



**CITY OF ELK GROVE
CITY COUNCIL & PLANNING COMMISSION
STAFF REPORT**

AGENDA TITLE: General Plan Update: City Council/Planning Commission Joint Session (Mobility and Transportation Analyses)

MEETING DATE: June 21, 2017

PREPARED BY: Christopher Jordan, AICP, Assistant to the City Manager
Jeff Henderson, AICP, Special Projects Planner

DEPARTMENT HEAD: Laura Gill, City Manager

RECOMMENDED ACTION

Staff is seeking specific policy direction from the City Council and Planning Commission regarding the General Plan Update, including the Mobility topics of Level of Service and Vehicle Miles Traveled. To that end, staff recommends that the City Council and Planning Commission:

1. Receive staff’s report and recommendations, with questions for staff.
2. Receive public comment on the information presented and possible policy direction.
3. Engage in a joint City Council-Planning Commission discussion and possible recommendation from the Commission.
4. Provide specific direction to staff from the City Council.

BACKGROUND

The City has undertaken a comprehensive update to its General Plan (Project). The General Plan is the City’s overarching policy document for creating a thriving, well-balanced, and sustainable community. All future development and actions of the City must be consistent with the General Plan. Since initiation of the Project, a number of tasks and components have been completed, including public outreach on vision and potential land plan changes, and study sessions on key topics and critical policies.

PURPOSE AND OVERVIEW OF THE JOINT STUDY SESSION

At the April 13, 2017 Joint Session, staff presented the recommended draft policies on Mobility, addressing both roadway efficiency and implementation of the forthcoming Vehicle Miles Traveled (VMT) thresholds under Senate Bill 743 (SB 743). During the presentation, the Council and Commission posed a number of questions and concerns, and requested that a separate study session (this meeting) be scheduled for further discussion on Mobility and Transportation.

During the presentation, staff will cover the following:

- The City's current approach to mobility and roadway efficiency (Level of Service);
- SB 743 - Why it was developed and what it is trying to solve;
- Current status of guidance from the State on implementing SB 743;
- Overview of VMT and how it is calculated;
- Staff's recommendations for implementing SB 743, including project-specific examples.

In preparation for the meeting, staff has identified some useful background information. First, the following is an excerpt from the [Governor's Office of Planning and Research \(OPR\) website](#):

What does SB 743 Change?

Governor Brown signed Senate Bill (SB) 743 (Steinberg, 2013), which creates a process to change the way that transportation impacts are analyzed under CEQA. Specifically, SB 743 requires the Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines to provide an alternative to LOS for evaluating transportation impacts. Particularly within areas served by transit, those alternative criteria must "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." (New Public Resources Code Section 21099(b)(1).) Measurements of transportation impacts may include "vehicle miles traveled, vehicle miles traveled per capita, automobile trip generation rates, or automobile trips generated." (Ibid.) Once the CEQA Guidelines are amended to include those alternative criteria, auto delay will no longer be considered a significant impact under CEQA. (Id. at subd. (b)(2).) Transportation impacts related to air quality, noise and safety must still be analyzed under CEQA where appropriate. (Id. at subd. (b)(3).) SB 743 also

amended congestion management law to allow cities and counties to opt out of LOS standards within certain infill areas. (See Amended Government Code Sections 65088.1 and 65088.4.)

Aside from changes to transportation analysis, SB 743 also included several important changes to CEQA that apply to transit oriented developments, including aesthetics and parking.

History

OPR published a preliminary evaluation of possible metrics to replace “level of service” in transportation analyses in December 2013, and invited public comment on that evaluation. OPR reviewed all of the comments that it received on the preliminary evaluation to develop the preliminary discussion draft. In August 2014, OPR released a Preliminary Discussion Draft of Updates to the CEQA Guidelines Implementing SB 743, and a Frequently Asked Questions document, accepted comments, and provided a summary of those comments.

OPR has been evaluating alternative traffic modeling methodologies for some time. For reference, OPR’s December 2013 Preliminary Evaluation of Alternative Methods of Transportation Analysis is available at this link (<http://tinyurl.com/y7kzp23k>). OPR’s August 2014 Preliminary Discussion Draft is available at this link (<http://tinyurl.com/ycgqqa5w>).

The current draft OPR Proposed Updates to the CEQA Guidelines (dated January 20, 2016) are provided as **Attachment 1** and are presented by OPR in three parts:

1. Introduction and overview, with summary of comments on the first draft and how OPR has responded to the comments.
2. Revised Proposed Changes to the CEQA Guidelines, which provide the specific changes that will occur, including the specific transportation impact analysis questions (see pages 7 of 8 of the document).
3. Technical Advisory on Evaluating Transportation Impacts in CEQA, which provides OPR’s technical recommendations and best practices regarding the evaluation of transportation impacts under the amended CEQA. Unlike section 2 of the document, this section is not regulatory. Rather, it provides guidance and recommendations to local agencies. The choice of VMT methodology and threshold of significance are left to the lead agency.

OPR is working on revisions to the draft updates. While no specific timeline has been announced, City staff expects a final version to be published before the end of 2017. The latest information points to a January 2019 implementation deadline. OPR has publically stated that local agencies should begin planning for (and implementing) the transition now, in preparation for adoption in the near future.

Additionally, in April, 2017, OPR published a list of selected resources on transportation planning, available at <http://tinyurl.com/yddosu8b>. One of these, a report from the American Planning Association, is provided as **Attachment 2** and provides an overview of the challenges with reliance on Level of Service and the types of emerging alternative metrics, such as VMT, and how they can be more successful for communities.

Staff's recommended mobility policies and implementation are provided as **Attachment 3**, including an introduction/overview, the specific policy language, and the draft analysis guidelines. In short, this draft:

- Establishes VMT performance metrics by land use category and for the City as a whole, based upon the draft Land Use Plan.
- Establishes VMT performance metrics based upon the draft land use programs for the Study Areas.
- Identifies pre-screening criteria for certain projects based upon size and/or location that would be exempt from VMT analysis.
- Provides a process for approving projects that exceed the performance metrics consistent with the provisions of CEQA.

Staff believes these draft policies and procedures provide a balanced approach between implementation of the pending CEQA changes and obligations under SB 743, and maintaining local land use authority.

The Council and Planning Commission also suggested at the August 2016 study session that the City retain LOS policies in the General Plan as a way of ensuring an efficient roadway system for residents and businesses. Having further analyzed this issue, planning and legal staff have concluded that retaining LOS presents CEQA compliance concerns by setting a threshold that may be viewed as inconsistent with the new VMT standard.

Therefore, staff is recommending an alternative process to ensure roadway efficiency and safety without using LOS. As indicated in Attachment 3, the efficiency and safety policy includes two parts:

1. For roadway segments, an “Average Daily Traffic Design Target” is identified. This target describes the general targeted capacity for various types of roadway segments, based upon their lane configuration and design characteristics (design speed, access control). Based upon Average Daily Traffic projections and design characteristics of a given roadway, the target lane configuration would be selected. This data is based upon criteria in the Highway Design Manual and follows engineering best practices.
2. For roadway intersections, the City would establish a series of Design Considerations. Basically, these are concepts/evaluation metrics that provide an analysis of the operations of an intersection. For instance, it would look at pedestrian safety/crossing time, bicycle comfort, queue lengths in turn pockets, and other operational aspects.

Additional provisions are included in both the segments and intersections to provide deviations from the targets based upon safety and site context (e.g., rural area). If this proposal is accepted and implemented into the General Plan, projects will be required to comply with both the Average Daily Traffic Design Target (to the extent called for in the policy) and the VMT standard. Note that where a project exceeds a mandated performance standard under CEQA, and the impacts cannot feasibly be mitigated to a less than significant impact, CEQA allows agencies to adopt a statement of overriding considerations, allowing the project to proceed despite a finding of significant and unavoidable impacts.

ATTACHMENTS

1. OPR Draft Proposed Updates to the CEQA Guidelines (dated January, 20 2016)
2. Report: Smart Transportation Metrics for Smart Growth
3. Draft Mobility Policies and Implementation
 - A. Introduction/Overview
 - B. Draft Policies (VMT and LOS)
 - C. Draft Transportation Analysis Guidelines (VMT Portion Only)



Revised
Proposal on
Updates to
the CEQA
Guidelines on
Evaluating
Transportation
Impacts in
CEQA

Implementing Senate Bill
743 (Steinberg, 2013)

January 20, 2016

I. Explanation of Revised Updates to the CEQA Guidelines Implementing Senate Bill 743

A. Background

Senate Bill 743 mandates a change in the way that public agencies evaluate transportation impacts of projects under the California Environmental Quality Act. Legislative findings in that bill plainly state that California’s foundational environmental law can no longer treat vibrant communities, transit and active transportation options as adverse environmental outcomes. On the contrary, aspects of project location and design that influence travel choices, and thereby improve or degrade our air quality, safety, and health, must be considered.

The Legislature mandated that these changes occur in the Guidelines that implement CEQA for several reasons. For one, as administrative regulations, updates to the CEQA Guidelines are vetted publicly and thoroughly. The Office of Planning and Research began to engage the public in the development of these recommendations as soon as Governor Brown signed Senate Bill 743 into law. Moreover, the development of these recommendations has been iterative, giving experts, the public and affected entities many opportunities to weigh-in. This revised draft of the Guidelines is the latest iteration. Further, as implementation is monitored, and methodologies improve, the Guidelines can be updated as needed.

Once finally adopted, these Guidelines should result in a better, more transparent evaluation of project impacts, and better environmental outcomes. Procedurally, traffic studies that accompany in-depth environmental review will now typically take days rather than weeks to prepare. Because models to estimate vehicle miles traveled are publicly available, decision-makers and the public will be better able to engage in the review process. Substantively, a focus on vehicle miles traveled will facilitate the production of badly-needed housing in urban locations. It will also facilitate transit projects and better uses of existing infrastructure as well as bicycle and pedestrian improvements. As a result, people will have better transportation options. It also means that CEQA will no longer mandate roadways that focus on automobiles to the exclusion of every other transportation option. It will no longer mandate excessive, and expensive, roadway capacity.

As indicated above, this revised draft is the product of many months of intensive engagement with the public, public agencies, environmental organizations, development advocates, industry experts, and many others. Because the changes from the preliminary discussion draft are meaningful and substantive, OPR again invites public review and comment on this proposal.

This document contains an explanation of how the proposal has changed from the [preliminary discussion draft](#). It also briefly explains how the proposal changed in response to specific public input. Finally, this document includes the revised draft of proposed new section 15064.3 as well as a draft Technical Advisory that more thoroughly describes recommended methodologies.

B. Explanation of What Changed from, and What Remains the Same as, the Preliminary Discussion Draft

Many of the basics of the proposal will look familiar. OPR continues to recommend vehicle miles traveled as the most appropriate measure of project transportation impacts. Further, this proposal continues to recommend that development proposed near transit, as well as roadway rehabilitation, transit, bicycle and pedestrian projects, should be considered to have a less than significant transportation impact. Moreover, OPR continues to recommend application of that measure across the state. Finally, OPR continues to recommend that implementation be phased in over time.

Reviewers will also see several improvements on the preliminary discussion draft. First, much of the detail that OPR originally proposed to include in the new Guidelines section has been moved to a new draft Technical Advisory (see Section III of this document). Doing so will make more clear what in the proposal is a requirement versus a recommendation. Second, the recommended thresholds of significance have been refined to both better align with the state's climate policies and recognize the tremendous diversity of California's communities. Further, the threshold recommendations are accompanied by better access to relevant data (such as [outputs from the Caltrans' Statewide Travel Demand Model](#)). Third, OPR now recommends that the new procedures remain optional for a two-year period. This opt-in period will enable those agencies that are ready to make the switch from level of service to vehicle miles traveled to do so, but gives time to other agencies that have indicated that they need more time to become acquainted with the new procedures.

C. How the Revised Draft Responds to Public Input

OPR received nearly 200 [comment letters](#) on the preliminary discussion draft. The following contains excerpts from those comments representing some of the major themes in the input that OPR received. Following each excerpt is a brief explanation of how OPR responded to the comment in the revised draft.

1. "We applaud the State of California and [OPR] for taking this **transformative step** forward..."

OPR agrees that the outcome of these changes may be transformative. The degree to which consideration of a project's vehicle miles traveled leads to healthier air and better transportation choices will depend on the choices of individual lead agencies. Those agencies will need to find that project changes, such as increasing transportation options and mix of uses, are feasible. We are more likely to see improved outcomes if these changes in CEQA are coupled with changes in local land use policies, such as reduced parking mandates, greater emphasis on transit, and more walkable community design.

2. “We applaud the selection of Vehicle Miles Traveled (VMT) as the primary metric for evaluating transportation impacts under CEQA. VMT is not only a **better measure of environmental impacts** than LOS; it is also **more equitable.**”

OPR agrees that vehicle miles traveled is the most appropriate measure to replace level of service. As explained in detail in the [Preliminary Evaluation of Alternatives](#), and in the [Preliminary Discussion Draft](#), vehicle miles traveled directly relates to emissions of air pollutants, including greenhouse gases, energy usage, and demand on infrastructure, as well as indirectly to many other impacts including public health, water usage, water quality and land consumption. Some comments expressed desire to maintain the status quo, and disagreement with the policy of analyzing vehicle miles traveled. However, none of the comments offered any evidence that vehicle miles traveled is not a measure of environmental impact. Moreover, none of the comments produced any credible evidence that level of service is a better measure of environmental impact, or would better promote the statutory goals set forth in CEQA. For these reasons, OPR continues to recommend vehicle miles traveled the primary measure of transportation impacts.

3. “... concerned that **regional average VMT** does not account for the diversity of communities within the various regions.”

While OPR finds that vehicle miles traveled is the best measure of transportation impact in all locations, some variation in *thresholds* may be appropriate in different parts of regions and the state. (See State CEQA Guidelines § 15064(b)(“...the significance of an activity may vary with the setting”).) Therefore, OPR’s revised threshold recommendations provide that outside of central urban locations, reference to a city’s average, or within unincorporated county areas, the average of the cities in the county, may be appropriate.

4. “*Unlike activity based models used by some of the larger MPOs, average VMT by land use type is **not readily available** from the typical 4-step travel demand model....*”

OPR acknowledges the concern expressed in some comments regarding data availability. The adequacy of any analysis “is to be reviewed in the light of what is reasonably feasible.” (State CEQA Guidelines § 15151.) Even outside of the large metropolitan planning organizations, statewide data on vehicle miles traveled are available. For example, the California Statewide Travel Demand Model provides [data on vehicle miles traveled throughout the state](#) which can be used both for setting thresholds and for estimating VMT resulting from a proposed project.

5. “... a threshold based on any average inherently **encourages only marginal improvement....** [W]e recommend that the threshold of significance be based on the **SB 375 regional targets.**”

OPR agrees. The numeric threshold recommendations in the draft Technical Advisory therefore recommends that, in many cases, a project will have a less than significant transportation impact if it

performs at least fifteen percent better than existing averages for the region or city. Fifteen percent is roughly consistent with the reduction targets set for the larger metropolitan planning organizations pursuant to SB 375. The greenhouse gas emissions reductions called for in AB 32 and Executive Orders [B-30-15](#) (forty percent reduction by 2030) and [S-3-05](#) (eighty percent reduction by 2050), which reflect scientific consensus on the magnitude of emissions reductions needed to avoid the worst effects of climate change, require that new development perform significantly better than average. Thus, OPR's revised threshold recommendation better reflects the greenhouse gas reduction goal set forth in SB 743, SB 375, AB 32 and other related climate goals.

6. The presumption [that projects near transit would have a less than significant impact] “would result in **missed opportunities** to include trip reduction measures where they are needed.”

OPR disagrees that recommending a presumption of less than significant impacts for development projects located near transit would prevent local governments from requiring trip reduction in project design. First, local governments may condition project approvals pursuant to their police powers. (Pub. Resources Code § 21099(b)(4).) Thus, even if a project would have a less than significant impact under CEQA, cities and counties may condition project approvals based on local policy. Second, the recommended presumption may be rebutted. A lead agency may find that details about the project or its specific location indicate that the project may cause a significant transportation impact, despite being near transit, and thereby require trip reduction measures. Third, SB 743 specified that lead agencies may find use more stringent thresholds. (Pub. Resources Code § 21099(e).) OPR notes, however, that transit-oriented development itself is a key strategy for reducing VMT, and thereby reducing environmental impacts and developing healthy, walkable communities.

7. “...transit proximity is not an adequate indicator of VMT.... [W]e recommend adding one simple indicator...: **the project's parking ratio.**”

OPR agrees that excess parking may indicate higher vehicle miles traveled. OPR has, therefore, included parking among several factors that might lead an agency to determine that the presumption of less than significant impacts does not apply to a particular project.

8. “For some large roadway projects, **analysis of induced demand may be appropriate.**” But there should be reasonable limits.

OPR agrees. [Academic research shows us that adding new roadway capacity increases vehicle miles traveled.](#) Not every transportation improvement will induce travel, however. The recommendations in the draft Technical Advisory clarify that certain transportation projects are not likely to induce significant new travel. Those projects include, among others, installation, removal, or reconfiguration of traffic lanes that are not for through traffic, such as left, right, and U-turn pockets, or emergency breakdown lanes, new local or collector streets, conversion of general purpose lanes (including ramps) to managed lanes or transit lanes, etc.

9. “The factors affecting transportation safety are numerous and nuanced, and thus **not well suited for enumeration within the CEQA Guidelines.**”

OPR agrees. While safety is a proper consideration under CEQA, the precise nature of that analysis is best left to individual lead agencies to account for project-specific and location-specific factors. OPR has removed the safety provisions from the proposed new section 15064.3. Instead, OPR describes potential considerations for lead agencies in the draft Technical Advisory.

10. “The inclusion of **an explicit list** [of mitigation measures and alternatives] creates the **presumption that each of the measures listed should be analyzed** for any project with a potentially significant impact.”

OPR disagrees that a suggested list of mitigation measures and alternatives creates any presumption regarding the feasibility of any particular project. Nevertheless, moving the suggested mitigation measures and alternatives to the draft Technical Advisory will accomplish several goals. First, it continues to provide helpful information to lead agencies. Second, it reduces the size and increases the clarity of the regulatory text. Third, the list may be updated more frequently as the practice evolves. Because those goals can be accomplished in a technical advisory, OPR no longer proposes changes to Appendix F of the CEQA Guidelines at this time.

11. “A **minimum of two years** worth of time should be allowed between incorporation by local agencies in transit priority areas and implementation statewide.”

OPR agrees that many lead agencies could benefit from additional time to implement the new rules. Indeed, OPR has seen significant strides in practitioners’ understanding of vehicle miles traveled, and how best to study and mitigate it, in the time since OPR released the preliminary discussion draft. Recognizing that some agencies are ready to begin implementation immediately, the revised draft provides that analysis of vehicle miles traveled will be voluntary for two years following adoption of the new Guidelines. During that time, OPR will monitor implementation and may evaluate whether any updates to the Guidelines or Technical Advisory are needed.

D. Next Steps

OPR invites public review and comment on the revised draft Guidelines and draft Technical Advisory. Input may be submitted electronically to CEQA.Guidelines@resources.ca.gov. While electronic submission is preferred, suggestions may also be mailed or hand delivered to:

Christopher Calfee, Senior Counsel
 Governor’s Office of Planning and Research
 1400 Tenth Street
 Sacramento, CA 95814

Please submit all suggestions before **February 29, 2016 at 5:00p.m.** Once the comment period closes, OPR will review all written input and may revise the proposal as appropriate. Next, OPR will submit the draft to the Natural Resources Agency, which will then commence a formal rulemaking process. Once the Natural Resources Agency adopts the changes, they will undergo review by the Office of Administrative Law.

E. Tips for Providing Effective Input

OPR would like to encourage robust engagement in this update process. We expect that participants will bring a variety of perspectives. While opposing views may be strongly held, discourse can and should proceed in a civil and professional manner. To maximize the value of your input, please consider the following:

- In your comment(s), please clearly identify the specific issues on which you are commenting. If you are commenting on a particular word, phrase, or sentence, please provide the page number and paragraph citation.
- Explain why you agree or disagree with OPR's proposed changes. Where you disagree with a particular portion of the proposal, please suggest alternative language.
- Describe any assumptions and support assertions with legal authority and factual information, including any technical information and/or data. Where possible, provide specific examples to illustrate your concerns.
- When possible, consider trade-offs and potentially opposing views.
- Focus comments on the issues that are covered within the scope of the proposed changes. Avoid addressing rules or policies other than those contained in this proposal.
- Consider quality over quantity. One well-supported comment may be more influential than one hundred form letters.
- Please submit any comments within the timeframe provided.

II. *Revised* Proposed Changes to the CEQA Guidelines

Section II of this document includes proposed additions to the CEQA Guidelines, which are found in Title 14 of the California Code of Regulations. Note, these additions, must undergo a formal administrative rulemaking process, and once adopted by the Natural Resources Agency, be reviewed by the Office of Administrative Law.

Proposed New Section 15064.3. Determining the Significance of Transportation Impacts

(a) Purpose.

Section 15064 contains general rules governing the analysis, and the determination of significance of, environmental effects. Specific considerations involving transportation impacts are described in this section. Generally, vehicle miles traveled is the most appropriate measure of a project's potential transportation impacts. For the purposes of this section, "vehicle miles traveled" refers to the amount and distance of automobile travel attributable to a project. Other relevant considerations may include the effects of the project on transit and non-motorized travel and the safety of all travelers. A project's effect on automobile delay does not constitute a significant environmental impact.

(b) Criteria for Analyzing Transportation Impacts.

Lead agencies may use thresholds of significance for vehicle miles traveled recommended by other public agencies or experts provided the threshold is supported by substantial evidence.

(1) Vehicle Miles Traveled and Land Use Projects. A development project that results in vehicle miles traveled exceeding an applicable threshold of significance may indicate a significant impact. Generally, development projects that locate within one-half mile of either an existing major transit stop or a stop along an existing high quality transit corridor may be presumed to cause a less than significant transportation impact. Similarly, development projects that decrease vehicle miles traveled in the project area compared to existing conditions may be considered to have a less than significant transportation impact.

(2) Induced Vehicle Travel and Transportation Projects. Additional lane miles may induce automobile travel, and vehicle miles traveled, compared to existing conditions. Transportation projects that reduce, or have no impact on, vehicle miles traveled may be presumed to cause a less than significant transportation impact. To the extent that the potential for induced travel has already been adequately analyzed at a programmatic level, a lead agency may incorporate that analysis by reference.

(3) Qualitative Analysis. If existing models or methods are not available to estimate the vehicle miles traveled for the particular project being considered, a lead agency may analyze the project's vehicle miles traveled qualitatively. Such a qualitative analysis would evaluate factors such as the availability of transit, proximity to other destinations (such as homes, employment and services), area demographics, etc. For many projects, a qualitative analysis of construction traffic may be appropriate.

(4) Methodology. The lead agency's evaluation of the vehicle miles traveled associated with a project is subject to a rule of reason. A lead agency should not confine its evaluation to its own political boundary.

A lead agency may use models to estimate a project’s vehicle miles traveled, and may revise those estimates to reflect professional judgment based on substantial evidence. Any assumptions used to estimate vehicle miles traveled and any revisions to model outputs should be documented and explained in the environmental document prepared for the project.

(c) Applicability.

The provisions of this section shall apply prospectively as described in section 15007. A lead agency may elect to be governed by the provisions of this section immediately provided that it updates its own procedures pursuant to section 15022 to conform to the provisions of this section. After [two years from expected adoption date], the provisions of this section shall apply statewide.

Note: Authority cited: Sections 21083 and 21083.05, Public Resources Code. Reference: Sections 21099 and 21100, Public Resources Code; *California Clean Energy Committee v. City of Woodland* (2014) 225 Cal. App. 4th 173.

Proposed Changes to Existing Appendix G

XVI. TRANSPORTATION/ TRAFFIC -- Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the addressing the safety or performance of the circulation system, including transit, roadways, bicycle lanes and pedestrian paths (except for automobile level of service)? taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

~~congestion management agency for designated roads or highways? Cause substantial additional vehicle miles traveled (per capita, per service population, or other appropriate efficiency measure)?~~

~~c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?~~

~~Substantially induce additional automobile travel by increasing physical roadway capacity in congested areas (i.e., by adding new mixed-flow lanes) or by adding new roadways to the network? increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?~~

~~d) Result in inadequate emergency access?~~

~~f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?~~

III. Technical Advisory on Evaluating Transportation Impacts in CEQA

Section III of this document includes a draft Technical Advisory which contains OPR's technical recommendations and best practices regarding the evaluation of transportation impacts under CEQA. Unlike the provisions in Section II of this document, the Technical Advisory is not regulatory in nature. The purpose of this document is simply to provide advice and recommendations, which lead agencies may use in their discretion. Notably, OPR may update this document as frequently as needed reflect advances in practice and methodologies.

Technical Advisory on Evaluating Transportation Impacts in CEQA

Implementing Senate Bill 743 (Steinberg, 2013)

January 2016

Contents

Introduction	III:13
Technical Considerations in Assessing Vehicle Miles Traveled.....	III:13
Considerations in what VMT to count	III:13
Recommendations Regarding Methodology	III:15
General Principles to Guide Consideration of VMT Thresholds	III:17
Recommendations Regarding Significance Thresholds	III:18
Screening Thresholds.....	III:20
Recommended Numeric Thresholds for Residential, Office and Retail Projects.....	III:22
Recommendations Regarding Land Use Plans.....	III:25
Recommendations Regarding Regional Transportation Plans	III:25
Other Considerations.....	III:25
Recommendations for Considering Transportation Project VMT Effects.....	III:26
Recommended Significance Threshold for Transportation Projects	III:30
Estimating VMT Impacts from Transportation Projects	III:31
Analyzing Safety Impacts Related to Transportation.....	III:34
Mitigation and Alternatives	III:45

A. Introduction

This technical advisory is one in a series of advisories provided by the Governor’s Office of Planning and Research (OPR) as a service to professional planners, land use officials and CEQA practitioners. OPR issues technical guidance from time to time on issues that broadly affect the practice of land use planning and the California Environmental Quality Act (CEQA). [Senate Bill 743](#) (Steinberg, 2013) required changes to the Guidelines Implementing the California Environmental Quality Act (CEQA Guidelines) regarding the analysis of transportation impacts. Those proposed changes identify vehicle miles traveled as the most appropriate metric to evaluate a project’s transportation impacts. Those proposed changes also provide that the analysis of certain transportation projects must address the potential for induced travel. Once the Natural Resources Agency adopts these changes to the CEQA Guidelines, automobile delay, as measured by “level of service” and other similar metrics, will no longer constitute a significant environmental effect under CEQA.

This advisory contains technical recommendations regarding thresholds of significance, safety, and mitigation measures. OPR will continue to monitor implementation of these new provisions and may update or supplement this advisory from time to time in response to new information and advancements in modeling and methods.

B. Technical Considerations in Assessing Vehicle Miles Traveled

Many practitioners are familiar with accounting for vehicle miles traveled (VMT) in connection with long range planning, or as part of the analysis of a project’s greenhouse gas emissions or energy impacts. While auto-mobility (often expressed as “level of service”) may continue to be a measure for planning purposes, Senate Bill 743 directs a different measure for evaluation of environmental impacts under CEQA. This document provides technical background information on how to assess VMT as part of a transportation impacts analysis under CEQA.¹

1. Considerations about what VMT to count

Consistent with the obligation to make a good faith effort to disclose the environmental consequences of a project, lead agencies have discretion to choose the most appropriate methodology to evaluate project impacts.² A lead agency can evaluate a project’s effect on VMT in numerous ways. The purpose of this document is to provide technical considerations in determining which methodology may be most useful for various project types.

¹ Additionally, Caltrans is in the process of completing a comprehensive multimodal Transportation Analysis Guide and Transportation Impact Study Guide (TAG-TISG), in collaboration with OPR and a variety of external partners, industry stakeholders, and analysis experts.

² The California Supreme Court has explained that when an agency has prepared an environmental impact report: [T]he issue is not whether the [lead agency’s] studies are irrefutable or whether they could have been better. The relevant issue is only whether the studies are sufficiently credible to be considered as part of the total evidence that supports the [lead agency’s] finding[.] (*Laurel Heights Improvement Ass’n v. Regents of the University of California* (1988) 47 Cal.3d 376, 409; see also *Eureka Citizens for Responsible Gov’t v. City of Eureka* (2007) 147 Cal.App.4th 357, 372.)

Background on Estimating Vehicle Miles Traveled

Before discussing specific methodological recommendations, this section provides a brief overview of modeling and counting VMT including some key terminology, starting with an example to illustrate some methods of estimating vehicle miles traveled.

Example

Consider the following hypothetical travel day (all by automobile):

1. Residence to Coffee Shop
2. Coffee Shop to Work
3. Work to Sandwich Shop
4. Sandwich Shop to Work
5. Work to Residence
6. Residence to Store
7. Store to Residence

Trip-based assessment of a project's effect on travel behavior counts VMT from individual trips to and from the project. It is the most basic, and traditionally most common, method of counting VMT. A trip-based VMT assessment of the residence in the above example would consider segments 1, 5, 6 and 7. For residential projects, the sum of home-based trips is called *home-based* VMT.

