BCAG SB 743 Implementation – VMT Analysis Methodology

Assessing Options

BACKGROUND

This technical document summarizes the VMT analysis methodology options that could be used in Butte County to comply with SB 743. Analysis methodology covers how projects will be analyzed to determine VMT impacts and involves three key questions for lead agencies.

- What model should be used to forecast VMT effects of land use and transportation projects?
- What VMT metrics should be used for VMT impact analysis?
- What analysis year constitutes baseline conditions for VMT impact analysis?

To help answer these questions, this document describes the available options along with their basic pros and cons and then offers a recommendation. This recommendation is not binding on lead agencies but does reflect the available evidence about which options are best suited to comply with CEQA expectations.

VMT ANALYSIS METHODOLOGY

State law does not dictate what VMT methodology or metric form to use. The CEQA Guidelines Section 15064.3(b)(4) provides substantial discretion for lead agencies to choose their methodology and VMT metric form.

> *15064.3(b)(4) Methodology. A lead agency has discretion to choose the most appropriate methodology to evaluate a project's vehicle miles traveled, including whether to express the change in absolute terms, per capita, per household or in any other measure. A lead agency may use models to estimate a project's vehicle miles traveled, and may revise those estimates to reflect professional judgment based on substantial evidence. Any assumptions used to estimate vehicle miles traveled and any revisions to model outputs should be documented and explained in the environmental document prepared for the project. The standard of adequacy in Section 15151 shall apply to the analysis described in this section.*

As allowed by this discretion, lead agencies may select from available models that produce VMT estimates and forecasts or create their own. Under some circumstances, lead agencies may also choose to use qualitative methods per the CEQA Guidelines.

> *15064.3(b)(3) Qualitative Analysis. If existing models or methods are not available to estimate the vehicle miles traveled for the particular project being considered, a lead agency may analyze the*

project's vehicle miles traveled qualitatively. Such a qualitative analysis would evaluate factors such as the availability of transit, proximity to other destinations, etc. For many projects, a qualitative analysis of construction traffic may be appropriate.

Model Options

The available models covering Butte County that are appropriate for SB 743 VMT impact analysis are limited to the California Statewide Travel Demand Model (CSTDM) and the BCAG TDM. Some local agencies may have older models used for past general plan updates but those models have not been updated or maintained. Other sketch planning models are also available that produce project generated VMT forecasts (see Appendix A). However, these models are not capable of producing city-wide or region-wide average VMT estimates that are recommended as benchmarks for VMT impact significance thresholds as specified in the *Technical Advisory on Evaluating Transportation Impacts in CEQA*, California Governor's Office of Planning and Research, December 2018. Therefore, they are not considered further in this study.

The CSTDM has a base year of 2015 and a future year of 2040 and is intended for inter-regional and statewide analysis. It was not designed for individual land use or transportation project scale applications but does produce VMT outputs that may be useful for purposes such as reasonableness checks. Other important limitations of this model are listed below.

- Model access is limited to Caltrans and select users.
- The 2015 analysis year was prior to the Camp Fire and too far removed from CEQA expectations for baseline conditions, which are typically current year (i.e., 2021).

