



**GUIDELINES FOR TRANSPORTATION IMPACT STUDIES
IN THE SAN DIEGO REGION**

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TABLE OF CONTENTS

SECTION	PAGE
1.0 Background.....	1-1
2.0 Purpose of Guidelines.....	2-1
3.0 Project Coordination and Staff Consultation	3-1
PART I – CEQA TRANSPORTATION ANALYSIS	
4.0 Individual Land Development Projects and Specific Plans.....	4-1
5.0 Community Plans and General Plans	5-1
6.0 Transportation Projects	6-1
PART II – LOCAL TRANSPORTATION ANALYSIS	
7.0 Roadway	7-1
8.0 Transit.....	8-1
9.0 Bicycle	9-1
10.0 Pedestrian	10-1

APPENDICES

APPENDIX

- A. Local Transportation Analysis Screen Check
- B. Ramp Meter Analysis
- C. Level of Service (LOS) Definitions

LIST OF FIGURES

SECTION—FIGURE #	PAGE
Figure 4–1	Transportation Impact Study Flow Chart – Individual Projects and Specific Plans 4-2
Figure 6–1	Transportation Impact Study Flow Chart – Transportation Projects..... 6-2
Figure 7–1	Flow Chart for LTA Roadway Analysis 7-2

LIST OF TABLES

SECTION—TABLE #	PAGE
Table 7–1	Thresholds for Roadway Improvements 7-6
Table 7–2	Roadway Classifications, Level of Service, and Average Daily Traffic..... 7-7

GUIDELINES FOR TRANSPORTATION IMPACT STUDIES (TIS) IN THE SAN DIEGO REGION

1.0 BACKGROUND

The original Guidelines for Traffic Impact Studies in the San Diego Region (ITE/SANTEC, 2000) have been in use for over 19 years. They were developed by a group of volunteers from the San Diego Section of the Institute of Transportation Engineers (ITE) and the San Diego Traffic Engineers Council (SANTEC). The guidelines were later incorporated into the region's Congestion Management Program (CMP) prepared by the San Diego Association of Governments (SANDAG, 2008). Although inclusion in the Congestion Management Program (CMP) increased the visibility of the guidelines for a period of time, SANDAG has since opted out of the CMP process.

The intent in preparing the year 2000 guidelines was to promote consistency in the methodology for traffic impact studies used by different agencies in the San Diego region. While these guidelines were not intended to be used as a standard or a requirement, they provided a methodology for traffic impact studies that was similar to the methodology used by most agencies within the region. Some agencies in the region have "adopted" the guidelines by specifying that traffic impact studies follow the procedures recommended by the guidelines. Other agencies, including San Diego County and the City of San Diego, prepared their own guidelines, which included some elements in common with the regional guidelines.

The impetus to develop a revised set of regional transportation impact study guidelines is primarily related to the passage of Senate Bill 743 (SB 743) in the fall of 2013. This legislation led to a change in the way that transportation impacts are measured under the California Environmental Quality Act (CEQA). Starting on July 1, 2020, automobile delay and level of service (LOS) may no longer be used as the performance measure to determine the transportation impacts of land development projects under CEQA. Instead, an alternative metric that supports the goals of the SB 743 legislation will be required. Although there is no requirement to use any particular metric, the use of vehicle miles traveled (VMT) has been recommended by the Governor's Office of Planning and Research (OPR). This requirement does not modify the discretion lead agencies have to develop their own methodologies or guidelines, or to analyze impacts to other components of the transportation system, such as walking, bicycling, transit, and safety. SB 743 also applies to transportation projects, although agencies were given flexibility in the determination of the performance measure for these types of projects.

The intent of SB 743 is to bring CEQA transportation analyses into closer alignment with other statewide policies regarding greenhouse gases, complete streets, and smart growth. Using VMT as a performance measure instead of LOS is intended to discourage suburban sprawl, reduce greenhouse gas emissions, and encourage the development of smart growth, complete streets, and multimodal transportation networks.

2.0 PURPOSE OF GUIDELINES

The guidelines described in this report were prepared to provide methodologies for transportation engineers and planners to conduct CEQA transportation analyses for land development and transportation projects in compliance with SB 743. Lead agencies may opt-in to using VMT at any time but will be required to use it for analysis of transportation impacts of land development projects starting July 1, 2020. In addition, methodologies are provided to evaluate automobile delay and LOS outside of the CEQA process. Although no longer incorporated in CEQA (starting July 1, 2020), automobile delay and LOS continue to be of interest to transportation engineers and planners who plan, design, operate, and maintain the roadway system. In addition, delay experienced due to traffic congestion is a concern to drivers and passengers of vehicles using the roadway system.

Given the need to prepare VMT-based CEQA transportation impact analyses to satisfy the requirements of SB 743 as well as the need to evaluate the performance of the roadway system based on delay and LOS, these guidelines are divided into separate parts. Part I is focused on CEQA transportation impact analyses, while Part II is focused on the more traditional LOS-based transportation analyses, called local transportation analysis for the purpose of these guidelines. Local transportation analysis includes evaluation of any multimodal transportation improvements (transit, bicycle, pedestrian) that are recommended to support a land development project but may or may not be required as mitigation measures for a project's significant VMT impacts. Background information for each is provided below with more detail included in the sections that follow.

CEQA TRANSPORTATION IMPACT ANALYSIS

The SB 743 legislation specified that the Governor's Office of Planning and Research (OPR) prepare guidelines for the implementation of SB 743. During the period from the passage of SB 743 in 2013 to the fall of 2018, OPR prepared various sets of guidelines and sought public comments from stakeholders. At the time of preparation of these transportation impact study guidelines, guidance regarding the changes to CEQA initiated by SB 743 were contained in the following documents:

- CEQA Guidelines Revisions: Revisions to the CEQA Guidelines were adopted into CEQA in December 2018 through a formal process conducted by the Natural Resources Agency. Additional changes can only be made through a future CEQA update process.
- Technical Advisory on Evaluating Transportation Impacts in CEQA (Technical Advisory): The technical advisory provides recommendations for the preparation of transportation impact analyses under SB 743. It is not formally included in CEQA and can be revised by OPR at any time without going through a formal process. Updated versions of the technical advisory are expected to be issued by OPR as new information becomes available and as California agencies gain experience in applying SB 743 to actual projects. As of the time of preparation of these transportation impact study guidelines, the current version of the technical advisory was dated December 2018.

In addition to the differences described above, the CEQA Guidelines revisions and the technical advisory also differ in the extent to which they must be followed by local agencies. The CEQA Guidelines revisions are rules that must be followed in order to prepare an adequate CEQA document. In contrast, the technical

advisory provides statewide guidance based on evidence collected by OPR that can be refined or modified by local agencies with appropriate justification and substantial evidence. (Refer to CEQA Guidelines Section 15384 for a definition of substantial evidence). As an example, the CEQA Guidelines revisions specify that a land development project's effect on automobile delay does not cause a significant environmental impact. The use of VMT is suggested as a performance metric, but there is no indication of what level of VMT increase would cause a significant environmental impact. The technical advisory suggests various thresholds for the significance of VMT impacts but does not require the use of a particular threshold. Therefore, lead agencies would be prohibited from using automobile delay to determine significant transportation impacts and would be required to use VMT instead. Lead agencies have discretion to select their preferred significance thresholds and could choose to use the thresholds suggested in the technical advisory or develop alternative thresholds. Either decision should be supported by substantial evidence that considers the legislative intent objectives of SB 743 and the specific direction the statute provides regarding setting thresholds (per the excerpts below):

SB 743 Statute - Legislative Intent – Senate Bill No. 743, Section (b)(2)

More appropriately balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of greenhouse gas emissions.

SB 743 Statute – Section 21099(b)(1)

Those criteria shall promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses.

Regardless of the changes described above, SB 743 is clear in its intent that CEQA documents continue to address noise, air quality, and safety (per the excerpt below):

SB 743 Statute – Section 21099(b)(3)

This subdivision does not relieve a public agency of the requirement to analyze a project's potentially significant transportation impacts related to air quality, noise, safety, or any other impact associated with transportation. The methodology established by these guidelines shall not create a presumption that a project will not result in significant impacts related to air quality, noise, safety, or any other impact associated with transportation.

Although State CEQA Guidelines section 15064.3 states that generally vehicle miles traveled is the most appropriate measure of transportation impacts, other relevant considerations may include the project's impact on transit and non-motorized travel. A complete environmental review will generally consider how projects effect VMT in addition to effects on walking, bicycling, transit, and safety.

The CEQA transportation impact analysis described in these transportation impact study guidelines is based on the technical advisory prepared by OPR, but refinements and clarifications have been added to reflect local conditions. For any subsequent revisions of the SB 743 technical advisory prepared by OPR, it would need to be determined whether the new information would suggest a change in the methodologies for conducting CEQA transportation impact studies in the San Diego region.

LOCAL TRANSPORTATION ANALYSIS

As stated above, localized traffic congestion remains a concern to transportation engineers and planners as well as the traveling public. It is recommended that consideration be given to preparation of a local

transportation analysis for all land development and transportation projects which evaluate a project's access and circulation within and nearby the project site. The local transportation analysis would provide analysis of roadway conditions where there is the potential that substantial worsening of traffic congestion would result due to implementation of the project. In addition, it would analyze the need for multimodal improvements in cases where there is the potential for the project to cause a substantial worsening of conditions for multimodal travel. Since any increases in traffic congestion or vehicular delay would not constitute a significant environmental impact, the local transportation analysis could be included in the project's CEQA document for information only or it could be provided in a separate document. The purposes of the local transportation analysis may include, but are not limited to the following:

- Recommendations for any roadway improvements that should be built/implemented by the project (or should be built/implemented by the project in coordination with other nearby land development projects) based on the project's expected effect on vehicular delay and LOS.
- Recommendations for any multimodal transportation improvements (transit, bicycle, pedestrian) that should be built/implemented by the project (or should be built/implemented by the project in coordination with other nearby land development projects). Recommended multimodal transportation improvements may be required as mitigation measures for transportation impacts related to VMT increases or they may be recommended for other reasons.
- Transportation analysis needed to determine the appropriate level of fees for multimodal transportation improvements if the local jurisdiction has a fee program in place.
- Documentation of the project's expected effect on vehicular delay and level of service in the nearby transportation system.

The roadway analysis methodologies recommended for conducting local transportation analysis, as detailed in Part II of these guidelines, are based on the previous regional traffic impact study guidelines, with changes to reflect evolution in the practice that has occurred. Users of these guidelines should note that transportation analysis advances occur each year as documented through key conferences, including the Transportation Research Board (TRB) Annual Meeting. Further, new data vendors, and new mobility options continue to evolve. As such, the recommended methodologies in this document may require ongoing updates and refinements. The recommended methodologies for multimodal transportation analysis generally reflect new procedures that were not included in the previous guidelines.

