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STAFF REPORT

Date: August 27, 2020

To: Transportation Technical Advisory Committee (TTAC)

From: TRPA Staff

Subject: Vehicle Miles Traveled (VMT) Threshold Update Baseline and Project Level Assessment Approach

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Summary:
The VMT threshold update and the project level assessment approach have been referred to the TTAC for review and recommendations (or recommendations with modifications) to the Regional Plan Implementation Committee. At this meeting the TTAC will review the baseline level of VMT, the California Air Resources Board passenger vehicle greenhouse gas emissions (GHG) target for the Tahoe Metropolitan Planning Organization, work plan elements for the project level assessment, Chapter 65 of TRPA Code of Ordinances 65 (Air Quality/Transportation) and California Senate Bill (SB) 743, VMT guidance from SB 743, and next steps for the project level assessment and mitigation fee updates. TTAC recommendations on six specific topics will then be requested.

Recommendation and Requested Action:
The TTAC is asked to provide a recommendation, or recommendation with modifications, on the following four topics related to threshold standard update and two topics on the project level assessment approach. The first three threshold standard topics inform the fourth. Brief descriptions of the topics as well as staff's recommendations are included below.

1. VMT to be included

   Description: The standard can be based on constraining VMT by A) Geography (eg. inside vs outside the Region), B) Trip purpose (e.g., recreation, work), or C) Traveler type (e.g. day visitors, commuters, residents).

   Recommendation: Include all VMT inside the region by any traveler or for any trip purpose in the threshold standard. Staff further recommends investment in refining methods to estimate trip length outside the region and continued programmatic emphasis to reduce external VMT.

2. Types of travel to be included

Description: Efficiency based metrics require an amount of an activity (vehicle miles traveled) per unit (population). Populations could include, residents, seasonal residents, workers, all travelers, or any subset of the travelling population.

Recommendation: The standard should seek to accurately reflect the overall efficiency of the transportation system. To do so, all travelers must be accounted for in the efficiency metric. Accounting for all travelers means the inclusion of visitors, residents, commuters, and anyone else traveling in the Region.

3. Time period

   Description: The time period used to establish and assess the standard. VMT can be measured on a multi-year, annual, seasonal, monthly, or daily basis.

   Recommendation: Use annual average VMT and include multiple years of data to establish the baseline VMT level. The 2020 VMT estimates should not be considered in the establishment of a VMT baseline because of the impact of Covid-19 and the fact that data for all of 2020 are not available. Uncertainty is inherent in VMT estimates. Use of multiple years and longer time periods as the basis for standard setting and evaluation generally reduces that uncertainty.

4. Baseline VMT

   Description: The amount of VMT that will serve as the basis for establishment of the standard.

   Recommendation: Three-year annual average daily VMT (2016-2018) 1,457,988. The estimate is based on StreetLight and Caltrans and NDOT data. Use of an annual average emphasizes the importance of reducing VMT at all times of the year and for all travelers. The use of multiple years reduces uncertainty and addresses interannual variability, and the application of publicly available data sources promotes transparency.

The TTAC is asked to provide a recommendation, or recommendation with modifications, on the following two topics related to project level assessment.

1. Dynamic (Case Study) Testing

   Description: To validate and improve the Tahoe Transportation model which will be used as the foundation for the project level assessment tool, up to five validation tests will be performed for different project types.

Recommendation: Staff recommends a mix of project types and locations around the Region be considered for dynamic (case study) testing. The TTAC's input on the selected list of projects provided in attachment B is requested.

2. VMT Metrics

   Description: The VMT metrics that will be used to evaluate projects and promote better project design.

   Recommendation: Total VMT, Total VMT per service population, Total VMT per resident, Total VMT per employee, Home-based VMT per resident, and Total VMT per visitor are the metrics that should be considered. These metrics are described in greater detail in attachment B.

Background:

The Regional Plan Implementation Committee (RPIC) last discussed and provided direction on these items at the March, April, and July 2020 meetings. These items have now been referred to the TTAC for review and recommendation. More detailed background on both the VMT threshold update and the project level assessment and air quality mitigation fee update is provided in attachments A and B, respectively.

Threshold Standard Update:

Standard development and TTAC feedback are divided into a three-step process; 1) Establish a VMT baseline, 2) Establish the population baseline, 3) Target setting and implementation. The August meeting of the TTAC will focus on the first of the three phases, and address questions necessary to establish a new baseline for VMT target setting. Key decisions and staff recommendations are summarized above with additional detail in Attachment A.

Project Level Transportation Impact Assessment & Air Quality Mitigation Fee:

TTAC feedback at the August meeting will focus on dynamic (case study) testing of the model and VMT metrics. In September, the TTAC will review VMT screening criteria, VMT mitigation, VMT Thresholds of Significance, and review and update on development of the project-level transportation impact assessment tool. The TTAC will also be updated on the mitigation fee nexus study, and begin discussion on setting the updated mitigation fee amount, timing of fee collection, and other administrative aspects of the work task. In October, the TTAC will review and make recommendations on staff's draft proposals for the project level transportation impact assessment and the mitigation fee update, and the necessary updates to the TRPA code and procedures.

Contact Information:

For questions regarding the threshold update process, please contact Dan Segan, Principal Natural Resource Analyst, at dsegan@trpa.org or (775) 589-5233. For questions regarding the update to project analysis or the Air Quality Mitigation Fee update, please contact Melanie Sloan, Senior Transportation Planner, at msloan@trpa.org or 775-589-5208.

Attachments:

A: VMT Threshold update: VMT Baseline Report
B: Project Impact Assessment and Air Quality Mitigation Fee Update
C: Tahoe Activity-Based Travel Demand Model Assessment Memorandum
D: Potential VMT Metrics for Use in the Tahoe Basin Memorandum
E: Recommendations for VMT Methods for Use in the Tahoe Basin Memorandum
F: Potential VMT Screening Criteria for Use in the Tahoe Basin (DRAFT)
G: Technical Advisory on Evaluating Transportation Impacts in CEQA

Attachment A
VMT Threshold Update: VMT Baseline Report

TAHOE REGIONAL PLANNING AGENCY

Threshold Update

VMT THRESHOLD UPDATE: VMT BASELINE REPORT

INTRODUCTION

This report is part of the larger workplan to review and update the threshold standards to ensure they are grounded in the best science. The report focuses on the Vehicle Miles Traveled (VMT) standard and addressing issues related to updating that standard from one rooted in concerns about nitrogen loading to the lake to one designed to promote mobility, reduce dependence on the automobile, and support attainment of the GHG reductions goals of California and Nevada.

The Bi-State Compact instructs the Tahoe Regional Planning Agency (TRPA) to develop a transportation plan for the Region with two goals: first, to reduce dependency on the automobile, and second, to reduce air pollution from motor vehicles (Public Law 96-551, 96th Congress 1980). As a result of increasingly stringent tail pipe emissions standards, vehicles today are far cleaner than they were when the Bi-State Compact was amended 40 years ago. Because of those improvements, air quality in Tahoe today is generally good.

On July 22, 2020, the Regional Plan Implementation Committee of the TRPA Governing Board directed staff to update the VMT threshold standard to support California and Nevada greenhouse gas reduction goals and implement the Compact's direction to reduce dependence on the private automobile. RPIC provided the following parameters to guide target establishment.

1. Establish a per capita VMT reduction goal
2. Establish a target date for achieving the goal
3. Ensure alignment with state policy

BACKGROUND

The VMT threshold standard was established in 1982 to improve water quality by reducing deposition from in-basin NOx emissions from mobile sources (e.g., cars and trucks). Nitrogen emissions from mobile sources in the Region have declined more than 66% since the standard was adopted, far in exceedance of the standard's goals. Regional NOx emissions have been steadily decreasing since 1989 and reductions far exceed the 10% reduction initially envisioned by the standard. Empirical observations over the last 30 years of the relationship between in-region nitrogen emissions and atmospheric deposition establish:

- Current in-basin NO_x emissions from mobile sources are substantially below 1981 levels.
- A 14-fold increase in VMT from 1981 levels would be required to equal the 1981 NOx emissions levels.
- The goal established by the VMT standard, a 10% reduction in NOx emissions from in-basin mobile source, was likely achieved more than 15 years ago.
- NO_x emissions are likely to continue to decline as a result of increasingly strict tailpipe emissions standards and increasing clean vehicle market share.
- Nitrogen emissions from mobile sources in the Region have declined by approximately 66%, far in exceedance of the standard's goals. Despite this decline, no significant change in atmospheric deposition of nitrogen has been observed.

Since the standard was adopted in 1982, the understanding of the drivers of clarity loss has improved significantly. The motivating concern at the time was algal growth in the lake, supported by atmospheric deposition of nitrogen. The following key points have been determined since 1982:

- Scientific research to support the Tahoe Total Maximum Daily Load (TMDL), the science-based framework to restore the historic clarity of the lake, demonstrated that clarity loss is primarily driven by fine sediment particle (FSP) accumulation.
- TMDL implementation focuses on reduction of FSP load
- The TMDL scientific research found that excess algal growth is responsible for roughly a third of clarity loss.
- Preliminary TMDL scientific research suggested that local VMT reduction was unlikely to be a cost-effective strategy to reduce nitrogen loading and, thus, algal growth.

The declines in NO_x emissions from mobile sources means that, functionally, the NOx emission goal of the VMT standard was achieved years ago. While reduction of regional NOx emissions is no longer a driving water quality concern, there is substantial work that suggests reduction of VMT per capita has additional benefits (Fang & Volker 2017).

SUMMARY OF POLICY CONSIDERATIONS AND RECOMMENDATIONS

At the August 27th meeting of the Transportation Technical Advisory Group, the group will be asked to provide guidance on four topics. The first three topics inform the fourth. A brief summary of each topic, as well as staff's recommendation, is below.

1. VMT included in the standard	
Description	The standard can be based on constraining VMT by A) Geography (eg. inside vs outside the Region), B) Trip purpose (e.g., recreation, work), or C) Traveler type (e.g. day visitors, commuters, residents).
Recommendation	Include all VMT inside the region by any traveler and for any trip purpose. Staff further recommends refining methods to estimate trip length outside the region and continued programmatic emphasis on reduction of external VMT.
2. Travelers included in the standard	
Description	Efficiency based metrics require an amount of an activity (vehicle miles traveled) per unit (population). Populations could include, residents, seasonal residents, workers, all travelers, or any subset of the travelling population.
Recommendation	The standard should seek to accurately reflect the overall efficiency of the transportation system. To do so, all travelers must be accounted for via an efficiency metric. Accounting for all travelers means the inclusion of visitors, residents, commuters, and anyone else traveling in the Region.
3. Time period for the standard	
Description	The time period used to establish and assess the standard. VMT can be measured on a multi-year, annual, seasonal, monthly, or daily basis.
Recommendation	Use annual average VMT and include multiple years of data to establish the baseline VMT level. The 2020 VMT estimates should not be considered in the establishment of a VMT baseline because of the impact of Covid-19 and the fact that data for all of 2020 are not available. Uncertainty is inherent in VMT estimates. Use of multiple years and longer time periods as the basis for standard setting and evaluation generally reduces that uncertainty.
4. Baseline VMT for standard establishment	

Description	The amount of VMT that will serve as the basis for establishment of the standard.
Recommendation	Three-year annual average daily VMT (2016-2018) 1,457,988. The estimate is based on StreetLight and Caltrans and NDOT data. Use of an annual average emphasizes the importance of reducing VMT at all times of the year and for all travelers. The use of multiple years reduces uncertainty and addresses interannual variability, and the application of publicly available data sources promotes transparency.

WHAT IS VMT?

Vehicle miles traveled (VMT) is a measure of the number of miles driven on roadways in a specified area and period of time. Estimates of VMT are generally approximations of actual vehicle miles traveled, based on estimates of trip distance and frequency (Salon et al. 2012a). VMT could be precisely measured using car odometers, but rarely is because of the difficulty in obtaining the information (Salon et al. 2012a) and the challenge of determining where the vehicle travel occurred.

VMT is influenced by a complex set of interconnected factors and the synergies between them. For example, higher fuel prices reduce regional VMT, but the response at the household level is influenced by household location and income (Salon et al. 2012b, 2013). Nationally, VMT has generally increased as the population has grown, the economy has expanded, and car ownership has increased. Federal Highway Administration (FHWA) forecasts suggest that nationwide VMT will continue to grow by 1.07 percent annually through 2035. The FHWA forecast is influenced by projections for population growth, economic growth, and increased disposable income, all of which are positively associated with VMT growth (FHWA 2017).

WHY USE AN EFFICIENCY BASED MEASURE?

VMT can be expressed in absolute terms (total miles traveled) or as a function of another factor (e.g. workers, visitors, residents). The latter are collectively referred to as efficiency-based measures. Efficiency based measures express the amount of VMT in a region as a function of a factor thought to be related to that VMT. One of the most common efficiency-based measures is expressing VMT in a region as a function of the region's population. Analyzing VMT as a function of the population (e.g., VMT per capita) allows for comparison of trends through time (Circella et al. 2016) or between regions (Clark & Cushing 2004; McMullen & Eckstein 2013) while controlling for differences in population size.

An efficiency-based metric is recommended for establishment of the VMT threshold standard because it accomplishes two things: first, it better aligns with factors that can be planned and managed by TRPA and meaningful differences in the regional land use and the transportation system; and second, it is consistent with California state policy with respect to VMT and GHG.

RESPONSIVENESS TO REGIONAL MANAGEMENT

TRPA's unique planning authority allows it to closely coordinate land use (Regional Plan) and transportation (Regional Transportation Plan) planning. The two plans work together to provide visitors and residents with alternatives to personal automobile travel and to reduce VMT. For more than twenty years the focus of both has been supporting compact, mixed-use development, and walkable, bikeable, transit-friendly communities.

The combination of the development footprint, the transportation infrastructure, and choices made by travelers in the region influence the VMT per traveler. The total amount of VMT is a function of the three factors listed above, and the choices of individuals that influence the total number of travelers in the region. Total number of travelers (i.e., the service population) in the region is influenced by the number of people that chose to live, work, or visit Tahoe. These decisions are largely independent of local policy setting but exert significant influence over the total VMT in the region.

The current threshold standard establishes a target for the total amount of VMT in the region. As a result, the attainment status of the threshold standard has varied in response to factors that do not meaningfully reflect the changes in regional land-use or transportation system from realization of the Regional Plan and Regional Transportation Plan.

To protect and preserve the national treasure that is Lake Tahoe for future generations, the Regional Plan places strict controls on the pace of and total amount of development allowed in the region (TRPA 2012). It does not, nor does TRPA have the power to, limit the total number of individuals that choose to reside in Tahoe or visit Tahoe.

VMT attainment has fluctuated over the years. Twenty years ago, the current VMT standard was assessed as out of attainment, while in the 2015 threshold evaluation it was in attainment (based on VMT in 2014) (TRPA 2016). The California Department of Transportation (CalTrans) estimates for VMT on the California side of the region during this same time period showed the same general pattern, but with even greater fluctuation than estimated in Tahoe[1]. In 2001, estimated daily VMT on the California side of the Region was 1,073,000 (CalTrans 2018a). In 2014, Regional VMT was estimated to have dropped to just over half the volume in 2001, at 560,840 daily (CalTrans 2018b). While it would be nice for the Region to have plans and implementation measures that result in significant changes like this, the changes are more likely attributed to the loss of resident population, decline in gaming visitation, and the great recession.

There are currently 47,655 residential units in the Tahoe Region. Occupancy rates published by the U.S. Census Bureau 2018 American Community Survey (ACS), estimate that 45% of residential units are occupied by full-time residents and 55% are not occupied by full-time residents (US Census Bureau 2019). In Tahoe, these not-occupied housing units may be second homes, time-shares, seasonal rentals, or short-term rentals. Population in the region can and does fluctuate for reasons that are not related to the number of residential units in the region. If more people choose to live in the Region, total VMT in

[1] Nevada Department of Transportation did not break of the estimate VMT in Tahoe until 2016.

the Region will likely increase as VMT generally increases as population increases (FHWA 2010, 2017). If people choose to live elsewhere, in Region VMT will likely decrease. Expanding the geographic range considered, the dynamics of VMT can also change. If current residents of the region are priced out of the market or chose to move outside the region, but continue to work in the region, the longer commute trips can increase total VMT (inside and outside the region) even if there is a reduction in the VMT within the region.

Similar dynamics exist with visitation and visitor generated VMT. While the total number of rooms available to visitors to the region is limited by the Regional Plan, VMT varies considerably in response to the use (occupancy rate) of the hotels, motels, resorts, and casinos in the region. In the "shoulder" season, when fewer visitors choose Tahoe as a destination, both occupancy rates and VMT decline. The same pattern can be seen in response to macro-economic conditions. During the great recession, there was a considerable decline in the number of overnight visitors in the Region (see figure 1). It wasn't until the last couple of years that the number of rooms rented returned to pre-recession levels. The economic recovery is also evident in CalTrans VMT estimates. CalTrans estimates suggest that after declining during the recession, daily VMT in 2018 was 1,032,960, just shy of the 2001 level (CalTrans 2018c).

Even in 2018, the number of rooms rented remains below where it had been at the turn of the century when Tahoe's gaming industry was stronger. The decline in gaming visitation is well documented, with estimates suggesting that between 1990-2010, the industry declined by two-thirds (Eadington 2011).

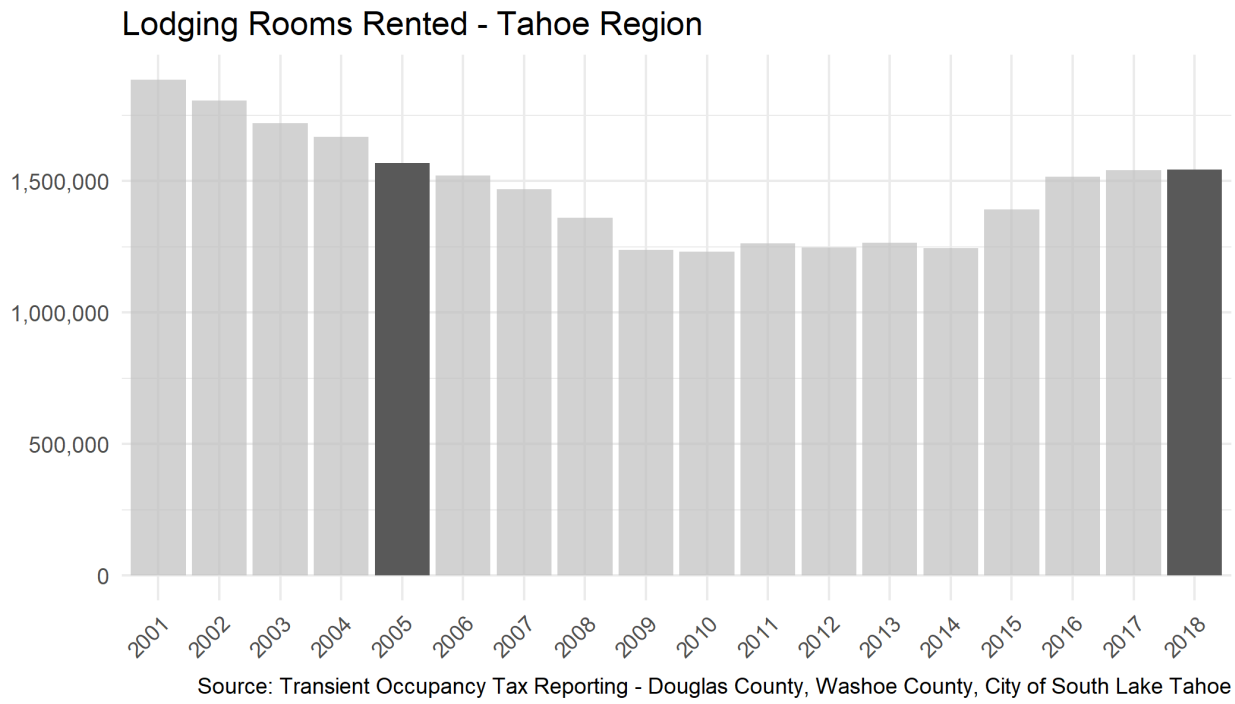

Figure 1: Total number of rooms rented (2001-2018)

Setting an absolute VMT target would require embedding specific assumptions about the number of people that live in and visit the region in the future. Embedding these types of assumptions within the threshold standard would make status relative to the standard highly dependent on the accuracy of the

embedded assumptions. Attainment of an absolute standard would likely be highly dependent on factors well outside the control of the agency.

Significant evidence suggests altering land-use patterns and improving the transportation system can reduce VMT per capita (Salon et al. 2012a; Marion Boarnet & Susan Handy 2017; Nelson 2017). However, questions remain about whether absolute VMT reduction is a realistic goal. In its guide to promoting sustainability performance measures in transportation decision-making, the EPA writes, "Because of population growth and economic development, most regions cannot feasibly reduce absolute VMT. Reducing per capita VMT can help a region achieve air quality, climate change, and congestion reduction goals without penalizing it for population growth.(EPA 2011)"

An absolute VMT metric would be less responsive to TRPA's regulatory authority and more likely to move in and out of attainment for reasons that do not reflect meaningful improvements in regional mobility or decreased reliance on the automobile. An efficiency-based metric is likely to be more response to regional authority, and better aligned with GHG reduction targets, and California state VMT requirements for local jurisdictions.

CONSISTENCY WITH STATE POLICY

California state policy emphasizes increased efficiency in VMT, and for reducing VMT per capita, but does not place an absolute cap on VMT. In the scoping plan for attaining the state's GHG targets, CARB writes, "There is no expectation or endorsement of any policy that would require the total statewide VMT to decrease such as to limit population growth, limit new housing growth, support out-migration, or slow economic growth in the State (CARB 2019a)." The proposed use of an efficiency based VMT target for the region is consistent with the California statewide approach to promoting more sustainable development patterns that provide residents with options other than driving, while not limiting population or visitation.

POLICY LANDSCAPE

Both California and Nevada are actively working to reduce GHG emissions. This discussion of the policy landscape focuses on providing an overview of the existing California state policy and targets for GHG and VMT, which are at the intersection of land use and transportation planning.

CALIFORNIA SENATE BILL 375, THE SUSTAINABLE COMMUNITIES AND CLIMATE PROTECTION ACT OF 2008.

California has established a suite of goals for reduction of GHG emissions and specifically for the reduction of emissions from the transportation sector. California Senate Bill 32 requires that statewide greenhouse gas (GHG) emissions be reduced by 40% from 1990 levels by 2030, and Executive Order B-16-12 established an additional target for the transportation sector of an 80 percent reduction from 1990 levels by 2050 (OPR 2018). State level policy to reduce GHG emissions is implemented through an integrated suite of sector level policies. State policies to reduce emissions from the transportation sector

can broadly be grouped into three categories; 1) promoting clean fuels, 2) increased emissions standards, and 3) VMT growth control.

The California Air Resources Board (CARB) is responsible for planning to achieve the state's GHG reduction goals (CARB 2019a). The transportation sector is the largest source of GHG emissions statewide, accounting for 40% of total emissions, and unlike other sectors, emissions from transportation have continued to grow in recent years (CARB 2019b). To achieve transportation sector GHG reduction goals, CARB's plan relies primarily on new vehicle technology and low carbon fuels, and to a lesser extent on slowing the growth of VMT statewide (CARB 2017a, 2017b).

CARB forecasts suggest that, absent policy intervention statewide, VMT in 2050 will be 24.3% higher than the 2015-2018 average (CARB 2019a, 2019c). To meet state targets, CARB developed an implementation scenario and associated GHG emissions forecast that included a mix of cleaner vehicle technology adoption and reducing the rate of VMT growth in the State. In the CARB planning scenario, statewide VMT in 2050 is 6.5% higher than the 2015-2018 average (CARB 2019a, 2019c).

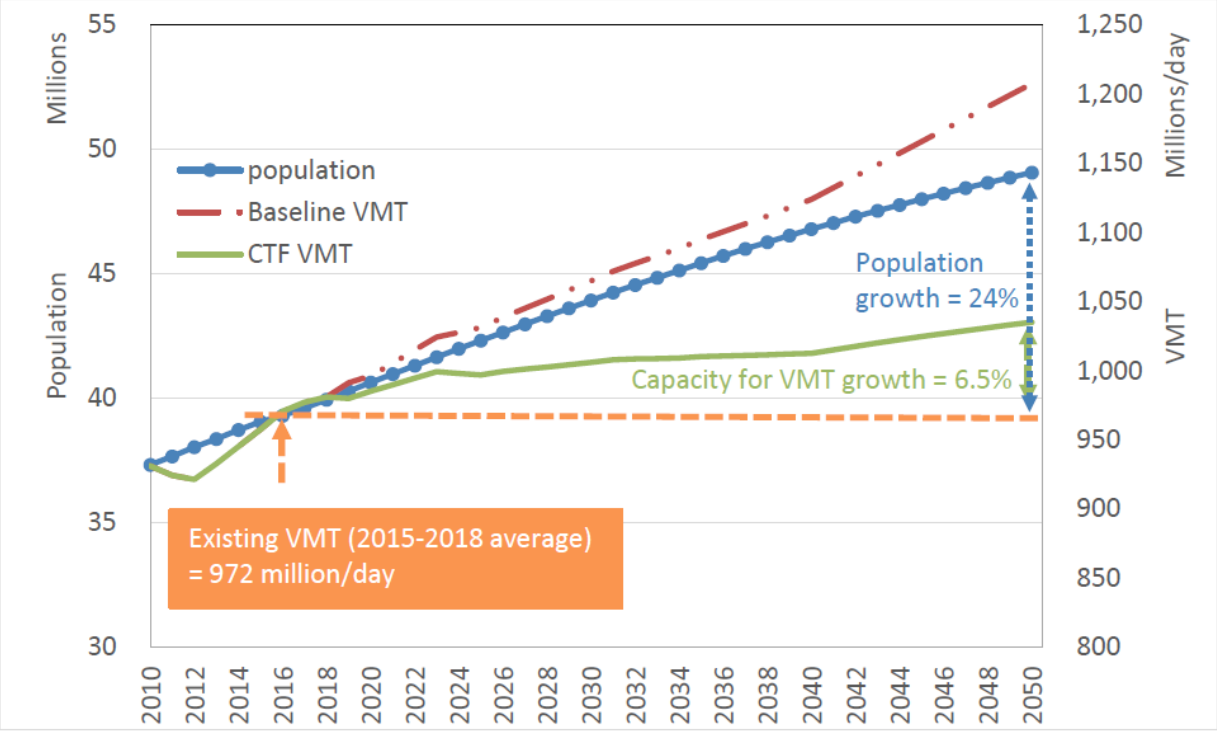

Figure 1: CARB forecast for California Statewide VMT growth. Source: (CARB 2019a)

Policy to control future growth in VMT is shaped by SB 375 and SB 743, each of which is discussed in additional detail below.

