Tools Assessment

FEHR PEERS

TECHNICAL MEMORANDUM

Date: 12.17.18

To: Chris Gray (WRCOG), Chris Tzeng (WRCOG), Sarah Dominguez (SCAG), Mike Gainor (SCAG)

From: Ronald T. Milam, AICP, PTP and Jason Pack, PE

Subject: Review and Assessment of Existing Planning/Travel Demand Tools for SB 743 OC18-0567

This technical memorandum presents a review of existing sketch planning tools and travel demand forecasting models available for SB 743 VMT analysis in the WRCOG region. We identified three travel forecasting models and 11 sketch planning tools that produce VMT forecasts or test VMT reduction strategies. However, SB 743 has an additional requirement that limits which models or tools are potentially acceptable for VMT analysis. The *Technical Advisory on Evaluating Transportation Impacts in CEQA*, State of California, Governor's Office of Planning and Research, April 2018 contains the following specification for models and methodologies.

> *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.*

Presuming that WRCOG member agencies will rely on the RIVTAM or SCAG travel forecasting models to establish VMT thresholds, then these models (or their inputs/outputs) would need to be used for project analysis. As a result, current sketch tools would not be used to estimate VMT for SB 743 purposes. Instead, these tools would largely be used for testing VMT mitigation measures such as transportation demand management (TDM) strategies.

Travel Forecasting Models

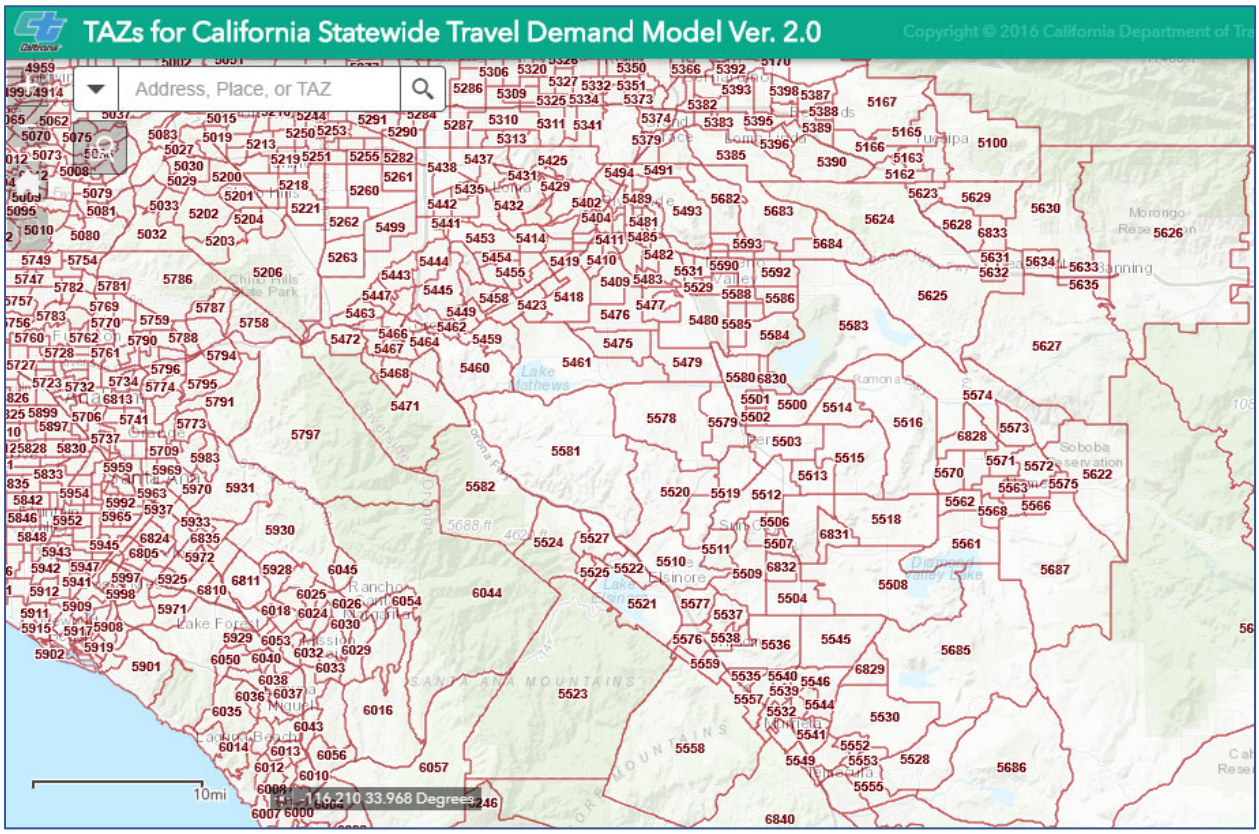
Three travel forecasting models are available for VMT forecasting in the WRCOG region including the California Statewide Travel Demand Model (CSTDM), the SCAG travel forecasting model, and the RIVTAM travel forecasting model. The CSTDM was developed by Caltrans and produces passenger travel demand forecasts. Details about the model can be found at the following website.

- http://www.dot.ca.gov/hq/tpp/offices/omsp/statewide_modeling/cstdm.html

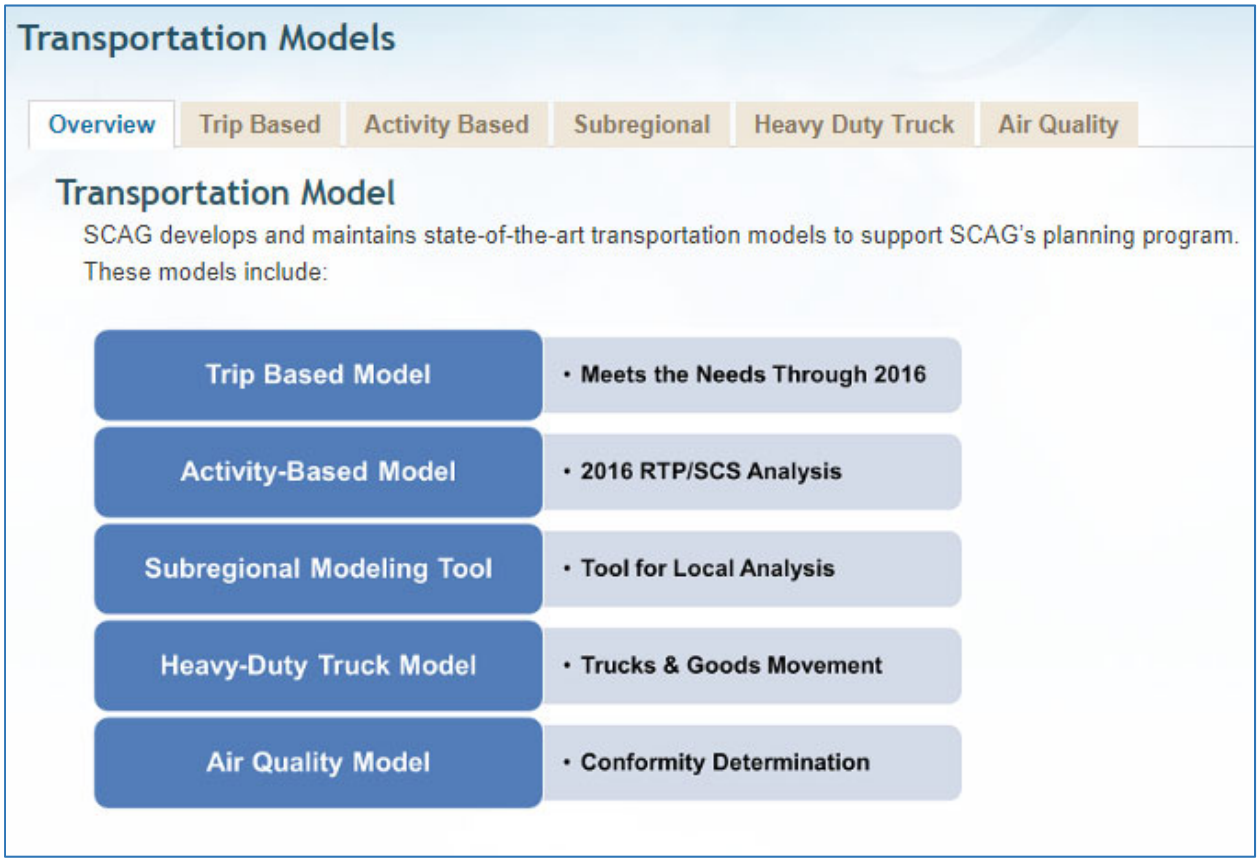
In addition, Caltrans has produced VMT output data by traffic analysis zone (TAZ) for purposes of SB 743 implementation and that data can be accessed at the following website.

- http://www.dot.ca.gov/hq/tpp/offices/omsp/SB743.html

As a statewide model, the level of detail for local project applications may not be sufficient to produce reasonable results since the model was not validated at a local scale. The traffic analysis zones (TAZs) are large as shown in the map excerpt below; so the resulting VMT outputs would have limited sensitivity to small scale land use projects and the influences of land use context.



SCAG has developed its own models for regional planning purposes including a trip-based model and an activity-based model (ABM). A variety of other models have also been created for specific purposes related to sub-regional modeling, heavy duty trucks, air quality, and scenario planning. As shown in the image below, SCAG is transitioning from the trip-based model, which was used for previous regional transportation plans/sustainable communities strategies (RTP/SCS) to the ABM for future versions.

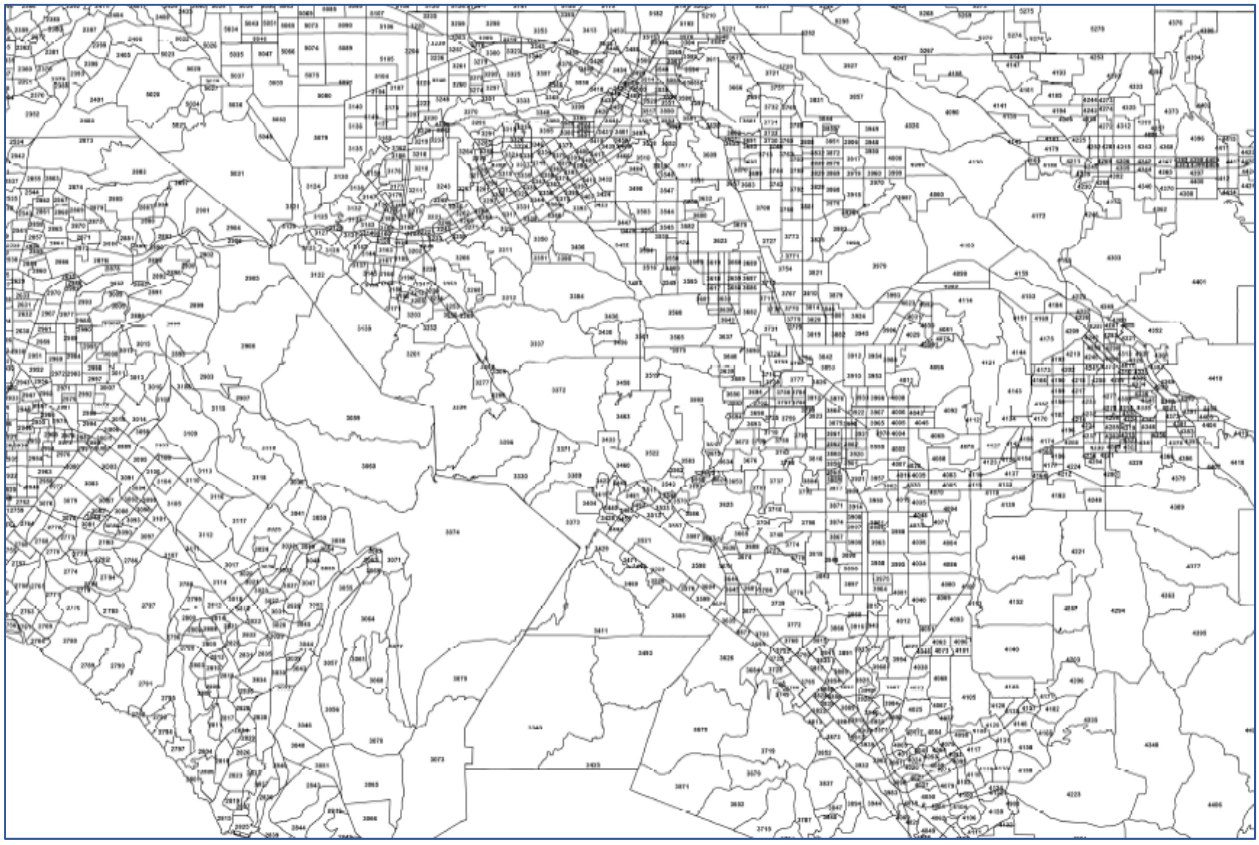


The SCAG trip-based and ABM model outputs can be post-processed to produce total VMT estimates at the traffic analysis zone (TAZ) level or for any aggregation of TAZs. The ABM can also produce household generated VMT estimates. These estimates are limited to trips that have origins and destinations within the model boundary. Trips to or from external model origins and destinations are not included. The models are sensitive to built-environment effects and have been calibrated and validated to represent the SCAG region as explained in the model development documentation available at the following website.

- http://www.scag.ca.gov/DataAndTools/Pages/TransportationModels.aspx

Since Riverside County is located at the edge of the SCAG model area, some modifications to the models may be necessary to provide a full accounting of VMT effects as recommended in the OPR Technical Advisory for SB 743 implementation. The specific modifications would be to adjust the lengths of trips entering and exiting the model boundary area to capture their full travel distance and not just the distance they travel inside the model area.

The final model evaluated is the RIVTAM travel forecasting model, which represents a sub-area version of the SCAG model. RIVTAM was completed in May 2009 and includes a 2008 base year and a 2035 forecast year. The model was designed to provide a greater level of detail and sensitivity in Riverside County compared to regional SCAG model (see image below of the current TAZ system.



As part of an update to the TUMF program, a new 2012 base year was established and the forecast year was extended to 2040. A major update of the model was started in July of 2018 and will extend into 2019. The current and updated models will be capable of producing VMT estimates for each TAZ or larger areas. To provide the full-accounting of VMT that is recommended for SB 743, the current model outputs will likely need further refinements similar to those described above for the SCAG model. The updated model is anticipated to include these changes.

Sketch Planning Tools

This review evaluated 11 sketch model tools using the following criteria. We also incorporated information from reviews conducted through academic research by UC Davis and UC Berkeley.

1. Defensibility – How defensible is the use of this tool in terms of the accuracy of its outputs and frequency of use by other agencies.
2. Sensitivity - How sensitive is to the tool to the specific land use contexts and TDM strategies (e.g., does the tool allow the user to import details related to the context surrounding the project site and the proposed TDM mitigation measures).
3. Utility – How easy is the tool to use to evaluate VMT and TDM strategies.

The 11 sketch model tools reviewed are listed below:

- **CalEEMod** - is a statewide computer model designed to estimate emissions of criteria air pollutant and greenhouse gas (GHG) associated with land use projects. This model also provides VMT estimates that are a part of the emissions modeling process.

- **Sketch 7** - is a spreadsheet tool that estimates percent reductions to VMT based on the 7 Ds (i.e., density, diversity, distance, design, destination, demographics, and development scale).

- **VMT Impact Tool/Salon** – is a spreadsheet tool created by Deborah Salon at UC Davis for the California Air Resources Board that quantifies how much VMT will change in response to changes in land use and transportation system variables.

- **GreenTRIP Connect** - is an online tool for residential projects that allows users to evaluate the VMT and GHG emissions of their project and to test a limited set of built-in TDM strategies.

- **MXD/MXD+** - is a mixed-use development trip generation tool developed for U.S. EPA that adjusts ITE daily trip generation estimates to reflect built environment effects. MXD+ incorporates the ITE mixed-use trip generation method to produce a.m. and p.m. peak hour trip generation estimates for mixed use projects. To estimate VMT, the trip generation results from

MXD/MXD+ must be multiplied by trip lengths from observed data or regional/local travel forecasting models.

- **UrbanFootprint (UF)** - is a scenario planning tools that produces VMT estimates relying on the MXD trip generation methodology. Trip lengths are calculated within the model but do not reflect network-based routing. SCAG uses a version of UF as part of its sketch planning model.

- **Envision Tomorrow** - is a scenario planning tool that produces VMT estimates.

- **California Smart-Growth Trip Generation Adjustment Tool** – is a spreadsheet tool that provides the number of trips generated by land use projects implementing smart growth principles.

- **TRIMMS** – is a visual basic application spreadsheet model that estimates mode share and VMT changes brought about by a number of TDM strategies.

- **VMT+** - is a web-based application that estimates VMT and emissions using ITE trip rates and user-defined trip and land use inputs.

- **TDM+** - is a spreadsheet tool that estimates the percent reduction in VMT due to the implementation of one or many different TDM strategies identified in the *Quantifying Greenhouse Gas Mitigation Measures*, CAPCOA, 2010.

The matrix in Attachment A provides a summary of the tool review. Each of the sketch models reviewed, except for the CA Smart Growth Tool and MXD/MXD+, provide direct estimates of 'project generated VMT' or calculates the percent change in VMT. None of the models are capable of fully evaluating the 'project's effect on VMT' or evaluating cumulative VMT impacts. Only CalEEMod, GreenTRIP Connect, TRIMMS, and TDM+ evaluate the impacts of TDM strategies for VMT mitigation.

Tool Recommendations for WRCOG Member Jurisdictions

According to the OPR technical advisory, the tools used to evaluate VMT must be consistent with the methodology used to determine VMT thresholds. To maintain consistency between methods and thresholds, we do not recommend using the available sketch planning tools to estimate project-generated VMT for land use projects if thresholds are based on the RIVTAM or SCAG model. However, the sketch tools may be useful for evaluating the impacts of potential TDM strategies.

If an efficiency form of VMT (VMT per service population, VMT per resident, or VMT per employee) is selected as the metric that is used to define the VMT thresholds, then we would recommend the development of a customized screening and forecasting tool (i.e., web-app). This tool would reflect the

specific transportation and land use context of the WRCOG region by relying on RIVTAM model inputs and outputs. The tool could be used for the following assessment and forecasting steps.

- Identify the TAZ associated with the project location.
- Identify the local jurisdiction of the project, based on the project's associated TAZ.
- Determine if the project meets screening criteria related to being located within a transit priority area (TPA).
- Determine if project meets screening criteria related to being located within a low VMT generating TAZ. This test would largely apply to residential and work-related land uses. Retail land uses have a separate screening related to whether the project is local serving, which could be based on size (e.g., less than 50,000 square feet) This step would rely on the model's base year (or baseline) estimate of the TAZ VMT per service population and would compare that value to the proposed threshold measured at the jurisdictional or a reasonable sub-regional area (i.e., WRCOG or TUMF districts).
- Provide baseline and cumulative estimates of project generated VMT if the project fails to be screened out including VMT estimates for use in other sections of CEQA analysis, such as air quality, greenhouse gases, and energy based on TAZ VMT averages.

Tool setup would include running the base year and future year scenarios of the travel demand model to obtain VMT and land use data for each TAZ, jurisdiction, and reasonable sub-region. Key features of this tool are described in Table 1.

Table 1: VMT Screening and Forecasting Tool Specifications			
Feature	**Description**	**Elements**	**Comments**

Setup inputs	Parcel boundaries, TPA boundaries, and travel demand model data required to prepare tool for use	• Parcel boundaries
		• TPA boundaries
		• Model data for each TAZ, jurisdiction, TUMF district under base year and future year conditions:
		  ○ TUMF districts
		  ○ Jurisdiction boundaries
		  ○ Land use, population, employment (and possibly students)
		  ○ Total VMT
		  ○ Total VMT per service population
			Only needs to be updated when model is updated

Project inputs	Data required for each project	• Project baseline year (year Notice of Preparation is filed) • Land use, population, employment (and possibly students) • Is project consistent with General Plan? (yes/no) • Is project consistent with RTP/SCS? (yes/no) • Does the project consist exclusively of local serving retail uses with a total project size of less than 50,000 square feet? (yes/no)	
Tool outputs	Results provided for each project	• Does project satisfy screening criteria? If yes, basis for determination • Estimated project total VMT per service population (project baseline and future years) • Estimated project total VMT (project baseline and future years)	VMT estimates based on TAZ average

For evaluating the impacts of TDM strategies for VMT mitigation, CalEEMod, GreenTRIP Connect, and TDM+ are available sketch tools, but each as potential limitations. The data supporting the VMT reductions associated with the TDM strategies in these tools is largely derived from urban areas. Their application in suburban and especially rural areas may not be valid without a detailed assessment of how the strategy is affected by the background land use context. As to individual tool limitations, GreenTrip Connect only applies to residential projects with just a few TDM strategies. CalEEMod includes the TDM strategies from *Quantifying Greenhouse Gas Mitigation Strategies*, CAPCOA, 2010, but has operational issues noted in the tool review in Attachment A that can misrepresent project generated VMT. TDM+ also includes the CAPCOA strategies plus recent ARB research documented in the "SB 743 Implementation TDM Strategy Assessment," June 11, 2018; however, this tool is proprietary and would need to be applied through Fehr & Peers.

