FEHR PEERS

Memorandum

Date: May 19, 2020

To: Olivia Ervin, City of Petaluma

From: Ian Barnes and Matt Goyne, Fehr & Peers

Subject: Summary of Key Decisions for SB 743 Implementation in the City of Petaluma

SF19-1023

This memorandum summarizes the key decisions that are required for implementation of Senate Bill (SB) 743 within the City of Petaluma. SB 743 eliminates the use of automobile delay from the CEQA environmental review process and the determination of CEQA transportation impacts. The new metric required by the CEQA Guidelines is vehicle-miles traveled (VMT). The shift from automobile delay to VMT changes the focus of transportation impact analysis in CEQA from measuring impacts *to* drivers, to measuring the impact *of* driving.

SB 743 takes full effect on July 1, 2020; after that time, all transportation impact analysis for CEQA must rely on VMT. CEQA Statute Section 21099(b)(2) states that upon certification of the 2018 CEQA Guidelines, LOS shall not be considered a significant impact on the environment; since the Guidelines were certified in December 2018, a literal reading of the statute would indicate that LOS can no longer be used. One recently published appellate court decision, *Citizens for Positive Growth & Preservation v. City of Sacramento*, supported the interpretation that LOS can no longer be used in findings of CEQA impact significance.

As described in this memorandum, SB 743 has ramifications for a range of City processes, including but not limited to the CEQA review process, the entitlements review process, and the traffic impact fee.

Key Decisions for SB 743 Implementation

Changing the metric used to determine significant transportation impacts requires the City to provide guidance on the following items:

- **Metrics,** or how VMT is presented;

- **Methods,** or how VMT will be calculated;
- **Screening,** or determining which projects require quantitative or qualitative VMT analysis;
- **Thresholds,** or how much VMT is determined to have a significant impact on the environment;
- **Mitigation Options,** or how project sponsors can address significant VMT impacts related to their projects; and,
- **Case Studies,** or how the findings of CEQA Transportation analysis could change under VMT for several previously-approved projects.

In addition, each of the above decisions must include guidance related to three separate project types:

- **Land Use Projects,** including development projects for a variety of land uses;
- **Land Use Plans,** including future General Plan updates and future Specific Plans, Area Plans, and Precise Plans; and,
- **Transportation Projects,** including infrastructure changes, lane additions or removals, bicycle and pedestrian facilities, etc.

The options and decisions available to Petaluma are further summarized in the accompanying matrix (**Attachment A**).

Metrics

The City of Petaluma may assess projects based on a preferred VMT metric. There are two options for measuring VMT: 1) project-generated VMT; and 2) the project's effect on VMT. There are several options for reporting VMT, including total VMT, partial VMT (such as VMT disaggregated by trip purpose), or VMT as an efficiency metric (such as VMT per resident).

Measuring VMT for CEQA Transportation Analysis

Project-generated VMT measures the total amount of automobile (or all vehicle type) travel generated by a project. Typically, this method is performed by running the travel demand model (where the total number and lengths of trips have been estimated and tracked through the roadway system) or by multiplying the estimated number of project trips generated by an average trip length. Project-generated VMT may be an appropriate measurement method for greenfield or standalone projects that reinforce prevailing land use patterns (i.e. residential development on the fringe of the City of Petaluma). In the past, project-generated VMT has been calculated for

use as an input in the CEQA Air Quality, Greenhouse Gas, and Energy sections, and it is anticipated that these CEQA sections will continue require a project-generated VMT estimate.

Project effect on VMT includes measuring all VMT on roadways within a selected area or boundary and can be used to assess a project's effect on VMT. Project effect information is more meaningful for VMT analysis because land use projects and land use plans often influence the vehicle travel associated with neighboring land uses and may displace other existing trips within the region (i.e. new retail development in an underserved area). Project effect on VMT is also the preferred type of VMT for measuring VMT for transportation projects. **Figure 1** illustrates the difference between these two types of VMT.

Reporting VMT for CEQA Transportation Analysis

There are several ways to report VMT, in which the VMT measured is converted into an efficiency metric and/or further subdivided by trip purpose. The reported VMT is what will typically be used in CEQA Transportation analyses.

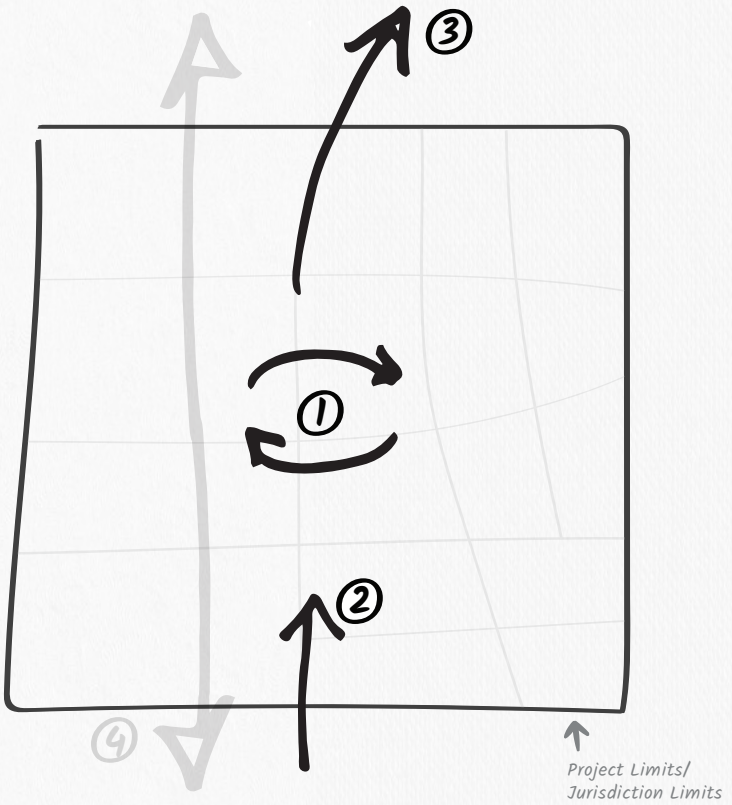
New land use projects accommodate population and employment growth; this growth generates new VMT (e.g., a new office building resulting from a land use rezone will generate new vehicle trips and VMT). Whether a project contributes to a more efficient land use pattern (i.e., one that requires less vehicle travel compared to similar land uses) can be determined by using a VMT efficiency metric. Efficiency metrics express a total increase in VMT relative to the increase in residents and employees (VMT per resident, or VMT per worker). Total project-generated VMT as a stand-alone metric tends to be more relevant as an input to Air Quality, Greenhouse Gas, and Energy consumption impact analysis.

VMT efficiency metrics can be further disaggregated into specific types of VMT and populations, such as considering only the VMT generated by residents making trips to and from home. Each of the VMT efficiency metrics listed below addresses a slightly different question in terms of impact analysis. **Table 1** also provides a primer on what types of VMT are captured under each category.

- **Home-based VMT per resident** measures VMT generated by trips that have an origin or destination at a home location and reflects how close households are to common destinations, as well as the available transportation options. Because the trip type is specific to local residents, it helps compare residential projects across different locations. However, it omits many different trip types (such as a trip made from a work location to a retail location or trip made by a delivery driver to a residence) and is considered a "partial" VMT metric.

  Answers the question: Do people living here drive more or less on average compared to other places?

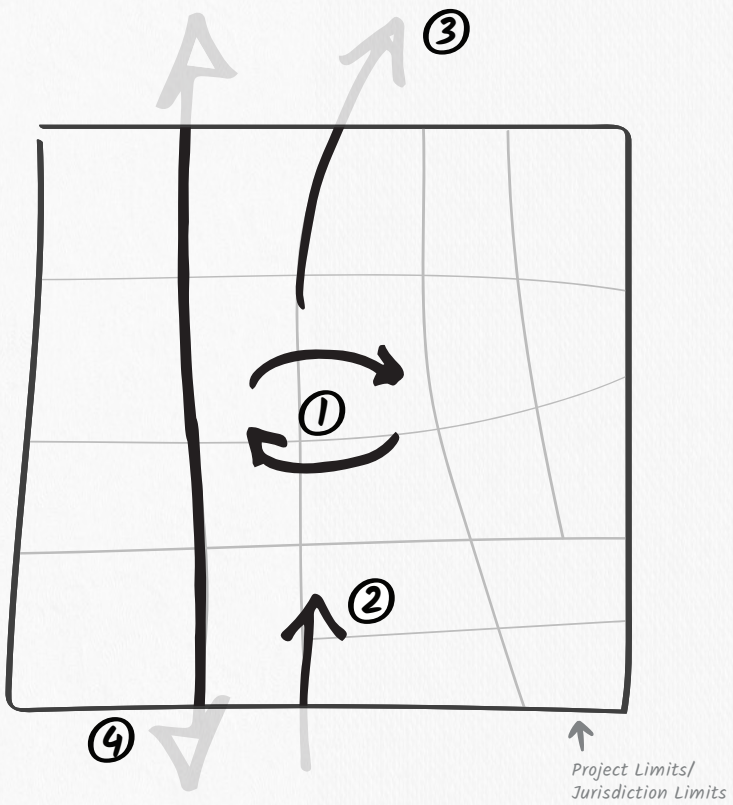
Project Generated VMT



① 2x Internal to Internal (2xII) VMT
② External to Internal (XI) VMT
③ Internal to External (IX) VMT
④ External to External (XX) VMT

Notes: External to External (XX) trips are excluded from this VMT metric. Adjustments to project generated VMT made to include the full length of trips that leave the jurisdiction to capture inter-jurisdiction travel.

Project Effect on VMT
(Boundary VMT)



① Internal to Internal VMT
② External to Internal (XI) VMT
③ Internal to External (IX) VMT
④ External to External (XX) VMT

Notes: Boundary VMT is all the VMT on the streets within the Project Limits / Jurisdiction Limits.

Figure 1

Measuring Vehicle Miles Traveled (VMT)

- **Home-based work VMT per employee** reflects how close a workplace is to places where employees live. Because the trip type is specific to work trips, it helps compare office or other employment projects across different locations. However, it omits many different trip types (such as a trip made by an employee traveling from work to the grocery store) and is considered a "partial" VMT metric.

  Answers the question: Do people working here drive more or less during their commutes compared to workers in other places?

- **Total project-generated VMT per service population** provides a more comprehensive understanding of VMT than the home-based per resident or home-based per employee, which are partial VMT metrics. By taking the total VMT to and from a project or geographic area and dividing it by the total number of residents *plus* the total number of employees, a comparison of how VMT intensive the project is as a whole can be made. For example, this metric would capture delivery trips to and from residences and businesses, which may be a substantially more considerable VMT source in the coming years.

  One caveat for total VMT per service population is that employment-based uses generate more total VMT than non-employment uses, so projects with more employment may have a higher VMT rate by this metric. Further, the VMT associated with employees also includes VMT generated by visitors and customers. Retail and commercial land uses, therefore, generate disproportionately higher levels of VMT per employee.

  Answers the question: Is this area or project as a whole more or less VMT intensive than other places?

- **Total project effect on VMT** assesses whether a project would cause a net increase or net decrease in VMT within the boundary of a geographic area, compared to a no project condition. Because the total project effect on VMT does not hinge on the ratio of residents to employees, it provides the most direct way of understanding how development would change local travel patterns. To reflect a project's effects, the boundary area should include full trip lengths and not be truncated at political or model boundaries.

  Answers the question: What effect would building this project have on the way people travel in Petaluma/Sonoma County/and the region? Would there be a net increase or net decrease in regional VMT compared to building a similar project elsewhere?

Table 1: Illustration of Common Types of VMT

Vehicle Trip Type Examples	Included in Home-Based VMT?	Included in Home-Based Work VMT?	Included in Total VMT?	
			Petaluma Project-Generated	Boundary Method[1]
A Petaluma resident drives directly from home to their workplace	X		X	X
A Petaluma employee drives directly from home to work		X	X	X
A Petaluma resident drives their child from home to soccer practice	X		X	X
A Petaluma resident drives their child from school to soccer practice				X
A Petaluma employee drives from work directly to the grocery store			X	X
A San Rafael resident drives from home to Santa Rosa through Petaluma, using US 101 or using city streets.				X
A Novato resident travels to Downtown Petaluma to eat out			X	X
A South San Francisco resident travels to the Petaluma to visit a family member who resides there			X	X
Amazon delivers to a resident of the Petaluma			X	X
Amazon delivers to an employer in the Petaluma			X	X

1. Boundary method VMT assumes that SCTA model trip lengths at the boundaries of Sonoma County are appropriately calibrated for these trips.
Source: Fehr & Peers, 2020

For most single-use projects (e.g. a residential subdivision), using one of the partial VMT efficiency metrics (home-based trips per resident, for example) is the simplest way to analyze the VMT generated by a project for screening purposes (as described in the following section). This is also the method recommended by the Office of Planning and Research (OPR) in its *Technical Advisory*.[1] If a project is not screened out of a VMT impact analysis, then a complete VMT analysis needs to be performed.

[1] http://opr.ca.gov/docs/20190122-743_Technical_Advisory.pdf

For mixed-use projects (e.g. ground floor retail with residential above) or land uses with large visitor populations (schools, medical office, breweries, hotels, etc.), total project-generated VMT per service population may be more useful than a partial VMT metric. However, the ratio of residents to employees and the types of employment uses can affect how this metric compares to a regional average. Therefore, it is important to evaluate both partial VMT metrics as well as total VMT per service population.

Methods

The City of Petaluma has discretion to select its preferred method for calculating VMT. The method used for setting VMT impact thresholds must be the same method used for project impact analysis.

For cases in which a project is not screened from a quantitative VMT analysis, a consistent methodology for calculating VMT should be developed. Travel forecasting models such as the Sonoma County Transportation Authority (SCTA) travel model are the most appropriate method for calculating VMT since they can produce forecasts for the project's effect on VMT and account for changes in travel behavior.

The matrix in **Attachment B** contains a comparison of three travel forecasting models with geographies that overlap with Petaluma. These models include the City of Petaluma model, the SCTA model, and the Metropolitan Transportation Commission (MTC) model. The matrix includes relevant evaluation criteria for each model and compares the applicability of each model for forecasting VMT within Petaluma. As described in the matrix in Attachment B, the SCTA travel model is the recommended forecasting model for producing VMT forecasts in Petaluma.

The SCTA model may be used to calculate the VMT metrics described above if the project is large enough for the model to be sensitive to changes in land use.[2] Ideally, this would consist of calculating total project-generated VMT, total Citywide or County VMT, and VMT per employee/resident/service population for model scenarios with and without the project. Impacts could be assessed based on both efficiency metrics (e.g., home-based VMT per resident) as well as the project's effect on VMT (the total change between no project and plus project scenarios). Because Petaluma is located near the edge of the SCTA model boundaries, VMT reported by the model should be adjusted to account for VMT that extends beyond the model limits (e.g., from Petaluma to San Rafael, which is outside the SCTA boundary). These adjustments should include adding an average trip length for vehicle trips leaving the model area based on data from the

[2] Model calibration and sensitivity testing should occur as part of any analysis involving travel demand model runs.

California State Travel Demand Model, the California Household Travel Survey, mobile devices, or the US Census Bureau. **Attachment C** describes the methodologies and data sources for making these adjustments.

Mixed-use projects should be analyzed using the SCTA model to assess the project's effect on VMT and report home-based VMT per resident and home-based work VMT per employee for residential and office components, respectively. Home-based VMT per resident may also be useful for other uses with similar travel characteristics, such as hotels or group quarters. Home-based work VMT per employee may be useful for other uses similar to employment, such as schools, universities, etc.

Some land use components (retail, restaurant, entertainment) may be assessed qualitatively if they serve primarily local trips. Particularly for retail uses, a qualitative discussion of how the uses would primarily serve local trips may be adequate to determine the project's effect on VMT. Otherwise, based on guidance in the OPR *Technical Advisory,* retail projects should be assessed based on the project's effect on VMT.

Some projects may not be large enough for the SCTA model to be sensitive to the changes they represent, but too large to qualify for small project screening. In these cases, spreadsheet-based methods based on a VMT generation rate for the project's TAZ may be useful. This method works well when the proposed project is similar to the types of land uses already present in the TAZ (for instance, adding a new multi-family development to a residential zone). If the project is small, and somewhat unique for the area in which it is proposed, additional data may need to be collected.

Other alternatives for assessing the VMT effects of smaller projects are to further validate a sub-area model (which requires additional time and effort for analysis and may be expensive), or to use a sketch planning tool such as CalEEMod or MXD+ that have been modified to reflect trip generation rates and trip lengths consistent with the SCTA model used to set thresholds.

The determination of whether a project requires a qualitative, sketch-level, or model-level assessment will need to be made during the environmental scoping process.

Screening

The City of Petaluma may choose to screen projects from conducting a quantitative VMT analysis, requiring only a qualitative discussion in the CEQA document. This is most appropriate for projects that are consistent with the General Plan, a Specific Plan, the Sustainable Community Strategy Plan (Plan Bay Area) and/or those that would reduce VMT

based on their characteristics. As with all CEQA screening, an impact presumption of less-than-significant must be based on substantial evidence for the project.

The OPR *Technical Advisory* includes suggested methods for screening projects to quickly identify when a project should be expected to cause a less than significant VMT impact for the CEQA Transportation section without conducting a detailed VMT analysis. The OPR *Technical Advisory* suggests that lead agencies may screen out VMT impacts for small projects, residential and office projects located in low-VMT areas (as per the SCTA travel demand model or other sources of VMT), projects located in proximity to a major transit stop (per specific definitions in the OPR *Technical Advisory*), affordable housing developments, and transportation projects that would not result in an increase to vehicle capacity. Since land use plans affect a larger area and serve as the basis for environmental analysis of future projects, all land use plans (including the General Plan, Precise Plans, and Specific Plans) should conduct a quantitative VMT analysis and not utilize screening, unless they can be screened out due to proximity to major transit.

It is generally recommended that the City use the screening criteria presented in the OPR *Technical Advisory*, with minor modifications or exclusions as the City deems necessary (e.g. limiting exemptions for restaurant projects with drive-throughs), as described below.

Screening for Small Projects

The City of Petaluma may choose to screen projects that generate or attract fewer than 110 trips per day. Based on research for small project triggers[3], this may equate to nonresidential (e.g., office) projects of 10,000 square feet or less and residential projects of 15 units or less. The City of Petaluma may also screen local-serving retail projects (projects with less than 50,000 square feet of retail) on the basis that they attract trips that would otherwise travel longer distances. A VMT analysis may still be required to provide inputs for the Air Quality, Greenhouse Gas and Energy CEQA analyses.

Screening for Projects Located in Low-VMT Areas

The City of Petaluma may choose to screen residential and office projects located in low-VMT areas (per the CEQA thresholds to be established by the City) that incorporate similar features to the nearby developments (i.e., density, mix of uses, and transit accessibility) on the basis that the project will exhibit similarly low VMT. Typically, this screening is performed by utilizing data from a travel demand model (e.g. the SCTA travel demand model) and comparing the project's

[3] Refer to technical memorandum on small project triggers in **Attachment D**.

characteristics to land uses currently in the low-VMT area. A VMT analysis may still be required to provide inputs for the Air Quality, Greenhouse Gas and Energy CEQA analyses.

Screening for Projects in Proximity to a Major Transit Stop

The City of Petaluma may choose to screen projects that are located within a half mile of an existing or planned high-quality transit corridor or major transit station. Proximity to transit is explicitly listed in the CEQA Guidelines as a reason to presume a project has no significant impacts based on VMT. In Petaluma, this includes the existing Downtown Petaluma SMART station, the planned Petaluma North SMART station (also known as the Corona Station), and at stops for bus routes with 15 minute or less headways. A VMT analysis may still be required to provide inputs for the Air Quality, Greenhouse Gas and Energy CEQA analyses.

The OPR *Technical Advisory* notes that a presumption of less than significant should not be applied, and a VMT analysis should be performed, if the project:

- Has a Floor Area Ratio (FAR) of less than 0.75
- Includes more parking than required by the City of Petaluma
- Is inconsistent with Plan Bay Area
- Replaces affordable residential units with a smaller number of moderate- or high-income residential units (although a small market-rate project could qualify for small project screening)

If any of the above conditions apply, a detailed VMT analysis should be conducted to determine whether the project exceeds the VMT thresholds.

Screening for Affordable Housing

The City of Petaluma may choose to screen residential projects containing a particular amount of affordable housing (based on local circumstances and substantial evidence as determined by the City) on the basis that affordable housing generates less VMT than market-rate housing. Furthermore, affordable housing located within infill locations generally improves jobs-housing balance and may thus result in shorter commutes for low-income workers. A VMT analysis may still be required to provide inputs for the Air Quality, Greenhouse Gas and Energy CEQA analyses.

Screening for Transportation Projects

The City of Petaluma may choose to screen transit projects, bicycle and pedestrian projects, and roadway maintenance projects that do not result in an increase in vehicle capacity or VMT. Refer

to pages 20 and 21 of the *Technical Advisory* for a complete list of transportation projects that may be screened.

Thresholds

The City of Petaluma has discretion to set its own VMT impact thresholds for land use and transportation projects. A key question that must be addressed as part of choosing this threshold is whether the City's expectations for VMT reduction align with state goals. State goals are tied directly to greenhouse gas (GHG) reduction goals, which may or may not be numerically in-line with Petaluma's sustainability goals. The City will need to carefully consider state guidance from OPR and ARB about VMT thresholds before making a determination. The Caltrans endorsement of the OPR thresholds is likely to establish the expectation that a state threshold has been set for land use projects that add VMT to the state highway system.

The CEQA Guidelines encourage local jurisdictions to adopt significance thresholds intended for general use by resolution or ordinance as part of a public process. Lead agencies also have the option to establish thresholds on a project-by-project basis. The City of Petaluma will need to identify VMT impact thresholds for land use projects, land use plans, and transportation projects. Adopting these thresholds through a public process improves transparency and can be used to help educate the public and project applicants about the City's expectations.

VMT goals that the City sets should be consistent with other adopted plans. Adopting a VMT threshold is a discretionary action and should be consistent with the General Plan in particular. VMT reduction is often a part of policies related to reducing air quality impacts, reducing greenhouse gas emissions, or improving energy efficiency. The City should also reconcile how its adopted VMT threshold would contribute to state goals for GHG reduction and discuss how it is helping to meet these goals.

Any CEQA impact threshold should be supported by substantial evidence, which in turn should consist of facts, reasonable assumptions based on facts, and expert opinions supported by facts. The discussion below focuses on the relative substantial evidence available for various threshold options the City may consider. Regardless of the specific threshold the City selects, Petaluma will

still need to consider other substantial evidence related to VMT impacts when analyzing specific projects and making determinations of VMT impact significance.[4]

Thresholds – Land Use Projects and Plans

The City of Petaluma has two primary options for setting a VMT threshold for land use projects and plans: adopt a threshold recommended by another public agency or adopt a jurisdiction-specific VMT threshold.

The state's guidance on thresholds is presented in the OPR *Technical Advisory* and the ARB *California Air Resources Board 2017 Scoping Plan – Identified VMT Reductions and Relationship to State Climate Goals*. The OPR threshold generally requires land use projects to achieve a VMT reduction of 15 percent below the city, county, or regional (e.g., Petaluma, Sonoma County or Bay Area) baseline average depending on the type of land use. The ARB analysis indicates that the VMT threshold would need to be 16.8 percent for automobile only VMT to achieve state GHG reduction goals. These points of reference are subject to change over time, however, depending on statewide forecasts of population and travel, as well as economic conditions.

Specific OPR guidance for individual land uses is as follows:

- Residential projects – A proposed project exceeding a level of 15 percent below existing (baseline) home-based VMT per resident may indicate a significant transportation impact. Existing home-based VMT per resident may be measured as regional, citywide, or geographic sub-area home-based VMT per resident.

- Office projects – A proposed project exceeding a level of 15 percent below existing (baseline) regional home-based work VMT per employee may indicate a significant transportation impact.

- Retail projects – A net increase in total VMT may indicate a significant transportation impact. This metric reflects the nature of most local-serving retail to distribute existing vehicle trips, rather than generate or induce new vehicle trips.

- Mixed-use projects – Lead agencies can evaluate each component of a mixed-use project independently and apply the significance threshold for each project type included (e.g.,

[4] One example of this evidence may be the SB 150 report provided by the California Air Resources Board (ARB), which provides evidence that statewide VMT per capita is increasing rather than decreasing. https://ww2.arb.ca.gov/sites/default/files/2018-11/Final2018Report_SB150_112618_02_Report.pdf

residential and office). In the analysis of each use, a project should take credit for internal capture.

- Other project types – Lead agencies, using more location-specific information, may develop their own more specific thresholds, which may include other land use types.
- Redevelopment projects – Where a project replaces existing VMT-generating land uses, if the replacement leads to a net overall decrease in VMT, the project would cause a less than significant VMT impact. If the project leads to a net overall increase in VMT, then the thresholds described above should apply.

While OPR generally recommends a threshold at 15 percent below baseline levels for residential and office projects, OPR also recommends that any increase in VMT from a retail project be treated as significant. This different treatment is not explained or supported by substantial evidence. Further, ARB recommends a VMT reduction of 16.8 percent below 2018 levels (for automobile-only VMT) for new development to contribute its fair share to meeting state emissions reduction goals. The ARB threshold is supported by substantial evidence given its direct connection to emissions goals and forecasts. A key challenge for Petaluma is that the city's current VMT rates for residents and employees are higher than the regional average (Table 1 below), and accomplishing a 15.0 or 16.8 percent reduction (when comparing cumulative VMT for projects to the existing Bay Area VMT average) would require mitigation strategies not previously attempted.