Signed in September 2008, Senate Bill (SB) 375, aligns regional GHG reduction targets with regional transportation and land use planning. SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) as part of the MPO's Regional Transportation Plan (RTP) that sets land use allocation and transportation investments necessary to meet GHG emission reduction

targets for the region (Steinberg 2008). In accordance with SB375, each MPO adopted an SCS designed to achieve a region-specific reduction in per capita GHG. Collectively, the adopted SCSs set the state on a trajectory to reduce per capita GHG emissions by 18% from 2005 levels by 2035. Targets for each MPO were updated in March 2018 and are listed in Table 1 (CARB 2018). Each target is expressed as a per capita reduction in GHG emissions from 2005 levels. The largest reductions are generally associated with the largest urban MPOs where statewide population growth is expected to be concentrated.

Statewide the collective 18% reduction in per capita GHG emissions in the current targets is lower than the 25% reduction in emissions that CARB identified as necessary to meet the SB 375 targets. In its review and analysis of the most recent set of regional SB 375 targets, CARB writes that it; "explored setting the updated 2018 SB 375 targets at the level necessary to attain state climate goals, and determined that those targets would be infeasible for MPOs to achieve with currently available resources (CARB 2019a)." During the target revision process, the four largest MPOs referenced four factors as challenges to achieving the previously established targets. Those factors were; 1) increasing vehicle fuel efficiency leading to more driving, 2) faster economic recovery following the great recession and the associated increase in VMT, 3) Insufficient funding for project implementation, and 4) lagging housing development rates (CARB 2018).

Table 1: SB375 Per capita GHG reduction targets

MPO	Targets	
	2020	2035
MTC/ABAG	-10%	-19%
SACOG	-7%	-19%
SANDAG	-15%	-19%
SCAG	-8%	-19%
Fresno COG	-6%	-13%
Kern COG	-9%	-15%
Kings CAG	-5%	-13%
Madera CTC	-10%	-16%
Merced CAG	-10%	-14%
San Joaquin COG	-12%	-16%
Stanislaus COG	-12%	-16%
Tulare CAG	-13%	-16%
AMBAG	-3%	-6%
Butte CAG	-6%	-7%
San Luis Obispo COG	-3%	-11%
Santa Barbara CAG	-13%	-17%
Shasta RTA	-4%	-4%
Tahoe MPO	-8%	-5%

As the RTPA for the Tahoe Region, TRPA's RTP/SCS is required to achieve the per capita GHG reduction goals established under SB 375. The last RTP/SCS for the Tahoe Region, adopted in 2017, forecast that the 2035 GHG region goals for the region would be achieved (Table 2). That analysis further suggested that per capita GHG reductions targets could be met despite a small increase (1%) in VMT per capita. TRPA and its partners are currently working on the 2020 RTP/SCS and expect that the SCS targets will be attained through a combination of reduced per capita VMT and cleaner vehicles.

Table 2: Mobile-Source Greenhouse Gas Emissions for California Portion of Region (2017 RTP)

	2005	2035	% Change
Daily VMT	1,041,890	1,149,601	10.3%
Population	41,377	45,166	9.2%
VMT/capita/day	25.18	25.45	1.1%
GHG Emissions (tons/day)	445	461	3.6%
GHG Emissions/Capita (pounds/person/day)	21.52	20.41	-5.2%

Senate Bill 743

SB743 aligns the environmental analysis requirements under CEQA to provide "more options to drive less," and support attainment of the SB 375 GHG reduction goals. With SB743, CEQA analysis shifts away from analyzing a projects' impact on automobile level of service to analyzing its impact on vehicle miles traveled (VMT), which are more closely related to GHG emissions. Additional detail on SB743 is included Attachment B

VMT INCLUDED IN THE STANDARD

Staff recommends the inclusion of all VMT by any traveler in the region for establishment of a new standard. This includes VMT associated with residents, day visitors, overnight visitors, students, and workers. It will also include all VMT associated with any type of vehicle: passenger car, bus, or truck.

TRAVELERS INCLUDED IN THE STANDARD

Efficiency based standards require defining how to calculate the amount of VMT and the population contributing to production of the amount of VMT. Staff recommends using an annualized amount of VMT (see prior section). What must also be decided is the types of travelers to use for the per capita measure.

Tahoe is a tourist destination. Like other tourist destinations, this means that the number of people moving around the region generally vastly exceeds the number of full-time residents, recently estimated at just over 50,000 (US Census Bureau 2019). The total number of people moving around the region, is referred to as the effective, traveling, or service population. The service population can include residents, visitors, workers, students, and anyone else traveling in the region (Fehr and Peers 2019).

Estimating visitation to the Region has always been a challenge. Early estimates suggested that 15 million people visited annually (TRPA 1978). More recent estimates have varied widely, suggesting between 13 and 24 million visitors annually (Svensson 2017; TTD 2017). Work is currently underway to develop and refine methods to better understand the number of visitors and effective traveling population in the Region. This work will be the subject of the next meeting of the working group.

Staff recommends that the service population, or total traveling population, associated with the annualized VMT measure be used for the establishment of the threshold standard.

TIME PERIOD FOR THE STANDARD

The current VMT threshold standard references 1981 as the baseline but does not specify a time period within the year. Evaluation of the standard has relied on the TRPA travel demand model. As described elsewhere, the TRPA travel demand model simulates travel on an early/late summer weekday. On the modeled day there are relatively high levels of both visitor and resident travel, which enhances the model's utility for evaluating projects and programs designed to improve the travel experiences of each. Because evaluation of the threshold has relied on the model, some have suggested that projects that are only active on days that are outside of the modeled period (e.g. shoulder season, winter) do not have an impact on threshold attainment.

An annual VMT standard also recognizes that the timing of GHG emissions during the year matters less than the total amount of emissions. An annual average also responds to comments previously received regarding periods outside the modeled day (Fehr and Peers 2019). An annual average VMT standard ensures a clear link to the goal of reducing VMT throughout the year. The use of annual average places equal emphasis on the automobile and travel other than the automobile, and on all travelers in the region no matter where or when they choose to travel. It would also begin to address prior suggestions that TRPA consider VMT from periods outside the modeled day (Fehr and Peers 2019). For the reasons stated above, staff recommends that the updated VMT standard consider all VMT in the region over the course of a year.

SOURCES OF VMT DATA

Establishing a VMT goal for the region requires an understanding of the amount of VMT in the region today, which requires identifying the appropriate data source(s) for estimating VMT. There are at least three sources of VMT data that are available for the Tahoe Region. Each is described in detail below.

TAHOE TRAVEL DEMAND MODEL

The Tahoe Travel Demand Model (Tahoe Model) is a travel demand model developed for the Lake Tahoe basin and maintained by the TRPA. It is a micro-simulated, activity-based model which can be used to simulate present day traffic patterns or forecast future conditions.

Like all activity-based travel demand models, the Tahoe Model simulates travel during a time-period over which there are consistent travel patterns. That time period is called the model day. The choice of a model day reflects the conditions and travel patterns to be understood and the problems to be solved. Tahoe's transportation program emphasizes reducing trips in multiple categories, including visitor, resident, and non-resident working commuter, in order to reduce reliance on the automobile. Because

of this broader objective, TRPA selected a model day that includes a mix of activity of residents, visitors, and commuters.

The current Tahoe Model focuses on travel patterns on an early and late summer weekday (the model day). The model day is formally defined as Mondays through Thursdays during the first two weeks of June, last week of August, and middle two weeks of September.

The model day used in the Tahoe Region is different than that used in most metropolitan areas. In most metropolitan areas the most common trip-pattern is work-home-school. As a result, most regions orient their modeling programs around a typical weekday (FHWA 2010; Fehr and Peers 2019). For example, the Sacramento Area Council of Government (SACOG) models a typical weekday (Tuesday, Wednesday, Thursday) in the spring or Fall (March, April, May, September or October). These days share similar travel behavior (commute to work, school in session) and are not generally impacted by extreme weather, high levels of workers on vacation, or weekend travel behavior (SACOG 2015). Similar model days are used by Santa Cruz County Regional Transportation Commission, San Francisco County Transportation Authority, and Regional Transportation Commission of Southern Nevada (Cambridge Systematics, Inc. 2002; Fehr & Peers 2016; RTCSNV 2016).

STREETLIGHT

StreetLight Data leverages navigation-GPS data and Location-Based Services (LBS) data from mobile phones to estimate a suite of travel based metrics (StreetLight 2018, 2020). In 2018, Streetlight estimated that it processes data from approximately 23% of adults, which it combines with information on the roadway network and from the U.S. Census. The information is then used to estimate the number of trips, trip origin and destination, and VMT, and links that information to anonymized socio-economic attributes about the travelers.

HIGHWAY PERFORMANCE MANAGEMENT SYSTEM

The Highway Performance Monitoring System (HPMS) is a national reporting program that provides information on all travel on public roads in the United States. States use standardized reporting and monitoring procedures to produce and submit a suite of travel related data to FHWA each year (FHWA 2016). CalTrans and NDOT both publish VMT estimates for their respective portions of the Tahoe region as part of their HPMS reporting requirements.

Links to the annual reports for each state are provided below:

- Caltrans: https://dot.ca.gov/programs/research-innovation-system-information/highway-performance-monitoring-system
- NDOT: https://www.nevadadot.com/doing-business/about-ndot/ndot-divisions/planning/roadway-systems/annual-vehicle-miles-of-travel

ESTIMATES OF VMT

Region estimates associated with the three potential sources discussed above are presented here.

TAHOE TRAVEL DEMAND MODEL

VMT

The TRPA travel demand model estimated average VMT in the Region on the model day in 2018 was 1,398,823.

STREETLIGHT

Streetlight estimates of VMT are available from 2016 to 2019. Streetlight data are also available for much of 2020, but those data cannot be reasonably compared to other estimates of VMT presented here because of the differences in the time period: 2020 is not yet complete and all of the TRPA model days have not yet occurred. Streetlight based estimates of VMT are provided for both the TRPA modeled day (Monday-Thursday in early or late summer), for comparison with the TRPA Model, and annually, for comparison with statewide estimates.

Table 3: StreetLight estimated VMT (2016-2019)

Year	Annual Daily Average	TRPA Model Day
2016	1,463,850	1,568,017
2017	1,429,714	1,362,321
2018	1,379,085	1,434,655
2019	1,364,724	1,288,535

There is significantly more variance in VMT year over year on the TRPA model day than there is annually. The greater variability on the modeled day is consistent with expectations for VMT estimation which generally suggest that the fewer the number of days considered in the estimate, the more likely the estimate is to be skewed by events on an individual day (e.g., special event, weather, accident). The TRPA modeled day represents data from 20 days during the year, while the annual average includes data from all 365 days in the year.

HIGHWAY PERFORMANCE MANAGEMENT SYSTEM

Caltrans has published estimates of VMT on the California side of the Region for each year since 2001. NDOT has published VMT estimates for the Nevada side of the basin since 2016. Table 4 summarizes the CalTrans and NDOT estimates for annual average daily VMT for the region. HPMS data is not yet available for 2019. NDOT estimates that it will release data in early September, and CalTrans expects to release the data in October.

Table 4: HPMS VMT Estimates for the Tahoe Region (2016-2019)

Year	CA	NV	Total
2016	1,016,891	435,213	1,452,104

2017	1,026,876	525,728	1,552,604
2018	1,032,957	437,612	1,470,569

VMT Threshold Baseline

A new baseline for the VMT threshold standard can be established using any one of the estimates above or a combination of those values. Tables 5-8 present different options for the establishment of a VMT threshold baseline. Table 5 includes the annual average daily VMT from StreetLight and HPMS between 2016-2019. The table also averages the two estimates of annual VMT data to produce a single year blended estimate of VMT, presented in the blended column.

Table 5: Annual average daily VMT (2016-2019)

Year	StreetLight	HPMS	Blended
2016	1,463,850	1,452,104	1,457,977
2017	1,429,714	1,552,604	1,491,159
2018	1,379,085	1,470,569	1,424,827
2019	1,364,724		

A multi-year average VMT can be used to establish the threshold standard baseline. Two- and three-year averages are presented in tables 6 and 7.

Table 6: Two-year annual average daily VMT (2016-2019)

Period	2-year average		
	StreetLight	HPMS	Blended
2016-2017	1,446,782	1,502,354	1,474,568
2017-2018	1,404,400	1,511,587	1,457,993
2018-2019	1,371,905		

Table 7: Three-year annual average daily VMT (2016-2019)

Period	3-year average		
	StreetLight	HPMS	Blended
2016-2018	1,424,216	1,491,759	1,457,988
2017-2019	1,391,174		

The standard baseline can also be established considering a narrower range of days, such as the early or late summer weekday that is the current focus of the Tahoe Travel Demand Model. Options for using multiple years are more limited because of the limited temporal alignment across estimates.

Table 8: Early/Late summer weekday average daily VMT (2016-2019)

Year	Tahoe Travel Demand Model	StreetLight	Blended
2016		1,568,017	
2017		1,362,321	
2018	1,398,823	1,434,655	1,416,739
2019		1,288,535	

Staff recommends that the blended three-year annual average of HPMS and StreetLight daily VMT be used as the baseline for establishment of the VMT threshold standard (i.e., 1,497,988). The use of two different data sources would likely produce a more accurate estimate by balancing the bias of a single estimation method.

Staff further recommends that the definition of the VMT threshold standard include both the baseline value (1,457,988) and the years included (2016-2018) to derive the baseline. By defining the time period used to establish the baseline, partners retain the possibility of updating the standard baseline if new data sources become available that provide more accurate estimates of VMT.

UNCERTAINTY

All data sources under consideration for use in establishing the VMT threshold standard baseline are estimates of, and not precise measurements of, VMT. HPMS guidelines establish minimum precision requirements for reporting HPMS data. The reporting requirements vary with population density and road type, but HPMS suggests that statewide summations will likely be at the 80-10 precision level or higher (FHWA 2016). A precision level of 80-10 means that the estimate will be within ±10 percent of the true value, 80 percent of the time.

StreetLight estimates also have uncertainty. A 2017 assessment of the performance of StreetLight based estimates of AADT in Oregon found that median error of Streetlight based data was 18% (Roll 2019). The study also suggested that traffic volume had a large influence on accuracy of the AADT estimate, with increasing roadway volume yielding increasingly more accurate estimates (Roll 2019).

Streetlight has continually worked to refine its algorithm for estimating travel metrics. Independent review suggests that the refinements are improving the quality of the data product. One assessment of StreetLight AADT estimates found that mean error decreased from 11.5% in 2017 to 6.2% in 2018 when compared to AADT estimates from the Virginia Department of Transportation estimates (Yang et al. 2020)

Uncertainty is inherent in VMT estimates. Use of multiple years, longer time periods, and multiple sources of data, as recommended, for standard setting and evaluation can reduce, but will not eliminate, uncertainty. To the extent possible, uncertainty should be considered and incorporated in programs and the regulatory framework designed to promote standard attainment.

DISCUSSION

Staff's recommendations will fundamentally alter the role of the Tahoe Model in threshold standard evaluation. Historically, the model has been used to assess status relative to the threshold standard. The recommendations would replace the model with third party data sources as the primary method for assessing threshold standard attainment.

The recommendations would also create a temporal mismatch between the modeled day and the basis for the threshold standard evaluation. The mismatch would not be an issue from a threshold standard evaluation standpoint but would need to be accounted for during planning to ensure model-based expectations about VMT reduction are appropriately accounted for over the course of the entire year (i.e., the model day reduction estimated by the Tahoe Model, when extrapolated to the entire year, will be slightly different than the average annual VMT figure based on the estimates from the third party data sources). Staff is actively working to leverage big data to more accurately extrapolate outside of the modeled time period.

The use of big data (e.g., cell phone, GPS) to estimate VMT is a rapidly changing field. The pace of change in the field means that there is uncertainty and risk associated with committing to a specific data product. The data product or vendor could easily be replaced by another vendor or estimation technique that refines and improves the ability to estimate VMT and understand travel. As the process moves forward, staff and stakeholders will have to adaptively manage to ensure that the region continues to apply the best available data.

Ambiguity has been a challenge for assessing numerous threshold standards, including the current VMT standard. The 17-word VMT standard ("Reduce vehicle miles of travel in the Basin by 10 percent of the 1981 base year values.") does not lend itself to objective evaluation because the parameters for evaluation are not fully defined. Staff's recommendation for baseline establishment would resolve a number of the shortfalls of the current standard.

At least three critiques raised relative to the current VMT threshold standard's formulation are addressed by staff's recommendations. The context for each critique is described below, and a proposed resolution to the issue is offered.

1. The threshold standard does not contain a specific target - The current threshold standard does not define the level of VMT in 1981. The lack of defined baseline for use in standard evaluation is a source of significant frustration for both the agency and its partners.

   Recommended resolution: The updated VMT standard should establish a specific target and define the baseline period used to derive that target.

2. The threshold standard references a single year - VMT in the Tahoe region varies year to year in response to changes to factors like macroeconomic conditions and weather. This variability in

annual VMT does not reflect meaningful changes made to regional transportation infrastructure or land use patterns.

Recommended resolution: Establish the baseline and the evaluation of standard status using data from multiple years. The use of multiple years of data to establish and assess progress against the standard will address interannual variability that is not reflective of meaningful changes in regional land use or transportation.

3. Threshold standard evaluation is not transparent – Stakeholders have critiqued the modelling process and the "shifting baseline" that the standard is evaluated against.

   Recommended resolution: Staff's recommendation is to use two publicly available data sources for threshold standard assessment. This will enable any interested party to assess status relative to the threshold standard. The recommendation will also enable standard assessment to occur more regularly than the current once every four years schedule.

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Attachment B

Project Impact Assessment and Air Quality Mitigation Fee Update

TAHOE REGIONAL PLANNING AGENCY

Project Impact Assessment and Air Quality Mitigation Fee Update

August 18, 2020

PROJECT LEVEL TRANSPORTATION IMPACT ASSESSMENT & AIR QUALITY MITIGATION FEE UPDATE

INTRODUCTION

The work tasks in this report are part of the larger workplan to update the vehicle miles traveled (VMT) threshold standard.

These work tasks focus on accelerating development of the walkable, bikeable, transit-friendly vision of the Regional Plan and Regional Transportation Plan, and attaining and maintaining TRPA's VMT threshold, by updating the:

- Project level transportation impact assessment incorporating best practices to support low VMT development (Section 65.2 TRPA Code of Ordinances)
- Air Quality Mitigation Fee program to ensure new development supports implementation of projects listed in adopted plans, including the Regional Plan, the Regional Transportation Plan, and local area plans (Section 65.2 TRPA Code of Ordinances)

The goal of these efforts is to update both processes and programs and to align each with the overall VMT threshold update workplan and its focus on a standard to promote mobility, reduce mobile source greenhouse gas (GHG) emissions, and reduce dependence on the automobile.

TASKS

Project Level Transportation Impact Assessment

The project level transportation impact assessment will incorporate today's best practices by refining the primary focus from trips to put emphasis on reducing longer trips and associated VMT, and to empower applicants with information they need to design better projects.

TRPA will develop, in collaboration with Placer County, California, a project level analytical tool that addresses Section 65.2 TRPA Code of Ordinances and state requirements under SB743 to ensure a coordinated and seamless process basin-wide.

Air Quality Mitigation Fee

The TRPA Air Quality Mitigation Fee (AQM fee) was last updated in 2007. This work item will review and consider changes to the AQM fee to better align it with the updated Regional Transportation Plan project list, better represent current day project costs, and to align with the Project Level Transportation Impact Assessment work. When completed, the fee will more directly support attaining and maintaining the updated VMT threshold. This work will also update applicable TRPA regulations, applications, and guidance.

SUMMARY OF REQUESTED INPUT

At the August 27th meeting of the Transportation Technical Advisory Group (TTAC), the group will be asked to provide input on key elements and staff recommendations for further analysis and consideration in the development of the Project Level Transportation Impact Assessment. A summary of each those is below.

PROJECT LEVEL TRANSPORTATION IMPACT ASSESSMENT

Project Level Transportation Impact Assessment	
1. Dynamic Testing	
Description	To validate and improve the Tahoe Transportation model, which will be used as the foundation for the project level assessment tool, up to five dynamic (case study) tests will be performed for different project types and locations.
Recommendation	Staff recommends a mix of project types and locations around the Region be considered for dynamic (case study) testing. The TTAC's input on the selected list of projects provided below is requested. 1. South Shore conversion in a town center of 12 Tourist Accommodation Units (TAU) to 10 Residential Units (RUU) 2. North Shore conversion in a town center from 14,839 square feet of Commercial Floor Area to 118 units (78 timeshare and 40 hotel) TAU, plus 3,858 square foot conference/meeting facilities, a 3,981 square foot restaurant, and 1,163 square foot food and beverage deck (Tahoe City) 3. North Shore 10 employee residential units in a town center (Tahoe City) 4. South Shore 23 new 4-bedroom RUUs (townhome single family dwellings) outside of a town center (SLT) 5. South Shore 3,000 – 5,000 square foot commercial redevelopment (e.g., Meyers) 6. North Shore small mixed-use development in town center: 10 Multifamily housing units, 2,623 SF Food/Beverage Retail Sales, 1,500 SF Eating and Drinking Places, and 1,250 SF Secondary Storage (Kings Beach) 7. Recreation: Bike path, East Shore, Spooner Summit to Sand Harbor, with the path set as an attractiveness factor for the Sand Harbor recreation use. 8. Transportation: parking management. Use the TRPA model's cost factor as a proxy for parking management.
2. VMT Metrics	
Description	VMT metrics that will be used to evaluate projects and promote better project design.
Recommendation	Total VMT, Total VMT per service population, Total VMT per resident, Total VMT per employee, Home-based VMT per resident, and Total VMT per visitor are the metrics that should be used. These metrics are described in greater detail below.

BACKGROUND

PROJECT LEVEL TRANSPORTATION IMPACT ASSESSMENT & AIR QUALITY MITIGATION FEE

Regulatory Approach

TRPA

Section 65.2 of the TRPA Code of Ordinances, entitled Traffic and Air quality Mitigation Program, details the requirements for assessing and addressing the impacts of projects.:

65.2.1.Purpose

The purpose of this section is to implement TRPA's 1992 Air Quality Plan and Goal #4, Policy 2 of the Development and Implementation Priorities Subelement, Implementation Element of the Goals and Policies, with respect to the establishment of fees and other procedures to offset impacts from indirect sources of air pollution.

65.2.2.Applicability

The provisions of this section are applicable to all additional development or transferred development and all changes in operation as defined in this section.

65.2.3.Definitions

For purposes of this section, the following terms are defined as provided below:

A. Approved Center

A multi-use commercial center with sufficient size, parking, diversity of use, level of service, and access management, as to which TRPA has found that limited changes in operation would cause insignificant increases in new vehicle trips.

B. Change in Operation

Any modification, change, or expansion of an existing or previous use resulting in additional vehicle trip generation. Changes in operation include, but are not limited to:

1. Expansion of gross floor area; or
2. Change in the type of generator on the trip table, normally indicated by a substantial change in products or services provided.

C. Insignificant Increase

An increase of 100 or fewer daily vehicle trips, determined from the trip table (subparagraph 65.2.3.H) or other competent technical information.

D. Maintenance Area

The urbanized portions of El Dorado and Douglas Counties within the Tahoe region that are designated as maintenance areas for carbon monoxide under the federal Clean Air Act. The plan area statements listed below are within the maintenance area.

1. Within the County of Douglas

South Shore Area Plan; Round Hill Community Plan; and PASs 057, 058, 059, 060, 061, 062, 063, 064, 065, 066, 067, 068, 070A, 070B, 072, 073, 074, and 080.

2. Within the City of South Lake Tahoe

   Tourist Core Area Plan; Tahoe Valley Area Plan; Bijou/Al Tahoe Community Plan; and PASs 089B, 090, 092, 093, 099, 100, 101, 103, 104, 105, 108, 111, 114, and 116.

3. Within the County of El Dorado

   Meyers Area Plan and PASs 116, 118, 119, 120, 122, 123,124, 130, 135, 136, 139, and 140.

E. Minor Increase

An increase of more than 100 but not more than 200 daily vehicle trips determined from the trip table or other competent technical information.

F. Previous Use

The most recent permanent use in the project area that existed for more than 90 consecutive days of operation within the 60 months preceding submission of a complete application to TRPA for review of a change in operation. Uses which have received CTRPA or TRPA approval, but have not operated for 90 consecutive days within the previous 60 months, shall not be recognized as previous uses. A use that regularly operated fewer than seven days per week shall have operated for 13 consecutive weeks within the previous 60 months to constitute a previous use.

G. Significant Increase

An increase of more than 200 daily vehicle trips, as determined from the trip table or other competent technical information.

H. Trip Table

TRPA shall adopt and maintain a trip table for the purpose of estimating the number of vehicle trips resulting from additional development or changes in operation. TRPA shall generate and update the data in the trip table by referring to recent publications on traffic and trip generation (for example, publications of the Institute of Transportation Engineers and California Department of Transportation) and field surveys conducted in the Tahoe region by TRPA or other competent technical experts.

I. Vehicle Trip

A one directional vehicle movement to or from a project area. The number of vehicle trips assigned to a project shall be the total daily vehicle trips to and from the project during its maximum hours of operation for the review period. When exact numbers of vehicle trips are not known for a use, they shall be determined from the trip table or other competent technical information.

65.2.4. Standards for Additional or Transferred Development

Additional development or transferred development shall be subject to the requirements provided below.

A. Applicant Responsibility

Information about vehicle trip generation relevant to the project shall be made available to TRPA by the applicant at the time application is made.

B. Traffic Analysis

As part of the project application for additional or transferred development that would result in a significant increase in daily vehicle trips at the project area, the applicant shall prepare and submit to TRPA a technically adequate analysis of potential traffic and air quality impacts. For additional or transferred development that would result in a minor increase in daily vehicle trips at the project area, and where the subject parcel is located within 300 feet of the center of the U.S. Highway 50 right-of-way and in a maintenance area, the applicant shall prepare and submit to TRPA as part of the project application an analysis of potential traffic and air quality impacts. A traffic analysis shall include:

1. Trip generation rates of the proposed project;
2. Impacts of the proposed project on the level of service at any impact intersections;
3. Impacts of the proposed project on regional vehicle miles travelled (VMT);
4. Impacts of the proposed project on regional and subregional air quality;
5. Ingress and egress characteristics of the proposed project, and their impacts on traffic flow adjacent to the project area;
6. Measures necessary to mitigate all traffic and air quality impacts to a level consistent with the environmental thresholds, the Goals and Policies, the Regional Transportation Plan, and the 1992 Air Quality Plan; and
7. Additional information that TRPA may require.

C. Required Offsets

Additional or transferred development shall offset the potential traffic and air quality impacts of the project in accordance with the provisions provided below.

