TAYLOR

TEXAS

January 2024

ENGINEERING MANUAL & DETAILS

CURRENT REVISION: January 10, 2024

RECORD OF REVISIONS

The initial version of this Manual was approved by the City Manager on: 11/01/2023.

The following list includes the effective date(s) of the City of Taylor's *Engineering Design Manual* and a summary of revisions and affected sections.

Revision No.	Effective Date	Signature	Description
0	11/01/2023	B. LaBorde	Final Draft Posted on City's Website Approved by City Manager
1	1/10/24	B. LaBorde	Sec 1.9.1 & 1.13.1.A: Added SUE Requirements for Utilities Sec 2.7.12: Added horizontal clearance for driveways Inserted Standard Construction Details

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SECTION 1 GENERAL DESIGN REQUIREMENTS

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SECTION 1 GENERAL DESIGN REQUIREMENTS

1.1 Title

These standards are hereby adopted and are cited as the "Engineering Design Manual & Details of the City of Taylor, Texas" ("Design Manual" or "Engineering Design Manual").

1.2 Introduction

The purpose of the Design Manual is to protect the public health, safety and welfare by establishing standard engineering practices, and minimum engineering construction and design requirements for the City of Taylor, TX and its extraterritorial jurisdiction ("ETJ"). This Design Manual consists of **Sections 1 through 9**, which provide generally applicable design requirements, as well as specific design requirements for the following facilities: thoroughfares (streets, paths, trails, roadways), traffic engineering; drainage; water; wastewater; appurtenant structures; and landscape/irrigation.

1.3 Interpretation, Applicability, and the Respective Roles of the Engineer and the City

1.3.1 Intent/Conflict Resolution – In the interpretation and application of the provisions of these regulations, it is the intention of the City that the principles, standards, and requirements provided for herein shall be minimum requirements for the design of both public and private development projects and City-maintained facilities located in the City and its ETJ where regulatory authority for design and construction is granted by the Charter or ordinances of the City, state or federal law, or interlocal agreement. Where City, State, Federal, or other applicable regulations are more restrictive than this Design Manual, such other ordinances or regulations shall govern.

1.3.2 References – All references herein shall be to the current edition. If there are any discrepancies between the data in this manual and the referenced publication, the data from the current edition of the referenced publication shall be used.

1.3.3 Definitions-Abbreviations – Refer to **Section 9**, Definitions-Abbreviations for applicable definitions of terms and abbreviations.

1.3.4 Figures – Figures in this manual are not necessarily to scale; the Engineer shall not rely upon the scale of figures included in this manual.

1.3.5 Responsibility of Engineer – The Engineer of Record shall be responsible for the application of the requirements of the Design Manual to the design of his/her project.

1.3.6 Role of City Review – City review of construction plans, reports and calculations will be conducted to verify that the submitted design has been performed in

compliance with the City's requirements but shall not be considered a detailed technical review for adequacy, accuracy, or completeness. The Engineer of Record performing the design shall remain responsible for the technical adequacy, accuracy and completeness of the design and shall not be relieved of any responsibility for such as a result of the City's review.

1.3.7 Other Requirements Applicable – The City has adopted various ordinances, master plans, policies, and documents that will apply to a project in addition to the requirements of this Manual. While not intended to be exhaustive, a list of potentially applicable regulations is provided below. The Engineer is responsible for compliance with all applicable City requirements, whether or not included on this list.

1.3.7.A General Notes – Refer to "City of Taylor General Construction Notes" template.

1.3.7.B Standard Details – Refer to City of Taylor Standard Construction Details and TxDOT Standards as applicable.

1.3.7.C Approved Materials Lists

1.3.7.D Technical Specifications as adopted or otherwise approved for use in the City of Taylor

1.3.7.E City of Taylor, TX City Code, as amended:

https://library.municode.com/tx/taylor/codes/code_of_ordinances

1.3.7.F Neighborhood Plan, Employment Center Plan – If a development project falls within an area covered by a Neighborhood Plan, Employment Center Plan, or other development agreement, compliance with those agreements is required.

1.3.7.G Master Plans & Maps

- Envision Taylor Comprehensive Plan
- Water Distribution System Master Plan & Map
- Wastewater Collection System Master Plan & Map
- Drainage Master Plan
- Main Street District Map
- Development Agreements Map
- Zoning Map
- Growth Sectors and Future Land Use Maps

1.3.7.H Additional Standards

- Construction Contract Documents (for public projects)
- Technical Specifications (for public projects)
- Irrigation Specifications and Details
- Landscaping Specifications
- Backflow Residential Irrigation Installation Requirements, Backflow Prevention Assembly Installation Guide, Backflow Exterior Installation Specifications

1.4 Enforcement

The City shall enforce the requirements of this Design Manual to the full extent authorized by law, including but not limited to the City Charter and ordinances, state, and federal law.

1.5 Website Posting

While the official copy of the approved Design Manual shall be kept on file in the Office of the City Clerk, the Design Manual and any updates will be posted on the City's website. The Engineer is directed to the City's website for the most current version of the Design Manual. A Design Manual Record of Revisions is provided in the posted Design Manual to identify significant revisions.

1.6 Design Manual Variance Requests

1.6.1 A formal request for a variance to the requirements of the Design Manual shall be submitted in accordance with the *Subdivision Variance* section of the LDC. A variance to the requirements of the Design Manual will not be granted unless the variance:

- Is not detrimental to the public welfare
- Does not adversely impact a public facility
- Is supported by a signed and sealed engineering analysis performed by a Professional Engineer licensed in the State of Texas
- Is not based solely on financial interests
- Preserves the aesthetics of the community
- Does not adversely impact the life expectancy and maintenance costs of infrastructure
- Does not create a potential danger to life and/or property
- Does not create threats to public safety, increase public expense or create a nuisance
- Does not conflict with state or federal laws or regulations
- Does not conflict with any City ordinance or requirement other than the

requirements of this Design Manual

- Does not increase the susceptibility of the proposed or existing facility, its contents or surrounding property to damage
- Does not result in increased flood heights, create erosive velocities, increase the frequency or duration of flooding, or create other adverse impacts to other property unless the adverse impact is approved by the affected property owners and the City, and documentation of this approval is provided
- Preserves or expands natural floodplain, greenbelts and associated buffer areas of aesthetic and/or environmental value
- Preserves adequate buffer distances to development and infrastructure from areas of potential flooding or erosion
- Does not decrease the safety of access to property or facilities for ordinary and emergency vehicles
- Is the only available and suitable location for the proposed facility that would not require a variance
- Does not increase cost of providing governmental services, including maintenance and repair of public infrastructure for streets, bridges, storm sewer and channels, water, sanitary sewer, gas, electrical, telephone and other public facilities
- Does not impede or interfere with the preservation of the historical character of structures or sites listed on the National Register of Historic Places or the State Inventory of Historic Places
- Is the minimum variance necessary to afford relief

1.7 Submittal Requirements for Construction Plans

1.7.1 Construction Plans – All new construction, reconstruction, modifications, alterations and improvements shall be designed in accordance with the Design Manual. Construction plan requirements are listed in the Subdivision Improvement Plan Submittal Requirements in the Development Manual. hAll engineering plans shall be sealed by a licensed Professional Engineer in the State of Texas in accordance with the Texas Engineering Practice Act except as exempted by the Texas Engineering Practice Act and Policy Advisory Opinions issued by the Texas Board of Professional Engineers. It is the responsibility of the Engineer to ensure that all construction plans submitted for review adhere to the current version of the Engineering Plan Submittal Checklist. The City will specify additional submission requirements, as necessary, to facilitate the review.

1.7.2 All construction plans or drawings must be accompanied by a Geotechnical Engineering Report/Pavement Design Report signed, sealed, and dated by a Licensed Professional Engineer.

1.7.3 Plans and drawings shall be furnished in accordance with the checklists found in the Development Manual.

1.8 Easements and Right-of-Way (ROW) Requirements

1.8.1 General

1.8.1.A The easement requirements stated in this section are intended to provide adequate room for construction and maintenance of the city-owned utilities, franchise utilities, and drainage improvements necessary for a proposed development. The City may approve less easement width on a case-by-case basis through the development review process in order to meet the City's objectives for new and infill development patterns.

1.8.1.B All ROW lines shall intersect at 90 degrees at intersections. Do not use angled or curved ROW cut-backs at intersections.

1.8.1.C The City will require placing water and wastewater facilities within public right-of-way, and franchise utilities within alleys for developments that include alleys.

1.8.1.D All easements created prior to the subdividing of any tract of land must be shown on the preliminary plat. The applicant shall plat lots and dedicate easements for utilities and drainage ways in the following manner:

1.8.1.D.i Easements for utilities, drainage ways, or transmission lines shall be retained on the front, side, and/or rear lot lines as required by the City and utility companies. Easements across parts of a lot other than as described above shall be required as deemed necessary and most appropriate by the City. The Development Services Director shall require access for ease of maintenance of all easements.

1.8.1.E Off-site Easements: Easements in areas adjoining a proposed development necessary to provide adequate drainage thereof or to serve such development with utilities shall be obtained by the applicant prior to final plat approval.

1.8.1.F Dedications – Easements and ROW required for construction of a proposed project dedicated to the City must be accepted prior to granting final acceptance of infrastructure. Permission must be obtained from off-site landowners prior to construction of offsite improvements on their property.

1.8.1.G Temporary Construction Easements – Temporary construction easements may be required for off-site grading, access, utility lines or other facilities to be constructed outside the Developer's property.

1.8.1.H Maintenance – The existence of an easement dedicated to the City does not change maintenance responsibility of the land. Perpetual maintenance responsibilities must be designated on the plat, typically a Homeowner/Property Owners Association.

1.8.2 Dedication of ROW and Easements

1.8.2.A Form of Dedication – ROW and easements shall be dedicated to the City by plat or by separate instrument. Refer to the LDC and Development Manual for further information.

1.8.2.B By Separate Instrument – For easements and ROW by separate instrument, Owner shall submit to the City a metes and bounds description and an exhibit that ties the proposed dedication to an established property corner or survey markers, signed and sealed by a Texas Registered Professional Land Surveyor, showing the easement or ROW, location, and current ownership information of subject and surrounding properties.

1.8.2.C Process – All easement and deed documents must be approved by the City prior to procuring any signatures. The Owner shall be responsible for procuring proper signatures and any required notarizations before delivering the fully executed original document to the City for filing in the Deed records of the County where the property is located.

1.8.2.D Fees – The Owner is responsible for any document preparation and all filing fees required for the recordation of executed documents with the County's Deeds Records office.

1.8.3 Abandonment of ROW and Easements – Approval by the City Council is required to abandon a public ROW or easement.

1.8.4 Sight Visibility Triangle Easements – Sight visibility triangle easements shall be provided where a public access driveway, an alley, or a stop-controlled street intersects an uncontrolled street and on any signalized intersection approach where right turn on red operation is permitted. Refer to **Section 2** (Sight Visibility) for additional requirements.

1.8.5 Stopping Sight Distance – Stopping sight distance shall also be provided for signalized and stop-controlled intersections.

1.8.6 Refer to LDC Section *Parking Lot Cross Access* Connections for requirements for

this type of driveway.

1.8.7 Screening Wall Maintenance Easements – Screening walls on private property shall be placed in the center of a minimum five-foot-wide screening wall easement.

1.8.8 Sidewalk and Trail Easements – Where not required within ROW, the width of the easement shall be the pavement width plus two feet on either side to allow sufficient area for maintenance. Refer to the LDC Sections: *Paths and Trails* and *Sidewalks* for further information.

1.8.9 Drainage Easements – Drainage easements are required for the following drainage facilities.

1.8.9.A Floodplains – A drainage easement shall be dedicated to encompass the City of Taylor floodplain.

1.8.9.B Channels - Easement width for open or lined channels shall encompass the channel top width plus any associated maintenance access required to accommodate the operation and maintenance plan for the channel.

1.8.9.C Detention Facilities and Levees – An easement must encompass the entire facility plus fifteen (15) feet on all sides measured from the top of bank. An access route must be provided in accordance with **Section 3** (Detention Facilities). Unpaved portions of the access route shall be within the easement.

1.8.9.D Positive Overflow Routes, Emergency Spillways, Swales, Berms, or Permanent BMPs – Minimum width must encompass the structure or graded area.

1.8.9.E Storm Drains – Storm drains shall be located in the center of a fifteen (15)-foot-wide drainage easement; or 1.5 times the depth to the flowline plus the width of the structure, rounded up to the nearest five feet; whichever is greater. If the storm drain is in ROW, and the easement size above is not contained within ROW, a drainage easement is required. If on private property, drainage easements shall be provided for all storm drains that are 18 inches or greater in diameter.

1.8.9.F Roadside Swales – The entire swale should be contained within the ROW of the roadway. If the roadside swale extends beyond the ROW, an additional drainage easement shall be dedicated extending at least five feet beyond the top of bank and the following note on the plat: Note: Drainage easements adjacent to roadways shall not be fenced and must be left so that access can be obtained for maintenance

purposes.

1.8.9.G Flumes – An easement must contain the entire width of the flume plus five feet on each side. The easement must be a minimum of fifteen (15) feet wide or wider if required by the City.

1.8.10 Utility Easements

Utility easements are required for all public utilities not located within public ROW has follows:

1.8.10.A Minimum Width – Utility easement minimum width requirements are summarized in **Table 1-1** through **Table 1-5** with depths less than or equal to ten (10) feet (as measured from ground level to flowline of pipe). This minimum width for exclusive utility easements is required when facilities are not located within the public ROW. The utility placement within the required easement dimensions shall be centered within the easement for mains less than or equal to twelve (12)-inch diameter. Larger mains greater than twelve (12)-inch in diameter shall not be centered within the easement width to allow for construction staging, and ability to add parallel mains in the future. Larger mains shall be located a minimum five (5)-feet clearance (as measured from outside diameter) to edge of easement.

1.8.10.B Width for Certain Facilities – The following equation shall be used for water mains, wastewater mains, and force mains with depths greater than ten (10) feet (as measured from ground level to flowline of pipe).

Easement Width

$$W = 2D+d+2$$

Where:

W	=	Easement width rounded up to nearest five (5) feet (feet)
D	=	Depth of pipe, measured from the surface to flowline of pipe (feet)
d	=	Inside pipe diameter (feet)

1.8.10.C Maximum Width – Easement shall not exceed 70 feet in width, unless required by the City for special circumstances.

1.8.10.D Widths to be Consistent – If depths of lines/mains vary across the easement, the largest resulting easement width shall apply. Easement widths shall not vary within the same parcel/lot.

Table 1-1. Easement Widths for Water Mains	
Water Mains and Service Lines	**Minimum Easement Width**
Water Mains (12-inch and smaller)	20 feet
Water Mains (16-inch and larger)	25 feet
Water Mains Adjacent to City ROW	15 feet
Water Mains Adjacent to TxDOT ROW	20 feet

Table 1-2. Easement Widths for Wastewater Mains	
Wastewater Mains and Service Lines	**Minimum Easement Width**
Wastewater Mains (12-inch and smaller)	20 feet
Wastewater Mains (15-inch and larger)	30 feet
Wastewater Mains Adjacent to City ROW	15 feet
Wastewater Mains Adjacent to TxDOT ROW	20 feet

Table 1-3. Easement Widths for Force Mains	
Force Mains	**Minimum Easement Width**
Force Mains (18-inch and smaller)	20 feet
Force Mains (24-inch and larger)	25 feet
Force Mains Adjacent to City ROW	15 feet
Force Mains Adjacent to TxDOT ROW	20 feet

Table 1-4. Easement Widths for Joint Utility Easements	
Joint Utility Easements	**Minimum Easement Width**
Water, Sewer, and Storm Drainage	Per approval of City
Note: Joint utility easement width shall be approved by the City. Utilities shall be spaced to provide a minimum of 5-foot clearance (as measured from outside diameter of each utility) except water/wastewater separation shall be 9-foot (as measured from outside diameter of each utility). Each utility shall be a minimum 5-feet clearance (as measured from outside diameter) to edge of easement.	

Table 1-5. Easement Widths for Facilities/Appurtenances[1]	
Facility/Appurtenance	**Minimum Easement Width**
Fire Hydrants and Automatic Flushing Valves	5 feet x 5 feet
Air Valve Assembly	10 feet x 10 feet
Blow-Off Valve Assembly	10 feet x 10 feet
1. For appurtenances not listed here, the width of the easement shall be determined by the City as required to ensure adequate area is available for facility maintenance.	

1.9 Subsurface Utility Engineering (SUE) Requirements

1.9.1 Prior to Initiation – All existing utilities shall be located and marked prior to initiation of survey for design.

1.9.1.A All existing City-owned utilities (water, sewer, storm water) with diameters greater than or equal to 12 inches shall have Quality Level A SUE performed and documented as part of design plan preparation prior to initiation.

For City-owned utilities parallel to construction activities, Quality Level A SUE shall be performed with pothole activities at points of inflection of the utility and every 400 linear feet along the utility.

For construction activities that cross existing City-owned utilities,

Quality Level A SUE shall be performed at crossing locations.

1.9.2 SUE Provider Requirements – SUE shall be managed by an Engineer or Land Surveyor licensed in the State of Texas, and the work shall be conducted by well-trained, experienced, and capable individuals using state-of-the-art designating equipment, vacuum excavation, or comparable non-destructive locating equipment as well as surveying, data recording equipment, and software systems, as necessary.

1.9.3 Quality Level Attributes – Utility Quality Level (QL) attributes are described in the current edition of *Standard Guidelines for Collection and Depiction of Existing Subsurface Utility Data*, CI/ASCE 38-02 by American Society of Civil Engineers (ASCE). Accordingly, QL C and QL D shall be conducted for all projects. QL A and QL B shall be conducted in those areas necessary for the City to review the proposed utility design. The requirements for the four SUE QLs are as follows:

1.9.3.A Quality Level D – Information derived from existing records or oral recollections.

1.9.3.B Quality Level C – Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D.

1.9.3.C Quality Level B – Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities. This work shall be performed to obtain horizontal location of subsurface utilities.

1.9.3.D Quality Level A – Precise horizontal and vertical location of utilities obtained by the actual exposure and subsequent measurement of subsurface utilities at a specific point, also called test holes.

1.9.4 Additional Field Work – Additional SUE field work shall be required as conditions change from initial SUE field exploration.

1.10 Survey Requirements

1.10.1 General – The requirements provided herein shall be minimum standards for projects involving a survey.

1.10.2 All subdivision and site development construction plans shall reference two (2) horizontal/vertical control points of known vertical and horizontal coordinates set to the State Plane Coordinate System. If benchmarks are not readily available to the project site, new benchmarks shall be set. Any existing benchmark monuments damaged by development construction shall be replaced by the contractor/developer at no cost to the City

1.10.3 Markers – Markers consisting of minimum 1/2-inch diameter steel rods at least 24 inches long with caps identifying responsible surveying firm or RPLS number, shall be placed at all:

1.10.3.A Lot and block corners (wherever a lot line bearing changes)

1.10.3.B Intersection points of alley and block lines

1.10.3.C Curve and tangent points along block, lot, and ROW lines within the subdivision

1.10.4 Monuments – Monuments shall be installed, and three-dimensional coordinates noted on the plat. Coordinates shall be established using the correct scale factor. Permanent benchmarks shall be brass disks set in an approved location with the elevation and benchmark number stamped in the disk.

1.10.5 Private Project Monuments – At least two Markers shall be placed at property corners. For developments greater than ten (10) acres, at least two monuments at opposing ends of the property and tied into City's GIS system shall be set.

1.10.6 Public Project Monuments – Found existing ROW monuments, survey markers or property corners, and proposed monuments shall be shown on the construction plans and located by station and offset, right or left from the control line, baseline or centerline, or by northing and easting.

1.10.7 Final Acceptance – If construction damages, destroys, or alters existing survey markers, monuments, or property corners, they must be reset by a licensed surveyor prior to final acceptance.

1.11 Revisions to the Design Manual

1.11.1 Content of Design Manual – Sections 1 through 9 of the Design Manual provide general procedures and design requirements for all development applications, as well as general design requirements for certain public facilities.

1.11.2 Procedure for Manual Sections Amendments – Sections 1 through 9 may be amended by the City Manager.

1.11.3 Posting – Upon approval by the City Manager, the proposed revisions will be incorporated into the Design Manual and posted on the City's website and take immediate effect.

1.11.4 Requests for Modification – A formal request to modify the Design Manual or design criteria or add new design criteria may be submitted in writing to the City Manager for consideration.

1.12 Specifications

1.12.1 General - All referenced specifications shall be implied to mean the latest version of specifications from each mentioned entity. The referenced specifications shall include all amendments thereto, and shall govern and constitute the technical specifications, except as amended by this Manual and is made a part thereof but is not physically bound within this document.

1.12.2 TxDOT Specifications - All applicable public improvements other than those specifically listed in this Manual shall be designed in accordance with the current edition of the Texas Department of Transportation's *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*.

1.12.3 Texas Architectural Barriers Act - All accessibility design and construction shall comply with the Texas Accessibility Standards in compliance with the Texas Architectural Barriers Act.

1.12.4 Texas Manual of Uniform Traffic Control Devices/Standard Highway Sign Designs - traffic control devices shall conform to the latest edition of the *Texas Manual of Uniform Traffic Control Devices* (TMUTCD), and *Standard Highway Sign Designs for Texas* (SHSD).

1.12.5 City of Austin - The following specification from the City of Austin, TX Standard Specifications Manual are incorporated into this Manual:

1.12.5.A Series 500 Pipe and Appurtenances

1.12.6 City of Taylor Fire Code Specifications - All designs, including fire hydrant spacing and location, fire lanes, and turning radii shall conform to the City of Taylor Fire Department requirements.

1.13 Construction Process

1.13.1 A project will not be authorized to start construction until the formal issuance of a permit. The Contractor must schedule a pre-construction meeting with the City prior to the commencement of construction.

1.13.1.A All City-owned utilities (water, sewer, storm water) with diameters greater than or equal to 12 inches within the project site must be exposed by the contractor and cleared of conflicts by the City prior to commencement of construction activities. (See City of Taylor's GIS for utility information)

1.13.2 During construction of the project, if the Contractor or Engineer desire to make formal changes to the approved plans, the Engineer must submit the proposed

revisions to the City for review and approval prior to commencement of the revised work.

1.14 City Engineer's Recommendation for Acceptance

1.14.1 A project will not be considered for acceptance by the City Engineer until the requirements in the LDC section *Acceptance of Public* Improvements are met.

1.14.2 A final walkthrough and completion of all punch list items are required.

1.14.3 Prior to subdivision acceptance, the Engineer shall submit documentation that the project was inspected by TDLR or a Registered Accessibility Specialist (RAS) and the subdivision is in compliance with the requirements of the Texas Architectural Barriers Act.

1.14.4 Certification from other agencies that final requirements have been met, as applicable.

SECTION 2 THOROUGHFARE AND TRAFFIC DESIGN REQUIREMENTS

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SECTION 2 THOROUGHFARE AND TRAFFIC DESIGN REQUIREMENTS

2.1 General

This section includes minimum design requirements associated with the City's thoroughfares, alleys, bicycle/pedestrian facilities, off-street parking lots/areas, and fire lanes, including geometry, traffic signals, street lighting, new signage, and pavement design requirements. Traffic Impact Analysis (TIA) requirements and procedures are also included in this section. References to City of Taylor Ordinances, Codes, or Plans shall mean current version as adopted by the City. All references to publications, manuals, or standards from other entities shall mean the current edition or version.

Refer to the Taylor Land Development Code (LDC) for the development process flowchart and requirements. The Developer and the Engineer shall work cooperatively early in the development process to establish thoroughfare and traffic design requirements consistent with the goals and objectives of the Development Services Department that guide future development within the City.

The LDC defines permissible street types, once the Place Type Zoning for the subject lot or tract has been determined (LDC Section 4.3).

New development using the LDC will be built as neighborhoods, not subdivisions. Flexibility and predictability take priority. The LDC uses Place Types to categorize places, rather than conventional zoning criteria found in other communities. Similarly, this section of the manual provides minimum criteria for thoroughfare and traffic elements of proposed neighborhoods and is not intended to remove flexibility and adjustability while guiding the development in the City.

This section of the manual, along with the requirements of the LDC, Taylor's Transportation Master Plan, Envision Taylor Comprehensive Plan, and good industry practice shall be used together to establish ROW widths, street sections, bicycle/pedestrian improvements, landscaping, pavement design, and other traffic elements to meet the development objectives of the City.

The thoroughfare and traffic design criteria for proposed neighborhoods must be established early in the process i.e., starting with a pre-application meeting with City staff.

Infill development shall be prioritized as described in the LDC. The City recognizes that thoroughfare and traffic design criteria from other agencies established criteria may not be applicable to infill development, therefore each neighborhood will be considered on a case-by-case basis.

2.2 Thoroughfare Design

2.2.1 Functional Classification

2.2.1.A General – The arrangement, character, extent, width, and location of all streets shall conform to the City's current adopted "Envision Taylor Comprehensive Plan" and "Transportation Master Plan" and as approved by the City. Thoroughfare and traffic design requirements for each of the Place Type Zoning Districts are also described in the Taylor Land Development Code (LDC). The Developer's Engineer shall consider the relation to existing and planned streets, topographical conditions, public safety, and the proposed uses of the land to be served by such streets. When such street is not on the City's Transportation Master Plan, the arrangement of streets shall either:

- Provide for the continuation or appropriate extension of existing streets in surrounding areas, or
- Conform to the approved Neighborhood Plan

Taylor's urban DNA is comprised of a network of streets that form small, walkable blocks. This form shall be extended as the City grows.

Alleys are part of Taylor's urban DNA and shall be considered in new neighborhoods.

2.2.1.B Grid vs. Dendritic Street Patterns – Traditional Neighborhood Development (TND) is the historic development pattern of Taylor. TND street patterns include small, walkable blocks and the continuation of the street grid as new neighborhoods are planned. This grid system allows for the creation of walkable neighborhoods with a mix of uses. TND is the primary and default development pattern in the City. A dendritic (branch-like) street pattern spreads development out into low-density enclaves, concentrates higher-speed traffic on arterials, and contributes to urban sprawl. Dendritic patterns are not the desired street pattern in the City.

2.2.1.C City of Taylor Street Types – The LDC establishes City of Taylor Street Types that are different than functional classifications from other design criteria manuals such as City of Austin, Williamson County, TxDOT, or AASHTO. The following **Table 2-1** may be used to correlate City of Taylor Street Types, unless noted otherwise in this manual.

Table 2-1. City of Taylor Thoroughfare Types & Correlation With other Design Criteria	
Taylor Street Classification	**Other Agencies Functional Classification**
Rural Street Yield Street Neighborhood Street	Local
Neighborhood Avenue Community Blvd (2-Lane) Community Blvd (4-Lane)	Collector

2.2.1.D Transportation Network – The Developer's Engineer shall plan and design for new streets as adopted in the Comprehensive Plan and the Transportation Master Plan.

- Streets will follow a grid network.
- Thoroughfare spacing within a neighborhood grid pattern shall be dictated by maximum block length and block perimeter criteria hfor each Place Type in the LDC. Refer to Place Type Zoning District Development Standards.
- Neighborhood avenues, neighborhood streets, rural streets, and alleys not shown on the Transportation Master Plan will be required to complete the grid network.
- The appropriate thoroughfare classifications and internal circulation will be selected through consideration of several factors, including alignment with the Transportation Master Plan, connectivity with the existing thoroughfare network, projected traffic volumes, thoroughfare spacing, and adjacent land use context. Internal thoroughfare and alley network shall also consider fire apparatus access, trash collection, and street maintenance considerations.
- The Developer shall schedule a pre-application meeting with the Development Review Committee (DRC) to determine the required thoroughfare network internal to each neighborhood and required improvements to the adjacent thoroughfare network.
- The transportation network internal to a neighborhood must be considered during the preliminary platting process since it will

affect thoroughfare and alley spacing, ROW widths, pavement widths, pedestrian facilities, landscape buffers, utility locations, and lot arrangement.

2.2.1.E Exceptions – Exceptions to the design criteria in this Manual will be considered on a case-by-case basis and shall require approval by the City. Refer to **Section 1 (Variance Requests)** for further information. Design criteria may also be spelled out in the following documents which would guide the next steps in detailed design of a neighborhood:

- Planned Development Ordinances – These ordinances may include specific variances from the requirements of this manual. All other requirements of this manual shall apply.
- Neighborhood Plans, Employment Center Plans – The ROW width, pavement width, utility locations (easements) landscape buffers, and street arrangement will be as described in the approved Neighborhood Plan or Employment Center Plan.
- Rural Applications – Rural thoroughfares with roadside ditch drainage are permitted in Place Types P2, P2C, or as otherwise approved by the City. The right-of-way (ROW) width required for rural thoroughfares varies based on the required roadside channel capacity and width. Refer to **Section 3 (Open Channels)** for applicable design criteria.
- Urban Streets – Transportation facilities which serve established communities, serve an urban mixed-use development, or require multiple modes of travel shall follow a context sensitive, multi-modal approach to identifying the typical street section(s).

2.2.1.F Street Spacing Criteria – **Table 2-2** lists the desired spacing for the various street types in the City. This spacing is considered a guideline and shall not be considered as minimum required spacing. Also refer to the LDC for criteria regarding maximum block lengths and maximum block perimeter for each Place Type.

2.2.1.G General Design Criteria – **Table 2-3** lists general design criteria for the street types in the City of Taylor.

Table 2-2. Desired Street Spacing Criteria	
Street Classification	**Desired Spacing**
Rural Street	N/A
Streets (Yield Street, Neighborhood Street)	330’
Neighborhood Avenue	1,320’
Community Boulevard (2-lane and 4-lane)	2,640’ or as designated on Transportation Master Plan
Regional Roadway	Defined by Williamson County or TxDOT
Alley (Residential/Commercial)	Typically, One per block
Note: Refer to Taylor LDC for allowable block length for each Place Type	

Table 2-3. General Thoroughfare Design Criteria							
Criteria[1]	**Classification (Street Type)**						
	Rural Street	**Yield Street**	**Neighborhood Street**	**Neighborhood Avenue**	**2-Lane Community Blvd**	**4-Lane Community Blvd**	**Residential/ Commercial Alley**
Typical ROW Width (ft)	100 (Varies)	50	60	60-80	80-100	80-100	16-20
Number of Through Travel Lanes	2	2	2	2	2	4	N/A
Typical Daily Traffic Volumes (vehicles per day)	0-3,000	0-3,000	0-3,000	3,000-10,000	3,000-18,000	10,000-35,000	N/A
Typical Posted Speed (mph)	30	15	20-30	30-35	35-45	35-45	N/A
Clear Zone (ft)	10	4	4	4	4	4	N/A
Minimum Horizontal Inside Radius (ft)[5]	200	333	333	510	762	762	50
Maximum Grade (%)[4]	7	7	7	7	6	6	7
Minimum Grade (%)	0.5 [2]	0.5	0.5	0.5	0.5	0.5	0.5
Design Vehicle[3]	Fire Truck	Fire Truck	Fire Truck	Fire Truck	WB-40	WB-40	Fire Truck
Area Free From Storm Water (100-Year) (ft)	N/A	Center 12’	Center 12’	One Lane Each Direction	One Lane Each Direction	One Lane Each Direction	

Notes:
1. Refer to City Taylor LDC for further information and requirements
2. For Rural Streets 0.5% minimum grade is acceptable, but parallel roadside channel slope must be sufficient to convey the design flow
3. Fire truck design vehicle shall be as directed by the City Engineer and Fire Marshal
4. Maximum grade should be limited to 5% where feasible to limit sidewalk grades to meet ADA criteria of 5%
5. Minimum radius in this table is related to the typical posted speed indicated here. Typical posted speed and minimum radius for a development will be established during the planning process and development of the preliminary plat.

Pedestrian Elements	**Sidewalks**	**Shared-Use Paths (SUP)**	**Path**	**Trail**
ROW Width (ft)	Per Typical Sections	20	10	20
Surface Width (ft)	5’ Min 6’ If adjacent to curb	10	6	10
Design Speed (mph)	N/A	18	N/A	18
Cross Slope (%)	1.5 Usual/2.0 Max	1 Usual/2.0 Max	1.5 Usual/2.0 Max	1 Usual/2.0 Max
Horizontal Clearance (ft)	N/A	5	5	5
Vertical Clearance (ft)	8	10	10	10

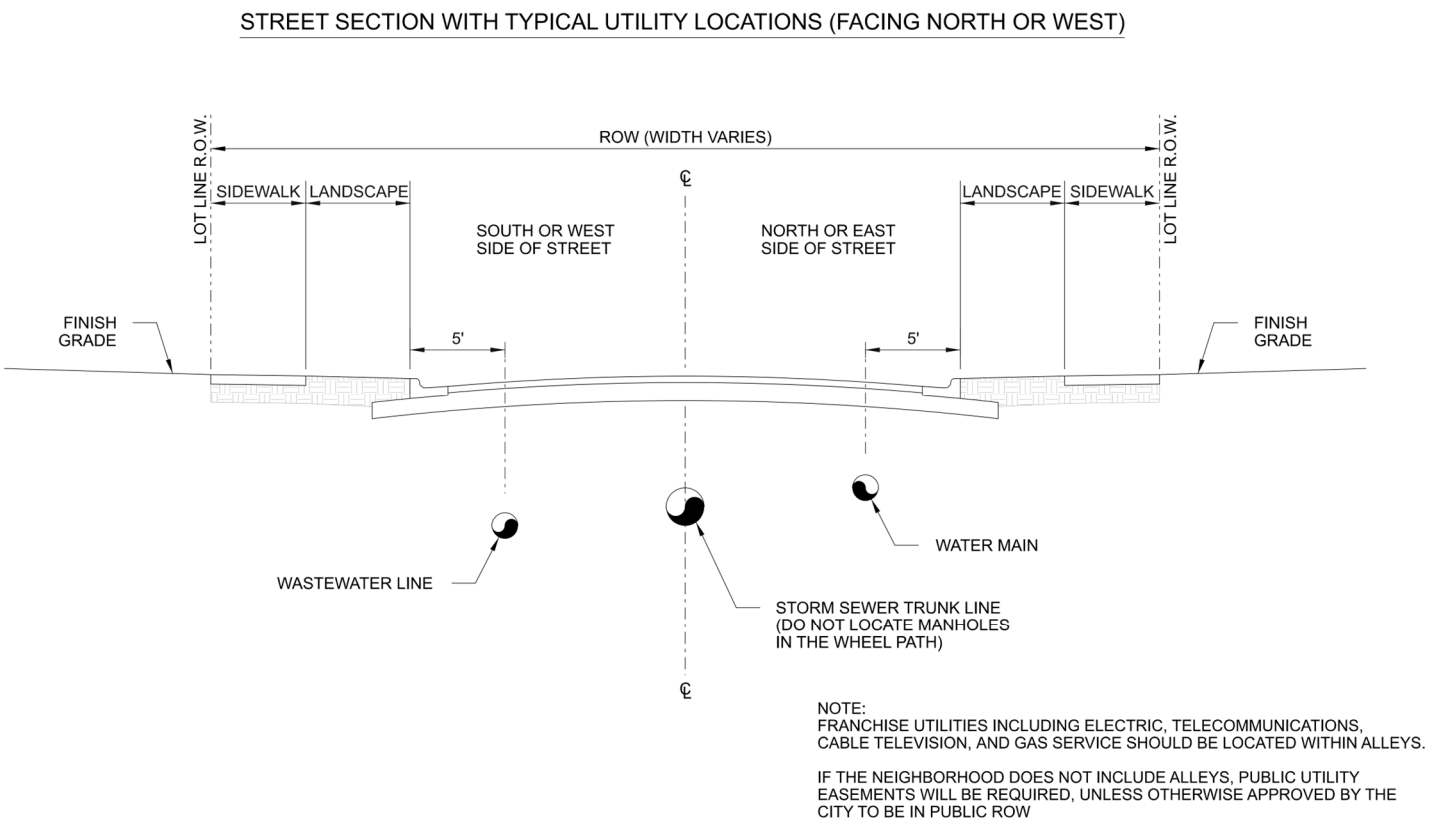


Figure 2-1 Typical Utility Locations For A Neighborhood Street

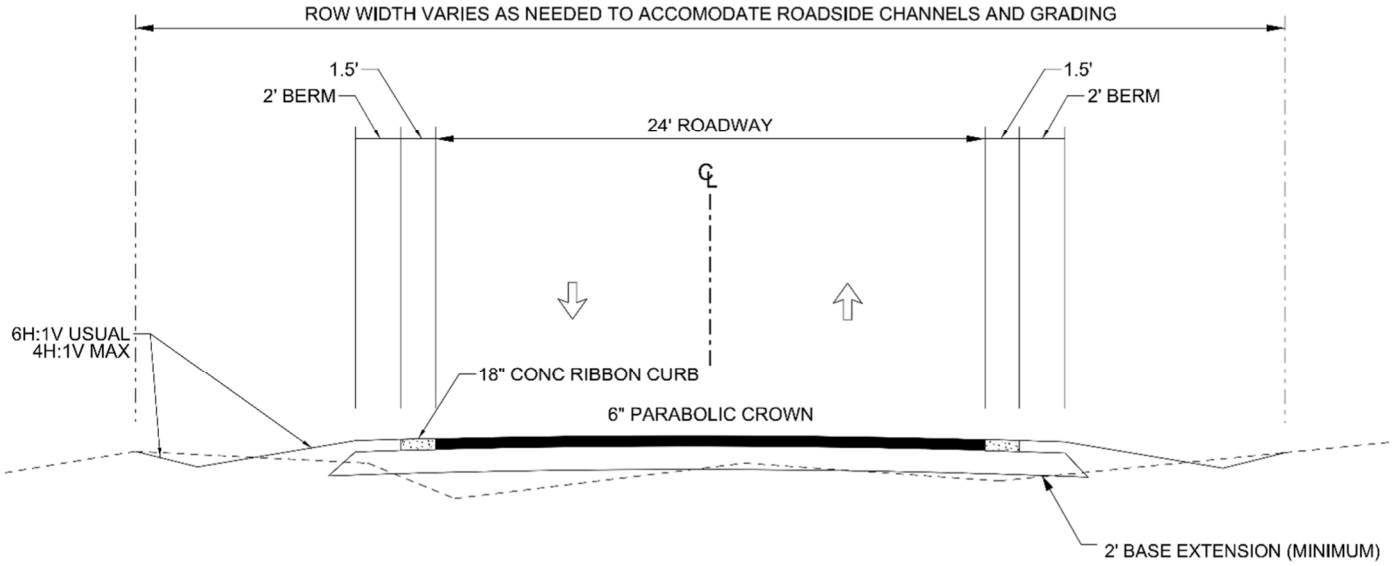
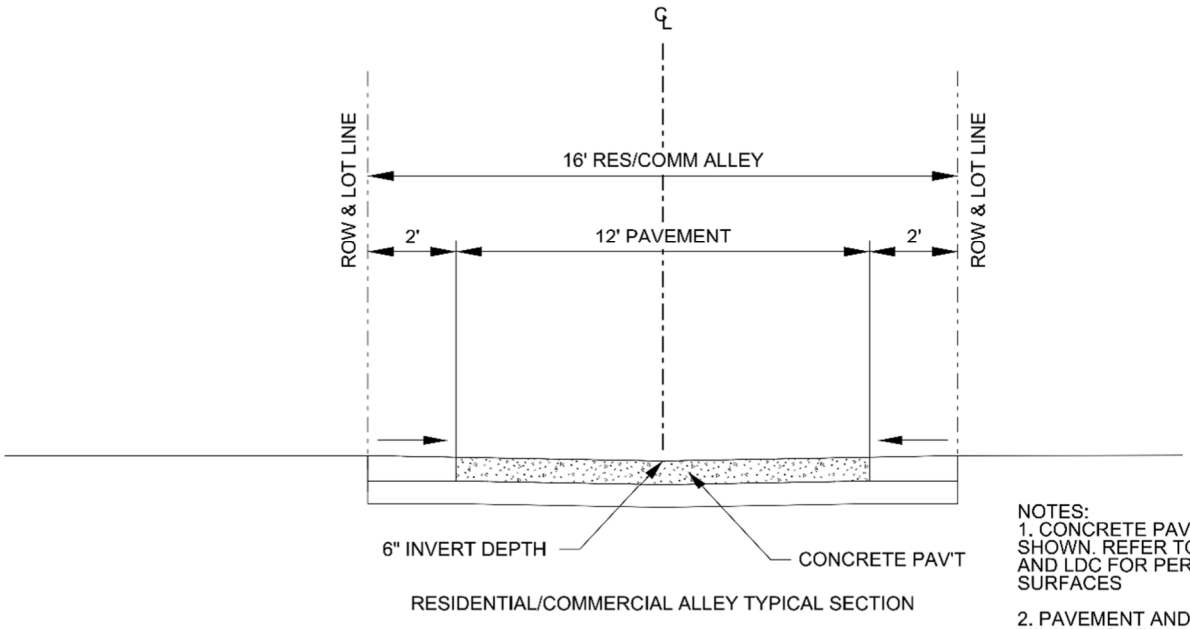


Figure 2-1 (a) RURAL STREET TYPICAL SECTION



RESIDENTIAL/COMMERCIAL ALLEY TYPICAL SECTION

NOTES:
1. CONCRETE PAVEMENT SECTION SHOWN. REFER TO ENGINEERING MANUAL AND LDC FOR PERMISSIBLE PAVEMENT SURFACES

2. PAVEMENT AND ROW WIDTHS ARE MINIMUMS PER LDC. WIDER ALLEY WIDTHS MAY BE NEEDED TO ACCOMMODATE UTILITIES, DESIGN VEHICLES, AND INTENDED SERVICES.

3. CITY PREFERENCE IS FOR NEW DEVELOPMENT TO INCORPORATE ALLEYS WITH NON-CITY (FRANCHISE) UTILITIES LOCATED WITHIN THEM. DEVELOPER TO COORDINATE UTILITY LOCATIONS.

Figure 2-1 (b) ALLEY TYPICAL SECTIONS

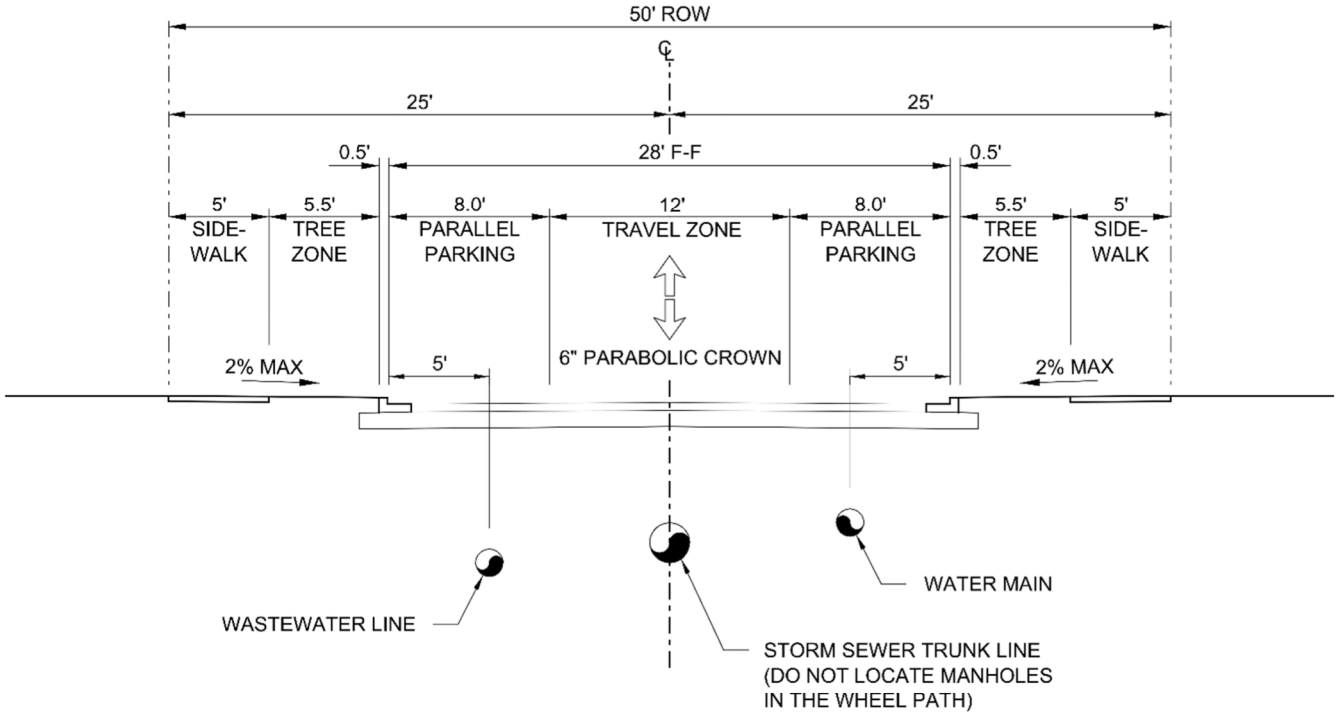


Figure 2-1 (c) YIELD STREET TYPICAL SECTION

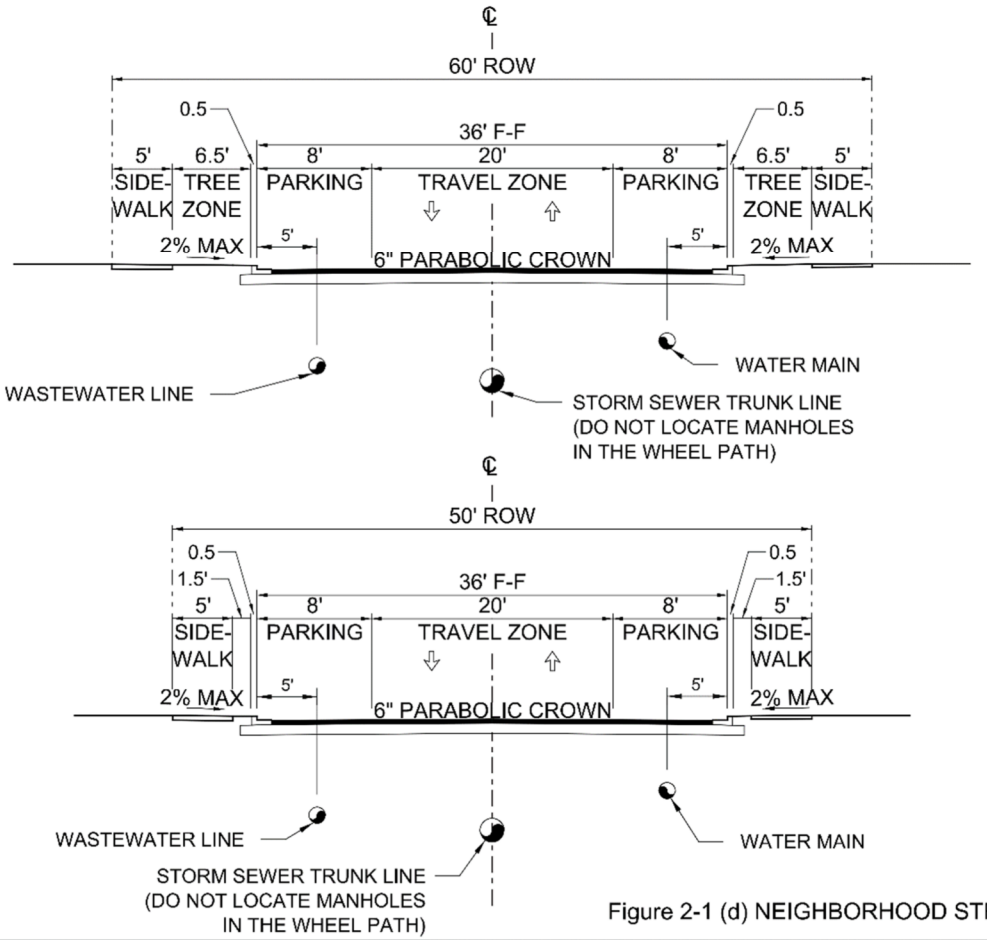
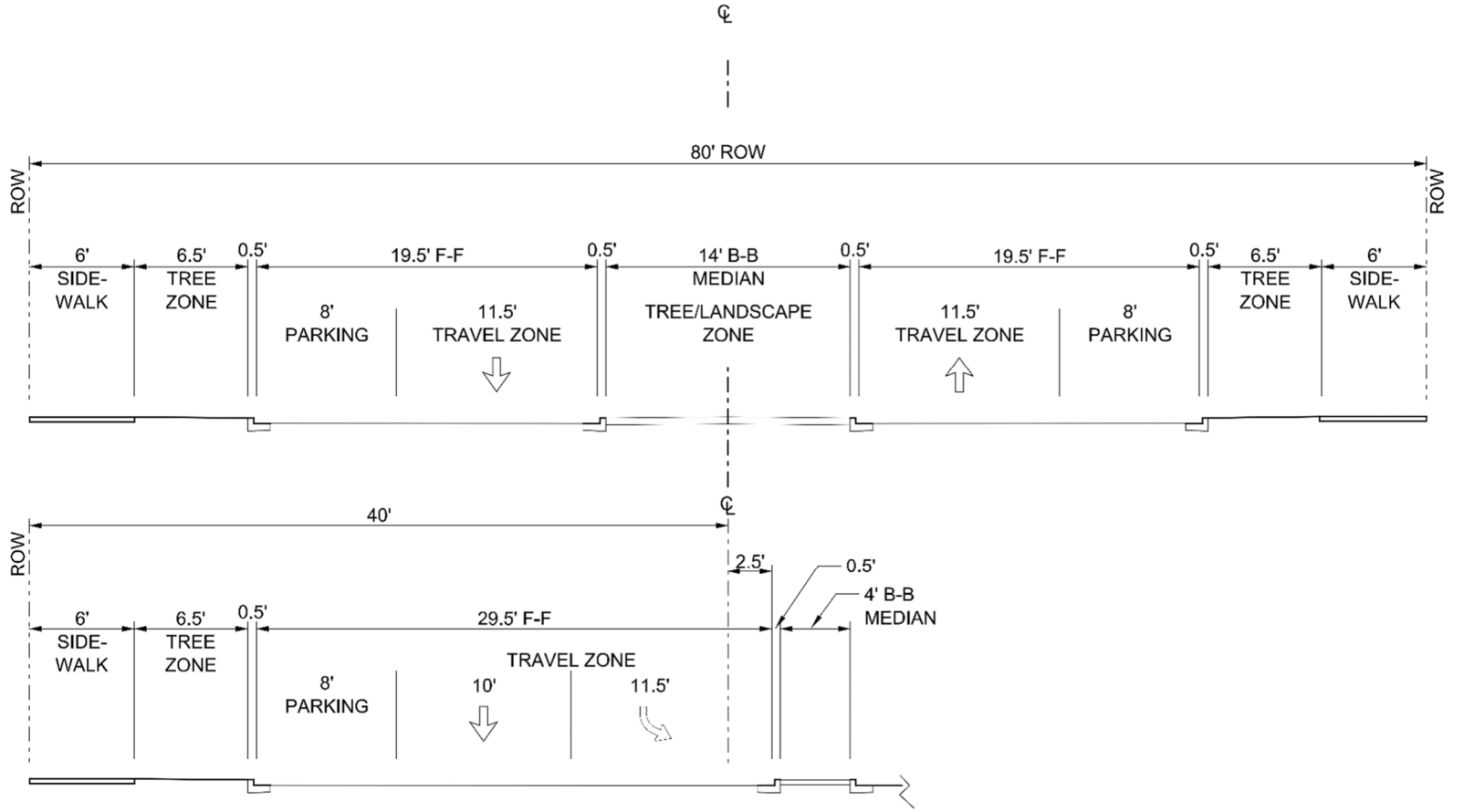
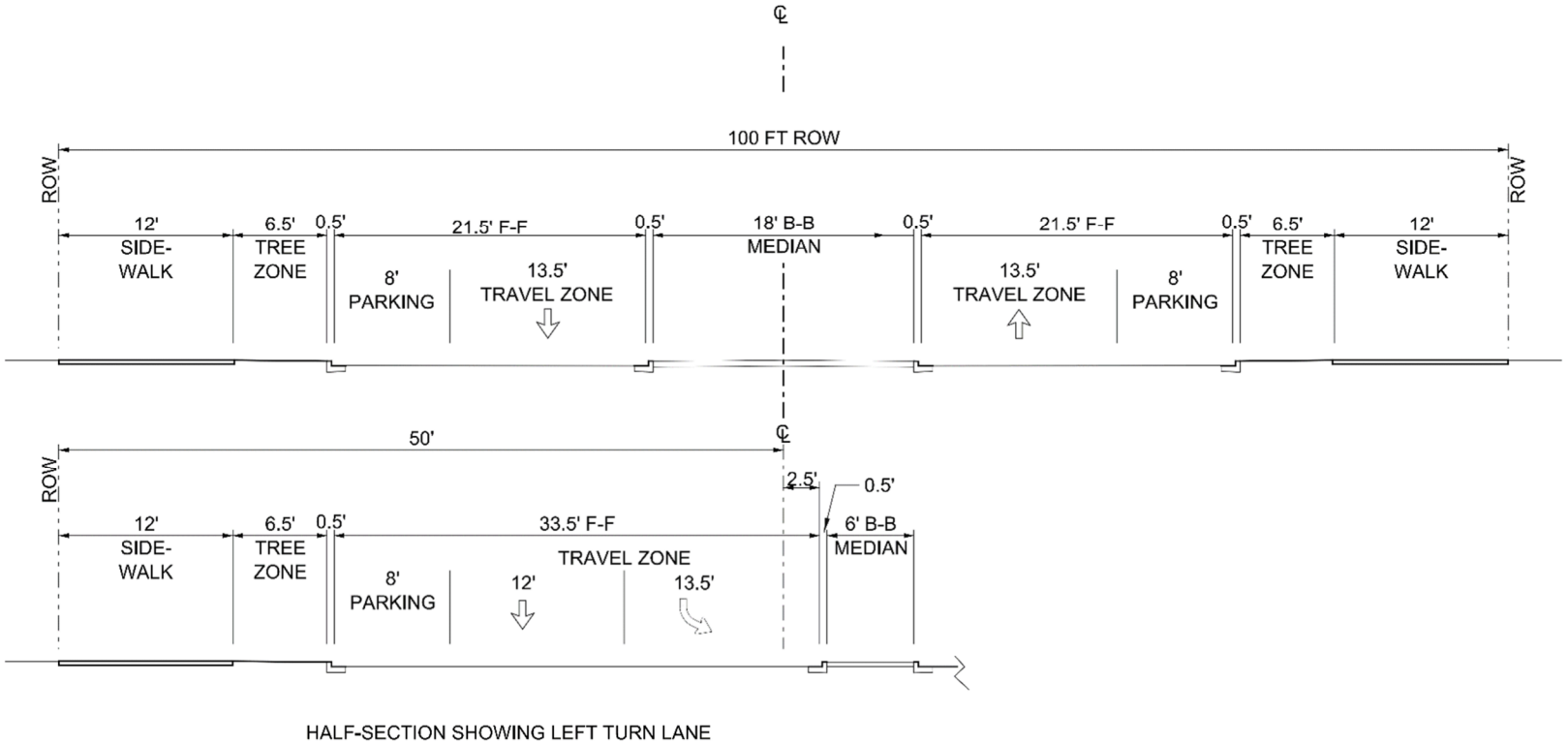


Figure 2-1 (d) NEIGHBORHOOD STREET TYPICAL SECTION



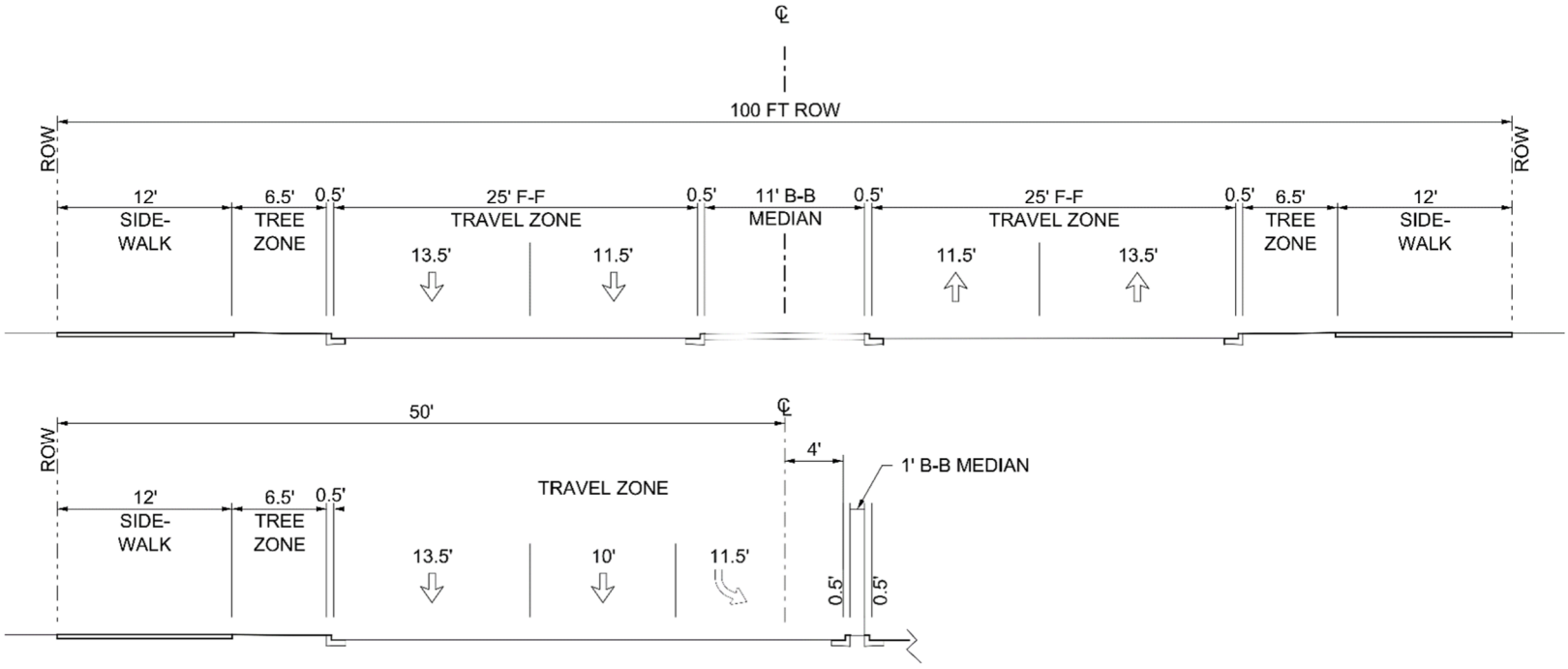
HALF-SECTION SHOWING LEFT TURN LANE

Figure 2-1 (e) NEIGHBORHOOD AVENUE TYPICAL SECTION



HALF-SECTION SHOWING LEFT TURN LANE

Figure 2-1 (f) COMMUNITY BOULEVARD - 2 LANE



HALF-SECTION SHOWING LEFT TURN LANE

Figure 2-1 (g) COMMUNITY BOULEVARD - 4 LANE

2.2.2 Horizontal Alignment

2.2.2.A Thoroughfares shall be typically placed in the center of the ROW. The City may require an off-center horizontal alignment due to the inclusion of pedestrian elements, landscape buffer or connection to existing streets.

2.2.2.B Streets shall be designed according to low-speed urban criteria, and therefore superelevation for city streets is generally not required.

2.2.2.C This manual does not include arterial or regional roadway design which are to be designed according to TxDOT or Williamson County Design Criteria.

2.2.3 Vertical Alignment

2.2.3.A A vertical curve is required when two profile grades intersect at a point of vertical intersection (PVI) and the algebraic difference is more than 1.0% for rural streets, yield streets, neighborhood streets and avenues. Vertical curves are required when the algebraic difference is more than 0.5% for Community Boulevards.

2.2.3.B Vertical curve length shall be three times the design speed when possible.

- Sag vertical curve length may be reduced when the thoroughfare is continuously lighted.
- In all cases, vertical curve alignment shall provide adequate stopping sight distance in accordance with AASHTO's *A Policy on Geometric Design of Highways and Streets*.

2.2.4 Street Widths

2.2.4.A Street types and widths shall be determined during the development of the Neighborhood Plan or Employment Center Plan.

2.2.5 Cross-Sectional Elements

2.2.5.A Pavement Cross-Slopes – Thoroughfares with up to two lanes in each direction shall have a typical cross-slope of 2%. Thoroughfares with three lanes in one direction shall have a typical cross-slope of 2.5%. The cross-slope can vary where there is a transition into or out of the typical cross slope at intersections.

2.2.5.B Vertical Clearance – No point within pavement surface area shall have a vertical clearance less than 16.5 feet from any bridge, structure, or other overhead obstruction. The vertical clearance for trees shall be 14.5 feet.

2.2.5.C Clear Zone – A clear zone shall be provided for all streets in

accordance with TxDOT's *Roadway Design Manual* and AASHTO's *Roadside Design Guide*. A minimum clear zone of four (4) feet shall be provided from the face of curb or edge of travelway. Where clear zone requirements cannot be met, a guardrail or other type of barrier shall be required in accordance with AASHTO's *Roadside Design Guide* and shall use TxDOT's standard details. Clear zone measurements to trees in the landscape zone and shown on the approved landscape plan would be exempt from clear zone requirements.

2.2.5.D Structures – Private fences, walls, screening devices, and other structures shall not be erected within the ROW or the sight visibility triangles. Power poles, signal poles, and streetlights are excluded from this restriction provided they maintain visibility.

2.2.6 Partial or Half-Streets

2.2.6.A The allowance of, and ROW dedication for partial or half-streets is governed by the City Code.

2.2.6.B If a partial street is allowed by the City Code, the Developer shall be responsible for at least two travel lanes of clear pavement width including bicycle facilities in both directions, if applicable. The travel lanes to be constructed shall be the two lanes closest to the property being developed (i.e., the outside lanes of the ultimate street configuration). Additional ROW and easements shall be dedicated as necessary to install signage and grading.

2.2.7 Culs-de-Sac

2.2.7.A Culs-de-sac streets are discouraged for new neighborhoods but may be approved when a street cannot be extended due to unique circumstances.

2.2.8 Residential Streets

2.2.8.A Residential Frontage – Residential lots shall conform to the City's Subdivision and Zoning Ordinances as well as City Council's plat approval requirements.

2.2.8.B Knuckles – Knuckles shall not be longer than three hundred and thirty (330) feet. The knuckle shall have a turnaround provided with a thoroughfare radius of fifty (50) feet and ROW line diameter of at least 120 feet.

2.3 Intersections

2.3.1 General – Intersections shall be designed to facilitate the safety, convenience, and efficiency for pedestrians, bicycles, and motor vehicles traveling through it. The City will prioritize pedestrian safety when evaluating intersection design.

2.3.2 Grading Plan – A separate grading plan shall be provided for any intersection involving the following street classifications: neighborhood avenue, or community boulevard, or TxDOT/County roadway. The grading plan shall include profiles and/or spot elevations for each curb return, curb ramp, and crosswalk.

2.3.3 Alignment – Through lanes shall line up across intersections with no offset unless otherwise approved.

2.3.4 ROW Corner Clips and Intersection Angles – To comply with the city's goal for traditional neighborhood planning, streets shall intersect at a 90-degree angle. ROW lines shall intersect at 90-degree angles, and 'cutbacks', either angled or curved, shall not be used in the ROW lines at street intersections. No ROW flares are to be used.

2.3.5 Gutter slope – Gutter slope along the curb returns shall be a minimum of 0.5%.

2.3.6 Cross-Slopes – Street cross-slopes shall be transitioned to minimize grade breaks across intersections. Cross-slope shall not exceed 2% at crosswalks.

2.3.7 Crosswalks – Crosswalks and pedestrian curb ramps shall be provided in all four directions.

2.3.8 Inlets – Drainage inlets shall be installed to capture stormwater prior to entering intersections in accordance with **Section 3** (Inlet Location and Capacity). Inlets shall be located to avoid inlet depressions encroaching into curb returns, cross walks, driveways, or bus stop areas.

2.4 Sight Visibility

2.4.1 General – Adequate sight visibility is required at all intersections via sight visibility triangles and corner clips as described in this section. At a minimum, all intersection visibility requirements shall meet the guidelines in AASHTO's *A Policy on Geometric Design of Highways and Streets*.

2.4.2 Sight Visibility Triangles

2.4.2.A ROW corner clips or dedicated easements for sight visibility triangles shall be provided where a public access driveway, an alley, or public street intersects an uncontrolled street and on any signalized intersection approach where right turn on red operation is permitted.

2.4.2.B Sight visibility triangles shall be free of obstructions between two (2) feet and nine (9) feet above the top of pavement. Obstructions include hedges, trees, shrubs, bushes, plants, foliage, signs, poles, fences, screens, buffers, billboards, structures, walls, motorized or non-

motorized vehicles, or any other man-made or natural item that conflicts with the visibility of pedestrians, bicycles, or motor vehicles approaching an intersection, public access driveway, or traffic control device. Utility poles and streetlights are excluded from this restriction provided they maintain visibility.

2.4.3 Corner Clips

2.4.3.A ROW lines shall intersect at 90-degrees without corner clips. Additional easements or setbacks may be required to provide appropriate to provide sight visibility as well as to provide sufficient room for sidewalks, barrier free ramps, signal poles, utility appurtenances, and other facilities.

2.5 Access Management

2.5.1 General – This section includes general access management requirements. Refer to **Section 2 (Traffic Impact Analysis)** for Traffic Impact Analysis (TIA) requirements.

2.5.2 Minimum Access Points – A minimum of two planned points of public ingress and egress are required to facilitate emergency vehicle access and to distribute traffic through the neighborhood or employment center as determined by the Fire Marshal and the City.

2.5.3 Unless otherwise approved by the City no lots shall have driveway access from a Neighborhood Avenue or Community Boulevard.

2.5.4 School Access and Location Criteria

2.5.4.A General – The location of a daycare or school facilities has an impact on adjacent land uses and mobility. Early designation of school sites helps to provide adequate access and traffic circulation as well as minimizing development costs. The following criteria are intended to assist City staff and Developers in the provision of proper site locations for these facilities during the development process. When applicable, Developers are encouraged to discuss with the school district where a proposed project is to be located, prior to submittal, to determine district's potential need of a facility as well as best placement within the neighborhood.

2.5.4.B Traffic Management Plan (TMP) – A TMP is required for all public and private school facilities. This study shall include the estimated maximum peak hour trip generation of the facility, the planned circulation of inbound and outbound traffic during drop-off and pick-up operations, and the estimated length of the queue of cars waiting to pick up students. The TMP must alleviate all conflicts with through-traffic and traffic movements on public right-of-way abutting and in

the vicinity of the application and must include a design for picking-up and dropping-off students without queuing vehicles into public right-of-way.

2.5.4.C Safe Routes to School Plan (SRTS) – A SRTS plan is required for all public and private school facilities. The plan shall document pedestrian and bicycle routes between the school and residential land uses located within one quarter mile of the site. The plan will document the presence and condition of pedestrian and bicycle infrastructure and make recommendations to provide safe access for all users to the site.

2.5.5 Drive-Through Facilities

2.5.5.A Drive-throughs are required to be located in the 2nd or 3rd layer of the lot or located from an alley. Where allowed, location and design of drive-through or gas station facilities shall follow the following criteria:

- Do not locate drive-through or gas station facilities to adjacent residential uses.
- Screen vehicular areas for drive-through facilities or gas stations placed on the street side of a building or any other location that is directly visible from adjacent properties with screen walls, mounding, and/or dense landscaping at least three (3) feet in height at the time of planting.

2.5.5.B Parking requirements will be market driven. Lot coverage shall not exceed the Place Type Standards.

2.5.5.C Drive-Through Requirements – The amount of stacking required on-site for a proposed development must accommodate anticipated queuing as defined in the approved TIA. Vehicle queuing length, storage requirements, and internal circulation shall be determined such that vehicles do not extend back onto the adjoining street.

2.6 Median Openings and Turn Lanes

2.6.1 General

Dimensions given are minimum design requirements. The City may alter parameters to fit the needs of specific situations, including, but not limited to, requiring longer storage lengths or providing cross-access to properties.

2.6.2 Medians and Median Openings

2.6.2.A Access points to neighborhoods and employment centers shall be spaced per these requirements. At the intersection of a new thoroughfare with an existing divided thoroughfare, the Developer shall construct a median opening in the divided thoroughfare to allow

direct access to the property per these spacing and dimensional requirements. The Developer shall be required to construct a left turn lane at all median openings.

2.6.2.B Median Access Classifications – The following median classifications may apply:

- Full Median Opening – An opening in the median of a roadway permitting mid-block median opening traffic movements into and out of a properly aligned access point
- Left Turn Entry Only (Hooded Left) – An opening in the median of a roadway that permits left turns into a properly aligned access point but prevents all other cross-median traffic movements
- Left Turn Exit Only – An opening in the median of a roadway that permits left turns from a properly aligned driveway but prevents all other cross- median traffic movements
- U-Turn Only – A median opening without cross access that permits U-turns.

2.6.2.C Cross-Median Access – Cross-median access to or from an existing or proposed access points may be allowed if:

- The median is of sufficient length to be subdivided into multiple medians, each of which meets or exceeds the minimum median length described in this section
- The median is of sufficient width to permit the construction of an exclusive left turn lane
- Such access does not adversely impact the provision for cross-median access to a lot, parcel, or tract of land on the opposite side of the street. If an existing driveway, street, or access point is already constructed on the opposite side of the roadway, the new driveway shall align with the existing driveway, street, or access point

2.6.2.D Median Opening Length – Median openings shall be a minimum of twenty (20) feet wider than the width of the driveway/street/access point throat width which they are serving. Regardless of driveway width, the minimum length of a full median opening shall be sixty (60) feet and shall accommodate all the turning maneuvers of the design vehicle for which the driveway is designed. The minimum length of a full median opening shall be of sufficient length so that concurrent turning maneuvers from exclusive left turn lanes serving the driveways on each side of the roadway do not conflict with each other. The maximum length of a full median opening shall be limited so that the

median opening serves only a single driveway on each side of the roadway. Turning movements of the design vehicle shall be shown with the plan submittal.

2.7 Driveway Spacing and Design Standards

2.7.1 Driveway spacing and minimum distance from nearest intersection shall be as shown in **Table 2-4**. The City may modify these standards based on anticipated traffic flow and in accordance with sound traffic engineering practices.

Table 2-4. Driveway Spacing Requirements

Description	Street Classification	Residential	Commercial
		Max.	Max.
Driveway Throat Width (ft)	Street (Rural, Yield, Neighborhood)	12	20
	Neighborhood Avenue	12	20
	Community Boulevard (2 or 4 Lane)	Not Permitted	20
	Regional	As approved by the City (Within City Limits)	
Minimum Driveway Spacing (centerline) (ft)	Street (Rural, Yield, Neighborhood)	22	100
	Neighborhood Avenue	32	100
	Community Boulevard (2 or 4 Lane)	Not Permitted	100
	Regional	As approved by the City (Within City Limits)	
Minimum Distance from Driveway to Intersection (ft)	Street (Rural, Yield, Neighborhood)	30	75
	Neighborhood Avenue	50	75
	Community Boulevard (2 or 4 Lane)	Not Permitted	100
	Regional	As approved by the City (Within City Limits)	

2.7.2 Driveway Access and Location Requirements – Refer to LDC Section *Driveways*

2.7.3 Minimum Standards – All driveways shall be concrete and shall be in accordance with the Standard Details.

2.7.4 Cross (joint-use) may be approved provided that a permanent, dedicated access easement is obtained. The developer must include a plat note and provide

dedication documents indicating that maintenance of the joint-use driveway shall be the responsibility of the lot owners served by the joint-use driveway.

2.7.5 Measurement – Spacing between driveways shall be measured along property lines from the closest edge of pavement (throat) from one driveway to the closest edge of pavement (throat) of the next driveway.

2.7.6 Ten (10) feet of separation shall be maintained between curb inlet opening and driveways to keep the driveway out of the inlet gutter depression.

2.7.7 Geometry

2.7.7.A Flare/Radius – Refer to Standard Details.

2.7.7.B Driveway/Public Street Intersection Angle

- The deflection angle of all full access or right turn in/right turn out partial access driveway connections to public streets may vary from 80 degrees to 100 degrees. The driveway shall be tangent and without curve from the right-of-way line to a point 25 feet within the lot, parcel or tract of land the driveway is accessing.
- The deflection angle of all entry-only or exit-only partial access driveway connections to public streets may vary from 45 degrees to 90 degrees. The driveway shall be tangent until it has fully entered private property.

