

Pinal County  
Traffic Impact Assessment  
Guidelines & Procedures

January 2007

The purpose of this manual is to establish uniform guidelines for conducting traffic impact analyses for a proposed new, or an expansion of, an existing development requesting access, either direct or indirect, or modification of access to the Pinal County Highway system and those roadways under its jurisdiction.

The regions within the boundary of Pinal County are experiencing high growth rates and therefore special attention to all proposed or modified developments should carefully examine the impacts resulting from the site's traffic distribution onto the existing or programmed roadway network.

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## SECTION 1 - IMPLEMENTING STATEMENT

Pinal County desires to operate a safe and efficient County 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 County highway system is managed through the right-of-way permit process. This permit process requires those desiring access to the County highway system to apply for a right-of-way use permit. Since access to a County highway for a development may impact traffic on the existing highway/roadway network, a Traffic Impact Analysis shall be prepared for developments which desire a permit and meet the specific requirements stated below.

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

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

Provide a Cost Sharing Analysis for Impacts to and Improvement of Existing Facilities.

The procedures outlined herein present the minimum information required when conducting a Traffic Impact Analysis (TIA). The preparer of the Traffic Impact Analysis shall contact the Pinal County Traffic Engineering Section to discuss the scope of the analysis, methodology, level of detail required for the specific project and the study limits prior to beginning the analysis.

## SECTION 2 - REFERENCES

*Traffic Studies*, Section 240 of the ADOT Traffic Engineering Policies, Guidelines and Procedures, Arizona Department of Transportation, January 2000.

*Trip Generation*, 7<sup>th</sup> Edition, Institute of Transportation Engineers, 2003

*Trip Generation Handbook*, Institute of Transportation Engineers, March 2001

*Highway Capacity Manual*, Transportation Research Board. 2000

*A Policy on the Geometric Design of Highways and Streets*, 5th edition, 2004, American Association of State Highway and Transportation Officials.

*MCDOT Traffic Impact Procedures*, Maricopa County Department of Transportation.

*Traffic Impact Analysis Report Guidelines*, Los Angeles County Department of Public Works, January 1, 1997.

*Traffic Manual*, Idaho Department of Transportation, January 2006

## SECTION 3- DEFINITIONS

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

**Annual Average Daily Traffic (AADT)** - is the total volume passing a point or segment of a highway or roadway facility, in both directions, for one year, divided by the number of days in the year.

**Background Traffic** - refers to an estimate of future traffic within the vicinity of the proposed development, without the site development traffic, but with existing traffic adjusted for expected growth, and addition of traffic from major vested projects.

**Diverted Linked Trips** – trips attracted from the traffic volume on roadways within the vicinity of the generator but that require a diversion from that roadway to the site.

**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.

**Internal Capture Rate** - is the percentage of the total number of trips from a site that are contained within on-site circulation systems only.

**Intersection Level of Service (LOS)** - The efficiency of traffic operations at a location is measured in terms of level of service (LOS), which is a description of traffic performance at intersections. The level of service concept is a measure of average operating conditions at intersections during an hour. It is based on volume-to-capacity (V/ C) ratio with the ability to carry (the capacity) compared to the level of traffic during the peak hours (volume). Levels range from A to F with A representing excellent (free-flow) conditions and F representing extreme congestion. Intersections with vehicular volumes, which are at or near capacity, experience greater congestion and longer vehicle delays.

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

**Multi-Use Development** – typically a single real-estate project that consists of two or more ITE land use classifications between which trips can be made without using the off-site road system.

**Pass-By Trips** – made as intermediate stops on the way from an origin to a primary trip destination without a route diversion.

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

**Peak Hour Factor (PHF)** - is the ratio of the hourly volume to four times the peak 15-minute volume.

**Peak Hour of Adjacent Street Traffic** – the hour when the combination of the trips generated by a site and the volume of traffic passing the site on adjacent streets is the highest.

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

**Peak Season** - consists of the 13 consecutive weeks of the year with the highest traffic volume.

**Peak Season Weekday Average Daily Traffic (PSWADT)** - is the average weekday traffic during the peak season measured as the highest 13 consecutive weeks during the year.

**Traffic Impact** - The effect of site traffic on highway and/or roadway operations and safety.

**Traffic Impact Analysis** - 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 improvements which may be necessary to accommodate the expected traffic.

**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 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.

**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.

**V/C Ratio** - is the ratio of demand flow rate to capacity for a traffic facility.

## SECTION 4 - REQUIREMENTS

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 or as required by the County Engineer.

Under the condition whereby the land use of a portion of the development has not been established and approved by both the Development Services Department and the Traffic Engineering Section of the Public Works Department, such uses will not be included within the site analysis. Therefore, once the land use(s) have been determined the traffic impact analysis for those specific elements will be considered as a separate study.

The specific analysis requirements and level of detail are determined by the following categories:

### 4.1 Category I

#### Characteristic:

Developments which generate 100 or more peak hour trips but less than 500 trips during the morning or afternoon peak hour of the development (overall if phased improvements) on the adjacent road(s) 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, a high number of traffic accidents, etc., or
- b. The sensitivity of the adjacent neighborhoods or other areas where the public may perceive an adverse impact, or
- c. The proximity of proposed site driveways to existing driveways or intersections, or
- d. Other specific problems or safety related concerns that may be aggravated by the proposed development.

## 4.2 Category II

### Characteristic:

Developments which generate more than 500 trips during the morning or afternoon peak hour of the development (overall if phased improvements) on the adjacent road(s) or during the peak hour of the generator.

The Pinal County Traffic Engineering Section makes the final decision on requiring a Traffic Impact Analysis and determining 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 Pinal County Traffic Engineering Section on the number of trips generated by the development. The developer may request that the Traffic Engineering Section assist in estimating the number of trips for the purpose of determining whether a Traffic Impact Analysis is required for the proposed development.

