



TxDOT Houston District Traffic Study Guidelines

Purpose

The Houston District may require a Traffic Study to determine if any proposed improvements are necessary to the transportation system to achieve traffic operations and safety level of service, while providing sufficient access to developments, and minimize operational impacts to the adjacent roadway network.

This document serves as guidance for completing a Traffic Study for permitting in the Texas Department of Transportation (TxDOT) Houston District.

This document is only a guide and TxDOT Houston District reserves the right to require any additional information and analysis needed to determine proposed improvements for safe and efficient operations.

Will I Need a Traffic Study?

Applicants will be required to submit a TxDOT Houston District Traffic Study Checklist (Checklist) for all proposed developments (new/change in land use). Upon submittal of a Checklist, TxDOT Traffic Engineering (TE) Section will review and advise applicant/representative based on the general criteria provided below. However, the TxDOT TE Section reserves the right to require a Traffic Study for any proposed development depending on location or anticipated impact.

- Exempt from Study:
 - A proposed development that generates fewer than 50 trips in the highest peak hour.
 - A proposed development that generates fewer than 150 trips in the highest peak hour in rural areas where the ADT is less than 10,000 vpd and/or the population is less than 10,000.
- Minor Traffic Study Required (Technical Memorandum):
 - Proposed developments that generate between 50-150 trips in the highest peak hour and less than 1,000-1,500 trips per day.
- Major Traffic Study Required (Formal Report):
 - Proposed developments that generate 150 or more trips in the highest peak hour and/or 1,500 or more trips per day.

General Requirements and Notes

Traffic Study shall be signed and sealed by a Professional Engineer (PE) licensed to practice in the State of Texas and shall include Engineer's Firm registration number per the Texas Board of Professional Engineers & Land Surveyors (TBPELS) rules.

Traffic data collected within the previous 12 months is acceptable. In rural areas where the ADT is less than 10,000 vpd and/or the population is less than 10,000, data collected within the previous



24 months is acceptable. However, TxDOT TE Section reserves the right to require new traffic data depending on location or anticipated impact

Traffic Study approvals are good for 12 months with the exception of Phased Developments which may require a Revised Traffic Study.

A Revised Traffic Study for a Phased Development(s) will replace the initial Traffic Study and void any previous Traffic Study approvals.

A Traffic Study approval older than 12 months may be acceptable for use in the permitting process subject to acceptance by the TxDOT TE Section. The Traffic Study may require new traffic counts, supplemented by a Technical Memorandum at the discretion of TxDOT TE Section.

A scope meeting may be required for 1) Major Traffic Study for Phased Development, 2) Major Traffic Study where the Proposed Development is part of a larger planned development, or 3) Applicant has requested a deviation from these Traffic Study guidelines. The applicant/representative shall initiate this meeting through the TxDOT Area Office to request a teleconference/virtual meeting.

Traffic Study Area Requirements

The applicant/representative should develop the study area based on the following criteria:

- All proposed development access connections (including existing and shared access),
- All freeway ramps within 1,000 feet of the proposed development,
- All intersections adjacent to the proposed development, and
- All major roadways and signalized intersections based on the following:
 - Minor Traffic Study - within 1,320 feet (1/4 mile) of any proposed development property line.
 - Major Traffic Study - within 5,280 feet (1 mile) of any proposed development property line.

Existing Conditions

Provide proposed development location and provide a vicinity map.

Document surrounding area land uses (including square footage, acreage, dwelling units, etc.) and major landmarks in the vicinity of the proposed development.

Document existing access to the development site including surrounding roadways (TxDOT or non-TxDOT facilities), especially major thoroughfares and collectors, for potential access.

Document existing roadway configuration and geometry, traffic control devices, and posted speed limits.

Identify all modes of transportation in the study area including transit/rail, bikeways, and pedestrian facilities.



Traffic Data

The traffic counts must be collected during typical traffic conditions (Tuesday through Thursday) for the AM and/or PM peak hour(s) during the school year with good weather and no incidents.

