Santa Cruz County Regional

VMT Mitigation Program

Final Report

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Executive Summary

This study evaluates program options that mitigate Vehicle Miles Traveled (VMT) in order to meet the requirements of the California Environmental Quality Act (CEQA) for the County of Santa Cruz and the cities within the county, collectively referred to as the "region" in this study. Entities such as the Regional Transportation Commission (RTC), the California Department of Transportation (Caltrans), and the University of California, Santa Cruz (UCSC), can also use the program to mitigate VMT impacts. The study was funded by a grant awarded to the County of Santa Cruz, the City of Watsonville, and the Santa Cruz County Regional Transportation Commission (SCCRTC) from the Caltrans Sustainable Communities Grants program. The goal of the grant project is to establish a framework for offsite mitigation of VMT for projects that are not able to mitigate the entirety of their impacts onsite. The VMT mitigation program would fund active transportation, transit, and other VMT reducing projects such as transportation demand management (TDM) programs throughout the region that decrease VMT and greenhouse gas (GHG) emissions, improve safety, combat climate change, and improve the quality of infrastructure within disadvantaged communities.

As detailed in the ***Background*** section, current VMT reducing strategies, which rely heavily on TDM measures onsite, often fall short of fully mitigating the VMT impacts of a project. This study explores the viability of a programmatic approach, primarily through fee assessments, to fund off-site projects within the region that reduce VMT as a solution to address transportation related CEQA mitigation needs in the region.

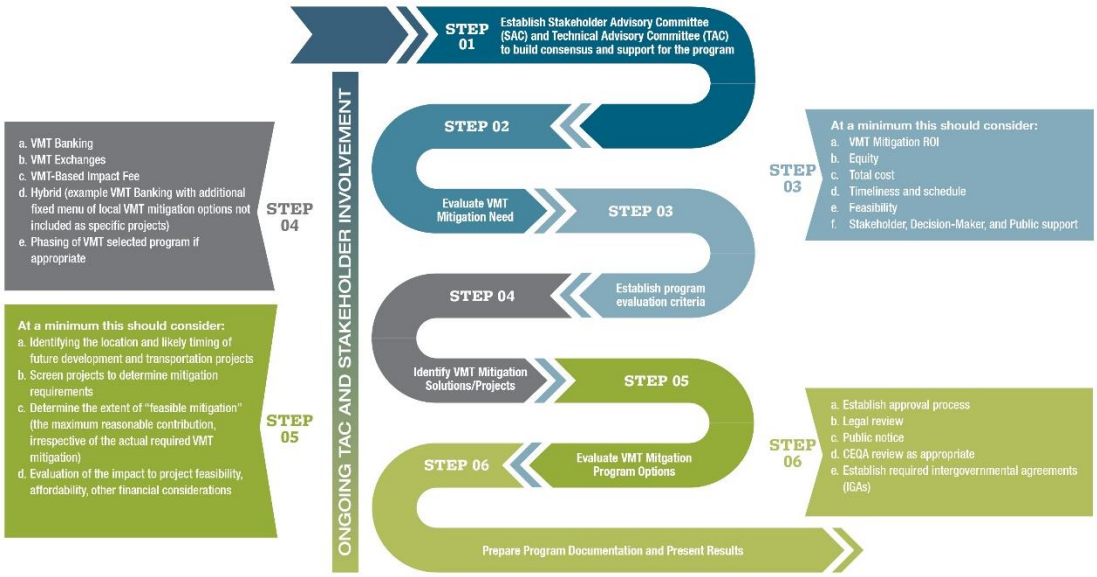
To determine feasibility and evaluate program options, this study considers the following questions:

- What is the ***state of the practice for VMT mitigation programs***?
- What is the magnitude of ***need for VMT mitigation*** within the region?
- What are the ***program options*** available to be considered to meet this need?
- What are the appropriate ***evaluation criteria to select a VMT mitigation program***?
- What types of ***VMT-reducing mitigation projects*** should be considered with a program?
- What are the ***challenges to implementing a program***?
- How can ***equity concerns be addressed within the program***?
- Which program has the potential to ***best meet the needs of the region***?
- What are the ***administration considerations when implementing the program***?
- Which ***projects could be potentially included*** in the region's future program?

Study Oversight

To guide the study, a Stakeholder Advisory Committee (SAC) and a Technical Advisory Committee (TAC) were assembled to provide oversight and input during the study. The committees were comprised of subject matter experts, member jurisdictions, community-based organizations (CBOs), and developers, including those who have expertise in affordable housing. Later in the project oversight the two groups were combined to reduce repetition.

Exhibit ES-1 – Study Process



VMT Mitigation Projects

If a project needs to address its VMT impact, there are various types of VMT reducing projects that could be implemented. **Exhibit ES-2** below presents examples of projects aimed at reducing VMT within a region. As part of a fee based VMT mitigation program, the implementation of projects other than site-specific TDM become more feasible as the region would pool mitigation fees increasing their spending power.

A regional VMT mitigation program holds the potential to implement more extensive mitigation projects, thereby achieving a more substantial impact on regional VMT. Given that many of the mitigation projects within these programs can entail significant costs, it is unlikely that any single project applicant would require such extensive VMT mitigation or have the capacity to independently finance these mitigation projects. However, through a program akin to the one under consideration in this study, multiple project applicants can pool their resources to fund larger and more impactful VMT-reducing projects.

Exhibit ES-2 – VMT Mitigation Project Types

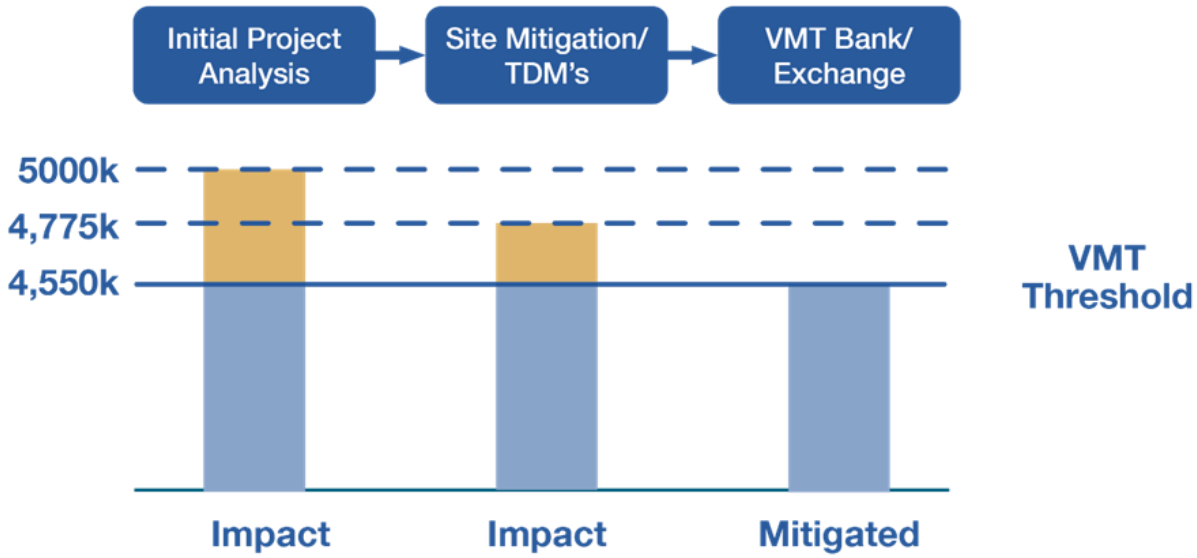
Example Projects		Comments
	Pedestrian	Adding sidewalks or filling in sidewalk gaps
	Bike	New lane miles of Class I - Class IV bike lanes, filling in gaps in bike infrastructre, or bike share
	Transit	New transit lines, extension of existing service, or adding new service types such as BRT
	Road Diet	Reducing capacity and providing non-auto infrastructure such as protected bike lanes or bus pull outs
	ITS/ TSM	Providing parking wayfinding, optimizing signal systems, providing trip planning services
	Mobility Hub	Provide infrastructure to link multiple types of transportation modes
	Affordable Housing	Providing affordable housing in dense areas, transit-oriented development, or other affordable housing supportive needs
	Vanpool/Carpool	Implement regionwide vanpool and carpool programs or expand existing programs
	Park-and-Ride	Construct park-and-ride lots to increase trip occupancy

VMT Mitigation Programs

This study evaluated different types of programmatic strategies for mitigating VMT, including VMT banks, VMT exchanges, and VMT impact fee programs. **Exhibit ES-3** offers a visual representation of how a project would proceed with mitigating its transportation impact in an area with a VMT fee program, such as a VMT bank. Even in instances where a VMT fee program is in place, project applicants still employ Transportation Demand Management (TDM) and other project-specific onsite measures to reduce VMT impacts before turning to a VMT mitigation program, as illustrated in **Exhibit ES-3**.

The example project in **Exhibit ES-3** below shows that a project is 450 VMT above its threshold (5,000 VMT – 4,550 VMT = 450 VMT). The project uses various TDM measures to reduce its VMT by 225 (5,000 – 4,775 = 225) and then pays into the fee program to reduce the final 225 VMT (450 – 225 = 225).

Exhibit ES-3 – Application of a VMT Mitigation Program



While ***VMT mitigation programs*** can manifest in various formats, this study primarily centers on the three most prevalent program categories, which are:

VMT Bank

VMT banking involves identifying, evaluating, and combining various VMT-reducing projects (like bike paths, pedestrian improvements, and public transit enhancements) to calculate a total VMT reduction and associated costs. Projects collectively reduce VMT by a specific amount, with a cost assigned per VMT reduced. With VMT bank, developers can buy VMT credits from the bank to offset their projects' VMT impacts, paying a fee based on the cost per VMT reduced. The bank requires replenishment once the available VMT credits are exhausted, necessitating continuous investment in new mitigation projects.

VMT Exchange

This is similar to a VMT bank but offers more flexibility by allowing applicants to select from a list of VMT-reducing projects or propose their own. The focus is on implementing specific projects rather than accumulating and selling VMT reductions as credits. With VMT Exchange, developers can sell excess VMT reductions (if their project mitigates more VMT than required) to others needing to offset their VMT impacts. It does not require monetizing VMT reductions unless the applicant wants to sell excess mitigation as credits, focusing more on direct implementation of projects.

VMT Impact Fee

This is similar to traditional development impact fee programs but tailored for VMT mitigation. Fees are calculated based on the anticipated VMT impact of new developments, with costs allocated according to the type of land use (residential, commercial, etc.). With a VMT Impact fee, developers pay a fee based on their project's size and land use type to offset the estimated VMT impact. This approach simplifies the process for developers by integrating VMT mitigation into existing fee structures. Fees can vary by zone,

encouraging development in areas with better VMT performance. The program can be tailored to regional and local needs, potentially incorporating benefit areas that align fees with local VMT efficiency.

Micro (Localized) VMT Banking

Focuses on establishing smaller, localized VMT banks catering to specific areas or jurisdictions. This can address equity issues by ensuring mitigation efforts are proportional and relevant to the areas most affected by development projects.

Hybrid VMT Mitigation Programs

Combines elements of VMT banks, exchanges, and impact fee programs, allowing for flexible, tailored approaches to VMT mitigation. This can involve distributing funds both regionally and locally, ensuring that mitigation efforts benefit both broader and more specific community needs.

Mitigation Projects

As shown in **Exhibit ES-2**, a variety of ***mitigation project*** types can be considered for inclusion within a regional VMT mitigation program. A list of candidate VMT-reducing projects was established to evaluate the feasibility of including them in a fee-based VMT mitigation program. Projects from the County of Santa Cruz Active Transportation Plan, the SCCRTC's Regional Transportation Plan, and local Capital Improvement Programs (CIPs) were screened for feasibility of implementation, their potential for VMT reduction, and the estimated cost of VMT reduction credits. Of those projects, 34 total projects were advanced for evaluation, including 19 bicycle projects, 6 transit projects, 3 land use/affordable housing projects, 2 mobility hub projects, and 3 TDM projects. Based on this evaluation the following are the key takeaways:

- **Bicycle Projects.** Bicycle projects were evaluated using big data[1] and (National Cooperative Highway Research Program) NCHRP 552 for their ability to reduce VMT. The projects resulted in a mitigation cost per VMT reduced that varied between $85 and $8,605 due to project cost and characteristics.
- **Transit Projects.** Transit projects were evaluated using the Bus Rapid Transit (BRT) Practitioner's Guide and the region's countywide travel demand model. The three projects evaluated resulted in a cost per VMT reduced that varied between $529 and $392,753.
- **Non-Infrastructure.** Affordable housing projects were evaluated based on a case study of affordable housing project costs proposed and constructed in the region. The projects resulted in a mitigation cost per VMT reduced that varied between $18,620 and $47,981.
- **Mobility Hub Projects.** Mobility hub projects were evaluated using the travel demand model and the BRT Practitioner's Guide. The projects resulted in a mitigation cost per VMT reduced that varied between $204 and $7,552.

[1] Big Data: a data analytics platform that provides detailed insights into the movement, behaviors, and patterns of people. It leverages aggregated and anonymized mobile location data to model the travel habits and demographics of populations. Replica, the platform used for this project, uses synthetic data that is calibrated and validated using anonymized real-world data sources.

- **TDM Projects.** TDM projects were evaluated using the travel demand model and assumptions based on research. The projects resulted in a mitigation cost per VMT reduced that varied between $485 and $3,528.

The costs per VMT for the improvements were calculated based on the assumption that they would be funded solely through the regional VMT mitigation program without other funding sources, such as state or federal grants. This cost analysis exercise highlights the substantial variations in capital expenses that are due to factors beyond just the type of project (transit, land use, etc), aligning with findings from other recent state-wide VMT mitigation studies. Because of this substantial cost variation, a viable program will likely need additional funding sources to maintain a per VMT dollar amount that is financially feasible. In other words, the VMT program would close gaps in funding for VMT reducing projects that have some funding identified but are short on complete funding for implementation.

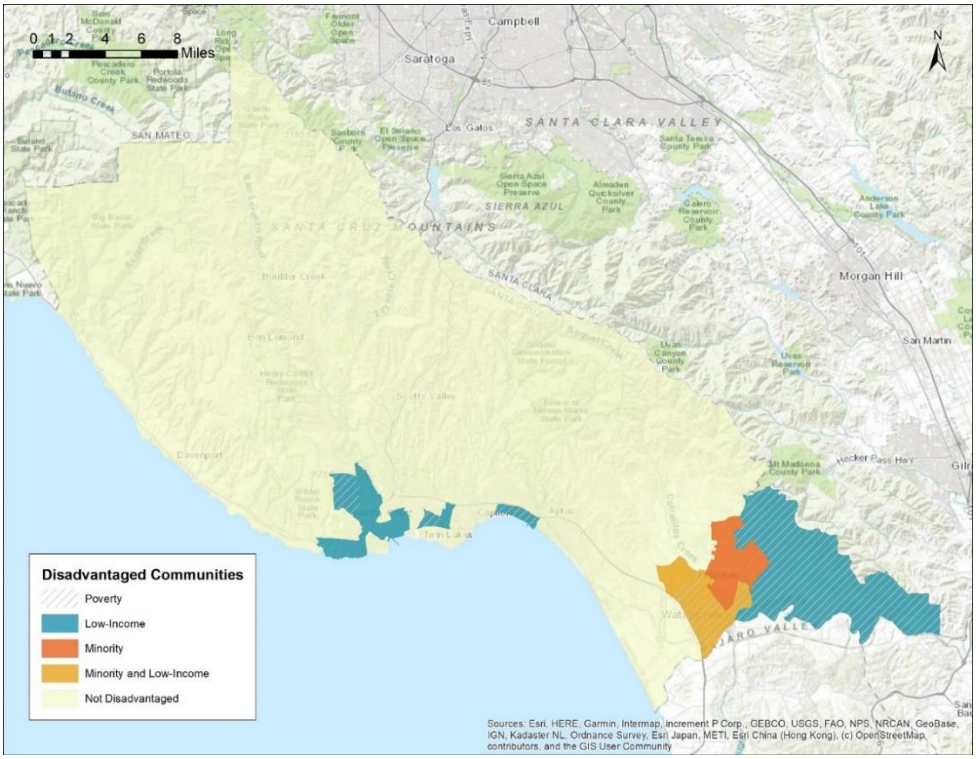
Equity and Mitigation

In contrast to Level of Service (LOS), which assesses specific impacts near a new development, VMT evaluates the entire trip, considering regional impacts. When a development project or large transportation project is built, its VMT impact can be offset by a VMT-reducing project anywhere in the region, as the impact is not confined to a particular location. However, concerns about equity can arise when new developments and transportation projects are concentrated in specific communities, while the corresponding VMT mitigation projects are implemented in different parts of the region. This scenario might lead to some communities experiencing the negative effects of new development and transportation infrastructure without reaping the benefits of VMT-reducing projects funded by a VMT bank or similar framework.

To assess the equity of a fee-based VMT mitigation program, an environmental justice (EJ) analysis was conducted. This analysis aimed to determine if the impacts of new development and VMT mitigation projects would be distributed fairly across the region. It specifically examined whether VMT impacts would disproportionately affect low-income and/or disadvantaged communities that are identified by the County of Santa Cruz General Plan[2] and where mitigation projects would most likely be implemented. **Exhibit ES-4** presented below highlights the different areas in the region categorized as low-income communities (marked in blue), minority and low-income communities (in light orange), minority (orange) and areas that are neither (depicted in pale yellow). The focus for the implementation of VMT mitigation projects should be in areas where it would yield the greatest impact, which are areas with high population density. **Exhibit ES-4** suggests that the majority of VMT mitigation projects would likely occur in environmental justice communities if VMT reducing projects are implemented in denser areas of the region. This study has integrated the categorization displayed below with an analysis aimed at assessing future VMT mitigation requirements for residential and employment purposes, please refer to the ***Equity Analysis*** section for detailed information.

[2] The Santa Cruz County General Plan/LCP, https://sccoplanning.com/Portals/2/County/Planning/SustainabilityUpdate/General_Plan/GeneralPlanChapter2_BuiltEnvironment_public_draft.pdf?ver=eW8J4dPc_PcM7wjL2sGWXg%3d%3d, accessed on 3/20/2024

Exhibit ES-4 – Santa Cruz County Environmental Justice Communities



Program Evaluation

As part of this study, mitigation program options were evaluated in terms of their potential to meet the identified needs of the region. The following are considerations and questions that guided the evaluation of the feasibility of the fee-based VMT mitigation program framework for Santa Cruz County:

Legal - Does the fee-based VMT mitigation program meet CEQA and statutory requirements, including additionality?
Effective - Does the fee-based VMT mitigation program result in a long-term financially feasible mitigation program?
Geography - Can the fee-based VMT mitigation program scale to meet the region's needs?
Administration - Does the fee-based VMT mitigation program fund oversight and management of the program and maintain analysis and technical requirements for administering the program?
Equitable - Does the fee-based VMT mitigation program avoid disproportionate impacts to disadvantaged and/or low-income communities? Does the program encourage an equitable benefit distribution throughout the region?
Alignment - Does the fee-based VMT mitigation program support good design of projects and align with community values and existing plans?

Exhibit ES-5 below provides a summary of the evaluation of each fee-based VMT mitigation program based on the considerations mentioned above. For more information, please refer to the ***Program Evaluation*** section.

Exhibit ES-5 – Regional VMT Mitigation Program Evaluation

	VMT Bank	VMT Exchange	VMT Impact Fee
Legal	●	◐	●
Effective	●	●	●
Geography	●	●	◐
Administration	●	◐	●
Equitable	●	◐	●
Alignment	●	◐	●

● Feasible ◐ Concern

In considering CEQA transportation mitigation, a key factor is the principle of ***additionality.*** The principle of additionality requires that mitigation measures must be improvements that would not have occurred were it not for the VMT program. Essentially, a project proponent must propose either a novel mitigation approach or significantly advance a planned one to offset their impact. Caltrans' recent guidance clarifies the interpretation of additionality, permitting applicants to claim complete VMT mitigation benefits from a VMT-reducing project even if they aren't the sole funder, provided no other claims exist on the mitigation. This interpretation allows the use of external funding sources to reduce the amount of money contributed by the VMT Program, effectively reducing per unit VMT costs, thus enhancing project viability.

An additional aspect considered in the assessment of a fee-based VMT mitigation program is the potential for ***unintended consequences***. These may arise from the program's execution and could lead to diverse outcomes such as significant alterations in development or transportation expenses, shifts in development patterns, or changes in prioritizing infrastructure projects. Historically, transportation programs and projects had disproportionate impacts on disadvantaged populations. It is also crucial that a VMT mitigation program does not deter sound project design or conflict with community values.

Study Outcome

Upon completing the VMT-reducing project analyses, study outreach, framework evaluations, and reviewing all considerations, feasible program options and candidate projects exist and can be implemented for Santa Cruz County. It was determined that a VMT Bank framework was the most appropriate for the region and that a mix of VMT-reducing bicycle, TDM, and transit projects were good candidates for inclusion in the program. This framework and these VMT-reducing projects were selected for their ease of understanding by the public and decision-makers and their ability to successfully address the considerations outlined above. Key findings and recommendations from the study include:

- A regional VMT mitigation program offers a new viable mitigation option for project applicants facing VMT impacts that cannot be mitigated through other means.
- Selectivity in choosing VMT-reducing projects for the program is crucial to ensure financial and practical feasibility. Projects should be evaluated for potential other funding sources and their ability to meet additionality requirements.
- Equity must be a core element in both the final design of the VMT mitigation program and the projects selected for it. This study suggests that a fee-based VMT mitigation program could lead to equitable outcomes, avoiding concentration of VMT impacts in environmental justice communities and ensuring mitigation is not limited to non-environmental justice areas.
- Developing a project list for the program will be an ongoing process, necessitating accurate methods of VMT analysis in line with best analysis practices to ensure robust outcomes. The study's established framework should serve as the basis for future analysis.
- There needs to be clear documentation of the connection (nexus) between the program's necessity and the impact of the VMT mitigation during final program design.
- The program's success hinges on support from decision-makers, agencies, the community, and participants in the VMT mitigation program. A diverse range of perspectives should be considered in the final design and project selection.
- Implementing a fee-based VMT mitigation program introduces a new fee, potentially increasing housing costs and other development expenses, as well as the cost of transportation capacity-enhancing projects.
- Without a well-defined and well-established VMT mitigation solution, significant uncertainty will persist for many projects, hindering their progress even if they align with other plans and programs.
- A single entity should administer the program, likely the SCCRTC, and work with member agencies in the form of a Joint Powers Authority (JPA) to ensure consistent application of the program and long-term viability.
- It is recommended that a pilot program be implemented prior to the full rollout of the program. This pilot program would include shovel ready or immediately implementable projects and programs that are cost efficient and run for a set time period. Once the pilot program ends, its effectiveness should be evaluated, and any lessons learned be incorporated into the full rollout of the program within the region.

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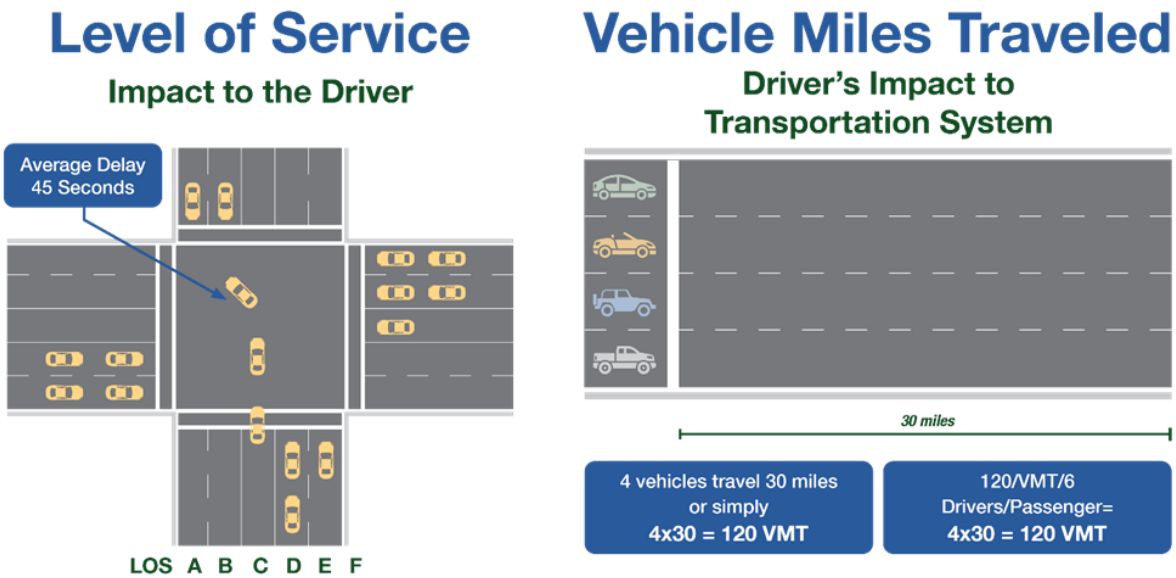
Background

California's Senate Bill (SB) 743 is a legislative bill altering the approach to review of transportation impacts for proposed projects, encompassing both land use initiatives like housing developments and transportation ventures such as road expansions. The bill shifts focus away from vehicle delay and instead to vehicle miles traveled (VMT) generated by a project.

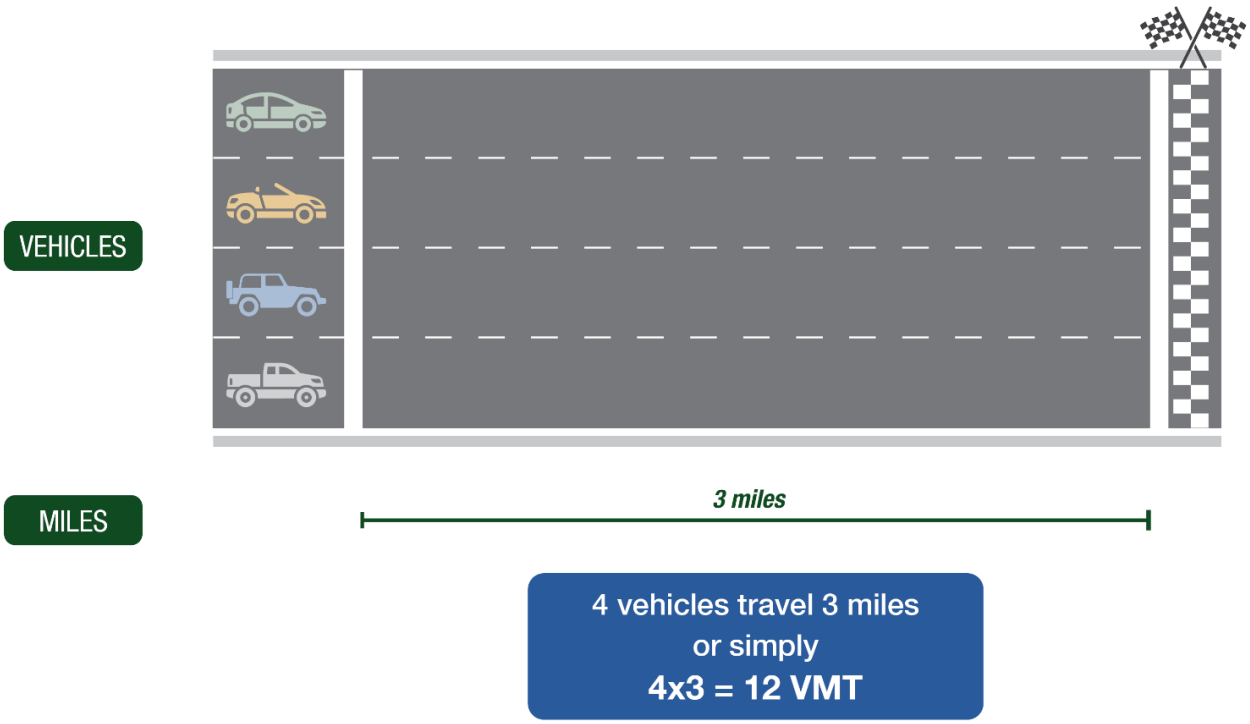
Historically, before SB 743's enactment, transportation impacts were evaluated based on delay, using the Level of Service (LOS) concept, a standard in the transportation sector since the first Highway Capacity Manual (HCM) was released in 1950. Over the HCM's seven editions, LOS influenced decision-making, yet LOS is linked to unwanted outcomes such as urban sprawl and adverse effects on active transportation (bikes, pedestrians) public transit, road safety, and public health. LOS focuses on vehicle travel speed and throughput and neglects other travel modes. Since the metric is based on the driver's experience and cost of time, the solution is often to increase roadway capacity either by adding vehicle lanes or new roadways. Another solution to improving LOS or reducing delay is to build in less populated areas, which increases sprawl and greenfield development. As has been shown in recent years, increased capacity can cause a phenomenon called "induced demand" wherein more people start using the previously congested facility, causing increases in driver demand and subsequent increases in delay thereby starting the whole cycle of increasing capacity all over again. SB 743 aims to reverse these trends by adopting VMT as a more holistic measure of impact on transportation systems. This shift from LOS to VMT encourages urban infill development, where VMT is typically lower. However, it also highlights the lack of practical, cost-effective mitigation options for suburban and rural projects, as many previously employed LOS mitigations do not align with VMT reduction goals. This change led to different outcomes in CEQA-related transportation analyses and necessitated novel mitigation approaches. **Exhibit 1** provides a summary of the differences between LOS and VMT.

