City of Belton

PUBLIC WORKS
DESIGN MANUAL • STANDARD DETAILS

2019

GENERAL REQUIREMENTS

Authority

Pursuant to Section 20-79 of the City of Belton Code of Ordinances, construction of infrastructure is regulated by this Public Works Design Manual. This Public Works Design Manual (also known as "Manual" herein) is intended to standardize design parameters and construction details in the City of Belton, Texas and the extraterritorial jurisdiction (ETJ) areas of the City. Modifications or departures from these standards shall be identified and supported using sound technical data. All departures and/or modifications to this document must receive final acceptance by the City Engineer.

Pursuant to Section 20-80 of the City of Belton Code of Ordinances, the Department of Public Works can apply additional requirements. All work shall be performed under the supervision of the City Engineer in such a manner and such times as the City Engineer shall prescribe and approve. In the event the design engineer disagrees with the decisions made by the City Engineer, the matter can be appealed to the City Manager for resolution.

General

All topographic, horizontal and vertical data used in the design process shall be based on the City of Belton current Williams-Stackhouse, Inc., NAT83, or LiDAR maps, whichever is the most recent and most complete, including elevation and coordinate data. City of Belton monuments may not be 100% accurate. If an inaccurate City of Belton monument is discovered, the engineer or surveyor should notify the City Engineer.

Changes in State and/or Federal regulations or standards may require modifications to the information contained herein. The user should always be aware of current regulations prior to using this document for design and construction purposes and is responsible for compliance with the most current State and Federal regulations. In the event local, state, or federal regulations are in conflict, the most stringent rule, regulation, or requirement shall govern.

Revisions to this Manual may be adopted periodically. The latest version will be available on the City's website at www.beltontexas.gov.

A maintenance bond is required per the Subdivision Ordinance before subdivisions and developments shall be accepted by the City. All material testing fees and sign assembly fees must be paid before acceptance of the subdivision or development by the City of Belton. The warranty for all completed infrastructure shall be one (1) year from the date of final acceptance by the City of Belton, Texas. Any repairs required within the warranty period will require an additional one (1) year warranty from the date the City accepts the repair work.

Construction activities shall be coordinated with City's On-site Representative 48 hours prior to commencing. A pre-construction meeting may be required before beginning construction.

Use, Modification and Approved Equals

The use of these standards shall be under the supervision and seal of a licensed professional engineer in the State of Texas. Any modification to these standard specifications and drawings shall be clearly noted on engineering plans and documents prepared under the supervision and seal of a Texas licensed professional engineer. Any deviation from the standard details must be submitted and accepted in writing by the City Engineer. Any substitutions for use as an approved equivalent must be submitted in writing and approved during the Final Plat (for private development) and Final Design (for City-projects) stage by the City Engineer.

Minimum Standards

The standards, adopted values, parameters and/or other accepted design data published in this Manual are minimum requirements. Existing conditions and project specifics may require a greater standard of care and the actual design and construction materials may need to be enhanced to assure that proposed infrastructure provides acceptable longevity, relative maintenance free status and general public safety and welfare expected of the engineering profession by Texas statutes and the citizens of Belton, Texas.

Concrete Work – Wash Out Areas

Per Details D-22, a concrete washout must be installed/constructed prior to beginning any concrete work, regardless of the size of project.

ROW Permits

For any work proposed in public rights-of-way or easements, the City of Belton requires a Right-of-Way Permit to be filled out and submitted to the City of Belton Director of Public Works.

Tree Trimming Requirements – only applicable to ROW permits

(a) Always paint fresh wounds on oaks, including pruning cuts and stumps, with a pruning seal spray.
(b) Clean all pruning tools with 10% bleach solution or Lysol™ spray between sites and/or trees.
(c) If possible, avoid pruning or wounding of oaks during the spring (currently defined as February 1 through June 30). Reasons to prune in the spring include:
    i. To accommodate public safety concerns such as hazardous limbs, traffic visibility or emergency utility line clearance.
    ii. To repair damaged limbs (from storms or other anomalies)
    iii. To remove limbs rubbing on a building or rubbing on other branches, and to raise low limbs over a street.
    iv. On sites where construction schedules take precedence; in this case, pruning any live tissue should only be done to accommodate required clearance.
    v. Dead branch removal where live tissue is not exposed.
(d) Pruning for other reasons (general tree health, non-safety related clearance or thinning, etc.) should be conducted before February 1 or after June 30.
(e) Debris from diseased oaks should be immediately chipped or taken away from the site for proper disposal.
(f) Regardless of the reasons or time of year, proper pruning techniques should be used. These techniques include making proper pruning cuts and avoiding injurious practices such as topping or excessive crown thinning.
(g) If you are uncertain about any of this information, consult with a Texas Oak Wilt Certified Arborist, ISA Certified Arborist, or an oak wilt specialist from the county or state government agency such as the Texas A&M Forest Service or Texas A&M AgriLife Extension Service.

Environmental Assessments and Clearance

Refer to the Natural Resources Code of Texas, Title 9 Heritage, Chapter 191 Antiquities Code of Texas. Also, federal permits may be required when infrastructure crosses a creek or wetland.

Per Section 191.0525 (d) of the Texas Antiquities Code, a project for a municipality requires advance project review by the Texas Historical Commission if the project affects a cumulative area larger than five (5) acres or disturbs a cumulative area of more than 5,000 cubic yards, whichever measure is triggered first, or if the project is inside a designated historic district or recorded archeological site.

The City of Belton has a national registered historic district and local historic districts.

This provision applies to subdivisions and developments in addition to City-funded projects. The City of Belton, per Section 191.174 of the Antiquities Code of Texas, is required to cooperate and assist the Texas Historic Commission and attorney general in carrying out the intent of the code.

Review and approval from the Texas Historical Commission and any federal permits must be received prior to approval of the construction plans or site plan for the subdivision or development. The subdivisions/development applicant shall identify important cultural or archeological features such as historical landmarks or burial grounds on the site plans.

No activity which may affect a Registered Texas Archeological or Historical Landmark is authorized until the owner or the project has complied with the provisions of the Antiquities Code of Texas.

If archeological sites or historic structures are discovered after construction operations are begun, the Contractor shall immediately cease operation in the particular area and notify the owner of the project, and the Texas Historical Commission at (512) 463-6100 or (512) 463-6100. The owner of the project shall take reasonable steps to protect and preserve the discoveries until they have been inspected by the City and State. The owner shall promptly coordinate with Texas Historical Commission and any other appropriate agencies to obtain necessary approvals or permits to enable the work to continue. The contractor shall not resume work in the area of the discovery until authorized to do so by the State.

SECTION 1 - TRANSPORTATION

1.01 Streets and Roadways

The purpose of this section is to define the general requirements of public street rights-of-way, pavement widths, pavement thickness, geometric alignments and construction details. As conditions are encountered beyond the scope of this section, coordination with the City of Belton Public Works Department, and approval of the City Engineer is required to establish new requirements and procedures.

A. Master Plan and Thoroughfare Plan

All street design must be in compliance with the City of Belton Comprehensive Master Plan and Thoroughfare Plan.

The Master Plan and Thoroughfare Plan were developed for orderly growth and major deviations from these plans will not be permitted. Requests for minor deviations from these plans shall be addressed through the platting process.

B. Rights-of-Way (ROW)

Refer to the City of Belton Subdivision Ordinance, Thoroughfare Plan and Rights-of-Way Management Ordinance. Typical Sections are provided with this section to depict those widths. Wider rights-of-way may be required if topography challenges, construction of boulevards or state participation projects are anticipated. Variations of ROW widths, including widening shall be approved by the City Engineer. Also, ROW may be increased or lessened subject to the placement and size of utilities to serve adjacent and connecting properties. Final street section design is subject to City Engineer approval.

C. Geometrics

1. Provisions must be made for the extension of arterials, collector streets, and minor streets to provide for circulation of traffic through a subdivision or development; and provisions for local residential streets extensions must be provided to accommodate development.

EXHIBIT 1.1
STREET DESIGN STANDARDS

	Major Arterial	Minor Arterial	Collector	Local/ Residential
Right-of-way	Refer to Typical Section, Thoroughfare Plan, and Subdivision Ordinance		60 - 80 feet	50 feet
Pavement (Curb back to Curb back)	Refer to Typical Section, Thoroughfare Plan, and Subdivision Ordinance		37 - 57 feet	31 or 37 feet
Grade^-Maximum	5%	5%	7%	10%
Grade^-Minimum	0.75%	0.75%	0.75%	0.50%
Sight Distance-Minimum Design Speed (AASHTO Standard)	80 mph	60 mph	50 mph	40 mph
Horizontal Curvature (Minimum Radius)	1800 feet	1000 feet	450 feet	200 feet
*Radius for Curb Return at Intersections	50 feet	50 feet	40 feet	20 feet

*Radii are a function of the width of the approach street width and the receptacle street width
^Grades refer to roadways within public rights-of-way.

2. Vertical Curves
Center line grade changes with an algebraic difference of 2 percent or more shall be connected with vertical curves with a minimum of 200 feet in length, where street lengths permit (i.e. at least 200-feet from an intersection or cul-de-sac). AASHTO design guidelines shall be used to determine the proper vertical curve length based on design speed.

Whenever a cross slope is necessary or desirable from one curb to the opposite curb, such cross slope shall not exceed twelve (12) inches in thirty-one (31) feet. The more common cross slope for streets is 2%. Pedestrian crosswalks of streets may dictate slopes equal to or less than 2%.

3. Street Intersections
The most desirable street intersection is 90 degrees. However existing street patterns may necessitate less than perfect conditions. No major street shall intersect any other major street at an angle of less than 60 degrees. No minor street shall intersect a major street at less than 45 degrees. No local residential street shall intersect any other street at less than 60 degrees.

Curb radii at intersections shall be in conformance with Exhibit 1.1 of this section. See Exhibit 1.1 - Street Design Standards Table for radii for the various street classifications. All radii are measured to the back curb.

Where sidewalks are adjacent to the street intersection, pedestrian ramps shall be constructed to City, State, and Federal Standards (see standard details).

4. Culs-de-Sac and Dead-end Streets
   a) The maximum length of a cul-de-sac or dead-end street with a permanent turnaround shall be per the City's subdivision ordinance.

   b) Turnarounds shall have a minimum ROW radius of 50 feet and a minimum forty (40) foot outside radius at back of curb for single-family and two-family uses, and a minimum right-of-way radius of 60 feet and a minimum fifty (50) foot outside radius at back of curb for all other uses.

   c) Temporary dead-end streets may be approved by the Planning and Zoning Commission if an adequate all-weather turnaround is provided. "Adequate, all-weather turnaround" is defined as a turnaround that is sufficient size to accommodate fire safety, emergency, medical and sanitation vehicles and is of a construction quality comparable to standard road cross-sections.

5. All streets shall be constructed with 24-inch standard concrete curb and gutter as detailed in this section; exception will be the rural section shown herein. Mountable curbs are permitted on drives serving as fire lanes, when approved by the Fire Marshal.

D. Pavement Specifications

1. Materials
   a) Pavement sections may be a combination of lime stabilization, geogrid, crushed limestone base and hot mix asphaltic concrete known as flexible pavement. Pavements also may be constructed of reinforced and jointed concrete paving which is known as rigid pavement. No seal coating of new construction will be allowed as a wearing surface.

   b) Geogrids used in pavements shall be Tensar TX-5, Tensar TX-130-5, or approved equivalent. A representative of the geogrid manufacturer shall be onsite during the initial geogrid installation. All shipments of geogrid shall be accompanied by a mill certificate or affidavit, signed by a legally authorized official from the company manufacturing the geogrid certifying that the material meets all stated chemical, physical, and manufacturing requirements. Minimum lap shall be one foot, based on the strength of the subgrade, or as specified in the geotechnical report. Care shall be taken to ensure that geogrid sections do not separate at laps during construction. Placement of geogrid around corners will require cutting of the geogrid and diagonal lapping to ensure that excessive bulking of grid material does not occur. Where existing geogrid must be cut for new construction, a geotechnical engineer shall specify the backfill and overlap between existing and new geogrid for City Engineer review. Geogrid shall be a pavement option when the subgrade plasticity index is 35 or greater.

c) All crushed limestone base material used shall be Texas Department of Transportation Item 247, Type A Grade 1-2, or better, as defined in the 2014 edition of the Texas Department of Transportation Standard Specifications for Construction of Highways, Streets, and Bridges. However, Item 247, Type A, Grade 2, or better, as defined in the 2004 edition of the Department of Transportation Standard Specifications for Construction of Highways, Streets, and Bridges can also be used. All base material should be compacted in 4-inch (minimum) to 6-inch (maximum) lifts to a minimum of 100% of TEX-113-E density within 2% of the optimum moisture content. Material sample shall be taken from windrow on-site after processing.

d) Any layer of crushed limestone base material (CLBM) for new roadway construction shall be placed, processed, and compacted according to the requirements of this Manual. During construction, the CLBM shall be maintained to the standards stated in this Manual. In the event any layer of CLBM remains exposed more than 30 calendar days after acceptable density and compaction testing, additional testing of the base may be required at the expense of the contractor. Regardless of time the CLBM is exposed, the City Engineer reserves the right to require additional testing of the base material, at the contractor's expense, when rutting, instability, and/or degradation of the base is noticed or witnessed. Any tests that result in unacceptable base conditions will require the contractor to rework the base according to the most recent TxDOT Specification Item No. 251 – Reworking Base Courses.

e) As an option to avoid additional testing of the CLBM, a single layer of chip seal (seal coat) is allowed to be applied to the CLBM using coated rock and prime oil of AC 10 at a rate of 0.35 gallons per square yard and aggregate shall be Grade 5 topping rock applied at a rate of 1 cubic yard per 110 square yards. The use of asphalts, oils, and emulsions shall be per the engineer's recommendations and approved by the City Engineer. The application of this type of chip seal shall only be used when ambient temperatures are 50F and rising. Other factors, such as forecast and humidity, may also dictate when chip seal can be placed. The chip seal layer shall be properly swept prior to HMAC application. In the event a street is to receive a chip seal layer during seasons of cool weather, the contractor shall propose a TxDOT-approved emulsion or oil to the City Engineer for approval before use. The application of cool weather chip seal shall be per the TxDOT specifications and at temperatures greater than 40F and rising.

f) In the event prime oil is used on prepared base, the prepared base shall be primed when the base is 2% less than the optimum moisture content. Prime oil shall cure a minimum of 48 hours before asphalt can be laid, or as otherwise approved by the City Engineer. If asphalt emulsion prime is recommended and used, the mixture shall be 60% oil to 40% water ratio by weight and a target application rate of 0.25 gallons per square yard.

g) Hot mix asphaltic concrete surface course material shall be Texas Department of Transportation Item 340, Type "D" or "C". Type 341 is also allowed. If Type 310 is proposed to be used, design submittals are required for all projects to determine if the mix is correct. The HMAC test results must be from a recent test. Recycled

Asphalt Product (RAP) is allowed as long as the HMAC product meets the TxDOT specifications.

h) For street maintenance purposes, chip seal as a wearing surface shall follow the above specifications with the exception of the grade of chip or rock. If chip seal is to be used as the wearing surface for the City seal coating program, Grade 4 chip shall be used.

2. Design

a) All pavements shall be designed by a geotechnical engineer or pavement design engineer, licensed in the State of Texas, based on representative soils data taken in the field and that satisfy requirements of this section. Design life for the pavement shall be a minimum of twenty (20) years. The assumptions, formulas and calculations for the pavement design shall be submitted with the geotechnical report and not just the results of those procedures.

b) Groundwater shall be assessed during the geotechnical investigation stage. French drains or under drains shall be considered and designed for all street pavement structures where the groundwater, existing pervious soils, or other conditions prove to be a long term issue for the integrity of the pavement structure.

c) If the subgrade has a plasticity index of 20 or greater and the soils are classified as a clay soil, at least one of the following improvement methods shall be used:
   a. Lime stabilization;
   b. Geogrid; or
   c. Removal of the high plasticity soils; replacement material shall be specified by the geotechnical engineer.

d) All pavement designs shall follow those procedures used by the Texas Department of Transportation (TxDOT) or The American Association of State Highway and Transportation Officials (AASHTO) for flexible and rigid pavements. All sub-grade materials shall be assigned a California Bearing Ratio (CBR) for design purposes.

e) Pavement structure behind the curb and gutter shall extend a minimum of twenty-four (24) inches in length at a minimum depth of four (4) inches under curb unless more is recommended by the pavement design engineer.

Street Type	Minimum Design 18 – Kip Axle Repetitions*
Major Arterial	800,000
Minor Arterial	500,000
Collector	200,000
Local/Residential^{+}	30,000

*Based on traffic counts and projections
$^{+}$Includes culs-de-sac

f) Subgrade
   a. All vegetation, tree roots, and unsuitable materials must be removed.

b. Scarify and re-compact the subgrade to at least 100% of TEX-113-E or TEX-114-E, depending on the soils per the geotechnical engineer, at a moisture content range of 0 to +3% of optimum.
c. Additional fill to raise the grade must be compacted in 6-inch lifts with these same compaction and moisture requirements.
d. Lime stabilization of the subgrade must be compacted with these same compaction and moisture requirements, and must be installed in accordance with TxDOT Item 260. Depth checks must be performed to verify that lime does not extend below the depth specified by the pavement designer.

g) Concrete used for concrete pavements and valley gutters shall have a 28-day compressive strength of 3,600 PSI or a 14-day flexural strength of 500 PSI. Sawcut joints must be made within eight (8) hours of concrete placement.

h) Curb and gutter shall cure a minimum of seven (7) days prior to installation of base course.

E. Construction Drawings

All construction drawings shall show the plan view, the profile view, and cross sections of proposed streets, subject to local or proposed site conditions. For City's capital improvement projects only, provide section cuts every 100 feet to identify cut and fill and changes in drainage patterns and design. All plan, profile, and cross section plans shall be labeled with mean sea level elevations, percent slopes, top of curb elevations (top of pavement elevations), and all effective dimensioning as approved by the City Engineer. For areas within the floodplain, a grading plan will be required for all buildings and lots. All radii returns and cul-de-sac improvements shall be shown with designed elevations at the Point of Curvature, Point of Tangency and regular locations along the edge of pavement or curb lines as approved by the City Engineer. Stop bars, pavement markings, and street signage are required and shall be shown on the plans per TxDOT Standard Pavement Marking Details.

F. Signage

1. Street signs shall be required at all intersections. Signs shall conform to current City sign standards and the standards set forth in the current Texas Manual on Uniform Traffic Control Devices for Streets and Highways.

a) Sign colors shall be approved by the City Engineer.
b) Street signs shall have 9-inch blades with 6-inch letters on street names. In addition to the street name, the street type (Street – ST, Drive – DR, Boulevard – BLVD, Circle – CIR, etc.) and block number shall be identified.
c) Street sign posts shall be 14-gauge steel, unless otherwise approved by the City Engineer.
d) An additional 'No Outlet' blade is required at intersections with a cul-de-sac or streets with no outlet.
e) The City will purchase and install all signage per the Fee Ordinance.

1.02 Sidewalks

A. Sidewalks are required in conformance with the Subdivision Ordinance. Sidewalk ramps for

handicap access shall be required at each intersection of a sidewalk and a street and comply with current Texas Department of Licensing and Regulation (TDLR) and Americans with Disabilities Act (ADA) Requirements.

B. Construction plans which include pedestrian facilities shall be submitted to the TDLR and receive TDLR approval/certification prior to construction, if applicable. If the estimated construction costs is $50,000 or more, a TDLR inspection is required per TDLR rules and regulations. For developments and subdivisions, costs for TDLR review and post-construction inspection shall be the developer's responsibility.

C. Sidewalks shall conform to the following standards:

1. Be parallel to the right of way line, located in the dedicated right-of-way or permanent access easement;
2. Have a continuing, common, non-slip surface that is not interrupted by steps or abrupt changes in level.
3. Have a gradual adjustment in level when approaching an intersecting street or parking area with a common level at the point of such intersection;
4. Sidewalk ramps are required at all street intersections including on the "through" street at "T" intersections; and
5. Be doweled into existing curbing or inlets, as applicable;
6. Meet current TDLR and ADA requirements.

D. The area between the curb and the sidewalk shall be excavated or filled to provide a uniform grade comparable to the adjacent street grade and shall be located so that the ground level at the right-of-way line is no more than two (2) feet, nor less than three (3) inches, above or below the adjacent curb grade.

E. Pedestrian and bicycle facilities shall be constructed in conformance with current City Design Standards. Pedestrian facilities shall have barriers (i.e. bollards, curbs, etc.) to prevent motor vehicle access, and bicycle facilities shall have pavement markings in conformance with the current edition of the Texas Manual on Uniform Traffic Control Devices for Streets and Highways.

F. Pedestrian handrails conforming to TxDOT standards are required wherever the grade adjacent to a sidewalk or pedestrian and bicycle facility exceeds 4H:1V with a vertical drop greater than one (1) foot.

G. Variances in texture, grade or alignment must be approved by the Texas Department of Licensing and Regulation (TDLR) in writing prior to consideration of the variance by the City Engineer.

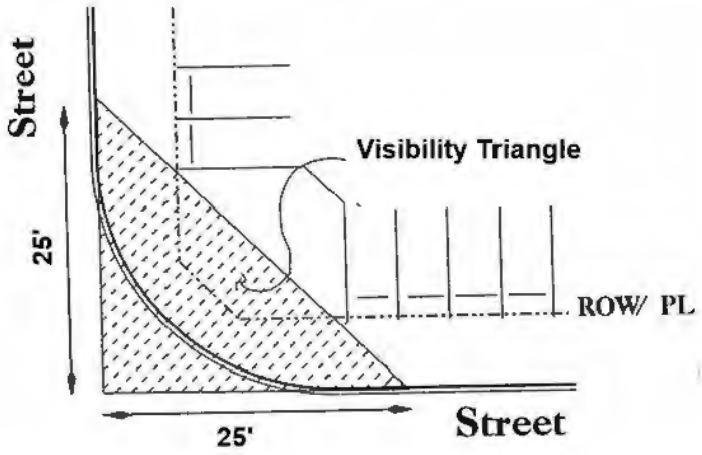
1.03 Visibility Triangle

A. A visibility triangle is defined as a triangular area formed by connecting together the point of intersection of an adjacent street curb line (or, if there is no street curb, what would be the normal street curb line) and points on each the street curb lines, 25 feet from the intersection in both directions.

B. No structures shall be placed on or within visibility triangles. No landscaping shall be

allowed to grow in such a manner as to limit or obstruct the sight distance of motorists entering or leaving the intersection.

C. The visibility triangle is depicted by the following as an example:



1.04 Materials Requirements for Transportation Improvements

A. Domestic Products
All iron, steel and manufactured components/materials used in any infrastructure project within the City of Belton or the City of Belton ETJ shall be manufactured in the United States of America. Proof of the manufacturer location shall be provided to the City Engineer prior to installation of components/materials. The City Engineer may waive this requirement when said City Engineer deems the waiver is in the best interest of the City of Belton.

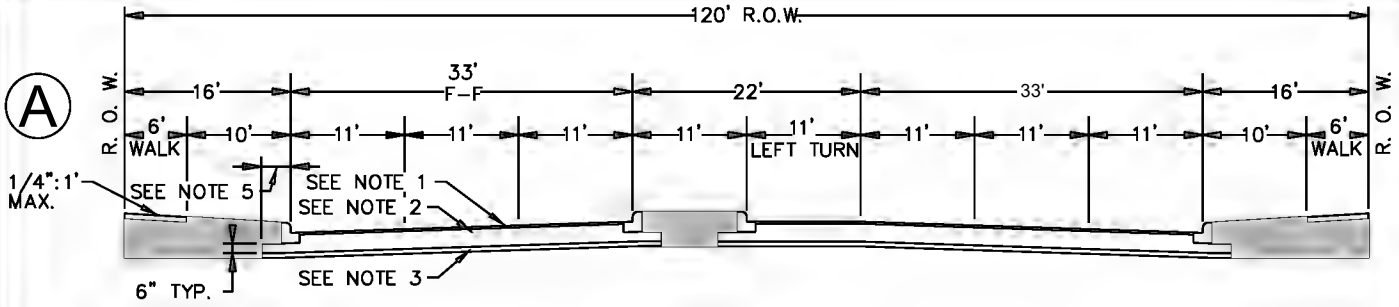
B. Concrete and Reinforcement Items
All concrete shall have a minimum 28-day compressive strength of 3,000 psi unless otherwise noted on the plans, specifications or other written document. Water shall not be added to the concrete after inspection and testing. Placed concrete shall be vibrated when necessary depending on slump, space available for concrete placement and depth of placement. The slump of concrete shall be placed at slumps per the Texas Department of Transportation Specifications for the Construction of Highways, Streets and Bridges under Item 420 with respect to the type of concrete structure being constructed.

Steel reinforcement shall be billeted conforming to ASTM specifications A615 Grade 60 or the latest revision to the ASTM A615 specification. All rebar shall be 2" from inside of form. Reinforcement shall be adequately supported, spaced and secured before placing the concrete. The reinforcement support system (metal support chairs) shall be as manufactured by Dayton Superior, models CHCP or CHCV, or equivalent and as noted in the details of the Transportation Section. The height of the metal support chairs shall generally be no more than one-half of the concrete thickness. The height of the metal support chairs shall be reviewed and approved by the City Engineer. Reinforcing steel shall be placed in accordance with ACI Standards with overlaps of 40 bar diameters. Rebar chairs shall be placed on 48-inch maximum spacing each way.

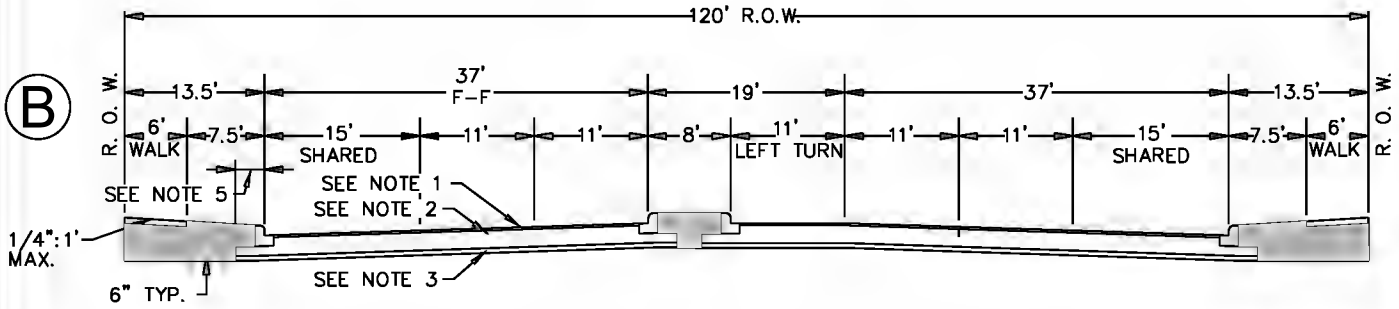
1.05 Traffic Control Plans

Traffic Control Plans are required for all collectors or arterials that are affected and may be required for local streets as requested by the City Engineer. Traffic Control Plans shall conform to the following requirements:

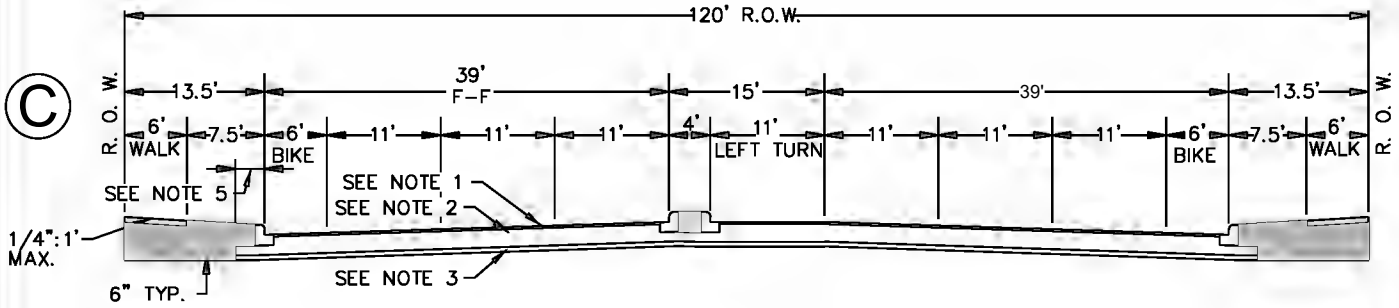
1. Plans must conform to current Texas Manual on Uniform Traffic Control Devices (TMUTCD);
2. Plans must clearly depict each construction stage or phase;
3. Plans must be designed and signed and sealed by a licensed professional engineer in the State of Texas;
4. Plans must be submitted to the City of Belton and to TxDOT (when appropriate) with construction submittals; and
5. All road closures shall meet TxDOT standards for road closures.



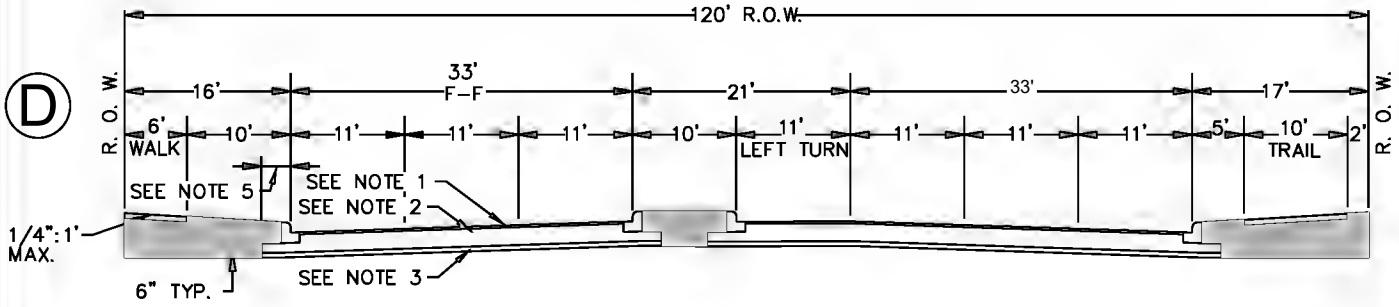
MAJOR ARTERIAL - 6 LANE DIVIDED ROADWAY, NO BIKE LANES, 6' SIDEWALKS



MAJOR ARTERIAL - 6 LANE DIVIDED ROADWAY, SHARED BIKE LANES, 6' SIDEWALKS



MAJOR ARTERIAL - 6 LANE DIVIDED ROADWAY, 6' BIKE LANES, 6' SIDEWALKS



MAJOR ARTERIAL - 6 LANE DIVIDED ROADWAY, NO BIKE LANES, 6' SIDEWALK ON ONE SIDE, 10' HIKE AND BIKE TRAIL ON OTHER SIDE

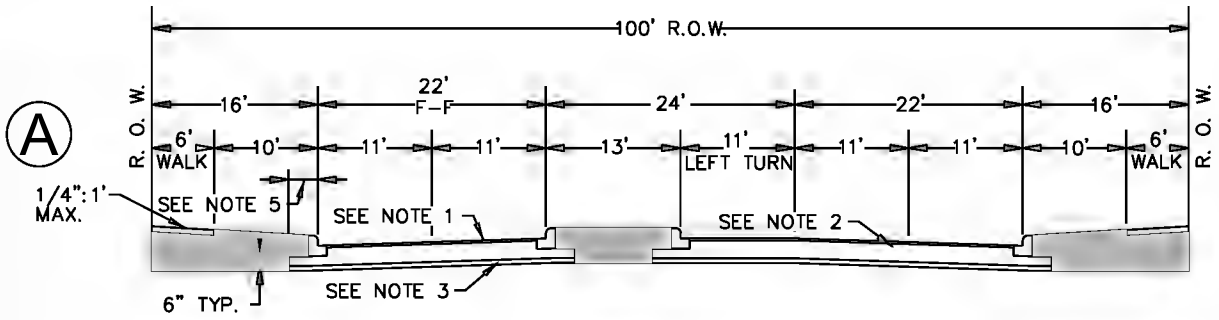
SEE SHEET T-05 FOR NOTES

CITY OF BELTON, TEXAS

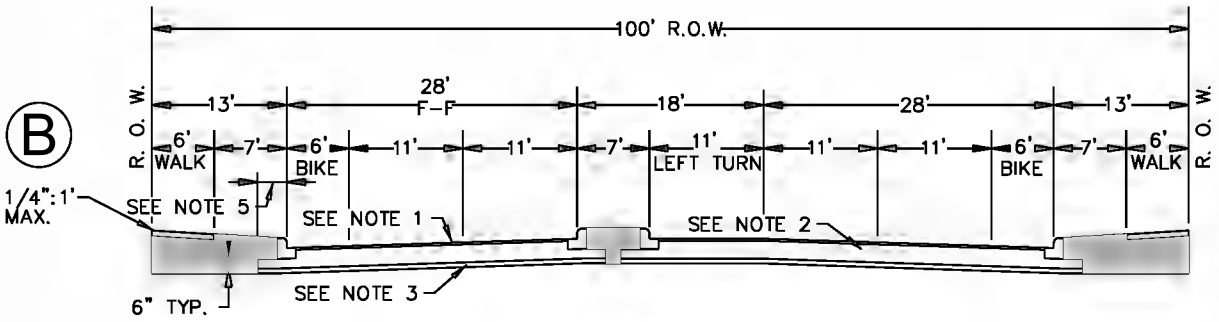
DEPARTMENT OF PUBLIC WORKS

TYPICAL SECTIONS
MAJOR ARTERIAL

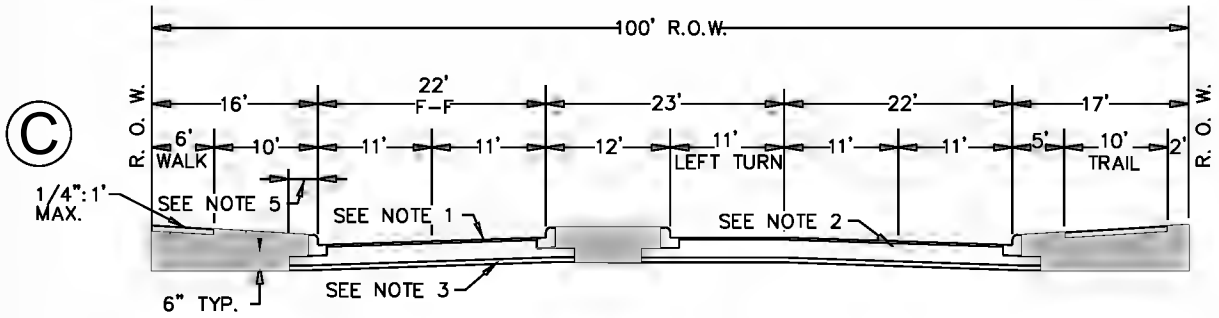
CONSTRUCTION STANDARDS AND DETAILS



MINOR ARTERIAL - 4 LANE DIVIDED ROADWAY, NO BIKE LANES, 6' SIDEWALKS



MINOR ARTERIAL - 4 LANE DIVIDED ROADWAY, 6' BIKE LANES, 6' SIDEWALKS



MINOR ARTERIAL - 4 LANE DIVIDED ROADWAY, NO BIKE LANES, 6' SIDEWALK ON ONE SIDE, 10' HIKE AND BIKE TRAIL ON OTHER SIDE

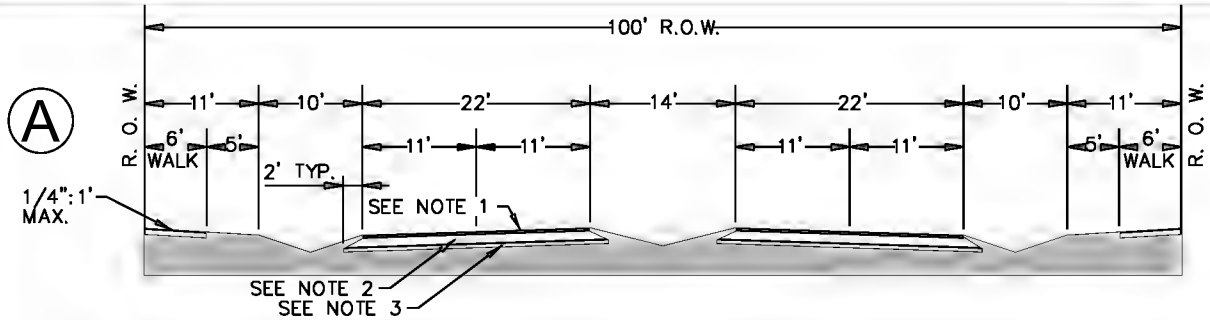
SEE SHEET T-05
FOR NOTES

CITY OF BELTON, TEXAS

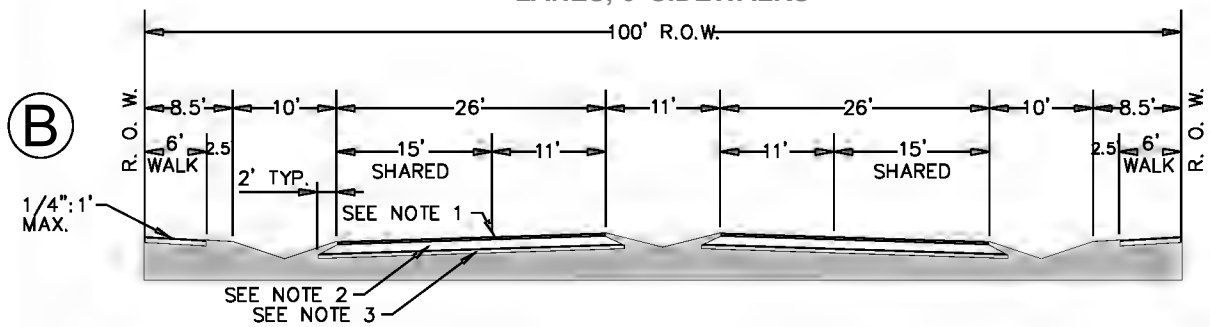
DEPARTMENT OF PUBLIC WORKS

TYPICAL SECTIONS
MINOR ARTERIAL

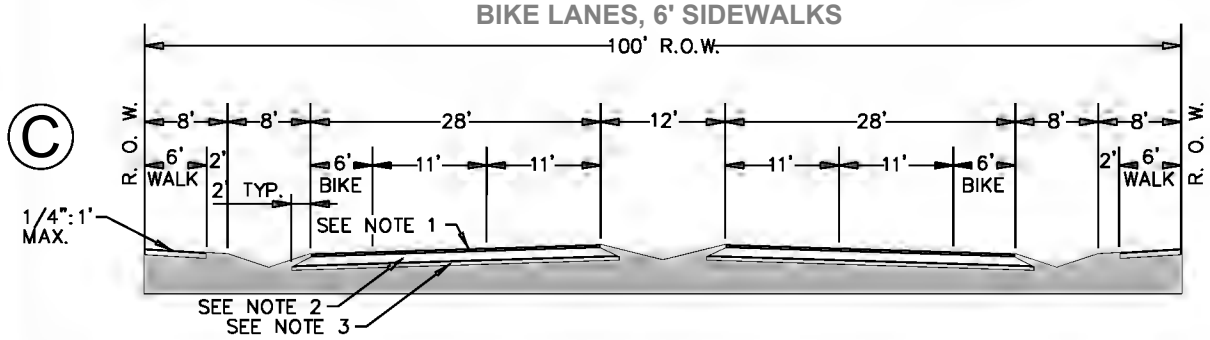
CONSTRUCTION STANDARDS AND DETAILS



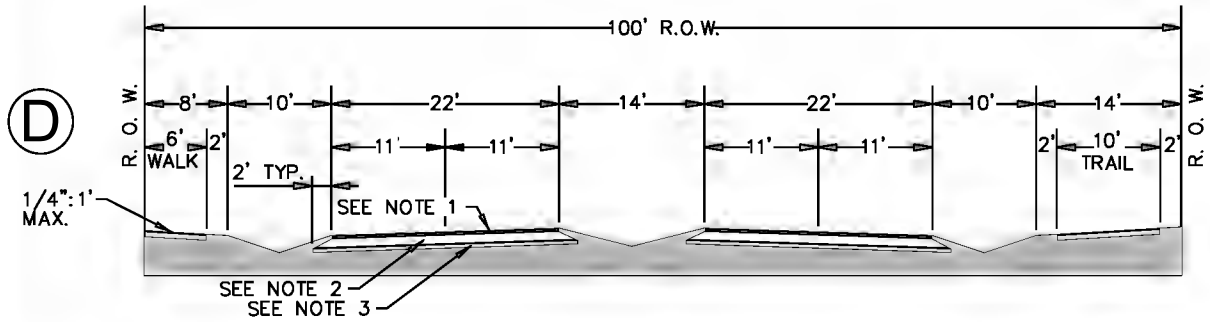
MINOR ARTERIAL (RURAL CROSS SECTION) - 4 LANE DIVIDED ROADWAY, NO BIKE LANES, 6' SIDEWALKS



MINOR ARTERIAL (RURAL CROSS SECTION) - 4 LANE DIVIDED ROADWAY, SHARED BIKE LANES, 6' SIDEWALKS



MINOR ARTERIAL (RURAL CROSS SECTION) - 4 LANE DIVIDED ROADWAY, 6' BIKE LANES, 6' SIDEWALKS



MINOR ARTERIAL (RURAL CROSS SECTION) - 4 LANE DIVIDED ROADWAY, NO BIKE LANES, 6' SIDEWALK ON ONE SIDE, 10' HIKE AND BIKE TRAIL ON OTHER SIDE

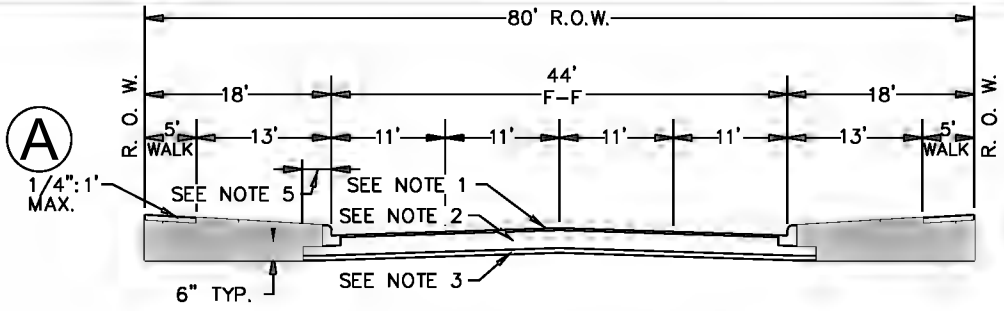
SEE SHEET T-05 FOR NOTES

CITY OF BELTON, TEXAS

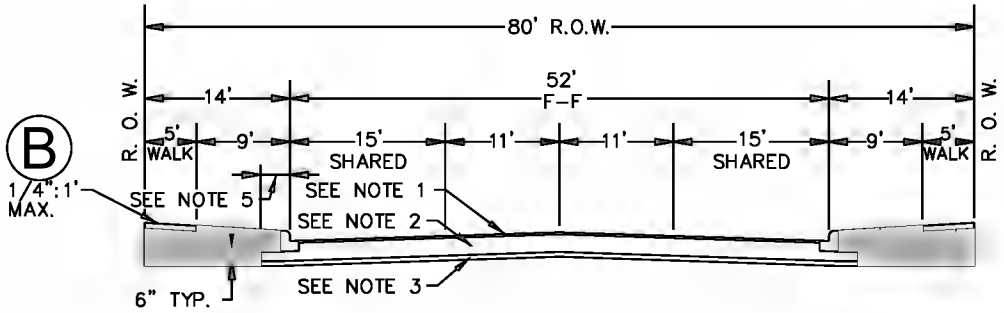
DEPARTMENT OF PUBLIC WORKS

TYPICAL SECTIONS
MINOR ARTERIAL (RURAL)

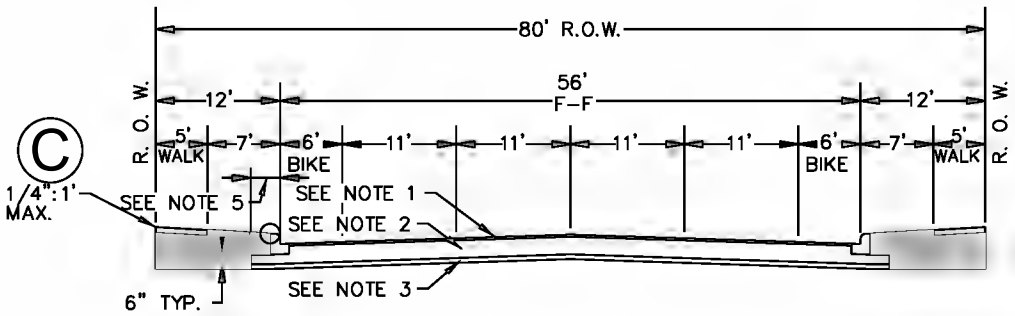
CONSTRUCTION STANDARDS AND DETAILS



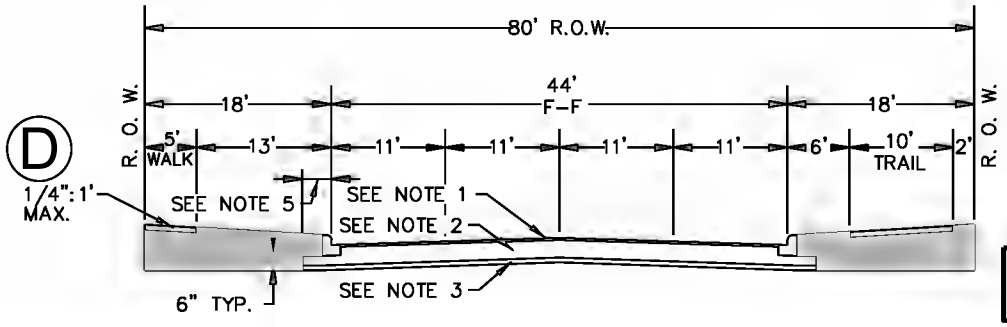
MAJOR COLLECTOR - 4 LANE UNDIVIDED ROADWAY, NO BIKE LANES, 5' SIDEWALKS



MAJOR COLLECTOR - 4 LANE UNDIVIDED ROADWAY, SHARED BIKE LANES, 5' SIDEWALKS



MAJOR COLLECTOR - 4 LANE UNDIVIDED ROADWAY, 6' BIKE LANES, 5' SIDEWALKS



SEE SHEET T-05
FOR NOTES

MAJOR COLLECTOR - 4 LANE UNDIVIDED ROADWAY, 5' SIDEWALK ON ONE SIDE,
10' HIKE AND BIKE TRAIL ON OTHER SIDE

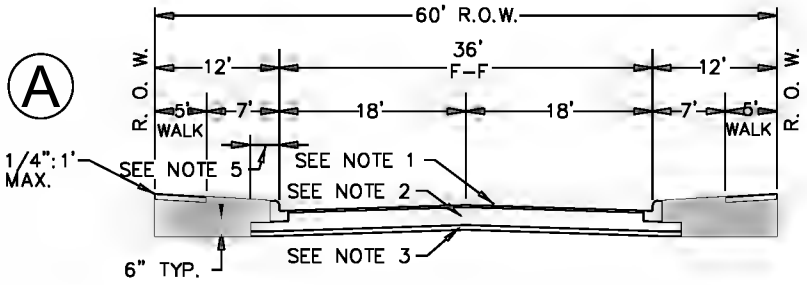
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

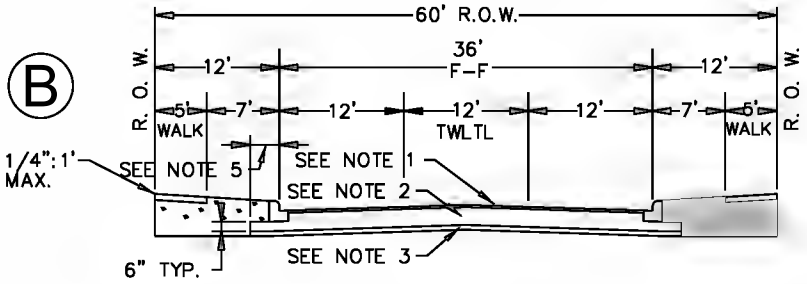
TYPICAL SECTIONS
MAJOR COLLECTOR

CONSTRUCTION STANDARDS AND DETAILS

MINOR COLLECTOR

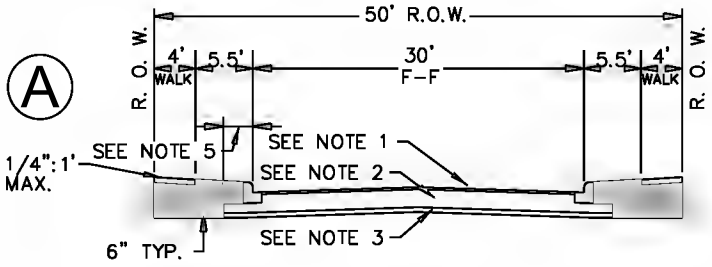


MINOR COLLECTOR - 2 LANE UNDIVIDED, SHARED BIKE LANE, 5' SIDEWALKS



MINOR COLLECTOR - 2 LANE UNDIVIDED W/ TWO-WAY LEFT-TURN LANE (TWLTL), NO BIKE LANES, 5' SIDEWALKS

LOCAL ROADWAY



LOCAL ROADWAY - 2 LANE UNDIVIDED, 4' SIDEWALKS

NOTES:

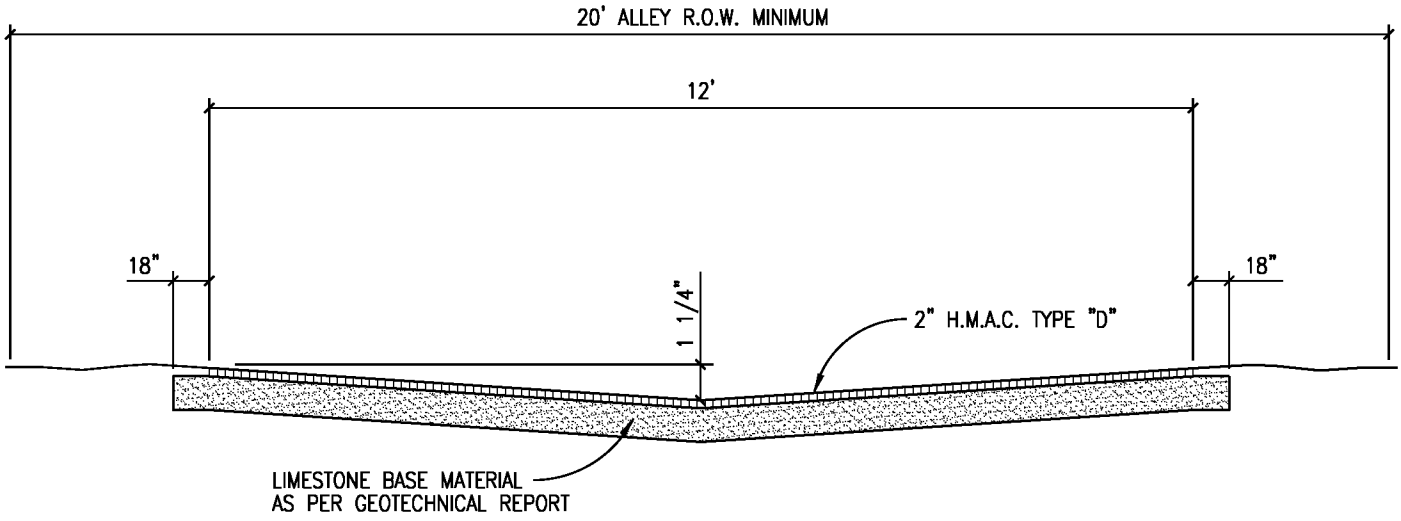
1. MINIMUM 1-1/2" TYPE "D" HOT MIX ASPHALTIC CONCRETE (HMAC) FOR LOCAL STREETS. MINIMUM 2" TYPE "D" OR "C" HMAC FOR COLLECTOR AND ARTERIAL STREETS. A MINIMUM DEPTH OF 2" IS REQUIRED FOR TYPE "C" REGARDLESS OF STREET CLASSIFICATION.
2. FLEXBASE, SHALL BE PLACED IN LIFTS NOT LESS THAN FOUR (4) INCHES AND NOT EXCEEDING SIX (6) INCHES COMPACTED DEPTH AND TO A MINIMUM 100% OF THE MAXIMUM DENSITY AS DETERMINED BY TEX-113-E. THE BASE MATERIAL SHALL BE PLACED AT OPTIMUM MOISTURE ±2%.
3. LIME STABILIZATION OR GEOGRID MAY BE USED TO REDUCE BASE MATERIAL THICKNESS WHEN PRESCRIBED BY A QUALIFIED GEOTECHNICAL REPORT.
4. COMBINED THICKNESS OF FLEXIBLE BASE COURSE, TREATED SUBGRADE OR SUBBASE SHALL BE AS REQUIRED TO SUPPORT TRAFFIC LOADS AND VOLUME ON SUBGRADE.
5. SUBGRADE/BASE SHALL BE EXTENDED 2'-0" BEHIND CURB FOR ALL STREET SECTIONS, AND SHALL BE COMPACTED.
6. SUBGRADE SHALL BE COMPACTED AND MAINTAINED AT OPTIMUM MOISTURE OR ABOVE PRIOR TO PLACING BASE MATERIAL.
7. ARTERIALS AND MAJOR COLLECTORS SHALL TYPICALLY HAVE A 1/4" PER FOOT STRAIGHT CROWN (5.5" HEIGHT). CROWN HEIGHT FOR MINOR COLLECTORS AND LOCAL ROADWAYS SHALL BE 4.5" AND 3.7", RESPECTIVELY.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

TYPICAL SECTIONS
MINOR COLLECTOR/LOCAL ROADWAY

CONSTRUCTION STANDARDS AND DETAILS



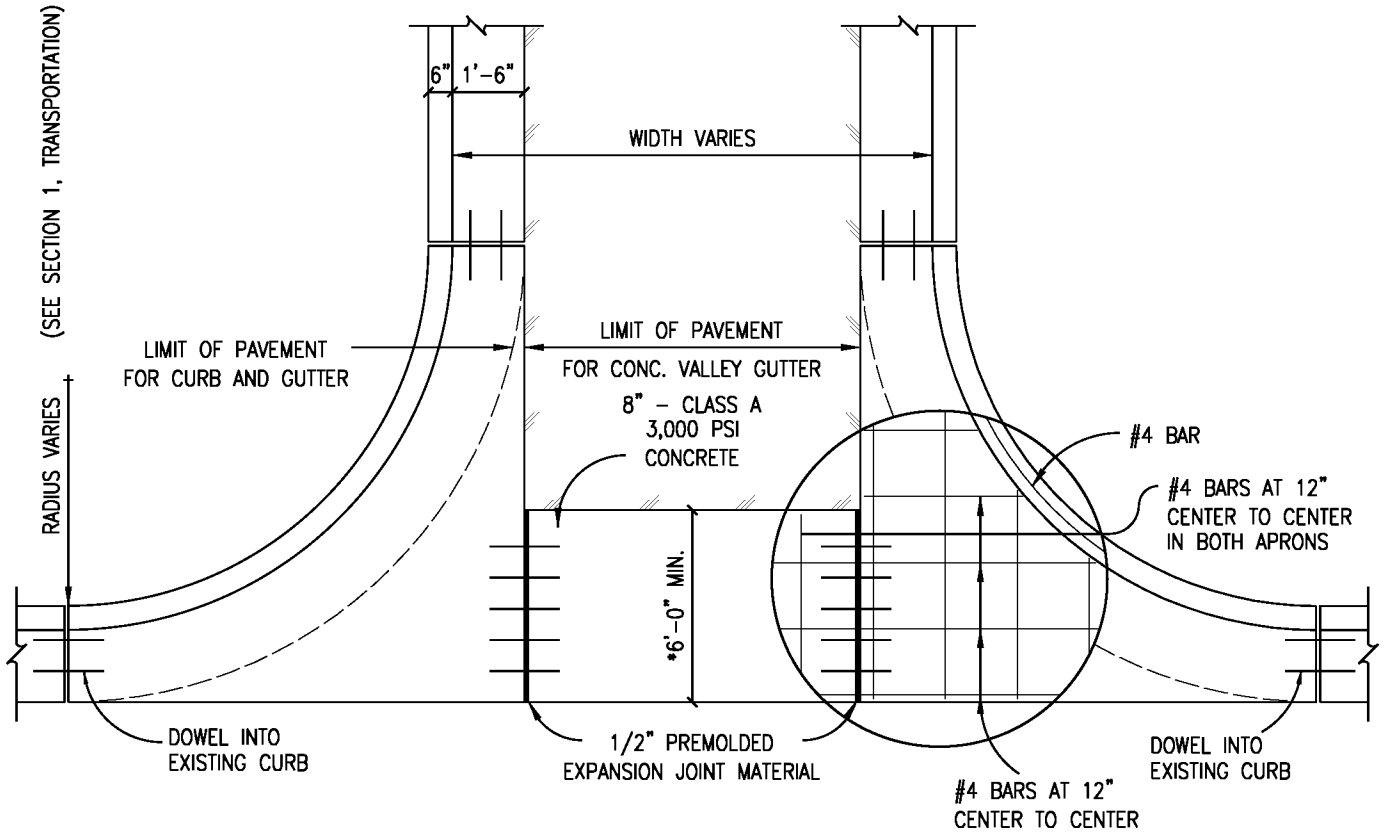
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

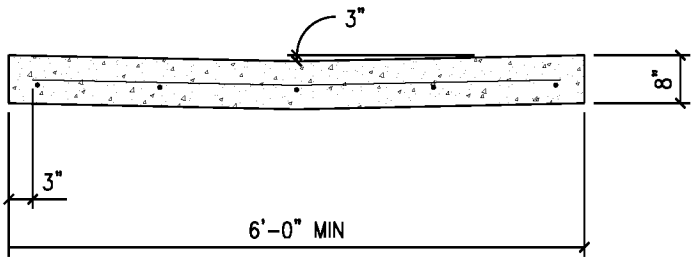
ALLEY WAYS

CONSTRUCTION STANDARDS AND DETAILS

T-06
SCALE: N.T.S.
ISSUE DATE: 5-28-19

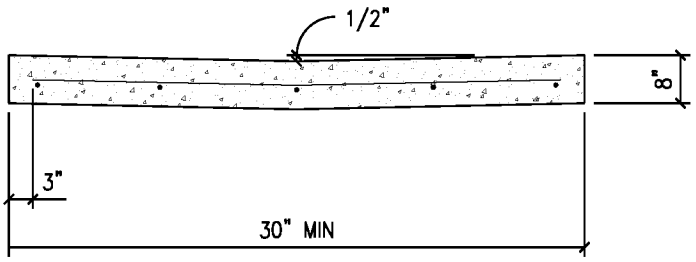


VALLEY GUTTER DETAIL FOR MID-BLOCK CROSSINGS, ARTERIAL STREETS, COLLECTORS, CROSSING PERPENDICULAR TO TRAFFIC FLOW



* FOR COLLECTORS AND ARTERIALS, CURB RETURN WIDTHS SHALL EXTEND TO PT OF RADIUS

VALLEY GUTTER DETAIL FOR RESIDENTIAL



*30" TYPICAL FOR RESIDENTIAL STREETS

NOTES:

1. CONCRETE RADIUS UNITS AND CONCRETE VALLEY GUTTERS ARE REQUIRED FOR ALL NEWLY CONSTRUCTED INTERSECTIONS, WHEN STORMWATER FLOWS ACROSS THE INTERSECTION.
2. ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.
3. REFER TO T-09 AND T-20 FOR DOWEL REQUIREMENTS.
4. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

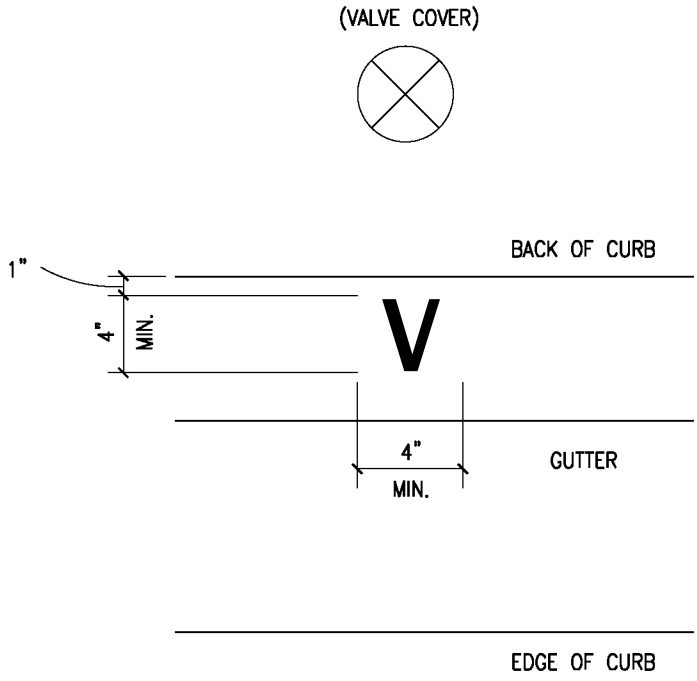
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

STREET INTERSECTION AND VALLEY GUTTER STANDARD

CONSTRUCTION STANDARDS AND DETAILS

T-07
SCALE: N.T.S.
ISSUE DATE: 5-28-19



PLAN VIEW

(TYPICAL)

NOTES:

1. ALL WATER SERVICE, WASTEWATER SERVICE, EMPTY CASINGS, AND VALVE LOCATIONS SHALL BE APPROXIMATELY MARKED AS FOLLOWS:

WATER SERVICE	"W"	FACE OF CURB*
WASTEWATER SERVICE	"S"	FACE OF CURB*
VALVE	"V"	FACE OF CURB*
EMPTY CASING	"C"	FACE OF CURB*

2. LETTERS SHALL HAVE A 1/4" – 1/2" STROKE WIDTH.
3. LETTER SHALL BE ETCHED, NOT PAINTED.

* IF NO CURB, INSTALL AND ETCH MARKER IN 1'x1'x 8" OR 1' DIAMETER BY 8" THICK CONCRETE BLOCK

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

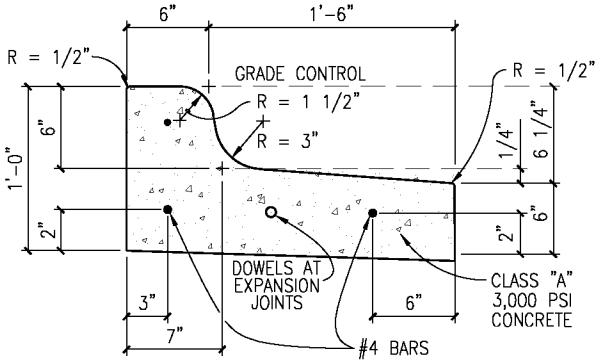
CURB STAMP STANDARD

CONSTRUCTION STANDARDS AND DETAILS

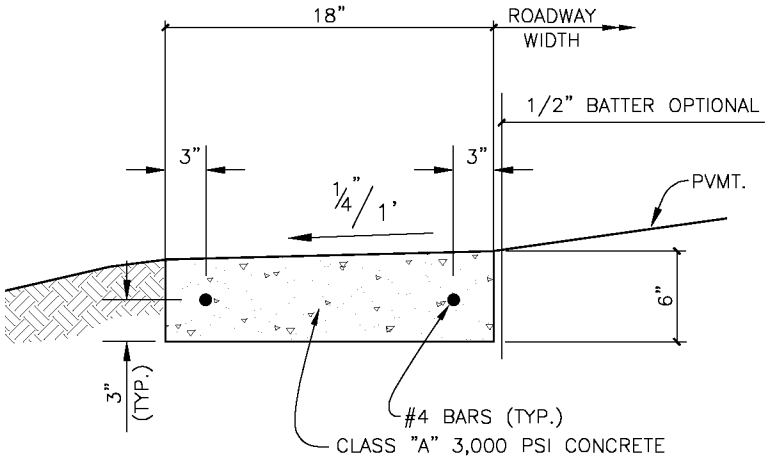
T-08

SCALE: N.T.S.

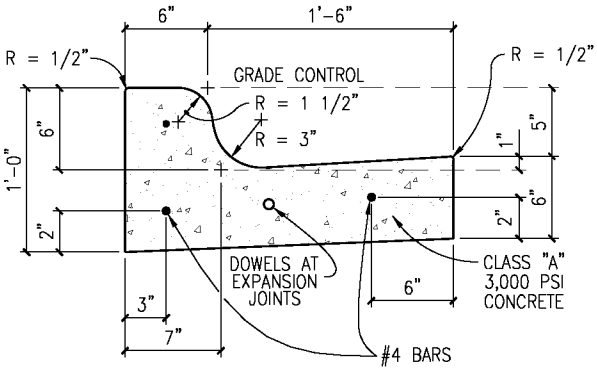
ISSUE DATE: 5-28-19



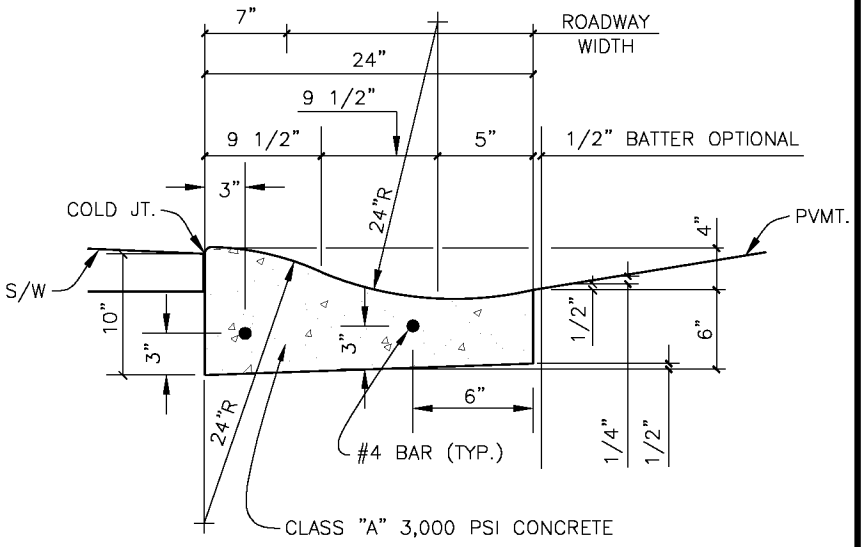
SPILL CURB



RIBBON CURB

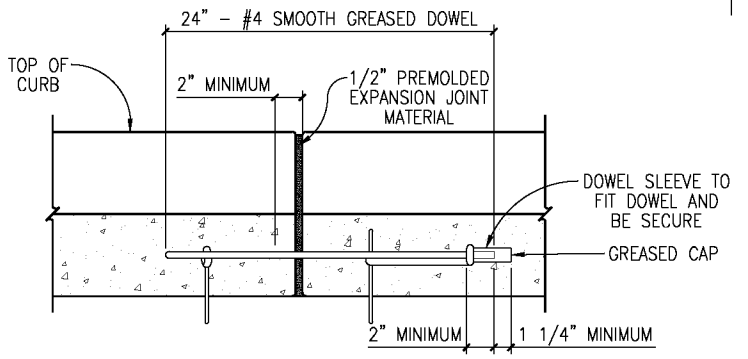


CATCH CURB



MOUNTABLE CURB*

* MOUNTABLE CURBS ARE NOT A STANDARD CURB AND WILL ONLY BE APPROVED WHEN DEMONSTRATED THAT SPILL OR CATCH CURBS CANNOT BE INSTALLED.



CURB DOWEL DETAIL

DOWELS SHALL BE SPACED EVERY 40 LF.

2 DOWELS ARE REQUIRED; ONLY 1 IS SHOWN IN DETAIL FOR CLARITY.

ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.

REFER TO DETAIL D-22 FOR CONCRETE WASHOUT AREAS, WHICH IS REQUIRED BEFORE ANY CURB WORK CAN BEGIN.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

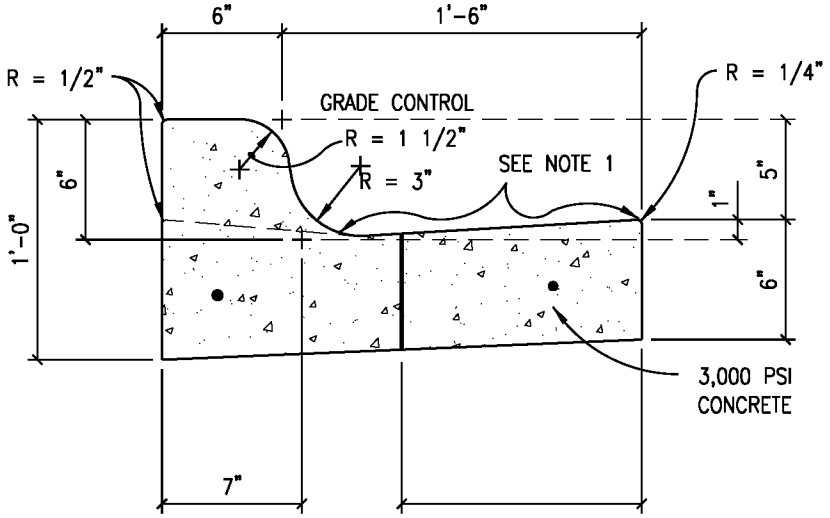
CURB AND GUTTER STANDARD

CONSTRUCTION STANDARDS AND DETAILS

T-09
SCALE: N.T.S.
ISSUE DATE: 5-28-19

1. ALL WORK AND MATERIAL SHALL CONFORM TO ASTM A615, A615M, C309, AND D1752. LIGHT BROOM FINISH EXPOSED SURFACE.
2. CONTRACTION JOINT SPACING 10' MAXIMUM.
3. EXPANSION JOINT MATERIAL AS PER STD. ASTM D-1751, WITH 40' MAX. SPACING.
4. 1/2" EXPANSION JOINT MATERIAL SHALL BE PROVIDED WHERE CURB IS ADJACENT TO SIDEWALK, DRIVE APPROACHES, RIP-RAP, AND RADII.
5. TRANSITIONS BETWEEN CURBS OR DIFFERING CROSS SECTIONS SHALL OCCUR OVER A 20 FOOT LENGTH AS APPROVED BY THE CITY OF ENGINEER.
6. ALL CONCRETE SHALL BE CLASS A, 3000 PSI.
7. ALL SURFACES THAT ARE CHIPPED OR OTHERWISE DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED AT THE DISCRETION OF THE CITY ENGINEER.
8. CURB AND GUTTER SHALL HAVE LONGITUDINAL REINFORCING BARS AS FOLLOWS: TWO #4 BARS SHALL BE PLACED 2" FROM BOTTOM OF GUTTER. SEE DETAIL BELOW.
9. REINFORCING BARS SHALL BE LAPPED A MINIMUM OF 15 INCHES. TRANSVERSE SLOPE OF GUTTER SHALL CONFORM TO ADA REQUIREMENTS AT ALL PEDESTRIAN CROSSINGS.
10. CURB DOWELS SHALL BE AS SHOWN ON T-09.
11. ALL CONCRETE SURFACES SHALL RECEIVE AN APPLICATION OF WHITE PIGMENTED CURING COMPOUND, 1600 SERIES, IN ACCORDANCE WITH TxDOT SPECIFICATION ITEM 420.
12. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CURB CUT EXAMPLE



NOTE:

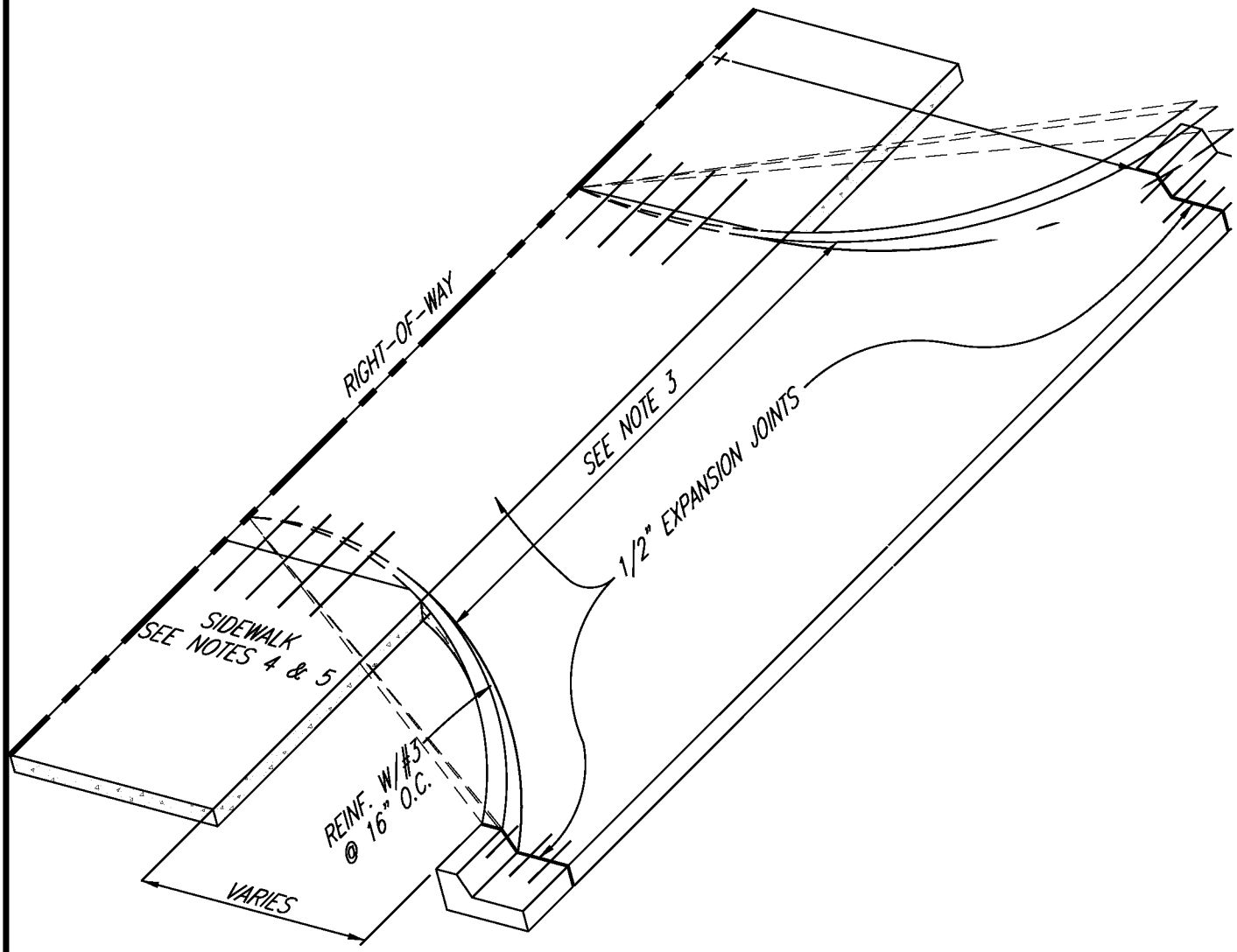
1. IF THE REMAINING CURB AND GUTTER SURFACE IS CHIPPED OR DAMAGED DURING REMOVAL AT THE NEW SAW CUT, THE ENTIRE GUTTER SECTION MUST BE REMOVED.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

CURB AND GUTTER NOTES AND CATCH AND LAYDOWN CURB REMOVAL AT DRIVEWAYS

CONSTRUCTION STANDARDS AND DETAILS

T-10
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

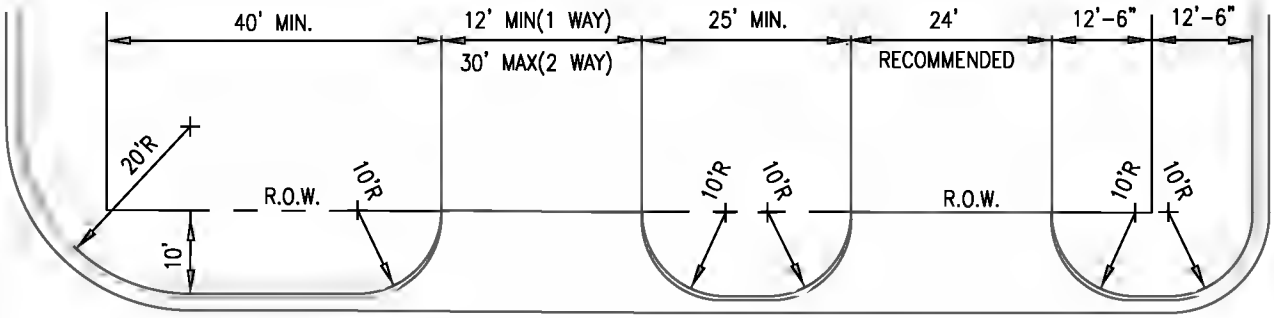
1. DRIVEWAY PERMITS TO BE ACQUIRED FROM THE CITY OF BELTON.
2. SPACING OF DRIVEWAY CUTS SHALL BE AS REQUIRED BY THE CITY ENGINEER.
3. SIDEWALK LOCATION TO BE APPROVED BY CITY ENGINEER PRIOR TO FINAL DESIGN. (SEE DETAIL, T-32 FOR SIDEWALK TREATMENT AT DRIVEWAYS). SIDEWALK WIDTH SHALL BE BY SUBDIVISION ORDINANCE.
4. SIDEWALK TO BE CONSTRUCTED PER DETAIL T-25, AS APPLICABLE.
5. METAL SUPPORT CHAIRS SHALL BE AS MANUFACTURED BY DAYTON SUPERIOR, CHCP OR CHCV, OR EQUIVALENT.
6. ALL CONCRETE SURFACES SHALL RECEIVE AN APPLICATION OF WHITE PIGMENTED CURING COMPOUND, 1600 SERIES, IN ACCORDANCE WITH TXDOT SPECIFICATION ITEM 420.
7. REFER TO T-09 AND T-20 FOR DOWEL REQUIREMENTS.
8. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

CONCRETE DRIVEWAY APPROACH

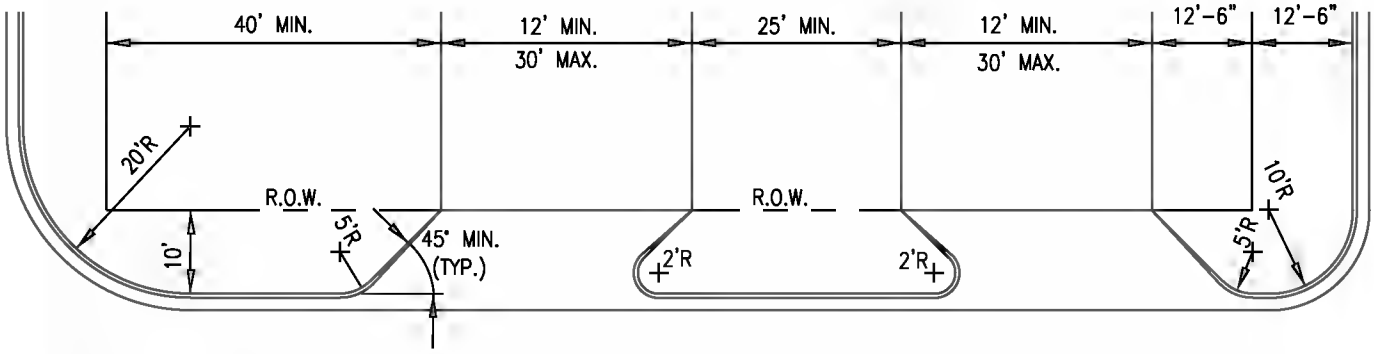
CONSTRUCTION STANDARDS AND DETAILS

T-11
SCALE: N.T.S.
ISSUE DATE: 5-28-19



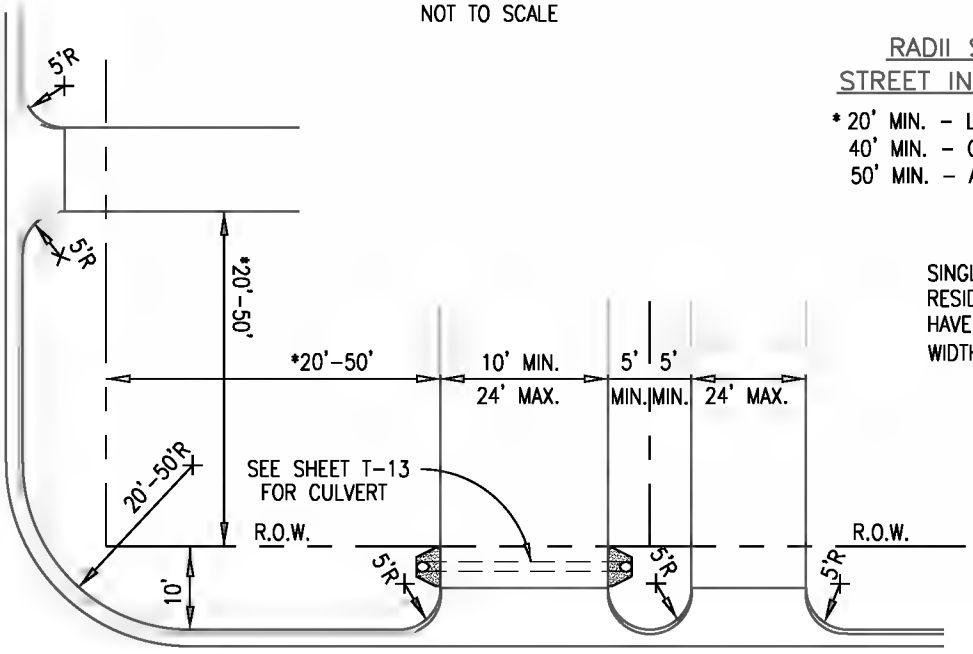
MULTI-FAMILY OR COMMERCIAL

NOT TO SCALE



MULTI-FAMILY OR COMMERCIAL ANGLE

NOT TO SCALE



RADII SIZE FOR STREET INTERSECTIONS

* 20' MIN. - LOCAL STREETS
40' MIN. - COLLECTOR OR
50' MIN. - ARTERIAL STREETS

SINGLE FAMILY RESIDENTIAL SHALL HAVE A MAXIMUM WIDTH OF 24'.

