

## CITY OF FREDERICK – TRAFFIC IMPACT STUDY GUIDELINES

### INTRODUCTION

The purpose of these guidelines is to establish criteria by which the traffic impacts of new development proposals will be evaluated by Planning Department staff. They define submission requirements, the need to prepare a study, study scope and methodology, and the format of the study.

### GENERAL REQUIREMENTS

The total trips that would be generated by a proposed development is the basis for determining whether a traffic impact study is required to be performed by the Applicant. ***An applicant will be required to submit a traffic impact study when a proposed development will generate more than 50 peak hour trips on a weekday and 100 peak hour trips on a weekend day.*** The basis for trip generation estimates will be the latest edition of *ITE Trip Generation*. ***Development of a project in stages, or on a piecemeal basis, will not avoid this requirement. The trips expected to be produced by the ultimate build-out of the development will be the basis for such study.*** However, even if a development generates less than 50 peak hour trips, it is not totally excluded from the adequacy requirements of these guidelines unless site traffic generation is anticipated to be de minimus (less than 5 peak hour trips). All submissions must include an evaluation of anticipated trip generation; however staff may perform its own evaluation of traffic impacts and determine the need for minor improvements or contributions to other needed improvements.

A traffic impact study will be required for at least one the following stages of development:

- Rezoning
- Planned Neighborhood Development, Planned Unit Development
- Preliminary Plan of Subdivision
- Final Subdivision (if not completed with Preliminary Subdivision)
- Site Plan (if not completed with Preliminary Subdivision)

Except for rezoning applications, all approvals based on transportation adequacy shall expire after four (4) years if subdivision has not been recorded and/or development is not substantially underway.

Exemptions may be permitted by the Planning Department, if it is determined that site traffic generation is anticipated to be minimal except for irregular or seasonal events.

### Conformance with Comprehensive Plan

If the proposed zoning or land use of a development application is not in conformance with the City's latest Comprehensive Plan, additional studies will be required. A trip generation study will be performed to determine whether the development proposal will add traffic volumes above levels anticipated in the development of the Comprehensive Plan. For those proposals, which would generate an increase in anticipated traffic, the impact of this increase on the Comprehensive Plan transportation network will be evaluated. Staff will determine the scope of study required and, if necessary, provide the Applicant with an electronic Synchro file of the Comprehensive Plan Network and traffic volumes. If additions to the Comprehensive Plan Network are required, the Applicant may be responsible for funding a pro-rata share of these improvements.

***Any study required to address Comprehensive Plan issues will be supplemental to, and not replace, the standard traffic impact study.***

### TRAFFIC IMPACT STUDY REQUIREMENTS

The Planning staff will notify an applicant if a traffic impact study is required and will schedule a scoping meeting with the applicant, City planning staff, County staff, and Maryland State Highway Administration (MSHA) staff as required based on the location of the project and the planned site access points.

Based on the scoping meeting, the Applicant shall submit a standard “Scoping Agreement Form” to the planner in charge of the development review. The information required to be submitted shall include:

- Size/type of development and proposed access points
- Conformance with Comprehensive Plan
- Study Area
- Background developments to be included in study
- Trip generation/rates based on ITE guidelines
- Directional distribution of traffic
- Annual through traffic growth rates
- Design year (development completion)
- Assumed planned and programmed roadway improvements (Must be 100% funded in current CIP)
- Assumed intercept trip percentages
- Analysis methodology, e.g. Synchro, CLV, HCS

The scoping agreement shall be signed by the Applicant or his designee. The agreement will be reviewed and, if acceptable, accepted, signed by the City, and returned to the Applicant.

## **TRAFFIC IMPACT STUDY CRITERIA**

The following criteria will be applicable to all traffic impact studies:

### **Study Area**

The study area for analysis will include the intersection of each site access point with a public street and extended as follows from the site access point intersection:

- Along public roadway in each direction to intersection with the first major collector/arterial
- Extend study area in all directions to major intersections (arterial/collector or arterial/arterial) with site impacts of > 50 peak hour trips subject to 1 mile limitation from site access point to closest signalized or unsignalized major intersection.

The Applicant should seek guidance from the City regarding whether a signalized intersection is isolated or in a coordinated signal system.