Under no circumstances may a developer waive the preparation of a Traffic Impact Analysis without the written consent of the Pinal County Engineer or his/her authorized representative.

## **SECTION 5 - ANALYSIS APPROACH AND METHODOLOGY**

### **5.1 First Step**

Prior to beginning any analysis the developer or his authorized representative shall contact the Pinal County Traffic Engineering Section and discuss the elements, approach, methodology, existing and programmed roadway network improvements, previous studies and scope of the study. The results of the discussion should be documented and presented within an appendix of the study.

The Traffic Impact Analysis approach and methodology are presented herein.

### **5.2 Study Area**

The minimum study area shall be determined by development's size and overall trip generation in accordance with the criteria in Table 1. The limits of the study area may be enlarged or decreased as determined by the Pinal County Traffic Engineering Section.

### **5.3 Study Horizon Years**

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

**Table 1  
Criteria for Determining Study Requirements**

<b>Analysis Category</b>	<b>Development Characteristics (d)</b>	<b>Study Horizons (a)</b>	<b>Minimum Study Area Limits (c)</b>
<b>I</b>	Small Development; < 500 peak hour trips	1. Opening year	1. Site access driveways 2. Adjacent signalized intersections and/or major unsignalized street intersections within ½ mile of the site boundary.
<b>II a</b>	Moderate Development; 500 – 1,000 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 1 mile of the site boundary.
<b>II b</b>	Large Development; > 1,000 peak hour trips but < 1,500 peak hour trips	1. Opening year 2. 5 years after opening (b) 3. 10 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and/or major unsignalized street intersections within 2 miles of the site boundary.
<b>II c</b>	Regional Development; > 1,500 peak hour trips	1. Opening year of each Phase 2. 5 years after opening (b) 3. 10 years after opening	1. Site access driveways 2. All State highways, signalized intersections, and major unsignalized street intersections within 3 miles of the site boundary.

- (a) Assume full occupancy and build-out.
- (b) Not required if the traffic impacts of the project are fully mitigated 10 years after opening with existing conditions plus 5-year programmed improvements.
- (c) An enlarged study area may be required by the Pinal County Traffic Engineering Section for certain projects.
- (d) The number of trips shall include all trips made to the site, i.e. pass-by and diverted link trips.

#### **5.4 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 Pinal County Traffic Engineering Section, 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 generator also shall be analyzed where its value exceeds the number of trips generated by the development during the peak hour of the adjacent highway (e.g., schools, certain commercial...etc.).

#### **5.5 Seasonal Adjustments**

The traffic volumes for the analysis hours should be adjusted for the peak season if appropriate. Use of seasonal adjustment factors should be approved by the Pinal County Traffic Engineering Section. The intent is not to assess maximum peak hourly volumes, such as the day after Christmas for a retail development, but to address peak seasonal volumes. If traffic counts were collected in a retirement community in July, and the peak traffic period occurs during the winter months, the counts should be adjusted to winter months.

Under the condition whereby the majority (> 50%) of the development's trips are anticipated to travel to external locations (e.g., Phoenix, Tucson...etc.), and travel along State highways, then the author should obtain seasonal adjustment factors (ATR) from the Arizona Department of Transportation and determine the applicability of such factors to any collected daily traffic counts.

#### **5.6 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 Pinal County Traffic Engineering Section.

- (A) 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 Pinal County Traffic Engineering Section.

Available turning movement and/or daily traffic counts may be used for the analysis provided the date of the collected information is no more than one year from the date of the initial report submittal with the written concurrence of the Pinal County Traffic Engineering Section.

- (B) The current and projected daily traffic volumes shall be presented in the report. Available daily count data may be obtained from previous transportation and traffic studies as prepared by Pinal County and extrapolated a maximum of one year with the concurrence of the Pinal County Traffic Engineering Section.

Traffic volume estimates from other approved developments within the study area which are expected to occur during the study horizon years should be obtained directly from those respective developments and included within the study report.

Where daily count data are not available or such counts are over 1 year old, mechanical counts shall be required.

- (C) Traffic accident data shall be obtained from the Pinal County Sheriff's Office or other source as approved by the Pinal County Traffic Engineering Section for the most current three-year period available. Any collected records must be presented in the report.
- (D). 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) The location and type of traffic controls shall be identified.
- (F) The author shall obtain from Pinal County a list of current or planned developments expected to occur during the study horizon years within the study area and present the findings within the report. Traffic data for those developments shall be obtained directly from the respective developer or by direct (e.g., site visit) determination or by estimate.
- (G) The author shall obtain from the Pinal County Public Works Department any current or planned County transportation improvement projects expected to occur during the study horizon years within the study area and type of traffic controls used/designed shall be identified.

## 5.7 Trip Generation

- (A) The latest edition of the Institute of Transportation Engineers' "Trip Generation" shall be used for selecting trip generation rates. For studies that may require an extended period of time to complete and if during this time a revision to the ITE Manual is made, the author shall obtain approval from the Pinal County Traffic Engineering Section to continue to use data as provided within the previous edition.
- (B) Other rates may be used with the prior approval of the Pinal County Traffic Engineering Section in cases where "Trip Generation" 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.
- (C) Reduction, due to internal interactions or as that applied to true mixed-use development, in the estimated site trip generation shall be in accordance with the methodology published within the latest edition of the Institute of Transportation Engineers' "Trip Generation Handbook". In general, reduction of trip generation between residential dwellings is not acceptable without prior approval from Pinal County Traffic Engineering Section.
- (D) In general, trip distribution for an unknown land use, in case of commercial sub regions multi or mixed-use sites shall not be included within the analyses. Once the land use has been determined and approved by the Pinal County Planning and Development Department the trip generation associated with the land use can be analyzed and included within a separate report if necessary.