ATTACHMENT A – Review of Available Sketch Models

ATTACHMENT A: SKETCH MODEL TOOL APPLICABILITY FINDINGS

Sketch Tool	Output	Defensibility	Sensitivity	Utility	Comments	User Experience: Benefits (UC Davis[1])	User Experience: Drawbacks (UC Davis[1])	Conclusions (UC Berkeley[2])	Conclusion
CalEEMod	VMT	++ Widespread use by air districts. Defensibility depends on use by others due to lack of documentation for trip lengths and known calculation problems.	+ Many parameters, but limited sensitivity to land use context, requires use of mitigation function to accurately represent mixed-use or infill projects, does not directly capture internalization, and mitigation function is not current or fully sensitive to TDM strategies.	++ Requires installation, which can cause errors due to older programming (not updated since 2016). Use of the tool is relatively straightforward but use of mitigation function is often necessary to accurately represent proposed projects.	CAPCOA/Trinity Consultants product, may not be able to make changes.	Many, customizable inputs; program interface reduces back-end error.	Many, customizable inputs; defaults and land use categories may misrepresent project and/or context area.	Easier data demands; difficult to determine location attributes, especially to avoid double counting; documentation did not provide enough guidance on method selection.	Not recommended for VMT calculations but could be used for TDM mitigation evaluation.
Sketch 7	% Change in VMT	+ Household (HH) VMT only. Hasn't been updated since 2012.	+ No internalization, no TDM reduction, no trip purpose. Produces % change in VMT, generic place types.	+ Must have regional travel demand model data as input.		Straightforward inputs & interface; system-level outputs; outputs include walk, bike, and transit trips.	Spreadsheet interface can become "buggy", break; regional TAZ data used to calibrate tool may be difficult to obtain.	[Not reviewed]	Not recommended.
VMT Impact Tool/Salon	% Change in VMT	+ HH VMT only	+ No internalization, no TDM reduction, no trip purpose.	+ Not intuitive as a project analysis tool.	Scenario testing for census tract level & above; not project-level.	[Not reviewed]	[Not reviewed]	[Not reviewed]	Not recommended.
GreenTRIP Connect	VMT; Change in VMT	+ HH VMT only	+ Affordable housing, TDM credit for 4 strategies,	++ Easy to use, but limited to residential land uses.	Would need to work with TransForm.	Simple user interface; straightforward outputs.	Measures only residential travel, even in mixed-use projects.	[Not reviewed]	Not recommended for VMT calculations, but could be used for TDM mitigation evaluation. Application in rural areas may not be valid.
UrbanFootprint	VMT	++ Uses MXD for trip generation. Trip lengths not based on observed data.	++ Many parameters. Sensitive to land use changes from adjacent parcels. No TDM reduction.	+ Robust tool but requires training to learn.	California acquired licenses for all cities and counties.	[Not reviewed]	[Not reviewed]	[Not reviewed]	Not recommended.
Envision Tomorrow	VMT	+ Added parameters diluted research.	++ Many parameters. No TDM reduction.	+ Open source, complex spreadsheet tool.	Primarily scenario planning; owned by Fregonese.	[Not reviewed]	[Not reviewed]	[Not reviewed]	Not recommended.
CA Smart Growth Tool	Trips	++	+ No trip purposes, no TDM reduction.	+		Few, intuitive inputs with direction of where to find them.	Calculates trips one land use at a time, and in limited context areas; calculates trips, not VMT.	[Not reviewed]	Not recommended.
TRIMMS	VMT	++ Used by SJCOG.	++ Includes TDM reductions for employees (not LU).	+	Has a few elements that do not exist in CAPCOA.	[Not reviewed]	[Not reviewed]	[Not reviewed]	Not recommended.
MXD/MXD+	Trips	+++	++ Many parameters, no TDM reduction.	++		Simple inputs categories; straightforward outputs.	Important input data may be difficult to find.	High data input demands; obtaining data required GIS capability.[3]	Not recommended.
VMT+	VMT	+ Educational Tool.	+ Limited parameters.	++ Easy to use.		[Not reviewed]	[Not reviewed]	[Not reviewed]	Not recommended.
TDM+	% Change in VMT	+++ CAPCOA-based.	++	++	Only does TDM reductions; needs to be coupled with VMT estimator. Being updated based on new TDM research from ARB Net Zero Building Feasibility Study.	[Not reviewed]	[Not reviewed]	[Not reviewed]	Could be used for TDM mitigation evaluation. Application in rural areas may not be valid.

Sources: Fehr & Peers, 2018; UC Davis, 2017; UC Berkeley, 2018.

Notes: + = lowest score, +++ = highest score

[1]Amy Lee, Kevin Fang, and Susan Handy; "Evaluation of Sketch-Level Vehicle Miles Traveled (VMT) Quantification Tools," National Center for Sustainable Transportation, August 2017.

[2]Elisa Barbour, Dan Chatman, Sarah Doggett, Stella Yip, and Manuel Santana; "SB 743 implementation: Challenges and Opportunities [Draft Final]," June 5, 2018.

[3]Analysis based on earlier, public spreadsheet tool; more advanced proprietary versions available.

VMT Impact Analysis Methodologies and Case Studies

FEHR PEERS

TECHNICAL MEMORANDUM

Date: 2.26.19

To: Chris Gray (WRCOG), Chris Tzeng (WRCOG), Sarah Dominguez (SCAG), Mike Gainor (SCAG)

From: Ronald T. Milam, AICP, PTP and Jason Pack, PE

Subject: VMT Impact Analysis Methodologies and Case Studies OC18-0567

This technical memorandum presents recommended SB 743 VMT analysis methodologies for lead agencies in the WRCOG area. Methodologies are included for VMT impact screening and for full impact analysis. In addition, land use project case studies are presented to evaluate the methodologies and to test the outcomes associated with different threshold options. Lead agencies have the discretion to select their own thresholds presuming they provide substantial evidence to support their selection (see the Thresholds Evaluation Technical Memorandum for more details). The following previously approved land use projects were evaluated as case studies in this effort.

- Eastvale Crossings – A commercial and retail development in Eastvale
- Nandina Distribution Center (Moreno Valley) – A logistics center in Moreno Valley
- A 136 Unit Single Family Residential Development in northeast Temecula
- Mission Lofts – A transit-oriented development in Riverside

The remainder of this memo is organized as follows.

- Project Threshold Analysis Methodology for Land Use Projects
- Land Use Project Case Study Tests
- Cumulative Threshold Analysis Methodology for Land Use Projects
- Analysis Methodology for Land Use Plans
- Analysis Methodology for Transportation Projects

Project Threshold Analysis Methodology for Land Use Projects

Lead agencies may choose to use an impact screening method to streamline land use project review for VMT impacts. WRCOG has created a web-based screening tool for this purpose available at http://gis.fehrandpeers.com/WRCOGVMT/. If a project does not pass an initial screening test, then a full impact analysis is warranted. In all, the process may include up to four steps as outlined below.

Step 1: Transit Priority Area (TPA) Screening

Projects located within a TPA[1] may be presumed to have a less than significant impact absent substantial evidence to the contrary. This presumption may not be appropriate if the project:

1. Has a Floor Area Ratio (FAR) of less than 0.75;
2. Includes more parking for use by residents, customers, or employees of the project than required by the jurisdiction (if the jurisdiction requires the project to supply parking);
3. Is inconsistent with the applicable Sustainable Communities Strategy (as determined by the lead agency, with input from the Metropolitan Planning Organization); or
4. Replaces affordable residential units with a smaller number of moderate- or high-income residential units.

Step 2: Low VMT Area Screening

Residential and office projects located within a low VMT generating area may be presumed to have a less than significant impact absent substantial evidence to the contrary. In addition, other employment-related and mixed-use land use projects may qualify for the use of screening if the project can reasonably be expected to generate VMT per resident, per worker, or per service population that is similar to the existing land uses in the low VMT area. For this screening in the WRCOG area, the RIVTAM travel forecasting model was used to measure VMT performance for individual jurisdictions and for individual traffic analysis zones (TAZs). TAZs are geographic polygons similar to Census block groups used to represent areas of homogenous travel behavior. Total daily VMT per service population (population plus employment) was estimated for each TAZ. Those TAZs that perform at or below the jurisdictional average of total VMT per service population under base year (2012) conditions are considered low VMT areas for purposes of this memo. Individual lead agencies may choose a different baseline threshold to define their low VMT areas. This presumption may not be appropriate if the project land uses would alter the existing built environment in such a way as to increase the rate or length of vehicle trips.

Step 3: Project Type Screening

Local serving retail projects less than 50,000 square feet may be presumed to have a less than significant impact absent substantial evidence to the contrary. Local serving retail generally improves the convenience of shopping close to home and has the effect of reducing vehicle travel.

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

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

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

Step 4: VMT analysis using RIVTAM

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

- Baseline conditions - This data is already available in the web map.

- Baseline plus project for the project - The project land use would be added to the project TAZ or a separate TAZ would be created to contain the project land uses. A full model run would be performed and VMT changes would be isolated for the project TAZ and across the full model network. The model output must include reasonableness checks of the production and attraction balancing to ensure the project effect is accurately captured. If this scenario results in a less-than-significant impact, then additional cumulative scenario analysis may not be required (more information about this outcome can be found in the Thresholds Evaluation memo).

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

- Cumulative plus project - The project land use would either be added to the project TAZ or a separate TAZ would be created to contain the project land uses. The addition of project land uses should be accompanied by a reallocation of a similar amount of land use from other TAZs. Land use projects will generally not change the cumulative no project control totals for population and employment growth. Instead, they will influence the land use supply through changes in general plan land use designations and zoning. If project land uses are simply added to the cumulative no project scenario, then the analysis should reflect this limitation in the methodology and acknowledge that the analysis may overestimate the project's effect on VMT.

The model output should include total VMT, which includes all vehicle trips and trip purposes, and VMT per service population (population plus employment). Total VMT is needed as an input for air quality, greenhouse gas (GHG), and energy impact analysis while total VMT per service population is recommended for transportation impact analysis.

Land Use Project Case Study Tests

For the case studies, three threshold options were tested to determine if the land use projects would cause a significant impact under baseline plus project conditions. Normally, baseline will represent the year in which the notice of preparation (NOP) is published for the project. Since all of the case studies are completed projects, the baseline year has simply been set to 2012, the base year of the RIVTAM model. Future projects may need to create specific baseline years and should consider methods such as interpolating VMT results between the 2012 base year output from RIVTAM and 2040 horizon year output. This data is available from WRCOG.

- Option 1 – A significant impact would occur if addition of a project to the base year model causes its corresponding TAZ to generate total daily VMT per service population above the baseline level for the TAZ.
- Option 2 – A significant impact would occur if addition of a project to the base year model causes its corresponding TAZ to generate total daily VMT per service population above the applicable jurisdictional average under baseline conditions.
- Option 3 – A significant impact would occur if addition of the project to the base year model causes the jurisdiction's average VMT per service population to increase.

These options rely on the VMT threshold being set at the baseline level for either the TAZ or jurisdiction. Lead agencies have discretion to set their own thresholds as explained in the Thresholds Evaluation memo. The locally adopted threshold can be substituted into any of these threshold statements.

Mission Lofts (TPA and Low VMT Screening Example)

Mission Lofts is an under-construction apartment complex near Downtown Riverside and the Riverside Metrolink Station. It is located both within a transit priority area and within a low VMT generating TAZ. It is therefore considered to have less than significant VMT impact, as it satisfies both screening criteria (although satisfaction of one criterion would have been sufficient).

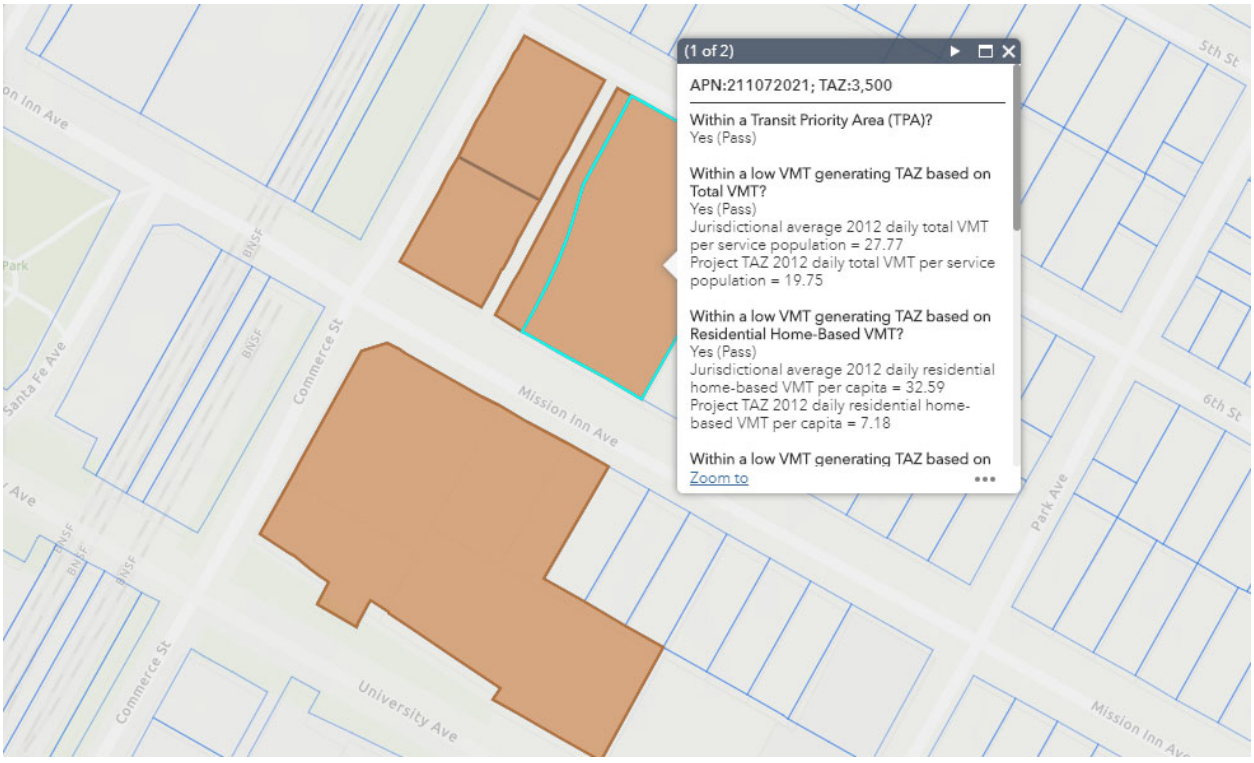


Figure 1: Mission Lofts Screening Results from the WRCOG VMT Screening Tool

Eastvale Crossings (Low VMT Screening Example)

Eastvale Crossings is an under-construction primarily retail commercial development located in the City of Eastvale. The project is too large to qualify as a local serving retail project for screening purposes and is not located in a TPA. However, the project is located in a low VMT generating TAZ based on the threshold where the baseline VMT per service population for the TAZ is lower than the citywide average for Eastvale. The OPR Technical Advisory reserves the use of low VMT generating area screening for residential and office projects. However, other land use projects may also qualify if evidence supports the conclusion that the project approval would not alter the low VMT generation of the area. Under this circumstance, it may be appropriate to presume that the project would have a less than significant VMT impact. To validate this conclusion, a full VMT impact analysis was performed for the project under baseline plus project conditions. Under this scenario, the project was modeled in RIVTAM as outlined above. Table 1 shows the baseline VMT and baseline plus project VMT for the project's TAZ and the City of Eastvale.

Table 1: Eastvale Crossings VMT Comparison

Scenario	Total Daily VMT/Service Population	
	Eastvale	TAZ 3149
Baseline	27.0	23.4
Baseline Plus Project	27.3	26.8
Change	+0.3	+3.4

The impact conclusions vary depending on the specific threshold option used.

- Under Option 1, the project would have a **significant** impact because it increases the TAZ's VMT per service population above the baseline average.
- Under Option 2, the project would have a **less than a significant** impact because it does not increase the VMT per service population of the TAZ above the city's average under baseline plus project conditions.
- Under Option 3, the project would have a **significant** impact because it increases the city's average VMT per service population under baseline plus project conditions.

These findings help explain why the OPR Technical Advisory reserves the general use of low VMT generating area screening. Larger retail projects may not result in VMT reductions similar to that of local serving retail so use of screening for these types of projects requires careful consideration.

Temecula Residential Development

A 136-unit residential development representative of typical development in Temecula was considered for case study testing. The theoretical project was presumed to be located in the northeast corner of the city. This location is not in a TPA and or a low VMT generating TAZ, so it must be modeled in RIVTAM to determine if it causes significant VMT impacts.

The specific project TAZ, 4105, is located partially within the City of Temecula and partially within unincorporated Riverside County. For WRCOG's SB743 implementation guidance, jurisdictional VMT averages have been calculated using VMT results for TAZs with all or the majority of their land area within the jurisdictional boundaries. While the project is located within city limits, the majority of the TAZ falls within unincorporated Riverside County, so the TAZ does not contribute to the City of Temecula's total VMT per service population average. While it was not done for the purposes of this test, a TAZ could be added to the model to more accurately represent the project within the appropriate jurisdiction if the majority of its TAZ does not fall within that jurisdiction. Table 2 shows the baseline VMT and baseline plus project VMT for the project's TAZ and the City of Temecula.

Table 2: Temecula Residential Development VMT Comparison

Scenario	Total Daily VMT/Service Population	
	Temecula	TAZ 4105
Baseline	26.2	40.2
Baseline Plus Project	26.2	34.5
Change	0.0	-5.7

For this case study test, the threshold option does not influence the impact finding.

- Under Option 1, the project would have a **less than significant** impact because it reduces the TAZ's VMT per service population under baseline plus project conditions.
- Under Option 2, the project would have a **less than significant** impact because it does not increase the total daily VMT per service population of the TAZ above that of the city's average under baseline plus project conditions.
- Under Option 3, the project would have a **less than significant** impact because it does not change the citywide average total VMT per service population under existing plus project conditions.

Analysts should note that the model underestimates VMT for projects at the edge of the model area because trip lengths for trips leaving the model area are truncated and only the portion of the trip length within the model area is accounted for. A more detailed analysis would require calculating the trip length outside of the model area for project trips leaving the model area. This can potentially be done using

California Statewide Travel Demand Model trip length information as well as trip length information from big data sources. VMT per service population for Temecula and TAZ 4105 would both be higher as a result.

Nandina Distribution Center

Nandina Distribution Center is a recently completed 740,000 square foot facility located in the southern part of Moreno Valley east of March Air Force Base. The project does not meet any of the screening criteria and therefore must be modeled in RIVTAM to determine if there are any significant VMT impacts.

Tenants of logistics centers and warehouses in the Inland Empire tend to operate as high cube warehouse facilities. RIVTAM does not have a specific land use type for high cube warehouse facilities, so any of these facilities must be considered as the next most appropriate land use type. High cube warehouse facilities tend to generate more trips than other logistics centers so model results for these types of projects may underestimate the total trips generated by the project if modifications aren't made to model inputs. For a more detailed analysis of high cube warehouse projects, inputs should be modified to better match independent trip generation estimates, or the model itself should be modified to include high cube warehouses as a land use type. These changes were not made for the purposes of this methodology test but are advisable for any project to ensure that RIVTAM trip generation estimates accurately represent the project.

Table 3: Nandina Distribution VMT Comparison

Scenario	Total Daily VMT/Service Population	
	Moreno Valley	TAZ 3771
Baseline	24.5	105.4
Baseline Plus Project	24.5	52.3
Change	0.0	-53.2

Similar to the previous case study test, the threshold option does not influence the impact finding.

- Under Option 1, the project would have a **less than significant** impact because it reduces the TAZ's VMT per service population under baseline plus project conditions.
- Under Option 2, the project would have a **less than significant** impact because it does not increase the total daily VMT per service population of the TAZ above that of the city's average under baseline plus project conditions.
- Under Option 3, the project would have a **less than significant** impact because it does not change the citywide average total VMT per service population under baseline plus project conditions.

Cumulative Threshold Analysis Methodology for Land Use Projects

Projects located in low VMT generating TAZs, projects located in TPAs, and local retail projects less than 50,000 square feet can all be screened from cumulative analysis. The project level analysis presumption applies under cumulative conditions for these projects.

For projects which are not screened, the project land use must either be added to the project TAZ or a separate TAZ must be created to contain the project land uses. The addition of project land uses should be accompanied by a reallocation of a similar amount of land use from other TAZs. Land use projects will generally not change the cumulative no project control totals for population and employment growth. Instead, they will influence the land use supply through changes in general plan land use designations and zoning. If project land uses are simply added to the cumulative no project scenario, then the analysis should reflect this limitation in the methodology and acknowledge that the analysis may overestimate the project's effect on VMT.

Under cumulative conditions, projects may have a significant impact as follows.

