the City of Lockhart unless said street is located within dedicated public street right-of-way. Public access easements shall not be considered public right-of-way for street lighting purposes. Street lights within the mobile home park shall be provided by the developer along internal streets. Light standards shall have a height and spacing to ensure an average illumination level of not less than 0.2 foot candles shall be maintained.

**E. Annexed Areas**

In newly annexed areas, the annexation assessment and service plan, if required, shall indicate the approximate number of street lights to be provided, the approximate annual cost of providing the lights and the timing for providing the street lights. Street lights shall be installed by

---

the City in developed areas with conventional “along the street utility areas” in subdivisions of 5 lots or more upon request.

The additional cost of providing street lights in annexed areas with underground utilities shall not be borne by the City. Street lights in areas with rear utilities shall be provided as soon as economically feasible. All street lights shall be provided within 5 years of the effective date of annexation where there are at least 5 contiguous home sites.

#### F. Existing Areas

When a request is received for a street light in previously developed areas, the Developer and/or his designee will complete the “Request for Street Light” form. All requests for street lights in existing subdivisions and public streets will be evaluated by the City Manager or his designee according to the standards set out in Section B New Subdivisions of this standard as follows:

1. Requested light(s) must not be closer than 250 feet (250’) to the closest existing street light(s) unless approved by the City Manager or designee.
2. Requested light will receive priority if located at a.) intersections of public streets, b.) sharp curves, c.) turns, d.) cul-de-sacs, e.) dead end streets, and f.) points of traffic conflict. Lumen measurements will also be considered.
3. Installation costs shall be reasonable and the number of trees along the street that hinder street light levels will be considered.
4. The City Manager or designee will evaluate a request for street light according to the above criteria. If a request is denied by the City Manager, the applicant may ask that his street light request be heard by the City Council; the Council’s decision will be final.

#### G. Moving Existing Installed Street Lights

It shall be the responsibility of the property owner, developer, or building contractor to move existing installed street lights where required in order to construct/alter/move a driveway or other appurtenance. A licensed electrical contractor must perform the work after review with the Electric Superintendent or designee and after obtaining the required permits.

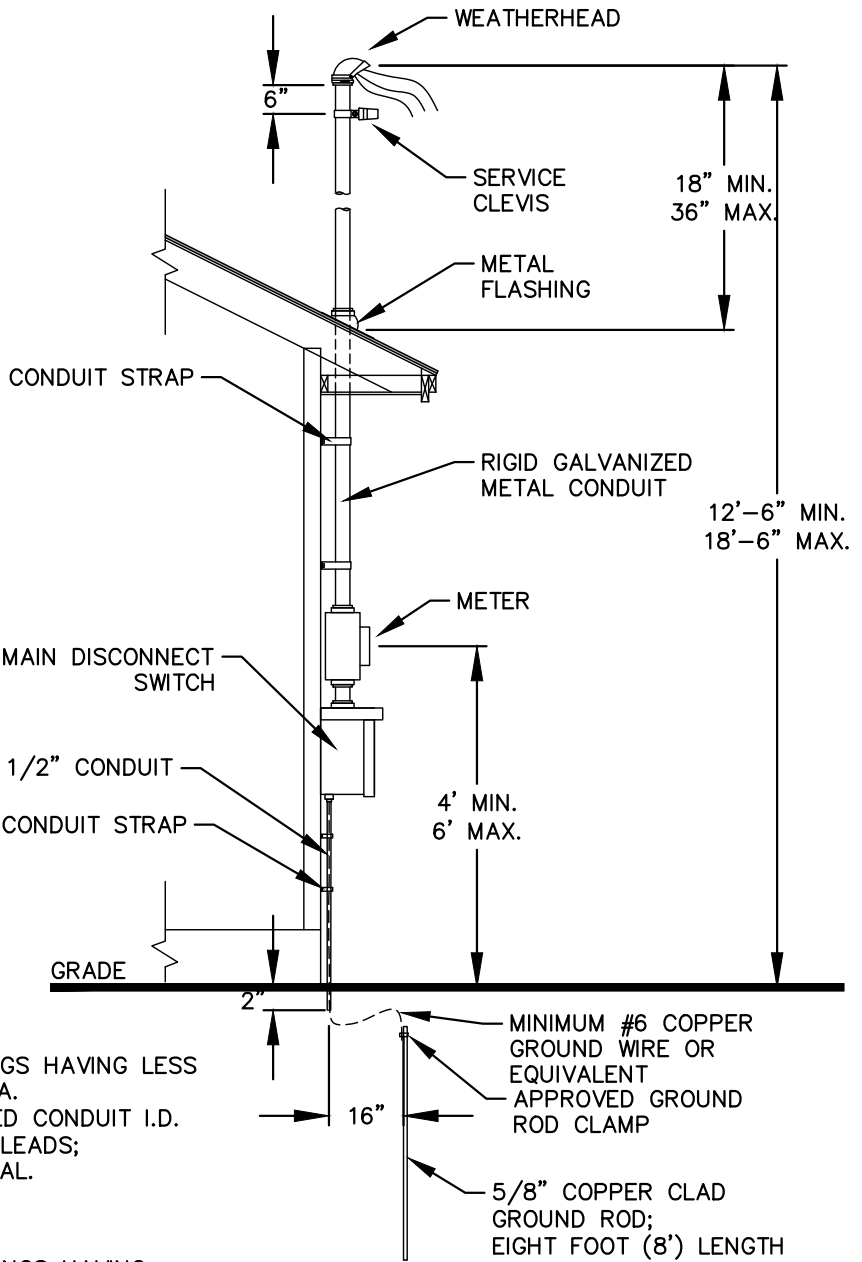
---

## VII. ELECTRICAL DETAILS

<b>Detail</b>	<b>Detail No.</b>
Single Overhead Service Single Phase Meter Loop	E-1
Overhead Service Multiple Metering	E-2
Overhead to Underground Single Phase Primary Riser	E-3
Overhead Primary to Underground Single Phase Secondary Riser	E-4
Overhead to Underground with Meter at Pole Single Phase Meter Loop	E-5
Overhead to Underground Mobile Home Park Meter Loop	E-6
Trench Installation	E-7
Single Underground Service Single Phase Meter Loop	E-8
Underground Secondary Service Multiple Metering in Apartment Complex	E-9
Overhead Service Temporary Meter Loop	E-10
Underground Service Temporary Meter Loop	E-11
Typical Transformer Pad	E-12
Overhead Primary to Underground Three Phase Secondary Riser	E-13

**NOTES**

1. PROVIDE MINIMUM FIVE FOOT (5') LEADS PAST WEATHERHEAD.
2. WEATHERHEAD HEIGHT ABOVE FINAL GROUND GRADE SHALL NOT BE LESS THAN 12'-6" AND NOT EXCEED 18'-6". IF WIRES CROSS MORE THAN FOUR LINEAR FEET (4') OF ROOF, THE CLEARANCE MUST BE RAISED FROM 18" TO 36".
3. CLEVIS SHALL BE SIX INCHES (6") BELOW WEATHERHEAD.
4. IF METAL ROOF, PLASTIC MAY BE SUBSTITUTED FOR METAL FLASHING.-\*SPECIAL ROOF PROBLEMS SHALL BE COORDINATED WITH CITY OF LOCKHART.
5. TWO CONDUIT STRAPS ON CONDUIT WALL; STRAP SIZE TO FIT SIZE OF CONDUIT.
6. CIRCUIT BREAKER AND CONDUCTOR SIZE SHALL BE PER N.E.C.
7. MAIN DISCONNECT SWITCH REQUIRED AT METER SOCKET.- \*THE HOUSE BREAKERS MAY BE LOCATED BELOW, ADJACENT TO, OR INSIDE HOUSE, BUT NOT INSIDE CLOSET OR BATHROOM.
8. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
9. ENCLOSE GROUND WIRE IN 1/2" CONDUIT, ATTACH TO EXTERIOR OF BUILDING WITH TWO (2) STRAPS, CONTINUE CONDUIT TO TWO INCHES (2") BELOW FINAL GROUND GRADE.
10. MINIMUM INSULATION REQUIREMENT ON SERVICE WIRE FOR ALL CONDUCTORS SHALL BE THW ON EQUIVALENT.



100 AMP LOOP

- SUITABLE FOR SINGLE FAMILY DWELLINGS HAVING LESS THAN 1,000 SQUARE FEET LIVING AREA.
- 1 1/2" MINIMUM SIZE RIGID GALVANIZED CONDUIT I.D.
- TWO #2 STRANDED COPPER FOR HOT LEADS;
- ONE #4 STRANDED COPPER FOR NEUTRAL.