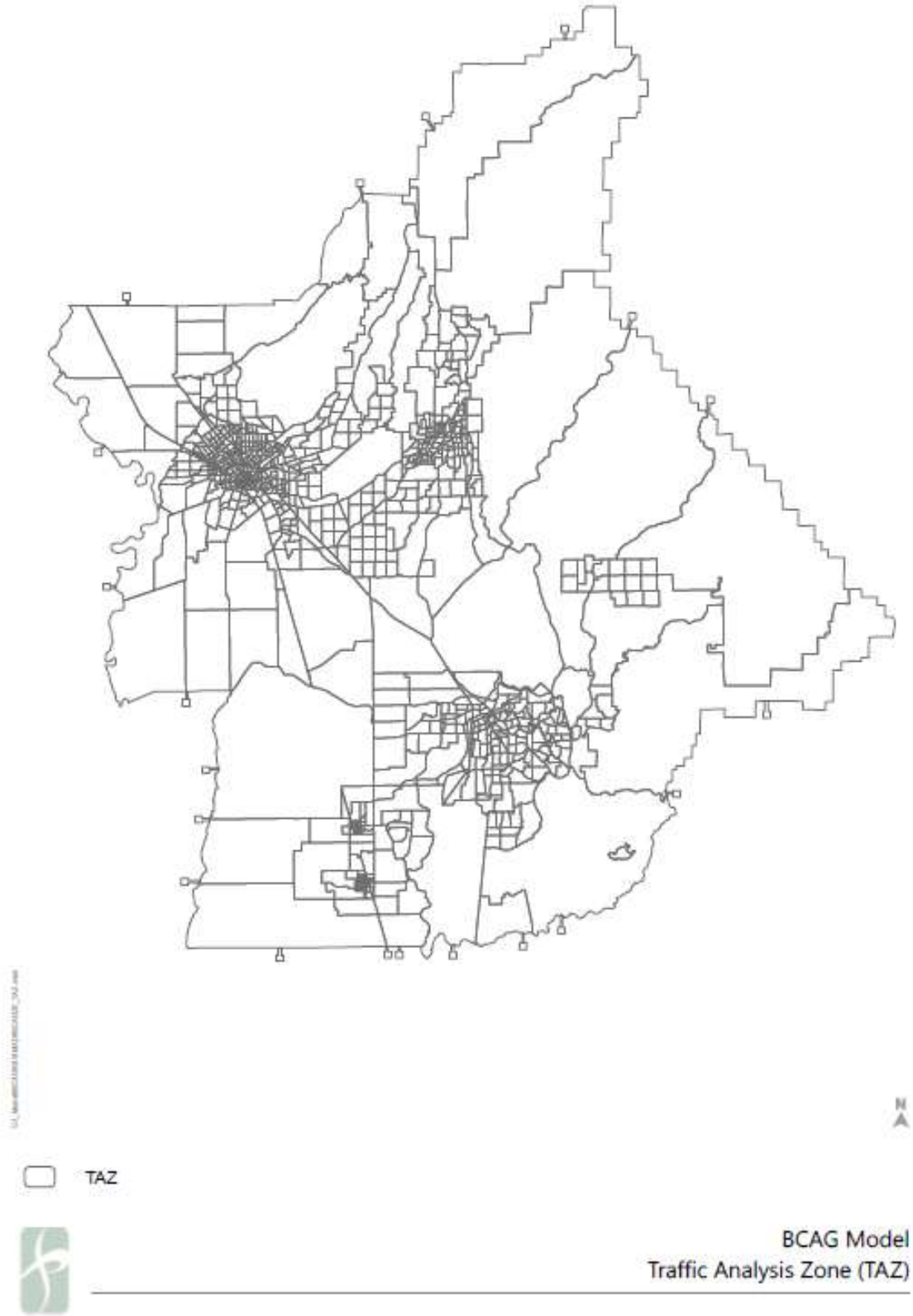
Access to static VMT outputs from the model are available at the following Caltrans website.

- https://dot.ca.gov/programs/transportation-planning/multi-modal-system-planning/statewide-modeling/sb-743-vmt-impact-assessment

The BCAG TDM was developed for regional planning and analysis purposes associated with the regional transportation plan/sustainable communities strategy (RTP/SCS). The current version of the model has a 2018 base year and forecast years of 2020 and 2040. The 2018 base year model represents pre-Camp Fire conditions while the 2020 version represents post-Camp Fire conditions. The 2020 version is currently being updated based on the Post Camp Fire Regional Population & Transportation Study. This study is using 'big data' such as mobile device tracking to update the 2020 population, employment, and traffic pattern inputs for the model.

