

B. DESIGN STANDARDS

DIVISION 1 - GENERAL AND PROCEDURE REQUIREMENTS

1.1 General

- 1.1.1 These Standards describe the general requirements for the preparation of construction plans and the supporting documents required for approval by the City of Rosenberg. Specific design requirements, in addition to these Standards, may be required by the City of Rosenberg.
- 1.1.2 Construction plans for public improvements within the City of Rosenberg or extraterritorial jurisdiction shall be reviewed by the Public Works Department, the Planning Commission and approved by the City Council.
- 1.1.3 Construction plans for private improvements that connect to or affect the public infrastructure shall be approved by the City of Rosenberg as required in Division 7.
- 1.1.4 All projects that are required to conform to these Standards shall also be in compliance with all applicable ordinances in the City.
- 1.1.5 All construction plans and supporting documentation shall conform to the requirements of these Standards and regulations of all Federal, State, County, and Local entities having jurisdiction.

1.2 Preliminary Research

- 1.2.1 Public Works Department personnel will be available for preliminary meetings to discuss a proposed project with the project engineer and/or developer. This preliminary meeting should be scheduled prior to submittal of any documents for review.
- 1.2.2 Research of all existing utility and right-of-way information with City, County, State, and other public and private utility agencies shall be completed and documented prior to submittal of any plans to the City.

1.3 Fees

- 1.3.1 Prior to beginning construction on a project, all applicable fees shall be paid to the City.

1.4 Design Review Requirements for Public Improvement Projects

- 1.4.1 Submit one (1) copy of construction plans and supporting documentation to the Department of Public Works for review. Plans will be circulated to City Engineer and appropriate departments and comments will be returned to the engineer in a timely manner. When plans are submitted that conform to these Standards, without specific approval or variance request, every effort possible to return plans within ten (10) working days from submittal.
- 1.4.2 After all comments have been adequately addressed, submit one (1) copy of the revised and final construction plans, with the redline plans, to the Department of Public Works for approval by the City Engineer. Revised plans must be submitted at least two (2) weeks prior to the Planning Commission meeting at which the plat will be reviewed.

- 1.4.4 Submit the original construction plan sheets to the Department of Public Works for signatures. The original cover sheet will be signed by the Director of Public Works and the City Engineer.
- 1.4.5 Submit two (2) copies of the original construction plans, two (2) copies reduced to eleven inches by seventeen inches (11" x 17"), and an electronic file copy (PDF format) to the Department of Public Works after the construction plans have been approved and signed by all appropriate parties.
- 1.4.6 All separate or special easements that may be required for construction shall be recorded in the Fort Bend County Official Records prior to final approval of the construction plans, except with specific approval of the City.

1.5 Construction Procedure Requirements for Public Improvement Projects

- 1.5.1 Construction shall not begin until construction plans are approved by the City Engineer and until all plat approvals, permits, licenses, etc. have been obtained.
- 1.5.2 Coordinate with the Department of Public Works for the pre-construction meeting for the project. Department staff must attend the pre-construction meeting.
- 1.5.3 Notify the Department of Public Works at least forty-eight (48) hours prior to beginning construction and at least twenty-four (24) hours prior to each time concrete is placed on the project and prior to all required inspections or tests. Inspections shall be conducted by department staff or any designee as may be provided by the City.
- 1.5.4 Notify the Department of Public Works at least forty-eight (48) hours prior to any final inspection.
- 1.5.5 Within thirty (30) days after completion of the project the project engineer shall provide to the city one set of full size reproducible record drawings, an electronic file copy (PDF format) and an Auto CAD file (dwg.), or a compatible .dxf file.
- 1.5.6 All delivery tickets for all materials (e.g., concrete, cement stabilized sand) shall be maintained by the contractor and upon written request be made available for review by the City. These delivery tickets shall be maintained for a maximum of one year from the completion of the project.
- 1.5.7 Changes from approved plans shall be approved by the City Engineer prior to construction.

1.6 Approval and Acceptance of Public Improvement Projects

- 1.6.1 Public Improvement projects shall have final approval by the City prior to placing the facilities in service.
- 1.6.2 Final approval by the City shall be granted when the following items are complete:
 - A. Construction is completed in accordance with the approved construction plans and final inspection items have been completed.
 - B. All required information including record drawings are submitted to the Department of Public Works. The project engineer shall certify the correctness of the record drawing and compliance of construction in accordance with these

Standards.

- C. Appropriate improvement bonds are in place for the maintenance period. For public improvement projects within the City of Rosenberg, bonds in the amount of one hundred percent (100%) of the total project cost, including utilities, drainage and paving, shall be provided in the name of the City of Rosenberg for one (1) year. For projects within the Rosenberg extraterritorial jurisdiction, copies of bonds meeting Fort Bend County criteria and/or District criteria for utilities, drainage, and paving shall be provided to the Department of Public Works. For development projects in the extraterritorial jurisdiction, a bond for street lights and sidewalks, if applicable, shall be provided in the name of the City of Rosenberg. A space on all applicable bonds shall be provided for the City of Rosenberg to sign off on the maintenance bond before releasing the Contractor.
- D. The City shall require certification from the Project Engineer or Contractor that all materials installed in the Project are completely in place in accordance with approved plans and specifications.

1.6.3 Final approval by the City will be documented in writing by the Department of Public Works.

1.6.4 Public Improvement projects within the City of Rosenberg and extraterritorial jurisdiction will be subject to a minimum one (1) year maintenance period. An inspection prior to the end of the maintenance period of a Public Works project shall be conducted by the Department of Public Works and all other entities having jurisdiction. All facilities, including street lighting, shall be operational and in good condition prior to final acceptance of a project.

1.7 Right-of-Way Use Permits

1.7.1 All applicable permits must be obtained from the City of Rosenberg, Fort Bend County, the Texas Department of Transportation, and/or any other entity or agency having jurisdiction prior to construction of any new facilities within a public right-of-way, or utility easement.

1.7.2 A request for a right-of-way use permit issued by the City of Rosenberg must be submitted with plans and complete supporting information, to the Department of Public Works for consideration. Staff will review the request and submit comments to the Owner and/or the right-of-way use permit will be provided if approved by the Public Works Director.

1.7.3 The Owner or authorized agent shall be responsible for the location of all facilities in the area of construction and all disturbed areas are to be restored when construction is completed.

1.7.4 Facilities permitted within a public right-of-way shall be the maintenance responsibility of the owner. If facilities are not maintained in good order, the permit shall be void and the facilities shall be removed at the expense of the owner.

1.8 Approvals and Variances

1.8.1 Approvals required in these Standards are the responsibility of the Owner. Failure to obtain appropriate approvals may be grounds for suspension of construction until appropriate approvals are granted. Items that do not conform to these Standards shall be submitted for a variance request.

- 1.8.2 Construction work related to any specific approval item should not begin until the written variance has granted approval in writing by the City Council. Any work that proceeds without specific approval will be subject to removal and replacement in accordance with these Standards. All variance requests shall be made in accordance with procedures as outlined in Chapter 25, Subdivisions, of the City of Rosenberg Code of Ordinances.
- 1.8.3 Materials and manufactured items used in construction of a Public Works project shall be approved by the Department of Public Works prior to installation. Water and sanitary sewer system appurtenances shall be subject to the approved items as listed in the Approved Water Products List available from the Department of Public Works. Items not appearing on the approved list shall not be used for construction of public works facilities in the City of Rosenberg or the extraterritorial jurisdiction.

DIVISION 2 - CONSTRUCTION PLAN AND MISCELLANEOUS REQUIREMENTS

2.1 Required Plan Sheets

- 2.1.1 Cover sheet.
- 2.1.2 Final plat. (Recorded plat shall be included in the record drawings.)
- 2.1.3 Construction notes and legend.
- 2.1.4 Overall plans for proposed improvements.
- 2.1.5 Drainage area map.
- 2.1.6 Lot grading plan.
- 2.1.7 Plan and profiles.
- 2.1.8 Specific construction details.
- 2.1.9 Standard Public Works construction details.

2.2 Drawing Requirements

- 2.2.1 The seal, date, and original signature of the engineer responsible for preparation of the plans is required on each sheet. The engineer may use a stamped or embossed imprint for his/her seal, however, the embossed imprint must be shaded such that it will reproduce on prints.
- 2.2.2 A bench mark elevation and description is required on construction plans.
- 2.2.3 Label each plan sheet as to street right-of-way widths, pavement widths and thickness, type of roadway materials, curbs, intersection radii, curve data, stationing, existing utilities type and location, etc.
- 2.2.4 Stationing must run from left to right except for short streets or lines originating from a major intersection where the full length can be shown on one sheet.
- 2.2.5 A north arrow is required on all sheets and should be oriented either upward or to the right. This requirement may be waived under the following conditions: a storm or sanitary sewer whose flow is from west to east or from south to north and a primary outfall ditch

whose flow is from west to east or from south to north.

- 2.2.6 Show all lot lines, property lines, rights-of-way lines, and easement lines.
- 2.2.7 A cover sheet shall be required for all projects involving three or more plan and profile sheets. All plan sheet numbers should be included on the cover sheet. A vicinity map should always be included to show the project location. City of Rosenberg standard approval block shall be provided for signatures.
- 2.2.8 If a roadway exists where plans are being prepared to improve or construct new pavement or to construct a utility, this roadway should be labeled as to its existing width, type of surfacing, and base thickness, if available.
- 2.2.9 Plans prepared for the City of Rosenberg shall be prepared using permanent ink, photographic or other approved process on mylar.
- 2.2.10 Do not place match lines in intersections.
- 2.2.11 Service areas shall be delineated on the cover sheet or area map.
- 2.2.12 All utility lines four inches (4") in diameter or larger within the right-of-way or construction easement should be shown in the profile view. All utility lines, regardless of size, should be shown in the plan view.
- 2.2.13 Show flow line elevations and direction of flow of all existing ditches.
- 2.2.14 Show natural ground profiles along the centerline of each right-of-way or easement line except as required below. When there is a difference of 0.50 feet or more from one right-of-way or easement line to the other, show dual right-of-way profiles.
- 2.2.15 Resolve all known conflicts of proposed utilities with existing utilities.
- 2.2.16 Plans shall be standard twenty-four inch by thirty-six inch (24" x 36") overall sheet dimensions.
- 2.2.17 Details of special structures not covered by approved standard drawings, such as stream and gully crossing, special manholes, etc., should be drawn with the horizontal and vertical scales equal to each other.
- 2.2.18 Plans shall be drawn to accurate scale, showing proposed pavement typical cross-sections and details, lines and grades, and all existing topography within the street rights-of-way; and at intersections, the cross street shall be shown at sufficient distance in each direction along the cross street for designing adequate street crossings.
- 2.2.19 Grades should be labeled for the top of curb except at railroad crossings. Centerline grades are acceptable only for paving without curbs and gutters.
- 2.2.20 Curb return elevations and grades for turnouts shall be shown in the profile.
- 2.2.21 Gutter elevations are required for vertical curves where a railroad track is being crossed.
- 2.2.22 The surface elevation at the property line of all existing driveways should be shown in the profile.

- 2.2.23 Station all esplanade noses affected by proposed construction, both existing and proposed.
- 2.2.24 Station all points of curvature, points of tangency, radius returns and grade change, points of intersection in the plan view. Station all radius returns and grade change points of intersection in the profile with their respective elevations.
- 2.2.25 The standard scales permitted for plans and profiles of paving and utility plans are as follow:
- A. Major thoroughfares or special intersections/situations:
1" = 2' Vertical; 1" = 20' Horizontal
 - B. Minor streets:
1" = 5' Vertical; 1" = 50' Horizontal
or
1" = 4' Vertical; 1" = 40' Horizontal
- (for reconstruction on minor streets, a larger scale may be required to show detail.)
- C. The scales described above are the minimum allowable. Larger scales may be required to show details of construction.
 - D. Deviations to these scales can only be allowed with the specific approval of the City.
- 2.2.26 In addition to the plan and profile sheets described above, each set of construction drawings shall contain paving and utility key drawings indexing specific plan and profile sheets. Key overall layouts may be drawn at a scale of one inch equals one hundred feet (1" = 100') or one inch equals two hundred feet (1" = 200').
- 2.2.27 Standard City details, where applicable, shall be included.
- 2.2.28 Construction plans shall include a legend describing standard symbols that may not be described in the plans.
- 2.2.29 All property ownership and easement information will be shown in the construction plans. Fort Bend County recording information shall be shown in the construction plans. When ownership, easement, and right-of-way recording information is not shown on the plat included in the plans, this information will be shown on the construction plan sheets.
- 2.2.30 The City shall be provided with an AutoCAD, .dwg file or a compatible .DXF file on computer disc of all construction plans.

2.3 Graphic Standards

The graphic standards for the City of Rosenberg are taken directly from the City of Houston's "General Design Requirements for Sanitary Sewers, Storm Sewers, Water Lines, and Paving". These graphic standards are provided in Appendix A.

2.4 Easements

- 2.4.1 All easements and recording information, existing and proposed, shall be shown in the construction plans in accordance with Section 2.2.29.
- 2.4.2 Storm sewer, sanitary sewer, and water line easements shall be dedicated for the specific intended use. Easements for a specific facility shall be exclusive and shall not overlap other easements, except to cross the easements.
- 2.4.3 Public utility easement requirements for a sixteen-foot (16') easement are as outlined in the "Typical Utility Location in 10-Foot Wide and 16-Foot Wide Easement Back-to-Back Lots and Perimeter Lots" drawing prepared by the Utility Coordinating Committee for Metropolitan Area, effective June 1, 1971. The public utility easement width for underground electric power distribution shall be sixteen feet (16'). Perimeter easement may be eight feet (8') by eight feet (8'), provided that the easement is dedicated by separate instrument or special notes on the plat.
- 2.4.4 Water line easements - the following minimum width easements are required when facilities are not located within public street rights-of-way or water line easements:
- A. Fire hydrants located outside of public rights-of-way or water line easements shall be encompassed by a ten-foot by ten-foot (10' x 10') exclusive, easement. Fire hydrants shall not be located within any other type of easements.
 - B. Water meter easements shall be exclusive and should be located adjoining a public right-of-way or water line easement.
 - C. Two-inch (2") and smaller meters shall be set in five-foot by five-foot (5' x 5') exclusive, water meter easements.
 - D. Three-inch (3") and larger meters shall be set in a minimum of ten-foot by twenty-foot (10' x 20') exclusive, water meter easements.
 - E. Water mains located in easements not adjacent to public street rights-of-way or semi-public rights-of-way shall be centered in a fifteen-foot (15') wide exclusive, easement restricted to water only.
 - F. For new construction, any water main, except at a fire hydrant, located less than five feet (5') from the right-of-way line and within the right-of-way shall have a water line easement adjoining the right-of-way. Water line easements adjoining a right-of-way for mains smaller than twelve inches (12") shall have a minimum width of five feet (5'). For mains greater than twelve inches (12") in diameter, the easement adjoining the right-of-way shall have a minimum width of ten feet (10').
- 2.4.5 Sanitary Sewer Easements - the following minimum easement widths are required for the type of service:
- A. The width of all exclusive sanitary sewer easements shall be equal to the depth of the sewer from finished grade plus two (2) pipe diameters. Sewer shall be located in the center of the easement. The minimum width of a sanitary easement shall be sixteen feet (16'), when split along a lot line and ten feet (10') wide for easements located within a single lot.
 - B. Exclusive sanitary sewer easement adjoining a public right-of-way may be ten feet (10') wide provided the sewer is seven and one-half feet (7.5') from the edge

of the easement and the sewer is no deeper than fifteen feet (15'). Sewers at greater depth than fifteen feet (15') shall be placed within easements as described in Section 2.4.5 A.

