

CITY OF LA MARQUE

CHAPTER 6

PAVING DESIGN CRITERIA

CHAPTER 6 – PAVING DESIGN

6.1 PAVING DESIGN GENERAL

6.1.1 Criteria for the geometric design guidelines for streets, street paving requirements, and standard paving notes for drawing call-outs are herein established.

6.2 DEFINITIONS

6.2.1 AASHTO - American Association of State Highway and Transportation Officials.

6.2.2 ACI - American Concrete Institute.

6.2.3 ASTM - American Society for Testing Materials.

6.2.4 Curb Sections: Full width concrete pavement with doweled-on 6 inch high vertical curbs or 4"x12" curbs. Curb and gutter sections require inlets and underground storm sewers.

6.2.5 Geotechnical Engineer: An engineer certified by the American Association for Laboratory Accreditation (AALA).

6.2.6 HMAC: Hot Mix Asphaltic Concrete.

6.2.7 Roadway Ditch Sections: Ditch sections adjacent to either full width reinforced concrete pavement or asphaltic pavement. Roadside ditch sections do not require underground storm sewers; however, the ditch sections must be designed to accommodate a 5-year storm runoff.

6.2.8 TxMUTCD - Texas Manual on Uniform Traffic Control Devices.

6.3 DESIGN REQUIREMENTS

6.3.1 The following design requirements are applicable to all pavement within right-of-way limits within the City of La Marque and its ETJ:

- A. All paving and construction plans shall be approved by the City of La Marque for all streets.
- B. Street design should conform to all applicable planning tools, such as the Texas Manual on Uniform Traffic Control Devices, major thoroughfare plans, and master plans. Other considerations for design should include street function, street capacity, service levels, traffic safety, pedestrian safety, and utility locations. These additional considerations may affect the minimum requirements set forth herein. Refer to the City Thoroughfare Plan.
- C. Design shall conform to the City of La Marque's Construction Details where applicable, or if not available, the standards of the City of Houston.

- D. Minimum Right-of-Way Width, Paving Section, and Maximum Design Speed Requirements for:
- a. Marginal Access Streets: Minimum 50 feet right-of-way, 2 lanes undivided without median. Maximum design speed 30 MPH
 - b. Local: Minimum 60 feet right-of-way, 2 lanes undivided without median. Maximum design speed 30 MPH
 - c. Minor Collector Streets: Minimum 80 feet right-of-way, 4 lanes undivided without median. Maximum design speed 30 MPH
 - d. Major Collector Streets: Minimum 80 feet right-of-way, 4 lanes divided with raised median, minimum 12 feet wide, Maximum design speed 35 MPH.
 - e. Minor Arterial: Minimum 120 feet right-of-way, 4 lanes divided with raised median, minimum 32 feet wide, Maximum design speed 45 MPH.
 - f. Major Arterial Streets: Minimum 120 feet right-of-way, 4 to 6 lanes divided with raised median, minimum 32 feet wide, Maximum design speed 40 MPH.
 - g. Super Arterial: As required by TxDOT
- E. Minimum Width Requirements and Paving:
- a. Curb and Gutter sections for low-density residential developments: 28 feet back-to-back of curb (B/B).
 - b. Pavement for open ditch sections for low density residential developments: 26 feet edge-to-edge of pavement, with a 6-foot shoulder on either side of the pavement:
 - (1) Reinforced Concrete: A thickened edge is required for this type of pavement. The thickened edge should be 8 inches decreasing to 6 inches at a point 4 feet from the edge of the pavement. Use only when approved by the City in large lot residential developments.
 - (2) Asphalt: 2 inch thick HMA with 8 inch thick crushed limestone or crushed concrete base. Use only when approved by the City in large lot residential developments.
 - c. Curb and gutter sections of medium density residential, industrial, and commercial development secondary and collector streets: 38 feet B/B of curb minimum.