- A significant impact would occur if the project increased the jurisdiction's total daily VMT per service population above the baseline level (or locally adopted threshold).
- A significant impact would occur if the project is inconsistent with the applicable regional transportation plan/sustainable communities strategy (RTP/SCS). Inconsistencies could include increasing land supply beyond areas designated for growth in the RTP/SCS, proposing land use densities and intensities below those identified in the RTP/SCS for the project site, or other actions that would result in higher levels of VMT growth compared to the cumulative no project scenario.

The model output should include total VMT, which includes all vehicle trips and trip purposes, and total VMT per service population (population plus employment).

Analysis Methodology for Land Use Plans

Land use plans are not subject to screening and require specific VMT analysis. Land use plans can be tested for significant impacts under cumulative conditions using the same cumulative threshold options (or lead agency thresholds) above. These thresholds require modeling the land use plan changes in the RIVTAM model to determine VMT impacts. To capture the project effect, the same cumulative year population and employment growth totals should be used model wide. The land use plan only influences land use allocation, so land use in other areas of the model should be adjusted such that the growth totals model-wide remain the same between the cumulative year no project and plus project scenarios.

Analysis Methodology for Transportation Projects

Use of VMT as an environmental impact metric for transportation projects is discretionary under the Section 15064.3(b)(2) of the updated CEQA Guidelines.

> **(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. For roadway capacity projects, agencies have discretion to determine the appropriate measure of transportation impact consistent with CEQA and other applicable requirements. To the extent that such impacts have already been adequately addressed at a programmatic level, such as in a regional transportation plan EIR, a lead agency may tier from that analysis as provided in Section 15152 .**

Source: http://resources.ca.gov/ceqa/docs/2018_CEQA_FINAL_TEXT_122818.pdf

If a lead agency wants to use VMT, it is important that the analysis methodology and the forecasting account for any induced vehicle travel effects. The RIVTAM model can be used to perform this analysis but it should be tested for induced vehicle travel sensitivity. The analysis should also account for potential increases in trip generation and changes in long-term land use patterns that may occur due to induced vehicle travel. These effects are not directly included in the RIVTAM model, but its inputs and parameters can be modified to include additional sensitivity, or off-model analysis methods such as the use of research-based elasticities can be used to measure regional VMT changes associated with changes in lane-miles associated with proposed projects. The following resources should be consulted for induced vehicle travel recommended analysis practices.

- OPR Technical Advisory (http://opr.ca.gov/docs/20190122-743_Technical_Advisory.pdf)
- Closing the Induced Vehicle Travel Gap Between Research and Practice, Transportation Research Record: Journal of the Transportation Research Board, Volume 2653, 2017 (https://trrjournalonline.trb.org/doi/pdf/10.3141/2653-02)

Using VMT as a transportation project impact metric would allow for a variety of transit, bicycle, and pedestrian projects to be presumed to have a less than significant impact. Smaller roadway network modifications such as intersection restriping could also be presumed to have a less than significant impact. Roadway capacity expansion projects are the types of projects that can increase vehicle travel and VMT by changing people's travel behavior including making new vehicle trips and making longer vehicle trips. If a lead agency treated transportation projects similar to land use projects in the above case studies, then a potential threshold option would be to consider any increase in baseline (or cumulative no project) total VMT per service population within the jurisdiction or region as a significant impact.

2. Thresholds

Thresholds Assessment

FEHR PEERS

TECHNICAL MEMORANDUM

Date: 3.2.19

To: Chris Gray (WRCOG), Chris Tzeng (WRCOG), Sarah Dominguez (SCAG), Mike Gainor (SCAG)

From: Ronald T. Milam, AICP, PTP and Jason Pack, PE

Subject: SB 743 Implementation Thresholds Assessment OC18-0567

This technical memorandum summarizes the consultant team assessment of potential VMT thresholds for land use projects and land use plans to comply with SB 743. For transportation projects, lead agencies have the discretion to select their own metrics and thresholds and no change to current practice is required. Hence, the remainder of this memo will focus on land use thresholds and is organized into four sections.

- Section 1 - Background on CEQA Thresholds
- Section 2 - OPR VMT Threshold Recommendations
- Section 3 - Lead Agency Discretion in Setting VMT Thresholds
- Section 4 - Recommendations for WRCOG member agencies

This memo was prepared with input from Remy Moose Manley. Their role focused on key questions associated with Sections 3 and 4.

Section 1 – Background on CEQA Thresholds

Establishing thresholds requires complying with the new statutes added by SB 743 as well as traditional guidance contained in CEQA Guidelines Section 15064.7 and new language being proposed as part of the *Proposed Updates to the CEQA Guidelines*, November 2017, California Governor's Office of Planning and Research (see excerpts below).

§ 15064. Determining the Significance of the Environmental Effects Caused by a Project.

(a) Determining whether a project may have a significant effect plays a critical role in the CEQA process.

(1) If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, the agency shall prepare a draft EIR.

(2) When a final EIR identifies one or more significant effects, the lead agency and each responsible agency shall make a finding under Section 15091 for each significant effect and may need to make a statement of overriding considerations under Section 15093 for the project.

(b) **(1)** The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting. For example, an activity which may not be significant in an urban area may be significant in a rural area.

(2) Thresholds of significance, as defined in Section 15064.7(a), may assist lead agencies in determining whether a project may cause a significant impact. When using a threshold, the lead agency should briefly explain how compliance with the threshold means that the project's impacts are less than significant. Compliance with the threshold does not relieve a lead agency of the obligation to consider substantial evidence indicating that the project's environmental effects may still be significant.

Source: http://resources.ca.gov/ceqa/docs/2018_CEQA_FINAL_TEXT_122818.pdf

§ 15064.7. Thresholds of Significance.

(a) ~~**Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects.**~~ A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant.

(b) **Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects.** Thresholds of significance to be adopted for general use as part of the lead agency's environmental review process must be adopted by ordinance, resolution, rule, or regulation, and developed through a public review process and be supported by substantial evidence. **Lead agencies may also use thresholds on a case-by-case basis as provided in Section 15064(b)(2).**

(c) When adopting **or using** thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence.

(d) Using environmental standards as thresholds of significance promotes consistency in significance determinations and integrates environmental review with other environmental program planning and regulation. Any public agency may adopt or use an environmental standard as a threshold of significance. In adopting or using an environmental standard as a threshold of significance, a public agency shall explain how the particular requirements of that environmental standard reduce project impacts, including cumulative impacts, to a level that is less than significant, and why the environmental standard is relevant to the analysis of the project under consideration. For the purposes of this subdivision, an "environmental standard" is a rule of general application that is adopted by a public agency through a public review process and that is all of the following:

(1) a quantitative, qualitative or performance requirement found in an ordinance, resolution, rule, regulation, order, plan or other environmental requirement;

(2) adopted for the purpose of environmental protection;

(3) addresses the environmental effect caused by the project; and,

(4) applies to the project under review.

Source: http://resources.ca.gov/ceqa/docs/2018_CEQA_FINAL_TEXT_122818.pdf

In summary, this threshold setting guidance emphasizes the need to use substantial evidence to help determine when a project will cause an unacceptable environmental condition or outcome. For SB 743, the specific outcome of focus is the change a project will cause in vehicle miles of travel (VMT). Since VMT is already used to determine air quality, energy, and greenhouse gas (GHG) impacts as part of CEQA compliance, the challenge for lead agencies is to answer the question, **"What type or amount of change in VMT constitutes a significant impact solely for transportation purposes?"**

Section 2 - OPR VMT Threshold Recommendations

SB 743 includes the following two legislative intent statements, which were used to help guide OPR's VMT threshold decisions.

1) *Ensure that the environmental impacts of traffic, such as noise, air pollution, and safety concerns, continue to be properly addressed and mitigated through the California Environmental Quality Act.*

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

The threshold recommendations are found in the *CEQA Guidelines* and the *Technical Advisory*. Specific excerpts and threshold highlights are provided below.

> CEQA Guidelines Section 15064.3
> *(b) Criteria for Analyzing Transportation Impacts.*
> *(1) Land Use Projects. Vehicle miles traveled exceeding an applicable threshold of significance may indicate a significant impact. 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 considered to have a less than significant transportation impact.*
> *(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. For roadway capacity projects, agencies have discretion to determine the appropriate measure of transportation impact consistent with CEQA and other applicable requirements. To the extent that such impacts have already been adequately addressed at a programmatic level, such as in a regional transportation plan EIR, a lead agency may tier from that analysis as provided in Section 15152.*

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

Technical Advisory on Evaluating Transportation Impacts in CEQA (page 18)
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.

Technical Advisory on Evaluating Transportation Impacts in CEQA – Rural Projects Outside of MPOs (page 19)
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.

These (and the other) threshold recommendations in the *Technical Advisory* rely on the following evidence associated with the state's GHG reduction goals and targets in combination with environmental case law.

- Assembly Bill 32 (2006) requires statewide greenhouse gas reductions to 1990 levels by 2020 and continued reductions beyond 2020.
- Senate Bill 32 (2016) requires at least a 40 percent reduction in greenhouse gas emissions by 2030.
- Pursuant to Senate Bill 375 (2008), the California Air Resources Board establishes greenhouse gas 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. Current targets for the largest metropolitan planning organizations range from 13% to 16% reductions 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.
- 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 greenhouse gas emissions from vehicles and quantifies VMT growth compatible with achieving state targets.
- The Caltrans Strategic Management Plan (2015) calls for a 15 percent reduction in VMT per capita compared to 2010 levels, by 2020.
- California Air Resources Board 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals (2019) identifies a 16.8 percent reduction in automobile VMT per capita below existing (2018) levels to achieve statewide GHG reduction goals.

Lead agencies should note that the OPR recommended VMT thresholds are almost exclusively based on GHG and air pollution reduction goals. While this is one of the SB 743 legislative intent objectives, a less clear connection is made to the other legislative intent objectives to encourage infill development and promote active transportation. And, as noted above, GHG impacts are already addressed in another CEQA section.

Another important distinction within the Technical Advisory is how projects within different land use contexts are treated. The general expectation that a 15 percent reduction below that of existing development may be reasonable is proposed for projects within metropolitan planning organizations (MPOs). For rural areas outside MPOs, the Technical Advisory recognizes that VMT mitigation options are limited so thresholds may need to be set on a case-by-case basis.

The recognition that land use context matters when it comes to the potential VMT mitigation options and effectiveness is important. The MPO boundary distinction is not relevant to the feasibility of VMT mitigation. A rural or suburban area inside or outside an MPO boundary will have very similar limitations when it comes to the feasibility of VMT reduction options. As such, land use context and not MPO status should be the defining criteria for setting threshold expectations. The land use context is also relevant to the potential range of effectiveness associated with VMT reduction strategies. The Technical Advisory relies on the *Quantifying Greenhouse Gas Mitigation Measures*, CAPCOA, 2010 resource document to help justify the 15 percent reduction threshold stating, "…fifteen percent reduction in VMT are achievable at

the project level in a variety of place types…". A more accurate reading of the CAPCOA document is that a fifteen percent is the ***maximum*** reduction when combining multiple mitigation strategies for the suburban center place type. For suburban place types, 10% is the maximum and requires a project to contain a diverse land use mix, workforce housing, and project-specific transit. It is also important to note that the maximum percent reductions were not based on data or research comparing the actual performance of VMT reduction strategies in these place types. Instead, the percentages were derived from a limited comparison of aggregate citywide VMT performance for Sebastopol, San Rafael, and San Mateo where VMT performance ranged from 0 to 17 percent below the statewide VMT/capita average based on data collected prior to 2002. Little to evidence exists about the long-term performance of similar TDM strategies in different land use contexts. As such, VMT reductions from TDM strategies cannot be guaranteed in most cases.

Section 3 - Lead Agency Discretion in Setting VMT Thresholds

Until SB 743, the CEQA Guidelines Section 15064.7 allowed lead agencies the discretion to select their own transportation metrics and thresholds although substantial evidence was required to support their decisions. SB 743 takes the 'metric' choice away by requiring VMT. As to thresholds, additional questions have arisen as listed below.

Question 1 - Do lead agencies have discretion to set a different VMT threshold than recommended by OPR?

Question 2 - Do lead agencies need to establish VMT thresholds for cumulative impacts?

Question 3 - Do lead agencies need to use the same VMT methodology for setting thresholds and for conducting project VMT forecasts?

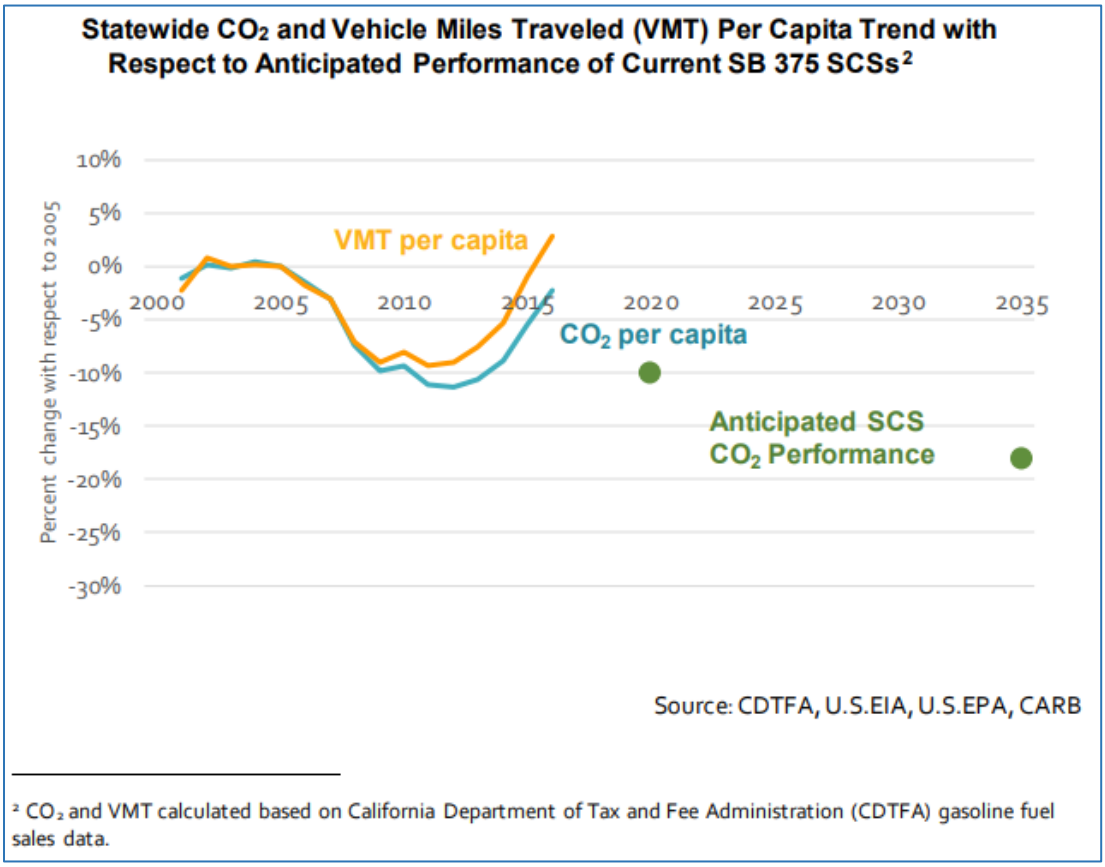
The first two questions require a legal perspective, so the project team requested input from Remy Moose Manley, which is one of the most recognized law firms in California when it comes to CEQA legal issues. Their full opinion is contained in Attachment A while a summary of their findings as augmented by other project team members is presented below.

Question 1 Response – Setting a threshold lower than the 15-percent reduction recommended by OPR in their *Technical Advisory* is likely legally defensible, so long as the threshold is supported by substantial evidence. The substantial evidence is critical in the threshold setting process and should explain why the OPR recommended threshold is not appropriate for the lead agency and why another threshold was selected. This evidence will be the basis for any legal defense if the threshold is challenged and should carefully consider the definition of substantial evidence contained Section 15384 of the CEQA Guidelines. This opinion considers the fact that the 15-percent reduction is not

included in the statute or the proposed CEQA Guidelines; rather it is only included in OPR's *Technical Advisory*.

Section 21099, subdivision (e) states, "This section does not affect the authority of a public agency to establish or adopt thresholds of significance that are more protective of the environment." A reasonable interpretation of this language is that subdivision (e) is referring to the SB 743 statute language in Section 21099 and possibly the related CEQA Guidelines changes that would result from OPR's compliance with the direction in 21099(b)(1) to recommended revisions to the CEQA Guidelines. The statute does not contain specific thresholds and the recommended revisions to the CEQA Guidelines only include statements about what land use project effects may be presumed to have a less than significant VMT impact. Additional evidence allowing for a lower threshold is also found in the discussion above about the recognition of land use context influencing the feasibility of VMT reduction. Other substantial evidence supporting the limitations of VMT mitigation based on land use context can also be found in *Quantifying Greenhouse Gas Mitigation Measures,* CAPCOA, 2010 and upcoming updates to this information from ARB based on their Zero-Carbon Buildings in California: A Feasibility Study.

Question 2 Response – Lead agencies should address VMT impacts in the cumulative context. The CEQA Guidelines (and the case law) are clear that consideration of cumulative impacts is key to CEQA compliance. That said, a separate quantitative threshold may not be required if the threshold applied for project-specific impacts is cumulative in nature. VMT thresholds based on an efficiency form of the metric such as VMT per capita, can address project and cumulative impacts in a similar manner that some air districts do for criteria pollutants and GHGs. Since VMT is a composite metric that will continue to be generated over time, a key consideration for cumulative scenarios is whether the rate of VMT generation gets better or worse in the long-term. If the rate is trending down over time consistent with expectations for air pollutant and GHGs, then the project level analysis may suffice. However, the trend direction must be supported with substantial evidence. This creates a potential issue for VMT because VMT rates in California have been increasing in direct conflict with RTP/SCS projections showing declines. The chart below from the *2018 Progress Report California's Sustainable Communities and Climate Protection Act,* California Air Resources Board, November 2018 charts recent VMT per capita trends. This evidence could be used to justify the need for separate cumulative analysis to verify a project's long-term effects.



California VMT Trends

Source: *2018 Progress Report California's Sustainable Communities and Climate Protection Act,* California Air Resources Board, 2018

For some projects, measuring project generated VMT though will only tell part of the impact story. Measuring the 'project's effect on VMT' may be necessary especially under cumulative conditions to fully explain the project's impact. This occurs because of the nature of discretionary land use decisions. Cities and counties influence land supply through changes to general plan land use designations and zoning for parcels. These changes rarely, if ever, influence the long-term amounts of regional population and employment growth. Viewed through this lens, a full disclosure of VMT effects requires capturing how a project may influence the VMT generated by the project and nearby land uses. Also, some mitigation strategies that improve walking, bicycling, or transit to/from the project site can also reduce VMT from neighboring land uses (i.e., installing a bike share station on the project site would influence the riding behavior of project residents and those living and working nearby).

Question 3 Response – Lead agencies need to use consistent methods when forecasting VMT for threshold setting and project analysis to ensure an apples-to-apples comparison for identifying potential impacts. The project team has confirmed through case study comparisons that failure to

comply with this *Technical Advisory* recommendation can lead to erroneous impact conclusions. This is an important finding since the *Technical Advisory* also accepts that VMT analysis can be performed using sketch planning tools. Off-the-shelf, sketch planning tools for VMT analysis do not contain trip generation rates or trip lengths consistent with the regional travel forecasting models used by MPOs and other regional agencies such as WRCOG. These regional models are the most likely source for city-wide and region-wide VMT estimates used in setting thresholds since sketch planning tools cannot produce these aggregate level VMT metrics. The *Technical Advisory* partially recognizes this issue by recommending that sketch planning tools use consistent trip lengths as the models used to produce thresholds but does not include a similar recommendation for trip generation rates. Both input variables need to be consistent with the travel forecasting model to produce accurate project impact analysis results.

Section 4 - Recommendations for WRCOG member agencies

So how should lead agencies approach VMT threshold setting given their discretion? Since an impact under CEQA begins with a change to the existing environment, a starting level for potential thresholds would the baseline (i.e., existing condition) VMT, VMT per capita, VMT per employee, or VMT per service population. Since VMT will increase or fluctuate with population and employment growth, changes in economic activity, and expansion of new vehicle travel choices (i.e., Uber, Lyft, Chariot, autonomous vehicles, etc.), expressing VMT measurement in an efficiency metric form allows for more direct comparisons to baseline conditions when it comes to land use projects, land use plans, and transportation projects. Establishing a threshold such as baseline VMT per service population would be essentially setting an expectation that future land uses perform similar to existing land uses. If this is the floor, then expectations for VMT reduction can increase depending on a community's values related to vehicle use and its associated effects on mobility, economic activity, and environmental consequences. Working towards the 15-percent reduction recommended in the Technical Advisory becomes more feasible as the land use context becomes more urban with higher densities and high-quality transit systems. In central cities, the 15-percent reduction can be surpassed because of the close proximity of land uses and the multiple options for accessing destinations by walking, using bicycles or scooters, sharing vehicles, and using transit.

