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## **240 TRAFFIC IMPACT ANALYSIS & STATEMENT**

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The purpose of this document is to establish uniform guidelines for conducting traffic impact analyses for a proposed new redevelopment of an existing site, or an expansion of an existing development requesting access or modification of access to the State highway system. Traffic Impact Analysis (TIA) and Traffic Impact Statement (TIS) will herein be referred to as traffic studies.

### **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 transportation system. Access to the State highway system is managed through the Encroachment Permit process. This 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 (whether direct or indirect access) may impact traffic operations on the highway, a traffic study shall be prepared for developments which desire such access and shall meet the specific requirement stated below.

The purposes of the traffic study procedures presented herein are to:

- Provide information to the permit applicant and/or their representatives on specific requirements of the analysis, and
- Level of Analysis that is required (Traffic Impact Analysis, Traffic Impact Statement, or Transportation Planning Study)
- Ensure consistency in the preparation and review of traffic study.

The procedures outlined herein present the minimum information required when conducting a traffic study. The preparer of the traffic study 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, Traffic Impact Analysis Pre-Submittal Form, to be used to compile information for the analysis. The Regional Traffic Engineer shall make the final decision on whether a traffic statement may be substituted for a Traffic Impact Analysis.

### **240.2 REFERENCES**

American Association of State Highway and Transportation Officials:

- Highway Safety Manual current Edition
- Highway Safety Manual Supplement, current Edition

Arizona Department of Transportation:

- ADOT TGP 611, "Traffic Signal Needs Studies"
- ADOT Roadway Design Guidelines, latest edition

Institute of Transportation Engineers:

- Manual of Transportation Engineering Studies, current edition
- Trip Generation, current edition
- Transportation and Land Development, current edition

Transportation Research Board:

- Highway Capacity Manual, current edition

### 240.3 DEFINITIONS

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

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.

Level of Service (LOS) - A qualitative measure used to relate the quality of motor vehicle traffic service. LOS is used to analyze roadways and intersections by categorizing traffic flow and assigning quality levels of traffic based on performance measure like vehicle speed, density, congestion, etc.

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

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.

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

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 Impact - The effect of site traffic on the operation and safety of the surrounding roadway network.

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

Traffic Impact Statement (TIS) – 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.

**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, and/or the modification of the site plan.

**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.

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

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

#### 240.4 REQUIREMENTS

A TIS may be required for all new developments, redevelopment of existing sites or additions to existing developments which generate less than 100 trips during any one hour of a day with no other negative factors; this will serve as the only traffic impact study document. It shall include at a minimum: the site location and access points, and expected trip generation. The following factors may require additional traffic analysis even if the development generates less than 100 peak hour trips.

- 1) Traffic concerns that currently exist and could be aggravated by the proposed development
- 2) Public concerns regarding the development
- 3) Negative impact on adjacent neighborhoods
- 4) Proximity of site driveways to existing driveways or intersections
- 5) Turn Lane Analysis per TGP 245 and 430
- 6) Other local issues that may be present

A TIA shall be required for all new developments, redevelopment of existing sites 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 TIA 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 peak hour of the highway or during the peak hour of the generator.

The Regional Traffic Engineer makes the final decision on requiring a TIA 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 as well as the traffic distribution on the network system. The developer may ask that the Regional Traffic Engineer assist them in estimating the number of trips for the purpose of determining whether a TIA is required for the proposed development. This information shall be documented on Exhibit 240-A, Traffic Impact Analysis Pre-Submittal Form, found at the end of this document.

Under certain conditions, identified by the Regional Traffic Engineer, the TIA may be required to analyze traffic impacts during construction of the development. High volumes of construction traffic shall be mitigated prior to the start of construction in order to provide safe access during construction.

