

# **Scope of Work For Traffic Impact Studies**

Traffic Engineering Division  
Public Works & Utilities Department  
**City of Chandler**



October 2023

# Table of Contents

1. Introduction	2
2. Study Requirements	2
3. Study Magnitude	3
4. Methodology	4
4.1 Study Area	4
4.2 Study Horizon	4
4.3 Analysis Time Periods	4
4.4 Data Collection	5
4.5 Background Information	5
4.6 Trip Generation	5
4.7 Modal Split	6
4.8 Trip Distribution	6
4.9 Trip Assignment	6
4.10 Traffic Analysis	7
4.11 Traffic Impact Mitigation Measures	7
5. Report Format	8
6. Queuing Analysis	9

## 1.0 Introduction

The purpose of this document is to provide criteria on when a Traffic Impact Study (TIS) will be required and guidelines for preparing a TIS for proposed development projects or additions to existing developments in the City of Chandler. This Scope of Work is a general guideline only, and additional requirements may be required for specific developments. Users of this document may wish to contact the Traffic Engineering Division of the City of Chandler to confirm these requirements prior to initiating a new TIS.

## 2.0 Study Requirements

The need to conduct a TIS is based on the land use and size of the development. More specifically, a TIS will be required where the development intensity meets or exceeds 100 trips during the peak hour. The table below shows the size of different land uses that are roughly equivalent to a development that generates approximately 100 peak hour trips.

Land Use	Size
Commercial	Shopping Center 24,000 square feet
	Supermarket 13,000 square feet
	Convenience Market with Gas Pump 2,000 square feet
	Discount Club 22,000 square feet
	Pharmacy with Drive-Thru 9,000 square feet
Office	General Office Building 68,000 square feet
	Medical/Dental Office Building 24,000 square feet
	Office Park 67,000 square feet
	Business Park 71,000 square feet
Industrial	General Light Industrial 109,000 square feet
	Industrial Park 244,000 square feet
	Manufacturing 123,000 square feet
	Warehouse 417,000 square feet
Residential	Single Family Detached 100 dwelling units
	Apartment 150 dwelling units

For mixed-use developments, a TIS is required when the combined trips generated by the individual land uses exceed 100 trips per peak hour. Phased projects must be evaluated as a whole assuming full build-out conditions for purposes of determining the need for a traffic study.

Additionally, a TIS will be required for any project that intensifies the land use and/or density, or modifies the occupancy of an existing facility resulting in an increase in trip generation of the site.

The need for a TIS may be waived at the discretion of the City Transportation Engineer, for such reasons as the streets adjacent to proposed development or redevelopment are already constructed to their ultimate build-out condition and all other required improvements have been previously been made.

Where the need for a Traffic Impact Study has been identified, this study shall be completed and submitted to the City Transportation Engineer for review within a reasonable period of time to allow: 1. traffic engineering stipulations and other requirements to be included in the Planning & Zoning staff report; and/or 2. study recommendations and traffic related requirements to be incorporated into construction documents, plats, and plans before being submitted to the City for review. It is encouraged to meet/discuss with the City Transportation Engineer prior to commencing work on a TIA to ensure a full understanding of the City's requirements and expectations for each specific site.

### **3.0 Study Magnitude**

Traffic Impact Studies for the City of Chandler are classified into three categories:

- Category I - Developments that generate between 100 and 500 vehicle trips during any peak hour.
- Category II - Developments that generate between 500 and 1,000 vehicle trips during any peak hour.
- Category III - Developments that generate more than 1,000 vehicle trips during any peak hour.

The developer shall communicate to the City Transportation Engineer the proposed land use(s), estimate the numbers of trips generated by the development, and confirm with the City Transportation Engineer the Land Use Codes (selected from the most current revision of the Institute of Transportation Engineers' *Trip Generation*) utilized and the category of study before initiating any work.

## 4.0 Methodology

### 4.1 Study Area

The study area for the proposed development shall include the following.

	Category I	Category II	Category III
All site driveways.	✓	✓	✓
All intersections abutting the development.	✓	✓	✓
All signalized intersections within 1/2 mile.		✓	✓
All signalized intersections within 1 mile.			✓
Additional locations as required by the City			✓

If the development is anticipated to generate heavy truck or other large vehicle traffic, the developer should also estimate the number of these trips and confirm with the City Transportation Engineer the study area before initiating any work. Since truck trips for certain land uses (e.g. distribution, warehousing) tend to be more regional in nature, a larger study area may be required.

