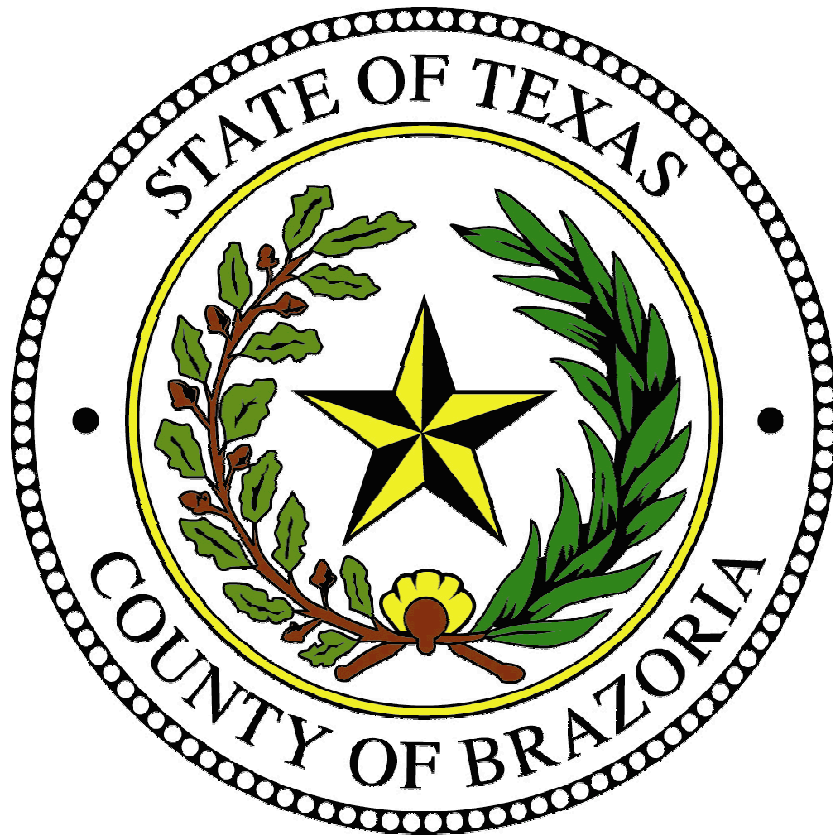


Brazoria County, Texas



Roadway Design Criteria Manual

September 2023



Table of Contents

- Section 1. General Requirements..... 3
 - 1.01. General.....3
 - 1.02. Predevelopment Research3
 - 1.03. Fees4
 - 1.04. Design Review Requirements.....4
 - 1.05. Construction Procedure Requirements.....4
 - 1.06. Approval and Acceptance of Public Improvement Projects.....5
 - 1.07. Approvals and Variances6
- Section 2. Construction Plan and Miscellaneous Requirements 7
 - 2.01. Required Plan Sheets.....7
 - 2.02. Drawing Requirements.....7
 - 2.03. Easements10
 - 2.04. Utility Locations.....10
 - 2.05. Utility Crossings.....11
 - 2.06. Trench Safety.....11
 - 2.07. Bench Marks.....11
 - 2.08. Flood Plain Management12
 - 2.09. Stormwater Management Plan12
- Section 3. Roadway Design Criteria..... 13
 - 3.01. General.....13
 - 3.02. Roadway Classifications13
 - 3.03. Geometric Street Design Standards15
 - 3.04. Pavement Design Requirements20
 - 3.05. Grading and Layout Requirements.....25
 - 3.06. Traffic Control Devices26
 - 3.07. Sidewalks.....26
 - 3.08. Driveways27
 - 3.09. Geotech27
 - 3.10. Bridges.....28
- Section 4. Traffic Design Criteria 29
 - 4.01. Traffic Impact Analysis (TIA).....29
- Section 5. Road Construction Specifications 35
 - 5.01. Clearing and Grubbing.....35
 - 5.02. Backfilling35
 - 5.03. Disposal of Waste Material35
 - 5.04. Grading.....35
 - 5.05. Subgrade35
 - 5.06. Width.....36
 - 5.07. Stabilization36
 - 5.08. Base36
 - 5.09. Acceptable Base Material.....36
 - 5.10. Compacted Depth36
 - 5.11. Forms.....36
 - 5.12. Prime Coat.....36
 - 5.13. Acceptable Types of Surface Pavement36



List of Tables

Table 3.1 Minimum Geometric Street Design Standards.....15
Table 3.2 Design Speed15
Table 3.3 Maximum Grades for Thoroughfares16
Table 3.4 Maximum Grades for Collectors.....16
Table 3.5 Summary of Minimum Design Traffic Requirements20
Table 3.6 Summary of General Pavement Thickness Design Parameters.....21
Table 3.7 Summary of Urban Street Pavement Thickness Requirements21
Table 3.8 Summary of Rural Street Pavement Thickness Requirements21



Section 1. General Requirements

1.01. General

- A. These Standards describe the general requirements for the preparation of construction plans and the supporting documents required for approval by Brazoria County (County). Specific design requirements, in addition to these standards, may be required by Brazoria County.
- B. Construction plans for public improvements within Brazoria County limits shall be approved by Brazoria County. If such improvements also are within a Municipal Utility District or a Drainage District, they shall be reviewed and approved by respective entity.
- C. Construction plans for private improvements within the Brazoria County that connect to or affect the public infrastructure shall be approved by Brazoria County.
- D. All projects that are required to conform to these Standards shall also comply with all applicable Brazoria County regulations.
- E. All construction plans and supporting documentation shall conform to the requirements of these Standards and regulations of all Federal, State, and entities having jurisdiction. It is the responsibility of the project engineer to use these standards professionally to produce a design product conforming to acceptable engineering practices.
- F. The Brazoria County Engineering Department shall review and maintain the Roadway Design Criteria Manual. Any recommended changes to the Roadway Design Criteria Manual shall be approved or disapproved by the Brazoria County Engineering Department.
- G. The Brazoria County Engineering Department shall develop and maintain Standard Construction Details. These Standard Construction Details shall be maintained and updated periodically by the Brazoria County Engineering Department. These documents are available in the Brazoria County Engineering Department and are available for review upon request.

1.02. Predevelopment Research

- A. Personnel from Brazoria County Engineering Department will be available for predevelopment meetings to discuss a proposed project with the project engineer and/or developer. This predevelopment meeting between the Brazoria County and the engineer/developer should be scheduled with the Brazoria County Engineering Department staff before submittal of any documents for review.
- B. Research of all existing utility and right-of-way information with Brazoria County, State, and other public and private utility agencies shall be completed and documented prior to submittal of any plans to Brazoria County.



1.03. Fees

- A. Before beginning construction on a project, all applicable fees shall be paid to Brazoria County.

1.04. Design Review Requirements

- A. Submit two (2) physical copies and electronic copies of construction plans and supporting documentation to the Brazoria County Engineering Department for review.
- B. Based on the trip estimates for the proposed development by the design engineer, a Traffic Impact Analysis may be required to determine necessary traffic mitigation measures to maintain the required level of service as dictated by Brazoria County regulations and requirements. Refer to Section 4 for further requirements.
- C. Final Drainage plan must be approved and signed by the Drainage District which has jurisdiction prior to submitting to Brazoria County for final approval. If not in a drainage district, Brazoria County Engineering Department will review in accordance with the Brazoria County Drainage Design Criteria Manual.
- D. After all comments have been adequately addressed, submit an electronic copy of the revised and final construction plans and responses to comments, with redline plans to the Brazoria County Engineering Department for final approval.
- E. After final approval has been granted, an electronic copy of the plans will be stamped by the Brazoria County Engineering Department for approval.
- F. If a project is not being platted, then record all easements prior to final acceptance.
- G. As warranted by scope and type of design, plans should be submitted for review and approval by Texas Commission on Environmental Quality.
- H. As warranted by scope and type of design, plans should be in compliance with Texas Accessibility Standards (TAC) and American with Disabilities Act (ADA) regulations and criteria. Plans should be submitted to an approved firm for such reviews and approvals.

1.05. Construction Procedure Requirements

- A. Construction shall not begin until construction plans are approved by the Brazoria County Engineering Department and permits, bonds, licenses, etc. have been obtained, and if applicable, plat is approved by the Engineering Department, or the appropriate municipality
- B. Coordinate with the Brazoria County Engineering Department for the pre-construction meeting for the project. Department staff overseeing the construction must attend the pre-construction meeting, which shall be held at the Brazoria County Engineering Department or at the project site.