A *tour-based* assessment counts the entire home-back-to-home tour that includes the project. A tour-based VMT assessment of the residence in the above example would consider segments 1, 2, 3, 4, and 5 in one tour, and 6 and 7 in a second tour. A tour-based assessment of the workplace would include segments 1, 2, 3, 4, and 5. Together, all tours comprise *household* VMT.

Both trip- and tour-based assessments can be used as measures of transportation efficiency, using denominators such as per capita, per employee, or per person-trip.

Trip- and Tour-based Assessment of VMT

As illustrated above, a tour-based assessment of VMT is a more complete characterization of a project's effect on VMT. In many cases, a project affects travel behavior beyond the first destination. The location and characteristics of the home and workplace will often be the main drivers of VMT. For example, a residential or office development located near high quality transit will likely lead to some commute trips utilizing transit, affecting mode choice on the rest of the tour.

Characteristics of an office project can also affect an employee's VMT even beyond the work tour. For example, a workplace located at the urban periphery, far from transit, can cause an employee to need to own a car, which in turn affects the entirety of an employee's travel behavior and VMT. For this reason, when estimating the effect of an office development on VMT, it may be appropriate to consider

total employee VMT if data and tools, such as tour-based models, are available. This is consistent with CEQA’s requirement to evaluate both direct and *indirect* effects of a project. (See CEQA Guidelines § 15064(d)(2).)

Assessing Change in Total VMT

A third method, estimating the *change in total VMT* with and without the project, can evaluate whether a project is likely to divert existing trips, and what the effect of those diversions will be on total VMT. This method answers the question, “What is the net effect of the project on area VMT?” As an illustration, assessing the total change in VMT for a grocery store built in a food desert that diverts trips from more distant stores could reveal a net VMT reduction. The analysis should address the full area over which the project affects travel behavior, even if the effect on travel behavior crosses political boundaries.

Using Models to Estimate VMT

Travel demand models, sketch models, spreadsheet models, research, and data can all be used to calculate and estimate VMT (see Appendix F of the [preliminary discussion draft](#).) To the extent possible, lead agencies should choose models that have sensitivity to features of the project that affect VMT. Those tools and resources can also assist in establishing thresholds of significance and estimating VMT reduction attributable to mitigation measures and project alternatives. When using models and tools for those various purposes, agencies should use comparable data and methods, in order to set up an “apples-to-apples” comparison between thresholds, VMT estimates, and mitigation VMT estimates.

Models can work together. For example, agencies can use travel demand models or survey data to estimate existing trip lengths and input those into sketch models such as CalEEMod to achieve more accurate results. Whenever possible, agencies should input localized trip lengths into a sketch model to tailor the analysis to the project location. However, in doing so, agencies should be careful to avoid double counting if the sketch model includes other inputs or toggles that are proxies for trip length (e.g. distance to city center). Generally, if an agency changes any sketch model defaults, it should record and report those changes for transparency of analysis. Again, trip length data should come from the same source as data used to calculate thresholds, to be sure of an “apples-to-apples” comparison.

Additional background information regarding travel demand models is available in the California Transportation Commission’s [“2010 Regional Transportation Plan Guidelines,”](#) beginning at page 35.

2. Recommendations Regarding Methodology

Proposed Section 15064.3 explains that a “lead agency may use models to estimate a project’s vehicle miles traveled....” CEQA generally defers to lead agencies on the choice of methodology to analyze impacts. This section provides suggestions to lead agencies regarding methodologies to analyze vehicle miles traveled associated with a project.

Residential and Office Projects. A tour-based analysis is usually the best way to analyze VMT associated with residential and office projects. Where tour-based models are employed for office project analyses, because workplace location influences overall travel, either employee work tour VMT or VMT from all employee tours may be attributed to the employment center (and the same should be used to set the significance threshold). For this reason, screening maps (discussed in more detail below) using tour-based regional travel demand models can be used where they are available. Where tour-based tools or data are not available for all components of an analysis, an assessment of trip VMT can serve as a reasonable proxy. For example, where research-based evidence on the efficacy of mitigation measures is available for trip-based, then estimating the threshold, analyzing unmitigated project VMT, and mitigation would all need to be undertaken using a trip-based methods, for an apples-to-apples comparison. In this case, home based trips can be the focus for analysis of residential projects; home-based work trips can be the focus of the analysis for office projects.

For office projects that feature a customer component, such as a government office that serves the public, a lead agency can analyze the customer VMT component of the project using the methodology for retail development (see below).

Models and methodologies used to calculate thresholds, estimate project VMT, and estimate VMT reduction due to mitigation should be comparable. For example:

- A tour-based estimate of project VMT should be compared to a tour-based threshold, or a trip-based estimate to a trip-based VMT threshold.
- Where a travel demand model is used to estimate thresholds, the same model should also be used to estimate trip lengths as part of estimating project VMT
- Where only trip-based estimates of VMT reduction from mitigation are available, a trip-based threshold should be used

Retail Projects. Lead agencies should usually analyze the effects of a retail project by assessing the change in total VMT, because a retail projects typically re-route travel from other retail destinations. A retail project might lead to increases or decreases in VMT, depending on previously existing retail travel patterns.

Considerations for All Projects. Lead agencies should not truncate any VMT analysis because of political or other boundaries. CEQA requires environmental analyses to reflect a “good faith effort at full disclosure.” (CEQA Guidelines § 15151.) Thus, where methodologies exist that can estimate the full extent of vehicle travel from a project, the lead agency should apply them to do so. Analyses should also consider both short- and long-term effects on VMT.

C. General Principles to Guide Consideration of VMT Thresholds

The CEQA Guidelines set forth the general rule for determining significance:

The determination of whether a project may have a significant effect on the environment calls for **careful judgment** on the part of the public agency involved, **based to the extent possible on scientific and factual data**. An ironclad definition of significant effect is not always possible because **the significance of an activity may vary with the setting**. For example, an activity which may not be significant in an urban area may be significant in a rural area.

(CEQA Guidelines § 15064(b) (emphasis added).) SB 743 directs OPR to establish specific “criteria for determining the significance of transportation impacts of projects[.]” (Pub. Resources Code § 21099(b)(1).)

As noted above, CEQA Guidelines Section 15064(b) confirms that context matters in a CEQA analysis. Further, lead agencies have discretion in the precise methodology to analyze an impact. (*See Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal. 3d 376, 409 (“the issue is not whether the studies are irrefutable or whether they could have been better” ... rather, the “relevant issue is only whether the studies are sufficiently credible to be considered” as part of the lead agency’s overall evaluation).) Therefore, lead agencies may perform multimodal impact analysis that incorporates those technical approaches and mitigation strategies that are best suited to the unique land use/transportation circumstances and specific facility types they are evaluating. For example, pedestrian safety need not be addressed on the mainline portion of a limited access freeway that prohibits pedestrian travel. Likewise, where multimodal transportation is to be expected, analysis might address safety from a variety of perspectives.

To assist in the determination of significance, many lead agencies rely on “thresholds of significance.” The CEQA Guidelines define a “threshold of significance” to mean “an identifiable **quantitative, qualitative or performance level** of a particular environmental effect, non-compliance with which means the effect will **normally** be determined to be significant by the agency and compliance with which means the effect **normally** will be determined to be less than significant.” (CEQA Guidelines § 15064.7(a) (emphasis added).) Agencies may adopt their own, or rely on thresholds recommended by other agencies, “provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence.” (*Id.* at subd. (c).) Substantial evidence means “**enough relevant information** and reasonable inferences from this information that a fair argument can be made **to support a conclusion**, even though other conclusions might also be reached.” (*Id.* at § 15384 (emphasis added).)

Thresholds of significance are not a safe harbor under CEQA; rather, they are a starting point for analysis:

[T]hresholds cannot be used to determine automatically whether a given effect will or will not be significant. Instead, thresholds of significance can be used only as a measure of whether a certain environmental effect “will normally be determined to be significant” or “normally will be determined to be less than significant” by the agency. ... In each instance, notwithstanding compliance with a pertinent threshold of significance,

the agency must still consider any fair argument that a certain environmental effect may be significant.

(*Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal. App. 4th 1099, 1108-1109.)

Finally, just as the determination of significance is ultimately a “judgment call,” the analysis leading to that determination need not be perfect. The CEQA Guidelines describe the standard for adequacy of environmental analyses:

An EIR should be prepared with a sufficient degree of analysis to provide decision makers with information which enables them to **make a decision which intelligently takes account of environmental consequences**. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is **reasonably feasible**. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among the experts. The **courts have looked not for perfection** but for **adequacy, completeness**, and a **good faith effort** at full disclosure.

(CEQA Guidelines § 15151 (emphasis added).)

These general principles guide OPR’s recommendations regarding thresholds of significance for vehicle miles traveled set forth below.

D. Recommendations Regarding Significance Thresholds

Section 21099 of the Public Resources Code states that the criteria for determining the significance of transportation impacts must promote: (1) reduction of greenhouse gas emissions; (2) development of multimodal transportation networks; and (3) a diversity of land uses.

Various state policies establish quantitative greenhouse gas emissions reduction targets. For example:

- [Assembly Bill 32](#) requires statewide greenhouse gas reductions to 1990 levels by 2020, and continued reductions beyond 2020.
- Pursuant to [Senate Bill 375](#), the California Air Resources Board establishes greenhouse gas reduction targets for metropolitan planning organizations to achieve based on land use patterns and transportation systems specified in Regional Transportation Plans and Sustainable Community Strategies. Targets for the largest metropolitan planning organizations range from 13% to 16% reduction by 2035.
- [Executive Order B-30-15](#) sets a GHG emissions reduction target of 40 percent below 1990 levels by 2030.
- [Executive Order S-3-05](#) sets a GHG emissions reduction target of 80 percent below 1990 levels by 2050.
- [Executive Order B-16-12](#) specifies a GHG emissions reduction target of 80 percent below 1990 levels by 2050 specifically for transportation.

- [Senate Bill 391](#) requires the [California Transportation Plan](#) support 80 percent reduction in GHGs below 1990 levels by 2050.

Considering these various targets, the California Supreme Court observed:

Meeting our statewide reduction goals does not preclude all new development. Rather, the Scoping Plan ... assumes continued growth and depends on increased efficiency and conservation in land use and transportation from all Californians.

(*Center for Biological Diversity v. California Dept. of Fish & Wildlife* (2015) 2015 Cal. LEXIS 9478.) Indeed, the Court noted that when a lead agency uses consistency with climate goals as a way to determine significance, particularly for long-term projects, the lead agency must consider the project's effect on meeting long-term reduction goals. (*Ibid.*)

The targets described above indicate that we need substantial reductions in existing VMT to curb greenhouse gases, and other pollutants. Those targets do not translate directly into VMT thresholds for individual projects for numerous reasons, however, including the following:

- Some, though not all, of the emissions reductions needed to achieve those targets will be accomplished by other measures, including increased vehicle efficiency and decreased fuel carbon content. The California Air Resources Board's updated Scoping Plan explains: "Achieving California's long-term criteria pollutant and GHG emissions goals will require four strategies to be employed: (1) improve vehicle efficiency and develop zero emission technologies, (2) reduce the carbon content of fuels and provide market support to get these lower-carbon fuels into the marketplace, (3) *plan and build communities to reduce vehicular GHG emissions and provide more transportation options*, and (4) *improve the efficiency and throughput of existing transportation systems.*" (California Air Resources Board, Scoping Plan, at p. 46 (emphasis added).) In other words, vehicle efficiency and better fuels are necessary, but insufficient, to address the greenhouse gas emissions from the transportation system. Land use patterns and transportation options must also change.
- New projects alone will not sufficiently reduce VMT to achieve those targets, nor are they expected to be the sole source of VMT reduction.
- Interactions between land use projects, and also between land use and transportation projects, existing and future, together affect VMT.
- Some projects will exhibit significant and unavoidable (above threshold) VMT impacts, while others will exhibit below-threshold VMT.
- Because regional location is the most important determinant of VMT, in some cases, streamlining CEQA review of projects in travel efficient locations may be the most effective means of reducing VMT.

- When assessing climate impacts of land use projects, use of an efficiency metric (e.g., per capita, per employee) may provide a better measure of impact than an absolute numeric threshold. (*Center for Biological Diversity, supra.*)

“Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects.” (CEQA Guidelines § 15064.7(a).) Further, “a lead agency may consider thresholds of significance ... recommended by other public agencies, provided the decision to adopt those thresholds is supported by substantial evidence.” (Id. at subd. (c).) Public Resources Code section 21099 directs OPR to provide guidance on determining the significance of transportation impacts.

To that end, OPR finds, absent any more project-specific information to the contrary, that per capita or per employee VMT fifteen percent below that of existing development may be a reasonable threshold, for the reasons described below. (Note: Lead agencies may apply more stringent thresholds at their discretion (Section 21099).)

First, as described above, Section 21099 states that the criteria for determining significance must “promote the reduction in greenhouse gas emissions.” SB 743 also states the Legislature’s intent that the analysis of transportation in CEQA better promotes the state’s goals of reducing greenhouse gas emissions. It cites in particular the reduction goals in the Global Warming Solutions Act and the Sustainable Communities and Climate Protection Act, both of which call for substantial reductions. As indicated above, the California Air Resources Board established long-term [reduction targets](#) for the largest regions in the state that ranged from 13 to 16 percent.

Second, Caltrans has developed a statewide VMT reduction target in its [Strategic Management Plan](#). Specifically, it calls for a 15 percent reduction in per capita VMT, compared to 2010 levels, by 2020.

Third, fifteen percent reductions in VMT are typically achievable at the project level in a variety of place types. ([Quantifying Greenhouse Gas Measures](#), p. 55 CAPCOA, 2010).

Fourth, the [First Update to the AB 32 Scoping Plan](#) states, “Recognizing the important role local governments play in the successful implementation of AB 32, the initial Scoping Plan called for local governments to set municipal and communitywide GHG reduction targets of 15 percent below then-current levels by 2020, to coincide with the statewide limit” (p. 113).

Achieving 15 percent lower per capita or per employee VMT than existing development is, therefore, both reasonably ambitious and generally achievable. The following pages describe a series of screening thresholds below which a detailed analysis may be not be required. Next, this advisory describes numeric thresholds recommended for various project types. Finally, this advisory describes analysis for certain unique circumstances.

1. Screening Thresholds

Screening Threshold for Small Projects

Many local agencies, including congestion management agencies, have developed screening thresholds (e.g., 100 vehicle trips per day) to indicate when detailed analysis is needed to determine consistency with the congestion management program. Projects that generate few trips will also generally tend to

generate low vehicle miles traveled. Absent substantial evidence indicating that a project would generate a potentially significant level of vehicle miles traveled, projects that generate fewer trips than the threshold for studying consistency with a congestion management program, or 100 vehicle trips per day, generally may be assumed to cause a less than significant transportation impact.

Map-Based Screening for Residential and Office Projects

Residential and office projects that locate in areas with low-VMT, and that incorporate similar features (i.e., density, mix of uses, transit accessibility), will tend to exhibit similarly low VMT. Therefore, lead agencies can use maps illustrating areas that exhibit below threshold VMT (see recommendations below) to screen out residential and office projects which may not require a detailed VMT analysis. A travel demand model or survey data can provide the existing household or work tour (or home-based or home-based-work) VMT that would be illustrated on such a map. (See illustration of home-based VMT in the Butte region.) Note that screening maps illustrating per household VMT (for residential projects) and per employee VMT (for office projects) will typically show below-threshold VMT for these land uses exists over different geographies. For projects that include both residential and office components, lead agencies may use each map as a screen for the respective portion of the project.

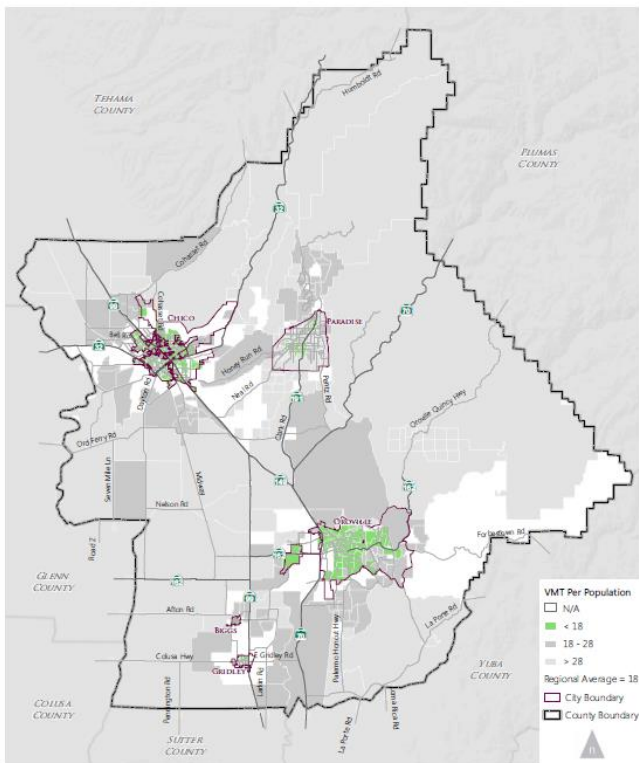


Figure x-x.
Home-Based (HBW & HBO) VMT Produced per Population

W:\p4e02\9420\data\2010\Project\RS10_2809_BCAG_Model_Update\mxd\BCAG_HPLD_VMT_Per_Poplt_2.mxd



Presumption of Less Than Significant Impact Near Transit Stations

Lead agencies generally should presume that residential, retail, and office projects, as well as mixed use projects which are a mix of these uses, proposed within ½ mile of an existing major transit stop³ or an existing stop along a high quality transit corridor⁴ 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. For example, the presumption might not be appropriate if the project:

- Has a Floor Area Ratio (FAR) of less than 0.75
- Includes more parking for use by residents, customers, or employees of the project than required by the jurisdiction (only for jurisdictions specifying a parking minimum)
- Is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Metropolitan Planning Organization)

If these exceptions to the presumption might apply, the lead agency should conduct a detailed VMT analysis to determine whether the project would exceed VMT thresholds (see below).

2. Recommended Numeric Thresholds for Residential, Office and Retail Projects

Recommended threshold for residential projects: A project exceeding *both*

- Existing *city* household VMT per capita minus 15 percent *and*
 - Existing *regional* household VMT per capita minus 15 percent
- may indicate a significant transportation impact

Residential development that would generate vehicle travel less than *both* a level of 15 percent below city-wide VMT per capita⁵ *and* a level of 15 percent below regional⁶ VMT per capita may indicate a less

³ Pub. Resources Code § 21064.3 (“‘Major transit stop’ means a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods”).

⁴ Pub. Resources Code § 21155 (“For purposes of this section, a high-quality transit corridor means a corridor with fixed route bus service with service intervals no longer than 15 minutes during peak commute hours”).

⁵ Note, use of an efficiency metric (e.g., per capita) is particularly appropriate when assessing VMT of certain land use projects such as residential and office buildings. (*Center for Biological Diversity, supra* (“a significance criterion

than significant transportation impact. (In other words, a project that generates greater than 85 percent of regional per capita VMT, but less than 85 percent of city-wide per capita VMT, would still be considered to have a less than significant transportation impact.) Residential development in unincorporated county areas generating VMT that exceeds 15 percent below VMT per capita in the aggregate of all incorporated jurisdictions in that county, *and* exceeds 15 percent below regional VMT per capita, may indicate a significant transportation impact. These thresholds can be applied to both household (tour-based) VMT and home-based (i.e. trip-based) VMT assessments.

Recommended threshold for office projects: A project exceeding a level of 15 percent below existing *regional VMT per employee* may indicate a significant transportation impact.

Office projects that would generate vehicle travel exceeding 15 percent below existing VMT per employee for the region may indicate a significant transportation impact. In cases where the region is substantially larger than the geography over which most workers would be expected to live, it might be appropriate to refer to a smaller geography, such as the county. Tour-based analysis of office project VMT, for example development of a tour-based screening map, typically should consider either total employee VMT or employee work tour VMT. Where tour-based information is unavailable for threshold determination, project assessment, or assessment of mitigation, home-based work trip VMT may be used throughout the analysis to maintain an “apples-to-apples” comparison.

Recommended threshold for retail projects: A net increase in total VMT may indicate a significant transportation impact

Because new retail development typically redistributes shopping trips rather than creating new trips,⁷ estimating the total change in VMT (i.e. the difference in total VMT in the area affected with and without the project) is the best way to analyze a retail project’s transportation impacts.

By adding retail opportunities into the urban fabric and thereby improving retail destination proximity, local-serving retail development tends to shorten trips and reduce VMT. Lead agencies generally, therefore, may presume such development creates a less than significant transportation impact. Regional-serving retail development, on the other hand, which can lead to substitution of longer trips for shorter ones, might tend to have a significant impact. Where such development decreases VMT, lead agencies may consider it to have a less than significant impact.

framed in terms of efficiency is superior to a simple numerical threshold because CEQA is not intended as a population control measure”).)

⁶ As used in these recommendations, the term “regional” refers to the metropolitan planning organization or regional transportation planning agency boundaries within which the project would be located.

⁷ Lovejoy et al. 2012.

Many cities and counties define local-serving and regional-serving retail in their zoning codes. Lead agencies may refer to those local definitions when available, but should also consider any project-specific information, such as market studies or economic impacts analyses that might bear on customers' travel behavior. Because lead agencies will best understand their own communities and the likely travel behaviors of future project users, they are likely in the best position to decide when a project will likely be local serving. Generally, however, development including stores larger than 50,000 square feet might be considered regional-serving, and so lead agencies should undertake an analysis to determine whether the project might increase or decrease VMT.

Mixed Use Projects

Lead agencies can evaluate each component of a mixed-use project independently, and apply the significance threshold for each project type included (e.g. residential and retail). In the analysis of each use, a project may take credit for internal capture.

Other Project Types

Residential, office and retail projects tend to have the greatest influence on VMT, and so OPR recommends the quantified thresholds described above for analysis and mitigation. Lead agencies, using more location-specific information, may develop their own more specific thresholds, which may include other land use types. In developing thresholds for other project types, or thresholds different from those recommended here, lead agencies should consider the purposes described in section 21099 of the Public Resources Code, in addition to more general rules in the CEQA Guidelines on the development of thresholds of significance.

Strategies that decrease local VMT but increase total VMT, for example strategies that forego development in one location and lead to it being built in a less travel efficient location, should be avoided.

RTP-SCS Consistency (All Land Use Projects)

Proposals for development outside of areas contemplated for development in a Sustainable Communities Strategy (SCS) may be less travel efficient than most development with the SCS. Further, Section 15125(d) of the CEQA Guidelines provides that lead agencies should analyze impacts resulting from inconsistencies with regional plans. For this reason, development in a location where the Regional Transportation Plan and Sustainable Communities Strategy (RTP/SCS) does not specify any development may indicate a significant impact on transportation.

3. Recommendations Regarding Land Use Plans

As with projects, agencies should analyze VMT outcomes of land use plans over the full area that the plan may substantively affect travel patterns, including beyond the boundary of the plan or jurisdiction geography. Analysis of specific plans may employ the same thresholds described above for projects. The following guidance for significance thresholds applies to General Plans, Area Plans, and Community Plans.

A land use plan may have a significant impact on transportation if it is not consistent with the relevant RTP/SCS. For this purpose, consistency with the SCS means all of the following must be true:

- Development specified in the plan is also specified in the SCS (i.e. the plan does not specify developing in outlying areas specified as open space in the SCS)
- Taken as a whole, development specified in the plan leads to VMT that is equal to or less than the VMT per capita and VMT per employee specified in the SCS

Thresholds for plans in non-MPO areas should be determined on a case-by-case basis.

4. Recommendations Regarding Regional Transportation Plans and Sustainable Communities Strategies

VMT outcomes of RTP/SCSs should be examined over the full area they substantively affect travel patterns, including outside the boundary of the plan geography.

An RTP/SCS achieving per capita VMT reductions sufficient to achieve SB 375 target GHG emissions reduction may constitute a less than significant transportation impact. In non-MPO counties, which do not receive GHG targets under SB 375, an RTP which achieves a reduction in per capita VMT may constitute a less than significant transportation impact.

5. Other Considerations

More Stringent Thresholds at Lead Agency Discretion

Public Resources Code section 21099 provides that a lead agency may adopt thresholds that are more protective of the environment than those that OPR recommends. Note that in some cases, streamlining projects in VMT-efficient locations may lead to larger VMT reductions than requiring VMT mitigation, by facilitating and thus increasing the share of location-efficient development.

Rural Projects Outside MPOs

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 on a percent per capita

reduction basis as transit oriented development described above. Therefore, evaluating per capita VMT is still recommended.

Impacts to Transit

Because criteria for determining the significance of transportation impacts must promote “the development of multimodal transportation networks,” lead agencies should consider project impacts to transit systems and bicycle and pedestrian networks. For example, a project that blocks access to a transit stop or blocks a transit route itself may interfere with transit functions. Lead agencies should consult with transit agencies as early as possible in the development process, particularly for projects that locate within one half mile of transit stops.

When evaluating impacts to multimodal transportation networks, lead agencies generally should not treat the addition of new users as an adverse impact. Any travel-efficient infill development is likely to add riders to transit systems, potentially slowing transit vehicle mobility, but also potentially improving overall destination proximity. Meanwhile, such development improves regional vehicle flow generally by loading less vehicle travel onto the regional network than if that development was to occur elsewhere.

Increased demand throughout a region may, however, cause a cumulative impact by requiring new or additional transit infrastructure. Such impacts may be best addressed through a fee program that fairly allocates the cost of improvements not just to projects that happen to locate near transit, but rather across a region to all projects that impose burdens on the entire transportation system.

E. Recommendations for Considering Transportation Project VMT Effects

A transportation project changes travel patterns and affects VMT. For example, a project that facilitates active transportation can cause mode shift away from automobile use, resulting in a reduction in VMT. Meanwhile, a roadway project can facilitate automobile travel, leading to more VMT. While CEQA does not require perfection in impact measurement, it is important to make a reasonably accurate estimate of effects on VMT from transportation projects in order to make reasonably accurate estimates of GHGs and other impacts associated with VMT.

Projects that would likely lead to an increase in VMT, and therefore should undergo analysis (including for purposes of accurately estimating GHG and other impacts that are affected by VMT), generally include:

- Addition of through lanes on existing or new highways, including general purpose lanes, HOV lanes, peak period lanes, auxiliary lanes, and lanes through grade-separated interchanges

Projects that would not likely lead to a substantial or measureable increase in VMT, and therefore should not require analysis, generally include:

- 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 additional motor vehicle lanes
- Roadway shoulder enhancements to provide “breakdown space,” otherwise improve safety or provide bicycle access
- Addition of an auxiliary lane of less than one mile in length designed to improve roadway safety
- Installation, removal, or reconfiguration of traffic lanes that are not for through traffic, such as left, right, and U-turn pockets, or emergency breakdown lanes that are not utilized as through lanes
- Addition of roadway capacity on local or collector streets provided the project also substantially improves conditions for pedestrians, cyclists, and, if applicable, transit
- 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 decrease impedance to use
- Reduction in number of through lanes, e.g. a “road diet”
- 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
- Installation, removal, or reconfiguration of traffic control devices, including Transit Signal Priority (TSP) features
- Traffic metering systems
- Timing of signals to optimize vehicle, bicycle or pedestrian flow
- Installation of roundabouts
- Installation or reconfiguration of traffic calming devices
- Adoption of or increase in tolls
- Addition of tolled lanes, where tolls are sufficient to mitigate VMT increase (e.g., encourage carpooling, fund transit enhancements like bus rapid transit or passenger rail in the tolled corridor)
- Initiation of new transit service
- Conversion of streets from one-way to two-way operation with no net increase in number of traffic lanes
- Removal of off-street parking spaces
- Adoption or modification of on-street parking or loading restrictions (including meters, time limits, accessible spaces, and preferential/reserved parking permit programs).
- Addition of traffic wayfinding signage
- Rehabilitation and maintenance projects that do not add motor vehicle capacity
- Any lane addition under 0.3 miles in length, including addition of any auxiliary lane less than 0.3 miles in length

Causes of Induced VMT. Induced VMT occurs where roadway capacity is expanded in a congested area, leading to an initial appreciable reduction in travel time. With lower travel times, the modified facility becomes more attractive to travelers, resulting in the following trip-making changes, which have implications for total VMT:

- **Longer trips.** The ability to travel a long distance in a shorter time increases the attractiveness of destinations that are further away, increasing trip length and VMT.
- **Changes in mode choice.** When transportation investments are devoted to reducing automobile travel time, travelers tend to shift toward automobile use from other modes, which increases VMT.
- **Route changes.** Faster travel times on a route attract more drivers to that route from other routes, which can increase or decrease VMT depending on whether it shortens or lengthens trips.
- **Newly generated trips.** Increasing travel speeds can induce additional trips, which increases VMT. For example, an individual who previously telecommuted or purchased goods on the internet might choose to accomplish those ends via automobile trips as a result of increased speeds.
- **Land Use Changes.** Faster travel times along a corridor lead to land development further along that corridor; that development generates and attracts longer trips, which increases VMT. Over several years, this component of induced VMT can be substantial, e.g. approximately half of the total effect on VMT.

These effects operate over different time scales. For example, changes in mode choice might occur immediately, while land use changes typically take a few years or longer. CEQA requires analysis to address both short term and long term effects.