Caltrans released a *VMT-Focused Transportation Impact Study Guide* (February 28, 2020) that recommends use of the OPR thresholds for land use projects and plans. This guidance did not specify whether to use the 15.0 or 16.8 percent threshold value (both values are included in the OPR Technical Advisory). The Caltrans Guide also mentions that Caltrans may request additional analysis for transportation projects; standards for those projects are discussed in the section below.

Base VMT thresholds for land use projects and plans within the City of Petaluma using the published threshold recommendations from OPR, ARB, and Caltrans are displayed in **Table 2.**

Table 2: Base VMT Threshold Options, City of Petaluma

VMT Metric	Petaluma Base VMT	Base VMT Threshold Options		
		OPR 15% Below City Average	ARB 16.8% Below City Average	Any Net VMT Increase[1]
Home-Based VMT per Resident	16.7	14.2	13.9	n/a
Home-Based Work VMT per Employee	17.6	15.0	14.7	n/a
Total VMT per Service Population	33.5	28.5	27.9	n/a
Total VMT (City-Generated)[1]	3,366,027	n/a	n/a	3,366,027

Notes:

1. A threshold of any net increase in VMT is most appropriate when analyzing total VMT and the possibility for induced vehicle travel resulting from transportation improvement projects. It may also be useful for assessing retail and other local-serving land use projects.

Source: SCTA Travel Demand Model; Fehr & Peers, 2020.

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 (per typical CEQA practice). 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 or project, and why another threshold was selected. This evidence will be the basis for supporting the recommended threshold and should carefully consider the definition of substantial evidence contained Section 15384 of the CEQA Guidelines. Additionally, while this approach would likely result in a more modest (and therefore more feasible) VMT reduction target, feasibility of mitigating an impact is not sufficient justification for setting an impact threshold.

A potential challenge to any VMT threshold is the ARB SB 150 report, which includes evidence that VMT per capita is increasing and, as a result, so are GHG per capita emissions. Furthermore, the thresholds published by ARB and OPR are based on a number of assumptions about future outcomes related to VMT generation of current residents, fuels, electric vehicles, that may not qualify as reasonably foreseeable under CEQA and do not consider the influence of transportation network companies (e.g., Uber and Lyft) and autonomous vehicles (AV) on travel behavior. These sorts of travel trends, if they continue, may contribute to 'other substantial evidence' that must be considered and discussed when making a significance finding.

Each of the thresholds above uses a nexus between VMT and GHG to establish substantial evidence. However, future court decisions may indicate that VMT as a metric may be more analogous to prior LOS analysis (i.e., allowing communities to determine what level of VMT change would result in effects that the *community* finds to be significant, including effects such as increased traffic and noise). If VMT thresholds are treated more like LOS thresholds, then lead agencies would have a similar level of discretion to establish thresholds based on context (i.e., sensitivity to the amount of vehicle travel). Past practice allowed lead agencies to set LOS thresholds based largely on the local community's sensitivity to travel delay. For example, rural areas that were more sensitive were allowed to establish LOS thresholds that equated to lower levels of delay. Using this analogy, a lead agency could set VMT thresholds based on a community's sensitivity to the amount of vehicle travel or its associated effects.

If a lead agency wants to treat VMT thresholds similar to LOS thresholds, they should consult with their CEQA counsel. The basic rationale would be that VMT is simply another way of measuring transportation network performance and that the lead agency is granted the discretion to measure network performance expectations and their effects on humans. These effects are not limited to GHG/air pollution/energy but should also consider the other legislative intents of CEQA. This approach may require that the lead agency demonstrate compliance with state goals for GHG reduction, air quality conformity, and energy consumption.

Thresholds – Transportation Projects

OPR and Caltrans recommend that a net increase in total VMT may indicate a significant impact for transportation projects. Why transportation projects should be treated differently than land use projects is not disclosed or supported by substantial evidence. A net decrease or no change in VMT would be evidence of a less than significant VMT impact.

Projects that reduce or have no impact on VMT include most active transportation projects, road diets, and minor operational changes to local roadways. However, capacity increases (i.e., lane additions) on arterial roadways or roadways that carry regional traffic have the potential to induce new vehicle traffic, and therefore new VMT. As an example, adding an additional lane on an arterial roadway that reduces delay, may make driving even more competitive than walking, and shift some trips to from walking to driving.

The no net new VMT threshold is the threshold preferred by Caltrans for assessment of impacts to Caltrans facilities and recommended in the OPR *Technical Advisory*. As a threshold, it is also reflective of whether a project simply improves operations for existing users (decreasing delay or improving safety with no change in VMT) or if it also results induces demand for driving.

Mitigation

Trip reduction measures or changes in project mix or density are two of the most common strategies for reducing significant VMT impacts at the project site. The City of Petaluma may use program-based approaches including impact fees, mitigation exchange, or mitigation bank. Program-based approaches rely on VMT reduction as the essential nexus and offer the ability to mitigate off-site. Use of transportation demand management (TDM) strategies for mitigation will require monitoring to demonstrate the effectiveness of the TDM strategies for a project.

The primary methods of mitigating a VMT impact are to either 1) change the project or 2) implement a program designed to reduce VMT, such as a TDM program. Project changes may include incorporating a mix of land uses or increasing a project's density. TDM measures include parking strategies to discourage automobile trips (e.g., unbundled parking, paid parking, etc.), promotional programs and incentives (e.g., hosting Bike to Work day or providing transit vouchers), subsidies for commuters using transit or carpooling, and facilities for bicyclists and pedestrians. The TDM programs may be implemented on a project-by-project basis or through a coordinated citywide or countywide program, potentially funded by a VMT impact fee. **Attachment E** contains a detailed memorandum describing mitigation measures applicable for the City of Petaluma.

The effectiveness of TDM programs varies widely based on many factors, including participant travel behavior and preferences, the level of investment, project location, and the quality of the multimodal transportation infrastructure. Because of this variation, mitigating a VMT impact using TDM requires a rigorous ongoing monitoring program that measures VMT performance over time until sufficient evidence exists that the VMT reduction goal has been achieved and will be maintained. This monitoring effort would require additional city staff or project applicant resources and may result in an increased number of projects that have VMT impacts that remain significant and unavoidable even after feasible mitigation.

Since the City already has a traffic impact fee in place, a VMT impact fee may be the first logical choice to develop a City-wide VMT mitigation program that new developments can use as part of the CEQA review process. Projects in the VMT impact fee could benefit the City as a whole and promote attainment of the sustainability-based goals in the General Plan. The VMT impact fee would generally require a CEQA clearance, and the VMT reduction effects could be quantified more fully at that stage.

Considerations for General Plan Goals and Policies

Retaining LOS and Other Metrics

The City of Petaluma may set operational metrics such as delay and LOS as standards in its Circulation Element. Future projects would then be required to conduct traffic studies as part of the entitlement process.

The City of Petaluma can continue to use vehicle LOS outside of the CEQA process if the City determines it is an important part of the transportation analysis process. For instance, the City may retain roadway operating standards based on LOS in the General Plan or use LOS to determine a nexus for a capacity enhancing transportation impact fee program (note that this is different than a VMT reduction impact fee program). Although the City of Petaluma can also continue to condition projects to build transportation improvements through the entitlement process in a variety of ways, projects that increase roadway capacity would likely be required to conduct a detailed CEQA VMT analysis to measure induced vehicle travel.

Currently adopted policies related to VMT and LOS are included in **Attachment F.** Most policies in the General Plan, Bicycle and Pedestrian Master Plan, and Safe Routes to Schools plan do not introduce VMT and LOS conflicts. However, some policies related to roadway network buildout and capacity enhancements may result in some level of induced VMT as the improvements would make travel by automobile more attractive. These potential conflicts should be identified and resolved as these long-range plans are updated. Additionally, modifications to policies to reflect the need for a more sustainable future transportation system (revising the LOS policy in the General Plan) would help align LOS-based polices with the promotion of a lower VMT per capita future.

Land Use Planning / EIR Tiering

A General Plan update can be used to address desired development on parcels outside a screening area, through analyzing the VMT impacts as part of the General Plan EIR.

While SB 743 presents new standards for transportation impact assessment, the option to "tier" CEQA analysis from previous environmental review will remain. The tiering process consists of streamlining topics studied for a project if that project was assessed under a previous EIR, such as a single parcel that is consistent with a previously analyzed Specific Plan. In this case, the project would only need to analyze those items which were not previously analyzed. Therefore, if the Specific Plan analyzed VMT in the EIR, then the project may not be required to conduct a detailed VMT analysis. In the near term, this may require investment in plan-area VMT analysis, however it

would streamline future projects consistent with an environmentally cleared General Plan or Specific Plan that analyzed VMT.

Should the City expect a future General Plan to cause a VMT impact, the CEQA review process can be streamlined by reviewing and mitigating projects in the General Plan at a citywide level. An updated General Plan with a certified EIR identifying the potential VMT impacts can serve as a starting point for tiered future analysis (Section 15183 exemptions), and potentially include a framework for developers to contribute to an impact fee program based on VMT reduction as the essential nexus. As the City is preparing to embark on a general plan update in the near term, this strategy will be of maximum value. The threshold setting efforts outlined previously in this document are a first step that prepares the City for SB 743 and the changes to CEQA in the near term, but also provides a framework for future discussions as part of the General Plan update process (which is not anticipated to be completed until 2023).

Mitigation Programs

Including improvement measures and plans/programs that reduce VMT in the General Plan Circulation Element can help establish a nexus for off-site mitigation.

To compensate for limitation of on-site project mitigation, the City can develop off-site mitigation programs as noted above, these types of programs are strengthened when the general plan circulation element includes VMT reduction policies and recommends a specific program type considering the other objectives of the general plan. The policies need to consider whether support exists in the community to mitigate in areas not adjacent to the project where the direct impact of new development will be felt the most.

Implications for Future CEQA Transportation Analysis

Under the updated CEQA Guidelines, CEQA transportation analyses for most projects in Petaluma would be substantially reduced in scope and schedule, allowing for a streamlined approach. Emphasis would be on discussion of transit, bicycle and pedestrian, and safety concerns rather than vehicular delay. For projects that are unable to be screened from a quantitative VMT assessment, there would be an additional analysis cost; however, this would likely remain somewhat less than the cost for assessing LOS impacts.

LOS analysis would not be included in the transportation analysis for CEQA but may be performed independently and used to inform conditions of approval for projects. The City would determine what level of LOS analysis is appropriate, as well as how to assess deficiencies in roadway operations. These criteria will be set in the Circulation Element of the General Plan. Critically, this

moves the LOS analysis process into the administrative and planning realm; while findings will still be presented to help decision-makers make an informed decision, the potential for litigation based on CEQA adequacy of LOS analysis is removed.

Case Studies

Implementing VMT for the CEQA Transportation analysis may alter the conclusions of project environmental analyses (versus traditional analysis methods using LOS), and may result in changes to the CEQA documents needed for a project (i.e. Mitigated Negative Declaration versus Environmental Impact Report).

Fehr & Peers has produced a high-level evaluation of several recent projects in the City of Petaluma to assess how the CEQA transportation conclusions may have been difference had SB 743 been in effect. The results of the evaluation are presented in **Table 3**. The case studies suggest that most projects in the downtown core area of the City would be screened out of CEQA transportation analysis on the basis of small project size or proximity to SMART stations. For projects further out from the center of the City, the impact determination under SB 743 would be different than under LOS analysis – it is likely that these projects would not qualify for a streamlined analysis or a Mitigated Negative Declaration, and an Environmental Impact Report may be required due to significant and unavoidable VMT impacts.

Table 3: Project Case Study Summary

Project Name and Location	Project Description	Trips Generated	Original CEQA Transportation Finding	Potential SB 743 CEQA Transportation Outcome
Silk Mill 450 Jefferson Street	76 hotel rooms, 1,800 square feet of restaurant	671 trips per day	Impacts less-than-significant or mitigated (MND used in entitlements)	Screened out due to proximity to SMART station (MND possible)
Cader Corporate 1480 Cader Lane	267,840 square feet of office	595 trips per day	Impacts less-than-significant or mitigated (MND used in entitlements)	***VMT impacts likely significant and unavoidable when compared to threshold of project home-based work trip VMT per worker 15% below 9-County MTC regional average (EIR required)***
Haystack 215 Weller Street	178 residential units, 24,855 square feet of commercial	732 trips per day	Streamlined – project consistent with previous environmental studies.	Screened out due to proximity to SMART station; commercial potentially screened out if locally-serving retail (MND possible)
Maria Dr. Apartments 35 Maria Drive	144 residential units	393 trips per day	Impacts less-than-significant or mitigated (MND used in entitlements)	***Depending on threshold, impacts potentially less-than-significant with or without mitigation due to proximity to schools and locally-serving retail (EIR potentially required)***
Brody Ranch 360 Corona Road	199 residential units	1,489 trips per day	Impacts less-than-significant or mitigated (MND used in entitlements)	Screened out due to proximity to future SMART station (MND possible)
131 Liberty Residential 131 Liberty Street	10 residential units, 1,500 square feet of commercial	53 trips per day	Streamlined due to small size.	Screened out due to small size of residential and locally-serving retail (MND possible)
Avila Ranch 511 Sonoma Mountain Parkway	21 residential units	*Trips per day not provided due to project not requiring a traffic study* 199 trips per day estimated	Project exempt from traffic analysis	***VMT impacts likely significant and unavoidable when compared to threshold of project residential VMT per capita 15% below Citywide average (EIR required)***

Source: City of Petaluma, Fehr & Peers, 2020.

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ATTACHMENT A – Matrix Summary of SB743 Decisions, Options, and Recommendations

Summary of SB743 Decisions, Options, and Recommendations

Lead Agency Decisions	Common Options	Common Limitations	Considerations	City of Petaluma Initial Recommendations
What form of VMT metrics could be used?	1. Total VMT 2. Total VMT per Service Population[1] 3. Household generated VMT per Resident (requires an activity/tour-based travel forecasting model) 4. Home-Based VMT per Resident (a partial VMT estimate) 5. Home-Based Work VMT per Employee (a partial VMT estimate) 6. Project's Effect on VMT, using Boundary VMT for a specific area	Metrics other than total VMT and total VMT per service population typically only represent partial VMT (i.e., some vehicle types and trip purposes are excluded in the models used to estimate VMT). This may be acceptable for screening purposes but not for a complete VMT impact analysis.	The expectations of a CEQA impact analysis to strive to provide a complete picture of the effects of a project on the environment are highlighted within the *CEQA Guidelines*. For lead agencies, VMT metrics and method should consider current practice for air quality, greenhouse gases, and energy consumption impact analysis. In general, VMT is used as an input for these other analyses and current practice is to produce VMT estimates and forecasts that comply with *CEQA Guidelines* expectations.	Include the following so that forms of VMT needed for screening and complete VMT analysis are available (this includes Total VMT by speed bin for air quality, GHG, and energy impact analysis) 1. Total VMT 2. Total VMT per service population 3. Home-based VMT per resident 4. Home-based work VMT per employee
What methods are available to use in estimating and forecasting VMT?	1. Caltrans Statewide Travel Demand Model 2. Metropolitan Transportation Commission (MTC) Regional Travel Forecasting Model 3. Sonoma County Transportation Authority (SCTA)Travel Model 4. Petaluma City Travel Model 5. Non-model "Accounting Methods" such as sketch planning tool or spreadsheet[2]	Statewide and regional models have limited sensitivity and accuracy for local scale applications off the shelf. Regional and local models, including the SCTA model, often truncate trips at model boundaries. Sketch and spreadsheet tools do not capture the 'project effect on VMT'.	Selection of an appropriate travel forecasting approach is an important step because the tool used to develop VMT thresholds must also be used to evaluate a project's direct and cumulative VMT impacts. Regional or local models should be calibrated and validated for local project-scale sensitivity/accuracy (including appending trip length data for trips with external trip ends) before using these models to analyze both 'project generated VMT' and 'project effect on VMT'.	Use SCTA travel model to evaluate both "project generated VMT" and "project effect on VMT" and establish screening guidelines Apply off-model calculation to account for trips leaving Sonoma County at the model gateways based on data from the California State Travel Demand Model, the California Household Travel Survey, mobile devices, or the US Census Bureau. For small projects, apply a spreadsheet-based method or further validate a SCTA sub-area model.
Is use of VMT impact screening desired?[3]	Projects that reduce VMT or are located within transit priority areas (TPAs) should be presumed to have a less than significant impact on VMT. Additional screening options identified in the OPR *Technical Advisory* for: 1. Map based screening for residential and office projects 2. Local-Serving Retail Projects 3. Transportation projects that do not add vehicle capacity 4. Projects that would not result in a net increase of VMT 5. Affordable housing projects 6. Small projects	Screening does not provide information about the actual VMT changes associated with the project.	Screening most appropriate if consistent with applicable general plan and supported by substantial evidence.	VMT Land Use Project Screening TBD following workshops VMT Transportation Project Screening TBD following workshops

[1] Service population includes population plus employment and may include students or visitors; it is intended to include all independent variables used in estimating trips.
[2] Sketch planning tool or spreadsheet method has limitations if using a citywide or regional average for a threshold.
[3] CEQA Guidelines Section 15064.3 states that projects that would reduce VMT or are located in a TPA should be presumed to have a less than significant impact on VMT. The OPR *Technical Advisory* contains other potential screening options.

Summary of SB743 Decisions, Options, and Recommendations

Lead Agency Decisions	Common Options	Common Limitations	Considerations	City of Petaluma Initial Recommendations
What is the VMT impact significance threshold for land use projects under baseline conditions?	1. Lead agency discretion consistent with general plan and expectations for 'project scale' VMT reductions not accounted for in general plan EIR and supported by substantial evidence. 2. OPR 15% below baseline average a city or region (automobiles only)[4] 3. 14.3% below baseline (2018) average of jurisdiction (all vehicles) based on ARB analysis (also included in OPR Technical Advisory) 4. 16.8% below baseline (2018) average of jurisdiction (automobiles only) based on ARB analysis (also included in OPR Technical Advisory) 5. Caltrans has endorsed OPR thresholds for their review of local land use projects. This endorsement did not specify, which percentage reduction above is preferred, but their endorsement can be interpreted as setting a VMT threshold for VMT added to the state highway system regardless of a local agency's threshold.	Difficult for lead agencies to determine what level of VMT change is unacceptable when viewed solely through a transportation lens. Uncertainty of VMT trends contributes to difficulty in setting thresholds. Connecting a VMT reduction expectation to baseline helps to reduce uncertainty associated with future conditions.	Since VMT is already used in air quality, GHG, and energy impact analysis, lead agencies should review thresholds for those sections to help inform new thresholds exclusively for transportation purposes. Lead agencies should carefully consider how they value state goals for VMT/GHG reduction in light of other general plan and community objectives. Translating state goals into VMT thresholds should consider substantial evidence such as California Air Resources Board 2017 Scoping Plan - Identified VMT Reductions and Relationships to State Climate Goals, January 2019, CARB. Absent development of a specific VMT threshold, lead agencies may rely on those of other state agencies or recommended by experts. ARB, provides evidence that the VMT reduction values presented in this matrix represent new development's fair share of the VMT reduction to achieve State air quality and GHG goals. The ARB analysis presumes that all future residents will generate VMT at these lower levels, which may not be a reasonably foreseeable expectation. Further, the ARB modeling did not consider the influence of new VMT sources including transportation network companies (TNCs) and autonomous vehicles (AVs).	TBD following workshops
What is the VMT impact significance threshold for land use projects under cumulative conditions?	1. Use a regional model to analyze the 'project's effect on VMT' based on RTP/SCS consistency (projects should not increase the total regional VMT forecast used to support the RTP/SCS air quality conformity and SB 375 GHG targets). 2. A lead agency can use the project analysis above if based on an efficiency metric form of VMT and evidence exists to demonstrate that cumulative trends in VMT rates are declining. 3. Establish a VMT reduction threshold for cumulative conditions consistent with long-term air pollution and GHG reduction expectations.	Uncertainty of VMT trends makes a cumulative impact finding less certain. Ability for a lead agency to identify the project's effect on land supply and corresponding VMT. Land use projects change land supply and the allocation of future population and employment growth. As such cumulative analysis should maintain the same control totals of regional population and employment growth. Requires knowledge of the forecasting tools available to test the project's effect on land supply and VMT.	Analyze the project's effect on land supply and VMT using an appropriate valid model. For impact findings, consider all available substantial evidence including 2018 Progress Report, California's Sustainable Communities and Climate Protection Act, November 2018, CARB and current research on the long-term effects of transportation network companies (TNCs), new mobility options, and autonomous vehicles (AVs). Specific research examples include Fehr & Peers AV effect model testing.	TBD following workshops

[4] The OPR and ARB thresholds do not consider the long-term influence of TNCs, internet shopping, new mobility options, or autonomous vehicles.

Summary of SB743 Decisions, Options, and Recommendations

Lead Agency Decisions	Common Options	Common Limitations	Considerations	City of Petaluma Initial Recommendations
What is the VMT impact significance threshold for transportation projects under baseline conditions?	Lead agencies have discretion to choose their own metrics and thresholds for transportation project impact analysis. If VMT is selected, OPR recommends treating projects that reduce, or have no impact on, VMT to be presumed to have a less than significant impact. Caltrans has selected VMT as its preferred metric for measuring transportation impacts, which would apply for any local agency transportation projects that add VMT to the state highway system.	Continued use of LOS is uncertain because of *CEQA Guidelines* Section 15064.3(b)(2) and 15064.7(d)(2). Transit, especially on-demand transit service, can generate new VMT, which should be considered as part of impact conclusions.	Consult CEQA legal advice about whether lead agency discretion allows continued use of LOS and whether VMT is required. VMT is required as an input to air quality, GHG, and energy impact analysis and should include induced vehicle travel effects.	TBD following workshops
What VMT reduction mitigation strategies are feasible?	Menu of built environment and transportation demand management (TDM) mitigation strategies contained in Quantifying Greenhouse Gas Mitigation Strategies, CAPCOA, 2010.	Built environment strategies require modifying the project, which may create inconsistencies with the project description and financial feasibility. TDM strategies are often building tenant dependent so their use requires on-going monitoring and adjusting to account for changes in build tenants and their travel behavior. Ad-hoc project-by-project mitigation is less effective for reducing VMT than larger scale program-based approaches such as an impact fee program.	Develop a VMT mitigation program using any of the following approaches. 1. Impact fee program based on a VMT reduction nexus. 2. In-lieu fee program for VMT reducing actions. 3. VMT mitigation bank or exchange program. 4. TDM ordinance applying to all employers.	Refer to VMT mitigation memorandum contained in Attachment E.

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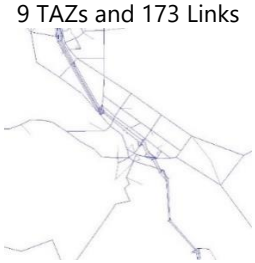
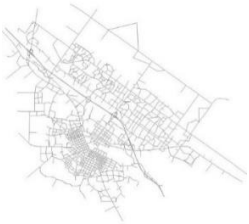
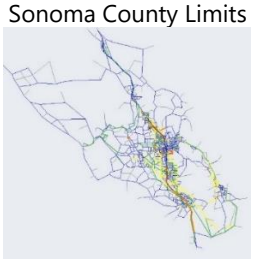
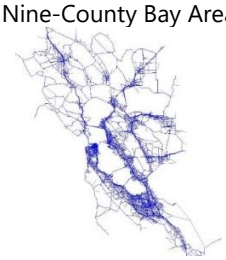
ATTACHMENT B – Travel Behavior Forecasting Model Comparison

Petaluma SB 743 Implementation – Travel Forecasting Model Comparison

Evaluation Criteria	City of Petaluma Model	SCTA Model	MTC Model
Model Structure	3-Step Trip-Based Model No Mode Split Step	4-Step Trip-Based Model With Mode Split Step	Activity-Based Model Auto-Ownership Model
Calibration Year[1]	2007	2015	2010
Model Detail within Petaluma	High: 383 TAZs and 2,146 Links 	Medium: 82 TAZs and 733 Links 	Low: 9 TAZs and 173 Links 
Model Boundaries	Petaluma City Limits 	Sonoma County Limits 	Nine-County Bay Area 
Level of Petaluma Trips Truncated at Model Boundaries	High: All trips leaving Petaluma City Limits are truncated.	Low: All trips leaving Sonoma County Limits are truncated, however Big Data is used to account for the truncated portion of trips.	Low: Only trips leaving Nine-County Bay Area are truncated.
Model Run Time	<1 hour	~1 hour	~24 hours
Key Limitations Requiring Action	Updated model calibration and validation is necessary to accurately assess VMT impacts. The update would require substantial time and cost.	Model update not ready until Fall 2019.	Model sensitivity to local project land use changes is untested. Changing model inputs for land use projects requires substantial time and cost.
Recommendation	**Not Recommended:** - High level of truncated trips - Model requires substantial update and recalibration - No mode split step	**Recommended:** - Petaluma is member agency - Most recent calibration - Supplemented with empirical data (i.e., Big Data) - SCTA has consistently provided model maintenance and updates	**Not Recommended:** - Coarse model detail in off-the-shelf version - Unknown model accuracy and sensitivity for local projects - Time consuming to make land use changes - Long run time

Source: Fehr & Peers, 2020.
Notes: 1. Model should be calibrated within the past five years.

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ATTACHMENT C – Adjustments at Model Gateways

Technical Memorandum

Date: November 5, 2019

To: Erik Ruehr, VRPA
Bruce Griesenbeck and Maricela Salazar, SACOG

From: Jimmy Fong, Jinghua Xu, and Ronald T. Milam, Fehr & Peers

Subject: Trip Length Adjustments for SB 743 VMT Analysis

Introduction

SB 743 implementation has created the need to modify travel demand models to ensure they capture the full trip length for those trips that start or end outside the model boundary. This need stems from the CEQA guidance listed below and the general desire to avoid arbitrary truncation of trip lengths based on model or political boundaries.

