Traffic Impact Analysis

Understanding the demands placed on the community's transportation network by development is an important dimension of assessing the overall impacts of development. All development generates traffic, and it may generate enough traffic to create congestion and to compel the community to invest more capital into the transportation network, whether it is in the form of new roads or traffic signals or turn lanes. Traffic congestion results in a number of problems, including economic costs due to delayed travel times, air pollution and accidents. As one roadway becomes congested, drivers may use others not necessarily intended for through traffic. As a result, traffic impact analyses are becoming more common as a planning tool to fore-see demands on the transportation network and to mitigate any negative impacts. Understanding traffic impacts becomes even more important as budgets for public facility and infrastructure improvements become increasingly strained.

WHAT IS TRAFFIC IMPACT ANALYSIS (TIA)?

A traffic impact analysis is a study which assesses the effects that a particular development's traffic will have on the transportation network in the community. These studies vary in their range of detail and complexity depending on the type, size and location of the development. Traffic impact studies should accompany developments which have the potential to impact the transportation network. They are important in assisting public agencies in making land use decisions. These studies can be used to help evaluate whether the development is appropriate for a site and what type of transportation improvements may be necessary.

Traffic impact studies help communities to:

- Forecast additional traffic associated with new development, based on accepted practices.
- Determine the improvements that are necessary to accommodate the new development.
- Assist communities in land use decision making.
- Assist in allocating scarce resources to areas which need improvements
- Identify potential problems with the proposed development which may influence the developer's decision to pursue it.
- Allow the community to assess the impacts that a proposed development may have.
- Help to ensure safe and reasonable traffic conditions on streets after the development is complete.
- Reduce the negative impacts created by developments by helping to ensure that the transportation network can accommodate the development.
- Provide direction to community decision makers and developers of expected impacts.
- Protect the substantial community investment in the street system.

Traffic impact analysis is only one component of the larger transportation puzzle. In addition, large communities in particular will need to determine appropriate mixes of transportation modes, including public transit options. Community growth pat-terns and characteristics can be substantially affected by highway expansion or re-alignment decisions made at state or federal levels. Traffic impact analysis is focused on the effects of a particular set of developments, but may provide information relevant to these broader plans and decisions. Traffic impact studies should be used as one piece of several kinds of information to judge the suitability of development from a transportation standpoint.

Traffic impact studies do not:

- Provide an indication of development's impact on other modes of transportation, such as bus service.
- Characterize the suitability of a development for other modes, particularly pedestrian and bicycle movement.
- Characterize the spatial patterns of demand, particularly where alternate route-seekers will travel.

WHEN IS A TRAFFIC IMPACT STUDY NECESSARY?

A traffic impact study is not necessary for every development. Those developments that are unlikely to generate significant traffic generally do not need a traffic impact assessment. When does a development warrant a traffic impact assessment? One of the approaches for determining whether a traffic impact analysis should be required for a proposed development is the use of trip generation data. The trip generation of a pro-posed development is essentially the number of inbound and outbound vehicle trips that are expected to be generated by the development during an average day or during peak hour traffic. The process outlined in this chapter entails calculating the expected trip generation of the proposed development and comparing it to accepted thresholds to determine whether the comprehensive traffic analysis is needed. A comprehensive traffic impact analysis procedure is beyond the scope of this workbook; however the workbook does describe the impacts that should be included in a full study.

Generally, a comprehensive traffic analysis should be completed whenever a development is expected to generate 100 or more new inbound or outbound trips during the peak hours (ITE recommended practice). Developments containing about 150 single-family homes, 220 multi-family units, 55,000 square feet of general office space or a 15,500 square foot shopping center would be expected to generate this level of traffic and hence, require a complete traffic analysis.

The trip generation process provides an estimate of the number of trips that will be generated due to the new development. Trip generation rates are then applied to the various land uses within the development.

The ITE trip generation manual is based on hundreds of trip generation surveys nationwide for a range of land use types. It is the most commonly accepted data source for trip generation rates. Generally, examining those numbers based on the peak-hour conditions are used in traffic assessments. An analysis of peak-hour conditions results in a more accurate identification of site traffic impacts.

Table 3.1 provides some examples of developments which would require a traffic impact analysis according to the thresholds recommended by ITE.

INSTITUTE OF TRANSPORTATION ENGINEER'S (ITE) GENERAL THRESHOLD RECOMMENDATION

Any proposed site plan or subdivision plan which would be expected to generate over one hundred (100) directional trips during the peak hour of the traffic generator or the peak hour on the adjacent streets, or over seven hundred fifty (750) trips in an average day.

