



Technical Memorandum

To: Board of Directors, Ozarks Transportation Organization
From: Sara Fields, AICP, Executive Director Ozarks Transportation Organization
Date: June 20, 2019
Re: Model Transportation Impact Study Guidelines – Tiered Study Parameters

The communities that make up the Ozarks Transportation Organization, two counties and seven cities, all have different development-related transportation policies. While the various policies all represent a good foundation, each community has room for improvement in defining the traffic impact study and improving the guidelines for a more comprehensive review. The purpose of this memorandum is to outline the tiered Transportation Impact Study parameters and guidelines adopted by the Ozarks Transportation Organization. This common policy will help ensure our communities receive a more comprehensive analysis when they review potential developments. This guidance will:

- Expand the definition of a ***traffic*** impact study into a ***transportation*** impact study.
- Identify the level of study necessary for proposed developments or redevelopments.
- Provide a consistent approach across the region.
- Provide the agencies as well as developers, consultants, and other interested parties a guide to the Transportation Impact Study process and recommended methodologies.
- Provide for the consistent review of Transportation Impact Studies.

This memo outlines the final guidance associated with the region's Transportation Impact Study Policy. The motivation for moving to a more comprehensive policy is described in some detail. The new policy is a tiered approach, and each tier is described in the memo's second section. While the requirements of the initial submittal and the first study tier are adequately described in that section, a third section has been added to outline, in great detail, the requirements of the three levels of Transportation Impact Studies. Since this policy may be implemented on a case-by-case basis in each of our member communities, a fifth section has been added to outline a consistency strategy for reviewing Transportation Impact Studies. The final section of this memo outlines how Transportation Impact Studies can be amended after it is submitted and how long a study can be considered valid after a study is submitted and before the development receives the necessary development permits and commences construction.

This memo contains many supporting documents. Examples of the initial submittal and all four tiers of studies are provided. A submittal checklist, intended for developers, has been created and is included as well. Since these studies may need to be updated or amended, examples of amendments are also included.

Goal and Definition of a Transportation Impact Study

The OTO region is once again experiencing development pressures. As communities have continued interacting with developers, an increasing number of questions concerning the interpretation of Traffic Impact Studies have increased. The OTO has recognized a need to develop a more comprehensive policy for evaluating development because of these questions. This memo outlines that policy.

Traditionally, the Traffic Impact Study's primary purpose was to evaluate how the expected traffic from a new land use (development or redevelopment) will impact vehicle operations on the surrounding



roadway system. The study provided a ‘before’ and ‘after’ analysis of traffic operations allowing an agency to determine where potential roadway geometric or traffic control improvements were necessary.

As more modes of travel become available and acceptable, the *Traffic Impact Study* needs to accommodate a more comprehensive evaluation than simply reviewing the movement of cars. This more comprehensive analysis is better referred to as a *Transportation Impact Study* (TIS). The goal of a TIS is broadened to determining the impact of a development or redevelopment on the transportation system, which includes examining parking, multi-modal facilities, and the movement of cars, trucks, bicycles, and pedestrians around a site. Where deficiencies or issues are discovered, the TIS identifies feasible solutions to the problem(s).

While a TIS is a planning tool to help agencies determine when improvements are necessary, it is not a long-range area-wide transportation plan. The focus is generally on a single site and the relatively short-term (up to ten years) impacts and improvements necessary. The TIS could be considered a reactive tool designed to mitigate concerns of impending development as opposed to a proactive approach to plan for, reserve right-of-way, and fund the long-term improvements of a transportation system. One weakness of a TIS is assigning mitigation to the last developer in the area when their traffic represents only a portion of all traffic.

The TIS is further not designed to assign costs or funding for recommended mitigation measures. Each agency will need to negotiate funding with a developer separately from this document and in combination with other factors beyond traffic and transportation issues. The TIS can assist in that effort but should not be mistaken as conveying responsibility for improvements.

Despite these limitations, a TIS provides valuable information as to when improvements are necessary, potential creative solutions to unique issues identified, and, ultimately, maintain acceptable levels of operation for all users of the transportation system.

Transportation Impact Study Tier Descriptions

The OTO’s Transportation Impact Study parameters are sub-divided into five categories; an initial submittal and four study tiers as follows:

Initial Submittal

Preliminary Transportation Assessment*

*Optional

Study Tiers	Thresholds
Transportation Impact Study: Level I	under 100 peak hour trips or Fewer than 50 new dwelling units
Transportation Impact Study: Level II	100 to 499 peak hour trips



Study Tiers	Thresholds
Transportation Impact Study: Level III	500 to 999 peak hour trips Or A change in access to a Primary Arterial or higher-class road (if peak hour trips are less than 1000)
Transportation Impact Study: Level IV	1,000 or more peak hour trips

The optional Preliminary Transportation Assessment is designed to provide critical basic information to the community very early in the negotiation and development process. This assessment helps the community determine what level of study is required and what areas need to be highlighted in that study. If developers are confident of what level of study is required and are confident they understand the issues the community will want highlighted, the developer may choose not to complete a Preliminary Transportation Assessment. The graphic below is illustrative of the relationship between the Preliminary Transportation Assessment and the four study tiers. A more complete flow chart that describes this tiered process is included at the end of this memo.