Exhibit 1 – Level of Service vs. Vehicle Miles Traveled



VMT is calculated exactly as the term sounds, the sum of the number of miles traveled by each vehicle in a system. As shown in **Exhibit 2** below, four vehicles each traveling 3 miles results in each individual vehicle producing 3 VMT. When combined, all four vehicles account for a total of 12 VMT.

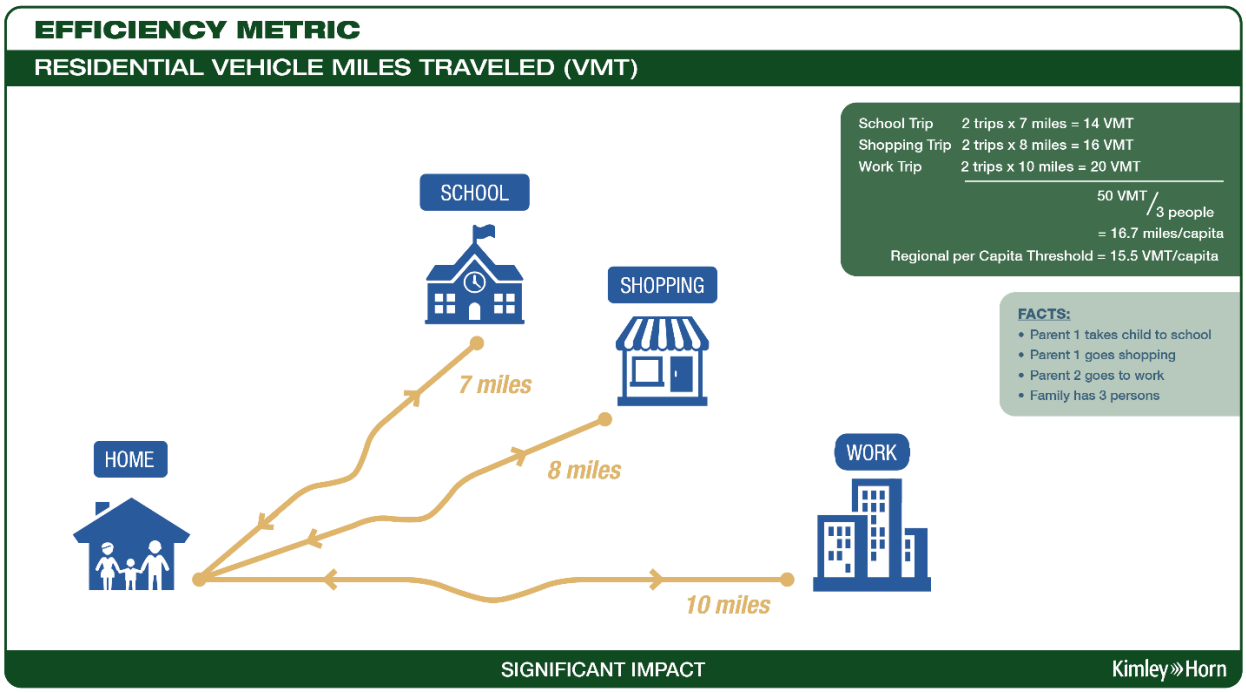
Exhibit 2 – How to Calculate Vehicle Miles Traveled (VMT)



When determining if a project results in a significant transportation impact, the project must be compared to a threshold of significance which is determined by the jurisdiction. Two types of thresholds exist: efficiency thresholds, such as VMT per capita, and net change thresholds. Residential and office projects can vary in size so using an efficiency metric allows the projects to be easily compared to a threshold. Retail and customer-serving projects often do not create new trips but can change trip lengths, so it is more appropriate to consider how the location of the project changes VMT; this is more easily measured as a net change in VMT.

Exhibit 3 summarizes how a residential project is evaluated using VMT. Each household has every trip measured, both to and from a location, to determine the total VMT. The graphic below shows how trips to the child's school are 7 miles each way (14 miles total), the trip to work is 10 miles each way (20 miles total), and the trip to the store is 8 miles each way (16 miles total). When adding the total length of all trips together, the household has 50 daily VMT.

Exhibit 3 – Vehicle Miles Traveled Residential Project Example

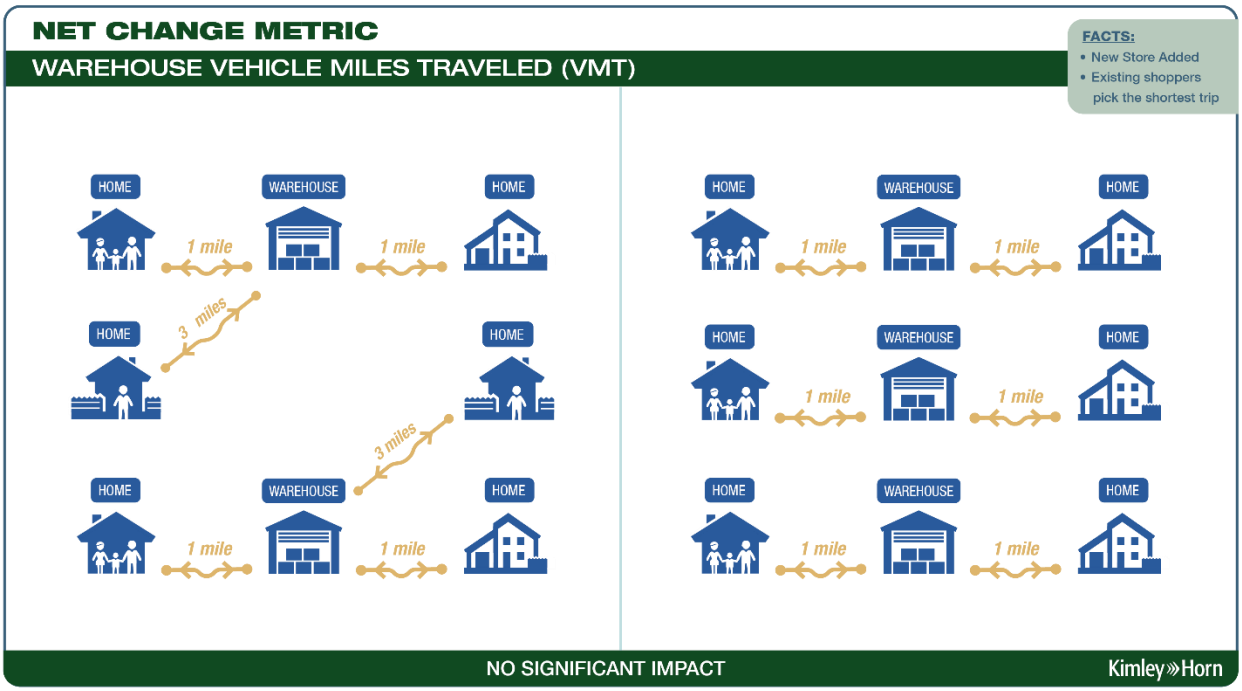


To determine whether the project results in an environmental impact, the project's VMT per capita must be compared to the regional threshold. In the example shown in **Exhibit 3**, the household contains 3 people, so the VMT per capita is determined by dividing the household's total VMT (50) by the household size (3) resulting in a household VMT per capita of 16.7. If the regional threshold is 17.5 VMT per capita, the project would not result in an impact as it is more efficient than the regional threshold.

There is a distinction between regional retail (e.g., Lowes or Target) and local-serving retail (e.g., coffee shops, restaurants, or gas stations) when it comes to evaluating VMT. Local-serving retail primarily serves preexisting needs: it does not generate new trips because it meets existing demand. Because of this, local-serving retail uses can be presumed to reduce trip lengths when a new store is proposed. Essentially, the assumption is that someone will travel to a newly constructed, local-serving store because of its proximity compared to a comparable store located further away. This results in a trip on the roadway network becoming shorter, rather than adding a new trip to the roadway network. Conversely, residential and office land uses often create new trips, given that they introduce new participants to the transportation system.

Exhibit 4 graphically explains this concept. It shows how a new retail store typically redistributes existing customer trips, reducing average trip lengths and thus decreasing VMT (e.g., reducing trip segments from 3 miles to 1 mile with the new store).

Exhibit 4 – Effect of Local-Serving Retail on Regional Vehicle Miles Traveled



Additional documentation on the County of Santa Cruz's VMT policy, including thresholds by land use, can be found on the County of Santa Cruz's VMT website[3].

VMT Mitigation Approaches

Various strategies are available for project applicants that need to reduce their VMT impacts. **Exhibit 5** below highlights examples of projects that can reduce VMT in the region. Pedestrian initiatives aim to enhance walkability with additional sidewalks or intersection improvements such as crossings, reducing reliance on short-distance driving. Bike projects introduce new facilities and bike-share programs, promoting cycling as an efficient transport alternative. Transit improvements, such as new lines and Bus Rapid Transit (BRT) systems, increase public transport use by offering faster and more reliable options. Road Diets rebalance street space to better accommodate non-automotive travel, creating safer routes for cyclists and pedestrians while calming traffic. Intelligent Transportation Systems (ITS) and Traffic System Management (TSM) leverage technology for better traffic flow and information, reducing idle time and unnecessary trips. Mobility Hubs centralize transport options, streamlining the transition between modes like cycling, buses, and trains, fostering a cohesive network. Affordable Housing projects in dense, transit-accessible areas encourage a mode shift away from driving toward the use of public transport and active transportation modes. Vanpool and Carpool programs expand shared travel, diminishing the number of vehicles on the road. Park-and-Ride facilities support these efforts by enabling commuters to combine car travel with public transit, lessening the VMT for individual journeys. Trip reduction programs encourage employers to develop telecommuting programs to reduce the number of commute trips made

[3] Santa Cruz County Vehicle Miles Traveled (VMT). https://sccoplanning.com/PlanningHome/Environmental/CEQAInitialStudiesEIRs/VehicleMilesTraveled(VMT).aspx

by employees. Each strategy is instrumental in curbing VMT by offering convenient, sustainable alternatives to single-occupancy vehicle use.

Exhibit 5 – VMT Mitigation Projects

Example Projects		Comments
	Pedestrian	Adding sidewalks or filling in sidewalk gaps
	Bike	New lane miles of Class I - Class IV bike lanes, filling in gaps in bike infrastructre, or bike share
	Transit	New transit lines, extension of existing service, or adding new service types such as BRT
	Road Diet	Reducing capacity and providing non-auto infrastructure such as protected bike lanes or bus pull outs
	ITS/ TSM	Providing parking wayfinding, optimizing signal systems, providing trip planning services
	Mobility Hub	Provide infrastructure to link multiple types of transportation modes
	Affordable Housing	Providing affordable housing in dense areas, transit-oriented development, or other affordable housing supportive needs
	Vanpool/Carpool	Implement regionwide vanpool and carpool programs or expand existing programs
	Park-and-Ride	Construct park-and-ride lots to increase trip occupancy

Fee-Based VMT Mitigation Program Framework Options

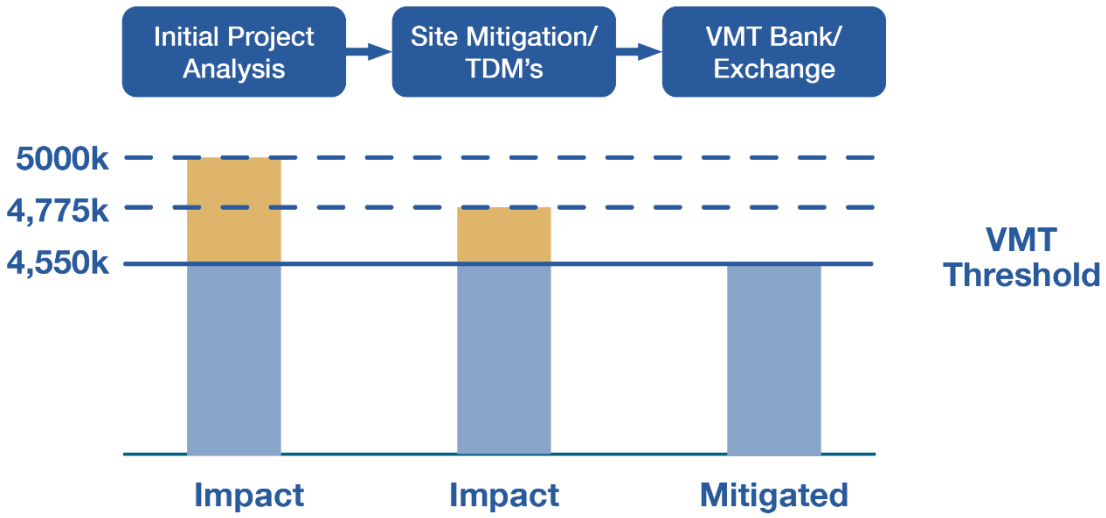
To broaden the scope of VMT mitigation options, regional VMT mitigation programs, like those under consideration in this study, are being explored for implementation across California. These regional programs support larger-scale development projects with more significant impacts by providing alternative options to reduce VMT. Often larger projects are not able to mitigate their VMT entirely on site, however given the high cost of more significant VMT reducing projects, often reaching millions of dollars, it's improbable for individual project applicants to afford such extensive VMT mitigation. A program as envisioned in this study would enable multiple applicants to collectively fund substantial VMT-reducing projects thereby mitigating the impacts of their individual projects.

This study evaluated various programmatic methods for VMT mitigation, including VMT banks, VMT exchanges, and VMT impact fee programs.

Exhibit 6 visually illustrates the process of mitigating transportation impacts in regions with a fee-based VMT mitigation program. Even in areas with a fee-based VMT mitigation program, project applicants still must exhaust mitigations on site to reduce their VMT impacts, using strategies such as a VMT bank to address any remaining VMT impacts.

The example project in **Exhibit 6** below shows that the project is 450 VMT above its threshold (5,000 VMT – 4,550 VMT = 450 VMT). The project uses various on-site TDM measures to reduce its VMT by 225 (5,000 VMT – 4,775 VMT = 225 VMT) and then pays into the fee program to reduce the final 225 VMT (450 VMT – 225 VMT = 225 VMT).

Exhibit 6 – Application of a VMT Mitigation Program



Although ***VMT mitigation programs*** can take multiple forms, the three most common program types, and the primary focus of this study, are discussed below.

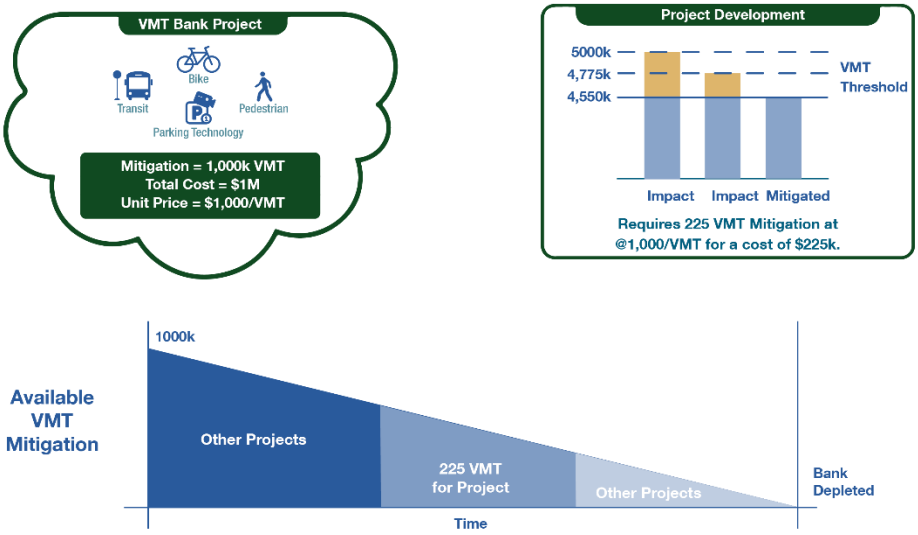
VMT Bank

As shown in **Exhibit 7**, the following steps are used to establish a VMT mitigation bank:

1. Identify VMT-reducing projects, such as bicycling facilities, pedestrian infrastructure, and public transit.
2. Evaluate these projects to determine the extent of VMT reduction.
3. Combine the VMT reductions from all projects to calculate the total mitigated VMT. For this example we will use, the total VMT reduction is 1,000 VMT.
4. Sum the costs associated with each project. In this instance, the collective cost of all VMT-reducing projects amounts to $1 million.
5. Calculate the cost per VMT reduced by dividing the total project cost by the total VMT reduction. In this example, the cost to mitigate 1 VMT is $1,000.

Once the cost per VMT is established, and the VMT bank is operational, a project can offset its VMT impact by paying a per VMT fee to the bank. As shown in **Exhibit 7** below, the example project needs to reduce its VMT impact by 225 VMTs to meet the regional threshold. Therefore, the total fee would be $225,000 calculated by multiplying the cost of each VMT reduced, $1,000, by the total VMT needing to be reduced, 225. Note that once the available VMT is used up by development projects purchasing VMT from the VMT bank, the VMT bank would need to be replenished with new VMT mitigation projects.

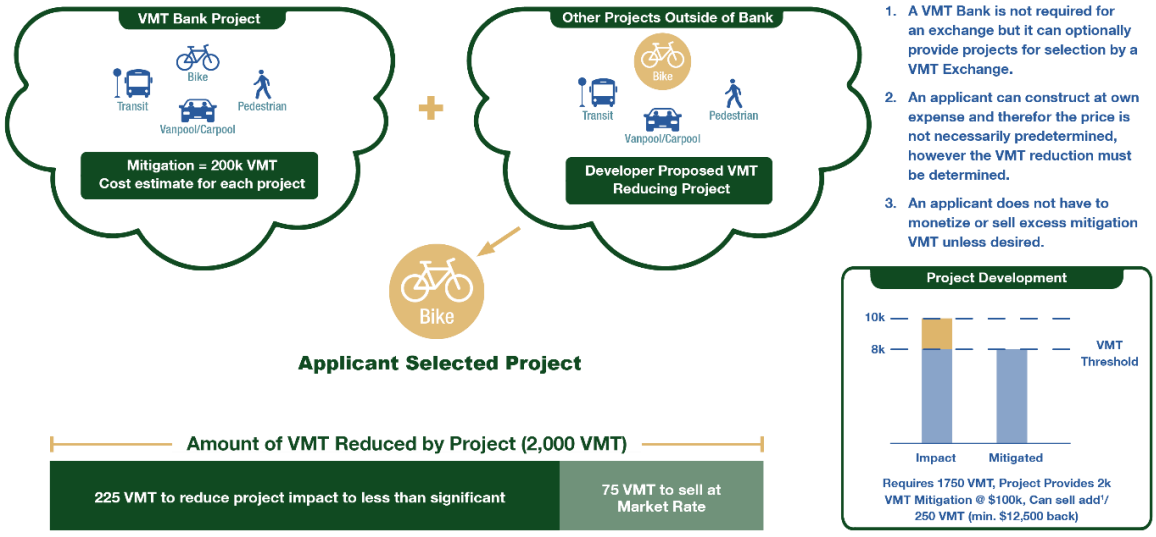
Exhibit 7 – VMT Bank Example



VMT Exchange

VMT exchanges function similarly to VMT banks, with the main difference being that in a typical VMT exchange, applicants have the option to choose a single project from an existing list or program of VMT-reducing projects or propose a VMT-reducing project for implementation which may not appear in a list or program. In the case of a VMT exchange, it is not necessary to monetize the selected VMT-reducing project unless the project applicant wishes to make excess VMT mitigation available to others for purchase as credits. As illustrated in **Exhibit 8** below, an applicant develops a bicycle project that reduces regional VMT by 300 VMT. However, the applicant only needs to reduce the VMT impact to the VMT threshold by 225 VMT. Consequently, the applicant has 75 surplus VMT available for sale to others at a market rate.

Exhibit 8 – VMT Exchange Example



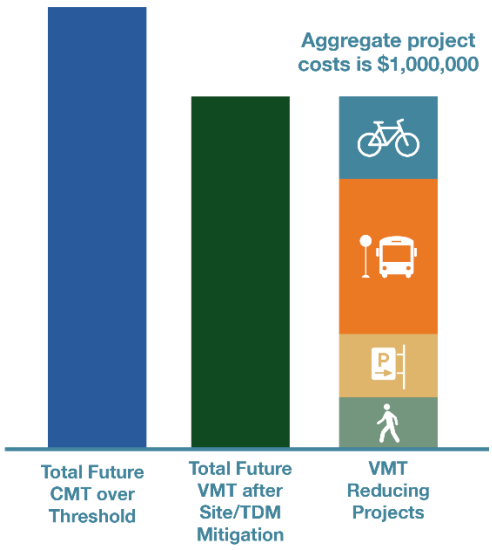
VMT Impact Fee

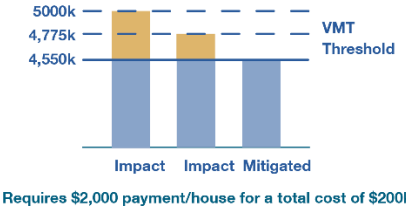
Instead of establishing a VMT bank or exchange, the program could be structured in a manner similar to existing development fee programs. In this setup, a new development project would be obliged to pay a fee to offset its VMT impact, determined by factors such as the total number of planned dwelling units or the total square footage of planned building construction. The VMT impact fee program would function akin to existing development fee programs, with the distinction that it exclusively includes projects that reduces VMT.

As shown in **Exhibit 9** below, the fees would be calculated by land use types based on the projected VMT generation from planned developments over the next 10-20 years, with a specific emphasis on offsetting the VMT mitigation requirement. Similar to the VMT bank, fees are computed by dividing the total VMT needed to be mitigated by future projects by the cumulative cost of VMT-reducing projects. However, unlike a VMT bank, this calculation is performed separately for each land use type rather than collectively.

The fee for each land use type is determined by first quantifying the VMT that needs to be mitigated for each land use type, calculating the share of the total VMT requiring mitigation, multiplying that percent share by the total cost of the VMT-reducing projects, and then dividing the land-use specific cost by the growth for each land use (either dwelling units or square-feet). For example, in **Exhibit 9**, if the residential land use accounts for 50-percent of all future VMT mitigation needs and the total cost of VMT-reducing projects is $1 million, then the residential land use would have a total mitigation cost of $500,000 (50% of $1 million). If the anticipated number of houses to be constructed in the future is 250 houses, the fee would be calculated by dividing $500,000 by 250, resulting in a fee of $2,000 per home.

Exhibit 9 – VMT Impact Fee Example





Requires $2,000 payment/house for a total cost of $200k.

VMT Impact Fee Schedule

Land Use Type	Amount	Units	Fee/Unit	Total
Residential	250	Houses	$2,000	$500,000
Industrial	2,500,000	S.F.	$0.10	$250,000
Office	1,000,000	S.F.	$0.13	$125,000
Regional Commercial	250,000	S.F.	$0.20	$125,000
			Total	$1,000,000

When considering a VMT impact fee framework, it may be beneficial to divide the region into multiple benefit areas. This allows for fees to be assessed based on the VMT efficiency of a benefit zone in terms of overall VMT performance. This approach can incentivize projects to locate in VMT-efficient areas within

the region. As shown in **Exhibit 10** below, the areas that combine to form Zone 1 all fall below the regional VMT threshold for both residential and non-residential uses, resulting in no fees being administered for projects in that zone. Alternatively, Zone 2 has the worst VMT performance and contains the highest fees charged for the region.

Exhibit 10 – VMT Impact Fee Program with Multiple Benefit Areas

Zone		Units	Fees/Unit
1	Residential	Houses	0
	Industrial	S.F.	0
	Office	S.F.	0
	Regional Commercial	S.F.	0
2	Residential	Houses	$2,200
	Industrial	S.F.	$0.12
	Office	S.F.	$0.15
	Regional Commercial	S.F.	$0.22
3	Residential	Houses	$1,500
	Industrial	S.F.	$0.08
	Office	S.F.	$0.11
	Regional Commercial	S.F.	$0.17

Fee-based VMT Mitigation Program Variations

Alongside the three primary fee-based VMT mitigation program frameworks, several alternative models were explored, including:

Micro (Localized) VMT Banking

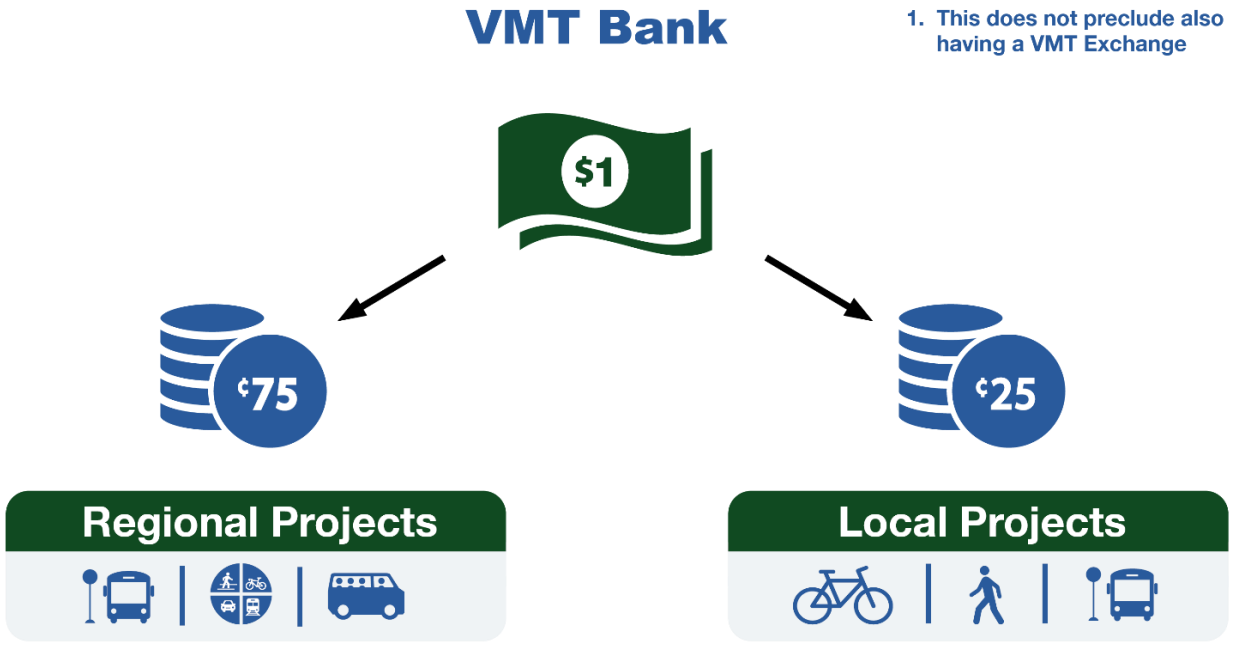
This approach considers establishing multiple VMT banking programs instead of a singular regional program. This method allows for funding and implementing smaller groups of projects simultaneously, potentially addressing equity issues by ensuring mitigation projects are located near the development projects causing VMT impacts. Alternatively, a micro VMT bank could be integrated with a regional VMT bank or VMT exchange. Smaller jurisdictions in less-populated areas may not have as many projects included in the bank or exchange due to lower efficacy with smaller population densities. In these cases, multiple smaller jurisdictions may join to form a single multi-jurisdictional banking program or participate in the regional-scale program as a backstop, while funding smaller group of projects through their local bank.