The intent of these guidelines is that agencies in the San Diego region be encouraged to implement Part I – CEQA guidelines to promote consistency in methodology and the pursuit of VMT reductions to meet regional and state goals. It is recognized that agencies may wish to make specific exceptions to these guidelines to account for local conditions. Agencies may also desire to have additional analyses conducted outside of the CEQA analyses to help inform staff and decision makers in reviewing a project. To that end, Part II – Local Transportation Analyses reflects an update to the previous regional Traffic Impact Study Guidelines.

3.0 PROJECT COORDINATION AND STAFF CONSULTATION

TIS preparers are encouraged to discuss the project with the lead agency's staff at an early stage in the planning process. An understanding of the level of detail and the assumptions required for the analysis should be reached. While a pre-submittal conference is highly encouraged, it may not be a requirement. For straightforward studies prepared by consultants familiar with these TIS procedures, a telephone call or email, followed by a verification of key assumptions, may suffice. Transportation impact studies should be prepared by a qualified transportation professional. Lead agencies should consider requiring that all transportation impact studies be prepared by or reviewed under the supervision of a licensed traffic engineer.

PART I – CEQA TRANSPORTATION ANALYSIS

4.0 INDIVIDUAL LAND DEVELOPMENT PROJECTS AND SPECIFIC PLANS

The recommended methodology for conducting a VMT analysis is based on guidance prepared by the California Governor's Office of Planning and Research (OPR) as provided in the published Technical Advisory on Evaluating Transportation Impacts in CEQA. At the time of writing of these guidelines, the current version of OPR's technical advisory was dated December 2018. The guidance recommended by OPR has been modified to be better suited to local conditions in the San Diego region. These modifications are noted in the details described later in this chapter.

The basic process is to compare a project's estimated VMT/capita or VMT/employee to average values on a regional, citywide, or community basis. The target is to achieve a project VMT/capita or VMT/employee that is 85% or less of the appropriate average based on suggestions in these guidelines. Note that lead agencies have discretion for choosing a VMT metric and threshold. The selection should represent how VMT reduction is balanced against other objectives of the lead agency and be supported by substantial evidence.

The methodology for determining VMT/capita or VMT/employee is related to the project's expected daily trip generation. The process for determining appropriate methodology to be used for conducting a VMT analysis for individual land development projects and specific plans is summarized in Figure 4-1.

The remainder of this section of the guidelines is divided into individual components that describe different aspects of the methodology. Other methodologies for VMT analysis could be considered at the discretion of the lead agency. However, it is recommended that any VMT methodologies within a particular analysis use consistent methodologies and that VMT analysis consider the differences between trip-based VMT analysis methodologies and tour-based VMT methodologies, as described in OPR's technical advisory.

MINIMUM PROJECT SIZE

It is recommended that lead agencies determine a minimum project size, below which VMT impacts are presumed to be less than significant. Two alternative approaches for determining minimum project size are described below.

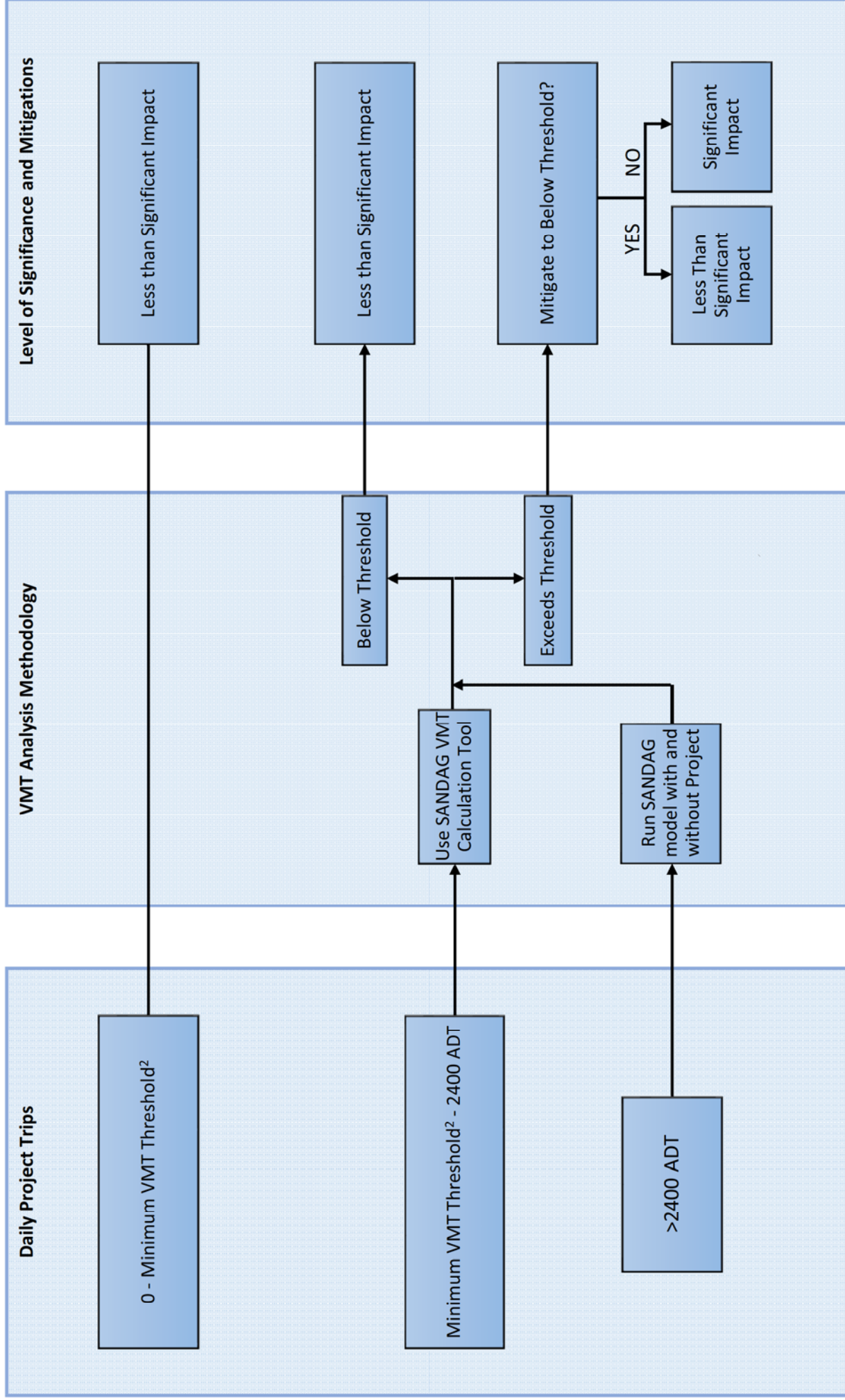
Alternative 1 – Minimum Project Size Based on Previous TIS Guidelines

Under this alternative, projects would be subjected to different levels of VMT analysis, depending on the size of the project and whether the project is consistent with the local jurisdiction's General Plan or Community Plan. Projects that are consistent with the General Plan or Community Plan are also considered to be consistent with the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

The determination of minimum project size for VMT analysis described below differs from the statewide guidance provided by OPR. It is based on regional standards for transportation analyses that were documented in the Guidelines for Traffic Impact Studies in the San Diego Region (ITE/SANTEC, 2000) and have been in use for over 19 years.

The following level of VMT analysis is recommended based on project size (expressed in terms of Average Daily Trips generated by the project; also known as ADT) and zoning:

Figure 4-1
VMT Analysis for Individual Land Development Projects¹



Footnotes:

1. VMT impacts presumed to be less than significant for certain local-serving retail projects, affordable housing projects, and projects within transit priority areas. See text.
2. Minimum VMT threshold to be determined by lead agency.

Projects Inconsistent with General Plan or Community Plan

<u>ADT</u>	<u>Level of Analysis</u>
0 – 500	VMT Analysis Not Needed/VMT Impacts Presumed Less Than Significant
500 and Greater	VMT Analysis Recommended

Projects Consistent with General Plan or Community Plan

<u>ADT</u>	<u>Level of Analysis</u>
0 – 1,000	VMT Analysis Not Needed/VMT Impacts Presumed Less Than Significant
1,000 and Greater	VMT Analysis Recommended

The advantage of this alternative for determining minimum project size is that it is based on the engineering judgment of professionals who are experts in determining the effect of projects on the transportation system. It has been used successfully for over 19 years in the San Diego region and has received wide acceptance from the transportation profession, decision makers, and the public. Transportation engineers and planners who support this alternative for determining minimum project size consider it to be equally valid for the current LOS-based transportation analyses as well as the new VMT-based analyses taking effect on July 1, 2020.

Alternative 2 – Minimum Project Size Based on Statewide Guidance

Under this alternative, the minimum project size for VMT analysis would be based on statewide guidance provided by OPR. In OPR’s technical advisory, the minimum project size is based a categorical exemption in CEQA that allows expansion of existing structures under certain circumstances. On page 12 of the December 2018 technical advisory, footnote 19, the following language describes the situation: “CEQA provides a categorical exemption for existing facilities, including additions to existing structures of up to 10,000 square feet, so long as the project is in an area where public infrastructure is available to allow for maximum planned development and the project is not in an environmentally sensitive area. [CEQA Guidelines, § 15301, subd. (e)(2).]”

OPR uses a general office building as the appropriate project type for the determination of minimum project size based on the exemption described above. Typical ITE trip generation rates are then applied to a 10,000 square-foot general office building which yields a minimum project size based on 110 daily trips.

If this alternative is used in the San Diego region, it is recommended that the use of regional or local trip generation rates be considered in addition to the typical trip generation rate used by OPR. For example, using the SANDAG trip generation manual (Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region, April 2002), a standard commercial office would generate 20 daily trips per 1,000 square feet. Therefore, a 10,000 square-foot office would be expected to generate 200 daily trips and projects that generate less than 200 daily trips would not require a VMT analysis and would be presumed to have less than significant VMT impacts.

One advantage of this alternative is that it is based on statewide guidance with a reference to CEQA provisions. A second advantage is that it was developed in consideration of VMT as the performance measure for the determination of the transportation impacts of land development projects.

PROJECTS LOCATED NEAR TRANSIT STATIONS

OPR's technical advisory contains the following guidance regarding projects located near transit stations:

- Proposed CEQA Guideline Section 15064.3, subdivision (b)(1), states that lead agencies generally should presume that certain projects (including residential, retail, and office projects, as well as projects that are a mix of these uses) proposed within ½ mile of an existing major transit stop or an existing stop along a high quality transit corridor will have a less-than-significant impact on VMT. This presumption would not apply, however, if project-specific or location-specific information indicates that the project will still generate significant levels of VMT.

