
240 TRAFFIC IMPACT ANALYSES

The purpose of this document is to establish uniform guidelines for conducting traffic impact analyses for a proposed new or an expansion of an existing development requesting access or modification of access to the State highway system.

240.1 IMPLEMENTING STATEMENT

ADOT desires to operate a safe and efficient State highway system. The management of access to the system in an effective manner is vital to maintain the overall safety and efficiency of this system. Access to the State highway system is managed through the encroachment permit process. **This permit process requires those desiring access to the State highway system to apply for an encroachment permit. Since access to a State highway for a development may impact traffic on the highway, a Traffic Impact Analysis shall be prepared for developments which desire a permit and meet the specific requirement stated below.**

The purposes of the Traffic Impact Analysis procedures presented herein are to:

- Provide information to the permit applicant and/or their representatives on specific requirements of the analysis, and
- Ensure consistency in the preparation and review of Traffic Impact Analyses.

The procedures outlined herein present the minimum information required when conducting a Traffic Impact Analysis. **The preparer of the Traffic Impact Analysis shall contact the appropriate ADOT Regional Traffic Engineer to discuss the scope of the analysis, methodology, and level of detail required for the specific project prior to beginning the analysis.** See Exhibit 240-A for a pre-submittal form that can be used to compile information for the analysis.

240.2 REFERENCES

American Association of State Highway and Transportation Officials:

- Highway Safety Manual, 2010 Edition
- Highway Safety Manual Supplement, 2014 Edition

Arizona Department of Transportation:

- ADOT TGP 611, "Traffic Signal Needs Studies"
- ADOT Roadway Design Guidelines
- ADOT Access Management Guidelines

Institute of Transportation Engineers:

- Manual of Transportation Engineering Studies, 2nd Edition, 2010
- Trip Generation, 9th Edition, 2012
- Transportation and Land Development, 2002

Transportation Research Board:

- Highway Capacity Manual, 2010 Edition

240.3 DEFINITIONS

Traffic Impact - The effect of site traffic on highway operations and safety.

Traffic Impact Analysis (TIA) - A traffic engineering study which determines the potential traffic impacts of a proposed traffic generator. A complete analysis includes an estimation of future traffic with and without the proposed generator, analysis of the traffic impacts, and recommended roadway changes which may be necessary to accommodate the expected traffic.

Traffic Statement – An abbreviated traffic engineering study which determines the potential traffic impacts of a proposed traffic generator. Analysis is similar to a Traffic Impact Analysis but is typically limited to site driveway concerns. **The Regional Traffic Engineer shall make the final decision on whether a traffic statement may be substituted for a Traffic Impact Analysis.**

Transportation Planning Study - A planning-level traffic study which focuses on roadway capacity and daily traffic volumes rather than peak-hour operations. The study is typically prepared prior to site planning and at the request of local jurisdictions in support of zoning changes.

Traffic Generator - A designated land use (residential, commercial, office, industrial, etc.) or change in land use that generates vehicular and/or pedestrian traffic to and from the site.

Traffic Mitigation - The reduction of traffic impacts on roadways and/or intersections to an acceptable level of service by way of roadway construction improvements, the upgrade of existing traffic control devices, or the modification of the site plan.

Traffic Generation - The estimation of the number of origins from and destinations to a site resulting from the land use activity on that site.

Mode Split - The estimation of the number of trips made by each mode (automobile, pedestrian, bicyclist, transit, etc.)

Trip Distribution - The allocation of the site-generated traffic among all possible approach and departure routes.

Trip Assignment - The assignment of site plus non-site traffic to specific streets and highways.

Influence Area - The geographic area surrounding the site from which the development is likely to draw a high percentage (80% or more) of the total site traffic.

Area of Significant Traffic Impact - The geographic area which includes the facilities significantly impacted by the site traffic.

Peak Hour - The single hour of a representative day when the traffic volume on the highway represents the most critical period for operation and the highest typical capacity requirements.

Peak Hour of Generator - The single hour of highest volume of traffic entering and exiting a site.