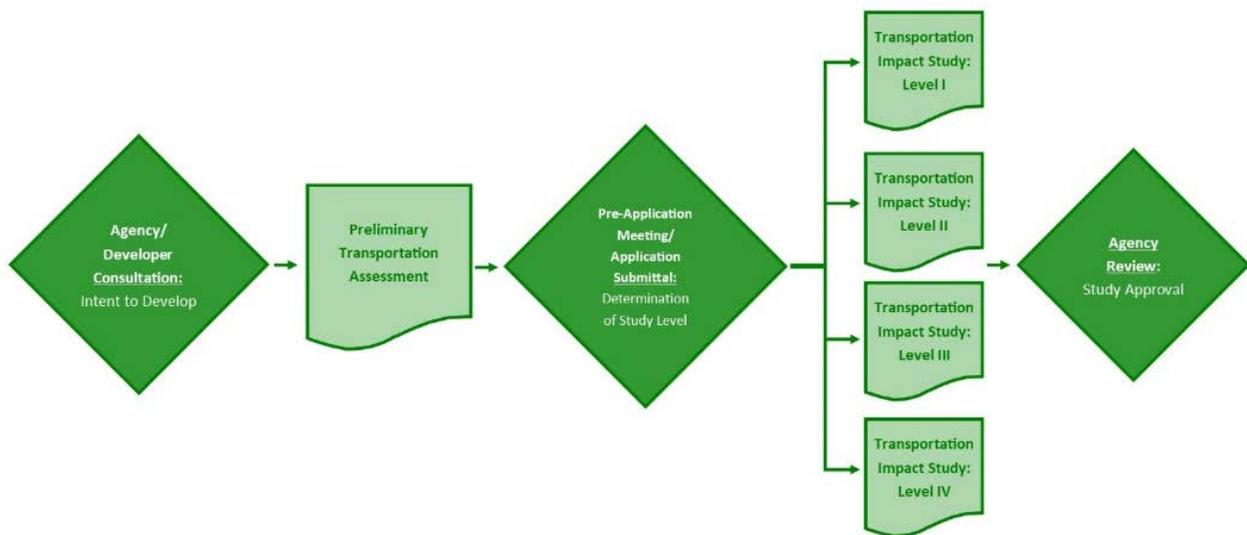


Illustration of TIS Process with the Optional Preliminary Transportation Assessment

The optional initial submittal and the four study tiers are described below. The Preliminary Transportation Assessment and the Transportation Impact Study Level I describe the report requirements. Due to the complexities of the TIS Level II through Level IV, a separate section is included to describe the requirements of these studies.

Preliminary Transportation Assessment- Optional

This initial submittal is recommended with every submittal that requires a Traffic Impact Study; new developments, redevelopments, or other agency categories. The purpose of the document is to present basic information about the existing site and the proposed new use, allowing the agency to see the



transportation basics and make informed decisions on the next steps. This basic memorandum should be submitted with the initial project preliminary plan submittal (realizing the site plan may be adjusted with comments on the preliminary plan). The Preliminary Transportation Assessment (PTA) should be able to be completed by an engineer in two to four hours depending on the complexity of the proposed development.

The components of this initial study are:

- Existing Conditions – a table and brief description of the surrounding key roads (name, classification, speed limits, daily volume, presence of transit, presence of trails/sidewalks). *Some* daily volume, transit, and classification data is available through the OTO.
- Proposed Development – summary of the proposed land uses, including the sizes (square footage, units, etc.) that will be used to determine the trip generation.
- Trip Generation – the raw daily and peak hour trip generation for each land use and the resulting total using data from the latest version of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. For well-defined land-uses, such as a known gas station, industry accepted methods for calculating trip generation are acceptable. For land uses that are more general, such as a strip mall, calculating trip generation using estimated floor area for each land use is preferred. Alternatively, local trip generation data is also encouraged for determining potential traffic assuming the data is local, directly relevant to the proposed land use and collected within the past two years.
- Sight Distance – a quick review of the sight distance provided at the proposed access points. As some site plans may not be refined enough to fully review the sight distance, this task could include a short discussion of how the access will be reviewed or potential issues that could impact the sight distance (development signing, landscaping plan, other building elements near the ROW or public roadway, etc.). The intent of this component is to highlight issues that are clearly expected or that currently exist, such as access in blind corners, neighboring structures located on the ROW-line, planned cut-and-fills that will limit site lines.
- Red Flag Review – a quick review of the proposed development from a transportation standpoint. The following checklist provides several categories of a basic transportation review. Any answer of ‘yes’ to these questions flags the need for additional review and consideration by staff on the level of study necessary for a proposed development.
 - Zoning – is a change in zoning being proposed?
 - Access – is a new access proposed (increasing the number of accesses on the surrounding roads) or an existing access relocated? Are the access spacing requirements based on the Functional Classification of the road violated?
 - Conflicts – are significant pedestrian/bicycle/vehicle conflicts present?
 - Drive-Thru – will the expected drive-thru queue exceed its storage?
 - Loading Areas – does the loading/unloading area(s) create internal conflicts?
 - Multi-Modal – are there any issues with connections to multi-modal facilities (existing or future transit, bicycle, and pedestrian amenities)?
 - Traffic Control – is a traffic control change being requested?
 - Parking – are the required parking spaces greater than the proposed supply?
 - Truck Routes – do heavy truck routes within the site create significant conflicts?
 - Safety – has an agency, or reviewed crash data, indicated a safety issue in the proposed area?



- Coordination – will/should the state, county, or other adjacent agencies be involved in the study review?
- Other – do other special traffic/transportation factors or issues exist on adjacent roadways or properties that should be considered for this review?

As demonstrated in the attached Preliminary Transportation Assessment, the Red Flag Review represents an initial, cursory, analysis. It is a check list with ‘Yes’, ‘No’, and ‘Not Applicable’ options. A short sentence may be added to explain any ‘Yes’ answer.

- Transportation Impact Study Need – based on the above information, propose the level of traffic impact study necessary for this site. The level of study is based on the raw trip generation (or local equivalent as discussed above) of the proposed land uses as follows:
 - Transportation Impact Study: Level I – under 100 peak hour trips, or fewer than 50 new dwelling units
 - Transportation Impact Study: Level II – 100 to 499 peak hour trips
 - Transportation Impact Study: Level III – 500 to 999 peak hour trips, or change in access to primary arterial or higher-class road (<1000 peak hour)
 - Transportation Impact Study: Level IV – 1,000 or more peak hour trips

A Transportation Impact Study: Level III may be triggered by new proposed access or failure to satisfy access spacing guidelines even if the trip generation does not indicate that level of study. Similarly, a ‘yes’ answer to one or more of the checklist Red Flag Review questions may indicate the need for a more detailed study.

The reviewing agency reserves the right to complete portions of the Preliminary Transportation Assessment. This could include portions of the Red Flag Review or traffic generation estimates.

The reviewing agency will make the final decision on the level of study necessary. This information is presented as a guide. Special concerns of the agency or specific issues in the area could provide the basis for an increase in the level of study beyond what the trip generation may indicate. Similarly, the agency may decide on a lower level of study depending upon various circumstances like recent study in the same area or recent improvements that already provide for increased roadway capacity.

A substantial amount of information will be communicated to the developer after the agency’s review of the PTA. Growth factors; traffic generation data for approved adjacent developments; the required study area, including required intersections and segments; known problem areas; information about adjacent multi-modal infrastructure; and plans and policies that reference the development lot are examples of information that will be provided to the developer.