SINGLE FAMILY ATTACHED & TWO FAMILY RESIDENTIAL

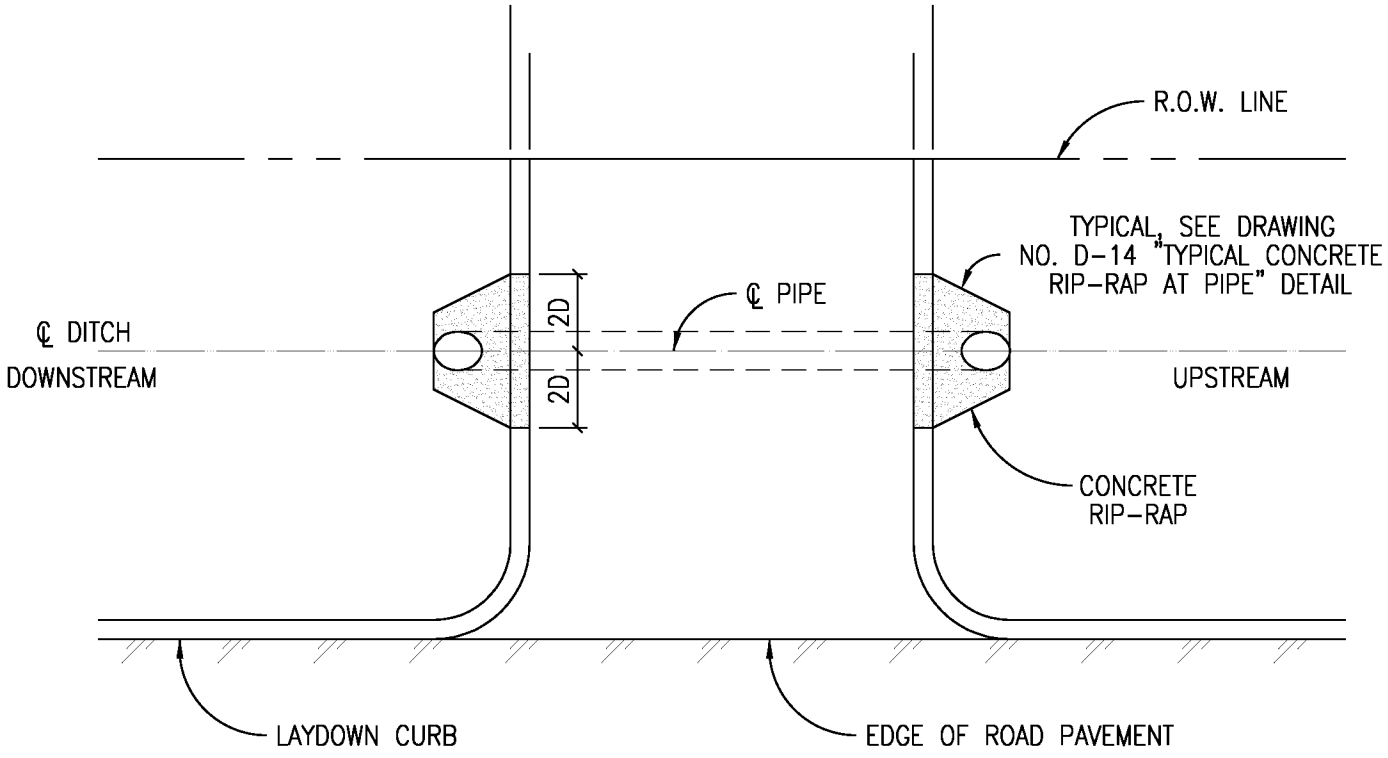
NOT TO SCALE

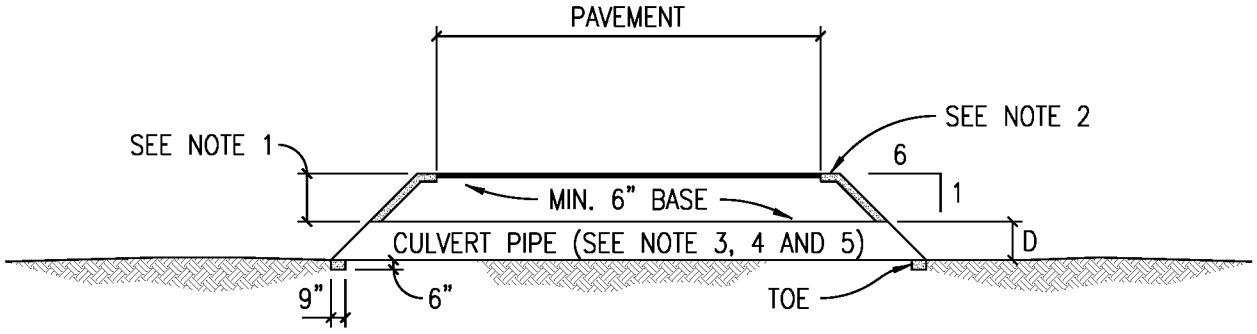
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

CONCRETE DRIVEWAY APPROACHES

CONSTRUCTION STANDARDS AND DETAILS





NOTES:

1. MINIMUM COVER OVER CULVERT PIPE SHALL BE 6" (SEE NOTE 5).
2. RIP-RAP SHALL BE INSTALLED. ACCORDING TO D-14.
3. CULVERT PIPE TO BE MINIMUM OF 18" DIAMETER.
4. CULVERT PIPE MATERIAL SHALL BE IN ACCORDANCE WITH DRAINAGE AND SIDEWALK SECTION.
5. MINIMUM COVER OVER CULVERT PIPE SHALL PROVIDE HS-20 LOADING.
6. BACKFILL AROUND CULVERT PIPE SHALL BE SELECT MATERIAL TO BE PLACED AND COMPACTED TO 95% TEX-114E.
7. MINIMUM CHANNEL SIDE SLOPE SHALL BE 6:1.
8. MINIMUM PIPE SLOPE SHALL BE 0.50%.

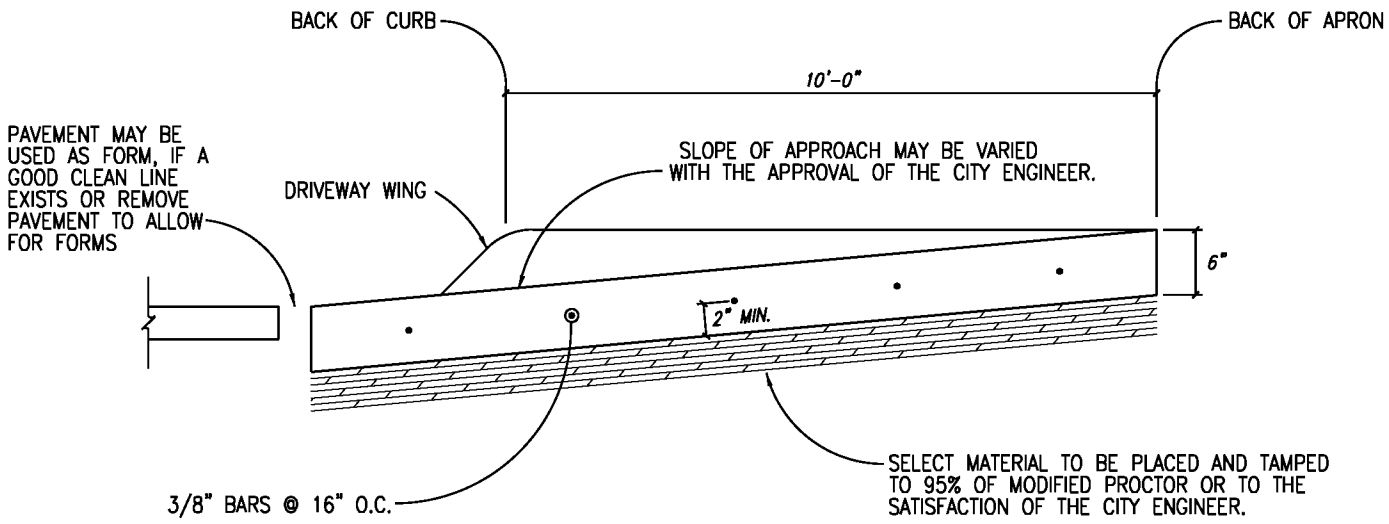
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

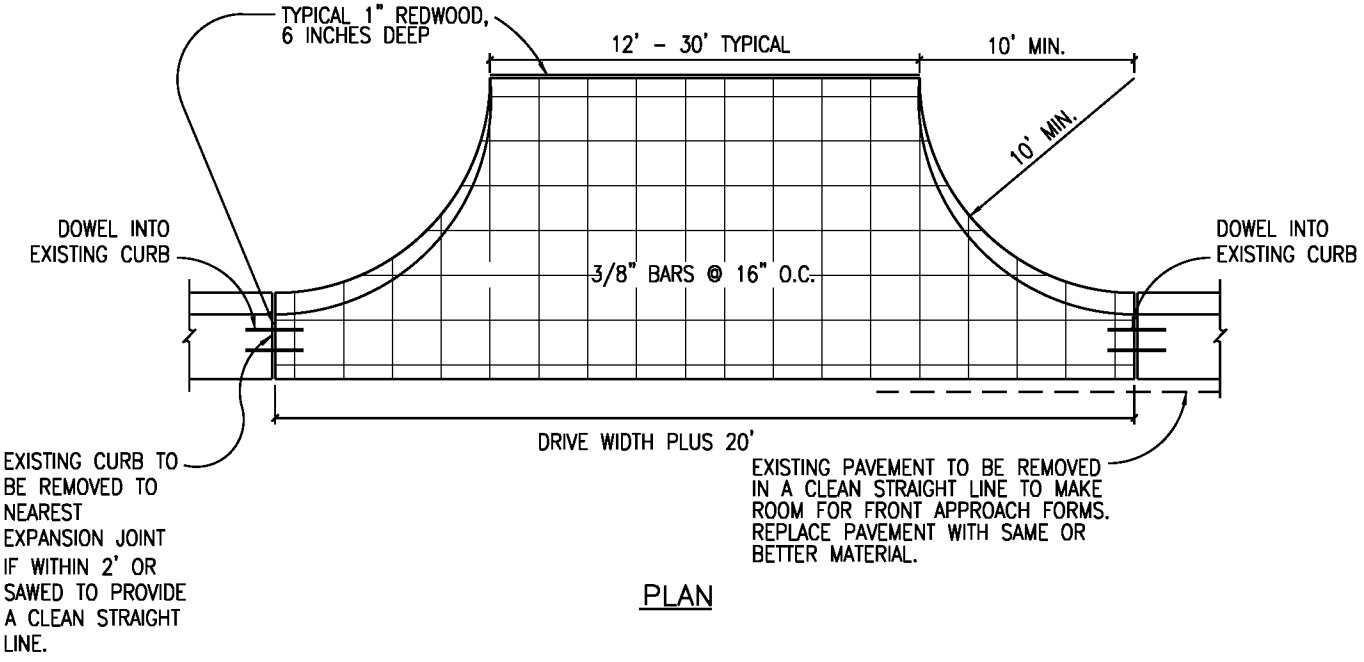
DRIVEWAY APPROACH WITH CULVERT PIPE

CONSTRUCTION STANDARDS AND DETAILS

T-13
SCALE: N.T.S.
ISSUE DATE: 5-28-19



SECTION



PLAN

NOTES:

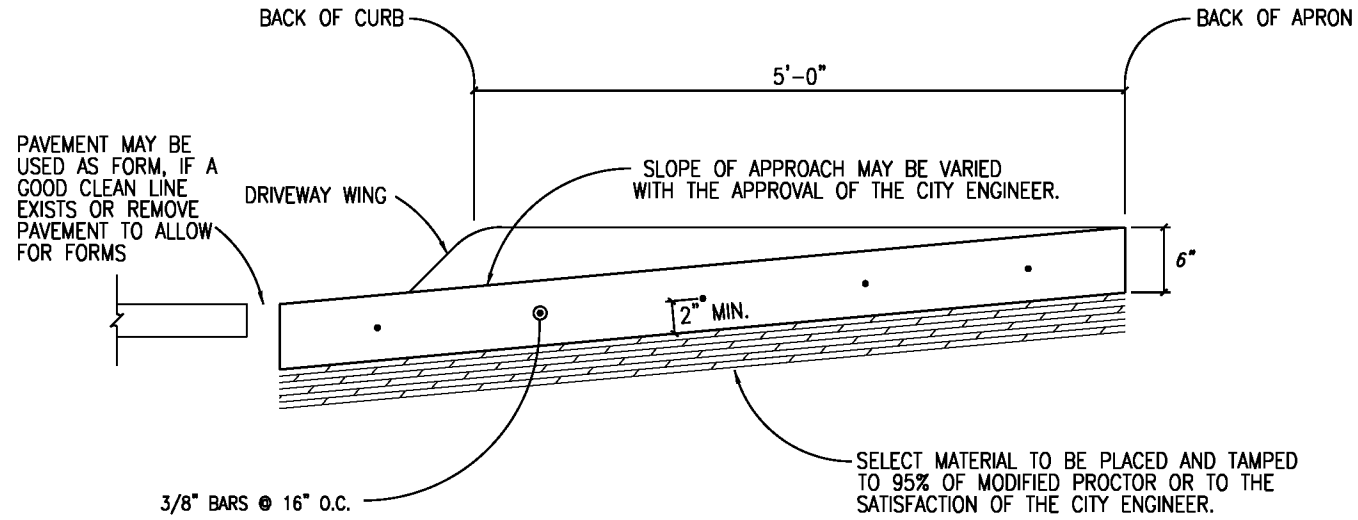
1. SEE DETAIL T-09 AND T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.
2. ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.
3. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

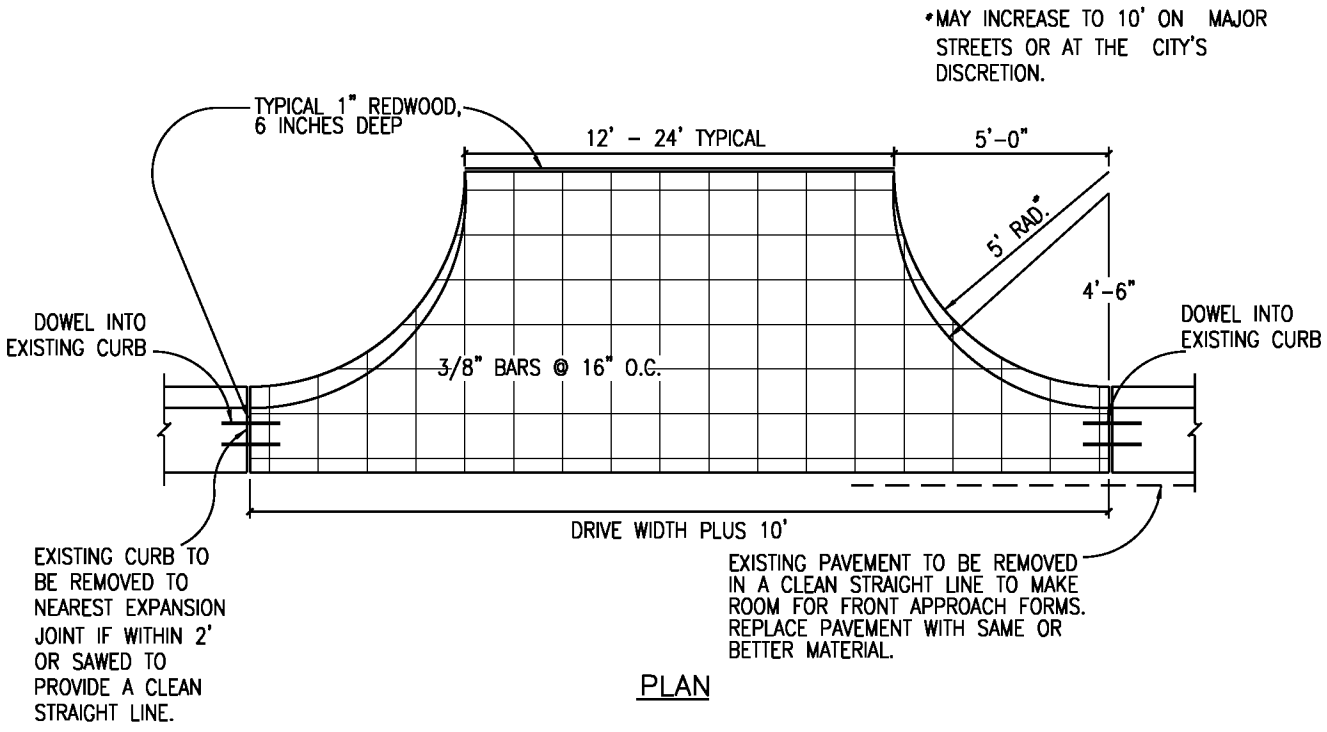
DRIVEWAY REINFORCEMENT
MULTI-FAMILY AND COMMERCIAL

CONSTRUCTION STANDARDS AND DETAILS

T-14
SCALE: N.T.S.
ISSUE DATE: 5-28-19



SECTION



PLAN

NOTES:

1. SEE DETAIL T-09 AND T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.
2. ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.
3. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS

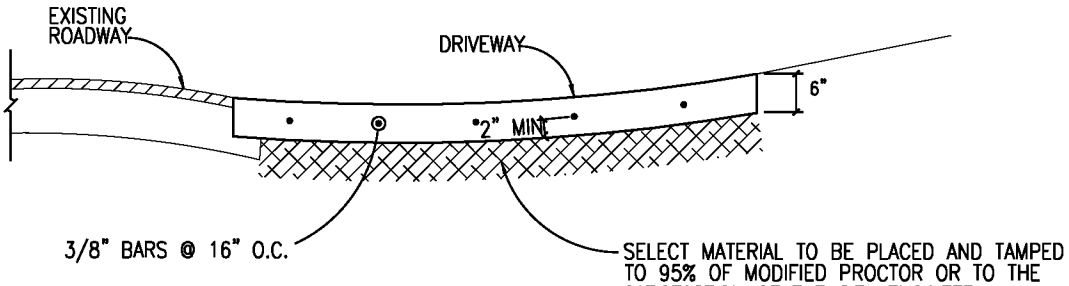
DEPARTMENT OF PUBLIC WORKS

DRIVEWAY REINFORCEMENT WITH RADIUS SINGLE AND TWO FAMILY RESIDENTIAL

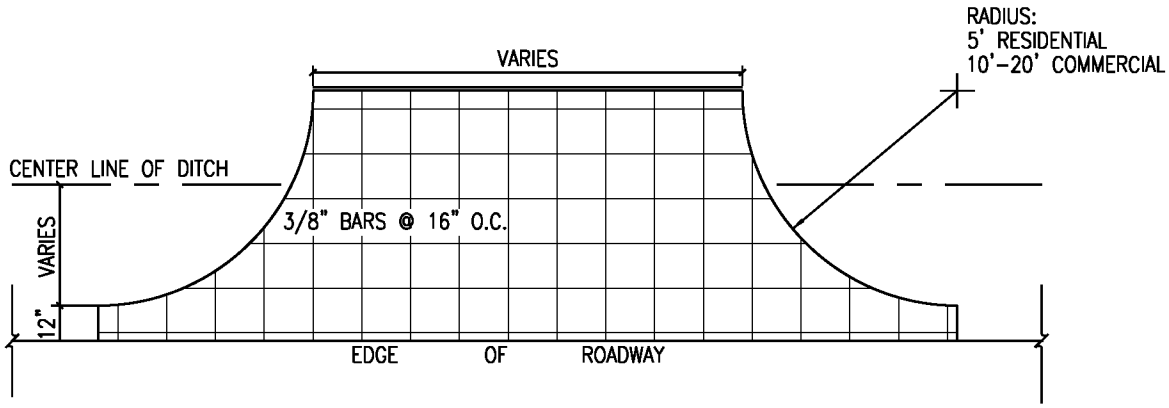
CONSTRUCTION STANDARDS AND DETAILS

T-15
SCALE: N.T.S.
ISSUE DATE: 5-28-19

NOTE:
DRIVEWAY TO CONFORM TO DITCH CROSS-SECTION IF DEPTH IS NOT PROHIBITIVE.



SECTION



PLAN

NOTE:

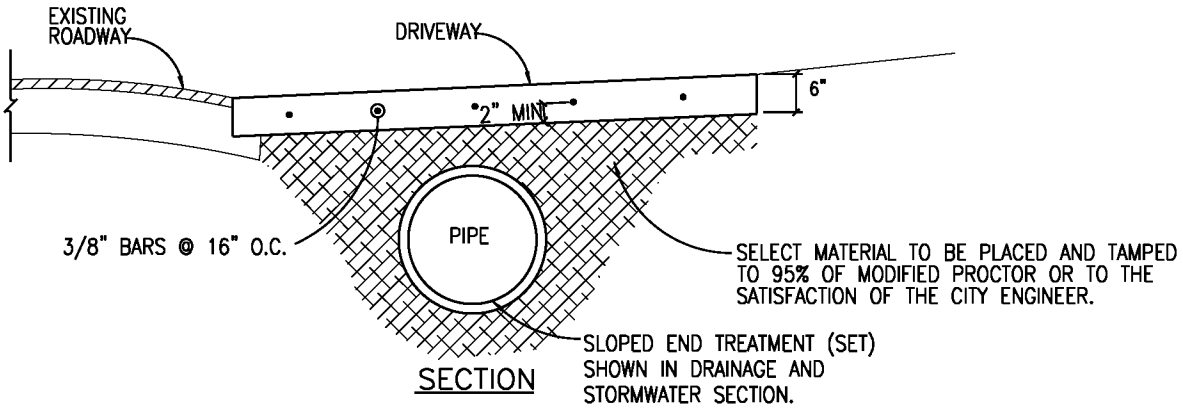
SEE DETAIL T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

DRIVEWAY REINFORCEMENT
NO CURB & GUTTER WITH SHALLOW DITCH CROSSING

CONSTRUCTION STANDARDS AND DETAILS

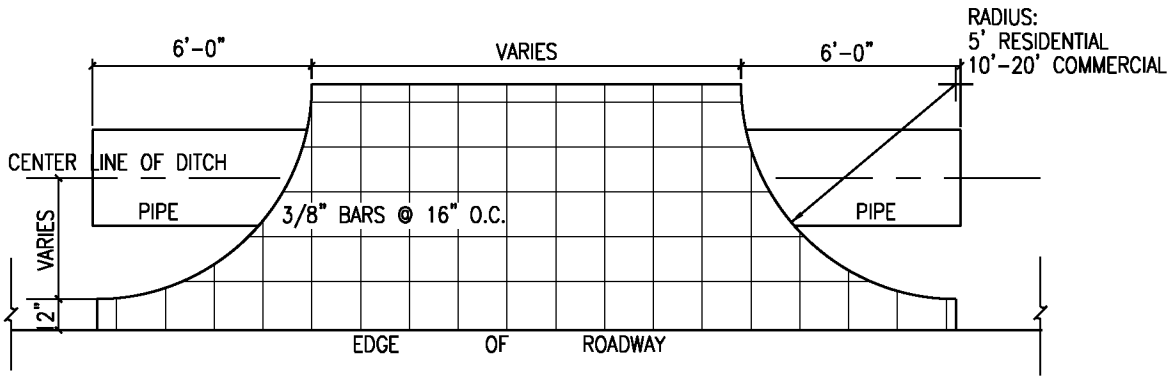
T-16
SCALE: N.T.S.
ISSUE DATE: 5-28-19



SECTION

NOTE:

INSTALL REINFORCED CONCRETE PIPE UNDER DRIVEWAY, AND INSTALL S.E.T. ON BOTH SIDES OF DRIVEWAY. PIPE DIAMETER SHALL BE A MINIMUM OF 15" TXDOT SPECIFICATION, 6:1 SLOPED ENDS WITH CONCRETE RIP-RAP. PIPE DIAMETER SHALL BE DETERMINED BY DITCH GEOMETRY AND A LICENSED PROFESSIONAL ENGINEER.



PLAN

NOTE:

SEE DETAIL T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.

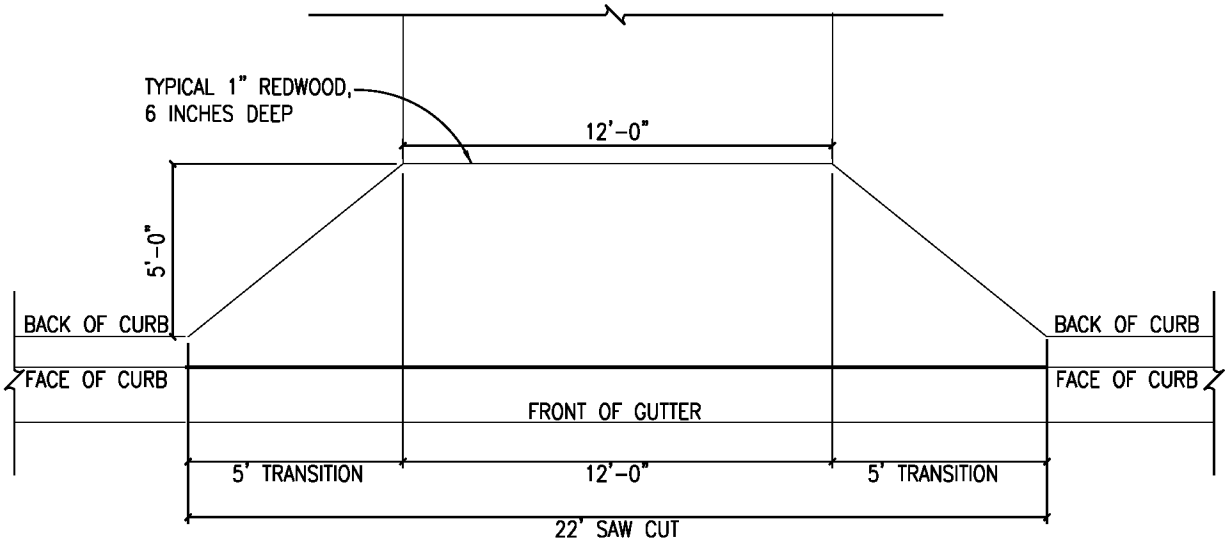
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

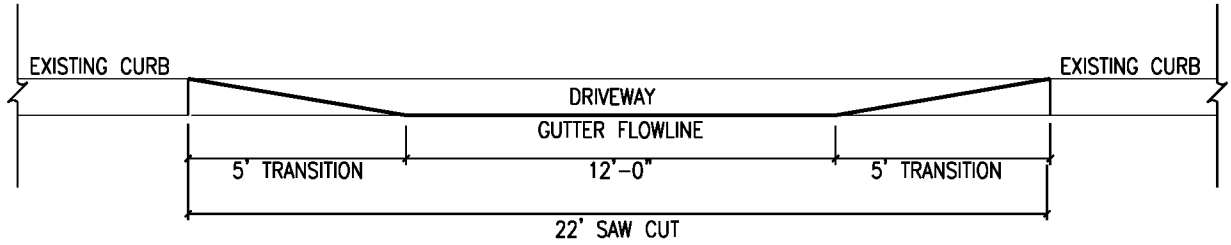
DRIVEWAY REINFORCEMENT
NO CURB & GUTTER WITH CROSSING

CONSTRUCTION STANDARDS AND DETAILS

T-17
SCALE: N.T.S.
ISSUE DATE: 5-28-19



PLAN



GUTTER LINE VIEW

NOTES:

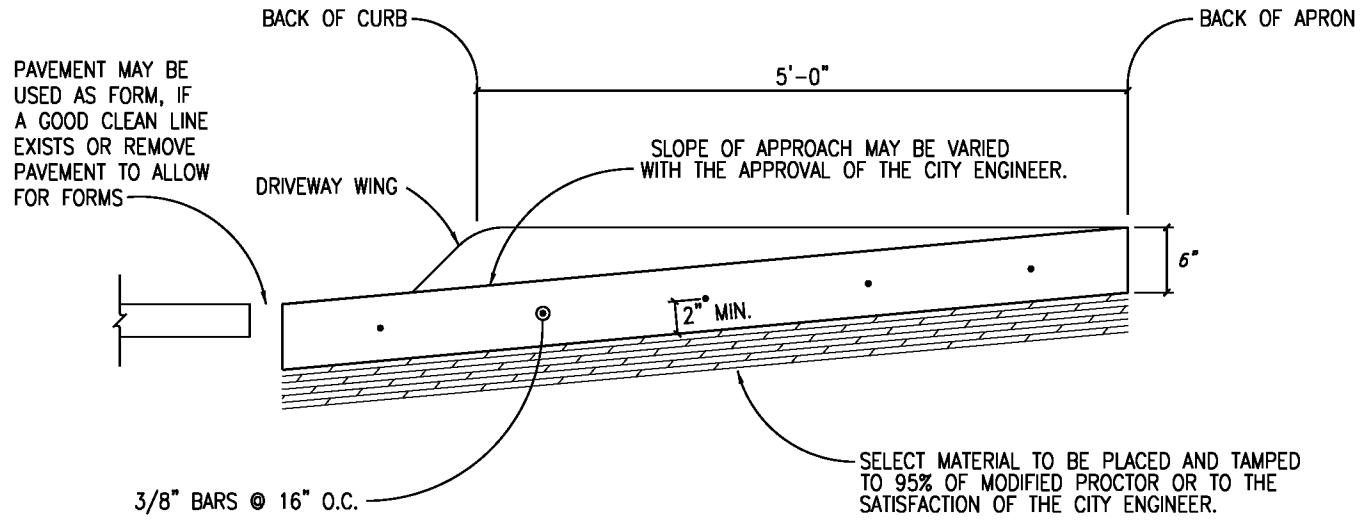
1. USE ONLY WITH APPROVAL OF THE CITY ENGINEER.
2. SEE DETAIL T-09 AND T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.
3. ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.
4. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

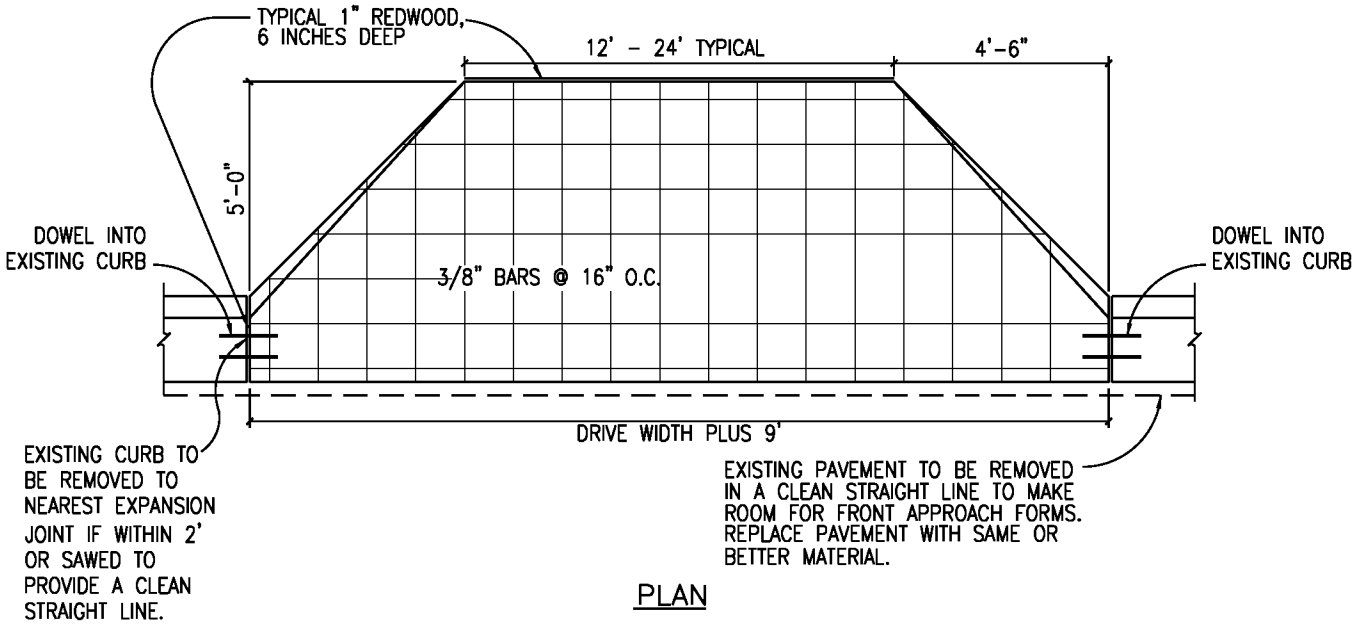
ALTERNATE
DRIVEWAY CONSTRUCTION

CONSTRUCTION STANDARDS AND DETAILS

T-18
SCALE: N.T.S.
ISSUE DATE: 5-28-19



SECTION



PLAN

NOTES:

1. USE OF LINEAR RADIUS RETURNS ONLY WHEN APPROVED BY THE CITY ENGINEER.
2. SEE DETAIL T-09 AND T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.
3. ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.
4. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

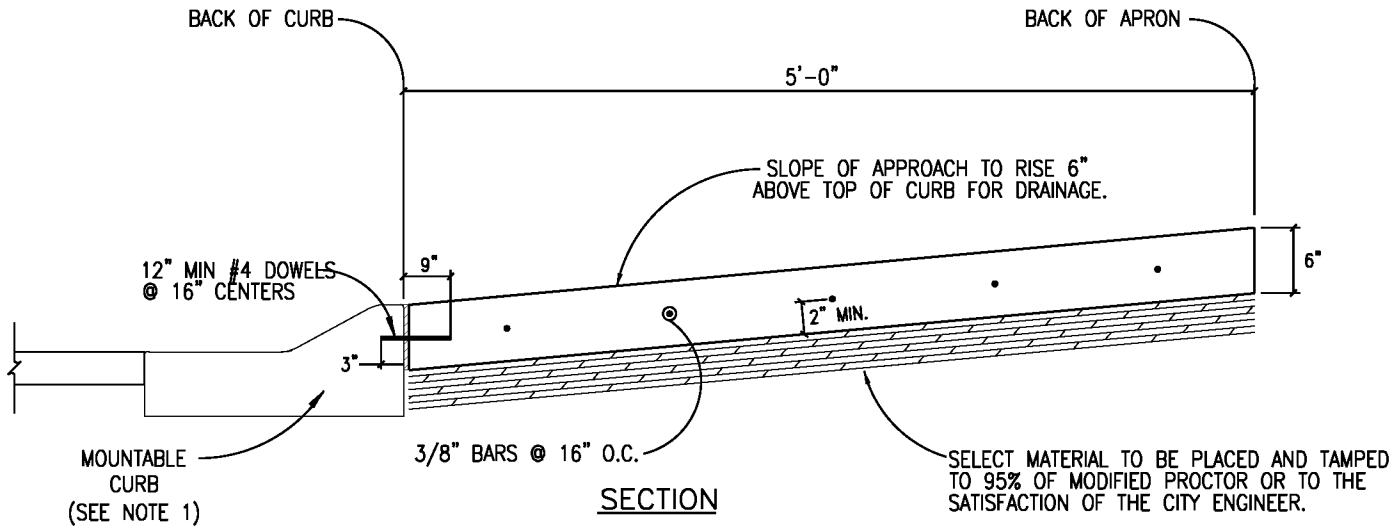
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

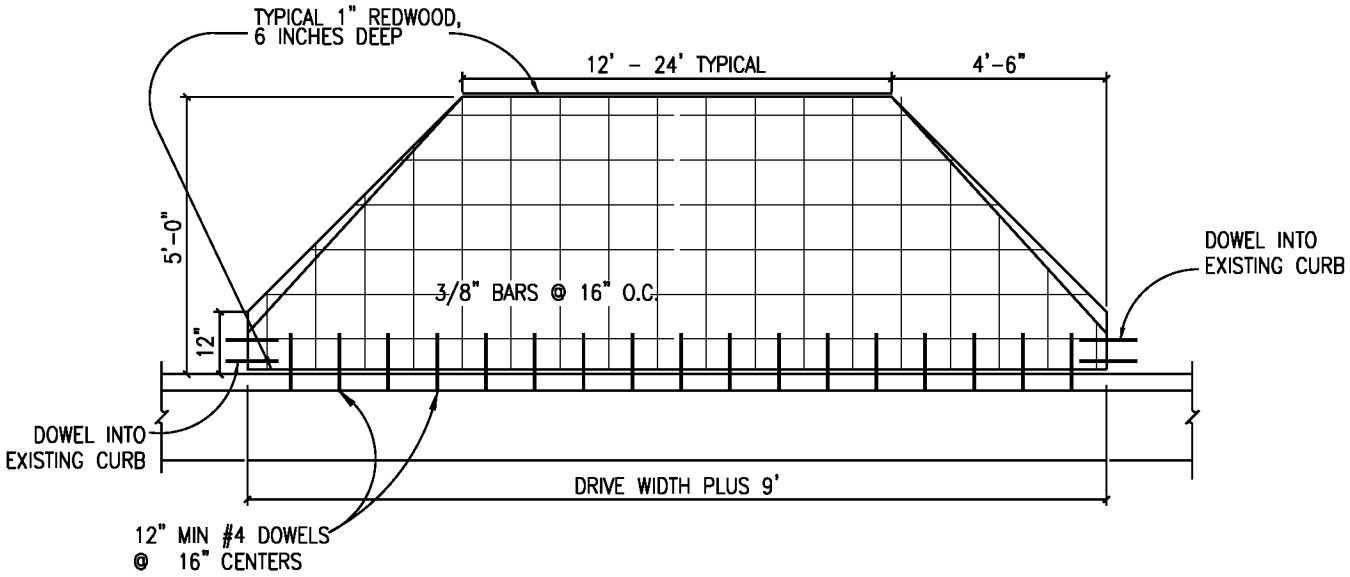
DRIVEWAY REINFORCEMENT (WINGS) SINGLE AND TWO FAMILY RESIDENTIAL

CONSTRUCTION STANDARDS AND DETAILS

T-19
SCALE: N.T.S.
ISSUE DATE: 5-28-19



SECTION



PLAN

NOTES:

1. WHEN CONSTRUCTION OCCURS IN STANDARD CURB AND GUTTER, THE CURB SHALL BE SAWCUT AND REMOVED AT THE GUTTER LINE AND THE DRIVEWAY SHALL BE CONSTRUCTED TO MATCH EXISTING GRADE.
2. USE OF LINEAR RADIOUS RETURNS ONLY WHEN APPROVED BY THE CITY ENGINEER
3. ALL DOWELS SHALL BE SLICK DOWELS WITH GREASE AND CAPS.
4. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS

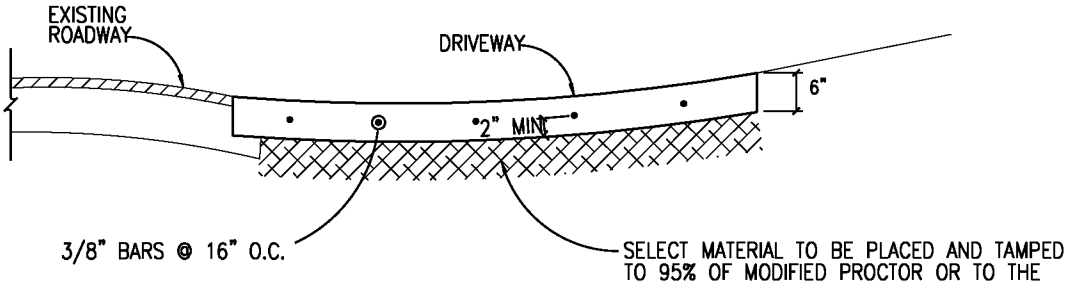
DEPARTMENT OF PUBLIC WORKS

DRIVEWAY REINFORCEMENT (WINGS & MOUNTABLE CURB) SINGLE AND TWO FAMILY RESIDENTIAL

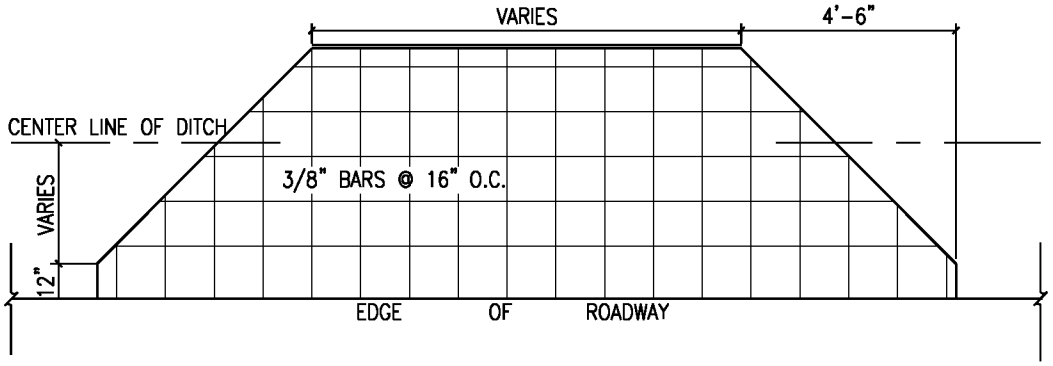
CONSTRUCTION STANDARDS AND DETAILS

T-20
SCALE: N.T.S.
ISSUE DATE: 5-28-19

NOTE:
DRIVEWAY TO CONFORM TO DITCH CROSS-SECTION IF DEPTH IS NOT PROHIBITIVE.



SECTION



PLAN

NOTES:

1. USE OF LINEAR RADIUS RETURNS ONLY WHEN APPROVED BY THE CITY ENGINEER.
2. SEE DETAIL T-20 FOR DOWEL SPACING AND SPECIFICATIONS FOR DOWELING INTO CURB ALONG THE DRIVEWAY WIDTH.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

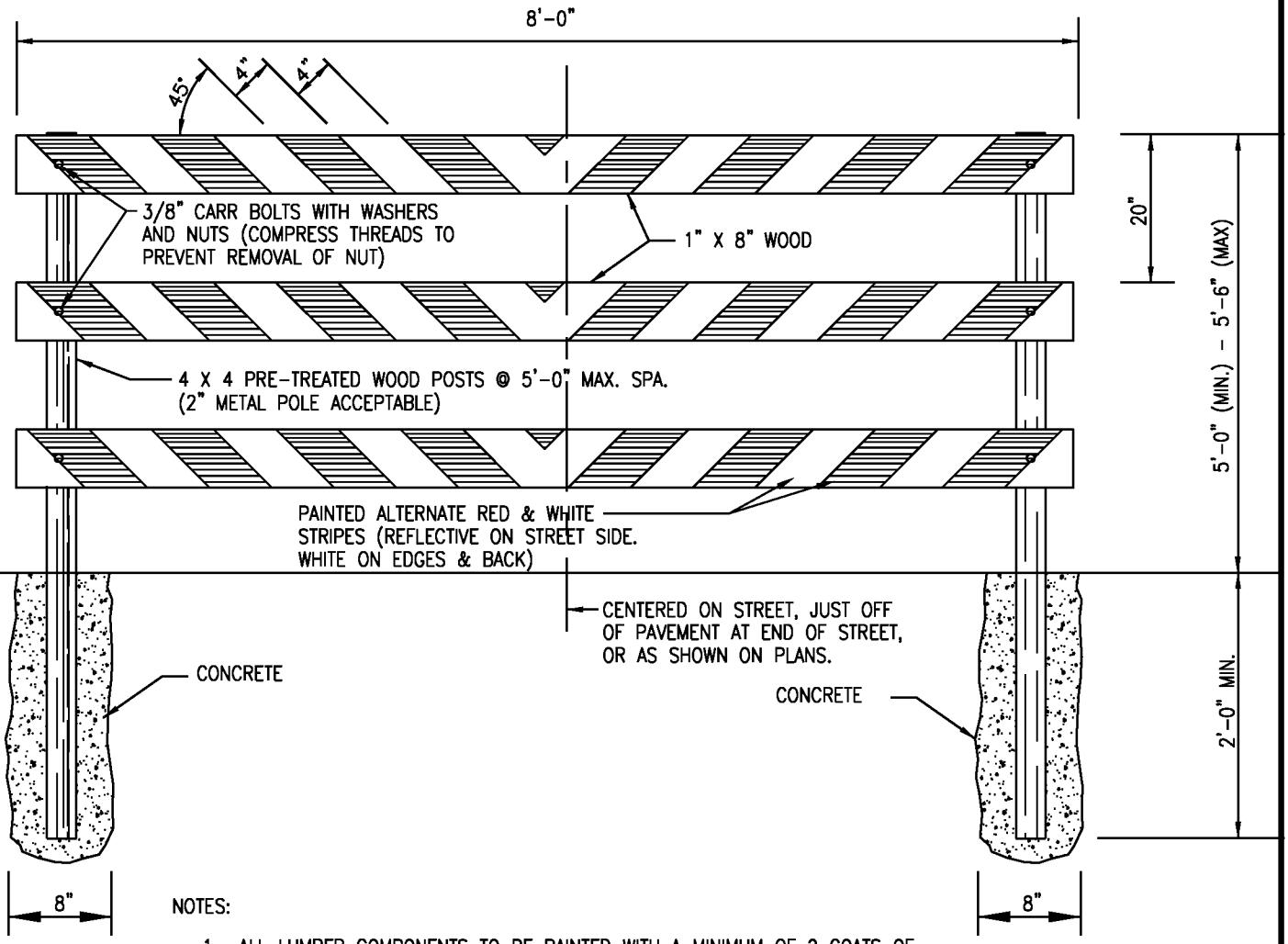
DRIVEWAY REINFORCEMENT (WINGS)
NO CURB & GUTTER WITH SHALLOW DITCH CROSSING

CONSTRUCTION STANDARDS AND DETAILS

T-21
SCALE: N.T.S.
ISSUE DATE: 5-28-19

SAFETY PROVISIONS:

THE CONTRACTOR SHALL COMPLY WITH "TEXAS MANUAL, UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS," VOLUME WITH CURRENT REVISIONS.



NOTES:

1. ALL LUMBER COMPONENTS TO BE PAINTED WITH A MINIMUM OF 2 COATS OF WHITE PAINT.
2. RAILS SHALL BE REFLECTIVE RED AND REFLECTIVE WHITE STRIPED ON ONE SIDE.
3. STRIPING SHALL COVER FULL WIDTH OF RAILS.
4. PERTAINING TO THIS DETAIL, SHORT TERM IS DEFINED AS A PERIOD OF TIME NO LONGER THAN 6 MONTHS.

CITY OF BELTON, TEXAS

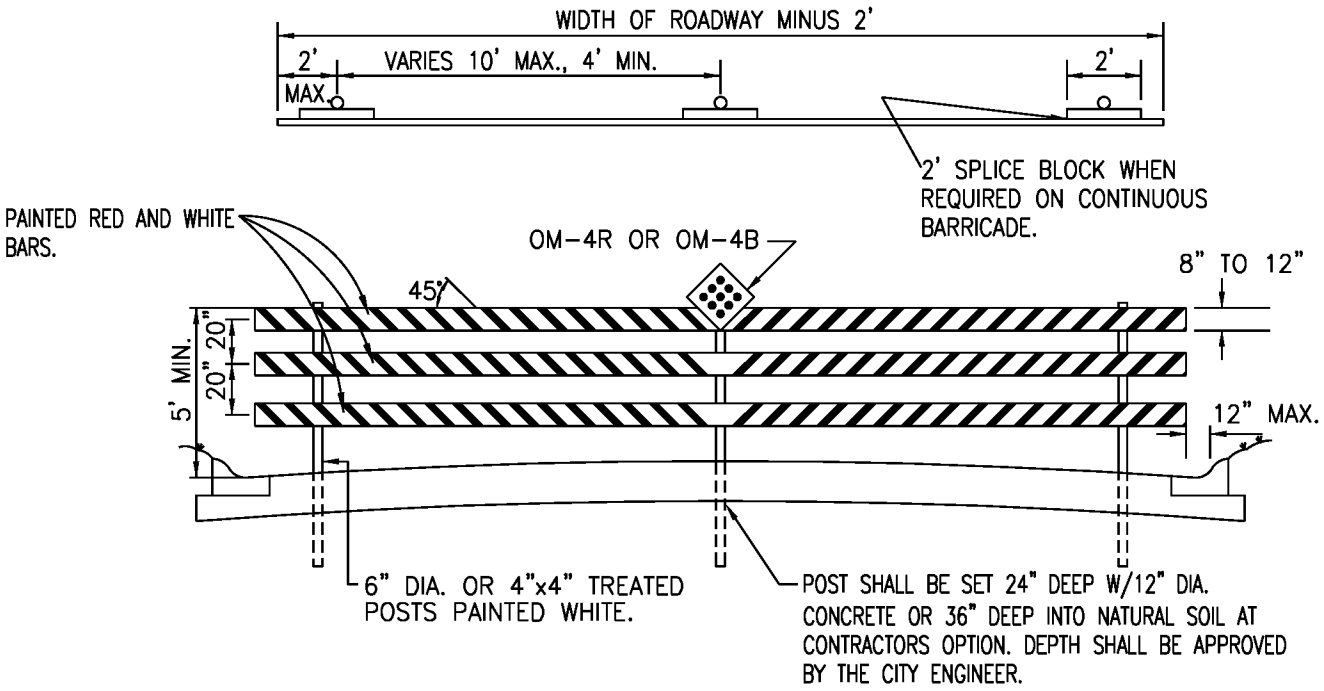
DEPARTMENT OF PUBLIC WORKS

STANDARD

TYPE III BARRICADE – SHORT TERM

CONSTRUCTION STANDARDS AND DETAILS

T-22
SCALE: N.T.S.
ISSUE DATE: 5-28-19



GENERAL NOTES FOR THIN WALL TUBE TYPE SIGN SUPPORT:

1. THE BASE SOCKET IS FORMED FROM 2 7/8 " O.D. X 12 GAUGE GALVANIZED PIPE.
2. THE WEDGE IS FORMED FROM 11 GAUGE STEEL GALVANIZED PER ASTM A525.
3. THE SIGN POST IS 2.375" O.D. X 0.095" THIN WALL STEEL TUBING.
4. STEEL SUPPORTS SHALL BE MADE FROM NEW MATERIAL AND SHALL BE CORROSION RESISTANT. STEEL SUPPORTS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM DESIGNATIONS A123 OR A525 (G-90 OR BETTER).
5. SUPPORTS SHALL BE STRAIGHT WITHIN 1/4 " PER 5 FEET OF LENGTH AND SHALL HAVE A SMOOTH, UNIFORM FINISH FREE FROM DEFECTS AFFECTING STRENGTH OR APPEARANCE. ANY BOLT HOLES AND SHEARED ENDS SHALL BE FREE FROM BURRS. BASES OF MULTISECTION SUPPORTS SHALL NOT EXTEND MORE THAN 5 INCHES ABOVE GROUND WHEN INSTALLED.
6. BOLTS, NUTS, SCREWS, WASHERS AND OTHER MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE TO ASTM DESIGNATION: A153 CLASS C OR D, OR B695 CLASS 50.
7. BARRICADE SUPPORTS SYSTEMS USED ON THIS SHEET MAY BE SUITABLE FOR ONLY CERTAIN SOIL TYPES. THE CONTRACTOR IS RESPONSIBLE FOR SELECTING THE APPROPRIATE SUPPORT SYSTEM FOR SOIL CONDITIONS ON EACH PROJECT WITH APPROVAL BY CITY ENGINEER.

TYPE III BARRICADES:

1. REFER TO THE COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD) FOR DETAILS OF THE TYPE III BARRICADES AND A LIST OF ALL MATERIALS USED IN THE CONSTRUCTION OF TYPE III BARRICADES.
2. TYPE III BARRICADES SHALL BE USED AT EACH END OF CONSTRUCTION PROJECTS CLOSED TO ALL TRAFFIC.
3. BARRICADES EXTENDING ACROSS A ROADWAY SHOULD HAVE STRIPES THAT SLOPE DOWNWARD IN THE DIRECTION TOWARD WHICH TRAFFIC MUST TURN IN DETOURING. WHEN BOTH RIGHT AND LEFT TURNS PROVIDED, THE CHEVRON STRIPING MAY SLOPE DOWNWARD IN BOTH DIRECTIONS FROM THE CENTER OF THE BARRICADE.
4. STRIPING OF RAILS, FOR THE RIGHT SIDE OF THE ROADWAY, SHOULD SLOPE DOWNWARD TO THE LEFT. FOR THE LEFT SIDE OF THE ROADWAY, STRIPING SHOULD SLOPE DOWNWARD TO THE RIGHT.
5. IDENTIFICATION MARKINGS MAY BE SHOWN ONLY ON THE BACK OF THE BARRICADE RAILS. THE MAXIMUM HEIGHT OF LETTERS AND/OR COMPANY LOGOS USED FOR IDENTIFICATION SHALL BE 1".
6. BARRICADES SHALL NOT BE PLACED PARALLEL TO TRAFFIC UNLESS AN ADEQUATE CLEAR ZONE IS PROVIDED.
7. WARNING LIGHTS SHALL NOT BE INSTALLED ON BARRICADES.
8. PERTAINING TO THIS DETAIL, LONG TERM IS DEFINED AS A PERIOD OF TIME LONGER THAN 6 MONTHS.

CITY OF BELTON, TEXAS

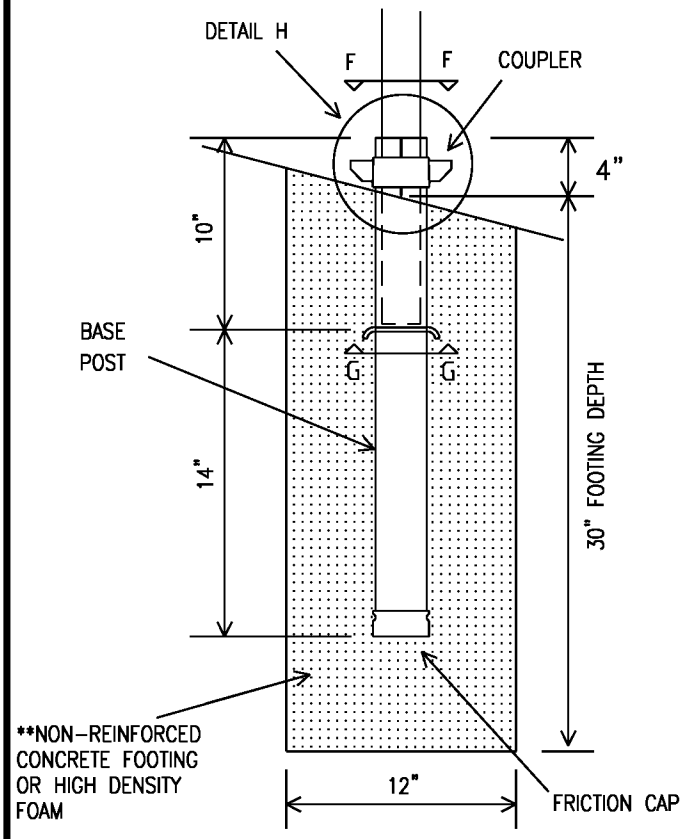
DEPARTMENT OF PUBLIC WORKS

STANDARD

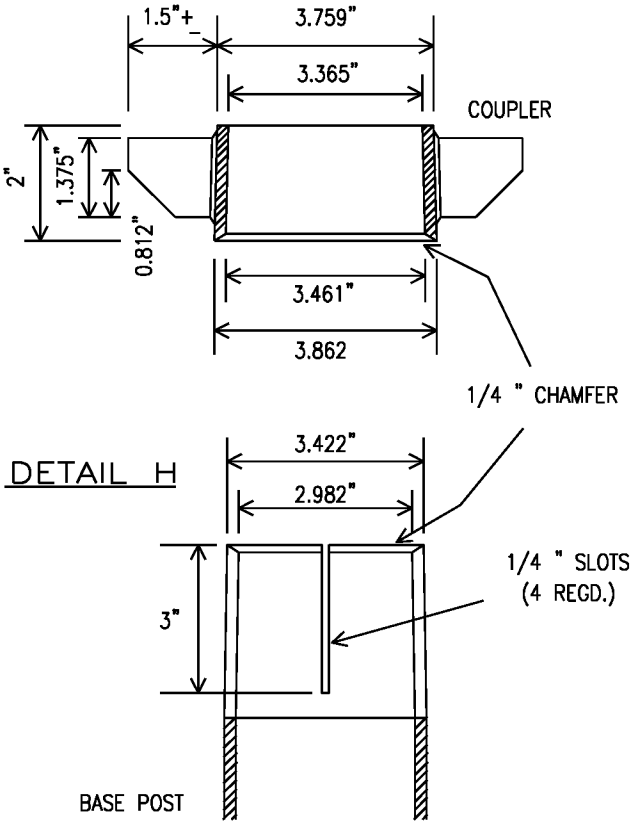
TYPE III BARRICADE – LONG TERM

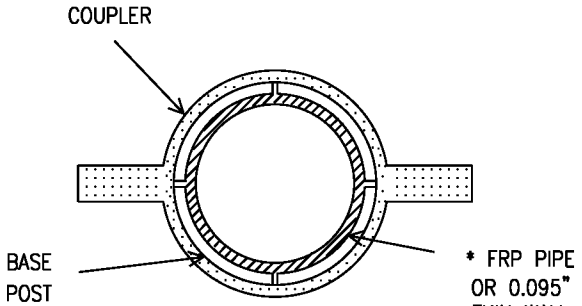
CONSTRUCTION STANDARDS AND DETAILS

T-23
SCALE: N.T.S.
ISSUE DATE: 5-28-19

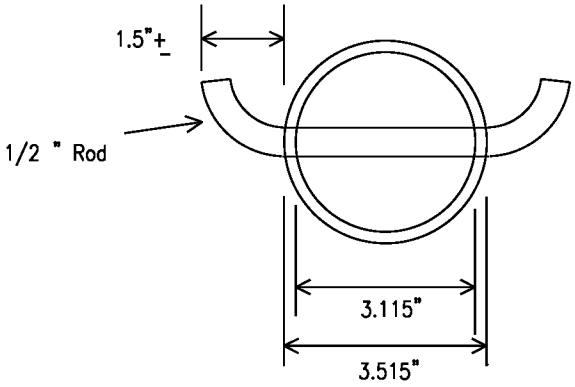


PROFILE





VIEW F-F



VIEW G-G

* PLASTING INSERT MUST BE USED WITH 1/16 " THIN WALL TUBING.

** FOOTING SHALL BE REMOVED AND BACKFILLED WHEN BARRICADE IS REMOVED.

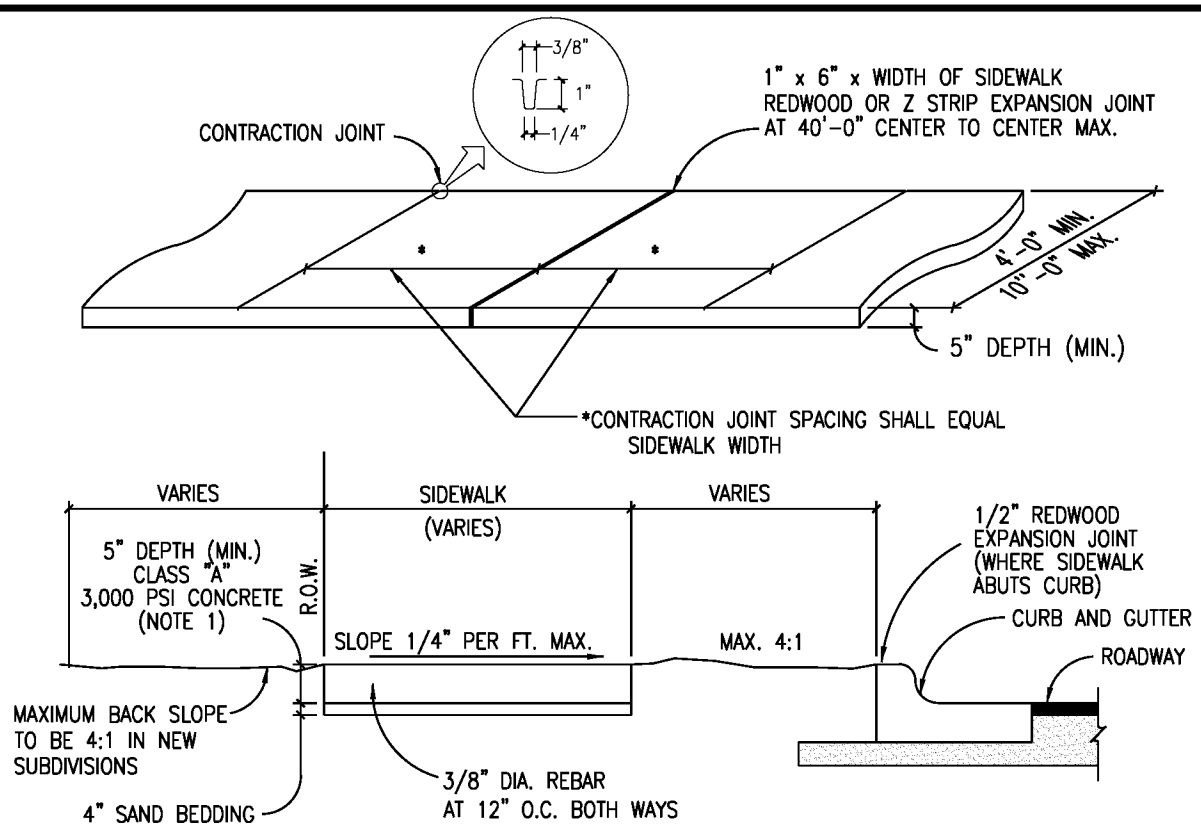
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

UNIVERSAL ANCHOR SYSTEM (TYPE III BARRICADE)

CONSTRUCTION STANDARDS AND DETAILS

T-24
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. FOR ROLLER STAMPED SIDEWALK: MATCH TO DESIGN ENGINEER SPECIFICATIONS.
2. SIDEWALK SHALL CONFORM TO CURRENT AMERICANS WITH DISABILITIES ACT STANDARDS.
3. FOR PROJECTS IN WHICH PEDESTRIAN COMPONENTS (SIDEWALKS, HANDICAP RAMPS, ETC.) TOTAL CONSTRUCTION COST $50,000 OR MORE, CONSTRUCTION PLANS SHALL BE SUBMITTED AND APPROVED BY THE TEXAS DEPARTMENT OF LICENSING AND REGULATION BY THE ENGINEER OR DESIGN PROFESSIONAL OF RECORD, AND INSPECTED AFTER CONSTRUCTION BY TDLR.
4. ANY VARIANCE IN TEXTURE, GRADE OR ALIGNMENT MUST BE APPROVED BY THE TEXAS DEPARTMENT OF LICENSING AND REGULATION.
5. ALL CONCRETE SURFACES SHALL RECEIVE A LIGHT BROOM FINISH UNLESS NOTED OTHERWISE IN THE PLANS.
6. ALL CONCRETE SURFACES SHALL RECEIVE AN APPLICATION OF WHITE PIGMENTED CURING COMPOUND, 1600 SERIES, IN ACCORDANCE WITH TxDOT SPECIFICATION ITEM 420.
7. METAL SUPPORT CHAIRS SHALL BE AS MANUFACTURED BY DAYTON SUPERIOR, CHCP OR CHCV.
8. ALL SUBRADE SHALL BE UNDISTURBED. THAT WHICH IS DISTURBED, SHALL BE COMPACTED AT 95% STANDARD PROCTOR.
9. PROPOSED SIDEWALKS SHALL COMPLY WITH CITY OF BELTON CODES AND ORDINANCES, AND THIS DESIGN MANUAL. WHEN EXISTING GRADE IS LOWER THAN NEW BACK OF SIDEWALK, FILL SHALL BE PLACED WITH A MAX SLOPE OF 25% DOWN TO EXISTING GRADE. FILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR AT OR ABOVE OPTIMUM MOISTURE CONTENT.
   ON HIKE AND BIKE TRAILS- CLEARANCE: SIGNAGE, ELECTRICAL POLES, GUY WIRES, STREET LIGHTS, OR ANY OTHER OBSTRUCTIONS ARE NOT ALLOWED IN SIDEWALKS OR TRAILS OR WITHIN 24" OF OUTSIDE EDGE OF THE SIDEWALK.
10. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

SIDEWALK SECTION
STANDARD

CONSTRUCTION STANDARDS AND DETAILS

T-25
SCALE: N.T.S.
ISSUE DATE: 5-28-19

NOTES:

1. SIDEWALK WIDTH SHALL BE PER SHEETS T-01 TO T-05 AND MOST CURRENT CITY OF BELTON SUBDIVISION ORDINANCE.

2. ALL SLOPES ARE MAXIMUM ALLOWABLE. FLATTER SLOPES THAT WILL STILL DRAIN PROPERLY ARE ENCOURAGED.

3. FOR PURPOSES OF WARNING, THE CURB RAMPS SHALL HAVE A LIGHT REFLECTIVE VALUE AND TEXTURE THAT SIGNIFICANTLY CONTRASTS WITH THAT OF ADJOINING PEDESTRIAN ROUTES.

4. TEXTURES MAY CONSIST OF PAVERS WITH TRUNCATED DOMED SURFACES. TEXTURES ARE REQUIRED TO BE DETECTABLE UNDERFOOT. SURFACES THAT WOULD ALLOW WATER TO ACCUMULATE ARE PROHIBITED. TEXTURES SHALL BE AT LEAST 2-FEET IN LENGTH IN THE DIRECTION OF THE RAMP AND COVER THE WIDTH OF THE RAMP. SEE DETAIL SHEET T-35.

5. COLOR CONTRAST SHALL BE ACCOMPLISHED WITH RED PAVERS THAT HAVE TRUNCATED DOMES WHICH WOULD PROVIDE A CONTRAST WITH TYPICALLY LIGHT COLORED CONCRETE. STAINED CONCRETE IS NOT ALLOWED. SEE DETAIL SHEET T-35.

6. ADDITIONAL INFORMATION ON CURB RAMP LOCATION, DESIGN, VISIBILITY AND TEXTURE MAY BE FOUND IN THE CURRENT EDITION OF THE TEXAS ACCESSIBILITY STANDARDS (TAS) PREPARED AND ADMINISTERED BY THE TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR).

7. RAISED MEDIANS SEPARATE OPPOSING DIRECTIONS OF TRAFFIC AND PROVIDE A REFUGE AREA FOR PEDESTRIANS IF THEY ARE UNABLE TO CROSS THE ENTIRE ROADWAY IN THE ALLOTTED SIGNAL PHASE. TO SERVE AS A REFUGE AREA, THE MEDIAN SHOULD BE A MINIMUM OF 6 FEET WIDE. MEDIANS SHOULD BE DESIGNED TO PROVIDE ACCESSIBLE PASSAGE OVER OR THROUGH THEM.

8. ANY PART OF THE ACCESSIBLE ROUTE WITH A SLOPE GREATER THAN 1:20 (5%) SHALL BE CONSIDERED A RAMP. IF A RAMP HAS A RISE GREATER THAN 6 INCHES OR A HORIZONTAL PROJECTION GREATER THAN 72 INCHES, THEN IT SHALL HAVE HANDRAILS ON BOTH SIDES. THE ONLY EXCEPTION IS AT CURB RAMPS. HANDRAILS ARE NOT REQUIRED ON CURB RAMPS. CURB RAMPS SHALL BE PROVIDED WHEREVER AN ACCESSIBLE ROUTE CROSSES (PENETRATES) A CURB. CURB RAMPS ARE GENERALLY INTERPRETED AS ONLY THE PORTION TYING DIRECTLY INTO THE ROADWAY.

