



# **WSDOT MULTIMODAL TRANSPORTATION IMPACT ANALYSIS GUIDELINE**

**July 2020**

**1<sup>st</sup> Edition**



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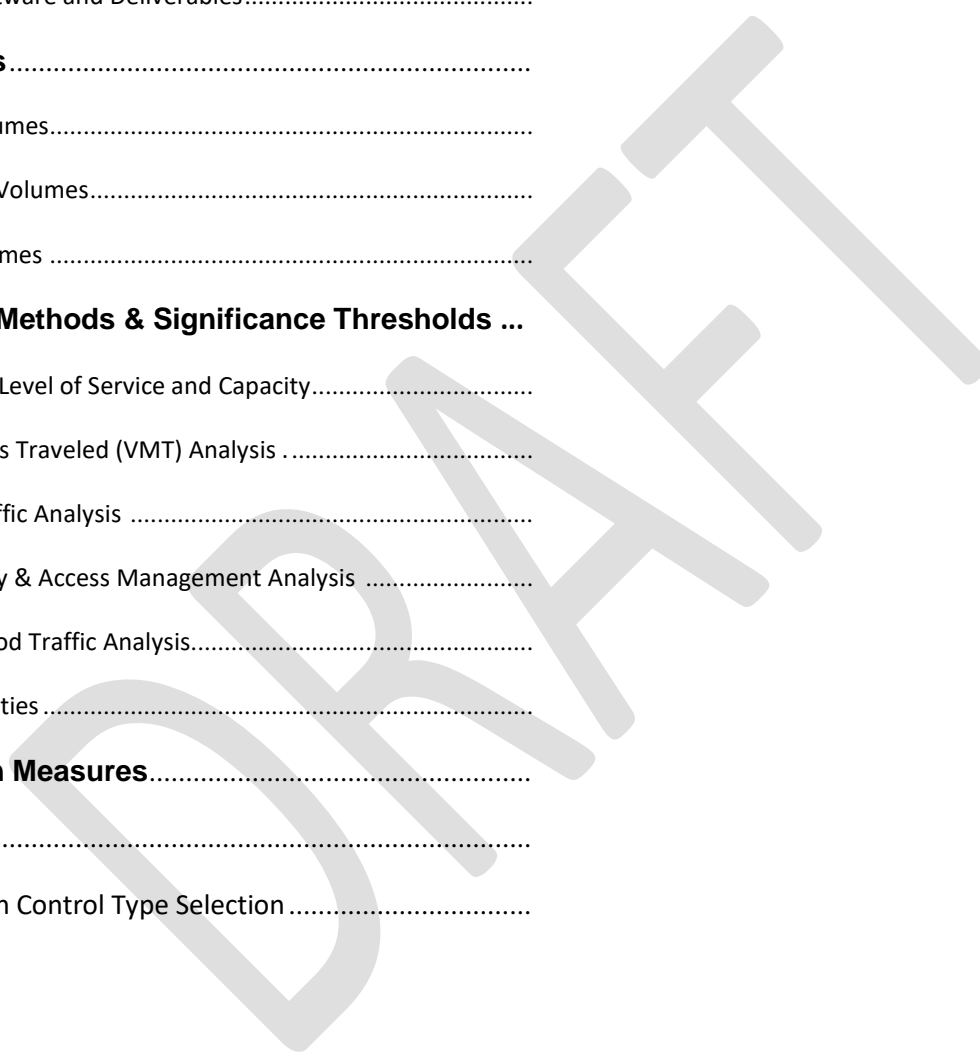
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## Introduction

These guidelines prescribe the methodologies for conducting Transportation Impact Analyses under WSDOT purview. They will be periodically updated to reflect changes in policies, the regulatory environment, and the state of the transportation impact analysis practice.

## Transportation Impact Study Scoping

Depending on the scale and extent of the proposed project the scope of a transportation impact study could range from a focused study, such as a simple intersection control type selection analysis for a proposed intersection, to a large –scale study, such as a complete analysis of all transportation facilities within a defined study area. The impact study scope will be collaboratively reviewed and refined by WSDOT and the traffic consultant and applicant teams. Advanced analysis such as travel demand model updates and meso or micro simulation may be required for certain studies.

