

City of Jonestown

TRAFFIC IMPACT ANALYSIS AND ACCESS MANAGEMENT MANUAL

INTRODUCTION

One of the city's primary objectives is to operate and maintain a safe and efficient roadway system. The review and management of development-generated traffic is an integral part of that objective. The Traffic Impact Analysis (TIA) procedures as outlined in this document have been established for this purpose. The TIA procedures establish a range of Traffic Impact Analysis categories based on the characteristics of development and estimated peak hour traffic volumes. The TIA procedures also outline the analysis approach and methods.

A TIA identifies existing traffic volumes and conditions, development traffic volumes and conditions and their combined impacts on the existing and future roadway system. Additionally, a TIA analyzes traffic circulation both on- and off- site. This is a useful tool for early identification of potential traffic problems and can play an important part in the success of a development. The need for a TIA should be assessed as early as possible in the development process when there is maximum flexibility to mitigate traffic-related problems. The results of the TIA can also affect the Site Plan or development proposal, so it is important to begin the traffic analysis early and incorporate the TIA recommendations into the development plans during design.

The procedures contained herein are provided to assist developers through the approval process by outlining the requirements and level of detail of traffic analysis that will be required of them during the approval process, to standardize the types and details of analysis required in the assessment of traffic impacts and to ensure consistency in the preparation and review of a TIA.

The purpose of this document is to provide criteria for the preparation of Traffic Impact Analysis (TIA) or a Traffic Impact Statement (TIS) for new land developments or additions to existing developments and to establish the report format for these studies.

TRAFFIC IMPACT ANALYSIS (TIA) CATEGORIES

A TIA or TIS prepared by a Registered Professional Engineer in the State of Texas is required for most developments. The requirement for a TIS for developments generating fewer than 100 peak hour trips may be waived by the city staff. Peak hour trips shall be estimated utilizing the most recent edition of the Institute of Transportation Engineers' (ITE) *Trip Generation Manual* or other relevant data as approved by the city. The developer should initially identify the land use, number of units, and estimated number of daily, AM, and PM peak hour vehicle trips that will be generated by the proposed development to determine the level of analysis. A pre-TIA scoping meeting should be scheduled during the pre-application meeting for TIAs falling in Categories 1 through 4 to discuss the methodology to be used in the analysis. In addition to the existing conditions, the study must analyze the horizon year(s) and study area as stated in **Table 1: Traffic Impact Analysis Categories**.

Table 1: Traffic Impact Analysis Categories

Traffic Impact Analysis Categories			
TIA Category	Trip Generation Threshold ¹	Horizon Year(s) ²	Study Area
Traffic Impact Statement	Developments that are estimated to generate less than 100 trips during the highest peak hour.	Opening Year	To be determined by city staff
1	Developments that are estimated to generate greater than 100 but less than 500 vehicle trips during the highest peak hour.	Opening Year and 5 years in the future	<ol style="list-style-type: none"> 1. Site access drives 2. All major signalized and unsignalized intersections within ¼ mile and all major driveways within 500 feet 3. All roadway segments within ¼ mile of the project site boundary
2	Developments that are estimated to generate more than 500 but less than 1,000 vehicle trips during the highest peak hour.	Opening Year plus 5 and 10 years in the future (phasing of the development must also be considered)	<ol style="list-style-type: none"> 1. Site access drives 2. All major signalized and unsignalized intersections and all major driveways within a ½ mile radius of the project site boundary 3. All roadway segments within ½ mile of the project site boundary
3	Those developments that are estimated to generate more than 1,000 but less than 1,500 vehicle trips during the highest peak hour.	Opening Year plus 5, 10, 15 years in the future (phasing of the development must also be considered)	<ol style="list-style-type: none"> 1. Site access drives 2. All major signalized and unsignalized intersections and all major driveways within a 1-mile radius of the project site boundary 3. All roadway segments within 1 mile of the project site boundary
4	Regional Development generating 1,500 or greater trips during the highest peak hour.	Opening Year plus 5, 10, 15, and 20 years in future or as specified in the Phasing Schedule	<ol style="list-style-type: none"> 1. Site access drives 2. All major signalized and unsignalized intersections and all major driveways within an impact area defined during the scoping meeting 3. All roadway segments within an impact area defined during the scoping meeting

1. The trip generation used for determining the TIA category shall not be reduced for internal or pass-by trips unless approved by the city. For developments with peaks different than the typical adjacent street peak such as churches, schools, shift work, sports complex, movie theater, etc., the peak hour of the generator shall be calculated.
2. The Traffic Impact Analysis shall consider the phasing of the development and make infrastructure improvement recommendations so an adequate level-of-service (LOS) is maintained with each phase of development.