- According to the Technical Advisory, the assessment should cover the full area in which driving patterns are expected to change, including induced growth impacts and cumulative impacts. OPR states that the VMT estimation should not be truncated at a modeling or jurisdictional boundary for convenience of analysis when travel behavior is substantially affected beyond that boundary. (p. 6 and 23 - Technical Advisory on Evaluating Transportation Impacts in CEQA, OPR, December 2018)

- CEQA Guidelines section 15277:
    - "…. Any emissions or discharges that would have a significant effect on the environment in the State of California are subject to CEQA where a California public agency has authority over the emissions or discharges." Since VMT is the key input for mobile emissions, tracking the full length of trips is essential for complying with this expectation.

Since all travel demand models in California have boundaries, they truncate trip lengths to varying degrees. Truncation tends to be most severe at the edge of the model boundary and when the modeled area exhibits a high proportion of external travel (i.e., from a suburban area in one region to a job center in another region). To compensate for the influence of model boundaries, the following steps can be used to modify trip lengths through model gateways.

Trip Length Adjustment Process

Adjusting the length of trips leaving a model boundary requires appending extra distance at the model gateway zone (or external centroid) connector as outlined below. This process results in new gateway distances that are weighted based on the amount and location of external travel origins and destinations. Other adjustment methods that are available include appending extra trip lengths to each individual origin-destination (OD) trip pair in the model or expanding the model's zone structure to cover a larger area. Both of the methods are much more resource and time intensive and are not covered further in this memo.

1. Model IX and XI Trips at Gateways

The first step of this process is to determine trip volume leaving or entering the model boundary. These are referred to in the remainder of this memo as internal-to-external (IX) and external-to-internal (XI) trips. This data can be generated either from OD trip matrices or by conducting a select zone analysis to track trips to the model gateways. The volume at the gateways for this purpose should not include external-to-external (XX) through trips. A table that identifies all gateways, IX volume, and XI volume should be prepared similar to the example below from the Mendocino Council of Governments (MCOG) model.

Table 1: Example Model Gateway and IX, XI Link Volumes Table

Gateway ID	Gateway	Link ID	IX Volume	XI Volume
7081	SR 1 - South	7081	1,190	1,190
7083	US 101 - South	7083	5,004	5,004
7082	US 101 - North	7082	567	567
7085	SR 20 - East	7085	3,529	3,529
7086	SR 175 - East	7086	551	551

2. Origin-Destination Data between Model and External Areas

Determining the full length of trips leaving or entering a model boundary requires an OD dataset that includes flows between the model area and the area external to the model. How much of the external area to include is an important question. Per the CEQA guidance cited, the full length of trip between their start and end is desired. Whether this extends outside of California has not been legally tested so it is possible that capturing trip lengths even beyond state limits could be necessary. An appropriate OD dataset should be chosen based on the details of your project, context of the study area, level of CEQA risk, and available time and budget for analysis. An assessment of each of the OD data sources is presented the Table 2.

Table 2: Origin-Destination Data Assessment

Origin-Destination Data Sources	Description	Advantages	Disadvantages
Available travel demand model larger than local model	All regional models in California nest within the California State Travel Demand Model (CSTDM). All local models (i.e., city models) nest within the CSTDM and their respective regional models.	• CSTDM Includes TAZs for the entire state of California • Regional models are often the source model for local model variants, so they have a high compatibility for making gateway adjustments. • CSTDM and regional models include changes in travel patterns over time between base and future years.	• Larger models may have greater aggregation and only coarse correspondence between TAZs in the smaller model. • Regional models may not fully capture full trip length. • CSTDM has not been recently calibrated and validated. • CSTDM truncates trip at state boundary.
California Household Travel Survey (CHTS)	Survey of California resident travel that documents full length of OD travel.	• Robust sample with data available for most cities and counties above 50,000 population. Data may be sufficient for smaller jurisdictions based on a review of the sample • Includes all trip purposes.	• Insufficient detail below city level. • 2012 data may not reflect recent changes in travel patterns. • Does not include data about future travel.
Longitudinal Employer-Household Dynamics Data (LEHD)	Employer/Employee data showing locations of where employees live and work, visualized in an online portal with export to OD tables, produced by the U.S. Census Bureau.	• Data available at the census tract level (or custom TAZ structure). • 2017 data is current. • Quick production of OD data.	• Employment data is only relevant for calculating trip lengths for home-based work trips, does not include other trip purposes. • Does not include data about future travel.
Mobile device OD Data	Data from smartphone/GPS devices that can be used to estimate OD trip tables associated with specific gateways.	• Data available at small scales (i.e., 250-meter grid cell, census block group, or custom traffic analysis zone). • Data scale allows isolation of specific land uses in many cases. • 2019 data available from multiple vendors. • Data includes all 365 days of the year and can be aggregated. • Limited trip length truncation. • Includes all trip purposes.	• Minimum purchase cost is about $5000, more expensive if greater detail/number of zones is desired. • Does not include data about future travel.

3. Gateway Identification

After identifying an appropriate OD data source, the next step requires determining the gateway(s) based on the model used in your project, which trips from the OD data source would travel through. An assessment of options for this process is presented in Table 3.

Table 3: Gateway Identification Methods and Assessment

Data Source	Gateway Identification Method
Available travel demand model larger than local model	• A highway skimming procedure to determine the gateway used for each OD pair for each assignment time period. This method is not able to track more than one gateway for an OD pair. • A select zone and select link assignment procedure to determine the gateway(s) for an OD pair. This method requires more processing/computing time – dependent on the specific travel model and software.
Mobile Device OD Data	• Data purchase includes identification of gateway locations and automatic filtering to create associated OD trip tables.
Streamlined selection with Google Maps (or online mapping program)	• Spreadsheet template that creates a link to Google Maps for each OD pair, manual identification of gateway(s) in the routing is required. • An off-model, quick assessment tool, suitable for limited number of OD pairs. • Not able to quantify the split across multiple routes/gateways (if applicable) for an OD pair. • Time consuming; not suitable for large number of OD pairs due to manual process.

4. Weighted Average Trip Length Beyond Model Gateways

The trip length adjustment process ultimately requires calculating the weighted average distance beyond each model gateway. A list of options for this process is identified in Table 4. Some of the processes calculate the distance beyond the model gateway directly; while other processes generate distance between each OD pair first, with a separate calculation for distance beyond the model gateway.

Table 4: Trip Length Beyond Model Boundary – Methods and Assessment

Data Source	Trip Length Method Description
Available travel demand model larger than local model	• Creates a new link variable equal to the link length for all the links external to the local model and 0 for all the links internal to the local model, and then uses a highway skimming procedure to skim this link variable to generate the total distance outside of the gateway for each OD pair for each assignment time period. • Uses a select zone and select link assignment procedure to generate the volume distribution for each selected gateway, and calculates the weighted average distance based on the select link volume associated with each gateway.
CHTS	• Estimates total OD distances between origin-destination for each trip record. • Calculates the distance from the trip-end within the model boundary to the gateway for each record, based on the distance skim from the model, and subtracts it from the total CHTS OD distance to generate external trip length for each trip record. • Aggregates the external trip distance across all the trip records to generate average external trip distance for each gateway.
Mobile Device OD Data	• Distance between origins-destinations through each gateway are provided in the dataset. • Calculates the distance from the trip-end within the model boundary to the gateway based on the distance skim from the model and subtracts it from the total mobile device OD distance to generate external trip length for each gateway.
Streamlined selection with Google Maps (or online mapping program)	• Links to Google Maps and generates a path for each OD pair. • Calculates the distance between the manually identified gateway(s) and the trip end location external to the model boundary, based on the shortest travel time path between the OD pair.

Process Summary

An analyst can mix and match the procedures based on the most appropriate method for each step. For example, if CHTS is the most appropriate OD dataset to generate external trip length estimates, the user can generate the OD trip matrices based on CHTS while following the TAZ structure of the CSTDM, then identify local model gateways in the CSTDM highway network, and calculate the average trip length beyond each gateway, using the distance skims of the CSTDM, weighted by trips from the CHTS OD trip matrices.

Trip Length Adjustment User Guide and Resources

This section provides a user-guide and links to resources for the data sources and processes previously described in this memorandum.

California Statewide Travel Demand Model (CSTDM)

Caltrans maintains and updates the California Statewide Travel Demand Model, and provides resources regarding the model on their website:

- https://dot.ca.gov/programs/transportation-planning/multi-modal-system-planning/statewide-modeling

Information regarding the previous version of the CSTDM is no longer available on Caltrans' website. Caltrans is currently in the process of updating the statewide travel demand model. Requests regarding statewide modeling should be directed to Caltrans.

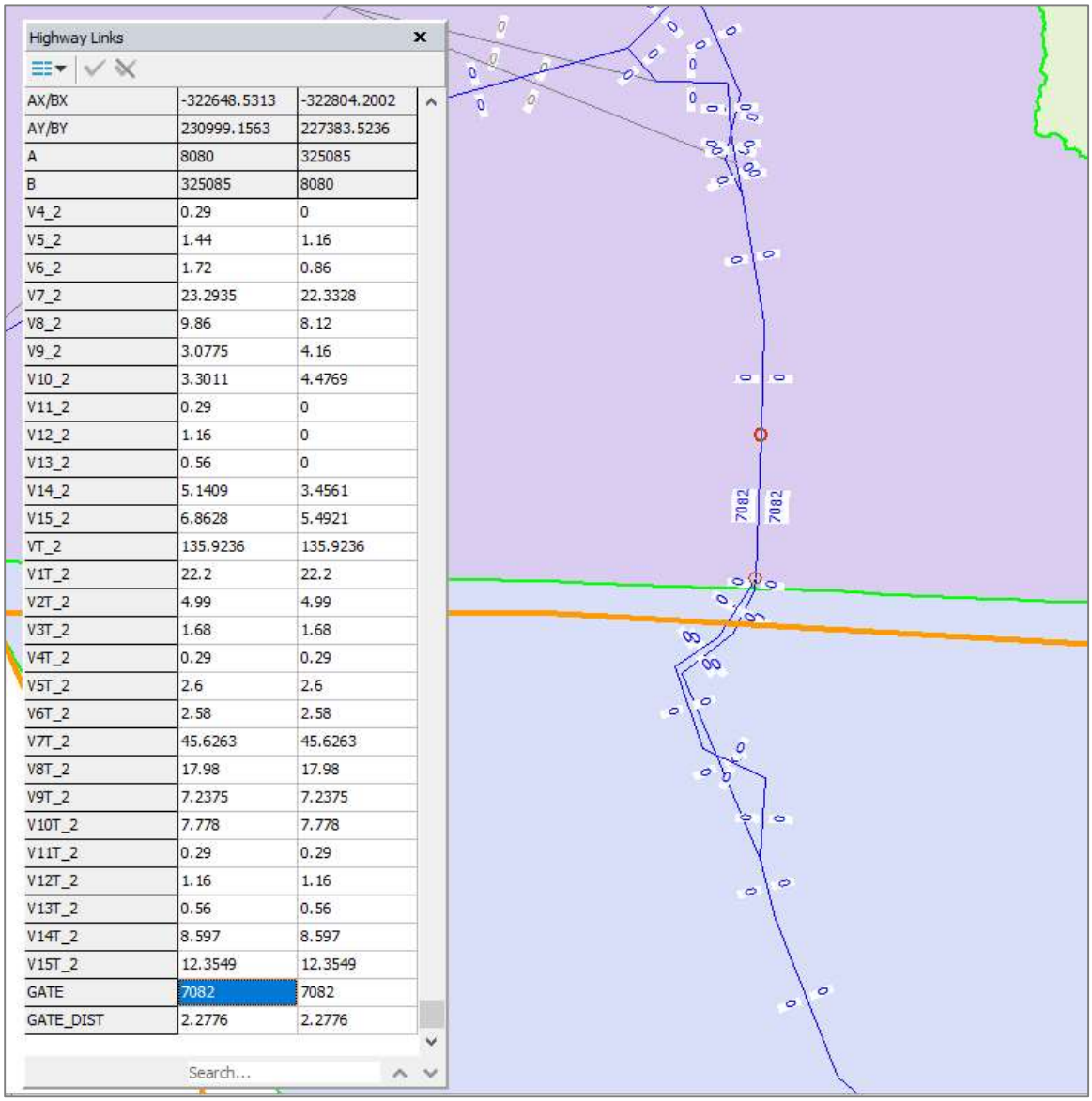
An example of the CSTDM used for OD data, gateway selection, and trip length beyond local model gateways is described below:

- Create correspondence between Study Area TAZs within local/regional model to the Statewide Model TAZs, similar to the example from the Mendocino Council of Governments (MCOG) Model, as shown in Table 5.

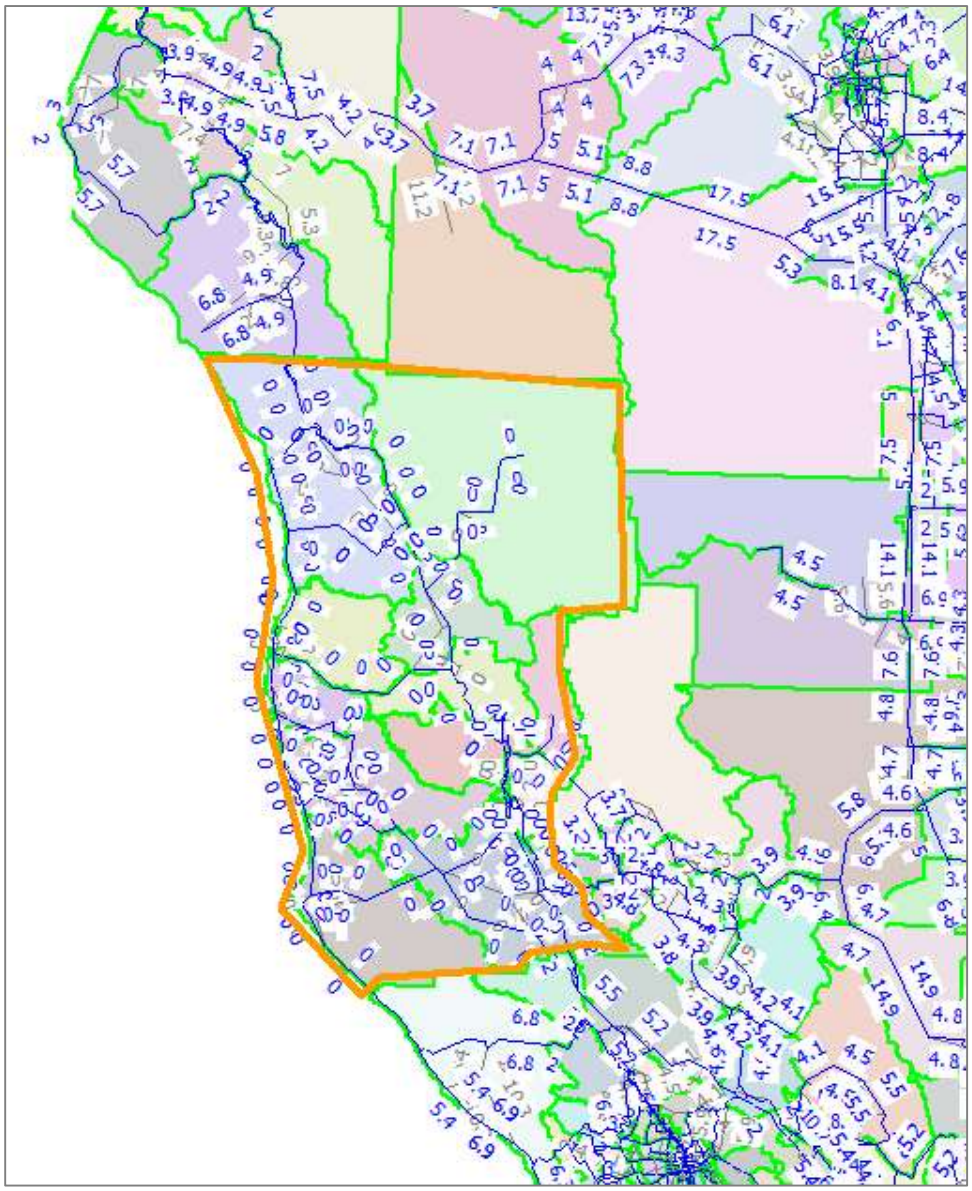
Table 5: Example TAZ Correspondence Table

MCOG TAZ	CSTDM TAZ
1	256
3	259
5	259
6	259
7	259
8	260
9	260
10	260

- Add "Gate" attribute to CSTDM roadway network links and set "Gate" equal to gateway id only for those links identified as the locations corresponding to the local/regional model gateways.



- Add "Gate_Dist" attribute to CSTDM roadway network links and set "Gate_Dist" equal to the link distance for those links outside the local/regional model boundary. All the CSTDM roadway links inside the local/regional model boundary will have a "Gate_Dist" attribute of 0.



- Run a highway skim on the CSTDM roadway network to skim the shortest travel time between each OD pair, tracking the gateway and distance outside the local model boundary. A sample Cube Voyager script for this step is included in the Appendix. An example output of this process is presented in Table 6.

Table 6: Example OD with Gate Identification and Distance Beyond Local Model

CSTDM Origin TAZ	CSTDM Destination TAZ	Volume	Gateway ID	Distance Beyond Local Model Boundary (mi)
246	2	0.21	7082	189.31
246	108	0.1	7082	82.73
246	118	0.42	7082	13.65
246	119	0.29	7082	22.88
246	139	0.13	7085	167.35
246	141	0.07	7085	169.53
246	173	0.25	7082	106.45
246	201	0.07	7085	126.73

- For each gateway, summarize the average distance beyond the local model boundary weighted by volume at each gateway. An example is presented in Table 7.

Table 7: Example Weighted Average Distance Beyond Local Model Boundary

Gateway ID	Gateway	Weighted Average Distance Beyond Local Model Boundary (mi)
7081	SR 1 - South	28.4
7083	US 101 - South	63.2
7082	US 101 - North	44.7
7085	SR 20 - East	46.4
7086	SR 175 - East	15.9

- Tag the gateway distance from the above step using CSTDM to the gateways in the local/regional model and multiply to the gateway volume from the local/regional model to determine the gateway external VMT to the local/regional model. Make sure not to double-count any overlap distance that's already accounted for in the VMT calculation from the local/regional model. An example for this calculation for IX trips from the MCOG model is shown in Table 8.

Table 8: Example Adjustment Gateway and IX, XI Link Volumes Table

Gateway	Weighted Average Distance Beyond Local Model Boundary (From CSTDM)	MCOG IX Volume	MCOG IX VMT Beyond Local Model Boundary
SR 1 - South	28.4	1,190	33,796
US 101 - South	63.2	5,004	316,253
US 101 - North	44.7	567	25,345
SR 20 - East	46.4	3,529	163,746
SR 175 - East	15.9	551	8,761

California Household Travel Survey (CHTS)

CHTS data was collected by Caltrans and is shared on the following website.

- https://www.nrel.gov/transportation/secure-transportation-data/tsdc-california-travel-survey.html

An example of CHTS data filtered for IX trips for Mendocino County is shown below. This example requires processing of the survey data and specific formatting such that it contains trip origin, destination, distance, and volume information.

oTract	oPlace	oCounty	dTract	dPlace	dCounty	distance_fine	time	avgSpeed	numVehTrips
6045010200	Unincorporatec	Mendocino	6023011500	Unincorpoi	Humboldt	24	30	50	232.2
6045010200	Unincorporatec	Mendocino	6023011500	Unincorpoi	Humboldt	24	30	50	0
6045010400	Fort Bragg	Mendocino	6033001000	Kelseyville	Lake	86	120	45	491.32
6045010500	Fort Bragg	Mendocino	6001450752	Dublin	Alameda	194	330	35	486.56
6045010700	Willits	Mendocino	6023001000	Arcata	Humboldt	133	170	45	0
6045010700	Willits	Mendocino	6023001000	Arcata	Humboldt	134	170	45	261.41
6045010700	Willits	Mendocino	6023011500	Unincorpoi	Humboldt	60	70	50	62.31
6045010700	Willits	Mendocino	6023011500	Unincorpoi	Humboldt	72	120	35	210.39
6045010700	Willits	Mendocino	6033000802	Clearlake	Lake	64	65	60	164
6045010700	Willits	Mendocino	6033001000	Kelseyville	Lake	51	70	45	221.9
6045010700	Willits	Mendocino	6075016500	San Francis	San Francisco	134	155	50	0
6045010700	Willits	Mendocino	6075016500	San Francis	San Francisco	135	155	50	49.48
6045010700	Willits	Mendocino	6081604800	Millbrae	San Mateo	149	200	45	89.91
6045010700	Willits	Mendocino	6097153403	Sebastopol	Sonoma	89	120	45	0
6045010700	Willits	Mendocino	6105000400	Mad River	Trinity	123	285	25	191.16
6045010801	Unincorporatec	Mendocino	6097152000	Santa Rosa	Sonoma	71	90	45	46.84
6045010802	Unincorporatec	Mendocino	6055201700	Angwin	Napa	83	120	40	103.69
6045010900	Unincorporatec	Mendocino	6023011100	Rio Dell	Humboldt	128	190	40	129.99
6045010900	Unincorporatec	Mendocino	6033000300	North Lake	Lake	28	60	30	274.5
6045010900	Unincorporatec	Mendocino	6033000400	Lakeport	Lake	34	40	50	916.13
6045011002	Unincorporatec	Mendocino	6001421700	Berkeley	Alameda	159	195	50	240.48

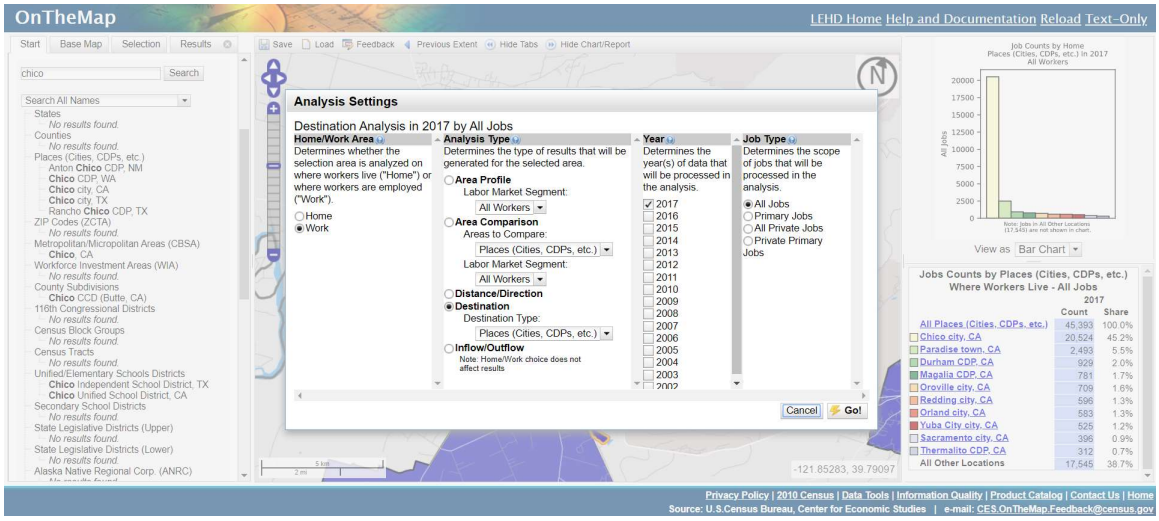
Longitudinal Employer-Household Dynamics Data (LEHD)

LEHD data can be accessed using the following online resource.

- https://onthemap.ces.census.gov/

OD data using this resource can be identified by searching a study area (City, County, or can upload a shapefile with specific geography) and looking at the "Destination" Analysis Type.

- For IX trips, use the "Home" setting for Home/Work Area
- For XI trips, use the "Work" setting for Home/Work Area



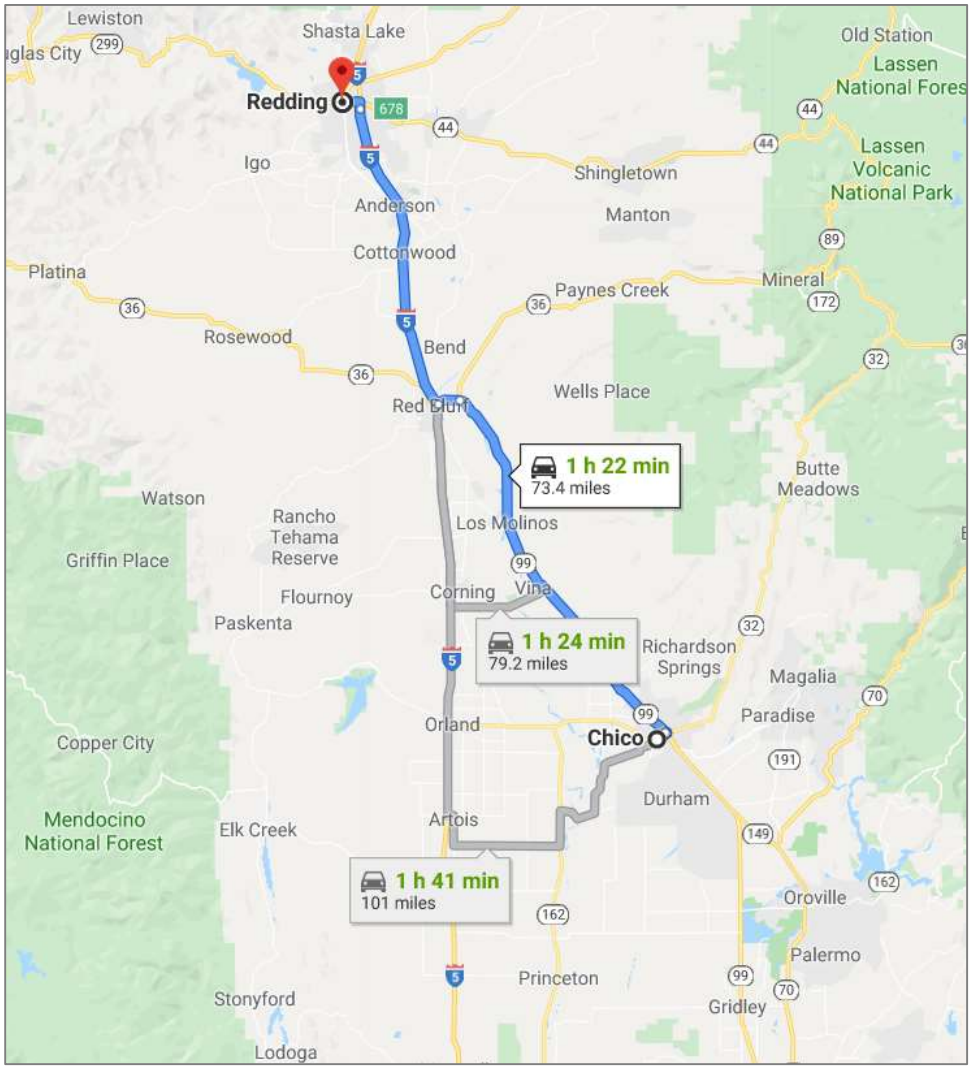
Mobile Device OD Data

Streetlight is one vendor that can provide data for OD, gateway identification, and trip lengths. A middle filter analysis is needed to determine which particular gateway a trip passes through. An example showing IX trips from Chico to areas beyond the Butte Council of Governments (BCAG) Model boundary is presented below.