## 5.8 Trip Distribution and Assignment

- (A) Projected trips shall be distributed and added to the projected non-site traffic (e.g., background, adjacent development...etc.) on the study area driveways and/or roadways.
- (B) The specific assumptions, methodology and data sources used in deriving trip distribution and assignment shall be documented in the report.
- (C) Trip distribution shall only be applied to existing County roadways and/or highways. Trip distribution may be applied to County programmed roadway improvements with prior approval of the Pinal County Traffic Engineering Section. Connections shall be complete to the ultimate point of trip destination. Trips shall not be assigned onto unimproved roadways that are not constructed or maintained by the



County, outside the improvement envelope of the site, or roadways that will be improved and/or constructed after the horizon year of the site. Trip distribution may be permitted on roadways expected to be improved by other surrounding developments provided such is evaluated as a secondary trip distribution pattern.

## 5.9 Capacity Analysis

- (A) Level of Service (LOS) shall be computed for signalized and unsignalized intersections in accordance with the latest edition of the “Highway Capacity Manual”.
- (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.
- (C) Analyses should include a roadway capacity analysis in accordance with the latest edition of the “Highway Capacity Manual”. For urban roadways, and rural highways where signal controlled intersections are at or less than 1 mile apart, the capacity of the roadway is generally dominated by the capacity of the adjacent signal controlled intersections. Roadway levels of service need not be computed for these facilities.
- (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 Pinal County Traffic Engineering Section:

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

## 5.10 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 five-year horizon.
- (B) Traffic signal needs studies shall be conducted per the ADOT Traffic Manual section on the Traffic Signal Needs Study.
- (C) Existing signals adjacent to the development’s access to the County highway shall be evaluated for continued signal warrants, phasing, timing, and coordination for each year in the five-year horizon.

### **5.11 Accident Analysis**

An analysis of three-years of accident data shall be conducted to determine if the level of safety will deteriorate due to the addition of site traffic or if special traffic safety concerns may result in an increase in traffic accident rates for a roadway segment(s).

### **5.12 Queuing Analysis**

A queuing analysis shall be conducted for all turn lanes under stop or signal control within the study area and shall include all turn lanes at site access points.

Various methods for computing queue lengths may be used. The following approximate methods for estimating queue lengths for signal controlled and non-signal controlled intersections are given below.

For signal controlled intersections:

$$\text{Storage length} = 2 \times (\text{vehicles/hour}) / (\text{cycles/hour}) \times 25 \text{ feet}$$

For non-signal controlled intersections:

$$\text{Vehicles/2 min period} = (\text{vehicles/hour}) / (30 \text{ periods/hour})$$

$$\text{Storage length} = (\text{vehicles/hour}) / (30 \text{ periods/hour}) \times 25 \text{ feet}$$

All results should be rounded up to the nearest 25 foot interval. The minimum turn lane queue length shall be 100 feet.

Turn lane warrants shall be applied to all intersections within the study area where the use of turn lanes are not apparent or required to meet the minimum Level of Service during an intersection's analysis. Turn lane warrants shall be evaluated in accordance within the warrant analysis contained within the Appendix of this manual.

### **5.13 Speed Considerations**

Vehicle speed is used to estimate safe stopping and cross corner sight distances. In general, the posted speed limit is representative of the 85<sup>th</sup> 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 and roadways are commonly higher than the posted speed limit. Therefore, a speed of 10 MPH over the posted speed limit or the 85th percentile speed, as directed by the Pinal County Traffic Engineering Section, should be

used to estimate safe stopping and cross corner sight distances for highways and/or roadways with posted speeds of 35 MPH or greater.

#### **5.14 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 highway will operate at a level of service C or better (i.e., worse case approach for unsignalized intersections and overall performance for signalized intersection) without the development, the traffic impact of the development on the highway shall be mitigated to level of service C.
- b. Where the highway will operate below a 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 (i.e., based on the delay time not merely the resulting LOS) at the horizon year(s).

#### **5.15 Regionally Significant Routes Statement**

The author shall include a statement that describes as to if the project is located along or has direct access onto a Regionally Significant Route as explained within the Regionally Significant Route/Access Management Concept Study Report, and how that would affect access management.

#### **5.16 Certification**

The Final Traffic Impact Analysis shall be prepared under the supervision of a registered Professional Engineer (Civil) authorized to practice in the State of Arizona.

Any Preliminary Traffic Impact Analysis, for the purposes of review by Pinal County, may be stamped, labeled or sealed in accordance with the rules and requirements of the Arizona State Board of Technical Registration. All Final Reports and associated documents must be sealed and signed in accordance with said rules.

## **SECTION 6 - STUDY AND REPORT FORMAT**

The study cover sheet shall contain the Pinal County tracking number assigned by the Development Services Department. If a number is not available then the author should state such on the cover (Pinal County Tracking No. N/A).

All reports must be correctly stamped or sealed in accordance with the requirements of the Arizona State Board of Technical Registration.

### **6.1 Introduction and Summary**

The report Introduction and Summary section shall contain at a minimum the following subsections.

- a. Purpose of Report and Study Objectives
- b. Executive Summary
  - i. Site Location and Study Area general description
  - ii. General Description of the Development
  - iii. Estimated Trip Generation for the Entire Development
  - iv. Assumptions used within the Study
  - v. Principal Findings
  - vi. Conclusions
  - vii. Recommendations

Additional guidance is provided herein.

#### **6.1.1 Site Location and Study Area**

The Site Location and Study Area should be shown on a street map and should show: the boundary of the proposed development, the study area (showing any and all existing roadways and intersections to be examined under the study), any necessary roadway network elements mentioned within the study's report body and surrounding land use. The site layout should not be shown within this section of report.