While the primary purpose of the BCAG TDM is to support the RTP/SCS analysis, the model was designed with sufficient detail for local and project scale applications including VMT impact analysis. However, the model should be tested and potentially refined prior to its use for a local area project. Testing should verify that the model is appropriately sensitive within specific study areas and for the type of project being analyzed. The traffic analysis zone (TAZ) map is shown below to help visualize the level of detail. The

TAZs are polygons that represent areas with similar land use and travel characteristics. Land use, demographic, and socioeconomic variables for each TAZ are used to estimate and forecast trips that travel between the TAZs. By tracking these trips across the network, VMT can be measured for each TAZ, any aggregation of TAZs, or for any physical network boundary. Project effects on VMT can be forecast by changing the TAZ inputs to represent the addition of the project and re-running the model to isolate changes in vehicle trips across the network. Preferably, a new TAZ will be created for the project site inputs. This approach makes it easier to track project effects throughout the model for a variety of travel demand output variables and the VMT changes can be visualized in terms of where volumes change due to the project.



BCAG Model
Traffic Analysis Zone (TAZ)

As part of this SB 743 implementation study, the BCAG TDM was reviewed and updated to improve its capabilities for project scale VMT analysis. Minor network and land use corrections were made along with adjustments to trip lengths for those trips that either start or end outside the region. These trips were previously truncated at the model boundary. The new adjustment accounts for the trip length occurring outside the model boundary. The model is available from BCAG through the following website.

- http://www.bcag.org/Planning/Transportation-Forecasting/index.html

This website also contains links to the model development documentation and user guide.

Model Recommendations

Of the available models, the BCAG TDM is the best available model for VMT forecasts and analysis to comply with CEQA expectations related to SB 743. The model has been calibrated and validated to Butte County and been routinely used for a variety of regional and local environmental impact analysis. While lead agencies have the discretion to choose their preferred methodology, this study recommends use of the BCAG TDM.

Metric Options

Lead agencies also have the discretion to select their preferred VMT metric(s). Visualizations and descriptions of several commonly used VMT metric options are provided below.

Metric	Definition	Visualization
Total VMT	All vehicle-trips (i.e., passenger and commercial vehicles) or passenger only vehicle-trips are assigned on the network within a specific geographic boundary (i.e., model-wide, region-wide, city-wide). Vehicle volume on each link is multiplied by link distance.	
Total VMT generated by a project	All vehicle-trips are traced to the zone or zones of study. This includes internal to internal (II), internal to external (IX), and external to internal (XI) trips. May use final assignment origin-destination (OD) trip tables or production (P) and attraction (A) estimates multiplied by distance skims.	

Metric	Definition	Visualization
Total VMT per service population	Same method as above (Total VMT generated by a project) to estimate VMT and then divide by the population and employment of the zone or zones of study.	
Home-based VMT per resident	All automobile (i.e., passenger cars and light-duty trucks) vehicle-trips that start or end at the home are traced, but non-home-based trips made by residents elsewhere on the network are excluded.	
Home-based work VMT per employee	All automobile trips between home and work are traced.	

All these metrics have potential use for environmental impact analysis. Choosing the appropriate ones depends on the purpose of the analysis (i.e., air quality versus transportation impacts). The recommendations below address this conditional aspect of VMT metrics.

Metric Recommendations

The following VMT metrics are recommended for use in VMT impact analysis according to the specific type of project and analysis.