- C. Exclusive easements for force mains of all sizes shall have a minimum width easement of ten feet (10') for a single force main where the force main is not located adjacent to a public right-of-way. A force main located within a public right-of-way line shall have a force main easement adjoining said right-of-way with a minimum width of five (5') feet.
- D. Combined storm and sanitary sewer easement shall have minimum widths as required in Section 2.4.6 for storm sewer easements. Additionally, the sanitary sewer main, trunk or force main shall be located such that the centerline of the pipe shall be not less than seven and one-half feet (7.5'), from the edge of the easement.
- E. For combined storm and sanitary sewer easements located adjacent to public or semi-public rights-of-way where the sanitary sewer is located along the outside of the easement, the centerline of the sanitary sewer pipe shall be not less than seven and one-half feet (7.5') from the outside edge of the easement.
- F. Where sanitary sewers or force mains are installed in easements separated from public or semi-public rights-of-way by other private or utility company easements, the sanitary sewer easement should be extended along or across the private utility company easement to provide access for maintenance of the sewer or force main.

2.4.6 Storm Sewer Easements - the following minimum easement widths are required:

- A. The minimum width shall be twenty feet (20') with the storm sewer centered in an exclusive easement, except as specifically approved by the City.
- B. For storm sewers greater than ten feet (10') and less than fifteen feet (15') in diameter or width, the minimum width of an exclusive easement shall be twenty-five feet (25').
- C. For storm sewer greater than fifteen feet (15') in diameter or width, the minimum width of an exclusive easement shall be determined by the City.
- D. For storm sewers whose depth to flow line is greater than fifteen feet (15'), add five feet (5') to the minimum easement width specified in section 2.4.6 A and/or 2.4.6 B, above.
- E. For all easements specified in section 2.4.6, a minimum distance of five feet (5') must be maintained from the easement line to the outside edge of the storm sewer.
- F. Where approvals are granted for a special use or combination easement located along side lot or back lot, the minimum width shall be twenty-five feet (25'). The easement width shall meet or exceed all other easement requirements.
- G. For storm sewers located in an exclusive easement adjacent to public rights-of-way, the minimum easement width shall be ten feet (10'). The easement width shall meet or exceed all other easement requirements.

2.5 Utility Locations

2.5.1 The utility locations for back lot easements are outlined in the "Typical Utility Location in 10-Foot Wide and 16-Foot Wide Easement Back-to-Back Lots and Perimeter Lots" drawing prepared by the Utility Coordination Committee for Metropolitan Area effective June 1, 1971. A portion of the Utility Coordination Committee drawings are provided in Appendix B.

2.5.2 Water Main Location

- A. All water mains shall be located within a public right-of-way or within dedicated water main easements. The location of water mains within a public street right-of-way is described in Section 3.3.
- B. Water mains shall not be located in combination easements without the specific approval of the City.

2.5.3 Sanitary Sewer Location

- A. Sanitary sewer laterals may not be located within a back lot easement.
- B. Sanitary sewers of twelve inches (12") or larger in diameter are usually located within a public right-of-way or an easement adjoining the right-of-way. Large sanitary sewers shall be located within the public street right-of-way in accordance with Section 4.3.1. Sanitary sewers may be located in exclusive or combination easements provided the easement widths comply with Section 2.4.5.
- C. Sanitary sewers shall not be located in side lot easements without the specific approval of the City.
- D. Sanitary sewers should be located within the right-of-way between the property line and the back of curb on the opposite side of the right-of-way from the water main.

2.5.4 Storm Sewers

- A. Storm sewer shall be located in the public street right-of-way in accordance with Section 5.3.
- B. All storm sewer lines shall be located within public rights-of-way or approved easements. Placement of a storm sewer in side lot and back lot easements is discouraged. Specific approval of the City for the use of side lot or back lot easements for storm sewers should be obtained prior to plan preparation.
- C. For boulevard paving sections with esplanades, the storm sewer is usually located in the center of the esplanade.

2.6 Private Facility Locations (Not Including Landscaping)

- 2.6.1 Installation of private facilities, including utilities, in public road rights-of-way and their adjoining easements shall be approved by the City.
- 2.6.2 Private facilities shall not conflict with other facilities in the right-of-way and shall not be located in exclusive easements as required in these Standards. All structures within the public right-of-way shall be approved by the City and shall be located so as to not interfere with existing or proposed public facilities.
- 2.6.3 All facilities in the right-of-way shall be located at least two feet (2') behind the curb at least two and one-half feet (2.5') below the top of curb on a public street.
- 2.6.4 Private facilities shall be constructed in accordance with construction plans approved by the City Council.
- 2.6.5 Landscaping within the public right-of-way or adjoining easements shall not affect public utilities or traffic visibility.

2.7 Crossings

2.7.1 Highway Crossings - All State and County Roads

- A. State Highway crossings shall be constructed in conformance with the requirements of the Texas Department of Transportation.
- B. A water main shall be encased in a steel pipe casing extending at least ten feet (10') from outside edge of each service road or outside edge of pavement, across the right-of-way to a similar location on the other side of the highway.
- C. County road crossing shall be constructed in accordance with the requirements of Fort Bend County.
- D. Where additional right-of-way has been acquired or will be required for future widening, the casing, where required, should be carried to within ten feet (10') of each future right-of-way line.

2.7.2 Street Crossings

- A. All water main and sprinkler line crossings under major thoroughfares shall be constructed using a minimum of P.V.C. pipe, C-900, as shown on the City of Rosenberg construction detail for "Water Main Encasement". Welded steel pipe may be substituted on street crossing, when specifically approved by the City.
- B. Conduits and sewers that do not carry liquid under pressure may be bored and jacked into place without a steel encasement pipe.
- C. Crossings under existing concrete streets, other than major thoroughfares, shall be constructed by boring and jacking. P.V.C. pipe shall be jacked into place using equipment designed for that purpose. Water may be used to facilitate the boring and jacking operations. Jetting the pipe main into the place will not be permitted. When conditions exist that warrant an open cut across an existing street, the City shall specifically approve the crossing.
- D. All open cut installations under existing or proposed streets shall be backfilled as shown in the City of Rosenberg Standard Details. Cement stabilized sand backfill

shall meet the requirements of Section 4.2.3.

- E. All street crossings shall be constructed in accordance with construction plans approved by the City. All street crossings shall be inspected by the Department of Public Works and meet the requirements of these Standards.

2.7.3 Railroad and Pipeline Crossings

- A. For railroad crossings, the carrier pipe shall be encased in steel pipe casing extending twenty-five (25') feet from the centerline of tracks.
- B. All construction within the railroad or pipeline right-of-way shall conform to minimum requirements set out in the agreement with the owner of the right-of-way.

2.7.4 Ditch and Stream Crossings

- A. Crossing under a stream or ditch is preferred by the City. The top of the carrier pipe shall be designed to provide a minimum clearance of at least four feet (4') below the ultimate flow line and sides of the ditch and with sufficient bottom length to exceed the ultimate future ditch sections.
- B. Where existing or proposed bridges have sufficient space and structural capacity for installing water mains or conduits (twelve inches (12") or smaller) under the bridge, but above the top of the bent cap elevation, such installation may be permitted upon specific approval of the construction plans. In all cases, the water main or conduit shall be above the bottom chord of the bridge and above the 100-year water surface elevation. All conduits attached to a bridge shall be constructed using steel pipe and shall extend a minimum of ten feet (10') beyond the bridge bent or to the right-of-way line, whichever is greater. All conduit attached to a bridge shall be maintained by the owner of the conduit or will be subject to removal.
- C. Separate, free-standing crossings across drainage ways are not allowed.
- D. All stream or ditch crossings shall be approved by City Engineer.

2.8 Trench Safety

All construction within the City of Rosenberg and its extraterritorial jurisdiction shall conform to the requirements of state and federal guidelines for trench safety. Adequate details for construction in accordance with applicable OSHA regulations will be required in all construction plans that are approved by the City of Rosenberg.

2.9 Street Lighting

- 2.9.1 The installation of street lighting shall be mandatory along all public streets in the City of Rosenberg. In addition, the installation of street lighting is strongly encouraged along existing or repaved streets. For areas in the extraterritorial jurisdiction of the City of Rosenberg, street lighting may be required and reviewed by the City of Rosenberg in accordance with these Standards.
- 2.9.2 The location of street lights will be designed by Centerpoint Energy and approved by the City of Rosenberg.

- 2.9.3 Private lighting systems may supplement or replace all or a portion of public street lighting. A perpetual entity, such as an incorporated homeowners association and/or an appropriate private entity, shall notify the City of Rosenberg of its agreement to pay for the operation, maintenance, and insurance of a private lighting system prior to installation of the system. The review by the City of Rosenberg will apply the same technical requirements as used for public street lighting.
- 2.9.4 Street lights shall be designed in accordance with the requirements set out in Appendix E.
- 2.9.5 Street lights shall comply with Fort Bend County orders for Regulation of Outdoor Lighting.

2.10 Bench Mark

- 2.10.1 A permanent bench mark shall be set in each subdivision section or at a spacing of one mile, whichever is greater. The bench mark shall have an elevation based on the National Geodetic Vertical Datum of 1929, current adjustment.
- 2.10.2 The bench mark elevation and location shall be certified by a Texas Registered Professional Land Surveyor in accordance with the Texas Society of Professional Surveyors "Standards and Specifications" for Category 8, Condition II, TSPS Second Order Vertical Control Survey. Accuracy shall comply with said specifications. All elevations will be based on the US Coast and Geodetic Datum of 1929 (NVD 1929).
- 2.10.3 The bench mark horizontal positions shall be certified by a Texas Registered Professional Land Surveyors "Standards and Specifications" for Category 7, Condition II, Second Order Horizontal Control. Accuracy shall comply with said specifications. All horizontal control will be based on the US Coast and Geodetic Datum of 1927 (NAD 1927).
- 2.10.4 All bench mark locations shall be provided with ties to existing monuments including coordinates using Texas Plane Coordinate System, South Central Zone.
- 2.10.5 Bench marks shall be constructed of a brass disc set in concrete as approved by the City. The concrete footing for the bench mark shall be eight inches (8") in diameter and three feet (3') deep. Concrete shall be reinforced with two number four (2 - #4) rebar.
- 2.10.6 The construction plans shall clearly identify the location of the bench mark and shall include a complete description, coordinates and elevation, with adjustment date, of the bench mark.

2.11 Residential Lots and Improvements

- 2.11.1 All residential lots shall drain to a public right-of-way directly adjoining the lot. Drainage from a residential lot to a public right-of-way at the rear or side of a lot may be permitted provided the drainage system has been properly designed to accept the flow. Drainage to a Fort Bend County drainage easement shall be approved by the Fort Bend County Drainage District.
- 2.11.2 A lot grading plan showing proposed minimum slab elevations will be included in the construction plans. If slab elevations do not change, a notice of minimum elevation will suffice. The minimum slab elevations shall also be shown on the subdivision plat.

2.12 Flood Plain Management

- 2.12.1 All development shall conform to the requirements of the National Flood Insurance Program, as required by the regulations of the local governing authority having jurisdiction.
- 2.12.2 Amendments to the published flood maps, map revisions and all requests for changes to the base flood elevation within the Rosenberg city limits shall be submitted to the City of Rosenberg for approval. Technical data required by the Federal Emergency Management Agency and justification for the proposed change must be included with all requests. All requests for changes to the base flood elevation within the City of Rosenberg extraterritorial jurisdiction shall be submitted to the City of Rosenberg for comments.
- 2.12.3 All data submitted shall be prepared under the supervision of a registered professional engineer and/or a registered public surveyor and shall comply with all requirements of the Federal Emergency Management Agency.

DIVISION 3 - WATER SYSTEM DESIGN REQUIREMENTS

3.1 General

Water system design requirements are established based on standards as established in this section.

- 3.1.1 Construction and sizing of all water mains and appurtenances shall meet or exceed the requirements of the Texas Commission on Environmental Quality.
- 3.1.2 The Public Water System shall not extend beyond the water meter. All private construction beyond the meter shall conform to the requirements of the codes and ordinances of the City.

3.2 Water Main Sizing and Materials

- 3.2.1 Water mains shall have a minimum size as follows:
- A. Two-inch (2") mains may serve a maximum of two (2) domestic, residential service connections. Two-inch (2") mains shall not exceed two hundred feet (200') in length and shall be installed with a blow off at the end of the line. All two-inch (2") mains shall be specifically approved by the Department of Public Works.
 - B. Four-inch (4") mains may serve a maximum of twenty (20) lots when supported on both ends by a larger main. A dead end four inch (4") main may supply a maximum of ten (10) lots, shall not exceed four hundred feet (400') long and shall be terminated with a blow off. Fire hydrants are not allowed on a four inch (4") main.
 - C. Six-inch (6") mains shall be a maximum of one thousand five hundred feet (1,500') long when supported on both ends by eight-inch (8") mains or larger and shall have no more than three (3) intermediate fire hydrants. Dead end six-inch (6") mains shall not be more than six hundred feet (600') in length and shall terminate at a fire hydrant. Six-inch (6") fire hydrant leads shall not exceed two

hundred feet (200') in length.

- D. Eight-inch (8") mains are required for mains over one thousand five hundred feet (1,500') long, or when more than three (3) intermediate fire hydrants are required. The maximum length of an eight-inch (8") main shall be three thousand five hundred feet (3500') and shall terminate with a fire hydrant.
- E. Twelve-inch (12") and larger mains will be required at locations established by the City.

3.2.2 Water mains in commercial, industrial, and multi-family shall have a minimum sizing as follows:

- A. Minimum size of mains shall be eight-inch (8"). Maximum length of a dead-end eight-inch (8") main shall be three hundred fifty feet (350'). A dead-end main shall be terminated with a fire hydrant.
- B. Twelve-inch (12") and larger mains will be required at locations established by the Department of Public Works.
- C. Six-inch (6") fire hydrant leads will not exceed two hundred feet (200') in length.

3.2.3 The length of a dead-end water main shall be measured from the intersection with a multiple feed (looped) main to the end of the main. The allowable length of a dead-end main with multiple sizes shall not exceed the allowable length of smallest main as required in Section 3.2.1.