Applying tolls to additional capacity will generally reduce the amount of additional VMT that results from adding that capacity. This is because tolls, like congestion, act as an “impedance factor” for traffic volumes in the lane. Because of the impedance effect, tolling can also be used to maintain free flow in a lane and keep it from becoming congested, resulting in the counterintuitive effect of impedance increasing flow. Studies have shown that *net* benefit from tolling improving vehicle flow can be greater than the sum of the tolls collected, leaving the tolls funds themselves as additional benefit that might be invested in transportation options.

Evidence of Induced VMT. A large number of peer reviewed studies have demonstrated a causal link between highway capacity increases and VMT increases. Of these, approximately twenty provide a quantitative estimate of the magnitude of the induced VMT phenomenon; of those, nearly all find substantial induced VMT.

Most of these studies express the amount of induced VMT as an “elasticity,” which is a multiplier that describes the additional VMT resulting from an additional lane mile of roadway capacity added. For example, an elasticity of 0.8 would signify a 0.8 percent increase in VMT for every 1.0 percent increase

in lane miles. Many distinguish “short run elasticity” (increase in vehicle travel in the first few years) from “long run elasticity” (increase in vehicle travel beyond the first few years). Long run elasticity is typically larger than short run elasticity, because as time passes, more of the components of induced VMT materialize. Generally, short run elasticity can be thought of as excluding the effects of land use change, while long run elasticity includes them. Most studies find a long run elasticity between 0.6 and just over 1.0 ([California Air Resources Board DRAFT Policy Brief on Highway Capacity and Induced Travel](#), p. 2.), meaning that for every increase in capacity of one lane-mile there is a concomitant increase in VMT of 0.6 to 1.0 lane miles. The most recent major study (Duranton and Turner, 2011) reveals an elasticity of VMT by lanes miles of 1.03; in other words, each lane mile built resulted in 1.03 additional miles of vehicle travel. (An elasticity greater than 1.0 can occur because new lanes leverage travel behavior beyond just the project location.) In CEQA analysis, the long-run elasticity should be used, as it captures the full effect of the project rather than just the early-stage effect.

Quantifying Induced VMT Using Models. Lead agencies can use the methodology provided below for most projects that increase roadway capacity. However, where a roadway capacity project may exhibit an unusual characteristic or be set in an unusual context, a travel demand model and other tools may be used to estimate VMT resulting from the project. If such analysis indicates a change in VMT per change in lane miles that is outside the range found in literature, reasons for the discrepancy should be discussed in the CEQA document.

Proper use of a travel demand model will yield a reasonable estimate of short run induced VMT, generally including the following components:

- Trip length (generally increases VMT)
- Mode shift (generally shifts from other modes towards automobile use, increasing VMT)
- Route changes (can act to increase or decrease VMT)
- Newly generated trips (generally increases VMT) (Note that not all travel demand models have sensitivity to this factor, so an off-model estimate may be necessary if this effect could be expected to be substantial.)

However, estimating long run induced VMT also requires an estimate of effects of the project on land use. This component of the analysis is important because it has the potential to be a large component of the effect. Options for estimating and incorporating the VMT effects that precipitate from land use changes resulting from the project include:

1. *Employ a land use model, running it iteratively with a travel demand model.* A land use model (such as a PECAS model) can be used to estimate the effects of a roadway capacity increase, and the traffic patterns that result from the land use change can be fed back into the travel demand model.
2. *Employ an expert panel.* In place of a model, an expert panel can estimate land use development resulting from the project. Once developed, the estimates of land use changes can then be analyzed by the travel demand model to assess VMT effects. (See, e.g., *Conservation Law Found. v. FHA* (2007) 630 F. Supp. 2d 183.)

3. *Acknowledge omission of land use in VMT analysis, and adjust results to align with the empirical research.* The travel demand model analysis can be performed without an estimate of land use changes, and then the results can be compared to empirical studies of induced VMT found in the types of studies described above. If the modeled elasticity falls outside of that range, then the VMT estimate can be adjusted to fall within the range, or an explanation can be provided describing why the project would be expected to induce a different amount of VMT than a typical project. (For an example of an EIR that includes a number of these elements, see [Interstate 5 Bus/Carpool Lanes Project Final EIR, pp. 2-52 to 2-56.](#))

In all cases, any limitation or known lack of sensitivity in the analysis that might cause substantial errors in the VMT estimate, e.g. model insensitivity to one of the components of induced VMT described above, should be disclosed and characterized, and a description should be provided on how it could influence the analysis results. A discussion of the potential error or bias should be carried also into analyses that rely on the VMT analysis, such as greenhouse gas emissions, air quality, and noise.

1. Recommended Significance Threshold for Transportation Projects

As explained above, Public Resources Code section 21099 directs OPR to recommend criteria for evaluating transportation impacts that promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses. These criteria would apply to all project types. This section of the technical advisory addresses criteria appropriate for transportation projects.

Transportation, including upstream (e.g. refinery) emissions, accounts for over half of California's greenhouse gas emissions. Achieving California's emissions reduction goals (described above) will, therefore, require steep reductions in emissions from the transportation sector. For example, the California Air Resources Board describes a scenario achieving the reduction goals set forth in Executive Order B-30-15 from the transportation sector in a fact sheet, [Cutting Petroleum Use in Half by 2030](#). In sum, achieving those goals will require improving vehicle efficiency, reducing fuel carbon content, and improving travel efficiency (i.e. reducing VMT). Even with steep improvements in vehicle efficiency, a significant shift to zero emissions vehicles and sharp reductions in the carbon content of fuels, total statewide VMT could increase no more than 4 percent over 2014 levels.

Assuming, based on that information, that statewide VMT can increase up to 4 percent without obstructing California's long-term emissions reduction goals, we can determine a total increment of allowable increased VMT.

Therefore:

$$4\% \times [\text{2014 statewide total VMT}] = [\text{Total Allowable VMT Increment}]$$

This VMT increment can be divided among transportation projects expected to be completed by 2030 in order to determine a project-level VMT threshold:

$$[\text{Total Allowable VMT Increment}] / [\text{Number of projects through 2030}] = [\text{Project VMT Threshold}]$$

A project that leads to an addition of more VMT than the Project VMT Threshold may indicate a significant impact on VMT.

Following is an initial estimate of a recommended Transportation Project VMT Threshold:

California Statewide VMT (2014)	185,320,000,000 VMT/year
Allowable increase by 2030 (4 percent)	7,412,800,000 VMT/year
Estimated total transportation projects in California, expected completion date 2015-2030	3,572 Projects ⁸
Fair share VMT per transportation project	2,075,220 VMT/year

2. Estimating VMT Impacts from Transportation Projects

CEQA requires analysis of a project’s potential growth-inducing impacts. (Public Resources Code § 21100(b)(5); State CEQA Guidelines, § 15126.2(d).) Many agencies are familiar with the analysis of growth inducing impacts associated with water, sewer and other infrastructure. This technical advisory addresses growth that may be expected from roadway expansion projects.

Because a roadway expansion project can induce substantial VMT, incorporating estimates of induced VMT is critical to calculating both transportation and other impacts of these projects. Induced VMT also has the potential to reduce or eliminate congestion relief benefits, and an accurate estimate of it is needed to accurately weigh costs and benefits of a highway capacity expansion project.

VMT effects should be estimated using the *change in total VMT* method (as described in the previous section *Technical Considerations in Assessing Vehicle Miles Traveled/Considerations in what VMT to count*). This means that an assessment of total VMT without the project, and an assessment with the project, should be made; the difference between the two is the amount of VMT attributable to the project. The assessment should cover the full area in which driving patterns are expected to change; as with other types of projects, VMT estimation should not be truncated at a modeling or political boundary for convenience of analysis when travel behavior is substantially affected beyond that boundary.

⁸ This preliminary estimate is based on a population-based extrapolation of SCAG’s project list (SCAG’s project list contains 1728 projects expected to be completed 2015-2030, and the SCAG region contains 48.4 percent of the population.) Agencies with more complete or specific data may use that data.

Transit and Active Transportation Projects

Transit and active transportation projects generally reduce VMT and therefore are presumed to cause a less than significant impact on transportation. This presumption may apply to all passenger rail projects, bus and bus rapid transit projects, and bicycle and pedestrian infrastructure projects. Streamlining transit and active transportation projects aligns with each of the three statutory goals by reducing GHG emissions, increasing multimodal transportation networks, and facilitating mixed use development.

Roadway Projects

Reducing roadway capacity (i.e. a “road diet”) will generally reduce VMT and therefore is presumed to cause a less than significant impact on transportation.

Building new roadways, adding roadway capacity in congested areas, or adding roadway capacity to areas where congestion is expected in the future, typically induces additional vehicle travel. For the types of projects indicated previously as likely to lead to additional vehicle travel, an estimate should be made of the change in VMT resulting from the project.

For projects that increase roadway capacity, lead agencies can evaluate the potential induced VMT by applying the results of existing studies that examine the magnitude of the increase of VMT resulting from a given increase in lane miles. These studies estimate the percent change in VMT for every percent change in miles to the roadway system (“elasticity”) (see U.C. Davis, Institute for Transportation Studies, [“Increasing Highway Capacity Unlikely to Relieve Traffic Congestion,”](#) (October 2015); Boarnet and Handy, [“Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions,”](#) California Air Resources Board Policy Brief, September 30, 2014). Given that lead agencies have discretion in choosing their methodology, and the studies on induced travel reveal a range of elasticities, lead agencies may appropriately apply professional judgment in studying the effect of a particular project. The most recent major study ([Duranton and Turner, 2011](#)), estimates an elasticity of 1.0, meaning that every percent change in lane miles results in a 1 percent increase in VMT.

To estimate VMT impacts from roadway expansion projects:

1. Determine the total lane-miles over an area that fully captures travel behavior changes resulting from the project (e.g. generally the region; for projects affecting interregional travel, all affected regions)
2. Determine the percent change in total lane miles that will result from the project
3. Determine the total existing VMT over that same area
4. Multiply the percent increase in lane miles by the existing VMT, and then by the elasticity from the induced travel literature:

$$[\% \text{ increase in lane miles}] \times [\text{existing VMT}] \times [\text{elasticity}] = [\text{VMT resulting from the project}]$$

Because the research providing these elasticity estimates was undertaken in congested urban regions, this method should be applied only within MPOs; it would not be suitable for rural (non-MPO) locations in the state.

Certain roadway capacity projects might be expected to induce greater or lesser VMT than typical projects; some will even reduce VMT. For example, adding an extra lane to an especially critical and congested link (e.g. the San Francisco Bay Bridge) may leverage VMT growth far beyond that link, increasing VMT to a greater degree. On the other hand, adding a link that greatly improves connectivity (i.e. provides drivers a shorter route in exchange for a longer one) may in select cases reduce total VMT. Such projects may require more detailed analysis using models, and execution of this analysis requires a more nuanced understanding of the factors involved in induced VMT.

This section assists lead agencies in determining the significance of VMT impacts by referencing statewide goals established to achieve the greenhouse gas emissions reduction scientists say is needed to avert global environmental catastrophe. The method for determining the significance of transportation projects described in this section could also be applied at a programmatic level in a regional planning process. In that case, lead agencies could tier from that analysis to streamline later analysis at the project level. (See State CEQA Guidelines Section 15168.) For example, the total expected statewide increase in VMT that would allow for attainment of statewide greenhouse gas emissions reductions could be divided between regions by population to determine a regional-level “threshold.” That program-level analysis of VMT would include effects of the program and its constituent projects on land use patterns, and the VMT that results from those land use effects. In determining whether a program-level document adequately analyzes potential induced demand, lead agencies should note that analyses that assume a fixed land use pattern, and which does not vary in response to the provision of roadway capacity, do not fully account for induced VMT from a project or program of roadway capacity expansion. On the other hand, where the analysis accounts for land use investment and development pattern changes that react in a reasonable manner to changes in

accessibility created by transportation infrastructure investments (whether at the project or program level), the resulting changes in VMT might provide an appropriate basis for tiering.

Mitigation and alternatives.

Induced VMT has the potential to reduce or eliminate congestion relief benefits, increase VMT, and increase other environmental impacts that result from vehicle travel. If those effects are significant, the lead agency will need to consider mitigation or alternatives. In the context of increased travel induced by capacity increases, appropriate mitigation and alternatives that a lead agency might consider include the following:

- Tolling new lanes to encourage carpools and fund transit improvements
- Converting existing general purpose lanes to HOV or HOT lanes
- Implementing or funding travel demand management offsite
- Implementing Intelligent Transportation Systems (ITS) strategies to improve passenger throughput on existing lanes

Tolling and other management strategies can have the additional benefit of preventing congestion and maintaining free-flow conditions, conferring substantial benefits to road users as discussed above.

F. Analyzing Safety Impacts Related to Transportation

Public Resources Code section 21099 suggests that while automobile delay is not an environmental impact, lead agencies may still evaluate project impacts related to safety. The CEQA Guidelines currently suggest that lead agencies examine projects' potential to "[s]ubstantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)".

As with any other potential impact, CEQA requires lead agencies to make a judgment call "based to the extent possible on scientific and factual data." (State CEQA Guidelines § 15064(b).) Also like any other potential impact, "the significance of an activity may vary with the setting." (Ibid.) Lead agencies must base their evaluations of safety on objective facts, and not personal or subjective fears. The purpose of this section is to review some relevant considerations in evaluating potential transportation-related safety impacts.

Transportation by its nature involves some degree of collision risk. Every project will affect transportation patterns, and as a result may involve some redistribution of that risk.

Lead agencies may consider whether a project may cause substantially unsafe conditions for various roadway users. This section is not intended to provide a comprehensive list of potential transportation safety risks, but rather guidance on how to approach safety analysis given numerous potential risks.

Generally:

- Safety analysis in CEQA should focus on risk of fatality or injury, rather than property damage.
- Lead agencies should focus on concerns that affect many people, not just an individual.

- The potential safety concern must relate to actual project conditions, and not stem solely from subjective fears of an individual.
- Safety analysis in CEQA should focus on undue risks that can be reduced without adding other risks, particularly without increasing risk to vulnerable road users. (State CEQA Guidelines § 15126.2(a)(1)(D).) Safety analysis and mitigation under CEQA should not undermine overall public health, e.g. by reducing the physical activity benefits of active transportation.
- In analyzing safety, lead agencies should note that automobile delay is not an indication of environmental impact. (Pub. Resources Code § 21099(b)(2).)

In the past, transportation safety has focused on streamlining automobile flow and accommodating driver error, sometimes confounding motor vehicle mobility and speed with transportation system safety. An updated and more holistic approach has developed over the past decade, however. This updated approach focuses on three overlapping strategies:

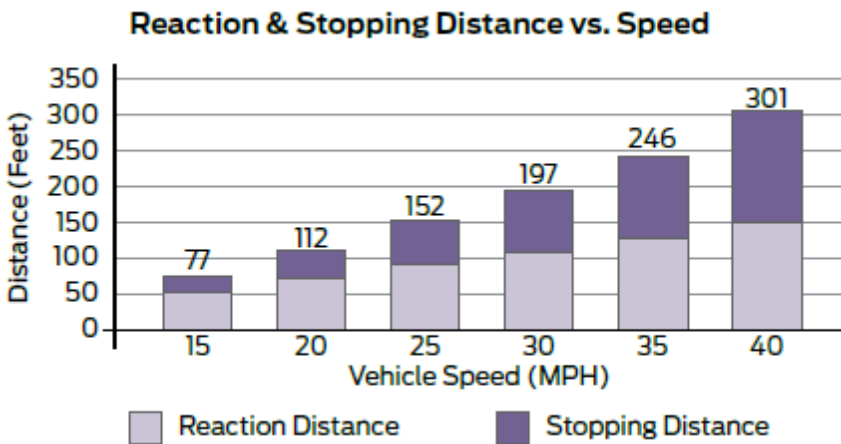
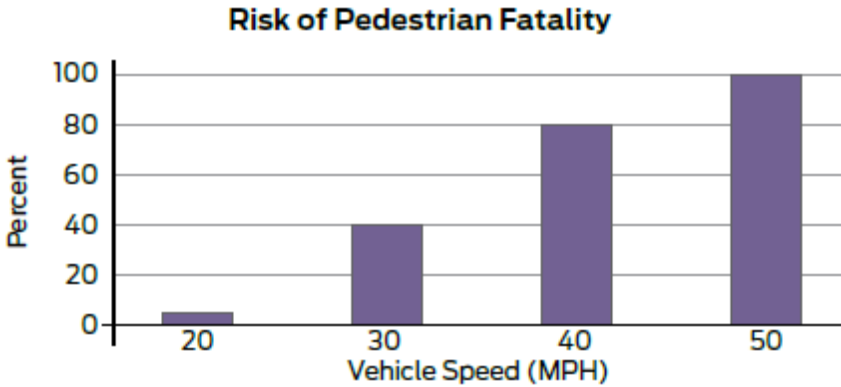
- Reduce speed and increase driver attention
- Protect vulnerable road users
- Reduce overall VMT and sprawl (see Ewing et al. (2003) below for definition of “sprawl”)

Newer design guidance builds on more recent research on transportation safety and articulates this updated approach. For example, the NACTO guidelines (which have been endorsed by Caltrans, as well as the cities of Davis, Oakland, San Francisco, San Diego, and San Mateo) state:

“Conventional street design is founded in highway design principles that favor wide, straight, flat and open roads with clear zones that forgive and account for inevitable driver error. This is defined as “passive” design. In recent years a new paradigm has emerged for urban streets called proactive design. A proactive approach uses design elements to affect behavior and to lower speeds. Embracing proactive design may be the single most consequential intervention in reducing pedestrian injury and fatality. Since human error is inevitable, reducing the consequences of any given error or lapse of attention is critical. Cities around the country that have implemented measures to reduce and stabilize speed have shown a reduction in serious injuries and deaths for everyone on the road, from drivers to passengers to pedestrians.”

Reducing Speed and Increasing Driver Attention

Vehicle speed plays a fundamental role in transportation safety. The NACTO Urban Street Design Guide, reports: “Vehicle speed plays a critical role in the cause and severity of crashes.” Two charts from those guidelines below show risk associated with motor vehicle speeds.



Source: NACTO Urban Street Design Guide Overview

Higher speeds increase both the likelihood and severity of collisions. (Elvik (2005).) According to Elvik:

- “Speed is likely to be the single most important determinant of the number of traffic fatalities.”
- “...[S]peed has a major impact on the number of accidents and the severity of injuries and that the relationship between speed and road safety is causal, not just statistical.”
- “Changes in speed are found to have a strong relationship to changes in the number of accidents or the severity of injuries.”
- “The relationship between speed and road safety is robust and satisfies all criteria of causality commonly applied in evaluation research.”

Regardless of posted speed limits, designing roads to accommodate higher speeds safely actually leads to higher speeds. Except on limited access highways (i.e. freeways), widening and straightening roads does not increase safety. “Wider and straighter roadways lead motorists to travel at higher speeds, thus offsetting any safety benefits associated with increased sight distances.” (Dumbaugh et al., 2009, citing Aschenbrenner & Biehl, 1994; Wilde, 1994).

Dumbaugh et al. (2009) breaks the problem down into its constituent parts, (1) crash incidence and (2) crash severity:

“The safety problem with urban arterials can best be understood as a product of systematic design error. Widening and straightening these roadways to increase sight distances also has the effect of enabling higher operating speeds, which in turn increase stopping sight distance, or the distance a vehicle travels from the time when a driver initially observes a hazard, to the time when he or she can bring the vehicle to a complete stop. Higher stopping sight distances pose little problem when vehicles are traveling at relatively uniform speeds and have few reasons for braking. When these operating conditions can be met, as they are on grade-separated freeways, higher operating speeds have little or no effect on crash incidence.

“But these operating conditions typically cannot be met on urban surface streets, where pedestrians, bicyclists, and crossing vehicles are all embedded in the traffic mix. Avoiding crashes under these conditions often requires motorists to bring their vehicles to a quick stop, which higher operating speeds and stopping sight distances make more difficult (Dumbaugh, 2005b; 2006...). The result is a systematic pattern of error in which drivers are unable to adequately respond to others entering the roadway, leading to increased crash incidence.”

Dumbaugh et al. also points out that speed reduction requires design features and/or commercial vibrancy and activity that provide cues to motorists to slow their vehicle’s speed, rather than simply a slower posted speed limit:

“...placing commercial uses on arterial thoroughfares created a pedestrian safety problem... In practice, the solution to this problem in the United States has been to continue to locate such uses on arterial thoroughfares, but to reduce posted speed limits. In the absence of aggressive police enforcement, however, such practices have been uniformly unsuccessful at reducing vehicle operating speeds (Armour, 1986; Beenstock, Gafni, & Goldin, 2001; Zaal, 1994). The principal alternative, adopted by European designers, is to design urban surface streets to reduce vehicle speeds to safe levels.

“We found pedestrian-scaled retail (the type of retail that was abandoned during the postwar period) to be associated with reductions in all types of crashes, and at significant levels for both total and injurious crashes. This is consistent with recent research on the subject, which finds that the pedestrian-scaled nature of these environments communicate to motorists that greater caution is warranted, leading to increased driver vigilance, lower operating speeds, and thus a better preparedness to respond to potential crash hazards that may emerge. The effective result is a reduction in crash incidence (Dumbaugh, 2005a; 2005b; 2006b; Garder, 2004; Naderi, 2003; Ossenbruggen, Pendharkar & Ivan, 2001).” (Dumbaugh et al. 2009, p. 323)

Dumbaugh et al. concludes that, except for limited-access freeways, reducing speeds is essential for safety, and also helps create livability:

“In areas where pedestrian activity is present or expected, or where eliminating a roadway’s access function [to businesses, residences, jobs, etc.] is either undesirable or inappropriate, the primary alternative to access management is to reduce operating speeds to levels that are compatible with the street’s access-related functions (see Figure 8). This approach, sometimes referred to as the livable street approach, incorporates design features that encourage lower operating speeds, such as making buildings front on the street, incorporating aesthetic street lighting or landscaping along the roadside, enhancing the visual quality of pavement and signage, and adopting traffic calming or intersection control measures. In short, livable streets

emphasize access over mobility. When compared to conventional arterial treatments, livable streets report roughly 35–40% fewer crashes per mile traveled, and completely eliminate traffic-related fatalities (Dumbaugh, 2005a; Naderi, 2003).” (Dumbaugh, 2009, p. 325)

Providing greater clear space around a roadway, e.g. wider shoulders or clearing trees, can lead to degraded driver attention, in addition to higher speeds. “In dense urban areas, less-“forgiving” design treatments—such as narrow lanes, traffic-calming measures, and street trees close to the roadway—appear to enhance a roadway’s safety performance when compared to more conventional roadway designs. The reason for this apparent anomaly may be that less-forgiving designs provide drivers with clear information on safe and appropriate operating speeds” (Ewing and Dumbaugh, 2009). Greater accommodation of driver error especially increases risk to vulnerable road users such as pedestrians and cyclists.

Lane width has a particularly discernable impact on safety. The traditional approach to sizing lanes opts for wider lanes to accommodate driver error and to attempt to increase throughput. However, research reveals that wider lanes hinder both of these objectives. Karim (2015) examined the relationship between lane width and crash rates. A number of findings were corroborated across cities:

- Wider lanes (over 10.8 to 11.2 feet) are associated with 33% higher impact speeds and higher crash rates.
- Both narrow (less than 9.2 feet) and wide (over 10.2 to 10.5 feet) lanes have proven to increase crash risks, with equal magnitude. Wider lanes (wider than 10.8 feet) adversely affect overall side-impact collisions.
- The overall capacity of narrower lanes is higher.
- For large vehicles, no difference on safety and carrying capacity is observed between narrower and wider lanes.
- Pedestrian volumes decline as lanes widen.
- Intersections with narrower lanes provide the highest capacity for bicycles.

The study finds that driver behavior is impacted by the street environment, and narrower lanes in urban areas result in less aggressive driving and more ability to slow or stop a vehicle over a short distance to avoid collision. It also points out that co-benefits of narrower lanes include utilization of space to provide an enhanced public realm, including cycling facilities and wider sidewalks, or to save money on the asphalt not used by motorists. (Karim, 2015)

Yeo et al (2014) summarizes past studies that show both reducing intersection density and widening traffic lanes to worsen safety:

“Wider traffic lanes turn out to be the reason for a higher risk of fatal crashes (Noland and Oh 2004), whereas a street with a narrower curb-to-curb distance is relatively safe (Gattis and Watts 1999). Areas with a high level of intersection density also tend to have fewer fatal crashes (Ladron de Gue- vara et al. 2004). According to Ewing and Dumbaugh (2009), the aforementioned road designs and street patterns create a less forgiving environment for drivers and thus help decrease traffic speed.” (Yeo et al., 2014, p. 402)

Numerous studies found that narrowing lanes from today’s standard practice would improve safety. However, one multi-state study found three specific circumstances where narrower lanes did not increase safety in all states studied, but only some of them. The following is provided as a caveat:

“The research found three situations in which the observed lane width effect was inconsistent—increasing crash frequency with decreasing lane width in one state and the opposite effect in another state. These three situations are:

- lane widths of 10 feet or less on four-lane undivided arterials.
- lane widths of 9 feet or less on four-lane divided arterials.
- lane width of 10 feet or less on approaches to four-leg STOP-controlled arterial intersections.

“Because of the inconsistent findings mentioned above, it should not be inferred that the use of narrower lane must be avoided in these situations. Rather, it is recommended that narrower lane widths be used cautiously in these situations unless local experience indicates otherwise.” (Potts, et al. 2007)

Protecting Vulnerable Road Users

To the extent that a lead agencies address safety in a CEQA analysis, the focus must be on protecting people. Thus, for example, lead agencies might analyze how a land use project or transportation infrastructure project that increases traffic speeds may burden its travel-shed with additional, undue risk. These risks might be mitigated by, for example, (1) reducing motor vehicle travel speeds, (2) increasing driver attention, (3) protecting vulnerable road users (e.g. providing a protected, Class IV bicycle path and/or shortening pedestrian crossing distances and providing pedestrian refuges and bulb-outs), or (4) reducing VMT by providing VMT mitigation. Mitigation should avoid creating additional risk to vulnerable road users and it should not reduce active transportation mode accessibility or connectivity.

Generally speaking, the safety of vulnerable road users (e.g. pedestrians and bicyclists) should be given relatively more attention, due to their vastly increased risk of serious injury and fatality. Also, policy and planning priorities to encourage multimodal and low-carbon travel, and improving safety is a key step in increasing use of those modes. Where there are safety tradeoffs, therefore, it is important to prioritize protection of vulnerable road users. Impacts to potential vulnerable road users should be considered whether or not specific facilities for those users are present.

Active transportation has substantial health benefits, so restricting pedestrian or bicycle access and connectivity in order to reduce collision risk may worsen overall health outcomes. And, any decision about whether to apply a safety measure that restricts access by pedestrians and cyclists should consider (1) the reduction in walking and biking that will result, and the resulting reduction in “safety in numbers” as well as overall health, and (2) the risk created by pedestrians or cyclists subverting the design purpose for convenience (e.g. crossing a street where prohibited) that might lead to additional safety risk.

Reducing overall VMT and Sprawl

Higher total amounts of motor vehicle travel creates higher crash exposure. Reducing vehicle miles traveled reduces collision exposure and improves safety (Dumbaugh and Rae, 2009, p. 325; Ewing, Scheiber, and Zegeer, 2003). As a result, infill development, which exhibits low VMT, itself provides safety benefits by reducing motor vehicle collision exposure, lowering speeds, and increasing pedestrian and cyclist volumes leading to “safety in numbers” (in addition to improving overall health broadly and substantially).

The fundamental relationship between VMT and safety is summarized by Yeo et al. (2014):

“Multiple traffic safety studies showed that higher VMT was positively associated with the occurrence of traffic crashes or fatalities (e.g., Ewing et al. 2002, 2003; NHTSA 2011). The causal relationship between the mileage of total vehicle trips and crash occurrences can be explained by probability. With higher VMT, it is more likely that more crashes will occur (Jang et al. 2012).”

Sprawl-style development has also been shown to lead to elevated crash risk. The cause lies both in higher VMT levels and in design variables which influence speed and driver behavior (Yeo 2014). Ewing et al. (2003) points out that “[s]uburban and outlying intersections have been significantly overrepresented in pedestrian crashes compared with more urban areas, after control for exposure and other location factors.”

More generally, Ewing et al. (2003) reveals that sprawl development (measured by (1) lowness of density, (2) lack of mixing of uses, (3) absence of thriving activity centers such as strong downtowns or suburban town centers, and (4) largeness of block sizes and poorness of street connectivity) leads to elevated transportation risk levels:

“Our study indicates that sprawl is a significant risk factor for traffic fatalities, especially for pedestrians. The recognition of this relationship is key; traffic safety can be added to the other health risks associated with urban sprawl—namely, physical inactivity and air and water pollution.

“...Sprawling areas tend to have wide, long streets that encourage excessive speed. A pedestrian struck by a motor vehicle traveling at 40 mph has an 85% chance of being killed, compared with a 45% chance of death at 30 mph and a 5% chance at 20 mph. Thus, developing land in a more compact manner may reduce pedestrian deaths, provided that the street network is designed for lower-speed travel.”