Weekend traffic counts are ideal for land uses that generate high weekend traffic, such as, flea markets, supermarkets, and churches. Weekend counts will be at the request of TxDOT TE Section.

Peak period turning movement counts should be collected in 15-minute increments from 6 AM-9 AM and 4 PM-7 PM during the school year with good weather and no incidents. For additional times contact TxDOT TE Section for approval.

All-way stop and traffic signal warrant studies for existing conditions should include turning movement counts for 13 hours (typically 6 AM to 7 PM). Conducting warrants for all-way stop and traffic signals in each future phase, full build-out or horizon year may require engineering judgement.

Determine and report the times of a study peak hour and calculate peak hour factors for each study intersection. Use calculated peak hour factors in Level-of-Service (LOS) analysis.

Traffic Study should be conducted in relation to the adjacent roadway(s) peak hour to evaluate the adjacent roadway(s) impact with the proposed development unless otherwise discussed and approved by TE Section.

A default peak hour factor of 0.92 may be used for new driveways in urban areas. For rural areas, applicant/representative should analyze and use the peak hour factor appropriate for the roadway facility/area.

The actual heavy vehicle percentage will need to be calculated and used in the LOS analysis.

Some developments, including large churches, schools, industrial plants with shift workers, and other development with unique traffic flow may require non-standard peak hour analyses. Traffic Study scoping meetings for these types of developments are highly recommended.

For traffic count data collected when schools are not in session (if approved), an adjustment factor will need to be determined for the area with a comparison to historical data along the roadway segment or in the vicinity of the site. (Document adjustment factor and methodology on the Traffic Study Checklist)

For intersections near schools where a PHF cannot be determined from adjusted counts, use minimum of both 0.60 for AM peak hour and 0.30 for School PM peak hours in LOS analysis.

Apply engineering judgement for intersections impacted by school traffic, but still influenced by normal traffic flows over the study peak hour.

Growth Rate

Utilize a growth rate calculated from the historical traffic data in the study area to project (from existing) future background traffic for each phase, full build-out, and 5-year horizon. A minimum of the five (5) most recent years should be used to calculate the average growth rate of traffic in the study area, unless otherwise approved by the TE Section.

The minimum growth rate acceptable is 1 percent. All annual growth rates applied to the Traffic Study should be discussed with TE Section and justified with data from the [Statewide Planning Map](#)



or other data sources. For long term developments (beyond 5 years), traffic demand model growth rates should be obtained from [HGAC](#) data sources and utilized.

Trip Generation Analysis

Site Trip Generation shall be based on the trip generation rates and recommended method contained in the Institute of Transportation Engineers (ITE) [Trip Generation Manual](#) (latest edition).

Provide trip generation data in tabular format for the site average daily traffic (ADT) and the AM and PM peak hour traffic.

Justification shall be provided for pass-by trips reduction greater than 25% and internal capture reduction greater than 10%. Provide documentation and reasoning for values used outside the ITE Trip Generation Manual. The use of pass-by trip reduction and internal capture reduction shall be clearly presented and explained in the Traffic Study.

Proposed Development

Briefly describe the proposed development's features such as lot size, building area, and proposed access points.

Describe access driveway(s) compliance with [TxDOT Access Management Manual \(AMM\)](#) access connection spacing criteria and [TxDOT Roadway Design Manual \(RDM\)](#) for desirable spacing between entrance/exit ramps and access connections.

Allowable access connection spacing distance is based on the posted speed limit of the adjacent roadway. These distances may be increased for specific circumstances of the site grades (primarily for downgrades) and truck traffic. If access connection spacings are not compliant, adjust site plan accordingly and/or discuss potential implementation of alternative mitigation measures.

City/County Street tie-in will require the need for a sponsor letter from the local agency.

Document pedestrian and bicycle facilities access.

Projected Traffic Requirements

Project traffic data and include the proposed development (trip generation analysis), other known proposed developments, and planned transportation improvements when/where applicable.

