City of Orange Traffic Impact Analysis Guidelines for Vehicle Miles Traveled and Level of Service Assessment

April 2026

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When is a TIA Required?

An applicant seeking project approval will submit the proposed project to the Community Development Department (CDD) with a planning and land used approval application. The project planner will transmit the application to Public Works Traffic Engineering for preliminary review, as part of the interdepartmental project review process. After a preliminary review of the project by Traffic Engineering, the applicant will be notified by the project planner in writing within 30 days of the application submittal date as to whether a Traffic Impact Analysis (TIA) is required.

The TIA should consider deficiencies in Level-of-Service (LOS) and impacts under CEQA on Vehicle Miles Traveled (VMT).

A TIA which includes LOS analysis shall be required for a proposed project that meets any of the following criteria:

- When either the AM or PM peak hour trip generation is expected to exceed 100 vehicle trips from the proposed development.
- Projects on the Arterial Highway System which generate 1,600 Average Daily Trips (ADT).
- Projects that will add 51 or more trips during either the AM or PM peak hours to any intersection.
- Any project where variations from the standards and guidelines provided in this manual are being proposed.
- When determined by the City Traffic Engineer that existing or proposed traffic conditions in the project vicinity have unique characteristics that warrant evaluation.

A TIA which includes VMT assessment shall be required for a proposed project that does not satisfy the identified project screening criteria:

- Transit Priority Areas Screening
- Low VMT-generating Areas Screening
- Project Type Screening

See Section, "CEQA Assessment - VMT Analysis" for details on these screening criteria.

Projects may be screened from VMT analysis and require LOS analysis, or vice-versa. In cases where insufficient information is available to make a preliminary assessment of a proposal's effect on traffic, the City Traffic Engineer shall determine, at his or her discretion, whether a TIA will be required.

A TIA must be prepared under the direction of a registered traffic engineer or a registered civil engineer with documented experience in traffic engineering and transportation planning. The TIA shall be submitted to the Traffic Engineering Division in a draft form. Comments relative to the analysis shall be provided by the City Traffic Engineer, or designee, in writing to the project proponent and its engineer so that any necessary revisions can be made prior to final submittal. The TIA is not deemed complete or final until it incorporates all necessary revisions and is prepared to the City's satisfaction.

Non-CEQA Transportation Assessment

Level-of-Service Analysis Procedure

Within the study area identified by the City Traffic Engineer, level-of-service (LOS) analysis shall be conducted at:

(1) Identified Intersections (signalized and unsignalized);
(2) Identified Midblock Segments; and
(3) Proposed access points to the project.

Methodology

Intersection capacity calculations for signalized and unsignalized intersections will be made using the Intersection Capacity Utilization (ICU) method unless the consultant conducting the traffic study and/or City Traffic Engineer or designee identify locations that can be better evaluated using the Operational or Planning Analysis methodologies found in the latest editions of the Highway Capacity Manual (HCM). Pre-approval to use HCM for signalized and unsignalized intersections shall be obtained in writing from the City Traffic Engineer or designee. Use of the HCM methodology, in addition to an ICU-type analysis, will be required at any study area intersection under the control of Caltrans.

Roadway segment LOS will be calculated using average daily traffic (ADT) carrying capacities defined in the City's General Plan. Un-signalized intersection analysis shall be calculated using the HCM methodology.

Scenarios and Volume Development

All traffic volume information used to represent existing conditions shall be no more than two years old. Additionally, the raw data from sources other than the City, on which existing conditions are based, must be supplied in the traffic study appendix identifying the source. The following five analysis scenarios should be evaluated (at the discretion of the City Traffic Engineer in coordination with Community Development) and summarized in a single table and throughout the analysis using the following designations:

a. Existing Conditions

Existing traffic conditions: data must have been collected within the previous 24-month period.

b. Existing Conditions + Approved and Pending Projects:

Existing traffic conditions plus ambient growth and traffic from all the development within the study area for which an application has been submitted ("pending projects"), or that

have been approved but not yet constructed. This scenario represents project opening year "Without Project" scenario.

c. Existing Conditions + Approved and Pending Projects + Project:

Existing traffic conditions of existing, plus ambient growth and approved and pending developments, plus traffic generated by the proposed project. This scenario represents the project opening year "With Projects" scenario.

d. General Plan Development:

Build-out of City General Plan combined with build-out of circulation system. Orange County Traffic Analysis Model (OCTAM) Build-out projections will be used for this purpose. A General Plan build out analysis is generally required for any project that contributes traffic to an intersection projected to have unacceptable LOS, any project that requires a General Plan Amendment or otherwise proposes development that exceeds the land use intensity assumed for the General Plan, and/or at the discretion of the City Traffic Engineer.

e. General Plan Development + Project:

Cumulative traffic conditions of General Plan build-out plus proposed project.