Communities may wish to use their own thresholds. A larger community with many high volume streets, for example, may need to consider a higher threshold. Thresholds may need to be lower for corridors which are already experiencing congestion. Table 3.2 provides some examples of thresholds used in other areas. They are generally based on either the size of the development, trip generation or level of service.

Table 3.1 Threshold Levels

Land Use	**100 Peak Hour Trips**	**750 Daily Trips**
Residential: Single Family	150 units	70 units
Apartments	245 units	120 units
Condos/Townhouses	295 units	120 units
Mobile Home Park	305 units	150 units
Shopping Center	15,500 sq. ft.	2,700 sq. ft.
Fast Food Restaurant (GFA)	5,200 sq. ft.	1,200 sq. ft.
Convenience Store w/ gas (GFA)	1,300 sq. ft. or 5 pumps	
Bank w/ Drive-In	4,400 sq. ft.	2,800 sq. ft.
Hotel/Motel	250 rooms	90 rooms
General Office	55,000 sq. ft.	45,000 sq. ft.
Medical/Dental Office	37,000 sq. ft.	26,000 sq. ft.
Research & Development	85,000 sq. ft or 4.5 acres	70,000 sq. ft or 4 acres
Light Industrial	115,000 sq. ft. or 8 acres	115,000 sq ft. or 11.5 acres
Manufacturing	250,000 sq. ft.	195,000 sq. ft.

To calculate the number of trips expected to be generated by the proposed development in your community, apply the appropriate rate below to the proposed land use.

Table 3.3 Trip Generation Rates

Land Use	Base Unit	Rates		
		AM Peak	ADT	ADT Range
Residential				
Single Family Home	per dwelling unit	.75	9.55	4.31-21.85
Apartment Building	per dwelling unit	.41	6.63	2.00-11.81
Condo/TownHome	per dwelling unit	.44	10.71	1.83-11.79
Retirement Community	per dwelling unit	.29	5.86	
Mobile Home Park	per dwelling unit	.43	4.81	2.29-10.42
Recreational Home	per dwelling unit	.30	3.16	3.00-3.24
Retail				
Shopping Center	per 1,000 GLA	1.03	42.92	12.5-270.8
Discount Club	per 1,000 GFA	65	41.8	25.4-78.02
Restaurant (High-turnover)	per 1,000 GFA	9.27	130.34	73.5-246.0
Convenience Mart w/ Gas Pumps	per 1,000 GFA		845.60	578.52-1084.72
Convenience Market (24-hour)	per 1,000 GFA	65.3	737.99	330.0-1438.0
Specialty Retail	per 1,000 GFA	6.41	40.67	21.3-50.9
Office				
Business Park	per employee	.45	4.04	3.25-8.19
General Office Bldg	per employee	.48	3.32	1.59-7.28
R & D Center	per employee	.43	2.77	.96-10.63
Medical-Dental	per 1,000 GFA	3.6	36.13	23.16-50.51
Industrial				
Industrial Park	per employee	.43	3.34	1.24-8.8
Manufacturing	per employee	.39	2.10	.60-6.66
Warehousing	1,000 GFA	.55	3.89	1.47-15.71
Other				
Service Station	per pump	12.8	168.56	73.0-306.0
City Park	per acre	1.59	NA	NA
County Park	per acre	.52	2.28	17-53.4
State Park	per acre	.02	.61	.10-2.94
Movie Theatre w/Matinee	per movie screen Saturday	89.48 (PM Peak)	529.47	143.5-171.5
Day Care Center	per 1,000 GFA	13.5	79.26	57.17-126.07

Source: Institute of Transportation Engineers (ITE). Trip Generation.

How do we account for "pass-by" trips?

Typical trip generation rates are derived from counts taken at the driveways of the various land uses. For many land uses, not all of the trips generated at the driveway represent new trips added to the roadways. This is due to "pass-by" trips. Pass-by trips are made by traffic already using the adjacent roadway and enter the site as an intermediate stop on the way from another destination. The trip may not necessarily be "generated" by the land use under study, and thus, not a new trip added to the transportation system. This pass-by factor should be taken into account in devising a trip generation estimate.