- C. Notify the Brazoria County Engineering Department 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 the Brazoria County Engineering Department staff or any designee as may be provided by Brazoria County.
- D. Notify the Brazoria County Engineering Department at least forty-eight (48) hours prior to any final inspection.
- E. Within thirty (30) days after completion of the project, the project engineer shall provide to the Brazoria County Engineering Department an electronic file copy (PDF format min. 400 dpi resolution), an AutoCAD Release 12 file (.dwg) or compatible .dxf file, and a GIS compatible file (see Section 2.02.II for more electronic file options and requirements). Project engineer shall coordinate with the Brazoria County Engineering Department on other project completion deliverables such as Maintenance Bond, Affidavit of Bills Paid, Engineer's Letter of Completion, applicable test results, etc.
- F. Record Drawings submitted by contractor to the project engineer for the preparation of official Record Drawings shall include verification (as applicable) of all manhole and junction box locations, line sizes and lengths, elevations and inverts, driveways, changes to roadway profile and geometrics, etc. the Project engineer shall modify plans accordingly and submit revised electronic plans as Record Drawings for approval.
- G. 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 Brazoria County Engineering Department. These delivery tickets shall be maintained for a maximum of one year from the completion of the project.
- H. Changes to approved plans shall be approved by the Brazoria County Engineering Department prior to construction. Any required changes during construction due to field conditions or errors shall be discussed with the Brazoria County Engineering Department for approval/coordination prior to making the change.
- I. Brazoria County Engineering Department shall be on the distribution list for all construction test results and reports.

1.06. Approval and Acceptance of Public Improvement Projects

- A. Public Improvement projects shall have final approval by the Brazoria County Engineering Department prior to placing the facilities in service.
- B. Final approval will be documented in writing by the Brazoria County Engineering Department.
- C. Public Improvement projects within Brazoria County will be subject to a minimum one (1) year maintenance period. An inspection prior to the end of the maintenance period shall be conducted by the Brazoria County Engineering Department and all other entities having jurisdiction. All facilities shall be operational and in good condition prior to final acceptance of a project in order to obtain the refund of the maintenance bond.



1.07. Approvals and Variances

- A. 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.
- B. Specific approval, as required by these Standards, will be requested by the Owner prior to or at the time of submittal of review plans for the project. In order to be valid, all specific approval items must be granted in writing by the Brazoria County Engineering Department.
- C. Construction work related to any specific approval item that has not been approved in writing should not begin until the Brazoria County Engineering Department has granted written approval. Any work that proceeds without specific approval will be subject to removal and replacement in accordance with these Standards.
- D. All projects that are required to conform to these Standards shall also comply with applicable Brazoria County requirements. Projects should be reviewed for compliance with, Subdivision, Floodplain, On-Site Sewage Facilities, Stormwater Management, and any other applicable requirements.



Section 2. Construction Plan and Miscellaneous Requirements

2.01. Required Plan Sheets

- A. Cover Sheet
- B. Approved Plat (latest version of the approved plat shall be included in the Record Drawings)
- C. Notes and Legend
- D. Overall plan Layouts for proposed improvements
- E. Permanent Street Signage Plan
- F. Drainage Area Map and Calculations
- G. Lot Grading Plan Showing Existing and Proposed Spot Elevations
- H. Plan and Profiles (including ROW limits, easements, owners, utilities, etc)
- I. Detention Pond Plan and Details, as Applicable
- J. Traffic Control Plans and Details, as Applicable
- K. Pavement Marking and Signage, as Applicable
- L. Storm Water Pollution Prevention Plans and Details
- M. Bore Logs, if applicable
- N. Survey Control Sheets
- O. Standard Brazoria County Construction Details

2.02. Drawing Requirements

- A. The seal, date, and signature of the engineer responsible for preparation of the plans is required on each sheet in compliance with the rules and regulations of the Texas State Board of Professional Engineers (TSBPE). The engineer may use TSBPE-accepted electronic seal, date, and signature.
- B. A benchmark elevation and description is required on each sheet along with flood plain information for the project. Date of datum adjustment for the benchmark shall be noted in plans. Benchmark should be tied to Brazoria County monuments with datum adjustment factor when applicable.
- C. 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.
- D. Stationing must run from left to right except for short streets or lines originating from major intersection where the full length can be shown on one sheet.



- E. A north arrow is required on all appropriate sheets and should be oriented either upward or to the right.
- F. Show all lot lines, property lines, rights-of-way lines, and easement lines. Provide grading elevation at each corner of lot.
- G. A cover sheet shall be required for all projects unless approved by the Brazoria County Engineering Department. All plan sheets should be listed by sheet number on the cover sheet. A vicinity map should always be included to show the project location. A Brazoria County signature block shall be provided. Cover sheet should include engineering firm's registrations number.
- H. 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.
- I. Plans prepared for Brazoria County shall be prepared using permanent ink, photographic or other approved process on paper. All plans shall be submitted physically as well as electronically.
- J. Do not place match lines in intersections.
- K. 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 in color.
- L. Show flow line elevations and direction of flow of all existing ditches and culverts.
- M. Show natural ground profiles along the centerline and each right-of-way or easement line except as required below. When there is a difference of less than 0.5 feet, one right-of-way profile is sufficient.
- N. Resolve all known conflicts of proposed utilities with existing utilities.
- O. Plans shall be standard twenty-two inch by thirty-four inch (22"x34"). All half-size plans shall be to exact half scale. All plans submittal shall be electronic (minimum 400 DPI to scale)
- P. Details of special structures not covered by approved standard drawings, such as stream and gully crossing, special manholes, etc., should be drawn to scale with the horizontal and vertical scales equal to each other.
- Q. 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 for designing adequate street crossings.
- R. Grades should be labeled for the top of curb except at railroad crossings. Centerline grades are acceptable only for paving without curbs and gutters.
- S. Curb return elevations and grades for turnouts shall be shown in the profile.
- T. Gutter elevations are required for vertical curves where a railroad track is being crossed.



- U. The surface elevation at the property line of all existing driveways should be shown in the profile.
- V. Station all esplanade noses affected by proposed construction, both existing and proposed.
- W. Station all points of curvature, points of tangency, and points of intersection in the plan view. Station all radius returns and grade change points of intersection in the profile with their respective elevations.
- X. The standard scales permitted for plans and profiles of paving and utility plans are as follow:
- Y. Thoroughfares or special intersections/situations:
 - 1. 1" = 2' Vertical; 1" = 20' Horizontal
- Z. Local Streets:
 - 1. 1" = 5' Vertical; 1" = 50' Horizontal or
 - 2. 1" = 4' Vertical; 1" = 40' Horizontal or
 - 3. 1" = 2' Vertical; 1" = 20' Horizontal
- AA. The scales described above are the minimum allowable. Larger scales may be required to show details of construction.
- BB. Deviations to these scales can only be allowed with the prior approval of the Brazoria County Engineering Department.
- CC. 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. 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').
- DD. Standard Brazoria County details, where applicable, shall be included.
- EE. Construction plans shall include a legend describing standard symbols that may not be described in the plans.
- FF. All property ownership and easement information will be shown in the construction plans with all proper information associated with it.
- GG. Ownership, easement, and right-of-way recording information shall be shown on construction plan sheets.
- HH. The Brazoria County Engineering Department shall be provided with a pdf (minimum 400 DPI) of final plans and eventually Record Plans on a CD.
- II. Coordinate points for project controls or various project points as deemed necessary by the engineer shall be based on Texas Coordinate System, South Central Zone, NAD 83. Coordinates shall be Surface.



2.03. Easements

- A. All easements and recording information, existing and proposed, shall be shown in the construction plans in accordance with Section 2.02.GG.
- B. Easements shall be dedicated for the specific intended use.
- C. Storm Sewer Easements - shall conform to the requirements within the Brazoria County Drainage Design Criteria Manual.