### **Traffic Data**

Recent traffic data, which is no more than one (1) year old at **the submission date of the Application**, must be included for all study area intersections and roadway links in excess of one (1) mile between signalized intersections. New counts may be requested by the City if it is determined that there have been significant changes in the study area that would have modified traffic patterns since the data was collected. Typical traffic data should only be collected in 15-minute increments on Tuesdays, Wednesdays, and Thursdays during peak periods (generally from 7-9 AM and 4-6 PM or as directed by the City) unless higher traffic impacts are anticipated on other days. For example, Saturday data may be required for shopping centers and Sunday data may be required for Churches. Current traffic volume data at intersections and roadway links on the State Highway System may be found at <http://www.marylandroads.com/tmsreports/>.

No counts should be performed from the end of the school year through the week of Labor Day – exceptions may be allowed based on study area, development use, and/or approval of seasonal factors. In addition, traffic data should not be collected during the following time frames:

- December 15 to the week which includes New Year's Day
- The day before, day of, or day after a holiday unless dictated by development use
- School holidays or late opening/early closing
- When traffic patterns are influenced by an accident, road closure, inclement weather, or other event

### **Other Traffic Study Data**

The Applicant's traffic study shall also include the following data, or sufficient justification for its omission:

- Existing traffic control devices, geometrics, and lane use designations
- Existing speed limits
- Lengths of existing turn lanes
- Sight distance measurements at driveways and unsignalized intersections
- Determination of 85<sup>th</sup> percentile speeds
- Turning radius into and out of the proposed development
- Trip generation and distribution of site generated traffic and background traffic
- Pass-by trips to be computed in accordance with ITE criteria
- Annual growth in thru traffic – compounded from traffic count date to design year
- Estimated build-out year of the proposed development.
- City to provide background (pipeline)development data to applicant
- City to provide Synchro file for study area
- Identify any access control restrictions
- Existing signal timing from City or SHA – any deviations must be justified.
- Programmed roadway improvements that are 100% funded for construction in the current City or State CIP.

### **Analysis Techniques**

The applicant's traffic study shall evaluate existing, background, and total future traffic conditions. Background traffic shall include existing traffic plus growth in through traffic (compounded percentage based on historical data) plus traffic generated from background developments. The total traffic conditions should reflect the addition of the background traffic volumes and trips generated by the site. The design year of the study shall be the build out year of the development or three (3) years from the collection date of the traffic volume data, whichever occurs later.

### **METHODOLOGIES**

The ability of the roadway network to accommodate projected traffic volumes generated by the proposed development must be assessed utilizing the appropriate techniques to measure capacity and level of service (LOS). A description of levels of service is included in the latest edition of the *Highway Capacity Manual*. The techniques selected to measure capacity and determine corresponding levels of service will depend on the nature of the study area and the facilities under study.

The methodologies that are identified for analyzing the transportation network are considered to be best suited to the needs of the Planning Board and its staff in applying City policy. Any proposed departure from these methods must be discussed with staff during the scoping process and prior to inclusion in a traffic study.

### **Isolated Signalized Intersections**

An isolated signalized intersection is defined as an intersection that is not part of a coordinated signal system nor is its timing referenced to any other signal. For isolated signalized intersections, the Critical Lane Procedure (similar to the planning analysis method from the *Highway Capacity Manual*, Chapter 16 Appendix) should be used to measure the level of service. Critical lane volume analysis is a broad evaluation of the capacity and LOS of a signalized intersection for a given set of demand volumes and geometrics. The advantage of the technique is that it is simple and easy to use. Appendix A herewith provides a description of the Critical Lane Procedure, and includes a sample

worksheet for reference.

When the sum of critical lane volumes exceeds 1400, additional analysis will be required. The intersection(s) shall be re-analyzed using the Highway Capacity Manual operational methodology (Chapter 16) using existing signal timing and phasing. This analysis may be performed using Synchro to obtain the **Highway Capacity Manual Level of Service (NOT SYNCHRO LOS)**.

### **Coordinated Signalized Intersections (Corridors)**

Coordinated signals along a corridor may be included in a computerized signal system or their timings may be manually coordinated. In either instance, the timing and phasing of a coordinated signal is interrelated to the settings of nearby signals.

To evaluate coordinated signals, the City will provide an electronic file including the portion of the City's Synchro network applicable to the subject study. This file will constitute the base network for the traffic study. No changes to signal timings/phasing from those included in the City's Synchro model shall be made without the approval of the City and the responsible operating agency.