Ewing et al. (2003) further demonstrates that, on the whole, counties characterized by the most sprawling land use patterns exhibit substantially higher crash risk (between four and five times the all-mode fatality rate) compared to the most compact counties:

TABLE 2—US Counties With Highest and Lowest Sprawl Index Values

	County	Metropolitan Area	Sprawl Index ^a	All-Mode Traffic Fatality Rate (per 100 000)
1	New York County, NY	New York	352.07	4.42
2	Kings County, NY	New York	263.65	4.46
3	Bronx County, NY	New York	250.72	4.20
4	Queens County, NY	New York	218.90	4.58
5	San Francisco County, Calif	San Francisco	209.27	6.31
6	Hudson County, NJ	Jersey City	190.06	5.91
7	Philadelphia County, Pa	Philadelphia	187.78	8.04
8	Suffolk County, Mass	Boston–Lawrence–Salem	179.37	4.49
9	Richmond County, NY	New York	162.89	5.63
10	Baltimore City, Md	Baltimore	162.76	7.68
439	Stokes County, NC	Greensboro–Winston-Salem–High Point	71.26	15.66
440	Miami County, Kans	Kansas City	71.03	38.80
441	Davie County, NC	Greensboro–Winston-Salem–High Point	70.99	25.84
442	Isanti County, Minn	Minneapolis–St Paul	70.12	12.78
443	Walton County, Ga	Atlanta	69.61	19.77
444	Yadkin County, NC	Greensboro–Winston-Salem–High Point	69.17	38.52
445	Goochland County, Va	Richmond–Petersburg	67.59	35.58
446	Fulton County, Ohio	Toledo	66.83	38.02
447	Clinton County, Mich	Lansing–East Lansing	66.63	16.99
448	Geauga County, Ohio	Cleveland	63.12	20.90

^aHigher values of the index indicate more compact urban form; lower values indicate more sprawling urban form.

Source: Ewing et al., 2003

Beyond crash incidence rates and severity, delay in receiving medical care after a crash contributes to worse health outcomes from transportation safety in sprawling neighborhoods. Traditional impact analysis focuses on congestion as an inhibitor to emergency responses times. However, research shows that emergency response suffers more from greater distances to destinations found in sprawling areas than from congestion in compact and congested areas:

“Emergency medical service (EMS) delay is another possible mediator that could help explain the direct non-VMT-involved sprawl effect on traffic fatalities. Urban sprawl increases EMS waiting time, and delay in ambulance arrival can increase the severity of traffic-related injuries (Trowbridge et al. 2009). ‘For every 10% increase in population density’...the models estimated by Lambert and Meyer (2006, 2008) predict ‘a 10.4% decrease in EMS run time’ in the Southeastern United States and nationwide ‘an average 0.61 percent decrease in average EMS run time.’” (Yeo et. al, 2014)

Collectively, research points to an approach on safety that aligns well with other state priorities and laws (e.g. infill priority, greenhouse gas reduction), as well as with the visions of many local jurisdictions for their own growth. Compact infill development, in addition to providing livable and vibrant neighborhoods, walkable communities, environmental benefits, land conservation, fiscal benefit and cost reduction for citizens, also improves traffic safety:

“Our study, which addresses the built environment in a more comprehensive manner [than past studies], found population density to be associated with significantly fewer total and injurious crashes. ...Individuals living in higher density environments drive less (Ewing & Cervero, 2001), thus reducing their overall exposure to crashes. When these reductions in VMT are aggregated across a larger population, they can potentially add up to notable reductions in population-level crash incidence.” (Dumbaugh and Rae, 2009)

“[Our] research findings suggest that enhancing traffic safety by reducing fatalities can be achieved by fighting against urban sprawl and promoting smart growth countermeasures. It will be important to revive city centers, to increase density, and to provide for mixed land uses. Urban design solutions that can enhance walkability at the meso- and microlevels may help reduce traffic fatalities.” (Yeo et. al, 2014)

Attribution of Safety Impacts

Some safety impacts result from the effects of many past projects accumulated over time. An infill project, for example, may add an additional vehicle to a queue in a turn pocket or on a ramp causing it to extend into mainline traffic. Such an impact is the cumulative effect of many projects. (In any case, vehicle queueing resulting from a particular project frequently cannot be estimated accurately, especially where traffic is affected by many factors. Typical modeling error on traffic volumes at an intersection can reach 40 percent, and microsimulation performed to estimate queue lengths introduce further error. Other factors affect travel demand (e.g. the economy, the price of gasoline). Therefore, it is frequently impossible to meaningfully predict whether the direct effect of a development in an infill area will be the cause of a vehicle queue extending onto a highway mainline.)

Meanwhile, if a development generates or attracts such large amounts of automobile travel that it contributes a substantial portion of the traffic that leads to a queue onto the mainline, attributing that proportion of the associated risk to that project would be appropriate. This might be particularly so on the urban periphery where that traffic would be easily attributable to the project.

Addressing Tradeoffs and Finding Win-Win Safety Improvements

Traditional solutions for safety risks sometimes create other safety risks, impact human health in other ways, and sometimes are at cross purposes with other state and community interests such infill priority, greenhouse gas reduction, cost reduction, or access to destinations. When addressing safety impacts, a jurisdiction should frame and address those risks in a manner that helps forward the community’s overall goals, while improving safety. Some modern approaches to reducing safety risk, developed over the past decade or two based on research, allow all safety to be improved while meeting these other goals. Here are three examples:

- (1) A queue extending out of a turn pocket or off ramp can increase the risk of rear-end collisions. However, addressing that risk by adding additional vehicle capacity such as a second lane will lead to additional risk for pedestrian crossing. Addressing that risk by adding extra green time in the traffic signal timing will lead to shorter pedestrian crossing times and/or additional pedestrian wait time. Addressing these secondary risks by prohibiting pedestrian crossing will reduce connectivity of the pedestrian network, leading to reduced pedestrian mode share, which will increase risk by decreasing “safety in numbers” benefits and impact the health benefits associated with active mode travel. Meanwhile, improving safety with street design features that lower travel speeds to reduce crash incidence and severity can improve walkability.

- (2) Surface roadway lanes can be redesigned from traditional 12.0 foot widths to with 9.2 to 10.8 foot widths with little or no down-side. Such a narrowing of lanes maintains motor vehicle capacity, increases bicycle capacity, maintains large vehicle capacity and safety, improves pedestrian crossings safety and comfort, increases pedestrian volumes, improves driver attention, decreases crash rates, decreases crash severity, reduces construction costs, reduces maintenance costs, reduces impermeable surface area, reduces construction and maintenance air quality and GHG emissions, and reduces space consumption. (Karim, 2015).

- (3) Improving safety by adding signage and pavement markings that help reduce speeds and increase pedestrian visibility can have an array of benefits, including:
 - Decrease in crash incidence for all users, including vulnerable road users
 - Decrease in crash severity for all users, including vulnerable road users
 - Increase safety and comfort for pedestrians and cyclists, resulting in increased walking and biking mode share, in turn increasing safety in numbers effects for vulnerable road users and improving public health both via improved safety and increased physical activity.

While reductions in automobile speed may initially increase auto mode travel times, improving conditions for pedestrians and cyclists can lead to finer grain land use development over time, and ultimately improve destination proximity and overall access to destinations.

Examples and Mischaracterizations of Detriments to Overall Safety

The following are examples of possible detriments to overall safety if not mitigated:

- An increase in VMT. More vehicle travel exposes motorists and other road users to more crash risk.
- An increase in pedestrian wait times. Many studies have found that pedestrian wait times play a role in crashes. Long wait times increase the risk some pedestrians will cross against a signal, creating a vulnerable road user collision risk (FHWA-RD-03-042, 2004)
- Site design elements that would create hazardous conditions for vulnerable road users

- Substantially increasing motor vehicle speeds, or increasing them to greater than 25 miles per hour where vulnerable road users are present without providing proper infrastructure for vulnerable road users (e.g. Class IV bikeways for cyclists)
- Substantially increasing intersection pedestrian crossing distances, e.g. for addition of a through or turn lane
- Signal lengths of greater than 90 seconds, which may lead to people crossing on a red signal with a gap in the vehicle platoons
- Increase in curb radius
- Installation of large curb radii, promoting higher speed motor vehicle turning movements, particularly endangering pedestrians and cyclists
- Addition or widening of on- and off-ramps where they meet surface roadways that increases pedestrian crossing distances or times, increase pedestrian wait times, or lead to a prohibition of pedestrian crossing
- Addition or widening of off-ramps in a manner that leads to higher speeds on surface streets
- Excessively large clearance zones along shoulders
- Wider than needed travel lanes (e.g. wider than 10.8 feet on surface streets)
- Multiple turn lanes at an intersection (e.g. a double left or double right turn lane)
- Placement of driveways in locations which will lead to highly elevated collision risk
- Excessively large driveways across sidewalks
- Substantially increased distances between pedestrian and bicycle crossings
- Roadway design speed (regardless of posted speed limit) that leads to actual speeds that are unsafe for cyclists and pedestrians

Safety issues can be mischaracterized with overly narrow perspective or traditional design guidance that has not been updated to reflect research. The following are examples of mischaracterizations of safety issues.

- Avoidance of installation of corner or mid-block crossings to avoid additional pedestrian traffic and conflict with vehicles (reduces pedestrian mode share, undoing safety in numbers)
- Avoidance of narrow (e.g. 10 foot) travel lanes on surface roadways (see discussion above)
- Avoidance of implementing sidewalk bulbs, widened sidewalks, parklets, or other curb extensions or removal of on-street parking for fear of exposing vulnerable users to vehicular traffic (these features slow traffic and improve walkability as discussed above)
- Addressing off-ramp queuing by limiting stop control on an exit ramp (this can lead to vehicles flowing unimpeded and at high speeds onto a local street, increasing risk for all road users).
- Avoidance of protected bicycle facilities adjacent to transit boarding islands to avoid conflicts between transit users and cyclists (this is safe with good design)
- Maintaining or providing parking spaces out of concern that road rage could result from traffic congestion or circling for parking as an outcome of the removal of on- or off-street parking spaces (adding parking increases VMT and overall crash exposure)

Examples of Potential Transportation Safety Mitigation Measures

- Intersection improvements
 - Visibility improvement
 - Shortening corner radii
 - Pedestrian safety islands
 - Accounting for pedestrian desire lines
- Signal changes
 - Reducing signal cycle lengths to less than 90 seconds to avoid pedestrian crossings against the signal
 - Providing a leading pedestrian interval
 - Provide a “scramble” signal phase where appropriate
- Roadway improvements
 - Add curb extensions or bulb-outs
 - Add bicycle facilities (On higher speed roads, add protected bicycle facilities)
 - Reduce travel lane width below 10.8 feet (but not below 9.2 feet)
 - Add traffic calming measures
 - Add landscaping features
- Network improvements
 - Provide shorter blocks
 - Provide mid-block crossings
- Reduce VMT
 - Increase density and/or diversity of land uses
 - Provide travel demand management measures
 - Provide transit
 - Provide pedestrian facilities
 - Provide bicycle facilities

G. Mitigation and Alternatives

When a lead agency identifies a significant impact, it must consider mitigation measures that would reduce that impact. The selection of particular mitigation measures, however, is always left to the discretion of the lead agency. Further, OPR expects that agencies will continue to innovate and find new ways to reduce vehicular travel. Several potential mitigation measures and alternatives to reduce vehicle miles traveled are described below. Notably, the suggested mitigation measures and alternatives were largely drawn from the California Air Pollution Control Officers Association’s guide on [Quantifying Greenhouse Gas Mitigation Measures](#). That guide relied on peer-reviewed research on the effects of various mitigation measures, and provides substantial evidence that the identified measures are likely to lead to quantifiable reductions in vehicle miles traveled.

Potential measures to reduce vehicle miles traveled include, but are not limited to:

- Improve or increasing access to transit.
- Increase access to common goods and services, such as groceries, schools, and daycare.
- Incorporate affordable housing into the project.
- Incorporate neighborhood electric vehicle network.
- Orient the project toward transit, bicycle and pedestrian facilities.

- Improve pedestrian or bicycle networks, or transit service.
- Provide traffic calming.
- Provide bicycle parking.
- Limit or eliminating 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.
- Provide transit passes.

Examples of project alternatives that may reduce vehicle miles traveled include, but are not limited to:

- Locate the project in an area of the region that already exhibits low vehicle miles traveled.
- 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.
- Deploy management (e.g. pricing, vehicle occupancy requirements) on roadways or roadway lanes.

IV. Case Studies

The following case studies provide sample applications of the *Draft Technical Advisory on Evaluating Transportation Impacts in CEQA* (“Draft Technical Advisory”).

The first is a mixed use residential and retail development in the City of Sacramento (Sacramento County). This case study employs the [Greenhouse Gas Quantification Methodology](#) (GGQM) developed by the Strategic Growth Council for the Affordable Housing and Sustainable Communities program (AHSC). To provide a more fine-grained analysis, we replace CalEEMod’s regional average default trip length estimates with data taken from the California Statewide Travel Demand Model (CSTDM). We use CSTDM home-based travel VMT output data for the region as a whole to calculate a significance threshold using the methodology recommended in the Draft Technical Advisory.

The second is an office development in a suburban area in the City of Mission Viejo (Orange County). This case study uses CSTDM home-based-work trip length data to estimate VMT of office uses in that location and to estimate the significance threshold, and the CAPCOA *Quantifying Greenhouse Gas Mitigation Measures* to quantify the VMT reduction of a set of mitigation measures.

The first and second case studies employ the CSTDM to estimate trip lengths and project VMT, and to help determine thresholds. In many cases, this methodology will be sufficient to adequately analyze a project’s vehicle miles traveled. However, where a lead agency desires a more rigorous analysis, it might choose to use a regional travel demand model where available. Regional travel demand are typically better calibrated and validated for local conditions and so may provide more precise estimates of vehicle miles traveled.

The third is a hypothetical typical highway expansion project in an outlying area in the Kern Council of Governments region. This case study uses Caltrans Performance Measurement System (PeMS) lane mile and VMT data, and elasticity estimates from academic literature, to assess additional VMT caused by the addition of lane miles to the highway network.

Note, these case studies provide merely examples of how various projects may be analyzed. Proposed new Section 15064.3(b)(4) leaves to lead agencies the precise choice of methodology:

A lead agency may use models to estimate a project’s vehicle miles traveled, and may revise those estimates to reflect professional judgment based on substantial evidence. Any assumptions used to estimate vehicle miles traveled and any revisions to model outputs should be documented and explained in the environmental document prepared for the project.

Thus, other models may appropriately be used to analyze vehicle miles traveled.

Mixed Use Project (Residential + Retail): Stockton and T

This case study provides an example of a VMT estimate for a mixed use (residential-retail) project. This case study is located in the City of Sacramento, Sacramento County, California.

Basic Project Characteristics

The proposed project is located at the corner of Stockton Boulevard and T Street—an inner-ring suburb near transit. It consists of 214 multifamily rental dwelling units and 6000 square feet retail in a 5 story building, as well as 24 single family dwelling owner-occupied units.

Analysis overview

Analyses for residential and retail portions of the development are conducted separately and results are compared to their respective recommended thresholds. For residential component, the AHSC GGQM is employed, with one enhancement: data recently made available from the California Statewide Travel Demand Model (CSTDM) are used to improve the accuracy of trip length estimates.

Note that a residential project that is located within ½ mile of transit is presumed to have a less than significant transportation impact. The project is located 0.27 miles from transit, and would therefore be presumed to have a less than significant transportation impact.

Further, the Draft Technical Advisory recommends that a residential project proposed in a location where existing development exhibits below-threshold VMT be presumed to have less than significant transportation impact. According to the CSTDM, the project is located in a Traffic Analysis Zone exhibiting 12.1 total VMT/cap and 8.4 Home Based VMT/capita. By comparison, the SACOG region as a whole exhibits an average 16.7 total VMT/capita and 12.8 Home Based VMT per capita. The Draft Technical Advisory's recommended threshold of fifteen percent below the regional average thus is 14.2 total VMT/capita and 10.88 Home Based VMT/per capita. Therefore, a screening map made using either total VMT/capita or Home Based VMT/capita would show the project to be in a below-threshold TAZ, and therefore may be presumed to lead to a less than significant transportation impact.

While the residential component of the project would be determined to have a less than significant impact on transportation by each of these two screening criteria, this case study nevertheless estimates VMT for the residential portion of the project in order to provide a demonstration of the methodology described in the Draft Technical Advisory.

The retail component consists solely of locally-serving retail, and therefore may be presumed to have a less than significant VMT impact. A lead agency that nevertheless chooses to estimate the retail component's vehicle miles traveled may conduct a travel demand model run. (CalEEMod is able to make a trip-based estimate of VMT from the retail portion of the project, but the Draft Technical Advisory cautions against using a trip-based methodology for retail uses, because it fails to account for the rerouting of trips from existing retail, and therefore falsely represents all trip-based VMT attracted to the project as new VMT.)

Estimate of Residential Project Component VMT

The following section provides a step-by-step description for using the [AHSC GGQM](#) to estimate project VMT. The AHSC GGQM employs the [California Emissions Estimator Model](#) (CalEEMod), a free and downloadable trip-based sketch model, substituting some off-model calculations where research and technical updates have not yet been incorporated into the model itself. We recommend obtaining a copy of the AHSC GGQM and referring to it alongside this description.

CalEEMod inputs on Project Characteristics and Land Use screens

On the CalEEMod Project Characteristics screen:

- Select “County” and enter “Sacramento”
- Set Land Use Setting to “Urban”
- Set operational year to 2016

CalEEMod Land Use Screen:

- Residential – Apartments Mid-Rise – 214 Units
- Residential – Single Family Housing – 24 Units
- Retail – Strip Mall – 6,000 square feet

Notes: The retail component is entered into CalEEMod solely so CalEEMod can estimate internal capture of the residential component trip-making activity by the retail contained within the project. We ignore CalEEMod’s trip-based VMT estimate for the retail component itself, for the reasons described above.

Mitigation: CalEEMod Land Use and Site Enhancements and Commute Pages (Mitigation tab), and prescribed off-model methods

CalEEMod requires the project setting to be selected from a menu on the Land Use and Site Enhancements Screen. Per the GGQM, for this project, Urban Center is selected from the menu.

Increase Density (LUT-1):

Per AHSC GGQM, this calculation is undertaken outside CalEEMod.

Increase Density (LUT-1)		
Project density	48.6	du/ac
% Density increase	539%	
% VMT reduction	37.8%	
% VMT reduction taken	30.0%	

Increase Diversity:

The project contains retail development, so the Increase Diversity checkbox is checked in CalEEMod.

Improve Walkability Design (LUT-9):

Per the AHSC GGQM, this calculation is undertaken outside CalEEMod.

Improve Walkability Design (LUT-9)		
Intersections per sq. mi.	141.4	intersections/sq. mi.
%VMT reduction	35.1%	
%VMT reduction taken	21.3%	

Improve Destination Accessibility (LUT-4):

Rather than use CalEEMod or the AHSC GGQM to adjust for regional location (i.e. “distance to Downtown/Job Center), trip lengths from the California Statewide Travel Demand Model are inputted into CalEEMod.

Increase Transit Accessibility (LUT-5):

Inputted distance to nearest transit station, 0.27 mi, into CalEEMod.

Integrate Below Market Rate Housing (LUT-6)

The project does not contain below market rate housing, so this item is left unchecked in CalEEMod.

Improve Pedestrian Network (SDT-1)

The project includes new sidewalks along its borders, so the item is checked in CalEEMod, and “project site” is selected from the menu.

Provide Traffic Calming Measures (SDT-2)

The project does not provide traffic calming measures, so the item is left unchecked and the menus are left blank.

Implement NEV Network (SDT-3)

The project does not implement an NEV network, so the item is left unchecked and the input field is left at 0.

Limit Parking Supply (PDT-1)

The project is not parked below zoning, so the item is left unchecked and the input field is left at 0.

Unbundle Parking Costs (PDT-2)

Parking costs are not unbundled, so the item is left unchecked and the input field is left at 0.

On-Street Market Pricing (PDT-3)

On street parking is by neighborhood parking permit, not priced, so the item is left unchecked and the input field is left at 0.

Provide BRT System (TST-1)

The project does not provide a BRT system, so the item is left unchecked and the input field is left at 0.

Expand Transit Network (TST-3)

The project does not expand transit the transit network, so the item is left unchecked and the input field is left at 0.

Increase Transit Frequency (TST-4)

The project does not increase transit frequency, so the item is left unchecked, the level of implementation is left blank, and the input field is left at 0.

Commute Mitigation

The project provides no commute reduction programs, so all fields on this page are left blank (at their default values).

CalEEMOD output

Per the AHSC GGQM, CalEEMod output data on VMT are recorded:

From "4.2 Trip Summary Information"	Annual VMT	
	Unmitigated	Mitigated
Land Use		
Apartment Mid Rise	2,673,841	1,917,994
Single Family Housing	433,117	310,682
Total	3,106,958	2,228,677

Addition of mitigation accounted for off-model

Per the AHSC GGQM, off model calculations, detailed above, are incorporated and an estimate of project VMT is made (in this case, capped at the maximum for a project in this location type):

Sum of additional % VMT Reductions	51.3%	
Additional VMT Reductions	1,593,869	VMT/year
Total Annual VMT Reductions	2,472,151	VMT/year
Percent VMT Reduction	79.6%	
Maximum Reduction for Urban Center (Compact Infill) Project Setting	40%	
Project VMT Reduction	40%	
Project VMT	1,864,175	VMT/year

Project per-capita VMT

CalEEMod estimates residential project population on the Land Use screen. For the Stockton and T project, it estimates a residential population of 635 persons.

Project Residential Population	635	persons
VMT/cap	2,936	VMT/pers-yr

Recommended Threshold

The CSTDM estimates Home Based VMT per capita in the SACOG region to be 12.8 VMT/cap per day. Applying an annualization factor of [Annual VMT] = [Daily VMT] * 365, annual per capita VMT is estimated at 4,672 VMT/cap per year. The threshold recommended by the Draft Technical Advisory is fifteen percent below regional VMT/cap, in this case 3,971 VMT/cap per year.

Daily VMT per capita	12.8	VMT/pers-day
Annual VMT per capita	4,672	VMT/pers-yr
Recommended threshold	3,971	VMT/pers-yr

Significance Determination

The project, factoring in mitigation (using the AHSC GGQM) and regional location (by employing the CSTDM trip lengths) would be expected to generate 2936 VMT/person-year. The threshold recommendation is 3971 VMT/person-year. The residential component of the Stockton and T project will generate VMT at rates well below the recommended threshold. This result is unsurprising for a centrally-located infill project near transit.

As discussed above, the retail portion of the project is locally-serving, and is therefore presumed to have a less than significant transportation impact. As a result, the project has a less than significant impact on transportation.

Office Project: Mission Viejo Medical Center

This case study provides an example of a VMT estimate for an office project. This Case Study is located in Mission Viejo, Orange County, California.

Basic Project Characteristics

The proposed project is located west of Medical Center Road, between Crown Valley Parkway and Marguerite Parkway. It is an office building consisting of 110,000 square feet of office space.

Analysis overview

An estimate of base (unmitigated) project VMT is made using data from the California Statewide Travel Demand Model (CSTDM). The threshold is also estimated using the CSTDM. Mitigation measures are quantified with substantial evidence from *Quantifying Greenhouse Gas Mitigation Measures* (California Air Pollution Control Officers Association (CAPCOA)).

VMT Quantification and Significance Determination

The CSTDM estimates average commute VMT for existing office uses in the vicinity of the project (specifically, within the Traffic Analysis Zone (TAZ) which encompasses the project) as 15.3 VMT/employee.

Meanwhile, the CSTDM estimates VMT/employee in the SCAG region as a whole to be 15.9 VMT/employee. Applying the threshold recommended by the Draft Technical Advisory, 15 percent below regional overall commute VMT/employee, the significance threshold would be 13.5 VMT/employee. Without any mitigation, therefore, this project could trigger a significant impact. To reduce its impact to below the recommended significance threshold, the project would need to reduce commute VMT to below 13.5 VMT per employee (in other words, reduce its VMT by 12.9 percent).

To mitigate VMT to less than significant levels, the project could implement a Trip Reduction Program. For example, the program could implement the following commute VMT reduction strategies to bring VMT below the threshold:

<i>Mitigation Measure</i>	<i>Percent Reduction</i>	<i>Substantial Evidence</i>
Implementation a 9/80 workweek for 10 percent of employees	0.7%	CAPCOA TRT-6
Provide a transit subsidy to all employees of 1.49/day	7.3%	CAPCOA TRT-4
Implement car sharing program	0.4%	CAPCOA TRT-9
Provide an employee vanpool program	2%	CAPCOA TRT-11
Implement a \$6 daily employee parking charge	6.8%	CAPCOA TRT-14
Total	17.2%	

Source: Quantifying Greenhouse Gas Mitigation Measures, CAPCOA

According to the CAPCOA *Quantifying Greenhouse Gas Mitigation Measures*, a Commute Trip Reduction Program can reduce VMT by up to 21 percent. The 12.9 percent reduction required is therefore achievable using proven mitigation for which substantial evidence exists. The mix of strategies listed above would be expected to reduce VMT by 17.2 percent. As mitigation measures, these measures would be identified in the project's mitigation monitoring and reporting program.

Roadway Capacity Expansion Project: Addition of 2.2 Lane Miles

This case study provides an example of a VMT estimate for a roadway expansion project. This case study estimates the VMT impact of a hypothetical project that adds 2.2 lane-miles to a highway in the Kern Council of Governments region.

Analysis

Research on VMT effects of lane mile additions can be used to estimate the VMT effects of proposed roadway expansions, as described in the Draft Technical Advisory:

$$\text{Elasticity} = [\% \text{ Change in VMT}] / [\% \text{ Change in Lane Miles}]$$

or

$$\text{VMT Impact} = [\% \text{ Change in Lane-Miles}] * [\text{baseline VMT on those lane-mi}] * [\text{elasticity}]$$

Lane mile and VMT data are available from the Caltrans Performance Measurement System (PEMS):

PEMS Data (2013)	Interstate		Principal Arterial - Other Freeways and Expressways	
	Existing Lane-Miles	VMT (millions)	Existing Lane-Miles	VMT (millions)
KernCOG	385.22	1,288.79	285.25	1,045.15

In order to best align this analysis with the academic research from which the elasticities are taken, this case study focuses on interstate highways, freeways, and expressways. Lane miles and VMT from these facilities are aggregated from the raw data, and VMT is calculated using the formula above:

Interstate, Principal Arterial (Freeways and Expressways only)			
Lane Miles	VMT (millions)	%chg in LM	Induced VMT/year
670.47	2,333.94	0.328%	7,658,312

The most recent major study on induced travel, [Duranton and Turner \(2011\)](#), reveals an elasticity of VMT by lane miles of 1.03.

The percent change in lane miles is calculated by dividing project lane miles (2.2 miles) by the total lane miles of the applicable functional classes (670.47 miles) to yield a percent change in lane miles (0.328 percent). This is multiplied by the baseline VMT on those facilities (2,333,940,000 VMT) and an elasticity from the academic studies (1.0) to yield the total induced travel: 7,658,312 VMT/year.

Significance Determination

The Draft Technical Advisory provides a methodology for calculating a VMT threshold. Making use of draft data from the California Air Resources Board and an estimate of the number of transportation projects statewide through 2015, the Draft Technical Advisory recommends a transportation project threshold of 2,075,220 VMT/year. The project is estimated to induce 7,658,312 miles/year, a significant amount of VMT.

As mitigation, the project could administer a toll on the new and/or existing lane miles sufficient to reduce VMT to below-threshold levels, or manage new and/or existing lane miles (e.g. with an HOV requirement) to similarly reduce VMT. Alternately or in conjunction, travel demand management measures such as providing transit or active transportation service or facilities, providing park and ride facilities, or providing a vanpool program could be employed to similarly reduce VMT.



American Planning Association
Making Great Communities Happen

July/August 2016

PAS MEMO

Smart Transportation Metrics for Smart Growth

By Chris Mitchell, PE, and Ronald T. Milam, AICP

Business strategists frequently tell us that what you measure is what you get, and it may, in fact, be *all* you get. Choose the wrong metric, and you may create undesirable incentives, leading to unintended consequences; omit a valuable metric and you may completely miss problems in an area that is important to you.

The same principle applies to planning and designing our cities, where we constantly make trade-offs to find the right balance among competing priorities. If we don't measure our performance against all of our goals and values, we may not fully understand the effects of our choices.

Throughout the United States, from Manhattan, New York, to Manhattan Beach, California, our transportation systems have all been designed based not just on what we say we value, but on what we actually measure. In many circumstances, communities have identified values that include prioritizing public transit, walkability, encouraging vibrant neighborhoods, efficient traffic flow, maintaining a good state of repair of our transportation network, and protecting the environment.

Despite these legitimate and sometimes competing goals, localized traffic congestion, measured using a concept known as vehicle Level of Service (LOS), is commonly the item that has the heaviest influence over planning decisions. This practice has resulted in many unintended consequences, including sprawl, less walkability, more vehicle travel, and inefficient public transit, to name a few. Some planners and engineers have even argued that this focus on minimizing localized traffic congestion at intersections has ultimately led to *more* traffic congestion overall, which, ironically, is the one thing that LOS was designed to measure.