#### **6.1.2 General Description of the Development**

The general description of the development should include a narrative of the land uses proposed for the overall development and the land uses examined within this report. Certain mix-use developments tend to examine only the residential uses under an initial study and at a later date provide an update or separate report to examine commercial uses once

they have been determined. Such should be stated clearly within this section of the study report.

### **6.1.3 Estimated Trip Generation for the Entire Development**

The estimated resulting trip generation for the entire site should be stated clearly and agree with the land uses described in Section 6.1.2. The figure should not consider pass-by or diverted link trips or trip generation of adjacent developments.

### **6.1.4 Assumptions used within the Study**

The author should clearly outline all assumptions employed within the report. Such elements may include trip distribution patterns, trip generation from adjacent development(s), published planned roadway network connections necessary to the development's primary trip distribution, roadway improvements necessary to accommodate background traffic alone (if necessary), any significant roadway constraints that would effect the site's trip distribution (e.g., a narrow bridge, limited right-of-way...etc.), seasonal adjustments or the lack thereof, inclusion or exclusion of pedestrian traffic and reasons for such, build-out year of the development, development phasing and/or timing (e.g., 300 homes built and occupied per year), among other possible assumptions.

### **6.1.5 Principal Findings**

The report should provide a brief outlined summary of the study's principal finding(s) including resulting Levels of Service and Roadway Capacity.

### **6.1.6 Conclusions**

The report should provide a brief outlined summary of the study's general conclusions.

### **6.1.7 Recommendations**

This section should contain sufficient information with regard to the recommendations made for the internal site roadway network (e.g., turn lane and associated storage, safety concerns and associated mitigation measures,..etc.) and the external roadway network (e.g., additional lanes, traffic signals, safety improvements, median construction...etc.).

## **6.2 Proposed Development**

This portion of the report should contain detailed information regarding the proposed development.

- a. Site Location
- b. Land Use, Intensity and/or Density
- c. Site Plan
- d. Development Phasing and Timing

Additional guidance is provided herein.

### **6.2.1 Site Location**

This section should include a general narrative of the site location.

### **6.2.2 Land Use, Intensity and/or Density**

This section should include detailed information with regard to the planned land uses within the site. Generally, a table is acceptable. For phased development plans, separate tables for each horizon year of the development are required.

### **6.2.3 Site Plan**

On a sheet no larger than 11"x17", the author should clearly show the complete layout of the site including: commercial areas, schools, internal and contiguous roadway network, phasing limits (if applicable), street names, scale or dimensions showing the distances between main study elements (e.g., distances to and/or between intersections...etc.) and any other information that would be relative when reviewing the study's content, conclusions and recommendations.

On a 24"x36" sheet, contained within the appendix of the report, the author shall show the site plan including existing and proposed traffic control features such as medians, opposing streets and driveways...etc. along the project's entire frontage within public rights of way.

### **6.2.4 Development Phasing and Timing**

This section should contain sufficient information regarding the phasing of the development and/or the anticipated timing. For large developments the phasing should be clearly stated as such developments may develop only isolated portions one at a time. Development phasing should be based on

reasonable building construction and occupation rates. In general, developments are not currently known to be built and occupy over a thousand residential homes within a single year unless otherwise approved by the Pinal County Traffic Engineering Section.

### **6.3 Study Area Conditions**

This portion of the report should contain detailed information regarding the conditions that occur or are planned to occur within the study area.

- a. Study Area
  - i. Area of Significant Traffic Impact
  - ii. Influence Area
- b. Land Use
  - i. Existing Land Use
  - ii. Anticipated Future Development
- c. Site Accessibility
  - i. Existing and Future Roadway Network

Additional guidance is provided herein.

#### **6.3.1 Study Area**

This section should include at a minimum the overall study area as defined in Table 1 and an additional distance outside of the limits of the study of no less than one mile. This information should be shown on a map with a sheet size no larger than 11"x17".

#### **6.3.2 Land Use**

This section should include a narrative and/or map discussing the land use surrounding the subject site and any planned developments within the influence area. Information regarding surrounding planned developments should include the planned opening year and any horizon years that are known or planned to occur.

#### **6.3.3 Site Accessibility**

This section should provide a narrative and an associated map detailing access into the site. The Site Layout Map, if sufficient detail is shown, may be used in place of this.

## **6.4 Analysis of Existing Conditions**

This portion of the report should contain detailed information regarding the results of the analysis of the existing conditions within the study limits including but not limited to roadway capacity and intersection Level of Service.

- a. Physical Characteristics
  - i. Roadway Characteristics
  - ii. Traffic Control Devices
  - iii. Transit Service
  - iv. Pedestrian & Bicycle Facilities
  - v. Existing Transportation Demand Management
- b. Traffic Volumes
  - i. Daily, morning and afternoon peak periods (two hours minimum), and others as required.
- c. Level of Service
  - i. Morning peak hour, afternoon peak hour and others as required.
- d. Traffic, pedestrian and bicycle safety
- e. Data Sources

Additional guidance is provided herein.

### **6.4.1 Physical Characteristics**

This section should include detailed information regarding the characteristics of the major existing roadways, main access facilities to be used by the development and other transit facilities located within or immediately contiguous to the study area. Characteristics of the roadways should include: general roadway alignment information (e.g., horizontal curves, sharp vertical curves), existing right-of-way widths, bridges and major culvert systems...etc.

The author should also include a narrative regarding the existing traffic control devices within or immediately adjacent to the study limits such as stop controlled intersections, traffic signals, posted and/or the 85<sup>th</sup> percentile speed...etc.