### Extents of Study

The TIA study area should include all transportation facilities that could be impacted by traffic generated by the project. This is generally determined by conducting an initial trip generation estimate and select zone analysis using a travel demand model to preliminarily assess the volume and distribution of project traffic. WSDOT will establish the study area on a case by case basis depending on the unique characteristics of each individual project. The study area and TIA scope shall be amended if during the study, trip generation indicates that less or fewer intersections could be potentially impacted by the project.

### Analysis Scenarios

Analysis scenarios shall be determined on a case by case basis depending on the unique characteristics of each project. Each scenario will include an evaluation of multimodal intersection and roadway segment metrics like: LOS, Vehicle Miles Traveled, Induced Traffic, & Safety analysis. Typical required items:

1. Existing Conditions – The most recent available traffic conditions and physical geometry
2. Project Trip Distribution with Select Zone Analysis – Multimodal Trip Generation, Distribution, and Assignment
3. Existing + Project Conditions – Existing Conditions & geometry plus project generated traffic and proposed geometric changes
4. Cumulative Conditions – Future year traffic conditions reflecting build out and funded public and private projects
5. Cumulative + Project Conditions – Cumulative conditions plus project generated traffic and proposed geometric or other changes. If phases are defined and solutions involve state or federal infrastructure which will be significantly impacted or mitigation suggested, include a 20 year projection scenario.

Near term analysis may be scoped for individual projects with significant near term development or infrastructure improvements in the vicinity.

## Form and Content of Impact Analysis Document

- I. Executive Summary
- II. Table of Contents
  - a. List of Figures
  - b. List of Tables
- III. Introduction
  - a. Description of the proposed project
  - b. Site plan include all access points and intersections on both sides of the roadway fronting the project side at a minimum of 150' beyond the project site
  - c. Circulation network depicting existing/proposed roadways, intersections, transit facilities, and pedestrian & bicycle facilities in study area
  - d. Land use and zoning summary or references to other appropriate documents
  - e. Phasing plan including approximate dates of completion for each phase
  - f. References to other traffic impacts studies or applicable research materials
  - g. All applicable Circulation Element and ancillary policies and plans
- IV. Multimodal Transportation Analysis
  - a. Clearly stated assumptions
  - b. Baseline traffic conditions including turning movements, geometry pertinent to LOS analysis, transit service, traffic controls, etc.
  - c. Project specific traffic conditions such as trip generation, distribution, and assignment
  - d. Multimodal Level of Service & Queuing Analysis
  - e. Vehicle Miles Traveled (VMT) Analysis (if associated with an MOE/project purpose and need)
  - f. Induced Traffic Analysis (if appropriate)
  - g. Traffic Safety & Access Mgmt. Analysis
  - h. Neighborhood Traffic Analysis (if applicable)
  - i. Modal Priority Analysis (if applicable)
- V. Conclusions and Recommendations
  - a. Summary of potentially significant impacts and proposed mitigations
  - b. Summary of MOE's before and after proposed mitigation
  - c. Cost estimates for mitigations measures & if scoped a preliminary financing plan
- VI. Appendices
  - a. Traffic Data Summary and Sources
  - b. Referenced methodologies and assumptions used in analyses
  - c. All electronic model files and worksheets used in analyses

## Analysis Software and Methods

Unless otherwise approved, use the most current version of following programs. It is the responsibility of the consultant / proponent to ensure all of the models are properly calibrated and validated for the study area prior use and that these efforts are documented a provided to WSDOT.

- Visum: Travel demand model for all forecasting and trip distribution estimation
- Synchro / SimTraffic: Primary operational and micro simulation model for intersection analysis
- McTrans: Multimodal Analysis tool for segments
- VISSIM: Secondary micro simulation model for complex analysis or multi-modal simulation
- IHSDM: Primary safety design model for predicting crash rates
- Sidra Intersection
- Others as approved by request.

It is expected that analyses follow WSDOT guidance. Ref: <https://www.wsdot.wa.gov/Design/Traffic/Analysis/>

## Baseline Conditions

Data at specific locations not already collected by and available through WSDOT will need to be collected as part of individual impact analyses. Consultants should inventory what data is already available and scope any necessary data collection.

## Existing Volumes

Average Daily Traffic (ADT) segment counts are collected in 15 or 5 minute intervals for a period of no less than 48 hours. Volumes used for segment analysis should be based on the average of the entire count period. Peak period (often, multi-hour) counts are collected in 15 minute intervals during the required peak hours identified from the segment counts. All traffic volumes are collected during clear environmental conditions, during regular school session, with no adjacent construction activities or special events. It is the responsibility of the consultant to validate traffic counts prior to their use in the analysis.