If a Preliminary Transportation Assessment is submitted, the developer is only responsible for studying segments and intersections listed by the local agency after its review of the PTA. If a Transportation Impact Study is submitted without a PTA, the agency has discretion to require additional intersections or segments be included in the final report. Limited justification, not including developer buy-in, is needed to require intersection and segments that are within the study area outlined for the TIS tier. Strong justification, and buy-in from the developer, is required to add intersections that lie outside the outlined study area. The agency’s review of the PTA is designed to avoid this situation at the time of final submission.



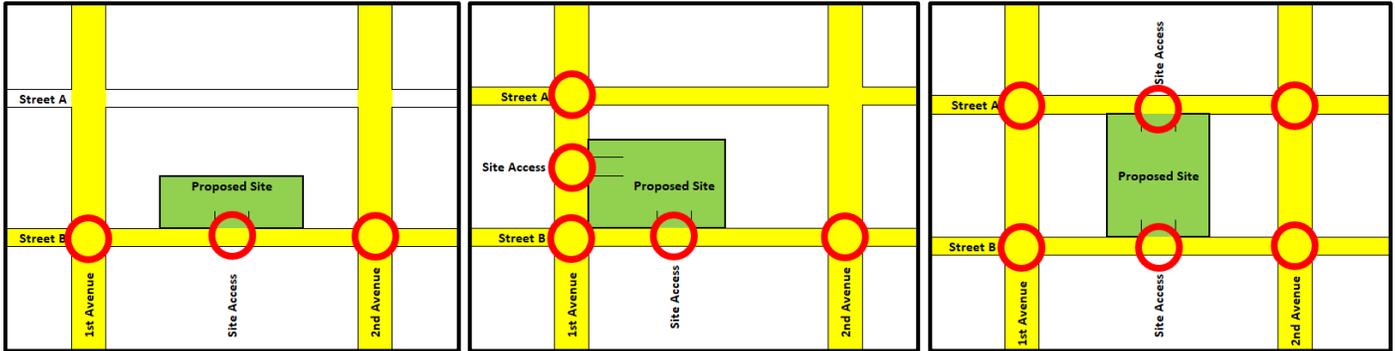
Transportation Impact Study: Level I

Using the same format as the initial submittal, the TIS Level I recognizes a proposed development will not generate significant amounts of activity. The focus is, therefore, to refine the Preliminary Transportation Assessment, moving beyond the checklist to discuss each item. These areas will need more detailed text, graphics, and charts to explain how each category is accommodated. For instance, sight distance checks may need a drawing to show sight lines or loading/unloading areas may need to be highlighted. For those items that do not apply to the proposed development, a simple “Not Applicable” if self-evident or a couple of sentences explaining why the item does not apply is sufficient.

Transportation Impact Study: Level II

A Transportation Impact Study: Level II study increases the analysis from a simple memorandum to a full report with detailed analyses and recommendations. This level of study is required for developments with between 100-499 peak hour trips or includes the construction of more than 50 new dwelling units. The report will contain the following components. These are described in greater detail starting on page 9, though specific page references are included for each report component.

- **Executive Summary** – one- or two-page summary of the project, results, and recommendations. *(page 10)*
- **Table of Contents/List of Figures/Charts/Tables.**
- **Introduction** – state the purpose of the report, the key objectives, and list the study corridors and intersections. *(page 10)*
- **Development Site** – list the location, existing land uses, zoning, proposed land uses and sizes, access locations, parking, and other key information about the site and development. *(page 10)*
- **Existing Conditions** – identify the current conditions of the surrounding transportation system, focusing on the key corridors and intersections. The surrounding transportation system encompasses roads, trails, sidewalks, and transit stops. *(page 10)*
- **Forecasts** – detail the trip generation and resulting scenario volumes. Trip generation data should include the raw daily and peak hour trip generation for each land use and the resulting total using data from the latest version of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. Alternatively, local trip generation data is also encouraged for determining potential traffic assuming the data is local, directly relevant to the proposed land use and collected within the past two years. *(page 10)*
- **Relationship to Current Plans** – summarize the how the site addressed in any local planning documents, listing how the proposed development conforms to or does not conform to the plan. *(page 11)*
- **Traffic Evaluation** – focuses on the vehicle operations around the proposed development. The study years include five scenarios: existing using counted volumes, No Build and Build for year of full buildout, and No Build and Build for 20 years after full buildout. The sketches below show three combinations of typical access that dictate the study roads and intersections. Yellow highlights indicate the study roads and red circles indicate the study intersections. *(page 11)*



- **Parking Evaluation** – compare the proposed off-street parking supply against the city or other agency code, as well as the expected demand for the proposed land uses. The expected parking demand should use the latest version of the Institute of Transportation Engineers (ITE) Parking Generation Manual to determine the average peak demand for each land use component of a proposed development. (page 14)
- **Multi-modal Evaluation** – separately examine transit, bicycle, and pedestrian facilities available near and within the proposed development. (page 15)
- **Sight Distance Review** – sight distance is an important component to maintain safety at each access driveway intersection. The latest version of the American Association of State Highway and Transportation Officials’ (AASHTO) *A Policy on Geometric Design of Highways and Streets* (also known informally as the Green Book) provides the requirements for this evaluation. (page 15)
- **Site Review** – evaluates the internal operations, which can be sub-divided into three categories: requirements, circulation, and conflicts. (page 16)
- **Conclusions and Recommendations** – summary of the key findings and resulting mitigation necessary for the site and surrounding transportation system.

The TIS can use tables, charts, and figures to reduce the text, ideally also making the document easier to read. Key information used in the evaluation should be provided in an Appendix or available upon request, including:

- Site plan.
- Collected turning movement counts.
- Detailed trip and parking generation information.
- Capacity result print-outs.
- Other information as necessary.

A full discussion of Transportation Impact Study: Level II, III, and IV report requirements can be found on page 9. Each level’s requirements are described, and tips are offered.

Transportation Impact Study: Level III

The Transportation Impact Study: Level III will follow the same process as the Level I study. This level of study is required for developments with between 500-999 peak hour trips or for developments with fewer than 999 peak hour trips that change access to a primary arterial or higher-classification road, as shown on the OTO’s Major Thoroughfare Plan. The difference between a Level II and Level III is an expanded set of study corridors and intersections. For the Level III study, the study area can be expanded to include all-



way stop control, roundabout, or traffic signal intersections with in a distance of up to .25-miles from the site and major side-street¹ stop control intersections within a distance of up to 0.125-miles of the site. For Level III studies in more rural areas, the distances may be expanded to .5 miles and .25 miles, respectively. This distance or list may be increased to include other intersections of concern or those that should reasonably be included if slightly over the recommended distance. For instance, both intersections of a freeway interchange should be evaluated even if only one is within the distance listed. A proposed development may also include internal intersections that should be considered for review. Study corridors should match the study intersections, including both cross-streets in the evaluation. The agency will provide a listing of required intersections and segments for each study.