Mass transit service does not in general exist within Pinal County however rail lines are present in several areas of the County and therefore should be contained within the report.

Pedestrian and bicycle facilities should be included within the report. Such are becoming a standard element within high growth areas of the County.



#### **6.4.2 Traffic Volumes**

Existing daily, morning and afternoon peak period should be documented in accordance with ITE's Manual of Traffic Engineering Studies. Morning and afternoon peak period documentation alone in general are not sufficient for developments including non-residential development or for developments located adjacent to regional commercial or industrial zones given that the peak period may not coincide with the peak hour of the adjacent street.

#### **6.4.3 Level of Service**

The existing level of service and roadway capacity shall be determined and presented within the study report. Levels of service and roadway capacity estimates shall be presented for the morning and afternoon peak period and that of the peak hour of the generator of the proposed development as determined by the author.

If the resulting Level of Service and/or roadway capacity are below "C" then the author shall include within the report a recommendation of what minimum improvements are necessary to elevate any substandard conditions to that of LOS = C. Such will be considered as the background conditions for any horizon years, excluding the opening year.

#### **6.4.4 Traffic, Pedestrian and Bicycle Safety**

Safety elements are of paramount concern given that such facilities may not be present within the study or that the existing facilities are substandard. The author shall conduct field observations to determine what, if any, safety elements are present within the study area and document the findings within the report.

#### **6.4.5 Data Sources**

The author will document and state all data sources used to determine the existing conditions within the study area.

## **6.5 Projected Traffic**

This portion of the report should contain detailed information regarding the projected traffic resulting from the proposed development and that resulting from non-site traffic (i.e., background traffic, adjacent traffic...etc.).

- a. Site Traffic Forecasting (each Horizon Year)
  - i. Trip Generation
  - ii. Mode Spilt
  - iii. Pass-by Traffic
  - iv. Trip Distribution
  - v. Trip Assignment
- b. Background Traffic Forecasting (each Horizon Year)
- c. Adjacent Traffic Forecasting (each Horizon Year)
- d. Total Traffic Condition (each Horizon Year)

Additional guidance is provided herein.

### **6.5.1 Site Traffic Forecasting**

This section should provide a detailed accounting of the base trip generation developed by the site or when the development is expected to be phased then an accounting of each phase's trip generation should be included. A tabular format is highly recommended.

The trip generation rate(s) should be taken from the ITE's most recent edition of the Trip Generation Manual or other trip generation sources if approved by the Pinal County Traffic Engineering Section prior to the analysis (See Section 5.1). The ITE Manual provides extensive trip generation rates and equations for various land use types. The author is highly recommended to use the more conservative trip generation resulting from either the average rate or the associate equation if available. If the development contains land use types that can not be determined from the categories listed within the Trip Generation Rate manual then the author should discuss which category or method of trip generation estimate to be used with the Pinal County Traffic Engineering Section.

If the author must estimate the trip generation of adjacent development then the results of such will be included within a separate table.

### **6.5.2 Pass-by Traffic**

Pass-by, diverted link and internal capture computations should conform to the ITE's Trip Generation Handbook. Other methods may be used provided approval for such has been obtained from the Pinal County Engineering Section. Such information will be presented within a separate section of the report.

### **6.5.3 Trip Distribution**

Careful consideration should be used when determining trip distribution patterns of the development, or when the author must apply such to adjacent development(s), on the surrounding roadway network. If the project occurs in phases across many years the distribution pattern may change over the course of time and therefore the author should consider such within the analysis. The author will show the resulting trip distribution(s) on a map.

### **6.5.4 Background Traffic Forecasting**

Regional unadjusted growth factors shall be applied to the existing traffic volumes for all study horizon years. Contact the Pinal County Traffic Engineering Section for growth rate(s) to be used. The Pinal County Traffic Engineering Section may request different growth rate(s) depending on the study area.

Level of Service analyses and roadway capacities computations for the background condition alone will be presented within a separate portion of the report. The author will show the resulting background traffic volumes and Level of Service on a map within the report.

### **6.5.5 Adjacent Traffic Forecasting**

As planned or partially constructed developments within the study area do not contribute to existing traffic volumes such shall be accounted for within the study and documented. The author shall obtain all necessary information from the adjacent development owner(s) directly.

The estimated trip generation from adjacent development(s) shall be contained within a separate portion of the study report.

Level of Service analyses and roadway capacities computations for the adjacent plus background conditions will be presented within a separate portion of the report

## **6.6 Traffic and Improvement Analysis**

This portion of the report should contain detailed information regarding the recommended traffic and roadway improvements required to mitigate any resulting substandard Levels of Service or Roadway Capacities due to the impacts of the development.

- a. Site Access
- b. Level of Service Analysis
  - i. Without site including programmed improvements.
  - ii. With site including programmed improvements.
- c. Roadway Improvements
  - i. Improvements programmed by Pinal County or others to accommodate non-site traffic.
  - ii. Additional programmed improvements to accommodate site traffic.
- d. Traffic Safety
  - i. Sight Distance
  - ii. Accelerations/decelerations, left and right turn lanes
  - iii. Adequacy of location and design of driveway access
- e. Pedestrian Considerations
- f. Speed Considerations
- g. Traffic Control Needs
- h. Traffic Signal Needs
- i. Transportation Demand Management

Additional guidance and/or requirements are provided herein.

### **6.6.1 Site Traffic Forecasting**

This section should provide a detailed accounting of the base trip generation developed by the site or when the development is expected to be phased then an accounting of each phase's trip generation should be included. A tabular format is highly recommended.

### **6.6.2 Sight Distance**

Sight distance evaluation(s) shall be included as a separate report and shall contain all necessary calculations and noting where any sight distance restrictions occur within the TIA Study Area, and stating whether or not they (i.e., the site owner/developer) are in compliance.