### 4.2 Study Horizon

The TIS shall include an analysis of the expected traffic conditions for the following scenarios:

- Background (existing) conditions
- Opening day conditions
- Each phase of the proposed development
- 5-year horizon beyond the full build-out of the development

Additional scenarios are required for the following categories:

- Category II: 10-year horizon
- Category III: 10 and 20-year horizon

### 4.3 Analysis Time Periods

The study should include an analysis of the impact of the development traffic on the adjacent street's weekday A.M. peak and P.M. peak hours, which normally occurs between 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m., respectively.

For developments with unusual peak hours, an analysis of the peak hour of the traffic generator is also required. For example, schools require an analysis of the peak period during the school start-up, and school let-out. Another example, banquet or church facilities require an analysis of evening and/or weekends.

#### 4.4 Data Collection

The Traffic Impact Study shall include information on the existing and proposed conditions within the study area.

Existing and proposed turning movement counts for the adjacent existing and proposed intersections and driveways should include the A.M. peak hour and P.M. peak hour (and other time periods as noted in the previous section). Daily traffic volumes shall be provided as 24-hour volumes, and peak hour volumes at intersections and driveways should be provided as turning movements. The analysis shall be based on traffic counts that are no more than one year old (or less if there are significant changes in traffic patterns). If current traffic volume data is not available from the City, the consultant shall be responsible to collect all necessary data. The estimation of existing peak hour turning movements based on automatic machine counts is not acceptable.

Projected traffic volumes should be based on the latest available traffic projections from the Maricopa Association of Governments, the City of Chandler Transportation Master Plan, or historical traffic volume trends. Projected traffic volumes shall include adjustments, as necessary, to reflect other adjacent future development.

#### 4.5 Background Information

The background information shall include a discussion of the existing and proposed land use of the development site. Roadway geometric conditions within the study area should include, but not be limited to, intersection and driveway spacing, road width, traffic lanes, medians, turn lanes, curb and gutter, speed limits, horizontal and vertical curvature, traffic control devices, and traffic signal phasing. The discussion on geometric conditions should include locations of driveways and intersections across the street from the development, and how this may impact traffic operations.

If applicable, the requirements for a TIS as noted in this document may need to be coordinated with the requirements of other local agencies such as adjacent cities or towns, the Maricopa County Department of Transportation or the Arizona 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 local reviewing agency for review and approval.

#### 4.6 Trip Generation

The trip generation for the proposed development shall be estimated using the latest edition of *Trip Generation* as published by the Institute of Transportation Engineers (ITE). As previously mentioned, the developer should communicate the proposed land use(s), and confirm the proposed Land Use Code(s) selected from the most current revision of the ITE's *Trip Generation*, with the City Transportation Engineer before initiating any work.

Actual measured trip generation rates from similar developments (in both land use and size) within the Phoenix metropolitan area may be accepted, and must be approved by the City Transportation Engineer before use.

If adjustments to the site traffic generation rates such as pass-by traffic or official trip reduction programs are proposed, this shall be discussed with the City Transportation Engineer before proceeding. This deviation should be clearly documented in the report.

If the development is anticipated to generate heavy truck or other large vehicle traffic, daily and peak hour truck trips shall be calculated and shown separately from passenger cars.

#### 4.7 Modal Split

Due to the current low modal split for trips by transit, autonomous vehicle, rideshare vehicle, cycling, and walking within in the City of Chandler, the combined mode split for these modes are typically assumed to be zero. In special situations where the mode split may be significant, this should be discussed with City Transportation Engineer before proceeding.

The Chandler Transportation Master Plan (as approved by City Council) supports encouraging alternative travel modes. Therefore, the TIS should identify how transit vehicles and patrons, autonomous vehicles and patrons, rideshare vehicles and patrons, bicycle parking and storage, and pedestrian and sidewalk connections are accommodated.

#### 4.8 Trip Distribution

Trip distribution should be based on population and employment figures depending on whether the development is a trip generator or attractor. The market area for commercial developments should be identified. The percentage of trips generated to and from each directional quadrant (North, South, East and West) should be identified in the report.

Market studies, in combination with traffic factors, should be used to develop the area of influence and trip distribution.