3.2.4 Water mains shall be constructed using the following materials:

- A. Poly Vinyl Chloride (PVC) Pressure Pipe, four-inch (4") through sixteen-inch (16"), shall conform to the requirements of ANSI/AWWA C900, current revision, Class 150 (or higher) DR 18. Pipe shall be designed and constructed in conformance with the minimum requirements of the "Manual of Water Supply Practices", AWWA Manual No. M23.
- B. Ductile-Iron Pipe (D.I.P.), four-inch (4") through fifty-four-inch (54"), shall conform to the requirements of "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds for Sand-Lined Molds, for Water and Other Liquids", AWWA C151, (ANSI A21.51), current revision. Pipe thickness shall be the minimum specified in C151. Under special conditions, the Department of Public Works may require thickness design in conformance with the minimum requirements of "Thickness Design for Ductile-Iron Pipe", AWWA C150 (ANSI A21.51), current revision. Pipe shall be installed in conformance with the minimum requirements of AWWA C600, "Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances". Ductile-Iron Pipe shall be furnished with bituminous or cement mortar lining, AWWA C104 (ANSI A21.4). Polyethylene tube encasement shall be provided as required in Section 3.8.6 of these Standards.
- C. Steel Water Pipe, four-inch (4") and larger shall conform to the requirements of "Standard for Steel Water Pipe Six Inches and Larger", AWWA C200. Steel pipe, minimum wall thickness shall conform to the thickness shown on the City of Rosenberg Construction Details. All steel pipe shall have coal tar exterior coating in accordance with "Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot Applied", AWWA C203, liquid

epoxy interior coating in accordance with "Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipelines", AWWA C210 and/or "Painting for Steel Water Storage Tanks" AWWA D102. All material used for internal coating of steel carrier pipe must be NSF61 listed as suitable for contact with potable water as required in Chapter 290, Rules and Regulations for Public Systems, TEXAS COMMISSION ON ENVIRONMENTAL QUALITY, latest revised.

- D. Other pipe materials may be used for construction of water mains, when specifically approved by the City.
- 3.2.5 Water mains and appurtenances are not allowed in the following sizes: three-inch (3") and fourteen-inch (14").
- 3.2.6 All public water mains shall be installed within a water line or public utility easement or right-of-way.
- 3.2.7 Construction of water mains shall be in accordance with approved construction plans and the City of Rosenberg Standard Details.

3.3 Location of Water Mains

The recommended locations for water mains within the right-of-way are as follows:

- 3.3.1 One-Hundred Foot (100') Right-of-Way
 - A. All mains - five feet (5') inside right-of-way.
- 3.3.2 Eighty Foot (80') Right-of-Way
 - A. All mains - seven feet (7') or thirteen feet (13') inside right-of-way.
- 3.3.3 Sixty Foot (60') Right-of-Way
 - A. Paving width: Thirty-nine feet (39') F/F (face-to-face).
 - (1) All size mains - five feet (5') inside right-of-way.
 - B. Paving width: Twenty-seven feet (27') F/F (face-to-face).
 - (1) All size mains - maximum of twelve feet (12') inside right-of-way.
 - (2) When future widening is anticipated, location shall conform to 3.3.3 A, above.
- 3.3.4 Fifty-Foot (50') Right-of-Way
 - A. Paving width: Twenty-seven feet (27') F/F (face-to-face).
 - (1) All main sizes - seven feet (7') from right-of-way.
 - B. Except when specifically approved by the City, a water line shall be placed in the center of a ten-foot (10') easement adjoining the right-of-way, when storm and sanitary sewers are both within the right-of-way.

- 3.3.5 Water mains shall be placed along a uniform alignment with the right-of-way. When necessary, the water main may be deflected at a fire hydrant location to accommodate proper installation of the fire hydrant. At all locations where a water main changes alignment, the location of the water main shall be clearly shown on the construction plans. A minimum distance of two feet (2') shall be maintained from the right-of-way line to the outside edge of the water line.
- 3.3.6 When necessary, water mains may be located within the esplanade section of boulevard type streets. Mains should be located as near the centerline as possible to avoid conflicts with future pavement widening.
- 3.3.7 Along streets with open ditch drainage, all twelve-inch (12") and smaller water mains may be located five feet (5') from the right-of-way line, and sixteen inch (16") and larger water mains shall be located subject to City approval.
- 3.3.8 Water mains may be located at the center of a ten foot (10') water line easement, provided the easement adjoins a public right-of-way.
- 3.3.9 Location of a water main in an easement not adjoining a public right-of-way shall be prohibited, except as specifically approved by the City.

3.4 Clearance of Water Lines from Other Utilities

Water mains shall be designed and located to conform to the regulations of the Texas Commission on Environmental Quality.

- 3.4.1 When a water main is placed parallel to another utility line at or near the same grade, it shall have a minimum of four feet (4') of horizontal separation. When the other utility is a sanitary sewer, a minimum of nine feet (9') of separation must be provided. In the event that a minimum of nine feet (9') cannot be maintained, the sanitary sewer must be constructed of pressure type pipe with water-tight joints as used in water main construction and the clearances must be as defined in the following sections or as specifically approved by the City. When a water main crosses a utility other than sanitary sewer, a minimum of six inches (6") of clearance must be maintained, and the water main shall have one joint of pipe, a minimum of eighteen feet (18') long, centered on the other utility.
- 3.4.2 For water mains crossing an existing or proposed sanitary sewer or force main, the following clearances shall be provided for protection from contamination. The minimum clearances will be approved only when justified and field conditions so dictate. The latest edition of "Rules and Regulations for Public Water Systems", Texas Commission on Environmental Quality, shall be followed for minimum criteria and instructions for water line crossings.
- 3.4.3 When water mains and sanitary sewers are installed, they shall be installed no closer to each other than nine feet (9') in all directions and parallel lines must be installed in separate trenches. Where the nine foot (9') separation distance cannot be achieved, the following procedures shall be used.
 - A. Where a sanitary sewer parallels the water main, the sanitary sewer shall be constructed of ductile iron or PVC pipe meeting AWWA specifications, having a minimum working pressure rating of one hundred fifty pounds per square inch

(150 psi) or greater, and equipped with pressure type joints. The water main and sanitary sewer shall be separated by a minimum vertical distance of two feet (2'), and a minimum horizontal distance of four feet (4'), measured between the nearest outside diameters of the pipes, and the water main shall be located above the sewer.

- B. Where a sanitary sewer crosses the water main, and that portion of the sewer within nine feet (9') of the water is constructed as described in Section 3.4.3 A, the water line may be placed no closer than six inches (6") from the sewer. The separation distance must be measured between the nearest outside pipe diameters. The water line shall be located at a higher elevation than the sewer, wherever possible, and one (1) joint, a minimum of eighteen feet (18') long, of the new pipe must be centered on the existing line.

3.4.4 Where water lines are installed in areas which have existing sanitary sewers, every effort should be made to maintain nine feet (9') of separation between the outside pipe diameters of the two lines. Where this separation cannot be achieved because of local conditions, which must be fully documented in any planning material submitted, the following spaces shall be observed.

- A. Where a new water line is to cross or be installed in parallel with an existing sanitary sewer, and the sewer is constructed as described in Section 3.4.3 A, the separation distances specified in those rules shall apply as though the sewer were new.
- B. Where a new water line is to be installed in parallel with existing clay, truss, or concrete gravity sewer showing no evidence of leakage and the water line is installed above the sewer a minimum of two feet (2') vertically and four feet (4') horizontally, the sanitary sewer need not be disturbed. Should excavation for the water line produce evidence that the sewer is leaking, then the sewer must be repaired.
- C. Where a new water main is to cross an existing clay, truss, or concrete gravity sewer showing no evidence of leakage, the sewer need not be disturbed if the water line is to be installed at least twenty-four inches (24") above the existing sewer. A full joint of the water line, at least eighteen feet (18') long, should be centered over the sewer crossing, in this case, so as to provide maximum protection against contamination.
- D. Existing clay, truss, or concrete sewer pipe which shows no evidence of leakage and because of physical limitations must remain at a higher elevation than a proposed intersecting water line or closer than two feet (2') may remain undisturbed if the water line is inserted in a joint of pressure type encasement pipe at least eighteen feet (18') long and two (2) nominal sizes larger than the water line. The encasement pipe should be centered on the sewer crossing and both ends sealed with cement grout. In lieu of this procedure, that portion of the sewer within nine feet (9') of the water line may be replaced with cast iron or ductile iron pipe with watertight joints as described in Section 3.4.3 (A), above.
- E. Unless sanitary sewer manholes and the connecting sewer can be made completely watertight and tested for no leakage, they must be installed so as to provide a minimum of nine feet (9') of horizontal clearance from an existing or proposed water line. Encasement of the water line in a carrier pipe as described in Section 3.4.4 D may be approved in special cases if the plans have approval of

the Texas Commission on Environmental Quality.

3.5 Depth of Cover

Minimum depth of cover for water mains shall be as follows:

- 3.5.1 Twelve-inch (12") and smaller mains shall have a minimum cover of four feet (4') from the top of curb. For open ditch roadway sections, twelve-inch (12") and smaller mains shall be installed at least three feet (3') below the ultimate flow line of ditch or six feet (6') below natural ground at the right-of-way line, whichever is deeper.
- 3.5.2 Sixteen-inch (16") and larger mains shall have a minimum cover of five feet (5') from the top of curb. For open ditch roadway sections, sixteen-inch (16") and larger mains shall be installed at least three feet (3') below the flow line of ditch or seven feet (7') below natural ground at the right-of-way line, whichever is deeper.
- 3.5.3 Changes in grade to clear other utilities or underground features may be made by deflecting pipe joints. The maximum designed deflection shall be one-half (1/2) of manufacturers allowable deflection. If a depth greater than eight feet (8') to the top of pipe is required, a welded steel section will be used. The standard depth of cover maintained on the water main and the grade change shall be made using the welded steel section. The installation of fittings for vertical deflections or changes in grade shall not be allowed except with specific approval of the City.

3.6 Valves

3.6.1 All water system valves shall conform to AWWA standards and shall be designed as follows:

- A. Two-inch (2") through sixteen-inch (16") valves shall be resilient seated gate valves, AWWA C509, counter-clockwise opening with mechanical joints. Valves shall have a complete coating on all iron parts in the valve interior to eliminate corrosion.
- B. Sixteen-inch (16") and larger valves in water plant piping may be butterfly valves, AWWA C504, with complete interior coating to avoid corrosion of all iron parts, and shall be installed in a vault of adequate size and construction, as approved by the City.
- C. Cast iron valve boxes are required on all gate valves except as noted below. Valve vaults are required on all valves larger than sixteen-inch (16").
- D. All valves shall be sized equal to the size of the main on which it is located.
- E. Valves shall be approved by the City and shall be listed on the Approved Water Products List found in Appendix G of these Standards.

3.6.2 Spacing - valves shall be set at maximum distances along the main as follows:

- A. Four-inch (4") through and including twelve-inch (12") mains - one thousand feet (1,000').
- B. Sixteen-inch (16") and larger mains - one thousand five hundred feet (1,500').

- C. All main intersections shall have a minimum of one (1) less valve than the number of mains at the intersection.

3.6.3 Location - valves shall be located as follows:

- A. All mains shall be valved within the street right-of-way. Valves shall not be placed under or within two feet (2') of ultimate pavement, except as specifically approved by the City.
- B. Valves are normally located on the projection of intersecting street right-of-way lines or at the curb return adjoining a paved street across the main. Tapping sleeves and valves are excluded from this requirement.
- C. All fire hydrants shall be isolated from the service main with a valve located in the fire hydrant lead.
- D. Intermediate valves not located on the projection of intersecting street right-of-way lines may be located at lot line projections or five feet (5') from fire hydrants.
- E. Valves shall be placed at the end of all mains that are to be extended in the future, and extend main a minimum of forty feet (40') past valve.

3.7 Fire Hydrants

3.7.1 Fire hydrants shall have three-way nozzle arrangement, five and one-quarter-inch (5-1/4") compression type main valve, mechanical joint boot, and conform to the requirements of AWWA C502. The pumper nozzle shall be four and one-half inch (4-1/2") NST and the hose nozzles shall be two and one-half-inch (2-1/2") NST threads. Fire hydrants shall be listed on the Approved Water Products List found in Appendix G of these Standards.

3.7.2 Spacing - fire hydrants shall be spaced along all mains six inches (6") and larger as follows:

- A. A maximum of five hundred foot (500') spacing.
- B. A maximum of three hundred foot (300') spacing in commercial and industrial developments.
- C. Fire hydrants should be set at street intersections.

3.7.3 Location - fire hydrants shall be located as follows:

- A. Fire hydrants shall be located three feet (3') behind the back of curb or projected future curb and be set at the point of curvature (PC) of the intersection curb radius. A parallel tee may be used for a fire hydrant lead at the water main when specifically approved by the City.
- B. On all State Highways and open-ditch roadways, set the fire hydrants or flushing valves within three feet (3') of the right-of-way.
- C. Fire hydrants located between right-of-way intersections should be set at a lot line, however, this location may be adjusted five feet (5') either way to miss driveways or other obstructions, in which case the fire hydrants should not be closer than three feet (3') from curbed driveways or five feet (5') from non-curbed

driveways.

- D. Fire hydrants may be located in the esplanade section of City streets only when it is not feasible to locate them between the right-of-way line and the back of the curb. In such case, it is preferable to locate the fire hydrants seven feet (7') behind the esplanade back of curb to provide access for parkway mowers; but in no instance shall they be located closer than three feet (3') from the esplanade back of curb or five feet (5') from the esplanade edge of pavement.
- E. All fire hydrants shall be located in protected, but easily accessible, areas behind the pavement.

- 3.7.4 Depth of Bury - the depth of bury for all fire hydrants shall be established such that the bury line on the fire hydrant is installed at the ground line at each location or at the finished ground after pavement construction is completed. The depth of bury for fire hydrants shall be shown on the construction plans. Minimum cover for fire hydrant leads shall be four feet (4').
- 3.7.5 Fire hydrants shall not be installed within nine feet (9') of a sanitary sewer system under any conditions.
- 3.7.6 Fire hydrants shall be color coded on the fire hydrant bonnet and caps. The color coded paint shall be as follows:

COLOR	Water Main Diameter (In.)
White	16"
Green	12"
Blue	10"
Orange	8"
Red	6"

The body of the fire hydrant will be painted silver in accordance with specifications from the City of Rosenberg Fire Department.

3.8 Fittings and Appurtenances

- 3.8.1 Fittings shall be Ductile-Iron Compact Fittings Three-Inch (3") - Twelve-Inch (12"), AWWA C153/A21.53.84, conforming to the minimum requirements of "Gray-Iron and Ductile-Iron Fittings, Twelve-Inch (12") through Forty-Eight-Inch (48")", for Water and Other Liquids", AWWA C110 (ANSI 21.10), current revision. Fittings shall be furnished with bituminous or cement mortar lined, AWWA C104 (ANSI A21.4).
- 3.8.2 All fittings shall be identified and described on the construction plans.
- 3.8.3 Fittings are not permitted in fire hydrant leads, except as approved by the City.

- 3.8.4 All water main fittings shall have mechanical joints. Push on joints may be used at special locations if specifically approved by the City.
- 3.8.5 All plugs shall be provided with retention clamps.
- 3.8.6 Polyethylene tube encasement shall conform to the minimum requirements of "Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids", ANSI/AWWA C105, current revision. Soils within the project shall be tested in accordance with Appendix A of ANSI/AWWA C105 to adequately determine the requirements for encasement.
- 3.8.7 Concrete thrust blocks shall be required on all bends, tees, plugs and combinations thereof. Refer to the City of Rosenberg Construction Details for specifications.