## **6.7 Study Conclusions**

This portion of the report should contain detailed information regarding the conclusions of the study.

## **6.8 Study Recommendations**

This portion of the report should contain detailed information regarding the recommendations of the study.

- a. Site Access
- b. Roadway Improvements
  - i. Phased Improvements
- c. Transportation Demand Management actions if appropriate
- d. Other
  - i. Pedestrian Facilities and/or Improvements
  - ii. Bicycle Facilities and/or Improvements

## **6.9 Appendices**

Appendices shall be located in the back of the report and shall contain the following subsections if applicable.

- a. Existing Traffic Counts and Turning Movement Counts
- b. Capacity Analyses Worksheets (separate based on the following)
  - i. Existing Conditions
  - ii. Background Conditions (for each Horizon Year)
  - iii. Background plus Adjacent Traffic (for each Horizon Year)
  - iv. Total Traffic (for each Horizon Year)
- c. Traffic Signal Needs/Warrants
- d. Accident Data and Summaries
- e. Pinal County Meeting Minutes and Review Comments

## **6.10 Study Exhibits and Maps**

The following diagrams shall illustrate the roadway network accurately and shall be included in the appropriate section of the Traffic Impact Analysis report. Reports which purpose is to update an existing report or study shall not merely reference any previous reports but shall be considered a new study in the regard of report requirements as that of an original report/study unless otherwise directed by the Pinal County Traffic Engineering Section.

### **6.10.1 Site Location Maps**

The Site Location Map(s) should consist of two parts:

- a. A Vicinity Map showing the general location of the site within Pinal County and,
- b. A Street Map showing the existing transportation network within at least one mile of the study limits.

### **6.10.2 Site Layout Map**

The Site Layout Map shall include the following:

- a. Internal street system including roadways meeting the Local Road functional classification, and
- b. The site's points of access, and
- c. The roadways within or immediately bordering the study limits.
- d. Direction of North
- e. Scale. If the site layout cannot be shown to scale on the sheet limit explained herein, then the site shall include sufficient dimensions from all major site access points to adjacent major intersections.
- f. Sheet size: no larger than 11"x17", to be attached within the report/study.
- g. Also include a 24"x36" site plan by an engineer showing existing and proposed traffic control features within public right of way such as medians, opposing driveways and streets...etc. along the project's frontage.

### **6.10.3 Existing Peak Hour Turning Volumes**

The Existing Peak Hour Turning Volume shall include at a minimum:

- a. The Average Daily Traffic Volume, seasonal adjusted if known, on all roadway segments within the study area based on estimates or preferably on actual field collected traffic counts, and
- b. Lane configurations of all existing roadways within the study limits and any intersections within or bordering the study limits. If lane configurations cannot be sufficiently displayed on the Existing Peak Hour Turning Volumes, then a separate exhibit page is acceptable.

### **6.10.4 Estimated Site Traffic Generation**

The Estimated Site Traffic Generation exhibit may be substituted with a table. If the site will be developed under a planned phased

implementation schedule then individual tables for each phase of development shall be separated into individual exhibits/tables.

#### **6.10.5 Directional Distribution of Site Traffic**

The Directional Distribution of Site Traffic exhibit shall be separated into individual exhibits when multiple distribution patterns are anticipated to occur between the opening year and any horizon year (Category II Only).

#### **6.10.6 Site Traffic Assignment**

The Site Traffic Assignment shall be separated into individual exhibits under the condition whereby the development will be done under a planned phased construction schedule.

#### **6.10.7 Projected Background Traffic**

The Projected Background Traffic exhibit will be shown for the opening and any horizon years (Category II only). Studies with horizon years must be shown on separate exhibits.

#### **6.10.8 Adjacent Traffic**

The Adjacent Traffic exhibit will be included within the study when traffic contributions from future developments (that cannot be adequately accounted for by existing conditions traffic count data) are located within or immediately adjacent to the study limits. A separate exhibit will also be required showing adjacent traffic plus background traffic.

#### **6.10.9 Total Traffic**

The Total Traffic exhibit will be shown for the opening year and each horizon year of the development (Category II only).

#### **6.10.10 Future Traffic Assignment**

Future Traffic Assignment exhibits will be shown for both “with development” and “without development” conditions for all horizon years.

#### **6.10.11 Level of Service**

Level of Service exhibits will be shown for existing conditions, non-site traffic including any horizon years and the total traffic condition including any horizon years.

#### **6.10.12 Recommended Improvements**

The recommendations exhibit shall include all necessary information for intersection and roadway improvements, including intersection control elements. Improvements shall be shown for the opening year along with separate exhibits for each horizon year when phased improvements are recommended. Turn lane storage may be summarized within a table. Cost estimates for all off-site improvements shall be included in this section of the report.

All figures and tables shall be legible.

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.



## SECTION 7 - APPROVALS

The traffic impact analysis shall be submitted to the Pinal County Traffic Engineering Section for approval. The Section has no set time limit whereby review comments and/or approval of the document must be completed. Therefore, review times will vary.

The Pinal County Traffic Engineering Section, the County Engineer or his/her designated representative shall approve or disapprove the Traffic Impact Analysis. Written comments will be provided to the developer or his/her authorized representative upon completion of any County reviews.

## SECTION 8 - DESIGN STANDARD REFERENCE

- A. Designs shall be in accordance with or exceed current ADOT Design, Construction, and Traffic Engineering policies, procedures, and standards.
- 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 Section 600 of the ADOT Traffic Engineering policies, procedures, and standards.
- D. Data collection in accordance with the latest edition of the ITE Manual of Traffic Engineering Studies
- E. Trip generation in accordance with the latest edition of the ITE publication Trip Generation.
- F. Reductions due to internal capture in accordance with the latest edition of the ITE publication Trip Generation Handbook.