An existing major transit stop is defined as “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.”

For the purposes of these guidelines, the distance between the project site and the transit station is typically based on direct walking distance without missing sidewalks or physical barriers.

Typically, a major transit stop would be considered to be applicable for this purpose if the transit stop were assumed to be in place in SANDAG's RTIP scenario (see Methodology for VMT analysis for further discussion of this scenario).

METHODOLOGY FOR VMT ANALYSIS

As mentioned above, it is recommended that VMT thresholds for SB 743 analysis will be developed by comparisons to average VMT/capita (for residential projects) or VMT/employee (for employment projects). The analysis can be conducted by comparing either the project VMT/capita or VMT/employee to both the San Diego regional average and the average for the city or community in which the project is located. It is recommended that if the project average is lower than either 85% of the regional average or 85% of the average for the city or community in which the project is located, the VMT impacts of the project can be presumed to be less than significant. Since this is the basis for the presumption of “less than significance,” it will be up to each city in the San Diego region and the County to adopt this recommended presumption and either define its jurisdiction as a single community for the purposes of determining VMT thresholds or subdivide its jurisdiction into smaller communities for the purpose of SB 743 analysis.

It should be noted that OPR's technical advisory includes special considerations for affordable housing and these considerations are also recommended for use in the San Diego area. Projects that include 100% affordable housing in infill locations can be presumed to have a less than significant VMT impact. Infill locations will typically have better than average access to transit and/or greater opportunities for walking and bicycling trips. The exact definition of infill locations will need to be determined based on local conditions.

The VMT methodology recommended above differs from the statewide guidance recommended by OPR in the following ways:

- OPR recommends that VMT/capita comparisons for residential projects be made both on a regional and citywide basis. These guidelines recommend that a city may choose to do

comparisons at a community level rather than at the citywide level. This recommendation applies to all cities within San Diego County and provides the lead agencies flexibility and discretion for selecting the threshold that is appropriate for their agency, based on their values and substantial evidence. Many communities within cities in the San Diego Region have a size and population that is comparable to a typical city on a statewide basis. The unincorporated area of San Diego County also has a governing structure in place for its communities, and the choice to do VMT/capita comparisons at a community level is also recommended to be extended to the unincorporated area of the County. The Cities of Encinitas and Chula Vista are also examples of cities that have distinct communities which have been treated differently for various historical planning considerations.

- OPR recommends that VMT/employee comparisons for employment projects be conducted at a regional basis only, as compared to VMT/capita comparisons that are made both at a regional and citywide basis. These guidelines recommend that VMT/employee comparisons be made at both the regional and at the citywide level (or community level as described above). The San Diego Region is the third largest region in California (after the Los Angeles Area and the San Francisco Bay Area). While some employment trips are made across the region (or even outside the region), there is a large incentive to live and work within a relatively short distance, even within the same city or community, to avoid the relatively long commute distances that can be experienced by traveling across the region during peak commute hours.
- OPR recommends that the VMT/capita comparisons for projects in unincorporated county areas be based on the region's VMT/capita or the average VMT/capita of all cities within the county. These guidelines recommend that VMT/capita and VMT/employee comparisons for projects in the unincorporated area of San Diego County be made to the overall average VMT/capita and VMT/employee for the unincorporated area of the county (or for individual communities if the County decides to use individual communities rather than the entire unincorporated area for VMT comparisons). San Diego County is one of the largest counties in California in terms of geography and also one of the most diverse in terms of topography and climate. While the VMT/capita comparison recommended by OPR may make sense for some counties in California, the comparisons between unincorporated areas and averages of the cities make less sense in San Diego County, where there are great differences in terms of distance and other factors between rural and urban areas of the county.

It is recommended that once the SB 743 analysis communities have been defined by local jurisdictions, SANDAG should then calculate the average VMT/capita (for residential projects) and the average VMT/employee (for employment projects) for each city or community. This calculation can be based on the Regional Transportation Improvement Plan (RTIP) scenario for future land use and transportation network, which includes expected growth through the end of the RTIP scenario and transportation network improvements that are considered to be funded through the RTIP. It is recommended that the RTIP scenario used for VMT analysis purposes will be held constant once it is created and will only be changed with each update of the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), typically every four years. It is recommended that the SANDAG online VMT analysis tool (described below) also be held constant and be updated on the same schedule as the RTP is updated and a new regional model is produced by SANDAG. If an online VMT analysis tool is not available for the RTIP scenario, it is recommended that analysts use the online VMT analysis tool published by SANDAG that most closely approximates the RTIP scenario.

Retail development falls into a category which is neither considered to be residential nor employment-based. For retail projects, these guidelines are based on the methodology recommended by OPR for retail projects. It is recommended that local-serving retail projects be presumed to have less than significant VMT impacts and regional-serving retail projects be presumed to have significant VMT impacts if they increase VMT above the level that would occur for conditions without the project. OPR's technical advisory recommends that lead agencies determine which retail projects are local-serving, but it does include a general guideline that retail projects larger than 50,000 square feet might be considered regional-serving rather than local-serving.

For some land development projects, it may not be immediately obvious whether the project is a residential project or an employment project. For these projects, the preferred methodology is to analyze the trip-making characteristics of the project and then use either the residential or employment methodology. For example, a hotel may be considered to have trip-making characteristics closer to an employment project, and therefore the employment methodology could be used for this land use category.

The recommended methodology for calculation of VMT depends on the size of the project as determined by the project's trip generation calculated in terms of ADT. The project's trip generation should be calculated using standard practice. For projects with a trip generation of less than 2,400 ADT, the recommended VMT analysis methodology is the SANDAG VMT calculation tool. SANDAG has prepared an online tool that calculates average VMT/capita and VMT/employee at the census tract level. Analysts would use this tool to determine the project's VMT/employee or VMT/capita to be compared to community, city, and/or regional averages.

Definitions of VMT/capita and VMT/employee that are used in SANDAG's VMT calculation tool are as follows:

- **VMT/Capita:** Includes all vehicle-based person trips grouped and summed to the home location of individuals who are drivers or passengers on each trip. It includes home-based and non-home-based trips. The VMT for each home is then summed for all homes in a particular census tract and divided by the population of that census tract to arrive at Resident VMT/Capita.
- **VMT/Employee:** Includes all vehicle-based person trips grouped and summed to the work location of individuals on the trip. This includes all trips, not just work-related trips. The VMT for each work location is then summed for all work locations in a particular census tract and divided by the number of employees of that census tract to arrive at Employee VMT/Employee.

The recommended methodology for projects over 2,400 ADT is to run the regional transportation model with and without the project to determine the project's net increase in VMT and then use that value to determine VMT/employee or VMT/capita to be compared to community, city, and/or regional averages.

REDEVELOPMENT PROJECTS

Recommendations for VMT analysis of redevelopment projects are based on guidance provided by OPR with the clarifications provided below.

Redevelopment projects represent a special case since the recommended VMT thresholds for SB 743 implementation represent an efficiency metric. Under SB 743, the primary goal is for all new land

development projects to achieve efficiency from a VMT point of view. The efficiency or lack of efficiency of the existing land use is typically not relevant per OPR.

The following methodology is recommended:

- A redevelopment project that reduces absolute VMT (i.e. the total VMT with the project is less than the total VMT without the project) would be presumed to have less than significant VMT impacts.
- If a project increases absolute VMT, it is recommended that the VMT analysis methodology described above be applied to the proposed land use, as if the project was proposed on a vacant parcel (i.e. the existing land use didn't exist).

OPR's technical advisory includes specific recommendations that relate to redevelopment projects that replace affordable residential units with a smaller number of market-rate residential units. Those recommendations are also considered applicable for the purposes of these guidelines.

MIXED-USE PROJECTS

Recommendations for VMT analysis of mixed-use projects are based on guidance provided by OPR with additional clarifications recommended for use in the San Diego region.

The following steps are recommended:

- Calculate trip generation separately for each component of the mixed-use project using standard practice.
- Determine the reduction in external vehicle trips due to internal capture based on guidance provided in the ITE Trip Generation manual, MXD methodologies or other techniques.
- Apply the reduction in trips to the individual land uses so that the total trip generation of the individual land uses is equal to the total project trip generation, including internal capture.
- Using the reduced trip generation, determine the VMT/capita or VMT/employee for applicable land uses. SANDAG's online VMT calculation tool may be used to determine an average trip length for the land uses within a mixed-use development based on the reported VMT/capita or VMT/employee in the census tract where the project is located. The number of residents or employees will need to be estimated for each applicable land use. When using SANDAG's VMT calculation tool to estimate average trip length, analysts should be aware that the data produced by the SANDAG VMT calculation tool is based all resident VMT/capita, so it includes the VMT associated with all trips made by the resident for the day, for example trip from home to daycare to office; office to meeting to office; office to store to home. The ITE trip generation rate for residential is only home-based trips, i.e. trips that start or end at the residence. The effect of the distinction between ITE's data and the data produced by the SANDAG VMT calculation tool will vary by location, type of project, and other factors.
- Compare the VMT/capita or VMT/employee values calculated using the reduced trip generation to applicable VMT thresholds to determine whether the individual components of the mixed-use development would be expected to have a significant VMT impact. If any component of the mixed-

use development would be expected to have a significant VMT impact, the project as a whole would be considered to have a significant VMT impact.

- Local-serving retail within a mixed-use development can be presumed to have a less than significant VMT impact.

PROJECTS IN RURAL AREAS

Land development projects in rural areas may be given special consideration due to their unique trip-making characteristics. OPR's technical advisory contains the following guidance regarding projects in rural areas:

- "In rural areas of non-MPO counties (i.e., areas not near established or incorporated cities or towns), fewer options may be available for reducing VMT, and significance thresholds may be best determined on a case-by-case basis. Note, however, that clustered small towns and small town main streets may have substantial VMT benefits compared to isolated rural development, similar to the transit oriented development described above."

If interpreted literally, this guidance would not apply to the San Diego region since it is an MPO County. However, rural areas are considered to have similar trip-making characteristics regardless of whether they are located in an MPO County or not. Therefore, different thresholds than described above could be considered for the rural areas of San Diego County. In order to apply this concept, local agencies would designate a portion of their jurisdiction as rural and then establish a separate threshold for the determination of significant VMT impacts.

PHASED PROJECTS

For projects proposed to be built in phases, it is recommended that each phase of the project be evaluated separately. This evaluation would include a determination of whether significant VMT impacts would occur and whether mitigation is recommended. The evaluation of VMT for each phase would include consideration of the previous project phases. For example, a project with three phases would include the following analyses:

- VMT Analysis of Phase 1: Assumes development of Phase 1 only.
- VMT Analysis of Phase 2: Assumes development of Phases 1 and 2.
- VMT Analysis of Complete Project: Assumes development of Phases 1, 2, and 3.