For projects planned for construction more than two years beyond existing conditions, an ambient traffic growth factor shall be included to account for annual increases in background traffic (i.e., 1% per year). This factor will be determined by the City Traffic Engineer or designee.

Projects that are to be constructed in more than one phase will require interim year future analysis to address each phase of the development and its associated traffic effects. The year(s) to be analyzed will coincide with the scheduled phasing and will be approved by the City Traffic Engineer or designee.

When calculating future traffic conditions, vehicular volumes and LOS associated with existing conditions and the various categories of projected volumes should be identified individually. Volume/capacity calculations that demonstrate the result of proposed improvements will be required for intersections where unsatisfactory LOS are identified, and improvements are necessary.

Trip Generation

Trip generation will be calculated using ITE rates, or as directed by City. If the generation rates do not address proposed land use in sufficient detail, rates from other documented sources (e.g., SCAG, SANDAG) may be used with prior approval from the City.

Trip Distribution/Assignment

Description of trip distribution and directional approach for vehicle trips to and from the site along with the specific roadways that will be utilized by site-generated traffic is required. The basic

methodology and assumptions used to develop trip distribution and assignments must be clearly stated. The City's Traffic Engineering staff will have significant input into these areas. Trip distribution and assignment assumptions are required during the preliminary stages of the study and subject to approval of the City Traffic Engineer or designee prior to inclusion within the study report.

Assumptions

Lost Time and Lane Capacity

A minimum clearance interval of 0.05 in conjunction with lane capacities of 1,700 per hour of green time for through and turn lanes will be used for all volume/capacity calculations. Where atypical geometry and/or operational constraints exist, the City Traffic Engineer or designee may adjust these values at their discretion.

Right Turns

If the distance from the edge of the outside through lane is at least 19 feet and parking is prohibited during the peak period, right turning vehicles may be assumed to utilize this de facto right turn lane. Otherwise, all right turn traffic shall be assigned to the outside through lane. If a right turn lane exists, right turn overlap may be assumed, if not prohibited at that location. However, the assumption of the number of vehicles turning right during the overlap phase cannot conflict with any other critical movement at that intersection. Any signal overlap assumptions must be clearly stated.

Pedestrians

Pedestrian adjustments shall be performed on a case-by-case basis and assessed according to the procedures outlined in Chapter 16 of the latest version of the HCM for those intersections that have more than 100 pedestrians in the peak period.

Transportation Effects

Per the City's General Plan Circulation Element and Growth Management Element requirements, a volume/capacity (V/C) ratio of 0.90 (LOS D) shall be the lowest acceptable Service Level at intersections following implementation of roadway improvements. Improvements required to bring intersections and roadway segments to the acceptable service levels must be identified. In order to maintain LOS "D" at intersections, arterial highway links should be maintained at LOS "C" or better.

An intersection will be deemed deficient and require improvements to achieve an acceptable LOS when the LOS is E or F (Final V/C Ratio>0.90) and the project-related increase in V/C is equal to or greater than 0.010.

For purposes of this calculation, the "Final V/C Ratio" shall mean the future V/C ratio at an intersection considering effects with Project, Ambient Growth and Approved and Pending Projects but without any proposed roadway improvements.

Transportation Systems Improvement Program (TSIP)

If the traffic analysis indicates unacceptable service levels at mid-block arterial segments and/or intersections within the study area, a description of proposed improvements to mitigate the deficiencies shall be included. The following areas are required to be addressed in the discussion of improvements:

1. The location and nature of the improvements (This information should be summarized in exhibit form).

2. V/C calculations showing the result of all proposed capacity improvements.

3. Implementation feasibility (including project cost).

4. Feasibility of right-of-way acquisition where additional right-of-way is needed to implement improvements.

5. Consistency with acceptable design standards.

6. Timing of the proposed improvements.

7. A table shall be submitted showing the V/C ratios and LOS of all studied intersections with and without project, and, with and without proposed improvements.