The percentage of pass-by trips varies by land use. The Institute of Transportation Engineers recommends the adjustments for pass-by trips included in Table 3.4. For example, "standard trip generation rates indicate that a 300,000 square foot shopping center would generate approximately 1,320 PM peak hour trips at its driveways. Given the above pass-by percentage of 25 percent, the amount of additional traffic on the adjacent roadway sys-tem would be approximately 990 trips ((1,320 X (1 - .25)). Note that the full 1,320 trips should be shown (and analyzed) at the site driveways—the pass-by reduction will only affect the amount of traffic at to non-driveway intersections within the study area.

Table 3.4 Pass-by Percentages

Land Use	Pass-by Percentages
Shopping Center	
Larger than 400,000 GLA	20
100,000 to 400,000 GLA	25
Smaller than 100,000 GLA	35
Convenience Market	40
Discount Club/Warehouse Store	20
Fast Food Restaurant	40
Sit Down Restaurant	15
Service Station	45
Supermarket	20

 Worksheet 3.1 is provided in the Appendix to allow you to calculate the number of trips generated by your proposed development.

How do we account for internal trips in a multi-use development?

The method of developing a trip generation estimate must also take into consideration the fact that some of the trips counted at stand-alone sites are actually made within a multi-use development, by vehicle or by an alternate mode such as walking. The most common example of this trip-making occurs at multi-use developments that include both residential and shopping areas. Some of the residents' work trips and shopping trips are made to the on-site shopping area. These trips are internal to the multi-use site. Because they are captured on-site, a capture rate is used. A capture rate is a percentage reduction in traditionally developed trip forecasts to account for internal trips. The reduction may be applied to the total trips estimated, just as is the pass-by percentage reduction.

The ITE has found that multi-use developments could reduce trip generation esti-mates by 24%. Note that this trip reduction for captured trips is separate from the reduction for pass-by trips. They are distinct phenomena and both may be applicable to a development.

What should be included in a traffic impact analysis?

Once you have determined that a traffic impact study is necessary, the scope of the study should be specified. The following provides an outline of the recommended content of an impact study and a series of questions for evaluating a study con-ducted for your community:

I. BACKGROUND:

- Description of proposed development
- Identification of peak hours and whether weekends will be used in the impact analysis
- Description of study area
- Location of proposed Access points

II. BASE TRAFFIC CONDITIONS:

- Description of road network and intersections adjacent to site and at access points
- Counts during peak-impact hours

III. SITE TRAFFIC GENERATION:

- Trip generation rates used and the source of these rates
- Traffic generated during peak impact hours

IV. SITE TRAFFIC DISTRIBUTION:

- Method used to distribute traffic
- Table showing estimated traffic movements by direction
- Discussion of method used for traffic assignment and assumptions for assignment of traffic to network

V. NON-SITE TRAFFIC PROJECTIONS:

- Definition of design year—opening of proposed development
- Identification of development in study area whose traffic is to be included in calculations
- Adjustments of off-site through traffic volumes
- Assembling of off-site traffic forecast for design year

VI. TRAFFIC ASSIGNMENTS:

- Assignment of peak-period traffic to intersections and access points
- Figures for existing peak impact traffic hours, site traffic and total traffic
- Recommended access design improvements

VII. REVIEW OF SITE PLAN:

- Internal Reservoir at access points
- Parking layout
- Loading dock locations and access, including design truck used
- Recommended changes

VIII. DISCUSSION OF FUTURE TRAFFIC CONDITIONS:

- Other developments in area

What are some guidelines to mitigate traffic congestion in your community?

- Encourage consolidation of trips by providing mixed use development.
- Encourage alternative modes of transportation.
- Design development to be pedestrian friendly by including smaller set-backs, requirements for parking behind buildings, and building sidewalks—including sidewalks that provide connections from the development to residential areas.

Endnotes

1. Definitions of each land use class here.
2. The AM Peak rate represents the average vehicle trip generation rate during the hour of highest volume of traffic entering and exiting the sit in the morning. ADT is the Average Daily Trip rate or the vehicle trip generation rate during a 24-hour period for a weekday (unless otherwise noted).

QUESTIONS ADDRESSED BY TIA

- Is the study area large enough to include all significant impacts from the development?
- Does it include all critical intersections?
- Were traffic counts taken during the critical time periods?
- Are traffic counts recent?
- Have all the assumptions used in the technical analysis been clearly identified?
- Do calculated levels of service seem reasonable?
- Does the community have acceptable standards for level of service?
- Does the description of the proposed site agree with the site plan submitted?
- Have trip rates been adjusted to account for public transportation, pedestrians or pass-by-trips?
- Does the directional distribution of the site traffic seem reasonable?
- Has pedestrian circulation been accommodated?
- Has adequate parking been provided to meet demand?