Hybrid VMT Mitigation Programs

This approach involves a combination of different strategies such as banking, exchanges, impact fee programs, and micro VMT banking. Combining regional and micro VMT banking programs appears most effective. As shown in **Exhibit 11**, mitigation funds are distributed both regionally and locally by a predetermined value, utilizing the efficiency of regional projects while supporting local communities. This hybrid model also addresses equity concerns by funding VMT-reducing projects in the communities where

the development projects are located. Similarly, a program may wish to form multiple "benefit basins" or zones within their respective regions to keep a sufficiently local focus under the rubric of a program administered by a single entity.

Exhibit 11 – VMT Bank with Regional and Local Split



Literature Review and State of the Practice

The initial phase of this study involved conducting a comprehensive literature review and analyzing current practices. This entailed evaluating existing programmatic approaches and examining both legal and non-legal factors that could impact the development of the program. The findings from this review are organized into four key sections: the advantages and disadvantages of various frameworks, legal considerations specific to fee-based VMT mitigation programs, details of the Mitigation Fee Act (AB 1600), and a general overview of the current state of practice.

The review covered a range of local pertinent documents. These included impact fee guidelines from member jurisdictions, regional guidelines for implementing SB 743 in Santa Cruz County, along with screening criteria and threshold parameters. Additionally, the review encompassed various significant documents such as climate action plans, bicycle and pedestrian master plans, transit plans, and transportation demand management ordinances from within the region. Moreover, the review also considered best practices in CEQA mitigation methods that align with the objectives of SB 743.

Other resources and documents that were reviewed as a part of this effort included new analysis methodologies from industry experts and relevant professional organizations (ITE, ITS, APA, CAPCOA, OPR, CARB, etc.) for providing multimodal solutions to mitigate VMT impacts. The complete literature

review can be found in **Appendix A**. The following are some of the key relevant findings that were identified during these efforts that helped shape this study:

- Agencies need to verify VMT reductions and additionality for projects before approving participation in the banking regime. Any agency implementing a bank or exchange must demonstrate both a reasonable substantive relationship and financial proportionality between the proposed development and the fee or condition placed on it.
- Agencies should also be diligent in their VMT mitigation duration as the nexus between improvements and timely use of fees varies region by region.
    - Banks that receive and pool funds from multiple projects should account for the delay between payment and deployment of funds.
    - All frameworks should also include a method of prioritization of individual mitigation projects, to ensure that reductions are achieved as quickly and efficiently as possible.
- A VMT exchange might be simpler for developers, but it could also limit the usefulness of funds from smaller developments and be less politically agreeable to local communities.
    - Offer more certainty for developers regarding the kinds and costs of mitigations needed to address cumulative VMT impacts.
- New plans and programs might increase new home costs, which can push disadvantaged communities further behind in their ability to access homeownership.
    - Significant equity issues may also arise if disadvantaged communities host developments but not beneficial mitigation projects.
    - Any lead agency will need to include rigorous backstops to ensure that disadvantaged communities are not negatively impacted by—and ideally can benefit from—the ability of developers to move mitigation off-site. Such backstops would include an accounting of where money is spent and ensuring geographic equity and of who the users are of the mitigations that were funded.
- Implementing agencies should consider requiring or providing incentives for developers or lead agencies to demonstrate that onsite mitigation is not feasible before being permitted to undertake off-site measures.
- VMT Banks and Exchanges comprehensively address VMT impacts across jurisdictional boundaries.
- Geography plays an important role in VMT reduction impact assessment. According to the difference between the VMT impact and the mitigation strategy as well as the variation among low and high VMT zones, using different ratios for impact and mitigation in the pricing structure seems necessary. For instance, Low VMT is defined as 15% below the defined thresholds for that area. For a detailed analysis on Geography please refer to Appendix A: Literature Review.
- Incorporating equity in VMT banking is essential and challenging, particularly in the case of off-site mitigation programs. The benefits of fee-based mitigation strategies must carefully be distributed. In general, VMT bank identifies lower income, communities of color, rural areas, and low transit accessible zones as equity priority. However, the local definition of equity and

disadvantaged communities should be considered as well since it affects public acceptance and political feasibility. In addition to local equity considerations, each mitigation project category comes with specific equity criteria to address while evaluating the VMT impacts and the effectiveness of mitigation strategies. Agencies can prioritize equity at various points, mainly before/at the beginning of a program or during the program's operation. Depending on this, the mechanism of intervention varies (Table 4). Community engagement in the jurisdictional decision-making process supports equity by reducing the risk of unintended consequences on communities of concern.

- Local jurisdictions should look for projects and programs and their financial constraints in the RTP before using for VMT Mitigation to ensure that the additionality criteria is met and that the project is feasible and timely.

Framework Pros and Cons

The literature review revealed advantages and disadvantages of different programmatic approaches for VMT mitigation, aiding in decision-making for implementing agencies. **Table 1** below outlines these pros and cons for two program types, mitigation exchanges and banks, highlighting factors like complexity, cost implications, and effectiveness.

Fee-Based VMT Mitigation Program Legal Considerations

The following is a summary of the legal requirements related to fee-based VMT mitigation programs:

- A fee-based VMT mitigation program can encompass projects aimed at reducing VMT that require clearance under the California Environmental Quality Act (CEQA). However, the program itself may not require environmental review. CEQA review may be completed once funding is secured for a VMT-reducing project, but before its construction or implementation starts. Furthermore, numerous VMT-reducing projects may be eligible for CEQA exemptions, such as active transportation projects already included in a master plan that has undergone CEQA evaluation.
- Fee-based VMT mitigation programs share many similarities with GHG (Greenhouse Gas) mitigation programs. CEQA case law offers guidance on the necessary features to meet legal requirements.
- A fee-based VMT mitigation program will need to adhere to the legal requirements for the timing of implementing mitigation.

Mitigation Fee Act (AB 1600)

The following presents a summary of essential considerations outlined in the Mitigation Fee Act as they pertain to non-voluntary fee-based VMT mitigation programs:

- The components of the Mitigation Fee Act are applicable to non-voluntary fee-based VMT mitigation programs, including VMT banks and exchanges, wherein developers make payments instead of constructing infrastructure. Many existing programs also permit direct infrastructure construction with credits offsetting owed fees.

- A notable departure from existing fee-based mitigation programs is the shift in focus from trips to VMT as the primary metric.
- It is important to recognize that the options for managing fees, whether through banking, exchanges, or other means, do not necessarily fall into a strict dichotomy.
- Regardless of the specific program, maintaining a clear nexus and proportionality remains a fundamental requirement.
- The nexus must demonstrate a delicate balance between mitigation efforts and their corresponding impacts.
- Proportionality should serve as the foundation for calculating the cost of mitigation measures.
- Each jurisdiction should exercise caution when implementing a fee-based VMT mitigation program, taking into account potential unintended consequences, such as inhibiting overall housing growth if the program becomes overly expensive.

Table 1 – Framework Pros and Cons

Program Type	Pros	Cons
Mitigation Exchange	• Limited complexity • Reduced nexus obligation • Expands mitigation to include costs for programs, operations, and maintenance • Allows for regional scale mitigation projects • Allows for mitigation projects to be in other jurisdictions • Increases potential VMT reduction compared to project site mitigation only	• Requires "additionality" • Potential for mismatch between mitigation need and mitigation projects • Increases mitigation costs for developers because it increases feasible mitigation options • Unknown timeframe for mitigation life • Effectiveness depends on scale of the program
Mitigation Bank	• Add certainty to development cost • Allows for regional scale projects • Allows for mitigation projects to be in other jurisdictions • Allows regional or state transfers • Expands mitigation options to include costs for programs, operations, and maintenance • Increases potential VMT reduction compared to project site mitigation only	• Requires "additionality" • Time consuming and expensive to develop, and maintain • Requires strong nexus • Political difficulty distributing mitigation dollars/projects • Increases mitigation costs for developers because it increases feasible mitigation options • Unknown timeframe for mitigation life • Effectiveness depends on scale of the program

State of the Practice

Table 2– Fee-based VMT Mitigation Program State of the Practice provides a high-level summary of the current state of the practice in California of fee-based VMT reduction/mitigation programs. As shown, there are relatively few fee-based VMT reduction/mitigation programs active in the state. Some of the programs included are not specifically focused on meeting CEQA VMT mitigation needs (they instead are focused on general VMT reductions), however they are still important models that show how specific elements programs being considered by the study could function.

Table 2– Fee-based VMT Mitigation Program State of the Practice

Agency	VMT Mitigation Program Format	Status[3]
Fresno COG	• TBD	• Study ongoing , completion in 2023
Contra Costa Transportation Authority (CCTA)	• TBD	• Ongoing, Review Final Program Early 2023
City of Fresno	• Active Transportation In-Lieu Impact Fee	• Ongoing, end date TBD
Santa Cruz County and incorporated Cities	• TBD	• Beginning September 2022
City of San Diego	• Impact Fee	• Ongoing, end date TBD
City of Watsonville	• VMT Bank	• Ongoing (initiated 2023)
City of Tracy	• VMT Bank	• Pending implementation
City of Salinas	• VMT Bank	• Pending implementation
City of Los Angeles	• Impact Fee	• Completed, understood to be implemented as part of the Westside Mobility Plan
City of Fremont	• TBD	• Ongoing, end date TBD
City of Lancaster	• VMT Mitigation Fee Optional Program	• Pending, waiting for the Council to adopt
City of Concord	• Impact Fee/Bank	• Pending implementation
Santa Clara Valley Transportation Authority (VTA)	• TBD	• Grant awarded; RFP date unknown
San Luis Obispo Council of Governments (SloCOG)	• TBD	• Grant awarded; RFP to be released in 2022
City/County Association of Governments of San Mateo County (C/CAG)	• TBD	• Grant awarded; RFP date unknown
Town of Los Gatos	• Impact Fee	• Ongoing, end-date anticipated

*Refer to Appendix A: Literature Review for more information.

Establishing Mitigation Need

Future development locations, development quantity, and the corresponding mitigation requirements play a crucial role in assessing the necessity of a regional VMT mitigation program and its potential scope. To accomplish this, a dataset was created by utilizing data from the current countywide travel demand model. This dataset estimates the VMT mitigation needs for the region as well as projects the potential revenue that a fee-based VMT mitigation program could generate. This data analysis assisted in evaluating the overall feasibility of different program options and determine the scale of projects that would be needed to mitigate the region's VMT. This dataset holds significance in understanding the potential cost magnitude that individual projects may need to bear to fully mitigate their VMT impacts. It also provides insights into how these costs may influence policy considerations concerning the definition of "feasible mitigation" under CEQA.

By leveraging the countywide travel demand model and previous VMT research in establishing thresholds, the total potential VMT to be mitigated was determined by calculating the difference between the VMT per capita and VMT per employee for each Traffic Analysis Zone (TAZ) that was over the established thresholds. The difference was then multiplied by the population and total employees for each TAZ to develop a total VMT per TAZ to be mitigated, which then allowed for a countywide total to be calculated. **Error! Not a valid bookmark self-reference.**,
Exhibit 12, and **Exhibit 13** show the VMT amount that will need to be mitigated through 2045 numerically and spatially, based on current land use plans. As shown in **Error! Not a valid bookmark self-reference.**, it is anticipated that based on the households and jobs that will be constructed or created between 2019 and 2045 in locations that are currently above the relevant adopted VMT threshold, a total VMT need of 119,005 VMT for residential land uses and 126,928 VMT for employment land uses is expected. **Error! Not a valid bookmark self-reference.3** displays the highest potential revenue per year that a fee-based VMT mitigation program could generate within the region when considering a cost of $1,000 per VMT reduced. It is important to emphasize that this calculation assumes that development will take place at the maximum possible rate per year, occurring in the same locations planned for through 2045. However, it is crucial to acknowledge that factors such as the need to mitigate VMT, economic fluctuations, and numerous other variables may diminish the actual revenue potential of implementing a fee-based VMT mitigation program.

Exhibit 12, and **Exhibit 13** breakdown the total VMT need for residential and employment by TAZs. A higher VMT within a TAZ indicates a significant need for VMT mitigation by 2045. Furthermore, these figures can highlight the maximum possible annual revenue per TAZ, assuming a reduction cost of $1,000 per VMT.

Table 3 – Potential Land Use Growth and VMT to Mitigate, 2019 to 2045

Agency	Future Vehicle Miles Traveled (VMT) to Mitigate	
	Residential	Employment
Total VMT (2019 – 2045)	119,005	126,928
Total VMT per Year	4,577	4,881
Potential Revenue per Year (Assumes $1,000/VMT	$4,577,115	$4,881,846

Exhibit 12 – Residential VMT Mitigation Need by TAZ

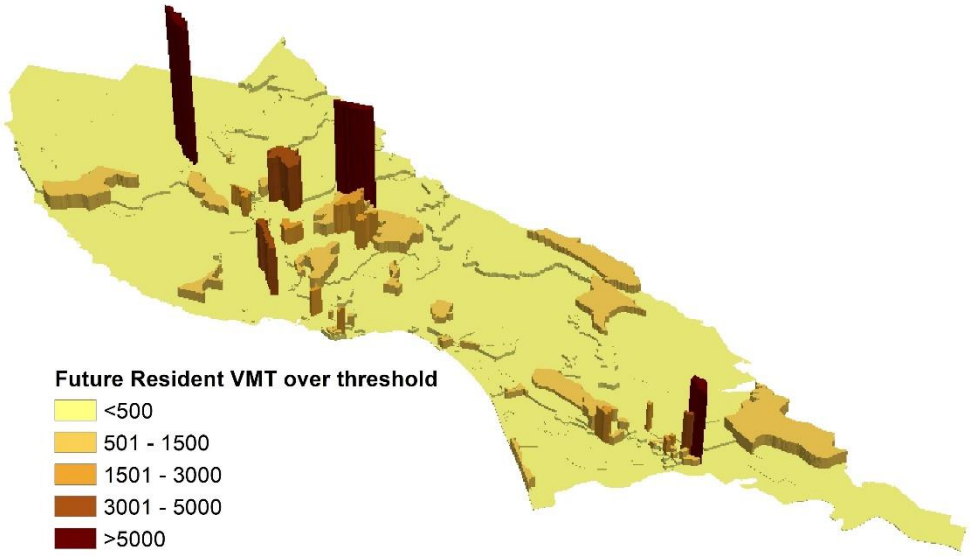
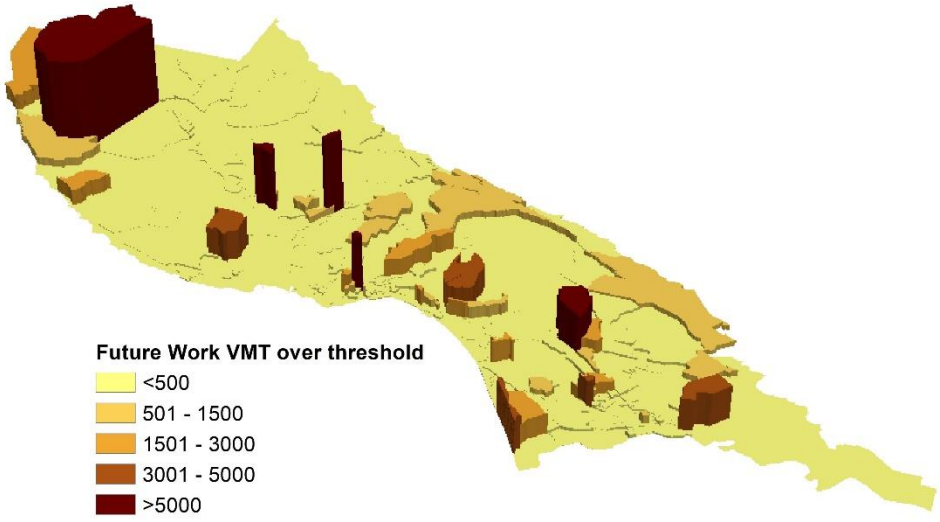


Exhibit 13 – Employment VMT Mitigation Need by TAZ



Identifying and Evaluating Candidate VMT-Reducing Projects

Along with evaluating the need and options for a fee-based VMT mitigation program, the study also analyzed the specific mitigation measures that could be offered. The initial phase involved the identification of project categories that would undergo review before individual projects were selected for evaluation. These project categories encompassed two overarching groups: transportation infrastructure projects and non-infrastructure projects. Further classification was applied to non-infrastructure projects, dividing them into land use and transportation demand management projects.

In 2023, possible candidate projects were solicited from study partner agencies. Example sources of projects include the Santa Cruz County Regional Transportation Commission's (SCCRTC's) Regional Transportation Plan, Active Transportation Plans produced by agencies throughout the region, the City of Watsonville VMT Mitigation Program, projects shared by Public Works departments, Santa Cruz Metro, the University of California-Santa Cruz, and affordable housing representatives.

Exhibit 14 below summarizes the project categories and provides project examples that are commonly considered in practice:

Exhibit 14 – VMT Mitigation Project Types

Example Projects		Comments
	Pedestrian	Adding sidewalks or filling in sidewalk gaps
	Bike	New lane miles of Class I - Class IV bike lanes, filling in gaps in bike infrastructre, or bike share
	Transit	New transit lines, extension of existing service, or adding new service types such as BRT
	Road Diet	Reducing capacity and providing non-auto infrastructure such as protected bike lanes or bus pull outs
	ITS/ TSM	Providing parking wayfinding, optimizing signal systems, providing trip planning services
	Mobility Hub	Provide infrastructure to link multiple types of transportation modes
	Affordable Housing	Providing affordable housing in dense areas, transit-oriented development, or other affordable housing supportive needs
	Vanpool/Carpool	Implement regionwide vanpool and carpool programs or expand existing programs
	Park-and-Ride	Construct park-and-ride lots to increase trip occupancy

Transportation Infrastructure Project Evaluation

Only projects meeting the criteria of "additionality" can be considered for inclusion within a fee-based VMT mitigation program. A methodology has been devised to further scrutinize and assess transportation projects eligible for potential implementation as VMT mitigation measures. A separate methodology has also been crafted for land use projects, which will be elaborated upon later in this report. Below is the methodology designed for candidate transportation projects:

- Step 1 – Screen for Candidate Mitigation Projects
- Step 2 – Evaluate Mitigation Project's Performance (project analysis)
- Step 2A – Set Project Benefit Area (buffer)
- Step 2B – Monetize Mitigation Project
- Step 3 – Implementation

To identify projects worthy of further evaluation, a screening process has been established for candidate mitigation projects. This process involves estimating the project cost and potential VMT reduced to determine whether it would exceed the established price per VMT of $1,000. Projects are also screened out if it is not feasible to construct it in the next 5 years. Once the project bucket is filtered down from the screening process, the following criteria are employed to select projects for further evaluation using the travel demand model, which determines their overall VMT reduction:

1. High non single occupancy or active transportation trip rate potential: improvements with higher usage (i.e., high bike ridership)
2. Located in a denser area: projects located in existing infill areas are favorable
3. Shorter trip lengths: shorter trips tend to favor active transportation and transit usage
4. Financial need: project has financial need sufficient to meet additionality requirements. Note that this can also be accomplished by advancing a project that would not otherwise be constructed in the next 5-10 years.
5. Project feasibility: other than financial needs, the project is likely to be constructed in the next 5-10 years.

Each project was organized with an ID, title, a description of the project, the estimated cost, and the project's total length in miles. The Replica big data platform was used to determine the average distance traveled for bicycle and pedestrian trips in the region. A target cost per VMT of $1,000 was established based on the result of the literature review and review of existing/proposed fee-based VMT mitigation programs. Note that the actual fee of a resultant program could be more or less, but that this value needs to be of sufficient order of magnitude to facilitate analysis. Using the Replica data for the average trip distance the number of trips needed to meet the target cost of $1,000 per VMT was calculated. These values were subsequently used to quickly sort the VMT-reducing potential of various projects both in terms of estimated usage and the cost/VMT so that projects could be screened for further analysis. **Exhibit 15** below provides an example of how the screening process was applied for bicycle projects.

Exhibit 15 – VMT-reducing Candidate Active Transportation Project Screening Example

PROJECT ID	PROJECT DESCRIPTION	EST TOTAL PROJECT COST	Project distance (miles)	Trips to Meet Target Cost/VMT	Trips/Mi to Meet Target Cost/VMT
1	Signage and striping	$62,000	0.83	27	33
2	Install Bike lanes	$88,000	0.83	38	46
3	Striping and signage	$56,000	1.51	24	16
4	BIKE LANE	$120,000	0.5	52	104
5	Signage and striping	$54,000	0.88	23	26
5	Install Bike lanes	$110,000	0.35	48	137
6	Convert from a 4 LU facility to 3 LD with bicycle facilities	$800,000	2.5	320	128
7	Modify from 4LU to 2L w/TWLTL AND Class IV Facilities	$1,000,000	4	400	100

Distance/Percent/Cost	Metric
2.3	County Bike Dist
0.46	County Ped Dist
2.5	City Bike Dist
0.42	City Ped Dist
67%	Bike Share
33%	Ped Share
$1,000	Target Cost/VMT

Shorter Trip Lengths

Project Location and Description

Financial Need

Higher Trip Rate

The screening process was completed for both active transportation projects and transit projects as these types of projects could be evaluated using the countywide travel demand model. In order to evaluate the effect that a particular project has on localized and regional VMT reductions, the baseline model run results were compared with the future build model run results to produce the VMT reduction associated with the VMT-reducing project.

The countywide travel demand model's most recent update for this program includes land use updates, calibration, and validation to represent the most recent travel patterns in the region. Documentation for the countywide travel demand model, including the recent update is provided as **Appendix B**.

VMT reductions due to small changes in the model network cannot be accurately captured by analyzing the change in regional VMT due to the size of the network and the inherency in the travel demand models. Therefore, as the model failed to reflect these nuances, projects were analyzed utilizing big data analytics platform called Replica to identify and analyze patterns of travel behavior and mobility trends at a granular level. Replica is a data analytics platform that provides detailed insights into the movement, behaviors, and patterns of people. It leverages aggregated and anonymized mobile location data to model the travel habits and demographics of populations. Replica uses synthetic data that is calibrated and validated using anonymized real-world data sources. This approach allowed for a more precise understanding of the impacts of smaller scale projects on regional VMT, ensuring that the smaller but significant changes in the transportation network were accounted for during project evaluation.

Bike Project Evaluation

The modeling approach to calculate VMT reductions typically involves a multi-step process that integrates various data inputs and modeling techniques. Here's an overview of the approach used in this study to analyze bicycle projects:

- Estimate future ridership based on National Cooperative Highway Research Program (NCHRP) 552[4] methodology

[4] NCHRP Report 552, produced under the auspices of the Transportation Research Board (TRB), offers a framework for evaluating bicycle infrastructure investments, guiding planners in assessing economic, social, and environmental impacts. It provides methods to quantify benefits like accessibility, reduced congestion, health,

    - Factor additional ridership using the Transit Cooperative Research Program (TCRP)[5] bus rapid transit (BRT) Practitioner's Guide 118 as needed.
- Use big data (Replica) to determine average trip distance along project alignment
    - To better isolate the effects of the project, the change in VMT was calculated for areas within 0.25, 0.5, and 1 mile of the project.
- Used big data to calibrate ridership levels using existing mode split and ridership along the project's alignment
    - Filter out trips not associated with replacing vehicle trips such as exercise trips.
- Multiply the factored ridership by average trip distance to determine total VMT reduction

Nineteen active transportation projects were evaluated to determine their feasibility for inclusion in a fee-based VMT mitigation program. **Table 4** below summarizes the change in VMT for the bicycle projects. Among the projects listed, the Soquel Drive Road Improvements project stands out as the most cost-effective, with a project cost of $410,000 and a cost per VMT reduced of $85/VMT, reducing a total of 4,833 VMT daily. The Soquel Avenue Corridor Widening (between Branciforte and Morrissey) also offers relatively low costs at $303 per VMT reduced with a project cost of $2,320,000, reducing a total of 7,653 VMT daily. Other notable projects in terms of lower cost per VMT include the Freedom Boulevard Multimodal Improvements (Bonita Drive to the City of Watsonville) with a cost per VMT of $585 and the 41st Avenue Improvements Phase 2 (Hwy 1 Interchange to Soquel Drive) with a cost per VMT of $531/VMT. In addition, the Bike Share Expansion project has a budget of $1,000,000 and aims to reduce 2,395 daily VMT, which results in a cost efficiency of $418 per VMT reduced. This project is specifically tailored for the Watsonville area, focusing on providing a realistic number of bikes for a bike-share program. In comparison, the Electric Bike Subsidies project, with the same budget of $1,000,000, is $150 per VMT reduced and is expected to reduce a total of 6,667 daily VMT. It is also notable that this project is designed to fund the expansion of the electric bike program.

Table 4 – Summary of Bike Project Evaluation

Project	Project Cost	Daily VMT Reduced	$/VMT
Soquel Dr Road Improvements	$410,000	4,833	$85
Soquel Dr Buffered Bike Lane and Congestion Mitigation Project	$27,000,000	12,548	$2,152
Monterey Bay Sanctuary Scenic Trail (MBSST) (Segments 5, 7-12, & 18)	79,100,000	23,756	$3,330
Soquel Ave Corridor Widening (Branciforte-Morrissey)	$2,320,000	7,653	$303
Main St/Beach St/Lake Ave Bike Facilities	$31,800,000	5,512	$5,769
Riverside (Hwy 129) Bike Facilities	$17,500,000	2,034	$8,605

and environmental gains, supporting informed decisions on bike facilities. The NCHRP itself is a program funded by member states of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA).

[5] TCRP Report 118, is managed by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine, serves as an essential manual for designing and implementing Bus Rapid Transit (BRT) systems. It provides comprehensive insights into planning, operating, and maintaining BRT services to improve urban mobility efficiently. The guide outlines best practices, operational strategies, and design principles to help practitioners develop high-quality BRT systems that are adaptable to different urban contexts.

Transit Project Evaluation

The modeling approach to calculate VMT reductions for transit was as follows:

- Used countywide travel demand model to determine ridership increases
- Factored additional ridership using BRT practitioners guide
- Determined average transit trip length using big data and countywide travel demand model
- Determined total VMT reduction by multiplying additional ridership by average trip length

Table 5 below summarizes the change in VMT for the transit projects. The Youth Ride Free Program emerged as the most cost-effective project with a low cost of $209 per daily VMT reduced, featuring a project cost of $740,950 and reducing 3,553 VMT daily. The Real-Time Travel Information initiative also presents a lower cost per VMT of $529, with a project cost of $1,600,000 and reducing 3,025 VMT daily. These projects are managed by METRO, with the Youth Ride Free Program allowing for free travel for youth, potentially increasing ridership and reducing the need for private vehicle trips. The Real-Time Travel Information project aims to provide signage at bus stops indicating next arrivals, which can enhance the usability of public transport.