8. A single or a series of sketch plans shall be included within the body of the traffic report graphically depicting all improvements dealing with roadway, parking, and access points. In cases where phased development of a project is proposed, a schedule identifying the improvements needed to improve traffic deficiencies at each phase will also be required.

The traffic analysis should provide the nexus between a project and the overall traffic effects on City arterials and intersections. For cumulative or long-range analysis (e.g.., General Plan build-out) the project is expected to participate in future improvements on a fair-share basis. In circumstances where a project proponent will be receiving a substantial benefit from an identified infrastructure improvement or where an improvement is proposed that specifically serves the private development (i.e., mid-block access and signalization at the project entry and/or associated striping modification) the project will take full responsibility towards providing the necessary infrastructure improvement.

Site Access Analysis

The project's effect on access points and on-site circulation shall be analyzed. The analysis shall, as appropriate, include the following:

- Number of access points proposed for the project site.
- Spacing between driveways and intersections.
- Potential signalization of driveways.
- On-site stacking distance. (Including uses with a drive thru.)
- Shared access.
- Turn conflicts/restrictions.
- Adequate sight distance.
- Driveway improvements.
- Pedestrian connections.
- Any other operational characteristics (as identified by City staff).

If the proposed project is a residential or commercial use with privacy gates, the applicant shall provide a stacking analysis for review and approval. The adequacy of the interface with the arterial network will need to be demonstrated and necessary improvements to adjacent intersections may be required.

On-Site Parking Analysis

A project provides adequate parking capacity if the project meets Orange Municipal Code (OMC) parking code requirements. Parking studies are required to support deviations from parking code requirements or the use of reciprocal parking. The parking rates to be used are based on OMC Chapter 17.34, "Off-Street Parking and Loading." In cases where the code does not address parking rates for a specific land use, or where deviations from code are proposed, documentation must be provided by the applicant showing how or where the proposed rates were obtained. The parking analysis must demonstrate that proposed parking supply is adequate to accommodate demand.

Analysis of New Facilities

Whenever new public streets, full access driveways, or private streets are proposed to intersect arterial streets, an evaluation of the intersection capacity, spacing, queuing and turn pocket lengths will be required.

Justification for installation of new traffic signal(s), or other traffic control devices, shall be discussed in the TIA, and based on the warrants stated in the latest edition of the Manual of Uniform Traffic Control Devices (MUCTD) or California Supplement. All traffic signal warrant calculations shall be provided in the appendix of the traffic study.

CEQA Assessment - VMT Analysis

A key element of Senate Bill (SB) 743, signed in 2013, is the elimination of automobile delay and LOS as the sole basis of determining CEQA impacts. The updated CEQA Guidelines, released in December 2018, recommend VMT as the most appropriate measure of project transportation impacts. However, SB 743 does not prevent a city or county from continuing to analyze delay or LOS as part of other plans (e.g., the general plan), studies, or ongoing network monitoring.

Analysis Methodology

For purposes of SB 743 compliance, a VMT analysis should be conducted for land use projects as deemed necessary by the Traffic Division and would apply to projects that have the potential to increase the baseline VMT per service population (i.e., population plus employment) for the City of Orange. Normalizing VMT per service population essentially provides a transportation efficiency metric that the analysis is based on.

Project Screening

There are three types of screening that may be applied to effectively screen projects from project-level assessment. These screening steps are summarized below:

Step 1: Transit Priority Area (TPA) Screening

A TPA is defined as a half mile area around an existing major transit stop or an existing stop along a high-quality transit corridor per the definitions below.

The California Public Resource code previously established the following definitions:

Pub. Resources Code, § 21064.3 - 'Major transit stop' means a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods.

Pub. Resources Code, § 21155 - For purposes of this section, a 'high-quality transit corridor' means a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours.

SCAG has also defined a high–quality transit corridor as a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours in Connect SoCal 2024. AB 2553 was signed in 2024 and went into effect in 2025 and redefined the CA PRC definition of major transit stop to reference service intervals of 20 minutes or less.