TRAFFIC IMPACT STATEMENT (TIS)

If the proposed project generates fewer than 100 peak hour trips, a TIS that addresses trip generation and any site-specific issues may be submitted in lieu of a full Traffic Impact Analysis. The TIS shall be signed and sealed by a Registered Professional Engineer in the State of Texas. The following should be included in the TIS:

Description of Existing Conditions

- Roadways, including existing street cross-section, street classification, posted speed limit, daily traffic volume, and 85th percentile speed (if available)
- Intersections, including existing lane configuration and traffic control
- Nearby driveways (adjacent, opposite and off-set), including locations and spacing
- Sight distance deficiencies
- Surrounding Land Use
- Transit, Pedestrian, and Bicycle facilities and access

Description of Proposed Development

- Location
- Site Plan, including spacing of driveways and distance from nearest intersection and other driveways, including opposite and off-set)
- Land Use & Project Size
- Hours of operation, if known
- Access, including location, type (full, partial, right-in/right-out), spacing, and alignment with existing/future driveways
- On-site Circulation and Queuing (if appropriate)
- Transit, Pedestrian, and Bicycle facilities and access

Trip Generation

- Calculate and summarize the daily, AM, and PM peak hour traffic. For developments with peaks different than the adjacent street peak, such as churches, schools, shift work, sports complex, movie theater, etc., the peak hour of the generator shall be calculated.

Street Classification and Circulation Map

- Discuss street classification.

Additional Site-Specific Analyses

- Additional site-specific analyses may be required at the request of the city.

- When an auxiliary lane analysis is required, a distribution and assignment of site traffic is required to evaluate location and storage lengths.

TRAFFIC IMPACT ANALYSIS (TIA):

A TIA is required for all projects that generate 100 or more trips during either the AM or PM peak hour. The most recent version of the *ITE Trip Generation Manual* should be used for all trip

generation calculations.

Traffic Impact Analysis will be classified into four categories:

Category 1: Proposed developments that are deemed to have minor traffic impacts.

Category 2: Proposed developments that have localized impacts to the city's transportation system.

Category 3: Proposed developments that have major impacts to the transportation system that may extend beyond the vicinity of the site.

Category 4: Proposed developments that have regional impacts to the transportation system that extend beyond the vicinity of the site and may cross jurisdictional boundaries.

SCOPE OF STUDY

PRE-TIA SCOPING MEETING

The purpose of the pre-TIA Scoping Meeting is to discuss the project scope and required/expected level of analysis to be performed by the engineer completing the TIA. Study intersections, time periods, horizon year(s), required traffic counts, intersections needing traffic signal warrant analysis, and future adjacent developments will be identified. Applicants should contact the Development Services department to request a pre-TIA Scoping Meeting to determine the analysis requirements of the TIA.

STUDY AREA (See Table 1)

The analysis shall include all intersections of two or more streets with a functional classification of Minor Collector or greater in the study area. Additional intersections, such as local streets or commercial driveways may be included in the analysis, if required by city staff or if in close proximity to (adjacent, opposite or off-set) or align with proposed driveways/roadways.

HORIZON YEAR(S) (See Table 1)

The horizon years shall consider proposed phasing to adequately assess the timing of improvements and/or necessary interim improvements. The TIA horizon years shall correlate to the phasing of the development so infrastructure improvements are in place to maintain an acceptable level-of-service (LOS) with each phase.

ANALYSIS TIME PERIODS

The study should include an analysis of the impact of the traffic generated by the development for the typical adjacent street peak hour conditions, which normally occur within the AM and PM peak periods on a typical weekday. Roadway segment analysis shall be conducted for average daily traffic (ADT) and peak hours. The city may require additional time periods if the development has unusual peaking characteristics such as a church, school, shift work, sports complex, movie

theater, etc. or if the adjacent non-site traffic conditions warrant an analysis of other peak traffic time periods.

DATA COLLECTION

The TIA shall include information on the following existing and proposed conditions within the study area:

EXISTING TRAFFIC VOLUMES

The Traffic Engineer preparing the TIA shall obtain approval of the scope of study from city staff before ordering traffic counts and submitting the TIA. The TIA shall provide daily traffic volumes for most Parkway, Major and Minor Arterial and Major and Minor Collector roadways. For study roadways without known daily traffic volumes, average weekday trip volumes shall be collected. Additionally, for study intersections identified in the pre-TIA scoping meeting, turning movement traffic counts in 15-minute intervals shall be conducted during the AM and PM peak hours. The existing traffic volumes and daily and peak hour turning movements shall be depicted on a figure in the TIA report.