2.04. Utility Locations

- A. All utilities shall be underground with the exception of electric primary lines. The electric primary lines, defined as feeders or three phase lines, should be located around the subdivision perimeter whenever possible.
- B. Water Main Location:
 - 1. All water mains shall be located within a public right-of-way or within dedicated water main easements.
 - 2. Water mains shall not be located in combination easements without the approval of the Brazoria County Engineering Department.
- C. Sanitary Sewer Location:
 - 1. 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.
 - 2. Sanitary sewers shall not be located in side lot easements without the approval from the County Engineering Department.
 - 3. 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.
- D. Storm Sewers:
 - 1. Storm sewer shall be located in the public street right-of-way.
 - 2. 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. Approval from the Brazoria County Engineering Department for the use of side lot or back lot easements for storm sewers should be obtained prior to plan preparation.
 - 3. All completed storm sewers shall have all internal joints verified by CCTV camera per TxDOT Special Specification 7019. A copy of the footage will be submitted to the Brazoria County Engineering Department.
- E. Private facility locations (not including landscaping):



1. Installation of private facilities, including utilities, in public road rights-of-way and their adjoining easements shall be approved by the Brazoria County Engineering Department.
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 require approval from the Brazoria County Engineering Department and shall be located so as to not interfere with existing or proposed public facilities.
3. All facilities in the right-of-way shall be located at least two feet (2') behind the curb and all underground facilities in the right-of-way shall be located at least two and one-half feet (2.5') below the top of curb on a public street.
4. Private facilities shall be constructed in accordance with construction plans approved by the Brazoria County Engineering Department.
5. Landscaping within the public right-of-way or adjoining easements shall not affect public utilities or traffic visibility.

2.05. Utility Crossings

A. Road Crossings

1. Shall conform with current Brazoria County Utility Permit Requirements. (<https://www.brazoriacountytexas.gov/departments/engineering/permits>)
2. Open cut installations under existing roadways shall not be allowed.

B. Railroad and Pipeline Crossings:

1. 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 and/or easement.

C. Ditch and Stream Crossings:

1. Shall conform with current Brazoria County Utility Permit Requirements.

2.06. Trench Safety

1. Trench safety is required for all excavations greater than five feet (5') in depth. Adequate details for construction in accordance with current OSHA regulations will be required in all construction plans that are approved by Brazoria County.

2.07. Bench Marks

- A. A permanent bench mark shall be set in each subdivision section or at a spacing of one mile, whichever is greater. The benchmark shall have an elevation based on the North American Vertical Datum of 1988, 2001 adjustment.



- B. The bench mark elevation and location shall be certified by a registered public surveyor as a Texas Society of Professional Surveyors (TSPS) Standard and Specifications for Category 8, TSPS Third Order Vertical Control Survey.
- C. Accuracy of elevations for benchmarks shall be Texas Society of Professional Surveyors Category 8, Third Order.
- D. All bench mark locations shall be provided with ties to existing horizontal and vertical control monuments including coordinates using Texas State Plane Coordinate System, South Central Zone, NAD 83 for horizontal control and NAVD 1988 datum, 2001 adjustment for vertical control.
- E. Bench marks shall be constructed of a brass disc set in concrete as approved by the Brazoria County Engineering Department. 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) rebars.
- F. 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.

2.08. Flood Plain Management

- A. All development shall conform with the current Brazoria County Flood Plain Requirements.

2.09. Stormwater Management Plan

- A. All development projects irrespective of the size must develop Stormwater Pollution Prevention Plan.



Section 3. Roadway Design Criteria

3.01. General

- A. All construction plans containing proposed roadways, sidewalks, and driveways in a public right-of-way shall be reviewed by the Brazoria County Engineering Department for all improvements within the Brazoria County jurisdictional limits.
- B. All new urban streets installed within Brazoria County shall be concrete curb and gutter. All new rural streets installed within Brazoria County can be either concrete or asphalt with open ditch, but only allowed in subdivisions/developments if within a development that has an approved variance as a “rural” subdivision per the Brazoria County Subdivision Requirements.
- C. Street design shall conform to all applicable planning tools such as the Brazoria County Subdivision Requirements, latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD), Brazoria County Major Thoroughfare Plan. Other consideration for design shall include roadway function, capacity, levels of service, traffic safety, the AASHTO Policy on Geometric Design of Highways and Streets, Americans with Disabilities Act (ADA) regulations on accessibility design, pedestrian safety, and all utility locations including gas, cable and power lines. Any deviation using other materials or other design criteria requires prior approval by the Brazoria County Engineering Department.
- D. Design shall conform to the Brazoria County construction details.
- E. On a case-by-case basis the Brazoria County reserves the right to allow deviations from these design criteria. This design criteria is not intended to cover repairs to -existing streets or street extensions when such repair work or extensions are performed by Brazoria County in whole or in part.
- F. These are to be considered minimum guidelines, but the Brazoria County Engineering Department may require a Traffic Impact Analysis at no cost to the Brazoria County where the Brazoria County deems it is warranted.

3.02. Roadway Classifications

Standard	Local		Collector		Thoroughfare	
	Urban	Rural	Urban	Rural	Urban	Rural
Expected ADT	< 800	< 800	> 2500	> 2500	> 12,500	> 12,500
Pavement Type	Concrete	HMAC	Concrete	HMAC	Concrete	HMAC



Standard	Local		Collector		Thoroughfare	
	Urban	Rural	Urban	Rural	Urban	Rural
Right-of-Way (min. feet)	60	60	80	80	≥120	≥120
Lot Frontage to County Rd (min. feet)	80	80	80	80	80	80
Paved Width (feet)	28	20	40 or 48	40 or 48	76	76
Base Width (feet)	N/A	24	N/A	44 or 52	N/A	80
Subgrade Width (feet)	32	28	42 or 50	48 or 56	80	84
Number of Traffic Lanes	2	2	4 or 2 w/ median	4 or 2 w/ median	4 w/ median	4 w/ median
Lane Width (feet)	12 28 B-B	10	12 (4 lane), 12 (2 lane)	12 (4 lane), 12 (2 lane)	12	12
Shoulder Type	None	Earthen	Paved	Paved	Paved	Paved
Shoulder Width (feet)	0	5	5	5	5	5
Median Type	None	None	Raised	Raised or Turn Lane	Raised	Raised or Turn Lane
Median Width (feet)	0	0	0 or 16	0 or 16	18	18
Drainage Type	Storm Sewer	Open Ditch	Storm Sewer	Open Ditch	Storm Sewer	Open Ditch
Curb Type	4 x 12	None	6 x 6	None	6 x 6	None
Min. Access Spacing	N/A	N/A	100	100	200	200



Standard		Local		Collector		Thoroughfare	
		Urban	Rural	Urban	Rural	Urban	Rural
Setbacks (min. feet)		25	25	35	35	40	40

- A. Thoroughfares, 4 lanes, divided or undivided roadway: Usually constructed within a minimum 120 ft. wide right-of-way.
- B. Collector, 4 lanes, undivided roadway: Shall be used in multi-family, commercial or industrial areas as well as secondary streets. Usually constructed within a minimum 80 ft. wide right-of-way.
- C. Local, 2 lane, undivided roadway: Include internal and access streets that allow direct access to residential properties and similar traffic destinations and typically have low design speeds and low traffic volumes. Usually constructed within a minimum 60 ft. wide right-of-way.
- D. Roads within development must meet all standards listed above (including lot frontage) if they are to be considered for acceptance into the Brazoria County Road Maintenance System as a county road.

3.03. Geometric Street Design Standards

- A. Minimum geometric street design standards for number of lanes and right-of-way widths shall be as follows:

Table 3.1

	Thoroughfare	Collector	Local
Right-of-Way Width	120 feet	80 feet	60 feet
Max. Number of Lanes (one direction)	2	2	1

- B. The design speeds shall conform to the following design standards. The posted speed limit shall never exceed the design speed. The design speed should be a minimum of 5 mph greater than the posted speed limit.

Table 3.2

Urban and Rural	Design Speed (not posted)
Thoroughfare	40-60 mph
Collectors	30-50 mph
Local	25-35 mph



- C. The maximum grade allowed refers to the uphill or downhill slope of the street and shall conform to the following design standards:

Table 3.3

Thoroughfares							
	Design Speeds (mph)						
	30	35	40	45	50	55	60
Type of Terrain	Maximum Grades (%)						
Level	8	7	7	6	6	5	5

Table 3.4

Collectors									
	Design Speeds (mph)								
	20	25	30	35	40	45	50	55	60
Type of Terrain	Maximum Grades (%) ⁽¹⁾								
Level	9	9	9	9	9	8	7	7	6

(1) Short lengths of grade in urban areas, such as grades less than 500 ft in length, one-way downgrades, and grades on low-volume urban collectors may be up to 2% steeper than the grades shown above. Note: Sidewalks along these roadways shall not exceed ADA maximum grade requirements.