200 AMP LOOP

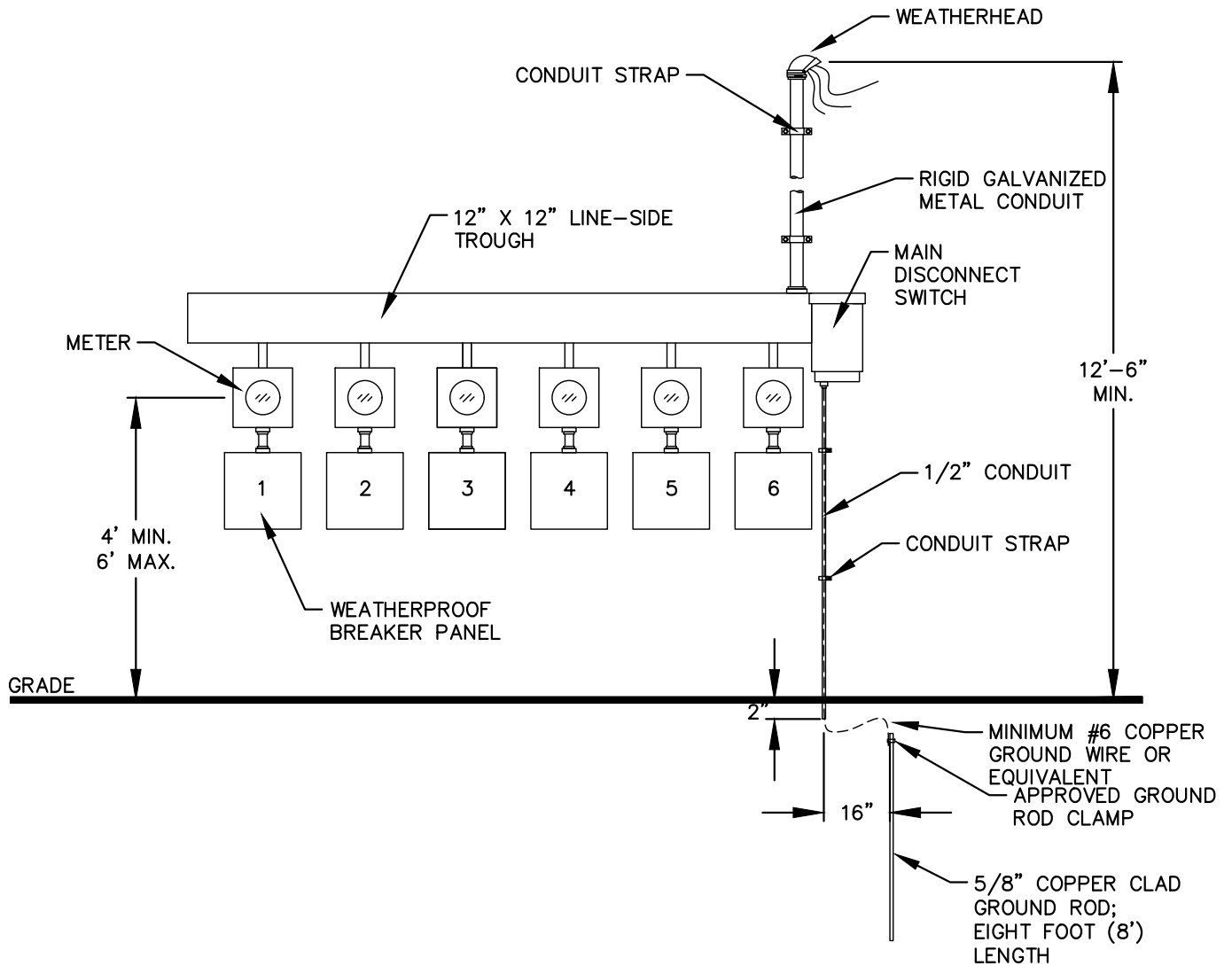
- REQUIRED FOR SINGLE FAMILY DWELLINGS HAVING 1,000 SQUARE FEET LIVING AREA OR MORE.
- 2" MINIMUM SIZE RIGID GALVANIZED CONDUIT I.D.
- TWO #2/0 STRANDED COPPER FOR HOT LEADS;
- ONE #1/0 STRANDED COPPER FOR NEUTRAL.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	OCT 2017	

TITLE:	
SINGLE OVERHEAD SERVICE SINGLE PHASE METER LOOP	
SCALE:	DRAWING No.
NTS	E - 1

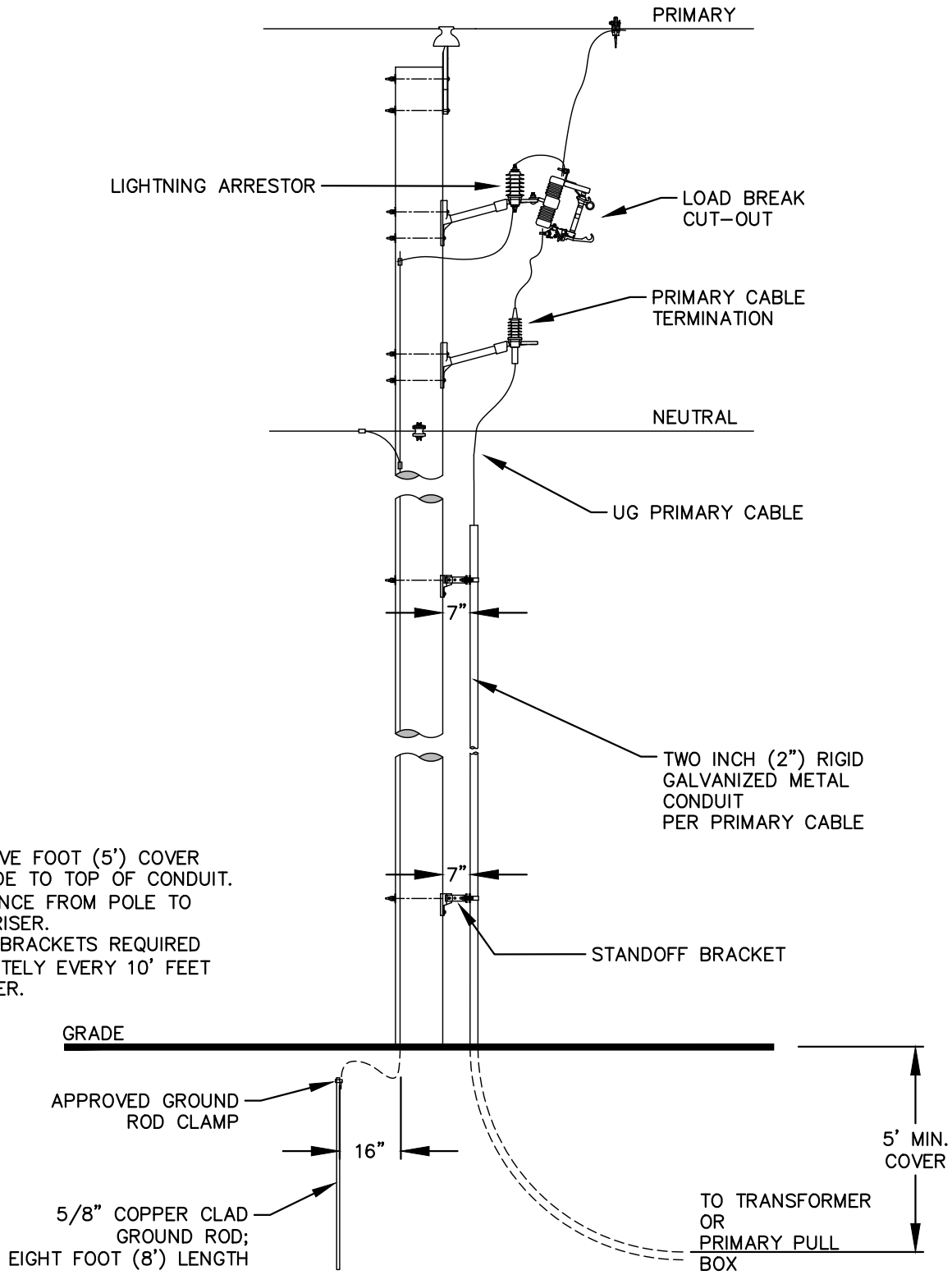


**NOTES**

1. PROVIDE MINIMUM FIVE FOOT (5') LEADS PAST WEATHERHEAD.
2. FOR WEATHERPROOF SUB-MAIN SWITCHES OR BREAKER PANELS, EACH SWITCH SHALL HAVE PERMANENT TYPE ADDRESS MARKING.
3. TROUGH SHALL BE CONSTRUCTED SO THAT THE CITY OF LOCKHART SEAL CAN BE USED TO PREVENT UNAUTHORIZED ENTRY.
4. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
5. ENCLOSE GROUND WIRE IN 1/2" CONDUIT, ATTACH TO EXTERIOR OF BUILDING WITH TWO (2) STRAPS, CONTINUE CONDUIT TO TWO INCHES (2") BELOW FINAL GROUND GRADE.
6. MINIMUM INSULATION REQUIREMENT ON SERVICE WIRE FOR ALL CONDUCTORS SHALL BE THW OR EQUIVALENT.
7. MULTIPLE METERED SERVICE CONDUCTORS TO BE DETERMINED BY LICENSED ENGINEER.