The number of time periods for review could also be expanded to include the weekday daily and three peak hours. A large retail development could cover the weekday daily, weekday noon peak, weekday p.m. peak, and Saturday peak. A resort or hotel may want a Friday night peak or Sunday morning peak included to cover key check-in and check-out times. A school could expand to review the a.m. peak, school p.m. peak, and p.m. peak. The agency will specify the requirements for individual studies, based unique characteristics.

The inclusion of mitigated scenarios is required if major mitigation activities are proposed. Mitigation might be needed to address increases in traffic attributed to the proposed development or attributed to increases in background traffic. No responsibility for proposed mitigation activities is determined in this evaluation.

Other than these expansions, the evaluations and review under the Level I study still apply. The study outline and key appendix information also remain the same.

A full discussion of Transportation Impact Study: Level II, III, and IV report requirements can be found on page 9. Each level's requirements are described, and tips are offered.

Transportation Impact Study: Level IV

The Transportation Impact Study: Level IV also follows the Level II process. The key difference remain the expanded set of corridors and intersections for study. For the Level IV study, the study area can be expanded to include all-way stop control, roundabout, or traffic signal intersections, as well as major side-street² stop control intersections, within a distance of up to .5-miles of the site. For Level IV studies in more rural areas, the distance may be expanded to one-mile. The study area be increased to include other intersections of concern or those that should reasonably be included if slightly over the recommended distance. For instance, both intersections of a freeway interchange should be evaluated even if only one is within the distance listed. A proposed development may also include internal intersections that should be considered for review. Study corridors should match the study intersections, including both cross-streets in the evaluation. The agency will provide a listing of required intersections and segments for each study.

¹ Functional Classification of collector or higher.

² Functional Classification of collector or higher.



The forecasts for the future year scenarios will include general background traffic growth and any specific developments expected before full build out. Adding traffic from the proposed development to the No Build forecasts provides the Build scenario forecasts. The 20-year scenario should consider any roadway extensions found in the OTO Major Thoroughfare Plan. Project phasing can be used to alter the time frames of future scenarios.

The number of time periods for review could also be expanded to include the weekday daily and three peak hours. A large retail development could cover the weekday daily, weekday noon peak, weekday p.m. peak, and Saturday peak. A resort or hotel may want a Friday night peak or Sunday morning peak included to cover key check-in and check-out times. A school could expand to review the a.m. peak, school p.m. peak, and p.m. peak.

The inclusion of mitigated scenarios is required if major mitigation activities are proposed. Mitigation might be needed to address increases in traffic attributed to the proposed development or attributed to increases in background traffic. No responsibility for proposed mitigation activities should be determined in this evaluation. The proximity of a mitigation activity to the development site will be a factor in any negotiations that might occur.

Other than these expansions, the evaluations and review under the Level I and II study still apply. The study outline and key appendix information also remain the same.

A full discussion of Transportation Impact Study report requirements can be found below. Each level's requirements are described, and tips are offered.

Transportation Impact Study: Level I, II, & III – Report Requirements

The TIS report outline should generally contain the following:

- Executive Summary
- Table of Contents/List of Figures/Charts/Tables
- Introduction
- Proposed Development
- Existing Conditions
- Forecasts
- Relationship to Current Plans
- Traffic Evaluation
- Parking Evaluation
- Multi-modal Evaluation
- Sight Distance Review
- Site Review
- Conclusions and Recommendations

The report can use tables, charts, and figures to reduce the text, ideally also making the document easier to read. Key information used in the evaluation should be provided in an Appendix or available upon request, including:

- Site plan.
- Collected turning movement counts.



- Detailed trip and parking generation information.
- Capacity result print-outs.
- Other information as necessary.

Below are summaries of each section required in the Transportation Impact Study reports.

Executive Summary

The executive summary must be a one- or two-page summary of the project, results, and recommendations.

Introduction

The introduction must state the purpose of the report, the key objectives, and list the study corridors and intersections.

Development Site

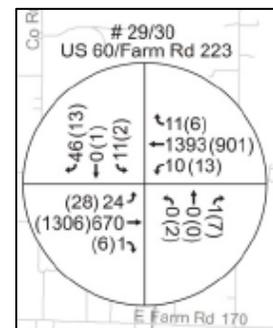
This section must list the location, existing land uses, current and proposed zoning, proposed land uses and sizes, access locations, parking, and other key information about the site and development. The study scenarios should also be described.

Existing Conditions

This section must identify the current conditions of the surrounding transportation system. The surrounding transportation system encompasses roads, trails, sidewalks, and transit stops. Key characteristics, such as volumes, hourly distributions, number of lanes, roadway classifications, speed limits, and the availability of bicycle and pedestrian infrastructure, of adjacent corridors and intersections should be included. Required corridors and intersections will be outlined the local agency.

Forecasts

Forecasts must be developed to detail trip generation and the required future scenarios. Trip generation data should include the raw daily and peak hour trip generation for each land use and the resulting total. Data from the latest version of the Institute of Transportation Engineers (ITE) *Trip Generation Manual* should be used. For well-defined land-uses, such as a known gas station, industry accepted methods for calculating trip generation are acceptable. For land uses that are more general, such as a strip mall, calculating trip generation using estimated floor area for each land use is preferred. Graphical representation of trip data, as shown to the right, is encouraged. The use of pass-by and multi-use reductions is allowed. Local agencies reserve the approve the assumptions underlying these reductions.



Graphical Representation of Trip Data

The ITE is not the only source of accepting trip generation data. Local trip generation data is also encouraged for determining potential traffic assuming the data is local, directly relevant to the proposed land use and collected within the past two years. A final option for trip generation is data generated by the owner. This information must be based on planned deliveries, freight flows, employee work schedules, and other development specific timetables. This data should be hourly and be in line with ITE estimates.



Non-site traffic forecasting should include expected traffic from nearby planned developments and expected increases along the study corridors. Completed Transportation Impact Studies for any planned developments will be provided to the developers as sources of traffic data. The number of required future scenarios is outlined in the tier descriptions and will be determined by the local agency. Project phasing can be used to alter the time frames of future scenarios.