3.9 Steel Water Pipe

- 3.9.1 Welded steel pipe is required for all water mains with cover of less than four feet (4') or greater than eight feet (8') and of offset assemblies.
- 3.9.2 All transitions from steel pipe to approved water main materials shall be constructed using electrically isolated flange joints.
- 3.9.3 Welded steel pipe shall be constructed in conformance with the City of Rosenberg Standard Details.

3.10 Crossings

Installation of a water main across a proposed or existing highway, county road, public street, railroad, pipeline, or drainage way shall conform to the requirements of Section 2.7.

3.11 Water Service

3.11.1 Water Service

- A. All water service from the main to the curb stop shall be at the time of the construction of the main.
- B. Minimum size water service line and fittings shall be one inch (1") for single meter connections for homes having more than three thousand (3,000) square feet of living area. For homes with less than three thousand (3,000) square feet of living area, a three-quarter-inch (3/4") diameter water service line will be permitted.
- C. Minimum size water service line shall be one inch (1") for a far side double residential meter connection for homes less than three thousand (3,000) square feet. Minimum size water service line shall be one and one-half inches (1-1/2") for a far side double residential meter connection for homes greater than three thousand (3,000) square feet.
- D. Water service lines shall be placed at a minimum depth of thirty-six inches (36") below final paving elevation.
- E. All water service fittings and appurtenances for all projects shall be approved by the City and shall be listed on the Approved Water Products List found in

Appendix C of these Standards.

- F. City maintenance shall end at the water meter. The water meter box or vault shall be constructed to meet the City's requirements and will be maintained by the City.

3.12 Overall System Layout

3.12.1 Layout and size of all water mains shall be consistent with the overall layout of the existing water system. Layout of the overall system and of all water mains within the City's extraterritorial jurisdiction shall be approved by the City. The overall water system shall be designed to maintain adequate pressure throughout the system. In special cases, specific water pressure and flow analysis and study may be required.

3.12.2 The layout of the water mains should provide maximum circulation of water to prevent future problems of odor, taste, or color due to stagnant water. Some factors to be considered are as follows:

- A. Provide a source of fresh water at each end or at multiple points in a subdivision.
- B. Provide adequate circulation and place valves and fire hydrants, so that flushing of all mains will be simplified.
- C. Dead-ends should be avoided. All dead-ends should be isolated with a line valve, be as short as possible, and be equipped with a fire hydrant or blow off at the end of the main.
- D. In unavoidable permanent dead-end situations, reduce the sizes of pipe successively. Carry a six-inch (6") pipe to the last fire hydrant, then use four-inch (4") PVC to the end of the line. Provide a standard two-inch (2") blow off at the end of the main.
- E. Where a water main is stubbed out for future extensions, place a valve to isolate the dead-end and provide no customer services from the dead-end until it is extended. Provide a standard two-inch (2") blow off at the end of the main.

3.13 Additional Standards

3.13.1 Construction Features - In conjunction with the design, the engineer shall determine the extent of, and fully exemplify on the plans, all special construction features required to complete the project in a manner of safety, convenience, and economics.

3.13.2 Bore and Jack - Bore and jack sections shall be clearly shown on plans by location and footage. The following criteria are generally used as a basis for setting bore and jack sections.

- A. Public Streets - All public streets are to be bored and jacked regardless of surface. Bore and jack length shall be computed as roadway width at proposed bore plus five feet (5') to either side.
- B. Driveways - Whenever it is cost effective, concrete driveways in good condition shall be bored and jacked. Bore and jack length shall be computed as driveway width at bore plus one foot (1') to either side. Where driveways cross culvert pipe sections along open ditch streets and the proposed water main is in close

proximity and parallel to the culvert pipe, the length of bore shall be the same as the length of culvert pipe.

- C. Sidewalks - When the water line crosses under a sidewalk four feet (4') or more in width and in good condition, the sidewalk shall either be bored and jacked or the sidewalk shall be removed and replaced to the City of Rosenberg criteria, whenever it is cost effective. Bore and jack length shall be at least the width of the sidewalk. The proposed type of construction shall be noted on the plans.
- D. Trees - When saving trees and shrubs are a consideration, all trees six inches (6") and larger in diameter within ten feet (10') of the centerline of the water main must be noted on the plans. The water main should be bored and jacked within the drip line of any tree larger than six inches (6") in diameter.
- E. Bore Pits - Bore pits shall be at least three feet (3') from back of curb and five feet (5') from back of curb on a major thoroughfare. Bore pits in highway, county road, or railroad right-of-way shall conform to these requirements and to the requirements of the crossing permit and/or use agreement. All bore pits shall be shored in accordance with OSHA requirements. Bore pits and/or receiving pits to be located in street or driveway paving, shall be shown on plans.

3.13.3 Open Cuts - Where open cuts are required in street paving, plans should call for steel plate covers to be installed and maintained over the cut during periods when contractor is not actively engaged in work at the site. Streets that are open cut shall be "saw cut".

3.13.4 All existing developed areas shall be restored to original condition after construction.

3.13.5 Proper barricading and signage, conforming to the Texas Manual of Uniform Traffic Control Devices, must be required on all projects. Adequate signage for vehicular and pedestrian traffic will be installed.

DIVISION 4 - SANITARY SEWER DESIGN REQUIREMENTS

4.1 General

4.1.1 Sanitary sewers within the City of Rosenberg's jurisdiction shall allow for orderly expansion of the system.

4.1.2 Sewers shall be sized based on the minimum requirements set out in this standard and the standard wastewater flow rates as established by the City of Rosenberg.

4.1.3 All sewers shall conform to the minimum requirements of the Texas Commission on Environmental Quality, "Design Criteria for Sewerage Systems".

4.1.4 Sewers shall be separated from water lines by a minimum of nine feet (9'). Where the minimum separation is not maintained, refer to Section 3.4 for allowable clearances.

4.1.5 The public sanitary sewer, as maintained by the City of Rosenberg, shall be defined as all sewers, including stacks and service leads, that serve more than one sewer connection, that are located in public easements or street rights-of-way, and that are installed in accordance with these Standards.

4.2 Sewer Design and Materials

- 4.2.1 Minimum design criteria for determining the size of a sewer shall be as follows:
- A. Wastewater flows shall be based on the current projected requirements for the area. The average day flow for the design of sanitary sewers shall be based on a minimum of three hundred fifty (350) gallons per day per single family connection for residential areas. Commercial, industrial, and office areas shall be designed for an average day flow that can be anticipated from the contributing area.
 - B. The peak design flow for sewers shall be four (4) times the average day flow of the fully developed service area. Sewers larger than eighteen-inch (18") may be sized using a peaking factor of less than four (4) with approval of the City. The minimum allowable values for the design peak factor are presented in Appendix C of these Standards.
 - C. Minimum size public sewer shall be eight-inch (8").
 - D. Minimum size sewer service lead shall be four-inch (4") when serving one residential unit or six-inch (6") if not serving more than two (2) residential services.
 - E. Commercial sewer service lead shall be six-inch (6") pipe or larger and shall not serve more than one (1) commercial connection. Specific approval shall be required for lines less than six inches (6").
- 4.2.2 Sewers will be constructed of materials specified in the City of Rosenberg Approved Product List.
- 4.2.3 Cement Stabilized Sand for Bedding and Backfill:
- A. Portland Cement, Type I, ASTM C150.
 - B. Clean, durable sand, with less than 0.5 percent clay lumps, ASTM C142; with less than 0.5 percent lightweight pieces, ASTM C123; with organic impurities, ASTM C40, not showing a color darker than standard color and a plasticity index of less than six (6) when tested in accordance with ASTM D423 and ASTM D424.
 - C. Compact to ninety-five percent (95%) Standard Proctor Density (ASTM D698) in lifts of eight inches (8") thick. Actual testing may be required as deemed necessary by the City.
 - D. The cement-sand mixture shall consist of at least one and one-half (1-1/2) sacks of cement per cubic yard of sand. The cement-sand mixture shall have a minimum unconfined compressive strength of one hundred pounds per square inch (100 psi) in forty-eight (48) hours, when compacted to ninety-five percent (95%) of Standard Proctor Density (ASTM D698), without additional moisture control, cured and tested in accordance with ASTM C31.

4.3 Location of Sanitary Sewers

4.3.1 Street Right-of-Way

Sanitary sewers with a maximum depth of ten feet (10'), measured from finished grade, shall be placed within the right-of-way at least five feet (5') from the right-of-way line, except as provided herein. Sewers in sixty-foot (60') rights-of-way with twenty-eight-foot (28') wide streets should be placed eight feet (8') from the right-of-way line. All sewers that are deeper than ten feet (10') shall be located in an easement parallel and adjoining the right-of-way. Where required in accordance with Section 2.4.5, additional easement shall be provided adjoining the right-of-way to provide required clearances.

4.3.2 Easements

- A. Sanitary sewers placed in easements shall conform to the requirements of Section 2.4.5.
- B. The maximum depth of sewer in a rear yard public utility easement shall be eight feet (8'). All sanitary sewers in easements shall conform to the requirements in Section 2.4.5.

4.3.3 Recommended location for utilities is shown in Appendix B.

4.4 Design Requirements

4.4.1 Allowable Depths

Sewers shall be designed to meet or exceed the pipe manufacturer's recommendations for depth. The approved list of specific material and guidelines for sewers is available from the Department of Public Works.

4.4.2 Minimum depth of a sewer shall be four feet (4') below finished grade or top of curb, whichever is lower.

4.4.3 Sewer bedding will be cement stabilized sand, as required in Section 4.2.3, or approved granular material. Bedding shall be compacted to ninety-five percent (95%) Standard Proctor Density to the spring line on sewer lines shallower than eight feet (8') and six inches (6") over pipe for sewer lines eight feet (8') deep and greater, prior to backfilling the trench. In water bearing sand, crushed shell or other approved granular material will be required with geotextile fabric wrap. When water bearing sands are encountered, the City shall be notified immediately.

4.4.4 A mandrel test shall be performed prior to acceptance of all installed P.V.C. pipe. The initial mandrel test shall be performed thirty (30) days after the trench has been backfilled. The mandrel must move freely inside the pipe and will be pulled by hand from the upstream end of the pipe to the downstream end. Test equipment shall conform to the requirements set out in Appendix D. A second mandrel test, after settlement has occurred, may be required by the City to determine long term deflections. Deflections in P.V.C. pipe shall not exceed five percent (5%).

4.4.5 Hydraulic Requirements

- A. Design velocity in a gravity sewer flowing full shall be a minimum of two feet (2') per second. Where sewers are anticipated to flow less than one-half full, consideration should be given to increasing the slope of sewer to provide two feet (2') per second velocity in the pipe for the anticipated flow rate.
- B. Minimum acceptable slopes in sewers shall be:

Size of Pipe (Inches)	Fall In Feet Per 100 Feet of Sewer
6	0.50
8	0.33
10	0.25
12	0.20
15	0.15
18	0.11
21	0.09
24	0.08

- C. Sewers are to be designed so that the crowns of the pipes are matched at manholes. The upstream sewer may be designed so that the flow line of the upstream sewer is higher than the flow line of the downstream sewer. When the flow line of the upstream sewer is raised more than three feet (3') above the flow line of the downstream sewer, a drop manhole connection is required, except as specifically approved by the City.
- D. Sanitary sewer service leads shall be laid at one percent (1.0%) slope.

4.4.6 Alignment

- A. Sewers should be laid in a straight alignment, where possible. Curved sewers may be allowed with specific approval of the City.
- B. Sewers less than eighteen-inch (18") in diameter may be curved by deflecting the pipe at the joint. Deflection shall not exceed one-half (1/2) of the pipe manufacturer's recommendations for joint deflection. Eighteen inch (18") and larger sewers may be curved using manufactured bends with a maximum deflection of eleven and one-quarter degrees (11-1/4°). Deflected pipe joints and bends shall be shown and specifically located on the construction drawings. Televising may be required at the City's discretion.

4.5 Appurtenances

4.5.1 Manholes

- A. Manholes should be placed at points of changes in alignment (except along a curved sewer), grade, or size of sewers, at the intersection of sewers and at the end of all sewers. Clean-outs will not be permitted.
- B. Manholes should be spaced at a maximum distance of four hundred feet (400') apart.
- C. Manholes at the end of sewers in rear lot easements shall be placed in street rights-of-way.
- D. Sewers laid in easements shall have a manhole in each street crossing.
- E. Manholes should be located to eliminate the inflow of storm water into the sanitary sewer. The top of manhole rim elevation shall be shown on the plans for all sanitary manholes, except in the paved area. Sealed manholes may be permitted, within the 100-year flood plain, when specifically approved by the City.
- F. Manholes shall be constructed in accordance with the City of Rosenberg Standard Details.
- G. A drop manhole should be constructed for any sewer twelve-inches (12") in diameter or less that enters a manhole of greater than thirty-six inches (36") above the invert of the manhole. Sewers larger than twelve inches (12") shall be designed to accommodate a drop at the manhole using standard pipe fittings.
- H. Steps in manholes will not be permitted.
- I. Fiberglass manholes with precast, gasketed, concrete bottoms may be permitted for manholes that are less than eight feet (8') deep and are located within an easement, upon specific approval by the city.
- J. Manhole covers shall be cast iron, traffic bearing type ring and cover with the words "Sanitary Sewer" and if within the City, the words "City of Rosenberg" cast into the cover.
- K. All manhole covers shall be minimum 32-inch diameter.

4.5.2 Stacks

Stacks shall be constructed for connections to sewers that are more than eight feet (8') below finished grade. Stacks shall be provided during the initial construction of the sewer.

4.5.3 Lift Stations

Lift stations shall be designed in conformance with the "Texas Commission on Environmental Quality Design Criteria for Sewerage Systems". Lift stations should be considered only when a gravity system cannot be achieved. All lift stations shall be specifically approved by the City. The Design Engineer shall provide design requirements and pertinent data with construction plans for review. A preliminary design meeting with the Department of Public Works is recommended. Lift stations shall be designed as follows:

- A. Pumps shall be sized to operate at optimum efficiency. Minimum acceptable efficiency at the operating point will be sixty percent (60%), unless specifically approved by the City.
- B. Operation and maintenance should be considered in the design of the station and the location of the station.
- C. Wet well working volume should size to allow for the recommended pump cycle time of fifteen (15) minutes for each pump.
- D. Controls and equipment shall be approved by the City.
- E. Emergency operations should be considered. Provide fittings and a blind flange that will be readily accessible for emergency bypass pumping.

4.6 Service Connections

4.6.1 Sewer service leads shall not exceed one hundred feet (100') in length.

4.6.2 Single-Family Residential Lots

- A. All service connections shall be installed at the time of construction of the sewer.
- B. Service connections shall be constructed of materials as described in Section 4.2.2.
- C. Service connections should be installed at a manhole, when possible.

4.6.3 Multi-Family Residential, Commercial, and Office Development

- A. Service connections shall be made at a manhole. All service connections should be installed at the time of construction of the sewer.
- B. Service connections shall be constructed of materials as described in Section 4.2.2.

4.6.4 Service Connections at Manholes

- A. Service connections at manhole should be made when possible. When a service connection stub-out is not provided, an opening shall be neatly cut out of the manhole at the required elevation. The service connection shall be extended into the manhole.