In contrast, the Capitola Mall Transit Center project is significantly less cost-effective, with a high cost per VMT of $392,753, due to only a slight reduction in daily VMT of 64 despite and a project cost of $25,000,000. This project involves changes to move the transit center from the mall to the streetside for faster service.

The other projects, including the Intercity Transit Expansion and the University of California, Santa Cruz (UCSC) Terminal, have higher costs per VMT of $9,416 and $3,255, respectively. The Intercity Transit Expansion is aimed at expanding service on Highway 1 and Highway 17 to a 15-minute peak, while the UCSC Terminal project would create a lay-over location at UCSC to restructure service routes and expand service beyond the downtown loop. The Rapid Bus Enhancements project falls in the mid-range in terms of cost-effectiveness with a cost of $3,112 per VMT, aimed at providing passenger boarding islands and other improvements for rapid bus service on selected corridors.

Overall, the Youth Ride Free Program and Real-Time Travel Information offer more cost-effective solutions for reducing VMT and enhancing public transport usage, suggesting that they may provide better value for the investment in terms of daily VMT reduction.

Table 5 – Summary of Transit Project Evaluation

Project	Project Cost	Daily VMT Reduced	$/VMT
Intercity Transit Expansion	$31,800,000	3,377	$9,416
Rapid Bus Enhancements	$7,875,000	2,531	$3,112
Youth Ride Free Program	$740,950	3,553	$209
Capitola Mall Transit Center	$25,000,000	64	$392,753
Real-Time Travel Information	$1,600,000	3,025	$529
UCSC Terminal	$5,000,000	1,536	$3,255
Intercity Transit Expansion	$31,800,000	3,377	$9,416

Non-Infrastructure Projects

The following methodology was developed for candidate land use projects:

- Step 1 – Screen for Candidate Mitigation Projects
- Step 2 – Evaluate Mitigation Project's Performance
- Step 2A – Monetize Mitigation Project (Optional)
- Step 3 – Implementation

A screening process was also developed for candidate land use mitigation projects based on several criteria including the socioeconomic details of an area, the existing VMT efficiency of an area, the availability of mobility options apart from vehicular travel, and the feasibility of constructing the project. The screening considerations used to develop the screening criteria are listed below:

1. Socioeconomic criteria – Low income correlates to low vehicular trip generation (i.e., affordable housing)
2. Low trip rate – Land uses with abnormally low trip generation (i.e., transit oriented development)
3. Located in a low VMT area – Existing land uses patterns in proximity are favorable to reducing trips.
4. Availability of alternate transportation options – Transportation options can lead to lower vehicular use.
5. Financial need – Project has financial need sufficient to meet ***additionality*** requirements.
6. Project feasibility – Other than financial need, it is likely to be constructed.

To evaluate affordable housing projects, the project team identified three affordable housing projects currently proposed and or previously constructed in the Santa Cruz region with cost data. The first project is an 88 unit affordable housing project in an unincorporated area just north of Watsonville. Second project is another affordable housing project with 72 units located at Miles Ln and Kimberly Ln in Watsonville. Third project located near the second the project on Freedom Blvd has 53 units.

For evaluation purposes, it was assumed that the average occupancy rate for Santa Cruz County would apply to this project, which is currently at 3.1 people per household. As summarized in

Table 6 below, based on the location of the project, project VMT per capita are compared to Santa Cruz County's regional threshold of 13.6 VMT per capita. When multiplied by the total population identified previously, it resulted in overall VMT reductions summarized in

Table 6 below. Focusing on the low cost per VMT, the Affordable Housing project in unincorporated area, referred to as Project 1, is the most cost-effective with a project cost of $34,800,000 and a daily VMT reduction of 1,869, resulting in a cost of $20,634 per VMT. This potential project is located on Freedom Blvd.

In comparison, the Affordable Housing, referred to as Project 2in Watsonville is the least cost-effective, with a high cost per VMT of $47,981 and a project cost of $54,000,000; it achieves a relatively low daily VMT reduction of 1,125. Project 3, another potential Watsonville affordable housing project in Watsonville, also has a cost per VMT of $35,676 with the same project cost of $43,000,000 but a lower daily VMT reduction of 1,205. The variation and the range in the daily VMT, and the cost per VMT depend on various factors, such as location of the project, total units, the VMT threshold.

Table 6 – Summary of Affordable Housing Project Evaluation

Project	Project Cost	Daily VMT Reduced	$/VMT
Affordable Housing – Unincorporated area– Project 1	$34,800,000	1,869	$18,623
Affordable Housing – Watsonville– Project 2	$54,000,000	1,125	$47,981
Affordable Housing – Watsonville– Project 3	$43,000,000	1,205	$35,676

Mobility Hub Projects

For the mobility hub projects, the following modeling approach was used:

- Used countywide travel demand model and BRT practitioners guide to estimate additional transit ridership
- Used NCHRP 552 to estimate additional bike ridership and pedestrian trips
- Used big data to estimate average trip length for bikes, transit and pedestrian
- Multiplied average trip distance by additional ridership/bike trips/pedestrian trips to determine total VMT reduction

The **Table 7 –** Summary of Mobility Hubs Project Evaluationdetails two multi-modal hub projects with different cost efficiencies. The Delaware Multi-Modal Hub, which is a part of the UCSC and located on the westside of Santa Cruz, has a significantly lower cost per VMT of $204. It costs $580,000 and reduces daily VMT by 2,843. This hub includes bus, bicycle, kiss & ride facilities, and housing units, with connections to the rail trail, but it does not include affordable housing.

On the other hand, the Watsonville Multi-Modal Hub is a more costly project at $55,230,000, reducing daily VMT by 7,313, which results in a higher cost per VMT of $7,552. This hub is situated in downtown

Watsonville and includes similar multi-modal facilities: bus, bicycle, kiss & ride, and also adds 60 affordable housing units, with rail trail connections.

Table 7 – Summary of Mobility Hubs Project Evaluation

Project	Project Cost	Daily VMT Reduced	$/VMT
Watsonville Multi-Modal Hub	$55,230,000	7,313	$7,552
Delaware Multi-Modal Hub	$580,000	2,843	$204

Transportation Demand Management (TDM) Projects

The Federal Highway Administration (FHWA) traditionally defines TDM as commuter ridesharing and its plannings applications restricted to air quality mitigation, reducing trip generation, and efforts to increase multi-modal travel[6]. In that context, when defining TDM projects for the region's VMT Mitigation Program, projects that focused on reducing car trips in the region either by increasing occupancy (carpools and vanpools) or incentivizing individual trip reduction (school bussing and commuter programs) were included. Other types of projects that may commonly be referred to as TDM projects for VMT mitigation prior to the advent of VMT Mitigation Programs were not defined as TDM projects for the purposes of the region's program as they could be difficult to address or quantify. For instance, spot amenities cannot be tracked, education programs are difficult to make an additionality argument for since it is a program expansion. Telework is also a measure that traditionally is defined as a TDM measure but was not included in the region's Program as it requires individual employers to separately implement the program on-site.

Therefore, for the region's Program several types of projects were evaluated under the TDM umbrella. For instance, a vanpool is a group of up to 15 people who lease a van for the purpose of commuting to and from work together and live at least 20 miles from their workplace. A carpool is a system administered and funded solely or in combination with an employer and/or a public agency that matches employees living in close proximity or along a similar commute route to ride together to and from their workplace. A school bussing program provides fixed school bus routes and stops to take children to and from school in school buses. Finally, a commuter program that involves incentives for commuters to rethink their ride and choose a different mode such as walk, bike, carpool or ride bus to work .

An evaluation of three types of TDM projects (**Table 8 –** Summary of TDM Project Evaluation) was undertaken to determine their feasibility for being included in a future fee-based VMT Mitigation Program.

Vanpool

An exercise was undertaken to determine the unit cost per VMT reduced if a vanpool program was implemented within the region based on previous vanpools operated by CalVans within the region.

Using the information provided by CalVans for vanpools that operated within Santa Cruz County, the following evaluation was undertaken:

- Average number of riders (excluding driver): 9.4

[6] Transportation Demand Management, U.S. Department of Transportation, Federal Highway Administration, https://ops.fhwa.dot.gov/plan4ops/trans_demand.htm, accessed on 3/20/2024.

- Monthly VMT reduced: 10,190 VMT reduced
- Monthly VMT reduced per person: 10,190 /9.4 passengers = 1,084 VMT reduced per person
    - This assumes that all vanpool participants would have driven separately absent the vanpool, but the driver of the vanpool's VMT remains the same
- Number of workdays per month: 21
- Total daily VMT reduced: 10,190 / 21 = 485 VMT per day reduced
- Monthly cost to operate vanpool: $1,202
- Total cost for a 20-year lifespan (design life of comparable infrastructure projects): $288,480
- Total cost per VMT reduced: $594.5

School Buses

The primary evaluation tool for this project was the countywide travel demand model, supplemented with research[7] on costs and participation on bussing programs throughout California. This evaluation assumes a 50% participation rate of students in the bussing program and average cost per student to operate the program is $530. The remainder of the variables were obtained from the countywide travel demand model.

Using the information provided by the countywide travel demand model and the research on bussing programs throughout California, the following evaluation was undertaken with a reference provided for each assumption:

- Number of students within the region: 11,726 (countywide travel demand model)
- Total number of shared-ride trips to a K12 school within the region: 13,800 (countywide travel demand model)
- Total daily VMT for shared-ride trips to a K12 school within the region: 66,767 VMT
- Percent of students who would take a school bus: 50% (California statewide research)
- Total daily VMT reduced when implementing a school bussing program: 66,767 VMT * 50% = 33,383 VMT
- Average cost per rider: $530 (California statewide research)
- Average annual cost for school bussing program: $530/student * 11,726 students = $3,107,390
- Total cost for a 20-year lifespan: $3,107,390 * 20 years = $62,147,800
- Total cost per VMT reduced: $1,862

Table 8 – Summary of TDM Project Evaluation

Project	Project Cost	Daily VMT Reduced	$/VMT
Vanpool (Cal-Vans)	$288,480	485	$595
School Buses	$62,147,800	33,383	$1,862
Cruz511 Expansion	$7,874,000	2,232	$3,528

[7] *Review of School Transportation in California*. State of California Legislative Analyst's Office. February 25, 2014. https://lao.ca.gov/reports/2014/education/school-transportation/school-transportation-022514.aspx. Accessed on 8/22/2023.

Cruz511 Expansion

An exercise was undertaken to determine the unit cost per VMT reduced if a commuter program was implemented within the region. This program would involve incentives for commuters to rethink their ride and choose a different mode such as walk, bike, carpool or ride bus to work. The following evaluation was undertaken with a reference provided for each assumption:

- Trip Type: Home-Based Work
- Trip Period: 5:00 AM – 10:00 AM
- Primary Mode: Private Auto, Single Occupant
- Total Trips: 33,350
- Median Trip Distance: 5.4
- %Employees Eligible: 20
- %Max VMT Reduction: 6.2
- Total daily VMT reduced: 2,232
- Total cost for a 20-year lifespan: $7,874,000
- Total cost per VMT reduced: $3,528

Additionality

Caltrans defines additionality as "a critical step in asserting such mitigation is to assure that the investment provides additional resources that otherwise would not have been provided or providing the additional resources substantially earlier than they otherwise would have been available." Put simply, additionality means that a mitigation can only be claimed by one person or project to avoid the benefits of a mitigation being claimed by multiple future projects.

The concept of proportionality traditionally implies that mitigation efforts should correspond to the level of investment. For instance, if a bike lane project leads to a 100 VMT reduction but is financed by various sources, with a fee-based VMT mitigation program covering 40-percent of the cost, then the bank can only claim a 40 VMT reduction.

This principle is particularly relevant for including affordable housing in a fee-based VMT mitigation program. The Caltrans SB 743 Program Mitigation Playbook notes that dense, affordable housing can reduce VMT more than lower-density housing. If a project funds half the cost of an affordable housing development that cuts VMT by 10,000 miles per day, it could claim a 5,000 mile per day reduction. However, this raises challenges since affordable housing is complex to build and often requires multiple funding sources. Strict adherence to proportionality, as defined by Caltrans, could make the unit cost per VMT too high for inclusion in a fee-based program.

Caltrans has recently [8]reconsidered this interpretation of proportionality, suggesting that a project does not need to be the sole funder to claim the full mitigation credit. This applies to models like in-lieu fee payments or mitigation programs where the sponsor transacts with another party for mitigation. As long as the mitigation is enforceable, feasible, not deferred, and mechanisms are in place to avoid double counting, a sponsor can claim full mitigation credit. This means a transportation project could claim full credit for a housing development's mitigation if it is shown that the development depended on its contribution, likely enforced through a funding agreement. This interpretation allows Santa Cruz County

[8]Caltrans, Housing and VMT Mitigation https://dot.ca.gov/programs/esta/sb-743/resources/housing, accessed on 3/6/2024

to calculate the unit cost per VMT for VMT-reducing projects using three methods: proportionality, remaining cost, and fixed cost. The proportionality method reflects Caltrans' original approach, assigning credit proportional to funding, and the unit cost is calculated by dividing the total cost of the project by the proportional VMT credit. Remaining cost, Caltrans' updated approach, allows for claiming full credit for VMT reduction assuming no other claims. The unit cost is calculated by dividing the proportional cost by the full VMT credit. Fixed cost, a method developed by this study's team, sets a standard unit cost per VMT for all VMT-reducing projects, with the program's contribution calculated by multiplying this cost by the total VMT reduction. If this funding doesn't fully cover the project, additional funding must be secured. This approach enables the inclusion of a wide array of VMT-reducing projects in the program but could pose difficulties in justifying the pre-set unit VMT cost and in securing extra funding to fill any financial shortfall if the program does not fully fund the project.

Exhibit 16 provides a visual representation of how either the unit cost per VMT or the amount of funding provided by the fee-based VMT mitigation program is calculated using each methodology.

Exhibit 16 – Calculating Cost per VMT Reduced

Method	VMT Bank Payment	Other Funding Sources	Total Project Cost	Bank VMT Mitigation	Price per VMT
Proportionality	$500,000	$1,000,000	$1,500,000	83	$6,000
Remaining Cost	$500,000	$1,000,000	$1,500,000	250	$2,000
Fixed Cost	$250,000	$1,250,000	$1,500,000	250	$1,000

Exhibit 17 below provides an example of how much funding would be provided by the fee-based VMT mitigation program for four different VMT-reducing project types, the unit cost per VMT for each of the projects, and the overall unit price per VMT sold to project applicants looking to purchase VMT to mitigate their project's VMT impact, based on the additionality method chosen. **Exhibit 17** assumes that all four project types provide an identical amount of VMT reduction (250 VMT) and that costs range from $250,000 to $1.5 million. As shown in **Exhibit 17**, the proportionality method results in the highest unit price per VMT for each project type both individually and collectively and the fixed cost method results in the lowest unit price per VMT for each project type both individually and collectively. The fixed cost method also provides the least amount of funding and for all project types except the bicycle/pedestrian

project and the projects would require more than 50-percent of funding to be identified elsewhere to fully fund the VMT-reducing project.

Exhibit 17 – Cost per VMT Reduced by Project Type and Additionality Method

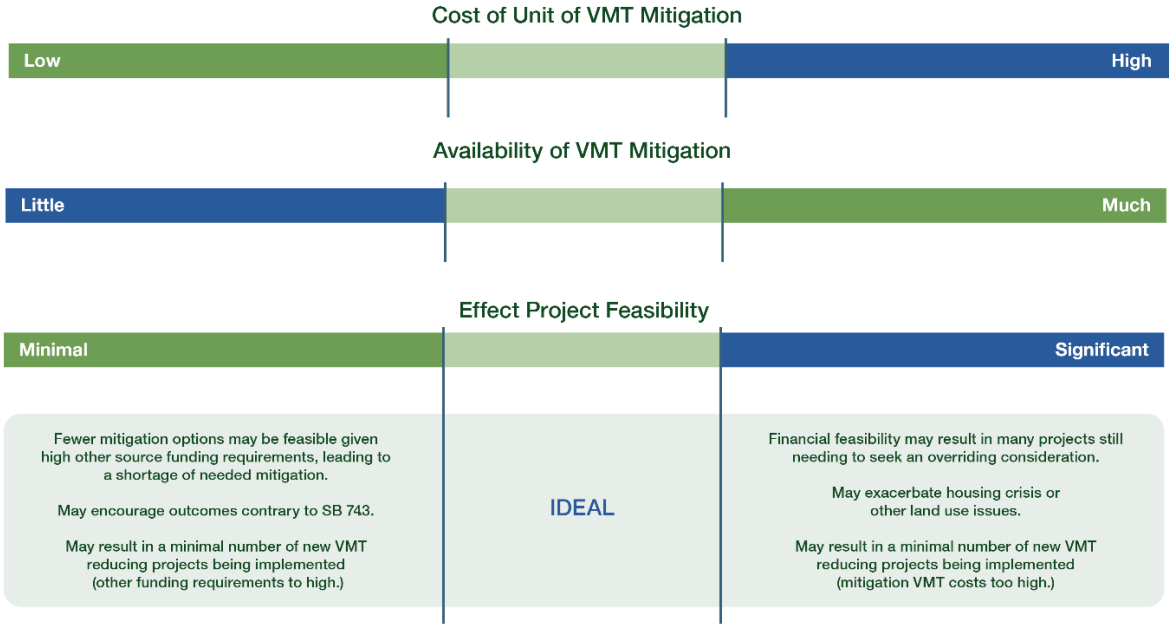
		Mitigation Source	Fees/Unit	Effective Project Funding	Cost/VMT	VMT Bank Cost
Proportionality		Affordable Housing	250 VMT	Fee	$3,750	$2,250
		Transit	250 VMT	Fee	$2,250	
		Bike/Ped	250 VMT	Fee	$750	
		Technology	250 VMT	Fee	$2,250	
Remaining Cost		Affordable Housing	250 VMT	Fee / Non-Funding Source	$1,500	$1,500
		Transit	250 VMT	Fee	$2,250	
		Bike/Ped	250 VMT	Fee	$750	
		Technology	250 VMT	Fee / Non-Funding Source	$1,500	
Fixed Price		Affordable Housing	250 VMT	Fee / Non-Funding Source	$750	$750
		Transit	250 VMT	Fee / Non-Funding Source	$750	
		Bike/Ped	250 VMT	Fee	$750	
		Technology	250 VMT	Fee / Non-Funding Source	$750	

Other factors

When setting up a fee-based VMT mitigation program, in addition to considering the additionality method to use, several additional factors should be also taken into consideration. These factors include the overall unit cost per VMT reduced, the availability of VMT mitigation, and the effect of project feasibility. Consideration of the effect each factor will have on the overall success of the fee-based VMT mitigation program needs to be balanced as each factor can come into conflict with one another.

Exhibit 18 below provides a summary of the balance needed between the three factors needed for a successful fee-based VMT mitigation program.

Exhibit 18 – Balance of Factors Needed for Successful Fee-based VMT Mitigation Program



As shown in **Exhibit 18**, an ideal fee-based VMT mitigation program can balance cost, availability, and the program's effect on project feasibility of VMT-reducing projects. Additional considerations include:

- Fewer mitigation options may be feasible given high funding requirements from other sources, which leads to a shortage of needed mitigation
- Low, little, and minimal effect on cost, availability, and feasibility may encourage outcomes contrary to SB 743
- Low, little, and minimal effect on cost, availability, and feasibility may result in a minimal number of new VMT-reducing projects being implemented due to the need for high funding requirements from other sources
- High, much, and significant effect on cost, availability, and feasibility may result in many development projects still needing to seek a finding of overriding considerations
- High, much, and significant effect on cost, availability, and feasibility may exacerbate the need for housing or other land use issues
- High, much, and significant effect on cost, availability, and feasibility may result in a minimal number of new VMT-reducing projects being implemented

Amount of Funding to Achieve $1,000/VMT Framework Cost

Based on the project evaluations summarized above, and on research completed during the literature review, it was determined that a unit cost of $1,000 per VMT mitigated is a reasonable target that the market can bear. $1,000 per VMT would provide necessary funding to the projects contained within a fee-based mitigation program and would not be so high as to discourage participation in the fee-based mitigation program by project applicants. Therefore, an exercise was undertaken to determine how much external funding would need to be secured to include each of the active transportation, transit, and TDM projects evaluated and summarized above in Santa Cruz County's Fee-based VMT Mitigation Program.

Bicycle Projects:

- Bike Share Expansion and Electric Bike Subsidies are highly cost-effective, with no additional funding needed as they were calculated to be funded at a unit cost well below the $1,000 per VMT target.
- Other projects, such as the Soquel Drive Road Improvements project, also perform exceptionally well, with costs per VMT of $85, needing no additional funding
- Projects such as the Monterey Bay Sanctuary Scenic Trail segments and Soquel Drive Buffered Bike Lane have significant daily VMT reductions but also considerably higher costs, leading to considerable funding needs of $55,344,210 and $14,451,539, respectively.
- Projects such as the Hwy 9 – Downtown Felton Bike Lanes & Sidewalks and Freedom Boulevard (Green Valley Road to Airport Boulevard) exceed the target cost per VMT but have relatively smaller funding needs compared to large-scale projects.

Non-Infrastructure Projects:

- Affordable Housing projects, particularly in the unincorporated parts of the county, have high costs per VMT, far exceeding the $1,000 target, resulting in substantial funding needs of up to $52,874,545.

Mobility Hub Projects:

- The Watsonville Multi-Modal Hub exceeds the cost per VMT target, with funding needs of $47,916,950.
- The Delaware Multi-Modal Hub is well within the target cost per VMT of $1,000, requiring no additional funding.

Transit Projects:

- Intercity Transit Expansion and Capitola Mall TC have costs per VMT much higher than the target, indicating a significant need for funding of $28,422,841 and $24,936,347, respectively.
- Ride Free Programs and Real-Time Travel Information have costs per VMT below the target and do not require additional funding.

TDM Projects:

- School Buses show a moderate cost per VMT of $1,862 but require a large funding need of $28,764,800 due to the overall project size.
- The Cruz511 Expansion exceeds the cost per VMT target, with funding needs of $5,642,000.

In summary, while several projects are efficient with costs per VMT below the $1,000 target and require no additional funding, others, particularly large-scale land use and transit projects, will need substantial financial support to meet the target cost per VMT reduced of $1,000 per VMT reduced.

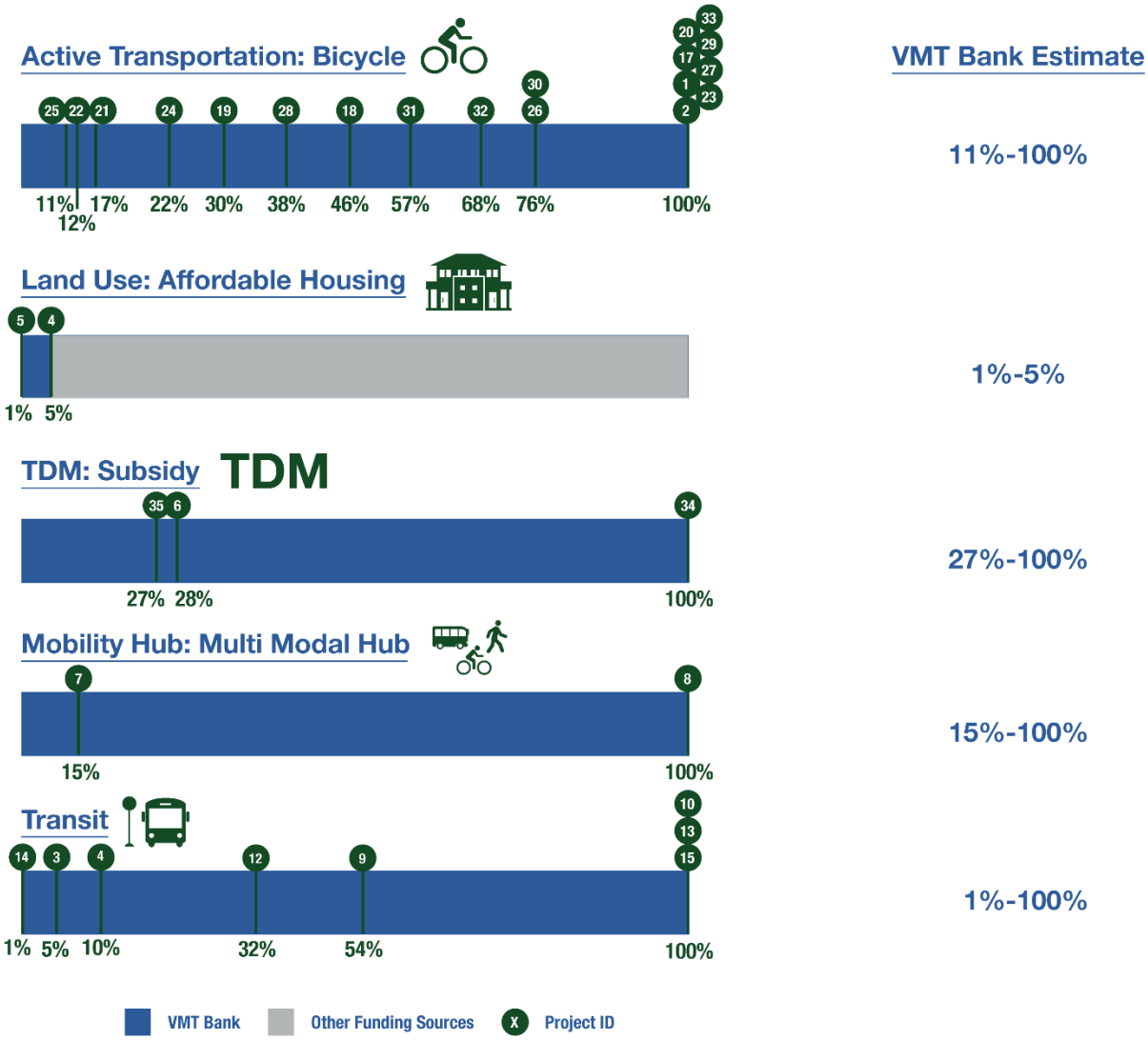
Table 9 – VMT-reducing Project Evaluation Summarybelow provides a summary of all projects analyzed in terms of their cost, VMT reduced, and price per VMT produced. As shown in **Table 9** – VMT-reducing Project Evaluation Summary, all thirty-three projects analyzed resulted in VMT reductions, with the daily VMT reduced ranging between 64 VMT (Capitola Mall Transit Center) and 33,383 VMT (School Bussing Program). The cost per VMT reduced ranged between $85 (Soquel Drive Road Improvements) and $392,753 (Capitola Mall Transit Center). The final test undertaken was a determination of what percentage of the total cost would be covered if the cost per VMT was fixed at $1,000/VMT reduced. As

shown in **Exhibit 19**, a cost of $1,000 per VMT reduced would cover between 1% and 100% of the project costs. Note that this considers the total cost of all projects, including the affordable housing projects, without additional other funding.