While LOS can still be a valuable metric, many communities are supplementing LOS with other important metrics that better capture their community values and allow decision makers to more clearly evaluate tradeoffs between competing priorities. This *PAS Memo* provides more detail about the unintended consequences of over-reliance on LOS; summarizes several alternative or additional emerging metrics; highlights some of the technical challenges with implementing new metrics; and provides three case studies of communities that have recently

implemented, or are evaluating, comprehensive changes to the way in which they measure their transportation system performance.

Challenges With Reliance on LOS

The concept of LOS has been used by traffic and transportation engineers for over 50 years to describe operating conditions for automobile travel on existing or planned roads. LOS is most commonly measured using average vehicle delay at an intersection. It is expressed as a letter grade, ranging from LOS A to LOS F, where LOS A represents completely free-flow conditions, LOS E represents capacity conditions, and LOS F represents over-capacity conditions with considerable delay (Table 1, p. 2).

This report-card grading is based on a driver's perspective and the notion that delay is to be minimized. The grading ignores intersection performance from the perspective of other users such as bicyclists and pedestrians. Further, LOS grades below LOS E also represent a low level of utilization, which normally would constitute a poor rating for public infrastructure. Many cities have adopted policies to maintain LOS D or better conditions during peak hours, based on guidance from *A Policy on Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials 2011) and other sources.

LOS can be a very useful and effective metric for designing infrastructure and understanding the consequences to *automobile traffic* of planning and design decisions. However, that is generally the extent of its utility. It does not help to inform us about a number of other factors that may be important to some communities.

If communities have not adopted specific, measurable goals or standards for other values, then the tradeoffs with traffic congestion are never well understood. In fact, LOS can actually be in direct conflict with several other often-stated community values:

- **Other Modes.** Roadway capacity expansion to minimize vehicle delay can make it more difficult to safely use other modes of travel. Figure 1 (p. 3) illustrates

Table 1. Signalized Intersection LOS Criteria

LOS	Average Control Delay (seconds/vehicle)	Description
A	≤ 10.0	Operations with very slight delay, with no approach phase fully utilized.
B	10.1 – 20.0	Operations with slight delay, with occasional full utilization of approach phase.
C	20.1 - 35.0	Operations with moderate delay. Individual cycle failures begin to appear.
D	35.1 – 55.0	Operations with heavier, but frequently tolerable delay. Many vehicles stop and individual cycle failures are noticeable.
E	55.1 - 80.0	Operations with high delay, and frequent cycle failures. Long queues form upstream of intersection.
F	> 80.0	Operation with very high delays and congestion. Volumes vary widely depending on downstream queue conditions.

Source: *Highway Capacity Manual, Transportation Research Board, 2000.*

the consequences of such expansions: a facility that is much more difficult for pedestrians to cross. And although bicycle lanes could be incorporated into this roadway expansion, bicycling adjacent to multiple lanes of swiftly moving traffic can be quite stressful. The wider roadway under construction in the figure is likely serving only the most serious and able-bodied cyclists. Likewise, attempts to remove auto capacity in favor of other modes, such as bicycle lanes or transit-only lanes, may achieve some community goals, but will frequently result in worse LOS for autos, making such improvements difficult to implement.

- **Safety.** While there are certainly some safety benefits of reduced traffic congestion and smooth traffic flow, increasing the capacity of roadways often means increasing travel speeds, which can have substantial effects to the severity of collisions. For example, as shown in Figure 2 (p. 3), a pedestrian hit by a motorist traveling at 40 mph is roughly 15 times more likely to die than if the motorist were traveling at 20 mph (Ewing and Dumbaugh 2009). Taken alone, an evaluation of design alternatives based on LOS would not capture the potential safety effects of the options.
- **Open Space.** Widening roads to achieve LOS targets often comes at the expense of adjacent open space.
- **Infill Development.** Infill development, which is a goal in many communities, tends to be in areas that have more congestion than greenfield development, so the likelihood of exceeding a city's LOS threshold is increased.
- **Cost.** Most communities (and state and federal governments) struggle to fully fund maintenance of their

existing infrastructure. The delay-based letter grading system for LOS implies that a roadway that is substantially under-utilized (i.e., over-built) receives the best possible grade. This type of analysis does not account for the increased cost associated with constructing more capacity than is required. Further, even if private parties are responsible for the capital construction costs as part of development agreements, for example, the local jurisdictions are ultimately responsible for maintaining the facilities. Decisions made solely to achieve a specific LOS target may not adequately account for the increase costs to the local jurisdiction.

Emerging Alternative Metrics

Because LOS does not account for — and actually can be in conflict with — a number of other values that communities may have, several jurisdictions across the U.S. have begun to develop new metrics that can be used instead of, or as supplements to, LOS to better capture their priorities.

Vehicle Miles Traveled

One of the consequences of over-reliance on LOS is that land development is often less expensive and therefore more desirable in lower-density areas with less traffic congestion and fewer localized intersection LOS problems. Frequently, this is greenfield development. This may reduce a development project's effect on localized intersection congestion, but may have other unintended consequences. For example, auto trips from this lower-density development further from the city center tend to be longer and are more likely by auto since transit options are limited. So, while accomplishing the goal of reduced localized intersection congestion, regional travel facilities that



Figure 1. Aerial photo of intersection widening in California. Courtesy Fehr & Peers.

carry travelers on longer distances tend to become more congested. In addition, more roadway space must be constructed to support lower-density travel patterns, which increases the cost burden on public agencies.

In response to this, some communities are exploring use of vehicle miles traveled (VMT) as a metric to evaluate the performance of the transportation system. VMT includes both the number of vehicle trips generated and the length of those trips. Instead of measuring the performance of specific locations in the system, VMT measures the efficiency of the overall system especially when expressed as VMT per capita or per employee.

Figure 3 (p. 4) illustrates a map prepared by the San Francisco County Transportation Authority indicating locations in San Francisco where VMT rates for retail uses will exceed acceptable ranges as defined by the City (San Francisco County Transportation Authority 2016). Development proposed within these areas would be considered to have environmental impacts, unless other measures such as Travel Demand Management (TDM) were implemented to reduce overall vehicle trip generation. Development in the other areas would not cause environmental traffic impacts because the areas already exhibit low VMT generation.

VMT is not a perfect metric and does not measure all the qualities of the transportation system that jurisdictions may be interested in. One five-mile trip in heavy traffic may not be the same, qualitatively, as one five-mile trip in free-flowing conditions,

Pedestrian Fatality Rates for Collisions at Different Speeds

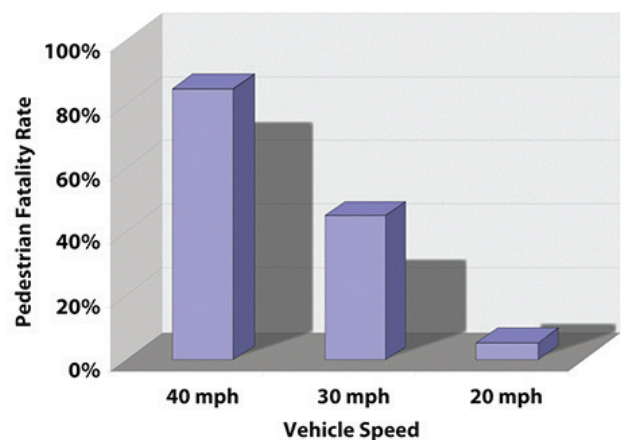


Figure 2. Pedestrian fatality rates by vehicle speed. Courtesy Fehr & Peers.

for example. Fortunately, VMT does not preclude use of LOS; in fact, many communities are implementing VMT in conjunction with LOS to augment their understanding of the transportation

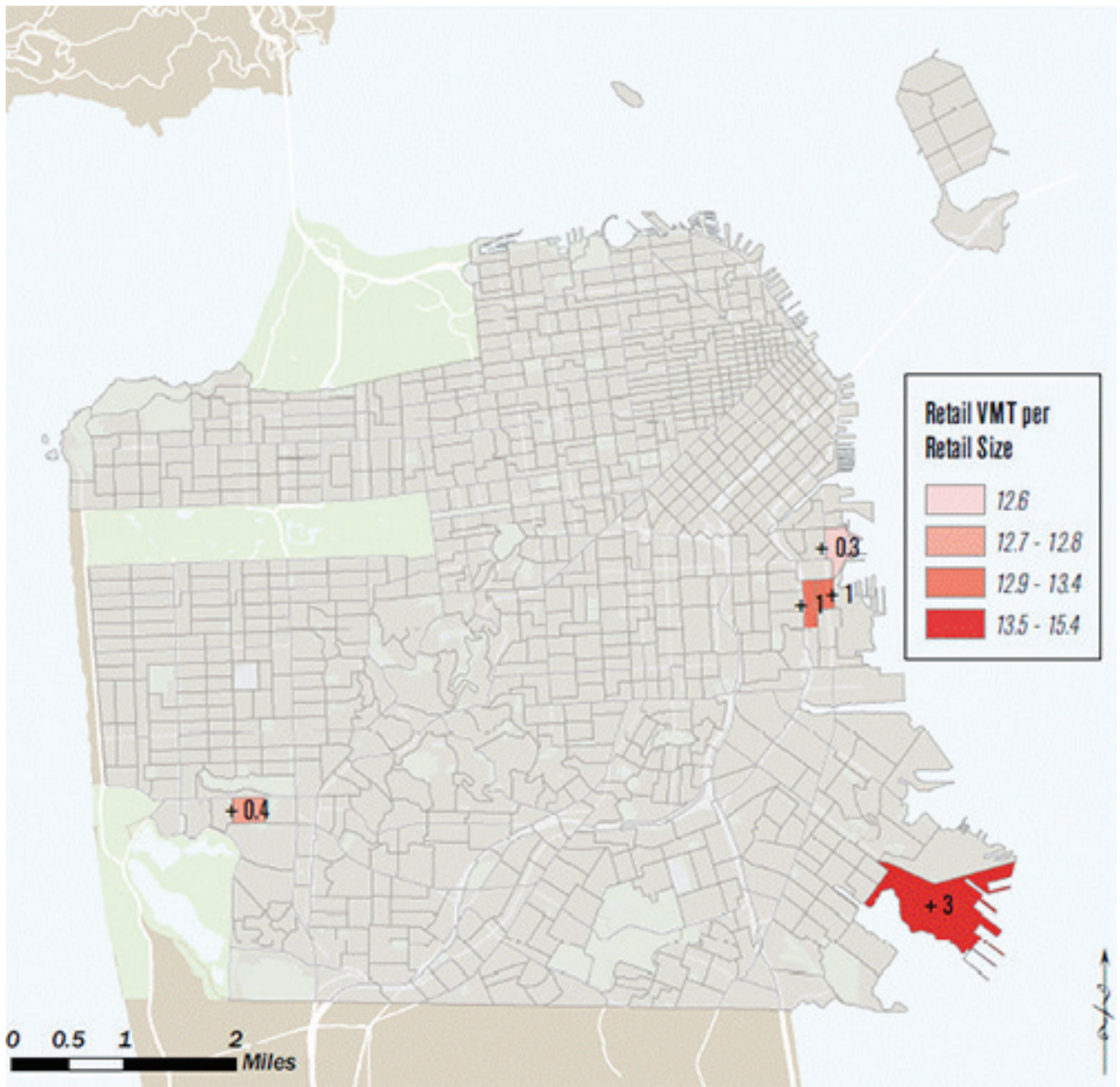


Figure 3. Retail VMT per capita in San Francisco. Courtesy San Francisco County Transportation Authority.

system and to make more informed decisions. LOS helps communities understand the localized performance of transportation facilities, while VMT helps them understand the efficiency of transporting people and goods from one place to another.

Safety

Safety is important to all communities and is a key consideration in a jurisdiction’s design decisions. In that sense it is not a new or emerging metric. However, it is becoming a greater priority in many jurisdictions, as evidenced through the emergence of “Vision Zero” policies in the U.S. [Vision Zero](#)

is a concept originally conceived in Sweden in the 1990s that aims to eliminate fatalities and serious injuries on the roadway system, with a particular focus on bicycle and pedestrian safety. Chicago, San Francisco, New York City, Boston, Los Angeles, and many other U.S. cities have recently introduced Vision Zero policies, and many more are considering such moves.

Examples of safety metrics include:

- Collision rates measured over time, perhaps with a goal of a particular degree of reduction in the rate
- Changes in the land-use context, or an increase in

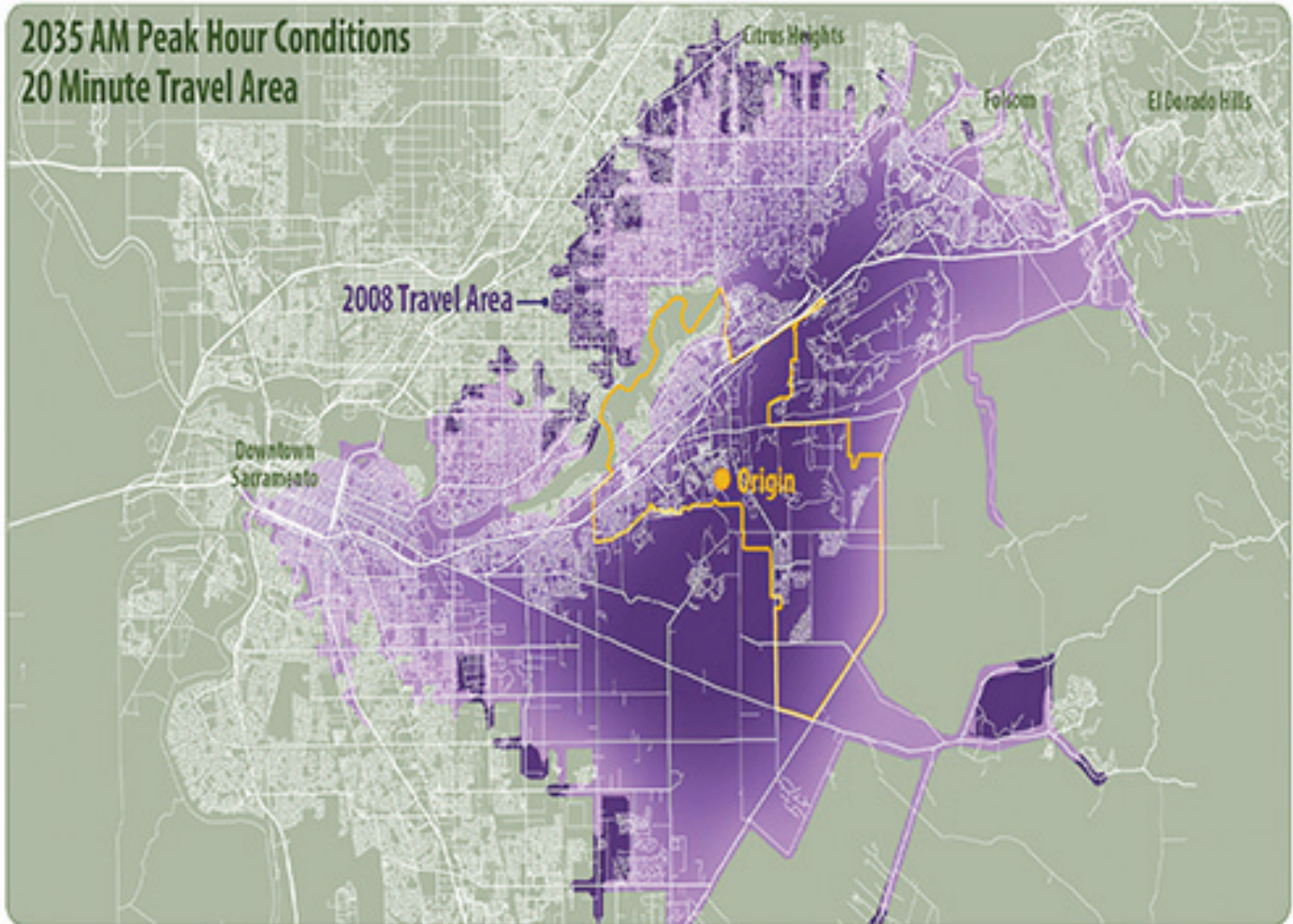


Figure 4. 20-minute travel area for a location in Sacramento, California. Courtesy Fehr & Peers.

trips, along a roadway such that the volume, mix, or speed of traffic was not anticipated as part of the original roadway design

- Changes in speed differentials between users or modes sharing the same facility, which contributes to collision potential
- Lengths of queues at freeway off-ramps, which may create unsafe conditions when they reach the freeway mainline

VMT can also serve as a proxy for safety based on research indicating the low VMT-generating areas that are designed for a pedestrian environment tend to have fewer and less severe collisions. The California Governor's Office of Planning and Research (OPR) has just released revised proposal for updates to the state's environmental laws with a detailed summary of VMT research related to safety (California Governor's Office of Planning and Research 2016).

Access vs. Mobility

When transportation planners think about moving people, they primarily consider two factors: accessibility and mobil-

ity. *Accessibility* in this context refers to the ability of people to reach destinations. *Mobility* refers to the relative ease with which people move through the transportation network, regardless of destination.

In terms of these factors, LOS is fundamentally a measure of mobility, designed to answer the question: How quickly does a vehicle move through a transportation facility, typically an intersection? And it makes sense that moving people with less congestion and delay tends to decrease overall travel times. But measuring mobility through measures of congestion such as LOS does not tell the full story about how much access people have to destinations. For example, is traveling two miles that include a single congested intersection with poor LOS worse than driving through 25 miles of uncongested freeway? Many commuters would prefer the former, with less overall travel time because the origin and destination are closer together, even though there is some congestion on the route.

Accessibility metrics are not as useful as exclusively evaluating transportation infrastructure projects, unless a detailed forecast of the associated land-use changes resulting from infrastructure investment is prepared simultaneously. For example, a new highway may serve to improve accessibility for

some trips; however, it could encourage growth to be further from a city center, increasing the length of trips, and ultimately decreasing accessibility. Figure 4 (p. 5) is one of several figures used in an accessibility study in the Sacramento, California, region showing how a given set of land-use and transportation changes would affect the area in which a traveler could access destinations within 20 minutes from a given origin.

Livability

Livability can mean a number of different things to different people and different communities. There is no single metric that captures “livability,” although the general concept is gaining momentum in transportation practice. Clearer definitions have evolved recently, such as the following from the Federal Highway Administration (2016):

Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safer streets and roads.

It will be up to each community to determine what qualities are important in their respective cases. As it relates to transportation, specifically, there is a wide range of criteria that could be identified. A few that have gained some traction recently include:

- **Level of Traffic Stress:** A methodology developed by the Mineta Transportation Institute at San Jose State University to evaluate how comfortable bicycling is in certain corridors (Mekuria 2012).
- **Walkscore:** An index that evaluates walking accessibility, the availability of transit and carsharing pods (where applicable), bikeability, and personal security (through crime statistics). These elements combine to formulate a score that can be compared to other locations. Some communities use Walkscore directly (www.walkscore.com) or have developed their own calculation methodology.
- **Public Health:** Many communities are viewing their transportation choices through the lens of public health. Personal security and safety are two key components of public health affected by the transportation system. And options that permit travelers to better move about using active modes, such as bicycling and walking, serve to encourage public health through exercise.

These are just a small handful of metrics related to livability that illustrate the wide range of values and priorities that communities may wish to measure.

Technical Considerations for New Metrics

One of the constraints for choosing new metrics is our technical ability to meaningfully and reliably forecast the effects of decisions. Further, sometimes we select metrics that are subjective and qualitative, which can lead to less transparency and controversy. Fortunately, the transportation industry has made

substantial progress toward improving its technical capabilities, opening up a wide range of new possibilities for how planners can measure performance.

Getting Trip Generation Right

Historically, transportation planners and engineers have used relatively static trip generation rates from the *Trip Generation* manual (Institute of Transportation Engineers 2012) or other local sources to forecast vehicle trips from new development projects. These rates are based on surveys conducted across the U.S., but are typically based on lower-density, suburban land uses, and most often are simply multiplied by the size of a particular development (such as square feet, number of employees, etc.). Those forecasts are then used to evaluate the impacts of new development, often resulting in a conclusion that traffic congestion will be worsened.

Under traditional approaches, projects that are higher density, mixed use, and located near high-quality transit service may be forecasted to have the same trip generation characteristics as those located in lower-density areas without access to transit. This represents somewhat of a bias against developments that may, in reality, have lower traffic generation. Fortunately, more recent research, such as that described in a previous [PAS Memo](#), (Walters, Bochner, and Ewing 2013) has presented evidence enabling us to quantify the effects of a number of additional variables, such as density, diversity of uses, distance to transit, and others (sometimes referred to as the 8Ds) in a way that produces much more accurate forecasts of travel behavior and eliminates the bias.

Quantifying Benefits of TDM

Whether focused on vehicle trip reduction to reduce congestion or lessen VMT, the interest in Transportation Demand Management (TDM) is growing. TDM is an umbrella term that encompasses a wide variety of physical and operational strategies that ultimately serve to better manage our transportation system. TDM measures can include such programmatic elements as enhanced wayfinding, real-time transit information, transit subsidies, and ride-matching services. TDM also includes physical elements aimed at reducing auto travel by generally making travel by other modes more convenient, such as lockers and showers to encourage bicycling, secure bike parking, shuttle services, and reductions in permitted auto parking.

Historically, each of these elements has been challenging to reliably quantify, either individually or in combination with each other, because the range of measures is so broad and their application has been somewhat inconsistent. However, as TDM has become a more essential part of managing growth, particularly in areas where there are constraints to expanding the transportation system, more studies have been conducted to identify TDM effectiveness. For example, the California Air Pollution Control Officers Association (CAPCOA) recently commissioned the study [Quantifying the Effects of Greenhouse Gas Mitigation Measures](#) (CAPCOA 2010) that examines the effectiveness of a wide variety of measures designed to reduce greenhouse gas emissions, including those associated with TDM.

The ability to more accurately forecast the efficacy of TDM measures allows cities to right-size requirements for new developments to achieve specific outcomes with a much higher level of confidence. Further, it allows a better understanding of travel demand, leading to better decisions about where to make investments in the transportation system.

Quick-Response Tools vs. Detailed Forecasting Models

Some of the metrics that communities may wish to evaluate,

such as VMT, can be best measured using complex travel demand forecasting or microsimulation models. While these tools are certainly useful to measure and forecast system performance, they can be cost-prohibitive to develop and not efficient for smaller applications or for quick-response scenario testing.

Fortunately use of alternative metrics that better reflect a community's values does not necessarily require substantial investment in new, complex tools. There are a number of "sketch model"

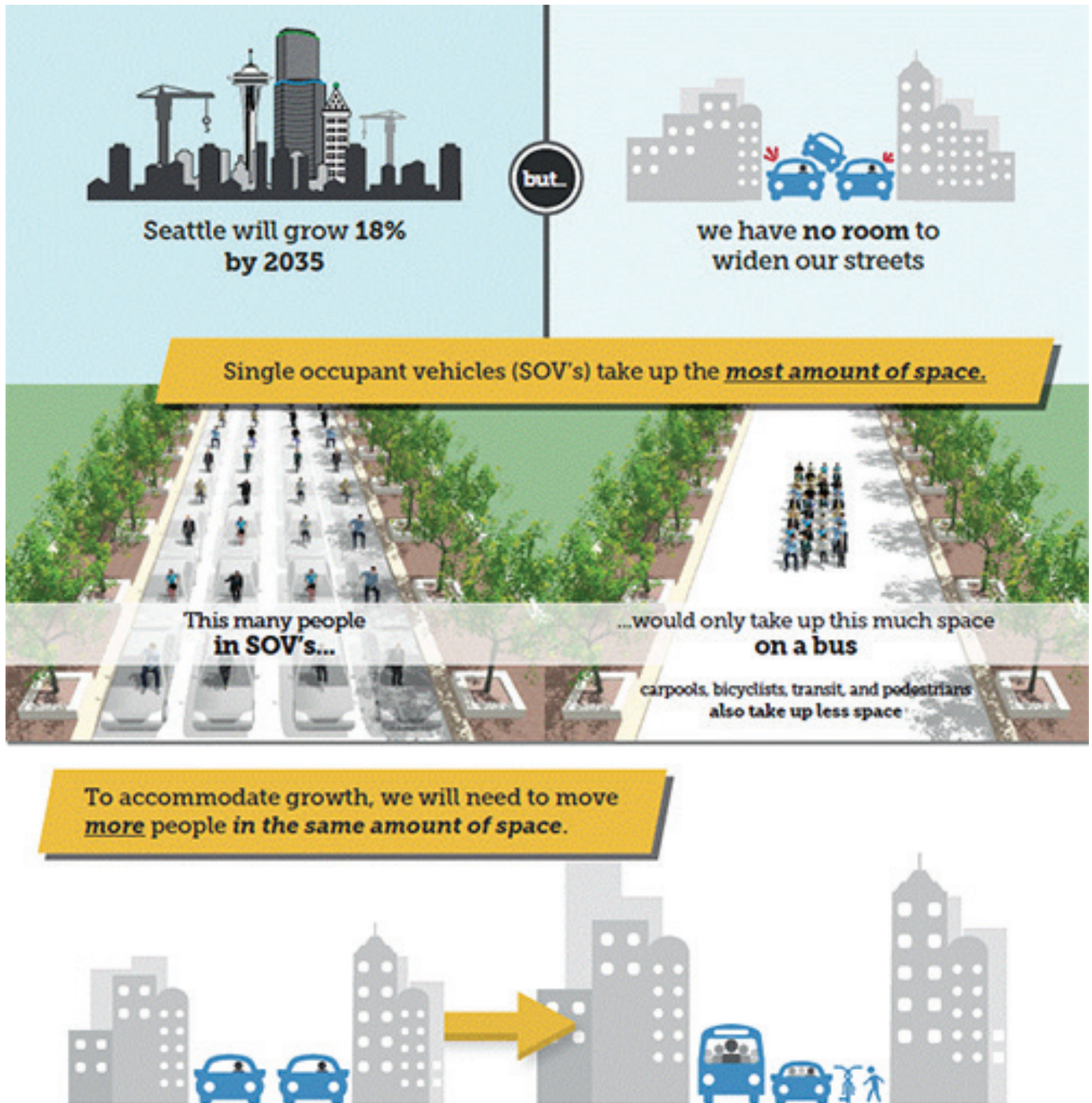


Figure 5. Seattle 2035: Challenges of Accommodating Growth in Limited Space. Courtesy City of Seattle.

tools on the market that use survey data to quickly give a rough estimate of a number of metrics, such as trip generation, mode share, and trip length/VMT. Examples include [CalEEMod](#), [Urban Footprint](#), and the [ASAP Platform](#). These sorts of quick-response tools are quite valuable for scenario development and comparison, where a relative comparison is most appropriate.

Case Studies

Several communities have begun to either shift away from LOS altogether as a primary transportation metric or have added other metrics that reflect other priorities, changing the way land use and transportation planning is evaluated. Below are three case studies from the West Coast.

Seattle

The City of Seattle is revising its transportation LOS standard to be based on single occupancy vehicle (SOV) mode share rather than intersection delay. Seattle is experiencing very rapid growth. The city has determined that widening arterials is not a practical way of accommodating growth in a mature urban environment. Furthermore, it is not consistent with the overall goals of the comprehensive plan, [Seattle 2035](#), which calls for using the current street right-of-way as efficiently as possible by encouraging forms of travel other than SOV.

The proposal to use mode share as a new way of measuring system performance directly ties to this policy goal, as it focuses on reducing travel that uses the least space-efficient mode. By shifting travel from SOVs to more efficient modes operating on less-congested transportation networks, Seattle is allowing more people to travel in the same amount of space. Figure 5 (p. 7) illustrates the relationship between forecasted growth in the city, the associated increases in travel demand, and the space requirements for different modes of travel that might be needed to accommodate that increased demand.

Seattle’s overall strategy of setting future mode-share targets is based on the idea that the city has finite capacity to accommodate growth in SOV travel. The city’s system can accommodate the number of SOV trips occurring today,

but future growth in SOV travel must be limited to maintain reasonable citywide mobility. This is an important concept because Americans tend to drive large vehicles, much larger in fact than needed to carry a single driver or even a driver and passenger. As demand for road space increases, cities will be faced with making tradeoff decisions about how best to utilize their rights-of-way based on the efficiency of the vehicle type.

Seattle 2035 establishes a standard for allowable SOV trips in the city by setting SOV mode-share targets by geographic sector. These SOV mode-share trip caps serve as a quantitative basis to measure whether the city is meeting its goals, much as the city’s volume-to-capacity-based LOS thresholds do today.