While OPR has developed specific VMT impact thresholds for project-related impacts, current practice has not sufficiently evolved where a clear line can be drawn between 'acceptable' and 'unacceptable' levels of VMT change for the sole purpose of determining a significant transportation impact especially when considering land use context. Until SB 743, VMT changes were viewed through an environmental lens that focused on the relationship to fuel consumption and emissions. For transportation purposes, VMT has traditionally been used to evaluate whether land use or transportation decisions resulted in greater dependency on vehicle travel. Trying to determine whether a portion of someone's daily vehicle travel is

unacceptable or would constitute a significant transportation impact is generally not clear to lead agencies.

Another consideration in threshold setting is how to address cumulative VMT impacts and whether addressing them in the general plan EIR is advantageous for streamlining the review of subsequent land use and transportation projects given CEQA relief available through SB 375 or CEQA Guidelines Section 15183. This section of the Guidelines relieves a project of additional environmental review if the environmental impact was adequately addressed in the general plan EIR and the project is consistent with the general plan (see below).

> **15183. PROJECTS CONSISTENT WITH A COMMUNITY PLAN OR ZONING**
> (a) CEQA mandates that projects which are consistent with the development density established by existing zoning, community plan, or general plan policies for which an EIR was certified shall not require additional environmental review, except as might be necessary to examine whether there are project-specific significant effects which are peculiar to the project or its site. This streamlines the review of such projects and reduces the need to prepare repetitive environmental studies.

The use of Section 15183 also addresses cumulative impacts as acknowledged in Section 15130(e).

> **15130. DISCUSSION OF CUMULATIVE IMPACTS**
> (e) If a cumulative impact was adequately addressed in a prior EIR for a community plan, zoning action, or general plan, and the project is consistent with that plan or action, then an EIR for such a project should not further analyze that cumulative impact, as provided in Section 15183(j).

For cities in the WRCOG region, addressing VMT impacts in general plan EIRs could be useful in understanding how VMT reduction should be balanced against other community values when it comes to setting new VMT impact thresholds for SB 743.

Given this information, lead agencies have at least four options for setting thresholds as outlined below. Under any option, the lead agency must develop its own substantial evidence to support their preferred threshold and should consider multiple perspectives. These perspectives include those from the community in general as well as specific stakeholder perspectives from the development community and environmental protection groups. A threshold that is too stringent could lead to a permanent significant and unavoidable VMT impact finding increasing the cost of environmental review for developers. Conversely, a threshold that does not result in any significant impacts could lead to missed opportunities to reasonably reduce VMT and related environmental impacts. In either case, attracting the attention of specific stakeholder groups can lead to CEQA challenges, which are often determined based on the strength of substantial evidence supporting lead agency decisions.

OPTION 1 – Rely on the OPR Technical Advisory Thresholds

The first option is to simply rely on the threshold recommendations contained in the OPR Technical Advisory. As noted above, the general expectation is that land use projects should be measured against a 15 percent reduction below that of existing baseline conditions. Specific VMT thresholds for residential, office (work-related), and retail land uses are summarized below.

- Residential projects – A proposed project exceeding a level of 15 percent below existing (baseline) 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.
- Office projects – A proposed project exceeding a level of 15 percent below existing (baseline) regional VMT per employee may indicate a significant transportation impact.
- Retail projects – A net increase in total VMT may indicate a significant transportation impact.

For land use plans (i.e., a general plan, area plan, or community plan), a significant impact would occur if the respective thresholds above were exceeded in aggregate. This means that new population and employment growth combined the planned transportation network would need to generate future VMT per capita or VMT per worker that is less than 85 percent of the baseline value to be considered less than significant. Land use project and land use plans would also need to be consistent with the applicable RTP/SCS.

A potential limitation of the OPR recommendations is that the substantial evidence used to justify the thresholds is largely based on the state's air quality and GHG goals. Three issues arise from this reliance.

- The OPR recommended threshold does not establish a level of VMT reduction that would result in the state meeting it's air quality and GHG goals according to the *California Air Resources Board 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals* (2019). This may create confusion with air quality and GHG impact analysis in environmental documents, which should already address the influence of VMT.

- The OPR recommended thresholds do not directly reflect expectations related to the other SB 743 objectives related to statewide goals to promote public health through active transportation, infill development, multimodal networks, and a diversity of land uses. Recommending a reduction below baseline levels is consistent with these objectives, but the numerical value has not been tied to specific statewide values for each objective or goal.

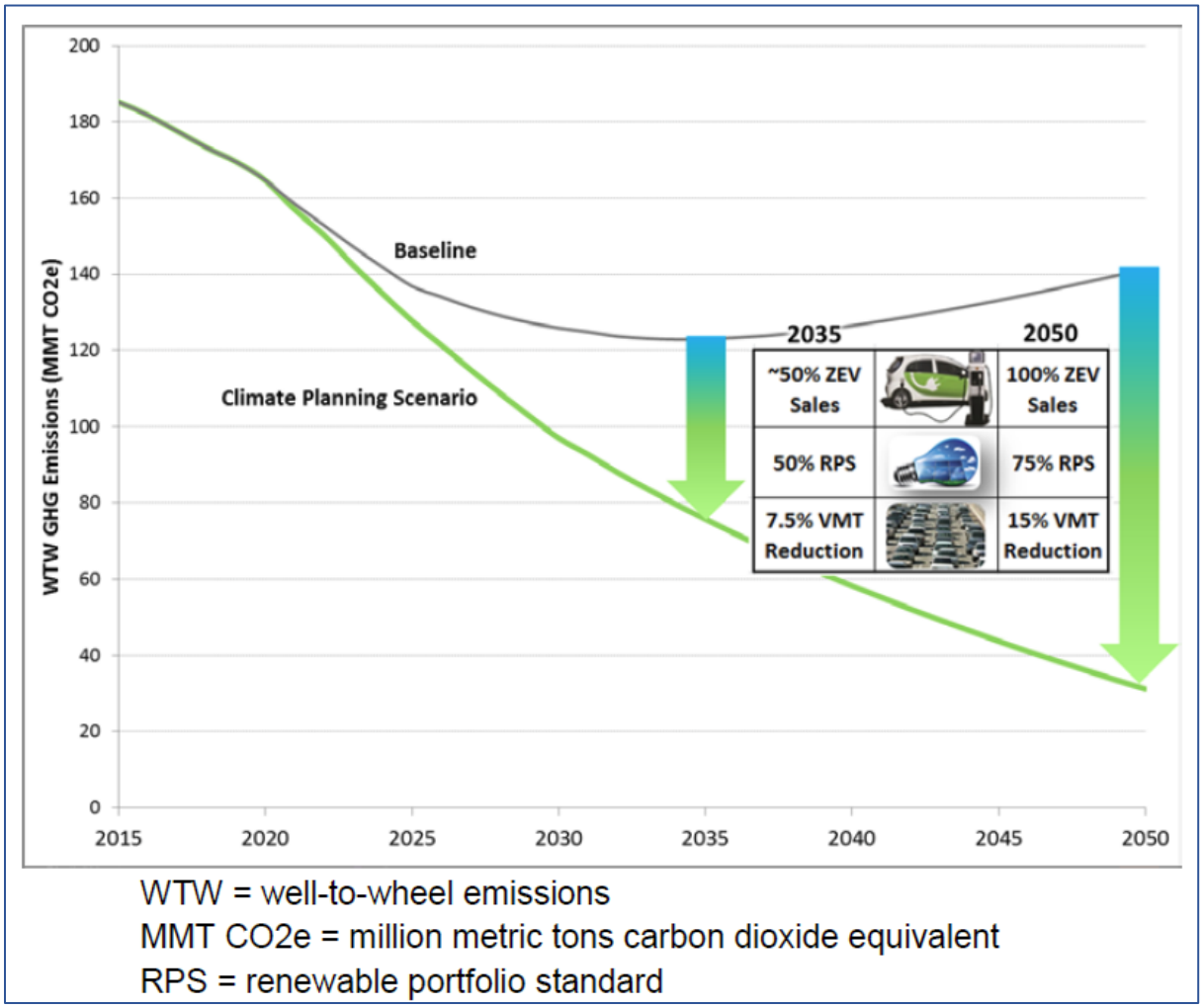
- State expectations for air quality and GHG may not align with local/lead agency expectations. Using state expectations for a local lead agency threshold may create inconsistencies with local city or county general plans.

OPTION 2 – Set Thresholds Consistent with Lead Agency Air Quality, GHG Reduction, and Energy Conservation Goals

This option sets a threshold consistent with a lead agency's air quality, GHG reduction, and energy conservation goals. This approach requires that local air quality and GHG reduction goals in general plans, climate action plans, or GHG reduction plans comply with the legislation and associated plans described above on pages 5 and 6. In general, most of the expectations set through legislation are related to the state's GHG reduction goals that were originally captured in EO S-3-05.

- 2000 levels by 2010
- 1990 levels by 2020
- 80 percent below 1990 levels by 2050

SB 32 expanded on these goals and added the expectation that the state should reach 40 percent below 1990 levels by 2030 followed by SB 391 that requires the California Transportation Plan to support 80 percent reduction in GHGs below 1990 levels by 2050. With respect to the land use and transportation sectors, SB 375 tasked ARB with setting specific GHG reduction goals through the RTP/SCSs prepared by MPOs. The ARB *Scoping Plan* and *Mobile Source Strategy* provide analysis related to how the state can achieve the legislative and executive goals while the Caltrans *Strategic Management Plan* and *Smart Mobility Framework* provide supportive guidance and metrics. An important recognition of the ARB *Scoping Plan* and *Mobile Source Strategy* is that the initial SB 375 targets were not aggressive enough. The state needs to achieve a reduction of 7 percent below projected 2030 VMT levels and 15 percent below projected 2050 VMT levels associated with the first round of RTP/SCSs (see chart below).



Statewide On-Road GHG Emissions

Source: https://www.arb.ca.gov/cc/sb375/final_staff_proposal_sb375_target_update_october_2017.pdf (pg. 12)

Note that the baseline trend in the chart did not consider key disruptive trends such as transportation network companies (TNCs) and autonomous vehicles (AVs) so it is possible that baseline VMT may be higher. Further, the climate planning scenario did not consider the recently issued Governor's Executive Order (EO) B-55-18 that establishes the goal to achieve carbon neutrality no later than 2045. Consideration of these factors would increase the level of VMT reduction needed to achieve the State's climate goals.

The most recent ARB analysis contained in *California Air Resources Board 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals*, January 2019 recommends project specific VMT reduction thresholds of 16.8 percent reduction from baseline for light-duty vehicle VMT (i.e., passenger cars and light trucks) or a 14.3 percent reduction for total VMT (i.e., all vehicles) – see excerpt below. These reductions are dependent on MPO RTP/SCS targets being met, which may not be a reasonable

assumption for CEQA purposes given the information presented above from the *2018 Progress Report California's Sustainable Communities and Climate Protection Act.* Also, ARB does not provide details about whether the VMT values should be compared against jurisdictional or regional baseline values. Since the analysis was based on statewide data, it may be reasonable to presume that the reduction expectation is a fair-share expectation for all jurisdictions.

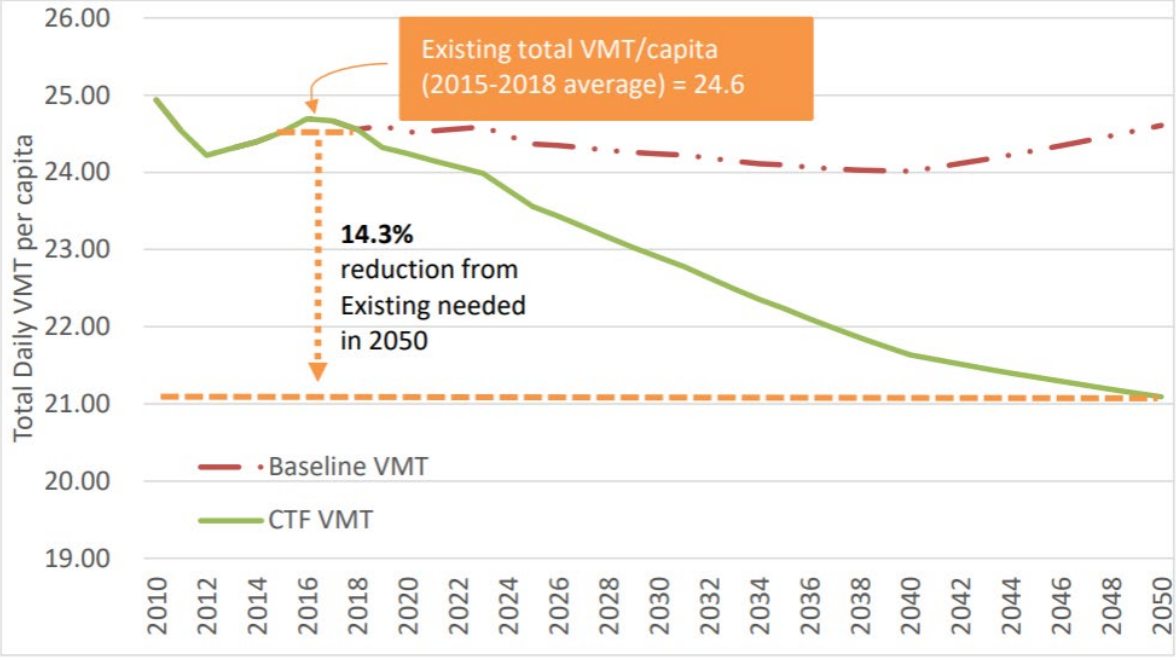


Figure 2: California Total Daily VMT Per Capita

ARB Recommended Total VMT per Capita Threshold

Source: *California Air Resources Board 2017 Scoping Plan-Identified VMT Reductions and Relationship to State Climate Goals*, January 2019

One benefit of relying on ARB or other state agencies for a threshold recommendation is the CEQA Guidelines provision in Section 15064.7(c) highlighted below.

§ 15064.7. Thresholds of Significance.

(a) ~~**Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects.**~~ A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect, non-compliance with which means the effect will normally be determined to be significant by the agency and compliance with which means the effect normally will be determined to be less than significant.

(b) **Each public agency is encouraged to develop and publish thresholds of significance that the agency uses in the determination of the significance of environmental effects.** Thresholds of significance to be adopted for general use as part of the lead agency's environmental review process must be adopted by ordinance, resolution, rule, or regulation, and developed through a public review process and be supported by substantial evidence. **Lead agencies may also use thresholds on a case-by-case basis as provided in Section 15064(b)(2).**

(c) When adopting **or using** thresholds of significance, a lead agency may consider thresholds of significance previously adopted or recommended by other public agencies or recommended by experts, provided the decision of the lead agency to adopt such thresholds is supported by substantial evidence.

ARB meets the criteria of being a public agency and having noted expertise in the areas of VMT and emissions analysis. Further, the recommended threshold values above were developed in specific consideration of SB 743 requirements.

One other agency threshold to consider is Caltrans. The Local Development-Intergovernmental Review (LD-IGR) Branch at Caltrans (http://www.dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa.html) has responsibility to reduce potential adverse impacts of local development on the state transportation system. As part of its responsibilities, each district branch performs reviews of CEQA environmental documents for local land use projects. These reviews include providing expectations for transportation impact analysis such as metrics and thresholds. Caltrans has published initial guidance related to SB 743 implementation.

- *Local Development – Intergovernmental Review Program Interim Guidance*, Caltrans, November 9, 2016 (http://www.dot.ca.gov/hq/tpp/documents/RevisedInterimGuidance11092016.pdf)

An important part of the Caltrans guidance are the following expectations for thresholds and impact findings related to VMT.

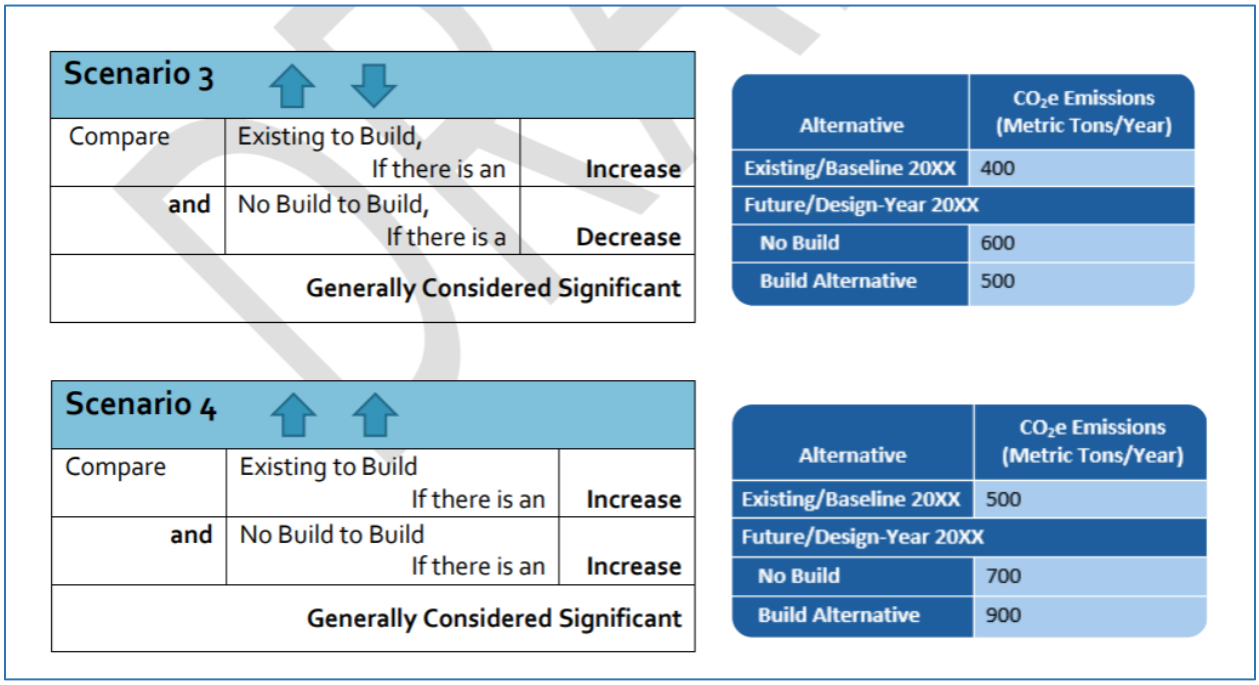
A. Comment on Vehicle Miles Traveled associated with the project.

Reviewers should comment on vehicle miles traveled resulting from the land use project, applying local agency thresholds or absent those, thresholds recommended ~~by the most recent draft of~~ in ~~OPR's~~ adopted CEQA Guidelines ~~and~~ or OPR's approved Technical Advisory. If an assessment of VMT is not presented, Caltrans should request it be presented. Though SB 743 clarifies requirements for transportation analysis, a VMT analysis is already needed to meet other CEQA requirements.[1] Methods for assessing VMT should be compared to the methods recommended in the OPR's approved Technical Advisory. Where methods are not consistent with the recommendations in the Technical Advisory, Caltrans should comment on those methods. Where the project exhibits less than threshold VMT, Caltrans comments should acknowledge the project's transportation efficiency. Where the project exhibits greater than threshold VMT, Caltrans should request mitigation. Examples of mitigation measures are included in the OPR Technical Advisory. Contact ~~the~~ Caltrans SB 743 Program Implementation Manager, Alyssa Begley, for assistance with VMT calculation.

Source: http://www.dot.ca.gov/hq/tpp/documents/RevisedInterimGuidance11092016.pdf

When Caltrans reviews CEQA documents, they may function as a reviewing agency or a responsible agency. In a responsible agency role, Caltrans has approval authority over some component of the project such as an encroachment permit for access to the state highway system. Comments from Caltrans should be adequately addressed, and special attention should be paid to those comments when Caltrans serves as a responsible agency since an adequate response may be required to obtain their required approval. The interim guidance above does not endorse the *Technical Advisory* recommendations for thresholds; it only requires IGR staff to 'comment' on VMT analysis. However, Caltrans is working to establish specific VMT thresholds per conversations with Alyssa Begley, SB 743 Program Implementation Manager with Caltrans. Further, Caltrans may have already establish GHG thresholds that could also serve as VMT thresholds.

In the draft *Interim Guidance: Determining CEQA Significance For Greenhouse Gas Emissions for Projects on the State Highway System,* California Department of Transportation, 2018, Caltrans recommends that any increase in GHG emissions would constitute a significant impact (see excerpt below).