Table 9 – VMT-reducing Project Evaluation Summary

Project Type	Project	Project Cost	Daily VMT Reduced	Cost per VMT	Funding need
Bicycle	Bike Share Expansion	$1,000,000	2,395	$418	$-
Bicycle	Electric Bike Subsidies	$1,000,000	6,667	$150	$-
Non-Infrastructure	Affordable Housing – Unincorporated area– Project 1	$34,800,000	1,869	$18,620	$32,931,000
Non-Infrastructure	Affordable Housing – Watsonville– Project 2	$54,000,000	1,125	$47,981	$52,874,545
Non-Infrastructure	Affordable Housing – Watsonville– Project 3	$43,000,000	1,205	$35,676	$41,794,720
TDM	Cruz511 Expansion	$7,874,000	2,232	$3,528	$5,642,000
Mobility Hub	Watsonville Multi-Modal Hub	$55,230,000	7,313	$7,552	$47,916,950
Mobility Hub	Delaware Multi-Modal Hub	$580,000	2,843	$204	$-
TDM	School Buses	$62,147,800	33,383	$1,862	$28,764,800
TDM	Cal-Vans	$288,480	485	$595	$-
Transit	Intercity Transit Expansion	$31,800,000	3,377	$9,416	$28,422,841
Transit	Rapid Bus Enhancements	$7,875,000	2,531	$3,112	$5,344,080
Transit	Ride Free Programs	$740,950	3,553	$209	$-
Transit	Capitola Mall TC	$25,000,000	64	$392,753	$24,936,347
Transit	Real-Time Travel Information	$1,600,000	3,025	$529	$-
Transit	UCSC Terminal	$5,000,000	1,536	$3,255	$3,464,000
Bicycle	Soquel Dr Road Improvements	$410,000	4,833	$85	$-
Bicycle	Soquel Dr Buffered Bike Lane and Congestion Mitigation Project	$27,000,000	12,548	$2,152	$14,451,539
Bicycle	MBSST (Segments 5, 7-12, & 18)	$79,100,000	23,756	$3,330	$55,344,210
Bicycle	Soquel Ave Corridor Widening (Branciforte-Morrissey)	$2,320,000	7,653	$303	$-
Bicycle	Main St/Beach St/Lake Ave Bike Facilities	$31,800,000	5,512	$5,769	$26,287,746
Bicycle	Riverside (Hwy 129) Bike Facilities	$17,500,000	2,034	$8,605	$15,466,390
Bicycle	Airport Blvd Modifications (Hanger Way to Ross Ave)	$750,000	777	$965	$-
Bicycle	Hwy 9 - Downtown Felton Bike Lanes & Sidewalks (San Lorenzo Valley Trail)	$3,500,000	777	$4,506	$2,723,189
Bicycle	Hwy 9 - North Felton Bike Lanes & Sidewalks (San Lorenzo Valley Trail)	$10,000,000	1,125	$8,891	$8,875,309
Bicycle	East Cliff Drive Improvements (32nd Ave to Harbor)	$4,750,000	3,595	$1,321	$1,154,789
Bicycle	Freedom Blvd Multimodal Improvements (Bonita Dr to City of Watsonville)	$3,100,000	5,297	$585	$-
Bicycle	Graham Hill Road Multimodal Improvements (City of SC to Hwy 9)	$7,020,000	2,695	$2,605	$4,324,667
Bicycle	41st Ave Improvements Phase 2 (Hwy 1 Interchange to Soquel Dr)	$1,240,000	2,335	$531	$-
Bicycle	Airport Blvd Improvements (Freedom Blvd to Green Valley Rd)	$1,240,000	946	$1,311	$294,495
Bicycle	Freedom Blvd (Green Valley Rd to Airport Blvd)	$3,300,000	1,869	$1,766	$1,431,407
Bicycle	Freedom Blvd (Airport Blvd to Buena Vista Dr)	$3,000,000	2,035	$1,474	$964,925
Bicycle	Main St Modifications (Pajaro River Bridge to Lake Ave)	$2,100,000	3,139	$669	$-

Exhibit 19 – VMT-Reducing Project by Revenue Percentage of Total Cost based on $1,000/VMT Reduced

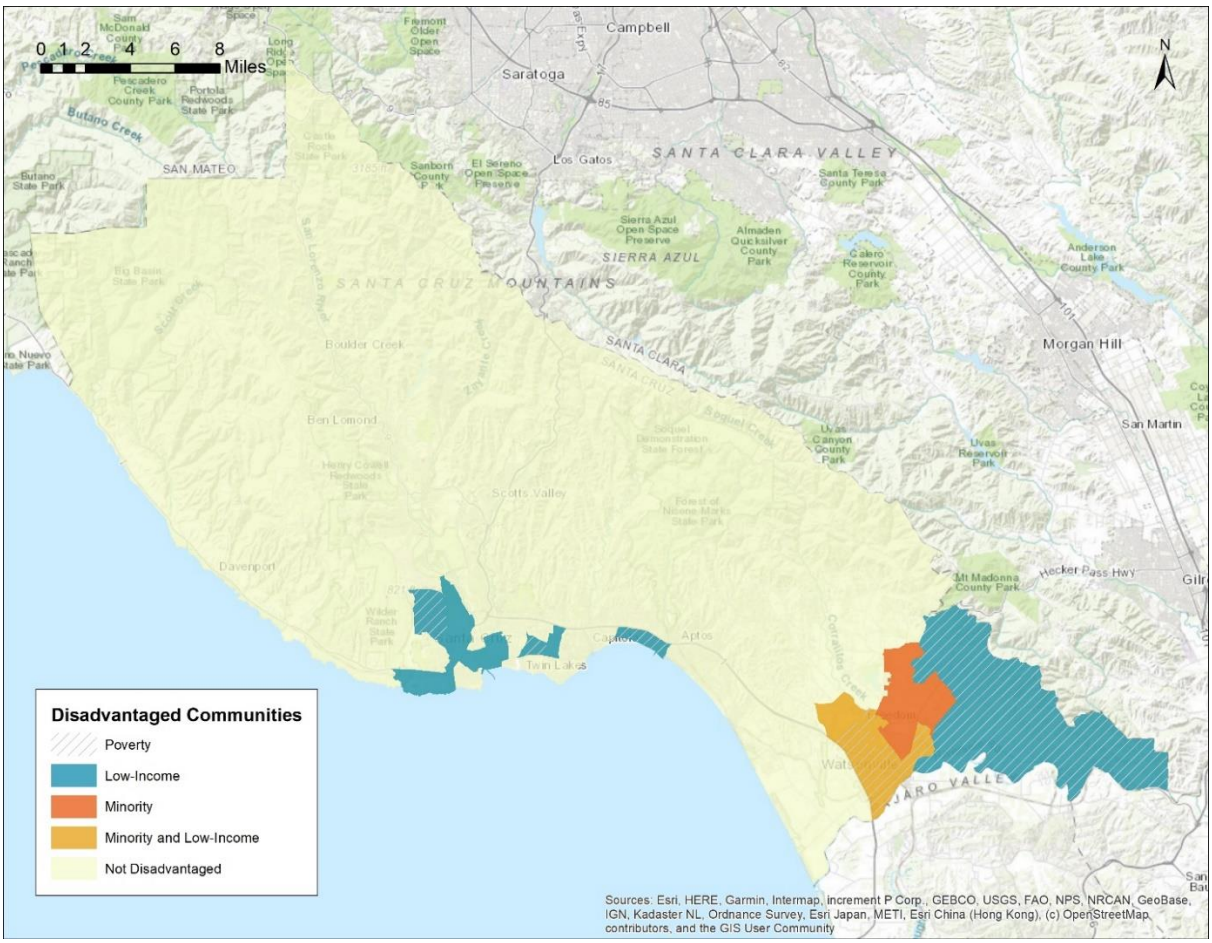


Equity Analysis

In order to determine whether the fee-based VMT mitigation program would be equitable, an environmental justice analysis was completed to determine whether the impact of new development and the mitigation projects to reduce the VMT from new development would occur equitably across the region. Specifically, the analysis was used to determine whether VMT impacts would be concentrated in low-income and disadvantaged communities while the mitigation would occur outside of these communities.

Exhibit 20 below identifies the areas in Santa Cruz County that are low-income communities (yellow), low-income and disadvantaged communities (red), or neither (green). Understanding that VMT mitigation would be concentrated in areas where they would be most effective, i.e., areas with the densest population, **Exhibit 20** shows that the majority of VMT mitigation projects would occur in environmental justice communities (non-green areas).

Exhibit 20 – Santa Cruz County Environmental Justice Communities



The categorization shown above was combined with an analysis completed to determine the future need for VMT mitigation for both residential and employment uses, as shown in **Exhibit 21** and **Exhibit 22**. The green areas in **Exhibit 21** and **Exhibit 22** are non-environmental justice communities while the others are low income, low income or disadvantaged. The height of the area indicates the amount of VMT that may be needed in the future based on how closely the area is to the region's VMT threshold multiplied by the total residential (dwelling unit) or employment (jobs) growth.

Exhibit 21 and **Exhibit 23** show that VMT is spread relatively consistently throughout the region and therefore the implementation of a fee-based VMT mitigation program can be considered equitable as VMT impacts would not be concentrated in environmental justice communities and VMT mitigation would not be concentrated in non-environmental justice communities.

Exhibit 21 – 20-year Vehicle Miles Traveled Mitigation Need (Residential)

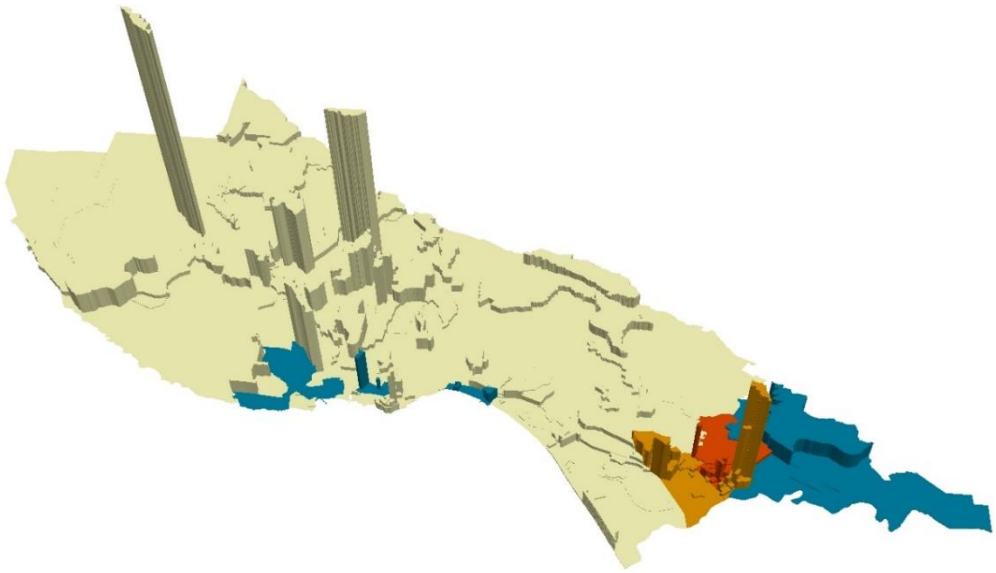
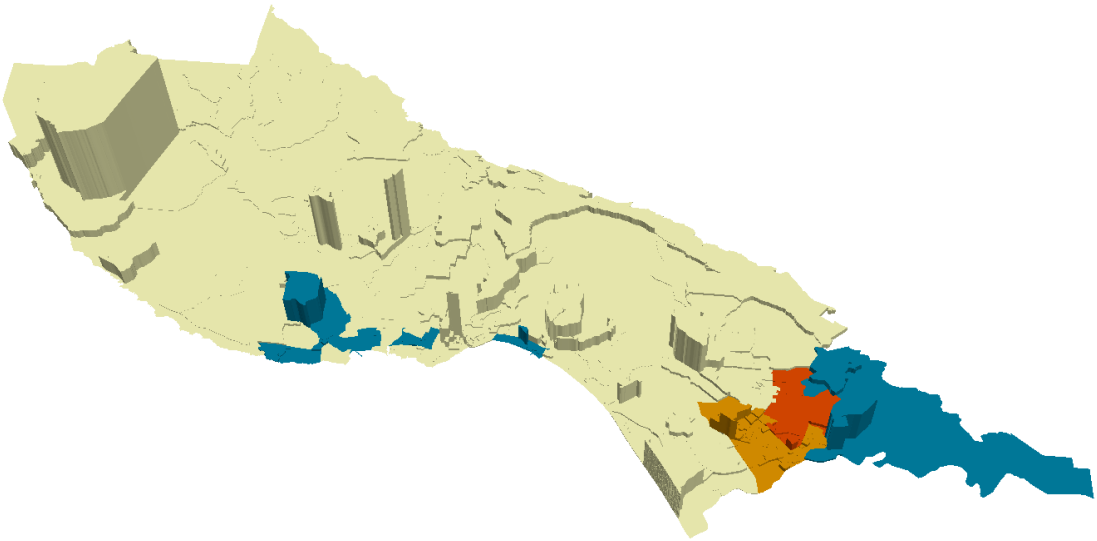


Exhibit 22 – 20-year Vehicle Miles Traveled Mitigation Need (Employment)



VMT Mitigation Need

The VMT mitigation need over the model horizon (2019 – 2045) is summarized in **Table 10** – VMT Mitigation Need by Environmental Justice Community below by environmental justice community to provide a numeric summary of what is displayed in **Exhibit 21** and **Exhibit 22**. VMT mitigation is often more effective for non-residential uses and when there is a high mix of residential and employment uses. Table 10 shows the total VMT needing mitigation between 2019 and 2045, aggregating to 119,005 VMT for residential and 126,928 VMT for employment across all community types. Environmental Justice VMT to Mitigate constitutes almost 20-30% of the total VMT mitigation need for both residential and employment categories. Regions in poverty constitutes around 20% of the total VMT mitigation need for both categories. This comprehensive data underscores the varying needs for VMT mitigation across different community types, with environmental justice communities, especially those that are both low income and disadvantaged, requiring significantly more effort in reducing vehicular travel compared to their non-environmental justice counterparts.

Table 10 – VMT Mitigation Need by Environmental Justice Community

Community Type	Future Vehicle Miles Traveled (VMT) to Mitigate	
	Residential	Employment
Poverty	*27,720*	*20,335*
Low income	5,528	11,999
Minority	10,331	2,162
Minority and Low Income	25,317	10,893
Total EJ VMT (2019-2045)	**41,176**	**25,054**
Non-Environmental Justice	77,829	101,874
Total VMT (2019-2045)	**119,005**	**126,928**

Program Evaluation

Once the candidate projects were evaluated, the framework options for a fee-based VMT mitigation program were revisited. Specifically, based on feedback received from the Stakeholder Advisory Committee (SAC), additional framework options were developed that combined portions of a VMT bank and VMT exchange into a new option. Details of the five framework options are summarized in **Exhibit 23** below and the options include:

1. VMT Bank
2. VMT Exchange
3. VMT Bank with Exchange (newly developed)
4. VMT Impact Fee

The mitigation program options were subsequently evaluated in terms of their potential to meet the identified needs of the region. The following are considerations and questions that guided the evaluation of the feasibility of the VMT mitigation program options:

Legal
Does the fee-based VMT mitigation program meet CEQA and statutory requirements, including additionality?

Effective
Does the fee-based VMT mitigation program result in a long-term financially feasible mitigation program?

Geography
Can the fee-based VMT mitigation program scale to meet the region's needs?

Administration
Does the fee-based VMT mitigation program fund oversight and management of the program and maintain analysis and technical requirements for administering the program?

Equitable
Does the fee-based VMT mitigation program avoid disproportionate impacts to disadvantaged and/or low-income communities? Does the program encourage an equitable benefit distribution throughout the region?

Alignment
Does the fee-based VMT mitigation program support good design of projects and align with community values and existing plans?

Exhibit 23 – Fee-Based VMT Mitigation Program Framework Variations

	VMT Bank	VMT Exchange	VMT Bank with Exchange	VMT Impact Fee
Predefined Projects	YES	NO	YES/NO	YES
Applicant Can Select a Predefined Project	NO	NO	YES	NO
Applicant Can Provide a Project Option	NO	YES	YES	NO
Option to have Regional/Local Distribution	YES	NO	YES	YES
Additionality Options	YES	YES	YES	YES
Non-Fee Funding Excluded	YES	YES	YES	YES
Voluntary Non-Fee Funding	YES	YES	YES	YES
Required Non-Fee Funding	YES	NO	YES/NO	YES/NO
Complexity to Administer	MEDIUM	HIGH	HIGH	LOW
Potential Cost Per Unit of VMT Mitigation	LOW	MEDIUM	MEDIUM	HIGH
Supportive of All SB 743 Goals	YES	YES	YES	YES/NO

Program Recommendation

Exhibit 24 below provides a summary of how each type of VMT mitigation program was evaluated against the above considerations. Yellow dots indicate a "concern" that the complexity of a specific program element or the lack of practical experience with it may represent a challenge to its implementation. As it is believed that all the program types are ultimately implementable, these designations should simply be thought of as areas of consideration that will require additional evaluation prior to their respective programs being considered for implementation. As shown in the exhibit below**Exhibit 24**, only the VMT bank framework would address all considerations identified.

Exhibit 24 – Regional VMT Mitigation Program Evaluation

	VMT Bank	VMT Exchange	VMT Bank with Exchange	VMT Impact Fee
Legal	●	○	○	●
Effective	●	●	●	●
Geography	●	●	●	○
Administration	●	○	○	○
Equitable	●	○	○	●
Alignment	●	○	○	●

● Feasible ○ Concern

A VMT exchange raised concerns about nexus and proportionality if an applicant or a city were to request improvements that were disproportionate in consideration of the impact and/or not closely tied to the VMT threshold of the region. Additionally, administering a program where unknown projects are proposed raises questions of predictability of VMT reductions available to the region. Since a VMT exchange allows for mitigation projects that may not be on the radar or plans of the jurisdiction there are also questions as to whether proposed mitigation projects would align with jurisdictional goals as established in community plans. Lastly such projects could be implemented indiscriminately around the region and/or with a bias towards certain areas therefore raising concerns about equitable distribution of mitigation.

While a VMT impact fee addresses many of the concerns raised by the VMT Exchange model it is fixed with regard to geographic implementation and does not allow for as much flexibility to respond to development mitigation needs. The way impact fees are calculated adds more complexity to administration of the program and more staff time on both the part of the jurisdiction and the bank organization.

After discussions with stakeholders, it was decided that any program with a VMT Exchange should be removed due to these concerns and that an impact fee approach was not a good fit for a pilot program given its complexity to administer. This left the two VMT banking options left for consideration. Ultimately, it is the recommendation of the stakeholders and the project team that a VMT Bank be implemented for this pilot program to reduce complexity and allow for concerns around equity to be addressed by the public agencies implementing the program.

In addition to the above and as mentioned previously, one of the important considerations that must be addressed when considering CEQA transportation mitigation is the requirement of ***additionality***. Along with additionality, there are ***other legal and administrative considerations***, depending on the program format, that will need to be considered during the implementation of a VMT mitigation program.

Another important consideration incorporated into the evaluation of a fee-based VMT mitigation program was the concept of ***unintended consequences***. Unintended consequences that relate to the implementation of a fee program include: significant changes to development or transportation costs, changes in development patterns, or changes to the priority of infrastructure implementation. Historically, transportation programs and projects had disproportionate impacts on disadvantaged populations. Another important consideration is that the implementation of a VMT mitigation program should not discourage good project design or contradict community values.

Outreach Summary

In assessing the viability of a fee-based VMT mitigation program for Santa Cruz County, a comprehensive outreach plan was established. This plan aimed to gather insights from various stakeholders in the region, including member agencies, community-based organization (CBO) representatives, and members of the development community. The goal was to form a Stakeholder Advisory Committee (SAC) and a Technical Advisory Committee (TAC) consisting of technical experts from across California. The project team convened with both committees twice during the beginning of the project, but due to the amount of attendees and overlap between the two groups, the two committees were combined into one single Stakeholder Advisory Committee that was convened an additional three times for a total of five meetings.

These meetings were held to share updates, gather feedback on possible VMT-reducing projects, discuss the most suitable framework type, choose between a regional or a hybrid regional/local framework, and decide on the method for calculating cost per VMT.

In addition to the five SAC meetings, three public meetings were held throughout the regoin over the project lifecycle to solicit feedback on the study from members of the public. The following is a summary of the dates and locations in which the public meetings were held:

- City of Santa Cruz and City of Capitola, March 6, 2023
- City of Watsonville, May 31, 2023
- Online Meeting, Nov 9, 2023

In conjunction with the three public meetings and the five meetings held with the SAC, a dedicated website[9] was established. This website served as a central hub for information, allowing the public to stay informed about the program's developments, access meeting materials, and provide feedback. In addition, a public survey was drafted with a link posted on the study's website and distributed to the public via social media posts to solicit direct feedback from the public on the study.

Furthermore, to ensure wide-reaching engagement and accessibility, social media posts were crafted to spread awareness about the study and the public meetings. These posts are designed to capture the attention of various demographics across different platforms.

To cater to a diverse audience and address language barriers, informational videos were produced and posted on the study's website in both Spanish and English. These videos are aimed at providing clear and concise explanations of the program's objectives, its potential impact, and how individuals can get involved in the process.

[9] Santa Cruz County VMT Mitigation Program, https://sccoplanning.com/PlanningHome/Environmental/VMTMitigationProgram.aspx, accessed on 3/6/2024.

Program Administration and Other Considerations

When considering the administration of a fee-based VMT mitigation program, the structure of the program is the first thing that needs to be determined. Based on feedback received from the SAC, the Santa Cruz County Regional Transportation Commission (SCCRTC) should oversee and administer the region's fee-based VMT mitigation program with the approval of mitigation projects provided by a Joint Powers Authority of the jurisdictions within the region. It is recommended that the JPA be represented by the Commission of the SCCRTC which includes representatives from all jurisdictions in the region. The SCCRTC is well suited to administering such a program given their current role in the region of administering funding to local entities. In this model the JPA as represented by SCCRTC's Commission would approve funding decisions, changes to the program, and provide general oversight. The SCCRTC interagency technical advisory committee (ITAC) which is comprised of staff from each of the JPA member agencies would review the program's projects, provide recommendations to the JPA, and suggest projects for the VMT Program.

The VMT Program would be rolled out initially as a pilot to provide insight and determine the feasibility of the program before implementing the program fully. The pilot program would include a limited number of projects, ideally those that are shovel-ready and cost efficient, to determine the feasibility of continuing the program with a wider array of projects that may not be as cost efficient. Frequency for updating the project list would be on an as needed basis depending on how quickly the VMT is purchased form the program. Based on the average amount of VMT purchased by each project applicant, ITAC staff could determine a point at which the program would need to be replenished with additional projects to provide enough VMT for future project applicants to purchase. Jointly, the JPA and the SCCRTC would be responsible for the implementation, monitoring, and enforcement of mitigation measures, facilitating the exchange of VMT credits, and maintaining transparency and accountability in the program's operations.

Nexus Documentation

The Court has been clear on land-use regulations stating that any regulation must "substantially advance legitimate state interests". This means including the establishment of an "essential nexus" between the mitigation fee and government interest. Furthermore, the doctrine requires those fees to be "rough[ly] proportional" to the adverse impacts of a project. This also means that mitigation must be appropriately sized to offset the actual impact. Under an approach where the VMT reductions are determined in terms of "vehicle miles" or similar units, an amount of mitigation that matches the impact can be purchased by developers through a fee program. As long as these fees are justified to further a legitimate purpose with an essential nexus to government interest and roughly proportional to the adverse impacts, they may be permissible.

Similar to traditional fee programs, the mitigation projects within the bank would be selected based on the need to mitigate VMT from anticipated development. However, unlike traditional fee programs the application of the fee is directly tied to the individual development project and is not based on a future need but the VMT mitigation for that individual proposal. When a development project is proposed the

VMT reduction required for the proposal would be calculated and the applicant would purchase the credits equal to the amount of VMT needed for their project. Once those VMT credits are purchased a VMT reducing mitigation would come online within a reasonable timeframe to mitigate the development proposal. Agencies should also be diligent in their VMT mitigation duration as the nexus between improvements and successful use of fees varies region by region. Bank arrangements that receive and pools funds from multiple projects should account for the delay between payment and deployment of funds as it measures the cost of VMT mitigation and negotiates with developers.

Other Considerations

One of the primary considerations of implementing a fee-based VMT mitigation program is the economics of providing feasible mitigation. If Santa Cruz County implements a VMT mitigation bank or other fee-based VMT mitigation program framework, such as a VMT exchange, a feasible mitigation option will be introduced that did not exist previously. The introduction of a feasible mitigation option will likely necessitate participation by development projects that have CEQA-specific significant impacts where previously they would seek to obtain a finding of "overriding considerations." The implementation of a fee-based VMT mitigation program results in more regional changes than solely providing an additional feasible mitigation option for development projects.

Often it is less expensive to construct development projects outside of urban areas than it is to construct those same projects at an infill location. This is primarily due to the use of "overriding considerations" for any VMT impacts identified at suburban and rural locations without feasible mitigations, as well as existing infrastructure and regulatory challenges facing infill sites, including the use of LOS to determine improvement recommendations by local jurisdictions. However, with the introduction of a fee-based VMT mitigation program, a new feasible mitigation for development projects is required and the cost of developing at those suburban and rural locations may increase as mitigation costs are included in the overall development cost. The net result is to bring the costs of developing in a suburban or rural location more in line with the cost to develop an infill location. The equaling of development costs between infill and suburban or rural locations could result in long-lasting impacts on future development patterns that may bring them more in line with an agency's long-term development plan and its associated Metropolitan Planning Organization's (MPO) Sustainable Communities Strategy (SCS). When combined with the number of state, regional, and local incentives to promote affordable and infill development, the implementation of a fee-based VMT mitigation program provides agencies with an additional tool to achieve their preferred long-range development growth plan and strengthens their overall strategy to achieve the VMT and GHG emission reduction goals set by the California Air Resources Board (CARB).

Additional Study Outcomes

Upon completing the project analyses, outreach, framework evaluations, and reviewing all considerations, feasible program options and candidate projects for the region were evaluated, as described above. These options were selected for their ease of understanding by the public and decision-makers and their flexibility in accommodating local VMT mitigation programs.

Other findings and recommendations that have resulted from the study include:

- A regional VMT mitigation program offers a new viable mitigation option for project applicants facing VMT impacts that cannot be mitigated through other means.
- Selectivity in choosing VMT-reducing projects for the program is crucial to ensure financial and practical feasibility. Projects should be evaluated for potential other funding sources and their ability to meet additionality requirements.
- Equity must be a core element in both the final design of the VMT mitigation program and the projects selected for it. This study suggests that a fee-based VMT mitigation program could lead to equitable outcomes, avoiding concentration of VMT impacts in environmental justice communities and ensuring mitigation is not limited to non-environmental justice areas.
- Developing a project list for the program will be an ongoing process, necessitating accurate methods of VMT analysis in line with best analysis practices to ensure robust outcomes. The study's established framework should serve as the basis for future analysis.
- There needs to be clear documentation of the connection (nexus) between the program's necessity and the impact of the VMT mitigation during final program design.
- The program's success hinges on support from decision-makers, agencies, the community, and participants in the VMT mitigation program. A diverse range of perspectives should be considered in the final design and project selection.
- Implementing a fee-based VMT mitigation program introduces a new fee, potentially increasing housing costs and other development expenses, as well as the cost of transportation capacity-enhancing projects.
- Without a well-defined and well-established VMT mitigation solution, significant uncertainty will persist for many projects, hindering their progress even if they align with other plans and programs.
- A single entity should administer the program, likely the SCCRTC, and work with member agencies in the form of a Joint Powers Authority (JPA) to ensure consistent application of the program and long-term viability.
- It is recommended that a pilot program be implemented prior to the full rollout of the program. This pilot program would include shovel ready or immediately implementable projects and programs that are cost efficient and run for a set time period. Once the pilot program ends, its effectiveness should be evaluated, and any lessons learned be incorporated into the full rollout of the program within the region.