LAND DEVELOPMENT PROJECTS WITH A ROADWAY COMPONENT

Some individual land development projects and specific plans include the implementation of roadways as a component of the project. This requires additional consideration since land development and roadway projects are likely have different significance thresholds for VMT analysis. See Chapter 6 for recommendations for VMT analysis of roadways and other transportation projects. Land development projects may also include transit, bicycle, and pedestrian facilities as components of the project, but these

types of projects would generally not be considered to increase VMT and would normally not need to be considered in the VMT analysis of a land development project.

For land development projects and specific plans with a roadway component, the following recommendations are provided:

- If it can be demonstrated that the roadway component of the project built on its own would have a less than significant impact, the roadway component of the project can be ignored and the VMT analysis can proceed based on analysis of the VMT aspects of the land development component of the project.
- If it can be demonstrated that the project as a whole would cause a net decrease in VMT, the VMT impact of the project may be considered less than significant.
- For projects with both land use and roadway components that are outside the circumstances described above, it is recommended that the VMT analysis be based on consideration of the net increase or decrease in VMT with the project implemented as compared to conditions without the project. For projects that would be expected to cause a net increase in VMT, the project would be expected to provide mitigation measures to reduce VMT to the level of the no project condition in order to have a less than significant impact. For projects in which the roadway component would require analysis of induced travel demand (see Chapter 6), the VMT generated by the induced travel should also be considered in the analysis.

MITIGATION

If a project's VMT exceeds the thresholds identified above for individual land development projects and specific plans, it may have a significant transportation impact. According to the OPR's technical advisory, when a significant impact is determined, feasible mitigation measures must be identified that could avoid or substantially reduce the impact. Lead agencies are generally given the discretion to determine what mitigation actions are "feasible," but they must rely on substantial evidence in making these determinations. In addition, CEQA requires the identification of feasible alternatives that could avoid or substantially reduce a project's significant environmental impacts.

Not all mitigation measures are physical improvements to the transportation network. A sample mitigation measure might include telework options for employees to reduce vehicular travel. Examples of other mitigation measures based on OPR's technical advisory include but are not limited to the following:

- Improve or increase access to transit.
- Increase access to common goods and services, such as groceries, schools, and daycare.
- Incorporate affordable housing into the project.
- Incorporate a neighborhood electric vehicle network.
- Orient the project toward transit, bicycle, and pedestrian facilities.
- Improve pedestrian or bicycle networks, or transit service.
- Provide traffic calming as a way to incentivize bicycling and/or walking.
- Provide bicycle parking.
- Limit or eliminate parking supply.
- Unbundle parking costs.
- Provide parking cash-out programs.

- Implement or provide access to a commute reduction program.
- Provide car-sharing, bike sharing, and ride-sharing programs.
- Provide partially or fully subsidized transit passes.
- Shift single occupancy vehicle trips to carpooling or vanpooling by providing ride-matching services or shuttle services.
- Provide telework options.
- Provide incentives or subsidies that increase the use of modes other than a single-occupancy vehicle.
- Provide on-site amenities at places of work, such as priority parking for carpools and vanpools, secure bike parking, showers and locker rooms, and bicycle repair services.
- Provide employee transportation coordinators at employment sites.
- Provide a guaranteed ride home service to users of non-auto modes.
- Contribute to a mobility fee program that funds multimodal transportation improvements, such as those described above.

Additional mitigation measures may become acceptable as agencies continue to innovate and find new ways to reduce vehicular travel.

Changes to the project design or location could potentially reduce VMT. Project alternatives based on OPR's technical advisory that may reduce vehicle miles of travel include but are not limited to the following:

- Locate the project in an area of the region that already exhibits low VMT.
- Locate the project near transit.
- Increase project density.
- Increase the mix of uses within the project or within the project's surroundings.
- Increase connectivity and/or intersection density on the project site.

OPR's technical advisory notes that because VMT is largely a regional impact, regional VMT-reduction programs may be an appropriate form of mitigation. In-lieu fees and development impact fees have been found to be valid mitigation where there is both a commitment to pay fees and evidence that mitigation will actually occur.

Fee programs are particularly useful to address cumulative impacts. The physical improvements that constitute the mitigation program as a whole must undergo CEQA evaluation, and the imposition of development impact fees or in-lieu fees shall be in accordance with applicable regulations, such as the Mitigation Fee Act. Other mitigation must be evaluated on a project-specific basis. That CEQA evaluation could be part of a larger program, such as a regional transportation plan analyzed in a Program EIR.

Quantifying the reduction in VMT associated with potential mitigation measures for land development projects and specific plans is a relatively new endeavor for transportation engineers and planners. Therefore, these guidelines do not recommend a methodology that has been in practice or has generally been accepted for local use.

One current resource that has been identified to quantify the reduction in vehicle miles traveled associated with a particular mitigation measure is the latest edition of California Air Pollution Control Officers Association's *Quantifying Greenhouse Gas Mitigation Measures, A Resource for Local Government to Assess Emission Reductions from Green Gas Mitigation Measures* (CAPCOA, August 2010), also known

as the CAPCOA Report. This report provides a methodology to quantify the reductions in vehicle miles traveled for many of the mitigation measures listed above. At the time of preparation of these guidelines, new research was underway that would provide an update to the CAPCOA Report.

The following elements should be considered when utilizing the CAPCOA Report:

- The CAPCOA VMT reduction strategies include built environment changes and transportation demand management (TDM) actions. The built environment changes are scalable from the project site to larger geographic areas and are often captured in regional travel forecasting models such as the SANDAG model. Prior to any application of a built environment change to a project as mitigation, the project analyst should verify that the project VMT forecasting tool or model is appropriately accurate and sensitive to built-environment effects and that no double counting will occur in the application of the mitigation measure. The TDM actions are sensitive to the project site and ultimate building tenants. As such, VMT reductions associated with TDM actions cannot be guaranteed through CEQA mitigation without ongoing monitoring and adjustment.
- There are rules for calculating the VMT reduction when applying multiple mitigation measures. The CAPCOA Report rules should be considered.
- Only “new” mitigation measures should be included in the analysis to prevent double counting. For example, if the project is located near transit, the VMT reduction cannot be applied if the project utilized a model that factored in the project’s proximity to transit. In addition, telecommuting is included in SANDAG’s base model.
- Mitigation measures should be applied to the appropriate user group (employees, guest/patrons, etc.). If a certain measure applies to multiple user groups, the weighted average should be considered as the effect of the mitigation measure will vary based on the user group.

A second resource that is available is the VMT calculation tool that was provided as part of SANDAG’s Mobility Management Toolbox project.

Additional VMT calculation tools are currently available or under development by several local agencies in California. Although these tools are being developed for specific jurisdictions, they could be adopted or modified for use in individual jurisdictions in San Diego County. At the time of development of these guidelines, the following calculation tools were publicly available.

- City of San Jose: A VMT calculation tool and other information can be found at the following website: <http://www.sanjoseca.gov/vmt>.

5.0 COMMUNITY PLANS AND GENERAL PLANS

The recommended methodology for conducting a VMT analysis for community plans and general plans is to compare the existing VMT/capita for the community plan or general plan area with the expected horizon year VMT/capita. The recommended target is to achieve a lower VMT/capita in the horizon year with the proposed plan than occurs for existing conditions.

The calculation of VMT for a planning area requires different considerations than the calculation of VMT for an individual project or a specific plan. Generally, the use of a computerized travel forecasting model (such as the SANDAG regional model) would be needed. For details on the calculation of VMT for a planning area, analysts are referred to ITE's paper on VMT calculations (Vehicle Miles Travelled Calculations Using the SANDAG Regional Model, 2013).

If VMT analysis for a community plan or general plan requires consideration of mitigation measures to mitigate significant VMT impacts, potential mitigation measures would be similar to those used for land development projects with some modifications. The following measures could be considered:

- Modify the land use plan to increase development in areas with low VMT/capita characteristics and/or decrease development in areas with high VMT/capita characteristics.
- Provide enhanced bicycle and/or pedestrian facilities.
- Add roadways to the street network if those roadways would provide shorter travel paths for existing and/or future trips.
- Improve or increase access to transit.
- Increase access to common goods and services, such as groceries, schools, and daycare.
- Incorporate a neighborhood electric vehicle network.
- Provide traffic calming to incentivize bicycling and walking.
- Limit or eliminate parking supply.
- Unbundle parking costs.
- Provide parking or roadway pricing or cash-out programs.
- Implement or provide access to a commute reduction program.
- Provide car-sharing, bike sharing, and ride-sharing programs.
- Shift single occupancy vehicle trips to carpooling or vanpooling by providing ride-matching services or shuttle services.
- Provide telework options beyond those already assumed in current plans.
- Provide incentives or subsidies that increase the use of modes other than a single-occupancy vehicle.
- Provide employee transportation coordinators at employment sites.
- Provide a guaranteed ride home service to users of non-auto modes.

Additional mitigation measures may become acceptable as agencies continue to innovate and find new ways to reduce vehicular travel.

6.0 TRANSPORTATION PROJECTS

STATEWIDE GUIDANCE

Statewide guidance for the analysis of transportation projects after the implementation of SB 743 is based on the revisions to CEQA guidelines adopted in December 2018 and OPR's technical advisory dated December 2018. This guidance may be summarized as follows:

- The revised CEQA guidelines allow lead agencies the discretion to choose a performance measure and significance thresholds for the determination of the significant impacts of transportation projects, including the continued use of level of service as a performance measure.
- OPR's technical advisory recommends the use of VMT as the appropriate performance measure for transportation projects, but it does not include a recommendation for significance thresholds. It also states that transit, bicycle, and pedestrian projects can generally be presumed to have less than significant VMT impacts.
- If VMT is selected as the performance measure for roadway projects, OPR's technical advisory recommends the inclusion of induced travel demand in the VMT calculations for roadway projects. Induced travel demand is the travel demand that would be generated by new land development projects that are built as a result of reduced travel times provided by a new roadway project.

RECOMMENDATIONS FOR THE SAN DIEGO REGION

The approach to analysis of transportation projects recommended for use in the San Diego Region is summarized as follows:

- Transit, bicycle, and pedestrian projects can generally be presumed to have less than significant VMT impacts since they will tend to reduce VMT, as suggested by OPR's technical advisory.
- For roadway projects, VMT is the recommended performance measure. This performance measure is considered to be best suited to meeting the intent of SB 743, since focusing on VMT tends to encourage smart growth development, a reduction in vehicle trips, and the construction of multimodal transportation networks.
- VMT analysis for roadway projects can best be considered at regional, citywide, and community levels prior to the consideration of individual projects. Most roadway projects are included in the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), city circulation elements of the general plan, and/or in the circulation elements of community plans. A typical process would be for a roadway to be added to a citywide or community plan first, then incorporated into the RTP/SCS prior to the initiation of a CEQA analysis for the project. Inclusion in the citywide or community plan is considered to be a point at which the project has been accepted into the future planning process. Therefore, inclusion of a project in the citywide or community plan is recommended as the threshold of significance for VMT analysis. It is recommended that projects included in the citywide or community plan may be presumed to have less than significant VMT impacts.