## Vehicle Volumes

Peak hour intersection vehicle movements are collected in UTDF (Universal Traffic Data Format). In order to calculate pedestrian intersection levels of service, intersections with protected/permissive phasing shall have the volume of permissive left turns by each left turn movement counted in addition to the total left turn volumes. At intersections where right turns on red (RTOR) are permitted, the volume of right turns on red by each right turn movement counted in addition to the total of right turn volumes. If any form of testing or research indicates pedestrian LOS is not sensitive to the expected volume of permissive left or right turn on red movements, these volumes may be estimated based on professional judgment in lieu of counting.

### *Bicycle Volumes*

Peak hour intersection bicycle volumes are collected by the approach direction to the intersection (ie.. EB, WB, NB, SB). If any form of testing or research indicates that bicycle LOS is not sensitive to the expected volume of bicycles, these volumes may be estimated based on field observations and professional judgment in lieu of counting.

### *Pedestrian Volumes*

Segment pedestrian flow rates can either be counted or estimated based upon adjacent peak hour intersection movements. Pedestrian movements shown in the figure below need to be counted or estimated in order to calculate pedestrian level of service. If any form of testing or research shows that pedestrian LOS is not sensitive to the expected pedestrian volumes, these volumes may be estimated based on field observations and professional judgment in lieu of counting.

### *Transit Volumes*

Currently line level transit frequency and load factor data may be available from the Short Range Transit Plan or the Transit Manager. In cases where this information is not available transit frequency can be estimated based on the established route schedule and the passenger load factor can be manually counted by the transit drivers upon request. At least two weeks prior to the study period the consultant should request that the local or transit agency have its drivers do passenger counts at scoped analysis locations.

### *Regional Vehicle Miles Traveled (VMT)*

If VMT data is needed, it shall be forecasted via cumulative VMT per trip by comparable land use type(s) via travel demand models from which this data can be derived.

### **Cumulative Volumes**

The most recent applicable travel demand model in the most current version shall be used. Derive ADT and Peak Hour volumes from the model consistent with forecasting methods established in NCHRP 716 or the latest version thereof. This model is only a tool for estimating future volumes, professional judgment shall be used in determining the

appropriate estimates to be used in the technical analysis. Any assumptions or modification to model inputs or outputs should be explicitly documented in final reports.

### *Vehicle Volumes*

Estimate peak period or hour vehicle movements. In addition right turn on red, permissive left turns, and permissive right turns shall be estimated based on the proportionality of those movements in the existing counts with projected traffic counts. Manual adjustments to the volumes produced by the travel demand model shall be reviewed and documented as appropriate.

### *Bicycle and Pedestrian Volumes*

Estimate peak hour intersection bicycle & pedestrian volumes by applying the forecasted local agency wide % increase in bicycle & pedestrian trips forecasted in the MPO travel demand model to the existing bicycle & pedestrian intersection movement counts. Segment pedestrian flow rates should be estimated in the same manner.

### *Transit Volumes*

Transit frequency and passenger load factor are to be derived from the transit network and forecasts of the MPO or local agency travel demand model.

### *Regional Vehicle Miles Traveled (VMT)*

Forecasted cumulative VMT is the baseline measure under both existing and cumulative analysis.

### **Project Volumes**

Currently there is limited data on project specific multimodal trip generation, therefore the consultant, local agency, and WSDOT should use a great deal of professional judgment based on methodologies and data presented in the Institute of Transportation Engineers' (ITE) Trip Generation Handbook, locally collected multimodal trip generation, research on mixed-use trip generation, mode splits predicted from the local agency's travel demand model, and other resources.

### *Vehicle Volumes*

Estimate vehicle volume trip generation using the most recent edition of ITE Trip Generation Manual. Upon approval from WSDOT, local trip generation rates are also acceptable and preferred if those rates are developed following the method established in the current version of the ITE Trip Generation Handbook and appropriate validation is provided to support them.

Because ITE Trip Generation rates are based on vehicle trips as opposed to person trips, modal split factors should not be used to reduce vehicle trip generation calculations. Modal conversion factors can be used as prescribed in the ITE Trip Generation Handbook.