Scenario 3		
Compare	Existing to Build, If there is an	**Increase**
and	No Build to Build, If there is a	**Decrease**
	Generally Considered Significant	

Alternative	CO_2e Emissions (Metric Tons/Year)
Existing/Baseline 20XX	400
Future/Design-Year 20XX	
No Build	600
Build Alternative	500

Scenario 4		
Compare	Existing to Build If there is an	**Increase**
and	No Build to Build If there is an	**Increase**
	Generally Considered Significant	

Alternative	CO_2e Emissions (Metric Tons/Year)
Existing/Baseline 20XX	500
Future/Design-Year 20XX	
No Build	700
Build Alternative	900

Interim Caltrans GHG Thresholds

Source: *Interim Guidance: Determining CEQA Significance For Greenhouse Gas Emissions for Projects on the State Highway System,* California Department of Transportation, 2018

Since any increase in VMT would result in an increase in GHG emissions, lead agencies could rely on this Caltrans threshold for VMT purposes using the same 15064.7(c) provision above. Using this threshold would result in most land use projects and land use plans resulting in significant impacts but it would also result in the maximum feasible mitigation for VMT.

OPTION 3 – Set Thresholds Consistent with RTP/SCS Future Year VMT Projections by Jurisdiction or Sub-Region

VMT is a composite metric that is created as an output of combining a community's long-term population and growth projections with its long-term transportation network (i.e., the general plan). Other variables are also in play related to travel behavior, but land use changes and transportation network modifications are the items largely influenced or controlled by cities and counties. As such, every city and county unincorporated area within WRCOG already has a VMT growth budget. This is the amount of VMT that is forecast to be generated from their general plans combined with other travel behavior inputs for the region as captured in the RIVTAM or SCAG regional travel forecasting models as part of regional planning and the RTP/SCS. This VMT growth has already been 'approved' by the community, the region, and the state and could serve as the basis of a VMT threshold expressed as a VMT growth budget or as a VMT

efficiency metric based on the future year VMT per capita, VMT per employee, or VMT per service population. The measurement of VMT could occur at the jurisdictional or sub-region level.

Potential limitations of this approach relate to model sensitivity and forecast accuracy/reasonableness. If a general plan includes policies or implementation programs designed to reduce VMT through transportation demand management (TDM) strategies, the regional models did not likely include these effects. Further, current regional models do not capture major disruptive trend effects such as TNCs, AVs, and internet shopping. The regional models may also have other issues with forecasting accuracy or reasonableness due to a disconnect between RTP/SCS expectations and the realities of transportation investments and local agency land use decisions as noted in the *2018 Progress Report California's Sustainable Communities and Climate Protection Act,* California Air Resources Board, November 2018.

OPTION 4 – Set Thresholds Based on Baseline VMT Performance

As noted above, an impact under CEQA begins with a change to the existing or baseline environment. There are a range of approaches to using this starting point for VMT impact analysis. At one end of the spectrum is 'total daily VMT' generated under baseline conditions. Setting this value as the threshold for a jurisdiction could result in a fixed budget that would limit increases such that even small increases could result in a significant impacts. Alternatively, the baseline VMT per capita, VMT per employee, or VMT per service population could be used to establish an efficiency metric basis for impact evaluation. Using this form of VMT would mean that future land use projects would be expected to perform no worse than existing land use projects and only projects that cause an increase in the rate of VMT generation would cause significant impacts. Since VMT will increase or fluctuate with population and employment growth, changes in economic activity, and expansion of new vehicle travel choices (i.e., Uber, Lyft, AVs, etc.), expressing VMT measurement in an efficiency metric form allows for more direct comparisons to baseline conditions when it comes to land use projects, land use plans, and transportation projects. Setting a threshold based on baseline levels should consider how the threshold complies with the SB 743 statute provisions described at the beginning of this memo as well as whether VMT reduction strategies are feasible in the jurisdiction.

ATTACHMENT A

REMY | MOOSE | MANLEY LLP

M E M O R A N D U M

To: Ron Milam,
on behalf of WRCOG

From: Tiffany Wright and Jim Moose

Date: May 28, 2018

Re: Questions re Establishing Thresholds for Vehicle Miles Travelled

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Introduction

You asked us two questions about the interpretation of SB 743 and its application to WRCOG's development of thresholds of significance for VMT impacts.

1. Can lead agencies (within MPO areas) set VMT thresholds lower than the 15-percent reduction recommended by OPR in their Technical Advisory?

2. Do lead agencies need to establish VMT thresholds for cumulative impacts?

These questions are addressed in turn below.

1. **Setting a threshold lower than the 15-percent reduction recommended by OPR in their Technical Advisory is likely legally defensible, so long as the threshold is supported by substantial evidence.**

SB 743 added Section 21099 to the Public Resources Code. That section directs OPR to prepare proposed revisions to the CEQA Guidelines "establishing criteria for determining the significance of transportation impacts of projects within transit priority areas. Those criteria shall promote 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]

Your question about whether an agency could set a threshold lower than the 15-percent reduction recommended by OPR in its Technical Advisory stems from Section 21099, subdivision (e), which provides that "[t]his section does not affect the authority of a public agency to establish or adopt thresholds of significance that are more protective of the environment."

We do not believe that subdivision (e) would preclude an agency from establishing a threshold that is lower than the 15-percent reduction recommended by OPR in its Technical Advisory. Our view is based mainly on the fact that the 15-percent reduction is not included in the statute or the proposed CEQA Guidelines; rather it is only included in OPR's Technical Advisory. A reasonable interpretation of Section 21099, subdivision (e) is that it only refers to the statute itself, and perhaps also the CEQA Guidelines that the Legislature directed OPR to develop, as those are the only thresholds of significance that are referred to in the statute.

As discussed above the statute only generally directs that any threshold shall "promote the reduction of greenhouse gas emission, the development of mulitmoldal transportation networks, and a diversity of land uses." Arguably then, based on the language of the statute, a quantitative threshold must be one that "promotes the reduction of greenhouse gas emissions."

The Guideline proposed by OPR does not establish a particular threshold. Rather, it provides that "[g]enerally, vehicle miles travelled is the most appropriate measure of transportation impacts." (Proposed CEQA Guidelines, § 15064.3, subd. (a).) For land use projects, the proposed Guideline provides that:

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[1] Section 21099, subdivision (b) goes on to provide that "[i]n developing the criteria, the office shall recommend potential metrics to measure transportation impacts that may include, but are not limited to vehicle miles traveled, vehicle mils traveled per capita, automobile trip generation rates, or automobile trips generated. The office may also establish criteria for models used to analyze transportation impacts to ensure the models are accurate, reliable, and consistent with the intent of this section."

> Vehicle miles traveled exceeding an applicable threshold of significance may indicate a significant impact. 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 considered to have a less than significant transportation impact.

The Guidelines, for the most part, carry the weight of law. Many case treated the Guidelines as having the effective authority of duly adopted regulations.[2] (See *Fall River Wild Trout Foundation v. County of Shasta* (1999) 70 Cal.App.4th 482, 490 [the Legislature "expressly authorized the Secretary of the Resources Agency to develop [the Guidelines] as an aid to agency implementation of CEQA," and they should be accorded "great weight and should be respected by the courts"]; *Lee v. City of Lompoc* (1993) 14 Cal.App.4th 1515, 1523 ["There is a strong presumption that the administrative interpretation set forth in the Guidelines is consistent with legislative intent. [Citation.] The Guidelines are to be given 'great weight' in interpreting CEQA statutory provisions. [Citation.]"]; *Benton v. Bd. of Supervisors* (1991) 226 Cal.App.3d 1467, 1478-1479 ["Guidelines are binding on all public agencies"; the sole function of a court in reviewing the substance of the Guidelines "is to decide whether the [Resources Agency] reasonably interpreted the legislative mandate"].)

OPR's Technical Advisories do not carry this weight of authority, however. While OPR does provide comment periods on its Technical Advisories, they are not subject to the full regulatory process that the Guidelines are. The Technical Advisory for SB 743 itself describes the limitations on the Technical Advisory's enforceability, describing it as "advice and recommendations, which agencies and other entities may use at their discretion." The Technical Advisory expressly provides that "This document should not be construed as legal advice." (OPR, SB 743 Technical Advisory, p.1.)

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[2] Other cases have referred to the Guidelines as "indications or outlines to be followed, allowing for flexibility of action." (See, e.g., *Karlson v. City of Camarillo* (1980) 100 Cal.App.3d 789, 804–805 [Guidelines are "indications or outlines to be followed, allowing for flexibility of action"].)

For these reasons, it is our opinion that an agency may adopt a threshold for VMT that is a reduction lower than the 15 percent provided in the advisory. As a practical matter, however, the Technical Advisory has created something like a presumption that a 15-percent reduction is the appropriate standard. By citing to the California Air Resources Board's 2017 Climate Change Scoping Plan and Mobile Source Strategy, and Caltrans's Strategic Management Plan, OPR has provided substantial evidence that the 15-percent reduction target is appropriate and feasible.

Lead agencies must therefore support any change from OPR's recommendations with substantial evidence.

2. Lead agencies should address VMT impacts in the cumulative context.

In your questions to us, you noted that while OPR has developed VMT impact thresholds for project-related impacts, the current guidance does not fully address cumulative impacts. And while the document recommends consistency with the relevant RTP/SCS, the CARB's 2017 Climate Change Scoping Plan and other documents make it clear that consistency with the RTP/SCS will not be enough for the state to make its climate change goals; further reductions in VMT will be necessary.

Neither Public Resources Code section 21099, nor the proposed CEQA Guidelines mention a threshold for cumulative VMT impacts. Nevertheless, the CEQA Guidelines (and the case law) are clear that consideration of cumulative impacts is key to CEQA compliance. (CEQA Guidelines, § 15130; *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 735.)

That said, lead agencies may not need to develop separate thresholds to be used for cumulative impacts. It may be that the threshold applied for project-specific impacts is cumulative in nature. For example, the 15-percent reduction recommended by OPR in its Technical Advisory is based on meeting California's 2050 greenhouse gas goals, and it takes into account reductions achieved by other sectors. There are other examples where a project-specific threshold also addresses cumulative impacts. This is the case for many quantitative thresholds recommended by air districts for criteria pollutants. Similarly, quantitative thresholds established by some air districts for greenhouse gas emissions are generally applied at the project level and cumulative level, since these types of emissions are, by their nature, cumulative.

For these reasons, we believe that certain types of VMT thresholds (efficiency thresholds on a per capita or per service population basis) will likely satisfy any requirement to consider cumulative impacts. Other types of thresholds, such as those based on a net change in VMT, would likely require additional consideration of cumulative impacts, although that consideration may not require a specific quantitative threshold.

3. Mitigation

TDM Strategies Evaluation

FEHR PEERS

TECHNICAL MEMORANDUM

Date: 2.26.19

To: Chris Gray (WRCOG), Chris Tzeng (WRCOG), Sarah Dominguez (SCAG), Mike Gainor (SCAG)

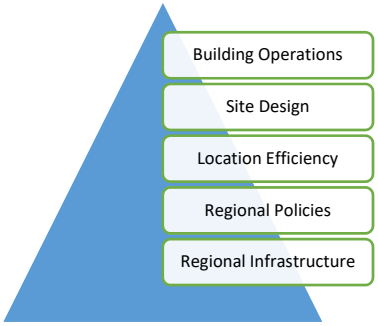
From: Ronald T. Milam, AICP, PTP and Jason Pack, PE

Subject: SB 743 Implementation TDM Strategy Assessment OC18-0567

This technical memorandum summarizes our assessment of new research related to transportation demand management (TDM) effectiveness for reducing vehicle miles of travel (VMT). The purpose of this work was to compile new TDM information that has been published in research papers since release of the *Quantifying Greenhouse Gas Mitigation Measures,* CAPCOA, August 2010 and to identify those strategies suited to WRCOG jurisdictions given the rural and suburban land use context. The matrix in Attachment A summarizes the overall evaluation of all the CAPCOA strategies while the matrix in Attachment B identifies the top seven strategies suited for the study area.

This information can be used as part of the SB 743 implementation to determine potentially feasible VMT mitigation measures for individual land use projects in the WRCOG area. An important consideration for the mitigation effectiveness is the scale for TDM strategy implementation. The biggest effects of TDM strategies on VMT (and resultant emissions) derive from regional policies related to land use location efficiency and infrastructure investments that support transit, walking, and bicycling. While there are many measures that can influence VMT and emissions that relate to site design and building operations, they have smaller effects that are often dependent on final building tenants. **Figure 1** presents a conceptual illustration of the relative importance of scale.

Figure 1: Transportation-Related GHG Reduction Measures



Of the 50 transportation measures presented in the CAPCOA 2010 report *Quantifying Greenhouse Gas Mitigation Measures*, 41 are applicable at building and site level. The remaining nine are functions of, or depend on, site location and/ or actions by local and regional agencies or funders. **Table 1** summarizes the strategies according to the scope of implementation and the agents who would implement them.

TABLE 1: SUMMARY OF TRANSPORTATION-RELATED CAPCOA MEASURES

Scope	Agents	CAPCOA Strategies (see full CAPCOA list below)
Building Operations	Employer, Manager	**26 total** from five CAPCOA strategy groups: • **3** from 3.2 Site Enhancements group • **3** from 3.3 Parking Pricing Availability group • **15** from 3.4 Commute Trip Reduction group • **2** from 3.5 Transit Access group • **3** from 3.7 Vehicle Operations group
Site Design	Owner, Architect	**15 total** from three strategy groups: • **6** from 3.1 Land Use group • **6** from 3.2 Site Enhancements group • **1** from 3.3 Parking group • **2** from 3.6 Road Access group
Location Efficiency	Developer, Local Agency	**3 shared** with Regional and Local Policies
Alignment with Regional and Local Policies	Regional and local agencies	**3 shared** with Location Efficiency
Regional Infrastructure and Services	Regional and local agencies	**6 total**

Of these strategies, only a few are likely to be effective in a rural or suburban setting such as the WRCOG area. To help winnow the list, we reviewed how land use context could influence each strategy's effectiveness and identified the seven for more detailed review. These strategies are described in Attachment B and listed below. Please note that disruptive trends, including but not limited to, transportation network companies (TNCs), autonomous vehicles (AVs), internet shopping, and micro-transit may affect the future effectiveness of these strategies.

1. Increase diversity of land uses – This strategy focuses on inclusion of mixed uses within projects or in consideration of the surrounding area to minimize vehicle travel in terms of both the number of trips and the length of those trips.

2. Provide pedestrian network improvements – This strategy focuses on creating a pedestrian network within the project and connecting to nearby destinations. Projects in the WRCOG area range in size, so the emphasis of this strategy for smaller projects would likely be the construction of network improvements that connect the project sites directly to nearby destinations. For larger projects, this strategy could focus on the development of a robust pedestrian network within the

project itself. Alternatively, implementation could occur through an impact fee program such as the TUMF or benefit/assessment district based on local or regional plans.

3. Provide traffic calming measures and low-stress bicycle network improvements – This strategy combines the CAPCOA research focused on traffic calming with new research on providing a low-stress bicycle network. Traffic calming creates networks with low vehicle speeds and volumes that are more conducive to walking and bicycling. Building a low-stress bicycle network produces a similar outcome. Implementation options are similar to strategy 2 above. One potential change in this strategy over time is that e-bikes (and e-scooters) could extend the effective range of travel on the bicycle network, which could enhance the effectiveness of this strategy.

4. Implement car-sharing program – This strategy reduces the need to own a vehicle or reduces the number of vehicles owned by a household by making it convenient to access a shared vehicle for those trips where vehicle use is essential. Note that implementation of this strategy would require regional or local agency implementation and coordination and would not likely be applicable for individual development projects.

5. Increase transit service frequency and speed – This strategy focuses on improving transit service convenience and travel time competitiveness with driving. While the WRCOG area has fixed route rail and bus service that could be enhanced, it's also possible that new forms of low-cost demand-responsive transit service could be provided. The demand-responsive service could be provided as subsidized trips by contracting to private TNCs or Taxi companies. Alternatively, a public transit operator could provide the subsidized service but would need to improve on traditional cost effectiveness by relying on TNC ride-hailing technology, using smaller vehicles sized to demand, and flexible driver employment terms where drivers are paid by trip versus by hour. This type of service would reduce wait times for travelers and improve the typical in-vehicle travel time compared to traditional transit. Note that implementation of this strategy would require regional or local agency implementation, substantial changes to current transit practices, and would not likely be applicable for individual development projects.

6. Encourage telecommuting and alternative work schedules – This strategy relies of effective internet access and speeds to individual project sites/buildings to provide the opportunity for telecommuting. The effectiveness of the strategy depends on the ultimate building tenants and this should be a factor in considering the potential VMT reduction.

7. Provide ride-sharing programs – This strategy focuses on encouraging carpooling and vanpooling by project site/building tenants and has similar limitations as strategy 6 above.

Because of the limitations noted above, strategies 1, 2, 3, 6, and 7 are initially considered the highest priorities for individual land use project mitigation subject to review and discussion with the project team and advisory committee.

The VMT reduction strategies can be quantified using CACPOA calculation methodologies and recent ARB research findings. Attachment C provides calculation methodologies for each of the mitigations provided above, along with their range of effectiveness.

Please review this information and let us know if you have any follow up questions.

FEHR PEERS

ATTACHMENT A

Comparison of CAPCOA Strategies Versus New Research Since 2010

					New Information Since CAPCOA Was Published in 2010		
CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Land Use/Location	3.1.1	LUT-1 Increase Density	0.8% - 30% VMT reduction due to increase in density	Adequate	Increasing residential density is associated with lower VMT per capita. Increased residential density in areas with high jobs access may have a greater VMT change than increases in regions with lower jobs access. The range of reductions is based on a range of elasticities from -0.04 to -0.22. The low end of the reductions represents a -0.04 elasticity of demand in response to a 10% increase in residential units or employment density and a -0.22 elasticity in response to 50% increase to residential/employment density.	0.4% -10.75%	Primary sources: Boarnet, M. and Handy, S. (2014). Impacts of Residential Density on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm Secondary source: Stevens, M. (2017). Does Compact Development Make People Drive Less? Journal of the American Planning Association, 83(1), 7-18.
Land Use/Location	3.1.9	LUT-9 Improve Design of Development	3.0% - 21.3% reduction in VMT due to increasing intersection density vs. typical ITE suburban development	Adequate	No update to CAPCOA literature; advise applying CAPCOA measure only to large developments with significant internal street structure.	Same	N/A
Land Use/Location	3.1.4	LUT-4 Increase Destination Accessibility	6.7%-20% VMT reduction due to decrease in distance to major job center or downtown	Adequate	Reduction in VMT due to increased regional accessibility (jobs gravity). Locating new development in areas with good access to destinations reduces VMT by reducing trip lengths and making walking, biking, and transit trips more feasible. Destination accessibility is measured in terms of the number of jobs (or other attractions) reachable within a given travel time, which tends to be highest at central locations and lowest at peripheral ones.	0.5%-12%	Primary sources: Handy, S. et al. (2014). Impacts of Network Connectivity on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm Handy, S. et al. (2013). Impacts of Regional Accessibility on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm Secondary source: Holtzclaw, et al. (2002.) Location Efficiency: Neighborhood and Socioeconomic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles, and Chicago. Transportation Planning and Technology, Vol. 25, pp. 1–27.