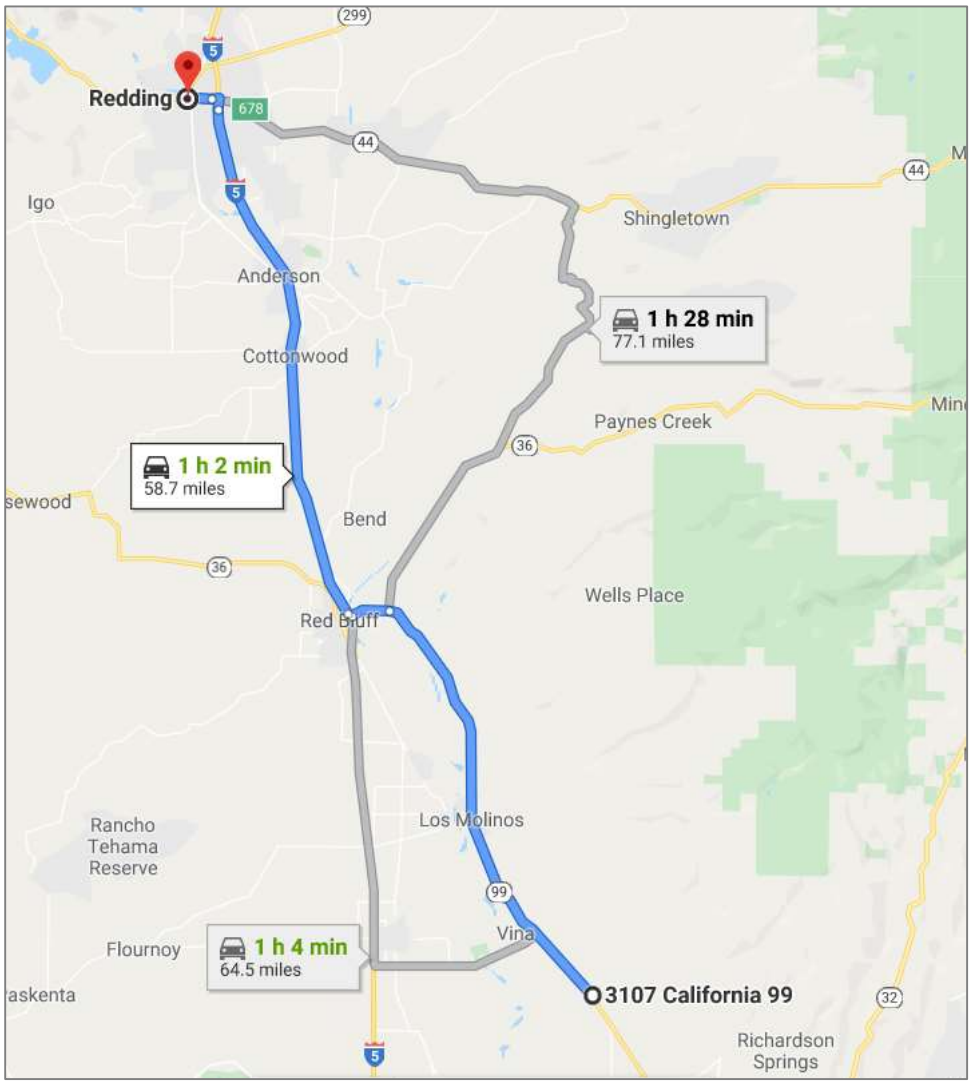
Type of Travel	Origin Zone ID	Origin Zone Name	Middle Filter Zone ID	Middle Filter Zone Name	Destination Zone ID	Destination Zone Name	Day Type	Day Part	Total O-M-D Traffic (Sample Trip Counts)
Personal	6	Biggs	1	CA 99 North of	16	Tehama County	1: Weekday (M-Th)	0: All Day (12am-12am)	3
Personal	6	Biggs	1	CA 99 North of	23	Shasta County	1: Weekday (M-Th)	0: All Day (12am-12am)	2
Personal	6	Biggs	9	Honcut Rd	30	Yuba County	1: Weekday (M-Th)	0: All Day (12am-12am)	3
Personal	6	Biggs	11	CA 70 South of	20	Nevada County	1: Weekday (M-Th)	0: All Day (12am-12am)	1
Personal	6	Biggs	11	CA 70 South of	26	Placer County	1: Weekday (M-Th)	0: All Day (12am-12am)	2
Personal	6	Biggs	11	CA 70 South of	30	Yuba County	1: Weekday (M-Th)	0: All Day (12am-12am)	4
Personal	6	Biggs	12	Larkin Rd	28	Sutter County	1: Weekday (M-Th)	0: All Day (12am-12am)	2
Personal	6	Biggs	12	Larkin Rd	30	Yuba County	1: Weekday (M-Th)	0: All Day (12am-12am)	1
Personal	6	Biggs	13	CA 99 South of	19	Glenn County	1: Weekday (M-Th)	0: All Day (12am-12am)	1
Personal	6	Biggs	13	CA 99 South of	26	Placer County	1: Weekday (M-Th)	0: All Day (12am-12am)	1
Personal	6	Biggs	13	CA 99 South of	27	Sacramento Coun	1: Weekday (M-Th)	0: All Day (12am-12am)	49
Personal	6	Biggs	13	CA 99 South of	28	Sutter County	1: Weekday (M-Th)	0: All Day (12am-12am)	174
Personal	6	Biggs	13	CA 99 South of	29	Yolo County	1: Weekday (M-Th)	0: All Day (12am-12am)	7
Personal	6	Biggs	13	CA 99 South of	30	Yuba County	1: Weekday (M-Th)	0: All Day (12am-12am)	17
Personal	6	Biggs	14	Almond Orchard	28	Sutter County	1: Weekday (M-Th)	0: All Day (12am-12am)	3
Personal	6	Biggs	15	Gridley Road	18	Colusa County	1: Weekday (M-Th)	0: All Day (12am-12am)	3
Personal	6	Biggs	17	Biggs-Willows R	18	Colusa County	1: Weekday (M-Th)	0: All Day (12am-12am)	3
Personal	6	Biggs	17	Biggs-Willows R	19	Glenn County	1: Weekday (M-Th)	0: All Day (12am-12am)	8
Personal	6	Biggs	19	Ord Ferry Road	19	Glenn County	1: Weekday (M-Th)	0: All Day (12am-12am)	1
Personal	6	Biggs	20	CA 32 Hamilton	19	Glenn County	1: Weekday (M-Th)	0: All Day (12am-12am)	2
Personal	7	Chico	1	CA 99 North of	16	Tehama County	1: Weekday (M-Th)	0: All Day (12am-12am)	2482
Personal	7	Chico	1	CA 99 North of	19	Glenn County	1: Weekday (M-Th)	0: All Day (12am-12am)	6
Personal	7	Chico	1	CA 99 North of	23	Shasta County	1: Weekday (M-Th)	0: All Day (12am-12am)	643
Personal	7	Chico	1	CA 99 North of	27	Sacramento Coun	1: Weekday (M-Th)	0: All Day (12am-12am)	2
Personal	7	Chico	1	CA 99 North of	30	Yuba County	1: Weekday (M-Th)	0: All Day (12am-12am)	1
Personal	7	Chico	3	CA 32 North of	14	Plumas County	1: Weekday (M-Th)	0: All Day (12am-12am)	19
Personal	7	Chico	3	CA 32 North of	16	Tehama County	1: Weekday (M-Th)	0: All Day (12am-12am)	4

Google Maps (for Gateway Identification and Trip Length Beyond Local Model Gateways)

Google Maps (or similar online mapping tool) can be used as a quick tool for gateway identification and for determining trip lengths beyond a local model boundary. An example of trips from Chico leaving the BCAG model boundary to Redding is shown below. Trips for this OD pair pass through the gateway on SR 99 (based on the shortest travel time).



After a gateway is identified, the distance from the gate location to the trip end outside of the local model boundary can also be searched, as shown below.



Appendix (Cube Voyager Sample Script)

```
;TAZs from local model within the CSTDM
Project1='246-261'
;================================================
; PM peak period highway skim
RUN PGM=highway
NETI=..\LoadedNetworks\HwyNetwork_Loaded_PM_?.net                    ; input network
MATO=Skim_PM_?.mat, MO=1-4, NAME=TIME,GATE,GATE_DIST,FULL_DIST  ; output skim matrix
   PHASE=ILOOP
      PATH=LI.TIME_2,MW[1]=PATHTRACE(LI.TIME_2), MW[2]=PATHTRACE(LI.GATE), MW[3]=PATHTRACE(LI.GATE_DIST),
MW[4]=PATHTRACE(LI.DISTANCE)
endphase
ENDRUN
;================================================
; Summarize OD Volumes and Skim Matrices
RUN PGM=MATRIX
   MATI[1]=..\TripTables\OD_?.mat
            MATI[2]=Skim_PM_?.mat
   MATO=OD_Gate_VMT_?.mat, MO=1-6, name=VOL_DAY,GATE,GATE_DIST,GATE_VMT_DAY,FULL_DIST,FULL_VMT
MW[1]=mi.1.1 + mi.1.2 + mi.1.3 + mi.1.4 + mi.1.5 + mi.1.6 + mi.1.7 + mi.1.8 + mi.1.9 + mi.1.10 + mi.1.11 + mi.1.12 +
mi.1.13 + mi.1.14 + mi.1.15      + mi.1.16 + mi.1.17 + mi.1.18 + mi.1.19 + mi.1.20 + mi.1.21 + mi.1.22 + mi.1.23 + mi.1.24 +
mi.1.25 + mi.1.26 + mi.1.27 + mi.1.28 + mi.1.29 + mi.1.30 + mi.1.31 + mi.1.32 + mi.1.33 + mi.1.34 + mi.1.35 + mi.1.36 +
mi.1.37 + mi.1.38 + mi.1.39 + mi.1.14 + mi.1.41 + mi.1.42 + mi.1.43 + mi.1.44 + mi.1.45 + mi.1.46 + mi.1.47 + mi.1.48 +
mi.1.49 + mi.1.50 + mi.1.51 + mi.1.52 + mi.1.53 + mi.1.54 + mi.1.55 + mi.1.56 + mi.1.57 + mi.1.58 + mi.1.59 + mi.1.60
            MW[2]=mi.2.2
            MW[3]=mi.2.3
            MW[4]=MW[1]*MW[3]
            MW[5]=mi.2.4
            MW[6]=MW[1]*MW[5]
ENDRUN
;=========================
; Export to CSV
run pgm=matrix
filei mati[1] = OD_Gate_VMT_?.mat
fileo mato[1]= OD_Gate_VMT_?_IX.csv, MO=1-6, FORMAT=csv, PATTERN=IJM:V, DEC=d, DELIMITER=','
fileo mato[2]= OD_Gate_VMT_?_XI.csv, MO=7-12, FORMAT=csv, PATTERN=IJM:V, DEC=d, DELIMITER=','
            IF (I=@Project1@)
                        MW[1]=MI.1.1  EXCLUDE=@Project1@
                        MW[2]=MI.1.2  EXCLUDE=@Project1@
                        MW[3]=MI.1.3  EXCLUDE=@Project1@
                        MW[4]=MI.1.4  EXCLUDE=@Project1@
                        MW[5]=MI.1.5  EXCLUDE=@Project1@
                        MW[6]=MI.1.6  EXCLUDE=@Project1@
            ELSE
                        MW[1]=0
                        MW[2]=0
                        MW[3]=0
                        MW[4]=0
                        MW[5]=0
                        MW[6]=0
            ENDIF

            JLOOP
            IF (I=@Project1@ & J=@Project1@)
                        MW[7]=0
                        MW[8]=0
```

```
                MW[9]=0
                MW[10]=0
                MW[11]=0
                MW[12]=0
        ELSEIF (J=@Project1@)
                MW[7]=MI.1.1
                MW[8]=MI.1.2
                MW[9]=MI.1.3
                MW[10]=MI.1.4
                MW[11]=MI.1.5
                MW[12]=MI.1.6
        ELSE
                MW[7]=0
                MW[8]=0
                MW[9]=0
                MW[10]=0
                MW[11]=0
                MW[12]=0
        ENDIF
        ENDJLOOP
ENDRUN
```

FEHR PEERS

ATTACHMENT D – Small Project Triggers

SMALL PROJECT SCREENING FOR SB743

The following document provides substantial evidence to support the screening on 'small' projects for SB 743 purposes. The OPR Technical Advisory relies on a trip trigger based on CEQA exemptions.

Screening Threshold for Small Projects

Many local agencies have developed screening thresholds to indicate when detailed analysis is needed. Absent substantial evidence indicating that a project would generate a potentially significant level of VMT, or inconsistency with a Sustainable Communities Strategy (SCS) or general plan, projects that generate or attract fewer than 110 trips per day[19] generally may be assumed to cause a less-than-significant transportation impact.

Map-Based Screening for Residential and Office Projects

Residential and office projects that locate in areas with low VMT, and that incorporate similar features (i.e., density, mix of uses, transit accessibility), will tend to exhibit similarly low VMT. Maps created with VMT data, for example from a travel survey or a travel demand model, can illustrate areas that are

---

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

Two potential limitations of this trigger have been identified. First, the trigger is not tied to a VMT estimate. Second, the trigger does not consider residential land uses. To strengthen the evidence, we used specific CEQA exemptions related to residential projects and 2012 California Household Travel Survey (CHTS) household VMT estimates to develop the following modification to the OPR approach. The CEQA exemption sections are provided below.

15303. NEW CONSTRUCTION OR CONVERSION OF SMALL STRUCTURES

Class 3 consists of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure. The numbers of structures described in this section are the maximum allowable on any legal parcel. Examples of this exemption include, but are not limited to:

(a) One single-family residence, or a second dwelling unit in a residential zone. In urbanized areas, up to three single-family residences may be constructed or converted under this exemption.
(b) A duplex or similar multi-family residential structure, totaling no more than four dwelling units. In urbanized areas, this exemption applies to apartments, duplexes and similar structures designed for not more than six dwelling units.
(c) A store, motel, office, restaurant or similar structure not involving the use of significant amounts of hazardous substances, and not exceeding 2500 square feet in floor area. In urbanized areas, the exemption also applies to up to four such commercial buildings not exceeding 10,000 square feet in floor area on sites zoned for such use if not involving the use of significant amounts of hazardous substances where all necessary public services and facilities are available and the surrounding area is not environmentally sensitive.
Note: Authority cited: Section 21083, Public Resources Code; Reference: Sections 21084, Public Resources Code.

15315. MINOR LAND DIVISIONS
Class 15 consists of the division of property in urbanized areas zoned for residential, commercial, or industrial use into four or fewer parcels when the division is in conformance with the General Plan and zoning, no variances or exceptions are required, all services and access to the proposed parcels to local standards are available, the parcel was not involved in a division of a larger parcel within the previous 2 years, and the parcel does not have an average slope greater than 20 percent.
Note: Authority cited: Sections Section 21083, Public Resources Code; Reference: Section 21084, Public Resources Code.

Based on the 2012 CHTS, here are a range of VMT estimates for 2, 4, and 6 units based on the CA and SACOG average VMT generation per household.

CA Average – 41.6 VMT per household

- 2 units = 83.2 VMT per day
- 4 units = 166.4 VMT per day
- 6 units = 249.6 VMT per day (urban areas only)

SACOG Average – 42.9 VMT per household

- 2 units = 85.8 VMT per day
- 4 units = 171.6 VMT per day
- 6 units = 257.4 VMT per day (urban areas only)

Another option is to rely on the maximum level of development allowed by CEQA exemptions and convert that value to a 'dwelling unit equivalent' measure similar to impact fee programs. OPR estimated that non-residential uses could generate 110-124 daily trips based on a maximum project exemption size of 10,000 square feet (KSF). Using the lower end of the range and CHTS trip lengths produces a VMT equivalent for 10 KSF for CA and SACOG of 836 and 869, respectively. This equates to about 20 residential households.

FEHR PEERS

ATTACHMENT E – VMT Mitigation Memorandum

FEHR PEERS

TECHNICAL MEMORANDUM

Date: December 6, 2019

To: Olivia Ervin, City of Petaluma

From: Neil Smolen, Ron Milam, & Ian Barnes, Fehr & Peers

Subject: SB 743 Implementation VMT Reduction Strategy Assessment

SF19-1023

This technical memorandum summarizes our assessment of tools and research on the effectiveness of strategies to reduce vehicle miles of travel (VMT). The information in this memorandum supports SB 743 implementation to determine potentially feasible VMT mitigation measures for individual land use projects in Petaluma upon formal adoption of the City's VMT policy.

The tools and research summarized in this memorandum include information published in *Quantifying Greenhouse Gas Mitigation Measures* (CAPCOA, 2010), *SB 743 Implementation TDM Strategy Assessment* (Fehr & Peers, 2019), and SANDAG's *Mobility Management Toolbox* (SANDAG, 2019)[1]. This memorandum documents the information from these sources and identifies the VMT reduction strategies most suited for Petaluma given its suburban land use context. Additional reference material is attached to this memorandum and described in more detail below.

An important consideration for the effectiveness of these VMT reduction strategies is the appropriate scale of implementation. The strategies described in this memorandum include programmatic strategies (e.g., VMT impact fee programs, VMT exchanges, and VMT banks), city-scale transportation infrastructure strategies (e.g., expanding the transit or bicycle network), and project-level strategies (e.g., building site transportation demand management [TDM] strategies such as parking pricing and transit pass subsidies). The largest reductions in VMT (and resulting emissions) derive from regional policies related to land use location efficiency and infrastructure investments that support transit, walking, and biking. While there are many measures related to site design and building operations that can influence VMT and emissions, these measures typically have smaller effects on VMT reduction and are often dependent on the travel behavior of the final building tenants.

To caveat the information presented in this memorandum, the existing tools and methods for quantifying VMT reduction are prone to a high margin of error due to limited data and research on this topic as a

[1] SANDAG refers to the San Diego Association of Governments.

result of recent regulatory changes (i.e., SB 743 and the policy change from LOS to VMT) as well as challenges in understanding the complex factors that influence travel behavior. To some degree, this is consistent with uncertainty that exists with currently accepted CEQA transportation practices, such as calculations of Level of Service (LOS) based on forecasted intersection volumes. However, unlike previous CEQA practices using LOS, monitoring of TDM effectiveness would be required at the project level as a condition of approval for discretionary projects. The ultimate strategies adopted for VMT reduction should be refined as additional research on the topic of VMT reduction becomes available and, as with all CEQA practice, based on substantial evidence.

Review of Research and Tools

The CAPCOA 2010 report *Quantifying Greenhouse Gas Mitigation Measures* identifies 50 transportation measures for reducing VMT that can be implemented at the project level or the community level. To quantify the effects of these measures, CAPCOA created calculation methodologies to estimate how each strategy would change VMT. Fehr & Peers further refined these calculation methodologies in *SB 743 Implementation TDM Strategy Assessment* (Fehr & Peers, 2019) based on new academic research. The matrix in Attachment A summarizes the overall evaluation of the CAPCOA strategies and the refinements to the VMT calculation methodologies.

In response to growing congestion, SB 743 implementation, and Climate Action Plan (CAP) efforts, SANDAG developed the Mobility Management Toolbox (Toolbox). The toolbox helps local jurisdictions and developers evaluate and implement TDM strategies at the project and community level. The Toolbox consists of the following resources:

- *Mobility Management Guidebook* – This document describes more than 30 mobility management strategies that can be implemented at the project and community levels to mitigate transportation impacts and includes descriptions, implementation considerations, and key references available.
- *VMT Reduction Calculator Tool* – This tool is an Excel Spreadsheet that allows users to estimate the percent reduction in VMT resulting from more than 20 TDM strategies, which are organized into project/site-level strategies and community/city-level strategies.
- *VMT Reduction Calculator Tool Design Document* – This document provides the overall methodology, inputs, and data sources used to develop the VMT Reduction Calculator Tool.

In addition to the sources above, SANDAG also provides recommended applications for the Mobility Management Toolbox[2] as well as web-based user training videos[3] that provide additional instructional guidance on how to use and update the VMT Reduction Calculator Tool.

[2] https://www.icommutesd.com/docs/default-source/planning/mobility-management-toolbox-applications-report.pdf?sfvrsn=2

[3] https://www.youtube.com/watch?v=lx3SPx9oIIU&list=PLm9w9mTQIGdZQwqxYXU1Wuy3tTrVKMDeD&index=1

Although the tools and research described above provide insight into the VMT reduction potential of TDM strategies, there remains a high degree of uncertainty regarding the effectiveness of TDM programs, both individually and in combination. This uncertainty is due to unknowns about the behavior of future tenants, how tenants will respond to VMT reduction strategies, and background conditions that influence travel behavior such as fuel prices. Therefore, while an individual tool may present a precise estimate of VMT reduction associated with each strategy, these estimates should be treated as the mid-point of a range of potential effectiveness. As such, different tools may provide different estimates of total VMT reduction based on assumptions around input variables and baseline conditions at the project or building site.

Recommended VMT Reduction Strategies

Of the strategies included in the tools and research described above, only a few strategies are likely to be effective in a suburban setting such as Petaluma. With Petaluma's land use context in mind, each strategy's effectiveness was considered and nine were selected for detailed review. These nine strategies are described in Attachment B and listed below. Strategies 1, 2, 3, and 4 present project-level mitigation, while strategies 5, 6, 7, 8 and 9 present community-level mitigation. Individual development projects have limited ability to implement community-level strategies, but may be able to contribute to established community-level strategies. Please note that disruptive trends, including but not limited to, transportation network companies (TNCs such as Uber and Lyft), autonomous vehicles (AVs), internet shopping, and micro-transit (e.g., electric scooters) may affect the future effectiveness of these strategies.

Project/Site Level 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. This strategy may not be feasible for smaller projects or projects subject to limited uses due to zoning such as single-family residential uses.
2. Increase density – This strategy focuses on increasing residential density within projects, which 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. This measure also applies at the city and community level, with neighborhoods of higher density typically having lower VMT per capita.
3. Increase transit accessibility – This strategy focuses on ensuring site design favors access to existing or planned transit stations and is commonly referred to as Transit-Oriented Development (TOD). This strategy includes maximizing the amount of developable space within walking distance to transit stations (typically considered a radius of ¼ to ½ mile of a transit station), including a central transit station in the site design, and/or deemphasizing automobile facilities such as vehicle parking, garages, and driveways.

4. Encourage telecommuting – This strategy relies on effective internet access/speeds, flex space, and/or accessory office units for individual project sites/buildings that provide the opportunity for telecommuting. The effectiveness of the strategy depends on the ultimate building tenants; this should be a factor in considering the potential VMT reduction, as tenants may change over time.

City/Community Level Strategies

5. Provide pedestrian network improvements – This strategy focuses on creating a pedestrian network and connecting projects to nearby destinations via pedestrian pathways. Projects in the City of Petaluma 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 or benefit/assessment district based on local or regional plans.

6. Provide traffic calming measures and low-stress bicycle network improvements – This strategy combines the CAPCOA research focused on traffic calming to provide a low-stress bicycle network. Traffic calming creates networks with low vehicle speeds and volumes that are more conducive to walking and bicycling. Implementation options are similar to those for providing pedestrian network improvements. 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.

7. Implement market price public parking (on-street) – This strategy focuses on implementing a market based pricing strategy for on-street parking within central business districts, employment centers, and retail centers to encourage "park once" behavior. This measure 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.

8. Increase transit service frequency and speed – This strategy focuses on improving transit service convenience and travel time competitiveness with driving. While the City of Petaluma has fixed route rail and bus service that could be enhanced, it is possible that new forms of low-cost, demand-responsive transit service could be provided. Given land use density in Petaluma, this strategy may be limited to traditional commuter transit where trips can be pooled at the start and end locations or require new forms of demand-responsive transit service. The demand-responsive service could be provided as subsidized trips by contracting to private transportation network companies (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. 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. Additionally,

this strategy is only effective in VMT reduction if it includes a pooling element to increase average vehicle occupancy.