Level of Service F - Traffic flow operations that have either broken down (i.e., demand exceeds capacity) or have exceeded a specified service measure value (or combination of service measure values) that most users would consider unsatisfactory.

240.4 REQUIREMENT

A traffic impact analysis shall be required for all new developments or additions to existing developments which generate 100 or more trips during any one hour of a day. The specific analysis requirements and level of detail are determined by the following categories:

- (1) Category I - Developments which generate 100 or more peak hour trips but less than 500 trips during the morning or afternoon peak hour of the highway or during the peak hour of the generator.

A Category I Traffic Impact Analysis may also be required for any of the following reasons:

- a. The existence of any current traffic problems or concerns in the local area such as an offset intersection, overcapacity of segments or intersections, a high number of crashes, etc., or
- b. The sensitivity of the adjacent neighborhoods or other areas where the public may perceive an adverse impact, or
- c. Impact on access to a State highway, such as proximity of proposed site driveways to existing driveways or intersections, or
- d. Other specific problems or safety concerns that may be negatively impacted by the proposed development.

- (2) Category II - Developments which generate more than 500 trips during the morning or afternoon peak hour of the highway or during the peak hour of the generator.

The Regional Traffic Engineer makes the final decision on requiring a Traffic Impact Analysis and the determination whether the Analysis falls within Category I or II. **A developer shall first estimate the number of vehicle trips generated by the development to determine if a Traffic Impact Analysis is required and the applicable category. The developer shall obtain concurrence from the Regional Traffic Engineer on the number and assignment of trips generated by the development.** The developer may ask that the Regional Traffic Engineer assist them in estimating the number of trips for the purpose of determining whether a Traffic Impact Analysis is required for the proposed development.

If a developer agrees to perform mitigation improvements as specified by the Regional Traffic Engineer, preparation of a Traffic Impact Analysis may be waived.

240.5 ANALYSIS APPROACH AND METHODS

The following diagrams illustrate the roadway network accurately and should be included in each Traffic Impact Analysis report, unless specifically waived by the Regional Traffic Engineer:

- a. Site location and study area map
- b. Site plan
- c. Existing peak hour turning volumes
- d. Existing transportation system
- e. Collision diagram(s)
- f. Recommended improvements
- g. Anticipated transportation system
- h. Estimated site traffic generation (a table may be substituted)
- i. Directional distribution of site traffic
- j. Site traffic assignment (For each horizon year/Build out)
- k. Future traffic assignment without development for each horizon year
- l. LOS for future traffic without development for each horizon year
- m. Total future traffic, i.e. future traffic with development, for each horizon year
- n. LOS for total future traffic for each horizon year
- o. Existing number and severity of crashes
- p. Predicted or expected number and severity of future crashes without development for each horizon year
- q. Predicted or expected number and severity of future crashes with development for each horizon year

For Category I, many of the items may be documented within the text. For Category II, the items should be included in figures and/or tables. **All figures and tables shall be legible.**

Additional diagrams may be required to illustrate development construction phases and proposed alternatives when applicable.

When transportation planning models are used to generate present and/or future traffic conditions, it is the responsibility of the submitter to illustrate the diagrams above to provide a clear, step-by-step analysis.

The traffic analysis approach and methods are presented below.

(1) Study Area

The minimum study area shall be determined by project type and size in accordance with the criteria in Table 240-1. The extent of the study area may be enlarged or decreased depending on special conditions as determined by the Regional Traffic Engineer.

(2) Study Horizon Years

The study horizon years shall be determined by project type and size in accordance with the criteria in Table 240-1.