2.7.8 Street Intersection Corner Clearance – When the adjacent street frontage is within the minimum corner clearance distance:

2.7.8.A If the lot, tract or parcel is in the process of being subdivided and re-platted from a larger tract of land with sufficient frontage to meet the minimum corner clearance distance, a joint access easement by plat shall be required of the subdivider so that the minimum corner clearance requirement is met.

2.7.8.B If the lot, tract, or parcel cannot obtain a joint access easement to meet the minimum corner clearance requirements, a single driveway connection shall be made at the point along the public street frontage that provides the maximum clearance distance.

2.7.9 Driveway Grades – Refer to the Standard Details for minimum and maximum driveway grades.

2.7.10 Commercial, Industrial, and Multi-Family Driveways

2.7.10.A A maximum of three driveways shall be permitted for each 1,000 feet of thoroughfare frontage, regardless of the minimum spacing requirements.

2.7.10.B Opposite Driveway Offset – Non-residential and multi-family

driveways on opposite sides of an undivided street shall align with each other or be spaced a minimum of 75 feet apart to ensure that conflicting movements do not overlap as shown in **Figure 2-2**.

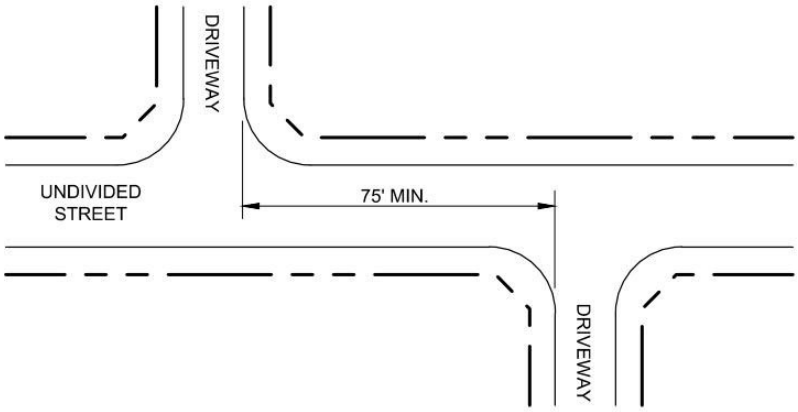


Figure 2-2. Driveway Spacing on Opposite Sides of an Undivided Street

2.7.11 Adequate storage areas as determined by the approved TIA must be provided for both inbound and outbound vehicles to facilitate the safe and efficient movement between the street and the neighborhood/employment center. Inbound vehicle storage areas must be of sufficient size to ensure that vehicles will not obstruct the adjacent street, sidewalk, or circulation within the facility.

2.7.12 Horizontal Clearance – Horizontal clearance from the edge of the driveway to obstructions shall be eighteen (18) inches minimum.

2.8 Alleys

2.8.1 Alleys serve neighborhoods to distribute services and vehicles to the rear of the lots. The City prefers that neighborhood plans include alleys; therefore, development and construction standards are flexible to encourage alleys.

2.8.2 Alleys shall include a driving surface width of twelve (12) feet and a minimum ROW of sixteen (16) feet.

2.8.3 Maximum alley length between access points to a road shall be dictated by the requirements of the LDC for maximum block size.

2.8.4 Alley alignment and offsets – Alley alignment, deflection angles, and curve radius shall be designed for the appropriate design vehicle and intended uses of the alley.

2.8.5 Dead-End Alleys – Dead-end alleys shall be considered on a case-by-case basis.

2.8.6 Obstructions – All alley ROW shall be kept free and clear of obstructions.

2.9 Roundabouts

2.9.1 General – Roundabouts are a proven safety countermeasure because they can substantially reduce crashes that result in serious injury or death. Roundabouts can:

- Improve safety
- Promote lower speeds and traffic calming
- Reduce conflict points
- Lead to improved operational performance
- Meet a wide range of traffic conditions because they are versatile in size, shape, and design

2.9.2 Design Sources – There are several sources for roundabout design including the following**:**

- TxDOT's *Roadway Design Manual*, Appendix E
- *NCHRP Report 672 (Roundabouts an Informational Guide, 2nd Edition)*
- *Texas Manual on Uniform Traffic Control Devices (TMUTCD)* for signing and pavement marking applications

2.10 Pedestrian Facilities

2.10.1 General – Pedestrian facilities shall be designed to promote pedestrian safety and efficiency, minimize conflicts with motorized and non-motorized vehicle traffic, minimize tripping hazards and protruding objects, and accommodate accessibility needs of pedestrians. All pedestrian facilities must conform to current Federal, State, and Local ADA requirements and to the criteria in this section. Pedestrian facilities include sidewalks, shared-use paths, paths, trails, hike and bike routes, and barrier free ramps.

2.10.2 Intent – Pedestrian comfort shall be the primary consideration for the design of streets in the City. Design conflicts between vehicular and pedestrian movement shall be decided in favor of the pedestrian.

2.10.3 Right-of-Way Permit Required – No person shall construct, reconstruct, alter, repair, remove or replace any sidewalk on any public property within the City Limits without first obtaining a permit from the building permit office.

2.10.4 Definitions –

2.10.4.A Sidewalk – A sidewalk is a paved pathway typically located within the street ROW and generally following the grade of the curb line and intended primarily for pedestrians and includes wheelchairs.

2.10.4.B Curb Ramp – A curb ramp is a connection between a sidewalk and a thoroughfare surface that is constructed with special surface, visual, and geometric characteristics. The clear width of the curb ramp shall match the width of the adjoining sidewalk, shared-use path, or trail, but no less than five (5) feet.

2.10.4.C Shared-use Path (SUP) – A shared-use path is a multi-use path designed for both transportation and recreational purposes and are typically separated from motorized vehicular traffic by an open space or barrier, either within a ROW or separate easement.

2.10.4.D Trail – A trail is a pedestrian route developed primarily for outdoor recreational purposes.

2.10.5 Inspection Required – All work done in construction, reconstruction, alteration, repair, or removal or replacement of sidewalks shall be inspected by the City to assure compliance with these regulations. When other public improvements are required, final acceptance of all other improvements shall not be made until sidewalks are approved.

2.10.6 Sidewalks, shared-use paths, trails, and curb ramps shall be constructed to comply with Chapter 4: "Accessible Routes" of the latest edition of the Texas Accessibility Standards (TAS) of the Architectural Barriers Act Article 9102, Texas Civil Statutes; the latest edition of the Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG) for Public Rights-of-Way; or the standards herein, whichever is more restrictive. The geometry and tolerances of the surface of a thoroughfare between curb ramps on either side of the thoroughfare, or of a driveway between the points where sidewalk intersects the driveway edges on either side of the driveway, shall also comply with the standards. Compliance with the *Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG)*, available from the United States Access Board, shall also be required for sidewalk and general pedestrian facility design, and is incorporated by reference.

2.10.7 All projects are required to comply with TAS. Projects with costs of $50,000 or more are required to be registered, reviewed, and inspected by the Texas Department of Licensing and Regulation (TDLR) or a Registered Accessibility Specialist (RAS). For roadway/street projects, the project cost is the cost of the pedestrian elements. Engineering Plans shall have the TDLR registration number noted on the title sheet. For pedestrian facilities in public ROW, the Engineer of Record shall arrange for the RAS review of the plans prior to construction, and inspection after construction with documentation provided to the City.

2.10.8 A design variance is required whenever the design criteria specified in the ADAAG and the TAS are not met. The Engineer of Record who is sealing the construction plans is responsible for obtaining approval of design variances from the Texas Department of Licensing and Regulation (TDLR). Contact the City prior to proceeding with the variance request to obtain concurrence that specific criteria cannot be met and a request for variance is reasonable.

2.10.9 Pedestrian Facilities Design Guidelines – Pedestrian facilities shall comply with the following standards:

- United States Access Board's *Americans with Disabilities Act Accessibility Guidelines* (ADAAG)
- United States Access Board's *Accessibility Guidelines for Pedestrian Facilities in Public Right-of-Way (PROWAG)*. Use final rule published 08/08/2023 and effective 09/07/2023.
- Texas Department of Licensing and Regulation's (TDLR) *Texas Accessibility Standards* (TAS)
- TxDOT's current edition of TMUTCD
- AASHTO's *Guide for the Development of Bicycle Facilities* (Chapter 5: Design of Shared Use Paths).

2.10.9.A All Pedestrian Paths – All pedestrian paths shall have a typical 1.5% cross-slope and maximum 2% cross-slope. The least possible longitudinal grade shall be used to maximize accessibility but should not exceed 5%. The grade may exceed 5% if it follows the grade of the parallel thoroughfare and is within public ROW.

2.10.9.B Barrier Free Ramps – Accessible ramps for sidewalk crossings at all street intersection corners, at all crosswalks, and across any stop control on residential or multi-family driveways shall be in accordance with this section. A single curb ramp shall be used for each crosswalk direction. Use of a single diagonal curb ramp leading to two cross walks shall not be used.

2.10.9.C Curb Ramp Widths – The clear width of curb ramps shall match the width of the connecting sidewalk, shared-use path, or trail.

2.10.9.D Curb ramps are not required at driveways but shall be provided if the driveway is controlled by a traffic signal.

2.10.9.E A five-foot by five-foot landing area with maximum cross slope of 2% in all directions is required at the top of the ramp.

2.10.9.F Where pedestrian routes, sidewalks, SUPs intersect with a public thoroughfare without curbs, the detectable warning surface is required, similar to a curb ramp.

2.10.9.G At signalized intersections, the curb ramp location and pedestrian push button locations shall be properly coordinated. Refer to Part IV of the TMUTCD.

2.10.9.H Pedestrian facilities shall be constructed according to TxDOT's current standards: "Pedestrian Facilities-Curb Ramps" and "Pedestrian Handrail Details". These standards are available from TxDOT's website and shall be included in the subdivision improvement plan set.

2.10.10 Sidewalks, Shared-Use Paths, and Trails

2.10.10.A Requirements

- Sidewalks are to be constructed with the paving of streets or building construction unless deferred by the City.
- Sidewalks in public ROW and constructed as part of a new neighborhood or re-development are considered public facilities and shall be constructed according to the requirements outlined in this section.
- When a lot is developed, pedestrian facilities along frontage of property shall be required at time of lot development. Sidewalks, ramps, and landing areas shall be installed along all thoroughfares and common areas prior to final acceptance.

2.10.10.B Geometry

- Width – Pedestrian facilities shall have a minimum width of five (5) feet when not adjacent to the back of curb. Sidewalks adjacent to curb shall be a minimum of six (6) feet in width.
- Paths shall have a minimum ROW width of ten (10) feet and minimum pavement width of six (6) feet.
- A trail or shared-use path shall have a minimum ROW width of twenty (20) feet and minimum width of ten (10).
- Sidewalk geometry, locations, pavement widths are to be confirmed with the City and shall be established during the planning process when the development is covered by a Neighborhood Plan or Employment Center Plan.

2.10.10.C Material – Sidewalks shall be constructed of concrete with reinforcement according to the standard details. Trail system sidewalks shall be a minimum thickness of five (5) inches. Reinforcement and joints shall be in accordance with the construction details. All trails and shared-use paths to be maintained by the City shall be concrete.

2.10.10.D Sidewalks at Bridges – All street bridges shall have a sidewalk constructed on each side of the bridge. The sidewalk shall be a minimum of six (6) feet wide with a parapet wall providing a minimum of two (2) feet behind the curb of the thoroughfare. A standard pedestrian bridge rail protecting the sidewalk shall be provided on the outside edge of the bridge.

2.10.10.E Sidewalks at Culverts and Retaining Walls – All culvert crossings shall have a sidewalk constructed across and on each side of the culvert. The sidewalk shall have a standard pedestrian handrail. Combination

rails or parapet walls may be required.

2.10.10.F Shielding - There are two cases that require shielding. A drop-off greater than ten (10) inches that is closer than two (2) feet from the pedestrians' or bicyclists' pathway or edge of sidewalk is considered a hazard and shall be shielded. A slope steeper than 2H:1V that begins closer than two (2) feet from the pedestrians' or bicyclists' pathway or edge of sidewalk is considered a hazard and shall be shielded when the total drop-off is greater than sixty (60) inches. Depending on the depth of the drop-off, horizontal/vertical geometry, and severity of the hazards, shielding may be necessary for cases other than described above. Shielding or protection of drop offs shall utilize TxDOT Standard Details for Pedestrian Railings.

2.10.11 Shared-Use Path (SUP) Requirements

2.10.11.A A shared-use path is a pedestrian route physically separated from the thoroughfare and may be located either within the street ROW, or outside with an easement. Shared-use paths may be used by bicyclists and pedestrians and therefore shall meet the design requirements of a bike facility and the PROWAG/ADA/TAS. Minimum width for a two-way shared-use path is twelve (12) feet, however an 8-10 foot width may be provided in constrained ROW instances, and if approved by the City.

2.10.11.B The path shall include a two (2) foot wide graded area at a maximum slope of 1V:6H adjacent to both sides of the path. Three-foot horizontal clearance to obstructions shall be maintained.

2.10.11.C The shared-use path shall have a minimum vertical clearance of eight (8) feet, however where practical, ten feet (10') should be provided.

2.10.11.D Railings, fences or barriers adjacent to a shared-use path shall be a minimum of forty-two (42) inches high.

2.10.12 Trail Enhancement Elements – Street Enhancements, Signed Shared Thoroughfares (Bike Routes), Trail-Roadway Crossings, and Signing and Striping at Roadway Crossings shall be included. The placement and location of enhanced sidewalks and trails shall be determined by the City. Additional ROW and easements may be needed to accommodate these improvements.

2.11 Bicycle Facilities

2.11.1 Refer to published design guidance such as AASHTO's *Guide for the Development of Bicycle Facilities* for further information. Another primary design reference for design of bicycle facilities is the National Association of City Transportation Officials (NACTO) *Urban Bikeway Design Guide*.

2.12 On-Site Parking and Fire Lane Geometry

2.12.1 General – This section includes requirements for on-site parking and fire lane geometry.

2.12.2 Fire Lanes

2.12.2.A The Development Services Director, DRC, and the Fire Marshal will review all proposed developments for safe and appropriate access, parking lanes, private streets, driveway access points, fire hydrant locations and other emergency access items.

2.12.2.B Fire Lanes shall meet the Standards of the International Fire Code (IFC) as adopted by the City.

2.12.2.C Fire Department access routes shall be provided by the Developer as required by Ordinance and shall be approved by the Fire Marshal. Where a cul-de-sac is required for fire apparatus access, it shall conform to the dimensions shown in **Figure 2-3** and **Table 2-5**. If a hammer head is used it shall conform to the dimensions shown in **Figure 2-4**. Minimum dimensions may vary based on direction from the Fire Marshal. Note that culs-de-sac within the City are discouraged. These dimensions apply to fire department access routes, when a cul-de-sac is required and approved by the City.

Table 2-5. Typical Cul-de-Sac Dimensions

Dimensions	Typical Dimensions
A	96’ minimum
B	25’ Typical
C	26’ minimum

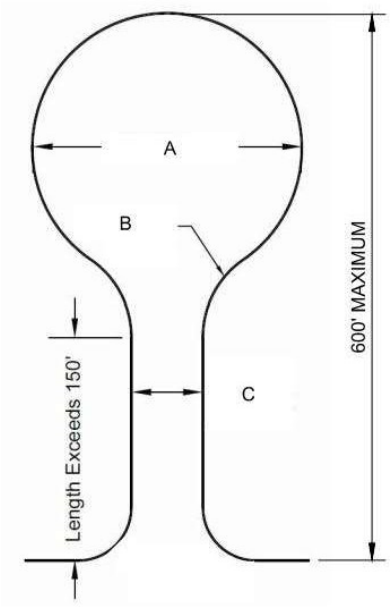


Figure 2-3. Typical Cul-de-Sac

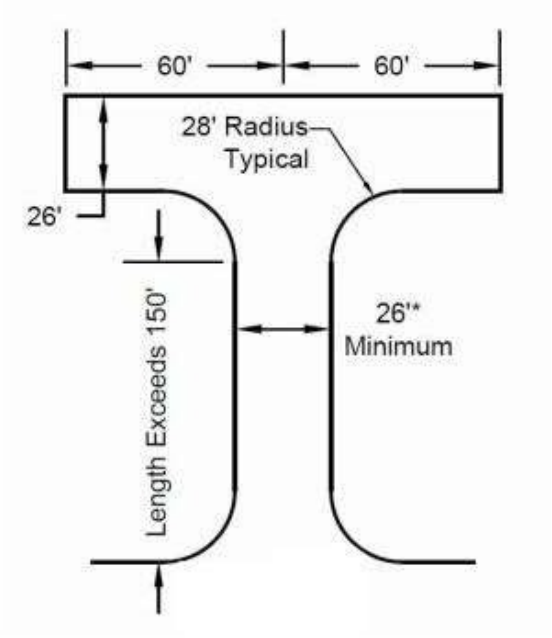


Figure 2-4. Typical 120-foot Hammer Head

2.12.2.D When a parking aisle is also serving as a fire lane, the aisle must meet

the minimum width, radius, and construction standards for a fire lane, if these are greater than the requirements for a parking aisle.

2.12.2.E Continuous marked fire lane access is required throughout the project. Vertical curbs shall be painted six (6") inches in height and shall be painted RED on the top and side, extending the length of the designated fire lane with four inch (4") white block lettering stenciled on the face "NO PARKING – FIRE LANE". The stenciling shall be spaced every fifty feet (50') maximum. Rolled curbs or surfaces without curbs shall have a six inch (6") wide RED stripe painted extending the length of the designated fire lane with four inch (4") white block lettering stenciled on stripe "NO PARKING – FIRE LANE". The stenciling shall be spaced every fifty feet (50') maximum.

2.12.2.F Fire lane markings shall be established and maintained as often as required by the Fire Marshall to clearly identify the designated area as a fire lane, at the sole expense of the property owner. The property owner shall have completed the required establishment or maintenance of fire lanes within thirty (30) days of receiving written notification that such is necessary.

2.12.3 On-Site Parking

2.12.3.A General – On-site parking shall not be the driver of site planning. The Standards in the LDC support this notion by eliminating minimum parking requirements. The intent of building a walkable, bikeable, and easily navigable City means all modes of transportation are available to reduce the reliance on the automobile.

2.12.3.B The location of the on-site parking shall be established and shown on the Neighborhood Plan, or Employment Center Plan, and the approved Site Development Plan. Refer to the LDC for further requirements.

2.12.3.C Surface Material – Refer to the LDC for parking lot standards.

2.12.4 Accessible Parking Spaces

2.12.4.A Accessible (Disabled) Parking Spaces - Adequately designed accessible parking spaces shall be provided as required by the IBC and designed in accordance with the parking area landscaping

2.12.5 Parking Landscaping

2.12.5.A Use landscape plant materials that are drought tolerant, have minimal dropping of pods and sap, and have canopies that can have a canopy bottom at least ten (10) feet above the ground.

2.12.5.B Use single-trunk trees in parking lot landscape areas in accordance

with the approved tree list by the City of Taylor.

2.12.6 Traffic Control Devices In On-Site Parking Lots

2.12.6.A The site development plans shall include necessary traffic control devices for on-site parking lots including pavement markings and signage.

2.13 Geotechnical and Pavement Design Requirements

2.13.1 Objective - The objective of this section is to provide the City Staff and applicant's Engineers with a pavement design overview covering the design inputs, design methodology, and minimum pavement sections for the various street types constructed by developers within public ROW and to be maintained by the City. This section is intended to address most pavement design considerations for the types of soils encountered in the City. Deviations from the pavement design methodology or minimum design criteria set forth in this section shall be documented in a Pavement Design Report and approved by the City prior to incorporating into the construction documents. This document is not intended to cover pavement design for highways under the authority of the Texas Department of Transportation (TxDOT) or Williamson County. For TxDOT or Williamson County roadways, the reader is referred to design manuals such as TxDOT's *Pavement Design Guide* or Williamson County's Design Criteria.

2.13.2 The City of Taylor has adopted the current City of Austin's *Transportation Criteria Manual, Appendix B – Pavement Design Guidelines For The Design of City Streets*. Pavement investigations, designs, and reports shall be in accordance with this Manual. The Geotechnical Engineer and Pavement Engineer shall become familiar with this Manual and the basis for its development which is the Capital Area Pavement Engineers Council's (CAPEC) *Phase 3 Report – Pavement Design Manual* (July 2017).

2.13.3 General - Streets shall be constructed or reconstructed using either dense-graded hot-mixed asphaltic concrete (HMAC) pavement (flexible pavement) or concrete pavement (rigid pavement) that meet or exceed the minimum requirements of this Manual and the Standard Details. The developer requiring street construction shall provide a geotechnical and pavement design report, sealed by a Licensed Professional Engineer, containing recommendations for thickness and specifications for pavement, base, and subgrade materials. The Geotechnical Engineer shall submit a preliminary pavement design to the City for review and approval prior to finalizing the pavement design report and Contract Bidding Documents. The City has final approval authority for all pavement designs for streets and alleys in the public ROW and to be maintained by the City after construction.

2.13.4 Standard of Care - The services described in this section shall be completed under the direction of an appropriately experienced Professional Engineer

registered in the State of Texas. Geotechnical and pavement engineers shall be retained to address the geotechnical related aspects of pavement designs described in this section and development of recommended pavement section(s). Roles and responsibilities adopted for the purpose of this manual are provided below:

2.13.4.A Thoroughfare Designer: Professional Civil Engineer with responsible charge for completion of the design project. The Thoroughfare Designer is responsible for coordinating all elements of the project (civil, thoroughfare, geotechnical, pavement, etc.), and preparing final plans and specifications required for contractors to bid on construction of the project. The Thoroughfare Designer is also responsible for developing design traffic parameters and thoroughfare design layouts for use by the Geotechnical Engineer and/or Pavement Engineer

2.13.4.B Geotechnical Engineer: Professional Civil Engineer responsible for the geotechnical engineering related aspects of pavement design, including subsurface investigation and subgrade treatment/ stabilization recommendations. Depending on the project, the Geotechnical Engineer may also assume the responsibilities of the Pavement Engineer

2.13.4.C Pavement Engineer: Professional Civil Engineer responsible for the pavement design, including pavement materials selection and layer thicknesses required to support design traffic loading.

2.13.5 Traffic Parameters for Pavement Design

2.13.5.A Traffic Data Collection - Traffic data must be developed for new roadways or existing roadways being widened for added capacity. Traffic data must address the variety of factors usually depicted with Traffic Impact Analyses (TIA) that predict the type and volume of future traffic. Traffic projections shall consider complete build-out of subdivisions and any future development that will be served by a specific street. Should the roadway's geometry require change (e.g., widening to add capacity or narrowing to add bicycle lanes or parking), these counts will need to be adjusted to a projected traffic level and number of lanes appropriate for the geometry changes.

2.13.6 Representative Traffic Design Parameters by City of Taylor Street Type

2.13.6.A The following **Table 2-6** provides the cross reference between the City of Taylor Street Types versus Street Classifications found in the City of Austin's *Transportation Criteria Manual, Appendix B*.

Table 2-6. Taylor Street Types Cross Reference	
Rural Street	Urban Local
Yield Street	Urban Local
Neighborhood Street	Urban Local
Neighborhood Avenue	Urban Collector Low Traffic
Community Blvd (2-Lane)	Urban Collector Low Traffic
Community Blvd (4-Lane)	Urban Collector High Traffic

2.14 Minimum Pavement Sections for Taylor Street Types

The following sections include minimum pavement sections for HMAC (flexible pavement) and concrete (rigid pavement) to be considered as minimums for the various City of Taylor street types. Depending on site conditions and expected traffic volumes, thicker pavement sections may be required than the minimums presented in **Section 2.15 and 2.16**. The minimum pavement sections shown in **Sections 2.15 and 2.16** do not relieve the Pavement Engineer from the responsibility of designing pavement structures that is appropriate for the specific site being developed.

2.15 Hot-Mix Asphaltic Concrete (Flexible) Pavement Minimum Sections

2.15.1 Local Streets (Rural Street, Yield Street, Neighborhood Street)

- Eight (8) inches Lime Treated Subgrade. Extend LTS two (2) feet past the back of curb line
- Geogrid TX-5
- Ten (10) inches minimum thickness flexible base according to the current TxDOT Specification for "Flexible Base". Lift thickness to be 4" to 6", and each lift compacted to 100% of the maximum dry density. Use Type A, Grade 1-2 or 5 unless otherwise approved. Extend base two (2) feet past the back of curb line
- Prime coat
- Three (3) inches Type "C" Dense-Graded Hot-Mix Asphalt (HMAC) according to the current TxDOT Specification for "Dense-Graded Hot-Mix Asphalt"

2.15.2 Collector Streets (2-Lane and 4-Lane Community Blvd, Neighborhood Avenue)

- Eight (8) inches Lime Treated Subgrade. Extend LTS two (2) feet past the back of curb line
- Geogrid TX-5
- Fourteen (14) inches minimum thickness flexible base according to the current TxDOT Specification for "Flexible Base". Lift thickness to be 4" to 6", and each lift compacted to 100% of the maximum dry density. Use Type ‘A’, Grade 1-2 or 5 unless otherwise approved. Extend base two (2) feet past the back of curb line

- Prime coat
- Four (4) inches Type "C" Dense-Graded Hot-Mix Asphalt (HMAC) according to the current TxDOT Specification for "Dense-Graded Hot-Mix Asphalt"

2.15.3 Geogrid

The City's experience has shown that geogrids are effective at controlling environmental cracking and shall be included in the flexible pavement sections. Triaxial Geogrid (Tensar TX-5 or equal) is the recommended geogrid type for subgrade improvement and shall be specified in the plans to be pinned during installation.

2.16 Concrete (Rigid) Pavement Minimum Sections

2.16.1.A Local Streets (Rural Street, Yield Street, Neighborhood Street)

- Eight (8) inches Lime Treated Subgrade (LTS). Extend LTS two (2) feet past the back of curb line
- Three (3) inches Type "B" Dense-Graded Hot-Mix Asphalt (HMAC) according to the current TxDOT Specification for "Dense-Graded Hot-Mix Asphalt". Extend base two (2) feet past the back of curb line
- Six (6) inches of concrete according to the current City of Austin Specification for “Concrete Pavement”
- Reinforcing and jointing per City of Austin’s *Transportation Criteria Manual, Appendix B – Pavement Design Guidelines*

2.16.2 Collector Streets (2-Lane and 4-Lane Community Blvd, Neighborhood Avenue)

- Eight (8) inches Lime Treated Subgrade (LTS). Extend LTS two (2) feet past the back of curb line
- Four (4) inches Type "B" Dense-Graded Hot-Mix Asphalt (HMAC) according to the current TxDOT Specification for "Dense-Graded Hot-Mix Asphalt". Extend base two (2) feet past the back of curb line.
- Seven (7) inches of concrete according to the current City of Austin Specification for “Concrete Pavement”
- Reinforcing and jointing per City of Austin’s *Transportation Criteria Manual, Appendix B – Pavement Design Guidelines*.

2.17 Construction Guidelines - All Streets

2.17.1.A Subgrade Preparation and Proof Rolling

- Density controlled subgrade: Scarify, blade, roll, and compact the subgrade to provide a uniform moisture content and density for the top 8 inches of the subgrade. Repeat grading and compaction until the specified lines, grades, and cross-sections are obtained and the materials are compacted to the specified depth and density.
- Proof roll and use density control prior to placement of any

embankment, borrow, or base material.

- Proof roll subgrade in accordance with TxDOT Item 216. Correct any unstable or spongy subgrade areas by additional re-working, drying and compaction, or by removal and replacement with approved material. Remove and replace all unsuitable material, as directed by the City with approved material.
- Provide the required density and moisture control for the subgrade based on the plasticity characteristics of the approved material. Sprinkle the subgrade material and compact to the extent necessary to provide the density specified below. The City will use TxDOT Tex-114-E Part 1 or Part 2, or Tex 113-E based on gradation of material to determine the maximum dry density (D_a) and optimum moisture content (W_{opt}).
- Meet the requirements for field density and moisture content for subgrade and each embankment lift per **Table 2-7.**

Table 2-7. Field Density Control Requirements

Soil Description	Density, Percent	Moisture Content
	Tex-115-E	
PI < 15	≥98% D_a * and ≤ 105% D_a	N/A
15 ≤ PI ≤ 35	≥98% D_a and ≤102% D_a	≥ W_{opt} + 3%
PI > 35	≥95% D_a and ≤100% D_a	≥ W_{opt} + 3%

2.17.1.B Guidelines and requirements for lime treated subgrade are provided below:

- Treatment Depth. Eight inches (8") minimum thickness lime treated subgrade according to TxDOT Specification "Lime Treatment (Road-Mixed)". Apply lime at the recommended percentage stated in the approved pavement design report. Adjust lime application as directed by the City during construction.
- Mix Design. Lime treatment mixture design shall be developed using one of the following procedures appropriate for the intended purpose of lime treatment:
    - Lime Conditioning Mix: TxDOT Test Method Tex-112-E,

"Method of Admixing Lime to Reduce Plasticity Index of Soils". Maximum PI is 20 after lime treatment.

- Lime Stabilizing Mix: TxDOT Test Method Tex-121-E, "Soil-Lime Testing", shall be used to establish the lime content that would produce a twenty-eight (28) day unconfined compressive strength (TxDOT Test Method Tex-117-E). Minimum compressive strength equals 100 psi and minimum pH of 12.3 for a lime-stabilized subgrade.

- Application Rate. The actual design application rate shall be determined by the Geotechnical Engineer or Pavement Engineer based on bench-scale lime series testing. Typical specified rate of lime solids application shall be 5% by weight (mass) for non-lime-reactive materials (pH of 7.0 or less); or 7% by weight (mass) for lime-reactive materials (pH greater than 7.0), unless indicated otherwise in the mix design process or as directed by the City. Lime stabilization of subgrade soils shall be in slurry form unless otherwise approved by the City.
- Sulfate Content. Soils with elevated soluble sulfate content are not suitable for lime treatment due to the risk of sulfate-induced heave. The following sulfate content guidelines shall be observed when considering lime treatment:
    - Soluble Sulfate < 3,000 ppm: Subgrade is compatible with lime treatment.
    - Soluble sulfate between 3,000 ppm and 8,000 ppm: Subgrade shall be identified as generally compatible with lime treatment, though the Pavement Engineer or Thoroughfare Designer shall consult with the City for approval to use lime treated subgrade in these cases. Refer to TxDOT's "Guidelines for Modification and Stabilization of Soils and Base for Use in Pavement Structures" and "Guidelines for Treatment of Sulfate-Rich Soils and Bases in Pavement Structures" for more information.
    - Soluble sulfate > 8,000 ppm: Subgrade shall be identified as being incompatible with lime treatment.

2.18 Curb and Gutter Requirements

2.18.1 All streets shall be provided with reinforced concrete curbs and gutters in accordance with the following specifications:

2.18.1.A All rural street sections will have an eighteen (18) inch-wide ribbon curb. All other street sections shall include a twenty-four (24) inch

curb and gutter with a gutter pan of eighteen (18") inches.

2.18.1.B Reinforcement shall be provided by three (3) No. 4 steel reinforcing bars by placing one (1) bar in the curb roll and two (2) bars in the curb and gutter base. Use manufactured chairs for concrete placement.

2.18.1.C Concrete for curbs and gutters shall be Class "A" and consist of five (5) sacks (minimum) of Portland Cement for each cubic yard of concrete mix and have a seven (7) day flexural strength of five hundred pounds per square inch (500 PSI) and a twenty-eight (28) day compressive strength of three thousand pounds per square inch (3,000 PSI).

2.18.1.D All driveway entrances constructed in existing curb and gutters shall be saw-cut at the curb return on both sides of the driveway and eighteen (18") inches into the street. After work is completed, the street sidewalk shall be repaired, and it shall be the responsibility of the party installing the driveway. All driveways cut into existing curb and gutter areas shall utilize the horizontal curb cutting method, leaving the original gutter in place. Smooth dowels shall be installed into the back of the existing curb.

2.18.1.E Provide control joints at ten (10') foot spacing, and expansion joints at fifty (50') foot spacing.

2.19 Testing/Inspection

2.19.1 General - All construction, such as grading, paving, curb and gutter, , are subject to inspection during the construction period by the City and shall be constructed in accordance with the approved Construction Plans and this Manual.

2.19.2 Periodic inspections will be performed by the City Inspector and/or City Engineer during construction of both proposed City-maintained improvements and private-maintained improvements. Inspections shall be scheduled by the Contractor at the following intervals:

2.19.2.A Density Controlled Subgrade and Lime Treated Subgrade when:

- All tests for subgrade have been witnessed by City and passed
- The subgrade conforms to the Construction Plans
- All grading, including ditches and erosion control, is complete
- All culverts, headwalls, and Safety End Treatments are installed; for cast-in-place concrete structures, inspection of placement of reinforcing bars shall be performed prior to pouring of concrete

2.19.2.B Flexible Base when:

- All tests for flexible base have passed

- The flexible base conforms to the Construction Plans

2.19.2.C Other periodic inspections during testing

2.19.2.D Final inspection when:

- All tests have passed
- All improvements are complete and record drawings are prepared and approved by the City

2.19.3 Request for inspection must be received by the City via e-mail and must include the subdivision name, current date, inspection requested (subgrade, base, etc.) and desired date and time of inspection.

Subgrade and flexible base inspections must be scheduled at least two (2) business days in advance of date requested for the inspection. For inspection during geotechnical testing, at least one business days' notice is required in advance of date requested for the inspection. At least five (5) business days' notice is required in advance of date requested for final inspections. Note that subgrade and base testing MUST be witnessed by the City. Subgrade and base testing shall include the area behind the curb line/edge of pavement as well as within the pavement limits. Test locations shall be as directed by the City and in accordance with this manual. The reinforcing steel in cast-in-place concrete structures must be inspected by City prior to pouring of concrete. Inspection shall be scheduled at least two (2) business days in advance of date requested for the inspection. All cast-in-place structures shall meet TxDOT Standards and Specifications. Cast-in-place concrete structures with uninspected reinforcing steel will be considered defective and must be removed and replaced at Contractor's expense.

2.19.4 If testing or inspection does not occur for the subgrade and/or base while the surface is exposed, the Contractor will be required to have an independent testing laboratory, acceptable to the City, perform testing at the Contractor's expense. Such testing may include core samples or additional density tests at 50-foot intervals measured longitudinally along the thoroughfare. If the road surface is concrete, X-ray tests will be required for density tests. During the progress of the work, all materials, equipment, and workmanship may be subjected to such inspections and tests as will assure conformance with the engineering requirements. All testing shall be done by an independent testing laboratory acceptable to the City and at the Contractor's expense. All final test reports submitted to the City and must be sealed by a Professional Engineer licensed in the state of Texas. The City shall approve the location of all testing. Testing locations shall be selected at varying distances from the centerline of the road. The Contractor is solely responsible for coordination with the testing laboratory, for scheduling of the tests, and for timely delivery of the results to

the City. Additional testing may be required, at the Contractor's expense, at the discretion of the City.

2.19.5 Minimum Testing Requirements

2.19.5.A Subgrade

- Raw Subgrade
  - Soil characteristics including liquid limit, plastic limit, plasticity index, and sieve analysis
  - Proof Rolling in accordance with TxDOT Item 216
  - Density tests are required at a minimum of every 300 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow
  - Standard Proctor tests are required for each existing soil type
- Lime or Cement Stabilized Subgrade
  - Soil characteristics including liquid limit, plastic limit, plasticity index, and sieve analysis
  - Pulverization Gradation tests are required at a minimum of every 300 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow
  - Standard Proctor tests are required for each existing soil type
  - Proof Rolling in accordance with TxDOT Item 216
  - Density tests are required at a minimum of every 300 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow
  - Core or probe tests are required to show thickness of the lime treated subgrade every 500 feet (measured longitudinally along the thoroughfare) with one test required in each cul-de-sac and eyebrow

2.19.5.B Flexible Base

- Wet Ball Mill, Sieve Analysis, and P.I. tests shall be performed in accordance with the appropriate TxDOT Test Procedures

- In-place density tests are required for each lift at a minimum of every 300 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow
- Core or Probe tests are required to show thickness of the base every 500 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow

2.19.5.C Hot-Mix Asphaltic Concrete (HMAC)

- A mix design is required to be submitted for the HMAC in accordance with the current TxDOT Specification
- Density tests are required at a minimum of every 500 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow in accordance with the appropriate TxDOT Test Procedure
- Core tests are required to show thickness of the HMAC every 500 feet (measured longitudinally along the thoroughfare) with three tests required in each cul-de-sac and eyebrow

2.19.5.D Hydraulic Cement Concrete (Portland Cement Concrete)

- A mix design is required to be submitted for the concrete
- Concrete shall be tested for slump, air content, and compression strength in accordance with ACI 318

2.20 Exterior Lighting

2.20.1 General

2.20.1.A Exterior lighting is intended to illuminate the Public Realm with the appropriate IES Luminaire Classification Systems (LCS) per the Place Type Zoning District. The Standards of this section are intended to provide the proper IES Luminaire Classification Systems (LCS) of Illuminance to safely illuminate the City of Taylor's Sidewalks, Pathways, Roadways, Highways, Civic Spaces, or other Public Realm features. International Dark-Sky Association (IDA) compliance for all exterior luminaires is required and is the key part of the City of Taylor's charm. The Exterior Lighting Standards preserve the City of Taylor's dark skies and promote a future dark sky community.

2.20.1.B All exterior luminaire's light source to be LED technology or equivalent energy conserving luminaire.

2.20.1.C All new Neighborhood and Employment Center plans shall require a public lighting plan in compliance with this Section and the LDC. All new lighting on private lots shall comply with the dark sky standards in this Section. Permitted public lighting types per Place Type are

included in the LDC. Refer to the LDC section *Lighting Standards* for further information.

2.20.2 Exterior Luminaire Types

2.20.2.A General – Refer to the LDC for public lighting types permissible for each Place Type.

2.20.3 Exemptions

2.20.3.A The following are exempt from the application of the Standards of this article:

- Exterior luminaires with a maximum output of 180 lumens per luminaire, regardless of the number of lamps, may be left unshielded provided the luminaire has a diffuser installed, and the light source is not visible from any other property. The output from these exterior luminaires shall not exceed 10% of the Total Exterior Lumens Output allowed.
- Exterior luminaires with a maximum output of 360 lumens per luminaire, regardless of the number of lamps, that are shielded with a medium to dark lens cover that reduces the Lumens output approximately in half, and the light source is not visible from any other property. The output from these luminaires shall not exceed 10% of the Total Exterior Lumens Output allowed.
- Exterior Lighting that is a light source produced directly by the combustion of fossil fuels.
- Festoon type low-output lamps are limited to small individual bulbs on a string with a maximum output of 56 lumens within any square foot. The bulbs must have a rating of no more than 2800 Kelvin, shall not be located within 3 feet of a reflective surface such as a light colored or metal wall, and the bulbs shall not be visible from any Residential property within 50 feet of the installed luminaires. The Lumens output from these luminaires shall be doubled for inclusion in the Total Exterior Lumens Output calculations and that doubled Lumens value shall not exceed 20% of the Total Exterior Lumens Output allowed for the property.
- Low-intensity mini-lights or rope-type lights in amber, gold, yellow, cream, red, orange, or warm white wrapped on a tree, post, or other similar object provided the layers are at least 6 inches apart. The output from these mini-lights shall not exceed 2% of the Total Exterior Lumens Output allowed for the property and will be included in the lumens calculation for the Total Exterior Lumens Output allowed.

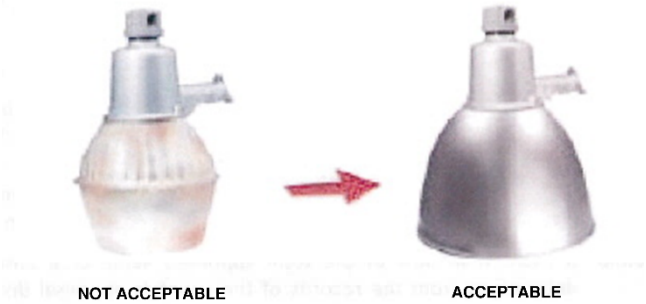
- Temporary Lighting for theatrical, television, performance areas, events, or Construction areas provided the luminaires are positioned so they don't create a glare for the eyes of motorists and the light source is shielded from any other property. This Temporary Lighting must not allow any illuminance to be projected or reflect above the Structures or trees on the property.
- Lighting required by Federal or State Laws or Standards.

2.20.4 Violations

2.20.4.A An individual, developer, or property owner is considered in violation and non-compliant to this Exterior Lighting Section by executing any of the following:

- The installation of any mercury vapor or non-LED/energy conserving luminaire or lamp for use as exterior lighting is prohibited.
- Luminaries rated at more than 3000 Kelvin (K) are prohibited with the exception of luminaries installed prior to the enactment of this revised article rated no more than 4000K, that are shielded on every side so that the light source is not visible from any other property and the combination of all such luminaires within any ten-foot by ten-foot area does not produce more than 4100 lumens for a pole mounted illumination assembly or 2050 lumens for a wall mounted luminaire. Luminaries with a higher Kelvin rating are permitted if the Scotopic-to-Photopic (S/P) ratio is no greater than 1.2.
- The installation of any barn-light style luminaire for use as Exterior Lighting is prohibited unless the luminaire includes a full opaque distribution optics lens instead of the standard translucent distribution optics lens. An example of barn-light style with and without the required opaque distribution optics lens is shown in **Figure I** below.
- The operation of searchlights for advertising purposes is prohibited.

Figure I: Acceptable Shielding of Barn-Style Luminaire



2.20.5 New Exterior Lighting

2.20.5.A General. All exterior luminaires shall be installed in conformance with the provisions of this article, applicable IES Luminaire Classification System (LCS) and Backlight, Uplight, Glare Light (B.U.G.) ratings, State/ Local Roadway/ Highway Lighting Standards, Electrical Codes, Energy Codes, and Building Codes, except as provided herein.

2.20.5.B Non-residential. All exterior luminaires installed on non-residential properties shall conform to the Standards by this section, except as otherwise provided herein.

2.20.5.C Residential. All exterior luminaires installed on residential properties that is affixed to a construction project that a building permit is required under the LDC shall conform to the Standards established by this section.

2.20.5.D Thoroughfares. All exterior illumination assemblies and luminaires installed on City thoroughfares, highways, sidewalks, and pathways shall conform to the Standards by this section, except as otherwise provided herein.

2.20.6 Shielding and Light Distribution Standards

2.20.6.A Utility-Owned Thoroughfare & Highway Luminaires, to be rated by the IES Luminaire Classification System (LCS) and Backlight, Uplight, Glare (B-U-G) ratings based on thresholds defined by the Illuminating Engineering Society (IES) and enforced by the International Dark-Sky Association (IDA):

- Shall be rated and installed with the maximum backlight component limited to the values in B-U-G Rating **Table 2-8** below based on location of the illumination assembly where the property line is considered 5 feet beyond the actual property line.

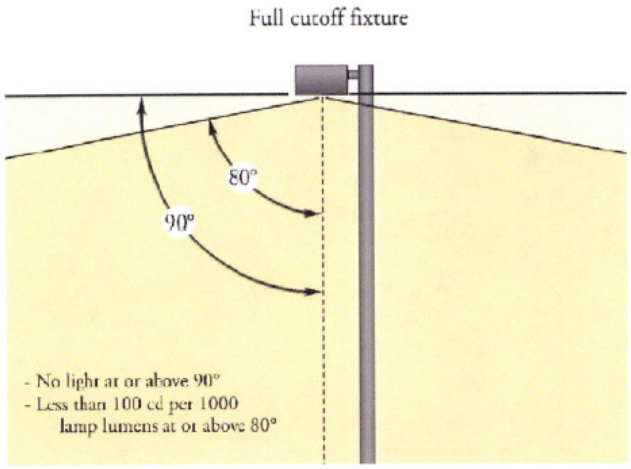
Table 2-8. B-U-G Ratings Table	
LUMINAIRE PLACEMENT	**BACKLIGHT RATING**
Illumination Assembly is greater than 2 mounting heights from property line	B3
Illumination Assembly is 1 to less than 2 mounting heights from property line	B2
Illumination Assembly is 0.5 to 1 mounting heights from property line	B1
Illumination Assembly is less than 0.5 mounting height to property line	B0

- Shall be rated and installed with the Uplight component of zero (U0); and
- Shall be rated and installed with the glare component of no more than G1 unless four-sided external shielding is provided so that the light source of the luminaires is not visible from any other property. Mounting height or topography may cause the light source of a G1 or G0 rated Utility-owned streetlight to require additional shielding to reduce glare.

2.20.6.B State/Government-Owned Thoroughfare & Highway Luminaires, to be rated by the IES Luminaire Classification System (LCS) and Backlight, Uplight, Glare (B-U-G) ratings based on thresholds defined by the Illuminating Engineering Society (IES) and enforced by the International Dark-Sky Association (IDA):

- Shall meet the qualifications to be full cutoff luminaire. (See Figure A). Mounting height or topography may cause the light source of a state/government-owned thoroughfare & highway luminaire to require additional shielding to reduce glare.

Figure A: Full Cutoff Luminaire



Full cutoff luminaires do not allow any light to be emitted above the luminaire. The luminaire limits the light output in the first 10 degrees below the horizontal, to less than 10% of the total luminaire intensity output.

2.20.6.C All other Exterior Luminaires, to be rated by the IES Luminaire Classification System (LCS) and Backlight, Uplight, Glare (B-U-G) ratings based on thresholds defined by the Illuminating Engineering Society (IES) and enforced by the International Dark-Sky Association (IDA):

- Shall be shielded so that the light source of the luminaire is not visible from any other property. Mounting height or proximity to property lines may cause the light source of a luminaire to require additional shielding (See Figure B and Figure C).

Figure B

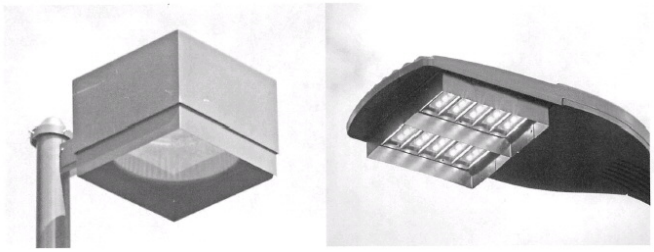


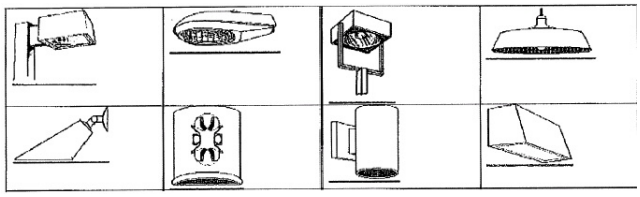
Figure C

- Shall be rated and installed with the maximum backlight component limited to the values in **Table 2-8** based on location of the luminaire where the property line is 5 feet beyond the actual property line.
- Shall be rated and installed with the Uplight components of zero (U0), except for Up-lighting covered in this section
- Shall be rated and installed with the glare component no more than zero (G0) unless four-sided external shielding is provided so that the light source of the luminaire is not visible from any other property.
- Shall be shielded in accordance with this section.
- Exterior Up-lighting is prohibited, except in cases where the luminaire is shielded by a roof overhang or similar structural shield and a Licensed Architect or Engineer has sealed a Lighting Plan that ensures that the luminaire(s) will not cause light to extend beyond the structural shield, and except as specifically permitted in this

section; and

- Exterior luminaires, except Up-lighting are not allowed to have light escape above a horizontal plane running through the lowest point of the light source. (See Figure D and Figure E).

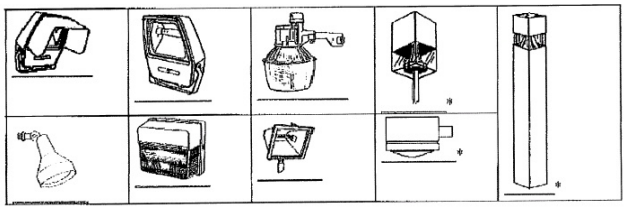
Figure D



This figure shows examples of exterior luminaires that may conform to the provision to not allow light to escape above a horizontal plane running through the lowest point of the Light Source if they are closed on top and mounted such that the bottom opening is horizontal. Note that the mounting height and proximity to the property line, or internal optics may cause them to need additional shielding to prevent the Light Source from being visible from any other property.

A practical way to determine if a luminaire will conform to the provision to not allow light to escape above a horizontal plane running through the lowest point of the light source: the light source, any reflective surface or lens cover (clear or prismatic) must not be visible when viewed from above or the side.

Figure E



This figure illustrates examples of luminaires that do not conform to the provision to not allow light to escape above a horizontal plane running through the lowest point of the light source.

**Note: Even though the light source in these luminaires is shielded from direct view when viewed from the side or above, reflective surfaces within the luminaires and/or lens covers are directly visible from the side.*

Total Exterior Lumens Output (excluding governmental owned streetlights used for illumination of public rights-of-way and outdoor recreation facilities) of any Nonresidential property shall not exceed 100,000 lumens per net acre in any contiguous illuminated area. This Lumens per net acre value is an upper limit and not a design goal; design goals should be the lowest levels that meet the requirement of the task.

2.20.6.D Total Exterior Lumens Output (excluding state/government-owned thoroughfare & highway illumination used for illuminating public rights-of-ways and outdoor recreation facilities), for any residential property shall not exceed 25,000 lumens per net acre in any contiguous illuminated area.

2.20.7 Outdoor Recreation Facilities

2.20.7.A Lumen cap exemption:

- Outdoor recreational facilities are not subject to the lumens per net acre limit.

2.20.7.B Exterior Lighting for sports facilities shall be designed to create minimum off-site spill, glare, and sky glow while honoring the

guidelines for class IV play, as defined by the Illuminating Engineering Society of North America (IESNA) publication, IES RP-06 or guidelines of a recognized sports organization such as the Texas University Interscholastic League (UIL), Little League, or the United States Soccer League. To be considered a recognized sports organization, the City must first approve such organizations' guidelines.

2.20.7.C Class IV levels of illumination, as defined by IESNA, are encouraged to be utilized during practices if the competition Lighting is established at a higher illuminance level than class IV.

2.20.7.D Shielding. Exterior luminaires used for non-aerial sports, such as track and field, shall be fully shielded. Exterior luminaires used for aerial sports, such as baseball and softball shall be shielded to the full extent possible while also allowing the minimum of vertical illuminance needed by the players to track the ball as stated in writing by a sports Lighting engineer recognized by peers as being an expert in that field. The Sports Facility Lighting vendor must meet the guidelines for the specific sport and have the lowest available off-site spill, glare, and sky glow values.

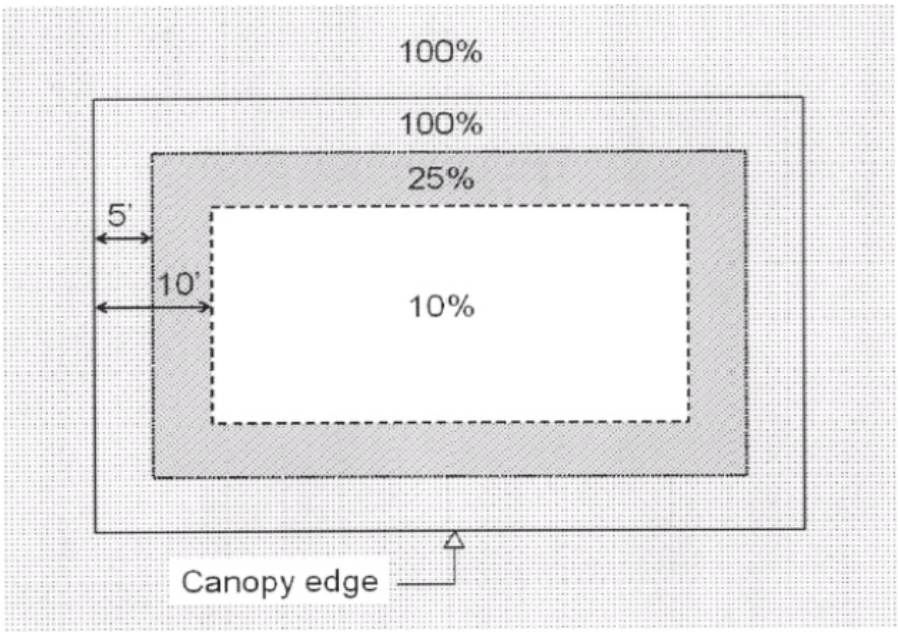
2.20.7.E Certification. Exterior Lighting systems for outdoor recreational facilities shall be designed and certified by an Engineer licensed in Texas as conforming to all applicable restrictions of this section before construction commences. Further, after installation is complete, an Engineer licensed in Texas shall certify that the Exterior Lighting system installation is consistent with the certified design.

2.20.7.F Curfew. No sports facility shall be illuminated between 10:30 PM and sunrise, except to conclude a scheduled recreational or sporting event in progress that began prior to 9:30 PM, luminaires under canopies, building overhangs, or roof eaves.

2.20.7.G All exterior luminaires located under canopies, under building overhangs, or under roof eaves must conform to all provisions of this section.

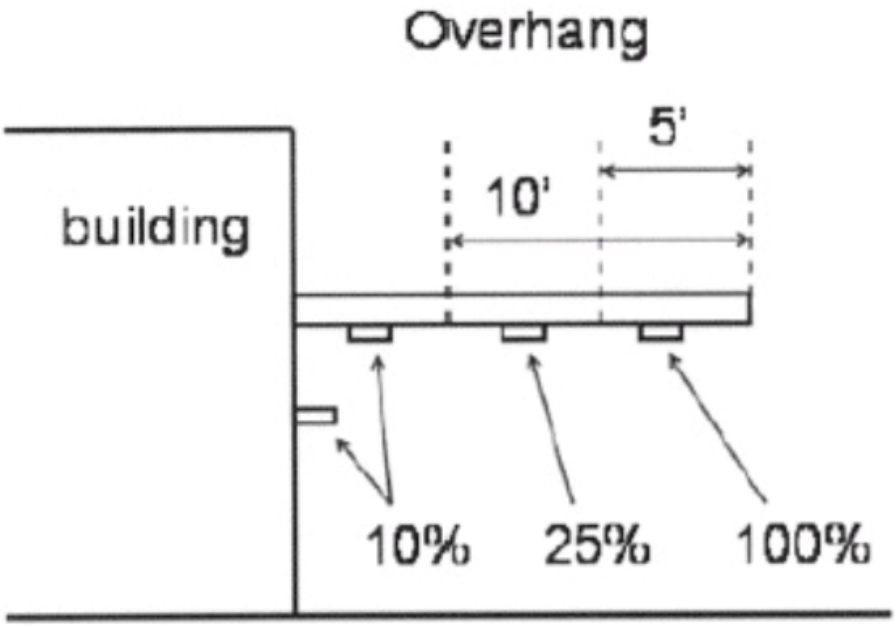
2.20.7.H Exterior luminaires located under canopies, under building overhangs, or under roof eaves where the center of the light source or luminaire is located at 5 feet, but less than 10 feet from the nearest edge of the canopy or overhang are to be included in the Total Exterior Lumens Output as though they produced only 1/4 of the Luminaire’s rated Lumens output. (See Figure F and Figure G).

Figure F



Plan view of a canopy, showing luminaire location and initial light source output percentage counted toward total lumens.

Figure G



2.20.8 Neon Lighting

2.20.8.A LED Neon Lighting is permitted, so long as Lumens calculations from such Neon type luminaires are included in the Total Exterior Lumens Output calculations for the site. Lumens are calculated on a per foot basis, rather than per "Luminaire." Such Neon type luminaires shall also be subject to the shielding requirements of this section, unless exempted under the exemptions Section of this article.

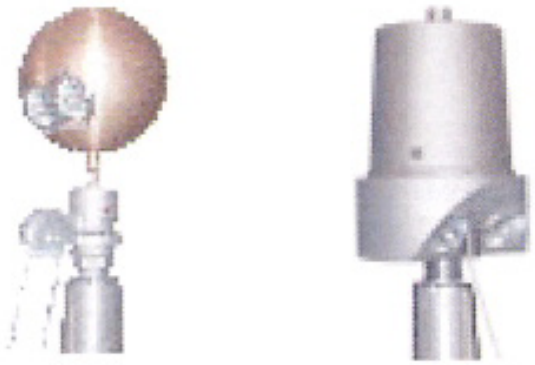
2.20.9 Flagpoles

2.20.9.A If the flag of the United States of America is displayed during the hours of darkness, it shall be illuminated as recommended in the Federal Flag Code.

2.20.9.B Lighting of up to a total of 2 flags per property is permitted with the following conditions:

- The flags must either be the flag of the United States of America, a flag of the state, a flag of a military branch of the United States of America or a flag of a branch of military of the state for flagpole illumination to be permitted.
- Flagpoles with a height greater than 20 feet above ground level shall be illuminated from above, if illuminated at all. This may be achieved by utilizing a luminaire attached to the top of the flagpole or a luminaire mounted above the top of the flagpole on a Structure within 15 feet of the flagpole and must comply with all sections of this article except for luminaires shown in Figure H. The total number of initial lumens output from any luminaire mounted on top of or above a flagpole is limited to 800 lumens.

Figure H



- Flagpoles with a height equal to or less than 20 feet above ground

level may be illuminated from below. They are to be illuminated with up to 2 spot type luminaires utilizing shields or diffusers to reduce glare, whose maximum combined Lumens output is 78 lumens per foot of pole height, measured from the luminaire to the top of the flagpole. The luminaire is to be mounted so that the light source is perpendicular to the flagpole and aims straight up at the flag.

- Luminaires used for flagpole illumination shall be included in the Total Exterior Lumens Output.

2.20.10 Thoroughfare Lighting

2.20.10.A General: This section includes thoroughfare lighting, electrical service system, and conduit system requirements for illumination on all thoroughfare classifications. All roadway and highway illumination shall be designed in accordance with the latest edition of IESNA Recommended Practice: Lighting Roadway and Parking Facilities, TxDOT Roadway Design Manual, and TxDOT Highway Illumination Manual, except as provided herein. Refer to the LDC for public lighting types permissible for each Place Type.

- All thoroughfare luminaires located in the City of Taylor public ROW will be owned and maintained by the Local Utility Company, Homeowners Association (HOA), Public Improvement District (PID) or other entity or person specifically approved by the City. All thoroughfare luminaires located on private property and non-public ROW will not be maintained by the City.
- Continuous Illumination is required on community boulevards.
- For neighborhoods, the City has chosen the “Washington” Post Top illumination standard which is a standard option from Oncor. This pole is a fifteen (15)-foot fluted fiberglass pole.
- For neighborhood avenues and neighborhood streets, safety illumination may be required at intersections. If safety lighting is warranted, a cobra head type pole may be approved by warrant.
- The Developer shall pay for the procurement and installation of the illumination foundations, poles, and luminaires, with prior approval from Local Utility Company and the Director of Public Works. Developer shall coordinate thoroughfare illumination installation and any civil work with the Local Utility Company and the Director of Public Works. Local Utility Company and the Director of Public Works shall inspect and approve all thoroughfare illumination pole foundations, conduit, and grounding prior to concrete being poured. Energizing of the thoroughfare illumination

to be per the applicable Local Utility Company or TxDOT design requirements.

- Thoroughfare Illumination shall be installed, inspected by City staff, and approved by Local Utility Company prior to final acceptance of the construction of a thoroughfare.
- Provide new, unused materials. Luminaires, foundations, ground boxes, conduit, cabling, and electrical service materials and installation methods shall comply with the applicable articles of the National Electrical Code (NEC), City, Local Utility Company, National Electrical Manufacturers Association (NEMA), TxDOT, and are listed by Underwriters Laboratories (UL), and the American Association of the State Highway and Transportation Officials (AASHTO) criteria.
- The clear distance measured from the back of curb to the face of the pole/face of drill shaft foundation shall be as detailed in the City, Local Utility Company, or TxDOT design requirements and details.
- The minimum design criteria for illuminance and uniformity ratio for all thoroughfare and highway classifications shall be per the City, Local Utility Company, or TxDOT design requirements. Photometric analysis is required for all thoroughfare construction projects.
- The developer shall confirm with the electric utility provider which illumination poles would be approved for their maintenance or accept maintenance responsibility.

2.20.10.B Decorative Poles and Luminaires – Decorative Illumination poles shall be approved by the City. Decorative poles shall be in accordance with the permitted types of exterior luminaires for the appropriate Place Type Zoning District as stated in this section and the LDC.

2.20.10.C Ground Boxes – Ground boxes shall be per City, Local Utility Company, or TxDOT design requirements.

2.20.10.D Foundations – Illumination foundations shall be designed in accordance with City, Local Utility Company, or TxDOT design requirements. Designer shall ensure that the bolt pattern of the foundation will accommodate the illumination poles selected. Local Utility Company and TxDOT have standard foundation details.

2.20.10.E Conduit and Cabling Systems – Conduit and Cabling shall be installed in accordance with City, Local Utility Company, or TxDOT design requirements.

2.20.10.F Electrical Service Pedestals – Electrical service pedestals shall be coordinated with City, Local Utility Company, or TxDOT to determine if the Local Utility Company will provide the pedestals or require purchase from an authorized supplier.

2.20.11 Lighting Curfews

2.20.11.A Non-residential Exterior Lighting operating at full luminaire lumens output more than 30 minutes after closing or the completion of activities must be reduced to 25% or less of the Total Exterior Lumens Output allowed.

2.20.11.B Motion sensor activation may be utilized to allow the luminaire to resume Total Exterior Lumens Output allowed only when activated by occupancy and to be reduced back to 25% or less of Total Exterior Lumens Output allowed within 5 minutes of sensing vacancy. The luminaire shall not be triggered by activity off the property.

2.20.11.C The 75% reduction of full luminaire lumens output shall be accomplished by dimming, by turning off 75% of the luminaires, by a combination of the two, or by any other method that results in a Total Exterior Lumens Output of no more than 25% of the Total Exterior Lumens Output allowed.

2.20.11.D Illumination for all advertising signs, both externally and internally illuminated, shall be turned off by the later of closing time or 10:00 PM, provided, however, that such Signs may be turned back on prior to sunrise, but no more than one hour prior to opening.

2.20.11.E Thoroughfare lighting, other than at the intersection of roadways, shall utilize half-night photocells or timers to turn off the lights halfway between dusk and dawn. Passive reflective roadway markings are encouraged.

2.20.11.F Outdoor recreational facilities must follow the curfew as defined in the Shielding and Light Distribution Standards Section.

2.20.11.G All Exterior Lighting is encouraged to be turned off when occupancy is not present to use the exterior luminaires.

2.20.12 Submission of Plans and Evidence of Compliance

2.20.12.A All thoroughfare, public ROW, non-public ROW, private, developer, and subdivision improvement plans and building permit applications must provide Thoroughfare Illumination plans or Exterior Lighting plans. The Thoroughfare Illumination plans or Exterior Lighting plans shall be reviewed and approved by the City prior to receiving a construction permit. The Thoroughfare Illumination plans or Exterior Lighting plans shall be prepared, signed, and sealed by a licensed

Professional Engineer in the State of Texas trained and qualified to provide lighting planning, engineering, and preparation of similar analyses. At a minimum, the submittal shall include the following information:

- Lighting Plans indicating the location of all existing and proposed exterior luminaires (may be included on the Site Plan), and the type of illuminating devices, lamps, supports, reflectors, and other devices.
- A photometric analysis plan(s) to determine lumens per net acre. It must include the square footage of the total area to be illuminated, the luminaire catalog model numbers, descriptions or ordering number, lamp types (i.e., incandescent, low pressure sodium, compact fluorescent, LED, etc.), the kelvin rating for the lamps, the B-U-G rating for all exterior luminaires; the number of luminaires or lamps (use the same unit corresponding to the unit used to determine how many lumens are produced), luminaire or lamp initial lumens, the location from the edge of a canopy (if applicable), and mounting height of all existing and proposed luminaires
- Manufacturer's specification sheets for all existing and proposed exterior luminaires. Description of the existing and proposed luminaires, illuminating devices, lamps, supports, reflectors, and other devices and the description shall include, but is not limited to, catalog cuts sheets by luminaire manufacturers and drawings (including sections where required) and height of the luminaires.
- Elevations with notes where luminaires are to be installed indoors that can be seen from the exterior.
- Existing and proposed utilities shall be shown on the plans identifying any possible location conflicts with existing and proposed thoroughfare and exterior lighting.
- Lighting plans to be provided with specific measurements in feet for the area to be illuminated. A scale notation is not sufficient.
- Acknowledgment that the Applicant has received notification of the provisions of this section.

2.20.12.B Verification that a Residential or Commercial Construction Project requiring a building permit application has complied with the provisions of this article shall occur during the final electrical inspection by the City Building Inspector.

2.20.12.C All new or modified thoroughfare illumination improvements are

required to provide an illumination plan. The plan shall be reviewed and approved by the City prior to receiving a construction permit. The Illumination plan shall be prepared, signed, and sealed by a licensed Professional Engineer in the State of Texas trained and qualified to provide lighting planning, engineering, and the preparation of similar analyses. At a minimum, the submittal shall include the following information:

- Lighting Plan indicating the location of all existing and proposed exterior luminaires, and the type of illuminating devices, lamps, supports, reflectors, and other devices
- A photometric analysis plan(s) to determine lumens per net acre. It must include the square footage of the total area to be illuminated, the luminaire catalog model numbers, descriptions or ordering number, lamp types (i.e., incandescent, low pressure sodium, compact fluorescent, LED, etc.), the kelvin rating for the lamps, the B-U-G rating for all exterior luminaires; the number of luminaires or lamps (use the same unit corresponding to the unit used to determine how many lumens are produced), luminaire or lamp initial lumens, and mounting height of all existing and proposed luminaires
- Manufacturer's specification sheets for all existing and proposed exterior luminaires. Description of the existing and proposed luminaires, illuminating devices, lamps, supports, reflectors, and other devices and the description shall include, but is not limited to, catalog cuts sheets by luminaire manufacturers and drawings (including sections where required) and height of the luminaires
- Lighting Plans to be provided with specific measurements in feet for the area to be illuminated. A scale notation is not sufficient
- Existing and proposed utilities shall be shown on plans identifying any possible location conflicts with existing and proposed thoroughfare lighting
- Acknowledgment that the Applicant has received notification of the provisions of this section

2.21 Traffic Signals

2.21.1 General

2.21.1.A Warrant Criteria – Traffic control signals shall not be installed unless one or more of the signal warrants are met in accordance with the TMUTCD. The satisfaction of a warrant or warrants is not in itself justification for a signal. Traffic signals shall only be used where an

Engineering Study indicates the need for a traffic signal. Traffic Signal Warrant Studies shall be submitted to the City and TxDOT for review and approval.

2.21.1.B Traffic Signal Plans – All traffic signal plans shall be reviewed and approved by the City and TxDOT.

2.21.1.C Minimum Standards – All traffic signal designs shall at a minimum meet the guidelines in the current editions of the TMUTCD, TxDOT's Traffic Signals Manual, TxDOT's Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges and TxDOT's Traffic Standards.

- Traffic signal poles shall be galvanized steel round-type in accordance with TxDOT's current details.
- Equipment and Materials – Refer to the TxDOT Approved Materials List and technical specifications for approved materials and for city supplied items.
- Traffic Signal Location – Traffic signals shall only be installed at intersections of two public streets, except as allowed by the City.
- Equipment Placement – All signal equipment shall be placed within ROW or dedicated easement area.
- Electrical Service Pedestals – Electrical service pedestals shall be 120V/240V and meet the local service provider's specifications.

2.21.2 Standards for Conduits and Wiring

2.21.2.A Conduit and wiring design for traffic signals shall conform to current TxDOT design standards and Austin District design guidelines.

2.22 Pavement Markings and Delineation

2.22.1 All pavement markings shall be designed and installed in accordance with the TMUTCD and TxDOT Pavement Marking Standards. Four-inch (4") edge and lane line pavement marking widths are to be used for City thoroughfares.

2.22.2 The pavement marking construction plans for public streets shall include the following information:

- Type of pavement marking, size, color, and alignment for each marking
- Spacing and lane widths
- Raised pavement markings type, color, and spacing, if used on the project
- Detail dimensions for crosswalks, lane tapers, etc
- Standard details for pavement markings
- Specification Items

2.22.3 Provide delineators and object markers as required and as shown on TxDOT D&OM Standards.

2.23 Signing

2.23.1 General - This section includes requirements for street name, regulatory, and warning signs.

2.23.2 All signing shall be designed and installed in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and Standard Highway Sign Designs for Texas (SHSD), latest editions.

2.23.3 Requirements – The Developer of all new residential and commercial developments shall furnish and install all street name, regulatory, and warning signs at the locations designated by the City. The Developer shall confirm the required number and location of all street signs with the City. The Developer shall show the type and location of the required street signs on the plans. No building permit will be issued for the subdivision until all street signs are installed in accordance with the approved plans.

2.23.4 Signing Plans – The construction plans for public streets shall include the following information:

- Location, size, and designation for all required signs
- Type of sign mount
- Sign details for non-standard signs
- Provision for street name signs i.e. sign brackets on STOP signs
- Standard details for applicable sign types
- Quantities and specifications

2.23.5 Sign Face Layouts – Sign face layouts shall meet the following requirements:

2.23.5.A Sign face layouts for all regulatory, warning, and guide signs, except street name signs, shall conform to TxDOT's current edition of Standard Highway Sign Designs for Texas and TMUTCD;

2.23.5.B Sizes of regulatory and warning signs shall conform to the dimensions listed in the current edition of TMUTCD, unless otherwise directed by the City

2.23.5.C Sign face layouts shall show the color and dimensions of all sign face legend components including background color, legend color, borders, symbols, letter size, and style; and,

2.23.5.D Sign face layouts, including the sizes of guide signs, shall be reviewed and approved by the City

2.23.6 Street Name Signs

2.23.6.A The applicant shall submit a signing plan with a graphical representation of the required signage for review and approval by the City.

2.23.6.B Location - Street signs for local street intersections shall be six (6")

inches extruded, have white lettering on a green background, be engineer grade reflectorized, and include the block numbers along with the street name. Street signs shall be furnished and installed by the subdivider for all intersections within or abutting the subdivision. All signs shall be located in accordance with the Texas Manual on Uniform Traffic Control Devices.

2.23.6.C Two nine (9) - inch tall street name sign assemblies shall be installed at all intersections that include one street that is listed as an avenue or community boulevard on the City's Transportation Master Plan and at other intersections designated by the City.

2.23.6.D Street Name signs shall include block numbers.

2.23.6.E One 6-inch-tall street name sign shall be installed at all intersections where all entering streets are classified as local streets, unless otherwise directed by the City.

2.23.6.F Refer to the Standard Details for requirements related to font, lateral spacing between letters and numbers, and sign fabrication.

2.23.7 Ornamental Signage – Standards for ornamental signage are determined on a case-by- case basis.

2.23.8 Installation

2.23.8.A All signs shall be installed on the appropriate small sign support as detailed on TxDOT's Sign Mounting Details. Location and height requirements are also found in these standards.

2.24 Traffic Impact Analysis (TIA)

2.24.1 General - The purpose of the Traffic Impact Analysis (TIA) is to determine whether mitigation improvements are necessitated by and attributable to the proposed development. The first step in the process is to determine whether a TIA will be required. To start the process, the applicant must submit the following information to the City:

2.24.1.A Conceptual site plan showing the following:

- North arrow
- Access locations indicating whether they are private or public
- Name of the project
- Address for the project
- Existing and planned boundary thoroughfares with names and types (per the Comprehensive Plan) labeled

2.24.1.B Land use information

2.24.2 Given the above information, the City will complete a TIA determination worksheet (TDW) which will indicate if a TIA is required.

2.24.3 If a Traffic Impact Analysis (TIA) is required:

2.24.3.A A TIA joint scoping meeting shall be held with the applicant and City of Taylor, and will include TxDOT and Williamson County, as needed. The meeting will result in a scope of work for the report, which will be signed by all parties and must be provided in the Technical Addendum of the TIA. A determination will be made at this meeting as to whether the project must complete a Level 1 or a Level 2 TIA.

2.24.3.B The TIA must be prepared by a licensed Professional Engineer (P.E.) in the State of Texas, preferably with PTOE certification, and experience in traffic and transportation engineering.