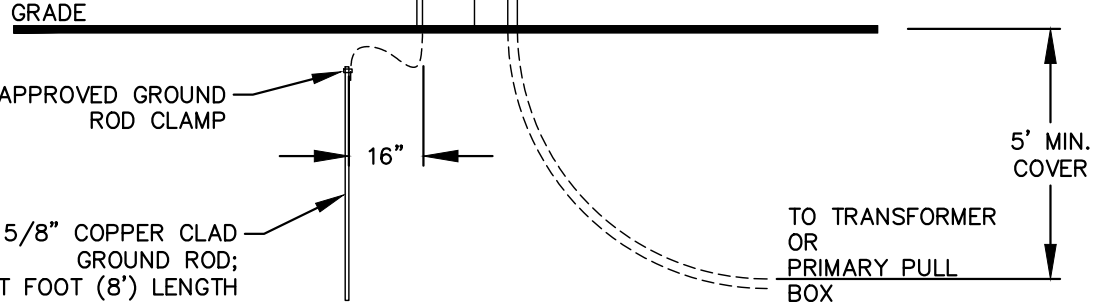
	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	OCT 2017	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD	SCALE: NTS		DRAWING No. E - 2





**NOTES**

1. MINIMUM FIVE FOOT (5') COVER FROM GRADE TO TOP OF CONDUIT.
2. 7" CLEARANCE FROM POLE TO VERTICAL RISER.
3. STANDOFF BRACKETS REQUIRED APPROXIMATELY EVERY 10' FEET ALONG RISER.



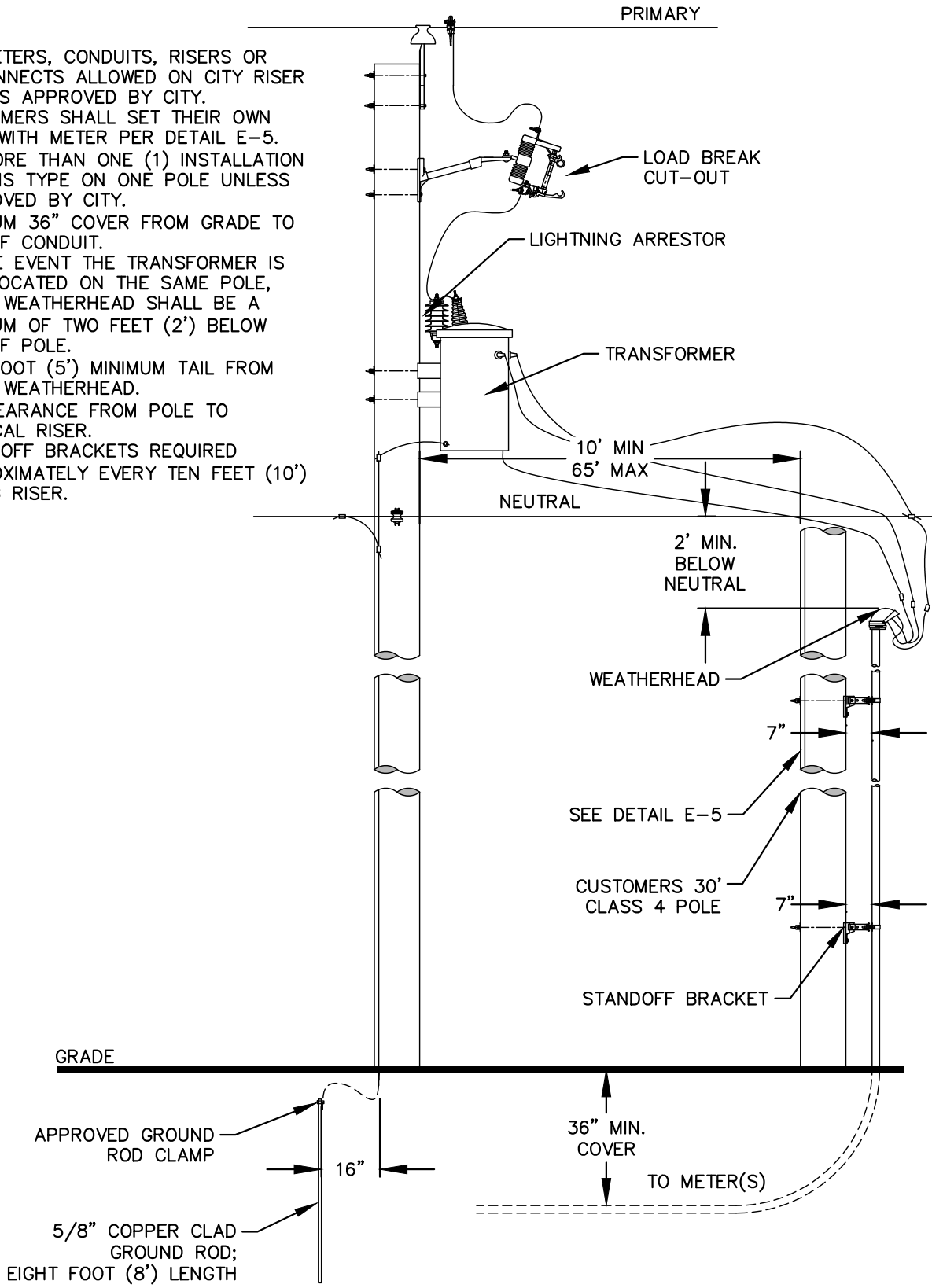
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	OCT 2017	

TITLE:	<b>OVERHEAD TO UNDERGROUND SINGLE PHASE PRIMARY RISER</b>	
SCALE:		
DRAWING No.	E - 3	

NOTES

1. NO METERS, CONDUITS, RISERS OR DISCONNECTS ALLOWED ON CITY RISER UNLESS APPROVED BY CITY. CUSTOMERS SHALL SET THEIR OWN POLE WITH METER PER DETAIL E-5.
2. NO MORE THAN ONE (1) INSTALLATION OF THIS TYPE ON ONE POLE UNLESS APPROVED BY CITY.
3. MINIMUM 36" COVER FROM GRADE TO TOP OF CONDUIT.
4. IN THE EVENT THE TRANSFORMER IS NOT LOCATED ON THE SAME POLE, RISER WEATHERHEAD SHALL BE A MINIMUM OF TWO FEET (2') BELOW TOP OF POLE.
5. FIVE FOOT (5') MINIMUM TAIL FROM RISER WEATHERHEAD.
6. 7" CLEARANCE FROM POLE TO VERTICAL RISER.
7. STANDOFF BRACKETS REQUIRED APPROXIMATELY EVERY TEN FEET (10') ALONG RISER.



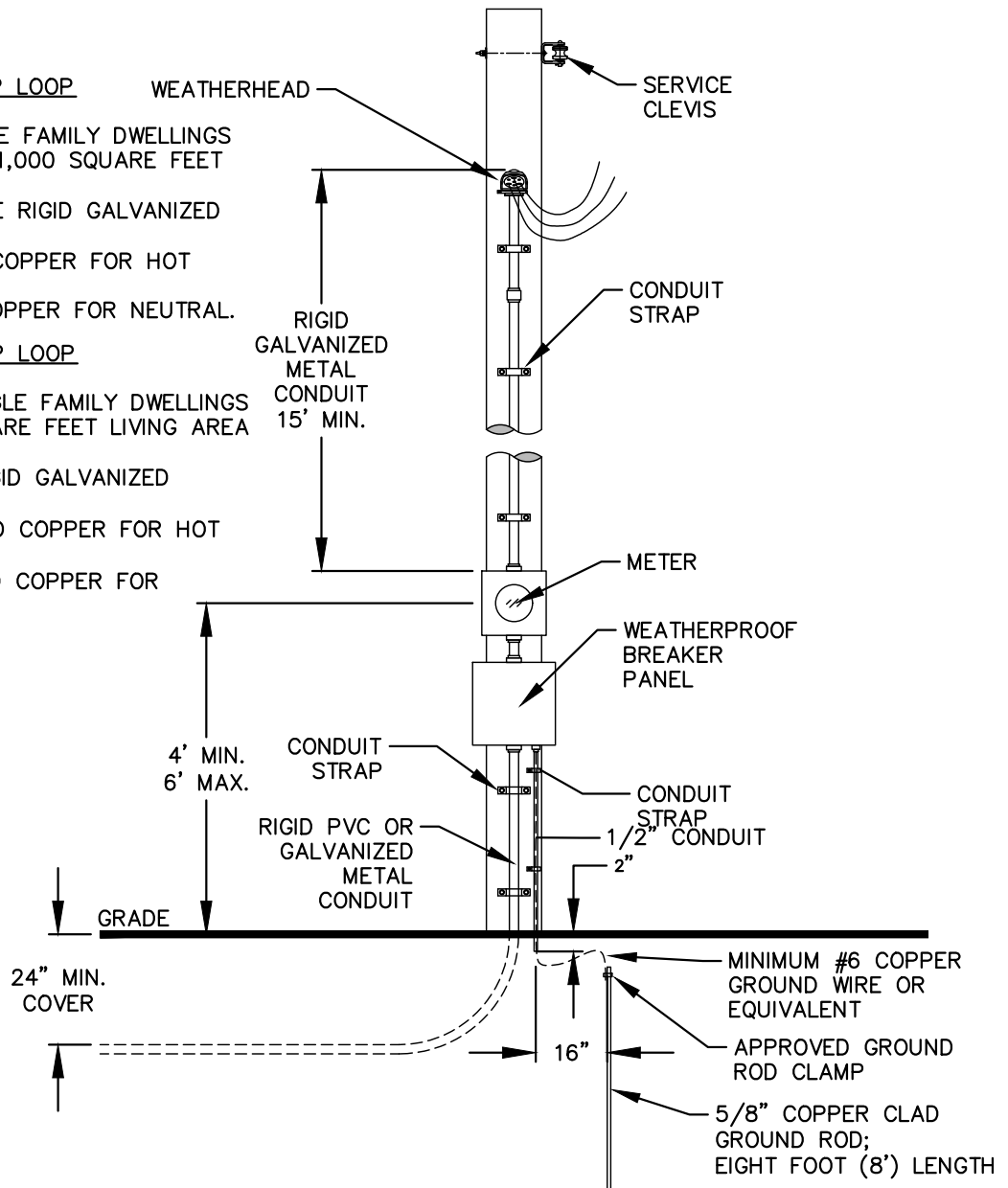
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	OCT 2017	
2	JAN 2020	JAD