D. Local Roads

1. Grades for local residential streets should be as level as practical, consistent with the surrounding terrain. The gradient for local urban streets should be less than 15%. Where grades of 4% or steeper are necessary, the drainage design shall be the critical governing design parameter. On such grades special care should be taken to prevent erosion on slopes of roadside ditches and earthen/grass lined open drainage facilities. For streets in commercial and industrial areas, grades should be less than 5% and flatter grades are encouraged.
2. Vertical curves shall be designed when algebraic difference in grade exceeds 1%. Elevations shall be shown on the construction plans at a minimum of 10 foot horizontal intervals through vertical curves. The gradient for tangents to vertical curves at railroad crossings shall be a maximum of 3.5%. 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 roadway classification as found in Table 3.2.
3. Intersections and curves shall be evaluated for adequate sight stopping distances based on the design speed.
4. Minimum stopping sight distances shall conform to the following design standards:



- a. The driver's eye height shall be assumed to be 3.5 feet above the finished pavement.
 - b. The height of the object seen by the driver shall be assumed to be 2.0 feet.
 - c. A deceleration rate of 11.2 feet/s² shall be used.
 - d. A brake reaction time of 2.5 seconds shall be used.
 - e. Minimum sight stopping distances shall be adjusted by the Professional Engineer of Record, when there is a presence of vertical curves within the distance needed for stopping as recommended by AASHTO's *A Policy on Geometric Design of Highways and Streets* where applicable.
- E. Open space clips shall be established at all intersections. Unless larger clips are required at a particular intersection, a minimum 10-foot x 10-foot triangular open space corner clip for zoned residential areas, as measured from the projected property line, is required at the intersection of two streets. At intersection of collector streets or greater, minimum 25-foot x 25-foot open space corner clip or larger, as design requires, shall be provided. Such clips shall be part of the public right-of-way and may not be located on private property.
- F. Thoroughfares with a centerline radius of the right-of-way less than 2000 feet shall be designed in accordance with the guidelines for superelevation as specified in the AASHTO *A Policy on Geometric Design of Highways and Streets*. Signage and design speed shall be accounted for in all curved thoroughfares. The maximum rate of superelevation shall be 0.06 for urban conditions. Streets with a centerline radius of over 2,000 feet are not required to have superelevation.
- G. Collector and local streets horizontal curves may be designed without superelevation.
- H. Minimum Horizontal Curve Radii Lengths:
1. Thoroughfares: 2,000 feet.
 2. Collector Streets: 850 feet
 3. Local Streets: 450 feet.
- I. For radii less than above, designer must receive specific approval from the Brazoria County Engineering Department.
- J. For the purposes of these design standards, tangent length is defined as the distance between the point of tangency and the point of curvature of two adjacent curves along the centerline of the street right-of-way.
1. The minimum tangent length between reverse curves shall be 100 feet on thoroughfares and collector streets.
 2. The minimum tangent length between reverse curves shall be 50 feet on all local streets.
- K. Intersections



1. Curb radii, measured from the face of curb, shall be 35 feet minimum on Thoroughfares. The minimum curb radius shall be 25 feet on collector and local streets. Skewed intersections shall be designed with larger radius.
 2. Streets and traffic lanes should be aligned across an intersection. Except where existing conditions will not permit, all streets should intersect at a 90-degree angle. The maximum allowable skew across an intersection shall be 5 degrees for thoroughfares, and 10 degrees on all collector and local streets.
 3. When turnouts are provided at an existing street, the ultimate cross section is required to the end of the curb return. Pavement transition is required to reduce the pavement width to the existing cross section.
 4. Taper rates for adding or dropping a lane shall be at a minimum of straight-line tapers with a minimum of an 8:1 rate for design speeds up to 30 mph and 15:1 for design speeds up to 50 mph. For design speeds over 50 mph the Professional Engineer of Record shall submit a design providing adequate taper lengths appropriate for the corresponding design speed. The use of partial tangent tapers, symmetrical reverse curves, and asymmetrical reverse curves are encouraged and should be designed to fit the design speed of the design road but are not required.
 5. Right-of-Way corner clips are required for all Thoroughfares. Triangular corner clips shall be a minimum of 25-foot x 25-foot.
 6. Collector and local roadways shall have a 25 ft. radius for the right-of-way at all intersections.
- L. Minimum lane transition lengths shall meet or exceed requirements of the A Policy on Geometric Design of Highways and Streets.
- M. Pavement width transitions shall conform to the following design standards:
1. Minimum deceleration lengths for auxiliary turning lanes on grades of less than or equal to 3%, with an accompanying stop condition, for design speeds of 30, 40, 45, 50, 55 mph are 230, 330, 430, 550 and 680 feet respectively. These lengths exclude the taper lengths.
 2. Taper lengths should be calculated for roads with design speeds greater than or equal to 45 mph by using taper lengths (L) equal to 0.6 times the design speed (S) multiplied by the offset (W), $L=0.6SW$. For design speeds less than 45 mph, the taper length (L) equals the offset multiplied by the design speed(s) squared, then divided by 155, $L=WS^2/155$. The distance for tapers should be lengthened if the road is curved based on recommendations from the Professional Engineer of Record.
- N. Left Turn Lanes
1. Minimum storage bay length shall be 100' for collector streets and 150' for thoroughfares. Longer storage bay lengths may be required based on the results of a Traffic Impact Analysis.



2. Mid-block left turn lanes may be allowed if a Traffic Impact Analysis and the Brazoria County Engineering Department recommend their use in relation to a proposed development. Left turn lanes shall be provided at the intersection of public street rights-of-way.
 3. Minimum transition taper length with 500' Radius shall be 180' for Collector streets and 200' for thoroughfares.
 4. The Brazoria County Engineering Department reserves the right to require that a Traffic Impact Analysis be submitted for any proposed development.
 5. Left-turn lane width shall be a minimum of 12 ft.
- O. On Thoroughfares, esplanade openings may be spaced a minimum of 600 feet apart. Median openings shall conform to the following design standards:
1. For median openings including left turn lanes, the storage and taper lengths mentioned in these design criteria shall apply.
 2. The median opening at the intersection of two streets shall be at least the width of the minor right-of-way plus 10 feet. These median openings may be wider based on lane configurations or traffic volumes. In such cases sufficient traffic analysis and data should be presented along with design.
 3. Variations to these criteria may be granted on a case by case basis by the Brazoria County Engineering Department.
- P. Cul-de-sac Pavement
1. Residential minimum pavement radii for the cul-de-sac bulb as measured to the face of curb shall be 40 feet.
 2. Commercial and industrial minimum pavement radii for the cul-de-sac bulb as measured to the face of curb shall be 45 feet.
 3. Right-of-way radius shall be clear of permanent obstructions.
 4. Curb radii at the transition to the cul-de-sac shall have a typical radius of 25 feet in single family residential areas and 35 feet in all other areas as measured at the face of curb.
 5. The length of a cul-de-sac is defined as the distance from the centerline of the intersecting pavement to the center of the cul-de-sac bulb measured along the centerline of the street right-of-way. Maximum length of cul-de-sac local streets for residential subdivisions shall be 600 feet. Dead end collectors and dead-end thoroughfares shall not be allowed.
 6. The Brazoria County Engineering Department reserves the right to require shorter maximum lengths of commercial and industrial cul-de-sacs or dead-end streets where high traffic volumes are present.
- Q. The design of on street parking shall conform to the following design criteria:



1. All on-street parking shall be parallel parking only.
2. On-street parking spaces shall be striped with white paint.
3. The width of on-street parking spaces shall be a minimum of 8 feet in width as measured from the inside of the painted stripe to the face of curb when allowed or approved by special design and with study by the Brazoria County Engineering Department.