2.24.3.C The final TIA report must be signed and sealed by the P.E.

2.24.3.D An electronic copy of the TIA, including all supporting data, such as the project's distribution spreadsheets, Synchro files, data collection information, etc. shall be submitted with the application.

2.24.3.E An initial review of the TIA by the City shall be completed within 45 calendar days from the submittal date.

2.24.3.F Subsequent reviews shall be completed within 15 calendar days of receipt response to comments.

2.24.3.G Longer review periods may be needed if TxDOT or Williamson County is involved in the review process.

2.24.4 **Level 1 TIA**

2.24.4.A **Required Analysis Components.** A Level 1 TIA (at least 50 trips during either the AM or PM Peak) shall include the following elements:

- General Site Description. The TIA shall include a description of the proposed land uses and the anticipated completion date (buildout year) of the development. This description, which may be in the form of a map, shall include the following items: (1) all existing and proposed ingress and egress locations, (2) discussion of the proposed internal thoroughfare network, (3) all existing thoroughfare widths and rights-of-way within 1/4 mile radius of the site, and (4) all existing and proposed public or private transportation services and facilities within a ¼ mile radius of the site.
- Comprehensive Plan. The TIA shall identify the thoroughfare classification and right-of-way requirements as defined above and in the Comprehensive Plan for all thoroughfares within the study area.
- Proposed Capital Improvements. The TIA shall identify any changes to the thoroughfare network within 1/4 mile radius of

the site that are proposed by any government agency or other developer. This description shall include the above items as well as any proposed construction project that would alter the width or alignment of thoroughfares affected by the proposed development.

- Trip Generation – The latest version of ITE's Trip Generation report shall be used to estimate trips for the project. Guidelines provided by ITE shall be used to determine whether a rate or equation is most appropriate. If there are existing land uses on the site, trip generation shall include a discussion of the total new (proposed minus existing) trips that will be generated by the site. If the land use changes prior to submittal of the project to the City, updated trip generation information must be submitted for review to ensure that a Level 2 TIA is not required or that changes to the scope are not required.
- Sight Distance – A sight distance analysis must be provided for each proposed access point. Data and analysis results shall be summarized on a plan/profile sheet.
- Access Spacing – Confirmation that each proposed access point meets spacing requirements defined above as well as block length requirements established in the LDC must be provided.
- Turn Lane Analysis – If access is being taken on either a TxDOT or County roadway, access points shall be analyzed to determine with either a left- or right-turn lane is required by either agency. Please note that TxDOT's current policy is to require a right-turn deceleration lane at all commercial access points regardless of volume projections.

2.24.5 **Level 2 TIA**

2.24.5.A **Required Analysis Components.** A Level 2 TIA (at least 100 trips during either the AM or PM peak) shall include the following elements:

- General Site Description. The TIA shall include a description of the proposed land uses and the anticipated completion date (buildout year) of the development. This description, which may be in the form of a map, shall include the following items: (1) all existing and proposed ingress and egress locations, (2) discussion of the proposed internal thoroughfare network, (3) all existing thoroughfare widths and rights-of-way within 1/4 mile radius of the site, and (4) all existing and proposed public or private

transportation services and facilities within a one-mile radius of the site.

- Comprehensive Plan. The TIA shall identify the thoroughfare classification and right-of-way requirements as defined above and in the Comprehensive Plan for all thoroughfares within the study area.
- Proposed Capital Improvements. The TIA shall identify any changes to the thoroughfare network within 1/4 mile radius of the site that are proposed by any government agency or other developer. This description shall include the above items as well as any proposed construction project that would alter the width or alignment of thoroughfares affected by the proposed development.
- Trip Generation – The latest version of ITE's Trip Generation report shall be used to estimate trips for the project. Guidelines provided by ITE shall be used to determine whether a rate or equation is most appropriate. If there are existing land uses on the site, trip generation shall include a discussion of the total new (proposed minus existing) trips that will be generated by the site. For multiuse projects that will develop over several years, an equivalent rate will be established for the uses assumed in the TIA. These equivalent rates will run with the life of the project and will be used to verify that the allowable trips are not exceeded as each site plan is submitted. If a land use not modeled in the TIA, but allowed within the development's zoning category, is proposed, then the most recent version of the Trip Generation report will be used for the new land use trip estimate. If the approved total number of trips are exceeded by the project, a TIA update could be required.
- Trip Reductions - Trip reductions for pass-by trips and internal capture are permitted subject to review and approval by the City. Methodologies for calculation and application of internal and pass-by capture shall be obtained from the latest version of the ITE Trip Generation Handbook.
- Study Time Periods – The TIA must evaluate the impact of the proposed project on the surrounding thoroughfare network by providing analysis results for the study intersection for 1) existing conditions, 2) the final buildout year without site traffic (No Build), and 3) the final buildout year with site traffic (Build). No phased analysis is required nor preferred.

- Trip Distribution. The distribution of trips through the study network shall conform with accepted traffic engineering principles, taking into consideration the land use categories of the proposed development, the area from which the proposed development will attract traffic, development phasing, and existing and projected traffic volumes.
- Driveway Sight Distance – A sight distance analysis must be provided for each proposed access point. Data and analysis results shall be summarized on a plan/profile sheet.
- Driveway Spacing – Confirmation that each proposed access point meets spacing requirements defined above as well as block length requirements established in the LDC must be provided. Turn Lane Analysis – If access is being taken on either a TxDOT or County roadway, access points shall be analyzed to determine with either a left- or right-turn lane is required by either agency. Please note that TxDOT's current policy is to require a right-turn deceleration lane at all commercial access points regardless of volume projections.
- Level of Service Adequacy Determination. The appropriate Level of Service (LOS) (using *Highway Capacity Manual* (HCM) delay values in seconds per vehicle) and Synchro shall be determined for each analysis period and each analysis scenario. The following scenarios shall be included at a minimum: Existing Condition, "No Build" Condition (existing traffic plus anticipated growth of existing traffic plus neighboring development activity and road improvements to be completed), and "Build" Condition ("No Build" plus project traffic).

2.24.6 An impact is identified as follows when comparing No Build results with Build results for any analyzed peak hour using the LOS and Measures of Effectiveness (MOE) per the HCM methodology for intersection capacity analysis:

2.24.6.A Signalized Intersections:

- If the No Build intersection LOS is D or better and the Build intersection LOS drops to E or F.
- If the No Build intersection LOS is E and the Build intersection drops to F.
- If the No Build intersection is LOS F and Build intersection delay increases by 10% or more.
- If a No Build lane group movement or turning movement LOS drops from D or better to a LOS E or F.

- If a No Build lane group movement or turning movement is LOS E and the Build condition LOS drops to F.
- If a No Build lane group movement or turning movement LOS is F and the Build condition delay increases by 10% or more.
- If the queue length of any storage lane exceeds the available space.

2.24.6.B Unsignalized All-Way Stop Control (AWSC) Intersections:

- If the No Build intersection LOS is D or better and the Build intersection LOS drops to E or F.
- If the No Build intersection LOS is E and the Build intersection LOS drops to F.
- If the No Build intersection LOS is F and the Build intersection delay increases by 10% or more.
- If a No Build lane group movement or turning movement LOS drops from D or better to a LOS E or F.
- If a No Build lane group movement or turning movement is LOS E and the Build conditions LOS drops to F.
- If a No Build lane group movement or turning movement LOS is F and the delay increases by 20% or more.
- If the queue length of any storage lane exceeds the available space.

2.24.6.C Unsignalized Two-Way Stop Control (TWSC) Intersections:

- If the No Build LOS for a stop-controlled approach or major road left-turn movement is D or better and the Build LOS drops to E or F.
- If the No Build LOS for a stop-controlled approach or major road left-turn movement is E and the Build intersection LOS drops to F.
- If the No Build LOS for a stop-controlled approach or major road left-turn movement is F and the Build intersection delay increases by 20% or more.
- If a No Build LOS for a lane group movement or turning movement at a stop-controlled approach or for a major road left-turn movement drops from D or better to a LOS E or F.
- If a No Build LOS for a lane group movement or turning movement at a stop-controlled approach or for a major road left-turn movement is E and drops to F.
- If a No Build LOS for a lane group movement or turning movement at a stop-controlled approach or for a major road left-turn

movement is F and the corresponding Build delay increases by 20% or more.

- If the queue length of any storage lane exceeds the available space.

2.24.7 **Mitigation of Impacts.**

2.24.7.A Mitigation of impacts are required if the proposed development would cause an impact as defined above. If mitigation is required:

- The Applicant is responsible to mitigate the impact of the proposed development and would not be responsible for alleviating deficiencies in the thoroughfare system that may occur without the proposed development.
- Mitigation improvements for each intersection shall be identified, for each time period of analysis, (with a preliminary cost estimate to implement the improvements) and thoroughfare segments.
- Mitigation improvements may consist of off-site improvements, the participation in funding for needed thoroughfares, and intersection improvement projects.
- If a TIA identifies new traffic signals as mitigation measures, the Signal Warrant Analysis for each new signal must be included in the TIA.
- Following the identification of mitigation improvements and any other improvements necessitated by and attributable to the development, the applicant shall utilize the methodology developed and approved by the city to determine if the mitigation improvements identified are roughly proportionate to the impact of the proposed development.

2.24.8 TIA Waiver

2.24.8.A The Developer and the City may agree that a TIA is not required for the proposed development or may agree on what improvements are to be constructed as part of the proposed development, and the City may waive the requirement to prepare a TIA.

2.25 Bicycle Parking

2.25.1 General – Refer to the LDC for bicycle parking requirements.

2.25.2 Bicycle Rack Examples are shown in **Figure 2-5**.

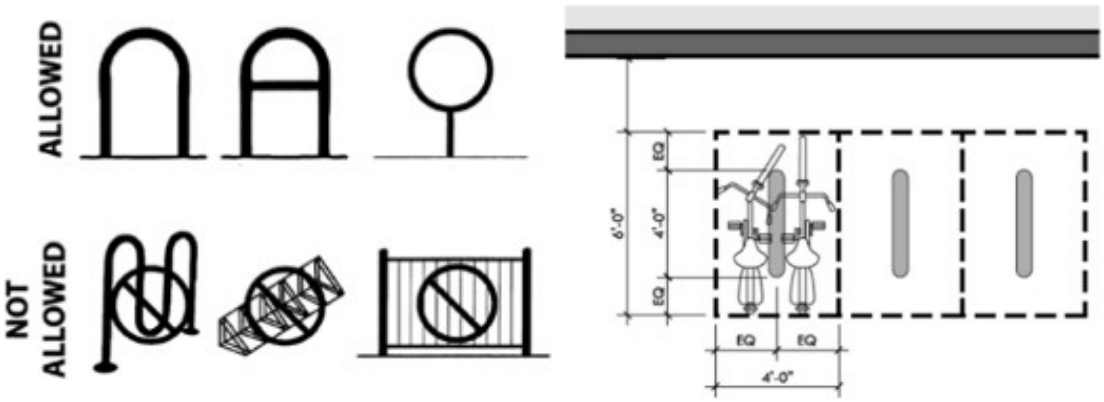


Figure 2-5. Bicycle Rack Standards

2.26 Traffic Control Plans During Construction

2.26.1 All Traffic Control Plans necessary for maintenance of traffic during construction shall be prepared in accordance with the latest edition of the Texas Manual on Uniform Traffic Control, Part VI (TMUTCD) and the TxDOT Standards.

2.26.2 A Traffic Control Plan (TCP) describes temporary traffic controls to be used for facilitating vehicle and pedestrian traffic through a temporary traffic control zone. The TCP may range in scope from being very detailed, to merely referencing typical drawings contained in the TMUTCD, TxDOT Standards, or specific drawings contained in the contract documents. The degree of detail in the TCP depends entirely on the complexity of the situation, and TCPs shall be prepared by a Professional Engineer knowledgeable about the fundamental principles of temporary traffic control and the work activities to be performed.

2.26.3 If a traffic setup shown on standard detail sheets does not address the traffic controls needed for a specific site, then a TCP shall be prepared that is specific to the site. A standard detail or TCP which shows the proposed method of warning, directing and guiding traffic, shall be approved by the City, prior to installing any devices in the right-of-way. The following information shall be provided with the standard detail or TCP:

- Activity location, right-of-way and curb-lines, and existing traffic controls of the street sought to be closed or blocked
- Areas of the street to be closed or blocked

- Proposed pedestrian and vehicular detour routes
- Location and type of all barricades, signals, signs, channelizing devices, pavement markings and other warning devices to be used to direct traffic; and,
- A schedule of construction showing each phase of work, start and completion dates for each phase, and proposed work hours.

2.26.4 Any changes to a previously approved traffic control plan shall be approved by the City, prior to implementing the revised plan.

2.26.5 Plans which propose to detour traffic to another thoroughfare shall demonstrate that such impacts cannot be reasonably avoided and that impacts to the detour route have been mitigated to the extent practicable. Impacts to the detour route shall be evaluated including, without limitation, intersection level of service, traffic speed and volume in residential neighborhoods and school zones and impacts to all modes of transportation.

2.26.6 Time Restrictions –

The City may restrict the hours of construction, repair or other activities affecting the free flow of traffic to nights, weekends or restricted hours due to potential congestion, other construction activities, and hazards to pedestrians or motorists.

Daily lane closures on community boulevards and regional roadways shall not be permitted during the hours of 6:00 a.m. to 9:00 a.m. and 4:00 p.m. to 7:00 p.m. Monday through Friday, except in emergencies or situations where it can be demonstrated that traffic flow or safety will not be adversely affected.

2.26.7 Plans which require the closure of sidewalks or shared-use paths shall incorporate the necessary barricades, signs and other measures as needed to ensure the safety of pedestrians and bicyclists. The closure of sidewalks, bike lanes, and shared-use paths will be allowed only if impacts cannot be avoided through alternative construction methods. The detour route must be of similar width and surface type to the permanent facility and shall meet the requirements of an accessible route in accordance with the ADA.

2.26.8 Special Requirements -

The City may require that any of the following special traffic control devices, working hours, project layout and operations be imposed on any temporary traffic control work zone:

- The use of additional barricades, signals, signs, flaggers, police officers or other traffic control devices or safety procedures
- That the activity be performed only at certain hours during the day or night or during specified days of the week, month or year

- That only a specified area or not more than a specified number of traffic lanes, parking meters and/or parking lanes shall be blocked or closed at the same time or at specified times of day
- That material and equipment used in the activity and materials removed from any excavation be located other than in the vehicle traffic lane of such a street
- Any other restrictions deemed necessary to ensure management of the rights-of-ways and the free flow of vehicular, bicycle and pedestrian traffic

SECTION 3 DRAINAGE DESIGN REQUIREMENTS

Contents

LIST OF TABLES

SECTION 3 DRAINAGE DESIGN REQUIREMENTS

3.1 General

3.1.1 General Application - This section pertains to general application of accepted principles of stormwater drainage engineering and is a working supplement to basic information obtainable from standard drainage handbooks and other publications on drainage. The statements of this section provide the underlying principles by which all drainage facilities shall be designed and constructed within the Corporate Limits of the City of Taylor and within all areas subject to its extra territorial jurisdiction (ETJ).

3.1.2 Low-Impact Development (LID) – The City's preference for drainage design during development is to incorporate Low-Impact Development (LID) principles. LID can achieve stormwater control through the creation of a hydrologically functional landscape that mimics a natural regime. This objective is accomplished by:

- Minimizing stormwater impacts by reducing impervious cover, conserving natural vegetation, maintaining natural drainage courses, reducing use of pipes and concrete channels, and minimizing clearing/grading.
- Providing runoff storage measures dispersed uniformly throughout a site
- Maintaining pre-development time of concentration (Tc) by strategically routing flows

3.1.3 General Drainage System Policy

3.1.3.A Storm Drain Design Event - Street curbs, gutters, inlets and storm drains shall be designed to intercept, contain and transport all runoff from the 25-year frequency storm.

3.1.3.B Public right of way (ROW) Design Event - The public drainage system shall be designed to convey the 100-year frequency storm within defined public rights-of-way or drainage easements.

3.1.4 Detention and Erosion Policy

3.1.4.A No Increase in Site Discharge - A developer shall develop the property so that the rate of runoff created by the development as it leaves the property does not exceed the rate of runoff that is currently occurring in the existing conditions.

3.1.4.B No Offsite Adverse Impacts - Land development shall not cause increased inundation of any building or roadway surface or create any additional adverse flooding upstream or downstream of the proposed development for the 2-, 10-, 25-, and 100-year frequency storms.

3.1.4.C Downstream Assessment - If flood or erosion problem areas are known downstream of the development, then the design Engineer shall

perform a downstream drainage assessment as described in Section 3.22 – Drainage Study Guidelines. The City Engineer is to determine if a downstream assessment is required.

3.1.4.D Channel Erosion Protection - Waterways within the Blackland Prairie are prone to erosion from changes in watershed land use and runoff. To reduce the potential for downstream stream erosion and degradation, the post-development 2-year frequency storm peak flow rate shall be attenuated onsite to less than $Q_{critical}$, with $Q_{critical}$ being defined as less than 2% of the pre-development 2-year frequency storm peak flow rate.

3.1.4.E Exemptions

The following may be exempt from the above detention and erosion requirements at the discretion of the City Engineer.

3.1.4.E.i A developer or builder of property at or less than one-half (½) acre.

3.1.4.E.ii Infill development that does not require an Infill Neighborhood Plan is exempt (see LDC 3.7). Lot-to-lot drainage requirements as defined in **Section 3.19** still apply.

3.1.4.F Regional Detention - Regional detention solutions are encouraged and may be utilized to mitigate for offsite adverse impacts.

3.1.5 Floodplain Policy

3.1.5.A City Floodplain - The City of Taylor floodplain shall be defined wherever there is greater than 64 acres of contributing drainage area to a waterway. The City floodplain shall be based on the specified design storm frequency and existing watershed conditions. A dedicated drainage easement is required to encompass the City of Taylor floodplain.

3.1.5.B Floodplain Development Permit

3.1.5.B.i The City of Taylor Drainage and Flood Control Ordinance shall be followed. A floodplain development permit shall be required to ensure conformance when development is proposed in the floodplain. The floodplain is defined as areas within the City of Taylor floodplain and within the Flood Insurance Study (FIS) for Williamson County, Texas and Incorporated Areas, dated December 20, 2019, or latest version.

3.1.5.B.ii Prior to approval of a floodplain permit, the applicant must provide to the City evidence that the provisions of the drainage criteria and Flood Control Ordinance are met.

3.1.5.C Floodplain Changes - Changes to the Federal Emergency Management Area (FEMA) regulatory floodplain, whether from updated analyses or development activity within the floodplain, may require the approval of a LOMR prior to the acceptance of the construction of a subdivision or issuance of building permits. A CLOMR may be required prior to recordation of a final plat. See Section 3.20 and 3.21 for additional information.

3.1.5.D Floodplain Preservation - Preservation and avoidance of floodplains is preferable to reclaiming and developing floodplain areas.

3.1.6 Drainage Study - The Developer is required to provide a drainage study for the total area to be developed. This study shall be submitted to the City Engineer as a part of the submitted data for consideration of preliminary plat or site plan approval for the portion of the property proposed for immediate development. Refer to Section 3.22 Drainage Study Guidelines for additional information.

3.1.7 Computations - Computations to support all drainage designs shall be submitted. The computations shall be in such a form to allow for timely and consistent review and to be made a part of the permanent City record for future reference. All computations shall be certified by a Professional Engineer licensed in the State of Texas.

3.1.8 Safety - Fencing (six feet in height) is required along the perimeter of a stormwater facility in the public right-of-way or an easement that has side slopes steeper than three feet horizontal to one foot vertical (3H:1V).

3.1.9 Emergency Overflow Path - The approved drainage system shall provide for positive overflow at all low points and these areas must be denoted on the plans as such. The term “positive overflow” means that when the inlets do not function properly or when the design capacity of the storm drain system is exceeded, the excess flow can be conveyed overland along a grassed or paved course. Normally, this would mean along a street or alley, or shall require the dedications of special drainage easements on private property.

3.1.10 Non-Erosive Outfalls - Discharge from storm drains, bridges, culverts, ditches, and ponds shall not cause channel, bluff, or stream bank erosion. If the discharge is to an open drainage facility, the applicant must show acceptable non-erosive conveyance to that drainage facility, and appropriately designed outfall including adequate energy dissipation, which may include stream stabilization.

3.1.11 Drainage Easements - Easements shall be provided, where necessary, for all drainage courses in and across property to be platted. An easement or right-of-way must be of sufficient width to provide continuous access for the operation, maintenance, or repair of a drainage facility or the conveyance of stormwater. See **Section 1.8** for drainage easement requirements.

3.1.12 Maintenance of Drainage Facilities - Drainage facilities that have been dedicated

to and accepted by the City and that are located within public right-of-way are maintained by the City. Private drainage facilities are typically maintained by the property Owner on which the facility is located. The existence of a drainage easement does not change ownership or maintenance responsibilities. Maintenance plans for detention ponds and other components of the drainage system are required and shall be in accordance with LDC 3.8.4.2 and this section and the City of Taylor Engineering Manual, as amended.

3.1.13 Drainage Structure Aesthetics - Drainage design in the urban environment must consider appearance as an integral part of the design. When utilized, the design of drop structures, armoring, and other hydraulic structures shall blend with the natural surroundings to maintain the aesthetics of the natural environment. Vertical walls for detention are discouraged unless design constraints limit the ability to provide earthen embankments.

3.1.14 Alternative Methods - Methods of design other than those indicated herein may be considered in those cases where experience indicates they are appropriate. However, any variations from the practices established herein must have the expressed written approval from the City Engineer.

3.1.15 Additional Measures - If any condition requiring additional measure of protection is identified by the City Engineer during design or construction, the Engineer shall make provisions within the design. All drainage designs shall at a minimum meet the requirements of the Federal Emergency Management Agency (FEMA), the United States Army Corps of Engineers (USACE), the Texas Commission on Environmental Quality (TCEQ), and other agencies, as applicable.

3.1.16 Engineer's Responsibility - It is the responsibility of the Engineer of Record to provide all necessary calculations and designs described herein. The Engineer shall provide the data, calculations, and designs necessary to demonstrate that the design does not adversely impact surrounding, upstream, or downstream properties and meets Local, State, and Federal regulations and requirements.

3.1.17 Certification - All drainage studies and/or plans including those which are part of a standard construction plan submittal shall be sealed and signed by an Engineer proficient in civil engineering and Licensed in the State of Texas.

3.1.18 Warning and Disclaimer of Liability - The degree of flood protection required by this policy is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. On rare occasions greater floods can and will occur and flood heights may be increased by man-made or natural causes. This policy does not imply that land outside the areas of street rights-of-way, drainage or floodplain easements will be free from flooding or flood damages. This policy shall not create liability on the part of the City of Taylor, Texas or any official or employee thereof for any flood damages that result from reliance on this policy, or any administrative decision lawfully made thereunder.

3.2 Runoff Calculations

3.2.1 Methodology - Numerous methods of rainfall-runoff computation are available on which the design of storm drainage and flood control systems may be based. The selection of which method to use for calculating runoff depends upon the size of the contributing drainage area at the most downstream point of the project. The "Rational Method" and "Modified Rational Method" are acceptable for designing projects in which the drainage area is less than one hundred (100) acres or with times of concentration totaling two (2) hours or less. The National Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) curve number method shall be used for detention sizing and for drainage areas larger than one hundred (100) acres but may also be used for smaller drainage areas. The NRCS hydrologic methods are available in the NRCS National Engineering Handbook (NEH) and the US Army Corps of Engineers' Hydrologic Engineering Center's HEC-HMS programs. The method of analysis must remain consistent when drainage areas are combined. The method used for the largest combined drainage area shall be used for the smaller drainage areas comprising that area. Regardless of drainage area size, certain situations require the use of NRCS hydrologic methods (e.g., a detention facility connected to a downstream storm drainage system). The Engineer may use other methods but must have their acceptability approved by the City Engineer.

3.2.2 Watershed Land Use Conditions - Runoff computations shall be based upon existing off-site land use watershed conditions. Aerial photographs, GIS base maps, physical surveys, as-built plans, etc. shall be used as aids in establishing surface character of the existing land use condition.

3.2.3 Upstream Detention Facilities - The design Engineer shall size drainage facilities by disregarding the detention effects of upstream property and calculating the runoff as if the off-site property was developed without any provided detention. If an approved regional detention/retention facility is in operation and maintained by the City, the design Engineer may size downstream drainage facilities based on consideration of the detention effects of the regional facility with written approval from the City Engineer. A regional detention/retention facility is generally defined as having a contributing drainage area of over sixty-four (64) acres and serving runoff attenuation for more than one landowner.

3.3 Design Rainfall

3.3.1 Rainfall Depth-Duration-Frequency (DDF) and Intensity-Duration-Frequency (IDF). These values are provided in **Tables 3-1** and **3-2**. The IDF curve coefficients are provided in **Table 3-3**. These values were developed based on NOAA Atlas 14, Volume 11, Version 2 data, at a specified location within the Brushy Creek Watershed (Latitude: 30.5317°, Longitude: -97.4774°), in accordance with Williamson County recommendations.

Table 3-1: Depth-Duration-Frequency (DDF) Table for City of Taylor										
Depth of Precipitation (in inches)										
Recurrence Interval (year)	**5-min**	**10-min**	**15-min**	**30-min**	**1-hr**	**2-hr**	**3-hr**	**6-hr**	**12-hr**	**24-hr**
2	0.520	0.829	1.040	1.470	1.910	2.350	2.610	3.050	3.490	3.970
5	0.650	1.040	1.300	1.820	2.390	2.990	3.360	3.980	4.580	5.200
10	0.761	1.220	1.520	2.120	2.800	3.570	4.050	4.860	5.610	6.380
25	0.921	1.470	1.830	2.550	3.390	4.410	5.080	6.190	7.180	8.170
50	1.050	1.680	2.090	2.900	3.850	5.110	5.940	7.320	8.530	9.700
100	1.180	1.900	2.350	3.250	4.350	5.870	6.910	8.620	10.100	11.500
200	1.320	2.110	2.610	3.630	4.890	6.730	8.020	10.100	11.900	13.500
500	1.500	2.380	2.980	4.150	5.660	7.990	9.650	12.300	14.600	16.700

Table 3-2: Intensity-Duration-Frequency (IDF) Table for City of Taylor										
Intensity of Precipitation (in inches per hour)										
Recurrence Interval (year)	**5-min**	**10-min**	**15-min**	**30-min**	**1-hr**	**2-hr**	**3-hr**	**6-hr**	**12-hr**	**24-hr**
2	6.240	4.970	4.170	2.930	1.910	1.180	0.868	0.510	0.290	0.165
5	7.800	6.220	5.190	3.640	2.390	1.500	1.120	0.665	0.380	0.217
10	9.130	7.300	6.080	4.250	2.800	1.780	1.350	0.812	0.466	0.266
25	11.100	8.840	7.330	5.110	3.390	2.210	1.690	1.030	0.596	0.340
50	12.600	10.100	8.340	5.790	3.850	2.550	1.980	1.220	0.708	0.404
100	14.200	11.400	9.390	6.510	4.350	2.940	2.300	1.440	0.838	0.478
200	15.800	12.600	10.500	7.260	4.890	3.370	2.670	1.690	0.988	0.564
500	18.000	14.300	11.900	8.310	5.660	3.990	3.210	2.060	1.210	0.694

Table 3-3: Taylor Intensity-Duration-Frequency (IDF) Curve Coefficients			
Return Period	**Fitting parameters for IDF equation (3-2)**		
Year	**a**	**b**	**c**
2	62.96	12.73	0.8150
5	71.39	12.07	0.7930
10	76.23	11.34	0.7723
25	83.02	10.62	0.7480
50	85.98	9.79	0.7273
100	89.08	9.22	0.7072
200	93.79	9.38	0.6901
500	99.17	9.42	0.6677
The a, b, and c parameters listed were derived using non-linear regression method and the IDF data included in **Table 3-2**			

3.4 Time of Concentration

3.4.1 Definition - The time of concentration is the time for surface runoff to flow from the most remote point in the watershed to the point of interest. This applies to the most remote point in time, not necessarily the most remote point in distance. Runoff from a drainage area usually reaches a peak at the time when the entire area is contributing. However, runoff may reach a peak prior to the time the entire drainage area is contributing if the area is irregularly shaped or if land use characteristics differ significantly within the area. Sound engineering judgment shall be used to determine a flow path representative of the drainage area and in the subsequent calculation of the time of concentration.

3.4.2 Methods - The preferred procedure is the NRCS method as described in NRCS's *Technical Release 55 (TR-55)*. Procedures for this method are outlined in the City of Austin's *Drainage Criteria Manual* (DCM) Section 2.4.2 and TxDOT's *Hydraulic Design Manual* Chapter 4.

3.4.2.A The minimum time of concentration for any drainage area shall be five (5) minutes.

3.4.2.B Sheet flow for both natural (undeveloped) and developed conditions shall be limited to a maximum of one hundred feet (100').

3.4.2.C The minimum slope used for the calculation of sheet and shallow-concentrated flow travel time components shall be 0.005 feet per foot (0.5%).

3.5 Rational Method

3.5.1 Definition - The Rational Method is based on the principle that the maximum rate of runoff from a given drainage area for an assumed rainfall intensity occurs when all parts of the area are contributing to the flow at the point of discharge.

3.5.2 Methodology - The formula for calculation of runoff by the "Rational Method" is:

$Q = CiA$ (Eq. 3-1)

Where:

Q = The maximum rate of discharge, expressed in cubic feet per second,

C = Coefficient of Runoff,

i = Intensity of Runoff in inches per hour; and

A = Drainage Area in acres.

3.5.3 Runoff Coefficient (C)

3.5.3.A Definition - The proportion of the total rainfall that will reach the drainage system depends on the surface vegetation condition, soil type,

imperviousness of the surface, land slope and ponding characteristics of the area. Impervious surfaces, such as asphalt pavements and roofs of buildings, will be subject to approximately one hundred percent (100%) runoff (regardless of the slope).

3.5.3.B Methodology - Suggested coefficients with respect to specific surface types are provided below in **Table 3-4**.

Table 3-4: Rational Method Runoff Coefficients for Composite Analysis Runoff Coefficient (C)							
Character of Surface	**Return Period**						
	2-year	5-year	10-year	25-year	50-year	100-year	500-year
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete / Buildings	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition* (Grass cover less than 50% of the area)							
Flat, 0—2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2—7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	0.40	0.43	0.45	0.49	0.52	0.55	0.62
Fair Condition (Grass cover on 50% to 75% of the area)**							
Flat, 0—2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2—7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition* (Grass cover larger than 75% of the area)**							
Flat, 0—2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2—7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56
Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58
UNDEVELOPED							
Cultivated							
Flat, 0—2%	0.31	0.34	0.36	0.40	0.43	0.47	0.57
Average, 2—7%	0.35	0.38	0.41	0.44	0.48	0.51	0.60
Steep, over 7%	0.39	0.42	0.44	0.48	0.51	0.54	0.61
Pasture/Range							
Flat, 0—2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2—7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Forest/Woodlands							
Flat, 0—2%	0.22	0.25	0.28	0.31	0.35	0.39	0.48
Average, 2—7%	0.31	0.34	0.36	0.40	0.43	0.47	0.56
Steep, over 7%	0.35	0.39	0.41	0.45	0.48	0.52	0.58
1. Composite "C" value for developed conditions (C_{DEV}) is: $C_{DEV} = (I)C_1 + (1-I)C_2$							
Where: I = Impervious cover, percent C_1 = "C" value for impervious cover C_2 = "C" value for pervious area (grass, lawns, parks, etc.)							
Source: City of Austin *Drainage Criteria Manual*, Table 2-3							

3.5.4 Rainfall Intensity (i)

3.5.4.A Definition - Rainfall intensity (i) is the average rainfall rate in inches per hour.

3.5.4.B Methodology - The rainfall intensity is calculated from the Intensity-Duration-Frequency (IDF) curves selected to represent the City of Taylor area. The following equation mathematically represents the City of Taylor area IDF curves deriving a best fit equation for each storm frequency. IDF curves were developed using a cubic spline interpolation of IDF data in **Table 3-2**:

$i = a/(t+b)^c$ (Eq 3-2)

Where:

i = Average rainfall intensity in inches per hour;

t = Storm duration in minutes, which is equal to the time of concentration for the entire drainage area of interest and less than 120 minutes; and

a, b, and c = Coefficients for different storm frequencies.
(See **Table 3-3**)

3.6 Natural Resources Conservation Service (NRCS) Hydrologic Method

3.6.1 Definition - The NRCS hydrologic method can be applied to urban drainage areas of any size. The primary parameters required to calculate a runoff hydrograph with the method include the rainfall distribution, runoff curve numbers, time of concentration and drainage area. The NRCS method is the same as used in the original SCS TR-20.

3.6.2 Methodology - The preferred method to apply the SCS method is using the US Army Corps of Engineers (USACE) HEC-HMS model. HEC-HMS can be downloaded from the USACE website at http://www.hec.usace.army.mil/.

3.6.3 Rainfall Duration and Distribution - The City of Taylor has adopted the use of a 24-hour HEC-HMS frequency storm distribution for use with time-varying rainfall simulations.

3.6.4 HEC-HMS Rainfall Distribution

3.6.4.A HEC-HMS Input - The DDF values from **Table 3-1** shall be entered directly into HEC-HMS software as frequency storm meteorologic models. HEC-HMS will generate the appropriate rainfall distribution for each recurrence interval. The Atlas 14 depths provided are based on a partial-duration analysis; no partial-to-annual output conversion is required.

3.6.4.B HEC-HMS Parameters - For use of the frequency storm in HEC-HMS for

the evaluation of the 24-hour event, the meteorological model parameters shall be set as follows:

- Input Type: Partial Duration (NOAA Atlas 14 precipitation frequency estimates are based on analysis of partial duration series)
- Output Type: Annual Duration
- Intensity Duration: 5 Minutes
- Storm Duration: 1 Day
- Intensity Position: 50 Percent
- Storm Area (mi^2): Blank for areas less than 10 sq. miles. Use areal reduction for larger areas.
- Curve: Uniform for All Subbasins

3.6.4.C The computational time interval for computer simulations shall be selected based on criteria for the minimum lag time in a given model. The computational time interval used in a HEC-HMS model shall be no more than 6 minutes.

3.6.5 Conservation Service Runoff Curve Numbers

3.6.5.A Definition - The NRCS has developed an index, the runoff curve number, to represent the combined hydrologic effect of soil type, land use, agricultural land treatment class, hydrologic condition, and antecedent soil moisture. These watershed factors have the most significant impact in estimating the volume of runoff, and can be assessed from soil surveys, site investigations and land use maps.

3.6.5.B Methodology - Reference **Table 3-5** for NRCS index values.

3.6.5.B.i Antecedent Moisture Condition (AMC) II represents the average condition and shall be used.

3.6.5.B.ii When calculating peak runoff rates the undeveloped curve number shall be used and the impervious cover entered separately to represent existing and proposed development.

3.6.5.B.iii The NRCS Soil Survey of Williamson County provides soil hydrologic information.

3.6.6 Lag Time

3.6.6.A Definition - The lag time, defined as the time between the center of mass of excess rainfall to the runoff peak, is typically used in the HEC-HMS implementation of the SCS methodology.

3.6.6.B Methodology - The lag time can be estimated with equation 3-3.

T_{lag} = 0.6 Tc (Eq. 3-3)

Where:

Tc = Time of Concentration (see **Section 3.4** above)

Table 3-5: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands (assumes AMC-II condition)					
Cover Description	**Avg. % Impervious Area[1]**	**Curve Numbers for Hydrologic Soil Group**			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads					
Paved: curbs and storm drains (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Pasture, grassland, or range-continuous forage for	Poor	68	79	86	89
	Fair	49	69	79	84

	grazing[2]	Good	39	61	74	80
	Meadow-continuous grass, protected from grazing & mowed for hay		30	58	71	78
	Brush-brush-weed, grass mixture with brush the major element[3]	Poor	48	67	77	83
		Fair	35	56	70	77
		Good	30	48	65	73
	Woods-grass combination (orchard or tree farms)[4]	Poor	57	73	82	86
		Fair	43	65	76	82
		Good	32	58	72	79
	Woods[5]	Poor	45	66	77	83
		Fair	36	60	73	79
		Good	30	55	70	77
	Farmsteads - buildings, lanes, driveways and surrounding lots		59	74	82	86

1. Average runoff condition, and $I_a = 0.2s$
2. Poor: Less than 50 percent ground cover or heavily grazed with no mulch
   Fair: 50 to 75 percent ground cover and not heavily grazed
   Good: Greater than 75 percent ground cover and lightly or only occasionally grazed
3. Poor: Less than 50 percent ground cover
   Fair: 50 to 75 percent ground cover
   Good: Greater than 75 percent ground cover
4. Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture
5. Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning
   Fair: Woods are grazed but not burned, and some forest litter covers the soil
   Good: Woods are protected from grazing, and litter and brush adequately cover the soil

Source: NRCS TR-55: Urban Hydrology for Small Watersheds

3.7 Design Storm Frequencies

3.7.1 All developments submitted must provide runoff data for the following design storm frequencies: 2-year, 10-year, 25-year, and 100-year frequency events.

3.7.2 Design recurrence interval for various drainage facilities is shown in **Table 3-6**:

Table 3-6: Design Recurrence Interval for various Drainage Facilities

Drainage Facility	Design Recurrence Interval
Enclosed Storm Drain Systems and Inlets	25-year, with 100-year positive overflow in streets such that the depth of flow in the street does not exceed the right-of-way or drainage easement
Inlets at Street Low Point or Sag	100-year with positive overflow
Culverts and Bridges	100-year
Roadside Ditches	100-year
Earthen Channels, Concrete-Lined Channels, and Improved Channels	100-year
Detention and Retention Basins	2-, 10-, 25-, and 100-year

3.8 Street Drainage

3.8.1 Streets and alleys - Streets and/or alleys in combination with storm drains and/or roadside swales within new developments shall be designed so that storm water runoff resulting from a design storm of a 100-year frequency is contained within the available right-of-way and/or drainage easement.

3.8.2 Permissible Spread of Water - The flow of water in gutters of typical streets during the 25-year frequency storm shall be contained below the top of curb and shall maintain the clear with as provided in **Table 3-7 below**:

Table 3-7: Minimum Clear Width for Roadway Design when Gutter is Flowing Full

Roadway Classification	Minimum Clear Width (feet)
Rural Street	Not Applicable with roadside channels
Yield Street, Neighborhood Street, Neighborhood Avenue	12 feet
Community Boulevard 2-Lane	12 feet
Community Boulevard 4-Lane	12 feet in each direction
Regional Roadway	Per TxDOT or Williamson County Criteria

3.8.3 Design Method

3.8.3.A HEC-22, FHWA-NHI-10-009 provides acceptable equations to calculate gutter flow for straight and parabolic crowned pavement sections. This method is outlined in the City of Austin DCM Section 3.3.0.

3.8.3.B Gutters shall have a minimum longitudinal slope of 0.005 feet per foot (0.5%).

3.8.4 Street Cross Flow - Cross flow is allowed only in case of superelevation of a curve or overflow from the higher gutter on a street with cross fall. No more than three cubic feet per second (3 cfs) for the 25-year storm event shall be allowed to cross flow from the higher elevation to the lower elevation.

3.8.5 Street Intersections - No more than three cubic feet per second (3 cfs) for the 25-year storm event shall be allowed to flow across a street intersection or be allowed to enter the bulb of a cul-de-sac or corner knuckle/bubble.

3.8.6 Street Crown - No lowering of the standard height of street crown shall be allowed for the purposes of obtaining additional hydraulic capacity.

3.8.7 Driveway Drainage Divide - At some point within the first ten feet (10') from the edge of the roadway gutter, the entire width of a driveway shall have the same or greater elevation as the top of the curb at the edge of the roadway.

3.9 Inlets

3.9.1 Inlet Placement

3.9.1.A The storm drain system is to begin at the point where the storm water in the street reaches top of curb depth or the permissible spread of water as allowed for the type of street (reference **Table 3-7**). At such point where the combined capacity of the street and storm drain system satisfies the 25-year street capacity criteria (as previously described) but the 100-year frequency storm runoff cannot be contained within the right-of-way, additional pick-up points (inlet capacity) shall be provided along with an increase in storm drain capacity so that the 100-year frequency storm runoff will be contained within the right-of-way.

3.9.1.B Inlets shall be placed upstream from an intersection whenever possible and is required when more than three (3) cfs for the 25-year frequency storm flows across the intersection.

3.9.1.C No more than three (3) cfs for the 25-year frequency storm shall be allowed to enter the bulb of a cul-de-sac or corner knuckle/bubble.

3.9.1.D Inlets shall not be placed inside the curb return at intersections.

3.9.1.E At any intersection, only one street shall be crossed with surface drainage and this street shall be the lower classified street. When an alley intersects a street, inlets shall be placed in the alley whenever flow

down that alley would cause the capacity of the intersecting street to be exceeded.

3.9.2 Inlet Capacity

3.9.2.A Methodology to calculate the interception capacity of inlets is provided in the City of Austin's *Drainage Criteria Manual* Section 4.3.

3.9.2.B The minimum inlet opening length shall be ten feet (10') and the maximum inlet length is twenty feet (20') at any given location.

3.9.3 Inlet Type

3.9.3.A Curb inlets shall be used to intercept surface runoff for curb and gutter streets.

3.9.3.B Grate inlets, combination inlets, and slotted/trench drains are discouraged from use due to the tendency of grates and slotted drains to clog. Prior approval of their use and application of appropriate clogging factor is required from the City Engineer.

3.10 Storm Drains

3.10.1 Design Guidelines

3.10.1.A Minimum Size - The minimum allowable storm drain and/ culvert size shall be eighteen inches (18") in diameter or height for boxes.

3.10.1.B Material

3.10.1.B.i All storm drain and culverts shall be made of reinforced concrete and shall be constructed of ASTM C76, Class-III or better.

3.10.1.B.ii Box culverts may be precast or cast-in-place

3.10.1.B.iii Storm drain/ culverts shall be designed to support anticipated loading. The Engineer shall provide load analysis as appropriate to demonstrate that class of pipe used is sufficient for the loading conditions. Higher strength pipes shall be used where loadings warrant such.

3.10.1.B.iv Manholes and Junction Boxes. Shall be reinforced concrete. Access lids shall follow City of Taylor standards.

3.10.1.C Minimum Cover

3.10.1.C.i Under Paved Surfaces – The minimum depth of cover under paved surfaces shall be a minimum of twelve (12) inches and greater than the pavement section, which includes any asphalt, concrete, and base material.

3.10.1.C.ii Under Unpaved Surfaces - The minimum depth of cover below unpaved surfaces shall be twelve (12) inches.

3.10.1.C.iii Depth of cover is measured from the finished ground elevation to the top outer edge of the storm drain or culvert.

3.10.1.D Layout

3.10.1.D.i At changes in storm drain size, the soffit (top inside surface), not the flow line, of the two storm drains shall be aligned, where practical.

3.10.1.D.ii No proposed pipe having a diameter greater than fifty percent (50%) of the minimum dimension of an existing box culvert shall be allowed to discharge into that box culvert. Exceptions must be justified by structural engineering analysis.

3.10.1.D.iii For all pipe junctions other than at a manhole or junction box, the angle of intersection between any two flow paths shall not be greater than forty-five (45) degrees. This includes discharges into box culverts and channels.

3.10.1.D.iv Storm drains between lots (crossing blocks) shall be avoided as much as possible. When unavoidable, such mains shall be laid along a straight alignment (absent of curves, jogs, and manhole/junction boxes when traversing between lots) with manholes/junction boxes provided at each intersecting street.

3.10.1.D.v Storm drains along rear of residential lots (through back yards) shall be avoided. Such systems will require dedication of a drainage easement.

3.10.1.D.vi Storm drain spacing clearances from other utilities shall comply with Chapter 4.5.2 of this manual, as amended.

3.10.2 Storm Drain Flow

3.10.2.A Storm drain shall be sized to flow full and shall only discharge into pipes of equal or greater size (capacity).

3.10.2.B All storm drain shall be designed by direct solution of the Continuity Equation and Manning's Equation.

$Q = AV$ (Eq. 3-4)

$Q = (1.49/n)AR^{⅔} S^{½}$ (Eq. 3-5)

Where:

Q = Pipe flow, cfs

A = Cross-sectional area of flow, $ft.^2$

V = Velocity of flow, ft./sec.

n = Coefficient of roughness of pipe (n = 0.013)

R = Hydraulic radius = A/W_p, ft.

S = Friction slope in pipe, ft./ft.

W_p = Wetted perimeter, ft.

3.10.2.C Minimum Velocity - The minimum velocities in storm drains shall be two and a half feet per second (2.5 fps) for the 25-year frequency storm. When backwater conditions prevent one or more portions of the system from attaining the minimum velocity during the design storm, the portion(s) of the system that fail to meet the criteria shall be checked to ensure that the minimum velocity is attained during a lesser and more frequent storm event.

3.10.2.D Maximum Velocity - Maximum velocity in the pipe shall not exceed fifteen feet per second (15 fps) for the 25-year frequency storm for storm drain trunklines. For storm drain inlet laterals there is no maximum velocity limit.

3.10.2.E Maximum Hydraulic Gradient - The hydraulic grade line shall remain below the surface of the ground or street for the 25-year storm event.

3.10.2.F Hydraulic Calculations - Hydraulic gradient calculations shall account for all friction and minor head losses that may occur in the storm drain line and start from an appropriate tailwater elevation.

3.10.2.F.i Friction Losses - Shall be determined by direct application of Manning's Equation.

3.10.2.F.ii Minor Losses - Minor losses are caused from turbulence in the storm drain system and can include the following: manholes, junctions, bends, curves, entrance and exit losses, enlargements, and contractions. City of Austin's Drainage Criteria Manual Section 5.5.2 outlines procedures for estimating minor losses.

3.10.2.F.iii Tailwater

- Design Engineer to calculate the appropriate tailwater elevation or use the results from a detailed hydraulic study.
- In no case shall the tailwater be assumed below top of pipe.
- If the outfall is a stream, then it shall be necessary to consider the joint or coincidental probability of two hydrologic events occurring at the same time to adequately determine the elevation of the tailwater in the receiving stream. The relative independence of the

discharge from the storm drain system can be qualitatively evaluated by a comparison of the drainage area of the receiving stream to the area of the storm drain system. **Table 3-8** can be used to establish an appropriate tailwater elevation for a storm drain system based on the expected coincident storm frequency on the outfall channel.

Table 3-8: Frequencies for Coincidental Occurrences for Receiving Stream Tailwater (adapted from HEC-22, 2013)

Watershed Ratio (outfall stream : local drainage area)	25-year Design Tailwater Elevation	100-year Design Tailwater Elevation
10,000:1	2-year	2-year
1,000:1	5-year	10-year
100:1	10-year	25-year
10:1	10-year	50-year
1:1	25-year	100-year

3.10.3 Manholes and Junction Boxes

3.10.3.A Manholes or junction boxes are required:

3.10.3.A.i Every three hundred feet (300');

3.10.3.A.ii At every change in pipe size;

3.10.3.A.iii Where two or more laterals intersect the main line within five feet (5') of each other; and

3.10.3.A.iv To meet maintenance path requirements.

3.10.3.B Maintenance Path - Provide a maintenance path from one access point to another within the storm drain that meets the following requirements:

3.10.3.B.i Path has no more than one horizontal bend, with that bend having a deflection of no more than forty-five (45) degrees in the direction of the maintenance path.

3.10.3.B.ii Path has no vertical bend with a deflection of greater than five (5) degrees.

3.10.3.B.iii Access points can include manhole/junction boxes, inlets, and storm drain outfalls.

3.10.3.C Junction boxes in lieu of manholes shall be provided where any pipe opening exceeds thirty-seven (37") inches and where the distance from the outside surfaces of any two pipes entering a manhole is less than one (1') foot, measured along the inside of the manhole.

3.10.3.D Manholes are to be a minimum four (4') feet in diameter and shall be precast, or cast in place if approved by City Engineer.

3.10.4 Storm Drain Outfalls

3.10.4.A Maximum Discharge Velocity - The maximum discharge velocities in the storm drain shall also not exceed the permitted velocity of the receiving channel or storm drain at the outfall to prevent erosive conditions. The maximum outfall velocity of a storm drain in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipater (e.g. stilling basins, impact basins, riprap protection). See Section 3.13 for maximum permissible velocities for channels.

3.10.4.B Stabilization

3.10.4.B.i Outfall and Stabilization Location - Locate the outfall away from existing eroded banks in the most stable location available. The location of the outfall, armoring, and channel stabilization must consider the location of existing infrastructure and utilities and provide adequate horizontal and vertical separation so as not to obstruct access or maintenance, nor adversely impact the infrastructure.

3.10.4.B.ii Outfall Orientation - The angle of intersection between the outfall flow path and the channel flow path shall not be greater than 45-degrees.

3.10.4.B.iii Bank and Bed Armoring - The surrounding banks and bed shall be appropriately armored or made geotechnically stable, to sufficiently resist erosive forces. Armor below the outfall shall extend from the toe of the bank into the channel equal to a length ten times the pipe diameter. For channel bottom widths less than ten times the pipe diameter, armoring shall extend up the opposite bank to an elevation equal to that of the top of the pipe.

3.10.4.B.iv Armor Type - Flexible armor, such as rock riprap, shall be utilized for bed and bank stabilization in erodible channels.

3.10.4.C Drop Height

3.10.4.C.i The drop height from a storm drain invert to a receiving

channel or detention pond grade shall be approximately one foot (1') to limit local erosion and to allow for potential sedimentation.

3.10.4.C.ii Concentrated discharges on steep embankments, ravine slopes, or high bluffs are to be avoided.

3.11 Roadway Cross-Culverts

3.11.1 Methodology - The Federal Highway Administration Hydraulic Design Series Number 5 (HDS 5) “Hydraulic Design of Highway Culverts” and the TxDOT “Hydraulic Manual” have published guidance for the hydraulic design of roadway culverts. Their guidance shall be used to perform culvert designs that meet the City's performance criteria.

3.11.2 Material - Per material requirements for storm drains in Section 3.10.

3.11.3 Minimum Size - Per minimum size requirements for storm drains in Section 3.10.

3.11.4 Minimum Cover – Per minimum cover requirements for storm drains in Section 3.10

3.11.5 Culvert placement

3.11.5.A Roadway Cross-Culverts shall be placed to relieve drainage at all low-points and drainage crossings.

3.11.5.B Horizontal alignment - Culverts shall be skewed such that impacts due to the flood and normal flow angles of attack on the structure are minimized. The culvert axis shall match the natural channel alignment upstream and downstream whenever practical.

3.11.5.C Vertical alignment - Place the upstream and downstream flow line elevations at the same elevations as the existing streambed whenever practical. Depressed entrances shall be avoided.

3.11.6 Culvert Headwalls

3.11.6.A Headwalls shall be constructed at the ends of all culverts to anchor the culvert to prevent movement due to hydraulic and soil pressure, to control erosion and scour resulting from excessive velocities and turbulence, and to prevent adjacent soil from sloughing into the waterway opening.

3.11.6.B All headwalls shall be constructed of reinforced concrete and may be either straight-parallel, flared or warped. They may or may not require aprons, as determined by site conditions. The following guidelines can be used to aid in the selection of the type of headwall:

3.11.6.B.i Parallel Headwalls - Approach velocities are low (below six (6) feet per second) and backwater pools are permitted.

3.11.6.B.ii Flared Headwalls - Approach velocities are between six (6) and ten (10) feet per second. Ample right-of-way or easement is available.

3.11.6.B.iii Warped Headwall - Approach velocities are between eight (8) and twenty (20) feet per second. Warped headwalls are effective with aprons to accelerate flow through the culvert.

3.11.6.C Headwalls shall be aligned with the direction of the receiving flow when discharging into a waterway.

3.11.6.D Precast headwalls and endwalls may be used if all other criteria area satisfied; generally precast headwalls and endwalls are available for smaller culverts eighteen (18") inches and twenty-four (24") inches in diameter.

3.11.6.E The safety ends or headwalls shall be constructed in accordance with TxDOT standards as required by the physical conditions of the particular installation. Rock rip-rap or other suitable erosion control may be required at each location as supplemental protection.

3.11.7 Hydraulics

3.11.7.A Freeboard - The culvert crossing shall not produce a 100-year headwater elevation at the roadway greater than the roadway crown or six (6) inches above any top of upstream curb elevation, whichever is lower.

3.11.7.B Culvert hydraulic grade line calculations shall consider both inlet and outlet control. Tailwater conditions shall be considered for outlet control conditions.

3.11.7.C The maximum velocity through a culvert shall be fifteen feet per second (15 fps) during the 25-year frequency storm. A minimum velocity through a culvert shall be two and one-half feet per second (2.5 fps) during the 25-year frequency storm.

3.11.8 Stream Stability

3.11.8.A Stream stability shall be assessed when determining the number of barrels, height and width and culvert skew. Potential for scour shall be accounted for in the design.

3.11.8.B Stream degradation - The local condition of the channel reach shall be evaluated to determine if there is degradation present. If channel degradation is anticipated, then the design shall accommodate for future erosion.

3.11.8.C If a depressed entrance is used, then an upstream apron shall be

designed to prevent progressive degradation of the upstream channel and the potential for deposition shall be considered.

3.11.8.D Outlet velocities

3.11.8.D.i When the outlet velocity exceeds the allowable erosive velocity in the downstream channel as specified in Section 3.13, channel erodibility and local scour potential shall be evaluated and taken into account. A flexible armoring system is preferred in streams subject to erosion.

3.11.8.D.ii Hydraulic jumps shall not be allowed from face of culvert to fifty feet (50') from the culvert.

3.11.8.E Erosion protection measures - A flexible armoring system is preferred in streams subject to erosion. Where energy dissipation is needed at a culvert outlet, a rock riprap basin is preferred over rigid structures (see HEC-14 for design guidelines).

3.11.8.F Multiple boxes - If multiple boxes or culverts are necessary, different flowline elevations for each structure shall be evaluated. The culverts at the center of the channel shall be lower to match with the existing natural channel with the outlying culverts raised up to more closely coincide with the natural channel "terrace" elevation. This will help minimize sedimentation in the outlying culverts, help preserve the integrity of the channel system, and reduce maintenance costs.

3.12 Bridges

3.12.1 Methodology - The Federal Highway Administration and the TxDOT Hydraulic Manual have published guidance for the hydraulic design of bridges. Their guidance shall be used to perform bridge designs that meet the City's performance criteria.

3.12.2 Construction Plans - Bridge details may be modifications of the current Texas Department of Transportation (TxDOT) Standards.

3.12.3 Freeboard - The bridge crossing shall not produce a 100-year headwater elevation at the roadway greater than the roadway crown or six (6) inches above any top of upstream curb elevation, whichever is lower. If the headwater elevation exceeds the bridge low chord elevation then the bridge design shall include shear keys per TxDOT standards.

3.12.4 Bridge configuration - The skew of the bridge piers and abutments shall be oriented as close to the normal or flood direction of flow resulting in an angle of attack as close to zero (0) degrees as possible.

3.12.5 Hydraulic modeling - Computer modeling programs used for the hydraulic analysis of bridges shall be HEC-RAS.

3.12.6 Stream stability

3.12.6.A Stream stability shall be assessed when designing the abutments and interior bents of the bridge. Scour shall be accounted for in the design.

3.12.6.B Flow shall not be supercritical in an area from one hundred feet (100') upstream from a bridge to twenty-five feet (25') downstream from a bridge.

3.13 Channels

3.13.1 Channel Types

3.13.1.A Natural Channels - An unlined and unimproved existing drainage channel that has not been graded, modified, cleared, or created by equipment, also known as natural creek and natural stream.

3.13.1.B New or Altered Channels - Constructed or existing channels that have been significantly altered by human effort. This section provides requirements for new or altered channels.

3.13.2 USACE Section 404 - When a project proposes to modify a channel, the Engineer shall check the requirements of Section 404, Permits for Dredged or Fill Material, of the Clean Water Act. If required, permit authorization shall be obtained from the USACE by the design Engineer.

3.13.3 Hydraulic Requirements

3.13.3.A Design Capacity - The flow from the 100-year frequency storm must be contained within channel while allowing for one foot (1') of freeboard. The channel freeboard shall consider superelevation, standing waves and/or other water surface disturbances. The channel shall be designed to accommodate existing and fully-vegetated conditions.

3.13.3.B Maximum Velocity - The velocities below are maximum allowable for the 100-year frequency storm event and includes all transitions to or from channels and waterways with similar or different channel materials. If a lower velocity cannot be achieved, scour or erosion countermeasures must be constructed or installed. Velocities in channel bends are usually higher and the design Engineer must account for these local velocities as well.

- Fine sand – 2 feet per second
- Course sand – 4 feet per second
- Fine gravel – 5 feet per second
- Sandy silt – 2 feet per second
- Sandy loam, noncolloidal – 2.5 feet per second
- Clay – 3.5 feet per second (soil most typical for Taylor area)

- Grass-lined sandy silt (slopes less than 5%) – 6 feet per second
- Silt clay – 3.5 feet per second
- Poor rock (usually sedimentary) – 10 feet per second
- Soft sandstone – 8 feet per second
- Soft shale – 3.5 feet per second
- Good rock (usually igneous or hard metamorphic) – 12 feet per second
- Reinforced concrete lining – 15 feet per second

3.13.3.C Minimum Velocity - The minimum permissible velocity for the 2-year frequency storm is 2 feet per second.

3.13.4 Lining Types and Requirements

3.13.4.A Grass-Lined - Use low maintenance vegetation for vegetative cover, as approved by the City Engineer prior to planting. All slopes shall be hydromulched, sodded or seeded with approved grass, grass mixtures or ground cover suitable to the area and season in which they are applied. Seeded side slopes shall be lined with erosion protection matting.

3.13.4.B Other Liner Types - Types such as concrete, rock rip-rap, rock walls and gabions may be used upon approval of the City Engineer.

3.13.4.C Rock Rip-Rap - Must be six-inch (6") diameter rock or greater.

3.13.4.D Concrete – Concrete liners must be steel reinforced.

3.13.5 Configuration

3.13.5.A Horizontal Curvature - The center line curvature of a channel shall have a minimum radius of twice the top width of the 100-year frequency storm flow.

3.13.5.B Side Slopes

3.13.5.B.i Earthen Channels - Maximum side slopes of four feet horizontal to one foot vertical (4H:1V) for earthen channels, or as recommended from a geotechnical analysis.

3.13.5.B.ii Concrete Lined Channels - Concrete lined channels do not require slope maintenance. Thus, the side slopes may be as steep as vertical with appropriate structural methods and safety measures applied.

3.13.5.C Bottom Width - The minimum flat bottom width is three feet (3').

3.13.5.D Channel Slopes

3.13.5.D.i Earthen or Grass-Lined Channels – The channel slope shall be set to meet the minimum permissible velocity requirement. A reinforced concrete pilot channel must be used if the channel slope is less than one percent (1%). The minimum slope for a concrete pilot channel is 0.5%. Any grass-lined portion of the channel bottom must have a slope of at least two percent (2%) from that portion to the concrete-lined pilot channel.

3.13.5.D.ii Concrete Lined Channels – Minimum channel slope of 0.5%

3.13.5.E Concrete Pilot Channel - The pilot channel must be at least four feet (4') wide, two inches (2") deep, and be capable of withstanding vehicular loading.

3.13.6 Channel Stability

3.13.6.A General - All channel sections must consider and account for channel bed and bank stabilization in their design. This requirement pertains to all sections whether they are left in their natural condition or are modified in any manner. The design of all drainage channels and swales shall assure adequate capacity, appropriate longitudinal slopes, and minimum maintenance to overcome the result of erosion, silting, sloughing of bends or similar occurrences.

3.13.6.B Concrete-lined Channels - In concrete-lined channels the probability of achieving supercritical flow is greatly increased. The designer must take care to ensure against the possibility of unanticipated hydraulic jumps forming in the channel when considering the 25- and 100-year frequency storms. Flow with a Froude number equal to one (1) is unstable and shall be avoided. If supercritical flow cannot be avoided, then freeboard and superelevation must be determined. In addition, all channels carrying supercritical flow shall be continuously lined with reinforced concrete.

3.13.6.C Drop Structures - The function of a drop structure is to reduce channel velocities by allowing for flatter upstream and downstream channel slopes. The City of Austin’s Drainage Criteria Manual Section 6.5.0 describes two commonly used drop structures.

3.13.6.D Energy Dissipators - Energy dissipators are used to dissipate excessive kinetic energy in flowing water that could promote erosion. An effective energy dissipator must be able to slow down the flow of fast-moving water without damage to the structure or to the channel below the structure. There are several types of energy dissipators such as impact type (baffled outlets and aprons), and hydraulic jump type (stilling basins). For more information, reference “Hydraulic Design of Stilling

Basins and Energy Dissipators" (EM 25) published by the U.S. Bureau of Reclamation.

3.13.7 Maintenance Access - Maintenance access shall be provided on one side of the channel unless other maintenance access provisions are incorporated into the design and associated operational and maintenance plan. See easement requirements in Section 1.8 of this manual.

3.13.8 Hydraulic Calculations

3.13.8.A Manning's Equation can be used to design channels/swales and determine water surface elevations and velocities when backwater effects are negligible. Channels/swales where backwater effects occur must be designed using HEC-RAS.

3.13.8.B Roughness Coefficients - The City of Austin's Drainage Criteria Manual Section 6.3.0 describes an acceptable procedure to determine appropriate Manning 'n' values. Roughness coefficients for channels shall represent fully-vegetated conditions and assume unmaintained conditions.

3.13.8.C Superelevation - Superelevation of the water surface shall be determined at all horizontal curves which deviate more than 45 degrees off the projected centerline of the channel. An approximation of the superelevation at a channel bend can be obtained from the following equation:

$h = V^2T_w/gR_c$ (Eq. 3-6)

Where:

h = Superelevation, feet

V = Flow velocity, feet/sec

T_w = Top width of channel, feet

R_c = Centerline radius of curvature, feet

g = acceleration due to gravity, feet/sec^2

3.14 Roadside Swales and Driveway Culverts

3.14.1 Roadside Swales - Roadside swales may be used along all roadways to convey drainage in accordance with the above channel criteria with the exception of the following specific roadside swale criteria:

3.14.1.A Design Capacity - Swales shall be designed to carry a 100-year frequency storm and the back water effects of the most restrictive culvert to be placed in the swale.

3.14.1.B Depth - Shall at all times maintain a minimum depth of thirty inches (30").

3.14.2 Driveway Culverts

3.14.2.A Applicability - All driveways and driveway culverts are the responsibility of the individual lot owner or developer. It is the developer's responsibility to ensure that all lot owners are aware of this requirement.

3.14.2.B Material - Per material requirements for storm drains in Section 3.10.

3.14.2.C Minimum Size - Per minimum size requirements for storm drains in Section 3.10.

3.14.2.D Minimum Cover - Per minimum cover requirements for storm drains in Section 3.10.

3.14.2.E Gradient - Driveway culverts shall have a minimum bottom slope of 0.5%.

3.14.2.F Length - Driveway culverts shall not be greater than fifty feet (50').

3.14.2.G Multiple Culverts - Where multiple culverts occur, the ditch bottom must be widened to have a bottom width that is six inches (6") greater on each side than the distance from the outside walls of the outer two culverts. Each culvert shall also be separated by at least six inches (6") of compacted fill material.

3.14.2.H All driveway culverts must be installed prior to issuance of building permits or construction activities on the individual lot.

3.14.2.I All culverts and related structures that are a part of road construction shall be in place prior to final acceptance of the improvements for the subdivision.

3.15 Detention Basins

3.15.1 General Detention Requirements

3.15.1.A Types of Detention Ponds

3.15.1.A.i Dry detention basins are open space areas designed to remain dry most of the time. They fill up during large storm events and drain completely through an outlet structure once the storm event has passed. Dry detention basins are preferred and allowed.

3.15.1.A.ii Wet detention basins are ponds designed to have a permanent pool. During a large storm event, detention storage is provided above the normal permanent pool level, and after the storm event, the detention storage drains through an outfall and the water surface level returns to the permanent pool/normal water level. Normal ponded volume below the permanent pool does not count towards

the active detention volume. Constructed wetlands are a type of wet detention basin. Wet detention basins are allowed given proper design of the permanent pool.

3.15.1.A.iii Retention basins are basins that do not have an outfall and drain completely by infiltration into the underlying soil and evaporation. During a large storm event, retention basins fill and provide storage. After the storm event, the water drains from the site and no water is released downstream. Retention basins are allowed but require analyses of site-specific percolation/infiltration rates, water balance analysis, and potential underdrain design.

3.15.1.A.iv Bioretention is a type of retention basin that typically features a filter bed that runoff infiltrates through to drain to either an underdrain or underlying native soils. The use of bioretention ponds is limited to drainage areas less than two acres. Rain gardens are a type of bioretention basin. Bioretention basins are allowed but require either an underdrain or an analysis of site-specific percolation/infiltration rates.

3.15.1.A.v Underground detention provides runoff storage in vaults, multiple large-diameter pipes, etc. Underground detention is not preferred but allowable given proper design, operational and maintenance considerations.

3.15.1.B General Performance Requirements - Detention shall be configured and sized to meet general detention requirements as stated in Section 3.1, which requires 'No Increase in Site Discharge', and 'No Offsite Adverse Impacts' for the 2-, 10-, 25- and 100-year, 24-hour duration frequency storm events and requires ‘Stream Erosion Protection’ through the attenuation of the post-development 2-year storm event to less than $Q_{critical}$ (as defined in Section 3.1.4.D).

3.15.1.C Drawdown Time - Dry detention facilities shall be designed to empty the complete detention volume from the time of peak stage in less than seventy-two (72) hours.

3.15.1.D Freeboard - A freeboard of one (1) foot will be required for all detention ponds. Freeboard distance is measured between the elevation of the emergency spillway crest and the elevation of the top of the detention basin containment embankment/berm. For underground detention an additional 10% of detention storage is required to account for future sedimentation and other unknowns.

3.15.1.E Detention within Paved Areas - Storm runoff may be detained within

paved areas (i.e. parking lots, driveways). The location of ponding areas shall be planned to minimize inconvenience to both pedestrians and traffic and the maximum 100-year ponding depth shall be limited to less than eight (8) inches.

3.15.1.F Emergency Spillway - An emergency spillway shall be provided at the 100-year water surface elevation with sufficient capacity to convey the 100-year storm event assuming blockage of the outlet works.

3.15.1.G Texas Commission on Environmental Quality (TCEQ) Requirements - All TCEQ requirements for water impoundments and dam safety shall apply. Detention ponds may be subject to the requirements of the TCEQ Dam Safety Program based on impoundment volume, embankment height, and level of hazard. The Owner shall be responsible for obtaining all necessary permits required by the TCEQ for impounding water. See Section 3.16 – Dam Safety.

3.15.1.H Stormwater Pumps - The use of stormwater pumps for purposes of maintaining flood control discharge from a detention facility are not allowed.

3.15.2 Detention Analysis Requirements

3.15.2.A Hydrograph Routing

3.15.2.A.i The volume of detention runoff storage shall be computed using unit hydrograph and storage routing procedures. The modified Rational Method may be used when the contributing drainage area is less than 100 acres.

3.15.2.A.ii The effects of tailwater or other outlet control considerations shall be considered.

3.15.2.A.iii When designing ponds in series (i.e., when the discharge of one pond becomes the inflow of another), the analysis must incorporate the construction of hydrographs for all inflow and outflow components.

3.15.2.A.iv The preferred method to perform this analysis is through application of the NRCS hydrologic method using the Corps of Engineers HEC-HMS models.

3.15.2.B Watershed Land Use Conditions - Any off-site areas which drain to the pond shall be assumed to remain in the existing conditions for both pre- and post-development conditions, unless the detention pond is serving as a regional detention pond for these off-site areas. Land use conditions for areas being served by a regional detention pond shall be considered at their ultimate build-out condition.

3.15.2.C Watershed Floodplain Models - Where applicable, City of Taylor

regulatory models shall be used as base models for the impact analysis and drainage design associated with development. Users shall be aware that floodplain models provided have been developed on a watershed-wide basis and may therefore not be applicable without modification on a site-by-site basis. Regulatory models used for flood insurance purposes shall be obtained directly from FEMA.

3.15.3 Dry Detention Design Requirements

3.15.3.A Embankments

3.15.3.A.i Minimum Top Widths are shown in **Table 3-9**.

Table 3-9: Embankment Top Widths

Total Height of Embankment (feet)	Minimum Top Width (feet)
0—6	4
6—10	6
10—15	8
15—20	10
20—25	12
25—35	15

3.15.3.A.ii Compaction - The constructed height of an earthen embankment shall be equal to the design height plus the amount necessary to ensure that the design height will be maintained once all settlement has taken place. This amount shall in no case be less than five percent (5%) of the total fill height. All earthen embankments shall be compacted to 95% of maximum density.

3.15.3.A.iii Side Slopes - Earthen embankment side slopes shall be no steeper than 4 horizontal to 1 vertical (4H:1V) or as recommended from a geotechnical analyses.

3.15.3.B Positive Drainage - A dry detention facility shall have enough gradient to ensure positive drainage to the outlet structures to avoid nuisance conditions such as standing water, odors, insects, and weeds. A minimum slope towards the outlet structure of two percent (2.0%) is required for all grass lined areas and of one-half percent (0.5%) for concrete pilot channels. See Section 3.13 for additional concrete pilot channel requirements.

3.15.3.C Detention Pond Inflow - All concentrated flows into a detention pond shall be collected and conveyed into the pond in such a way as to

prevent erosion of the side slopes and pond bottom.

3.15.3.D Detention Pond Outlet

3.15.3.D.i Outlet Pipes - Shall have a minimum diameter of eighteen inches (18”) and be constructed of reinforced concrete.

3.15.3.D.ii Orifice plates - Orifice plates may be used to further restrict flow area but must be assessable for maintenance and removal of storm debris. Orifice openings smaller than twelve inches (12”) shall not be used unless a method to prevent debris blockage is provided.

3.15.3.D.iii No outlet structure from a detention pond shall be designed to discharge concentrated flow directly onto roadways. Such discharges shall be conveyed by a closed storm drain to the nearest existing storm drain trunk line or channel. If there is no existing storm drain/channel within three hundred feet (300’), the outlet design shall provide for a change in the discharge pattern from concentrated flow back to sheet flow.

3.15.3.D.iv Outlet Structure Design - There are two basic types of outlet control structures: Those incorporating orifice flow and those incorporating weir flow. Rectangular and V-notch weirs are the most common types. Generally, if the crest thickness is more than sixty percent (60%) of the nappe thickness, the weir shall be considered broad-crested. The coefficients for sharp-crested and broad-crested weirs vary. The respective weir and orifice flow equations are provided below. Analytical methods and equations for other types of structures shall be approved prior to use.

<u>Rectangular Weir Flow Equation</u>

$Q = CLH^{⅔}$ (Eq. 3-7)

Where:

Q = Weir discharge, cubic feet per second

C = Weir Coefficient (reference source)

L = Horizontal length, feet

H = Head over weir, feet

<u>V notch Weir Flow Equation</u>

$Q = 4.28C_e\tan(\Theta/2)H^{2.5}$ (Eq. 3-8)

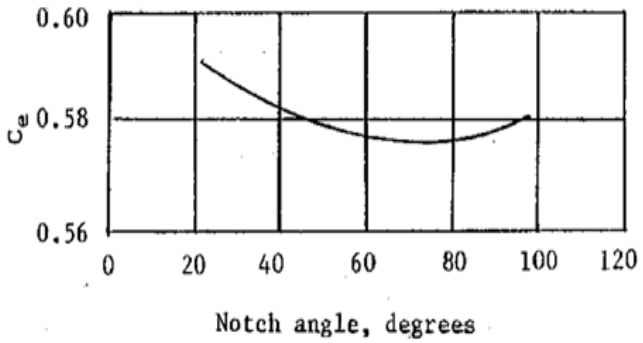
Where:

Q = Weir Discharge, cubic feet per second

C_e = Weir Coefficient, $25° < \Theta < 100°$

Θ = Angle of the weir notch at the apex (degrees)

H = Head on Weir, feet



Orifice flow equation

$Q = C_o A (2gH)^{0.5}$ (Eq. 3-9)

Where:

Q = Orifice Flow, cubic feet per second

C_o = Orifice Coefficient (use 0.6 or reference source)

A = Orifice Area, square feet

g = Gravitational constant, 32.2 feet/sec^2

H = Head on orifice, measured from centerline, feet

3.15.4 Wet Detention Design Requirements

3.15.4.A Wet detention basins are required to meet the same requirements of dry detention basins with the exception of the positive drainage requirements, as wet basins have a permanent pool.