Unsignalized study intersections requiring a traffic signal warrant analysis shall be identified in the pre-TIA Scoping Meeting. Turning movement counts for a 24-hour period in 15-minute periods shall be obtained for each study intersection requiring a traffic signal warrant analysis. For future driveways anticipated to warrant a traffic signal, 24-hour traffic counts shall be conducted on the adjacent street.

If 24-hour turning movement traffic counts are not conducted for intersections requiring a traffic signal warrant analysis, the TIA may need to be revised and resubmitted.

Typical AM peak hours are 7:00 to 9:00 AM and typical PM peak hours are 4:00 to 6:00 PM. Different time periods may be required for developments with different peaking characteristics, such as churches, schools, shift work, sport complexes, movie theaters, etc. Saturday and Sunday counts may be required if peak hours do not occur on a weekday.

FUTURE BACKGROUND TRAFFIC VOLUMES

When appropriate, obtain traffic projections from the Capital Area Metropolitan Planning Organization, TxDOT, relevant documented traffic projection sources, volumes from TIAs prepared for nearby developments, or historical traffic volume trends. Future background traffic volumes shall be estimated for each horizon year.

SURROUNDING LAND USE

Identify the existing land uses within the study area.

PROPOSED DEVELOPMENT

Relevant details for the proposed development need to be obtained such as size (dwelling units,

square feet, students, employees, etc.), hours of operation, on-site circulation, and site access. Distances between access points shall be labeled on the site plan as well as locations of adjacent driveways and intersections to verify proper spacing. Streets or driveways in close proximity to other streets or driveways may be required to align for on- or off-site circulation. Drive aisles and their alignments will be reviewed for on-site access and circulation. A location map and site plan shall be included in the TIA.

EXISTING TRANSPORTATION SYSTEM

Existing characteristics shall be identified, including street cross-section, type and location of median openings, speed limits, functional classification, intersection lane configuration, traffic control devices, and sight distance. The existing transportation system shall be depicted on a figure in the TIA.

FUTURE TRANSPORTATION SYSTEM

Future transportation improvements for all modes of transportation and their timing should be identified along with reviewing relevant traffic studies.

CRASH DATA

Crash data for a three-year period shall be obtained from the Texas Department of Transportation for the study area.

NEW TRIPS FROM PROPOSED DEVELOPMENT

TRIP GENERATION

The trip generation for any proposed development shall be estimated using the latest edition of *Trip Generation Manual* published by ITE. Exceptions to the use of this document must be approved by the city and may include actual trip generation counts from an existing facility of similar size, land use and surrounding area characteristics or from other recognized sources that provide trip generation data not included in the ITE Manual. The trip generation shall be summarized in a table in the TIA report.

INTERNAL CAPTURE AND PASS-BY PERCENTAGE

Typically, all trips entering and exiting a new development are new trips not made to or through the area prior to the development being completed. However, for some non-residential developments, a portion of these trips may be “captured” from trips already being made to other existing developments on the adjacent street system or they may be merely passing by on the way from one place to another. The driveway volume for a new development may be significantly different from the traffic volume added to the adjacent street system. For example, retail establishments, restaurants, banks, service stations, and convenience markets attract people from the passing stream of traffic. These are known as pass-by trips.

ITE's Trip Generation Handbook contains discussions and references on the issue of pass-by trips. Because of the limited data available, adjustments for pass-by trips should be applied carefully. If pass-by trips are a major consideration, studies and interviews at similar land uses must be conducted or referenced.

The use of internal capture and pass-by percentage reductions will be allowed for certain types and sizes of Mixed-Use Developments. Allowable sources for internal capture and pass-by reduction rates for land uses are identified below:

1. The internal capture rates or equations contained in the most recent version of the *ITE Trip Generation Manual*, as approved for use by the city.
2. The internal capture rate from a previously approved TIA of similar land uses, if approved by the city.
3. Any proposed internal capture rates shall be approved by the city in writing prior to implementation.

Any trip reduction adjustments applied to reflect pass-by traffic, internal capture, alternative modes, or other means shall be clearly identified and documented in the TIA and discussed with the city staff prior to use within the report.

TRIP DISTRIBUTION AND TRAFFIC ASSIGNMENT

Manual traffic distribution and assignment can be accomplished using experience, judgment, and knowledge of local conditions. Site traffic shall be assigned to the proposed site driveways and street network system included within the study area based on the distribution of existing traffic counts, an analysis of future market area within the area of influence, or by computer-based modeling software.