- B. Service connection at a concrete manhole shall be grouted in place using non-shrink grout. When a hole for a service connection in a brick manhole exceeds eighteen inches (18"), the manhole shall be rebuilt above the disturbed area.
 - C. Service connections at fiberglass manholes shall be drilled, uniformly, through the manhole wall. A neoprene gasket shall be installed around the pipe to provide a water-tight seal through the wall. Where required, fiberglass mat and resin shall be used, in accordance with the manufacturer's recommendations, to repair wall openings.
 - D. Service connections entering a manhole three feet (3') or more above the flow line of the manhole shall include a drop pipe with fittings outside the manhole. The drop shall be installed adjoining and anchored to the wall of the manhole, unless specifically approved otherwise.
- 4.6.5 Provide adequate markings on site and accurate as built locations, so that the service connection stub-out can be recovered at the time that the connection to the service is made.
- 4.6.6 All connections to the public sewer system shall be approved by the Department of Public Works prior to construction. Actual connections to the public sewer system within the City Limits shall be inspected by a representative of the City.
- 4.6.7 Service connections that are installed after initial construction of a sewer shall be constructed using a P.V.C. saddle with gasket and stainless steel straps as approved by the City.

4.7 Unsewered Building Site

- 4.7.1 Sanitary sewer shall be extended to all building sites prior to development. Septic systems are not allowed, except as specifically approved by the City.

4.8 Testing Installed Pipe

- A. An infiltration, exfiltration or low pressure air test shall be performed. All tests shall be in accordance with the TEXAS COMMISSION ON ENVIRONMENTAL QUALITY Design Criteria for Sewage Systems and ASTM C828, C924, F141, or other appropriate procedures. Testing times are outlined in the TEXAS COMMISSION ON ENVIRONMENTAL QUALITY design criteria.
- B. Deflection testing shall be performed on all flexible pipes. The test shall be conducted after the final backfill has been in place at least thirty (30) days. Testing shall be done in accordance with the TEXAS COMMISSION ON ENVIRONMENTAL QUALITY Design Criteria for Sewerage Systems.

DIVISION 5 - DRAINAGE DESIGN REQUIREMENTS

5.1 General

- 5.1.1 All drainage plans and construction shall meet or exceed the requirements of the City of Rosenberg.
- 5.1.2 All drainage systems that are to become a maintenance responsibility of the City of Rosenberg shall be enclosed storm sewers, except as specifically approved by the City.
- 5.1.3 Public storm sewers are defined as sewers and appurtenances that provide drainage for a public right-of-way or easement. Private storm sewers provide internal drainage for a reserve or other tract. Private storm sewer connections to public storm sewers shall occur at a manhole or at the back of an inlet as approved by the City. All private storm sewers within the public right-of-way shall be constructed in conformance with these Standards.
- 5.1.4 All construction shall conform to the City of Rosenberg Standard Details.
- 5.1.5 All storm sewers shall meet or exceed the requirements of the "Drainage Criteria Manual for Fort Bend County, Texas" and the requirements of the City of Rosenberg.

5.2 Storm Sewer Materials

- 5.2.1 Storm sewer and culvert pipe shall be precast reinforced concrete pipe, unless specifically approved by the City. Concrete pipe shall be manufactured in conformance with the requirements of ASTM C 76, "Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe", current revision. Reinforced concrete pipe shall be Class III or stronger. The design engineer shall provide for increased pipe strength when conditions of the proposed installation exceed the allowable load for Class III pipe. All concrete pipe constructed in water bearing soil or forty-two inches (42") in diameter or larger, shall have rubber gasket joints meeting the requirements of ANSI/ASTM C 443, "Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets", current revision. Concrete pipe with a diameter of less than forty-two inches (42") may be installed using pipe with tongue and groove type joint and Ram-neck, or approved equal, as joint filler. When specifically approved by the City, reinforced concrete arch and elliptical pipe conforming to ASTM C506 and C507, respectively, current revision may be installed in lieu of circular pipe. Reinforced concrete box culverts shall meet the minimum requirements of ASTM C789, "Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers", current revision. Pipe joints for arch and elliptical pipe and box culverts shall be sealed using Ram-neck or approved equal.
- 5.2.2 Storm sewer outfalls into open channels shall be constructed using polymer coated corrugated steel pipe. Polymer coated corrugated steel pipe shall be manufactured in conformance with the requirements of AASHTO M245 and M246, current revision. Polymer coating shall be both inside and outside of pipe, with a minimum thickness of 10 mil. Pipe joints and fittings shall meet the minimum requirements of these specifications and shall have an O-ring gasket seal meeting the requirements of AASHTO C-361, current revision.
- 5.2.3 Storm sewer outfalls shall have slope protection to prevent erosion. Slope protection may be constructed of slope paving or rip rap. Slope paving shall be four-inch (4") five (5) sack concrete with six-inch by six-inch (6" X 6") welded wire mesh (W3 X W3) or three-

eighths-inch (3/8") steel rebar on twenty-four-inch (24") centers, each way. Rip rap shall be a minimum of six-inch (6") broken concrete rubble with no exposed steel or well-rounded stone and shall be a minimum of eighteen inches (18") thick. Slope protection texturing shall be required where public access is likely. Refer to the City of Rosenberg Standard Construction Details for minimum dimensions.

- 5.2.4 Alternate materials may be used with specific approval from the Department of Public Works.

5.3 Location of Storm Sewer

- 5.3.1 Public storm sewers shall be located within a public street right-of-way or a storm sewer easement, dedicated to the public and adjoining a public street right-of-way.

- 5.3.2 Recommended alignment within a public street right-of-way.

- A. One-hundred-foot (100') right-of-way with two (2) twenty-five-foot (25') streets - along centerline of the right-of-way.
- B. Eighty-foot (80') right-of-way with forty-five-foot (45') street - six feet (6') inside right-of-way.
- C. Sixty-foot (60') street right-of-way.
 - (1) Twenty-eight-foot (28') street (except when widening is anticipated) - five feet (5') inside right-of-way.
 - (2) Forty-one-foot (41') street - five feet (5') inside right-of-way.
- D. Fifty-foot (50') street right-of-way.
 - (1) Twenty-eight-foot (28') street - six feet (6') inside right-of-way.
 - (2) For all storm sewer located in a public street right-of-way, a minimum distance of two feet (2') shall be maintained inside the right-of-way line to the outside edge of the storm sewer.
- E. Alternate locations for a storm sewer may be permitted by the City.

- 5.3.3 Storm sewers within easements shall be placed no closer than seven and one-half feet (7.5') measured from the outside edge of the pipe to the edge of an easement, except when adjoining another easement or public right-of-way. The total width of an easement shall be equal to the maximum depth of the line plus twice the outside diameter of the storm sewer. The storm sewer shall be placed in the center of the easement. When the storm sewer adjoins a public right-of-way, the easement may be reduced and the storm sewer may be aligned closer to the right-of-way line with specific approval of the City. In all cases, the minimum width of a storm sewer easement shall be fifteen feet (15') with the sewer located in the center of the easement.

5.4 Construction Plan Requirements

- 5.4.1 A drainage area map shall be included in the construction plans. The drainage area map shall include:

- A. Drainage areas, including areas draining from off-site onto or adjoining the

project.

- B. Design storm runoff.
- C. 100-year storm runoff.
- D. Route of overland flow including the overflow to a drainage way sized to accommodate the 100-year flow.
- E. Elevations for the 25-year and 100-year storms in the outfall channel.
- F. Flow per inlet.
- G. Maximum 100-year ponding elevation.

5.4.2 Detailed drainage calculations shall be submitted with the construction plans.

5.4.3 The hydraulic gradient for the design storm shall be shown on the construction drawings. Calculations for the elevation of the hydraulic gradient shall be provided with the design storm drainage calculations.

5.5 Design Requirements

5.5.1 Minimum depth of a storm sewer (measured to the top of pipe) shall be twenty-four inches (24") below top of curb or finished grade, whichever is lower. Minimum size storm sewer for main and inlet lead shall be twenty-four inch (24").

5.5.2 Storm sewers shall be bedded using cement stabilized sand or approved granular materials (See specification in Section 4.2.3.) as shown in the City of Rosenberg Standard Details.

5.5.3 Pipe Requirements

- A. Reinforced concrete pipe, as described in Section 5.2.1 shall meet or exceed the following minimum requirements:

Pipe Class	Maximum Cover (Ft.)
III	15'
IV	30'

Reinforced concrete pipe installed at a depth greater than thirty feet (30') shall be designed by the engineer for the specific installation and approved by the City. Reinforced concrete pipe shall be designed in accordance with the American Concrete Pipe Association, "Concrete Pipe Design Manual". Maximum cover on the pipe shall be measured from the top of pipe to the ultimate finished grade or natural ground, whichever is greater.

B. Corrugated steel pipe shall have a minimum thickness as follows:

Pipe Size (Inches)	Minimum Thickness Corrugations	(Inches)
24	2-2/3" X 1/2"	0.052
30-48	2-2/3" X 1/2"	0.064
54-72	3" X 1" or 5" X 1"	0.064
78-102	3" X 1" or 5" X 1"	0.079

Bedding for corrugated steel pipe shall be cement stabilized sand (See specification in Section 4.2.3.) and shall have a minimum density of ninety-five percent (95%) Standard Proctor. Corrugated steel pipe less than or equal to fifty-four inches (54") in diameter and less than thirty feet (30') deep shall have the minimum thickness given above. Corrugated steel pipe larger than fifty-four inches (54") in diameter and greater than thirty feet (30') deep shall be designed by the engineer for the specific installation and approved by the City. Corrugated steel pipe shall be designed in accordance with the American Iron and Steel Institute, "Handbook of Steel Drainage and Highway Construction Products".

5.5.4 Storm sewers shall have a minimum clearance of six inches (6") from all other utilities. The clearance shall be measured from the outside wall of the pipe.

5.5.5 Design storm runoff shall be calculated in accordance with the "Drainage Criteria Manual for Fort Bend County, Texas".

5.5.6 Hydraulic Requirements.

A. Storm sewers shall be designed to have a minimum velocity of three feet per second (3 fps), when flowing full. Manning's formula should be used to compute the size of the storm sewer. Manning's coefficient, n, is 0.013 for concrete pipe and 0.024 for corrugated metal pipe.

B. Minimum acceptable slopes in reinforced concrete pipe storm sewers shall be:

Size of Pipe (inches)	Fall in Feet Per 100 Feet of Sewer
30	0.1300
36	0.1000
42	0.0800
48	0.0700
54	0.0600
60	0.0500
66	0.045
72	0.040
78	0.036
84	0.033
90	0.030
96	0.028

C. Inlet capacity for the design storm shall be computed using a maximum water surface elevation equal to the top of curb at the inlet. Design capacity for a H-2 inlet with a six-inch (6") standard curb shall be five (5) cubic feet per second.

D. Design storm flow in a street shall not exceed the capacity of the street, for the water surface equal to the top of curb, and shall not exceed the inlet capacity. Design storm flow shall meet Fort Bend County criteria.

E. Street ponding criteria shall meet minimum Fort Bend County Drainage Criteria. The maximum allowable ponding level for a minor or collector street is the lowest of the following: (1) one foot (1') above natural ground; (2) one foot (1') above top of curb; or (3) one foot (1') below the lowest slab elevation for a 100-year storm event. The storm sewer system must convey flows from a 100-year storm event without ponding water in the street at levels that exceed the maximum allowable level. The maximum allowable ponding level for a major thoroughfare is the lowest of the following: (1) one foot (1') above natural ground; (2) top of curb (low side), or; (3) one foot (1') below the lowest slab elevation adjacent to the thoroughfare for a 100-year storm event. Drainage calculations, along with water surface or hydraulic grade line profiles shall be submitted to the City for approval.

F. The lowest chord of all bridges must be a minimum of eighteen inches (18") above the 100-year water surface elevation in accordance with the Federal Emergency Management Agency (FEMA.) regulations.

- 5.5.7 Storm sewers less than forty-two inches (42") in diameter shall be constructed on a straight horizontal and vertical alignment between manholes. Storm sewers greater than or equal to forty-two inches (42") in diameter may be laid along a curve using manufactured bends of less than or equal to 11-1/4 degrees. Camera inspection may be required on storm sewers constructed along a curve.

5.6 Appurtenances

5.6.1 Manholes

- A. Manholes shall be placed at all changes in alignment (except sewers laid along a curve), grade and size of storm sewers; at the intersection of two or more storm sewers; at all inlet leads; and at the end of all storm sewers.
- B. Maximum spacing between manholes shall be six hundred feet (600').
- C. Manhole covers shall be cast iron, traffic bearing, type ring and cover with the words "Storm Sewer", and if within the City, "City of Rosenberg" cast into the cover.
- D. All manhole covers shall be minimum 32-inch diameter.

5.6.2 Inlets

- A. Curb inlets shall be spaced and sized to intercept the calculated runoff for the design storm. The water surface elevation at the inlet shall be less than or equal to the top of curb for the design storm flow.
- B. Maximum travel distance of water in the street to a curb inlet shall be three hundred feet (300') on a major thoroughfare and in a commercial area. The maximum travel distance of water in the street permitted in a single-family residential area shall be six hundred feet (600').
- C. Curb inlets should be located on the intersecting side street at an intersection with major thoroughfare. Locations on the major thoroughfare at intersections shall be specifically approved by the City.
- D. Grated inlets will not be permitted in an open ditch.
- E. Back slope swale interceptors shall be placed in accordance with the requirements of Fort Bend County.
- F. Backfill around inlets with cement stabilized sand (section 4.2.3) to the top of first stage of the inlet, or to within 6 inches of bottom of pavement, whichever is higher.

DIVISION 6 - PAVING AND STREET DESIGN REQUIREMENTS

6.1 General

- 6.1.1** All paving plans and construction shall be approved by the City of Rosenberg for all streets within the City and its extraterritorial jurisdiction.
- 6.1.2** All paving plans and construction shall also be approved by the Fort Bend County Engineer for work in the extraterritorial jurisdiction.
- 6.1.3** All streets shall be concrete, with concrete curb and gutter.
- 6.1.4** Fire lane easements shall be specified on all multi-family and non-residential plats. All fire lane easements must have access to public roadways. Location, alignment width, and construction specifications shall be reviewed and approved by the City.

6.2 Pavement

6.2.1 Minimum Allowable Pavement Width

- A.** A minor (single family residential) street shall be twenty-seven feet (27') wide measured from the inside of curb to inside of curb.
- B.** A collector street shall be thirty-nine feet (39') wide measured from the inside of curb to inside of curb.
- C.** A major thoroughfare (undivided) shall be a minimum of fifty-one feet (51') wide measured from the inside of curb to inside of curb or as specified by the city.
- D.** A major thoroughfare (divided) shall be a minimum of two (2) twenty-four feet (24') paved lanes measured from the inside of curb to the inside of curb for each section, with a fifteen feet (15') median for a four lane divided roadway.
- E.** Alleys may be required in commercial and industrial districts. Service alleys in commercial and industrial districts shall have a minimum concrete pavement width of twenty feet (20'). An easement may be substituted upon approval by the City if the easement is also an extra width fire lane easement. In residential districts, alleys shall be parallel, or approximately parallel to the frontage of the street. Alleys in residential districts shall provide a minimum of twenty feet (20') of right-of-way and twelve feet (12') of concrete pavement.
- F.** Interior streets for a Townhouse subdivision shall be a minimum of a thirty-six (36') foot paving section, measured from inside of curb to inside of curb.
- G.** Cross streets for Townhouse subdivision shall be thirty-two (32') feet wide, measured from inside of curb to inside of curb.
- H.** Interior streets for Patio Home subdivisions shall be twenty-eight (28') feet wide, measured from inside of curb to inside of curb.