3.15.4.B Permanent Pool - The permanent pool shall have a permanent pool depth ranging from 3 to 8 feet, side slopes shall be no steeper than 3:1, and safety benches with a maximum slope of 6% are required for any slopes steeper than 4:1. A drain must be provided that is capable of draining the permanent pool within 48 hours unless water rights are obtained.

3.15.5 Underground Detention Requirements

3.15.5.A The bottom of underground detention shall be at least two feet above seasonal high groundwater.

3.15.5.B Underground detention shall not be located underneath any structure unless approved by the City Engineer.

3.15.5.C Underground utilities shall not cross through the underground detention area.

3.15.5.D If underground detention is located underneath an area with vehicular traffic, the structural design must meet the requirements for emergency vehicle loading.

3.15.5.E Maintenance access is required at both ends of the underground detention facility. Spacing between access openings shall not exceed 50 feet unless approved by the City Engineer. If the value or pipe contains cells, then one access per cell is required. Confined space entry regulations shall be followed if applicable.

3.15.5.F For underground detention systems, minimum cover requirements shall be per 3.10 – Storm Drains. The maximum fill depth to the top of the pipe shall be governed by geotechnical/structural considerations. Calculations must be provided for review.

3.15.6 Detention Facility Maintenance Requirements

3.15.6.A Maintenance Access

3.15.6.A.i Detention ponds shall be designed with adequate area around the perimeter for access and maintenance. Ponds shall have a seven (7) foot wide clear perimeter access strip for ponds with depths of five (5) feet or less (back slopes included) and a minimum of fifteen (15) feet wide clear perimeter access strip for ponds over five (5) feet deep or with back slopes in excess of five (5) feet high. Area shall not slope more than five percent (5%).

3.15.6.A.ii A means of access to the bottom of the pond and to the outlet structures shall be provided. The access ramp shall be graded no steeper than 15% and shall be as wide as the perimeter access width provided.

3.15.6.B O&M Plan Requirements - O&M plans are required for all detention facilities. See Appendix A – Maintenance Agreement for Drainage Facilities.

3.16 Dam Safety

3.16.1 Applicability - Any hydraulic structure designed to impound stormwater that has: (1) a height greater than or equal to six feet and a minimum impoundment storage of 50 acre-feet; or (2) a height greater than or equal to 25 feet and a minimum impoundment storage of 15 acre-feet, may be classified as a dam by the Texas Administrative Code (TAC), Chapter 299.13, and must be designed to safely pass the minimum design flood hydrograph expressed as a percentage of the Probable Maximum Flood (PMF).

3.16.1.A The height of the hydraulic structure is measured from the top of the structure to the downstream intersection of the structure and the natural or excavated ground, whichever is lower.

3.16.1.B A dam must be designed to pass the PMF as defined in Texas Administrative Code Chapter 299 Dams and Reservoirs (Figure: 30 TAC § 299.15(a)(1)(A)).

3.16.1.C The State of Texas has the primary regulatory authority for dams in Texas. The State's Dam Safety Program is under the purview of the TCEQ and Title 30, Chapter 299 of the Texas Administrative Code contains applicable rules. The primary guidance for the analysis of dam performance during a PMF event can be found in the "Hydrologic and Hydraulic Guidelines for Dams in Texas". This manual and other dam safety and maintenance manuals are available on the TCEQ's web site at https://www.tceq.texas.gov/.

3.16.2 Dam Design - TCEQ's *Design and Construction Guidelines for Dams in Texas* shall be referenced for dam design. The following list several important dam design considerations:

3.16.2.A Woody Vegetation Free Zone - Dams shall not be designed or constructed with any trees or other woody vegetation on the dam structure or within twenty feet (20') of the upstream or downstream toe of the dam.

3.16.2.B No permanent irrigation systems - Dams shall not have permanent irrigation systems installed on or within the dam.

3.16.2.C Vegetation maintenance - Earthen dam embankments must be vegetated with grasses that do not exceed twelve inches (12") in height and can be mowed as frequently as weekly. Examples include Bermuda grass and buffalo grass.

3.17 Flumes

3.17.1 The use of flumes is discouraged. Flumes shall not be permitted when the purpose of a permanent flume is to carry runoff down the sides of earthen channels or detention ponds.

3.17.2 A flume may be used to direct overflow runoff along property lines until the runoff can be intercepted by streets or a storm drain system. A flume shall not carry more than ten (10) cubic feet per second during the 100-year frequency storm event with a slope of one (1) percent.

3.17.3 All flumes crossing sidewalks shall be covered or bridged such as to minimize danger to pedestrians.

3.17.4 All edges are to be protected with rock rip-rap or other form of protection for erosion control and scour purposes.

3.18 Lakes

3.18.1 Approval to develop in any area subject to inundation by a lake must be obtained from the appropriate agency responsible for that particular lake before the City grants its approval. Agencies that shall be contacted include, but are not limited to U.S. Army Corps of Engineers, TCEQ, the Brazos River Authority, and FEMA.

3.18.2 Regardless of approvals obtained from those agencies listed above, no filling, development, or construction in any area subject to inundation by a lake shall occur without the approval of the City Engineer. The City Engineer may require any studies necessary to determine that filling, development, or construction will not have a detrimental effect on adjacent, upstream, or downstream properties and buildings. This subsection in no way diminishes other requirements of this section.

3.19 Lot-To-Lot Drainage

3.19.1 A comprehensive grading plan shall be included with subdivision construction plans. The grading plan shall be designed to ensure all lots will adequately drain upon completion of the subdivision improvements.

3.19.2 Infill development must be drained to an abutting street or alley unless drainage to a street or alley is infeasible. Infill development must not obstruct the existing natural drainage pattern of adjacent public or private property or redirect or increase the existing quantity or velocity of water draining onto adjoining private property. The City Engineer may require the submittal of detailed drainage plans and engineering calculations if the potential exists for negative impacts to adjacent property owners.

3.19.3 All lots shall be graded from rear to front at which point the drainage shall be intercepted by the street. Alternate grading schemes may be utilized if it can be demonstrated to the satisfaction of the City Engineer that grading from rear to front would be detrimental to trees or other natural features; or it would not be reasonably adaptable to the existing topography because of excessive cuts and fills, or future lot development (i.e., commercial, industrial or multi-family lots).

3.19.4 All lots shall be graded at a minimum of one (1) percent. Grading of lots with existing slopes of one (1) percent or greater will not be required provided the conditions under 3.19.2 above have been satisfied and it is demonstrated to the satisfaction of the City Engineer that there are no existing or proposed features that will prevent the lots from adequately draining.

3.19.5 Grading and drainage of all residential lots shall be designed in a manner which will allow a maximum of one lot to drain in a sheet flow manner across an adjacent lot and into a permanent structure, such as a concrete flume, lined channel, or proper inlet to an adequate drainage facility, or to a street right-of-way. If an approved drainage structure is not present, it will be required of the developer to construct the necessary facilities.

3.19.6 Surface swales shall be designed and provided along lot lines when more than two lots will be contributing to stormwater runoff at any given point. Side slopes for swales shall not exceed 10:1 (horizontal: vertical) unless otherwise accepted by the City Engineer.

3.19.7 Sheet flow techniques shall be used for lot-to-lot drainage.

3.20 Floodplain Delineations and Easements

3.20.1 City of Taylor Floodplain

3.20.1.A A floodplain shall be delineated for all waterways with a contributing drainage area greater than sixty-four (64) acres. A waterway is defined as any watercourse, drainage way, branch, creek, or stream including, but not limited to, the limits of the one percent floodplain.

3.20.1.B Floodplain determination shall be based on the 100-year frequency storm event runoff and the existing land use conditions of all properties contributing to the point of consideration.

3.20.1.C The design Engineer is responsible for delineating the floodplain based on the most accurate information available.

3.20.2 Federal Emergency Management Agency Floodplain

3.20.2.A The Federal Emergency Management Agency (FEMA) maintains Flood Insurance Rate Maps (FIRMs) that depict floodplain and floodway boundaries. The floodplain and floodway boundaries depicted on FIRMs are based on existing conditions of development in the contributing area at the time the floodplain study that delineated the floodplain was completed.

3.20.2.B FEMA reviews and approves or denies all revisions or amendments to FIRM's. FEMA revises or amends FIRM's by approval of a Letter of Map Amendment (LOMA) or Letter of Map Revision (LOMR). FEMA establishes the process and fees necessary for review of an application for a LOMA or LOMR.

3.20.2.C FEMA reviews the impact of proposed site developments and offers or denies conditional assurance that a FIRM may be changed by the proposed development. FEMA offers this assurance by a Conditional Letter of Map Amendment (CLOMA) or Conditional letter of Map Revision (CLOMR). The CLOMA or CLOMR is a conditional statement that the FIRM may be changed if: (1) the development is constructed as proposed in the CLOMA/CLOMR application; and (2) a complete LOMA/LOMR is submitted after construction of the proposed development.

3.20.2.D As the local floodplain administrator, the City must review and acknowledge certain LOMR or CLOMR requests. The City establishes the

process necessary for review of an application for a LOMR or CLOMR.

3.20.3 Floodplain Drainage Easements

3.20.3.A The floodplain as defined by FEMA on the effective FIRM and as defined by the City of Taylor floodplain is the basis for dedication of drainage easements.

3.20.3.B If the floodplain on the FIRM extends beyond a drainage easement required by the Code, or offered by the applicant, then the floodplain depicted on the FIRM must be changed by FEMA. This requirement assures that floodplain boundaries and associated regulations are coordinated between the City of Taylor and FEMA.

3.21 FEMA FIRM Floodplain Revisions

3.21.1 Reasons for Revision

3.21.1.A FIS Incorrect - FEMA will revise an effective FIS to reflect new information which shows the original FIS to be incorrect and to reflect physical changes which invalidates the original FIS analyses or presentation of data.

3.21.1.B New Information - Updated or corrected topographic mapping, hydrologic data, or hydraulic data constitute new information which may warrant a revision.

3.21.1.C Physical Changes - Flood protection projects and any form of topographic alterations (cut and fill) constitute physical changes which may also warrant a map revision.

3.21.2 If the floodplain depicted on the FIRM is desired to be changed due to updated analysis of the floodplain under existing conditions, then the following requirements are applicable:

3.21.2.A Prior to recordation of a final plat, the applicant must provide to the City a letter of acknowledgement by FEMA of receipt of a complete application for a LOMR.

3.21.2.B Prior to final acceptance of the construction of the subdivision or issuance of building permits, the applicant must provide to the City evidence of final acceptance by FEMA of the LOMR submitted.

3.21.3 If the floodplain depicted on the FIRM is changed due to land development activities that alter existing conditions in a manner that causes increases in the floodplain on other properties, then the following requirements are applicable:

3.21.3.A Prior to approval of a final plat, the applicant must provide to the City a letter of acknowledgement by FEMA of receipt of a complete application for a CLOMR.

3.21.3.B Prior to the recordation of a final plat, the applicant must provide to the

City evidence of approval of the CLOMR.

3.21.3.C If the final plat is approved before it is determined that a CLOMR is necessary or desired, then prior to release of subdivision construction plans, the applicant must provide to the City a letter of acknowledgement by FEMA of receipt of a complete application for a CLOMR.

3.21.3.D Prior to final acceptance of the construction of the subdivision or issuance of building permits, the applicant must provide to the City evidence of final acceptance by FEMA of the LOMR submitted.

3.22 Drainage Study Guidelines

The purpose of a Drainage Study is to determine the requirements for drainage facilities, floodplain delineation, and/or drainage easements either within the proposed development or offsite. A Drainage Study is required for every subdivision plat or a development requesting a building permit on a parcel which does not have a previously approved Drainage Study, unless the City Engineer has waived this requirement due to existing conditions. The Drainage Study must be approved prior to Final Plat or issuance of a building permit.

3.22.1 General Requirements

3.22.1.A The Drainage Study shall be sealed and certified by a Professional Engineer licensed by the State of Texas. The study shall include a Drainage Area Map and report per the requirements below.

3.22.1.B Drainage studies shall be based on the ultimate build-out condition of the proposed development with any interim phase also considered as a distinct condition.

3.22.1.C Drainage studies approved by the City are valid for 25 years. After this time, a new study must take place to incorporate changes in rainfall, development, and other contributing factors to the analysis.

3.22.2 Drainage Area Map

3.22.2.A Drainage Calculations. Provide summaries of key drainage calculation assumptions and results for both existing and proposed conditions.

3.22.2.A.i Sub-Drainage Areas - Provide drainage area IDs, size in acres, Curve Number, Impervious Cover (IC), Time of Concentration (Tc), and Peak Flow Rate (Q) for 25- and 100-year storm for each sub-drainage area. Provide Runoff Coefficients (C) and Intensity (I) when using the Rational Method.

3.22.2.A.ii Points of Discharge - Provide summary table of peak flow rates at all identified points of interest for the 25-, and 100-

year storm events.

3.22.2.A.iii Assumptions - Document rainfall source and other key hydrologic assumptions.

3.22.2.B Drainage Areas - Provide both existing and proposed drainage areas for each collection point and inlet. Provide a separate drainage area map if drainage areas vary between the two conditions. Include overall drainage areas for the site and off-site areas and indicate area for each. Distinguish all drainage areas by heavy dashed lines.

3.22.2.C Key Points of Discharge - Include points of discharge to and from the site, and at other key hydrologic junctions. Points of discharge to directly correlate with discharge summary tables. Points of discharge to be used to evaluate No Offsite Adverse Impact (as defined by Section 3.1.4.B).

3.22.2.D Flow Paths - Depict time of concentration flow path with overland, sheet flow, and channel flow paths identified. Include flow arrows indicating the direction of flow to collection points and outfalls shown.

3.22.2.E Land use - Depict land use through aerial or planimetric data. The plan shall include the building footprint and parking areas when the Drainage Study is prepared for a building permit.

3.22.2.F Off-Site Areas - The map shall indicate any offsite or adjoining areas outside the limits of the area being developed.

3.22.2.G Significant Physical Features - Show all significant existing and proposed physical features such as structures, detention facilities, bridges, culverts, storm drains, channels, ditches, dams, water bodies, streams, roads, and railroads. Provide names of significant features such as roadways, etc.

3.22.2.H Contours - The map must include labeled contour lines at a sufficient interval (1’ or 2’) to depict the topography for the entire off-site drainage basin and 50’ beyond the property boundary. The datum for topography shall be that of the United States Coast and Geodetic Survey or the City of Taylor GIS datum.

3.22.2.I Proposed Grading - Provide preliminary grading to sufficient detail to depict method proposed to convey stormwater runoff across development and to detention facilities and outfalls. Provide overflow points and control elevations. Indicate key low and high points.

3.22.2.J Floodplain Extents

3.22.2.J.i Depict the City of Taylor 100-year floodplain for waterways with contributing drainage areas greater than sixty-four (64) acres.

3.22.2.J.ii Depict and identify any special flood hazard areas as defined by the FEMA on their current Flood Insurance Rate Map.

3.22.2.J.iii Note identifying reference for floodplain information.

3.22.3 Drainage Report

3.22.3.A Project Location - Provide project location depicted on a 7.5 minute series USGS, aerial, or other similar type map. Include land plan and limit of downstream drainage assessment, if applicable.

3.22.3.B Provide a narrative with the following information:

3.22.3.B.i Acreage to be developed, type of development, and explanation of any proposed project phasing.

3.22.3.B.ii Watershed in which project is located, general soil conditions, and downstream channel conditions.

3.22.3.B.iii Methods to be used for handling stormwater runoff (i.e. drainage easements, channels, curb inlets, storm drains, detention, etc.).

3.22.3.B.iv Justification for exemptions from code requirements.

3.22.3.B.v Provide a summary assessment of impact of development to upstream and downstream properties and facilities. Provide a downstream drainage assessment, if required, as described below.

3.22.3.B.vi Source of floodplain information (calculations where applicable).

3.22.3.B.vii Provide other relevant information to demonstrate compliance with the Drainage Design and Analysis Criteria section.

3.22.3.C Provide the following calculations:

3.22.3.C.i Calculations supporting adequacy of existing and proposed on-site channels, storm drains, inlets, culverts, bridges, and other drainage structures.

3.22.3.C.ii Calculations supporting adequacy of detention pond size. Provide percent impervious cover calculations. Provide hydrologic detention routing assumptions and results. Provide stage-storage-discharge information for detention facilities, including information for each outlet component (i.e. pipes, orifice, weirs, and spillways).

3.22.3.C.iii Calculations for floodplain modifications and cross sections.

3.22.3.C.iv Calculations of existing flows. Provide existing and proposed drainage areas, time of concentration calculations, impervious cover, and runoff coefficients. Provide rainfall and hydrograph development assumptions.

3.22.3.C.v Calculations of off-site flows.

3.22.3.C.vi Provide source/documentation for all parameters used in calculations if not in City of Taylor Engineering Manual.

3.22.3.C.vii Provide hydrologic and hydraulic model files (preferably HEC-HMS and HEC-RAS).

3.22.3.D Downstream Assessment Requirements

3.22.3.D.i A downstream drainage assessment, if required, shall extend from the outfall of the subdivision to a point downstream, determined by the Zone of Influence and Known Flood Problem Areas:

- Zone of Influence - Point downstream where the discharge from a proposed development no longer has a significant impact upon the receiving stream or storm drainage system. The zone of influence can initially be assumed to be the point where the drainage area controlled by the detention facility comprises ten percent (10%) of the total drainage area.
- Known Flood Problem Areas - Locations of reported historic flooding or areas known to be at a high risk of flooding for the 100-year storm event.

3.22.3.D.ii Downstream Assessment Steps

- Determine the outfall location of the site and the pre- and post-development site conditions.
- Using a topographic map, determine a preliminary lower limit of the zone of influence using the initial ten percent (10%) estimate.
- Using a hydrologic model determine the pre-development peak flows at each junction beginning at the development outfall and ending at the next junction beyond the preliminary lower limit of the zone of influence (10% point). Evaluate discharges for the 2-, 10-, 25-, and 100-year frequency storms.
- Change the land use on the subdivision site to post-development conditions and rerun the model.

- Compare the pre- and post-development peak discharges at the downstream end of the model. If the post-developed flows are higher than the pre-developed flows for the same frequency event, extend the model downstream. Repeat steps 3 and 4 until the post-development flows are less than the pre-developed flows.
- Add additional proposed storm water management storage or facilities to the model designed so that the model shows that adverse effects are mitigated. Adverse effects can be shown to be mitigated if peak flow rates are not increased within the downstream assessment limits and at known flood problem areas.

3.23 Trench Safety

All projects that require trench excavation shall include temporary Excavation Safety Systems at a minimum conform to United States Department of Labor Rules 29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation (OSHA). Construction plans shall include the appropriate specification and bid item.

3.24 Testing/Inspection

3.24.1 Storm Drain

3.24.1.A The compaction of backfill shall meet or exceed the requirements of the applicable details.

3.24.1.B All storm drains shall be inspected prior to acceptance by the City. All storm drains forty-two inch (42") or less shall be inspected using television inspection. Storm drains larger than forty-two inch (42") may be inspected visually.

3.24.1.C A City representative shall be present during the television inspection.

3.24.1.D Televised Inspection Criteria:

3.24.1.D.i All television equipment used shall have a minimum of two hundred twenty (220) lines of horizontal resolution. The picture shall be in color.

3.24.1.D.ii All video information on DVD must have good picture quality.

3.24.1.D.iii As a title heading on the tape and during the televising, the operator must:

- Note the project name and Contractor name.

- Note the name of the company and the operator performing the video inspection.
- Note line size and material, joint type and length.
- Line segment to be televised including beginning and ending station numbers.
- Note page of plans used and year plans were stamped.
- Note date and time of inspection.
- A footage counter must be displayed on the DVD during the filming.
- Show the above title block before and after each line segment. Show the title block at one hundred (100') foot intervals while filming the line segment.
- All defects shall be shown on film for a minimum of 10 seconds before proceeding with the televising.

3.24.1.D.iv The Contractor shall supply a log sheet used in conjunction with the video tape for written documentation. All written information gathered must be legible and clearly understandable.

- Note the project name, Contractor name and contract number.
- Note the name of the company and the operator performing the video inspection.
- Note pipe size and material, joint type and length between joints.
- Note the DVD footage counter, start to end.
- Note line segment to be televised, station numbers from and station numbers to length of line segment as indicated on plans.
- Note page of plans used and year plans were stamped.
- Note date and time of inspection.
- Indicate by sketch the line segment to be televised in relation to surrounding street intersections and street addresses. Identify manhole station numbers. Show direction of flow with arrows and direction the camera is going. Indicate direction of north on the sketch.

- Note the water depth at the beginning, every fifty (50') foot station, every change in grade, and at the end of the line segment.
- Identify the clock location, direction, size and type of laterals entering main. Indicate laterals as saddles, punched, or glued fittings.
- Indicate final footage televised at end of the log sheet.

3.24.1.E One DVD per visual televised inspection project shall be furnished to the Project Inspector.

3.24.1.F Recording must be done on DVD discs.

3.24.1.G All DVDs and run sheets shall be submitted to the City. All tapes and log sheets shall become the property of the City.

3.25 Erosion and Sediment Control

3.25.1 Construction activities that discharge storm water runoff into or adjacent to any surface water of the state are regulated by the State of Texas under the Construction General Permit (CGP) (TXR150000). The governing agency is the Texas Commission on Environmental Quality (TCEQ). Construction related sediment is a significant pollutant of streams, lakes, ponds and reservoirs. Sedimentation can also carry pesticides, phosphates and many other chemical pollutants which can be carried to the waterway and reduce the quality of water.

3.25.2 Erosion and sediment BMPs are required for all construction, (conducted with or without a permit) and all other activities for which land clearing, trenching, or grading is a part. It is the intent of City of Taylor policy to closely parallel the requirements set forth in the Texas Pollution Discharge Elimination System (TPDES) Construction General Permit (TXR150000) and any applicable updates to National Pollution Discharge Elimination System (NPDES) or TPDES.

3.25.3 Temporary Stabilization Controls - 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 used in accordance with the Construction Standards.

3.25.4 Final Stabilization Controls

3.25.4.A The Contractor shall restore all areas within public right-of-way and public easements that have been disturbed as a result of construction activities. Such areas shall be returned to pre-disturbed conditions or better. New open areas or facilities within the public right-of- way or public easements shall be covered with a minimum of four (4) inches of topsoil prior to the application of grass seed.

3.25.4.B Seed 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 ten (10) day intervals in a manner that will not erode the topsoil but at a rate sufficient to thoroughly soak the soil to a depth of six (6) inches. The watering schedule may be postponed with a rainfall occurrence of one-half (1/2) inch or greater.

3.25.4.C Restoration shall be acceptable when the grass has grown to a height of at least one-half (1/2) inch and covers ninety (90%) percent of the area with bare spots no greater than ten (10) square feet.

3.25.5 Erosion and Sedimentation Control Plan

3.25.5.A All projects disturbing natural conditions are required to plan, design, and implement BMPs to minimize erosion and sedimentation to the greatest extent practicable. All activities requiring a permit shall submit an erosion and sedimentation control plan that identifies, addresses and minimizes to the City Engineer's satisfaction, all potential sources of sediment and other construction related pollution.

3.25.5.B Erosion and Sedimentation Control Plan (ESCP) shall include:

3.25.5.B.i A comprehensive plan addressing limits of disturbance, phasing, temporary and permanent erosion and sedimentation BMPs that comply with all applicable Federal, State and Local regulations.

3.25.5.B.ii Construction standards to illustrate, review and construct the BMPs that minimize erosion and sedimentation to the maximum extent practicable; (and where appropriate, correlate with and outlined in the ESCP).

3.25.5.B.iii The general direction of flow of storm water drainage entering and leaving the site. If the drainage patterns will be altered, both the existing and proposed drainage patterns shall be shown.

3.25.5.B.iv A description of how run-on storm water will be handled, including sheet flow entering the site from adjoining property.

3.25.5.B.v A description and the location of any environmentally sensitive area that is located on the site or that adjoins the site and that will receive storm water directly from the site.

3.25.5.B.vi The location of any Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map 100-year floodplain boundaries, floodway boundaries, or FEMA Velocity Zone boundaries that encroach on the site. A preliminary boundary line may be used with a preliminary

plat. The ESCP shall be amended prior to filing of a final plat, once a final boundary determination has been made.

3.25.5.B.vii A description and location of all temporary control measures that will be implemented during construction to control erosion, sedimentation, and the discharge of pollutants.

3.25.5.B.viii Standards and schedules for maintenance and replacement for all temporary and permanent BMPs in the plans.

3.25.5.B.ix Standards for topsoil, vegetative materials and vegetation BMPs in the plans.

3.25.5.B.x Computations for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.

3.25.5.B.xi A Licensed Professional Engineer shall sign, seal and date the ESCP.

3.25.6 Temporary Stabilization

3.25.6.A Portions of a site that have been disturbed, but where no work will occur for more than 21 days shall be temporarily stabilized as soon as practicable, and no later than 14 days, except when precluded by seasonal arid conditions, or prolonged drought. A written request to the City Engineer shall be submitted for approval of exceptions.

3.25.6.B Temporary stabilization shall consist of providing a protective cover, designed to reduce erosion on disturbed areas. Temporary stabilization may be achieved using temporary seeding, soil retention blankets, hydro-mulches and other techniques that cover 100 percent of the disturbed areas until either final stabilization can be achieved or until further construction activities take place.

3.25.6.C Perimeter controls such as silt fence, vegetated buffer strips or other similar perimeter controls are intended to act as controls when stabilization has not occurred. Perimeter controls may remain in place during temporary stabilization.

3.25.7 Final Stabilization

3.25.7.A Final stabilization within the public right-of-way shall conform to this Section and may consist of soil cover as vegetation, geo-textiles or mulch. For stabilizing vegetated drainage ways, sod or seeded soil retention blankets shall be used. Hydro mulch will not be allowed in vegetated swales, channels, or other drainage ways.

3.25.7.B The plan for final stabilization shall be coordinated with permanent controls in the ESCP and with the landscaping plan.

3.25.8 Waste and Hazardous Materials Controls

3.25.8.A Covered containers shall be provided for waste construction materials and daily trash. Hazardous material shall be stored in a manner that prevents contact with rainfall and runoff. On-site fuel tanks and other containers of motor vehicle fluids shall comply with the latest applicable TCEQ requirements for storm water pollution controls during construction.

3.25.8.B The SWPPP shall require federal, state and local reporting of any spills and releases of hazardous materials greater than the regulated Reportable Quantity (RQ) and reporting to the City of Taylor Engineer and Public Works Director of all spills and releases to the storm drainage system.

3.25.9 Notice of Intent (NOI) or Construction Site Notice (CSN)

3.25.9.A If applicable, a copy of the NOI/CSN shall be sent to the City Engineer.

3.25.10 TCEQ Site Notice

3.25.10.A A signed copy of the Construction Site Notice or NOI shall be posted at the construction site in a location where it is readily viewed by the general public during all construction activities.

3.25.11 Notice of Termination (NOT)

3.25.11.A All primary operators shall submit a copy of the NOT to the City Engineer after construction has been accepted.

3.25.12 Inspection and Maintenance During Construction

3.25.12.A The primary operator shall construct all controls required by the SWPPP and ESCP. The primary operator shall have qualified personnel inspect the controls at least every two weeks during construction and within 24 hours after a storm event of 0.5 inches, or greater.

3.25.12.B Certified inspection reports shall be retained as part of the SWPPP on site. Within seven days of the inspection, controls identified as damaged or deteriorated shall be repaired or replaced, as appropriate. Controls shall also be routinely cleaned or repaired to maintain adequate functionality.

3.25.12.C Changes, repairs and/or additions shall be made to the controls within 7 days to prevent discharges from the site. The primary operator shall implement procedures to remove discharges from all portions of the storm drainage system including streets, gutters, inlets, storm drain, channels, creeks, ponds, etc.

SECTION 4 GENERAL UTILITIES DESIGN REQUIREMENTS

Contents

SECTION 4 GENERAL UTILITIES DESIGN REQUIREMENTS

4.1. General

4.1.1 Compliance with Master Plans – All water and wastewater construction plans shall comply with the City's current adopted Water Master Plan and Wastewater Master Plan and be submitted to the City Engineer for review.

4.1.2 General Design Criteria – It is the responsibility of the Engineer to ensure that all water and wastewater construction plans are in conformance with the current edition of the following requirements:

- Texas Commission on Environmental Quality (TCEQ) Rules and Regulations
- 30 Texas Administrative Code (TAC) Chapter 290 – Public Drinking Water Subchapter D: Rules and Regulations for Public Water Systems
- 30 TAC Chapter 217 – Design Criteria for Domestic Wastewater Systems Subchapter C: Conventional Collection Systems
- American Water Works Association (AWWA) Standards.

4.2. Policy

4.2.1 Water and Wastewater Main Extensions – Water and wastewater mains shall be sized and extended through the limits of a development to provide a connection for ultimate development of all adjacent properties. Refer to the City Code for policies and appeal process concerning the extension of water and wastewater mains, water and wastewater connection fees, and pro-rata fees.

4.2.2 Easements

4.2.2.A Minimum Easement Widths – Refer to **Section 1** (Easements and Right-of- Way Requirements) for easement widths.

4.2.2.B Easements Required for Relocation/Replacement – The developer shall dedicate such easements or ROW within the development as may be required to permit construction of the relocation/replacement. Responsibility for the acquisition of necessary easements outside of the development shall be the responsibility of the developer to obtain.

4.3. Typical Utility Layouts Within Right-of-Way

4.3.1 General – Water and wastewater mains shall be placed on opposite sides of the street paving.

4.3.2 Water Main Locations – Water mains are generally placed under the pavement five (5) feet from back of curb on north or east side of street, unless otherwise approved by the City Engineer.

4.3.3 Wastewater Main Locations – Wastewater mains are generally placed under the pavement five (5) feet from back of curb on the south or west side of the street, unless otherwise approved by the City Engineer.

4.3.4 Typical Locations – Refer to **Section 2, Figure 2-1** for typical utility assignments within a city street. Manholes and valves shall not be located in wheel paths, bike lanes, driveways, or sidewalks.

4.4. Separation of Water Mains from Wastewater Mains

4.4.1 Minimum Horizontal Spacing – The minimum horizontal space between wastewater main and a water main shall be nine (9) feet as measured from outside diameter of each utility. The wastewater main that is parallel to a water main shall be installed in a separate trench.

4.4.2 TCEQ Requirements – When the nine (9)-foot separation distance cannot be achieved, water mains and wastewater mains shall be separated per TCEQ Rules and Regulations. Refer to the following:

- 30 TAC Chapter 290 – Public Drinking Water Subchapter D: Rules and Regulations for Public Water Systems
- 30 TAC Chapter 217 – Design Criteria for Domestic Wastewater Systems Subchapter C: Conventional Collection Systems.

4.5. Clearance Requirements

4.5.1 General – Water and/or wastewater mains, services, and laterals shall have a standard minimum vertical clearance of two (2) feet as measured from the outside diameter of the water/wastewater mains to the outside diameter of the crossing utility unless otherwise noted in this section. A minimum 6-inch vertical clearance may be approved by the City Engineer (with exception of water and/or wastewater mains, services, and laterals crossing each other) by placing an Ethafoam pad on the lower utility and backfilling the trench with Concrete Stabilized Sand (CSS) or Controlled Low Strength Material (CLSM) to a minimum 12-inches above the outside diameter of the higher utility.

4.5.2 Storm Drains

4.5.2.A When water or wastewater mains are parallel to storm drains, the minimum horizontal clearance shall be five (5) feet as measured from the outside diameters of each main.

4.5.2.B Water mains shall be designed over storm drains.

4.5.2.C Water service lines shall cross over storm drain mains and laterals.

4.5.2.D Water mains may only be placed under a storm drain if approved by the City Engineer. If the water main crosses under a storm drain, the water

main shall have a steel casing pipe with a minimum vertical clearance of two (2) feet as measured from the outside diameter from the bottom of the storm drain to the outside diameter of the casing pipe. The casing pipe shall be extended a minimum of ten (10) feet from the outside edge of a box storm drain or the outside diameter of the storm drain.

4.5.2.E Additional Storm Drain Crossing Requirements for Wastewater Mains are as follows:

4.5.2.E.i Cement Stabilized Sand (CSS) or Controlled Low-Strength Material (CLSM) backfill is required for any storm drain crossings

4.5.2.E.ii In no case shall wastewater mains be permitted to cross through storm drains or storm drain junction structures.

4.5.3 Franchise Utilities – Franchise utilities, excluding Gas/Energy Transmission lines discussed in **Section 4.5.4**, shall provide a minimum clearance of five (5) feet horizontally from all City Utility lines.

4.5.4 Gas/Energy Transmission Pipelines – Water or wastewater mains proposed to parallel or cross existing gas pipelines shall adhere to the owner of the gas pipeline's clearance and other requirements. When feasible, water and wastewater mains shall maintain a minimum horizontal clearance of five (5) feet as measured from the outside diameters of each utility. Coordination with the pipeline owner is required to confirm clearance requirements. The more stringent clearance requirements will be enforced.

4.5.5 Drilled Shafts – Wastewater and/or water mains within steel casing pipe shall be designed with a minimum horizontal clearance of five (5) feet as measured from the outside diameter of the casing pipe to the outside edge of the drilled shaft, or two times the outside diameter of the drilled shaft, whichever is greater. Water mains that are not cased shall be designed with a minimum horizontal clearance of ten (10) feet.

4.5.6 Drainage Headwalls, Manholes, and Inlets

4.5.6.A Water or wastewater mains shall not cross under headwalls, manholes, or inlets.

4.5.6.B Water or wastewater mains adjacent or perpendicular to headwalls shall be designed with a minimum clearance of ten (10) feet to headwall as measured from the outside diameter of the main to the outside edge of the headwall.

4.5.6.C Water or wastewater mains adjacent or perpendicular to manholes and/or inlets shall be designed with a minimum clearance of five (5) feet

to headwall as measured from the outside diameter of the main to the outside edge of the manhole and/or inlet.

4.5.7 Mechanically Stabilized Earth (MSE) or Other Retaining Walls

4.5.7.A Water or wastewater mains adjacent to MSE or other retaining walls shall be designed to have the trench excavation to be placed outside of the zone of influence of the wall, typically 1H:1V and as determined by the Engineer.

4.5.7.B Water or wastewater mains crossing MSE or other retaining walls shall be designed with steel casing through the entirety of the zone of influence of the wall and shall be extended a minimum of five (5) feet from the zone of influence, typically 1H:1V and as determined by an Engineer.

4.5.7.C Water, wastewater, and storm sewers shall not be permitted within the strap volume of MSE walls.

4.5.8 Other Bridge Features – A minimum clearance of ten (10) feet horizontally and five (5) feet vertically shall be maintained from all other bridge features.

4.5.9 Coordination with Other Entities – In situations where water or wastewater mains are required to be placed adjacent, within, or crossing easements or ROW of highway or railroad entities, the Engineer is responsible for coordinating with such entity to confirm that future expansions from the entity will not impact the proposed water/wastewater lines. Documentation of such correspondence shall be provided to the City.

4.6. Pipe Materials

The specification of pipe material is the responsibility of the Engineer based on the analysis of specific site, soil conditions, loading conditions, and pressure requirements. The guidelines in the City's Approved Materials Lists are based on pipe size only and do not relieve the Engineer of the responsibility of providing pipe material specifications applicable to the specific project and restrictions due to special construction methods.

4.7. Pipe Embedment

4.7.1 Refer to the Standard Details for typical water and wastewater main pipe embedment requirements.

4.8. Crossings

4.8.1 Casing Requirements – Casing pipe shall be used for City utilities at all crossings of TxDOT or railroad ROW and other situations as indicated in this section and shall meet the permitting and insurance requirements of the respective governing authority.

4.8.2 Pipeline Crossings – Refer to **Section 1** (General Design Requirements) for requirements regarding coordination with regulatory agencies.

4.8.3 TxDOT and Williamson County Crossing

4.8.3.A The design of utilities within TxDOT ROW must be in compliance with the requirements of TxDOT. Refer to the current edition of the TxDOT's *ROW Utilities Manual* and the 43 TAC Chapter 21 Subchapter C for Utility Accommodation.

4.8.3.B The design of utilities within Williamson County ROW must be in compliance with the requirements of the County.

4.8.3.C Approved permits for construction of utilities within TxDOT or Williamson County ROW shall be furnished to the City.

4.8.3.D Water valves, meters, fire hydrants, manholes, cleanouts, and other appurtenances shall be placed outside the limits of the TxDOT or Williamson County ROW.

4.8.3.E Water main crossings shall include a valve on each side of the TxDOT or Williamson County ROW.

4.8.4 Railroad Crossings

4.8.4.A The design of mains within railroad ROW must comply with the requirements of the appropriate railroad company and the 43 TAC Chapter 21 Subchapter O for Utility Accommodation for Rail Facilities. The Engineer shall determine which railroad company ROW is being crossed and obtain their utility accommodation policies prior to beginning the design.

4.8.4.B Approved permits for construction of utilities within railroad ROW shall be furnished to the City.

4.8.4.C Water valves, meters, fire hydrants, manholes, cleanouts, and other appurtenances shall be placed outside the limits of the railroad ROW.

4.8.4.D Water main crossings shall include a valve on each side of the railroad crossing.

4.8.5 Creek Crossings

4.8.5.A Pursuant to 30 TAC Chapter 290, where water mains are laid under any flowing stream or semi-permanent body of water, such as a marsh or pond, the water main shall be installed in a separate watertight casing pipe or installed with valves on each side of the crossing to allow the isolation and testing of that portion of the water main to determine if there are any leaks.

4.8.5.B A watertight casing pipe with a manhole on each side of the crossing shall be used for wastewater mains.

4.8.5.C A primary consideration in the design of creek crossings is the prevention of soil erosion and scour at the areas of trench backfill. At a minimum, CLSM backfill shall be used from bank to bank. The CLSM backfill shall be covered with riprap if the velocity of the flowing water is anticipated to be greater than the maximum permissible velocity in **Section 3** of this manual. Refer to **Section 3** (Drainage Design Requirements) for drainage study and rock riprap sizing requirements. In areas where there is a planned channel improvement, the stabilized backfill shall be used up to the line of planned improvement. The area above this planned line of improvement shall be compacted fill. The Engineer shall provide a scour analysis to determine the minimum depth under the channel but in no case shall be less than five (5) feet from the top of the pipe to the bottom of the channel. If minimum clearance cannot be met, the main shall follow the requirements of **Section 4.8.6** if an elevated crossing is permitted by the City Engineer.

4.8.6 Elevated (Aerial) Crossings

4.8.6.A Elevated crossings create special design problems in which no set of circumstances is duplicated from one design to another. Elevated crossings for water and wastewater mains shall be avoided and will only be considered upon approval by the City Engineer.

4.8.6.B Two methods of elevated crossings acceptable for consideration by the Engineer are either:

- Attaching the water or wastewater main to a roadway bridge; or,
- Designing a specific pier foundation/utility bridge for the support of the water or wastewater main crossing.

4.8.6.C The following basic criteria must be addressed by the Engineer for all crossings attached to a bridge:

- Increased loading effects on the bridge created by a full main and its supports; and,
- Proposed elevation of the main shall meet low chord bridge requirements and be two (2) feet above the 100-year water surface elevation to prevent damage to the main.
- Pipe material shall be ductile iron with epoxy coating in accordance with AWWA C-210.

4.8.6.D Elevated crossings shall be designed in accordance with American

Association of State Highway and Transportation Officials' (AASHTO) current editions of Load and Resistance Factor Design (LRFD) Bridge Design Specifications and Standard Specifications for Highway Bridges. In addition, the Ductile Iron Pipe Association (DIPRA) publication Design of Ductile Iron Pipe on Supports provides guidance on the design of elevated crossing pipe structures. Stream velocities and impact loading must be considered.

4.8.6.E Elevated crossing and pier foundation design and construction plans shall be coordinated with appropriate erosion control plans for bank protection where the main enters and exits the creek.

4.8.6.F Drainage Study – Refer to **Section 3** (Floodplain Modifications) for applicable Flood Study requirements for any elevated crossings located over a creek or stream.

4.8.6.G Additional Requirements for Pier Foundations

4.8.6.G.i Site Specific Design – In all cases, the Engineer shall be responsible for obtaining sufficient subsurface investigations and performing all necessary structural and hydraulic calculations for the elevated crossing and associated piping, piers, and attachments. Final pier shape, bearing depth, reinforcing configuration, etc. shall be determined by the Engineer.

4.8.6.G.ii Geotechnical Report – A geotechnical report with design requirements is required for all elevated crossings to determine soil strata and design bearing loads for piers.

4.8.7 Trenchless construction methods may be used for water and wastewater main placement and shall be installed in casing pipe. Only straight pipe alignments for both horizontal and vertical alignment are allowed. Utility bores shall, where practicable, be located at approximately right angles with no less than a 70° angle to ROW, streets, and alleys. All bores shall be performed using auger boring and have a vertical profile on the construction plans.

4.8.7.A Engineers shall consider the location, size, and depth of boring and receiving pits when choosing the beginning and ending stations for boring. The location of the bore/jacking pit and receiving pit shall be shown and dimensioned on the plan and profile views of the utility construction plans. Size of the bore pit and receiving pit shall be adequate to accommodate the boring/jacking equipment and the pipe joint lengths being used. Wet bore crossings are not allowed.

4.8.7.B A bore pit typically exceeds twenty (20) feet in length to accommodate one joint of pipe. Bore pit width varies depending on the depth and size

of pipe.

4.8.7.C Auger boring shall be designed in accordance with the Standard Details. The anticipated size and location for all bore pits shall be included in the design for the main and shown on the drawings. Launching pits shall be located at the lower elevation end of the tunnel. Excavation and backfill of bore pits shall be as follows:

4.8.7.C.i Do not allow excavation over the limits of the bore or tunnel as specified. Shore the trench walls as necessary to protect workmen, the public, structures, roadways, and other improvements.

4.8.7.C.ii Excavations within the right-of-way and not under surfacing shall be backfilled and consolidated by mechanical methods as specified in these standards for compaction of trenches under roadways. Surplus material shall be removed from the right-of-way and the excavation finished to original grades. Backfill pits immediately after the installation of the carrier pipe is completed. If carrier pipe is not installed immediately after casing pipe installation, the City may require the access pits be temporarily backfilled until installation of carrier pipe.

4.8.7.C.iii Where seeding or sodding is disturbed by excavation or backfilling operations, such areas shall be restored to the existing or better conditions.

4.8.7.D Casings shall be required under major and minor collector roadways, arterial roadways, highway crossings, railroad crossings, and creek crossings. The construction bore pit shall be located outside of pavement at a minimum distance of five (5) feet behind the back of curb or edge of pavement where no curb is present. Casing pipe shall be designed to meet the following loading conditions and applicable combinations thereof:

4.8.7.D.i Minimum steel casing thickness shall be one-half (1/2) inch and shall be new and suitable for the purpose intended and shall have a minimum yield strength of 35,000 psi.

4.8.7.D.ii Casing shall meet ASTM A-36, ASTM A-570, ASTM A-135, ASTM A-139, or approved equal.

4.8.7.D.iii Pipe shall be coated with coal tar epoxy (15 mils min.) in accordance with AWWA C-210.

4.8.7.D.iv Pipe joints shall be welded in accordance with AWWA C-206. After pipe is welded, coating shall be repaired.

4.8.7.D.v AASHTO HL-93 loading as applicable.

4.8.7.D.vi Earth loading with the height of fill above the casing as shown on the plans.

4.8.7.D.vii Loads applied during jacking, including axial load from jacking.

4.8.7.D.viii All other applicable loading conditions, including loads applied during transportation and handling.

4.8.7.E Stainless steel casing spacers are required for any type of carrier pipe. Insulators shall be high density polyethylene. Insulators shall fit snug over the carrier pipe and position the carrier pipe approximately in the center of the casing pipe to provide adequate clearance between the carrier pipe bell and the casing pipe. Insulators shall be manufactured by "Recon" and be Raci Type or approved equal

4.8.7.F Water mains shall include valves at each side of a cased bore or tunnel within effective distances at each side of the crossing to allow isolation of the water main within the bore.

4.8.7.G Casing pipe length shall be determined by the respective governing authority.

4.8.7.H Plan and profile view of the bore shall include all existing utility lines, trees, signs, guidelines/wires, light poles, and other obstacles.

4.8.7.I Casing pipe depth shall be determined by the respective governing authority but in no case shall a vertical clearance of less than five (5) feet from the outside diameter of the casing pipe to the crossing utility.

4.8.7.J Trenchless Rehabilitation Methods – When renewing, rehabilitating, and/or renovating existing water and/or wastewater mains, acceptable trenchless rehabilitation methods may include pipe bursting, slip lining, or cured-in-place pipe. These methods shall be designed by the Engineer and require submittal of design and technical specifications for review by the City Engineer.

4.8.7.K Other Trenchless Construction – When traditional auger boring is not feasible for construction of the improvements, other trenchless methods of construction shall be designed by the Engineer. Submittal of these design and technical specifications is required for review by the City Engineer.

4.9. Abandonment of Water and Wastewater Mains and Appurtenances

4.9.1 General Water Mains – Any existing water main being replaced shall be cut and

plugged, or removed, as directed by the City Engineer. Pipe ends shall be plugged for a length of at least three times the pipe diameter with a minimum length of two (2) feet and a maximum length of six (6) feet. Valve stacks for abandoned mains shall be removed and/or filled with concrete.

4.9.2 General Wastewater Mains – Any existing wastewater main being replaced or abandoned is to be cut and plugged, or removed, at the City Engineer's direction. Wastewater service lines shall be abandoned by cutting and plugging. Pipe ends shall be plugged for a length of at least three times the pipe diameter with a minimum length of two (2) feet and a maximum length of six (6) feet. The service line tap shall be removed from the wastewater main. If crossing an abandoned service line, service line shall be abandoned by cutting and plugging with grout.

4.9.3 Abandonment of Mains in Critical Areas – All water and wastewater mains within street ROW and less than ten (10) feet in depth, under major intersections, or in areas that could impact major infrastructure, shall be abandoned by draining the existing main and cutting and filling the existing main with grout.

4.9.4 Abandonment of Manholes – All manholes less than ten (10) feet deep shall be removed in their entirety. Other manholes or junction structures shall be abandoned by filling the bottom of the manhole with grout to a minimum of 12-inches above the crown of the highest pipe, removing the top four (4) feet of the manhole, and filling the remainder of the manhole with CLSM.

4.10. Testing/Inspection

4.10.1 All water and wastewater testing shall comply with the City of Austin water/wastewater specifications for testing.

SECTION 5 WATER DESIGN REQUIREMENTS

Contents

SECTION 5 WATER DESIGN REQUIREMENTS

5.1 General

5.1.1 This section pertains to general design requirements for water distribution system construction in the City of Taylor. All water lines shall be sized and designed in accordance with the City of Taylor standards and as approved by the City Engineer. In the absence of specific standards, all water supply, distribution, pumping, and storage improvements shall be designed in accordance with the most current standards of the American Water Works Association criteria adopted by the Texas Administrative Code, Chapter 290.

5.1.2 The Applicant shall provide all water lines necessary to properly serve each lot of the development and ensure that existing and/or new water facilities can supply the required demand for domestic use and for fire protection at the desired pressure. The Applicant shall bear all costs for extending water service from existing City water lines to and through the Development. All water lines and service connections shall meet the current City of Taylor Construction Standards. The Applicant shall submit a certificate to the Development Review Committee (DRC) certifying that the system has been designed in accordance with the current requirements of the state regulatory agency and the City of Taylor. Water lines shall be extended across entire development frontage and to boundaries of the development to facilitate extension to potential adjacent developments, as approved by the City Engineer.

5.1.3 Fire Flow - Fire flow for water systems shall be designed to comply with the LDC and the City's current edition of the International Fire Code (IFC) with adopted City amendments.

5.1.4 Water System Design – All components of the water system (pipe, valves, fittings, restraints, blocking, services, and appurtenances) shall be ANSI/NSF Standard 61 and designed at a minimum for 150 psi working pressure and an American Association of State Highway and Transportation Officials (AASHTO) HL-93 live load except where loading conditions could exceed HL-93 live load limits, in which case, the City Engineer shall specify the appropriate design load.

5.1.5 Water Plan Requirements – Construction plans are required for all water mains. A profile is required for all water mains eight (8) inches or larger, or for four (4) inches or larger water services when any of the following circumstances exist:

5.1.5.A Crossing and/or within corridors where there are several existing utilities present and the space available for the water main is limited

5.1.5.B City rights-of-way

5.1.5.C Creek crossings

5.1.5.D By other than open cut crossings

5.1.5.E Gas line crossings

5.1.5.F Transmission main crossings

5.1.5.G Other circumstances requiring special design considerations

5.2 Line Sizes and Locations

5.2.1 Standard water line sizes are, 8-inch, 12-inch, 16-inch, 18-inch, 20-inch, and 24-inch diameter. 6-inch water line size is only allowed for fire hydrant leads. Other sizes may be approved by the City Engineer.

5.2.2 All water lines shall be looped where possible. Dead end lines shall not exceed 500 feet, unless approved by the City Engineer.

5.2.3 Water lines shall be located within the right-of-way or an approved utility easement. A steel casing shall be required under new community boulevards, County roadways, and TxDOT Highways. A steel casing will be required for all water lines installed using jack and bore methods.

5.2.4 Automatic flushing valves are required for all dead-end mains of 50' or longer.

5.2.5 Refer to **Section 1** (Easements and Right-of- Way Requirements) for easement widths for water line construction.

5.2.6 All piping with mechanical couplings, push-on, or similar joints subject to internal pressure shall be designed with blocking, anchors, and restraining harnesses to preclude separation of joints.

5.2.7 Water lines exclusively for fire protection shall have a water service meter within the ROW or easement. A backflow preventor will be required outside of the ROW or easement but shall be accessible by City inspection staff. Water lines between the connection to the City main and the backflow preventor shall be a minimum of eight (8) inches in diameter. Water lines after the backflow preventor shall be considered private and shall be looped when possible.

5.2.8 Water service for multiple units on a single lot shall be served via one Master Meter. The developer is responsible for providing and metering service to individual units.

5.3 Materials

5.3.1 All water lines and fittings shall be new materials and comply with the following:

5.3.2 <u>Materials:</u>

5.3.2.A Six (6) Inch Through Twelve (12) Inch:

5.3.2.A.i Polyvinyl Chloride (PVC) material and be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C-900 and shall be a minimum pressure class 150, DR 18. Pressure class 200, DR 14 pipe may be required by the City Engineer in areas of high distribution system pressure, under roadways or other unusual circumstances. All PVC water pipe shall be blue in color.

5.3.2.A.ii Ductile Iron Pipe (DIP) material and be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C-151 and shall be a minimum pressure class 250. DIP pipe shall be cement mortal lined per AWWA C104 and installed in polyethylene encasement in accordance with AWWA C-105.

5.3.2.B Sixteen (16) Inch and Larger Water Lines:

5.3.2.B.i Polyvinyl Chloride (PVC) material and be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C-905 and shall be a minimum pressure class 165, DR 25. Pressure class 200, DR 21 pipe may be required by the City Engineer in areas of high distribution system pressure, under roadways or other unusual circumstances. All PVC water pipe shall be blue in color.

5.3.2.B.ii Ductile Iron Pipe (DIP) material and be designed, manufactured, and tested in accordance with the applicable requirements of AWWA C-151 and shall be a minimum pressure class 250. DIP pipe shall be cement mortar lined per AWWA C104. A cathodic protection system shall be incorporated into the design of the system consisting as determined by Engineer but shall consist of a minimum of polyethylene encasement and test stations.

5.3.2.C Other Pipe Material – All other materials must be submitted for approval by the City Engineer.

5.3.3 Fittings - Fittings shall be ductile iron in accordance with AWWA C110 or AWWA C153.

5.3.3.A Fittings: ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber and factory installed.

5.3.3.B All waterline pipe and fittings shall be new materials and produced in the USA.

5.4 Installation

5.4.1 All installations shall conform to the latest TCEQ, and AWWA Specifications, and these standards.

5.4.2 All pipe shall be installed with a minimum of forty-eight (48) inches of cover over top of pipe.

5.4.3 The amount of open trench shall not exceed two hundred (200) feet from the end of the pipe laying operations, and no more than three hundred (300) feet of total open trench will be allowed. At the end of each workday, all trench excavation shall be backfilled and compacted to the end of the pipe laying operation.

5.4.4 All connections to existing water mains shall be made under pressure unless dry connections will not cause any loss of service. Connections that cause an interruption of service may be performed with approval of the City Engineer and will require a minimum of twenty-one (21) calendar days advance notice.

5.4.5 Coated tracer wire and tape shall be installed in the embedment material twelve (12) inches above the pipe with the tracer wire terminating in in-line gate valve boxes accessible by the City.

5.4.6 Density tests shall be taken at a minimum of every three hundred (300) feet for every lift or less as determined by City Inspector. A maximum thickness of eight (8)-inch lift is required for all trench backfill. A geotechnical report is required for all trenches. The density reports shall be submitted to the City Inspector. The City has the right to require additional tests if they are deemed necessary.

5.4.7 All density reports and bacteria test reports shall be completed, delivered to the City Engineer and Inspector, and approved before paving is allowed to begin. Bacteria test samples shall be taken by the City.

5.4.8 A City inspector will be on-site at all times when testing is being performed. The City Inspector shall be present during the placement of trench backfill lifts.

5.4.9 PVC water pipe and appurtenances shall be installed as specified in AWWA M-23 and in accordance with the pipe manufacturer's recommendations.

5.4.10 DIP water pipe and appurtenances shall be installed as specified in AWWA M-41 and in accordance with the pipe manufacturer's recommendations.

5.4.11 Fittings shall be installed in accordance with AWWA C-600.

5.4.11.A All mechanical joint bends, tees, and reducers which require blocking shall be additionally restrained with EBAA Megalug retainer gland or approved equal.

5.4.11.B All fittings must be polyethylene encased.

5.5 Fire Hydrants

5.5.1 Fire hydrants will be provided at a maximum spacing of 500 feet in Residential areas and 300 feet in Commercial or Industrial areas. All hydrants shall be standard three-way post-type dry barrel hydrants complying to AWWA Standards with six (6) inch or larger connections to mains. Fire hydrants shall be in accordance with current City of Taylor Construction Standards.

5.5.2 Materials

5.5.2.A Fire hydrants shall be manufactured in accordance with AWWA C-502, Dry-Barrel Fire Hydrants.

5.5.2.B Hydrants shall be manufactured such that all maintenance and adjustments can be performed without excavation and such that hydrants may be faced in any direction in relation to base. The hydrant shall be of a design that will permit extensions without disturbing the bottom section of the hydrant.

5.5.2.C A gate valve shall be installed with each fire hydrant.

5.5.3 Manufacturers

5.5.3.A Clow Medallion

5.5.3.B Mueller Centurion

5.5.3.C Kennedy K81D

5.5.3.D American Darling - B84B

5.5.4 Locations

5.5.4.A Fire hydrants are to be located a minimum of three (3) feet behind the back of curb unless sidewalks are adjacent to the curb, then they are to be set outside of the sidewalk a minimum of two (2) feet. If no curb and/or sidewalk is present, the fire hydrant shall be located a minimum of five (5) feet from edge of pavement and shall be located a minimum of two (2) feet from the top of the ditch. Fire hydrants shall be located within twenty (20) feet of a street corner.

5.6 Valves

5.6.1 Resilient seated gate valves shall be used for six (6) inch and up to twenty-four (24) inch water lines. Butterfly valves may be allowed as an addition to gate valves for lines eighteen (18) inches and larger when approved by the City Engineer.

5.6.2 Valves of approved design shall be installed at the intersections of all water mains to provide for proper maintenance and operation of the system and to provide a means of shutting off the supply to portions of the system for repairs. Valves shall be located on each line at all intersections unless approved by the City Engineer.

5.6.3 Materials

5.6.3.A Resilient Seated Gate Valves

5.6.3.A.i Resilient seated gate valves six (6) inches through twenty-four (24) inches shall meet or exceed the latest revisions of AWWA C509 and shall meet or exceed the requirements of these standards.

5.6.3.A.ii Resilient seated gate valves for buried service shall be furnished with a square two (2) inch operating nut. The valve box shall be Tyler Pipe 6850 series or approved equal. The valve box lid shall be painted safety blue. The paint shall be approved via submittal to the City.

5.6.3.A.iii All valves must open left and close right.

5.6.3.B Butterfly Valves

5.6.3.B.i Butterfly valves eighteen (18) inches and larger shall meet or exceed the latest revision of AWWA Standard C504 for Class 150B butterfly valves and shall meet or exceed the requirements of this specification.

5.6.3.B.ii All valves must open left and close right.

5.6.4 Installation

5.6.4.A Valves shall be furnished with extensions, such that the working nut is a maximum of thirty-six (36) inches below grade.

5.6.4.B Adjustable valve boxes shall be furnished and set on each valve in accordance with these standards. Valves that are deeper than forty-eight (48) inches, AWWA C900 PVC pipe shall be used for stacks, as long as the adjustable valve box is used at the top.

5.6.4.C After the final clean-up and alignment has been completed, the contractor shall cast in place a concrete block, around all valve box tops at the finish grade. See Standard Construction Details.

5.6.4.D Valves located within a right-of-way shall be indicated on the face of the curb, or where curbs do not exist, on a conspicuous location adjacent to the valve location. Markings are to be the stamping of a four (4) inch high letter "V" with a three-eighths (3/8) inch stroke with the point of the "V" pointing towards the valve location.

5.6.4.E Valve markers shall be provided in rural areas.

5.6.5 Manufacturers

5.6.5.A Clow

5.6.5.B Mueller

5.6.5.C Kennedy

5.6.5.D American Darling - B84B

5.7 Air Release and Flushing Valves

5.7.1 Adequate air relief, and flushing valves shall be provided for flushing, disinfecting, daily operation requirements, and repairs when required by the City Engineer. Water lines shall be designed so that each section of the water line can be flushed at its lowest and highest points.

5.7.2 Air release valves shall be required on twelve (12) inches and larger water lines at all high points and at the down-slope side of all valve locations. Air/vacuum and vacuum release valves shall be approved on a case-by-case basis.

5.7.3 A fire hydrant shall be required at high points on water lines smaller than twelve (12) inches for air relief and flushing.

5.7.4 All dead-end lines shall have a fire hydrant installed for flushing purposes. If installation of a fire hydrant is not possible, a flushing valve is required.

5.7.5 Air release valves and air/vacuum valves shall meet or exceed the latest revision of AWWA C512.

5.7.6 Automatic Flushing Valves shall be installed at the end of all dead-end mains that extend 150 linear feet or longer. Approved Manufacturer: Hydro Guard Standard Unit.

5.8 Tapping Sleeves

5.8.1 A tapping sleeve and valve shall be used when connecting a new water line to an existing line. A resilient seated gate valve shall be flanged to the tapping sleeve.

The tapping sleeve shall be a Smith-Blair Spec. 664-665 stainless steel tapping sleeve or approved equal.

5.9 Water Service

5.9.1 The water meter box shall be placed a minimum of two (2) feet behind the back of curb unless sidewalks are adjacent to the curb, then they are to be set outside of the sidewalk a minimum of two (2) feet, and the water service shall be a minimum of twelve (12) inches deep, covered with a meter box in place at grade. If no curb and/or sidewalk is present, the water service shall be located within the right-of-way and adjacent to the property line, a minimum of twelve (12) inches deep, covered with a meter box in place at grade. Along roadways with a drainage swale, the water service line shall be constructed at a minimum of three (3) feet below the ditch flow line.

5.9.2 Meter and service sizes will be determined by the developer prior to requesting service from the City. The minimum water service size between the water main and the meter shall be one (1) inch.

5.9.3 Water services on undeveloped lots shall be located within the right-of-way and adjacent to the property line and shall be a minimum of one (1) inch in diameter.

5.9.4 Materials

5.9.4.A Service saddles shall be double strap bronze with brass body or nylon/epoxy coated stainless steel double bolt wide straps. Minimum size tap shall be one (1) inch diameter. Service saddles shall be manufactured by Smith Blair based on the following:

5.9.4.A.i Saddles up to two (2) inches shall be epoxy coated with stainless steel straps.

5.9.4.A.ii Tapping Sleeve four (4) inches and larger shall be epoxy coated steel or ductile iron.

5.9.4.B Service lines shall be one (1) inch (single services) to one and one-half (1.5) inch (double services) polyethylene SDR9

5.9.4.C Corporation.

5.9.4.C.i Corporation stop shall be ball type with a diameter equal to the pipe size with compression outlet fitting, designed for a minimum working pressure of two hundred pounds per square inch (200 psi) and threaded counterclockwise.

5.9.4.C.ii Approved manufacturers are Ford or Mueller.

5.9.4.D Angle Stop

5.9.4.D.i Angle stop shall be set with compression inlet fitting and locking wings.

5.9.4.D.ii Approved manufacturers are Ford, Mueller or Smith Blair.

5.9.4.E Meter Boxes

5.9.4.E.i Single Meter boxes are to be DFW 1200 Series with AMR lid.

5.9.4.E.ii Double Meter boxes are to be DFW 1500 Series with AMR lid.

5.9.4.E.iii Traffic Rated Meter boxes shall be DFW "C" Series.

5.9.5 Installation

5.9.5.A General

5.9.5.A.i All water service shall be installed in accordance with these standards.

5.9.5.A.ii Each individual service location shall be saw cut into the face of the curb with a four (4) inch high "W" painted blue by the Contractor. If no curb exists a similar mark shall be placed in the pavement near the edge of the roadway.

5.10 Flushing Valves

5.10.1 Materials

5.10.1.A Corporation stop shall be two (2) inch ball type with compression outlet fitting, designed for a minimum working pressure of two hundred pounds per square inch (200 psi).

5.10.1.B Two (2) inch curb stop shall be ball type with compression inlet fitting with tee head shut off.

5.10.1.C Pipe shall be two (2) inches diameter, polyethylene.

5.10.1.D All flushing valves shall be installed within a twenty-four (24) inch round metal meter box.

5.10.1.E Tie to storm sewer inlet whenever possible.

5.11 Water Line Boring

Refer to **Section 4** (General Utilities Design Requirements) for crossing requirements for water line construction.

SECTION 6 WASTERWATER DESIGN REQUIREMENTS

Contents

SECTION 6 WASTERWATER DESIGN REQUIREMENTS

6.1 General

6.1.1 This section pertains to general design requirements for wastewater collection system construction in the City of Taylor. All sewer lines shall operate under gravity conditions and sized and approved by the City Engineer. In the absence of, or in conflict with a specific standard contained in this Chapter, all collection, treatment, and disposal systems shall be designed in accordance with the most current criteria adopted by the Texas Administrative Code, Chapter 217, "Design Criteria for Domestic Wastewater Systems".

6.1.2 The Applicant shall provide all sewer lines necessary to properly serve each Lot of the Development and ensure that existing lines and facilities can adequately serve the proposed Development. The Applicant shall bear all costs for extending existing City sewer lines and facilities to service the proposed Development. All sewer lines and service connections shall meet the current City of Taylor Construction Standards. Connection to the City's wastewater collection system shall only be permitted if the recipient of City sewer service is also a recipient of City of Taylor water service at the location being connected. Extension of wastewater lines to the development boundaries will be required if necessary to facilitate development of adjoining property.

6.2 Wastewater Main Sizes and Design

6.2.1 Standard wastewater main sizes are eight (8) inches, twelve (12) inches, fifteen (15) inches, and eighteen (18) inches in diameter. Other sizes shall be approved by the City Engineer.

6.2.2 Wastewater lines shall be constructed at a minimum depth of seven (7) feet to minimize potential vertical conflicts with storm drain and water mains and be located within the right-of-way or an approved utility easement. A wastewater line is either required to be constructed on both sides of a State or County Highway or the wastewater line shall be constructed at a minimum depth of thirteen (13) feet to accommodate wastewater service for properties on the opposite side of the State or County Highway.

6.2.3 Refer to **Section 1** (Easements and Right-of- Way Requirements) for easement widths for wastewater line construction.

6.2.4 Wastewater mains shall be designed with straight alignment whenever possible. When horizontal curvatures must be used to maintain the horizontal alignment within the curvature of the street right-of-way, pipe joints will be allowed to be deflected but must be used in accordance with 50% of the pipe manufacturer's recommendation for allowable deflection.

6.2.5 All proposed wastewater lines shall comply with the Master Plan. The City may agree to a cost-sharing agreement if oversizing of wastewater lines is required.

6.2.6 All wastewater mains shall be designed with consideration for serving the full drainage area based on proposed land use subject to collection by the wastewater in question. The drainage area may be modified with the concurrence of the City Engineer because of the projected rate of development or the financial feasibility of the proposed extension. Pipe shall be sized as follows:

6.2.6.A For wastewater mains fifteen (15) inches in diameter or smaller, the main shall be designed such that the Peak Wet Weather Flow (PWWF) shall not exceed eighty (80) percent of the capacity of the pipe flowing full.

6.2.6.B For wastewater mains eighteen (18) inches in diameter or larger, the main shall be designed such that the PWWF shall not exceed full flow capacity. Full flow shall mean the capacity of a pipe that has a depth of flow equal to the pipe diameter, and the hydraulic grade is at the inside top of the pipe. The hydraulic grade may exceed the top of the pipe if approved by City Engineer but in no case shall hydraulic grade be less than 2-feet below existing ground elevations and 4-feet below finished floor elevations at sewer service connections.

6.2.6.C All wastewater mains shall be designed with hydraulic slopes sufficient to achieve a minimum of two feet per second during average dry weather flows (ADWF) and a maximum velocity of ten feet per second during PWWF. The velocity is determined using the Manning's formula:

$$V = \frac{1.49}{n} \times R_h^{0.67} \times \sqrt{S}$$

Where:

V = Velocity (ft. /sec)

n = Manning's roughness coefficient (0.013)

R_h = Hydraulic radius (ft.)

S = Slope (ft. /ft.)

6.3 Wastewater Line Materials

All wastewater lines and fittings shall be new materials and comply with the following:

6.3.1 All wastewater pipes shall be Polyvinyl Chloride (PVC) pipe type SDR-26 for wastewater lines for depths less than twenty (20) feet. For depths greater than twenty (20) feet, pipe stiffness or alternate pipe material is to be determined by the Engineer and must be approved by the City Engineer.

6.3.2 All PVC wastewater pipe shall be green in color. Developer to provide a manufacturer's statement for pipe color other than green.

6.3.3 PVC sewer pipe and fittings shall conform to the current ASTM Designation D3034 for up to and including fifteen (15) inches and ASTM Designation F679 for eighteen (18) inches and greater.

6.4 Wastewater Line Installation

6.4.1 General

6.4.1.A All installations shall conform to the current ASTM Designation D2321, and in accordance with the pipe manufacturer's recommendations.

6.4.1.B Wastewater lines shall not be installed within nine (9) feet horizontally as measured from outside diameter to any water main or fire hydrant. Where this is not possible, separation shall be in accordance with TCEQ standards.

6.4.1.C Construction shall begin at the downstream end of the line and continue upstream with the bell facing upstream. No upstream piping shall be installed before downstream piping unless approved by the City Engineer.

6.4.2 Excavation and Backfill

6.4.2.A The amount of open trench excavation shall not exceed two hundred (200) feet from the end of the pipe laying operations, and no more than three hundred (300) feet of total open trench will be allowed. At the end of each workday, all trench excavation shall be backfilled to the end of the pipe laying operation.

6.4.2.B Density tests shall be taken every three hundred (300) feet for every lift or less as determined by City Inspector. A maximum thickness of eight (8) inches per lift is required for all trench backfill. A geotechnical report shall be submitted for all trenches. The density reports shall be submitted daily to the City Inspector. The City has the right to require additional tests if they are deemed necessary.

6.4.2.C A City inspector will be on site at all times when testing is being performed. The City Inspector shall be present during the placement of trench backfill lifts.

6.4.2.D All density reports shall be completed, delivered to the City's Engineer and Inspector, and approved before paving is allowed to begin.

6.5 Manholes

6.5.1 Manholes shall be located at all intersections of wastewater lines and at intermediate spacing along the line. Manholes shall not be placed greater than five hundred (500) feet for wastewater mains smaller than and including fifteen (15) inches. Manholes shall not exceed eight (800) feet for wastewater mains eighteen (18) inches and larger.

6.5.2 Manholes are required at all changes in grade; junction of wastewater lines with different inside pipe diameters; and at the ends of all wastewater lines.

6.5.3 An elevation drop of at least one-tenth of a foot (0.1) is required through the manhole for wastewater mains smaller than and including fifteen (15) inches.

6.5.4 A drop manhole is required when the flow line is greater than the crown of the wastewater main out.

6.5.5 Minimum manhole inside diameter is four (4) feet. If depth of cover is greater than fifteen (15) feet, the minimum manhole inside diameter shall be five (5) feet. Inside manhole diameters may need to be larger based on pipe sizes, number of pipe connections, and pipe angles entering and exiting manholes as determined by the Engineer and approved by the City Engineer.

6.5.6 Drop manholes shall have an exterior drop connection.

6.5.7 Manholes shall have eccentric cone placed over flowline of the largest diameter upstream wastewater main for CCTV inspection purposes. If upstream connection is drop, eccentric cone to be placed over flowline of downstream wastewater line.

6.5.8 All manholes shall be precast concrete manholes in accordance to ASTM Designation C-478. Manholes shall have a minimum wall thickness of five (5) inches with a spread footing manhole base placed on a minimum of twelve (12) inches of crushed rock.

6.5.9 Manholes shall be constructed of or lined with a corrosion resistant material. Where new construction ties into an existing manhole, the existing manholes must be lined, coated, or replaced with a corrosion resistant material. If the existing manhole is in poor condition, the manhole must be repaired or replaced prior to lining or coating.

6.5.10 Manholes within the pavement shall not be located within the wheel path.

6.5.11 Cast-in-place manholes may be allowed and require approval by the City Engineer with the following requirements:

6.5.11.A The manhole foundation shall be poured on undisturbed soil or approved subgrade and shall have a minimum thickness of eight (8) inches.

6.5.11.B The inlet and outlet pipes shall be poured into the foundation of the manhole. When straight through flow occurs, the pipe shall be laid continuously through the manhole.

6.5.11.C The invert shall be shaped and smoothed so that no projections will exist, and the invert shall be self-cleaning.

6.5.11.D When a cast-in-place manhole is used to connect to an existing wastewater line the manhole shall be poured, tested and approved before the top of the existing line is cut out.

6.5.11.E Concrete work shall conform to all requirements of ACI 301, Standard Specification for Structural Concrete, published by the American Concrete Institute, except as modified herein.

6.5.11.F Detailing of concrete reinforcement and accessories shall be in accordance with ACI Publication 315.

6.5.11.G Portland cement shall be Type II, low-alkali and conform to ASTM Designation C-150.

6.5.11.H The manhole shall not be backfilled within twelve (12) hours after the concrete placement. Backfill shall be compacted and reports submitted to the City.

6.5.12 The face of curb shall be stamped with a three (3) inch "MH" to mark the location of all manholes. The location of the stamp shall be a line that intersects the center of the manhole cover and the curb perpendicular to the centerline of the street. For manholes located in intersections, the curb shall be stamped at the closest location to the manhole. If no curb exists a similar mark shall be placed in the pavement near the edge of the roadway.

6.5.13 Manhole ventilation shall be required when consecutive manholes are located within the floodplain. Manhole ventilation will consist of a four (4) inch ductile iron pipe with Protecto 401™ lining extending a minimum of two (2) feet above the floodplain elevation with four (4) inch stainless steel turbine. Manhole ventilation will be required as follows:

6.5.13.A Every third manhole (i.e., no more than fifteen hundred (1,500) feet) for wastewater mains smaller than and including fifteen (15) inches.

6.5.13.B Every other manhole (i.e., no more than sixteen hundred (1,600) feet) for wastewater mains eighteen (18) inches and larger.

6.6 Manhole Frame and Cover

6.6.1 Cover

6.6.1.A Materials

All manhole covers shall conform to the Standard Specifications for Domestic Grey Iron Castings, ASTM A-48, Class 30 B.

6.6.1.B Installation

6.6.1.B.i All manhole covers shall be thirty (32) inches in diameter.