### *Pedestrian, Bicycle, and Transit Volumes*

At this time there is little information on multimodal trip generation, therefore professional judgment should be used in estimating project pedestrian, bicycle, and transit trip rates.

Multimodal trip generation rates should be derived from the MPO or local agency travel demand model and the current edition of the ITE Trip Generation Handbook. In some cases it may be necessary to collect local data to estimate multimodal trip generation; in these cases the methodology prescribed in the current version of the ITE Trip Generation Handbook should be used.

If any form of testing or research indicates pedestrian, bike, or transit LOS is not sensitive to the expected volumes, these volumes may be estimated by applying a local agency wide buildout mode split values as reported in the MPO or local agency's travel demand model.

### *Project Trip Distribution*

Project trip distribution should be derived from the MPO or local agency's travel demand model by conducting a select zone analysis of the TAZ in which the project is contained. In some cases trip distribution may need to be estimated manually such as when estimating trip distribution for pedestrian and bicycles, in these cases the assumptions and methodology must be documented in the report.

### *Project Vehicle Miles Traveled (VMT)*

The recommended methods for calculating project VMT are provided in the table below. Quick-response VMT estimation tools are not sensitive to regional production / attraction imbalances and therefore should not be used on larger projects, however this methodology may be appropriate for smaller projects. The consultant should consider which method will be most appropriate for the proposed project and document the reasoning behind selecting that method in the TIA. These recommendations may be updated in the future.

## **Transportation Analysis Methods**

### **Multimodal Level of Service and Capacity**

All interrupted and uninterrupted facility analysis shall be based upon the current version of the Highway Capacity Manual with the exception of roundabouts and Meso/Micro analysis. Unless otherwise scoped, intersection level of service and capacity (or other MOEs) analysis should be done using the current version of Synchro/Simtraffic and or Sidra Intersection (see [WSDOT Sidra Brochure](#)) unless more complex analysis is required. Intersection Analysis periods should, at a minimum, include AM and PM peak hours or periods and segment analysis periods should include 24 hours unless otherwise specified. Do not look at just one period simply because it has higher volumes (traffic must return where it came from so, AM lefts outbound become PM rights inbound, for example). Existing and Existing + Project scenarios should assume actual traffic signal timing unless otherwise directed for opening year but logical timing is acceptable for projected scenarios. The network should be geometrically correct and include peak hour factors recorded with the traffic counts by approach for base and opening year but do not use peak hour factors to further grow projected volumes.

## Automobiles

**Intersections** Level of service and delay at signalized/roundabout intersections should be reported for the overall intersection as well as any deficient turn pocket capacities. The maximum Volume to Capacity ratio (v/c) for the overall intersection should be reported as well as any deficient approaches or movements. Vehicle queues should be reported for each lane group.

**Unsignalized Intersections** Level of service for unsignalized intersections should be reported for side street approaches as well as any deficient turn pocket capacities. The maximum Volume to Capacity ratio (v/c) for the overall intersection should be reported as well as any deficient approaches or movements. If an unsignalized intersection exceeds minimum level of service thresholds a signal warrant analysis shall also be conducted.

**Segments** Level of service should be reported for street segments. Average arterial speeds and level of service grades shall be reported by direction for each approach.

## Bicycles & Pedestrians

Bicycle & pedestrian level of service analysis should follow the methodologies established in the current Highway Capacity Manual (HCM). For the purposes of forecasted LOS calculation pavement condition rating should be assumed at 3.0 unless there are other overriding circumstances. It's acknowledged that under certain high vehicle volumes conditions the HCM methodology for bicycle and pedestrian level of service estimation can be insensitive to mitigation measures, therefore it may not be appropriate to make a significance finding on a project under these circumstances. In cases where MMLOS results are non-intuitive or inappropriate alternative analysis techniques maybe more appropriate such as:

1. Using HCM 2010 Off-Street Pedestrian and Bicycle analysis methodologies when a physical barrier is provided separating bicycles (ie. Protected Lanes) or pedestrians (Landscaped Parkways) from vehicle traffic.
2. Using an MMLOS equivalent to the Bicycle / Pedestrian Environmental Quality Index (BEQI/PEQI).
  - 100-86 (A)
  - 85-71 (B)
  - 70-66 (C)
  - 65-51 (D)
  - 50> (E & F)

When alternative analysis methods are agreed upon and used, results from both methodologies and justification for alternative analysis shall be documented.