Shifting travel from SOVs to more space-efficient modes would expand the transportation capacity of the current system without necessarily increasing the vehicular capacity. To quantify this capacity increase, each of the following modes were compared to an SOV in terms of how much less space would be required:

- **Carpools** – Using the Puget Sound Regional Council’s estimate that the average carpool carries 2.2 people, the city estimated that carpools take up 55 percent less space than an SOV per person trip.
- **Bicyclists** – Using a very conservative assumption that bicycles are roughly one-quarter of the size of a car and only one-quarter of cyclists are using arterial travel lanes (the rest are using existing exclusive facilities, including trails, cycle tracks, and bike lanes or quiet residential streets and greenways), a bicyclist uses an estimated 93 percent less space per person trip.
- **Transit** – Based on an estimate that an SOV requires approximately 180 square feet per person, and each bus requires five square feet of space per passenger (Transportation Research Board 2013), the city estimated that transit requires roughly 97 percent less space per person trip than an SOV.
- **Walking** – Because most pedestrian travel occurs outside of arterial travel lanes in existing sidewalks, the city’s process assumes that pedestrian travel takes 99.9 per-

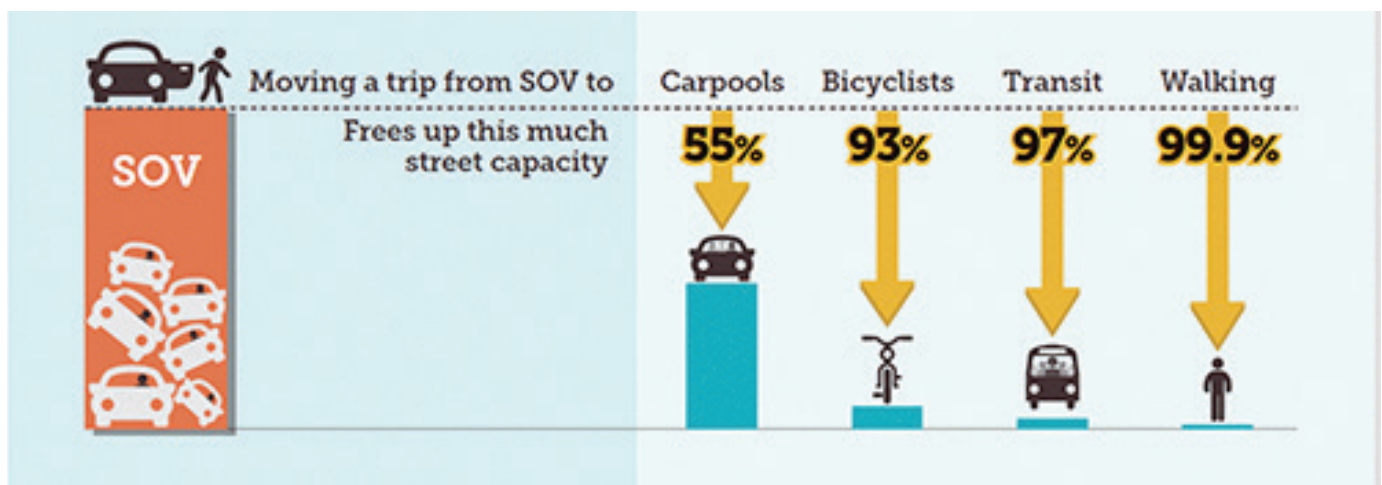


Figure 6. *Seattle 2035: Space Consumption by Mode.* Courtesy City of Seattle.



Figure 7. San Francisco's transportation sustainability program. Courtesy City and County of San Francisco.

cent less space per person trip. (The city does acknowledge that additional pedestrian travel may result in lower capacity for turning vehicles or slightly narrower travel lanes where sidewalks are widened — spread across the entire city, most additional pedestrian travel would have no discernable reduction in street capacity).

Figure 6 (p. 8) summarizes these assumptions and illustrates how lowering the SOV mode share will help the city maintain accessibility and mobility in the future with increased demand but without substantially widening roadways.

San Francisco

Much like Seattle, the City of San Francisco is experiencing rapid growth. With limited ability to increase roadway capacity for SOVs, the city embarked upon a project to study how to improve the overall efficiency of its transportation system to accommodate expected growth.

Until early 2016, San Francisco used intersection LOS as the primary metric by which it evaluated the performance of roadways. (It also considered transit volume-to-capacity ratios at

key locations, and on a qualitative level, bicycle and pedestrian circulation as well). However, for reasons outlined above and in response to California's switch toward requiring VMT assessment for environmental review, the city sought to identify a process that better aligned with its existing policies aimed at decreasing auto mode share and improving the bicycle and pedestrian realm. The resulting [Transportation Sustainability Program](#) offers a three-pronged approach toward rethinking transportation planning (Figure 7).

Invest: Enhance Transportation to Support Growth. Whichever modes are to accommodate the increased transportation demand in San Francisco, it is clear that a substantial investment in new infrastructure will be necessary. The city determined what level of increases in transit, cycling, and walking would be required to accommodate the majority of growth in transportation demand, and what level of investment would be required to construct and maintain new facilities. It then adopted a Transit Sustainability Fee, which applies to new development in San Francisco, to fund the required investment. Funded projects will increase capacity through new infrastructure, improve efficiency on existing transportation infrastructure, and provide

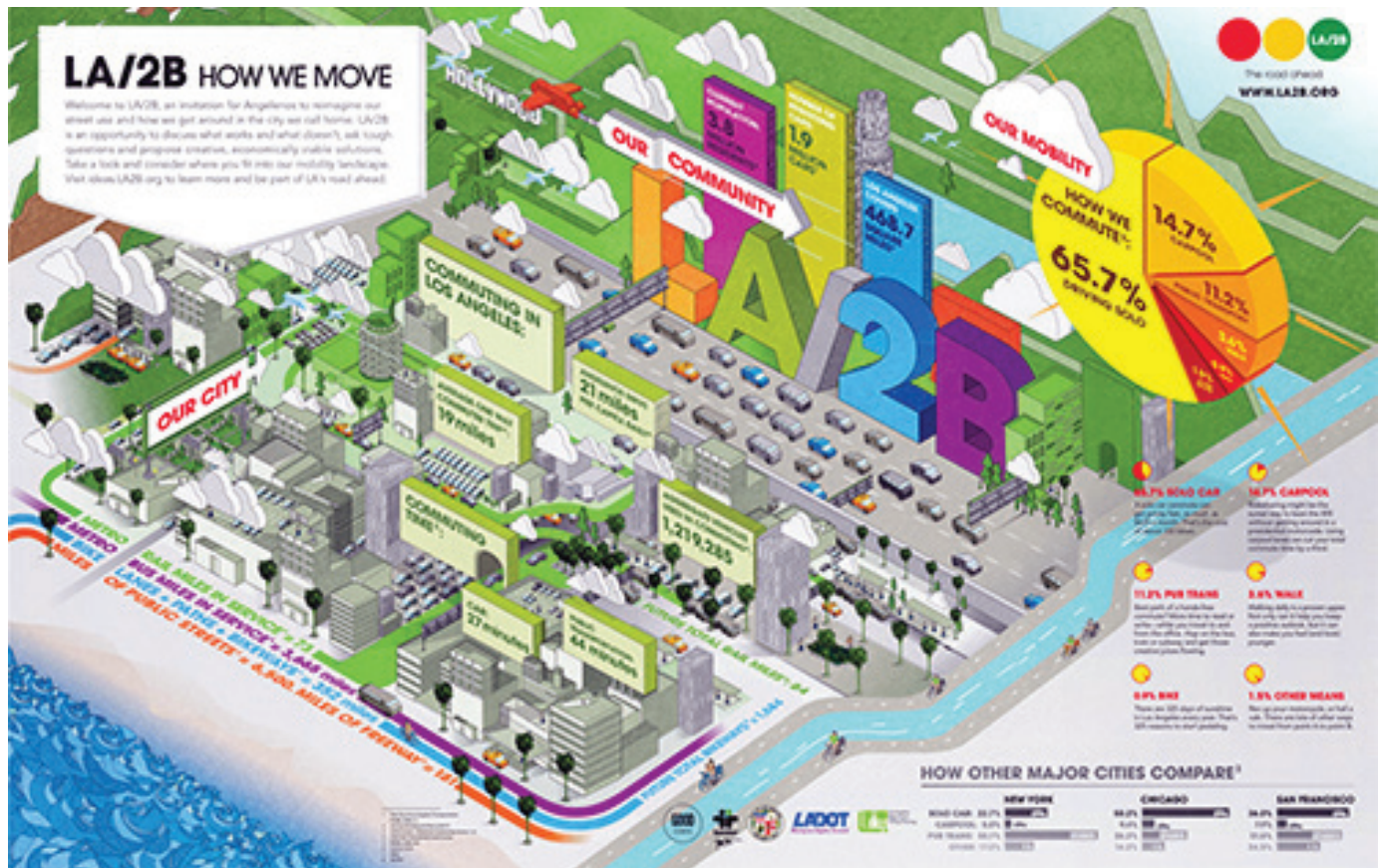


Figure 8. Los Angeles Mobility Plan 2035. Courtesy Los Angeles Department of City Planning.

a contribution to regional transit, which is essential to San Francisco’s vitality.

Align: Modernize Environmental Review. The city recognized the inherent disconnect between its use of LOS to assess transportation impacts and a number of adopted policies that support transit and building at higher densities. After exploring a number of potential alternative metrics, the city settled on VMT per capita as a metric to assess impacts of new development. The city now requires that new development demonstrate that it would generate at least 15 percent less VMT per capita than the existing citywide VMT per capita for a given land-use type, measured using the city’s travel demand model. This new metric encourages development in transit-rich areas and supports higher densities that encourage walking and bicycling.

Shift: Encourage Sustainable Travel. The third component of the Transportation Sustainability Project is based on San Francisco’s desire to ensure effective TDM measures are core to each project. For those projects that don’t meet the 15 percent threshold described above, the city’s environmental review process will now call for use of TDM as mitigation to reduce VMT within the threshold. Further, for all projects (even those that do meet the 15 percent reduction threshold), the city has adopted a new TDM ordinance that outlines a menu of TDM measures and an associated number of points (loosely based on the efficacy of each measure at reducing VMT). Based on a proposed development project’s proposed parking supply, the

city’s ordinance will assign a number of points that much be achieved through TDM, and the development will be required to demonstrate that it is including adequate TDM to meet the target set forth by the city.

Los Angeles

In a substantial shift away from its 20th century autocentric reputation, Los Angeles is in the process of overhauling its transportation engine to reflect changing community interests and comply with statewide environmental goals. Building on one of the largest transit expansion programs in the country led by LA Metro, the City of Los Angeles reimagined its 15-year-old Transportation Element and created a new [Mobility Plan for 2035](#), also known as LA/2B (Figure 8), to better match the needs and values of a diverse and changing population.

The goals developed for the MP 2035 reflect changing attitudes revealed in a broad outreach and community engagement campaign as well as statewide shifts in legislation around complete streets and climate change. Community goals include:

- Safety First
- World Class Infrastructure
- Access for All Angelenos
- Collaboration, Communication, and Informed Choices
- Clean Environments and Healthy Communities

Table 2. Mobility Plan 2035 Performance Metrics

Performance Metric	Desired Change
Mode Share	Any increase in the peak-period auto mode share would be an undesirable outcome
Transit Boardings	Any increase in the number of daily transit boardings would be a desirable outcome
Vehicle Trips	Any increase in the number of daily vehicle trips would be an undesirable outcome
Vehicle Miles Traveled	Any increase in the total number of vehicle miles traveled citywide would be an undesirable outcome
Vehicle Hours Traveled	Any increase in the total number of vehicle hours traveled citywide would be an undesirable outcome
Accessibility	Any increase in the percent of the city's total population or employment within one-quarter mile of the Bicycle Enhanced Network would be a desirable outcome
	Any increase in the percent of the city's total population or employment within one-quarter mile of the Transit Enhanced Network would be a desirable outcome

Source: *Mobility Plan 2035, Los Angeles Department of City Planning.*

In response to these new goals, the city recognized the need to change both project evaluation metrics and design standards to achieve the desired outcomes, especially around safety, health, and access goals.

Building on the existing transportation system and overarching goals, the Mobility Plan 2035 established a series of “enhanced networks” to achieve the city’s transportation objectives and better connect people walking, cycling, and riding transit. The networks consist of transit, bicycle, and vehicle priority corridors as well as neighborhood and pedestrian street enhancements that prioritize design and operating elements to best serve a particular travel mode. Layered together, they create a complete network of options for any mode of travel throughout the city.

In the environmental review process, analysis was completed using the existing LOS metrics as well as a series of additional performance metrics related to the plan’s vision (Table 2) to better reflect the spectrum of community values.

These metrics allowed the city to quantify the benefits associated with the expanded multimodal networks and describe the expected changes in mode share, vehicle travel, and multimodal accessibility.

Additionally, the resulting [Complete Streets Design Guide](#) provides a compilation of design concepts and best practices that promote the major tenets of Complete Streets — safety and accessibility. A key innovation in this effort is a shift to design for the “target operating speed” for drivers, not the prevailing or observed speeds, which can work against safety goals for vulnerable roadway users. Ranging from 35 mph for boulevards (previously major arterials) down to five mph for alleys and shared streets, each street designation includes cross

section options as well as context-related modifications to the desired operating speed.

Action Steps for Planners

Given changing priorities in many communities and the availability of new data sources and technical tools, many planners are rethinking how they measure the performance of the transportation system. Here are a few tips for finding the best metric for your community.

1. Define community values and recognize trade-offs

Public agencies need goals and objectives that are derived from their community values (i.e., what to avoid, what to protect, what to create, etc.). These goals and objectives should be clearly defined and articulated through their general plans or comprehensive plans. However, when faced with real-world questions, decision makers may discover that some of their well-intentioned goals may compete or conflict. This is not a failure in goal-setting; planning cities is a complex effort. Communities who recognize and acknowledge potential tensions or competing interests in their goals will find it much easier to develop a roadmap for decision makers that reflects public input as to how to resolve those tensions. In the end, tradeoffs need to be recognized and priorities established.

2. Prioritize community values

Once tradeoffs are understood, communities should outline priorities reflecting the relative importance of various values. For example, some communities have identified a goal of reducing traffic congestion and goals supporting an improved pedestrian environment. As noted earlier, projects that increase

roadway capacity through widening may degrade the pedestrian environment by increasing pedestrian exposure at intersections, so these goals may be in conflict.

In this example, a community may determine that in certain areas, such as commercial centers, the pedestrian environment should not be compromised to improve traffic flow, but in others, like industrial and warehousing zones, traffic flow and ease of goods movement is a higher priority than a generous sidewalk. Communities that undertake a public and transparent process to prioritize competing interests will have an easier time implementing their plans and measuring their progress.

3. Develop metrics that reflect community values

Given the breadth of new tools and data now available, planners can be much more creative in measuring transportation system performance. New types of data, including satellite imagery, GIS databases, and GPS data; a wealth of new technology to apply that data; and a growing body of research on travel behavior allows planners to measure and predict the effects of community choices on achieving stated goals.

Communities that have clearly articulated goals will have a much easier time developing metrics that support those goals, and will not necessarily have to rely on traditional metrics that may not necessarily reflect their values. Although many communities will certainly find value in traditional metrics, such as LOS, a complete listing of all community values and priorities may allow communities to supplement those traditional metrics with new, creative measures of effectiveness.

4. Measure Performance Regularly

Once a community has defined its goals, identified a road-map for resolving competing interests, and determined what it wants to measure, the last step is to implement a rigorous and regular process to measure and report on performance. This includes routine measurement, such as an annual report, as well as an evaluation of how various choices (e.g., land use decisions, transportation investment, etc.) would influence the community's ability to achieve its goals as part of the decision-making process.

Conclusion

Many communities have found that overreliance on traditional metrics such as LOS has created undesirable secondary effects, such as promoting sprawl and degradation of the pedestrian environment. Several of these communities have developed innovative approaches through use of different metrics to better capture the breadth of values in their community, including, but not exclusively, traffic congestion.

As planners, helping our communities clearly articulate their goals and values and measuring performance against those goals with a full understanding of the trade-offs will help us all plan for and live in communities that are shaped to our needs.

About the Authors

Chris Mitchell, PE, is a principal with Fehr & Peers in San Francisco. Since joining Fehr & Peers in 2000, he has worked on a wide variety of transportation-related projects, including specific area plans, environmental impact reports, various micro-simulation and traffic operational studies, and site transportation impact analyses. He specializes in planning for and environmental review of some of California's most complex, high-profile, and controversial development and transportation projects.

Ronald T. Milam, AICP, PTP is the technical director for Fehr & Peers. He is actively involved in a wide variety of project work but also finds time to lead the firm's research and development efforts, teach courses for the U.C. Davis Extension program on transportation planning and California's Senate Bill 743 implementation. Milam has an extensive background in travel demand model development and applications, traffic operations analysis, micro-simulation modeling, and transportation impact studies involving NEPA and CEQA. He has also published papers on a wide variety of transportation planning and traffic engineering topics and received recognition for his work that includes the Institute of Transportation Engineers' National Past President's Award and best paper honors at the Transportation Research Board Conference on Planning Applications. He is currently assisting Caltrans in the development of new transportation analysis guidelines and transportation impact study guidelines.

References and Resources

American Association of State Highway and Transportation Officials (AASHTO). 2011. *A Policy on Geometric Design of Highways and Streets*. 6th Edition, 5-3. Washington, D.C.: AASHTO. https://bookstore.transportation.org/collection_detail.aspx?ID=110

California Air Pollution Control Officers Association (CAPCOA). 2010. *Quantifying the Effects of Greenhouse Gas Mitigation Measures*. Sacramento: CAPCOA. www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

California Air Pollution Control Officers Association (CAPCOA). N.d. "California Emissions Estimator Model™ (CalEEMod)." <http://caleemod.com/>

California Governor's Office of Planning and Research (OPR). 2016. *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA*. Sacramento: Governor's Office of Planning and Research. www.opr.ca.gov/docs/Revised_VMT_CEQA_Guidelines_Proposal_January_20_2016.pdf

Calthorpe Analytics. N.d. "Software for Sustainable Decision-Making: Urban Footprint." <http://calthorpeanalytics.com/index.html#software>

Ewing, Reid, and Eric Dumbaugh. 2009. "The Built Environment and Traffic Safety — A Review of Empirical Evidence." *Journal of Planning Literature* 23(4).

Federal Highway Administration. 2016. "Livability Initiative." www.fhwa.dot.gov/livability

Fehr & Peers. "ASAP Platform." <http://asap.fehrandpeers.com>

Institute of Transportation Engineers. 2012. *Trip Generation, 9th Edition*. Washington, D.C.: ITE. www.ite.org/tripgeneration/trippubs.asp

Los Angeles (California), City of. 2015. *Complete Streets Design Guide*. https://losangeles2b.files.wordpress.com/2015/05/2015_csdg_web-4-22.pdf

Los Angeles (California), City of, Department of City Planning. 2015. *Mobility Plan 2035: An Element of the General Plan*. <http://planning.lacity.org/documents/policy/mobilityplmemo.pdf>

Mekuria, Maaza. 2012. *Low-Stress Bicycling and Network Connectivity*. San Jose: Mineta Transportation Institute, San Jose State University. <http://transweb.sjsu.edu/project/1005.html>

San Francisco (California) City and County of, Planning Department. n.d. "Transportation Sustainability Program." <http://sf-planning.org/transportation-sustainability-program>

San Francisco County Transportation Authority (SFCTA). 2016. "Memorandum: Quantification of Impacts Under CEQA Following New Guidelines from the Governor's Office of Planning and Research." Prepared by Michael Schwartz and Drew Cooper, February 25. Appendix A of Attachment F in *Resolution Modifying Transportation Analysis*, San Francisco Planning Department, March 3, 2016. http://commissions.sfplanning.org/cpcpackets/Align-CPC%20exec%20summary_20160303_Final.pdf

Seattle (Washington), City of. 2016. "Seattle 2035." <http://2035.seattle.gov/>

Sweden, Government Offices of. "Vision Zero: Traffic Safety by Sweden." www.visionzeroinitiative.com/

Transportation Research Board (TRB). 2013. *Transit Capacity and Quality of Service Manual*. 3rd Edition. Washington, D.C.: TRB. www.trb.org/Main/Blurbs/169437.aspx

Walkscore. 2016. www.walkscore.com

Walters, Jerry, Brian Bochner, and Reid Ewing. 2013. "Getting Trip Generation Right: Eliminating the Bias Against Mixed Use Development," *PAS Memo*, May/June. www.planning.org/pas/memo/2013/may/

Copyright © Fehr & Peers 2016. All Rights Reserved. PAS Memo (ISSN 2169-1908) is published by the American Planning Association, 205 N. Michigan Ave., Ste. 1200, Chicago, IL 60601.

PAS Memo is the bimonthly online publication of APA's Planning Advisory Service, a subscription service providing members with the latest planning resources and customized research assistance; learn more at www.planning.org/pas.

City of Elk Grove General Plan Update

A. Introduction of Draft Mobility Policies and Process



Introduction

The State is preparing changes to the California Environmental Quality Act (CEQA) that shift the analysis for transportation impacts from the existing standards of vehicle delay (measured as level of service, or LOS) to a metric that looks at the effect on the natural environment and more closely aligns with other recent changes in CEQA, such as impacts to air quality and greenhouse gases. In the most recent draft guidelines for implementation of Senate Bill (SB) 743 published by the State¹ (which the State has indicated closely reflect the final version that will be adopted), vehicle miles traveled (VMT) has been identified as the preferred metric for this analysis. VMT is directly linked to both greenhouse gas emissions analysis and criteria air pollutant analysis for emissions sources within the transportation sector. Reducing community-wide VMT thus represents an important component toward greenhouse gas reduction objectives identified at the State, regional, and local levels.

Reducing VMT can typically be accomplished in new development projects by placing opportunities to live and work within close proximity, efficient layout of land uses and structures, promoting transportation demand management techniques, and building effective alternative transportation infrastructure. New development projects that provide integrated land uses that meet housing, employment, and service needs allow multiple trip types to be satisfied locally, as opposed to requiring travel outside the neighborhood or City. Designing future projects to meet these characteristics is a key strategy to reduce VMT.

At the August 25, 2016, study session on the General Plan update, staff presented the topic of VMT and a number of implementation ideas. Specific within this presentation was the concept of eliminating LOS review for future projects. After discussion by the Council and Planning Commission, staff received direction to maintain LOS standards in the General Plan and include them as part of future development project analysis. The intent of this direction, as identified by the Council, was that an efficient vehicular transportation system was important to the community, provided the improvements were designed respective of the site context and character. Having further analyzed this issue, planning and legal staff have concluded that retaining LOS presents CEQA compliance concerns by setting a threshold that may be viewed as inconsistent with the new VMT standard. Therefore, staff is recommending an alternative process to ensuring roadway efficiency and safety without using LOS.

The updated General Plan will include two separate, but related, transportation policies – a VMT policy that establishes limits to be used as significance thresholds for CEQA analysis of future projects; and a roadway operations policy that promotes an efficient vehicular transportation system that reflects local context. VMT analysis will be included as part of future CEQA documents (negative declarations,

¹ Draft dated January 20, 2016

environmental impact reports). Roadway operations analysis will also be considered and could impact project design and environmental considerations.

Proposed General Plan Policies

Staff proposes that within the General Plan, the City establish a series of VMT-based transportation performance measures. These have been drafted to align with State legislation and guidelines and to implement the community's overall mobility vision. As drafted, the General Plan would establish VMT performance metrics and VMT limits for the community as a whole, for various types of land uses, and for each of the Study Areas beyond the existing (2017) City limits. These limits are designed to reduce community-wide VMT. The following are the established limits and rules:

- VMT limits by land use designation are 15% below a 2015 baseline per service population for that land use type.
- The Citywide VMT limits require land use projects in accumulation and build-out to not exceed 2015 baseline conditions.
- The Study Area VMT limits require land use projects to achieve a VMT level 15% below the baseline (2015).
- The VMT limits require transportation projects to be consistent with regional plans and not exceed the project's baseline VMT in the short-term.

While VMT has historically increased with the addition of new residents, a reduction in VMT can be achieved through a diverse land use mix that includes both employment and service uses, allowing residents to meet daily needs within a short distance of home. This reduces trip lengths, and provides improved access to alternative transportation modes (e.g., pedestrian, bicycle, transit).

As described below, discretionary development proposals will be screened by project type, size and location. Certain projects that do not meet size and location criteria may require further evaluation, and VMT reduction measures may be imposed.

Concurrent with the VMT policy, the draft Mobility policies also include a new roadway operations policy with the following two parts:

1. For roadway segments, an "Average Daily Traffic Design Target" is identified. This target describes the general targeted capacity for various types of roadway segments, based upon their lane configuration and design characteristics (design speed, access control). Based upon Average Daily Traffic projections and design characteristics of a given roadway, the target lane configuration would be selected. This data is based upon criteria in the Highway Design Manual and follows engineering best practices.
2. For roadway intersections, the City would establish a series of Design Considerations. Basically, these are concepts/evaluation metrics that provide an analysis of the operations of an intersection. For instance, it would look at pedestrian safety/crossing time, bicycle comfort, queue lengths in turn pockets, and other operational aspects.

VMT Implementation and Analysis Process

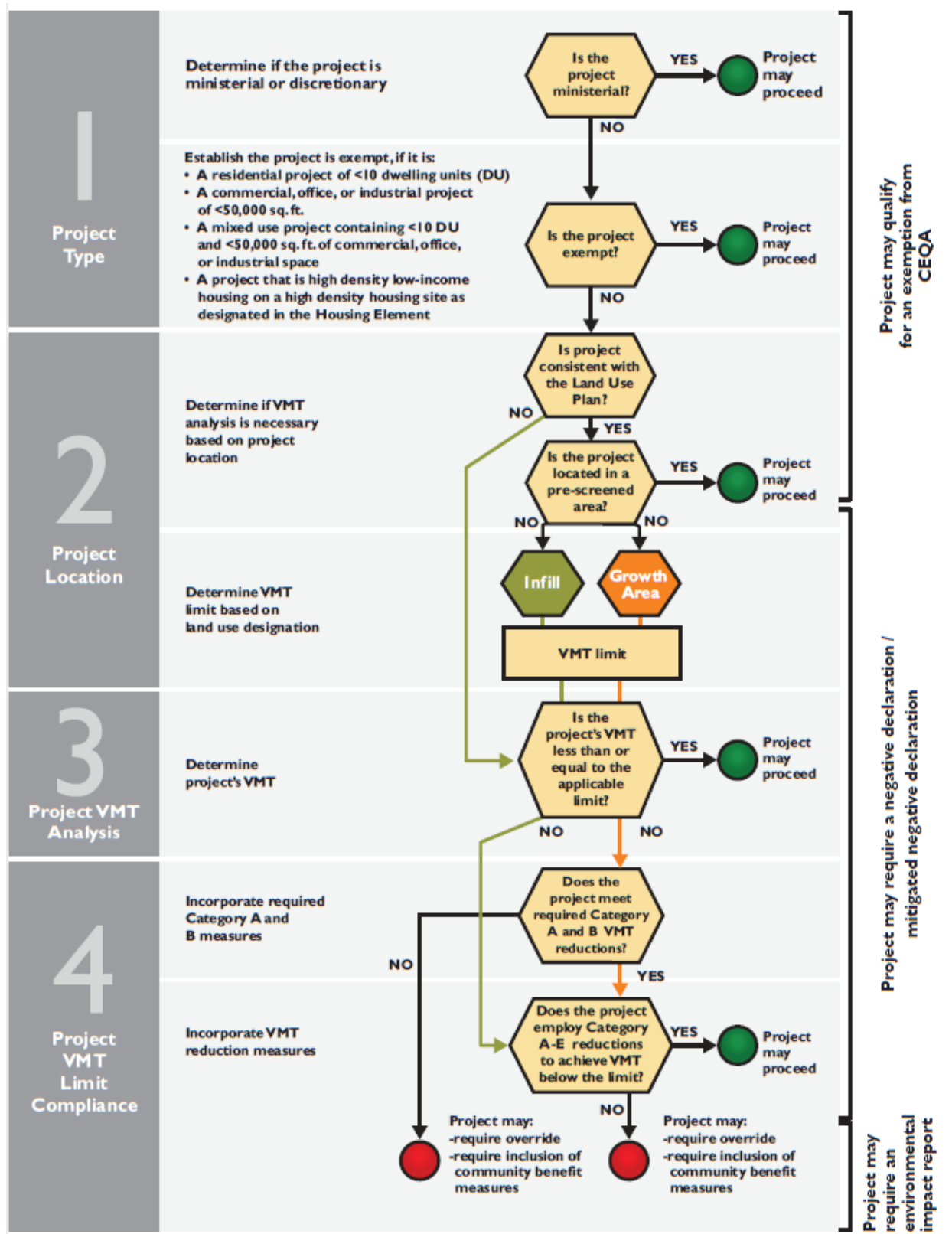
The implementation and enforcement of the VMT policies follows a different process for land use development projects and for transportation projects, as described below. Transportation projects, by

their nature, pose different VMT questions than land use projects and the VMT policy and the draft Transportation Analysis Guidelines recognize this difference.

Land Use Projects

VMT analysis for land use projects utilizes a four-step process, as shown in **Figure 1**. Simpler projects or projects with below-limit VMT will have fewer required steps, or could be considered exempt. The process for calculating and determining VMT impacts is documented in the draft Transportation Analysis Guidelines, which will ultimately replace the existing Traffic Impact Study Guidelines as part of the General Plan update.

Figure 1: Land use project VMT analysis process



The first step in the VMT analysis process is determining if the project is exempt. Ministerial projects are exempt from this process as they are exempt from CEQA.

Project scale plays a role in understanding the VMT impacts of a project. Consistent with the State's guidance, projects that are below the following thresholds and are consistent with the General Plan Land Use Plan are exempt from further analysis as the number of trips generated by these types of projects would be relatively few. Therefore, the VMT generated by these projects would be low and would not produce a substantial change in VMT.

- A residential project of less than 10 dwelling units, or
- A commercial, office, or industrial project of less than 50,000 sq. ft.