9. Implement a 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.

The VMT reduction strategies can be quantified using CAPCOA calculation methodologies, recent ARB research findings, or SANDAG's VMT calculator. Attachment C provides calculation methodologies for each of the mitigations provided above, along with their range of effectiveness.

Additional VMT reduction strategies that are not quantified in this memorandum but may be considered for future implementation in Petaluma include:

- Engagement with bicycle advocacy groups such as the League of American Bicyclists to work towards certification as a bicycle friendly community
- Implement education strategies to inform the public about the Vision Zero strategies to improve road safety, increase health outcomes from active transportation, and decrease VMT
- Add additional wayfinding signage and safety procedures for bicycling through Downtown
- Incentivize non-vehicular tourism in Petaluma through partnerships with SMART and upcoming Bike Share providers as well as providing protected bicycle routes for tourists to major destinations, such as between SMART and Downtown
- Improve Petaluma's existing dirt trails to accommodate wider range of bicyclists
- Incentivize active transportation through market pricing strategies with employers, stores, and public transit.[4]
- Collaborate with TNCs to provide first mile/last mile connections to high frequency transit corridors. Transit timing, carpooling, and ride discounts associated with TNC partnerships should be considered as simultaneous strategies, following the lead of other cities implementing such programs.

Combining VMT Reduction Strategies

Each of the TDM measures described above can be combined with others to increase the effectiveness of VMT mitigation; however, the interaction between the various TDM measures is complex and sometimes

[4] The Dutch government pays workers 22 cents for every kilometer they pedal, reported by Huffington Post. https://www.huffpost.com/entry/netherlands-pays-bike-work-commute_n_5c6dc15ae4b0e2f4d8a23e3e

counter-intuitive. Generally, with each additional measure implemented, a VMT reduction is achieved, but the incremental benefit of VMT reduction may diminish. To quantify the VMT reduction that results from combining TDM measures, the formula below can be applied absent additional information:

$$Total\ VMT\ Reduction = (1 - P_a) * (1 - P_b) * (1 - P_c) * \dots$$

Where:

- P_x = percent reduction of each VMT reduction strategy

This adjustment methodology is simply a mathematical approach to dampening the potential effectiveness and is not supported by research related to the actual effectiveness of combined TDM strategies. The intent of including this formula is to include a mechanism for dampening to minimize the potential to overstate the VMT reduction effectiveness.

Another important consideration when combining TDM measures is whether a maximum VMT reduction should be applied based on the land use context. The CAPCOA methodology identifies VMT reduction maximums based on community types tied to land use context. The caps are applied at each step of the VMT reduction calculation (i.e., at the strategy scale, the combined strategy scale, and the global scale). However, these caps are not based on research related to the effectiveness of VMT reduction strategies in different land use contexts. The cap differences are largely based on VMT generation differences within different land use contexts and serves as a proxy for potential limits on VMT reduction strategy effectiveness. For suburban jurisdictions such as Petaluma, CAPCOA identifies a global VMT reduction maximum of 15 percent. For more information on VMT reduction maximums, see Attachment D, which contains an excerpt from the CAPCOA report describing the calculation of combined VMT reduction strategies.

As noted previously, additional data is needed to support and refine the above approach for quantifying the effects of combining VMT reduction strategies. Analysts should consider the available substantial evidence at the time a study is prepared to determine the most appropriate approach for CEQA review. We recommend conducting additional research into the effects of combining VMT reduction strategies, which may include the collection of measurable data from within Petaluma or cities of similar size and land use context.

Implementing VMT Reduction Strategies

Project or site-level VMT reduction strategies often involve increasing land use density, changing the mix of uses, or altering the transportation network. However, a potential limitation of these physical design changes is that they may result in a project that no longer resembles the original applicant submittal. CEQA is intended to disclose the potential impacts of a project and mitigate those impacts but has limitations with regards to using mitigation to fundamentally change the project. Therefore, these strategies may result in an inconsistency with the project description when applied on an ad hoc basis.

Another common strategy is to add a TDM program to the project as a condition of approval. While evidence exists that TDM programs can reduce VMT, their success depends on the performance of future building tenants that can change over time. Hence, an effective TDM mitigation program will often require ongoing monitoring and adjustment to ensure long-term VMT reduction is achieved. The cost to provide this monitoring may not be feasible for all projects.

In response to the limitations of focusing exclusively on site-level TDM strategies, new mitigation concepts are emerging that cover larger areas and rely on citywide programs to achieve VMT reductions. These mitigation concepts (or programs) are outlined below. As with all VMT mitigation, these programs require substantial evidence to document that the projects included in the programs would achieve the expected VMT reductions. Additionally, the discretionary action to adopt the program may require CEQA review.

1. VMT Impact Fee Program – This concept resembles a traditional impact fee program in compliance with the mitigation fee act and uses VMT as a metric. The nexus for the fee program would be a VMT reduction goal consistent with the CEQA threshold established by a lead agency for SB 743 purposes. The main difference from a fee program based on a metric such as vehicle LOS is that the VMT reduction nexus results in a capital improvement program (CIP) consisting largely of transit, bicycle, and pedestrian projects. These types of fee programs are time consuming to develop, monitor, and maintain but are recognized as an acceptable form of CEQA mitigation if they can demonstrate that the CIP projects will be fully funded and implemented. The City of Los Angeles is the first city in California to complete a nexus study for this type of program.
2. VMT Exchanges – This concept (along with VMT banks) borrows mitigation approaches from other environmental analysis such as wetlands. The concept relies on a developer agreement to implement a predetermined VMT-reducing project in exchange for the ability to develop a VMT-generating project. The projects may or may not be located near each other. The concept requires a facilitating entity (such as the lead agency) to match the VMT generator (the development project) with the VMT-reducing project and ensure through substantial evidence that the VMT reduction is valid (i.e., the VMT reduction is caused by the mitigation and would not occur otherwise; this concept is known as additionality). VMT Exchanges also require a determination of the necessary time period to demonstrate a VMT reduction.
3. VMT Banks – This concept attempts to create a monetary value for VMT reduction (e.g., credits) that can be exchanged amongst individual projects. This program is more complicated than a simple exchange and would require more time and effort to set up and implement. Another key challenge of this program is determining how much VMT reduction is associated with each credit. Similar to VMT exchanges, this mitigation program must also demonstrate additionality.

Table 1 compares the pros and cons of the above programs. As seen in Table 1, all of the program options have challenges.

TABLE 1: COMPARISON OF PROGRAMMATIC VMT REDUCTION STRATEGIES

Program Structure	Pros	Cons
Impact Fee Program	• Common practice • Accepted for CEQA mitigation • Adds certainty to development costs • Allows for regional scale projects	• Time consuming and expensive to develop and maintain • Requires strong nexus
Mitigation Exchange	• Limited complexity • Reduced nexus obligation	• Requires additionality • Mismatch between mitigation need and mitigation projects • Unknown timeframe for mitigation life
Mitigation Bank	• Adds certainty to development costs • Allows for regional scale projects • Allows regional or state transfers	• Requires additionality • Time consuming and expensive to develop and maintain • Requires strong nexus • Political difficulty distributing mitigation dollars/projects

Although implementation of these programs would require an upfront cost, they have several advantages over site-level TDM strategies:

- CEQA streamlining – These programs provide a funding mechanism for project mitigation and require significantly less monitoring to demonstrate that significant impacts are reduced to a less-than-significant level. Additionally, projects could be screened from completing a quantitative VMT analysis; or, if a quantitative VMT analysis is required, the cost would be somewhat less than the cost for analyzing LOS impacts.
- Greater VMT reduction potential – Since these programs coordinate citywide land use and transportation projects, they have the potential to result in greater VMT reduction potential than site-level TDM strategies applied on an ad hoc basis. Additionally, these programs expand the amount of feasible mitigation for reducing VMT impacts.
- Legal defensibility – The VMT reduction programs can help build a case for a nexus between a VMT impact and funding for capital improvement programs.

A General Plan update is a desirable time to identify and implement any preferred VMT reduction programs as it allows for coordination between land development, capital improvement projects, and funding programs.

FEHR PEERS

ATTACHMENT A – Comparison of CAPCOA Strategies Versus New Research Since 2010

FEHR PEERS

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
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.

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
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
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.*

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
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.
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	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

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
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
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

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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
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.
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	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.

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ATTACHMENT B – Relevant Strategies for Implementation in Petaluma (Due to Land Use Context)

Relevant Strategies for Implementation in Petaluma 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	3.1.1	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	3.1.3	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."

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Relevant Strategies for Implementation in Petaluma 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	3.1.5	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
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.

Relevant Strategies for Implementation in Petaluma Due to Land Use Context

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(1)	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	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	3.5.4	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
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

NOTES:

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

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ATTACHMENT C – Methodologies to Quantify VMT Reduction

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."

Increase Residential Density

Range of Effectiveness:

0.4% – 10.75% VMT reduction due to increasing residential density

Measure Description:

Designing the Project with increased densities, where allowed by the General Plan and/or Zoning Ordinance reduces GHG emissions associated with traffic in several ways. Density is usually measured in terms of persons, jobs, or dwellings per unit area. Increased densities affect the distance people travel and provide greater options for the mode of travel they choose. This strategy also provides a foundation for implementation of many other strategies which would benefit from increased densities. For example, transit ridership increases with density, which justifies enhanced transit service.

The reductions in GHG emissions are quantified based on reductions to VMT. The relationship between density and VMT is described by its elasticity (CAPCOA 2010, p. 155). 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.

Measure Applicability:

- Urban and suburban context
    - Negligible impact 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:

- Number of housing units per acre or jobs per job acre

Mitigation Method:

$$\%\ VMT\ Reduction = A * B\ [not\ to\ exceed\ 30\%]$$

Where:
A = Percentage increase in housing units per acre or jobs per job acre = (number of housing units per acre or jobs per job acre – number of housing units per acre or jobs per job acre for typical ITE development) / (number of housing units per acre or jobs per job acre for typical ITE development). For small and medium sites (less than ½ mile in radius) the calculation of housing and jobs per acre should be performed for the development site as a whole, so that the analysis does not erroneously attribute trip reduction benefits to measures that simply shift jobs and housing within the site with no overall increase in site density. For larger sites, the analysis should address the development as several ½-mile-radius sites, so that shifts from one area to another would increase the density of the receiving area but reduce

the density of the donating area, resulting in trip generation rate decreases and increases, respectively, which cancel one another.
B = Elasticity of VMT with respect to density (from literature)

Detail:

- A: [not to exceed 500% increase]
    - If housing: (Number of housing units per acre – 7.6) / 7.6
    - If jobs: Number of jobs per acre – 20) / 20
- B: -0.04 elasticity 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

Discussion:

The VMT reductions for this strategy are based on changes in density versus the typical suburban residential and employment densities in North America (referred to as "ITE densities"). These densities are used as a baseline to mirror those densities reflected in the ITE Trip Generation Manual, which is the baseline method for determining VMT. There are two separate maxima noted in the fact sheet: a cap of 500% on the allowable percentage increase of housing units or jobs per acre (variable A) and a cap of 30% on % VMT reduction. The rationale for the 500% cap is that there are diminishing returns to any change in environment. For example, it is reasonably doubtful that increasing residential density by a factor of six instead of five would produce any additional change in travel behavior. The purpose for the 30% cap is to limit the influence of any single environmental factor (such as density). 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.

References:

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

Quantifying Greenhouse Gas Mitigation Measures, California Air Pollution Control Officers Association (CAPCOA), 2010. Chapter 3.1.1 Increase Density

Stevens, M. (2017). Does Compact Development Make People Drive Less? Journal of the American Planning Association, 83(1), 7-18.

Increase Transit Accessibility

Range of Effectiveness:

1) 0 – 5.8% VMT reduction

   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) 0 – 7.3% VMT reduction

   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

Measure Description:

Locating a project with high density near 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. 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

Measure Applicability:

- Urban and suburban context

- Appropriate in a rural context if development site is adjacent to a commuter rail station with convenient rail service to a major employment center
- Appropriate for residential, retail, office, industrial, and mixed-use projects

Inputs:

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

- Distance to transit station in project

Mitigation Method:

$$\%\ VMT\ Reduction = Transit * B[not\ to\ exceed\ 30\%]$$

Where:

Transit = Increase in transit mode share = % transit mode share for project - % transit mode share for typical ITE development

% transit mode share for project (see Table)

Distance to transit Transit mode share calculation equation	Distance to transit Transit mode share calculation equation
(where x = distance of project to transit)	(where x = distance of project to transit)
0 – 0.5 miles -50*x + 38	0 – 0.5 miles -50*x + 38
0.5 to 3 miles -4.4*x + 15.2	0.5 to 3 miles -4.4*x + 15.2
> 3 miles no impact	

B = adjustments from transit ridership increase to VMT (0.67)

Discussion:

The purpose for the 30% cap on percent VMT reduction is to limit the influence of any single environmental factor (such as transit accessibility). This emphasizes that community designs that implement multiple land use strategies (such as density, design, diversity, transit accessibility, etc.) will show more of a reduction than relying on improvements from a single land use factor.

References:

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

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 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 Market Price Public Parking (On-Street)

Range of Effectiveness:

2.8% - 14.5% VMT reduction.

Measure Description:

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.

The 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.

Inputs:

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

- Location of project site: low density suburb, suburban center, or urban location
- Percent increase in on-street parking prices (minimum 25% needed)

Mitigation Method:

$$\%\, VMT\ Reduction = Park\$ * B$$

Where:

$$Park\$ = Percent\ increase\ in\ on\ street\ parking\ prices\ (minimum\ 25\%\ increase)$$

$$B = Elasticity\ of\ VMT\ with\ respect\ to\ parking\ price$$

Discussion:

The range of parking price increases should be a minimum of 25% and a maximum of 50%. The minimum is based on Moving Cooler discussions, which state that a less than 25% increase would not be a sufficient amount to reduce VMT. The case study looked at a 50% price increase, and thus no conclusions can be made on the elasticities above a 50% increase. This strategy may certainly be implemented at a higher price increase, but VMT reductions should be capped at results from a 50% increase to be conservative.

References:

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.

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

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.

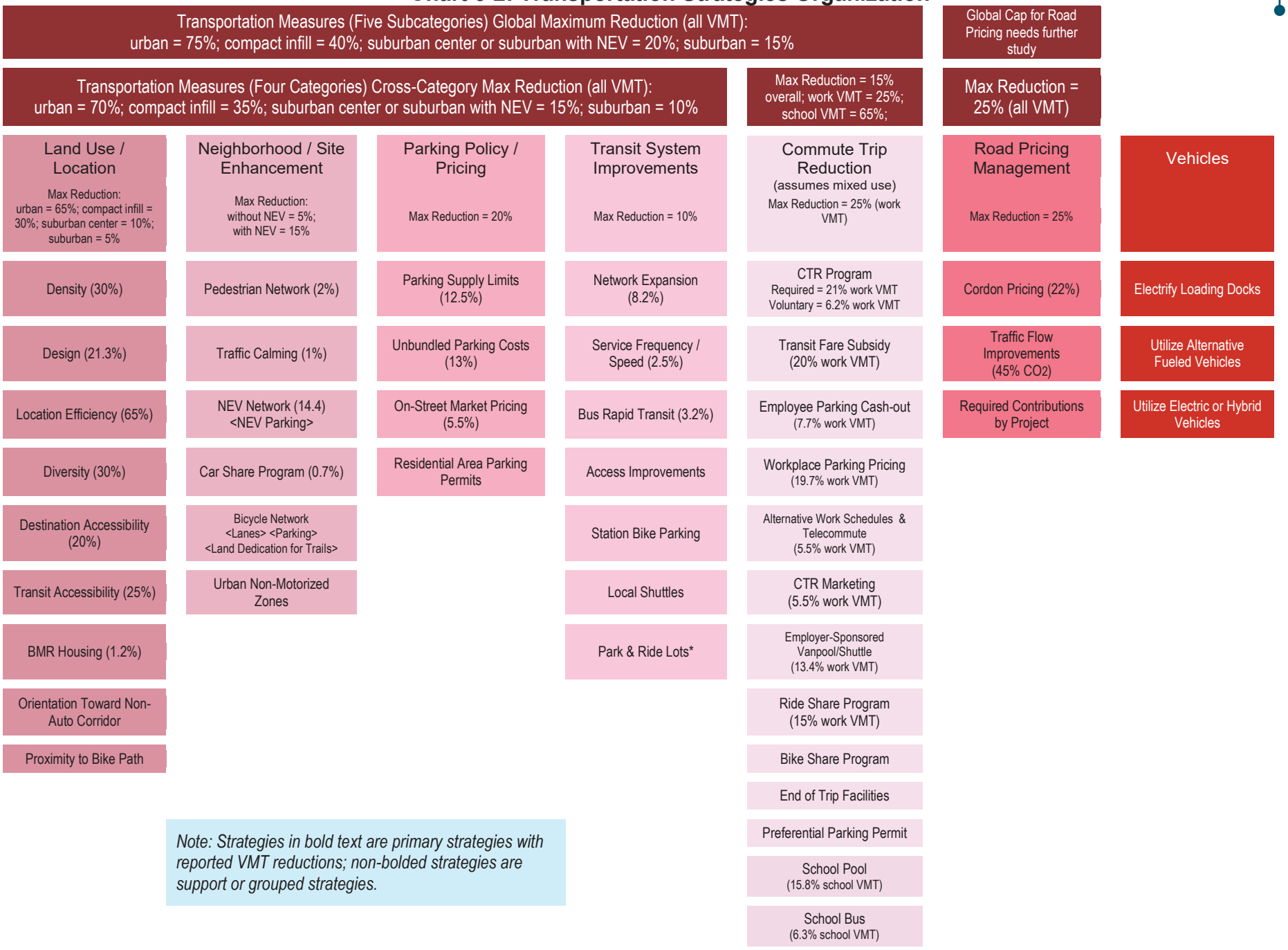
Lovejoy, K. et al. (2013). Impacts of Carsharing on Passenger Vehicle Use and Greenhouse Gas Emissions - Policy Brief and Technical Background Document. California Air Resources Board. Retrieved from: https://arb.ca.gov/cc/sb375/policies/policies.htm

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

FEHR PEERS

ATTACHMENT D – CAPCOA Guidance on Combining VMT Reduction Strategies

Chart 6-2: Transportation Strategies Organization



Note: Strategies in bold text are primary strategies with reported VMT reductions; non-bolded strategies are support or grouped strategies.

Grouping of Strategies

Strategies noted as "grouped" are separately documented in individual Fact Sheets but must be paired with other strategies within the category. When these "grouped" strategies are implemented together, the combination will result in either an enhancement to the primary strategy by improving its effectiveness or a non-negligible reduction in effectiveness that would not occur without the combination.

Rules for Combining Strategies or Measures

Mitigation measures or strategies are frequently implemented together with other measures. Often, combining measures can lead to better emission reductions than implementing a single measure by itself. Unfortunately, the effects of combining the measures are not always as straightforward as they might at first appear. When more and more measures are implemented to mitigate a particular source of emissions, the benefit of each additional measure diminishes. If it didn't, some odd results would occur. For example, if there were a series of measures that each, independently, was predicted to reduce emissions from a source by 10%, and if the effect of each measure was independent of the others, then implementing ten measures would reduce all of the emissions; and what would happen with the eleventh measure? Would the combination reduce 110% of the emissions? No. In fact, each successive measure is slightly less effective than predicted when implemented on its own.

On the other hand, some measures enhance the performance of a primary measure when they are combined. This Report includes a set of rules that govern different ways of combining measures. The rules depend on whether the measures are in the *same* category, or different categories. Remember, the categories include: Energy, Transportation, Water, Landscape Equipment, Solid Waste, Vegetation, Construction, Miscellaneous Categories, and General Plans.

Combinations Between Categories: The following procedures must be followed when combining mitigation measures that fall in separate categories. In order to determine the overall reduction in GHG emissions compared to the baseline emissions, the relative magnitude of emissions between the source categories needs to be considered. To do this, the user should determine the percent contribution made by each individual category to the overall baseline GHG emissions. This percent contribution by a category should be multiplied by the reduction percentages from mitigation measures in that category to determine the scaled GHG emission reductions from the measures in that category. This is done for each category to be combined. The scaled GHG emissions for each category can then be added together to give a total GHG reduction for the combined measures in all of the categories.

For example, consider a project whose total GHG emissions come from the following categories: transportation (50%), building energy use (40%), water (6%), and other (4%). This project implements a transportation mitigation measure that results in a 10% reduction in VMT. The project also implements mitigation measures that result in a 30% reduction in water usage. The overall reduction in GHG emissions is as follows:

Reduction from Transportation: 0.50 x 0.10 = 0.5 or 5%
Reduction from Water: 0.06 x 0.30 = 0.018 or 1.8%

Total Reduction: 5% + 1.8% = 6.8%

This example illustrates the importance of the magnitude of a source category and its influence on the overall GHG emission reductions.

The percent contributions from source categories will vary from project to project. In a commercial-only project it may not be unusual for transportation emissions to represent greater than 75% of all GHG emissions whereas for a residential or mixed use project, transportation emissions would be below 50%.

Combinations Within Categories: The following procedures must be followed when combining mitigation measures that fall within the same category.

Non-Transportation Combinations: When combining non-transportation subcategories, the total amount of reductions for that category should not exceed 100% except for categories that would result in additional excess capacity that can be used by others, but which the project wants to take credit for (subject to approval of the reviewing agency). This may include alternative energy generation systems tied into the grid, vegetation measures, and excess graywater or recycled water generated by the project and used by others. These excess emission reductions may be used to offset other categories of emissions, with approval of the agency reviewing the project. In these cases of excess capacity, the quantified amounts of excess emissions must be carefully verified to ensure that any credit allowed for these additional reductions is truly surplus.

Category Maximum- Each category has a maximum allowable reduction for the combination of measures in that category. It is intended to ensure that emissions are not double counted when measures within the category are combined. Effectiveness levels for multiple strategies within a subcategory (as denoted by a column in the appropriate chart, above) may be multiplied to determine a combined effectiveness level up to a maximum level. This should be done first to mitigation measures that are a source reduction followed by those that are a reduction to emission factors. Since the combination of mitigation measures and independence of mitigation measures are both complicated, this Report recommends that mitigation measure reductions within a category be multiplied unless a project applicant can provide substantial evidence indicating that emission reductions are independent of one another. This will take the following form:

GHG emission reduction for category = 1-[(1-A) x (1-B) x (1-C)]

Where:

A, B and C = Individual mitigation measure reduction percentages for the strategies to be combined in a given category.

Global Maximum- A separate maximum, referred to as a global maximum level, is also provided for a combination across subcategories. Effectiveness levels for multiple strategies across categories may also be multiplied to determine a combined effectiveness level up to global maximum level.

For example, consider a project that is combining 3 mitigation strategies from the water category. This project will install low-flow fixtures (measure WUW-1), use water-efficient irrigation (measure WUW-4, and reduce turf (measure WUW-5). Reductions from these measures will be:

- low-flow fixtures 20% or 0.20 (A)
- water efficient irrigation 10% or 0.10 (B)
- turf reductions 20% or 0.20 (C)

To combine measures within a category, the reductions would be
= 1-[(1-A) x (1-B) x (1-C)]
= 1-[(1-.20) x (1-.10) x (1-.20)]
= 1-[(0.8) x (0.9) x (.8)]
= 1-0.576 = 0.424
= 42.4%

Transportation Combinations: The interactions between the various categories of transportation-related mitigation measures is complex and sometimes counter-intuitive. Combining these measures can have a substantive impact on the quantification of the associated emission reductions. In order to safeguard the accuracy and reliability of the methods, while maintaining their ease of use, the following rules have been developed and should be followed when combining transportation-related mitigation measures. The rules are presented by sub-category, and reference Chart 6-2 Transportation Strategies Organization. The maximum reduction values also reflect the highest reduction levels justified by the literature. The chart indicates maximum reductions for individual mitigation measures just below the measure name.

Cross-Category Maximum- A cross-category maximum is provided for any combination of land use, neighborhood enhancements, parking, and transit strategies (columns A-D in Chart 6-1, with the maximum shown in the top row). The total project VMT reduction across these categories should be capped at these levels based on empirical evidence.[3] Caps are provided for the location/development type of the project. VMT reductions may be multiplied across the four categories up to this maximum. These include:

- Urban: 70% VMT
- Compact Infill: 35%
- Suburban Center (or Suburban with NEV): 15%
- Suburban: 10% (note that projects with this level of reduction must include a diverse land use mix, workforce housing, and project-specific transit; limited empirical evidence is available)

(See blue box, pp. 58-59.)

[3] As reported by Holtzclaw, et al for the State of California.