6.6.1.B.ii All manhole covers shall have two (2) integrally cast pick bars.

6.6.1.C Manufacturers (Traffic rated)

6.6.1.C.i East Jordan Iron Works

6.6.1.C.ii Bass & Hayes

6.6.2 Frames

6.6.2.A Materials

All manhole frames shall conform to the Standard Specifications for Grey Iron Castings, ASTM A-48, Class 30 B.

6.6.2.B Installation

All manhole frames shall provide a thirty (30) inch by one quarter (¼) inch opening to assure proper fit of the manhole cover.

6.6.2.C Manufacturers

6.6.2.C.i East Jordan Iron Works

6.6.2.C.ii Bass & Hayes

6.6.2.D Manholes located within the floodplain are to be watertight with an approved bolt-down cover and frame.

6.6.3 Extension Ring

6.6.3.A Materials

All precast reinforced concrete extension rings shall conform to ASTM C-478.

6.6.3.B Installation

6.6.3.B.i The number of extension ring sections shall be kept to a minimum (i.e., use 1 to 12 inch extension ring instead of 2 to 6 inch extension rings). The use of extension rings shall not exceed a height of over eighteen (18) inches above manhole.

6.6.3.B.ii A one (1) inch by three-and-a half (3½) inch bitumastic gasket shall be used to seal the extension ring at both joints.

6.6.4 Manhole Inserts - Rain Pan

Shall be required on all Manholes.

6.6.4.A Materials

Rain pans shall be High Strength Stainless Steel to fit each manhole

6.6.4.B Manufacturers

Southwestern Packing and Seals.

6.7 Wastewater Service

6.7.1 No wastewater service line (lateral) shall be less than four (4) inches in diameter.

6.7.2 Wastewater laterals shall be a minimum of ten (10) feet downstream of the water service. Services will be identified in the field by a three (3) inch "S" cut into the curb, on the record drawings (As-Built Plans) and with a stake in the field for location purposes.

6.7.3 Wastewater service laterals shall have a minimum of four (4) feet of cover at the property line with a cleanout to be placed at grade within the right-of-way and adjacent to the property line. If sidewalk is adjacent to the property line, the cleanout shall be placed on private property in a separate easement as defined in **Section 1** (Easements and Right-of- Way Requirements) directly adjacently to the right-of-way.

6.7.4 If wastewater lines or services are located within an alley they generally will be located in the center of the alley. Coordinate utility locations with other city-owned and franchise utilities to be located within the alley.

6.7.5 Materials

6.7.5.A All lateral wastewater service lines shall be gasketed PVC pipe type SDR-26.

6.7.5.B All PVC wastewater pipe used for lateral services shall meet ASTM D3034.

6.7.6 Installation

All service laterals shall be installed in accordance with the wastewater embedment and backfill standards of the City of Taylor.

6.8 Main Line Cleanouts

Cleanouts shall be installed on lines that are permanent dead ends. The line shall not exceed two hundred fifty (250) feet. Any line exceeding that length must end with a manhole.

6.9 Wastewater Line Boring

Refer to **Section 4** (General Utilities Design Requirements) for crossing requirements for wastewater line construction.

6.10 Septic Systems

6.10.1 Will be permitted on lots of 1 acre or more with city water and lot of 2 acres or more if using private well for water source. Septic systems must comply with the City Utility Standards, permits, and processes.

6.10.2 Williamson County's On-Site Sewage Facilities (OSSF) regulates On-Site Sewage Facilities (a.k.a septic tanks) located within Williamson County. This includes permitting, inspections, complaint investigation and providing program information. Williamson County Engineer's Office has been authorized by the Texas Commission on Environmental Quality (TCEQ) to administer the On-Site Sewage Facilities (OSSF) Program. The program falls primarily under the authority

of TCEQ rules contained within 30 TAC Ch.285 On-Site Sewage Facilities. OSSF's installed and operated within Williamson County's jurisdiction must follow the requirement established in the Williamson County Engineer's On-Site Sewage Facility Rules.

6.11 Lift Stations

Lift stations are discouraged and shall not be maintained by the City.

Lift stations will be allowed only where conventional gravity service is not feasible and if approved by the City. The City shall impose additional requirements for individual lift stations as conditions warrant. Wastewater service facilities within a site or subdivision shall be designed to minimize the number of lift stations needed to serve the lots and meet the TCEQ Chapter 217 rules as amended. Lift stations will be privately operated and maintained.

SECTION 7 STRUCTURAL DESIGN REQUIREMENTS

Contents

SECTION 7 STRUCTURAL DESIGN REQUIREMENTS

7.1 General

7.1.1 Responsibility

7.1.1.A The Engineer of Record shall bear the sole responsibility for meeting the engineering standard of care for all aspects of the structural design and providing a design that is required by the site-specific conditions and intended use of the facilities.

7.1.1.B The structural design must be signed and sealed by a Professional Engineer (Texas). The Engineer is responsible for all engineering and recognizes that specific site circumstances or conditions may require improvements that exceed minimum standards contained in this Manual. The Engineer is responsible for evaluating and applying appropriate standards and specifications.

7.1.1.C The Engineer shall rely on the geotechnical investigation recommendations as minimum design criteria. If in the Engineer's judgment, the structural design needs to be based upon more conservative geotechnical design criteria, the Engineer shall provide the more conservative design.

7.1.2 Structures – For this section of the Manual, structures shall be limited to vehicular and pedestrian bridges, retaining walls, screening walls, culverts, headwalls and wingwalls, and other civil structures or foundations. This section of the manual does not apply to buildings.

7.1.3 Right-of-Way – All elements of private structures including foundations, walls, slabs, beams, etc. shall not extend inside the City's public ROW.

7.1.4 TxDOT Standard Sheets – If TxDOT standard sheets pertaining to structures are utilized, the Engineer shall verify the loading, geometry, and allowable soil pressures are applicable to the standard design selected. Consideration shall be given to the site-specific geotechnical requirements and whether a TxDOT standard design is applicable. No TxDOT standard sheets shall be modified unless the Engineer designs, draws, signs, and seals the modified standard. If TxDOT standard sheets are not applicable, a custom structural design shall be provided. The Engineer shall provide design calculations validating that any TxDOT standard details used for custom designs are applicable.

7.1.5 Aesthetics – Aesthetic treatments of structures are required and shall complement the surrounding features. Aesthetic treatments shall not interfere with the functionality of the structure. Aesthetic treatments of handrails and

guardrails shall comply with all Local, State, and Federal requirements. The City Engineer will approve all aesthetic treatments.

7.1.6 Drainage – The Engineer shall consider any potential negative impacts resulting from the structure's drainage system design. Refer to Section 3 (Drainage Design Requirements) for additional drainage requirements.

7.1.7 Corrosive Conditions – Salts, chlorides, and sulfates can be detrimental to foundations and concrete at grade. Where these conditions exist, the Engineer shall take preventative measures. For transportation-related structures, refer to TxDOT's *Structure Design – Corrosion Protection Guide*, TxDOT Bridge Division.

7.1.8 Structural Plan Requirements

7.1.8.A Construction plans and specifications shall be prepared and submitted to the City Engineer in accordance with **Section 1** (Submittal Requirements for Construction Plans) and the appropriate Checklists.

7.1.8.B Calculations pertinent to the design of all structures within public ROW or easements shall be submitted to the City electronically in PDF format and will be filed for record purposes by the City. The Engineer remains responsible for the design of the structure(s).

7.2 Code Requirements

7.2.1 For this section of the Manual, "current edition" shall refer to the edition of a code, standard, or guidance document at the time of submittal to the City.

7.2.2 At a minimum, all structures shall be designed using the current editions of relevant codes and guidance documents as adopted by the City and shall meet all applicable Local, State, and Federal standards in effect at the time of contract execution.

7.2.3 For design of structures without adopted standards, the design criteria shall be submitted to the City Engineer for approval. This includes but is not limited to non-building structures at airports, elevated utility crossings, architectural features, canopies, shade structures, and miscellaneous foundations.

7.2.4 More stringent requirements shall be utilized as required for unusual designs such as rehabilitations, reconstructions, or for unusual site conditions.

7.2.5 For any structure, the City Engineer may require the quality of materials and construction to be higher than the minimum requirements as stated in the codes based on structure usage or site conditions.

7.3 Construction Inspections

7.3.1 Inspections of structures shall be performed in accordance with this section. Inspection for structures not performed directly by the City shall be performed by the Engineer of Record or their third-party firm and include a letter signed and sealed by their Engineer stating that the structure was constructed in general compliance with the City-approved construction plans and specifications.

7.3.2 Non-Bridge Construction Inspection

7.3.2.A Inspections of non-bridge structures shall be performed during construction, and reports shall be provided to the City. The inspections and reports shall be performed at the following stages of construction (at a minimum):

- Subgrade/Foundation preparation – including but not limited to slabs, strips, footings, piles, and drilled shaft foundations prior to concrete placement
- Formwork – including but not limited to formwork for footings, walls, slabs, and other elements requiring formwork prior to concrete placement
- Reinforcing placement
- Drainage system construction (if applicable)
- Concrete/Masonry/Mortar placement
- Completion – post concrete placement

7.3.2.B A third-party inspector shall verify and document that construction inspections were performed at the prescribed stages of construction. The inspection reports and final certificate of compliance shall be submitted to the City and include the following:

- Specific reference to the City-approved construction plans and specifications
- Specific reference to the address and/or legal description for the construction location
- Specific reference to the name and date of the project-specific geotechnical engineering report
- A letter signed and sealed by an Engineer that includes a statement that the structure was constructed in general compliance with the geotechnical design criteria identified in the

construction plans and specifications and the City-approved construction plans and specifications

7.3.3 Bridge Construction Inspection

7.3.3.A Inspections of bridge structures shall be performed during construction, and reports shall be provided to the City. The inspections and reports shall be performed at the following stages of construction (at a minimum):

- Foundation preparation – including but not limited to footing excavations, piles, and drilled shafts
- Formwork and Falsework – including but not limited to formwork for footings, walls, slabs, and other elements requiring formwork prior to concrete placement; falsework for steel or precast construction
- Reinforcing placement
- Concrete placement
- Completion – post concrete placement

7.3.3.B A third-party inspector shall verify and document that bridge construction inspections were performed at each stage of construction. The inspection reports and final certificate of compliance shall be submitted to the City.

7.4 Excavation Support

7.4.1 Trench excavation protection shall be used for the installation of linear drainage or utility facilities that result in trenches deeper than five (5) feet. Such trench protection includes vertical or sloped cuts, benches, shields, support systems, or other systems providing the necessary protection in accordance with Occupational Safety Heath Administration's (OSHA) current Standards and Interpretations, 29 CFR 1926, Subpart P (Excavations).

7.4.2 Temporary shoring (including trench excavation discussed above) shall be used for installations of walls, footings, and other structures that require excavations deeper than five (5) feet. Temporary shoring shall be designed and constructed to hold the surrounding earth, water, or both out of the work area. Options may include, but not be limited to, vertical or sloped cuts, benches, shields, support systems, or other systems to provide the necessary protection in accordance with the approved design. Unless a complete design for temporary shoring systems is included in the construction plans, the Contractor is responsible for

the design of the temporary shoring system.

7.4.3 Temporary shoring must be provided as applicable to protect adjacent infrastructure during construction. Infrastructure is defined as structures, pavement, utilities, hardscaping, or any other structure or facility.

7.4.4 For all types of shoring, the Contractor must submit to the City (for informational purposes only) the design calculations and details sealed by an Engineer before constructing the shoring. The design of the shoring must provide protection in accordance with OSHA's current Standards and Interpretations, 29 CFR 1926, Subpart P (Excavations).

7.5 Geotechnical Performance Specifications

7.5.1 Field investigation, geotechnical testing, and geotechnical engineering shall be performed in accordance with the TxDOT Geotechnical Manual and with the standard of care considering local experience and conditions. The geotechnical recommendations shall establish the minimum design criteria upon which the Engineer can rely.

7.5.2 The complexity of geological conditions and the type, length, and width of the structure shall determine the number and locations of test holes required. The following shall be considered by the Engineer in coordination with the Geotechnical Engineer:

- Depth of test hole
- Location of proposed grade relative to existing grade
- Location of groundwater
- Channel relocations and/or channel widening
- Scour
- Foundation loads
- Foundation types

7.5.3 Identify test hole locations on the construction plans.

7.5.4 Provide a complete soil and bedrock classification and log record for each test hole, including all pertinent information to complete the standard log. Location and surface elevation shall be shown on the boring logs.

7.5.5 Perform the appropriate field and laboratory tests necessary to determine the soil properties for geotechnical design criteria. The Geotechnical Engineer shall consider both the short-term and long-term conditions.

7.5.6 Presence of ground water and elevation shall be included as part of the data acquisition. Site conditions may require the installation of piezometers to establish a true groundwater surface elevation and a method of monitoring water surface fluctuations.

7.5.7 Boring Requirements – Minimum boring requirements are specified below. Based on the Geotechnical Engineer's experience and engineering judgment, if competent rock is encountered, the minimum boring depths specified below may be reduced with approval from the City Engineer.

7.5.7.A Bridges

7.5.7.A.i In general, drill test holes shall penetrate a minimum of fifteen (15) feet into proposed bearing strata. Where depth of bearing strata becomes impractical, the City Engineer will determine minimum bore depth.

7.5.7.A.ii Test holes shall be drilled near each abutment and bent location of the proposed structure. Do not space test holes more than 300 ft apart. For stream crossings, locate a test hole on each bank as close to the water's edge as possible. Intermediate holes may be required to determine depth and location of all significant soil and rock strata.

7.5.7.A.iii A site inspection by the driller or logger shall be performed to evaluate site accessibility and special equipment needs.

7.5.7.A.iv Grade Separations – If the borings indicate soft surface soils (fewer than 10 blows per foot), additional borings and testing shall be required for the design of the bridge approach embankments.

7.5.7.B Retaining Walls – Obtain soil borings for walls taller than four (4) feet. Soil borings shall also be obtained for any retaining wall (regardless of height) under unusual circumstances including but not limited to live loading or other surcharges.

7.5.7.B.i Minimum Number/Spacing – Obtain a minimum of two soil borings within limits of wall footprint. For walls longer than 200 feet, borings shall be obtained at a maximum spacing of 200 feet unless site conditions or the Engineer requires closer spacing. A greater spacing may be allowed by the City Engineer only if requested in writing by the Geotechnical Engineer.

7.5.7.B.ii Fill Walls – For spread footing walls and Mechanically Stabilized Earth (MSE) walls, the depth of the boring shall be at least equal to the wall height depending on the wall type. The minimum boring depth is fifteen (15) feet below the bottom of the proposed wall unless rock is encountered. Extend borings at least five (5) feet into rock for fill walls unless additional depth is recommended by the Geotechnical Engineer.

7.5.7.B.iii Cut Walls – For drilled shaft walls, tied-back walls, and soil and rock nail walls, the depth of the boring shall be based on the proposed ground line. Cantilever drilled shaft walls require the depth of boring to extend to the anticipated depth of the shaft below the cut, which is typically between one and two times the wall height unless additional depth is recommended by the Geotechnical Engineer. Borings for soil nails, tiebacks, and rock nailed walls shall be advanced through the material that is to be nailed. The minimum boring depth is twenty (20) feet below the bottom of the proposed wall. Borings for proposed cut walls may need to penetrate bearing strata significant distances depending on the depth of the cut and wall height.

7.5.7.B.iv Additional Testing/Modeling – Additional testing and modeling shall be provided for taller walls, walls on slopes, or walls on soft founding strata as necessary or as recommended by the Geotechnical Engineer to completely evaluate wall stability.

7.5.7.C Slopes and embankments including bridge approaches – Obtain soil borings for cuts greater than ten (10) feet or embankments taller than fifteen (15) feet. This requirement is in addition to the borings required for pavement design. The exploration shall include the following:

7.5.7.C.i Soil Under Future Embankments – Advance borings to a depth at least equal to the embankment height or twenty (20) feet, whichever is greater, unless a greater depth is recommended by the Geotechnical Engineer.

7.5.7.C.ii Soil in Proposed Cuts – Advance borings to a depth of at least 15 feet below the bottom of the proposed cut unless a

greater depth is recommended by the Geotechnical Engineer.

7.5.8 Slope Stability – All slopes exceeding eight (8) feet in height with a steepness of 4H:1V or greater, regardless of soil type, cut, or fill, shall be evaluated for global stability for both the short-term and the long-term conditions. Additionally, any known areas of existing fill, deleterious material, or soft soils which have a height over 4 feet or slope angle greater than 6H:1V shall be evaluated for global stability for both the short-term and the long-term conditions. Specific site conditions may require evaluation for additional types of slope failure, such as bearing capacity, settlement, shear, and undercutting. For global stability of a slope, a minimum factor of safety of 1.3 is required for both the long-term drained condition and the short-term undrained condition. Make the factor of safety 1.5 or greater for slope or walls that support abutments, critical utilities, or other installations with a low tolerance for failure. Calculations pertinent to the analysis shall be submitted with the construction plans, unless included with the geotechnical report.

7.6 Vehicular Bridges

7.6.1 The design and construction of roadway bridges and bridge-class culverts shall be provided in accordance with the current edition of AASHTO's *LRFD Bridge Design Specifications* and supplemented using TxDOT's *Bridge Design Manual*, *Bridge Design Guide*, and *Geotechnical Manual*. TxDOT standards shall also be used as applicable. Bridge-class culverts are defined as having a dimension of twenty (20) feet or more, measured along the roadway alignment.

7.6.2 Specifications for bridge construction shall be in accordance with TxDOT's current edition of *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*.

7.6.3 Temporary works for bridge construction

7.6.3.A Temporary works shall include the following items, but not be limited to form work, false work, scaffolding, work platforms, bracing, and shoring.

7.6.3.B For all types of temporary works, the Contractor must submit to the City (for informational purposes only) the design calculations and details sealed by an Engineer before construction. The design of the temporary works must be in accordance with applicable Subparts of OSHA's current Standards and Interpretations, 29 CFR 1926.

7.6.4 Foundations: The Engineer shall be responsible for selecting the appropriate

bridge foundation based on design loads, existing geotechnical conditions, and the Geotechnical Engineer's recommendations. For guidance not provided in this Manual, refer to TxDOT's *Bridge Design Manual* and TxDOT's *Geotechnical Manual*. In general, drilled shafts are well suited to areas with competent soil and rock while piles are well suited to areas with softer soil. Drilled shafts are the preferred foundation type subject to concurrence from the Geotechnical Engineer. Alternative foundation types require approval in writing from the City Engineer.

7.6.4.A Drilled Shaft Foundations:

7.6.4.A.i Disregard surface soil in the design of drilled shaft foundations. The disregarded depth is the amount of surface soil that is not included in the design of the foundation due to potential erosion from scour, future excavation, seasonal moisture variation (shrinkage and swelling), lateral migration of waterways, and disturbed material or fill. The disregard depth shall be per the recommendations of the geotechnical investigation, but at a minimum shall be five (5) feet over non-water crossings and 10 feet over stream crossings. For abutments, disregard the portion of foundation passing through embankment fills.

7.6.4.A.ii Drilled shaft capacity relies upon penetrating a specific stratum with a specified depth. The construction plans shall provide a note instructing the contractor and field personnel of the penetration requirement. The construction plans shall identify the specific type of material to be penetrated and the minimum penetration depth. The plan may allow for the drilled shaft to be shortened if the founding stratum is encountered at a shallower depth, and it requires the shaft to be lengthened if the founding stratum is not encountered at the expected elevation.

7.6.4.A.iii When the founding stratum is present at or near the surface, the Engineer shall consider the load-carrying capacity along with the stability of the superstructure on the foundation. For these conditions, a minimum drilled shaft length shall be specified on the construction plans, typically three shaft diameters, and the drilled shaft will not be allowed to be shortened from plan length, but it may be lengthened if the founding stratum is not encountered at

the expected elevation.

7.6.4.B Pile Foundations:

7.6.4.B.i Use of steel piling must incorporate recommendations in TxDOT's *Guidelines for the Use of Steel Piling for Bridge Foundations*. Do not use timber piling for permanent foundations.

7.6.4.B.ii Piling design shall consider skin friction. Because piling has small tip areas and is generally placed in softer soil, the point bearing contribution shall be disregarded in design.

7.6.4.B.iii Disregard surface soil in the design of pile foundations. The disregarded depth is the amount of surface soil that is not included in the design of the foundation due to potential erosion from scour, future excavation, seasonal moisture variation (shrinkage and swelling), lateral migration of waterways, and disturbed material or fill. The disregard depth shall be per the recommendations of the geotechnical investigation, but at a minimum shall be five (5) feet over non-water crossings and ten (10) feet over stream crossings. For abutments, disregard the portion of foundation passing through embankment fills.

7.6.4.B.iv See TxDOT's *Geotechnical Manual* for additional considerations related to vehicle and flood debris impact, scour, and corrosion.

7.6.4.B.v Take care when designing piling in areas with shallow hard or dense soils. If piling cannot be driven through these areas, the contractor will need to pilot hole or jet the piling to achieve the desired penetration.

7.6.4.C Scour

7.6.4.C.i For evaluating scour, TxDOT guidelines from *Evaluating Scour at Bridges* and HEC-18 *Evaluating Scour at Bridges* shall be used.

7.6.4.C.ii Bridge foundation scour analysis is required. Abutments shall be protected against potential scour through use of flexible revetment where possible or hard armoring.

7.6.4.C.iii Design bridge foundations to withstand the scour depths for

either the fully developed 100-year flood or smaller flood if it will cause scour depths deeper than the fully developed 100-year flood as described in **Section 3** of this manual.

7.6.4.C.iv Check the bridge foundations against the scour depth associated with the 500- year flood as described in **Section 3** of this manual. This flood event is considered an extreme event and the factor of safety on the bridge foundations shall be greater than or equal to one (1).

7.6.5 Substructure and Superstructure

7.6.5.A For guidance not provided in this Manual, refer to TxDOT's *Bridge Design Manual*.

7.6.5.B Reinforced concrete is preferred for substructure construction. TxDOT standard details shall be used when practical. Post-tensioned concrete straddle bents may be used when the cap span exceeds practical reinforced concrete limits.

7.6.5.C Prestressed concrete girders and beams typically used on TxDOT bridges are the preferred superstructure type. Steel plate girders or tub girders may be used for long-span or tightly curved conditions. Refer to TxDOT's *Preferred Practices for Steel Bridge Design, Fabrication, and Erection* for details on steel construction.

7.6.5.D TxDOT bridge standard practices and detailing shall be used when applicable.

7.6.6 Bridge Railings:

7.6.6.A All bridge railing shall be in accordance with TxDOT's *Bridge Railing Manual* and shall meet the specifications outlined in AASHTO's *Manual for Assessing Safety Hardware (MASH)* and the National Cooperative Highway Research Program (NCHRP) *Report 350*. All railing shall be appropriately rated railing based on the roadway design speed (Test Level) and site conditions.

7.6.6.B Guardrail, end treatments, or other features associated with bridge construction shall be in accordance with AASHTO's *A Policy on Geometric Design of Highways and Streets*, AASHTO's *Roadside Design Guide*, and current TxDOT standards. All bridge railing shall meet applicable sight distance requirements.

7.6.6.C The nominal face of railing shall be a minimum of two (2) feet beyond

edge of outside travel lane.

7.6.7 Bridges over or adjacent to Railroads

7.6.7.A Refer to the TxDOT *Rail-Highway Operations Manual* for responsibilities and best practices on projects that impact both roadway and railroad rights-of-ways.

7.6.7.B Refer to the UPRR's and BNSF's joint *Guidelines for Railroad Grade Separation Projects*.

7.6.7.C Refer to *UPRR's Guidelines for Temporary Shoring* when shoring will be subject to railroad loading.

7.6.7.D For structures with a clear distance of 25 feet or less from the center line of a railway track, adhere to the requirements of American Railway Engineering and Maintenance-of-Way Association (AREMA), or the governing railroad company.

7.6.8 For all bridges and bridge-class culverts adjacent to or in conjunction with roadways, sight visibility exhibits shall be submitted to the City for review and approval in accordance with **Section 2** (Sight Visibility).

7.7 Pedestrian and Bicycle Bridges

7.7.1 Pedestrian bridges shall be designed in accordance with AASHTO's *LRFD Guide Specifications for the Design of Pedestrian Bridges* and AASHTO's *Guide for the Development of Bicycle and Pedestrian Facilities*.

7.7.2 Design Requirements – Refer to **Section 2** (Pedestrian Facilities) for applicable design requirements.

7.7.3 Loading – Design loads shall be in accordance with the applicable codes outlined in this section and shall include, but not be limited to, dead loads, live loads, surcharge loads, wind loads, hydrostatic loads, loads related to construction methods, and loads from other structures. Loading shall conform to the specified use (i.e., bicycle, pedestrian, emergency vehicle traffic, and/or maintenance vehicle traffic).

7.7.4 Bridge foundations and substructures shall be designed for a specified bridge superstructure. Preferred pedestrian bridge superstructures are prefabricated. The foundation loads, substructure loads, and shop drawings for the prefabricated bridge superstructure shall be submitted to the City Engineer for review and approval. When prefabricated superstructures are not an option, a design for the full bridge shall be provided by the Engineer.

7.7.5 Hydraulics – Refer to **Section 3** (Drainage Design Requirements) for design flood,

freeboard, and flood study requirements associated with pedestrian bridge design.

7.7.6 Maintenance – Maintenance considerations of railing for pedestrian bridges that do not contain the fully developed 100-year flood with freeboard in accordance with **Section 3** (Drainage Design Requirements - Bridges) shall be specified in the construction plans.

7.8 Retaining Walls

7.8.1 For guidance not provided in this Manual, refer to the TxDOT's *Geotechnical Manual*.

7.8.2 The Engineer is responsible for selecting the appropriate type of retaining wall for a given location. The retaining wall selection process shall consider the following:

7.8.2.A Height – Walls shall be measured from the top of wall footing to the top of the wall (not the top of the retained fill).

7.8.2.A.i An engineered design is required for all walls 4 feet in height or greater.

7.8.2.A.ii For a wall that has a variable height where part of the wall is under 4 feet and part of the wall is over 4 feet, an engineering design will be necessary for the entire wall.

7.8.2.B Geometry – Determine applicability of wall type – cut, cut/fill, or fill – based on geometry, site constraints, existing and proposed topography, and wall alignment and location. Identify available ROW and any necessary ROW or easements to accommodate the proposed improvements and the access room necessary for maintenance. Identify location and type of existing and proposed utilities and drainage structures.

7.8.2.C Economics – Evaluate the total installed cost of the wall and consider long-term maintenance requirements. Identify necessary excavation requirements (including shoring), required utility adjustments and costs, project schedule, construction phasing requirements, and these effects on the wall design and construction.

7.8.2.D Global Stability – The Engineer is responsible for the global stability design of the wall. Evaluate all walls such that minimum applicable factors of safety are met or exceeded. Walls shall not be placed on slopes if avoidable.

7.8.2.E Passive Resistance to Sliding – The Engineer shall follow the Geotechnical Engineer's guidance for use of passive resistance. If there is a slope in front of the wall, passive resistance shall be neglected.

7.8.2.F Constructability – Determine whether walls are near water or subject to inundation or groundwater. Identify access limitations for equipment both during and after construction. Provide adequate horizontal and vertical clearances for installation of the retaining wall, particularly tied-back, mailed, and drilled shaft walls.

7.8.2.G Drainage – Design the wall to prevent the build-up of hydrostatic pressure behind the wall. If conditions warrant (such as but not limited to, the inability to include a drainage system or situations of rapid draw down), the City may require the wall design to withstand full hydrostatic pressure load. The wall design shall consider potential deleterious short- and long-term effects of water inundation including scour and rapid draw down.

7.8.2.H Loading – Design loads shall include construction loads and surcharge loads from slopes, structures, and vehicles.

7.8.2.H.i If any wall has embedded posts, poles, or other structures anchored directly into the wall structure, wall design must also take into consideration the additional loadings due to these structures (axial, lateral, and wind). The structural design shall be provided in accordance with the geotechnical recommendations and minimum design criteria provided herein.

7.8.2.I Maintenance – Retaining wall design shall consider long-term maintenance accessibility which may require additional right-of-way or easement at the top and bottom of the wall, generally 10 feet.

7.8.3 Analyze and design walls following accepted geotechnical engineering industry standards for the area and in accordance with this Manual. In analysis, use earth pressures that follow the requirements of the project's geotechnical investigation specifically addressing the retaining wall design requirements for the project's specific location.

7.8.4 The Engineer shall design for all potential modes of wall system failure including sliding, overturning, bearing pressure, global stability, and structural capacity of the wall itself.

7.8.5 If a TxDOT retaining wall standard is used for the wall design, it is the designer's

responsibility to validate the strength values shown on the retaining wall standard used. If the actual soil conditions show a strength weaker than that shown on the governing standard, the designer must determine what modifications, if any, are necessary to the standard, and determine if any ground improvements are necessary.

7.8.6 "Perched walls" such as walls placed on new embankments shall be avoided, unless otherwise approved by the City. Perched walls, if allowed, shall be analyzed as both independent structures and as a single unit for all design parameters.

7.8.7 Placement of walls adjacent to roadways must comply with AASHTO's *Roadside Design Guide* unless otherwise approved by the City Engineer.

7.8.8 Retaining walls adjacent to bike trails must have at least a 2-foot setback/clear zone.

7.8.9 Tree placement within the zone of influence of a retaining wall shall be avoided. Any trees placed within zone of influence must be addressed in the structural design of the wall and submitted as a part of the calculation package.

7.8.10 Swimming pools, pergolas, and other structures placed within the zone of influence of a retaining wall are discouraged. Any of these placed within the zone of influence must be addressed in the structural design of the wall and submitted as a part of the calculation package.

7.8.11 If fences will be installed on top of walls, connection details must be included in the construction plans and considered during design as a part of the calculation package.

7.9 Screening Walls

7.9.1 General

7.9.1.A All screening walls in the City and within its Extraterritorial Jurisdiction (ETJ), both privately and publicly maintained, shall be designed and constructed in accordance with this section.

7.9.1.B The purpose of these standards is to provide design and construction standards for precast concrete decorative screening walls that are extremely durable with extended service life, economical to maintain, and aesthetically pleasing.

7.9.1.C These standards are minimum design, construction, and maintenance standards. All construction plans and specifications submitted for permit and construction shall be signed and sealed by an Engineer. All

construction plans and specifications submitted for permit shall be accompanied by supporting design calculations, assumptions, code references, and sketches clearly notated for ease of review by the City Engineer. Submitted supporting design calculations, assumptions, and sketches shall be signed and sealed by an Engineer.

7.9.1.D All screening walls and associated structural elements such as columns, footings, piers, and pier caps shall be designed and constructed in accordance with the current edition of either AASHTO's *LRFD Bridge Design Specifications* or ASCE 7-16 and ACI 318: *Building Code Requirements for Reinforced Concrete*. In addition, the minimum design wind speed shall be 115 miles per hour (mph) with the equivalent pressure calculated per AASHTO or ASCE-7.

7.9.1.E Screening walls shall be located, designed, constructed, and maintained in compliance with the specific development ordinances and agreements applicable to the property where the wall is being constructed or as directed by the City.

7.9.1.F Screening walls shall be designed, constructed, and maintained in compliance with **Section 2** (Sight Visibility).

7.9.1.G Whenever screening walls are located on public ROW, easement, or other publicly owned property, the perpetual maintenance shall be assured by a viable property owners association, subject to the approval of the City Engineer.

7.9.1.H Screening walls and mow strips shall be designed to accommodate through drainage if required by the drainage plans approved by the City Engineer.

7.9.2 Placement of Screening Walls

7.9.2.A The location, height, and appearance of screening walls shall be approved as part of the Site Plan process.

7.9.2.B Screening walls constructed within public ROW shall be as close to the ROW line as possible without any encroachment of overhangs, foundations, piers, or mow strips onto private property.

7.9.2.C Screening walls placed on private property shall be placed in a screening wall maintenance easement a minimum of 5-foot in width.

7.9.2.D Screening walls adjacent to bike trails must have at least a 2-foot setback/clear zone.

7.9.3 General Materials and Colors

7.9.3.A Screening walls shall be precast reinforced concrete form liner with simulated brick, stone, or other texture approved by the City and shall achieve the final effect of realistic stone, brick, or other surface texture or design approved by the City.

7.9.3.B Precast screening walls and associated elements and other product materials shall be from a TxDOT-approved or City-approved supplier and of a design for which replacement units are readily available to the City.

7.9.3.C All concrete for the precast screening wall panels, precast columns, and associated elements such as drilled piers, pier caps, mows strips, footings, and column fill, shall be in accordance with TxDOT's Item 421 Class 'C' concrete.

7.9.3.D Wall panels and columns shall include a texture/pattern approved by the City on each side. Pattern shall cover the entire face of panels exclusive of a maximum 1-foot-wide border, if provided. Pattern shall cover the entire face of columns exclusive of a maximum 2-inch-wide border, if provided. The City may require differing patterns on the two sides of the wall and different patterns for different segments of the wall.

7.9.3.E Stone patterns shall incorporate an average relief of ½-inch minimum.

7.9.3.F Brick patterns shall include a minimum ¼-inch relief at the bricks and 3/8- inch at any included border.

7.9.3.G All exposed concrete surfaces shall be painted/stained with a City-approved water-based acrylic concrete paint/sealer to provide protection from rain, pollution, and other elements and to achieve the desired natural stone, real brick, or other City-approved appearance.

7.9.3.H Concrete surfaces shall be colored in the field after installation. All brick and stone patterns visible to the public shall be painted or stained to achieve a natural (earth tone) stone appearance and incorporate a base color and at least three accent colors. All brick patterns visible to the public shall be painted or stained to achieve a realistic brick appearance including separate colors for mortar and brick.

7.9.4 Screening Wall Foundations

7.9.4.A Reinforcing steel shall at a minimum meet the requirements of either AASHTO's *LRFD Bridge Design Specifications* or *ACI 318: Building Code Requirements for Reinforced Concrete*. The construction plans showing the reinforcing placement shall be signed and sealed by an Engineer. The following minimums shall be followed if greater than requirements of the applicable code:

- Reinforcing steel in drilled shafts shall be minimum of six #4 deformed bars conforming to ASTM A615 grade 60.
- Tie bars, stirrups, and spirals shall be minimum #3 bars.
- Reinforcing steel that extends into the columns shall be embedded in the foundation to develop the full strength of the bars.

7.9.4.B Foundations shall be designed based on the results of performing a geotechnical investigation. Design criteria obtained shall be the basis for drilled shaft diameter, depth of embedment, lateral capacity, uplift capacity, end bearing capacity, depth of footing, and depth and width of over-excavation, at a minimum. Drilled shafts shall be a minimum 18-inch diameter.

7.9.4.C All drilled shaft and footing construction shall be in accordance with required geotechnical report and TxDOT Item 416 (Drilled Shaft Foundations).

7.9.5 Screening Wall Concrete Mow Strip

7.9.5.A The concrete mow strip between piers shall be at least as wide as the maximum outside dimension of the pier/pier cap and no less than 24 inches wide. If mow strip will be three (3) feet or less from pavement (including sidewalk) then mow strip shall extend to the pavement and be separated from the pavement with a minimum 1" expansion joint.

7.9.5.B The concrete mow strip shall include a minimum of three longitudinal #4 steel reinforcing bars with 12-inch maximum spacing and #3 steel reinforcing bars at 24-inch maximum spacing transversely.

7.9.5.C The concrete mow strip shall be a minimum thickness of 6-inches and be variable height to limit the gap between the wall panels and the mow strip finished grade to a maximum of 1.5-inches. The mow strip must be formed above ground and a minimum of six (6) inches below the finished grade at all locations.

7.9.5.D City-approved expansion material 3/4-inch in thickness shall be placed on each side of the fence column pier caps where the concrete mow strip meets the pier caps.

7.9.5.E Screening walls and mow strips shall be designed to accommodate through drainage if dictated by the drainage plans approved by the City Engineer.

7.9.6 Wall Panels

7.9.6.A Reinforcing steel shall be determined by the Engineer and shall meet the requirements of either AASHTO's *LRFD Bridge Design Specifications*, or *ACI-318: Building Code Requirements for Reinforced Concrete,* or minimums specified herein, whichever is greater.

7.9.6.B Wall panels shall be, at a minimum, continually reinforced along the top and bottom portions of the panels with deformed steel reinforcing bars conforming to ASTM A615 Grade 60 with reinforcement provided being #4 bars or larger as required.

7.9.6.C Wall panels shall be continually reinforced with a minimum of one mat of grade 60 welded wire reinforcement (WWR) conforming to ASTM A185 or A497 and with a minimum vertical and horizontal area of 0.08 inch- squared/foot or larger as required. WWR shall be attached to the panel's perimeter rebar. WWR shall be furnished as flat sheets; rolls of welded wire reinforcement are not permitted.

7.9.6.D The construction plans showing the reinforcing placement shall be signed and sealed by an Engineer.

7.9.6.E Minimum panel thickness shall be five (5) inches for rebar reinforced portions of the wall and four (4) inches for wire mesh reinforced portions of the wall.

7.9.6.F Panels shall be uniform in finish, color, and appearance and shall be readily interchangeable.

7.9.6.G Panels shall include lifting eyes for lifting with additional reinforcing at lift points adequate to support the weight of the panels during construction operations.

7.9.7 Columns

7.9.7.A Columns shall be precast. Cast-in-place columns may be used if approved by the City Engineer. The preferred minimum column size is 18 inches square, and designers shall coordinate with precast suppliers to utilize standard dimensions

7.9.7.B Column minimum and maximum spacing shall be 12-feet and 15-feet, respectively, between columns measured from the center of the column, except for end panels or at angle points which may be shorter as dictated by the design and approved by the City.

7.9.7.C Reinforcing steel shall be minimum #4 deformed bars conforming to ASTM A615 grade 60. Tie bars and spirals shall be minimum #3 bars. The construction plans showing the reinforcing placement shall be signed and sealed by an Engineer.

7.9.7.D Columns shall be connected to foundations with either steel reinforcing bars or a W-shape wide flange steel beam post within a grouted hollow core of the pre-cast column to develop the full capacity of the column. Rebar shall extend into the full height of the column.

7.9.7.E Grout shall be a Portland cement non-shrink grout conforming to ASTM C1107.

7.9.8 Column Caps

7.9.8.A Column caps are required on all columns and shall include a lip that extends down over the column a minimum of one (1) inch to prevent lateral movement or affixed to the column by a method approved by the City.

7.9.8.B Column caps shall be compatible with the wall and uniform in size and appearance.

7.9.9 Approved Suppliers – Submit the supplier for the proposed screening wall to the City Engineer for approval.

7.10 Culverts, Headwalls, and Wingwalls

7.10.1 The design and construction of bridge-class culverts shall be provided in accordance with AASHTO's *LRFD Bridge Design Specifications* and supplemented using TxDOT's *Bridge Design Manual* and *Geotechnical Manual*. TxDOT standards may also be used as applicable.

7.10.2 Specifications for culvert construction shall be in accordance with TxDOT's *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*.

7.10.3 Refer to **Section 3** (Drainage Design Requirements – Roadway Cross-Culverts and Bridges) for applicable design requirements.

7.10.4 All headwalls and wingwalls shall be reinforced concrete. Wingwalls shall be

either straight (parallel), flared, or tapered. Approach and discharge aprons shall be provided for all culvert headwall designs.

7.11 Drop Structures

7.11.1 Refer to **Section 3** (Drainage Design Requirements) for hydraulic design requirements of drop structures.

7.11.2 The design of drop structures shall be based on the height of the drop, the flow depths upstream and downstream of the drop structure, and the flow rate. All drop structures shall be constructed of reinforced concrete, gabions, or other material approved by the City Engineer. To facilitate maintenance, drop structures shall be accessible to equipment normally used for maintenance, as approved by the City Engineer.

7.11.3 An apron shall be provided immediately upstream and downstream of a drop structure to protect against scour caused by the increasing velocities and turbulence at each drop structure. Apron dimensions shall be site specific and based on velocities. At a minimum, the upstream apron shall extend at least ten (10) feet upstream from the point where flow becomes supercritical and shall include a cutoff wall into the ground sufficient to protect the structure from scour and hydraulic uplift. The downstream apron shall extend a minimum of twenty (20) feet beyond the anticipated location of the jump and shall include a cutoff wall into the ground. The cutoff wall at each end shall extend below the calculated scour depth or sound bedrock in accordance with Hydraulic Engineering Center No. 18 (HEC-18) but shall be a minimum of three (3) feet below channel flowline.

SECTION 8 LANDSCAPE AND IRRIGATION DESIGN REQUIREMENTS

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SECTION 8 LANDSCAPE AND IRRIGATION DESIGN REQUIREMENTS

8.1 General

8.1.1 This section includes the minimum requirements and standards to address landscaping and irrigation requirements within the medians and right-of-way (ROW) of public roadways. Refer to the following ordinances and documents for additional standards:

- City of Taylor Standard Landscaping Specifications
- City of Taylor Standard Irrigation Specifications
- City of Taylor Standard Irrigation Details
- City of Taylor Code of Ordinances

8.1.2 Landscape construction plans shall be prepared and sealed by a Registered Landscape Architect (RLA), with a license to practice within the State of Texas.

8.1.3 Irrigation construction plans shall be prepared and sealed by a Licensed Irrigator (LI), with a license to practice within the State of Texas.

8.1.4 Approved Plantings – Refer to the list of approved plantings within medians and ROW, provided in Chapter 28 of the Code of Ordinances.

8.1.5 Approved Irrigation Products – Refer to the City of Taylor approved irrigation products and materials list.

8.2 Landscape Requirements Within the Public Right-of-Way

8.2.1 General – This section includes the general requirements for tree and shrub plantings located within the public ROW.

8.2.1.A Sight Distance and Visibility (includes the private realm)

8.2.1.A.i Compliance with these landscaping requirements is required to eliminate visibility obstructions and blind corners at intersections and median openings.

8.2.1.A.ii When two or more streets or driveways intersect, a sight visibility triangle is created in accordance with **Section 2** (Sight Visibility). Landscaping within the sight visibility triangle shall be designed to provide unobstructed cross-visibility between eighteen (18) inches and eight (8) feet in height above the pavement elevation. Maximum mature trunk diameter in this area shall be eight (8) inches. Shade trees typically are not permitted in this triangle unless they

are trimmed so that no limbs or foliage extend into the cross-visibility area, and the trees are not planted, aligned, or grouped so that the trunks of the trees provide a visibility obstruction. Refer to **Section 2** (Sight Visibility) for additional visibility requirements regarding landscaping and obstructions at intersections and within medians.

8.2.1.B Clearance and Setbacks

8.2.1.B.i Street trees shall generally be placed in the center of the tree zone. Shade trees planted within ten (10) feet of any paving, back of roadway curbs, and utilities shall include a thirty (30)-inch minimum depth rigid root barrier, as approved by the City.

8.2.1.B.ii Tree canopies and limbs shall be maintained to limit conflicts with pedestrian and vehicular traffic. A minimum seven (7)-foot vertical clearance shall be provided along all pedestrian pavement (sidewalks, trails and shared-use paths), and a minimum twelve (12)-foot vertical clearance shall be provided along all vehicular pavement plus a minimum of three (3) feet behind back of curb.

8.2.1.C Planting Requirements

8.2.1.C.i Refer to the Place Type Zoning District Details in the LDC for Landscape Zone requirements per Place Type.

8.2.1.C.ii Xeriscaping should be considered where appropriate to reduce or eliminate the need for irrigation. Additional benefits include lower maintenance and increased biodiversity through use of native plants.

8.2.1.C.iii Trees and planting areas shall not be installed on slopes steeper than 4H:1V. All trees and planting areas shall have soils prepared prior to seeding, planting, or installation.

8.2.1.C.iv Trees shall be planted within medians to provide the appearance of natural planting and grouping. Trees in medians shall not be planted within the sight visibility triangle at median openings.

8.2.1.C.v Shrubs shall be planted within medians and parkways to provide the appearance of natural planting and grouping. Shrubs shall be grouped in clusters and planted with triangular spacing. Where requirements differ, shrubs shall be planted according to the requirements of the Place

Type Zoning in the Land Development Code.

8.2.1.C.vi All median landscape areas designated as lawn planting areas shall receive solid sod. Sod shall be placed within the parkway along curbs and sidewalks for a minimum distance of four (4) feet. All sod shall be placed after properly preparing the ground as designated on the construction plans and in accordance with the City's Standard Specifications.

8.2.1.C.vii Areas not required to be sodded shall be treated (seeded, mulched, etc.) after properly preparing the ground as designated on the construction plans and in accordance with the City's Standard Details and Specifications.

8.2.1.C.viii All landscape areas shall be planted with materials in living and thriving condition. Placement of artificial or non-living plant materials is prohibited.

8.2.1.C.ix Plantings within medians shall meet the requirements of **Table 8- 1**.

Table 8-1. Median Landscaping Requirements

Median Width (feet)	Landscaping Requirements
< 6	Hardscape Components Only
6 to 10	Ornamental Trees, Shrubs, Turf Grass, Groundcover, Hardscape Components and Native Grasses/Wildflowers (Maximum 18-inch Height)
> 10	Trees, Shrubs, Turfgrass, Groundcover, and Native Grasses/Wildflowers (Maximum 24-inch Height)

8.2.1.C.x Plantings within the ROW shall be limited to the preferred plant list found in Appendix A of Chapter 28 of the Code of Ordinances. A variety of tree species shall be provided within the ROW. All City projects shall be designed with species variation and shall not exceed 25% of any single species.

8.2.1.C.xi Other native or well-adapted plants may be used if drawings are sealed by a registered Texas Landscape Architect and approved by the City. The invasive potential of non-native plants shall be considered when developing landscape plans.

8.3 Tree Preservation and Mitigation Protected and Heritage Trees

8.3.1 For Tree Preservation and Mitigation requirements in the public right of way see Chapter 28 of the Code of Ordinances.

8.3.2 Tree Determinations

8.3.2.A Protected or heritage tree designations are determined by measuring at the height of the tree at 24 inches above the ground or Diameter at Breast Height (DBH), for various tree species for purposes of applying the Standards of this section. Multi-trunk trees are to be measured with the largest trunk counting for full DBH inches plus 50 percent of the DBH sum of the additional trunks, if the tree is classified as protected or heritage.

8.3.2.B When the trunk branches or splits less than 4.5 feet from the ground, measure the smallest circumference below the lowest branch. If the tree has a branch or a bump at 4.5 feet, it is better to measure the diameter slightly below or above the branch/bump.

8.3.3 Protected Trees:

8.3.3.A Tree species listed in Chapter 28 Section 28-31 of the Code of Ordinances with a diameter of six (6) inches or more, measured 24 inches above natural grade.

8.3.3.B Protected trees must be preserved, protected, and integrated into the development of the property.

8.3.3.C The proposed removal of healthy protected trees must be submitted for approval to the Development Review Committee (DRC). See Chapter 28 Section 28-31.3 for Tree Removal Permit requirements.

8.3.3.D Protected Trees shall be mitigated according to Chapter 28 Section 28-31.4.a of the Code of Ordinances.

8.3.3.E Alternative compliance may be submitted to the DRC for approval or a fee-in-lieu shall be paid if the Site cannot meet the Standards of this section. See the City Fee Schedule for tree replacement cost.

8.3.4 Heritage Trees:

8.3.4.A Tree species listed in Chapter 28 Section 28-31 of the Code of Ordinances with a diameter of 24 inches or more, measured 24 inches

above natural grade.

8.3.4.B Heritage trees must be preserved, protected, and integrated into the development of the property.

8.3.4.C The proposed removal of healthy heritage trees must be submitted for approval to the DRC. See Chapter 28 Section 28-31.3 for Tree Removal Permit requirements.

8.3.4.D Granted removal of heritage trees shall be replaced by planting trees from the Preferred Plant List on the property equal to the total caliper inches removed, measured at twelve (12) inches in height from the ground with a minimum of 3 inches in caliper.

8.3.4.E Alternative compliance may be submitted to the DRC for approval or a fee in lieu shall be paid if the Site cannot meet the Standards of this section. See the City Fee Schedule for tree replacement cost.

8.3.5 Exempt Trees: Any protected or heritage trees determined to be diseased, overly mature, dying, or dead, by a certified arborist are exempted from these Standards.

8.4 Street Trees

8.4.1 General – This section includes the general requirements for street tree plantings located within the public ROW.

8.4.2 Intent - These requirements and standards are intended to optimize conditions for street trees in all Place Types categories, where street trees are required, as defined in the Land Development Code. They address these key items:

- Preferred plant list for approved types of plants and trees
- Soil volumes based on Place Type, street type, and soil availability
- Design methods to create soil volume where soil is not available. Design methods include soil cells to achieve soil volume, open soil areas, covered soil areas, and utility integration
- Evaluation based on the geographic nature of Taylor, these items shall be reviewed:
    - Height and Spread: Will the tree bump into anything such as power lines, awnings, tall trucks, etc. when mature?
    - Is the tree deciduous or coniferous? Will it lose its leaves in the winter?
    - Form and shape. A columnar tree will grow in less space. Round and V-Shaped species provide the most shade.

- Growth rate. How long will it take for the tree to reach its full height? Slow-growing species typically live longer than fast-growing species.
- Soil, sun, and moisture requirements.
- Hardiness zone indicates the temperature extremes in that a tree can grow.

8.4.3 Street Trees – Soil Volume

8.4.3.A As a standard, trees shall be placed a minimum of the following distances depending on tree size from paved surfaces unless otherwise approved by the City.

8.4.3.A.i Small Trees (<30'): Min 3'-0" from Paved Surfaces or centered in the tree zone.

8.4.3.A.ii Medium Trees (<50'): Min 6'-0" from Paved Surfaces

8.4.3.A.iii Large Trees (>50'): Min 10'-0" from Paved Surfaces

8.4.3.B A minimum of 1,000 cubic feet of soil volume shall be maintained for every individual large deciduous canopy street tree. Where this minimum soil volume is not attainable in the planting area, alternate methods may be used as mentioned below.

8.4.3.C Design Methods for Achieving Soil Volume: To achieve the required soil volume in areas where native soil is available, several methods can be used.

8.4.3.C.i Continuous Trenches: In areas where several trees are to be planted, the area shall be treated as one continuous trench, that connects several tree pits, to provide extra soil volume for root growth by allowing trees to share soil space, unless there are site constraints, and must be approved by the City.

8.4.3.C.ii Shallow Geocelluar Sandwich System:

- For uses with lightweight traffic, the sandwich system creates rootable soil volume for trees, underneath the hardscapes in urban areas. This system, also known as a suspended pavement system, consists of shallow, high-strength modular cells suitable for sub-base replacement that spread weight loads over a large area, preventing compaction of soil in the tree's root zone. At the same time, the open structure of the system prevents roots from causing any damage to the pavement and serves as a distribution and delivery

mechanism for air and water for the entire rootable soil volume. This system can be used underneath sidewalks, bike-lanes, light weight traffic, and parking lots without reducing the available above ground urban space.

- Soil Cells are plastic structures designed to be filled between the voids with soil and covered with pavement. Tree roots grow in the soil between the structural supports. There are many brands on the market. Install per manufacturer's instructions.
- Products recommended for use are: Stratavault ™ by Citygreen ©, Stratacell ™ by Citygreen ©, and Silva Cell by Deeproot.

8.4.3.C.iii Root Paths:

- Native soils under or at the back of sidewalk may count towards soil volume if there is an opportunity provided for the tree roots to pass under the paved area where they can grow at a normal rate and connect the tree to the adjacent open soil area. Root paths can make this connection.
- Root paths are narrow trenches, roughly four (4) inches wide by one (1) foot deep, installed in a compacted subgrade before the gravel base for pavement is added.
- A commercially available aeration mat material and quality topsoil can be added to the trench to support drainage. Root paths will be installed for new plantings during construction, at the time of subgrade preparation and before the paved surface is installed.
- Root paths extend radially from the tree pit and may connect to adjacent tree pits, and/or other nearby planting areas such as native soil, lawns, or civic space on the opposite side of the sidewalk from the street.
- Root paths may be most applicable in Place Types P4 and P5 areas where tree roots need to be directed around utilities and planting space is limited.

8.4.3.C.iv Creating Soil Volume in Place Types P5, and some designs for P4:

- For areas where little or no native soil is available,

current research shows that soil cells are the best method for creating soil volume under pavement.

- An open soil area is an unpaved area of soil surrounding a tree, that contains existing, new or amended soil. An open soil area may be planted or covered with mulch.
- Open soil areas have the benefit of reducing impervious surfaces and stormwater runoff.

8.4.3.C.v Root Barrier: Root barrier must be used in areas adjacent to pavements, sidewalks and buildings. Deflector barriers are acceptable. They must be 30" deep minimum and installed per manufacturer's instructions.

- In planter strips, Root Barrier shall be minimum 30" deep and ten (10) feet in length placed vertically on the concrete side of tree and centered on the trunk of the tree.
- Do not undermine the structural components of adjacent pavement or other feature when excavating for root barrier installation.
- All street trees with trunks closer than four (4) feet to paved surfaces shall be planted with root barrier between the root ball and paving.
- Street Trees indicated on **Table 8-2** and having a lateral root system shall have a root barrier whenever trunks are placed within ten (10) feet of any paved surface.
- Plantings within tree wells require root barriers along all sides of the tree well.

8.4.3.C.vi Tree Well Openings:

- There must be space between the curb and the tree trunk. The opening around the base of the tree must allow a transition zone at maturity. For a 4' x 6' tree well opening at the mature trunk to flare as the tree matures. The minimum opening allowed is 4' x 6'.
- A variety of pavements, both solid and permeable, can be used to create a covered tree space. Pavers, such as granite cobbles and permeable paver blocks, placed with gaps between the stones allow water to flow to

the soil below. Tree grates, if used, shall have removable center rings so the tree opening can expand as the tree grows.

- A long-term maintenance plan is required to address issues such as a trunk growing into a grate, watering, mulch and soil that needs replenishing, pavers that must be leveled, etc.

8.4.4 Coordination of Utilities with Soil Cells

8.4.4.A Using the Soil Cells in areas with utilities requires good coordination. The respective utility owners need to be involved in the conversation. They may have specific requirements that need to be addressed, such as vertical and/or horizontal separation, minimum depth/cover, or protective measures such as encapsulating their lines in granular bedding or insulating them to prevent freezing.

8.4.4.B If Soil Cells will be installed over utility lines, it is also important to discuss what level of loading or ground pressure the utility line can withstand.

8.4.4.C Soil Cells must have openings on all four sides and because there is a considerable amount of void space in each frame, running utilities through the Cell frames is a simple way to integrate utilities directly into the system. This approach can be applied to new or existing utilities.

8.4.4.D Each frame is its own separate component and can be maneuvered to leave the utility inside of the frame.

8.4.4.E Note: This method is not applicable to storm, sanitary sewer, or water mains.

8.5 Irrigation Requirements Within Public Right-of-Way

8.5.1 Irrigation system shall be designed and installed to minimize runoff onto paved surfaces. Overspray on streets and sidewalks is prohibited. All irrigation systems shall be installed in accordance with the current and published laws and regulations of the Texas Commission on Environmental Quality (TCEQ).

8.5.2 Irrigation shall be required as follows:

8.5.2.A All proposed landscape areas shall be irrigated, unless otherwise directed by the City.

8.5.2.B Turf areas within the public ROW are not required to be permanently irrigated but shall be at a minimum temporarily irrigated until fully established. However, there may be featured areas, plazas, gateways

or other specific areas that shall be landscaped with trees, shrubs, and groundcover in addition to turf. These landscaped areas shall have an irrigation system. The specific limits shall be determined by the City

8.5.2.C Medians shall be landscaped using the guidance of the standard requirements and have an irrigation system designed with different zones for plantings, tree bubblers, and turf to allow water conservation.

8.5.2.D Systems used may be either permanent or temporary, as long as they provide a constant moisture level at an amount and frequency adequate to sustain growth for at least the first two (2) years after planting. Any systems used must be maintained and kept operational at all times to provide for efficient water distribution.

8.5.2.E No irrigation is required for undisturbed natural areas or undisturbed existing trees.

8.5.2.F Irrigation systems shall be required to have a separate meter, minimum three (3) inches in size.

8.5.3 Irrigation systems in subdivisions shall be maintained and operated by the Home Owner's Association.

8.6 Preferred Plant Lists

The Preferred Street Tree List is found in **Table 8-2**. The Preferred Plant List for all other plantings is found in Chapter 28 of the Code of Ordinances. Other native or well adapted plants may be used if drawings are sealed by a registered Texas Landscape Architect and approved by the City. The invasive potential of non-native plants shall be considered when developing landscape plans.

Table 8-2. Preferred Street Tree List		
DECIDUOUS TREES	**HEIGHT**	**FEATURES (N = Native)**
Bigtooth Maple Acer grandidentatum	30'-40'	**N**, outstanding fall foliage, requires drainage
Cedar Elm Ulmus crassifolia	50'-60'	**N**, fall color, small leaves
Chinquapin Oak Quercus Muhlenbergii	40'-60'	**N**, tall, slender form, dark glossy lush foliage
Drake Elm Ulmus parvifolia 'Drake'	20'-30'	nearly evergreen, drought tolerant
Monterey Oak Quercus polymorpha	30'-40'	**N**, medium tree, dark to light gray bark
Texas Red Oak Quercus texana	30'-40'	**N**, white patches on bark, fall color
Texas Ash Fraxinus texensis	40'-50'	**N**, fast growing shade tree, exceptional fall color
Pecan Carya illinoinensis	60'-80'	**N,** 50—60 feet across, plant new improved varieties for better disease and insect resistance, large shade tree, regular spraying for good nut production

SECTION 9 DEFINITIONS AND ABBREVIATIONS

DEFINITIONS

The definitions within this section are intended to provide descriptions for terms used within this *City of Taylor Engineering Manual & Details* document. When words and terms are defined herein and in other City ordinances, they shall be read in harmony. If an irreconcilable conflict exists, the definition contained herein shall control in the construction and application of this document. Where no definition appears, the term should be interpreted according to their customary usage in the practice of municipal planning and engineering. The following City Staff will have the final determination of interpretation, as appropriate: the City Engineer, Assistant City Manager/Development Services Director, Director of Public Works, or Fire Marshal.

Words used in the present tense include the future tense. Words in the singular tense include the plural tense. The words "shall" and "must" are mandatory and not directory. The words "may" and "should" are permissive.

100-year – A flood event that statistically has a recurrence interval (return period) of 100 years and a one-percent probability of being equaled or exceeded in any given year. The event shall be based upon fully developed watershed conditions unless otherwise specified.

Alley – A vehicular drive located to the rear of lots providing access to service areas, parking, rear building access and utilities. Alleys should be considered in new neighborhoods.

Applicant – A person or entity who submits to the City an application for an approval required by the City Ordinance. To be qualified as an applicant, the person or entity must have sufficient legal authority or proprietary interests in the land to commence and maintain proceedings under the City Ordinance. The term shall be restricted to include only the property owner(s), or a duly authorized agent and representative of the property owner.

Average Daily Traffic (ADT) – A volume that represents the total two-way traffic on a roadway for a period of less than a year, divided by the total number of days it represents, and that includes both weekday and weekend traffic. ADT is typically adjusted for day of the week, seasonal variations, and/or vehicle classification.

Base Flood – The flood event having a one percent probability of being equaled or exceeded in any given year based on existing watershed conditions, FEMA guidelines, and SFHA as shown in the current effective FIS and FIRM and differs from design flood. The resulting water surface elevation from the base flood shall correspond with the FEMA BFE.

Best Management Practice (BMP) – Schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control runoff, spills or leaks, waste disposal, or drainage

from raw material storage areas. A BMP may be temporary to protect during construction, or permanent to protect from long-term impacts of the development.

Casing Pipe – An exterior protective pipe that encases a carrier pipe for various types of crossings, including roadways, creeks, and railroads. Also known as encasement pipe.

Civic Space – A public or semi-public place that provides opportunities to gather and celebrate together. Refer to the *Land Development Ordinance for requirements.*

Community Boulevard – The classification for a long-distance, moderate capacity street with limited access and separated multi-modal facilities.

Connection – The point at which a facility is provided service by the City water or wastewater system.

Corner Clip – Right-of-way dedication at intersection corners to provide sufficient room for intersection sight triangles/visibility, pedestrian access, utilities and other street facilities.

Crown – Depending on context, (a) the highest point on the inside of a closed conduit; or (b) the highest point of a roadway cross section.

Deceleration Lane – A speed-change lane, including tapered areas, which enables a vehicle exiting a roadway to leave the travel lanes and slow before making a turn.

Depression Storage – The collection and storage of rainfall in natural depressions or puddles after exceeding the infiltration capacity of the soil.

Design Flood – The flood event that is used as the basis for design to provide a stated degree of protection or other specified result. The design flood for the City of Taylor is the frequency flood specified in Section 3 of this manual based on fully developed watershed conditions. Also known as design storm and differs from base flood.

Design Speed – A selected speed used to determine the various geometric design features of the street or roadway.

Detention Basin – A dry basin or depression constructed to temporarily store stormwater runoff and discharge the water over time at a reduced rate than would have otherwise occurred.

Development Review Committee (DRC) – The Committee made up of City of Taylor staff including representatives from the Development Services, Planning, Building, Engineering, Public Works, Parks & Recreation, Fire Marshal, or others as determined by the City Manager.

Distribution System – A system of pipes that conveys potable water from a water treatment plant to consumers. Distribution systems include pump stations, ground and elevated storage tanks, potable water mains, potable water service lines, and all associated valves, fittings, and meters, but excludes potable water customer service lines.

Drainage System – Storm drainage facilities including streets, alleys, ditches, inlets, storm drain systems, creeks, floodplains, bridges, culverts, detention facilities, retention facilities, overflow routes, and any other facility through which or over which stormwater flows.

Emergency Overflow Path – A path stormwater will take when a drainage facility becomes clogged or does not function as designed.

Employment Center Plan – All areas designated as EC-Employment Center Place Type require an Employment Center Plan intended to allow for customization of development standards for sites that are intended to provide locations for job centers that may require deviations from the development standards of the other Place Type zoning districts.

Engineer – The Professional Engineer (P.E.) licensed in the State of Texas through the Texas Board of Professional Engineers (TPBE) who is responsible for the signing and sealing of construction plans, studies, calculations, and/or any other engineering documents in accordance with TBPE's requirements for professional practice.

Flood Control – The elimination or reduction of stormwater damage by means of land use restrictions, detention storage, erosion control, drainage systems, channel improvements, dikes and levees, bypass channels, and/or other engineering works. Also known as stormwater management.

Floodplain Administrator – The City Engineer or his/her designee appointed to administer and implement the provisions of the Drainage and Flood Hazard Area Regulations Ordinance and other appropriate sections of 44 CFR (Emergency Management and Assistance – NFIP Regulations) pertaining to floodplain management.

Floodplain Reclamation – The act of removing property from floodplain.

Floodplain, FEMA – an area of land subject to inundation by a 100-year frequency flood as determined using standard engineering practices and generally as shown on the FIRM (Flood Insurance Rate Map) of the City of Taylor.

Floodway, FEMA – The channel of a watercourse and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation by more than one foot. Also known as regulatory floodway.

Flowline – The floor, bottom, or lowest elevation of an open channel or closed conduit. Also known as invert.

Freeboard – The distance between the design flood elevation and the freeboard reference point specified in Section 3 of this manual.

IBC/ICC (International Building Code/International Code Council) – The Code or Codes adopted by the City of Taylor to ensure public health and safety of buildings, including all related Codes.

Improved Channel – A channel or area of concentrated drainage that has been cleared, excavated, realigned, lined, graded, stabilized, or created by equipment. Also known as improved creek and improved stream.

Infill Development – Infill development is the process of reconstructing within, or increasing the development intensity of an already developed area or neighborhood. Infill development shall be prioritized in the City.

Infill Neighborhood Plan – Infill Neighborhood Plans are for development projects over 2.5 acres (one or more standard city blocks) in an infill location.

Intersection – Any at-grade connection with a roadway. Includes the connection of two roadways or a driveway and a roadway.

Land Development Code (LDC) – The Land Development Code including amendments currently in affect and adopted by the City Council. The purpose of the LDC is to align the land development policies, including subdivision, zoning, and signs, to the *Envision Taylor Comprehensive Plan*.

Level of Service (LOS) – A measure of traffic flow and congestion. LOS is a qualitative measure describing operational conditions within a traffic stream, generally described in terms of speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Low-Impact Development (LID) – A different approach to conventional stormwater management that represents a significant advancement in the state of the art in stormwater management. LID enhances the ability to protect surface and ground water quality, maintain the integrity of aquatic living resources and ecosystems, and preserve the integrity of receiving streams.

Maximum Daily Demand – The total amount of water used during the day of heaviest consumption in any given year and the minimum rate which the high service pumps shall be capable of pumping. Water shall be supplied to the pumps at this rate.

Maximum Hourly Demand – The rate at which water is drawn from the entire system during the hour of maximum consumption on the day of maximum demand. This rate is generally of a short duration and is most economically provided for by the use of elevated storage in addition to water supplied to the system by pumps. The distribution system, including storage and pumping capacity, shall be able to satisfy this demand. Also known as peak flow.

Median – The portion of a divided roadway separating the opposing traffic flows. A median may be traversable or non-traversable.

Median Opening – An opening in a non-traversable median that allows accessing or crossing the opposing traffic lanes.

Minimum Hourly Demand – The rate at which water is drawn from the distribution system during the hour of minimum demand on the day of maximum demand. This rate is used in the water distribution analysis to determine the adequacies of the system to replenish elevated storage.

Natural Channel – An unlined and unimproved existing drainage channel that has not been graded, modified, cleared, or created by equipment. Also known as natural creek and natural stream.

Neighborhood Avenue – The classification for a moderate capacity, low speed street accommodating multiple travel modes and connecting neighborhood centers.

Neighborhood Plan – Neighborhood Plans are for development projects over 2.5 acres (one or more standard city blocks on previously undeveloped and/or un-platted land. A neighborhood design plan created through a series of maps defining the physical form, Place Type allocation, block types, and extent of settlement as required by the LDC.

Non-traversable Median – A physical barrier in a roadway or driveway that separates vehicular traffic traveling in opposite directions and prohibits movement of traffic across the median. Non-traversable medians include, but are not limited to, concrete barriers, raised concrete curbs and/or islands, and grass or swale medians.

Normal Water Surface Elevation – The typical observed water surface elevation in the absence of a flood event. Also referred to as ordinary high-water mark or normal pool level.

Open Channel – A channel in which water flows with a free surface. Includes creeks, lakes, flood control sags, or natural water ways.

Owner – Except for in the Technical Specifications, the term Owner means the person or entity financially responsible for developing a particular site or project. Also referred to as Developer. When used in Technical Specifications, the term Owner is the City of Taylor.

Parking Zone – That portion of the street pavement dedicated for parking and excluding the Vehicular Travel Zone.

Pedestrian Shed (Walkshed) – The area covered by a 5-minute walk (about 0.25 miles). The acreage of the pedestrian shed is determined by the development pattern.

Place Type or Place Type Zoning District – Place Types are the transition of places from natural to urban through the use of specific standards. Place Types replace conventional zoning districts with identifiable characteristics that represent the arrangements of places. They are intended to promote compatible patterns of land use and site development consistent with the City's adopted Comprehensive Plan. The DNA of the Taylor community inspired the Place Types zoning district standards. The City of Taylor is divided into ten (10) Place Types Zoning Districts as follows:

- P1: Nature
- P2: Rural
- P2C: Rural Commercial
- P2.5: Large Lot
- P3: Neighborhood
- P3M: Manufactured Housing
- P4: Mix
- P5: Urban Center
- EC: Employment Center
- CS: Civic Space (Park, Green, Square, Plaza, Pocket Park)

Post-development – The condition of the given site and drainage area after the anticipated development has taken place. Also known as proposed condition or post-project.

Pre-development – The existing condition of the given site and drainage area prior to development. Also known as existing condition or pre-project.

Private Realm – Privately owned areas in large part developed with buildings and associated improvements. It is more limited in its accessibility to the public.

Public Realm – The streets, parks, squares, green spaces, and other interconnected outdoor places that require no key to access them and are available without charge for everyone to use.

Record Drawings – The set of drawings for public improvements submitted to the City after construction is complete indicating the 'as-built' construction and certified by a Professional Engineer that all improvements comply with City Ordinance.

Regional Roadway – The classification for a high-speed, high-capacity roadway with the primary goal of efficiently moving vehicles. Regional roadways are typically operated and maintained by TxDOT or Williamson County.

Right-of-Way (ROW) – A strip of land dedicated by plat or separate document for use of public roadways and/or related facilities. Other facilities include, but are not limited to, utilities, drainage systems, and other transportation uses. Unless otherwise specified, the term right-of-way shall refer to a public right-of- way.

ROW Width – The shortest horizontal distance between the lines which delineate the limits of right-of- way.

Schools – A public, private, or parochial institution for the education of students in any grade between pre-kindergarten through twelfth grade or any combination thereof. A public school includes an open enrollment charter school as defined under the Texas Education Code. Includes elementary and secondary schools. Does not include trade, vocational, or commercial schools.

Shared-Use Path – A path designated to accommodate the movement of pedestrians, cyclists, and other micro-mobility modes. Shared-use path design criteria is according to the *AASHTO's Guide for the Development of Bicycle Facilities*, Chapter 5.

Sidewalk – A paved area behind the curb intended for the use of pedestrians.

Sidewalk Zone – Includes a sidewalk that is usually clear of all obstructions. The purpose is to allow for pedestrian movement in parallel with the street.

Sight Distance – The distance visible to the driver of a passenger vehicle measured along the normal travel path of a roadway from a designated location and to a specified height above the roadway when the view is unobstructed by traffic.

Sight Triangle – A triangular shaped area required on corner lots at the intersection of two streets including alleys that impact multi-modal traffic safety.

Standard of Care – The care and skill ordinarily used by members of the subject profession practicing under similar circumstances at the same time and in the same locality. No provision or requirement of this Manual shall relieve the Engineer of his/her responsibility to meet the standards of conduct and ethics established by the Texas Board of Professional Engineers (TPBE) or other applicable licensing agency.

Street Type – A particular type of street and its characteristics, including right-of-way width, number and dimensions of elements, and the intended purpose of the street.

Storage Length – The portion of a turn lane required to store the number of vehicles expected to

accumulate in the lane during an average peak period.

Street Types – Street types are determined during the Neighborhood Plan process and are based on the "Envision Taylor Comprehensive Plan" sections. Refer to the Land Development Ordinance for descriptions.

City of Taylor Street Types are the following:

- Rural Street
- Side Street (No On-Street Parking)
- Yield Street
- Neighborhood Street
- Neighborhood Avenue
- 2-Lane Community Boulevard
- 4-Lane Community Boulevard
- Residential or Commercial Alley

Note: Regional Roadways are under the jurisdiction of TxDOT or Williamson County and are not included in City of Taylor Street Types.

Texas Department of Transportation or TxDOT – The state agency authorized by the State Legislature, or its successor agency, to regulate matters related to highway and road construction. (Note: When any TxDOT standard, "Item" regulation, definition or other matter is referenced, utilized, or adopted herein, the City also specifically adopts by this note of reference, and shall automatically apply without further amendment to this Ordinance, the applicable successor TxDOT standard(s), "Item(s)", regulation(s), definition(s) or other matter(s), as amended by state law over time).

Time of Concentration (Tc) – The estimated time required for runoff to flow from the most hydraulically remote point of the drainage area to the point at which the flow is to be determined. Hydraulically remote refers to the travel path with the longest flow travel time, not necessarily the longest linear distance.

Traditional Neighborhood Development (TND) – Traditional Neighborhood Development is the historic development pattern of Taylor and includes small, walkable blocks; the continuation of the street grid; a variety of lot sizes; a range of housing types; well-defined public spaces; a definable neighborhood center; and amenities. TND is the primary and default development pattern in the City of Taylor.

Tree/Landscape Zone – That portion of the Right-of-Way behind the curb line or edge of pavement reserved for landscape and trees.

Trunk Line – The main line of a storm drain system. Includes lines extending from manhole to manhole or from manhole to outlet structure.

Utility Easement – An easement for the use of any City owned and/or maintained utility, including storm, water, sewer, fiber optic, etc. The utility and appurtenances may be located above or below ground.

Vehicular Parking Zone – That portion of the pavement utilized for parking. This may be striped

or unstriped and consists of parallel or diagonal parking conditions.