3.04. Pavement Design Requirements

A. All streets shall be constructed on a compacted or stabilized subgrade, and shall consist of a base layer and hot mix asphaltic concrete (HMAC) surface layer, and/or a Portland cement concrete (PCC) pavement, designed by an engineer. All streets and roads must meet minimum design requirements regarding subgrade, base and pavement; but additional subgrade, base and pavement may be required depending on the engineering design, environmental conditions, and specific criteria. All collectors, and thoroughfares shall be designed by an engineer using the AASHTO Guide for Design of Pavement Structures. This design procedure is available in hard copy from American Associates of State Highway and Transportation Officials and in automated form (DARWin® program) available from AASHTOWare. Although the pavement section for each street should be designed for its specific conditions and uses, the following tables summarize the minimum criteria to be used for the pavement thickness design process. Table 3.5 summarizes minimum traffic levels. Table 3.6 summarizes general pavement design criteria.

Table 3.5 Summary of Minimum Design Traffic Requirements

Traffic Parameter	Local	Collector	Thoroughfare
Min. Two-way Design ADT	800	2,500	12,500
Min. ADT Growth Rate, %/year	3	3.5	3.5
Min. Percent Heavy Trucks, %/day	2	3	3.5
18-kip ESAL Truck Factor-Rigid Pvt	0.46	0.58	0.66
18-kip ESAL Truck Factor-Flexible Pvt	0.4	0.53	0.62



Table 3.6 Summary of General Pavement Thickness Design Parameters

Design Parameter	Local	Collector	Thoroughfare
Initial Serviceability	4.2	4.2	4.2
Terminal Serviceability	1.5	2.5	3
Reliability Level	80	85	85

- B. The following tables (3.7 and 3.8) include parameters broken down into urban and rural. For the minimum thicknesses recommended in these tables, designs were performed with DARWin® assuming the subgrade strength, resilient modulus value, was 4,000 psi. The minimum PCC thickness of 6 inches is based on past experience. The minimum subgrade thickness is interpreted as moisture controlled compacted or stabilization determined for site-specific conditions.

Table 3.7 Summary of Urban Street Pavement Thickness Requirements

Design Parameter – Urban Conditions	Local	Collector	Thoroughfare
Min. PCC Thickness (in.)	8	8	10
Min. Subgrade Thickness (in.)	8	10	10

Table 3.8 Summary of Rural Street Pavement Thickness Requirements

Design Parameter – Rural Conditions	Local	Collector	Thoroughfare
Min HMAC Thickness (in.)	2.5	3.5	3.5
Min. Flexible Base Thickness (in.)	8	10	10
Min. Subgrade Thickness (in.)	8	10	10

- C. **Material Testing Requirements** - Construction materials and operations shall be under controlled testing and inspection by a recognized laboratory. A recognized laboratory means that the laboratory must be accredited by the American Association for Laboratory Accreditation (A2LA) in the field of construction materials testing. All laboratory personnel shall be NICET approved and certified, Level II minimum for soils and ACI approved and certified for concrete.



Upon completion of the work and prior to acceptance by the Brazoria County, the recognized laboratory shall submit to the Brazoria County Engineering Department a written certification sealed by an engineer, certifying that all construction materials and operations as specified above were under controlled testing and inspection by the laboratory and same complies with all specifications applicable to the project.

Testing of materials used for bedding and backfill of storm sewers as well as other utilities, when located underneath or within 1 foot of subgrade shall be conducted to ensure compliance with TxDOT requirements.

D. Testing Requirements for Flexible Base Pavement – Thickness of flexible base pavement shall conform to requirements provided in Table 3.8.

1. **Subgrade** - Densities shall be made on each 300 linear feet or less as conditions may require and 95% proctor density (ASTM 1557) shall be uniformly achieved.

In the event of rainwater standing on the subgrade after the densities are made, or other conditions beyond property owner and/or developer's control, additional densities as specified above will be required prior to progressing with the work.

In no case shall there be less than three (3) density tests made for each day's activity and there shall be a minimum of three (3) density tests made for each street, unless approved otherwise by the Brazoria County Engineering Department.

The contractor is required to have subgrade density test reports in his possession at the construction site at the time of placement of base material. Date of same shall be clearly marked.

Frequency of testing shall be every 500 LF per travel way, per course, unless otherwise directed by the Brazoria County Engineering Department.

Base Materials - Approved base material shall be spread and uniformly compacted to 95% modified proctor density (ASTM 1557) prior to commencing surfacing. Testing shall be done in accordance as set out above.

Frequency of testing shall be every 500 LF per travel way, per course, unless otherwise directed by the Brazoria County Engineering Department.

2. **Surfacing** - Surfacing shall be in accordance with Section 3.02 – Roadway Classification Table and Table 3.7. Testing requirements shall be in accordance with TxDOT Specification Item 340.
3. **Roadway** – Roadway sections shall conform to provisions contained in Tables 3.5, 3.6, 3.7, 3.8 and Section 3.02 – Roadway Classification Table.

All applicable portions contained herein shall be strictly followed without exception.

E. Testing Requirements for Concrete Pavement



1. **Subgrade** – Densities shall be made on each 300 linear feet or less as conditions may require. Preparation of the subgrade shall be in accordance with applicable Brazoria County Engineering Department specifications and TxDOT Specification Item No. 260 or 275. A minimum of 95% modified proctor density (ASTM 1557) shall be uniformly achieved. Gradation shall be 1¾ inches – 100%, 3/4 inches – 85%, No. 4-60%.

In the event of excessive rain water standing on the subgrade after densities are made and before concrete is placed on the prepared subgrade or other conditions beyond contractor's control, additional densities as specified above will be required prior to placement of the concrete.

In no case shall there be less than three (3) density tests made for each day's activity and there shall be a minimum of three (3) density tests made for each street, unless approved otherwise by the Brazoria County Engineering Department.

The contractor is required to have density test reports in his/her possession at the construction site prior to placement of concrete. Date of same shall be clearly marked.

2. **Concrete Test Requirements (General)** - The testing laboratory shall review the mix design for each project. Proportioning of concrete shall be in accordance with all applicable portions of the TxDOT Specification Item No. 360, "Concrete Pavement."

Unless otherwise permitted, the concrete mix design shall be proportioned to provide a slump of no more than 5" when tested. A slump test will be made for each new concrete load or when consistency of the mix changes, at the point of discharge.

The laboratory shall inspect and confirm batch design proportions at the plant site each day prior to placement of that day's concrete.

Pavement mix designs shall meet compressive strength requirements of 4000 psi at 28 days.

Traffic will not be allowed until 3,500 psi is achieved.

3. **Testing Requirements (Cylinders)** - A minimum of four (4) cylinders shall be made for each 750 square yards, or less, of pavement placed each day. Samples are to be taken and molded and cured in accordance with TxDOT standards. Any deviations from these requirements shall be recorded on the test report.



Test specimens in accordance with TxDOT standards are as follows: One (1) specimen shall be tested at seven (7) days and two (2) shall be tested at 28 days. The acceptance test results shall be the average of the strengths of the two (2) specimens tested at 28 days. If one (1) specimen in a test manifests evidence of improper sampling, handling, molding or testing, it shall be discarded and the strength of the remaining specimens shall be considered the test result. Should both specimens manifest evidence of any of the above defects, the entire test shall be discarded and cores from the area in question may be required by the Brazoria County Engineering Department in accordance with "Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" (ASTM C42). These cores and tests will be at the expense of the property owner and/or developer. If the average seven (7) day break and the 28 day breaks do not meet minimum requirements, even though evidence of improper procedures are not apparent, the Brazoria County Engineering Department may, again, require cores from the area in question in accordance with ASTM C42.

In the event low strength concrete is confirmed, pavement in the area in question will not be accepted.

4. **Concrete Test Requirements (Cores)** - After pavement has been in place for a minimum of 14 days, one (1) core shall be taken for each 1000 square yards of pavement, or portions thereof, except that not less than one (1) core shall be taken on each street. Cores shall be taken alternately in each one-half section of the pavement in order to obtain a representative sample for thickness. Location of cores shall be selected by the Brazoria County Engineering Department.

Pavement Thickness: Pavement thicknesses contained herein and in the Pavement Design Section are minimums. Therefore, there will not be any tolerance for pavement that is too thin, or less than plan requirements. However, in the event pavement thickness is less than plan requirements, the following shall apply:

The thickness of individual cores shall be determined in accordance with ASTM C174 by averaging no less than three (3) such measurements. Any core with thickness equal to or greater than 1/4 inch less than the thickness shown on the approved drawings shall be considered one of deficient thickness. Cores drilled for thickness measurements shall be a minimum of 4 inches in diameter and backfilled with in-kind material.