As used in this Report, location settings are defined as follows:

Urban: A project located within the central city and may be characterized by multi-family housing, located near office and retail. Downtown Oakland and the Nob Hill neighborhood in San Francisco are examples of the typical urban area represented in this category. The urban maximum reduction is derived from the average of the percentage difference in per capita VMT versus the California statewide average (assumed analogous to an ITE baseline) for the following locations:

Location	Percent Reduction from Statewide VMT/Capita
Central Berkeley	-48%
San Francisco	-49%
Pacific Heights (SF)	-79%
North Beach (SF)	-82%
Mission District (SF)	-75%
Nob Hill (SF)	-63%
Downtown Oakland	-61%

The average reflects a range of 48% less VMT/capita (Central Berkeley) to 82% less VMT/capita (North Beach, San Francisco) compared to the statewide average. The urban locations listed above have the following characteristics:

- Location relative to the regional core: these locations are within the CBD or less than five miles from the CBD (downtown Oakland and downtown San Francisco).
- Ratio or relationship between jobs and housing: jobs-rich (jobs/housing ratio greater than 1.5)
- Density character
  - typical building heights in stories: six stories or (much) higher
  - typical street pattern: grid
  - typical setbacks: minimal
  - parking supply: constrained on and off street
  - parking prices: high to the highest in the region
- Transit availability: high quality rail service and/or comprehensive bus service at 10 minute headways or less in peak hours

Compact infill: A project located on an existing site within the central city or inner-ring suburb with high-frequency transit service. Examples may be community redevelopment areas, reusing abandoned sites, intensification of land use at established transit stations, or converting underutilized or older industrial buildings. Albany and the Fairfax area of Los Angeles are examples of typical compact infill area as used here. The compact infill maximum reduction is derived from the average of the percentage difference in per capita VMT versus the California statewide average for the following locations:

Location	Percent Reduction from Statewide VMT/Capita
Franklin Park, Hollywood	-22%
Albany	-25%
Fairfax Area, Los Angeles	-29%
Hayward	-42%

The average reflects a range of 22% less VMT/capita (Franklin Park, Hollywood) to 42% less VMT/capita (Hayward) compared to the statewide average. The compact infill locations listed above have the following characteristics:

- Location relative to the regional core: these locations are typically 5 to 15 miles outside a regional CBD
- Ratio or relationship between jobs and housing: balanced (jobs/housing ratio ranging from 0.9 to 1.2)
- Density character
  - typical building heights in stories: two to four stories
  - typical street pattern: grid
  - typical setbacks: 0 to 20 feet
  - parking supply: constrained
  - parking prices: low to moderate
- Transit availability: rail service within two miles, or bus service at 15 minute peak headways or less

As used in this Report, additional location settings are defined as follows:

Suburban Center: A project typically involving a cluster of multi-use development within dispersed, low-density, automobile dependent land use patterns (a suburb). The center may be an historic downtown of a smaller community that has become surrounded by its region's suburban growth pattern in the latter half of the 20th Century. The suburban center serves the population of the suburb with office, retail and housing which is denser than the surrounding suburb. The suburban center maximum reduction is derived from the average of the percentage difference in per capita VMT versus the California statewide average for the following locations:

Location	Percent Reduction from Statewide VMT/Capita
Sebastopol	0%
San Rafael (Downtown)	-10%
San Mateo	-17%

The average reflects a range of 0% less VMT/capita (Sebastopol) to 17% less VMT/capita (San Mateo) compared to the statewide average. The suburban center locations listed above have the following characteristics:

- Location relative to the regional core: these locations are typically 20 miles or more from a regional CBD
- Ratio or relationship between jobs and housing: balanced
- Density character
  - typical building heights in stories: two stories
  - typical street pattern: grid
  - typical setbacks: 0 to 20 feet
  - parking supply: somewhat constrained on street; typically ample off-street
  - parking prices: low (if priced at all)
- Transit availability: bus service at 20-30 minute headways and/or a commuter rail station

While all three locations in this category reflect a suburban "downtown," San Mateo is served by regional rail (Caltrain) and the other locations are served by bus transit only. Sebastopol is located more than 50 miles from downtown San Francisco, the nearest urban center. San Rafael and San Mateo are located 20 miles from downtown San Francisco.

Suburban: A project characterized by dispersed, low-density, single-use, automobile dependent land use patterns, usually outside of the central city (a suburb). Suburbs typically have the following characteristics:

- Location relative to the regional core: these locations are typically 20 miles or more from a regional CBD
- Ratio or relationship between jobs and housing: jobs poor
- Density character
  - typical building heights in stories: one to two stories
  - typical street pattern: curvilinear (cul-de-sac based)
  - typical setbacks: parking is generally placed between the street and office or retail buildings; large-lot residential is common
  - parking supply: ample, largely surface lot-based
  - parking prices: none
- Transit availability: limited bus service, with peak headways 30 minutes or more

The maximum reduction provided for this category assumes that regardless of the measures implemented, the project's distance from transit, density, design, and lack of mixed use destinations will keep the effect of any strategies to a minimum.

Global Maximum- A global maximum is provided for any combination of land use, neighborhood enhancements, parking, transit, and commute trip reduction strategies (the first five columns in the organization chart). This excludes reductions from road-pricing measurements which are discussed separately below. The total project VMT reduction across these categories, which can be combined through multiplication, should be capped

at these levels based on empirical evidence.[4] Maximums are provided for the location/development type of the project. The Global Maximum values can be found in the top row of Chart 6-2.

These include:

- Urban: 75% VMT
- Compact Infill: 40% VMT
- Suburban Center (or Suburban with NEV): 20%
- Suburban: 15% (limited empirical evidence available)

Specific Rules for Subcategories within Transportation- Because of the unique interactions of measures within the Transportation Category, each subcategory has additional rules or criteria for combining measures.

❖ Land Use/Location Strategies – Maximum Reduction Factors: Land use measures apply to a project area with a radius of ½ mile. If the project area under review is greater than this, the study area should be divided into subareas of radii of ½ mile, with subarea boundaries determined by natural "clusters" of integrated land uses within a common walkshed. If the project study area is smaller than ½ mile in radius, other land uses within a ½ mile radius of the key destination point in the study area (i.e. train station or employment center) should be included in design, density, and diversity calculations. Land use measures are capped based on empirical evidence for location setting types as follows:[5]

- Urban: 65% VMT
- Compact Infill: 30% VMT
- Suburban Center: 10% VMT
- Suburban: 5% VMT

❖ Neighborhood/Site Enhancements Strategies – Maximum Reduction Factors: The neighborhood/site enhancements category is capped at 12.7% VMT reduction (with Neighborhood Electric Vehicles (NEVs)) and 5% without NEVs based on empirical evidence (for NEVs) and the multiplied combination of the non-NEV measures.

❖ Parking Strategies – Maximum Reduction Factors: Parking strategies should be implemented in one of two combinations:

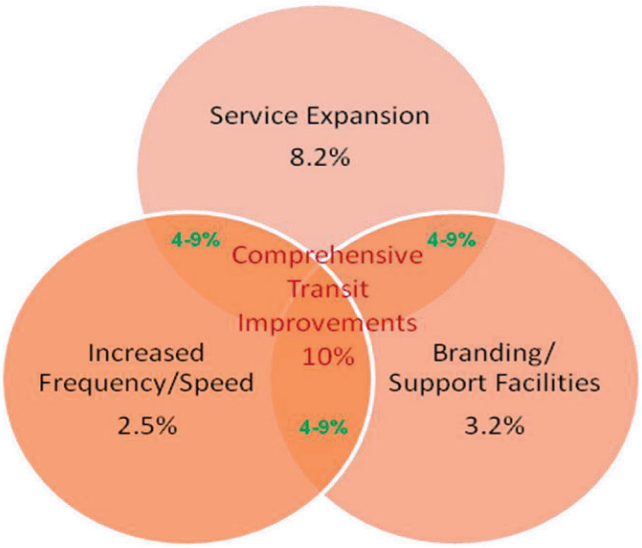
- Limited (reduced) off-street supply ratios plus residential permit parking and priced on-street parking (to limit spillover), or
- Unbundled parking plus residential permit parking and priced on-street parking (to limit spillover).

[4] As reported by Holtzclaw, et al for the State of California. Note that CTR strategies must be converted to overall VMT reductions (from work-trip VMT reductions) before being combined with strategies in other categories.

[5] As reported for California locations in Holtzclaw, et al. "Location Efficiency: Neighborhood and Socioeconomic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles, and San Francisco." *Transportation Planning and Technology*, 2002, Vol. 25, pp. 1–27.

Note: The reduction maximum of 20% VMT reflects the combined (multiplied) effect of unbundled parking and priced on-street parking.

- Transit System Strategies – Maximum Reduction Factors: The 10% VMT reduction maximum for transit system improvements reflects the combined (multiplied) effect of network expansion and service frequency/speed enhancements. A comprehensive transit improvement would receive this type of reduction, as shown in the center overlap in the Venn diagram, below.



- Commuter Trip Reductions (CTR) Strategies – Maximum Reduction Factors: The most effective commute trip reduction measures combine incentives, disincentives, and mandatory monitoring, often through a transportation demand management (TDM) ordinance. Incentives encourage a particular action, for example parking cash-out, where the employee receives a monetary incentive for not driving to work, but is not punished for maintaining status quo. Disincentives establish a penalty for a status quo action. An example is workplace parking pricing, where the employee is now monetarily penalized for driving to work. The 25% maximum for work-related VMT applies to comprehensive CTR programs. TDM strategies that include only incentives, only disincentives, and/or no mandatory monitoring, should have a lower total VMT reduction than those with a comprehensive approach. Support strategies to strengthen CTR programs include guaranteed-ride-home, taxi vouchers, and message boards/marketing materials. A 25% reduction in work-related VMT is assumed equivalent to a 15% reduction in overall project VMT for the purpose of the global maximum; this can be adjusted for project-specific land use mixes.

  Two school-related VMT reduction measures are also provided in this category. The maximum reduction for these measures should be 65% of school-related VMT based on the literature.

- Road Pricing/Management Strategies – Maximum Reduction Factors: Cordon pricing is the only strategy in this category with an expected VMT reduction potential. Other forms of road pricing would be applied at a corridor or region-wide level rather than as mitigation applied to an individual development project. No domestic case studies are available for cordon pricing, but international studies suggest a VMT reduction maximum of 25%. A separate, detailed, and project-specific study should be conducted for any project where road pricing is proposed as a VMT reduction measure.

Additional Rules for Transportation Measures- There are also restrictions on the application of measures in rural applications, and application to baseline, as follows:

- Rural Application: Few empirical studies are available to suggest appropriate VMT reduction caps for strategies implemented in rural areas. Strategies likely to have the largest VMT reduction in rural areas include vanpools, telecommute or alternative work schedules, and master planned communities (with design and land use diversity to encourage intra-community travel). NEV networks may also be appropriate for larger scale developments. Because of the limited empirical data in the rural context, project-specific VMT reduction estimates should be calculated.

- Baseline Application: As discussed in previous sections of this report, VMT reductions should be applied to a baseline VMT expected for the project, based on the Institute of Transportation Engineers' 8th Edition *Trip Generation Manual* and associated typical trip distance for each land use type. Where trip generation rates and project VMT provided by the project Applicant are derived from another source, the VMT reductions must be adjusted to reflect any "discounts" already applied.

Range of Effectiveness of Mitigation Measures

The following charts provide the range of effectiveness for the quantified mitigation measures. Each chart shows one category of measures, with subcategories identified. The charts also show the basis for the quantification, and indicate applicable groupings. IMPORTANT: these ranges are approximate and should NOT be used in lieu of the specific quantification method provided in the fact sheet for each measure. Restrictions on combining measures must be observed.

FEHR PEERS

ATTACHMENT F – Adopted Goals and Polices Related to VMT and LOS

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
1-P-2	VMT		Use land efficiently by promoting infill development, at equal or higher density and intensity than surrounding uses.
1-P-6	VMT	LOS	Encourage mixed-use development, which include opportunities for increased transit access.
1-P-10	VMT	LOS	Develop and maintain the following areas as neighborhood centers. These centers will serve to focus commercial activity close to residential uses, providing convenient retail and services for all Petaluma residents: Lakeville Highway at Casa Grande Road, Caulfield Lane at Lakeville Street, Along Petaluma Boulevard, near McNear Avenue, at Shasta Avenue/Sycamore Lane, and at Corona Road, Sonoma Mountain Parkway, at Riesling Road, McDowell Boulevard South at Casa Grande Road, McDowell Boulevard North at Old Redwood Highway.
1-P-11	VMT		Allow land use intensification at strategic locations along the arterial corridors leading to Downtown and Central Petaluma, including aging commercial and industrial sites.
1-P-12	VMT		Encourage reuse of under-utilized sites along East Washington Street and Petaluma Boulevard as multi-use residential/commercial corridors, allowing ground-floor retail and residential and/or commercial/office uses on upper floors. A. Develop incentives in the Development Code to encourage lot consolidation to enable efficient multi-story buildings, and relocation of driveways to side streets.
1-P-15	VMT	LOS	Under a discretionary review process, consider allowing live-work or limited commercial uses within medium and high-density residential development when abutting an arterial roadway.
1-P-26	VMT	LOS	Work with public agencies and utilities to facilitate joint-use where feasible. A. Work with utility companies to use and enhance utility corridors to link open space lands with activity centers. B. Work with regulatory and transportation agencies to utilize unused railroad rights-of-way to link open space lands and activity centers
1-P-47		LOS	Ensure that the pace of growth does not create spikes that unduly strain City services. A. Monitor the availability of resources necessary to serve new development, prior to granting entitlements. B. Upon adoption of the General Plan, immediately reevaluate the Residential Growth Management System, with the possibility of reducing the annual allocation numbers and/or eliminating or reducing exemptions, to keep pace with infrastructure capacities and to allow a reasonable annual growth rate through 2025 C. Evaluate the need for a nonresidential growth management program.
1-P-48		LOS	Ensure all new development provides necessary public facilities to support the development. A. Collect proportionate fair share of long-term infrastructure improvement costs as entitlements are granted. B. Initiate design of long-term infrastructure improvements in a timely manner to insure their completeness to coincide with demand.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
2-P-9		LOS	Provide for the extension of Copeland Street to Petaluma Boulevard North in the vicinity of Oak Street. A. Establish a plan line for the extension of Copeland Street to Petaluma Boulevard North.
2-P-10	VMT	LOS	Provide for the extension of Caulfield Lane from Lakeville Street to Petaluma Boulevard South (Southern Crossing). A. Establish a plan line for the extension of Caulfield Lane to Petaluma Boulevard South.
2-P-12	VMT	LOS	Support the establishment of pedestrian access to the River, including the provision of a facility to allow launching of small, lightweight waterborne craft.
2-P-14	VMT		Promote the development and intensification of the Downtown commercial core as both a visitor destination and a neighborhood retail center.
2-P-16	VMT	LOS	Enhance linkages between Downtown and the river, and increase street connectivity with the surrounding neighborhoods.
2-P-19	VMT	LOS	Maintain the grid street pattern within Downtown, and improve connections between Downtown and surrounding areas.
2-P-22	VMT	LOS	Encourage development with active ground level uses, plazas and open spaces, while allowing residential and commercial uses at upper floors.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
2-P-23	VMT	LOS	Facilitate development patterns that provide an urban edge along East Washington Street, providing visual continuity and cohesiveness, and increased safety. A. Undertake streetscape improvements to slow traffic speeds, widen sidewalks and promote a pedestrian orientation. Add trees that maximize shade and sense of enclosure. Select street trees appropriate to the scale and character of the area. B. Maintain design and development standards in the Development Code that incorporate: C. Design standards to promote a pedestrian orientation. Parking lots at the rear of buildings, accessible from side streets where feasible. D. Provide for a transition between the more traffic-oriented East Washington Street corridor and the residential areas immediately adjacent to the corridor. E. Explore the feasibility of establishing a parking district or other methods of consolidated parking for the corridor, including joint use possibilities with the Fairgrounds or other uses in the area. F. Using the Mobility Element as a guide, develop a cohesive streetscape plan for the corridor west of Highway 101 that incorporates widened sidewalks, street trees, reduced traffic lanes or elimination of center turn lane (or addition of a landscaped median between left turn lanes if lane is maintained), and reduction or elimination of mid-block driveways.
2-P-24	VMT	LOS	Enhance pedestrian crossings in the Washington Street section to improve safety and neighborhood connectivity.
2-P-25	VMT	LOS	Improve bicycle circulation through the corridor by adding bicycle lanes on or parallel to East Washington Street (i.e., East D Street and/or Madison Street.
2-P-26	VMT	LOS	Foster development of a cohesive high-density residential neighborhood adjacent to Shollenberger Park, with a new “main street” style neighborhood center at or along Casa Grande Road. Require new development adjacent to the street to include neighborhood-oriented commercial uses facing the street at the ground level, while allowing other uses at the upper level; Require new development to be built to the edge of property line along Casa Grande Road; and work with property owners on a streetscape plan to provide a pedestrian orientation and a gateway into the evolving residential neighborhood.
2-P-27	VMT	LOS	Enable opportunities for a variety of synergistic and compatible uses adjacent to the Petaluma Marina.
2-P-32	VMT	LOS	Improve accessibility through the neighborhood and vacant lands by extending the street grid as opportunities arise, such as Burlington, Jesse/Rocca, Edith, or new roadways and or pedestrian/bikeways over the river/creeks.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
2-P-38	VMT		Promote greater accessibility to the Petaluma River and vacant lands through road extensions, bikeways, and trails, including: Extending Burlington Drive northward across Lynch Creek, and consider other options to extend streets through to new developments. Requiring new development to be oriented to the river, and providing continuous public access to the riverfront.
2-P-41		LOS	Provide gateway improvements both east and west of the Highway 101 overcrossing. A. East of Highway 101, undertake a streetscape improvement program that recognizes existing trees, incorporates new trees and vegetation, while reinforcing a visual and physical connection to the Petaluma River and estuary. B. Preserve and expand river-dependent industrial uses, while improving appearance from Petaluma Boulevard South with landscaping. C. Develop the terminus of the Caulfield Lane "southern crossing" with Petaluma Boulevard •South as a gateway, with methods—such as a roundabout, tree-lined median, reduced lane widths, or other traffic calming/design treatments—to slow traffic and define an entrance into the community and new neighborhoods. D. With or without the southern crossing develop traffic calming measures to address traffic speeds.
2-P-43	VMT	LOS	Provide additional pedestrian/bicycle access to and along the riverfront to connect to existing and future trails toward Downtown.
2-P-45	VMT		Allow intensification of the bowling alley site to an appropriately-scaled Neighborhood Commercial center, extending along the southern side of Petaluma Boulevard to Mountain View Avenue.
2-P-46	VMT		Explore the feasibility of extending I Street and Mountain View Avenue to the Petaluma River and a pedestrian connection between Petaluma Boulevard and the river as redevelopment opportunities arise.
2-P-54	VMT	LOS	Reinforce existing Neighborhood Commercial uses at west Payran Street; encourage intensification and expansion of the existing center to provide a wider range of products to meet the needs of the surrounding neighborhoods.
2-P-55	VMT		Encourage development of the area south of Payran Street as an urban corridor, with a mix of uses comparable to those of the Central Petaluma Specific Plan, increasing in intensity approaching Downtown.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
2-P-59	VMT		Promote greater accessibility and views to Petaluma River through road extensions, bikeways, and trails, including: Requiring new development to be oriented to the river, and provide continuous public access parallel to the riverfront. Extending Industrial Avenue south of Corona Road. Requiring a new pedestrian/bicycle connection to the river east of Jessie Lane and intersecting with Petaluma Boulevard North. Requiring a new street connection to the river at, or near, the intersection of Gossage Avenue. Requiring paths from the area of Jessie Lane southwest toward Magnolia Avenue to link with existing neighborhoods. Enhancing the ecological diversity of the riparian corridor. Requiring development to enhance the natural ecology along the river.
2-P-67	VMT		Create an open space network through residential areas by requiring integration of open space with public trails when properties are developed.
2-P-76	VMT	LOS	Develop the area with a diverse range of commercial and residential uses with intensity and character appropriate to a central urban neighborhood.
2-P-79	VMT	LOS	Extend traditional street grids as opportunities arise.
2-P-80	VMT		Encourage intensification of the Petaluma Plaza and Plaza North sites with a diverse range of Community Commercial uses. Ensure that new development: Presents an urban face along McDowell Boulevard, with parking tucked behind buildings. Incorporates bike access from Lynch Creek.
2-P-81	VMT	LOS	Permit a range of large and small-sized retail and office as well as residential uses on the former Kenilworth School site, while ensuring that the development: Presents an urban/pedestrian face on Washington Street, with parking tucked behind buildings. Incorporates a plaza or other civic open space. Provides adequate open space to meet the needs of residents.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
2-P-82	VMT	LOS	Work with the Sonoma-Marin Fair to explore more optimal use or relocation of the Fair's site. A. Optimal use could include redesign and intensification of the existing acreage; reduction and intensification of the existing site; or master planning of the Fairground and adjacent property(ies) to create an improved layout of the fairground; improve compatibility with existing neighborhoods, and enhance adjacent development potential. B. If the Fairground is relocated, permit a diverse range of residential and commercial uses appropriate in intensity and character to compliment the residential neighborhood to the southwest, and new commercial uses toward Highway 101. Require provision of park and open space and extension of the existing street grid.
2-P-86	VMT	LOS	Provide enhanced facilities to encourage improved pedestrian and bicycle mobility along East Washington Street and East D Street, such as: Enhancing the existing pedestrian overcrossing of Highway 101. Improving and expanding connections to the Lynch Creek trail system. Improve pedestrian and bicycle facilities on the East Washington Street overpass.
2-P-87		LOS	Where applicable, provide a transition in scale along North McDowell Boulevard between the industrial uses on the west side of the boulevard and the residential developments to the east, while allowing new development at intensities reflective of enhanced connections provided by the new cross-town connector and interchange at Rainier Avenue.
2-P-88	VMT	LOS	Provide enhanced pedestrian and bicycle network connections between the industrial, commercial and residential clusters.
2-P-90	VMT	LOS	work with regional and other agencies to create a new light rail transit station near Corona Road with high-intensity, transit-oriented development.
2-P-91	VMT	LOS	Promote walkability by clustering business parks and increasing pedestrian linkages between office structures and nearby commercial and restaurant uses. A. Develop a program for modifying existing lawn areas fronting industrial development to provide sidewalks.
2-P-92	VMT	LOS	Promote greater accessibility to the Petaluma River and neighboring areas, while enhancing the ecology and providing native planting through road extensions, bikeways, and trails, including: Extending Lynch Creek Way northwest through new developments, connecting with the Rainier Avenue extension. Extending Rainier Avenue westward to Petaluma Boulevard North, creating a new interchange with Highway 101.
2-P-93	VMT	LOS	Work with Caltrans and other agencies to establish a park-and-ride lot close to the new interchange. Include parking spaces with electric vehicle recharging facilities, secure bicycle parking, and reserved spaces for ride-sharing vehicles.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
2-P-96	VMT	LOS	Develop High and Medium Density Residential near the proposed rail transit station on Corona Road.
2-P-98	VMT	LOS	Continue the Urban Separator and path along the northeastern boundary of Santa Rosa Junior College to provide the continuous link between neighborhoods.
2-P-99	VMT	LOS	Improve older streetscapes with added street trees, landscaping and pedestrian amenities.
2-P-101	VMT		East of Maria Drive, narrow East Washington Street from four lanes to two lanes (that is, one lane in either direction), with increased landscaping to screen sound walls, and with expanded sidewalks and bikeways.
2-P-104	VMT		Keep Corona Road as a rural two-lane road (east of Sonoma Mountain Parkway) with an improved cross-section to facilitate safer bicycle and pedestrian use utilizing innovative design standards that increase connectivity and safety while maintaining the rural context.
2-P-107	VMT	LOS	Encourage the development/redevelopment of small neighborhood serving commercial.
2-P-108	VMT	LOS	Encourage intensification/redevelopment of the existing Neighborhood Commercial uses at Casa Grande Road/McDowell Boulevard South.
2-P-110	VMT	LOS	Improve pedestrian and bicycle amenities along Frates Road/Cader Lane as access to industrial/employment areas and Shollenberger Park.
2-P-111	VMT	LOS	Extend bicycle paths along Adobe Creek, and provide new paths along major local connectors and city arterials.
2-P-113	VMT	LOS	Strengthen pedestrian connections to Downtown and the Central Petaluma Specific Plan (CPSP) subarea through streetscape improvements along the Washington Street/Bodega Avenue corridor.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
4-P-7	VMT		Reduce motor vehicle related air pollution. A. Enforce land use and transportation strategies described in Chapter 1: Land Use and Chapter 5: Mobility that promote use of alternatives to the automobile for transportation, including walking, bicycling, bus transit, and carpooling. B. Motor vehicles, regulations of whose emissions by local agencies is preempted by State law, are the major source of criteria air pollutants in the Bay Area Air Basin, accounting for the vast majority of carbon monoxide and particulate matter and over a quarter of the reactive oxygen gas and nitrogen dioxide in the region. Increased use of transit and carpooling, coupled with land use and circulation patterns that promote walking and bicycling, can lead to a decrease in daily trips, less emissions, and improved air quality.
4-P-11	VMT	LOS	Promote ride-sharing and car-sharing programs.
4-P-12	VMT	LOS	Prohibit new drive-thru food and service facilities with the exception of vehicle serving businesses, such as car wash and oil/lube, and limit expansion of the drive-thru components of existing facilities which increase idling vehicles.• Discretionary approvals for such facilities shall include provisions which decrease or eliminate idling vehicles, to the extent feasible and practical.
4-P-13		LOS	Require development of traffic roundabouts, where feasible, as an alternative to a traffic signal, to reduce idling vehicles.
4-P-14	VMT	LOS	Develop and integrate Intelligent Transportation Technologies, as applicable, into Petaluma's transportation system.
4-P-26	VMT		Implement all measures identified in the municipal Climate Action Plan to meet the municipal target set in Resolution 2005-118 (20% below 2000 levels by 2010).
4-P-27	VMT		The City shall prepare a Community Climate Action Plan to identify and prioritize programs, projects, and procedural policies that will help the City achieve the community greenhouse gas emission goals of Resolution 2005-118 (25% below 1990 levels by 2015).
4-P-31	VMT		Provide information and tips on reducing greenhouse gas emissions to the community. A. Advertise "Green Tip" in the local newspaper. B. Work with utilities to offer Green Tips with the utility bills. C. Continue sponsoring Petaluma's green programs, including, but not limited to, the Going Green Expo. D. Create a program of on-going community education. E. Support the efforts of the Sonoma Green Business Program.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
5-P-1	VMT	LOS	Develop an interconnected mobility system that allows travel on multiple routes by multiple modes. Develop a network that categorizes streets according to function and type, considering the surrounding land use context. Develop a network for off-street paths and routes according to function and type, considering the intensity of use and purpose. Review and update the City's Street Design Standards to be consistent with street function and typology. Explore the redesign of existing streets to potentially reduce the width and/or number of travel lanes, improve the multimodal function of intersections and street segments, and introduce amenities such as wider sidewalks, special paving treatments, bus priority treatments, landscaped medians, and street trees within parking lanes. Evaluate the feasibility of road diets on streets with projected excess capacity at buildout (see Section 5.3).
5-P-2	VMT	LOS	Ensure the identified mobility system is provided in a timely manner to meet the needs of the community by updating the City's transportation impact fee program to insure that necessary citywide improvements are funded. Transportation impact fees will be determined based on each project's fair share of the aggregate costs of roadway improvements identified within the Mobility Element and EIR. The fee program is intended to ensure that new developments pay its proportionate share of traffic infrastructure improvements to mitigate direct traffic impacts from new development. Some portion(s) of the identified mobility system improvements will be constructed as part of project related frontage improvements. Allocation of mitigation funds shall be designated to the capital improvement project for which it was exacted. Transportation impact fees will be routinely updated to reflect project timing and costs.
5-P-4	VMT	LOS	New development and/or major expansion or change of use may require construction of off-site mobility improvements to complete appropriate links in the network necessary for connecting the proposed development with existing neighborhoods and land uses.
5-P-5	VMT	LOS	Consider impacts on overall mobility and travel by multiple travel modes when evaluating transportation impacts.
5-P-6	VMT	LOS	Ensure new streets are connected into the existing street system and encourage a grid-based network of streets.
5-P-7	VMT	LOS	Where aesthetic, safety, and emergency access can be addressed, allow narrower streets in residential development to create a pedestrian scaled street environment.
5-P-8		LOS	The priority of mobility is the movement of people within the community including the preservation of quality of life and community character. Develop formal transportation impact analysis guidelines that consider multi-modal impacts of new developments. Develop and adopt multi-modal level of service (LOS) standards that examine all modes and vary the standards by facility type to imply a preference to selected modes based upon the context (including street type and location).LOS analysis data shall utilize the peak hour (60 minutes) rather than the peak period (15 minutes) for determining intersection LOS.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
5-P-10		LOS	Maintain an intersection level of service (LOS) standard for motor vehicle circulation that ensures efficient traffic flow and supports multi-modal mobility goals. LOS should be maintained at Level D or better for motor vehicles due to traffic from any development project.
5-P-13	VMT	LOS	Encourage existing major employers to develop and implement Transportation Demand Management programs to reduce peak period trip generation.
5-P-15	VMT	LOS	Implement the bikeway system as outlined in the Bicycle and Pedestrian Plan, and expand and improve the bikeway system wherever the opportunity arises. Fund and implement the Bicycle Plan and complete gaps in the bikeway network through new development, redevelopment and the Capital Improvements Program. Develop and update guidelines and standards for the design of bicycle facilities. Design and maintain bikeways at or above local, state, and federal standards in order to maximize safety for bicyclists (e.g. width). Develop and implement a uniform bicycle signage program to enhance safety and ease of travel for all who use the city transportation network. Identify loop detectors along bikeways with stencils where (a) the outline of the loop is not identifiable on the surface of the roadway, or (b) where it is unclear which of the identifiable loops will activate the signal. Preserve the Highway 101 pedestrian/bicycle over-crossing south of East Washington Street interchange. Continue to outfit local transit busses with bike racks; and encourage regional transit providers to provide bike racks as well.
5-P-16	VMT	LOS	If Class II bike lanes are not possible on streets designated as such on the Bicycle Facilities Map, those streets shall become enhanced Class III bike routes using such markings as edge striping, shared lane markings, and signs.
5-P-18	VMT	LOS	The City shall require Class II bike lanes on all new arterial and collector streets.
5-P-19	VMT	LOS	All new and redesigned streets shall be bicycle and pedestrian friendly in design.
5-P-20	VMT	LOS	Ensure that new development provides connections to and does not interfere with existing and proposed bicycle facilities.
5-P-21	VMT	LOS	Strive to create a five percent bicycle commute share by 2025.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
5-P-22	VMT	LOS	Preserve and enhance pedestrian connectivity in existing neighborhoods and require a well connected pedestrian network linking new and existing developments to adjacent land uses. Improve the pedestrian experience through streetscape enhancements, focusing improvements where there is the greatest need, and by orienting development toward the street. Improve street crossings and complete gaps in the sidewalk system through development review and capital improvement projects. Allocate funds and/or identify funding sources (including the potential formation of assessment districts) for pedestrian and streetscape improvements in existing neighborhoods. Create a pedestrian priority program emphasizing pedestrian circulation needs and safe street crossings. Conduct an inventory of key pedestrian facilities and routes to identify missing or deficient links, pedestrian crossings or intersections, and focusing initially on pedestrian priority areas. Establish a prioritization and funding mechanism for completing gaps in the sidewalk system, identifying locations for improving street crossings, and installing curb ramps to meet ADA specifications. Improve the integration of pedestrian projects into the Capital Improvement Program and consider opportunities to construct pedestrian improvements concurrently with other roadway improvements. Develop guidelines and standards for the design of pedestrian facilities and establish pedestrian-friendly residential and commercial design guidelines. Review and update the City's street design standards to address pedestrian-friendly street designs such as maximum lane widths, maximum curb radii, detached sidewalks, dual left turn lanes at intersections, pedestrian refuge islands, and curb ramp standards. Collaborate with the Santa Rosa Junior College to identify measures that enhance pedestrian circulation to and within the Petaluma Campus. Establish a Pedestrian Safety Program that provides pedestrian educational materials and a regularly updated pedestrian safety report. Conduct regular maintenance of pedestrian related facilities.
5-P-23	VMT	LOS	Require the provision of pedestrian site access for all new development.
5-P-24	VMT	LOS	Give priority to the pedestrian network and streetscape amenities near schools, transit, shopping, and mixed use corridors emphasized in the General Plan.
5-P-25	VMT	LOS	Establish a network of multi-use trails to facilitate safe and direct off-street bicycle and pedestrian travel. At the minimum, Class I standards shall be applied unless otherwise specified. Review the status of ownership and use of railroad rights-of-way, creek maintenance rights-of-way, dedicated public or utility easements in favor of the city, and other public lands and seek to include new bicycle and pedestrian routes by working with all appropriate agencies. Fully implement the non-motorized components of the Petaluma River Access and Enhancement Plan. Support the implementation of a continuous SMART bicycle/pedestrian path along the NWPRR corridor and integrate it with the citywide bicycle network. Study, seek funding for, construct and maintain a "Petaluma Ring Trail," a connected system of multi-use trails in the Urban Separator, or otherwise approximately parallel with (if not immediately adjacent to) the Urban Growth Boundary. The Petaluma Ring Trail shall form a continuous, unbroken path around the city. Build new river (upstream of navigable waters) and creek crossings for bicycles and pedestrians to provide greater connectivity and more efficient cross-town routes.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
5-P-29	VMT	LOS	Work with the Bay Area Ridge Trail Council to implement a revised route (for bicyclists, hikers, and equestrians) through the City located off surface streets and along greenways wherever possible with connections to regional destinations (e.g. Petaluma Adobe State Park, Jack London State Historic Park, Helen Putnam Regional Park, and Mt. Burdell).
5-P-30	VMT	LOS	Require all new development abutting any public trail to provide access to the trail.
5-P-31	VMT	LOS	Make bicycling and walking more desirable by providing or requiring development to provide necessary support facilities throughout the city. Provide secure, protected parking facilities and support services for bicycles at locations with high bicycle-parking demands such as multi-family housing and shopping and employment centers. Install drinking fountains serving people and their pets in strategic locations to make it easier and healthier for pedestrians and bicyclists to be outdoors and travel long distances. Provide easily accessible and aesthetically pleasing public restrooms wherever feasible. Require projects subject to discretionary approval to install public benches where appropriate. Install non-glare lighting along multi-use paths that serve as commuter routes.
5-P-32	VMT	LOS	Promote bicycle and pedestrian safety and increased use of non-motorized transportation alternatives through engineering, education, and enforcement programs. Request an annual bicycle and pedestrian report from the Police Department to the City Council and PBAC. Encourage an annual meeting with the Police and Public Works Departments to analyze annual collision data, identify collision "hot spots," and develop and implement measures to improve safety. Encourage the Police Department to positively reinforce the Motor Vehicle Code for pedestrians, bicyclists, and motorists – especially violations that are most likely to cause injury such as running red lights, speeding, wrong-way riding, riding on sidewalks where illegal, and not yielding to pedestrians - through education and enforcement. Encourage helmet use among all bicyclists, and enforce the law for those under the age of 18.Implement the use of bicycle- and pedestrian-friendly traffic calming methods. Make bicycle and pedestrian safety improvements at street crossings a priority. Publicize existing bikeways and recommended travel routes throughout the community. Participate in and support recommendations of the Safe Routes to Schools program. Work with Petaluma schools to encourage more children to walk and bicycle to school. Promote the benefits of walking and bicycling through Bike to Work Week, Walk and Roll to School Week, and develop new citywide programs. Conduct annual bicycle and pedestrian counts to monitor the growth of bicycle use and walking. Encourage and recognize Petaluma employers that (a) install more bicycle- and pedestrian-friendly facilities and (b) implement incentives to facilitate bicycling and walking as transportation.
5-P-33	VMT	LOS	Fund and perform regular maintenance on all public bicycle and pedestrian facilities. Conduct regular scheduled street sweeping, vegetation management, and re-striping on designated bikeways, especially on bike lanes. Respond in a timely manner to citizen requests regarding maintenance concerns on all public bicycle and pedestrian facilities. Give special attention to the construction and maintenance of speed humps, drainage ditches, manhole covers, sewer and drainage grates, railroad crossings, and asphalt/concrete interfaces to eliminate hazards to bicyclists and pedestrians. Give priority to trail maintenance, including vegetation removal, pavement quality, and litter control. Repair, or require the property owner to repair, broken sidewalks.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
5-P-34	VMT	LOS	Utilize a creative variety of measures to fully implement all projects and programs of the Petaluma Bicycle and Pedestrian Plan. Consider assigning a staff member as "Bicycle and Pedestrian Coordinator" whose job may include monitoring bicycling and pedestrian issues both within the entire transportation network and with regard to development and redevelopment. Research, apply for, and obtain available funding for bicycle and pedestrian improvements. Continue the institutional structure that gives the Pedestrian and Bicycle Advisory Committee review of development and redevelopment projects that require discretionary approval.
5-P-35	VMT	LOS	Encourage continuing education and training for City staff to create awareness of bicycle and pedestrian needs and of the importance of planning for bicycle and pedestrian travel at the start of the development process.
5-P-36	VMT	LOS	Review, and update as necessary, the Petaluma Bicycle and Pedestrian Plan every five years, concurrent with the General Plan. Amend the Municipal Code, development related codes, and design and construction standards & specifications to implement the goals, policies, and programs of the Bicycle and Pedestrian Plan. At the time of update, coordinate efforts with the SCTA Countywide Bicycle Plan.
5-P-37	VMT	LOS	Continue to solicit and review progressive ideas from other communities and organizations related to bicycling and walking.
5-P-38	VMT	LOS	Coordinate efforts and resources with the County to construct bikeways called for in the SCTA Countywide Bicycle Plan.
5-P-39	VMT	LOS	Promote public/private partnerships in the development, implementation, operation, and maintenance of bicycle and pedestrian facilities.
5-P-40	VMT	LOS	Provide loan bicycles for City staff.
5-P-41	VMT	LOS	Continue to provide facilities for bicycles on City buses
5-P-42	VMT	LOS	Expand the bus transit system so that it is convenient and provides frequent, regular service along major City corridors serving education, shopping, and employment destinations, and SMART park-and-ride lots. Identify increased funding sources for local transit service and improvements.