Vehicular Travel Zone – That portion of the pavement for automobile traffic and excluding the Parking Zone.

Watershed – The area contributing stormwater runoff to a stream or drainage system. Also known as drainage area, drainage basin, and catchment area.

ABBREVIATIONS

% – Percent

’ – Foot or feet

” – Inch or inches

AASHTO – American Association of State Highway and Transportation Officials

ACI – American Concrete Institute

ADA – Americans with Disabilities Act

ADAAG – Americans with Disabilities Act Accessibility Guidelines

ADT – Average Daily Traffic

ADU – Accessory Dwelling Unit

ASCE – American Society of Civil Engineers

ASTM – American Society for Testing and Materials

AWWA – American Water Works Association

b-b – Back of curb to back of curb distance

BFE – Base Flood Elevation

BMP – Best Management Practice

CAD, CADD – Computer-aided Design

CBR – California Bearing Ratio

CFR – Code of Federal Regulations

cfs – Cubic feet per second

CLD – Cluster Land Development

CLOMR – Conditional Letter of Map Revision

CLSM – Controlled low strength material

CO – Certificate of Occupancy

CSS – Cement stabilized sand

DIPRA – Ductile Iron Pipe Association

DRC – City of Taylor Development Review Committee

EGL – Energy grade line

EPA – Environmental Protection Agency

ET – Evapotranspiration

ETJ – Extraterritorial Jurisdiction

FDC – Fire Department Connection

FEMA – Federal Emergency Management Agency

f-f – Face of curb to face of curb distance

FFE – Finished Floor Elevation

FHWA – Federal Highway Administration

FIRM – Federal Insurance Rate Map

FIS – Flood Insurance Study

fps – Feet per second

gpcd – Gallons per capita per day

GPS – Global Positioning System

H – Horizontal or Height (depending on context)

HDPE – High Density Polyethylene

HEC-HMS – Hydrologic Engineering Center Hydrologic Modeling System

HEC-RAS – Hydrologic Engineering Center River Analysis System

HGL – Hydraulic grade line

IBC – International Building Code

I.D. – Inside Diameter

IFC – International Fire Code

ILSN – Illuminated Street Name Sign

in – Inch

iSWM – Integrated Stormwater Management

ITE – Institute of Transportation Engineers

lbs – Pound or pounds

LDC – Land Development Code of the City of Taylor, Texas as adopted or amended

LED – Light-emitting diode

LF – Linear Feet

LI – Licensed Irrigator

LID – Low Impact Development

LOG – Lip of Gutter

LOMR – Letter of Map Revision

LOS – Level of Service

LRFD – Load and Resistance Factor Design

MASH – Manual for Assessing Safety Hardware

Max – Maximum

MGD – Million gallons per day

Min – Minimum or Minutes (depending on context)

mph – Miles per hour

MPR – Matched Precipitation Rate

MS4 – Municipal Separate Storm Sewer System

MSE – Mechanically Stabilized Earth

msl – Mean seal level

NCHRP – National Cooperative Highway Research Program

NFIP – National Flood Insurance Program

NFPA – National Fire Protection Association

NOI – Notice of Intent

NOT – Notice of Termination

NPDES – National Pollution Discharge Elimination System

NRCS – National Resources Conservation Service (formerly SCS)

OSHA – Occupational Safety and Health Administration

OSSF – On-site sewage facility, septic system

P&Z Commission – Planning & Zonning Commission of Taylor Texas

P.E. – Professional Engineer, Licensed in the State of Texas

PBMP – Permanent Best Management Practice

PC – Point of curvature

pci – Pounds per cubic inch

PD – Planned Development

PI – Plasticity Index or Point of intersection (depending on context)

PMF – Probable Maximum Flood

ppm – Parts per million

PROWAG – Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way

psi – Pounds per square inch

PT – Point of tangency

PUD – Planned Unit Development

PVC – Polyvinyl Chloride

PVI – Point of Vertical Intersection

PVR – Potential Vertical Rise

QL – Quality Level

RCP – Reinforced concrete pipe

RLA – Registered Landscape Architect

ROW – Right-of-Way

SCADA – Supervisory Control and Data Acquisition

SD – Sight Distance

SFHA – Special Flood Hazard Area

SOP – Standard operating procedure

SPF – Standard Project Flood

SUE – Subsurface Utility Engineering

SWMP – Stormwater Management Program

SWPPP – Stormwater Pollution Prevention Plan

TAC – Texas Administrative Code

TAS – Texas Accessibility Standards

TBPE – Texas Board of Professional Engineers

Tc – Time of Concentration

TCEQ – Texas Commission on Environmental Quality

TCP – Traffic Control Plan

TDLR – Texas Department of Licensing and Regulation

TIA – Traffic Impact Analysis

TMP – Traffic Management Plan

TMUTCD – Texas Manual on Uniform Traffic Control Devices

TND – Traditional Neighborhood Development

TPDES – Texas Pollution Discharge Elimination System

TRB – Transportation Research Board

TxDOT – Texas Department of Transportation

U.L. – Underwriters Laboratories

U.S. – United States

USACE – United States Army Corps of Engineers

V – Vertical, Velocity, or Volume (depending on context)

VCD – Village Center Development

VIVDS – Video Imagery Vehicle Detection System

ZBA – Zoning Board of Adjustment

STANDARD CONSTRUCTION DETAILS

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GENERAL CONSTRUCTION NOTES

Revised July 2009

1. General Contractor shall call for all utility locates prior to any construction. Water & wastewater owned by the City of Taylor can be located by calling the Utility Department 512-352-3251. Allow three business days for utility locates by the City of Taylor.
2. All construction shall be in accordance with the latest City of Taylor ENGINEERING MANUAL.
3. The contractor shall give the City a minimum of 48 hours notice before beginning each phase of construction. The phases of construction are as follows.
4.

Prior to City acceptance of all improvements, all graded and disturbed areas are to be re-vegetated in accordance with the City of Austin Specification Item #604 unless another re-vegetation specification is specifically identified in the plans and/or bid form. When appropriate in the opinion of the Public Works Department, the City of Taylor may require native grasses to be used.

5. The Contractor shall provide the City of Taylor copies of all test results prior to acceptance of this project.
6. City, owner, engineer, contractor, representatives of all utility companies, and a representative from the testing lab shall attend pre-construction conference prior to start of construction. The contractor shall schedule the meeting with the City of Taylor Engineering Department 48 hours prior to this pre-construction meeting (512-352-3633).
7. Excess soil shall be removed at the contractor's expense. Notify the City of Taylor for approval if the disposal site is inside the City's jurisdictional boundaries.
8. Burning is prohibited. No blasting is allowed.
9. Any changes or revisions to these plans must first be submitted to the City by the design engineer for review and written approval.
10. The Contractor will reimburse the City for all cost incurred as a result of any damage to any City utility by the Contractor, regardless of these plans.
11. Prior to City acceptance of this project, an engineer's concurrence letter and 22"x34" record drawings (one Mylar copy, one blue-line or Xerox, and a digital copy on a CD ROM) shall be submitted to the Engineering Department. The Consulting Engineer and Contractor shall verify that all final revisions and changes have been made to the Mylar, blue-line, and digital copy prior to City submittal. Record construction drawings shall be provided to the City in digital format as AutoCad ". dwg" files, or ESRI ".shp" files on CD ROM. Line weights, line types and text size shall be such that if half-size prints (11" x 17") were produced, the plans would still be legible. All required digital files shall contain a minimum of two (2) control points referenced to the State Plane Grid Coordinate System - Texas Central Zone (4203), in US feet and shall include rotation information and scale factor required to reduce surface coordinates to grid coordinates in US feet. Half-size plans may also be required (see contract).
12. ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAINS WITH THE ENGINEER WHO PREPARED THEM. IN REVIEWING THESE PLANS, THE CITY OF TAYLOR MUST RELY ON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.
13. A traffic control plan, in accordance with the Texas Manual on Uniform Traffic Control Devices, shall be submitted to the City for review and approval prior to any partial or complete roadway closures.
14.

The contractor shall keep the site clean and maintained at all times, to the satisfaction of the City. This project will not be accepted until the site has been cleaned and re-vegetated to the satisfaction of the City.

15. Signs are not permitted in Public Utility Easements or Drainage Easements.
16. Inspect temporary erosion controls on a daily basis. Adjust the controls and/or remove any sediment buildup as necessary.
17. Contractor will be responsible for keeping roads and drives adjacent to and near the site free from soil, sediment and debris. Contractor will not remove soil, sediment or debris from any area or vehicle by means of water, only shoveling and sweeping will be allowed. Contractor will be responsible for dust control from the site.
18. The Contractor shall be responsible for all damage to private property, which occurred as a result of any portion of this project. Any damage to private property shall be repaired to equal or better condition. The Contractor shall coordinate all repairs to private property with the property owner. Contractor shall pay and/or settle with private property owner for all costs related to any damage. The City will not provide separate pay for repair of any damages, reimbursements or settlements.
19. Contractor shall provide the services of the City's approved SCADA consultant and controls instrumentation consultant. (When applicable to SCADA) the cost of the consultant and/or any equipment shall be subsidiary to the cost of the project (no separate pay) unless specifically identified on the bid form.
20. Contractor shall be responsible for any and all utility relocations. Including but not limited to: ONCOR Electric, ATMOS Gas, AT&T Telephone, United Stated Post Office, Time Warner Cable Television, City of Taylor Water & Wastewater. Contractor shall call 800-DIG-TESS and maintain all confirmation numbers.
21. If telephone service is required by this project, the contractor shall coordinate with phone company to provide/extend/re-locate the service. No separate pay will be provided and the City shall not be responsible for scheduling or coordinating with phone company.
22. Electric and/or telephone poles that need to be re-located for this project will be at the expense of the contractor. The City of Taylor will not provide separate pay for pole re-location and the cost of the relocation is considered subsidiary to the project bid. The contractor is responsible for identifying poles that may conflict with these plans and making arrangements to resolve the conflict with the appropriate utility. If electric, telephone, or CATV service will be interrupted as a result of the re-location; the City shall approve the maximum allowable time the service will be interrupted.
23. The contractor shall make applications to the electric company for electric service if new service is required. The City will assume the service upon acceptance of the project (if required). The contractor will pay for electric power until the meter is transferred to the City

of Taylor. Impact fees and Application Fees required by the electric company will be the responsibility of the Contractor unless specifically identified in the contract.

24. The contractor shall provide combination locks for all gates, hatches, vaults, and MCC boxes. Each lock shall be pre-approved and set to the City's requirements. (No separate pay)
25. All work on these plans shall be performed. Pay for work shown on these plans, which are not identified in the contract, shall be considered incidental to the items specifically identified for payment.
26. The contractor shall provide a competent and qualified superintendent to supervise all work. The superintendent shall be present during all construction activities.
27. Any survey monuments damaged or moved as a result of this project shall be replaced to equal or better condition. A Texas Registered Land Surveyor shall oversee the replacement and certify the replacement for its intended use. No separate pay will be provided.
28. Adequate drainage conditions, in accordance with the City Engineering Manual, shall be maintained at all times.
29. Any tree removed or damaged by this project, which is not specifically identified to be removed by the plans, will be replaced according to the requirements of the City of Taylor Code of Ordinances. No separate pay will be provided.
30. **The contractor shall uncover all utilities within the limits of construction and verify their location prior to any construction activities. The contractor shall notify the City and the Engineer, IN WRITING, of any conflicts prior to any other construction including but not limited to exact locations of conflicts with proposed or existing utilities. No additional pay unless specifically identified for payment in the contract documents. The contractor shall also make his own sub-surface investigation prior to bid.**
31. Only stainless steel casing spacers are allowed in encasement pipe(s).
32. No separate pay will be given to de-water trenches or other excavated areas.
33. Soil material imported for re-vegetation of disturbed areas shall be approved by the Public Works department prior to placement. A sample (submittal) is required.
34. The contractor shall perform pumping stations and/or lift station start-up independently: prior to requesting witness or acceptance by the City. When a final start-up fails to be complete and acceptable and when City personnel are present at start-up, each additional start-up will be charged to the contractor, as liquidated damages, $500.00 per additional meeting.
35. Shutout of any customers of the City's utility due to tie-ins shall only be scheduled for nighttime work unless approved by the Engineering Department. The City's field representative shall coordinate and inspect all nighttime shutouts and tie-ins. The contractor shall request shutouts two weeks in advance. Shutouts will only be allowed in the following

times and are subject to approval by the City: 10 PM - 6 AM; beginning on Tuesday, Wednesday or Thursday night(s). No extra time will be granted to the contract for unscheduled work in the time period allowed or due to requests outside the approved time periods.

Street Notes:

1. No trenching of compacted base will be allowed. A penalty and/or fine may be imposed to the general contractor if trenching of compacted base occurs without City approval, regardless of who performed the trenching.
2. All sidewalks shall comply with the Americans With Disabilities Act. The City of Taylor has NOT reviewed these plans for compliance with the Americans With Disabilities Act, or any other accessibility legislation, and does not warranty or approve these plans for any accessibility standards.
3. Street barricades shall be installed on all dead end streets and as necessary during construction to maintain job safety.
4. Any damage caused to existing pavement, curbs, sidewalks, ramps, etc., shall be repaired by the contractor to the satisfaction of the City prior to acceptance of this project.
5. Density testing of compacted subgrade material, first course and second course compacted base, shall be made at 500 foot intervals. Any failed tests will be re-tested at the expense of the contractor.
6. The contractor shall coordinate with the City's field representative 48 hours prior to scheduled density testing. The City's field representative shall witness all testing.
7. The CONTRACTOR shall schedule all testing with an approved materials testing laboratory and notify the City's field representative of the time and location of all tests.
8. Traffic control signs and pavement markings in accordance with the Texas Manual on Uniform Traffic Control Devices to be installed as directed by the City of Taylor prior to City acceptance of this project.
9. Slope of natural ground adjacent to the right-of-way shall not exceed 4:1. If a 4:1 slope is not possible, a retaining wall or some other form of slope protection approved by the City shall be placed in a location acceptable to the City.
10. The City, engineer, contractor, and a representative from the testing lab shall attend a pre-paving conference prior to the start of paving. The contractor shall give the City's field representative 48 hours notice prior to this meeting.
11. Failed tests shall be the financial responsibility of the contractor.

Wastewater Notes:

1.

The contractor, with City approval, shall raise manhole frames and covers and water valve boxes to finished pavement grade at the contractor's expense. All utility adjustments shall be completed prior to final paving construction.

2. The location of any existing utility lines shown on these plans may not be accurate. Any damage to existing utility lines, both known and unknown, shall be repaired at the expense of the contractor. The contractor shall locate all utilities prior to bidding the project.
3. All iron pipe and fittings shall be wrapped with at least 8-mil polyethylene wrap, according to the COA Specification.
4. All water mains, wastewater mains and service lines shall meet City of Taylor minimum cover specifications. All streets are to be cut to subgrade prior to installation of water mains.
5. All wastewater lines shall be TV Video taped according to COA 510. The contractor shall supply two copies to the City's Field Representative.
6. Gasketed PVC sewer main fittings shall be used to connect SDR-35 PVC to SDR-26 PVC pressure pipe or C-900.
7. SDR-35 WW is not allowed.
8. All sanitary sewers, excluding service lines, shall be mandrel tested per TCEQ criteria. A mandrel test will not be performed until backfill has been in place for a minimum of 30 days.
9. All sanitary sewers, including service lines, shall be air tested per City of Austin Standard Specifications.
10. Density testing of compacted backfill shall be made at a rate of one test per two foot lifts per 500 feet of installed pipe, unless specified otherwise by the City.
11. City to be given 48 hours notice prior to all testing of water and wastewater lines. City inspection is required for all testing of water and wastewater lines.
12. Water or wastewater line crossings shall be installed per TCEQ requirements.
13. All manhole lids outside the pavement shall be bolted.
14. Contractor to notify City of Taylor 48 hours prior to connecting to existing utilities. Inspection of connections to existing utilities is required.
15. All pipe bedding material shall conform to City of Austin Standard Specifications.
16. Unless otherwise specified by the Engineer all concrete is to be Class "A" (5 sack, 3000 psi ~ 28-days), and all reinforcing steel to be ASTM A615 60.
17. Piping in and around lift station valve vaults will be painted and/or coated to the City's specifications.
18. MCC's, junction boxes or any housing for electrical components shall be NEMA 4X stainless steel. Painted metal or any other type of box will not be accepted unless specifically identified in the plans.

Water Notes:

1. The top of valve stems shall be at least 18", and no more than 36", below finished grade. Valve stem risers shall be welded on each end to the City's satisfaction.
2. Fire hydrant leads to be ductile iron, Class 350, and installed per City of Taylor standard specifications and detail.
3. The contractor shall provide cuts for all water lines and FH bury lines in accordance with the contract.
4. Approved 5¼" fire hydrants: American Flow Control, B84B Mueller Company, Super Centurion 250, Clow Medallion Hydrant.
5. *All fire hydrants must meet City of Taylor thread specifications (National Thread).
6. *Blue reflector markers shall be located on the centerline of the pavement across from all fire hydrants. Pavement markers at intersections shall be four-sided.
7. All water lines, including service lines, shall be pressure and leak tested per City of Austin Standard Specifications and witnessed by the City of Taylor representative. All failed tests shall be the fiscal responsibility of the contractor, and the contractor may be required to re-test lines if the testing is not witnessed by the City. Contractor must notify the City of Taylor 48 hours prior to any testing.
8. All water lines shall be sterilized and bacteriologically tested in accordance with City of Austin Standards. The contractor is responsible for sterilization and the City of Taylor is responsible for submitting bacteriological samples to the State unless otherwise approved by the Engineering department.
9. All water valve risers not in pavement shall be set in concrete in accordance with the City's specifications and details. The standard detail is available on the City's web site.
10. Density testing of compacted backfill shall be made at a rate of one test per two foot lifts per 500 feet of installed pipe unless otherwise approved by the Public Works department.
11. Contractor to obtain a water meter from the City of Taylor for any water that may be required during construction. (512-352-3251)
12. All water pipe and appurtenances larger than 12" shall have a maximum operating pressure greater than 250 psi unless specifically identified on the bid form.
13. Manhole frames and covers and water valve boxes shall be raised to finished pavement grade at the contractor's expense with City inspection. All utility adjustments shall be completed prior to final paving construction.
14. The location of any existing utility lines shown on these plans is the best available and may not be totally accurate. Any damage to existing utility lines, both known and unknown shall be repaired at the expense of the contractor. The Engineer and/or the City make no guarantee or

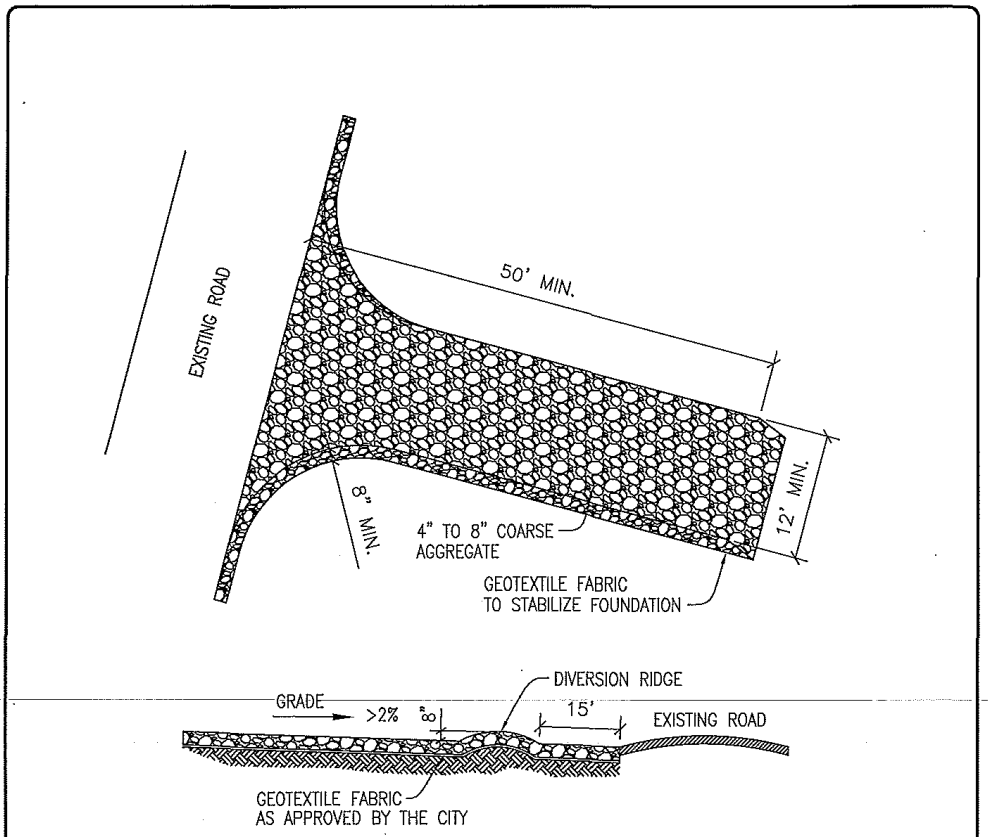
warranty to the accuracy of these plans.

15. All iron pipe and fittings shall be wrapped with at least 8-mil polyethylene wrap in accordance with the COA specification.
16. All water mains, wastewater mains and service lines shall meet City of Austin Specifications minimum cover requirements. All streets are to be cut to subgrade prior to installation of water mains.
17. City to be given 48 hours notice prior to all testing of water and wastewater lines. City inspection is required for all testing of water and wastewater lines.
18. All water valves over 24" in size shall have a by-pass line and valve installed. By-pass valves and lines are subsidiary to the cost of the valve unless specifically identified on the bid form.
19. Contractor to notify City of Taylor 48 hours prior to connecting to existing utilities. Inspection is required.
20. All pipe bedding material shall conform to City of Taylor Standard Details.
21. Tracer tape shall be installed on all water and wastewater mains in accordance with City of Austin Standards regardless of the type of pipe or depth of pipe installed.
22. Unless otherwise specified by the Engineer all concrete is to be Class "A" (5 sack, 3000 psi ~ 28-days), and all reinforcing steel to be ASTM A615 60.
23. The City considers protection of its water system paramount to construction activities. City personnel will operate, or authorize the contractor to operate, all water valves that will pass through the City's potable water. The contractor may not operate any water valve, existing or proposed, that will allow water from the City's water system to flow to a proposed or existing water system without the express consent of the City. Notify the City two business days in advance of any request to operate a water valve. The general contractor may be fined $500 or more, including additional theft of water fines, if a water valve is operated in an unauthorized manner, regardless of who operated the valve.

Storm Sewer Notes:

1. The contractor with City inspection shall raise manhole frames and covers and water valve boxes to finished pavement grade. All utility adjustments shall be completed prior to final paving construction. The contractor will backfill around manholes and junction boxes with Class A concrete.
2. All manhole lids shall be 32" or larger, unless expressly approved in writing by the Engineering Department. All lids outside the pavement will be bolted.
3. The location of any existing utility lines shown on these plans is the best available and may not be totally accurate. Any damage to existing utility lines, both known and unknown, shall be repaired at the expense of the contractor.

4. Contractor to notify City of Taylor 48 hours prior to connecting to existing utilities.
5. All pipe bedding material shall conform to City of Taylor Standard Details.
6. Unless otherwise specified by the Engineer all concrete is to be Class "A" (5 sack, 3000 psi ~ 28-days), and all reinforcing steel to be ASTM A615 60.
7. Contractor to install and maintain geo-textile fabric barrier (inlet protection) around storm sewer leads and inlets to prevent silt and other material from entering the storm sewer collection system.



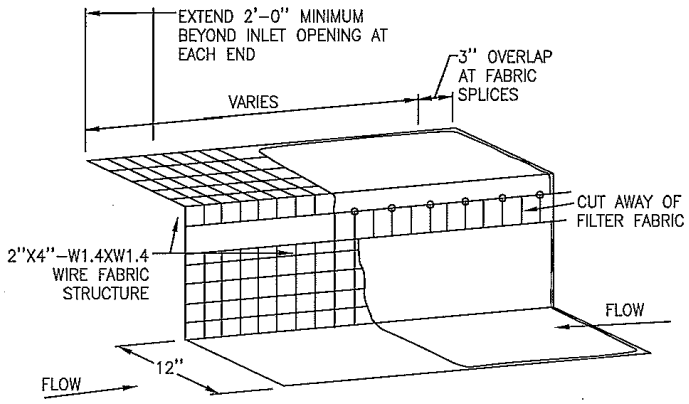
INSTALLATION:

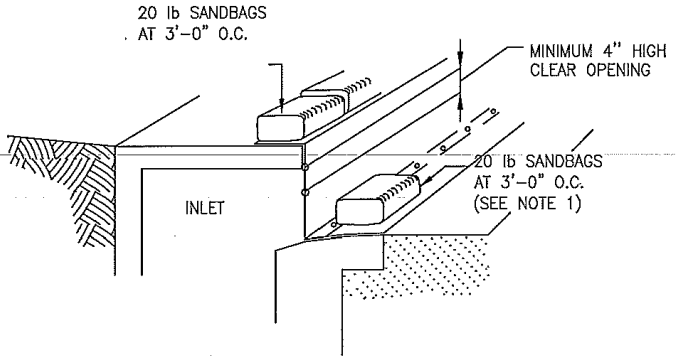
- CLEAR THE AREA OF DEBRIS, ROCKS OR PLANTS THAT WILL INTERFERE WITH INSTALLATION.
- GRADE THE AREA FOR THE ENTRANCE TO FLOW BACK ON TO THE CONSTRUCTION SITE. RUNOFF FROM THE STABILIZED CONSTRUCTION ENTRANCE ONTO A PUBLIC STREET WILL NOT BE ACCEPTED.
- PLACE GEOTEXTILE FABRIC AS APPROVED BY THE CITY.
- PLACE ROCK AS APPROVED BY THE CITY.

INSPECTIONS AND MAINTENANCE GUIDELINES:

- THE ENTRANCE SHOULD BE MAINTAINED IN A CONDITION, WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
- ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ON TO PUBLIC RIGHTS-OF-WAY SHOULD BE REMOVED IMMEDIATELY BY CONTRACTOR.
- WHEN NECESSARY, WHEELS SHOULD BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY.
- WHEN WASHING IS REQUIRED, IT SHOULD BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
- ALL SEDIMENT SHOULD BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH OR WATER COURSE BY USING APPROVED METHODS.

CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS	DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD EN 001
			STABILIZED CONSTRUCTION ENTRANCE	

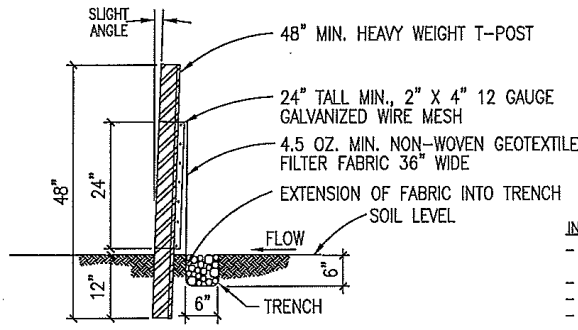




NOTES:

1. WHERE MINIMUM CLEARANCES CAUSE TRAFFIC TO DRIVE IN THE GUTTER, THE CONTRACTOR MAY SUBSITITUTE A 1" X 4" BOARD SECURED WITH CONCRETE NAILS 3' O.C. NAILED INTO THE GUTTER IN LIEU OF SANDBAGS TO HOLD THE FILTER DIKE IN PLACE. UPON REMOVAL, CLEAN ANY DIRT/DEBRIS FROM NAILING LOCATIONS, APPLY CHEMICAL SANDING AGENT AND APPLY NON-SHRINK GROUT FLUSH WITH SURFACE OF GUTTER.
2. A SECTION OF FILTER FABRIC SHALL BE REMOVED AS SHOWN ON THIS DETAIL OR AS DIRECTED BY THE ENGINEER OR DESIGNATED REPRESENTATIVE. FABRIC MUST BE SECURED TO WIRE BACKING WITH CLIPS OR HOG RINGS AT THIS LOCATION.
3. DAILY INSPECTION SHALL BE MADE BY THE CONTRACTOR AND SILT ACCUMULATION MUST BE REMOVED WHEN DEPTH REACHES 2".
4. CONTRACTOR SHALL MONITOR THE PERFORMANCE OF INLET PROTECTION DURING EACH RAINFALL EVENT AND IMMEDIATELY REMOVE THE INLET PROTECTIONS IF THE STORM WATER BEGINS TO OVERTOP THE CURB.
5. INLET PROTECTIONS SHALL BE REMOVED AS SOON AS THE SOURCE OF SEDIMENT IS STABILIZED.

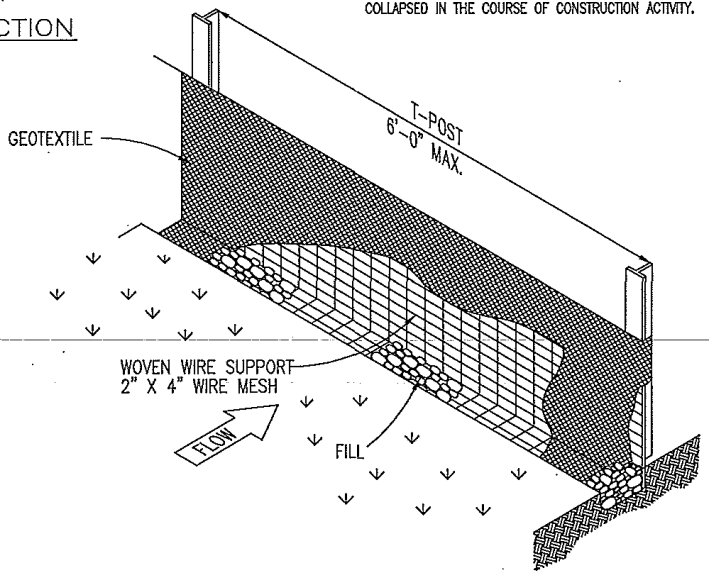
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	FILTER DIKE CURB INLET PROTECTION	EN 002



CROSS SECTION

INSPECTION AND MAINTENANCE GUIDELINES:

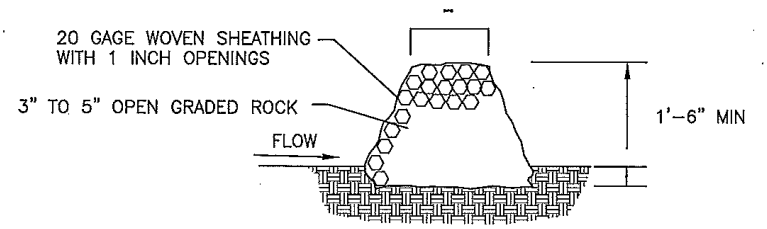
- INSPECT ALL FENCING WEEKLY, AND AFTER ANY RAINFALL EVENT.
- REMOVE SEDIMENT WHEN BUILDUP REACHES 6 INCHES.
- REPLACE ANY TORN FABRIC.
- REPLACE OR REPAIR ANY SECTIONS CRUSHED OR COLLAPSED IN THE COURSE OF CONSTRUCTION ACTIVITY.

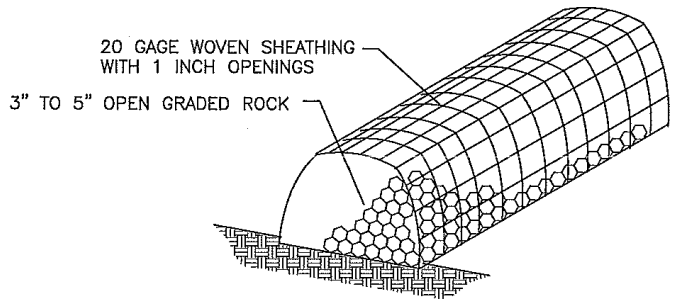


INSTALLATION:

- 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 6" DEEP X 6" 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 (NOT LARGER THAN 2").
- GEOTEXTILE SPLICES SHOULD BE A MINIMUM OF 18" WIDE ATTACHED IN AT LEAST 6 PLACES. SPLICES IN CONCENTRATED FLOW AREAS WILL NOT BE ACCEPTED.
- SILT FENCE SHALL BE REMOVED WHEN THE SITE IS COMPLETELY STABILIZED SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	SILT FENCE DETAIL	EN 003





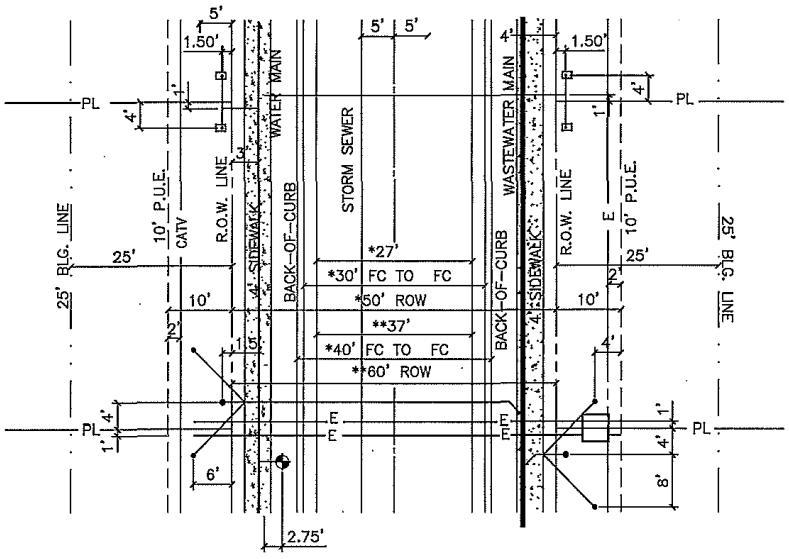
INSTALLATION:

- LAYOUT OF ROCK BERM FOLLOWING AS CLOSELY AS POSSIBLE TO THE CONTOUR.
- CLEAR THE AREA 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.
- THE ENDS OF THE BERM SHOULD BE TIED INTO EXISTING UPSLOPE GRADE AND THE BERM SHOULD BE BURIED IN A TRENCH APPROX. 4 INCHES DEEP TO PREVENT FAILURE OF THE CONTROL.
- THE ROCK BERM SHOULD BE LEFT IN PLACE UNTIL ALL UPSTREAM AREAS ARE STABILIZED AND ACCUMULATED SILT IS REMOVED.

INSPECTIONS AND MAINTENANCE GUIDELINES:

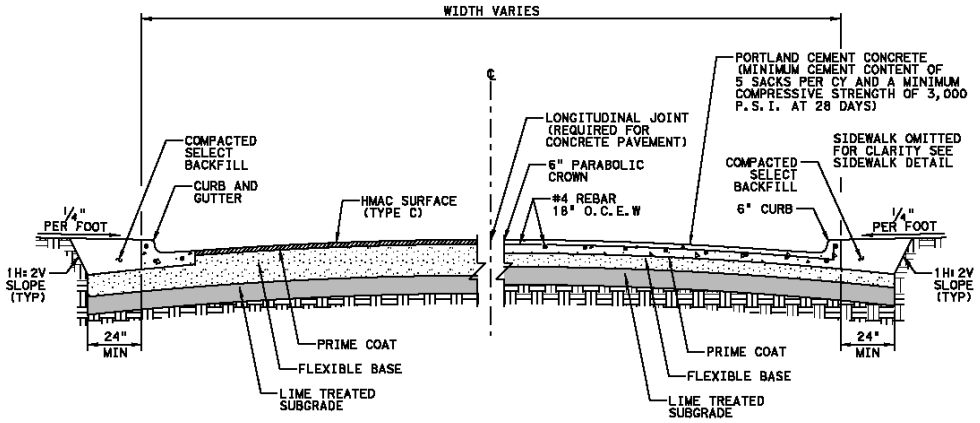
- INSPECTION SHOULD BE MADE WEEKLY AND AFTER EACH RAINFALL EVENT BY THE RESPONSIBLE PARTY. FOR INSTALLATION IN STREAM BEDS, ADDITIONAL DAILY INSPECTIONS SHOULD BE MADE.
- REMOVE SEDIMENT AND OTHER DEBRIS WHEN BUILDUP REACHES 6 INCHES AND DISPOSE OF THE ACCUMULATED SILT IN AN APPROVED MANNER.
- REPAIR ANY LOOSE WIRE SHEATHING.
- THE BERM SHOULD BE RESHAPED AS NEEDED DURING INSPECTION.
- THE BERM SHOULD BE REPLACED WHEN THE STRUCTURE CEASES TO FUNCTION AS INTENDED DUE TO SILT ACCUMULATION AMONG THE ROCKS, WASHOUT, CONSTRUCTION TRAFFIC DAMAGE, ETC.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	ROCK BERM DETAIL	EN 004



MINIMUM COVER BELOW FINISH-GRADE	
ELECTRIC PRIMARY	36"
ELECTRIC SECONDARY	24"
WATER	48"
WASTEWATER	48"
STORM SEWER	36"
GAS	24"
TELECOMMUNICATIONS	24"

CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS TYPIAL STREET LAYOUT AND UTILITY ASSIGNMENTS	STANDARD PV 001



ASPHALT PAVING

LOCAL STREET ASPHALT PAVEMENT SECTION:

TWO (2") INCHES TYPE "C" HMAC

FOURTEEN (14") INCHES MINIMUM THICKNESS FLEXIBLE BASE (LIFT THICKNESS 4" TO 6")

EIGHT (8") INCHES MINIMUM THICKNESS LIME TREATED SUBGRADE

COLLECTOR STREET ASPHALT PAVEMENT SECTION:

THREE (3") INCHES TYPE "C" HMAC

EIGHTEEN (18") INCHES MINIMUM THICKNESS FLEXIBLE BASE (LIFT THICKNESS 4" TO 6")

EIGHT (8") INCHES MINIMUM THICKNESS LIME TREATED SUBGRADE

CONCRETE PAVING

LOCAL STREET ASPHALT PAVEMENT SECTION:

SIX (6") INCHES TYPE "A" CONCRETE

SIX (6") INCHES MINIMUM THICKNESS FLEXIBLE BASE

EIGHT (8") INCHES MINIMUM THICKNESS LIME TREATED SUBGRADE

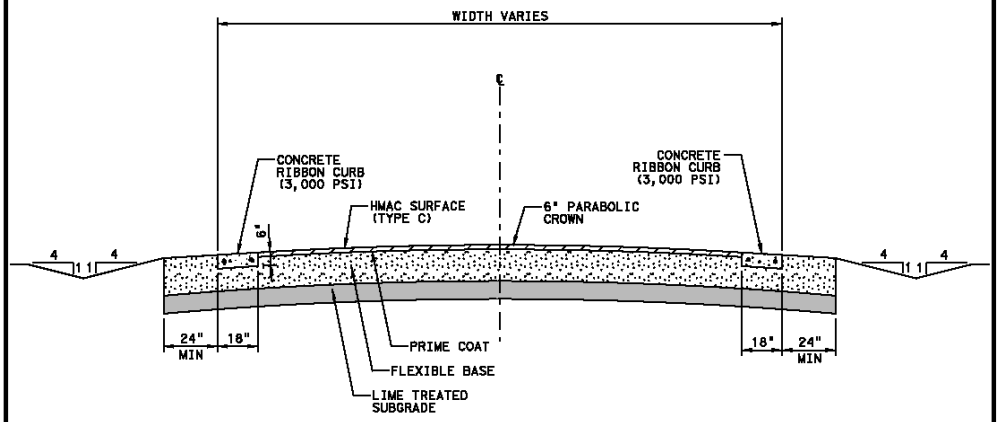
COLLECTOR STREET ASPHALT PAVEMENT SECTION:

SEVEN (7") INCHES TYPE "A" CONCRETE

EIGHT (8") INCHES MINIMUM THICKNESS FLEXIBLE BASE (LIFT THICKNESS 4" TO 6")

EIGHT (8") INCHES MINIMUM THICKNESS LIME TREATED SUBGRADE

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
Taylor Texas		DECEMBER 2020	**TYPICAL STREET SECTION DETAIL W/ STANDARD CURB & GUTTER**	**PV002**



ASPHALT PAVEMENT SECTION

LOCAL STREET ASPHALT PAVEMENT SECTION:

TWO (2") INCHES TYPE "C" HMAC

FOURTEEN (14") INCHES MINIMUM THICKNESS FLEXIBLE BASE (LIFT THICKNESS 4" TO 6")

EIGHT (8") INCHES MINIMUM THICKNESS LIME TREATED SUBGRADE

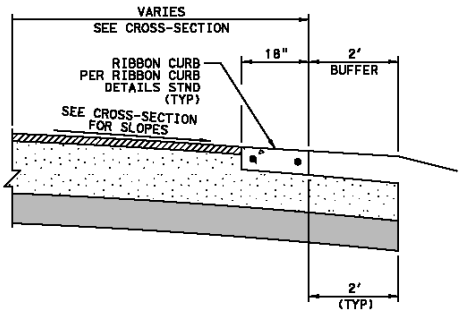
COLLECTOR STREET ASPHALT PAVEMENT SECTION:

THREE (3") INCHES TYPE "C" HMAC

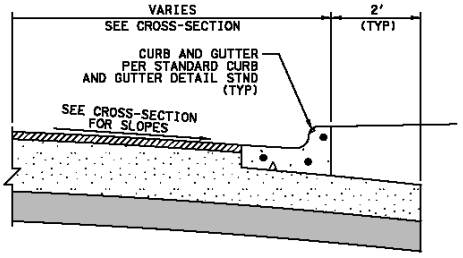
EIGHTEEN (18") INCHES MINIMUM THICKNESS FLEXIBLE BASE (LIFT THICKNESS 4" TO 6")

EIGHT (8") INCHES MINIMUM THICKNESS LIME TREATED SUBGRADE

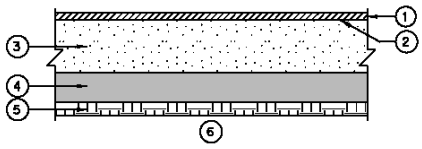
	APPROVED BY:	DATE: DECEMBER 2020	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
			TYPICAL STREET SECTION DETAIL W/ RIBBON CURB	**PV003**



TYPICAL STREET SECTION WITH RIBBON CURB



TYPICAL STREET SECTION WITH STANDARD CURB AND GUTTER

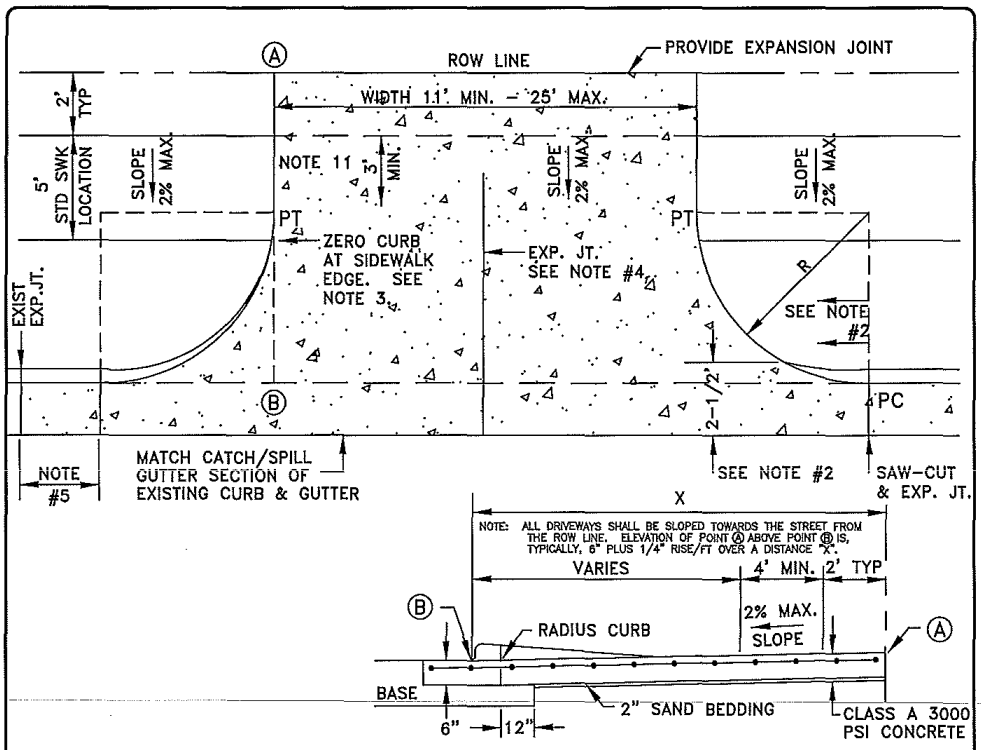


HMAC PAVEMENT SECTION

NOTES:

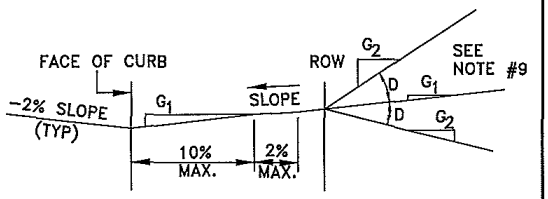
1. TYPE "C" HOT MIX ASPHALTIC CONCRETE ACCORDING TO TxDOT SPECIFICATION FOR "DENSE-GRADED HOT-MIX ASPHALT".
2. MC-30 PRIME COAT ACCORDING TO TxDOT SPECIFICATION "PRIME COAT" WILL BE APPLIED AT A RATE OF 0.25 GALLON/SQUARE YARD. (RATE WILL BE ADJUSTED IN THE FIELD TO PROVIDE UNIFORM COVERAGE WITHOUT RUNOFF AS APPROVED BY THE ENGINEER).
3. FLEXIBLE BASE ACCORDING TO TxDOT SPECIFICATION FOR "FLEXIBLE BASE". LIFT THICKNESS TO BE 4" TO 6", AND EACH LIFT COMPACTED TO 100% FOR THE MAXIMUM DRY DENSITY. USE TYPE A, GRADE 5 UNLESS OTHERWISE SHOWN. EXTEND BASE TWO FEET (24") INCHES PAST THE BACK OF CURB LINE.
4. LIME TREATED SUBGRADE ACCORDING TO TxDOT SPECIFICATION "LIME TREATMENT (ROAD MIXED)". APPLY LIME AT THE RECOMMENDED PERCENTAGE STATED IN THE APPROVED PAVEMENT DESIGN REPORT. ADJUST LIME APPLICATION AS DIRECTED BY THE CITY DURING CONSTRUCTION.
5. FILL SECTIONS WILL BE FREE OF VEGETATION OR ORGANICS. PROVIDE THE REQUIRED DENSITY AND MOISTURE CONTROL FOR THE SUBGRADE BASED ON THE PLASTICITY CHARACTERISTICS OF THE APPROVED SUBGRADE MATERIAL. SPRINKLE THE SUBGRADE MATERIAL AND COMPACT TO THE EXTENT NECESSARY TO PROVIDE THE DENSITY SPECIFIED IN THE ENGINEERING MANUAL FOR THE SPECIFIC STREET CLASSIFICATION USED.
6. EXISTING UNDISTURBED SOIL.

	APPROVED BY:	DATE: DECEMBER 2020	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
Taylor Texas			**PAVEMENT SECTIONS**	**PV004**



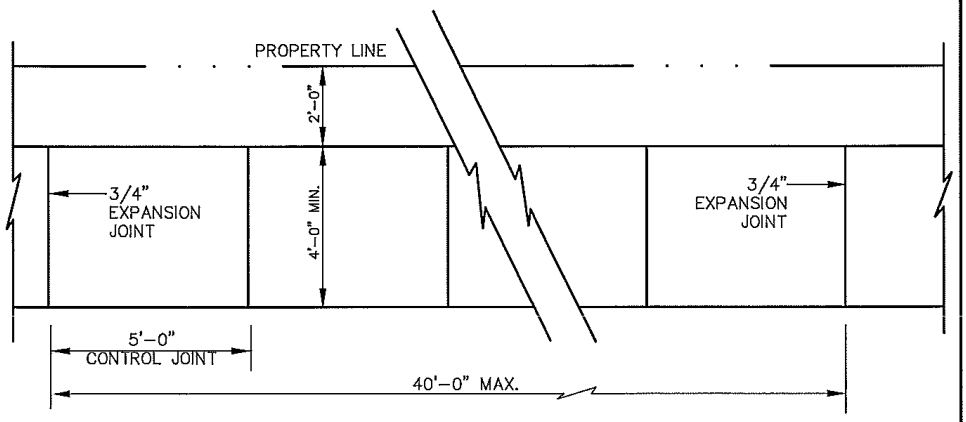
NOTES:

1. ALL DRIVEWAYS SHALL HAVE RADIUS ENDS. MINIMUM 5' RADIUS.
2. THE DRIVEWAY EDGE SHALL BE SMOOTHLY TRANSITIONED INTO THE SIDEWALK BEGINNING AT THE RADIUS PC LINE.
3. "ZERO" CURB AT PT OR SIDEWALK EDGE, WHICHEVER IS ENCOUNTERED FIRST.

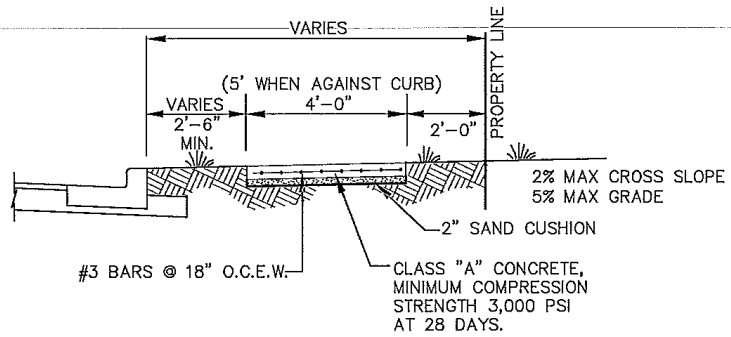


4. PLACE AN EXPANSION JOINT DOWN THE CENTER OF DRIVEWAY IF WIDTH IS GREATER THAN 15'.
5. IF DIMENSION IS LESS THAN FIVE FEET, REMOVE CURB & GUTTER TO EXISTING EXPANSION JOINT AND POUR MONOLITHICALLY WITH DRIVEWAY.
6. IF THE BASE IS OVER-EXCAVATED WHERE THE CURB & GUTTER WAS REMOVED, BACKFILL WITH CONCRETE MONOLITHICALLY WITH THE DRIVEWAY.
7. TYPE II DRIVEWAYS ARE TO BE LOCATED NO CLOSER TO THE CORNER OF INTERSECTING RIGHTS OF WAY THAN 60 PERCENT OF PARCEL FRONTAGE OR 100 FEET; WHICHEVER IS LESS.
8. DRIVEWAYS SHALL NOT BE CONSTRUCTED WITHIN THE CURB RETURN OF A STREET INTERSECTION.
9. WHILE THE PROPERTY OWNER REMAINS RESPONSIBLE FOR GRADE BREAKS WITHIN PRIVATE PROPERTY, THE FIRE DEPARTMENT SHOULD BE CONSULTED WHERE THE DRIVEWAY IS ESSENTIAL TO EMERGENCY VEHICLE ACCESS AND "G2" IS GREATER THAN 15%. "G1" PLUS "D" SHOULD NOT EXCEED 15%.
10. DRIVEWAYS SHALL BE 6 INCHES THICK WITH #4 REBAR @ 18" O.C.E.W.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	DRIVEWAY DETAIL	PV 005

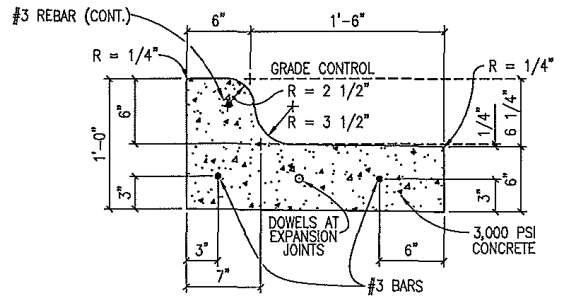


PLAN

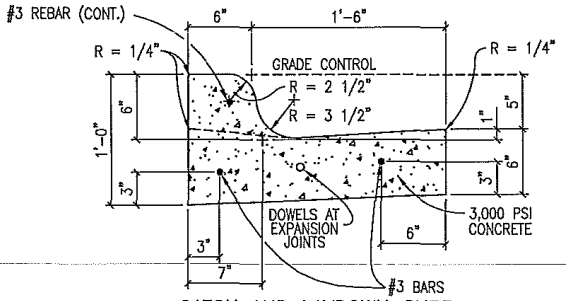


SECTION

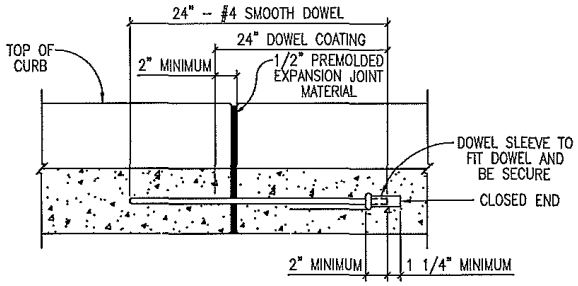
CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD PV 006
		SIDEWALK DETAILS	



SPILL CURB



CATCH AND LAYDOWN CURB

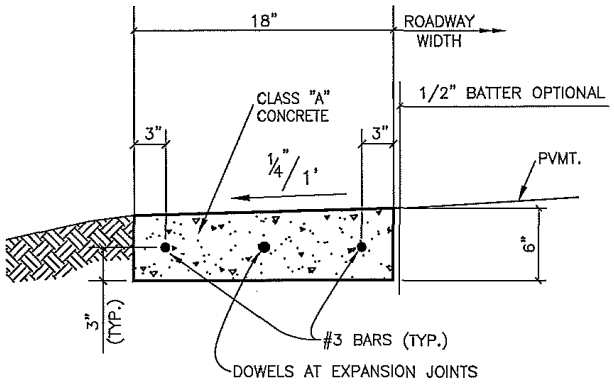


CURB DOWEL DETAIL

NOTES:

1. EXPANSION JOINT INTERVALS NOT TO EXCEED 40'-0".
2. 4" MINIMUM FLEX BASE UNDER CURB AND GUTTER.

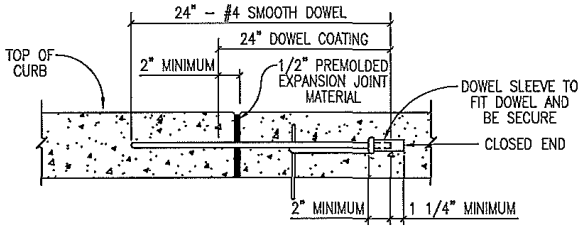
CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD PV 007
		STANDARD CURB AND GUTTER DETAIL	



NOTES:

1. ALL WORK AND MATERIAL SHALL CONFORM TO ASTM A615, A615M, C309, AND D1752. BROOM FINISH EXPOSED SURFACE.
2. CONTRACTION JOINT SPACING 10' MAX.
3. EXPANSION JOINTS AS PER STD. ASTM D-1752.

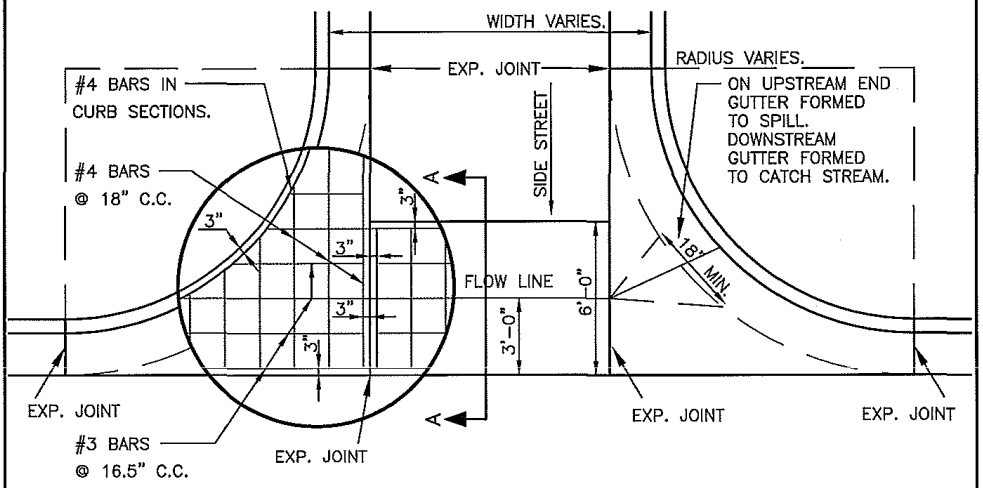
RIBBON CURB



NOTE:
EXPANSION JOINT INTERVALS NOT TO EXCEED 40'-0".

CURB DOWEL DETAIL

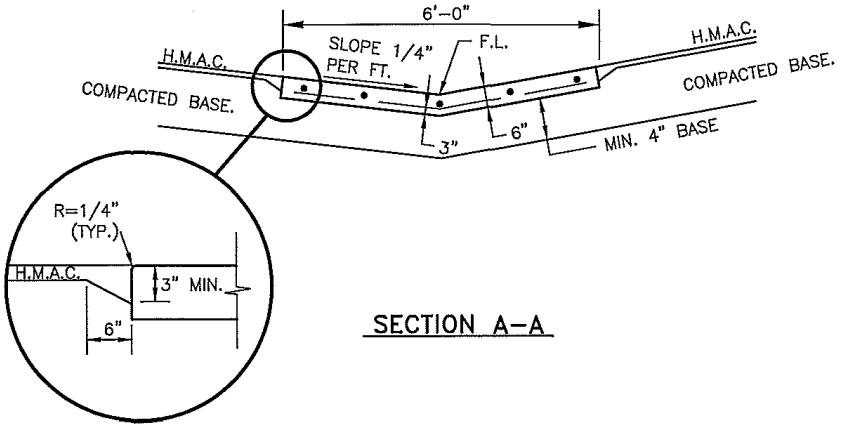
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	RIBBON CURB DETAILS	PV 008



NOTE:

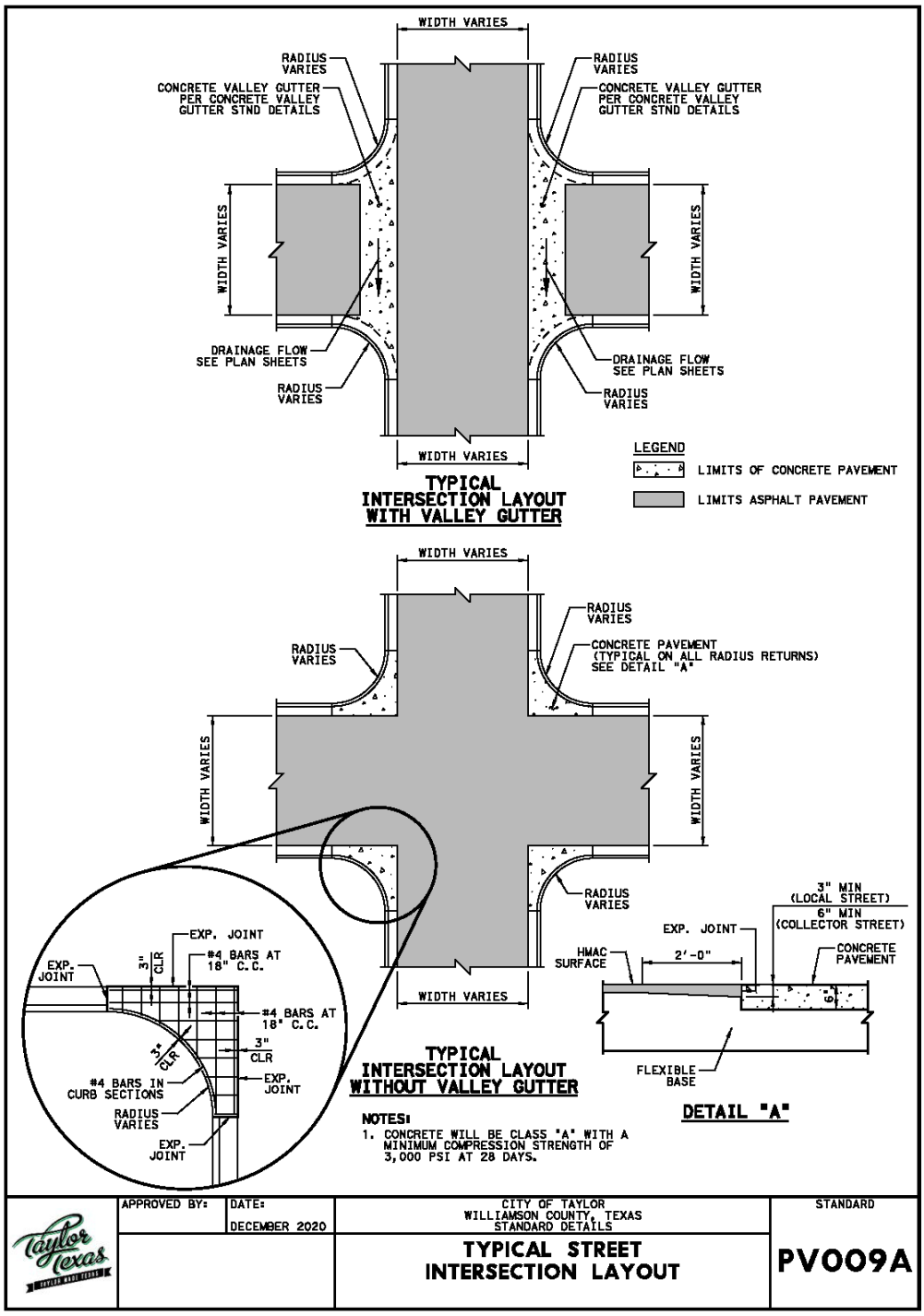
1. ALTERNATE #4 BARS TO BE CONTINUOUS ACROSS EXPANSION JOINT. BREAK BOND 6" ON EACH SIDE OF EXPANSION JOINT.
2. CONCRETE SHALL BE CLASS "A". MINIMUM COMPRESSION STRENGTH 3,000 PSI AT 28 DAYS.

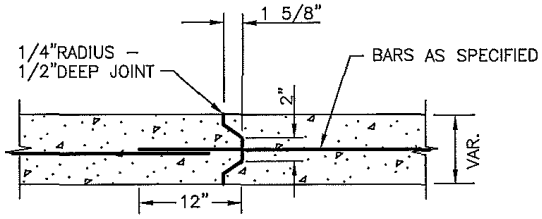
PLAN



SECTION A-A

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	CONCRETE VALLEY GUTTER DETAIL	PV 009


WIDTH VARIES
RADIUS VARIES
CONCRETE VALLEY GUTTER PER CONCRETE VALLEY GUTTER STND DETAILS
DRAINAGE FLOW SEE PLAN SHEETS
LEGEND
LIMITS OF CONCRETE PAVEMENT
LIMITS ASPHALT PAVEMENT
TYPICAL INTERSECTION LAYOUT WITH VALLEY GUTTER
CONCRETE PAVEMENT (TYPICAL ON ALL RADIUS RETURNS) SEE DETAIL "A"
EXP. JOINT
#4 BARS AT 18" C.C.
3" CLR
#4 BARS IN CURB SECTIONS
TYPICAL INTERSECTION LAYOUT WITHOUT VALLEY GUTTER
NOTES:
1. CONCRETE WILL BE CLASS "A" WITH A MINIMUM COMPRESSION STRENGTH OF 3,000 PSI AT 28 DAYS.
3" MIN (LOCAL STREET)
6" MIN (COLLECTOR STREET)
HMAC SURFACE
2'-0"
CONCRETE PAVEMENT
FLEXIBLE BASE
DETAIL "A"
APPROVED BY:
DATE:
DECEMBER 2020
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
STANDARD DETAILS
TYPICAL STREET INTERSECTION LAYOUT
STANDARD
PV009A



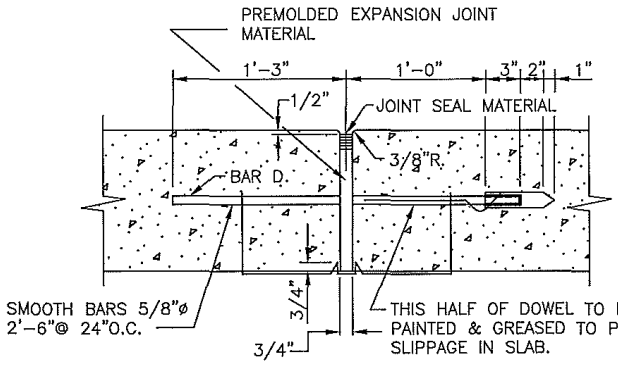
NOTE:
CONTRACTOR SHALL PROVIDE TRANSVERSE CONSTRUCTION JOINT SIMILAR IN DETAIL TO LONGITUDINAL CONSTRUCTION JT. OR EXPANSION JT. AT THE END OF EACH DAYS POUR OR WHEN DIRECTED BY ENGINEERS.

GENERAL NOTES:

1. CONCRETE OR BRICK CHAIRS APPROVED BY THE ENGINEER SHALL BE USED TO SUPPORT REINFORCING STEEL AND SHALL BE PLACED AT THE INTERSECTION OF LONGITUDINAL AND TRANSVERSE BARS AT SPACING AT 3'–8" LONGITUDINALLY AND 4'–0" TRANSVERSELY.
2. PAVEMENT LAYOUT WILL NECESSITATE THAT ALL CONSTRUCTION AND WARPING JOINTS COINCIDE WITH LANE LINES – THRU LANE CONSTRUCTION WILL BE CONTINUOUS WITH ALL LEFT TURN LANES AND TRANSITIONS TO BE POURED AS FILL–INS SUBJECT TO APPROVAL BY THE ENGINEER.
3. ALL TRANSVERSE AND LONGITUDINAL CONTRACTION JOINTS SHALL BE SPACED NOT TO EXCEED 20 FEET AND SHALL BE SAWED WITHIN 24 HOURS FOLLOWING CONCRETE PLACEMENT.

LONGITUDINAL CONSTRUCTION JOINT

NOT TO SCALE



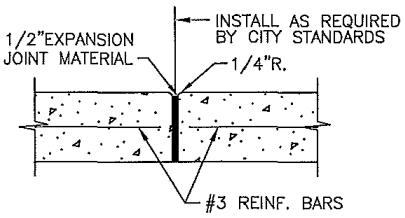
EXPANSION JOINTS TO BE AT INTERSECTIONS, BRIDGES, AND OTHER STRUCTURES AND AT SPACINGS NOT TO EXCEED 300 FEET. ALL JOINTS TO BE PROPERLY SEALED.

CONTINUOUS WELDED DOWEL BAR CHAIR CONSISTING OF 2 WIRE NO. 6 GAUGE WIRE CHAIR & DOWEL HOLDER AT EACH DOWEL & 2 3/8"ø STEEL BARS WELDED AT EACH INTERSECTION.

EXPANSION JOINT

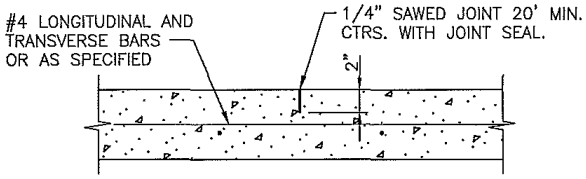
NOT TO SCALE

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	JOINT DETAILS (1 OF 2)	PV 010



CURB & GUTTER EXPANSION JOINT DETAIL

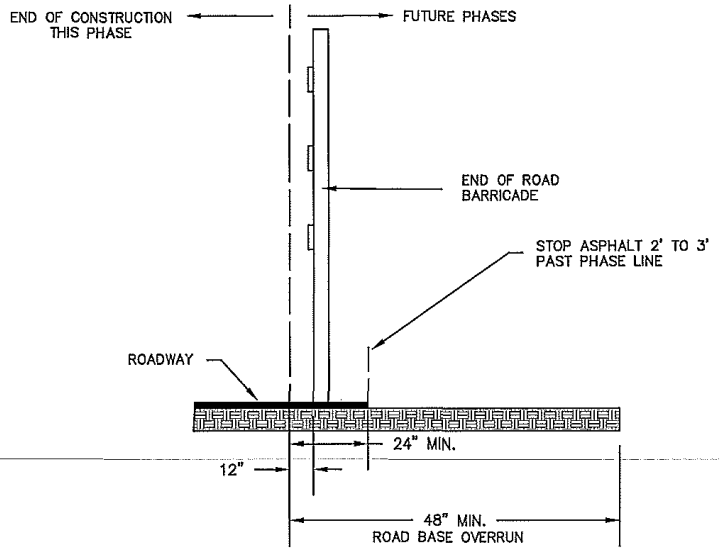
NOT TO SCALE



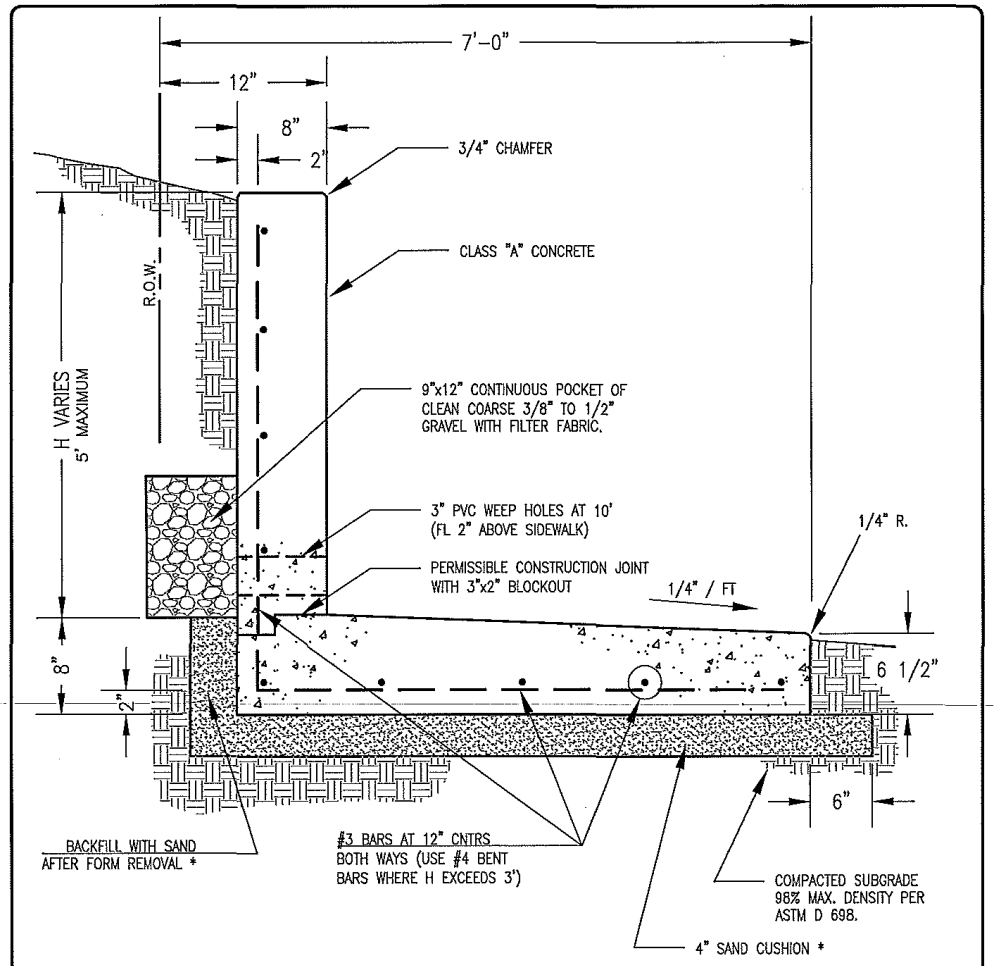
CONTRACTION JOINT DETAIL

NOT TO SCALE

CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
		JOINT DETAILS (2 OF 2)	PV 011



CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS CONSTRUCTION LIMITS AT STREET HEADER WITH BARRICADE	STANDARD PV 012

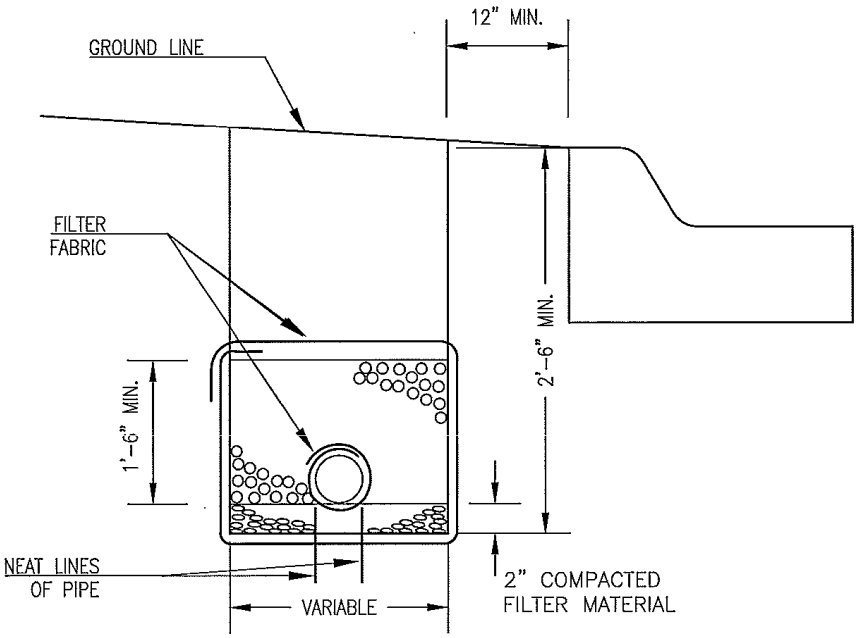


NOTES:

1. PROVIDE VERTICAL EXPANSION IN WALL AT 25' MAXIMUM SPACING (SEE JOINT DETAILS AND MODIFY AS REQUIRED)
2. WALL DESIGN ASSUMES NO SURCHARGE. A SPECIAL ENGINEERING ANALYSIS IS REQUIRED FOR OTHER CONDITIONS.