TITLE:	OVERHEAD PRIMARY TO UNDERGROUND SINGLE PHASE SECONDARY RISER	
SCALE:	NTS	DRAWING No. E - 4

- 100 AMP LOOP
- SUITABLE FOR SINGLE FAMILY DWELLINGS HAVING LESS THAN 1,000 SQUARE FEET LIVING AREA.
  - 1 1/2" MINIMUM SIZE RIGID GALVANIZED CONDUIT I.D.
  - TWO #2 STRANDED COPPER FOR HOT LEADS;
  - ONE #4 STRANDED COPPER FOR NEUTRAL.

- 200 AMP LOOP
- REQUIRED FOR SINGLE FAMILY DWELLINGS HAVING 1,000 SQUARE FEET LIVING AREA OR MORE.
  - 2" MINIMUM SIZE RIGID GALVANIZED CONDUIT I.D.
  - TWO #2/0 STRANDED COPPER FOR HOT LEADS;
  - ONE #1/0 STRANDED COPPER FOR NEUTRAL.



**NOTES**

1. PROVIDE MINIMUM FIVE FOOT (5') LEADS PAST WEATHERHEAD.
2. THREE (3) STRAPS ON CONDUIT SECURING TO POLE; SIZE OF STRAP TO FIT SIZE OF CONDUIT.
3. METER SOCKET AND WEATHERPROOF BREAKER PANEL WILL BE CONNECTED TO POLE WITH LAG SCREWS.
4. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
5. ENCLOSE GROUND WIRE IN 1/2" CONDUIT, SECURE TO POLE WITH TWO (2) STRAPS, CONTINUE CONDUIT TO TWO INCHES (2") BELOW FINAL GROUND GRADE.
6. RIGID PVC OR GALVANIZED METAL CONDUIT PROPERLY SECURED TO PANEL BOX WITH WEATHER-TIGHT FITTINGS AND STRAPPED TO POLE WITH TWO STRAPS SIZED TO CONDUIT BELOW PANEL.
7. WHENEVER POSSIBLE, POSITION METER TO FACE THE ROAD OR DRIVEWAY.
8. MINIMUM INSULATION REQUIREMENT ON SERVICE WIRE FOR ALL CONDUCTORS SHALL BE THW OR EQUIVALENT.
9. THIRTY FOOT (30') CLASS FOUR (4) UTILITY GRADE POLE SET IN POLE FOAM REQUIRED.



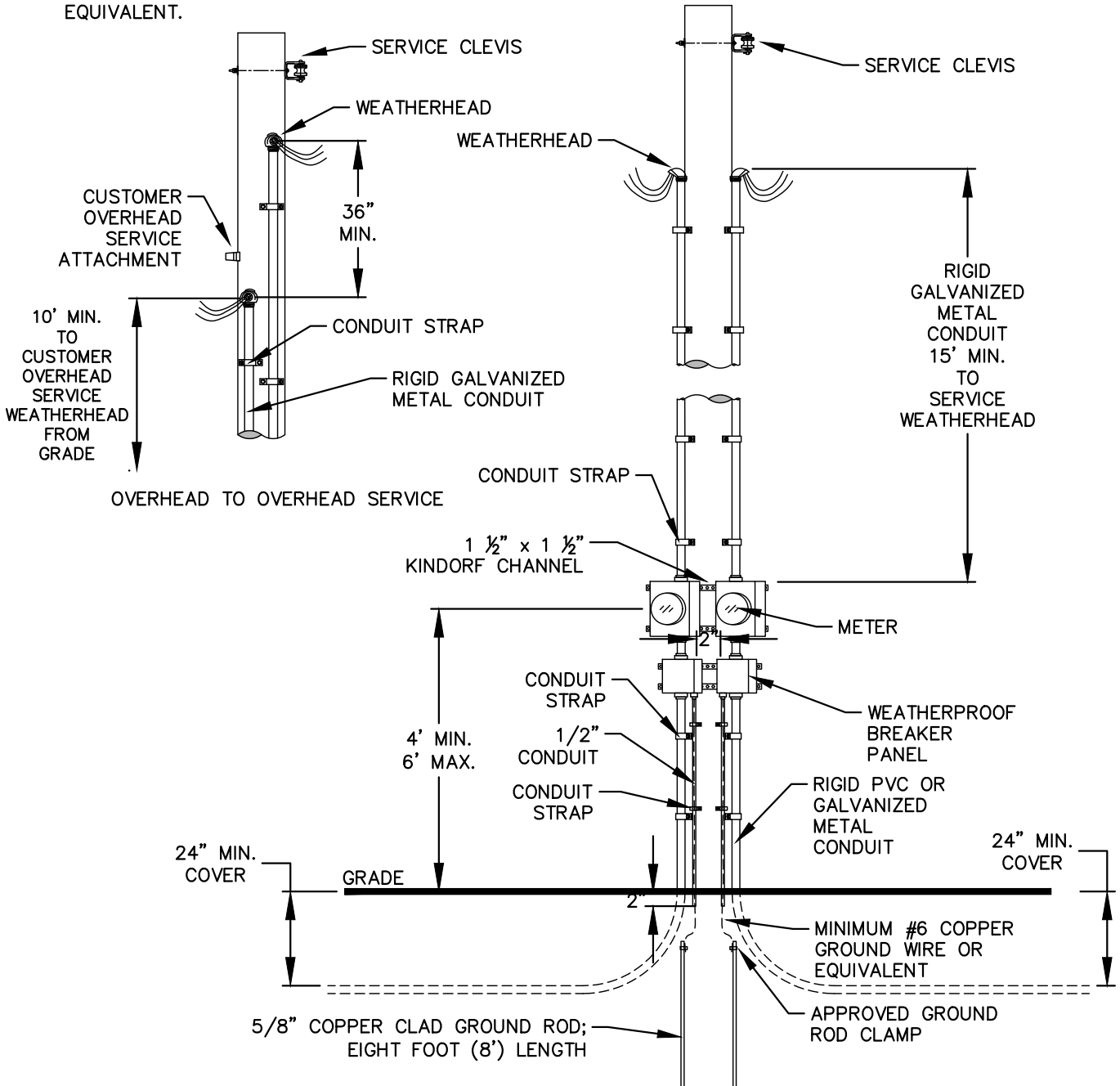
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987		
REV	DATE	BY	
1	OCT 2017		

TITLE:	
<b>OVERHEAD TO UNDERGROUND WITH METER AT POLE SINGLE PHASE METER LOOP</b>	
SCALE:	DRAWING No.
NTS	E - 5

NOTES

1. PROVIDE MINIMUM FIVE FOOT (5') LEADS PAST WEATHERHEAD.
2. ALL MOBILE HOME PARKS SHALL USE A 30' CLASS 4 POLE APPROVED BY THE CITY. THE POLE SHALL BE PROPERLY GROUNDING WITH AN APPROVED GROUND ROD INSTALLED. WHEN ANCHOR AND GUY ARE REQUIRED THEY SHALL BE APPROVED BY THE CITY.
3. 1 1/2" X 1 1/2" KINDORF CHANNEL MOUNTED TO POLE WITH 3/8" LAG SCREWS. A TWO INCH (2") SPACE REQUIRED BETWEEN METERS.
4. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
5. ENCLOSE GROUND WIRE IN 1/2" CONDUIT, SECURE TO POLE WITH TWO (2) STRAPS, CONTINUE CONDUIT TO TWO INCHES (2") BELOW FINAL GROUND GRADE.
6. MINIMUM INSULATION REQUIREMENT ON SERVICE WIRE FOR ALL CONDUCTORS SHALL BE THW OR EQUIVALENT.




THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

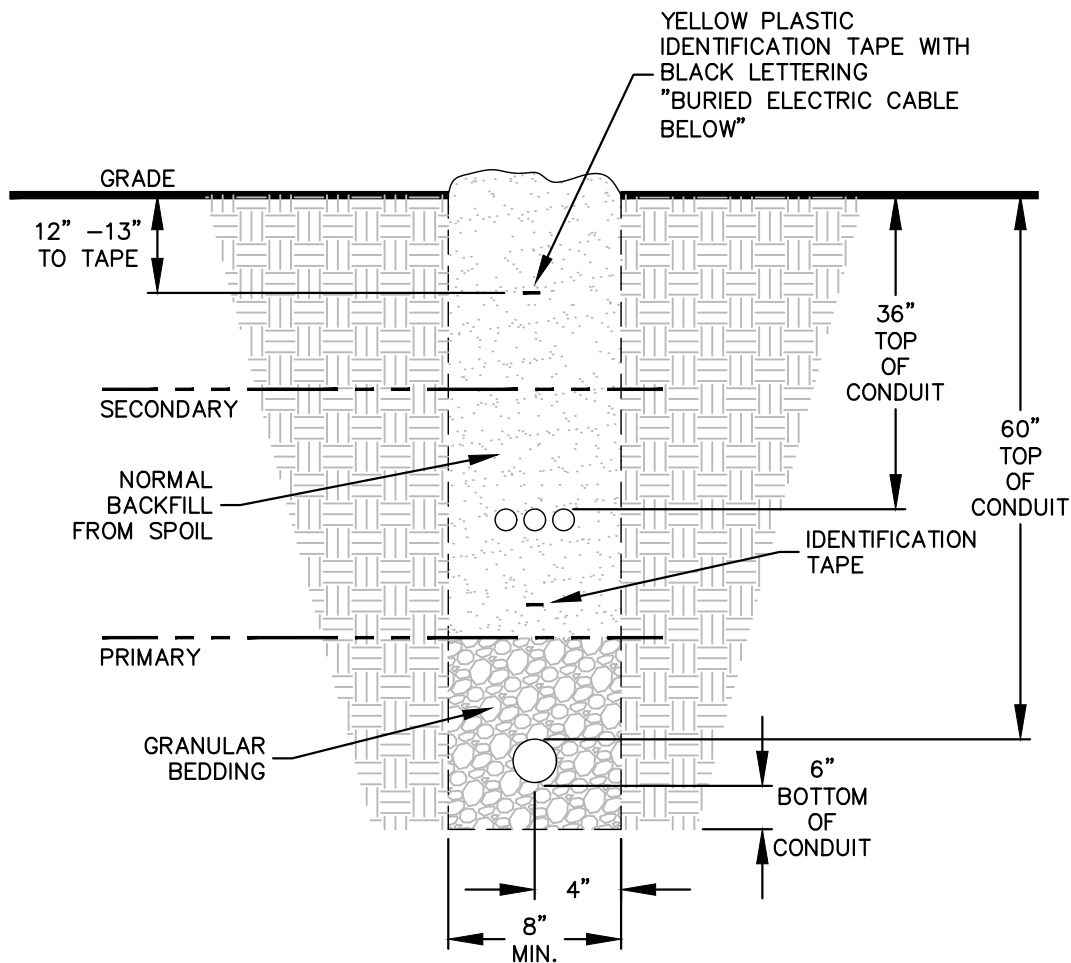
DATE ISSUED:	APRIL 1987		
REV	DATE	BY	
1	OCT 2017		

TITLE:

**OVERHEAD TO UNDERGROUND MOBILE HOME PARK METER LOOP**

SCALE: NTS

DRAWING No. E - 6



**NOTES**

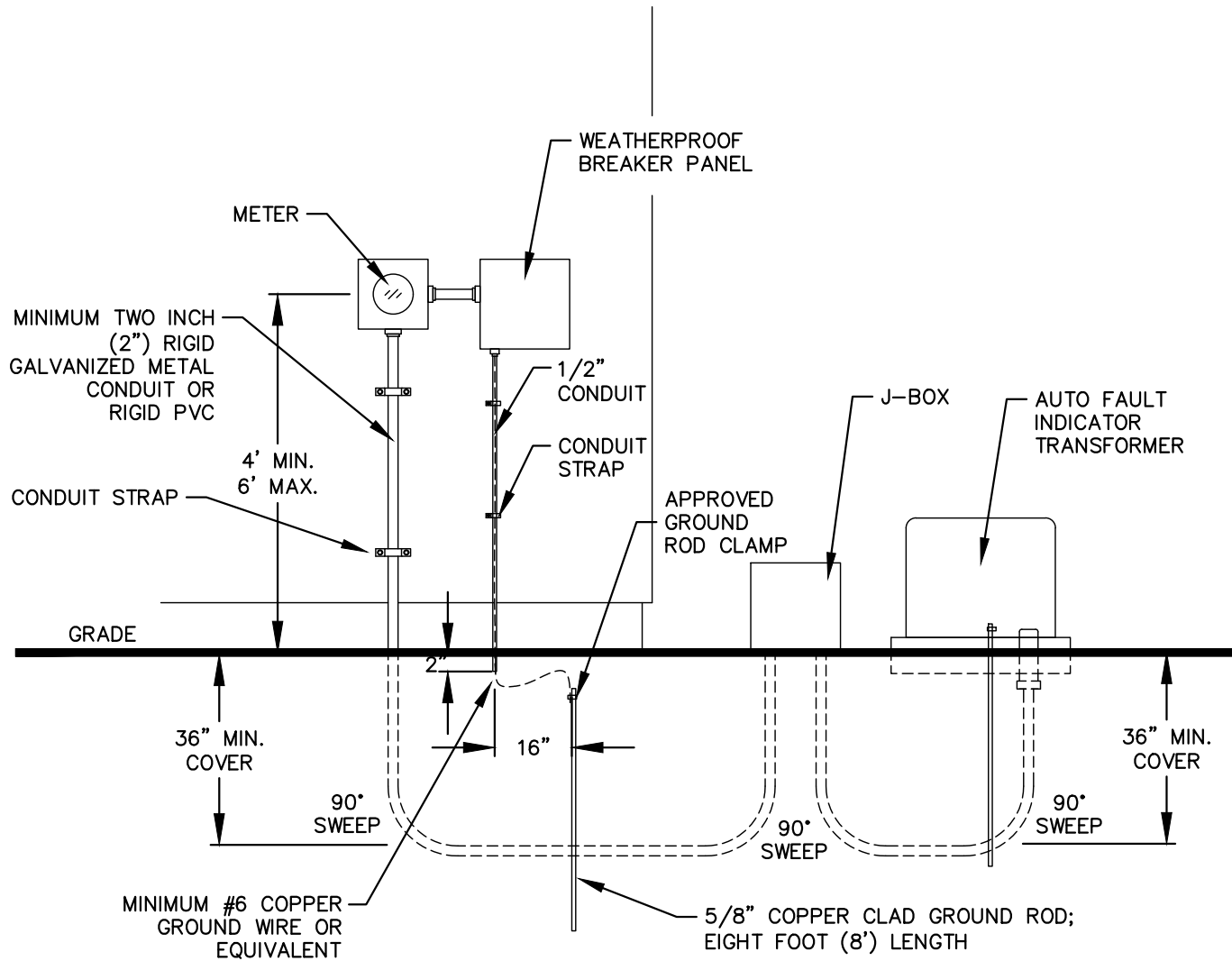
1. WHEN CROSSING EXISTING STREETS AND DRIVEWAYS, SURFACE MATERIAL SHALL BE EQUAL TO MATERIAL REMOVED--MINIMUM AMOUNTS INCLUDE 8" GRAVEL, 1-1/2" ASPHALT, OR 6" CONCRETE.
2. INSTALLATION OF COMPACTED CRUSHED STONE (100%) AS PER TDHPT METHOD TEX 113-E, IS REQUIRED WHEN CROSSING EXISTING STREETS OR DRIVEWAYS.
3. NORMAL BACKFILL FROM SPOIL (MAXIMUM 6" IN GREATEST DIMENSION).
4. GRANULAR BEDDING AS REQUIRED.
5. A YELLOW PLASTIC IDENTIFICATION TAPE WITH BLACK LETTERING THAT READS "BURIED ELECTRIC CABLE BELOW" MUST BE PLACED IN THE CABLE TRENCH AT A DEPTH OF 12" TO 13" BELOW FINISHED GROUND GRADE.
6. AT NO TIME WILL ANY CONDUIT, PIPE, OR DIRECT BURIAL CABLE, WHETHER COMMUNICATIONS, GAS, OR WATER, BE PLACED CLOSER THAN 12" VERTICALLY OR HORIZONTALLY FROM ANY UNDERGROUND ELECTRICAL CONDUCTOR.
7. AT NO TIME WILL ANY ELECTRIC LINE BE CONNECTED FOR SERVICE IF FOUND TO CROSS UNDER ANY BUILDING FOUNDATION.
8. WHEN CABLES ARE POSITIONED AT MORE THAN ONE (1) LEVEL IN THE SAME TRENCH, ADDITIONAL IDENTIFICATION TAPE MUST BE PLACED BETWEEN LEVELS.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:		APRIL 1987	
REV	DATE	BY	
1	OCT 2017		