APPENDIX A – LITERATURE REVIEW

Santa Cruz County Regional VMT Mitigation Program

Task 1: Review Existing and Concurrent Research Efforts

05/09/2023

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Abbreviation	Definition
AB	Assembly Bills
C/CAG	City/County Association of Governments of San Mateo County
CA	California
CAP	Cap-and-Trade Program
CAPCOA	California Air Pollution Control Officers Association
CBTP	Community-Based Transportation Plan
CCTA	Contra Costa Transportation Authority
CEQA	California Environmental Quality Act
CMP	Congestion Management Program
COG	Council of Governments
EIR	Environmental Impact Report
FGC	Fish & Game Code
Gov	Government
GHG	Greenhouse Gas
GPA	General Plan Amendment
IE	Inland Empire
MMF	Mobility Mitigation Fee
MTC	Metropolitan Transportation Commission
MUNI	The San Francisco Municipal Railway
LA	Los Angeles
LOS	Level of Service
RFP	Request for Proposal
ROI	Return of Investment
RTIP	Regional Transportation Improvement Program
RTP	Regional Transportation Plan
SANDAG	San Diego Association of Governments
SB	Senate Bill
SBCTA	San Bernardino County Transportation Authority
SCS	Sustainable Communities Strategies
SEIR	Supplemental Environmental Impact Report
SloCOG	San Luis Obispo Council of Governments
SR	State Route
TBD	To Be Determined
TDM	Transportation Demand Management
TIA	Transportation Impact Assessment
TIM	Traffic Impact Mitigation
TOD	Transit-oriented development
TS	Transportation System
TSF	Transportation Sustainability Fee
TMP	Transportation Master Plan
TPA	Transportation Priority Area
TRPA	Tahoe Regional Planning Agency
UC	University of California
VMT	Vehicle Miles Traveled
VTA	Valley Transportation Authority


MANSION HOUSE

Chapter 1: Introduction

The sustainable transportation planning grant program is released by The California Department of Transportation (Caltrans) for cities and counties to begin or complete planning toward a variety of sustainable transportation projects, including but not limited to environment friendly mobility and emission reduction technologies, with the aim to support state climate goals. This grant program consists of Sustainable Communities Grants and Strategic Partnerships Grants. The former is to encourage local and regional planning that extend state goals and the latter is to identify and address the deficiencies on the State highway system in partnership with Caltrans.

County of Santa Cruz is a grantee of Sustainable Communities Grants with City of Watsonville and Santa Cruz County Regional Transportation Commission to develop and adopt Vehicle Miles Traveled (VMT) mitigation program to work, school, and essential services by building active transportation and transit improvements on and off the state highway system that decrease VMT and greenhouse gas emissions, improve safety, combat climate change and improve the quality of lifeline infrastructure provided to disadvantaged communities within the Santa Cruz region. This document presented is the first task of this project.

Senate Bill (SB) 743 reformed the transportation impacts review process under California Environmental Quality Act (CEQA) to align with greenhouse emissions reduction goals. As a result, VMT became the key metric to measure transportation impacts and estimate mitigation effects. The California Air Pollution Control Officers Association (CAPCOA) Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity, which is an updated version of the VMT and Greenhouse Gas (GHG) mitigation guide released previously in 2010, was released in January 2022. CAPCOA's Handbook is one of the primary sources for estimating mitigation effects in California (CA). Although this resource is invaluable, it is still challenged by the limitations of the prior 2010 version given that it provides solutions that work best in highly urbanized areas, with Transportation Demand Management (TDM) applications in suburban and rural contexts often having limited or questionable efficacy. TDMs can also be challenging from the standpoint of mitigation monitoring and are often unpopular with project applicants because they may need to be managed and paid for in perpetuity. These limitations have led jurisdictions to increasingly consider other programmatic approaches to VMT mitigation. In response, policymakers started considering new designs such as "banks" and "exchanges". This document summarizes example programmatic approaches in practice, assesses the legal and non-legal considerations that can identify a direction for jurisdictions, as well as provides key takeaways.

Chapter 2: Fee-based VMT Mitigation

Programmatic approaches that rely on collectively funding projects appear to hold great promise for VMT mitigation as they can allow a project to obtain an amount of mitigation precisely commensurate with their impact. In addition, these programmatic approaches allow developers to make a single payment, avoid the complexity of ongoing Transportation Demand Management (TDM) management and do not require mitigation monitoring by the project applicant. Programmatic approaches can also provide a public benefit in terms of funding transportation improvements that would not otherwise be constructed, resulting in potential improvements to congestion, Greenhouse Gas Emissions (GHG) emissions, increased transportation choices, and additional opportunities for active transportation and related health benefits. This study focuses on programmatic approaches to VMT mitigation including VMT Banking, VMT Exchanges, and VMT Mitigation Impact Fee Programs, as described below:

VMT Banking – Under a VMT Banking framework, multiple VMT-reducing projects are grouped and their associated VMT reductions are monetized in the form of credits. These credits are then purchased for the purposes of mitigating VMT in excess of determined impact thresholds. The underlying projects may be either regionally or locally beneficial to the area in which the project is located.

VMT Exchanges – VMT Exchanges are similar to VMT Banking with the exception that they deal with a single VMT-reducing project that can be established by the project applicant, other entity, or potentially be selected from a predetermined project list. As this approach eliminates the need to convert a group of projects into equivalent VMT-reducing credits, its administration could potentially be simplified, and funding can be directed at a single mitigation solution which may be of greater benefit to the project than funding a VMT Bank.

VMT Mitigation Impact Fee Programs – Some jurisdictions have also considered the creation or conversion of an existing Transportation Impact Mitigation (TIM) Fee Program to serve the purpose of VMT mitigation. This, however, can be complicated for most jurisdictions given that, to not be counterproductive in terms of VMT mitigation, all capacity-enhancing projects would need to be purged from the TIM Fee Program. Simply, a TIM Fee Program cannot have roadway widening projects and be VMT mitigating at the same time. While a full conversion to VMT mitigation projects is feasible in some urban locations, most jurisdictions still desire to have some level of roadway widening/capacity enhancement within their programs for the purpose of facilitating travel and reducing congestion, even if the approach may be conflicting with Senate Bill (SB) 743 given that most capacity-enhancing projects result in induced demand and increased VMT. An important difference between a VMT Mitigation Impact Fee Program and a Banking/Exchange program is that every project would participate in it, not just those projects that require VMT mitigation under CEQA law. Note that, SB 743 modifies CEQA for VMT to be used as the metric based on which the impacts from transportation projects are evaluated. In response to SB 743, agencies are required to use VMT to evaluate the transportation impacts under CEQA.

The next chapter will introduce some of the example programs across the state: actual programs, quasi programs, and wetland banks.

Chapter 3: Example Programs

This chapter will present some examples from around the state to compare how different jurisdictions have approached VMT mitigation under SB743 over the years. The chapter will consider examples as follows:

- Actual Programs that fully implements fee-based mitigation programs (Actual programs) within a jurisdiction
- Quasi programs focusing on one aspect of VMT mitigation
- Wetland Banks where bank sponsors are allowed to transfer credits to permit developers to compensate for environmental impacts in exchange for permanent protection and monitoring of the wetlands

Mote that, unless otherwise noted all the examples provided here are using thresholds that follow the Office of Planning and Research Technical Guide to Implementing SB 743.

ACTUAL PROGRAMS

City of San Diego – Active Transportation In-Lieu Fee Program

In 2020, the City of San Diego proposed implementing a program for the purpose of complying with SB 743.[1] The intent of this program was to reduce Citywide VMT to address impacts of development related to noise, air pollution, and greenhouse gas emissions, and to promote public health and enjoyment, by investing in active transportation infrastructure and measures that will result in reductions to Citywide VMT.

Under the program, the city has identified four (4) zones, as follows:

- Mobility Zone 1 – reflects the Downtown Community Planning Area boundary
- Mobility Zone 2 – includes any parcel that falls wholly, or partially, within the State's identified
- Transit Priority Areas (TPAs)
- Mobility Zone 3 – reflects any Community Planning Area boundary with a VMT ***threshold*** that is 85% or less of the regional average for either VMT per capita or VMT per employee
- Mobility Zone 4 – represents an area that is not located within Mobility Zones 1, 2, or 3; Mobility. Zone 4 generally reflects the non-urban areas of the city

Under the Program, all development located in Mobility Zone 4 would be required to pay an active transportation in-lieu fee instead of funding the cost of VMT reducing mitigation measures. In addition, development projects in Mobility Zone 4 would not be required to provide on-site TDM. This is mainly because zone 4 is less bike and walk friendly, located farther away from jobs, services, and shopping centers, and has limited access to transit. Thus, it is not effective to implement VMT reduction strategies though the VMT generation rate would be high. Funds collected from the program would be used to pay for transportation and VMT-reducing multimodal infrastructure projects within Mobility Zones 1, 2, and 3, thereby reducing Citywide VMT impacts. The regulations required that all development located in Mobility Zones 2 and 3 provide on-site TDM measures that reduce VMT. TDM measures could include a variety of pedestrian improvements (e.g., eliminating sidewalk gaps, new crosswalks), bicycle supportive

[1] County of San Diego, *San Diego Citywide Active Transportation In Lieu Fee Program Estimated Impacts and Cost Savings, https://www.sandiego.gov/sites/default/files/8_active_transportation_in_lieu_fee_cost_impact_analysis.pdf*, accessed on April 11th,2022

amenities (e.g., lockers, showers), transit improvements (e.g., installing a shelter), and other multi-modal enhancements (e.g., moving or adding a new stop closer to the project. Average total cost for regional VMT normalized across modes of bike/transit/pedestrian is identified $1,400.

Key Takeaways
The city is divided into zones
Developments in non-urban areas pay an Active Transportation In-Lieu Fee
Developments in urban areas would provide on-site Transportation Demand Management (TDM) amenities that reduce VMT

City of San Jose – Transportation Analysis Policy

Effective by March 29, 2018, the City adopted a Transportation Analysis Policy replacing the Transportation Impact Policy to align with SB 743.[2] Transportation projects that are environment friendly and support land use and goals of City and State by mitigating traffic significantly or at least are neutral against City's screening criteria are listed by SB 743 publication. Projects that do not meet the screening criteria must include a detailed evaluation to measure the VMT against City's thresholds of significance and include feasible mitigation measures to offset the effects if needed. In case a project is unable to fully mitigate VMT, the project must fund multimodal transportation improvements—called Transportation System Improvements— that would improve system efficiency and/or safety, enhance non-auto travel modes, and promote the citywide reduction of VMT. San José provides an example of a way to use the VMT "budget" to create a transportation project threshold of significance. San José evaluates transportation projects in relation to the regional transportation plan. The City of San Jose Transportation Analysis Handbook identifies screening criteria that determines whether a CEQA transportation analysis would be required for development projects. The criteria are based on the type of project, characteristics, and/or location. If a project meets the City's screening criteria, the project is expected to result in less-than-significant VMT impacts and a detailed CEQA VMT analysis is not required. Projects must demonstrate consistency with the Envision San José 2040 General Plan to address cumulative impacts. Consistency with the City's General Plan is based on the project's density, design, and conformance to the General Plan goals and policies. If a project is determined to be inconsistent with the General Plan, a cumulative impact analysis is required per the City's Transportation Analysis Handbook. Per VMT cost was stated as follows:

- Commercial/Industrial: $3,200 per Vehicle Mile Traveled not mitigated
- Residential $2,300 per Vehicle Mile Traveled not mitigated

Key Takeaways
Applicants must construct or fund citywide multimodal transportation improvement(s) if a project was unable to fully mitigate VMT
Improvements to the citywide multimodal transportation system would not necessarily reduce or avoid the significance of VMT impacts that cannot be mitigated
An improvement would be one of the overriding benefits to the community

[2] City of San Jose Council Policy, *Transportation Analysis Policy*, 636691896044230000 (sanjoseca.gov), accessed on April 11th,2022

Contra Costa Transportation Authority (CCTA)

A California Department of Transportation Sustainable Planning Grant of $400,000 was awarded to the Contra Costa Transportation Authority (CCTA) in 2021 to build a VMT Mitigation Framework.[3] The study will examine the possibility of allowing developers and transportation agencies whose projects contribute to VMT increases to offset emissions by paying into a "VMT Mitigation Program".

In March 2023, A draft VMT mitigation framework has been released. CCTA has expressed interest in establishing a pilot hybrid exchange/in-lieu fee program targeted toward implementing the Mobility on Demand (MOD) app. The MOD app would function as a voluntary commute trip reduction program and a source of community-based travel information. The app offers the ability to monitor the VMT generation, hence quantifying the VMT effects. This would create the ability to directly calculate the program's cost-effectiveness for VMT. The draft framework estimates a $0.10 -$0.35 per VMT reduced over 10 years. If MOD proves to be effective, it could use demonstrated VMT reductions and cost data as the basis for a future fee program.

Key Takeaways
The program is funded by the California Department of Transportation Sustainable Planning Grant
The county is establishing a pilot hybrid exchange/in-lieu fee program
Estimated cost: $0.10 -$0.35 per VMT reduced over 10 years

San Bernardino County Transportation Authority (SBCTA)

In August 2022, A VMT mitigation bank was proposed by City/County Manager's Technical Advisory Committee. SBTA would develop this bank using a mode-choice based framework, with telework as the initial regional mitigation measure. Initially, the program would focus on incentivizing individuals to earn reduction credits by making choices to reduce their travel. After establishing a verified home-based work trip (HBW) "baseline," individuals who volunteer for the program can generate credits whenever they choose to telework for a particular day. The volunteers would need to live or work in the County. The verified VMT reduction credit would then be assigned an economic value and the volunteers would be paid a share of that value as an incentive for reducing their VMT. The purchased credit would be banked by SBCTA and then sold to development projects that would need mitigation. Additional projects and programs already established under the Inland Empire (IE) Commuter Rideshare Program could be added in the future (e.g. choices to ride transit or vanpool/carpool). It is estimated to have a cost of $0.05 -$0.08 per VMT reduced over 20 years.

Key Takeaways
SBCTA would develop a regional VTM Mitigation bank using a mode-choice based framework
The program is focusing on telework as the initial regional mitigation measure
Estimated cost: $0.05 -$0.08 per VMT reduced over 10 years

Tahoe Regional Planning Agency – Mobility Mitigation Fee Program

As of April 2021, the Tahoe Regional Planning Agency (TRPA) introduced the Mobility Mitigation Fee (MMF) program basing the fee on average daily VMT instead of the average daily trip ends.[4] VMT mitigating projects are drawn from the 2020 Regional Transportation Plan (RTP) constrained project list.

[3] Contra Costa Transportation Authority, *Press Release*, https://ccta.net/wp-content/uploads/2021/10/CCTA_SustainableGrantAward_FINAL.pdf, accessed on April 11th,2022

[4] Tahoe Regional Planning Agency, *Mobility Mitigation Fee Update*, 2021. https://www.trpa.gov/wp-content/uploads/Ops-Committee-Item-5-Mobility-Mitigation-Fee-Update.pdf, accessed on April 11th,2022

MMF may charge as high as $218.00 per VMT depending on the development. This program is different from its equivalents in the region as it strictly charges a VMT mitigation fee. These fees are for mitigating project impacts on transportation, not for revenue-generating to offset the vehicular impacts of a project including roadway improvements. The updated process requires all projects to mitigate their transportation impacts through payment in the MMF Program and to do more at the project level if generated VMT is significant. The new process charges a fee for retail/commercial development only if it generates a net increase in VMT.

The process encourages projects located in low-VMT areas, and any needed VMT-reducing strategies to further reduce VMT can be reflected in lower MMF fees. TRPA's mitigation fund release policy states that collected funds can only be used for VMT mitigating transportation projects.

Key Takeaways
Fee based on VMT instead of daily trip ends and dependent on type of project
Fees are strictly for mitigating project impacts on transportation, not for revenue-generating to offset the vehicular impacts of a project
The new process charges a fee only if project generates a net increase in VMT

City of Salinas

As of October 2020, the City of Salinas started developing a VMT mitigation bank based solely on bicycle infrastructure projects. As a part of developing the bank, several key citywide bicycle projects were costed and the VMT reductions associated with them were calculated. Projects that could be constructed in the next ten years were included in the program.[5] However, in order for the City to more easily administer the program, the cost was calculated on a per trip basis rather than a per mitigated VMT basis. The resulting program charges $204.89 per gross vehicle trip. A project that wishes to mitigate its VMT impact must determine the number of vehicle trips to be reduced before determining its overall mitigation cost.

An important aspect of this program is that additional projects can be added to the bank to increase the supply of VMT for mitigation purposes. The City of Salinas is one of the first cities in California to undertake the development of a VMT Banking program.

Key Takeaways
VMT Bank comprised by bicycle infrastructure projects only
Developer pays one time to mitigate amount of total VMT project that is over the threshold
VMT Bank can be refilled by new projects if additional VMT is needed

City of Watsonville

As of September 2022, The City of Watsonville developed a VMT mitigation bank based on bicycle and pedestrian infrastructure projects. The proposed projects were taken from existing plans such as the bicycle master plan. Then, projects were costed, and the VMT reductions associated with their construction were calculated. Projects that could be constructed in the next ten years were included in

[5] While this VMT Banking program consists of potential projects that could be constructed in the next ten years, some but not all of them are anticipated to be constructed in that timeframe.

[6] Project level depends on project site and land use types. Chapter 65: Air Quality / Transportation of the TRPA Code of Ordinances details the defined levels

the program.[6] This provides a small program with a cost per VMT reduced that the developers can use to reduce their project's VMT impact as part of a regional VMT banking approach to VMT mitigation. The resulting cost for each VMT to be reduced was calculated to be $1,524.21 per VMT reduced. Note that this rate does not include any non-fee funding sources (grants, etc.). The addition of any funding sources for these projects could significantly reduce the cost of per VMT reduction cost.

An important aspect of this program is that additional projects can be added to the bank to increase the supply of VMT for mitigation purposes.

Key Takeaways
VMT Bank comprised by bicycle and pedestrian infrastructure projects
Developer pays one time to mitigate amount of total VMT project that is over the threshold
VMT Bank can be refilled by new projects if additional VMT is needed

City of Tracy

As of July 2022, The City of Tracy developed a VMT mitigation bank based on bicycle and pedestrian infrastructure projects, as well as a mobility hub project. The mobility hub links several different modes of travel together at a transit station to make commuting by transit easier and reduce the number of drive-alone automobile trips. As a part of developing the bank, the proposed projects were taken from existing documents such as the transportation master plan (TMP), then the projects were costed, and the VMT reductions associated with their construction were calculated. Projects that could be constructed in the next ten years were included in the program. This resulted in a small program with a cost per VMT reduced that the developers can use to reduce their project's VMT impact that can be use as part of a VMT banking approach to VMT mitigation. The resulting cost for each VMT to be reduced was calculated to be $633.11 per VMT reduced. Note that this rate does not include any non-fee funding sources (grants, etc.). The addition of any funding sources for these projects could significantly reduce the cost per VMT reduction cost.

An important aspect of this program is that additional projects can be added to the bank to increase the supply of VMT for mitigation purposes.

Key Takeaways
VMT Bank comprised by bicycle, pedestrian, and mobility hub projects
Developer pays one time to mitigate amount of total VMT project is over threshold
VMT Bank can be refilled by new projects if additional VMT is needed

QUASI PROGRAMS

San Francisco Transportation Demand Management Program

The San Francisco Transportation Demand Management Program, which "seeks to promote sustainable travel modes by requiring new development projects to incorporate design features, incentives, and tools that support transit, ride-sharing, walking, and bicycle riding" is one potential example of a VMT exchange program. Each project was given several points based on its land-use category, size, and parking requirements by program staff. The project developers must then choose applicable demand-management measures (primarily on-site) totaling an equal number of points from a city-prepared

[6] While this VMT Banking program consists of potential projects that could be constructed in the next ten years, some but not all of them are anticipated to be constructed in that timeframe.

menu of options and develop a plan to put the measures in place. Each point corresponds to a 1% reduction in VMT.[7]

KEY TAKEAWAYS
An early example of VMT Exchange
Each project was given several points based on its land-use category, size, and parking requirements
Project developers choose applicable measures totaling the points from this menu and develop a plan

San Francisco Transportation Sustainability Fee

San Francisco Transportation Sustainability Fee (TSF) required developers of qualifying projects to pay approximately $8 per square foot of residential development and $18 per square foot of commercial development into a fund. Millions of dollars generated from this program were funneled to transit improvements such as adding more The San Francisco Municipal Railway (MUNI) services, expanding the fleet, and improving services as well as transit stops, and streets. A thorough nexus study was conducted to explore legality, justified fees and other aspects, and potential projects. A well-designed analysis of transportation demand and adjusted fees and measures was enough to set the groundwork to satisfy core CEQA requirements.[8]

KEY TAKEAWAYS
San Francisco Transportation Sustainability Fee required developers of qualifying projects to pay development commercial development into a fund
Fees were funneled to transit improvements such as MUNI services expanding fleets, and improving services
A well-designed analysis of transportation demand and adjusted fees and measures was enough to set the ground to satisfy core CEQA requirements

City of Pasadena Complete Streets Program

The City of Pasadena had organized its Complete Streets Program to implement innovative approaches to reduce VMT. [9] Thresholds that require analysis and potential mitigation for any significant impacts were included for both VMT and Level of Service (LOS), along with other metrics. The guidelines set the significance threshold for VMT at 22.6 additional trips per capita (residential population plus jobs) and require LOS to be held at D.

This also helped solve a potential CEQA-Congestion Management Plan (CMP) compliance conflict by evaluating LOS and VMT at the same geographical scale on which VMT mitigation is permitted. Since VMT programs are designed to reduce vehicle miles traveled, LOS may not be negatively impacted at the intersection level, for instance. If the scale of LOS evaluation is expanded from intersection impacts to larger segments in the region, then VMT mitigation should coincide with LOS goals under CMP. Additionally, if project reduces VMT but would not comply with LOS requirements under CMP, jurisdiction can designate “infill opportunity zones” that are exempt from the LOS requirements under LOS. These zones are within one-half mile of a major transit stop or high-quality transit corridor included in the application regional transit plan.[10] Agencies must consider all aspects of legal requirements.

[7] City and County of San Francisco Planning Commission, *Standards for the Transportation Demand Management Program* (2016), *See* http://www.sftdmtool.org/, accessed on April 11th,2022

[8] Robert D. Spencer, San Francisco Municipal Transportation Agency, *San Francisco Transportation Sustainability Fee* (TSF) Nexus Study (2015).

[9] City of Pasadena Department of Transportation, *Mobility Element* (2015). https://ww5.cityofpasadena.net/transportation/complete-streets/development-review/pasadena-transportation-management-association, accessed on April 11th,2022

[10] *See* Cal. Gov’t Code § 65088.4.

Key Takeaways
Complete Streets Program was organized to implement innovative approaches to reduce VMT
Thresholds included both VMT and LOS, along with other metrics
This helped solve a potential CEQA-CMP compliance conflict by evaluating LOS and VMT at the same level

City of Los Angeles Coastal Transportation Corridor Specific Plan, West LA Transportation Improvement and Mitigation Specific Plan

As the earliest application of mitigation fee programs, these area-wide-specific plans included lists of transportation improvements such as transit, bicycle, pedestrian, roadway, intelligent transportation system (TS), and trip reduction programs to be funded by the impact fees collected from new development. The fair share (trip fee) is based on a "nexus" and is calculated in direct proportion to PM Peak hour trips generated by new development. The amount of the TIA fees is based on each land uses proportionate to the use of the transportation facilities. At the time, the Transportation Impact Assessment fee program was also updated to include a VMT-based nexus plan, revisions to the fees, exemptions, in-lieu credits, affordable housing credits; and new transit-oriented development credit. Other proposed changes include administrative amendments and minor revisions that are consistent with SB 743.[11]

Key Takeaways
The earliest application of VMT Mitigation programs
Area-specific plans included lists of transportation improvements to be funded by the impact fees
The transportation Impact assessment program included VMT-based nexus plans, in-lieu credits, and new transit-oriented development credit

Los Angeles Metro Transit Pass Study

Metro is the Los Angeles County mobility provider. One of the programs they offer is a transit pass subsidy and based on a study in 2020 it may qualify as a VMT mitigation exchange. Metro offers some students and employees free transit by allowing anyone to 'sponsor' a particular school or employer. [12] LA Metro considered a program as an SB 743 VMT mitigation exchange where developers could purchase these passes and could use the Metro performance data to estimate the VMT reduction per pass. However, this process is still experimental.

Key Takeaways
LA Metro transit passes could be sponsored by anyone
LA Metro considered a program as an SB 743 VMT mitigation exchange where developers could purchase these passes
This may have qualified as a VMT exchange

Metropolitan Transportation Commission Bay Area Express Lanes Strategic Plan

The Metropolitan Transportation Commission (MTC) is exploring a simplified VMT bank or exchange options as on-site mitigation may not be feasible for all projects. [13] MTC is considering a VMT exchange program that can reinforce existing multi-county efforts focusing on corridor-planning within the express lane corridor. Through VMT exchange, implementing agencies will offset any VMT impacts of

[11] Los Angeles Department of Transportation, *Transportation Impact Assessment (TIA) Fee Program Study for Coastal Transportation Corridor Specific Plan and West Los Angeles Transportation Improvement and Mitigation Specific Plans Amendment Project*, 2015.
[12] Fehr & Peers, *VMT Mitigation Through Fees, Banks, and Exchanges*, April 2020
[13] Metropolitan Transportation Commission, *Bay Area Express Lanes Strategic Plan*, https://mtc.ca.gov/sites/default/files/Bay_Area_Express_Lanes_Strategic_Plan_Appendices.pdf, accessed on April 11th,2022

the express lanes. On the other hand, MTC is also considering VMT banks that allow developers to fund off-site mitigation projects. In this case, an improved Impact fee that is used to fund demonstrated VMT mitigation projects, could fund current mitigation such as a regional express bus service.

MTC notes that implementing agencies should consider scenarios where the toll revenue drops, and mitigation funds are needed to operate and maintain highways. In that sense, how and where these banks are used remains an important challenge for these agencies.

Key Takeaways
MTC is exploring a simplified VMT bank or exchange options for Bay Area express lanes
VMT exchange can reinforce existing multi-county efforts focusing on corridor planning within the express lane corridor
Implementing agencies could offset any VMT impacts of the express lanes

WETLAND BANKS

Wetland banks have been in practice for years now. A wetland (mitigation) bank is "*privately or publicly owned land managed for its natural resource values. In exchange for permanently protecting, managing, and monitoring the land, the bank sponsor is allowed to sell or transfer habitat credits to permits who need to satisfy legal requirements and compensate for the environmental impacts of developmental projects.*"[14] Although there may be a variety of technical and legal differences, they can be potential models for VMT mitigation strategies. These models typically include a process through which the impacts of various transportation projects are estimated. Mitigation (Wetlands) banking credits are established to compensate for unavoidable wetland losses. One of the differences with VMT banks is the use of mitigation banks. This must occur in advance of development when the mitigation is not possible at the site or would not be as beneficial. Here are some examples sponsored by Caltrans[15]:

- State Route (SR) 149 Freshwater Marsh (1990) – Caltrans mitigated impacts of SR 149 widening project. Initial mitigation funding was provided by local funds for cash flow that is later reimbursed by Caltrans.
- Beach Lake Mitigation Bank (1991) – Beach Lake Mitigation Bank compensated for losses to wetland resources from future Caltrans projects in 14 counties. As of 2014, 43 projects in total had been debited from the bank to mitigate the impacts.
- Elkhorn Slough Early Mitigation Partnership (2009) – Program developed funding strategies and conservation agreements for the watershed. Caltrans sponsored the partnership to set up advance mitigation for four transportation projects.

Key Takeaways
Collaboration with local/regional partners facilitates state-level (Caltrans) efforts to develop advanced mitigation
The timeline for bank development could be different from agency to agency
Sometimes smaller agencies can have the flexibility to achieve advance mitigation, since they may have less restricted processes compared to Caltrans.

[14] California Department of Fish and Wildlife, Conservation and Mitigation Banking (ca.gov), accessed on April 11th,2022
[15] Sciara, G., Bjorkman,J., Lederman,J., Thorne, J.H., Schlotterbeck, M., Wachs, M., *Setting the Stage for Statewide Advance Mitigation in California*, UC Davis, Institute of Transportation Studies, 2015.

Chapter 4: Legal Considerations

There are a few potential sources of legal considerations that need to be considered to create a VMT mitigation bank, exchange, or impact fee program including CEQA, associated court decisions, California's Mitigation Fee Act, associated Assembly Bills (AB), the Congestion Management Program, and other Senate Bills. Any agency or authority designing or operating a bank would need to consider these to minimize risk of litigation. This section will discuss these considerations in further detail.