- Individual roadway projects that are not included in the citywide or community plan could be presumed to have less than significant VMT impacts if they have no net increase in VMT compared to the no project condition or if they provide mitigation measures that would reduce VMT to levels at or below the no project condition.

Additional details are provided below.

VMT is the recommended performance measure for the analysis of transportation projects. The recommended methodology for conducting a VMT analysis for transportation projects is to compare the project with the community plan or general plan in which the project is located to determine whether the project would increase VMT as compared to the VMT that would be expected to occur with the community plan or general plan. This is summarized in Figure 6-1. The analysis would vary depending on the mode of travel associated with the project and based on whether the project is currently included in the community plan or general plan.

- Transit, bicycle, and pedestrian projects that would encourage the use of these modes of travel would be expected to reduce VMT, would not require a detailed VMT analysis, and would be presumed to have a less than significant impact on transportation. For these project types, the presumption of less than significant impact would apply even if the project was not in the community plan or general plan.
- Roadway projects (or multimodal projects that include roadways) that are included in the community or general plan would be presumed to have less than significant VMT impacts. In the case of some projects, a similar project may have been included in the community plan or general plan, but revisions or refinements have been incorporated. If the revisions or refinements are expected to cause increases in VMT, analysis should be conducted to compare the proposed project to the project description in the community plan or general plan. Projects that cause VMT increases, in comparison to similar projects proposed in the community plan or general plan, would need to reduce VMT levels below the level of VMT expected in the community plan or general plan in order to avoid a significant VMT impact.
- Roadway projects (or multimodal projects that include roadways) that are not included in the community or general plan would need a detailed analysis of VMT to determine whether the project would be expected to increase or decrease VMT as compared to VMT levels in the community plan or general plan. For small projects, the VMT analysis could be conducted using sketch planning techniques. For large projects, the analysis would generally require the use of a computerized travel forecasting model (such as the SANDAG regional model). For very large projects (i.e. projects that would reduce travel time by five minutes or more for any individual trips), consideration should be given to conducting an analysis of induced demand as described in OPR's technical advisory. The five-minute threshold for analysis of induced demand is based on a research paper published by the Transportation Research Board (Effects of Increased Highway Capacity: Results of Household Travel Behavior Survey, Richard G. Dowling and Steven B. Colman, Transportation Research Record 1493, Transportation Research Board, 1995). This research concluded that projects that decrease travel time by more than five minutes for a large number of trips would probably warrant an upward adjustment of travel demand.

The statewide guidance for VMT analysis of transportation projects is less specific than the guidance provided for land development projects. In the case of transportation projects, new CEQA guidance allows

lead agencies the discretion to choose the performance measure for transportation analysis, including the use of level of service and delay as a performance measure. OPR's technical advisory provides guidance indicating that VMT is the preferred measure of effectiveness for transportation projects but it has no authority to require the use of VMT as a performance measure. Although OPR's technical advisory encourages the use of VMT as a performance measure, it does not recommend a particular threshold of significance for VMT.

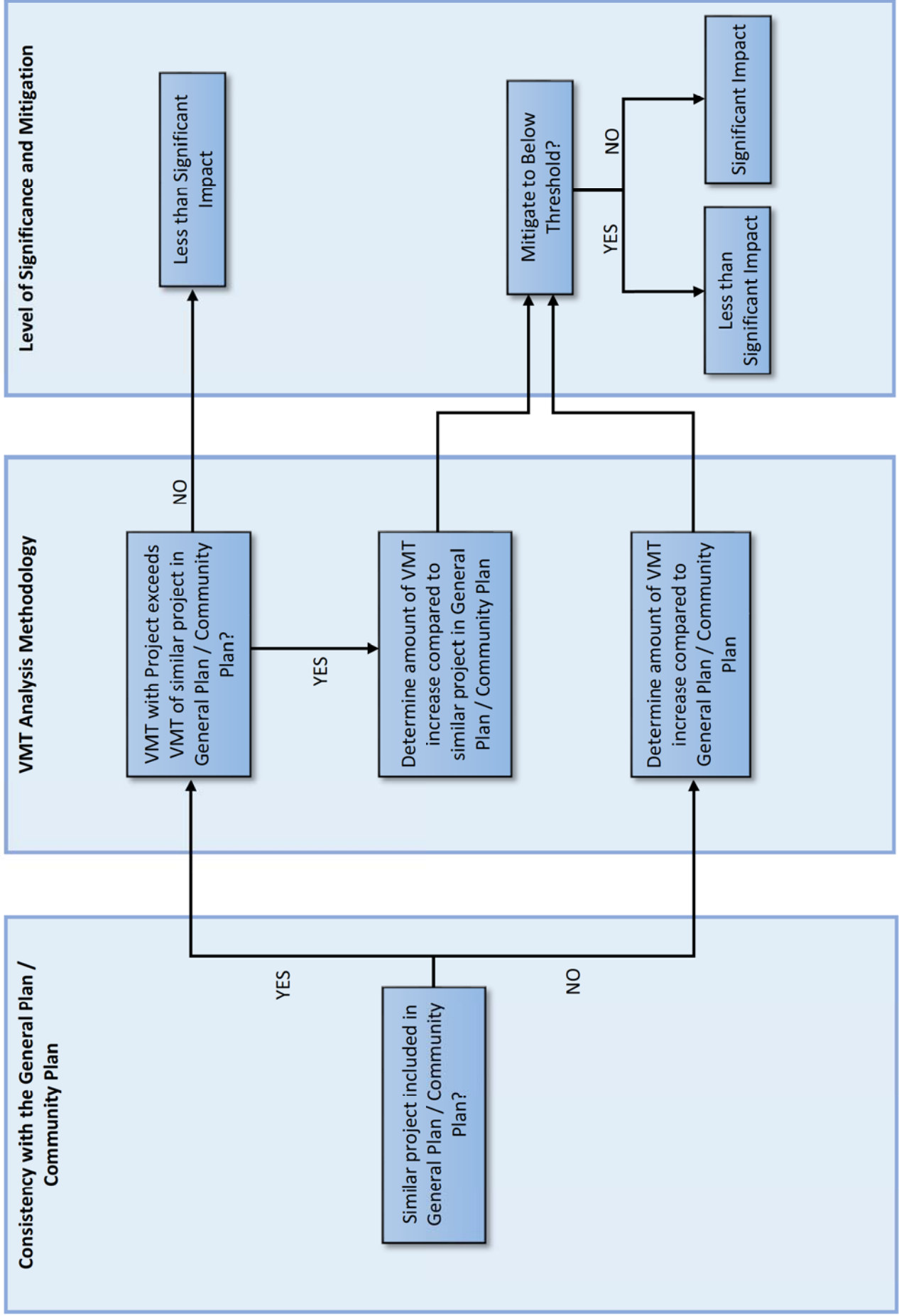
Given the available statewide guidance, these guidelines recommend the use of VMT as the performance measure for transportation projects. The recommended significance threshold is the level of VMT expected based on the community plan or general plan in which the project is located. This methodology is recommended for the following reasons:

- Although the new CEQA guidance allows for the use of any appropriate performance measure for the analysis of transportation projects, the intent of the SB 743 legislation was taken into consideration in the selection of a performance measure. SB 743 is intended to promote multimodal transportation networks, encourage infill development, and promote reduction of greenhouse gases. VMT is considered to be the performance measure that best reflects this intent.
- OPR's technical advisory encourages the use of VMT as a performance measure. Although this recommendation is not binding, the intent of these guidelines is to follow OPR's guidance, except in cases where there are regional characteristics or other factors that suggest a revision or clarification.
- The use of community plan or general plan consistency as a VMT threshold is based on the process by which transportation projects are incorporated into a community plan or general plan. In order for a transportation project to be incorporated into a community or general plan, a considerable amount of analysis is typically conducted. Community plans and general plans typically include the preparation of an Environmental Impact Report that considers a variety of environmental impacts, including transportation impacts. Since community plans and general plans are considered to represent sound urban planning decisions, consistency with these plans is considered to be a reasonable benchmark for the determination of a VMT significance threshold.

While the guidance described above is considered to be appropriate for larger transportation projects, smaller projects would be presumed to have less than significant VMT impacts based on their size or other considerations. Following is a list of projects considered to be in this category. This list is based on information in OPR's technical advisory, with revisions and clarifications based on local conditions:

1. Rehabilitation, maintenance, replacement and repair projects designed to improve the condition of existing transportation assets (e.g., highways, roadways, bridges, culverts, tunnels, transit systems, and assets that serve bicycle and pedestrian facilities) and that do not add motor vehicle capacity
2. Roadside safety devices or hardware installation such as median barriers and guardrails

Figure 6-1
VMT Analysis Flow Chart for Transportation Projects



3. Roadway shoulder enhancements to provide “breakdown space,” dedicated space for use only by transit vehicles, to provide bicycle access, or otherwise to improve safety, but which will not be used as automobile vehicle travel lanes
4. Addition of an auxiliary lane of less than two miles in length
5. Installation, removal, or reconfiguration of traffic lanes at intersections that are intended to provide operational or safety improvements
6. Addition of roadway capacity on local or collector streets provided the project also includes appropriate improvements for pedestrians, cyclists, and, if applicable, transit
7. Conversion of existing general purpose lanes (including ramps) to managed lanes or transit lanes, or changing lane management in a manner that would not substantially increase vehicle travel
8. Addition of a new lane that is intended to be restricted to use only by transit vehicles
9. Reduction in number of through lanes
10. Grade separation to separate vehicles from rail, transit, pedestrians or bicycles, or to replace a lane in order to separate preferential vehicles (e.g., HOV, HOT, or trucks) from general vehicles
11. Installation, removal, or reconfiguration of traffic control devices, including Transit Signal Priority (TSP) features
12. Installation of traffic metering systems, detection systems, cameras, changeable message signs, and other electronics designed to optimize vehicle, bicycle, or pedestrian flow
13. Timing of signals to optimize vehicle, bicycle, or pedestrian flow
14. Installation of roundabouts or traffic circles
15. Installation or reconfiguration of traffic calming devices
16. Adoption of or increase in tolls
17. Addition of tolled lanes, where tolls are sufficient to mitigate any potential VMT increase
18. Initiation of new transit service
19. Conversion of streets from one-way to two-way operation with no net increase in number of traffic lanes
20. Removal or relocation of off-street or on-street parking spaces
21. Adoption or modification of on-street parking or loading restrictions (including meters, time limits, accessible spaces, and preferential/reserved parking permit programs)

22. Addition of traffic wayfinding signage
23. Addition of new or enhanced bike or pedestrian facilities on existing streets/highways or within existing public rights-of-way
24. Addition of Class I bike paths, trails, multi-use paths, or other off-road facilities that serve non-motorized travel
25. Installation of publicly available alternative fuel/charging infrastructure
26. Addition of passing lanes, truck climbing lanes, or truck brake-check lanes in rural areas that do not increase overall vehicle capacity along the corridor
27. Roadway striping modifications that don't change the number of through lanes

Regardless of the project type and analysis method, projects that would be expected to have a significant VMT increase would be expected to consider mitigation measures. Potential mitigation measures would include the following:

- Deploy management strategies (e.g., pricing, vehicle occupancy requirements) on roadways or roadway lanes.
- Improve pedestrian or bicycle networks, or transit service.