Comparison of CAPCOA Strategies Versus New Research Since 2010

					New Information Since CAPCOA Was Published in 2010		
CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Land Use/ Location	3.1.3	LUT-3 Increase Diversity of Urban and Suburban Developments	9%-30% VMT reduction due to mixing land uses within a single development	Adequate	1] VMT reduction due to mix of land uses within a single development. Mixing land uses within a single development can decrease VMT (and resulting GHG emissions), since building users do not need to drive to meet all of their needs. 2] Reduction in VMT due to regional change in entropy index of diversity. Providing a mix of land uses within a single neighborhood can decrease VMT (and resulting GHG emissions), since trips between land use types are shorter and may be accommodated by non-auto modes of transport. For example when residential areas are in the same neighborhood as retail and office buildings, a resident does not need to travel outside of the neighborhood to meet his/her trip needs. At the regional level, reductions in VMT are measured in response to changes in the entropy index of land use diversity.	1] 0%-12% 2] 0.3%-4%	1] Ewing, R. and Cervero, R. (2010). Travel and the Built Environment - A Meta-Analysis. Journal of the American Planning Association,76(3),265-294. Cited in California Air Pollution Control Officers Association. (2010).Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf Frank, L., Greenwald, M., Kavage, S. and Devlin, A. (2011). An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy. WSDOT Research Report WA-RD 765.1. Washington State Department of Transportation. Retrieved from: http://www.wsdot.wa.gov/research/reports/fullreports/765.1.pdf Nasri, A. and Zhang, L. (2012). Impact of Metropolitan-Level Built Environment on Travel Behavior. Transportation Research Record: Journal of the Transportation Research Board, 2323(1), 75-79. Sadek, A. et al. (2011). Reducing VMT through Smart Land-Use Design. New York State Energy Research and Development Authority. Retrieved from: https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-29%20Final%20Report_December%202011%20%282%29.pdf Spears, S.et al. (2014). Impacts of Land-Use Mix on Passenger Vehicle Use and Greenhouse Gas Emissions- Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm 2] Zhang, Wengia et al. "Short- and Long-Term Effects of Land Use on Reducing Personal Vehicle Miles of Travel."
Land Use/ Location	3.1.5	LUT-5 Increase Transit Accessibility	0.5%-24.6% reduce in VMT due to locating a project near high-quality transit	Adequate	1] VMT reduction when transit station is provided within 1/2 mile of development (compared to VMT for sites located outside 1/2 mile radius of transit). Locating high density development within 1/2 mile of transit will facilitate the use of transit by people traveling to or from the Project site. The use of transit results in a mode shift and therefore reduced VMT. 2] Reduction in vehicle trips due to implementing TOD. A project with a residential/commercial center designed around a rail or bus station, is called a transit-oriented development (TOD). The project description should include, at a minimum, the following design features: • A transit station/stop with high-quality, high-frequency bus service located within a 5-10 minute walk (or roughly ¼ mile from stop to edge of development), and/or • A rail station located within a 20 minute walk (or roughly ½ mile from station to edge of development) • Fast, frequent, and reliable transit service connecting to a high percentage of regional destinations • Neighborhood designed for walking and cycling	1] 0%-5.8% 2] 0%-7.3%	1] Lund, H. et al. (2004). Travel Characteristics of Transit-Oriented Development in California. Oakland, CA: Bay Area Rapid Transit District, Metropolitan Transportation Commission, and Caltrans. Tal, G. et al. (2013). Policy Brief on the Impacts of Transit Access (Distance to Transit) Based on a Review of the Empirical Literature. California Air Resources Board. Retrieved from: https://www.arb.ca.gov/cc/sb375/policies/transitaccess/transit_access_brief120313.pdf 2] Zamir, K. R. et al. (2014). Effects of Transit-Oriented Development on Trip Generation, Distribution, and Mode Share in Washington, D.C., and Baltimore, Maryland. Transportation Research Record: Journal of the Transportation Research Board. 2413, 45–53. DOI: 10.3141/2413-05

Comparison of CAPCOA Strategies Versus New Research Since 2010

					New Information Since CAPCOA Was Published in 2010		
CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Land Use/ Location	3.1.6	LUT-6 Integrate Affordable and Below Market Rate Housing	0.04%-1.20% reduction in VMT for making up to 30% of housing units BMR	Weak - Should only be used where supported by local data on affordable housing trip generation.	Observed trip generation indicates substantial local and regional variation in trip making behavior at affordable housing sites. Recommend use of ITE rates or local data for senior housing.	N/A	"Draft Memorandum: Infill and Complete Streets Study, Task 2.1: Local Trip Generation Study." Measuring the Miles: Developing new metrics for vehicle travel in LA. City of Los Angeles, April 19, 2017.
Neighborhood Site Enhancements	3.2.1	SDT-1 Provide Pedestrian Network Improvements	0%-2% reduction in VMT for creating a connected pedestrian network within the development and connecting to nearby destinations	Adequate	VMT reduction due to provision of complete pedestrian networks. Only applies if located in an area that may be prone to having a less robust sidewalk network.	0.5%-5.7%	Handy, S. et al. (2014). Impacts of Pedestrian Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Neighborhood Site Enhancements	3.2.2	SDT-2 Provide Traffic Calming Measures	0.25%-1% VMT reduction due to traffic calming on streets within and around the development	Adequate	Reduction in VMT due to expansion of bike networks in urban areas. Strategy only applies to bicycle facilities that provide a dedicated lane for bicyclists or a completely separated right-of-way for bicycles and pedestrians. Project-level definition: Enhance bicycle network citywide (or at similar scale), such that a building entrance or bicycle parking is within 200 yards walking or bicycling distance from a bicycle network that connects to at least one of the following: at least 10 diverse uses; a school or employment center, if the project total floor area is 50% or more residential; or a bus rapid transit stop, light or heavy rail station, commuter rail station, or ferry terminal. All destinations must be 3-mile bicycling distance from project site. Include educational campaigns to encourage bicycling.	0%-1.7%	Zahabi, S. et al. (2016). Exploring the link between the neighborhood typologies, bicycle infrastructure and commuting cycling over time and the potential impact on commuter GHG emissions. Transportation Research Part D: Transport and Environment. 47, 89-103.
Neighborhood Site Enhancements	3.2.3	SDT-3 Implement an NEV Network	0.5%-12.7% VMT reduction for GHG-emitting vehicles, depending on level of local NEV penetration	Weak - not recommended without supplemental data.	Limited evidence and highly limited applicability. Use with supplemental data only.	N/A	City of Lincoln, MHM Engineers & Surveyors, Neighborhood Electric Vehicle Transportation Program Final Report, Issued 04/05/05, and City of Lincoln, A Report to the California Legislature as required by Assembly Bill 2353, Neighborhood Electric Vehicle Transportation Plan Evaluation, January 1, 2008. Cited in: California Air Pollution Control Officers Association. (2010). Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

Comparison of CAPCOA Strategies Versus New Research Since 2010

CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New Information Since CAPCOA Was Published in 2010		
					New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Neighborhood Site Enhancements	3.4.9	TRT-9 Implement Car-Sharing Program	0.4% - 0.7% VMT reduction due to lower vehicle ownership rates and general shift to non-driving modes	Adequate	Vehicle trip reduction due to car-sharing programs; reduction assumes 1%-5% penetration rate. Implementing car-sharing programs allows people to have on-demand access to a shared fleet of vehicles on an as-needed basis, as a supplement to trips made by non-SOV modes. Transit station-based programs focus on providing the "last-mile" solution and link transit with commuters' final destinations. Residential-based programs work to substitute entire household based trips. Employer-based programs provide a means for business/day trips for alternative mode commuters and provide a guaranteed ride home option. The reduction shown here assumes a 1%-5% penetration rate.	0.3%-1.6%	Lovejoy, K. et al. (2013). Impacts of Carsharing on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm Need to verify with more recent UCD research.
Parking Pricing	3.3.1	PDT-1 Limit Parking Supply	5%-12.5% VMT reduction in response to reduced parking supply vs. ITE parking generation rate	Weak - not recommended. Fehr & Peers has developed new estimates for residential land use only that may be used.	CAPCOA reduction range derived from estimate of reduced vehicle ownership, not supported by observed trip or VMT reductions. Evidence is available for mode shift due to presence/absence of parking in high-transit urban areas; additional investigation ongoing	Higher	Fehr & Peers estimated a linear regression formula based on observed data from multiple locations. Resulting equation produces maximum VMT reductions for residential land use only of 30% in suburban locations and 50% in urban locations based on parking supply percentage reductions.
Parking Pricing	3.3.2	PDT-2 Unbundle Parking Costs from Property Cost	2.6% -13% VMT reduction due to decreased vehicle ownership rates	Adequate - conditional on the agency not requiring parking minimums and pricing/managing on-street parking (i.e., residential parking permit districts, etc.).	Reduction in VMT, primarily for residential uses, based on range of elasticities for vehicle ownership in response to increased residential parking fees. Does not account for self-selection. Only applies if the city does not require parking minimums and if on-street parking is priced and managed (i.e., residential parking permit districts).	2%-12%	Victoria Transport Policy Institute (2009). Parking Requirement Impacts on Housing Affordability. Retrieved March 2010 from: http://www.vtpi.org/park-hou.pdf.

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CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Parking Pricing	3.3.3	PDT-3 Implement Market Price Public Parking	2.8%-5.5% VMT reduction due to "park once" behavior and disincentive to driving	Adequate	Implement a pricing strategy for parking by pricing all central business district/employment center/retail center on-street parking. It will be priced to encourage park once" behavior. The benefit of this measure above that of paid parking at the project only is that it deters parking spillover from project supplied parking to other public parking nearby, which undermine the vehicle miles traveled (VMT) benefits of project pricing. It may also generate sufficient area-wide mode shifts to justify increased transit service to the area. VMT reduction applies to VMT from visitor/customer trips only. Reductions higher than top end of range from CAPCOA report apply only in conditions with highly constrained on-street parking supply and lack of comparably-priced off-street parking.	2.8%-14.5%	Clinch, J.P. and Kelly, J.A. (2003). Temporal Variance Of Revealed Preference On-Street Parking Price Elasticity. Dublin: Department of Environmental Studies, University College Dublin. Retrieved from: http://www.ucd.ie/gpep/research/workingpapers/2004/04-02.pdf. Cited in Victoria Transport Policy Institute (2017). Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior. Retrieved from: http://www.vtpi.org/tdm/tdm11.htm Hensher, D. and King, J. (2001). Parking Demand and Responsiveness to Supply, Price and Location in Sydney Central Business District. Transportation Research A. 35(3), 177-196. Millard-Ball, A. et al. (2013). Is the curb 80% full or 20% empty? Assessing the impacts of San Francisco's parking pricing experiment. Transportation Research Part A. 63(2014), 76-92. Shoup, D. (2011). The High Cost of Free Parking. APA Planners Press. p. 290. Cited in Pierce, G. and Shoup, D. (2013). Getting the Prices Right. Journal of the American Planning Association. 79(1), 67-81.
Transit System	3.5.3	TST-3 Expand Transit Network	0.1-8.2% VMT reduction in response to increase in transit network coverage	Adequate	Reduction in vehicle trips due to increased transit service hours or coverage. Low end of reduction is typical of project-level implementation (payment of impact fees and/or localized improvements).	0.1%-10.5%	Handy, S. et al. (2013). Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Transit System	3.5.4	TST-4 Increase Transit Service Frequency/Speed	0.02%-2.5% VMT reduction due to reduced headways and increased speed and reliability	Adequate	Reduction in vehicle trips due to increased transit frequency/decreased headway. Low end of reduction is typical of project-level implementation (payment of impact fees and/or localized improvements).	0.3%-6.3%	Handy, S. et al. (2013). Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Transit System	3.5.1	TST-1 Provide a Bus Rapid Transit System	0.02%-3.2% VMT reduction by converting standard bus system to BRT system	Adequate	No new information identified.	Same	N/A
Commute Trip Reduction	3.4.1	TRT-1 Implement CTR Program - Voluntary	1.0%-6.2% commute VMT reduction due to employer-based mode shift program	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-2 Implement CTR Program - Required Implementation/Monitoring" or with CAPCOA strategies TRT-3.4.3 through TRT-3.4.9.	Reduction in vehicle trips in response to employer-led TDM programs. The CTR program should include all of the following to apply the effectiveness reported by the literature: • Carpooling encouragement • Ride-matching assistance • Preferential carpool parking • Flexible work schedules for carpools • Half time transportation coordinator • Vanpool assistance • Bicycle end-trip facilities (parking, showers and lockers)	1.0%-6.0%	Boarnet, M. et al. (2014). Impacts of Employer-Based Trip Reduction Programs and Vanpools on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Commute Trip Reduction	3.4.2	TRT-2 Implement CTR Program - Required Implementation/Monitoring	4.2%-21.0% commute VMT reduction due to employer-based mode shift program with required monitoring and reporting	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or with CAPCOA strategies TRT-3.4.3 through TRT-3.4.9.	Limited evidence available. Anecdotal evidence shows high investment produces high VMT/vehicle trip reductions at employment sites with monitoring requirements and specific targets.	Same	Nelson/Nygaard (2008). South San Francisco Mode Share and Parking Report for Genentech, Inc.(p. 8) Cited in: California Air Pollution Control Officers Association. (2010). Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

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CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Commute Trip Reduction	3.4.4	TRT-4 Implement Subsidized or Discounted Transit Program	0.3%-20% commute VMT reduction due to transit subsidy of up to $6/day	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or "TRT-2 Implement CTR Program - Required Implementation/Monitoring."	1] Reduction in vehicle trips in response to reduced cost of transit use, assuming that 10-50% of new bus trips replace vehicle trips; 2] Reduction in commute trip VMT due to employee benefits that include transit 3] Reduction in all vehicle trips due to reduced transit fares system-wide, assuming 25% of new transit trips would have been vehicle trips.	1] 0.3%-14% 2] 0-16% 3] 0.1% to 6.9%	1] Victoria Transport Policy Institute. (2017). Understanding Transport Demands and Elasticities. Online TDM Encyclopedia. Retrieved from: http://www.vtpi.org/tdm/tdm11.htm 2] Carolina, P. et al. (2016). Do Employee Commuter Benefits Increase Transit Ridership? Evidence rom the NY-NJ Region. Washington, DC: Transportation Research Board, 96th Annual Meeting. 3] Handy, S. et al. (2013). Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Commute Trip Reduction	3.4.15	TRT-15 Employee Parking Cash-Out	0.6%-7.7% commute VMT reduction due to implementing employee parking cash-out	Weak - Effectiveness is building/tenant specific. Research data is over 10 years old (1997).	Shoup case studies indicate a reduction in commute vehicle trips due to implementing cash-out without implementing other trip-reduction strategies.	3%-7.7%	Shoup, D. (1997). Evaluating the Effects of Cashing Out Employer-Paid Parking: Eight Case Studies. Transport Policy. California Air Resources Board. Retrieved from: https://www.arb.ca.gov/research/apr/past/93-308a.pdf. This citation was listed as an alternative literature in CAPCOA.
Commute Trip Reduction	3.4.14	TRT-14 Price Workplace Parking	0.1%-19.7% commute VMT reduction due to mode shift	Adequate - Effectiveness is building/tenant specific.	Reduction in commute vehicle trips due to priced workplace parking; effectiveness depends on availability of alternative modes. Workplace parking pricing may include: explicitly charging for parking, implementing above market rate pricing, validating parking only for invited guests, not providing employee parking and transportation allowances, and educating employees about available alternatives.	0.5%-14%	Primary sources: Concas, S. and Nayak, N. (2012), A Meta-Analysis of Parking Price Elasticity. Washington, DC: Transportation Research Board, 2012 Annual Meeting. Dale, S. et al. (2016). Evaluating the Impact of a Workplace Parking Levy on Local Traffic Congestion: The Case of Nottingham UK. Washington, DC: Transportation Research Board, 96th Annual Meeting. Secondary sources: Victoria Transport Policy Institute. (2017). Understanding Transport Demands and Elasticities. Online TDM Encyclopedia. Retrieved from: http://www.vtpi.org/tdm/tdm11.htm Spears, S. et al. (2014). Impacts of Parking Pricing on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Commute Trip Reduction	3.4.6	TRT-6 Encourage Telecommuting and Alternative Work Schedules	0.07%-5.5% commute VMT reduction due to reduced commute trips	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or "TRT-2 Implement CTR Program - Required Implementation/Monitoring."	VMT reduction due to adoption of telecommuting. Alternative work schedules could take the form of staggered starting times, flexible schedules, or compressed work weeks.	0.2%-4.5%	Handy, S. et al. (2013). Policy Brief on the Impacts of Telecommuting Based on a Review of the Empirical Literature. California Air Resources Board. Retrieved from: https://www.arb.ca.gov/cc/sb375/policies/telecommuting/telecommuting_brief120313.pdf
Commute Trip Reduction	3.4.7	1] TRT-7 Implement CTR Marketing 2] Launch Targeted Behavioral Interventions	0.8%-4.0% commute VMT reduction due to employer marketing of alternatives	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or "TRT-2 Implement CTR Program - Required Implementation/Monitoring."	1] Vehicle trips reduction due to CTR marketing; 2] Reduction in VMT from institutional trips due to targeted behavioral intervention programs	1] 0.9% to 26% 2] 1%-6%	1] Pratt, Dick. Personal communication regarding the Draft of TCRP 95 Traveler Response to Transportation System Changes – Chapter 19 Employer and Institutional TDM Strategies. Transit Cooperative Research Program. Cited in California Air Pollution Control Officers Association. (2010).Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf Dill, J. and Mohr, C. (2010). Long-Term Evaluation of Individualized Marketing Programs for Travel Demand Management. Portland, OR: Transportation Research and Education Center (TREC). Retrieved from: http://pdxscholar.library.pdx.edu/usp_fac 2] Brown, A. and Ralph, K. (2017.) "The Right Time and Place to Change Travel Behavior: An Experimental Study." Washington, DC: Transportation Research Board, 2017 Annual Meeting. Retrieved from: https://trid.trb.org/view.aspx?id=1437253
Commute Trip Reduction	3.4.11	TRT-11 Provide Employer-Sponsored Vanpool/Shuttle	0.3%-13.4% commute VMT reduction due to employer-sponsored vanpool and/or shuttle service	Adequate - Effectiveness is building/tenant specific.	1] Reduction in commute vehicle trips due to implementing employer-sponsored vanpool and shuttle programs; 2] Reduction in commute vehicle trips due to vanpool incentive programs; 3] Reduction in commute vehicle trips due to employer shuttle programs	1] 0.5%-5.0% 2] 0.3%-7.4% 3] 1.4%-6.8%	1] Concas, Sisinnio, Winters, Philip, Wambalaba, Francis, (2005). Fare Pricing Elasticity, Subsidies, and Demand for Vanpool Services. Transportation Research Record: Journal of the Transportation Research Board, 1924, pp 215-223. 2] Victoria Transport Policy Institute. (2015). Ridesharing: Carpooling and Vanpooling. Online TDM Encyclopedia. Retrieved from: http://vtpi.org/tdm/tdm34.htm 3] ICF. (2014). GHG Impacts for Commuter Shuttles Pilot Program.

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CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA	Literature or Evidence Cited
Commute Trip Reduction	3.4.3	TRT-3 Provide Ride-Sharing Programs	1%-15% commute VMT reduction due to employer ride share coordination and facilities	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or "TRT-2 Implement CTR Program - Required Implementation/Monitoring."	Commute vehicle trips reduction due to employer ride-sharing programs. Promote ride-sharing programs through a multi-faceted approach such as: • Designating a certain percentage of parking spaces for ride sharing vehicles • Designating adequate passenger loading and unloading and waiting areas for ride-sharing vehicles • Providing an app or website for coordinating rides	2.5%-8.3%	Victoria Transport Policy Institute. (2015). Ridesharing: Carpooling and Vanpooling. Online TDM Encyclopedia. Retrieved from: http://vtpi.org/tdm/tdm34.htm
Commute Trip Reduction	3.4.10	TRT-10 Implement a School Pool Program	7.2%-15.8% reduction in school VMT due to school pool implementation	Adequate - School VMT only.	Limited new evidence available, not conclusive	Same	Transportation Demand Management Institute of the Association for Commuter Transportation. TDM Case Studies and Commuter Testimonials. Prepared for the US EPA. 1997. (p. 10, 36-38) WayToGo 2015 Annual Report. Accessed on March 12, 2017 from http://www.waytogo.org/sites/default/files/attachments/waytogo-annual-report-2015.pdf
Commute Trip Reduction	3.4.13	TRT-13 Implement School Bus Program	38%-63% reduction in school VMT due to school bus service implementation	Adequate - School VMT only.	VMT reduction for school trips based on data beyond a single school district. School district boundaries are also a factor to consider. VMT reduction does not appear to be a factor that was considered in a select review of CA boundaries. VMT reductions apply to school trip VMT only.	5%-30%	Wilson, E., et al. (2007). The implications of school choice on travel behavior and environmental emissions. Transportation Research Part D: Transport and Environment 12(2007), 506-518.
Not Applicable - not a CAPCOA strategy	Not Applicable - not a CAPCOA strategy	Not Applicable - not a CAPCOA strategy	Not Applicable - not a CAPCOA strategy	Not Applicable - not a CAPCOA strategy	Bikeshare car trip substitution rate of 7-19% based on data from Washington DC, and Minneapolis/St. Paul. Annual VMT reduction of 151,000 and 57,000, respectively. Includes VMT for rebalancing and maintenance. VMT reduction of 0.023 miles per day per bikeshare member estimated for Bay Area bikeshare, utilizing Minneapolis/St. Paul data from study above.	57,000-151,000 annual VMT reduction, based on two large US cities. VMT reduction of 0.023 miles per day per member, based on one large US city estimate.	Fishman, E., Washington, S., & Haworth, N. (2014). Bike share's impact on car use: Evidence from the United States, Great Britain, and Australia. Transportation Research Part D: Transport and Environment, 31, 13-20. TDM Methodology: Impact of Carsharing Membership, Transit Passes, Bikesharing Membership, Unbundled Parking, and Parking Supply Reductions on Driving. Center for Neighborhood Technology, Peter Haas and Cindy Copp, with TransForm staff, May 5, 2016.