1. Regional and Cumulative Impact Fees: In order to offset regional and cumulative impacts, additional development shall contribute to the Air Quality Mitigation Fund, except as provided for in subparagraph 2 below. The amount of contribution is established in subparagraph 65.2.4.D.
2. Regional and Cumulative Mitigation Measures: To offset regional and cumulative impacts, and in lieu of the contribution required under subparagraph 65.2.4.C.1, additional development may provide mitigation measures. The cost of such measures shall be equal to or greater than the contribution required under subparagraph 65.2.4.C.1. Regional and cumulative mitigation measures may include, but are not limited to:
    a. Transit facility construction;

b. Transportation systems management measures, including, but not limited to, bicycle facilities, pedestrian facilities, and use of alternative fuels in fleet vehicles; or

c. Transfer and retirement of offsite development rights.

3. Localized Mitigation Measures: In order to offset the localized impacts of a project, when a traffic analysis has been prepared pursuant to subparagraph 65.2.4.B, all necessary mitigation measures shall be required as a condition of project approval for all additional or transferred development. Mitigation measures may include, but are not limited to:

a. Acceleration/deceleration lanes;

b. Left turn lanes;

c. Stop or yield controls;

d. Access management;

e. Transportation systems management measures, including but not limited to, bicycle facilities and pedestrian facilities; or

f. Contribution to the Air Quality Mitigation Fund in an amount sufficient to pay for the necessary mitigation measures.

D. Fee Schedule

The air quality mitigation fee shall be assessed in accordance with the mitigation fee schedule in the Rules of Procedure.

E. Limited Exception for Additional or Transferred Development within Adopted Community Plans

Additional or transferred development located within an adopted community plan, the traffic and air quality impacts of which were evaluated in the EIS for the community plan and mitigated by the provisions of the community plan, shall be exempt from the requirements of subparagraph 65.2.4.C, provided TRPA finds that the implementation element of the community plan as a whole meets the standards of subparagraphs 65.2.4.Band 65.2.4.C.

65.2.5. Standards for Changes in Operation

The standards provided below shall apply to changes in operation.

A. Applicant Responsibility

Information about vehicle trip generation relevant to the project shall be made available to TRPA by the applicant at the time application is made.

B. Traffic Analysis

As part of the project application for changes in operation that would result in a significant increase in daily vehicle trips, the applicant shall prepare and submit to TRPA a technically adequate analysis of potential traffic and air quality impacts. For changes in operation that would result in a minor increase in daily vehicle trips and are located within 300 feet of U.S. Highway 50 in a maintenance

area, the applicant shall prepare and submit to TRPA, as part of the project application, a technically adequate analysis of potential traffic and air quality impacts. A traffic analysis shall include the elements listed in subparagraph 65.2.4.B.

C. Required Offsets

All changes in operation shall offset the potential traffic and air quality impacts of the project in accordance with the provisions below.

1. Regional and Cumulative Impact Fees

To offset regional and cumulative impacts, changes in operation shall contribute to the Air Quality Mitigation Fund, except as provided for in subparagraph 2 below. The amount of contribution is established in subparagraph 65.2.5.D.

2. Regional and Cumulative Mitigation Measures

To offset regional and cumulative impacts, and in lieu of the contribution required under subparagraph 65.2.5.C.1, mitigation measures may be provided. The cost of such measures shall be equal to or greater than the contribution required under subparagraph 65.2.5.C.1. Regional and cumulative mitigation measures may include, but are not limited to, the elements listed in subparagraph 65.2.5.C.2.

3. Localized Mitigation Measures

In order to offset the localized impacts of a project, when a traffic analysis has been prepared pursuant to subparagraph 65.2.5.B, all necessary mitigation measures shall be required as a condition of project approval. Mitigation measures may include, but are not limited to, the elements listed in subparagraph 65.2.4.C.3.

D. Fee Schedule

As provided in subsection 65.2.5.C, TRPA shall assess an air quality mitigation fee, based on data from the Trip Table or other competent technical information, according to the fee schedule in subsection 10.8.5 in the Rules of Procedure.

E. Limited Exception for Approved Centers

TRPA shall evaluate multi-use commercial centers and the adjacent roadways as to their size, parking, diversity of use, level of service, and ingress and egress. Where TRPA finds that limited changes in operation in a multi-use commercial center would cause insignificant increases in new vehicle trips, the center shall be included on a list of approved centers. An approved center shall be exempt from subparagraphs 65.2.5.A through D, with the following exceptions:

1. Changes in operation where the previous or proposed use occupies more than 5,000 square feet of gross floor area;

2. Changes in operation where the previous or proposed use is identified for case-by-case review on the trip table;

3. Changes in operation where the vehicle trip generation rate of the proposed use is identified on the trip table as being greater than 300 vehicle trips per 1,000 square feet of gross floor area; or

4. Changes in operation in an area with a monitored worsening in level of service of nearby streets or intersections.

65.2.6. Use and Distribution of Mitigation Funds

A. TRPA shall deposit air quality mitigation funds in a trust account. Interest accruing to the trust account shall remain in the account until used on air quality mitigation projects. TRPA shall keep track of the amount of funds collected for each local jurisdiction, with interest, and shall disburse funds to the local jurisdiction, or to the Tahoe Transportation District at the local jurisdiction's request, for expenditure within the jurisdiction of origin, provided TRPA finds that the expenditure is consistent with TRPA's Regional Transportation Plan or the 1992 Air Quality Plan. Pursuant to subparagraphs 65.2.4.C.2 and 65.2.5.C.2, certain funds may be identified for the construction of specific projects. By October 1 of each year, the recipient shall submit to TRPA an annual report of the funds expended as of June 30 each year.

B. As an alternative to distributing air quality mitigation funds to the jurisdiction of origin, a portion of the air quality mitigation funds may be distributed across jurisdictional boundaries to support projects of regional priority that are specifically identified in a regional capital improvement program developed in cooperation with local jurisdictions, such as the Five Year Environmental Improvement Program (EIP) Priority Project List.

65.2.7. Revision of Fee Schedules

TRPA shall review the fee schedules in accordance with subsection 10.7 in the Rules of Procedure.

65.2.8. Mitigation Credit

The two programs below address air quality mitigation credit.

A. Mitigation Fee Credit

If a project approval expires and the project is not complete, then an air quality mitigation fee credit may be given for a subsequent similar project approval. This subparagraph shall not be construed to require a refund of an air quality mitigation fee. Credit shall be given if the following requirements are met:

1. The prior project approval was granted within the same project area as the project approval for which a credit is sought;

2. The applicant provides sufficient evidence of the payment of an air quality mitigation fee; and

3. An air quality mitigation fee is required as part of the project approval for which a credit is sought.

B. Regional and Cumulative Mitigation Credit Programs

In those instances when a reduction in daily vehicle trip ends (DVTE) of 1,000 or greater will result from the implementation of an EIP program that is not associated with any required mitigation,

TRPA may allow for a regional and cumulative mitigation credit to be given to the participating entities. Credit shall be given based on the number of DVTE that will be reduced as a result of the proposed program. Credit cannot be awarded when the reduction in vehicle trips is a mitigation requirement pursuant to subparagraphs 65.2.4.C or 65.2.5.C above. Candidate credit recipients shall submit a plan to TRPA describing the proposed program, quantifying the reduction in DVTE, and specifying the areas where the credit can be used. The award of mitigation credit shall be reviewed and approved by TRPA, in consultation with the appropriate local jurisdiction and the Tahoe Transportation District, on an individual basis. Credit shall be awarded at such time that the proposed program is implemented. TRPA staff may reevaluate the 1,000 DVTE minimum requirement to determine if the level should be adjusted.

California

California State Bill 743 (SB 743) went into effect July 1, 2020.

SB 743 requires California jurisdictions to change their transportation metric from Level of Service (LOS), which measures the quality of the driving experience based on measures like speed, density, and congestion, to Vehicle Miles Traveled (VMT) which captures the impacts of driving on the environment.

SB 743 requires projects be assessed for their generated (i.e. immediate) VMT and VMT effect (i.e. cumulative).

OPR

The California Governor's Office of Planning and Research (OPR) released a Technical Advisory on Evaluating Transportation Impacts in CEQA in December 2018. The Technical Advisory acknowledges that "CEQA generally defers to lead agencies on the choice of methodology to analyze impacts" and "to set or apply their own thresholds of significance (for project assessment)." Therefore, the Technical Advisory provides "advice and recommendations," which CEQA lead agencies may use at their discretion for implementing SB 743 changes but "does not alter lead agency discretion in preparing environmental documents subject to CEQA." The advice and recommendations discuss methodologies for assessing VMT, significance thresholds for land use and transportation projects, and VMT mitigations.

To slow VMT growth under SB743, OPR's guidance directs agencies to establish VMT based standards of significance for project evaluation. Under Public Resource Code 21099, OPR is required to consider the promotion of three goals when establishing the criteria; (1) reduction of greenhouse gas emissions; (2) development of multimodal transportation networks; and (3) a diversity of land uses. OPR's initial guidance for establishment of standards of significance for evaluating projects is set at 15 percent lower than existing per capita (residential) or per employee (office) development, and for any net increase in VMT for retail projects. The 15% per capita reduction targets were identified because they reflected targets that were "both reasonably ambitious and generally achievable (OPR 2016)." The 15 percent reduction target is also grounded in evidence that connects it to the State's emissions goals (OPR 2018). Better project design is one of the policy mechanisms the Region expects to use to establish a new VMT target.

For more information on the Technical Guidance, see the Technical Advisory on Evaluating Transportation Impacts in CEQA report attached to this report.

Local Jurisdictions

In addition to this assessment, projects may be required to undergo a separate project impact assessment at the jurisdictional level, e.g., El Dorado County, Placer County, Douglas County, Washoe County, etc.

CONSIDERATIONS

PROJECT LEVEL TRANSPORTATION IMPACT ASSESSMENT

The consultant Fehr & Peers was hired to assist in analysis and to make recommendations for the creation of a project-level transportation impact assessment tool.

The analysis and recommendations include the following (memos attached for the completed tasks, in bold):

- **Existing methodologies for calculating project-level VMT**
- **Best practices for VMT metrics**
- **Best practices for methods for calculating VMT**
- **Best practices for VMT screening criteria (draft)**
- Best practices for VMT mitigations
- Project-level thresholds of significance

Existing Methodologies

A qualitative assessment was completed for the Tahoe activity-based travel demand model (Tahoe Model) based on model documentation provided by TRPA. The purpose of this assessment was to determine the Tahoe Model's ability to produce VMT estimates for project-level transportation impact assessment under Section 65.2 and to support local jurisdiction assessment for CEQA compliance under SB 743.

Fehr & Peers' analysis determined that the Tahoe Model has some limitations but these are generally fewer than other available tools for producing project-level VMT estimates in the Tahoe Basin.

Next steps include conducting additional dynamic (case study) testing to further validate the TRPA Model's sensitivity to project assessments, and definition of the project assessment day in relation to the TRPA Model's modeled day.

For more information on this assessment, see the Tahoe Activity-Based Travel Demand Model Assessment Memorandum attached to this report.

VMT Metrics

An evaluation of potential VMT metrics for use within the Tahoe Region included analysis of best practices for calculating VMT, tools for calculating VMT, and VMT metrics; inclusion of additional metrics relevant to the Tahoe Basin; and provides a summary of each metric.

For more information on the Fehr & Peers analysis detailed below, please see the Potential VMT Metrics for Use in the Tahoe Basin memorandum attached to this report.

VMT metrics that can be used to evaluate land use plans, land use projects, and transportation projects, are divided into two general types: absolute, which measures a specific amount of VMT, such as total VMT on a network, and efficiency, which expresses VMT as a ratio or rate, such as VMT per capita.

Staff recommends the use of efficiency metrics because environmental goals are typically designed to improve the efficiency of vehicle travel by influencing land use and transportation network decisions versus preventing growth altogether to stay under a fixed amount of VMT.

The Tahoe Basin economy, and much of the VMT within the region, is attributable to visitors and recreational travelers and non-resident workers, who live outside of the region but work within it. A VMT metric that recognizes these factors allows greater flexibility for evaluating potential impacts of workforce housing projects, short-term rental policies, and similar projects and programs.

Some models may be used to calculate efficiency based VMT metrics (such as the Tahoe Model), and tools may be developed to include them, such as those using big data.

The VMT metrics that staff are advancing for further consideration are:

- Total VMT
- Total VMT per service population (includes all travelers: resident, employee, visitor, and pass-through)
- Total VMT per resident
- Total VMT per employee, by model employment-related land use type
- Home-based VMT per resident
- Total VMT per visitor

VMT Methods

An evaluation of potential VMT calculation methodologies to estimate project level VMT in the Tahoe Region was completed. The results of this evaluation summarize those discussed under Existing Methodologies and VMT Metrics above. For more information see the Recommendations for VMT Methods for Use in the Tahoe Basin Memorandum attached to this report.

VMT Screening Criteria

Screening criteria are used to exempt or simplify classes of projects anticipated to have no or minor impacts. Examples provided by OPR include affordable housing or projects in low-VMT producing areas.

Staff are considering potential policy objectives that should be further evaluated for potential project screening. Discussion of specific screening criteria will occur once these goals are determined.

Fehr & Peers provided analysis and recommendations for next steps for VMT screening criteria. For more information see the Potential VMT Screening Criteria for Use in the Tahoe Basin (DRAFT) memorandum attached to this report.

VMT Mitigations

A memorandum summarizing potential VMT mitigations is underway and expected in September. These mitigations will be based on local, regional, and best practices and discuss their consistent application to ensure appropriate VMT reductions.

Project-Level Thresholds of Significance

Recommendations for project level thresholds of significance, in cooperation with Placer County and the TRPA, are underway and targeting a November completion.

NEXT STEPS

The purpose of this report is to introduce the two work tasks, review existing and best practices research, and receive feedback on the next steps for the project-level transportation impact assessment task, including TRPA model dynamic (case study) testing and VMT metrics.

In September, the TTAC will review staff recommendations based on input from the August meeting; review VMT screening criteria, VMT mitigations, VMT Thresholds of Significance, and project-level transportation impact assessment tool progress; and review an update on the mitigation fee nexus study, as well as begin discussion on setting the updated mitigation fee amount, timing of fee collection, and other administrative aspects of the work task.

In October, staff will present and the TTAC will review and make recommendations on draft proposals for the project level transportation impact assessment and the mitigation fee update, and for necessary updates to TRPA code and procedures.

Attachment C

Tahoe Activity-Based Travel Demand Model Assessment Memorandum

FEHR PEERS

Memorandum

Date:	July 17, 2020
To:	Stephanie Holloway, Placer County Melanie Sloan, TRPA
From:	Rob Hananouchi, Kashfia Nehrin, & Ron Milam, Fehr & Peers
Subject:	**Tahoe Activity-Based Travel Demand Model Assessment**

RS20-3907

This memorandum presents a qualitative assessment of the Tahoe activity-based travel demand model (Tahoe AB model) based on model documentation provided by Tahoe Regional Planning Agency (TRPA) staff. This assessment uses the model documentation to assess the Tahoe AB model's capabilities of producing vehicle miles of travel (VMT) estimates for transportation impact assessment in compliance with the California Environmental Quality Act (CEQA). The results of this assessment are compared alongside previously completed assessments of the California Statewide Travel Demand Model (CSTDM) and VMT sketch planning tools. The intent of this assessment is to start a dialogue with TRPA and local agencies about the strengths and weaknesses of available tools to estimate VMT for project-scale effects in the Tahoe Basin.

Background

TRPA and local lead agencies in the Tahoe Basin need to estimate VMT for impact assessment purposes. This includes environmental impact assessment per the requirements identified in Article VII of the Tahoe Regional Planning Compact and under the California Environmental Quality Act (CEQA). Article VII requirements would apply to all projects in the Tahoe Basin while CEQA requirements apply to projects in the State of California portion of the Tahoe Basin only.

The TRPA VMT Threshold Standard was adopted in 1982 to address nitrogen oxides (NOx) tailpipe emissions from vehicles and their effect on lake clarity. Since 1982, NOx emissions from mobile sources have greatly reduced as a result of increasingly stringent tailpipe emissions standards. However, VMT

remains an important performance measure in efforts to reduce auto dependence, reduce greenhouse gases (GHG), and comply with related TRPA and California goals. Therefore, TRPA is in the process of updating its VMT Threshold Standard for assessing the VMT impacts of projects in the Tahoe Basin.

Senate Bill (SB) 743 in California initiated considerable changes to the evaluation of transportation impacts under CEQA. Specifically, SB 743 directed the Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines to establish new metrics for determining the significance of transportation impacts, and established that automobile delay, as described by level of service (LOS) or similar measures of vehicular capacity or traffic congestion, shall not be considered a significant impact on the environment upon certification of the amended CEQA Guidelines by the Natural Resources Agency. The amended CEQA Guidelines were certified in December 2018, eliminating the use of LOS as a measure for environmental impact. The amended CEQA Guidelines also state that "generally, VMT is the most appropriate measure of transportation impacts" and require the use of VMT statewide as of July 1, 2020. The CEQA Guidelines further explain that a "lead agency may use models to estimate a project's vehicle miles traveled."

To aid in SB 743 implementation, OPR released a *Technical Advisory on Evaluating Transportation Impacts in CEQA* (Technical Advisory) in December 2018. The Technical Advisory acknowledges that "CEQA generally defers to lead agencies on the choice of methodology to analyze impacts." Therefore, the Technical Advisory provides "advice and recommendations," which CEQA lead agencies may use at their discretion for implementing SB 743 changes but "does not alter lead agency discretion in preparing environmental documents subject to CEQA." The Technical Advisory includes technical recommendations regarding the assessment of VMT. With regards to methodology for estimating VMT, the Technical Advisory states that "travel demand models, sketch models, spreadsheet models, research, and data can all be used to calculate and estimate VMT. To the extent possible, lead agencies should choose models that have sensitivity to features of the project that affect VMT." The Technical Advisory further states that "when using models and tools for [establishing thresholds of significance and estimating VMT], agencies should use comparable data and methods, in order to set up an 'apples-to-apples' comparison between thresholds, VMT estimates, and VMT mitigation estimates."

CEQA Expectations

CEQA compliance has two basic elements. The first is the legal risk of challenge associated with inadequately analyzing impacts due to use of models that do not meet benchmark expectations. The second is the mitigation risk of mis-identifying the impact and the mitigation strategies to reduce the impact. Agencies with a high risk of legal challenges will likely be concerned about both elements while

agencies with less legal risk should still be concerned about the second element since it is also relevant for all other transportation analysis based on model forecasts.

The CEQA Guidelines contain clear expectations for environmental analysis as noted below; however, the CEQA Guidelines are silent about what data, analysis methods, models, and mitigation approaches are adequate for transportation impacts.

CEQA Guidelines – Expectations for Environmental Impact Analysis

§ 15003 (F) = fullest possible protection of the environment…

§ 15003 (I) = adequacy, completeness, and good-faith effort at full disclosure…

§ 15125 (C) = EIR must demonstrate that the significant environmental impacts of the proposed project were adequately investigated…

§ 15144 = an agency must use its best efforts to find out and disclose…

§ 15151 = sufficient analysis to allow a decision which intelligently takes account of environmental consequences…

All of these suggest accuracy is important and have largely been recognized by the courts as the context for judging an adequate analysis. So, then what is the basis for determining adequacy, completeness, and a good faith effort when it comes to forecasting and transportation impact analysis? A review of relevant court cases suggests the following conclusions.

- CEQA does not require the use of any specific methodology. Agencies must have substantial evidence to support their significance conclusions. (Association of Irritated Residents v. County of Madera (2003) 107 Cal.App.4th 1383.)
- CEQA does not require a lead agency to conduct every test or perform all research, study, and experimentation recommended or demanded by commenters. (CEQA Guidelines, § 15204, subd. (a))
- CEQA does not require perfection in an EIR but rather adequacy, completeness and a good faith effort at full disclosure while including sufficient detail to enable those who did not participate in the EIR preparation to understand and consider meaningfully the issues raised by the project. (Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692)
- Lead agencies should not use scientifically outdated information in assessing the significance of impacts. (Berkeley Keep Jets Over the Bay Comm. v. Board of Port Comm. (2001) 91 Cal.App.4th 1344.)

- Impact analysis should improve as more and better data becomes available and as scientific knowledge evolves. (Cleveland National Forest Foundation v. San Diego Association of Governments, Cal. Supreme Ct. S223603, 2017).

These conclusions tend to reinforce the basic tenet of CEQA that requires having substantial evidence to support all aspects of the impact analysis and related decisions. Further, analysis should rely on the latest state of the practice, or even best practice methods, to provide accurate and meaningful results. This expectation is grounded in the basic purpose behind environmental regulations like CEQA that attempt to accurately identify and disclose potential impacts and to develop effective mitigation. Having accurate and reliable travel forecasts is essential for meeting these expectations. A key challenge in following the state-of-the-practice is that it can vary depending on many factors. Some of the key factors are listed below:

- Complexity of the transportation network and number of operating modes
- Available data
- Urban versus rural setting
- Planned changes in the transportation network (particularly to major roads or transit systems)
- Availability of resources to develop and apply travel demand models
- Population and employment levels
- Congestion levels
- Regulatory requirements
- Types of technical and policy questions posed by decision makers
- Desired level of confidence in the analysis findings
- Anticipated level of legal scrutiny

In California, travel forecasts are generated using various forms of models that range from simple spreadsheets based on historic traffic growth trends to complex computer models that account for numerous factors that influence travel demand. According to Transportation and Land Development, 2nd Edition, ITE, 2002, the appropriate model depends on the size of the development project and its ability to affect the surrounding area. As projects increase in size, the likelihood of needing a complex model (such as a four-step model) increases because of the number of variables that influence travel demand and transportation network operations. The study area can also influence the type of model needed especially if congestion occurs or if multiple transportation modes operate in the study area. Either of these

conditions requires robust models that can account for the myriad of travel demand responses that can occur from land use or transportation network changes.

The other relevant national guidance on model applications and forecasting is the *NCHRP Report 765, Analytical Travel Forecasting Approaches for Project-Level Planning and Design*, Transportation Research Board, 2014. This is a detailed resource with many applicable sections. A few highlights related to forecasting expectations for models are listed below.

- A travel forecasting model should be sensitive to those policies and project alternatives that the model is expected to help evaluate.
- A travel forecasting model should be capable of satisfying validation standards that are appropriate to the application.
- Project-level travel forecasts, to the extent that they follow a conventional travel model, should be validated following the guidelines of the Travel Model Validation and Reasonableness Checking Manual, Second Edition from FHWA. Similar guidelines are provided in NCHRP Report 716. This level of validation is necessary, but not sufficient, for project-level forecasts. Project-level forecasts often require better accuracy than can be obtained from a travel model alone.
- The model should be subject to frequent recalibrations to ensure that validation standards are continuously met.

Tahoe AB Model Assessment

The information above was used to as the basis for the model assessment, which includes two components. The first component is a review of model ownership and maintenance, and the second component is assessing the adequacy of the Tahoe AB model against select criteria from the guidance material above.

Model Ownership and Maintenance Assessment

Public agencies that develop travel forecasting models for planning and impact analysis must maintain those models and frequently update and recalibrate them as explained above to ensure they remain

accurate and dependable for generating travel demand forecasts. This model ownership and maintenance assessment considers whether TRPA controls the following model components.

- Model documentation – does TRPA have the Tahoe AB model development documentation and any related user guidance?
    - Yes; TRPA maintains both model development documentation and a User Guide via a Github site that is publicly accessible.
- Model files – does TRPA maintain the model input and output files?
    - Yes; TRPA maintains both model input and output files.
- Model distribution – does TRPA control the distribution of the model files to users?
    - The Tahoe AB model is accessible through TRPA's Github site to distribute to users. However, currently TRPA does not require a user agreement or strictly control distribution of the model files.

Adequacy Assessment

The following section details the assessment of the Tahoe AB model's adequacy in producing reasonable travel (i.e., VMT) forecasts. This qualitative assessment uses the following specific criteria.

- Model documentation – availability of documentation regarding the model's development including its estimation, calibration, and validation as well as a user's guide.
- Completed calibration and validation within the past 5 years – recent calibration and validation is essential for ensuring the model accurately captures evolving changes in travel behavior. Per NCHRP Report 765, "The model should be subject to frequent recalibrations to ensure that validation standards are continuously met."
- Demonstrated sensitivity to VMT effects across demographic, land use, and multimodal network changes – validation reporting will be checked for static and dynamic tests per the *2017 Regional Transportation Plan Guidelines for Metropolitan Transportation Planning Organizations*, CTC, 2017 and *Travel Model Validation and Reasonableness Checking Manual, Second Edition*, TMIP, FHWA, 2010.
- Capable of producing both "project-generated VMT" and "project effect on VMT" estimates for households, home-based trips, work trips, and total trips – both metrics are essential for complete VMT analysis. Project-generated VMT is useful for understanding the VMT associated with the trips traveling to/from a project site. The 'project's effect on VMT' is more essential for understanding the full influence of the project since it can alter the VMT generation of neighboring land uses.

- Capable of producing regional, jurisdictional, and project-scale VMT estimates – VMT analysis for air quality, greenhouse gases, energy, and transportation impacts requires comparisons to thresholds at varying scales. For SB 743, the OPR Technical Advisory recommends thresholds based on comparisons to regional or city-wide averages.
- Level of VMT estimates that truncate trip lengths at model or political boundaries – The OPR Technical Advisory states that lead agencies should not truncate any VMT analysis because of jurisdictional or model boundaries. The intent of this recommendation is to ensure that VMT forecasts provide a full accounting of project effects.

The following matrix summarizes the assessment findings for the Tahoe AB model using these criteria.