- I. Access street for Patio Home subdivisions shall be thirty-six (36') feet wide, measured from inside of curb to inside of curb.

6.2.2 Pavement Structure Requirements

- A. Minor residential streets shall have a minimum thickness of six (6") inches with number four (#4) rebar spaced at twenty-four inches (24") measured center to center of the rebar, each way.
- B. Residential collector streets and all streets in multi-family residential, commercial, or industrial areas shall have a minimum thickness of seven inches (7") with number four (#4) rebar spaced at eighteen inches (18") measured center to center of the rebar, each way.
- C. Major thoroughfares shall have a minimum thickness of seven inches (7") with number four (#4) rebar spaced at eighteen inches (18") measured center to center of the rebar, each way.
- D. The pavement structure for each roadway shall be designed based on soil data from the site and based on the anticipated traffic volume, loading and service life of the proposed pavement structure. The design engineer is responsible to insure that the pavement structure is designed to withstand the anticipated loads that are expected on the roadway.
- E. Alleys for commercial and industrial districts shall have a minimum thickness of seven inches (7") with number four (#4) rebar spaced at eighteen inches (18") measured center to center of the rebar, each way. Residential alleys shall have a minimum thickness of six inches (6") with number four (#4) rebar spaced at twenty-four inches (24") measured center to center of the rebar, each way.

6.2.3 Materials

- A. Concrete - five and one-half (5-1/2) sacks cement per cubic yard concrete, with a minimum twenty-eight (28) day compressive strength of 3,500 psi.
- B. Reinforcing steel - Grade 60, ASTM A615, current.

6.2.4 Subgrade should be stabilized with a minimum six percent (6%) lime by weight, six inches (6") thick and compacted to ninety-five percent (95%) standard proctor density. Alternative subgrade stabilization may be substituted when specific recommendations are made by the geotechnical engineer for the project and when specifically approved by the City.

6.2.5 Concrete pavement thickness design is required for all pavement within industrial areas and on major thoroughfares. Concrete pavement thickness design shall be based on American Association of State Highway and Transportation Officials design procedures for rigid pavements.

6.3 Grading and Layout Requirements

6.3.1 Minimum gradient on gutter shall be 0.30 percent. For special conditions where the gutter must be placed at a flatter grade, the minimum grade may be 0.25 percent with specific approval of the City.

6.3.2 Inlet spacing as defined in Section 5.6.2.

6.3.3 Maximum cut measured from finished grade at the right-of-way line to top of curb shall be 1.75 feet. The recommended maximum slope for driveways shall be ten

- (10) to one (1) slope. Variation of this requirement may be allowed with specific approval of the City.
- 6.3.4 Minimum one percent (1%) fall around intersection turnout for a minimum radius of twenty-five feet (25'). Grade for larger radius shall be determined on an individual basis.
- 6.3.5 All streets shall have a six-inch (6") high concrete curb as shown in the City of Rosenberg Standard Details, unless otherwise specifically approved.
- 6.3.6 Cul-de-sac pavement:
- A. Single family, residential - pavement radius measured to the back of curb shall be forty feet (40').
 - B. Multi-family, residential, commercial, and industrial - radius measured to the back of curb shall be fifty feet (50').
 - C. Cul-de-sac pavement with an unpaved median is permitted. The minimum pavement width for the cul-de-sac will be forty feet (40') for single family residential areas and fifty feet (50') for multi-family residential, commercial, and industrial areas. Right-of-way radius shall be increased to accommodate the increased paving width.
 - D. The distance from the back of curb of a cul-de-sac to the right-of-way line shall be a minimum of ten feet (10').
 - E. Curb radii at the transition to the cul-de-sac shall have a minimum radius of twenty-five feet (25') in single family residential areas and thirty-five feet (35') in other areas.
 - F. Maximum lengths of cul-de-sac streets for residential subdivision shall be one thousand feet (1,000'), serving a maximum of twenty-four (24) residential lots. Maximum length of cul-de-sac streets for commercial or industrial developments shall be six hundred feet (600'). A traffic analysis may be required in commercial or industrial areas to determine high traffic volumes that may be generated from the development, reducing the maximum length of cul-de-sac allowed.
- 6.3.7 Minimum slope for the gutter of a cul-de-sac or of the long radius of an L-type street shall be 0.60 percent.
- 6.3.8 Major thoroughfares with a centerline radius of the right-of-way less than two thousand feet (2,000') shall be designed considering recommendations for super elevation in accordance with the American Association of State Highway and Transportation Officials, "A Policy on Geometric Design of Highways and Streets", 1984, or latest addition. Signage and design speed shall be considered for all curved thoroughfares. A maximum rate of super elevation should be 0.04 for urban conditions.
- 6.3.9 The amount of cross slope over the pavement section should be shown on the plans (the usual cross slope is three-eighths-inch (3/8") per foot from the curb line to quarter point, and one-fourth-inch (1/4") per foot from quarter point to centerline, and one-eighth-inch (1/8") per foot for left turn lanes).
- 6.3.10 When connecting to an existing curbed street, the gutter lines for the proposed and existing streets shall be matched.

- 6.3.11 Proposed top of curb elevations should be designed to match the top of the curb at an existing inlet.
- 6.3.12 Top of curb elevations shall be shown on the construction plans.
- 6.3.13 Gutter elevations are required for vertical curves where a railroad track is being crossed.
- 6.3.14 Where railroad crossings are not at right angles to the pavement slab, vertical curves should be calculated for each curb line and should be posted at ten-foot (10') intervals in the profile.
- 6.3.15 Vertical curves shall be designed when algebraic difference in grades exceeds one percent (1%). Elevations shall be shown on the construction plans at ten-foot (10') intervals through vertical curves. The gradient for tangents to vertical curves at railroad crossings shall be a maximum of 3.5 percent. All crest vertical curves shall be determined by sight distance requirements for the design speed. The minimum design speed on any vertical curve shall be based on the street classification.
- 6.3.16 Intersections:
- A. Curb radii shall be twenty-five feet (25') minimum in residential areas and thirty feet (30') minimum in commercial or industrial areas or on major thoroughfares. Refer to Appendix F for allowable curb radii at intersections for various intersecting streets.
 - B. Streets and traffic lanes shall be properly aligned across an intersection. Proposed streets shall be aligned with existing streets.
 - C. When turnouts are provided at an existing street, the ultimate cross section is required to the end of curb return. Pavement transition is required to reduce the pavement width to the existing cross section.
 - D. Intersections should be designed as a high point in the drainage system, when possible.
- 6.3.17 Pavement width transitions shall conform to Appendix F of the Design Standards. Minimum transition lengths shall meet or exceed requirements of the Texas Manual of Uniform Traffic Control Devices.
- 6.3.18 Left turn lanes shall conform to Appendix F of the Design Standards. Minimum bay storage lengths may need to be calculated as per traffic analysis. The referenced standards are minimum requirements. Middle block left turns may be permitted when approved by the City.
- 6.3.19 Median openings for major thoroughfares shall conform to Appendix F of the Design Standards. When areas adjoining the right-of-way are not planned for immediate development, esplanade opening may be spaced one thousand feet (1,000') apart when specifically approved by the City.
- 6.3.20 Horizontal dowels are required when making a connection of a proposed street to an existing concrete street that has no exposed steel.
- A. Dowels should be number four (#4) bars, sixteen inches (16") long, eighteen inches (18") center-to-center, embedded eight inches (8") and epoxied.

- B. As an alternate to paragraph A above, saw cut and remove existing concrete to expose a minimum of ten inches (10") of longitudinal steel, in good condition, with an equivalent cross section area of steel equal to the proposed pavement steel.

6.3.21 Dead-end streets designed to be extended in the future shall have fifteen inches (15") of reinforcing steel exposed beyond the pavement, coated with asphalt and wrapped with burlap for future pavement tie.

6.3.22 Paving headers shall be placed at the end of all concrete slabs.

6.3.23 All concrete to be removed shall be removed either to an existing joint or a sawed joint.

6.4 Sidewalks

6.4.1 Sidewalks are required and shall be four feet (4') in width on each side of all public residential streets. Sidewalks of five feet (5') in width are required on each side of a collector street and a major thoroughfare. Construction of a sidewalk along a single-family residential local street may be deferred until a lot is improved, provided there is a note regarding sidewalk construction on the recorded subdivision plat.

6.4.2 Sidewalk wheelchair ramps shall be required at all intersections.

6.4.3 Sidewalk construction in an esplanade: Concrete sidewalk, six inches (6") thick may be constructed in all esplanades. All concrete sidewalks in esplanades shall be a minimum of six feet (6') wide as measured from the esplanade nose. Patterned concrete or brick may be used with specific approval of the City.

6.5 Traffic Control Devices

6.5.1 Type III barricades shall be permanently installed at the end of all dead-end streets no terminating in a cul-de-sac and at all turnouts. Barricades must meet the requirements of the Texas Manual of Uniform Traffic Control Devices for Type III barricades. Type III barricades must be Scotchlite brand, or approved equal, high intensity sheeting on a nominal two-by-eight inch (2" x 8") non-pressured treated #2 pine wood, painted white with latex enamel paint.

6.5.2 Traffic and street signage locations shall be shown on the paving site plan in the construction plans. Traffic signs shall conform to the requirements of the Texas Manual of Uniform Traffic Control Devices. Prior to final approval of a construction project, all signage shall be installed in accordance with the approved construction plans.

6.5.3 Traffic Signs

A. Standard sign blanks shall be aluminum conforming to ASTM B209; alloy 5052-H38. Preparation of aluminum sign blanks must conform to specification MIL-C-5541C. The coating material must be included on the OPL-871706-10 list or subsequent additions thereto. Sheeting for signs must be Scotchlite, or approved equal. Visual Impact Performance (VIP) Diamond Grade Sheeting shall be used on all signs on all roadways classified as Collector or greater. Scotchlite brand, or approved equal, High Intensity Sheeting shall be used on all other road signs. Signs shall be mounted on a 2-3/8 inch diameter by twelve foot (12') long galvanized tubular post with vandal proof mounting brackets.

B. Street name signs shall be at least nine inches (9") in height. The sign sheeting color type shall be green, electrocut film #1177. Sheeting for

signs must be Scotchlite, or approved equal. Visual Impact Performance (VIP) Diamond Grade Sheeting shall be used on all street name signs on all roadways classified as Collector or greater. Scotchlite brand, or approved equal, High Intensity Sheeting shall be used on all other street name signs. All signs shall include three inch (3") size hundred blocks and abbreviated roadway classifications. All three inch (3") numbers and letters shall be 7/16" stroke width. "No Outlet" signs, where required or used, shall be incorporated into the street name signs and the yellow background with black three inch (3") lettering shall be at the end of the sign pointing towards the "No Outlet".

- C. The nine inch (9") street name sign blanks shall be aluminum conforming to ASTM B209; alloy 5052-H38 or 2154-H38. Preparation of aluminum sign blanks must conform to specification MIL-C-5541C. The coating material must be included on the QPL-81706-10 list or subsequent additions thereto. The sign blanks shall be extruded aluminum and shall be installed on tubular sign supports with a minimum sign length of thirty inches (30") and a maximum length of forty-eight inches (48"). When a "No Outlet" is included, the maximum sign length is fifty-four inches (54"). Letters shall be white six inch (6") upper case with Helvetica Medium, font #H0907 letter style. The six inch (6") letters shall have a stroke width of 1-1/4 inch. To accommodate longer street names, alternative stroke widths may be approved.
- D. Overhead street name signs are required on all traffic signals. Overhead street name signs shall be fourteen inch (14") in height, with green electrocut film #1177. Signs shall be Scotchlite brand, or approved equal, VIP sheeting and the aluminum shall be 0.125 gauge with radius corners. Preparation of aluminum sign blanks shall conform to specification MIL-C-5541C. The coating material must be included on the QPL-81706-10 list or subsequent additions thereto. All signs shall include four inch (4") size hundred blocks and abbreviated roadway classifications. All four inch (4") numbers and letters shall be 13/16 inch stroke width. The fourteen inch (14") signs shall include a 3/4 inch white border on the outside edge of sign. Letter sizes shall be eight inch (8") upper case with a 1-11/16 inch stroke width.
- E. All permanent and temporary (construction zone) traffic control devices shall conform to the Texas Manual of Uniform Traffic Control Devices and Texas Department of Transportation standards (where applicable), latest revision.
- F. All posts shall be mounted in concrete eighteen inches (18") deep with a minimum of three inches (3") in diameter of concrete surrounding the post. All sign posts and signs shall remain in their natural condition with no painting or coating allowed.

6.5.4 Pavement markings shall be shown on the approved construction plans. All pavement markings shall be retro-reflective material applied to the road surface in a molten state by screed/extrusion, suspend extrusion or spray means, with a surface application of glass beads. For lane delineation, reflectors shall be used on all roadways classified as Collectors or greater. The Public Works Director may approve variations of types of materials due to phasing, temporary construction, etc. All pavement markings shall comply with the Texas Manual of Uniform Traffic Control Devices and Texas Department of Transportation standards, latest revision.

- 6.5.5 Developer shall install traffic control devices as warranted by a traffic study approved by the City.
- 6.5.6 Traffic Signal hardware for mast arms and other appurtenances shall be designed to meet Texas Department of Transportation load requirements.

6.5 Miscellaneous Requirements

- 6.5.1 Roadway connections to existing roadways shall be accomplished using a "Metropolitan Intersection", except as specifically approved by the City.
- 6.5.2 All special, non-standard items, such as bomanite or concrete pavers and special signage, that are installed by the developer, shall be specifically approved by the City and shall be maintained by the developer or his assigns. Any maintenance of non-standard items by the City of Rosenberg will be done using standard materials and methods.
- 6.5.3 All materials and workmanship shall conform to the Texas Department of Transportation Standard Specifications, 1993, and the Texas Manual on Uniform Traffic Control Devices, 1980, and any revisions thereto.
- 6.5.4 Developer shall install traffic control devices as deemed necessary.

6.6 Roadway Geometric Design

6.6.1 Right-of-Way (R.O.W.) Width

Right-of-way width is generally determined by the pavement section (roadway type/classification) required to perform the function and carry the traffic. Other considerations of right-of-way may include the provisions of vehicle safety areas, sidewalks, bus turnouts, bicycle paths, and utility locations. Right-of-way widths shall be determined from the major thoroughfare plan or applicable planning tool for classifications and other width considerations.

6.6.2 Horizontal Curvature and Vertical Curves

Horizontal curvature and vertical curve criteria for roadways are referenced to and shall conform to the major thoroughfare study for additional design criteria when special traffic hazards exist.

6.6.3 Storage Length

Storage lengths provided in turning lanes should be sufficiently long to store the maximum number of vehicles likely to accumulate during a critical period. A storage length which is too short could cause vehicles to undesirably back up into through traffic lanes.