* WHEN SPECIFIED ON PLANS

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	REINFORCED CONCRETE RETAINING WALL WITH INTEGRAL SIDEWALK	PV 013



SECTION

LIMITS OF EXCAVATION

DEPTH OF TRENCH	DIST. IN FT. OUTSIDE NEAT LINES OF PIPE SUBDRAIN
0 TO 6	1.00
6 TO 10	1.50
10 TO 15	2.00
OVER 15	2.50

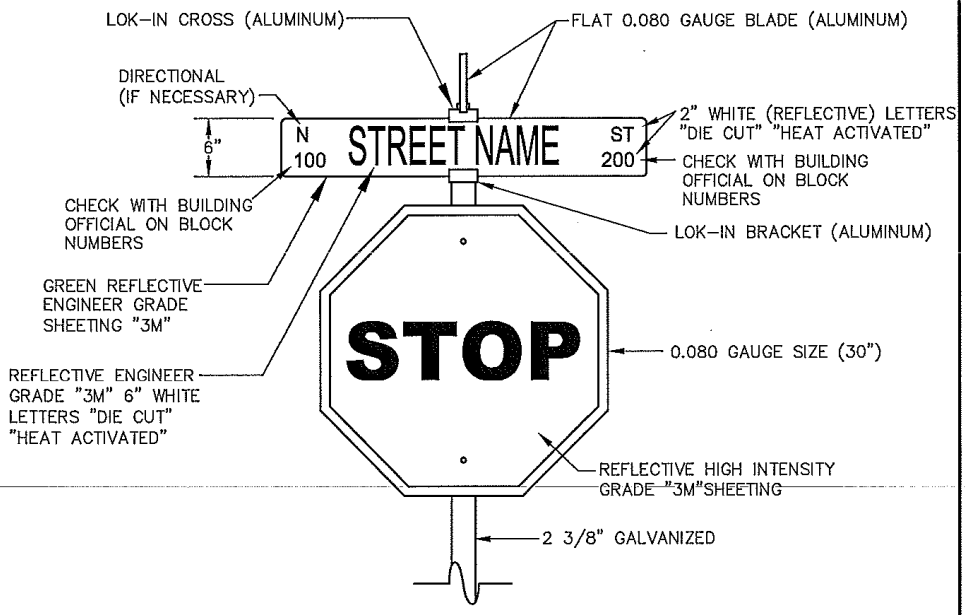
TYPES OF PIPES ACCEPTABLE FOR USE AS SUBDRAINS

1. PERFORATED PVC PIPE.
2. PERFORATED POLYETHYLENE PIPE.

FILTER MATERIAL SPECIFICATIONS

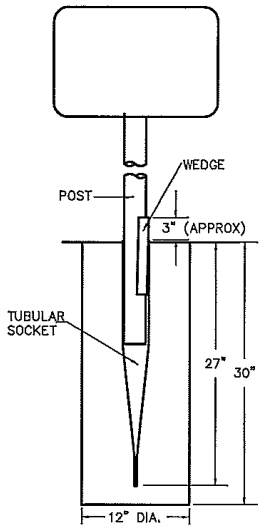
SIEVE SIZE	PERCENTAGE RETAINED ON SIEVE	
	TYPE A	TYPE B
1 1/2	---	0–10
3/4	0–10	20–40
3/8	15–35	---
No. 4	35–55	40–60
MATERIAL FINER THAN No. 4 SIEVE		
4		---
20		35–65
50		75–100

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	PAVEMENT SUBDRAIN DETAIL	PV 014

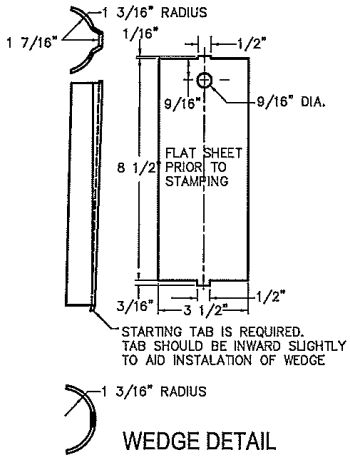


NOTE:
1. 7–FOOT MIN. HEIGHT FROM GROUND TO BOTTOM OF LOWEST SIGN

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	STANDARD STREET SIGN DETAIL	PV 015

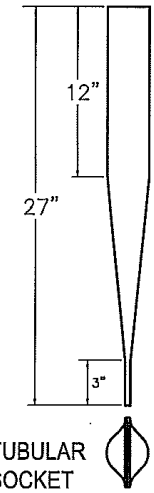


POST DETAIL



WEDGE DETAIL

WEDGE IS FABRICATED FROM 0.109" TO 0.124" THICK GALVANIZED SHEET STEEL PER ASTM A653 SS GRADE 40 G210 STAMPED INTO PROFILE SHOWN.



TUBULAR SOCKET DETAIL

POST – 13 BWM TUBING (2.375" OUTSIDE DIAMETER)

0.095" NORMINAL WALL THICKNESS
SEAMLESS OR ELECTRIC–RESISTANCE WEIDED STEEL TUBING
STEEL SHALL BE HSLAS Gr 55 PER ASTM A1011 OR ASTM A1008
OTHER STEEL MAY BE USED IF THEY MEET THE FOLLOWING:
- 55,000 PSI MINIMUM YIELD STRENGTH
- 70,000 PSI MINIMUM TENSILE STRENGTH
- 18% MINIMUM ELONGATION IN 2"

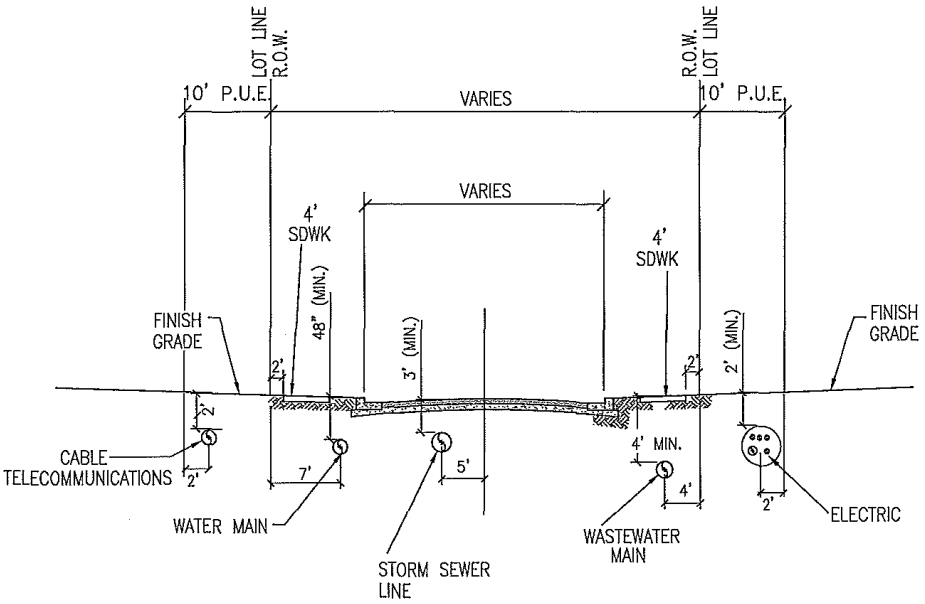
WALL THICKNESS (UNCOATED) SHALL BE WITHIN THE RANGE OF 0.083" TO 0.099"
OUTSIDE DIAMETER (UNCOATED) SHALL BE WITHIN THE RANGE OF 2.369" TO 2.381"
GALVANIZATION PER ASTM A123 OR A653 G210. FOR PRECOATED STEEL TUBING (ASTM A653)
RECOAT TUBE OUTSIDE DIAMETER WELD SEAM BY METALLIZING WIRE PER ASTM B833

SOCKET

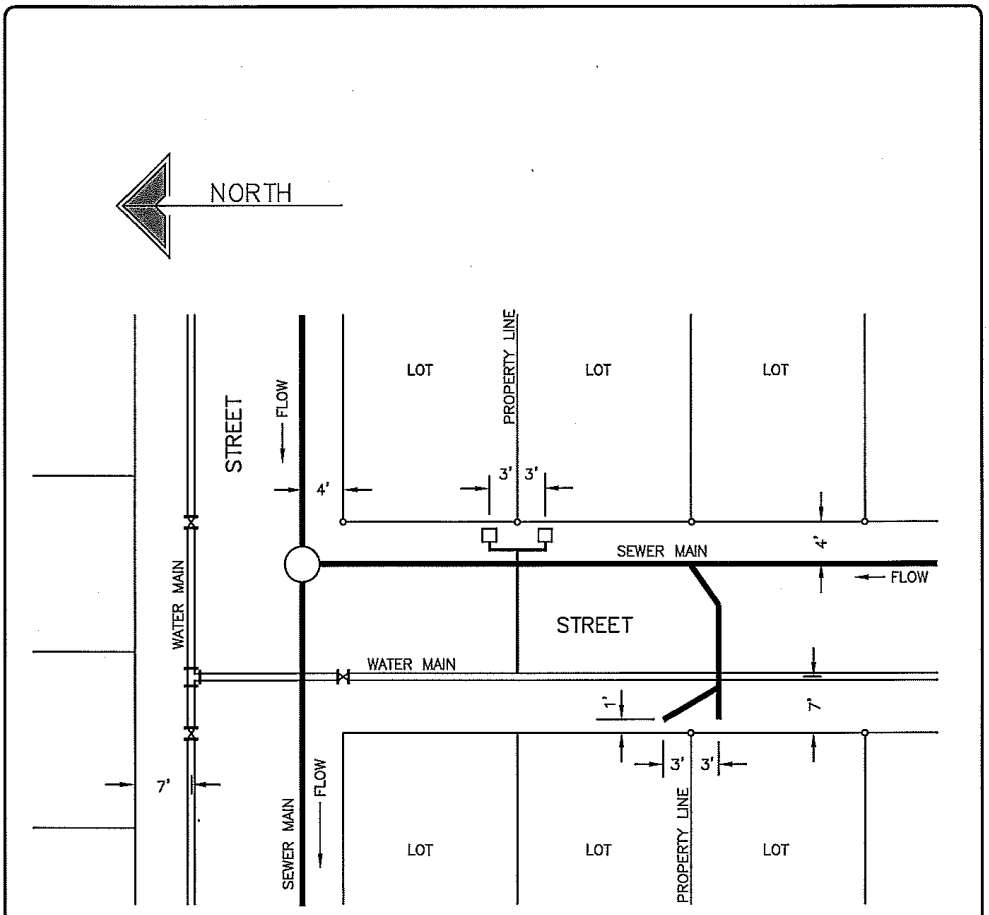
TUBULAR SOCKET PREFABRICATED FROM 12 BWM SEAMLESS OR ELECTRIC–RESISTANCE WELDED STEEL TUBING
2.875" OUTSIDE DIAMETER X 0.109" NORMAL WALL THICKNESS
STEEL SHALL BE HSLAS Gr 55 PER ASTM A1011 OR ASTM A1008
OTHER STEEL MAY BE USED IF THEY MEET THE FOLLOWING:
- 55,000 PSI MINIMUM YIELD STRENGTH
- 70,000 PSI MINIMUM TENSILE STRENGTH
- 20% MINIMUM ELONGATION IN 2"

WALL THICKNESS (UNCOATED) SHALL BE WITHIN THE RANGE OF 0.097" TO 0.113"
GALVANIZATION PER ASTM A123 AFTER FABRICATION, OR PER ASTM A653 G210. FOR PERCOATED STEEL TUBING (ASTM A653) RECOAT TUBE OUTSIDE DIAMETER WELD SEAM BY METALLIZING WITH ZINC WIRE PER ASTM B833.

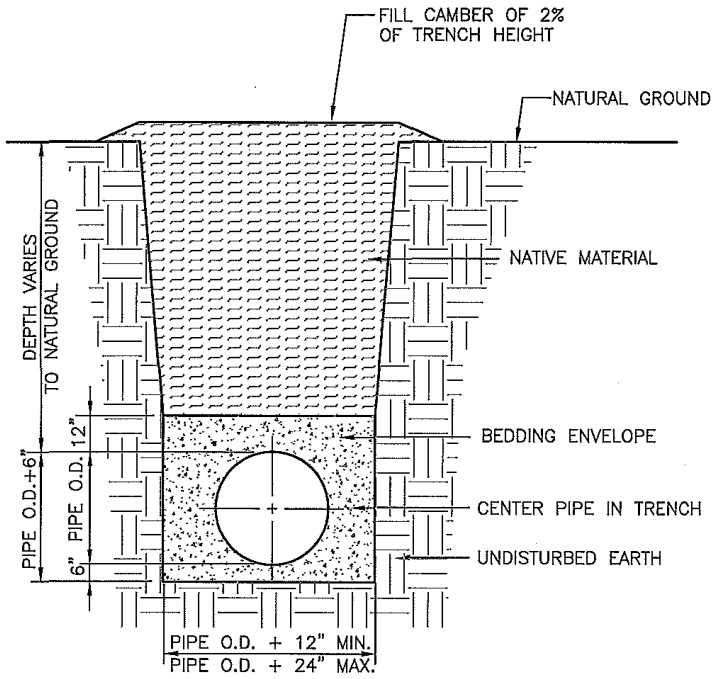
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	WEDGE ANCHOR SYSTEM	PV 016



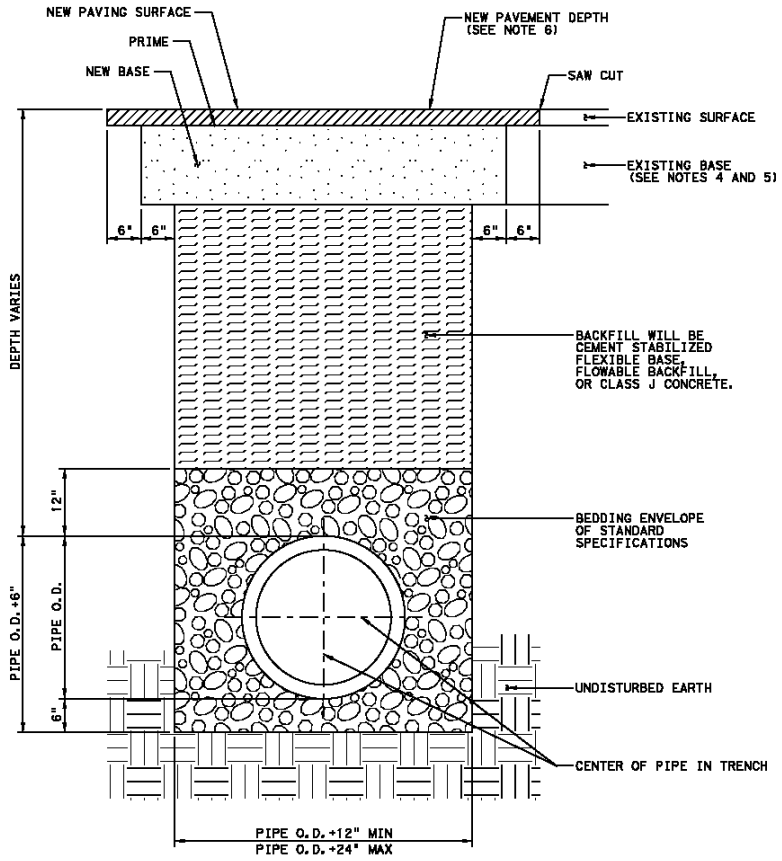
CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS TYPICAL UTILITY ASSIGNMENTS	STANDARD UT 001



CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS TYPICAL MAIN & SERVICE LOCATIONS	STANDARD UT 002



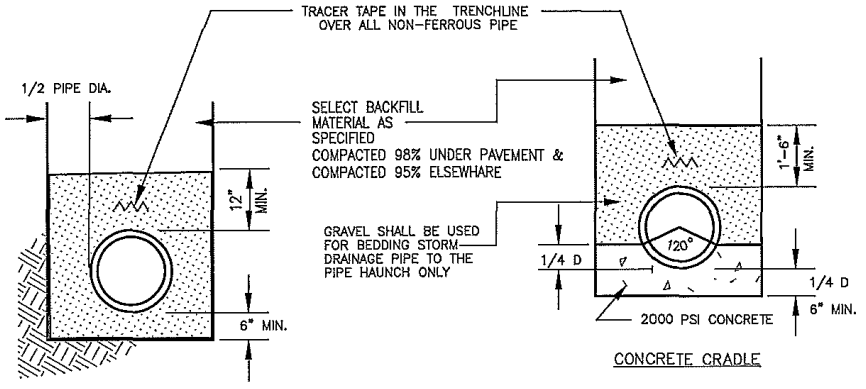
CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS TYPICAL TRENCH WITH UNFINISHED SURFACE	STANDARD UT 003



NOTES:

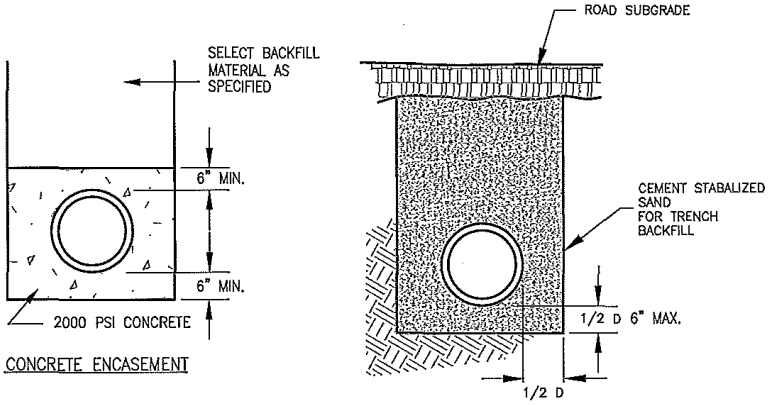
1. THE EXISTING PAVING SURFACE WILL BE SAW CUT IN A STRAIGHT LINE A MINIMUM OF 12" WIDER THAN THE UNDISTURBED SIDES OF THE TRENCH, SYMMETRICAL ABOUT THE CENTERLINE OF THE EXCAVATION.
2. ANY CONCRETE PAVING WILL BE SAW CUT 6" WIDER THAN THE UNDISTURBED SIDES OF THE EXCAVATION.
3. IF THE EXCAVATION AREA IS OPEN FOR TEMPORARY PUBLIC USE, THE SURFACE WILL BE MAINTAINED LEVEL WITH THE ADJACENT RIDING SURFACE WITH COLD MIX OR TEMPORARY HOT MIX.
4. ROAD BASE AND SURFACE MATERIALS IN THE TRENCH CUT WILL BE REPLACED IN KIND OF EQUAL THICKNESS, OR A MINIMUM BASE THICKNESS OF 10 INCHES, WHICHEVER IS GREATER.
5. ALL DAMAGED AREAS OF PAVEMENT OUTSIDE THE TRENCH CUT WILL BE REMOVED AND REPLACED WITH A MINIMUM OF 8 INCHES OF BASE OR MATCH EXISTING, WHICHEVER IS GREATER.
6. SURFACE PAVEMENT WILL BE OF THE KIND AND THICKNESS AS EXISTING, OR A MINIMUM OF 2 INCHES, WHICHEVER IS GREATER.
7. ALL PRESSURE PIPE WILL BE PROVIDED WITH THRUST BLOCKS WHERE CHANGES IN DIRECTION OCCUR AT TEES, BENDS, CROSSES, CHANGES IS SLOPE, STOPS (DEAD ENDS), VALVES, AND OR AS SHOWN ON THE PLANS, OR AS DIRECTED BY THE ENGINEER.

	APPROVED BY:	DATE: DECEMBER 2020	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
Taylor Texas			**TYPICAL TRENCH WITH PAVED SURFACE**	**UT004**



GRANULAR

CONCRETE CRADLE



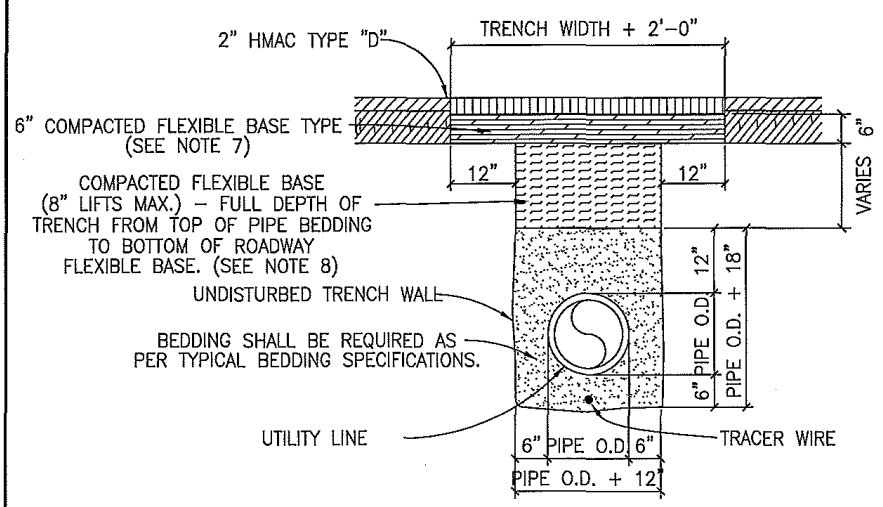
CONCRETE ENCASEMENT

SHALLOW DITCH EMBEDMENT

** TYPICAL BEDDING SPECIFICATIONS:

SIEVE SIZE	3/8" F % RETAINED	1/2" D % RETAINED	WASHED GRAVEL % RETAINED
1/2"	0	0	0
3/8"	0–2	5–25	–
4m	40–85	80–100	–
10m	95–100	96–100	–
3/4"	–	–	100

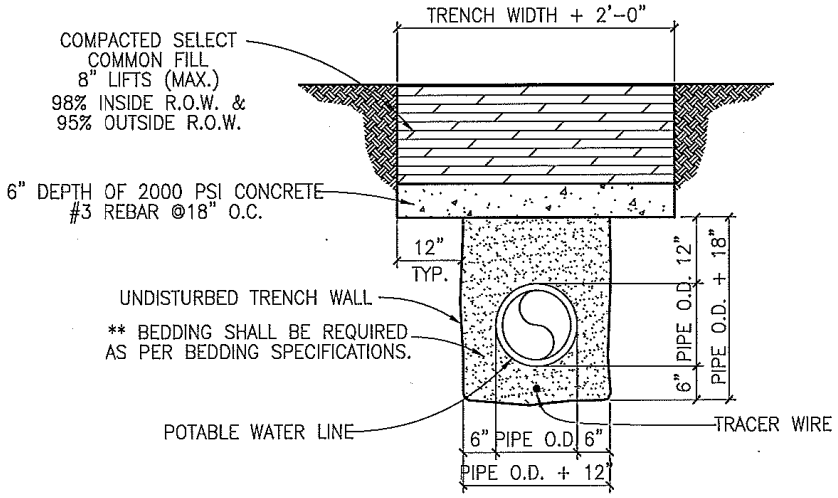
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	STANDARD EMBEDMENT AND ENCASEMENT	UT 005



NOTES:

1. REPLACED BASE MATERIAL OVER DITCH SHALL BE TWICE THE THICKNESS OF THE ORIGINAL BASE.
2. BASE MATERIAL SHALL BE PLACED IN TWO OR THREE LAYERS AND EACH LAYER 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 FIVE HUNDRED (500) FEET FOR EACH SIX (6) INCH LIFT 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 IN ACCORDANCE WITH THE LATEST EDITION OF "THE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" AT THE TIME THE PERMIT WAS ISSUED. 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.
6. THESE SPECIFICATIONS MAY BE SUPERSEDED BY THE GOVERNING AGENCY.
7. FLEXIBLE BASE: (ROADWAY BASE)
   TxDOT TYPE A – GRADE 2 OR BETTER CRUSHED LIMESTONE BASE COMPACTED TO 100% OF TxDOT 113E AT OPTIMUM MOISTURE. PROCTOR TO BE PROVIDED BY THE CONTRACTOR TO THE CITY INSPECTOR.
8. FLEXIBLE BASE: (TRENCH BACKFILL)
   TxDOT TYPE A – GRADE 2 OR BETTER CRUSHED LIMESTONE BASE COMPACTED TO 98% OF TxDOT 113E AT OPTIMUM MOISTURE. PROCTOR TO BE PROVIDED BY THE CONTRACTOR TO THE CITY INSPECTOR.
9. CONTRACTOR OR ENGINEER MAY REQUEST FOR USE OF ALTERNATE BACKFILL MATERIAL. ALTERNATE MATERIALS AND TESTING PROTOCOL MUST BE SUBMITTED TO AND APPROVED BY THE CITY ENGINEER PRIOR TO USE.

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	TRENCH DETAIL WITH PAVEMENT REPLACEMENT UNDER EXISTING ROADWAY	UT 006

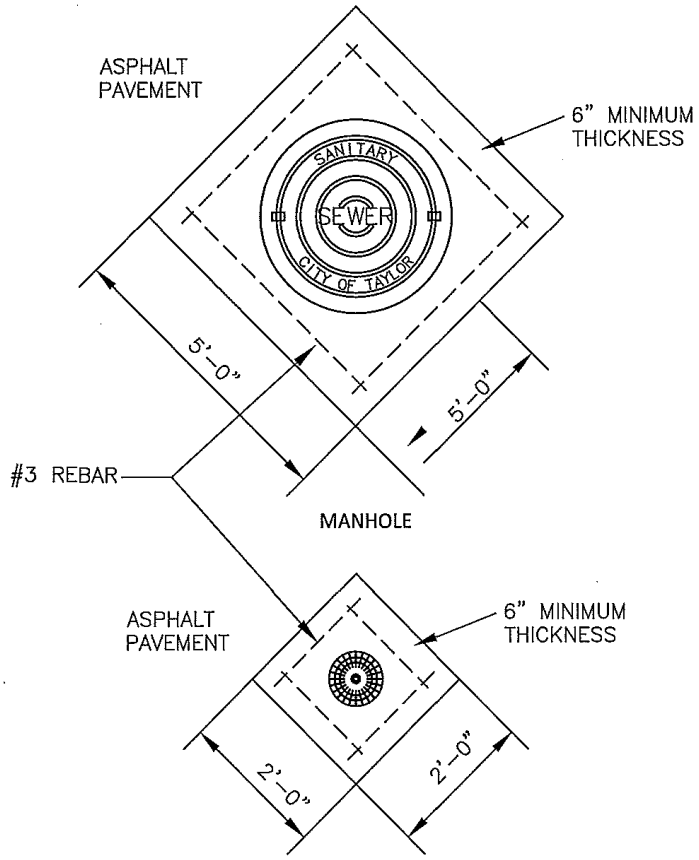


* WHERE 48" MINIMUM COVER CAN NOT BE OBTAINED OR DUE TO POTENTICAL SURFACE LOADING THE CITY MAY REQUIRE A CAP TO BE INSTALLED.

** TYPICAL BEDDING SPECIFICATIONS:

SIEVE SIZE	3/8" F % RETAINED	1/2" D % RETAINED	WASHED GRAVEL % RETAINED
1/2"	0	0	0
3/8"	0–2	5–25	–
4m	40–85	80–100	–
10m	95–100	96–100	–
3/4"	–	–	100

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	CONCRETE TRENCH CAP DETAIL	UT 007

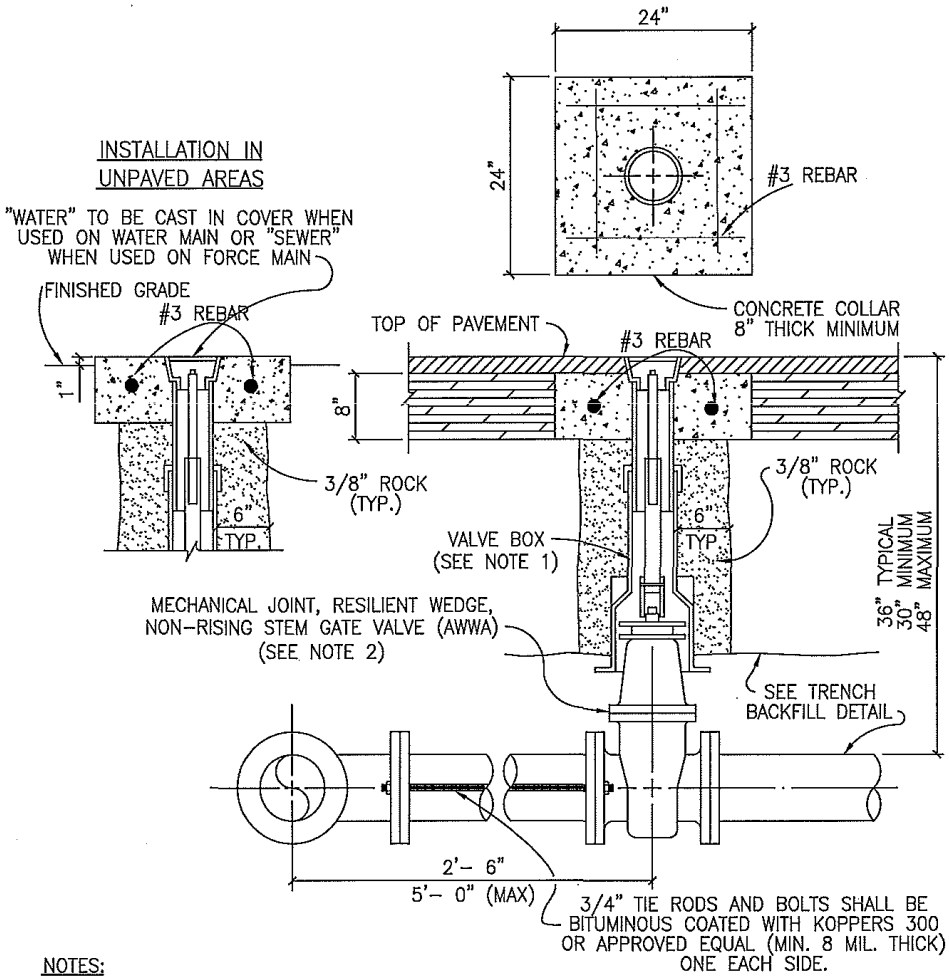


MANHOLE

WATER VALVE

NOTES:
1. ALL ASPHALT PAVEMENT SHALL BE REMOVED ALONG NEAT SAW CUT LINES.
2. MANHOLE BOXOUT REQUIRED FOR ALL MANHOLES (STORM AND SANITARY) AND CLEANOUTS LOCATED IN THE STREET.
3. 1/2" RADIUS EDGE ON CONCRETE
4. #3 REBAR – 3000 PSI

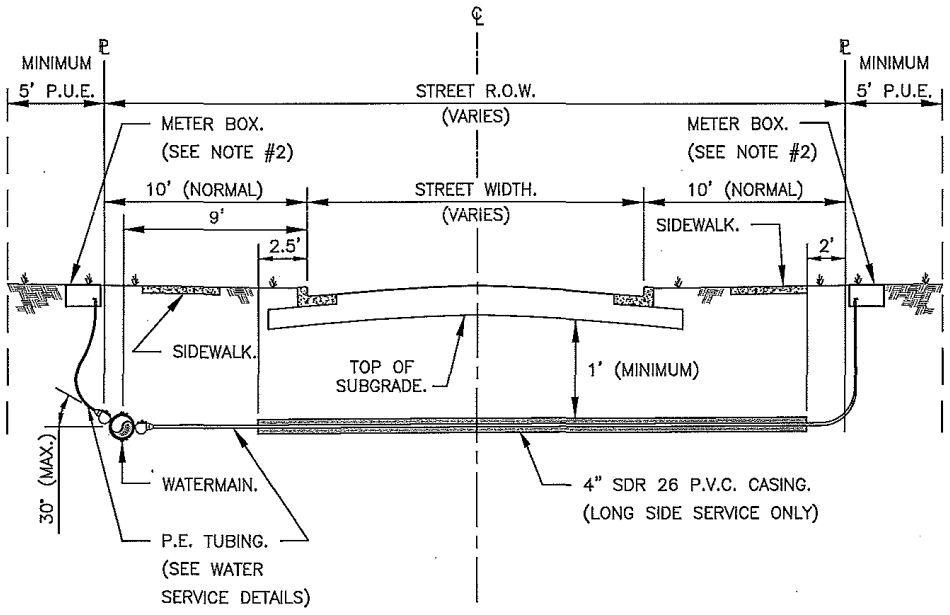
	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	MANHOLE AND WATER VALVE BOXOUT	UT 008



NOTES:

1. VALVE BOX SHALL BE AMERICAN FLOW CONTROL TRENCH ADAPTER OR APPROVED EQUAL HAVING AN ADJUSTABLE RANGE OF + OR - 6 INCHES FROM INSTALLED FINISH GRADE.
2. ACCEPTABLE GATE VALVES ARE:
   A. AMERICAN FLOW CONTROL - SERIES 2500
   B. MUELLER - 2360 SERIES
   C. CLOW

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	TYPICAL VALVE SETTING	UT 009



NOTE:

1. REFER TO "STANDARD INSTALLATION DETAIL FOR ONE OR TWO METERS" FOR SERVICE SPECIFICS.

2. METER BOXES SHALL BE SET AS CLOSE TO R.O.W. (℄) AS POSSIBLE, WITH NO PART OF BOX WITHIN R.O.W. METER BOXES SHALL BE LEVEL FROM SIDE TO SIDE AND NO MORE THAN 1/4"/FT. SLOPE FROM FRONT TO BACK (OR BACK TO FRONT). GRADING IN P.U.E. AROUND METER BOX SHALL BE 3:1 MAXIMUM AND SHALL BLEND TO OTHER UTILITY APPURTENANCES WITHOUT ABRUPT ELEVATION CHANGES.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	WATER SERVICE CASING DETAIL	UT 010

MATERIAL LIST

A. SERVICE CLAMP REQUIRED.

B. 1" CORPORATION STOP --- SERVICE PIPE OUTLET.

C. 1" SERVICE PIPE.

D. LOCKING ANGLE METER STOP; SERVICE PIPE INLET X SWIVEL COUPLING NUT OUTLET:
- FOR 5/8" AND 3/4" METERS: 1" x 3/4"
- FOR 1" METERS: 1" x 1"

E. PLASTIC RECTANGULAR METER BOX. (SEE NOTE #5)

F. PIPE CASING WHERE APPLICABLE. (SEE SEPARATE DETAIL)

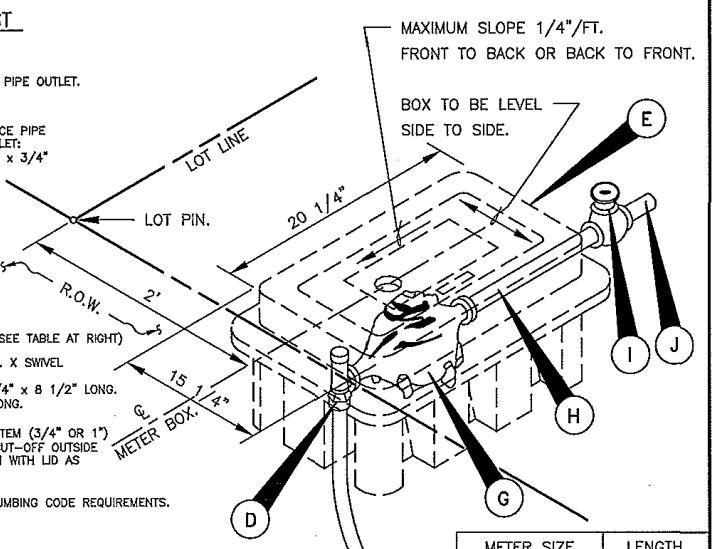
NOTE: G THRU J TO BE INSTALLED UNDER SEPARATE BUILDING PERMIT.

G. WATER METER, CENTERED IN BOX. (SEE TABLE AT RIGHT)

H. WATER METER COUPLING; MALE I.P.T. X SWIVEL COUPLING NUT:
- FOR 5/8" AND 3/4" METERS: 3/4" x 8 1/2" LONG.
- FOR 1" METERS: 1" x 8 1/2" LONG.

I. BRONZE GATE VALVE: NON-RISING STEM (3/4" OR 1") FEMALE I.P.T. (PROPERTY OWNERS CUT-OFF OUTSIDE METER BOX IN SEPARATE VALVE CAN WITH LID AS PER CITY STANDARDS).

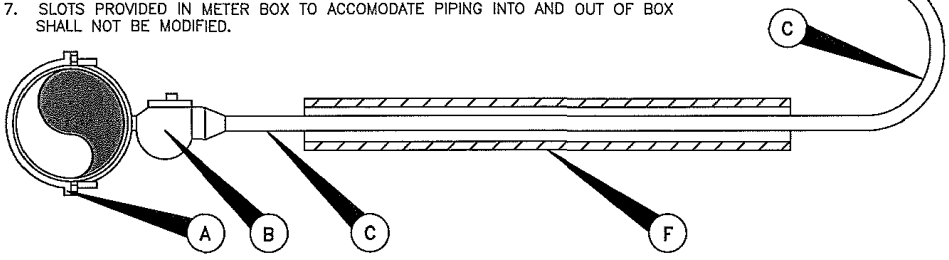
J. 3/4" OR 1" PIPE MEETING CITY PLUMBING CODE REQUIREMENTS.



METER SIZE	LENGTH
5/8"	7 3/4"
3/4"	9"
1"	11"

NOTES:

1. SERVICE PIPE SHALL BE COPPER TUBE SIZE. IT MAY BE 150 PSI ANNEALED SEAMLESS TYPE "K" COPPER TUBING.
2. SERVICE SADDLES SHALL BE WRAPPED COMPLETELY WITH 8 MIL. POLYETHYLENE FILM.
3. TOP OF BOXES SHALL BE 1" ABOVE FINISHED GRADE.
4. PIPING AND TUBING SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 510.3 OF THE STANDARD SPECIFICATIONS. SPECIAL ATTENTION IS CALLED TO "PIPE BEDDING ENVELOPE" AND "BACKFILLING", SECTIONS 510.3 (14) AND 510.3 (25), RESPECTIVELY.
5. METER BOX TO BE MODEL DFW-3612 BY DFW ROTEC, INC. OR APPROVED EQUAL . PROVIDE BLACK-PAINTED METAL LID WITH METER READER.
6. AXIS OF METER ASSEMBLY (METER STOP, METER, PIPING AND OWNERS CUTOFF) SHALL BE 10" BELOW TOP OF BOX.
7. SLOTS PROVIDED IN METER BOX TO ACCOMODATE PIPING INTO AND OUT OF BOX SHALL NOT BE MODIFIED.



CITY OF TAYLOR FOUNDED 1876

DRAWN BY: PM	DATE: 01/29/2009
APPROVED BY: CS	DATE: -
REVISION NO.:	FILE NAME:
REVISED BY:	DATE:

CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
STANDARD DETAILS

SINGLE 5/8", 3/4" OR 1"
WATER METER DETAIL

STANDARD

UT 011

MATERIAL LIST

A. SERVICE CLAMP REQUIRED.

B. 2" CORPORATION STOP -- SERVICE PIPE OUTLET.

C. 2" SERVICE PIPE.

D. BUSHING (IF NECESSARY) AND LOCKING ANGLE METER STOP; SERVICE PIPE INLET X FLANGED COUPLING OUTLET:
- FOR 1 1/2" METERS: 1 1/2" X 1 1/2"
- FOR 2" METERS: 2" x 2"

E. PLASTIC RECTANGULAR METER BOX. (SEE NOTE #5)

F. PIPE CASING WHERE APPLICABLE. (SEE SEPARATE DETAIL)

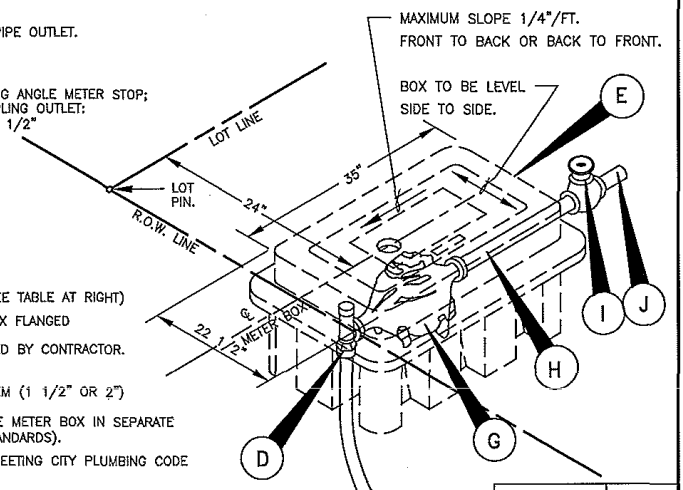
NOTE: G THRU J TO BE INSTALLED UNDER SEPARATE BUILDING PERMIT.

G. WATER METER, CENTERED IN BOX. (SEE TABLE AT RIGHT)

H. WATER METER COUPLING; MALE I.P.T. X FLANGED COUPLING NUT:
- LENGTH OF PIPE TO BE DETERMINED BY CONTRACTOR.

I. BRONZE GATE VALVE: NON-RISING STEM (1 1/2" OR 2") FEMALE I.P.T. (PROPERTY OWNERS CUT-OFF OUTSIDE METER BOX IN SEPARATE VALVE CAN WITH LID AS PER CITY STANDARDS).

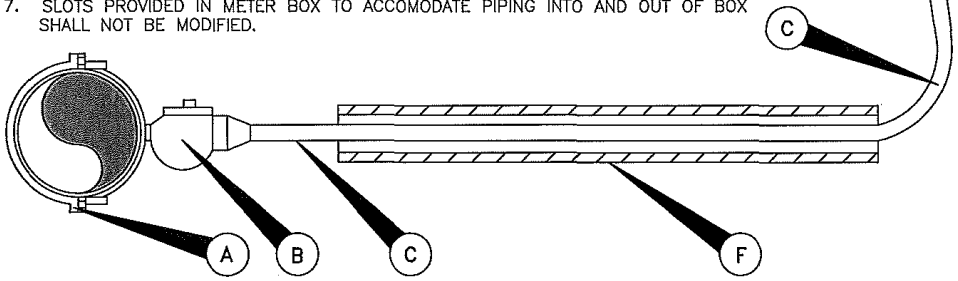
J. BUSHING (IF NECESSARY) AND PIPE MEETING CITY PLUMBING CODE REQUIREMENTS.



METER SIZE	LENGTH
1 1/2"	13"
2"	17"

NOTES:

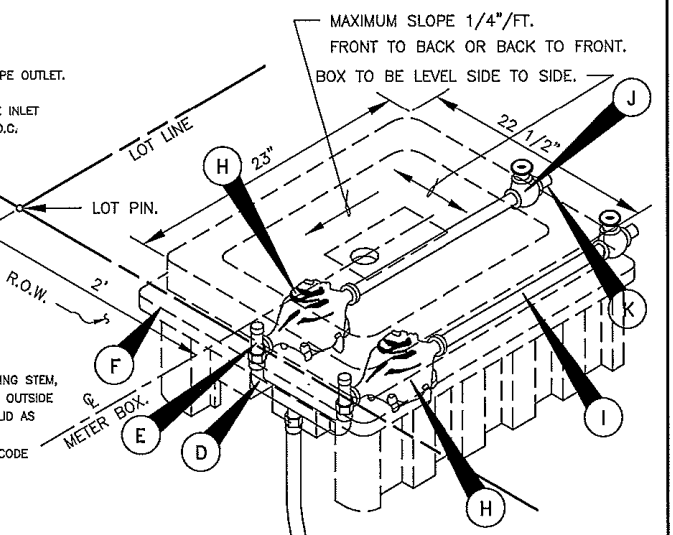
1. SERVICE PIPE SHALL BE COPPER TUBE SIZE. IT MAY BE 150 PSI ANNEALED SEAMLESS TYPE "K" COPPER TUBING OR 200 PSI BLACK COLORED POLYETHYLENE HAVING A DIMENSION RATIO OF 9 (DR9).
2. SERVICE SADDLES SHALL BE WRAPPED COMPLETELY WITH 8 MIL. POLYETHYLENE FILM.
3. TOP OF BOXES SHALL BE 1" ABOVE FINISHED GRADE.
4. PIPING AND TUBING SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 510.3 OF THE STANDARD SPECIFICATIONS. SPECIAL ATTENTION IS CALLED TO "PIPE BEDDING ENVELOPE" AND "BACKFILLING", SECTIONS 510.3 (14) AND 510.3 (25), RESPECTIVELY.
5. METER BOX TO BE MODEL DFW-6512 BY DFW ROTEC, INC. OR APPROVED EQUAL. PROVIDE BLACK-PAINTED METAL LID WITH METER READER.
6. AXIS OF METER ASSEMBLY (METER STOP, METER, PIPING AND OWNERS CUTOFF) SHALL BE 10" BELOW TOP OF BOX.
7. SLOTS PROVIDED IN METER BOX TO ACCOMODATE PIPING INTO AND OUT OF BOX SHALL NOT BE MODIFIED.



APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	SINGLE 1 1/2" OR 2" WATER METER DETAIL	UT 012

MATERIAL LIST

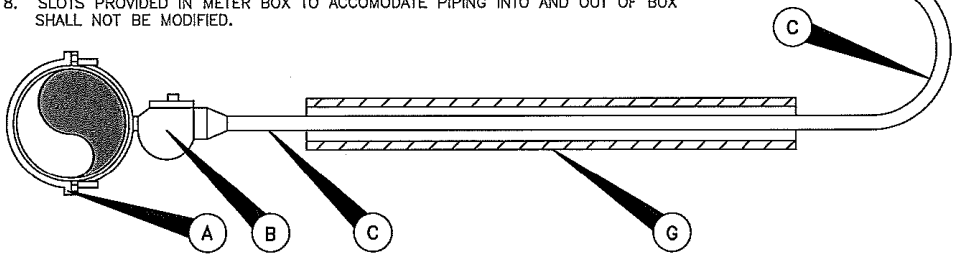
A. SERVICE CLAMP REQUIRED.
B. 1 1/2" CORPORATION STOP --- SERVICE PIPE OUTLET.
C. 1 1/2" SERVICE PIPE.
D. BRANCH CONNECTION: 1 1/2" SERVICE PIPE INLET AND 2 3/4" MALE I.P.T. OUTLETS 7 1/2" O.C.
E. 3/4" LOCKING ANGLE METER STOP; FEMALE I.P.T. INLET AND SWIVEL COUPLING NUT OUTLET.
F. PLASTIC RECTANGULAR METER BOX. (SEE NOTE #6)
G. PIPE CASING WHERE APPLICABLE. (SEE SEPARATE DETAIL) NOTE: H THRU K TO BE INSTALLED UNDER SEPARATE BUILDING PERMIT.
H. WATER METERS, CENTERED IN BOX. (SEE TABLE AT RIGHT)
I. WATER METER COUPLING: 3/4" X 8 1/2" MALE I.P.T. X SWIVEL COUPLING NUT.
J. 3/4" OR 1" BRONZE GATE VALVE: NON-RISING STEM, FEMALE I.P.T. (PROPERTY OWNERS CUT-OFF OUTSIDE METER BOX IN SEPARATE VALVE CAN WITH LID AS PER CITY STANDARDS)
K. 3/4" OR 1" PIPE MEETING CITY PLUMBING CODE REQUIREMENTS.



METER SIZE	LENGTH
5/8"	7 3/4"
3/4"	9"

NOTES:

1. SERVICE PIPE SHALL BE COPPER TUBE SIZE. IT MAY BE 150 PSI ANNEALED SEAMLESS TYPE "K" COPPER TUBING.
2. SERVICE SADDLES SHALL BE WRAPPED COMPLETELY WITH 8 MIL. POLYETHYLENE FILM.
3. TOP OF BOXES SHALL BE 1" ABOVE FINISHED GRADE.
4. BRANCH CONNECTION AND BOTH ANGLE METER STOPS MUST BE INSTALLED PRIOR TO FIRST METER INSTALLATION EVEN THOUGH, THE SECOND PROPERTY MAY NOT BE READY FOR SERVICE.
5. PIPING AND TUBING SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 510.3 OF THE STANDARD SPECIFICATIONS. SPECIAL ATTENTION IS CALLED TO "PIPE BEDDING ENVELOPE" AND "BACKFILLING", SECTIONS 510.3 (14) AND 510.3 (25), RESPECTIVELY.
6. METER BOX TO BE MODEL DFW-3812 BY DFW ROTEC, INC. OR APPROVED EQUAL. PROVIDE BLACK-PAINTED METAL LID WITH METER READER.
7. AXIS OF METER ASSEMBLY (METER STOP, METER, PIPING AND OWNERS CUTOFF) SHALL BE 10" BELOW TOP OF BOX.
8. SLOTS PROVIDED IN METER BOX TO ACCOMODATE PIPING INTO AND OUT OF BOX SHALL NOT BE MODIFIED.



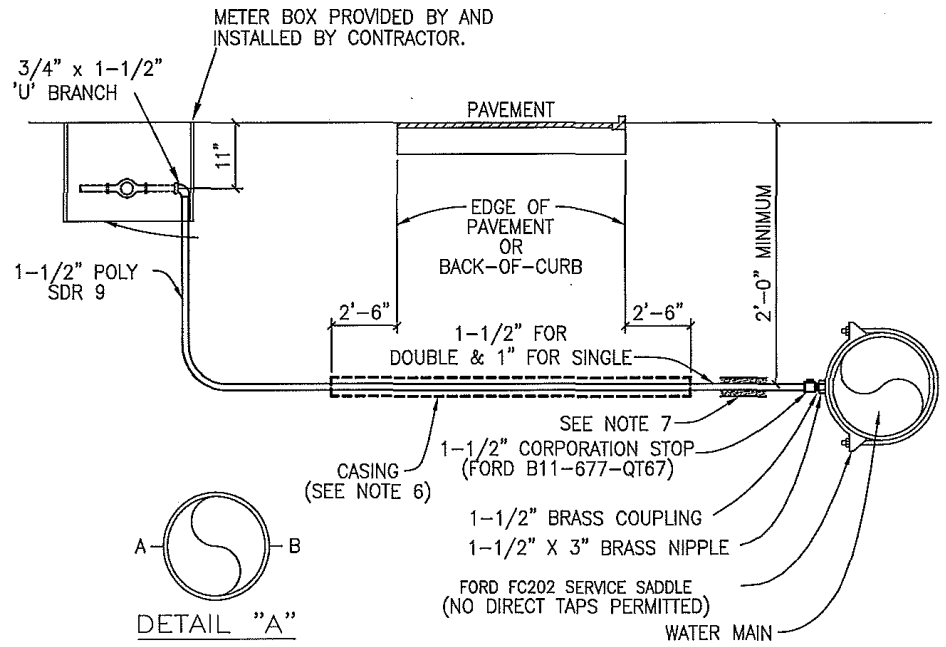
CITY OF TAYLOR FOUNDED 1876

APPROVED BY:	DATE:
CS	JULY 2009

CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
STANDARD DETAILS

DOUBLE 5/8" OR 3/4"
WATER METERS DETAIL

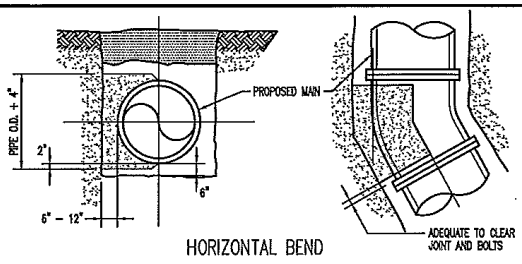
STANDARD
UT 013



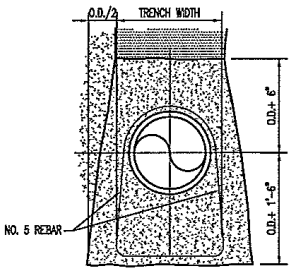
NOTES:

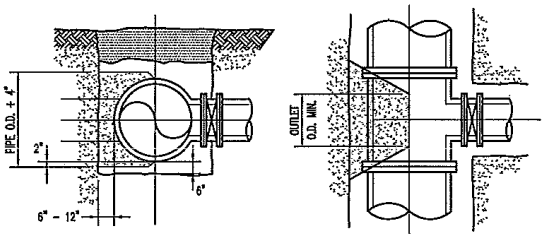
1. SUCCESSIVE TAPS INTO THE WATER MAIN SHALL BE SPACED A MINIMUM OF 18" OFFSET AND AT THE CENTERLINE AS SHOWN ON DETAIL "A".
2. WHERE NO SIDEWALK EXISTS, METER BOXES SHALL BE SET TO CONFORM TO FINISHED GRADE.
3. AUTHORIZED SERVICE LINE MATERIAL: TYPE 'K' COPPER OR POLY SDR 9.
4. SERVICE LINES SHALL BE CONTINUOUS FROM CORPORATION STOP TO CORPORATION STOP WITH NO FITTINGS IN BETWEEN.
5. SERVICE CASING SHALL NOT BE INSTALLED BY WATER JETTING UNDER ROADWAY.
6. CASING REQUIRED FOR ALL PAVEMENT CROSSINGS. 4" SDR-26 REQUIRED FOR OPEN-CUT. STEEL CASING PIPE REQUIRED FOR JACK AND BORE. LIMITS OF CASING SHOULD EXTEND SIX FEET BEYOND THE EDGE OF PAVEMENT OR BACK-OF-CURB WHERE REASONABLE WITH 2.5' MINIMUM.
7. THERE SHALL BE A 6" ENVELOPE OF 3/8" ROCK AROUND ALL SERVICE PIPE.
8. ANY VARIATIONS ON FITTINGS MUST BE APPROVED BY THE CITY ENGINEER.
9. SINGLE METER BOX AND LID - HUGHES SUPPLY PART NO. D12-BAMR, OR APPROVED EQUAL. DOUBLE METER BOX - HUGHES SUPPLY PART NO. D1500-DUB/O, LID - D15-BAMRL, OR APP. EQUAL.

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	TYPICAL WATER SERVICE - ELEVATION	UT 014

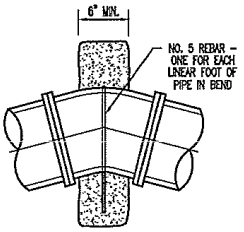


HORIZONTAL BEND





TEE/OUTLET



VERTICAL BEND

THRUST BLOCK DESIGN AS FOLLOWS:

A. PRESSURE OF 150 P.S.I. (ACTUAL IF HIGHER) + 50% SURGE ALLOWANCE

B. MAXIMUM SOIL BEARING:

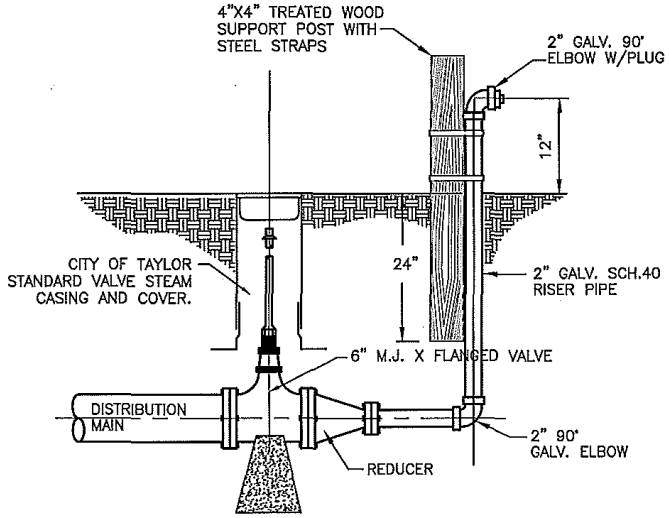
SOIL TYPE	PRESSURE
LIMESTONE	4000 LBS./SQ. FT.
UNDISTURBED SOIL, CALICHE	2000 LBS./SQ. FT.
LOOSE OR SPONGY SOIL	1500 LBS./SQ. FT.

CONCRETE THRUST BLOCKING SCHEDULE **

PIPE SIZE (INCHES)	THRUST (POUNDS)	AREA REQUIRED (SQUARE FEET) BEARING AGAINST TRENCH WALL FOR PRESSURE PIPE						
		TEES AND PLUGS	BENDS					
			90°	45°	22-1/2°	11-1/4°	5°	1°
4	2.513	1.00	1.00	0.50	0.50	N/A	N/A	N/A
6	5.655	1.41	2.00	1.08	1.00	0.50	N/A	N/A
8	10.053	2.51	3.55	1.92	1.00	0.50	0.50	N/A
12	22.619	5.65	8.00	4.33	2.21	1.11	0.50	N/A
16	40.212	10.05	14.22	7.69	3.92	1.97	1.00	N/A
24	90.478	22.62	31.99	17.31	8.83	4.43	1.97	0.50
30	141.372	35.34	49.98	27.05	13.79	6.93	3.08	1.00
36	203.575	50.89	71.97	38.95	19.86	9.98	4.44	1.00
42	277.088	69.27	97.97	53.02	27.03	13.58	6.04	1.21
48	361.911	90.48	127.95	69.29	35.30	17,74	7.89	1.58
54	458.044	114.51	161.94	87.64	44.68	22.45	9.99	2.00

** BASED ON A 4,000 P.S.F. SOIL BEARING CAPACITY AND A 200 P.S.I. MAX. LINE PRESSURE INCREASE AND DECREASE BEARING AREA IN ACCORDANCE WITH THE BEARING STRENGTH OF SOIL AS DESCRIBED IN SCHEDULE.

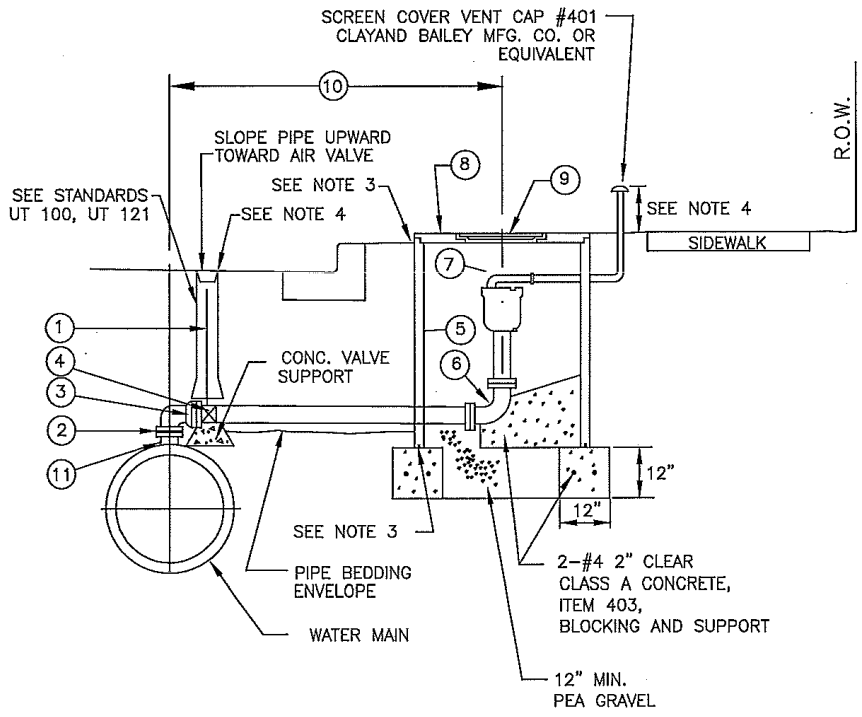
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	CONCRETE THRUST BLOCKING	UT 015



FLUSHING VALVE DETAIL

(FOR PERMANENT DEAD END LINES, USE 2" BALL VALVE – FORD OR EQUAL)

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	FLUSHING VALVE DETAIL	UT 016



1. STEM EXTENSION
2. INSULATED FLANGE CONNECTION
3. 90° BEND (FLG X FLG)
4. GATE VALVE FLG X MJ
5. CLASS III R.C.P. MANHOLE 60" MIN. I.D.
6. 90° BEND (FLG. X FLG.)
7. COMBINATION AIR RELEASE VALVE WITH GOOSNECK
8. REINFORCED PRECAST CONCRETE LID (AASHTO H-20 LOADING)
9. RING AND 32" COVER
10. PER PLAN DIMENSION OR AS DETERMINED BY ENGINEER OR DESIGNATED REPRESENTATIVE
11. FLANGED OUTLET PER ANSI B16.1

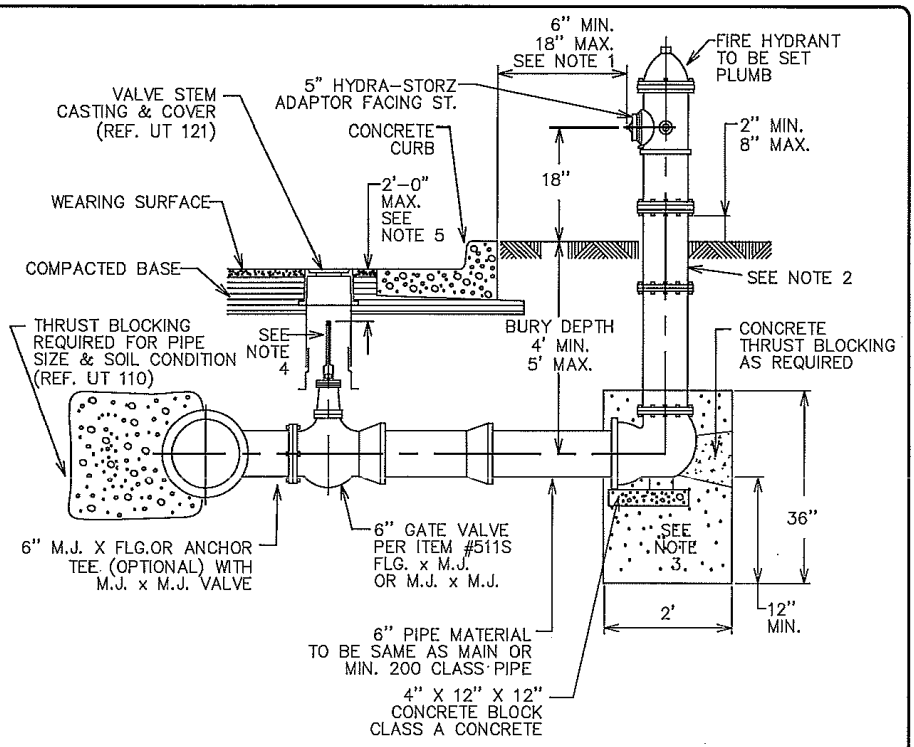
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	3" OR LARGER VENTED AIR / VACUUM VALVE INSTALLATION	UT 017 1 of 2

NOTES:

1. ON 10" AND LARGER TWO PIECE COMBINATION AIR VALVES, THE OUTLET PIPING OF THE SMALL VALVE SHALL BE VENTED WITHIN THE MANHOLE INTO THE SIDE OF THE LARGER VENT PIPE THAT GOES ABOVE GROUND.
2. AIR VENT PIPE 6" AND LARGER SHALL BE D.I. (CLASS 350 MIN.) PIPE FLANGE FITTINGS ORDERED SPECIAL WITH SHOP APPLIED KOPPER INERTOL RUST INHIBITIVE PRIMER 621, OR EQUAL, IN LIEU OF COAL TAR. EXTERIOR SURFACES OF ALL EXPOSED PIPE SHALL BE PAINTED WITH RUST-OLEUM ACRYLIC 5225 (SAFETY BLUE), OR EQUAL, PER COATING MANUFACTURER'S INSTRUCTIONS PRIOR TO INSTALLATION.
3. SEALANT SHALL BE 1¼" FLEXIBLE BUTYL RESIN SEALANT CS-102 AS MANUFACTURED BY CONCRETE SEALANTS, INC. OR EQUAL.
4. INSTALLATION OF VALVE CASING RING SHALL BE PER CITY OF TAYLOR STANDARD NO. UT 100 AND OR UT 121.
5. AIR VENT PIPE INSTALLATION SHALL BE AS NEAR AS PRACTICAL TO THE RIGHT-OF-WAY LINE.
6. CONCRETE MANHOLE PENETRATIONS SHALL BE CORE BIT DRILLED. VOID SHALL BE FILLED BY PRESSING SEAL GASKET COPR. PSX RESILIENT CONNECTOR MEETING ASTM C923 OR APPROVED EQUAL.
7. CROSS SECTIONAL AREA OF OPENING TO BE EQUAL TO OR GREATER THAN CROSS SECTIONAL AREA OF AIR VENT PIPE.
8. AIR/VACUUM VALVE SHALL BE INSTALLED IN A MANNER WHICH WILL ALLOW REMOVAL OF ASSEMBLY WITHOUT REMOVAL OF PRECAST CONCRETE LID.

AIR VALVE	GATE VALVE	VENT PIPE (MIN.)	M.H. DIA. (MIN.)
3"	3"	3"	5'
4"	4"	4"	6'
6"	6"	6"	6'
8"	8"	8"	6'
10"	10"	10"	7'
12"	12"	12"	7'

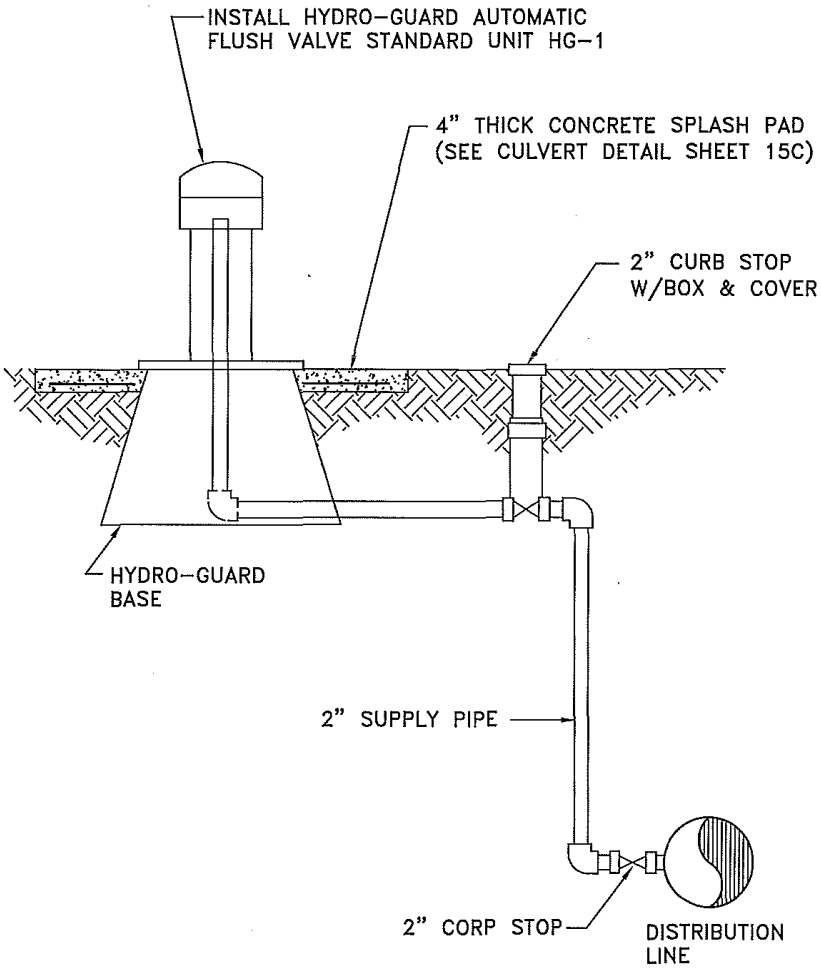
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	3" OR LARGER VENTED AIR / VACUUM VALVE INSTALLATION	UT 017 2 of 2



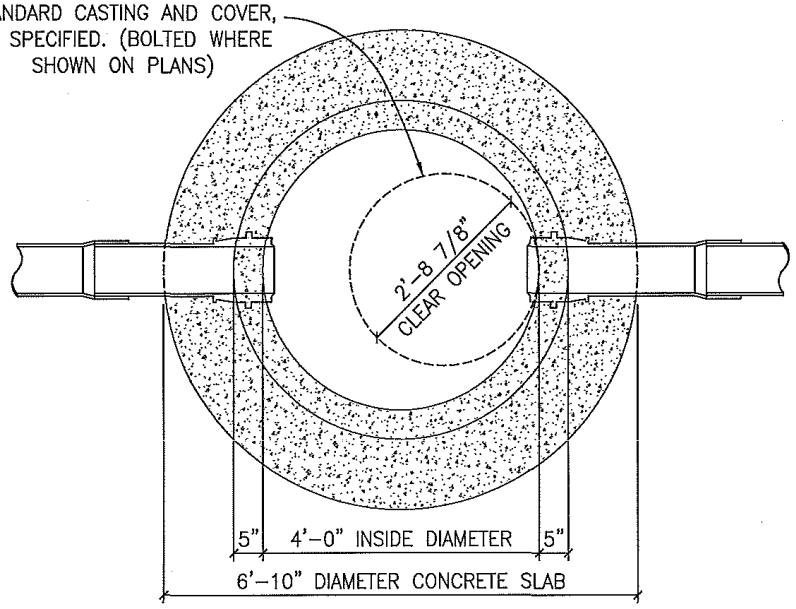
NOTES:

1. DIMENSIONS ARE APPLICABLE IN SPACE BETWEEN CURB AND SIDEWALK. WHERE WALK ABUTS CURB, AND IN PUBLIC OR COMMERCIAL AREAS, DIMENSION FROM BACK OF CURB SHALL BE 3' TO 6'. HYDRANTS ARE NOT TO BE PLACED IN SIDEWALK OR RAMP AREAS. SEE CITY OF TAYLOR STANDARD SPECIFICATIONS FOR LOCATION OF HYDRANT.
2. FOR BURY DEPTHS GREATER THAN 5', ONE BARREL EXTENSION NOT EXCEEDING 2' LENGTH SHALL BE INSTALLED DIRECTLY BELOW THE FIRE HYDRANT.
3. CRUSHED STONE OR 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.
4. WELD SOCKET 2½" X 2" DEEP TO 1" SCH. 40 ROUND STEM EXTENSION, FITTED ON OPERATING NUT, SCH. 80 FOR LENGTHS OVER 10'.
5. VALVE EXTENSIONS ARE REQUIRED ON ALL VALVES THAT EXCEED 3' DEEP FROM FINISHED GRADE. VALVE EXTENSIONS SHALL BE PLACED SUCH THAT THE EXTENSION NUT IS BETWEEN 18" & 24" FROM FINISHED GRADE.
6. HYDRANTS ARE TO BE PAINTED BY MANUFACTURER WITH "KEM-LUSTER" VERMILLION RED.
7. HYDRANTS ARE TO BE MUELLER "CENTURION" OR EQUIVALENT, CAPS AND CHAINS ARE NOT TO BE SUPPLIED WITH HYDRANTS.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	STANDARD FIRE HYDRANT	UT 018



CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS AUTOMATIC FLUSHING VALVE	STANDARD UT 019



MANHOLE PLAN

CITY OF TAYLOR NOTES:

MANHOLE DETAILS SHALL REFLECT THE CITY'S MINIMUM SPECIFICATIONS, AS STATED BELOW:

A. ALL MANHOLES SHALL BE 48" I.D., R.C.P., CLASS III, WITH RUBBER O-RING GASKET JOINTS CONFORMING TO ASTM C478, C433 AND C76.