For each intersection in the corridor network, the following results from the Synchro evaluation shall be documented:

- Highway Capacity Manual LOS
- Overall Intersection Delay
- Approach Delays
- Queue lengths (95<sup>th</sup> percentile) for each intersection movement

The Synchro and Highway Capacity Manual procedures do not take into account that the operation of a study intersection may be affected by spillover congestion from nearby intersection or intersections. Nor do the methodologies detect and adjust for the impacts of turn-pocket overflows on through traffic and intersection operation. SimTraffic, however, analyzes the cumulative effects of corridor traffic movements. To account for these situations, SimTraffic simulations shall be performed whenever any of the following results occur at an intersection from the Synchro evaluation:

- Overall Intersection LOS = F
- Overall Intersection Delay > 50 seconds
- Queue length for a movement exceeds the available storage length

Measures of Effectiveness (MOE's) that contribute to operational characteristics of the corridor should include the following parameters obtained from SimTraffic:

- Queue lengths
- Intersection delays
- Corridor delays

### **Unsignalized Intersections**

In areas where a significant portion of the traffic generated by the proposed development must utilize a two or four-way stop controlled unsignalized intersection, the procedures identified in Chapter 17 of the *Highway Capacity Manual* should be employed.

When average vehicle delay for a turning movement exceeds 50 seconds, additional studies should be conducted to determine potential means to correct the deficiency. The type of study deemed appropriate should be determined in consultation with staff. If a traffic signal warrant study is deemed appropriate, the warrant study must be conducted in accordance with the requirements of the MUTCD, MSHA, and the City and submitted with the traffic impact study.

When an intersection is proposed to be signalized in the traffic study, the intersection should be analyzed under the CLV procedure to ensure that further physical improvements to the intersection beyond the signalization are not needed to achieve adequacy. If, however, a proposed new signal would be coordinated with existing signals, then the analysis shall include the procedure described for coordinated signals utilizing Synchro and/or SimTraffic.

### **Roadway Links**

When the distance between signals is less than two miles the intersections in the study area will generally control the flow of traffic. However, when a proposed development impacts a roadway segment (link) when the distance between traffic signals is two miles or greater, link volumes should be analyzed when requested by staff. In such cases the procedures outlined in Chapters 20 and 21 of the *Highway Capacity Manual* should be utilized.

### **STANDARDS FOR ADEQUACY**

The proposed standards for determining adequacy of transportation facilities are listed below. **THESE STANDARDS ARE SUBJECT TO APPROVAL OF THE MAYOR AND BOARD OF ALDERMEN**

Transportation facilities are deemed to be adequate if the following standards are met:

#### **Isolated Signalized Intersections:**

- Level of Service D/E
- $CLV \leq 1472$
- HCM intersection  $V/C \leq 0.92$

#### **Coordinated Signalized Intersections (Corridors):**

(All standards must be met)

- All Intersections Level of Service E or better
- All Overall Intersection Delays  $\leq 60$  seconds
- SimTraffic queue lengths (95<sup>th</sup> percentile)  $\leq$  storage lengths

#### **Unsignalized Intersections**

- All movements Level of Service E or better (delays  $\leq 50$  sec)
- Sight distance (stopping and intersection) meets AASHTO criteria for 85<sup>th</sup> percentile speeds

### **Roadway Links**

- $V/C$  ratio  $\leq 0.92$

### **MITIGATION**

Mitigation of traffic impacts is required when transportation adequacy standards are not met for full buildout or intermediate stages of a proposed development. It is recognized that a specific development proposal may not, in itself, create an inadequacy, but that an inadequacy would exist regardless of whether the property were to be developed. The mitigation criteria takes prevailing conditions into account when assessing the required level of mitigation.

#### **Mitigation Criteria**

- If background conditions are adequate, then mitigation must restore adequacy
- If background conditions are inadequate, then mitigation must either provide adequacy or mitigate 120% of the

- development's impact on levels of service (critical lane volume or v/c ratio) and/or overall intersection delays
- All sight distance inadequacies at unsignalized intersections must be addressed regardless of whether these conditions exist prior to consideration of the subject development

## Types of Mitigation

When a traffic study identifies an inadequate condition(s) within the study area, the applicant may choose to recommend any action, which would result in adequate operations per the prescribed. Such action(s) can consist of physical improvements, which add capacity to the transportation system or programs to enhance operational efficiency or to reduce trip generation.

Physical improvements could include roadway widening, intersection geometric improvements, or signalization improvements. The design and construction of any recommended improvement must receive the concurrence of the appropriate State or City operating agency. The design policies and standards of the agency, including provision of sidewalks, trails, and bike lanes adjacent to the roadway or intersection improvements and maintained within the agency's right-of-way or easements, shall apply to applicants or their heirs, successor or assigns who propose to construct the improvements under permit to the agency.