If a developer agrees to perform mitigation improvements as specified by the Regional Traffic Engineer, preparation of a TIA 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) with existing number and severity of crashes
- f. Anticipated transportation system
- g. Estimated site traffic generation (a table is required)
- h. Directional distribution of site traffic
- i. Site traffic assignment (For each horizon year/Build out)
- j. Future traffic assignment without development for each horizon year
- k. LOS for future traffic without development for each horizon year
- l. Total future traffic, i.e. future traffic with development, for each horizon year
- m. LOS for total future traffic for each horizon year

- n. Predicted or expected number and severity of future crashes with and without development for each horizon year
- o. Recommended Off-site improvements

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)
Traffic Statement	Small Development <100 peak hour trips	1. Opening year	1. Site access driveways 2. Immediate impacts determined by the RTE
I	Small Development 100 $\geq$ and < 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 $\geq$ and < 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 $\geq$ 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.
(a) Assume full occupancy and build-out. (b) An enlarged study area may be required by the Regional Traffic Engineer for certain projects. (c) The number of trips shall include all trips made to the site, i.e. pass-by and diverted link trips. (d) Multi-phase developments shall not exceed 3 phases for purposes of analysis and mitigation. (e) Multi-phase developments should only be considered if the phases are separated by 2 or more years.			

(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) Traffic Volume 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.

The traffic volumes may also be adjusted to account for the internal capture and bypass trips as defined in the Institute of Transportation Engineers Trip Generation Manual

(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.

Only counts that are within two years shall be used. Counts older than two years may be used with the concurrence from the RTE

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 latest 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 latest edition of the Highway Capacity Manual or with any software that uses HCS methodology. 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 Study

- 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. A Traffic Signal Needs Study shall be conducted in accordance with ADOT Traffic Guidelines and Processes 611.
- c. Existing traffic 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, in accordance with Table 240-1.

(10) Crash Analysis

An analysis of three years of traffic crash data and crash prediction per HSM (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 the longest queue length from the following three methods:

- 1) HCM methodologies that represent the 95<sup>th</sup> percentile conditions.
- 2) TGP 430
- 3) Synchro Queue

(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.
- c. In some situations, a series of individual developments in the same general area may not warrant any highway improvements on their own merit. However, when combined with the other nearby developments, the total combined impact could warrant highway improvements. Under this scenario, each development in the area shall be required to contribute their fair share of the cost of the ultimate

highway improvements based on their trip generation as a percentage of the overall trip generation.

(14) Certification

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

240.6 APPROVALS

240.7 STUDY AND REPORT FORMAT

(1) Introduction and Summary The TIA shall be submitted to the Regional Traffic Engineer for review and approval. The Regional Traffic Engineer or their designated representative shall approve, provide acceptance, or disapprove the TIA. Should the results of the Traffic Study indicate mitigation measures are necessary to maintain traffic operations per any other ADOT TGP, these mitigation measures will be required to be provided by the developer/owner at no cost to the Department. These mitigations will be provided through the ADOT Encroachment Permit process.

- 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. Queueing analysis for all left and right turn lanes (show existing storage bay length, existing queues, and projected queues.)
- d. Roadway improvements
  - Improvements programmed by ADOT or others to accommodate non-site traffic
  - Additional alternative improvements to accommodate site traffic
- e. Traffic safety
  - Sight distance
  - Acceleration/deceleration lanes, left-turn lanes

- Adequacy of location and design of driveway access
- Crash predictions
- f. Pedestrian and bicyclist considerations
- g. Speed considerations
- h. Traffic control needs
- i. Traffic signal needs (base plus each year in five-year horizon)
- j. Transportation demand management

(7) Conclusions

(8) Recommendations

- a. Site access
- b. Offsite roadway improvements
  - Phasing based on Horizon Years, if applicable.
- 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

(10) Electronic Files

- a. PDF copy of the Report
- b. Synchro File

240.8 Re-evaluation

Any TIA older than 24 months shall be updated to reflect the current roadway condition and volumes, as determined by the Regional Traffic Engineer. All assumptions in the original studies shall be validated unless approved by the Regional Traffic Engineer.

**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 Required (choose one)  Yes  No

Traffic Study Type (choose one if yes, none if no)

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: \_\_\_\_\_