ATTACHMENT B

Relevant Strategies for Implementation in WRCOG Jurisdictions Due to Land Use Context

					New Information Since CAPCOA Was Published in 2010		
CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA(1)	Literature or Evidence Cited
Land Use/ Location	3.1.3	LUT-3 Increase Diversity of Urban and Suburban Developments	9%-30% VMT reduction due to mixing land uses within a single development	Adequate	1] VMT reduction due to mix of land uses within a single development; 2] Reduction in VMT due to regional change in entropy index of diversity.	1] 0%-12% 2] 0.3%-4%	1] Ewing, R. and Cervero, R. (2010). Travel and the Built Environment - A Meta-Analysis. Journal of the American Planning Association,76(3),265-294. Cited in California Air Pollution Control Officers Association. (2010).Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf Frank, L., Greenwald, M., Kavage, S. and Devlin, A. (2011). An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy. WSDOT Research Report WA-RD 765.1. Washington State Department of Transportation. Retrieved from: http://www.wsdot.wa.gov/research/reports/fullreports/765.1.pdf Nasri, A. and Zhang, L. (2012). Impact of Metropolitan-Level Built Environment on Travel Behavior. Transportation Research Record: Journal of the Transportation Research Board, 2323(1), 75-79. Sadek, A. et al. (2011). Reducing VMT through Smart Land-Use Design. New York State Energy Research and Development Authority. Retrieved from: https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-29%20Final%20Report_December%202011%20%282%29.pdf Spears, S.et al. (2014). Impacts of Land-Use Mix on Passenger Vehicle Use and Greenhouse Gas Emissions- Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm 2] Zhang, Wengia et al. "Short- and Long-Term Effects of Land Use on Reducing Personal Vehicle Miles of Travel."
Neighborhood Site Enhancements	3.2.1	SDT-1 Provide Pedestrian Network Improvements	0%-2% reduction in VMT for creating a connected pedestrian network within the development and connecting to nearby destinations	Adequate	VMT reduction due to provision of complete pedestrian networks.	0.5%-5.7%	Handy, S. et al. (2014). Impacts of Pedestrian Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm
Neighborhood Site Enhancements	3.2.2	SDT-2 Provide Traffic Calming Measures	0.25%-1% VMT reduction due to traffic calming on streets within and around the development	Adequate	Reduction in VMT due to building out a low-stress bike network; reduction in VMT due to expansion of bike networks in urban areas.	0%-1.7%	1] California Air Resources Board. (2016). Greenhouse Gas Quantification Methodology for the California Transportation Commission Active Transportation Program Greenhouse Gas Reduction Fund Fiscal Year 2016-17. Retrieved from: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/ctc_atp_finalqm_16-17.pdf. 2] Zahabi, S. et al. (2016). Exploring the link between the neighborhood typologies, bicycle infrastructure and commuting cycling over time and the potential impact on commuter GHG emissions. Transportation Research Part D: Transport and Environment. 47, 89-103.
Neighborhood Site Enhancements	3.4.9	TRT-9 Implement Car-Sharing Program	0.4% - 0.7% VMT reduction due to lower vehicle ownership rates and general shift to non-driving modes	Adequate	Vehicle trip reduction due to car-sharing programs; reduction assumes 1%-5% penetration rate. Car sharing effect on VMT is still evolving due to TNC effects. UCD research showed less effect on car ownership due to car sharing participation and an uncertain effect on VMT.	0.3%-1.6%	Lovejoy, K. et al. (2013). Impacts of Carsharing on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm Clewlow, Regina R. and Mishra, Gouri Shankar, (2017). Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States. UC Davis, Institute of Transportation Studies. Research Report - UCD-ITS-RR-17-07.
Transit System	3.5.4	TST-4 Increase Transit Service Frequency/Speed	0.02%-2.5% VMT reduction due to reduced headways and increased speed and reliability	Adequate	Reduction in vehicle trips due to increased transit frequency/decreased headway.	0.3%-6.3%	Handy, S. et al. (2013). Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm

Relevant Strategies for Implementation in WRCOG Jurisdictions Due to Land Use Context

					New Information Since CAPCOA Was Published in 2010		
CAPCOA Category	CAPCOA #	CAPCOA Strategy	CAPCOA Reduction	Strength of Substantial Evidence for CEQA Impact Analysis?	New information	Change in VMT reduction compared to CAPCOA(1)	Literature or Evidence Cited
Commute Trip Reduction	3.4.6	TRT-6 Encourage Telecommuting and Alternative Work Schedules	0.07%-5.5% commute VMT reduction due to reduced commute trips	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or "TRT-2 Implement CTR Program - Required Implementation/Monitoring."	VMT reduction due to adoption of telecommuting	0.2%-4.5%	Handy, S. et al. (2013). Policy Brief on the Impacts of Telecommuting Based on a Review of the Empirical Literature. California Air Resources Board. Retrieved from: https://www.arb.ca.gov/cc/sb375/policies/telecommuting/telecommuting_brief120313.pdf
Commute Trip Reduction	3.4.3	TRT-3 Provide Ride-Sharing Programs	1%-15% commute VMT reduction due to employer ride share coordination and facilities	Adequate - Effectiveness is building/tenant specific. Do not use with "TRT-1 Implement CTR Program - Voluntary" or "TRT-2 Implement CTR Program - Required Implementation/Monitoring."	Commute vehicle trips reduction due to employer ride-sharing programs	2.5%-8.3%	Victoria Transport Policy Institute. (2015). Ridesharing: Carpooling and Vanpooling. Online TDM Encyclopedia. Retrieved from: http://vtpi.org/tdm/tdm34.htm

NOTES:

(1) For specific VMT reduction ranges, refer to the cited literature.

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ATTACHMENT C

Increase Diversity of Urban and Suburban Developments (Mixed Use)

Range of Effectiveness:

0 – 12% vehicle miles traveled (VMT) reduction due to a mix of land uses within a single development (Ewing and Cervero, 2010).

0.3 – 4% VMT reduction due to change in land use entropy index (i.e., land use mix) within a project's sphere of influence (Zhang).

Measure Description:

Having different types of land uses near one another can decrease VMT since trips between land use types are shorter and may be accommodated by non-auto modes of transport. For example, when residential areas are in the same neighborhood as retail and office buildings, a resident does not need to travel outside of the neighborhood to meet his/her trip needs. A description of diverse uses for urban and suburban areas is provided below (CAPCOA 2010, p. 162)

Urban:

An urban project is predominantly characterized by properties on which various uses, such as office, commercial, institutional, and residential, are combined in a single building or on a single site in an integrated development project with functional interrelationships and a coherent physical design. These mixed-use developments should encourage walking and other non-auto modes of transport from residential to office/commercial/institutional locations (and vice versa). The residential units should be within a quarter mile of parks, schools, or other civic uses. These projects minimize the need for external trips by including services/facilities for day care, banking/ATM, restaurants, vehicle refueling, and shopping (CAPCOA 2010, p. 162).

Suburban:

A suburban project has at least three of the following on site and/or offsite within a quarter mile: residential development, retail development, park, open space, or office. These mixed-use developments should encourage walking and other non-auto modes of transport from residential to office/commercial locations (and vice versa). These projects minimize the need for external trips by including services/facilities for day care, banking/ATM, restaurants, vehicle refueling, and shopping (CAPCOA 2010, p. 162).

Measure Applicability:

- Urban and suburban context
- Negligible impact in a rural context (unless the project is a master-planned community)
- Appropriate for mixed-use projects

Inputs:

The following information needs to be provided by the project applicant:

- Percentage of each land use type in the project

Mitigation Method:

$$\%\ VMT\ Reduction\ =\ Land\ Use \times E_{Diversity}$$

$$(not\ to\ exceed\ 15\%\ for\ non-work\ trips\ and\ 25\%\ for\ commute\ trips)$$

Where:

$$Land\ Use = (Land\ Use\ Index - 0.15)/0.15\ (not\ to\ exceed\ 500\%\ increase)$$

$$Land\ Use\ Index = -a/\ln(6)$$

$a = \sum_{i=1}^{6} a_i \times \ln(a_i)$ (Song and Knaap, 2004)

$a_i = Building\ floor\ area\ of\ land\ use\ i/total\ square\ feet\ of\ project\ land\ area$

- $a_1 = Single\ family\ residential$
- $a_2 = Multifamily\ residential$
- $a_3 = Commercial$
- $a_4 = Industrial$
- $a_5 = Institutional$
- $a_6 = Park$

$E_{Diversity}\ = Elasticity\ of\ VMT\ with\ restpect\ to\ land\ use\ index = 0.02\ to\ 0.08$ [4]

If land use a_i is not present, set a_i equal to 0.01

Discussion:

In the above calculation, a land use index of 0.15 is used as a baseline representing a development with a single land use. There are two separate maxima that should be noted: an effective cap of 500% on the allowable percentage increase of land use index and a cap of 15% and 25% on percent VMT reduction for non-work and commute trips, respectively. The 500 percent cap reflects the expected change in a land use index from 0.15 to 0.90, or from single use to a nearly equal balance of all six uses included in this method. The purpose for the 15% and 25% caps is to limit the influence of any single environmental factor (such as diversity). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, etc.) will show more of a reduction than relying on improvements from a single land use factor (CAPCOA 2010, p. 164).

The land use (or entropy) index measurement looks at the mix of land uses of a development. An index of 0 indicates a single land use while 1 indicates a full mix of uses. The preferred elasticity of VMT with respect to the land use mix index for Riverside County is 0.02, per work examining policy effects on VMT conducted by Salon et al for the Air Resource Board.

Example:

Sample calculations are provided below:

90% single family homes, 10% commercial

- $Land\ use\ index = -[0.9 \times \ln(0.9) + 0.1 \times \ln(0.1) + 4 \times 0.01 \times \ln(0.01)]/\ln(6) = 0.3$
- $Low\ Range\ \%\ VMT\ Reduction = (0.3 - 0.15)/0.15 \times 0.02 = 2\%$

1/6 single family, 1/6 multi-family, 1/6 commercial, 1/6 industrial, 1/6 institutional, 1/6 parks

- $Land\ use\ index = -[6 \times 0.17 \times \ln(0.17)]/\ln(6) = 1$
- $High\ Range\ \%\ VMT\ Reduction\ (land\ use\ index = 1)$
- $Land\ use = (1 - 0.15)/0.15 = 5.6\ or\ 566\%.\ Since\ this\ is\ greater\ than\ 500\%, set\ to\ 500\%$
- $\%\ VMT\ Reduction = (5 \times 0.02) = 10\%$

References:

Ewing, R. and Cervero, R. (2010). Travel and the Built Environment - A Meta-Analysis. Journal of the American Planning Association,76(3),265-294. Cited in California Air Pollution Control Officers Association. (2010). Quantifying Greenhouse Gas Mitigation Measures. Retrieved from: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

Frank, L., Greenwald, M., Kavage, S. and Devlin, A. (2011). An Assessment of Urban Form and Pedestrian and Transit Improvements as an Integrated GHG Reduction Strategy. WSDOT Research Report WA-RD 765.1. Washington State Department of Transportation. Retrieved from: http://www.wsdot.wa.gov/research/reports/fullreports/765.1.pdf

Nasri, A. and Zhang, L. (2012). Impact of Metropolitan-Level Built Environment on Travel Behavior. Transportation Research Record: Journal of the Transportation Research Board, 2323(1), 75-79.

Sadek, A. et al. (2011). Reducing VMT through Smart Land-Use Design. New York State Energy Research and Development Authority. Retrieved from: https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-29%20Final%20Report_December%202011%20%282%29.pdf

Salon, D., Boarnet, M. G., Handy, S., Spears, S., & Tal, G. (2012). How do local actions affect VMT? A critical review of the empirical evidence. *Transportation research part D: transport and environment, 17(7),* 495-508

Song, Y., and Knaap, G., "Measuring the effects of mixed land uses on housing values." Regional Science and Urban Economics 34 (2004) 663-680.(p. 669) http://urban.csuohio.edu/~sugie/papers/RSUE/RSUE2005_Measuring%20the%20effects%20of%20mixed%20land%20use.pdf

Spears, S.et al. (2014). Impacts of Land-Use Mix on Passenger Vehicle Use and Greenhouse Gas Emissions-Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.1.3 Increase Diversity of Urban and Suburban Developments (Mixed Use).

Zhang, Wengia et al. "Short- and Long-Term Effects of Land Use on Reducing Personal Vehicle Miles of Travel."

Provide Pedestrian Network Improvements

Range of Effectiveness:

0.5 – 5.7% VMT reduction

Measure Description:

Providing pedestrian access at and near a project site encourages people to walk instead of drive, presuming that desirable destinations exist within walking distance of the project. This mode shift results in people driving less and thus a reduction in VMT. The pedestrian access network should internally link all uses and connect to all existing or planned external streets and pedestrian facilities contiguous with the project site. It should also minimize barriers to pedestrian access and interconnectivity. Physical barriers such as walls, landscaping, and slopes that impede pedestrian circulation should be eliminated (CAPCOA 2010, p. 186).

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects
- Reduction benefit only occurs if the project has both pedestrian network improvements on site and connections to the larger off-site network. All calculations should incorporate the status of the network in the project's walkshed (i.e., within a ¼ mile radius).
- Desirable destinations external to the project site must be within walking distance (i.e., preferably within a ¼ mile and no greater than ½ mile).

Inputs:

The project applicant must provide information regarding pedestrian access and connectivity within the project and to/from off-site destinations. The change in sidewalk coverage should represent the share of quality sidewalk and pedestrian facilities available in the surrounding area; for instance, if one block-face of ten is missing sidewalks, the existing coverage is 90%. This measure is not effective in reducing VMT in locations with already fully-developed, high quality sidewalk networks.

Mitigation Method:

$$\%\ VMT\ Reduction = E_{PedAccess} \times Sidewalk\ Delta$$

Where:

$$E_{PedAccess} = \%\ Change\ in\ VMT\ per\ \%\ Increase\ in\ Sidewalk\ Coverage$$

$$Sidewalk\ Delta = Assumed\ change\ in\ sidewalk\ coverage\ compared\ to\ background\ condition$$

Detail:

$E_{PedAccess} = 0.0\ to\ 0.14$ (0.07 preferred in absence of other data)

$Sidwalk\ Delta = 5\%\ to\ 100\%$

Discussion:

Pedestrian Access Elasticity varies at the local level and is dependent on many factors such as the urban form of the immediate area and population characteristics. When reliable studies are available and applicable to the project area, this elasticity should be calculated. Otherwise, 0.07 is recommended based on the range provided by Handy, S. et al.

References:

Handy, S. et al. (2014). Impacts of Pedestrian Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions – Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.2.1 Provide Pedestrian Network Improvements.

Provide Traffic Calming Measures

Range of Effectiveness:

0 – 1.7% VMT reduction

Measure Description:

Providing traffic calming measures encourages people to walk or bike instead of using a vehicle. This mode shift results in a decrease in VMT. Project design should include pedestrian/bicycle safety and traffic calming measures in excess of jurisdiction requirements. Roadways should be designed to reduce motor vehicle speeds and encourage pedestrian and bicycle trips with traffic calming features. Traffic calming features may include: marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, roundabouts or mini-circles, on-street parking, planter strips with street trees, chicanes/chokers, etc. (CAPCOA 2010, p. 190).

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for residential, retail, office, industrial and mixed-use projects

Inputs:

The following information needs to be provided by the project applicant:

- Percentage of streets within project with traffic calming improvements
- Percentage of intersections within project with traffic calming improvements

Mitigation Calculation:

The VMT reduction is a function of the percentage of streets and intersections within the project with traffic calming improvements based on the following look up table.

% VMT Reduction		% of Streets with Improvements			
		25%	50%	75%	100%
% of Intersections with Improvements	25%	0.425%	0.425%	0.85%	0.85%
	50%	0.425%	0.85%	0.85%	1.275%
	75%	0.85%	0.85%	1.275%	1.275%
	100%	0.85%	1.275%	1.275%	1.7%

Discussion:

The table above allows the project applicant to calculate a VMT reduction estimate based on the project's street and intersection design with respect to traffic calming. The applicant should look at the rows on the left and choose the percent of intersections within the project which will have traffic calming improvements. Then, the applicant should look at the columns along the top and choose the percent of streets within the project which will have traffic calming improvements. The intersection cell of the row and column selected in the matrix is the VMT reduction estimate.

Though the literature provides some difference between a suburban and urban context, the difference is small and thus the lower VMT reduction estimate was used to be applied to all contexts. Rural context is not specifically discussed in the literature but is presumed to have little to no effect on VMT reduction due to the long-distances between trip origins and destinations.

Research by Zahabi, S. et al. attributes up to a 1.7% VMT reduction to traffic calming measures. The table above illustrates the range of VMT reductions based on the percent of streets and intersections with traffic calming measures implemented. CAPCOA 2010 used a range of 0.25% to 1% for VMT reduction. The VMT reductions were updated using the same methodology to allow for reductions up to 1.7%.

Because of the high potential for double-counting, caution should be used when combining this measure with "Provide Pedestrian Network Improvements."

References:

California Air Resources Board. (2016). Greenhouse Gas Quantification Methodology for the California Transportation Commission Active Transportation Program Greenhouse Gas Reduction Fund Fiscal Year 2016-17. Retrieved from: https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/ctc_atp_finalqm_16-17.pdf.

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.2.2 Provide Traffic Calming Measures.

Zahabi, S. et al. (2016). Exploring the link between the neighborhood typologies, bicycle infrastructure and commuting cycling over time and the potential impact on commuter GHG emissions. Transportation Research Part D: Transport and Environment. 47, 89-103.

Implement Car-Sharing Program

Range of Effectiveness:

0.3 – 1.6% VMT reduction

Measure Description:

Implementation of a car-sharing program allows people to have on-demand access to a shared fleet of vehicles on an as-needed basis. VMT reduction occurs due to reductions in private vehicle ownership, lower convenience associated with indirect vehicle access, and the transparent cost of vehicle use. User costs are typically determined through mileage or hourly rates, with deposits and/or annual membership fees. The car-sharing program could be created through a local partnership or through one of many existing car-share companies. Car-sharing programs may be grouped into three general categories: residential- or citywide-based, employer-based, and transit station-based. Transit station-based programs focus on providing the "last-mile" solution and link transit with commuters' final destinations. Residential-based programs work to substitute entire household-based trips. Employer-based programs provide a means for business/day trips for alternative mode commuters and provide a guaranteed ride home option (CAPCOA 2010, p. 245).

Measure Applicability:

- Urban and suburban context
- Negligible in a rural context
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Inputs:

The following information needs to be provided by the project applicant:

- % reduction in car share member annual VMT
- Number of car share members per household

Mitigation Method:

$$\%\ VMT\ Reduction = P_{CarShare} \times Adoption\ Rate$$

Where:

$$P_{CarShare} = \%\ reduction\ in\ car\ share\ member\ annual\ VMT$$

$$Adoption\ Rate = number\ of\ car\ share\ members\ per\ household$$

Detail:

$$P_{CarShare} = 26.9\ to\ 37\%$$

$$Adoption\ Rate = 1\%\ to\ 2\%$$

Discussion:

The applicant must consider the demand for car-shares in a community before calculating a VMT reduction. If a community cannot support the proposed number of cars deployed, VMT reduction may be overestimated.

The percent reduction in car share member annual VMT is dependent on characteristics of the community, its residents, and for what purposes the car-sharing program is to be used for. Analysts should consult the literature to understand how these variables affect the range of reductions prior to completing the calculation of VMT reduction.

References:

Clewlow, Regina R. and Mishra, Gouri Shankar, (2017). Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States. UC Davis, Institute of Transportation Studies. Research Report - UCD-ITS-RR-17-07.

Lovejoy, K. et al. (2013). Impacts of Carsharing on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.4.9 Implement Car-Sharing Program

Increase Transit Service Frequency/Speed

Range of Effectiveness:

0.03 – 6.3% VMT reduction.

Measure Description:

This measure reduces transit-passenger travel time through reduced headways and increased speed and reliability. This makes transit service more attractive and may result in a mode shift from auto to transit which reduces VMT (CAPCOA 2010, p. 280).

Inputs:

The following information needs to be provided by the project applicant:

- Percentage reduction in headways (increase in frequency) for applicable transit routes
- Level of implementation
- Project setting: urban center, urban, suburban
- Existing transit mode share

Mitigation Method:

$$\%\ VMT\ Reduction = Headway \times B \times C \times Mode$$

Where:

$$Headway = \%\ reduction\ in\ headways$$

$$B = Elasticity\ of\ transit\ ridership\ with\ respect\ to\ increased\ frequency\ of\ service$$

$$C = Ratio\ of\ vehicle\ trips\ reduced\ to\ number\ of\ new\ transit\ riders$$

$$Mode = Existing\ transit\ mode\ share$$

Detail:

$$B = 0.50$$

$$C = 25\%\ to\ 75\%$$

Discussion:

A 1% reduction in headways leads to 0.5% increase in transit ridership. This change is translated into a VMT reduction by applying a mode shift adjustment to account for new transit trips that do not represent displaced vehicle trips in addition to considering the existing transit mode share.

Variable C should be calculated based on local data. It is calculated by taking the length of an average transit trip within the sphere of influence of the project divided by the average vehicle trip length within the sphere of influence of the project.

References:

Handy, Lovejoy, Boarnet, Spears. 2013. "Impacts of Transit Service Strategies on Passenger Vehicle Use and Greenhouse Gas Emissions." http://www.arb.ca.gov/cc/sb375/policies/transitservice/transit_brief.pdf

Litman, T. (2004). Transit price elasticities and cross-elasticities. Journal of Public Transportation, 7(2), 3.

Taylor, B. D., Miller, D., Iseki, H., & Fink, C. (2009). Nature and/or nurture? Analyzing the determinants of transit ridership across US urbanized areas. Transportation Research Part A: Policy and Practice, 43(1), 60-77.