Additional mitigation measures may become acceptable as agencies continue to innovate and find new ways to reduce vehicular travel.

PART II – LOCAL TRANSPORTATION ANALYSIS

7.0 ROADWAY

It is recommended that consideration be given to preparation of a local transportation analysis (LTA) for all land development and transportation projects. This section describes the recommended methodology for analysis of local roadway conditions.

The purpose of the roadway analysis portion of an LTA is to forecast, describe, and analyze how a development will affect existing and future circulation infrastructure for users of the roadway system, including vehicles, bicycles, pedestrians, and transit. The LTA assists transportation engineers and planners in both the development community and public agencies when making land use, mobility infrastructure, and other development decisions. An LTA quantifies the expected changes in transportation conditions and translates these changes into transportation system effects in the vicinity of a project.

The roadway transportation analysis included in an LTA is separate from the transportation impact analysis conducted as part of the environmental (CEQA) project review process, as described in Part I. The purpose of the roadway transportation analysis is to ensure that all projects provide a fair share of roadway infrastructure improvements in order to accommodate their multimodal transportation demands.

The following guidelines were prepared to assist local agencies throughout the San Diego Region in promoting consistency and uniformity in local transportation studies. These guidelines do not establish a legal standard for these functions but are intended to supplement any individual manuals or level of service objectives for the various jurisdictions. These guidelines attempt to consolidate regional efforts to identify when an LTA is needed, what professional procedures should be followed, and what constitutes a significant traffic effect that should be dealt with.

The instructions outlined in these guidelines are subject to update as future conditions and experience become available. Special situations may call for variation from these guidelines. It is recommended that consultants who prepare an LTA submit a scoping letter (methodology memo) for review by the lead agency to verify the application of these guidelines and to identify any analysis needed to address special circumstances. The scoping letter in this context is used for transportation analysis only and is not related to a formal scoping process that occurs with preparation of a CEQA study. Caltrans and lead agencies should agree on the specific methods used in local transportation analysis studies involving any State Route facilities, including metered and unmetered freeway ramps.

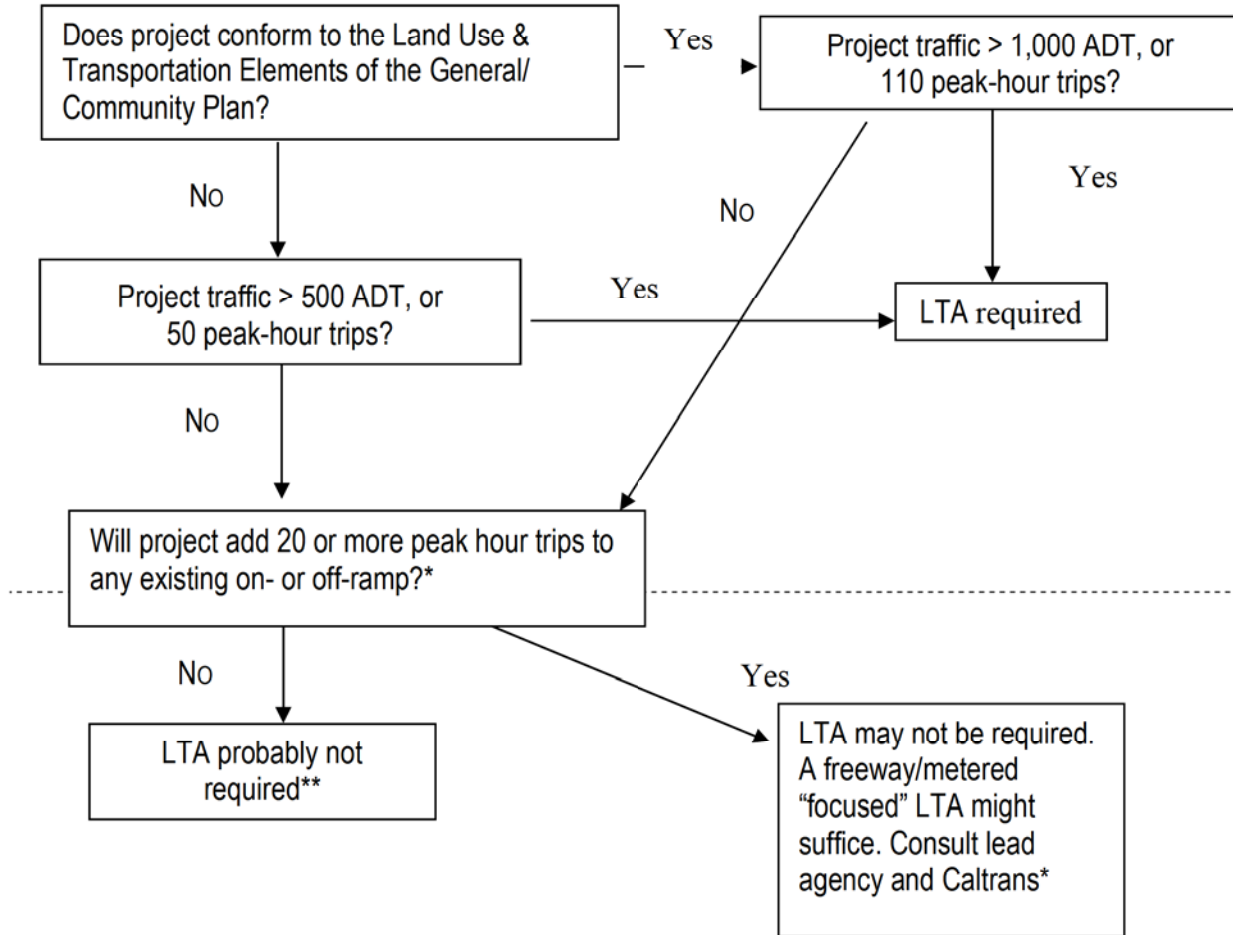
NEED FOR A STUDY

Figure 7-1 shows the flow chart for determination of when a roadway analysis should be conducted. A roadway analysis should be prepared for all projects which generate traffic greater than 1,000 total average daily driveway trips (ADT) or 100 peak-hour trips. If a proposed project is not in conformance with the land use and/or transportation element of the general or community plan, use threshold rates of 500 ADT or 50 peak-hour trips.

Early consultation with any affected jurisdictions is strongly encouraged since a “focused” or “abbreviated” roadway analysis may still be required – even if the above threshold rates are not met. An understanding of the level of detail and the assumptions required for the analysis should be reached. A pre-submittal in-person conference may not be required. However, the applicant should prepare a scoping letter for the agency’s review and approval prior to preparation of the analysis.

Figure 7-1

FLOW CHART FOR LTA ROADWAY ANALYSIS



* Check with Caltrans for current ramp metering rates. (See Attachment B – Ramp Metering Analysis)

** However, for health and safety reasons, and/or local and residential street issues, an “abbreviated” or “focused” LTA may still be requested by a local agency. (For example, this may include traffic backed up beyond an off-ramp’s storage capacity or may include diverted traffic through an existing neighborhood.)

STUDY PARAMETERS

It is recommended that the geographic area examined in the LTA include the following for roadways:

- All local roadway segments between signalized intersections (including all State surface routes), intersections, and mainline freeway locations where the proposed project will add 50 or more peak-hour trips in either direction to the existing roadway traffic.
- All freeway entrance and exit ramps where the proposed project will add a substantial number of peak-hour trips to cause any traffic queues to exceed ramp storage capacities (see Figure 1). (NOTE: Care must be taken to include other ramps and intersections that may receive project traffic diverted as a result of already existing or project causing congestion at freeway entrances and exits.)

The data used in the LTA should generally not be more than two years old and should not reflect a temporary interruption (special events, construction detour, etc.) in the normal traffic patterns unless that is the nature of the project itself. If recent traffic data is not available, current counts should be made by the project applicant's consultant. For areas near beaches or bays, counts should be taken during summer or adjusted to reflect summer conditions.

In general, the region-wide goal for roadway level of service (LOS) on all freeways, roadway segments, and intersections is "D." For central urbanized areas, the goal may be to achieve a level of service of "E." Individual jurisdictions have slightly different LOS objectives.

SCENARIOS TO BE STUDIED

The following scenarios are recommended to be addressed in the roadway analysis (unless there is concurrence with the lead agency that one or more of these scenarios may be omitted). Some exceptions are noted at the end of this list:

Existing Conditions: Document existing traffic levels and peak-hour levels of service in the study area. Identify locations where roadways do not meet target levels of service for existing conditions.

Existing Plus Project Conditions: Analyze the effect of the proposed project in addition to existing conditions. This scenario identifies the effect of a project on the transportation network with no other changes in conditions.

Near-term (approved and pending): Analyze the cumulative conditions resulting from the development of "other" approved and "reasonably foreseeable" pending projects (application on file) that are expected to influence the study area. This is the baseline against which project effects are assessed. The lead agency may be able to provide copies of the traffic studies for the "other" projects if they are already approved. If data is not available for near-term cumulative projects, an ambient growth factor should be used. If applicable, transportation network improvements should also be included in this scenario. This would include programmed and fully funded network improvements that are scheduled to open prior to the project's expected opening day.

Near-term + Proposed Project: Analyze the effects of the proposed project at its expected opening day in addition to near-term baseline conditions. For phased projects, a separate analysis could be conducted for each phase.

Horizon Year: Identify traffic forecasts, typically 20 years in the future, through the output of a SANDAG model forecast or other computer model approved by the local agency.

Horizon Year + Proposed Project: Analyze the additional project traffic effect to the horizon year condition. When justified, and particularly in the case of very large developments or new general/community plans, a transportation model should be run with, and without, the additional development to show the net effect on all parts of the area's transportation system.