Table 240-1. Criteria for Determining Study Requirements

Analysis Category	Development Characteristic (c)	Study Horizons (a)	Minimum Study Area On the State Highway(s) (b)
I	Small Development < 500 peak hour trips	1. Opening year 2. 3 years after opening	1. Site access driveways 2. Adjacent signalized intersections and/or major unsignalized street intersections within a minimum of ½ mile.
II a	Moderate, single phase 500 - 1000 peak hour trips	1. Opening year 2. 5 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and/or major unsignalized street intersections within a minimum of 1 mile.
II b	Large, single phase > 1000 peak hour trips	1. Opening year 2. 5 years after opening 3. 10 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and/or major unsignalized street intersections within a minimum of 1 mile.
II c	Moderate or large, multi-phase (d, e)	1. Opening year of each phase 2. 5 years after opening of final phase for developments with < 1000 peak hour trips. 3. 10 years after opening of final phase for developments with > 1000 peak hour trips.	1. Site access driveways 2. All State highways, signalized intersections, and major unsignalized street intersections within a minimum of 1 mile dependent on category.
<p>(a) Assume full occupancy and build-out.</p> <p>(b) An enlarged study area may be required by the Regional Traffic Engineer for certain projects.</p> <p>(c) The number of trips shall include all trips made to the site, i.e. pass-by and diverted link trips.</p> <p>(d) Multi-phase developments shall not exceed 3 phases for purposes of analysis and mitigation.</p> <p>(e) Multi-phase developments should only be considered if the phases are separated by 2 or more years.</p>			

(3) Analysis Time Period

Both the morning and afternoon weekday peak hours shall be analyzed except:

- a. If the proposed project is expected to generate no trips or a very low number of trips during either the morning or evening peak periods, then the requirement to analyze one or both of these periods may be waived by the Regional Traffic Engineer, or
- b. **Where the peak traffic hour in the study area occurs during a different time period than the normal morning or afternoon peak travel periods (for example midday), or occurs on a weekend, or if the proposed project has unusual peaking characteristics, these additional peak hours shall also be analyzed.**

The peak hour of generation also shall be analyzed where its value exceeds the number of trips generated by the development during the peak hour of the adjacent highway.

(4) Seasonal Adjustments

The traffic volumes for the analysis hours shall be adjusted for the peak season, if appropriate, in cases where seasonal traffic data are available and approved by the Regional Traffic Engineer.

(5) Data Collection Requirements

All data shall be collected in accordance with the latest edition of the Institute of Transportation Engineers “Manual of Transportation Engineering Studies” or as directed by the Regional Traffic Engineer.

- a. Turning Movement Counts

Turning movement counts shall be obtained for all existing cross-street intersections to be analyzed during the morning and afternoon peak periods and the peak hour of the generator. Turning movement counts may be required during other periods as directed by the Regional Traffic Engineer. Data should be broken into 15 minute increments in order to determine if any atypical PHF exists.

Available turning movement counts may be extrapolated a maximum of two years with the concurrence of the Regional Traffic Engineer.

b. Daily Traffic Volumes

The current and projected daily traffic volumes shall be presented in the report. Available daily count data may be obtained from ADOT and extrapolated a maximum of two years with the concurrence of the Regional Traffic Engineer.

Traffic volume estimates from other developments within the study area which are expected to occur during the study horizon years should be obtained from ADOT and presented in the report.

Where daily count data are not available, mechanical counts may be required at the Regional Traffic Engineer's discretion.

c. Crash Data

Traffic crash data shall be obtained from ADOT for the most current three-year period available. Requests for crash data by entities outside ADOT should follow the Public Records Request process.

d. Roadway and Intersection Geometrics

Roadway geometric information shall be obtained including roadway width, number of lanes, turning lanes, vertical grade, location of nearby driveways, and lane configuration at intersections.

e. Traffic Control Devices

The location and type of traffic control devices, including signs, markings, signals, and other devices, shall be identified.

(6) Trip Generation

a. **The listed edition of the Institute of Transportation Engineers' "Trip Generation" shall be used for selecting trip generation rates.**

b. Other rates may be used with the prior approval of the Regional Traffic Engineer in cases where the Trip Generation reference does not include trip rates for a specific land use category, or includes only limited data, or where local trip rates have shown to differ from the "Trip Generation" rates.