A figure depicting the assumed distribution percentages is required in the TIA. Figures are also required illustrating the daily and peak hour site traffic for each phase of development.

BACKGROUND TRAFFIC

Future projected background traffic volumes should be based on available traffic projections, other relevant and documented traffic projection sources, volumes from TIAs prepared for nearby developments, or historical traffic volume trends analyses. Projected traffic volumes shall include adjustments, as necessary, to reflect other adjacent future development and seasonal trends. Trend growth rates from historic count data may also be utilized to project future background traffic volumes.

Sources and background growth rates shall be clearly identified in the TIA. Figures depicting the background traffic volumes and daily and peak hour turning movement are required in the TIA for each horizon year.

LEVEL-OF-SERVICE ANALYSIS

The desired level-of-service (LOS) designations for all roadway segments shall be used in the traffic analysis to support street classifications and the sizing of interim roadways. At each intersection, the LOS for each movement shall be analyzed, in order to determine the required mitigation to maintain an acceptable LOS. Infrastructure improvements shall be recommended for each phase so that an adequate LOS is maintained with each phase of development. LOS analyses are required for the following scenarios:

1. Existing conditions
2. Future non-site background traffic conditions for each horizon year/phase
3. Future total background plus project traffic conditions for each horizon year/phase

ROADWAY SEGMENTS

All study area roadway segments shall be reviewed to determine daily traffic volume and recommended appropriate street sizing and classification. Refer to the **Planning Level Roadway Capacity** table included in Appendix A for guidance with roadway sizing.

INTERSECTIONS

A level-of-service (LOS) analysis should be performed for every movement of each study intersection and project driveway in accordance with the Federal Highway Administrations (FHWA) *Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways* (edition adopted by the Texas Department of Transportation) and the latest edition of the *Highway Capacity Manual (HCM)*. The analysis should identify necessary improvements to maintain an acceptable LOS D or better during the peak hours. The level-of-service criteria for intersections as stated in the *Highway Capacity Manual* is provided in **Table 2**.

Table 2: Level-of-Service Criteria for Intersections

Level-of-Service	Average Delay (seconds per vehicle)		Traffic Conditions
	Unsignalized	Signalized	
A	≤ 10	≤ 10	Free flow
B	> 10 to 15	> 10 to 20	Stable flow (slight delays)
C	> 15 to 25	> 20 to 35	Stable flow (acceptable delays)
D	> 25 to 35	> 35 to 55	Approaching unstable flow (tolerable delay, occasionally waits through more than one signal cycle)
E	> 35 to 50	> 55 to 80	Unstable flow (intolerable delay)
F	> 50	> 80	Forced flow (congested and queues fail to clear)

The complete LOS analysis output shall be included in the Appendix of the TIA report and be summarized in table or figure format for the movement, approach, and overall intersection for both peak hours at each study intersection. The LOS for each movement of all study intersections shall be identified clearly with and without mitigation. The Synchro model shall be provided to the city upon request.

Typically, LOS of D or better is required for each movement of all study intersections. Minor movements may have a lower LOS during limited times, such as AM or PM peak, at the discretion of the city. Minor movements may not be penalized in favor of major movements in order to improve the overall LOS of a signalized intersection.

ACCESS MANAGEMENT

New commercial sites shall coordinate and provide access to existing and future adjacent commercial centers whenever possible.

INTERSECTIONS

Collector streets shall not intersect Parkway, Major Arterial, or Minor Arterial streets at spacing other than $\frac{1}{4}$ mile or $\frac{1}{2}$ mile points of an arterial. Local residential streets shall not intersect parkway or arterial roadways. Where street and driveway intersections are restricted to partial access, a raised median shall be required to reinforce access restrictions. Turn diverter islands may be used in conjunction, but shall not be used in lieu of a raised median.

MEDIAN OPENINGS

Raised medians are required on Parkways and designated Arterial and Collector streets to separate traffic flows, channelize left turns, and reduce conflicts. Median openings are limited according to the street classification.

On Parkways and Major Arterial streets, full access median openings shall not be permitted at intervals less than $\frac{1}{4}$ mile. Partial access median openings, which allow only left turns off the major street, shall not be permitted at intervals less than $\frac{1}{8}$ mile spacing.

On Minor Arterial streets, full access median openings shall not be permitted at intervals less than $\frac{1}{8}$ mile. Partial access median openings shall not be permitted at intervals less than 330 feet.

In some cases where reasonable alternate access is not available, median openings may be permitted at closer intervals with the approval of the city. **Table 3** summarizes the median opening spacing per street classification.