Present results in tabular and/or graphic format for the following scenarios:

1. Minor/Major Traffic Study
 - a. Background Traffic (each phase and full build-out),



- b. Site-Generated Trips,
 - c. Pass-By/Internal Capture Reduction (if applicable),
 - d. Net Generated Trips (each phase and full build-out),
 - e. Background Traffic plus Net Generated Trips (each phase and full build-out),
2. Major Traffic Study Only
- a. Five-Year Horizon Background Traffic (not required for Minor Traffic Studies); and
 - b. Five-Year Horizon Background Traffic plus Net Generated Trips (not required for Minor Traffic Studies).

Auxiliary Lane Analysis

Provide an analysis of the need for deceleration and acceleration lanes as required by the [TxDOT Access Management Manual \(AMM\)](#). Refer to the RDM, Chapter 3, for auxiliary lanes geometry and associated transition and storage requirements.

If “full length” auxiliary lanes cannot be provided that meet all [TxDOT Roadway Design Manual \(RDM\)](#) criteria, but otherwise auxiliary lanes are necessary/warranted, then shorter length auxiliary lanes with reduced tapers should be recommended.

Turning path analysis

For Proposed Developments generating higher volumes of heavy vehicles or buses, utilize [AASHTO Green Book](#) minimum turning paths and ensure that the largest design vehicle expected to regularly access the site will do so without encroaching upon curbs or traveling off the pavement at each proposed access connection.

Turning path analyses may also be applicable at off-site intersections to be modified as part of the permitting process.

HCM Intersection LOS Analysis

The latest edition of the [Highway Capacity Manual \(HCM\)](#) is recommended for LOS analysis. Capacity analysis shall be completed for the existing conditions, background traffic, each phase of the proposed development, full build-out, and the five-year horizon scenarios.

Additionally, if the result of the capacity analysis suggests the need for mitigation measures, an iterative analysis should be performed to demonstrate the recommended mitigation has improved the LOS for that phase, full build-out and/or the five-year horizon.



For TxDOT facilities, an overall intersection LOS of D will be the minimum accepted with or without mitigation.

If the existing conditions or background traffic conditions capacity analysis results indicate a LOS of E (without proposed development), the projected LOS should not fall to LOS F.

If the existing conditions or background traffic conditions capacity analysis results indicate a LOS of F (without proposed development), the projected average vehicle delay should be evaluated to determine feasible improvements to reduce the delay.

Before approval of projected LOS E or F conditions with proposed development, mitigation action may be required. Compare LOS between existing, background traffic (without development), background plus net generated trips (with development), and five-year horizon background plus net generated trips scenarios.

It is preferred to contact the TxDOT Signal Timing Section if existing signalized intersections are within the study area to obtain existing timing sheets for use in the analysis.

All capacity analysis LOS/delay values reported shall be generated using the HCM method rather than those determined by traffic engineering software.

Sight Distance Analysis

Conduct a stopping sight distance (SSD) and Intersection Sight Distance (ISD) analysis at proposed development access connections to/from TxDOT roadways where applicable based on engineering judgement.

If ISD analysis is required, the following scenarios should be examined in accordance with the latest AASHTO Policy on Geometric Design of Highways and Streets ([AASHTO Green Book](#)): 1) Left turn from the minor road (Case B1), 2) Right turn from the minor road (Case B2), and 3) Left turn from the major road (Case F).

Traffic Signal Warrant Analysis

Traffic signal warrants shall follow criteria and thresholds per the latest [TMUTCD](#) (Chapter 4).

Traffic signal warrant should be completed by utilizing the latest version of the [TxDOT Form TFF-TSCA](#) and included as an appendix of the Traffic Study.

If the existing traffic volume and/or the projected traffic volumes reported in a Traffic Study indicates that a particular location may warrant signalization, the applicant shall include a traffic signal warrant analysis for the location.

Traffic signal warrant analysis shall include existing and/or projected traffic volumes, pedestrian characteristics, and physical characteristics of the proposed intersection to determine if installation of a traffic control signal is justified at the location.