Court Decisions

The Court has been clear on land-use regulations stating that any regulation must "substantially advance legitimate state interests". This means including the establishment of an "essential nexus" between the mitigation fee and government interest.[16] Furthermore, the doctrine requires those fees to be "rough[ly] proportional" to the adverse impacts of a project.[17] This also means that mitigation must be appropriately sized to offset the actual impact. Under an approach where the VMT reductions are determined in terms of "vehicle miles" or similar units, an amount of mitigation that matches the impact can be purchased by developers through a fee program. As long as these fees are justified to further a legitimate purpose with an essential nexus to government interest and roughly proportional to the adverse impacts, they may be permissible.

Key Takeaways
Essential Nexus: There must be an essential nexus between the mitigation fee and the government interest
Roughly Proportionality: Mitigation must be approximately sized to offset the actual impact

Regional Transportation Plans

A bank or exchange may need to take into account certain transportation planning frameworks that are covered by California law. Regional Transportation Plans (RTPs) are long-term plans created and updated frequently by regional transportation agencies (RTAs) and metropolitan planning organizations (MPOs) incorporating local, regional, state and federal plans and priorities. While RTPs are not focused on VMT reduction, in certain cases there might be overlaps. A project that is to be funded under an RTP may not qualify as additional for mitigation. In addition, large scale mitigation investment might overlap with RTPs as they reflect regional transportation investment priorities. VMT Programs should include mechanisms to make sure additionality requirements are met.

Key Takeaways
The components of the RTP must be considered by the VMT mitigation bank and exchange programs to guarantee that the project satisfies the criteria for additionality and prioritization requirements

The California Environmental Quality Act

SB 743 directly amends The California Environmental Quality Act (CEQA) to require an updated analysis of transportation impacts. Reducing greenhouse gas emissions through means such as VMT is a justified purpose for the state's interest. CEQA requires that feasible mitigation be applied to projects that result in a significant impact. The impact is defined as the changes to the baseline environment caused by the

[16] See *Nollan*, 483 U.S. at 837.
[17] *Dolan v. City of Tigard*, 512 U.S. 374, 391,1994

project. Lead agencies or authorities can choose their thresholds to determine the significance of the impact. Here are the main statutes and guidelines:

- CEQA Statute (CA Public Resources Code 21099)
- CEQA Guidelines (CA Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15064.3)

Other relevant statues and guidelines are as following:

- CEQA Statute (CA Public Resources Code 21068.5, 21083, 21093, 21094, 21100, 21002)
- CEQA Guidelines (CA Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15007, 15041(a), 15064(h)(3), 15093,15091,15125, 15151,15152, 15364, 15384,15385)

Mitigation Fee Act (AB 1600)

Development Impact Fees thar\t were created under Assembly Bill 1600 (AB 1600), also known as the Mitigation Fee Act is now codified as Government (Gov.) Code Sections 66000 through 66008 ("Mitigation Fee Act"). The main purpose of the mitigation fee act is to "address concerns over the fact that local agencies are imposing fees for purposes unrelated to development projects."[18]

KEY TAKEAWAYS
Gov. Code § 66000 (d) – The bank or the recipient of the fund should use funds for a public facility. While it is defined broadly, mitigation measures such as public transit infrastructures or subsidies can be defined as a public facility
Gov. Code § 66001(a) – A reasonable relationship between the development fee, its use, and the need for the mitigation measure should be identified. Mitigation projects such as contributions to transit services should meet legal requirements and the relationship should be properly documented
Gov. Code § 66005 identifies a course for a fee reduction regarding new infill or transit-oriented housing developments. If development is a one-half mile from a transit station and meets basic requirements – generates lower auto trips–that development is entitled to a fee reduction. Under SB743, affordable housing, housing within ½ mile of transit, housing projects generating fewer than 110 trips per day, and new housing in existing low-VMT neighborhoods can forego transportation analysis and mitigation entirely. SB 743 makes it easier to use two CEQA exemptions for infill projects that can only be used when a project will not have significant transportation/traffic impacts. These are Public Resources Code section 21159.25's statutory exemption for housing projects in unincorporated areas and the Class 32 categorical exemption for infill projects within city limits.

Congestion Management Program

The current CMP in California requires urban areas to develop and adopt a program to enforce the LOS of E or promote alternative methods if below LOS E. However, SB 743 identifies VMT as the new measure of effectiveness for CEQA considerations, which creates a conflict with the existing CMP. VMT mitigation banks or exchanges may be funding or permitting a VMT reducing project that does not necessarily improve LOS.

KEY TAKEAWAYS
Until the CMP is updated to comply with SB 743, a simple solution would be to consider, having transportation impact analysis thresholds for both LOS and VMT on the same geographical scale

[18] Elkind, N.E., Lamm,T., Prather,E., *Implementing SB 743 An Analysis of Vehicles Miles Traveled Banking and Exchange Frameworks*, October 2018, U.C. Berkeley.

Senate Bill 375

SB 375 (Steinberg, 2008) requires MPOs to create and implement Sustainable Communities Strategies (SCS) and that adopted RTP components to integrate land use, housing, and transportation planning strategies to meet regional greenhouse gas emission reduction goals set by the state of California.SB475 promotes robust planning process that integrate regional and local strategies. However, in terms of implementation significant gaps has been observed. One of the limitations was the adequate incentives for inducing local development choices conducive to regional plan goals. Disruptive technology such as Uber, Lyft, and autonomous vehicles, increased vehicle availability, reduced time spent driving, lower operating costs in shared platforms potentially increases VMT absent new regulations. One of the other challenges were local zoning and permitting practices that constrain housing production and/or make it more expensive. Also, SB375 state that no aspect of it should be understood to initiate local control of land use decision-making, which makes it hard for MPOs to impose policy directives upon local jurisdictions. There has been concerns about infill strategies, lack of adequate incentives and support for compact development.

Key Takeaways
While it is unlikely that SCSs will conflict with SB 743, lead agencies must review the applicable Sustainable Communities Strategies (SCS) for any potential conflicts.
SB 375 can provide useful considerations to design and operate VMT banks or exchanges as it ensures that cities and counties are closely involved in developing effective plans for the regions, increases public participation and local government input, strengthens several existing requirements for public involvement in regional planning. It establishes a collaborative process between regional and state agencies to set GHG goals and prices CEQA incentives for development projects that are consistent with regional plan.

Assembly Bill 602

AB 602 reforms housing impact fees to make them more fair, transparent and streamlined such that smaller, more affordable units are not unfairly penalized with higher costs.[19] AB 602 requires impact fees to be proportional to the size of a new home so that smaller individual homes pay reduced fees. However, before the adoption of the fee, an impact fee nexus study should be adopted that identifies the existing level of service for each public facility, proposed new level of service, and should include an explanation of why the new level of service is needed. If a fee program was adopted before the state adopted AB 602, it would require a capital improvement plan as part of its nexus study.

Key Takeaways
This bill would require that a local agency that calculates fees proportionately to the square footage of the proposed units be deemed to have used a valid method to establish a reasonable relationship between the fee charged and the burden posed by the development. Bill went into effect on January 1, 2022
VMT banking rates are not calculated based on service levels or standards. The fee is based on VMT reduction and therefore housing square footage is not applicable. . However, lead agencies should review and consider AB 602 for potential conflicts with their programs

California Fish & Game Code

While research shows there are no specific statutes for VMT exchanges and banks, U.C. Berkeley used conservation programs as a proxy established under the California Fish & Game Code (FGC) to develop a

[19] California Legislative Information, AB 602 Development Fees: Impact fee nexus study, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB602, accessed on April 11th, 2022

list of requirements associated with existing statutes as shown in **Table 1**.[20] The intent is to show that behind VMT exchanges and banks aligning as a VMT mitigation program, is a form of conservation where they are trying to limit environmental impacts and the VMT generated through development.

Table 1 Sample VMT Mitigation Bank/Exchange Plan

Requirements	Statutory Ref.
An explanation of the VMT mitigation purpose and need for the bank or exchange.	FGC § 1852(c)(1)
The geographic area covered by the bank or exchange and rationale for the selection of the area, together with a description of the existing transportation and development dynamics that provide relevant context for the development of the bank or exchange.	FGC § 1852(c)(2)
The public transit and VMT reduction opportunities are currently located within the bank or exchange area.	FGC § 1852(c)(3)
Important residential and commercial communities and transportation resources within the bank or exchange area, and an explanation of the criteria, data, and methods used to identify those important communities and resources.	FGC § 1852(c)(4)
A summary of historic, current, and projected future transportation stressors and pressures in the bank or exchange area, including economic, population growth, and development trends.	FGC § 1852(c)(5)-(6)
Provisions ensure that the bank or exchange will be in compliance with all applicable state and local legal and other requirements and does not preempt the authority of local agencies to implement infrastructure and urban development in local general plans.	FGC § 1852(c)(7)
VMT mitigation goals and measurable objectives for regional transportation resources and important mitigation elements identified in the plan that address or respond to the identified stressors and pressures on transportation within the bank or exchange area.	FGC § 1852(c)(8)
VMT mitigation projects, including a description of specific projects that, if implemented, could achieve the mitigation goals and objectives, and a description of how the mitigation projects were prioritized and selected about the mitigation goals and objectives.	FGC § 1852(c)(9)
Provisions ensuring that the bank or exchange plan is consistent with and complements any local, regional, or federal transportation or congestion management plan that overlaps with the bank or exchange area, a summary of any such plans, and an explanation of such consistency.	FGC § 1852(c)(10)-(11)

LEGAL CHALLENGES

SB 743 has completely changed how jurisdictions analyze transportation impacts under CEQA. In 2018, the Governor's Office of Planning and Research (OPR) released technical recommendations regarding SB 743, which were helpful in evaluating transportation impacts for certain types of projects, such as housing, office and retail development. However, the guidelines do not comprehensively cover every land use scenario and there are still legal and practical scenarios falling through the cracks as shown in the three cases described below.

Case 1: Petitioners vs County of San Diego[21]

California Appellate Court rejected San Diego County's plan to mitigate greenhouse gas impacts with off-site offsets. The appellate court held that a mitigation measure in the Supplemental Environmental

[20] Elkind, N.E., Lamm,T., Prather,E., Implementing SB 743 An Analysis of Vehicles Miles Traveled Banking and Exchange Frameworks, October 2018, U.C. Berkeley.

[21] Court of Appeal, Fourth Appellate District, https://law.justia.com/cases/california/court-of-appeal/2020/d075328.html, accessed on October 3rd, 2022

Impact Report (SEIR) that permitted the purchase of carbon offsets from projects outside the County, including international projects, violated CEQA because the mitigation measure did not require that offsets meet AB 32 requirements, that greenhouse gas emission reductions be additional, and that the offsets originating outside California have greenhouse emissions programs equivalent to or stricter than California's program.

Case 2: Petitioners vs County of San Diego

VMT banks and exchanges are presenting unique solutions to VMT mitigation. However, they also bring quite a few legal challenges with them in terms of implementation. One of these challenges is the use of carbon offsets. Recently, the County of San Diego was challenged over the use of carbon offsets to achieve GHG reduction goals in the County's climate action plan.[22] The court petition states that revised CAP (Cap-and-Trade Program) and General Plan Amendment (GPA) Procedures lack standards sufficient to ensure that offsets are real, enforceable, additional, and otherwise consistent with CEQA's mitigation requirements. It also states that these procedures also fail to ensure that offset purchases will mitigate GHG emissions because they defer any judgment regarding the adequacy of a particular offset purchase until the issuance of a building permit. This could be an obstacle to creating VMT banks or exchange programs.

Case 3: Petitioners vs Governor's Office of Planning and Research, California Natural Resources Agency, Office of Administrative Law

In 2019, the Governor's Office of Planning and Research, California Natural Resources Agency, and Office of Law were challenged by the Two Hundred, an unincorporated association of civic leaders and additional individuals. Petitioners challenged five new regulations, one regulatory appendix, and two underground regulations. Essentially, petitioners argued that new plans increase new home costs, which pushes too many families of color far behind in their ability to access homeownership. It also mandates a VMT mileage quote for each driver, a quote which will arguably raise commute costs of lower and moderate-income workers who commute from outlying affordable home communities.[23] If successful, as the case is still ongoing, this could affect the legality of VMT policy setting.

[22] Superior Court of the State of California, *Court Petition*, https://www.biologicaldiversity.org/programs/urban/pdfs/San-Diego-CAP-Petition-for-Writ-of-Mandate.pdf, accessed on April 11th, 2022

[23] Superior Court of the State of California, *Court Petition*, 200-v-OPR-Complaint-12-18.pdf (thetwohundred.org), accessed on April 11th, 2022

Chapter 5: Non-legal Considerations

Research shows that there are other important considerations to take into account namely targeted structure, verification and additionality, geography, linkage between governments, equity, funding status, unwanted consequences This chapter will shed light on these considerations to establish a basis for fee-based VMT programs.

TARGETED STRUCTURE

A Fee-Based VMT Mitigation Program should only be imposed when a project can't sufficiently or cost-effectively mitigate its transportation impact. Unlike a typical TIM Fee Program that requires every development project to pay into it, a VMT Fee-Based Mitigation Program would only collect money from projects that cannot effectively mitigate their significant transportation impacts on their own. As a result, forecasting revenue may be more difficult given the need to predict a project's location and timing, its land-use characteristics, and whether it will require mitigation.

VERIFICATION AND ADDITIONALITY

Agencies need to consider questions concerning both "additionality" and verifiable VMT reductions before participating in a banking regime. Additionality concerns the requirement under CEQA that VMT reductions would not have occurred absent funding from the bank. The verification ensures that a project's anticipated reductions match the need generated by the development in question. It also makes sure that those anticipated reductions occur after implementation/construction. These two interrelated considerations are important both from the perspective that VMT reductions are quantifiable and realistic in the VMT estimating technique and that this is truly new mitigation rather than shifting money around. For specific proposed reductions, the public agency or the developer must demonstrate that reductions would not have occurred under the current plan but under this new project (additionality). Otherwise, the developer is responsible on generating further reductions. To track the additionality in the context of VMT mitigation banking/exchanges, two basic approaches can be taken[24] in the phases of investment selection and implementation:

- Project-specific (pre-investment): The lead agency or bank/exchange program administrator verifies the project's additionality before funding an individual mitigation project using available documented assessments, plans and/or funding resources of the applicable RTP(s).

- Programmatic (post-investment on a regular programmatic basis): The bank/exchange program administrator identifies classes of investment such as "likely to be added" or "unlikely to be added" based on the applicable RTP before selection. To do so, the program administrator conducts a comprehensive review of fund transactions, VMT impacts, mitigation supported investments, and the relationship of the investment cohort to the relevant investment plans (i.e., applicable RTP) and funding sources regularly. The administrator shall verify the additionality of the investments relative to a baseline scenario for the same period.

[24] Berkeley Law – Center for Law, Energy & The Environment, *Implementing SB 743: Design Considerations for Vehicle Miles Traveled Mitigation Bank and Exchange Programs*, August 2022.

For verification purposes, agencies could try to create an in-house smaller body to handle verifications at the regional level. In that case, agencies will likely need to increase their computations capabilities and modeling capacities as there will be a significant need for monitoring of any potential discrepancies between the forecasts. If agencies cannot conduct verification efforts in-house, they could contract third-party off-set verifiers.[25] This may have an added benefit of possibly avoiding concerns about self-verification, such as improper influence, that could undermine public trust.

Table 2 below represents the type of assessment a program administrator could make and the associated evaluation checklist.

Table 2 Evaluation Checklist for Program Administrator

Documentation / Project	Project location/status within RTP	Investment type	New construction/installation	Previously unfunded project phase/stage	Increased capacity/reliability	Accelerated deployment	Additionality of VMT reduction compared to	Project type/origin	Agency/third party commitment to project implementation/ownership	Implementation/investment plan
Unprogrammed and in the unconstrained portion of the RTP										
Unprogrammed and in the constrained portion of the RTP										
Programmed in the RTP										
Already built										
Not included in the RTP										
Housing/density										
Planning action										

Figure 1 below depicts a conceptual framework for VMT mitigation and additionally assessment for agencies and the existing limitations.[26]

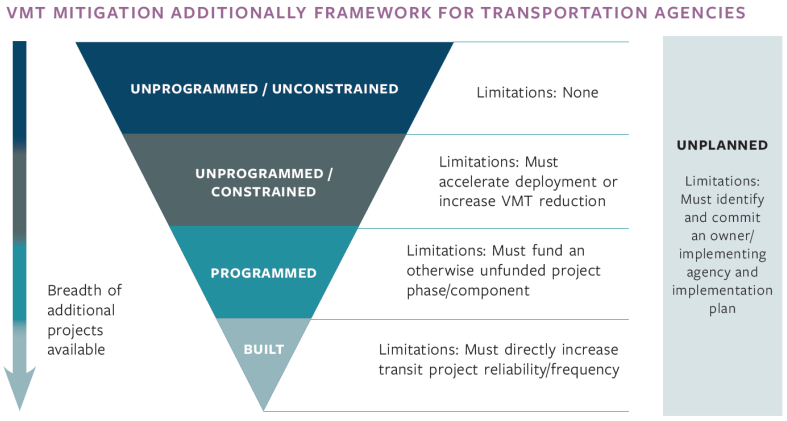

Figure 1 Sample VMT Mitigation Additionality Framework

[25] Elkind, N.E., Lamm,T., Prather,E., *Implementing SB 743 An Analysis of Vehicles Miles Traveled Banking and Exchange Frameworks*, October 2018, U.C. Berkeley.
[26] *Ibid*.

GEOGRAPHY

While addressing the duration of a mitigation mechanism matters, the geography dimension and the distance between impact and mitigation must not be disregarded. Reflecting geography in pricing structure is essential for bank/exchange jurisdictions with distinct high- and low-VMT zones. In such cases, the bank/exchange could apply an equal or less than 1 ratio for mitigation projects within the vicinity or community of an impact, while requiring a greater than 1 level of mitigation for projects with a greater distance between mitigation and impact generation.

One line of thinking is that since VMT is largely a regional phenomenon, it should be addressed regionally in terms of VMT mitigation options. There is potentially a transparent exchange between local and regional approaches to VMT. Local programs that reduce VMT could be used to offset regional level VMT generating projects. However, Offsite mitigation for example, while promising, might disproportionally increase VMT or harm accessibility in disadvantaged communities.

Another study conducted among agencies states that larger infrastructure investments are not considered attractive options for off-site mitigation, whereas in practice they prefer roadway improvements (e.g., roadway shoulder enhancement). One of the interviewees argued that incremental approach taken by the cities satisfies the public's desire to see some return. [27] Mitigation banks or exchanges could also include measures to ensure that developers or agencies to first exhaust their on-site VMT mitigation options before authorizing their participation in the program unless they direct those measures to disadvantaged communities. Programs such as bike-sharing or micro-mobility in different communities might not generate the same value for every community. These communities need to be engaged in a meaningful as part of the process. Program designers should work with the communities to identify current mobility needs and historic disinvestments. Finally, program designers should set goals to develop accessible, affordable, reliable, and safe mobility options while safeguarding equitable distribution of economic opportunity. Regional demand management practices potentially cause some local VMT mitigation banks or exchanges to be overlooked for developing transit-oriented or disadvantaged communities. Small elements such as streetlights, paved pathways, improved walking experiences are key elements in developing these communities where they can accomplish significant VMT reductions at a much lower cost. They beautify the area and can encourage active transportation and transit ridership in these communities.[28] Overall, the micro-design features can have significant impact on mitigating VMT. Thus, factors such as accessibility, built environment, urban design features, and income must be considered for VMT while addressing geographical dimension.

LINKAGE BETWEEN GOVERNMENTS

The linkage between local and regional governments and agencies must be strengthened to create linkages between VMT impact nexus, project and plan-level funding streams, and administrative/implementation pathways. The continual development of the VMT body of knowledge through grants could also be managed at the state level.

In addition, transportation experts note that VMT estimation is still challenging, and margin of error is still very large. A study noted that some agencies are using more than one tool since local experts don't

[27] MINETA Transportation Institute, *Safeguarding Equity in Off-Ste Vehicle Miles Traveled (VMT) Mitigation in California*, 2021

[28] Ogra,A., and Ndebele,R. *The Role of 6Ds: Density, Diversity, Design, Destination, Distance, and Demand Management in Transit Oriented Development (TOD)*, Conference Paper, published October 2014, https://www.researchgate.net/publication/268813431

have confidence in the existing tools to estimate VMT. [29] Developing robust VMT estimation and evaluation tools should be prioritized and deployed to local governments for their use.

EQUITY

Some programs that are not well-designed may lead to equity issues – where mitigation is provided in an area already suffering from VMT when the source is in a distant suburb. In another scenario, while off-site mitigation is considered, an existing community adjacent to the development could expect an immediate mitigation effort since they are the ones being impacted. Off-site mitigation that safeguards equity does not necessarily alleviate community's localized concerns as they might not be aligning with the community's mobility needs. For instance, programs such as bike-sharing or micro-mobility in different communities might not generate the same value for disadvantaged communities.

One study on the subject found that VMT-efficient areas should be identified since they present the biggest opportunities for VMT mitigation.[30] If a development site is in a VMT-inefficient area, it might be too difficult to have the best opportunities for mitigation in that region. This consideration aligns with some of the current practices as equity is a foundational aspect of VMT mitigation. For instance, the Bay Area's Metropolitan Transportation Commission has developed Community-Based Transportation Plans (CBTPs) that help identify specific project sites. San Diego's "Climate Equity Index" is another tool that is used to address historical inequities suffered by communities of color. It is argued that racial equity is as challenging as geographical equity to address. Off-site mitigation strategies might not necessarily address social and historical injustices, and inequalities by communities of color. While transportation investments might benefit these communities, that may not necessarily address the impacts of VMT increase as a result of the new development. Displaced low-income households that need access to job centers in downtowns or city centers find an increase in their VMT due to long commute. These disadvantaged communities are experiencing higher crash rates, and limited access to essential services. It is important to integrate affordable housing strategies into transit-oriented development, and systematically analyze the potential impacts of such development on low-income and minority communities. However, the access to transit does not necessarily result in mode-shift. Any access to transit should be reinforced and supported with urban design features such as bus lanes, strong, street-level walkability, trees, and so on.

The programs need to be carefully vetted to avoid the potential for disproportionate impacts on low-income and minority communities. Benefits of Fee-Based VMT Mitigation Programs should also be distributed equitably. Generally, the bank or exchange must ensure that the program does not exacerbate equity concerns at the first level, and then, it should address existing equity concerns. The way to prioritize equity in a program design differs based on the local definitions of inequity and disadvantaged communities, which impacts public acceptance, political feasibility, and efficacy in return. This ensures the program is compatible with local city plans or legislations as well as the state's broader social values and objectives. Various factors such as geography, demography, and socioeconomics, shape VMT equity definition in this context. **Table 3** below summarizes the criteria for the main categories of concern. Specifically, banks/exchanges may consider the following when prioritizing VMT equity:

[29] Alexander, S.E., Alfonzo,M., Lee,K., *Safegurding Equity in Off-Site Vehicle Miles Traveled (VMT) Mitigation in California*, 2021. https://transweb.sjsu.edu/sites/default/files/2027-Alexander-Equity-Off-Site-VMT-Mitigation.pdf

[30] Ibid.

- Lower-income communities
- Communities of color
- Lower transit access communities
- Rural and exurban communities
- Total amount of geographic distance between impacts and benefits

Table 3 Categories for VMT Equity Concerns

Category	Criteria
Transit and transportation	Transit access, current VMT, safety including rates of serious injuries and fatalities, historical transportation investment, age and quality of infrastructure, and vehicle ownership rates
Built environment	Neighborhood walkability, access to open space, bicycle and pedestrian safety and accessibility, and proximity to employment and critical services
Socioeconomic and demographic	Income, age, employment, public health data, and housing burdens
Environmental	Air quality, water quality, and proximity to hazardous waste sites

In the context of VMT mitigation, VMT inequity arises when there is an unequal distribution of benefits and costs between different areas. Off-site VMT mitigation programs are major concerns in this regard as off-site mitigation could occur so far from the location of the initial impact that the benefit is not received by the community. VMT mitigation banks and exchanges should determine which neighborhoods may merit prioritization, either by keeping more mitigation on-site or by ensuring that a set amount of off-site mitigation occurs within those neighborhoods.

Points at which an agency could consider prioritizing equities include, but are not limited to, the initial point a lead agency enters a project into the bank/exchange, during the project prioritization process, or as a discount or incentive in project selection. Similarly, bank/exchange program designers can incorporate equity into their design and implementation at several different points. They can build equity thresholds into a pre-approved set of projects, geographic limitations, or geographic prioritization for off-site mitigation. They can also create minimum equity requirements for all projects to ensure equity throughout the program's implementation. **Table 4** below presents mechanisms to be implemented by bank/exchange program designers before and during the program operation.

Additionally, administrative leaders can integrate community engagement throughout the decision-making process in various ways, such as requiring specific, measurable engagement metrics, to identify the options that best serve the needs of the jurisdiction(s). This can also be facilitated by a commitment to having a diverse representation in policy making through including at least one local community representative on panels or on the administrative management bodies management team itself. This can reduce the risk of unintended negative consequences for affected communities.

Table 4 VMT Mechanism before and during the Program Operation

Stage of the Program	Mechanism
Before or at the program entry threshold	➢ Limit the geographic range allowed for off-site mitigation ➢ Pre-approve a set of projects that adhere to equity standards ➢ Establish prerequisite equity standards for all projects to participant in the bank/exchange and qualify for mitigation credit ➢ Create an equity threshold for project entry into the program
During the program's operation	➢ Prioritize projects that advance equity goals Create a point category for scoring projects and determining their eligibility for bank/exchange participation ➢ Assign a greater weight to mitigation projects located in the areas of greatest concern ➢ Set a minimum amount or percentage of funding

VMT MITIGATION FUNDING STATUS

Programmed Projects

An approved programming document, such as the Regional Transportation Improvement Program (RTIP), that lists a project or program as funded means that funds are or will be made available for that project. As a result, if a project with this level of funding commitment was suggested to mitigate VMT for another project, it would not be offering any new or extra benefits to offset the impact of VMT. The project is ineligible to be used to reduce VMT in this case. A scheduled project without full funding might be acceptable as mitigation, but this would require a strong justification to show why the project would not have advanced without the mitigation support.

Projects in a "Fiscally-Constrained" Portion of a Regional Transportation Plan

A Regional Transportation Plan's section for fiscally constrained projects frequently does not have any short-term funding budgeted for the projects or services listed there. RTPs typically cover at least 20 years' worth of anticipated funding and projects. Consequently, throughout the planning period, a lot of projects are included in projected "phases". The impact of VMT may be mitigated in several ways by projects with this funding status, including by advancing the project from a later phase to deliver benefits earlier, ensuring funding certainty, and/or reducing the risk of unanticipated downturns in future funding. On the other hand, some projects included in the RTP's later phases for design or construction funding may have had development funds granted for earlier or completed phases, again indicating that there is a present or more significant commitment to providing funding for the project. Therefore, to be used as VMT mitigation, projects or programs in the financially constrained RTP would need to individually present strong proof of VMT reduction over and beyond what was already committed for funding.

Projects in an "Unconstrained" Portion of a Regional Transportation Plan

Projects or programs listed in the unconstrained portion of an RTP have no funding programmed or anticipated during the planning period covered by the Plan. These projects are, in principle, acknowledged as needs, but the estimated amount of funds that will likely be available throughout the

planning period is insufficient to cover their costs, as well as the investments needed for the projects in the budget-constrained section of the plan. Since the benefits would be in addition to those that are already committed, funded, or planned for funding, reviews projects from this component of the RTP to produce benefits to balance VMT impacts could be accelerated and therefore acceptable for VMT mitigation.