Table 3: Median Opening Spacing

Street Classification	Median Opening Spacing	
	Full	Partial (left-in, right-in & right-out)
Parkway/Major Arterial	1/4 mile	1/8 mile
Minor Arterial	1/8 mile	330 feet (increase spacing if required for back-to-back left-turn movements)

DRIVEWAY SPACING AND LOCATION

The TIA shall review spacing between driveways, distance to nearest intersection, distance to driveways adjacent to and opposite from the site, and distance to offset driveways. Typically, one driveway per development will be permitted. The distances shall be depicted on the site plan. Guidelines for minimum driveway spacing are summarized in **Table 4**. Spacing shall be increased to accommodate a required right-turn deceleration lane storage length or to provide space for back-to-back left-turn lanes. Additional driveways would need to be evaluated in the TIA and approved by the city.

Table 4: Minimum Driveway Spacing

Street Classification	Required Minimum Spacing
Parkway	350 feet ¹
Major Arterial/Minor Arterial	250 feet ¹
Major Collector/Minor Collector	150 feet ¹

1. Spacing shall be increased from the minimum required to accommodate a required right-turn deceleration lane or to provide sufficient spacing for back-to-back left-turn lanes.

Corner clearance is required to keep the functional area of an intersection clear of conflict. **Table 5** summarizes the minimum required corner clearances.

Table 5: Minimum Corner Clearance

Street Classification	Minimum Required Corner Clearance	
	Approaching Intersection	Departing Intersection
Parkway	550 feet	350 feet ¹
Major Arterial/Minor Arterial	450 feet	250 feet
Major Collector/Minor Collector	350 feet	150 feet ¹

1. When right-turn deceleration lanes are required, the minimum corner clearance departing an intersection on a Parkway, Arterial, or Collector street is at least 250 feet to accommodate the right-turn lane. Additional distance may be required depending on right-turn lane storage length.

On a parkway, the corner clearance approaching an intersection shall be 550 feet to avoid conflict, and the corner clearance departing an intersection shall be a minimum of 350 feet. On an arterial street, the corner clearance approaching an intersection shall be 450 feet to avoid conflict, and the corner clearance departing an intersection shall be a minimum of 250 feet. On a Collector street, the corner clearance approaching an intersection shall be a minimum of 350 feet, and the corner clearance departing an intersection shall be a minimum of 150 feet. When right-turn deceleration lanes are required, the minimum corner clearance departing an intersection on a Collector is increased to 250 feet at minimum to accommodate the right-turn lane.

DRIVEWAY DESIGN

Driveway widths shall be analyzed for necessary turning radii, truck turning movements, and ingress/egress lanes. Driveway lengths shall be reviewed for minimum throat length needed to accommodate all inbound traffic safely on-site without backups onto the intersecting street, and to accommodate all outbound traffic queued at the driveway to exit without blocking intersecting drive aisles, median openings, or parking spaces. The effective length of a vehicle shall be measured in increments of 25-feet. The minimum throat length of all accesses/driveways shall be 100 feet. For commercial driveways that could potentially be signalized, the minimum throat length shall be 150 feet. Longer throat lengths may be required based on the requirements of the TIA.

Driveways may be required to align with existing or future driveways or streets in close proximity for proper on- or off-site circulation and to reduce vehicle conflicts at the discretion of the city.

AUXILIARY LANES

When warranted, turn lanes permit separation of conflicting traffic movements and remove slower turning traffic from through traffic, improving capacity and reducing rear-end crashes. Determining the need for turn lanes is a key element of a TIA.

LEFT-TURN LANES

Left-turn lanes should be provided on Parkways, Major and Minor Arterials, and Major Collector streets. Dual left-turn lanes will be required at signalized intersections when the turn volume exceeds 200 vehicles per hour (VPH), the opposing through volume exceeds 1,000 VPH, or the delay to left turning vehicles exceeds 45 seconds.

RIGHT-TURN LANES

Right-turn lanes shall be provided on each approach for Arterial/Arterial and Arterial/Collector intersections. Right-turn lanes shall be provided at driveways on streets classified as Major Arterial or higher, and at street intersections and driveways where warranted. Right-turn deceleration lanes shall be provided at driveways on roadways meeting any of the following

criteria:

1. At driveways when the roadway is classified as Major Arterial or higher.
2. At least 30 vehicles are expected to make right turns into the driveway(s) during any one-hour period (existing or future).
3. Sites with a larger than average number of heavy vehicles (industrial, storage, and warehouse uses).

Deceleration lanes may be required at additional driveways not meeting these criteria, at the discretion of the city. Adjacent driveways shall not be located within the area of a deceleration lane or taper, unless approved by the city.