## **TURN LANES WARRANTS**

**General.** The need for turn lanes on County Highways shall be addressed during the Traffic Impact Analysis stage or prior to any new construction. All public-use approaches to the County Highway System, including private approaches to subdivisions and/or adjacent businesses, shall be reviewed for the need to provide turn lanes on the County Highway.

Justification for each turn lane shall be supported by an engineering study approved by the Pinal County Traffic Engineering Section that considers at least the following factors:

- Operating speed of the highway,
- Traffic volumes,
- Number of anticipated turning moves,
- Availability of passing opportunities,
- Sight distance, and
- Past collision history and/or potential for collisions.

Turn lanes shall not be constructed to enhance an existing roadside business, unless the applicant is willing to participate in the cost. However, when the safety of the traveling public is a significant factor, the participation requirement may be waived. If the engineering study does not support justification for a turn lane, the turn lane may not be approved even when requested by the applicant.

When the need for a turn lane is the result of a planned commercial development(s), and the requirements for a turn lane are met, the turn lane shall be paid for by the developer(s).

### **Left-Turn Lanes**

The chart below provides warrants for a left-turn lane based on the portion of the current year design hourly volume (DHV) on the highway carried in a single lane, the peak-hour volume of vehicles turning left, and the posted speed. A left-turn lane is warranted when the single-lane portion of the DHV of the highway and the DHV of left turns intersect at a point on or above the curve for the posted speed. In most cases, left-turn lanes should be provided where there are more than 12 left turns per peak hour.

Where the DHV of the left turn into the access is more than 12 vph and the highway's inside lane volume exceeds 250 vph on 45 to 65 mph highways or 400 vph on 25 to 40 mph highways, a left turn lane may be required due to the high traffic volumes or other unique site-specific safety considerations.

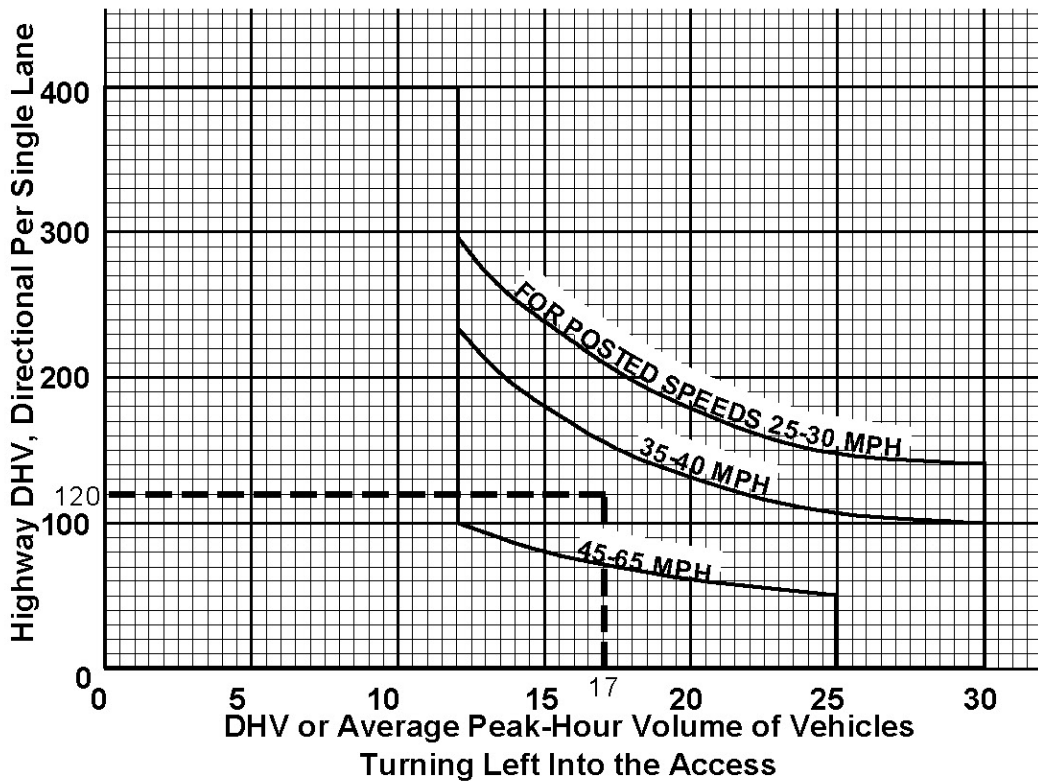
Left-turn lanes should also be considered if there have been four accidents per year at an existing approach, or if that number of accidents could be expected to occur as a result of a new approach without turn lanes.

The effect that a left-turn lane will have on restricting passing opportunities must be weighed against the safety benefit the left-turn lane may provide. On a highway section where passing opportunities are critical, the adverse effect that construction of a left-turn lane would have on the capacity of that roadway section may be more significant than the safety benefit from the left-turn lane.

Example:

A rural highway with a posted speed of 55 mph has a current year DHV of 200 vehicles per hour and a directional distribution of 60/40. At an intersection the left-turning DHV is 17 vehicles per hour.

### LEFT TURN LANE WARRANT



The highest single-lane DHV is  $0.6 \times 200 = 120$  vph. Entering the left-turn warrant chart with 17 vph on the horizontal axis and 120 vph on the vertical axis gives a point of intersection above the 45-65 mph curve. A left-turn lane should be considered at this intersection after evaluation of all the above factors.

## **Right-Turn Lanes**

The chart below provides warrants for a right-turn lane based on the current year design hourly volume on the highway, the peak-hour volume of vehicles turning right, and the posted speed. A right-turn lane is warranted when the single-lane portion of the DHV of the highway and the DHV of right turns intersect at a point on or above the curve for the posted speed.