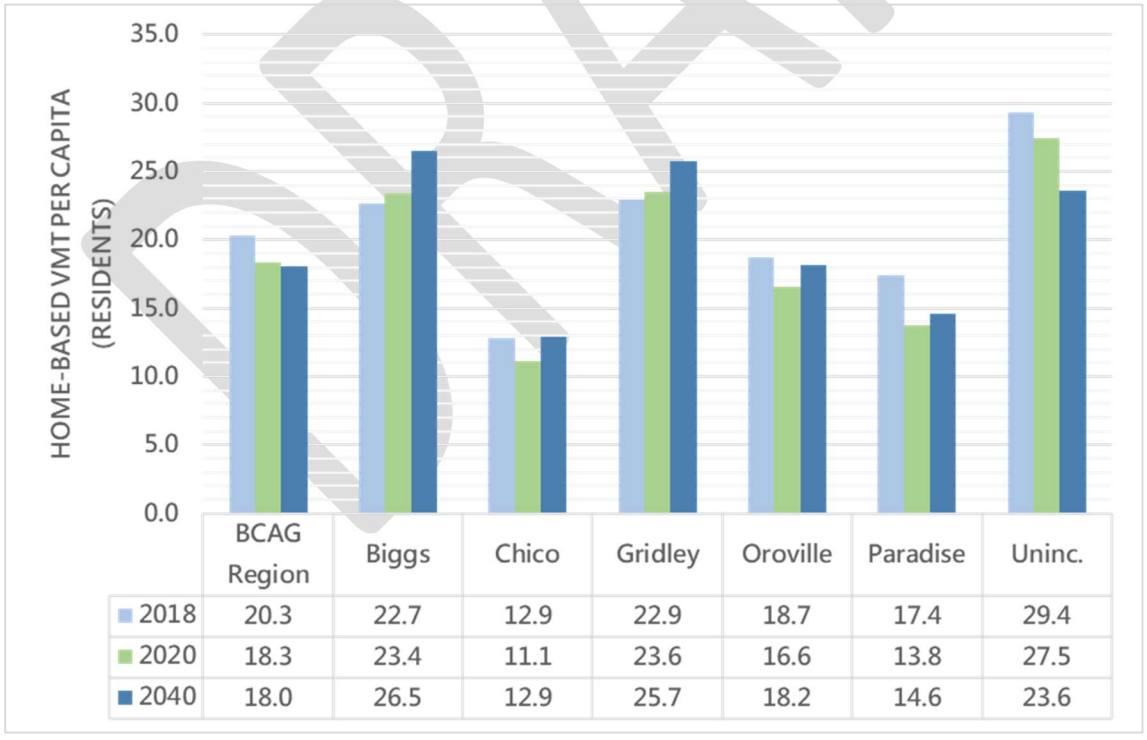
- Total VMT (by speed bin) – Used for air quality, energy, GHG and transportation impact analysis.
- Total project generated VMT – Used for air quality, energy GHG, and transportation impact analysis.

- Total VMT per service population (population plus employment) – Used for transportation impact analysis typically under cumulative conditions and for large area plans such as general and specific plans.
- Home-based VMT per resident – Used for transportation impact screening and analysis of residential projects.
- Home-based work VMT per employee – Used for transportation impact screening and analysis of work-related land uses

Of these metrics, the OPR *Technical Advisory on Evaluating Transportation Impacts in CEQA* recommends the following uses for VMT impact screening.

- Use Total VMT for retail and similar land use projects.
- Use Home-based VMT per resident for residential land use projects.
- Use Home-based work VMT per employee for office projects.

All of the metrics above can be produced by the BCAG TDM for base year and future year conditions. An example of the home-based VMT per resident metric from the model is provided below for each jurisdiction in Butte County. As shown in the chart, home-based VMT per resident changes over time. This is an important when considering the final methodology question related to the selecting a specific analysis year to represent baseline conditions.



	BCAG Region	Biggs	Chico	Gridley	Oroville	Paradise	Uninc.
2018	20.3	22.7	12.9	22.9	18.7	17.4	29.4
2020	18.3	23.4	11.1	23.6	16.6	13.8	27.5
2040	18.0	26.5	12.9	25.7	18.2	14.6	23.6

Source: Modified version of the BCAG RTP/SCS TDM. Modifications to the BCAG TDM are still being refined so these estimates and forecasts are expected to be updated including a new 2020 forecast year based on the results of the Post Camp Fire Regional Population and Transportation Study (PCFS).

Baseline Options

Baseline is normally defined as the analysis year when the environmental impact analysis is commenced. So, a project starting its impact analysis in 2021 would use this year as its baseline. The 2020 forecast above is the closest year to 2021 but will become less relevant over time. Further, an updated 2020 is being prepared as part of the Post Camp Fire Regional Population and Transportation Study (PCFS). The Camp Fire creates a unique methodology question for lead agencies. The base year of the model is 2018 representing conditions prior to the Camp Fire. The current 2020 forecast year was designed to represent post Camp Fire conditions but does not reflect the most complete data that was collected for the Post Camp Fire Regional Population and Transportation Study. As such, which year best represents current baseline conditions for CEQA analysis?