Projects with a mix of dwelling units and non-residential space are exempt only if both components meet the criteria above.

Projects that propose including high density lower-income housing on high density housing sites as designated within the housing element are also exempt from additional VMT analysis. Incorporating lower-income housing in a development project typically generates low VMT, and is identified as a potential measure to reduce VMT in the Office of Planning and Research (OPR) guidelines. Because lower-income housing is a low VMT producer (due to the nature of the travel patterns of these residents) and the City wishes to facilitate its production through streamlined permit processes, it is appropriate to exclude these kinds of projects from VMT analysis.

The next step for a land use project is to determine consistency between the project and the General Plan Land Use Plan. Projects that are inconsistent with the Land Use Plan are automatically considered inconsistent with the VMT policy and shall conduct a VMT analysis. In these cases VMT analysis should compare proposed land uses against existing conditions as well as against the adopted land uses in the Land Use Plan. A general plan amendment may be required. Projects that are consistent with the Land Plan move to the next step.

Next occurs an analysis of the project's VMT limits based on the project location. Some areas of the City already perform at a VMT level sufficiently below the reduction target such that adding new land uses, consistent with the Land Plan, would not result in VMT above the overall reduction target. As a result, infill projects in some areas may require less stringent analysis and reduction requirements than those in other areas with higher projected VMT. These location determinations would be based on a screening map prepared by the City and incorporated into the Transportation Analysis Guidelines (a draft of the current version of this map is included in the Transportation Analysis Guidelines for review). If a project is located within the designated areas and is consistent with the Land Use Plan, it would be exempt from further analysis. Based on ongoing monitoring, this map may be updated over time as land use and circulation patterns in Elk Grove change based on implementation of the General Plan. This is why the map is included in the Guidelines rather than in the General Plan.

If a project does not meet any of the above exemptions and cannot be pre-screened, a project-specific transportation analysis is required. Under this analysis, the project must show consistency with two specific VMT limits. The first is relative to the underlying General Plan land use designation. These limits were developed based on a 15% reduction from the daily VMT produced by parcels within each land use in the City in the 2015 base year. Base year VMT results will be documented in the General Plan Appendix as well as the accompanying environmental impact report (EIR). Once a project reaches this

step, its projected build-out VMT must be compared to the underlying land use designation limit. If the project's projected VMT is equal to or below the limit, it need not implement any VMT reduction measures.

If a project's VMT analysis indicates it exceeds the relevant limit, VMT reduction strategies must be identified. The City has identified several different categories of acceptable reduction strategies, which are documented in the Transportation Analysis Guidelines and discussed further below. These strategies may be updated based on need and effectiveness, which is why they are included in the Guidelines and not the General Plan. Strategies that provide reductions by optimizing project location and types of planned land uses are prioritized as a way of ensuring that the applied mitigation promotes the overall objectives of the updated General Plan.

If a project is able through application of approved VMT reduction strategies to reduce VMT below or equal to the applicable limits, it may proceed. Projects that cannot achieve VMT reductions to levels at or below the limit may be found to have significant and unavoidable transportation impacts under CEQA. Consistent with CEQA, the City may override these impacts provided some other form of community benefit is achieved by the project (see State CEQA Guidelines section 15093(a)).

Options to Reduce VMT

VMT reductions can be accomplished by optimizing the location and types of land uses in the project and its immediate vicinity and through site enhancements to roads as well as bike and pedestrian networks to encourage the use of alternative transportation modes. Mode shifts are also encouraged by implementing parking policies, transit system improvements, and trip reduction coordination or incentive programs. As detailed in the Transportation Analysis Guidelines, VMT reduction strategies are addressed in five categories:

- A. Land use/location strategies
- B. Site enhancement strategies
- C. Transit system improvement strategies
- D. Commute trip reduction strategies
- E. In-lieu fee

Under the proposed draft, the City would require that new development projects that are not infill projects first exercise all VMT reductions possible through project location and proposed land use mix and site enhancement strategies (Category A and Category B) within the project and in the immediate vicinity. Once those opportunities have been exhausted, these projects can utilize reductions in the remaining four categories (Categories C through E). Specifically, in-lieu fees and transportation demand management (TDM) programs represent appropriate reduction strategies. TDM measures can promote, for example, carpooling, vanpooling, telecommuting, transit, bicycle, flexible work hours, compressed workweeks, and parking policies/pricing structures. The VMT reduction options available in each category are detailed in the City's Transportation Analysis Guidelines.

The most effective way to achieve VMT reductions in new development areas is through master planning (e.g., specific plans, community plans). This approach enables comprehensive analysis of a range of land uses that can effectively interact and achieve VMT reductions holistically.

Baseline and VMT Calculation

The City has used regional models, including Urban Footprint and the SACMET travel demand model, to estimate VMT produced in 2015 (the latest year for which data is available) throughout the community. Based on these results, the City determined average VMT produced per service population within each land use designation. **Table 1** (which will be incorporated into the General Plan) identifies 2015 VMT levels, which will be used as the baseline for the City’s VMT target limits.

Staff has selected the VMT per service population methodology because it uses an allocation system to look at daily residential and worker VMT. First, daily home-based residential VMT per capita is calculated. This looks at all home-based auto vehicle trips, traced back to the residence of the trip-maker, including home-based work, home-based other, home-based school, and home-based shopping trips. Non-home-based trips are excluded.

Next, the home-based worker VMT per worker is calculated. This looks at all vehicle trips between home and work. Commercial vehicle trips (e.g., delivery trucks) are excluded from the analysis.

The following illustrates how this calculation is completed:

Allocation Method					
Input	Quantity	VMT	Home-Based Portion of VMT	VMT/Input	Description
Population	100	1,000	500	5.0	<--- Daily Home-Based Residential VMT per Capita
Employment	1,000	20,000	10,000	10.0	<--- Daily Home-Based Work VMT per Worker
Population and Employment	1,010	21,000	10,500	10.4	<--- Daily Home-Based Residential and Work VMT per Worker

$500/100 = 5.0$

This method allows for possible calculation from both trip-based models and activity-based and tour-based models and surveys.

Table 1: Vehicle Miles Traveled Baseline (2015) by Land Use Designation²

Land Use Designation	Average Daily VMT per Service Population
Commercial and Employment	
Community Commercial	81.4
Regional Commercial	48.1
Employment Center	14
Light Industrial/Flex	30.8
Light Industrial	49.7
Heavy Industrial	36.6
Mixed Use Land Use Designations	
Village Center Mixed Use	32
Residential Mixed Use	20.6 ¹
Public/Quasi Public and Open Space	
Parks and Open Space	0 ²
Resource Management and Conservation	0 ²
Public Services	23.5
Residential Land Use Designations	
Rural Residential	23.6
Estate Residential	18.8 ¹
Low Density Residential	14.1
Medium Density Residential	12.9
High Density Residential	9.2 ¹
Other Land Use Designations	
Agriculture	35.9

Notes:

¹ The City had limited operating land uses of this type in 2015. Therefore, the baseline 2015 VMT numbers for these land use designations were extrapolated based on most similar land uses.

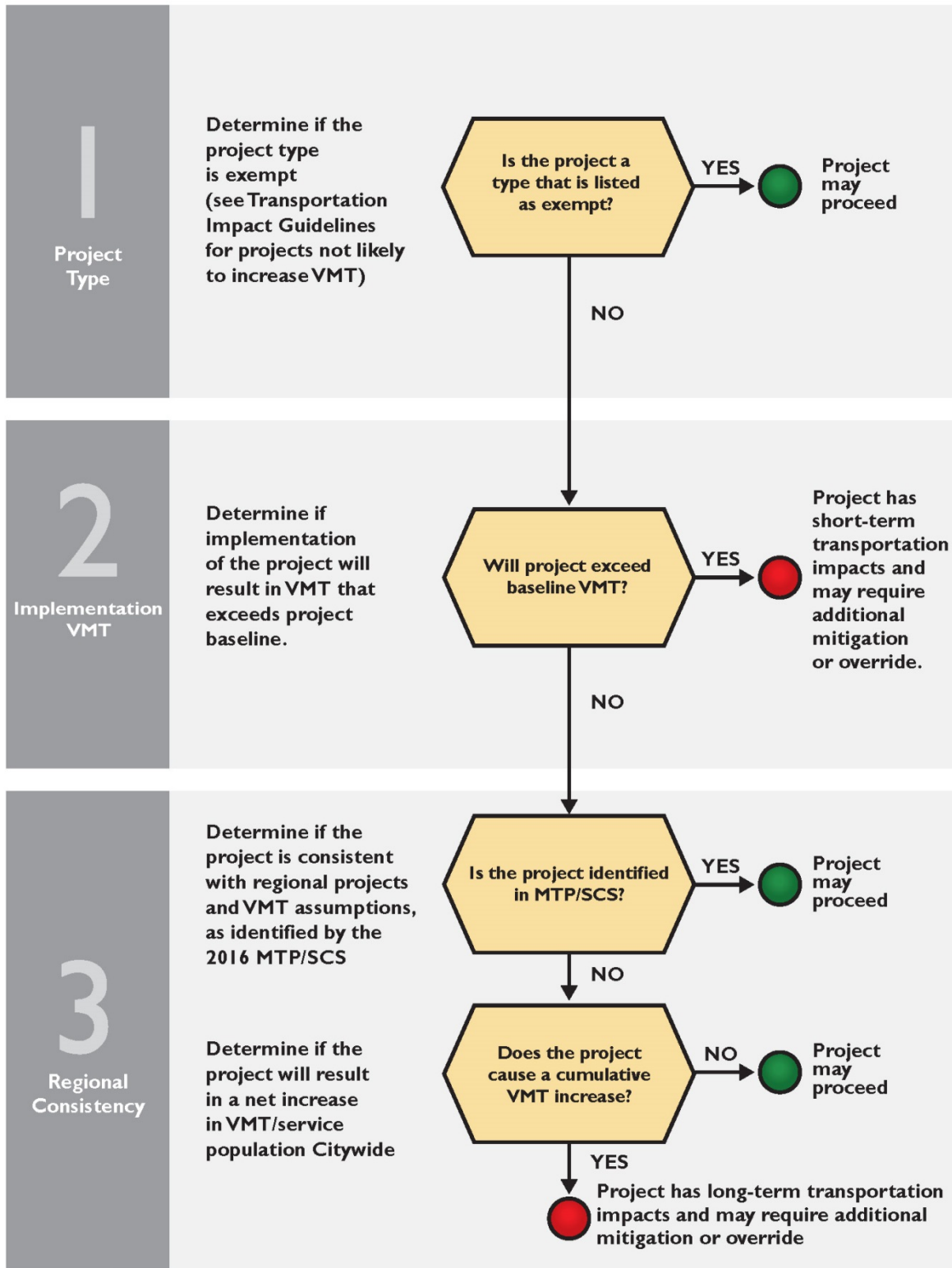
² These land use designations are not anticipated to produce significant VMT, as they have no residents and limited to no employees.

Transportation Projects

Transportation projects follow a three-step process, as shown in **Figure 2**. Projects that would not result in measurable increases in VMT are considered exempt. Such projects are identified in the Transportation Analysis Guidelines and are based on those listed on page III:27 of the OPR's Technical Advisory Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA (January 2016).

² Baseline 2015 VMT averages will be updated upon completion of SACSIM modeling.

Figure 2: Transportation project VMT analysis process



Transportation projects that are not exempt must go through an analysis process that is two-fold: assessing both short-term VMT impacts and long-term VMT impacts from a regional perspective.

Short-term analysis should generally be conducted first and is required for all projects determined not to be exempt. To conduct short-term analysis, projects should use the City of Elk Grove baseline year travel forecasting model to estimate the CEQA baseline no project VMT/Service Population. Projects should not exceed baseline VMT at the time of initiation of the project. If the per service population VMT exceeds the CEQA baseline, the project may be subject to additional mitigation measures recommended by staff or may require an override, as such a project would be considered to have significant and unavoidable transportation impacts if not mitigated.

Long-term VMT analysis is only required if the project is not consistent with the current Sacramento Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). In general, transportation projects should only be proposed when they are part of the regional transportation plan, which includes a full list of anticipated projects that have been incorporated into the regional travel forecasting model. If the project is accounted for in the MTP/SCS its impacts are already accounted for within regional VMT models and assessments. However, if a project is not accurately represented in the regional travel forecasting model it is subject to an alternative analysis based against the MTP/SCS travel forecast model, or alternatively against the VMT/Service population using the ratio of City-generated VMT (using an origin-destination method) and Citywide service population.

If the project exceeds long-term VMT limits by either analysis method, the transportation project will be determined to have transportation impacts. Additional mitigation measures may be required of the project.

Projects with Prior CEQA Review

Legacy projects (those approved prior to General Plan adoption) that are still valid have been incorporated within the General Plan Land Use Plan and will be accounted for in the General Plan EIR's VMT analysis. Therefore, these projects would not require subsequent VMT analysis unless changes are proposed to the originally approved project. In cases where a development project considered after adoption of the updated General Plan proposes changes from what was previously approved, the project may be subject to VMT analysis pursuant to the process described above.

Projects located within an approved Community Plan, Specific Plan, or Special Planning Area (SPA) for which a CEQA analysis was approved or certified would likely also not require additional CEQA review. For example, a specific development application (e.g., tentative subdivision map, design review) in the Southeast Policy Area, the Laguna Ridge Specific Plan, or Lent Ranch SPA would benefit from the corresponding EIR when the development application is consistent with the General Plan as SEPA, Laguna Ridge, and Lent Ranch have been incorporated into the General Plan. In the case of a change to a Community Plan, Specific Plan, or SPA, the VMT analysis may consider the entirety of the Community, Specific Plan, or SPA as the basis for the analysis, taking advantage of benefits provided from the mix of uses, trails, and other transportation modes present in the underlying plan.

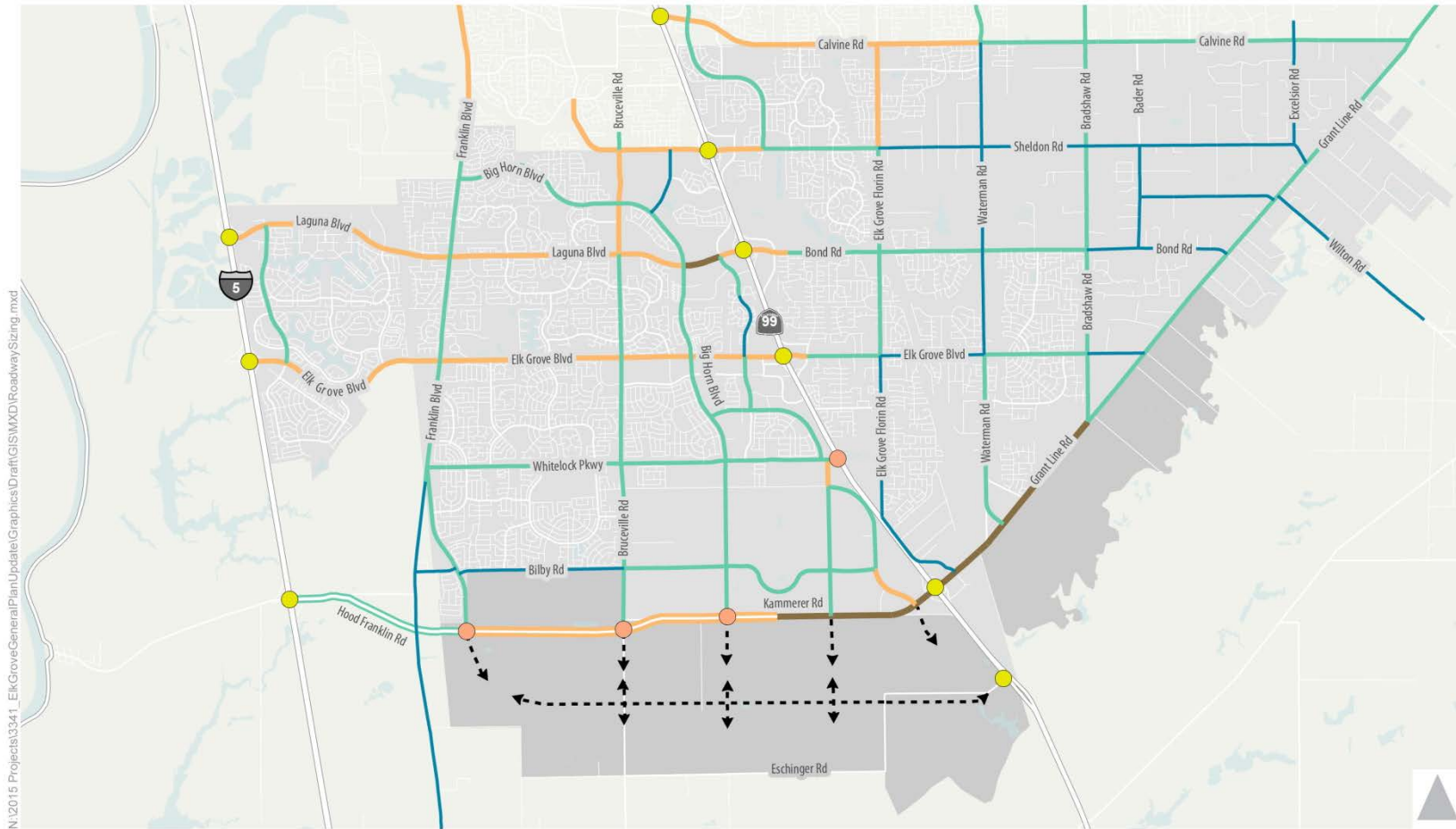
Roadway Operations and Sizing

As stated, the General Plan will include a policy regarding roadway efficiency; however, the efficiency of the roadway network will no longer be measured through LOS. Rather, the policy has been restructured to evaluate a range of metrics including vehicular capacity, intersection delay, pedestrian and bicycle safety and stress levels, the cost of constructing and maintaining the improvements, and the character and context of the surrounding environment. This approach is much more subjective than a traditional LOS grade. The metrics included in the draft policy are identified as targets to guide decision making. Ultimately, the City Council may approve deviations from the targets based upon any of the relevant factors.

At the April 13, 2017 study session, the Council directed the composition of the City's Roadway System and Sizing Diagram. Specifically, the Council directed that:

Staff has completed a preliminary analysis of the City's roadway system, looking at the potential lane configurations of various segments. This analysis is based upon Alternative B and Scenario 2 and will be adjusted based upon the land use and policy direction of the City Council. The map included in this draft (Figure M-1) illustrates staff's recommended roadway sizing diagram, which accomplishes the following:

- Roads in the Sheldon Rural Area shall remain 2-lane, except for Bradshaw Road, which should be 4-lane.
- Elk Grove Boulevard through Old Town shall be 2-lanes
- Targets lane reductions and "road diets" along select corridors for potential on-street bicycle (Class 2) and off-street trail improvements. Examples include but are not limited to:
 - Bruceville Road south of Laguna Boulevard
 - Elk Grove Boulevard east of Waterman



N:\2015 Projects\3341_Elk Grove General Plan Update\Graphics\Draft\GIS\MXD\Roadway\Sizing.mxd

- 2-lane Arterial/Collector
- 4-lane Arterial
- 5-lane Arterial
- 6-lane Arterial
- 8-lane Arterial
- 4-lane Expressway
- 6-lane Expressway
- Freeway Interchange
- Future Interchange
- Study Area
- City of Elk Grove City Limits
- > Future Study Area Road



Figure M-1
Roadway System and
Sizing Diagram

City of Elk Grove General Plan Update

B. Draft Mobility Policies



The following represents a portion of the mobility policies to be included in the updated General Plan. This excerpt highlights only the roadway performance and Vehicle Miles Traveled (VMT) policies, which implement forthcoming changes to the California Environmental Quality Act (CEQA). Other policies relative to transit, active transportation (e.g., bicycles, pedestrians), goods movement, complete streets, and interagency coordination will be included in the complete draft document at a later date.

*Existing General Plan policies that are carried forward to this draft are highlighted with an **E**. This is not a complete list of existing policies that will carry forward.*

GOAL 1: A CONNECTED TRANSPORTATION NETWORK THAT PROVIDES FOR THE SAFE AND EFFICIENT MOVEMENT OF PEOPLE AND GOODS ACROSS ALL MODES WHILE ACCOUNTING FOR THE ENVIRONMENTAL EFFECTS OF THOSE SYSTEMS.

Policy 1-1: Implement the Circulation Plan with the Roadway System and Sizing Diagram, shown as **Figure M-1**.

Action 1-1-1: E { Where a development project is required to perform new roadway construction or road widening, the entire roadway shall be completed to its planned width from curb-to-curb prior to the operation of the project for which the improvements were constructed, unless otherwise approved by the City Engineer. Such roadway construction shall also provide facilities adequate to ensure pedestrian safety as determined by the City Engineer

Policy 1-2: Circulation planning shall consider all modes (e.g., automobile, transit, pedestrian, bicycle) and the overall mobility of these travel modes when evaluating transportation design and potential impacts.

Policy 1-3: The City desires a robust and efficient roadway network that provides access to properties in a safe and convenient manner while also balancing with the tangible and financial implications of these improvements. Factors included in this balance include, but are not limited to, the role and function of the subject roadway(s), availability and comfort level with available pedestrian and bicycle facilities (to the extent applicable), character of the surrounding area, and the cost to complete the improvement and ongoing maintenance obligations.

The Roadway System and Sizing Diagram (shown in **Figure M-1** and as discussed in Policy 1-1) reflects the implementation of this policy at a macro level; the City will

consider the specific design of individual segments and intersections in light of this Policy and the guidance provided by the Roadway System and Sizing Diagram.

E { The City acknowledges that the Capital SouthEast Connector has identified specific efficiency standards for certain segments. The City will strive to achieve these standards to the extent feasible and will work with the JPA as necessary.

To facilitate this analysis, the City shall use the following guidelines or targets. Deviations from these metrics may be approved by the approving authority (whether Planning Commission or City Council). These targets shall be aspirational goals but shall not be mandated performance standards.

- A. **Vehicular Design Considerations** – The following targets apply to vehicular mobility:
 1. **Intersection Performance** – Generally, and except as otherwise determined by the City Council or as provided in this General Plan, the City will seek to achieve the peak hour delay target identified in **Table 1**.

Table 1: Vehicular Design Considerations: Intersection Performance Targets

Intersection Control	Peak Hour Delay Design Target [seconds/vehicle]
Stop (Side-Street & All-Way)	< 35.1
Signal	< 55.1
Roundabout	< 35.1

2. **Roadway Performance** – Generally, and except as otherwise determined by the approving authority (whether Planning Commission or City Council) or as provided in this General Plan, the City will seek to achieve the average daily traffic design target identified in **Table 2**. These targets shall be aspirational goals but shall not be mandated performance standards.

Table 2: Vehicular Design Considerations: Segment Performance Targets

Facility Type	Number of Lanes	Median	Speed	Average Daily Traffic Design Target		
Arterial	2	No	25	13,600		
			30	14,600		
			35	15,700		
			40	16,600		
			45	17,700		
			55	18,600		
			25	14,300		
	4	Yes	30	15,400		
			35	16,500		
			40	17,500		
			45	18,600		
			55	19,600		
			4	No	30	29,800

Facility Type	Number of Lanes	Median	Speed	Average Daily Traffic Design Target
			35	31,600
			40	33,500
			45	35,300
	4	Yes	30	31,400
			35	33,300
			40	35,300
	5	Yes	45	45,600
			30	46,400
	6	Yes	35	48,900
			40	51,500
			45	54,000
	7	Yes	45	59,400
	8	Yes	45	64,800
			55	72,000
Expressway	4	Yes	55	64,800
	6	Yes	55	97,200
Freeway	4	Yes	55+	74,400
	6	Yes	55+	111,600
	8	Yes	55+	148,800

- 3. Pedestrian and Bicycle Performance** – The City will seek the lowest stress scores possible for pedestrian and bicycle performance after considering factors including design limitations and financial implications.

Action 1-3-1: The City shall update its guidelines for the preparation of transportation analyses for consistency with this policy. As part of the guidelines, the City shall:

- Identify appropriate methodologies for calculating intersection and roadway performance.
- Identify appropriate methodologies for calculating pedestrian and bicycle performance and stress scores.

Policy 1-4: The City desires to achieve a reduction in the travel distances of automobile trips, referred to as Vehicle Miles Traveled (VMT). Reductions in VMT can be accomplished through a combination of land use and mobility actions. To reduce VMT, the City has established the following metrics and limits. These metrics and limits shall be used as thresholds of significance in evaluating projects subject to CEQA.

Projects that do not achieve the limits outlined below shall be subject to all feasible mitigation measures necessary to reduce the VMT for, or induced by, the project to the applicable limits. If the VMT for or induced by the project cannot be reduced consistent with the performance metrics outlined below, the City may consider approval of the project, subject to a finding of overriding consideration and mitigation

of transportation impacts to the extent feasible, provided some other form of community benefit is achieved by the project.

- A. **New Development** – Any new land use plans (and amendments to such plans) and other discretionary development proposals (referred to as “development projects”) are required to demonstrate a 15 percent reduction in VMT from existing (2015) conditions. To demonstrate this reduction, conformance with following land use and cumulative VMT limits is required:
1. **Land Use** – Development projects shall demonstrate that the VMT produced by the project at buildout is equal to or less than the VMT limit of the underlying land use designation, as shown in **Table 3**, which incorporates the 15 percent reduction:

Table 3: Vehicle Miles Traveled Limits by Land Use Designation

Land Use Designation	VMT Limit (daily per service population)
Commercial and Employment Land Use Designations	
Community Commercial	69.2
Regional Commercial	40.9
Employment Center	11.9
Light Industrial/Flex	26.2
Light Industrial	42.2
Heavy Industrial	31.1
Mixed Use Land Use Designations	
Village Center Mixed Use	27.2
Residential Mixed Use	17.5
Public/Quasi Public and Open Space Land Use Designations	
Parks and Open Space	0 ¹
Resource Management and Conservation	0 ¹
Public Services	20
Residential Land Use Designations	
Rural Residential	20.1
Estate Residential	18
Low Density Residential	12
Medium Density Residential	10.9
High Density Residential	7.8
Other Land Use Designations	
Agriculture	30.5

Notes:

1. *These land use designations are not anticipated to produce substantial VMT, as they have no residents and limited to no employees. These land use designations therefore have no limit and are exempt from analysis.*

2. **Cumulative for Development Projects within the Existing City (2017)** – Development projects located within the existing (2017) City limits shall demonstrate that cumulative VMT would be equal to or less than the established Citywide limit of 5,565,587 VMT (total daily VMT), which incorporates the 15 percent reduction.
3. **Cumulative for Development Projects within Growth Areas** – Development projects located within Study Areas shall demonstrate that cumulative VMT within the applicable Study Area would be equal to or less than the established limit shown in **Table 4**, which incorporates the 15 percent reduction.

Table 4: Study Area Total Vehicle Miles Traveled Limits

Study Area	VMT Limit (total VMT at buildout)
East Study Area	342,855
South Study Area	1,219,516
West Study Area	550,040

Transportation projects that are exempt from these requirements because they are not likely to lead to a substantial or measurable increase in VMT are listed in the Transportation Analysis Guidelines.

B. Transportation Projects – Transportation projects likely to lead to a substantial or measurable increase in VMT shall:

1. **Not increase VMT per service population.** Projects must demonstrate that the VMT effect of the project does not exceed the project’s baseline condition VMT.
2. **Be consistent with the regional projections and plans.** The project shall be specifically referenced or listed in the MTP/SCS and accurately represented in the regional travel forecasting model. Qualifying transportation projects that are not consistent with the region’s MTP/SCS shall also demonstrate that the cumulative VMT effect does not increase regional VMT per service population.

Action 1-4-1: The City shall prepare and regularly update guidelines for the preparation of transportation impact analysis for consistency with this policy. As part of the guidelines, the City shall:

- Identify appropriate methodologies for calculating VMT for both land use and transportation projects,
- Monitor Citywide VMT and identify areas of the City that may be exempt from subsequent analysis, and
- Monitor the effectiveness of VMT reduction strategies and update a list of appropriate strategies on an ongoing basis.

City of Elk Grove General Plan Update

C. Transportation Analysis Guidelines



The following is an excerpt of the new Transportation Analysis Guidelines, which will replace the current Traffic Impact Analysis Guidelines. This excerpt addresses when a VMT analysis is required (consistent with the draft General Plan policies) and how this analysis is to be conducted. The final draft Transportation Analysis Guidelines will address the following additional topics:

- *Roadway segment capacity analysis*
- *Roadway intersection delay analysis*
- *Multimodal transportation analysis (when required and how to complete), which will often assist in identifying feasible mitigation to potential VMT impacts, as well as addressing consistency with other General Plan policies related to pedestrian, bicycle, and transit.*

This document also includes some preliminary information regarding pedestrian and bicycle stress analysis, which will be expanded in the final document.

Vehicle Miles Traveled (VMT) Analysis

Background

Vehicle miles traveled, or VMT, is a meaningful metric for measuring transportation impacts on the natural environment. It considers the number of miles traveled by motor vehicles that are generated by or attracted to a project. VMT captures both motorized trip generation rates and trip length. This allows for an accounting of both the effects of a project's features and its surroundings, as well as its location within the region. VMT considers only motor vehicle trips and excludes trips by other modes. Therefore, the benefits of transit and active transportation trips are captured through reductions in VMT.