(7) Trip Distribution and Assignment

- a. **Projected trips shall be distributed and added to the projected non-site traffic on the State highway(s).**
- b. **The specific assumptions and data sources used in deriving trip distribution and assignment shall be documented in the report.**

(8) Capacity Analysis

- a. **Level of service shall be computed for all signalized and unsignalized intersections within the study area in accordance with the listed edition of the Highway Capacity Manual. The level of service shall be calculated and reported by intersection, intersection approach, and lane group within the approach.**
- b. **For signalized intersections, operational analyses shall be performed for time horizons up to five years.** The planning method will be acceptable for time horizons beyond five years. Analyses may include modifications to the existing signal timing if the study area is within a coordinated signal system; Highway Capacity Manual signal timing methods should not be used for generating signal timing.
- c. Analyses may include an arterial analysis in accordance with the latest edition of the Highway Capacity Manual.
- d. **Peak hour factors used for future conditions shall not exceed 0.90. The following peak hour factors shall be used unless otherwise directed by the Regional Traffic Engineer:**

PHF = 0.80 for < 75 vph per lane
PHF = 0.85 for 75 - 300 vph per lane
PHF = 0.90 for > 300 vph per lane

(9) Traffic Signal Needs

- a. **A traffic signal needs study shall be conducted for all new proposed signals for the base year.** If the warrants are not met for the base year, they should be evaluated for each year in the study horizon.
- b. **Traffic signal needs studies shall be conducted in accordance with ADOT Traffic Engineering Guidelines and Processes 611.**
- c. **Existing signals adjacent to the development's access to the State highway shall be evaluated for continued signal**

warrants, phasing, timing, and coordination for each year in the study horizon.

(10) Crash Analysis

An analysis of three years of traffic crash data (and crash prediction, if required) calculations shall be conducted to determine if the level of safety will deteriorate due to the addition of site traffic.

(11) Queuing Analysis

A queuing analysis shall be conducted for all turn lanes, median openings, and ramp termini within the study area. Queuing analysis should be supported by HCM methodologies and represent 95th percentile conditions.

(12) Speed Considerations

Vehicle speed is used to estimate stopping and cross corner sight distances. In general, the posted speed limit is representative of the 85th percentile speed on the highway and may be used to estimate safe stopping and cross corner sight distances. However, the 85th percentile speeds for some highways are commonly higher than the posted speed limit. Therefore, a speed of 5 MPH over the posted speed limit or the 85th percentile speed, as directed by the Regional Traffic Engineer, should be used to estimate stopping and cross corner sight distances for highways with posted speeds of 55 MPH or greater.

(13) Improvement Analysis

The roadways and intersections within the study area shall be analyzed with and without the proposed development to identify any projected impacts in regard to level of service and safety.

- a. **Where the roadways, intersections, intersection approaches or lane groups will operate at arterial level of service C or better without the development, the traffic impact of the development on the State highway in the horizon year shall be mitigated to level of service C. Mitigation to level of service D may be acceptable in urban areas of over 50,000 population at the discretion of the Regional Traffic Engineer and with the concurrence of all affected municipalities.**
- b. **Where the roadways, intersections, intersection approaches or lane groups will operate below arterial level of service C in the horizon year(s) without the development, the traffic impact of the development shall be mitigated to provide the same level of service at the horizon year(s). If the roadways,**

intersections, intersection approaches or lane groups operate at a level of service of F before the development – mitigation is required to maintain the same degree of level of service F (i.e. same level of delay) which would occur without the development.

(14) Certification

The Traffic Impact Analysis shall be prepared under the supervision of a registered Professional Engineer (Civil). For analyses prepared by persons external to ADOT, the report shall be sealed and signed.

240.6 APPROVALS

The traffic impact analysis shall be submitted to the Regional Traffic Engineer for review and approval.

The Regional Traffic Engineer or their designated representative shall approve or disapprove the Traffic Impact Analysis.