Baseline Recommendations

As of the writing of this document in February 2021, lead agencies may select the 2018 base year or current 2020 forecast year VMT forecasts as the best available data to represent CEQA baseline conditions. The VMT output from both model versions represent pre COVID-19 conditions but how well they match post Camp Fire conditions may differ. Determining which model version to use should consider how well the model volume outputs match available traffic counts in the study area and associated jurisdiction under pre-COVID-19 conditions in 2019 or 2020. When the new PCFS 2020 forecast year is ready, that 2020 version of the model is expected to better represent post Camp Fire conditions but should still be checked against local traffic counts as noted above.

Over time, baseline conditions may require the use of interpolation to represent the current year. For example, an analysis in 2023 may require an estimate of 2023 VMT conditions. As part of the PCFS, a 2025 version of the model is being developed. Interpolating between 2020 and 2025 may be necessary to produce baseline year VMT estimates for 2022, 2023, 2024, etc. BCAG typically updates the TDM every four to five years so interpolation may only be necessary in between model updates.

APPENDIX A

Sketch Planning Tool Assessment

Sketch planning tools are generally designed for project-scale applications to estimate VMT or to evaluate VMT reduction strategies associated with transportation demand management (TDM). Given their project-scale focus, a major limitation for all these tools is that they are not capable of producing region-wide or city-wide average VMT metrics for purposes of threshold setting. The OPR *Technical Advisory on Evaluating Transportation Impacts in CEQA* 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.*

Given the above, the sketch models are not appropriate for VMT impact analysis. Therefore, the focus of this assessment is on the strength of the tools for VMT mitigation testing. To the extent that these tools are currently being used by lead agencies for VMT analysis related to air quality or GHG impacts, other limitations of the tools may be important to note as highlighted in reviews by UC Davis and UC Berkeley.[1]

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).

[1] Specific Citations:

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

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

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 tool 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.

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 various 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 below provides a summary of the tool review related to VMT mitigation testing.

Sketch Tool	Output	Includes VMT Mitigation Testing?	Strength of Evidence Supporting VMT Estimates and Mitigation Reductions
CalEEMod	VMT	Yes	Limited. Relies on *Quantifying Greenhouse Gas Mitigation Measures*, CAPCOA, 2010, which is currently undergoing an update. The tool does not differentiate between VMT reduction strategies that are appropriate at the community versus project scale and does not consider whether strategies have sufficient evidence for CEQA application.
Sketch 7	% Change in VMT	No	Not applicable.
VMT Impact Tool/Salon	% Change in VMT	No	Not applicable.
GreenTRIP Connect	VMT; Change in VMT	Yes	Limited. Includes affordable housing and TDM credit for 4 strategies but lacks sufficient evidence for CEQA application.
UrbanFootprint	VMT	Yes	Limited. No TDM reduction but land use changes can be tested (e.g., density and diversity of uses).
Envision Tomorrow	VMT	No	Not applicable.
CA Smart Growth Tool	Trips	No	Not applicable.
TRIMMS	VMT	Yes	Limited. Includes a variety of TDM strategies but research support is often prior to 2010 and the tool does not differentiate between VMT reduction strategies that are appropriate at the community versus project scale and does not consider whether strategies have sufficient evidence for CEQA application.
MXD+	Trips; VMT	Yes	Limited. No TDM reduction but land use changes can be tested (e.g., density and diversity of uses)
VMT+	VMT	No	Not applicable.
TDM+	% Change in VMT	Yes	Robust. Relies on *Quantifying Greenhouse Gas Mitigation Measures*, CAPCOA, 2010 but limits strategies to those applicable at the project scale and with sufficient evidence for CEQA application.