Storage lengths should be calculated if turning volumes are known or may be accurately estimated. The formula for calculating storage length is:

$L = 25N$

Where:

L = Length of storage lane in feet and,

N = Number of vehicles expected in the queue during the peak thirty (30) minute traffic period, using a Poisson Distribution, ninety percent (90%) confidence level, and a ninety (90) second arrival period.

Where analysis indicates that dual left-turn lanes are needed, a lane distribution of fifty-five percent (55%) in the leftmost lane and forty-five percent (45%) in the rightmost lane should be used for calculations.

Unless a longer storage length is indicated by the calculation, the minimum length of a left-turn storage lane for collector level or lower streets is one-hundred feet (100') from the nose to the point of transition. On major streets (collectors and thoroughfares), the minimum length is one-hundred fifty feet (150').

6.6.4 Intersection Sight Distance:

Each intersection design should consider the required sight distances before establishing corner right-of-way clips. Unless larger clips are indicated at a particular intersection, a twenty foot by twenty foot (20' X 20') triangular public open space corner clip, measured at the property line, is required on corner lots at the intersection of two public streets. A fifteen foot by fifteen foot (15' X 15') triangular corner clip or easement is required at the intersection of a public street and a dedicated alley. Intersection sight distance requirements shall conform to the major thoroughfare study for criteria.

6.6.5 Geometric street design standards shall conform to Appendix F of the Design Standards.

DIVISION 7 - SITE DEVELOPMENT REQUIREMENTS

7.1 General

- 7.1.1 Site development plans for all site developments within the City of Rosenberg and its extraterritorial jurisdiction shall be approved by the City prior to construction.
- 7.1.2 Site developments, not including single family residential, shall include any project that affects public water, wastewater, storm drainage, or paving facilities.
- 7.1.3 All site developments shall conform to the requirements of these Standards and applicable rules and regulations of the City of Rosenberg.

7.2 Design Review Requirements for Site Development Plans

- 7.2.1 All site development plans for proposed developments shall be submitted to the City for approval prior to construction. Site development plans shall show all proposed water, wastewater, paving, parking, drainage, and flood protection facilities.
- 7.2.2 One (1) copy of the site development plans shall be submitted for review. The City will respond within fourteen (14) days with an approval letter and/or with plans showing the required changes.
- 7.2.3 When plan changes are requested, two (2) copies of the revised site development plans shall be resubmitted to the City for final review and issuance of an approval letter.
- 7.2.4 Site development plans for projects located within the City of Rosenberg shall be submitted to the Public Works Department, with the approval letter attached, and construction plans, for issuance of a permit prior to construction.

7.3 Building Slab Elevations

- 7.3.1 Minimum building slab elevations within the City Limits shall be set at or above the elevation shown on the recorded plat, twelve inches (12") above the 100-year flood plain elevation and maximum ponding elevation, or eighteen inches (18") above natural ground or twelve inches (12") above the top of curb at the front of the lot, whichever is higher. Minimum building slab elevations within the extraterritorial jurisdiction of the City of Rosenberg shall conform to the requirements of Fort Bend County.

7.4 Water Service

Water service lines and meters shall be sized in accordance with requirements set out in Division 3 of these Standards (3.11).

7.5 Sanitary Sewer Service

Sanitary sewer service leads are normally installed during construction of the public sanitary sewer. When a sanitary sewer service lead is to be installed for a site development, refer to requirements set out in Division 4 of these Standards. All lots, tracts, or reserves shall be connected directly to a public sanitary sewer by a single lead, except as specifically approved by the City.

7.6 Site Drainage Requirements

All commercial, industrial, office, recreational, and multi-family tracts deeper than one hundred feet (100') measured from the right-of-way line shall have an internal drainage system. The internal drainage system shall collect all site runoff beyond one hundred feet (100') from the right-of-way line into a storm sewer system that shall connect to the public drainage facilities in the area, except with specific approval. The one hundred foot (100') area adjacent to the right-of-way may sheet flow to the roadway drainage system if the roadway system is designed to accommodate the additional sheet flow from development.

- 7.6.1 The internal site storm sewer shall be connected to a public storm sewer at a manhole or at an inlet adjoining the site. The site drainage outfall shall be connected to the nearest existing drainage system with adequate capacity to serve the drainage area. Where extension of the existing drainage system is required, all costs for extension shall be the responsibility of the development.
- 7.6.2 All internal site storm sewers extended into a public right-of-way or easement shall be reinforced concrete pipe at least twenty-four inches (24") in diameter. Only one connection will be allowed into the back of a curb inlet. Storm sewers shall be reinforced concrete pipe, ASTM C-76, Class III, with rubber gasket joints, ASTM C-443.
- 7.6.3 All internal facilities shall be designed by a registered professional engineer and shall be sized to drain the site in accordance with these Standards.
- 7.6.4 Drainage calculations shall be submitted with all site development plans. Other supporting data may be required by the City.
- 7.6.5 When the site drains directly into a Fort Bend County drainage facility and/or into a highway right-of-way, the appropriate governmental entity (entities) shall approve the site development connection to public facilities.

7.7 Driveways

- 7.7.1 The location and width of all driveways that will connect to a public street must be reviewed and approved by the City prior to construction and may be required to be identified at the time of platting, prior to the submission of a building permit, or at the time a land plan or site plan is submitted. This includes replats where relocating or shared access may be required or denial of an additional driveway on the newly formed lot.
- 7.7.2 All driveways, residential and non-residential, must be installed in compliance with the City of Rosenberg Driveway Design Standards as provided in Appendix G, List of Construction Details.
- 7.7.3 All driveways are required to first obtain a permit through the City of Rosenberg. In addition, if the driveway is located on a state roadway, the City requires the applicant to obtain a driveway access permit from TX Dot. No permit from the city shall be released until a permit has been approved by TX Dot and delivered to the City. The City will adhere to the guidelines, rules adopted and approved by TX Dot on all TX Dot controlled roadways, unless lesser requirements can be demonstrated to the satisfaction of the city after approval of the City Council and recommendation of the Planning and Zoning Commission. All applications for permits shall be filed with the City prior to seeking approval from TX Dot.

- 7.7.4 Residential – specific. No residential driveway shall be allowed on a major thoroughfare except as allowed under section 25-67. of the City of Rosenberg’s subdivision ordinance. If it is an existing lot, access will be allowed if there is no adjacent side street or rear street in which safer access is available. When located on a major thoroughfare, if possible, a circle driveway will be designed in which the driveway width will be a minimum twenty feet wide, the driveway entrances are to be thirty feet (30’) apart from outside turning radii at curb line, and turning radii at curb line shall be a minimum of twenty feet (20’). If not possible, every effort should be made to create space on the lot to provide a turn around maneuver and turning radius at the curb line of twenty feet (20’). All other streets, residential driveways shall be a minimum of ten feet (10’) wide at the right-of-way line with a turning radius of five (5) feet on local streets and ten (10) feet on collectors. No lot shall have more than one driveway (circle drive is considered two drives) on a local street unless it has at least one hundred (100) feet of frontage or the additional drive is on an other street. Under no condition shall a single lot be allowed more than two drives unless it is approved by the planning and zoning commission and the lot has more than two acres. No turn radius with the curb return shall extend beyond the property line of the property when extended in a straight line from the right-of-way to the curb line.
- 7.7.5 A traffic impact study may be required as a part of the approval process for driveways and other roadway access. A traffic impact analysis (TIA), when required, shall be prepared by an individual, group, firm or corporation having demonstrated professional emphasis and experience in transportation planning, engineering and in the preparation of similar analyses. The TIA document shall bear the seal and signature of a Texas Registered Professional Engineer.
- 7.7.5.1. A traffic impact analysis shall include the following information:
- A. Study purpose and objectives.
 - B. Description of the site and study area – to include entire property or master plan, not just portion submitted for building permit or plat approval.
 - C. Existing conditions in the area of the development.
 - D. Recorded or approved nearby development.
 - E. Trip generation and trip distribution.
 - F. Projected future traffic volumes.
 - G. An assessment of the change in roadway operating conditions resulting from the development traffic.
 - H. Recommendations for site access and transportation improvements needed to maintain traffic flow to, from, within, and past the site at an acceptable and safe level of service.
- 7.7.5.2 Prior to preparation of a traffic impact analysis, the project engineer is required to meet with the Planning Director to identify the study area, define the area of influence, non-site impacts, and determine or define essential elements such as but not limited to study area, design year, trip generation rates, trip assignments, non-site traffic estimates, etc.

- 7.7.5.3 The analysis shall be presented in the following manner:
- A. Straightforward and in a logical sequence; step by step toward conclusions and identifying recommendations and alternatives.
 - B. It shall allow the reviewer to duplicate the calculations.
 - C. Recommendations shall specify the time period within which the improvements should be made, particularly if the improvements are associated with various phases of the development.
 - D. Recommendations shall also specify the time period for any monitoring of operating conditions.
 - E. Data shall be presented in tables, graphs, maps, and diagrams wherever possible for clarity and ease of review.
 - F. A brief executive summary of one or two pages be provided, concisely summarizing the purpose, conclusions, recommendations, and alternatives.

- 7.7.6 Large speed differentials shall be minimized to prevent unsafe conditions. Every attempt should be made to have driveway designs that create no more than 20 mph maximum speed differential on roadways. Driveway approaches accessing major thoroughfares should be situated in a manner that minimizes the number of potential conflict points. Use of deceleration lanes, acceleration lanes, turning lanes, turning bays, shared driveways, access easements for adjoining properties, cross driveway easements (an easement allowing two or more properties to share a common drive(s).), traffic signals and traffic control devices, special lanes for pedestrians, crosswalks, medians and median markings, special signage, and other internal and external designs, signage, devices, markings, etc. shall be considered on all driveway requests.
- 7.7.7 Anyone planning on developing a site, parcel of land, or preparing a parcel of land or site for such shall be prepared to submit a driveway plan for the entire property. If the parcel to be platted is a portion of a larger tract, the city may require all driveways be identified or at a minimum the number, general location and access easements identified to allow joint use of driveway(s) located on separate tracts or parcels on the larger tract before the platting of the smaller tract or sub-parcel. A TIA may be required to take into consideration a larger section of roadway or other roadways other than the roadway immediately adjoining the tract(s) of land under consideration.
- 7.7.8 An individual may be required to negotiate driveway access on an adjacent property prior to or instead of being granted a driveway access on a tract or parcel of land.
- 7.7.9 Driveways serving non-residential and multi-family tracts that connect to a street classified as a thoroughfare or collector street or has a speed limit exceeding 35 mph must be thirty-five (35) feet wide at the right-of-way line. Non-residential and multi-family tracts fronting on all other streets shall be twenty-five (25) to thirty-five (35) feet wide at the right-of-way line.
- 7.7.10 It is the City's policy to minimize whenever practical the number of non-single family residential driveways on all arterial and collector streets in order to reduce the number of conflict points and facilitate traffic flow. To facilitate that policy, driveways shall be placed no closer than the following distances from adjacent streets and driveways (measured

from the turn radius at the curb line to the nearest turn radius at the curb line). More than one driveway may be allowed as long as it meets the following criteria:

<u>Roadway Classification</u>	<u>Minimum Separation</u>
Major Highways, U.S 59	200 ft. or greater as determined by a Traffic Impact Analysis.
Highways, State Hwy 36	200 ft. or greater as determined by a Traffic Impact Analysis.
Thoroughfare	165 ft.
Collectors	165 ft.
Local streets	75 ft.

- 7.7.11 If the separation requirements for non-single family residential driveways cannot be met because of the location of existing driveways on adjoining tracts, joint access driveways, access easements, or cross driveway easements, across adjoining tracts should be used. When minimum separation requirements cannot be met with the existing private driveway on the adjacent property and joint access cannot be obtained, the controlling factor shall be to maximize the distance between the subject property's private driveway and the public cross street.
- 7.7.12 On streets classified as collectors, thoroughfares (arterials), and highways that do not contain medians, non-residential driveways must align with driveways on the opposite side of the street the minimum separation requirements.
- 7.7.13 At signalized intersection in which one public street terminates at the intersection of a connecting cross street, a driveway should be avoided in the area of the signal at a spacing outlined above and not be placed on the cross street as to be in alignment with the terminating street. If the requirements for driveways otherwise allow the placement of a driveway within the area due to size or a TIA, then the driveway width must match the cross-section of the intersection public street and be properly aligned. Non-residential driveway connections to the public street shall be approved and inspected by the City of Rosenberg.
- 7.7.14 No turn radius with the curb return shall extend beyond the property line of the property when extended in a straight line from the right-of-way to the curb line.
- 7.7.15 Driveways shall be located and designed so as to have adequate sight distances along the intersecting street.
- 7.7.16 Non-residential minimum driveway radii accessing a thoroughfare or greater shall have a radii of thirty-five (35) feet. Radii for driveways on the other roadways shall be a minimum of twenty-five (25) feet. Refer to details as outlined in the Driveway Design Standards, Appendix G, List of Construction Details.

7.8 Fire Lanes

- 7.8.1 Fire lane easements shall be created on all multi-family and non-residential tracts. Fire lane easements shall be an all-weather driving surface capable of supporting the imposed loads of fire apparatus and subject to the approval of the Fire Official and the Director of Public Works. All fire lane easements must have access to public-access streets.

- 7.8.2 Fire lanes shall be of an unobstructed width of not less than twenty feet (20'), with adequate turning radius capable of supporting the imposed loads of fire apparatus and shall extend for the minimum length necessary to provide access for emergency vehicles as determined by the Fire Official in accordance with accepted fire safety standards. A ninety (90) degree intersection is acceptable with prior approval of the Fire Official. All fire lanes have a minimum vertical clearance of thirteen feet six inches (13' 6").
- 7.8.3 Fire lanes shall be constructed using the same pavement structural requirements as public pavement. Alternate materials may be used with specific approval from the Department of Public Works.
- 7.8.4 Fire lanes shall be designed to drain in compliance with the site development requirements.

APPENDIX A – B
(SCANNED ITEMS)

APPENDIX C

SANITARY SEWER - PEAK DESIGN FACTOR

All gravity sewers will be designed to accommodate the peak flow from the contributing drainage area. The peak flow will be computed using the appropriate peaking factor, F, multiplied by the average day flow for the contributing area. For non-residential areas, the peak flow should include consideration of flow characteristics from the anticipated development. In all cases, the design peaking factor, F, shall meet or exceed the values as follows:

An equivalent population less than 5,000 persons,

$$F = 4$$

An equivalent population greater than or equal to 5,000 persons,

$$F = (14 / (3.316 + P^{0.5})) + 1.5$$

For, P = equivalent population in thousands

Additional consideration of peak flow shall be given for design of pumping stations. The impact of pumping stations on the upstream and downstream sanitary sewer system shall be evaluated. The peak flow for design of a pumping station shall be based on the actual flow into the station. A reduced peak flow, based on the peaking factor presented above, may be used for design of larger pumping stations provided a detailed hydraulic analysis is performed on the sanitary sewer system. Specific approval by the Department of Public Works shall be required prior to use of a reduced peak flow for the design of a pumping station and related sanitary sewer system.

APPENDIX D

MANDREL REQUIREMENTS

All gravity sanitary sewers, constructed using P.V.C. pipe, shall be tested using a Mandrel that will measure five percent (5%) deflection in the pipe. ASTM 3034, current, provides diameters for seven and one-half percent (7-1/2%) deflection. Five percent (5%) deflection requirements are listed below.