Relationship to Area Plan(s)

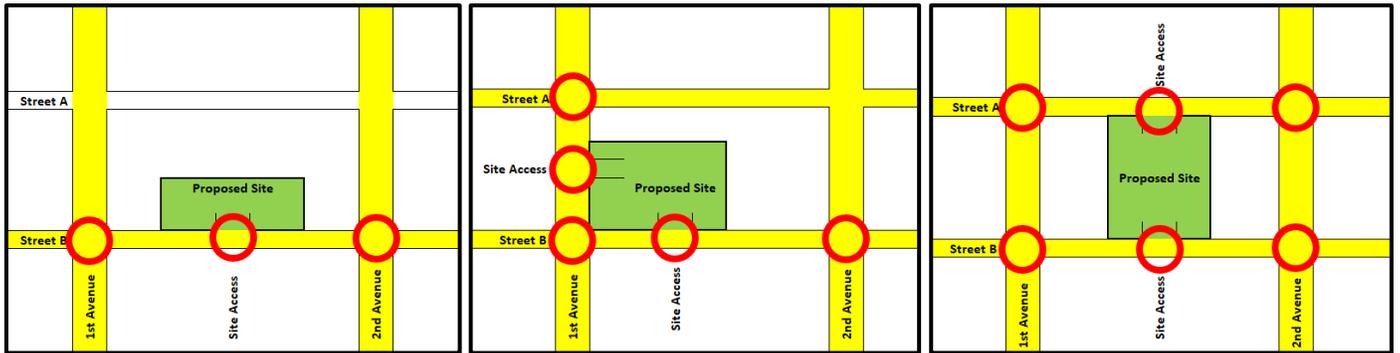
A site will sometimes be covered under a community's comprehensive, transportation, major thoroughfare, or small-area plan. These plans will have an initial assumption about the land use planned for this site as well as potential future improvements needed. Conformity to local and OTO thoroughfare plans should also be evaluated. The TIS should summarize the information, listing how the proposed development conforms to or does not conform to the plan(s). If the proposed land use is different from a current plan, more discussion will be necessary to detail the exact differences and what that could mean for the site and the area. Trip generation data and other analyses will show the differences between the community's vision, as outlined in local plans, and the developer's plans. Improvements listed in the community's plan provide the initial mitigation measures the developer should consider, should improvements be necessary for the proposed project. In subsequent evaluations, the TIS can determine if the envisioned improvements are necessary, given the development's impacts.

This section should also consider whether the development's proposed driveways are consistent with the applicable access spacing guidelines, both local and OTO. Assuming the guidelines are met, a simple statement is sufficient. If access spacing guidelines are not satisfied, this section can start a justification of why the access should be allowed, including any prior discussions with the community. Access discussion could continue in following sections, evaluating the operations, sight distance, and other aspects as part of justifying access, if necessary.

If the development does not comply with area plans, developers should outline efforts made to initiate a plan amendment or submit an application for a plan exception. A conflict will not automatically result in the rejection of the TIS. The lack of a plan to address known conflicts could result in a rejection.

Traffic Evaluation

This component of the study focuses on the vehicle operations around the proposed development. The study intersections for a Transportation Impact Study: Level I will include the access driveway intersections and the two to four surrounding intersections. The sketches below show three combinations of typical access that dictate the study roads and intersections. Yellow highlights indicate the study roads and red circles indicate the study intersections.



The study area should be expanded for Level II and Level III studies. For Level II studies, the study area can be expanded to include all-way stop control, roundabout, or traffic signal intersections within a distance of up to .25-miles from the site and major side-street³ stop control intersections within a distance of up to 0.125-miles of the site. The study intersections are expanded to include all-way stop control, roundabout, or traffic signal intersections, as well as major side-street stop control intersections, within a distance of up to 0.5-mile of the site for a Level IV study. Studies in rural areas may be expanded to twice the distance outlined for each level.

To obtain current volumes, turning movement counts across multiple days are required at each study intersection. A minimum of two-hour counts are required each day. The count period required will be determined by the local agency. The average of the individual days provide the daily volumes on the study corridors and identify the peak hours. The turning movement counts will reflect the cars, trucks, bicycles, and pedestrians moving through the intersection. Seven-day ADT counts are required for study segments.

The forecast years for a Level II, III, or IV study may include up to five scenarios:

No-Build Scenario	Build Scenario
Existing	
Year of Full Build Out	Year of Full Build Out
20yr. After Full Build Out	20yr. After Full Build Out

The forecasts for the future year scenarios will include general background traffic growth and any specific developments expected before full build out. Adding traffic from the proposed development to the No Build forecasts provides the Build scenario forecasts. The 20-year scenario should consider any roadway extensions found in the OTO Major Thoroughfare Plan. Project phasing can be used to alter the time frames of future scenarios.

The vehicle analysis will typically focus on the daily volumes and two peak hours, typically the a.m. and p.m. peak hours of the adjacent roadway. Some developments may require adjustments to the peak hours or number of peak periods. For instance, retail development may also need a Saturday peak, religious facilities may require a Sunday peak, and schools may need an earlier p.m. peak corresponding with the release of classes. The turning movement counts can be adjusted to obtain data for different expected peak periods as needed.

³ Functional Classification of collector or higher.



The analysis will use the methodology of the latest version of the Highway Capacity Manual (HCM), or other current software package. For the daily volume analysis, determine the volume-to-capacity ratio (v/c ratio) for each study road using the planning level capacities. For intersection analyses using the peak hour volumes, many different analysis softwares incorporate the HCM methods. Deterministic or analytical analysis (formulas with specific inputs where the same inputs result in the same outputs every time) is usually sufficient for the intersection analyses. Some communities stipulate that specific roadway capacities be used. In such cases, those prescribed capacities should be used.

However, stochastic software, or micro-simulation, may be necessary if one or more of the following can be answered “yes”:

- Is there unique geometry or a special situation that cannot be analyzed using the Highway Capacity Methodology?
- Are there progression issues from intersections over-capacity or the mixing of traffic control options (like a roundabout within a timed traffic signal corridor)?
- Are special measures of effectiveness needed to properly analyze a situation, like corridor travel times?
- Will visualization be necessary for an agency meeting or other public involvement?

These situations are not expected to be common, so micro-simulations are not a typical expectation of local agencies.

Acceptable results generally include daily v/c ratios less than 0.85, Level of Service grades D or better for signalized, all-way stop control, and roundabout control. Vehicle queues should also be examined to determine if stacking blocks turn lanes or adjacent accesses. Side-street stop control intersections may exhibit high delays during the peak hours but are still considered acceptable if the vehicle queue is less than five vehicles or less than ten vehicles with relatively low volumes.