The methodology presented in these guidelines therefore combines the statutory definitions presented in the CA PRC and the methodology defined for the SCAG region in Connect SoCal.

Projects located within a TPA may be presumed to have a less than significant impact absent substantial evidence to the contrary. This presumption may ***NOT*** be appropriate if the project:

1. Has a Floor Area Ratio (FAR) of less than 0.75;
2. Includes more parking for use by residents, customers, or employees of the project than required by the City;
3. Is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Southern California Association of Governments [SCAG]); or
4. Replaces affordable residential units with a smaller number of moderate- or high-income residential units.

The procedure for establishing if a project falls within in a TPA is as follows:

1. Review the four appropriate checks listed above.
2. Procure the current bus schedule[1] from any local transit providers operating service within ½ mile of the project site[2].
3. Review the current bus schedule and establish the service interval (frequency) during peak commute hours.
    a. Peak commute hours are generally 6 AM – 9 AM and 3 PM – 7 PM.
    b. Frequency should be calculated by tallying the number of bus trips (scheduled stops) during the combined AM and PM peak commute hour. This should be divided by 420 minutes (the combined 7-hour AM and PM peak periods). The calculated frequency must be 20.0 or less at a major transit stop (two routes) or 15.0 or less on a high-quality transit route (one route).
    c. Frequency should only be compared at the same stop, on the same routes, and in the same direction. 15-minute frequency only needs to be met in one direction or on one route to qualify for TPA screening. 20-minute frequency needs to be met by at least two routes in one direction to qualify for TPA screening.

Step 2: Low VMT Area Screening

Residential and office projects located within a low VMT-generating area may be presumed to have a less than significant impact absent substantial evidence to the contrary. In addition, other employment-related and mixed-use land use projects may qualify for the use of screening if the project can reasonably be expected to generate VMT per resident, per worker, or per service population that is similar to the existing land uses in the low VMT area.

[1] Current transit service schedules should be reviewed at the time of analysis. It is expected public transit service schedules and route locations may change regularly.

[2] Fixed route bus service stops must be located within ½ mile of the project site

For this screening in the North Orange County area, the OCTAM travel forecasting model was used to measure VMT performance for individual jurisdictions and for individual traffic analysis zones (TAZs). TAZs are geographic polygons similar to Census block groups used to represent areas of homogenous travel behavior. Total daily VMT per service population (population plus employment) was estimated for each TAZ. This presumption may not be appropriate if the project land uses would alter the existing built environment in such a way as to increase the rate or length of vehicle trips. The Project applicant should document whether or not any increase to the rate or length of vehicle trips is expected.

To identify if the project is in a low VMT-generating area, the analyst may review "NOCC+". **Contact City of Orange Traffic Division for access to the NOCC+ spreadsheet tool.** Additionally, as noted above, the analyst must identify if the project is consistent with the existing land use (e.g., if the project is proposing single-family housing, there should be existing single-family housing of approximately the same density) within that TAZ and use professional judgement that there is nothing unique about the project that would otherwise be misrepresented utilizing the data from the travel demand model.

Step 3: Project Type Screening

Some project types have been identified as having the presumption of a less than significant impact. The following uses can be presumed to have a less than significant impact absent substantial evidence to the contrary as their uses are local serving in nature:

- Local-serving K-12 public schools
- Local parks
- Day care centers
- Local-serving retail uses less than 50,000 square feet, including:
    - Gas stations
    - Banks
    - Restaurants
    - Shopping Center
- Local-serving hotels (e.g., non-destination hotels)
- Student housing projects on or adjacent to college campuses
- Local-serving assembly uses (places of worship, community organizations)
- Community institutions (public libraries, fire stations, local government)
- Affordable, supportive or transitional housing
- Assisted living facilities
- Senior housing (as defined by HUD)

VMT Assessment for Non-Screened Development

Projects not screened through the steps above should complete VMT analysis and forecasting through the OCTAM model to determine if they have a significant VMT impact. This analysis should include "project generated VMT" and "project effect on VMT" estimates for the project TAZ (or TAZs) under the following scenarios:

- Baseline conditions - This data is available from OCTAM. The NOCC+ VMT Project Screening spreadsheet tool also provides the baseline VMT per service population in the City of Orange.