P.V.C. Pipe - SDR-35

Nominal Pipe Size (In.)	Average Inside Diameter (In.)	Base Inside Diameter (In.)	5% Deflection Mandrel
6	5.893	5.742	5.45
8	7.891	7.665	7.28
10	9.864	9.563	9.08
12	11.737	11.361	10.79
15	14.374	13.898	13.20

P.V.C. Pipe - SDR-26

Nominal Pipe Size (In.)	Average Inside Diameter (In.)	Base Inside Diameter (In.)	5% Deflection Mandrel
6	5.764	5.612	5.33
8	7.715	7.488	7.11
10	9.644	9.342	8.87
12	11.480	11.102	10.55
15	14.053	13.575	12.90

For P.V.C. pipe sizes larger than fifteen inch (15") diameter, specific requirements for the Mandrel will be established by the Department of Public Works.

APPENDIX E

STREET LIGHTING REQUIREMENTS

Area	Minimum Distance (1)	Maximum Lumens (2)
Minor/Local Streets	195 - 300'	16,000
Collector / Thoroughfare Streets	195 - 300	16,000
Commercial Areas	225 - 350'	16,000
Divided Roads	195 - 350' (4)	16,000
	225 - 350' (4)	16,000 (5)
	275 - 450' (4)	16,000 (5)

Notes:

1. Distances are measured along centerline of road. Shorter distances may apply in the vicinity of street intersections.
2. All lights shall be High Pressure Sodium Vapor with elliptical lighting pattern. Due to this lighting pattern, it is recommended that street lights not be installed within the radius of a cul-de-sac.
3. Where practical, lights shall be located on alternating sides of roadway.
4. Distance applies to each side of a divided roadway, i.e. double the number of lights.
5. For boulevard streets, double-arm steel standards in the median may be utilized with 16,000 lumen and 25,500 lumen lights. Light standards and electrical conduit should not conflict with public facilities in the right-of-way.

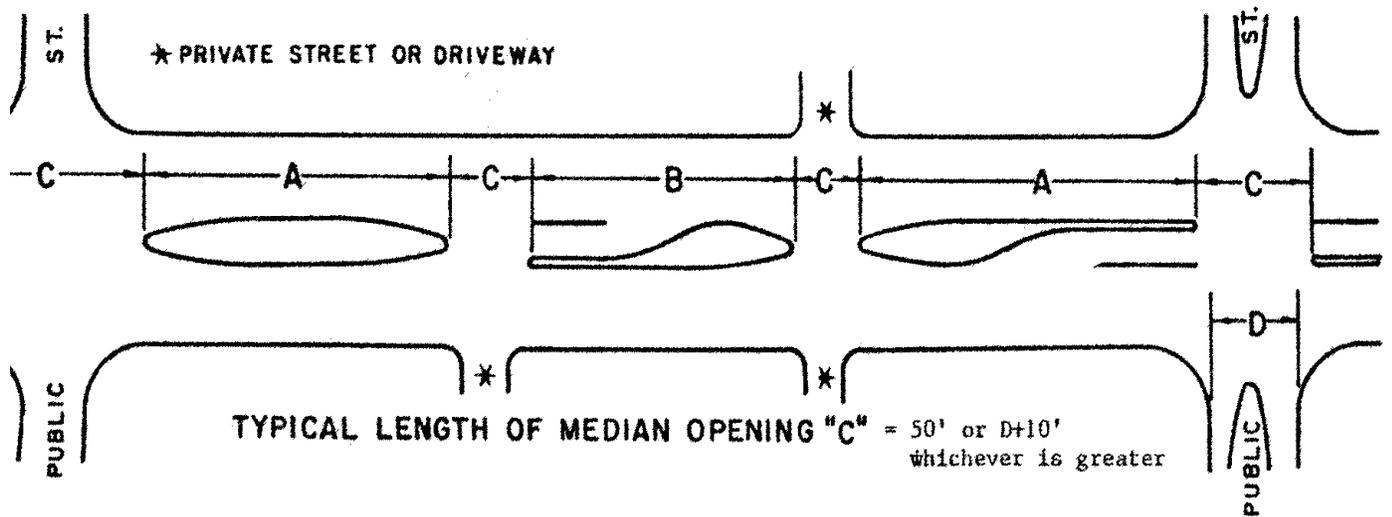
APPENDIX F

THE GUIDELINES PRESENTED IN THIS DOCUMENT INCLUDE THE MOST OFTEN REQUESTED INFORMATION REGARDING GEOMETRIC DESIGN OF SUBDIVISION STREETS. DESIGNATED MAJOR THOROUGHFARES AND EXISTING ACCESS STREETS SHALL BE CONSIDERED FOR SPECIAL DESIGN FEATURES AND MAY REQUIRE HIGHER DESIGN CRITERIA THAN SHOWN HEREIN. ALSO DESIGN FEATURES NOT SHOWN IN THESE GUIDELINES SHOULD BE CONSIDERED SPECIAL DESIGN FEATURES.

IT IS ADVISABLE TO CONSULT WITH THE APPROPRIATE AGENCIES AND REVIEW THE FOLLOWING PUBLICATIONS TO DETERMINE ADEQUATE THOROUGHFARE REQUIREMENTS AND SPECIAL DESIGN FEATURES.

- RECOMMENDED GUIDELINES FOR SUBDIVISION STREETS, INSTITUTE OF TRANSPORTATION ENGINEERS, 1984.
- GUIDELINES FOR URBAN MAJOR STREETS DESIGN, INSTITUTE OF TRANSPORTATION ENGINEERS, 1984.
- A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS, AASHTO, 1984.
- TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUYCD) STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION, 1980.

TYPICAL LENGTH OF MEDIAN AND MEDIAN OPENING



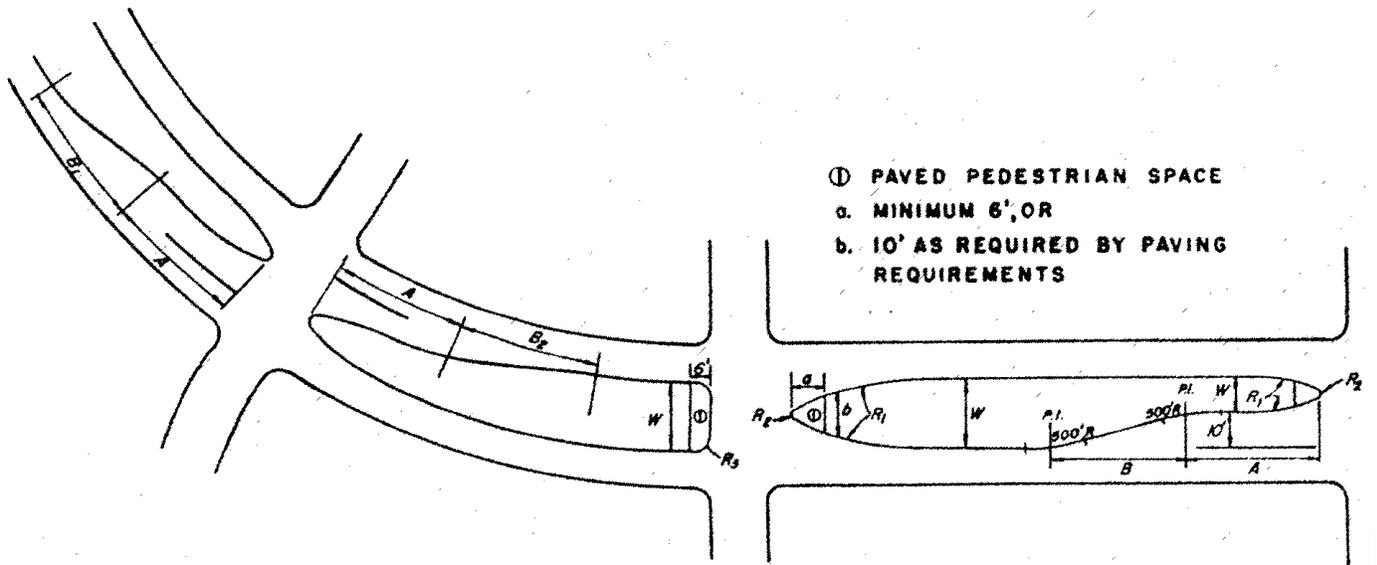
MINIMUM ACCEPTABLE MEDIAN LENGTH FOR TYPE OF STREET

IF PLANNED DIVIDED STREET IS	PURPOSE OF MEDIAN INTERRUPTION			
	MAJOR STREET / THOROUGHFARE (A)	COLLECTOR STREET (A)	LOCAL STREET (A)	PRIVATE STREET OR DRIVEWAY (B)
MAJOR STREET / THOROUGHFARE	350'	300'	300'	300'
COLLECTOR STREET	300'	250'	250'	250'
LOCAL STREET	250'	250'	250'	200'

ROADWAY TAPERS FOR SUBDIVISION STREETS

(INSERT PICTURE)

MEDIAN NOSE AND LEFT TURN BAY DESIGN



MEDIAN DIMENSIONS

W	R ₁	R ₂	R ₃
≤ 8'	NONE	W/2	N/A
> 8' ≤ 38'	90'	W/5	N/A
≥ 38'	NONE	NONE	15'

N/A - NOT APPLICABLE

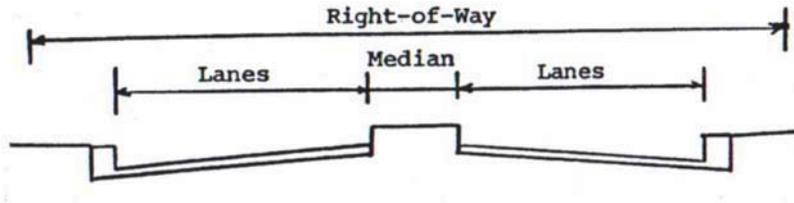
LEFT TURN BAY DIMENSIONS

A	=	150' MINIMUM AT INTERSECTION OF TWO MAJOR STREETS. = 100' MINIMUM AT ALL OTHER INTERSECTIONS
B	=	100' MINIMUM ON STRAIGHT ROADWAY
B ₁	=	TAPER LENGTH MAY BE SHORTER IF IT IS ON A HORIZONTAL CURVE TO THE LEFT
B ₂	=	TAPER LENGTH MAY BE LONGER IS CURVE IS TO THE RIGHT.
NOTE	=	DIMENSIONS MAY BE ADJUSTED AS DETERMINED BY THE DEPARTMENT OF PUBLIC WORKS

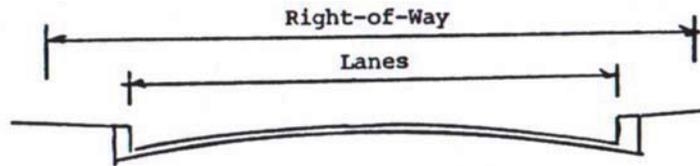
GEOMETRIC STREET DESIGN STANDARDS

(Minimum Standards)

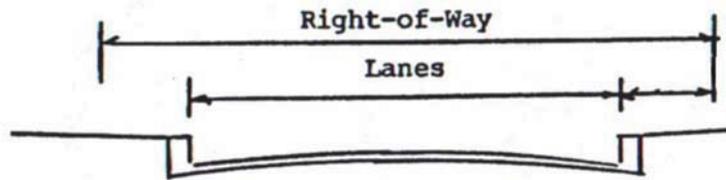
Divided Roadways (T4D)
Major Thoroughfare



Undivided Roadways (T4U, C3U)
Major Thoroughfare, Collectors



Minor Street (L2U)



Design Element	Roadway Type			
	T4D	T4U	C3U	L2U
Number Traffic Lanes	4	4	3	2
Lane Width (ft.)	12	12	12	12
R.O.W. Width (ft.)	100	100	80	60
Pavement Width (ft.) (inside of curb to inside of curb)	23	51	39	27
Design Speed (MPH)	40-50	30-45	30-45	20-30
Max. Grade (%)	6	8	8	10
Stopping Sight (ft.)	325-475	200-325	200-325	125-200
Horizontal Curvature Min. Radius (ft.) (minimum unless approved by the city engineer)	2000	850	850	450 or 300*
Min. Median Width (ft.)	15	-	-	-

*For local street less than 2000' long

APPENDIX G

APPROVED PRODUCTS LIST **APPENDIX G**

APPROVED WATER PRODUCTS LIST

1. Fire Hydrants (AWWA Approved)
 - A. Mueller - Model: Centurion or Modern Centurion
 - B. American Darling - Model: B-84-B
 - C. Clow - Model: Medallion Hydrant

2. Valves (AWWA Approved Resilient Wedge Type)
 - A. Mueller
 - B. American Darling
 - C. Clow

3. P.V.C. Pipe (AWWA C-900)
 - A. J-M Pipe
 - B. Certainteed
 - C. Napco

4. Ductile Iron Pipe (AWWA C151, C150 and C600)
 - A. U.S. Pipe
 - B. American

5. Castings (D.I.P. AWWA C153)
 - A. U.S. Pipe
 - B. Nappco
 - C. Tyler

6. Curb Stop - Bronze, Ball Valve, 360° Rotation, Locking Wing
 - A. Ford
 - B. Mueller - Model: Mark II Oriseal
 - C. James Jones
 - D. Hays

7. Corporation Stop - Bronze
 - A. Ford - Model: F100
 - B. Mueller - Model: H-15008 or H-15013
 - C. James Jones
 - D. Hays

8. Service Saddle - Single Strap, Epoxy with CC Tap
 - A. Ford
 - B. Mueller
 - C. Clow

- D. James Jones
 - E. Smith Blair
 - F. Romac
9. Water Meters (AWWA Approved)
 - A. Rockwell
 - B. Neptune Trident
 - C. Badger
 10. Service Tubing
 - A. Copper - Type K
 11. Tapping Sleeve & Valve (M.J. or All Stain Less Steel)
 - A. JMC
 - B. Rockwell

APPROVED SANITARY SEWER PRODUCTS LIST

1. Gravity or Force Main
 - A. P.V.C., 12-inch - SDR 26, ASTM 3034
 - B. P.V.C. > 12-inch - DR 25, 165 PSI Rating
 - C. Centrifugally Cast Fiber Glass Pipe, Class PN200/SN72
 - D. Ductile Iron Pipe, Class 50
4" sch 40 DWV PVC Pipe
2. Coating for Manholes (40 Mils. Minimum Thickness)
 - A. Ipagard Epoxy
 - B. Thane Coat FE 100
 - C. Strong Seal MS-2
3. Lift Station Submersible Pumps
 - A. Gorman-Rupp
 - B. Flygt
 - C. ABS
 - D. Davis EMU
4. Lift Station Control Panels
 - A. E.G. Controls
 - B. Consolidated Electric
 - C. Murphymatic
 - D. Sta-Con, Inc.

NOTE: Materials and manufactured items used in construction of a Public Works project shall be approved by the Department of Public Works prior to installation. Water and sanitary sewer system appurtenances shall be subject to the approved items as listed in the above Approved Products List. Items not appearing on this approved list shall not be used for construction of public works facilities in the City of Rosenberg and the Rosenberg extraterritorial jurisdiction.

LIST OF CONSTRUCTION DETAILS

(SCANNED ITEMS)