240.7 STUDY AND REPORT FORMAT

(1) Introduction and Summary

- a. Purpose of report and study objectives
- b. Executive summary
 - Site location and study area
 - Development description
 - Principal findings
 - Conclusions
 - Recommendations

(2) Proposed Development

- a. Site location
- b. Land use and intensity
- c. Site plan (readable version shall be provided)
 - Access geometrics
- d. Development phasing and timing

(3) Study Area Conditions

- a. Study area
 - Area of significant traffic impact
 - Influence area

- b. Land use
 - Existing land use
 - Anticipated future development
 - c. Site accessibility
 - Existing and future area roadway system
- (4) Analysis of Existing Conditions
- a. Physical characteristics
 - Roadway characteristics
 - Traffic control devices
 - Transit service
 - Pedestrian/bicycle facilities
 - Existing transportation demand management
 - b. Traffic volumes
 - Daily, morning, and afternoon peak periods (two hours), and others as required
 - c. Level of service
 - Morning peak hour, afternoon peak hour, and other as required
 - d. Safety
 - e. Data sources
- (5) Projected Traffic
- a. Site traffic forecasting (each horizon year)
 - Trip generation
 - Mode split
 - Pass-by traffic (if applicable)
 - Trip distribution
 - Trip assignment
 - b. Non-site traffic forecasting (each horizon year)
 - Projections of non-site traffic by ADOT may be used. For larger developments and study areas, a more comprehensive method may be required which includes: trip generation, trip distribution, modal split, and trip assignment.
 - c. Total traffic (each horizon year)
- (6) Traffic and Improvement Analysis
- a. Site access
 - b. Level of service analysis
 - Without project including programmed improvements (each horizon year)
 - With project including programmed improvements (each horizon year)
 - c. Roadway improvements
 - Improvements programmed by ADOT or others to accommodate non-site traffic
 - Additional alternative improvements to accommodate site traffic

- d. Traffic safety
 - Sight distance
 - Acceleration/deceleration lanes, left-turn lanes
 - Adequacy of location and design of driveway access
 - Crash predictions
 - e. Pedestrian and bicyclist considerations
 - f. Speed considerations
 - g. Traffic control needs
 - h. Traffic signal needs (base plus each year in five-year horizon)
 - i. Transportation demand management
- (7) Conclusions
- (8) Recommendations
- a. Site access
 - b. Roadway improvements
 - Phasing
 - c. Transportation demand management actions if appropriate
 - d. Other
- (9) Appendices
- a. Traffic counts
 - b. Capacity analyses worksheets
 - c. Traffic signal needs studies
 - d. Accident data, analysis, and summaries

240.8 DESIGN REFERENCES

- A. **Designs shall be in accordance with or exceed current ADOT Design and Construction standards and guidelines as applicable and appropriate.**
- B. **Capacity analyses shall be in accordance with the latest edition of the Highway Capacity Manual.**
- C. **Traffic signal needs studies shall be in accordance with ADOT TGP 611.**

Exhibit 240-A. Traffic Impact Analysis Pre-Submittal Form

Project Name: _____
Developer/Owner: _____
Phone Number: _____
Email: _____

Project Location

State Route (with nearest MP or Street): _____
Local Jurisdiction: _____

Stage of Development (choose one)

Planning/Zoning

Development Plan

Brief Description of Project (land use, intensity, timeframe/phasing)

Proposed Access (number, location, restrictions)

Preliminary Assumptions (provide as attachment)

- Trip Generation
- Study Horizon Years
- Trip Distribution
- Pass-By Or Internal Capture
- Future Roadway Network
- Study Area Intersections

Traffic Study Type (choose one)

- Transportation Planning Study
- Traffic Impact Analysis
- Traffic Impact Statement

Traffic Study Preparer

Firm Name: _____
Contact: _____
Phone: _____
Email: _____

Pre-Submittal Forms are not required for each project but are a useful tool to reduce the number of submittals/reviews and aid development timeframes. When submitted, Regional Traffic Engineering staff will review and confirm the form in a timely manner. Changes to the above information should be provided in writing. A hard copy of an approved Pre-Submittal Form shall be included in the Study appendix.

Approval by: _____ Date: _____