Tahoe Activity Based Model

Screening Criteria	Screening Determination	Notes
Model Documentation	Available	Includes full overview of model, each sub-model, traffic assignment, external travel summary, and documentation of static and dynamic validation tests. Also includes User Guide.
Completed calibration and validation within the past 5 years	Yes – 2018	Static validation and calibration was conducted for 2018 conditions using Streetlight data and traffic counts. Three dynamic validation tests were also conducted.
Demonstrated sensitivity to VMT effects across demographic, land use, and multimodal network changes	No documentation of sensitivity tests for demographic changes.	Dynamic validation tests included: (1) modifying recreational attractiveness in Kings Beach, (2) adding residential units in Incline Village, and (3) increasing transit frequency. Each dynamic test revealed model outputs tended to change in the appropriate direction and magnitude for these land use and transportation changes.
	Yes – dynamic validation tests included land use and multimodal network changes.	
Capable of producing both "project-generated VMT" and "project effect on VMT" estimates for households, home-based trips, work trips, and total trips	Project-generated VMT – Yes	As an activity (tour)-based model, the Tahoe AB model can track household and work-based tours. The model does not automatically produce home-based or home-based work VMT output. However, these trip purposes are part of individual tour and could be isolated through additional programming.
	Project effect on VMT – Yes	
	Total VMT – Yes	
	Household VMT – Yes	
	Home-based VMT – Possible	
	Work VMT – Yes	
	Home-based work VMT – Possible	

Tahoe Activity Based Model

Screening Criteria	Screening Determination	Notes
Capable of producing regional, jurisdictional, and project-scale VMT estimates	Regional VMT – Yes	Would need to review the traffic analysis zone (TAZ) system to confirm TAZ boundaries nest within jurisdictional boundaries such that jurisdictional VMT could be isolated The model documentation included three dynamic validation tests. While the model produced reasonable results in these tests, this is too small a sample to verify sufficient sensitivity to the wide variety of potential projects that may require VMT analysis.. Model users should consider performing additional dynamic tests to verify model sensitivity for their projects within their specific geographic setting before applying the model 'off the shelf'.
	Jurisdictional VMT – Likely	
	Project-scale VMT – Uncertain	
Level of VMT estimates that truncate trip lengths at model or political boundaries	Minimal	The model includes the entire Tahoe Basin. External trips at model gateways are distinguished between short-distance and long-distance trips. External trip lengths for short-distance and long-distance trips have been added to the gateways to reflect trip lengths "outside the model area." These appended external trip lengths are calibrated/ validated based on Streetlight Data. Since Streetlight Data only captures the trip length to the "next stop outside the Tahoe Basin," it does not capture the full length of trips with intermediate stops (e.g., a trip from Sacramento to South Lake Tahoe with a stop in Placerville would only capture the leg from Placerville to South Lake Tahoe).

Overall, the Tahoe AB model generally is capable of producing VMT estimates for a variety of VMT metrics (i.e., Total VMT, Household VMT, Work VMT, etc.) at the regional, jurisdictional, and project level with the following conditions.

- Jurisdictional estimates will depend on the TAZ system and how will it conforms to jurisdictional boundaries.
- Project level sensitivity should be verified with each application by performing additional dynamic validation tests. The intent is to verify sensitivity for the type of project under analysis within the specific geographic area for that project. TRPA could also perform additional tests covering the most common projects to help reduce the level of modeling needed for subsequent projects. The dynamic tests could include a range of changes from minor to major and in different contexts (i.e., rural versus small-town versus urban (South Lake Tahoe)) to confirm that both the magnitude and

direction of change in travel behavior is appropriate. Some potential dynamic test options to consider include, but are not limited to:

- Demographic changes
  - Effects of converting residential units from short-term rental (STR) use to resident occupied units
- Land Use changes
  - New residential units targeted at certain income levels (i.e., workforce housing) at various locations in the Tahoe Basin (e.g., North Shore, South Shore, etc.)
  - Recreational attractions, which could range from:
    - Visitor/tourist-oriented amenities (i.e., commercial or recreational businesses)
    - Winter-sports attraction
    - Summer-sports attraction
    - Passive recreation destination (i.e., hiking trails, mountain biking trails, parkland, etc.)
- Transportation changes
  - Road diet
  - New roadways/bridges
  - New bikeway

Additional Considerations

Depending on the type of analysis, the following characteristics of the model may cause some limitations related to its forecasts.

- The Tahoe AB model does not have a freight or goods movement component. Currently, freight trips are accounted for in trips associated with residents, visitors, and workers such that they cannot be isolated and are not sensitive to change over time.
- The model inputs generally produce forecasts for a "model day" that represents a unique time period, specifically, the first two weeks of June, last week of August, and middle two weeks of September when summer recreation activity and local school operations briefly overlap. This "model day" may not match the appropriate analysis period for CEQA compliance.

Comparison to Other Tools & Methods

Fehr & Peers previously completed a qualitative assessment of the California Statewide Travel Demand Model (CSTDM) and sketch planning tools that estimate project-scale VMT. Appendix A presents the results of this qualitative assessment.

The table below provides a comparative assessment of these tools and data sources, alongside the Tahoe AB model. For quick comparison, the main findings are color coded as follows:

- Green – model or tool generally meets criterion expectations
- Orange – model or tool partially meets criterion expectations
- Red – model does not meet criterion expectations

Comparative Assessment of VMT Tools for Tahoe Basin

Criteria	Comparative Assessment		
	Tahoe AB Model	CSTDM	Sketch Planning Tools
Sensitive to VMT effects across demographic, land use, and multimodal network changes	No documentation of sensitivity tests for demographic changes.	Documentation does not reflect any sensitivity tests for demographic or land use changes.	Ranges from limited sensitivity to demographic and land use changes to some sensitivity to land use changes.
	Partial – dynamic validation tests included land use and multimodal network changes.	Documentation reflects sensitivity test for some multimodal network changes.	Most have no to limited sensitivity to multimodal network changes.
Capable of producing both "project-generated VMT" and "project effect on VMT" estimates for households, home-based trips, work trips, and total trips	Project-generated VMT – Yes	Project-generated VMT – No; scale is too large for project-level applications.	Most tools produce project-generated VMT estimates. Only UrbanFootprint and MXD+ are capable of producing project-effect on VMT.
	Project effect on VMT – Yes	Project effect on VMT – No; same as note above.	
	Total VMT – Yes	Total VMT – Yes	Some tools produce Total VMT only; others do household VMT only.
	Household VMT – Yes	Household VMT – Yes	
	Home-based VMT – Possible	Home-based VMT – Yes	Home-based VMT – No
	Work VMT – Yes	Work VMT – No	Work VMT – No
	Home-based work VMT – Possible	Home-based work VMT – No	Home-based work VMT – No

Comparative Assessment of VMT Tools for Tahoe Basin

Criteria	Comparative Assessment		
	Tahoe AB Model	CSTDM	Sketch Planning Tools
Capable of producing regional, jurisdictional, and project-scale VMT estimates	Regional VMT – Yes	Regional VMT – Yes	Regional VMT – No
	Jurisdictional VMT – Likely	Jurisdictional VMT – depends on jurisdiction's size and TAZ detail	Jurisdictional VMT – Most do not, but some may be able to produce for small jurisdictions.
	Project-scale VMT – Model is capable but requires verification for each project	Project-scale VMT – No; scale is too large for project-scale VMT estimates.	Project-scale VMT – Yes
Other strengths or limitations	Most detailed and locally-calibrated tool for the Tahoe Basin	Limited detail in the Tahoe Basin given the scale of the model.	Most tools can be applied relatively quickly, producing results with fewer inputs or processes than travel demand models. Some tools are dependent on subjective input of users. Most tools are not recommended for VMT calculations but could have utility for TDM mitigation evaluation. Tools are not calibrated to the Tahoe Basin.
	Model network does not extend beyond the Tahoe Basin, and therefore does not model trips with external origins or destinations (e.g., Sacramento, San Francisco Bay Area, Reno/Carson City, etc.)	Does not cover Nevada side of the Tahoe Basin. May not reflect full trip length for trips that leave California (i.e., trips to/from Nevada).	

While the Tahoe AB model has some limitations, it generally has fewer limitations than other available tools for producing VMT estimates for projects in the Tahoe Basin. Use of the model for project-scale application should include further dynamic validation tests as explained above. When a high level of confidence is desired in the model's VMT estimates, additional reasonableness checks can be made against StreetLight Data VMT estimates, which is described in further detail below.

Supplemental VMT Data

Big data vendors, such as StreetLight Data, offer VMT-specific data products that could be used to support VMT analyses. These big data vendors use anonymized location records from smart phones and

navigation devices to evaluate mobility patterns. This has several benefits when compared to baseline VMT estimates from travel forecasting models, including:

- Reflects actual travel behavior as opposed to the simulation of travel behavior generated by travel models
- Includes distinct travel behavior data over time, allowing for a breakdown by season or aggregation into a broader summary as opposed to modeling of a specific timeframe
    - This also allows for a more precise understanding for variation or changes in VMT over time (e.g., review changes resulting from a disruptive event, like the current COVID-19 pandemic).
    - Data can also be summarized over a longer time period to create a reasonable average estimate of daily VMT.

The VMT-specific data products offered by big data vendors can be used to estimate existing VMT levels for trips that travel to, from, through, and within the Tahoe Basin. Streetlight Data, in particular, offers VMT data products that produce VMT estimates for specific user-defined geographies and timeframes. Hence, customers can request VMT for a region (i.e., entire Tahoe Basin), jurisdiction (e.g., City of South Lake Tahoe), down to a specific census block group; and for a range of timeframes. This VMT data product can also disaggregate VMT into specific trip-purposes, such as work-related trips (i.e., commute trips), household or home-based trips, and visitor trips.

Since this data provides existing or past VMT-generation information, it could be used for proposed projects if those projects are generally consistent with the existing built environment characteristics (i.e., density, mix of uses, multimodal accessibility, etc.). However, it would not be appropriate to apply to proposed projects that would dramatically alter the existing demographics, land use, or multimodal transportation network.

Recommendations

This review revealed some limitations with the Tahoe AB model that can be addressed through the following model improvements.

- Address truncation of trip lengths for external trips with intermediate stops. This could be addressed by:
    - Obtaining customized smart phone/navigation device location data through a vendor to better capture the full length of the external trip tour.
    - Expanding the model network to include larger areas of Northern California and Northern Nevada that generate travel to/from the Tahoe Basin

- Add a freight component to the model to distinguish between freight travel and passenger travel
- Clearly define the required transportation 'analysis days' in the Basin and re-estimate the model to match those days
- Conduct additional dynamic tests to verify the model produces reasonable changes in VMT based on changes in demographics, land use, and transportation inputs at the project scale in various geographic locations throughout the Basin.
- Review, and if necessary, adjust TAZ boundaries to align with jurisdictional boundaries to produce model outputs by jurisdiction.
- Conduct additional reasonableness checks of the model's VMT estimates at the regional, jurisdictional, and project-scale against StreetLight Data VMT estimates based on mobile device data.

Attachment D

Potential VMT Metrics for Use in the Tahoe Basin Memorandum

Memorandum

Date: July 24, 2020

To: Stephanie Holloway, Placer County
Melanie Sloan, TRPA

From: Rod Brown, Rob Hananouchi, and Ron Milam, Fehr & Peers

Subject: Potential VMT Metrics for Use in the Tahoe Basin

RS20-3907

Introduction

This memorandum describes and evaluates potential vehicle miles traveled (VMT) metrics for use in CEQA transportation impact analysis within the Tahoe Basin. Because VMT methods, metrics, and thresholds are inherently related, and necessarily so for accurate VMT analysis, this memo is part of a larger analysis and discussion that will continue in future memos.

This memorandum first reviews metrics considered during development of the Placer County SB 743 implementation plan, then discusses additional metrics relevant to the Tahoe Basin but not included in the Placer County project, and lastly summarizes conclusions regarding metrics for the Tahoe Basin. The evaluation also recognizes that TRPA already uses total VMT as a metric for Article VII analysis and in regional planning.

Methodologies and Metrics Summary from the Placer County SB 743 Implementation Plan

The memorandum "Placer County SB 743 Implementation – VMT Methodologies and Metrics," dated November 15, 2019, reviewed potential VMT calculation methodologies and metrics under CEQA that that can be derived from a trip-based travel forecasting model, SACOG's SACSIM activity-based model, or spreadsheet tools and web applications. Because SACOG's SACSIM activity-based model does not cover the Tahoe Basin, conclusions related to that model have been excluded from this summary. Additional comments related to the Tahoe Basin have been added where appropriate. The full memorandum is included in Appendix A.

Types of Calculations

When considering methodologies and metrics, it is important to consider the types of calculations that may be required. For VMT impact analysis, two types of calculations are most relevant:

- Project-generated VMT (land use projects)
- Project-effect on VMT (land use project, land use plans, and transportation projects)

Project-generated VMT is calculated by multiplying a project's vehicle trip generation by a trip length. However, this calculation is only part of the VMT analysis. The project-effect on VMT is the remaining part of the analysis and often more important for understanding whether a project will have a VMT impact. These two types of VMT calculations are summarized in Table 1.

Table 1: Summary of Types of VMT Calculations

	Project-generated VMT	Project-effect on VMT
Definition	VMT from trips that start or end at the project site	Change in VMT due to influence of the project on • VMT generation from the surrounding land uses, or • Length of trips already using the transportation network
Required by (typically)	• Land use projects	• Land use projects • Land use plans • Transportation projects
Values	Always positive	Positive or negative
Ease of calculation (relative)	Simpler	More complicated
Tools required	Either • Travel forecasting model • Spreadsheet tool • Web tool	Travel forecasting model that can capture the influence of the project on the VMT generation of surrounding land uses and on trips already using the transportation network
Calculation method	Either • Isolate the project's VMT through model select zone analysis • Multiply the project's vehicle trip generation by a trip length	Conduct two model runs, one with and one without the project. The difference in the VMT estimates from the two model runs represents the project's effect on network-wide VMT.

Source: Fehr & Peers.

Types of Tools Used for VMT Calculations

Travel forecasting models, spreadsheet tools, and web applications can all be used to perform VMT calculations. However, their applicability and ease of use varies. Table 2 summarizes the capabilities and applications of each type of tool.

Table 2: Summary of Types of Tools Used for VMT Calculations

	Travel forecasting models	Spreadsheet tools and web applications
Types of calculations	• Project-generated VMT • Project-effect on VMT	• Project-generated VMT
Types of projects	• Land use projects • Land use plans (i.e., general, community, and specific plans) • Transportation projects	Generally • Land use projects • Induced travel effects of roadway capacity projects
Tahoe Basin coverage	Tahoe AB model currently covers entire Tahoe Basin	Typically limited to project site or small area
Time required to conduct VMT analysis	Hours to multiple days	A few minutes

Source: Fehr & Peers.

The Tahoe activity-based travel forecasting model (Tahoe AB model) is available for use in entire the Tahoe Basin. The California Statewide Travel Demand Model (CSTDM) covers the California portion of the basin. Although they do not specifically address the Tahoe Basin, other organizations have developed spreadsheet or web application tools designed for land use project analysis using trip rate and trip length information from sources such as the *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, 2017), the California Household Travel Survey (CHTS), the California Statewide Travel Demand Model (CSTDM), or big data providers like StreetLight Data.

The main benefit of spreadsheet tools and web applications is that they can produce a project-generated VMT estimate in a few minutes. This time saving approach to VMT analysis is particularly useful when applying screening methods to determine whether a project requires a more complete VMT analysis. VMT calculation methodologies are not mutually exclusive, and thus differences in these methods may be useful. Faster methods such as spreadsheet tools and web applications may be appropriate for initial project screening while other methods such as applying a travel forecasting model may only be required for projects warranting a complete VMT analysis.

For transportation projects, VMT impacts can be evaluated using travel forecasting models, spreadsheet tools, or web applications. However, spreadsheet tools and web applications are

generally limited to roadway capacity expansion projects. These tools estimate the potential change in VMT using elasticities derived from academic research on induced vehicle travel.

Types of VMT Impact Analysis

VMT impact analysis can be divided into two different categories:

- Project screening
- Complete analysis

The purpose of a project screening analysis is to determine if a project is likely to result in substantial VMT impacts, without requiring a complete VMT analysis using a travel demand model spreadsheet tools, or web-based tools. Projects that are generally consistent in size and land use type compared to their surrounding built environment will have similar VMT values to the existing land uses near the project site. As a result, if a proposed project occurs within a low VMT generating area and has similar features to the surrounding area it will likely not result in substantial increases in VMT. The Governor's Office of Planning and Research (OPR) *Technical Advisory on Evaluating Transportation Impacts in CEQA*, December 2018, (page 10) supports this approach.

If a project does not pass the screening criteria, or if the type and size of project is substantially different from the surrounding land uses, then complete VMT analysis is needed. These two types of analysis are summarized in Table 3.

Table 3: Summary of Types of VMT Impact Analysis

	Screening analysis	Complete analysis
Purpose	• Determine if a project is likely to result in substantial VMT impacts, without requiring a complete VMT analysis	• Evaluate transportation VMT impacts under CEQA • Provide the inputs necessary for the Air Quality, Greenhouse Gas, and Energy sections of an EIR
Project characteristics	Generally consistent in size and land use type compared to their surrounding built environment	Any project that is within model design parameters
Metrics	• Partial VMT estimates (i.e. home-based VMT per resident for evaluating residential land use projects or home-based work VMT per employee for commercial land use projects) • Full VMT estimates (i.e., total VMT per service population)	Ideally include: • Total VMT (already used by TRPA for Article VII analysis) • Total VMT by speed (for use in air quality analyses) • Partial VMT (i.e., home-based worked VMT per resident and home-based work VMT per employee) • Full VMT (i.e., total VMT per service population)

Source: Fehr & Peers.

VMT Metrics

Various VMT metrics that can be used to evaluate land use plans, land use projects, and transportation projects. VMT metrics can be divided into two types:

- Absolute
    - Measures a specific amount of VMT such as total VMT on a network
    - Useful for estimating project generated VMT and project effect on VMT
- Efficiency
    - Expresses VMT as a ratio or rate such as VMT per capita
    - Useful for estimating project generated VMT but not project effect on VMT

Both forms of the metric are useful, but some types of environmental impact analysis require only one form. For example, air quality and greenhouse gas (GHG) analyses use an absolute metric (total VMT by speed bin). The use of efficiency metrics in part acknowledges that population and employment are still growing. As such, environmental goals are typically designed to improve the efficiency of vehicle travel by influencing land use and transportation network decisions versus preventing growth altogether to stay under a fixed amount of VMT.

Table 4 provides a summary of the different performance metrics and their applicable land uses, trip purposes, vehicle types, and project types.

Table 4: Summary of Potential VMT Metrics

VMT Metric	Metric Type		Land Use Types	Trip Purposes	Vehicle Types[3]	Applicable Project Types			Model/Platform		
	Absolute	Efficiency				Land Use Plans	Land Use Projects	Transportation Projects	Trip-Based Models	Activity-Based Models[4]	Spreadsheet Tools & Web Applications
Total VMT[1]	X		All	All	All	X	X	X	X	X	
Total VMT[1] by Speed Bin	X		All	All	All	X	X	X	X	X	
Total VMT[1] per Service Population	X		All	All	Personal & commercial	X	X	X	X	X	
Total VMT[1] per Resident	X		All	All	Personal & commercial	X	X	X	X	X	
Percent Change in Total VMT	X		All	All	Personal & commercial	X	X	X	X	X	X[2]
Total VMT Generated by a Project	X		All	All	Personal & commercial	X	X	X[5]	X	X	X
Project-Generated VMT per Service Population		X	All	All	Personal & commercial	X	X	X	X	X	X
Project-Generated VMT per Resident		X	Residential	All	Personal & commercial		X	X	X	X	X
Project-Generated VMT per Employee		X	Employment	All	Personal & commercial		X	X	X	X	X
Total VMT per Employee		X	Employment	All	Personal & commercial	X	X	X	X	X	
Residential VMT per Resident		X	Residential	All	Personal		X	X		X	
Home-Based VMT per Resident		X	Residential	Home-based purposes	Personal		X	X	X		
Home-Based Work VMT per Employee		X	Employment	Home-based work	Personal		X	X		X	

Notes:

1. Total VMT is the VMT for a specific geography, whether the entire region, a geographic sub-region, or individual project, depending on the scale of the tool (i.e., regional travel forecasting model vs. a project-specific spreadsheet tool).
2. Spreadsheet tools and web applications ability to accurately predict a percent change in total VMT for land use plans or land use projects may be limited to estimating the effectiveness of programmatic measures, such as travel demand management programs, as opposed to the project's effect on regional or sub-regional total VMT.
3. "All" includes personal and commercial vehicles and heavy trucks.
4. The Tahoe AB model is an activity-based model.
5. Induced vehicle travel caused by transportation projects.
6. Metrics of particular relevance to the Tahoe Basin are highlighted in gray. See "Conclusions for the Tahoe Basin" section for further discussion.

Source: Fehr & Peers.

VMT Metrics for Evaluating Land Use Plans

The following VMT metrics can be used to evaluate general plans, area plans, and other land use plans (see Appendix B for a lexicon of VMT metrics):

- Total VMT
- Total VMT by speed bin
- Total VMT per service population
- Residential VMT per resident
- Home-based VMT per resident
- Home-based work VMT per employee

Key characteristics of these metrics include:

- The total VMT and total VMT per service population metrics represent VMT generated from all land use types, vehicle types, and trip purposes.
- Total VMT by speed bin metrics are used as the basis for emissions analysis.
- The home-based VMT per resident and home-based work VMT per employee metrics are useful to evaluate the impacts of residential and employment-related land uses independently, which is common for screening applications.

VMT Metrics for Evaluating Land Use Projects

The same metrics that can be used to evaluate land use plans listed above can also be used to evaluate land use projects. For project screening, total VMT per service population is appropriate for mixed use projects while home-based VMT per resident is appropriate for exclusively residential projects. Likewise, home-based work VMT per employee is appropriate for employment only land use projects. If performing a complete analysis, then total VMT per service population is preferred, but a complete evaluation of all the relevant metrics may be desired. The OPR Technical Advisory recommends evaluating mixed-use land development projects by individual land use types.

VMT Metrics for Evaluating Transportation Projects

Transportation projects can be evaluated using both absolute measures of VMT (total VMT or VMT by speed bin), or VMT efficiency metrics (total VMT per service population or total VMT per capita, etc.). When selecting a VMT metric to use for evaluating a transportation project, it is important to consider the type of analysis (screening or complete analysis) and the intended uses of the outputs. For example, total VMT by speed bin is typically used as an input for emissions analysis. The VMT impacts of transportation projects can be evaluated using travel demand models, spreadsheet tools, or web applications that have been designed to estimate the VMT associated the induced vehicle travel generated from the transportation project.

Other Metrics for Potential Use in the Tahoe Basin

Additional VMT metrics may be considered for the Tahoe Basin. These metrics are often not available from the typical sources identified in the previous section, but some models may be used to calculate them, and tools may be developed to include them. The main types of additional VMT metrics relevant to the Tahoe Basin are:

- Visitor VMT: VMT created by people who come to visit the region or live within it on a seasonal basis.
- Non-resident worker VMT: VMT created by people who live outside of the region but work within it. Non-resident worker VMT is one part of employee VMT, which includes both internal and external workers.
- Recreational VMT: VMT associated with recreational trip purposes

The Tahoe Basin economy, and much of the VMT within the region, is associated with tourists, recreational users, and seasonal residents. It is also dependent on workers who live outside of the region but work within it. Including these factors allows greater flexibility in evaluating potential impacts of workforce housing projects, short-term rental policies, and similar projects and programs.

The memorandum "Tahoe Activity-Based Travel Demand Model Assessment," dated July 17, 2020, summarizes VMT data sources, including the Tahoe AB model and StreetLight Data. The Tahoe AB model separately analyzes resident, visitor, and non-resident worker (labelled "external worker" in the model) travel. Model output files include separation of VMT by residents, visitors, and external workers. Additionally, TRPA StreetLight data may be used to analyze some VMT metrics related to these factors.

Recreational travel may be considered a separate trip purpose, part of what is typically considered as home-based other VMT or non-home-based VMT in trip-based models. Within the Tahoe AB model, recreation and gaming are specific recreation-related activities for visitors. These activities are not identified for residents within the model. Further discussion with TRPA modeling staff is recommended if estimation of recreational travel VMT is desired for residents.

Possible metrics related to these inputs are summarized in Table 5.

Table 5: Summary of Additional Potential VMT Metrics

VMT Metric	Metric Type		Land Use Types	Trip Purposes	Vehicle Types	Applicable Project Types			Model/Platform		
	Absolute	Efficiency				Land Use Plans	Land Use Projects	Transportation Projects	Trip-Based Models	Activity-Based Models[2]	Spreadsheet Tools & Web Applications[3]
Project-Generated VMT per Visitor		X	All	All	Personal & commercial		X	X		X	X
Total VMT[1] per Visitor		X	All	All	Personal & commercial	X	X	X		X	X
Project-Generated VMT per Non-Resident Worker		X	Employment	All	Personal & commercial		X	X	X	X	X
Total VMT[1] per Non-Resident Worker		X	Employment	All	Personal & commercial	X	X	X		X	X
Home-Based Work VMT per Non-Resident Worker		X	Employment	Home-based work	Personal		X	X	X	X	X
Recreational VMT	X		Employment (recreational and gaming only), Beach	Subset of home-based other and non-home based	Personal	X	X	X		X	X
Project-Generated Recreational VMT per Worker		X	Employment (recreational and gaming only)	Subset of home-based other and non-home based	Personal	X	X	X		X	X
Recreational VMT per Worker		X	Employment (recreational and gaming only)	Subset of home-based other and non-home based	Personal	X	X	X		X	X

Notes:

1. Total VMT is the VMT for a specific geography, whether the entire region, a geographic sub-region, or individual project, depending on the scale of the tool (i.e., regional travel forecasting model vs. a project-specific spreadsheet tool).
2. The TRPA model is an activity-based model capable of calculating these metrics. Not all activity-based models can do so.
3. TRPA StreetLight data is a possible data source for further analysis of these metrics. See text for discussion.
4. Metrics of particular relevance to the Tahoe Basin are highlighted in gray. See "Conclusions for the Tahoe Basin" section for further discussion.

Source: Fehr & Peers.

Seasonality is a factor that strongly influences travel in the Tahoe Basin due to the changes in destinations and subsequent differences in visitor and recreational travel during the summer and winter seasons. Visitors also create different travel patterns on weekdays and weekends, compared to other regions where weekday travel generates most VMT. Consequently, separate analysis for each of these periods may be justified to ensure that the factors most strongly influencing VMT are assessed.

As noted in the VMT data source summary memo, there are some limitations with the Tahoe AB model as it exists today, which may affect analysis of these metrics:

- External trip lengths for short-distance and long-distance trips have been added to the gateways to reflect trip lengths outside the model area. These appended external trip lengths are calibrated and validated based on Streetlight Data. Since Streetlight Data only captures the trip length to the next stop outside the Tahoe Basin, it does not capture the full length of trips with intermediate stops (e.g., a trip from Sacramento to South Lake Tahoe with a stop in Placerville would only capture the leg from Placerville to South Lake Tahoe).Thus, some portion of external VMT is estimated by the model, but not all.
- Jurisdictional estimates will depend on the TAZ system and how well it conforms to jurisdictional boundaries.
- Project level sensitivity should be verified with each application by performing additional dynamic validation tests. The intent is to verify sensitivity for the type of project under analysis within the specific geographic area for that project.
- The model does not have a freight or goods movement component. Currently, freight trips are accounted for in trips associated with residents, visitors, and workers such that they cannot be isolated and are not sensitive to change over time.
- The model inputs generally produce forecasts for a model day that represents a unique time period, specifically, the first two weeks of June, last week of August, and middle two weeks of September when summer recreation activity and local school operations briefly overlap. This model day may not match the appropriate analysis period for CEQA compliance.