Mitigation measures should be recommended for any corridor or intersection with unacceptable results. Generally, the lowest cost mitigation measure should be recommended. Mitigation measures should consider both the supply-side (roadway capacity) and demand-side (amount of generated traffic) for improvements. Examples of supply-side mitigation include:

- Signal timing improvements, including phasing changes.
- Improved signing and pavement markings.
- Peak hour turning restrictions.
- Traffic control changes.
- Adding exclusive turn lanes.
- Adding additional through lanes.
- Alternative intersection traffic controls.
- Access management.
- Intelligent Transportation Systems (ITS) options.

Demand-side mitigation includes:

- Pay for parking.
- Peak hour parking restrictions.
- Truck/delivery peak hour restrictions.
- Staggered work hours.



- Active encouragement of alternative methods of travel (transit, bicycle, walking) through facility improvements or monetary incentives.
- Active encouragement of carpooling or other forms of ride-share.
- Smaller development size.

For some improvements, warrants or minimum thresholds should be checked to confirm their applicability. Traffic signal warrants and the typical guidance of a minimum 300 left turn movements for dual left turn lanes are examples of this type of guidance.

The inclusion of mitigated scenarios should be included if major mitigation activities are proposed. Mitigation might be needed to address increases in traffic attributed to the proposed development or attributed to increases in background traffic. No responsibility for proposed mitigation activities should be determined in this evaluation.

Parking Evaluation

The parking review consists of comparing the proposed off-street parking supply against the city or other agency code as well as the expected demand for the proposed land uses. The proposed development site plan should identify the provided off-street parking supply. The city code can be obtained from the appropriate agency.

The expected parking demand should use the latest version of the Institute of Transportation Engineers (ITE) *Parking Generation Manual* to determine the average peak demand for each land use component of a proposed development. Alternatively, local parking generation data is also encouraged for determining expected parking demand assuming the data is relevant to the proposed land use and collected within the past two years. Other methods of calculating the peak parking demand (such as using the number of employees with vehicle occupancy rates and shift times) could also be used to determine the demand. If another method is used, the text should justify its use and provide sufficient detail for agency review of assumptions and methodology.

Other factors the parking evaluation should consider in the comparison between the supply and demand are:

- The time of peak parking, which can identify compatible land use regarding parking needs. For instance, residential uses have peak parking overnight while office parking peaks are typically mid-morning.
- The potential for internal traffic where one parked vehicle represents trips to two or more land uses on the proposed site.
- Active encouragement of alternative modes of travel.
- Active encouragement of carpooling or other forms of ride-share.

These factors may result in a reduction of the peak parking demand. Any discount should be explained and justified in the report, detailing the efforts or methods being applied and the amount of discount taken.

The text should explain and detail why the parking supply is sufficient, particularly if the parking supply does not satisfy the city code but is enough for the calculated demand.



Multi-modal Evaluation

The multi-modal evaluation element of the model TIS policy is highly individualized. Given a TIS can be required at multiple points in the development process, a complete site plan may not be available. The intent is to review what is available, to the degree possible. Reviewers will seek to determine if multi-modal transportation options have been considered in the design and conceptualization of the development. This section of the study could be further sub-divided to examine transit, bicycle, and pedestrian facilities separately. The transit evaluation examines any stops in or adjacent to the proposed development. Consider the type of facility provided and how people will travel between the stop and the front door(s) of the proposed development. If the transit stop is one or more blocks away, review the facilities on the adjacent blocks even if beyond the study area identified for the traffic analysis. Where transit is not currently provided, the analysis could explore whether the proposed development is of sufficient size to add a stop.

Bicycle facility review should include the method of travel on the adjacent transportation system (bike lanes, trails, etc.) as well as the bicycle parking on the site and the connection between the two. Other amenities, if provided by the proposed development, should also be detailed to show how the bicycle system is improved or maintained. Amenities could include outdoor features, like a stationary bicycle maintenance station, or indoor features, like long-term bicycle storage for apartment residents.

Pedestrian facilities can be focused on the site and the connections around the site. The report should consider how people move from a parked vehicle to the entrance and back, connections between adjacent sidewalks/trails and the front door, and connections between entrances of different buildings or land uses. External facilities around the site are also important to review including crosswalk locations, ADA-compliant domes, and pedestrian signal timing. There should be some correlation between this analysis and the Site Review component of the study.

If discounts for trip generation or parking demand are used in the traffic or parking evaluations, the reasons for those discounts can be further detailed in this section. It is also possible that no facilities are necessary due to the site location or other reasons. This section can document that decision and consider whether right-of-way should be reserved for future amenities.

Sight Distance Review

The intersection sight distance is an important component to maintain safety at each access driveway intersection. The latest version of the AASHTO *A Policy on Geometric Design of Highways and Streets* provides the requirements for this evaluation. The time gap and time adjustment factors for intersection sight distances are detailed in this manual.

If collecting this data, a sufficient number of surveys shall occur to provide a reasonable average and range of results to compare against the threshold required. Providing sight triangles or straight-line distances on the site plan can also convey the necessary information but may not account for vertical deflection. Sufficient sight distance is required at each access driveway intersection.

Depending upon the level of development, this section may expand upon the Preliminary Transportation Assessment or provide completely new information.



Site Review

The site review element of the model TIS policy is highly individualized. Given a TIS can be required at multiple points in the development process, a complete site plan may not be available. The intent is to review what is available, to the degree possible. Reviewers will seek to determine if transportation has been considered in the design and conceptualization of the development. Generally, this element of the study evaluates the site's internal operations, which can be sub-divided into three categories: requirements, circulation, and conflicts. These three areas are described below.

Requirements are those items dictated by the Manual on Uniform Traffic Control Devices (MUTCD), the American with Disabilities Act, or other similar manuals. The report should note areas that do not meet the requirements and how to move into compliance with those manuals.

Circulation is the ability of people and vehicles to safely move around the site. This evaluation should consider how everyday motorists, delivery trucks, bicyclists, and pedestrians travel around the site.

Conflict areas are important because they directly reflect on the safety of the site. Related to the circulation, conflicts include those areas within the site where car, truck, bicycle, pedestrian, or other types of travel interact and cross.

Policy makers acknowledge the challenges associated with this review. The element is intended to determine to what extent has transportation been considered in the design and conceptualization of the development.