The Traffic Study shall state when the traffic signal(s) is to be operational. For example, the traffic signal may include a flasher to be constructed in the interim, with a future conversion to a fully



actuated traffic signal.

Proposed Mitigation Measures

The Traffic Study shall provide mitigation measures to address unacceptable LOS as determined during capacity analysis efforts.

The Traffic Study shall clearly indicate who is responsible for the design, construction/implementation, and financial responsibility of each recommended mitigation measure. Additionally, the Traffic Study should state when each recommended mitigation measures should be operational and/or implemented.

Proposed Mitigation Measures (Phased Developments)

For multi-phase developments, all improvements and mitigations measures should be discussed with TE Section to determine installation timelines.

TxDOT's preference is to have all improvements and mitigation measures installed at the earliest phase possible. All improvements will be required to be constructed by the beginning of the phase in which the improvement is found to be required or warranted.

Example: A traffic signal is warranted in phase four (4) of the Traffic Study. The applicant/representative should arrange to install interim measure such as flashers on mast arms in phase two (2) to be converted to fully actuated signal in phase four (4).

When providing Traffic Study approval, TxDOT assumes that existing conditions which may impact the safety and mobility of the adjacent highway facility including property use, traffic patterns, roadway operations, and adjoining property access connections do not substantially change prior to your next submission. Improvements that are warranted later than 5 years will require a future analysis to evaluate the improvements are adequate unless otherwise directed by TxDOT.

Proposed Mitigation Review

Proposed mitigation measures shall be reviewed by the TxDOT TE Section after the capacity (LOS analysis) is complete but before final approval. Revisions to the Traffic Study may be required.

All proposed mitigation measures including traffic signal warrants, deceleration/acceleration lanes, all-way stop warrants, and stopping sight distance/intersection sight distance analysis shall be conducted in accordance with the [TxDOT RDM](#), [TxDOT AMM](#), [AASHTO Green Book](#), and [TMUTCD](#).



Suggested Minor Traffic Study Format (Technical Memorandum)

Minor Traffic Studies are intended to be submitted in a brief technical memorandum format (typically 2-5 pages of text not including the Appendix). A table of contents and executive summary is not required. Appendices can be of any length. Suggested format for a technical memorandum includes:

1. Introduction
2. Existing Conditions
3. Proposed Development
4. Projected Traffic
5. Trip Generation/Distribution
6. Capacity Analysis (LOS) Results
7. Signal Warrants/Sight Distance/Turn Lane Analysis
8. Conclusions and Recommendations
9. Appendices
 - a. Exhibits,
 - b. Raw and summarized traffic data collected for the analysis,
 - c. Trip Generation and Distribution details,
 - d. Reports from TE software and any other software,
 - e. Photographs, and
 - f. Relevant references to the study.

Suggested Major Traffic Study Format (Formal Report)

Major Traffic Studies should be a formal report, organized so that the reviewer can easily find sections for review. A suggested format includes:

1. Title Page
2. Executive Summary
3. Table of Contents, Figures and Tables
4. Introduction and Study Area
5. Existing Conditions
 - a. Land Use
 - b. Site Access
 - c. Traffic Volumes/Data
6. Proposed Development
 - a. Development Characteristics
 - b. Phasing (if applicable)
 - c. Proposed Access Connections
 - d. Driveway/Ramp Spacing Compliance
 - e. Pedestrian/Bicycle Access
7. Projected Traffic
 - a. Background Traffic
 - b. Trip Generation/Distribution



- c. Pass-By/Internal Circulation
 - d. Background plus Net Generate Trips (phases and full build-out)
 - e. Five-Year Horizon Background plus Net Generated Trips (phase and full build-out)
8. Capacity Analysis
 - a. Existing Conditions
 - b. Background Conditions
 - c. Background plus Proposed Development (phased, if applicable)
 - d. Full Build-Out plus 5-Years
 - e. Mitigation Measures (if applicable)
9. Safety and Operations Analysis
 - a. Intersection and Stopping Sight Distance
 - b. Turn Lanes Analysis (AMM and RDM)
 - c. Multi-way Stop Warrants
 - d. Traffic Signal Warrants
10. Conclusions and Recommendations
11. Appendices
 - a. Exhibits,
 - b. Raw and summarized traffic data collected for the analysis,
 - c. Trip Generation and Distribution details,
 - d. Reports from traffic engineering software and any other software,
 - e. Photographs, and
 - f. Relevant references to the study.