9. ALL SIDEWALKS SHALL BE DOWELED INTO EXISTING SIDEWALKS, DRIVEWALKS, DRIVEWAYS, INLET BOXES, RETAINING WALLS, ETC.

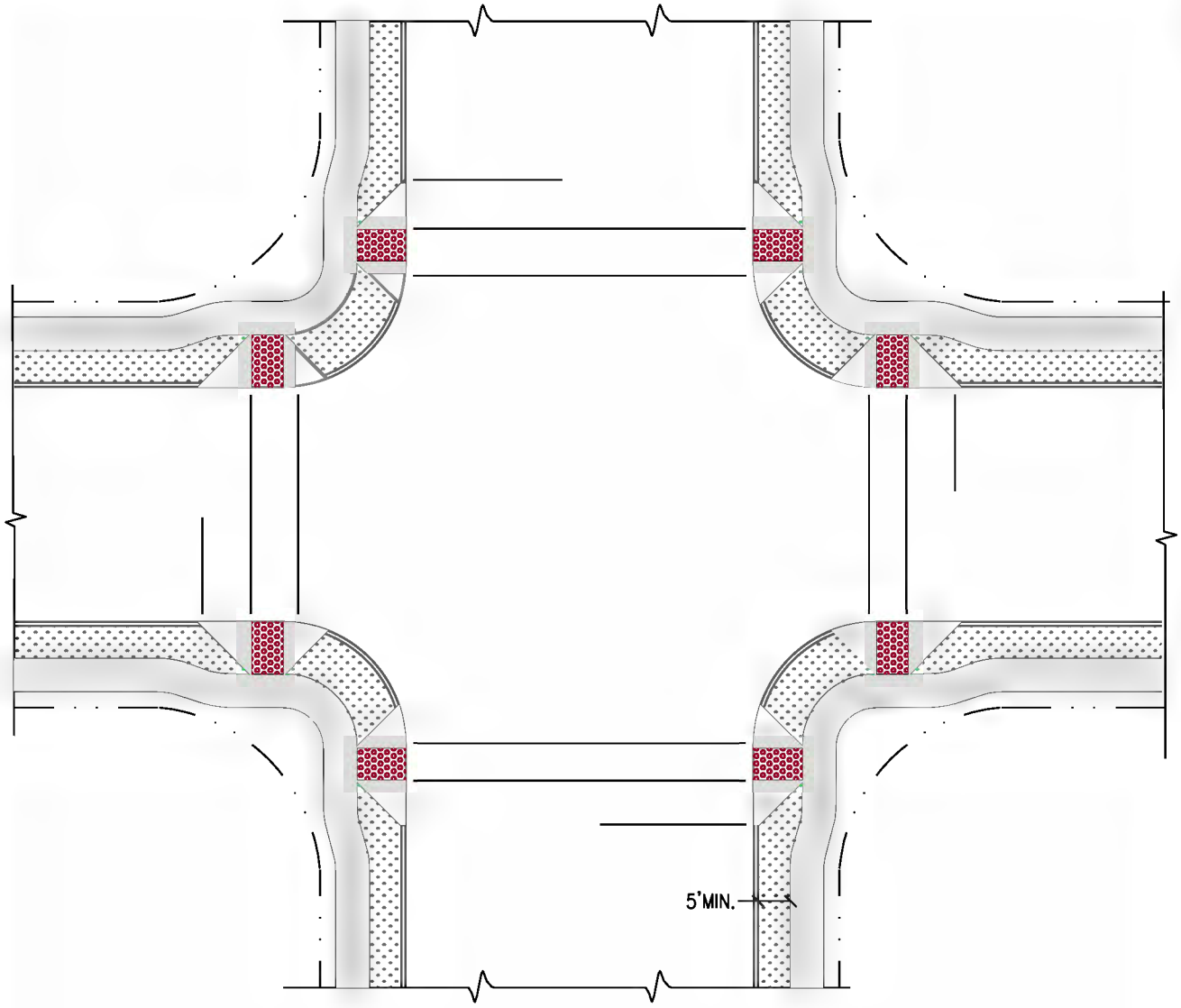
10. WHEN DOWELING INTO EXISTING CONCRETE, THE DOWELS SHALL BE EPOXIED IN.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

PEDESTRIAN RAMPS
GENERAL NOTES

CONSTRUCTION STANDARDS AND DETAILS

T-26
SCALE: N.T.S.
ISSUE DATE: 5-28-19



OFFSET SIDEWALKS

NOTE: CURB RAMPS WITH RETURNED CURBS INSTEAD OF SIDE FLARES ARE PERMITTED WHERE PEDESTRIANS WOULD NOT NORMALLY WALK ACROSS THE RAMP

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

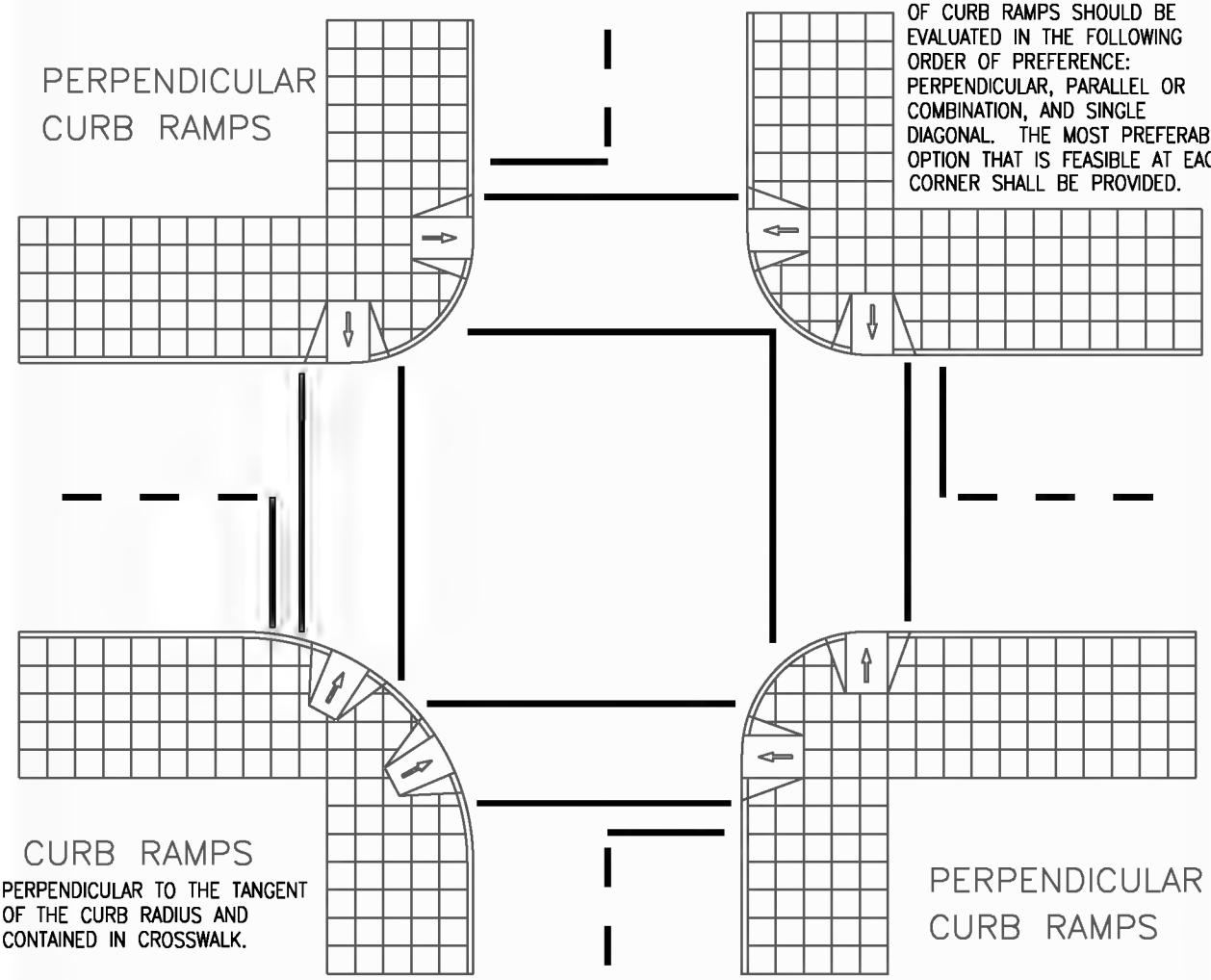
TYPICAL INTERSECTION LAYOUT

CONSTRUCTION STANDARDS AND DETAILS

SINGLE DIAGONAL CURB RAMP

FOR ON-SYSTEM NEW CONSTRUCTION, RECONSTRUCTION AND REHABILITATION PROJECTS WHERE PEDESTRIAN FACILITIES ARE NEWLY CONSTRUCTED OR SUBSTANTIALLY ALTERED, CONSTRUCTION OF SINGLE DIAGONAL RAMPS IS NOT PERMITTED.

FOR ON-SYSTEM PROJECTS SUCH AS RESTORATION, SEAL COAT AND OVERLAY PROJECTS, PLACEMENT OF CURB RAMPS SHOULD BE EVALUATED IN THE FOLLOWING ORDER OF PREFERENCE: PERPENDICULAR, PARALLEL OR COMBINATION, AND SINGLE DIAGONAL. THE MOST PREFERABLE OPTION THAT IS FEASIBLE AT EACH CORNER SHALL BE PROVIDED.



CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

CURB RAMPS PLACEMENTS AT INTERSECTIONS

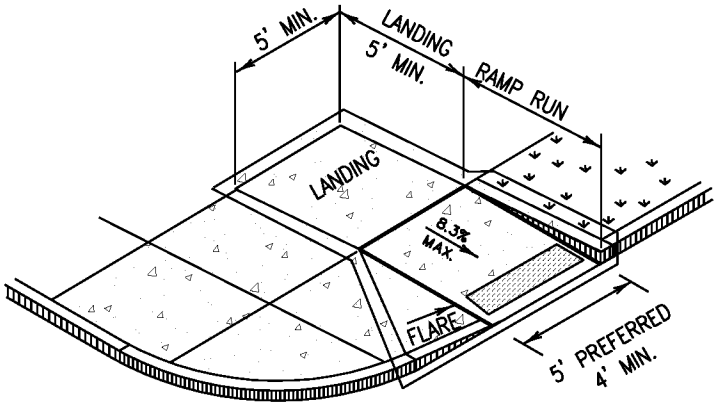
CONSTRUCTION STANDARDS AND DETAILS

LEGEND

DETECTABLE WARNING PAVERS
SEE DETAIL T-35

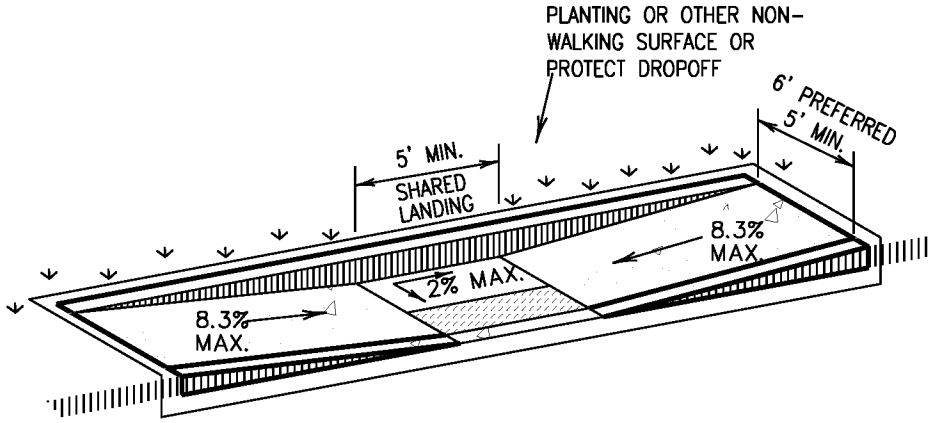
CONCRETE

NON-WALKING SURFACE



PERPENDICULAR CURB RAMP

TxDOT TYPE 1



PARALLEL CURB RAMP
(USE ONLY WHERE WATER WILL NOT POND IN THE LANDING.)

TxDOT TYPE 2

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SIDEWALK RAMP DETAILS
TYPES 1 & 2

CONSTRUCTION STANDARDS AND DETAILS

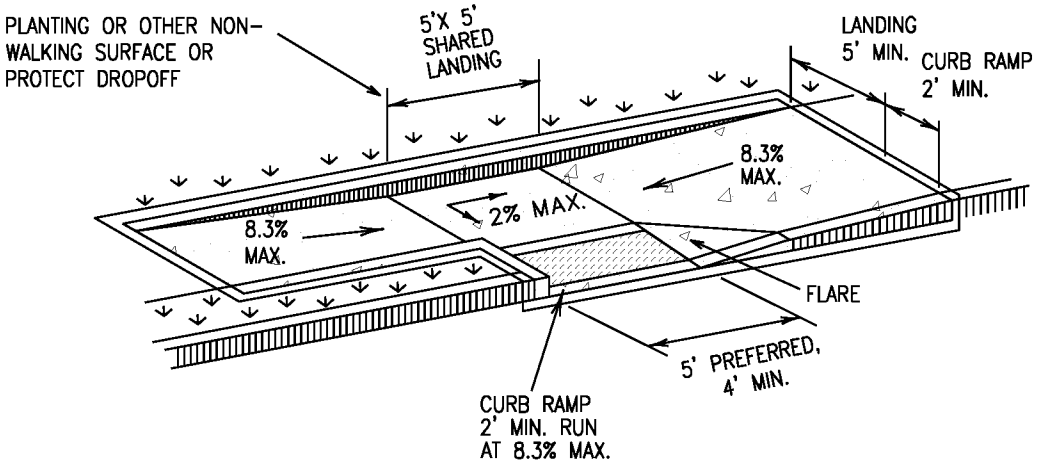
T-29
SCALE: N.T.S.
ISSUE DATE: 5-28-19

LEGEND

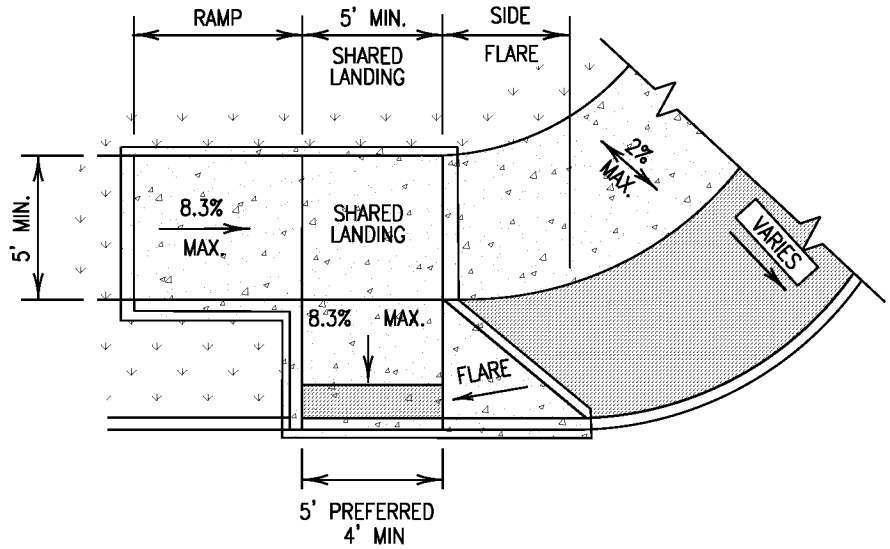
DETECTABLE WARNING PAVERS
SEE DETAIL T-35

CONCRETE

NON-WALKING SURFACE



TxDOT TYPE 3



TxDOT TYPE 6

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

SIDEWALK RAMP DETAILS
TYPE 3 & 6

CONSTRUCTION STANDARDS AND DETAILS

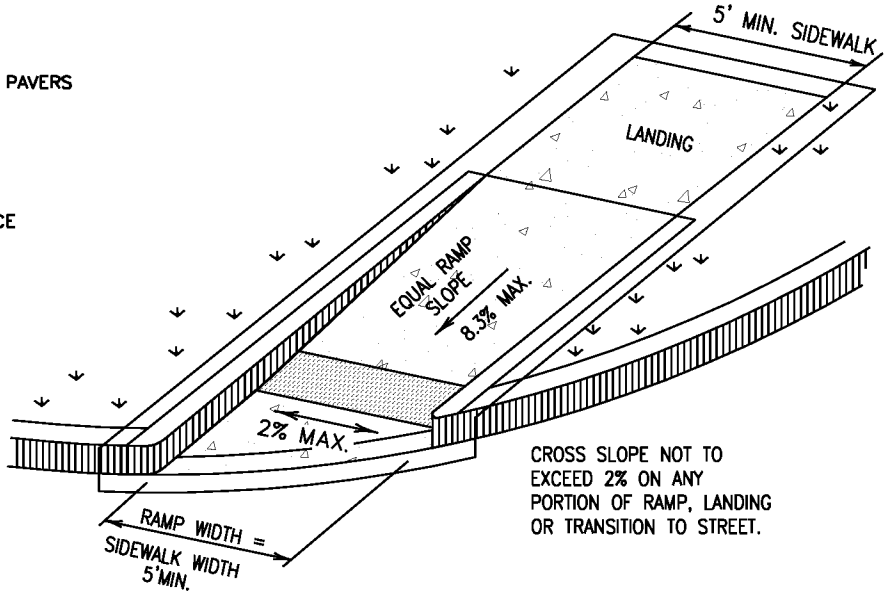
T-30
SCALE: N.T.S.
ISSUE DATE: 5-28-19

LEGEND

DETECTABLE WARNING PAVERS
SEE DETAIL T-35

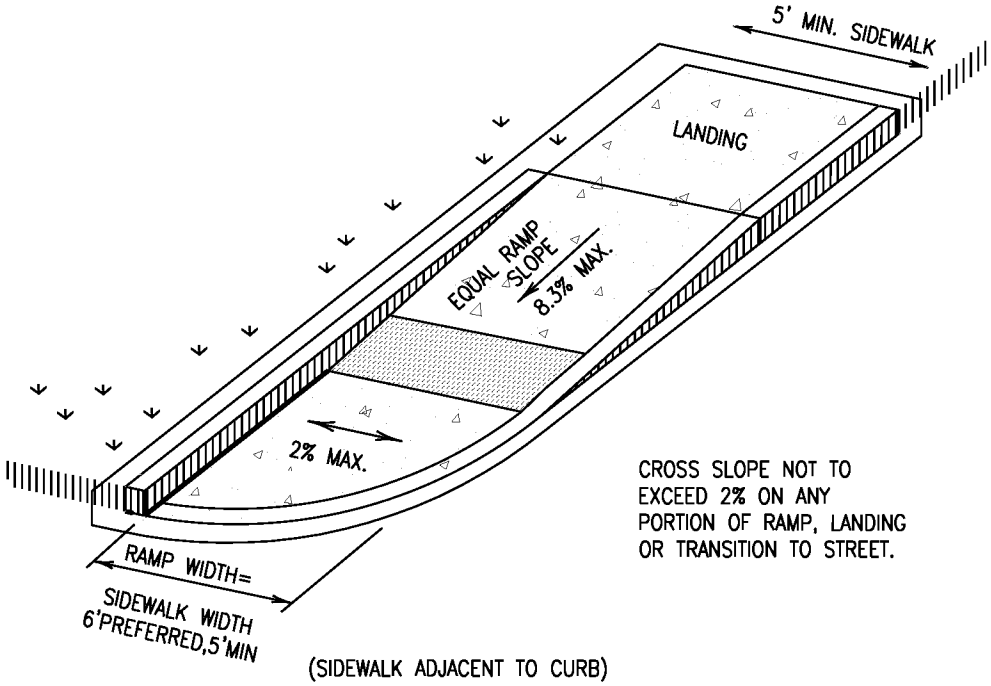
CONCRETE

NON-WALKING SURFACE



(SIDEWALK SET BACK FROM CURB)

TxDOT TYPE 7



(SIDEWALK ADJACENT TO CURB)

TxDOT TYPE 10

DIRECTIONAL RAMP WITHIN RADIUS

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SIDEWALK RAMP DETAILS
TYPES 7 & 10

CONSTRUCTION STANDARDS AND DETAILS

T-31A

SCALE: N.T.S.

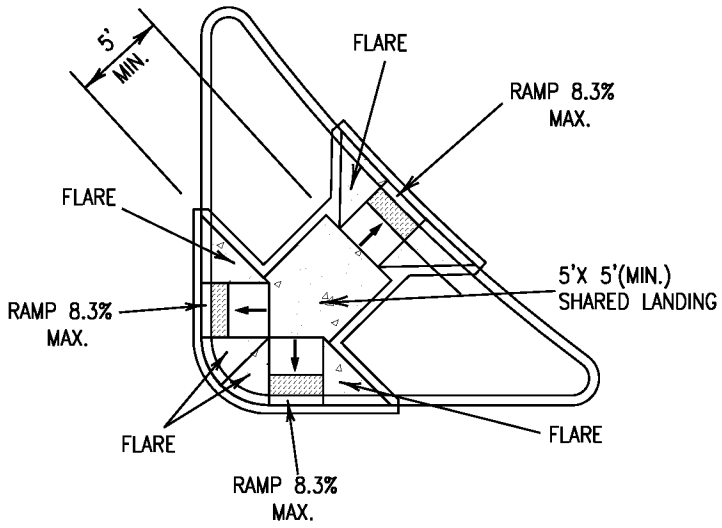
ISSUE DATE: 5-28-19

LEGEND

DETECTABLE WARNING PAVERS
SEE DETAIL T-35

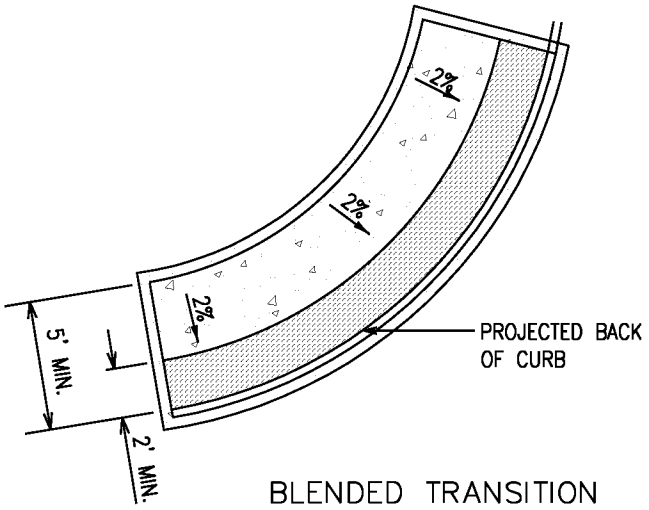
CONCRETE

NON-WALKING SURFACE



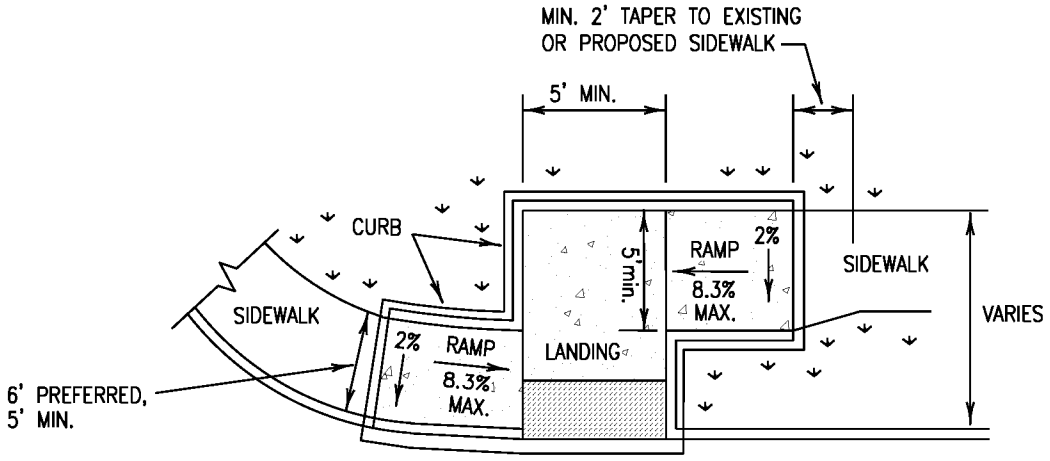
COMBINATION ISLAND RAMPS

TxDOT TYPE 22



BLENDED TRANSITION

TxDOT TYPE 5



OFFSET PARALLEL CURB RAMP

TxDOT TYPE 11

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SIDEWALK RAMP DETAILS
TYPES 5, 11 & 22

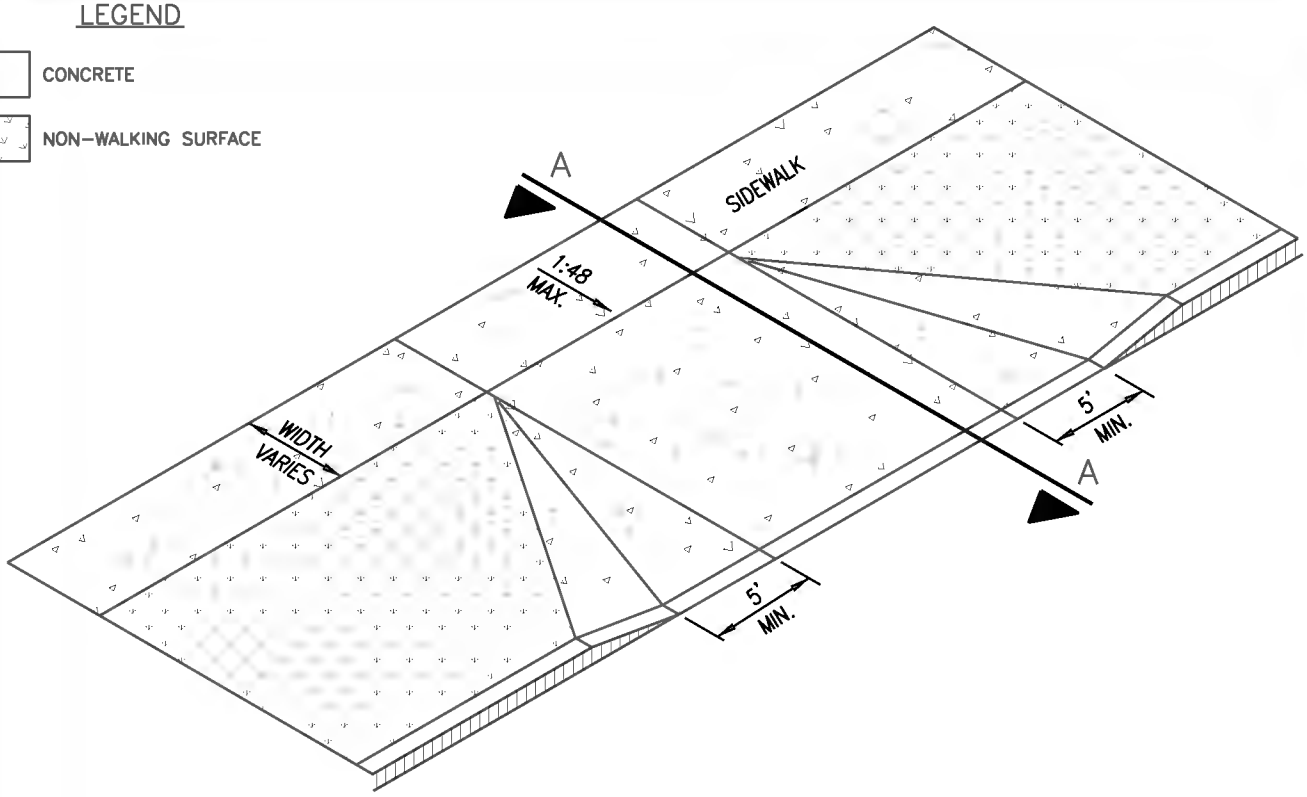
CONSTRUCTION STANDARDS AND DETAILS

T-31B
SCALE: N.T.S.
ISSUE DATE: 5-28-19

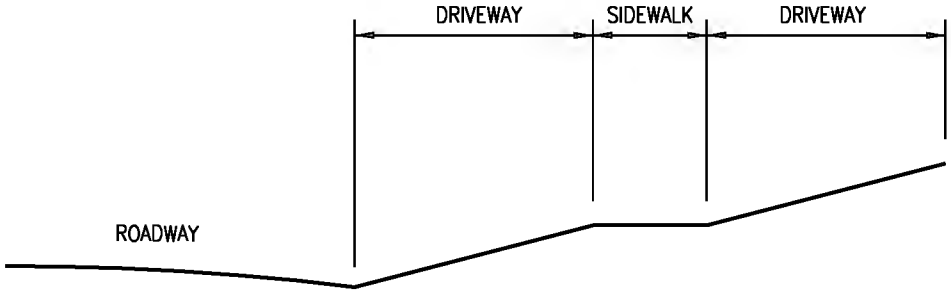
LEGEND

CONCRETE

NON-WALKING SURFACE



SIDEWALK AT DRIVEWAY



SECTION "A-A"

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SIDEWALK TREATMENT AT DRIVEWAYS

CONSTRUCTION STANDARDS AND DETAILS

F-32

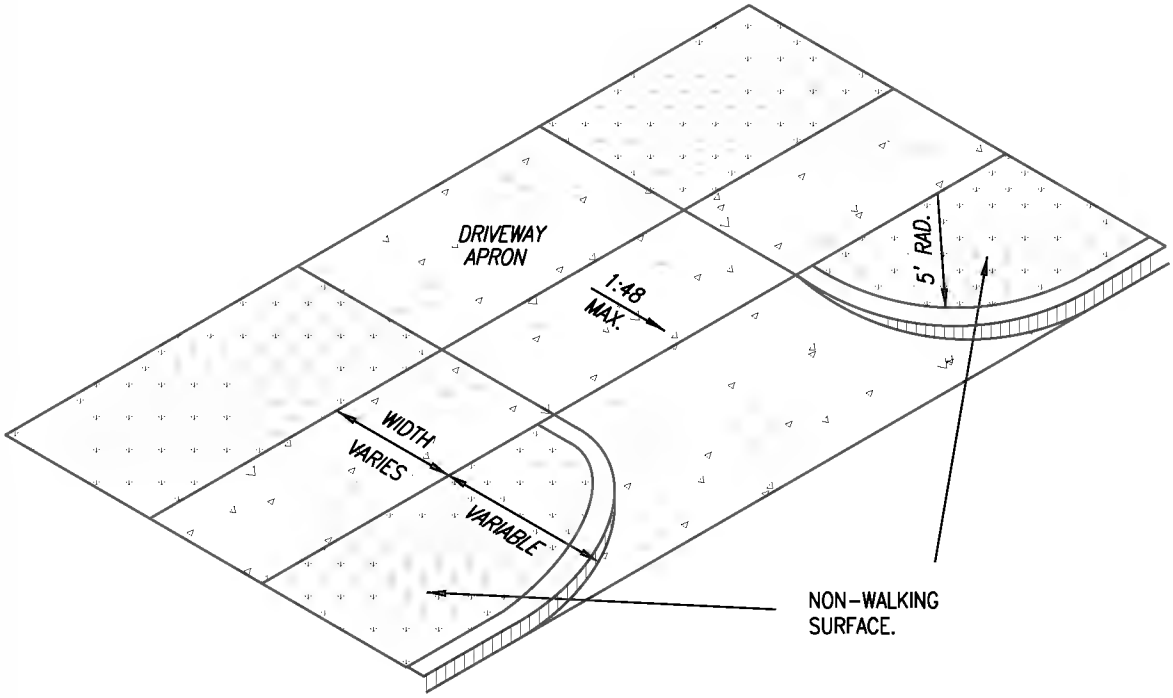
SCALE: N.T.S.

ISSUE DATE: 5-28-19

LEGEND

CONCRETE

NON-WALKING SURFACE



CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

TYPICAL SIDEWALK WITH DRIVEWAY APPROACH

CONSTRUCTION STANDARDS AND DETAILS

T-33

SCALE: N.T.S.

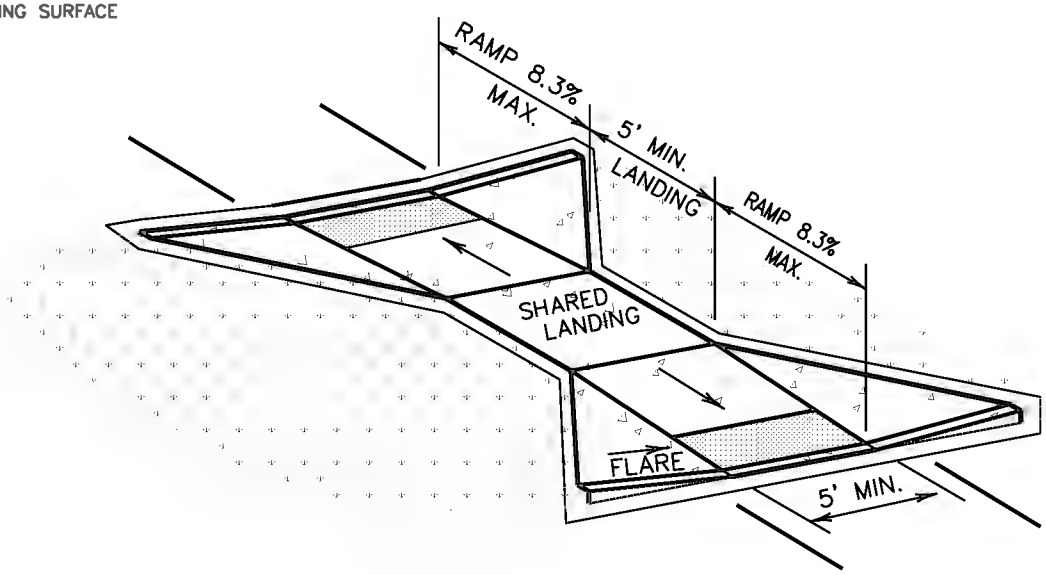
ISSUE DATE: 5-28-19

LEGEND

DETECTABLE WARNING PAVERS
SEE DETAIL T-35

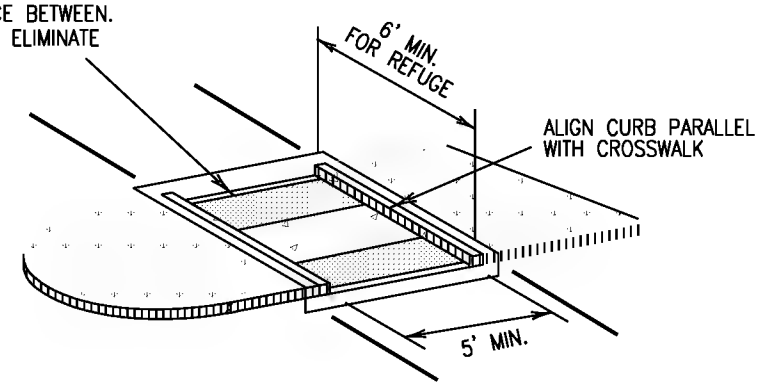
CONCRETE

NON-WALKING SURFACE



TxDOT TYPE 20

INSTALL DETECTABLE WARNING SURFACE AT EACH END OF CUT-THROUGH RAMP WITH MINIMUM 2' SMOOTH SURFACE BETWEEN. IF MEDIAN IS LESS THAN 6' WIDE, ELIMINATE DETECTABLE WARNING SURFACES.



CURB DETAILS ARE SHOWN ELSEWHERE IN THE PLANS.

TxDOT TYPE 21

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

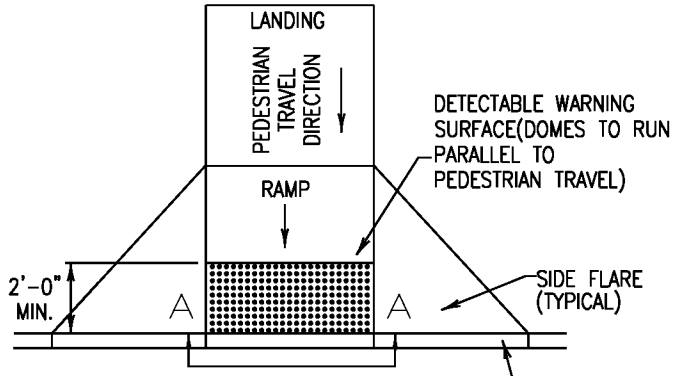
CURB RAMP DETAILS AT MEDIAN ISLANDS TYPES 20 & 21

CONSTRUCTION STANDARDS AND DETAILS

T-30

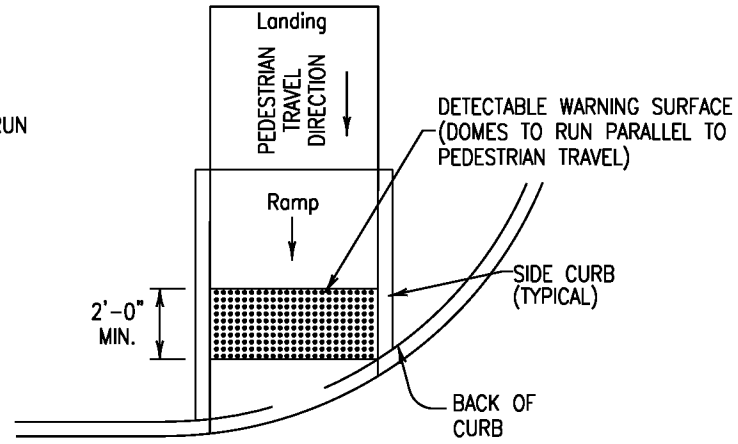
SCALE: NTS

ISSUE DATE: 5 JUL 19



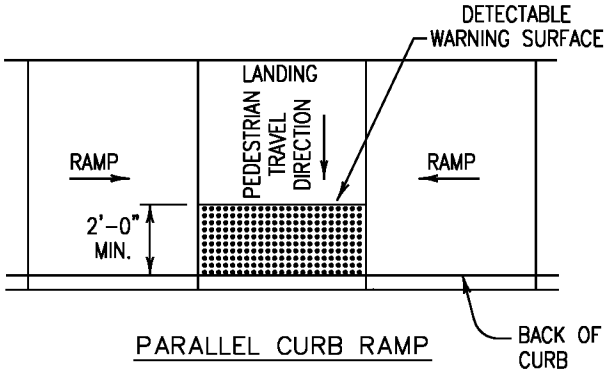
PERPENDICULAR CURB RAMP

TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.



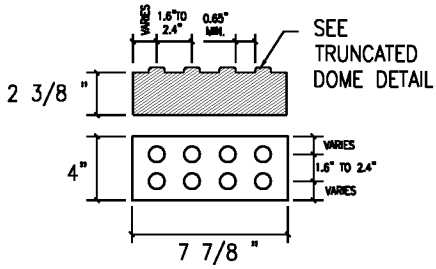
DIRECTIONAL CURB RAMP

TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON SLOPING RAMP RUN.



PARALLEL CURB RAMP

TYPICAL PLACEMENT OF DETECTABLE WARNING SURFACE ON LANDING AT STREET EDGE.



CONCRETE PAVER WITH TRUNCATED DOME SURFACE

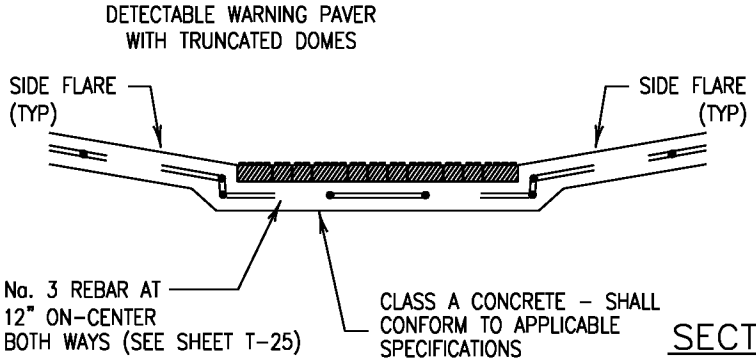
GENERAL NOTES

CONCRETE PAVER UNITS SHALL MEET ALL REQUIREMENTS OF ASTM C-936, C-33, AND SHALL BE LAID IN A TWO BY TWO UNIT BASKET WEAVE PATTERN, UNLESS SHOWN OTHERWISE IN THE PLANS.

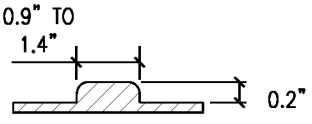
CONCRETE PAVER UNIT SHALL HAVE A TRUNCATED DOME TOP SURFACE FOR DETECTABLE WARNING TO PEDESTRIANS.

CONCRETE PAVER UNIT COLOR FOR THE RAMP SHALL BE A CONTRASTING COLOR (TO BE APPROVED BY CITY ENGINEER) TO THE ADJACENT SURFACES. THE COLOR OF THE CONCRETE PAVER UNITS SHALL BE SHOWN ELSEWHERE IN THE PLANS. (ADJACENT SURFACES INCLUDE SIDE FLARES).

CONCRETE PAVER UNITS SHALL BE SAW CUT ONLY AND ANY CUT UNIT SHALL BE NOT LESS THAN 25 PERCENT OF A FULL UNIT.



SECTION A-A



TOP OF TRUNCATED DOME SHALL HAVE DIAMETER OF 50%-65% OF THE BASE DIAMETER.

TRUNCATED DOME

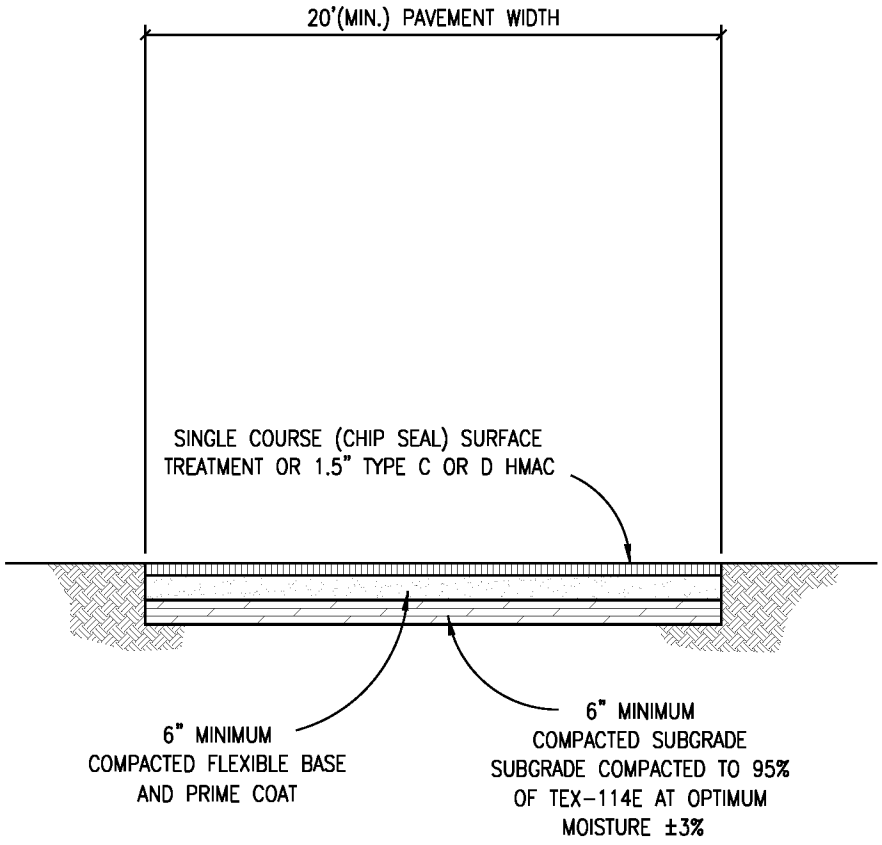
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

CURB RAMP DETECTABLE WARNING PAVERS

CONSTRUCTION STANDARDS AND DETAILS

T-35
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTE:

1. PERTAINING TO THIS DETAIL, TEMPORARY IS DEFINED AS A PERIOD OF TIME NO LONGER THAN 1 YEAR.

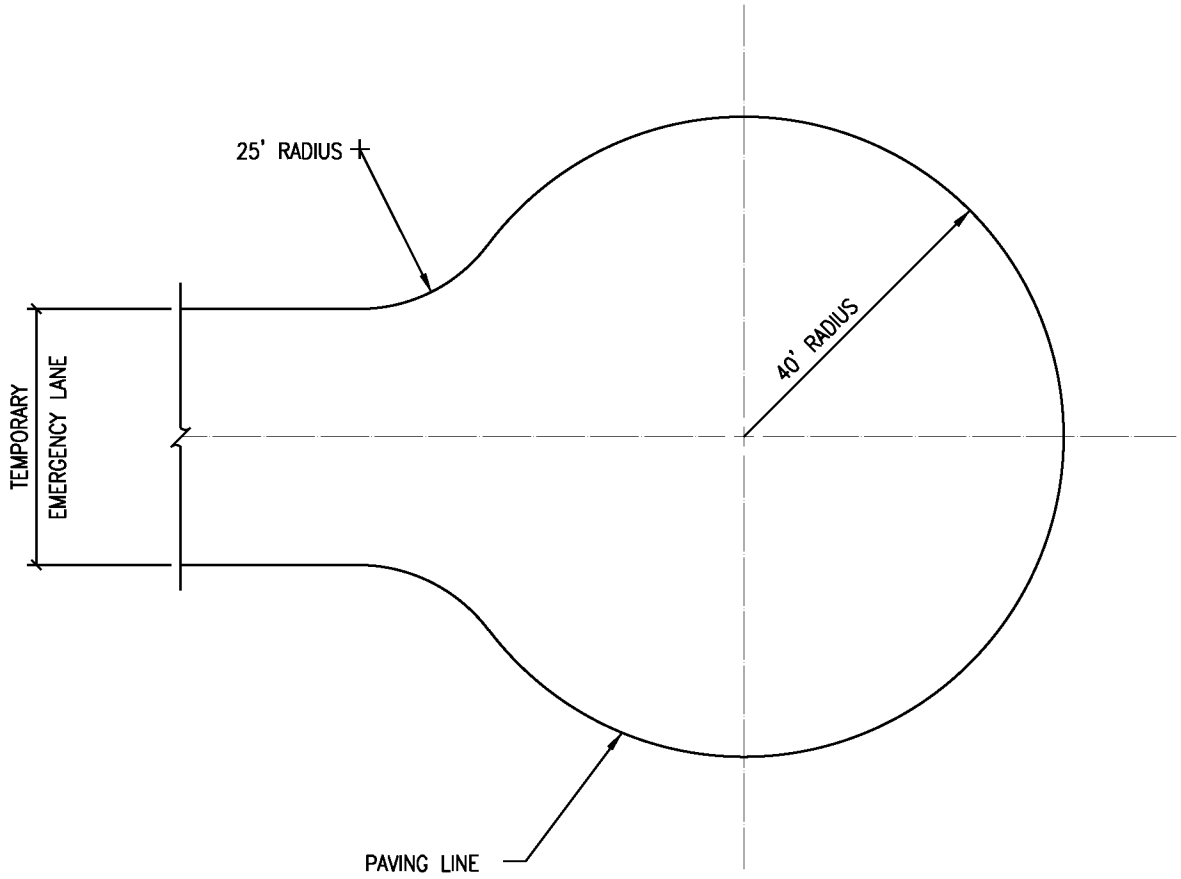
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

TEMPORARY ALL WEATHER DRIVING SURFACE

CONSTRUCTION STANDARDS AND DETAILS

T-36
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. CONSTRUCTION OF TEMPORARY ALL WEATHER DRIVING SURFACE TURN AROUND SHALL BE IN ACCORDANCE WITH DETAIL T-36.

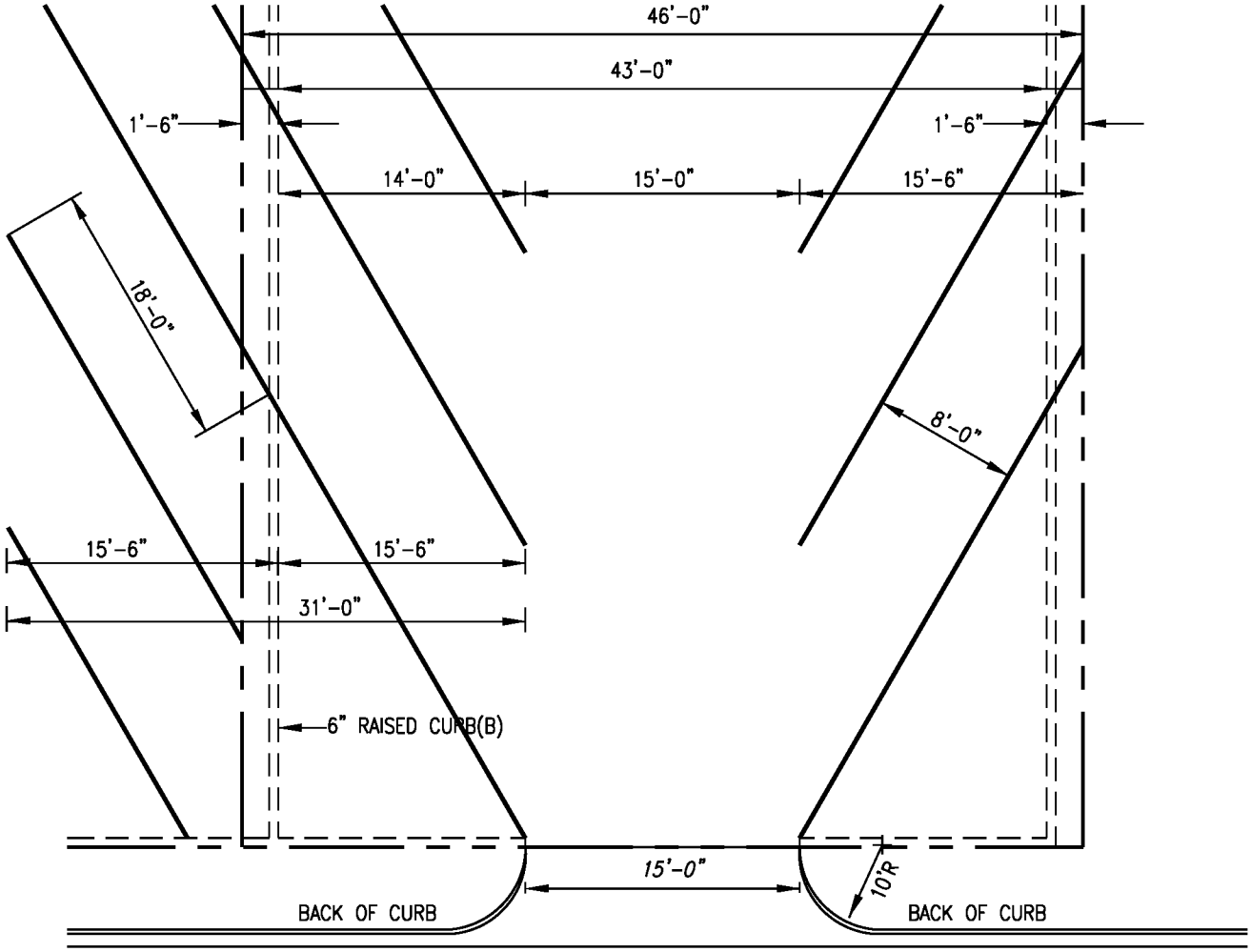
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

TEMPORARY ALL WEATHER DRIVING SURFACE TURN AROUND

CONSTRUCTION STANDARDS AND DETAILS

T-37
SCALE: N.T.S.
ISSUE DATE: 5-28-19



(A) MINIMUM REQUIRED FOR SINGLE ROW OF PARKING.

(B) TOP WIDTH 6"- INCREASE TO 10" IF COMMON BARRIER FOR TWO ROWS OF PARKING.

PROPERTY LINES

STALL LINES

NOTES:

1. ALL DISTANCES SHOWN ARE ABSOLUTE DISTANCES.
2. IF THE DISTANCES FROM THE PROPERTY LINE TO THE BACK OF CURB IS NOT SUFFICIENT TO ALLOW VEHICLES TO EASILY USE THE FIRST PARKING SPACE ON EACH SIDE OF THE FACILITY, THE FIRST TWO SPACES ON EACH SIDE SHALL BE USED AS OPEN SPACE/TRAFFIC QUEUING SPACE AND SHALL NOT COUNT AS PART OF THE CALCULATION OF THE REQUIRED PARKING SPACES.
3. LARGER RADII ON MAJOR ROADS MAY BE REQUIRED.

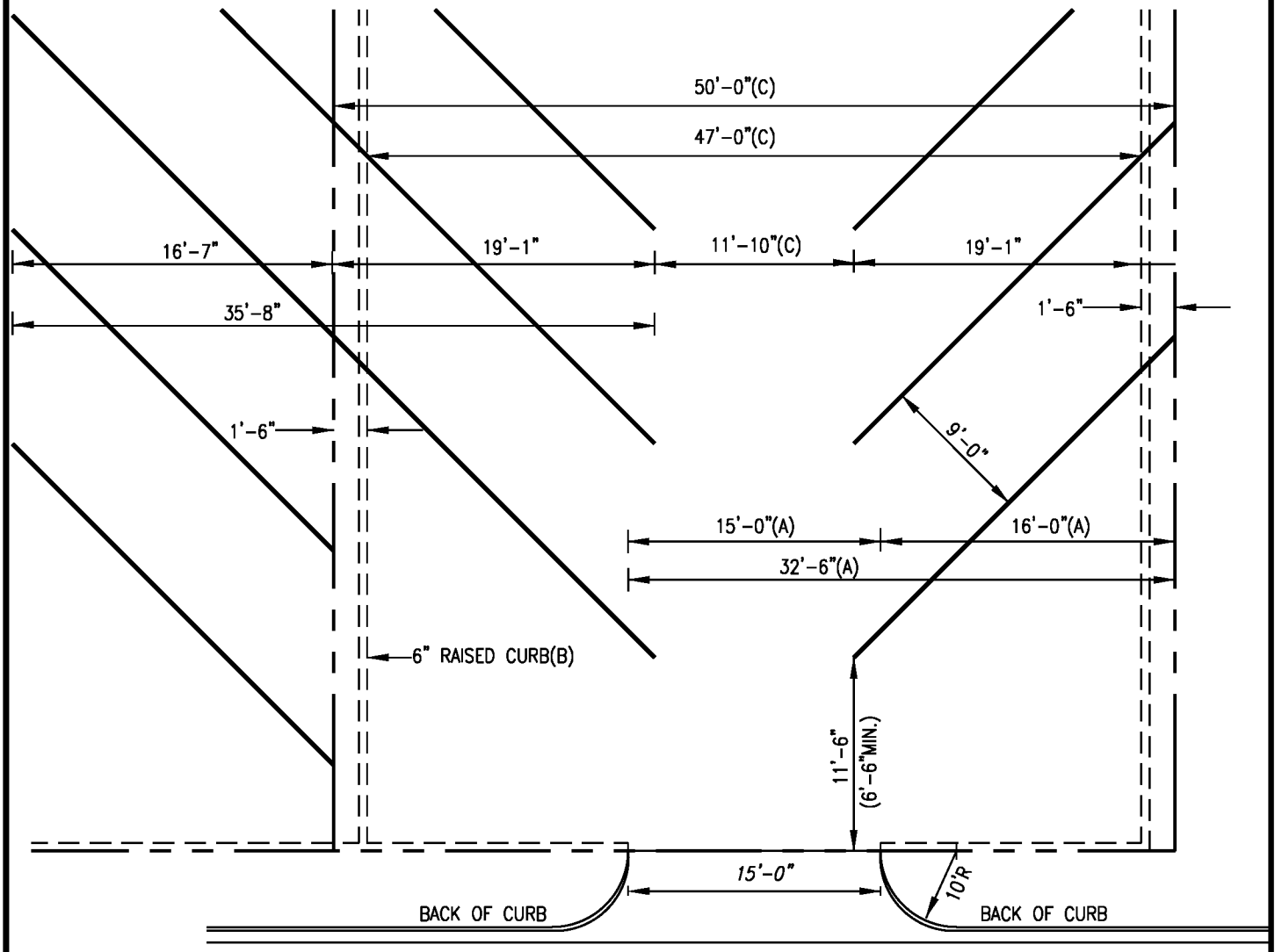
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

30° PARKING STRIPING

CONSTRUCTION STANDARDS AND DETAILS

T-38
SCALE: N.T.S.
ISSUE DATE: 5-28-19



(A) MINIMUM REQUIRED FOR SINGLE ROW OF PARKING.

(B) TOP WIDTH 6"- INCREASE TO 10" IF COMMON BARRIER FOR TWO ROWS OF PARKING.

(C) MINIMUM FOR ONE WAY TRAFFIC IN SHORT LOTS - INCREASE BY 5 FEET FOR TWO WAY TRAFFIC.

PROPERTY LINES

STALL LINES

NOTES:

1. ALL DISTANCES SHOWN ARE ABSOLUTE DISTANCES
2. IF THE DISTANCES FROM THE PROPERTY LINE TO THE BACK OF CURB IS NOT SUFFICIENT TO ALLOW VEHICLES TO EASILY USE THE FIRST PARKING SPACE ON EACH SIDE OF THE FACILITY, THE FIRST TWO SPACES ON EACH SIDE SHALL BE USED AS OPEN SPACE/TRAFFIC QUEUING SPACE AND SHALL NOT COUNT AS PART OF THE CALCULATION OF THE REQUIRED PARKING SPACES
3. LARGER RADII ON MAJOR ROADS MAY BE REQUIRED.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

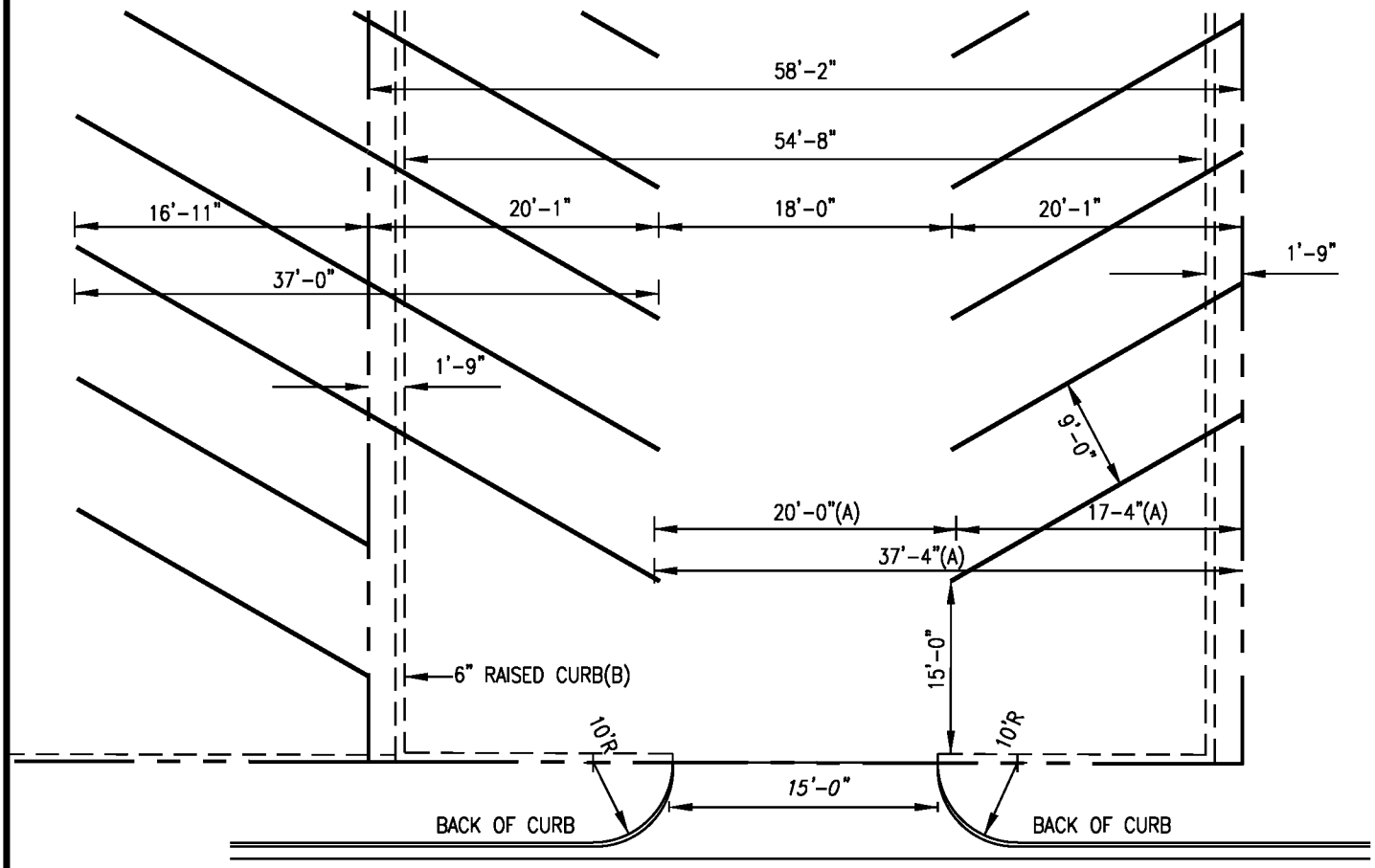
45° PARKING STRIPING

CONSTRUCTION STANDARDS AND DETAILS

T-39

SCALE: N.T.S.

ISSUE DATE: 5-28-19



(A) MINIMUM REQUIRED FOR SINGLE ROW OF PARKING.

(B) TOP WIDTH 6"– INCREASE TO 10" IF COMMON BARRIER FOR TWO ROWS OF PARKING.

NOTES:

1. ALL DISTANCES SHOWN ARE ABSOLUTE DISTANCES
2. IF THE DISTANCES FROM THE PROPERTY LINE TO THE BACK OF CURB IS NOT SUFFICIENT TO ALLOW VEHICLES TO EASILY USE THE FIRST PARKING SPACE ON EACH SIDE OF THE FACILITY, THE FIRST TWO SPACES ON EACH SIDE SHALL BE USED AS OPEN SPACE/TRAFFIC QUEUING SPACE AND SHALL NOT COUNT AS PART OF THE CALCULATION OF THE REQUIRED PARKING SPACES
3. LARGER RADII ON MAJOR ROADS MAY BE REQUIRED.

PROPERTY LINES

STALL LINES

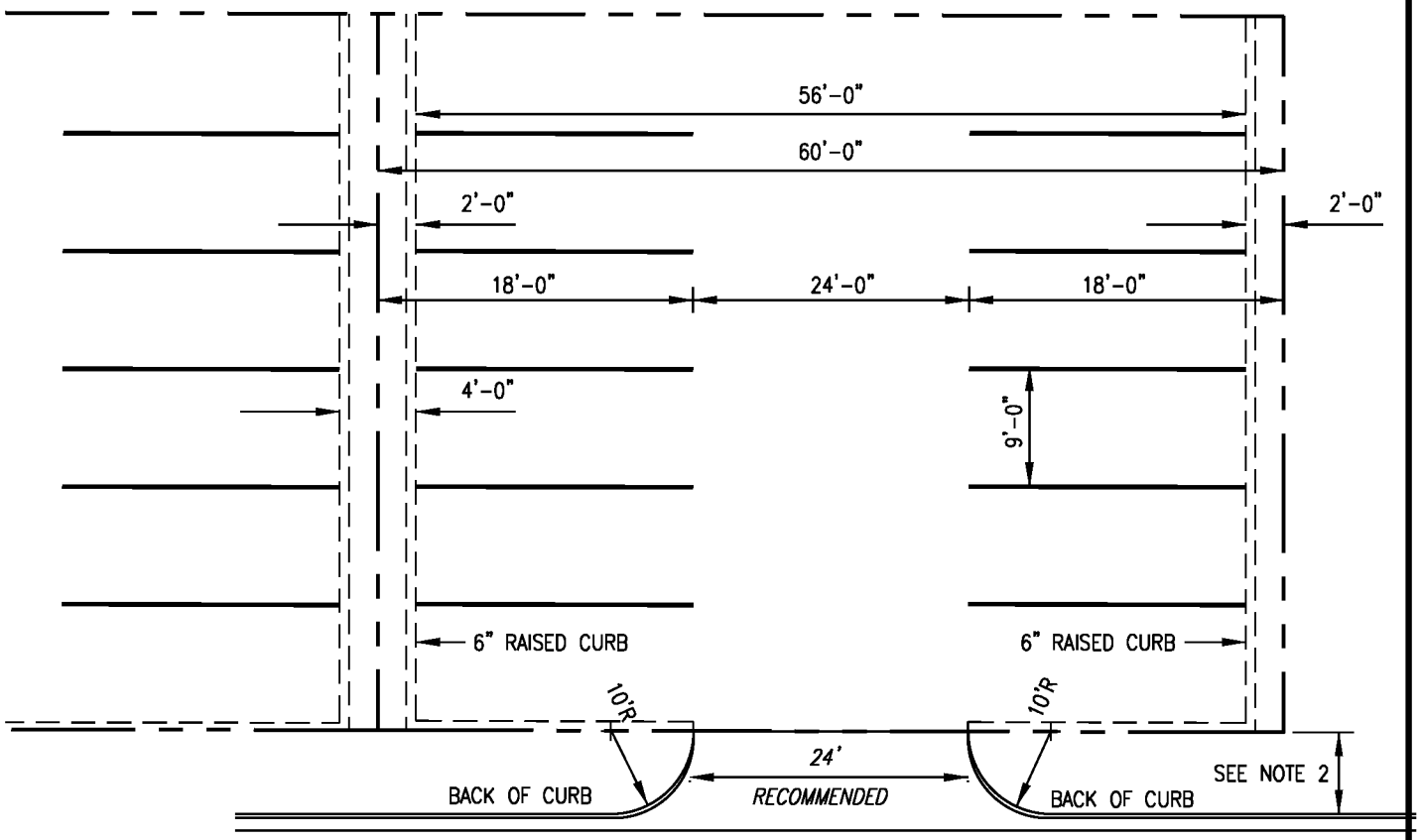
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

60° PARKING STRIPING

CONSTRUCTION STANDARDS AND DETAILS

T-40
SCALE: N.T.S.
ISSUE DATE: 5-28-19



PROPERTY LINES

STALL LINES

NOTES:

1. ALL DISTANCES SHOWN ARE ABSOLUTE DISTANCES
2. IF THE DISTANCES FROM THE PROPERTY LINE TO THE BACK OF CURB IS NOT SUFFICIENT TO ALLOW VEHICLES TO EASILY USE THE FIRST PARKING SPACE ON EACH SIDE OF THE FACILITY, THE FIRST TWO SPACES ON EACH SIDE SHALL BE USED AS OPEN SPACE/TRAFFIC QUEUING SPACE AND SHALL NOT COUNT AS PART OF THE CALCULATION OF THE REQUIRED PARKING SPACES
3. LARGER RADII ON MAJOR ROADS MAY BE REQUIRED.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

90° PARKING STRIPING

CONSTRUCTION STANDARDS AND DETAILS

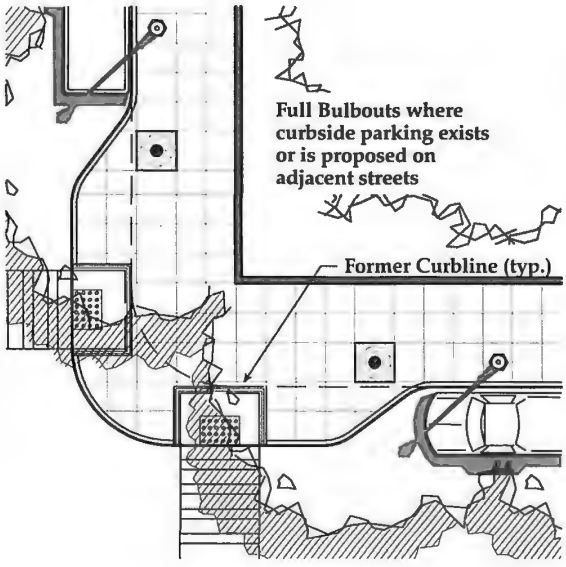
T-41

SCALE: N.T.S.

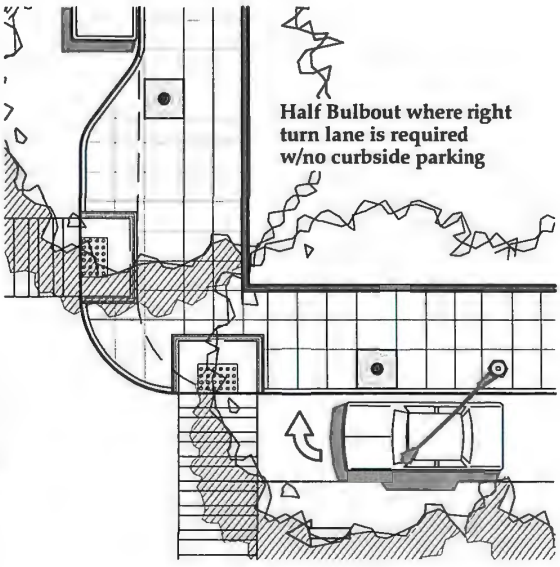
ISSUE DATE: 5-28-19

NOTE:

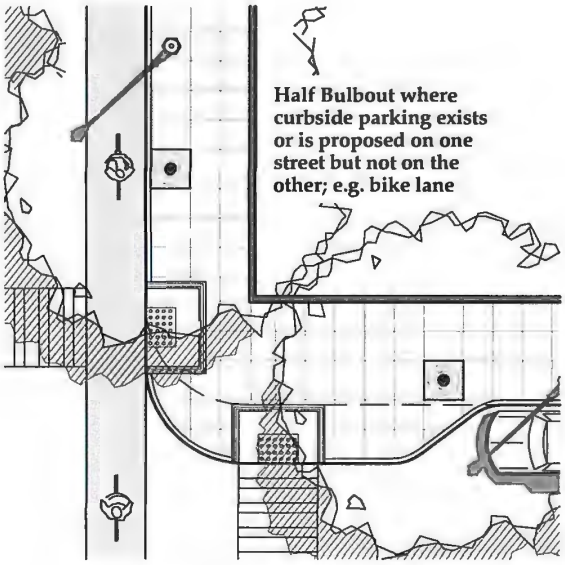
TO ALLEVIATE TRAFFIC CONGESTION AND PROVIDE A PEDESTRIAN-FRIENDLY ENVIRONMENT, CORNER BULB-OUTS SHALL BE CONSIDERED. BULB-OUTS EXPAND THE STREET CORNER, INCREASE PEDESTRIAN VISIBILITY, AND REDUCE PEDESTRIAN CROSSING DISTANCES. CORNER BULB-OUTS SHALL EXTEND APPROX. 6 FEET FROM THE FACE OF THE CURB, WITH A 10-FOOT OUTSIDE RADIUS FOR STREET SWEEPING. BULB-OUTS SHALL HAVE A MINIMUM LENGTH OF 20 FEET.



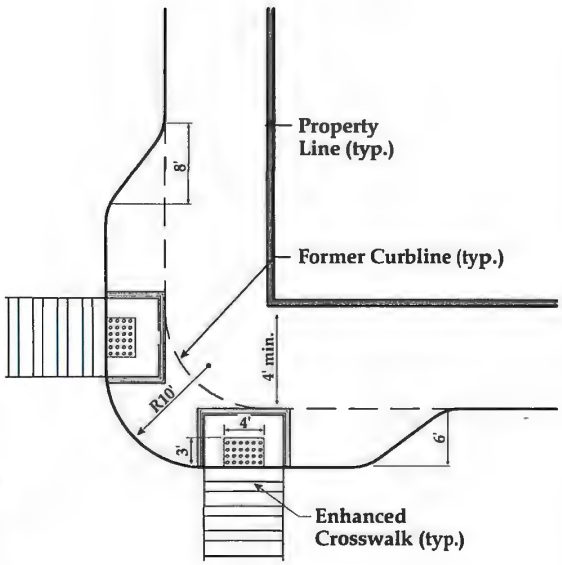
Full Bulb-Out



Half Bulb-Out - Right Turn



Half Bulb-Out - Bike Lane



Typical Dimensions

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

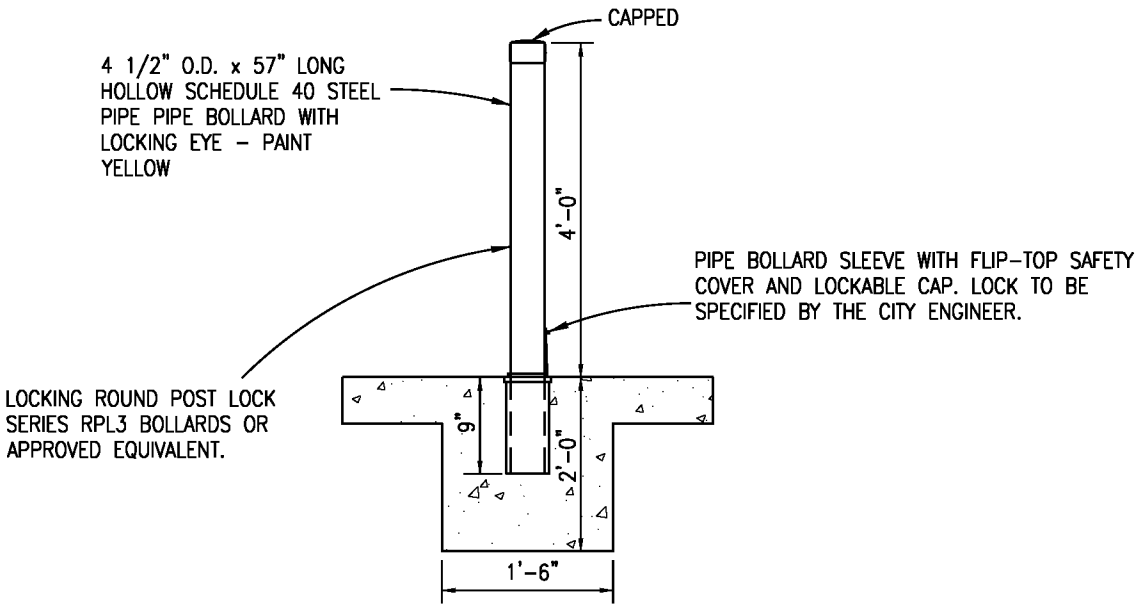
CORNER BULB-OUTS

CONSTRUCTION STANDARDS AND DETAILS

T-42

SCALE: N.T.S.

ISSUE DATE: 5-28-19



CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

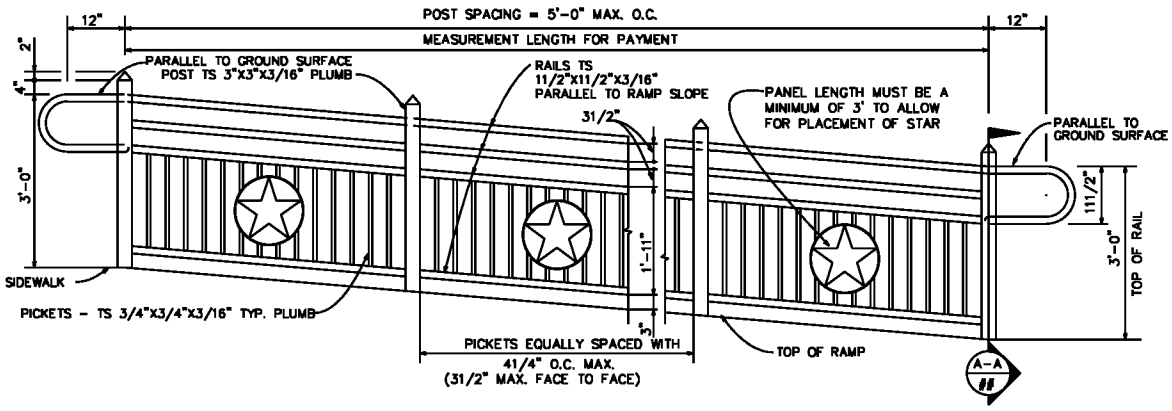
REMOVABLE BOLLARD

CONSTRUCTION STANDARDS AND DETAILS

T-43

SCALE: N.T.S.

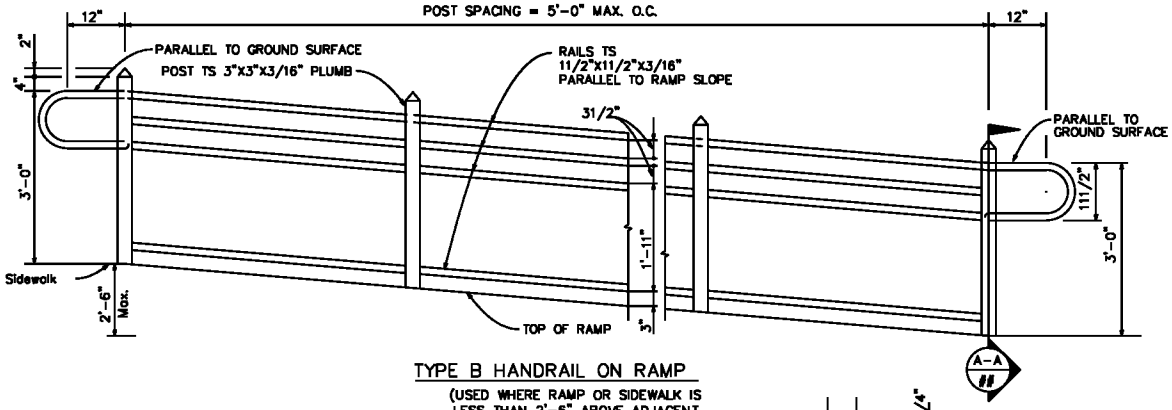
ISSUE DATE: 5-28-19



NOTE:
TYPE D HANDRAIL ELIMINATES THE GRASPING BAR AND RAIL RETURNS. ALL OTHER ELEMENTS REMAIN THE SAME. TYPE D HANDRAIL SHALL BE USED ONLY FOR A BARRIER.

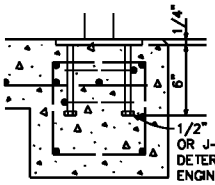
TYPE A HANDRAIL ON RAMP

(USED IN ALL CASES UNLESS THE USE WILL CREATE A SITE OBSTRUCTION)

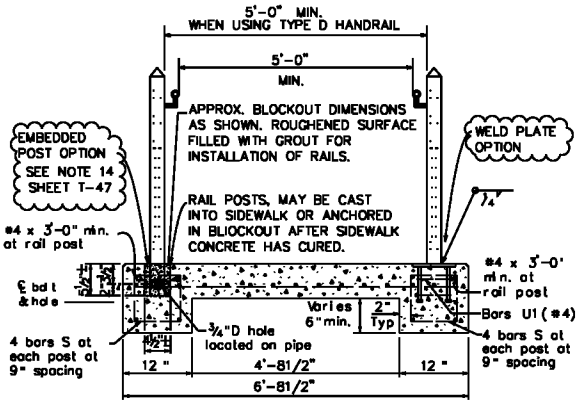


TYPE B HANDRAIL ON RAMP

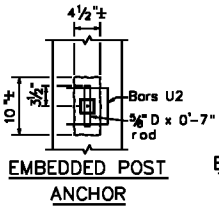
(USED WHERE RAMP OR SIDEWALK IS LESS THAN 2'-6" ABOVE ADJACENT SURFACE AND WHERE TYPE A RAIL CREATES A SIGHT OBSTRUCTION.)