- d. Pavement of major arterials and thoroughfares: Two divided traffic lanes, each way, of 25 feet B/B four (4) lane divided roadways or 34 feet B/B of curb for six (6) lane divided roadways.
- F. Minimum Thickness and Reinforcement Requirements for Concrete Pavements: The following requirements are the minimum allowable. Pavement thickness and reinforcement shall be designed by the Professional Engineer responsible for the project based on a current soils analysis and recommendations by a qualified geotechnical engineer. All concrete shall have a minimum compression strength of 4,000psi. The design requirements in special cases may dictate a greater strength. Pavement design based on soils analysis, use, loading, and life span may require greater thickness and more reinforcement than the following minimums:
- a. For pavement widths less than or equal to 28 feet B/B of curb:
 - (1) Minimum concrete slab thickness shall be 6 inches with $F_c = 4,000$ psi and reinforcement shall be Grade 60, $f_y = 60,000$ psi, #4 deformed reinforcing bars spaced at 18 inches center-to-center both ways and minimum lap lengths of 18 inches. Expansion joints shall be placed at the end of each curb return and at a maximum spacing of 40 feet 6 inches. Expansion joints shall include a $\frac{3}{4}$ inch redwood header, $\frac{3}{4}$ smooth dowel bar (18 inches length) and a 26 gauge hard plastic tube. The expansion joint shall include a standard steel wing plate.
 - (2) Minimum stabilized subgrade thickness shall be 8 inches.
 - b. For pavement widths greater than 28 feet B/B and for minor and major collectors
 - (1) Minimum concrete slab thickness shall be 7 inches with $f_c = 4,000$ psi and reinforcement shall be Grade 60, $f_y = 60,000$ psi, #4 deformed reinforcing bars spaced at 18 inches center-to-center both ways and minimum lap lengths of 18 inches. Expansion joints shall be placed at the end of each curb return and at a maximum spacing of 40 feet 6 inches on residential and collector streets, and a maximum spacing of 60 feet 6 inches on boulevards and major thoroughfares.
 - (2) Minimum stabilized subgrade thickness shall be 8 inches.
 - c. For pavement minor and major and arterials:
 - (1) Minimum concrete slab thickness shall be 8 inches with $f_c = 4,500$ psi and reinforcement shall be Grade 60, $f_y = 60,000$ psi, #5 deformed reinforcing bars spaced at 16 inches center-to-center both ways and minimum lap lengths of 18 inches.

(2) Minimum stabilized subgrade thickness shall be 12 inches.

G. Subgrade Treatment: The Geotechnical Engineer shall base depth of subgrade stabilization on structural number (SN) in conjunction with pavement thickness design. Following is a general guidance for subgrade treatment:

- a. For subgrade soil conditions with a plasticity index (PI) of 10 or more, the subgrade shall be stabilized with lime and compacted to 95% standard proctor density. Subgrade shall be stabilized with the recommended percent of lime (6% min.) by weight as determined by the Geotechnical Engineer.
- b. For subgrade soil conditions containing a clean sand with no clay content, the subgrade shall be stabilized with cement.
- c. For subgrade soil conditions containing silt, the subgrade shall be stabilized with lime-fly ash.

H. Requirements for Intersections, Turnouts, Transitions, and Thoroughfares:

- a. At a "T" intersection with a street that has not been improved to its ultimate width, concrete pavement should be stopped either at the right-of-way line or at the end of the curb return, whichever would require less concrete removal at a future date.
- b. For roadway turnouts placed at an existing street intersection, the turnout should be designed to fit the ultimate pavement width of the intersecting cross-street and then transitioned to the existing roadway.
- c. The usual transition length for meeting an open ditch street is 50 feet for street widths less than or equal to 28 feet B/B; 75 feet for up to 38 feet B/B width, and 100 feet for 41 feet B/B width.

(1) Streets other than concrete shall have transitions of a minimum thickness of 8 inches of lime stabilized subgrade, 6 inches of hot-mix asphaltic concrete base, or approved equal, with 2 inches of hot-mix asphaltic surfacing.

(2) Concrete streets shall have transitions of a minimum thickness of 6 inches of stabilized subgrade and 6 inches of concrete pavement.

- d. When paving only one roadway of a proposed two roadway thoroughfare (boulevard section) all left turn lanes and esplanade crossovers shall be paved to the centerline of the street right-of-way.