Analysis of near-term scenarios may not be necessary if this scenario is incorporated in the agency's Traffic Impact Fee (TIF) program. If an agency has established a fee program to cover near-term improvements on all key roadways, the payment of traffic impact fees could be considered to be sufficient to offset a project's effect on these roadways.

Horizon year studies may not be needed, depending on the discretion of the lead agency. Reasons for including these scenarios may vary, but they would generally be added because the proposed project is substantially different than was expected in the Community Plan/General Plan, or if the area near the project is expected to experience land use or network changes that have not been adequately accounted for in previous planning studies.

In order to use LOS criteria to determine the need for roadway improvements (see Table 7-1), proposed model or manual forecast adjustments must be made to address scenarios both with and without the project. Model data should be carefully verified to ensure accurate project and "other" cumulative project representation. In these cases, regional or subregional models conducted by SANDAG need to be reviewed for appropriateness.

PROJECT TRAFFIC GENERATION

Use of SANDAG [*Traffic Generators Manual and (Not So) Brief Guide....*] or City of San Diego (*Trip Generation Manual*) rates should first be considered. Trip generation rates from ITE's latest *Trip Generation Manual* or *ITE Journal* articles could also be considered. Smart growth projects should consider use of the SANDAG Smart Growth Trip Generation and Parking Study guidelines. If local and sufficient national data do not exist, conduct trip generation studies at multiple sites with characteristics similar to those of the proposed project.

Reasonable reductions to trip rates may also be considered: (a) with proper analysis of pass-by and diverted traffic on adjacent roadways, (b) for developments near transit stations, and (c) for mixed-use developments. (Note: Caltrans and local agencies may use different trip reduction rates. Early consultation with the reviewing agencies is strongly recommended.)

Project trips can be assigned and distributed either manually or by a computer model based upon review and approval of the local agency Traffic Engineer. The magnitude of the proposed project will usually determine which method is employed.

If the manual method is used, the trip distribution percentages could be derived from existing local traffic patterns or optionally (with local agency approval) by professional judgement. If the computer model is used, the trip distribution percentages could be derived from a computer generated "select zone assignment." The centroid connectors should accurately represent project access to the street network. Preferably the project would be represented by its own traffic zone. Some adjustments to the output volumes may be needed (especially at intersections) to smooth out volumes, quantify peak volumes, adjust for pass-by and diverted trips, and correct illogical output.

ANALYSIS OF PROJECT EFFECT ON THE ROADWAY SYSTEM

It is recommended that the roadway analysis determine the effect that a project will have for each of the previously outlined study scenarios. Peak-hour capacity analyses for freeways, roadway segments (ADTs may be used here to estimate V/C ratios), intersections, and freeway ramps can be conducted for existing, near-term, and long-term conditions. The methodologies used in determining the traffic effects are not only critical to the validity of the analysis, they are pertinent to the credibility and confidence the decision-makers have in the resulting findings, conclusions, and recommendations. Methodologies for roadway capacity analyses vary by agency and change over time so it is recommended that consultation be conducted with the lead agency and/or Caltrans to determine an appropriate methodology for a particular study.

NEED FOR ROADWAY IMPROVEMENTS

Table 7-1 indicates when a project's effect on the roadway system is considered to justify need for roadway improvements. That is, if a project's traffic effect causes the values in this table to be exceeded, roadway improvements should be considered. Table 7-2 provides guidance on the levels of ADT that can be accommodated on various types of roadways, based on level of service.

It is the responsibility of Caltrans, on Caltrans initiated projects, to analyze the effect of ramp metering, for initial as well as future operational effect, on local streets that intersect and feed entrance ramps to the freeway. Developers and/or local agencies, however, should consider improvements to existing ramp meter facilities, future ramp meter installations, or local streets, when those effects are attributable to new development and/or local agency roadway improvement projects. When conducting analyses related to ramp meters, it is recommended that analysts consider calibrating the analysis in the transportation impact study to observed conditions in the field.

Not all improvement measures can feasibly consist of roadway widening (new lanes or new capacity). A sample improvement might include financing toward a defined ITS (Intelligent Transportation System) project, enhanced traffic signal communications project, or active transportation projects. This type of improvement would allow a project applicant (especially with a relatively small project) to provide improvements to the roadway system by paying into a local or regional fee program, providing the fee can be established in the near future.

Other improvement measures may include Transportation Demand Management recommendations – transit facilities, bike facilities, walkability, telecommuting, traffic rideshare programs, flex-time, carpool incentives, parking cash-out, complete or partial subsidization of transit passes, etc. Additional improvement measures may be identified as future technologies and policies evolve.

Table 7-1

DETERMINATION OF THE NEED FOR ROADWAY IMPROVEMENTS

LEVEL OF SERVICE WITH PROJECT*	ALLOWABLE CHANGE DUE TO PROJECT EFFECT**					
	FREEWAYS		ROADWAY SEGMENTS		INTERSECTIONS	RAMP*** METERING
	V/C	SPEED (MPH)	V/C	SPEED (MPH)	DELAY (SEC.)	DELAY(MIN.)
E, & F (OR RAMP METER DELAYS ABOVE 15 MIN.)	0.01	1	0.02	1	2	2

NOTES:

* All level of service measurements are based upon Highway Capacity Manual (HCM) procedures for peak-hour conditions. However, V/C ratios for Roadway Segments may be estimated on an ADT/24-hour traffic volume basis (using Table 7-2 or a similar LOS chart for each jurisdiction). The target LOS for freeways, roadways, and intersections is generally "D." For metered freeway ramps, LOS does not apply; however, ramp meter delays above 15 minutes are considered excessive.

** If a proposed project's traffic causes the values shown in the table to be exceeded, the effects of the project are determined to justify improvements. These changes may be measured from appropriate computer programs or expanded manual spreadsheets. The project applicant shall then identify feasible improvements within the LTA report that will maintain the traffic facility at the target LOS or restore to pre-project conditions. If the LOS with the proposed project becomes worse than the target (see above * note), or if the project adds a significant amount of peak-hour trips to cause any traffic queues to exceed on- or off-ramp storage capacities, roadway improvements should be considered.

*** See Attachment B for ramp metering analysis.

KEY: V/C = Volume to Capacity ratio
 Speed = Speed measured in miles per hour
 Delay = Average stopped delay per vehicle measured in seconds for intersections, or minutes for ramp meters
 LOS = Level of Service

Table 7-2

**ROADWAY CLASSIFICATIONS, LEVELS OF SERVICE (LOS)
AND AVERAGE DAILY TRAFFIC (ADT)**

STREET CLASSIFICATION	LANES	LEVEL OF SERVICE W/ADT				
		A	B	C	D	E
Expressway	6 lanes	30,000	42,000	60,000	70,000	80,000
Prime Arterial	6 lanes	25,000	35,000	50,000	55,000	60,000
Major Arterial	6 lanes	20,000	28,000	40,000	45,000	50,000
Major Arterial	4 lanes	15,000	21,000	30,000	35,000	40,000
Major Arterial (One-Way)	3 lanes	12,500	16,500	22,500	25,000	27,500
Major Arterial (One-Way)	2 lanes	10,000	13,000	17,500	20,000	22,500
Secondary Arterial/ Collector	4 lanes	10,000	14,000	20,000	25,000	30,000
Collector (no center lane)	4 lanes	5,000	7,000	10,000	13,000	15,000
Collector (continuous left-turn lane)	2 lanes	5,000	7,000	10,000	13,000	15,000
Collector (no fronting property)	2 lanes	4,000	5,500	7,500	9,000	10,000
Collector (commercial- industrial fronting)	2 lanes	2,500	3,500	5,000	6,500	8,000
Collector (multi-family)	2 lanes	2,500	3,500	5,000	6,500	8,000
Collector (One-Way)	3 lanes	11,000	14,000	19,000	22,500	26,000
Collector (One-Way)	2 lanes	7,500	9,500	12,500	15,000	17,500
Collector (One-Way)	1 lane	2,500	3,500	5,000	6,500	7,500
Sub-Collector (single-family)	2 lanes	---	---	2,200	---	---

NOTES:

1. The volumes and the average daily level of service listed above are only intended as a general planning guideline.
2. Levels of service are not applied to residential streets since their primary purpose is to serve abutting lots, not carry through traffic. Levels of service normally apply to roads carrying through traffic between major trip generators and attractors.

8.0 TRANSIT

It is recommended that the geographic area examined in the LTA include the following for transit:

- All existing transit lines and transit stops within a ½ mile walking distance of the project
- Any planned transit lines or upgrades within a ½ mile walking distance of the project

In general, the region-wide goal for evaluating pedestrian, bicycle, and transit facilities is to identify opportunities to increase connectivity, frequency of service, and level of comfort. Individual jurisdictions may have different qualitative or quantitative ways of performing these evaluations.

9.0 BICYCLE

It is recommended that the geographic area examined in the LTA include the following for bicycle travel:

- All roadways adjacent to the project, extending in each direction to the nearest intersection with a classified roadway or with a Class I path
- Both directions of travel should be evaluated

In general, the region-wide goal for evaluating pedestrian, bicycle, and transit facilities is to identify opportunities to increase connectivity and level of comfort. Individual jurisdictions may have different qualitative or quantitative ways of performing these evaluations.

10.0 PEDESTRIAN

It is recommended that the geographic area examined in the LTA include the following for pedestrians:

- All pedestrian facilities directly connected to project access points or adjacent to the project development, extending in each direction to the nearest intersection with a classified roadway or connection with a Class I path
- Facilities connecting to transit stops within two blocks of the project
- Only facilities on the side of the project or along the walking route to transit stop
- Additional geographic areas may be included in certain cases to address special cases such as schools or retail centers

In general, the region-wide goal for evaluating pedestrian, bicycle, and transit facilities is to identify opportunities to increase connectivity and level of comfort. Individual jurisdictions may have different qualitative or quantitative ways of performing these evaluations.