WELD PLATE ANCHOR

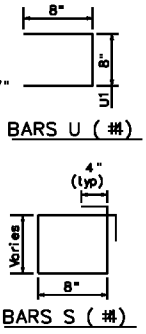


ELEVATION



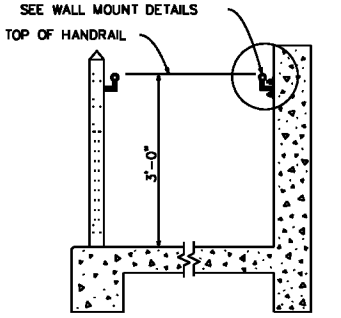
EMBEDDED POST ANCHOR

BASE PLATE DETAILS



BARS U (#)

BARS S (#)



COMBINATION OF HANDRAIL ON WALL AND RAMP

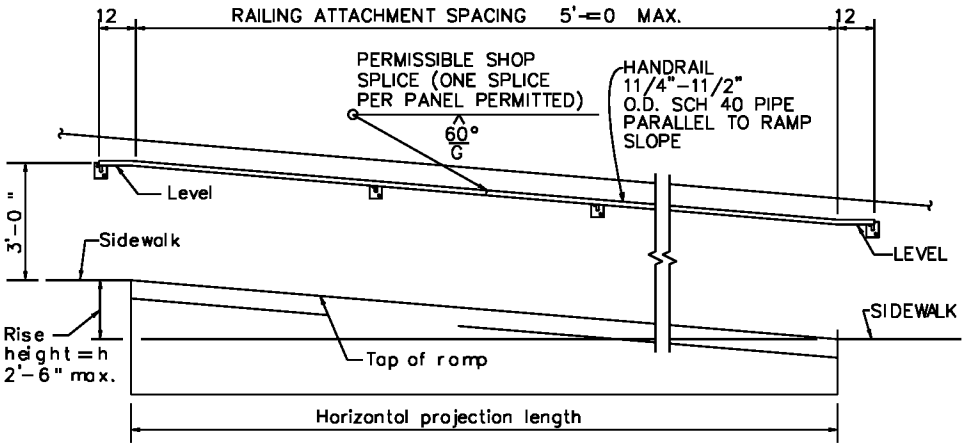
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

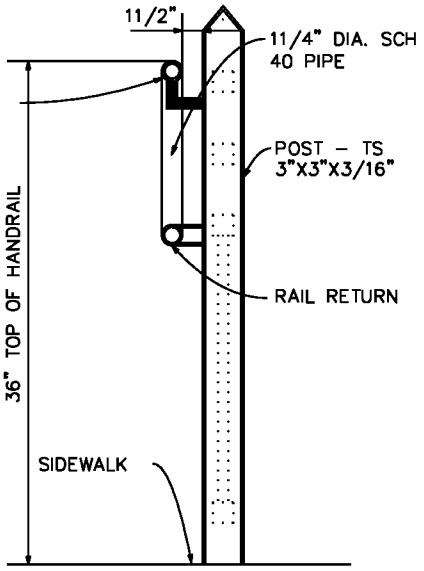
TxDOT WACO DISTRICT HANDRAIL

CONSTRUCTION STANDARDS AND DETAILS

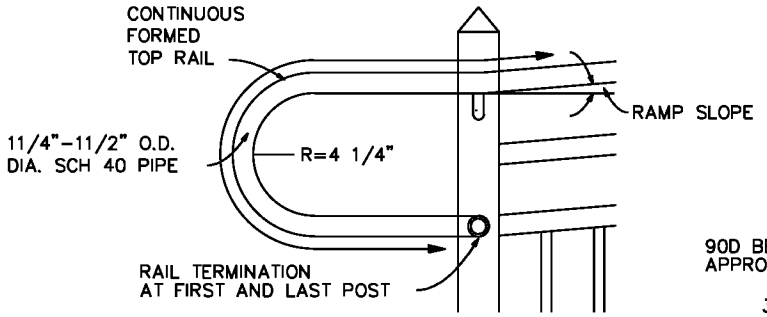
T-44
SCALE: N.T.S.
ISSUE DATE: 5-28-19



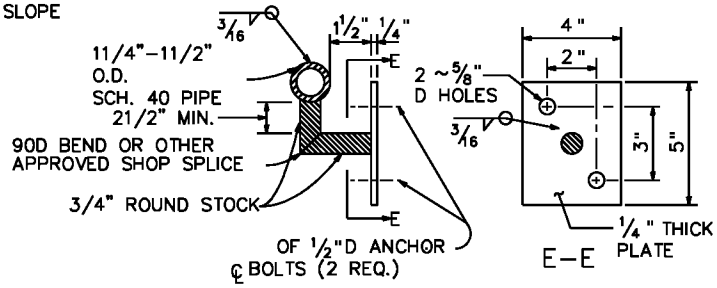
TYPE C HANDRAIL ON WALL

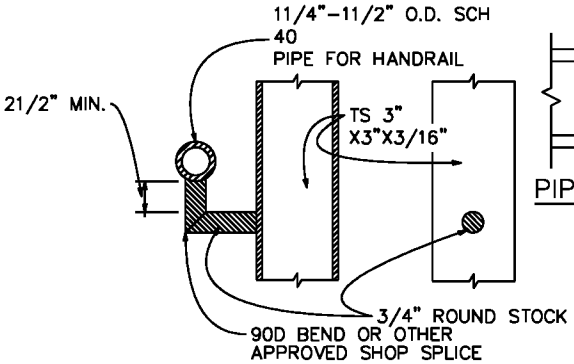


POST SECTION A-A ##

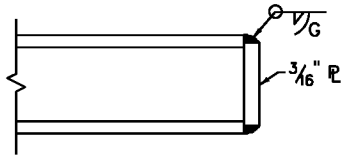


RAIL RETURN DETAIL



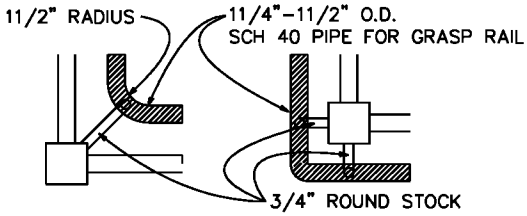


HANDRAIL TO POST MOUNT DETAILS



PIPE END DETAILS

WALL MOUNT DETAILS



INSIDE CORNER

OUTSIDE CORNER

HANDRAIL ATTACHMENT DETAIL

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

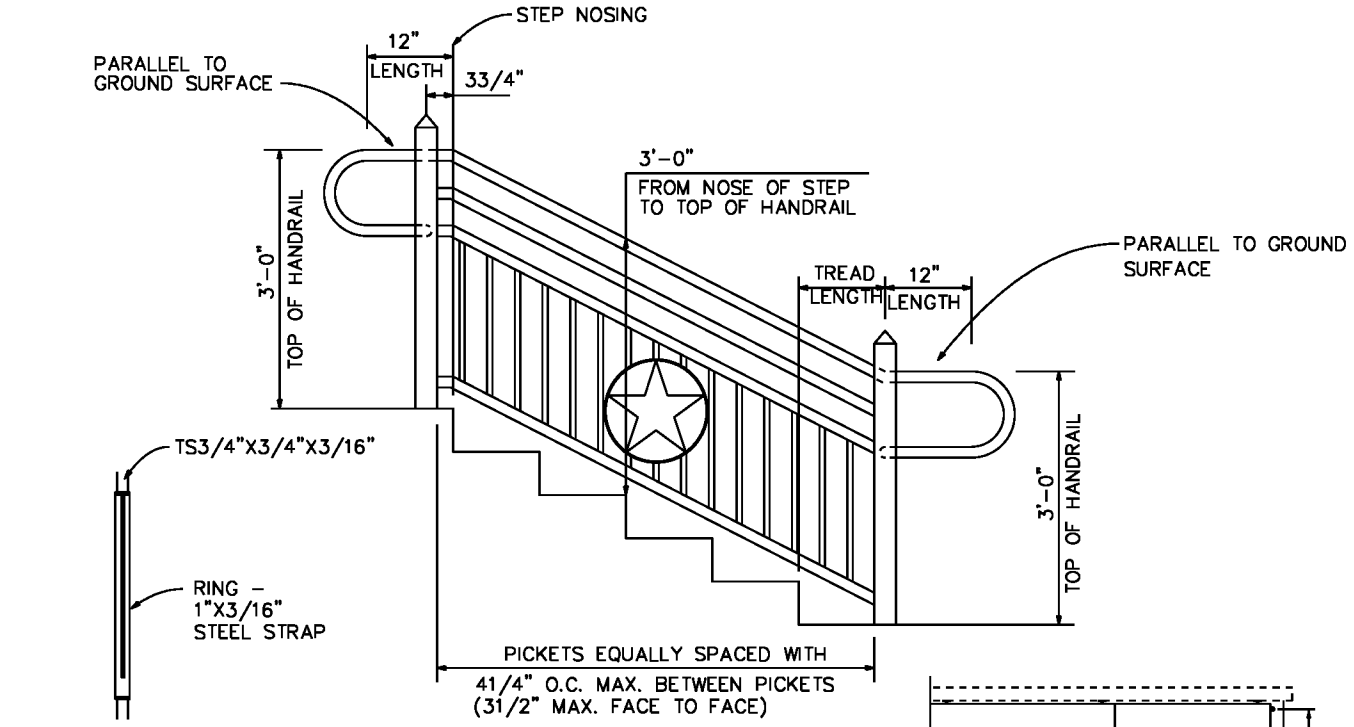
TxDOT WACO DISTRICT HANDRAIL (CONTINUED)

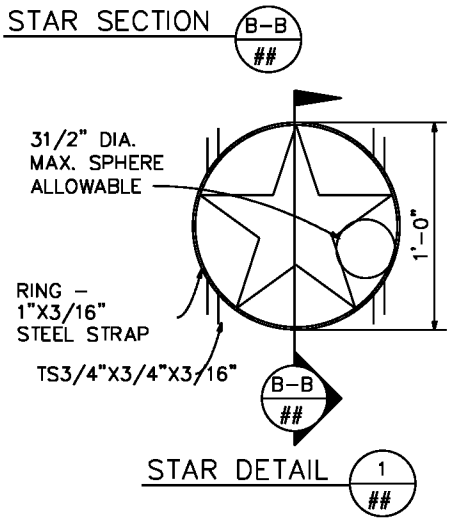
CONSTRUCTION STANDARDS AND DETAILS

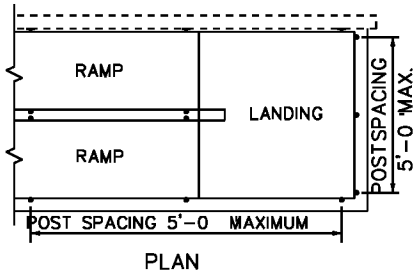
T-45

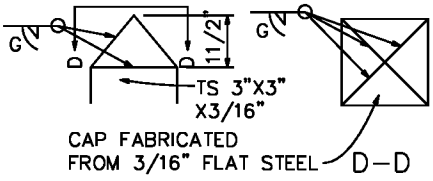
SCALE: N.T.S.

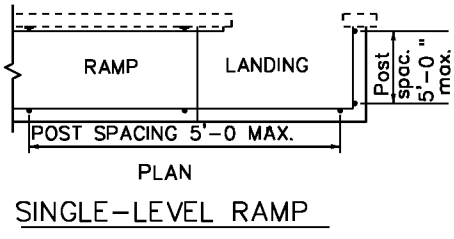
ISSUE DATE: 5-28-19











GENERAL NOTES

1. THE DESIGNER SHOULD CAREFULLY EVALUATE THE SITE CONDITIONS TO DETERMINE THE NECESSITY AND EXTENT OF THE WARRANT FOR HANDRAIL.
2. THE DESIGNER SHOULD USE CAREFUL JUDGEMENT IN SPECIFYING THE TYPE OF HANDRAIL TO BE USED.
3. TYPE "A" HANDRAIL IS TO BE USED IN ALL CASES, UNLESS ITS USE WILL CREATE A SITE OBSTRUCTION, OR IT IS ADJACENT TO THE WALL OF A BUILDING OR A RETAINING WALL.
4. TYPE HANDRAIL IS TO BE USED IN CASES WHERE THE TYPE 'A' HANDRAIL CREATES A SITE OBSTRUCTION. IF TYPE 'B' HANDRAIL IS USED, THE RAMP AND/OR SIDEWALK HEIGHT ABOVE ANY ADJACENT SURFACE SHALL NOT BE MORE THAN 2'-6" TYPE 'B' HANDRAIL CAN BE USED ADJACENT TO CONCRETE BLOCK RETAINING WALLS (KEYSTONE OR SIMILAR TYPE WALL CONSTRUCTION).

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

TxDOT WACO DISTRICT HANDRAIL (CONTINUED)

CONSTRUCTION STANDARDS AND DETAILS

T-46
SCALE: N.T.S.
ISSUE DATE: 5-28-19

5. TYPE D HANDRAIL IS TO BE USED ONLY AS A BARRIER.

6. WHERE HANDRAIL IS PLACED ADJACENT TO THE WALL OF A BUILDING, TYPE 'B' HANDRAIL IS TO BE USED UNLESS THERE IS AN AGREEMENT WITH THE BUILDING OWNER TO USE TYPE 'A' HANDRAIL.

7. HANDRAIL 'C' IS TO BE USED ON CONCRETE RETAINING WALLS, PROVIDED THE RETAINING WALL IS TxDOT PROPERTY, OTHERWISE, USE HANDRAIL 'B', OR FOR SCREENING PURPOSES, USE HANDRAIL 'A'.

8. IF HANDRAIL IS PLACED ON A RETAINING WALL OR THE WALL OF A BUILDING, AND THE WALL SURFACE IS IRREGULAR, ENSURE THERE IS A MINIMUM OF 1-1/2" CLEARANCE BETWEEN THE WALL SURFACE AND THE HANDRAIL.

9. IF HANDRAIL IS USED ON A RAMP FOR ITS INTENDED PURPOSE OF ACCESSIBILITY ASSISTANCE, IT MUST BE PLACED ON BOTH SIDES OF THE RAMP. IF HANDRAIL IS USED ONLY AS A DROP OFF OR FALL BARRIER TO PEDESTRIAN TRAFFIC. IT MAY BE USED AS NECESSARY ON ONLY ONE SIDE OF A RAMP OF SIDEWALK.

10. DESIGN CONFORMS TO TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR) TEXAS ACCESSIBILITY STANDARDS (TAS). AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES (ADAAG), AND AASHTO SPECIFICATIONS. HANDRAIL MUST BE INSTALLED IN COMPLIANCE WITH THESE STANDARDS AND GUIDELINES.

11. HANDRAILS SHALL NOT ROTATE WITHIN THEIR FITTINGS.

12. HANDRAILS SHALL BE A CONSISTENT HEIGHT ABOVE RAMP SURFACE.

13. SEE SIDEWALK AND RAMP DETAILS AND/OR PLAN DRAWINGS FOR RAMP SLOPES, DIMENSIONS, CONFIGURATIONS, AND REINFORCING STEEL. THIS STANDARD SHOWS ADDITIONAL REINFORCING STEEL REQUIRED FOR HANDRAIL.

14. POSTS ARE TO BE ATTACHED TO THE CONCRETE UTILIZING WELD PLATES OR EMBEDDED POSTS. BOLT DOWN ANCOR PLATES ARE NOT ACCEPTABLE. WELD PLATES ARE SPECIFICALLY TO BE USED WHERE THERE IS A HIGH POSSIBILITY THE HANDRAIL CAN BE DAMAGED BY VEHICLES.

15. MEASUREMENT FOR PAYMENT WIL BE THE DIMENSION BETWEEN THE CENTERLINE OF THE OUTSIDE POSTS. THE DIMENSION OF THE RAIL RETURN WILL NOT BE INCLUDED IN THE MEASUREMENT FOR PAYMENT, BUT WILL BE CONSIDERED SUBSIDIARY TO ITEM 450.

16. MATERIAL FOR POSTS AND HANDRAILS SHALL BE ASTM A53 GR B, OR A501, WELD PLATES SHALL BE A36.

17. IF THE RAIL RETURN CREATES A HAZARD OR OBSTRUCTION, IT MAY BE TURNED OUTWARD 90° TO THE DIRECTION OF THE HANDRAIL.

18. ALL COMPONENTS SHALL BE PAINTED IN STRICT ACCORDANCE TO TxDOT SPECIFICATION ITEM 446, CLEANING AND PAINTING STEEL, SYSTEM II, CLASS A BLAST CLEANING. THE PAINT SHALL BE ACRYLIC LATEX. PRIMER AND PAINT SHALL BE FROM THE SAME MANUFACTURER. THE SURFACE PREPARATION SHALL MEET THE REQUIREMENTS OF SSPC-SP 10. THE PAINT COLOR SHALL BE SELECTED BY THE TxDOT DISTRICT LANDSCAPE ARCHITECT. A LIST OF PRE-APPROVED STRUCTURAL STEEL PAINT MANUFACTURERS CAN BE FOUND ON TxDOT'S WEBSITE.

19. ALL WELDS SHALL BE 3/16" x 3/16" FILET FULL PERIMETER ON ALL CONNECTIONS, UNLESS OTHERWISE SHOWN ON THE PLANS.

20. ANCHOR BOLTS FOR HANDRAIL ATTACHED TO A RETAINING WALL SHALL BE PLACED USING ON ADHESIVE DOWELING SYSTEM APPROVED BY THE ENGINEER. ANCHOR BOLTS SHALL HAVE AN ALLOWABLE CAPACITY OF 2400 lbs IN TENSION AND 2300 lbs IN SHEAR. INSTALLATION OF THE ANCHOR BOLTS, INCLUDING HOLE DEPTH AND DIAMETER, SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION. IF REQUIRED BY THE ENGINEER, 3 OF THE FIRST 10 ANCHORS, AND 5% OF THE REMAINING ANCHORS SHALL BE TESTED TO 70% OF THE MINIMUM YIELD. THE CONTRACTOR SHALL PROVIDE A SUITABLE RAM, PUMP, RESSURE GAUGE, AND REACTION SYSTEM.

21. ANCHOR BOLTS FOR THE ATTACHMENT OF HANDRAIL TO CONCRETE RETAINING WALL SHALL CONFORM TO ASTM A36 OR APPROVED EQUAL. NUTS FOR ANCHOR BOLTS SHALL CONFORM TO ASTM A563 GR A OR BETTER HEAVY HEX, THREADS FOR ANCHOR BOLTS AND NUTS SHALL BE ROLLED OR CUT THREADS OF UNIFIED NATIONAL COARSE (UNC) THREAD SERIES. BOLTS AND NUTS SHALL HAVE CLASS 2A AND 2B FIT TOLERANCES. WASHERS SHALL BE INCLUDED WITH EACH BOLT.

22. EXPOSED EDGES OF HANDRAIL AND POSTS SHALL BE ROUNDED OR CHAMFERED BY GRINDING. FINISHED HANDRAIL SYSTEM SHALL HAVE NO BURRS.

23. WELD PLATES, OTHER ANCHORING SYSTEMS, RAIL RETURNS, POST CAPS, STAR EMBLEM, AND PAINTING ARE TO BE INCLUDING IN THE UNIT BID PRICE FOR RAILING.

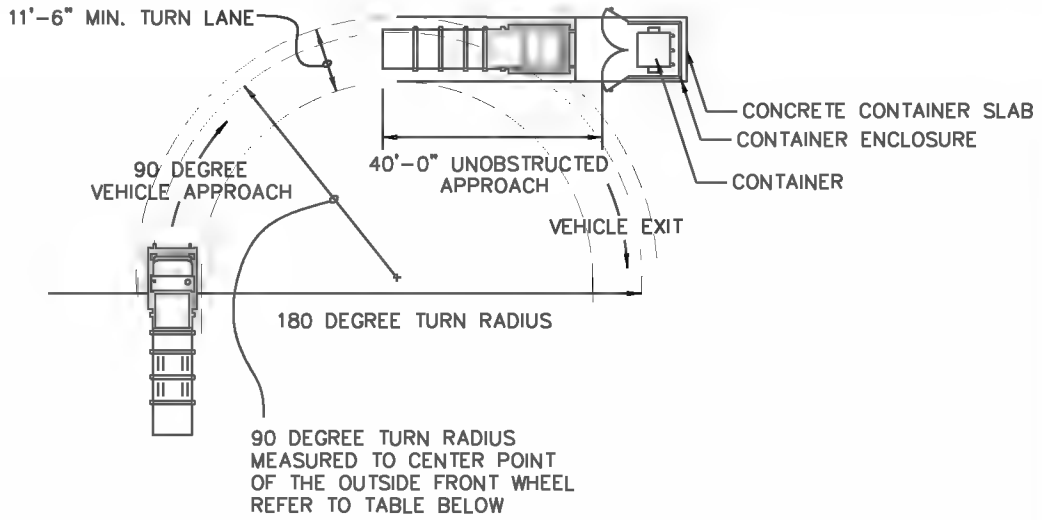
24. ERECTION DRAWINGS SHOWING PANEL LENGTHS, SPLICE LOCATIONS, RAIL POST SPACING, STAR EMBLEM PLACEMENT, AND ANCHORING SELECTION SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO INSTALLATION OF ANY HANDRAIL COMPONENT. ANY HANDRAIL COMPONENT INSTALLATION PRIOR TO APPROVAL OF ERECTION DRAWING WILL BE SUBJECT TO REJECTION.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

TxDOT WACO DISTRICT HANDRAIL (CONTINUED)

CONSTRUCTION STANDARDS AND DETAILS

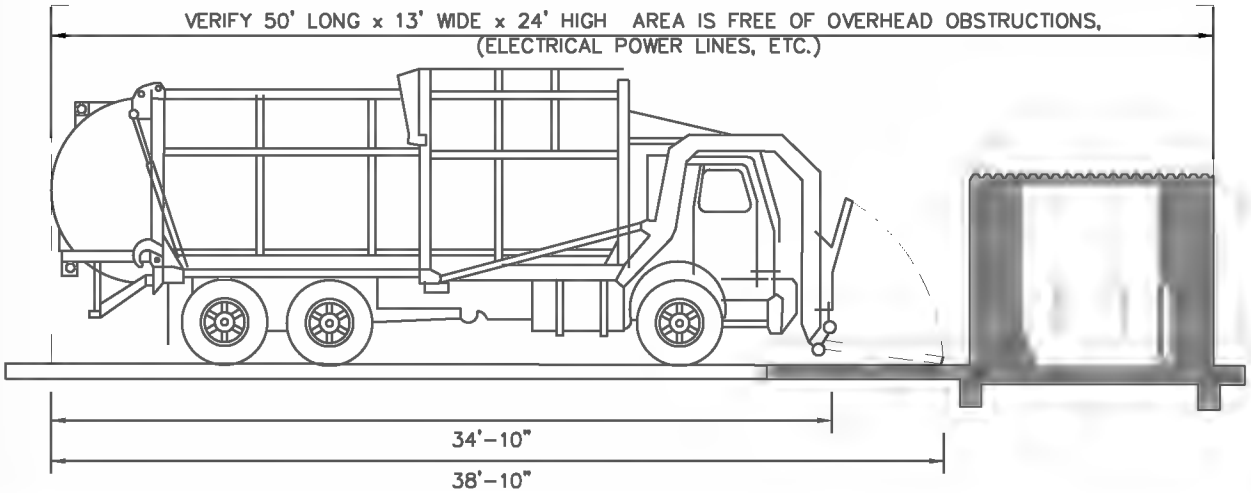
T-47
SCALE: N.T.S.
ISSUE DATE: 5-28-19



COLLECTION VEHICLE APPROACH AND TURN RADIUS DIAGRAM

VEHICLE	90 DEGREE TURN RADIUS	180 DEGREE TURN RADIUS
CRANE CARRIER	36 FEET	72 FEET
WHITE EXPEDITOR WX64	45 FEET	90 FEET
MACK MR	38 FEET	76 FEET
PETERBILT	35 FEET	70 FEET

NOTE: VERIFY ACTUAL REQUIRED TURNING RADIUSES WITH VEHICLE MANUFACTURER'S SPECIFICATIONS.



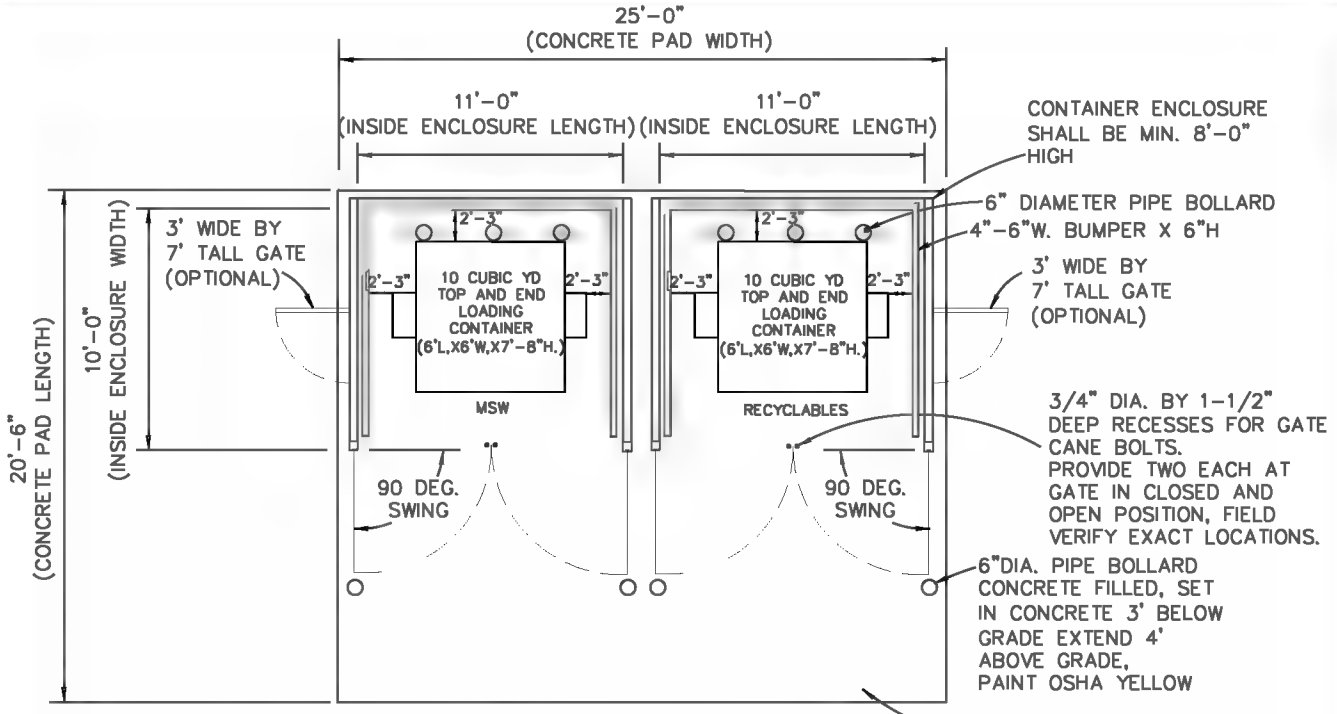
VEHICLE SHOWN IS A STANDARD 40 CY FRONT END LOADING COLLECTION TRUCK. ACTUAL DIMENSIONS WILL DIFFER BASED ON TRUCK MANUFACTURER. COORDINATE DESIGN WITH COLLECTION PROVIDER.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

VEHICLE APPROACH AND TURN RADIUS

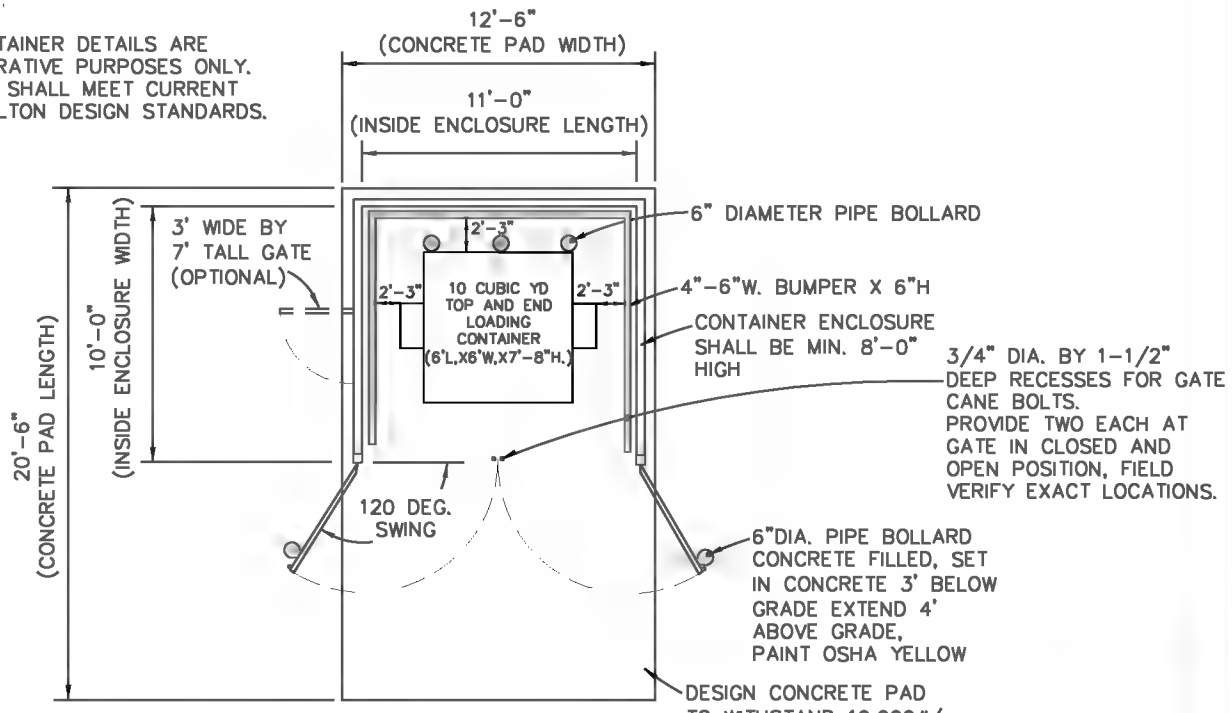
CONSTRUCTION STANDARDS AND DETAILS



MSW & RECYCLABLES
CONTAINER ENCLOSURE PLAN

NOTE:

1. ADDITIONAL CONTAINER CLEARANCE MAY BE REQUIRED TO ACCESS THE POWER DISCONNECT.
2. THESE CONTAINER DETAILS ARE FOR ILLUSTRATIVE PURPOSES ONLY. ENCLOSURE SHALL MEET CURRENT CITY OF BELTON DESIGN STANDARDS.



CONTAINER ENCLOSURE PLAN

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SOLID WASTE
CONTAINER ENCLOSURE

CONSTRUCTION STANDARDS AND DETAILS

SECTION 2 – DRAINAGE AND STORMWATER

2.01 General

This section presents guidelines and methods for determining stormwater runoff for watersheds within the City of Belton and its ETJ as well as outlining the stormwater control measures. It describes the method used for determining storm runoff from watersheds of less than 200 acres. It then briefly describes hydrologic models which can be used on watersheds greater than 200 acres. The recommended models for the major watersheds in Belton are provided.

There are several methods for determining the appropriate storm runoff from a watershed. The Rational Method may be used as the primary tool for the determination of peak stormwater runoff rates from areas 200 acres or less and is especially useful for the design of storm sewer systems. In instances where detention is modeled, a hydrograph producing method is required, such as the Soil Conservation Service Tabular Method, TR-20, HEC-1 or HEC-RAS. The most extensively used methodology for computing runoff hydrographs is based on the Soil Conservation Services (SCS) Unit Hydrograph procedures. These procedures are used to quantify the effects of urbanization, to determine peaks flows for large drainage areas, and to design stormwater storage facilities. The SCS Unit Hydrograph Method is used and accepted nationwide.

The presentation of these methods is not intended to preclude the use of other methods. However, the designer shall obtain written approval from the City Engineer before utilizing different methods.

2.02 Master Plan

All drainage design must be coordinated with the City of Belton Comprehensive Master Plan, the City of Belton Strategic Drainage Plan, the most recent Storm Water Management Program (as approved by the Texas Commission on Environmental Quality), and the 2008 Floodway and Flood Boundary Map prepared by the Federal Emergency Management Agency. These planning documents and stormwater guidelines were developed to provide for orderly growth and stormwater protection in Belton; major deviations from these plans will not be allowed.

2.03 Design Storm Frequencies

Storm drainage planning requires the establishment of standards to accomplish design objectives. Storm frequency is a basic criterion necessary in storm drainage design and refers to the magnitude of a storm. Therefore, the selected design frequency establishes the degree of protection desired. Initial storms, as referred to in this Manual, designate a storm frequency with a 10-year reoccurrence cycle. Runoff from an initial storm shall be intercepted and conveyed by inlets and an enclosed pipe system. A major storm refers to a rainfall having a 1% probability of reoccurrence every year. Major storms may be partially controlled and conveyed in open drainage systems. Design storm frequencies are as follows:

EXHIBIT 2.1
DESIGN STORM FREQUENCIES

Area or Facility	Frequency
Enclosed Pipe System (3)	5 & 10 years
Channels and Creeks (1) (3)	25 years
Culverts and Small Bridges (1) (3)	25 & 100 years
Large Bridges (1) (2) (3)	50 & 100 years
Floodways Between Building Lines (1) (3)	100 years

1. Channels, creeks, culverts, bridges, and floodways shall have one (1) foot of freeboard for the 25-year storm.
2. Large bridges are those with a total span greater than 50 feet.
3. All stormwater conveyance systems require consideration of 100-year frequencies and positive overflow provisions.

2.04 Water Spread Limit

Streets function primarily to serve traffic and for that reason must be expected to maintain usability during periods of rainfall. Water spread limits are an effective way of defining the protection required to achieve that usability. The following water spread limits are established:

EXHIBIT 2.2
WATER SPREAD LIMITS

Street Classification	Permissible Water Spread
Major Arterial	25-year storm – 1-12’ traffic lane may be closed each direction
Minor Arterial	25-year storm – 1-12’ traffic lane must remain open in each direction
Collector	10-year storm – 1-12’ traffic lane must remain open
Residential Streets	5-year storm – water flow must not exceed top of curb

The permissible water spreads are based upon the stated storm frequencies, but consideration must be given to street conveyance of the major storm (100 year) and possible flooding. All streets shall be capable of conveying a major storm without water encroaching into adjacent buildings. Therefore, the maximum spread limits in streets for a major storm shall be the building lines. This requirement of utilizing the streets to convey the major storm runoff may require increasing the capacity of the enclosed drainage system.

2.05 Drainage System Requirements

The complete drainage system is composed of: (1) the initial system, consisting of inlets, storm drains, and the associated appurtenances to convey the initial storm runoff (10 year), and; (2) the major system for the major runoff (100 year), which consists of swales, creeks, channels, floodways and emergency overflows to prevent water encroachment into residential and commercial facilities.

Inlets and storm drains shall be designed in accordance with applicable portions of this section. The sizing of inlet boxes shall be per Exhibit 2.3 below or the latest TxDOT Guide to Standard Inlet and Manhole Program. Exhibit 2.3 shall be included in construction drawings that specify inlets. All dimensions for inlets shall refer to internal widths and internal lengths.

EXHIBIT 2.3
INLET BOX DIMENSIONS

Pipe I.D.	"B" Wall RCP		"C" Wall RCP	
	Pipe O.D.	Minimum Base Wall Width[1]	Pipe O.D.	Minimum Base Wall Width[1]
18"	23"	3'	24 ½"	3'
24"	30"	3'	31 ½"	3'
30"	37"	4'	38 ½"	4'
36"	44"	4'	45 ½"	5'
42"	51"	5'	52 ½"	5'
48"	58"	6'	59 ½"	6'
54"	65"	6'	66 ½"	6'
60"	72"	7'	73 ½"	7'
66"	79"	7'	80 ½"	7'
72"	86"	8'	87 ½"	8'

Connection of pipe to inlet box made at 0° skew.

A closed pipe system shall convey quantities up to and including the capacity of a 48-inch pipe. For flows exceeding the capacity of a 48-inch pipe, channel(s) or a multi-pipe system(s) shall be utilized. All pipe systems maintained as a public facility shall be constructed with reinforced concrete pipe (RCP), and pipe shall conform to ASTM C76, Class III at a minimum. However, HDPE pipe will be considered up to 48 inches in diameter in current and potentially future unpaved areas, as approved by the City Engineer. All runs of HDPE pipe shall include an 8-foot long (minimum) joint of RCP at each end, headwall, inlet structure and outlet structure. The design engineer shall design and specify an appropriate anchoring system for the HDPE pipe.

All City owned channels shall include a concrete pilot channel which is also known as a concrete trickle channel.

All drainage channels shall be designed to convey the 25-year channel flow with one (1) foot of freeboard. For all open channels, the 100-year flow shall be contained within the building lines; channels shall be expanded as necessary to meet this requirement. All grass lined channels with trickle channels shall have a maximum side slope (horizontal to vertical) of 4:1 for stability and maintenance. All channels shall be sloped for positive drainage.

Fully concrete lined channels are allowed to have vertical walls. Concrete flumes are also acceptable and are allowed to have vertical walls. However, any vertical walls taller than 12 inches will be required to have handrail or approved safety measures installed along the vertical walls.

All culverts crossing under streets shall extend from property line to property line, plus sufficient length on each end to permit a 3:1 slope to extend from the street property line to a point 6-inches beneath the top of the headwall. All culverts shall be 18-inch minimum diameter, have adequate reinforced concrete headwalls, wingwalls for a 3:1 fill slope, and concrete aprons at each end.

Additional storm drain criteria follows:

1. Minimum velocity with the pipe flowing full shall be 3 feet per second.
2. Within a storm sewer system, the minimum storm drain pipe diameter shall be 18 inches.
3. Pipe diameters shall not decrease downstream.
4. Pipe soffits at size changes should be set at the same elevation.
5. All culverts shall include safety end treatments (SETs) on both ends of the culvert. Cast-in-place SETs are not permitted in City rights-of-way for pipe sizes 36 inches or less, unless approved by the City Engineer in writing. For any cast-in-place SETs, the slopes shall be constructed at the correct angles and be of acceptable quality or the treatment shall be removed and reconstructed at no cost to the City.
6. Vertical and horizontal curves in culverts are not permitted. Junction boxes are required at all culvert bends, except at inlets. The use of 'tees' are permitted within 10 feet of the edge of curb inlets.
7. Inverted crown street sections will be permitted only in alleys.
8. Street crowns shall be reduced for approximately 100 feet on each side of valleys and only one valley crossing for each street shall be used at an intersection.
9. Utilization of detention ponds are encouraged once proper location and design are achieved and approved by the City of Belton.
10. At streets with culverts or bridges, an emergency overflow shall be provided to contain the 100-year channel flow within the building lines.
11. All manholes shall be per the detail shown in this section.
12. All openings in the curb line to allow drainage to sheet flow from the street to a channel shall have curb cuts. Curb cuts shall have no larger than 12-inch openings.
13. All rip-rap stone shall be grouted with a low strength concrete, flowable fill, or approved equal.
14. All conveyance system outfalls shall meet the requirements of the Texas Water Code and City of Belton Subdivision Ordinance.
15. Refer to the requirements listed in the City's adopted Strategic Drainage Plan.

For non-City owned drainage facilities, concrete trickle channels are recommended and encouraged, but are not required. The safety features listed in this section are also recommended and encouraged for all non-City owned drainage infrastructure. In the event the private owner or HOA become no longer in affect, the City will install the required safety features at the cost of the property owners within the HOA.

2.06 Development Responsibilities

Drainage design is an integral part of any new development. Proper planning and coordination of the drainage scheme, along with the development plans, is required to achieve a proper and adequate storm drainage system. Lack of drainage consideration during the initial planning phase will lead to numerous complaints due to flooding and to added cost due to extension of the drainage system into areas not properly considered. Existing sites, new development and redevelopment areas require appropriate detention and/or mitigation measures to be designed and constructed as determined by the following guidelines and shall meet the requirements of the Texas Water Code:

1. Any proposed project that would cause damage to downstream properties or improvements or that would cause unsafe conditions for the general public due to an increase in stormwater runoff as determined by the City Engineer;

2. Any receiving stream, drainage system or roadway system that is deemed inadequate to accommodate the increase in runoff or the redirection of runoff from a proposed project.

3. Any existing facilities that would be damaged or would otherwise cause the unsafe conveyance of stormwater by a proposed project.

2.07 Design Parameters

Hydrology

The primary consideration in any drainage study must begin with determination of rainfall in terms of intensity, duration and frequency. The data to be used for calculating the amount of rainfall and the determination of runoff shall be that found in the Hydraulic Manual prepared and compiled by the Texas Department of Transportation – Bridge Division.

The Rational Method will be used due to its general simplicity and acceptance. The Rational Method is based on the principal that if rain persists at a uniform rate, the runoff will equal the rate of rainfall. This solution method is applicable to small areas and shall not be applied to areas exceeding 200 acres.

The Exhibits 2.4, 2.5 and 2.6 show the adopted values for minimum times of concentration, runoff coefficients for C, and percentage of impervious area to be used in the City of Belton.

EXHIBIT 2.4
MINIMUM TIMES OF CONCENTRATION

Areas	Minimum Time (Minutes)
Parks & Open Areas	20
Residential	15
Commercial	10
Roofs & Paved Areas	10

This section continues onto the next page.

EXHIBIT 2.5: VALUES OF RUNOFF COEFFICIENT "C"

All suggested runoff coefficients are subject to calculation of existing and proposed impervious areas for any given drainage basin. In lieu of using suggested runoff coefficients, the Design Engineer may submit alternative composite runoff coefficients for review and consideration by the City Engineer. Submittals shall include all calculations and assumptions used by the Design Engineer to develop the alternative composite runoff coefficients.

Description of Area	Return Period					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Park and Open Spaces						
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49
Steep, Over 7%	0.37	0.40	0.42	0.46	0.49	0.53
Residential Land Use						
Residential Estates Zoning and residential lots greater than 20,000 sq. feet						
Flat, 0-2%	0.32	0.34	0.36	0.41	0.44	0.48
Average, 2-7%	0.38	0.41	0.44	0.49	0.52	0.56
Steep, Over 7%	0.42	0.45	0.48	0.53	0.56	0.60
Single Family-1 Zoning and residential lots between 10,000 and 20,000 sq. feet						
Flat, 0-2%	0.38	0.41	0.44	0.48	0.51	0.56
Average, 2-7%	0.44	0.47	0.51	0.55	0.58	0.63
Steep, Over 7%	0.47	0.51	0.54	0.58	0.62	0.66
Single Family-2 Zoning and residential lots between 7,500 and 10,000 sq. feet						
Flat, 0-2%	0.44	0.47	0.50	0.55	0.58	0.62
Average, 2-7%	0.49	0.52	0.56	0.60	0.64	0.68
Steep, Over 7%	0.52	0.55	0.58	0.63	0.66	0.71
Single Family-3 Zoning, patio homes and residential lots between 5,000 and 7,500 sq. feet						
Flat, 0-2%	0.50	0.54	0.56	0.61	0.64	0.69
Average, 2-7%	0.54	0.58	0.61	0.65	0.69	0.74
Steep, Over 7%	0.56	0.60	0.63	0.68	0.71	0.76
Multi-family and 2-Family Zoning						
Multi-family Detached	0.56	0.60	0.63	0.68	0.71	0.76
Multi-family Attached	0.59	0.63	0.66	0.71	0.75	0.80
Commercial Land Use						
General Office Building Sites	0.63	0.67	0.70	0.75	0.79	0.84
Shopping Center Sites, Neighborhood Services, Office Parks and Districts, University Campus	0.67	0.71	0.74	0.79	0.83	0.88
Central Business Districts	0.74	0.79	0.82	0.87	0.91	0.96
Industrial Land Use						
General (office with open space)	0.67	0.71	0.74	0.79	0.83	0.88
Heavy (surface parking, warehousing)	0.74	0.79	0.82	0.87	0.91	0.96

Runoff Coefficients for Surface Types

Character of Surface	Return Period					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Developed						
Asphalt	0.73	0.77	0.81	0.86	0.90	0.95
Concrete/Roof	0.75	0.80	0.83	0.88	0.92	0.97
Grass Areas (Lawns, Parks, etc.)						
Poor Condition (grass cover less than 50 percent of the area)						
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53
Steep, Over 7%	0.40	0.43	0.45	0.49	0.52	0.55
Fair Condition (grass cover on 50 to 75 percent of the area)						
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49
Steep, Over 7%	0.37	0.40	0.42	0.46	0.49	0.53
Good Condition (grass cover larger than 75 percent of the area)						
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46
Steep, Over 7%	0.34	0.37	0.40	0.44	0.47	0.51
Undeveloped						
Cultivated Land						
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51
Steep, Over 7%	0.39	0.42	0.44	0.48	0.51	0.54
Pasture/Range						
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49
Steep, Over 7%	0.37	0.40	0.42	0.46	0.49	0.53
Forest/Woodlands						
Flat, 0-2%	0.22	0.25	0.28	0.31	0.35	0.39
Average, 2-7%	0.31	0.34	0.36	0.40	0.43	0.47
Steep, Over 7%	0.35	0.39	0.41	0.45	0.48	0.52

EXHIBIT 2.6
PERCENTAGE OF IMPERVIOUS AREA

Description	Plot Size (sq ft)	Average Impervious Area (Percentage)
Residential Estate	>43,560	9
Residential Dwelling	43,560	17
Residential Dwelling	21,780	38
Residential Dwelling	16,000	43
Residential Dwelling	10,000	46
Residential Dwelling	7,500	46
Residential Dwelling	<5,000	50
Multiple-Family Dwelling	Variable	72
Schools	Variable	35
Churches	Variable	85
Commercial District	Variable	85
Shopping Center District	Variable	100
Industrial District	Variable	72
Freeway	Variable	100
Open Land [(1)]		1

[(1)] Open land in rural areas and public parks increased to 1.0 percent to account for roads, drives and scattered buildings.

2.08 Detention

Detention shall be required to provide temporary storage of stormwater runoff to control discharge rates and to provide gravity settling of potential pollutants. The City Engineer will determine in which instances detention is required. The adopted detention calculation methods shall be those known as the modified Rational Method or the Soil Conservation Service (SCS) Method or other methods approved for use by the City Engineer. Approved method(s) shall be obtained prior to design.

All detention ponds shall be designed with concrete or hard surfaced trickle channels. All trickle channels shall be sodded a minimum width of 16-inches on both sides for the length of the trickle channel. All detention ponds shall be designed for the 10-year, the 25-year, and the 100-year storms unless the downstream or upstream conditions dictate otherwise.

2.09 Hydraulics

Stormwater is conveyed usually on the upper end of a drainage basin by inlets and storm sewers (closed conduit systems) to channel and through culverts and bridges. All calculations and design procedures for this hydraulic work shall follow the Hydraulic Manual prepared and compiled by the Texas Department of Transportation – Bridge Division.

Exhibits 2.7 through 2.11 show adopted Manning's Coefficients, minimum pipe slopes, maximum channel velocities and roughness coefficients.

EXHIBIT 2.7
MANNING'S COEFFICIENT OF ROUGHNESS
FOR PIPE

Material	Value of n	Adopted
Asbestos-Cement Pipe	0.011 – 0.015	0.013
Cast Iron Pipe Coated	0.010 – 0.014	0.012
Cast Iron Pipe Uncoated	0.011 – 0.016	0.013
Concrete Monolithic Conduit	0.012 – 0.017	0.015
Concrete Pipe	0.011 – 0.015	0.013
Corrugated Metal Pipe	0.022 – 0.026	0.024
(1/2" x 2-2/3")		
25% Paved	0.021 – 0.023	0.022
Fully Paved	0.012 – 0.015	0.013
Plastic Pipe (Smooth)	0.011 – 0.015	0.013
Vitrified Clay Pipe	0.011 – 0.015	0.013

EXHIBIT 2.8
MINIMUM PIPE SLOPES

Pipe Diameter	Slope in Feet Per Foot	
	n= 0.013	n= 0.024
12"	0.00435	0.01490
15"	0.00324	0.01110
18"	0.00254	0.00868
21"	0.00208	0.00709
24"	0.00174	0.00592
27"	0.00148	0.00510
30"	0.00129	0.00439
33"	0.00113	0.00386
36"	0.00101	0.00345
42"	0.00082	0.00280
48"	0.00069	0.00235
54"	0.00059	0.00201
60"	0.00051	0.00175
66"	0.00045	0.00154
72"	0.00040	0.00137

EXHIBIT 2.9
ADOPTED MAXIMUM CHANNEL VELOCITIES

Channel Material	Maximum Channel Velocity, fps
Fine Sand	2.0
Coarse Sand	4.0
Fine Gravel	6.0
Earth	
Sandy Silt	2.0
Silt Clay	3.5
Clay	6.0
Grass Lined Earth	
Bermuda Grass – Sandy Silt	6.0
– Silt Clay	8.0
Poor Rock (usually sedimentary)	10.0
Soft Sandstone	8.0
Soft Shale	3.5
Reinforced Concrete Lining	15.0

EXHIBIT 2.10
ADOPTED MAXIMUM STORM SEWER PIPE VELOCITIES

The maximum velocity of storm sewer piping shall be 15 feet per second for all collection trunk lines and selected lateral lines as determined by the City Engineer. Manning's Equation shall be used as the test standard for said velocity determinations with no entrance or exit head losses to be considered. Only pipe friction losses will be used as per Manning's Equation:

$$V = \frac{1.486}{N} (R)^{2/3} (S)^{1/2}$$

EXHIBIT 2.11
MANNING'S COEFFICIENT OF ROUGHNESS FOR CHANNELS

	N Values*		Adopted
	Min.	Max	'N' Values
Lined Channels			
Metal corrugated	0.021	0.024	0.023
Concrete	0.012	0.030	0.025
Cement rubble	0.017	0.030	0.025
Concrete gutter	0.015	0.020	0.016
Rock Rip-rap	0.030	0.045	0.035
Unlined Channels			
Poor grass growth	0.025	0.035	0.030
Average grass growth	0.035	0.045	0.040
Dense grass growth	0.040	0.050	0.045
Stony beds, weeds on bank	0.025	0.040	0.035
Rock cuts, smooth & uniform	0.025	0.035	0.030
Rock cuts, rugged & irregular	0.035	0.045	0.040
Natural Stream Channels			
Some grass & weeds; little or no brush	0.030	0.035	0.035
Dense growth of weeds, depth of flow materially greater than weed height	0.035	0.050	0.045
Some weeds, light brush on banks	0.035	0.050	0.045
Some weeds, heavy brush on banks	0.050	0.070	0.060
For trees within channels with branches submerged at high stage, increase all values above by	0.010	0.020	0.015
Pasture, no brush			
Short grass	0.030	0.035	0.030
Tall grass	0.035	0.050	0.040
Cultivated areas			
No crop	0.030	0.040	0.035
Mature right-of-way crops	0.035	0.045	0.040
Mature field crops	0.040	0.050	0.045
Heavy weeds, scattered brush	0.050	0.070	0.060
Wooded	0.120	0.160	0.140

**Maximum and minimum "n" values adopted from the Texas Department of Transportation.*

2.10 Construction Drawings

All construction drawings for stormwater conveyance systems such as pipe systems, channels, culverts, bridges, open channels, etc. shall show the plan view, profile view and typical cross sections of sufficient intervals as approved by the City Engineer. The plan, profile and cross sections for the drainage conveyance systems shall be labeled with percent slopes, horizontal and vertical dimensions, inlet and outlet elevations, mean sea level elevations, and 100-year water surface elevations (shown in plan and profile). The carrying capacity required, carrying capacity provided, and the hydraulic gradeline can be provided on the construction plans or in the drainage report. All concrete used for stormwater conveyance systems, except for valley gutters as specified in the Transportation Section, shall be Class A with a 28-day compressive strength design of 3,000 psi.

Construction plans or drainage reports shall include results of calculations for storm runoff, inlet design, and storm sewer design as shown in Tables A-1 through A-4 in this section. If detention ponds are included, calculations shall include pre-project, post project and post project with detention hydrologic output for the 2, 10, 25 and 100-year storm events, rating tables for the outfall structure, and a stage-storage-discharge table.

2.11 Stormwater Control

Erosion Control

1. Temporary Control

Temporary controls shall be used during construction to prevent the erosion of soil and sedimentation of waterways until restoration is complete. Temporary controls shall be in accordance with the Texas Commission on Environmental Quality (TCEQ) and the latest version of the City of Belton Stormwater Management Plan.

Primary erosion control strategies are to divert runoff away from unstable areas or to provide a stable surface that will resist the effects of rain and runoff. The principle measures for diverting runoff during construction include perimeter swales and dikes, and slope drains. Where temporary vegetation is planted to prevent erosion, blankets, matting and mulches can help stabilize the area until the vegetation is adequately established. Exhibit 2.12 identifies various erosion control measures.

EXHIBIT 2.12
TEMPORARY EROSION CONTROL BMPS

Erosion Control	Area	Application	Notes
Interceptor Swale	< 5 acres	Used as a perimeter control or to shorten slope distances	
Diversion Dike	< 10 acres	Used to route runoff away from disturbed areas	
Pipe Slope Drain	< 5 acres	Transport runoff down steep, erodible slopes	
Channel Stabilization	Along Channels	Conveyance of concentrated runoff	
Outlet Stabilization	At Outlets	Prevent erosion at outlet of channel or conduit	
Level Spreader	Based on flow	Outlet device for dikes and diversions	Slope < 10% and stable
Subsurface Drain	Sized as required	Prevent soils from becoming saturated and prevent seeps	
Vegetation	Up to Mild Slopes	Temporary and permanent stabilization of disturbed areas	Permanent vegetation required for all disturbed areas
Blankets/Matting w/vegetation	Steep Slopes	Used in channels and on steep slopes	Suggested max. slope 2H:1V for slope applications
Brush Mulch/Erosion Control Logs	NA	Temp. stabilization of disturbed areas stabilization in channels, around inlets, on steep slopes	Suggested max. slope 2H:1V for slope applications
Hydraulic Mulch	Small Channel	Stabilization of newly seeded areas	Suggested max. slope 3H:1V
Sod	Up to Mild Slopes	Immediate stabilization in channels, around inlets, or for aesthetics	
Dust Control	As Required	Areas subject to on- or off-side impacts from surface/air movement of dust	

All areas within existing public rights-of-way that have been stripped or filled as a result of construction activities shall be restored to previous condition. All grass-lined drainage channels and ponds shall be seeded per this section. Such areas shall be covered with a minimum of four (4) inches of topsoil prior to the application of grass seed. Topsoil is defined as a sandy loam and is free of rocks larger than one-inch in diameter and free of trash or other debris.

Rocks greater than 3-inches in diameter and debris shall be removed from the rights-of-way post-construction.

As a condition of final approval from the City, developers are required to install one of the following along the back of curb or back of sidewalk when sidewalk exists. The following shall be done prior to acceptance of the subdivision.

- Erosion control blanket that is pre-seeded for a width of 5 feet;
- Hydromulch for a width of 5 feet;
- Silt fencing
- Straw wattle
- Or other erosion control best management practice (BMP) material as approved by the City Engineer.

Also, developers are also required to install and maintain inlet protection on all inlets and curb cuts for drainage flumes prior to acceptance of the subdivision.

Prior to and during construction of the home/structures, the owners of the lots are required to maintain such erosion control measures to prevent mud, debris, and silt from entering the roadways, inlets, and stormwater piping. In the event franchised utilities are responsible for damage to erosion control measures, the ultimate responsibility for clean-up, damages, and erosion control is the lot owner.

Erosion control will be inspected periodically by the City. The owner of the lot will be notified of maintenance issues. The City will be responsible for inlet protection post-subdivision acceptance.

2. Permanent Control

Grass seed shall be applied in accordance with Exhibit 2.13.

EXHIBIT 2.13
RESEEDING STANDARDS

Time Of Year	Seed Type	Amount of Seed per 1,000 SF
October – February	Unhulled Bermuda or Winter Rye	2 lbs
March – September	Hulled Bermuda	2 lbs

Seedlings shall be watered until uniform growth is established. During the first two (2) months after application of the seed, the planted area shall be irrigated or sprinkled at seven (7) day intervals in a manner that will not erode the topsoil but at a rate sufficient

to thoroughly soak the soil to a minimum depth of four (4) inches. Rainfall occurrences of one-half ($^1/_2$) inch or greater shall postpone the watering schedule by one (1) week intervals.

Restoration shall be considered to be acceptable when the grass has grown to a height of at least twelve (12) inches, has had its first mow, and covers 95% percent of the area with bare spots no greater than twenty-five (25) square feet.

Conservation Areas – All streets, utilities, drainage improvements, and buildings shall be constructed and located so as to protect conservation areas or environmentally sensitive areas as designated/defined by the City.

Landscape Requirements – Refer to the City of Belton Planning Design Standards for Landscape Requirements.

Construction Entrance/Exit – Construct an 8" thick, 8" average rock size, washed coarse aggregate surface for temporary construction entrances and exits according to the City of Belton Standard Details.

Tree Preservation – Tree preservation shall be in accordance with the Erosion/Sedimentation and Tree Protection Notes and Details included herein.

2.12 Materials Requirements for Drainage Improvements

A. Domestic Products

All iron, steel and manufactured components/materials used in any infrastructure project within the City of Belton or the City of Belton ETJ shall be manufactured in the United States of America. Proof of the manufacturer location shall be provided to the City Engineer prior to installation of components/materials. The City Engineer may waive this requirement when said City Engineer deems the waiver is in the best interest of the City of Belton.

B. Concrete and Reinforcement Items

All concrete shall have a minimum 28-day compressive strength of 3,000 psi unless otherwise noted on the plans, specifications or other written document. Water shall not be added to the concrete after inspection and testing. Placed concrete shall be vibrated when necessary depending on slump, space available for concrete placement and depth of placement. The slump of concrete shall be placed at slumps per the Texas Department of Transportation Specifications for the Construction of Highways, Streets and Bridges under Item 420 with respect to the type of concrete structure being constructed.

Steel reinforcement shall be billeted conforming to ASTM specifications A615 Grade 60 or the latest revision to the ASTM A615 specification. All rebar shall be 2" from inside of form. Reinforcement shall be adequately supported, spaced and secured before placing the concrete. The reinforcement support system (metal support chairs) shall be as manufactured by Dayton Superior, models CHCP or CHCV, or equivalent and as noted in the details of the Transportation Section. The height of the metal support chairs shall generally be no more than one-half of the concrete thickness. The height of the metal support chairs shall be reviewed and approved by the City Engineer. Reinforcing steel shall be placed in accordance

with ACI Standards with overlaps of 40 bar diameters. Rebar chairs shall be placed on 48-inch maximum spacing each way.

Precast stormwater infrastructure is permissible, if approved by the City Engineer. Precast stormwater infrastructure is allowed to vary from these standard details, with the approval of the City Engineer. TxDOT standard details for precast drainage infrastructure may also be used.

COMPUTATION SHEET A-1

RATIONAL METHOD SUB-AREA RUNOFF CALCULATIONS

Project: _____

Design Storm: _____

DESIGN POINT	DRAINAGE AREA		CA' VALUES FOR INDIVIDUAL SUB-AREAS									WEIGHTED 'CA' VALUE	TIME OF CONCENTRATION COMPUTATION							RAINFALL INTENSITY I	PEAK FLOW Q
													OVERLAND FLOW TIME			GUTTER FLOW TIME			TOTAL TIME T_C		
	AREA NO.	TOTAL ACRES	$(CA)_1$	$(CA)_2$	$(CA)_3$	$(CA)_4$	$(CA)_5$	$(CA)_6$	$(CA)_7$	$(CA)_8$	$(CA)_9$		L_o	S_o	t_o	L_g	S_g	t_g			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

$(CA)_1$: C =

$(CA)_2$: C =

$(CA)_3$: C =

$(CA)_4$: C =

$(CA)_5$: C =

$(CA)_6$: C =

$(CA)_7$: C =

$(CA)_8$: C =

$(CA)_9$: C =

Computation Sheet A-1

COMPUTATION SHEET A-2

CURB INLETS AND DROP INLETS IN SUMPS

INLET NO.	FLOW TO INLET Q (cfs)	LENGTH OF INLET OPENING L (ft)	AREA OF INLET OPENING A (sq ft)	DISCHARGE PER UNIT FOOT OF OPENING q = Q/L (cfs/ft)	COMPUTED HEAT AT INLET		MAXIMUM ALLOWABLE HEAD H (ft)	WATER SPREAD LIMITS S_p (ft)	NOTES
					WEIR FLOW $H = (q/3)^{2/3}$ (ft)	ORIFICE FLOW $H = [(Q/A)/4.82]^2$ (ft)			
1	2	3	4	5	6	7	8	9	10

Computation Sheet A-2

COMPUTATION SHEET A-3

CURB INLETS ON GRADE

INLET		DRAINAGE AREA	SUB-AREA PEAK FLOW	CARRY-OVER FROM UPSTRM INLET	TOTAL FLOW	STRAIGHT CROWN SLOPES					PARABOLIC STREET SLOPES				CAPACITY PER FOOT OF INLET	LENGTH OF INLET REQ'D FOR	INLET LENGTH			FLOW INTRCPTD	CARRY-OVER FLOW	COMMENTS
TYPE & NO.	STATION	NO.	QP (cfs)	q (cfs)	Q (cfs)	CROWN SLOPE Z	Z/N	STREET SLOPE S_o (ft/ft)	FLOW DEPTH Y_o (ft)	WIDTH OF SPREAD S_p (ft)	TYPE OF STREET SECTION	STREET SLOPE S_o (ft/ft)	FLOW DEPTH Y_o (ft)	WIDTH OF SPREAD S_p (ft)	Q/L_o (cfs/ft)	Q_o (ft)	L (ft)	L/L_o	Q/Q_o	$Q=Q_o x Q/Q_o$ (cfs)	q (cfs)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

COMPUTATION
SHEET A-3

Column 1	Design Point; this point is the first junction point upstream. "Junction Point" refers to any inlet, manhole, bend, etc. that occurs which would cause a minor head loss.
Column 2	Junction point immediately downstream of design point.
Column 3	Distance between the design point in Column 1 and the design point in Column 2.
Column 4	Incremental drainage sub-area designation.
Column 5	Incremental drainage sub-area size contributing to the design point in Column 1.
Column 6	Total drainage sub-area size contributing to the design point in Column 1.
Column 7	Weighted runoff coefficient for incremental drainage sub-area.
Column 8	Column 5 times Column 7.
Column 9	Total "CA" for all drainage sub-areas contributing to the design point in Column 7.
Column 10	Time of concentration to the design point in Column 1.
Column 11	Flow time in storm drain system from the design point in Column 1 to the design point in Column 2; Column 3 divided by Column 21 of previous row.
Column 12	Column 10 + Column 11.
Column 13	Design frequency of storm drain system.
Column 14	Rainfall intensity determined from the value calculated in Column 12 and the intensity curve for Bell County.
Column 15	Design discharge; Column 9 times Column 14.
Column 16	Size of pipe chosen to carry an amount equal to or greater than the design discharge (Figures A-6 and A-7 can be used to determine this)
Column 17	Slope of frictional gradient Sf (can be determined from Manning's Equation).
Column 18	Elevation of hydraulic gradient at upstream end of pipe = elevation of downstream end + column 17 times Column 3.
Column 19	Elevation of hydraulic gradient at downstream end of pipe.
Column 20	Velocity of flow in incoming pipe at design point (use Q=AV for full flow and Figures A-8 and A-9 for partial flow).
Column 21	Velocity of flow in outgoing pipe at design point.
Column 22	Velocity head loss for outgoing pipe at design point.
Column 23	Velocity head loss for incoming pipe at design point.

Column 24 Head loss coefficients at junction (see Figures A-10 and A-11).

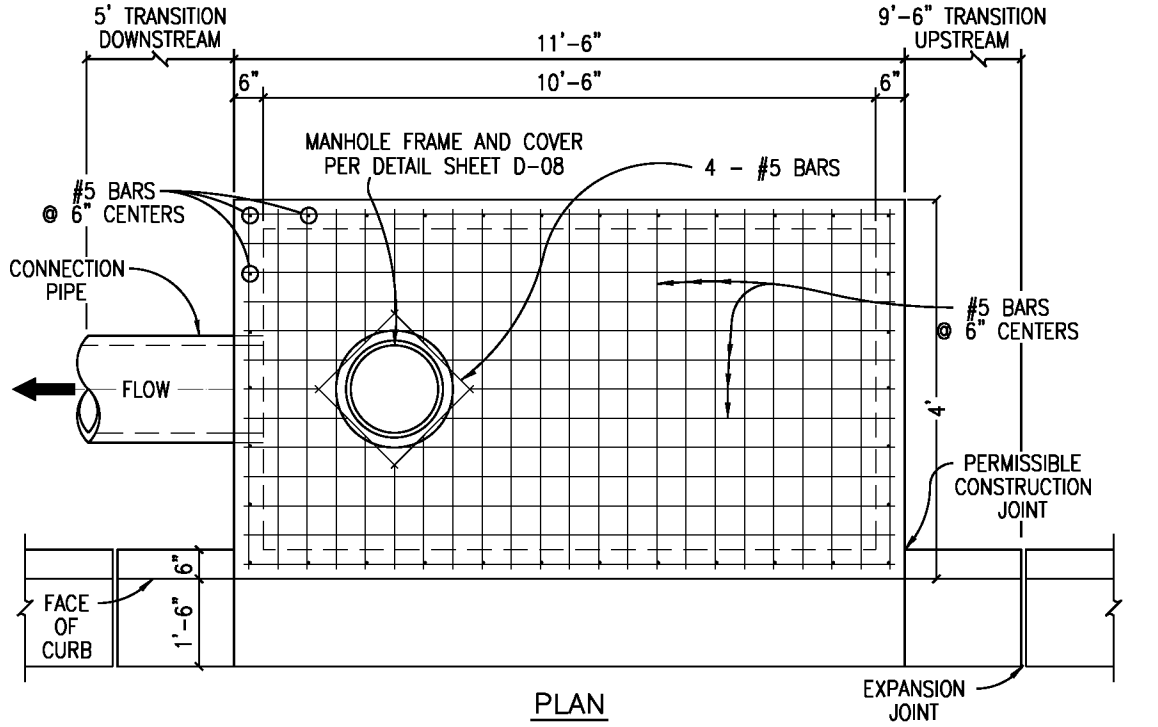
Column 25 Column 23 times Column 24.

Column 26 Column 22 - Column 25 (note for bends and inlets or manholes at the beginning of a line V1 = V2 and the appropriate Kj value should be used in Column 25; Column 25 = Column 26.

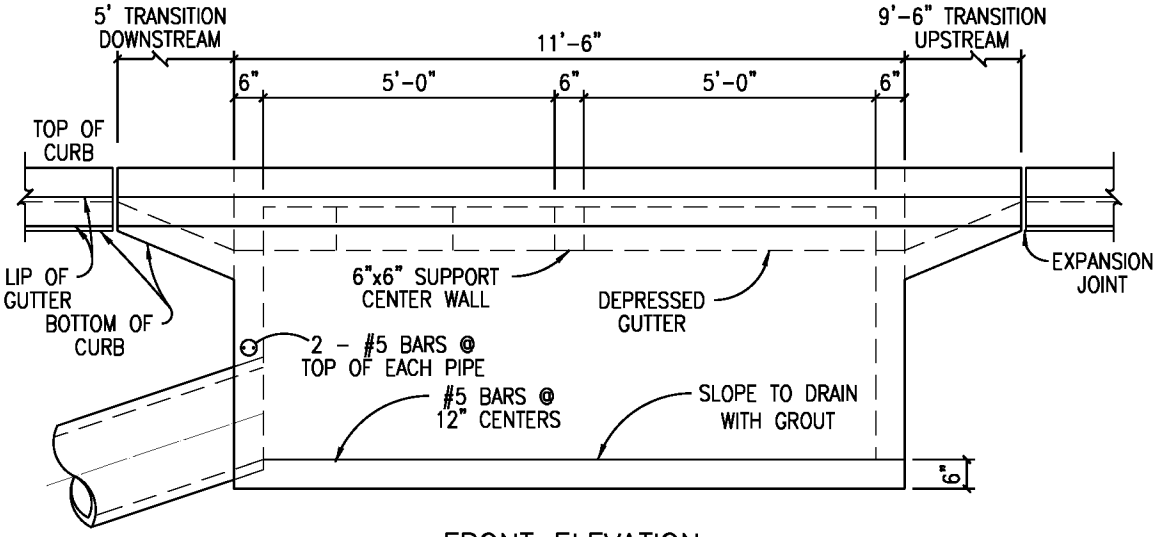
Column 27 Column 18 + Column 26.

Column 28 Invert elevation at design point for incoming pipe.

Column 29 Invert elevation at design point for outgoing pipe.



PLAN



FRONT ELEVATION

NOTES:

1. ALL CONCRETE SHALL BE CLASS "A" 3,000 PSI CONCRETE.
2. SHOULD THE CURB INLET BE LOCATED IN A SAG, CONTRACTOR SHALL TRANSITION 9'-6" ON BOTH SIDES OF CURB INLET.
3. THE MAXIMUM LENGTH OF CURB INLET, WITH EXTENSIONS, SHALL BE 20'.
4. EXTENSIONS OF 5' OF OPEN CURB SHALL BE ACCOMPANIED BY 6" WIDE POST SUPPORTS. UNSUPPORTED LENGTH SHALL NOT EXCEED 5'.
5. RECESSED INLETS SHALL BE USED UNLESS R.O.W. REQUIREMENTS/UTILITY CONFLICTS MAKE THEIR USE IMPRACTICAL.

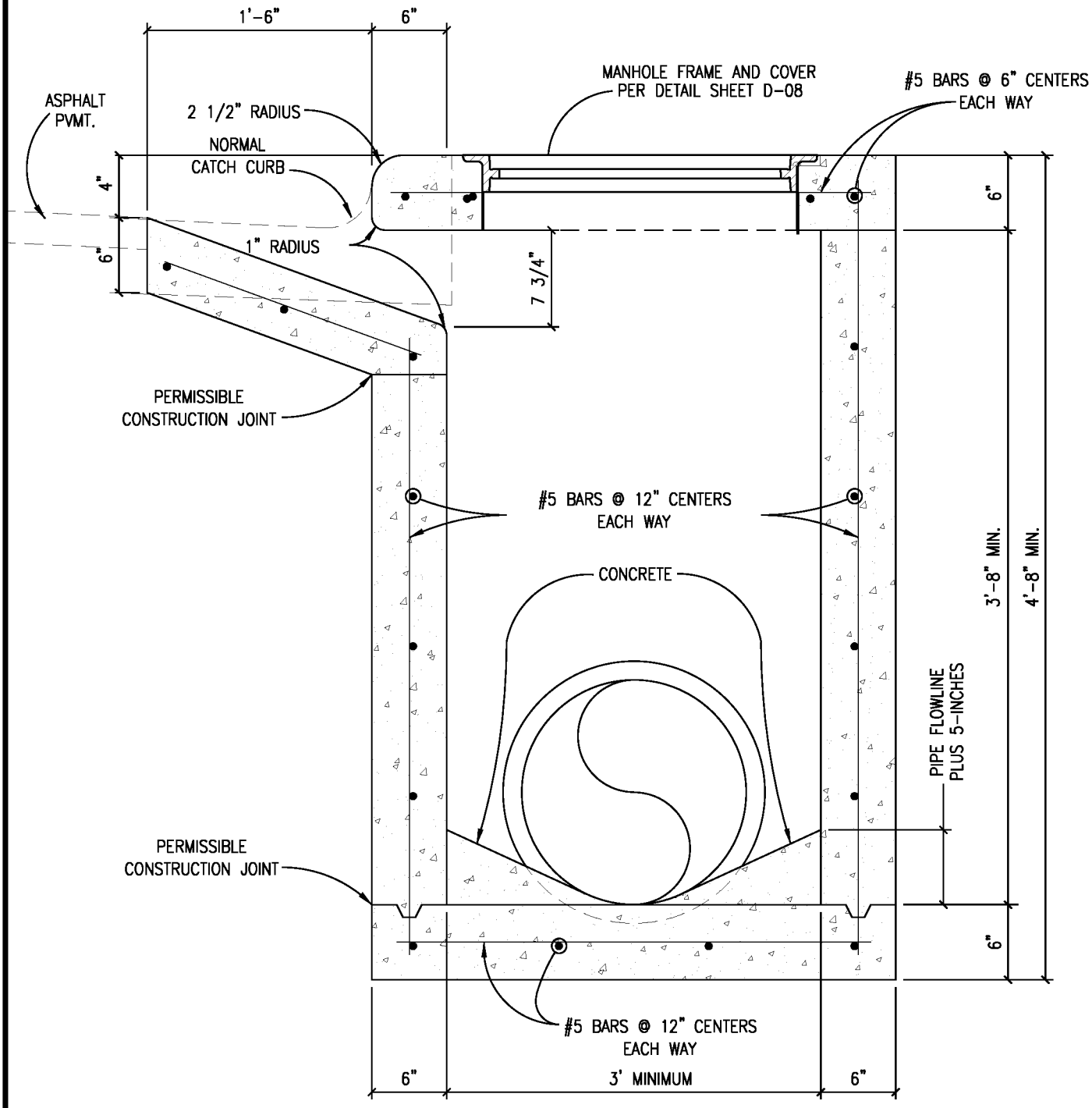
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

CURB INLET

CONSTRUCTION STANDARDS AND DETAILS

D-01
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. ALL CONCRETE SHALL BE CLASS "A" 3,000 PSI CONCRETE.
2. STORM SEWER PIPE MATERIAL TO BE R.C.P. (CLASS III) UNLESS OTHERWISE SPECIFIED BY THE CITY OF BELTON.
3. RECESSED INLETS SHALL BE USED UNLESS R.O.W. REQUIREMENTS/UTILITY CONFLICTS MAKE THEIR USE IMPRACTICAL.