QUEUING ANALYSIS

The storage length of turn lanes depends on several factors and must be determined on a case-by-case base and approved by the city. The TIA should recommend minimum storage lengths based on a queuing analysis. The queuing analysis should be performed using accepted formulas as specified in the *AASHTO A Policy on Geometric Design of Highways and Streets* and with proper documentation. 95th percentile queue lengths from the LOS analysis should also be referenced when determining the recommended storage lengths.

- A. Storage lane lengths shall be determined based on a minimum length of 25 feet per vehicle during the highest peak hour. The minimum length of a storage lane shall be 100 feet, unless otherwise approved by the city.
- B. The lengths of deceleration lanes outlined in this section do not include taper length. Deceleration lane tapers should be approximately 12.5-feet longitudinally per 1-foot transversely (12.5:1), typically a 150' taper for a 12' wide lane.
- C. The city may require longer storage lengths and/or tapers for deceleration lanes based on specific site conditions.

For all right- and left-turn lanes, a table shall be provided in the TIA report that summarizes the existing (if applicable), required (as calculated per the TIA), and recommended storage lengths for all driveways and intersections analyzed.

ROADWAY FUNCTIONAL CLASSIFICATION AND CIRCULATION MAP

Identify the functional street classification for existing and proposed roadways within the study area and determine if proposed roadways follow the Thoroughfare Plan. Any deviation shall provide adequate justification for modification. Refer to the Planning Level Roadway Capacity table included in Appendix A for guidance with roadway sizing.

Areas within the city without an existing or proposed roadway shown on the Thoroughfare Plan shall provide a sufficient roadway network that addresses the proposed development and provides future local and regional connections to adjacent land.

PEDESTRIAN FACILITIES

Developments that generate pedestrian activity as an origin or destination shall discuss pedestrian access across any adjacent or nearby Arterial or Collector street. The development may need to provide appropriate pedestrian crossing infrastructure if not existing and available within 1/8 mile of each access to the development. Typically, arterial streets crossings require a Pedestrian Hybrid Beacon (PHB).

The proposed development shall provide stubs and access points along the edge of the proposed development to create contiguous networks.

ON-SITE CIRCULATION

Adequate on-site circulation is essential to provide safe and efficient access. The analysis shall provide a circulation plan with a figure and assessment of circulation internal to the development, including all accessways and easements, as well as access routes to adjacent developments..

On-site drive aisles and alignments will be reviewed for safe and efficient on-site circulation. Streets or driveways in close proximity to other streets or driveways may be required to align for on- or off-site circulation. Drive aisles and their alignments will be reviewed for on-site access and circulation. All internal drive aisle intersections shall provide a minimum 15' x 15' sighttriangle.

Additionally, a queuing analysis shall be included to demonstrate the site has adequate storage for all turn lanes, drive-thru lanes, and drop-off/pick-up zones. The effective length of a vehicle shall be measured in increments of 25-feet. Drive-in and drive-thru establishments shall be provided with adequate queue storage capacity to accommodate normal peak queues for the specified land use. Because many of these businesses have major daily or seasonal variations in activity, peaking characteristics should be carefully evaluated, and cannot be less than the required length prescribed in the city's zoning ordinance.

Planned commercial sites that consist of two or more parcels shall have internal connectivity that is clear of obstacles to minimize the impact to the adjacent streets. New commercial sites shall coordinate and provide access to existing adjacent commercial centers whenever possible. Exceptions must be submitted to the Development & Engineering Director with an accompanied traffic study for review and approval.

SAFETY ANALYSIS

CRASH ANALYSIS

Crash data for three-year period should be reviewed within the study area to identify trends and/or potential safety hazards.

SIGHT DISTANCE

Existing or potential sight distance deficiencies should be identified. For roadways with vertical curvature, minimum intersection sight distances shall be evaluated per AASHTO.

INTERLOCKING AND BACK-TO-BACK LEFT-TURN LANES

Existing conditions and the proposed site accesses shall be reviewed to identify any conflicts with left-turn movements. Interlocking left-turn conflicts shall be identified and mitigated. Storage lengths for back-to-back left-turn lanes shall be calculated per the TIA and recommendations made to ensure safe operation.

MITIGATION MEASURES

All recommended on-site and off-site improvements required to mitigate future projected traffic congestion or safety issues to maintain the before condition LOS or the minimum standard of LOS C or D shall be identified. The improvements shall be identified as by others or the responsibility of the development. Figures shall be included in the TIA depicting the future and recommended lane configuration and traffic control for each phase of development to adequately assess the timing of improvements and/or necessary interim improvements. The TIA horizon years shall correlate to the phasing of the development such that infrastructure improvements are in place to maintain an acceptable LOS with each phase.