No standard significance thresholds have been established for Bike, Pedestrian, and Transit LOS using HCM 2010 methodologies. In some cases small changes in the MMLOS score may be perceived by the public whereas in other cases a small change in MMLOS would be indistinguishable. A qualitative assessment of potential impacts should be conducted to estimate if changes in MMLOS might be perceivable by the public, if a potential impact is likely perceivable this would be considered "contextually significant".

**Intersections** Bicycle & Pedestrian level of service analysis should be conducted at intersections scoped in the traffic study. Pedestrian & Bicycle level of service score and grade should be reported for each intersection, approach, or crosswalk. Off-Street parallel paths significantly improve bike & pedestrian service, however they are not considered in the level of service calculations. If a separate adjacent & parallel bike or pedestrian facility is present LOS shall be estimated based on that off-street facility.

**Segments** Pedestrian level of service analysis should be conducted on public Collectors and Arterials that front or are internal to the project, Bicycle level of service should be conducted on existing or planned bike routes that front or are internal to the project. In some cases facilities that are not fronting or internal to a project may also be scoped for analysis. As with intersections, if a separate adjacent & parallel bike or pedestrian facility is present LOS shall be estimated based on that off-street facility.

### *Transit*

**Segments** Transit level of service analysis should be conducted at segments scoped in the traffic study that have current or planned transit service. Transit frequency, load factor, and LOS score should be reported for transit routes servicing the project.

### **Vehicle Miles Traveled (VMT) Analysis**

Areas within one-half mile of a Major Transit Stop or High Quality Transit Route are defined as “Transit Zones”. Projects that are within transit zones shall include an analysis of project VMT versus forecasted regional VMT. The Consultant shall confirm the most up to date presence of any transit zones.

### **Induced Traffic Analysis**

Projects that include or may be conditioned to construct infrastructure improvements that result in significant auto travel time reductions should be scoped for analysis of shifts in auto travel and growth inducing potential as a result of those reductions. No standard significance thresholds have been established for induced traffic analysis therefore a qualitative assessment should be conducted to determine the resulting shift in auto travel and/or potential growth inducing characteristics are consistent with the MPO or local agency’s land use and transportation policies.

### **Traffic Safety**

All traffic impact studies shall include a safety assessment of scoped intersections and segments based on the project’s potential operational and geometric affects; examples of this include turn

pocket queues spilling into thru travel lanes, vehicle queues occluding or extending past minimum sight distance requirements, rear-end collision potential as a result of heavy congestion, etc...

In addition to a safety evaluation of scoped intersections and segments the safety analysis shall also include a functional area analysis of project driveways in close proximity to other intersection or major driveways on collector and arterial roadways.

In some cases a complete geometric assessment of new or modified facilities based on the AASHTO Highway Safety Manual may be required. This would typically only be required when significant modification or new infrastructure is being proposed.

### Neighborhood Traffic Analysis

Projects which include new local residential streets or have trips forecasted on local residential street will typically be required to evaluate the impact of neighborhood traffic conditions.

### Modal Priorities

In addition to maintaining minimum levels of service, the MPO or local agency's circulation element establishes priorities for various modes such that construction, expansion, or alternation for one mode should not degrade the level of service of a higher priority mode.

### Mitigation Measures

When significant impacts are identified as part of the traffic impact analysis mitigation measures shall be included to address those impacts. The impact study should establish the legal nexus between the project and the mitigation measures. The traffic study's description of each mitigation measure should include the following:

1. Comparison table of impacted locations listing conditions (ie. LOS, VMT, etc..) with and without mitigation.
2. Figure schematically depicting location and nature of each mitigation measure and description of implementation feasibility (ie..ROW requirements, constructability, etc..).
3. If specifically scoped planning level cost estimation of each mitigation measure, timing/phasing of measures, and equitable share calculation.

### Strategies

Development of mitigation measures should follow the MPO or local agency's Circulation Element Goals & Objectives. For example if a project creates a vehicle capacity impact at an intersection, mitigation measures that would reduce vehicle demand generated by the project, such as enhanced bike & pedestrian facilities or improved transit service, should be considered before measures that would increase vehicle capacity.

### Intersection Control Type Selection

See WSDOT Design Manual Chapter 1300 et al.