UNINTENDED CONSEQUENCES

Given the relative recent development of these programmatic approaches, the potential for unintended consequences exists. Care needs to be given to avoiding program designs that disincentivize good public policy or that do not create an appropriate balance between efficient VMT mitigation in terms of return on investment and community values. It is not easy to navigate between financial cost, political cost, and feasibility. Having an exchange program would lay the ground for the long-term market to track performances of different mitigation options and streamline fees at a regional scale.

Agencies should also be thorough in their VMT mitigation duration. If a roadway capacity investment is tied to LOS, the duration would last until additional traffic depreciates the LOS to what it was before the investment was implemented. If the mitigation is a program such as a transportation management organization, the duration could last in perpetuity, which would be very expensive. Neal Peacock's paper provides examples of annual reporting mechanisms that demonstrate that transportation impact fees are being collected in sufficient volumes, year to year, to effectively fund projects.[31] Research shows that the nexus methodologies between impacts and improvements and the successful use of these fee programs as mitigation under CEQA as discussed above vary by region.

OTHER CHALLENGES

Projects approved before SB743:

A challenge arises for those projects that rely on existing environmental documents, but where LOS analysis was used to approve the project. [32] As a result, some lead agencies are taking the position that previously relied-on mitigation measures are not feasible or enforceable. OPR provided guidance on when projects can rely on a prior environmental document that analyzed traffic impacts using LOS rather than VMT, finding that "an agency may use its discretion to determine that a VMT analysis is not required for later-prepared documents."[33] However, it is argued that VMT impacts are not new information and were known at the time. It can be argued that agencies were aware of VMT but did not choose to study and share those impacts. So far, courts have not yet had a chance to weigh on CEQA issues in this context of the project's reliance on prior environmental documents that use a LOS analysis. To avoid any challenges, VMT bank and exchange programs should rely on new environmental reports. If not possible, demonstrating that the project falls below VMT thresholds or reviewing applied development policies to show findings that they would substantially mitigate the impact could be solutions.

[31] Neil Peacock, *The Potential for Regional Transportation Impact Mitigation Fee Programs and Mitigation Banks to Help Streamline the Implementation of SB 743*, March 2017

[32] Grid Legal, *VMT Impacts: Can Prior CEQA Documents Be Relied on That Did Not Study VMT Impacts?* , https://www.gridlegal.com/post/vmt-impacts-prior-ceqa-documents, accessed on October 19th, 2022.

[33] SB 743 Frequently Asked Questions, https://opr.ca.gov/ceqa/sb-743/faq.html#draft-docs, accessed on October 19th, 2022.

Slow Down on Home Building:

Adopting SB 743 arguably slowed down the amount of residential development and construction, especially the larger developments.[34] For instance, Clovis County Council is moving forward with an all-encompassing Environmental Impact Report (EIR) to take some of the law's uncertainty out of the equation so that not every project is subject to preparing an EIR.[35] Developers will be asked to fund an umbrella EIR, but questions arise about whether the city was helping developers make profits by paying for an umbrella EIR.

In addition, developers might be discouraged from building housing across the state if large mitigation fees are used to support public transportation projects. Another aspect of the problem is that retail development typically requires attracting customers who would drive to the shops. In the absence of truly exceptional transit service and service riders, mitigation efforts to reduce driving, say to a regional shopping center, would be counterproductive to the goals of the development.

Charging Developers a VMT Tax

San Diego Association of Governments (SANDAG) is considering taxing developers based on vehicle miles traveled by their tenants (an additional $10,000 - $22,000 per mile traveled). [36] As the revenue from gas tax shrinks due to electric and hybrid vehicles becoming more common, this could allow collecting revenue to achieve state and regional goals. A VMT tax would also encourage residential developments to be built close to job and activity centers. During the housing crisis, anything that increases the cost of housing could have adverse effects on the market and the public eye. A similar proposal faced opposition in other regions of the country. A proposal circulated to replace the 18.4 cents per gallon tax with a VMT tax in Washington D.C. was not successful.[37] Proponents in California state that the state's gas tax could be replaced by a "miles drive fee" of $0.05, even though the elimination of the gas tax is not guaranteed. However, opponents claim that this proposal penalizes low-income and working families who drive long distances to work. In addition, the VMT tax could singularly equate to or exceed the construction cost of a new home through its lifespan, which could go as high as $640,000 if the project is not close to a transit station.

[34] GVWire, *State's VMT Law Driving Builders Away, Making Homes More Expensive*, Say Valley Lawmakers, https://gvwire.com/2021/03/02/states-vmt-law-driving-builders-away-making-homes-more-expensive-say-valley-lawmakers/, accessed on April 11th, 2022.

[35] GVWire, *With State VMT Law Limiting Home Building, Clovis Takes Action*, https://gvwire.com/2021/04/07/states-vehicle-miles-traveled-law-is-limiting-home-building-city-of-clovis-takes-bold-action/, accessed on October 11th, 2022.

[36] StreetBlog Cal, *San Diego County Ponders a VMT Tax, with a Twist*, San Diego County Ponders a VMT Tax, with a Twist – Streetsblog California,accessed on October 11th, 2022.

[37] Powering California, *ANALYSIS: Vehicle Miles Traveled Tax (VMT),* https://poweringcalifornia.com/analysis-vehicle-miles-traveled-vmt-tax/,accessed on October 11th, 2022.

Chapter 6: Current Situation in California

In California, there is growing interest in considering mitigation projects that are less conventional, including affordable housing implementation, other land use options including transit-oriented development (TOD), TDM measures, mobility hubs, and micro-mobility options. There is also interest in considering mitigation projects that are already under development or programmed with the idea that either expediting their development or solidifying funding needs could be a basis for their inclusion in a VMT mitigation program. This is partly because agencies have difficulties identifying mitigation projects with a feasible return of investment (ROI), especially considering conventional options such as transit and active transportation options. Agencies believe in some locations the cost of conventional options may make VMT mitigation programs difficult to implement. In that sense, many agencies are taking an iterative approach. They are undertaking efforts to evaluate potential mitigation projects to be in included in the program as the first step towards viability rather than focusing on the format initially.

Table 5 includes the identified agencies as either planning to undertake a relevant study, having a relevant study ongoing, or identified as having a relevant program under development but the status is unknown, or completed.

Table 5 Current Situation in California

Agency	VMT Mitigation Program Format	Status
Fresno COG	TBD	Ongoing, completion in 2023
Contra Costa Transportation Authority (CCTA)	Pilot Hybrid Exchange/In-Lieu Fee	Draft Framework released in early 2023
City of Fresno	Active Transportation In-Lieu Impact Fee	Ongoing, end date TBD
San Bernardino County Transportation Authority	Pilot VMT Bank	Framework waiting Board of Directors approval
Santa Cruz County and incorporated Cities	TBD	Beginning September 2022
City of San Diego	Impact Fee	Ongoing, end date TBD
City of Watsonville	VMT Bank	Pending implementation
City of Tracy	VMT Bank	Pending implementation
City of Salinas	VMT Bank	Pending implementation
City of Los Angeles	Impact Fee	Completed, understood to be implemented as part of the Westside Mobility Plan
City of Fremont	TBD	Ongoing, end date TBD
City of Lancaster	VMT Mitigation Fee Optional Program	Pending, waiting for the council to adopt.
City of Concord	Impact Fee/Bank	Pending implementation
Santa Clara Valley Transportation Authority (VTA)	TBD	Grant awarded; RFP date unknown
San Luis Obispo Council of Governments (SloCOG)	TBD	Grant awarded; RFP to be released in 2022
City/County Association of Governments of San Mateo County (C/CAG)	TBD	Grant awarded; RFP date unknown
Town of Los Gatos	Impact Fee	Ongoing, end-date anticipated

Chapter 7: Key Takeaways

This chapter summarizes the key takeaways and detailed considerations for implementing agencies to successfully design and create fee-based VMT mitigation programs.

- Agencies need to verify VMT reductions and additionality for projects before approving participation in the banking regime. The agencies can also try in-house verification upon availability of resources or can ask a thirds party off-set verifier. Any agency implementing a bank or exchange must demonstrate both a reasonable substantive relationship and financial proportionality between the proposed development and the fee or condition placed on it
- Agencies should also be diligent in their VMT mitigation duration as the nexus between improvements and successful use of fees varies region by region
    - Bank arrangements that receive and pools funds from multiple projects should account for the delay between payment and deployment of funds as it measures the cost of VMT mitigation and negotiates with developers
    - All models should also determine a comprehensive framework for the prioritization of individual mitigation projects, to ensure that reductions are achieved as quickly and efficiently as possible
- A VMT exchange might be simpler for developers, but it could also limit the usefulness of funds from smaller developments and be less politically agreeable to local communities
    - Offer more certainty for developers regarding the kinds and costs of appropriate mitigations needed to address cumulative VMT impacts
- New plans and programs might increase new home costs, which can push disadvantaged communities further behind in their ability to access homeownership
    - Significant equity issues may also arise if disadvantaged communities host developments but not beneficial mitigation projects
    - Any lead agency will need to include rigorous backstops to ensure that disadvantaged communities are not negatively impacted by—and ideally can benefit from—the ability of developers to move mitigation off-site
- Implementing agencies should consider requiring or providing incentives for developers or lead agencies to demonstrate that on-site mitigation is not feasible before being permitted to undertake off-site measures
- VMT Banks and Exchanges comprehensively address VMT impacts across jurisdictional boundaries
- Geography plays an important role in VMT reduction impact assessment. According to the difference between the VMT impact and the mitigation strategy as well as the variation among low and high VMT zones, using different ratios for impact and mitigation relations in the pricing structure seems necessary.
- Incorporating equity in VMT banking is essential and challenging, particularly in the case of off-site mitigation programs. The benefits of fee-based mitigation strategies must carefully be distributed. In general, VMT bank identifies lower income, communities of color, rural areas, and low transit accessible zones as equity priority. However, the local definition of equity and

disadvantaged communities should be considered as well since it affects public acceptance and political feasibility. In addition to local equity considerations, each transportation project category comes with specific equity criteria to address while evaluating the VMT impacts and the effectiveness of mitigation strategies. Agencies can prioritize equity at various points, mainly before/at the beginning of a program or during the program's operation. Depending on this, the mechanism of intervention varies (Table 4). Community engagement in the jurisdictional decision-making process supports equity by reducing the risk of unintended consequences on communities of concern.

- Local jurisdictions pay attention to projects and programs and their financial constraints in the RTP before using for VMT Mitigation.

APPENDIX B – MODELING APPROACH

Kimley»Horn

Memorandum

To: Anais Schenk
County of Santa Cruz, Community Development & Infrastructure

From: Ayberk Kocatepe, Ph.D
Chris Gregerson, P.E., T.E., PTOE, PTP
Michael Schmitt, P.E., AICP CTP, PTP, RSP1

Re: Santa Cruz County Travel Demand Model (SCC TDM) Update
Santa Cruz County Regional VMT Mitigation Program, Santa Cruz County

Date: August 8, 2023

This memorandum documents the process undertaken to update the Santa Cruz County Travel Demand Model (SCC TDM) for the purposes of performing VMT Mitigation analysis for projects selected as part of the Santa Cruz County Regional VMT Mitigation Program.

Model Overview

The Santa Cruz County Travel Demand Model is designed to forecast future travel patterns on both roadway and transit routes throughout Santa Cruz County (SCC). The model can be used to assess how changes in population, employment, demographics, and transportation infrastructure affect travel patterns within the county. The SCC Model is a four-step travel demand model based on the TransCAD platform. The SCC Model was developed to provide more detailed information on travel patterns within Santa Cruz County than could be accomplished by the tri-county regional travel demand model provided by the Association of Monterey Bay Area Governments (AMBAG).

The California Transportation Commission publishes and periodically updates guidelines for the development of long-range transportation plans that includes guidelines for regional travel demand modeling. The SCC Model follows these guidelines. These guidelines include sensitivity to the following policies/programs including:

- Land Use
- Geographic scale
- Sensitivity to mode
- Pricing
- Sensitivity to congestion
- Validation
- Documentation

The SCC Model is an enhanced four-step model. The four primary sub-models making up the four-step model process are:

1. Trip Generation. This initial step calculates person ends using trip generation rates established during model estimation and refined to Santa Cruz County. Truck trips are currently included in non-home based and are not estimated separately. The SCC TDM runs a series of complex steps to estimate daily trip productions and attractions by various trip purposes for each TAZ. The trip purposes are listed below:
    a. Home-Based Work (HW)

b. Home-Based Other (HO)
c. Home-Based School, K-12 (HK)
d. Home-Based College (HC)
e. Home-Based Shopping (HS)
f. Work-Based Other (WO)
g. Other-Based Other (OO)

The production model uses several variables to generate trips such as the number of workers, household income, age, household size, and car availability. Trip productions for every TAZ in the model are compiled separately by each trip purpose. The attraction model uses employment categories for the HW trip purpose and employment categories and the number of students (K-12 and University) for all other trip purposes. The attraction model estimates trip attractions to each TAZ by regression coefficients that vary by employment type. Trip attractions for every TAZ are compiled by each purpose and by each employment type based on these regression coefficients.

2. Trip Distribution. The second general step estimates how many trips travel from one zone to any other zone. The distribution is based on the number of trip ends generated in each of the two zones, and on factors that relate the likelihood of travel between any two zones to the travel time between the two zones such as distance, cost, and time, and varies by accessibility to passenger vehicles, transit, and walking or biking. This step also determines how many trips enter or leave the model area.
3. Mode Choice. This step uses demographics and the comparison of distance, time, cost, and access between modes to estimate the proportions of the total person trips using drive-alone or shared-ride passenger auto, transit, walk, or bike modes for travel between each pair of zones.
4. Trip Assignment. In this final step, vehicle trips and transit trips from one zone to another are assigned to specific travel routes between the zones. Congested travel information is used to influence each of the steps described above starting with vehicle availability for all models and starting with land use location for integrated land-use transportation models.

Methodology

The SCC TDM was most recently updated to contain the base year of 2019 and a future year of 2045. The land use updates were incorporated into the model by updating the information at the Traffic Analysis Zone (TAZ) level. There are 696 TAZs within the County, including 364 TAZs within the unincorporated parts of the County. In consultation with the SCCRTC and Santa Cruz County, the transportation analysis zone (TAZ) geography for the SCC Model is based on the AMBAG TAZ geography with revisions for Santa Cruz County. The land use updates included updating the households and population information in each TAZ, as well as the employment by category.

Socioeconomic and Employment Data

In order to ensure that SCC travel demand model accurately reflects the current conditions of Santa Cruz County, we gathered the latest information on various key factors. We obtained this data from the AMBAG travel demand model that was updated in 2022. By leveraging the insights provided by AMBAG, we were able to incorporate the most up-to-date details on population growth, land use patterns, and socio-economic factors into the Santa Cruz County travel demand model.

When updating the residential data within the model (households and population), socioeconomic data (SED) associated with each TAZ must also be updated. The SED in the SCC TDM provides information about the makeup of the households in each TAZ. There are several different variables in the model SED,

including the age of the residents, household size, household income, number of vehicles per household, number of workers per household, and the number of vehicles per worker. It should be noted that while the SCC TDM uses dwelling units as its input, there is no differentiation between single-family and multi-family residential in terms of trip generation and distribution.

To update the employment variables, we made modifications to reflect the accurate number of workers based on specific employment categories. These categories were established by AMBAG and were inherited in the 2022 model update. They were defined using the North American Industry Classification System (NAICS) codes, as outlined in Exhibit 1. During the migration process of incorporating these employment categories into the SCC model, we regrouped them into six overarching categories.

1. Agriculture
2. Construction
3. Industrial and Manufacturing
4. Retail
5. Service (White Collar, Food Services, and jobs not included in other categories)
6. Public Administration (Government, Health Care, and Educational jobs)

Exhibit 1 – Land Use Categories in the AMBAG TDM

Category	Description and NAICS codes
Agriculture	Agriculture, Forestry, Fishing, and Hunting (11)*
Construction	Construction (23), Utilities (22), Transportation and Warehousing (48-49), Administrative and Support and Waste Management and Remediation Services (56), Public Administration (92)*
Manufacturing and Mining	Mining (21), Manufacturing (22, 31-33),
Wholesale	Wholesale Trave (42), Agriculture, Forestry, Fishing, and Hunting (11)*
Retail	Retail Trade (44-45), Agriculture, Forestry, Fishing, and Hunting (11)*
Finance and Real Estate	Information (51), Finance and Insurance (52), Real Estate Rental and Leasing (53), Professional, Scientific, and Technical Services (54), Management of Companies and Enterprises (55)
Education	Educational Services (61), Public Administration (92)*
Healthcare	Health Care and Social Assistance (62)
Service	Art, Entertainment, and Recreation (71), Accommodation and Food Service (72), and Other Services (81)
Public	Public Administration (92)*
*Note: Some NAICS industry sectors have been divided up, based on business operations and transportation demand, across AMBAG sectors.	

Calibration and Validation

Once the travel demand model was updated with the latest information, we proceeded with the validation process to ensure its accuracy and reliability. A crucial aspect of this validation process was the utilization of traffic counts to validate the model at the link level. By comparing the model's predicted traffic volumes with the actual observed counts, we could assess the model's performance and identify any discrepancies. Furthermore, the validation of the model encompassed the evaluation of traffic flows across screenlines, which consist of multiple roadways. This comprehensive approach aimed to capture the overall traffic patterns effectively. Our objective was to meet or surpass the validation guidelines set by Caltrans and the Federal Highway Administration. As part of the validation process, adjustments were

made to elements within the trip generation, trip distribution, and traffic assignment modules whenever necessary to ensure the model's accuracy and reliability.

Traffic counts (50 locations) used for the travel demand model update were gathered during late October and November 2022 (Appendix A). All 7-day-hour ADT counts (21 locations) were specifically collected as part of this project. Other 3-day-hour ADT counts (29 locations) were part of the 'Countywide Traffic Data Collection Program' efforts currently ongoing in the county. To enhance the accuracy of the model, the project team also used big data sources by accessing their AADT data for 44 locations (Appendix A). These counts were used for link-level calibration. Where applicable, these counts were also used in the cutline/screenline calibration.

The results of the model validation and comparison to best practice standards are shown in Exhibit 2 and Exhibit 3. The calibration results were within industry-accepted ranges for all measures for the daily validation exercise. This certifies that the model meets standard validation criteria.

To facilitate this validation, we performed other tests that provide valuable insights into the model's accuracy at different levels. These included the percentage of Root Mean Square Error (%RMSE) by facility type or volume groups and the Model/Count comparison by facility type or volume groups. We observed that the margin of error was slightly higher for the small-volume links (Appendix B-C). The limitations of travel demand models cause small-volume links to have a higher margin of error. These limitations include focusing on overall trends, variability in traffic patterns compared to high-volume links, sensitivity to model assumptions, and spatial resolution.

Travel demand models strive to represent overall travel patterns as accurately as possible. As long as the model behaves consistently and aligns with the larger travel patterns, the acceptable margin of error for small-volume links is deemed reasonable for practical purposes in transportation planning and analysis. Based on Caltrans and Federal Highway Administration (FHWA) requirements, and tests we performed, the Santa Cruz County Travel Demand Model (TDM) has been determined to be statistically valid.

Exhibit 2 – Static Model Validation for 2019 Base Year Model

Static Model Validation		
Criteria	***Target***	**Daily**
Model/Count Ratio	*0.90-1.10*	1.09
Percent Within Caltrans Maximum Deviation	*> 75%*	75.2%
Percent Root Mean Square Error	*< 40%*	37%
Correlation Coefficient	*> 0.88*	0.97

Exhibit 3 – Static Model Validation for 2019 Base Year Model (Screenline)

Static Model Validation (Screenline)		
Criteria	***Target***	**Daily**
Model/Count Ratio	*0.90-1.10*	1.08
Percent Within Caltrans Maximum Deviation	*> 75%*	75.2%
Percent Root Mean Square Error	*< 40%*	44%
Correlation Coefficient	*> 0.88*	0.96

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Appendix A

Traffic Count Locations

No	Location	Description	No	Location	Description
1	Freedom Blvd	S of Alta Vista Ave,N of Crestview Dr	27	Graham Hill Rd	W of Mt. Hermon Rd
2	7th ave	South of Tanner Tt, North of Harbor Oaks Ct	28	Freedom Blvd	N of Buena Vista Dr
3	Main St	NW of Riverside Dr, SE of Beach St	29	Riverside Dr	E of Coward Rd
4	7th Ave	South of Soqeul Ave, North of Bostwick Ln	30	San Andreas Rd	S of Bonita Dr
5	E Cliff Dr	E of 9th Ave Sw of Prospect St	31	17th Ave	S of Brommer St
6	Brommer St	W of 30th Ave, E of Darlene Dr	32	Brommer St	W of 17th Ave
7	Soqeul Wharf Road	S of Cabrillo Hwy, N of Clares St	33	Soquel Dr	W of Rodeo Gulch Rd
8	Bay Dr	S of Meder St, N of Nobel Dr	34	Portola Dr	E of 24th Ave
9	Empire Grade	W of Western Dr, E of Highview Dr	35	Portola Dr	W of 41st Ave
10	Park Ave	W of Wesley St, E of Washburn Ave	36	Park Ave	N of Hwy 1
11	Rodriquez St	W of Koopmans Ave, E of Jose Ave	37	Porter St	S of Main St
12	Seabright Ave	North of Windsor St, S of Broadway	38	Soquel Dr	W of 41st Ave
13	Murray St	W of Brook Ave, E of Pilkington Ave	39	Soquel Dr	W of Porter St
14	Blackburn St	NW od Riverside Dr, SE of Wildcatz Way	40	Hwy 9	N of Redwood Dr
15	S Green Valley Rd	N of Kralj Dr, S of Oakridge St	41	Hwy 9	West of Main St
16	Cabrillo Hwy	E of Park Avenue interchange after ramps	42	Hwy 9	S of Clear Creek Rd
17	E Cliff Dr	W of 24th Ave, E of Coastview Dr	43	Hwy 9	S of Pool Dr
18	Airport Boulevard	W of Hangar Way, N/E of Nielson St	44	Hwy 9	N of Lakeview Dr
19	W Beach St	W of Rodriguez, E Walker St	45	Hwy 9	N of Graham Hill Rd
20	Graham Hill Rd	W of Lockewood Ln, E of E Zayante Road	46	Hwy 9	S of Glen Arbor Rd SOUTH
21	Front St	N of Laurel St, S of Cathcart St	47	Central Ave/SR 9	S of Big Basin Way/SR 236
22	Freedom Blvd	E of Soquel Dr	48	Hwy 9	S of Bear Creek Rd
23	Sea Ridge Rd	W of State Park Dr	49	Hwy 9	S of Graham Hill Rd
24	Soquel Dr	W of State Park Dr	50	Central Ave/SR 9	N of Big Basin Way/SR 236
25	State Park Dr	S of Soquel Dr			
26	Gross Rd	W of 41st Ave	S:South, N:North, E:East, W:West		

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Locations of AADT Data gathered from Big Data sources

No	Location	Description
1	41st Ave	North of Portola Dr
2	Ramp	Westbound - S of Cory St
3	SR-1 NB West Of Bay	E of Capitola Mall Interchange,
4	Bonita Dr	Freedom Blvd And Vista Del Mar Dr
5	Freedom Blvd	East of Green Valley Rd
6	17th Ave	S of Kinsley St
7	30th Ave	N Or Roland Dr
8	Soquel Dr	Between Capitola Ave And Rosedale Ave
9	Soquel Dr	Between Capitola Rd And 7th Ave
10	Soquel Dr	E of Perimeter Rd, W of Haas Dr.
11	Mount Hermon Rd	W of Lockewood Ln
12	Laurel St	East of Front St
13	High St	Cl Se/High View - Western Dr
14	Bear Creek Rd	N Flat St, S of Mountain St
15	Water St	N Branciforte Ave - Poplar Ave
16	41st Ave	N of Clares St
17	Wharf Rd	Cliff Dr - Capitola Rd
18	Portola Dr	E of Laurel Ave, S of Nova Dr
19	Capitola Rd	W of 30th Ave
20	Soquel Dr	Between Mattison Ln And Rodeo Gulch Rd
21	Eaton St	Between Lake Ave And Lago Ln
22	Soquel Ave	Between Capitola Rd And 7th Ave
23	Capitola Rd	7th Ave And 17th Ave
24	Capitola Rd	W of El Dorado Ave
25	7th Ave	S of Mello Ln
26	Brommer St	E of 7th Ave
27	Ocean St	Soquel Ave - Broadway
28	State Hwy 1	Between Morissey And Soquel
29	Mcgregor Dr	E of Potbelly Beach Rd
30	Rodriguez St	Main St - W Lake Ave
31	S Green Valley Rd	Lawrence Rd - Freedom Blvd
32	Hwy 1	E of 41st Ave Interchange
33	Hwy 1	E of 41st Ave Interchange
34	Hwy 1	E of Park Ave
35	State Hwy 1	Between Freedom Blvd And San Andreas Rd
36	41st Ave	41st Ave Interchange
37	41st Ave	Sprr - Clares St
38	Glenn Coolidge Dr	Coolidge Dr North of High St
39	Airport Blvd	Ross Ave - Roache Rd
40	Main St	W of Rodriguez St
41	Freedom Blvd	S of Altavista Ave
42	Bay St	S of Meder St
43	State Hwy 1	E of Park Ave
44	N Rodeo Beach	N of Soquel Dr

S:South, N:North, E:East, W:West

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Appendix B
Tests performed for all links

Model/Count by ADT Volume Groups	
Link Volume	M/C
> 50,000	1.09
25,000 - 49,999	1.18
10,000 - 24,999	1.04
5,000 - 9,999	1.05
2,500 - 4,999	1.28
1,000 - 2,499	1.39
< 1,000	1.42

RMSE by ADT Volume Groups			
Link Volume	%RMSE	FHWA threshold	Target
> 50,000	10%	< 21%	< 20%
25,000 - 49,999	20%	< 22%	< 25%
10,000 - 24,999	22%	< 25%	< 25%
5,000 - 9,999	36%	< 29%	< 45%
2,500 - 4,999	64%	< 36%	< 100%
1,000 - 2,499	92%	< 47%	< 100%
< 1,000	171%	< 60%	< 100%

Model/Count by Facility Type	
Facility Type	M/C
Other Freeways or Expressways	1.16
Ramp	1.00
Principal Arterial	1.10
Minor Arterial	1.03
Major Collector	0.96
Minor Collector	1.76
Local	1.21

RMSE by Facility Type		
Facility Type	%RMSE	Target
Other Freeways or Expressways	22%	<20%
Ramp	39%	N/A
Principal Arterial	34%	<35%
Minor Arterial	41%	<45%
Major Collector	45%	<100%
Minor Collector	76%	<100%
Local	77%	<100%

Appendix C
Tests performed for Screenlines

Model/Count by ADT Volume Groups	
Link Volume	M/C
> 50,000	N/A
25,000 - 49,999	1.26
10,000 - 24,999	1.14
5,000 - 9,999	0.94
2,500 - 4,999	1.23
1,000 - 2,499	0.86
< 1,000	1.23

RMSE by ADT Volume Groups			
Link Volume	%RMSE	FHWA Threshold	Target
> 50,000	N/A	< 21%	< 20%
25,000 - 49,999	28%	< 22%	< 25%
10,000 - 24,999	21%	< 25%	< 25%
5,000 - 9,999	28%	< 29%	< 45%
2,500 - 4,999	94%	< 36%	< 100%
1,000 - 2,499	65%	< 47%	< 100%
< 1,000	42%	< 60%	< 100%

Model/Count by Facility Type	
Facility Type	M/C
Other Freeways or Expressways	1.26
Principal Arterial	1.08
Minor Arterial	1.04
Major Collector	0.84
Local	0.96

RMSE by Facility Type	
Facility Type	%RMSE
Other Freeways or Expressways	28%
Principal Arterial	27%
Minor Arterial	77%