Executive Summary should be less than one page and summarize the location and description of the proposed land use, present an estimate of the number of projected development trips (daily, and for each study peak hour), and document the main conclusions and recommendations.

Submittal Requirements:

All submittals shall be electronically submitted. The report and appendix shall be submitted as a PDF. The submittal shall also include all traffic simulation files in their native format and traffic data in Microsoft Excel format.



Definitions

Acceleration Lane: A speed-change lane, that enables a vehicle entering a street to increase its speed to a rate at which it can more safely merge with through traffic.

Access: A way or means to provide vehicular or pedestrian entrance or exit to a property.

Access Connection: A facility, such as a driveway, street, turnout, or other means that provides movement to or from the public street system.

Access Management: The process of controlling access to land development while preserving the flow of traffic and safety.

ADT: Average Daily Traffic – The total volume during a given time period (in whole days), greater than one day and less than one year, divided by the number of days in that time period. Also known as raw data and unadjusted or non-factored data.

Adjacent Street: A public street that is adjacent to and/or abutting one or more sides of the proposed site.

Applicant/Representative: Owner or representative (e.g., traffic engineering consultant) actively involved in the permitting process and submitting the required checklist and/or traffic study to TxDOT.

Auxiliary Lane: A lane striped for use as an acceleration lane, or deceleration lane, right-turn lane, or left-turn lane, but not for through traffic use.

Background Traffic: Traffic volumes projected by applying a growth rate to collected or known traffic volumes.

Capacity: The rate at which vehicles can reasonably traverse a point during a given time period under prevailing street and traffic conditions. Generally based on methods in the Highway Capacity Manual and express qualitatively as Level-of-Service (LOS).

Deceleration Lane: A speed change lane that enables a vehicle that is exiting a street to leave the travel lanes and slow to a safe exit.

Driveway: An entrance used by vehicular traffic to access property abutting a street.

Five-Year Horizon: Projected traffic volumes including background traffic for five years after the full build-out year plus net generated trips.

Full Build-out Year: The expected year of completion of the proposed development, when its capacity for attracting and producing traffic is maximized.

Joint/Shared Access: A driveway connecting two or more contiguous or adjacent sites to the public street system.

Level of Service (LOS): shall mean the measure of traffic flow and congestion. As defined in the Highway Capacity Manual, it is a qualitative measure describing operational conditions within a traffic stream, generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Multi-Phase Development: Any proposed development that is developed with more than a single phase of construction.

Peak Hour: The heaviest hour of use determined by the number of traffic units generated by and attracted to the proposed development and/or the traffic data collected for the Traffic Study.



Peak Hour Factor (PHF): The hourly volume during the maximum traffic volume hour of the day divided by 15-minute volume multiplied by four, a measure of traffic demand fluctuation within the peak hour.

Phase: An intermediate phase of construction associated with a multiple-phase development. There may be several intermediate construction phases that precede the final construction phase. The final construction phase is completed in the full build-out year.

Signalized Intersection: An intersection under the operational control of a traffic signal having a designated cycle length with red, yellow, and green signal head assemblies.

Site-Generated Trips: Vehicular trips attracted to or produced by the proposed development site. Generally determined using the ITE Trip Generation Manual.

Site Plan: A drawing that shows the existing and proposed conditions of a development.

Storage Length: The portion of an auxiliary lane used to store vehicles.

Study Area: The limits of the area for which the analysis is to be conducted.

Traffic Study: An engineering analysis that meets all the requirements of the Houston District Traffic Study Guidelines.

Unsignalized Intersection: An intersection under the operational control of stop sign(s) or yield sign(s).

VPD: Vehicles Per Day