#### 4.9 Trip Assignment

Trips should be assigned to the existing and proposed road system based on the most direct route or the route offering the lowest average delay, and taking into consideration the capacity of the roadway network. For Category I and II developments, a manual trip assignment is acceptable. Category III type developments may require computer model simulation using EMME/2 or other similar type software.

#### 4.10 Traffic Analysis

A capacity analysis of all driveways, signalized and unsignalized intersections containing site-generated traffic are required. The software used for this analysis shall be the latest edition of the Highway Capacity Software (HCS), SYNCHRO, or other software acceptable to the City Transportation Engineer.

The results of the above analysis shall be summarized in tabular form identifying the average delay, Level of Service (LOS), and volume-to-capacity (V/C) ratios for the intersection and all critical movements. All intersections and specific turning movements with a LOS D or higher shall clearly identified.

Where queuing is an issue, a queuing study should be conducted to determine the extent of queues spilling out of left turn bays, right turn bays, drive-thru facilities, and also from intersection to intersection.

Where appropriate, traffic signal warrants for unsignalized intersections shall be conducted consistent with the guidelines identified in the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD). These signal warrants shall be conducted, subject to the following revisions:

- Peak Hour Warrant typically does not apply.
- Four-Hour Warrant typically does not apply.
- Side street right turning volumes typically deducted from the warrant calculations where more than one lane exists for the subject approach.

Other analyses as requested by the City of Chandler may be required due to the type and location of the proposed development, such as weaving analyses, parking analyses, on-site circulation, pick-up and drop-offs, the number of accesses, and sight distance calculations, among others.

#### 4.11 Traffic Impact Mitigation Measures

All intersections showing a LOS D or greater must be analyzed for on-site and off-site traffic and roadway improvements that are necessary to bring the intersection back to a LOS D. It is important to emphasize that this analysis is required regardless of whether congested conditions already exist without the proposed development.

A list of recommended on-site and off-site improvements required to mitigate the projected traffic congestion or safety issues shall be identified for comparison to the "before" conditions.



## 5.0 REPORT FORMAT

The TIS shall include the following items and report sections:

1. Title Page.
2. Table of Contents, List of Figures and Tables.
3. Introduction including description of project, purpose of report and executive summary.
4. Proposed development description including location, land use and proposed use. Include vicinity map and site plan.
5. Study Area description.
6. Existing conditions including study site land use, adjacent roadway description and traffic volumes. Include summary of existing traffic counts, graphic of existing daily and peak hour traffic and roadway condition diagram.
7. Projected traffic including site traffic generation, distribution and assignment and non-site traffic for each time period to be analyzed. Graphics should be included showing the daily and peak hour traffic volumes for each analysis time period and project phase for both the on and off-site traffic.
8. Background, Site Traffic, and Total Traffic volumes should be shown for each analysis time period.
9. Traffic analysis showing tabular and graphic results of the analyses.
10. Summary and Conclusions.
11. Appendix to include all HCS and/or SYNCHRO computer runs. Provide any material related to the traffic study data collection and study results.

Two hard copies of the Traffic Impact Study shall be submitted for review. Additional hard copies may be required for review by other public agencies. Additionally, one electronic copy (in PDF format) of the Traffic Impact Study, including the report, appendices (e.g. Synchro outputs, tables, graphs, calculations), and any other materials submitted in hard copy format, shall also be submitted.

## 6.0 Queuing Analysis

Queuing analysis is to determine the minimum storage length of a proposed drive-through queue storage area. One of the two following methods should be used to determine the expected maximum drive-through vehicle queue length.

1. Conduct a survey of at least three (3) similar sites to determine the maximum number of vehicles waiting in the queue. Expected maximum drive-through length should be the number of vehicles waiting in queue times 20 feet- per vehicle. The survey should be conducted during the peak hour of the similar sites.
2. Poisson arrivals and exponential service times can be used to predict the average number of vehicles in the system.

$$\text{Average number of vehicles in the system} = \frac{\lambda}{\mu - \lambda}$$

Where  $\lambda$  is the arrival rate and  $\mu$  is the service rate. Arrival rate should be obtained from at least three (3) similar sites by conducting a survey. Service rate should be obtained from at least three (3) similar sites internal control system.

Expected drive-through queue length = average number of vehicles x 20 feet

The minimum storage length should be equal to or greater than the maximum expected drive-through queue length.

If a dual drive-through lane is proposed, the minimum storage area length for each of the drive-through lanes should be 75% of the expected drive-through queue length.