Limitations of the TRPA model will be discussed further in the VMT methods memo.

Conclusions for the Tahoe Basin

Based on the discussion above, the following metrics are of particular relevance to the Tahoe Basin:

- Total VMT (and total VMT by speed bin)
- Total VMT per employee, by model employment-related land use type
- Residential VMT per resident
- Total VMT per visitor
- Home-based VMT per resident
- Home-based work VMT per employee

The Tahoe AB model is an activity-based model, which, when properly calibrated and validated, allows more options for analysis than a trip-based model, including the VMT efficiency metrics listed above.

Separating employment-related land use efficiency metrics by employment type reduces comparison of unlike land uses; for example, office land use will have lower total VMT per

employee than retail land use due to the greater customer component of trips to retail destinations. Non-resident employee VMT would also be included in this metric.

Including total VMT per visitor as a metric allows the large visitor component of travel to be measured and included. This metric would also include recreational travel.

Home-based VMT per resident and home-based work VMT per employee may be considered for screening purposes. OPR's *Technical Advisory on Evaluating Transportation Impacts in CEQA* (December 2018) notes that "[r]esidential 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." Similar screening has also been done for other work purposes in other jurisdictions. These metrics can be used to identify low-VMT areas for project screening.

As noted, seasonality causes different travel patterns in the region winter and summer, weekends and weekdays. Travel data, from surveys and big data sources such as StreetLight Data, may be reviewed to assess this variation and determine which periods VMT metrics should be assessed for to assure major VMT-influencing travel is measured.

Appendices

Appendix A: Placer County SB 743 Implementation – VMT Methodologies and Metrics, November 15, 2019

Appendix B: VMT Modeling Lexicon

APPENDIX A:
PLACER COUNTY SB 743 IMPLEMENTATION
VMT METHODOLOGIES AND METRICS MEMORANDUM

Memorandum

Date: November 15, 2019

To: Katie Jackson & Stephanie Holloway, Placer County

From: Rob Hananouchi & Eric Howard, Fehr & Peers

Subject: Placer County SB 743 Implementation – VMT Methodologies and Metrics

RS19-3812

This memorandum provides a review of the potential vehicle miles of travel (VMT) calculation methodologies and metrics for VMT analysis under CEQA. Based on the findings presented in the October 16, 2019 *Placer SB 743 Implementation – Model Assessment* memorandum and conversations with Placer County staff, this review focuses on VMT methodologies and metrics that can be derived from a trip-based travel forecasting model, SACOG's SACSIM activity-based model, or spreadsheet tools and web applications.

Methodology Tools Overview

Both trip-based and activity-based travel forecasting models can be used to evaluate the VMT impacts of land use projects, transportation projects, and program-level planning documents like the Placer County General Plan. Additionally, using a travel forecasting model will allow the evaluation of "project-generated VMT" and "project-effect on VMT" for proposed land use projects. Spreadsheet and web-based tools can be simpler to use for project evaluation but can only produce estimates of project-generated VMT and must rely on inputs from travel forecasting models when thresholds are established at larger scale (i.e., city-wide or region-wide average).

VMT Calculation Methodologies

There are a variety of VMT calculation methodologies options available for use in Placer County. Before describing the details of various VMT metrics, it is important to explain what constitutes a calculation methodology. For VMT impact analysis, two types of calculations are relevant.

1. Project-generated VMT: The VMT from trips that start or end at the project site.
2. Project-effect on VMT: The influence the project has on the VMT generation from the surrounding land uses, or on the length of trips already using the transportation network.

Land use plans and land use projects will typically require both calculations while transportation projects tend to measure only the project-effect on VMT. Project-generated VMT is calculated by multiplying a project's vehicle trip generation by a trip length. The calculation will always produce a positive value. However, this calculation is only part of the VMT analysis. The project-effect on VMT is the remaining part of the analysis and often more important for understanding whether a project will have a VMT impact. The project-effect calculation is more complicated and requires the aid of a travel forecasting model that can capture the influence of the project on the VMT generation of surrounding land uses and on trips already using the transportation network.

SACSIM and SACMET are regional travel forecasting models that can be used to perform both calculations for a variety of project types including land use plans (i.e., general, community, and specific plans), land use projects, and transportation projects in the western portion of Placer County. Outside this area, the County is likely to rely on spreadsheet tools and web applications unless a new travel forecasting model covering these remaining areas is developed. SACSIM and SACMET can calculate project-generated VMT by isolating a project's VMT through select zone analysis. The project-effect on VMT, whether for a land use project, land use plan, or transportation project, is determined by conducting two model runs, one with and one without the project. The difference in the VMT estimates from the two model runs represents the project's effect on network-wide VMT.

Spreadsheet tools and web applications are generally limited to analyzing land use projects and induced travel effects of roadway capacity projects. Existing spreadsheet or web application tools designed for land use project analysis have been developed using trip rate and trip length information from sources such as the *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, 2017), the California Household Travel Survey (CHTS), the California Statewide Travel Demand Model (CSTDM), or big data providers like StreetLight Data.

To understand the benefit of a travel forecasting model for performing both the "project-generated VMT" and the "project-effect on VMT" calculations, consider an example project where a retail space containing a grocery store is proposed in a portion of the County that currently does not have one. Once implemented, the project will generate new vehicle trips to and from the store. A project-generated VMT calculation would only quantify this number; it would not provide any insight as to the project's influence on existing VMT. Since the project does not change the local population, income, or amount of groceries purchased by residents, its main effect is to provide a new shopping opportunity that is closer to existing residents. Presuming that existing shopping trips have to travel further, the proposed new grocery store could effectively reduce community-wide VMT by shortening the shopping trip lengths and by allowing some trips to be made by walking or bicycling. This project-effect on VMT when measured across the full community would be a net reduction in VMT. Land use projects that make significant changes to the land use context of an area (i.e. projects that increase the diversity of land uses, or improve the areas jobs-housing balance) could reduce area-wide VMT, but this effect would not be captured if using spreadsheet or web app tools that only produce project-generated VMT.

The main benefit of spreadsheet tools and web applications is that they can produce a project-generated VMT estimate in a few minutes. The example below from the City of San Jose can estimate project-generated VMT in less

than 15 minutes. This time saving approach to VMT analysis is particularly useful when applying screening methods to determine whether a project requires a more complete VMT analysis. Hence, the County's decisions related to a VMT calculation methodology should not treat all the options as mutually exclusive. Instead, some calculation methods may be appropriate for initial project screening while other methods such as applying a travel forecasting model may only be required for projects warranting a complete VMT analysis.

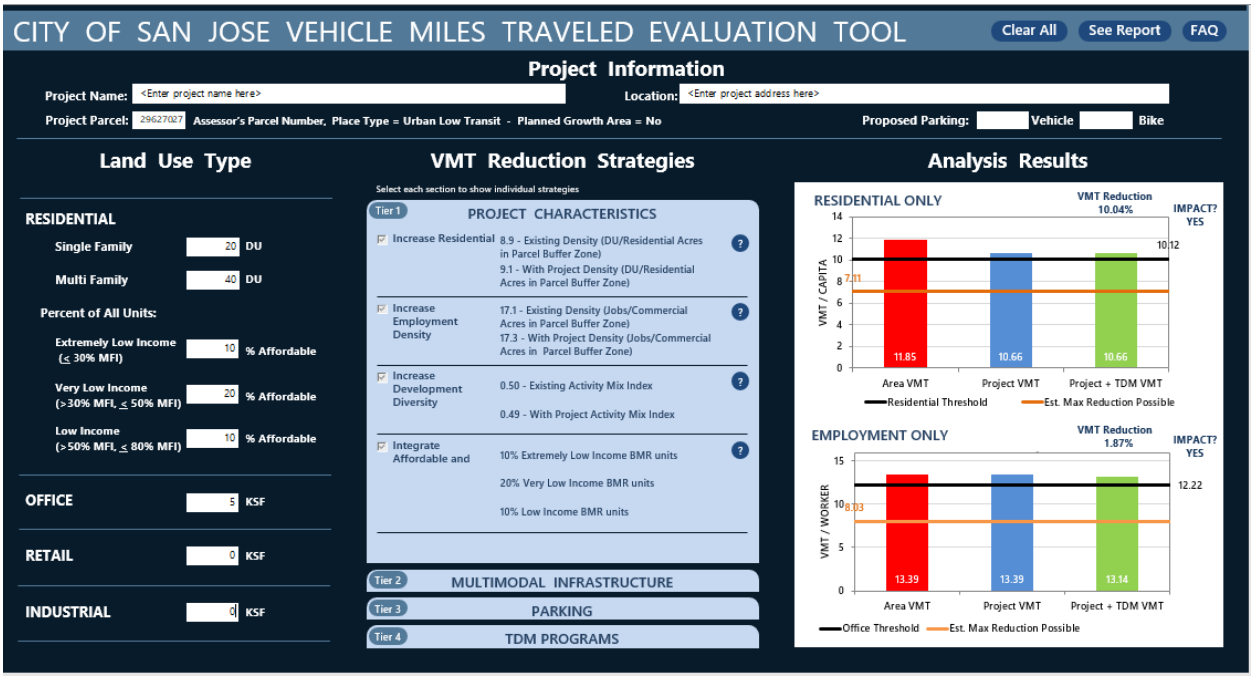

Figure 1: City of San Jose VMT Evaluation Tool (http://www.sanjoseca.gov/vmt)

The VMT impacts of transportation projects can also be evaluated using travel forecasting models, spreadsheet tools, or web applications. Travel forecasting models such as SACSIM and SACMET can analyze multi-modal projects while the spreadsheet tools/web applications are generally limited to roadway capacity expansion projects where the potential change in VMT is estimated using elasticities derived from academic research on induced vehicle travel. The specific steps used in induced vehicle travel calculations are shown below in Figure 2. An example calculation using the UC Davis induced travel calculation link noted at the bottom of Figure 2 is shown in Figure 3.

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 (generally the region, but for projects affecting interregional travel look at 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 multiply that by the elasticity from the induced travel literature:

[% increase in lane miles] x [existing VMT] x [elasticity] = [VMT resulting from the project]

A National Center for Sustainable Transportation tool can be used to apply this method:
https://ncst.ucdavis.edu/research/tools

Figure 2: Elasticity Method for Evaluating the Change in VMT from Transportation Projects

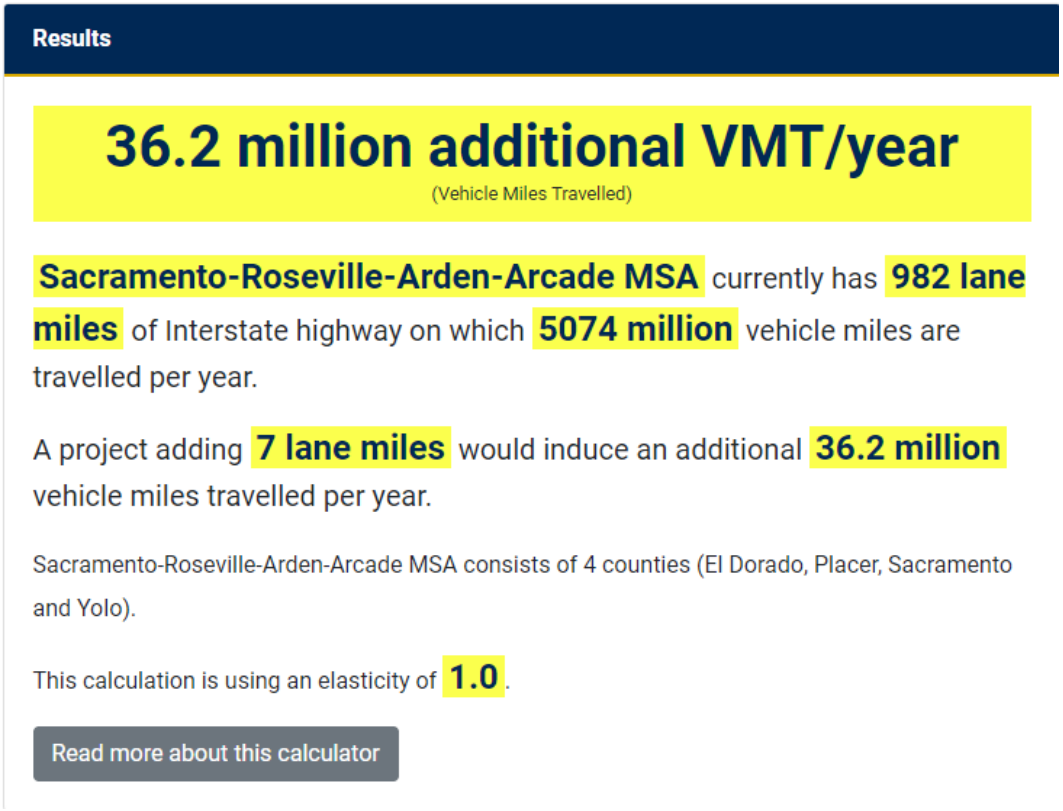

Figure 3: Results from the Induced Travel Calculator (https://blinktag.com/induced-travel-calculator/)

Type of VMT Impact Analysis

VMT impact analysis can be divided into two different categories: project screening and complete analysis. A screening analysis can be used to determine if a proposed project is within a low VMT generating area. If a project is not determined to be within a low VMT generating area, then a complete VMT analysis will be required. The VMT metrics used in the screening analysis can include partial VMT estimates (i.e. home-based VMT per resident for evaluating residential land use projects, or home-based work VMT per employee for commercial land use projects) or they can use full VMT estimates like total VMT per service population.

The purpose of the screening analysis is to determine if a project is likely to result in substantial VMT impacts, without requiring a complete VMT analysis using a travel demand model spreadsheet tools, or web-based tools. Projects that are generally consistent in size and land use type compared to their surrounding built environment will have similar VMT values to the existing land uses near the project site. As a result, if a proposed project occurs within a low VMT generating area and has a similar features to the surrounding area it will like not result in substantial increases in VMT. The Governor's Office of Planning and Research (OPR) *Technical Advisory on Evaluating Transportation Impacts in CEQA* supports this approach as described in the excerpt below.

Technical Advisory on Evaluating Transportation Impacts in CEQA (page 10)

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. Maps created with VMT data, for example from a travel survey or a travel demand model, can illustrate areas that are currently below threshold VMT. Because new development in such locations would likely result in a similar level of VMT, such maps can be used to screen out residential and office projects from needing to prepare a detailed VMT analysis.

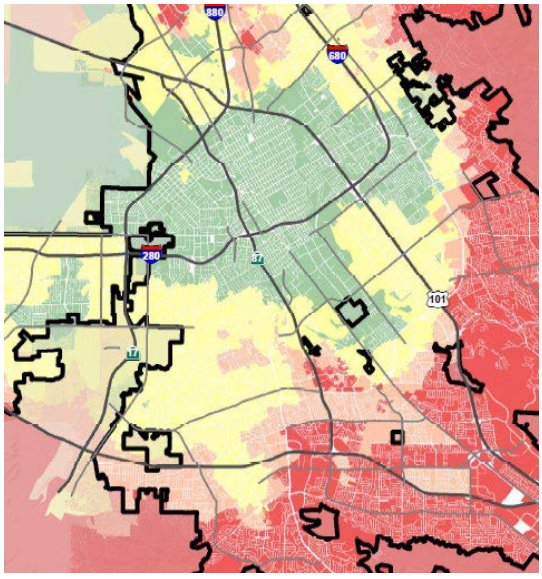

Figure 2. Example map of household VMT that could be used to delineate areas eligible to receive streamlining for VMT analysis.

(Source: City of San José, Department of Transportation, draft output of City Transportation Model.)

If a project does not pass the screening criteria, or if the type and size of project is substantially different from the surrounding land uses, then complete VMT analysis is needed. This analysis can be used to evaluate transportation VMT impacts under CEQA and provide the inputs necessary for the Air Quality, Greenhouse Gas, and Energy sections of an EIR. The outputs of this analysis should ideally include total VMT, total VMT by speed for use in air quality analyses, total VMT per service population, home-based worked VMT per resident, and home-based work VMT per employee. Details on each of these VMT metrics can be found in the section below.

VMT Metrics

The following section provides an overview of the various VMT metrics that can be used to evaluate land use plans, land use projects, and transportation projects. Table 1 provides a summary of the different performance metrics and their applicable land uses, trip purposes, vehicle types, and project types.

The VMT metrics in Table 1 include two types: absolute metrics and efficiency metrics. An absolute metric measures a specific amount of VMT such as total VMT on a network. An efficiency metric expresses VMT as a ratio or rate such as VMT per capita. Both forms of the metric are useful but some types of environmental impact analysis require only one form. For example, air quality and greenhouse (GHG) analysis use an absolute metric (total VMT by speed bin). For SB 743 purposes, no metric form preferences exist although the OPR *Technical Advisory* recommends use of efficiency metrics. The preference for efficiency metrics in part reflects the acknowledgement that state population and employment are still growing and VMT along with them. As such, the state's goals are to improve the efficiency of vehicle travel by influencing land use and transportation network decisions versus preventing growth altogether to stay under a fixed amount of VMT. Another consideration for metric form is whether the calculation is producing a project-generated VMT estimate or the project's effect on VMT. Project-generated VMT estimates can produce both an absolute or efficiency metric, while project-effect on VMT is best measured comparing absolute values since the net difference between a no project and a plus project model run is the basis for this calculation.

Table 1: Summary of Potential VMT Metrics

VMT Metric	Land Use Types	Trip Purposes	Vehicle Types	Applicable Project Types	Model/ Platform
Total VMT[1]	All	All	All	Land use plans, land use projects, transportation projects	Trip-based (SACMET) & activity-based models (SACSIM)
Total VMT[1] by Speed Bin	All	All	All	Land use plans, land use projects, transportation projects	Trip-based (SACMET) & activity-based models (SACSIM)
Total VMT[1] per Service Population	All	All	Personal & commercial	Land use plans, land use projects, transportation projects	Trip-based (SACMET) & activity-based models (SACSIM)
Total VMT[1] per Capita	All	All	Personal & commercial	Land use plans, land use projects, transportation projects	Trip-based (SACMET) & activity-based models (SACSIM)
Percent change in Total VMT[2]	All	All	Personal & commercial	Land use plans, land use projects, transportation projects	Trip-based model (SACMET); Activity-based model (SACSIM); Spreadsheet Tools & Web Applications
Total project-generated VMT	All	All	Personal & commercial	Land use plans, land use projects	Trip-based model (SACMET); Activity-based model (SACSIM); Spreadsheet Tools & Web Applications
Project-generated VMT per Service Population	All	All	Personal & commercial	Land use plans, land use projects, transportation projects	Trip-based model (SACMET); Activity-based model (SACSIM); Spreadsheet Tools & Web Applications
Project-generated VMT per Resident	Residential	All	Personal & commercial	Land use projects	Trip-based model (SACMET); Activity-based model (SACSIM); Spreadsheet Tools & Web Applications
Project-generated VMT per Employee	Employment (retail, office, medical, industrial)	All	Personal & commercial	Land use projects	Trip-based model (SACMET); Activity-based model (SACSIM); Spreadsheet Tools & Web Applications
Total VMT per Employee	Employment (retail, office, medical, industrial)	All	Personal & commercial	Land use plans, land use projects, transportation projects	Trip-based (SACMET) & activity-based models (SACSIM)
Total Household VMT per Resident	Residential	All	Personal	Land use projects	Activity-based model (SACSIM)
Total Home-based VMT per Capita	Residential	Home-based purposes	Personal	Land use projects	Trip-based (SACMET) model
Total Home-based Work VMT per Employee	Employment (retail, office, medical, industrial)	Home-based work	Personal	Land use projects	Trip-based (SACMET) model

Notes:

1. Total VMT is the VMT for a specific geography, whether the entire region, geographic sub-region of Placer County, or individual project, depending on the scale of the tool (i.e., regional travel forecasting model vs. a project-specific spreadsheet tool).
2. Spreadsheet tools and web applications ability to accurately predict a percent change in total VMT for land use plans or land use projects may be limited to estimating the effectiveness of programmatic measures, such as travel demand management programs, as opposed to the project's effect on regional or sub-regional total VMT.

VMT Metrics for Evaluating Land Use Plans

The following VMT metrics can be used to evaluate General Plans and other Land Use Plans:

- Total VMT
- Total VMT by speed bin
- Total VMT per service population
- Household VMT per resident
- Home-based VMT per resident
- Home-based work VMT per employee

Figure 4 illustrates the differences of the last three of these VMT metrics.

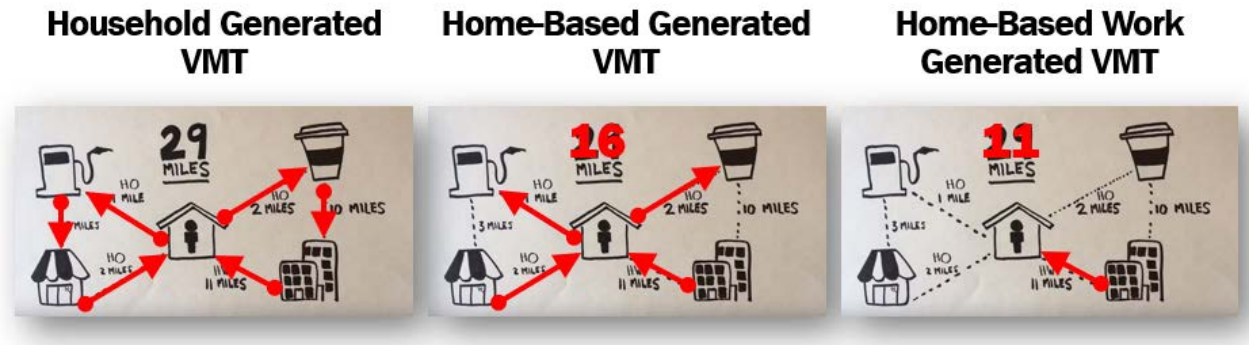

Figure 4: Trip Purpose VMT Metrics (Fehr & Peers)

The total VMT and total VMT per service population metrics represent VMT generated from all land use types, vehicle types, and trip purposes. Total VMT by speed bin metrics are used as the basis for air quality analysis. The home-based VMT per resident and home-based work VMT per employee are useful to evaluate the impacts of residential and employment-related land uses independently. The basic process to generate these metrics is similar for both trip-based and activity-based travel forecasting models. The process these travel forecasting models is described below:

1. Determine the number of trips that occur between each pair of origin and destination TAZs from the model's trip matrices. The trip purpose and land use type generating the trip needs to be tracked if using the home-based VMT per resident, home-based work VMT per employee, or household VMT per resident metrics.

2. Determine the length of trips between each of origin-destination pairs by generating a skim matrix over the model's loaded networks.

3. Adjust the length of trips that begin or end at one of the model's gateways.

4. Calculate the VMT associated with each origin-destination pair by multiplying the number of trips by the adjusted trip lengths. Exclude the pass-through (gateway TAZ to gateway TAZ trips).
5. Determine the number of intrazonal trips (trips that being and end within the same TAZ).
6. Estimate the length of the intrazonal trips & calculate the intrazonal VMT.
7. Summarize the origin-destination and intrazonal VMT estimates by TAZ and for the entire county (or geographic subregion).
8. Divide the summarized TAZ by the corresponding population or service population (number of residents and employees) if using an efficiency metric.

VMT Metrics for Evaluating Land Use Projects

The same metrics that can be used to evaluate land use plans listed above can also be used to evaluate land use projects. For project screening, total VMT per service population is appropriate for mixed use projects while home-based VMT per resident is appropriate for exclusively residential projects. Likewise, home-based work VMT per employee is appropriate for employment only land use projects. If performing a complete analysis, then total VMT per service population is preferred, but a complete evaluation of all the relevant metrics may be desired.

The OPR *Technical Advisory* recommends evaluating land use projects by individual land use types. The total home-based VMT per resident metric can be used to evaluate residential projects using a trip-based model, and total household VMT per resident metric can be used to evaluate residential projects using an activity-based model. The total home-based work VMT per employee metric could be used to evaluate employment land uses using a trip-based model, and the total VMT per employee metric could be used to evaluate these land uses using an activity-based model. The process to estimate these VMT metrics is similar to the process outlined in the planning documents section, but the land uses and trip purpose trips need to be tracked separately in the model runs, if evaluating land uses and trip purposes separately is desired.

Spreadsheet tools and web applications can be used to calculate project-generated VMT metrics that can be used to evaluate proposed land use projects. These metrics include project-generated total VMT per service population, home-based generated VMT per resident, and home-based work generated VMT per employee. These estimates can be calculated by applying trip generation rates and trip lengths to the number of proposed housing units and employees associated with the project.

VMT Metrics for Evaluating Transportation Projects

Transportation projects can be evaluated using both absolute measures of VMT (total VMT or VMT by speed bin), or VMT efficiency metrics (total VMT per service population or total VMT per capita, etc.). When selecting a VMT metric to use for evaluating a transportation project, it is important to consider the type of analysis (screening or complete analysis) and the intended uses of the outputs. For example, total VMT by speed bin is typically used as an input for

air quality analysis. The VMT impacts of transportation projects can be evaluated using travel demand models, spreadsheet tools, or web applications that have been designed to estimate the VMT associated the induced travel generated from the transportation project.

APPENDIX B:
VMT MODELING LEXICON

Metric	Model Types Used to Produce Metric (1)	Definition	Example
Total VMT	ABM, TOUR, TRIP	All vehicle-trips (i.e., passenger and commercial vehicles) assigned on the network within a specific geographic boundary (i.e., model-wide, region-wide, city-wide). Vehicle volume on each link is multiplied by link distance.	
Total VMT generated by a project	ABM, TOUR, TRIP	All vehicle-trips are traced to the zone or zones of study. This includes internal to internal (II), internal to external (IX), and external to internal (XI) trips. May use final assignment origin-destination (OD) trip tables or production (P) and attraction (A) estimates multiplied by distance skims. When the model has multiple assignment periods, OD trip tables and congested skims from each period should be used.	

Total VMT per service population	ABM, TOUR, TRIP	• Same method as above (Total VMT generated by a project) to estimate VMT and then divide by the population and employment of the zone or zones of study. If the model generates vehicle trips from other sources such as students and visitors, then include those variables in the service population. Note that employment is often used as the independent variable for total vehicle trip generation associated with non-residential land uses. This means that vehicle trips made by people other than the employees are accounted for in the trip rate including visitors, customers, vendors, custodians, and delivery companies. For this reason, it is often difficult to draw conclusions about VMT patterns and use of the metric should be limited to analysis scenarios comparing full model runs typically focused on changes at the sub-regional, city, county, or regional scale. • Some trip-based models may not use population and employment as trip generation variables. Instead, they will rely on land uses. A 'correspondence' between the model land use input variables and population and employment rates is required for these types of models.	