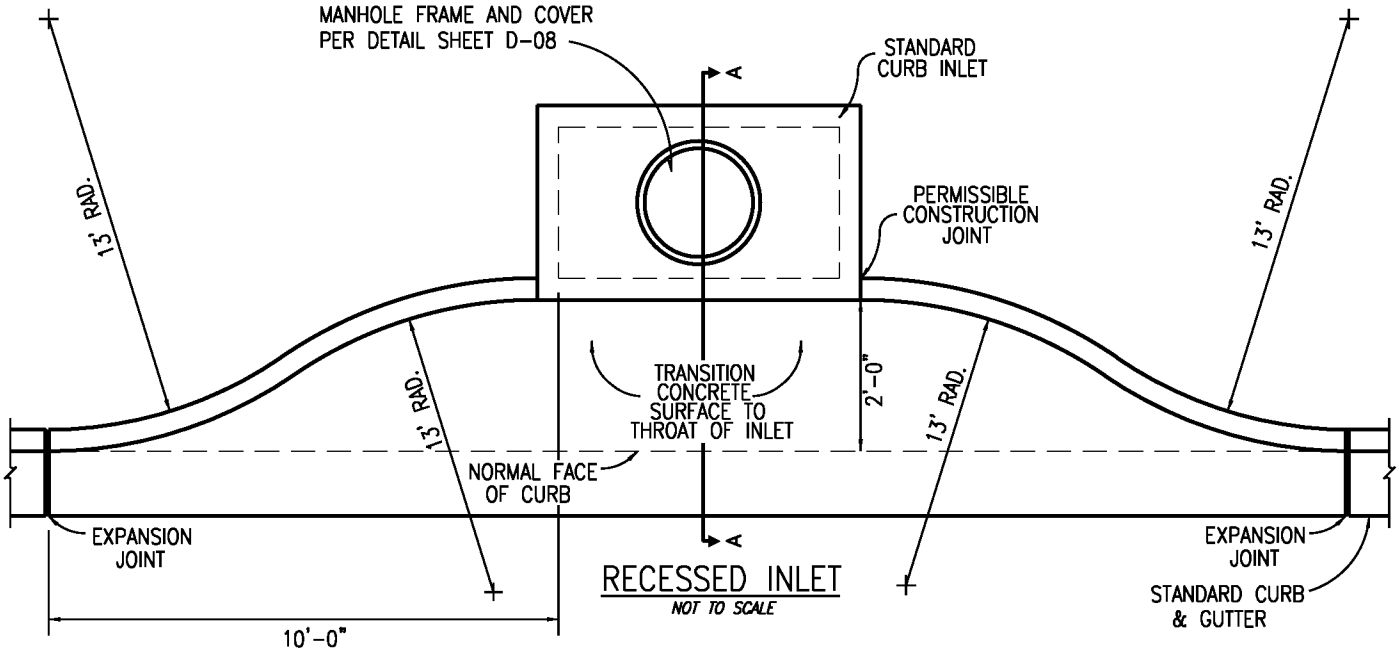
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

CURB DRAIN INLET TYPICAL SECTION

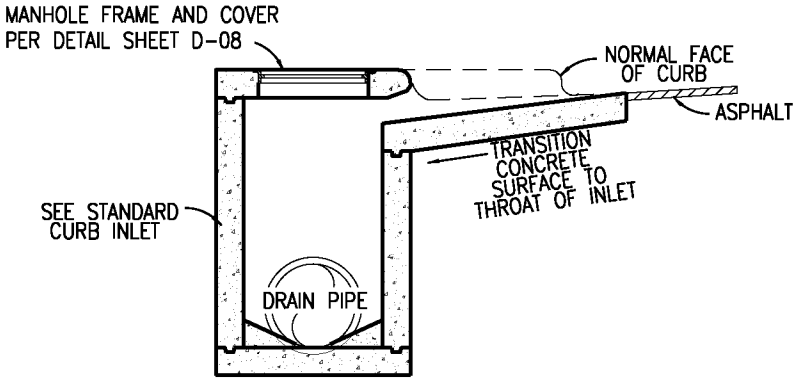
CONSTRUCTION STANDARDS AND DETAILS

D-02
SCALE: N.T.S.
ISSUE DATE: 5-28-19



RECESSED INLET

NOT TO SCALE



SECTION A-A

NOT TO SCALE

NOTES:

1. ALL CONCRETE SHALL BE CLASS "A" 3,000 PSI CONCRETE.
2. STORM SEWER PIPE MATERIAL TO BE R.C.P. (CLASS III) UNLESS OTHERWISE SPECIFIED BY THE CITY OF BELTON.
3. RECESSED INLETS SHALL BE USED UNLESS R.O.W. REQUIREMENTS/UTILITY CONFLICTS MAKE THEIR USE IMPRACTICAL.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

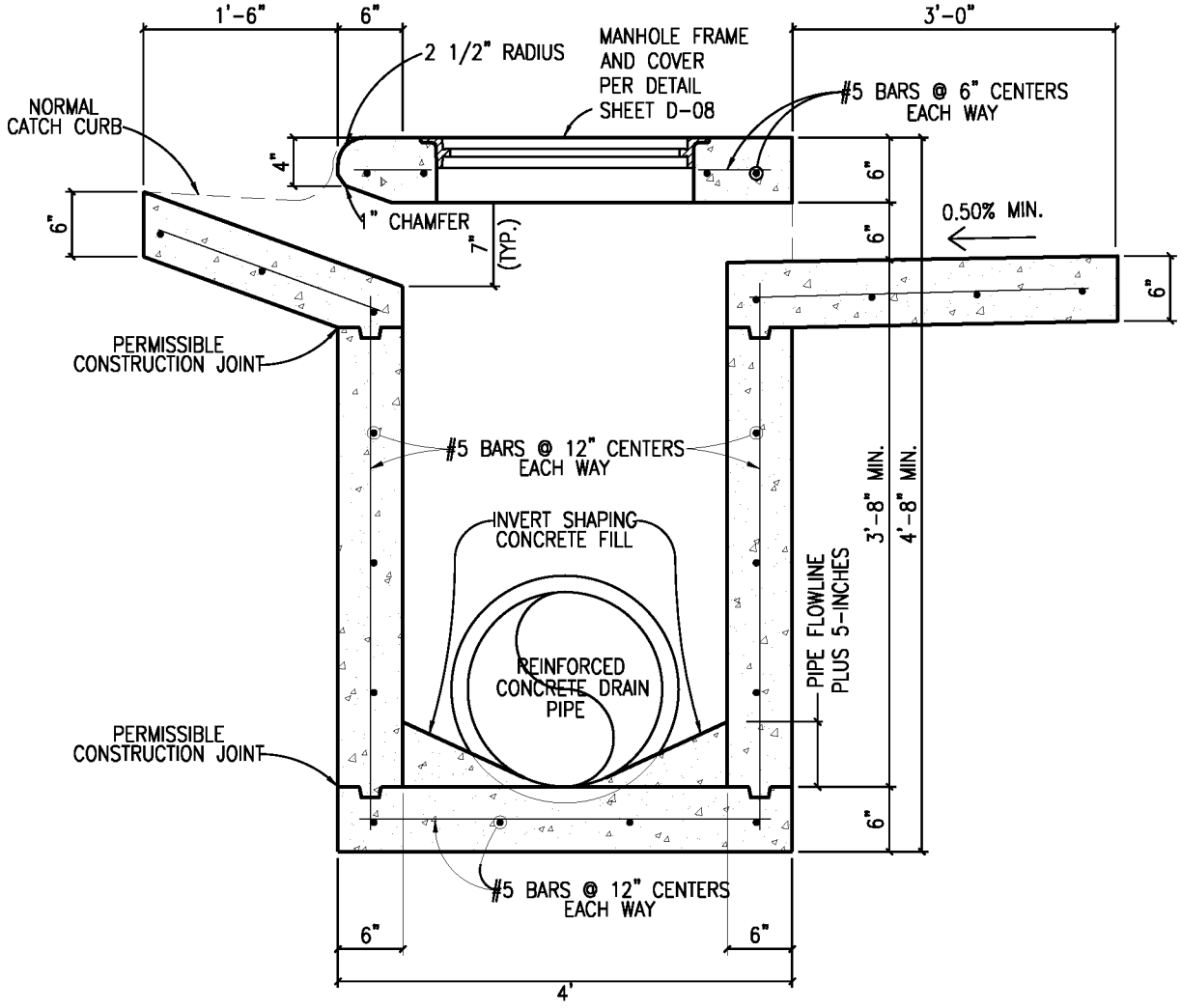
RECESSED INLET

CONSTRUCTION STANDARDS AND DETAILS

D-03

SCALE: N.T.S.

ISSUE DATE: 5-28-19



SIDE SECTION

NOTES:

1. ALL CONCRETE SHALL BE CLASS "A" CONCRETE.
2. STORM SEWER PIPE MATERIAL TO BE REINFORCED CONCRETE PIPE CLASS III.
3. MANHOLE COVER SHALL HAVE "NO DUMPING" STAMP PER SHEET D-08.
4. MANHOLE COVER SHALL BE PER DETAIL ON D-08.

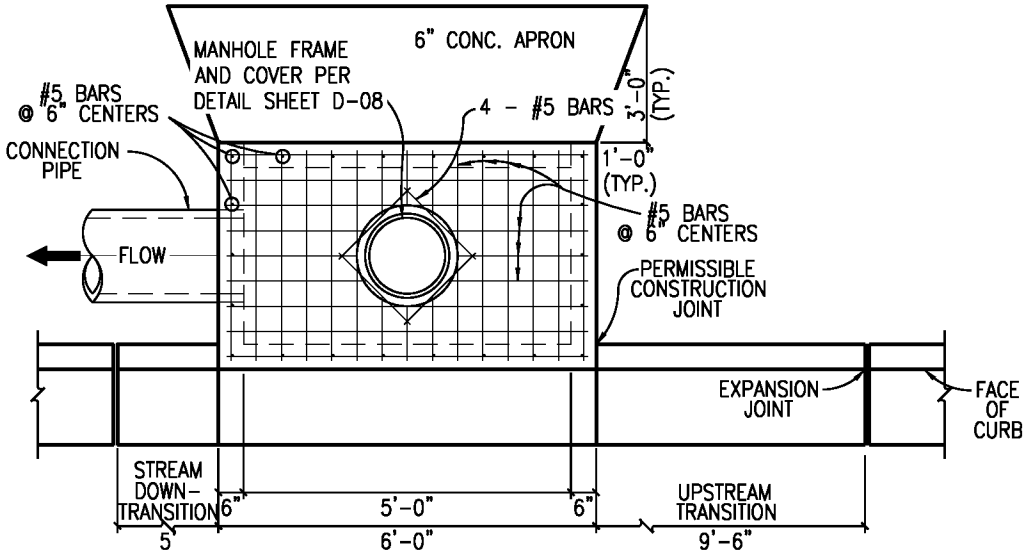
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

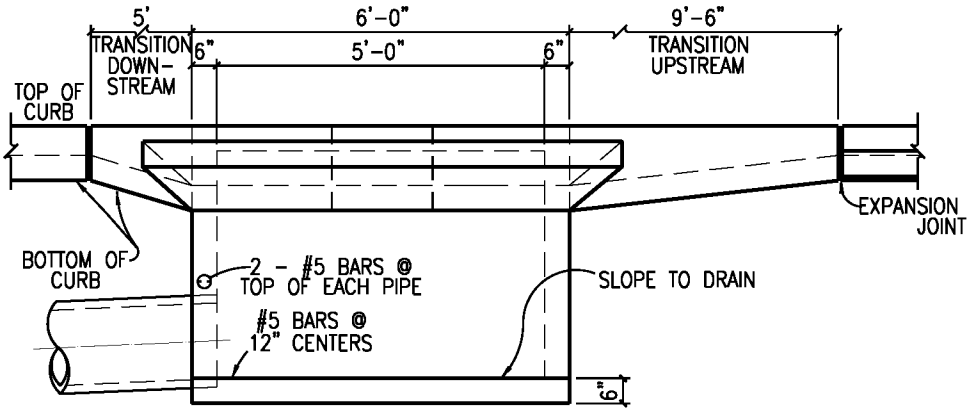
TWO-SIDED DRAIN INLET

CONSTRUCTION STANDARDS AND DETAILS

D-04
SCALE: N.T.S.
ISSUE DATE: 5-28-19



PLAN



BACK SIDE ELEVATION

TWO-SIDED DRAIN INLET

NOT TO SCALE

NOTES:

1. SHOULD THE CURB INLET BE LOCATED IN A SAG, CONTRACTOR SHALL TRANSITION 9'-6" ON BOTH SIDES OF CURB INLET.
2. THE MAXIMUM LENGTH OF CURB INLET, WITH EXTENSIONS, SHALL BE 20'.
3. EXTENSIONS OF 5' OF OPEN CURB SHALL BE ACCOMPANIED BY 6" WIDE POST SUPPORTS.
4. MANHOLE COVER SHALL BE PER DETAIL ON D-08.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

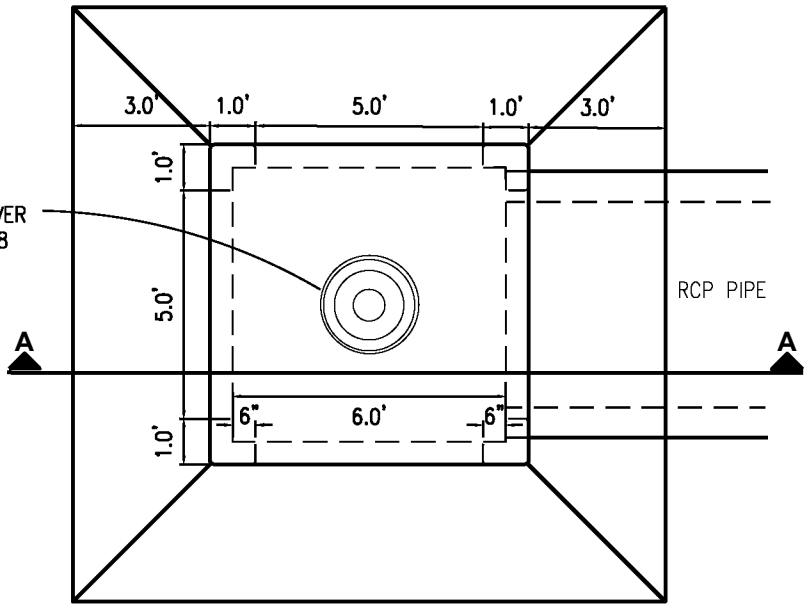
TWO-SIDED DRAIN INLET

CONSTRUCTION STANDARDS AND DETAILS

D-05

SCALE: N.T.S.

ISSUE DATE: 5-28-19

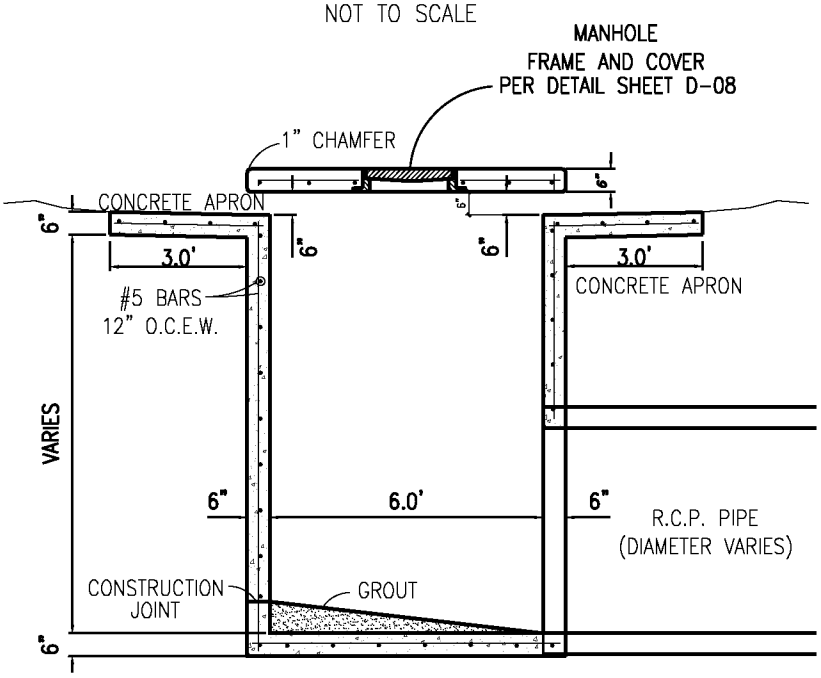


PLAN

NOT TO SCALE

NOTES:

1. ALL CONCRETE SHALL BE A MINIMUM OF 3000 P.S.I.
2. CONCRETE FOR ALL ITEMS ON THIS SHEET SHALL BE CLASS "A", 5 SACK, 3000 P.S.I. CONCRETE AT 28 DAYS UNLESS OTHERWISE SPECIFIED ON THE PLANS OR SPECIFICATIONS. ALL CONCRETE SHALL BE GIVEN A BROOM FINISH UNLESS OTHERWISE SPECIFIED. ALL REINFORCING SHALL HAVE 2" MINIMUM COVER, 3" MINIMUM IF PLACED AGAINST EARTH FORM.
3. ALL EXPOSED CORNERS TO BE TOOLED TO A 1/4" RADIUS.



SECTION A-A

NOT TO SCALE

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

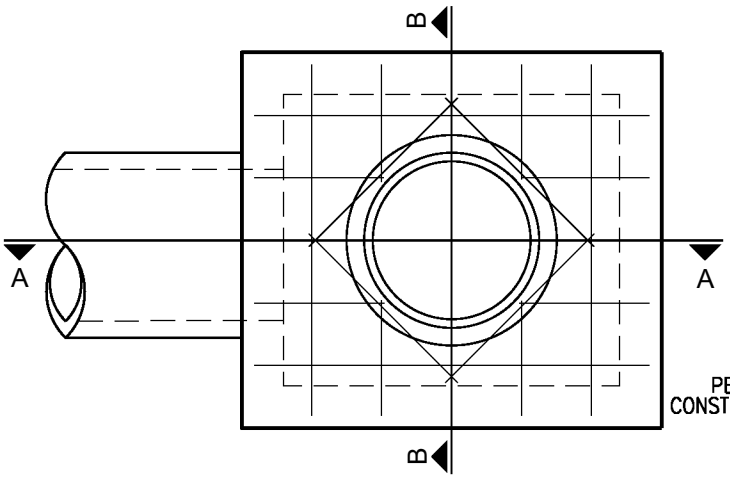
AREA INLET

CONSTRUCTION STANDARDS AND DETAILS

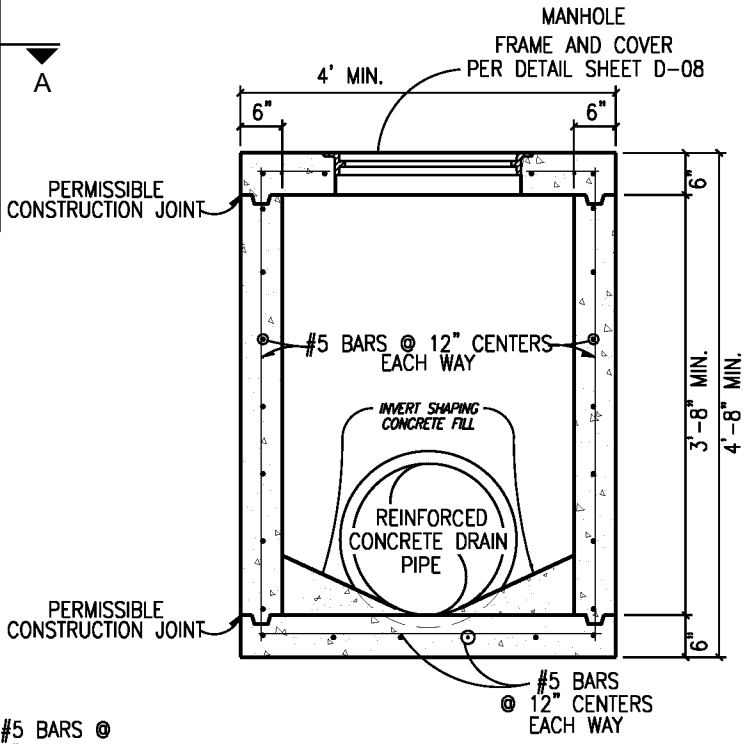
D-06

SCALE: N.T.S.

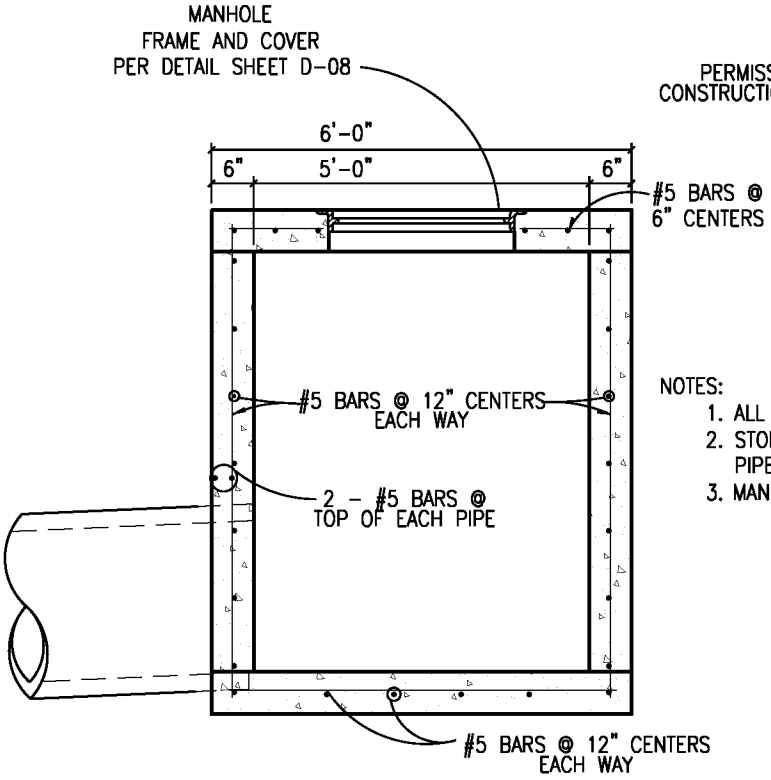
ISSUE DATE: 5-28-19



PLAN VIEW



SECTION B-B



SECTION A-A

NOTES:

1. ALL CONCRETE SHALL BE CLASS "A" CONCRETE.
2. STORM SEWER PIPE MATERIAL TO BE REINFORCED CONCRETE PIPE CLASS III.
3. MANHOLE SHALL BE PER DETAIL SHEET D-08.

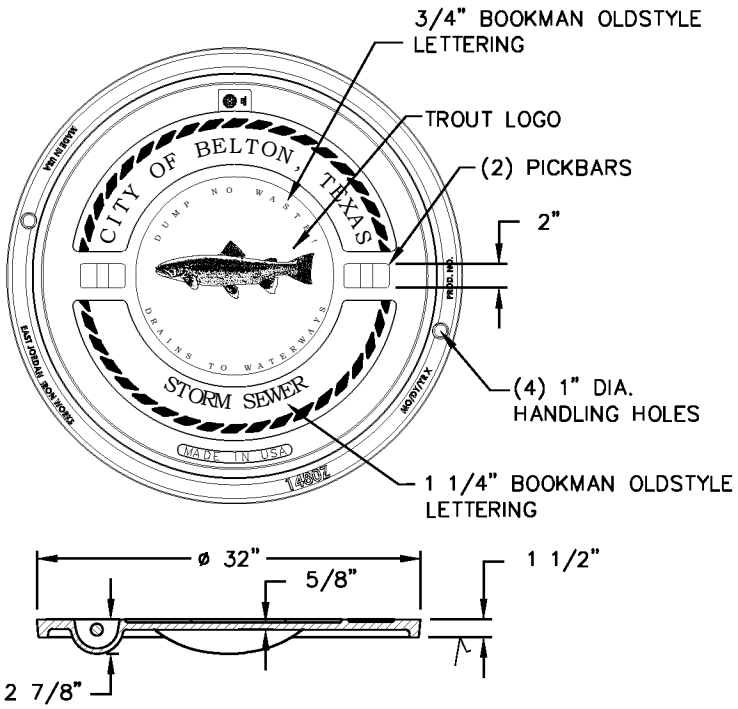
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

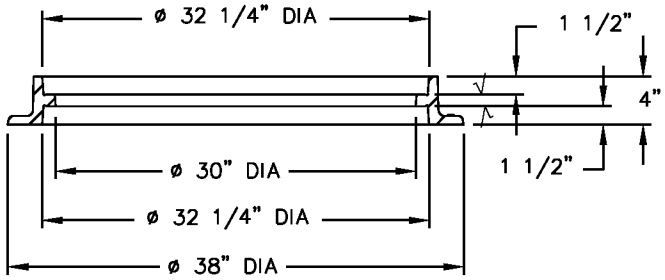
JUNCTION BOX

CONSTRUCTION STANDARDS AND DETAILS

D-07
SCALE: N.T.S.
ISSUE DATE: 5-28-19



COVER SECTION



FRAME SECTION

NOTES:

1. LID SHALL HAVE TWO (2) TYPE 4 PICK BARS AND THE TROUT LOGO AND LABELED "STORM SEWER". NO PICK HOLES IN CASTING.
2. ASPHALTIC COATING FROM MANUFACTURER IS REQUIRED.
3. MUD RING IS REQUIRED.

1432 – LID
1480 – RING

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

STORM DRAIN MANHOLE SET

CONSTRUCTION STANDARDS AND DETAILS

D-08
SCALE: N.T.S.
ISSUE DATE: 5-28-19

NOTES:

1. REPLACED BASE MATERIAL OVER TRENCH SHALL BE TWICE THE THICKNESS OF THE ORIGINAL BASE.
2. BASE MATERIAL SHALL BE IN LIFTS NOT TO EXCEED 6" AND EACH LIFT THOROUGHLY ROLLED OR TAMPED TO SPECIFIED MAXIMUM DENSITY.
3. ASPHALT CONCRETE PAVEMENT JOINTS SHALL BE MECHANICALLY SAWED.
4. SURFACE MATERIAL WILL BE CONSISTENT WITH THE EXISTING SURFACE.
5. A MINIMUM OF ONE DENSITY TEST SHALL BE TAKEN EVERY TWO HUNDRED FIFTY (250) FEET FOR EACH SIX (6) INCH LIFT (10" FOR COMMON FILL OUTSIDE OF ROADWAY) OF SUBGRADE AND EACH OPEN CUT CROSSING. PROCTORS FOR MATERIALS USED IN BACKFILLING SHALL BE OBTAINED BY A CERTIFIED LABORATORY. DENSITY TESTS SHALL BE CONDUCTED BY A CERTIFIED LABORATORY OR THE PERMITTEE'S CONSULTANTS. THE PERCENTAGE OF MAXIMUM DENSITY REQUIRED SHALL BE AS STATED IN NOTE 7. ALL DENSITY TESTS SHALL BE COMPLETED AND ACCEPTED ON EACH LAYER PRIOR TO ADDITIONAL BACKFILLING. A COPY OF ALL COMPLETED AND ACCEPTED DENSITY TESTS SHALL BE FURNISHED TO CITY OF BELTON.
6. BASE TYPE

   TxDOT TYPE A – GRADE 2 CRUSHED LIMESTONE BASE COMPACTED TO 95% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D1557 (METHOD D) AT OPTIMUM MOISTURE +2% PROCTOR TO BE PROVIDED BY THE CONTRACTOR TO THE CITY INSPECTOR. COMPACTED NATIVE MATERIAL: COMPACT PER FIELD DENSITY CONTROL REQUIREMENTS TABLE. SELECT MATERIAL: COMPACT PER FIELD DENSITY CONTROL REQUIREMENTS TABLE.

FIELD DENSITY CONTROL REQUIREMENTS

DESCRIPTION	DENSITY	MOISTURE CONTROL
	TEX – 115 – E	
PI ≤ 15	≥ 98% MAXIMUM DRY DENSITY	
15 < PI ≤ 35	98% ≥ MAX. DRY DENSITY ≤ 102%	≥ OPTIMUM MOISTURE CONTENT
PI > 35	95% ≥ MAX. DRY DENSITY ≤ 100%	≥ OPTIMUM MOISTURE CONTENT

7. CONTRACTOR OR ENGINEER MAY USE FLOWABLE BACKFILL AS AN ALTERNATE BACKFILL MATERIAL
8. PIPE SHALL BE REINFORCED CONCRETE PIPE CLASS III UNLESS THE DEPTH OF PIPE REQUIRES A STRONGER CLASS. PIPE SHALL HAVE A MINIMUM OF 24" COVER IN UNPAVED AREAS AND 18" OF COVER FROM BOTTOM OF SUBGRADE IN PAVED AREAS. WHERE LESS THAN 36" OF COVER IS PROVIDED, CLASS IV REINFORCED CONCRETE PIPE SHALL BE USED. IN NO CASE SHALL A STORM SEWER HAVE LESS THAN 12" OF COVER OVER THE TOP OF PIPE.
9. HIGH DENSITY POLYETHYLENE (HDPE) PIPE MAY BE USED UP TO 48–INCHES IN DIAMETER IN UNPAVED AREAS OUTSIDE OF CITY STREETS, OR OUTSIDE OF FUTURE CITY STREETS. BACKFILL SHALL BE PER PIPE MANUFACTURER. TRANSITION TO RCP SHALL OCCUR 8'–0" PRIOR TO END WITH FABRICATED ADAPTOR.
10. ALL FITTINGS AND WYES SHALL BE MANUFACTURED AND NOT CONSTRUCTED ON THE PROJECT WITHOUT PRIOR APPROVAL FROM CITY ENGINEER.
11. ALL JOINTS THAT ARE NOT SEALED WITH A WATERTIGHT CONNECTION SHALL BE WRAPPED WITH MARAFI–140–N GEOTEXTILE FABRIC OR APPROVED EQUIVALENT. THE JOINT SHALL BE WRAPPED WITH 18" WIDE FABRIC SPLITTING THE JOINT.
12. EMBEDMENT FOR RCP STORM SEWER SHALL BE AS FOLLOWS:

GRADATION
(ASTM C33–SIZE 56)

SIEVE SIZE	ASTM C33 SPECIFICATIONS
1–1/2"	100
1"	90–100
3/4"	40–90
1/2"	15–60
No. 4	0–5
No.200	1.0 max

L.A. ABRASION
(ASTM C–131, GRADING "B")

PERCENT LOSS: 50 max

NOTE:
1. SEE D–10 FOR TRENCH WIDTH DEFINITION.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

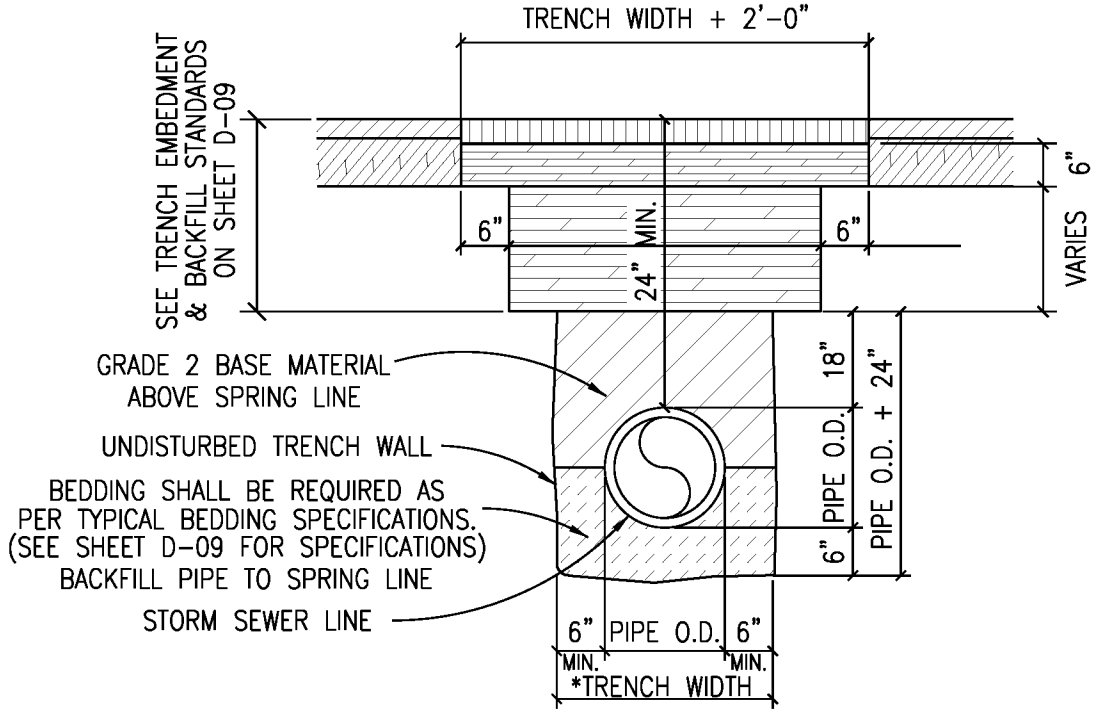
TRENCH AND EMBEDMENT NOTES FOR STORM SEWER

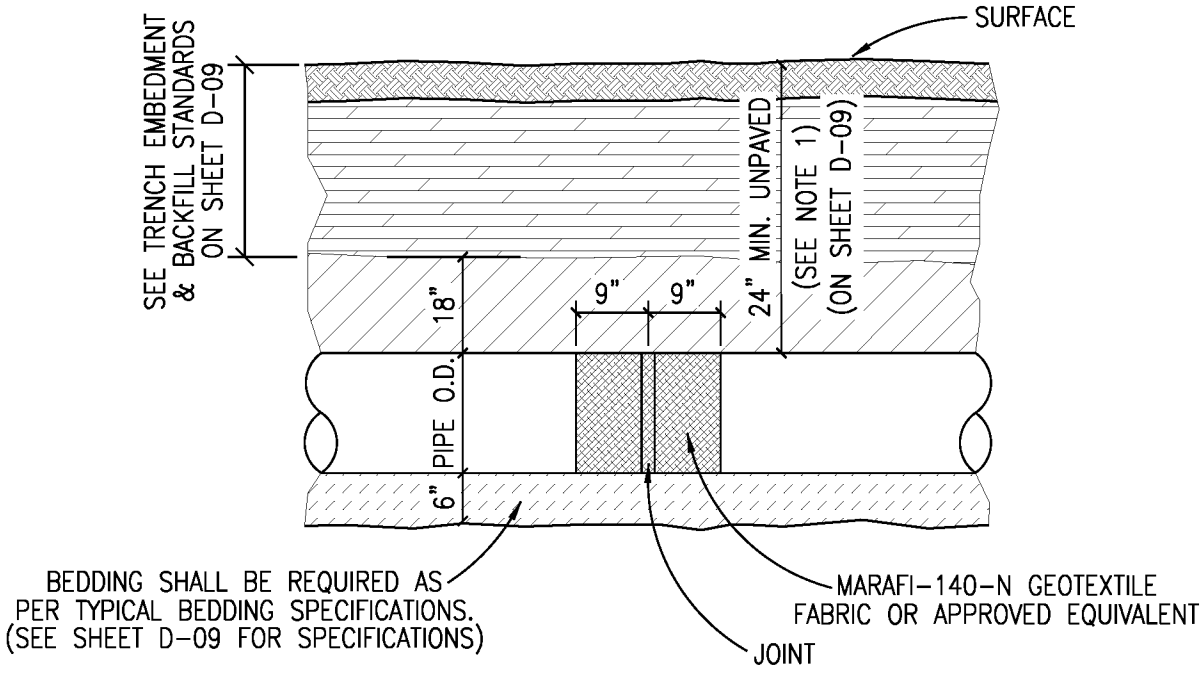
CONSTRUCTION STANDARDS AND DETAILS

D–09
SCALE: N.T.S.
ISSUE DATE: 5–28–19

*TRENCH WIDTH

PIPE LESS THAN 20" DIAMETER
1'-0" + PIPE O.D.
20" DIAMETER AND LARGER
2'-0" + PIPE O.D.



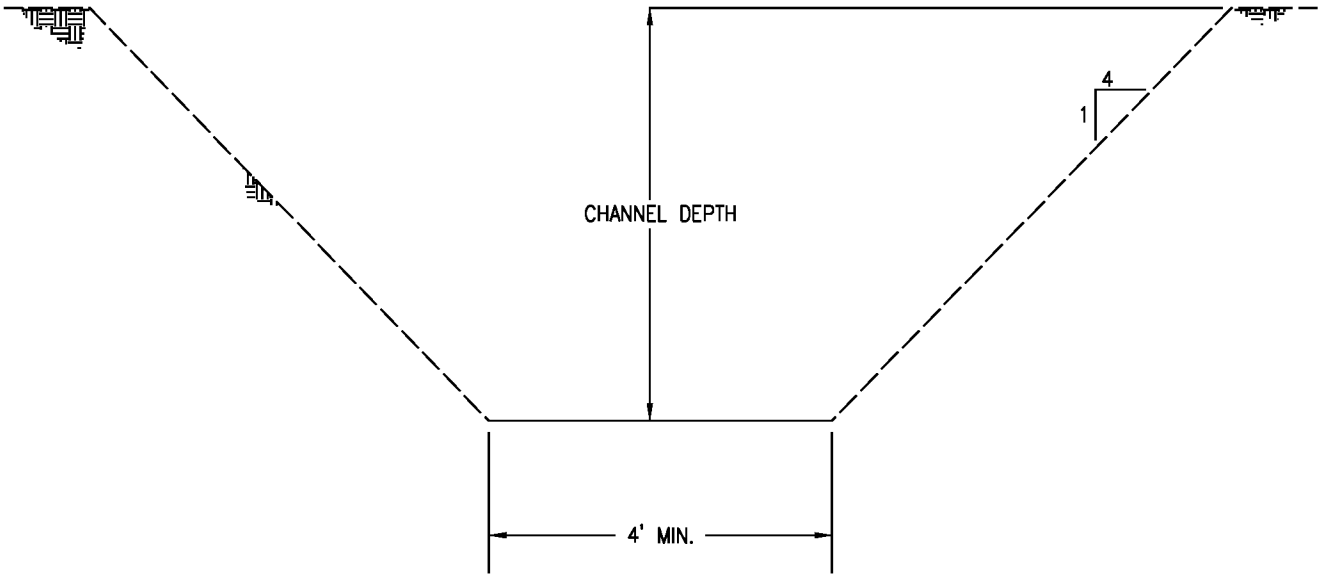


CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

TRENCH AND EMBEDMENT DETAIL FOR STORM SEWER

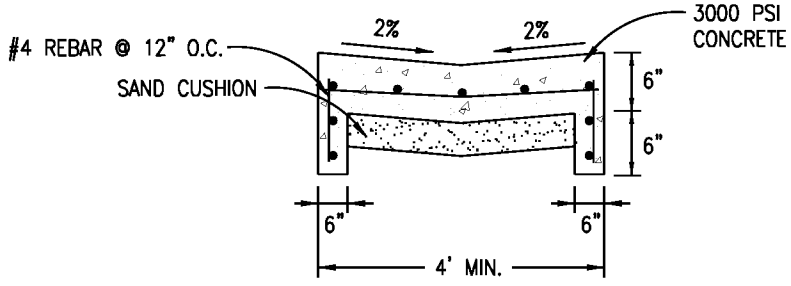
CONSTRUCTION STANDARDS AND DETAILS

D-10
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. MINIMUM LONGITUDINAL SLOPE OF CHANNEL IS 0.5%.
2. CHANNELS SHALL BE VEGETATED BY HYDRO-MULCHING, SODDING OR SEEDING.
3. FENCING MAY BE REQUIRED AT DISCRETION OF CITY ENGINEER.
4. CONCRETE PILOT/TRICKLE CHANNELS ARE REQUIRED IN ALL UN-LINED CHANNELS.
5. PILOT/TRICKLE CHANNELS SHALL HAVE CONTRACTION JOINTS EVERY 20'.



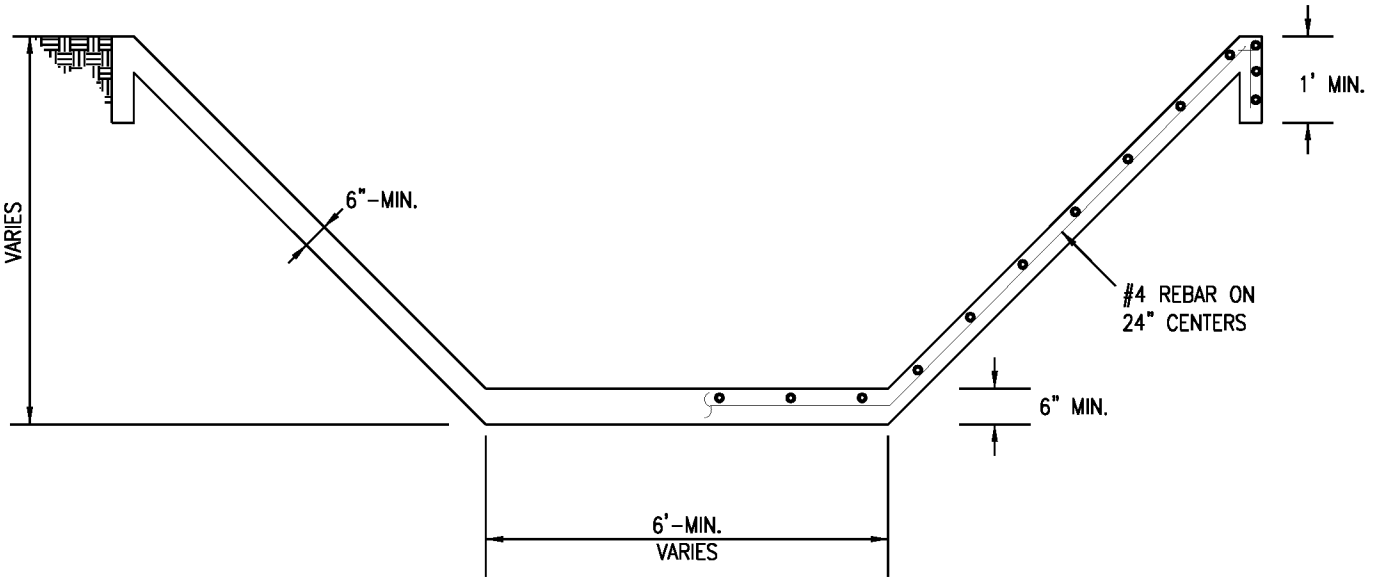
TYPICAL CONCRETE PILOT/TRICKLE CHANNEL

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

GRASS LINED CHANNEL

CONSTRUCTION STANDARDS AND DETAILS

D-11
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

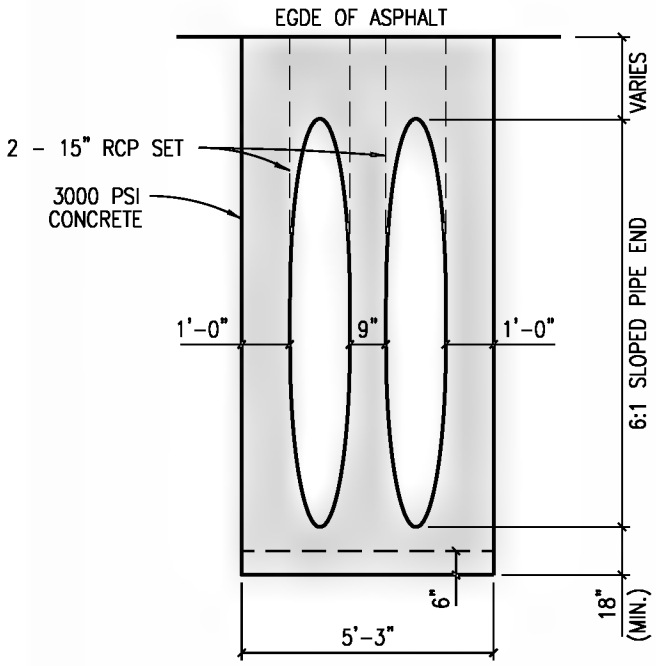
1. CONCRETE SHALL BE MINIMUM 3,000 PSI COMPRESSIVE STRENGTH (28-DAYS).
2. MINIMUM LONGITUDINAL SLOPE OF CHANNEL IS 0.5%.
3. CONCRETE SHALL BE MINIMUM 6 - INCHES THICK WITH 1 - FOOT MINIMUM TOES AT EDGES.
4. REINFORCEMENT SHALL BE #4 ASTM A-615 GRADE 60 BARS, 12" ON CENTER EACH WAY. REINFORCEMENT TO HAVE 2" MINIMUM COVER.
5. ALL CONCRETE SHALL BE GIVEN A LIGHT BROOM FINISH UNLESS OTHERWISE SPECIFIED.
6. FENCING OR RAILING MAY BE REQUIRED AT DISCRETION OF THE CITY ENGINEER.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

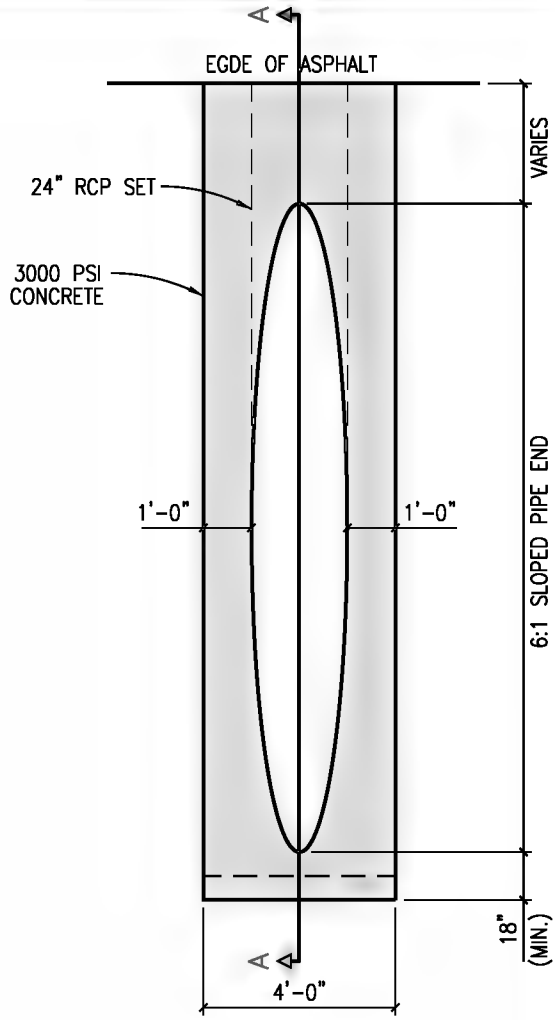
CONCRETE LINED CHANNEL

CONSTRUCTION STANDARDS AND DETAILS

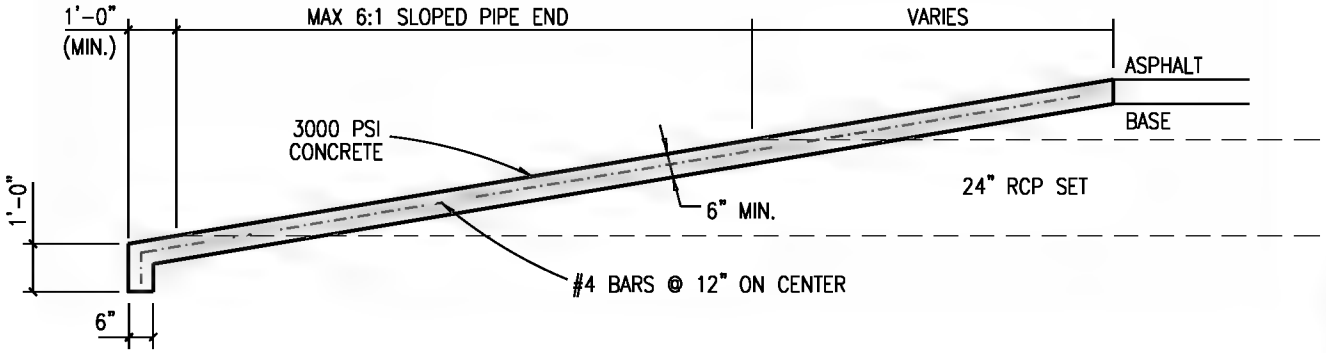
D-12
SCALE: N.T.S.
ISSUE DATE: 5-28-19



2 - 15" RCP SET
NOT TO SCALE



24" RCP SET
NOT TO SCALE



SECTION A-A
NOT TO SCALE

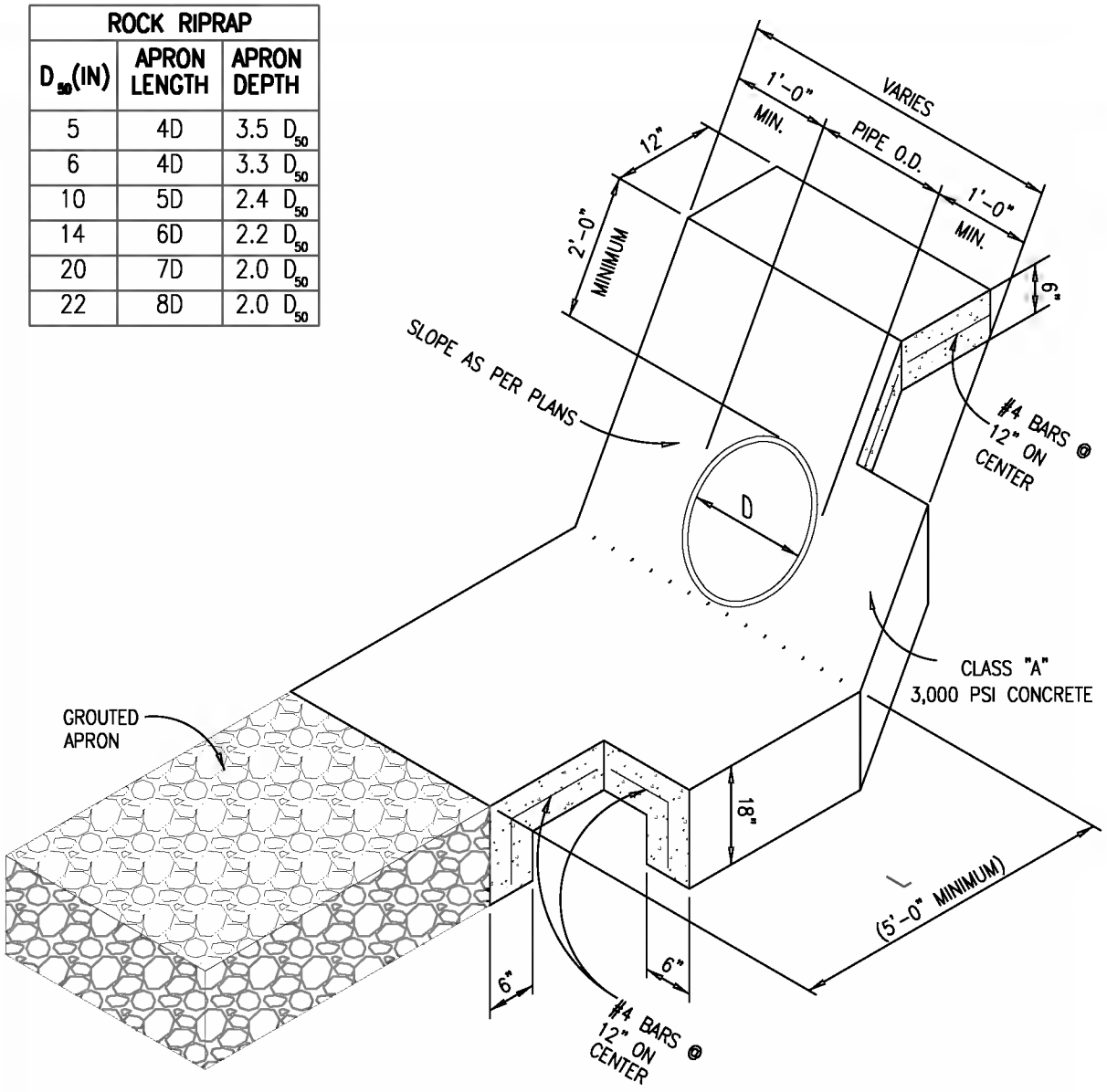
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

TYPICAL SLOPED END TREATMENT

CONSTRUCTION STANDARDS AND DETAILS

ROCK RIPRAP		
D_{50}(IN)	APRON LENGTH	APRON DEPTH
5	4D	3.5 D_{50}
6	4D	3.3 D_{50}
10	5D	2.4 D_{50}
14	6D	2.2 D_{50}
20	7D	2.0 D_{50}
22	8D	2.0 D_{50}



L = 0.2 VD
L = APRON LENGTH, FEET
V = CULVERT DISCHARGE VELOCITY FT/SEC.
D = HEIGHT OF BOX CULVERT OR DIAMETER OF PIPE CULVERT, FEET.

NOTES:

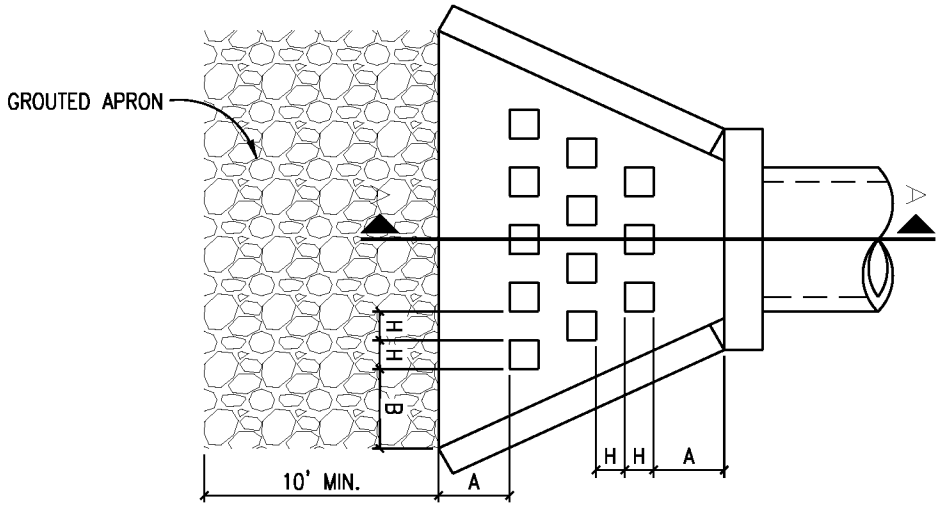
1. WHEN HEADWALLS AND WINGWALLS ARE REQUIRED, THEY SHALL CONFORM TO THE TEXAS DEPARTMENT OF TRANSPORTATION STANDARDS, OR AS DIRECTED BY THE CITY ENGINEER.
2. ENERGY DISSIPATERS SHALL BE REQUIRED IF PIPE VELOCITY IS GREATER THAN 6.0 F.P.S. OR AS DIRECTED BY THE CITY ENGINEER.
3. THE LENGTH OF THE CONCRETE APRON SHALL BE DETERMINED BY THE EQUATION LISTED ABOVE.
4. D_{50} IS DEFINED AS THE MEDIAN SIZE OF STONE.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

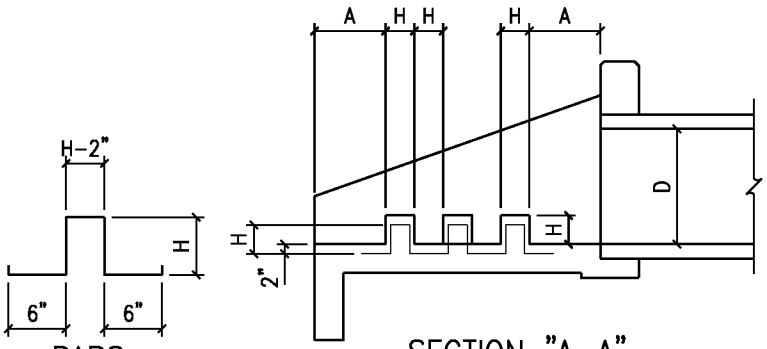
CONCRETE RIP-RAP AT PIPE

CONSTRUCTION STANDARDS AND DETAILS

ROCK RIPRAP		
D_{50}(IN)	APRON LENGTH	APRON DEPTH
5	4D	3.5 D_{50}
6	4D	3.3 D_{50}
10	5D	2.4 D_{50}
14	6D	2.2 D_{50}
20	7D	2.0 D_{50}
22	8D	2.0 D_{50}



PLAN VIEW



BARS

SECTION "A-A"

NOTES:

1. USE CLASS "A" CONCRETE, 3,000 PSI AT 28 DAYS, UNLESS NOTED.
2. REINFORCING STEEL – ASTM A615, GRADE 60, UNLESS NOTED.
3. LAP REINFORCING 30 BAR DIAMETERS MIN. AT SPLICES, UNLESS NOTED.
4. CHAMFER EXPOSED EDGES OF CONCRETE 3/4", UNLESS NOTED.
5. PLACE REINFORCING WITH THE CENTER OF THE OUTSIDE BARS 2 INCHES FROM THE SURFACE OF THE CONCRETE.

D PIPE DIAMETER (INCHES)	NUMBER OF ROWS OF DISSIPATORS	NUMBER OF DISSIPATORS IN FRONT ROW	H (INCHES)	A (INCHES)	B (INCHES)
12	1	3	4	4	9.1875
18	2	4	4 1/2	9 1/2	15.5625
24	2	5	6	14 3/4	16 1/2
30	3	6	7 1/2	12 1/2	14 3/8
36	3	6	9	16 1/4	18 5/16
42	3	6	10 1/2	20	22 1/4
48	3	6	12	23 3/4	26 1/4
54	3	6	13 1/2	27 1/2	27 3/4
60	3	6	15	31 1/4	31 5/8

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

ENERGY DISSIPATOR

CONSTRUCTION STANDARDS AND DETAILS

D-15

SCALE: N.T.S.

ISSUE DATE: 5-28-19

NOTE: THIS SECTION IS INTENDED TO ASSIST THOSE PERSONS PREPARING STORMWATER POLLUTION PREVENTION PLANS (SW3P) THAT COMPLY WITH FEDERAL, STATE AND/OR LOCAL STORMWATER REGULATIONS.

1. CONTRACTOR TO INSTALL AND MAINTAIN EROSION/SEDIMENTATION CONTROLS AND TREE/NATURAL AREA PROTECTIVE FENCING PRIOR TO ANY SITE PREPARATION WORK (CLEARING, GRUBBING, GRADING, OR EXCAVATION). CONTRACTOR TO REMOVE EROSION/SEDIMENTATION CONTROLS AT THE COMPLETION OF PROJECT AND GRASS RESTORATION.

2. PLACEMENT OF EROSION/SEDIMENTATION CONTROLS TO BE IN ACCORDANCE WITH THE APPROVED EROSION AND SEDIMENTATION CONTROL PLAN AND STATE APPROVED SW3P. DEVIATIONS FROM THE APPROVED PLAN MUST BE SUBMITTED TO AND APPROVED BY THE CITY ENGINEER OR THEIR REPRESENTATIVE. THE CITY OF BELTON SHALL BE COPIED ON ALL CORRESPONDENCE RELATED TO SW3P INCLUDING (NOI, NOC, NOT, AND WEEKLY INSPECTION REPORTS.)

3. ALL DISTURBED AREAS TO BE RESTORED TO PREVIOUS CONDITION.

4. SEEDING FOR EROSION CONTROL TO BE APPLIED OVER AREAS DISTURBED BY CONSTRUCTION AS FOLLOWS:
   FROM SEPTEMBER 15 TO MARCH 1, SEEDING TO BE WITH A COMBINATION OF 2 POUNDS PER 1,000 SQUARE FEET OF UNHULLED BERMUDA AND 2 POUNDS PER 1,000 SQUARE FEET OF WINTER RYE WITH A PURITY OF 95% WITH 90% GERMINATION.
   FROM MARCH 2, TO SEPTEMBER 14, SEEDING TO BE WITH HULLED BERMUDA GRASS (CYNODEN DACTOLYN) AT A RATE OF 2 POUNDS PER 1,000 SQUARE FEET WITH A PURITY OF 95% WITH 85% GERMINATION.

5. PLANTED AREA TO BE IRRIGATED OR SPRINKLED IN A MANNER THAT WILL NOT ERODE THE TOPSOIL, BUT WILL SUFFICIENTLY SOAK THE SOIL TO A MINIMUM DEPTH OF FOUR (4) INCHES. THE IRRIGATION TO OCCUR AT 7-DAY (MINIMUM) INTERVALS DURING THE FIRST TWO MONTHS. RAINFALL OCCURRENCES OF 1/2 INCH MINIMUM OR GREATER TO POSTPONE THE WATERING SCHEDULE ONE WEEK.

6. RESTORATION TO BE ACCEPTABLE WHEN THE GRASS HAS GROWN AT LEAST 12 INCHES HIGH WITH 95% COVERAGE, PROVIDED NO BARE SPOTS LARGER THAN 25 SQUARE FEET EXIST AFTER FIRST MOWING.

7. A MINIMUM OF FOUR (4) INCHES OF TOPSOIL TO BE PLACED IN ALL AREAS DISTURBED BY CONSTRUCTION.

8. CONTRACTOR TO HYDROMULCH OR SOD (AS SHOWN ON PLANS) ALL EXPOSED CUTS AND FILLS UPON COMPLETION OF CONSTRUCTION.

9. EROSION AND SEDIMENTATION CONTROLS TO BE INSTALLED OR MAINTAINED IN A MANNER WHICH DOES NOT RESULT IN SOIL BUILDUP WITHIN TREE DRIPLINE.

10. TO AVOID SOIL COMPACTION, CONTRACTOR SHALL NOT ALLOW VEHICULAR TRAFFIC, PARKING, OR STORAGE OF EQUIPMENT OR MATERIALS IN THE TREE DRIPLINE AREAS.

11. WHERE A FENCE IS CLOSER THAN FOUR (4) FEET TO A TREE TRUNK, PROTECT THE TRUNK WITH STRAPPED-ON PLANKING TO A HEIGHT OF EIGHT (8) FEET (OR TO THE LIMITS OF LOWER BRANCHING) IN ADDITION TO THE FENCING.

12. TREES TO BE REMOVED IN A MANNER WHICH DOES NOT IMPACT TREES TO BE PRESERVED.

13. ANY ROOT EXPOSED BY CONSTRUCTION ACTIVITY TO BE PRUNED FLUSH WITH THE SOIL. BACKFILL ROOT AREAS WITH GOOD QUALITY TOPSOIL AS SOON AS POSSIBLE. IF EXPOSED ROOT AREAS ARE NOT BACKFILLED WITHIN TWO DAYS, COVER THEM WITH ORGANIC MATERIAL IN A MANNER WHICH REDUCES SOIL TEMPERATURE AND MINIMIZES WATER LOSS DUE TO EVAPORATION.

14. CONTRACTOR TO PRUNE VEGETATION TO PROVIDE CLEARANCE FOR STRUCTURES, VEHICULAR TRAFFIC, AND EQUIPMENT BEFORE DAMAGE OCCURS (RIPPING OF BRANCHES, ETC.). PRUNING INCLUDES DISINFECTING ALL PRUNING EQUIPMENT BETWEEN BUSHES AND TREES. BLEACH, OR AN APPROVED EQUIVALENT, MAY BE USED TO DISINFECT EQUIPMENT.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

STORMWATER NOTES

CONSTRUCTION STANDARDS AND DETAILS

D-16
SCALE: N.T.S.
ISSUE DATE: 5-28-19

15. CONTRACTOR IS TO INSPECT THE CONTROLS AT WEEKLY INTERVALS AND AFTER EVERY RAINFALL EXCEEDING 1/2 INCH TO VERIFY THAT THEY HAVE NOT BEEN SIGNIFICANTLY DISTURBED. ANY ACCUMULATED SEDIMENT AFTER A SIGNIFICANT RAINFALL TO BE REMOVED AND PLACED IN THE OWNER DESIGNATED SPOIL DISPOSAL SITE. THE CONTRACTOR TO CONDUCT PERIODIC INSPECTIONS OF ALL EROSION/SEDIMENTATION CONTROLS AND TO MAKE ANY REPAIRS OR MODIFICATIONS NECESSARY TO ASSURE CONTINUED EFFECTIVE OPERATION OF EACH DEVICE.

16. WHERE THERE IS TO BE AN APPROVED GRADE CHANGE, IMPERMEABLE PAVING SURFACE, TREE WELL, OR OTHER SUCH SITE DEVELOPMENT IMMEDIATELY ADJACENT TO A PROTECTED TREE, ERECT THE FENCE APPROXIMATELY TWO TO FOUR FEET (2'-4') BEHIND THE AREA IN QUESTION.

17. TEMPORARY FUEL STORAGE IS ALLOWED. HOWEVER, LOCATIONS OF FUEL STORAGE SHALL BE APPROVED BY THE CITY ENGINEER. ANY FUEL STORAGE SHALL INCLUDE THE APPROPRIATE SECONDARY CONTAINMENT.

18. IF EROSION AND SEDIMENTATION CONTROL SYSTEMS ARE EXISTING FROM PRIOR CONTRACTS, CITY ENGINEER AND THE CONTRACTOR TO EXAMINE THE EXISTING EROSION AND SEDIMENTATION CONTROL SYSTEMS FOR DAMAGE PRIOR TO CONSTRUCTION. ANY DAMAGE TO PREEXISTING EROSION AND SEDIMENTATION CONTROLS NOTED TO BE REPAIRED AT CONTRACTOR'S EXPENSE.

19. INTENTIONAL RELEASE OF VEHICLE OR EQUIPMENT FLUIDS ONTO THE GROUND IS PROHIBITED. CONTAMINATED SOIL RESULTING FROM ACCIDENTAL SPILL TO BE REMOVED AND DISPOSED OF PROPERLY BY THE CONTRACTOR AT THE CONTRACTORS EXPENSE.

20. ALL (SW3P) PLANS AND EROSION CONTROL MEASURES MUST BE INSPECTED AND APPROVED BY A CITY CONSTRUCTION INSPECTOR PRIOR TO COMMENCING ANY OTHER CONSTRUCTION ACTIVITIES.

21. IN THE EVENT OF A CONFLICT BETWEEN THE SPECIFIED REQUIREMENTS AND STORMWATER POLLUTION CONTROL LAWS, RULES, REGULATIONS OR OTHER LOCAL, STATE OR FEDERAL AGENCIES, THE MORE RESTRICTIVE LAWS, RULES OR STANDARDS SHALL APPLY.

22. UPON COMPLETION OF CONSTRUCTION AND ACHIEVEMENT AND FINAL STABILIZATION, PROPERLY REMOVE THE TEMPORARY POLLUTANT CONTROL STRUCTURES AND COMPLETE THE AREA AS REQUIRED.

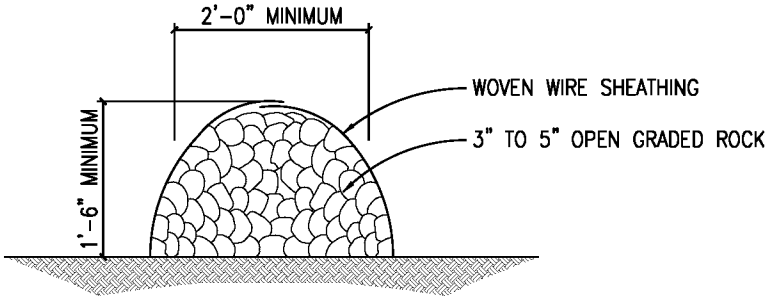
23. THE TCEQ GENERAL PERMIT SHALL BE POSTED AT THE JOB SITE WITH ALL OTHER REQUIRED DOCUMENTS. THE SW3P SHALL ALSO BE AVAILABLE ON THE JOB SITE.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

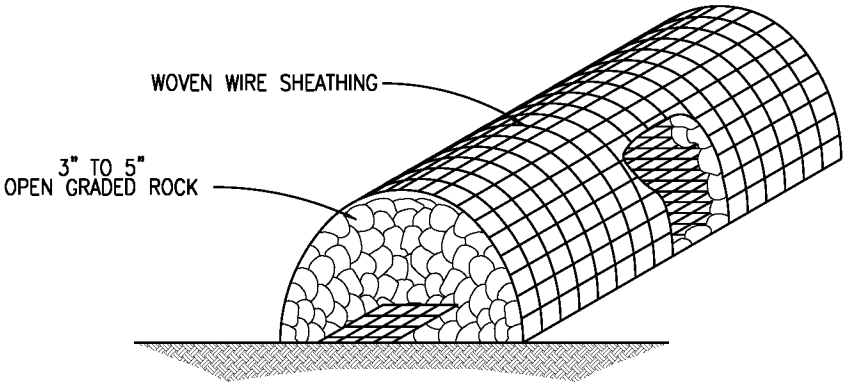
STORMWATER NOTES (CONTINUED)

CONSTRUCTION STANDARDS AND DETAILS

D-17
SCALE: N.T.S.
ISSUE DATE: 5-28-19



CROSS SECTION



INSTALLATION:

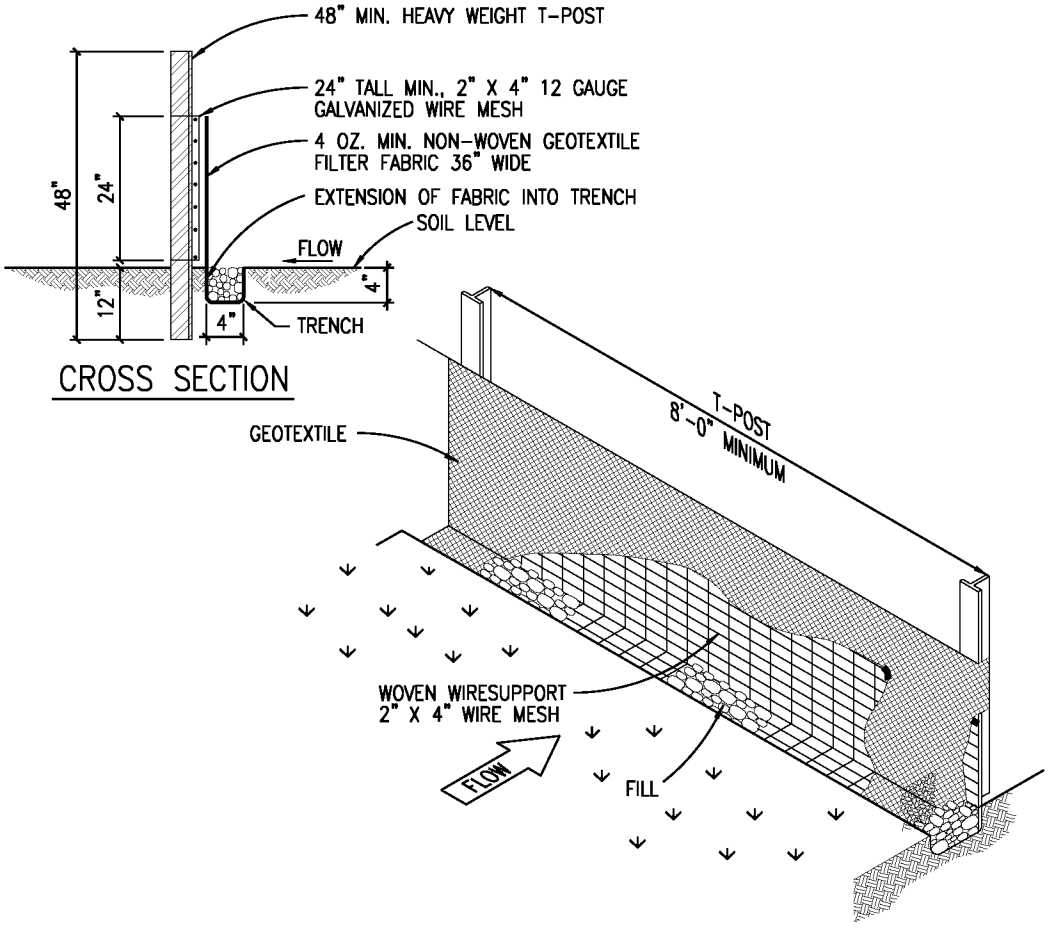
- LAYOUT THE ROCK BERM FOLLOWING AS CLOSELY AS POSSIBLE TO THE CONTOUR.
- CLEAR THE GROUND OF DEBRIS, ROCKS OR PLANTS THAT WILL INTERFERE WITH INSTALLATION.
- PLACE WOVEN WIRE FABRIC ON THE GROUND ALONG THE PROPOSED INSTALLATION WITH ENOUGH OVERLAP TO COMPLETELY ENCIRCLE THE FINISHED SIZE OF THE BERM.
- PLACE THE ROCK ALONG THE CENTER OF THE WIRE TO THE DESIGNATED HEIGHT.
- WRAP THE STRUCTURE WITH THE PREVIOUSLY PLACED WIRE MESH SECURE ENOUGH SO THAT WHEN WALKED ACROSS THE STRUCTURE RETAINS IT'S SHAPE.
- SECURE WITH TIE WIRE.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

ROCK BERM

CONSTRUCTION STANDARDS AND DETAILS

D-18
SCALE: N.T.S.
ISSUE DATE: 5-28-19



STRAW WATTLE IS AN ACCEPTABLE FORM OF EROSION CONTROL IN LIEU OF SILT FENCING. STRAW WATTLE MUST BE KEPT SECURE USING WOODEN STAKES. STRAW WATTLE MUST BE REPLACED WHEN IT IS DAMAGED, SWEPT AWAY, OR WHEN STRAW IS EXPOSED.

INSTALLATION:

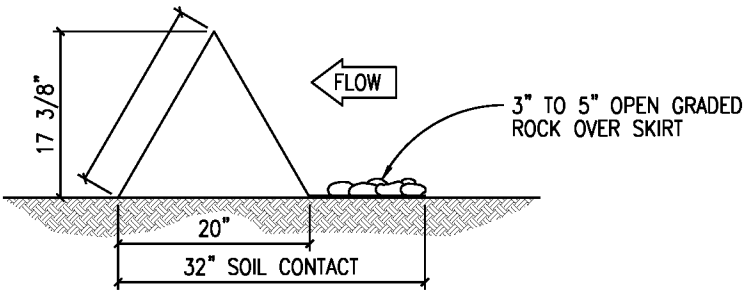
- LAYOUT THE SILT FENCE FOLLOWING AS CLOSELY AS POSSIBLE TO THE CONTOUR.
- CLEAR THE GROUND OF DEBRIS, ROCKS, PLANTS (INCLUDING GRASSES TALLER THAN 2") TO PROVIDE A SMOOTH FLOW APPROACH SURFACE. EXCAVATE 4" DEEP X 4" WIDE TRENCH ON UPSTREAM SIDE OF FACE PER PLANS.
- DRIVE THE HEAVY DUTY T-POST AT LEAST 12 INCHES INTO THE GROUND AND AT A SLIGHT ANGLE TOWARDS THE FLOW.
- ATTACH THE 2" X 4" 12 GAUGE WELDED WIRE MESH TO THE T-POST WITH 11 1/2 GAUGE GALVANIZED T-POST CLIPS. THE TOP OF THE WIRE TO BE 24" ABOVE GROUND LEVEL. THE WELDED WIRE MESH TO BE OVERLAPPED 6" AND TIED AT LEAST 6 TIMES WITH HOG RINGS.
- THE SILT FENCE TO BE INSTALLED WITH A SKIRT A MINIMUM OF 11" WIDE PLACED ON THE UPHILL SIDE OF THE FENCE INSIDE EXCAVATED TRENCH. THE FABRIC TO OVERLAP THE TOP OF THE WIRE BY 1".
- ANCHOR THE SILT FENCE BY BACKFILLING WITH EXCAVATED DIRT AND ROCKS.
- GEOTEXTILE SPLICES SHOULD BE A MINIMUM OF 18" WIDE ATTACHED IN AT LEAST 6 PLACES. SPLICES IN CONCENTRATED FLOW AREAS WILL NOT BE ACCEPTED.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

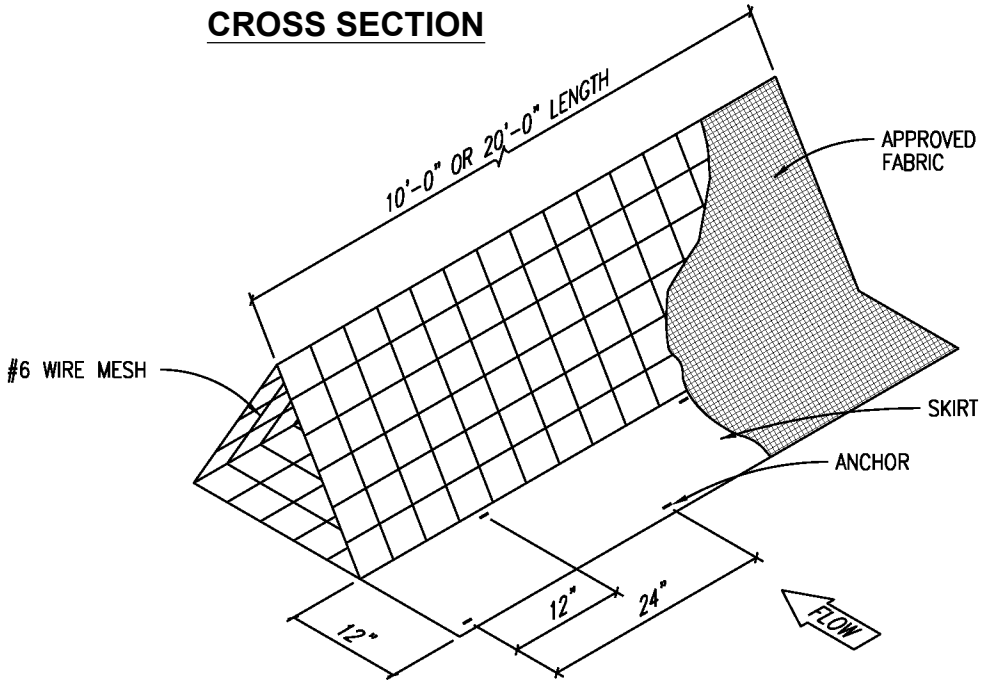
SILT FENCE

CONSTRUCTION STANDARDS AND DETAILS

D-19
SCALE: N.T.S.
ISSUE DATE: 5-28-19



CROSS SECTION



INSTALLATION:

- LAYOUT THE FILTER DIKE FOLLOWING AS CLOSELY AS POSSIBLE TO THE CONTOUR.
- CLEAR THE GROUND OF DEBRIS, ROCKS OR PLANTS THAT WILL INTERFERE WITH INSTALLATION.
- PLACE THE FILTER DIKE SECTIONS ONE AT A TIME, WITH THE SKIRT ON THE UPHILL SIDES TOWARD THE DIRECTION OF FLOW, ANCHORING EACH SECTION TO THE GROUND BEFORE THE NEXT SECTION IS PLACED.
- ANCHORS SHOULD BE PLACED ON 2'-0" CENTERS ALTERNATING FROM FRONT TO BACK SO THAT THERE IS ACTUALLY ONLY 1'-0" IN BETWEEN ANCHORS.
- SECURELY FASTEN THE SKIRT FROM ONE SECTION OF FILTER DIKE TO THE NEXT.
- FILTER DIKES MUST MAINTAIN CONTINUOUS CONTACT WITH THE GROUND.