I. Requirements for Roadway Pavement with Open Ditch Sections (large lot residential subdivisions only):

- a. Minimum grade on ditches shall be 0.20 percent.
 - b. Ditch capacity shall be designed to accommodate a 5-year storm runoff event.
 - c. Maximum side slopes of ditches shall be 3 feet horizontally to 1 foot vertically (3:1). Sides may be sloped to 4:1 or 5:1 for easier maintenance by property owner.
 - d. Culverts for roadside ditches only shall be designed to carry ditch discharge but not less than 18 inches diameter. Culverts shall be Class III RCP conforming to ASTM C-76 or smooth interior dual wall corrugated polyethylene pipe conforming to AASHTO M294.
 - e. The minimum paving radius for cul-de-sac shall be 40 feet in a 50-foot radius right of way if the cul-de-sac is located on the interior of a residential subdivision, and is 600 feet or less in length. If the cul-de-sac opens onto a thoroughfare or exceeds 600 feet in length, the minimum pavement radius shall be 45 feet in a 50-foot radius right of way.
- J. Requirements for Roadway Pavement with Curb and Gutter Sections:
- a. Minimum gutter gradient shall be 0.30 percent.
 - b. Maximum cut from finished grade at property line to top of curb shall be 1.75 feet. The desired slope for driveways is 2% to 8%.
 - c. Minimum grade shall be 0.70 percent fall around intersection turnout for a maximum radius of 25 feet. Grades for larger radius shall be determined on an individual basis.
 - d. Vertical curves shall be installed when algebraic differences in grades exceed 1 percent. Elevations shall be shown at 10 feet intervals through vertical curves. Maintain a minimum of 0.02 feet elevation change at 10 feet intervals by altering the calculated elevations.
 - e. When a curb and gutter intersects a drainage ditch, the grade of gutter shall be above the designed water surface of the ditch.
 - f. The maximum travel distance of water in the street gutter to a curb inlet shall be 300 feet on a major thoroughfare and in commercial areas. The maximum travel distance of water in the street gutter to a curb inlet in a single-family residential area shall be 500 feet.
 - g. All new residential and local streets poured with a curb and gutter shall have a minimum of a 4 inch rollover, lay down curb. All new collector and thoroughfare streets shall have the standard 6 inch stand up curb. A

standard 6 inch curb shall be used adjacent to all storm sewer inlets; 4 inch rollover curbs shall be transitioned to a 6 inch curb near the inlet.

- h. Major thoroughfares shall be super-elevated in accordance with AASHTO whenever the centerline radius of lanes or right-of-way is less than 2,000 feet.
 - i. The amount of cross-slope over the pavement section shall be 2% sloping away from the crown of road or centerline.
 - j. A minimum gradient of 0.70 percent around the longest radius is required on an L-Type street intersection or cul-de-sac.
 - k. Fill lines shall be shown on the drawings. If this type of fill is required and the pavement is adjacent to a nonparticipating property owner, fill easements shall be obtained from the property owner and recorded. A copy of the easements shall accompany the final drawings. Construction of this nature will require back-slope drainage design to prevent trapping storm runoff.
 - l. Grades should be labeled for all tops of curb. Centerline grades are acceptable for open-ditch sections only.
 - m. The minimum paving radius for cul-de-sac shall be 40 feet in a 50-foot radius right of way if the cul-de-sac is located on the interior of a residential subdivision, and is 600 feet or less in length. Islands within cul-de-sacs are allowed provided that the minimum fire apparatus turning radius requirements are met. If the cul-de-sac opens onto a thoroughfare or exceeds 600 feet in length, the minimum pavement radius shall be 45 feet in a 50-foot radius right of way.
- K. Requirements for Curbs and Sidewalks:
- a. Standard height of a curb is 4 inches and 12 inches wide for curbs located along residential streets. Curb height for streets other than residential shall be 6 inches. The curb height for all esplanades shall be 6 inches.
 - b. Sidewalk wheelchair ramps shall be required at all intersections and driveways. The design and installation of ramps shall comply with Texas Accessibility Standards Architectural Barriers requirements.
 - c. All sidewalks are to be a minimum 5 feet in width and are to be constructed in accordance with the City of La Marque standard details.
 - d. Sidewalks are required along all curb and gutter streets. The developer, prior to the City's final one-year acceptance of the public infrastructure, must install sidewalks along right of way and reserves.