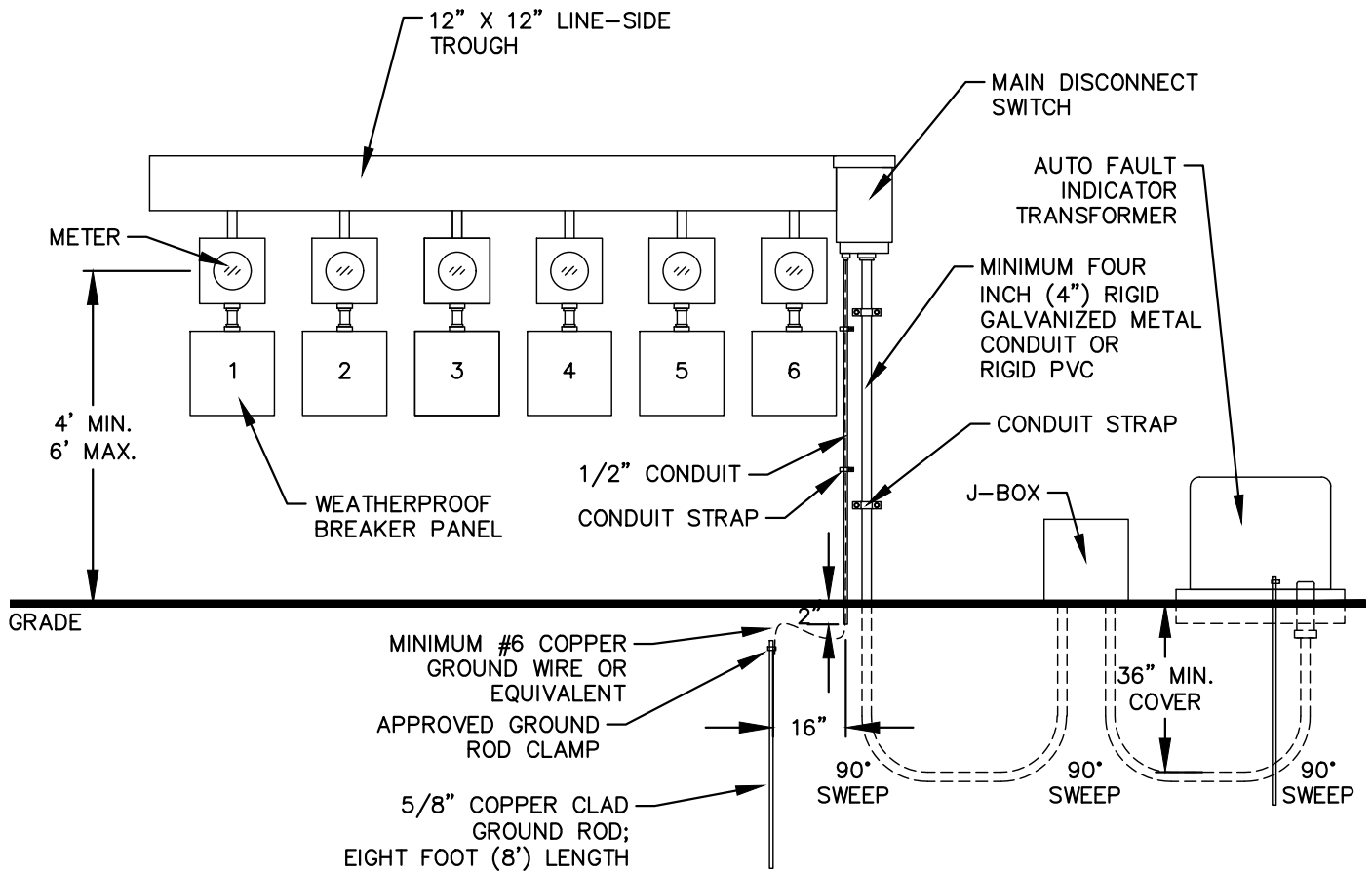
TITLE:	
<b>TRENCH INSTALLATION</b>	
SCALE:	DRAWING No.
NTS	E - 7



**NOTES**

1. METER SHALL BE MOUNTED ON SIDE OF BUILDING AND AT A POINT ACCESSIBLE TO SERVICE LATERAL CONDUCTORS, EXCEPT WHERE METER IS NEXT TO TRANSFORMER.
2. USE MINIMUM TWO INCH (2") CONDUIT AND STRAP SECURELY TO EXTERIOR OF BUILDING WITH TWO (2) STRAPS.
3. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
4. ENCLOSE GROUND WIRE IN 1/2" CONDUIT, ATTACH TO EXTERIOR OF BUILDING WITH TWO (2) STRAPS, CONTINUE CONDUIT TO TWO INCHES (2") BELOW FINAL GROUND GRADE.

	DATE ISSUED: APRIL 1987		TITLE:
	REV	DATE	BY
	1	OCT 2017	
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD	SCALE: NTS		DRAWING No. E - 8



**NOTES**

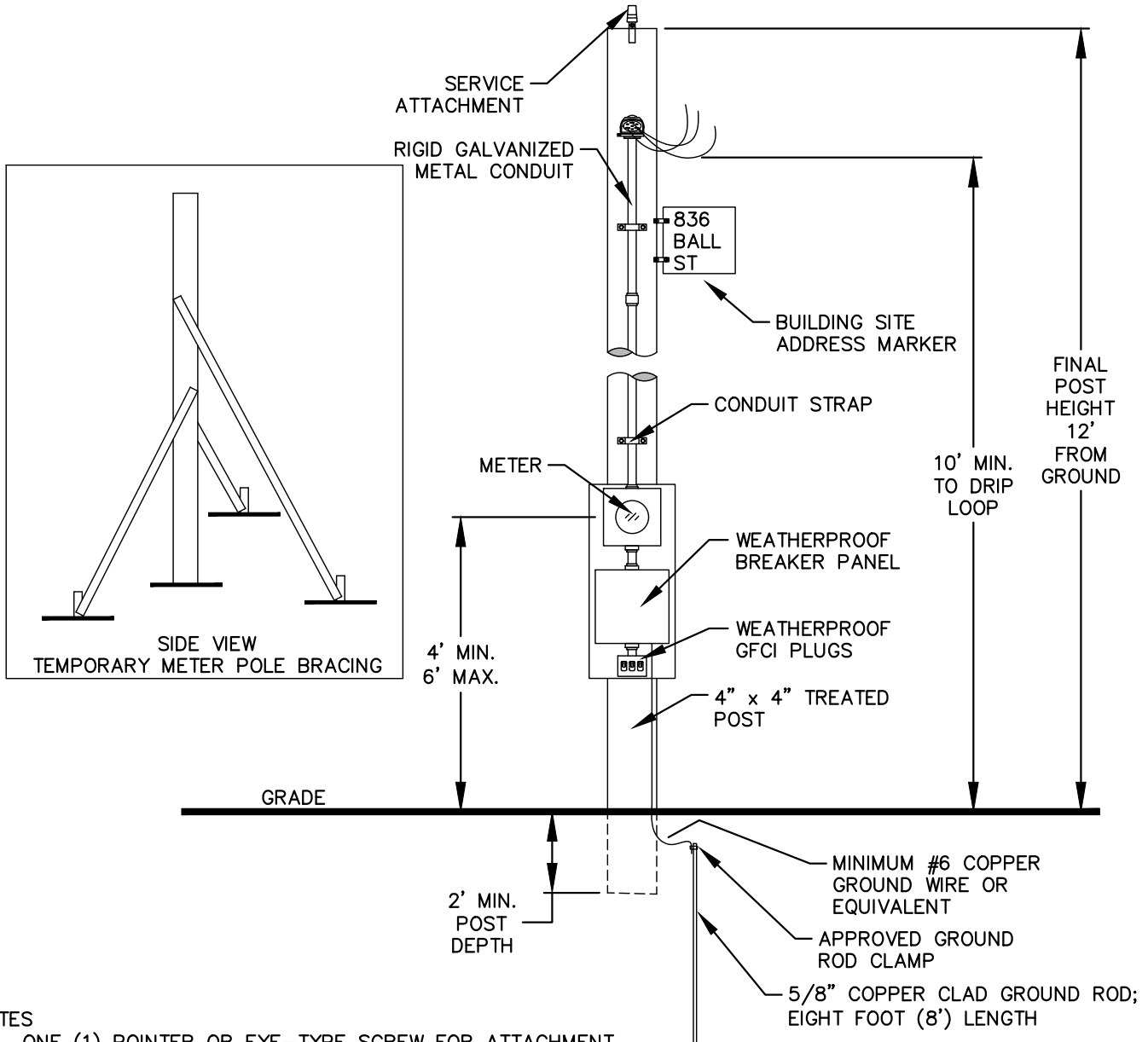
1. FOR WEATHERPROOF SUB-MAIN SWITCHES OR BREAKER PANELS, EACH SWITCH SHALL HAVE PERMANENT TYPE ADDRESS MARKING.
2. TROUGH SHALL BE CONSTRUCTED SO THAT THE CITY OF LOCKHART SEAL CAN BE USED TO PREVENT UNAUTHORIZED ENTRY.
3. MINIMUM 4" CONDUIT SECURELY STRAPPED TO EXTERIOR OF BUILDING WITH TWO (2) STRAPS.
4. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
5. ENCLOSE GROUND WIRE IN 1/2" CONDUIT, ATTACH TO EXTERIOR OF BUILDING WITH TWO (2) STRAPS, CONTINUE CONDUIT TO TWO INCHES (2") BELOW FINAL GROUND GRADE.
6. MULTIPLE METERED SERVICE CONDUCTORS TO BE DETERMINED BY LICENSED ENGINEER.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD


DATE ISSUED:		APRIL 1987	
REV		DATE	BY
1		OCT 2017	

TITLE:	
<b>UNDERGROUND SECONDARY SERVICE MULTIPLE METERING IN APARTMENT COMPLEX</b>	
SCALE:	DRAWING No.
NTS	E - 9

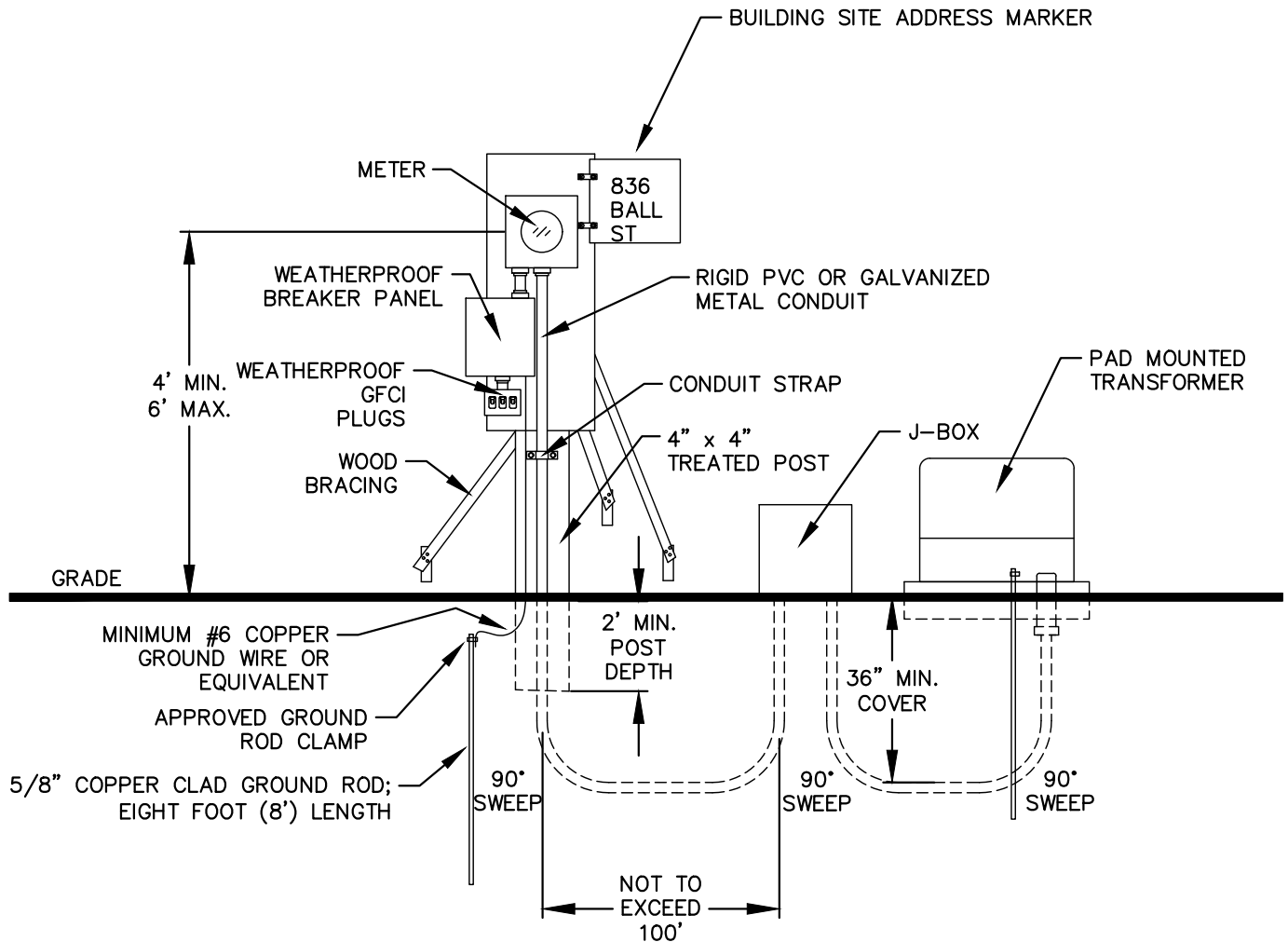


**NOTES**

1. ONE (1) POINTER OR EYE-TYPE SCREW FOR ATTACHMENT.
2. FINAL HEIGHT OF POST IS TWELVE FOOT (12') FROM GROUND.
3. THREE (3) EACH #8 COPPER WIRE, 36" IN LENGTH WITHOUT SPLICES IN 1 1/2" PIPE.—\*THREE (3) WIRE TEMPORARY SERVICE, THW OR EQUIVALENT.
4. ADDRESS OF BUILDING SITE MARKED WITH TWO INCH (2") LETTERS ON EXTERIOR PAINTED PLYWOOD OR MARINE SIGN.
5. 4"x4" TREATED POST BURIED TWO FEET (2") INTO GROUND.
6. THREE (3) LEG WOOD BRACING AGAINST SERVICE (PULL) 2"x4" BRACES AND 2"x4" STAKES.
7. WEATHERPROOF BREAKER PANEL; ONE (1) 240, 30 AMP CIRCUIT, TWO (2) 15 OR 20 AMP, 120 VOLT CIRCUITS; GROUND FAULT CIRCUIT INTERRUPTER REQUIRED.
8. TWO (2) 120 VOLT GROUNDING-TYPE PLUGS AND ONE (1) 240 POLARIZED PLUG—ALL THREE TO BE WEATHERPROOF OR IN WEATHERPROOF METAL BOX.
9. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
10. NOT TO BE PLACED FURTHER THAN 65 FEET (65') FROM EXISTING SECONDARY SERVICE.
11. WHENEVER POSSIBLE, POSITION METER TO FACE THE ROAD OR DRIVEWAY.


	DATE ISSUED: APRIL 1987		TITLE:	
	REV	DATE	BY	<b>OVERHEAD SERVICE TEMPORARY METER LOOP</b>
	1	OCT 2017		
<small>THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD</small>				SCALE: NTS DRAWING No. E - 10