Residential VMT per resident	ABM, TOUR	• All automobile (i.e., passenger cars and light-duty trucks) vehicle-trips are traced back to the residence of the trip-maker, even non-home-based trips. • Not applicable for trip-based models since non-home-based (NHB) trips aren't tied to the households making them. • Can be calculated either by averaging the daily VMT of all residents or by calculating total VMT, counting total residents, and dividing. • Allocation of responsibility within a jurisdiction (e.g., cities within a county) is straight-forward, since each trip is attached to a resident and each resident has a single home location. • Requires household size determination, which can be subject to debate for different housing types (i.e., single-family, multi-family, and age-qualified housing products). • Commercial vehicle trips are not included. • A related metric is residential VMT per household – denominator is the total number of households instead of the total number of residents. The benefit of this metric form is that it doesn't require an estimate of household size.	

Home-Based VMT per resident	ABM, TOUR, TRIP	• All home-based automobile vehicle trips are traced back to the residence of the trip-maker; non-home-based trips are excluded. • Similar to Total VMT per service population.	
Total VMT per employee	ABM, TOUR	• All automobile vehicle-trips made by employed persons are traced back to the workplace of the trip-maker, even trips that aren't part of the work tour (i.e., all trips from home to work location and the return to home). • Allocation of responsibility within a jurisdiction is straight-forward, since each trip is attached to a worker. But if some workers have multiple work locations then deciding which to count may be an issue. • Commercial vehicle trips are not included.	

Total VMT per land use unit (e.g., KSF)	TRIP	• All vehicle trips are traced to the zone or zones of study. This includes internal to internal (II), internal to external (IX), and external to internal (XI) trips. Use trip estimates or trip tables multiplied by distance skims similar to total VMT generated by a project.	
Work Tour VMT per employee	ABM, TOUR	• All automobile trips which are part of home-work tours or work-based tours are counted. Intermediate stops along the tour between home and work locations should not be used to truncate the total home-work tour distance. • Allocation of responsibility within a jurisdiction is straight-forward, since each tour or half-tour should be attached to a specific workplace. • Commercial vehicle trips are not included.	
Home-Based Work (HBW) VMT per employee	ABM, TOUR, TRIP	• All automobile trips between home and work are counted. (A variant might also count work-based other trips.) • Allocation of responsibility within a jurisdiction should be straight-forward except for work-based other trips from one work location to another; even in this case it should be possible to decide which to count. • Commercial vehicle trips are not included.	

NOTE: (1) ABM = Activity-Based Model, TOUR = Tour-Based Model, TRIP = Trip-Based Model

Attachment E

Recommendations for VMT Methods for Use in the Tahoe Basin Memorandum

Memorandum

Date: July 24, 2020

To: Stephanie Holloway, Placer County
Melanie Sloan, TRPA

From: Rod Brown, Rob Hananouchi, and Ron Milam, Fehr & Peers

Subject: Recommendations for VMT Methods for Use in the Tahoe Basin

RS20-3907

Introduction

This memorandum describes and evaluates potential vehicle miles traveled (VMT) calculation methodologies to estimate project-level VMT in the Tahoe Basin. Both short-term recommendations, which can be accomplished in approximately two months or less, and long-term recommendations are discussed. Because VMT methods, metrics, and thresholds are inherently related, and necessarily so for accurate VMT analysis, this memo is part of a larger analysis and discussion that began with the memorandum "Potential VMT Metrics for Use in the Tahoe Basin" and that will continue in future memos.

As part of this review, TRPA's current requirements for VMT analysis to fulfill Compact Article VII (Environmental Impact Statements) were also considered. These requirements are summarized in TRPA memo "Guidance for Assessment of Vehicle Miles Traveled (VMT) Impacts of Projects in the Tahoe Basin," dated April 14, 2020. This memo states,

> TRPA's Vehicle Miles Traveled (VMT) threshold was established in 1982 through TRPA's Resolution 82-11 as an indicator of nitrate deposition in the air quality threshold category. The threshold language reads "reduce vehicle miles of travel in the Basin by 10% of the 1981 base year values." TRPA's threshold evaluation reports, produced every four to five years, have consistently interpreted this to mean that daily VMT should be reduced by 10% of 1981 VMT levels, as estimated for a peak summer day[1] using the TRPA transportation model.
>
> [1] Modeled for a day in late August.

This methodology is used to estimate the project's effect on total VMT (to estimate nitrate deposition). As methods are developed to meet the requirements of SB 743, this additional requirement must also be considered.

Near-Term Recommendations

Near-term recommendations to estimate project-level VMT were developed based on the condition that they could be implemented quickly (within approximately two months) prior to implementation of more complex recommendations that would require more time to develop.

Tahoe Activity-Based Travel Demand Model

The memorandum "Tahoe Activity-Based Travel Demand Model Assessment," dated July 17, 2020, reviewed the TRPA travel forecasting model, the California State Travel Demand Model (CSTDM), and sketch planning tools for assessment. The memo also discussed VMT-specific big data products that could be used to support VMT analyses. This memo concluded that while the Tahoe activity-based travel demand model (Tahoe AB model) has some limitations, it generally has fewer limitations than other available tools for producing VMT estimates for projects in the Tahoe Basin.

To address the limitations of the Tahoe AB model, the model assessment memo recommended the following actions. Some could be accomplished in the near term, as described below:

- Address truncation of trip lengths for external trips with intermediate stops. This improvement could be accomplished through one of the following options:
    - Obtaining customized smart phone/navigation device location data through a big data vendor to better capture the full length of the external trip tour. This change could be accomplished in the near term. Another option would be to append the truncated trip length to the model gateways as an interim measure. Fehr & Peers has developed a method to make this adjustment using a variety of data sources including mobile device data.
    - Expanding the model network to include larger areas of Northern California and Northern Nevada that generate travel to/from the Tahoe Basin. This expansion would be a long-term improvement.
- Add a freight component to the model to distinguish between freight travel and passenger travel. This addition would be a long-term improvement.
- Clearly define the required transportation 'analysis days' in the Basin and re-estimate the model to match those days. This update would be a long-term improvement.
- Conduct additional dynamic tests to verify that the model produces reasonable changes in VMT based on changes in demographics, land use, and transportation inputs at the project scale in various geographic locations throughout the Basin. These checks could be

conducted in the near term. If necessary, model changes would be a long-term improvement.

- Review, and if necessary, adjust TAZ boundaries to align with jurisdictional boundaries to produce model outputs by jurisdiction. Review could be conducted in the near term. If necessary, adjustment of TAZ boundaries would be a long-term improvement.
- Conduct additional reasonableness checks of the model's VMT estimates at the regional, jurisdictional, and project-scale against StreetLight Data VMT estimates based on mobile device data. These checks could be conducted in the near term. If necessary, model changes would be a long-term improvement.

In some cases, the near-term improvements identified above could be completed as part of individual project analysis where the size, scale and nature of the project warrants a more thorough modeling effort. Otherwise, the improvements could be made by TRPA such that they would benefit all future project applications. Implementation of these improvements would also improve the estimation of total VMT to fulfill Compact Article VII.

Spreadsheet Methods

In addition to using the Tahoe AB model to develop near-term VMT estimates, spreadsheet methods may also be used to estimate project-level VMT. Typically, these methods rely on the vehicle trip generation estimates from the local model (or other models sensitive to local land use context) and use complete trip lengths based on other observed travel data sources.

Possible sources of data include:

- Tahoe AB model trip rates: These rates are specific to the region.
- Institute of Transportation Engineers *Trip Generation Manual* trip rates: These rates are based on data from locations nationwide and are not specific to the Tahoe Basin or California or Nevada.
- California Household Travel Survey (CHTS) trip rates and trip lengths: These data are from 2012 and only include trips related to household travel, and thus exclude employment-related non-home-based trips. Additionally, they do not include data for Nevada.
- California State Travel Demand Model (CSTDM) trip rates and trip lengths: These data represent 2010 and do not include data for Nevada. Additionally, the CSTDM truncates trips at model boundaries and therefore underestimates trip lengths especially for regions like the Tahoe Basin near the border of California.
- Big data sources such as StreetLight: These data are based on current travel behavior measured through mobile devices. Some bias exists in this dataset due to origination of the data and the dataset may not fully represent travel across all demographic characteristics. These sources are further discussed in the model assessment memo.

A spreadsheet analysis would also need to calculate the threshold total weekday VMT per service population for the region and determine if the project meets the threshold. The threshold analysis would need to meet the substantial evidence criterion of CEQA Guidelines Section 15064.7, thus considering data, facts, research, and analysis.

Spreadsheet methods can estimate the VMT generated by the project but cannot estimate the project's effect on VMT. Therefore, they would not be useful in estimating total VMT to fulfill Compact Article VII requirements.

Recommendations

For the near term, the Tahoe AB model is recommended for estimating project VMT. If possible, customized smart phone/navigation device location data should be used to better capture the full length of the external trip tour. The Tahoe model is also the best available tool for measuring the project effect on VMT in the near team to provide VMT analysis consistent with the Article VII requirement.

Spreadsheet methods are an acceptable alternative to the Tahoe model if they are populated with locally valid trip rate, trip length, or VMT data. StreetLight's SB 743 VMT data could be used to estimate home-based VMT per resident and home-based work VMT per employee. Alternatively, StreetLight's trip length estimates could be combined with trip rates from the Tahoe AB model to estimate project VMT.

Long-Term Recommendations

For the long term, the Tahoe AB model is recommended for estimating project VMT after both the near-term and long-term model improvements described above are implemented.

Attachment F

Potential VMT Screening Criteria for Use in the Tahoe Basin (DRAFT)

Memorandum

Date: July 31, 2020

To: Stephanie Holloway, Placer County
Melanie Sloan, TRPA

From: Rod Brown, Rob Hananouchi, and Ron Milam, Fehr & Peers

Subject: Potential VMT Screening Criteria for Use in the Tahoe Basin (DRAFT)

RS20-3907

Introduction

This memorandum describes and evaluates potential vehicle miles traveled (VMT) screening criteria for use in the Tahoe Basin for compliance with the California Environmental Quality Act (CEQA). The memorandum does not address whether CEQA VMT impact screening would comply with TRPA Article VII analysis requirements. Because VMT screening criteria are inherently related to VMT methods, metrics, and thresholds, this memo is part of a larger analysis and discussion that began with the memorandums "Recommendations for VMT Methods for Use in the Tahoe Basin" and "Potential VMT Metrics for Use in the Tahoe Basin."

The main goal of screening is to streamline VMT impact assessment for projects expected to have a less than significant impact. The basic methodology relies on a checklist approach that is intended to provide sufficient evidence to either support the presumption that the project would have a less than significant VMT impact or to require a complete VMT analysis. Screening for such projects is an option that lead agencies have under CEQA but does have some risks. The presumption is based on limited information, which could be legally challenged. The alternative is to do a complete VMT impact analysis for each project, trading more work for increasing the substantial evidence supporting a lead agency's VMT impact decisions.

This memorandum includes the following:

- Summary of screening criteria contained in the *CEQA Guidelines* and discussed in the Governor's Office of Planning and Research (OPR) *Technical Advisory on Evaluating Transportation Impacts in CEQA*, December 2018
- Summary of screening criteria considered during development of the Placer County SB 743 implementation plan

- Additional screening options not discussed in the above sources

Conclusions regarding screening criteria for the Tahoe Basin will be developed following completion of the actions described in the "Next Steps" section of this memo.

Screening Summary from the *CEQA Guidelines* and OPR *Technical Advisory*

The *CEQA Guidelines* contain the first screening options as listed below.

- §15054.3(b)(1) Generally, projects within one-half mile of either an existing major transit stop or a stop along an existing high-quality transit corridor should be presumed to cause a less than significant transportation impact. Projects that decrease vehicle miles traveled in the project area compared to existing conditions should be presumed to have a less than significant transportation impact.
    - §21064.3 of the CEQA Statute defines a major transit stop as a "site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or major bus routes with a frequency interval of 15 minutes or less during the morning and afternoon peak commute periods."
- §15064.3(b)(2) Transportation Projects. Transportation projects that reduce, or have no impact on, vehicle miles traveled should be presumed to cause a less than significant transportation impact.

These screening criteria are unique because they are embedded directly in the *CEQA Guidelines*, which are part of the laws and rules governing the CEQA process. Other screening criteria are offered in the *Technical Advisory on Evaluating Transportation Impacts in CEQA* (California Governor's Office of Planning and Research, December 2018).

The *Technical Advisory* suggests that lead agencies may screen projects using the following criteria, absent substantial evidence indicating that a project would generate a potentially significant level of VMT or be inconsistent with an applicable Sustainable Communities Strategy (SCS) or general plan.

Small Projects

Projects that generate or attract fewer than 110 trips per day generally may be assumed to cause a less-than-significant transportation impact. This criterion is based on the CEQA categorical exemption allowed for projects up to 10,000 square feet, as described in *CEQA Guidelines* Section 15303, and trip rates for typical office projects.

Some local agencies have identified a maximum daily VMT generation in lieu of trip thresholds or identified a higher daily trip maximum based on local air district greenhouse gas (GHG)

thresholds to define a "small project." Typically, these thresholds consider the average trip length for a given area or jurisdiction to develop these values, and often result in larger project sizes that would qualify as a small project compared to the 110 trips per day definition identified in the *Technical Advisory*.

Residential and Office Projects in Areas With Low VMT

Residential and office projects in areas with low VMT that incorporate similar features (namely, density, mix of uses, transit accessibility) to the existing land use will tend to exhibit similarly low VMT.

Projects With Close Proximity to High Quality Transit

The *Technical Advisory* also refers to the *CEQA Guidelines* screening for projects near high quality transit stations and includes the following additional details about when this type of screening may not be appropriate.

- 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 (if the jurisdiction requires the project to supply parking)
- Is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Metropolitan Planning Organization)
- Replaces affordable residential units with a smaller number of moderate- or high-income residential units. A project or plan near transit which replaces affordable residential units with a smaller number of moderate- or high-income residential units may increase overall VMT because the increase in VMT of displaced residents could overwhelm the improvements in travel efficiency enjoyed by new residents.

Affordable Residential Development

A project consisting of a high percentage of affordable housing may be a basis for the lead agency to find a less-than-significant impact on VMT. The *Technical Advisory* offers evidence supporting a presumption of less than significant impact for a 100-percent affordable residential development in infill locations. Lead agencies may develop their own presumption of less than significant impact for residential projects based on local circumstances and evidence.

Local-Serving Retail Development

By adding retail opportunities into the urban fabric and thereby improving retail destination proximity, local-serving retail development tends to shorten trips and may reduce total VMT in the community area. Generally, stores of 50,000 square feet or less might be considered local serving. 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 may

reflect customers' expected travel behavior. Lead agencies will best understand their communities and likely travel behaviors and should consider this when developing screening criteria.

Transportation Projects Unlikely to Increase Vehicle Travel

The *Technical Advisory* has a lengthy list of transportation projects that would not likely lead to a substantial or measurable increase in vehicle travel. Generally, projects of these types should not require VMT analysis unless other factors indicate travel may be induced. This list is provided on pages 20 and 21 of the *Technical Advisory*. The remainder of this memo focuses on land use projects.

Screening Summary from the Placer County SB 743 Implementation Plan

Placer County memorandum "Senate Bill 743 Implementation Plan," dated May 5, 2020, noted that the following screening criteria are being evaluated by County staff:

- Projects under 110 average daily trips (OPR *Technical Advisory* recommendation), with modifications to be made based on SACOG research and analysis
- Affordable housing
- Local serving retail under 50,000 square feet
- Projects that are generally consistent in size and land use type compared to their surrounding built environment and are located in low VMT generating areas
- Locally serving recreational amenities (e.g. parks, libraries, bike trails, etc.)

On February 26, 2020 and March 16, 2020, the County hosted two focus group meetings in Tahoe City and Auburn to receive feedback from CEQA practitioners, traffic engineers, local agencies, and the development community. The Tahoe City focus group attendees supported the concept of screening out below-market affordable housing, similar to OPR's recommendation of screening out deed-restricted affordable housing. This approach would not require below-market housing projects to undergo VMT analysis but would instead rely upon established substantial evidence regarding below-market housing trip characteristics to reach a conclusion of less than significant for VMT impacts. Placer County staff recognizes that affordable housing throughout the county is a priority and is exploring options to screen these types of projects countywide.

The Placer County memorandum referred to upcoming SACOG research and analysis about the 110 average daily trips screening criterion recommended by OPR. Potential issues raised in the SACOG research and other SB 743 implementation projects are listed below.

- OPR's recommendation results in a relatively low minimum project size for which a VMT analysis is required, especially in comparison to minimum project sizes that some agencies use for LOS-based traffic impact studies. Agencies who are not prepared for the

use of 110 ADT as a minimum project size may find that they are processing many more transportation studies than previously. In addition, many of these studies for projects in suburban and rural areas may indicate a significant and unavoidable VMT. This finding would require the preparation of an environmental impact report, which would involve additional processing time and may make projects more difficult to implement.

- OPR's recommendation could be challenged because it is not based on VMT. To strengthen the criterion, it is recommended that agencies develop a minimum project size based on VMT. One option would be to combine the 110 ADT with the local area average trip length to estimate VMT. Sources for trip lengths may be household travel surveys, mobile device data, or travel demand models.
- Previous minimum project size recommendations used for LOS analysis were generally not supported by substantial evidence. As with all screening criteria, lead agencies should have substantial evidence supporting their minimum project size consistent with *CEQA Guidelines* Section 15064.7, thus considering data, facts, research, and analysis.

Final screening recommendations for Placer County have not yet been developed (as of July 2020).

Other Screening Options

One other screening option being considered by other lead agencies is to expand the type of land use projects that would be considered local serving. Using logic like that for local-serving retail development, screening criteria for other local-serving land uses (for example, a local urgent care medical building or public facilities, such as a public K-12 school, community center, post office, library, police station, fire station, etc.) may be developed. Evidence such as local survey data and/or economic data is strongly recommended to support such criteria.

Goals and Intent for Screening

Selection of screening criteria needs to consider the goals and intent of the lead agency while also having substantial evidence that would support a presumption that the type of project under evaluation would have a less than significant VMT impact. Goals for lead agencies in the Tahoe Basin may include the following:

- Streamline development review for smaller, less complex land use projects – Without streamlining, the cost of full VMT analysis for these projects adds to project cost and may discourage development. Potential types of projects screened could include:
    - Housing projects below a specified number of units
    - Retail and service land use projects that increase convenience of obtaining goods and services in closer proximity to existing residential uses

- Streamline creation of affordable housing, especially for the workforce – Promotion of housing for full-time and seasonal residents and workers is a primary goal of the TRPA Regional Plan. Potential types of projects screened could include:
    - Housing projects with 100% of units specified as affordable
    - Housing projects with a lesser share of affordable units, as supported by data
    - Housing projects restricted to local employees
- Increase bicycling, walking, and use of transit – TRPA Regional Plan goals and policies also seek to enhance connectivity for all modes, notably transit and active transportation such as walking and bicycling. Potential types of projects screened could include:
    - Projects located within close proximity to high quality transit
    - Housing projects with restrictions on car parking or ownership
- Lower entitlement and environmental review costs for projects consistent with local and regional plans – The presumption of a less than significant VMT impact using project screening can be performed quickly. The benefit of streamlined review is somewhat offset by not having a complete VMT impact analysis supporting the VMT impact significance determination. Hence, the decision to use screening must balance the objective of streamlined review for projects well aligned with the local and regional envisioned futures against the potential for legal environmental challenges. The alternative to screening is a complete VMT analysis for each project, trading more work for increasing the substantial evidence supporting an agency's VMT impact decisions.

Next Steps

Following submission of this draft memorandum to the project team, Fehr & Peers will:

- Meet with Placer County and TRPA staff to review and obtain feedback on the memo
- Develop a final summary of screening options, based on the goals and intent, and including:
    - Possible criteria and approach
    - Discussion of legal defensibility
    - Limitations
- Summarize conclusions for the Tahoe Basin

Attachment G

Technical Advisory on Evaluating Transportation Impacts in CEQA

TECHNICAL ADVISORY

ON EVALUATING TRANSPORTATION IMPACTS IN CEQA

December 2018

Contents

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 assistance on issues that broadly affect the practice of land use planning and the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). (Gov. Code, § 65040, subds. (g), (l), (m).) The purpose of this document is to provide advice and recommendations, which agencies and other entities may use at their discretion. This document does not alter lead agency discretion in preparing environmental documents subject to CEQA. This document should not be construed as legal advice.

Senate Bill 743 (Steinberg, 2013), which was codified in Public Resources Code section 21099, required changes to the guidelines implementing CEQA (CEQA Guidelines) (Cal. Code Regs., Title 14, Div. 6, Ch. 3, § 15000 et seq.) regarding the analysis of transportation impacts. As one appellate court recently explained: "During the last 10 years, the Legislature has charted a course of long-term sustainability based on denser infill development, reduced reliance on individual vehicles and improved mass transit, all with the goal of reducing greenhouse gas emissions. Section 21099 is part of that strategy . . . ." (*Covina Residents for Responsible Development v. City of Covina* (2018) 21 Cal.App.5th 712, 729.) Pursuant to Section 21099, the criteria for determining the significance of transportation impacts must "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses." (*Id.*, subd. (b)(1); see generally, adopted CEQA Guidelines, § 15064.3, subd. (b) [Criteria for Analyzing Transportation Impacts].) To that end, in developing the criteria, OPR has proposed, and the California Natural Resources Agency (Agency) has certified and adopted, changes to the CEQA Guidelines that identify vehicle miles traveled (VMT) as the most appropriate metric to evaluate a project's transportation impacts. With the California Natural Resources Agency's certification and adoption of the changes to the CEQA Guidelines, automobile delay, as measured by "level of service" and other similar metrics, generally no longer constitutes a significant environmental effect under CEQA. (Pub. Resources Code, § 21099, subd. (b)(3).)

This advisory contains technical recommendations regarding assessment of VMT, thresholds of significance, and mitigation measures. Again, OPR provides this Technical Advisory as a resource for the public to use at their discretion. OPR is not enforcing or attempting to enforce any part of the recommendations contained herein. (Gov. Code, § 65035 ["It is not the intent of the Legislature to vest in the Office of Planning and Research any direct operating or regulatory powers over land use, public works, or other state, regional, or local projects or programs."].)

This December 2018 technical advisory is an update to the advisory it published in April 2018. OPR will continue to monitor implementation of these new provisions and may update or supplement this advisory in response to new information and advancements in modeling and methods.

B. Background

VMT and Greenhouse Gas Emissions Reduction. Senate Bill 32 (Pavley, 2016) requires California to reduce greenhouse gas (GHG) emissions 40 percent below 1990 levels by 2030, and Executive Order B-16-12 provides a target of 80 percent below 1990 emissions levels for the transportation sector by 2050. The transportation sector has three major means of reducing GHG emissions: increasing vehicle efficiency, reducing fuel carbon content, and reducing the amount of vehicle travel. The California Air Resources Board (CARB) has provided a path forward for achieving these emissions reductions from the transportation sector in its 2016 Mobile Source Strategy. CARB determined that it will not be possible to achieve the State's 2030 and post-2030 emissions goals without reducing VMT growth. Further, in its 2018 Progress Report on California's Sustainable Communities and Climate Protection Act, CARB found that despite the State meeting its 2020 climate goals, "emissions from statewide passenger vehicle travel per capita [have been] increasing and going in the wrong direction," and "California cannot meet its [long-term] climate goals without curbing growth in single-occupancy vehicle activity."[1] CARB also found that "[w]ith emissions from the transportation sector continuing to rise despite increases in fuel efficiency and decreases in the carbon content of fuel, California will not achieve the necessary greenhouse gas emissions reductions to meet mandates for 2030 and beyond without significant changes to how communities and transportation systems are planned, funded, and built."[2]

Thus, to achieve the State's long-term climate goals, California needs to reduce per capita VMT. This can occur under CEQA through VMT mitigation. Half of California's GHG emissions come from the transportation sector[3], therefore, reducing VMT is an effective climate strategy, which can also result in co-benefits.[4] Furthermore, without early VMT mitigation, the state may follow a path that meets GHG targets in the early years, but finds itself poorly positioned to meet more stringent targets later. For example, in absence of VMT analysis and mitigation in CEQA, lead agencies might rely upon verifiable offsets for GHG mitigation, ignoring the longer-term climate change impacts resulting from land use development and infrastructure investment decisions. As stated in CARB's 2017 Scoping Plan:

> "California's future climate strategy will require increased focus on integrated land use planning to support livable, transit-connected communities, and conservation of agricultural and other lands. Accommodating population and economic growth through travel- and energy-efficient land use provides GHG-efficient growth, reducing GHGs from both transportation and building energy use. GHGs can be further reduced at the project level through implementing energy-efficient construction and travel demand management approaches."[5] (*Id.* at p. 102.)

[1] California Air Resources Board (Nov. 2018) *2018 Progress Report on California's Sustainable Communities and Climate Protection Act*, pp. 4, 5, available at https://ww2.arb.ca.gov/sites/default/files/2018-11/Final2018Report_SB150_112618_02_Report.pdf.
[2] *Id.*, p. 28.
[3] See https://ca50million.ca.gov/transportation/
[4] Fang et al. (2017) *Cutting Greenhouse Gas Emissions Is Only the Beginning: A Literature Review of the Co-Benefits of Reducing Vehicle Miles Traveled*.
[5] California Air Resources Board (Nov. 2017) *California's 2017 Climate Change Scoping Plan*, p. 102, available at https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf.