If a core is determined to be deficient in thickness, additional cores shall be taken at 10-foot intervals on either side of the deficient core to establish the length of the deficient section. The length of the deficient section shall be the distance between the nearest cores of satisfactory thickness, and the width shall be the entire width of the pavement. That pavement shall be removed and replaced with concrete that meets or exceeds requirements. This shall be done at the cost of the property owner and/or developer.

Defective Concrete: Any defective concrete discovered, after the forms have been removed, shall be removed immediately and replaced. If the surface of the concrete is bulged, uneven, shows excessive honeycombing, or form marks, which the developer's engineer and the Brazoria County Engineering Department determine cannot be repaired satisfactorily, the entire section shall be removed or renewed in a manner which is satisfactory to the Brazoria County Engineering Department.



Cores shall be broken at minimum 28 days in accordance with ASTM C42. A minimum compressive strength of 4,000 psi is required. In the event low strength concrete is confirmed, pavement represented by the sample will not be accepted.

Thickness shall conform to minimum requirements contained in Table 3.7. In the event minimum thickness is not attained, pavement will not be accepted.

If a core fails to meet minimum strength requirements, additional cores may be required by the Brazoria County Engineering Department and tested in accordance with the procedures outlined in ASTM C42.

5. **Testing Requirements (Structures)** - Bridges and box culvert testing shall be in accordance with TxDOT Specification Item No. 420 "Concrete Structures" and other TxDOT specifications, as they apply.

Copies of all test reports are to be submitted to the Brazoria County Engineering Department in an expeditious manner.

3.05. Grading and Layout Requirements

- A. Minimum gradient on any gutter shall be 0.30%.
- B. See the Brazoria County Drainage Design Criteria Manual for inlet spacing requirements.
- C. The maximum allowable slope for driveways shall be in accordance with the Brazoria County's Standard Construction Details.
- D. The algebraic sum of grades to an inlet at an intersection should not exceed 1%.
- E. All new residential, local streets, collector, and arterial streets poured with a curb and gutter arrangement shall have the standard 6 inch stand up type curb or approved equal. A standard 6-inch curb shall be used immediately adjacent to all storm sewer inlets; where necessary 4-inch rollover curbs shall be transitioned to a 6 inch curb at the inlet.
- F. The minimum grade line around a cul-de-sac shall be 0.70%.
- G. The amount of cross slope over the pavement section shall be 2% sloping away from the crown of road or centerline.
- H. When connecting to an existing curbed street, the gutter lines for the proposed and existing streets shall be matched.
- I. Proposed top of curb elevations should be designed to match the top of the curb at an existing street in cases where a proposed street is being connected to an existing street.
- J. Top of curb elevations shall be shown on the construction plans along with a detail of the type of curb used.



- K. Gutter line elevations for vertical curves shall be shown on the construction drawings in cases where a railroad track is being crossed. Where railroad crossings are not at right angles to the pavement, vertical curves should be calculated for each curb line and should be posted at 10-foot intervals of the centerline of the road on the construction drawings in both plan and profile view. The grade of the railroad track shall be matched with the centerline of the road at the intersection of the crossing.
- L. All Major and Minor Arterials shall be designed so that, at all valley locations, ponding water from the 100-year rainfall events does not exceed 3-inches of depth along the gutter line of inside curb. This condition is described as “one lane passable”.

3.06. Traffic Control Devices

- A. Standard Type III barricades shall be permanently installed by the developer at the end of all dead-end streets not terminating in a cul-de-sac, and at all turnouts. These barricades shall meet at least the minimum requirements of the TMUTCD. The erection of these Type III barricades shall not preclude the installation of other decorative fencing or landscaping behind the barricade for the purposes of maintaining private property, safety, aesthetics etc.
- B. Traffic signage locations, street signage locations, and pavement markings shall be shown on the paving overall layout in the construction drawings. The construction drawings should include pavement marking details where applicable.
- C. Pavement markings shall be shown on the final construction plans for a project. ReflectORIZED paint with supplemental reflectors, or approved equal, shall be used on all Major Arterials and on major collector streets. Turn lanes shall have proper pavement markings. All pavement markings shall conform to the latest edition of TMUTCD.
- D. A blue reflectORIZED raised pavement marker or button is required at all fire hydrants and shall be located 6 inches off the pavement centerline toward the fire hydrant.
- E. The developer shall install requisite traffic control devices when a signal is warranted by a traffic study.

3.07. Sidewalks

- A. If a developer chooses to install sidewalks within the public ROW, the sidewalks must meet Americans with Disabilities Act (ADA) and Texas Accessibility Standards (TAS) parameters. The developer is responsible for obtaining any and all agreements with the public utilities for the installation of sidewalks across applicable easements.
- B. Sidewalk wheelchair ramps shall be installed if the developer installs sidewalks at all intersections and 90-degree bends in the street and shall adhere to ADA design criteria.



- C. Sidewalk construction in an esplanade shall be at the esplanade noses only and shall conform to the following parameters: A transverse concrete sidewalk, 6 inches thick, shall be constructed in all esplanades as a pedestrian refuge area. All concrete sidewalks in esplanades shall be 6-10 feet wide as measured from the esplanade nose. Patterned concrete or brick stamp may be used. Any ramps associated with sidewalks in an esplanade shall conform to ADA design criteria.
- D. Specialty sidewalks such as brick sidewalks or other non-standard sidewalk material must receive special approval from the Brazoria County Engineering Department.
- E. Maintenance of the sidewalks will not be assumed by Brazoria County and must be the responsibility of the property owners

3.08. Driveways

- A. Driveways shall conform to Brazoria County Requirements for Driveway Permits.

3.09. Geotech

- A. On projects built by developers and accepted for maintenance by Brazoria County, a geotechnical report is required. This section should guide the boring spacing, depth, location, etc., of the geotechnical investigation.
- B. Storm Sewer Construction – Boring Depth and Frequency
 1. Trench depth plus 5 feet for trenches up to 10 feet deep.
 2. Trench depth plus 10 feet for trenches from 10 to 25 feet deep.
 3. One- and one-half times trench depth for trenches greater than 25 feet deep.
 4. Bore an additional 5 feet if the last planned sample is in water-bearing sand.
 5. Frequency shall be at a spacing not greater than 500 feet.
- C. Street Paving – Boring Depth and Frequency
 1. Boring depth shall be at least 10 feet below existing grade or the final grade elevation (if provided before the exploration commences), whichever is greater.
 2. Frequency shall be at a spacing not greater than 500 feet.
- D. Bridges and retaining walls – Boring Depth and Frequency
 1. Follow the most current TxDOT guidelines with the exception that the Texas Cone Penetrometer (TCP) testing and associated analysis will not be required.
 2. If there is existing pavement, borings are required where new and old pavement connect.
- E. Detention Ponds – Boring Depth and Frequency



1. Minimum two (2) borings
 2. One (1) boring per acre for the first five (5) acres; one additional boring for each additional five (5) acres.
 3. Minimum depth of 2.0 times the ultimate depth of channel or basin. If adjacent to an existing channel or basin, deeper depth will govern.
- F. All projects requiring a geotechnical study should include, as a separate task, a review of available existing fault maps and a field visit to identify any significant visual fault activity along the project alignment or at the specific project site that may have an impact on the design of the project.
- G. A boring location map and soil profile drawing(s) should be included in the geotechnical report. The boring location map should be on sheets no larger than 11" X 17" and can be constructed from a variety of sources such as Baca maps, ground surveys, and USGS Quad maps. The boring location map should clearly show landmarks such as cross streets, outfall channels, or any other permanent feature that can be used to describe the location.

3.10. Bridges

- A. Bridges should be designed per the TxDOT Bridge Design Guide.