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.5.4 Implement Transit Service Frequency/Speed

Encourage Telecommuting and Alternative Work Schedules

Range of Effectiveness:

0.2 – 4.5% commute VMT reduction.

Measure Description:

Encouraging telecommuting and alternative work schedules reduces the number of commute trips and therefore VMT traveled by employees. Alternative work schedules could take the form of staggered starting times, flexible schedules, or compressed work weeks (CAPCOA 2010, p. 236).

Measure Applicability:

- Urban, suburban, and rural context
- Appropriate for retail, office, industrial, and mixed-use projects
- VMT reduction is dependent on the performance of individual building tenants and may change over time. On-going monitoring and adjustment is necessary to achieve sustained reductions in VMT.

Inputs:

The following information needs to be provided by the project applicant:

- Percentage of employees participating (1 – 25%)
- Telecommute elasticity (see discussion below)

Mitigation Method:

$$\%\ Commute\ VMT\ Reduction = E_{Telecommute} * Telecommute\ Delta$$

Where:

$$Telecommute\ Delta = \%\ change\ in\ workers\ telecommuting\ with\ TDM\ Program$$

$$E_{Telecommute} = \%\ change\ in\ VMT\ per\ \%\ change\ in\ workers\ telecommuting$$

$$E_{Telecommute} = \ 0.18\ to\ 0.90$$

Discussion:

Telecommute Delta and $E_{Telecommute}$ should consider the potential for building tenants to change over time. Higher values require the employer at the site to be known and unlikely to change over time. $E_{Telecommute}$ will be lower in places with higher non-drive alone mode share, and higher in places with more drive alone vehicle mode share.

References:

Handy, Tal, Boarnet. 2013. "Policy Brief on the Impacts of Telecommuting Based on a Review of the Empirical Literature."
https://www.arb.ca.gov/cc/sb375/policies/telecommuting/telecommuting_brief120313.pdf

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.4.6 Encourage Telecommuting and Alternative Work Schedules

Provide Ride-Sharing Programs

Range of Effectiveness:

2.5 – 8.3% commute VMT reduction.

Measure Description:

Increasing vehicle occupancy by ride-sharing results in fewer cars driving the same trip, and thus a decrease in VMT. Projects must implement a ride-sharing program as well as a permanent transportation management association membership and funding requirement to see VMT benefits. Funding may be provided by Community Facilities, District, or County Service Area, or other non-revocable funding mechanism (CAPCOA 2010, p. 227). Projects should promote ride-sharing programs through a multi-faceted approach such as:

- Designating a certain percentage of parking spaces for ride sharing vehicles
- Designating adequate passenger loading and unloading and waiting areas for ride-sharing vehicles
- Providing a web site or message board for coordinating rides
- Providing a guaranteed ride home program to carpool participants

Measure Applicability:

- Urban and suburban context
- Negligible impact in many rural contexts, but can be effective when a large employer in a rural area draws from a workforce in an urban or suburban area, such as when a major employer moves from an urban location to a rural location
- Appropriate for residential, retail, office, industrial, and mixed-use projects
- VMT reduction is dependent on the performance of individual building tenants and may change over time. On-going monitoring and adjustment is necessary to achieve sustained reductions in VMT.

Inputs:

The following information needs to be provided by the project applicant:

- Percent reduction in commute VMT
- Shared trips to VMT factor

Mitigation Method:

$$\%\ VMT\ Reduction = \%\ reduction\ in\ commute\ VMT \times Shared\ trips\ to\ VMT\ factor$$

Where:

$$\%\ reduction\ in\ commute\ VMT = 1.0\%\ to\ 20.0\%$$

$$Shared\ Trips\ to\ VMT\ Factor = 0.25\ to\ 0.50$$

Discussion:

The extent of reduction in VMT and the number of employees sharing a car is dependent on the employer, characteristics of employee's commutes and their home communities.

References:

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.4.3 Provide Ride-Sharing Programs

TCRP Report 95. Chapter 3: Park-and-Ride/Pool - Traveler Response to Transportation System Changes (2004).

TCRP Report 95. Chapter 5: Vanpools and Buspools - Traveler Response to Transportation System Changes (2005).

TCRP Report 95. Chapter 19: Employer and Institutional TDM Strategies - Traveler Response to Transportation System Changes (2010).

Mitigation Programs

FEHR PEERS

TECHNICAL MEMORANDUM

Date: 11.7.18

To: Chris Gray (WRCOG), Chris Tzeng (WRCOG), Sarah Dominguez (SCAG), Mike Gainor (SCAG)

From: Ronald T. Milam, AICP, PTP and Jason Pack, PE

Subject: Assessment of VMT Mitigation Programs for SB 743 OC18-0567

This technical memorandum presents an assessment of VMT mitigation programs that could be used for SB 743 implementation in the WRCOG region. The intent of this effort is to identify an approach to mitigation that goes beyond conventional project-site transportation demand management (TDM) strategies alone. The land use and transportation context for the WRCOG region presents a challenge to the effectiveness of common TDM strategies for VMT reduction when applied at individual project sites due to limited travel choices.

The approach to the overall assessment includes two parts. The first part evaluated how VMT reduction strategies or projects could be developed or incorporated into existing funding programs such as the Transportation Uniform Mitigation Fee (TUMF) program. The purpose of incorporating VMT reduction strategies directly into existing programs is to provide greater certainty and effectiveness for VMT impact mitigation. The second part of the assessment identified potential new mitigation program concepts that may be worthy of further evaluation.

Existing Programs

Two existing programs in Riverside County connect land use development projects to transportation network improvements: the Transportation Uniform Mitigation Fee (TUMF) and the Congestion Management Program (CMP). WRCOG developed and administers the TUMF as a traditional transportation impact fee program. The program collects a fair-share fee payment from new development to contribute to the cost of a capital improvement program (CIP) consisting of long-term transportation network expansion projects identified to accommodate planned population and employment growth. The TUMF program largely focuses on roadway capacity expansion with a total program cost of $3.76 billion. The CMP is prepared by the Riverside County Transportation Commission (RCTC). The CMP is designed to assess and monitor traffic congestion and transit performance while also

developing strategies to better manage congestion and its impacts on air quality. It includes a local land use development review component that normally occurs during the environmental review of projects. This review considers potential impacts that new land use projects may have on the CMP network. A common theme for the TUMF and CMP is that they focus on vehicle LOS as the key metric for determining deficiencies and developing CIP projects although the CMP includes a public transit element.

In their current form, the TUMF and CMP would not qualify as VMT impact mitigation programs. For the example, the TUMF CIP is largely focused on roadway capacity expansion that contributes to VMT increases. Direct evidence of the VMT increase can be found in program documentation such as the following table excerpt from the TUMF nexus study. The table includes a comparison of VMT with and without the TUMF program. The TUMF projects induce total VMT under 2040 conditions from 29,277,587 to 31,022,272.

Table 4.6 – Regional Highway System Measures of Performance
(2012 Baseline and 2040 No-Build Scenarios to 2040 TUMF Build Scenario)

Measure of Performance*	Peak Periods (Total)		
	2012 Baseline	2040 No-Build	2040 Build
VMT - Total ALL FACILITIES	19,532,437	29,277,587	31,022,272
VMT - FREEWAYS	11,019,155	14,487,570	13,411,377
VMT - ALL ARTERIALS	8,513,282	14,790,016	17,610,895
TOTAL - TUMF ARTERIAL VMT	**5,585,202**	**9,089,495**	**9,902,433**
VHT - TOTAL ALL FACILITIES	575,154	1,361,907	1,180,647
VHT - FREEWAYS	296,542	736,433	530,849
VHT - ALL ARTERIALS	278,611	625,474	649,797
TOTAL TUMF ARTERIAL VHT	**181,151**	**396,981**	**354,639**
VHD - TOTAL ALL FACILITIES	175,765	739,075	489,238
VHD - FREEWAYS	117,430	502,549	312,669
VHD - ALL ARTERIALS	58,334	236,527	176,569
TOTAL TUMF ARTERIAL VHD	**45,080**	**172,944**	**114,833**
VMT LOS E - TOTAL ALL FACILITIES	6,188,644	16,966,992	14,299,498
VMT LOS E - FREEWAYS	4,532,703	10,156,363	8,982,566
VMT LOS E & F - ALL ARTERIALS	1,655,941	6,810,629	5,316,932
TOTAL TUMF ARTERIAL VMT w/ LOS E or worse	**1,462,061**	**5,160,911**	**3,735,762**
% of TUMF ARTERIAL VMT w/ LOS E or worse	**26%**	**57%**	**38%**

* Based on RivTAM 2012 network provided by Riverside County Transportation Department and SCAG 2016 RTP/SCS SED with updated 2015 arterial network completed by WSP, September 2016.

NOTES:

Volume is adjusted by PCE factor

VMT = vehicle miles of travel (the total combined distance that all vehicles travel on the system)

VHT = vehicle hours of travel (the total combined time that all vehicles are traveling on the system)

VHD = vehicle hours of delay (the total combined time that all vehicles have been delayed on the system based on the difference between forecast travel time and free-flow (ideal) travel time)

LOS = level of service (based on forecast volume to capacity ratios).

LOS E or Worse was determined by V/C ratio that exceeds 0.9 thresholds as indicated in the Riverside County General Plan.

Despite this VMT increase, the TUMF program does include some transit, bicycle, and pedestrian projects that could contribute to VMT reduction. For example, the following table from the TUMF Nexus Study identifies specific transit projects that are included in the program.

Table 4.3 - Unit Costs for Transit Capital Expenditures

Component Type*	Cost Assumptions as published October 18, 2002	Cost Assumptions per 2009 Nexus Update October 5, 2009	**Cost Assumptions per 2015 Nexus Update**	Description
Transit Center 1			**$6,000,000**	Relocation/expansion of existing Regional Transit Center with up to 14 bus bays and park and ride
Transit Center 2	$6,000,000	$5,655,000	**$9,000,000**	New Regional Transit Center with up to 14 bus bays and park and ride
Transfer Facility			**$1,000,000**	Multiple route transfer hub
O & M Facility			**$50,000,000**	Regional Operations and Maintenance Facility
Bus Stop	$10,000	$27,000	**$40,000**	Bus Stop Amenities Upgrade on TUMF Network
BRT Service Capital	$540,000	$550,000	**$60,000**	BRT/Limited Stop Service Capital (per stop**)
Vehicle Fleet 1			**$155,000**	Medium Sized Bus Contract Operated
Vehicle Fleet 2	$325,125	$550,000	**$585,000**	Large Sized Bus Directly Operated
COA Study			**$950,000**	Comprehensive Operational Analysis Study component of Nexus Study Update

* Transit Cost Component Types were restructured as part of the 2015 Nexus Update in accordance with the RTA Comprehensive Operational Analysis (January 2015)
** BRT Service Capital Cost Assumption was based on a per mile unit in 2009 Nexus Update. 2016 Nexus Update uses a per stop unit cost for BRT Service Capital

If the transit, bicycle, and pedestrian projects were separated into a stand-alone CIP with a supporting nexus study based on VMT reduction, then a new VMT fee program could be developed that is dedicated to VMT impact mitigation. This could be a new program implemented by WRCOG or individual jurisdictions. An example of this type of program has been developed the City of Los Angeles as part of their Coastal Transportation Corridor Specific Plan and West Los Angeles Transportation Improvement and Mitigation Specific Plan. Details are provided at the following website.

http://www.westsidemobilityplan.com/ctcspwla-timp-final-eir/

The nexus relies on VMT reduction and the nexus study is included as Appendix B in the Draft EIR link on the website.

It may also be possible for a development project applicant to fully fund a transit, bicycle, or pedestrian project from the TUMF as an alternative to paying the fee directly. The TUMF program currently allows fee credits for development that expedites and completes TUMF-identified projects (most recently exhibited by the development funding the Cajalco Interchange project). Using this option requires inclusion of the mitigation in a development agreement or an EIR.

The CMP program could also be adapted to blend the congestion management objectives with VMT reduction. The current focus is to expand roadway capacity to address vehicle LOS deficiencies. This approach does not reduce congestion (i.e., travel speeds do not increase). Instead, expanding roadway capacity in congested areas induces new vehicle travel that diminishes congestion relief benefits and generates new VMT and emissions. Refer to the following websites for more research information and technical details.

- http://www.dot.ca.gov/newtech/researchreports/reports/2015/10-12-2015-NCST_Brief_InducedTravel_CS6_v3.pdf
- https://www.arb.ca.gov/cc/sb375/policies/hwycapacity/highway_capacity_brief.pdf
- https://trrjournalonline.trb.org/doi/abs/10.3141/2653-02

Managing and reducing demand could accomplish the CMP goal especially by focusing on reducing peak period VMT. The main source of congestion as defined by the CMP is that vehicles move too slow (i.e., peak period speeds are lower than posted speed limits). This definition of congestion describes a symptom and fails to recognize that peak period travel consists of vehicles with poor seat utilization caused by not managing demand more effectively and mispricing travel demand. The existing roadway network has a limited capacity and this capacity is routinely filled up during peak periods in Riverside County by vehicles with solo drivers (i.e., low seat utilization). Further, limited facilities exist that prioritize travel by high occupancy vehicles. Increasing vehicle speeds and reducing delays substantially requires much greater seat utilization in existing vehicles (i.e., private vehicles and public transit). This change would also reduce VMT. Hence, refocusing the CMP on the combination of congestion management and VMT reduction would result in a different CIP that could qualify as VMT impact mitigation.

New Mitigation Program Concepts

Beyond the conventional programs described above are two new concepts that are not currently available in Riverside County. For purposes of this study, these programs are defined as follows.

- **VMT Mitigation Exchange** – An exchange program is a concept where VMT generators can select from a pre-approved list of mitigation projects that may be located within the same jurisdiction or possibly from a larger area. The intent is to match the project's needed VMT

reduction with a specific mitigation project of matching size and to provide evidence that the VMT reduction will reasonably occur.

- **VMT Mitigation Bank** – A mitigation bank is intended to serve as an entity or organization that pools fees from development projects across multiple jurisdictions to spend on larger scale mitigation projects. This concept differs from the more conventional impact fee program approach described above in that the fees are directed to a few larger projects that have the potential for a more significant reduction in VMT and the program is regional in nature.

As these new mitigation program concepts are still evolving, the specific descriptions and elements of the programs will likely change. The first resource document to describe and assess these programs was recently published by U.C. Berkeley and is entitled, "Implementing SB 743, An Analysis of Vehicle Miles Traveled Banking and Exchange Frameworks," The University of California Institute of Transportation Studies, October 2018. This document is a useful starting place for a dialogue about these programs.

The findings of the report are supportive of these concepts noting the following about the reasoning for their consideration.

> *Yet while methods for reducing VMT impacts—such as mileage pricing mechanisms, direct investments in new public transit infrastructure, transit access subsidies, and infill development incentives—are well understood, they may be difficult in some cases to implement as mitigation projects directly linked or near to individual developments. As a result, broader and more flexible approaches to mitigation may be necessary. In response, state and local policy makers are considering the creation of mitigation "banks" or "exchanges." In a mitigation bank, developers would commit funds instead of undertaking specific on-site mitigation projects, and then a local or regional authority could aggregate these funds and deploy them to top-priority mitigation projects throughout the jurisdiction. Similarly, in a mitigation exchange, developers would be permitted to select from a list of pre-approved mitigation projects throughout the jurisdiction (or propose their own), without needing to mitigate their transportation impacts on-site. Both models can be applied at a city, county, regional, and potentially state scale, depending on local development patterns, transportation needs and opportunities, and political will.*

This reasoning is important for lead agencies in the WRCOG area because mitigating VMT impacts on a project-by-project basis is challenging especially in suburban and rural land use contexts where travel choices are limited. That said, the UCB report and research conducted for this study identified the following key challenges with these types of programs.

- Challenges for Mitigation Exchanges
    - Potential mismatch between funds and mitigation projects available
    - Potential for reduced oversight of project selection
    - Difficulty in verifying VMT reductions and their sustainability especially with VMT generation changing over time due to disruptive transportation trends such as transportation network companies (TNCs) and autonomous vehicles (AVs)
    - Difficulty in demonstrating an essential nexus
    - Potential opposition to mitigation not directly occurring in the project impact area especially if impacts are concentrated in or near disadvantaged communities and the mitigation occurs in more affluent areas

- Challenges for Mitigation Banks
    - Increased need to conduct careful CEQA/Mitigation Fee Act analysis
    - Accounting challenge in delay from fee payment to project funding
    - Greater need for program administration budget
    - Political difficulty in distributing mitigation projects and coordinating across jurisdictions
    - Difficulty in verifying VMT reductions and their sustainability especially with VMT generation changing over time due to disruptive transportation trends such as transportation network companies (TNCs) and autonomous vehicles (AVs)
    - Difficulty in demonstrating an essential nexus
    - Potential opposition to mitigation not directly occurring in the project impact area especially if impacts are concentrated in or near disadvantaged communities and the mitigation occurs in more affluent areas

Another important element for either of these concepts is to have an entity that is responsible for establishing, operating, and maintaining the program. This is a potential role for a sub-regional or regional entity especially for programs that would extend mitigation projects beyond individual jurisdictional boundaries. A key part of 'operations' is that the entity will need the capability to provide verification of the VMT reduction performance and to adjust the program projects over time. Whether the entity is regional or sub-regional is another important consideration. A sub-regional entity could help minimize potential concerns about mitigation not occurring near the project site or in the same community,

The potential desire for VMT Mitigation Exchanges or Banks may depend on how lead agencies and developers respond to the initial implementation of SB 743 currently schedule to go into effect July 1, 2020. If many projects are found to have significant VMT impacts and problems occur with finding feasible mitigation measures for individual projects, then interest may grow for more program-based mitigation.

Summary

To help understand the full range of VMT impact mitigation and their particular benefits and challenges, Table 1 provides a high-level summary comparison.

Table 1 – Summary of VMT Impact Mitigation Options

Mitigation Option	Description	Benefits	Challenges
No feasible action	This option recognizes that feasible mitigation is not available due to the land use or transportation context.	- Recognizes the limitations of VMT impact mitigation when alternatives to driving are not reasonably available.	Could result in more significant and unavoidable (SAU) impacts that require an EIR instead of a negative declaration.
Change project	This option would tend to focus on changing built environment characteristics of a project such as its land use density or diversity to reduce vehicle travel.	- Mitigation may not require long-term monitoring (see substantial evidence summarized in the *SB 743 Implementation TDM Strategy Assessment Technical Memorandum dated 6.11.18*). - Mitigation reduces VMT (and other vehicle travel) in immediate vicinity of the project site.	Project applicants may resist land use or other built environment changes due to financial concerns and market feasibility.
TDM	This option relies on strategies to reduce vehicle travel through incentives and disincentives often tied to the cost and convenience of vehicle travel.	- Mitigation reduces VMT (and other vehicle travel) in immediate vicinity of the project site. - Multiple mitigation strategies to choose from such that a project applicant may find co-benefits from the strategies also serving as project amenities.	- Mitigation monitoring required because effectiveness depends on building tenants, which can change over time. As a result, impacts will remain SAU. - Creates potential financial equity issues between existing and new land uses. Existing land use with TDM mitigation will have lower operating costs.

Table 1 – Summary of VMT Impact Mitigation Options

Mitigation Option	Description	Benefits	Challenges
Impact fee program	This option requires developing a new impact fee program with a nexus based on VMT reduction. This type of nexus would allow the fee program capital improvement program (CIP) to include transit, bicycle, pedestrian and other types of projects that can demonstrate VMT reduction effectiveness.	- Provides clear expectations for developers about the VMT mitigation costs. - Increases funding for VMT reduction projects such that larger and more effective projects may be implemented. - May result in greater levels of VMT reduction compared to project-by-project mitigation.	- Requires lead agency to develop stakeholder support and funding to create and maintain the fee program. - Mitigation (e.g., CIP projects) may not occur in immediate vicinity of the project site where impacts of vehicle travel will be most directly felt by neighbors.
Mitigation bank/exchange	This option matches VMT generators with VMT reducers within or beyond jurisdictional boundaries through a third party.	- Could create mitigation options that may not otherwise be available or feasible. - Not limited to jurisdictional boundaries. - Could create incentive for new innovative mitigation ideas.	- Requires an entity capable of operating and maintaining the program with the ability to verify VMT reductions. - Mitigation may not occur in immediate vicinity of the project site where impacts of vehicle travel will be most directly felt by neighbors.
General plan coverage	This option would address VMT impacts through a general plan update or amendment EIR and rely on CEQA Guidelines Section 15183 for subsequent project streamlining (as summarized in the *SB 743 Implementation Thresholds Assessment Technical Memorandum dated 10.31.18*).	- Addresses VMT reduction expectations in consideration of other jurisdictional objectives. - Offers a wider range of mitigation options than at the project-scale. - For subsequent projects consistent with the general plan, additional VMT impact analysis would not be required.	- General plan updates or amendments require substantial time and funding commitments.