CITY OF BELTON, TEXAS

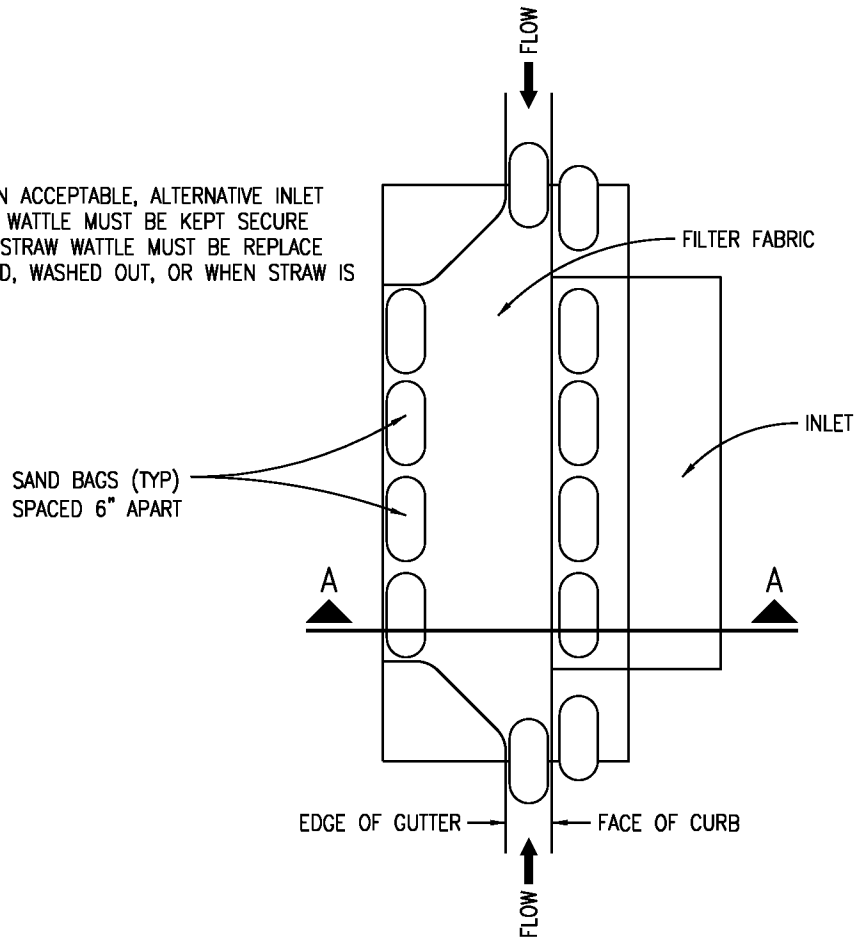
DEPARTMENT OF PUBLIC WORKS

TRIANGULAR FILTER DIKE

CONSTRUCTION STANDARDS AND DETAILS

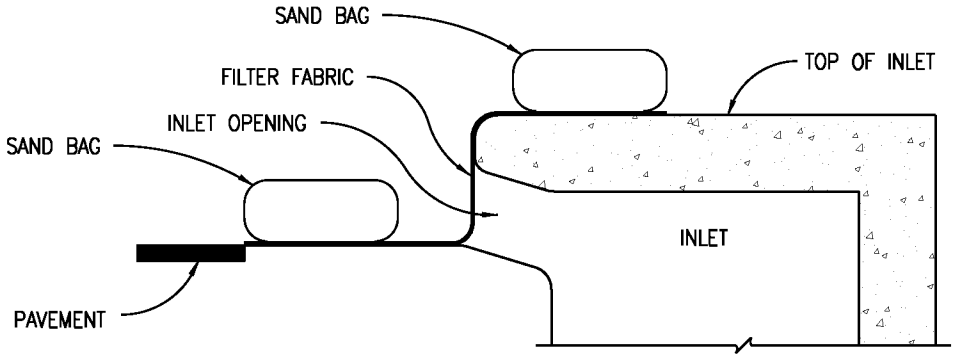
D-20
SCALE: N.T.S.
ISSUE DATE: 5-28-19

STRAW WATTLE IS AN ACCEPTABLE, ALTERNATIVE INLET PROTECTION. STRAW WATTLE MUST BE KEPT SECURE USING SAND BAGS. STRAW WATTLE MUST BE REPLACE WHEN IT IS DAMAGED, WASHED OUT, OR WHEN STRAW IS EXPOSED.



PLAN

NOT TO SCALE



NOTE:

FILTER FABRIC TO EXTEND 5'-0" BEYOND INLET OPENING, UPSTREAM OF INLET. TERMINATE FABRIC IN STREET GUTTER WITH SAND BAGS PLACED IN GUTTER FLOWLINE.

SECTION A-A

NOT TO SCALE

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

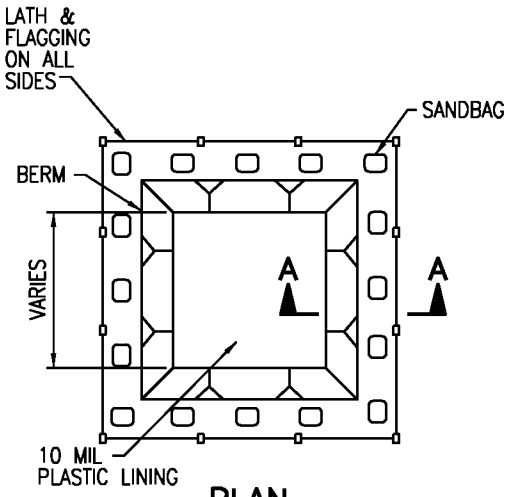
CURB INLET PROTECTION

CONSTRUCTION STANDARDS AND DETAILS

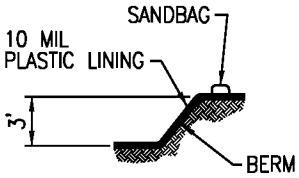
D-21

SCALE: N.T.S.

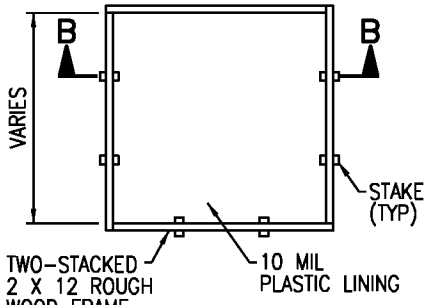
ISSUE DATE: 5-28-19



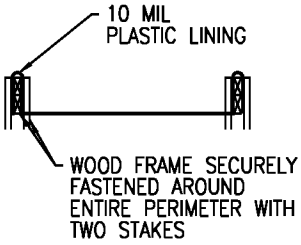
PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"



SECTION B–B
NOT TO SCALE

NOTES:

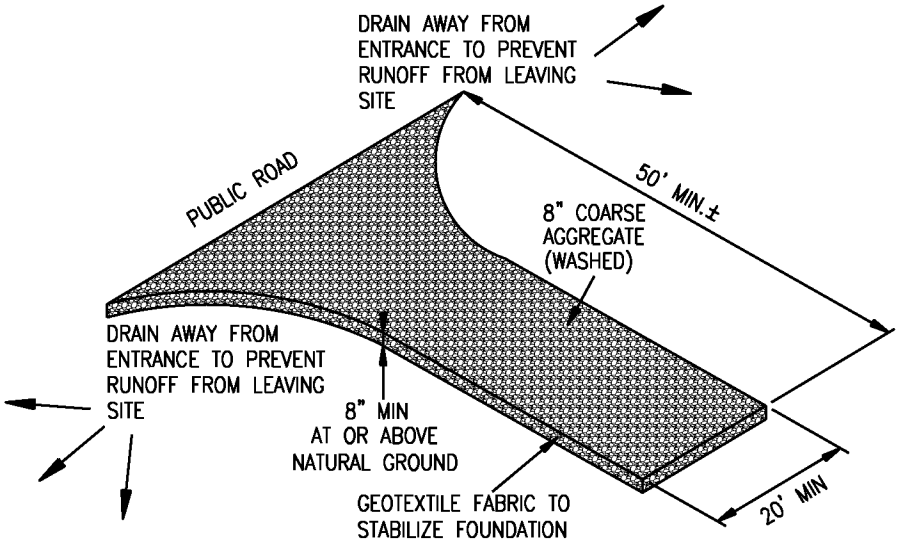
1. WASHOUT SHALL BE MINIMUM 10'x10' AND DEPTH AND CLEANOUT TO BE DETERMINED BY THE CONTRACTOR.
2. TO BE CLEANED AT A FREQUENCY TO PREVENT OVERFLOW.
3. INSTALL WASHOUTS BEFORE ANY CONCRETE WORK BEGINS, REGARDLESS OF SIZE OF PROJECT.

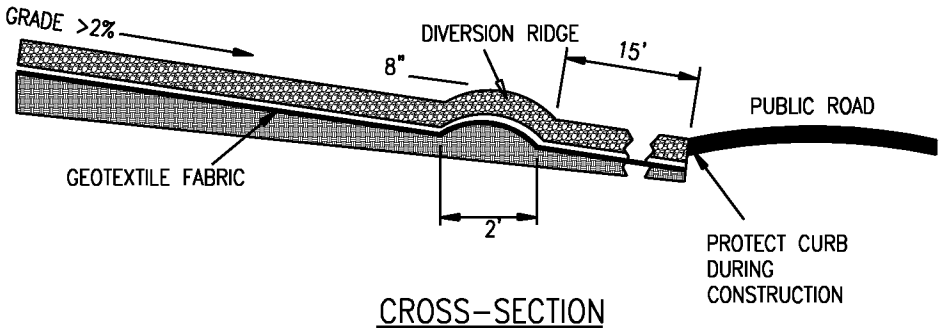
CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

CONCRETE WASHOUT AREAS

CONSTRUCTION STANDARDS AND DETAILS

D–22
SCALE: N.T.S.
ISSUE DATE: 5–28–19





CROSS-SECTION

N.T.S.

NOTE:

1. DESIGN AND MAINTENANCE SHALL BE ADEQUATE TO PREVENT SEDIMENT FROM ENTERING THE ROADWAY.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

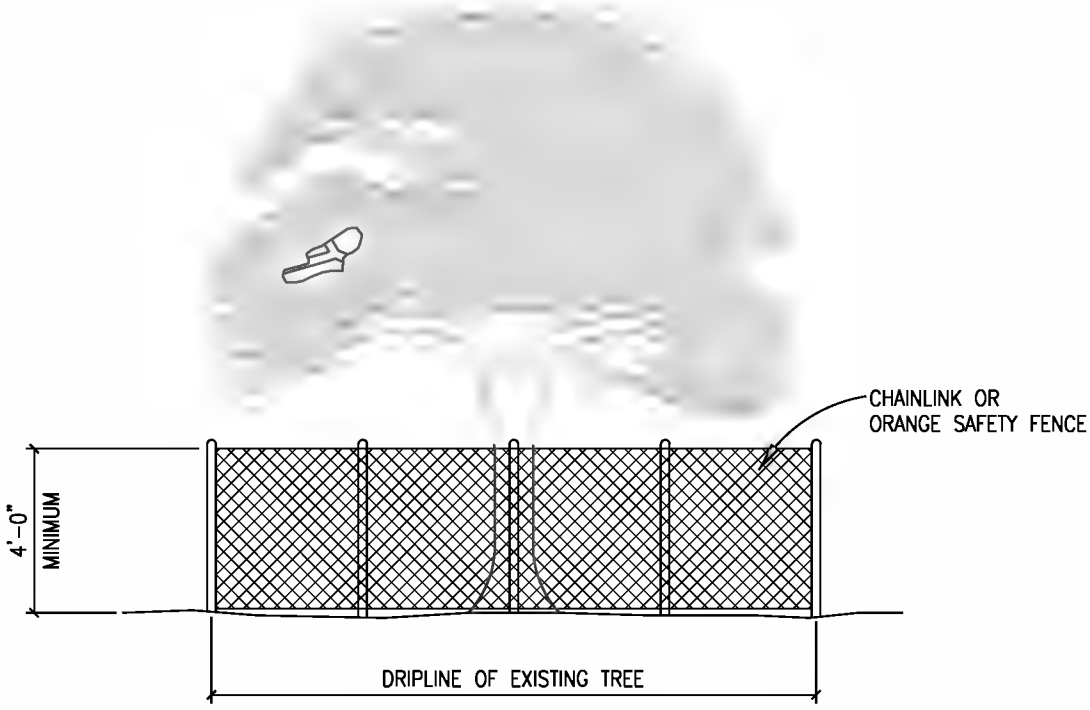
TEMPORARY CONSTRUCTION ENTRANCE/EXIT

CONSTRUCTION STANDARDS AND DETAILS

D-23

SCALE: N.T.S.

ISSUE DATE: 5-28-19



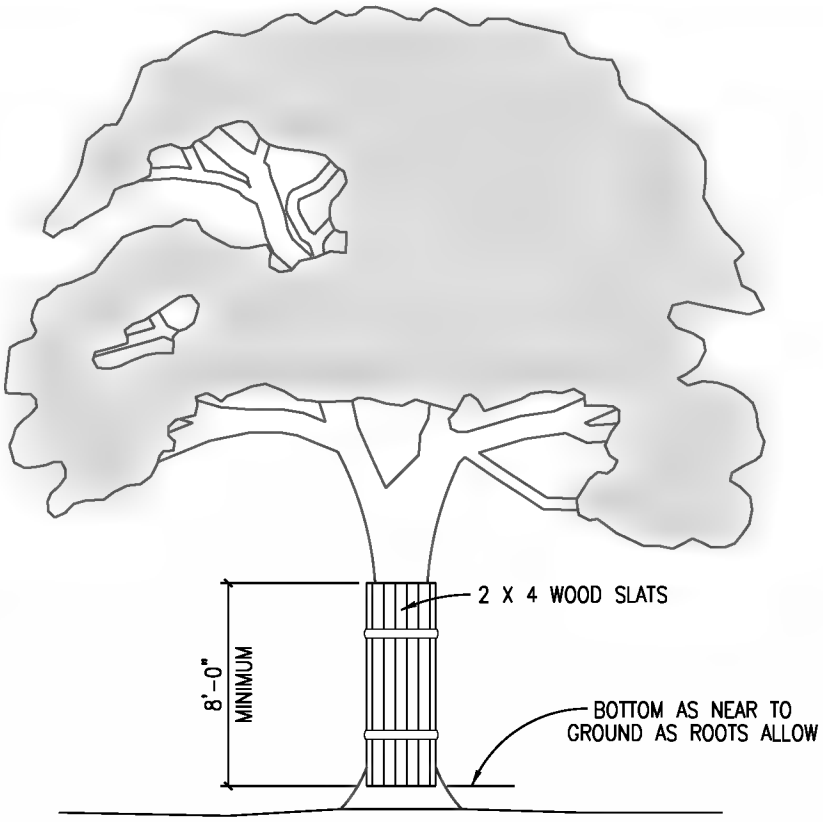
NOTES:

1. TREE PROTECTION SHALL BE PROVIDED FOR TREES DESIGNATED AS HERITAGE TREES BY THE CITY AND/OR AS DESIGNATED IN THE PLANS.
2. TREE PROTECTION FENCES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY SITE PREPARATION WORK (CLEARING, GRUBBING OR GRADING).
3. FENCES SHALL COMPLETELY SURROUND THE TREE, OR CLUSTERS OF TREES; WILL BE LOCATED AT THE OUTERMOST LIMIT OF THE TREE BRANCHES (DRIPLINE), AND WILL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PROJECT IN ORDER TO PREVENT THE FOLLOWING:
   A. SOIL COMPACTION IN THE ROOT ZONE AREA RESULTING FROM VEHICULAR TRAFFIC, OR STORAGE OF EQUIPMENT OR MATERIALS.
   B. ROOT ZONE DISTURBANCES DUE TO GRADE CHANGES (GREATER THAN SIX INCHES (6") CUT OR FILL OR TRENCHING NOT REVIEWED AND AUTHORIZED BY THE CITY.
   C. WOUNDS TO EXPOSED ROOTS, TRUNKS OR LIMBS BY MECHANICAL EQUIPMENT.
   D. OTHER ACTIVITIES DETRIMENTAL TO TREES, SUCH AS CHEMICAL STORAGE, CEMENT TRUCK CLEANING AND FIRE.
4. EXCEPTIONS TO INSTALLING FENCES AT TREE DRIPLINES MAY BE PERMITTED IN THE FOLLOWING CASES:
   A. WHERE PERMEABLE PAVING IS TO BE INSTALLED, ERECT THE FENCE AT THE OUTER LIMITS OF THE PERMEABLE PAVING AREA.
   B. WHERE TREES ARE CLOSE TO PROPOSED BUILDINGS, ERECT THE FENCE NO CLOSER THAN SIX FEET (6'-0") TO BUILDING.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

TREE PROTECTION
CHAIN LINK FENCE/ORANGE SAFETY FENCE

CONSTRUCTION STANDARDS AND DETAILS



NOTES:

1. TREE PROTECTION SHALL BE PROVIDED FOR TREES DESIGNATED AS HERITAGE TREES BY THE CITY AND/OR AS DESIGNATED IN THE PLANS.
2. WHERE ANY EXCEPTIONS RESULT IN A FENCE BEING CLOSER THAN FOUR FEET (4'-0") TO A TREE TRUNK PROTECT THE TRUNK WITH STRAPPED-ON-PLANKING TO A HEIGHT OF EIGHT FEET (8'-0"), OR TO THE LIMITS OF LOWER BRANCHING IN ADDITION TO THE REDUCED FENCING PROVIDED.
3. ANY ROOTS EXPOSED BY CONSTRUCTION ACTIVITY SHALL BE PRUNED FLUSH WITH THE SOIL. BACKFILL ROOT AREAS WITH GOOD QUALITY TOP SOIL AS SOON AS POSSIBLE. IF EXPOSED ROOT AREAS ARE NOT BACKFILLED WITHIN TWO (2) DAYS, COVER THEM WITH ORGANIC MATERIAL IN A MANNER WHICH REDUCES SOIL TEMPERATURE, AND MINIMIZES WATER LOSS DUE TO EVAPORATION.
4. PRIOR EXCAVATION OR GRADE CUTTING WITHIN TREE DRIPLINE. MAKE A CLEAN CUT BETWEEN THE DISTURBED AND UNDISTURBED ROOT ZONES WITH A ROCK SAW OR SIMILAR EQUIPMENT, TO MINIMIZE DAMAGE TO REMAINING ROOTS.
5. TREES MOST HEAVILY IMPACTED BY CONSTRUCTION ACTIVITIES SHOULD BE WATERED DEEPLY ONCE A WEEK DURING PERIODS OF HOT, DRY WEATHER. TREE CROWNS SHOULD BE SPRAYED WITH WATER PERIODICALLY TO REDUCE DUST ACCUMULATION ON THE LEAVES.
6. ANY TRENCHING REQUIRED FOR THE INSTALLATION OF LANDSCAPE IRRIGATION SHALL BE PLACED AS FAR FROM EXISTING TREE TRUNKS AS POSSIBLE.
7. NO LANDSCAPE TOPSOIL DRESSING GREATER THAN FOUR INCHES (4") SHALL BE PERMITTED WITHIN THE DRIPLINE OF A TREE. NO SOIL IS PERMITTED ON THE ROOT FLARE OF ANY TREE.
8. PRUNING TO PROVIDE CLEARANCE FOR STRUCTURES, VEHICULAR TRAFFIC AND EQUIPMENT SHALL TAKE PLACE BEFORE CONSTRUCTION BEGINS.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

TREE PROTECTION
WOOD SLATS

CONSTRUCTION STANDARDS AND DETAILS

SECTION 3 – GENERAL UTILITIES

3.01 General

The purpose of this section is to define the general requirements for the design and construction of utility infrastructure. The City Engineer shall review all dry utilities on construction plans.

3.02 Dig Once Policy

Reserved.

3.03 Materials Requirements

A. Domestic Products
All iron, steel and manufactured components/materials used in any infrastructure project within the City of Belton or the City of Belton ETJ shall be manufactured in the United States of America. Proof of the manufacturer location shall be provided to the City Engineer prior to installation of components/materials. The City Engineer may waive this requirement when in the best interest of the City of Belton.

B. Concrete and Reinforcement Items
All concrete shall have a minimum 28-day compressive strength of 3,000 psi unless otherwise noted on the plans, specifications or other written document. Water shall not be added to the concrete after inspection and testing. Placed concrete shall be vibrated when necessary depending on slump, space available for concrete placement and depth of placement. The slump of concrete shall be placed at slumps per the Texas Department of Transportation Specifications for the Construction of Highways, Streets and Bridges under Item 420 with respect to the type of concrete structure being constructed.

Steel reinforcement shall be billeted conforming to ASTM specifications A615 Grade 60 or the latest revision to the ASTM A615 specification. All rebar shall be 2" from inside of form. Reinforcement shall be adequately supported, spaced and secured before placing the concrete. The reinforcement support system (metal support chairs) shall be as manufactured by Dayton Superior, models CHCP or CHCV, or equivalent and as noted in the details of the Transportation Section. The height of the metal support chairs shall generally be no more than one-half of the concrete thickness. The height of the metal support chairs shall be reviewed and approved by the City Engineer. Reinforcing steel shall be placed in accordance with ACI Standards with overlaps of 40 bar diameters. Rebar chairs shall be placed on 48-inch maximum spacing each way.

C. Hatches
All hatches shall be manufactured by Halliday Products and shall be series H1R (single leaf) or H2R (double leaf). All hatches shall be heavy duty, H-20 rated. All hatch openings shall be a minimum of 36"x36", or as required by the City Engineer. Double leaf hatches (series H2R) shall be used for openings larger than 42"x42". All hatches shall have a 1/4 inch (7mm) thick, aluminum diamond plate, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. The inside of the frame shall have a door-support ledge on two (2) sides. Both frame and ledge must be supported by a full bed of

Class A concrete. Doors shall open to 90 degrees and automatically lock in an open position with a T-316 stainless steel hold open arms with release handles. Doors shall also incorporate enclosed stainless steel compression spring assists. Doors shall close flush with the frame. Hinges and all fastening hardware shall be T-316 stainless steel. Unit shall lock with a T-316 stainless steel slam lock with removable keys and have a non-corrosive handle. The Halliday hatches shall be installed per the manufacturer's recommendations.

D. Installation of Pipe
Pipe shall be installed with the lettering/label facing up for maintenance purposes.

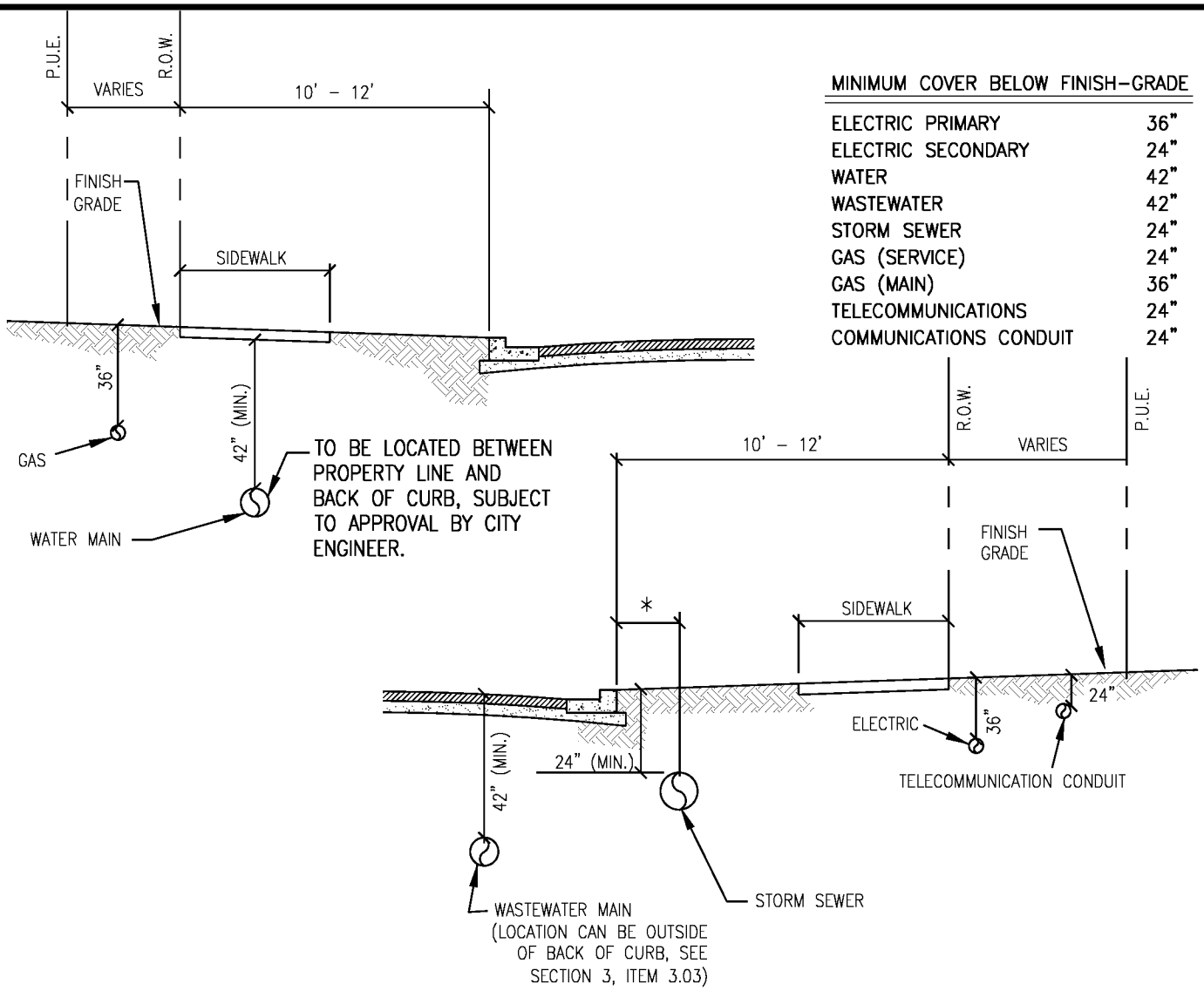
E. Location of Wastewater Mains and Manholes
Wastewater mains and manholes are allowed to be located outside of the back of curb, in the public right-of-way, if no storm sewer pipe or drainage channels exist or are proposed or likely to be installed in the future. The location of wastewater mains outside of the pavement must be approved by the City Engineer.

3.04 ROW Permitting

A. For any non-City utilities proposing to be placed in public rights-of-way, the City of Belton requires a Right-of-Way Permit to be filled out and submitted to the City of Belton Director of Public Works.

3.05 Utility Clearances

A. The minimum clearance between utilities and other infrastructure shall be dictated by the following:
   a. Minimum TCEQ required clearances, and
   b. At least 12 inches for waterlines and sewer lines in any direction, measured outside of pipe to outside of pipe or outside of wall. If the 12-inch clearance cannot be obtained, the pipeline shall be encased. The encasement shall follow the detail herein. However, if the encasement is not crossing under a roadway, the encasement is allowed to be C900 PVC. The encasement shall extend 12 inches past the pipe or structure that is to be avoided.



MINIMUM COVER BELOW FINISH-GRADE	
ELECTRIC PRIMARY	36"
ELECTRIC SECONDARY	24"
WATER	42"
WASTEWATER	42"
STORM SEWER	24"
GAS (SERVICE)	24"
GAS (MAIN)	36"
TELECOMMUNICATIONS	24"
COMMUNICATIONS CONDUIT	24"

GENERAL NOTES:

1. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION AND ELEVATION OF ALL UTILITIES BEFORE ANY EXCAVATION BEGINS. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ANY DAMAGE TO UTILITIES.
2. THE CONTRACTOR SHALL CONTACT ALL LOCAL UTILITIES AND TEXAS 811 BEFORE COMMENCING ANY EXCAVATION OR DIGGING OPERATIONS.
3. BRACE UTILITY POLES AS REQUIRED TO MAINTAIN STABILITY OF THE POLES DURING CONSTRUCTION.
4. ALL INFRASTRUCTURE SHALL MEET TCEQ MINIMUM SEPARATION REQUIREMENTS.
5. WHEN USING JOINT TRENCH FOR ELECTRIC AND TELECOMMUNICATIONS, GAS MAIN SHALL BE LOCATED ON THE OPPOSITE SIDE OF THE STREET FROM THE JOINT TRENCH.
6. UTILITY ASSIGMENTS ARE TYPICAL AND VARIANCES ALLOWED AS APPROVED BY THE CITY ENGINEER.
7. GAS/ELECTRIC/CABLE/TELECOMMUNICATIONS SHALL BE LOCATED IN P.U.E.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

TYPICAL UTILITY ASSIGNMENT FOR SIDEWALK AT PROPERTY LINE

CONSTRUCTION STANDARDS AND DETAILS

G-01
SCALE: N.T.S.
ISSUE DATE: 5-28-19

NOTES:

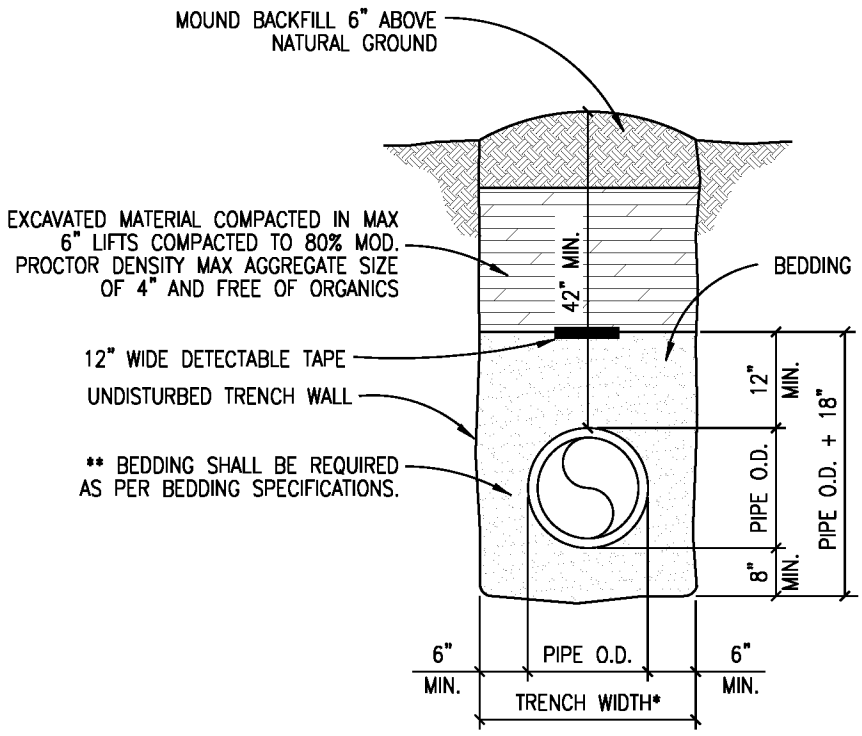
1. SEWER EMBEDMENT SHALL BE 1" CRUSHED WASHED LIMESTONE UNLESS OTHERWISE NOTED.
2. ALL AGGREGATES SHALL BE CLEAN AND DURABLE PARTICLES OF NATURAL MATERIAL.
3. PIPE EMBEDMENT FOR WATER LINES SHALL BE MANUFACTURED SAND, WASHED AND FREE OF DEBRIS.
4. BEDDING MATERIAL SHALL BE PLACED AND CONSOLIDATED TO ELIMINATE VOIDS.
5. MANUFACTURERS RECOMMENDATIONS FOR BEDDING MATERIALS SHALL BE CONSIDERED WHERE STRUCTURAL INTEGRITY IS REQUIRED.
6. THE EXISTING PAVING SHALL BE SAW CUT IN A STRAIGHT LINE A MINIMUM OF 12" WIDER THAN THE UNDISTURBED SIDES OF THE TRENCH, SYMMETRICAL ABOUT THE CENTERLINE OF THE EXCAVATION, PRIOR TO TRENCHING.
7. IF EXCAVATION AREA IS OPEN FOR TEMPORARY PUBLIC USE, THE SURFACE SHALL BE MAINTAINED LEVEL WITH ADJACENT RIDING SURFACE WITH COLD MIX OR TEMPORARY HOT MIX ASPHALT.
8. ALL DAMAGED AREAS OF PAVEMENT RESULTING FROM CONTRACTOR'S OPERATIONS OUTSIDE THE TRENCH CUT SHALL BE REMOVED AND REPLACED WITH MINIMUM OF 8" OF ROAD BASE OR MATCH EXISTING THICKNESS, WHICHEVER IS GREATER. SURFACE PAVEMENT SHALL BE OF THE SAME KIND AND THICKNESS AS EXISTING.
9. TRENCH WIDTHS SHOWN ARE MINIMUM FOR PROPER PLACEMENT AND COMPACTION OF EMBEDMENT
10. THE MINIMUM CLEAR WIDTH OF TRENCH (SHEETED OR UNSHEETED) MEASURED AT SPRINGLINE OF PIPE SHALL BE 12" GREATER THAN THE OUTSIDE DIAMETER OF THE PIPE.
11. WHERE PIPE INSTALLATION IS IN ROCK (OR OTHER INCOMPRESSIBLE FOUNDATION), THE CONTRACTOR SHALL EXCAVATE SO AS TO PROVIDE A MINIMUM OF 8" BEDDING BENEATH THE PIPE.
12. INSTALLATION OF ANY PIPE WITHIN 4' OF THE BACK OF CURB OR EDGE OF STREET, SHALL REQUIRE THE SAME BACKFILL AS STATED IN G-03 BUT WITH 95% COMPACTION. HOWEVER, PIPE INSTALLED WITHIN 2 FEET OF BACK OF CURB SHALL REQUIRE THE SAME BACKFILL AS FOR INSTALLATION IN STREETS.
13. CONTRACTOR SHALL SHAPE EMBEDMENT MATERIAL TO ACCOMODATE THE BELLED JOINTS OF PIPES TO INSURE SUPPORT THROUGHOUT THEIR LENGTH. BELLED JOINTS SHALL HAVE A MINIMUM OF 4 INCHES OF FILL BENEATH THEM.
14. IF EXCAVATED MATERIAL IS NOT ACCEPTABLE TO THE ENGINEER FOR BACKFILL, CONTRACTOR WILL PROVIDE SELECT IMPORT MATERIAL AS REQUIRED.
15. FOR ROCK AND OTHER CONDITIONS NOT SPECIFIED HERE, REFER TO ENGINEER FOR BACKFILL DESIGN.
16. GREEN TAPE TO BE USED FOR WASTEWATER GRAVITY AND FORCE MAINS, BLUE TAPE TO BE USED FOR WATER MAINS. TAPE SHALL BE 12-INCHES WIDE, FULL BACK TYPE.
17. CRUSHER FINES ARE NOT ALLOWED FOR BEDDING.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

EMBEDMENT AND BACKFILL NOTES

CONSTRUCTION STANDARDS AND DETAILS

G-02
SCALE: N.T.S.
ISSUE DATE: 5-28-19



*TRENCH WIDTHS

PIPE LESS THAN 20" DIAMETER
1'-0" + PIPE O.D.

20" DIAMETER PIPE AND LARGER
2'-0" + PIPE O.D.

BEDDING MATERIAL SPECIFICATIONS:

1. PIPE EMBEDMENT FOR SEWER LINES SHALL BE CLEAN AND DURABLE PARTICLES OF NATURAL OR MANUFACTURED MATERIAL, AND SHALL BE 1- INCH CRUSHED STONE, PER GRADATION SHOWN OR ASTM C 33 TYPE 57 STONE.
2. PIPE EMBEDMENT FOR WATER LINES SHALL BE MANUFACTURED SAND, WASHED AND FREE OF DEBRIS.
3. BEDDING MATERIAL SHALL BE PLACED AND CONSOLIDATED TO ELIMINATE VOIDS.
4. MANUFACTURERS RECOMMENDATIONS FOR BEDDING MATERIALS SHALL BE CONSIDERED WHERE STRUCTURAL INTEGRITY IS REQUIRED.

BEDDING SPECIFICATIONS OPTIONS

	PERCENT PASSING	
SIEVE	GRADE 1	GRADE 2
2"	100	100
1-1/2"	95-100	95-100
3/4"	35-70	60-90
3/8"	10-30	25-60
NO. 4	0-5	0-5

L.A. ABRASION
(ASTM C-131, GRADING "B")
PERCENT LOSS: 50 MAX.

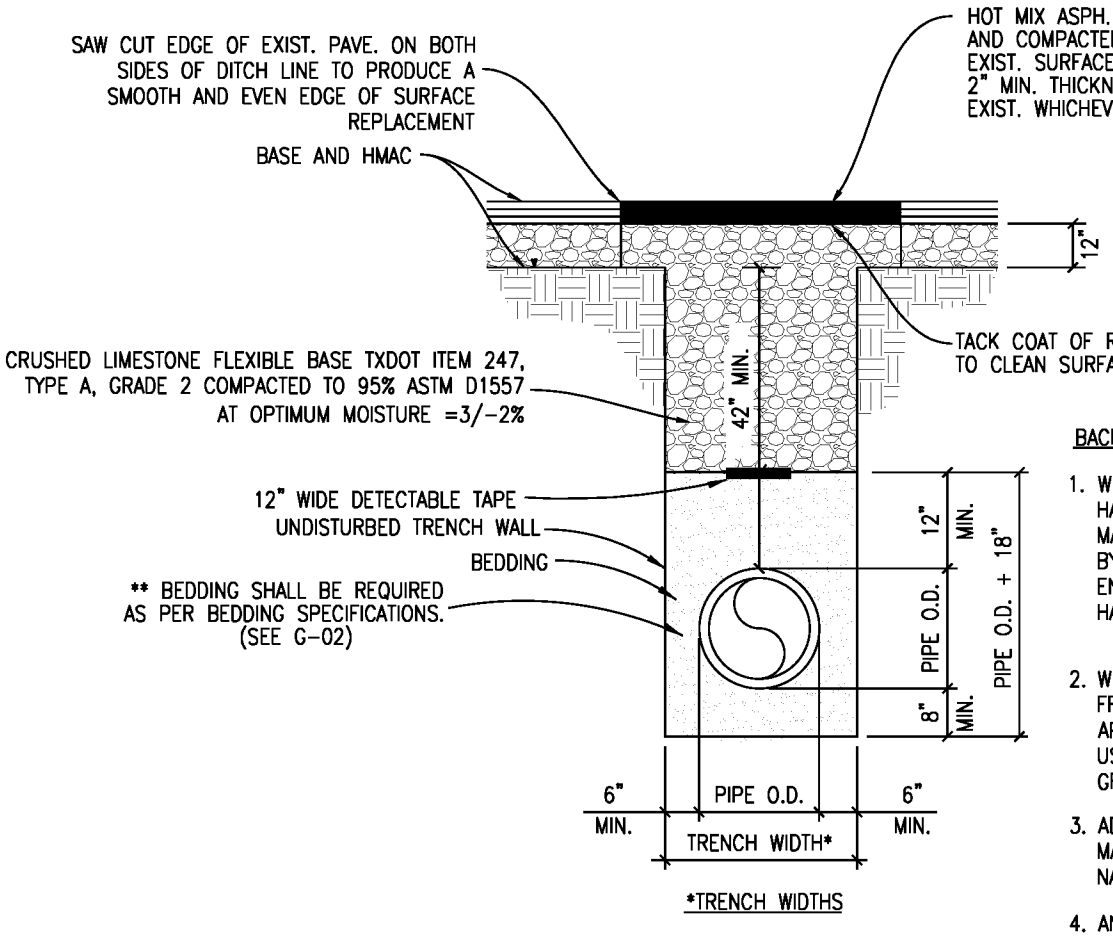
(CONCRETE AGGREGATE)
GRADATION
(ASTM C33-SIZE 56)

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

EMBEDMENT AND BACKFILL OUTSIDE PAVED AREAS

CONSTRUCTION STANDARDS AND DETAILS

G-03
SCALE: N.T.S.
ISSUE DATE: 5-28-19



*TRENCH WIDTHS

BACKFILL MATERIAL SPECIFICATIONS:

1. WHEN NATIVE, EXISTING SOILS HAVE A PI>20, BACKFILL MATERIAL SHALL BE SPECIFIED BY THE GEOTECHNICAL ENGINEER. BACKFILL SHALL HAVE A PI BETWEEN 9 AND 15.
2. WHEN GROUNDWATER EXISTS, FRENCH DRAINS OR OTHER APPROVED METHODS SHALL BE USED TO ALLEVIATE GROUNDWATER PRESSURE.
3. ADDITIONAL ROAD BASE MATERIAL MAY BE REQUIRED WITH HIGH PI NATIVE SOIL.
4. ANY DEVIATIONS FROM TxDOT ITEM 247, TYPE A, GRADE 2 REQUIRES APPROVAL FROM CITY ENGINEER.

PIPE LESS THAN 20" DIAMETER
1'-0" + PIPE O.D.

20" DIAMETER PIPE AND LARGER
2'-0" + PIPE O.D.

BEDDING MATERIAL SPECIFICATIONS:

1. PIPE EMBEDMENT FOR SEWER LINES SHALL BE CLEAN AND DURABLE PARTICLES OF NATURAL OR MANUFACTURED MATERIAL, AND SHALL BE 1-INCH CRUSHED STONE, PER GRADATION SHOWN OR ASTM C 33 TYPE 57 STONE.
2. PIPE EMBEDMENT FOR WATER LINES SHALL BE MANUFACTURED SAND, WASHED AND FREE OF DEBRIS.
3. BEDDING MATERIAL SHALL BE PLACED AND CONSOLIDATED TO ELIMINATE VOIDS.
4. MANUFACTURERS RECOMMENDATIONS FOR BEDDING MATERIALS SHALL BE CONSIDERED WHERE STRUCTURAL INTEGRITY IS REQUIRED.

BEDDING SPECIFICATIONS OPTIONS

	PERCENT PASSING	
SIEVE	GRADE 1	GRADE 2
2"	100	100
1-1/2"	95-100	95-100
3/4"	35-70	60-90
3/8"	10-30	25-60
NO. 4	0-5	0-5

L.A. ABRASION
(ASTM C-131, GRADING "B")
PERCENT LOSS: 50 MAX.

(CONCRETE AGGREGATE)
GRADATION
(ASTM C33-SIZE 56)

NOTE:

1. ALTERNATE EMBEDMENT FOR UTILITIES LOCATED IN FUTURE ROADWAY ARE SUBJECT TO APPROVAL BY CITY ENGINEER.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

EMBEDMENT AND BACKFILL EXISTING OR FUTURE ROADWAY/PAVEMENT

CONSTRUCTION STANDARDS AND DETAILS

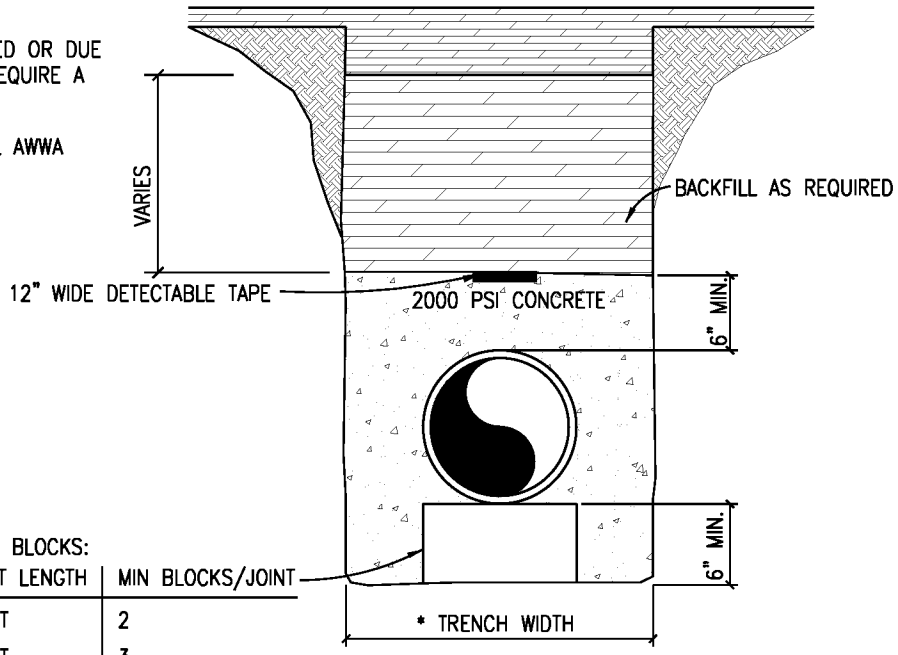
G-04
SCALE: N.T.S.
ISSUE DATE: 5-28-19

NOTE:

1. WHERE 42" MINIMUM COVER CAN NOT BE OBTAINED OR DUE TO POTENTIAL SURFACE LOADING THE CITY MAY REQUIRE A CAP TO BE INSTALLED.
2. PIPES AND FITTINGS SHALL BE WRAPPED IN 8 MIL AWWA STAMPED POLY, WHERE CONCRETE IS PLACED.

*TRENCH WIDTH

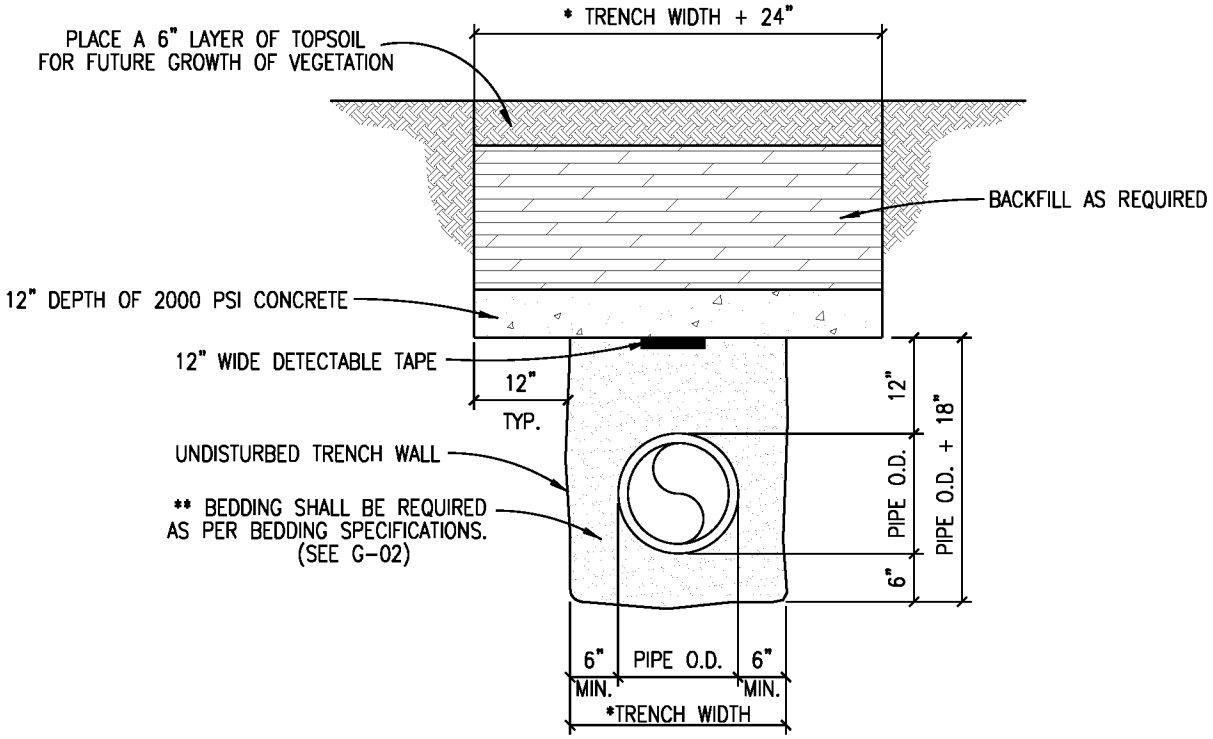
PIPE LESS THAN 20" DIAMETER
1'-0" + PIPE O.D.
20" DIAMETER AND LARGER
2'-0" + PIPE O.D.



CONCRETE BLOCKS:

PIPE JOINT LENGTH	MIN BLOCKS/JOINT
≤ 14 FEET	2
> 14 FEET	3

CONCRETE ENCASEMENT



CONCRETE CAP

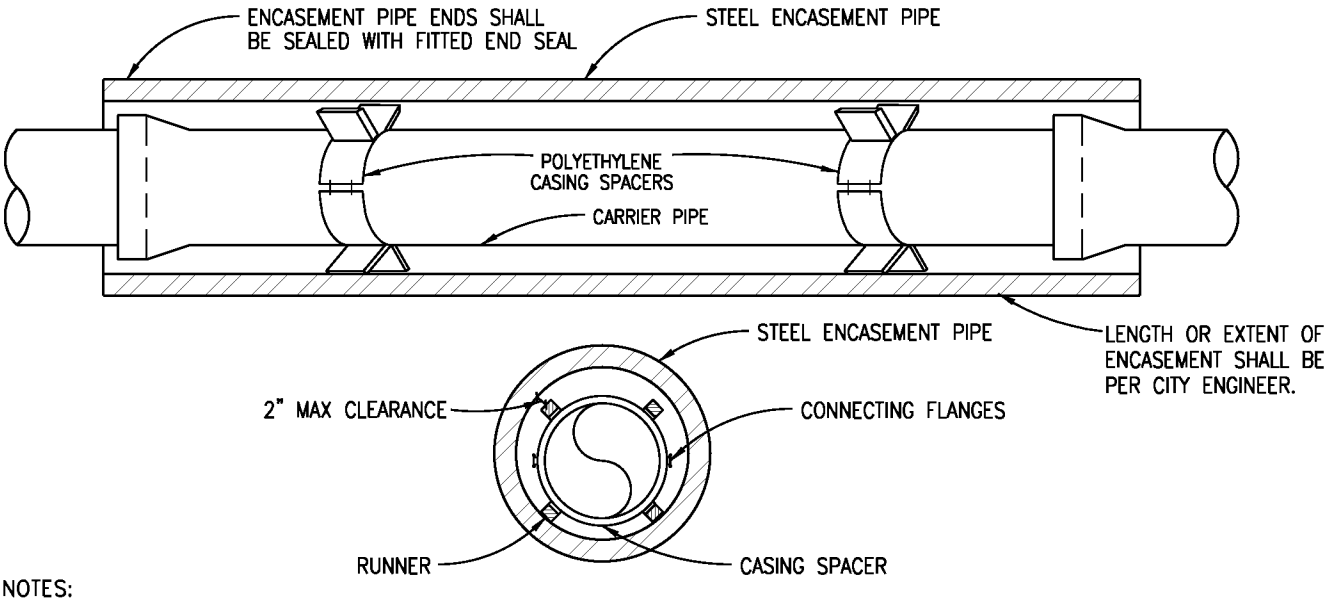
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

CONCRETE CAP AND ENCASEMENT

CONSTRUCTION STANDARDS AND DETAILS

G-05
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. CASING SPACERS SHALL BE POLYETHYLENE CASING SPACERS AS MANUFACTURED BY RACI OR APPROVED EQUAL. CONNECTING FLANGES SHALL BE RIBBED FOR EXTRA STRENGTH.
2. ENDS OF THE ENCASEMENT PIPE WILL BE SEALED WITH FITTED END SEAL. END SEALS SHALL BE 1/8" THICK NEOPRENE RUBBER. ADVANCE PRODUCTS AND SYSTEMS, INC. MODEL AWN OR EQUAL.
3. CARRIER PIPE WITHIN STEEL ENCASEMENT PIPE SHALL BE RESTRAINED WITH BELL JOINT RESTRAINTS. GASKET LOCKS ARE AN ACCEPTABLE MEANS OF RESTRAINT FOR PIPELINES WITHIN STEEL ENCASEMENT PIPE.
4. DO NOT USE WEDGES BETWEEN TOP OF CARRIER PIPE AND INSIDE OF CASING TO KEEP CARRIER PIPE FROM MOVING.
5. PRIOR TO INSERTING CARRIER PIPE, ANY WATER SHOULD BE PUMPED OUT OF THE CASING PIPE SO THAT NO WATER REMAINS.
6. SPACERS WILL BE REQUIRED WITHIN AT LEAST 3 FEET FROM BOTH OPENINGS OF THE ENCASE-MENT PIPE AND SPACED NO GREATER THAN 5 FEET THROUGHOUT THE ENCASEMENT PIPE.
7. CASING SPACERS WILL NOT BE PAID DIRECTLY BUT SHALL BE CONSIDERED SUBSIDIARY TO THE APPROPRIATE BID ITEM FOR INSTALLING PIPE.
8. ENCASEMENT PIPE SHALL BE SMOOTH STEEL 35,000 PSI YIELD STRENGTH WITH 1/4" MIN. WALL THICKNESS; 3/8" MIN. WALL THICKNESS WHEN CROSSING TxDOT ROADWAY; 1/2" MIN. WALL THICKNESS WHEN CROSSING RAILROAD.
9. SPIRAL WELD ENCASEMENT PIPE SHALL NOT BE USED.
10. MINIMUM COVER FOR CASING SHALL BE 42".
11. ALL COMPONENTS SHALL BE USA DOMESTIC.

PIPE SIZE-CARRIER (DIAMETER)	PIPE SIZE-CASING (MINIMUM DIAMETER)	CASING (MINIMUM THICKNESS)
4"	10"	1/4"
6"	12"	1/4"
8"	16"	1/4"
10"	18"	1/4"
12"- 14"	24"	3/8"
16" - 18"	30"	1/2"
20" - 24"	36"	1/2"
30"	42"	1/2"

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

INSTALLATION OF PIPE THROUGH CASING

CONSTRUCTION STANDARDS AND DETAILS

G-06
SCALE: N.T.S.
ISSUE DATE: 5-28-19

Specifications

1. Font: Helvetica
2. Letter Height: 3 inches
3. Material: Aluminum, 0.080 gauge
4. Reflectivity: Engineer-Grade
5. Sign shall be affixed to security fence using stainless steel hardware and shall meet TCEQ Chapter 217 requirements.
6. Fencing shall be per the Design Guidelines and in adherence with TCEQ Chapter 217 requirements.

SIGN SHALL BE AFFIXED TO SECURITY FENCE AND VISIBLE TO THE PUBLIC IN ACCORDANCE WITH TCEQ REQUIREMENTS WITH STAINLESS STEEL HARDWARE.

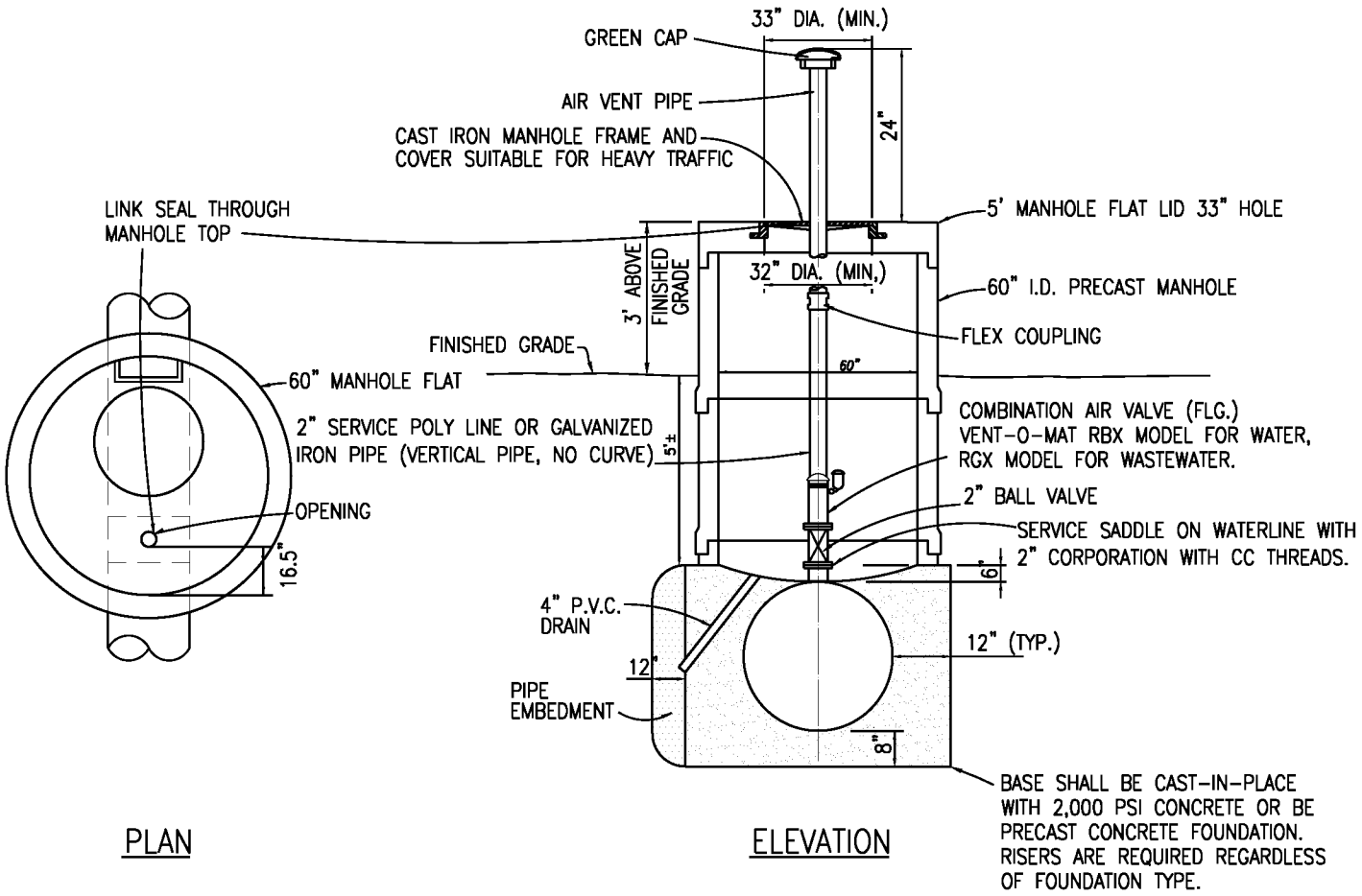
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

LIFT STATION/PUMP STATION SIGNAGE

CONSTRUCTION STANDARDS AND DETAILS

G-07
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. MANHOLES SHALL BE CAST IN PLACE OR PRECAST. ALL MANHOLES SHALL BE WATER TIGHT. PRECAST MANHOLES SHALL HAVE JOINTS SEALED WITH ALL RING.
2. ALL PIPE OPENINGS IN MANHOLES SHALL INCLUDE COUPLINGS WITH "O" RING RUBBER GASKETS.
3. SEAL PENETRATION IN MANHOLE FOR PIPING UTILIZING RAM NECK, SYNCHOFLEX AND NON-SHRINK GROUT.
4. PLACE 2000 P.S.I. GROUT AROUND VALVE OPENING ABOVE MANHOLE. EXTEND GROUT A MINIMUM OF 6 INCHES ALL AROUND.
5. VALVE BOX SHALL BE CUT OFF AT INSIDE FACE OF PRECAST MANHOLE.
6. AIR AND VACUUM RELEASE VALVE SHALL BE INSTALLED AS REQUIRED AND PER THE CITY ENGINEER.
7. ALL COMPONENTS SHALL BE USA DOMESTIC.
8. WHEN SIDEWALK IS EXISTING OR PLANNED, OFFSET THE WATERLINE FROM UNDER THE SIDEWALK TO PLACE THE ARV OUTSIDE OF THE EDGE OF SIDEWALK OR ANY REQUIRED CLEAR ZONE. LOCATION OF THE ARV SHALL BE APPROVED BY THE CITY.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

AIR AND VACUUM RELEASE VALVE

CONSTRUCTION STANDARDS AND DETAILS

G-08
SCALE: N.T.S.
ISSUE DATE: 5-28-19

SECTION 4 - WATER

4.01 General

The requirements of this section apply to Belton's Water CCN. If water improvements or new infrastructure is proposed within Belton's ETJ or City Limits and within a non-Belton Water CCN, the engineer shall consult with the CCN owner for the water infrastructure requirements. However, all utilities proposed in Belton rights-of-way shall be coordinated with and approved by the City of Belton.

The purpose of this section is to define the general requirements for the design and construction of potable water infrastructure and to provide typical construction details for the improvements. The City of Belton City Engineer should be consulted if variations from these standards are anticipated.

4.02 Master Plan

All potable water infrastructure design must be sized and located according to the land uses projected in the Comprehensive Plan and/or Thoroughfare Plan. Also, the City of Belton periodically updates the Water Master Plan which should be followed and adhered to during the design process.

4.03 Water Improvements

The subdivider shall provide all water lines required to properly serve each lot of the subdivision and to ensure that existing and/or new water facilities can supply the required demand at the desired pressure for both domestic use and for fire protection. The subdivider shall bear all costs for extending water service from existing City water lines that have sufficient capacity to serve the subdivision. All water lines and service connections shall conform to this Manual, requirements of the Texas Commission on Environmental Quality, and the fire insurance standards of the State Board of Insurance.

A. Design Standards

1. Piping for water mains and connections shall be in accordance with this Manual and Texas Commission on Environmental Quality Regulations (Texas Administrative Code Title 30, Part 1, Chapter 290). All pipe and fittings shall be new and shall conform to the current standards of the American Water Works Association.

2. Water connections shall be made readily available to proposed park sites with water lines located along the street frontage of the park. The subdivider must demonstrate that there is sufficient water line capacity available to serve the park.

3. All water mains shall extend to the border of the proposed subdivision property lines. A valve, plug, automatic flush assembly, restraints, and concrete block shall be provided on the end of each said main such that an extension of the main can be made

without removing said main from service. All service lines shall be extended to lot lines.

4. Refer to the Belton Code of Ordinances Section 23-36 for minimum waterline pipe sizes. Water lines shall be designed to serve the anticipated and future development including fire demand, unless otherwise approved by the City Engineer. Minimum waterline size shall be eight (8) inches in diameter in order to meet the latest adopted International Fire Code minimum fire flows, unless a Texas registered Professional Engineer demonstrates otherwise using an approved and acceptable modeling software. The modeling software shall be provided to the City in electronic form to verify the parameters used to run the model. The model shall be based on realistic existing system conditions and be able to sustain the required residual pressure during fire flow conditions in addition to the required domestic flow per connection. Regardless, in no case shall waterlines be less than six (6) inches diameter.

5. The subdivider may be required to upsize proposed water lines and water utility facilities as directed by the City Engineer, with the City cost participating in the said upsizing.

6. At the intersection of water distribution lines, the number of valves shall be one less than the number of radiating lines [two (2) valves for tee connections and three (3) for cross connections]. Valves shall be located at street intersections, the Point of Curve (PC), or the Point of Tangency (PT) of the nearest property line. Also, valves shall be provided on all water mains so that not more than 1,000-feet of main must be removed from service at one time for repairs. All valves shall conform to the current standards of the American Water Works Association. Valve locations shall be marked in accordance with the Curb Stamp Standard Detail in the Transportation Section.

7. All water pipe shall have minimum cover of 42 inches, unless otherwise approved by the City Engineer.

8. All water lines shall be installed to as to avoid high points, which will encourage air entrapment. Water lines shall follow the contour of the topography with regard to the minimum pipe depths, but if any line is designed to a flat or 0% grade, the pipe shall be installed with a minor slope in one direction to avoid a potential area of air entrapment.

9. Each subdivision or phase of a subdivision shall install a sampling station as required by the City Engineer. Where a subdivision or phase of a subdivision has in excess of 100 lots, an additional sampling station will be required per 100 lots, and the location of such to be determined by the City Engineer. The location of the sampling station shall be at the recommendation of the City Engineer. The sampling station shall be provided and paid for by the Developer. Sampling stations shall be manufactured by Kordeen, Model 0001-3, furnished and installed by the Developer and shall be in accordance with the latest regulations of the TCEQ and the City of Belton.

10. Separation distances between water and wastewater infrastructure shall be in accordance with TCEQ Regulations (Chapters 217 and 290). Where encasement is required, steel casing shall be in accordance with the detail included in the General Utilities section.

11. Where dead-end water lines are unavoidable, automatic flush assemblies are required. The engineer shall consider drainage of the automatic flush assembly when specifying the placement of such assemblies.

B. Materials and Sizing

1. All materials used in water improvement projects shall be North American domestic and comply with the American Water Works Association (AWWA). The following are general requirements for water mains as to materials and types.

2. All water mains shall have cast or ductile iron outside diameters and conform to the following material specifications:

   a) 2" pipe or smaller shall be PVC DR-21, Ductile Iron 250 psi, or HDPE DR7, with ring-tite seal. 3" pipe is not allowed.

   b) Pipe 4" to 12" shall be PVC, AWWA C900 DR-18 with ring-tite seal.

   c) Pipe Larger than 12" shall be either PVC, AWWA C905 DR-18 or ductile iron pressure class 150 or better as required to meet system conditions. Ductile iron pipe must:
      i. Meet or exceed AWWA specifications C150/A21.5 & C151/A21.51;
      ii. Contain bell & spigot joints with a single rubber gasket, meeting or exceeding AWWA specifications CIII/A21.11;
      iii. Meet or exceed thickness AWWA C150/A21.50 and C151/A21.51;
      iv. Fittings shall be in accordance with C110 & C153; and
      v. All buried ductile iron pipe and fittings shall be wrapped with 8 mil, Type I, Grade E-1, AWWA stamped-polyethylene film according to AWWA C105/A21.50.

3. Potable water lines shall be blue in color. Re-use/reclaimed water lines shall be purple in color in accordance with TCEQ Chapter 210.

4. Tapping sleeve & valve:
   Tapping sleeve to meet AWWA specifications with a minimum working pressure of 150 PSI. Tapping valves shall meet AWWA specifications with a minimum working pressure of 175 PSI.

5. Bends & Fittings:
   All bends and fittings shall be equipped with a mechanical joint restraint system, such as megalug or preapproved equal, in the flange/gland. All bends and fittings will be cast iron mechanical joint 2" or larger (C.I.M.J.) meeting the specifications of ANSI/AWWA C-110-77.

6. Pressure Reducing Valves (PRV), if necessary, shall be Cla-Val or approved equivalent. PRV Assemblies shall include a bypass with isolation valves. The bypass shall be located within the PRV box or PRV vault. PRV(s) sizing shall consider flow rate(s) for both initial and ultimate conditions.

7. All water services shall be Endopure tubing unless otherwise approved by the City Engineer.

8. Backflow Prevention shall be in accordance with TCEQ Section 290.44 and the City's current Cross Connection Control and Backflow Prevention Ordinance, whichever is more stringent. Backflow devices shall be installed, certified and tested by a licensed backflow inspector.

9. Irrigation lines shall be installed perpendicular to ROW when irrigation is present in the ROW.

4.04 Testing and Disinfection of Water Mains

A. Testing of installed improvements shall meet all TCEQ and AWWA C651 specifications and regulations for Disinfecting Water Mains. Samples shall be sent to a City-approved laboratory, and a copy of the results shall be sent to the City Engineer.

All water lines shall be complete in place including all bends, blocking, fittings, restraints, services, and appurtenances before pressure testing. New water line shall not be placed into service until pressure testing and bacteriological testing has been completed.

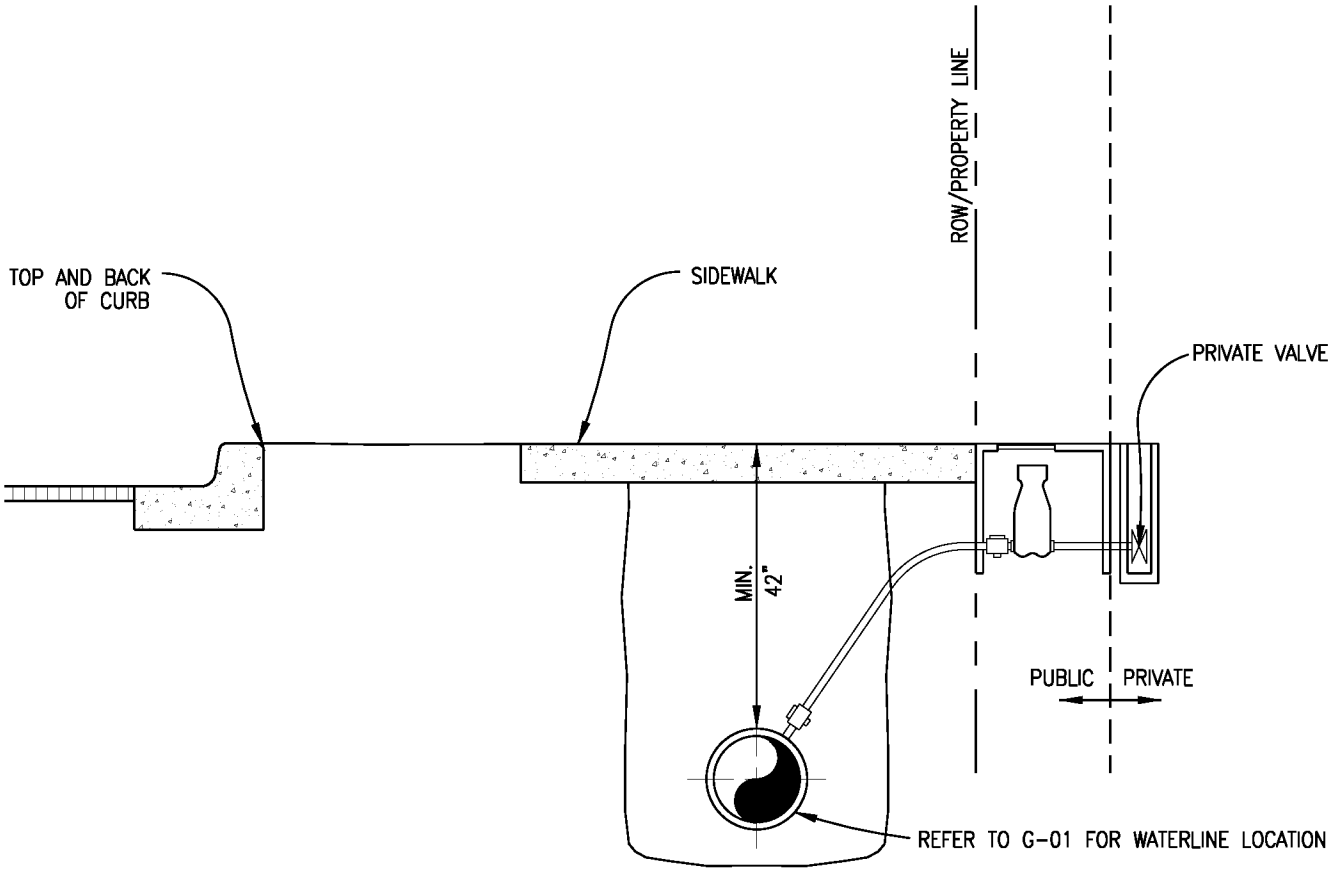
Pressure test will be completed in a manner that is against all new valves in order to check for leaking valves. All original reports shall be provided to the City Engineer.

All new fire hydrants shall be flow tested by the contractor at the contractor's expense. Hydrants are to be tested for the minimum flow and residual pressure as required in the latest adopted International Fire Code. The flow test must be done under the inspection of the Belton Fire Marshal prior to City acceptance of the water infrastructure. The contractor must call for the inspection by the Fire Marshal via the City's Construction Inspector.

The testing and any repairs are required prior to City acceptance of the water infrastructure.

4.05 Construction Drawings

Construction drawings for water line installation shall contain both plan and profile view labeled with top of pipe elevations (based on mean sea level elevations) at horizontal and vertical PIs. Show horizontal dimensioning to easement and/or property line in the plan view, and vertical dimensioning at critical crossings in profile view.