B. ALL MANHOLES SHALL HAVE WATER-TIGHT FRAME AND COVER, WITH A MINIMUM 36" CLEAR OPENING, AS MANUFACTURED BY EAST JORDAN IRON WORKS (AS PER DETAIL # WW-07) OR APPROVED EQUAL.

C. ALL MANHOLES SHALL BE CONCRETE WITH CAST IRON FRAME AND COVER.

D. ALL MANHOLES SHALL HAVE AN ECCENTRIC CONE.

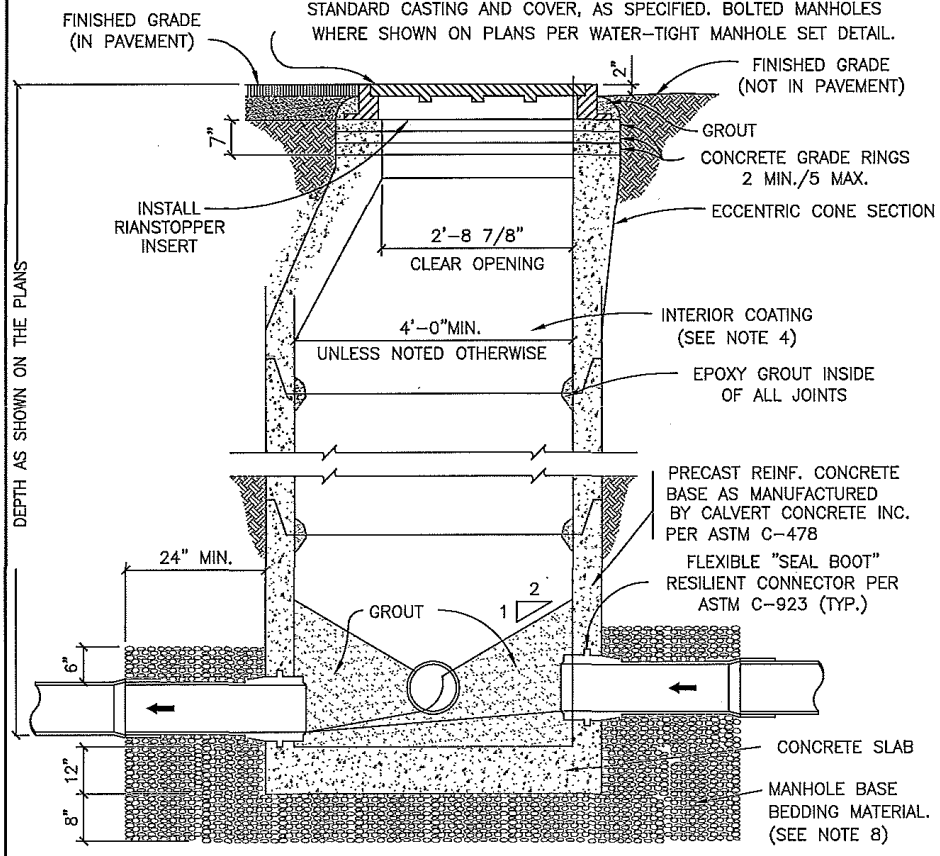
E. MANHOLES MAY HAVE A FLAT LID, IF APPROVED BY CITY OF TAYLOR, BEING 12" THICK WITH A MINIMUM 30" OPENING, AS MANUFACTURED BY CALVERT CONCRETE OR APPROVED EQUAL M.F.G. CONFORMING TO ASTM C478, 5000 P.S.I. CONCRETE, TRAFFIC BEARING, AND O-RING JOINT CONFORMING TO ASTM C443.

F. INVERTS AND FLEXIBLE SEAL BOOTS, PER ASTM C-923, SHALL BE CAST INTO BASE SECTION.

G. MINIMUM DROP BETWEEN INVERTS SHALL BE ONE-TENTH OF A FOOT (0.1').

H. TWO (2") INCH GRADE RINGS WITH AN I.D. TO MATCH FRAMES CLEAR OPENING, MINIMUM OF TWO (2), MAXIMUM OF FIVE (5) GRADE RINGS REQUIRED.

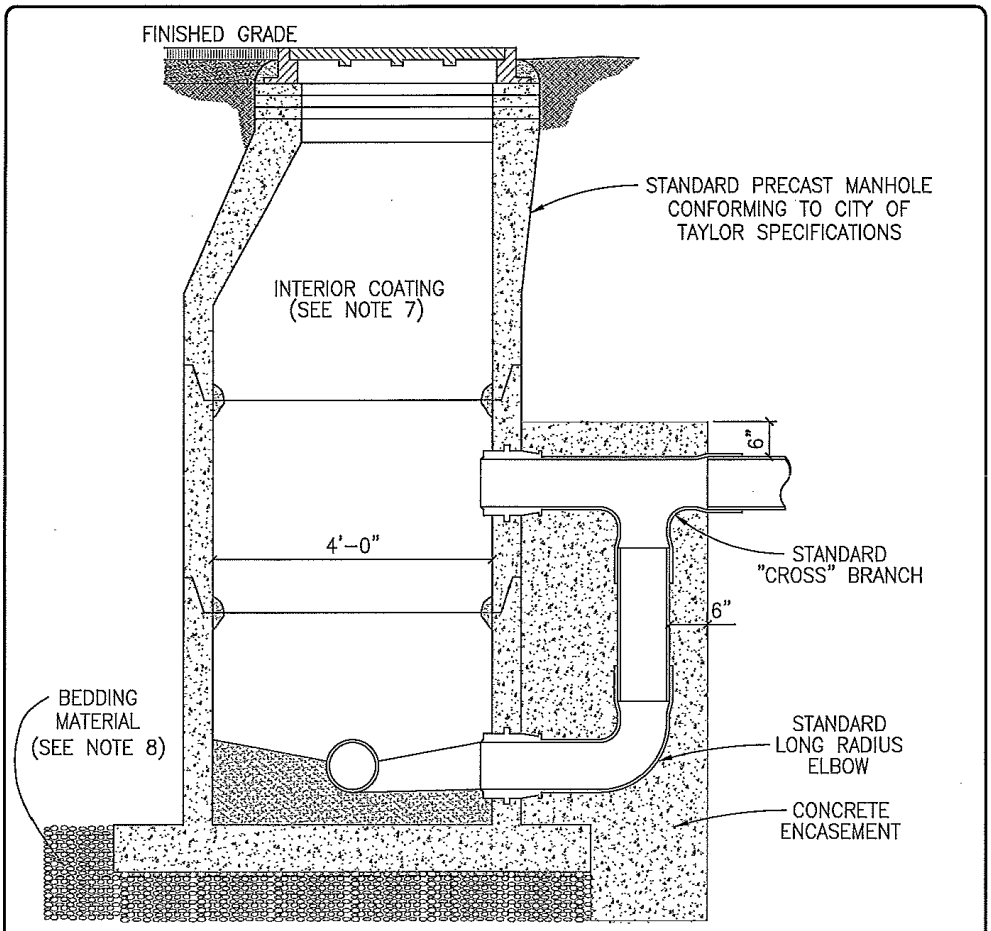
	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	STANDARD MANHOLE - PLAN	UT 200



NOTES:

1. MANHOLES SHALL BE PRECAST ASTM C-478 BELL AND SPIGOT WITH "O" RING JOINTS.
2. SEE PLANS AND MANHOLE SCHEDULE, FOR MANHOLE SIZE, LOCATION, CONFIGURATION, TYPE OF TOP SECTION, VENTING REQUIREMENTS, PIPE SIZE AND TYPES.
3. SEE SPECIFICATIONS ON MATERIALS AND CONSTRUCTION.
4. AN 80 MIL COAT OF RAVEN LINING SYSTEMS, RAVEN 405 ULTRA HIGH BUILD EPOXY COATING, OR APPROVED EQUAL, TO BE APPLIED TO ENTIRE INTERIOR OF EACH WASTEWATER MANHOLE AND UNDERSIDE OF FLAT TOPS.
5. ALL MANHOLE COVERS SHALL BE BOLTED AND GASKETTED WHEN MANHOLES ARE LOCATED OUT FROM PAVEMENT.
6. MANHOLES TO BE VENTED ARE IDENTIFIED ON MANHOLE SCHEDULE. REFERENCE MANHOLE VENT DETAIL.
7. MANHOLES ARE TO 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.
8. MANHOLE BASE BEDDING MATERIAL SPECS. FOR 3/4" WASHED GRAVEL:
   SIEVE SIZE 2", PERCENT (%) RETAINED 0
   SIEVE SIZE 1 1/2", % RETAINED 0-10
   SIEVE SIZE 1", % RETAINED 45-80
   SIEVE SIZE 3/4", % RETAINED 85-100
   SIEVE SIZE 3/8", % RETAINED 95-100

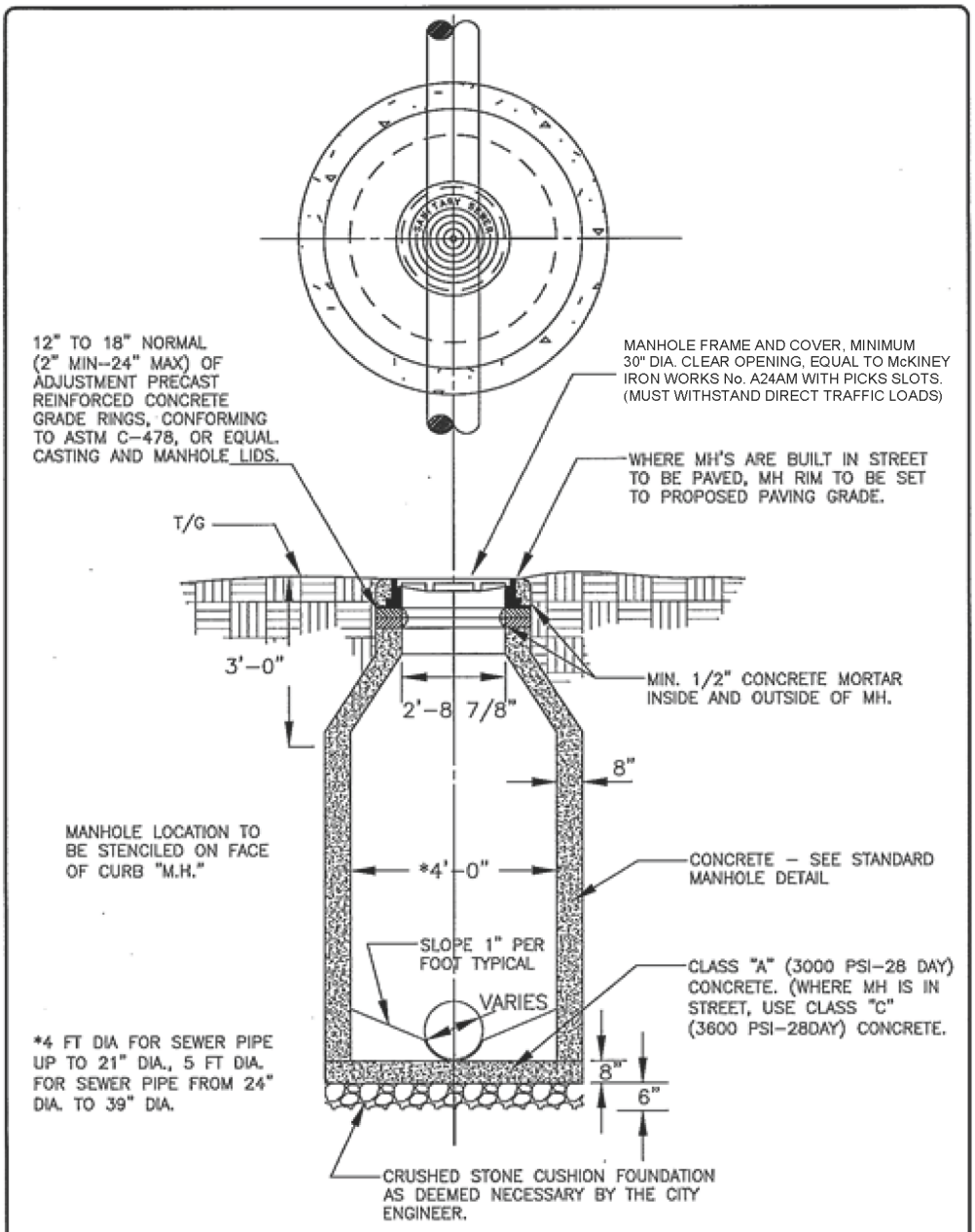
	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	STANDARD MANHOLE - SECTION	UT 201

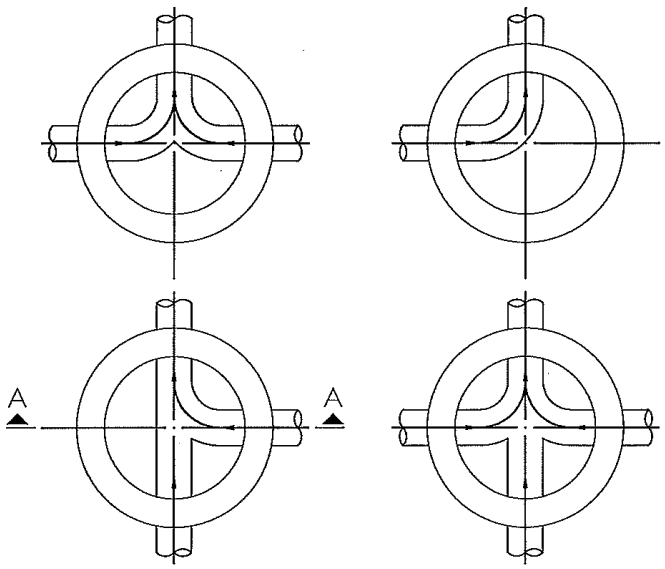


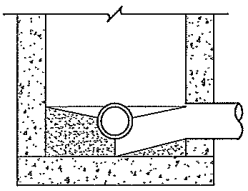
NOTES:

1. CONCRETE ENCASEMENT FOR DROP CONNECTION TO BE POURED INTEGRALLY WITH BOTH MANHOLE SLAB AND WALL.
2. DROP CONNECTIONS SHALL BE REQUIRED WHENEVER AN INFLUENT SEWER IS LOCATED TWO FEET (2') OR MORE ABOVE THE MAIN INVERT CHANNEL.
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. MINIMUM PIPE SIZE FOR DROP IS EIGHT INCHES (8").
6. SEE STANDARD MANHOLE DETAIL FOR ADDITIONAL REQUIREMENTS.
7. AN 80 MIL COAT OF RAVEN LINING SYSTEMS, RAVEN 405 ULTRA HIGH BUILD EPOXY COATING, OR APPROVED EQUAL, TO BE APPLIED TO ENTIRE INTERIOR OF EACH WASTEWATER MANHOLE AND UNDERSIDE OF FLAT TOPS.
8. MANHOLE BASE BEDDING MATERIAL SPECS. FOR 3/4" WASHED GRAVEL:
   SIEVE SIZE 2", PERCENT (%) RETAINED 0
   SIEVE SIZE 1 1/2", % RETAINED 0-10
   SIEVE SIZE 1", % RETAINED 45-80
   SIEVE SIZE 3/4", % RETAINED 85-100
   SIEVE SIZE 3/8", % RETAINED 95-100

CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD UT 202
		DROP CONNECTION PRECAST MANHOLE TYPE "A"	


12" TO 18" NORMAL (2" MIN–24" MAX) OF ADJUSTMENT PRECAST REINFORCED CONCRETE GRADE RINGS, CONFORMING TO ASTM C–478, OR EQUAL. CASTING AND MANHOLE LIDS.
MANHOLE FRAME AND COVER, MINIMUM 30" DIA. CLEAR OPENING, EQUAL TO McKINEY IRON WORKS No. A24AM WITH PICKS SLOTS. (MUST WITHSTAND DIRECT TRAFFIC LOADS)
WHERE MH'S ARE BUILT IN STREET TO BE PAVED, MH RIM TO BE SET TO PROPOSED PAVING GRADE.
T/G
3'–0"
2'–8 7/8"
MIN. 1/2" CONCRETE MORTAR INSIDE AND OUTSIDE OF MH.
8"
MANHOLE LOCATION TO BE STENCILED ON FACE OF CURB "M.H."
*4'–0"
CONCRETE – SEE STANDARD MANHOLE DETAIL
SLOPE 1" PER FOOT TYPICAL
CLASS "A" (3000 PSI–28 DAY) CONCRETE. (WHERE MH IS IN STREET, USE CLASS "C" (3600 PSI–28DAY) CONCRETE.
VARIES
*4 FT DIA FOR SEWER PIPE UP TO 21" DIA., 5 FT DIA. FOR SEWER PIPE FROM 24" DIA. TO 39" DIA.
8"
6"
CRUSHED STONE CUSHION FOUNDATION AS DEEMED NECESSARY BY THE CITY ENGINEER.
CITY OF TAYLOR FOUNDED 1876
APPROVED BY: CS
DATE: JULY 2009
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
STANDARD DETAILS
STANDARD
UT 203
STANDARD CAST-IN-PLACE MANHOLE



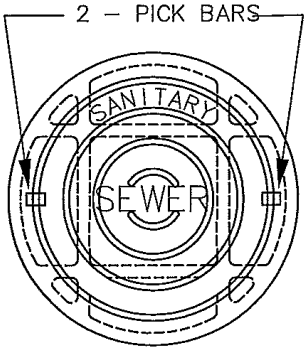


SECTION "A–A"

NOTES:

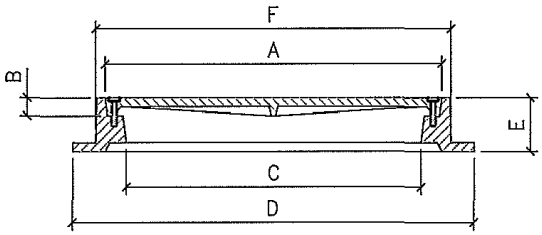
1. INVERT CHANNELS TO BE CONSTRUCTED FOR SMOOTH FLOW WITH NO OBSTRUCTIONS.
2. SPILLWAYS SHALL BE CONSTRUCTED BETWEEN PIPES WITH DIFFERENT INVERT ELEVATIONS PROVIDING FOR SMOOTH FLOW.
3. CHANNELS FOR FUTURE CONSTRUCTIONS (STUBS) SHALL BE CONSTRUCTED, FILLED WITH SAND, AND COVERED WITH 1" OF MORTAR.
4. SLOPE MANHOLE ITSELF WITH A 1:2 SLOPE FROM MANHOLE WALL TO CHANNEL.
5. INVERT SHALL BE A MINIMUM OF 1/2 THE DIAMETER OF THE LARGEST PIPE OR 4" DEEP.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	FLOW PATTERNS FOR INVERT CHANNELS	UT 204



VULCAN #VM–42 OR
APPROVED EQUAL

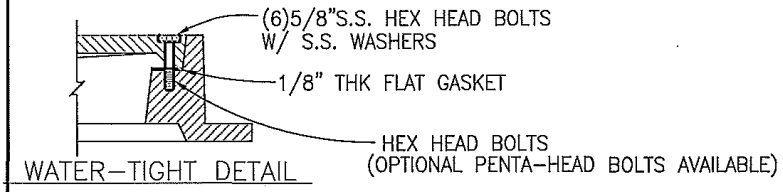
NOTE:
LID SHALL HAVE TWO (2)
TYPE 4 PICK BAR



PLEASE SPECIFY TOP OR BOTTOM FLANGE WHEN ORDERING.
FOR TOP FLANGE ORDER No. V–1800–5 (East Jordan Iron Works, inc.)
FOR BOTTOM FLANGE ORDER No. V–1600–5 (East Jordan Iron Works, inc.)

THE WATER–TIGHT MANHOLE SETS (V–2600–5) FEATURE SIX STAINLESS STEEL BOLTS IN COUNTERSUNK POCKETS AND A SEALING FLAT GASKET IN THE RING SET.

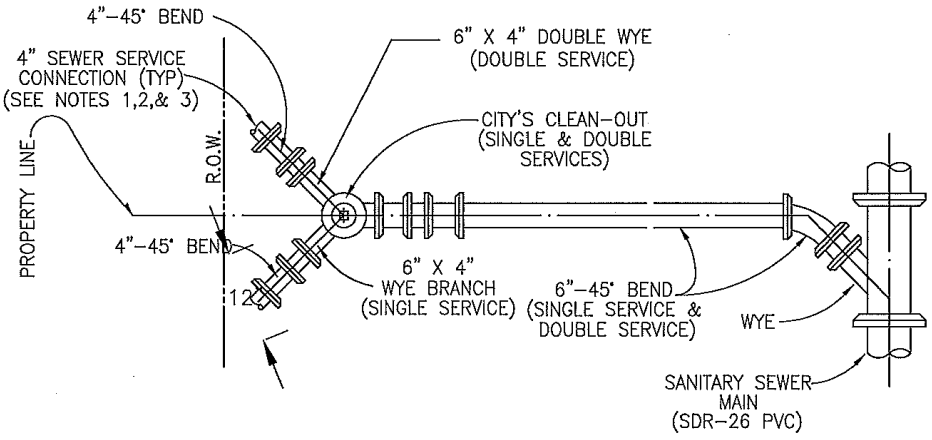
BOLTING PADS REDUCE THE STANDARD CLEAR OPENING BY TWO TO THREE INCHES.



WATER–TIGHT DETAIL

	DIMENSIONS						COVER		RING		SET
	A	B	C	D	E	F	CASTING	WEIGHT	CASTING	WEIGHT	WEIGHT
V–1600–5	38	2	36	46	6	40	41600523	365 LBS	41600510	320 LBS	685 LBS
V–1800–5	38	2	36	46	6	40	41600523	365 LBS	41600510	320 LBS	685 LBS
V–2600–5	38	2	36	46	6	40	42600523	365 LBS	41600511	320 LBS	685 LBS

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	STANDARD WASTEWATER MANHOLE SET	UT 205

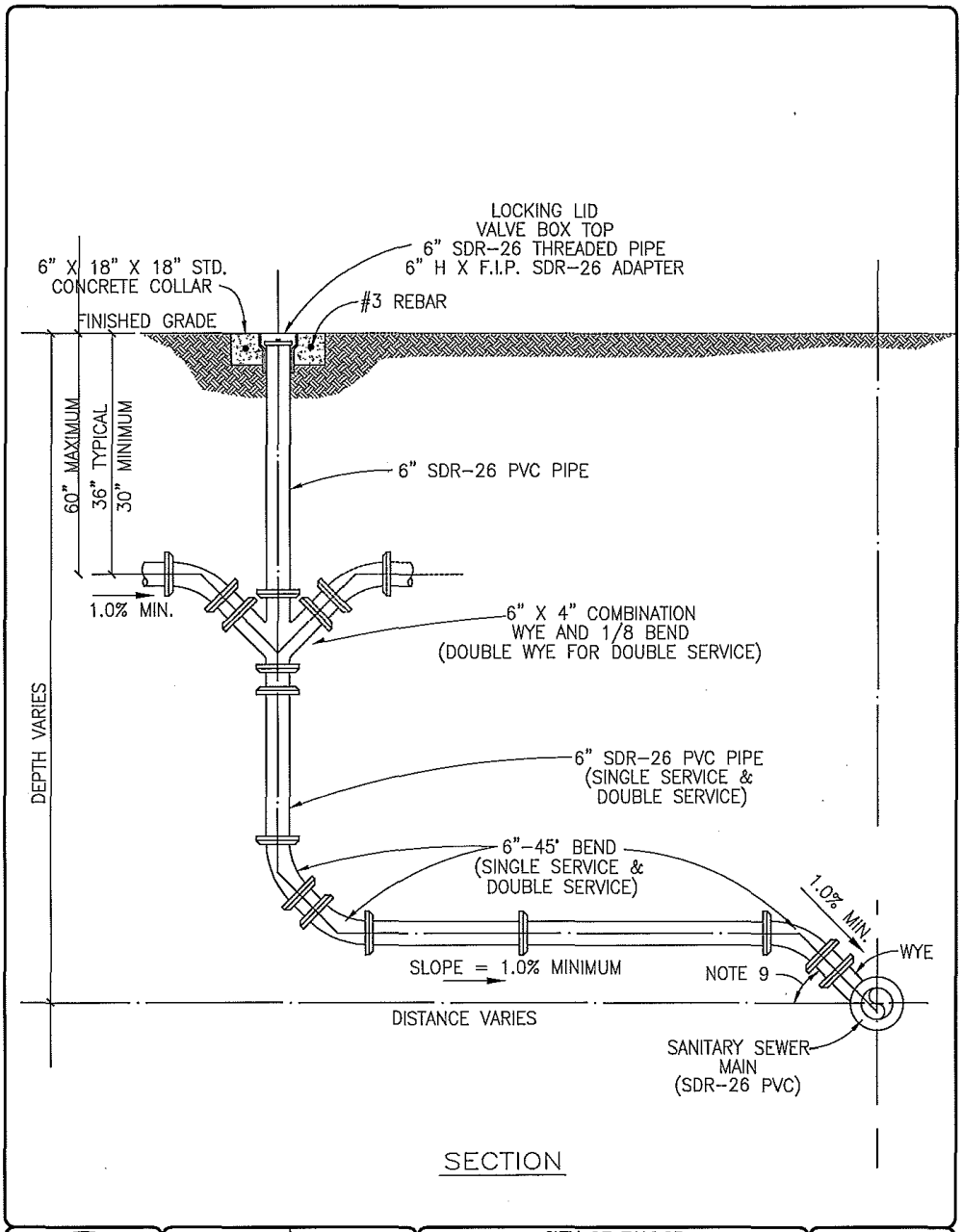


PLAN

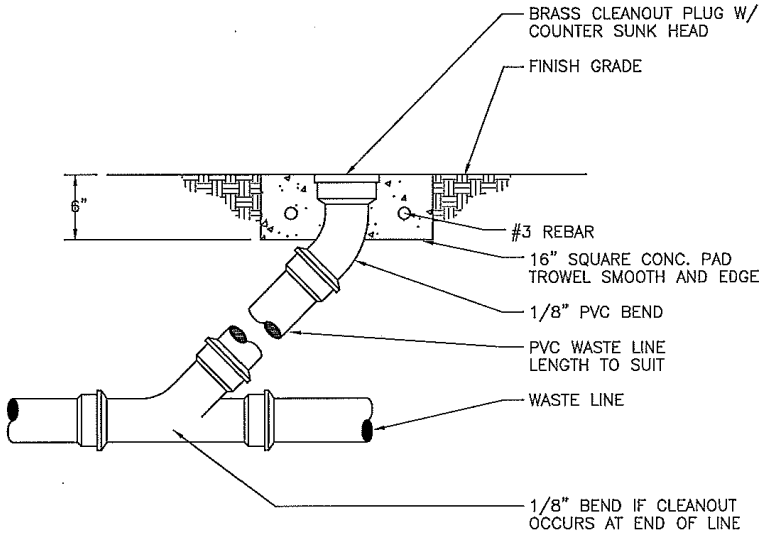
NOTES:

1. FOR INSTALLATION WITHIN UTILITY EASEMENTS, SERVICE CONNECTION RISERS MAY BE LOCATED INSIDE THE PROPERTY LINE.
2. ~~THE CLEAN–OUT SHALL BE EXTENDED 12" ABOVE FINISH GRADE.~~
3. EACH SERVICE CONNECTION SHALL BE PLUGGED WATER–TIGHT WITH AN APPROVED CAP OR PLUG.
4. CONNECT YARD LINE TO SERVICE LINE WITH RIGID, SOLVENT–WELDED PVC TO PVC ADAPTER.
5. SOLIDLY TAMP BACKFILL AT LEAST ONE FOOT (1'–0") ABOVE TOP OF PIPE. SERVICES UNDER PAVED AREAS SHALL BE BACKFILLED TO THE SAME SPECIFICATIONS AS SHOWN ON PAVEMENT REPLACEMENT DETAIL.
6. CONTRACTOR SHALL MARK ON A CLEAN SET OF PLANS THE FINAL STATIONING OR DISTANCE AND DIRECTION FROM MANHOLE TO EACH SERVICE LATERAL AND GIVE TO ENGINEER FOR RECORD DRAWING PURPOSES.
7. ANY DEVIATION FROM THESE METHODS MUST BE APPROVED BY THE CITY ENGINEERING DEPARTMENT.
8. SERVICE LINE MATERIAL SHALL BE P.V.C., SDR–26.
9. SEWER SERVICE SLOPE TO BE 45° OFF CENTERLINE OF MAIN.

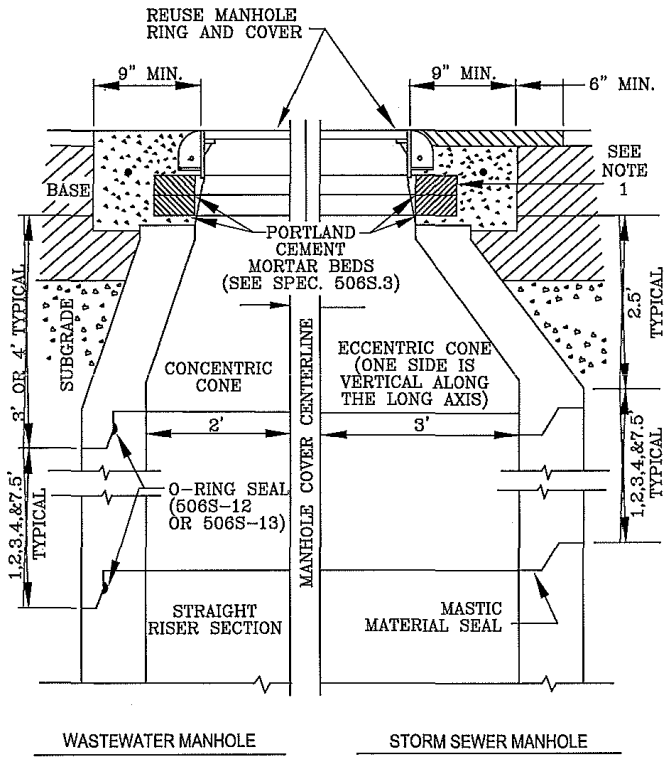
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	SEWER SERVICE CONNECTION PLAN VIEW	UT 206



CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS SEWER SERVICE CONNECTIONS SECTION VIEW	STANDARD UT 207

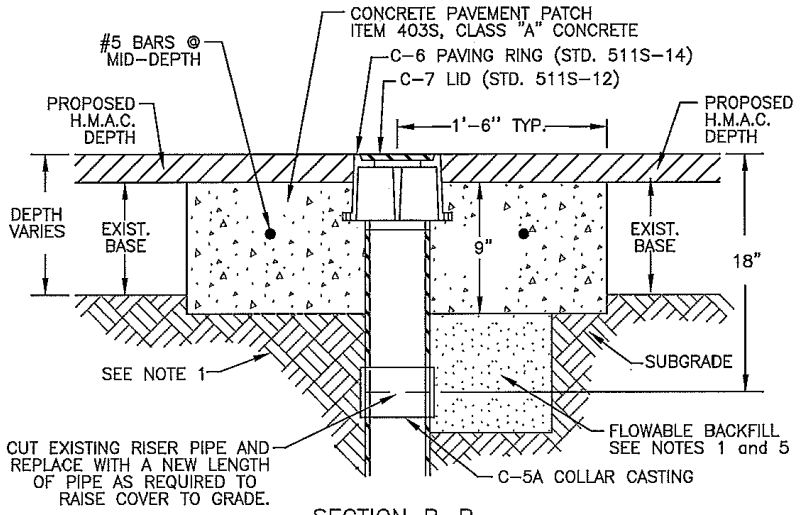


	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	SANITARY SEWER CLEANOUT	UT 208

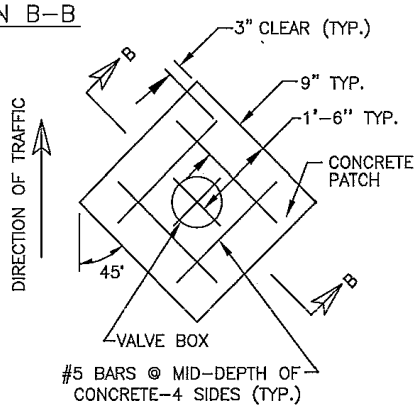


1. SEE "MINOR MANHOLE ADJUSTMENTS" STANDARD 506S-4 FOR CLARITY.
2. MANHOLE SECTIONS TEMPORARILY REMOVED FOR ROADWAY CONSTRUCTION MAY BE REUSED ONLY WITH THE WRITTEN APPROVAL OF THE INSPECTOR. O-RINGS SHALL NOT BE REUSED.
3. ANY COMBINATION OF REMOVING THE CONCRETE RINGS, AND / OR THE MANHOLE CONE, AND/OR THE STRAIGHT RISER SECTION OF THE MANHOLE SHALL BE ACCEPTABLE TO TEMPORARILY LOWER THE MANHOLE GRADE FOR ROADWAY RECONSTRUCTION.
4. WHILE THE MANHOLE IS TEMPORARILY LOWERED, A SHEET OF STEEL SUITABLE TO SUPPORT ALL IMPOSED LOADS SHALL BE USED TO COVER THE OPENING. FOR WASTEWATER MANHOLES, THE STEEL PLATE SHALL BE SET IN MORTAR TO PREVENT LEAKAGE.
5. SUBGRADE AND BASE MATERIALS SHALL BE COMPACTED TO 95% AND 100% DENSITIES, RESPECTIVELY, COMPACTION SHALL BE BY MECHANICAL TAMPING TO THE DENSITIES SPECIFIED.

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	MAJOR MANHOLE ADJUSTMENT	UT 209



SECTION B-B

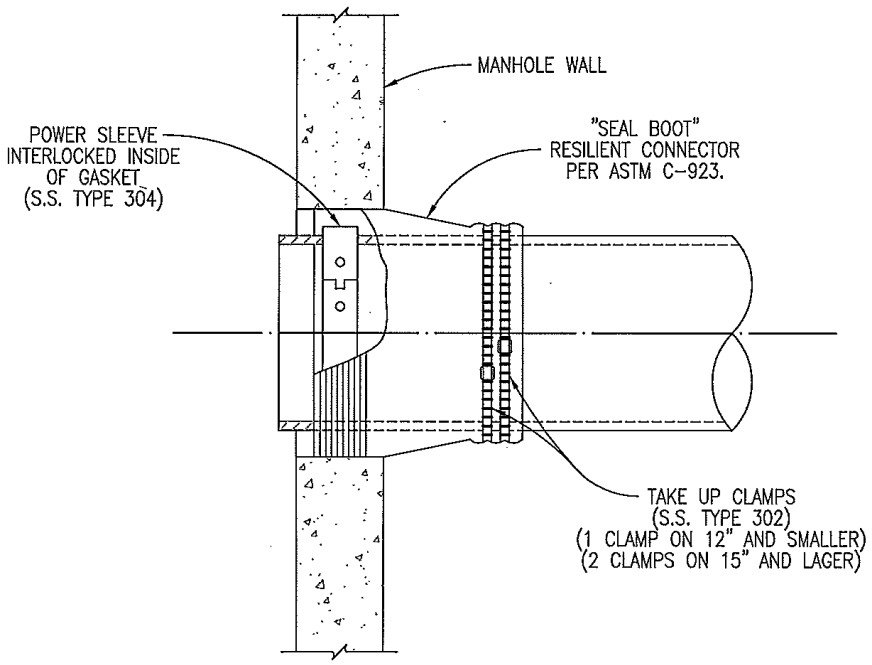


PLAN VIEW

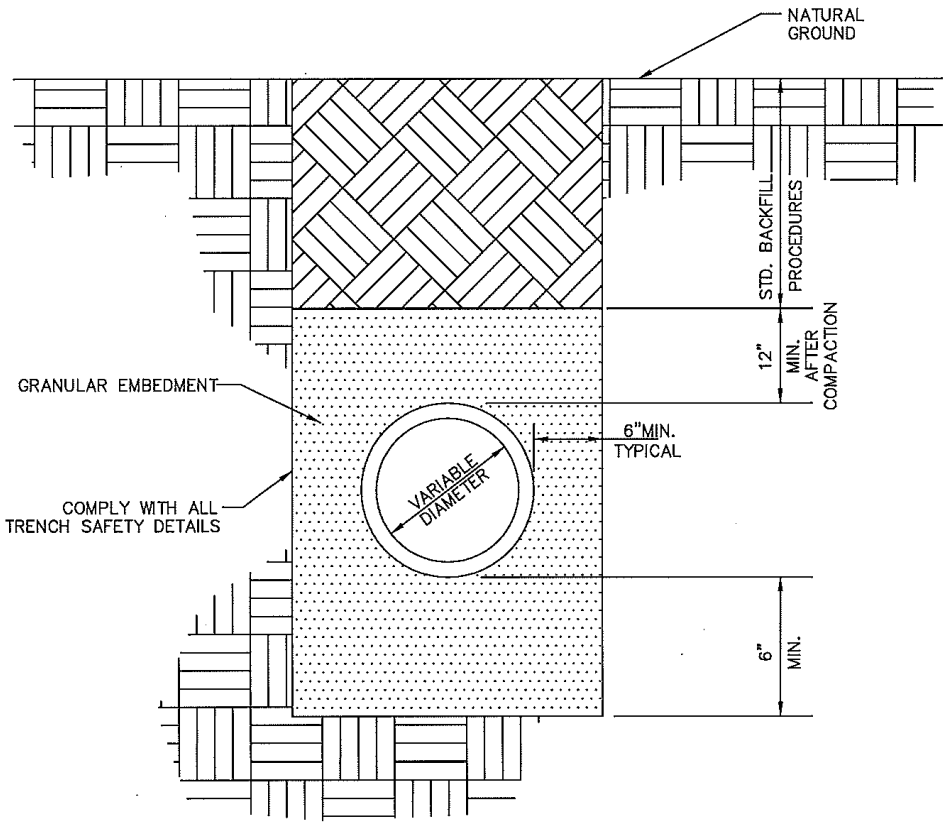
NOTES:

1. SUBGRADE SHALL BE COMPACTED AS PER ITEM 201S, SUBGRADE PREPARATION.
2. VALVE CASTINGS SHALL BE ADJUSTED TO GRADE AFTER FINAL LIFT OF OVERLAY IS IN PLACE.
3. CLEAN VALVE BOX OF ALL DEBRIS DOWN TO THE BASE OF THE VALVE.
4. REMOVE EXISTING RISER PIPE DOWN 18" AND REPLACE TO THE NEW ELEVATION NEW PIPE AND A C-5A CASTING.
5. WHERE CAST IRON CASTINGS TO BE REMOVED REQUIRE EXCAVATION GREATER THAN 20" DEEP, CONTRACTOR MAY ELECT TO FILL EXCAVATION WITH CONTROLLED LOW STRENGTH MATERIAL (ITEM 402S) TO THE UNDERSIDE OF THE CONCRETE PAVEMENT PATCH IN LIEU OF COMPACTED BACKFILL.
6. REINFORCING STEEL SHALL MEET ITEM 406S, REINFORCING STEEL.

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	VALVE BOX ADJUSTMENT DETAIL	UT 210



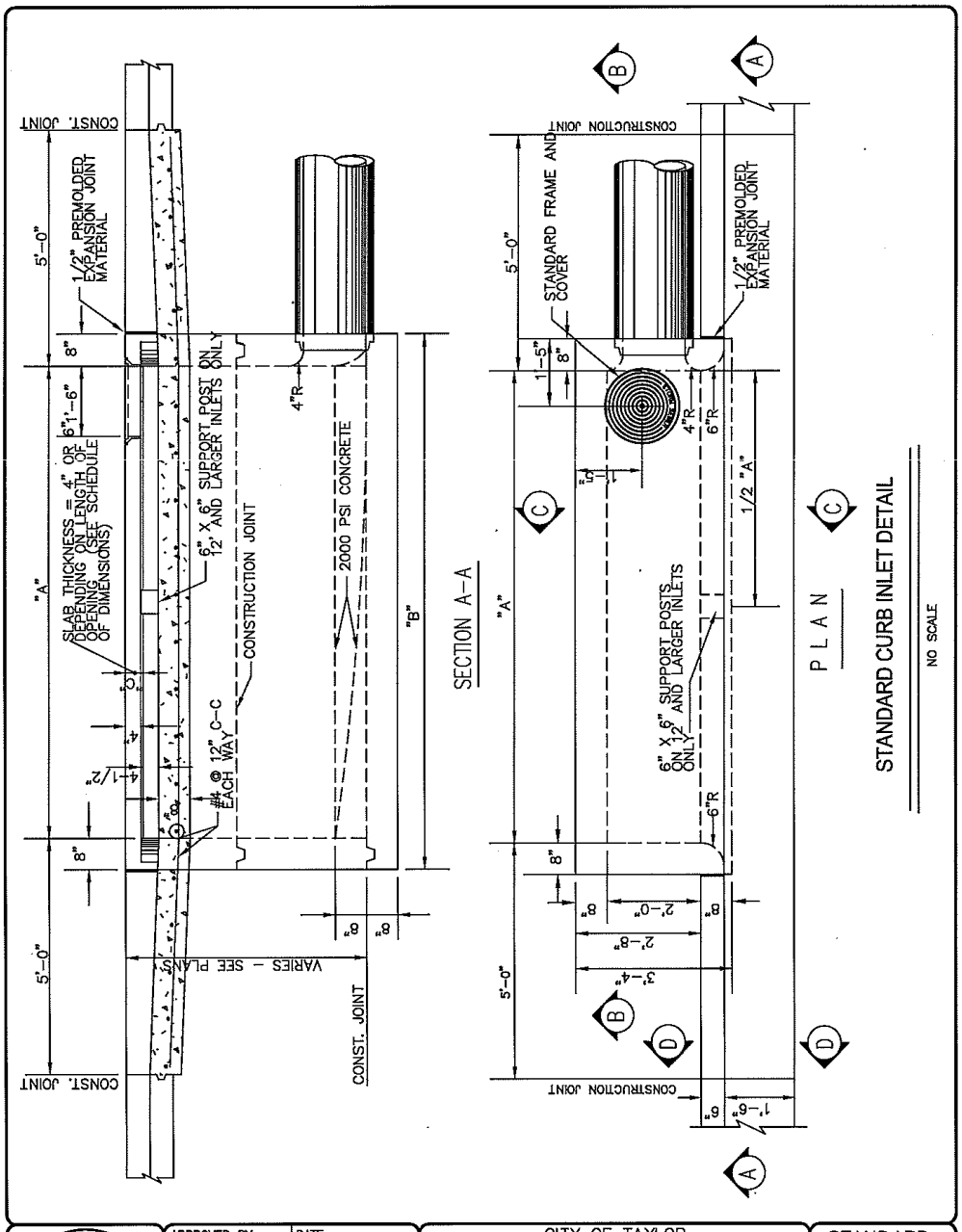
CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS FLEXIBLE "SEAL BOOT" CONNECTOR	STANDARD UT 211



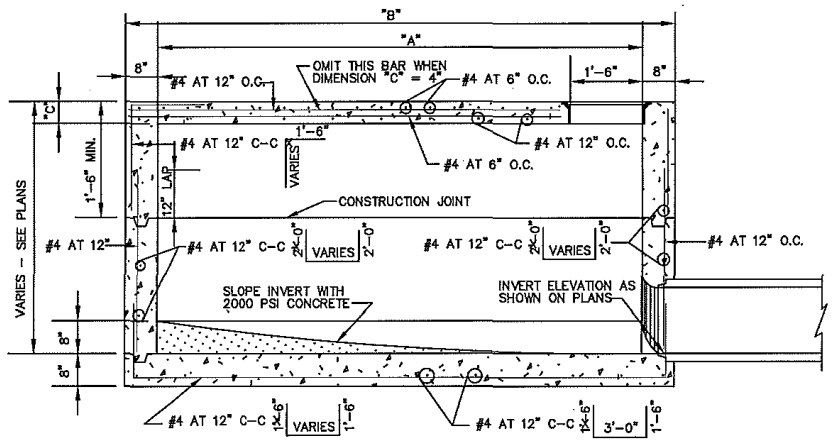
NOTE:

COST OF GRANULAR EMBEDMENT IS INCLUDED IN PRICE BID PER LINEAR FOOT OF SEWER PIPE.

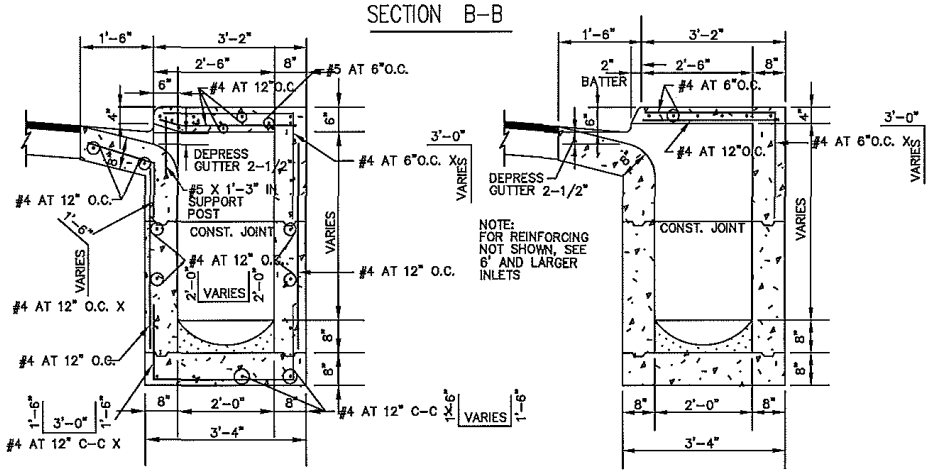
CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS STORM DRAIN PIPE EMBEDMENT DETAIL	STANDARD UT 300



CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS STANDARD CURB INLET DETAIL	STANDARD UT 301 1 of 2



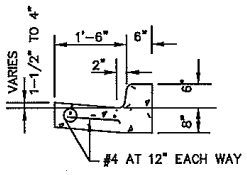
SECTION B-B



(6' AND LARGER INLETS) SECTIONS C-C (3'-5' INLETS)

NO SCALE

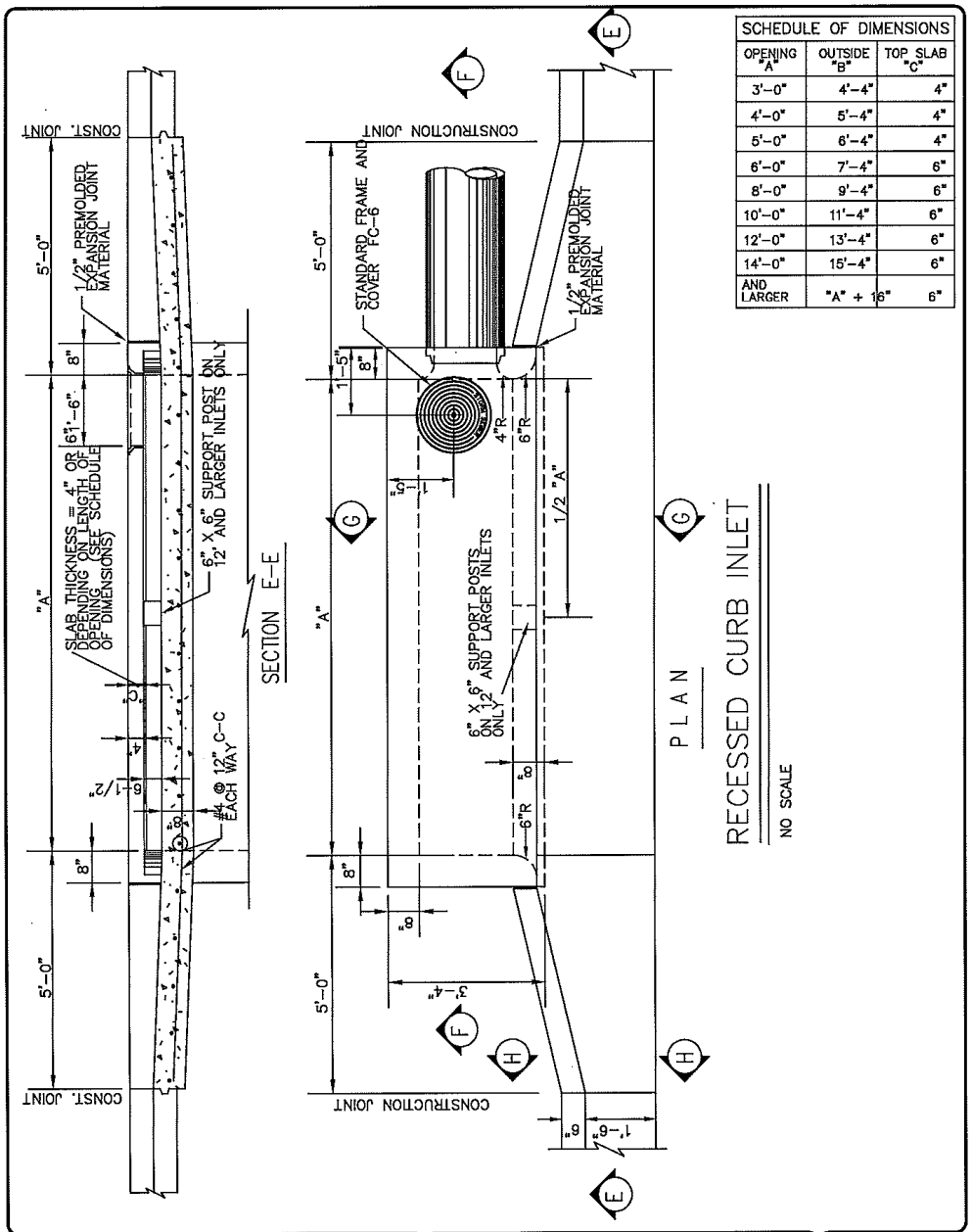
SCHEDULE OF DIMENSIONS		
OPENING "A"	OUTSIDE "B"	TOP SLAB "C"
3'-0"	4'-4"	4"
4'-0"	5'-4"	4"
5'-0"	6'-4"	4"
6'-0"	7'-4"	6"
8'-0"	9'-4"	6"
10'-0"	11'-4"	6"
12'-0"	13'-4"	6"
14'-0"	15'-4"	6"
AND LARGER	"A" + 16"	6"

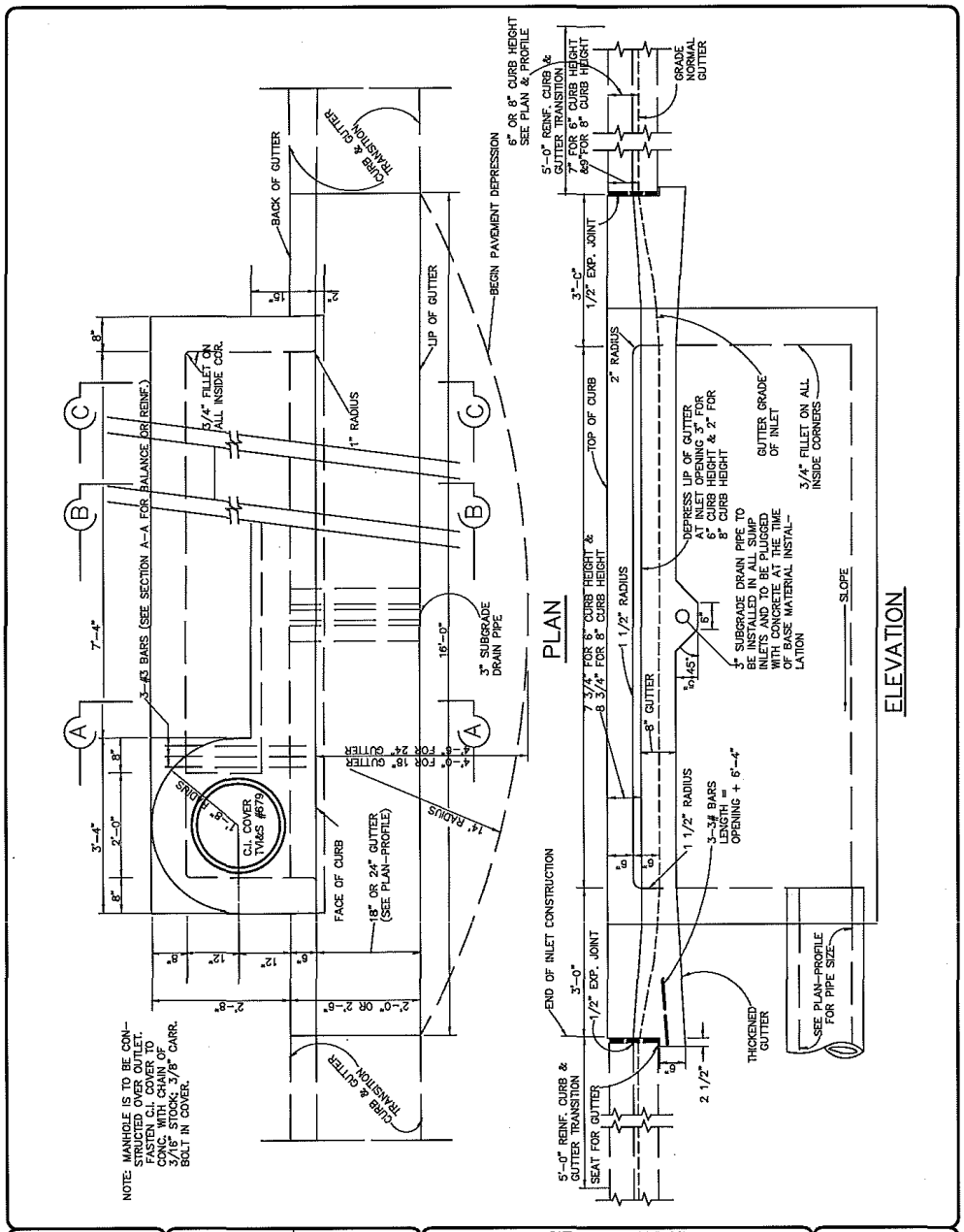


SECTION D-D

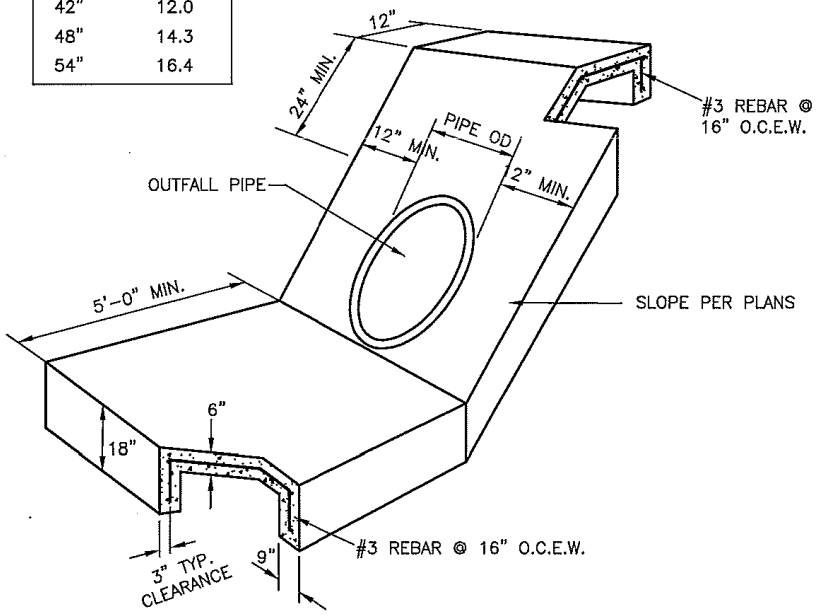
NO SCALE

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	STANDARD CURB INLET DETAIL	UT 301 2 of 2


SCHEDULE OF DIMENSIONS
OPENING "A" | OUTSIDE "B" | TOP SLAB "C"
3'-0" | 4'-4" | 4"
4'-0" | 5'-4" | 4"
5'-0" | 6'-4" | 4"
6'-0" | 7'-4" | 6"
8'-0" | 9'-4" | 6"
10'-0" | 11'-4" | 6"
12'-0" | 13'-4" | 6"
14'-0" | 15'-4" | 6"
AND LARGER | "A" + 16" | 6"
CONST. JOINT
1/2" PREMOLDED EXPANSION JOINT MATERIAL
SLAB THICKNESS = 4" OR 6" DEPENDING ON LENGTH OF OPENING (SEE SCHEDULE OF DIMENSIONS)
6" X 6" SUPPORT POST ON 12' AND LARGER INLETS ONLY
#4 @ 12" C-C EACH WAY
SECTION E-E
CONSTRUCTION JOINT
STANDARD FRAME AND COVER FC-6
6" X 6" SUPPORT POSTS ON 12' AND LARGER INLETS ONLY
PLAN
RECESSED CURB INLET
NO SCALE
CITY OF TAYLOR FOUNDED 1876
APPROVED BY: CS
DATE: JULY 2009
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
STANDARD DETAILS
RECESSED CURB INLET
STANDARD
UT 302


PLAN
ELEVATION
BACK OF GUTTER
LIP OF GUTTER
BEGIN PAVEMENT DEPRESSION
FACE OF CURB
END OF INLET CONSTRUCTION
3" SUBGRADE DRAIN PIPE
C.I. COVER TYMES #879
18" OR 24" GUTTER (SEE PLAN-PROFILE)
3-#3 BARS (SEE SECTION A-A FOR BALANCE OF REINF.)
3/4" FILLET ON ALL INSIDE CORNERS
1" RADIUS
14" RADIUS
CURB & GUTTER TRANSITION
5'-0" REINF. CURB & GUTTER TRANSITION SEAT FOR GUTTER
6" OR 8" CURB HEIGHT SEE PLAN & PROFILE
5'-0" REINF. CURB & GUTTER TRANSITION 7" FOR 6" CURB HEIGHT & 9" FOR 8" CURB HEIGHT
GRADE NORMAL GUTTER
3'-0" 1/2" EXP. JOINT
TOP OF CURB
2" RADIUS
7 3/4" FOR 6" CURB HEIGHT & 8 3/4" FOR 8" CURB HEIGHT
1 1/2" RADIUS
8" GUTTER
45°
4" SUBGRADE DRAIN PIPE TO BE INSTALLED IN ALL SUMP INLETS AND TO BE PLUGGED WITH CONCRETE AT THE TIME OF BASE MATERIAL INSTALLATION
DEPRESS LIP OF GUTTER AT INLET OPENING 3" FOR 6" CURB HEIGHT & 2" FOR 8" CURB HEIGHT
GUTTER GRADE OF INLET
3/4" FILLET ON ALL INSIDE CORNERS
SLOPE
3-3/4 BARS LENGTH = OPENING + 6'-4"
THICKENED GUTTER
SEE PLAN-PROFILE FOR PIPE SIZE
2 1/2"
NOTE: MANHOLE IS TO BE CONSTRUCTED OVER OUTLET. FASTEN C.I. COVER TO CONC. WITH CHAIN OF 3/16" STOCK; 3/8" CARR. BOLT IN COVER.
CITY OF TAYLOR FOUNDED 1876
APPROVED BY: CS
DATE: JULY 2009
CITY OF TAYLOR
WILLIAMSON COUNTY, TEXAS
STANDARD DETAILS
STANDARD 10' CURB INLET DETAIL
STANDARD
UT 303

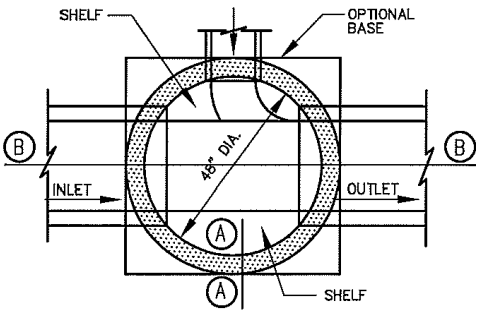
MINIMUM RIP–RAP QUANTITIES	
PIPE	SQ. YDS.
18"	6.2
24"	6.9
27"	7.8
30"	9.5
36"	10.4
42"	12.0
48"	14.3
54"	16.4



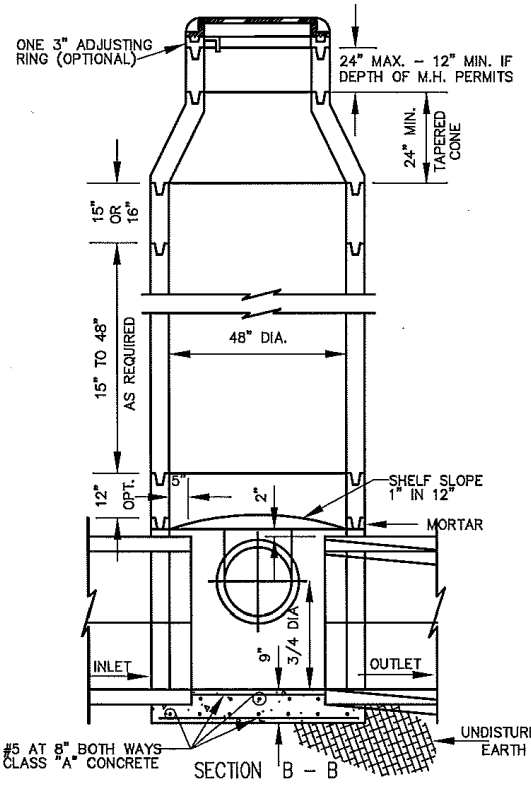
NOTES:

1. WHEN HEADWALLS AND WINGWALLS ARE REQUIRED, THEY SHALL CONFORM TO THE TEXAS HIGHWAY DEPARTMENT STANDARDS, OR AS DIRECTED BY THE CITY.
2. ENERGY DISSIPATERS SHALL BE INSTALLED IF PIPE VELOCITY EXCEEDS 5.0 F.P.S., OR AS DIRECTED BY THE CITY.

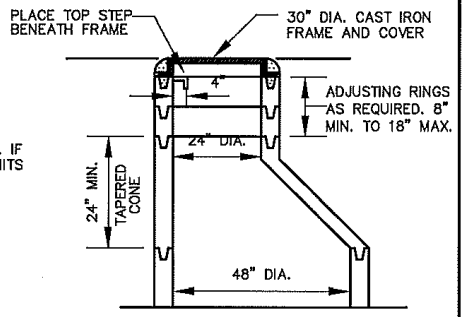
APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	RIP-RAP AT PIPE OUTFALL	UT 304



PLAN

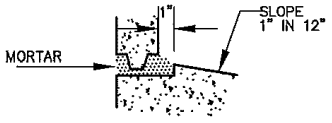


SECTION B – B



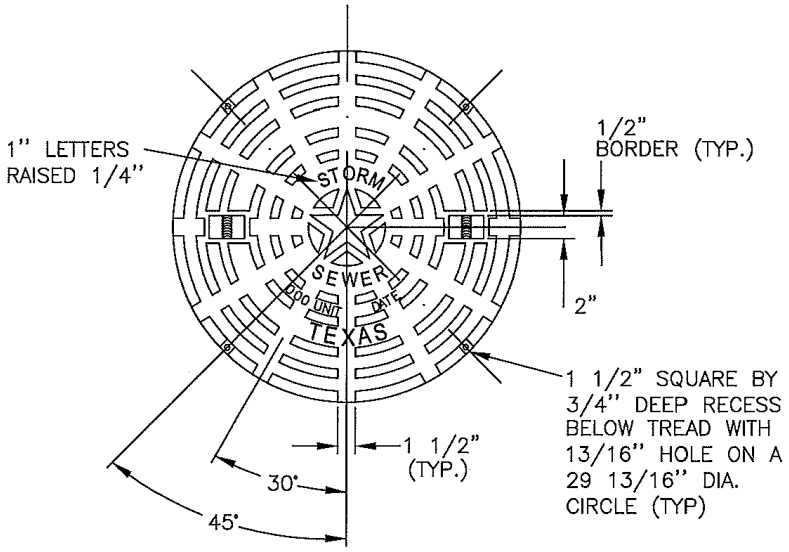
ALTERNATE SECTION MAY BE SUBMITTED FOR APPROVAL

NOTES: USE 24" FRAME AND COVER MINIMUM SIZES:
4' DIA. – 18" TO 30"
5' DIA. – 36" TO 42"
6' DIA. – 48" TO 54"
7' DIA. – 60" TO 66"
SIZES TO BE USED ARE DEPENDENT ON SEWER ANGLES.

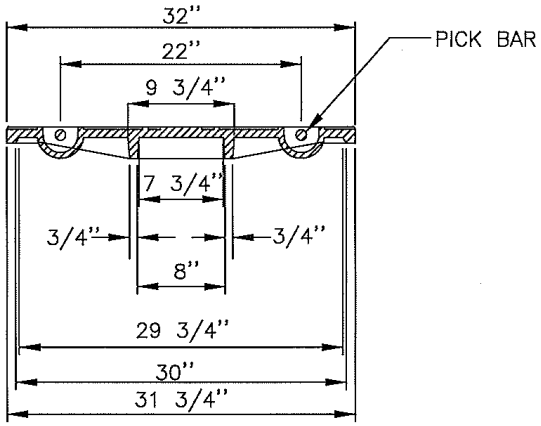


SECTION A – A

	APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CITY OF TAYLOR FOUNDED 1876	CS	JULY 2009	STORM SEWER MANHOLE - PRECAST	UT 305

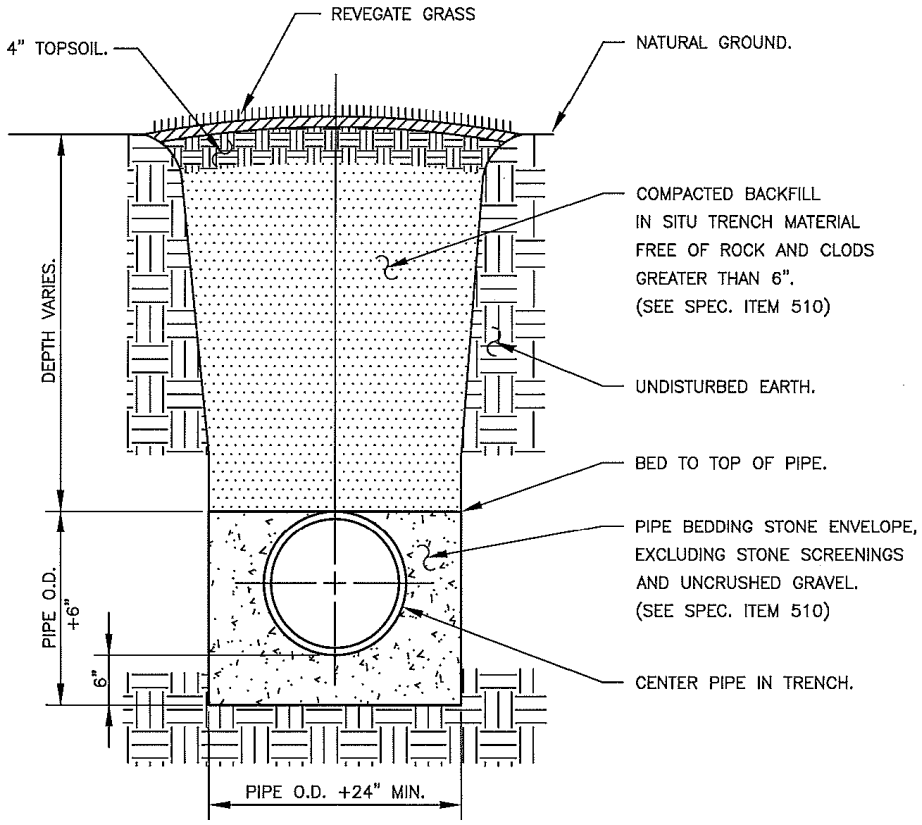


LID PLAN VIEW

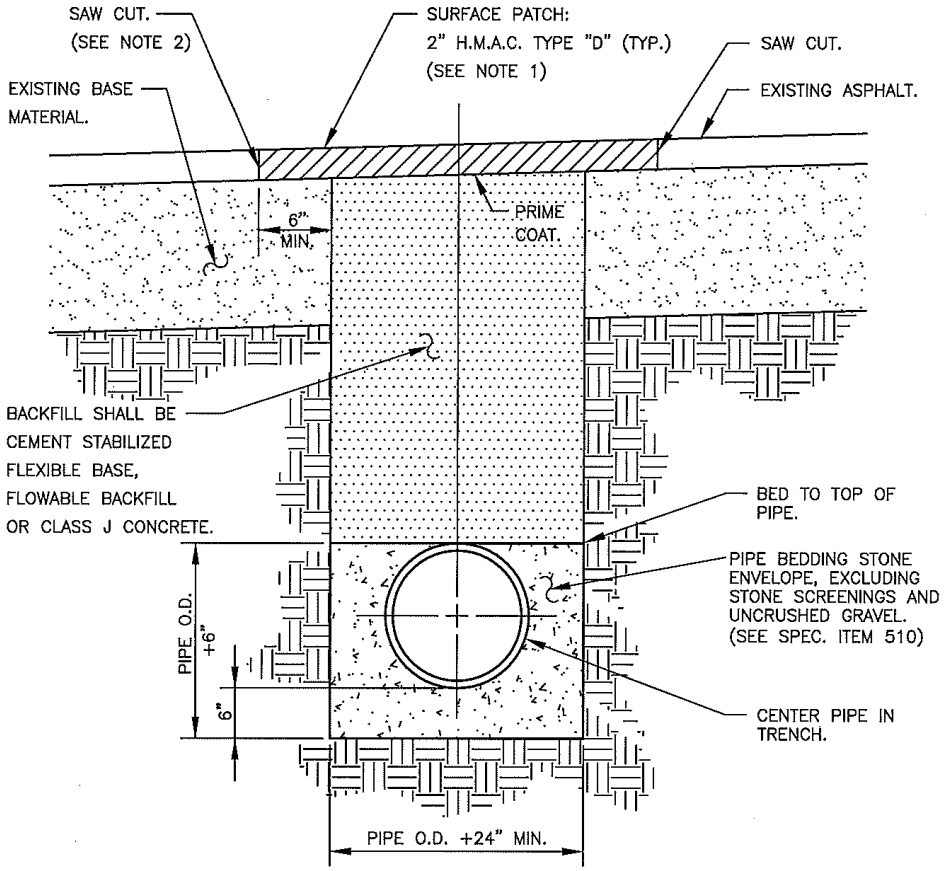


LID SECTION VIEW

CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS STANDARD STORM SEWER MANHOLE COVER (32")	STANDARD UT 306



CITY OF TAYLOR FOUNDED 1876	APPROVED BY: CS / DATE: JULY 2009	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS **STORM SEWER LINE BEDDING DETAIL (NON-PAVED SURFACE)**	STANDARD **UT 307**



NOTES:

1. H.M.A.C. SHOWN IN THIS DETAIL IS SEPARATE FROM ANY ADDITIONAL THICKNESS CREATED BY ANY OVERLAY ITEM IN CONTRACT.
2. THE CONTRACTOR SHALL SAW CUT, REMOVE AND REPLACE EXISTING PAVEMENT A MINIMUM OF 6" BEYOND EITHER THE EDGE OF THE STORM SEWER TRENCH OR THE POINT WHERE EXISTING PAVEMENT IS DAMAGED DUE TO TRENCHING OPERATIONS, WHICHEVER IS GREATER.
3. INSTALLATION OF BACKFILL, SAW CUTTING AND REMOVAL OF EXISTING PAVEMENT AND SURFACE PATCH, SHALL NOT BE PAID FOR SEPARATELY. COSTS FOR THESE ITEMS SHALL BE INCLUDED IN UNIT PRICE BIDS FOR STORM SEWER PIPE.
4. THE CONTRACTOR SHALL PROVIDE STEEL PLATES TO SPAN THE TRENCH AS NECESSARY OR TO ALLOW BACKFILL TO CURE. SUCH PLATES SHALL BE SUITABLE FOR VEHICLE PASSAGE OVER THE TRENCH AND SHALL BE SATISFACTORILY ANCHORED IN PLACE. COSTS FOR THIS ITEM SHALL BE INCLUDED IN UNIT PRICE BIDS FOR STORM SEWER PIPE.

APPROVED BY:	DATE:	CITY OF TAYLOR WILLIAMSON COUNTY, TEXAS STANDARD DETAILS	STANDARD
CS	JULY 2009	STORM SEWER LINE BEDDING DETAIL (PAVED SURFACE)	UT 308

(Ord. No. 2009-37, § 3, 2-9-2010 ; Ord. No. 2019-32 , § 2(Exh. A), 12-12-2019; Ord. No. 2020-03 , § 2(Exh. A), 5-14-2020; Ord. No. 2021-02 , § 2(Exh. A), 1-14-2021)