- Baseline plus project - The project land use would be isolated in the project TAZ or a separate TAZ would be created to contain the project land uses. A full base year model run would be performed and VMT changes would be isolated for the project TAZ and across the full model network. The model output must include reasonableness checks of the production and attraction balancing to ensure the project effect is accurately captured. If this scenario results in a less-than-significant impact, then additional cumulative scenario analysis may not be required (more information about this outcome can be found in the Thresholds Evaluation discussion later in this chapter).
  The NOCC+ tool provides an estimate of the Baseline plus project conditions. This data could be presented in lieu of results from the full model run. However, it is recommended that a base year plus project run always be performed as a check for reasonableness and consistency with the cumulative year results.

- Cumulative no project - This data is available from OCTAM.

- Cumulative plus project - The project land use would either be isolated in the project TAZ or a separate TAZ would be created to contain the project land uses. The addition of project land uses should be accompanied by a reallocation of a similar amount of land use from other TAZs; especially if the proposed project is significant in size such that it would change other future developments. Land use projects are often represented in the assumed growth of the cumulative year population and employment. It may be appropriate to remove land use growth that represents the Project from the cumulative year model to represent the cumulative no project scenario. If project land uses are simply added to the cumulative no project scenario, then the analysis should reflect this limitation in the methodology and acknowledge that the analysis may overestimate the project's effect on VMT.

The model output should include total VMT, which includes all vehicle trips and trip purposes, and VMT per service population (population plus employment). Total VMT (by speed bin) is needed as

an input for air quality, greenhouse gas (GHG), and energy impact analysis while total VMT per service population is recommended for transportation impact analysis.

Both "plus project" scenarios noted above will summarize two types of VMT: (1) project generated VMT per service population and comparing it back to the appropriate benchmark noted in the thresholds of significance, and (2) the project effect on VMT, comparing how the project changes VMT on the network looking at citywide VMT per service population comparing it to the no project condition.

Project-generated VMT shall be extracted from the travel demand forecasting model using the origin-destination trip matrix and shall multiply that matrix by the final assignment skims. The project-effect on VMT shall be estimated using the City boundary and extracting the total link-level VMT for both the no project and with project condition.

A detailed description of this process is attached to these guidelines. See "Detailed VMT Forecasting Information."

CEQA VMT Impact Thresholds

VMT Impacts

An example of how VMT thresholds would be applied to determine potential VMT impacts is provided below.

> A project would result in a significant project-generated VMT impact if either of the following conditions are satisfied:
>
> 1. The baseline project-generated VMT per service population exceeds the City of Orange General Plan Buildout VMT per service population, or
> 2. The cumulative project-generated VMT per service population exceeds the City of Orange General Plan Buildout VMT per service population
>
> The project's effect on VMT would be considered significant if it resulted in either of the following conditions to be satisfied:
>
> 1. The baseline link-level boundary Citywide VMT per service population increases under the plus project condition compared to the no project condition, or
> 2. The cumulative link-level boundary Citywide VMT per service population increases under the plus project condition compared to the no project condition.

Please note that the cumulative no project shall reflect the adopted RTP/SCS; as such, if a project is consistent with the SCAG RTP/SCS, then the cumulative impacts (project effect on VMT) shall be considered less than significant subject to consideration of other substantial evidence.

VMT Mitigation Measures

To mitigate VMT impacts, the following choices are available to the applicant:

1. Modify the project's built environment characteristics to reduce VMT generated by the project.
2. Implement Transportation Demand Management (TDM) measures to reduce VMT generated by the project.
3. Participate in a VMT fee program and/or VMT mitigation exchange/banking program (if available) to reduce VMT from the project or other land uses to achieve acceptable levels.

As part of the North Orange County Cities Implementation Study, key TDM measures that are appropriate to the region were identified. Measures appropriate for most of the City of Orange are summarized in Attachment B of the TDM Strategies Evaluation Memorandum.

VMT reductions should be evaluated using state-of-the-practice methodologies recognizing that many of the TDM strategies are dependent on building tenant performance over time. As such, actual VMT reduction cannot be reliably predicted and monitoring may be necessary to gauge performance related to mitigation expectations.