Supporting Materials

Key information used in the evaluation should be provided in an Appendix or available upon request, including:

- Site plan.
- Collected turning movement counts.
- Detailed trip and parking generation information.
- Capacity result print-outs.
- Other information as necessary.

The supporting materials should be sufficient to recreate the analysis performed during the creation of the Transportation Impact Report.

Review Guidance

This model policy provides guidance for the consistent creation of Transportation Impact Reports, and it provides guidance for the consistent review of these reports. These reports will be reviewed by a range of staff throughout the OTO region. The guidance below should create consistent expectations across the region's seven cities and two counties. Each component of the report is discussed. The discussion includes the overall importance of each component and includes specific content that should be found in each component. A checklist for developers based on this information is included with the supporting materials.



If a Preliminary Transportation Assessment was submitted, the reviewer is limited to ensuring the agreed to intersections and segments are included. If a Transportation Impact Study is submitted without an initial Preliminary Transportation Assessment, the reviewer has discretion to require additional intersections or segments be included in the final report. Limited justification, not including developer buy-in, is needed to require intersection and segments that are within the study area outlined for the study tier. Strong justification, and buy-in from the developer, is required to add intersections that lie outside the outlined study area. The initial submittal review process is designed to avoid this situation.

Executive Summary

The overall quality of the executive summary should not impact the review of the Transportation Impact Study. Glaring omissions, such as the exclusion of key findings, can be considered.

Table of Contents/List of Figures/Charts/Tables

The overall quality of the Table on contents should not impact the review of the Transportation Impact Study. Missing components can be considered.

Introduction

The overall quality of the introduction should not impact the review of the Transportation Impact Study. Glaring omissions, such as the omission of key corridors, can be considered.

Development Site

Reviewers should consider if the description matches the description included in the Preliminary Transportation Assessment, if completed. The description should specifically note if changes to the development have occurred since the review of the Preliminary Transportation Assessment. The reviewer should also consider if the description includes accurate information on existing land uses and current zoning. The reviewer should also ensure the study scenarios are appropriate for the tier and for any planned phasing.

Existing Conditions

The reviewer should consider the accuracy of the information included in the existing conditions section. If the report is missing important existing conditions, the final recommendations may be flawed. Ensure accurate information on available transit and bicycle/pedestrian infrastructure is included. The lack of existing transit or bicycle/pedestrian infrastructure should not impact the review of the study.

The reviewer should verify the traffic volumes. The appropriateness of the selected peak hours should also be evaluated, both for surrounding roadways and site access.

Forecasts

The reviewer should focus on the quality of the site-specific traffic forecasting and of the non-site-specific forecasting. The review of site-specific data should focus on the appropriateness of trip generation estimates and of the trip distribution. Specifically, the reviewer should consider the following questions:

- Is the most correct Land Use Code used?
- Are owner-supplied estimates in line with corresponding Land Use Code estimates?
- Does the trip distribution make sense given existing development patterns?
- Are the pass-by and multi-use reductions reasonable?



The review on non-site-specific data should focus on the assumptions made in the forecasts and the supporting data included in the appendix. Specifically, the reviewer should consider the following questions:

- Do the forecast assumptions match city expectations for traffic?
- Do the site specific and non-site-specific traffic estimates total the future build scenario estimates for traffic?
- Are the 5 build and no-build scenarios included?

Relationship to Current Plans

The reviewer should focus on the compatibility of the proposed development with existing planning efforts.

- Does the study reference all relevant plans?
- Does the study reference applicable Major Thoroughfare Plans, including local and OTO?
- Does the proposed development advance the transportation related objectives in citywide and regionwide plans?
- Does the proposed development mesh with the future vision for the area, if current plans specifically address the area surrounding the development site?
- Do the planned driveways conform with local, or OTO, design standards?
- If the proposed development is not in line with current plans, does the study offer compelling reasoning for why the development is appropriate for the area?
- Does the study describe efforts to apply for amendments or exceptions?

Traffic Evaluation

The reviewer should focus on determining if the traffic evaluation is reasonable. If the evaluation is determined reasonable, the reviewer should consider the feasibility of the proposed mitigations. No consideration should be made concerning who is responsible for the proposed mitigations.

Attention should be paid to both the corridor and intersection analyses. Generally, the review should verify:

- the latest version of the Highway Capacity Manual was used,
- that micro-simulations are used if a special situation exists that precludes the HCM, such as intersections well over capacity or traffic control options are mixed in a corridor, or visualization is needed to accurately communicate the project to public officials.

For the corridor analysis, the reviewer should verify:

- the correct capacities were used,
- that the reported V/C ratio relates to existing condition,
- the reasonableness of the results for any future year scenarios.

For the intersection analysis, the reviewer should verify:

- that the intersections were accurately modeled,
- that the appropriate number of turning movement counts were conducted,
- that 7-day ADT counts are included for study segments.
- the reported current LOS data matches drivers' experiences,
- that side street stop-controlled intersections are analyzed using a queue-length analysis, and



- the reasonableness of the results for any future year scenarios.

Finally, the reviewer should also make sure that intersection and corridor analyses are compatible. For example, a highly congested corridor should not have several intersections with minimal delay.

When reviewing the mitigation analysis, special attention should be appropriateness of each mitigation.

- Are mitigation measures proposed for all corridors with a V/C ratio over 0.85 or an intersection with a LOS of E or less?
- Do the mitigation measures seem to address the identified problem?
- Does the report recommend the lowest cost options?
- Do the mitigation measures comply with local design and spacing standards?
- Does the report contain tables and charts showing how the mitigation measures impact LOS, V/C, or queue length?

Parking Evaluation

The reviewer should verify the report includes:

- the number of planned automobile parking spaces,
- an accurate description of the community's automobile parking requirements,
- automobile parking demand information for the appropriate land use codes,
- a justification for the provision of fewer parking spaces than provided in the code, especially referencing any site-specific features that might encourage alternative modes of travel and reduce parking demand,
- a discussion of planned bicycle parking and the community's bicycle parking requirements

Special attention should be paid to any situation where planning automobile parking greatly exceeds city parking requirements or expected parking demand. Efforts should be made to reduce the supply of parking.

The reviewer should also expect to see provision of bicycle parking for developments near the region's greenway trails or many marked bike routes. There should be some correlation between this evaluation and the bicycle component of the multi-modal evaluation.