NOTES:

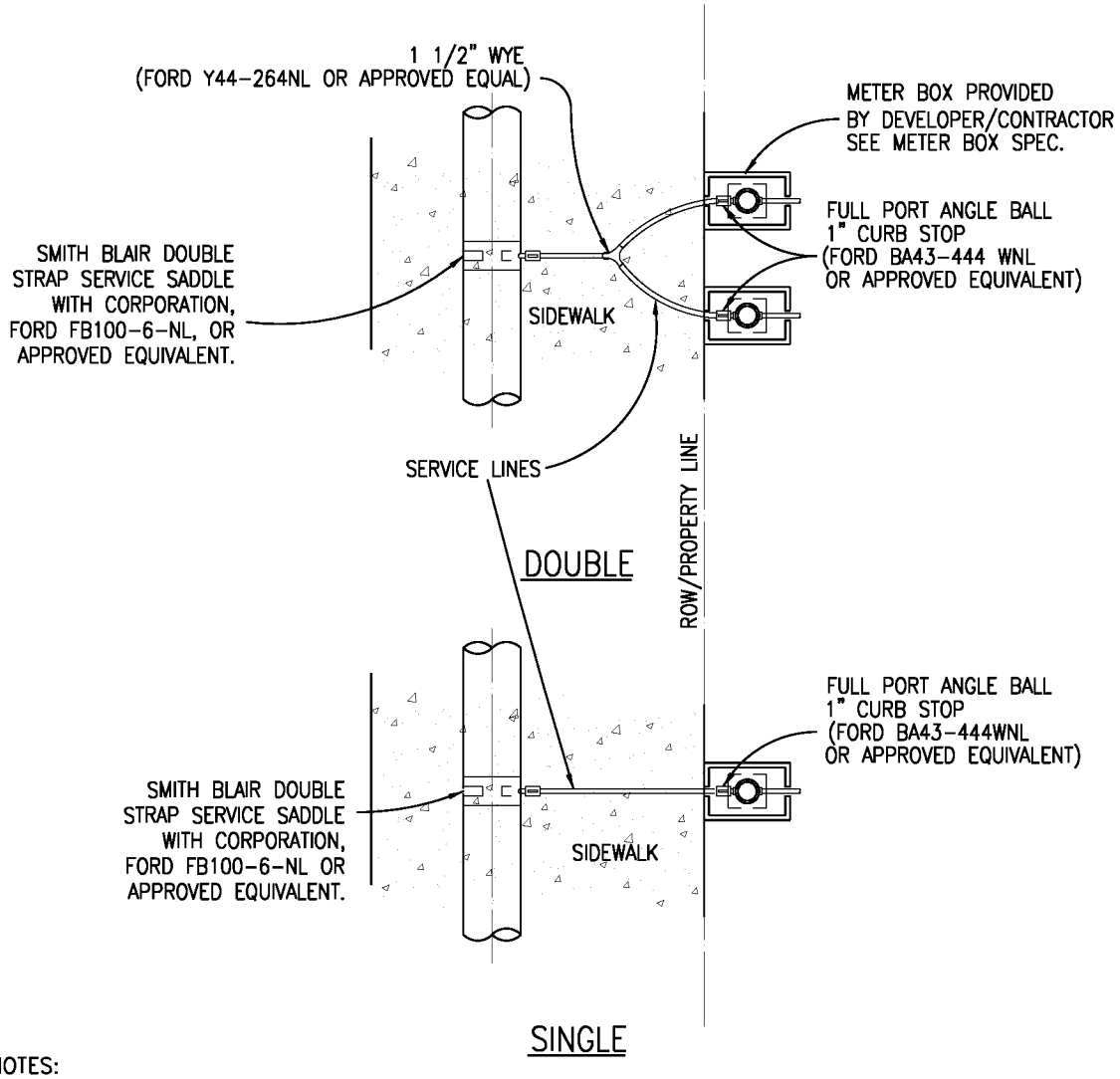
1. SUCCESSIVE TAPS INTO THE WATER MAIN SHALL BE SPACED A MINIMUM OF 5-FEET OFFSET.
2. METER BOXES SHALL BE SET 1-3 INCHES ABOVE FINAL LANDSCAPED GRADE.
3. SERVICE LINE POLY TUBING SHALL BE BLUE ENDOPURE ASTM D2737 SODR-9 (CTS), 250 PSI OR APPROVED EQUIVALENT, AS APPROVED BY THE CITY ENGINEER.
4. SERVICE LINES SHALL BE CONTINUOUS FROM CORPORATION STOP TO ANGLE STOP WITH NO FITTINGS IN BETWEEN.
5. SERVICE CASING SHALL NOT BE INSTALLED BY WATER JETTING UNDER ROADWAY.
6. SERVICE LINES SUPPORTING 2 METERS SHALL BE A MINIMUM OF 1 1/2 INCHES.
7. SERVICE LINES FOR A SINGLE METER SHALL BE A MINIMUM OF 1 INCH.
8. METERS SHALL BE PLACED IN THE STREET R.O.W., UNLESS OTHERWISE APPROVED BY CITY ENGINEER.
9. SERVICE LINES CROSSING STREET SHALL BE BURIED A MINIMUM OF 24" BELOW SUBGRADE
10. ALL BRASS SHALL BE LEAD FREE AND MANUFACTURED BY MUELLER OR FORD.
11. LONG SERVICES SHALL BE CASED IN A WHITE SCHEDULE 40 CONDUIT.
12. APPROVED METER BOXES SHALL BE PROVIDED TO THE CITY OF BELTON DEPARTMENT OF PUBLIC WORKS AT 1502 HOLLAND ROAD. PUBLIC WORKS STAFF WILL INSTALL METER, METER BOX.
13. METER REGISTER SHALL BE NEPTUNE 450i.
14. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

WATER SERVICE ELEVATION

CONSTRUCTION STANDARDS AND DETAILS

W-01
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

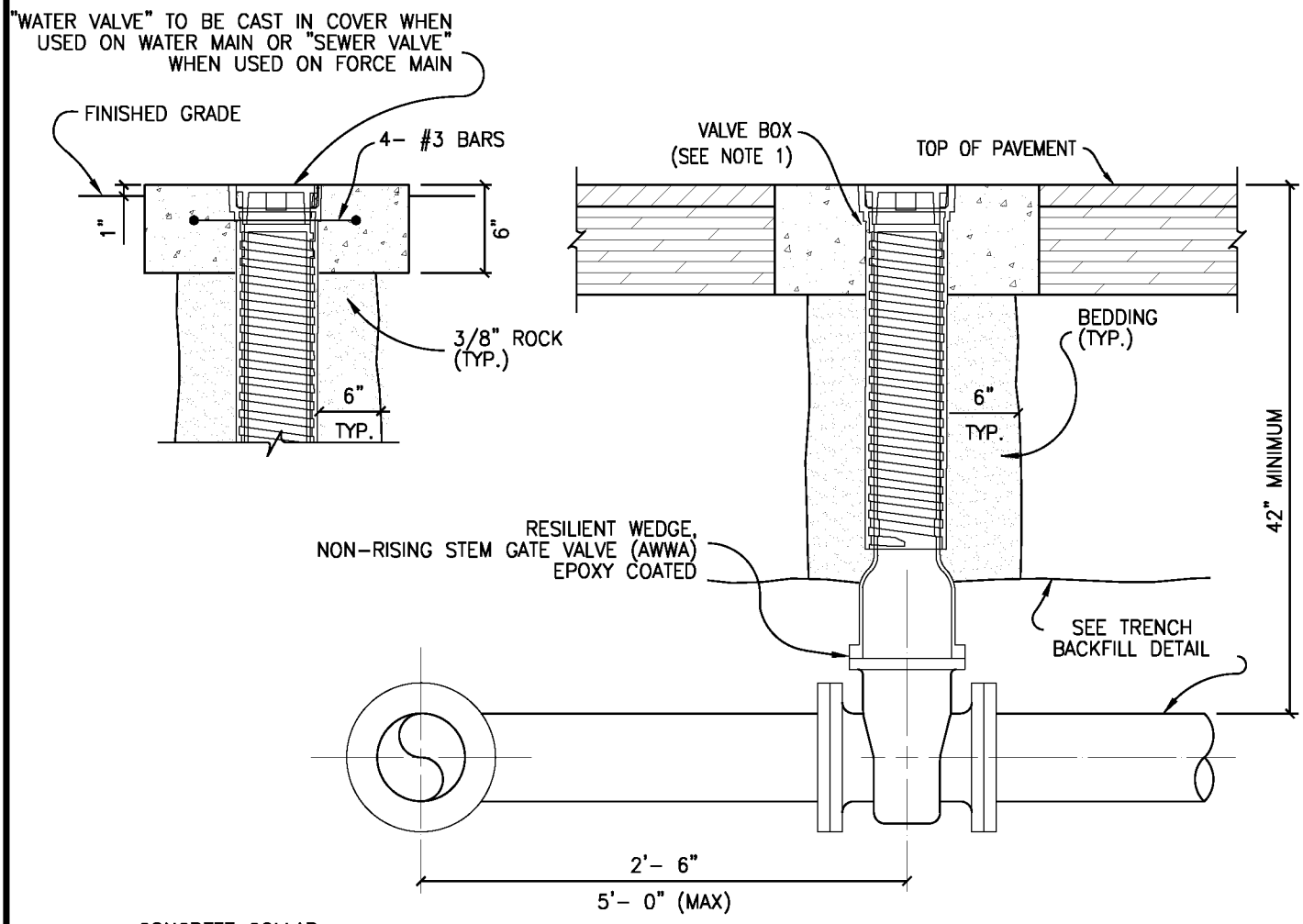
1. SERVICE LINE POLY TUBING SHALL BE BLUE ENDOPURE ASTM D2737 SODR-9 (CTS), 250 PSI OR APPROVED EQUIVALENT, AS APPROVED BY THE CITY ENGINEER.
2. ANGLE STOP SHALL BE 1-INCH MINIMUM FOR SINGLE SERVICE AND 1.5-INCH FOR DOUBLE SERVICE.
3. MULTIPLE SERVICE/METER INSTALLATIONS OF MORE THAN 2 METERS PER SERVICE AND SERVICE LINES SHALL BE A DOUBLE SERVICE.
4. ALL ANGLE STOPS SHALL BE PROVIDED WITH LOCK WING AND METER NUT.
5. ANGLE STOPS SHALL BE INSTALLED 8" BELOW FINISHED GRADE AND MARKED WITH A 2" X 2" X 48" TREATED WOOD STAKE, PAINTED BLUE.
6. THERE SHALL BE A 6" ENVELOPE OF BEDDING AROUND SERVICE PIPE.
7. ANY VARIATIONS ON FITTINGS MUST BE APPROVED BY CITY ENGINEER.
8. COMMON TAPS & METERS SHALL BE NO MORE THAN 2' FROM LOT LINE.
9. SERVICES SHALL BE STAMPED WITH 'W' IN CURB.
10. SERVICE SADDLE SHALL BE INSTALLED AT 45° ANGLE.
11. ALL BRASS FITTINGS SHALL COMPLY WITH "NO LEAD" BRASS LAW (SDWA SECTION 1417(A)).
12. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

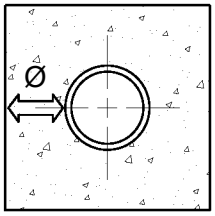
WATER SERVICE PLAN

CONSTRUCTION STANDARDS AND DETAILS

W-02
SCALE: N.T.S.
ISSUE DATE: 5-28-19



CONCRETE COLLAR
6" THICK MINIMUM



Ø – PIPE DIAMETER

⟺ – PIPE DIRECTION

TO BE ETCHED IN CONCRETE.

NOTES:

1. VALVE BOX AND EXTENSION SHALL BE EJ 8550, 6800 SET.
2. EXTENSION REQUIRED WHEN VALVE OPERATING NUT IS GREATER THAN 3' FROM VALVE BOX COVER. UNLESS OTHERWISE NOTED ON PLANS, VALVE BOX EXTENSIONS SHALL BE CONSTRUCTED OF PVC C900 OR D.I.P.
3. ALL FITTINGS SHALL BE WRAPPED IN 8 MIL AWWA STAMPED POLY.
4. VALVE COLLARS LOCATED WITHIN THE ROADWAY SHALL BE 24"x24" SQUARE, OR 24" DIAMETER.
5. WHERE 2 OR MORE VALVES ARE LOCATED ADJACENT TO ONE ANOTHER, ONE LARGER VALVE COLLAR SHALL BE USED.
6. ALL COMPONENTS SHALL BE USA DOMESTIC.

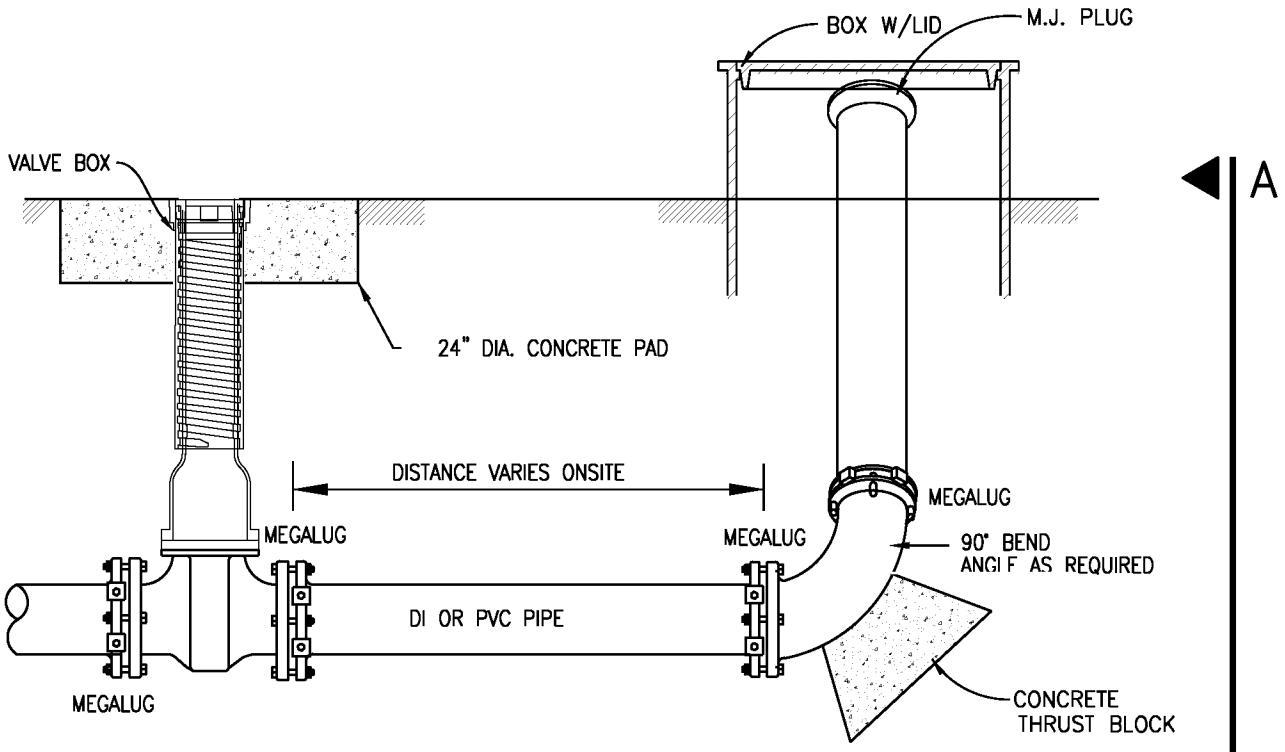
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

VALVE SETTING

CONSTRUCTION STANDARDS AND DETAILS

W-03
SCALE: N.T.S.
ISSUE DATE: 5-28-19



SECTION A–A

NOTES:

1. STANDARD FLUSH ASSEMBLY SHALL ONLY BE USED WHEN AUTO FLUSH ASSEMBLIES ARE NOT APPROPRIATE, AND SHALL BE APPROVED BY THE CITY ENGINEER.
2. VALVES TO BE RESILIENT SEATED GATE VALVE, (AWWA) EPOXY COATED INSIDE AND OUT, WITH A NON-RISING STEM.
3. CONCRETE NOT TO BE IN CONTACT WITH BOLTS OR NUTS.
4. ALL FITTINGS TO BE WRAPPED IN 8 MIL AWWA STAMPED POLY.
5. 90° BEND SHALL BE RESTRAINED.
6. VALVE COLLARS LOCATED WITHIN THE ROADWAY SHALL BE 24"x24" SQUARE OR 24" DIAMETER.
7. FLUSH ASSEMBLIES SHALL BE LOCATED AT ALL ENDS OF WATER LINES.
8. ALL COMPONENTS SHALL BE USA DOMESTIC.

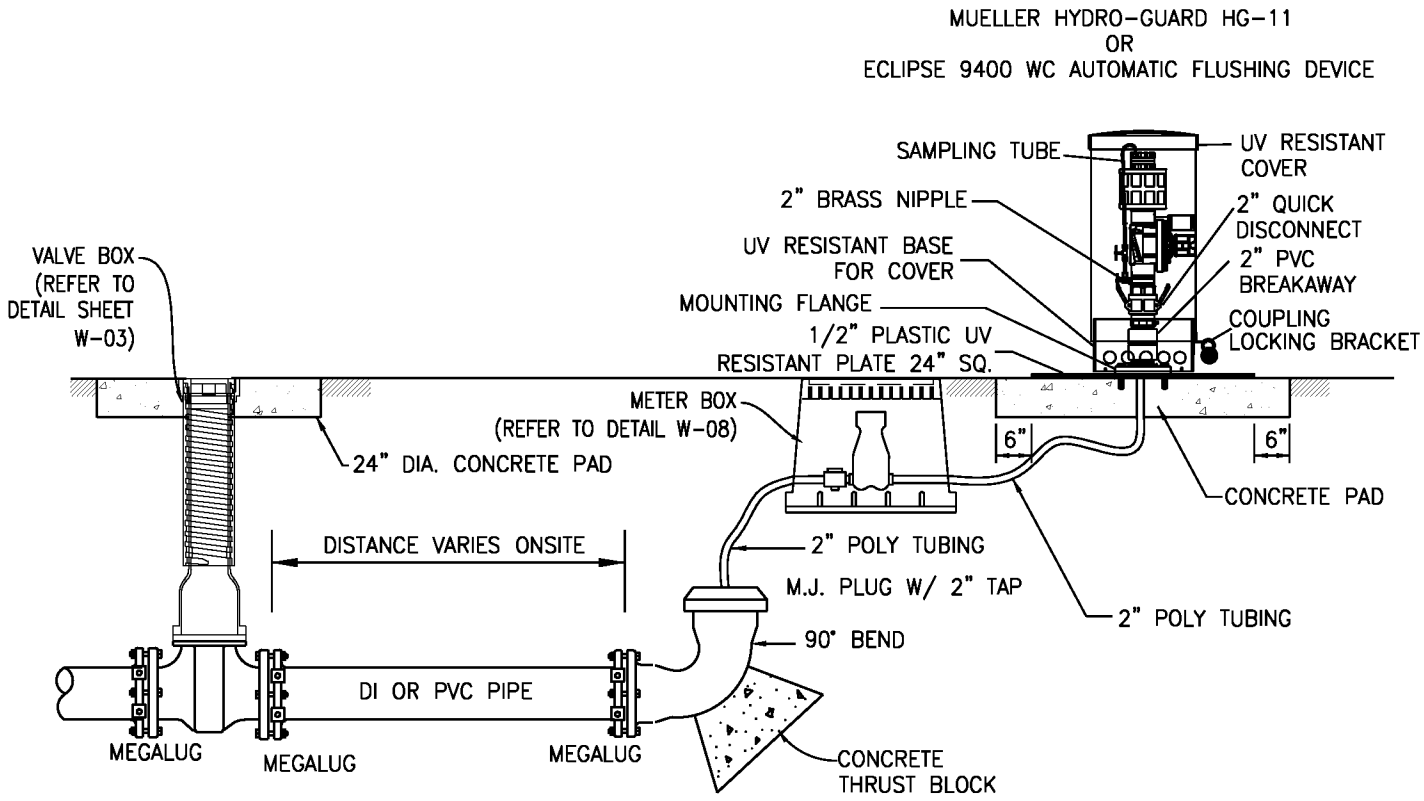
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

STANDARD FLUSH ASSEMBLY

CONSTRUCTION STANDARDS AND DETAILS

W-04
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

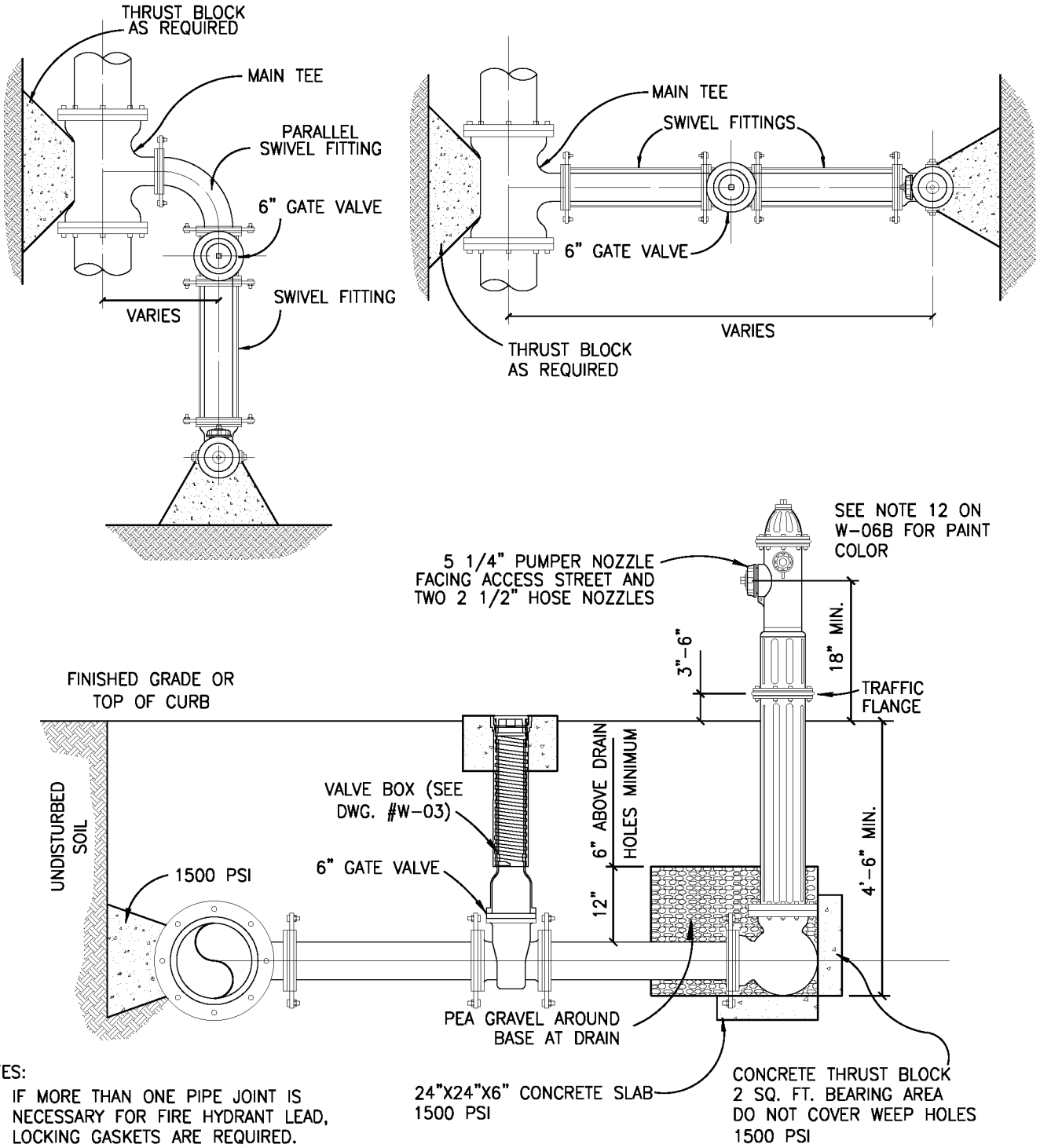
1. VALVES TO BE RESILIENT SEATED GATE VALVE, (AWWA) EPOXY COATED INSIDE AND OUT, WITH A NON-RISING STEM.
2. CONCRETE NOT TO BE IN CONTACT WITH BOLTS OR NUTS.
3. ALL FITTINGS TO BE WRAPPED IN 8 MIL AWWA STAMPED POLY.
4. 90° BEND SHALL BE RESTRAINED.
5. VALVE COLLARS LOCATED WITHIN THE ROADWAY SHALL BE 24"x24" SQUARE OR 24" DIAMETER.
6. FLUSH ASSEMBLIES SHALL BE INSTALLED WITH 3-FOOT CLEARANCE ON ALL SIDES.
7. APPROPRIATE EROSION CONTROL MEASURES SHALL BE PROVIDED FOR FLUSH ASSEMBLY DISCHARGE.
8. FLUSH ASSEMBLIES SHALL BE LOCATED AT ALL ENDS OF WATER LINES. FOR DEAD-END WATER MAINS IN CUL-DE-SAC, LOCATE FLUSH ASSEMBLY AT END OF THE CLU-DE-SAC BETWEEN BACK OF CURB AND R.O.W.
9. SERVICE LINE POLY TUBING SHALL BE BLUE ENDOPURE ASTM D2737 SODR-9 (CTS), 250 PSI OR APPROVED EQUIVALENT, AS APPROVED BY THE CITY ENGINEER.
10. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

AUTOMATIC FLUSH ASSEMBLY

CONSTRUCTION STANDARDS AND DETAILS

W-05
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

IF MORE THAN ONE PIPE JOINT IS NECESSARY FOR FIRE HYDRANT LEAD, LOCKING GASKETS ARE REQUIRED.

ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

FIRE HYDRANT INSTALLATION

CONSTRUCTION STANDARDS AND DETAILS

W-06A

SCALE: N.T.S.

ISSUE DATE: 5-28-19

NOTES:

1. FIRE HYDRANT SHALL BE INSTALLED ON SAME SIDE OF ROAD AS WATER MAIN.
2. FIRE HYDRANT SHALL BE INSTALLED PLUMB AND TRUE.
3. HEEL AND THRUST BLOCKS TO REST IN UNDISTURBED SOIL.
4. FIRE HYDRANTS SHALL BE MUELLER SUPER CENTURION MODEL 250 OR M&H MODEL B-29.
5. FIRE LINE SHALL HAVE JOINT RESTRAINT FROM MAIN TO HYDRANT.
6. PEA GRAVEL SHALL BE PLACED AROUND THE BOTTOM OF THE HYDRANT FOR A RADIUS OF AT LEAST 12", AND EXTEND AT LEAST 12" ABOVE THE OUTLET. DO NOT BLOCK DRAIN HOLES.
7. VALVE EXTENSIONS SHALL BE PLACED SUCH THAT THE OPERATING NUT IS NO MORE THAN 3'-0" FROM FINISHED GRADE AND HAVE DEBRIS RINGS.
8. FOR BURY DEPTHS GREATER THAN FIVE (5) FEET, A MAXIMUM OF ONE BARREL EXTENSION SHALL BE PROPERLY PLACED.
9. CONCRETE SHALL NOT BE IN CONTACT WITH BOLTS OR NUTS.
10. ALL FITTINGS AND HYDRANT BOOT SHALL BE WRAPPED IN BLACK 8 MIL AWWA STAMPED POLY.
11. FIRE HYDRANT SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
12. FIRE HYDRANT SHALL BE FACTORY PAINTED FLYNT ALUMINUM FOR NOZZLE SECTION AND RUST PRIMER FOR BONNET.
13. FOR PARALLEL ASSEMBLY, ANCHOR 90 SHALL BE USED BETWEEN VALVE AND HYDRANT.
14. FIRE HYDRANT SHALL BE LOCATED 3-FEET TO 10-FEET BEHIND THE CURB, WITHIN R.O.W., AND COMPLY WITH CURRENT APPROVED FIRE CODE.
15. CONTRACTOR SHALL INCLUDE RISER EXTENSION AND ITS INSTALLATION IN THE BID AS NECESSARY TO ACHIEVE THE SHOWN CONFIGURATION.
16. FIRE HYDRANT REFLECTIVE MARKERS AND FLAGS SHALL BE INSTALLED WHEN HYDRANT IS MORE THAN 50 FEET FROM STREET CURB/EDGE OF PAVEMENT OR WHEN HYDRANT IS INSTALLED BELOW ROAD GRADE.
17. TYPE II-B-B (BLUE), REFLECTIVE PAVEMENT MARKERS SHALL BE PLACED IN THE PAVEMENT ADJACENT TO ALL FIRE HYDRANTS.
18. FIRE HYDRANTS SHALL BE INSTALLED AT THE BEGINNING OF EACH CUL-DE-SAC BULB, AND EACH 'TEARDROP' CUL-DE-SAC BULB.
19. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

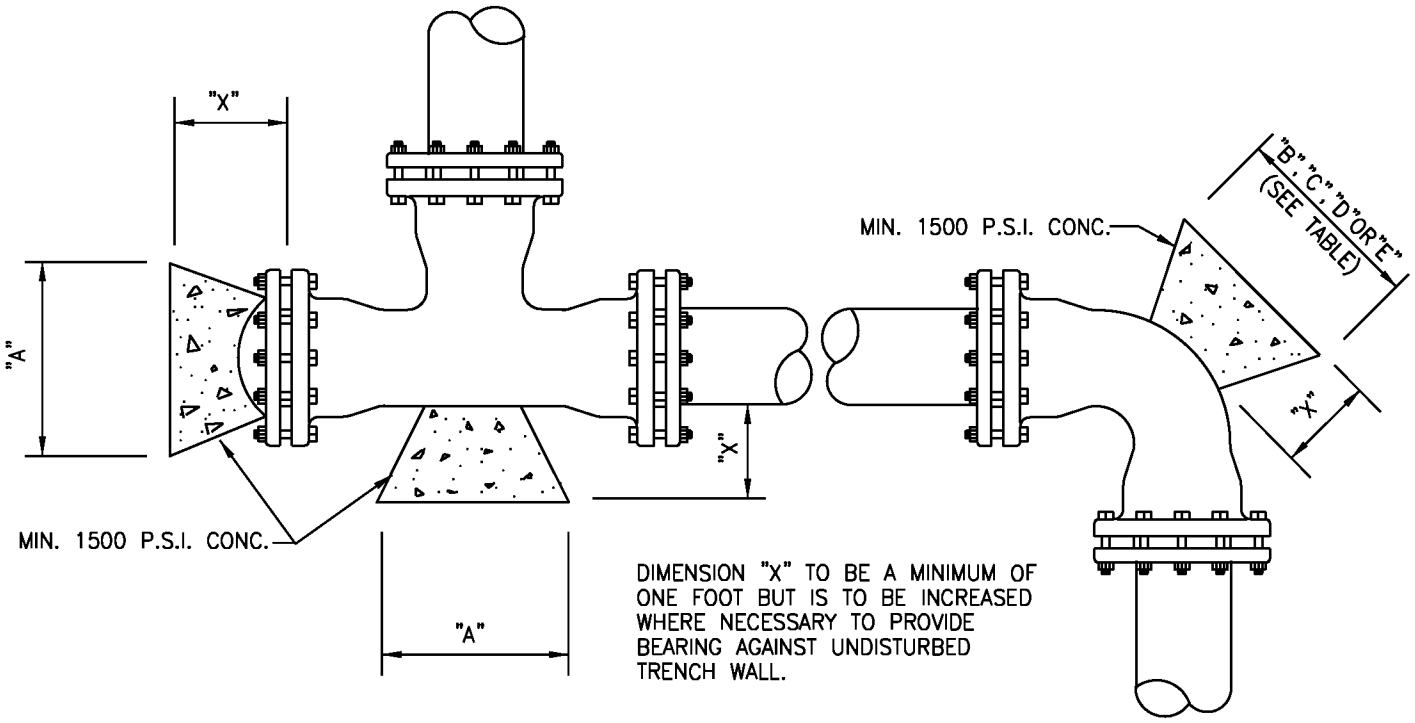
TYPICAL FIRE HYDRANT INSTALLATION - NOTES

CONSTRUCTION STANDARDS AND DETAILS

W-06B

SCALE: N.T.S.

ISSUE DATE: 5-28-19



DIMENSION "X" TO BE A MINIMUM OF ONE FOOT BUT IS TO BE INCREASED WHERE NECESSARY TO PROVIDE BEARING AGAINST UNDISTURBED TRENCH WALL.

HORIZONTAL BLOCKING TABLE

PIPE SIZE	"X" DIM.	PLUGS & TEES			90° BENDS			45° BENDS			22 1/2° BENDS			11 1/4° BENDS		
		"A"	MIN. AREA	MAX. VOL.	"B"	MIN. AREA	MAX. VOL.	"C"	MIN. AREA	MAX. VOL.	"D"	MIN. AREA	MAX. VOL.	"E"	MIN. AREA	MAX. VOL.
4"	1'-0"	1'-0"	.83	.05	1'-0"	.83	.05	1'-0"	.83	.05	1'-0"	.83	.05	1'-0"	.83	.05
6"	1'-6"	1'-0"	1.06	.06	1'-2"	1.50	.09	1'-0"	.83	.05	1'-0"	.83	.05	1'-0"	.83	.05
8"	1'-6"	1'-3"	1.89	.11	1'-6"	2.66	.15	1'-3"	1.44	.08	1'-0"	.83	.05	1'-0"	.83	.05
10"	1'-6"	1'-9"	2.95	.17	2'-0"	4.17	.24	1'-6"	2.26	.13	1'-3"	1.15	.07	1'-0"	.83	.05
12"	1'-6"	2'-0"	4.25	.24	2'-3"	6.00	.34	1'-9"	3.25	.18	1'-3"	1.65	.10	1'-0"	.83	.05
16"	2'-0"	2'-7"	7.54	.56	3'-0"	10.65	.79	2'-3"	5.76	.43	1'-8"	2.94	.22	1'-2"	1.48	.11
18"	2'-0"	2'-11"	7.70	.57	3'-5"	10.89	.82	2'-6"	5.89	.44	1'-10"	3.01	.22	1'-5"	1.51	.11
20"	2'-0"	3'-3"	7.86	.59	3'-9"	11.12	.84	2'-9"	6.01	.45	2'-0"	3.07	.23	1'-7"	1.54	.12
24"	2'-0"	3'-8"	11.33	.84	4'-3"	16.00	1.20	3'-2"	8.65	.65	2'-6"	4.42	.33	1'-10"	2.22	.17

NOTES:

1. CALCULATIONS IN MIN. AREA COLUMN ARE IN SQUARE FEET. CALCULATIONS IN MAX. VOL. COLUMN ARE IN CUBIC YARDS.
2. ALL FITTINGS SHALL BE WRAPPED IN 8 MIL AWWA STAMPED POLY. CONCRETE SHALL NOT BE IN CONTACT WITH BOLTS.
3. MEGALUGS ARE REQUIRED IN ADDITION TO CONCRETE THRUST BLOCKS.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

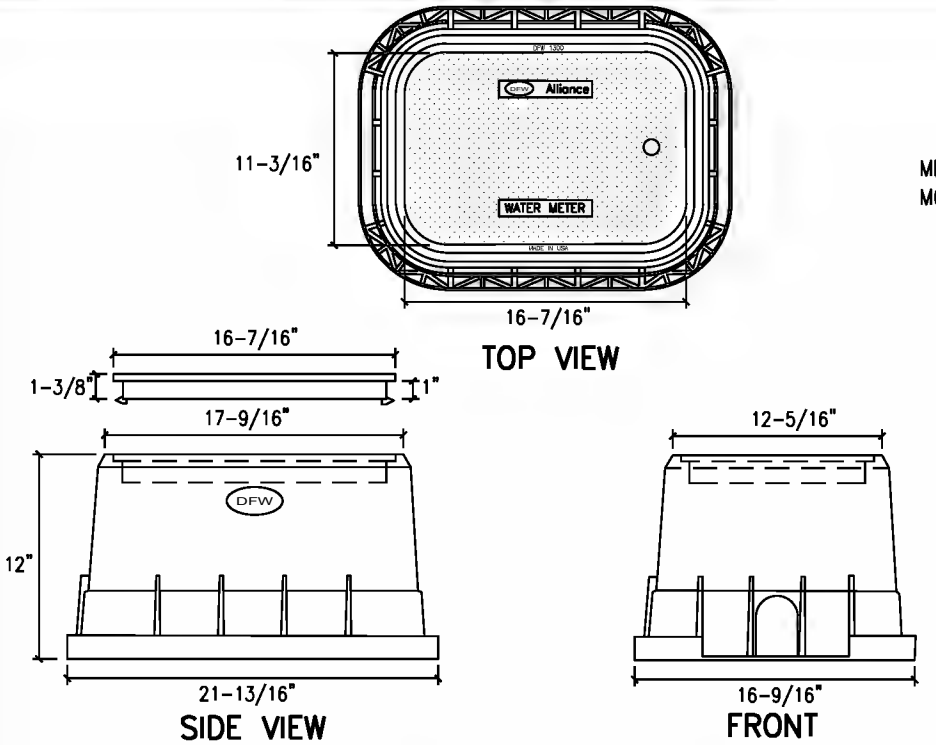
THRUST BLOCKS FOR WATER AND FORCE MAINS

CONSTRUCTION STANDARDS AND DETAILS

W-07

SCALE: N.T.S.

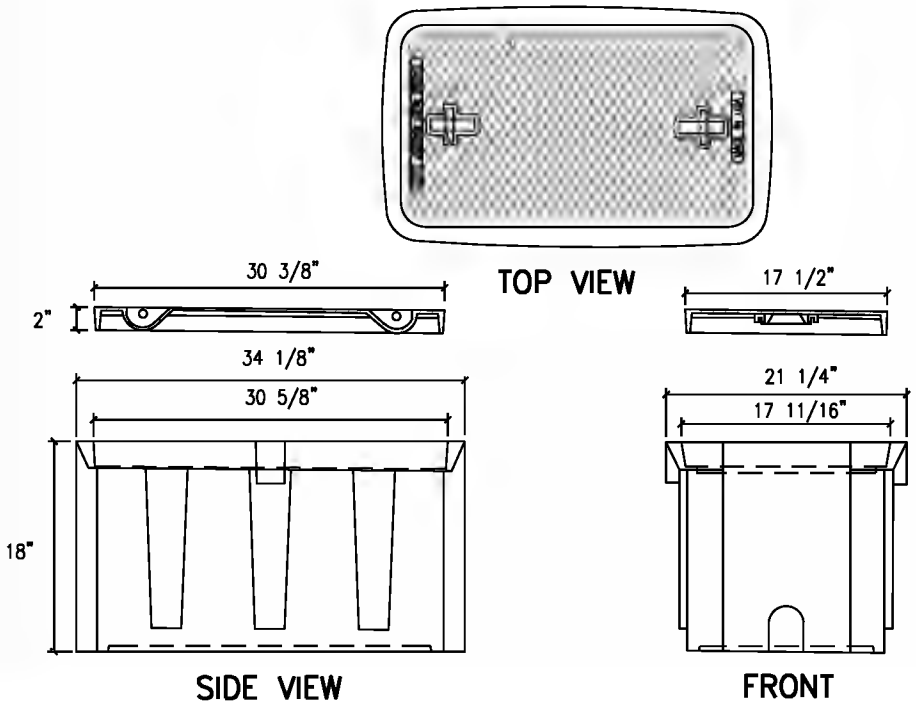
ISSUE DATE: 5-28-19



METER BOX SHALL BE DFW 1300 MODEL, 12" DEEP.

FOR 5/8", 3/4" AND 1" METERS

NOT TO SCALE



METER BOX SHALL BE EAST JORDAN 1730 MODEL, 18" DEEP.

NOTES:

1. REFER TO DETAIL W-02 FOR METER BOX PLACEMENT.
2. METER BOXES SHALL BE CAST IRON IF LOCATED IN A TRAFFIC AREA.

FOR 1-1/2" AND 2" METERS

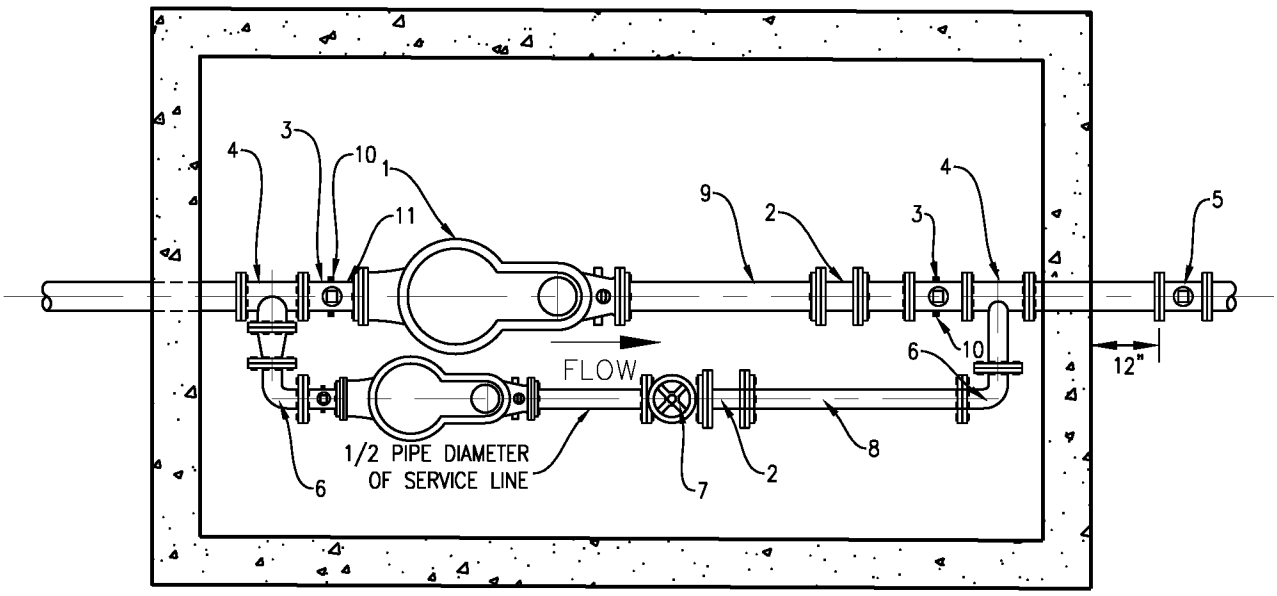
NOT TO SCALE

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

METER BOXES

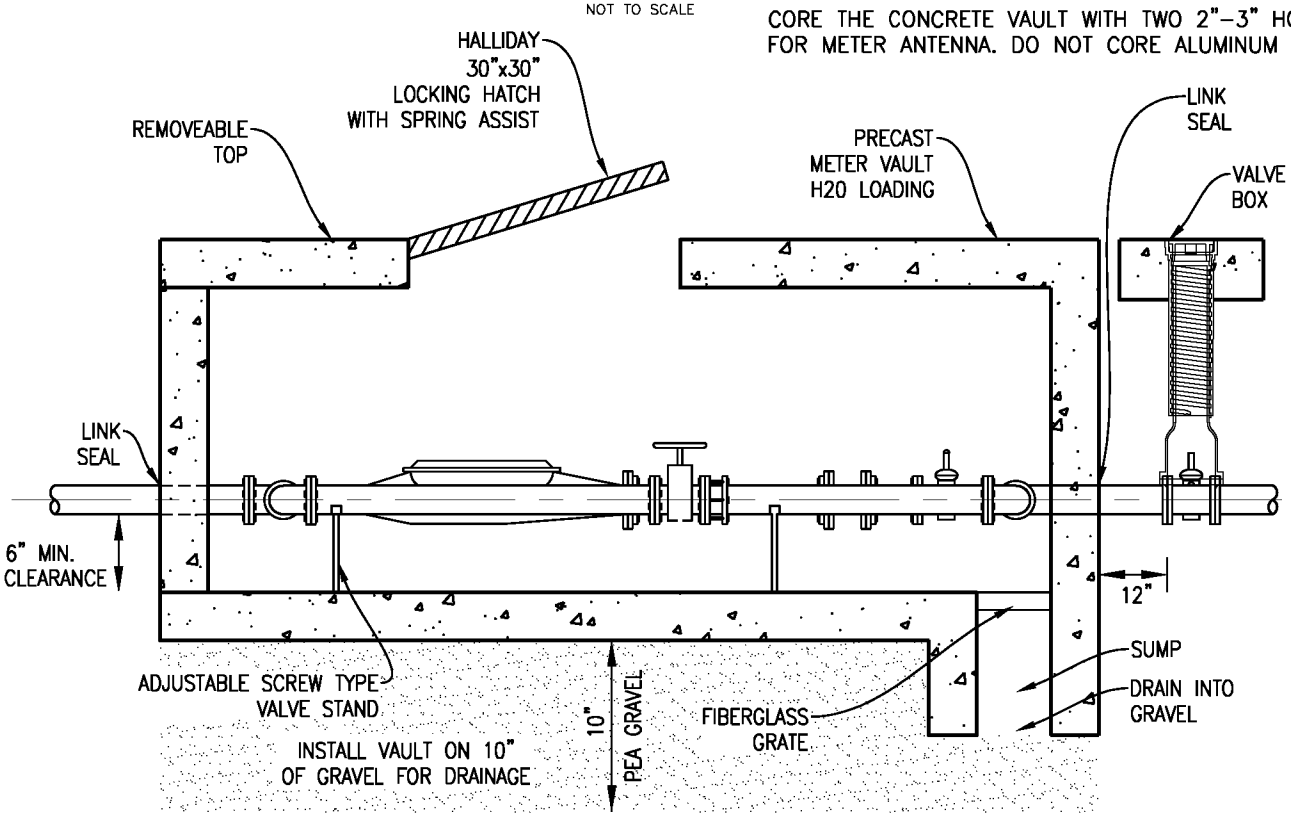
CONSTRUCTION STANDARDS AND DETAILS



PLAN VIEW
NOT TO SCALE

NOTES:
CITY OF BELTON WATER METER, NEPTUNE 450i, IS REQUIRED ON ALL BYPASS LINES.

CORE THE CONCRETE VAULT WITH TWO 2"–3" HOLES FOR METER ANTENNA. DO NOT CORE ALUMINUM LID



ELEVATION
NOT TO SCALE

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

METER VAULT LAYOUT FOR 2" AND LARGER WITH AND WITHOUT BYPASS

CONSTRUCTION STANDARDS AND DETAILS

W-09A
SCALE: N.T.S.
ISSUE DATE: 5-28-19

No.	DESCRIPTION
1.	METER
2.	SOLID SLEEVE WITH MEGALUGS
3.	FLANGED GATE VALVE
4.	FLANGED TEE
5.	PROPERTY OWNER'S GATE VALVE SQUARE NUT
6.	FLANGED ELBOW 90°
7.	BYPASS GATE VALVE WITH HANDWHEEL
8.	BYPASS DUCTILE IRON PIPE
9.	FLANGED SPOOL
10.	ADJUSTABLE PIPE STAND
11.	STRAINER

NOTES:

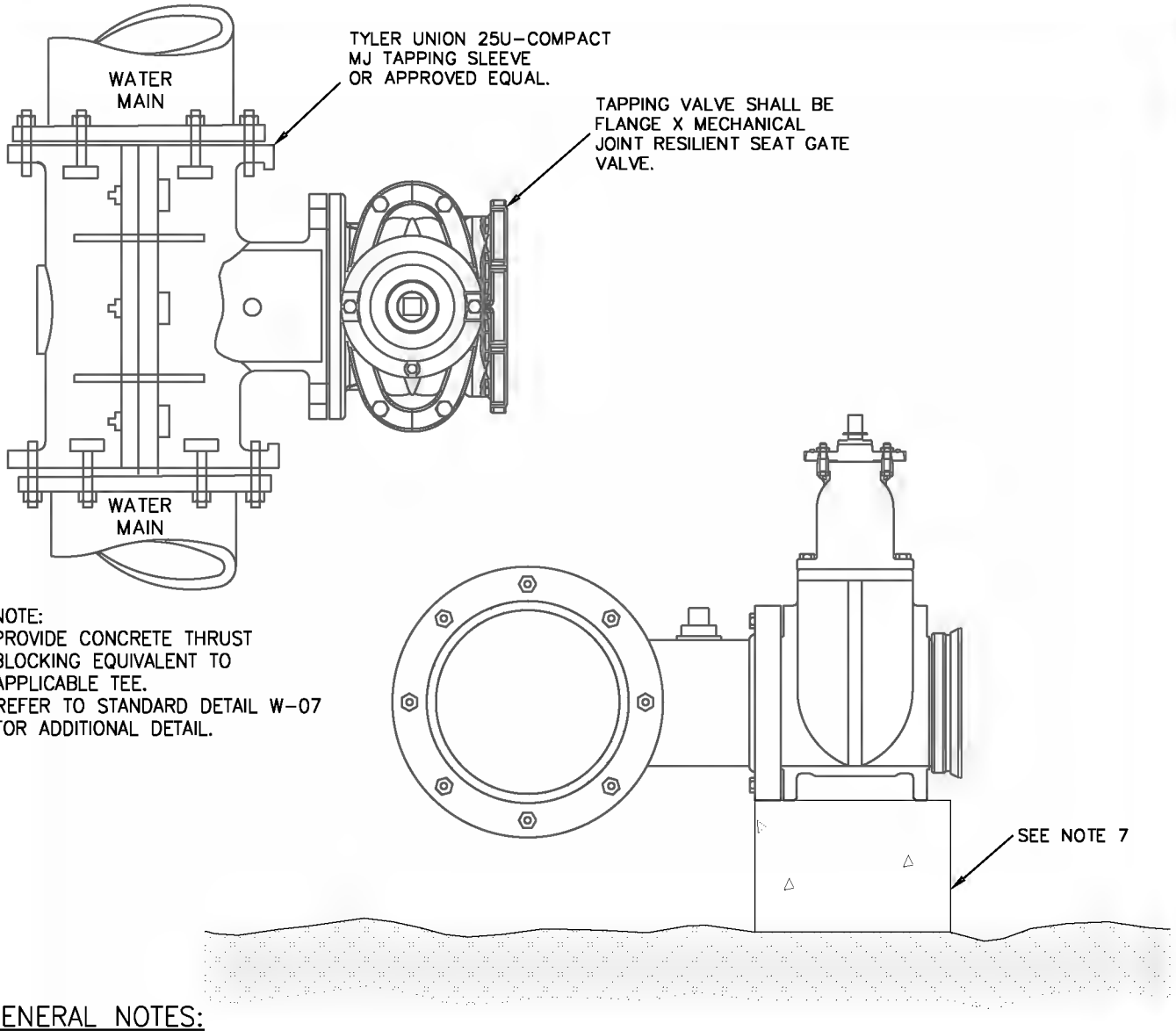
1. PIPING 8-INCH AND LARGER SHALL BE DUCTILE IRON.
2. PIPE AND METER SIZE SHALL BE AS APPROVED BY CITY ENGINEER. BYPASS SHALL BE ONE PIPE DIAMETER SMALLER THAN MAIN.
3. METER VAULT MUST BE BEHIND CURB AND/OR WALK AND OUT OF VEHICULAR TRAFFIC.
4. MAIN LINE AND BYPASS VALVES SHALL BE RESILIENT SEAT TYPE WITH CORROSION RESISTANT FUSION BANDED EPOXY COATING INSIDE AND OUTSIDE, NON-RISING STEM. MAIN LINE VALVES SHALL HAVE SQUARE OPERATING NUTS. BYPASS VALVE SHALL HAVE A HANDWHEEL. PROPERTY OWNER'S VALVE SHALL BE LOCATED OUTSIDE OF THE METER VAULT.
5. METER HATCH LOCATION SHALL BE MODIFIED TO READ METER FROM TOP OF VAULT.
6. HATCH OPENING SHALL BE 30" X 30" WITH HALLIDAY HATCH.
7. ALL FITTINGS INSIDE VAULT SHALL BE FLANGED. FITTINGS OUTSIDE VAULT SHALL BE MJ WITH MEGALUGS.
8. NOTCHES WHERE PIPING GOES THROUGH VAULT SHALL BE FILLED WITH MORTAR.
9. THE TOP OF THE METER VAULT SHALL BE SET AT AN ELEVATION SUCH THAT THE SURROUNDING GROUND SLOPES AWAY FROM THE VAULT.
10. APPROVED CITY OF BELTON LOCK AND CHAIN SHALL BE INSTALLED.
11. ALL EXTERNAL NUTS, BOLTS, AND WASHERS SHALL BE STAINLESS STEEL.
12. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

METER VAULT NOTES

CONSTRUCTION STANDARDS AND DETAILS

W-09B
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTE:
PROVIDE CONCRETE THRUST BLOCKING EQUIVALENT TO APPLICABLE TEE.
REFER TO STANDARD DETAIL W-07 FOR ADDITIONAL DETAIL.

GENERAL NOTES:

1. TAPPING SLEEVE FOR SIZE ON SIZE SHALL BE FULL BODY CONSTRUCTED OF CAST IRON.
2. FOR STANDARD TAPPING SLEEVES, STAINLESS STEEL WITH DUCTILE FLANGE IS PERMISSIBLE.
3. RUBBER GASKET SHALL BE A 360° COMPLETE FULL CIRCLE.
4. TAPPING SLEEVE SHALL BE SUPPLIED WITH FLANGE FACE ON BRANCH.
5. TAPPING SLEEVE SHALL HAVE A FLANGE FACE GASKET PERMANENTLY ATTACHED TO SLEEVE AT FACTORY.
6. LUGS SHALL BE STRUCTURALLY WELDED TO THE SHELL OR BOLTED.
7. TAPPING VALVE AND TAPPING EQUIPMENT SHALL BE SUPPORTED BY BLOCKING DURING AND AFTER INSTALLATION.
8. THOROUGHLY CLEAN WATER MAIN WITH WIRE BRUSH PRIOR TO INSTALLATION OF TAPPING SLEEVE.
9. FLANGE FACE SHALL BE INSTALLED VERTICALLY TRUE AND PLUMB.
10. TAPPING SLEEVE SHALL NOT BE INSTALLED WITHIN 5 (FIVE) PIPE DIAMETERS OF AN EXISTING PIPE BELL UNLESS APPROVED OTHERWISE.
11. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
12. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

TAPPING SLEEVE AND VALVE

CONSTRUCTION STANDARDS AND DETAILS

SECTION 5 - WASTEWATER

5.01 General

The requirements of this section apply to Belton's Sewer CCN. If sewer improvements or new infrastructure is proposed within Belton's ETJ or City Limits and within a non-Belton Sewer CCN, the engineer shall consult with the CCN owner for the sewer infrastructure requirements. However, all utilities proposed in Belton rights-of-way shall be coordinated with and approved by the City of Belton.

The purpose of this section is to define the general requirements for the design of wastewater infrastructure and to provide typical construction details for the improvements. The City of Belton City Engineer should be consulted if variations from these standards are anticipated.

5.02 Master Plan

All wastewater improvements design must be sized and located according to the land use projected in the Comprehensive Plan. Also, the City of Belton periodically updates the Wastewater Master Plan which should be followed and adhered to during the design process.

5.03 Wastewater

The subdivider shall provide all wastewater lines required to properly serve each lot of the subdivision and to ensure that existing and new wastewater lines and facilities can adequately serve the subdivision. The subdivider shall bear all costs for extending existing City wastewater lines and wastewater facilities to have sufficient capacity to serve the subdivision. All wastewater lines and service connections shall conform to this Manual, Texas Commission on Environmental Quality Regulations (Texas Administrative Code Title 30, Part 1, Chapter 217) and the requirements of the Texas Department of Health.

A. Design Standards

1. Piping for wastewater lines shall be in accordance with this Manual and Texas Commission on Environmental Quality Regulations. All pipe shall be new and shall conform to American Society of Testing Materials, Standard D3034. PVC sewer pipe joints shall comply with American Society of Testing Materials, Standard D3212.

2. Minimum and maximum allowable slopes in percent shall be in accordance with TCEQ Chapter 217.

3. Wastewater connections shall be readily available to proposed park sites. The subdivider must demonstrate that there is sufficient wastewater line capacity available to serve the park.

4. Septic tanks shall not be permitted, unless approved by the Director of Public Works and the Bell County Health Department.

5. Manholes shall be constructed at all changes in direction of sewer line, intersection of sewer lines, termination points of sewer lines, and at intervals of not more than five-hundred (500) feet, unless approved by the City Engineer.

6. A clear access path with compacted crushed limestone base of 10' wide shall be installed along all off-site manholes for accessibility purposes. Off-site does not include manholes located in parks, landscaped areas, or manholes located in residential lots. Clear is defined as free of vegetation and structures, such as fences. If the access path crosses a clear drainage channel or creek, drainage must be addressed in order to preserve the life of the access path. If culverts are required to pass stormwater across the access path, tin horns will be allowed under the access path. All off-site manholes shall be within the access path or within 10 feet of the path, as reasonably as possible. Any manholes placed outside of the edge of path must include a concrete collar/diamond and a reflective marker per the enclosed detail. Any manholes placed within the access path are not required to have concrete collars/diamonds. The access path is not required to be contiguous, as long as the manholes are accessible in one direction or another.
    a. However, in the event the sewer line is placed within a creek or floodway and an access path is not feasible to construct, every other manhole, or as deemed reasonably appropriate by the City Engineer, shall be accessible by the City's vehicles from a public roadway or other City easement. The City's jetting hose is 500 feet in length and must be able to access manholes for jetting and unclogging purposes.

7. A minimum 100 mil coat of Raven 405 Ultra High Build Epoxy Coating or approved equal shall be applied to entire interior of each wastewater manhole and underside of flat tops where accepting influent from force mains and to include the nearest manhole upstream, as appropriate. The City's On-site Representative shall inspect each manhole prior to application of coating system or the manhole shall be coated at the manufacturing facility with approved certificates/submittal.

8. Pipe invert elevations of mains flowing into manholes shall be 0.1 feet above the invert of the out-flowing main.

9. Separation distances between water and wastewater infrastructure shall be in accordance with TCEQ Regulations (Chapters 217 and 290). Where encasement is required, steel casing shall be in accordance with the detail included in the General Utilities section.

B. Materials and Sizing

1. All materials used in wastewater improvement projects shall be North American domestic.

2. All wastewater lines shall conform to the following specifications:
    a) Gravity wastewater lines shall be a minimum of six (6) inches in diameter, PVC SDR 26 with elastomeric joints and meet the requirements of ASTM specification D-3034. PVC sewer pipe joints shall comply with American Society of Testing Materials, Standard D3212. All fittings shall be SDR 26.
    b) The minimum house connection size shall be four (4) inches in diameter.
    c) All force mains shall be PVC, AWWA DR-18, C900 for 4" to 12" pipe and C905 for pipe sizes larger than 12" in diameter. Force Mains are allowed to be ductile

iron with the interior wall cement lined and seal coated, unless specified differently. A shop applied bituminous coating shall be applied on the exterior surface of pipe. Coatings shall be applied in accordance with AWWA C104 and the Painting Specifications. The interior surface of the pipe shall be lined with Protecto 401 ceramic epoxy lined or preapproved equal with a minimum thickness of 40 mil.

3. Gravity PVC wastewater lines shall be green in color. PVC force mains shall be green or white in color.

4. All buried ductile iron pipe and fittings shall be wrapped with 8 mil, Type I, Grade E-1, AWWA stamped-polyethylene film according to AWWA C105/A21.50.

C. Appurtenances

Manholes, cleanouts, and other associated items for completion of a wastewater system are shown on the following detail sheets as to material types and dimensions. Valve requirements for force mains shall be the same as for water lines as described in this Manual.

5.04 Testing

Testing of installed improvements shall meet all Texas Commission on Environmental Quality requirements and guidelines.

A. Vacuum air testing shall be done after the rings are in place per ASTM No. C1244 with the cover omitted.

B. Low Pressure Air Tests shall be based on time versus pressure drop from 3.5 PSI to 2.5 PSI.

C. Deflection testing shall be done 30 days or more following the completion of installation. Mandrels shall measure 95% of the base inside diameter of the pipe involved.

5.05 Construction Plans

Construction drawings for wastewater installation shall contain a profile view labeled with percent slopes and flowline elevations (based on mean sea level elevations) at each manhole. The plan view shall include horizontal dimensioning to easement and/or property line. The required design capacity and actual capacity shall either be shown on the plans or within an engineer's report.

5.06 Lift Stations

The following are minimum standards for all proposed lift stations in the City of Belton and the City of Belton Sewer CCN. Applications proposing grinder pump stations shall also follow these standards, as applicable.

All lift stations and appurtenances shall meet the requirements of the City of Belton Design Standards as well as the Texas Administrative Code, Chapter 217. For any conflicts between this Manual and the regulatory requirements, the more stringent detail shall apply. All lift stations and appurtenances shall be designed by a Texas Registered Professional Engineer.

A. Submittals

1. All lift station shop drawings and submittals shall be reviewed by the City Engineer, and construction shall not proceed until submittals are approved by the Department.
2. Record drawings, approved submittals, and all operation and maintenance (O&M) manuals shall be provided to the City Engineer following construction. Two (2) printed sets of O&M manuals are required along with a PDF version. Also, provide a maintenance checklist of typical or routine maintenance items required for the pumps and generator.
3. The final document package shall include pump and motor descriptions, capacities for all equipment and wells, control diagrams, material descriptions, and contact name and number for maintenance and repairs on all equipment.

B. Location and Site Details

1. The site layout, location, and site grading must be approved by the City Engineer.
2. Lift stations shall be located outside any drainage areas and 100-year floodplains, including wave action.
3. Clearance between the lift station fencing and the lift station equipment shall be five (5) feet at minimum.
4. Concrete is required along the entire perimeter of the lift station. The concrete must be a minimum of 6 inches thick with No. 4 rebar placed every 12 inches on center and includes an 18 inches deep footer around the perimeter. Interior footings may be required. The concrete for the columns and exterior masonry walls may be poured at the same time as the interior floor provided the appropriately sized footer is included. Concrete shall be poured a minimum of 6 inches outside of the exterior masonry walls as a “mow strip”. Subgrade must be prepared per the geotechnical report.
5. The interior of the lift station shall be concrete as specified above, or a 6-inch layer of imported rock with a weed barrier installed under the rock layer.
6. Landscape and fencing shall meet the City’s most current Design Guidelines and shall include weed barrier and automatic irrigation. In addition to the Design Guidelines, the entry gate to the lift station shall be two equally sized, 8-foot wide gates made of steel, have a lock open device, be equipped with a lockable slide hasp, and have an 18-inch star made into and of the same material gauge as the fence.

C. Access

1. The access road shall be a minimum of 10 feet wide and be paved with a minimum of 1.5 inches of Type “D” or Type “C” HMAC. The base for the access road shall be minimum 6” compacted crushed limestone material.
2. The access road shall have an adequate turnaround at the lift station, as approved by the City Engineer.

D. Electrical and Controls

1. Control Panel shall be NEMA 4X and be manufactured by a certified UL508 facility.
2. Each station must be equipped with a two service 110 volt 20 amp weather proof electrical outlets at a minimum. These outlets shall not be within the control panel.

3. Emergency alarm lights must be mounted at a location that is visible through the gate or high enough to be above the masonry wall.
4. Pump wires shall be installed in a separate NEMA 4X Junction Box w/terminal block. Exposed wires, nuts, etc. shall be coated with appropriate corrosion protection.
5. Control wires (floats) shall be installed in a separate NEMA 4X Junction Box w/terminal block. Exposed wires, nuts, etc. shall be coated with appropriate corrosion protection.
6. Omni Site hardware and provisions shall be provided. Any antenna boosters required shall be included.
7. Stations requiring any building or a motor control center (MCC) will be reviewed and approved by the City Engineer and the City Building Official.

E. Manholes and Wet/Dry Wells

1. Install a manhole located near the fenced area prior to the sewer entering the wet well. Multiple manholes may be required by the City Engineer.
2. Wet wells must be equipped with a "stilling well" on the influent pipe. The stilling well shall be a PVC or HDPE pipe at least 8 inches in diameter.
3. Concrete wet wells must be Raven coated with a minimum of 120 mils or as required by the coatings manufacturer, whichever is thicker.
4. Fiberglass Wet Wells may be allowed with appropriate backfill and written approval from the City Engineer.
5. See the General Utilities section for hatch requirements.
6. Vents shall be required, and shall be stainless steel and designed to hold an odor neutralizing agent such as activated carbon as recommended by the design engineer. Size and type of odor control mechanism shall be approved by the City Engineer.

F. Utilities

1. Potable water shall be metered and be equipped with a RPZ backflow prevention assembly. All potable water utilities shall be installed in a freeze proof cabinet with easy access doors on each side. A frost free hydrant shall be installed as well as a hose rack.
2. Piping shall be class 350 ductile iron unless alternate piping has been preapproved, in writing, by the City Engineer.
3. Bypass pumping connections shall be equipped with a properly sized bypass including vault, valves, and quick disconnect hose adaptor and cap.
4. All ductile iron fittings, valves, etc. shall be coated with suitable 401 epoxy paint as recommended by the engineer. All piping shall have Protecto 401 epoxy lining. All buried ductile iron pipe and fittings shall be wrapped with 8 mil, Type I, Grade E-1, AWWA stamped-polyethylene film according to AWWA C105/A21.50.

G. Emergency Provisions and Security

1. A generator is required at every lift station for power outages. The generator shall be manufactured by Generac or approved equal, and shall have an automatic transfer switch. The unit shall be fueled by natural gas or diesel.
2. The audio and visual alarms and signage must be able to be heard and seen from the adjacent roadway.

3. The generator shall be designed to operate the lift station according to TCEQ Texas Administrative Code, Title 30, Chapter 217, Section 217.63 and fueled to operate the lift station for a minimum of 16 run-time hours.
4. Security lighting shall be adequately provided to illuminate the site well enough to safely enter the station.
5. Provide and install an identification sign according to the details provided in this Manual. Sign shall be made of noncorrosive materials. A proof of the sign shall be submitted to the City Engineer and a written approval must be received prior to the sign being ordered.

H. Pumps and Motors

1. Pumps shall be manufactured by ABS, Flygt, Flowserve, Zoeller, Hydromatic, or approved equal. Pump motors shall be manufactured by US Motors (Nidec), TECO-Westinghouse, or approved equal. Pump and motor manufacturers shall be approved by the City Engineer.
2. A minimum of two pumps are required in each lift station.
3. Each pump shall have a separate hour meter located on the control panel.
4. Controls shall be equipped with a switch that automatically switches the lead pump designation.
5. Provide provisions for future expansion of the lift station, if directed by the City Engineer.

I. Materials

1. All brackets, rails, hardware, nuts, bolts, float hangers, etc. shall be made of stainless steel.

NOTES:

1. MANHOLES SHALL BE PRECAST ASTM C-478 BELL WITH RUBBER GASKET JOINTS PER ASTM C443. FIBERGLASS MANHOLES ARE ALSO PERMISSABLE WITH PROPER BACKFILL.
2. SEE PLANS AND MANHOLE SCHEDULE, FOR MANHOLE SIZE, LOCATION, CONFIGURATION, TYPE OF TOP SECTION, VENTING REQUIREMENTS, PIPE SIZE AND TYPES.
3. A MINIMUM 100 MIL COAT OF RAVEN 405 ULTRA HIGH BUILD EPOXY COATING OR APPROVED EQUAL SHALL BE APPLIED TO ENTIRE INTERIOR OF EACH WASTEWATER MANHOLE AND UNDERSIDE OF FLAT TOPS WHERE ACCEPTING INFLUENT FROM FORCE MAINS, AND THE NEAREST MANHOLE UPSTREAM, AS APPROPRIATE. THE CITY'S ON-SITE REPRESENTATIVE SHALL INSPECT EACH MANHOLE PRIOR TO APPLICATION OF COATING SYSTEM OR THE MANHOLE SHALL BE COATED AT THE MANUFACTURING FACILITY WITH APPROVED CERTIFICATES/SUBMITTAL.
4. ALL MANHOLE COVERS SHALL BE BOLTED AND GASKETED WHEN MANHOLES ARE LOCATED IN THE FLOODPLAIN. VENTING SHALL BE PROVIDED IN ACCORDANCE WITH TCEQ CHP. 217 REGULATIONS
5. MANHOLES TO BE VENTED SHALL BE IDENTIFIED IN PLANS. REFERENCE MANHOLE VENT DETAIL.
6. MANHOLES SHALL BE DESIGNED TO RESIST LATERAL AND VERTICAL SOIL FORCES RESULTING FROM MANHOLE DEPTH. ADDITIONALLY, MANHOLES LOCATED IN PAVEMENT TO BE DESIGNED FOR HS-20 TRAFFIC LOADS.
7. ALL MANHOLE JOINTS SHALL BE WRAPPED ON OUTSIDE WITH 12" MASTIC TAPE.
8. ALL MANHOLES SHALL BE VACUUM TESTED PER ASTM C1244. GROUTING SHALL OCCUR AFTER VACUUM TESTING.
9. ALL MANHOLE PENETRATIONS SHALL BE CAST OR CORED AND A SEAL BOOT INSTALLED.
10. DROP CONNECTIONS SHALL BE REQUIRED WHENEVER AN INFLUENT SEWER IS LOCATED TWENTY FOUR INCHES (24") OR MORE ABOVE THE MAIN INVERT CHANNEL.
11. EXISTING MANHOLES WITH INTERIOR COATING THAT ARE CORED, SHALL BE RECOATED.
12. PIPING LAID THROUGH NEW MANHOLES SHALL BE REMOVED AFTER INVERT IS IN PLACE. INVERT SHALL BE SHAPED AND FINISHED BY HAND FLOAT AND TROWEL.
13. MANHOLES LOCATED IN AREAS SUBJECT TO FLOODING SHALL HAVE A RIM ELEVATION OF 12-INCHES ABOVE NATURAL GROUND. CONSIDERATION SHALL BE GIVEN TO WATERTIGHT MANHOLES WITH VENTS.
14. FOR MANHOLES WITH VARYING SIZE PIPELINES, PIPE CROWNS SHALL BE MATCHED AS MINIMUM DROP ACROSS INVERT.
15. MINIMUM MANHOLE DIAMETERS SHALL BE AS FOLLOWS:

PIPE DIAMETER	MANHOLE DIA.
≤15"	4'-0"
18" TO 30"	5'-0"
≥ 36"	6'-0"

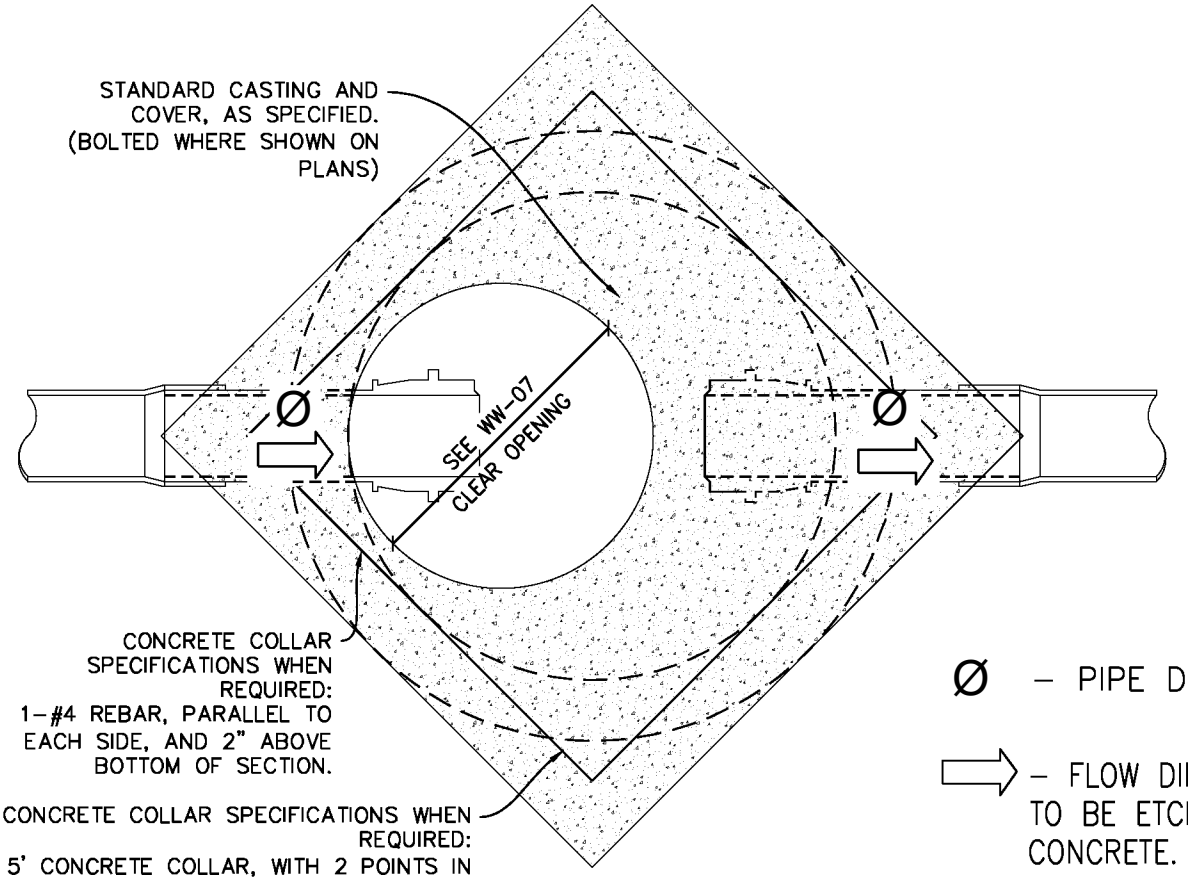
16. ALL COMPONENTS SHALL BE USA DOMESTIC.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

MANHOLE NOTES

CONSTRUCTION STANDARDS AND DETAILS

WW-01
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

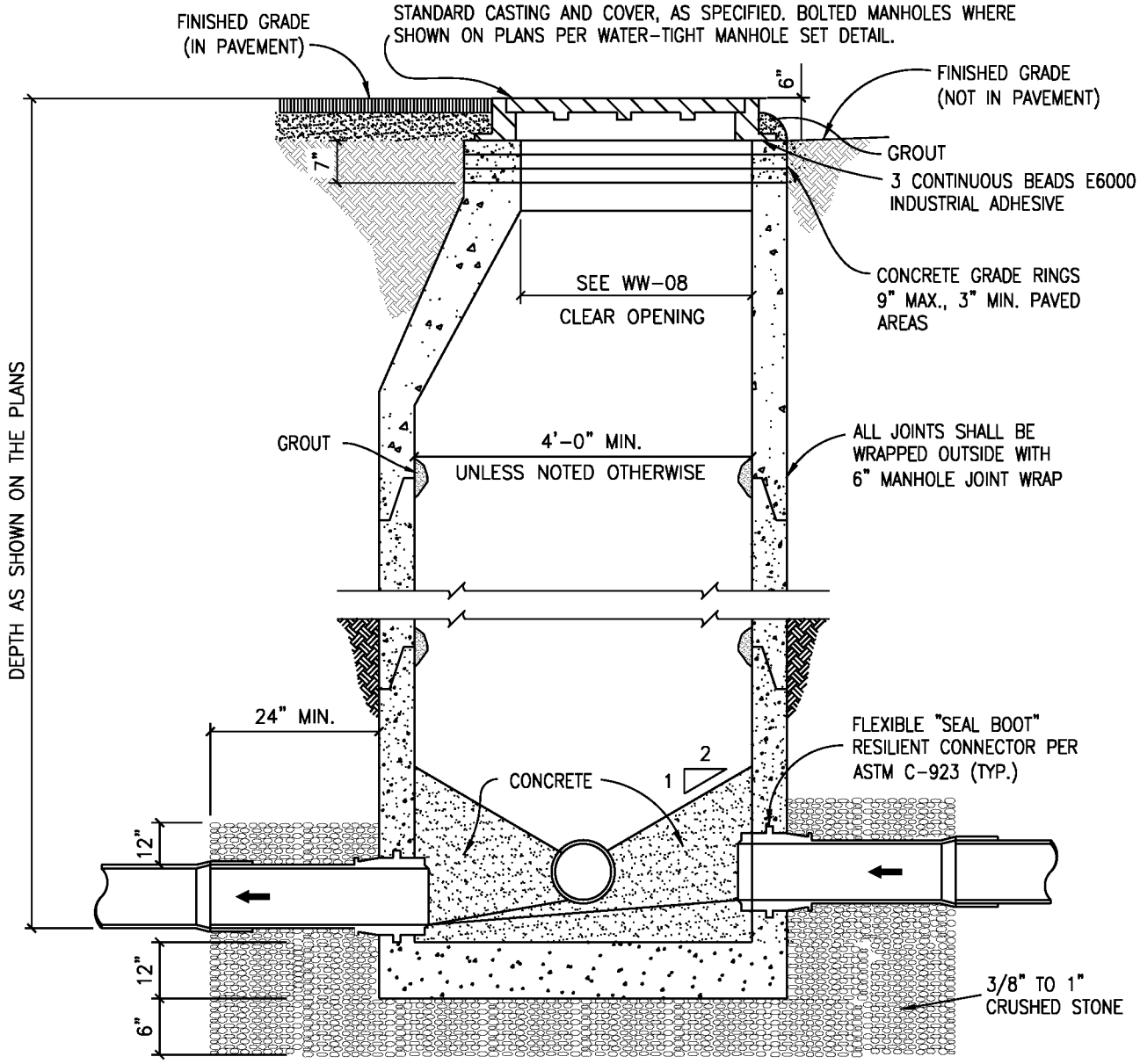
1. ALL MANHOLES SHALL BE 48" I.D., WITH RUBBER GASKET JOINTS CONFORMING TO ASTM C478 AND C433, UNLESS OTHERWISE APPROVED.
2. ALL MANHOLES SHALL HAVE FRAME AND COVER, AS MANUFACTURED BY EAST JORDAN IRON WORKS (AS PER DETAIL # WW-06A OR WW-06B) OR APPROVED EQUIVALENT.
3. ALL MANHOLES SHALL HAVE AN ECCENTRIC CONE.
4. MANHOLES MAY HAVE A FLAT LID, IF APPROVED BY THE CITY ENGINEER, WITH A MINIMUM 30" OPENING, CONFORMING TO ASTM C478, 5000 P.S.I. CONCRETE, TRAFFIC BEARING, AND RUBBER GASKET JOINT CONFORMING TO ASTM C443.
5. INVERTS AND FLEXIBLE SEAL BOOTS, PER ASTM C-923, SHALL BE CAST INTO BASE SECTION.
6. MINIMUM DROP BETWEEN INVERTS SHALL BE ONE-TENTH OF A FOOT (0.1').
7. GRADE RINGS WITH AN I.D. TO MATCH FRAMES MINIMUM CLEAR OPENING WITH A MAXIMUM GRADE RING HEIGHT OF 1'-0", 4" MINIMUM PAVED AREAS.
8. REFER TO ADDITIONAL WASTEWATER NOTES ON WW-01.
9. CONCRETE COLLARS ONLY REQUIRED ON OFFSITE MANHOLES OUTSIDE OF AN ACCESS PATH.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

STANDARD MANHOLE PLAN

CONSTRUCTION STANDARDS AND DETAILS

WW-02
SCALE: N.T.S.
ISSUE DATE: 5-28-19



REFER TO ADDITIONAL MANHOLE NOTES ON WW-01.

NOTE:

ALL CONCRETE SHALL BE CLASS "A" 3,000 PSI CONCRETE.