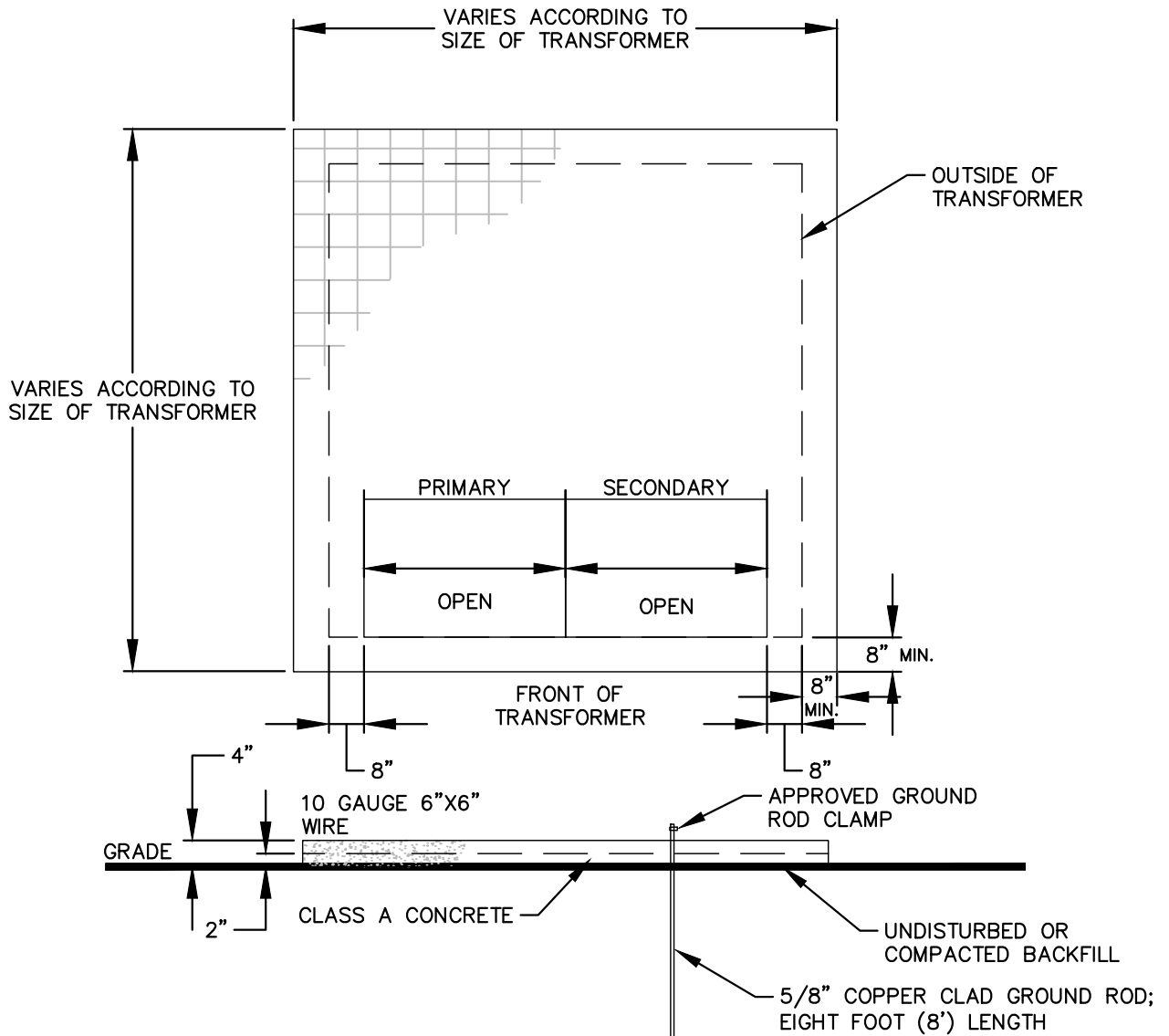




**NOTES**

1. ADDRESS OF BUILDING SITE MARKED WITH TWO INCH (2") LETTERS ON EXTERIOR PAINTED PLYWOOD OR MARINE SIGN.
2. CONNECTIONS SHALL BE MADE ON TOP SIDE OF METER SOCKET.
3. LEADS TO BE FIVE FEET (5') IN LENGTH GOING INTO J-BOX.
4. 4"x4" TREATED POST BURIED TWO FEET (2") INTO GROUND.
5. THREE (3) LEG WOOD BRACING, 2"x4" BRACES AND 2"x4" STAKES.
6. WEATHERPROOF BREAKER PANEL; ONE (1) 240, 30 AMP CIRCUIT, TWO (2) 15 OR 20 AMP, 120 VOLT CIRCUITS; GROUND FAULT CIRCUIT INTERRUPTER REQUIRED.
7. TWO (2) 120 VOLT GROUNDING-TYPE PLUGS AND ONE (1) 240 POLARIZED PLUG-ALL THREE TO BE WEATHERPROOF OR IN WEATHERPROOF METAL BOX.
8. SERVICE GROUNDING FROM THE GROUND ROD TO THE METER SOCKET SHALL BE A MINIMUM #6 COPPER WIRE OR EQUIVALENT.
9. NOT MORE THAN 100 FEET (100') FROM EXISTING SECONDARY SERVICE.
10. WHENEVER POSSIBLE, POSITION METER TO FACE THE ROAD OR DRIVEWAY.

	DATE ISSUED: APRIL 1987		TITLE:	
	REV	DATE	BY	<b>UNDERGROUND SERVICE TEMPORARY METER LOOP</b>
	1	OCT 2017		
THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD		SCALE: NTS	DRAWING No. E - 11	



NOTES

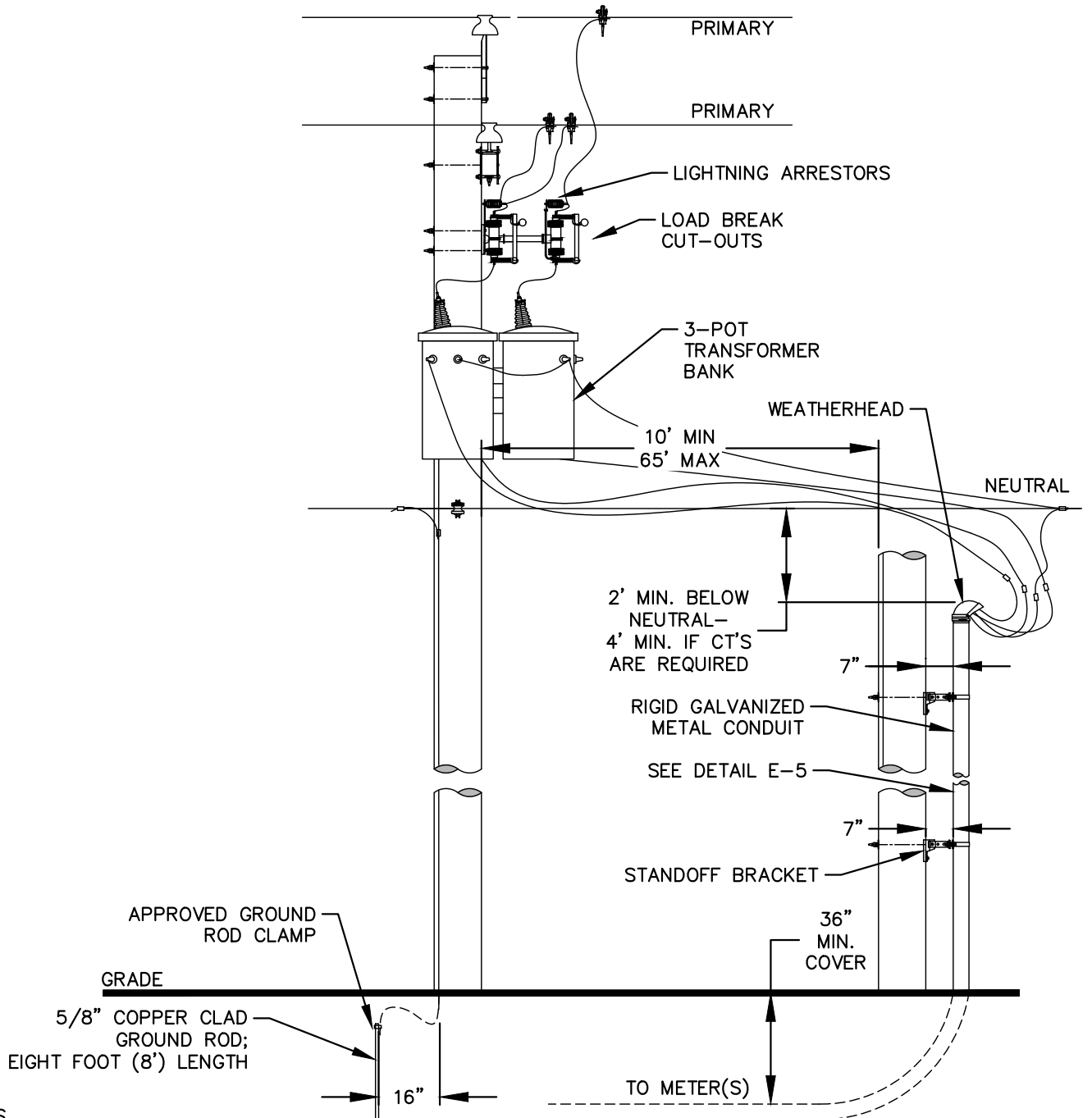
1. 100 KVA OR SMALLER WIRE MESH IS ACCEPTABLE. LARGER THAN 100 KVA REQUIRES #3 REBAR AT 12" O.C., E.W.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987	
REV	DATE	BY
1	OCT 2017	

TITLE:	TYPICAL TRANSFORMER PAD	
SCALE:	NTS	DRAWING No. E - 12



**NOTES**

1. IF TRANSFORMERS ARE NOT LOCATED ON THE SAME POLE, POSITION WEATHERHEAD A MINIMUM OF TWO FEET (2') BELOW TOP OF POLE.
2. TWENTY FOOT (20') MINIMUM TAILS FROM RISER WEATHERHEAD.
3. STANDOFF BRACKETS REQUIRED APPROXIMATELY EVERY TEN (10') FEET ALONG RISER.
4. NO METERS, CONDUITS, RISERS OR DISCONNECTS ARE ALLOWED ON CITY RISER POLE, UNLESS APPROVED BY CITY.
5. NO MORE THAN ONE (1) INSTALLATION OF THIS TYPE ON ONE POLE UNLESS APPROVED BY CITY.
6. MINIMUM 36" COVER FROM GRADE TO TOP OF CONDUIT.
7. IF NECESSARY, CONTRACTOR WILL FURNISH CT'S AND PT'S AND WILL BE INSTALLED BY CITY ELECTRIC DEPARTMENT.



THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD

DATE ISSUED:	APRIL 1987		
REV	DATE	BY	
1	OCT 2017		
2	JAN 2020	JAD	

TITLE:	OVERHEAD PRIMARY TO UNDERGROUND THREE PHASE SECONDARY RISER		
SCALE:	NTS		
DRAWING No.	E - 13		