Section 4. Traffic Design Criteria

4.01. Traffic Impact Analysis (TIA)

A. Purpose

1. Brazoria County requires a TIA be performed if it is determined that a proposed site development is expected to have an impact on operation of a Brazoria County or State roads within the Brazoria County limits. Such studies are necessary to define the possible magnitude of impact(s) of the proposed development on traffic operation of affected roads. The Brazoria County may require any and all public improvements, or a proportionate share, as recommended by the TIA be implemented to provide accommodation of the traffic generated by the proposed development. These guidelines detail the procedures to be utilized when conducting a TIA for a proposed site development. These guidelines have been developed to ensure that the TIA will include the necessary information in a format that allows the Brazoria County Engineering Department to review and make informed comments and decisions in a timely manner.
2. Before any work is performed on the TIA, it is required that the applicant meet with the Brazoria County Engineering Department to determine the scope of requirements for the TIA. Items to be agreed to include, but not limited to, study area and intersections, applicable standards and methodologies, ultimate analysis year, growth rate methodologies, nearby proposed developments to be accounted for, etc.

B. Determining the Need for a Traffic Impact Analysis

1. A Traffic Impact Analysis is conducted to enable the Brazoria County Engineering Department to identify the potential impacts of a proposed development and determine any roadway improvements necessary to provide an acceptable level of service. The TIA should be conducted during the initial stages of the site development review and approval process in order to adequately consider the impacts the development will have on the Brazoria County's transportation network.
2. Not all developments will have a significant enough impact to require a TIA. The use of engineering judgment is necessary in making this determination and consideration should be given not only to changes in projected traffic volumes but also safety and capacity deficiencies which could impact the highway system. At a minimum, a TIA shall be performed when any of the following conditions are satisfied:
 - a. The proposed development is expected to generate 1,000 or more vehicle trips per day (total inbound and outbound development traffic.)
 - b. The proposed development is expected to generate 50 or more vehicle trips during a peak hour of the adjacent roadway.
 - c. Development is 100 acres or larger. This acreage is inclusive of all rights-of-way, reserves, and easements.
 - d. Amendment to Brazoria County Thoroughfare Plan.



- e. When required by the Brazoria County Engineering Department.
3. In order to assist Brazoria County Engineering Department in determining whether a TIA should be performed, the applicant must fill out a Trip Generation Worksheet. This worksheet must be submitted with each plat and/or site plan for developments that do not have an approved TIA. This worksheet must be filled out using the latest edition of the Institute of Transportation Engineers Trip Generation Manual. If the development land use is not known at the time of the submittal then the applicant should make assumption based on the worst-case scenario for the site. Should this be the case, at a minimum, designer should evaluate the maximum amount of developable land, taking into account setbacks and other restrictions such as detention, easement, etc., logical assumptions by the designer, and adjacent land uses. If the proposed land use is not listed in the Trip Generation Manual, the Brazoria County Engineering Department will require a letter from a Texas registered professional engineer, in lieu of the trip generation worksheet, documenting the type of development proposed and identify the number of trips generated based on either a trip generation study performed for a similar land use or designer's professional opinion if such report is not available. This letter report must be signed and sealed by a registered professional engineer in the State of Texas.
- C. A Traffic Impact Analysis report shall include, at a minimum, the following information:
1. An executive summary,
 2. Study purpose and objectives,
 3. Description of the proposed development and study area,
 4. Existing conditions in the area of the development,
 5. Recorded or approved nearby development
 6. Trip generation and trip distribution,
 7. Projected future traffic volumes,
 8. An assessment of the change in roadway operating conditions resulting from the development traffic,
 9. 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.
 10. Exhibits to show all existing, proposed and future facilities on the site, all proposed traffic movements, and all existing, generated, future background and proposed traffic volumes within the existing and proposed street network
 11. Appendices to include detailed site plan, existing 24-hour directional counts, existing AM & PM peak hour turning movement counts, all Synchro (or similar software) report, traffic signal warrant analysis, and CD containing Synchro (or similar software) files, and any other pertinent information.



- D. Prior to preparation of a Traffic Impact Analysis report, the design engineer is to meet with the office of the Brazoria County Engineer to identify the study area, define the area of influence, and non-site traffic impacts.
- E. The analysis shall be presented in a straightforward and logical sequence. It shall lead the reader step-by-step through the various stages of the process and resulting conclusions and recommendations. The analysis shall be presented in a manner that allows the reviewer to easily duplicate the calculations. The 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 construction. The recommendations shall also specify the time period for any required monitoring of operating conditions. Data shall be presented in tables, graphs, maps, and diagrams wherever possible for clarity and ease of review.
- F. The Traffic Impact Analysis report shall conform with the following process of analysis:
1. **Preparer** – The report shall be prepared under the supervision of a qualified and experienced transportation engineer with specific training in traffic and transportation engineering and at least two (2) years of experience related to preparing Traffic Impact Analysis reports. A professional engineer, registered in the state of Texas, shall seal the report.
 2. **Study Area** - The study area shall be based on the characteristics of the surrounding area. The Brazoria County Engineering Department and the traffic engineer preparing the study shall mutually agree upon the intersections.
 3. **Design Year** – The traffic forecasts shall be prepared for the anticipated opening year of the development, assuming full build-out and occupancy. This year is referred to as the “Design Year”. If development is phased, provide forecast for each phase of the development.
 4. **Trip Generation Rates** – The Traffic Impact Analysis report shall include a table showing the categories and quantities of land uses, with the corresponding trip generation rates or equations, and resulting number of trips. The trip generation rates used must be either from the latest edition of “Trip Generation Manual” (Institute of Transportation Engineers (ITE), Washington, D.C.) or from a local study of corresponding land uses and quantities and approved by the Brazoria County Engineering Department. All sources must be referenced in the study and calculations must be documented and included in the study report.
 5. **Pass-by and/or Shared Trips** – If pass-by or shared trips are a major consideration for the land use in question, studies and interviews at similar land uses must be conducted or referenced. Any significant difference between the sums of single-use rates and proposed mixed-use estimates must be justified in the report. Pass-by trips and/or shared trips shall be shown separately and clearly in diagram form at each driveway and intersection affected. Designer to follow ITE Trip Generation Handbook or regional Metropolitan Planning Organization studies from similar land uses.



6. **Non-Site Traffic Estimates** – Estimates of non-site traffic shall be made and will consist of through traffic and traffic generated by all other developments within the study area for which preliminary estimated or final plans have been approved. Non-site traffic may be estimated using trends or growth rates, approved by the Brazoria County Engineering Department.
 7. **Estimates of Trip Distribution** – Trip distribution shall be estimated for the site design year and shown separately and clearly using diagrams. A multi-use development may require more than one distribution and coinciding assignments for each phase. Consideration must also be given to whether inbound and outbound trips will have similar distributions.
 8. **Trip Assignments** – Assignments must be made considering logical routings, available roadways capacities, left turns at critical intersections, and projected (and perceived) minimum travel times. In addition, multiple paths should often be assigned between origins and destinations to achieve realistic estimates rather than assigning all of the trips to the route with the shortest travel time. The assignments must be carried through the external site access points and in large projects through the internal roadways. When the site has more than one access driveway, logical routing and possibly multiple paths should be used to obtain realistic driveway volumes. The assignment should reflect conditions for the time period being analyzed.
- G. If a thorough analysis is required to account for pass-by trips, the following procedure should be used:
1. Determine the percentage of pass-by trips in the total trips generated.
 2. Estimate a trip distribution for the pass-by trips.
 3. Perform two separate trip assignments, based on the new and pass-by trip distributions, and
 4. Continue the pass-by and new trip assignments.
- H. Upon completion of the initial site traffic assignment, the results should be reviewed to see if the volumes appear logical given characteristics of the road system and trip distribution. Adjustments should be made if the initial results do not appear to be logical or reasonable.
- I. **Total Traffic Impacts** – Traffic estimates for any site with current traffic activity must reflect not only new traffic associated with the site's development, but also the trips subtracted from the traffic stream because of the removal of an existing land use. The traffic impact report should clearly depict the total traffic estimate and each of its components.
- J. **Capacity Analysis** – Capacity analysis must be performed at each of the major streets and project site access intersection locations, signalized and unsignalized, within the study area. Signalized intersections in coordinated systems must be analyzed as a system. In addition, analysis must be completed for roadway segments, deemed sensitive to site traffic within the study area. These may include such segments as weaving section, ramps, internal site roadways, parking facility access points, and reservoirs for vehicles queuing off-site and on-site. Other locations may be deemed appropriate depending on the situation.