APPENDICES

**GUIDELINES FOR TRANSPORTATION IMPACT
STUDIES
IN THE SAN DIEGO REGION**

APPENDIX A

LOCAL TRANSPORTATION ANALYSIS
SCREEN CHECK

Completed by Staff: _____
Date Received _____
Reviewer _____
Date Screen Check _____

To be completed by consultant (including page #):

Name of Study _____
Consultant _____
Date Submitted _____

		Satisfactory		NOT REQUIRED
		YES	NO	
Indicate Page # in report:				
pg. ___	1. Table of contents, list of figures and list of tables.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	2. Executive summary.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	3. Map of the proposed project location.	<input type="checkbox"/>	<input type="checkbox"/>	
	4. General project description and background information:			
pg. ___	a. Proposed project description (acres, dwelling units....)	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	b. Total trip generation of proposed project.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	c. Community plan assumption for the proposed site.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	5. Parking, transit and on-site circulation discussions are included.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	6. Map of the Study Area and specific intersections studied in the traffic report.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	7. Existing Transportation Conditions:			
	a. Figure identifying roadway conditions including raised medians, median openings, separate left and right turn lanes, roadway and intersection dimensions, bike lanes, parking, number of travel lanes, posted speed, intersection controls, turn restrictions and intersection lane configurations.	<input type="checkbox"/>	<input type="checkbox"/>	
	b. Figure indicating the daily (ADT) and peak-hour volumes.	<input type="checkbox"/>	<input type="checkbox"/>	
	c. Figure or table showing level of service (LOS) for intersections during peak hours and roadway sections within the study area (include analysis sheets in an appendix).	<input type="checkbox"/>	<input type="checkbox"/>	
	8. Project Trip Generation:			
pg. ___	Table showing the calculated project generated daily (ADT) and peak hour volumes.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	9. Project Trip Distribution using the current travel demand model (provide a computer plot) or manual assignment if previously approved. (Identify which method was used.)	<input type="checkbox"/>	<input type="checkbox"/>	
	10. Project Traffic Assignment:			
pg. ___	a. Figure indicating the daily (ADT) and peak-hour volumes.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	b. Figure showing pass-by-trip adjustments, and, if cumulative trip rates are used.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	11. Existing Near-term Cumulative Conditions:			
pg. ___	a. Figure indicating the daily (ADT) and peak-hour volumes.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	b. Figure or table showing the projected LOS for intersections during peak hours and roadway sections within the study area (analysis sheets included in the appendix).	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	c. Traffic signal warrant analysis (Caltrans Traffic Manual) for	<input type="checkbox"/>	<input type="checkbox"/>	

Indicate Page # in report: appropriate locations.		Satisfactory		NOT REQUIRED
		YES	NO	
	12. Existing Near-term Cumulative Conditions + Proposed Project (each phase when applicable)			
pg. ___	a. Figure or table showing the projected LOS for intersections during peak hours and roadway sections with the project (analysis sheets included in the appendix).	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	b. Figure showing other projects that were included in the study, and the assignment of their site traffic.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	c. Traffic signal warrant analysis for appropriate locations.	<input type="checkbox"/>	<input type="checkbox"/>	
	13. Horizon Year Transportation Conditions (if project conforms to the General/ Community Plan):			
pg. ___	a. Horizon Year ADT and street classification that reflect the Community Plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pg. ___	b. Figure or table showing the horizon LOS for intersections during peak hours and roadway sections <u>with</u> and <u>without</u> the project (analysis sheets included in the appendix).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pg. ___	c. Traffic signal warrant analysis at appropriate locations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	14. Horizon Year Transportation Conditions + Proposed Project (if project does not conform to the General/Community Plan):			
pg. ___	a. Horizon Year ADT and street classification as shown in the Community Plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pg. ___	b. Horizon Year ADT and street classification for two scenarios: with the proposed project and with the land use assumed in the Community Plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pg. ___	c. Figure or table showing the horizon LOS for intersections during peak hours and roadway sections for two scenarios: <u>with</u> and <u>without</u> the proposed project and with the land use assumed in the Community Plan (analysis sheets included in the appendix).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pg. ___	d. Traffic signal warrant analysis at appropriate locations with the land use assumed in the General/Community Plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
pg. ___	15. A summary table showing the comparison of Existing, Existing + Near-term Cumulative, Existing + Near-term Cumulative + Proposed Project, Horizon Year, and Horizon Year + Proposed Project (if different from General/Community Plan), LOS on roadway sections and intersections during peak hours.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	16. A summary table showing the project's "significant traffic effects."	<input type="checkbox"/>	<input type="checkbox"/>	
	17. Transportation Improvements:			
pg. ___	a. Table identifying the improvements required that are the responsibility of the developer and others. A phasing plan is required if improvements are proposed in phases.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	b. Figure showing all proposed improvements that include: intersection lane configurations, lane widths, raised medians, median openings, roadway and intersection dimensions, right-of-way, offset, etc.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	18. The Highway Capacity Manual Operation Method or other approved method is used at appropriate locations within the study area.	<input type="checkbox"/>	<input type="checkbox"/>	
pg. ___	20. Appropriate freeway analysis is included.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indicate Page # in report:

- pg. ___ 21. Appropriate freeway ramp metering analysis is included.
- pg. ___ 22. The traffic study is signed by a California Registered Traffic Engineer.

Satisfactory		NOT
YES	NO	REQUIRED
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	

THE STUDY SCREEN CHECK FOR THE SUBJECT PROJECT IS:

_____ Approved

_____ Not approved because the following items are missing:

APPENDIX B

ATTACHMENT B

RAMP METERING ANALYSIS

Ramp metering analysis should be performed for each horizon year scenario in which ramp metering is expected. The following table shows relevant information that should be included in the ramp meter analysis, "Summary of Freeway Ramp Metering Effects."

LOCATION	DEMAND (veh/hr) ¹	METER RATE (veh/hr) ²	EXCESS DEMAND (veh/hr) ³	DELAY (min) ⁴	QUEUE (feet) ⁵

NOTES:

¹ DEMAND is the peak hour demand expected to use the on-ramp.

² METER RATE is the peak hour capacity expected to be processed through the ramp meter. This value should be obtained from Caltrans.

³ EXCESS DEMAND = (DEMAND) – (METER RATE) or zero, whichever is greater.

⁴ DELAY = $\frac{\text{EXCESS DEMAND}}{\text{METER RATE}} \times 60 \text{ MINUTES/HOUR}$

⁵ QUEUE = (EXCESS DEMAND) X 29 feet/vehicle

NOTE: Delay will be less at the beginning of metering. However, since peaks will almost always be more than one hour, delay will be greater after the first hour of metering. (See discussion on next page.)

SUMMARY OF FREEWAY RAMP METERING EFFECTS
(Lengthen as necessary to include all affected meter locations)

LOCATION(S)	PEAK HOUR	PEAK HOUR DEMAND D	FLOW (METER RATE) F	EXCESS DEMAND E	DELAY (MINUTES)	QUEUE Q (feet)
	AM PM					
	AM PM					
	AM PM					

DISCUSSION OF RAMP METER ANALYSIS

- A. CAUTION: The ramp metering analysis shown in Attachment B may lead to grossly understated results for delay and queue length, since important aspects of queue growth are ignored. Also, the draft guidelines method derives average values instead of maximum values for delay and queue length. Utilizing average values instead of maximum values can lead to obscuring important effects, particularly in regard to queue length.

Predicting ramp meter delays and queues requires a storage-discharge type of analysis, where a pattern of arriving traffic at the meter is estimated by the analyst, and the discharge, or meter rate, is a somewhat fixed value set by Caltrans for each individual metered ramp.

Since a ramp meter queue continues to grow longer during all times that the arrival rate exceeds the discharge rate, the maximum queue length (and hence, the maximum delay) usually occurs after the end of the peak (or highest) one hour. This leads to the need for an analysis for the entire time period during which the arrival rate exceeds the meter rate, not just the peak hour. For a similar reason, the analysis needs to consider that a substantial queue may have already formed by the beginning of the "peak hour." Traffic arriving during the peak hour is then stacked onto an existing queue, not just starting from zero as the draft analysis suggests.

Experience shows that the theoretical queue length derived by this analysis often does not materialize. Motorists, after a brief time of adjustment, seek alternate travel paths or alternate times of arrival at the meter. The effect is to approximately minimize total trip time by seeking out the best combinations of route and departure time at the beginning of the trip. This causes at least two important changes in the pattern of arriving traffic at ramp meters. First, the peak period is spread out, with some traffic arriving earlier and some traffic arriving later than predicted. Second, a significant proportion of the predicted arriving traffic will use another ramp, use another freeway, or stay on surface streets.

It is acceptable to make reasonable estimates of these temporal and spatial (time and occupying space) diversions as long as all assumptions are stated and that the unmodified, or theoretical values are shown for comparison.

- B. Additional areas for study include being able to define acceptable levels of service (LOS) and "significant" thresholds (e.g., a maximum ramp meter delay of 15 minutes) for metered freeway entrance ramps.

Currently there are no acceptable software programs for measuring project effects on metered freeway ramps nor does the Highway Capacity Manual (HCM) adequately address this issue. Hopefully in the near future a regionwide study will be initiated to determine what metering rate (at each metered ramp) would be required in order to guarantee that traffic will flow (even at LOS "E") on the entire freeway system during peak-hour conditions. From this, the ramp delays and resultant queue lengths might then be calculated. Overall, this is a very complex issue that needs considerable research and refinement in cooperation with Caltrans.

APPENDIX C

LEVEL OF SERVICE (LOS) DEFINITIONS (generally used by Caltrans)

The concept of Level of Service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A Level of Service^s definition generally describes these conditions in terms of such factors as speed, travel time, freedom to maneuver, comfort and convenience, and safety. Levels of Service definitions can generally be categorized as follows:

LOS	D/C*	Congestion/Delay	Traffic Description
(Used for freeways, expressways and conventional highways ^A)			
"A"	<0.41	None	Free flow.
"B"	0.42-0.62	None	Free to stable flow, light to moderate volumes.
"C"	0.63-0.79	None to minimal	Stable flow, moderate volumes, freedom to maneuver noticeably restricted.
"D"	0.80-0.92	Minimal to substantial	Approaches unstable flow, heavy volumes, very limited freedom to maneuver.
"E"	0.93-1.00	Significant	Extremely unstable flow, maneuverability and psychological comfort extremely poor.
(Used for conventional highways)			
"F"	>1.00	Considerable	Forced or breakdown. Delay measured in average flow, travel speed (MPH). Signalized segments experience delays >60.0 seconds/vehicle.
(Used for freeways and expressways)			
"F0"	1.01-1.25	Considerable 0-1 hour delay	Forced flow, heavy congestion, long queues form behind breakdown points, stop and go.
"F1"	1.26-1.35	Severe 1-2 hour delay	Very heavy congestion, very long queues.
"F2"	1.36-1.45	Very severe 2-3 hour delay	Extremely heavy congestion, longer queues, more numerous breakdown points, longer stop periods.
"F3"	>1.46	Extremely severe 3+ hours of delay	Gridlock.

^s Level of Service can generally be calculated using the latest Highway Capacity Manual. However, contact Caltrans for more specific information on determining existing "free-flow" freeway speeds.

* Demand/Capacity ratio used for forecasts (V/C ratio used for operational analysis, where V = volume)

^A Arterial LOS is based upon average "free-flow" travel speeds, and should refer to definitions in the HCM.