Multi-modal Evaluation

The multi-modal evaluation may be brief, depending on where in the region the development is located. Fixed-route transit services are only available in one community. Many industrial areas in the region are not located in areas adjacent to residential developments, where bicycle and pedestrian connections are critically important. However, many developments will happen in areas where transit, bicycle, and pedestrian facilities are needed. The reviewer must pay close attention to where a proposed site is located. Reviewers should seek to determine if transportation was considered in the design and conceptualization of the development.

Major transit analysis will only apply to developments within communities that offer fixed-route services. However, OATS, Inc. is constantly expanding its community-based employment services, so some consideration for cutaway-bus access may be applicable. For developments within communities with fixed-route services, the reviewer should verify service availability.



Reviewers should look for ways the development will improve bicycle access on, and around, the site. This may include:

- widening sidewalks into multi-use trails,
- providing marked facilities within the development, or
- providing bicycle parking

Existing roads may have limited bicycle facilities, but that does not preclude people accessing the site via bicycle. There should be some correlation between this evaluation and the bicycle parking evaluation.

Reviewers should look for clearly defined pedestrian facilities within the development site. These facilities should connect to surrounding facilities, should they exist. If no surrounding facilities exist, the reviewer should consider if the internal system could easily be connected in the future. Attention should also be paid to issues related to ADA-compliance. Also, there should be some correlation between this analysis and the Site Review component of the study.

Sight Distance Review

The reviewer should look for evidence of sufficient sight distance. Since the guidance specifically references the time-based methodology, the reviewer should look for this first. The reviewer should ensure that:

- several time-based sight distance evaluations were completed, and
- the threshold time accounts for any proposed use of the intersection by heavy truck traffic.

If site triangles or straight-line distances are provided, the reviewer should look for any vertical deflection that might reduce visibility. The reviewer should also look for any signs or landscaping that might impeded sight distances. If impediments are identified, the reviewer should work with the developer to have the design altered in such a way as to maintain sight distances.

Site Review

The site review element is highly individualized. Given a TIS can be required at multiple points in the development process, a complete site plan may not be available. The intent is to review what is available, to the degree possible. Reviewers should seek to determine if transportation was considered in the design and conceptualization of the development.

The reviewer should evaluate the internal operations of the development by looking for compliance with standard requirements, evidence of safe circulation, and minimal points of conflicts. These areas are highlighted in the report requirements. Depending on the exact land use and unique characteristics of the site, the reviewer may also consider other elements, as outlined in the report requirements. Reviewers may consider drive-through stacking sufficiency or the location of tanker truck when refilling gas stations, amongst many others.

Many standard policy guides, such as the MUTCD or the Americans with Disabilities Act, could be employed during the compliance review of the site plan. Striping and signing are key features that should be checked for compliance. For example, the site plan should contain, or the report have identified deficiencies related to, accessible paths and clear directional signage. The reviewer should be familiar with all standards they are applying in his or her review.



Beyond strict compliance to standard requirements, the reviewer should look for evidence of a safe and efficient circulation system in the site plan. The report should describe how cars, trucks, buses, bikes, and pedestrians will interact within the site, and what efforts have been made to separate these users. There should be evidence of some critical review of the site plan by the report's authors. Design compromises are nearly always required in the creation of the site plan, and those compromises should be described in the report. The goal of this review is to limit foreseeable issues before they are permanently constructed on the site.

The reviewer should explicitly look for potential conflicts when reviewing the site plan's circulation. The reviewer should look for evidence that the conflicts are managed appropriately, such as the inclusion of clearly signed crosswalks or points of pedestrian refuge.

Conclusions and Recommendations

The intent of this review is to ensure that key findings and recommendations from throughout the report are accurately summarized. The reviewer should ask the report's author to add any key finds or recommendation that is left out.

Supporting Materials

The reviewer should verify all necessary supporting materials are included. These materials include the information required to recreate the analyses performed during the creation of this Transportation Impact Study, such as site plans, detailed trip and parking generation information, turning movement counts, capacity results print-outs.

Possible MoDOT Requirements

This policy outlines requirements placed on developers by the seven cities and two counties comprising the OTO. MoDOT may require additional studies or documentation. This may include a crash analysis for a period of five full years, a Highway Safety Analysis for proposed improvements, or an Access Justification Report for new access to the interstate system. Developers are responsible for ensuring their Transportation Impact Study satisfies the requirements of the local community and the state.

Period of Study Acceptability

Transportation impact studies reflect the conditions at the time of study and the future projections based on those existing conditions. In general, Transportation Assessments and Transportation Impact Studies are valid for two years once the final report is accepted by the overseeing agency. Changes in the proposed development (land use type or size, access, etc.), the traffic volumes in the study area, or the area conditions could require a new study of the proposed development.

Within the two-year timeframe, the agency is responsible for identifying significant changes in the area traffic volumes or conditions that would impact the results of a TIS. Examples of significant changes could include new development to account for in the study area, changes to the study area road or intersection geometry, changes to the study area traffic control, or an updated long-range plan for the area that significantly changes the previous planning. The overseeing agency has the authority to determine what it considers significant changes to call for a new study. An example of a TIS addendum is included in the supporting materials.



Beyond two years, or if the proposed development has changes in access or land use type and size, the developer is responsible to justify the acceptability of the TIS. An Update or Revision Memorandum is an option to show that acceptability. This type of Memorandum can generally follow similar guidelines to the Preliminary Transportation Assessment, noting the differences or lack thereof, between the study conditions and those of the current situation. For instance, if the land use type or size changes, the trip generation table could show the previous and current data. If the change is minor, the results of the current TIS should still be valid without the need to re-do the study.

The agency still has the ability to require a new study if they believe the changes are significant and will impact the results (regardless of what the developer has prepared). However, the agency could decide only one or more sections of a study need to be revised. For instance, if the traffic volumes and development trip generation remain similar, the Traffic Evaluation could be re-used without changes while the rest of the document is updated.

Discussions between the developer and agency are important when an update or revision occurs. The goal is to provide the best analysis of the situation, not provide an update 'just because'. These discussions should help outline what areas, if any, need an update or revision and the best methodology to accomplish it (i.e. new study, update memorandum, etc.). While the developer is encouraged to present their information and reasoning, the agency will make the final determination of necessary updates or revisions.

Attachments

Process Flow Chart

Submittal Checklist

Example of Preliminary Transportation Assessment

Example of Transportation Impact Study: Level I

Example of Transportation Impact Study: Level II

Example of Transportation Impact Study: Level III

Example of Transportation Impact Study: Level IV

Example of Addendum Memo for TIS: Level IV