There are cases when the analysis indicates that an improved LOS could be achieved by changing the timing or phasing of an existing signal or re-striping the approach to an intersection. **The approval of the appropriate operating agency must be obtained by the applicant before such a change will be considered in any staff recommendation.**

Larger developments may be developed in stages so that any necessary transportation improvements may also be staged. Each stage of development must, however, demonstrate adequacy.

The projected potential of physical improvements or trip reduction actions to reduce anticipated traffic impacts will be evaluated as part of the review of submitted traffic studies. Applicants are encouraged to discuss potential actions with staff prior to submittal. The traffic study should recommend improvements only after potential traffic impacts of the proposed development (without considering physical improvements or trip reduction actions) have been determined. The Applicant should provide analysis results including the proposed mitigation measures, based on the methodology that applies to the intersection or roadway segment

## SUBMISSION REQUIREMENTS

**All traffic studies must be submitted a minimum of 60 calendar days in advance of an anticipated hearing date.**

The study shall be signed and sealed on the inside title page by a Maryland Registered Professional Engineer with specific contact information. Traffic studies must include all relevant information, as indicated in the Study Requirements and methodologies sections of the Guidelines, for staff to review the study in accordance with the Guidelines. The study shall include Appendices showing the approved scoping agreement, raw traffic counts and all level of service computation worksheets. All input assumptions must clearly be seen on computerized worksheets. The receipt of a study does not in any way deem it to be accepted. Any study judged to provide incomplete information will be returned to the Applicant within ten (10) business days of its receipt. (The "review clock" will be frozen until an acceptable study is re-submitted.

## GLOSSARY OF TERMS USED IN THE GUIDELINES

Access Controls	Regulations by which access to a road facility from individual driveways, minor streets or major streets may be limited for the purpose of increasing roadway capacity and improving safety
Arterial	A roadway for through traffic with partial control of access linking major traffic generators and communities to regional highway facilities
Intersection	The location at which two roadways cross and join at the same vertical

		elevation; access through the intersection may be controlled by traffic signals or stop/yield signs
Average Daily Traffic (ADT)		The total traffic volume passing a point or segment of a roadway in both directions during an average 24-hour period
Background Traffic		In a traffic analysis, current traffic in accordance with recent traffic counts plus traffic generated by pipeline development plus growth in through traffic, on the current road network plus all roadway improvements which are fully funded by the State, the City or another party
Capacity		On a roadway link, the maximum number of vehicles which can pass a given point during one hour under prevailing roadway and traffic conditions
Collector		A roadway with no control of access linking residential communities with the arterial system
Critical Lane Volume (CLV)		At an intersection, the sum of the critical movements in the north-south direction and the east-west direction
Critical Movement		At an intersection, the highest total of the through movement plus its opposing left-turn movement in one direction on an hourly per-lane basis (for example, the critical movement in the north-south direction is the higher of the northbound through movement plus the southbound left-turn movement, computed on an hourly per-lane basis, and the southbound through movement plus the northbound left-turn movement, computed on an hourly per-lane basis)
De Minimus Development		A development which generates 5 or fewer peak hour trips
Existing Traffic		In a traffic analysis, current traffic in accordance with recent traffic counts on the current road network
Highway Manual	Capacity	Transportation Research Board Publication, which defines criteria and methodologies for capacity and level of service.
ITE		Institute of Transportation Engineers
ITE Trip Generation		ITE publication defining the number of trips that would be generated by various land use and development types
Level-of-Service (LOS)		A qualitative measure using a sequence of letters from A through F to describe the quality of operational conditions within an intersection or a roadway link
MUTCD		The <i>Manual on Uniform Traffic Control Devices</i> , or MUTCD defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.
Pass-By Trip		A trip generated by a land use which is already using the road adjacent to the land use; most frequently associated with land uses such as retail centers, service stations and fast food restaurants
Peak Hour		The one-hour period of greatest utilization of a transportation facility; weekdays normally have two peaks, one in the morning and one in the afternoon
Peak Period		A three-hour period during which a transportation facility has significantly increased levels of use; includes the peak hour
Phase		A portion of a traffic signal cycle allocated to any traffic movement or combination of traffic movements
Pipeline Development		Development having an approved and valid Preliminary Plan of Subdivision, Final Plat or Record Plat