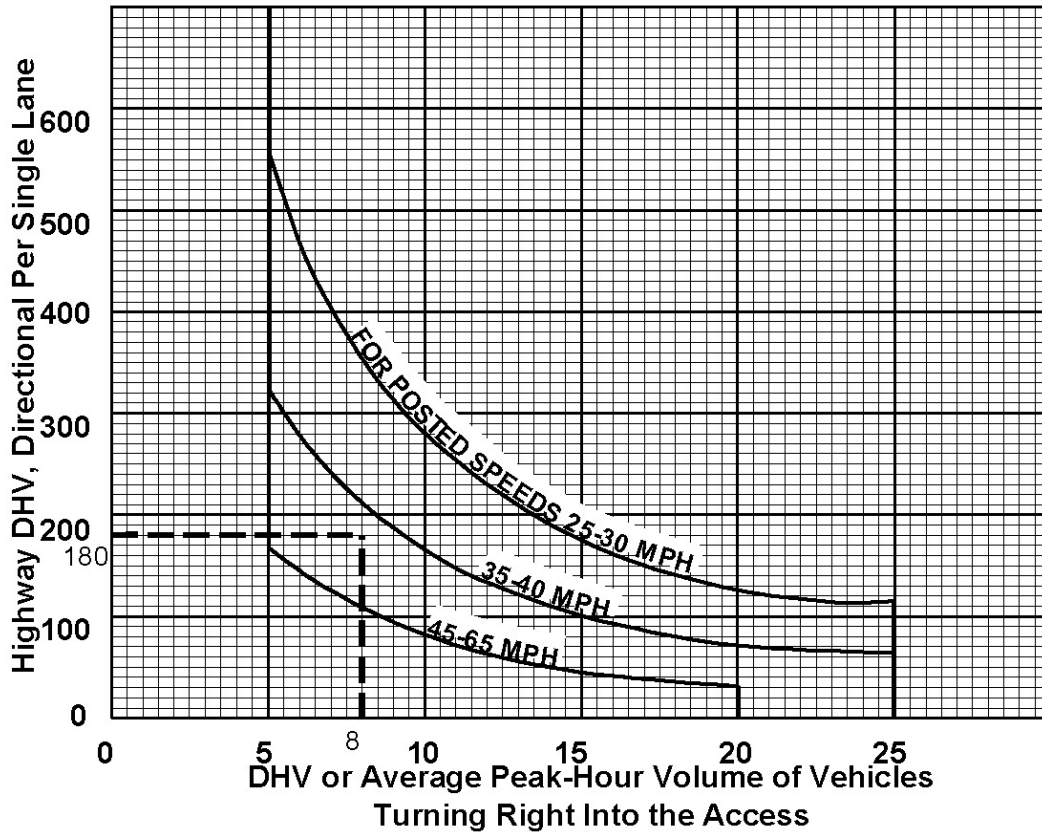
Where the DHV of the right turn into the access is less than 5 vph and the highway's outside lane volume exceeds 250 vph on 45 to 65 mph highways or 450 vph on a 35 to 40 mph highway, or 600 vph on a 25 to 30 mph highway, a right-turn lane may be required due to the high traffic volumes or other unique site-specific safety considerations.

Where the existing shoulder is of adequate width, it may be possible to adjust the pavement markings to provide a sufficient right-turn lane without widening the road.

Example:

A rural highway with a posted speed of 40 mph has a current year DHV of 360 vehicles per hour and a directional distribution of 50/50. At an intersection the right-turning DHV is 8 vehicles per hour.

## RIGHT TURN LANE WARRANT



The single-lane DHV is  $0.5 \times 360 = 180$  vph. Entering the right-turn warrant chart with 8 vph on the horizontal axis and 180 vph on the vertical axis gives a point of intersection below the 35-40 mph curve. A right-turn lane should not be considered at the intersection.

**EXHIBIT A**  
**TRAFFIC IMPACT ANALYSIS REPORT CONTENT CHECK LIST**

*Note: Before a full review is conducted, the Pinal County Traffic Engineering Section or their authorized Consultant will check the completeness of the Traffic Impact Analysis Report. If the Report is missing any of the items listed below, it will be returned for revision prior to the review.*

<b>CONTENT</b>	<b>YES /NO</b>	<b>COMMENT</b>
<b>Site Plan Items</b>		
- Access Location(s)		
- Interior Circulation		
- Identified Land Use (e.g., residential, commercial, school...)		
<b>Study Area</b>		
- Limits of Area clearly defined		
- Existing Roadway and Major Intersections shown		
<b>Trip Generation Rates</b>		
- Institute of Transportation Engineers (ITE) trip generation rates		
- Documentation for use of alternative rates		
<b>Trip Distribution</b>		
- Regional		
- Phased Project Patterns (am/pm) if applicable		
<b>Traffic Counts</b>		
- Taken within one year previous to the TIA submittal		
- Date / Time / Day of the Week		
- Turning Movement Counts		
<b>Discounting</b>		
- Internal trip discounts for mixed use developments		
- Pass-by-trip discounts for commercial/retail developments		
<b>Level of Service Calculations</b>		
- Calculation sheets		
- Scenarios as required per Guidelines		
- Existing/Future lane configurations		
<b>Signal Warrant Analysis if Applicable</b>		
- Warrant Analysis per ADOT Standards		
<b>Mitigation Measures</b>		
- Mitigation of Project Impacts		
- Mitigation of Cumulative Developments Impacts		
- Projects percent share of the cost to mitigate cumulative development impacts		
<b>Study Assumptions</b>		
- Clearly stated and reasonable		