When a Project is found to have a significant impact under CEQA, the City of Orange requires developers and the business community to assist in reducing peak hour and total vehicular trips by implementing TDM plans. The potential of a proposed project to reduce traffic through the use of a TDM plan should be addressed in the traffic study.

If a TDM plan is proposed as a mitigation measure for a project, and the traffic study attributes a reduction in peak and total traffic to the TDM plan, the following information must be provided:

1. A detailed description of the major components of the TDM plan and how it would be implemented and maintained on a continuing basis.
2. Case studies or empirical data that supports the anticipated reduction of traffic attributed to the TDM plan.
3. Additional V/C ratio calculations that illustrate the circulation benefits of the TDM plan.
4. Enforcement Measures – how it will be monitored and enforced.
5. How it complies with the South Coast Air Quality Management District Regulations.

CEQA Assessment - Active Transportation and Public Transit Analysis

Potential impacts to public transit, pedestrian facilities and travel, and bicycle facilities and travel can be evaluated using the following criteria:

- A significant impact occurs if the project conflicts with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decreases the performance or safety of such facilities.

Therefore, the TIA should include analysis of a project to examine if it is consistent with adopted policies, plans, or programs regarding active transportation or public transit facilities, or otherwise increases or decreases the performance or safety of such facilities and make a determination as to whether it has the potential to conflict with existing or proposed facilities supporting these travel modes.

Transportation Impact Study Format

Prior to the beginning of any study, the project proponent shall coordinate with staff from Community Development and Traffic Engineering. A tentative schedule for reviewing and processing the TIA will be developed. Initial discussions shall also include a discussion of any key issues along with the development scope and boundaries of the study area. The proponent will submit a detailed site plan at this meeting. City staff will provide input into the following specific areas of the analysis:

- Defining the general study area boundaries.
- Project access.
- Approved development in the vicinity of the project for cumulative analysis.
- Approved General Plan (build-out) traffic volumes.
- Appropriate Trip Generation rates for the project.

The project proponent shall coordinate with the Traffic Engineering staff so that detailed and technical aspects of the analysis can be discussed prior to a formal submittal. Topics of discussion will include:

- Trip distribution and assignment assumptions.
- Intersections and roadway segments where capacity analysis will be required.
    - As a minimum, intersections where the project will add 51 or more trips during either the AM or PM peak hours will need to be analyzed. This threshold may be reduced, at the discretion of the City Traffic Engineer, for intersections that are projected to or currently operate at LOS "E" or "F".
- Intersection Capacity Analysis assumptions.
- Potential for project-level VMT screening.
- VMT Analysis assumptions.
- Inclusion of a TDM Plan to mitigate traffic impacts and promote the use of alternate modes of transportation.
- Any specific issues that require special consideration such as pedestrian circulation, access, parking and on-site circulation.

The content and level of analysis necessary to evaluate a project will vary and are dependent on the scope of land use proposal and location within the City. All traffic studies will be organized and contain, as a minimum, the information provided in the following outline. Additional study elements may be required by the City Traffic Engineer.

1. Executive Summary

A clear concise summary of the study area, findings, and proposed improvements are required in the Executive Summary.,

2. Introduction

a. Site Location and Study Area Boundaries

Briefly describe the proposed development and the general geographical location of the project. Provide the study area limits mutually agreed upon by the developer, its engineer, and the City.

b. Existing Land Uses and Project Proposals

The existing site conditions, the proposed project and, if applicable, the previously proposed land use(s) associated with the site shall be identified. The specific land use proposed will be presented since a variety of uses and land use densities may be permitted under existing general plan or zoning designations with varying degrees of impact.

c. Committed and Proposed Developments in the Vicinity of the Proposed Project

Information pertaining to projects that would contribute traffic to the project study area, including both approved developments and proposed developments where an application has been submitted, shall be identified. The TIA should include a brief description of these projects, and their traffic-related impacts. During its preliminary meetings with the applicant, City staff will identify the need to assess impacts associated with approved and proposed developments.

d. Existing and Proposed Roadways and Intersections

Identify and describe the roadways and intersections within the study area and the role each will play in providing circulation and access to the project. Number of lanes, driveways locations, ultimate right-of-way, intersection geometrics, bus stops, bike lanes, sidewalks and traffic controls shall be included.