The City, consistent with changes in State law, requires the analysis of VMT as part of environmental reviews under the California Environmental Quality Act (CEQA). To this end, the City has established VMT-based transportation performance analysis guidelines for both new development projects requiring discretionary approval and transportation projects. New land use plans or development projects must demonstrate that VMT produced by the proposed project does not exceed established VMT limits for the applicable land use designation. Limits are determined as a 15 percent reduction from 2015 VMT in the City by land use designation, as recommended by the State. The VMT limits ensure the City is meeting local greenhouse gas emissions goals and State requirements (Senate Bill (SB) 743) for conducting transportation impact analysis as part of CEQA compliance.

Transportation projects that are not likely to lead to a substantial or measurable increase in VMT and will not be subject to analysis requirements are detailed in the Project Type and Exemptions section.

New land use plans or development projects within the planning area must also demonstrate that VMT produced by the proposed project, in accumulation with other existing and planned projects, does not exceed established VMT limits for the City as a whole or for the applicable Study Area. Citywide and Study Area limits are based on 2015 baseline daily VMT.

Transportation projects that are likely to lead to a substantial or measurable increase in VMT must demonstrate that: (a) the VMT effect of the project does not exceed baseline conditions, and (b) the project is consistent with regional projections and plans (i.e., the Sacramento Area Council of Governments Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS)). Projects likely to be exempt are described on page 9.

These guidelines were prepared to ensure that analyses are consistent, comprehensive, and provide decision-makers with adequate information to quantify impacts of development on the City's transportation system.

Vehicle Miles Traveled Goal

The City has established VMT limits for projects which are designed to achieve a 15 percent reduction in VMT below a 2015 baseline for new land use development. The VMT limits are established at the Citywide or Study Area level as well as the land use designation level underlying the project.

The City has also established VMT limits for new transportation projects to not exceed project baseline VMT and to be consistent with regional VMT forecasts and transportation plans. Transportation projects in Elk Grove that are identified within the Sacramento Area Council of Governments (SACOG) Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS) are considered to be regionally consistent.

Projects with VMT less than or equal to the established limits may be found to have less than significant transportation impacts under CEQA. Projects with VMT exceeding the established limits that are unable to reduce VMT through reduction strategies identified below:

1. May be required by the City to demonstrate clear community benefit, within the context of the General Plan; and/or
2. May be found to have significant and unavoidable transportation impacts, requiring the City to adopt a statement of overriding considerations. Projects would be required to mitigate transportation impacts to the extent feasible.

Baseline and VMT Calculation

The City has selected the VMT per service population methodology as the basis for VMT analysis. This methodology was selected because it uses an allocation system to consider daily residential and worker VMT. First, daily home-based residential VMT per capita is calculated. This considers all home-based auto vehicle trips, traced back to the residence of the trip-maker, including home-based work, home-based other, home-based school, and home-based shopping trips. Non-home-based trips are excluded.

Next, the home-based worker VMT per worker is calculated. This looks at all vehicle trips between home and work. Commercial vehicle trips (e.g., delivery trucks) are excluded from the analysis.

The following illustrates how this calculation is completed:

Allocation Method					
Input	Quantity	VMT	Home-Based Portion of VMT	VMT/Input	Description
Population	100	1,000	500	5.0	<--- Daily Home-Based Residential VMT per Capita
Employment	1,000	20,000	10,000	10.0	<--- Daily Home-Based Work VMT per Worker
Population and Employment	1,010	21,000	10,500	10.4	<--- Daily Home-Based Residential and Work VMT per Worker

$500/100 = 5.0$

This method allows for possible calculation from both trip-based models and activity-based and tour-based models and surveys.

The City has used regional models, including Urban Footprint and the SACMET travel demand model, to estimate VMT produced in 2015 throughout the community. Based on these results, the City has determined average VMT produced per service population within each land use designation. This data has been incorporated into the VMT policy established in the General Plan.

VMT Analysis Requirements

When required, a VMT analysis shall be prepared by a qualified transportation consultant, as determined by the City. The consultant shall prepare and submit a scope of services acceptable to the Public Works Director. The scope shall include a discussion of analysis methodology, typically using SACOG’s SACSIM model or a similar approach. Work on the study shall not commence until a written Notice to Proceed is received from the Development Services Department. For studies to be included in environmental documents, the scope shall also:

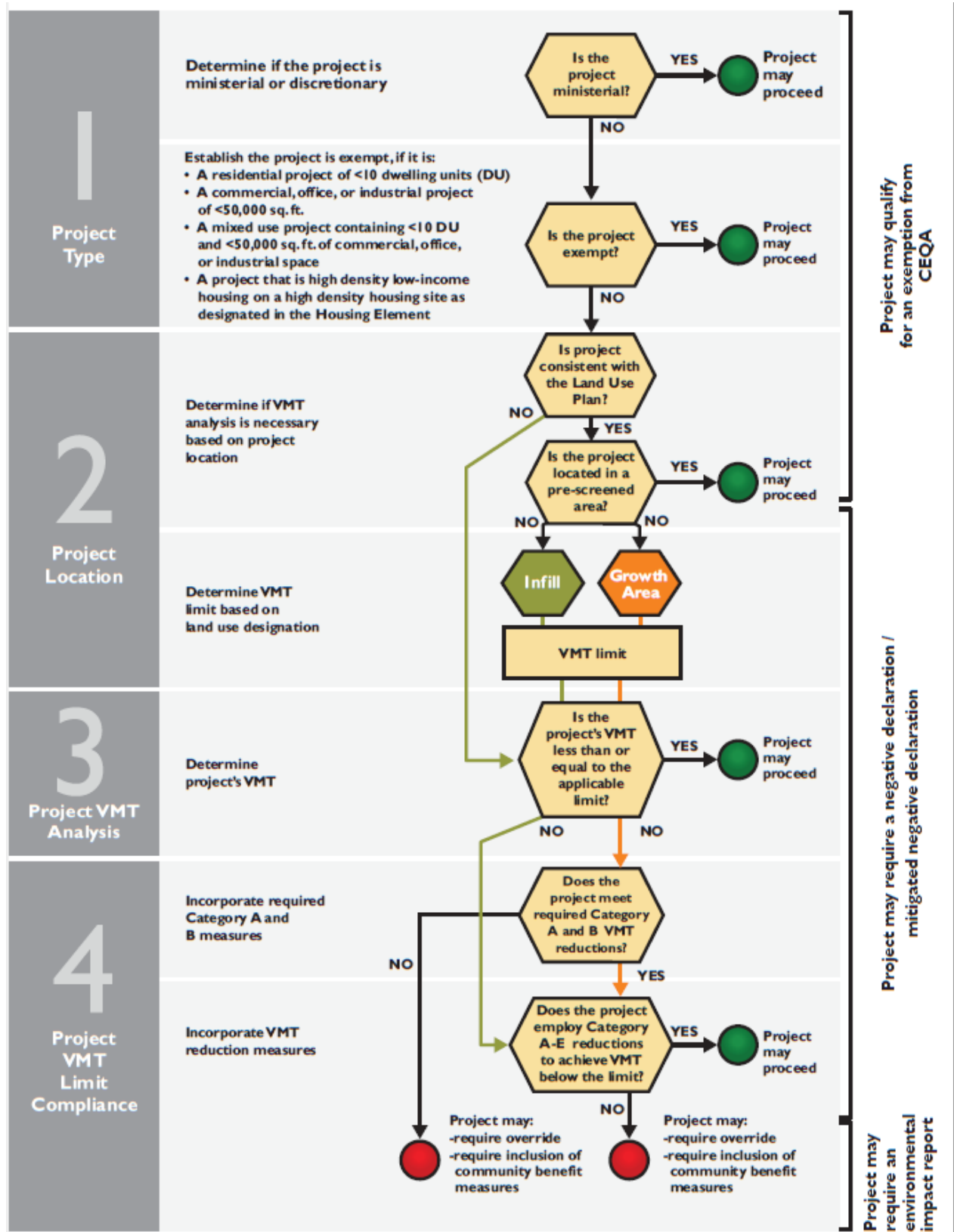
- Identify project location, appropriate VMT metrics, and analysis procedure.
- Identify available VMT reduction strategies by category.
- Identify scenarios and alternatives necessary for environmental documentation.
- Include efforts and documentation for public outreach.
- Identify key entities whose review is required.

VMT analysis shall also include, to the greatest extent feasible, analysis of all conditions of approval requiring additional improvements (e.g., roadway widening, additional transit or transportation facilities) or project redesign (e.g., increase in density or intensity, additional project amenities). Revisions to the VMT analysis may be necessary to address such conditions of approval for evaluation of potential impacts prior to project approval.

Land Use Project Analysis

The following describes the VMT analysis process for land use projects. This process is summarized in the flow chart in Figure 1.

Figure 1: Land use project VMT analysis process



Project Type and Exemptions

The City has established specific limits on VMT allowable for each land use project by General Plan land use designation as well as Citywide limits and limits within each Study Area. The City's Development Services Department will conduct an initial assessment of each project based on the project description and proposed uses. Projects that are inconsistent with the General Plan Land Use Plan for the site must conduct a VMT analysis.

A VMT analysis shall also not be required as part of the project review process if it is determined that the project is anticipated to meet any of the following criteria:

- Transit (e.g., establishing new routes or services or modifying existing routes or services).
- Addition of active transportation improvements (e.g., new trail segments), like on-street bike lanes and shoulder improvements to improve conditions for cyclists.
- Addition of roadway capacity on local and collector roadways provided the project substantially improves conditions for pedestrians, cyclists, and transit (as applicable).
- Rehabilitation, maintenance, replacement, and repair projects that do not add additional roadway capacity.
- Installation, removal, or modification of turn lanes.
- Installation, removal, or modification of traffic control devices, including wayfinding and traffic signal priority systems.
- Traffic signal optimization to improve vehicle, bicycle, or pedestrian flow.
- Installation of roundabouts.
- Installation or modification of traffic calming devices.
- Lane reductions (i.e., road diets”).
- Any lane addition, including auxiliary lanes under 0.3 miles in length.
- Removal of off-street parking and addition, adoption or modification of parking devices and management strategies.
- Safety improvements, including roadway shoulder enhancements and auxiliary lanes under one mile, and grade separations for rail, transit, pedestrian, and bicycle facilities.
- Is located outside pre-screened areas on the VMT Screening Map [**Figure 2**]

Notwithstanding these provisions, the Public Works Director may determine that a VMT analysis is required for any discretionary project where substantial evidence indicates the project is likely to result in substantial VMT.

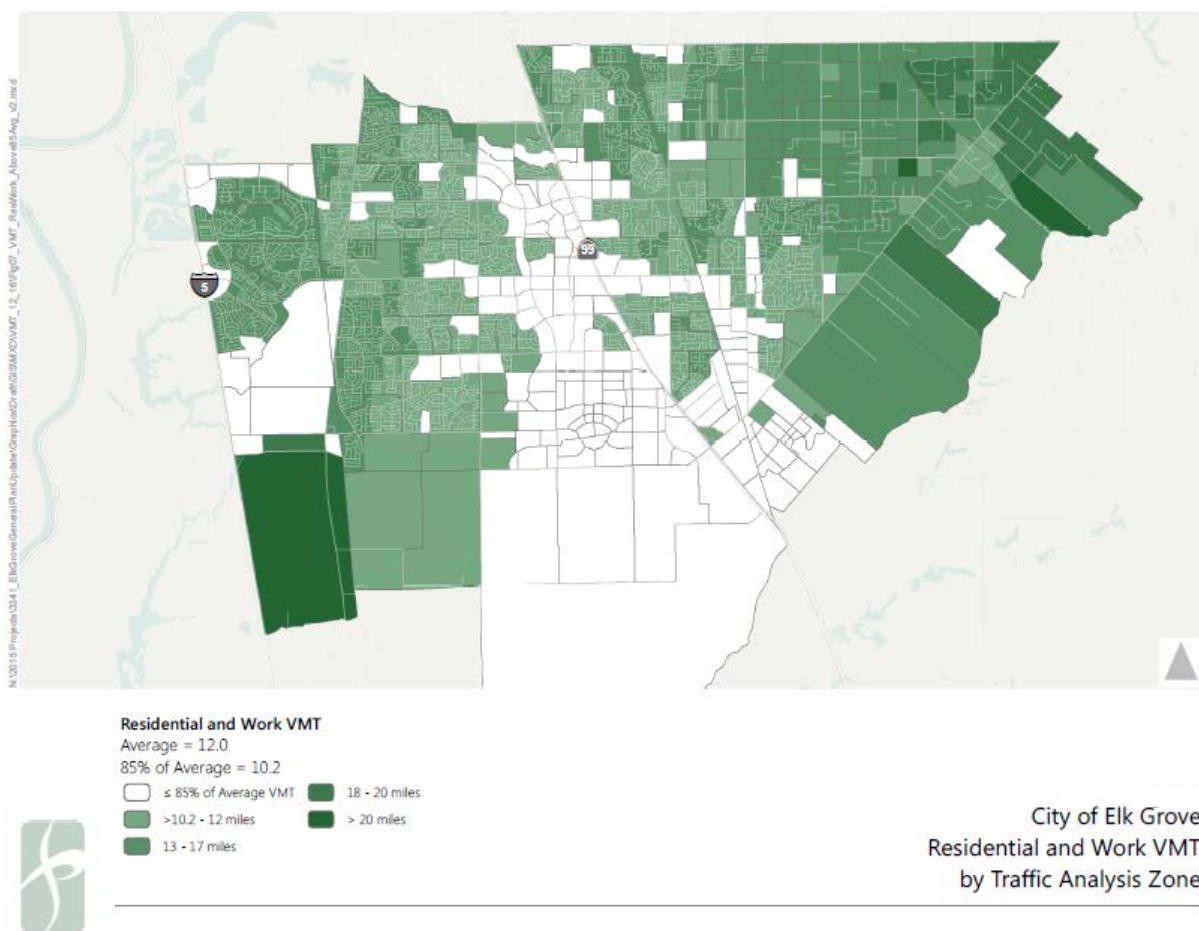
Land use projects must show consistency with the General Plan Land Use Plan. Projects that are inconsistent with the Land Use Plan are automatically considered inconsistent with the VMT policy and shall conduct a VMT analysis. Projects that are consistent with the Land Use Plan move to the next step.

All existing and proposed land uses within the primary influence area of the proposed development are to be evaluated to identify project daily VMT. The primary influence area includes the areas that directly impact projected home-based auto trips of the proposed development. Each general plan land use designation, as well as the City as a whole and each Study Area has a specific VMT limit. Land use designation limits apply directly to each project, while Citywide and Study Area limits must be considered by the project consultant in a cumulative analysis along with other existing and likely projects in the Study Area at build-out.

The VMT Screening Map (**Figure 2**) identifies areas in the City that are exempt from VMT analysis. These include sites that have been pre-screened through Citywide VMT analysis. Pre-screened areas are shown in white and have been determined to result in 15 percent or below the average service population VMT established for that land use designation if built to the specifications of the Land Use Plan. The map was developed using an allocation method. It incorporates daily home-based residential VMT per capita, including all home-based auto vehicle trips traced back to the residence of the trip-maker, and daily home-based VMT per employee, including commute trips from within and outside of the City.

Areas shown in green on the screening map have not been pre-screened, based on analysis indicating that daily home-based residential and worker VMT will likely exceed the 15 percent below baseline limit unless reduction strategies are employed. Projects not pre-screened must proceed to VMT analysis.

Figure 2: Land Use Project VMT Screening Map



Project VMT Analysis

The project’s total daily VMT should be evaluated against the underlying General Plan Land Use Designation limit of VMT per service population and Citywide (or Study Area) limit of total daily VMT (see **Table 1**). VMT analysis methods should be consistent with those employed by SACOG’s SACSIM model and calculate daily home-based residential VMT per capita and the home-based worker VMT per worker.

Table 1: Vehicle Miles Traveled Metrics

Metric	Description	Purpose
Total Daily VMT	Sum of all daily vehicle miles traveled produced by all uses within the City or applicable Study Area.	Assessing a project against Citywide or Study Area total limits.
VMT per Service Population	Sum of all vehicle miles traveled produced by uses in the applicable land use designation, divided by the sum of total employees working within the assessed area and dwelling units in the assessed area.	Assessing a project against land use designation limits.

VMT analysis must be submitted to and approved by the Public Works Director. If the Public Works Director determines the project's daily VMT is at or below the established limits, no further analysis or VMT reduction measures are required. The project may proceed, and may require a negative declaration based on less than significant transportation impacts.

Project VMT Limit Compliance

If the Public Works Director determines the project's daily VMT for the underlying land use designation is above the established limits, the VMT study shall be augmented to identify VMT reduction strategies, drawn from the accepted categories shown in **Table 2**, and associated VMT reductions to achieve daily values below the established limit. Infill projects may use any category of reduction strategies. Projects within the growth areas must incorporate the highest available reductions through Category A and/or Category B reduction strategies first (as determined by the City) before utilizing strategies in other categories.

Table 2: Vehicle Miles Traveled Reduction Strategies

Category	Description
A Land Use/ Location	Land use-related components such as project density, location, and efficiency related to other housing and jobs; and diversity of uses within the project. Also includes access and proximity to destinations, transit stations, and active transportation infrastructure.
B Site Enhancement	Establishing or connecting to a pedestrian/bike network; traffic calming within and in proximity to the project; car sharing programs; shuttle programs.
C Transit System Improvement ¹	Improvements to the transit system including reach expansion, service frequency, types of transit, access to stations, station safety and quality, parking (park-and-ride) and bike access (to transit itself and parking), last-mile connections.
D Commute Trip Reduction ¹	<u>For residential:</u> transit fare subsidies, education/training of alternatives, rideshare programs, shuttle programs, bike share programs <u>For employer sites:</u> transit fare subsidies, parking cash-outs, paid parking, alternative work schedules/telecommute, education/training of alternatives, rideshare programs, shuttle programs, bike share programs, end of trip facilities

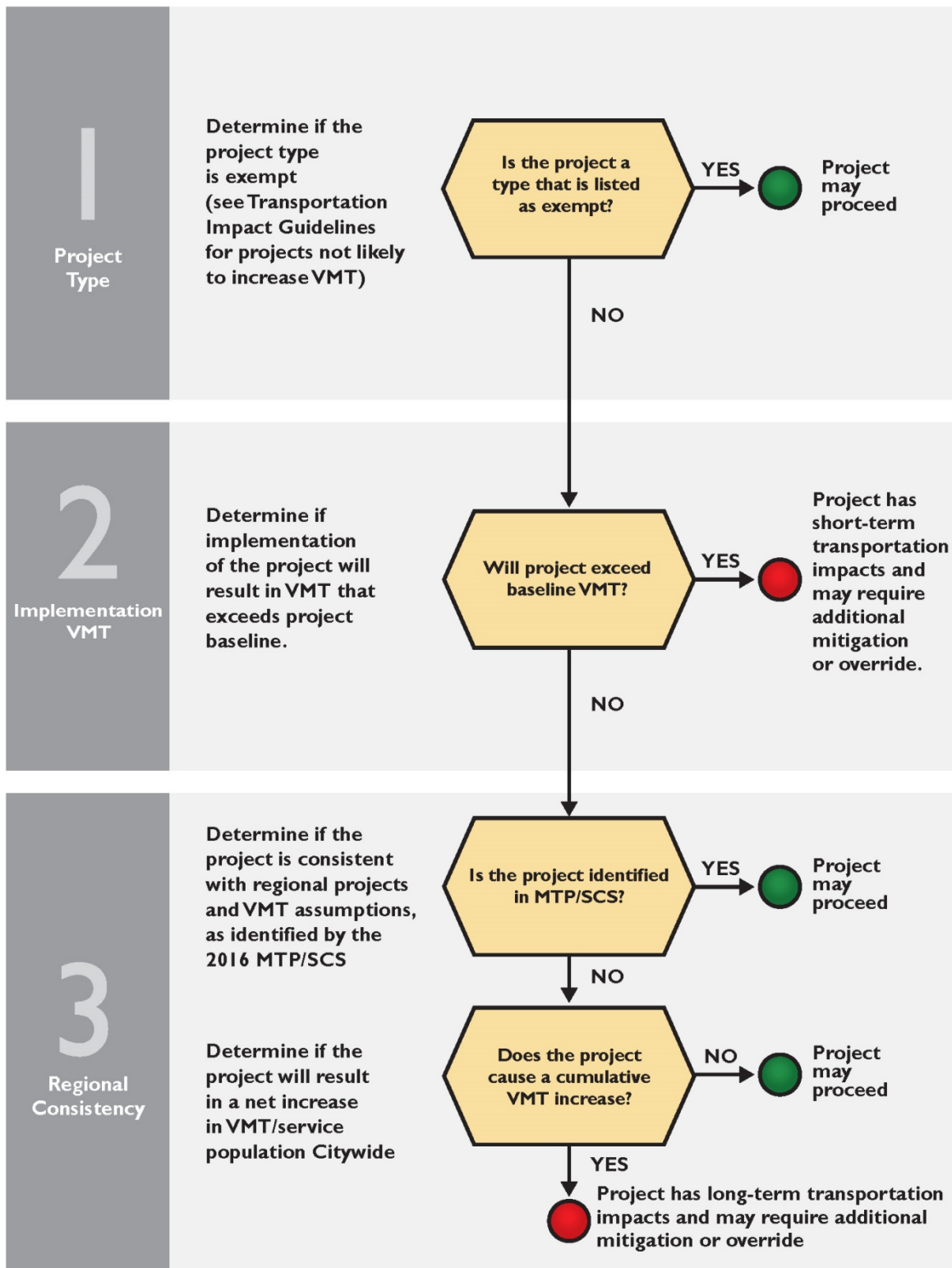
E In-Lieu Fee	A fee is levied that is used to provide non-vehicular transportation services that connect project residents to areas of employment or vice versa. This service may be provided by the project applicant in cooperation with major employers.
----------------------	---

Notes:¹ Can be achieved through TDM program measures.

Transportation Project Analysis

The following describes the VMT analysis process for transportation projects. This process is summarized in the flow chart in **Figure 3**.

Figure 3: Transportation project VMT analysis process



Project Type and Exemptions

Projects that are not likely to lead to a substantial or measurable increase in VMT include, but are not limited to, the following¹:

- Transit (e.g., establishing new routes or services or modifying existing routes or services).
- Addition of active transportation improvements (e.g., new trail segments), like on-street bike lanes and shoulder improvements to improve conditions for cyclists.
- Addition of roadway capacity on local and collector roadways provided the project substantially improves conditions for pedestrians, cyclists, and transit (as applicable).
- Rehabilitation, maintenance, replacement, and repair projects that do not add additional roadway capacity.
- Installation, removal, or modification of turn lanes.
- Installation, removal, or modification of traffic control devices, including wayfinding and traffic signal priority systems.
- Traffic signal optimization to improve vehicle, bicycle, or pedestrian flow.
- Installation of roundabouts.
- Installation or modification of traffic calming devices.
- Lane reductions (i.e., road diets”).
- Any lane addition, including auxiliary lanes under 0.3 miles in length.
- Removal of off-street parking and addition, adoption or modification of parking devices and management strategies.
- Safety improvements, including roadway shoulder enhancements and auxiliary lanes under one mile, and grade separations for rail, transit, pedestrian, and bicycle facilities.

The City shall conduct an initial assessment of each project to determine if the proposed project is likely to substantially increase VMT, as determined by the Public Works Director, and would therefore require VMT analysis.

Project VMT Analysis

Short-term analysis is required for all projects determined not to be exempt. To conduct short-term analysis, projects should use the City of Elk Grove base year travel forecasting model to estimate the CEQA baseline no project VMT/Service Population, as follows:

1. Add the transportation project to the base year travel forecasting model to estimate the CEQA baseline plus project VMT/Service Population.
2. Provide the City with a comparison of project VMT estimates to the VMT policy limits to determine if the addition of the transportation project would result in a short-term transportation impact.

Long-term VMT analysis is only required if the project is not consistent with the current Sacramento Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). The City shall review and determine if the project is specifically referenced or listed in the MTP/SCS and accurately

¹ OPR provides a more detailed list of project types that the State anticipates would not result in increased VMT in the *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA (January 2016)*. Applicants may find this discussion helpful in determining which types of projects to pursue.

represented in the regional travel forecasting model. If the project is not listed, the City shall conduct long-term VMT analysis using one of two methods.

1. Use the current MTP/SCS travel forecasting model to estimate the cumulative no project VMT/Service Population. Add the transportation project to the base year travel forecasting model to estimate the cumulative plus project VMT/Service Population. Compare VMT estimates to the VMT policy limits to determine if the addition of the transportation project would result in a long-term transportation impact.
2. Calculate VMT/Service population using the ratio of City-generated VMT (using an origin-destination method) and Citywide service population. If the project would result in a net increase of VMT/Service Population, the project may have a long-term transportation impact.

Project VMT Limit Compliance

If the City determines that the project exceeds short-term or long-term VMT limits, the transportation project shall be determined to have transportation impacts. Additional mitigation measures may be required of the project. Possible mitigation measures may include the following:

- Addition of Class 1, Class 2, or Class 4 bicycle lanes
- Addition of sidewalks or other pedestrian improvements
- Incorporation of transit-related improvements

Pedestrian Streetscore Level of Traffic Stress (LTS)

The Pedestrian LTS² refers to the pedestrian comfort associated with a roadway or intersection. Roadway segments and intersection approaches receive individual scores based on different considerations. The following factors are considered in developing the Pedestrian Streetscore+ for roadways and intersections:

<u>Roadways</u>	<u>Intersections</u>
Usable sidewalk space	Crossing distance
Driveways	Accessibility
Pedestrian-scale lighting	Channelized right-turns
Street trees and landscaping	Leading pedestrian intervals (LPIs) and pedestrian scrambles
Speed	
Sidewalk quality	
Number of travel lanes	
Heavy vehicle volumes	
Crosswalk frequency	

The Pedestrian Streetscore LTS uses scale that ranges from 1 to 4, with 1 being the least stressful and 4 being the most stressful.

Table 3: Pedestrian Streetscore LTS

Streetscore LTS	Description
1	Highly comfortable, pedestrian-friendly, and easily navigable for pedestrians of all ages and abilities, including seniors or school-aged children walking unaccompanied to school. These streets provide an ideal “pedestrian-friendly” environment.
2	Generally comfortable for many pedestrians, but parents may not feel comfortable with children walking alone. Seniors may have concerns about the walking environment and take more caution. These streets may be part of a “pedestrian-friendly” environment where it intersects with a more auto-oriented roadway or other environmental constraints.
3	Walking is uncomfortable but possible. Minimum sidewalk and crossing facilities may be present, but barriers are present that make the walking experience uninviting and uncomfortable.
4	Walking is a barrier and is very uncomfortable or even impossible. Streets have limited or no accommodation for pedestrians and are inhospitable and possibly unsafe environment for pedestrians.

² The Pedestrian LTS methodology builds on Mekuria, Furth, and Nixon’s 2012 *Low Stress Bicycling and Network Connectivity* report and LTS methodology with a corresponding index for pedestrian comfort. A tool to evaluate Pedestrian and Bicycle LTS called Streetscore+ was developed by Fehr & Peers and includes recommended parameters for the pedestrian environment provided by the NACTO Urban Streets Design Guide (USDG) and additional considerations of comfort informed by practitioner and best practice experience.

Bicycle Streetscore Level of Traffic Stress (LTS)

Bicycle LTS ³ refers to the comfort associated with roadways, or the mental ease people experience riding on them. Factors influencing LTS include:

- Number of travel lanes
- Speed of traffic
- Number of vehicles
- Presence of bike lanes
- Width of bike lanes
- Presence of physical barrier

Recent research has correlated these different bicycle riders with the level of “traffic stress” they are willing to experience while cycling. Bicycle LTS uses scale that ranges from 1 to 4, with 1 being the least stressful and 4 being the most stressful.

Table 4: Bicycle Streetscore LTS

Streetscore LTS	Description
1	Most children and elderly riders can tolerate this level of stress and feel safe and comfortable. LTS 1 roadways typically require more separation from traffic.
2	This is the highest level of stress that the mainstream adult population will tolerate while still feeling safe.
3	Bicyclists who are considered “enthused and confident” but still prefer having their own dedicated space for riding will tolerate this level of stress and feel safe while bicycling.
4	For bicyclists, this is tolerated only by those characterized as “strong and fearless,” which comprises a small percentage of the population. These roadways have high speed limits, multiple travel lanes, limited or non-existent bike lanes and signage, and large distances to cross at intersections.

Bicycle riders vary in experience, skill, ability, and confidence. As such, they rely on the bikeway system to cater to their specific needs and abilities. Some cyclists are more comfortable riding in traffic and value bikeways and routes that are direct and limit unnecessary delay. They more comfortably utilize facilities that share the roadway with automobiles or have limited bicycle infrastructure. People with

³ Mekuria, Maaza C., Peter G. Furth, and Hilary Nixon, (2012). *Low-Stress Bicycling and Network Connectivity*. San Jose, California: Mineta Transportation Institute. The criteria establish a “weakest link” approach, as roadways are classified based on their segments with the highest level of traffic stress, assuming that only those that are comfortable riding under the higher stress would travel on that road.

limited bicycling confidence and lower or developing skill levels such as children and older adult riders may desire more separation from traffic to feel comfortable enough to ride.