Attachment F1 – General Plan Goals and Polices Related to VMT and LOS

General Plan Policy	Relationship to		Policy Text
	VMT	LOS	
5-P-43	VMT	LOS	Support efforts for transit oriented development around the Petaluma Depot and along the Washington Street, Petaluma Boulevard, McDowell Boulevard, Lakeville Street, and other transit corridors. Reserve and plan for future bus stop enhancement and transit priority along Washington Street and Petaluma Boulevard. Enhance the use of the Park and Ride facility at the Fairgrounds through education and marketing.
5-P-44	VMT	LOS	Maintain a transit system of nominal cost, or no cost, to riders. Investigate the creation of subsidies for designations such as education, significant employment, and/or recreation destinations. Collaborate with Santa Rosa Junior College to promote measures to enhance transit access and service at the Petaluma Campus.
5-P-45	VMT	LOS	Coordinate transit improvement efforts and schedules among Petaluma Transit, Sonoma County Transit, Golden Gate Transit, airport shuttle services, paratransit, taxi services, commuter rail, and schools; coordinate local transit to include after-school activity schedules.
5-P-46	VMT	LOS	Consider benefits to the possible consolidation of transit serving agencies.
5-P-50	VMT	LOS	Maintain the Northwestern Pacific Railroad (SMART) corridor for mobility purposes and ensure that any future projects adjacent to or near the rail corridor be planned with safety of the rail corridor in mind, especially with regard to pedestrian and vehicle circulation. Design treatments should include appropriate fencing, improvements to existing at-grade crossings, and coordination with the California Public Utilities Commission (PUC).Ensure that land use decisions and public improvements enhance the viability of the Northwestern Pacific Railroad (SMART) corridor for use as a multi-modal mobility corridor.
5-P-53	VMT	LOS	Support efforts to re-establish a local trolley line utilizing the old spur line into the Downtown area.
6-P-3	VMT	LOS	Connect city parks with other public facilities, open spaces, employment centers, and residential neighborhoods by locating new recreation facilities in proximity to these uses and by fully integrating the parks system with the city's pedestrian, bicycle, and transit systems.
7-P-15	VMT	LOS	Improve and expand safe pedestrian, bicycle, and transit access to all school sites and campuses. Implement the City Pedestrian and Bike Plan. Continue support for the schools' Safe Routes to Schools Program. Utilize the development review process to complete gaps in existing routes serving the proposed development. Encourage an increase in transportation services for the developmentally disabled to schools.
7-P-42	VMT	LOS	Recognize the health benefit of a 'walkable' community with neighborhood access to parks and trails. As development occurs, ensure that connectivity is established to recreational amenities and retail opportunities. Maintain communication with the health care industry to incorporate new means of sustaining a healthy community environment.

Attachment F2 – Bicycle and Pedestrian Master Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
Policy 1	VMT	LOS	Implement the bikeway system as outlined in the Bicycle and Pedestrian Plan, and expand and improve the bikeway system wherever the opportunity arises. Program A Fund and implement the Bicycle Plan and complete gaps in the bikeway network through new development, redevelopment Program B Develop and update guidelines and standards for the design of bicycle facilities. Program C Design and maintain bikeways at or above local, state, and federal standards in order to maximize safety width). for bicyclists Program D Develop and implement a uniform bicycle signage program to enhance safety and ease of travel for all who use the city transportation network. Program E Identify loop detectors along bikeways with stencils where (a) the outline of the loop is not identifiable on the surface of the roadway, or (b) where it is unclear which of the identifiable loops will activate the signal. Program F Preserve the Highway 101 pedestrian/bicycle over-crossing south of East Washington Street interchange. Program G Continue to outfit local transit busses with bike racks; and encourage regional transit providers to provide bike racks as well.
Policy 2	VMT	LOS	If Class II bike lanes are not possible on streets designated as such on the Bicycle Facilities Map, those streets shall become enhanced Class III bike routes using such markings as edge striping, shared lane markings, and signs.
Policy 4	VMT	LOS	The City shall require Class II bike lanes on all new arterial and collector streets.
Policy 5	VMT	LOS	All new and redesigned streets shall be bicycle and pedestrian friendly in design.
Policy 7	VMT	LOS	Strive to create a five percent bicycle commute share by 2025.

Attachment F2 – Bicycle and Pedestrian Master Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
Policy 8	VMT	LOS	Preserve and enhance pedestrian connectivity in existing neighborhoods and require a well connected pedestrian network linking new and existing developments to adjacent land uses. Program A Improve the pedestrian experience through streetscape enhancements, focusing improvements where there is the greatest need, and by orienting development toward the street. Program B Improve street crossings and complete gaps in the sidewalk system through development review and capital improvement projects. Program C Allocate funds and/or identify funding sources (including the potential formation of assessment districts) for pedestrian and streetscape improvements in existing neighborhoods. Program D Create a pedestrian priority program emphasizing pedestrian circulation needs and safe street crossings. Program E Conduct an inventory of key pedestrian facilities and routes to identify missing or deficient links, pedestrian crossings or intersections, and focusing initially on pedestrian priority areas. Program F Establish a prioritization and funding mechanism for completing gaps in the sidewalk system, identifying locations for improving street crossings, and installing curb ramps to meet ADA specifications. Program G Improve the integration of pedestrian projects into the Capital Improvement Program and consider opportunities to construct pedestrian improvements concurrently with other roadway improvements. Program H Develop guidelines and standards for the design of pedestrian facilities and establish pedestrian-friendly residential and commercial design guidelines. Program I Review and update the City's street design standards to address pedestrian-friendly street designs such as maximum lane widths, maximum curb radii, detached sidewalks, dual left turn lanes at intersections, pedestrian refuge islands, and curb ramp standards. Program J Collaborate with the Santa Rosa Junior College to identify measures that enhance pedestrian circulation to and within the Petaluma Campus. Program K Establish a Pedestrian Safety Program that provides pedestrian educational materials and a regularly updated pedestrian safety report. Program L Conduct regular maintenance of pedestrian related facilities.
Policy 9	VMT	LOS	Require the provision of pedestrian site access for all new development.
Policy 10	VMT	LOS	Give priority to the pedestrian network and streetscape amenities near schools, transit, shopping, and mixed use corridors emphasized in the General Plan.

Attachment F2 – Bicycle and Pedestrian Master Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
Policy 11	VMT	LOS	Establish a network of multi-use trails to facilitate safe and direct off-street bicycle and pedestrian travel. At the minimum, Class I standards shall be applied unless otherwise specified. Program A Review the status of ownership and use of railroad rights-of-way, creek maintenance rights-of-way, and other public lands and seek to include new bicycle and pedestrian routes by working with all appropriate agencies. Program B Fully implement the non-motorized components of the Petaluma River Access and Enhancement Plan. Program C Support the implementation of the SMART bicycle/pedestrian path along the NWPRR corridor and integrate it with the citywide bicycle network. Program D Study, seek funding for, construct and maintain a "Petaluma Ring Trail," a connected system of multi-use trails in the Urban Separator, or otherwise approximately parallel with (if not immediately adjacent to) the Urban Growth Boundary. The Petaluma Ring Trail shall form a continuous, unbroken path around the city. Program E Build new river (upstream of navigable waters) and creek crossings for bicycles and pedestrians to provide greater connectivity and more efficient cross-town routes.
Policy 15	VMT		Work with the Bay Area Ridge Trail Council to implement a revised route (for bicyclists, hikers, and equestrians) through the City located off sur- face streets and along greenways wherever possible with connections to regional destinations (e.g. Petaluma Adobe State Park, Jack London State Historic Park, Helen Putnam Regional Park, and Mt. Burdell).
Policy 16	VMT		Require all new development abutting any public trail to provide access to the trail.
Policy 17	VMT	LOS	Make bicycling and walking more desirable by providing or requiring development to provide necessary support facilities throughout the city. Program A Provide secure, protected parking facilities and support services for bicycles at locations with high bicycle-parking demands such as multi-family housing and shopping and employment centers. Program B Install drinking fountains serving people and their pets in strategic locations to make it easier and healthier for pedestrians and bicyclists to be outdoors and travel long distances. Program C Provide easily accessible and aesthetically pleasing public restrooms wherever feasible. Program D Require projects subject to discretionary approval to install public benches where appropriate. Program E Install non-glare lighting along multi-use paths that serve as commuter routes.

Attachment F2 – Bicycle and Pedestrian Master Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
Policy 18	VMT	LOS	Promote bicycle and pedestrian safety and increased use of non-motorized transportation alternatives through engineering, education, and enforcement programs. Program A Request an annual bicycle and pedestrian report from the Police Department to the City Council and PBAC. Encourage an annual meeting with the Police and Public Works Departments to analyze annual collision data, identify collision "hot spots," and develop and implement measures to improve safety. Program B Encourage the Police Department to positively reinforce the Motor Vehicle Code for pedestrians, bicyclists, and motorists – especially violations that are most likely to cause injury such as running red lights, speeding, wrong-way riding, riding on sidewalks where illegal,, and not yielding to pedestrians - through education and enforcement. Program C Encourage helmet use among all bicyclists, and enforce the law for those under the age of 18. Program D Implement the use of bicycle- and pedestrian-friendly traffic calming methods. Program E Make bicycle and pedestrian safety improvements at street crossings a priority. Program F Publicize existing bikeways and recommended travel routes throughout the community. Program G Participate in and support recommendations of the Safe Routes to Schools Program. Program H Work with Petaluma schools to encourage more children to walk and bicycle to school. Program I Promote the benefits of walking and bicycling through Bike to Work Week, Walk and Roll to School Week, and develop new citywide programs. Program J Conduct annual bicycle and pedestrian counts to monitor the growth of bicycle use and walking. Program K Encourage and recognize Petaluma employers that (a) install more bicycle- and pedestrian-friendly facilities and (b) implement incentives to facilitate bicycling and walking as transportation.
Policy 19	VMT	LOS	Fund and perform regular maintenance on all public bicycle and pedestrian facilities. Program A Conduct regular scheduled street sweeping, vegetation management, and re-striping on designated bikeways, especially on bike lanes. Program B Respond in a timely manner to citizen requests regarding maintenance concerns on all public bicycle and pedestrian facilities. Program C Give special attention to the construction and maintenance of speed humps, drainage ditches, manhole covers, sewer and drainage grates, railroad crossings, and asphalt/concrete interfaces to eliminate hazards to bicyclists and pedestrians. Program D Give priority to trail maintenance, including vegetation removal, pavement quality, and litter control. Program E Repair, or require the property owner to repair, broken sidewalks.

Attachment F2 – Bicycle and Pedestrian Master Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
Policy 20	VMT	LOS	Utilize a creative variety of measures to fully implement all projects and programs of the Petaluma Bicycle and Pedestrian Plan. Program A Appoint a staff member as "Bicycle and Pedestrian Coordinator" whose job shall include monitoring bicycling and pedestrian issues both within the entire transportation network and with regard to development and redevelopment. Program B Research, apply for, and obtain available funding for bicycle and pedestrian improvements. Program C Continue the institutional structure that gives the Pedestrian and Bicycle Advisory Committee review of development and redevelopment projects that require discretionary approval.
Policy 21	VMT	LOS	Encourage continuing education and training for City staff to create awareness of bicycle and pedestrian needs and of the importance of planning for bicycle and pedestrian travel at the start of the development process.
Policy 22	VMT	LOS	Review, and update as necessary, the Petaluma Bicycle and Pedestrian Plan every five years, concurrent with the General Plan. Program A Amend the Municipal Code, development related codes, and design and construction standards & specifications to implement the goal, policies, and programs of the Bicycle and Pedestrian Plan. Program B At the time of update, coordinate efforts with the SCTA Countywide Bicycle Plan.
Policy 23	VMT	LOS	Continue to solicit and review progressive ideas from other communities and organizations related to bicycling and walking.
Policy 24	VMT	LOS	Coordinate efforts and resources with the County to construct bikeways called for in the SCTA Countywide Bicycle Plan.
Policy 26	VMT	LOS	Provide loan bicycles for City staff.
Policy 27	VMT	LOS	Continue to provide facilities or bicycles on City buses.