- K. The operational analysis and methodology in the latest edition of the “Highway Capacity Manual, Special Report 209” (Transportation Research Board, National Research Council, Washington, D.C.) should be used for analyzing existing conditions, traffic impacts, access requirements, or other future conditions for which traffic, geometric and control parameters can be established.
- L. **Internal Site Review** – A review of the site shall be made and must include traffic circulation, pedestrian accommodations, vehicle storage requirements and any other traffic concerns.
- M. **Required Levels of Service** – The recommendations of the traffic impact shall provide safe and efficient movement of traffic to and from and within and past the proposed development, while minimizing the impact to non-site trips. The current levels of service must:
1. Be maintained if they are “C” or less, and
 2. Not deteriorate to worse than “C” if they are currently “A” or “B”.
- N. **Intersection Geometry** – Analysis shall include a thorough evaluation of intersection geometry at affected driveways and intersections to determine the need for and required length of turn lanes.
- O. **Pedestrians and Bicycles** - As warranted, TIA must consider and provide adequate and safe facilities for pedestrians, bicyclists, and those with disabilities, to ensure that internal circulation system and external access points designed to minimize conflicts with vehicular traffic. Pedestrian circulation should be comprehensive and provide connections between buildings, and from all streets, and signals into the site.
- P. **Schools** – For sites where schools are proposed, site specific analysis of school site plan must be performed as part of the TIA to consider and provide a safe route to school plan, crossing locations, necessary traffic control, traffic calming devices if necessary, driveway locations, pedestrian and bicycle circulation, on-site drop off/pick-up area with adequate queuing to avoid back-ups onto public streets, and bus circulation.
- Q. **Speed Zone** - If TIA recommends designation of a school zone, a Speed Zone study and report must be performed to define the required speeds and the installation of appropriate signage. This report must be signed and sealed by a registered professional engineer in the State of Texas.
- R. **Traffic Signal Warrant Analysis** – Traffic signal warrant analyses must be performed based on the procedure outlined in the latest edition of the TMUTCD.
- S. **Roundabouts** - If a roundabout and/or other traffic calming features are proposed as part of the development, the TIA must present justifications for such installation. Design of roundabout must be in accordance with requirements of this Design Criteria Manual and the latest edition of AASHTO’s “A Policy on Geometric Design of Highways and Streets”.



- T. **Service and Delivery Vehicles** - As warranted, TIA must consider and provide adequate facilities and circulation for the movement of service and delivery vehicles to and from the site. Of particular interest is that adequate turning paths are provided for large service vehicles to allow entry and exit without encroaching upon opposing lanes or curbed areas. In addition, sufficient storage areas and loading zones must be provided to avoid parking and circulation routes issues for other vehicles.
- U. **Responsibility for Improvements** – The report shall include a list of required improvements, the anticipated date the improvement will be required, and a cost estimate for each recommended improvement. The applicant shall be responsible for the improvements required to provide safe and convenient ingress and egress to the development site.
- V. **Report Approval** – Approval of a specific development is contingent upon approval of the traffic impact analysis and agreement by the Brazoria County Engineering Department on required improvements.



Section 5. Road Construction Specifications

The following shall be the minimum specifications for the preparations and construction of streets dedicated to the public. All work, methods, materials and equipment, not covered by these Subdivision Regulations, shall conform to the most current issue of "Standard Specifications and Construction of Highways, Streets and Bridges" of TxDOT.

Thoroughfares shall be built in accordance with the requirements herein and set out by the Thoroughfare Plan as adopted by the Court.

5.01. Clearing and Grubbing

- A. New road construction must be cleared and grubbed which shall consist of the removal and disposal of trees, stumps, brush, roots, vegetation, logs, rubbish and other objectionable matter.

5.02. Backfilling

- A. Excavations and depressions must be properly backfilled and compacted in accordance with good engineering practice or as recommended by the geotechnical report. Backfill, compact, and restore areas where obstructions have been removed, unless otherwise directed. Use approved material for backfilling.
- B. All excess water and mud should be removed from the trench prior to backfilling. Any backfill placed during a rainy period or at other times, where excess water cannot be prevented from entering the trench, will be considered temporary and should be removed as soon as weather permits. All disturbed base material or base undermined should be removed.
- C. Whenever caving occurs in the sidewalls of any excavation, the pavements above such caving should be cut away prior to backfill and restoration. No side or lateral tamping to fill voids under a pavement will be allowed.

5.03. Disposal of Waste Material

- A. Muck and peat shall be completely removed within the area between points 5 feet outside the edges of the pavement and spread uniformly 2 inches loose, on shoulders and front slopes, or disposed of by the property owner and/or developer.

5.04. Grading

- A. The fill section shall be constructed in 8-inch maximum lifts to provide 95% density.

5.05. Subgrade

- A. See Section 3.02.

**5.06. Width**

- A. See Section 3.02.

5.07. Stabilization

- A. Per TxDOT Specification No. 260 – Lime Treatment, No. 265 – Fly Ash or Lime-Fly Ash Treatment, or No. 275 – Cement Treatment;
- B. Mix Design in accordance with Tex-127E; and
- C. Requires density controlled compaction (95% optimum density).

5.08. Base

- A. Per TxDOT Specification Item No. 247- Flexible Base.

5.09. Acceptable Base Material

- A. Per TxDOT Specification No. 247 – Flexible Base;
- B. Use Grade 1 or Grade 2 Aggregate; and
- C. Allowable Aggregate Material Types: B, C, D (including crushed concrete).

5.10. Compacted Depth

- A. Per Tables 3.7 and 3.8 in Section 3.04.B.

5.11. Forms

- A. No form board will be required unless, in the opinion of the Brazoria County Engineering Department, the developer is not taking precautions to obtain the full depth at the edges.

5.12. Prime Coat

- A. Shall meet the TxDOT Specification Item No. 310 – Prime Coat. Application rate and application temperature will be selected by the developer’s engineer.

5.13. Acceptable Types of Surface Pavement

- A. Bituminous Surface
- B. Asphaltic Concrete
 - 1. Hot mix, hot laid, 2.5 inches thick minimum. Type B for base and Type D for surface. Shall meet the TxDOT Specification Item No. 340 – Dense-Graded Hot-Mix Asphalt. Pavement shall be designed by an engineer, using the AASHTO Guide for Design of Pavement Structures.



- C. Portland Cement Concrete
 - 1. Per TxDOT Specification Item No. 360 – Concrete Pavement – Class P Concrete. Pavement shall be designed by an engineer using the AASHTO Guide for Design of Pavement Structures.
 - 2. All reinforcing steel shall conform to TxDOT Specification Item No. 440, Reinforcing Steel; and
 - 3. Minimum average 3,200 psi seven-day compressive strength. Minimum average 4,000 psi 28-day compressive strength. Use seven (7)-day job control by compressive strength.
- D. Local Streets
 - 1. All concrete is to be a minimum of 6 inches uniform thickness in rural subdivisions and 8 inches uniform thickness in urban subdivisions, Portland cement reinforced with No. 4 (one-half inch) steel reinforcing and is to be spaced 18 inches center-to-center each way.
- E. Collector Streets
 - 1. All concrete is to be a minimum of 8 inches uniform thickness, Portland cement, reinforced with No. 4 (one-half inch) steel reinforcing and is to be spaced 18 inches center-to-center each way.
- F. Thoroughfares
 - 1. All concrete is to be 10 inches uniform thickness, Portland cement. Reinforcement shall be supported by design analysis.
- G. The property owner and/or developer's engineer/land surveyor will have his survey party establish blue tops and tack points on offsets at intervals not exceeding 50 feet on tangents and 25 feet on all vertical and horizontal curves to which the pavement is to be laid, set radius points, and will be required to check the subgrade, form lines and grade immediately prior to the pour, in order to attain both a true line, a uniform thickness and a smooth riding surface. No concrete shall be laid at any time unless the Brazoria County Engineering Department is notified 24 hours in advance. Expansion joints with standard load transmission device, or equal, are to be placed a maximum of 60 feet center-to-center. All joints are to be poured with an asphaltic compound as quickly as possible after the concrete has been laid.
- H. Testing shall be conducted per the testing requirements specified in Section 3.04.
- I. All other paving construction details shall conform to "Road Pavement Standard Drawings".
- J. Weakened plane (or dummy) joints shall be sawed transversely, 1 inch deep, every 20 feet, ie: two (2) joints per each 60-foot slab.