- e. The location of all proposed and existing sidewalks shall be shown on the construction drawings.

L. Requirements for Driveways

- a. Driveways shall be asphalt or reinforced concrete, and shall be installed from the existing pavement to the right-of-way line (property line), minimum. This applies to all types of new construction. It does not apply to property being actively used for agricultural purposes and designated with the agricultural-use exemption.
- b. Refer to La Marque Standard Construction Details (Paving) for various driveway configurations.

M. Requirements for Miscellaneous Items:

- a. The type and amount of subgrade treatment shall be shown on the drawings.
- b. Paving headers shall be placed at the end of all concrete pavements.
- c. All concrete to be removed shall be removed either to an existing joint or to a sawed joint.
- d. Sight distance requirements based on the design speed of the roadway shall be used for determining lengths of crest vertical curves for all pavements except boulevard sections, which shall be designed for 45 mph.
- e. Standard Type III City barricades shall be placed at the end of all dead-end streets not terminating in a cul-de-sac.
- f. A letter of agreement from the affected pipeline company approving the construction plan crossing is required when paving is placed or construction work occurs over a transmission pipeline.
- g. When meeting existing concrete pavement, horizontal dowels shall be used if no exposed reinforcing steel for interconnection with new pavement exists. Horizontal dowels shall be Grade 60, #6 rebars, 24 inches long, drilled and embedded 12 inches into the center of the existing slab and epoxied. Dowels shall be 18 inches center-to-center, unless otherwise specified.
- h. When concrete is removed for interconnections, the pavement shall be saw cut and existing concrete removed to expose a minimum of 15 inches of reinforcing steel. If no reinforcing steel exists, use horizontal dowels as previously described.

- i. Dead-end streets or ends of concrete slabs designed to be extended in the future shall have paving headers and 15 inches of reinforcing steel exposed beyond the pavement, coated with asphalt and wrapped with burlap or paving headers and dowel type expansion joint for future pavement tie.
- j. Pavement extensions shall connect to the existing pavement with a pavement undercut and a minimum steel overlap of 18 inches.
- k. Concrete pavement thickness design is required for all pavement within industrial areas and on major thoroughfares. Concrete pavement thickness design shall be based on AASHTO design procedures for rigid pavements.
- l. Adjust manhole frames and covers within the limits of the pavement to meet the proposed final top of slab.
- m. Adjust manhole frames and covers outside the limits of the pavement to conform to the final grading plan.
- n. No more than one shrinkage crack shall be allowed in each forty foot header section. A shrinkage crack is defined as extending one-fourth or more of the full depth of the concrete (i.e. 1.5" or more on 6" thick concrete) appearing within one year of the final concrete placement. If two or more shrinkage cracks appear in one header section, the entire section shall be removed and replaced at contractor's expense.
- o. If shrinkage cracks are less than one-quarter the depth of the concrete, then a recommendation letter and data sheets are required from the testing laboratory as to the type of sealant which will be used to seal the shrinkage cracks. This recommendation shall be approved by the City Engineer before application of sealant. Cracks shall be sealed at contractor's expense.
- p. Core samples for the sections will be taken no sooner than the 28 day break of the original concrete pour sample.

6.4 QUALITY ASSURANCE

- 6.4.1 All construction drawings and specifications shall be prepared by or under the supervision of a currently Registered Professional Engineer of the State of Texas, and all documents shall be sealed, dated, and signed by the engineer responsible for the preparation.
- 6.4.2 A geotechnical report shall be performed by or under the supervision of a currently Registered Professional Engineer of the State of Texas disciplined in the science of soils analysis. All reports and documents shall be sealed, dated, and signed by the engineer responsible for the preparation.

- 6.4.3 All pavement design shall be supported by calculations to establish the required thickness and reinforcement.
- 6.4.4 The current soils report shall be the basis for design considering the use, loading, and life span of the proposed pavement.