Attachment F3 – Safe Routes to Schools Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
General	VMT		• Form a SR2S coalition and seek out partnerships • Establish a SR2S task force for each school • Include junior high and high schools in the SR2S program • Continue to apply for grants and funding • Examine crossing guard assignment • Update City's school signage to meet current standards • Establish goals and monitor progress • The City should develop a standard configuration for the portable "yield to pedestrian" sign installation that is consistent with the standards provided for an R1-6 in the California Manual on Uniform Traffic Control Devices to achieve citywide uniformity and increase overall driver recognition. These signs should be placed at the school crossings by school staff or crossing guards when needed and be removed after the school traffic period ends. • The City should consider giving a higher priority to installing handicap ramps at crosswalks for park and school as part of their ADA Transition Plan. • It is recommended that school crossing and other warning and regulatory signs in the vicinity of school sites be replaced and an ongoing maintenance strategy be established to replace the signs on a five- to seven-year basis to ensure conformance with the CA-MUTCD as well as adequate retro-reflectivity. • The City should consider a monitoring program of periodic inspection of walkways and other pedestrian areas to identify encroachment of landscaping into the walkways. Such a program could potentially be staffed by volunteers either on a City-wide basis or school by school. Letters would be issued to property owners establishing a reasonable timeframe within which to remove the obstructions. • School staff should continue established SR2S programs such as walk-n-roll to school day, bicycle rodeos, etc. As part of this effort, an inventory of bicycle parking at existing school bicycle racks should be performed during these 'peak parking demands' and if inadequate, consideration should be given by the school community to provide additional bicycle racks.
Short-Term	VMT		• Add yield limit lines "Sharks Teeth" in advance of crosswalks • Mark crosswalks • Add pedestrian crossing signs • Convert white crosswalk markings to yellow • Convert standard parallel-line crosswalk markings to ladder style
Long-Term	VMT		• Provide pedestrian ramps • Provide an all-weather pathway • Replace 8-inch signal heads with 12-inch versions

Attachment F3 – Safe Routes to Schools Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
Corona Creek Elementary	VMT		• (2005) The City should consider if modifications to the striping at the intersection of Hartman Lane with Riesling Road are warranted. This recommendation has not been addressed. • Mark crosswalks at the following locations: on Fieldstone Lane at Ely Road on Southpoint Boulevard at Wood Sorrel Drive • Back-to-back pedestrian crossing signs should be added at the mid-block crossing of Ely Road at the Corona Creek Class I multi-use path; the existing installation includes one sign in each direction and one is located at the back of the crosswalk. • Install pedestrian crossing signs on Hartman Lane at the Quarry Street crossing. • Existing crosswalk markings installed by the school at driveways and within the City Right-of-Way should be yellow to conform to the CA-MUTCD. • Either install an ADA-compliant curb ramp or re-stripe crosswalk such that it aligns with the existing curb ramp on the southeast corner of Hartman Lane/Quarry Street. • Provide an all-weather path connecting the Corona Creek Class I path with Ely Road on the east side of Ely Road. • The City and the Waugh School District should work with the County of Sonoma to develop all-weather pathways on Corona Road and Ely Road to accommodate non-motorized users. • The City should consider replacing 8-inch side-mounted vehicle signal indications with12-inch signal heads on Sonoma Mountain Parkway at Ely Road, at Maria Drive and at Campus Circle to increase visibility to motorists.
Grant Elementary	VMT		• (2005) Gaps in the sidewalk on I Street and Grant Avenue should be filled in by development of adjacent parcels or by the City, as previously recommended in the 1974 Safest Route to School Study. This recommendation has not been implemented on I Street and is still valid. • (2005) Sight distance at the southwest corner of I Street/Grant Avenue should be addressed by trimming the wildflowers at this location in order to improve lines of sight to children in the crosswalk across Grant Avenue. The utility pole at this corner should be relocated if the opportunity arises in order to further improve sight distance to and from Grant Avenue and I Street south of Grant Avenue. This recommendation has not been implemented. • The gate at the McNear Avenue cul-de-sac should be closed during pick-up and drop off. The gate can be latched but not locked for Emergency Vehicle Access. This would eliminate the parking area as a drop off and pickup point. • Signs discouraging drop off and pick up at the McNear Avenue cul-de-sac should be relocated to the intersection of Mountain View Avenue/McNear Avenue, on all three street approaches and in advance of the intersection. A staff member or volunteer can be assigned to that location to assist with orderly drop off and pick up, and to ensure drivers avoid entering the cul-de-sac. • The curb adjacent to the staff parking lot driveway should be painted red address parking along the curb return and increase visibility. • The City should consider installing all-way stop controls (if warranted) at the following locations:

Attachment F3 – Safe Routes to Schools Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			I Street/Grant Street I Street/Olive Street • Provide additional parent/driver education or encouragement to drop students off curbside rather than in a travel lane, especially addressing drivers using East Sunnyslope Road. Additional enforcement to achieve safe u-turns and eliminate double-parking is also recommended. • The City should consider establishing a monitoring program to require property owners to install sidewalks along their frontages with special attention to Grant Avenue, I Street, McNear Avenue, Mountain View Avenue and Phillips Avenue. • Pedestrian ramps in vicinity of Grant School are out of compliance with current ADA standards. The City should consider upgrading the priority of ramps within one-quarter mile of the school for replacement under the City's ADA Transition Plan. • The poor condition of the pavement at the mid-block crossing on Grant Avenue that has IRWL will likely experience early failure. When this system fails Rapid Rectangular Flashing Beacons (RRFB) added to the crossing signs should be considered as replacements. • The utility pole at the corner of I Street/Grant Avenue should be relocated if the opportunity arises in order to further improve sight distance to and from Grant Avenue and I Street south of Grant Avenue.
Kenilworth Junior High	VMT		• Add yield limit lines or "Sharks Teeth" in advance of crosswalks at: Ely Road at Corona Creek Trail • Additional red curb/stopping restrictions should be installed on Riesling Road near the marked crosswalks at the intersection of Riesling Road/Sandstone Drive to help alleviate sight obstructions. • Back-to-back pedestrian crossing signs should be added at the mid-block crossing of Ely Road at the Corona Creek Class I multi-use path; the existing installation includes one sign in each direction located behind the crosswalk. • It is suggested that school district staff add a four- to five-foot plastic extension that can be connected to the STOP paddles used by the crossing guards in order to relieve the guard of having to support the weight of the stop paddle for long periods. • Provide an all-weather path connecting the Corona Creek Class I path with Ely Road on the east side of Ely Road. • The City and the Petaluma School District should work with the County of Sonoma to develop all-weather accessible pathways on Corona Road and Ely Road to accommodate non-motorized users. • Replace the non-functioning IRWL system at the mid-block crosswalk on Riesling Road with a Rectangular Rapid Flashing Beacon (RRFB) system.
La Tercera Elementary	VMT		• If it is the intent of school staff to remove the third, previously-existing crosswalk across the parking lot drive aisle, the crosswalk markings should be completely removed, and the school should consider modifying the sidewalk that leads directly to this location. Although it is not desirable to have too many drive aisle crossings, children tend to cross this on-campus parking lot wherever it is convenient for them, and allowing this third crosswalk may have the effect of centralizing the crossings and pulling more students to a crosswalk since one would be closer to them. Either way, a deliberate action should be taken with this crosswalk rather than leaving it only partially removed. This is an ongoing consideration.

Attachment F3 – Safe Routes to Schools Plan Goals and Polices Related to VMT and LOS

B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	• The school or PTA should consider investing in fluorescent vests or other apparel to make the parent volunteers at the on-site crosswalks and loading locations more visible and to distinguish them from others parents walking around on-campus. This may give them more presence when directing traffic flow. It is unknown if school staff has implemented this recommendation. • The "School Xing" pavement markings on the approaches to Albin Way/Crinella Drive should be deleted by attrition as pavement work occurs at this location. School crossing pavement legends are inappropriate in advance of stop-controlled approaches, as stated in the California Vehicle Code. This is ongoing. • Add more school pedestrian crossing warning signs and placards (downward arrows) to standard crosswalks, to enhance the crossing visibility at: Albin Way/St. Louis Court – both approaches Crinella Drive/Albin Way – both crosswalks New school crossing signs were installed at Albin Way/Rancho Way prior to April 2015. • Relocate the existing 'School Zone' sign on eastbound Albin Way as it creates a sidewalk obstruction and may also create an inaccessible path. • Change the curb color from white to red on the south side of Albin Way between the two crosswalks at Marguerite Way. This area is within the intersection and should be kept clear of sight obstructions created by parked vehicles. • Lengthen the white zone west of the inbound school driveway on Albin Way to increase capacity, from the existing terminus to the easterly property line, except in the vicinity of the fire hydrant which should remain red. • Replace the 'No Parking 7:30 am to 3:30 pm' sign located at the crosswalk on Albin Way that is equipped with the IRWL equipment with 'No Stopping 7:30-8:30 am and 2:30-3:30 pm on School Days.' • Paint the curb return red on the northeast corner of Albin Way/Marguerite Way to eliminate the need to deploy portable orange cones. A school crossing ahead sign was added on Marguerite Way prior to April 2015. • Consider installing time-restricted parking between 7:30-8:30 a.m. and 2:30-3:30 p.m. in front of the residence on the west side of Crinella Drive at Albin Way, just south of the southerly crosswalk, to improve sight distance during student-crossing times. • Install missing bike lane legends in bike lanes on Ely Boulevard South south of Caulfield Lane. • Request that Petaluma police officers continue their effective enforcement of all-way stop traffic controls at the intersection of Baywood Drive/Crinella Drive as it is a popular elementary school crossing that is also subject to significant use by high school students. • Upgrade the school crossing on Caulfield Lane at Victoria Drive to an Actively Enhanced Crosswalk, with Rectangular Rapid Flashing Beacons or other pedestrian-activated equipment, useful for bicyclists and pedestrians on their school commute. New school crossing signs were installed and existing signs replaced prior to April 2015. • Consider adding a pedestrian refuge island to the southerly crosswalk on Crinella Drive at Albin Way, as the street is subject to mid-range traffic volumes.

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			• The worn dirt path in La Tercera Park from the alley terminus from Crinella Drive would be much more effective year-round if it were upgraded to an all-weather surface. The path from Peggy Lane is another important access to school through the park, and resurfacing is necessary.
Mary Collins Elementary	VMT		• Crossing guard services should be provided to assist students crossing at the intersection of Cherry Street/Antone Way. The unusual intersection configuration includes marked crosswalks but needs a crossing guard to control the extensive lack of orderliness. • Cherry Street/Antone Way intersection operations under review by City staff should include evaluation of the need for additional signs and markings that could permit additional school parking on Antone Way, together with better clarification of one-way operations. • School administrators should enforce staff only parking rules to improve student safety in the onsite drive aisle. This enforcement should be sustained and reinforced via written communication to the parents and other drivers of students. • The existing bus stop should be relocated to between the parking lot entrance and Antone Way since the service is not utilized, and allocate the curb space between the two driveways for parent pick up and drop off. • Yellow curb should be painted white along all school-owned Cherry Street frontage except the relocated bus stop, and encourage parents to use it. • The crosswalk markings at the intersection of Cindy Lane/Vanessa Way should be enhanced and/or access to the school via the park encouraged in order to better utilize this well-designed school access. • School administrators should consider continuing or establishing a pro-active relationship with St. Vincent High School to ensure student drivers who drive near Mary Collins Elementary School campus are attentive to traffic safety especially during the school afternoon commute period. • Curb stops should be added to the parking spaces in the parking lot at the rear of the school building in order to prevent vehicles from encroaching into adjacent on-site walkways. • Appropriate bikeway signs and possibly Shared Lane Markings should be installed on all Class III designated streets in order to encourage students that may be willing to travel to school on a bicycle. • Marked crosswalks are recommended at the following locations: On Keokuk Street at Magnolia Avenue, On all four approaches to Keokuk Street/West Street • To ensure slow travel speeds, essential for students crossing Cherry Street, traffic calming features such as a raised intersection at Cherry Street/Antone Way or speed humps could be installed in two or three locations on Cherry Street between Elm Drive and Antone Way. • The wood pole-and-chain barrier system located at the back of sidewalk along the south side of Cherry Street should be removed to allow pedestrians to pass open car doors. As an alternative, this sidewalk could be widened. • Accessible curb ramps should be installed at various intersections along the recommended routes to school as follows: Cherry Street/Antone Way (three of four corners), Cherry Street/Elm Drive (three corners), Antone Way/Kazen Way (westerly corners),

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			Antone Way/Magnolia Avenue, Elm Drive/Schuman Lane (two northerly corners), Elm Drive/West Street (two northerly and one southwesterly corner), Howard Street/West Street (southwest corner), West Street/Amber Way (two southerly corners), West Street/Joelle Heights (two southerly corners), West Street/Larch Drive (two southerly corners)
McDowell Elementary	VMT		• (2005) Consideration should be given to widening the sidewalks on South McDowell Boulevard and McGregor Avenue along the school grounds to eight feet if an opportunity arises. Fencing along the school grounds would need to be relocated to accommodate wider sidewalks. Students can be advised to avoid South McDowell Avenue as they walk to and from school, and an additional gate opening to the school grounds to the north may be considered to route children off of South McDowell Boulevard. This long-term recommendation has not been implemented and is still valid. • Add yield limit lines "Sharks Teeth" in advance of crosswalks at the following location. McDowell Boulevard at Lindberg Lane-Weaverly Drive • Mark crosswalks at the following locations: on Park Lane at Maria Drive, on the northeast leg of Maria Drive at Park Lane • Paint red curb at Park Lane and McGregor Avenue in advance of crosswalks at the intersection. • An exclusive pedestrian phase should be implemented at South McDowell Boulevard/McGregor Avenue during the brief morning and afternoon drop-off and pick-up periods when the push buttons are activated. • (On Campus) Install larger pavement arrows on the campus driveway entrance to direct motorists. • (On Campus) Replace old and worn out signs on campus to provide direction to motorists. • (On Campus) Relocate a 20-foot segment of chain link fence on the south side of the exit driveway as the fence creates a screen effect that blocks visibility for exiting motorists and pedestrians. • (On Campus) Relocate the 'Do Not Enter' sign to the northeast corner of the driveway for better visibility. • (On Campus) Paint red curb in front of the administration building. • (On Campus) Consider parking tees for buses in the queue for transfers on Maria Drive. This would cluster the buses and increase the separation of the two adjacent driveways. • The sidewalks along the school campus and some adjacent properties on McGregor Avenue need repair, and the sidewalks on South McDowell Boulevard and McGregor Avenue along the school grounds should be widened to eight feet if an opportunity arises. Fencing along the school grounds would need to be relocated to accommodate wider sidewalks.
McKinley Elementary	VMT		• (2005) Because several of the collisions near McKinley Elementary School involving both younger and older children were due to pedestrian and bicycle right-of-way violations, safety programs at the school may be appropriate to educate children on their responsibilities as pedestrians and bikers. It is unknown if the school has implemented this recommendation. • The sidewalk should be widened along the school frontage on Ellis Street to make a uniformly smooth walkway. • Failed pavement in the crosswalk area on Martin Circle should be replaced. • The southwest corner pedestrian ramp at Ellis Street/Madison Street should be reconstructed to meet current ADA standards as part of the City's ADA transition Plan improvements.

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
McNear Elementary	VMT		• (2005) Although it might require right-of-way acquisition or restructuring of the travelway, the City should install sidewalks on the north side of I Street between 8th Street and Sunnyslope Avenue either when adjacent properties develop or with discretionary approval. The neighborhood generally has sidewalks on both sides of the street, and the north side of I Street is inconsistent with the area. This was a recommendation in the 1974 Safest Routes to School Report that has not yet been implemented. If this is infeasible, the City should consider installing crosswalks at 8th Street/I Street or I Street/Olive Street to serve children who will need to use the sidewalks on the south side of I Street. Sidewalks along I Street would also serve students of Grant Elementary School, as the attendance boundary between the two schools is located in this vicinity. This recommendation has not been fully implemented and is still valid. • (2005) The City should extend the red curbs on G Street east of the school crosswalk on both sides of the street so that there is at least 20 feet of red curb to increase clear sight distance for children standing at the ends of the crosswalk to approaching vehicles (and vice versa). This recommendation has not been implemented and is still valid. • Add yield limit lines and "Sharks Teeth" in advance of the mid-block crosswalk on G Street between 8th and 11th Streets. • The pavement is in poor condition at the mid-block crossing on G Street that has an In-Roadway Warning Light system, and the pavement will likely translate to early failure of the IRWL system. At such time as this occurs, it is recommended that Rectangular Rapid Flashing Beacons (RRFB) to supplement crossing signs be considered as replacements. • Install sidewalk on the west side of I Street between 8th Street and Sunnyslope Avenue. • Install one curb ramp on the north side of Sunnyslope Avenue at Deer Valley Court to serve one of the new crosswalks at this intersection. • When the curb ramp is constructed, install two yellow-colored crosswalks at the intersection of Sunnyslope Avenue/Deer Valley Court, including one on the west leg across Sunnyslope Avenue and one on the south leg across Deer Valley Court. School crossing signs should be installed at the west leg crosswalk, together with advanced warning signs.
Meadow Elementary	VMT		• (2005) The City should consider installing a new crosswalk across Maria Drive east of Yarberry Drive to serve students coming from the west and south, as well as those unloading on the far side of Maria Drive. These students would no longer have to walk to the crosswalks at Maria Way/Dupree Way or cross the street without a crosswalk, as the new crosswalk will be more conveniently located for them. School staff should consider moving the crossing guard from her current position at Maria Drive/Dupree Way to this new crossing. The installation of this crosswalk would need to be coupled with on-site improvements to accommodate pedestrians on the school grounds at the point where the crosswalk deposits them. Such improvements could include, for example, a speed table across the parking lot to continue the path of the crosswalk across the site's drive aisle. This has not been implemented. • (2005) Pavement legends and school crossing signs should be installed along with the recommended new crosswalk on Maria Drive east of Yarberry Drive per standards in the Manual on Uniform Traffic Control Devices (MUTCD). This has not been implemented.

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			• (2005) Tree branches obscure the yellow school-related sign on the east side of Maria Drive at the southern end of the school campus. The City should work with the school or residential property owners to trim foliage and improve the visibility of this sign for northbound drivers on Maria Drive, as this is their first indication that they are approaching a school. Alternatively, the City may want to move this sign closer to the roadway, as it is set back from the curb. This has not been addressed. • Add yield limit lines or "Sharks Teeth" in advance of crosswalks at: Ely Road at Corona Creek Trail • Mark crosswalks at the following location: Morning Glory Drive at Maria Drive • Increase the red (No Parking) zone on the northerly side of Colombard Road at Claret Court in advance of the crosswalk. • It is suggested that district staff add a 4 to 5-foot extension, made of plastic pipe, to the stop paddle to relieve the guard of having to support the weight of the stop sign for long periods. • The City should consider installation of a radar feedback sign in conjunction with the existing 25 mph speed limit sign (R2-25) for southbound motorists on Maria Drive near Morning Glory Drive. • The City should consider replacing eight-inch side-mounted vehicle signal indications with12-inch signal heads on Sonoma Mountain Parkway at Ely Road and also at Maria Drive to increase visibility to motorists.
Miwok Elementary	VMT		• (2005) Consideration should be given to installing a new mid-block crosswalk on St. Francis Drive between Beechwood Drive and Baywood Drive at the school's southerly architectural pedestrian entryway. This crosswalk would serve many students and parents who cross St. Francis Drive between Beechwood Drive and Baywood Drive, and would centralize crossings in front of the school. In order to bring increased visibility to this new uncontrolled crosswalk, some form of enhanced or pedestrian-activated warning lights are recommended at this location, in addition to school crossing pavement legends in both directions in advance of the crosswalk and associated signage. New signage should conform to standards contained in the Manual on Uniform Traffic Control Devices (MUTCD). The safety benefit of this crosswalk installation would outweigh the resulting loss of some on-street parking. This has not been implemented. • (2005) Consideration should be given to installing a speed table in the parking lot directly in front of the school as a sort of continuation of the new mid-block crosswalk across St. Francis Drive. This would help create a clear and logical walking path for children to use to get to the school buildings and would centralize crossings of the on-campus drive aisle and St. Francis Drive. This has not been implemented. • Lengthen red curb zones that are adjacent to several existing crosswalks to eliminate visual obstructions created by parked vehicles at: Both sides of Beechwood Drive in advance of the crosswalk at St. Francis Drive, Both sides of St. Francis Drive in advance of the crosswalk at Beechwood Drive, All approaches to all four crosswalks at the intersection of St. Francis Drive/Baywood Drive • At Baywood Drive/St. Francis Drive terminate use of the temporary 'Stop for Pedestrians' signs as their use is inappropriate at an all-way stop controlled intersection such as this. • Improve the on-site crosswalks to standard width, coloring, and signing, comparable to crosswalks marked on public streets, to enhance the overall continuity of 'safe routes to school'. Pedestrian Crossing Signs should be included at both ends of these three crosswalks.

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			• Baywood Drive is a four-lane undivided street with an uncontrolled school crossing at Cottonwood Court. Traffic volumes are significantly less than the level requiring a four-lane roadway in this area, and reducing the lane configuration to three lanes, including two travel lanes plus a center turn lane, bicycle lanes and parking lanes, would reduce the crossing distance through which students are in conflict with vehicular traffic, making it safer. • Upgrade the school crossing on Baywood Drive at Cottonwood Court to an Actively Enhanced Crosswalk, with Rectangular Rapid Flashing Beacons or other pedestrian-activated equipment, useful for bicyclists and pedestrians on their school commute. This should be done with or without the recommended road diet on Baywood Drive.
Petaluma Junior High	VMT		• Add a four-inch edgeline to delineate the parking lanes along North Webster Street between Western Avenue and Bodega Avenue. This will also serve as a traffic calming measure on this existing Class III Bikeway. • Add yield limit lines "Sharks Teeth" in advance of crosswalks at: North Webster at the mid-block crossing • Add stop limit lines in advance of crosswalks at two locations. Western Avenue and North Webster Street, all approaches, Sonoma Avenue at North Webster Street • Crossing guard services should be provided to assist students crossing at the intersection of North Webster Street/Western Avenue. There is a very large number of students crossing at this all-way stop-controlled intersection and confusion is occasionally created when pedestrians and drivers are unclear on who has the right of way. • The signal timing at the intersection of Bantam Way/Bodega Avenue should be reviewed and possibly adjusted to address the morning and afternoon school peak periods in order to provide effective commute operations. • Add pedestrian ramps at the following locations. Northeast corner of North Webster Street/Sonoma Avenue, Northeast and northwest corners of North Webster Street at Western Avenue • Upgrade the existing red flashing beacon which enhances the all-way stop-controls at the intersection of North Webster Street/Western Avenue to red LEDs to increase visibility. • Install sidewalk on the north side of Western Avenue between North Webster Street and Bantam Way, and the east side of Bantam Way from Western Avenue to the campus entrance in order to create a continuous sidewalk from North Webster Street to/from the school campus along this popular route. This sidewalk crosses a jurisdictional boundary between the City of Petaluma and the County of Sonoma, therefore requiring a cooperative project between the two agencies. • The existing crossing of Western Avenue at North Fair Street should be enhanced and modified to meet ADA requirements. Enhancements may include an RRFB system, bulb-outs, and other changes to signing and markings.
Sonoma Mountain Elementary	VMT		• (2005) The City should install red curbs on Rainier Circle adjacent to the crosswalks at Rainier Circle/ Tulare Street to maintain clear lines of sight between children and approaching motorists and to create safer crossing conditions. The loss of parking due to the painting of red curbs at this location should be minimal as ample on-street parking exists along Rainier Circle. Alternatively, the installation of bulb-outs at each end of this crosswalk would increase the visibility of children waiting to cross and would create a shorter crossing distance. This change has not been made.

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			• To address U-Turns in front of the school during drop-off and pick –up times, school staff should place traffic cones on the centerline to discourage this maneuver. • An additional 10 to 20 feet of red curbing should be added to the existing curb markings on the southerly side of Rainier Circle at Tulare Street to improve sight lines. • Crossing enhancements such as a pedestrian activated Rectangular Rapid Flashing Beacon system should be considered to provide additional warning to motorists that pedestrians are crossing at Rainier Circle/Tulare Street.
Valley Oaks Alternative	VMT		• Remove the 'School Crossing' legends on Jefferson Street on both approaches to the intersection of Vallejo Street/Jefferson Street as such markings are not to be installed in advance of stop-controlled crossings. • Add crosswalks at the following location: On Vallejo Street at Jefferson Street (yellow) • In conjunction with the school district, which seems to be the owner of the parcel on the south side of Vallejo Street, construct sidewalk across their driveway. This would eliminate the most significant gap in the sidewalk network that serves the students who attend the Valley Oaks Alternative School for their respective safe routes of travel. • Work with Pacific Gas & Electric Company (PG&E) to relocate the guy wire in the curb ramp at the northwest corner of Edith Street/ Jefferson Street. Once this is accomplished, a crosswalk should be installed on Edith Street at this location.
Valley Vista Elementary	VMT		• (2005) The City should grind off the former mid-block crossing of North Webster Street in front of Valley Vista Elementary School to fully remove the painted crosswalk. While it is obscured by a black covering, it is obvious that a crosswalk was once at this location, and this may be confusing to children. This recommendation has not been implemented. • (2005) In order to discourage children from walking behind cars parked in the perpendicular spaces in front of Valley Vista Elementary School, the City should consider installing street furniture, trash cans or sidewalk enhancements at the locations where the sidewalk bends in toward the school. The placement of these enhancements may serve to direct pedestrians along the sidewalk and make it less appealing and harder to cut behind the parked cars. As demonstrated by the collision history, at least one driver has in the past backed out and struck a child at this location. This recommendation has not been implemented. • (2005) The Petaluma Police Department should periodically cite drivers who park in residential driveways so that they block the sidewalk, forcing pedestrians to walk in the street. Before ticketing, the school or the Police Department may consider sending letters to property owners alerting them to the fact this is a citable offense, as given in Section 22500 of the California Vehicle Code, and poses a safety issue for children. This is especially a concern near the busy intersection of Bodega Avenue/ North Webster Street. It is unknown if this recommendation has been implemented. • (2005) The school crossing pavement markings at the approaches to North Webster Street/Townview Lane should be deleted by attrition as pavement work occurs at this location. School crossing pavement legends are inappropriate in advance of stop-controlled approaches, as stated in the California Vehicle Code. This is a long-term recommendation that will occur over time. • Add a four-inch edgeline to delineate the parking lanes along North Webster Street between Western Avenue and Bodega Avenue. This will also serve as a traffic calming measure on this existing Class III Bikeway.

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B&P Master Plan Policy	Relationship to		Policy Text
	VMT	LOS	
			• Add yield limit lines "Sharks Teeth" in advance of crosswalks at four locations. North Webster Street mid-block, North Webster Street at Sonoma Avenue, Western Avenue at Fair Street, Western Avenue at North Fair Street • Add stop limit lines in advance of crosswalks at two locations. Western Avenue and North Webster Street, all approaches, Sonoma Avenue at North Webster Street • Pedestrian ramps are missing at the following locations: Northeast corner of North Webster Street/Sonoma Avenue, Northwest and northeast corners of North Webster Street/Western Avenue • The poor condition of the pavement at the two crossings on North Webster Street that have IRWL's will likely experience early failure. When these systems fail, Rapid Rectangular Flash Beacon (RRFB) systems added to the crossing signs should be considered as replacements. • The existing crossing of Western Avenue at North Fair Street should be enhanced and modified to meet ADA requirements. Enhancements may include an RRFB system, bulb-outs, and other changes to signing and markings.