Roadway Link	A segment of roadway between two points
Synchro	A traffic model which evaluates intersection and corridor traffic operations and signal timing.
SimTraffic	A traffic model (associated with Synchro) simulating the movement of traffic through a roadway network.
Through Traffic	Trips which begin <u>and</u> end outside of a given study area which pass through the study area
Total Traffic	In a traffic analysis, background traffic plus traffic generated by the development under consideration
Traffic Control Device	Any sign, signal, pavement marking or device placed or erected for the purpose of regulating, warning or directing traffic and/or pedestrians
Staff	City of Frederick Planning and Engineering staff or other staff persons who may be designated to advise the Planning Commission on transportation issues
Trip	A one-way movement by a person or a vehicle having an origin and a destination
Trip Assignment	The process of allocating vehicle travel generated within a land parcel to each link of the roadway network
Trip Distribution	The process of estimating the direction of travel and the length of vehicle trips originating from or destined for the uses on a land parcel
Trip Generation	The process of estimating the number of vehicle trips originating from or destined for the uses on a land parcel
Volume-to-Capacity Ratio (V/C)	A performance measure computed using the ratio of an actual roadway volume to the capacity of a roadway link

### Procedure for Critical Lane Volume Analysis (Signalized Intersections)

#### 1. Input Information

- **Geometrics** - number of lanes on each approach and turning movements assigned to each lane
- **Volumes** - total vehicles per hour (vph), as determined over the applicable Peak Period, for each movement of each approach

The procedure does not consider the details of lane width, parking conditions or other features, nor does it consider the number of trucks and buses in the traffic stream.

#### 2. Critical lane volume analysis identified critical movements by individual lanes; thus, volume must be assigned by lane

- Where exclusive turning lanes are present, all turns are assigned to the appropriate turning lane.
- When two or more lanes are present on an approach, volume is distributed among the available lanes as follows:

Number of Approach Lanes	Lane Use Factor
1	1.0
2	0.55
3	0.40

4	0.30
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- When permitted left turns are included in shared lanes, vehicles are assigned to available lanes such that the number of vehicles using each lane is equal. All right-turning and through vehicles have a passenger car equivalent (PCE) of 1.00, while permitted left turns have the following PCE values:

Opposing Through and Right-Turn Volume (VPH)	Passenger Car Equivalent (PCE)
0 to 199	1.1
200 to 599	2.0
600 to 799	3.0
800 to 999	4.0
1,000 and over	5.0
It should be noted that all left turns must be assigned to the leftmost lane.	

- When trucks, through buses and local buses are included in the traffic volumes, the volumes must be adjusted to reflect their impact on intersection capacity. The adjustment factors to be used are as follows:

Vehicle Type	Passenger Car Equivalent (PCE)
Passenger car or motorcycle	1.0
Truck or through bus	2.0
Local bus	5.0

- Because signal design is not known in the planning analysis, combinations of critical lane volumes are identified by considering conflicting movements. For a north-south street, critical conflicts are the northbound left-turn movement with the southbound through movement and the southbound left-turn movement with the northbound through movement. The critical volume for the north-south street is the largest sum among:

- Northbound single-lane left-turn volume plus the maximum single-lane volume for the southbound through plus right-turn movement, or
- Southbound single-lane left-turn volume plus the maximum single-lane volume for the northbound through plus right-turn movement.

- Similarly, the critical volume for the east-west street is the greatest sum among:

- Eastbound single-lane left-turn volume plus the maximum single-lane volume for the westbound through plus right-turn movement, or
- Westbound single-lane left-turn volume plus the maximum single-lane volume for the eastbound through plus

right-turn movement.

The total critical lane volume for the intersection is the sum of the critical volumes for the north-south and east-west streets. The critical volume for the intersection is then compared to the following criteria.

<b>Critical Lane Volume (CLV)</b>	<b>Level of Service (LOS)</b>
<b>≤ 1000</b>	<b>A</b>
<b>1001 – 1150</b>	<b>B</b>
<b>1151 - 1300</b>	<b>C</b>
<b>1300 - 1450</b>	<b>D</b>
<b>1451 -1472</b>	<b>D/E</b>
	<b>(proposed standard)</b>
<b>1473 - 1600</b>	<b>E</b>
<b>&gt;1600</b>	<b>F</b>

In those cases when it is known that an existing intersection is controlled by a three- or four-phased signal, it should be assumed that such phasing will continue to be used in the future. The critical lane analytical procedure should be modified to reflect the presence of the additional phases.

#### **SOURCES:**

- Frederick County Guidelines
- Prince George's County Guidelines
- SHA Guidelines for the Traffic Analysis of Development Proposals