In light of this, the 2017 Scoping Plan describes and quantifies VMT reductions needed to achieve our long-term GHG emissions reduction goals, and specifically points to the need for statewide deployment of the VMT metric in CEQA:

> "Employing VMT as the metric of transportation impact statewide will help to ensure GHG reductions planned under SB 375 will be achieved through on-the-ground development, and will also play an important role in creating the additional GHG reductions needed beyond SB 375 across the State. Implementation of this change will rely, in part, on local land use decisions to reduce GHG emissions associated with the transportation sector, both at the project level, and in long-term plans (including general plans, climate action plans, specific plans, and transportation plans) and supporting sustainable community strategies developed under SB 375."[6]

VMT and Other Impacts to Health and Environment. VMT mitigation also creates substantial benefits (sometimes characterized as "co-benefits" to GHG reduction) in both in the near-term and the long-term. Beyond GHG emissions, increases in VMT also impact human health and the natural environment. Human health is impacted as increases in vehicle travel lead to more vehicle crashes, poorer air quality, increases in chronic diseases associated with reduced physical activity, and worse mental health. Increases in vehicle travel also negatively affect other road users, including pedestrians, cyclists, other motorists, and many transit users. The natural environment is impacted as higher VMT leads to more collisions with wildlife and fragments habitat. Additionally, development that leads to more vehicle travel also tends to consume more energy, water, and open space (including farmland and sensitive habitat). This increase in impermeable surfaces raises the flood risk and pollutant transport into waterways.[7]

VMT and Economic Growth. While it was previously believed that VMT growth was a necessary component of economic growth, data from the past two decades shows that economic growth is possible without a concomitant increase in VMT. (Figure 1.) Recent research shows that requiring development projects to mitigate LOS may actually reduce accessibility to destinations and impede economic growth.[8,9]

[6] *Id.* at p. 76.
[7] Fang et al. (2017) *Cutting Greenhouse Gas Emissions Is Only the Beginning: A Literature Review of the Co-Benefits of Reducing Vehicle Miles Traveled*, available at https://ncst.ucdavis.edu/wp-content/uploads/2017/03/NCST-VMT-Co-Benefits-White-Paper_Fang_March-2017.pdf.
[8] Haynes et al. (Sept. 2015) *Congested Development: A Study of Traffic Delays, Access, and Economic Activity in Metropolitan Los Angeles*, available at http://www.its.ucla.edu/wp-content/uploads/sites/6/2015/11/Haynes_Congested-Development_1-Oct-2015_final.pdf.
[9] Osman et al. (Mar. 2016) *Not So Fast: A Study of Traffic Delays, Access, and Economic Activity in the San Francisco Bay Area*, available at http://www.its.ucla.edu/wp-content/uploads/sites/6/2016/08/Taylor-Not-so-Fast-04-01-2016_final.pdf.

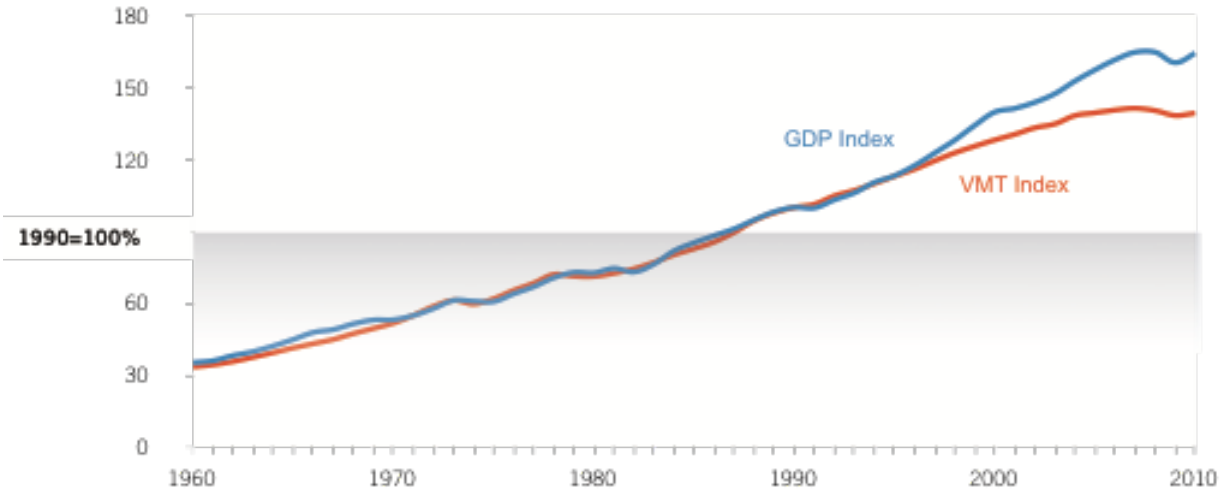

Figure 1. Kooshian and Winkelman (2011) *VMT and Gross Domestic Product (GDP), 1960-2010*.

C. Technical Considerations in Assessing Vehicle Miles Traveled

Many practitioners are familiar with accounting for VMT in connection with long-range planning, or as part of the CEQA analysis of a project's greenhouse gas emissions or energy impacts. This document provides technical information on how to assess VMT as part of a transportation impacts analysis under CEQA. Appendix 1 provides a description of which VMT to count and options on how to count it. Appendix 2 provides information on induced travel resulting from roadway capacity projects, including the mechanisms giving rise to induced travel, the research quantifying it, and information on additional approaches for assessing it.

1. 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. (*Santa Monica Baykeeper v. City of Malibu* (2011) 193 Cal.App.4th 1538, 1546; 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].) This section provides suggestions to lead agencies regarding methodologies to analyze VMT associated with a project.

Vehicle Types. Proposed Section 15064.3, subdivision (a), states, "For the purposes of this section, 'vehicle miles traveled' refers to the amount and distance of automobile travel attributable to a project." Here, the term "automobile" refers to on-road passenger vehicles, specifically cars and light trucks. Heavy-duty truck VMT could be included for modeling convenience and ease of calculation (for example, where models or data provide combined auto and heavy truck VMT). For an apples-to-apples

comparison, vehicle types considered should be consistent across project assessment, significance thresholds, and mitigation.

Residential and Office Projects. Tour- and trip-based approaches[10] offer the best methods for assessing VMT from residential/office projects and for comparing those assessments to VMT thresholds. These approaches also offer the most straightforward methods for assessing VMT reductions from mitigation measures for residential/office projects. When available, tour-based assessment is ideal because it captures travel behavior more comprehensively. But where tour-based tools or data are not available for all components of an analysis, a trip-based assessment of VMT serves as a reasonable proxy.

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 assessment of project VMT should be compared to a tour-based threshold, or a trip-based assessment to a trip-based VMT threshold.
- Where a travel demand model is used to determine thresholds, the same model should also be used to provide trip lengths as part of assessing project VMT.
- Where only trip-based estimates of VMT reduction from mitigation are available, a trip-based threshold should be used, and project VMT should be assessed in a trip-based manner.

When a trip-based method is used to analyze a residential project, the focus can be on home-based trips. Similarly, when a trip-based method is used to analyze an office project, the focus can be on home-based work trips.

When tour-based models are used to analyze an office project, either employee work tour VMT or VMT from all employee tours may be attributed to the project. This is because workplace location influences overall travel. For consistency, the significance threshold should be based on the same metric: either employee work tour VMT or VMT from all employee tours.

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).

Retail Projects. Generally, lead agencies should analyze the effects of a retail project by assessing the change in total VMT[11] because 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.

[10] See Appendix 1, *Considerations About Which VMT to Count,* for a description of these approaches.
[11] See Appendix 1, *Considerations About Which VMT to Count, "*Assessing Change in Total VMT" section, for a description of this approach.

Considerations for All Projects. Lead agencies should not truncate any VMT analysis because of jurisdictional or other boundaries, for example, by failing to count the portion of a trip that falls outside the jurisdiction or by discounting the VMT from a trip that crosses a jurisdictional boundary. 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. Where those VMT effects will grow over time, analyses should consider both a project's short-term and long-term effects on VMT.

Combining land uses for VMT analysis is not recommended. Different land uses generate different amounts of VMT, so the outcome of such an analysis could depend more on the mix of uses than on their travel efficiency. As a result, it could be difficult or impossible for a lead agency to connect a significance threshold with an environmental policy objective (such as a target set by law), inhibiting the CEQA imperative of identifying a project's significant impacts and providing mitigation where feasible. Combining land uses for a VMT analysis could streamline certain mixes of uses in a manner disconnected from policy objectives or environmental outcomes. Instead, OPR recommends analyzing each use separately, or simply focusing analysis on the dominant use, and comparing each result to the appropriate threshold. Recommendations for methods of analysis and thresholds are provided below. In the analysis of each use, a mixed-use project should take credit for internal capture.

Any project that includes in its geographic bounds a portion of an existing or planned Transit Priority Area (i.e., the project is within a ½ mile of an existing or planned major transit stop or an existing stop along a high quality transit corridor) may employ VMT as its primary metric of transportation impact for the entire project. (See Pub. Resources Code, § 21099, subds. (a)(7), (b)(1).)

Cumulative Impacts. A project's cumulative impacts are based on an assessment of whether the "incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects." (Pub. Resources Code, § 21083, subd. (b)(2); see CEQA Guidelines, § 15064, subd. (h)(1).) When using an absolute VMT metric, i.e., total VMT (as recommended below for retail and transportation projects), analyzing the combined impacts for a cumulative impacts analysis may be appropriate. However, metrics such as VMT per capita or VMT per employee, i.e., metrics framed in terms of efficiency (as recommended below for use on residential and office projects), cannot be summed because they employ a denominator. A project that falls below an efficiency-based threshold that is aligned with long-term environmental goals and relevant plans would have no cumulative impact distinct from the project impact. Accordingly, a finding of a less-than-significant project impact would imply a less than significant cumulative impact, and vice versa. This is similar to the analysis typically conducted for greenhouse gas emissions, air quality impacts, and impacts that utilize plan compliance as a threshold of significance. (See *Center for Biological Diversity v. Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 219, 223; CEQA Guidelines, § 15064, subd. (h)(3).)

D. General Principles to Guide Consideration of VMT

SB 743 directs OPR to establish specific "criteria for determining the significance of transportation impacts of projects[.]" (Pub. Resources Code, § 21099, subd. (b)(1).) In establishing this criterion, OPR was guided by the general principles contained within CEQA, the CEQA Guidelines, and applicable case law.

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[12] 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, subd. (a) (emphasis added).) Lead agencies have discretion to develop and 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); *Save Cuyama Valley v. County of Santa Barbara* (2013) 213 Cal.App.4th 1059, 1068.) 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); *Protect the Historic Amador Waterways v. Amador Water Agency* (2004) 116 Cal.App.4th 1099, 1108-1109.)

Additionally, the analysis leading to the determination of significance 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 VMT set forth below.

[12] Generally, qualitative analyses should only be conducted when methods do not exist for undertaking a quantitative analysis.

E. Recommendations Regarding Significance Thresholds

As noted above, lead agencies have the discretion to set or apply their own thresholds of significance. (*Center for Biological Diversity v. California Dept. of Fish & Wildlife* (2015) 62 Cal.4th 204, 218-223 [lead agency had discretion to use compliance with AB 32's emissions goals as a significance threshold]; *Save Cuyama Valley v. County of Santa Barbara* (2013) 213 Cal.App.4th at p. 1068.) However, 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. It further directed OPR to prepare and develop criteria for determining significance. (Pub. Resources Code, § 21099, subd. (b)(1).) This section provides OPR's suggested thresholds, as well as considerations for lead agencies that choose to adopt their own

The VMT metric can support the three statutory goals: "the reduction of greenhouse gas emissions, the development of multimodal transportation networks, ***and*** a diversity of land uses." (Pub. Resources Code, § 21099, subd. (b)(1), emphasis added.) However, in order for it to promote and support all three, lead agencies should select a significance threshold that aligns with state law on all three. State law concerning the development of multimodal transportation networks and diversity of land uses requires planning for and prioritizing increases in complete streets and infill development, but does not mandate a particular depth of implementation that could translate into a particular threshold of significance. Meanwhile, the State has clear quantitative targets for GHG emissions reduction set forth in law and based on scientific consensus, and the depth of VMT reduction needed to achieve those targets has been quantified. Tying VMT thresholds to GHG reduction also supports the two other statutory goals. Therefore, to ensure adequate analysis of transportation impacts, OPR recommends using quantitative VMT thresholds linked to GHG reduction targets when methods exist to do so.

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

- Assembly Bill 32 (2006) requires statewide GHG emissions reductions to 1990 levels by 2020 and continued reductions beyond 2020.

- Senate Bill 32 (2016) requires at least a 40 percent reduction in GHG emissions from 1990 levels by 2030.

- Pursuant to Senate Bill 375 (2008), the California Air Resources Board GHG emissions reduction targets for metropolitan planning organizations (MPOs) to achieve based on land use patterns and transportation systems specified in Regional Transportation Plans and Sustainable Community Strategies (RTP/SCS). Current targets for the State's largest MPOs call for a 19 percent reduction in GHG emissions from cars and light trucks from 2005 emissions levels by 2035.

- Executive Order B-30-15 (2015) sets a GHG emissions reduction target of 40 percent below 1990 levels by 2030.

- Executive Order S-3-05 (2005) sets a GHG emissions reduction target of 80 percent below 1990 levels by 2050.

- Executive Order B-16-12 (2012) specifies a GHG emissions reduction target of 80 percent below 1990 levels by 2050 specifically for transportation.

- Executive Order B-55-18 (2018) established an additional statewide goal of achieving carbon neutrality as soon as possible, but no later than 2045, and maintaining net negative emissions thereafter. It states, "The California Air Resources Board shall work with relevant state agencies to develop a framework for implementation and accounting that tracks progress toward this goal."

- Senate Bill 391 requires the California Transportation Plan to support 80 percent reduction in GHGs below 1990 levels by 2050.

- The *California Air Resources Board Mobile Source Strategy* (2016) describes California's strategy for containing air pollutant emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.

- The California Air Resources Board's *2017 Climate Change Scoping Plan Update: The Strategy for Achieving California's 2030 Greenhouse Gas Target* describes California's strategy for containing GHG emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.

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*, *supra*, 62 Cal.4th at p. 220.) 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*.) And more recently, the Supreme Court stated that "CEQA requires public agencies . . . to ensure that such analysis stay in step with evolving scientific knowledge and state regulatory schemes." (*Cleveland National Forest Foundation v. San Diego Assn. of Governments* (2017) 3 Cal.5th 497, 504.)

Meeting the targets described above will require substantial reductions in existing VMT per capita to curb GHG emissions and other pollutants. But targets for overall GHG emissions reduction do not translate directly into VMT thresholds for individual projects for many reasons, including:

- Some, but not all, of the emissions reductions needed to achieve those targets could be accomplished by other measures, including increased vehicle efficiency and decreased fuel carbon content. The CARB's *First Update to the Climate Change 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.**"[13] CARB's *2018 Progress Report on California's Sustainable Communities and Climate Protection Act* states on page 28 that "California cannot meet its climate goals without curbing growth in single-occupancy vehicle activity." In other words, vehicle efficiency and better fuels are necessary, but insufficient, to address the GHG emissions from the transportation system. Land use patterns and transportation options also will need to change to support reductions in vehicle travel/VMT.

- New land use projects alone will not sufficiently reduce per-capita 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.

- Because location within the region 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 some types 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*.)

Public Resources Code section 21099 directs OPR to propose criteria for determining the significance of transportation impacts. In this Technical Advisory, OPR provides its recommendations to assist lead agencies in selecting a significance threshold that may be appropriate for their particular projects. While OPR's Technical Advisory is not binding on public agencies, CEQA allows lead agencies to "consider thresholds of significance . . . recommended by other public agencies, provided the decision to adopt those thresholds is supported by substantial evidence." (CEQA Guidelines, § 15064.7, subd. (c).) Based on OPR's extensive review of the applicable research, and in light of an assessment by the California Air Resources Board quantifying the need for VMT reduction in order to meet the State's long-term climate goals, **OPR recommends that a per capita or per employee VMT that is fifteen percent below that of existing development may be a reasonable threshold**.

Fifteen percent reductions in VMT are achievable at the project level in a variety of place types.[14]

Moreover, a fifteen percent reduction is consistent with SB 743's direction to OPR to select a threshold that will help the State achieve its climate goals. As described above, section 21099 states that the

[13] California Air Resources Board (May 2014) *First Update to the Climate Change Scoping Plan*, p. 46 (emphasis added).
[14] CAPCOA (2010) *Quantifying Greenhouse Gas Mitigation Measures*, p. 55, available at http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf.

criteria for determining significance must "promote the reduction in greenhouse gas emissions." In its document *California Air Resources Board 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals*[15], CARB assesses VMT reduction per capita consistent with its evidence-based modeling scenario that would achieve State climate goals of 40 percent GHG emissions reduction from 1990 levels by 2030 and 80 percent GHG emissions reduction levels from 1990 by 2050. Applying California Department of Finance population forecasts, CARB finds per-capita light-duty vehicle travel would need to be approximately 16.8 percent lower than existing, and overall per-capita vehicle travel would need to be approximately 14.3 percent lower than existing levels under that scenario. Below these levels, a project could be considered low VMT and would, on that metric, be consistent with 2017 Scoping Plan Update assumptions that achieve climate state climate goals.

CARB finds per capita vehicle travel would need to be kept below what today's policies and plans would achieve.

CARB's assessment is based on data in the 2017 Scoping Plan Update and 2016 Mobile Source Strategy. In those documents, CARB previously examined the relationship between VMT and the state's GHG emissions reduction targets. The Scoping Plan finds:

> "While the State can do more to accelerate and incentivize these local decisions, local actions that reduce VMT are also necessary to meet transportation sector-specific goals and achieve the 2030 target under SB 32. Through developing the Scoping Plan, CARB staff is more convinced than ever that, in addition to achieving GHG reductions from cleaner fuels and vehicles, California must also reduce VMT. Stronger SB 375 GHG reduction targets will enable the State to make significant progress toward needed reductions, but alone will not provide the VMT growth reductions needed; there is a gap between what SB 375 can provide and what is needed to meet the State's 2030 and 2050 goals."[16]

Note that, at present, consistency with RTP/SCSs does not necessarily lead to a less-than-significant VMT impact.[17] As the Final 2017 Scoping Plan Update states,

> VMT reductions are necessary to achieve the 2030 target and must be part of any strategy evaluated in this Plan. Stronger SB 375 GHG reduction targets will enable the State to make significant progress toward this goal, but alone will not provide all of the VMT growth reductions that will be needed. There is a gap between what SB 375 can provide and what is needed to meet the State's 2030 and 2050 goals."[18]

[15] California Air Resources Board (Jan. 2019) *California Air Resources Board 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals*, available at https://ww2.arb.ca.gov/resources/documents/carb-2017-scoping-plan-identified-vmt-reductions-and-relationship-state-climate.
[16] California Air Resources Board (Nov. 2017) *California's 2017 Climate Change Scoping Plan*, p. 101.
[17] California Air Resources Board (Feb. 2018) *Updated Final Staff Report: Proposed Update to the SB 375 Greenhouse Gas Emission Reduction Targets*, Figure 3, p. 35, available at https://www.arb.ca.gov/cc/sb375/sb375_target_update_final_staff_report_feb2018.pdf.
[18] California Air Resources Board (Nov. 2017) *California's 2017 Climate Change Scoping Plan*, p. 75.

Also, in order to capture the full effects of induced travel resulting from roadway capacity projects, an RTP/SCS would need to include an assessment of land use effects of those projects, and the effects of those land uses on VMT. (See section titled "*Estimating VMT Impacts from Transportation Projects"* below.) RTP/SCSs typically model VMT using a collaboratively-developed land use "vision" for the region's land use, rather than studying the effects on land use of the proposed transportation investments.

In summary, achieving 15 percent lower per capita (residential) or per employee (office) VMT than existing development is both generally achievable and is supported by evidence that connects this level of reduction to the State's emissions goals.

1. Screening Thresholds for Land Use Projects

Many agencies use "screening thresholds" to quickly identify when a project should be expected to cause a less-than-significant impact without conducting a detailed study. (See e.g., CEQA Guidelines, §§ 15063(c)(3)(C), 15128, and Appendix G.) As explained below, this technical advisory suggests that lead agencies may screen out VMT impacts using project size, maps, transit availability, and provision of affordable housing.

Screening Threshold for Small Projects

Many local agencies have developed screening thresholds to indicate when detailed analysis is needed. Absent substantial evidence indicating that a project would generate a potentially significant level of VMT, or inconsistency with a Sustainable Communities Strategy (SCS) or general plan, projects that generate or attract fewer than 110 trips per day[19] 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. Maps created with VMT data, for example from a travel survey or a travel demand model, can illustrate areas that are

[19] CEQA provides a categorical exemption for existing facilities, including additions to existing structures of up to 10,000 square feet, so long as the project is in an area where public infrastructure is available to allow for maximum planned development and the project is not in an environmentally sensitive area. (CEQA Guidelines, § 15301, subd. (e)(2).) Typical project types for which trip generation increases relatively linearly with building footprint (i.e., general office building, single tenant office building, office park, and business park) generate or attract an additional 110-124 trips per 10,000 square feet. Therefore, absent substantial evidence otherwise, it is reasonable to conclude that the addition of 110 or fewer trips could be considered not to lead to a significant impact.

currently below threshold VMT (see recommendations below). Because new development in such locations would likely result in a similar level of VMT, such maps can be used to screen out residential and office projects from needing to prepare a detailed VMT analysis.

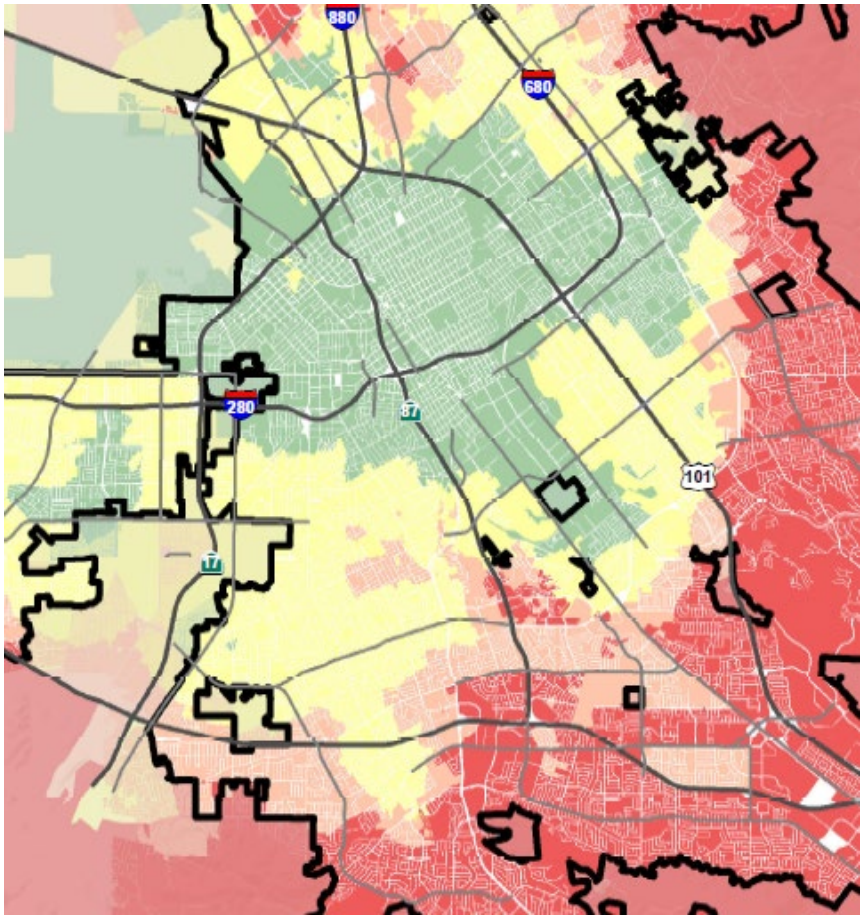

Figure 2. Example map of household VMT that could be used to delineate areas eligible to receive streamlining for VMT analysis. (Source: City of San José, Department of Transportation, draft output of City Transportation Model.)

Presumption of Less Than Significant Impact Near Transit Stations

Proposed CEQA Guideline Section 15064.3, subdivision (b)(1), states that lead agencies generally should presume that certain projects (including residential, retail, and office projects, as well as projects that are a mix of these uses) proposed within ½ mile of an existing major transit stop[20] or an existing stop

[20] 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.").

along a high quality transit corridor[21] 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 (if the jurisdiction requires the project to supply parking)
- Is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Metropolitan Planning Organization)
- Replaces affordable residential units with a smaller number of moderate- or high-income residential units

A project or plan near transit which replaces affordable residential units[22] with a smaller number of moderate- or high-income residential units may increase overall VMT because the increase in VMT of displaced residents could overwhelm the improvements in travel efficiency enjoyed by new residents.[23]

If any of 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).

Presumption of Less Than Significant Impact for Affordable Residential Development

Adding affordable housing to infill locations generally improves jobs-housing match, in turn shortening commutes and reducing VMT.[24,25] Further, "… low-wage workers in particular would be more likely to choose a residential location close to their workplace, if one is available."[26] In areas where existing jobs-housing match is closer to optimal, low income housing nevertheless generates less VMT than market-

[21] 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.").
[22] Including naturally-occurring affordable residential units.
[23] Chapple et al. (2017) *Developing a New Methodology for Analyzing Potential Displacement,* Chapter 4, pp. 159-160, available at https://www.arb.ca.gov/research/apr/past/13-310.pdf.
[24] Karner and Benner (2016) *The convergence of social equity and environmental sustainability: Jobs-housing fit and commute distance* ("[P]olicies that advance a more equitable distribution of jobs and housing by linking the affordability of locally available housing with local wage levels are likely to be associated with reduced commuting distances").
[25] Karner and Benner (2015) *Low-wage jobs-housing fit: identifying locations of affordable housing shortages.*
[26] Karner and Benner (2015) *Low-wage jobs-housing fit: identifying locations of affordable housing shortages.*

rate housing.[27,28] Therefore, a project consisting of a high percentage of affordable housing may be a basis for the lead agency to find a less-than-significant impact on VMT. Evidence supports a presumption of less than significant impact for a 100 percent affordable residential development (or the residential component of a mixed-use development) in infill locations. Lead agencies may develop their own presumption of less than significant impact for residential projects (or residential portions of mixed use projects) containing a particular amount of affordable housing, based on local circumstances and evidence. Furthermore, a project which includes any affordable residential units may factor the effect of the affordability on VMT into the assessment of VMT generated by those units.

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

Recommended threshold for residential projects: A proposed project exceeding a level of 15 percent below existing VMT per capita may indicate a significant transportation impact. Existing VMT per capita may be measured as regional VMT per capita or as city VMT per capita. Proposed development referencing a threshold based on city VMT per capita (rather than regional VMT per capita) should not cumulatively exceed the number of units specified in the SCS for that city, and should be consistent with the SCS.

Residential development that would generate vehicle travel that is 15 or more percent below the existing residential VMT per capita, measured against the region or city, may indicate a less-than-significant transportation impact. In MPO areas, development measured against city VMT per capita (rather than regional VMT per capita) should not cumulatively exceed the population or number of units specified in the SCS for that city because greater-than-planned amounts of development in areas above the region-based threshold would undermine the VMT containment needed to achieve regional targets under SB 375.

For residential projects in unincorporated county areas, the local agency can compare a residential project's VMT to (1) the region's VMT per capita, or (2) the aggregate population-weighted VMT per capita of all cities in the region. In MPO areas, development in unincorporated areas measured against aggregate city VMT per capita (rather than regional VMT per capita) should not cumulatively exceed the population or number of units specified in the SCS for that city because greater-than-planned amounts of development in areas above the regional threshold would undermine achievement of regional targets under SB 375.