TRAFFIC SIGNAL WARRANT ANALYSIS

Study intersections currently unsignalized and needing a traffic signal warrant analysis shall be identified in the pre-TIA Scoping meeting. Turning movement counts for a 24-hour period in 15-minute periods shall be obtained for each study intersection requiring a traffic signal warrant analysis. The turning movement counts are important to identify an appropriate right-turn reduction. For future driveways anticipated to warrant a traffic signal, 24-hour traffic counts shall be conducted on the adjacent street.

The traffic signal warrant analysis shall be conducted per the methodology in the most recent edition of the *Manual of Uniform Traffic Control Devices (MUTCD)*, particularly the eight-hour warrant. Other signal warrants shall be applied when relevant and using engineering judgement. A right-turn volume reduction shall be applied per engineering judgement and verification with the city. Typically, right-turn volumes should not be considered when there is a dedicated right-turn lane.

To estimate future hourly traffic volumes from the development for use in the traffic signal warrant analysis, the trip generation and trip assignment from the TIA shall be utilized and distributed per the hourly percentages provided in the ITE *Trip Generation Manual* or another relevant source. At least eight hours shall be estimated to consider the eight-hour traffic signal warrant. The appendices of ITE's *Trip Generation Manual* provide percent of daily traffic during each hour of a weekday, Saturday, and Sunday for different land uses when available.

ADDITIONAL CRITERIA FOR K-12 SCHOOL SITES

The study for any public, charter, or private school with students ranging in grades K-12 shall provide the following additional information:

a) Student Enrollment

The maximum student enrollment at build out shall be indicated. Partial student enrollment may be discussed but will not reduce drop-off/pick-up vehicle queue length requirements.

b) Parking

The total number of parking spaces onsite shall be provided. Additional off-site parking available through shared-use facilities, such as adjacent parks or community centers, or on-street parking should be discussed as well.

c) School Traffic Circulation Overview

A school traffic circulation overview with diagrams shall detail motor vehicle, bus, bicycle, and pedestrian circulation on site and on adjacent streets, including:

1. Direction of traffic flow and number of lanes throughout diagram;
2. Ingress and egress from the site;
3. Minimum and high demand drop-off/pick-up vehicle queue lengths;
4. School bus loading areas;
5. A Suggested Route to School walking map of the proposed walking boundaries using routes that minimize crossings of busy streets and busy driveways; and
6. A figure depicting all proposed school-related traffic control associated with the new school

d) Drop-off/Pick-up Vehicle Queue

The site shall accommodate a minimum and high demand vehicle queue for student drop-off and pick-up. The entire drop-off/pick-up vehicle queue should be contained within the school site and/or on a consenting adjacent shared-use site. The length of a right turn lane may be added to the high demand queue length, if approved by the city. These values take into account typical percentages of walking, bus riding, and carpooling students, and may not be reduced based on staggered start or dismissal times, after-school activities, or other special program expected to reduce the number of students arriving in vehicles.

1. **Traditional Public Elementary Schools serving grades K-8:** The minimum queue length provided onsite shall be 1.7 feet per student based on the school's maximum enrollment at build-out. Additionally, the site shall provide a contingency circulation plan that accommodates a high demand queue length of 2.2 feet per student based on the school's maximum enrollment at build-out.

2. **Charter, Magnet, or Private Schools:** The minimum queue length provided onsite shall be 4.3 feet per student based on the school's maximum enrollment at build-out. Additionally, the site shall provide a contingency circulation plan that accommodates a high demand queue length of 5.5 feet per student based on the school's maximum enrollment at build-out.
3. **High Schools:** The minimum queue length provided onsite shall be 0.6 feet per student based on the school's maximum enrollment at build-out. Additionally, the site shall provide a contingency circulation plan that accommodates a high demand queue length of 0.8 feet per student based on the school's maximum enrollment at build-out.

COORDINATION WITH OTHER PUBLIC AGENCIES

If applicable, the requirements for a Traffic Impact Analysis as noted in this document may need to be coordinated with the requirements of other local agencies such as adjacent cities, Travis County, or the Texas Department of Transportation. Any deviation from the requirements of this document due to the requirements of other agencies should be presented in written form to the city for review and approval or denial. Contact city staff for details on coordinating with other agencies.