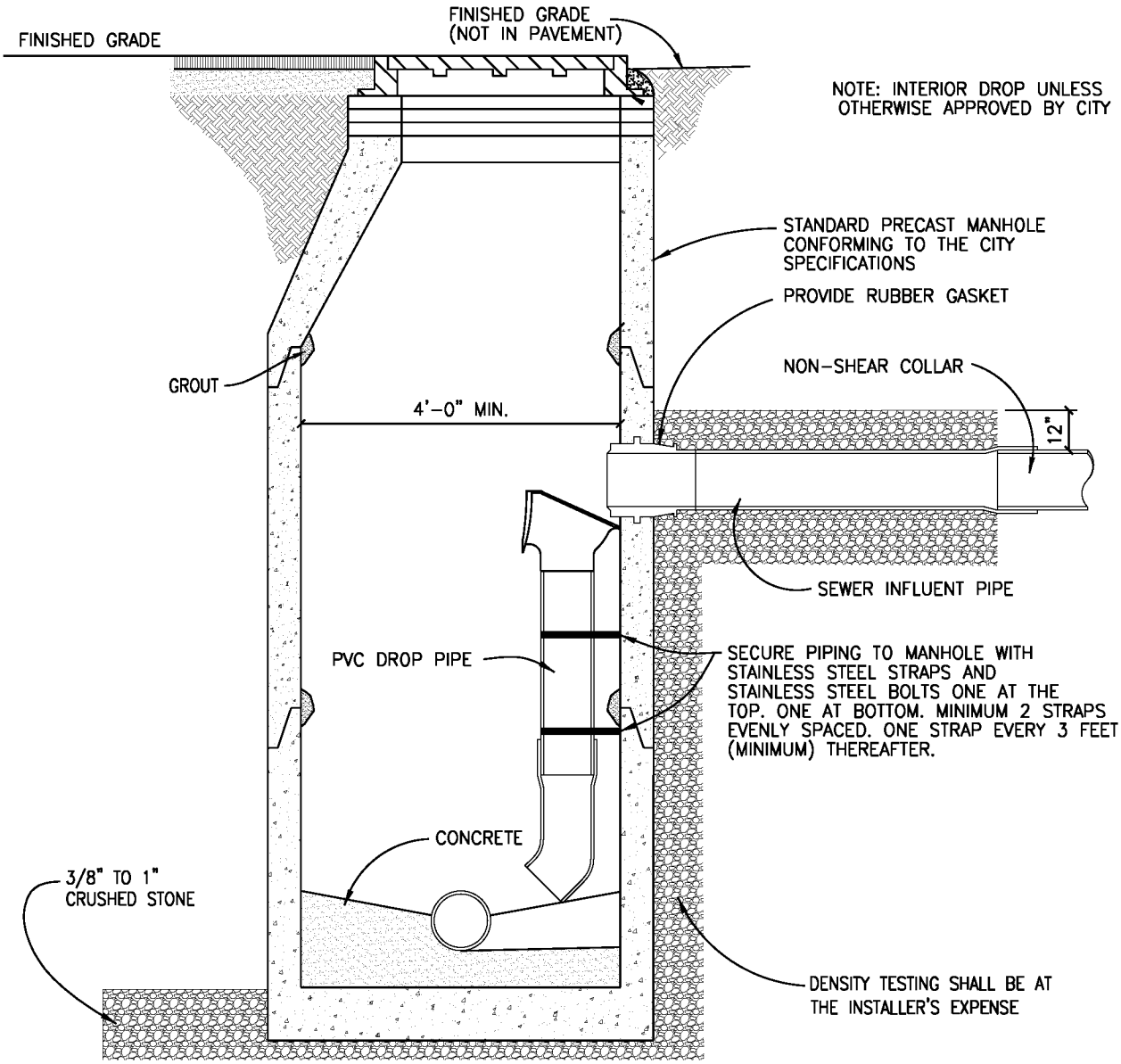
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

STANDARD MANHOLE SECTION

CONSTRUCTION STANDARDS AND DETAILS

WW-03
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTES:

1. DROP CONNECTIONS SHALL BE REQUIRED WHENEVER AN INFLUENT SEWER IS LOCATED TWENTY FOUR INCHES (24") OR MORE ABOVE THE MAIN INVERT CHANNEL.
2. DROP MANHOLES, AND ONE MANHOLE UPSTREAM, AS APPROPRIATE SHALL BE COATED ENTIRELY WITH 100 MIL OF RAVEN 405 ULTRA HIGH BUILD EPOXY.
3. A FLOW CHANNEL SHALL BE CONSTRUCTED INSIDE MANHOLE TO DIRECT INFLUENT INTO FLOW STREAM.
4. WHEN P.V.C. IS USED IN SANITARY SEWER LINES, SOLVENT TYPE JOINT P.V.C. FITTINGS MAY BE UTILIZED IN THE DROP ASSEMBLY ONLY.
5. SEE STANDARD MANHOLE DETAIL (DWG. # WW-03) FOR ADDITIONAL REQUIREMENTS.
6. EXTERNAL DROP CONNECTION PERMITTED ONLY WITH WRITTEN APPROVAL FROM THE CITY ENGINEER.
7. REFER TO ADDITIONAL NOTES ON WW-01.
8. ALL CONCRETE SHALL BE CLASS "A" 3,000 PSI CONCRETE.
9. DROP BOWL SHALL BE MANUFACTURED BY RELINER/DURAN INC., TYPE AND SIZE SHALL BE BASED ON PIPE DIAMETER AND FLOW RATE.

CITY OF BELTON, TEXAS

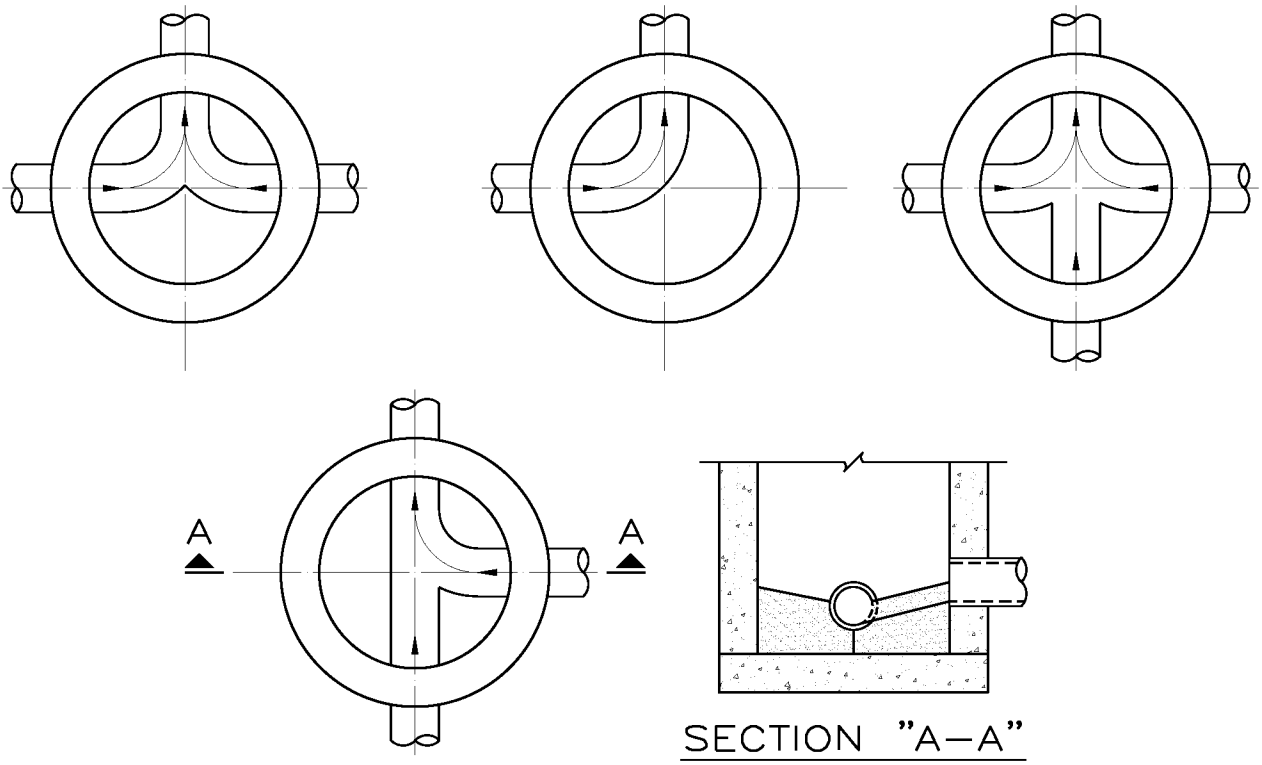
DEPARTMENT OF PUBLIC WORKS

DROP CONNECTION PRECAST MANHOLE

CONSTRUCTION STANDARDS AND DETAILS

WW-04
SCALE: N.T.S.
ISSUE DATE: 5-28-19

FLOW PATTERNS FOR INVERT CHANNELS



SECTION "A–A"

NOTES:

1. INVERT CHANNELS TO BE CONSTRUCTED FOR SMOOTH FLOW WITH NO OBSTRUCTIONS.
2. HYDRAULIC SLIDES SHALL BE CONSTRUCTED BETWEEN PIPES WITH DIFFERENT INVERT ELEVATIONS PROVIDING FOR SMOOTH FLOW.
3. CHANNELS FOR FUTURE CONSTRUCTION (STUBS) SHALL BE CONSTRUCTED, FILLED WITH SAND, AND COVERED WITH 1" OF MORTAR.
4. SLOPE MANHOLE BENCH WITH A 1:2 SLOPE FROM MANHOLE WALL TO CHANNEL.
5. INVERT DEPTHS SHALL BE AS FOLLOWS:

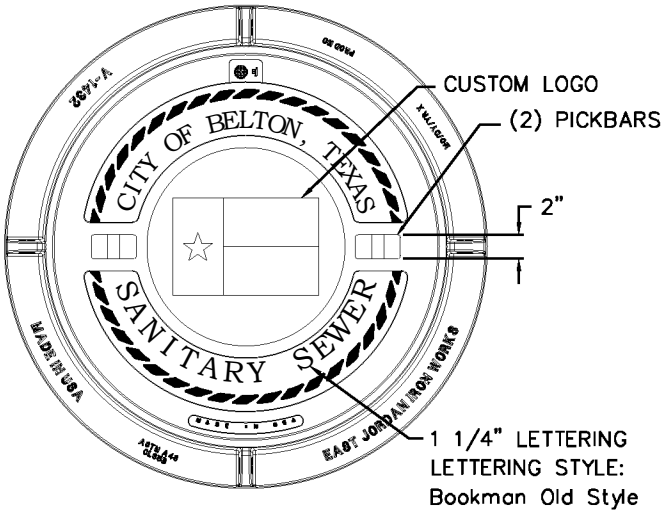
PIPE DIAMETER	INVERT DEPTH (BENCH)
< 15"	1/2 LARGEST PIPE DIA.
15" TO 24"	3/4 LARGEST PIPE DIA.
> 24"	EQUAL TO LARGEST PIPE DIA.

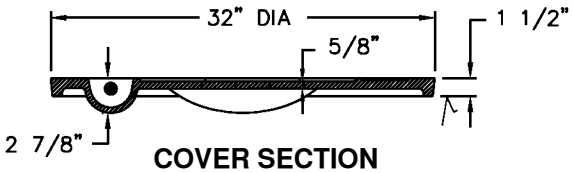
CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

FLOW PATTERNS
FOR INVERT CHANNELS

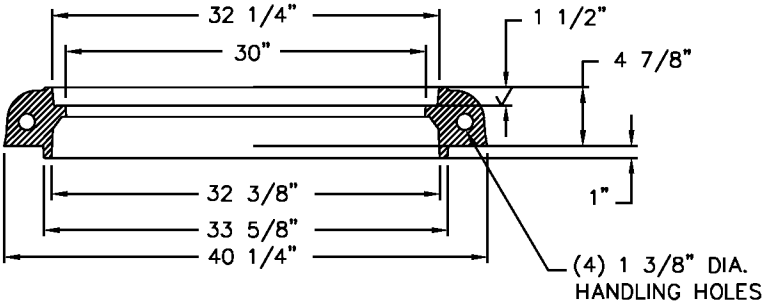
CONSTRUCTION STANDARDS AND DETAILS

WW-05
SCALE: N.T.S.
ISSUE DATE: 5-28-19





COVER SECTION



FRAME SECTION

NOTES:

1. LID SHALL HAVE TWO (2) TYPE 4 PICK BARS AND THE CITY LOGO AND LABELED "SANITARY SEWER". NO PICK HOLES IN CASTING.
2. ASPHALTIC COATING FROM MANUFACTURER IS REQUIRED.
3. MUD RING IS REQUIRED.

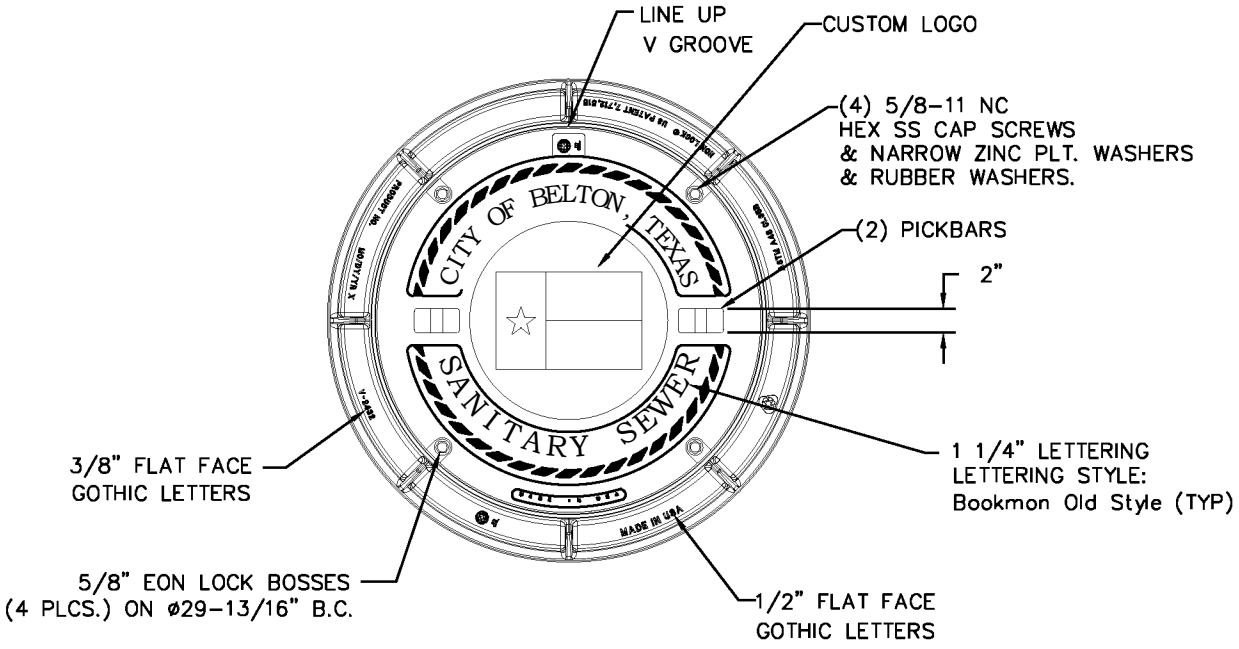
1432 – LID
1480 – RING

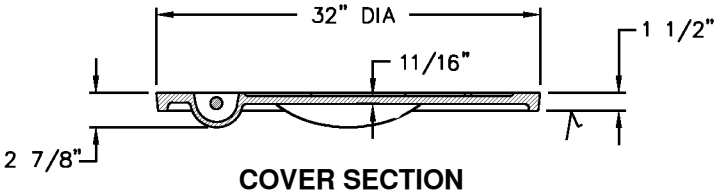
CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

WASTEWATER MANHOLE SET

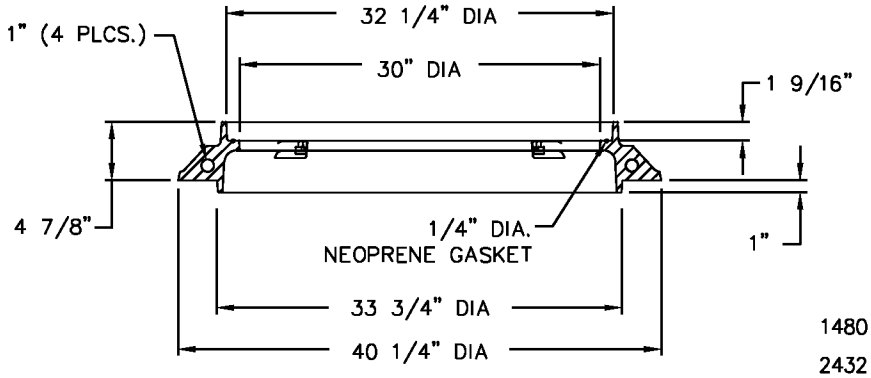
CONSTRUCTION STANDARDS AND DETAILS

WW-06A
SCALE: N.T.S.
ISSUE DATE: 5-28-19





COVER SECTION



1480 – RING

2432 – WATERTIGHT LID

FRAME SECTION

NOTES:

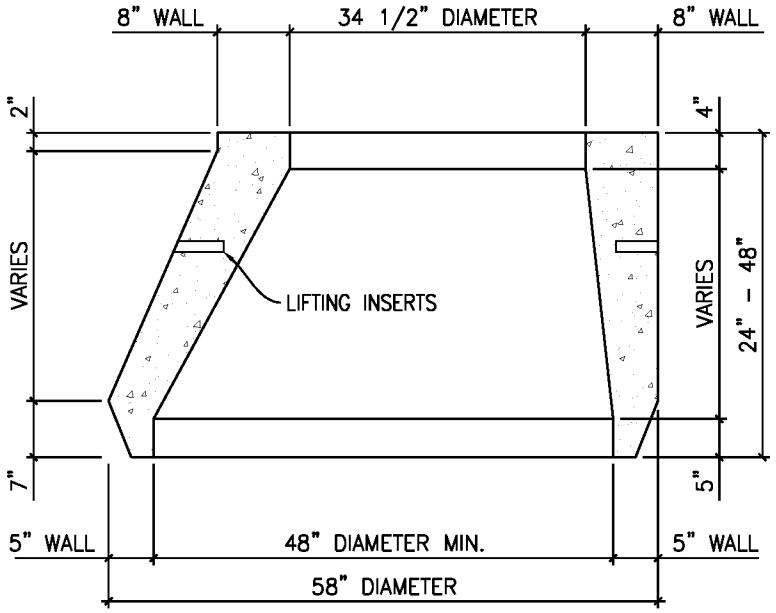
1. LID SHALL HAVE TWO (2) TYPE 4 PICK BARS AND THE CITY LOGO AND LABELED "SANITARY SEWER". NO PICK HOLES IN CASTING.
2. ASPHALTIC COATING FROM MANUFACTURER IS REQUIRED.
3. MUD RING IS REQUIRED.
4. APPLY EZ-STIK TROWELABLE SEALANT OR APPROVED EQUIVALENT TO WATER TIGHT MANHOLE JOINTS AND RINGS.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

WASTEWATER
WATER TIGHT MANHOLE SET

CONSTRUCTION STANDARDS AND DETAILS

WW-06B
SCALE: N.T.S.
ISSUE DATE: 5-28-19



CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

ECCENTRIC CONCRETE CONE

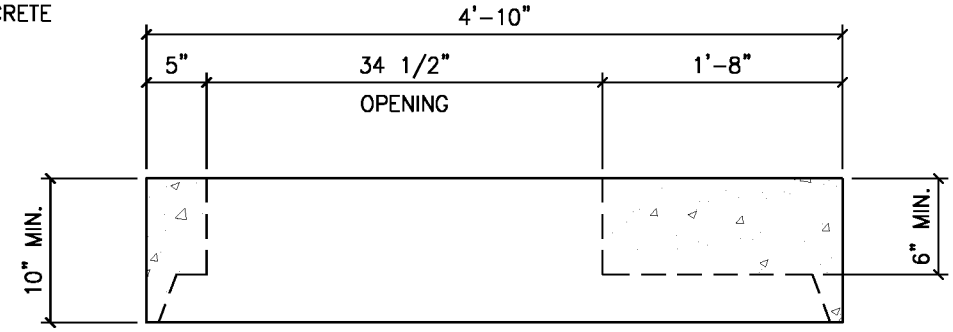
CONSTRUCTION STANDARDS AND DETAILS

WW-07

SCALE: N.T.S.

ISSUE DATE: 5-28-19

M.F.G. PER ASTM-C478
5000 P.S.I. CONCRETE
TRAFFIC BEARING
JOINT PER C443



NOTES:

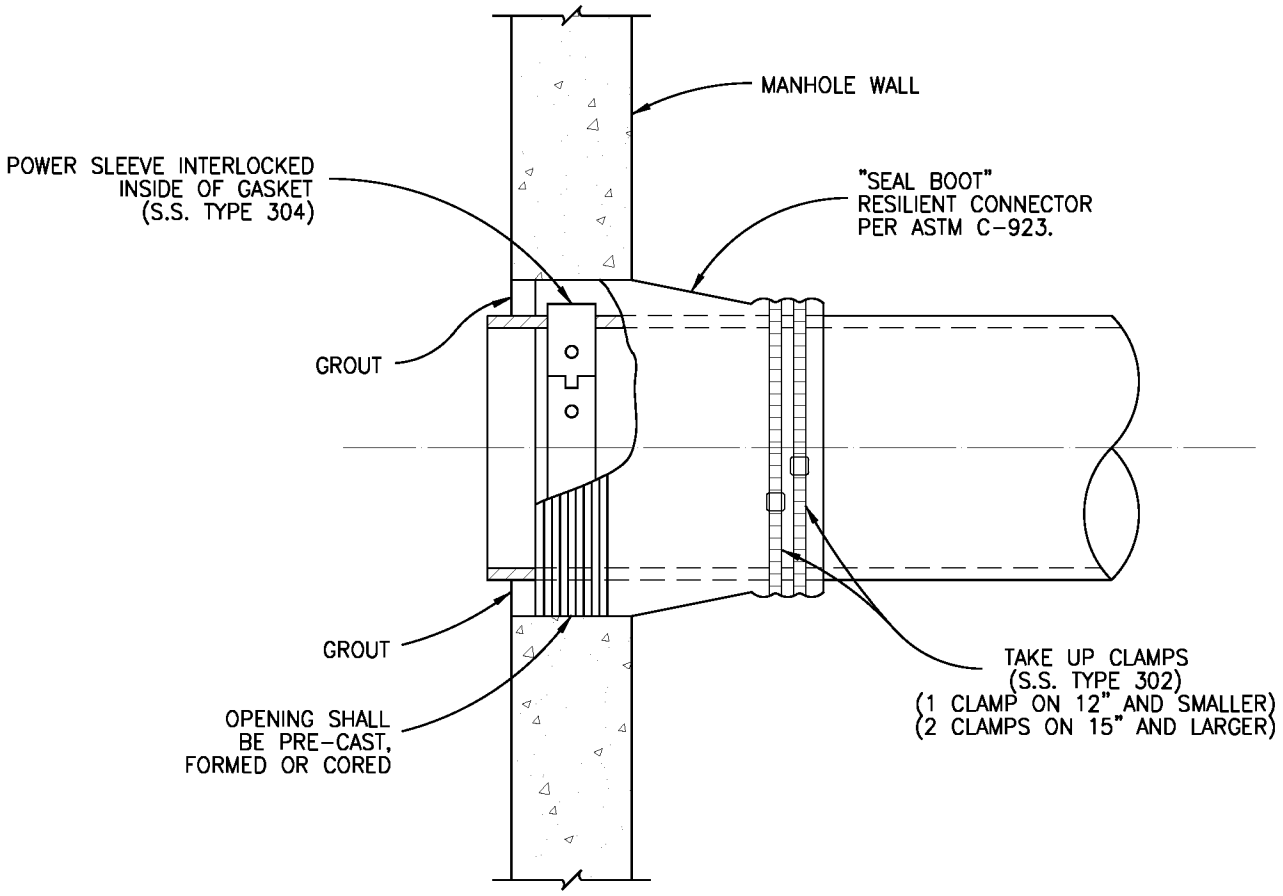
1. AVAILABLE WITH CAST IRON RING AND COVER CAST IN PLACE.
2. PERMITTED ONLY WITH WRITTEN APPROVAL FROM THE CITY ENGINEER.
3. REINFORCEMENT SHALL MEET DESIGN REQUIREMENTS FOR AASHTO HS-20 LOADING.

CITY OF BELTON, TEXAS
DEPARTMENT OF PUBLIC WORKS

48" MANHOLE FLAT LID SECTION

CONSTRUCTION STANDARDS AND DETAILS

WW-08
SCALE: N.T.S.
ISSUE DATE: 5-28-19



NOTE:

1. INSERT-A-TEE MAY BE USED IN LIEU OF SEAL BOOT FOR FIBERGLASS MANHOLES.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

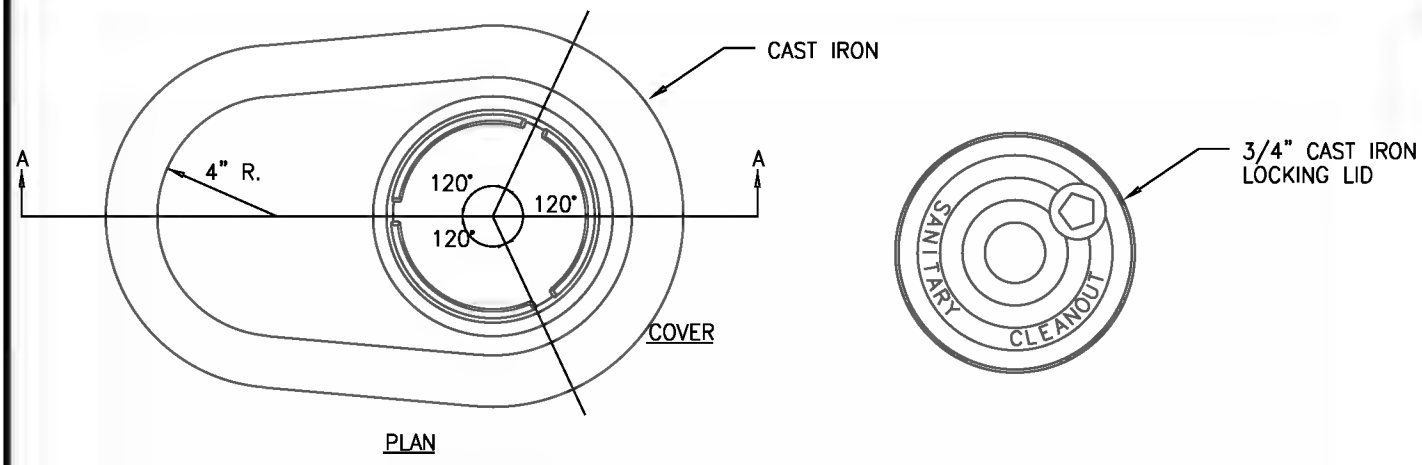
FLEXIBLE "SEAL BOOT" CONNECTOR

CONSTRUCTION STANDARDS AND DETAILS

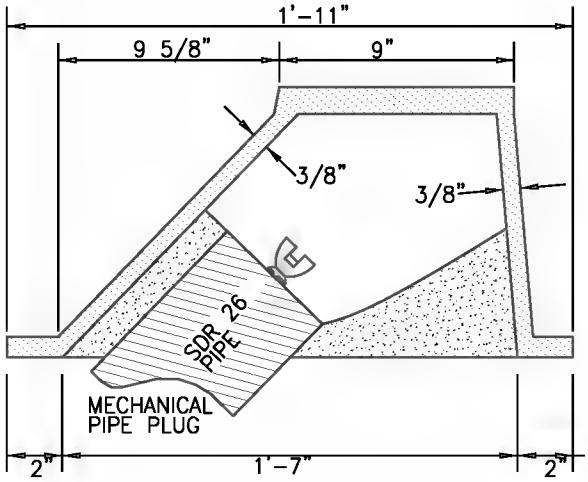
WW-09

SCALE: N.T.S.

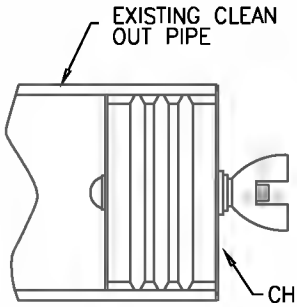
ISSUE DATE: 5-28-19



PLAN



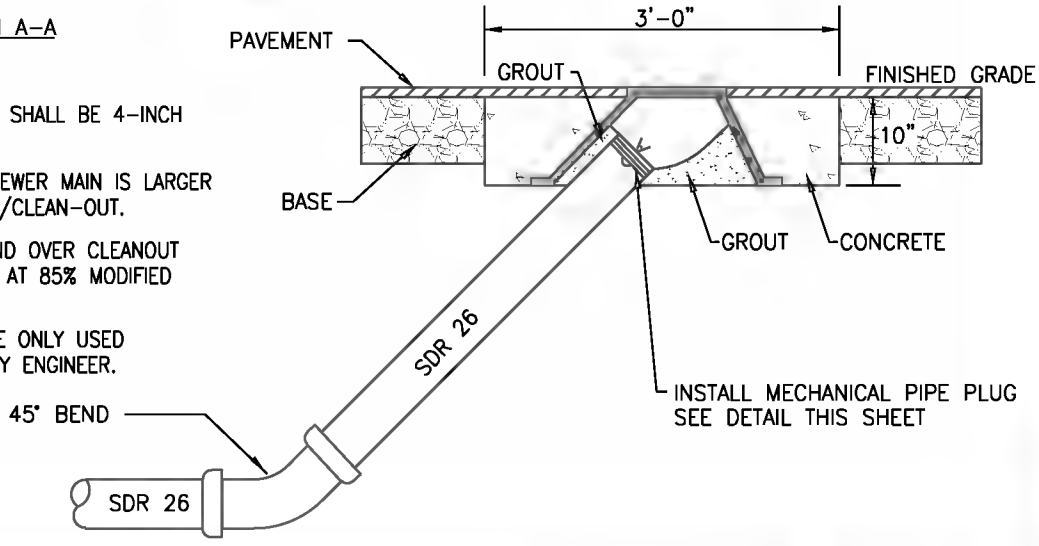
SECTION A-A



CHERNE MECHANICAL ECON-O-GRIP PIPE PLUG. PART #271-578, OR APPROVED EQUAL.

NOTES:

1. CLEANOUT AND FITTINGS SHALL BE 4-INCH MINIMUM.
2. USE REDUCER WHERE SEWER MAIN IS LARGER DIAMETER THAN SERVICE/CLEAN-OUT.
3. BACKFILL IN AROUND AND OVER CLEANOUT PIPE SHALL BE TAMPED AT 85% MODIFIED PROCTOR OF SOIL.
4. SEWER CLEAN-OUTS ARE ONLY USED WHEN APPROVED BY CITY ENGINEER.

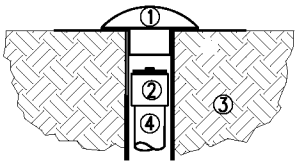


CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SEWER CLEAN-OUT
STANDARD FOR SEWER MAINS

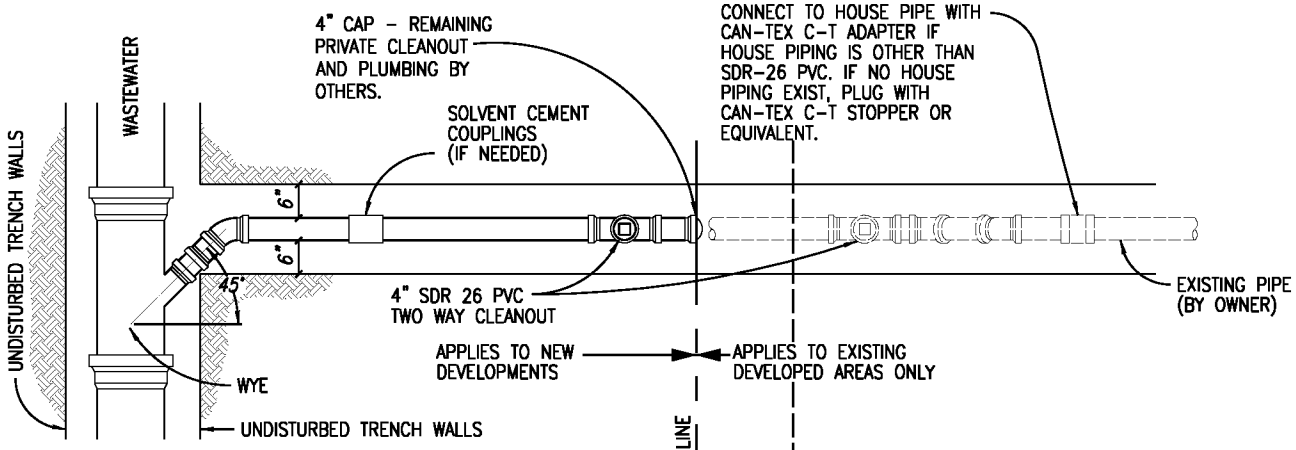
CONSTRUCTION STANDARDS AND DETAILS



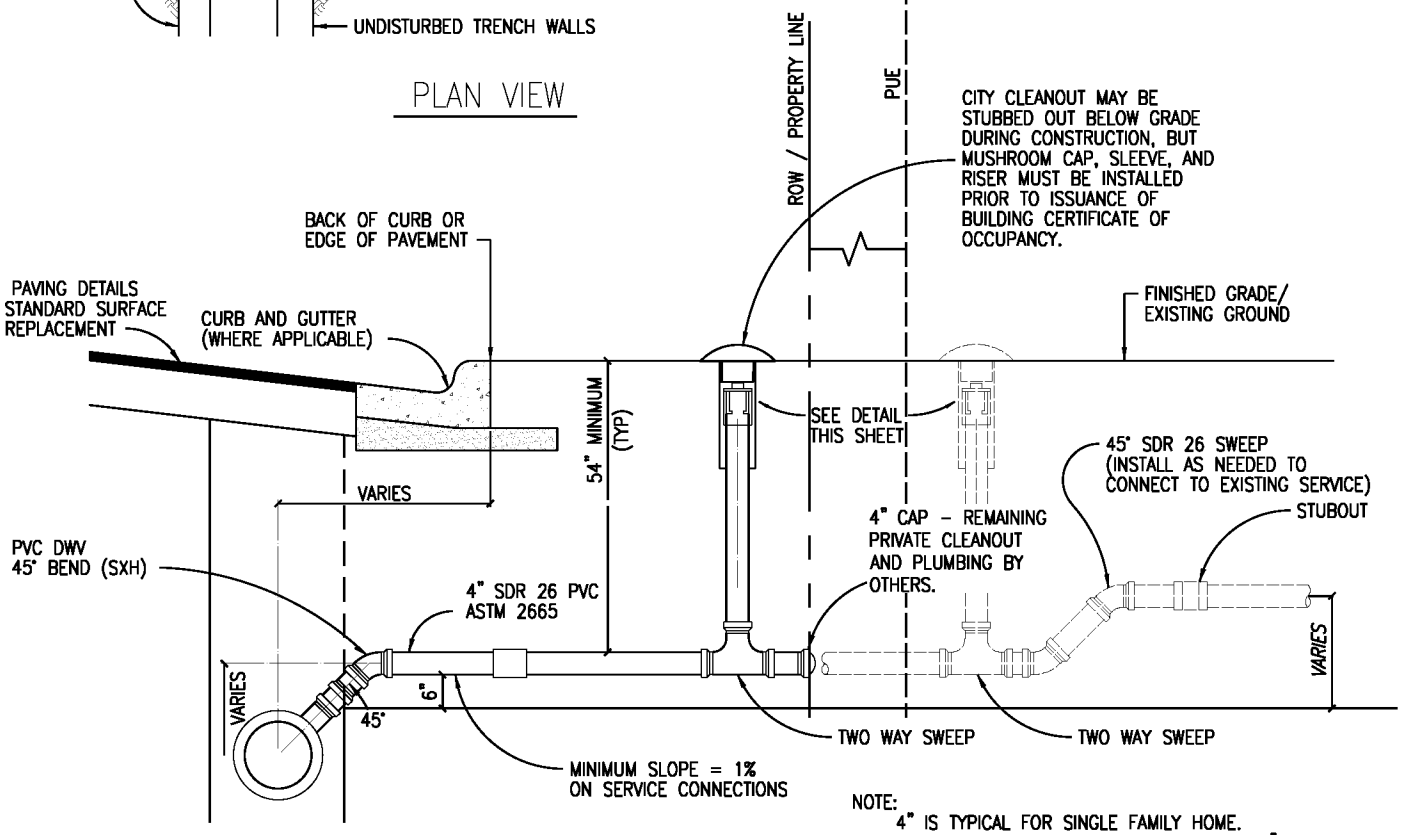
CLEANOUT

CLEANOUT NOTES:

1. MUSHROOM CAP PART NO. AccuCast #115901 or SIMILAR
2. 4" SDR 26 PVC THREADED COLLAR & PLUG
3. 6" SDR 26 18" PVC SLEEVE
4. 4" SDR 26 CLEANOUT RISER



PLAN VIEW



NOTE:
4" IS TYPICAL FOR SINGLE FAMILY HOME.
BUSINESS OR INDUSTRY MAY NEED TO BE 6" OR LARGER.

SECTION VIEW

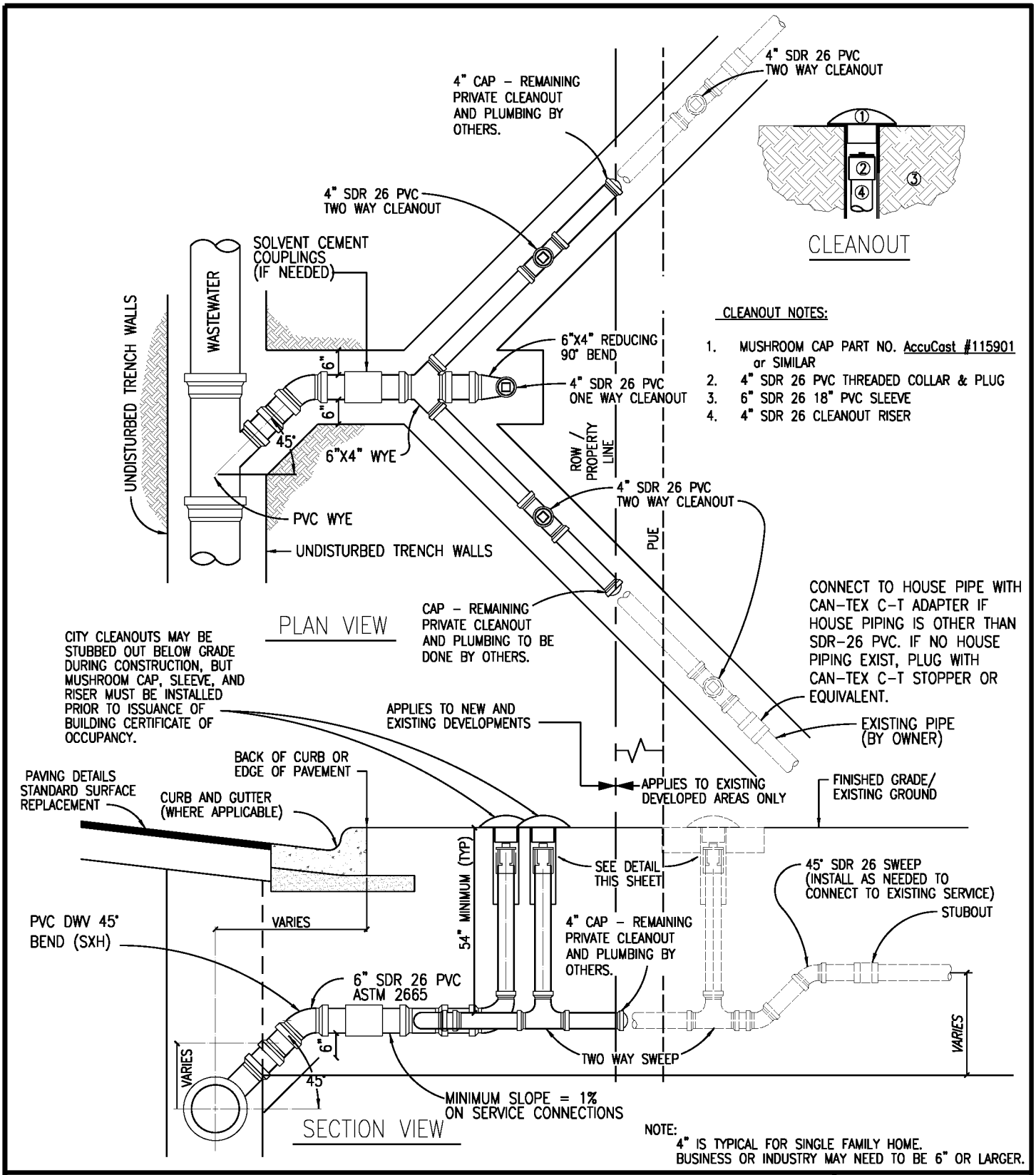
CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

SINGLE WASTEWATER SERVICE CONNECTION

CONSTRUCTION STANDARDS AND DETAILS

WW-11
SCALE: N.T.S.
ISSUE DATE: 5-28-19



CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

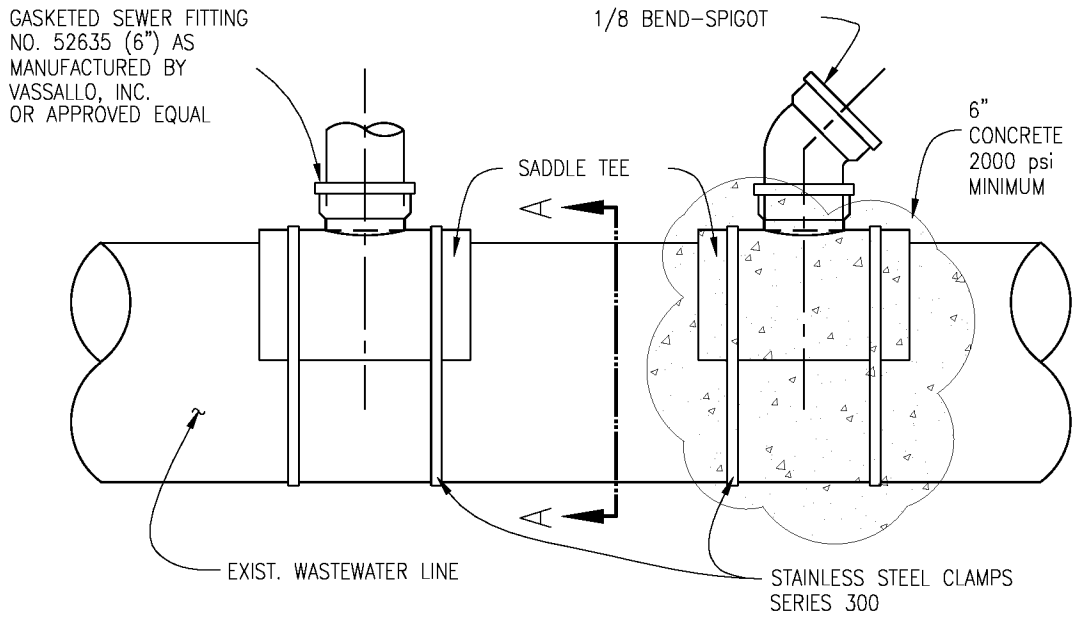
DUAL WASTEWATER SERVICE CONNECTION

CONSTRUCTION STANDARDS AND DETAILS

WW-12

SCALE: N.T.S.

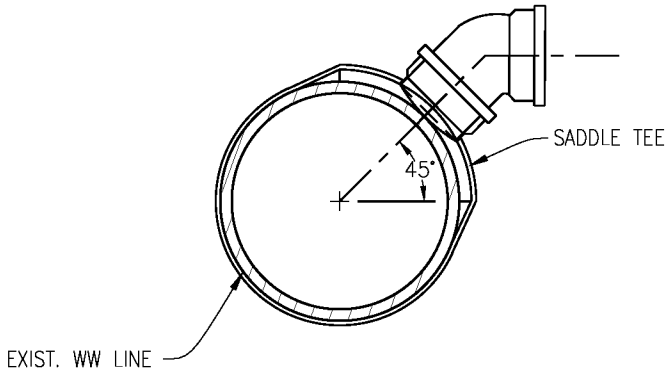
ISSUE DATE: 5-28-19



PLAN VIEW

SADDLE TEE				
PART NO.	SIZE	L1	H	P
52635	8"X6"	5.625	5.659	1.448

PLASTIC TRENDS INC. – 1/8 BEND – SPIGOT					
PART NO.	SIZE	A	B	C	D
G 406	6	11.270	6.146	1.870	6.090



SECTION A-A

NOTES:

1. FLEXIBLE SADDLE TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS.
2. SADDLE TEE SHALL BE ORIENTATED 45° TO MAIN.
3. EXCAVATE AROUND EXISTING 8-INCH PIPE, EXPOSING SUFFICIENT ROOM FOR S.S. CLAMPS.
4. THOROUGHLY CLEAN AND DRY THE MATING SURFACE WITH RAG OR PAPER TOWEL MAKE SURE THEY ARE FREE OF DUST AND MOISTURE.
5. MARK THE SIZE OF THE HOLE TO BE CUT USING THE GASKET SKIRT OR THE SADDLE ITSELF AS THE TEMPLATE.
6. SAW OUT THE SECTION OF THE PIPE WHERE THE SADDLE WILL BE LOCATED, WITH A SABER OR KEY HOLE SAW.
7. TEST TO MAKE SURE SADDLE FITS HOLE PROPERLY.
8. SERVICE PIPE SHALL NOT EXTEND MORE THAN ONE-HALF INCH INTO THE MAIN.
9. PLACE GASKET SKIRT AND SADDLE OVER OPENING AND TIGHTEN BAND CLAMPS EVENLY UNTIL SADDLE IS FIRMLY ATTACHED TO THE PIPE. APPLY PRESSURE ON THE SADDLE AGAINST THE PIPE WHILE TIGHTENING THE CLAMPS AS INDICATED ABOVE. DO NOT OVER TIGHTEN, DO NOT STRIP THREAD.
10. REPLACE THE BEDDING AND BACKFILL IN ACCORDANCE WITH THE TRENCH EMBEDMENT DETAIL.
11. CONCRETE SHALL BE PLACED AROUND SADDLE.

CITY OF BELTON, TEXAS

DEPARTMENT OF PUBLIC WORKS

GASKETED SEWER FITTING FOR SEWER SERVICE CONNECTIONS TO EXISTING MAINS

CONSTRUCTION STANDARDS AND DETAILS

WW-13
SCALE: N.T.S.
ISSUE DATE: 5-28-19

Appendix A
Public Works Design Manual

for the

Installation of Network Nodes and Node Support Poles

pursuant to Tex. Loc. Gov. Code, Chapter 284.

Table of Contents

SECTION 1. PURPOSE AND APPLICABILITY.

The City of Belton ("City") recognizes that the State of Texas has delegated to the City the fiduciary duty, as a trustee, to manage the public right-of-way for the health, safety, and welfare of the public to Texas municipalities.

Purpose: Loc. Gov. Code, Chapter 284 allows certain wireless Network Providers to install in the public rights-of-way their wireless facilities, described and defined in Tex. Loc. Gov. Code, Chapter 284, Sec. 284.002 as "Micro Network Nodes", "Network Nodes", and "Node Support Poles".

As expressly allowed by Tex. Loc. Gov. Code, Chapter 284, Section 284.108, and pursuant to its police power authority reserved in Sec. 284.301, the City enacts these Design Guidelines in order to meet its fiduciary duty to the citizens of the City, and to give assistance and guidance to wireless telecommunications providers to assist such companies in the timely, efficient, safe and aesthetically pleasing installation of technologically competitive equipment.

Applicability: This Public Works Design Manual is for siting and criteria for the installation Wireless Facilities, including Micro Network Nodes, Network Nodes, Node Support Poles and related ground equipment being installed pursuant to Loc. Gov. Code, Chapter 284

This Manual shall apply to any sitings, installations, collocations in, on, over or under the public rights-of-way of Network nodes, Node support poles, Micro network nodes, Distributed Antenna Systems, microwave communications or other Wireless Facilities, by whatever nomenclature, whether they are installed pursuant to Chapter 284, or installed pursuant to an agreement as agreed to and consented to by the City in its discretion, or installed as may otherwise be allowed by state law.

City Rights-of-Way Management Ordinance: A Network Provider shall comply with the City's Rights-of-Way Management Ordinance except where in conflict with this Manual or Chapter 284, Subchapter C.

SECTION 2. DEFINITIONS.

The definitions as used in Tx. Loc. Gov. Code, Chapter 284, Sec. 284.002 and City of Belton Code of Ordinances, Section 20-143 shall be used in this Manual, unless otherwise noted below.

Abandon and its derivatives means the facilities installed in the right-of-way (including by way of example but not limited to: poles, wires, conduit, manholes, handholes, cuts, network nodes and node support poles, or portion thereof) that have been left by Provider in an unused or non-functioning condition for more than 120 consecutive calendar days unless, after notice to Provider, Provider has established to the reasonable satisfaction of the City that the applicable facilities, or portion thereof, is still in active use.

Antenna means communications equipment that transmits or receives electromagnetic radio frequency signals used in the provision of wireless services.

Applicable codes means:

(A) uniform building, fire, electrical, plumbing, or mechanical codes adopted by a recognized national code organization; and

(B) local amendments to those codes to the extent not inconsistent with Chapter 284.

City means the City of Belton, Texas or its lawful successor, or its designated agent.

Chapter 284 means Tex. Loc. Gov. Code, Chapter 284.

Collocate and c*ollocation* mean the installation, mounting, maintenance, modification, operation, or replacement of network nodes in a public right-of-way on or adjacent to a pole.

Concealment or Camouflaged means any Wireless Facility or Pole that is covered, blended, painted, disguised, camouflaged or otherwise concealed such that the Wireless Facility blends into the surrounding environment and is visually unobtrusive as allowed as a condition for City advance approval under Chapter 284, Sec. 284.105 in Historic or Design Districts. A Concealed or Camouflaged Wireless Facility or Pole also includes any Wireless Facility or Pole conforming to the surrounding area in which the Wireless Facility or Pole is located and may include, but is not limited to hidden beneath a façade, blended with surrounding area design, painted to match the supporting area, or disguised with artificial tree branches.

Decorative pole means a streetlight pole specially designed and placed for aesthetic purposes and on which no appurtenances or attachments, other than specially designed informational or directional signage or temporary holiday or special event attachments, have been placed or are permitted to be placed according to nondiscriminatory municipal codes.

Design District means an area that is zoned, or otherwise designated by municipal code, and for which the city maintains and enforces unique design and aesthetic standards on a uniform and nondiscriminatory basis.

Disaster emergency or *disaster* or *emergency* means an imminent, impending, or actual natural or humanly induced situation wherein the health, safety, or welfare of the residents of the city is threatened, and includes, but is not limited to any declaration of emergency by city state or federal governmental authorities.

Distributed Antenna System or DAS shall be included as a type of "Network Node."

Easement means and shall include any public easement or other compatible use created by dedication, or by other means, to the city for public utility purposes or any other purpose whatsoever. "Easement" shall include a private easement used for the provision of utilities.

Federal Communications Commission or FCC means the Federal Administrative Agency, or lawful successor, authorized to oversee cable television and other multi-channel regulation on a national level.

Highway right-of-way means right-of-way adjacent to a state or federal highway.

Historic district means an area that is zoned or otherwise designated as a historic district under municipal, state, or federal law.

Law means common law or a federal, state, or local law, statute, code, rule, regulation, order, or ordinance.

Local means within the geographical boundaries of the City.

Location means the City approved and lawfully permitted location for the Network Node.

Macro tower means a guyed or self-supported pole or monopole greater than the height parameters prescribed by Chapter 284, Section 284.103 and that supports or is capable of supporting antennas.

Micro network node means a network node that is not larger in dimension than 24 inches in length, 15 inches in width, and 12 inches in height, and that has an exterior antenna, if any, not longer than 11 inches.

Municipal park means an area that is zoned or otherwise designated by municipal code as a public park for the purpose of recreational activity.

Municipally owned utility pole means a utility pole owned or operated by a municipally owned utility, as defined by Section 11.003, Utilities Code, and located in a public right-of-way.

MUTCD means Manual of Uniform Traffic Control Devices.

Network node means equipment at a fixed location that enables wireless communications between user equipment and a communications network. The term:

(A) includes:

(i) equipment associated with wireless communications;

(ii) a radio transceiver, an antenna, a battery-only backup power supply, and comparable equipment, regardless of technological configuration; and

(iii) coaxial or fiber-optic cable that is immediately adjacent to and directly associated with a particular collocation; and

(B) does not include:

(i) an electric generator;

(ii) a pole; or

(iii) a macro tower.

Network provider means:

(A) a wireless service provider; or

(B) a person that does not provide wireless services and that is not an electric utility but builds or installs on behalf of a wireless service provider:

(i) network nodes; or

(ii) node support poles or any other structure that supports or is capable of supporting a network node.

Node support pole means a pole installed by a network provider for the primary purpose of supporting a network node.

Permit means a written authorization for the use of the public right-of-way or collocation on a service pole required from a municipality before a network provider may perform an action or initiate, continue, or complete a project over which the municipality has police power authority.

Pole means a service pole, municipally owned utility pole, node support pole, or utility pole.

Private easement means an easement or other real property right that is only for the benefit of the grantor and grantee and their successors and assigns.

Provider has the same meaning as "Network Provider."

Public right-of-way means the area on, below, or above a public roadway, highway, street, public sidewalk, alley, waterway, or utility easement in which the municipality has an interest. The term does not include:

(A) a private easement; or

(B) the airwaves above a public right-of-way with regard to wireless telecommunications.

Public right-of-way management ordinance means an ordinance that complies with Chapter 284, Subchapter C.

Service pole means a pole, other than a municipally owned utility pole, owned or operated by a municipality and located in a public right-of-way, including:

(A) a pole that supports traffic control functions;

(B) a structure for signage;

(C) a pole that supports lighting, other than a decorative pole; and

(D) a pole or similar structure owned or operated by a municipality and supporting only network nodes.

Small cell shall be included as a type of "Network Node."

Street means only the paved portion of the right-of-way used for vehicular travel, being the area between the inside of the curb to the inside of the opposite curb, or the area between the two parallel edges of the paved roadway for vehicular travel where there is no curb. A "Street" is generally part of, but smaller in width than the width of the entire right-of-way, while a right-of-way may include sidewalks and utility easements, a "Street" does not. A "street" does not include the curb or the sidewalk, if either are present at the time of a permit application or if added later.

SWPPP shall mean Storm Water Pollution Prevention Plan.

TAS means Texas Accessibility Standards.

Traffic Signal means any device, whether manually, electrically, or mechanically operated by which traffic is alternately directed to stop and to proceed.

Transport facility means each transmission path physically within a public right-of-way, extending with a physical line from a network node directly to the network, for the purpose of providing backhaul for network nodes.

Underground Requirement Area shall mean means an area where poles, overhead wires, and associated overhead or above ground structures have been removed and buried or have been approved for burial underground pursuant to municipal ordinances, zoning regulations, state law, private deed restrictions, and other public or private restrictions, that prohibit installing aboveground structures in a public right-of-way.

User means a person or organization which conducts a business over facilities occupying the whole or a part of a public street or right-of-way, depending on the context.

Utility pole means a pole that provides:

(A) electric distribution with a voltage rating of not more than 34.5 kilovolts; or

(B) services of a telecommunications provider, as defined by Chapter 284, Section 51.002, Utilities Code.

Wireless service means any service, using licensed or unlicensed wireless spectrum, including the use of Wi-Fi, whether at a fixed location or mobile, provided to the public using a network node.

Wireless service provider means a person that provides wireless service to the public.

Wireless facilities mean "Micro Network Nodes," "Network Nodes," and "Node Support Poles" as defined in Texas Local Government Code Chapter 284.

SECTION 3. PROHIBITED AND PREFERRED LOCATIONS OF MICRO NETWORK NODE, NETWORK NODE, NODE SUPPORT POLE AND RELATED GROUND EQUIPMENT.

A. Prohibited or Restricted Areas for Certain Wireless facilities, except with Separate City Agreement or Subject to Concealment Conditions.

1. ***Municipal Parks and Residential Areas***. In accordance with Chapter 284, Sec. 284.104 (a), a Network Provider may not install a Node Support Pole in a public right-of-way without the City's discretionary, nondiscriminatory, and written consent if the public right-of-way is in a Municipal park or is adjacent to a street or thoroughfare that is:

(1) not more than 50 feet wide of paved street surface, being the area measured as the shortest distance between the inside of the curb to the inside of the opposite curb, or the area measured as the shortest distance between the two parallel edges of the paved roadway for vehicular travel where there is no curb; and

(2) adjacent to single-family residential lots or other multifamily residences or undeveloped land that is designated for residential use by zoning or deed restrictions.

1.1. In accordance with Chapter 284, Sec. 284.104 (b), a Network Provider installing a Network Node or Node Support Pole in a public right-of-way described above shall comply with private deed restrictions and other private restrictions in the area that apply to those facilities.

Each permit application shall disclose if it is within a Municipal Park and Residential Areas as described above.

2. ***Historic District and Design Districts***. In accordance with Chapter 284, Sec. 284.105, a Network Provider must obtain advance written approval from the City before collocating Network Nodes or installing Node Support Poles in a Design District with Decorative Poles or in an area of the City zoned or otherwise designated as a Design District or Historic District.

2.1. As a condition for approval of Network Nodes or Node Support Poles in Design Districts with Decorative Poles or in a Historic District, the City shall require reasonable design or Concealment measures for the Network Nodes or Node Support Poles. Therefore, any request for installations in a Design District with Decorative Poles or in a Historic District, must be accompanied with proposed Concealment measures in the permit applications.

2.2. The City request that a Network Provider explore the feasibility of using Camouflage measures to improve the aesthetics of the Network Nodes, Node Support Poles, or related ground equipment, or any portion of the nodes, poles, or equipment, to minimize the impact to the aesthetics in Design Districts or in an Historic District.

2.3. Network Provider shall comply with and observe all applicable City, State, and federal historic preservation laws and requirements.

2.4. Each permit application shall disclose if it is within a Design District with Decorative Poles or in an area of the City zoned or otherwise designated as a Design District or Historic District.

3. ***Historic Landmarks.*** A Network Provider is discouraged from installing a Network Node or Node Support Pole within 300 feet of a historic site or structure or Historic Landmark recognized by the City, state or federal government (*see, for example, and not limited to* §442.001(3) of the Texas Government Code, and 16 U.S.C. §470), as of the date of the submission of the permit. It is recommended that each permit application disclose if it is with 300 feet of such a structure.

4***. Compliance with Undergrounding Requirements.*** In accordance with Chapter 284, Sec. 284.107, a Network Provider shall comply with nondiscriminatory undergrounding requirements, including municipal ordinances, zoning regulations, state law, private deed restrictions, and other public or private restrictions, that prohibit installing aboveground structures in a public right-of-way without first obtaining zoning or land use approval.

4.1 Areas may be designated from time to time by the City as Underground Requirement Areas in accordance with filed plats, and or conversions of overhead to underground areas, as may be allowed by law.

4.2 Each permit application shall disclose if it is within an area that has undergrounding requirements.

B. **Least preferable locations**.

1. **Residential Areas and Parks**. A Network Provider is not allowed to install a Network Node on an existing pole in a public right-of-way without written consent from the City if the public right-of-way is located in or adjacent to a street or thoroughfare that is adjacent to a municipal park or single-family residential lots or other multifamily residences or undeveloped land that is designated for residential use by zoning or deed restrictions.

1.1 In accordance with Chapter 284, Sec. 284.104 (b) a Network Provider installing a Network Node or a Node Support Pole in a public right-of-way shall comply with private deed restrictions and other private restrictions in the area that apply to those facilities.

2. **Historic Districts and Design Districts**. A Network Provider is not allowed to install a Network Node or a Node Support Pole in the public right-of-way in any area designated by the City as a Design Districts or in an area of the City zoned or otherwise designated as a Historic District without written consent from the City and unless such a Network Node or a new Node Support Pole is camouflaged.

C. Most preferable locations

1. *Industrial areas* if not adjacent to a Municipal Park, Residential area, Historic District or Design District.

2. *Highway Rights-of-Way* areas if not adjacent to a Municipal Park, Residential area, Historic District or Design District.

3. *Retail and Commercial areas* if not adjacent to a Municipal Park, Residential area, Historic District or Design District.

D. Designated Areas.

1. The City may designate an area as a Historic District or a Design District under Chapter 284.105 at any time. Both historical and design districts require decorative black powdered poles and fixtures, brick pavers in sidewalks, stealth/camouflaged facilities, and underground facilities, unless otherwise approved.

2. Currently designated *Historic Districts* are:

(a) Ordinance 2012-48 – Lower West Belton Historic District.
(b) Ordinance 2012-49 – South Main Historic District.
(c) Ordinance 2012-50 – Downtown Belton Commercial Historic District.
(d) Ordinance 2012-51 – Central Belton Historic District.
(e) Ordinance 2012-52 – North Central Belton Historic District.

3. Currently designated *Design District* areas are:

(a) Design District Number 1 is the area referred to as Central Belton Design District. Its boundaries are generally between 6th Avenue and Nolan Creek and generally between Penelope Street and Interstate 35.

(b) Design District Number 2 is the area referred to as Main Street Design District. Its boundaries are along the east side of Main Street, generally between 2nd Avenue and 6th Avenue.

4. The failure to designate an area in this Chapter shall not mean that such an area is not within a defined district, if so designated by the City. Future areas may be designated as one of these Districts at any time. Such a designation does not require a zoning case.

5. Currently designated *Underground Compliance Areas* are historical and design districts.

E. Exceptions

The City by its discretionary consent and agreement may grant exception to the above prohibited locations and sizes, but only in a non-exclusive, and non-discriminatory manner, as allowed or required by Chapter 284, Sec. 284.109 and Sec. 284.110.

F. Order of Preference regarding Network Node attachment to existing facilities and New Node Support Poles.

1. *Existing telephone or electrical lines between existing utility poles*. Micro Network Nodes shall only be lashed on existing telephone or electrical lines between existing utility poles (electric poles or telephones poles), with notice to and approval by the pole owner as required by the Federal Pole Attachment Act, and not placed on Utility Poles, Node Support Poles or Service Poles.

2. *Existing Utility Poles* (electric poles or telephones poles), shall be the preferred support facility for Network Nodes and related ground equipment.

3. *Municipal Service Poles*:

a. *Non-decorative street lights* with a height of more than 20 feet.

b. *Traffic signal structures* when such installation will not interfere with the integrity of the facility and will not interfere with the safety of public and in accordance with an agreement as allowed by Chapter 284, Sec. 285.056 and Sec. 284.101 (a) (3), and (b).

c. *Street signage* shall be a low priority use for attachment of a Network Node and such installation shall not interfere with the integrity of the facility and will not interfere with the safety of public and in accordance with an agreement as allowed by Chapter 284, Sec. 285.056 and Sec. 284.101 (a) (3), and (b). Installation of nodes shall not conflict with MUTCD requirements.

d. The use of existing *automatic meter infrastructure towers* may be allowed, if tower loading analysis proves the installation is acceptable and the node causes no interference with the meter infrastructure.

e. *Water tower* use is discouraged.

f. *City Way Finding Signs* use is discouraged.

g. *Other municipal Service pole* use is discouraged.

4. *New node support poles* shall be the least preferred type of allowed facility for attachment of Network Nodes.

4. *Ground Equipment***.** Ground equipment should be minimal and the least intrusive.

SECTION 4. GUIDELINES ON PLACEMENT.

A. Generally.

In accordance with Chapter 284.102, a Network Provider shall construct and maintain Network Nodes and Node Support Poles in a manner that does not:

1. obstruct, impede, or hinder the usual travel or public safety on a public right-of-way;

2. obstruct the legal use of a public right-of-way by other utility providers;

3. violate nondiscriminatory applicable codes;

4. violate or conflict with the municipality's publicly disclosed public right-of-way management ordinance or this Manual.

5. violate the federal Americans with Disabilities Act of 1990 (42 U.S.C. Section 12101 et seq.).

B. General Requirements and Information:

1. *Size Limits.* Network Providers shall provide detailed drawings, with calculations to show strict conformity to the size limitations as set forth in Chapter 284, in accordance with, but not limited to Chapter 284, Sec. 284.002, size of a Micro Network Node, Sec. 284.003, Size of Network Nodes, and Sec. 284.103, Max. pole height, with each application and with each request for a permit for each location.

2. *State and Federal Rights-of-way permit*. If the project lies within a Highway Right-of-Way, the applicant must provide evidence of a permit from the State or Federal Government.

3. *Confirmation of non-interference with City Safety Communication Networks*.

a. The Network Provider needs to provide analysis that the proposed network node shall not cause any interference with City public safety radio system, traffic signal light system, or other city safety communications components in accordance with Chapter 284, Sec. 284.304.

b. It shall be the responsibility of the Network Provider to evaluate, prior to making application for permit, the compatibility between the existing City infrastructure and Provider's proposed Network Node. A Network Node shall not be installed in a location that causes any interference. Network Nodes shall not be allowed on City's public safety radio infrastructure.

4. *Improperly Located Network Node facilities, Node Support Poles and related ground equipment*:

a. Improperly Located Network Node facilities, Node Support Poles and related ground equipment shall not impede pedestrian or vehicular traffic in the Right-of-Way. If any Network Node facilities, Node Support Poles or ground equipment is installed in a location that is not in accordance with the plans approved by the City and impedes pedestrian or vehicular traffic or does not comply or otherwise renders the Right-of-Way non-compliant with applicable Laws, including the American Disabilities Act, then Network Provider shall promptly remove the Network Node facilities, Node Support Poles or ground equipment.

b. Notice to Remove unauthorized facilities and relocate and penalty: After 30 days' notice to remove of Network Node facilities, Node Support Poles or ground equipment that is located in the incorrect permitted location, if not relocated the Network Provider shall be subject to a penalty as stated in the City's current adopted Right-of-Way Management Ordinance until the Network Node facilities, Node Support Poles or ground equipment is relocated to the correct area within the permitted Location, regardless of whether or not the Network Provider's contractor, subcontractor, or vendor installed the Network Node facilities, Node Support Poles or ground equipment in strict conformity with the City Rights-of-way management ord., and other applicable ordnances concerning improperly located facilities in the rights-of-way.

B. Underground Requirement Areas.

1. In accordance with Chapter 284.107, a Network Provider shall, in relation to installation for which the City approved a permit application, comply with nondiscriminatory undergrounding requirements, including municipal ordinances, zoning regulations, state law, private deed restrictions, and other public or private restrictions, that prohibit installing aboveground structures in a public right-of-way without first obtaining zoning or land use approval.

2. If a location is designated by the City to transits to be an Underground Requirement Area, then a Network Provider's permit for the location of the Micro Network Node, Network Node, Node Support Pole, and related ground equipment at such location will be revoked 90 days after the designation, with removal of said the Micro Network Node, Network Node, Node Support Pole, and related ground equipment at such location within 90 days of such designation, or as otherwise reasonably allowed by the City for the transition of other overhead facilities.

C. Network Node facilities placement*:*

1. *Right-of-Way:* Network Node facilities, Node Support Poles and related ground equipment shall be placed, as much as possible, within two feet of the outer edge of the Right-of-Way line to minimize any obstruction, impediment, or hindrance to the usual travel or public safety on a public right-of-way.

2. *Height above ground.* Network Node attachments to a pole shall be installed at least eight (8) feet above the ground in accordance with Chapter 284, Sec. 284.108, and if a Network Node attachment is projecting toward the street, for the safety and protection of the public and vehicular traffic, the attachment shall be installed no less than sixteen (16) feet above the ground.

3. *Protrusions.* In accordance with Chapter 284, Sec. 284.003 (a) (1) (C), Sec. 284.003 (a) (2) (C) and Sec. 284.003 (a) (3) (B) no protrusion from the outer circumference of the existing structure or pole shall be more than two (2) feet.

4. *Limit on number of Network Nodes per Site*. There shall be no more than one Network Node on any one Pole.

D. New Node Support Poles.

1. *New Node Support Poles Spacing.* New node support poles shall be spaced apart from existing utility poles or Node Support poles at the same as the spacing between utility poles in the immediate proximity, but no less than at a minimum 300 feet from a utility pole or another Node Support Pole to minimize the hazard of poles adjacent to road ways and to minimize effect on property values and aesthetics on the area.

2. *Height of Node Support Poles or modified Utility Pole*. In accordance with Chapter 284, Sec. 284.103 a Node support pole or modified Utility Pole may not exceed the lesser of:

(1) 10 feet in height above the tallest existing utility pole located within 500 linear feet of the new pole in the same public right-of-way; or

(2) 55 feet above ground level.

E. Ground Equipment.

1. *Ground Equipment near street corners and intersections:* Ground equipment should be minimal and the least intrusive. In accordance with Chapter 284.102 (1), to minimize any obstruction, impediment, or hindrance to the usual travel or public safety on a public right-of-way the maximum line of sight required to add to safe travel of vehicular and pedestrian traffic and in order to maximize that line of sight at street corners and intersections and to minimize hazards at those locations, ground equipment may not be installed within 250 feet of a street corner or a street intersection.

2. *Ground Equipment near Municipal Parks.* For the safety of Municipal park patrons, particularly small children, and to allow full line of sights near Municipal park property, the Network Provider shall not install Ground Equipment in a Right-of-Way that is within a Park or within 250 feet of the boundary line of a Park, unless approved by the City in writing.

F. Municipal Service Poles:

1. *In accordance with Agreement*: Installations on all Service Poles shall be in accordance with an agreement as allowed by Chapter 284, Sec. 285.056 and Sec. 284.101 (a) (3), and (b).

2. *Required industry standard pole load analysis*: Installations on all Service Poles shall have an industry standard pole load analysis completed and submitted to the municipality with each permit application indicating that the Service Pole to which the Network Node is to be attached will safely support the load, in accordance with Chapter 284.108.

3. *Height of attachments*: All attachments on all Service Poles shall be at least 8 feet above grade, in accordance with Chapter 284, Sec. 285.108 (a) (1) - (2) and if a Network Node attachment is projecting toward the street, for the safety and protection of the public and vehicular traffic, the attachment shall be installed no less than sixteen (16) feet above the ground.

3. *Installations on Traffic Signals*: Installations on all Traffic signal structures must not interfere with the integrity of the facility in any way that may compromise the safety of the public and must be in accordance with an agreement as allowed by Chapter 284, Sec. 285.056 and Sec. 284.101 (a) (3), and (b). Installation of Network Node facilities on any traffic signal structures shall:

i. Be encased in a separate conduit than the traffic light electronics;

ii. Have a separate electric power connection than the traffic signal structure; and

iii. Have a separate access point than the traffic signal structure; and

4. *Installations on Street signage*: Installations on all street signage structures must not interfere with the integrity of the facility in any way that may compromise the safety of the public. Installation of Network Node facilities on any street signage structures that has electrics shall:

i. Be encased in a separate conduit than any City signage electronics;

ii. Have a separate electric power connection than the signage structure;

iii. Have a separate access point than the signage structure; and

SECTION 5. GENERAL AESTHETIC REQUIREMENTS

A. Concealment.

1. Concealment of Network Nodes and Node support poles shall be required by the City in Design Districts with Decorative Poles and in Historic Districts pursuant to Chapter 284.105.

2. It is also the City's preference that all new node support poles be camouflaged, except those located in an area zoned or predominantly industrial area. Companies shall submit their proposal for camouflage with the permit application.

3. The Network Node facilities shall be concealed or enclosed as much as possible in an equipment box, cabinet, or other unit that may include ventilation openings. External cables and

wires hanging off a pole shall be sheathed or enclosed in a conduit, so that wires are protected and not visible or visually minimized to the extent possible, except to the extent not consistent with Chapter 284.

B. New Node Support Pole Spacing.

New node support poles shall be at a minimum 300 feet from a utility pole or another Node Support Pole to minimize the hazard of poles adjacent to road ways and to minimize effect on property values and aesthetics on the area.

C. Allowed Colors.

Colors in Historic Districts and Design Districts must be approved by the City from a palette of approved colors. Unless otherwise provided, all colors shall be earth tones or shall match the background of any structure the facilities are located upon and all efforts shall be made for the colors to be inconspicuous. Colors in areas other than in Historic Districts and Design Districts shall conform to colors of other installations of telecommunication providers in the immediately adjacent areas.

SECTION 6. ELECTRICAL SUPPLY

A. Network Provider shall be responsible for obtaining any required electrical power service to the Micro Network Node, Network Node facilities, Node Support Poles and ground equipment. The City shall not be liable to the Network Provider for any stoppages or shortages of electrical power furnished to the Micro Network Node, Network Node facilities, Node Support Poles or ground equipment, including without limitation, stoppages or shortages caused by any act, omission, or requirement of the public utility serving the structure or the act or omission of any other tenant or Network Provider of the structure, or for any other cause beyond the control of the City.

B. Network Provider shall not allow or install generators or back-up generators in the Right-of-Way in accordance with Chapter 284, Sec. 284.002 (12) (B) (1).

SECTION 7. INSURANCE, INDEMNITY, BONDING AND SECURITY DEPOSITS.

1. Insurance, bonding and security deposits shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

2. Indemnity shall be in accordance with Chapter 284, Sec. 284.302, as provided for in Chapter 283, Sec. 283.057 (a) and (b) of the Texas Loc. Gov't Code.

SECTION 8. INSTALLATION AND INSPECTIONS

A. INSTALLATION.

Network Provider shall, at its own cost and expense, install the Micro Network Node, Network Node facilities, Node Support Poles and related ground equipment in a good and workmanlike manner in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

B. INSPECTIONS.

The City, or designee, may perform visual inspections of any Micro Network Node, Network Node, Node Support Pole or related ground equipment located in the Right-of-Way

shall be allowed in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284

SECTION 9. REQUIREMENTS UPON ABANDONMENT OF OBSOLETE MICRO NETWORK NODE, NETWORK NODE, NODE SUPPORT POLE AND RELATED GROUND EQUIPMENT.

Abandoned or obsolete Micro Network Node, Network Node, Node Support Pole and related ground equipment shall be removed in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

SECTION 10. GENERAL PROVISIONS.

1. As Built Maps and Records. Network Provider's as built maps and records shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

3. DRUG POLICY. Drug policy of Network provider's personnel, and contractors in the rights-of-way shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

4. **ALLOCATION OF FUNDS FOR REMOVAL AND STORAGE**. The City has appropriated $0 to pay for the cost of any removal or storage of Micro Network Node, Network Node, Node Support Pole and related ground equipment, as authorized under this Article, and no other funds are allocated.

5. **OWNERSHIP**. Ownership of Network Node and related equipment shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

6. Tree Maintenance. Tree maintenance shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

7. Signage. Signage shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

8. Graffiti Abatement. Graffiti abatement shall be in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

9. Restoration.

Network Provider shall restore and repair of the rights-of-way from any damage to the Right-of-Way, or any facilities located within the Right-of-Way, and the property of any third party resulting from Network Provider's removal or relocation activities (or any other of Network Provider's activities hereunder) in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

10. Network provider's responsibility.

Network Provider shall be responsible and liable for the acts and omissions of Network Provider's employees, temporary employees, officers, directors, consultants, agents, Affiliates, subsidiaries, sub-Network Provider's and subcontractors in connection with the installations of any Micro Network Node, Network Node, Node Support Pole and related ground equipment, as if such acts or omissions were Network Provider's acts or omissions in strict accordance with the City's rights-of-way management ordinance, and other applicable ordinances, except to the extent not consistent with Chapter 284.

SECTION 11-19 RESERVED

SECTION 20. PUBLIC WORKS DESIGN MANUAL - UPDATES

Placement or Modification of Micro Network Node, Network Node, Node Support Pole and related ground equipment shall comply with the Public Works Design Manual at the time the Permit for installation or Modification is approved and as amended from time to time.