[27] Chapple et al. (2017) *Developing a New Methodology for Analyzing Potential Displacement*, available at https://www.arb.ca.gov/research/apr/past/13-310.pdf.
[28] CAPCOA (2010) *Quantifying Greenhouse Gas Mitigation Measures*, pp. 176-178, available at http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf.

These thresholds can be applied to either household (i.e., tour-based) VMT or home-based (i.e., trip-based) VMT assessments.[29] It is critical, however, that the agency be consistent in its VMT measurement approach throughout the analysis to maintain an "apples-to-apples" comparison. For example, if the agency uses a home-based VMT for the threshold, it should also be use home-based VMT for calculating project VMT and VMT reduction due to mitigation measures.

Recommended threshold for office projects: A proposed 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, that includes the area over which nearly all workers would be expected to live.

Office VMT screening maps can be developed using tour-based data, considering either total employee VMT or employee work tour VMT. Similarly, tour-based analysis of office project VMT could 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 should be used throughout all steps of 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,[30] 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. Thus, lead agencies generally 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, may tend to have a significant impact. Where such development decreases VMT, lead agencies should consider the impact to be less-than-significant.

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-

[29] See Appendix 1 for a description of these approaches.
[30] Lovejoy, et al. (2013) *Measuring the impacts of local land-use policies on vehicle miles of travel: The case of the first big-box store in Davis, California, The Journal of Transport and Land Use*.

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, retail 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). Alternatively, a lead agency may consider only the project's dominant use. In the analysis of each use, a project should take credit for internal capture. Combining different land uses and applying one threshold to those land uses may result in an inaccurate impact assessment.

Other Project Types

Of land use projects, residential, office, and retail projects tend to have the greatest influence on VMT. For that reason, OPR recommends the quantified thresholds described above for purposes of 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 and regulations in the CEQA Guidelines on the development of thresholds of significance (e.g., CEQA Guidelines, § 15064.7).

Strategies and projects that decrease local VMT but increase total VMT should be avoided. Agencies should consider whether their actions encourage development in a less travel-efficient location by limiting development in travel-efficient locations.

Redevelopment Projects

Where a project replaces existing VMT-generating land uses, if the replacement leads to a net overall decrease in VMT, the project would lead to a less-than-significant transportation impact. If the project leads to a net overall increase in VMT, then the thresholds described above should apply.

As described above, a project or plan near transit which replaces affordable[31] residential units with a smaller number of moderate- or high-income residential units may increase overall VMT, because

[31] Including naturally-occurring affordable residential units.

displaced residents' VMT may increase.[32] A lead agency should analyze VMT for such a project even if it otherwise would have been presumed less than significant. The assessment should incorporate an estimate of the aggregate VMT increase experienced by displaced residents. That additional VMT should be included in the numerator of the VMT per capita assessed for the project.

If a residential or office project leads to a net increase in VMT, then the project's VMT per capita (residential) or per employee (office) should be compared to thresholds recommended above. Per capita and per employee VMT are efficiency metrics, and, as such, apply only to the existing project without regard to the VMT generated by the previously existing land use.

If the project leads to a net increase in provision of locally-serving retail, transportation impacts from the retail portion of the development should be presumed to be less than significant. If the project consists of regionally-serving retail, and increases overall VMT compared to with existing uses, then the project would lead to a significant transportation impact.

RTP/SCS Consistency (All Land Use Projects)

Section 15125, subdivision (d), of the CEQA Guidelines provides that lead agencies should analyze impacts resulting from inconsistencies with regional plans, including regional transportation plans. For this reason, if a project is inconsistent with the Regional Transportation Plan and Sustainable Communities Strategy (RTP/SCS), the lead agency should evaluate whether that inconsistency indicates a significant impact on transportation. For example, a development may be inconsistent with an RTP/SCS if the development is outside the footprint of development or within an area specified as open space as shown in the SCS.

3. Recommendations Regarding Land Use Plans

As with projects, agencies should analyze VMT outcomes of land use plans across the full area over which the plan may substantively affect travel patterns, including beyond the boundary of the plan or jurisdiction's geography. And as with projects, VMT should be counted in full rather than split between origin and destination. (Emissions inventories have sometimes spit cross-boundary trips in order to sum to a regional total, but CEQA requires accounting for the full impact without truncation or discounting). Analysis of specific plans may employ the same thresholds described above for projects. A general plan, area plan, or community plan may have a significant impact on transportation if proposed new residential, office, or retail land uses would in aggregate exceed the respective thresholds recommended above. Where the lead agency tiers from a general plan EIR pursuant to CEQA Guidelines sections 15152 and 15166, the lead agency generally focuses on the environmental impacts that are specific to the later project and were not analyzed as significant impacts in the prior EIR. (Pub. Resources Code, § 21068.5; Guidelines, § 15152, subd. (a).) Thus, in analyzing the later project, the lead agency

[32] Chapple et al. (2017) *Developing a New Methodology for Analyzing Potential Displacement,* Chapter 4, pp. 159-160, available at https://www.arb.ca.gov/research/apr/past/13-310.pdf.

would focus on the VMT impacts that were not adequately addressed in the prior EIR. In the tiered document, the lead agency should continue to apply the thresholds recommended above.

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

4. Other Considerations

Rural Projects Outside of 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 to the transit oriented development described above.

Impacts to Transit

Because criteria for determining the significance of transportation impacts must promote "the development of multimodal transportation networks" pursuant to Public Resources Code section 21099, subd. (b)(1), 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 are located within one half mile of transit stops.

When evaluating impacts to multimodal transportation networks, lead agencies generally should not treat the addition of new transit users as an adverse impact. An infill development may add riders to transit systems and the additional boarding and alighting may slow transit vehicles, but it also adds destinations, improving proximity and accessibility. Such development also improves regional vehicle flow by adding less vehicle travel onto the regional network.

Increased demand throughout a region may, however, cause a cumulative impact by requiring new or additional transit infrastructure. Such impacts may be adequately 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, since transit can broadly improve the function of the transportation system.

F. Considering the Effects of Transportation Projects on Vehicle Travel

Many transportation projects change travel patterns. A transportation project which leads to additional vehicle travel on the roadway network, commonly referred to as "induced vehicle travel," would need to quantify the amount of additional vehicle travel in order to assess air quality impacts, greenhouse gas emissions impacts, energy impacts, and noise impacts. Transportation projects also are required to

examine induced growth impacts under CEQA. (See generally, Pub. Resources Code, §§ 21065 [defining "project" under CEQA as an activity as causing either a direct or reasonably foreseeable indirect physical change], 21065.3 [defining "project-specific effect" to mean all direct or indirect environmental effects], 21100, subd. (b) [required contents of an EIR].) For any project that increases vehicle travel, explicit assessment and quantitative reporting of the amount of additional vehicle travel should not be omitted from the document; such information may be useful and necessary for a full understanding of a project's environmental impacts. (See Pub. Resources Code, §§ 21000, 21001, 21001.1, 21002, 21002.1 [discussing the policies of CEQA].) A lead agency that uses the VMT metric to assess the transportation impacts of a transportation project may simply report that change in VMT as the impact. When the lead agency uses another metric to analyze the transportation impacts of a roadway project, changes in amount of vehicle travel added to the roadway network should still be analyzed and reported.[33]

While CEQA does not require perfection, it is important to make a reasonably accurate estimate of transportation projects' effects on vehicle travel in order to make reasonably accurate estimates of GHG emissions, air quality emissions, energy impacts, and noise impacts. (See, e.g., *California Clean Energy Com. v. City of Woodland* (2014) 225 Cal.App.4th 173, 210 [EIR failed to consider project's transportation energy impacts]; *Ukiah Citizens for Safety First v. City of Ukiah* (2016) 248 Cal.App.4th 256, 266.) Appendix 2 describes in detail the causes of induced vehicle travel, the robust empirical evidence of induced vehicle travel, and how models and research can be used in conjunction to quantitatively assess induced vehicle travel with reasonable accuracy.

If a project would likely lead to a measurable and substantial increase in vehicle travel, the lead agency should conduct an analysis assessing the amount of vehicle travel the project will induce. Project types that would likely lead to a measurable and substantial increase in vehicle travel generally include:

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

Projects that would not likely lead to a substantial or measurable increase in vehicle travel, and therefore generally should not require an induced travel analysis, include:

- Rehabilitation, maintenance, replacement, safety, and repair projects designed to improve the condition of existing transportation assets (e.g., highways; roadways; bridges; culverts; Transportation Management System field elements such as cameras, message signs, detection, or signals; tunnels; transit systems; and assets that serve bicycle and pedestrian facilities) and that do not add additional motor vehicle capacity
- Roadside safety devices or hardware installation such as median barriers and guardrails

[33] See, e.g., California Department of Transportation (2006) *Guidance for Preparers of Growth-related, Indirect Impact Analyses*, available at http://www.dot.ca.gov/ser/Growth-related_IndirectImpactAnalysis/GRI_guidance06May_files/gri_guidance.pdf.

- Roadway shoulder enhancements to provide “breakdown space,” dedicated space for use only by transit vehicles, to provide bicycle access, or to otherwise improve safety, but which will not be used as automobile vehicle travel lanes
- 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, two-way left turn lanes, 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 increase vehicle travel
- Addition of a new lane that is permanently restricted to use only by transit vehicles
- Reduction in number of through lanes
- 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
- Installation of traffic metering systems, detection systems, cameras, changeable message signs and other electronics designed to optimize vehicle, bicycle, or pedestrian flow
- Timing of signals to optimize vehicle, bicycle, or pedestrian flow
- Installation of roundabouts or traffic circles
- 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
- 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 or relocation of off-street or on-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
- Addition of new or enhanced bike or pedestrian facilities on existing streets/highways or within existing public rights-of-way
- Addition of Class I bike paths, trails, multi-use paths, or other off-road facilities that serve non-motorized travel
- Installation of publicly available alternative fuel/charging infrastructure
- Addition of passing lanes, truck climbing lanes, or truck brake-check lanes in rural areas that do not increase overall vehicle capacity along the corridor

1. Recommended Significance Threshold for Transportation Projects

As noted in Section 15064.3 of the CEQA Guidelines, lead agencies for roadway capacity projects have discretion, consistent with CEQA and planning requirements, to choose which metric to use to evaluate transportation impacts. This section recommends considerations for evaluating impacts using vehicle miles traveled. Lead agencies have discretion to choose a threshold of significance for transportation projects as they do for other types of projects. As explained above, Public Resources Code section 21099, subdivision (b)(1), provides that criteria for determining the significance of transportation impacts must promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses. (*Id.*; see generally, adopted CEQA Guidelines, § 15064.3, subd. (b) [Criteria for Analyzing Transportation Impacts].) With those goals in mind, OPR prepared and the Agency adopted an appropriate transportation metric.

Whether adopting a threshold of significance, or evaluating transportation impacts on a case-by-case basis, a lead agency should ensure that the analysis addresses:

- Direct, indirect and cumulative effects of the transportation project (CEQA Guidelines, § 15064, subds. (d), (h))
- Near-term and long-term effects of the transportation project (CEQA Guidelines, §§ 15063, subd. (a)(1), 15126.2, subd. (a))
- The transportation project's consistency with state greenhouse gas reduction goals (Pub. Resources Code, § 21099)[34]
- The impact of the transportation project on the development of multimodal transportation networks (Pub. Resources Code, § 21099)
- The impact of the transportation project on the development of a diversity of land uses (Pub. Resources Code, § 21099)

The CARB Scoping Plan and the CARB Mobile Source Strategy delineate VMT levels required to achieve legally mandated GHG emissions reduction targets. A lead agency should develop a project-level threshold based on those VMT levels, and may apply the following approach:

1. Propose a fair-share allocation of those budgets to their jurisdiction (e.g., by population);

[34] The California Air Resources Board has ascertained the limits of VMT growth compatible with California containing greenhouse gas emissions to levels research shows would allow for climate stabilization. (See *The 2017 Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Target* (p. 78, p. 101); *Mobile Source Strategy* (p. 37).) CARB's *Updated Final Staff Report on Proposed Update to the SB 375 Greenhouse Gas Emission Reduction Targets* illustrates that the current Regional Transportation Plans and Sustainable Communities Strategies will fall short of achieving the necessary on-road transportation-related GHG emissions reductions called for in the 2017 Scoping Plan (Figure 3, p. 35). Accordingly, OPR recommends not basing GHG emissions or transportation impact analysis for a transportation project solely on consistency with an RTP/SCS.

2. Determine the amount of VMT growth likely to result from background population growth, and subtract that from their "budget";
3. Allocate their jurisdiction's share between their various VMT-increasing transportation projects, using whatever criteria the lead agency prefers.

2. Estimating VMT Impacts from Transportation Projects

CEQA requires analysis of a project's potential growth-inducing impacts. (Pub. Resources Code, § 21100, subd. (b)(5); CEQA Guidelines, § 15126.2, subd. (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 quantitative estimates of induced VMT is critical to calculating both transportation and other impacts of these projects. Induced travel also has the potential to reduce or eliminate congestion relief benefits. An accurate estimate of induced travel is needed to accurately weigh costs and benefits of a highway capacity expansion project.

The effect of a transportation project on vehicle travel should be estimated using the "change in total VMT" method described in *Appendix 1*. 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, the VMT estimation should not be truncated at a modeling or jurisdictional boundary for convenience of analysis when travel behavior is substantially affected beyond that boundary.

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 contained in SB 743 by reducing GHG emissions, increasing multimodal transportation networks, and facilitating mixed use development.

Roadway Projects

Reducing roadway capacity (for example, by removing or repurposing motor vehicle travel lanes) will generally reduce VMT and therefore is presumed to cause a less-than-significant impact on transportation. Generally, no transportation analysis is needed for such projects.

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 previously indicated as likely to lead to additional vehicle travel, an estimate should be made of the change in vehicle travel resulting from the project.

For projects that increase roadway capacity, lead agencies can evaluate induced travel quantitatively 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 (i.e., "elasticity").[35] 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 transportation effects of a particular project. The most recent major study, estimates an elasticity of 1.0, meaning that every percent change in lane miles results in a one percent increase in VMT.[36]

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 (generally the region, but for projects affecting interregional travel look at 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 multiply that by the elasticity from the induced travel literature:

[% increase in lane miles] x [existing VMT] x [elasticity] = [VMT resulting from the project]

A National Center for Sustainable Transportation tool can be used to apply this method: https://ncst.ucdavis.edu/research/tools

This method would not be suitable for rural (non-MPO) locations in the state which are neither congested nor projected to become congested. It also may not be suitable for a new road that provides new connectivity across a barrier (e.g., a bridge across a river) if it would be expected to substantially

[35] See U.C. Davis, Institute for Transportation Studies (Oct. 2015) *Increasing Highway Capacity Unlikely to Relieve Traffic Congestion*; Boarnet and Handy (Sept. 2014) *Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions*, California Air Resources Board Policy Brief, available at https://www.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_brief.pdf.
[36] See Duranton and Turner (2011) *The Fundamental Law of Road Congestion: Evidence from US cities*, available at http://www.nber.org/papers/w15376.

shorten existing trips. If it is likely to be substantial, the trips-shortening effect should be examined explicitly.

The effects of roadway capacity on vehicle travel can also be applied at a programmatic level. For example, in a regional planning process the lead agency can use that program-level analysis to streamline later project-level analysis. (See CEQA Guidelines, § 15168.) A program-level analysis of VMT should include effects of the program on land use patterns, and the VMT that results from those land use effects. In order for a program-level document to adequately analyze potential induced demand from a project or program of roadway capacity expansion, lead agencies cannot assume a fixed land use pattern (i.e., a land use pattern that does not vary in response to the provision of roadway capacity). A proper analysis should account 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).

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.[37] If those effects are significant, the lead agency will need to consider mitigation or alternatives. In the context of increased travel that is 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 off-site travel demand management
- 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.

G. Analyzing Other Impacts Related to Transportation

While requiring a change in the methodology of assessing transportation impacts, Public Resources Code section 21099 notes that this change "does not relieve a public agency of the requirement to analyze a project's potentially significant transportation impacts related to air quality, noise, safety, or any other impact associated with transportation." OPR expects that lead agencies will continue to

[37] See National Center for Sustainable Transportation (Oct. 2015) *Increasing Highway Capacity Unlikely to Relieve Traffic Congestion*, available at http://www.dot.ca.gov/newtech/researchreports/reports/2015/10-12-2015-NCST_Brief_InducedTravel_CS6_v3.pdf; see Duranton and Turner (2011) *The Fundamental Law of Road Congestion: Evidence from US cities*, available at http://www.nber.org/papers/w15376.

address mobile source emissions in the air quality and noise sections of an environmental document and the corresponding studies that support the analysis in those sections. Lead agencies should continue to address environmental impacts of a proposed project pursuant to CEQA's requirements, using a format that is appropriate for their particular project.

Because safety concerns result from many different factors, they are best addressed at a programmatic level (i.e., in a general plan or regional transportation plan) in cooperation with local governments, metropolitan planning organizations, and, where the state highway system is involved, the California Department of Transportation. In most cases, such an analysis would not be appropriate on a project-by-project basis. Increases in traffic volumes at a particular location resulting from a project typically cannot be estimated with sufficient accuracy or precision to provide useful information for an analysis of safety concerns. Moreover, an array of factors affect travel demand (e.g., strength of the local economy, price of gasoline), causing substantial additional uncertainty. Appendix B of OPR's General Plan Guidelines summarizes research which could be used to guide a programmatic analysis under CEQA. Lead agencies should note that automobile congestion or delay does not constitute a significant environmental impact (Pub. Resources Code, §21099(b)(2)), and safety should not be used as a proxy for road capacity.

H. VMT Mitigation and Alternatives

When a lead agency identifies a significant impact, it must identify feasible mitigation measures that could avoid or substantially reduce that impact. (Pub. Resources Code, § 21002.1, subd. (a).) Additionally, CEQA requires that an environmental impact report identify feasible alternatives that could avoid or substantially reduce a project's significant environmental impacts.

Indeed, the California Court of Appeal recently held that a long-term regional transportation plan was deficient for failing to discuss an alternative which could significantly reduce total vehicle miles traveled. In *Cleveland National Forest Foundation v. San Diego Association of Governments, et al.* (2017) 17 Cal.App.5th 413, the court found that omission "inexplicable" given the lead agency's "acknowledgment in its Climate Action Strategy that the state's efforts to reduce greenhouse gas emissions from on-road transportation will not succeed if the amount of driving, or vehicle miles traveled, is not significantly reduced." (*Cleveland National Forest Foundation*, *supra*, 17 Cal.App.5th at p. 436.) Additionally, the court noted that the project alternatives focused primarily on congestion relief even though "the [regional] transportation plan is a long-term and congestion relief is not necessarily an effective long-term strategy." (*Id.* at p. 437.) The court concluded its discussion of the alternatives analysis by stating: "Given the acknowledged long-term drawbacks of congestion relief alternatives, there is not substantial evidence to support the EIR's exclusion of an alternative focused primarily on significantly reducing vehicle trips." (*Ibid*.)

Several examples of potential mitigation measures and alternatives to reduce VMT are described below. However, the selection of particular mitigation measures and alternatives are left to the discretion of

the lead agency, and mitigation measures may vary, depending on the proposed project and significant impacts, if any. Further, OPR expects that agencies will continue to innovate and find new ways to reduce vehicular travel.

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

- Improve or increase access to transit.
- Increase access to common goods and services, such as groceries, schools, and daycare.
- Incorporate affordable housing into the project.
- Incorporate 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 eliminate parking supply.
- Unbundle parking costs.
- Provide parking cash-out programs.
- Implement roadway pricing.
- Implement or provide access to a commute reduction program.
- Provide car-sharing, bike sharing, and ride-sharing programs.
- Provide transit passes.
- Shifting single occupancy vehicle trips to carpooling or vanpooling, for example providing ride-matching services.
- Providing telework options.
- Providing incentives or subsidies that increase the use of modes other than single-occupancy vehicle.
- Providing on-site amenities at places of work, such as priority parking for carpools and vanpools, secure bike parking, and showers and locker rooms.
- Providing employee transportation coordinators at employment sites.
- Providing a guaranteed ride home service to users of non-auto modes.

Notably, because VMT is largely a regional impact, regional VMT-reduction programs may be an appropriate form of mitigation. In lieu fees have been found to be valid mitigation where there is both a commitment to pay fees and evidence that mitigation will actually occur. (*Save Our Peninsula Committee v. Monterey County Bd. of Supervisors* (2001) 87 Cal.App.4th 99, 140-141; *Gentry v. City of Murrieta* (1995) 36 Cal.App.4th 1359; *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 727–728.) Fee programs are particularly useful to address cumulative impacts. (CEQA Guidelines, § 15130, subd. (a)(3) [a "project's incremental contribution is less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact"].) The mitigation program must undergo CEQA evaluation, either on the program as a whole, or the in-lieu fees or other mitigation must be evaluated

on a project-specific basis. (*California Native Plant Society v. County of El Dorado* (2009) 170 Cal.App.4th 1026.) That CEQA evaluation could be part of a larger program, such as a regional transportation plan, analyzed in a Program EIR. (CEQA Guidelines, § 15168.)

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 VMT.
- Locate the project near transit.
- Increase project density.
- Increase the mix of uses within the project or within the project's surroundings.
- Increase connectivity and/or intersection density on the project site.
- Deploy management strategies (e.g., pricing, vehicle occupancy requirements) on roadways or roadway lanes.

Appendix 1. Considerations About Which 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.[38] 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.

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.

Here is an illustrative example of some methods of estimating vehicle miles traveled. 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 the 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.

[38] 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 Assn. 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.)

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 beyond the work tour. For example, a workplace located at the urban periphery, far from transit, can require an employee 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, subd. (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 VMT mitigation 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.

Appendix 2. Induced Travel: Mechanisms, Research, and Additional Assessment Approaches

Induced travel occurs where roadway capacity is expanded in an area of present or projected future congestion. The effect typically manifests over several years. Lower travel times make the modified facility more attractive to travelers, resulting in the following trip-making changes:

- **Longer trips.** The ability to travel a long distance in a shorter time increases the attractiveness of destinations that are farther away, increasing trip length and vehicle travel.
- **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 vehicle travel.
- **Route changes.** Faster travel times on a route attract more drivers to that route from other routes, which can increase or decrease vehicle travel depending on whether it shortens or lengthens trips.
- **Newly generated trips.** Increasing travel speeds can induce additional trips, which increases vehicle travel. For example, an individual who previously telecommuted or purchased goods on the internet might choose to accomplish those tasks via automobile trips as a result of increased speeds.
- **Land Use Changes.** Faster travel times along a corridor lead to land development farther along that corridor; that new development generates and attracts longer trips, which increases vehicle travel. Over several years, this induced growth component of induced vehicle travel can be substantial, making it critical to include in analyses.

Each of these effects has implications for the total amount of vehicle travel. 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 lead agencies to analyze both short-term and long-term effects.

Evidence of Induced Vehicle Travel. A large number of peer reviewed studies[39] have demonstrated a causal link between highway capacity increases and VMT increases. Many provide quantitative estimates of the magnitude of the induced VMT phenomenon. Collectively, they provide high quality evidence of the existence and magnitude of the induced travel effect.

[39] See, e.g., Boarnet and Handy (Sept. 2014) Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions, California Air Resources Board Policy Brief, available at https://www.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_brief.pdf; National Center for Sustainable Transportation (Oct. 2015) *Increasing Highway Capacity Unlikely to Relieve Traffic Congestion*, available at http://www.dot.ca.gov/research/researchreports/reports/2015/10-12-2015-NCST_Brief_InducedTravel_CS6_v3.pdf.

Most of these studies express the amount of induced vehicle travel as an "elasticity," which is a multiplier that describes the additional vehicle travel resulting from an additional lane mile of roadway capacity added. For example, an elasticity of 0.6 would signify an 0.6 percent increase in vehicle travel for every 1.0 percent increase in lane miles. Many of these studies 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 larger than short run elasticity, because as time passes, more of the components of induced vehicle travel 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,[40] meaning that every increase in lanes miles of one percent leads to an increase in vehicle travel of 0.6 to 1.0 percent. The most recent major study finds the elasticity of vehicle travel by lanes miles added to be 1.03; in other words, each percent increase in lane miles results in a 1.03 percent increase in vehicle travel.[41] (An elasticity greater than 1.0 can occur because new lanes induce vehicle travel that spills beyond 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 Vehicle Travel Using Models. Lead agencies can generally achieve the most accurate assessment of induced vehicle travel resulting from roadway capacity increasing projects by applying elasticities from the academic literature, because those estimates include vehicle travel resulting from induced land use. If a lead agency chooses to use a travel demand model, additional analysis would be needed to account for induced land use. This section describes some approaches to undertaking that additional analysis.

Proper use of a travel demand model can capture the following components of induced VMT:

- Trip length (generally increases VMT)
- Mode shift (generally shifts from other modes toward 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 substantial.

However, estimating long-run induced VMT also requires an estimate of the project's effects on land use. This component of the analysis is important because it has the potential to be a large component of

[40] See Boarnet and Handy (Sept. 2014) *Impact of Highway Capacity and Induced Travel on Passenger Vehicle Use and Greenhouse Gas Emissions*, California Air Resources Board Policy Brief, p. 2, available at https://www.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_brief.pdf.

[41] Duranton and Turner (2011) *The Fundamental Law of Road Congestion: Evidence from US cities*, available at http://www.nber.org/papers/w15376.

the overall induced travel effect. Options for estimating and incorporating the VMT effects that are caused by the subsequent land use changes include:

1. *Employ an expert panel.* An expert panel could assess changes to land use development that would likely result from the project. This assessment could then be analyzed by the travel demand model to assess effects on vehicle travel. Induced vehicle travel assessed via this approach should be verified using elasticities found in the academic literature.
2. *Adjust model results to align with the empirical research.* If the travel demand model analysis is performed without incorporating projected land use changes resulting from the project, the assessed vehicle travel should be adjusted upward to account for those land use changes. The assessed VMT after adjustment should fall within the range found in the academic literature.
3. *Employ a land use model, running it iteratively with a travel demand model.* A land use model can be used to estimate the land use effects of a roadway capacity increase, and the traffic patterns that result from the land use change can then be fed back into the travel demand model. The land use model and travel demand model can be iterated to produce an accurate result.

A project which provides new connectivity across a barrier, such as a new bridge across a river, may provide a shortened path between existing origins and destinations, thereby shortening existing trips. In rare cases, this trip-shortening effect might be substantial enough to reduce the amount of vehicle travel resulting from the project below the range found in the elasticities in the academic literature, or even lead a net reduction in vehicle travel overall. In such cases, the trip-shortening effect could be examined explicitly.

Whenever employing a travel demand model to assess induced vehicle travel, any limitation or known lack of sensitivity in the analysis that might cause substantial errors in the VMT estimate (for example, 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 into analyses that rely on the VMT analysis, such as greenhouse gas emissions, air quality, energy, and noise.