To summarize the information presented in the introduction, a vicinity map depicting the project site, study boundaries, existing lane configurations, traffic controls and any additional features that are pertinent to the study shall be provided.

3. Methodology and Thresholds

Identify the methodology used to calculate LOS and VMT. Include the criteria used for screening projects from project-level VMT analysis, if applicable. Identify the impact threshold for VMT, and deficient LOS operations for roadways and intersections.

4. LOS Analysis

Refer to Pages 6 and 7. A table summarizing the types of lane use; the corresponding generation rates and land use units and the resulting a.m. peak, p.m. peak, and total daily trip ends generated by the project is required.

Refer to Pages 6 and 7. As part of the analysis, a graphic that shows project distribution by percentage and the direction of travel shall be included. The results of the various LOS and V/C

calculations should be summarized using figures that graphically represent the roadways within the study area.

5. Traffic Signal Warrant Analysis

Identify any unsignalized intersections which were studied and operate deficiently. Perform a signal warrant analysis to determine if the installation of a traffic signal is warranted.

6. Site Access Analysis

See the Site Access Analysis on Page 10.

7. On-site Parking Analysis

See the On-Site Parking Analysis on Page 10.

8. Active Transportation and Public Transit Analysis

Refer to Page 19.

9. Improvements and Recommendations

a. Proposed improvements at intersections
b. Proposed improvements at roadway segments
c. Recommended improvements categorized by whether they are included in fee plan or not. (Identify if these improvements are included in an adopted fee program)

10. Vehicle Miles Traveled (VMT) Analysis

Present the Project VMT per service population for all analysis scenarios and the Project effect on VMT for all analysis scenarios. Data should be presented in tabular format. If the project meets the criteria for screening from project-generated VMT analysis, this should be documented. All VMT impacts should be identified in accordance with the VMT Impact Thresholds described above. Proposed VMT mitigation measures should be identified.

13. Appendix

a. Approved scope of work
b. Traffic counts
c. Intersection analysis worksheets
d. VMT and TDM calculations
e. VMT and TDM mitigation calculations
f. Signal warrant worksheets

Attachments

Detailed VMT Forecasting Information

Most trip-based models generate daily person trip-ends for each TAZ across various trip purposes (HBW, HBO, and NHB, for example) based on population, household, and employment variables. This may create challenges for complying with the VMT guidance because trip generation is not directly tied to specific land use categories. The following methodology addresses this particular challenge among others.

Production and attraction trip-ends are separately calculated for each zone, and generally: production trip-ends are generated by residential land uses and attraction trip-ends are generated by non-residential land uses. OPR's guidance addresses residential, office, and retail land uses. Focusing on residential and office land uses, the first step to forecasting VMT requires translating the land use into model terms, the closest approximations are:

- Residential: home-based production trips
- Office: home-based work attraction trips

Note that this excludes all non-home-based trips including work-based other and other-based trips.

- Re-skim final loaded congested networks for each mode and time period
- Run a custom PA to OD process that replicates actual model steps, but:
    - Keeps departure and return trips separate
    - Keeps trip purpose and mode separate
    - Converts person trips to vehicle trips based on auto occupancy rates and isolates automobile trips
    - Factors vehicle trips into assignment time periods
- Multiply appropriate distance skim matrices by custom OD matrices to estimate VMT
- Sum matrices by time period, mode, and trip purpose to calculate daily automobile VMT
- Calculate automobile VMT for individual TAZs using marginal totals:
    - Residential (home-based) - row of departure matrix plus column of return matrix
    - Office (home-based work) - column of departure matrix plus row of return matrix

Appropriateness Checks

Regardless of which method is used, the number of vehicle trips from the custom PA to OD process and the total VMT should match as closely as possible with the results from the traditional model process. The estimated results should be checked against the results from a full model run to understand the degree of accuracy. Note that depending on how each model is setup, these custom processes may or may not include IX/XI trips, truck trips, or special generator trips (airport, seaport, stadium, etc.).

When calculating VMT for comparison at the study area, citywide, or regional geography, the same methodology that was used to estimate project-specific VMT should be used. The VMT for these comparisons can be easily calculated by aggregating the row or column totals for all zones that are within the desired geography.