REPORT FORMAT

The TIA shall be sealed by a Professional Engineer in the State of Texas and should include the following items and report sections:

- Cover Page
- Table of Contents, List of Figures, and Tables
- Executive Summary and Introduction
- Scope of Study
 - TIA Category
 - Study Area and Study Intersections
 - Horizon Years and Phasing
 - Analysis Time Periods
- Study Area Map and Site Location
- Existing Conditions
 - Discussion of Existing Traffic Counts
 - Description of Roadways and Street Classification
 - Description of Study Intersections and Traffic Control
 - Existing Sight Distance Deficiencies
 - Existing LOS summarized in table or figure
- Figure depicting daily and peak hour existing traffic volumes
- Figure of existing street cross-sections, intersection lane configuration, and traffic control
- Description of Existing and Surrounding Land Use
- Discussion of Future Transportation Improvements
- Project Description
 - Land Use (size, units, employees, students)
 - Operation Hours
 - Phasing
 - Access points and Spacing
- Site Plan with Access Points and Driveway Spacing Labeled
- Trip Distribution (Document sources and assumptions and depict distribution on figure)
- Site Traffic Figures for each horizon year depicting daily and peak hour traffic
- Discussion of Background Traffic-Cite sources, assumptions, trends, relevant studies, and nearby developments
- Background Traffic Figures for each horizon year depicting daily and peak hour traffic
- Total Traffic Figures for each horizon year depicting daily and peak hour traffic
- Level-of-Service Analysis for Each Horizon Year summarized in table or figure
- Driveway Spacing (Discuss driveway spacing and depict on site plan)
- Auxiliary Lanes (Evaluate need and location and recommended storage lengths)
- Discussion of On-site Circulation
- Additional Criteria for K-12 School Sites (if relevant) including Drop-off/Pick-up queue, parking, circulation diagram, pedestrian and bicycle facilities, and suggested safe route to school map
- Safety Analysis (5-year crash trend, sight distance, and consideration of interlocking or back to back left-turn movements)
- Discussion of Street Classification and Street Sizing
- Discussion of Proposed Improvements Per Horizon Year/Phase
- Figures with Proposed Improvements per each Horizon Year/Phase
- Conclusions & Recommendations
- Appendices (traffic counts, relevant study excerpts, trip generation, detailed LOS analysis output sheets, queuing analysis, traffic signal warrant analysis, and other pertinent documentation)

APPENDIX A – Planning Level Roadway Capacity Table

Planning Level Roadway Capacity					
Functional Street Classification	Cross-Section ¹	Description ¹	Minimum Design Speed (MPH) ¹	# of Travel Lanes	Planning Level Capacity ^{2,3} (ADT, vehicles per day)
Limited Access Parkway	150' ROW: 6 lanes divided by raised median	A Major Arterial that serves high volumes of traffic traveling relatively long distances and is managed to reduce conflict between through traffic and traffic entering, leaving and crossing the facility with limited access to intersections.	65	6	60,000
Major Arterial	130' ROW: 6 lanes divided by raised median	Roadway that is of regional importance and is intended to serve high volumes of traffic traveling relatively long distances. A Major Arterial is primarily intended to serve through traffic, service to abutting land is limited and access is controlled.	55	6	48,000
Minor Arterial	110' ROW: 4 lanes divided by raised median	Operates under lower traffic volumes than Major Arterials, serves trips of shorter distances, and provides a higher degree of property access than Major Arterials.	50	4	36,000
Major Collector	ROW Varies: 4 lanes divided by raised median or left-turn lane	Provides for traffic movement between arterials and local streets and carries moderate traffic volumes over moderate distances (less than 3 miles). Provides direct access to abutting land and has some access control through spacing and location of driveways and intersections.	40	4	24,000
Minor Collector	ROW Varies: 4 lanes or 2 lanes divided by raised median or left-turn lane	Similar in function to a Major Collector but carries lower traffic volumes at lower speeds over shorter distances (less than 3 miles) and has a higher degree of property access.	40	4	18,000
				2	9,000
Local	50' ROW: 2 lanes, no median	Roadway that is intended to provide access to abutting properties, tends to accommodate lower traffic volumes at lower speeds, serves short trips, and provides connection to collector streets.	35 Desirable 25 Minimum	2	1,500

1. Street cross-sections, descriptions, and design speed are excerpted from the city's Engineering Standards Manual.
2. *Source:* Adapted from Highway Capacity Manual, 6th Edition Transportation Research Board of the National Academies Exhibit 16-16. Capacity varies based on roadway characteristics.
3. This table is for general planning use and should not be used to analyze any specific urban street facility or to make final decisions on important design features. A more detail operational analysis is required for such applications.